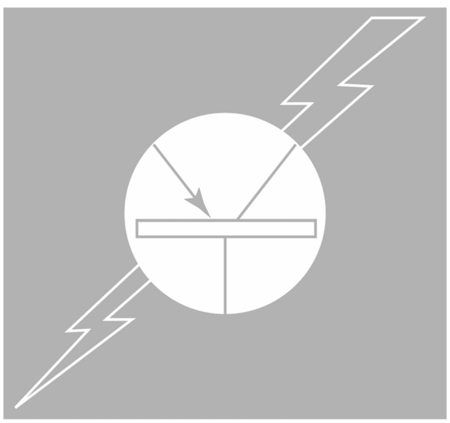
TRAINING PROGRAM

JAGUAR ADVANCED ELECTRICAL SYSTEMS



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OBJECTIVE

- Familiarize the professional Jaguar technician with Jaguar advanced electrical systems
- Distinguish specific electrical system differences between each Jaguar model line
- Understand Jaguar multiplexed systems and operation
- Understand the function and effects of software vs. hardware
- Be able to diagnose multiplex system concerns using the knowledge and practice obtained during this course.

PROGRAM CONTENT

1. INTRODUCTION
2. GENERAL INFORMATION
3. JAGUAR MULTIPLEXING SYSTEMS
4. CONTROL MODULE PROGRAMMING
5. CONTROL MODULE FUNCTIONS
6. BODY ELECTRICAL SYSTEMS
7. SECURITY
8. ADVANCED DIAGNOSTICS

INTRODUCTIONS

The illustrations, technical information, data and descriptive text in this publication, to the best of our knowledge, were correct at the time of going to print. The right to change specifications, equipment, procedures and maintenance instructions at any time without notice is reserved as part of our policy of continuous development and improvement.

No liability can be accepted for any inaccuracies or omissions in this publication, although every possible care has been taken to make it as complete and accurate as possible.

Jaguar Cars North America Service Training Department

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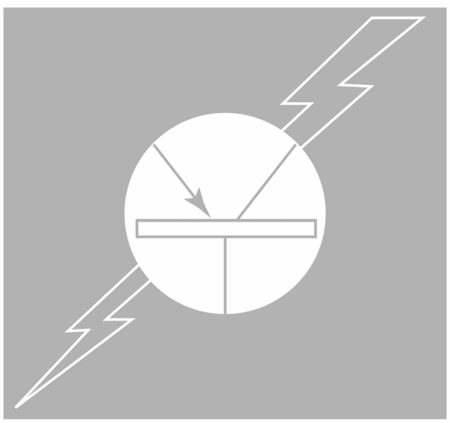

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ACRONYMS

- AACV — Air Assist Control Valve
- AAI — Air Assisted Injection
- ABS — Anti-lock Braking System
- A/C — Air Conditioning
- A/C CM Air Conditioning Control Module
- ACC — Adaptive Cruise Control
- APP Sensor — Accelerator Pedal Position Sensor
- BOF — Black Optical Fiber
- BPM — Body Processor Module
- B+ — Battery Voltage
- CAN — Controller Area Network
- CCV — Canister Close Valve
- CKP Sensor – Crankshaft Position Sensor
- CHT — Cylinder Head Temperature sensor
- CM — Control Module
- CMP Sensor (A) 1 — Camshaft Position Sensor - RH Bank
- CMP Sensor (B) 2 — Camshaft Position Sensor - LH Bank
- C/O — Carry Over
- CO — Carbon Monoxide
- CPU — Central Processing Unit
- CSMA — Carrier Sense Multiple Access
- D2B — Digital Data Bus
- DC — Direct Current
- DDCM — Driver's Door Control Module
- DDM — Driver's Door Module
- DHRCM — Driver Head Restraint Control Module
- DIN — Deutsche Industrie Normen
- DOM — Driver's Door Module
- DLC — Data Link Connector
- DPFE — Differential Pressure Feedback EGR
- DRDCM — Driver Rear Door Control Module
- DSCCM — Dynamic Stability Control — Control Module
- DSCM — Driver Seat Control Module
- DSC — Dynamic Stability Control
- DSM — Driver's Seat Module
- DTC — Diagnostic Trouble Code
- ECATS — Enhanced Computer Active Technology Suspension
- ECM — Engine Control Module
- ECT Sensor — Engine Coolant Temperature Sensor
- ECU — Electronic Control Unit
- EEPROM — Electrically Erasable Programmable Read Only Memory
- EFT Sensor — Engine Fuel Temperature Sensor
- EGR — Exhaust Gas Recirculation
- EMS — Engine Management System
- EPROM — Erasable Programmable Read Only Memory
- EOT Sensor — Engine Oil Temperature Sensor
- EVAP Canister Close Valve — Evaporative Emission Canister Close Valve
- FPDB — Front Power Distribution Box
- FEM — Front Electronic Control Module
- FMEM — Failure Mode Effects Management
- FSC — Fail Safe Cooling strategy
- FTP Sensor — Fuel Tank Pressure Sensor
- GECM — General Electronic Control Module
- GEM — General Electronic Module
- HC — Hydrocarbons
- HO2 Sensor 1/1 — Heated Oxygen Sensor - RH Bank/Upstream
- HO2 Sensor 1/2 — Heated Oxygen Sensor - RH Bank/Downstream
- HO2 Sensor 2/1 — Heated Oxygen Sensor - LH Bank/Upstream
- HO2 Sensor 2/2 — Heated Oxygen Sensor - LH Bank/Downstream

- HSM — Heated Seat Module
- IAT Sensor — Intake Air Temperature Sensor
- IC — Instrument Cluster
- ICE — In Car Entertainment Module
- IG — Ignition
- IMT Valve — Intake Manifold Tuning Valve (1 = top, 2 = bottom)
- IP Sensor — Injection Pressure Sensor
- ISO — International Standards Organization
- ISO 9141 — Defines one of several OBDII communication protocol standards
- JTIS — Jaguar Technical Information System
- KAM — Keep Alive Memory
- KS 1 — Knock Sensor RH bank
- KS 2 — Knock Sensor LH bank
- KTM — Key Transponder Module
- LED — Light Emitting Diode
- LEV — Low Emissions Vehicle
- LTFT — Long Term Fuel Trim
- LWB — Long Wheel Base
- MAF Sensor – Mass Air Flow Sensor
- MIL — Malfunction Indicator Lamp
- N/A — Normally Aspirated
- NAS — North American Specification
- NAV — Navigation Control Module
- NDA — Non-Destructive Arbitration
- NRZ — Non-Return to Zero
- NTC — Negative Temperature Coefficient
- NOx — Oxides of Nitrogen
- OBD — On-Board Diagnostics
- O/C — Open Circuit
- OVR — On-board refuelling Vapor Recovery
- PATS — Passive Anti-Theft System
- PACM — Parking Aid Control Module
- PAD — Passenger Airbag Deactivation light
- PCB — Printed Circuit Board
- PCM — Powertrain Control Module
- PDCM — Passenger Door Control Module
- PHRCM — Passenger Head Restraint Control Module
- PJB — Passenger Junction Box
- PRDCM — Passenger Rear Door Control Module
- PTEC — PowerTrain Engine Control
- PPS — Pedal Position Sensor
- PSCM — Passenger Seat Control Module
- PWM — Pulse Width Modulation
- RAM — Random Access Memory
- RCM — Restraints Control Module
- RCCM — Remote Climate Control Module
- RCCP — Rear Climate Control Panel
- REM — Rear Electronic Module
- ROM — Read Only Memory
- RPC — Reverse Park Control
- RHS — Right Hand Side
- RMM — Rear Memory Module
- RPDB — Rear Power Distribution Box
- ROW — Rest of the World Specification
- RSCM — Rain Sensing Control Module
- SAE — Society of Automotive Engineers
- SAE — SAE that defines the requirements of the OBD II scan tool.
- S/C — Super Charged
- SCP — Standard Corporate Protocol Network
- SLCM — Security and Locking Control Module
- STFT — Short Term Fuel Trim
- SWAS — Steering Wheel Angle Sensor
- TACM — Throttle Motor Control Module
- TCM — Transmission Control Module
- TFT Sensor — Transmission Fluid Temperature Sensor
- TM — Throttle Motor
- TOT — Transmission Oil Temperature
- TP — Throttle Position
- VAPS — Variable Assist Power Steering

- VID — Vehicle IDentification
- VIS — Variable Intake System
- VSV — Vacuum Solenoid Valves
- VVT 1 — Variable Valve Timing solenoid valve - RH Bank
- VVT 2 — Variable Valve Timing solenoid valve - LH Bank
- WDS — World Diagnostic System
- WOT — Wide Open Throttle

WHAT THIS BOOK CONTAINS

This book covers the Advanced Electrical Systems on the following models:

Table 1 Models

Internal Designation	Model and Model Year
X100	1997–2002 XK
X103	2003–2004 XK
X105	2005 XK Onward
X200	2000–2002 S-TYPE
X202	2003–2004 S-TYPE
X204	2005 Onward S-TYPE
X308	1998–2003 XJ
X350	2004 XJ Onward
X400	2002–2003 X-TYPE
X404	2004 Onward X-TYPE

Although there are slight differences in some of the electrical systems, the electrical system architecture and operational logic is basically the same.

The book contains model-specific information needed to understand the individual electrical systems and know the difference between each of the following model ranges:model range.

- X100 Series
- X200 Series
- X300 Series
- X400 Series

The sections are broken down as follows:

- Multiplexing
- Control Modules
- Body Electrical Systems
- Security
- Advanced Diagnostics

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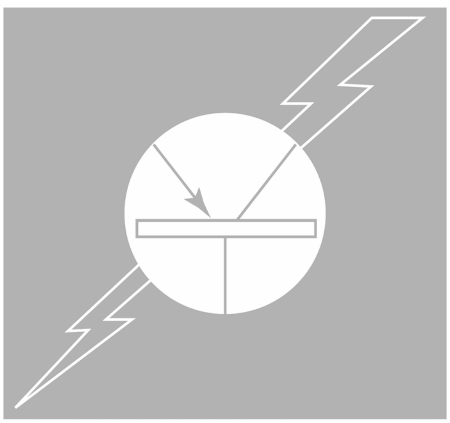
JAGUAR ADVANCED ELECTRICAL SYSTEMS



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JAGUAR ELECTRICAL SYSTEMS: MULTIPLEXING VS. HARD WIRING

Benefits of Multiplexing

Today's cars use electronic modules to control everything from the engine and transmission to the radio and brakes. Many of these controllers require the same INPUT information to operate efficiently. For example, seemingly unrelated systems like the transmission and anti-lock brakes both require vehicle speed information. If both systems could get vehicle speed information from the same INPUT, it would reduce the number of sensors and the amount of wiring on the vehicle.

Jaguar vehicles have this ability to share information through the use of NETWORKS. A network refers to the control modules and wiring that allow information to be sent or received, using an electrical or electronic medium. Some networks allow electronic modules to share input information. Networks can enable multiple modules to act together to perform complex vehicle operations.

In addition to improved vehicle diagnostic capabilities, the use of networks provides the following opportunities:

- Eliminates redundant sensors and dedicated wires for each function (lower cost, lower weight, better reliability)
- Reduces the number of wires and connectors (lower cost, lower weight, better reliability, easier-to-package wiring harness)
- Allows more features and more flexibility (modules share data, more flexible design and vehicle option content)
- Allows additional features to be added after sale via software upgrades

Jaguar uses five different types of networks depending on the model:

- The Controller Area Network (CAN)
- The Standard Corporate Protocol Network (SCP)
- The Serial Data Link (ISO 9141)
- The Audio Control Protocol Network (ACP)
- The Digital Data Bus Network (D2B)

Table 2 Network application by model/year range

Internal Designation	Model and Model Year	Network
X100	1997–2002 XK	CAN, SCP, ISO, ACP*
X103	2003–2004 XK	CAN, SCP, ISO, ACP
X105	2005 XK Onward	CAN, SCP, ISO, ACP
X200	2000–2002 S-TYPE	SCP, ISO, ACP
X202	2003–2004 S-TYPE	CAN, SCP, ISO, D2B
X204	2005 Onward S-TYPE	CAN, SCP, ISO, D2B
X308	1998–2003 XJ	CAN, SCP, ISO, ACP*
X350	2004 XJ Onward	CAN, SCP, ISO, D2B
X400	2002–2003 X-TYPE	CAN, SCP, ISO, D2B
X404	2004 Onward X-TYPE	CAN, SCP, ISO, D2B

ACP* 2001 Onwards

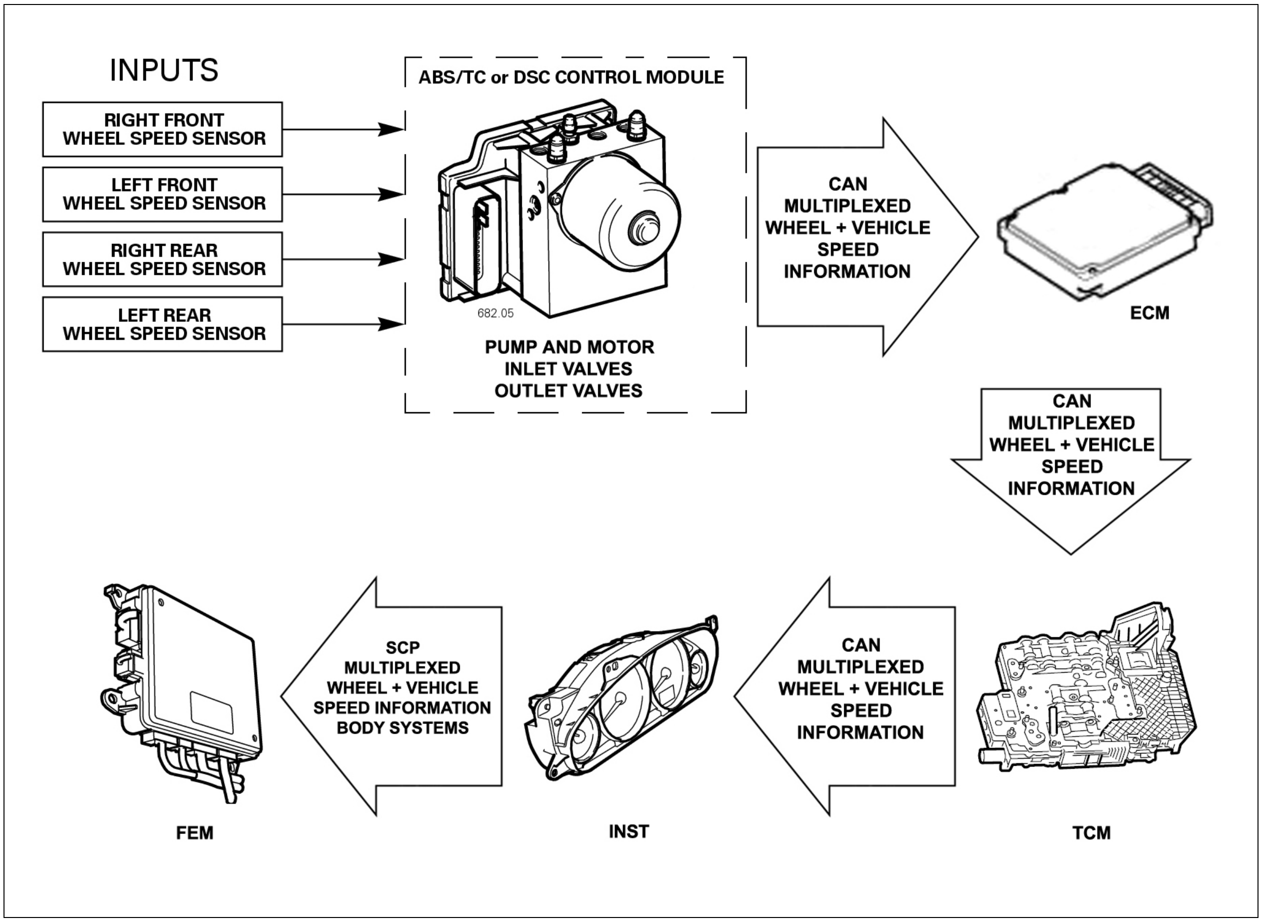


Fig. 1 Network Control Modules Can Share Information

Electronic control modules connected to a network allow controllers to "work together" to coordinate the operation of vehicle systems. This allows for the best operation and provides the ability for many complex vehicle functions.

For example, some networked vehicles with traction control use two control modules to maintain vehicle traction.

- Below a certain speed and engine load the Anti-Lock Braking/Traction Control (ABS/TC) Control Module may prevent wheel spin by pulsing the drive wheel brakes ON and OFF. At the same time the ECM may retard ignition control to reduce engine torque.

However, above that speed and engine load only the ECM will take action to prevent wheel spin by reducing engine torque. This is done by retarding ignition control, controlling fuel injection or reducing throttle angle.

In this system the communication between the two electronic control modules provides the best vehicle operation to prevent wheel spin.

Without a network, ECM and ABS/TC modules require their own sensors to provide this information. Some networks allow input information to be shared by all the modules on the network, eliminating the need to provide individual sensors for each module.

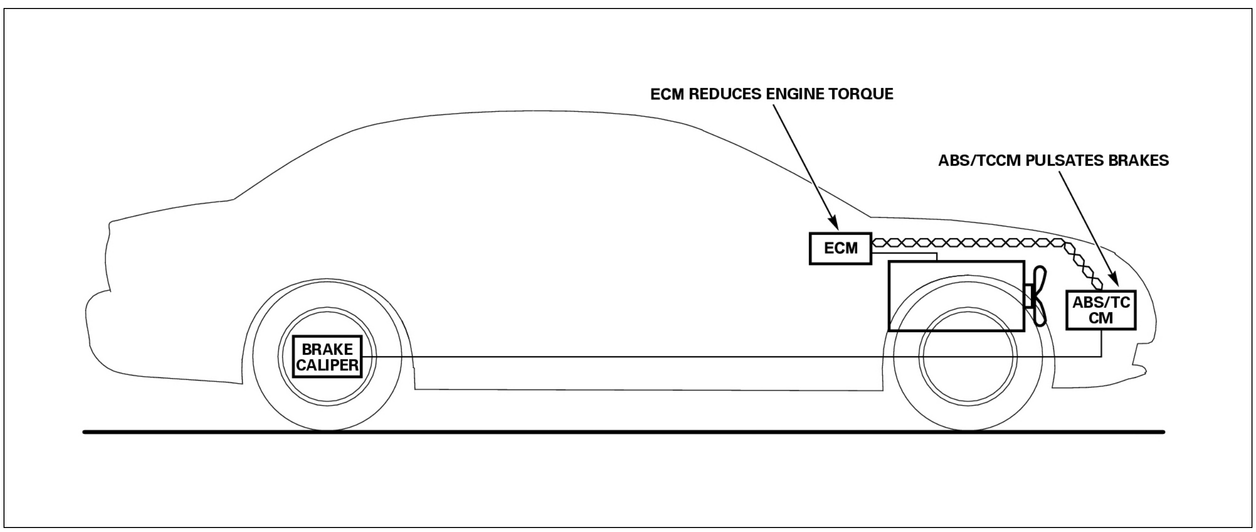


Fig. 2 Complex Functions Using a Network for ABS Operation

MULTIPLEX CONTROLLED FUNCTIONS

Inputs, Processing, Outputs (IPO)

Understanding IPO and how it fits into today's electrical systems will help you decipher and understand systems more easily.

Inputs

Multiplexed control modules use conventional inputs from the sensors or switches that are directly connected to them (hard wired). The control modules also use data message inputs from other control modules connected to the multiplex circuit. For example, the instrument cluster may receive the vehicle speed value from the ABS module via a multiplex circuit.

Processing

Control modules have microprocessors that process data based on inputs received from switches, sensors or other control modules. Inputs are typically hard wired to the closest module in the vehicle. For example, in the X350, the Front Electronic Module (FEM) is generally responsible for components in the front of the vehicle, and the Rear Electronic Module (REM) is responsible for components in the rear of the vehicle. In a similar way, outputs are also typically hard wired to the closest module in the vehicle. This is sometimes called Zonal Partitioning.

Outputs

The control modules output conventional voltage signals (via individual hard wires) to directly control components. For example, vehicles with returnless fuel transmit data messages from the ECM to the fuel pump module to control the fuel pump duty cycle. Control modules also output data messages to the network that are used by other control modules.

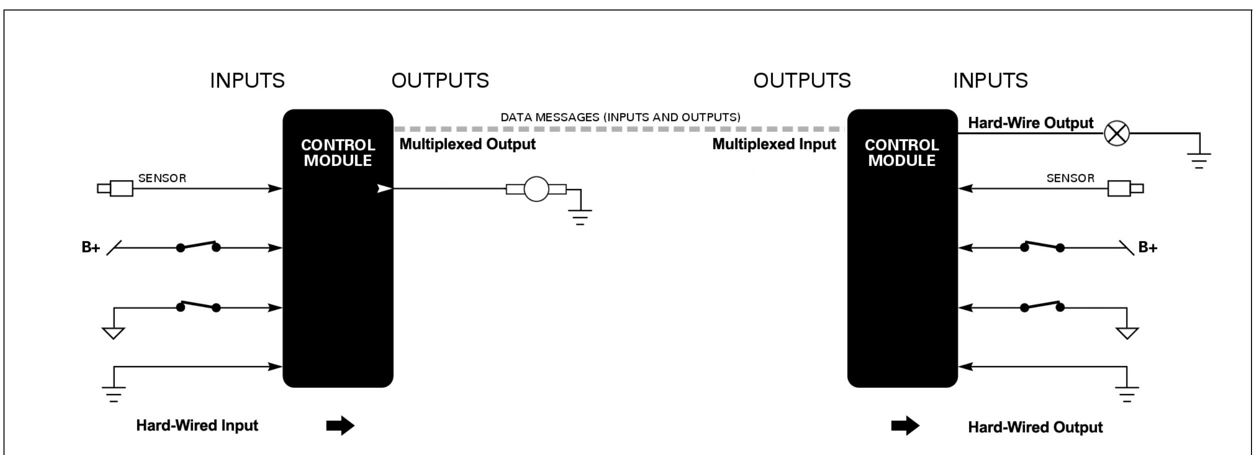


Fig. 3 Examples of Multiplex Inputs and Outputs

Shared Function Control

Because control modules can transmit data messages to each other over the shared network, they can share control functions. One module can activate a function based on inputs received from one or a number of other modules.

To make this point, we will compare a traditional, non-multiplexed signal distribution, the vehicle speed distribution from the X300, to the X308's replacement for that signal's distribution. This comparison will demonstrate the reduction in connectors and wires, as well as the added features allowed by the increased distribution of this signal.

Non-multiplexed Signal Distribution — X300

The circuit diagram demonstrates how a vehicle without multiplexing distributes a vehicle speed signal output using the inputs from the four wheel speed sensors.

The ABS CM transmits one wheel speed sensor signal to the instrument pack to be used as the vehicle speed signal for the speedometer and for distribution to other vehicle systems.

Each of the components receives its vehicle speed input via a separate (hard wired) circuit.

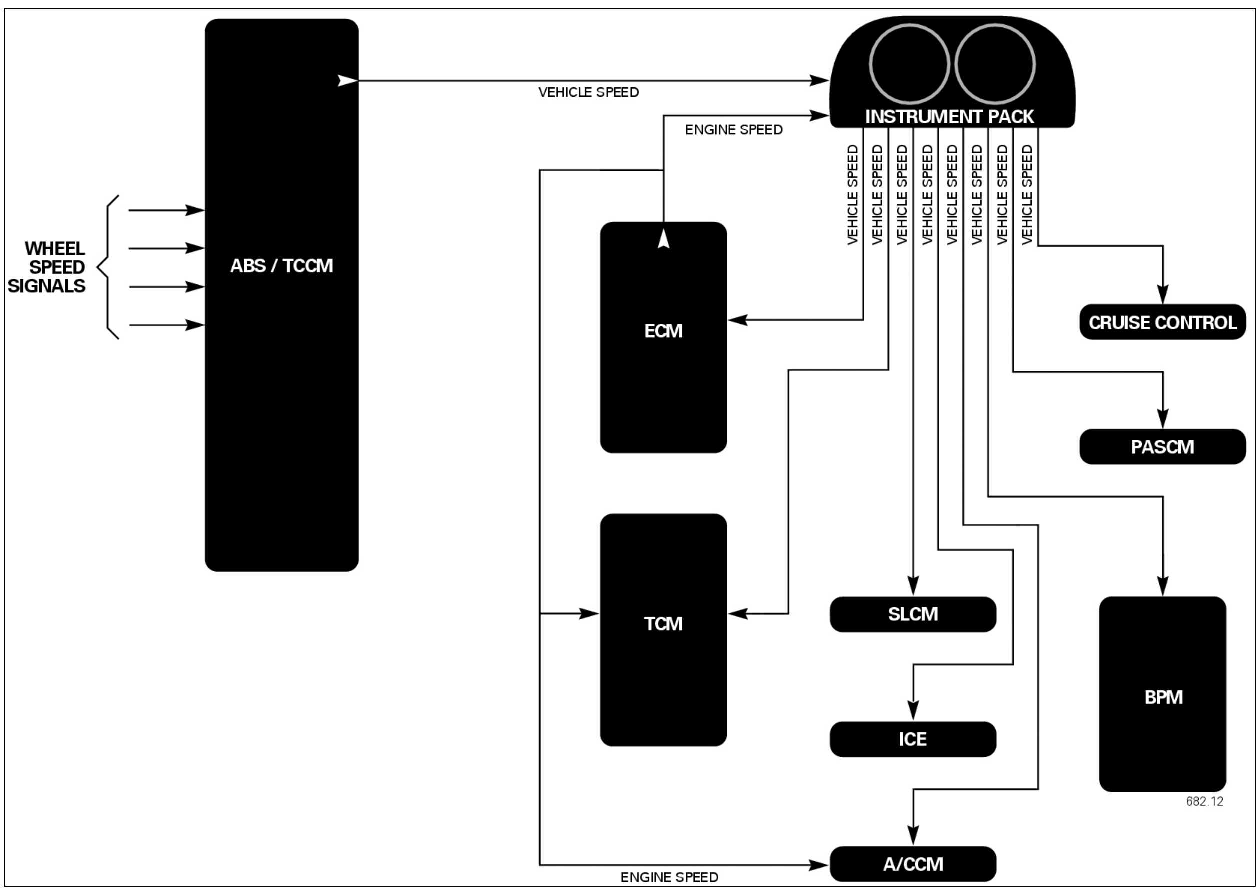


Fig. 4 Non-Multiplexed Wheel and Vehicle Speed Signal Distribution: X300

Table 3 Non-Multiplexed Wheel and Vehicle Speed Signal Function: X300

Control component	Function
INST (instrument pack)	Speedometer
TCM (transmission control module)	Transmission shift control
ICE (radio/cassette head)	ICE volume
A/CCM (air conditioning control module)	Climate control blower speed
ECM (engine control module)	Engine control
PASCM (power assisted steering control module)	Variable assist power steering
SCCM (speed control control module)	Cruise control
BPM (body processor control module)	Wiper speed control
SLCM (security and locking control module)	Locking and security functions

Multiplexed Signal Distribution — X308

The four wheel speed signals are used by the ABS/TCCM to provide anti-lock braking and traction control. The ABS/TCCM communicates data messages on the CAN multiplex network containing data for the four individual wheel speeds and the vehicle speed. The TCM and ECM are connected to the CAN multiplex circuit and use the wheel and vehicle speed data for control of their functions.

The INST (instrument pack) is also connected to the CAN network and converts the vehicle speed data message for use by the speedometer, SCP (body systems) multiplex circuit and non-multiplexed components. All modules connected to the multiplex circuits share the same message data using only the network wiring and connectors. Modules not connected to the networks (ICE, PASCM and A/CCM) receive the vehicle speed signal via separate hard wires.

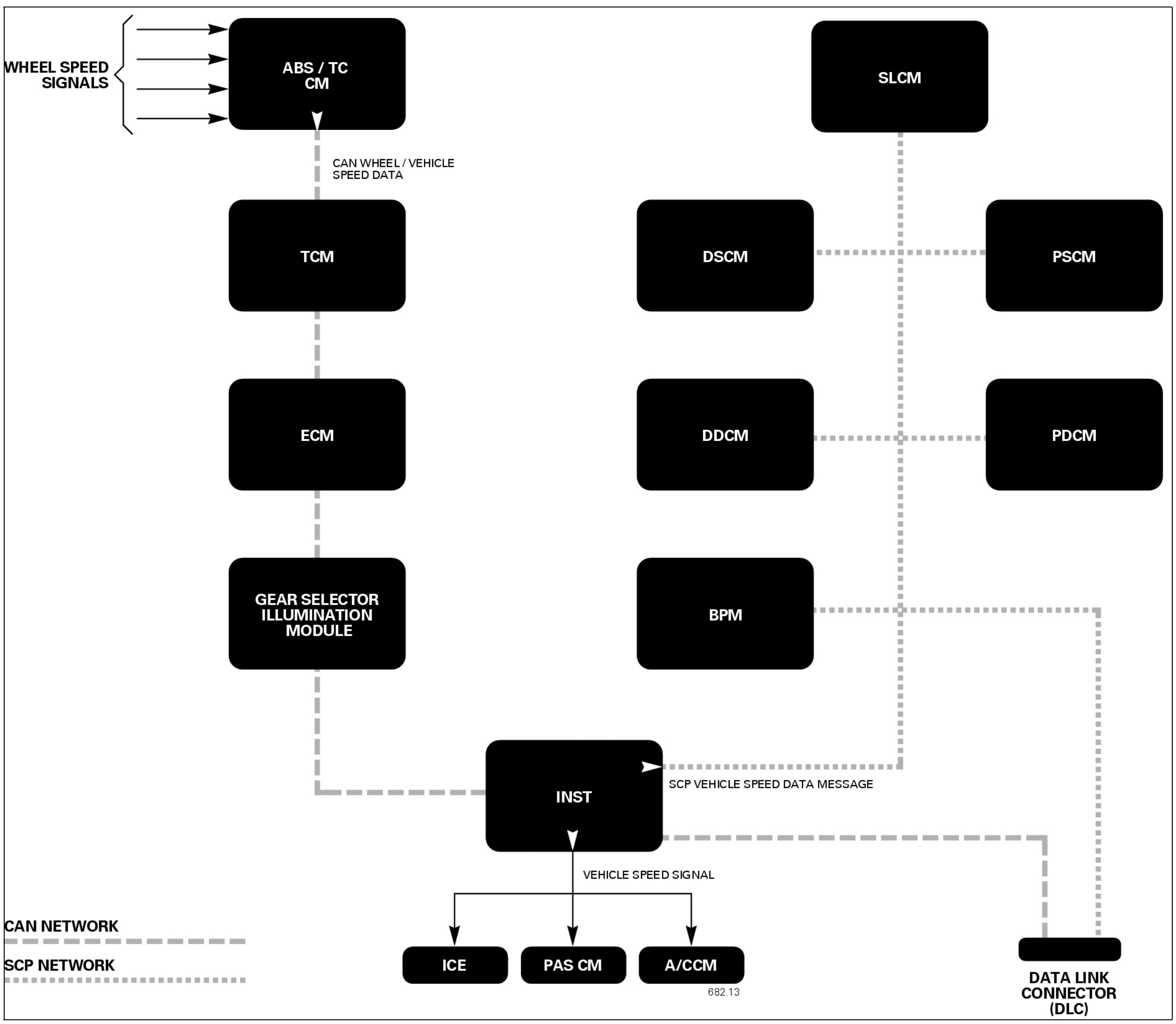


Fig. 5 Multiplexed Wheel and Vehicle Speed Signal Distribution: X308

Table 4 Multiplexed Wheel and Vehicle Speed Signal Function: X308

Control component	Function
TCM (transmission control module)	Transmission shift control
ECM (engine control module)	Engine control, cruise control
INST (instrument pack)	Speedometer
BPM (body processor control module)	Convertible top
SLCM (security and locking control module)	Locking and security functions
ICE (radio/cassette head)	ICE volume
A/CCM (air conditioning control module)	Climate control blower speed
PASCM (power steering control module)	Variable assist power steering

Multiplex Controlled Fuel Filler Flap Circuit — X100

The following example demonstrates an increase in functionality over a traditional, direct wired circuit. In the circuit shown below, a ground input from the fuel filler flap release switch triggers the body processor module to broadcast an open fuel filler flap data message on the SCP multiplex network. In response to the data message, the security and locking control module (the closest module to the filler flap) may output a voltage to activate the filler flap release solenoid.

If other data messages on the network indicate that the engine is running or the security system is armed, however, the vehicle is either locked then the open fuel filler flap data message is inhibited. With this multiplexed system, security control is applied to the fuel filler door without an added relay or hard input from the door locking system.

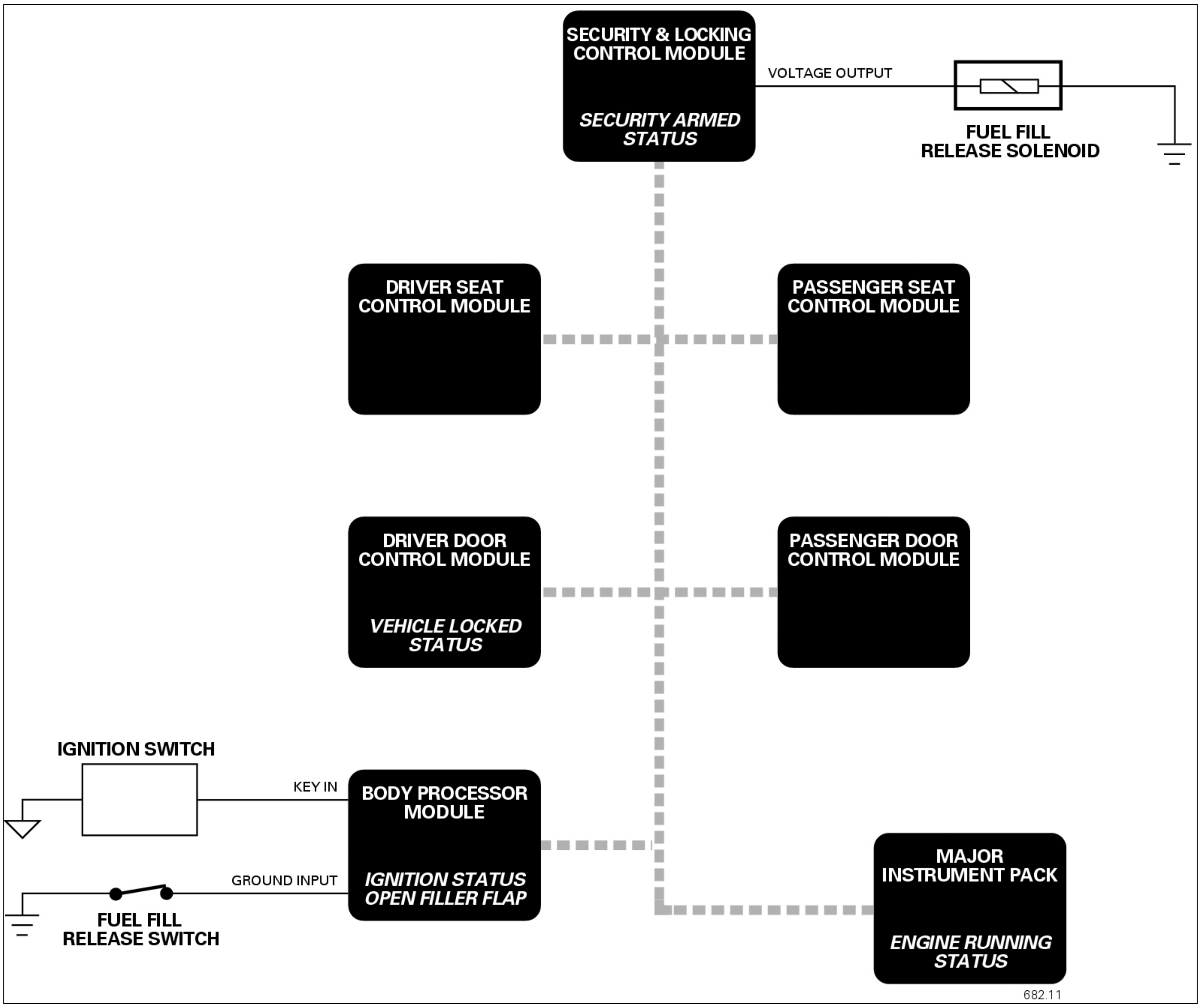


Fig. 6 Multiplex Controlled Fuel Filler Flap: X100

MULTIPLEX NETWORKS

Communication Protocols

Current Jaguar models use multiplex networks consisting of separate circuits (buses) that operate at different speeds and communicate using different protocols (languages).

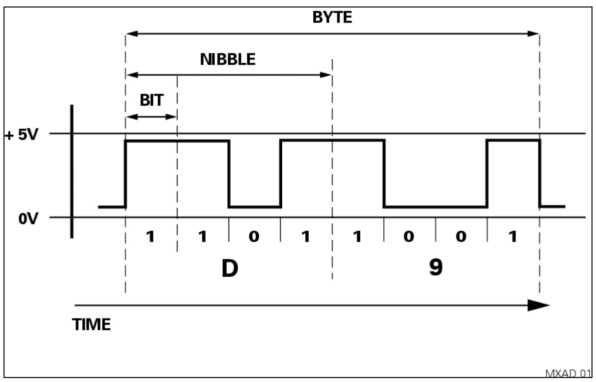


Fig. 7 Typical Binary Code Data Voltage

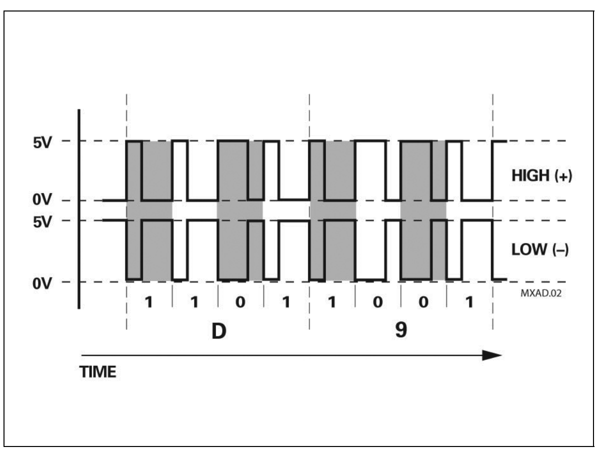


Fig. 8 Typical Binary Code Data Voltage on Multiplex Bus

Automotive Multiplex System Classification

Multiplex systems are classified as follows:

- Class A transmits up to 10,000 bits of data per second (10 K baud)
- Class B transmits up to 125,000 bits of data per second (10 – 125 K baud)
- Class C transmits over 125,000 bits of data per second (125 K baud)
- Digital data networks transmits over 5.6 million bits of data per second (5.6 M baud)

Table 5 Communication Speed Summary for Jaguar Networks

System	Class	Speed	Comm. between
CAN — Controller Area Network	C	500 K baud	Engine, Transmission, Braking System
SCP — Serial Corporate Protocol network	B	41.6 K baud	Lower Speed Body Systems
Serial Data Link (ISO 9141)	B	10.4 K baud	Diagnostic connector and ECM; control modules with self-diagnostic capability not connected to CAN or SCP
D2B — Digital Bus network	N/A	5.6 M baud	ICE
ACP — Audio Control Protocol network	A	9.6 K baud	Audio System

Serial Communications

Additional serial communications circuits allow WDS diagnosis of non-multiplexed control modules via the DLC (Data Link Connector). The additional serial communication links perform the same function as on previous models. The links are often referred to as ISO (International Standards Organization) links because they conform to the ISO 9141 standard and the SAE (Society of Automotive Engineers) standard J1978, thereby allowing communication with non-proprietary (non-OEM) diagnostic tools.

Data Messages

Data messages are binary code values transmitted as a series of timed voltage signals on the multiplex bus. Each binary code 1 or 0 is called a bit. Four binary code data bits (called a nibble) make up one character. Eight data bits (called a byte) make up two characters.

Jaguar uses a “time divided” multiplex system that distinguishes the serial bits of binary code (1’s and 0’s) by the amount of time that the signal is high or low.

Data Message Transmission

Binary code values can be converted by a decimal or hexadecimal decoding system so they can be understood as alpha or numeric characters.

Table 6

Binary	Decimal	Hexadecimal	Binary	Decimal	Hexadecimal
0000	0	0	1000	8	8
0001	1	1	1001	9	9
0010	2	2	1010	10	A
0011	3	3	1011	11	B
0100	4	4	1100	12	C
0101	5	5	1101	13	D
0110	6	6	1110	14	E
0111	7	7	1111	15	F

The binary code byte 11011001 translates as D9 when hexadecimal decoded or the number 139 when decimal decoded.

Multiplexed Control System Harness

On current production vehicles, the major control modules connect to one of two multiplex electrical circuits. One multiplex circuit (CAN network) typically provides communication between the power train system modules. The second multiplex circuit (SCP network) typically provides communication between the body systems control modules. Both networks connect to the major instrument cluster (INST), which allows communication of certain data between the CAN and SCP networks.

CAN Powertrain Multiplex Harness

The control modules for the engine, transmission and braking systems connect to each other with a two wire “twisted pair” multiplex circuit. The multiplex circuit allows the control modules to share data and systems control responsibility via “real time” high speed data communication. Sensors “owned” by each module and components directly controlled by the module connect with conventional “hard wired” circuits.

SCP Body Systems Multiplex Harness

The vehicle body systems control modules are similarly connected, utilizing a separate “twisted pair” multiplex circuit allowing the modules to share data and zoned component control responsibilities via multiplex data communication.

D2B Harness

The D2B Network harness is comprised of a 3.5 mm (0.138 in.) diameter Black Optical Fiber (BOF), plastic tubing internally lined with a 1 mm (0.039 in.) polymer fiber core. The D2B bus is a unidirectional ring with two “lines”, one acting as an input and the other as the output, to complete the communication ring needed to successfully control all ICE modules or “nodes” on the vehicle.

CAUTION:

Multiplex harnesses require special repair procedures. Refer to the applicable Service Literature for special tools and procedures.

CAN (CONTROLLER AREA NETWORK)

The CAN bus is two standard 0.5 mm (0.020 in.) copper wires twisted as a pair, with 40 twists per meter (approx. one twist per inch). One wire of the pair is designated as CAN High (+) and the other is designated as CAN Low (–). Although CAN appears wired as a series circuit, it is parallel because of internal module wiring. However, a fault in the internal wiring or connector can stop the network from communicating across the fault. But, each module will still continue to control its own functions by substituting default information for any missing data messages. Refer to the Electrical Guide Appendix pages for individual module messages.

CAN is called "real time" communication because its speed allows extremely fast response time for controlling time critical operations.

The following X308 control modules communicate directly through the CAN network:

- Anti-lock braking/traction control module (ABS/TCCM)
- Engine control module (ECM)
- Transmission control module (TCM)
- Gear selector illumination module – does not transmit, used only for gear selector position illumination
- Instrument pack (INST)

The CAN network is also connected to the DLC (data link connector) for diagnostics.

CAN does not communicate directly with SCP. However, the INST converts specific message data allowing communication between networks.

Most modules can have fail-safe default modes in the event of a network failure.

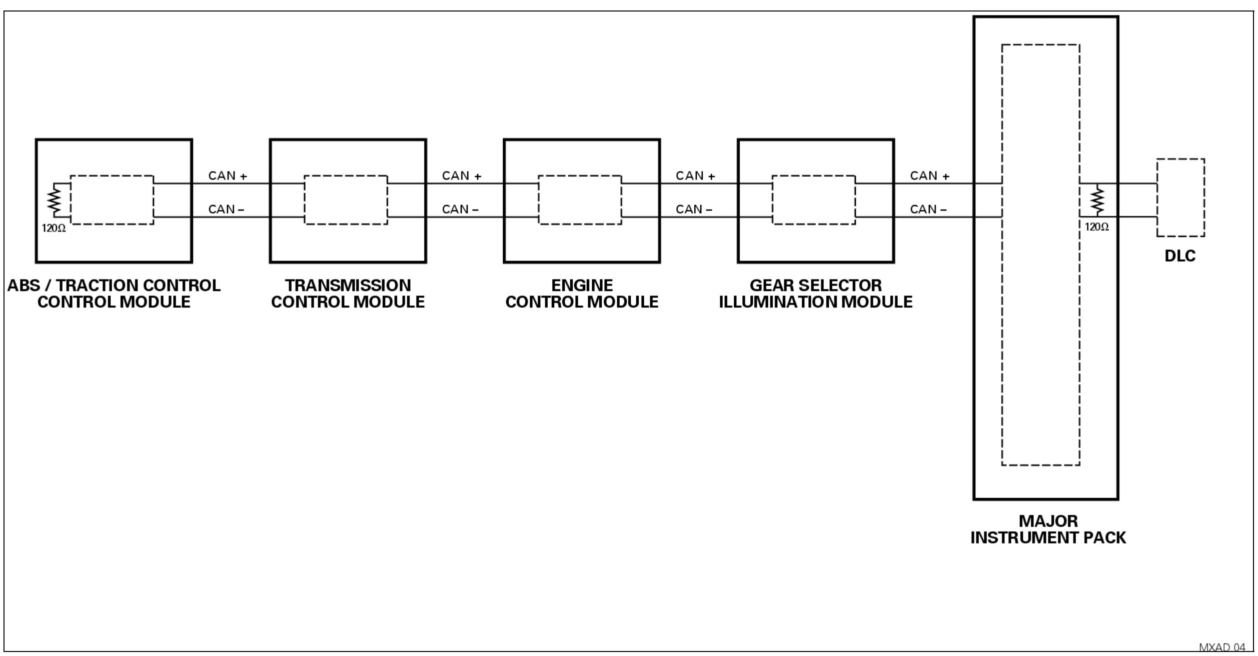


Fig. 9 Typical CAN Multiplex Circuit Layout: X308

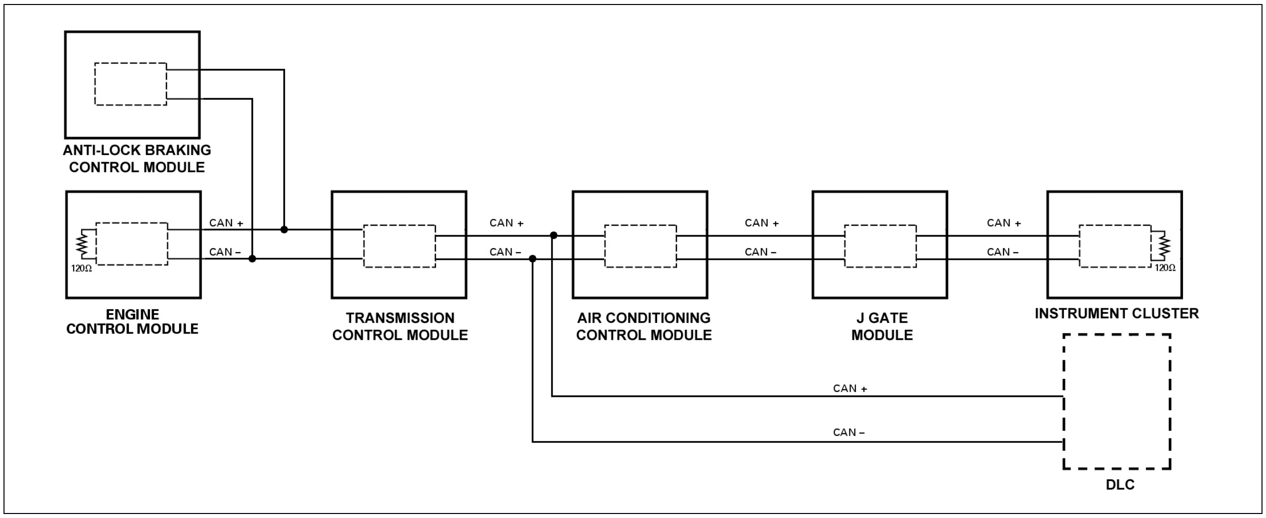


Fig. 10 Typical CAN Multiplex Circuit Layout: X400

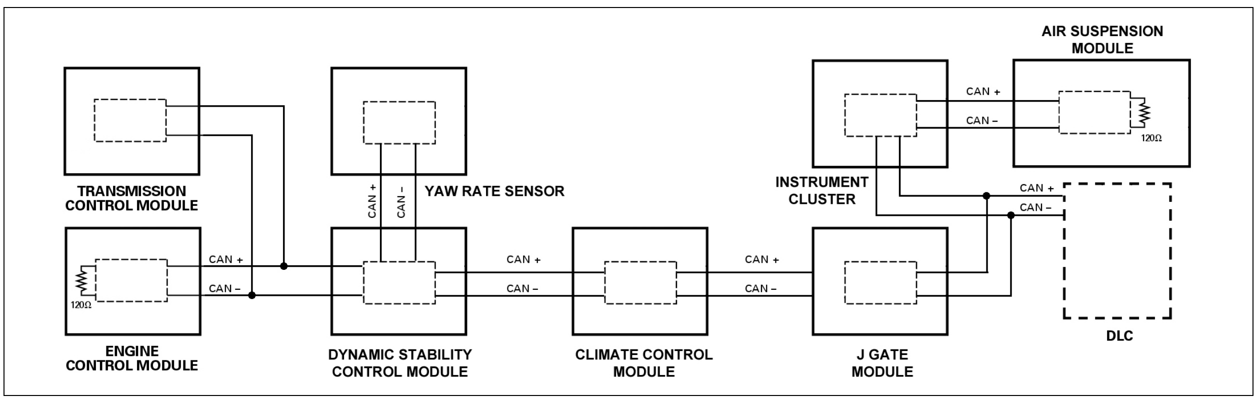


Fig. 11 Typical CAN Multiplex Circuit Layout: X350

CAN Data Message Frames

CAN data message frames generally contain more data than SCP message frames. CAN message frames are transmitted at intervals of from 4 to 20 ms. depending on the message. The data is available to all modules but is only “used” by those modules that require it.

Each CAN module transmits three types of data message frames.

- Token data message frames (cyclical transmission) – The token message tells the network that the module is “alive.”
- Diagnostic data message frames (request transmission) – The diagnostic message is a response to a WDS request for specific diagnostic information.
- Vehicle operation data message frames (cyclical transmission) – The vehicle operation message contains the vehicle operational information from the module.

Modules transmit more than one vehicle operation data frame because the amount of data from the module exceeds the capacity of a single data frame. The ID (identification) field of each CAN message frame not only identifies the transmitting module, it also identifies the type of data and its precise location within the frame’s data message field.

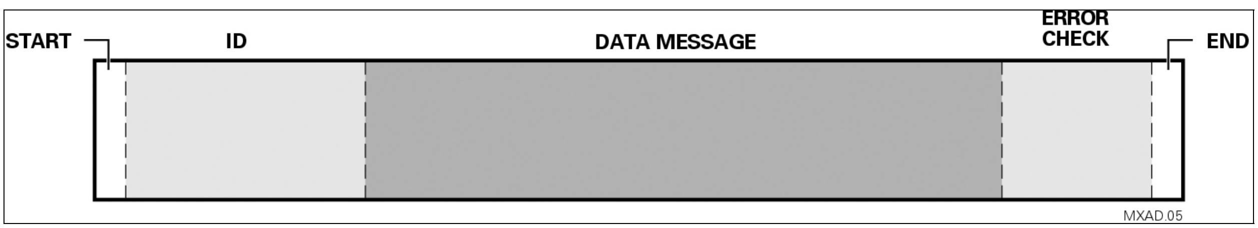


Fig. 12 Typical CAN Data Message Frame

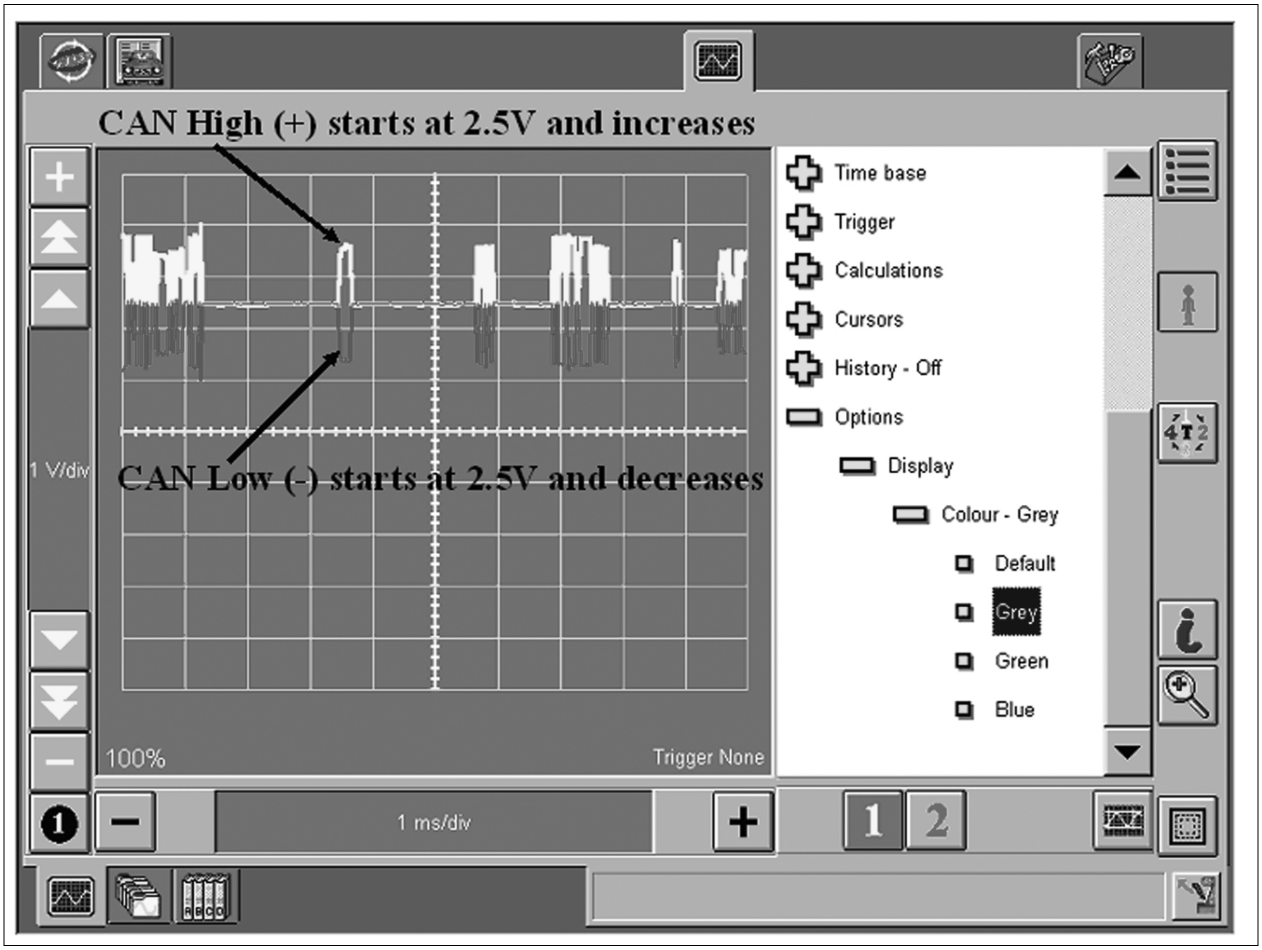


Fig. 13 CAN Oscilloscope Pattern On WDS

CSMA and Non-Destructive Arbitration

The protocols use Carrier Sense Multiple Access (CSMA). Each control module has the intelligence to monitor each bit on the line and detect when it is an "idle" condition and when it may try to transmit on the bus. However, more than one control module may try to communicate at the same time, and there are various mechanisms to detect and control this. A popular one is the Non-Destructive Arbitration (NDA) system. In this example, a "0" is Dominant and a "1" is Recessive. A Dominant "0" always wins over a Recessive "1" . In Non-Return to Zero (NRZ), bit synchronization is restored using the bit stuffing technique.

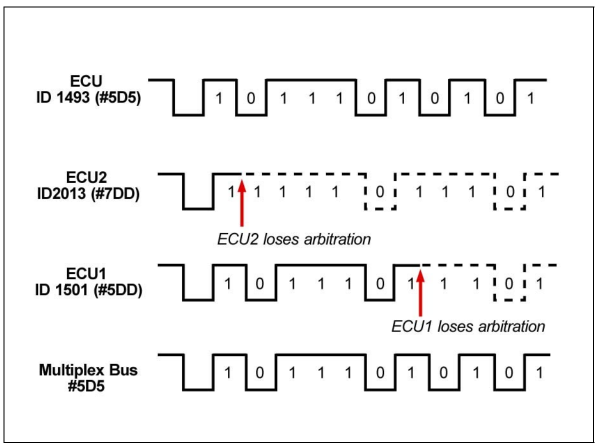


Fig. 14 CSMA

CAN NETWORK DIAGNOSTICS USING WDS

WDS automatically tests the network integrity and communications before running specific diagnostic routines. First, WDS establishes communication with the vehicle via the DLC and begins its automatic test sequence. Once network integrity and communications are both confirmed, WDS begins the specific diagnostic routine. If the network communications and integrity test is failed, WDS directs the user to an appropriate test from the CAN network menu.

CAN Network Failure Modes

The WDS diagnostic routine tests the network wiring but will not pin point an individual module failure. If a network failure is established using WDS, then pin point the fault using the following information and a DVOM.

An open circuit in both the CAN high (+) AND the CAN low (-) wires will stop communications at the open circuit. Modules on either side of the open circuit will continue to communicate with modules on the same side of the open circuit but no data will be cross the open circuit. Modules will continue to operate by substituting default values for the missing data.

CAN modules will communicate only when the CAN high (+) and CAN low (-) are in an acceptable electrical state. The following shows communication possibilities depending on the electrical state of each wire. If all communication is lost on the CAN bus, the modules will continue to function but will substitute default values for any missing data.

Table 7 CAN Network Failure Modes

Wire	Condition	Communication
CAN high (+)	open circuit	NO
CAN high (+)	short circuit to ground	NO
CAN high (+)	short circuit to B+ voltage	NO
CAN high (+)	short circuit to CAN low (-)	NO
CAN low (-)	open circuit	YES (if CAN high (+) is functioning)
CAN low (-)	short circuit to ground	YES (if CAN high (+) is functioning)
CAN low (-)	short circuit to B+ voltage	NO

SCP (STANDARD CORPORATE PROTOCOL) NETWORK

SCP Overview

The SCP bus is two standard 0.5 mm (0.020 in.) copper wires twisted together with 40 twists per meter (approximately one twist per inch). One wire in the bus is designated as SCP high (+) and the other is designated as SCP low (-). The network is wired as a "star" circuit. This method of wiring keeps the network bus as short as possible and allows the rest of the system to continue communication should one module fail. Bus integrity is maintained by using the vehicle speed data message as a "keep alive" signal. If a module does not receive the "keep alive" message, the module assumes a fault and takes itself off line.

During normal operation SCP networks allow the electronic control modules linked to the network to exchange information directly with each other. For example, on X200, the Powertrain Control Module (PCM) supplies the A/CCM with engine temperature information. This allows the A/CCM to consider engine temperature when activating the heater blower motor.

Input data that is received by one control module can also be broadcast to any other module through the data bus. An example of this is the X350 Anti-Lock Brake System/Traction Control Module broadcasting vehicle speed to both the ECM, for engine operation strategy, and to the air suspension module, which uses the information to set correct ride height and firmness for changing driving conditions.

A module may also request information from another module on the network. For example, the ECM requests an all-clear message from the Passive Anti-Theft System (PATS) module before allowing the engine to run.

SCP Data Message Frames

Each SCP data message frame is a complete message unit communicating only the data for one action. Messages on the bus are available to all of the modules connected to the bus but are only "used" by a module if required. There are three general types of SCP data messages:

Cyclical messages

Cyclical messages are transmitted on the bus at specified intervals. VEHICLE SPEED, ENGINE RUNNING and CHARGING OK are examples of three separate cyclical messages that are transmitted by the INST at least every 150 ms.

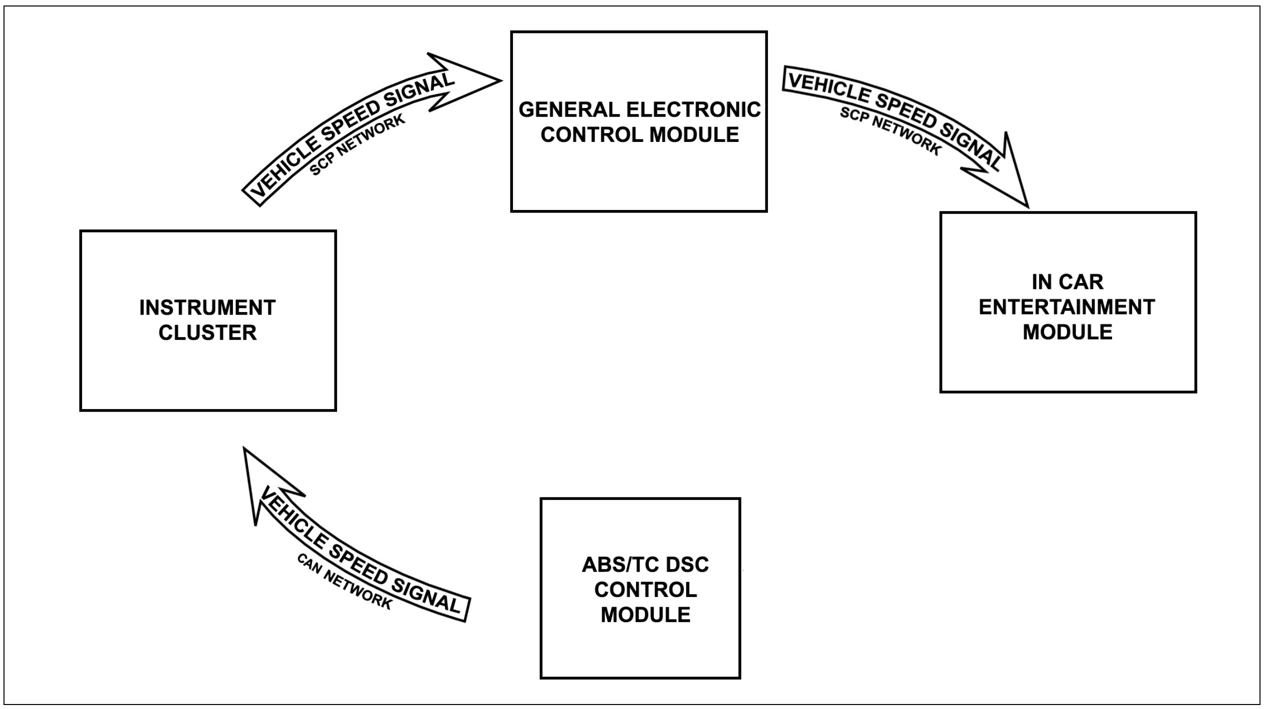


Fig. 15 Typical Cyclical Messages: X400

Event messages

Event messages are sent either once or for a specified number of times when something specific happens. For example, on X100 series and X308, KEY IN IGNITION is a message sent by the BPM. The message is transmitted when the key is put into the ignition switch.

When the key is withdrawn from the switch, KEY NOT IN IGNITION is sent by the BPM. Event messages are often used to “toggle” a function ON and OFF through other modules.

Periodic Event Messages

Periodic event messages are broadcast repeatedly only until a particular result is achieved. For example, during traction control operation, the ABS/TC control module may request a reduction in engine torque. The control module will continue to broadcast this request until it receives the message that the engine torque has been reduced.

Modules on the SCP network are connected with pairs of twisted wires, similar to previous Jaguar vehicles. Some vehicles had portions of the network wires shielded to prevent interference. The primary wire colors are slate (+) and blue (-).

The network will remain operational if one of the bus wires is open circuit, short circuit to ground or short circuit to B+ voltage. In addition, the network will remain operational if some, but not all, control module termination resistors have failed.

Request messages

Request messages ask for a specific piece of data. An example of a request message on an X308 is REQUEST KEY-IN STATUS sent by the SLCM, DDCM or PDCM. The BPM then responds with a key status message – either KEY IN IGNITION or KEY NOT IN IGNITION .

The above request also occurs on X200, X202, X350, X400, and X404, except that the broadcasting module is INST, not BPM.

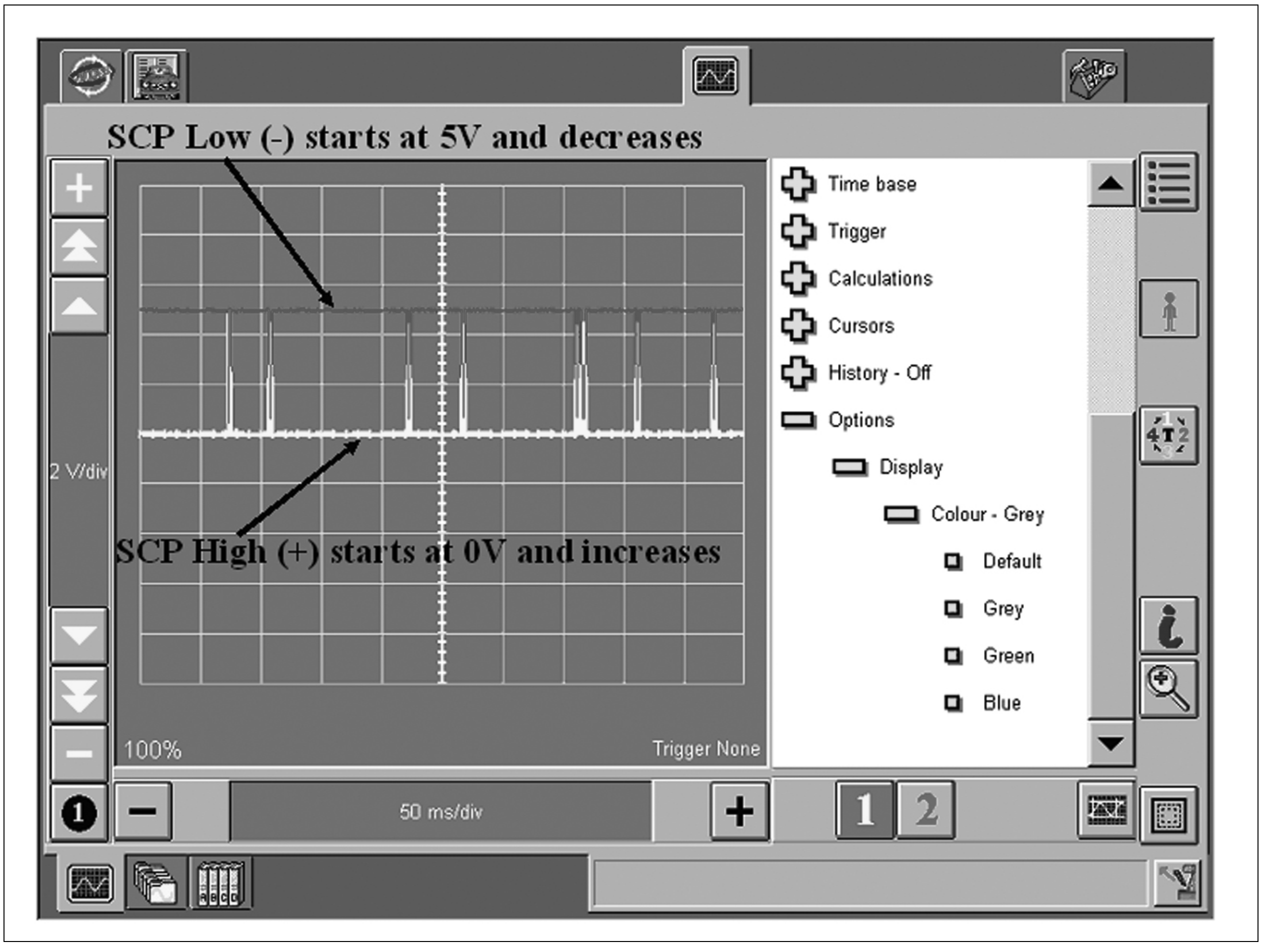


Fig. 16 SCP Oscilloscope Pattern on WDS

Network Protocol

Standard Corporate Protocol (SCP) enables the network to communicate using electric signals over a data bus. The wires in this data bus are twisted to help resist electromagnetic interference.

- The data bus wires are designed Bus + and Bus – .
- Electrical impulses vary between 5.0 volts and zero volts to represent a digital logic “1” or “0”.
- When there are no messages, Bus – is 5.0 volts and Bus + is zero volts.
- When messages are being sent, the readings are reversed.
- Data bus wires are usually identified in an Electrical Guide wiring diagram as circuits SCP (+) and SCP (-).

NOTE: Wires are not always shown as twisted pair in schematics.

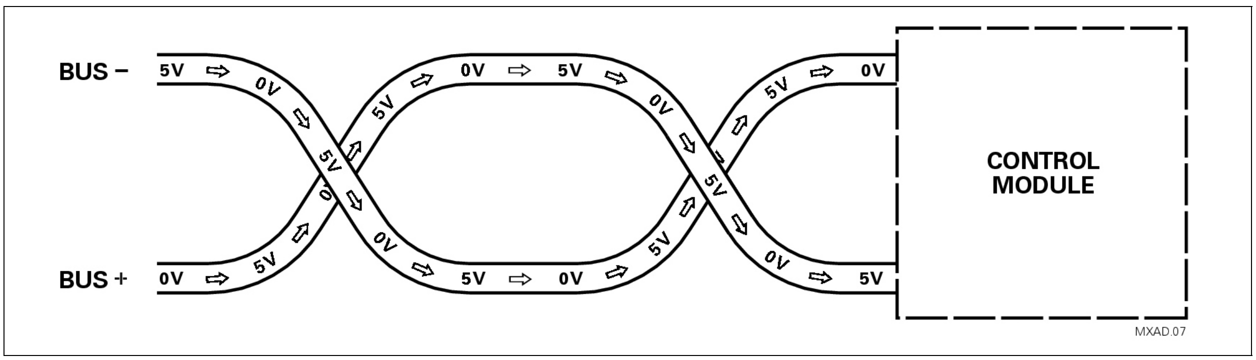


Fig. 17 SCP Data Transmission

SCP NETWORK TROUBLESHOOTING

SCP Network Diagnostics using WDS

When WDS is used for diagnostics, it automatically tests network integrity and communications before running specific diagnostic routines.

Network integrity and communications tests

WDS tests the CAN and SCP networks separately, indicating the status while testing. CAN is tested first followed by SCP. Test procedures for CAN and SCP follow similar routines. Each network is tested with the ignition OFF, then with the ignition ON. Each module is tested in a sequence that may vary depending on the diagnostic software version. Watch the WDS screen during testing. If WDS fails the network, the communications problem is with the last module shown on the WDS screen.

With the ignition OFF, WDS transmits a "request for identification" message to the first module. If module response is correct, the next module on the network is tested. If module response is missing or incorrect, the test is failed and WDS terminates diagnostics directing the user to an appropriate specific test routine. When all modules have passed, WDS switches the ignition ON and WDS transmits a vehicle speed signal to the ECM. The ECM transmits a CAN vehicle speed message, which is also the module "wake up" call. Each module should respond with an "I'm awake" message. If WDS does not recognize an "I'm awake" message from each module, the test is failed and WDS terminates diagnostics directing the user to an appropriate specific test routine. Because the INST translates the CAN message and transmits it to the SCP modules, the same procedure is used for the SCP network test. When all tests are passed, WDS begins the user specified diagnostic routines.

SCP Network Failure Modes

The WDS diagnostic routine tests the network wiring but will not pinpoint an individual module failure. If a network failure is established by WDS, then pinpoint the fault by using the following information and a DVOM.

An open circuit or a short circuit in an SCP high (+) OR an SCP low (-) wire will not stop communication. Data will still be communicated over the remaining wire using the chassis as ground. However, some data errors may occur.

An open circuit in both the SCP high (+) AND the SCP low (-) wires will stop communication at the open circuit. Modules on either side of the open circuit will continue to communicate with modules on the same side, but no data will cross the open circuit.

SCP modules will communicate only when the SCP high (+) and the SCP (-) circuits are in an acceptable electrical state. The following shows communication possibilities depending on the electrical state of each wire.

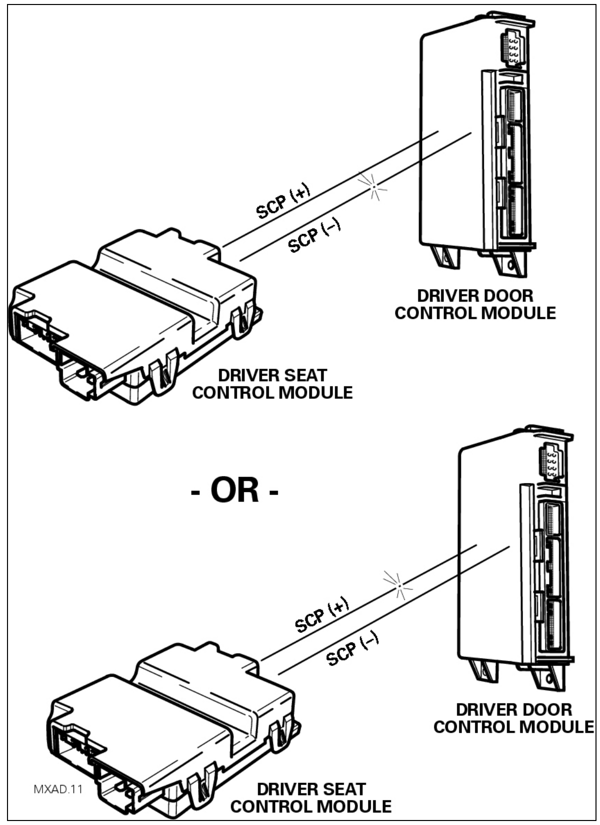


Fig. 18 No Customer Concern, but Network Diagnostic Capability May be affected

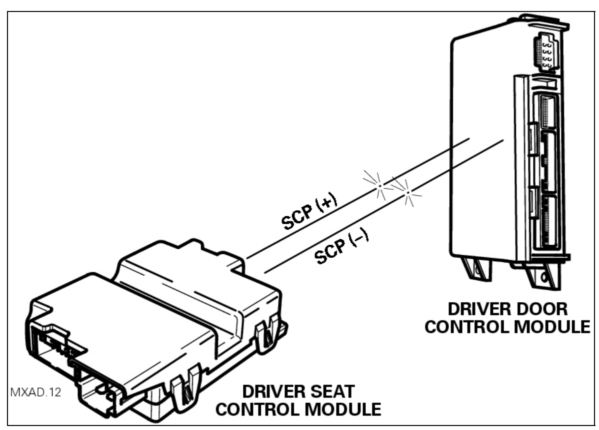


Fig. 19 One Section of Network Not Functional to Module

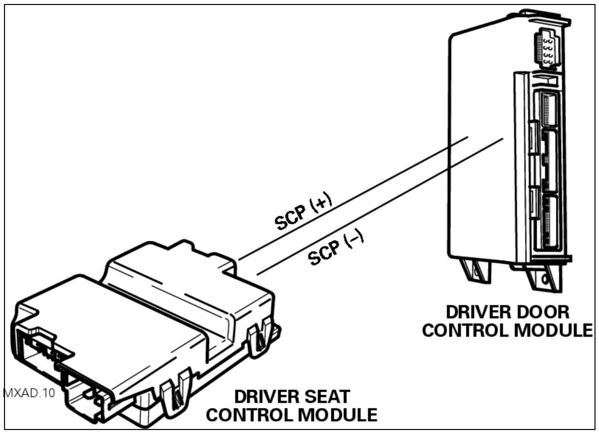


Fig. 20 Network 100% Functional

Table 8 SCP Network Failure Modes

Wire	Condition	Communication
SCP high (+) OR SCP low (-)	open circuit	YES (if other SCP circuit is functioning)
SCP high (+) OR SCP low (-)	short circuit to ground	YES (if other SCP circuit is functioning)
SCP high (+) OR SCP low (-)	short circuit to B+ voltage	YES (if other SCP circuit is functioning)
SCP high (+) AND SCP low (-)	short circuit to ground	NO
SCP high (+)	short circuit to SCP low (-)	YES (unless one is also short circuit to ground)

SCP Network Communications Function Check

The following procedure confirms that data message communication is possible between all of the control modules connected to the SCP bus without using WDS.

- With the doors and windows closed, lock the vehicle using the key.
- Using the key, unlock the vehicle and hold the key in the unlocked position (global open). X100 series: If both doors unlock, all windows open, and if equipped, the convertible top opens, data messages were communicated between the DDCM, PDCM, BPM and SLCM. X350: If all doors unlock and all windows open, data messages were communicated between the DDCM, DRDCM, PDCM, PRDCM, BPM and SLCM.

SERIAL DATA LINK (ISO 9141)

ISO 9141 Network

This is the diagnostic communication network used to allow diagnostic communication between systems that are not directly connected to either the CAN or the SCP network.

The exception to this is the ECM which is connected to the CAN and the ISO 9141 bus.

The following control modules are connected to the ISO 9141 bus:

- Engine Control Module (ECM)
- Restraint Control Module
- Headlamp Leveling Modules
- Reverse Parking Aid Module

Data Link Connector (DLC)

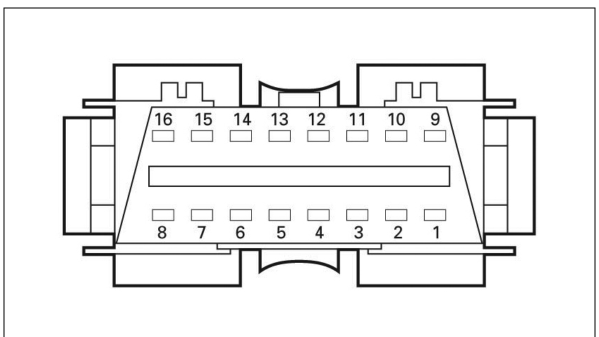


Fig. 21 Data Link Connector (DLC)

Both the CAN and SCP busses are directly connected to the DLC. WDS contains hardware and software that allows it to function as a “node,” an additional module added to networks. The software and hardware supports direct communications between WDS and the networks for diagnostics and module programming. In addition, WDS communicates via the DLC with non-multiplexed modules using a Serial Data Link (ISO 9141).

Generic scan tools access the legislated OBD II DTCs and freeze frame information in the ECM via DLC pins 7 and 15.

A Serial Data Link (ISO 9141) is provided for diagnostic purposes. The Serial Data Link only allows communication, through the network's single wire data bus, between the WDS and modules on the network. This communication will only occur when it is initiated by WDS. There is no module-to-module communication on a Serial Data Link.

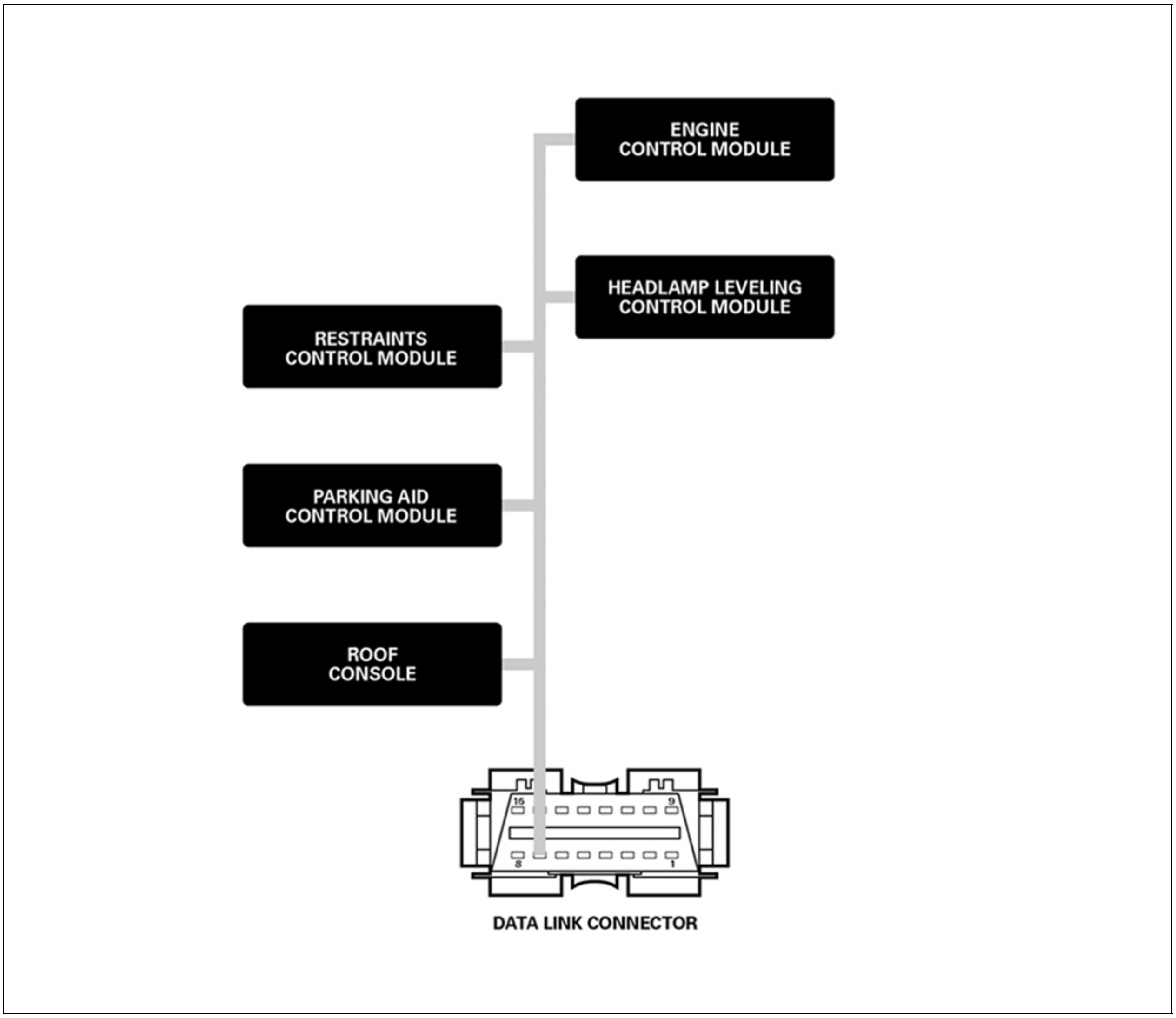


Fig. 22 Single Wire Communication on Serial Data Link

Network Activation

In order to activate the Serial Data Link, WDS must be connected to the 16-pin data link connector (DLC). Once this is done, WDS can communicate on the network. This allows WDS to perform several functions:

- Access and display DTCs.
- Access Parameter Identification Data (PID).
- Initiate active commands (Output State Control).
- Test network communication.

Both continuous and on-demand DTCs are retrieved from one control module at a time.

Network Protocol

The Serial Data Link (ISO 9141) uses unique protocol (language) for communication. Serial Data Link protocol consists of electrical pulses. Messages are converted digitally to “1” or “0” depending upon the voltage level of the message signal. A signal of more than 70% of battery voltage is interpreted by the control module as a logic “1”. A signal of less than 30% of battery voltage is interpreted as a logic “0”.

NOTE:

The Serial Data Link has a relatively slow protocol speed. Because of this, momentary changes in Input or Output (I/O) states may not be seen on WDS while performing diagnostics. When performing diagnostics on the Serial Data Link, allow time for WDS to display changes in I/O state.

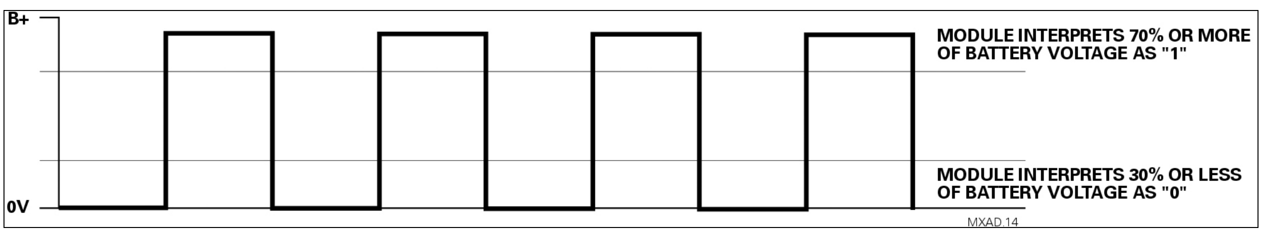


Fig. 23 Network Protocol

ACP NETWORK

Introduction

The Audio Control Protocol (ACP) network is used on X100 series, X308, X200 models.

This network consists of the Radio Head Unit, acting as the control module, and various other audio system-related modules. These modules are connected by a twisted pair data bus.

Operation

The Radio Head Unit communicates with other network modules by sending and/or receiving electronic messages on the data bus. The ACP data bus consists of a pair of wires twisted to help prevent electromagnetic interference.

NOTE:

Be aware that unlike the SCP network, if either of the data bus wires are open or shorted, the ACP network will not operate.

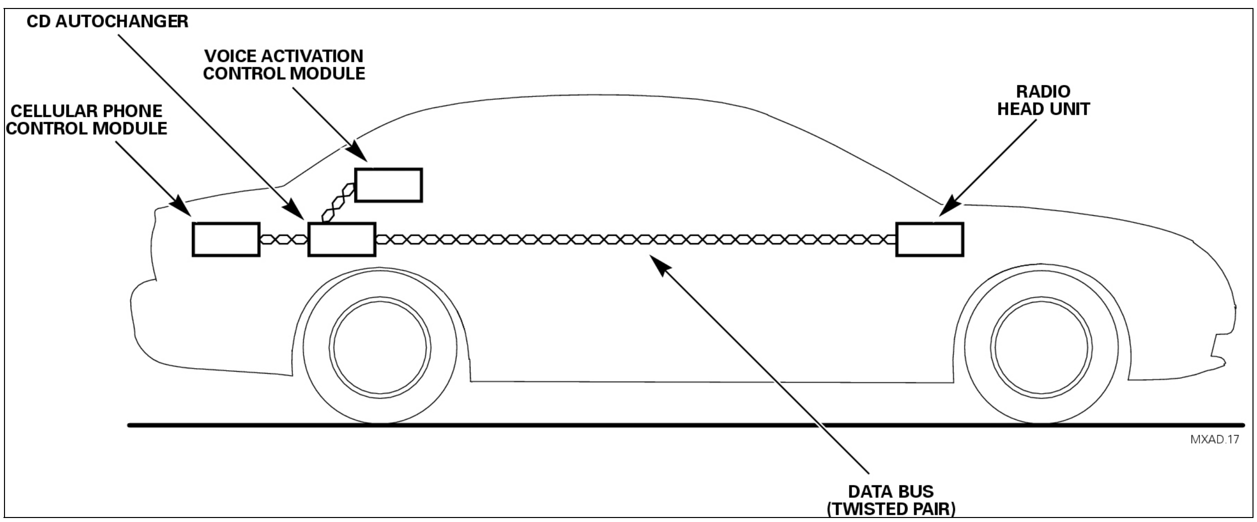


Fig. 24 ACP Network Components: X200

D2B OPTICAL NETWORK

The D2B optical network is based on distributed devices such as head units, CD players, speech control units, telephones, navigation voice guidance (but not map video). D2B enables complex and distributed functionalities, minimizes electromagnetic interference (EMI) problems, decreases weight and cost to the harness, and achieves a high data rate of up to 5.6 Mb/sec.

D2B optical network is a synchronous bus with a ring structure in which two devices each build an optical point-to-point link to the closed ring. The head unit serves as a network master and each D2B device is equipped with a network transceiver chip that serves the physical layer.

The optical cabling to interconnect all network devices inside the vehicle consists of Black Optic Fiber (BOF).

The fiber comprises a 1 mm (0.039 in.) diameter polymer core with a 3.5 mm (0.138 in.) diameter outer protective jacket.

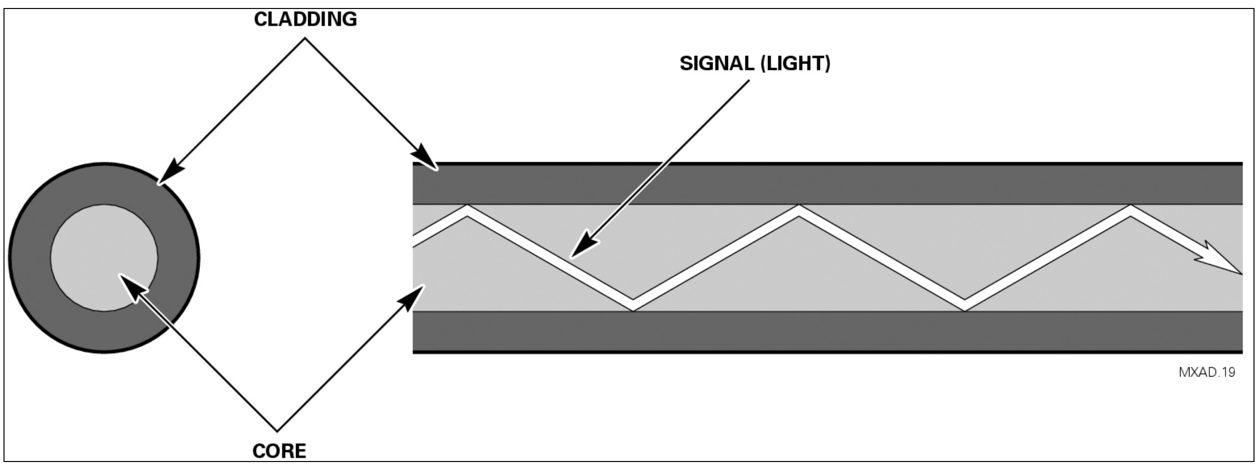


Fig. 25 Fiber Optic Cable

In these cables, measurement data and switching signals can travel at nearly the speed of light. Consequently, nodes connected to the “D2B” ring network can transfer much larger amounts of data in a shorter time than in the CAN bus: up to 5.6 million bits are transmitted per second in the fiber optic cable, representing a transmission rate some 60 times faster than CAN. The fiber optic cable therefore carries many more information units in a comparable time, so that even the data of a music CD can be transferred with perfect sound quality.

Optical fiber is composed of microscopic strands of glass. The fiber optic strands of glass are enclosed inside protective sleeves. The sleeves consist of several layers of material, including Kevlar, the same material used in bullet-proof jackets.

In fiber optics, data is converted to light impulses using a transmitter/receiver. The light impulse signal travels to another location where another transmitter/receiver converts the light impulses back to data. Its advantages include the ability to transmit data over long distances, low error rates, lightning protection, immunity to radio frequency interference and ease of installation. It also does not carry current, which means it’s not dangerous to touch or short, unlike live electric wires.

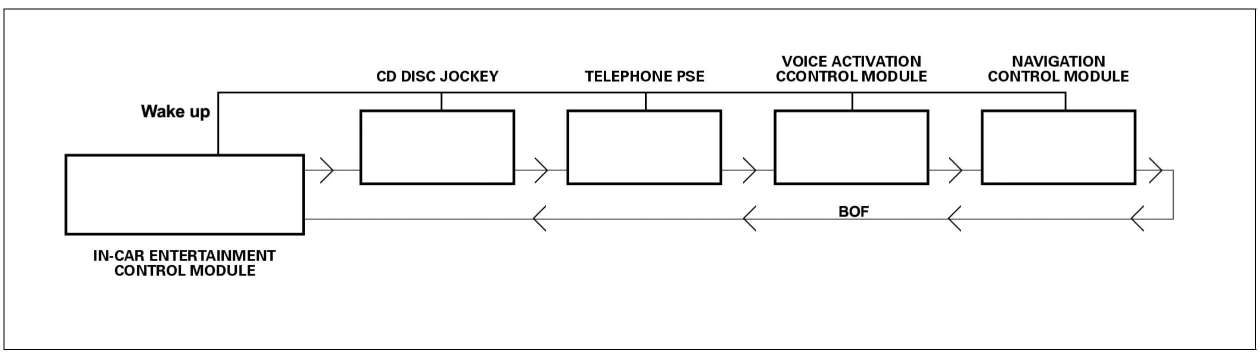


Fig. 26 D2B Network Schematic

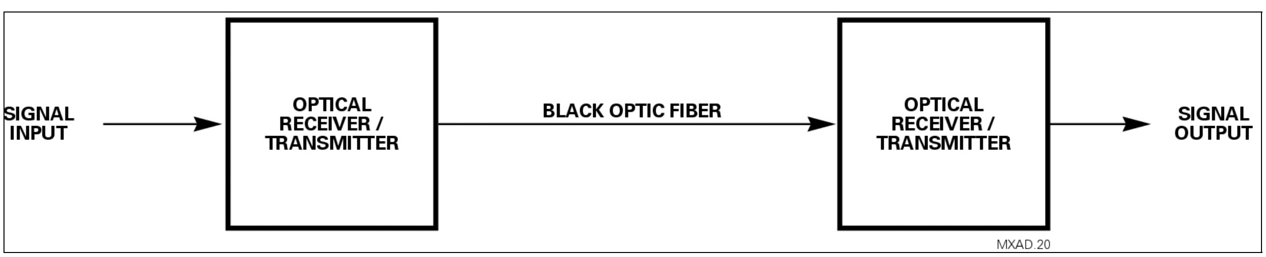


Fig. 27 Fiber Optic Data Transmission

Working with the D2B network

D2B is inherently safe. No laser transmitters are used so the light transmitted around the ring will not cause damage to the human eye. However, the use of laser light pens for fiber tracing or diagnosis may result in an unsafe condition and should be avoided. Always use the correct tools for diagnosis.

Do not use any tools such as a screwdriver to unlatch connectors as the subsequent locking function may be lost.

Take special care to avoid damage or contamination when handling or working in the vicinity of the fiber optic cables.

WARNING:

When handling optical fibers, cleanliness is of paramount importance. The fiber ends should not be touched even with clean bare hands, as the natural oils deposited from the skin may penetrate the fiber or my may cause dirt to adhere to the fiber end.

System malfunctions and unnecessary warranty claims can be minimized by following these guidelines:

- After disconnection of any cables, carefully install an appropriate dust cap to protect the mating face of the connectors from damage or contamination.
- Avoid introducing tight bends (less than 25 mm radius) or kinks into the optical fiber during service or repair, as tight bends or kinks could:
    - cause immediate system failure
    - cause future system failure
    - impair system operation
- Avoid excessive force, strain or stress on the fibers and connectors, especially permanent stress after reinstallation.

Network Initialization

The network automatically initializes at each key cycle to enter its normal operating state. This initialization is carried out by the ICE, which sends a hard-wired electrical pulse to each of the slave modules. The ICE does this only in response to the key being turned to the accessory position. When the slave modules receive the electrical wake-up signal they will look for a light signal from the preceding module. Each slave module will receive this signal and then transmit it on to the next in the ring. The last slave module in the ring will transmit it back to the ICE. The receipt of this signal allows the ICE to lock the ring.

To complete the initialization the ICE sends out the following messages:

- Set Position: The first slave module receives this message, modifies it and transmits it to the next slave. Each slave can see how many times the message has been previously modified and can therefore identify its numerical position in the ring.
- Report Position: On receipt of this message each slave will transmit its position in the ring to the ICE.

This completes the initialization procedure. The modules are now ready to transmit and receive command messages and audio signals.

Module Configuration

During the network initialization procedure the ICE receives a position report from all the slave modules. This tells the ICE how many modules are in the ring. The ICE will compare this figure with the value found in its configuration memory, which was originally stored during the vehicle build process. If the two figures are different a DTC will be logged.

NOTE:

It is important to use WDS to reconfigure the ICE if any extra systems e.g. telephone or CD are fitted or removed at a later date.

Network Diagnostics

The D2B master module and most of the slave modules can log DTCs in the event of a network failure. These DTCs can then be read by the WDS via the SCP network. The only slave module that doesn't store DTCs is the CDDJ. Any DTCs relating to the CDDJ are stored by the ICE.

Table 9 DTCs which can be logged by any module

DTC	Description
U2609	D2B electrical wake up pulse width out of specification. Master and slave modules monitor the wake up line and log this DTC if the pulse width is outside the specification 50ms – 110ms.
U2601	Wake up line shorted to ground. Master and slave modules monitor the wake up line during network initialization and log this DTC if the line is shorted to ground for greater than 1 second.

NOTE:

Any malfunction during the initialization stage will cause a DTC to be stored by the ICE.

Table 10 Switch Position I and II and Impact on loss of Signal

Device Level	AUDIO	CD	PHONE	VOICE	NAV
Loss of wake-up (device operates in bypass modes)	n/a	no operation	in bypass	in bypass	in bypass
Loss of Position I at engine start-up	no operation	n/a	no operation	no effect	no operation
Loss of Position I during operation	n/a	n/a	Power Down	no effect	network ring dies
Loss of Position II at engine start-up	n/a	n/a	no effect	no effect	n/a
Loss of Position II during operation	n/a	n/a	no effect	no effect	n/a
Loss of Position I and II at engine start-up	n/a	n/a	no operation	no operation	n/a
Loss of Position I and II during operation	n/a	n/a	Power Down	no effect	n/a

D2B Response to a Break in the Ring

If there is a break in the fiber optic ring, then all telematics will become inactive. The following symptoms will occur:

- No navigation voice guidance (map will display)
- Telephone will not respond (May display “not installed”)
- Radio with external amp will have no sound (radio with integral amp will have sound)
- CDDJ will not play (may display ”not installed”)
- Voice button will act as a mute button

Unlike the other networks that communicate with WDS via the diagnostic connector, the optical network interfaces with the diagnostic connector via the audio unit and the SCP network.

NOTE:

The optical network currently uses a transfer protocol known as D2B. Although this protocol may change in the future, the optical network will be referred to as 'D2B' throughout this and other Jaguar technical publications.

Visual (human eye) measurement of optical power loss

Shining a light down a fiber is a useful aid to route tracing and fiber identification, however it must not be used as a method of determining fiber integrity. Excessive light loss in a fiber will cause a network malfunction but the human eye cannot accurately measure light intensity. For this reason, neither a flashlight nor any other light source should be used in conjunction with the human eye to infer loss in the fiber. Use the D2B Optical Bus Tester tool #415-S003.

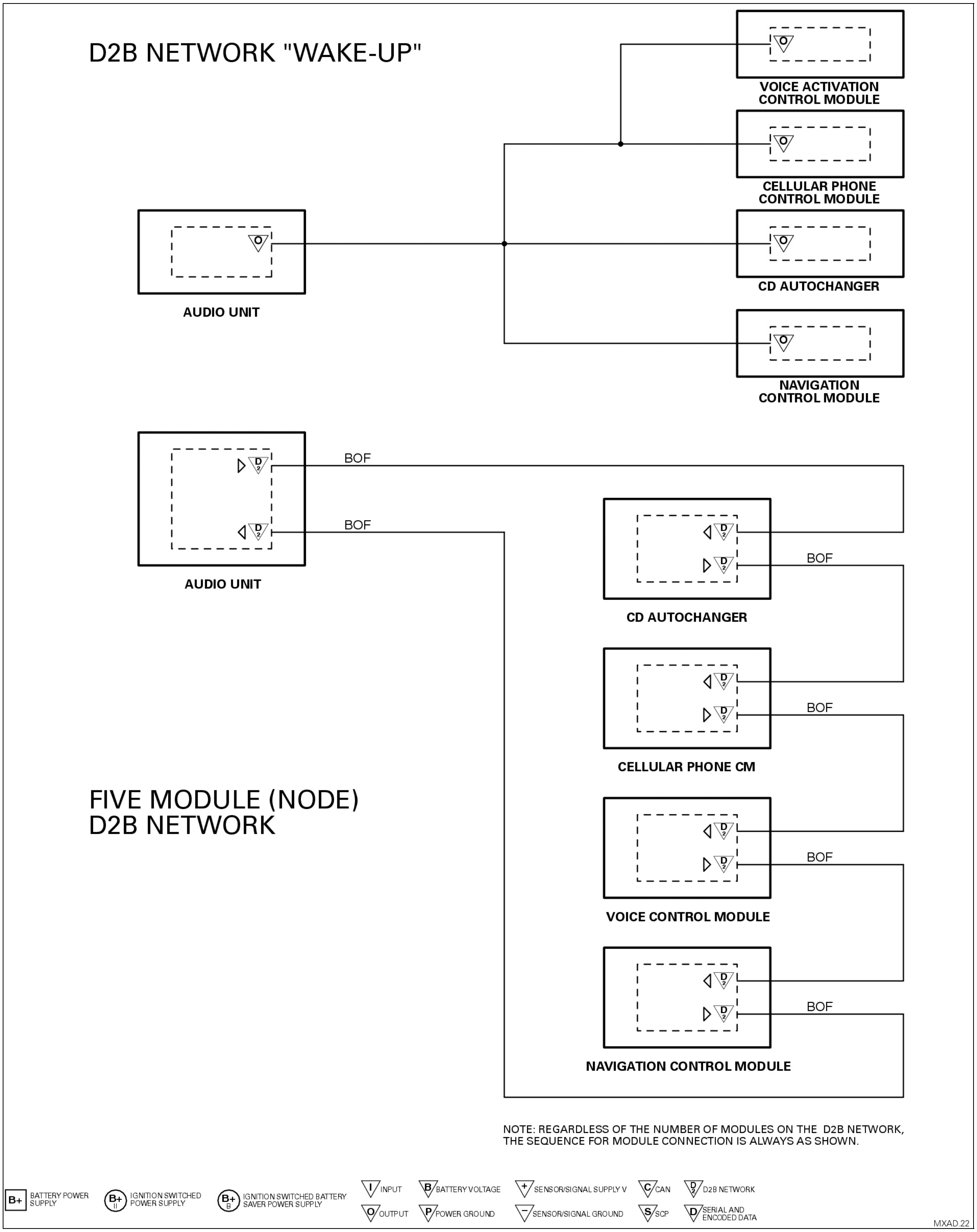


Fig. 28 Typical D2B Network: X400

MULTIPLEXING: X100 SERIES, X308

The vehicle has 4 networks as follows:

- SCP
- ISO 9141
- ACP
- CAN

SCP

- Introduced on 1997 MY X100 and 1998 MY X308 and used primarily for body systems
- The major instrument pack is the gateway

The following control modules communicate directly through the SCP network:

- Instrument pack (INST)
- Body processor module (BPM)
- Security and locking control module (SLCM)
- Driver door control module (DDCM)
- Passenger door control module (PDCM)
- Driver seat control module (DSCM)
- Driver rear door control module (DRDCM)
- Passenger seat control module (PSCM)
- Passenger rear door control module (PRDCM)

The network is also connected to the DLC (data link connector) for diagnostics.

ISO 9141

- The ISO 9141 network allows diagnostic communication

ACP

- The radio head unit acts as the control module

CAN

- CAN was introduced on the 1997 MY X100 and then on the 1998 MY X308
- Its functionality is common among all Jaguar vehicles
- Some modules are spliced off the main chain. This should be remembered when using a multimeter to check the continuity of the network
- The ABS and the IC are at the ends of the network and these contain the 120 Ohm termination resistors
- The IC is the gateway to the SCP network

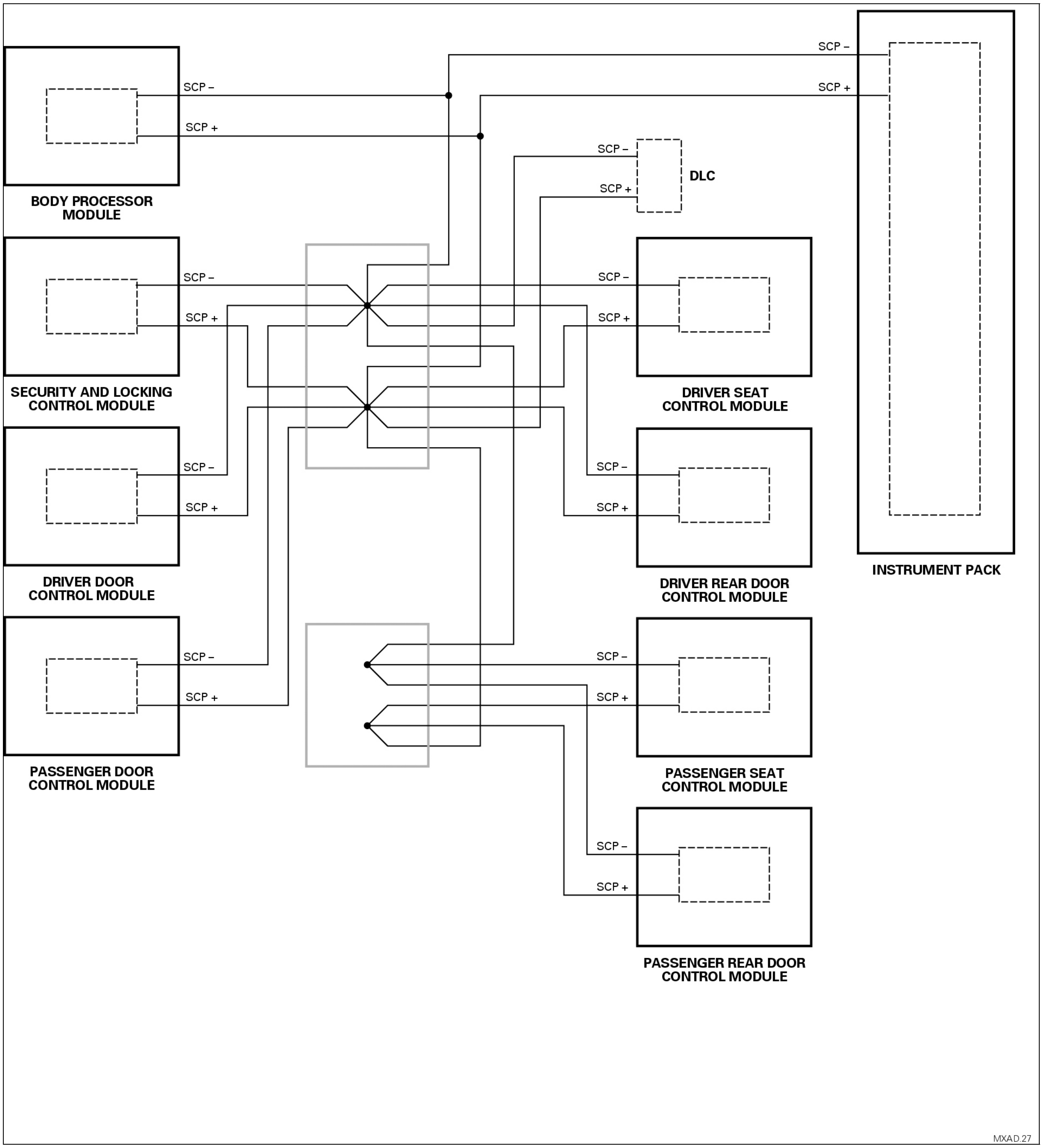


Fig. 29 Typical SCP Network: X308

MULTIPLEXING: X350

The XJ employs 4 communication networks:
SCP, ISO 9141, CAN and D2B.

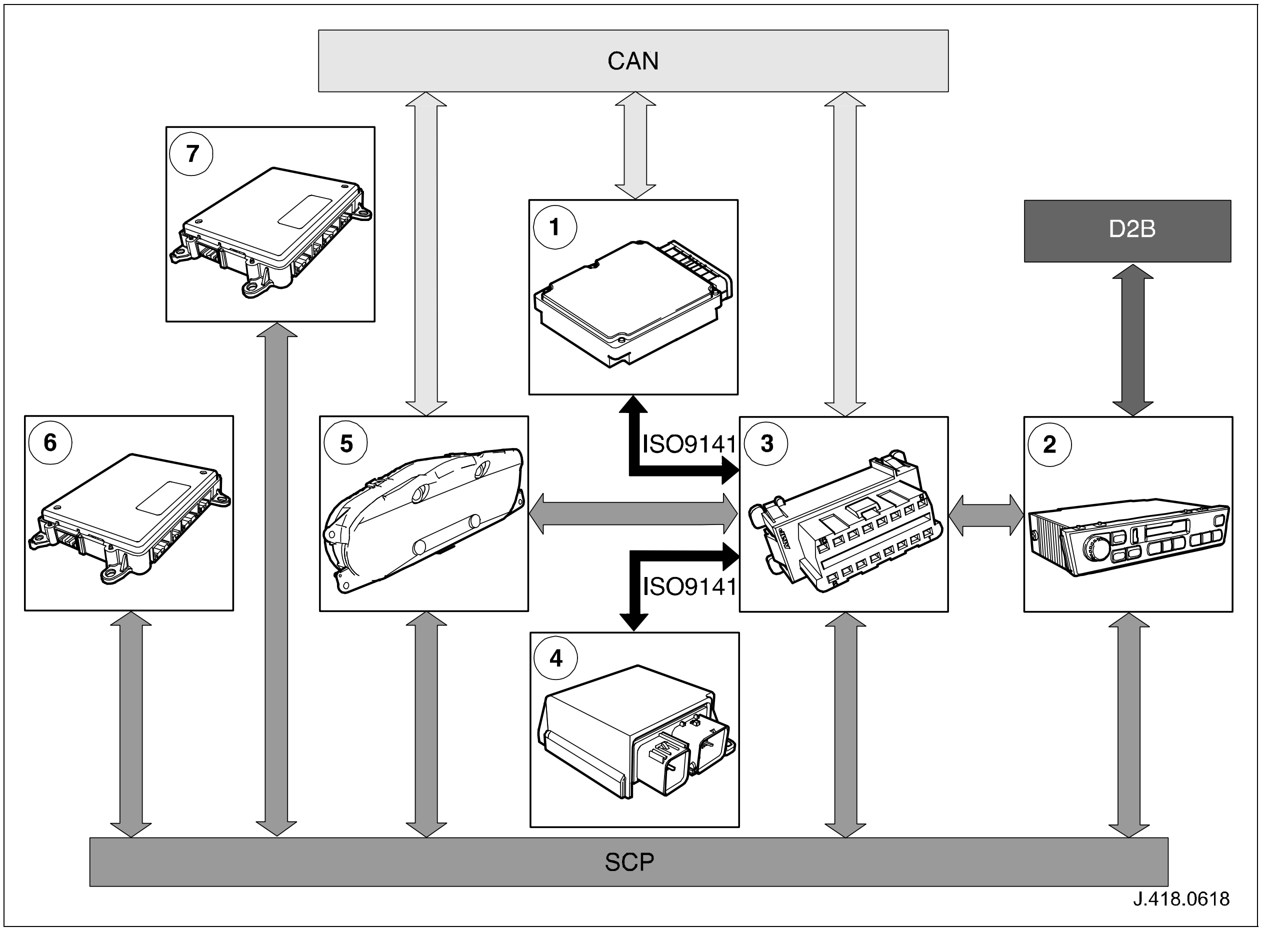


Fig. 30 Network Interconnections: X350

1. Engine control module
2. Audio unit
3. DLC
4. Restraints control module
5. Instrument cluster
6. Front electronic module
7. Rear Electronic module

CAN network — X350

The following control modules are connected to the CAN network:

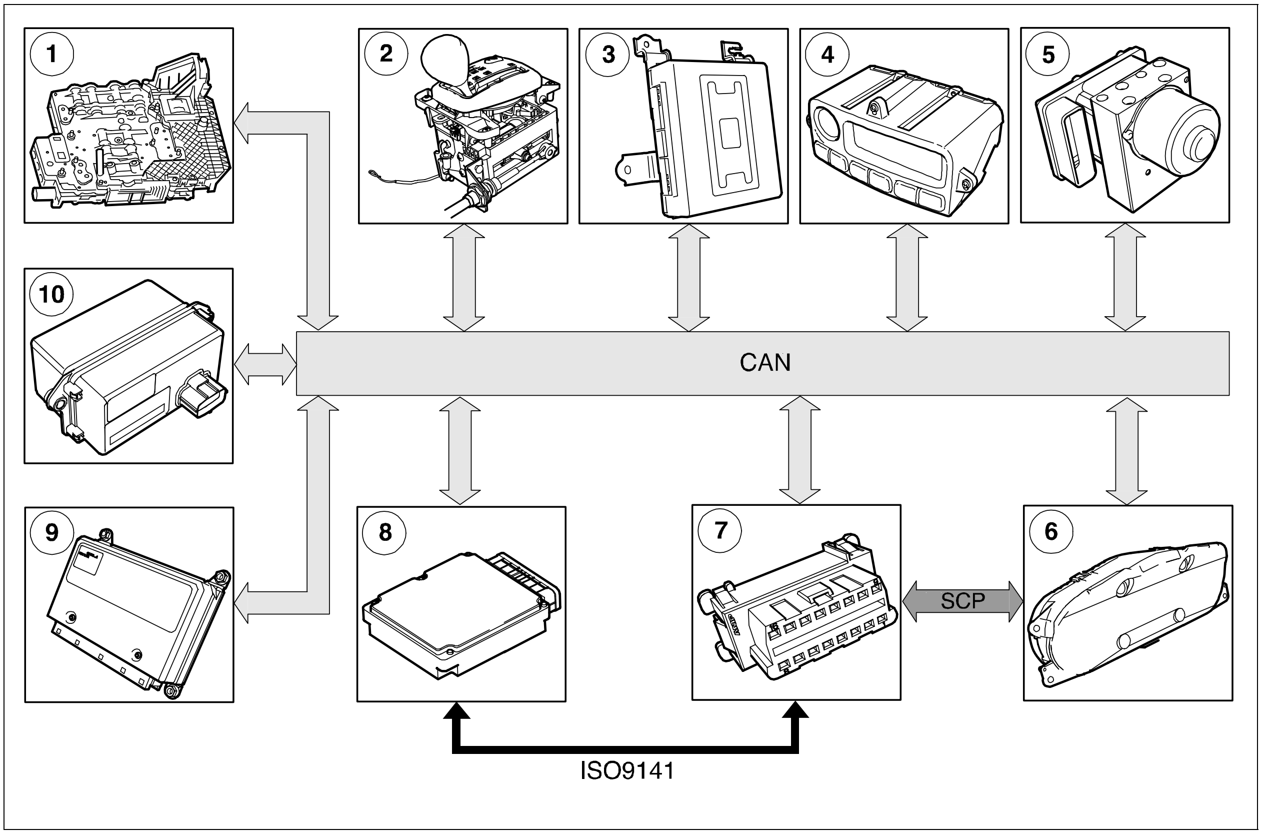


Fig. 31 CAN Network: X350

1. Transmission Control Module (TCM)
2. J-Gate Module (JGM)
3. Remote Climate Control Module (RCCM)
4. Rear Climate Control Panel (RCCP)
5. Anti-lock Braking System module (includes traction and dynamic stability control functions)
6. Instrument Cluster (IC) (Gateway between SCP and CAN network)
7. Data Link Connector (DLC)
8. Engine Control Module (ECM)
9. Air Suspension Module (ASM)
10. Adaptive Cruise Control (ACC)

SCP — X350

The following control modules are connected to the SCP network:

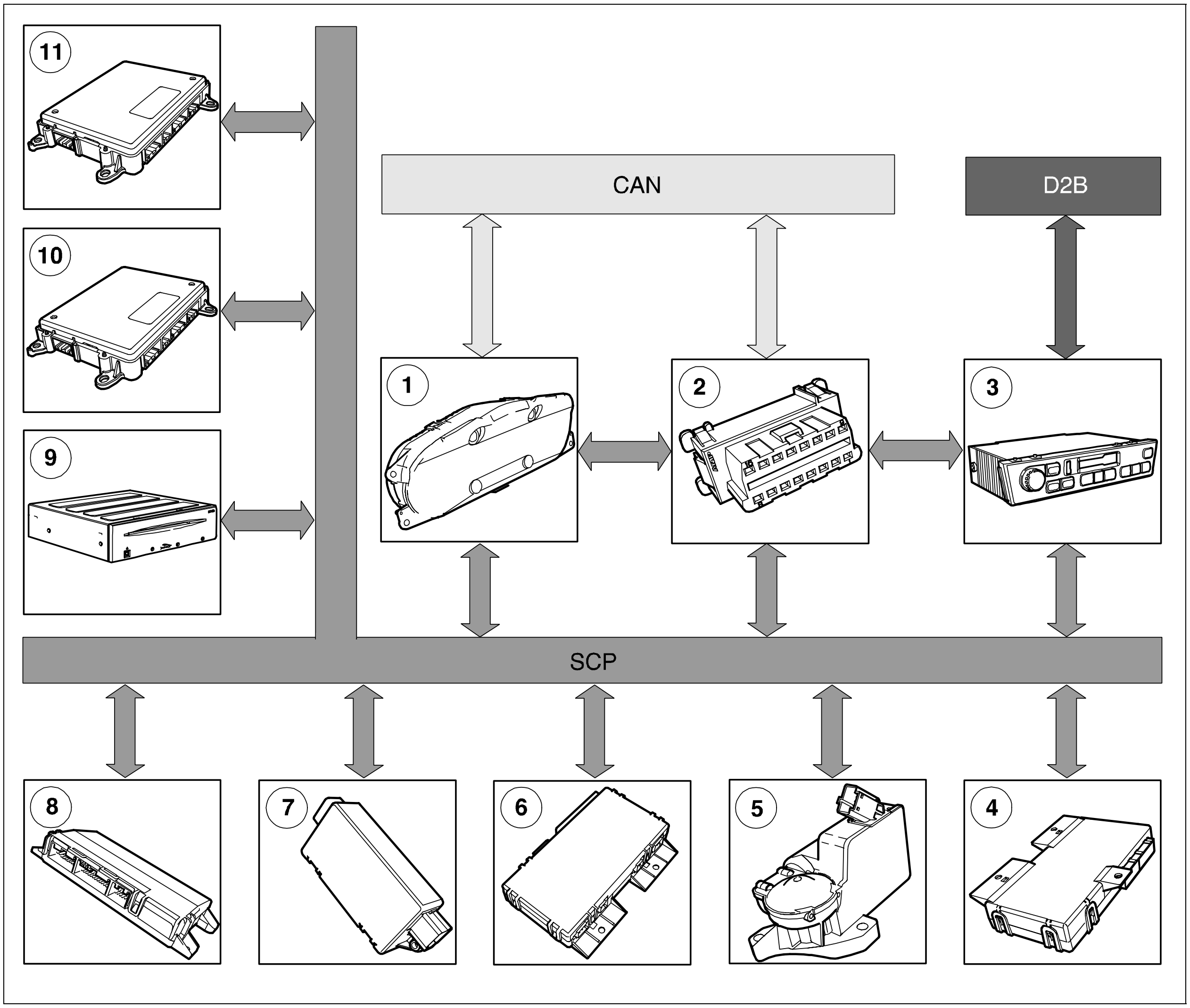


Fig. 32 SCP network: X350

1. Instrument Cluster (gateway to CAN network)
2. Data Link Connector (DLC)
3. In-car Entertainment Head (ICE) (Gateway between SCP and D2B network)
4. Driver Seat Module (DSM)
5. SCLM (Not for NAS vehicles)
6. Driver Door Module (DDM)
7. Electronic Park Brake (EPB)
8. Rear Memory Module (RMM)
9. Navigation Module (NAV)
10. Front Electronic Module (FEM)
11. Rear Electronic Module (REM)

D2B — X350

There are 2 intermediate connectors, one close to the J-Gate (providing a connection to the audio unit, and one located in the luggage compartment on the LH-side that provides the interconnection for the slave modules.

Vehicles installed with the rear multimedia system have two additional intermediate connectors, one close to the passenger entertainment control panel and one located in the luggage compartment on the LH-side that provides the interconnection point for the slave modules.

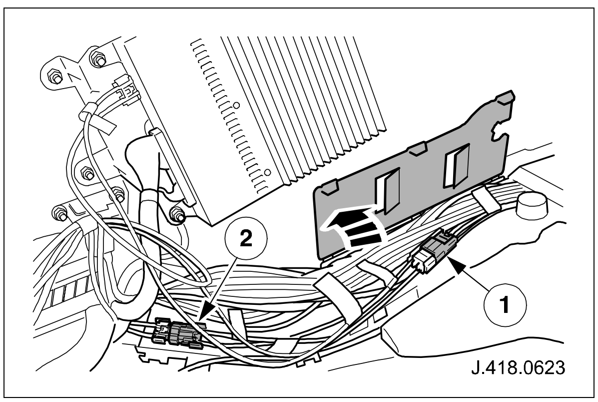


Fig. 33 D2B trunk area connectors

1. D2B connector
2. D2B connector

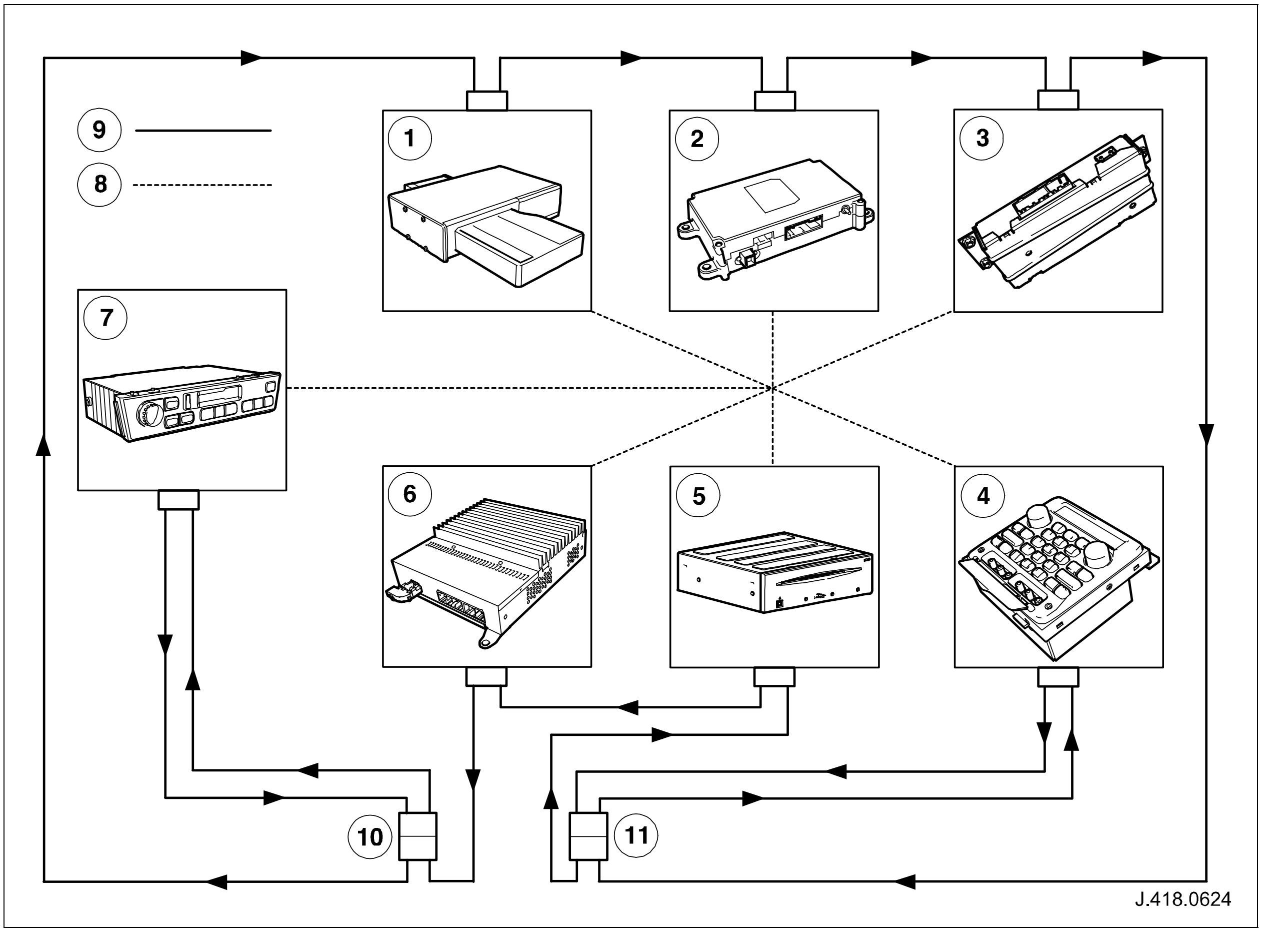


Fig. 34 D2B Network: X350

1. CD changer
2. Phone module
3. Voice module
4. Rear entertainment control panel
5. Navigation module
6. Power amplifier
7. Audio unit
8. Wake-up wire
9. Optical fiber
10. D2B connector
11. D2B connector

MULTIPLEXING: X200

The vehicle has 3 networks as follows:

- SCP
- ISO 9141
- ACP

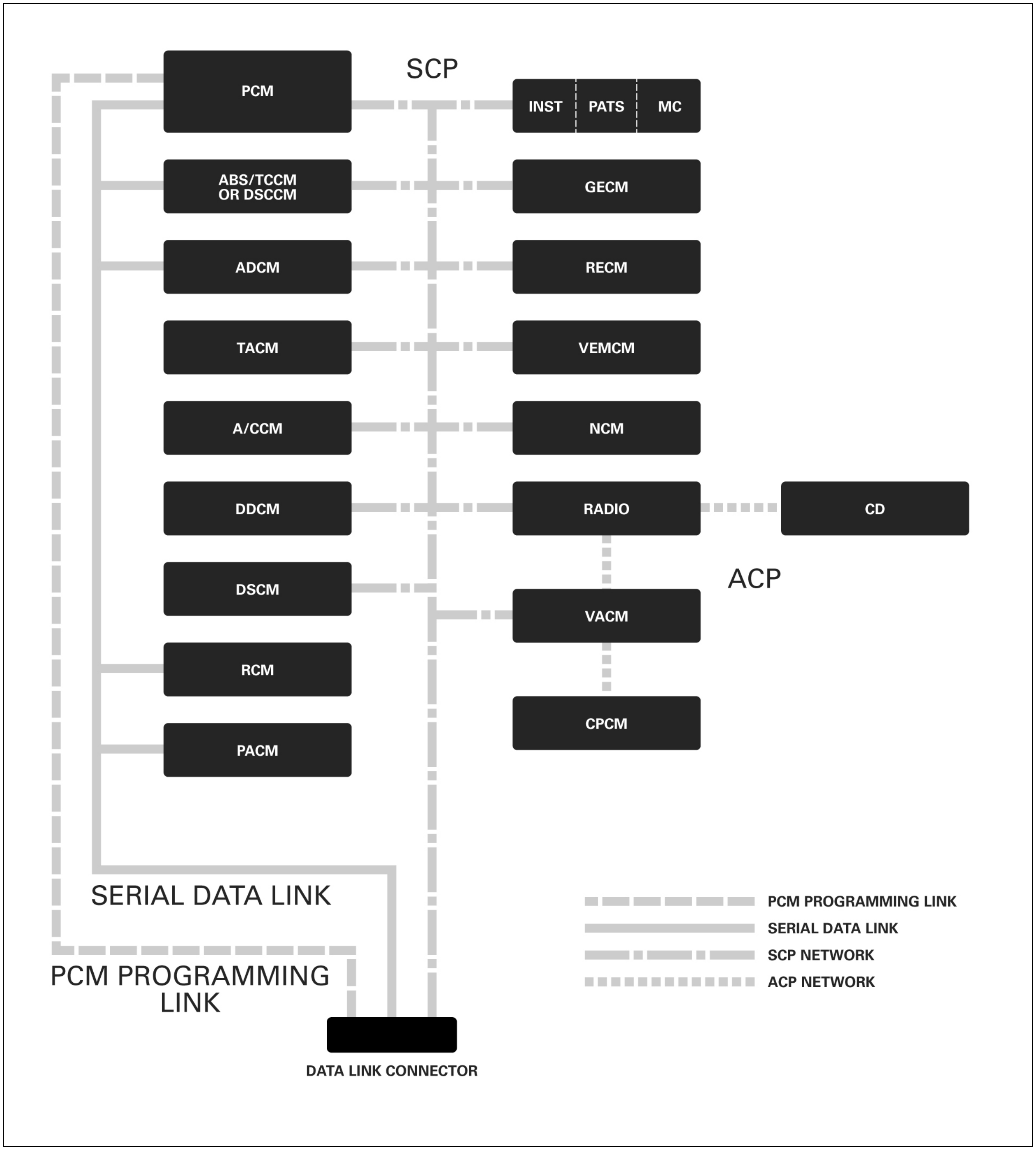


Fig. 35 X200 Networks

SCP — X200

The Standard Corporate Protocol (SCP) Network on the X200 is the only communication network controlling the drivability of the vehicle and vehicle body systems. SCP is able to replace the faster Controller Area Network (CAN) for powertrain control because both engine management and transmission control are combined into a single Powertrain Control Module (PCM).

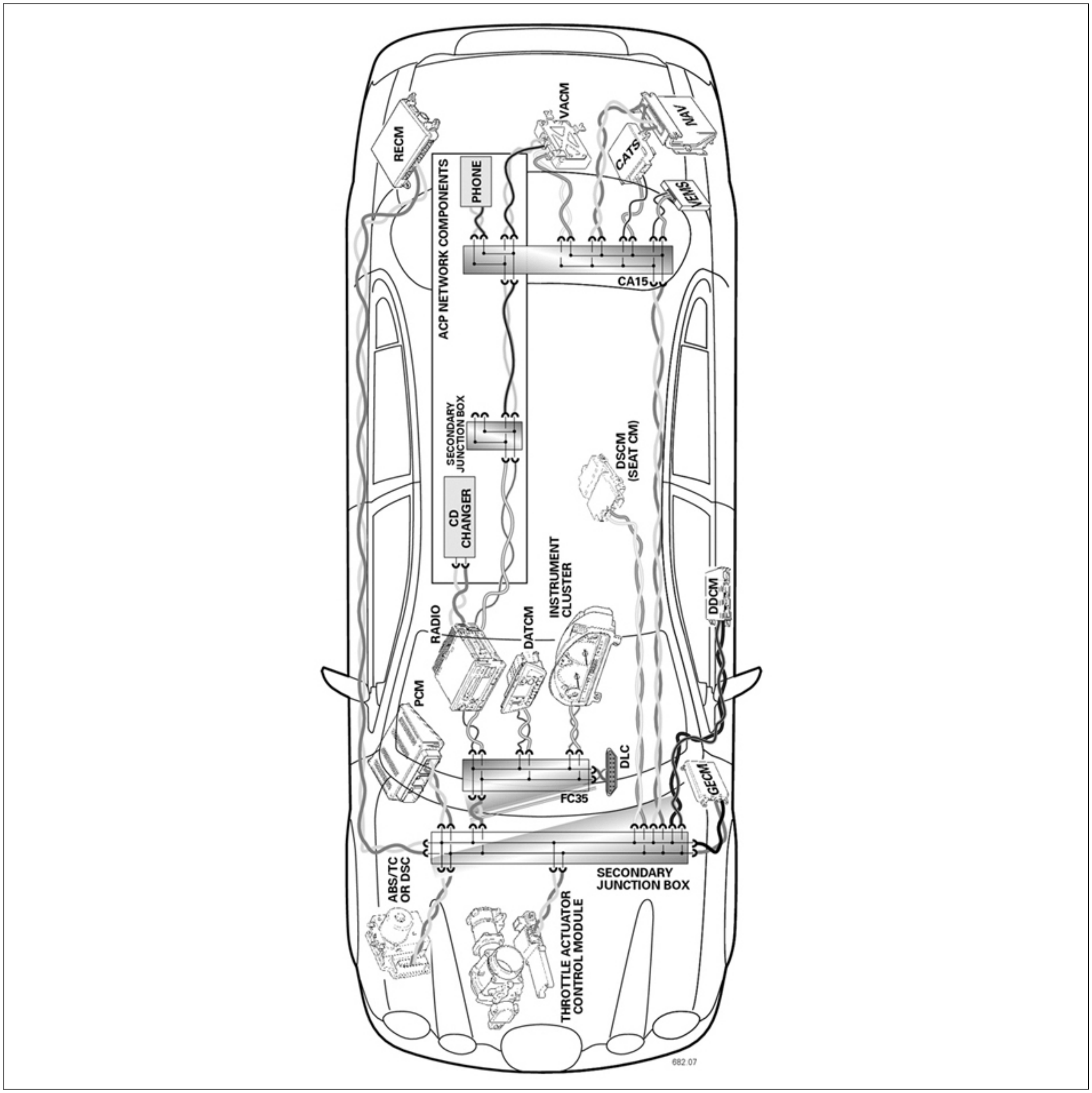


Fig. 36 SCP Network: X200

ISO 9141

The ISO 9141 network is used for diagnostics, and as such is J1978 compliant.

ACP

The radio head unit acts as the control module, and communicates with the CD changer, VACM, and CPCM if an or all of the modules are installed.

MULTIPLEXING: X202

The vehicle has 4 networks as follows:

- SCP
- ISO 9141
- CAN
- D2B

Many electronic modules previously on the SCP network have been reallocated to the controller area network (CAN) that was introduced on the 2003MY X202.
In addition to CAN, the most significant change to the X202 distribution system is the introduction of the D2B optical fiber cables, which accommodate the transfer of very high-speed, real-time audio data.

SCP, CAN and ISO 9141 networks

The standard corporate protocol (SCP), controller area network (CAN) and ISO 9141 networks are configured in a similar ways to current Jaguar models to accommodate different data types and flow rates as required for the various vehicle features

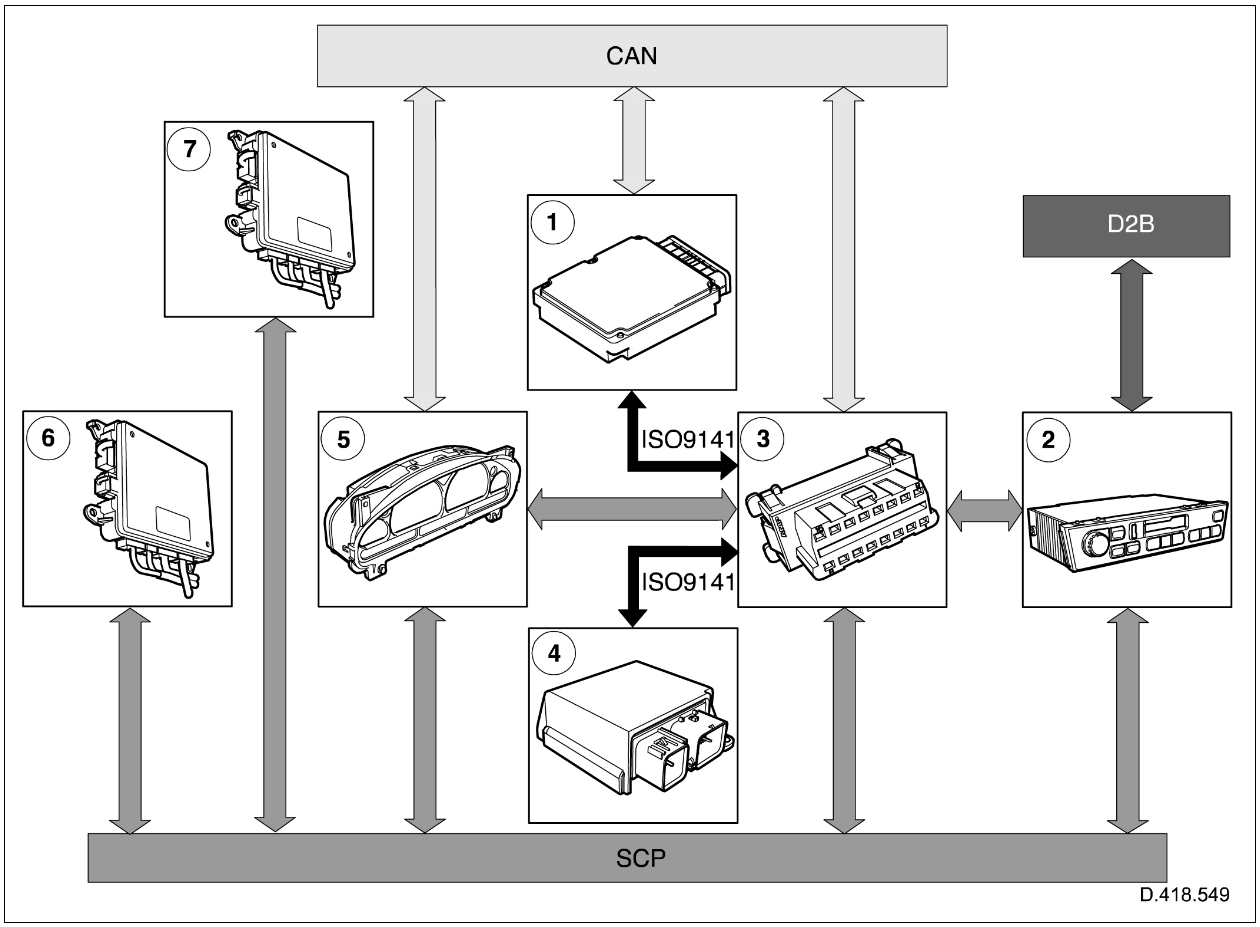


Fig. 37 Network Interconnection: X202

1. Engine control module
2. Audio Unit
3. Diagnostic Connector
4. Restraints control module
5. Instrument Cluster
6. General electric control module
7. Rear electronic control module

SCP

The ICE is the gateway to the D2B network, while the instrument cluster is the gateway to the CAN network.

The vehicle body systems control modules are connected to allow zoned component control responsibilities via multiplex data communication.

The following control modules are connected to the SCP network:

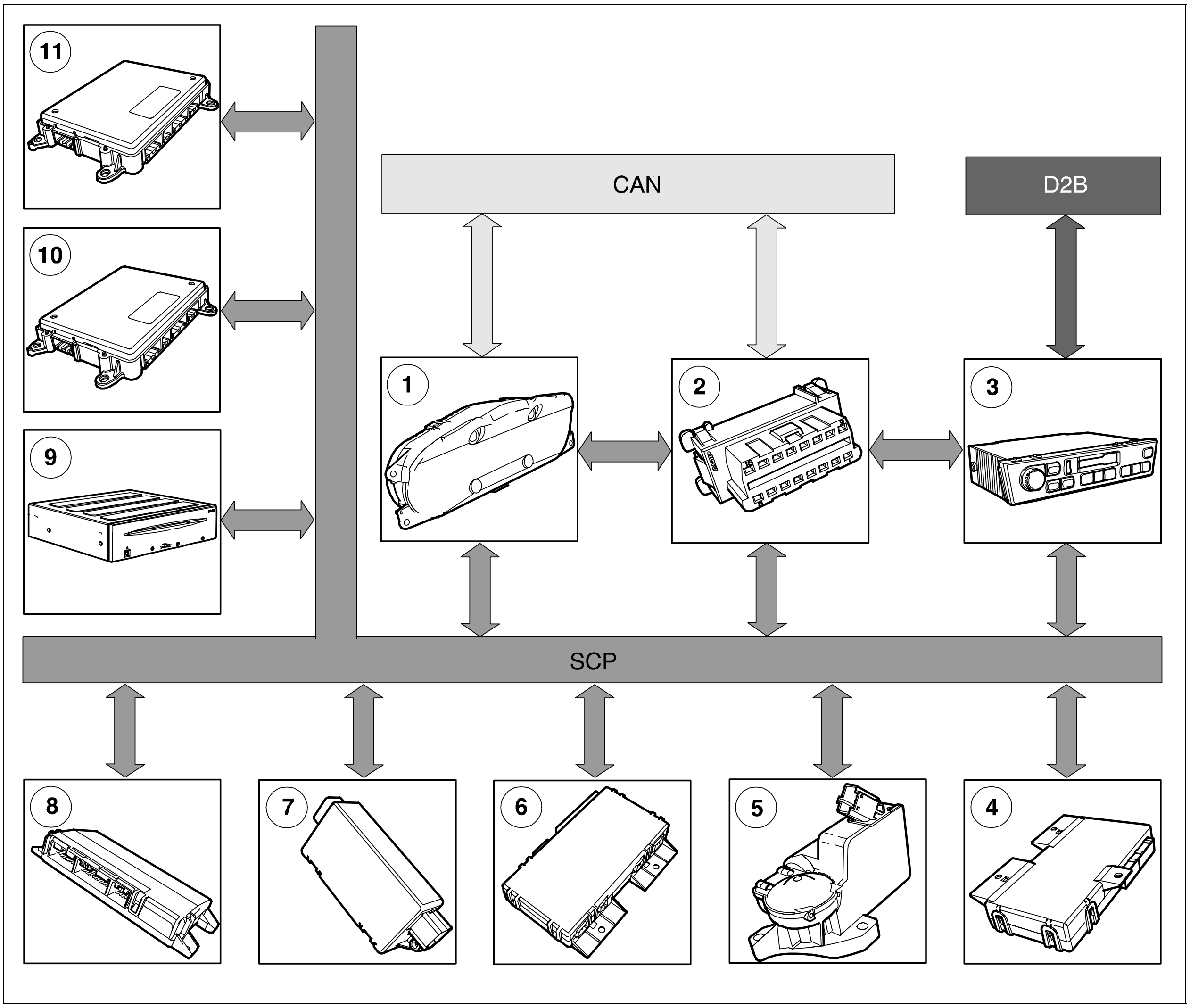


Fig. 38 SCP Network: X202

1. Instrument cluster
2. Diagnostic connector
3. Audio unit
4. Driver seat control module
5. Steering column lock module *
6. Adaptive damping control module
7. Parking brake module
8. Driver door control module
9. Navigation control module
10. General electrical control module
11. Rear electronic control module

* (2003–2004 MY manual transmission only)

ISO 9141

The ISO 9141 network is very similar to X200.

CAN

The following control modules are connected to the CAN network:

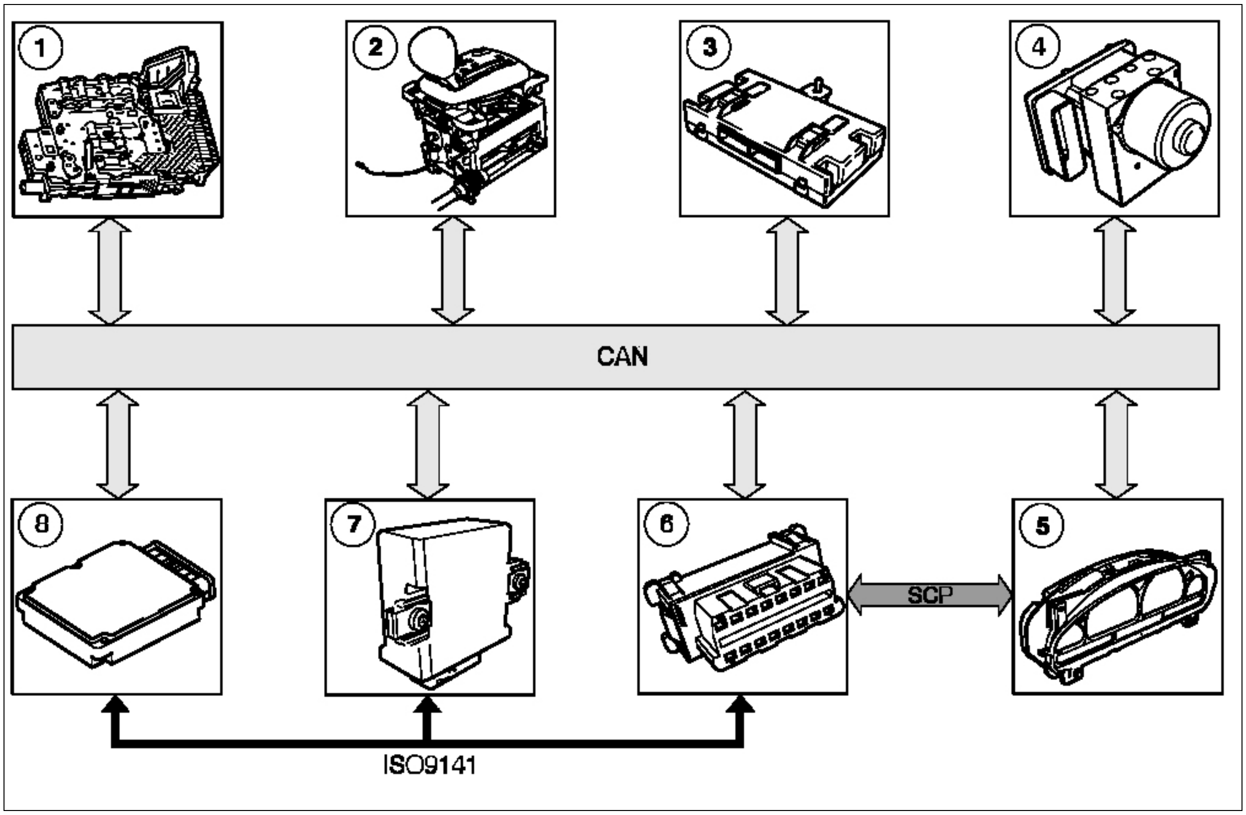


Fig. 39 X202 CAN Network

1. Transmission Control Module (TCM)
2. J-gate Module
3. Remote Climate Control Module (RCCM)
4. ABS/TC/DSC Module
5. Instrument Cluster (Gateway between SCP and CAN)
6. Headlamp Leveling Control Module
7. Engine Control Module (ECM)

CAN was introduced for the 2003 MY X202, necessitated by the reintroduction of separate engine and transmission control modules. The CAN functionality is the same as other Jaguar vehicles. Some modules are spliced off the main chain. This should be remembered when using a multimeter to check the continuity of the network. The ECM and the IC are at the ends of the network and these contain the 120 Ohm termination resistors. The IC is the gateway to the SCP network.

D2B

The D2B network is new to X202 but was introduced one year earlier on the X400. The ICE is the master module. Diagnostics on the D2B network can be performed using pinpoint diagnostics on the WDS.

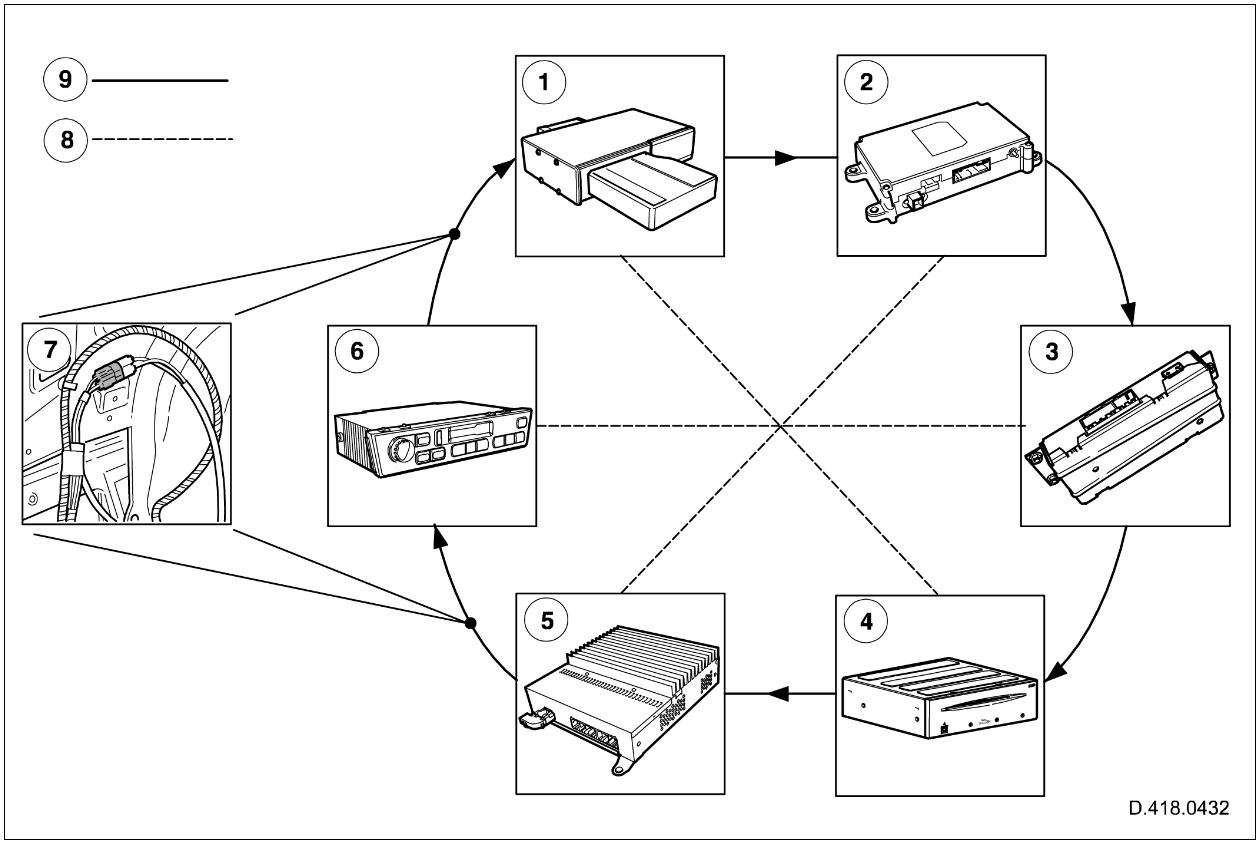


Fig. 40 D2B Network: X202

1. CD changer
2. Cellular phone control module
3. Voice activation
4. Navigation control module
5. Power amplifier
6. Audio unit (master module)
7. D2B intermediate connector
8. Wake-up wire
9. Optical fiber

MULTIPLEXING: X400, X404

The vehicle has 4 networks as follows:

- SCP
- ISO 9141
- CAN
- D2B

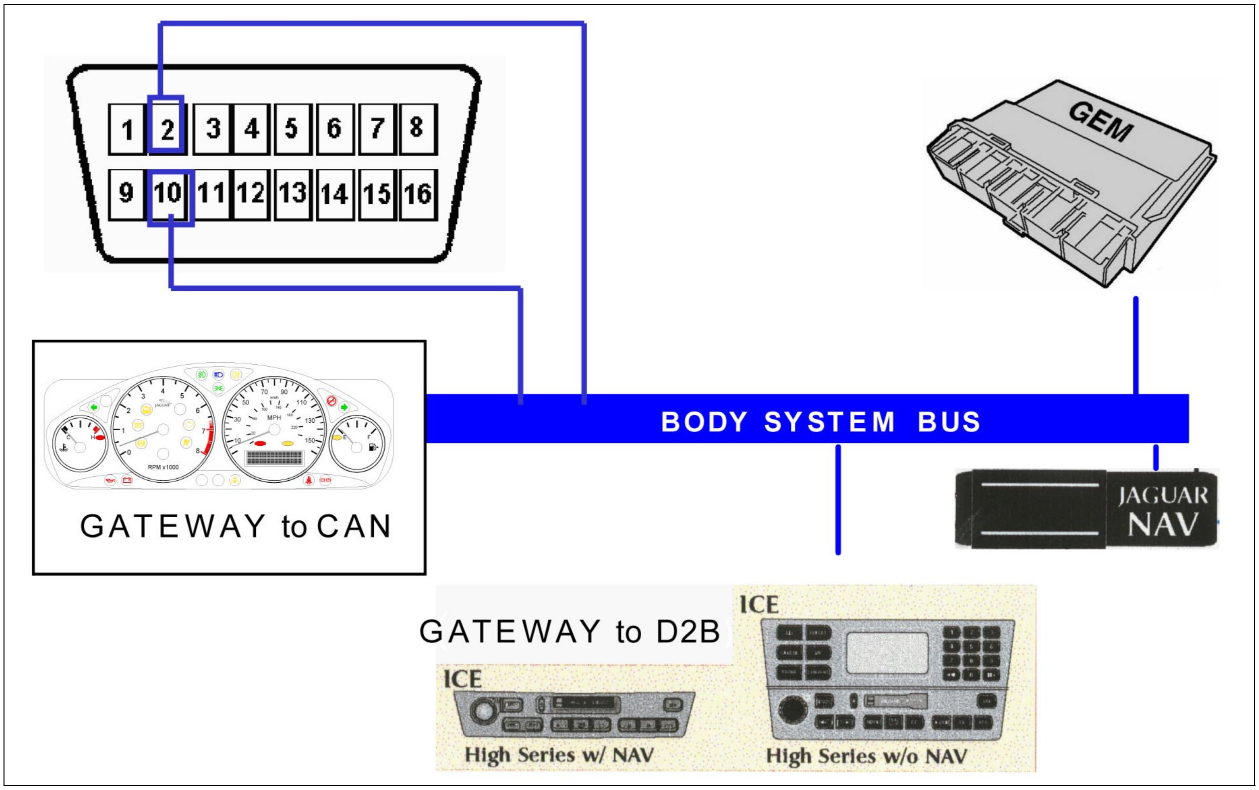


Fig. 41 SCP: X400, X404

SCP

Its functionality is the same as other Jaguar vehicles. The ICE is the gateway to the D2B network, while the instrument cluster is the gateway to the CAN.

ISO 9141

- The ISO 9141 network is very similar to X200.

CAN

Its functionality is the same as other Jaguar vehicles. The ECM and the IC are at the ends of the network and these contain the 120 Ohm termination resistors. The instrument cluster is the gateway to the SCP network.

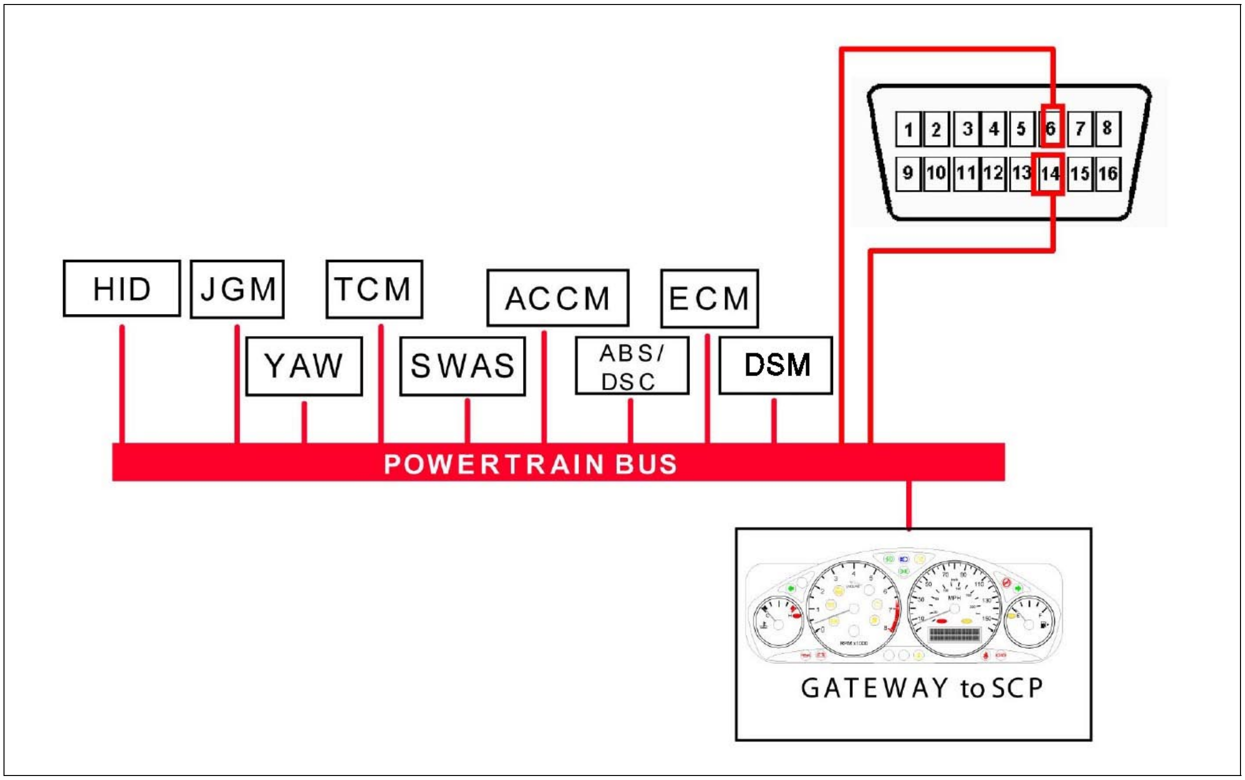


Fig. 42 CAN: X400, X404

D2B

D2B was first used on the 2002MY X400. The ICE is the master module. Diagnostics are with WDS. WDS pin point diagnostics will indicate the Optical Bus Tester.

NOTE:

Radio Amplifier has been added to the D2B network on X404.

The D2B network comprises:

- Optical fiber
- Wake-up wire
- Master module (audio unit)
- Slave module(s)
- Intermediate connectors.

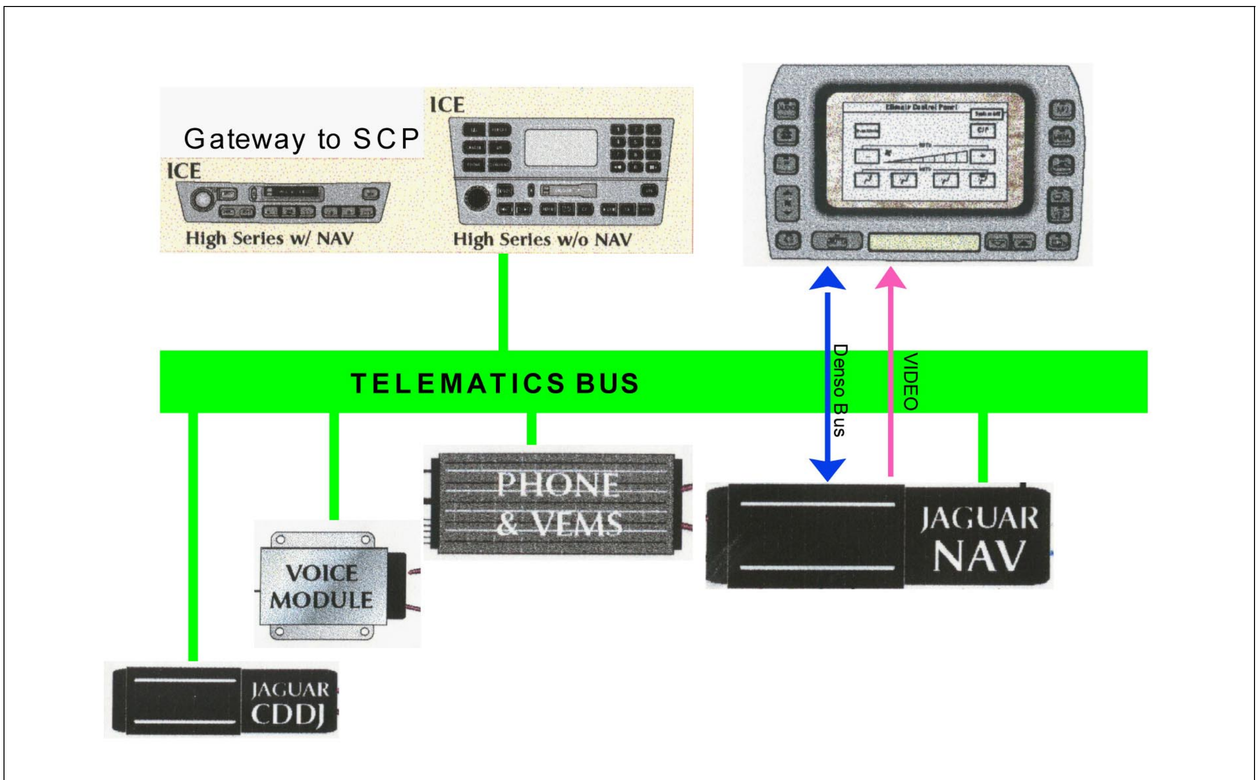


Fig. 43 D2B: X400, X404

WORKSHEET – REVIEW QUESTIONS

1. Which statement about Jaguar multiplexing is true?

   a. Modules can send both input and output data messages.

   b. Multiplex vehicle networks work on 12 volts.

   c. Requires two wires in a twisted pair.

   d. All of the above.

2. Networked systems allow for:

   a. shared function control.

   b. a reduction in the number of control modules.

   c. a reduction in vehicle wiring.

   d. all of the above.

3. Which of the following are types of networks used on Jaguar vehicles?

   a. SPC

   b. DLC

   c. ISO 9141

   d. INST

   e. ACP

   f. TCP/IP

   g. 51850

   h. CON

4. The IS0 9141 data bus:
   a. consists of one wire.
   b. consists of a twisted pair of wires.
   c. is a heavy-duty control module.
   d. cycles between 5 volts and 10 volts.

5. The SCP data bus:
   a. is a twisted pair of wires
   b. is a single wire
   c. has a wake-up wire
   d. none of the above

6. The prefix "U" at the beginning of a DTC indicates:
   a. a body concern.
   b. a powertrain concern.
   c. a chassis concern.
   d. a network concern.

7. Before condemning a control module what should always be checked?
   a. module programming chips
   b. all module power and ground circuits
   c. pinpoint tests should be performed on all inputs and outputs
   d. none of the above

WORKSHEET – CAN-1 NETWORK INTEGRITY CHECK WITH DVOM AND WDS OSCILLOSCOPE

Use a calibrated DVOM and correct professional practices.

1. With the ignition switched OFF, connect the red probe to Pin 6, CAN high (+). Connect the black probe to Pin 14, CAN low (-).

2. Select the Ohms function. A reading of approximately 60 Ohms indicates good CAN Bus continuity. This test verifies the CAN Bus wires only, not the communications or the modules themselves. A reading significantly higher or lower may indicate high resistance or a short circuit to ground. Measured value:

   ____

   ____

3. Select the DC Voltage function. With the black probe on chassis ground or battery negative, and the red probe still connected to Pin 6, CAN high (+), the reading will be approximately 2.7 V. Measured value:

   ____

   ____

4. Install the red probe to Pin 14, CAN low (-). The reading will be approximately 2.3 V. Measured value:

   ____

   ____

5. On a WDS, from the Toolbox, select the Oscilloscope. Select Channel 1, Auto, CAN+. Select Channel 2, Auto, CAN-. Use the yellow minus button on left side of screen to set Channel 1 voltage value to 1 V per division. Select Channel 2 and use the red minus button on left side of screen to set Channel 2 voltage value to 1 V per division. Set the time scale value to 2 ms/div. for both channels.

6. Reconnect the red probe to Pin 6, CAN high (+) and the black probe to Pin 14, CAN low (-).

7. Push the Start button. Using red or yellow arrow buttons on left side of screen to move the trigger points together for a better view of the patterns.

WORKSHEET – CAN-2 CAN NETWORK INTEGRITY CHECK WITH DVOM

When completing this task sheet, use WDS wiring adapter No.7 and correct professional practices.

1. Select the DC Voltage function. Connect the black probe to Battery Negative or chassis ground. Turn the ignition ON (Pos.II). With the red probe connected to Pin 6, CAN high (+), the reading will be approximately 2.7 V. Measured value: ___________
2. Install the red probe to Pin 14, CAN low (-). The reading will be approximately 2.3 V. Measured value: ___________
3. Reconnect the red probe to Pin 6, CAN high (+) and the black probe to Pin 14, CAN low (-).
4. From the Toolbox, select the Oscilloscope.
5. Touch the **+Channel 1** , **+Manual** , **+Sense** , Choose **Red probe** , Touch **+Scale** , Choose **1V/div** , Set time scale to **2 ms/div** .
6. Touch the **+Channel 2** , **+Manual** , **+Sense** , Choose **Black probe** , Touch **+Scale** , Choose **1V/div** , Set time scale to **2 ms/div** .
7. Turn the ignition switch on.
8. Push the Start button.
9. Where does the voltage start? ___________
10. How much change is there in the voltage signal? ___________

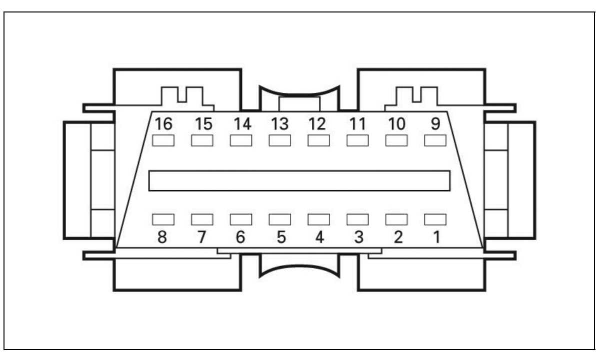


Fig. 44 Data Link Connector (DLC)

WORKSHEET – SCP-1 NETWORK INTEGRITY CHECK WITH DVOM

On the assigned vehicle, complete the questions below using WDS and following the same set up instructions as on the previous worksheets.

1. Battery Connected – Key OFF

   What's the Voltage with: SCP + (Pin 2) to SCP – (Pin 10)?

   ____

   ____

   What's the Voltage with: SCP + (Pin 2) to ground?

   ____

   ____

   What's the Voltage with: SCP - (Pin 10) to ground?

   ____

   ____

2. Battery Connected – Key ON

What's the Voltage (varying) with: SCP + (Pin 2) to SCP – (Pin 10)?

What's the Voltage (varying) with: SCP + (Pin 2) to ground?

What's the Voltage (varying) with: SCP - (Pin 10) to ground?

3. Battery Disconnected – Key OFF

What's the Resistance (Ohms) with: Red Probe on SCP + (Pin 2), Black Probe on SCP – (Pin 10)?

____

____

What's the Resistance (Ohms) with: Red Probe on SCP - (Pin 10), Black Probe on SCP + (Pin 2)?

____

____

What's the Resistance (Ohms) with: SCP + (Pin 2) to ground?

____

____

What's the Resistance (Ohms) with: SCP - (Pin 10) to ground?

____

____

WORKSHEET – SCP-2 NETWORK COMMUNICATIONS FUNCTIONAL CHECK

The following procedure confirms that data message communication is possible between all of the control modules connected to the SCP Bus without using WDS.

1. With the doors and windows closed, lock the vehicle using the key.
2. Using the key, unlock the vehicle and hold the key in the unlocked position (global open). If all doors unlock, all windows open, and if equipped, the convertible top opens, then data messages were communicated between the control modules on the SCP network. Name the SCP network control modules on the assigned vehicle: ___________________
3. Switch the ignition to Pos.II, set and recall a seat memory position. Open and close the driver door while watching the INST door ajar warning. If the seat memory works, data messages were communicated between DDCM, BPM and DSCM. If the door ajar warning is active with the door open and becomes inactive with the door closed, a data message was communicated between the DDCM and the INST.
4. Is your assigned vehicle equipped to global open/close with the remote? _________
5. If YES, which module on your assigned vehicle receives the RF signal from the remote?

   ____
6. Does this module send a command to another module via the SCP network or is it hard wired directly to the window motors? ___________________

WORKSHEET – D2B-1 NETWORK FAULT FINDING WITHOUT WDS

The following procedure will help to identify D2B network faults.

1. Visually inspect the security and integrity of D2B network connectors, cables and harnesses where possible without major disassembly of trim panels. This should include the following:— Sharp bending of optical fibers (check this before disturbing any modules or connectors). Correct engagement of optical connectors.

   — Correct placement of optical connectors (ring order).

   — Correct engagement of electrical connectors.

   — Damage to optical fibers (chafing, abrasion, kinking, cuts, breaks).

   — Correct assembly of optical connectors (backing out, etc.).

2. Verify the wake up pulse and module power supplies (battery, accessory and ignition).
3. Disconnect the D2B connector from the slave module which identified the fault.
4. Turn the key to the accessory position and check for light pulses at the incoming pin from the previous module.
5. If light pulses are present, then the fault is most likely with the receiver of the identifying module or with the module itself. In either case, the module should be replaced.
6. If no light pulses are present, then the fault must be in the previous module or in the optical cable.
7. Reconnect the identifying module and disconnect the previous module. Check for light pulses from the transmitter of this module when the key is turned to the accessory position.
8. If no light is present, then the fault must be in the transmitter of this module or in the module itself. In either case, the module should be replaced.
9. If light pulses are present, then the fault must be in the fiber optic cable.

WORKSHEET – D2B-2 NETWORK FAULT FINDING WITH BUS TESTER TOOL #415-S003 AND WDS

The following procedure will help to identify D2B network faults.

1. Visually inspect the security and integrity of D2B network connectors, cables and harnesses where possible without major disassembly of trim panels. This should include the following:— Sharp bending of optical fibers (check this before disturbing any modules or connectors). Correct engagement of optical connectors.

   — Correct placement of optical connectors (ring order).

   — Correct engagement of electrical connectors.

   — Damage to optical fibers (chafing, abrasion, kinking, cuts, breaks).

   — Correct assembly of optical connectors (backing out, etc.).

2. Connect WDS and extract fault codes for the audio system
3. Follow pin point test procedure.
4. What fault was found? _____________

WORKSHEET – D2B-3 D2B NETWORK AND DIAGNOSTICS

If the D2B ring is running and functioning correctly, then the software revision level of all Telematic modules connected on the ring will be displayed on the navigation screen with the following steps:

1. Turn the ignition ON.
2. Simultaneously press the EJECT and AM/FM keys on the ICE head.
3. Wait until the navigation display screen sets to AUDIO SETUP.
4. Simultaneously press the EJECT and MIX keys on the ICE head.
5. Keep pressing EJECT and MIX to scroll through all modules on the D2B network until all module software levels have been seen.
6. List the software levels on the assigned vehicle: ____________________
7. Turn the ignition OFF and disconnect the audio amplifier from the D2B network by removing the fiber optic connector. Turn the ignition ON again so that the network attempts to initialize. Now repeat the process in steps 2 through 5 above. What are the results now? ____________________
8. What conclusions can you draw from this? ____________________

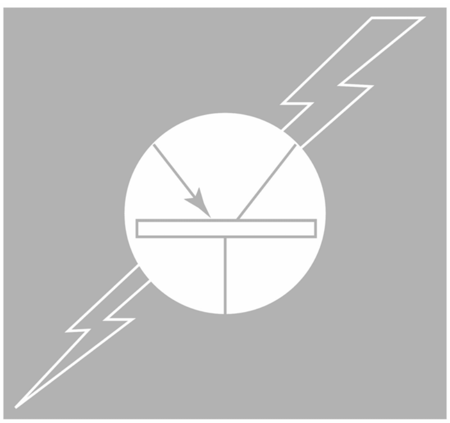
NOTE:

On X350, the ICE head has an additional coprocessor identified as DTS along with its software ID number. This processor is internal to the ICE head and is not the fiber optic ring.

JAGUAR

TRAINING PROGRAM

JAGUAR ADVANCED ELECTRICAL SYSTEMS



PUBLICATION CODE – 684

MODULE CONFIGURATION AND PROGRAMMING

Module Configuration versus Module Program

There is a subtle difference between a module configuration and module program. A module configuration is actually data input that allows choices to be made as to the vehicle application or customer preferences that should be known to the module. For example, the Rear Electronics Module that is provided as a service part for an X202 may also be the service part for some applications of an X350. In both cases, the module must be configured by telling it in which vehicle it has been installed before it will function correctly.

A module program is the software that defines the ways inputs are processed and outputs are generated. There are times that new programs are released for a vehicle which enhance functionality. In such cases, a module will be reprogrammed with a new program For example, an ECM may need to be reprogrammed with a new calibration to eliminate a rough idle concern, if a fix for this condition had been found by the engineering team.

Control Module Configuration

There are two modes of data configuration. The first type requires configuration information so that the module can interact with the vehicle correctly. This information will be transferred to the new module using WDS, so that it will contain the same settings as the old module.

The second type of configuration data is customer preference driven. These are items that the customer may or may not want to have enabled. Customer preference items can be toggled on or off by using WDS. You may need to ask the customer which preferences they had enabled prior to installation of the new module, although after installation they will automatically learn the settings by receiving information from existing modules. Note that some of the features require additional hardware to function.

Table 11 WDS Configurable Features

Feature	X100	X308	X350	X200	X204	X400
Security / Locking						
Glass Break Sensor Enable	x					
Passive arm enable	x	x	x		x	x
Reset the security system using the key						x
Inclination sensor enable	x	x	x			x
Intrusion Sensing enable		x		x	x	
Audible chirp on arm / disarm	x	x		x	x	
Audible chirp on second button press			x			
Battery backed sounder enable	x	x	x	x	x	x
Turn signal flash on error			x			
Error warning enable		x	x			
Superlocking chirp enable		x	x			
Intrusion sensor sensitivity		x				
Horn operation during alarm enable	x		x	x		x
Sounder operation during alarm enable	x		x		x	
Automatic locking with re-lock						x
Automatic locking					x	x
Automatic relocking enable			x			x
Passive arming delay (time)	x	x				
Passive immoblization enable	x					
Side and tail lamp flash during alarm enable	x					
Side and tail lamp on during alarm enable	x					
Headlamp flash during alarm enable	x					
Turn signal flash during alarm enable	x		x			
Key barrel disarm enable	x			x	x	
Key barrel arm enable	x					
Central locking enable				x		
Passive arming on central locking enable	x					
Active arming enable	x					

Feature	X100	X308	X350	X200	X204	X400
Single door unlocking with the key						x
Single door unlocking with the remote						x
Driver's two stage locking enable	x			x	x	
Driver's slam locking enable	x					
Driver's superlocking enable	x					
Passenger's slam locking enable	x					
Passenger's superlocking enable	x					
Alarm duration (time)				x		
Security enable				x		
Remote enabled with key-in enabled				x		
Number of remote transmitters programmed				x		
Number of button presses to release the trunk						x
Convenience Features						
Driver's door glass one touch up enable	x					
Passenger's door glass one touch up enable	x					
Remote memory recall enable		x	x			
Passenger's mirror memory movement enable	x					
Driver's mirror memory movement enable	x					
Remote locking enable			x			
Remote panic alarm enable	x	x	x		x	
Remote luggage compartment lid release enable	x	x	x		x	
Remote headlamp convenience enable	x	x	x			
Drive away door locking enable	x	x		x	x	
Seat entry/exit enable		x		x		
Drip wipe enable	x	x	x			x
Fold flat mirror enable	x		x			
Automatic mirror fold enable			x			
Passenger mirror dip in reverse enable	x		x			
Driver's mirror dip in reverse enable			x			
Reverse park control enable				x		
Parking aid activation speed threshold				x		

Feature	X100	X308	X350	X200	X204	X400
Parking aid de-activation speed threshold				x		
Front parking aid sensors enable				x		
Rear parking aid sensors enable				x		
Parking aid system enable				x		
Reverse warning enable				x		
Power column enable				x		
Driver's memory seat movement enable	x			x		
Column memory movement	x					
Global closing enable					x	
Remote global open enable			x	x		x
Global closing enable			x			
Global closing request by key						x
Driver's remote door glass close enable	x					
Passenger's remote door glass close enable	x					
Key-in audible warning	x					
Dual electronic climate control moisture purge					x	
Double lock horn chirp					x	
Miss lock horn chirp					x	
Ambient temperature display enabled						x
Convertible						
Convertible Model?	x					
Convertible top movement at speed enable	x					
Convertible top movement at speed limit	x					
Lighting						
Turn signal repeater enabled		x		x		
Front fog lamps inhibited wiht high beam enable	x	x		x		
Rear fog lamps inhibit enable				x		
Daylight running lamps mode	x	x		x		
Daytime running lamps enabled			x		x	
Windshield						

Feature	X100	X308	X350	X200	X204	X400
Rain Sensing enable	x	x				
Heated wiber rest area enable				x		
Heated windshield enable				x		
Other						
Trailer fitted				x		
Transmission control module vehicle (saloon / sedan)						x
Language/Country						
Horn audible chirp configuration						x
Speed Control selection (units)	x					
Fuel economy units			x	x	x	x
US or UK gallons			x	x		x
Instrument pack display language			x	x	x	x
Climate Control module						
Pollen filter fitted / not fitted	x	x				
Audio System						
Instrument pack with message center fitted			x			
Fitted with rear audio?			x			
Digital audio broadcasting?			x			
CD autochanger enable				x		
Cellular telephone enable				x		
Voice activation enable				x		
Navigation enable				x		
In car entertainment system				x		
Safety Features						
Safety belt minder configuration			x			
Safety belt reminder			x	x		
Safety belt warning indicator timeout enable				x		
Overspeed warning				x	x	x
Speed Control						
Speed control enable				x		

New Module Programming

The ”Programming of New Modules” option is available under the WDS configuration tab once a vehicle's VIN is entered. Once selected, a list of programmable modules will be displayed to the operator. The number of modules displayed will depend on the vehicle that was entered at the start of the session and the components and features that are fitted to that particular vehicle.

Vehicle Configuration and Test System (VCATS)

On X100 and X308 vehicles, the VCATS data has to be supplied to Jaguar for some control module market-specific configurations. The data is added to the Control Module (CM) at the factory. VCATS matches hardware part numbers with the correct software; therefore care must be taken when exchanging control units from another vehicle for diagnosis.

To cover the many variations in vehicle specification, which are available in various markets, information is programmed into the Control Modules (CM) during vehicle manufacture, which in many cases may be specific to a very limited number of vehicles within a single market.

For example, the Security and Locking Control Module (SLCM) of a coupe does not contain the control system for the power-operated convertible top.

Malfunctions may occur if a similar, but not identical control module is installed from a donor vehicle. Since the CM may then ‘learn’ information from the second vehicle, incorrect data would then be transferred back to the first vehicle when the CM is transferred back to its original location. This is particularly applicable in the case of the Engine Control Module (ECM).

With the increasing number of control units on a given vehicle, it is becoming less cost effective to have replacements pre-programmed at the factory. Also, the space required to store all market configurations becomes prohibitive.

Starting with X200, Jaguar supplies a blank (un-programmed) units that must be configured during installation. WDS is the main tool for programming and with the latest CD updates that include the latest software for the vehicles control modules (the CD release notes should be read to see the scope of programming and what vehicles it affects).

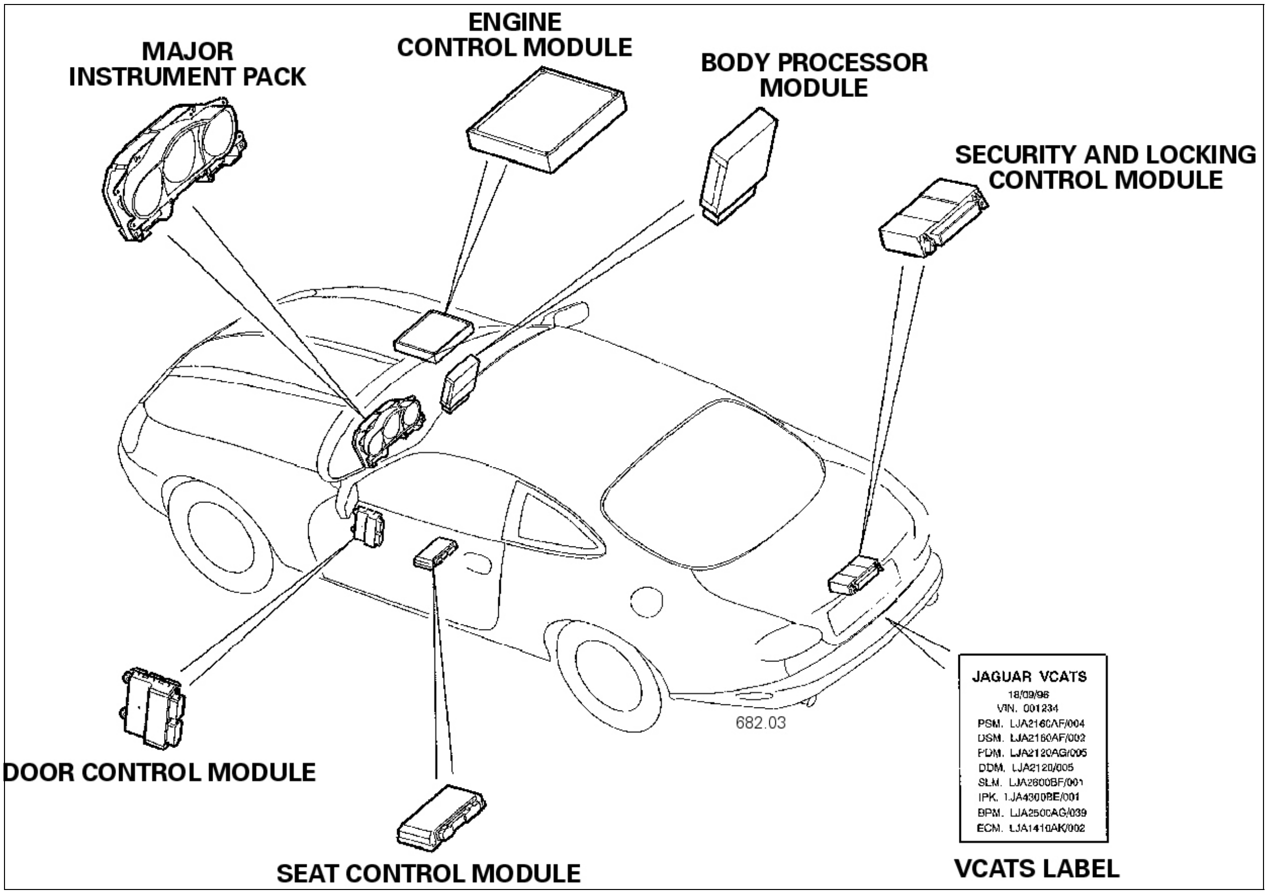
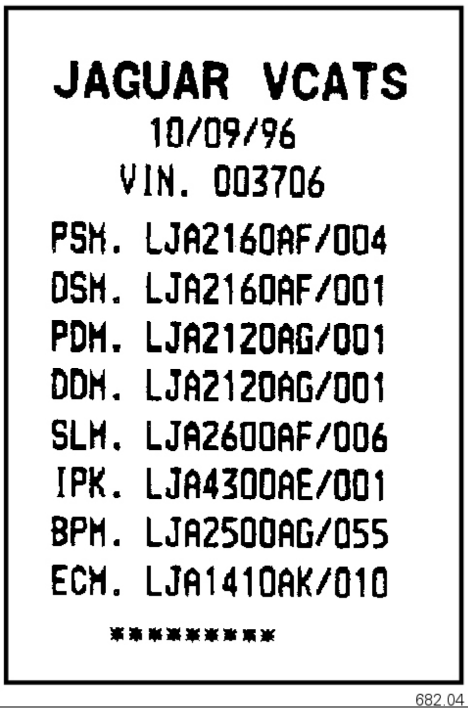


Fig. 45 Typical Programmable Control Modules: X100



ABBREVIATIONS:

PSM	Passenger Seat Control Module
DSM	Driver Seat Control Module
PDM	Passenger Door Control Module
DDM	Driver Door Control Module
SLM	Security and Locking Control module
IPK	Major Instrument Pack
BPM	Body Processor Module
ECM	Engine Control Module

Fig. 46 X100 VCATS Label

NOTE:

The V CATS label on X100 and X308 vehicles was previously located on the rear trunk compartment lower panel. This label was relocated to the left side longitudinal in the trunk compartment. This was done to avoid possible damage occurring to the V CATS Label. The change was introduced into production at VIN: A11051.

VID Block

VID Block is an acronym for Vehicle Identification Block and is supported in X103, X105, X200, X202, X350, X400 and X404 vehicles. The VID Block is only stored in the vehicle's ECM and is programmed into the module on the assembly line during build using a computer called a VCATS station.

The VID block contains 256 bytes of data vital to the ECMs own functionality as well as being needed when programming new modules other than the ECM. In this way, the ECM VID block is essentially the configuration keeper for the whole vehicle.

Each vehicle VID Block is partitioned into two separate areas, the first 64 bytes contain data used for the ECMs own configuration purposes and the last 192 bytes are used to store data for the other configurable modules that are fitted to the vehicle.

Replacing an ECM

The VID Block is only stored in the ECM, and so when an ECM is replaced the configuration process is different than that for the other control modules. Data cannot simply be extracted from the VID Block and downloaded to the new module, as the VID in the new module isn't programmed.

Once the ECM has been selected from the "New Modules" menu and the VIN verification has been carried out the WDS application will first Flash Program the module with the latest appropriate software that is identified on the WDS database. When the flash programming has completed successfully the next stage is to transfer the ECMs unique Passive Anti Theft System Identification (PATS ID) to the other modules on the vehicle that require the ID. The modules that store the PATS ID vary from vehicle type to vehicle type.

After Flash Programming and PATS ID transfer have been completed the next stage is to configure the ECM with it's own configuration data as well as mirror data for all the configurable modules that are also stored in the VID Block. The ECM's own configuration will be constructed from data extracted from the VCATS code stored in the WDS database for the VIN entered at the start of the session, and from operator questions when certain data isn't available from the VCATS Code.

The seventeen character VIN that forms part of the VID Block will be copied from the Instrument Pack. Once this part of the VID Block has been rebuilt the WDS will interrogate all modules that store a mirrored copy of their configuration data in the VID Block and construct the remaining part of the VID Block before downloading it to the new ECM. DTCs will then be cleared and the whole programming and configuration process for the ECM will be complete.

Configuration of the ECM

The exception to the previous procedure is when the VID block itself needs to be reprogrammed. This situation would arise if a new ECM was fitted. The procedure would be as follows:

- The operator should select the Vehicle Configuration application tab followed by Program New Module and ECM.
- The WDS will check the VIN stored in the Instrument Cluster and compare this with the VIN entered by the operator at the start of the session. If these are different, the operator will be given a VIN mismatch warning and will be asked if the manually entered data should be used.
- If the operator selects No, a keyboard will be displayed and the VIN can be re-entered manually.
- If the operator selects Yes, the calibration files and VCATS data stored by WDS relating to that VIN will be displayed for the operator to check and confirm.
- The calibration procedure will then take place after which the operator will be told to cycle the ignition.
- The appropriate Dealer Option screens will be presented for the operator to select the appropriate dealer fit and customer options.
- Finally, the VID block programming will be carried out where the configuration details from the other modules and the vehicle VIN are stored in the VID block. At this stage, the PATS code alignment to the Instrument Cluster will be carried out without any input required from the operator.

Programming Existing Modules other than ECM

When a new module is fitted to the vehicle it will have either no configuration data stored in memory or it will have default data stored. Either of these scenarios could result in functionality issues or error messages in the Instrument Cluster until the module has been properly programmed and configured. The extent of these issues will depend on which module has been fitted.

For modules other than ECM, once a module has been fitted and the relevant module selected from the list of new modules in the WDS configuration tool, the WDS will carry out a VIN verification check between the VIN entered manually into the WDS at the start of the session and the VIN stored within the VID Block of the ECM. If a mismatch is detected the application will then move onto the next module to verify the VIN until a match has been found. If no match is found a “VIN Mismatch” message will be displayed to the operator, showing the modules and the VINs read from each module.

“Programming Existing Modules” basically consists of flash programming the latest available calibration. The required time and procedure necessary to flash program each module differs between modules, vehicles, and model years.

Programming an existing module does not affect a module's configuration, as this is located in a protected area of memory (except X200 PTEC). Also, while programming an existing module, neither the PATS ID will be erased nor will immobilization need to be run. If a module fails to be successfully flash programmed it is possible to retry a number of times.

If failures do occur it is generally down to either the vehicle battery voltage being low, faulty WDS communication leads or poor connections at the vehicles J1962 diagnostic (DLC) connector. Finally, the module may need to be replaced if it cannot be succesfully flashed.

NOTE:

It is vital that when programming an existing module the vehicle configuration screen displays the correct configuration for the vehicle VIN that has been entered at the start of the session. I.e. engine size, engine type, market, cruise control type, transmission etc.

How Programming Affects Diagnosis

There are two possible malfunctions of a control unit:

- A hardware problem
- A software problem (Programming).

A large majority of all control units that are replaced during service have a software problem that can be corrected by reprogramming of the hardware. It is suggested before any modules are replaced a hard reset and/or reprogramming should be carried out. Several options are available with WDS: Program New Module, Program Existing Module, Dealer options, Setup and configuration.

NOTE:

A hard reset does not repair a fault condition. It simply brings all control modules back to their baseline condition. If a hard reset eliminates the symptoms, then further diagnosis is needed to determine the cause of the conditions i.e. low battery causing a single control module to come off line temporarily.

On vehicles that cannot be programmed via the diagnostic equipment, note the three conditions below before interchanging control modules between identical vehicles to confirm diagnosis.

The VCATS label is located on the floor of the luggage compartment of X100 only models. Each label is specific to each individual vehicle, and lists the VIN of the vehicle along with the part numbers of the CMs originally fitted to the vehicle during manufacture.

The part number of the Body Processor Module is identified as: LJA2500AG/ 055. In the illustration, the basic part number LJA2500AG has been programmed during vehicle manufacture for the specific market and features of the vehicle concerned, and is identified as 055. This would be the complete part number for a replacement BPM for the vehicle concerned if it were necessary to order one from Jaguar Parts Operations. Note that the suffix 055 (in the example above) does not appear on the label on the CM concerned. This number appears only on the VCATS label of the vehicle.

It is permissible to **temporarily** interchange a CM from another vehicle for testing purposes, only if:

a. The full vehicle history of both vehicles is available
b. The history of both vehicles indicates that the CM in question has not previously been replaced by a CM from another vehicle or by a replacement part
c. The VCATS label information for the full part number of the CM in question on vehicle is **identical** as illustrated above.
d. The donor vehicle is known to have no electrical defect.

Always disconnect the battery first, and reconnect it after connecting the replacement CM. The possibility exists, particularly for control modules that control the movement of door windows or power operated convertible tops, for inadvertent uncontrolled operation of these systems if the battery remains connected during such operations. This can result in injury to persons working on the vehicle.

Each year, vehicles seem to get more and more complicated. For example, the X404 can be fitted with as many as 23 control modules depending on the model. Although this high number of control modules will likely make you think that working with them will make your job harder, the fact is that they actually make it easier to service and diagnose the vehicle.

Some of the reasons for this increase in the number of control modules are:

- The need for sophisticated engine controls to meet emissions and fuel-economy standards
- Advanced diagnostics
- Simplification of the manufacture and design of cars
- Reduction of the amount of wiring in cars
- New safety features
- New comfort and convenience features

For example, one of the most important modules is the instrument cluster. The instrument cluster gathers and displays data from various parts of the vehicle. Other modules in the car already use most of this data. For instance, the ECM knows the coolant temperature and engine speed. The transmission controller knows the vehicle speed. The controller for the anti-lock braking system (ABS) knows if there is a problem with the ABS.

Over the last decade, safety systems such as ABS and airbags have become standard equipment across the whole Jaguar model range. Other safety features such as traction-control and stability-control systems are starting to become common as well. Each of these systems adds a new module to the car, and this module contains multiple microprocessors. In the future, there will be more and more of these modules all over the car as new electronically controlled systems need their own computer controlled device to operate accordingly.

As you will see in the following model-specific chapters, knowing all the specific modules used on each model line and also how to service and program them, will make your job much easier.

WORKSHEET – DOWNLOADING A VID BLOCK

You suspect that the VID block on the vehicle you are working is corrupted, the technical helpline has asked you to download it to a floppy disk and send it to them for re-configuration.

This worksheet, is designed to take you step by step on how to perform this procedure.

Vehicle Identification Block Read is located under the Vehicle Configuration tab / Special applications menu. Highlight the application and press the tick to enter.

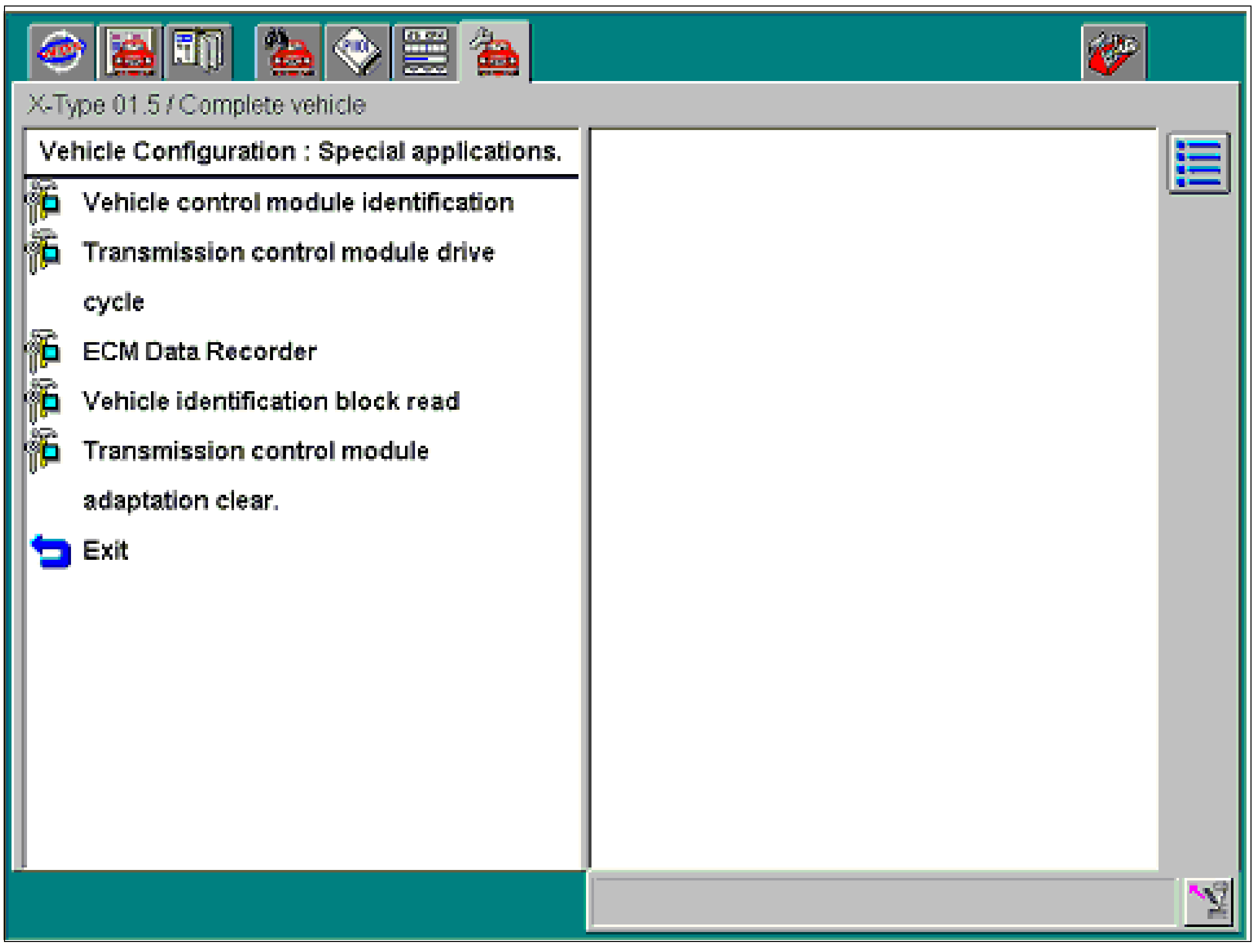


Fig. 47 VID Block Application Location

The first two screens displayed contain general information for the operator. This contains basic knowledge of where the Vehicle Identification Block is stored and what state the vehicle needs to be in before the read can take place. Once these screens have been passed the WDS displays the complete VID Block and various icons.

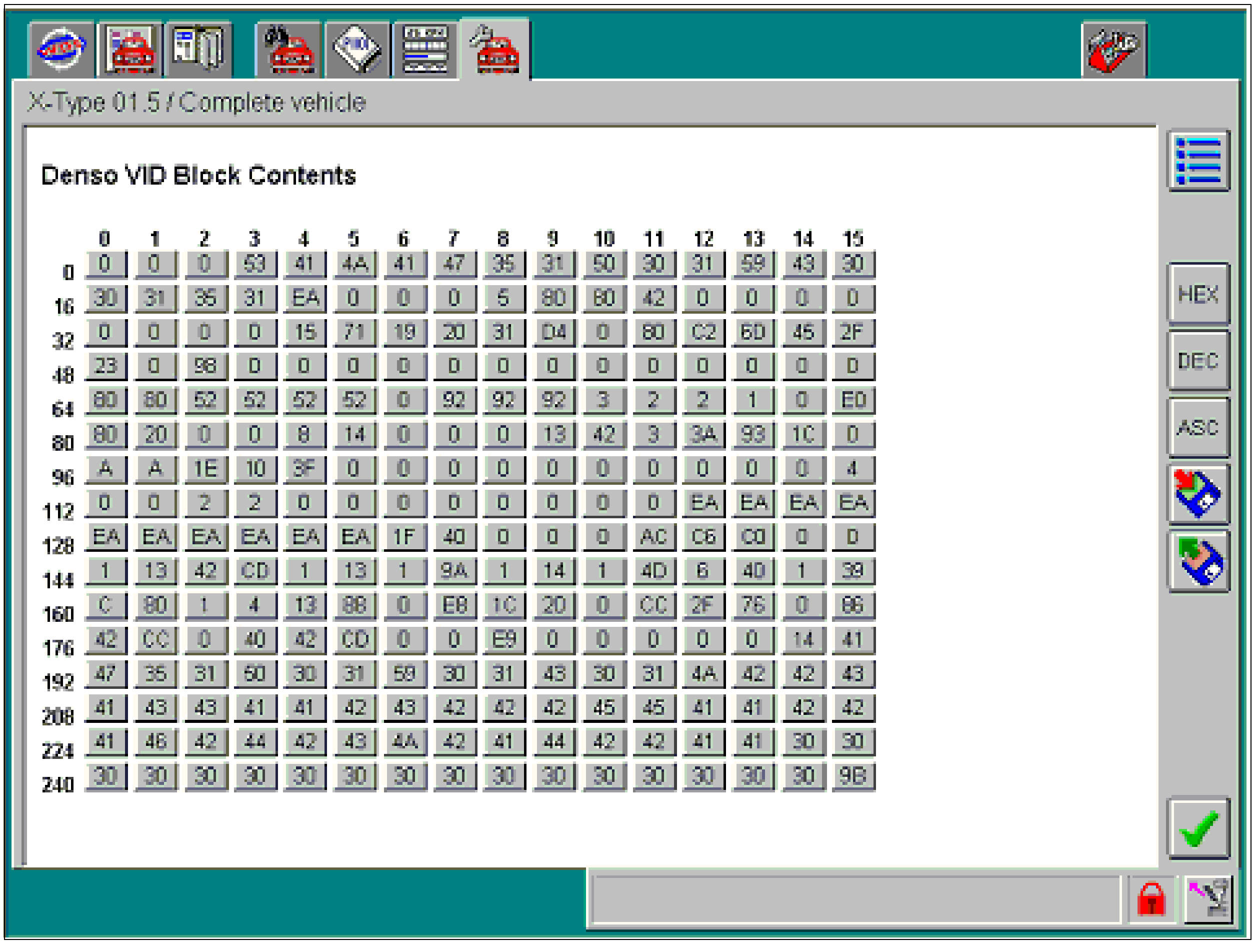


Fig. 48 VID Block screen display

Press the Floppy disc “IN” icon to save the VID capture file. Ensure that the PTU is “docked”, with power and that a disc is inserted into the “A” drive. The WDS should display that the save has been completed successfully.

The VID Block file is now ready to E-mailed to the dealer technical helpline.

JAGUAR

TRAINING PROGRAM

JAGUAR ADVANCED ELECTRICAL SYSTEMS

PUBLICATION CODE – 684

CONTROL MODULE FUNCTION — OVERVIEW

While control modules can support multiple functions, they can be organized by their primary functions into 3 groups: Powertrain, Vehicle Dynamics, and Body modules.

These groups again can be broken down by subgroups, as defined by function. Examples of these subgroups are:

Powertrain

- Engine control module (ECM)
- Transmission control module (TCM)
- Gear selector module (J-gate)
- Adaptive speed control
- Fuel pump module

Vehicle Dynamics

- Dynamic stability controls module (DSC)
- Air suspension module
- Parking brake module

Body Subsystems

- Climate control (RCCM, climate control panel)
- In car entertainment (Audio head unit, cd autochanger)
- Windows, locks and security (driver door module, sliding roof module)
- Restraint system (Restraints control module, occupant sensing module)
- Lighting and cross network communication (FEM, REM, instrument cluster)
- Trailer towing module

The number of modules under each grouping varies, by vehicle model, dependent on the number of features found in the vehicles.

Table 12 Control Modules by Vehicle Line

Vehicle Model	Modules (front of vehicle to back)
X100	ABS, TCM, ECM, SLCM, BPM, ACCM, KTM, Major Instrument pack, PAS control module, Occupancy sensing module, RSM, RCM, DDCM, Gear selector illumination module, DSCM, DHRCM, Dimmer module, PDCM, PSCM, PHRCM, Cellular phone control module, NAV, Adaptive dampening control module, RPC module, Lamp control module (deleted 2001 MY on)
X103	ASC, DSCM, ECM, SLCM, ACCM, BPM, Key Transponder Module, Major Instrument Cluster, PASM, RSM, Occupancy Sensing Module, Dimmer Module, RCM, DDCM, PDCM, DHRCM, PHRCM, J Gate Illumination Module, Cellular Phone Control Module, Navigation Control Module, Adaptive Damping Control Module
X308	Radiator fan control module, ABS, SLCM, TCM, ECM, BPM, SRS single point sensor, A/CCM, Adaptive dampening control module, KTM, Dimmer module, Instrument pack, PAS control module, Occupancy sensing module, Sliding roof control module, Garage door opener, RCM, DDCM, Gear selector illumination module, DSCM, PDCM, PSCM, DRDCM, PRDCM, NAV, RPC module, SLCM, Cellular phone control module
X350	LH Headlamp Leveling Module, SLCM, RH Headlamp Module, DSCM, ECM, FEM, ACC, RCCM, IC, RCM, Audio Unit, NAV, DDM, DSM, JGM, Occupancy Sensing Module, RCCP, RMM, ASM, VIM, EPB, Fuel Pump 2 Module, REM, Parking Aid Module, Trailer Towing Module
X200	TACM, ABS/DSC, GECM, PCM, Instrument Pack, ACCM, RCM, DDCM, DSCM, SRCM, DRHCM, PSHCM, PACM, CTCM, RECM, VACM, NCM, VICM, ADCM
X202	ASC, DSCM, SLCM, SCLM, GECM, ECM, HLCM, IC, RCM, Remote Air Conditioning Control Module, Air Conditioning Control Panel, DDCM, DSCM, DSHCM, PSHCM, Occupancy Sensing Control Module, Passenger Seat Weight Sensing Control Module, VICM, VACM, CPCM, Parking Brake Control Module, RECM, PACM, Trailer Towing Module, ADCM
X400	CFM, ABS/DSC, ECM, ACCM, TCM, KTM, IC, HLCM, RCM, JGM, RCM, GEM, NAV, FPM, Radio antenna module, VACM, PACM, CD
X404	CFM, ABS/DSC, RCCM, Speed control module, ECM, RCCM, TCM, RCM, IC, HLCM, RCM, DSM, JGM, RCM, GEM, NAV, FPM, CPCM,VACM, VICM, PACM, CD

CONTROL MODULES: X100 SERIES, X308

While module locations may differ, the basic control module architecture of the X100 and X308 are virtually identical. The module function will be described for both vehicle models.

Engine Control Module — X100/X308

The engine management system is controlled by the ECM, which is installed in the control module enclosure in the engine compartment. It also incorporates a comprehensive component monitoring and diagnostic capability.

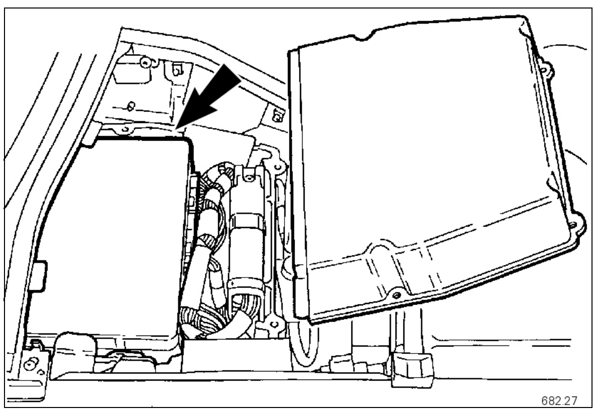


Fig. 49 Engine Control Module: X100 series, X308

Transmission Control Module — X100/X308

The transmission management system uses both analog and digital signals to control the operation of the transmission. Digital signals are processed by the TCM to and from the vehicle multiplex network. Other input / output analogue signals are hard-wired to the TCM. This information is used primarily by the TCM to decide which shift program to implement, which gear to select and for shift energy management. If a fault occurs, the TCM will take default action and inform the driver via the Message center and amber warning light.

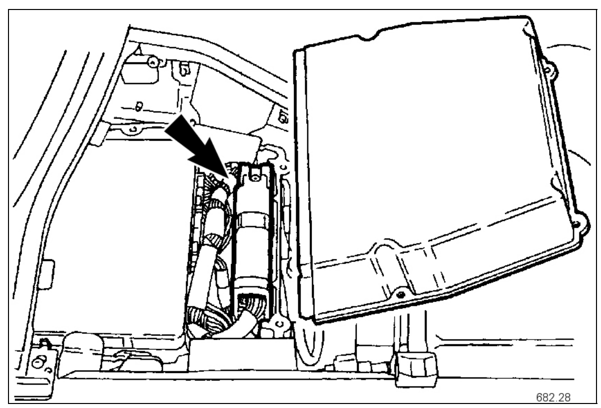


Fig. 50 Transmission Control Module — X100/X308

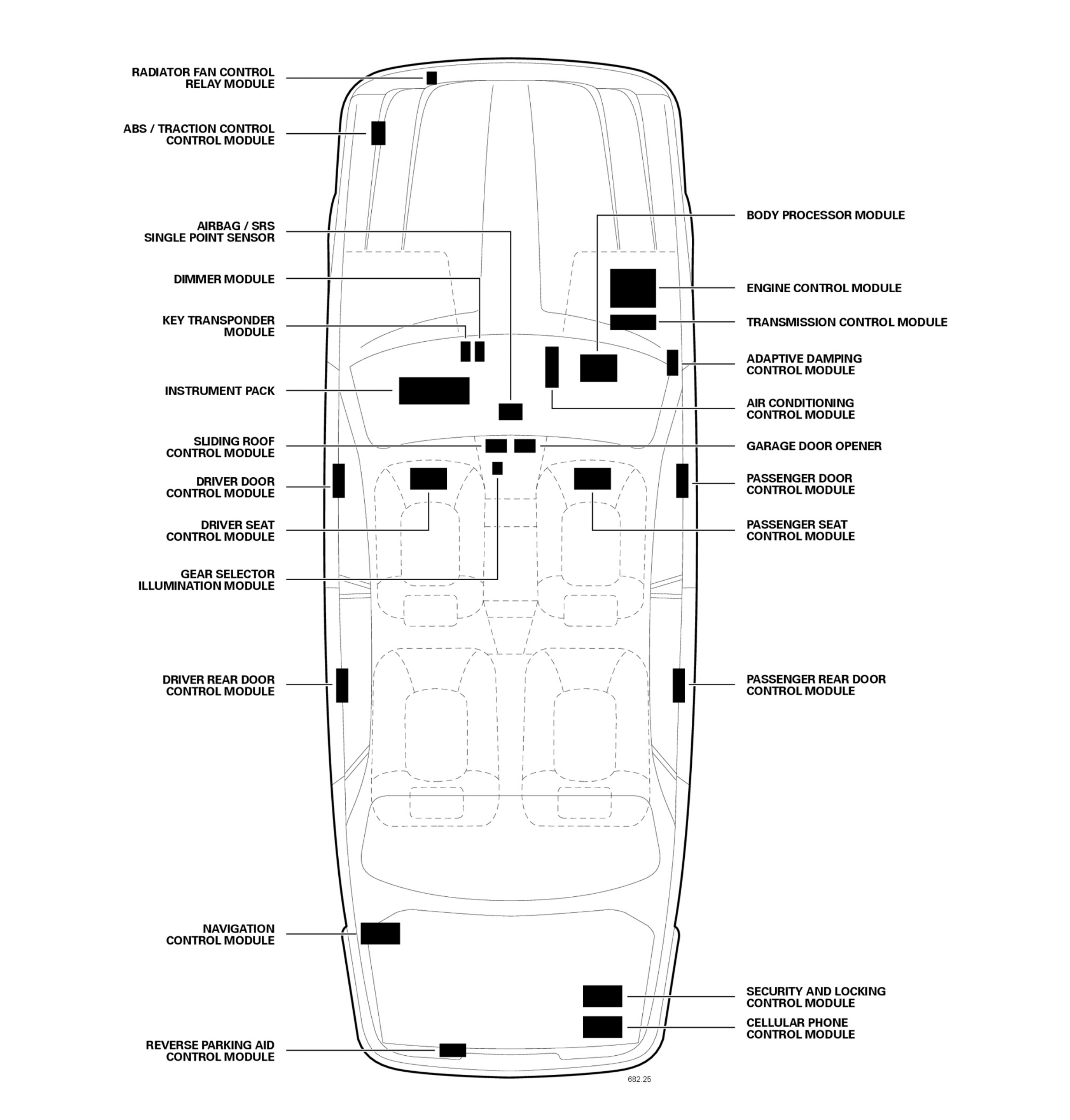


Fig. 51 Control Module Locations: X308

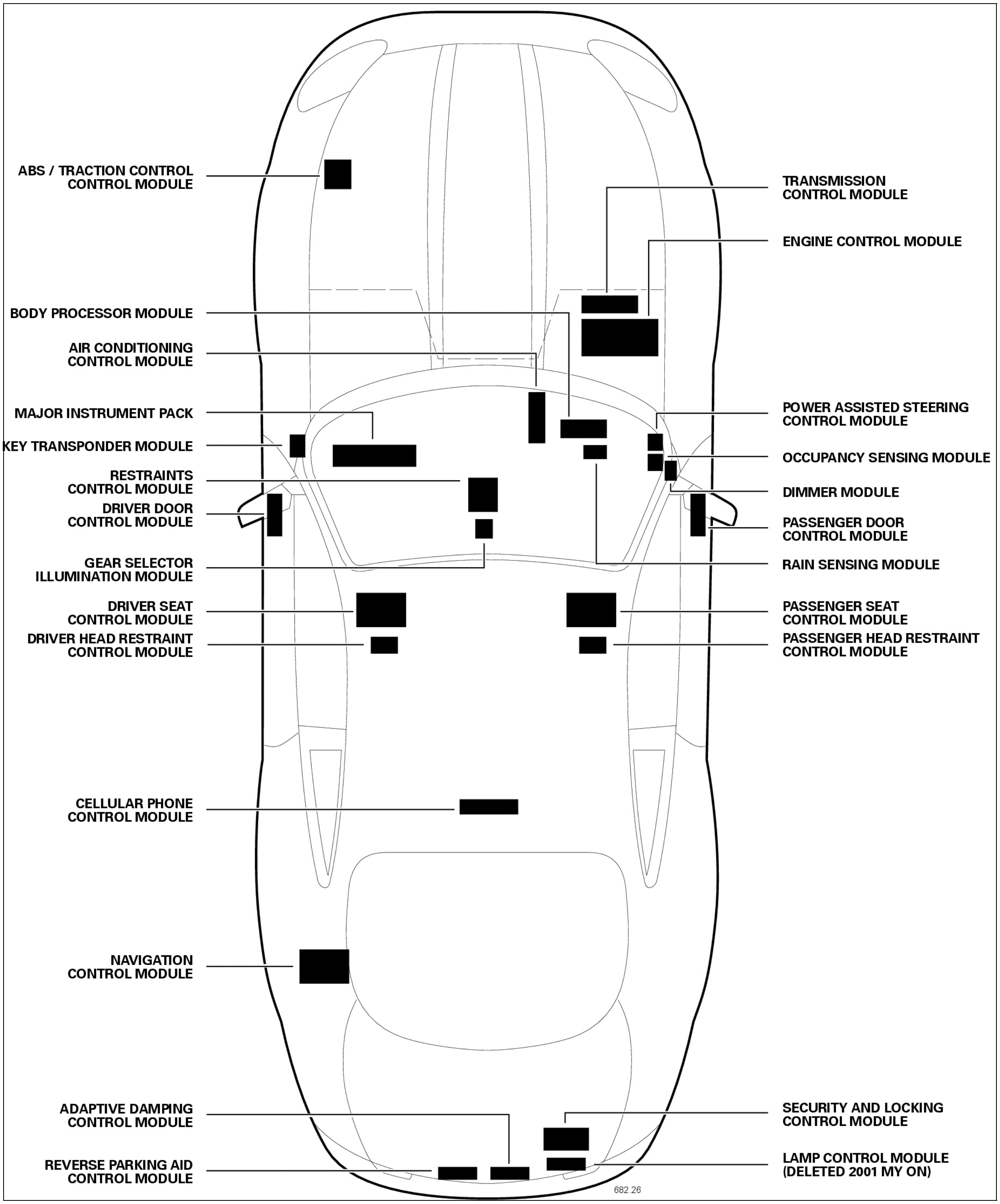


Fig. 52 Control Module Locations: X100 series

Body Control System — X100/X308

The Body Control System consists of a combination of the following modules:

- Body Processor Module (BPM)
- Security and Locking Control Module (SLCM)
- Driver Door Control Module (DDCM)
- Passenger Door Control Module (PDCM)
- Driver Seat Control Module (DSCM)
- Passenger Seat Control Module (PSCM)
- Driver Rear Door Control Module (DRDCM X308)
- Passenger Rear Door Control Module (PRDCM X308)
- Driver Head Restraint Control Module (DHRCM X100 series)
- Passenger Head Restraint Module (PHRCM X100 series)

Body Processor Module — X100/X308

The BPM is located in the fascia, mounted on the passenger airbag/SRS bracket, behind and above the glovebox.

The BPM functions are (can include):

- Interior and exterior lighting, except for the door puddle lamps and the rear lamp bulb failure
- Windshield wash/wipe and headlamp power wash
- Steering column memory
- Action alarm lights and sounders and inhibits engine crank
- Gearshift and ignition key interlocks
- Various switches, for example: convertible top, trunk release, fuel filler flap release
- Various audible and visual alarms, for example: sidelight on warning, convertible top operating, seat belt status.

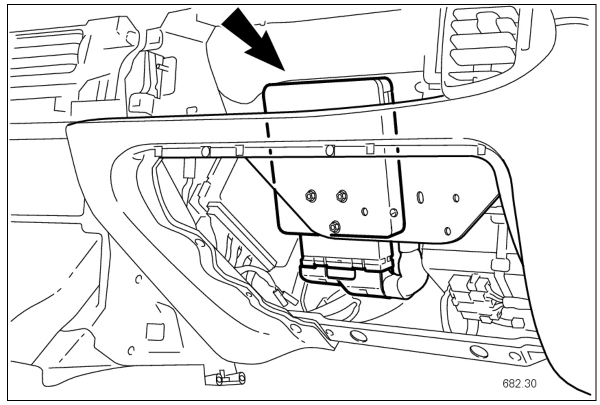


Fig. 53 Body Processor Module: X308

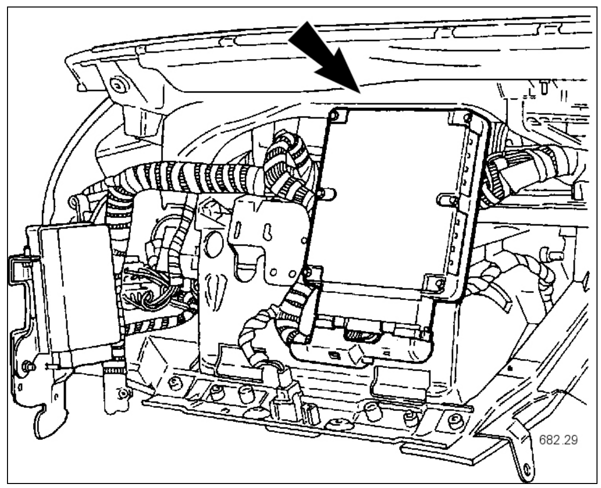


Fig. 54 Body Processor Module: X100 series

Door Control Modules: X308

The door control modules operate the windows, the door unlock, the door guard lamps and, on the front doors, the door mirrors. They also produce SCP outputs for operation of the courtesy lights, the central locking system and the security system.

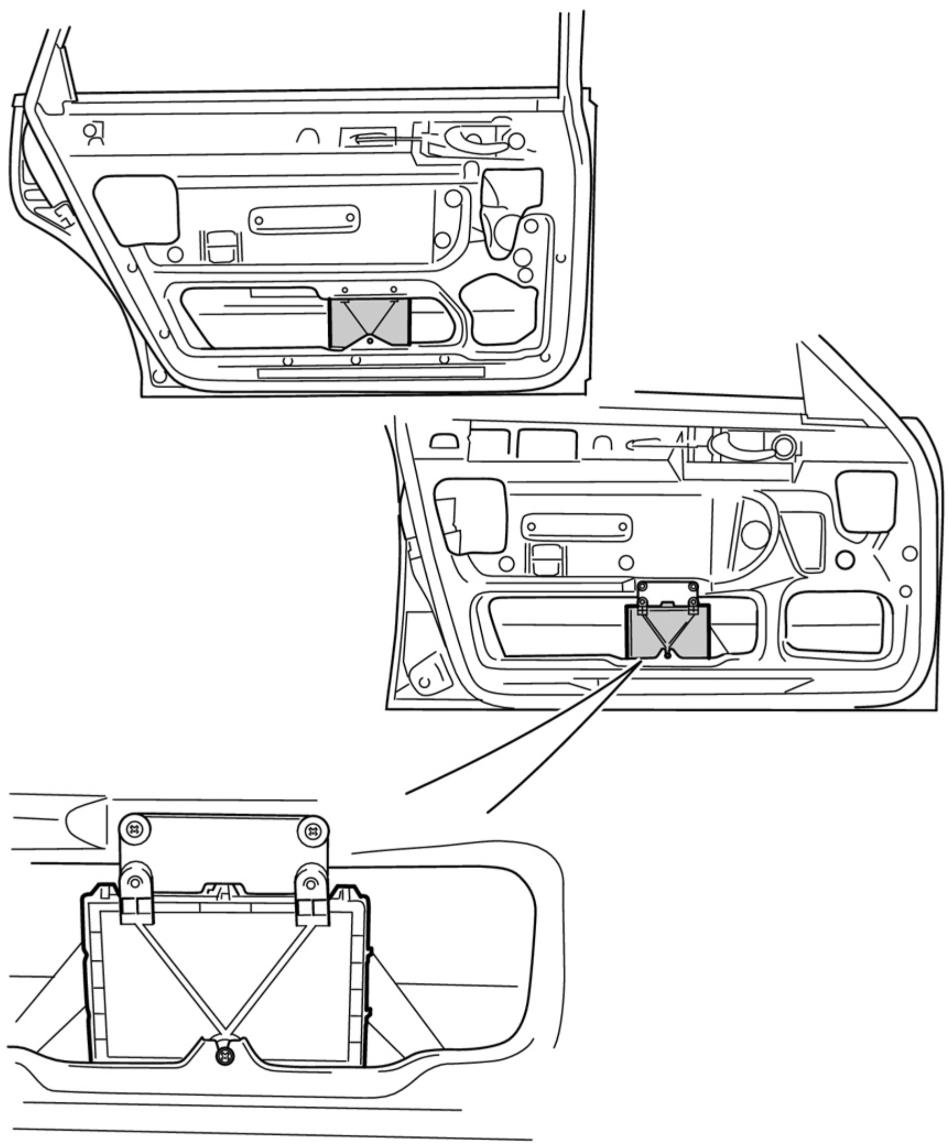


Fig. 55 Door Control Module — X308

CONTROL MODULES: X350

The most significant change on the new 2004MY onwards XJ (X350) is the higher number of control modules due to the addition of new systems such as ACC, Air suspension, HIDs, 4 zone A/C, rear seat memory (LWB only) , rear ICE, etc.

The illustration on the following page shows the location of all vehicle modules used on the 2004MY XJ.

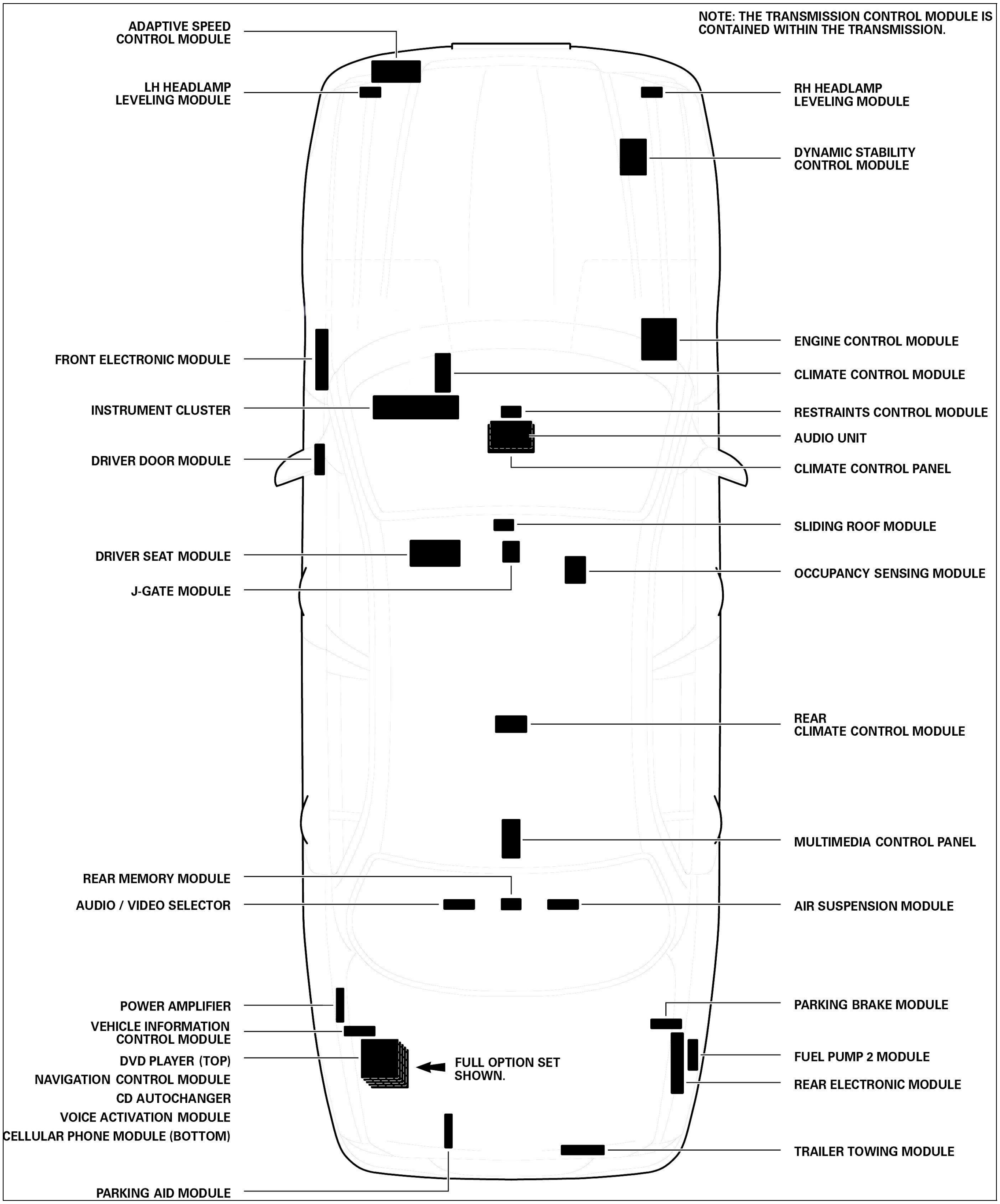


Fig. 56 X350 Control module locations

Module Overview — X350

Table 13 Control Module Properties: X350

Module	Flash Programmable using WDS	Configurable	Dealer Options available	Full VIN storage supported
Driver's Seat Module	No	No	No	Yes
Driver's Door Module	No	Yes	Yes	Yes
Front Electronic Module	No	Yes	Yes	Yes
Rear Electronic Module	No	Yes	Yes	Yes
Rear Memory Module	No	No	No	Yes
Parking Aid Module	No	No	No	No
Navigation Module	No	No	No	No
Voice	No	Yes	Yes	Yes
Phone	No	No	No	Yes
In Car Entertainment	No	Yes	Yes	Yes
Restraints Control Module	No	No	No	No
Adaptive Cruise Control	No	Yes	Yes	Yes
Air Suspension Unit	No	Yes	No	No
DSC/ABS/TCS	No	No	No	No
Electronic Park Brake	No	Yes	Yes	No
Auto-Levelling Module (HID)	No	Yes	No	No
Instrument Cluster	No	Yes	Yes	Yes
Engine Control Module	Yes	Yes	Yes	Yes
Amplifier Module	No	Yes	Yes	Yes
Rear Entertainment Module	No	No	No	No
Transmission Control Module	Yes	No	No	Yes
Climate Control Module	Yes	Yes	No	Yes

Body Control Module Functions — X350

The body control modules are all connected to the SCP communication network.

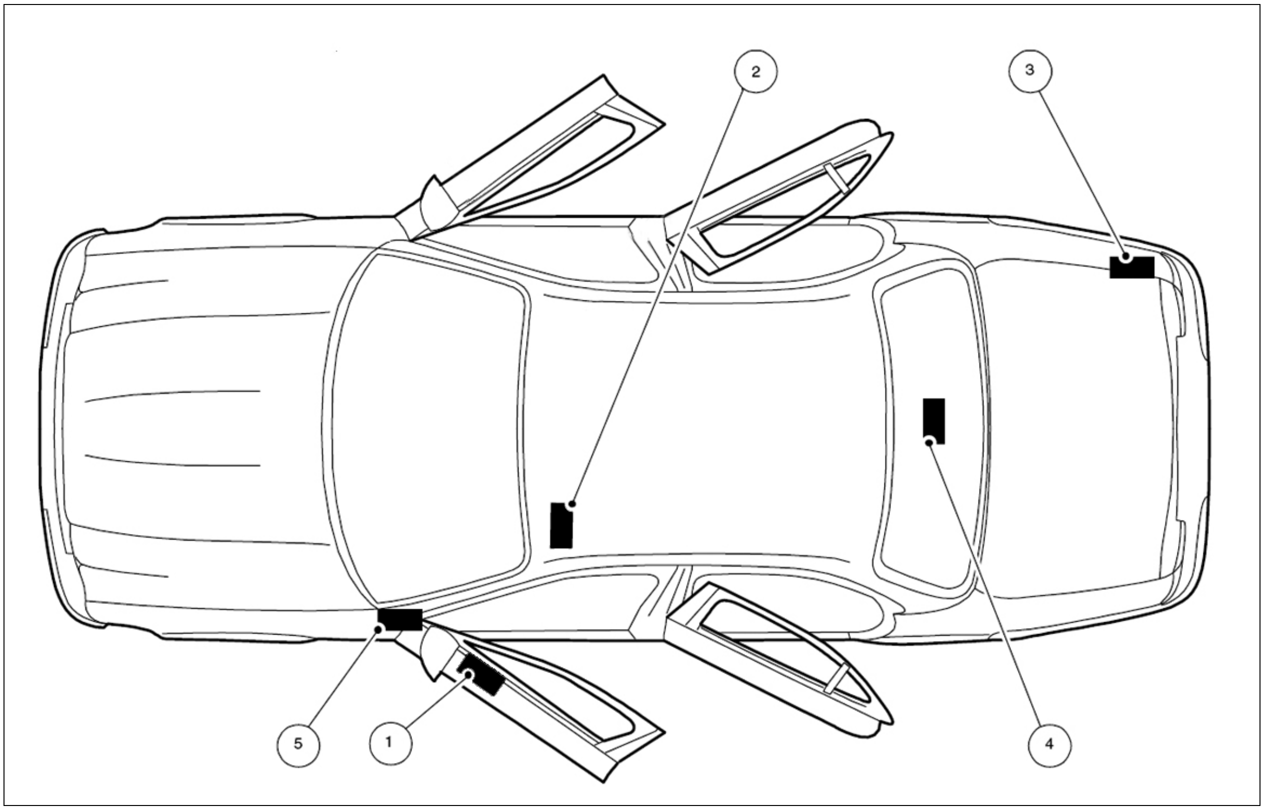


Fig. 57 Body Control Module Location — X350

1. DDM (DDM (Driver Door Module)
2. DSM (DSM (Driver Seat Module)
3. REM (REM (Rear Electronic Module)
4. RMM (Rear Memory Module)
5. FEM (FEM (Front Electronic Module) AKA GECM)

The following table lists the functions of each control module.

- Front Electronic Module (FEM)
- Rear Electronic Module (REM)
- Driver's Door Module (DDM)
- Driver's Seat Module (DSM)
- Rear Memory Module (RMM)

Table 14 Body Control Module Functions — X350

FEM	REM	DDM	DSM	RMM
Security & Locking • Bonnet ajar switch • Master lock switch • Valet mode switch • Electric glove box • Front passenger door ajar • Anti-theft lines (FEM, REM, DDM, radio unit) • Central door locking switch • Interior luggage compartment release	Security & Locking • Passive sounder • Passenger rear door lock • Luggage compartment latch • Fuel filler flap • Inertia switch • Anti-theft lines (FEM, REM, DDM, radio unit) • Rear doors ajar • luggage compartment ajar • luggage compartment closed status • PATS ID transfer	Security & Locking • RF receiver for RKE (remote keyless entry) function • Drivers door locking • Anti-theft lines (FEM, REM, DDM, radio unit) • Drivers door ajar • RES (remote entry system), Rooker interface • Central door locking • Two Stage unlocking	Seat Control • Driver seat movement • Drivers Seat memory recall	Seat Control • Move-ment of the rear seat • Rear seat memory recall

FEM	REM	DDM	DSM	RMM
Exterior Lighting • Front direction indicators • Side repeaters • Front side lamps • Dip beam • Main beam • Front fog lamps • Front direction indicator bulb fail detection • Side repeater direction indicator bulb fail detection • Auto lamps • Exit delay • Headlamp convenience • Daylight running lamps • Hazard warning lamps	Exterior Lighting • Rear fog lamps • Rear side markers • Tail lamps • Reverse lamps • Stop lamps (including HMSL) • Registration plate lamps • Rear direction indicator lamps • Rear direction indicator bulb fail detection	Convenience features • Drivers door mirror movement and memory functions • Folding mirror control • Memory switch pack interface • Rear window lockout • Memory set LED	Miscellaneous • Connection to SCP network • Diagnostics • VIN storage	Miscella-neous • Connec-tion to SCP net-work • Power park headrest (when available) • Diagnos-tics • VIN storage
Interior Lighting • Interior lighting switch • Front puddle lamps • Courtesy fade output • Approach lamps • Halo lighting	Interior Lighting • Courtesy fade • Puddle lamps • Luggage compartment lamps	Miscellaneous • Connection to SCP network • Diagnostics • Personaliza-tion • VIN storage		
Wipers & Washers • Wiper control • Power wash • Screen wash • Washer fluid level • Lights on with wipers	Miscellaneous • Fuel pump • Rear seat heaters • Fuel level sender • Brake pedal switch • Electrochromic rear view mirror • Connection to SCP network • VIN storage • Diagnostics • Load management • Bulb fail monitor for tow bar connection			

FEM	REM	DDM	DSM	RMM
Convenience features • Passenger door mirror movement functions and memory • Adjustable pedals • Window enable output • Heated steering wheel				
Miscellaneous • Three level seat heater (front seats) • Back lighting PWM output • Horn output • Connection to SCP • VIN storage • Diagnostics • Load management				

Instrument Cluster — X350

The instrument cluster is new for the new X350.

The gauges are operated by stepper motors which is the same as previous models.

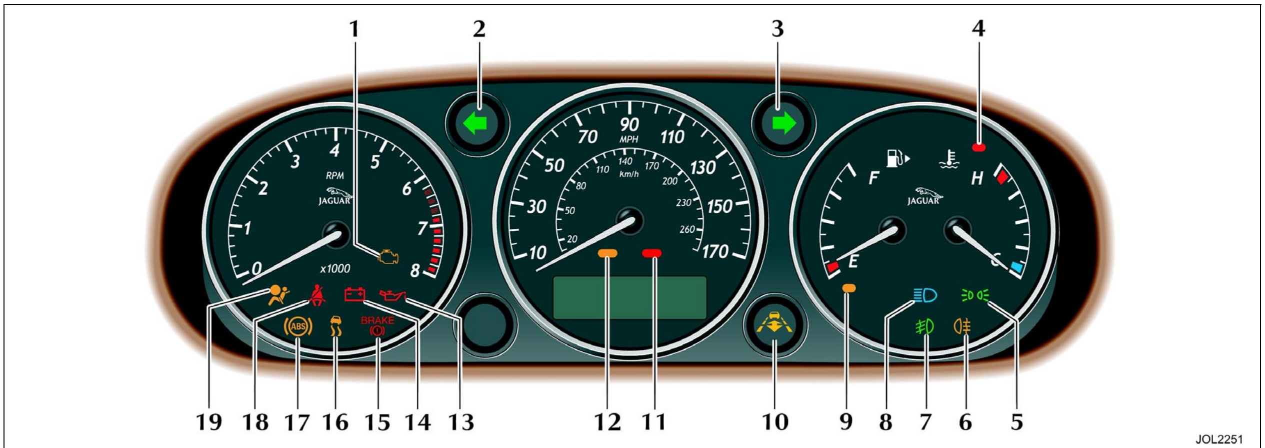


Fig. 58 Instrument Cluster — X350

1. Engine Malfunction (MIL)
2. Left-hand indicator
3. Right-hand indicator
4. Engine temperature
5. Side lights
6. Rear fog lights
7. Front fog lights
8. Main beam
9. Low fuel level
10. Adaptive cruise control follow mode
11. Priority warning message center — Red
12. Priority warning message center — Amber
13. Low oil pressure
14. Charge indicator
15. Park brake on, brake fluid indicator or park brake fault
16. Dynamic Stability control
17. Anti-lock braking system
18. Seat belt
19. Airbag

The instrument cluster is illuminated at all times when the ignition switch is in position II. If the master lighting switch is OFF then the instrument cluster will be illuminated at full intensity. When the master lighting switch is ON, illumination intensity of the instrument cluster is controlled by the dimmer switch.

Instrument Cluster Functions:

- Display vehicle information
- Display vehicle warning messages
- Gateway between the CAN and the SCP networks
- Control the adjustment operation of the electric steering column
- Control the Servotronic II steering rack
- Partial Control of PATS
- Provide audible warning tones

A number of warning lights are arranged within the dials of the instrument cluster. The color of each warning light indicates the potential severity of the condition indicated.

- If a red warning light illuminates then action is required immediately
- If an amber warning light illuminates then action is required as soon as possible
- Green and blue warning lights are used for exterior light tell-tales

When activated, some warning lights have associated messages which are displayed in the message center. (See Driver's handbook for complete details of displayed messages).

When the ignition switch is turned to position II, the instrument cluster will carry out a warning light check for three seconds to confirm the operation of the warning lights.

The SRS warning light is illuminated for six seconds due to the SRS system carrying out a self test.

NOTE:

Not all warning lights are illuminated during the self test period, such as the following examples:

- Main beam warning light
- Indicator warning light

If a warning light remains illuminated after the bulb check period then this indicates that a fault is present which will require investigation.

Certain faults will cause a warning light to be illuminated only, while others will cause a warning light to illuminate with the addition of a text message displayed in the message center.

The message center does not display a warning message during the bulb check period.

Speedometer — X350

Vehicle speed is measured by averaging the speed of both rear wheels. This ensures that the speedometer will work correctly on a Dynamometer.

Tachometer — X350

The tachometer displays the engine speed in rpm. The range of the tachometer is:

0 rpm – 8000 rpm, N/A vehicles.

0 rpm – 7000 rpm, S/C vehicles.

Messages — X350

Messages are displayed immediately as they occur. If more than one message is active, each is displayed in turn for two seconds in order of priority.

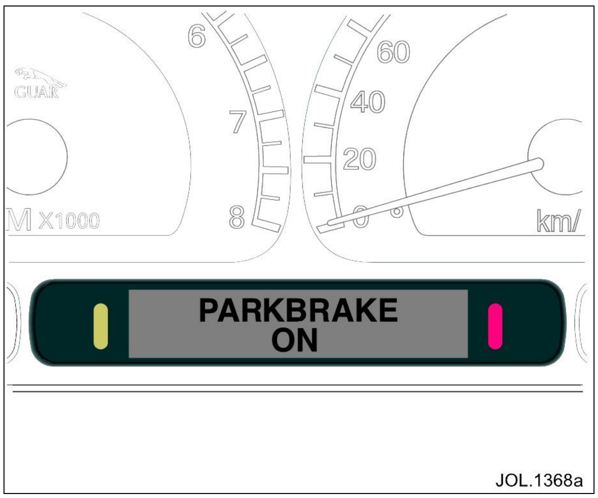


Fig. 59 Message Center — X350

Messages can be hidden by pressing the RESET button on the trip computer switch pack. One press will hide one message. Once all messages have been hidden, the display will show trip data. A further press will display the odometer reading. If RESET is pressed again, all active messages will be re-displayed.

If the trip computer function is selected by pressing the TRIP button while messages are displayed, the trip data will be displayed for 10 seconds. After 10 seconds the message will be displayed again.

The language that the messages are displayed in can be changed to suit the appropriate market.

To change the language carry out the following procedure:

- Press and hold the ml/km button on the trip computer switch pack
- Turn the ignition switch to position II
- Release the ml/km button on the trip computer switch pack
- Press the ml/km button on the trip computer switch pack. Each press of the button will select a different language
- When the desired language is shown, press the A/B button

After three seconds the language will be selected.

Table 15 Message Center Definitions

MESSAGE CENTER	MEANING
WASHER FLUID LOW	Indicates that the windscreen washer fluid level is low. If wash/wipe is selected by the driver when this message is displayed (even if it has been cleared), the programmed wipe after washing will be disabled, to avoid smearing the screen if the reservoir is empty.
VALET MODE	Indicates that valet mode has been selected. Also indicates when an attempt is made to open the boot using the interior boot release whilst valet mode is selected.
LISTENING	Indicates that the voice recognition system is listening for commands from the driver.
VEHICLE TOO LOW	Warns that the vehicle is too low.
PARKBRAKE ON	Warns that the parking brake is engaged whilst the vehicle is moving. Either the parking brake was applied via the switch whilst the car was moving or the Drive Away Release is not working. If this is indicated whilst the car is not moving, check that the EPB module is receiving vehicle speed correctly.
PARKBRAKE FAULT	Indicates that an electrical fault has been detected with the parking brake system. It may not be possible to apply the parking brake. If the red brake warning light is flashing it will NOT be possible to apply the parking brake.
APPLY PARKBRAKE	It is not possible to determine whether the parkbrake is applied or not. If you are driving the vehicle, stop the car when it is safe to do so. When the car is stopped, apply the handbrake using the EPB switch. The message should then be extinguished.
EBD FAULT	A fault has been detected with the Electronic Brake force Distribution system. Drive with caution.
DSC NOT AVAILABLE	There is a fault with the Dynamic Stability Control system. Drive with caution.
RESTRICTED PERFORMANCE	Warns that vehicle speed is limited to 120km/h (75 M.p.h.) and engine power is also restricted.

ENGINE SYSTEM FAULT	Warns that vehicle speed is limited to around 10 – 15 m.p.h. Drive the car to the nearest safe area (hard shoulder, car park etc.). When safe, switch the ignition off and then back on to attempt to clear the problem.
FAILED FRONT LH INDICATOR FAILED FRONT RH INDICATOR FAILED LEFT SIDE REPEATER FAILED RIGHT SIDE REPEATER FAILED REAR LH INDICATOR FAILED REAR RH INDICATOR	Warns that an exterior lamp has failed. Check the lamp indicated.
CATS FAULT	There is a fault with the adaptive damping (CATS) system.
AIR SUSPENSION FAULT	There is a fault with the air suspension system. Also shown when the vehicle is in transit mode
CHECK FUEL FILLER CAP	The fuel tank leak test performed by the engine management system indicates a leak. Check that the fuel filler flap is shut.
CONFIG	An electronic module indicated by its initial letter has not been configured.
VIN:	The vehicle's VIN is displayed when the A/B button is held down while the ignition is switched on.

NOTE:

To exit the language changing procedure and keep the originally selected language, do not press the A/B button. Wait 10 seconds or turn the ignition switch to the OFF position.

The last two digits of the VIN can displayed on the message center by pressing the A/B button on the trip computer and turning the ignition on.

Instrument Cluster Configuration Messages — X350

The message center on the X350 has the capability of showing module configuration messages if a module has not been properly programmed. The message center will display a message**CONFIG "X"** which indicates which module or bus is exhibiting the concern.

If for example the message centers displays the**CONFIG B** message, this means that one of the modules on the D2B network was not properly programmed. In this situation, the best way to determine which module is experiencing the concern is to retrieve DTCs using WDS.

The following table describes the**CONFIG** display characters:

Table 16

CHARACTER	MODULE/BUS
A	DSC
C	ACC
D	DDM
E	ECM
F	FEM
I	IC
M	RMM
R	REM
S	DSM
T	TCM
B	TELEMATICS BUS

Audible Warnings — X350

The instrument cluster contains a speaker which will sound an audible warning tone when the required conditions are met. Only one audible warning can be sounded at a time. If more than one audible warning is required, the warning with the highest priority is sounded.

Table 17 Instrument Cluster Audible Warnings — X350

Audible Warning	Reason	Mut-ing	Pri-ority
Seatbelt reminder	Sounded when the front seat belt is not fastened when the seat is occupied and the ignition switch is in position II.	No	1
SRS fault	Sounds five short tones at intervals when a fault is detected with the SRS system	No	2
Park brake applied dynamically	Warns that the park brake has been applied while the vehicle is moving	No	3
Key 'in' Ignition Switch	Sounded when the driver's door is opened with the ignition key in the ignition switch and the switch is in position 0 or I	No	4
Park brake release inhibited	Sounded if the park brake release inhibit is active	No	5
Vehicle Armed (entry delay)	Sounds when the door is opened to warn that the alarm will sound shortly	No	6
Gear selector not in PARK	Warns that the gear selector is not in PARK when the ignition switch is turned from position II to position 0 or I	No	7
Valet mode	Indicates that valet mode has been set or that access to a restricted area has been prevented because valet mode has been set	Yes	8
Lights on	Warns that the master light switch is not in the OFF or AUTO position when the driver's door is opened	Yes	9
Memory set	Confirmation of memory setting procedure	Yes	10
Direction Indicator 'Tick Tock'	Sounds when the direction indicator or the hazard warning lamps are operated	Yes	11

Engine Coolant Temperature Gauge — X350

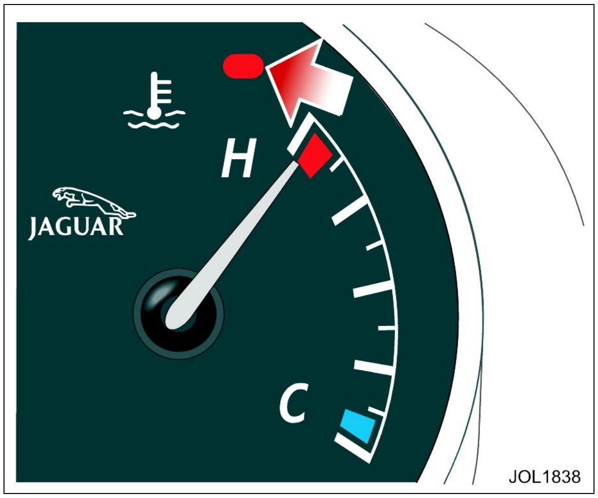


Fig. 60

The engine coolant temperature gauge indicates the temperature of the engine coolant.

The gauge will start to move from cold (blue) when the engine coolant temperature is approximately 65°C (149°F).

The gauge will indicate normal when the engine coolant temperature is between 85°C to 115°C (185°F to 239°F).

The gauge will indicate hot when the engine coolant temperature is 120°C (248°F) or above. The coolant temperature warning light will also be displayed.

Fuel Gauge — X350

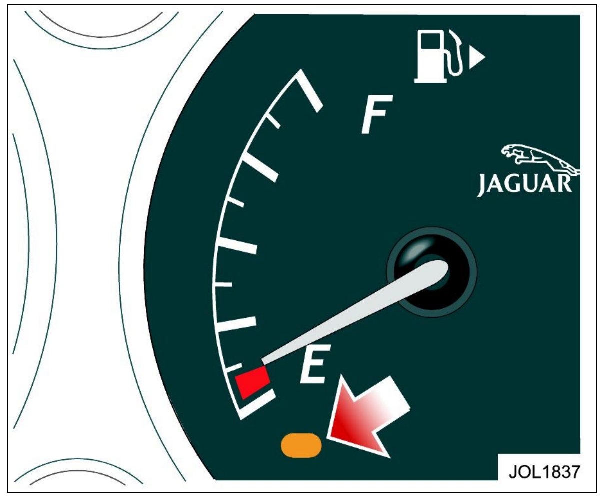


Fig. 61

The low fuel warning light will always illuminate halfway though the red section on the fuel gauge, leaving approx. 10 liter (2.6 gallons) of fuel.

Installation of a replacement Instrument Cluster — X350

If a replacement instrument cluster is installed, it must be configured to the vehicle using the Jaguar WDS.

The following information must be entered when programing a replacement instrument cluster:

- Steering column serial number
- Tire size
- ECM ID

When performing the IC replacement, the upper steering column has to be removed from the vehicle to allow the steering column barcode (serial number) to be read, and the column recalibrated.

CONTROL MODULES: X200

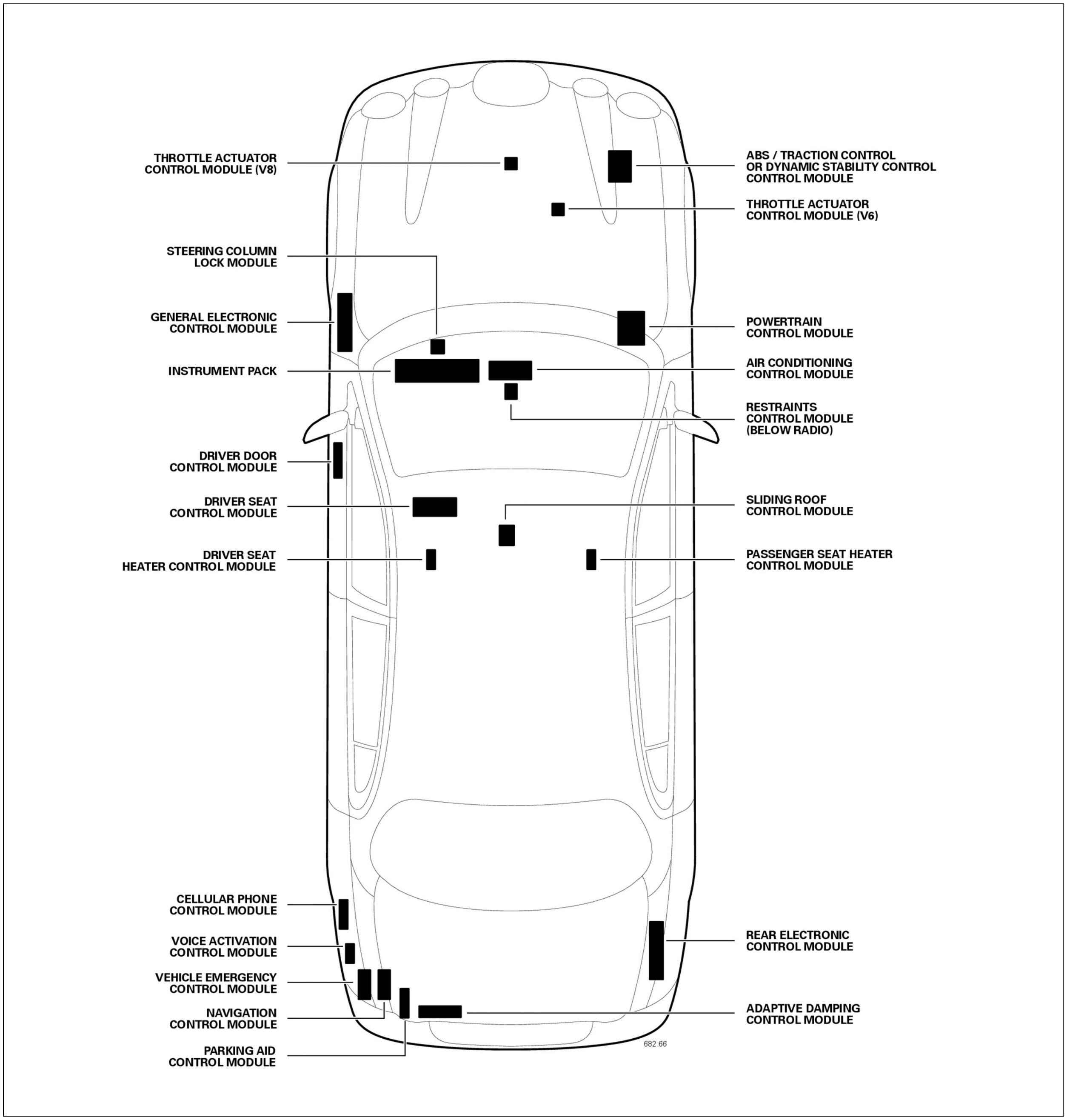


Fig. 62 Control Module Locations: X200

Control Module Configuration — X200

Most X200 control modules require configuration when replaced. Configuration sets up the control module to correctly function in the vehicle in which it is installed. If configuration is not carried out, one or more difficulties will occur:

- The engine will not start
- Incorrect operation may occur
- Certain features may not function

Configuration is performed using WDS and is carried out by performing the following steps:

- Select the “Vehicle Configuration” main tab
- Highlight “Configure New Modules”
- Select the appropriate module and follow on-screen prompts

Powertrain Control Module (PCM) — X200

NOTE:

Once a PCM is configured to a vehicle, it cannot be reconfigured to another vehicle.

After a PCM is replaced and the battery reconnected, connect WDS. WDS will perform the configuration during which you will be prompted to enter the Vehicle Identification Number.

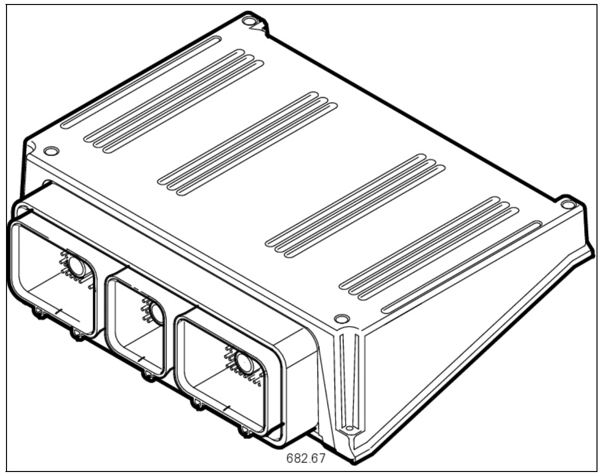


Fig. 63 PCM — X200

During configuration WDS writes vehicle identification information into a section of the PCM memory called the VID Block (Vehicle Identification Block). Once the VID Block space is occupied, it can be overwritten with a re-flash. The VID Block stores data pertaining to certain other vehicle control modules. For example, the instrument pack identification data.

NOTE:

The PCM must be configured to the instrument pack as part of the security system set up. If this is not carried out, the engine will not start.

Drivers Door Control Module (DDCM) — X200

The DDCM contains the antenna for the ignition key fob transmitters and must be configured to accept the transmitted signals.

The module can be configured for these market options and functions:

- RF decoder for remote keyless entry
- Personality configurations 1 and 2 linked to memory feature
- Power windows
- Driver mirror
- Exterior mirror movement
- Power or automatic door locks
- Easy entry/exit Horn chirp

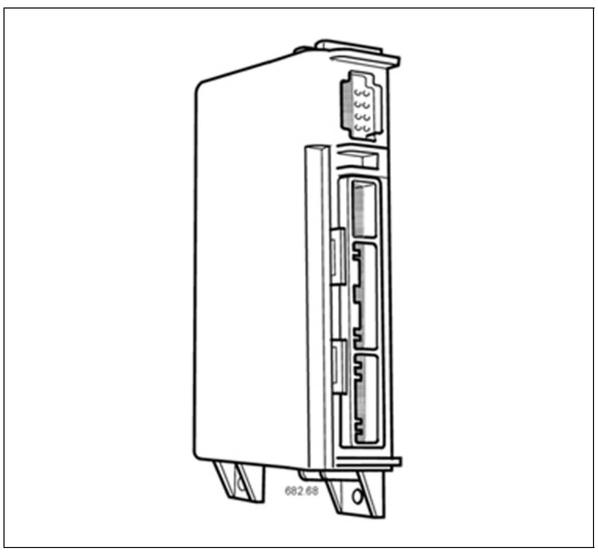


Fig. 64 DDCM — X200

Drivers Seat Control Module (DSCM) — X200

NOTE:

The DSCM is only fitted to vehicles with memory-operated devices.

The DSCM must be configured to know the range of seat and steering column travel for correct memory operation. If the DSCM, seat motors, or column motors are replaced, perform module configuration. Failure to carry out this operation will result in failure of all memory- operated devices.

CAUTION:

Ensure that there are no obstructions and that the seat is not occupied during this operation.

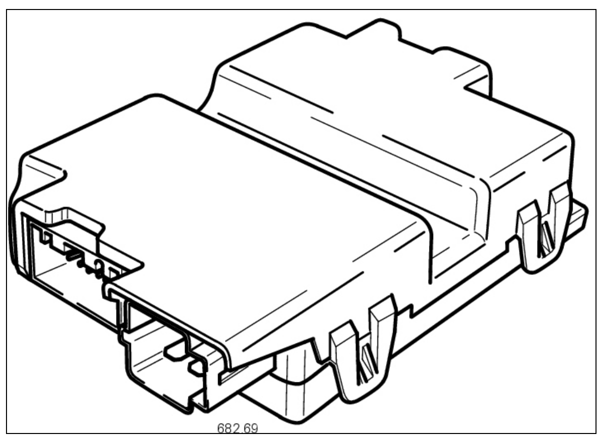


Fig. 65 DSCM — X200

Dynamic Stability Control — Control Module (DSCCM) — X200

The DSCCM requires configuration if it is replaced, or if either the Lateral Accelerometer or Yaw Velocity Sensor are replaced. In addition the DSCCM requires configuration if either of the DTCs relating to the Steering Angle Rate Sensor have been flagged.

If any of the DSC system components are replaced, configuration of the module will be required. If the DSC indicator light is flashing, configuration is necessary.

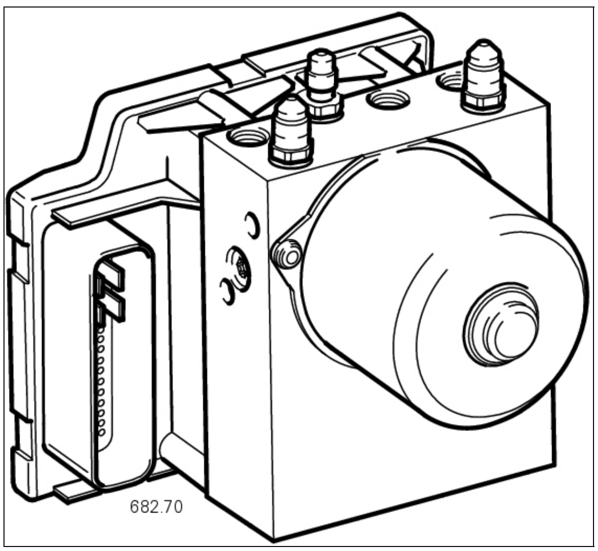


Fig. 66 DSCCM — X200

Air Condition Control Module (A/CCM) — X200

Replacement A/CCMs require configuration for several vehicle options and vehicle variants.

Correct differentiation between heated wiper park function and heated windshield is required. These two systems will not operate if the module is not properly configured.

NOTE:

Canadian specification vehicles have heated windshields. The on/off strategy differs from the heated wiper park due to heated windshields requiring (2) relays.

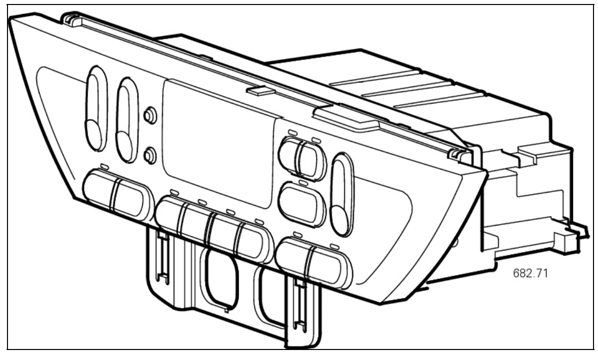


Fig. 67 A/CCM — X200

Radio Head Unit — X200

Replacement radios require configuration for vehicle audio and telematics options.

This module should be configured in line with whichever additional systems are fitted to the vehicle, such as CD Autochanger, Navigation, Voice Activation and VEMS (JaguarNet).

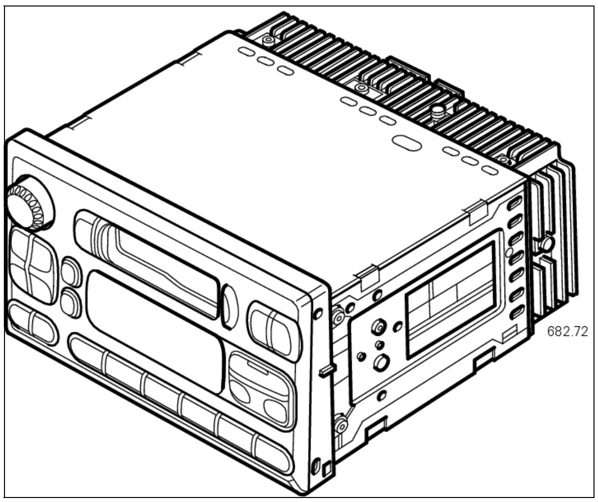


Fig. 68 Radio Head Unit — X200

VEMS (JaguarNet) — X200

The VEMS module (part of the Luxury Communications package) must be configured with the vehicle VIN number. Otherwise the on-screen warning of assist failure and the red LED in the "I" (information) button will be illuminated.

Failure to program the VIN will result in incorrect vehicle identification to the VEMS telephone operator.

VEMS is only available in the US.

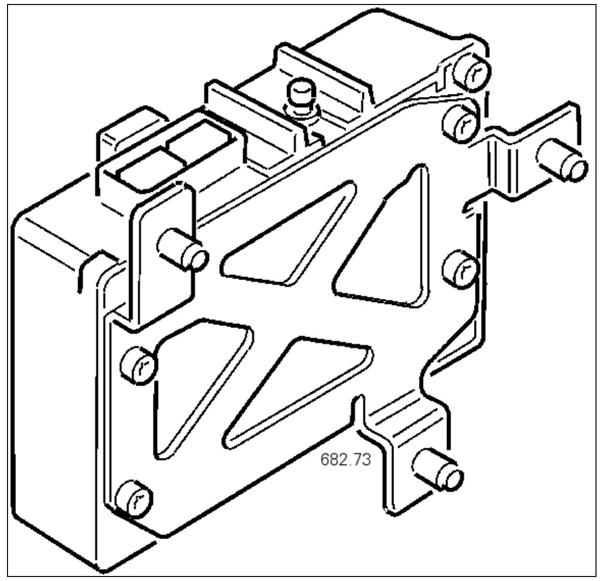


Fig. 69 VEMS (JaguarNet) MODULE — X200

Instrument Pack — X200

The instrument pack must be configured to the PCM. If a replacement instrument pack is a new unit, this procedure can be carried out without using WDS. After a new instrument pack is installed and the battery reconnected, the instrument pack reads the VID Block of the PCM via the SCP network and automatically configures itself based on the VID Block data.

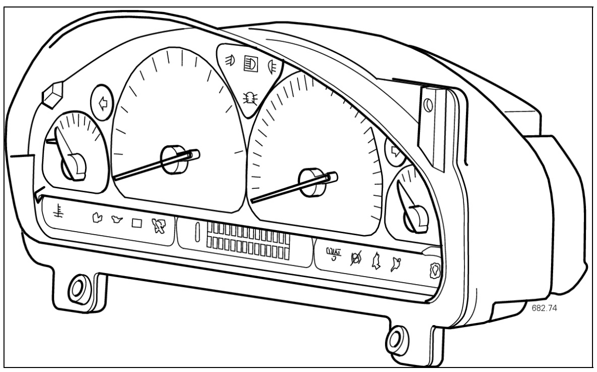


Fig. 70 Instrument Pack — X200

After instrument pack configuration is complete, the ignition keys can be programmed manually, or using WDS. A minimum of two keys are required. Refer to the security section for more information on programing keys.

CONTROL MODULES: X202

Overview — X202

The Electrical Body System is made up of the following modules:

- FEM
- REM
- DDM
- DSM
- HSM

The FEM, REM, DDM and DSM are programmable modules.

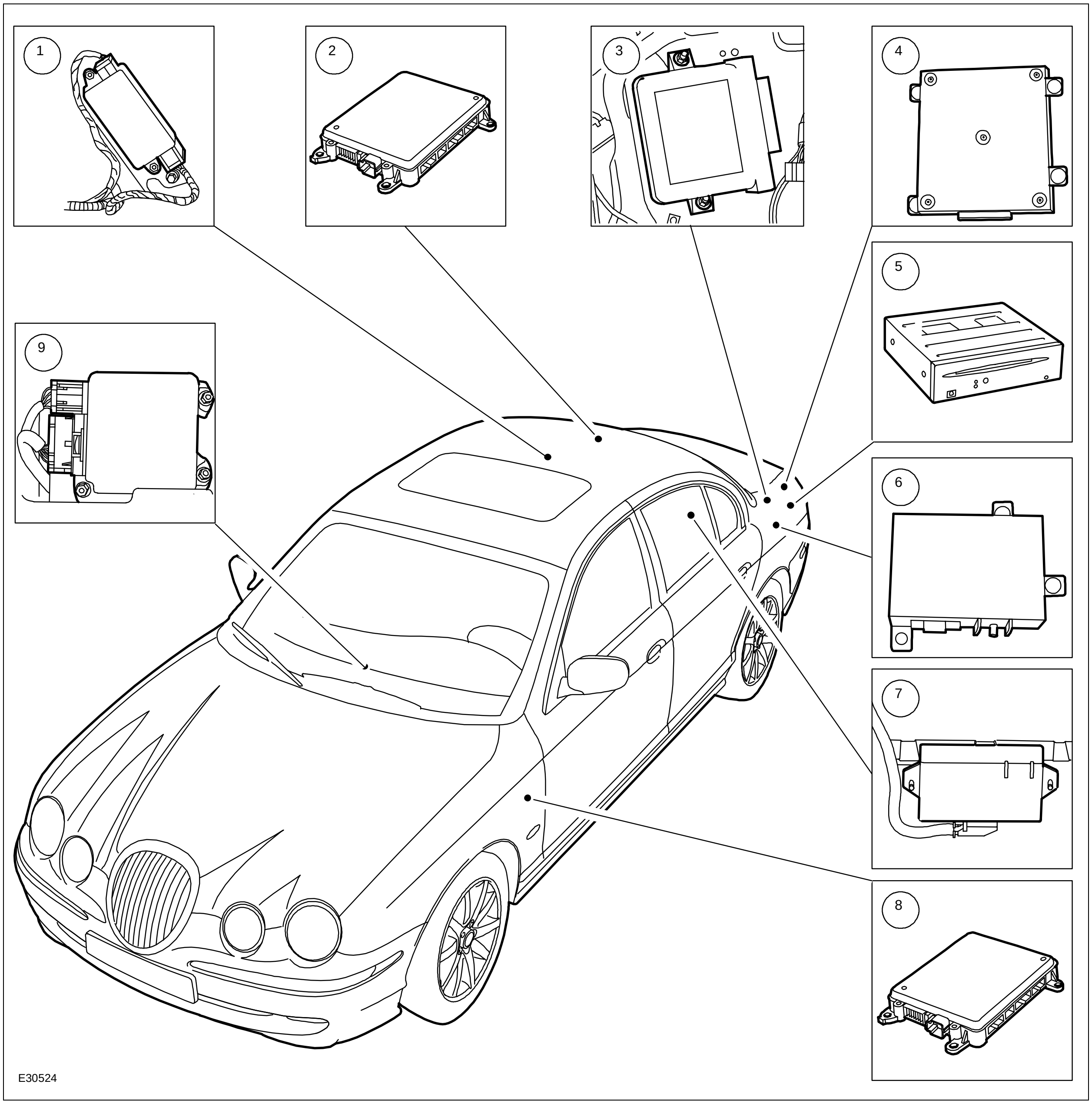


Fig. 71 Module Location: X202

1. (EPB) Electronic Park Brake
2. (REM) Rear Electric Module
3. (ADCM) Adaptive Damping Control Module (ECATS)
4. (VOICE) Voice Activation Control Module
5. (CDDJ) CD Disc Jockey
6. (VEMS) Vehicle Emergency Messaging System (JaguarNet)
7. (RAM) Reverse Aid Module
8. (FEM) Front Electronic Module
9. (RCM) Restraint Control Module

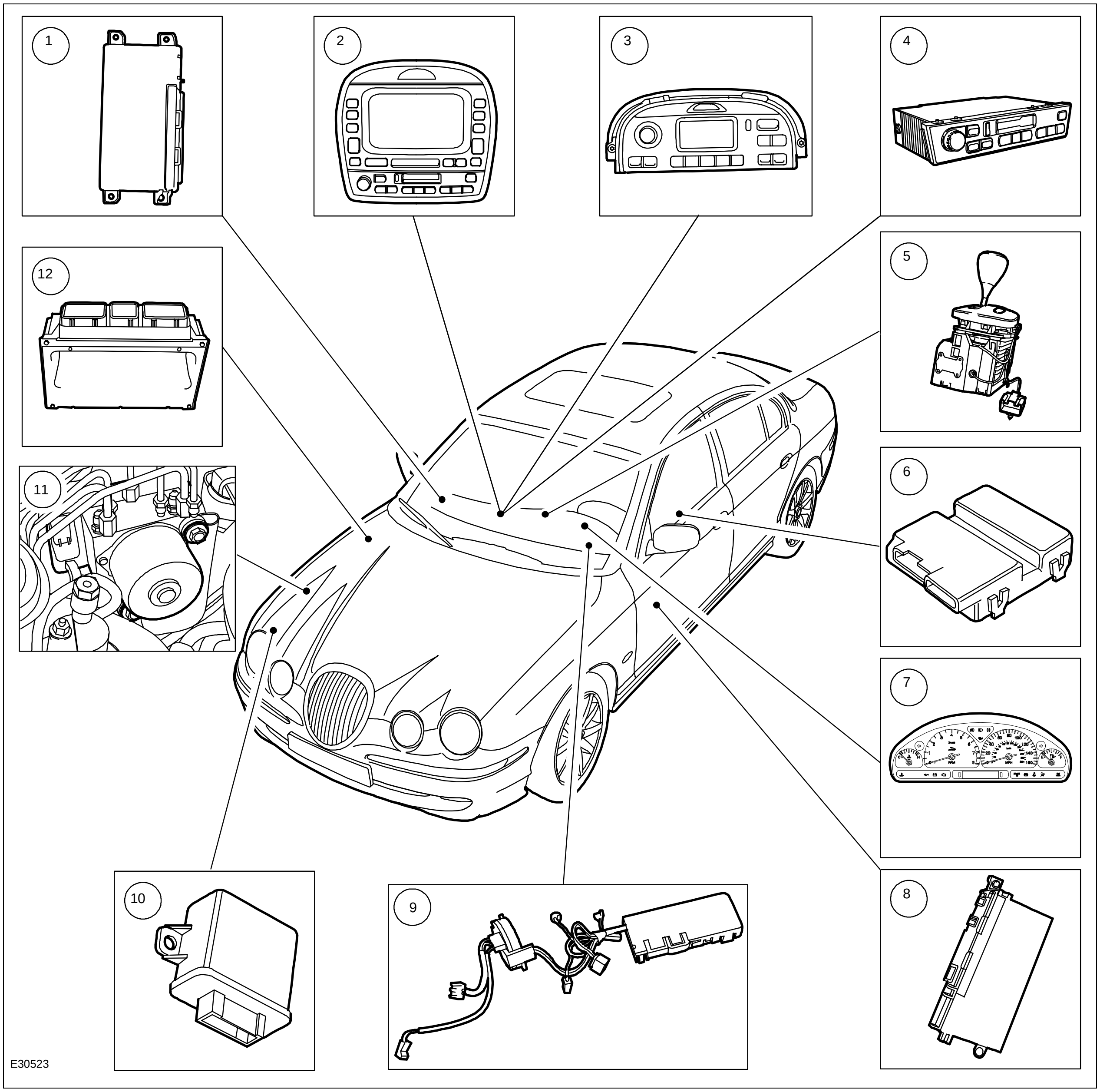


Fig. 72 Module Location: X202

1. (RCCM) Remote climate control module
2. (NAV) Navigation control module
3. Climate control module
4. (ICE) In Car Entertainment Module
5. (JGM) J-Gate Module
6. (DSM) Driver Seat Module
7. (IC) Instrument Cluster
8. (DDM) Driver Door Module
9. SRS Clockspring
10. (HID) headlamp leveling module
11. (ABS) Anti Lock Braking System
12. (ECM) Engine control module
13. (TCM) Transmission Control Module (Not Shown)

Front Electronic Module (FEM)

The front electronic control module (FEM) is located at the base of the left-hand side A-post.

There are five electrical connectors each with unique keyways.

The FEM communicates via the SCP network, is configured for market options and where appropriate controls or provides an interface for the following major functions:

- Easy entry-easy exit lighting
- Courtesy/demand lighting
- Front exterior lighting
- Battery saver (interior lights)
- Turn signals and hazard warning lamps
- Fluid and pressure metrics (low washer fluid, low oil pressure)
- Memory functions
- Day-time running lamps
- Security
- VAPS solenoid
- Passenger Exterior Mirror
- Passenger door lock
- Passenger door window

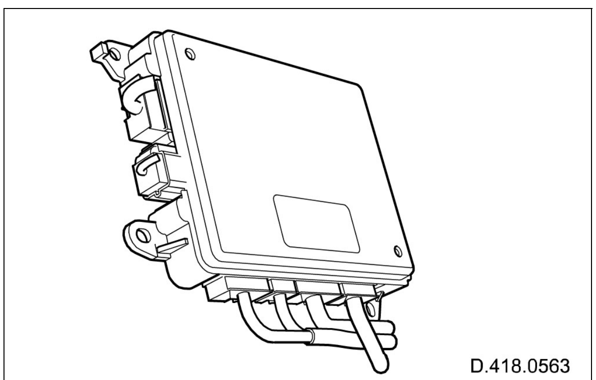


Fig. 73 Front Electronic Module (FEM) — X202

Rear Electronic Module (REM) — X202

The rear electronic control module (REM) is located to the right-hand side of the luggage compartment, behind a trim panel.

The REM communicates via the SCP network, is configured for market options and where appropriate controls or provides an interface for the following major functions:

- Inertia switch operation (disables fuel pump driver and triggers door unlock command)
- Fuel pump driver circuit and fuel level indication
- Exterior rear lamps, park, fog, stop, turn, hazard, reversing lamps
- Heated rear window
- Luggage compartment lid release
- Trailer functionality
- Electrochromic mirror operation (reverse)
- Security
- Rear Door Locks
- Rear Door Windows

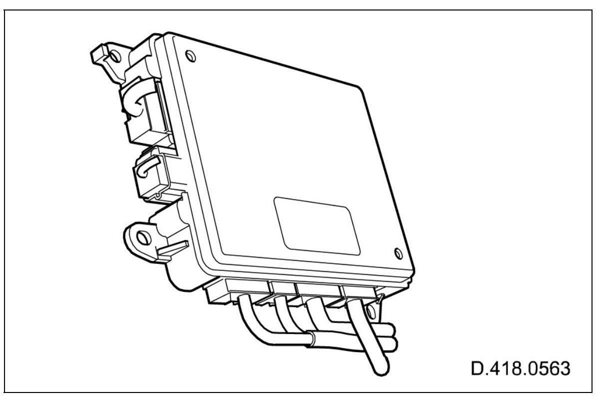


Fig. 74 Rear Electronic Module — X202

Drivers Door Module (DDM) — X202

The driver door module (DDM) is matched to the operating frequency of the appropriate market and located in the driver's door.

The DDCM communicates via the SCP network, is configured for market options and where appropriate controls or provides an interface for the following functions:

- Radio Frequency Antenna (decoder)
- Personality configurations 1 and 2 linked to memory feature.
- Power windows.
- Driver mirror.
- Exterior mirror movement
- Power locks/automatic door locks
- Easy entry/exit
- Horn chirp

A remote keyless module is installed for certain markets.

Drivers Seat Module (DSM) — X202

The DSM is located under the drivers seat fixed to the seat frame, and controls the following functions:

- Power movement of the seat up to 10 directions
- Seat position, memory settings 1 and 2

Heated Seat Module (HSM) — X202

The HSMs are located under each front seat, and have the following functionality:

- Two stage heating
- High and low temperature
- 10 minute time out

Instrument Cluster — X202

A new type of Instrument cluster was introduced on the X202.

In addition to the usual instrument cluster control functions such as PATS, gateway functionality, warning lamps, chimes, etc., this instrument cluster features the following:

- Provides lock/unlock command to the steering column lock module via the SCP network (2003–2004 manual transmission only)
- provides the control for the steering column position and adjustable pedals

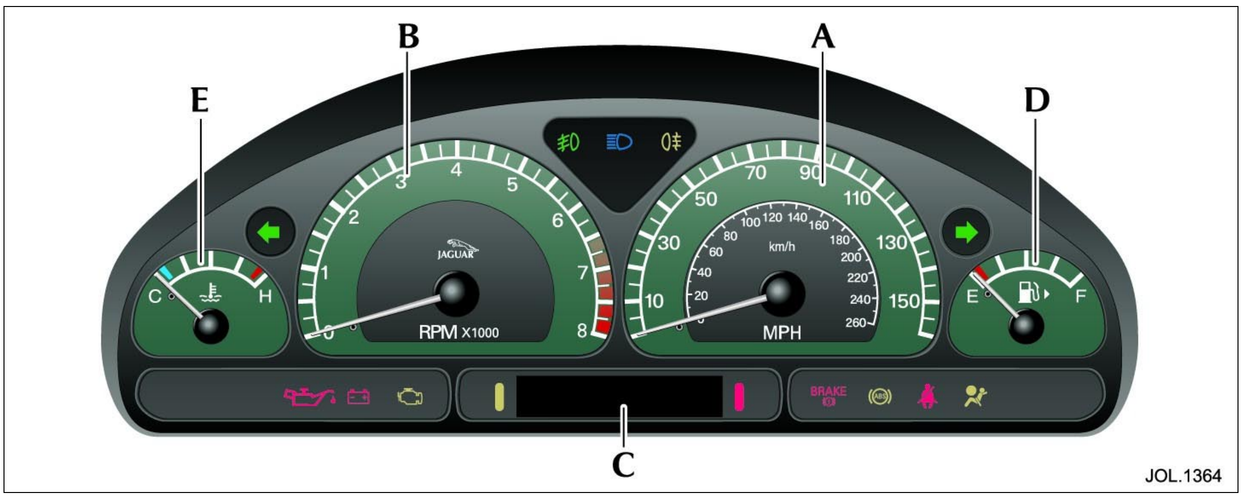


Fig. 75 Instrument Cluster — X202

a. Speedometer
b. Tachometer
c. Message center
d. Fuel level
e. Engine coolant Temperature

Instrument Cluster — X204

A new instrument cluster has been designed having the following redesigned features - two message centers, all illumination of the instruments and warning lamps is now by light emitting diodes (LED), new chime unit and new, automatic autolamp calibration procedure.

The slimmer cluster package makes removal of the cluster in service easier.

Features: Instrument Cluster — X204

Two message centers:

- Allows full time display of the clock and the odometer with the ignition on. The clock is displayed in the speedometer message center and the odometer is displayed in the tachometer message center.
- Allows concurrent display of the trip or warning information (tachometer display) at the same time as ACC/cruise information (speedometer display).
- Used to indicate electric park brake status with ignition off.

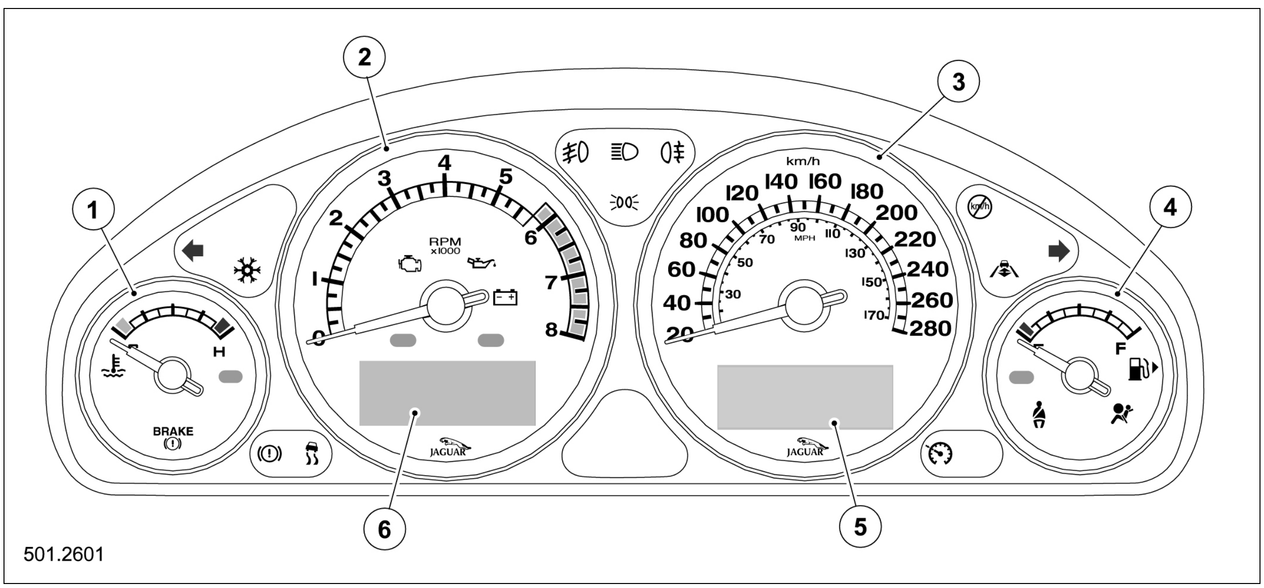


Fig. 76 Instrument cluster — X204

1. Engine coolant temperature
2. Tachometer
3. Speedometer
4. Fuel level
5. Message centre, clock and ACC/Cruise information
6. Message centre, odometer, and trip computer

Installation of the Instrument Cluster — X204

If a replacement instrument cluster is installed, it must be configured to the vehicle using the Jaguar WDS.

The following information must be entered when programing a replacement instrument cluster:

- Steering column serial number
- Tire size for Servotronic steering operation
- ECM ID

When performing the instrument cluster replacement, the upper steering column has to be removed from the vehicle to allow the steering column barcode (serial number) to be read, and the column recalibrated.

For vehicles after VIN N04842, do not remove the column to gain access to the steering column barcode. From VIN N04842, an additional steering column barcode sticker is now fitted in the wheel well, in the trunk of the vehicle, above the fuse box. For vehicles prior to N04842, the steering column barcode must be obtained from the column itself. No substitute steering column barcodes should be used, as this can cause incorrect configuration and subsequent operating issues.

CONTROL MODULES: X400

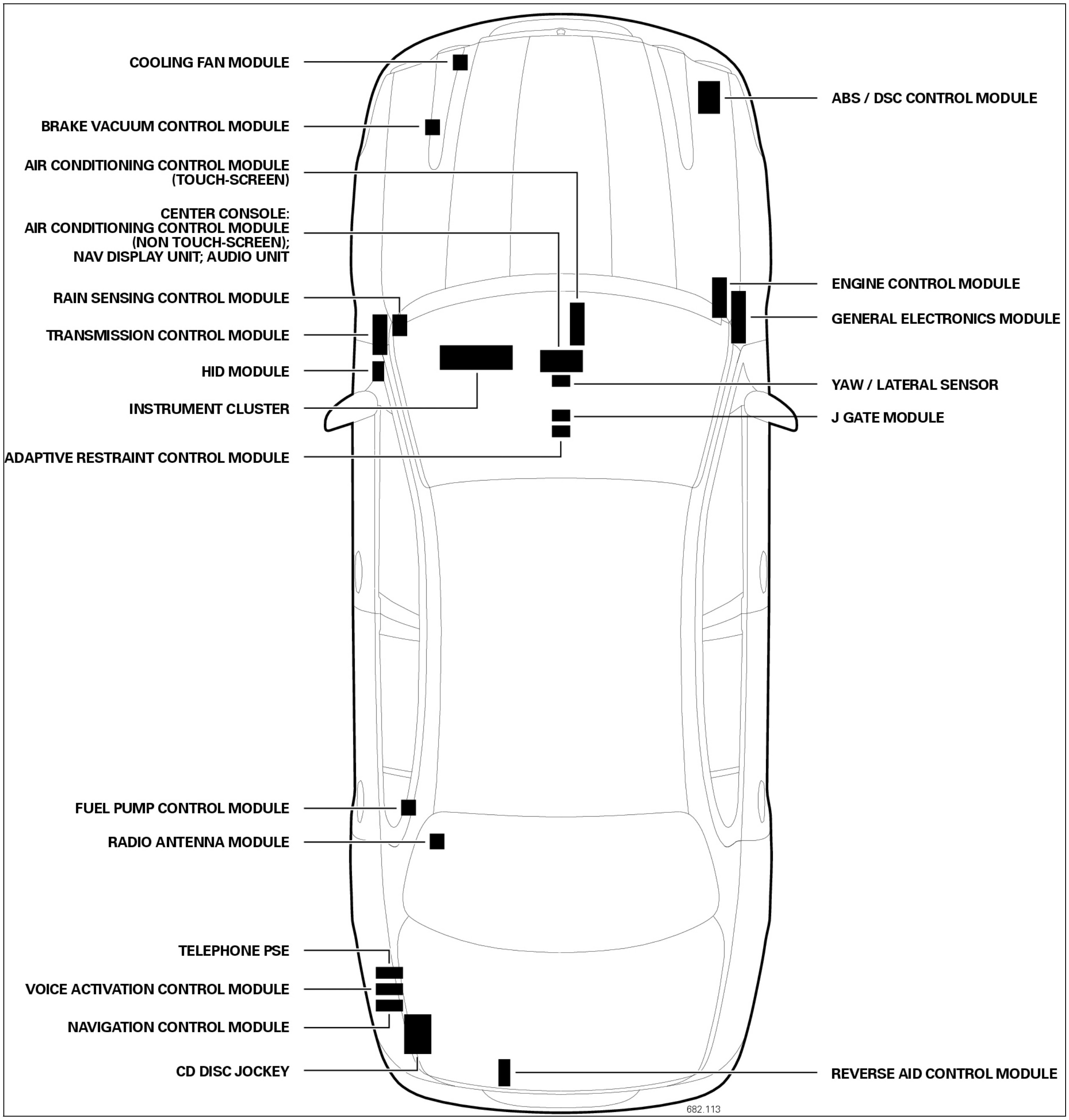


Fig. 77 Control Module Locations: X400

Instrument Cluster — X400

The Instrument Cluster:

- Provides multiplex network gateway functionality for CAN and SCP. Refer to Multiplexing.
- Includes the PATS control functions.
- Processes the speed-sensitive steering inputs.

The instrument cluster comprises four gauges, warning lamps and a dot-matrix message center.

Vehicles fitted with the message center have two warning lamps – one red, the other amber – located above the message center. The warning lamps alert the driver to the status of the warning message simultaneously displayed:

- The 'RED' warning lamp indicates a primary warning message that requires immediate investigation by the driver or a Jaguar Dealer.
- The 'AMBER' warning lamp indicates a secondary warning message requiring:

– Appropriate response by the driver
– The reporting of any associated malfunction to a Jaguar Dealer at the earliest opportunity.

The following warnings do not illuminate indicators on the instrument cluster, but instead display the appropriate text via the message center:

- Transmission fault
- Door ajar warnings
- Low washer fluid
- Traction control warning
- Cruise control
- Low outside temperature (latched and unlatched)
- Can be disabled with WDS.

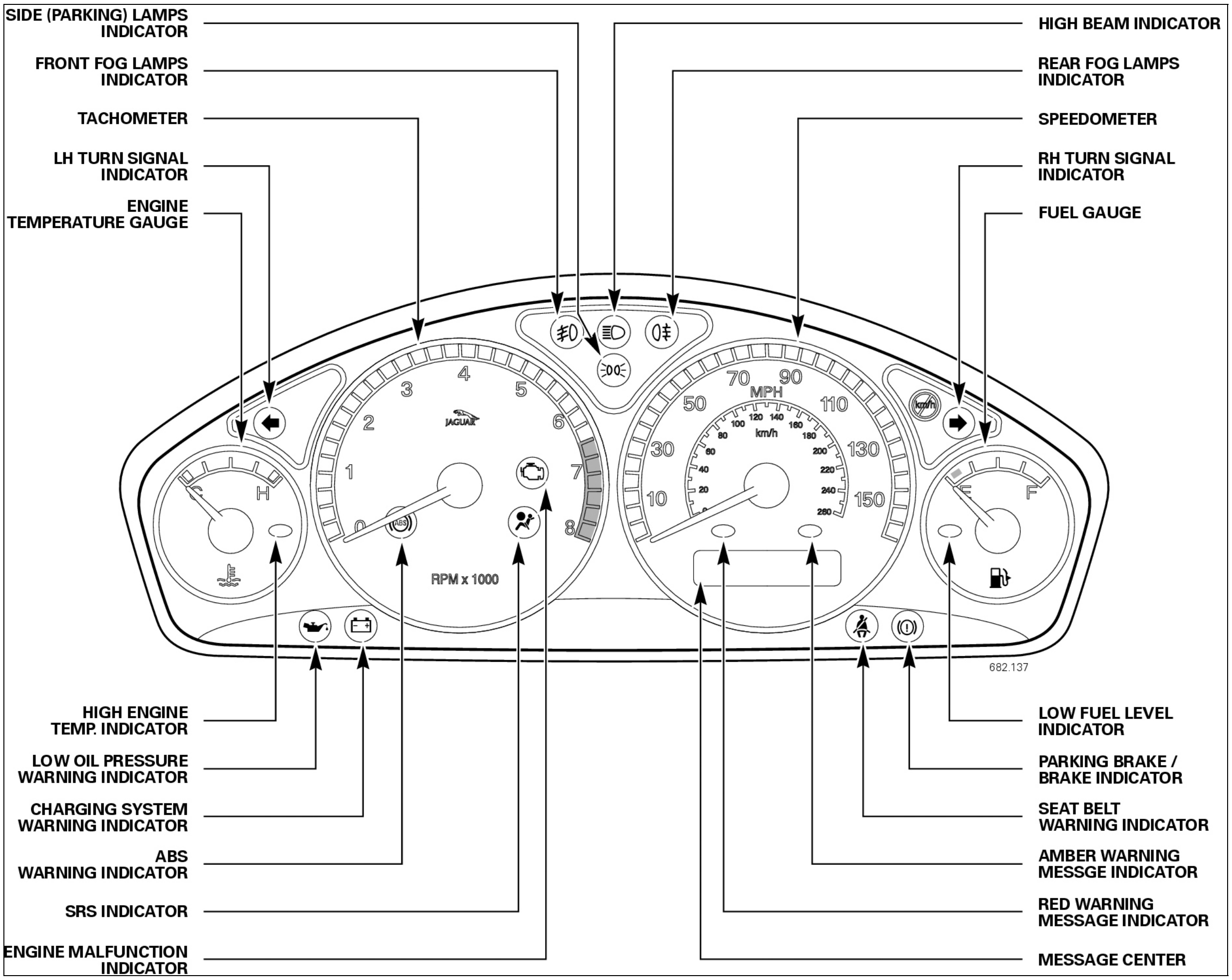


Fig. 78 Instrument Cluster: X400

Odometer — X400

Odometer readings will be displayed by the message center.

Trip Computer (where applicable) — X400

The trip computer is an integral part of the instrument cluster and is controlled by the three switches located at the bottom of the main lighting switch.

Selection of A or B switches permits the tracking of two separate journeys. The following calculations and readings are possible for both journeys:

- Trip distances
- Average fuel economy
- Average speed
- Range

Pressing the switch at the end of the LH column stalk will cycle the trip computer information and messages. The reset button is used to reset/clear the currently displayed trip computer.

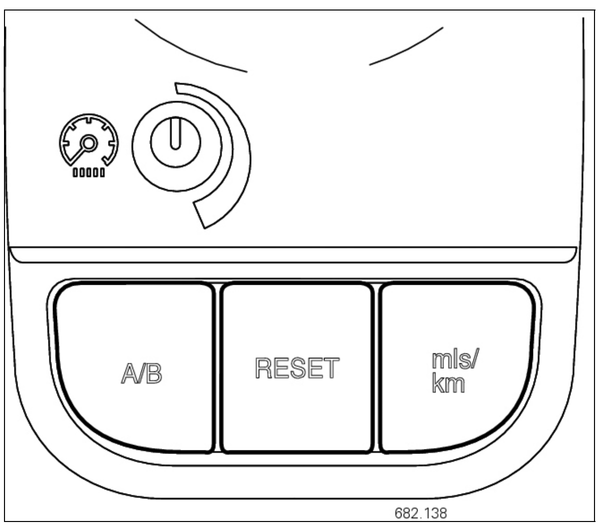


Fig. 79 Trip Computer Control Switches — X400

Information and Message Center — X400

The message center (where fitted) is a dot-matrix type comprising 14 lines in two character rows with each character consisting of 5 x 7 dots.

NOTE:

The message center is an integral part of the instrument cluster and cannot be serviced separately.

The primary function of the message center is to provide the driver with text messages including:

- Warnings
- Temporary alerts
- General information

The message center also displays messages for the benefit of the service technician.

Multiple messages will cycle in order of priority until they either expire or are cleared (temporary alerts) from the display. Warning messages are suppressed temporarily while the message center is cycling.

Instrument Cluster Test Mode — X400

Engineering Test Mode (ETM) is entered by holding down the stalk mode button while turning the ignition on. During this mode, the trip and ODO display internal data that can be cycled through by pressing the stalk mode button.

ETM can be exited by holding the stalk mode for longer than 3 seconds or cycling the ignition. All gauges and lamps will operate normally during this test mode.

Function and display is the same for both high and low series.

General Electronic Module (GEM) — X400

Features controlled by the GEM:

- Interior lights with power saving
- Turn signals, hazard lights and tick tock
- Intermittent wipers
- Windscreen wash
- Headlight power wash
- Driver audible warning sounder
- Locking and unlocking with key and remote
- Security (contains RF receiver)
- Trunk release
- Battery saver relay (provides power to foot well, vanity mirror, roof console, rear interior, puddle and boot lamps)

Warning Devices — X400

The warning device system uses the GECM to control audible and visual warnings for the benefit of the driver and occupants. Warnings are associated with the following:

- Key-in ignition warning switch
- Door ajar switches (including trunk and engine compartment)
- Seat belt sensor
- Headlamp switch
- SRS malfunctions
- J-gate park switch (where applicable)

The driver audible warnings sounder is integral to the GECM.

The visual warnings, where appropriate, are displayed via the instrument cluster using illuminated icons or the message center. Refer to Instrument Cluster.

General Electronic Module (GEM) — X400

- Mounted in the upper dash, close to the right-hand A post on top of the engine control module.
- Contains all alarm system functionality.
- Contains all locking functionality.
- Contains RF receiver board. North American market: 315 MHz, 10 m range.

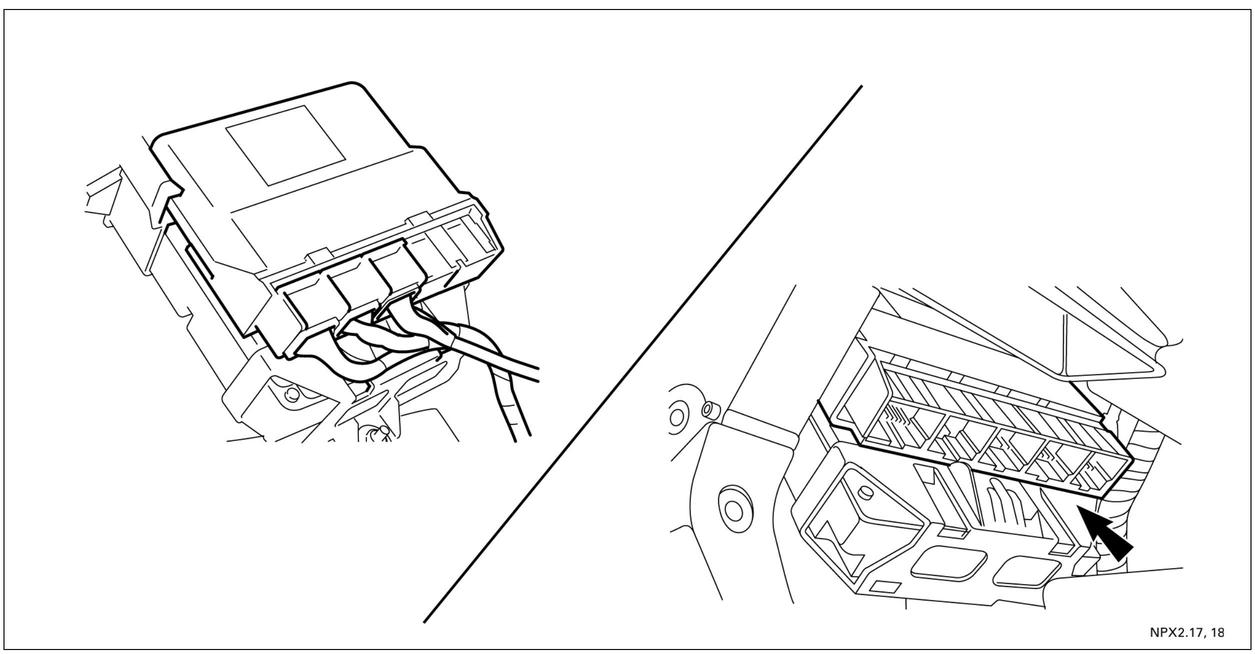


Fig. 80 GEM: X400

Integrated Keyhead / Transmitter — X400

- 4 button design — lock, unlock, trunk release, and headlamp convenience / panic
- Operates at 315 MHz
- Uses rolling code technology.

Security LED — X400

- Located in the center console (shared package with traction control switch)
- Driven by the instrument cluster
- Indicates both immobilizer and alarm system functions

Door Latch and Ajar Switches — X400

- Central locking and double locking functionality.
- Door ajar switch closed when door closed.
- Door ajar switch integrated into the latch.

Trunk Latch and Ajar Switch — X400

- Trunk ajar switch closed when trunk closed.
- Trunk ajar switch integrated into the latch.

Hood Ajar Switch — X400

- Closed when hood closed.
- Stand alone switch – carry-over from X200.

Radio Sense Line — X400

- Integrated into the ICE head unit, the alarm system detects loss of radio.
- Ground sensed.

RF Antenna — X400

- Located in GEM harness, adjacent to module.

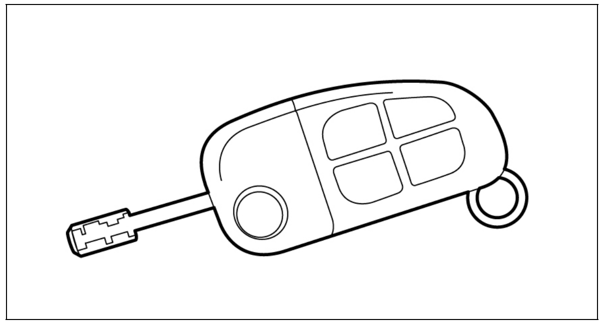


Fig. 81 Keyhead: X400

D2B Modules: X400

The master module is the audio unit. It is also the gateway to the SCP network. The D2B slave modules include:

- Navigation control module
- CD changer
- Cellular phone control module
- Voice activation control module

NOTE:

X404 models also have an amplifier on the D2B network.

Master Module — X400

The master module is the audio unit; it manages the D2B network and provides the gateway to the SCP network.

Non-Navigation Head Unit: X400

- Large bezel
- AM/FM radio cassette
- LCD display including clock
- Integrated phone keypad
- Integral amplifiers 4 x 35W
- Can be upgraded to CD/MD
- Communicates with WDS via the SCP network
- Stores DTCs for itself and the CD changer
- Master module for the D2B network

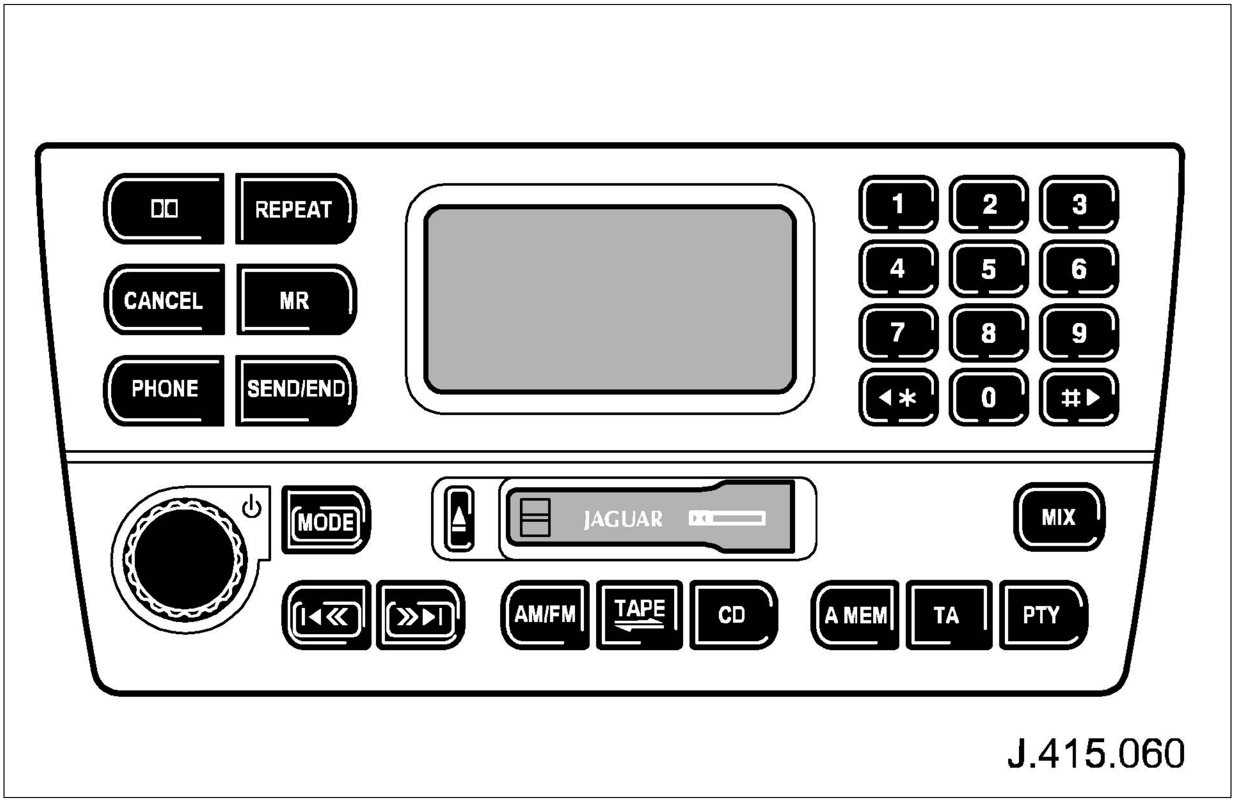


Fig. 82 Non-Navigation Head Unit: X400

Navigation Head Unit: X400

- Small bezel
- AM/FM radio cassette
- Integral amplifier 4 x 35W
- Display via navigation touch screen
- Phone functions via navigation touch screen
- Can be upgraded to MD/CD
- Communicates with WDS via the SCP network
- Master module for the D2B network

Fig. 83 Navigation Head Unit: X400

Slave Module — X400

A slave module is any other system module that is connected to the D2B network and includes:

- Navigation control module
- CD changer
- Cellular phone control module
- Voice activation control module

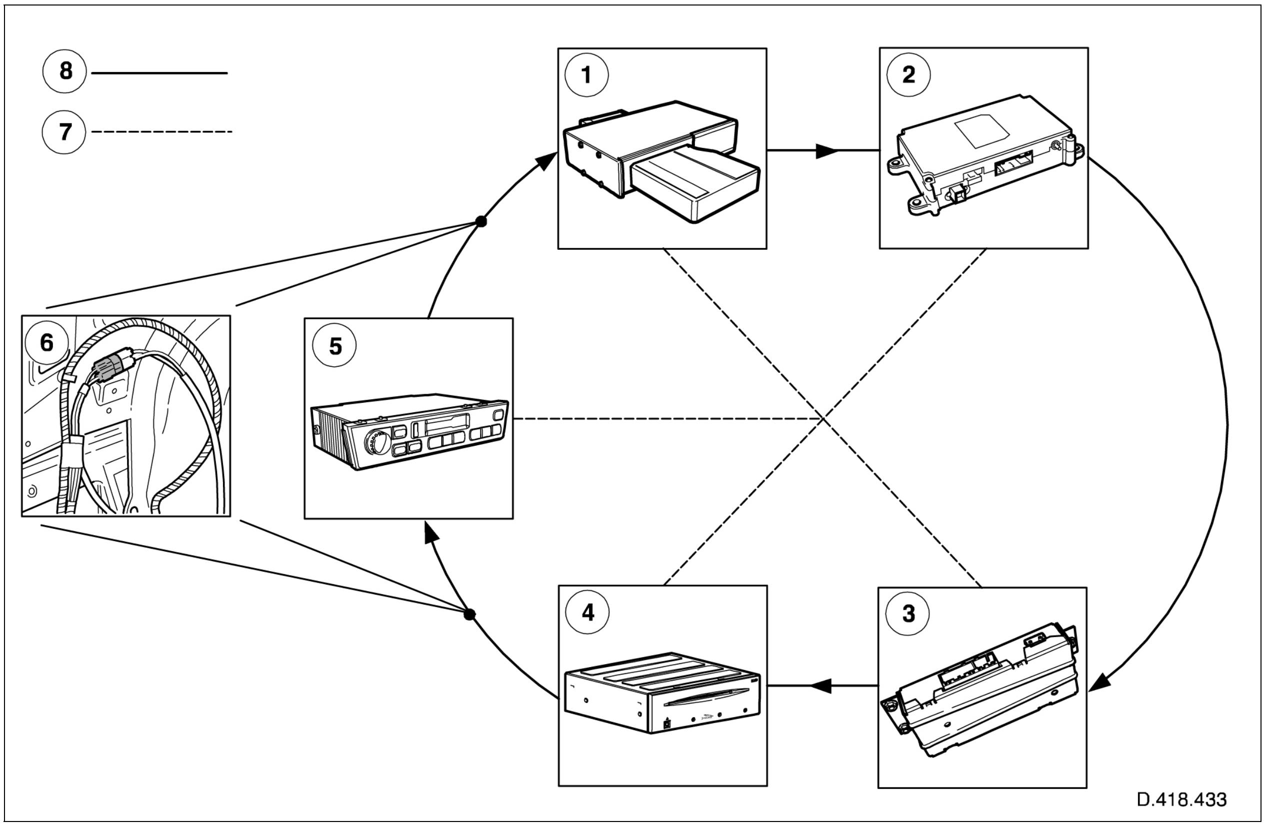


Fig. 84 D2B Network: X400

1. CD Changer
2. Cellular phone control module
3. Voice activation control module
4. Navigation control module
5. Audio unit (master module)
6. D2B intermediate connector
7. Wake-up wire
8. Optical fiber

NOTE:

X404 models also have an amplifier on the D2B network.

CD Auto Changer: X400

The CD auto changer is available with either head unit and either sound system. The CD auto changer is located in the left-hand rear corner of the trunk. All cars are pre-wired to accept the CD auto changer.

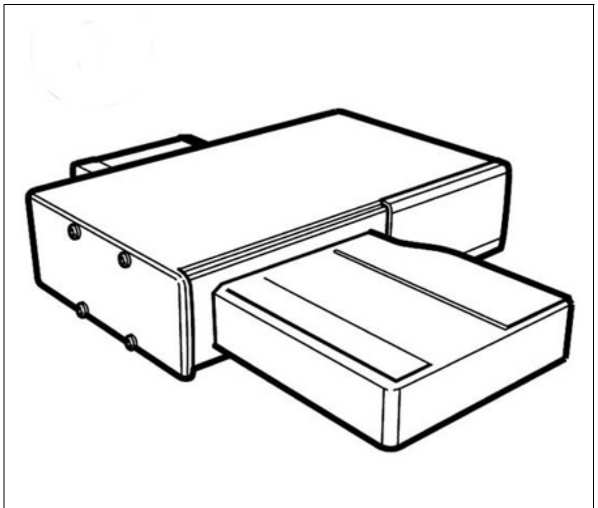


Fig. 85 CD Auto Changer — X400

D2B network Module Configuration Requirements — X400

Please be advised that when installing a CD player, Telephone and/or Voice Activation module, you will need to reconfigure the radio for the components to operate. This can be achieved by using WDS under "Dealer Options"; you will need to "enable" the component that you have installed.

Table 18 X400 Module Configuration Requirements

Module	Configurable?	Dealer Options Available?	VIN Storage?	Setup Required for New Module?
ABS/DSC	NO	NO	NO	YES (DSC only)
A/CCM (Automatic)	NO	NO	YES	NO
A/CCM (Manual)	NO	NO	YES	NO
IC	YES	YES	YES	YES
ECM	YES	YES	YES	YES
HLCM	YES	NO	YES	YES
NAV	NO	NO	NO	NO
PSE	NO	NO	YES	NO
ARM	NO	NO	YES	NO
RAM	NO	NO	NO	NO
TCM	YES	YES	YES	NO
VOICE	YES	YES	YES	NO
GECM	YES	YES	YES	YES
AUDIO	YES	YES	YES	NO

CONTROL MODULES: X404

There are very few changes to the vehicle module architecture on the 2004 MY X-TYPE.

There are two new module additions to the vehicle. The first addition is the driver seat module, which controls the memory seat, mirrors and also serves as the control device for the heated seats.

The memory module is part of the CAN network.

The second module is the power amplifier which is part of the D2B fiber optic network. This new feature follows the same D2B network architecture as X202 and X350.

NOTE:

The following Control Module Location illustration shows a Speed Control Module, Vehicle Information Control Module and Vacuum Module which are fitted to the non-NAS 2.0 Liter X404. These modules are not fitted on the 2.5 & 3.0 Liter models sold in this market.

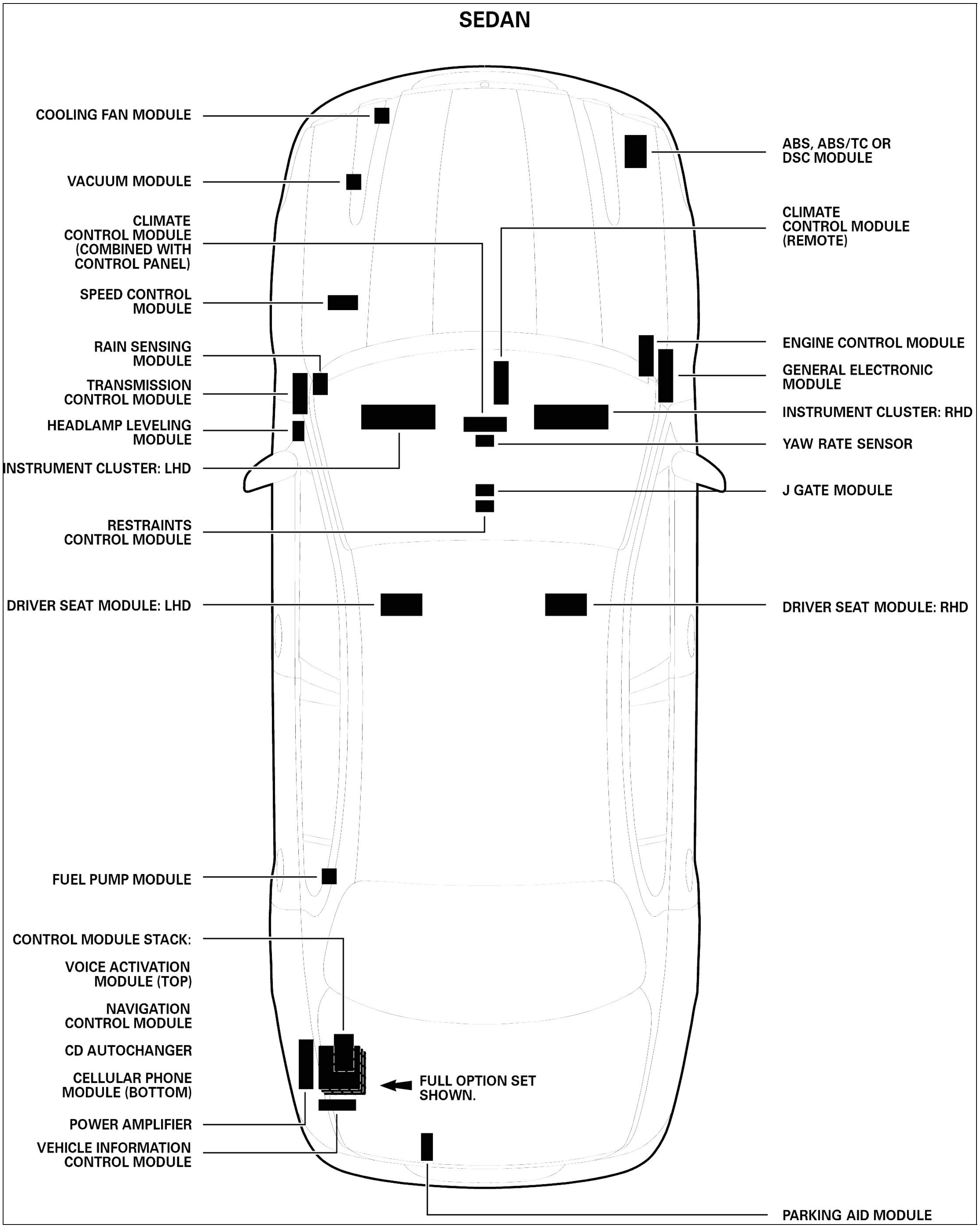


Fig. 86 Vehicle Module Location: X404

Instrument Cluster — X404

The instrument cluster has undergone some minor revisions:

- A new "all black" appliqué has been introduced
- New text messages support memory seats (where applicable)
- "Low Outside Temperature" warning light instead of the message on previous X400 models
- "Powertrain Malfunction Indicator" light in addition to the check engine light on vehicles with no message center
- "Low washer fluid" warning light on vehicles with no message center

A dedicated warning lamp (snowflake symbol) has been introduced, which replaces the text message to indicate "low ambient temperature." The lamp illuminates to indicate that temperatures have fallen low enough for frost or ice to form on road surfaces. The lamp will remain illuminated until the ambient temperature rises to a safer level.

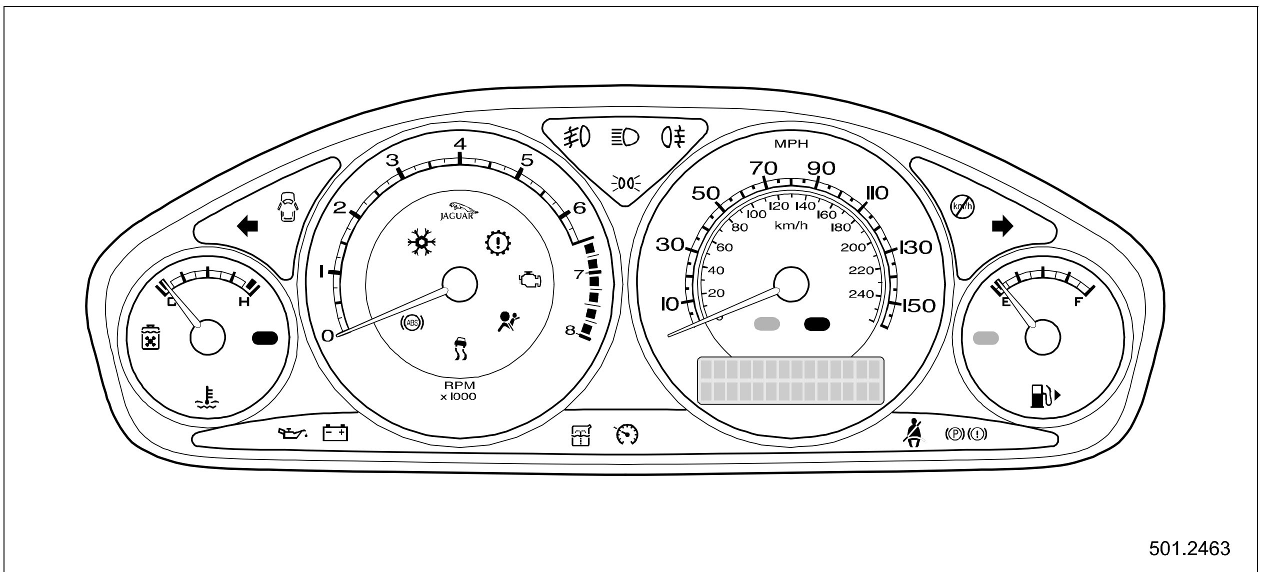


Fig. 87 Instrument Cluster (AWD variants): X404

Powertrain Malfunction (Red) — X404

Illuminates when there is an engine malfunction or transmission system malfunction.

NOTE:

If a message center is fitted, the light will not illuminate but instead a message will be displayed.

The warning indicates the following activities:

- That there is an engine system malfunction (non-MIL/OBD II)
- That there is an automatic transmission system malfunction

Fig. 88 Powertrain Malfunction (Red) — X400

Low Outside Temperature (Amber) — X404

Illuminates when frost or ice is likely to form on road surfaces. The light will continue to be illuminated until the outside temperature rises to a safer level.

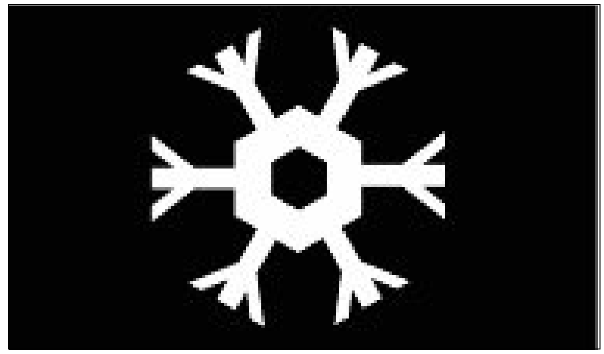


Fig. 89 Low Outside Temperature (Amber) — X404

When the temperature is equal to or less than 39°F (4°C), the yellow light will illuminate. When the temperature rises to 42°F (6°C) or higher, the yellow light turns off.

The low warning temperature. light can be turned off using WDS if the customer wishes not to have this feature.

Low Washer Fluid Level (Amber) — X404

Illuminates when the washer fluid level is low. If a message center is fitted the light will not illuminate but instead a message will be displayed.

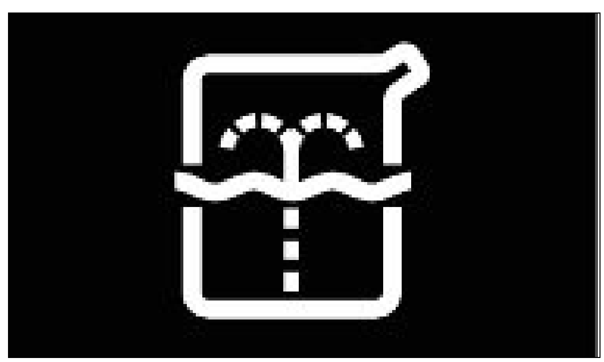


Fig. 90 Low Washer Fluid Level (Amber) — X404

WORKSHEET – CM2 - X100 CONTROL MODULE LOCATIONS

Using the control module location diagram in the beginning of the section, locate as many control modules as possible. Visually locate the modules on the vehicle and write-in the location.

Table 19

Control Module	Location
ABS/TCS Control Module	
Adaptive Damping Control Module	
Adaptive Speed Control Booster Control Module	
Adaptive Speed Control Module	
Air Conditioning Control Module	
Body Processor Module	
Cell Phone Control Module	
Dimmer Module	
Driver Door Control Module	
Driver Head Restraint Control Module	
Driver Seat Control Module	
Engine Control Module	
Gear Selector Illumination Module	
Key Transponder Module	
Major Instrument Pack	
Navigation Control Module	

Occupancy Sensing Module	
Passenger Door Control Module	
Passenger Rear Door Control Module	
Passenger Seat Control Module	
Power Assisted Steering Control Module	
Rain Sensing Module	
Restraints Control Module	
Security and Locking Control Module	
Transmission Control Module	

WORKSHEET – CM1 - X308 CONTROL MODULE LOCATIONS

Using the control module location diagram in the beginning of the section, locate as many control modules as possible. Visually locate the modules on the vehicle and write-in the location.

Table 20

Control Module	Location
ABS/TCS Control Module	
Adaptive Damping Control Module	
Air Conditioning Control Module	
Body Processor Module	
Cell Phone Control Module	
Dimmer Module	
Driver Door Control Module	
Driver Rear Door Control Module	
Driver Seat Control Module	
Engine Control Module	
Garage Door Opener Module	
Gear Selector Illumination Module	
Instrument Cluster	
Key Transponder Module	
Navigation Control Module	
Passenger Door Control Module	
Passenger Rear Door Control Module	

Passenger Seat Control Module	
Radiator Fan Control Relay Module	
Rear Seat Control Module	
Reverse Parking Aid Control Module	
Security and Locking Control Module	
Sliding Roof Control Module	
Transmission Control Module	

WORKSHEET – CM7 - X350 CONTROL MODULE LOCATIONS

Using the control module location diagram in the beginning of the section, locate as many control modules as possible. Visually locate the modules on the vehicle and write-in the location.

Table 21

Control Module	Location
Adaptive Cruise Control	
Air Suspension Module	
Audio Unit	
Audio/Video Selector Module	
Auto-Leveling Module (HID)	
Cell Phone Control Module	
Climate Control Module	
Driver Door Control Module	
Driver Seat Control Module	
DSC/ABS/TCS	
Electronic Park Brake Module	
Engine Control Module	
Front Electronic Module	
Fuel Pump Module	
Instrument Cluster	
J-Gate Module	

Navigation Control Module	
Occupancy Sensing Module	
Parking Aid Control Module	
Power Amplifier Module	
Rear Climate Control Module	
Rear Electronic Module	
Rear Memory Module	
Restraints Control Module	
Sliding Roof Control Module	
Steering Column Lock Module	

WORKSHEET – CM3 - X200 CONTROL MODULE LOCATIONS

Using the control module location diagram in the beginning of the section, locate as many control modules as possible. Visually locate the modules on the vehicle and write-in the location.

Table 22

Control Module	Location
ABS/TCS/DSC Control Module	
Adaptive Damping Control Module	
Air Conditioning Control Module	
Cell Phone Control Module	
Driver Door Control Module	
Driver Seat Control Module	
Driver Seat Heater Control Module	
General Electronic Control Module	
Instrument Pack	
Navigation Control Module	
Parking Aid Control Module	
Passenger Seat Heater Control Module	
Powertrain Control Module	
Rear Electronic Control Module	
Restraints Control Module	
Sliding Roof Control Module	

Steering Column Lock Control Module	
Throttle Actuator Control Module	
Vehicle Emergency Control Module	
Vehicle Information Control Module	
Voice Activation Control Module	

WORKSHEET – CM6 - X202 CONTROL MODULE LOCATIONS

Using the control module location diagram in the beginning of the section, locate as many control modules as possible. Visually locate the modules on the vehicle and write-in the location.

Table 23

Control Module	Location
Dynamic Stability Control — Control Module	
Adaptive Damping Control Module	
Adaptive Speed Control — Control Module	
Air Conditioning Control Module	
Audio Unit	
CD Autochanger	
Cell Phone Control Module	
Driver Door Control Module	
Driver Seat Control Module	
Driver Seat Heater Control Module	
Engine Control Module	
General Electronic Control Module	
Headlamp Leveling Control Module	
Instrument Cluster	

Navigation Control Module	
Occupancy Sensing Control Module	
Parking Aid Control Module	
Parking Brake Control Module	
Passenger Seat Heater Control Module	
Passenger Seat Weight Sensing Control Module	
Power Amplifier	
Rear Electronic Control Module	
Restraints Control Module	
Steering Column Lock Control Module	
Trailer Towing Module	

WORKSHEET – CM4 - X400 CONTROL MODULE LOCATIONS

Using the control module location diagram in the beginning of the section, locate as many control modules as possible. Visually locate the modules on the vehicle and write-in the location.

Table 24

Control Module	Location
CD Autochanger	
Cell Phone Control Module	
Climate Control Module	
Cooling Fan Control Module	
Driver Seat Control Module	
DSC/ABS/TCS Control Module	
Engine Control Module	
Fuel Pump Module	
General Electronic Control Module	
Headlamp Leveling Control Module	
Instrument Cluster	
J-Gate Module	
Navigation Control Module	
Parking Aid Control Module	
Power Amplifier	
Rain Sensing Control Module	

Restraints Control Module	
Speed Control Module	
Transmission Control Module	
Vacuum Module	
Vehicle Information Control Module	
Voice Activation Control Module	
Yaw Rate Sensor	

WORKSHEET – CM5 - X404 CONTROL MODULE LOCATIONS

Using the control module location diagram in the beginning of the section, locate as many control modules as possible. Visually locate the modules on the vehicle and write-in the location.

Table 25

Control Module	Location
Air Conditioning Control Module	
Cell Phone Control Module	
Cooling Fan Control Module	
DSC/ABS/TCS Control Module	
Engine Control Module	
Fuel Pump Module	
General Electronic Control Module	
Headlamp Leveling Control Module	
Instrument Cluster	
J-Gate Module	
LH Seat Heater Module	
Navigation Control Module	
Parking Aid Control Module	
Rain Sensing Control Module	
Restraints Control Module	
RH Seat Heater Module	

Speed Control Module	
Traffic Master Control Module	
Trailer Towing Module	
Transmission Control Module	
Vacuum Module	
Vehicle Information Control Module	
Voice Activation Control Module	
Yaw Rate Sensor	

JAGUAR

TRAINING PROGRAM

JAGUAR ADVANCED ELECTRICAL SYSTEMS

PUBLICATION CODE – 684

BODY ELECTRICAL SYSTEMS X100 AND X308 SERIES

Electrical System Architecture: X100 series, X308

The X100 series, and X308 vehicle electrical system is a ground-side switched system. The ignition switch switches ground circuits on/off to complete system circuits and apply power. Circuits that require ignition switch position control are supplied with “ignition switched grounds”.

Both power grounds (high current consumers) and logic grounds (electronic switching circuits) are used throughout the system.

POWER WINDOWS: X100 SERIES, X308

The door windows are controlled by the DDCM with input from the window switches in the driver door switch pack. Manual operation is enabled in ignition switch positions I and II. In addition, when the ignition is switched off, manual operation is still available until any door is opened. When a passenger door window is operated by the driver door switch pack, the DDCM transmits an SCP message to the selected door control module, which drives the window. The passenger door switch pack inputs directly to the PDCM for passenger operation of the window. Single switches on the passenger doors control the passenger window only.

If one-touch window operation is enabled, the window fully opens when the switch is active for between 50 and 250 milliseconds. If the switch is active for greater than 250 milliseconds, window operation stops when the switch becomes inactive.

Window Drop: X100 series

The door windows are programmed to drop 12 mm (0.47 in.) before the doors open to prevent seal damage. The door handle switch is mechanically connected to the inner and outer door handle. If a window is closed when the door handle switch becomes active, the window opens 12 mm (0.47 in.). If the window is within 12 mm from the closed position when the door ajar switch becomes inactive, door is closed, the window closes.

If a window is closed with the door ajar switch active, the window stops 12 mm (0.47 in.) from the closed position.

NOTE:

The X105 does have a different window drop operating method when operating the convertible top. When the top close is selected the door glass and rear quarters will drop all the way down, the hood will close, then the quarter windows will raise fully and finally the door glass go up. This change is to stop the quarter glass coming up on the wrong side of the door glass.

Door Window Position Memory: X100 series

Door window open and closed positions are retained in door control modules volatile memory. If power is interrupted to a door control module the window positions must be reprogrammed. To reprogram windows after power is restored, perform the following procedure (with door closed):

- Fully open the window and continue to hold the open switch active for 5 seconds
- Fully close the window and continue to hold the close switch active for 5 seconds

NOTE:

Refer to the appropriate electrical guide for this system.

Quarter Windows: X100 series

The quarter windows are operated with the convertible top switch, and can be one-touch-opened without lowering the top. The top switch is hard wired to the BPM , which controls the window relays for open and close functionality.

CONVERTIBLE TOP X100 SERIES

System operation

The convertible top is hydraulically raised and lowered and incorporates a hydraulically operated header latch. An electric motor provides the hydraulic power. The BPM and SLCM control the top's automatic operation using inputs from the convertible top switch, five microswitches and SCP data messages. Three of the microswitches are located in the header rail and two are located on the right side hydraulic cylinder.

Top Operation

The top is operated by the convertible top switch when the ignition is in position I or II and the vehicle speed is below 10 mph (16 km/h). The convertible top switch must be held active throughout the raise or lower operation.

The top can also be operated using the global open/close functions of the door key lock.

Table 26 Four microswitches connect to the BPM:

	Location	Function
Top raised switch	Top of hydraulic cylinder	signals top is raised over center
Top ready-to-latch switch	Header rail	signals top is in contact with latch
Top latch closed switch	Header rail	signals top is engaged in latch
Top closed switch	Header rail	signals top is closed and fully latched

Table 27 One microswitch connects to the SLCM:

Switch	Location	Function
Top down switch	Bottom of hydraulic cylinder	signals top is fully down

NOTE:

Refer to the appropriate electrical guide for this system.

INTERIOR LIGHTING: X100 SERIES, X308

Interior lighting is divided into two functional modes: illumination enable and fade. The illumination enable circuit provides constant intensity illumination. The fade circuits provide timed fade up, timed fade off, and illumination intensity.

Interior lighting is controlled by the BPM with input from the door control modules and control signal inputs from various switches. All timing functions are controlled by the BPM.

Table 28 Interior Lamp Output Control

Lamp	Primary Input	Output Module	Output Circuit
Trunk lamps	Trunk switch	BPM	Illumination Enable
Glove box lamp	Glove box lamp switch	BPM	Illumination Enable
Vanity lamps	Vanity lamp switches	BPM	Illumination Enable
Map lamps	Map lamp switches	BPM	Illumination Enable
Courtesy Lamps	Door switches	BPM	Fade 1
Footwell Lamps (X100 only)	Door switches	BPM	Fade 1
Reading Lamps	E post switches	BPM	Fade 2
Puddle Lamps	Door switches	Door Modules	Puddle Lamp

Illumination Enable Circuit

The BPM illumination enable circuit is active with the ignition in position II. When the ignition is switched OFF, the illumination enable circuit will remain active for fifteen minutes after the last input from the door ajar switch, the trunk switch, or ignition switch position I.

Illumination Fade Circuits

The BPM fade circuits activate in the following manner:

- **Vehicle unlocked with key or remote transmitter:** The 2 minute timer is set and the lights fade up to 75% of their power. The lights fade up to full power when a door is opened.
- **Engine not running and door opened:** The lights fade up and fade off after 2 minutes. If the lights are on when the last door closes, the 2 minute timer is reset and a 15 second timer is set. The lights will fade off when the first of the timers runs out. If the lights are off when the last door is closed, the lights fade up and only the 15 second timer is set.
- **Ignition switched to position 3 (crank):** All interior lights switch off.
- **Engine running and door opened:** The lights fade up and fade down when the last door is closed.
- **Ignition key removed from ignition:** The lights fade up and the 15 second timer is set.
- **Ignition key not in ignition and doors closed and locked:** The lights fade off.

Door Puddle Lamps

The door puddle lamps are controlled by the door control modules with input from the door switches. When a door is opened, its puddle lamp is activated for 5 minutes or until the door is closed.

Locate Illumination

Locate illumination is conventionally controlled by the dimmer module and the dimmer control switch when the side markers are active.

NOTE:

Refer to the appropriate electrical guide for this system.

EXTERIOR LIGHTING: X100 SERIES, X308

Table 29 Exterior Lamp Output Control

Lamp	Primary Input	Output Module	Output circuit	Lamp Monitoring? (Yes/No)
Headlamps	Lighting stalk	BPM	#3/#5 relay, engine compartment	No
Front side markers	Lighting stalk	BPM	direct	No
Directional indicators	Lighting stalk	BPM	direct	Yes — BPM
Front fog lamps	Fog lamp switch	BPM	#2 relay, engine compartment	
Stop lamps	Brake switch	SLCM/BPM	direct	Yes — SLCM
High-mounted stop lamp	Brake switch	Trunk fuse box	#5 relay, trunk	No
Reverse lamps	Trans rotary switch	SLCM	direct	Yes — SLCM
Rear side markers	Lighting stalk	BPM	#3 relay, trunk	Yes — SLCM
Tail lamps	Lighting stalk	SLCM/BPM	direct	Yes — SLCM
Number plate lamps	Lighting stalk	SLCM	#3 relay, trunk	Yes — SLCM

Headlamps, Side Markers, Tail Lamps and Front Fog Lamps

Front fog lamps require the side markers to be active and the front fog lamps selected. The front fog lamps are deactivated when the main (high) beams are active.

Stop, rear side markers, tail and number plate lamps

For the 2000MY and earlier, the stop lamp relay supplies B+ voltage to the stop lamps via the lamp control module. If the lamp control module detects a stop, side, tail, or number plate bulb failure it outputs a hard wired signal to the SLCM, which transmits the SCP rear bulb fail data message on the network.

Reverse Lamps

Reverse lamp power is supplied directly from the SLCM. The SLCM activates the reverse lamps when the INST REVERSE GEAR SELECTED SCP message is on the network. The INST determines reverse gear selection from CAN data provided by the TCM. The transmission rotary switch provides the hard wired gear position signal to the TCM.

Front fog lamps

The BPM activates the front fog relay when the side markers or dip beams are active and the fog lamp switch enables the front fog light function. The front fog state LED is driven by the relay coil circuit. Front fog lights are disabled by a second momentary ground signal from the front fog switch.

Directional Indicators and Hazard Warnings

Directional indicators and hazard warnings are directly controlled by the BPM using inputs from the hazard and directional switches. The BPM operates the directional indicator lamps at 75 cycles per minute via hard wired connections. The INST directional signal indicators are also operated by the BPM via SCP data messages to the INST. If the BPM detects a bulb failure, it operates the INST directional signal indicator at 144 cycles per minute. The exterior indicator lamps continue to operate at 75 cycles per minute. The directional indicator audible warning is a BPM generated audio signal to the column switch gear speaker. The audible warning tone cycles with the INST indicator lights.

The ignition must be in position II for the directional indicators to activate. The hazard warning lamps operate in any ignition position.

Bulb Failures: X308 series

X308 vehicles do not use a separate bulb failure module to monitor the rear lamps. The brake lamps are monitored by a bulb fail function in the SLCM. A bulb fail function in the BPM monitors the tail lamps. Rear side markers and number plate lights are driven by the BPM and are not monitored for bulb failure.

If the SLCM detects a brake lamp failure it transmits a STOP LAMP FAIL SCP message to the INST. The INST activates the AMBER MIL and displays the STOP LAMP FAIL driver message.

If the BPM detects a tail lamp failure it transmits a TAIL LAMP FAIL SCP message to the INST. The INST activates the AMBER MIL and displays the TAIL LAMP FAIL driver message.

Rear Lamp Monitoring: X100 Lamp Control Module (through 2000 MY)

A lamp control module is installed in the trunk electrical carrier along with the SLCM, trunk fuses and relays. The lamp control module monitors the state of the rear side markers, tail lamps and brake lamps. The high mounted stop lamp is not monitored for bulb failure.

If the lamp control module detects a bulb failure a signal is sent to the SLCM, which transmits a REAR BULB FAILURE SCP message to the INST. The INST activates the AMBER MIL and displays the BULB FAIL REAR driver message.

If the BPM detects a short circuit in either the tail lamp circuit or the tail lamp assembly, it will shut off the tail lamps and front marker lamps. When the headlamp switch is cycled off/on, lamps that are not short-circuited will be flashed rapidly by the SLCM. This will occur each time the headlamp switch is cycled for as long as the short circuit(s) are present.

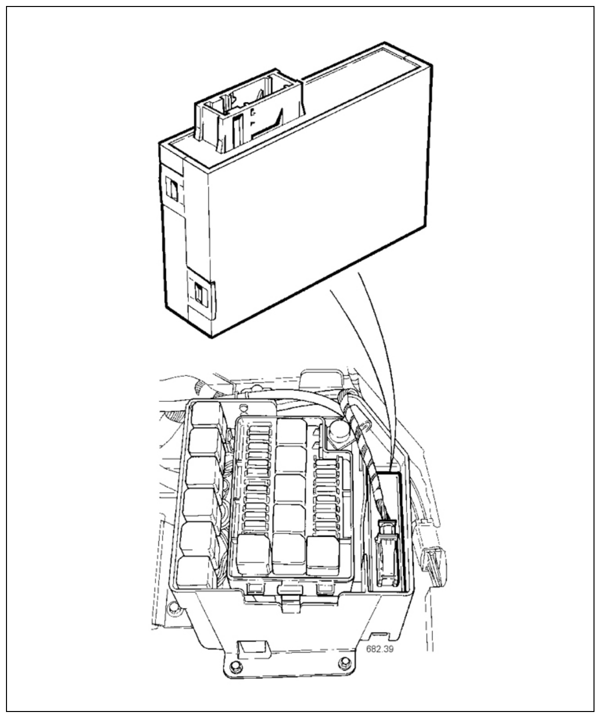


Fig. 91 Lamp Control Module

NOTE:

Refer to the appropriate electrical guide for this system.

High Intensity Discharge (HID) Headlights: X103, X105

HIDs feature automatic headlight leveling and power wash. The leveling of the lights during acceleration, deceleration and terrain variation is fully automatic. An additional benefit of HIDs (Xenon) headlights over halogen is the bulb has a greater service life.

A new feature added to the X103 is the "LIGHTS ARE OFF" message on the instrument cluster message center. When this message appears, it means that if autolamps are fitted on the vehicle and the exterior light switch is off, this message informs the driver that the exterior ambient light is low enough for the exterior lamps to be on if autolamps were active. This feature is available with either HID or conventional halogen light systems.

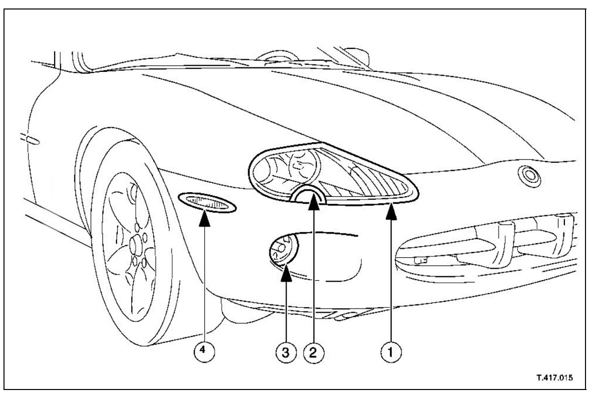


Fig. 92 High Intensity Discharge (HID) Headlights: X103, X105

1. Head Lamp assembly
2. Power wash jet
3. Fog Lamp
4. Side marker lamp

Each headlamp has its own HID ballast/control module integrated into the lamp. The same fixings and locations as on the previous model are used to secure the lamp to the vehicle. The lens and bezel assembly are the same parts, albeit slightly modified: black for HID, with a chrome dip beam embellisher and new lens markings to comply with regulations.

Each headlamp assembly incorporates a new housing with new internals and integrated ballast and control module. A new 9-way connector is used for the power supply, ground and other required signals. Two caps provide access to headlamp components; one cap is for the HID burner, while the other is used for the stepper motor.

A new type of anti-tampering device for the horizontal adjust is now used. This is a cap that is pushed home before the vehicles leave the plant.

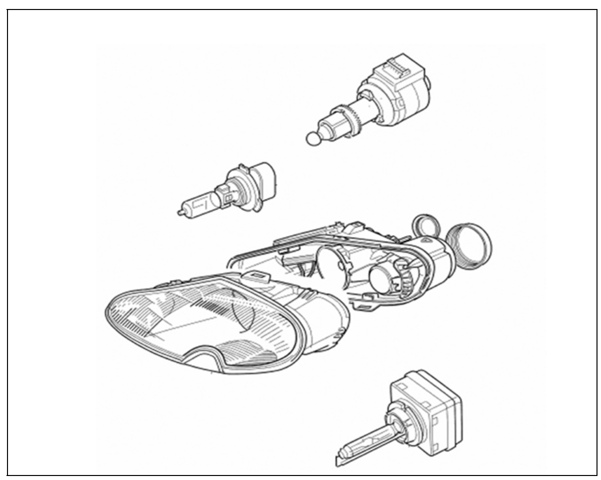


Fig. 93 HID Headlamp Assembly: X103, X105

NOTE:

Refer to the appropriate electrical guide for this system.

HID Headlight Leveling: X103, X105

On X103 systems, a leveling control module is used on each headlamp, integrated into the headlamp assembly itself. This control module also contains the burner (ballast) for the Xenon lights.

The headlamp leveling system comprises the following:

- Front sensor located on the left hand side of the front suspension / cross car beam.
- Rear sensor located on the left hand side of the rear suspension / A-frame.

NOTE:

Refer to the appropriate electrical guide for this system.

REVERSE PARK CONTROL: X100 SERIES, X308

Previously fitted as an accessory only, the reverse park control (RPC) is now offered as a customer option.

Function

The function of the RPC is to provide an audible proximity warning when reversing the vehicle. If an object in the vehicle's path is detected by the RPC, a beep tone will be heard which increases in rate as the vehicle approaches the object. At a predetermined distance from the object the beep will become continuous for three seconds and then turn off, informing the driver to stop. The RPC cannot be switched off.

Operation

When the ignition is on and reverse gear is selected, the four ultrasonic sensors located in the bumper emit beams covering the area behind, and to the side of the bumper. These beams are reflected by a detected object and reenter the sensors. The reflected beam information is processed by the Parking Aid Control (PACM), which calculates the distance of the object from the vehicle's bumper. The sounder is activated and gives the appropriate warning signal starting from an intermittent beep at approximately 150 cm (59.1 in) from the object, increasing in rate to a continuous "stop" tone at approximately 20 cm (7.9 in.). The two sensors on the corner of the bumper also detect objects to within 20 to 50 cm (7.9 to 19.7 in.) of the side of the bumper. If the object is not high enough to do damage to the vehicle it will not be detected by the sensors.

Malfunction Indication

If a malfunction occurs in the system, the reverse warning beep will be cancelled until the malfunction is rectified. Also, each time the ignition is switched on, a continuous tone lasting 6-8 seconds will sound the first time that reverse gear is selected, but not on subsequent selections of reverse.

Diagnosis must be undertaken using the Worldwide Diagnostic System (WDS).

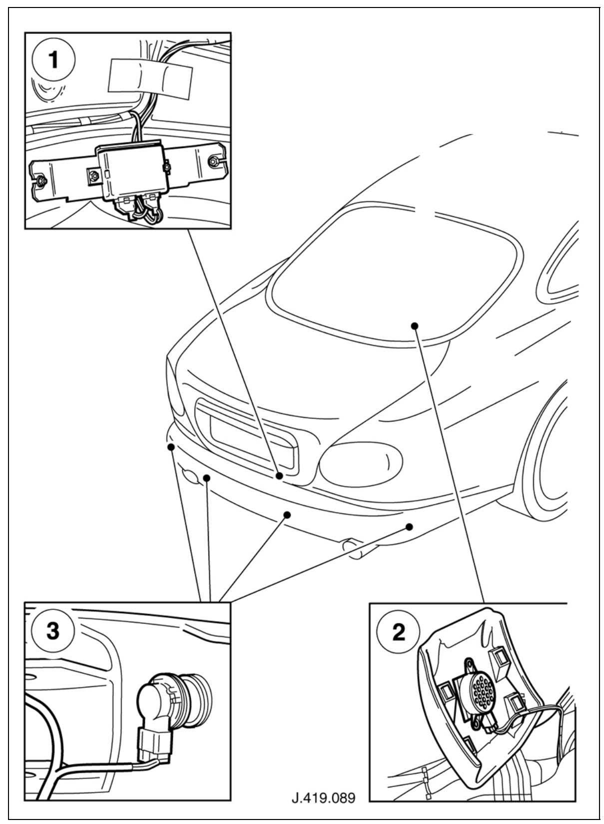


Fig. 94 Reverse Park Control

NOTE:

Refer to the appropriate electrical guide for this system.

WIPERS: X100 SERIES, X308

Windshield Wash/Wipe and Headlamp Power Wash

Wash/wipe functions are controlled by the wash/wipe stalk in the column switch gear with input from the lighting stalk switch for headlamp power wash. Control inputs are hard wired to the BPM, which directly operates the windshield washer pump. The power wash pump and wiper motor are controlled by the BPM via relays.

Two-Speed Wipers

When the slow or fast wipe switch is active, the BPM activates the wiper run/stop relay coil. The stop/run relay supplies B+ voltage to the fast/slow relay. The BPM controls the coil ground of the fast/slow relay depending on the position of the wiper speed switches. The fast/slow relay supplies the B+ voltage to operate the wiper motor.

If ignition position II or the wipe switches become inactive, the stop/run circuit remains active until the wiper motor park switch open circuits. If the wipers are operating at fast speed when they are switched off, they default to low speed during the period from switch off to park.

Intermittent wipe

When the intermittent wipe switch is active, the wipers operate once at slow speed, pause in the park position for the selected delay period and operate once again. This cycle continues until the wipers are switched off, switched to another mode or ignition position II becomes inactive.

Table 30

Wiper Delay Position	Delay Time
1	2 seconds
2	4 seconds
3	7 seconds
4	11 seconds
5	15 seconds
6	20 seconds

Flick Wipe

When flick wipe is activated, the wipers operate once at slow speed and return to the park position. Flick wipe does not cancel intermittent wipe. After the flick wipe cycle is complete, the wiper delay timer is reset and intermittent wipe continues.

Programmed wash/wipe

If the windshield washer fluid level is low, programmed wash wipe is inhibited. When the wash/wipe switch is held active for less than 1.2 seconds, the windshield wash pump is activated for 1.2 seconds and the wipers operate at slow speed. The wipers continue operation for 3 additional sweeps after the pump becomes inactive. If drip wipe is enabled and fast/slow or intermittent wipe is not selected, the wipers perform 1 additional sweep 4 seconds later.

If the wash/wipe switch is held active for more than 1.2 seconds, the pump operates for until the switch becomes inactive, for a maximum of 20 seconds. The wipers operate at slow speed while the pump is active. When the pump becomes inactive the wipers will continue for three additional sweeps plus the drip wipe cycle as described above. Programmed wash/wipe does not cancel intermittent wipe. After the programmed wash/wipe cycle is complete, the wiper delay timer is reset and intermittent wipe continues.

Headlamp power wash

If the windshield washer fluid level is low, headlamp power wash is inhibited. Headlamp power wash is activated by the wash/wipe switch when the headlamps are on dip (low) beam.

When the switch is held active for more than 48 milliseconds, the headlamp power wash pump activates for 800 milliseconds followed by a 6 second pause and another 800 millisecond activation. If the switch is still active after the second pump activation, the cycle will continue until the wash/wipe switch is inactive, for a maximum of 20 seconds.

Once the wash wipe switch is released, power wash is inhibited for the next 5 wash/wipe operations.

Rain Sensing

The rain sensing system provides an automatic wiper action when rain is detected on the windshield. Different amounts of rain can be detected, causing a corresponding variation in wiper speed from slow intermittent to maximum continuous rate. The facility is selected at the wiper stalk by the driver and does not replace normal manual control of the wipers. The system is a common, optional feature for X103 and X308 vehicles.

The system consists of the rain sensor, a separate Rain Sensing Control Module (RSCM) and the wiper stalk selector switch.

Operation

The rain sensor is an optical transducer which senses changes to infrared light caused by the refractive effects of water droplets on the windshield. The sensor is fixed to the inside of the windshield with the sensing elements looking outwards through the glass (see figure on facing page). The sensor elements consist of two groups of light emitting diodes (LED) which alternately produce the infrared light, and a photodiode which receives the infrared reflections from the windshield. With no moisture on the windshield, all of the infrared light is reflected back and the sensor produces a constant 5V output.

Any rain drops falling on the sensing area of the windshield cause some of the light to be refracted and scattered via the droplets and produce a reduction and imbalance in the light received by the photodiode. These signals are analyzed in the sensor and output as a pulsed signal. Pulse duration is a measure of droplet size and number of pulses is related to the number of droplets. The output from the rain sensor is taken to the rain sensing control module.

The rain sensor is an active device and incorporates the optical elements and electronic control and processing circuits. A B+ power input is supplied from the rain sensing control module. The output signals from the rain sensor are processed in the rain sensing control module to mimic the column switchgear. The module output signals are spliced to the wires from the stalk switch positions and input to the Body Processor Module (BPM). The BPM therefore does not recognize the difference in wiper speed requests between the manual controls and the rain sensor signals.

Rain Sensor

The rain sensor is fixed to the windshield by adhesive but can be easily removed if it is to be replaced. The sensor must be located within the clear circle in the obscuration band. The mirror assembly is modified and now has a sliding cover to enclose the rain sensor.

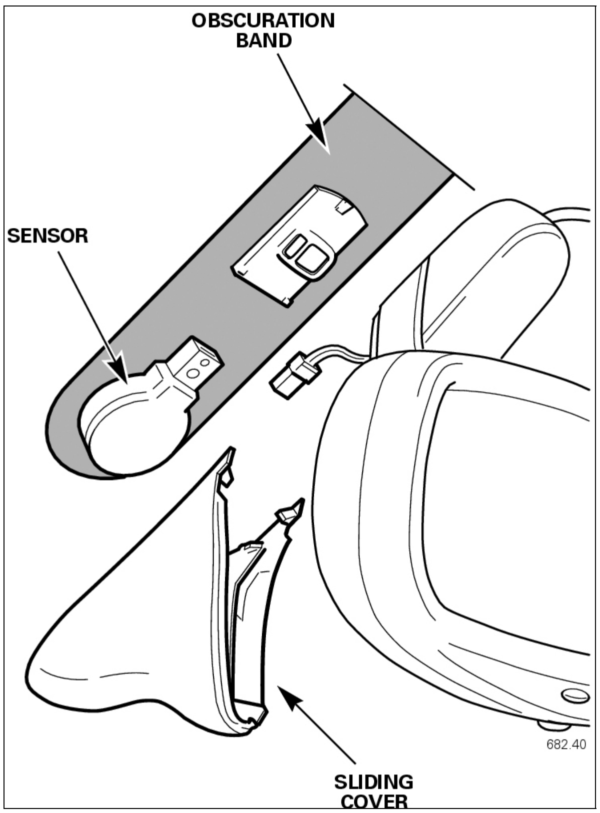


Fig. 95 Rain Sensor

Rain Sensing Control Module: X100 series, X308

The Rain Sensing Control Module (RSCM) is a non-serviceable electronic unit with connections to the rain sensor and the body processor module (BPM). On X308 vehicles, the module is fitted inside the engine bay cool box. On X100, and X103 vehicles, the module is mounted on the passenger side dash panel.

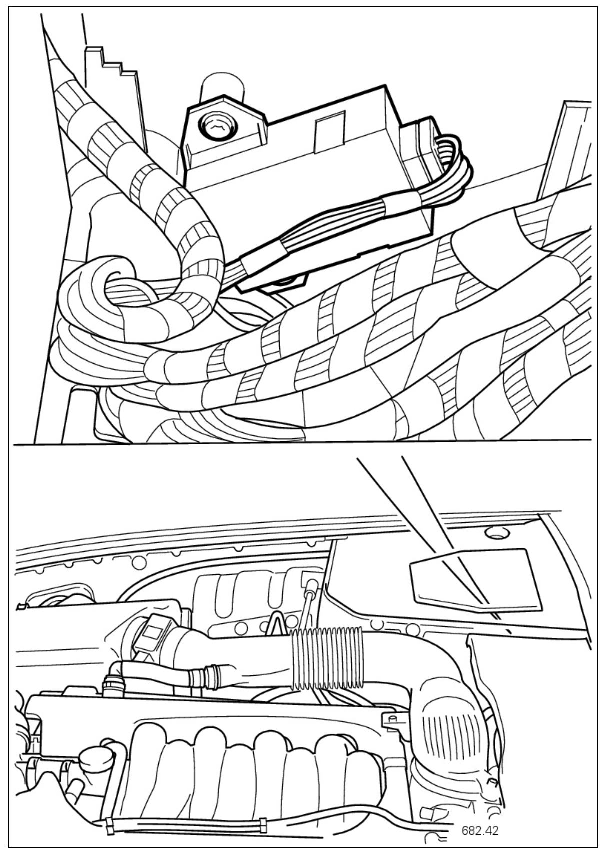


Fig. 96 Rain Sensing Control Module: X308

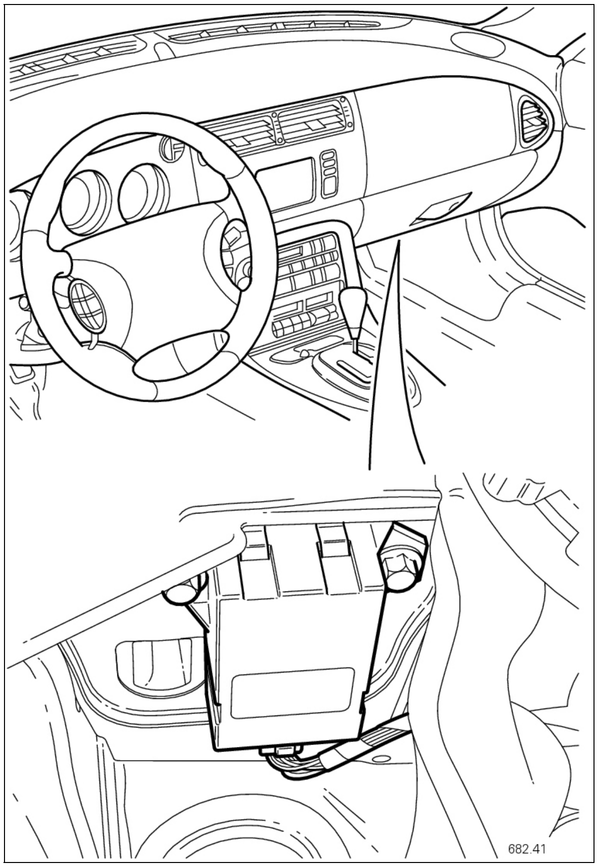


Fig. 97 Rain Sensing Control Module: X100 series

Auto Headlights With Wipers On

If the wipers are active via any mode EXCEPT windshield wash or flick, the exterior lights will be switched on, in AUTO headlight mode, after a delay of 20 seconds. The exterior headlights will switch off 2 minutes after the wipers are switched off, or will go off straight away if auto lights mode is deselected or the ignition is switched off.

NOTE:

Refer to the appropriate electrical guide for this system.

Column Stalk

The rain sensing feature is identified on the column stalk by the marked AUTO position which takes the place of the first intermittent wipe position on vehicles without rain sensing.

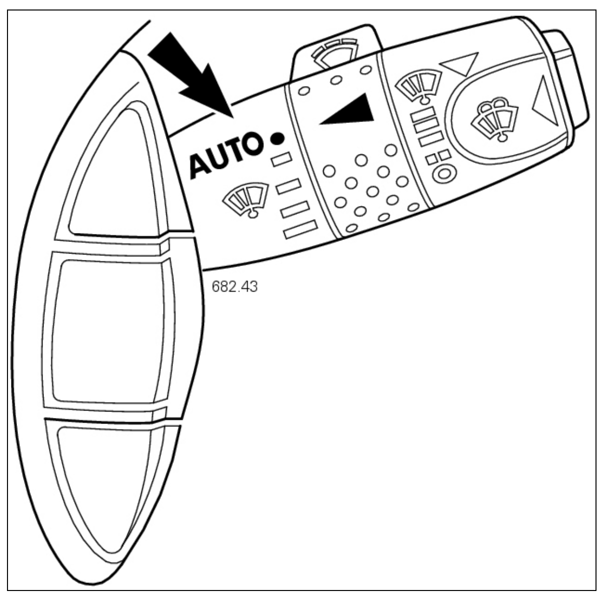


Fig. 98 Column Stalk Rain Sensing Setting

SEATS: X100 SERIES, X308

Power Seat Control

The power seats are controlled by their respective seat switches via the seat control module. Power seat adjustment is available during either of the following conditions:

- Ignition is in position I or II
- If the associated door is open or has been closed within 30 seconds.

Only one of the seat motor outputs can be driven at a time.

If the gear selector is not in P or N, seat operation is enabled for 2 seconds only. The seat movement switch must be pressed again to get an additional 2 seconds of movement. This function prevents continuous seat movement while the vehicle is being driven.

Seat heater switch inputs are processed by the BPM and transmitted to the respective seat control module, which controls the heaters via hard wires.

Non-Memory Driver Seat

The non-memory seats function the same as the memory seats with the exception of the memory functions.

Seat belt engagement

The seat belt switch is hard wired to the DSCM. When the driver seat belt activates the seat belt switch, the DSCM transmits an SCP seat belt tell tale ON or OFF message to the INST and an SCP seat belt chime ON or OFF to the BPM.

Adjustable Head Restraint System: X100 series

As of 2001 MY, the head restraints are adjustable, for occupant safety and comfort. Due to the limited head room and confined area in an XK the head restraints have to be lowered when the seat back is moved forward to gain access to the rear seat area.

Four hardwire inputs control the functionality of the head restraint.

Two inputs (up/down) from the seat switch pack are used to control occupant requests. The seat back tilt switch input is active when the seat back lever is raised or lowered and commands the head restraint control module (HRCM) to move the head restraint to the full down position prior to seat back movement. This input overrides the 2 switch pack inputs. The seat back latch switch input is active when the seat back is in the “forward/unlatched” position and commands the HRCMs to keep the head restraints in the fully lowered position regardless of the seat switch pack or the seat back tilt switch inputs.

Seat Entry/Exit

On X103, the steering column moves fully up and fully forward for easy entry/easy exit. The seat does not move. On X308, both the steering column and the seat move.

STEERING COLUMN: X100 SERIES, X308

Steering Column Movement

Steering column movement is accomplished by two motors (tilt and reach) that are driven by the BPM. The driver side fuse box supplies power to the column switch gear joy stick. Four switches route the joy stick control voltage inputs to the BPM through resistors. The BPM interprets the voltage inputs to determine the required column movement direction.

The auto tilt switch enables automatic column movement for entry and exit. When the auto tilt switch is active, a logic ground is provided directly to the BPM.

Auto tilt memory recall adjustment is enabled when the following conditions are met:

- Ignition in position I or II
- Within 30 seconds of driver door close
- Within 30 seconds of ignition key in

Column movement is canceled when the 30 second timer expires, or when the ignition is switched to position III (crank).

Tilt away steering — auto tilt switch enabled

400 milliseconds after the ignition key is removed, with the gear selector in park, the steering column will move up and away from the driver. When the ignition key is inserted, the column will revert to its last memory position.

NOTE:

Refer to the appropriate electrical guide for this system.

MIRRORS: X100 SERIES, X308

Manual Control

Door mirror position control is enabled by the driver door switch pack via the DDCM and the PDCM. The switch pack provides a logic ground to the DDCM indicating the mirror to be controlled and the movement direction required. If the ignition is in position I or II or the driver door is open, the selected mirror is driven in response to the switch pack inputs. The DDCM drives the driver door mirror motors via hard wires. Commands for the passenger mirror are transmitted as SCP messages to the PDCM, which is hard wired to the passenger door mirror motors.

Mirror Tilt (Reverse Dip)

Mirror tilt is accomplished by activating the mirror down switch with reverse selected and the ignition in position II. The passenger door mirror can be tilted down 7 degrees from its present position. The mirror returns to its previous position when reverse gear is deselected, the mirror up switch is activated or the ignition is switched out of position II. Left and right mirror switch commands are ignored while the mirror is tilted down.

Mirror Compass

The interior mirror with compass was introduced on 2003 MY X103.

NOTE:

Refer to the appropriate electrical guide for this system.

POSITION MEMORY SYSTEM: X100, X308

Memory Control

Mirror memory positions are stored in the respective door modules. Driver seat memory positions are stored in the DRDCM (XJ) or the DSCM (XK) and steering column memory positions are stored in the BPM.

When memory is recalled, the driver door switch pack memory buttons activate the DDCM to transmit the SCP recall memory 1 or recall memory 2 SCP message. The BPM, PDCM and DSCM respond by recalling the stored position data and driving the steering column, passenger door mirror and driver seat position to their positions. The DDCM drives the driver door mirror to its position. As feedback tells each module that the stored position has been achieved, the module transmits an SCP memory recalled message, which is received by the BPM.

Memory Recall

On X100 series, memory recall is available from the driver's door switch pack only.

On X308, memory settings are available from both the driver’s door switch pack and the key fob.

NOTE:

Refer to the appropriate electrical guide for this system.

BODY ELECTRICAL SYSTEMS X350 SERIES

Electrical System Architecture: X350

Power Supplies

The X350 vehicle electrical system is a supply-side switched system. The ignition switch directly carries much of the ignition switched power supply load. Power supply is provided via three methods: direct battery power supply, ignition switched power supply, and “Switched System Power Supply”. The “Switched System Power Supply” circuit is controlled via the FEM (Front Electronic Module) and the REM (Rear Electronic Module).

Fuse Boxes

The electrical harness incorporates three serviceable power distribution fuse boxes: the Front Power Distribution Fuse Box located in the engine compartment, the Rear Power Distribution Fuse Box located in the trunk and the Passenger Junction Fuse Box located in the front right-hand foot well. All fuses and relays (except the trailer towing accessory kit) are located in the three fuse boxes.

Some of the relays used are of the Printed Circuit Board (PCB) type. This type of relay is not serviceable and replacement requires the complete fuse box to be serviced.

POWER WINDOWS: X350

The X350 power windows provide the following features:

- One Touch Up/Down
- Obstruction sensing and logic

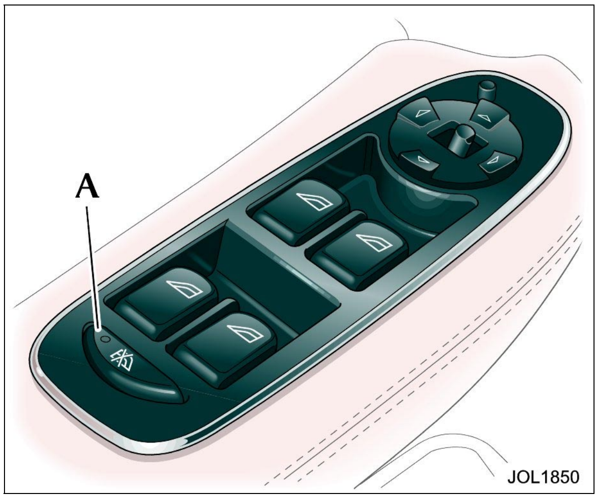


Fig. 99 Rear Window Immobilization Switch: X350

A. Rear Window immobilization switch

When the vehicle power supply is disconnected, the obstruction sensing and one-touch up features will no longer function when the power supply is restored. The windows must be initialized to restore one-touch up capability.

Unlike the X308 design, the X350 power window system uses direct wiring from the switches to each window control module. The power window motor is integral with the control module. The control module monitors an integral hall effect sensor feedback signal to determine when the normal travel of the motor is limited. The initialization procedure must be carried out to restore operation.

When the vehicle power supply is disconnected, the obstruction sensing and one-touch up features will no longer function when the power supply is restored.

Power Window Initialization

- Lift and hold the window switch in the up direction until the window seats completely. Continue to hold the switch for a further 2 seconds.
- Release the switch and then lift and hold it again for a further 2 seconds. This procedure ensures that the window is fully seated into the seal.
- Press the window switch to lower the window to its fully open position.
- Verify the operation of the obstruction sensing and one-touch up operation.

NOTE:

This procedure can be carried out either from the individual window switches or from the driver's switchpack.

Obstruction Sensing

The window will raise until the obstruction is reached. The obstruction sensing feature will operate, lowering the window to a minimum of 50 mm (1.97 in) below the point at which reversing was initiated (or at least 200 mm (7.87 in) from the close position).

See Global Open / Close table 22.

NOTE:

Refer to the appropriate electrical guide for this system.

Roof Opening Panel Function and Initialization

The sun roof motor receives input from either the FECM (for global close only) or the switch, integrated into the roof console. The sun roof motor module monitors an integral hall effect sensor feedback signal to determine when the normal travel of the motor is limited.

The sun roof is not affected by battery disconnection and will not need to be initialized. However, if power is disconnected while the sun roof is actually being operated, then memory will be lost and the following initialization procedure will have to be carried out. This procedure will also have to be carried out if the sun roof motor is changed.

- Press the switch in the tilt position until the roof moves to the fully tilt position and stops.
- Release the switch.
- Within 5 seconds, press and hold the switch in the tilt position again. The roof will travel automatically to the fully open position, back to the fully closed position and stop.
- Verify the operation of the antitrap and one-touch features.

NOTE:

Refer to the appropriate electrical guide for this system.

To re-initialize, run the roof panel into the tilt position. Release, then press and hold the switch for 20–30 seconds. The roof panel will move up and down signaling memory erasure of the previous initialization.

The roof panel can then be re-initialized as described above.

Table 31 Global Open / Global Close: All Models

	With Key	Functionality With Central Lock	With Remote	Conv. Top	Sun Roof
X308	Open/Close	Close	None	N/A	Close
X100	Open/Close	N/A	None	Open/Close	N/A
X103	Open/Close	N/A	None	Open/Close	N/A
X105	Open/Close	N/A	None	Open/Close	N/A
X350	Open/Close	Open/Close	Open/Close	N/A	Open/Close

Electrically Operated Rear Sunblind

The electrically operated sunblind is operated by the switch located in the roof console. The sunblind operates by "one touch" operation of the switch.

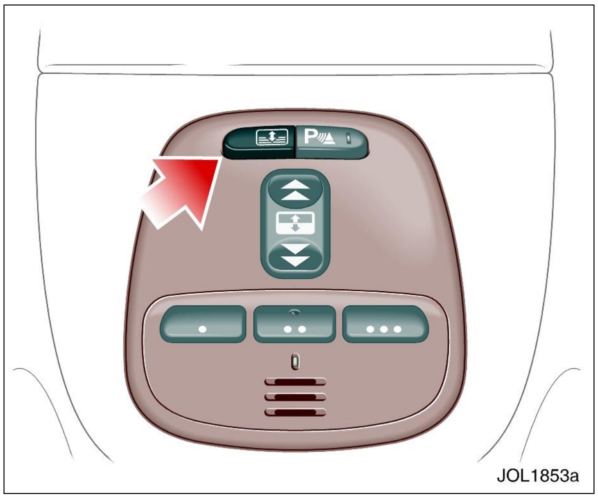


Fig. 100 Rear Sunblind Switch Button

The sunblind has its own ECU which will fully raise or lower the sunblind when the switch is operated. The ECU can be replaced independent of the complete assembly. The sunblind is raised and lowered by two motors, which is part of the sunblind and is not serviceable.

To replace the sunblind the rear parcel shelf must first be removed from the vehicle. It is easier to remove the sunblind from the rear parcel shelf if the sunblind has been raised by approximately 15 cm (6 in.). Due to the one touch operation of the sunblind this can be done by reconnecting the sunblind harness, operating the switch and then disconnecting the harness as the sunblind begins to raise.

NOTE:

Refer to the appropriate electrical guide for this system.

INTERIOR LIGHTING: X350

The interior lighting is improved from the X308, and the controlling modules have changed:

Table 32 Interior Lamp Output Control

Lamp	Primary Input	Output Module	Circuit Power Supply
Trunk lamps	Trunk switch	RECM	Power Relay 3
Glove box lamp	Glove box lamp switch	Hardwired	Power Relay 1
Vanity lamps	Vanity lamp switches	RECM	Power Relay 2
Map lamps	Map lamp switches	RECM	Power Relay 2
Courtesy Lamps	Door switches	BPM	Power Relay 4
Front Footwell Lamps	Door switches	FECM	Power Relay 1
Rear Footwell Lamps	Door switches	RECM	Power Relay 4
Rear Map Lamps	Integral lamp switch	RECM	Power Relay 4
Drivers Door Puddle and Approach Lamps	Door switches	DDCM	DDCM
Front Passenger Door Puddle and Lamp	Door switches	FECM	FECM
Rear Door Puddle Lamps	Door switches	RECM	RECM

Battery Saver

A timer function within the GECM and RECM controls the battery saver feature:

- The timer is initialized when the ignition key is turned to position ‘0' or removed from the ignition barrel.
- After a 40 minute period, the GECM and/or RECM will remove the battery voltage from the interior lighting by deactivating the appropriate relays.

The battery saver feature will be reactivated when:

- The ignition key position is changed.
- Any door (including the luggage compartment door) becomes ajar or is opened.
- An external unlock is activated using either the door lock cylinder or the integrated key transmitter.
- The courtesy lamps' switch is activated.

The Switched System Power (SSP) is controlled by the FEM and the REM.

Courtesy Lighting

The courtesy lamps are controlled by the rear electronic control module in the following circumstances:

- Any of the vehicle's doors are open.
- An external unlock is activated using either the door lock cylinder or the integrated key transmitter.

Provided that the courtesy lamps' switch is not activated, the courtesy lighting feature extinguishes the courtesy lamps when all the vehicle's doors are closed and any of the following occurs:

- Twenty seconds have elapsed since either an external unlock or the last door has closed, whichever occurs last.
- The engine is started.
- An external lock is activated using the door lock cylinder or integrated key transmitter.

In addition, the courtesy lighting feature extinguishes the courtesy lamps when the battery saver timer has expired.

During normal operation the courtesy lamps fade up and fade off.

NOTE:

Refer to the appropriate electrical guide for this system.

EXTERIOR LIGHTING: X350

Front Side Lamps

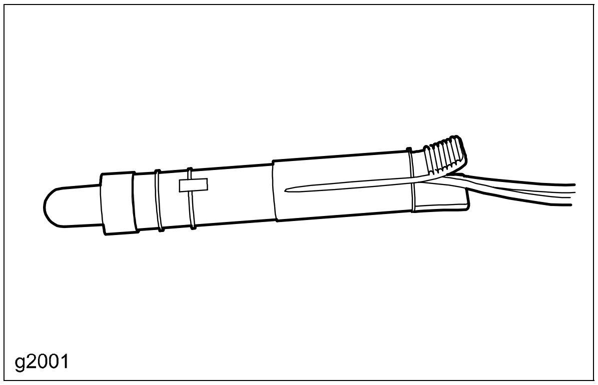


Fig. 101 Front side lamp bulb holder

The front side lamps are located within the headlamp. The bulb holder has been extended to allow for ease of bulb replacement.

Side Repeater Lamps

The side repeater lamps are fitted to the front wings between the front door and the wheel arch. Bulb replacement is carried out after first removing the lamp.

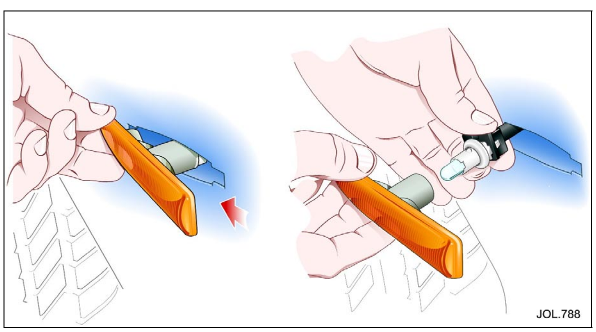


Fig. 102

Approach Lamps

Approach lamps are integrated in the exterior mirrors to provide ground illumination for the area around the front doors. The approach lamps will illuminate only if the ambient light, as determined by the autolamp sensor, is below a predetermined level. At levels of low ambient light, the approach lamps are activated when:

- the vehicle is unlocked using the key, the key transmitter or the master locking switch;
- the headlamp convenience button on the key transmitter is pressed;
- reverse is selected.

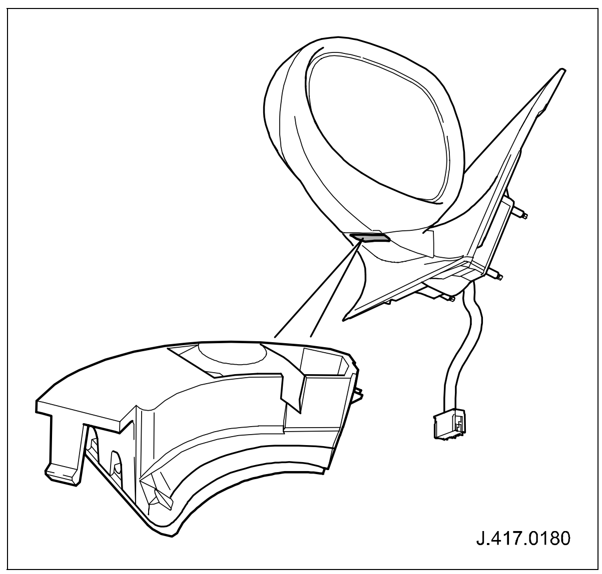


Fig. 103 Approach lamp

Illumination is done by a 5W bulb which is replaced as a complete lamp assembly. The lamps are "handed" accordingly to the relevant side of the vehicle.

Removal of the lamp is carried out by first folding out the mirrors. The lower trim cover of the mirror is then removed with the ground illumination lamp. The lamp connector is "trapped" between the mirror harness and the body of the mirror. Access to the connector is gained by repositioning the mirror harness. The lamp can then be removed from the mirror lower trim. For additional information refer to JTIS.

NOTE:

Refer to the appropriate electrical guide for this system.

Rear Lamps

The rear lamps are a new design and use 24 light emitting diodes (LEDs) for the operation of the rear tail and stop lamps. The LEDs are mounted on a printed circuit board (PCB) attached to the rear lamp cluster by two screws.

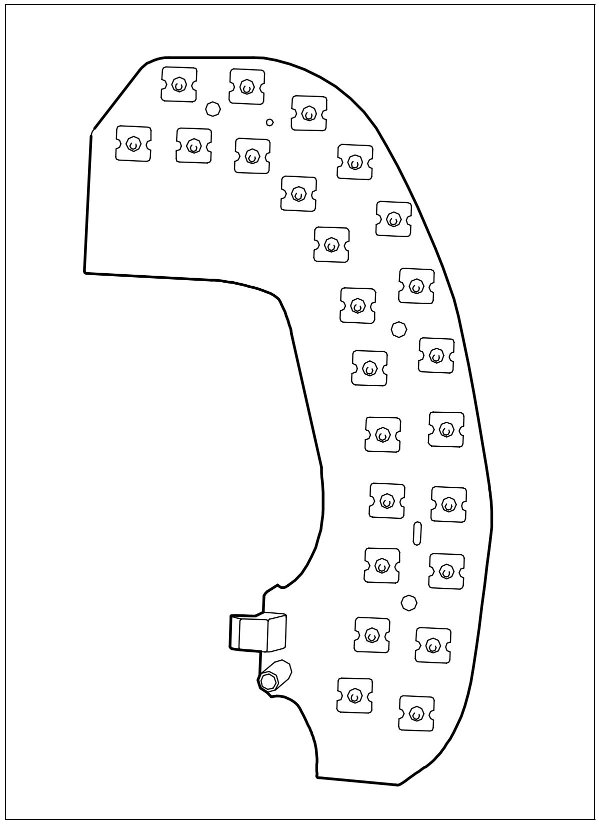


Fig. 104 LED stop and tail PCB

Operation of the rear tail and stop lamps is done by illuminating all of the LEDs. The intensity of the LEDs is varied to distinguish between tail lamp and stop lamp operation. During operation of the rear tail lamps all LEDs are supplied with reduced power allowing them to illuminate at a reduced intensity. During stop lamp operation, the LEDs are supplied with increased power, causing them to operate at a higher intensity.

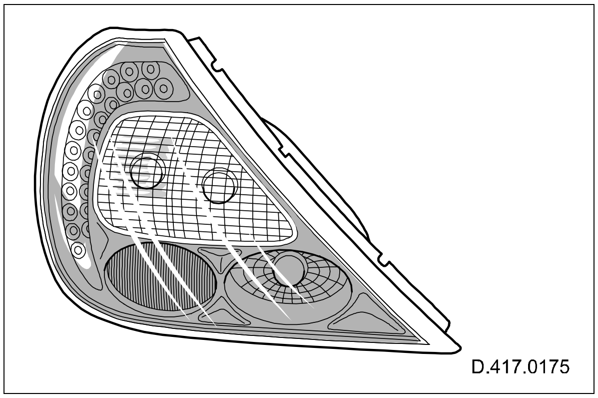


Fig. 105 Lens - rear lamp assembly

The LEDs are not serviceable separately, but can be replaced as a PCB assembly.

The LEDs are arranged in six banks of four. The PCB must be replaced when a single bank of four LED's fail to operate.

The advantage of using LEDs compared to conventional tungsten filament bulbs are:

- Low heat emissions (allowing the distance between the lens and the light source to be reduced)
- Faster operational response time
- Increased reliability and longer service life compared to a conventional bulb
- Constant intensity over the life of LED

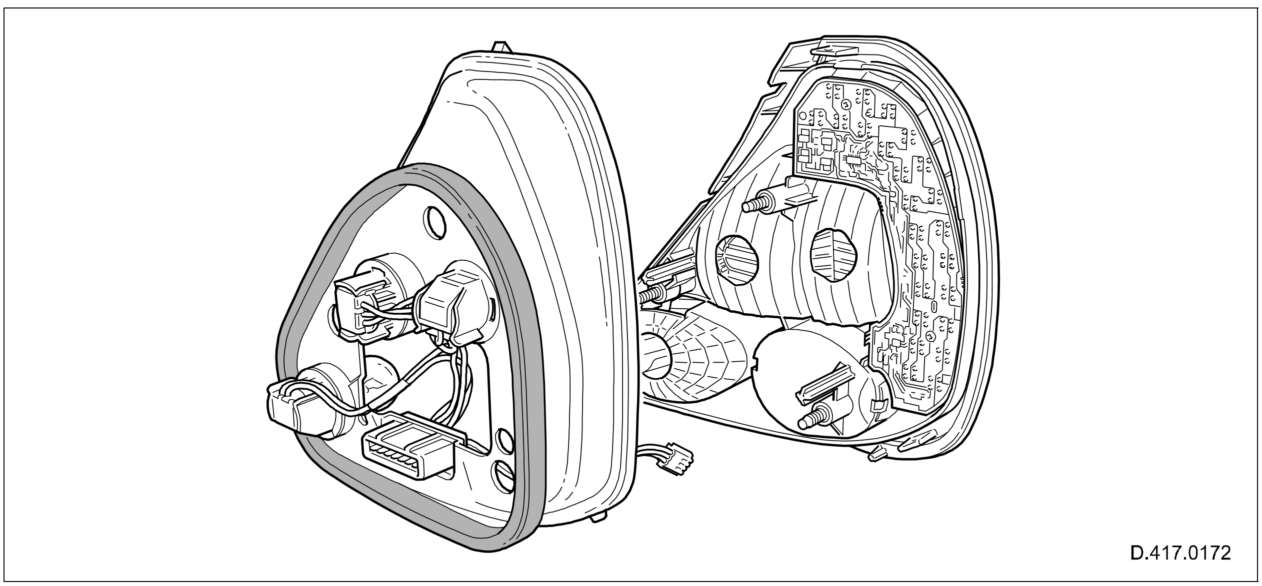


Fig. 106 Rear lamp assembly

The operational response time of an LED is 130 ms compared to a response time of 210 ms for a conventional bulb. This will reduce the distance travelled after applying the brakes before the stop lamps are operated, warning the driver of the vehicle behind sooner. This will be equivalent to a distance of 2.5 m at 70 m.p.h. (112 kmh).

Bulbs are used for the operation of the other lamps.

The third brake light also uses LEDs and operates concurrently with the tail lamp based stop lamps.

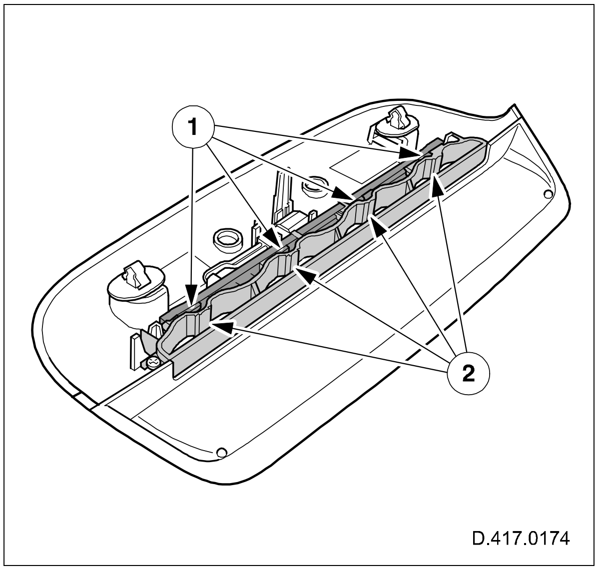


Fig. 107 Third brake light

1. LEDs
2. Fresnel lens

Daytime running lamps (Canadian vehicles only)

The daytime running lamps (DRL) system is designed to switch the low beam headlamps ON at normal intensity and the front and rear park lamps (including license plate lamps and side markers) ON at normal intensity under the following conditions:

- The ignition is in the RUN position.
- The headlamp switch is in the OFF position or an Autolamp position (if the Autolamp sensor is in DAY mode).
- The parking brake is in the OFF (released) position.
- The transmission is not in PARK.

If the above conditions are met, the low beam headlamps are illuminated by a Pulse Width Modulated signal (PWM) for the vehicles fitted with halogen headlamps (when the average voltage exceeds 14V). Vehicles with High Intensity Discharge (HID) headlamps operate the dip beam at normal supply voltage.

The front park lamps (including front side markers) and low beam lamps are illuminated from the Front Electronic Module (FEM), the rear park lamps (including the rear side markers and the license plate lamps) are illuminated by the Rear Electronic Module (REM).

The daytime running lamps are extinguished under the following conditions:

- The ignition switch is moved out of the RUN position.
- The transmission is returned to PARK.
- The parking brake is in the ON (not released) position.

The daytime running lamps interact with the following components:

- The instrument cluster
- The FEM
- The REM
- The Electronic Park Brake (EPB)

NOTE:

Refer to the appropriate electrical guide for this system.

HIGH INTENSITY DISCHARGE (HID) HEADLAMPS

High Intensity Discharge (HID) Headlights: X350

The HID headlamp contains the following:

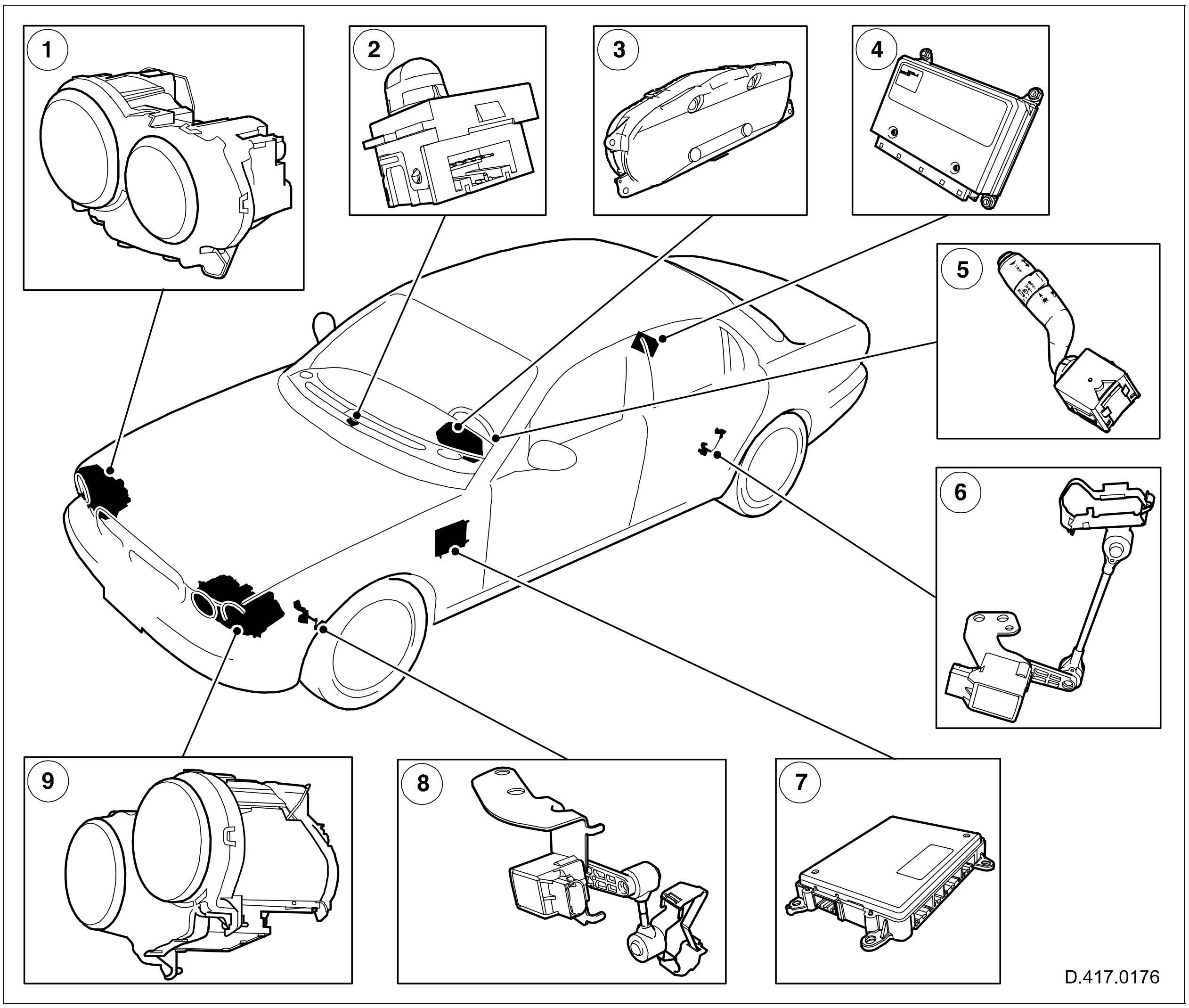


Fig. 108 HID and Headlamp Leveling System Components: X350

1. RH-side headlamp assembly
2. Autolamp sensor
3. Instrument cluster
4. Air suspension module
5. Main light switch
6. LH-side rear axle level sensor assembly
7. Front electronics module
8. LH-side front axle level sensor assembly
9. LH- side headlamp assembly

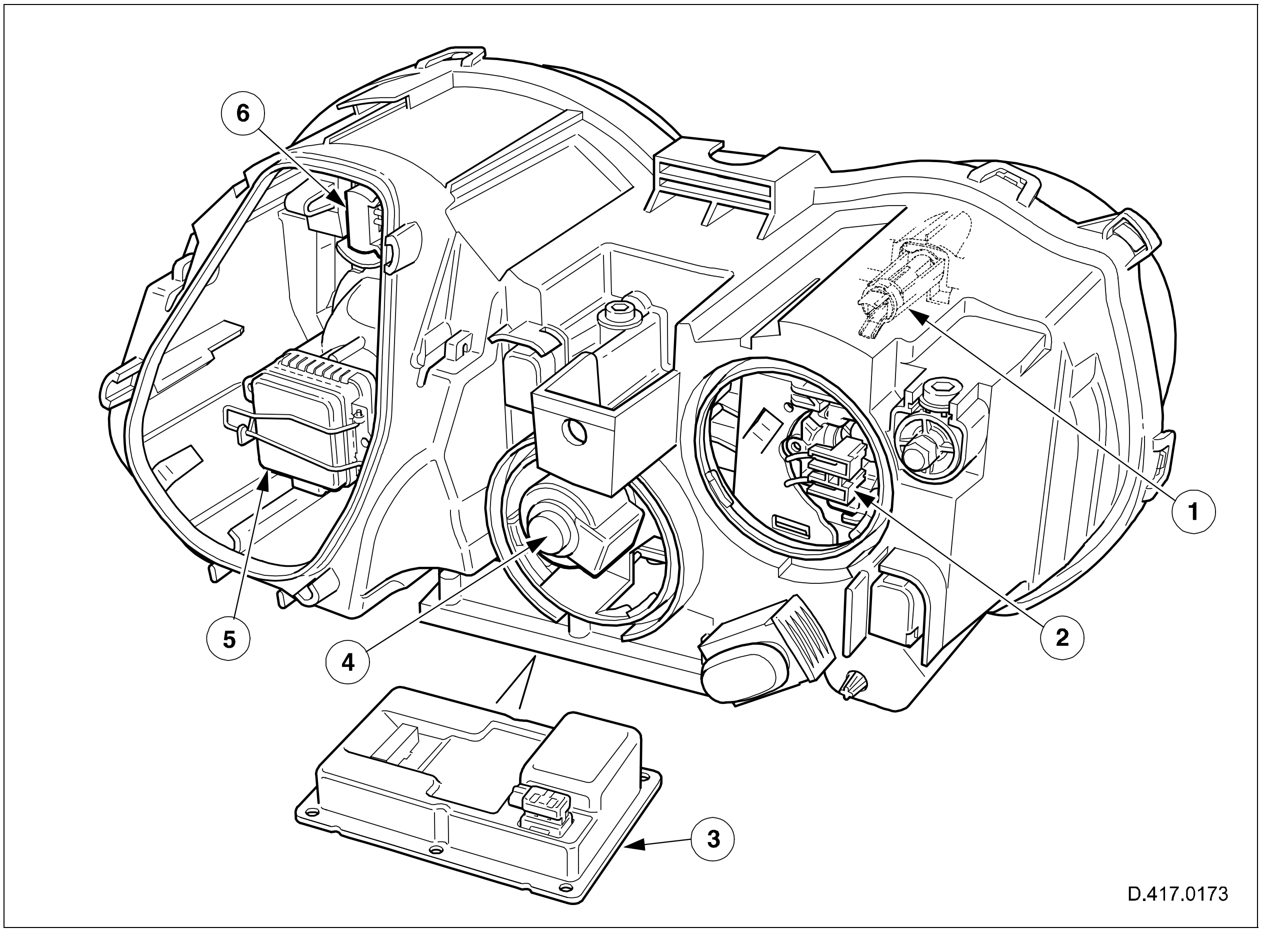


Fig. 109 HID Lamp Assembly: X350

1. Pilot lamp
2. High beam (flash to pass) lamp
3. Xenon lamp control module
4. Motor (automatic headlamp levelling)
5. Xenon lamp assembly
6. Turn signal lamp

Control Module Replacement

The HID control modules are located on the underside of each headlamp and are secured by six anti-tamper type Torx screws.

To access the control module, the headlamp must be removed from the vehicle after first removing the front bumper. For additional information refer to JTIS.

After replacement of the module, the module must be configured to the vehicle using WDS before it will operate.

Headlamp Levelling Control

Each of the HID headlamps contain a headlamp levelling servo to maintain the headlamp alignment at the correct height with changes in vehicle attitude. Unlike previous models the headlamp system does not have its own levelling sensors. Data is taken from the air suspension unit (ASM) control module. The ASM uses data from four suspension height sensors, although the headlamp levelling system only uses data supplied by the two left hand suspension height sensors.

Each time that the ignition switch is turned to position II, the headlamp levelling servos will be operated by the headlamp control modules to ensure that the headlamps are set at the correct height in relation to vehicle attitude.

NOTE:

The headlamps must be correctly aligned to the vehicle in order for the headlamp levelling control to be accurate. For additional information refer to JTIS.

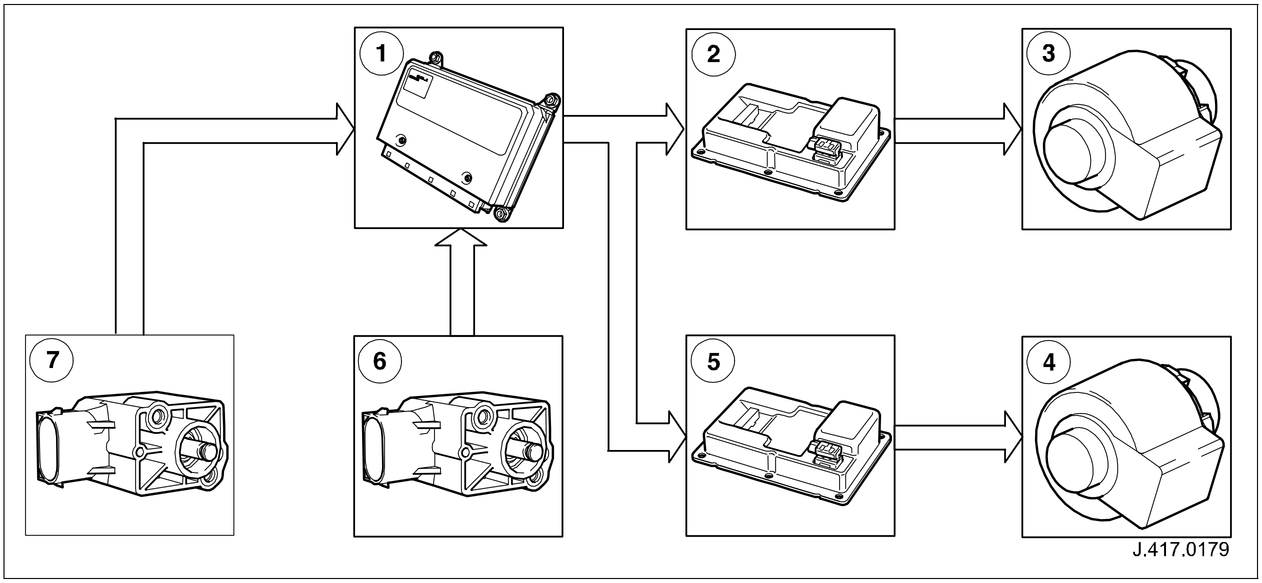


Fig. 110 Automatic Headlamp Levelling System: X350

1. Air suspension module
2. LH-side Xenon lamp control module
3. LH-side Xenon lamp levelling motor
4. RH-side Xenon lamp levelling motor
5. RH-side Xenon lamp control module
6. LH side front height sensor
7. LH side rear height sensor

The headlamp control module receives a PWM signal, which is proportional to suspension height, from the (ASM). The headlamp control modules will monitor this information every 40 ms and will adjust the headlamp height as necessary, providing the data is outside the normal threshold.

The time taken to adjust the headlamps compared to changes is suspension height is approximately 80 ms, since the suspension height sensor data must first be processed by the ASM before it is passed onto the headlamp control modules.

NOTE:

The headlamp levelling system was eliminated from the X350 during the 2005MY, starting with VIN G39155 onward. The system was deemed unnecessary due to the self-leveling capabilities of the air suspension.

PARKING AID SYSTEM: X350

Front Parking Aid system

Front parking aid is optional original equipment only. It is not a dealer fit option.

The front sensors will detect objects up to a range of 0.8 m (31.5 in.) along the width of the bumper while the detection distance at the corners of the front bumper is reduced to 50 cm (19 in.).

Due to the curvature of the front bumper, the bumper is shaped to enable face of the sensor to be positioned vertically to the vehicle axis. This will ensure that the beam from the sensors are correctly positioned to detect obstacles.

The front parking aid sensors are active when:

- Reverse gear is selected
- Forward gear is selected and the vehicle speed is below 9 m.p.h. (15 kmh)

The front parking aid sensors are active when a forward gear is selected. The system is deactivated when the vehicle speed exceeds 9 m.p.h. (15 kmh) and becomes active again when the vehicle speed falls below 6 m.p.h. (10 kmh).

To prevent the system from continually monitoring the vehicle in front when in slow moving traffic, the system may be disabled by operation of the cancellation switch located in the roof switch pack.

The system will automatically default to active whenever the ignition switch is turned to position II.

The front parking aid is controlled by the parking aid module, the same module that controls the rear parking aid system, located in the spare tire wheel well area.

NOTE:

Even though the module for the front/rear parking aid systems is the same, there are different part numbers for modules with rear parking aid-only and front/rear parking aid.

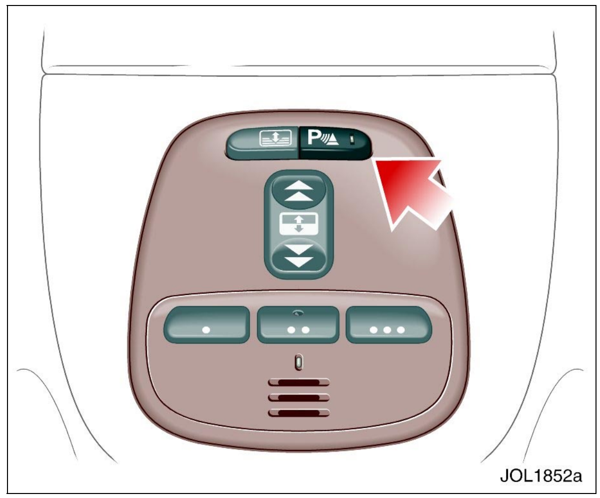


Fig. 111 Front/rear parking aid button

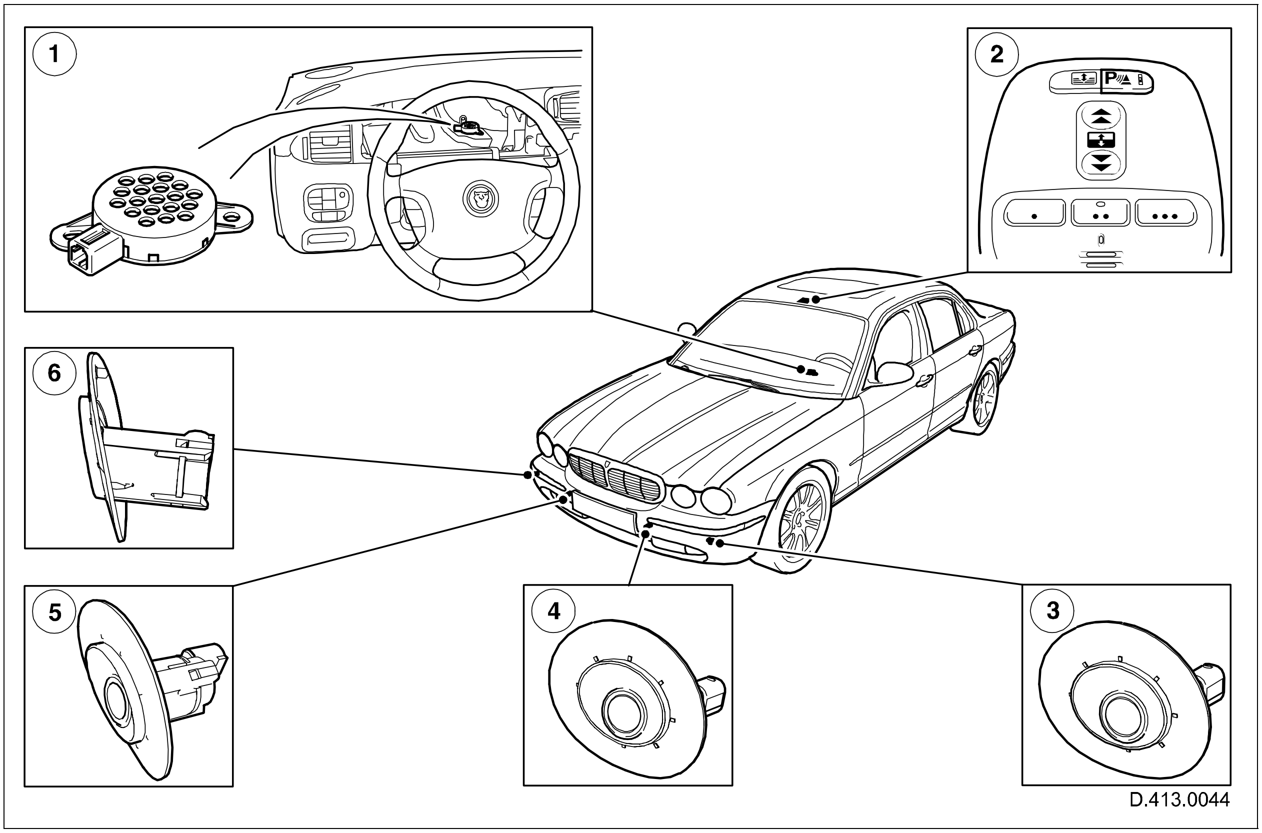


Fig. 112 Front Parking Aid System Components: X350

1. Speaker
2. Deactivation switch
3. Parking aid sensor
4. Parking aid sensor
5. Parking aid sensor
6. Parking aid sensor

Rear Parking Aid System

Rear parking aid is fitted to all models of the new X350 range.

Parking aid is fitted to the front and rear of the vehicle to provide an audible warning to the driver relating to the distance of obstacles near the front or rear bumper when parking or travelling at a slow speed.

The rear sensors will detect objects up to a range of 1.8m (70.89 in.) along the width of the bumper while the detection distance at the corners of the rear bumper is reduced to 50cm (19 in.).

The system provides assistance to the driver when parking in order to help avoid collision with obstacles. The system will detect curbs with a minimum height of 18cm (7 in.). Curbs below this height will allow the vehicle to pass over them and so will not be detected by the system.

Four ultrasonic sensors are used in the front and the rear bumpers. All of the sensors are compatible. However, the two front sensors in the middle of the front bumper have their connectors angled at 90° to provide clearance between the front bumper reinforcing beam.

Two speakers are used to provide an audible warning to the driver when an obstacle is detected. One is mounted under the rear parcel shelf and the other mounted behind the instrument cluster.

The rear speaker is used to warn the driver of an obstacle at the rear of the vehicle, while the front speaker is used to warn the driver of an obstacle at the front of the vehicle.

When an obstacle is detected, the system activates the appropriate speaker with a tone signifying the distance to the obstacle. The tone consists of a beep and defined space ratio which varies depending on the calculated distance. When the distance to the obstacle is less than 20 cm (8 in.) the speaker tone is continuous.

If a tow bar is fitted, the rear parking aid system is disabled when the trailer tow socket is connected.

A cancellation switch is provided in the roof console to deactivate the parking aid system when it is not required. The cancellation switch is not provided on vehicles with rear parking aid only.

NOTE:

The sensors should be kept clean to prevent the signal from the sensors becoming blocked.

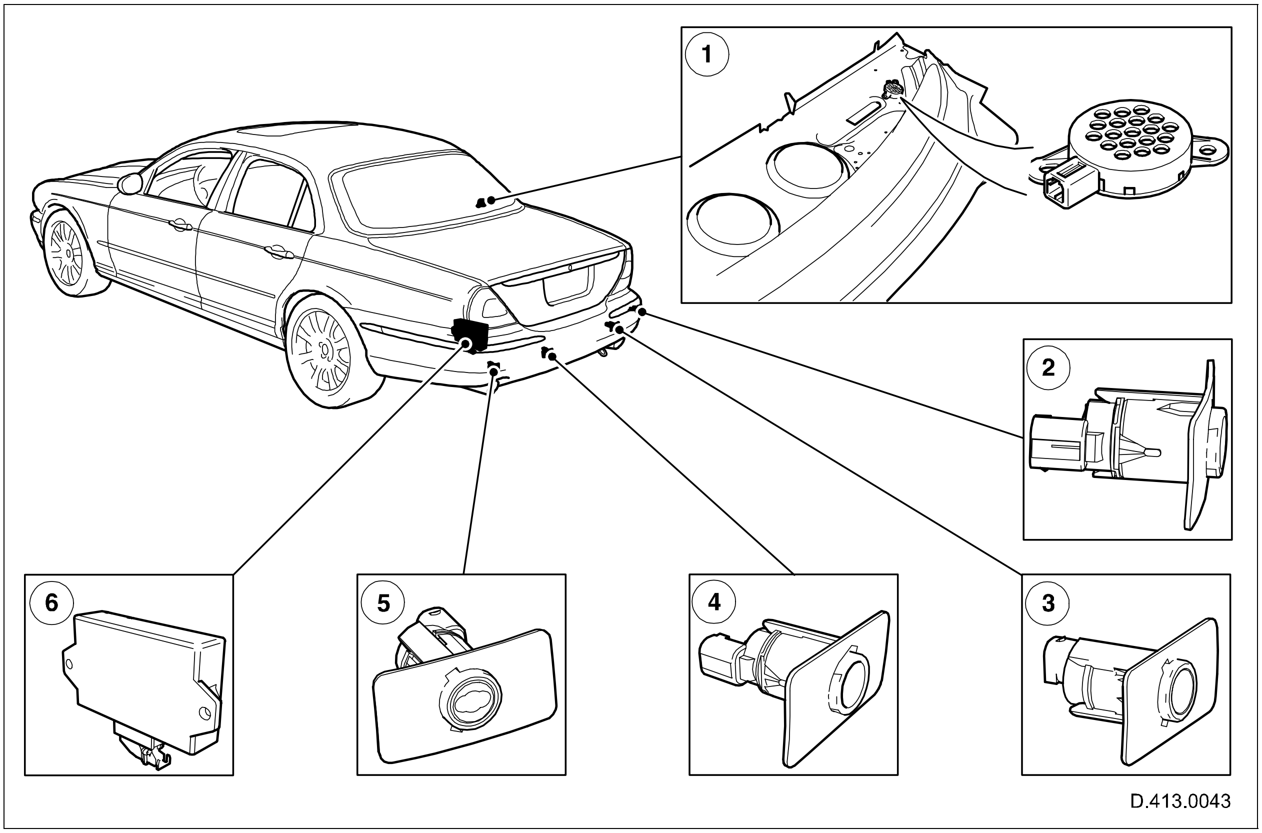


Fig. 113 Reverse Parking Aid System Component Location: X350

1. Speaker
2. Rear parking aid sensor
3. Rear parking aid sensor
4. Rear parking aid sensor
5. Rear parking aid sensor
6. Parking aid module

Diagnostics

When the ignition is turned to position II, the system will carry out a self check. If a fault is detected a fault code will be generated by the control module, a continuous warning tone will be emitted from the speakers for 3.5 seconds and the system will be deactivated.

Workshop diagnostics is carried out using WDS, which will communicate with the control module via the ISO bus through the diagnostic connector.

NOTE:

Refer to the appropriate electrical guide for this system.

REVERSE PARK CONTROL DIAGNOSIS (ALL MODELS)

WDS offers several effective methods for isolating defective non functioning parking sensors.

In addition to using the WDS, there are two non-WDS methods that can be used to diagnose faulty sensors:

Method Number 1

- The Jaguar evaporative emission 'Ultrasonic Leak Detector' can be used to listen for clicking noises that are emitted by each individual sensor when the car is in reverse. This tester is used primarily for diagnosing OBDII related emission leaks, Jaguar part number 134-00056J, K Line Industries manufactures it under part number KL3633. If your shop is equipped with one it can greatly enhance the ability to hear the sensors audibly and determine which ones aren't functioning. The U.L.D. consists of an enhanced listening devise that plugs into a pair of earphones, the end of the detector can be placed on or near the suspected reverse sensor to listen for its operation.

Method Number 2

- Open the trunk of the vehicle so you can hear the warning sounder. With key on engine off place the vehicle in reverse. While standing at the side of the vehicle move your hand downward in an arc fashion over each sensor, listening for the increasing tone density. To check each sensor individually, unplug the ones next to it. In this manner you can check the whole sideways span of the sensor. The same procedure can be used to check the outward sensitivity range, which could indicate a disparity among the sensors tested.

Wipers: X350

Operation is similar to X308, as the wiper inputs are hard-wired directly to the FECM, which drives the wash and wiper relays.

NOTE:

Refer to the appropriate electrical guide for this system.

FRONT SEATS: X350

WARNING:

Prior to seat removal and before disconnecting the seat harness (which includes air-bag connectors), the vehicle battery should be disconnected and a period of at least 120 seconds allowed to elapse. The same amount of care should be taken when handling and storing these seats, as would be taken when handling and storing vehicle air bags in isolation. Refer to JTIS for detailed Removal and Installation instructions.

All front seats are fitted with the following features as standard:

- Integral side air bags.
- Head restraints.
- Safety belt buckle/pretensioner.
- Anti-whiplash mechanism.

Electrically Operated Front Seats: Position

The driver and passenger seats, although almost identical, have some unique components fitted: the driver's seat has a seat-track position sensor and the passenger's seat has a weight-sensing system. In both instances the components form an integral part of the occupant safety system.

NOTE:

Individual components of the passenger seat weight-sensing system, which includes the seat cushion, are not serviceable and must be replaced as a complete cushion-unit; refer to JTIS.

The seat frames are constructed from magnesium alloy and are fitted with the following safety features:

- Integral side air bag
- Safety belt-buckle pre-tensioner
- Anti whiplash system (AWS)
- Weight sensor (Passenger front seat only)
- Seat track position sensor (Driver seat only)

Electrically Operated Front Seats: Heaters

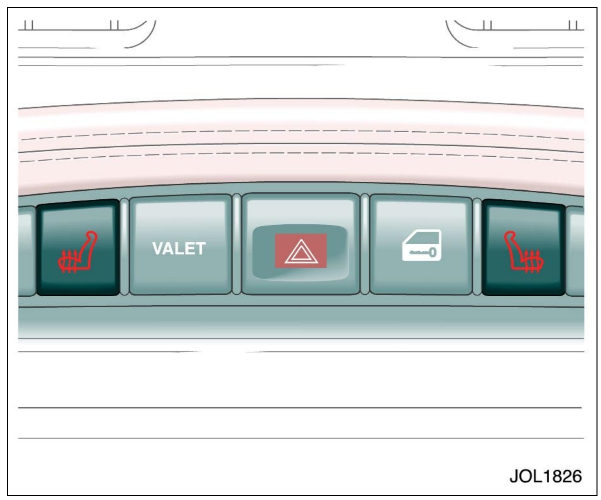


Fig. 114 Front seat heater switches

There are three temperature settings allowing high and a low temperature setting.

- Pressing the switch once activates the high setting and the surface temperature of the seat will be controlled at a temperature of 42°C (107°F).
- A second operation of the switch activates the middle setting and the surface temperature of the seat will be controlled at a temperature of 37°C (98°F).
- A third operation of the switch activates the lowest setting and the surface temperature of the seat will be controlled at a temperature of 35°C (95°F).

NOTE:

Where applicable, the heated steering wheel function is automatically activated concurrent with the driver heated seat switch.

Once activated the seat heaters will continue to operate until:

- The seat heater switch is operated a fourth time
- The ignition switch is no longer in position II
- A malfunction is detected by the appropriate control module

Confirmation that the heated seat function is active is provided by illumination of the appropriate switch.

- Illumination of a single red LED indicates the low temperature setting is active
- Illumination of two red LEDs indicates the medium temperature setting is active
- Illumination of three red LEDs indicates the highest temperature setting is active

The FEM controls the seat heating feature by providing the appropriate response depending on the status of the heated seat switches.

NOTE:

Heated seats are not a dealer fit option.

REAR SEATS: X350 LWB

Electrically Operated Rear Seats

The XJ long wheel base (LWB) is available with an electrically adjustable rear bench seat.

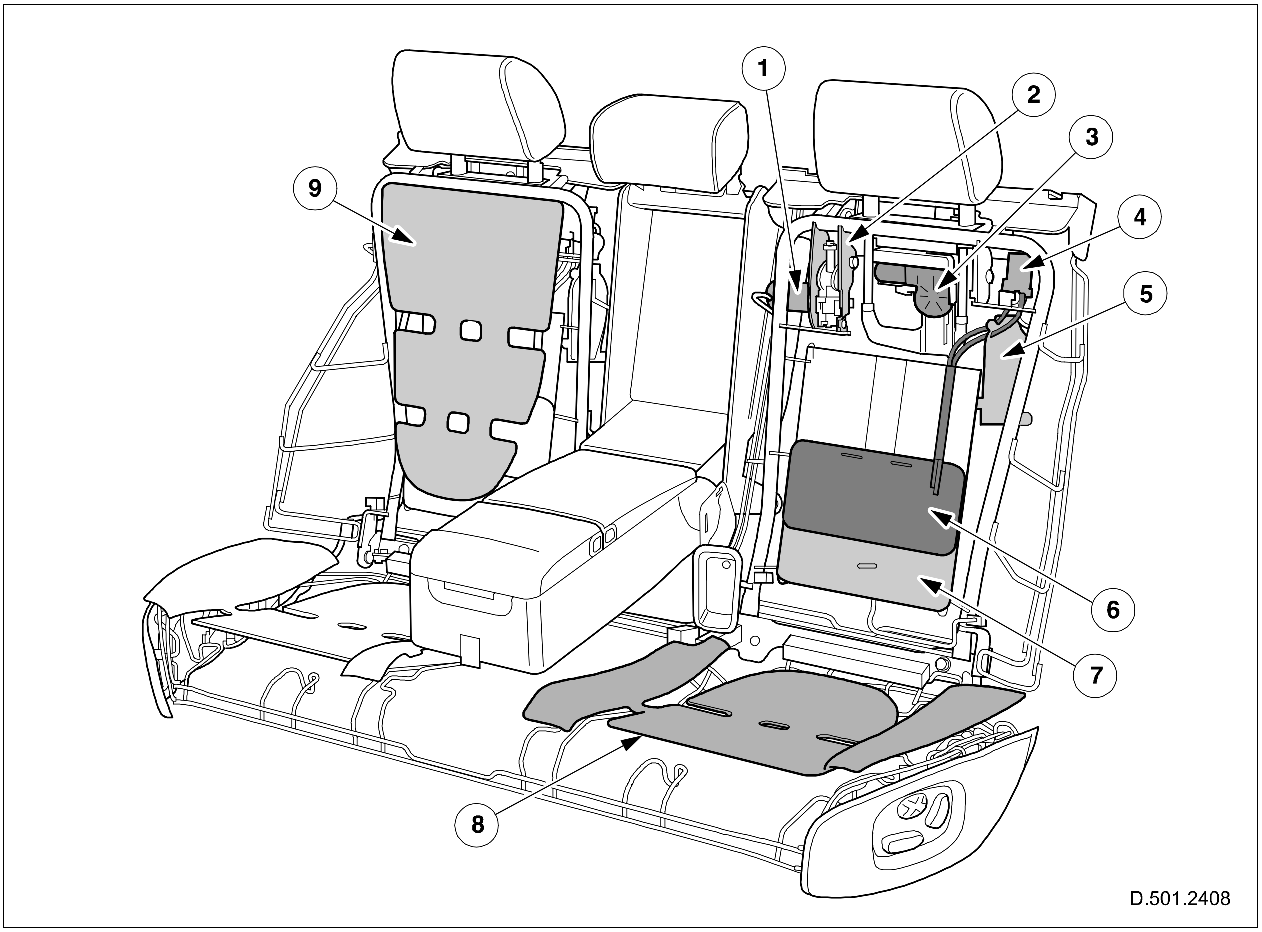


Fig. 115 Electrically adjustable rear bench seat with armrest

1. Recline mechanism motor
2. Recline mechanism
3. Head restraint mechanism
4. Lumbar support solenoid pack
5. Motor driven lumbar support
6. Upper air cell
7. Lower air cell
8. Heater cushion
9. Heater backrest

The electrically adjustable bench seats have:

- Head restraint height adjustment
- Four way lumber adjustment
- Recline function
- Memory function

The rear seat memory function is controlled by the rear memory module located behind the rear seat back rest adjacent to the rear multimedia module.

In addition the following options are available:

- Ski Hatch
- Rear ICE
- Seat heaters

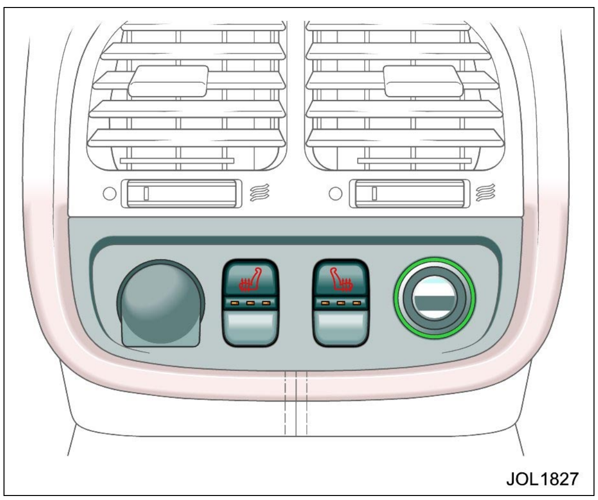


Fig. 116 Rear seat heater switches (if fitted)

Electrically adjustable backrest

The electrically adjustable backrest (when fitted) is occupant controlled from the seat mounted switch. The rear memory module responds to the switch position chosen by providing an output to the motor.

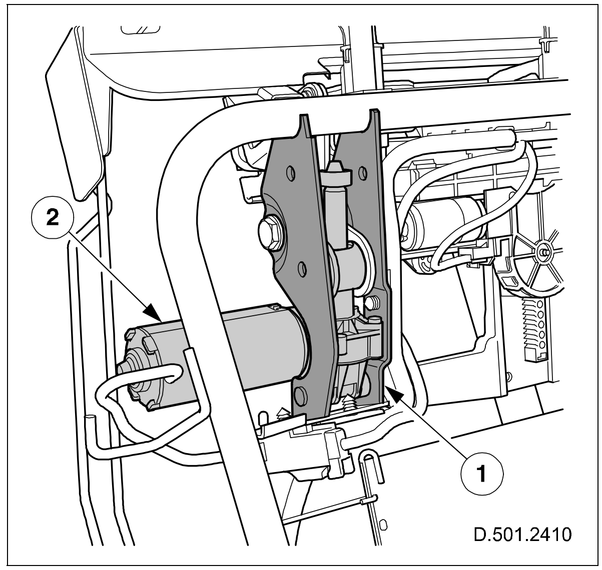


Fig. 117 Electrically adjustable backrest

1. Backrest recline mechanism
2. Backrest recline adjustment motor

Backrest release mechanism

Access for service purposes is achieved by un-latching the backrest using a release strap. This strap is accessible once the seat cushion has been removed.

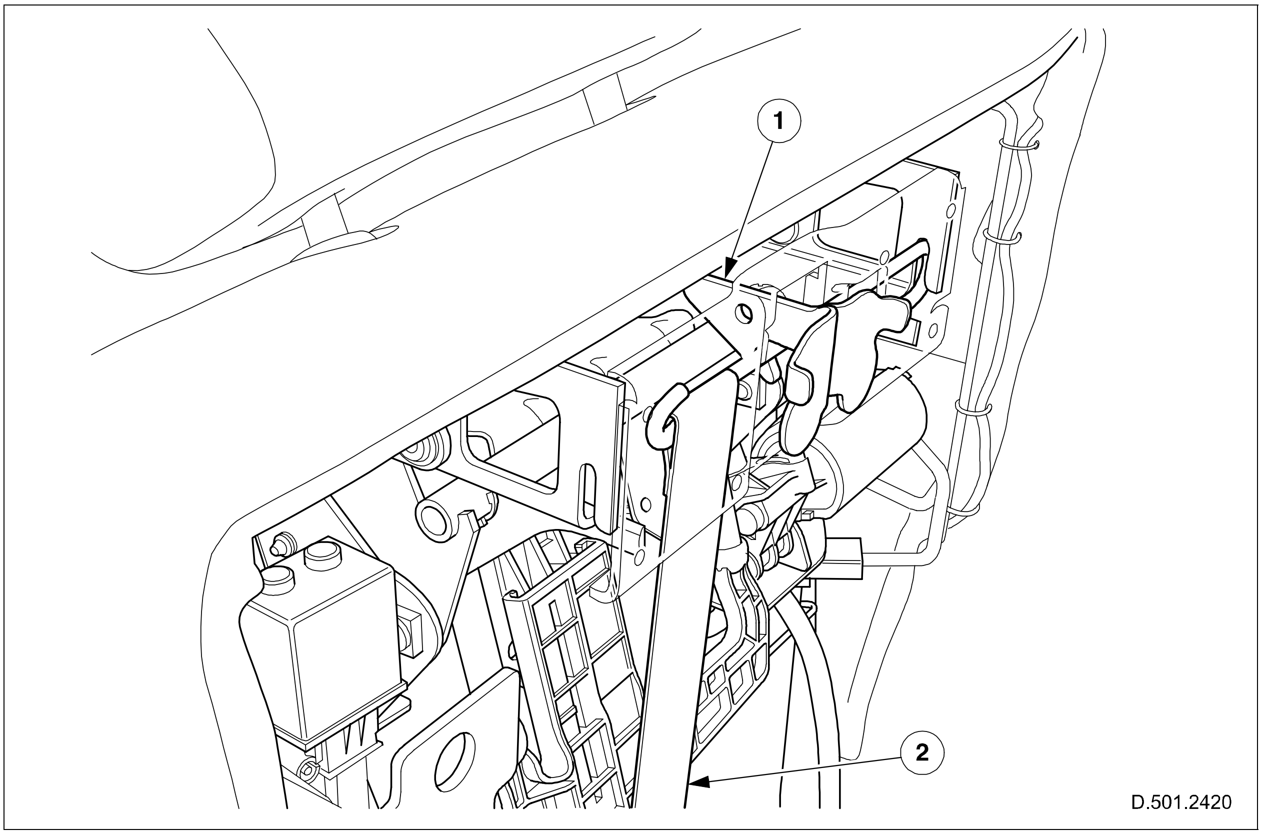


Fig. 118 Backrest release mechanism

1. Latch (secured to body panel)
2. Release strap

STEERING WHEEL: X350

Electrically Heated Steering Wheel

The electrically heated steering wheel (HSW) is available in full wood or half leather.

The heated steering wheel is operated at the same time as the driver's heated seat switch is turned on. The temperature is controlled by a thermostat within the steering wheel, which is set to give a surface temperature of 30°C (86°F).

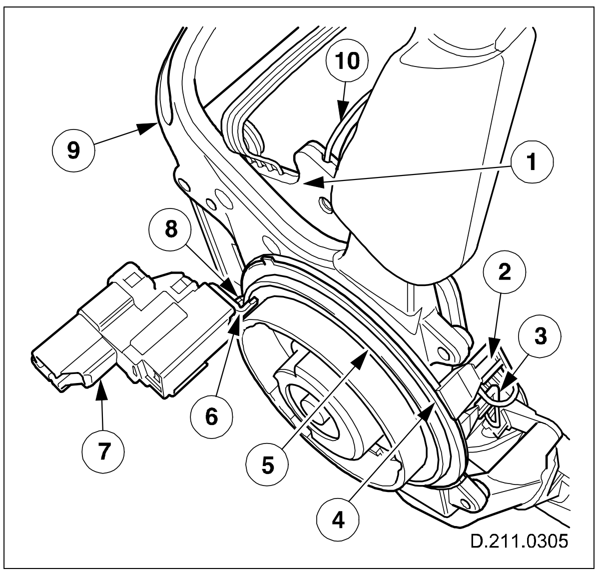


Fig. 119 Heated steering wheel connections

1. HSW electronics
2. Spade connector (positive)
3. Spade connector (negative)
4. Slip ring (positive)
5. Slip ring (negative)
6. Spring contact
7. Power coupling
8. Spring contact (positive)
9. Steering wheel armature
10. To HSW heater element

Power is supplied through two slip rings together with the associated contacts which are fitted to the clockspring cassette.

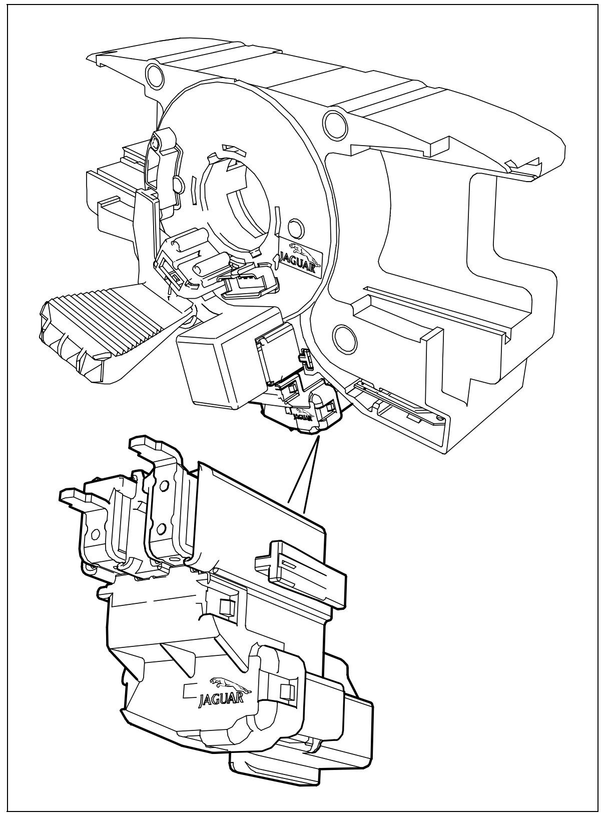


Fig. 120 Clockspring cassette and heated steering wheel contacts

A special grease, Sombin (Ford service part #GRMB 30) is required for lubrication between spring contact and the slip rings. This grease provides the electrical path for the steering wheel heating system. Refer to the appropriate service literature for more information.

PEDAL ADJUSTMENT SYSTEM: X350

The pedal-adjustment system is an optional installation, designed to allow drivers of particular statures to improve their driving-position. The system provides a range of adjustments up to a maximum of 70mm (2.75 in). It can be adjusted with the following restrictions:

- Pedal adjustment can be activated when the ignition key is in any position
- Is inhibited during cruise control operation
- Requires initialization when any component is replaced

The following components create the pedal adjustment system:

- front electronic control module (FECM)
- pedal-adjustment motor
- pedal-adjustment sensor
- pedal-adjustment switch

The front electronic control module (FECM) controls the position of the pedals by providing an electrical output signal to the motor, in response to the:

- current position of the pedal-adjustment position sensor
- pedal position chosen by the driver (using the pedal-adjustment switch)

NOTE:

Using the driver switchpack, two different pedal-position settings may be stored in the vehicle memory-system.

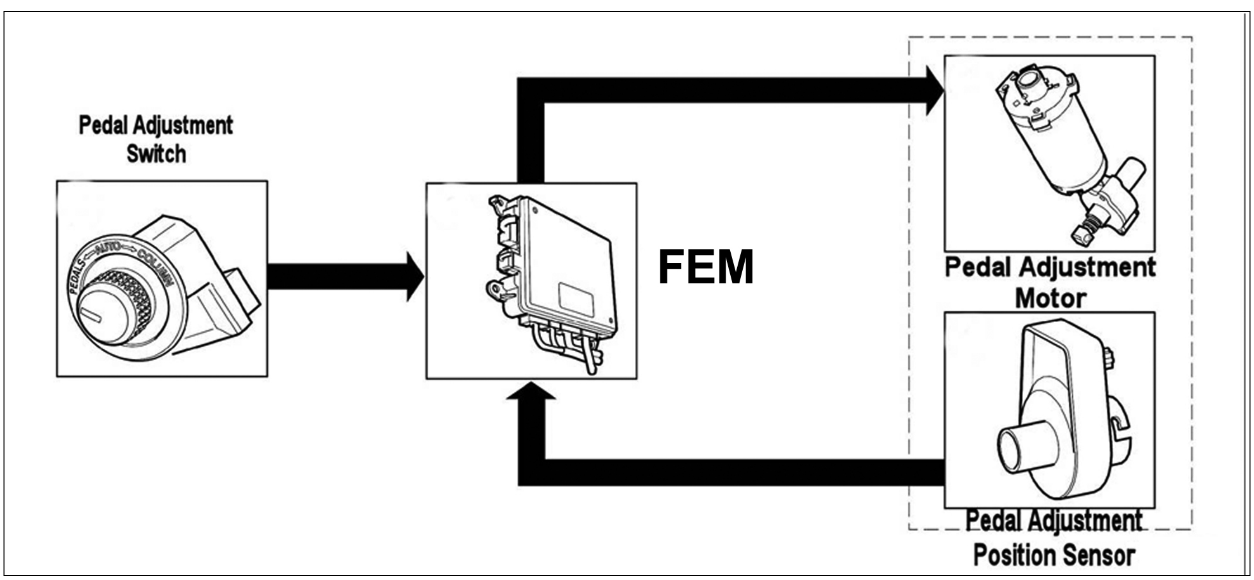


Fig. 121 Adjustable Pedals

MIRRORS: X350

Fig. 122 Rear View Mirror with Compass

- Compass not available with navigation
- New electrochromic type used
- Where electrochromic door mirrors are fitted they are operated in conjunction with the interior mirror by the same buttons and function in the same manner

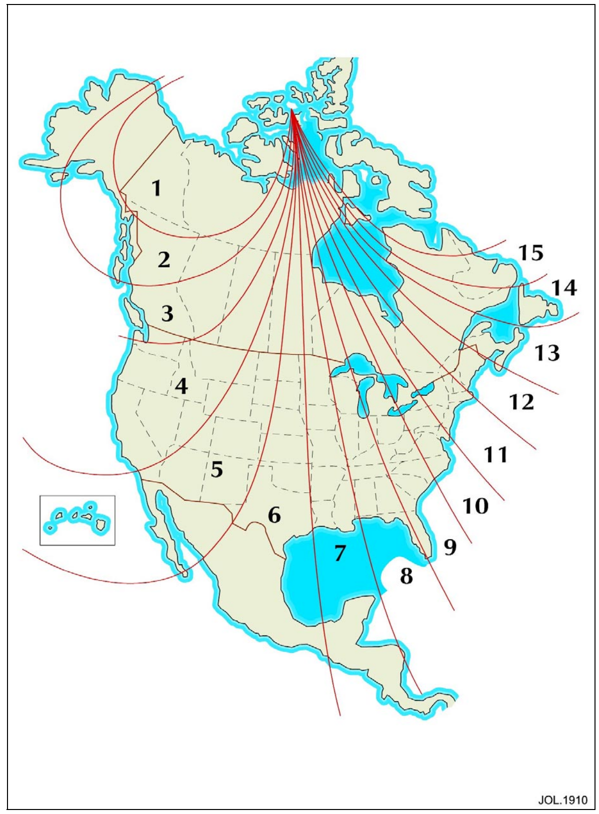


Fig. 123 Compass Zone Map

Zone Setting

If the wrong zone has been entered then the compass may display the wrong compass bearing.

To manually change the area zone:

- Press and hold the "COMP" button for three seconds. The zone number will be displayed in the display window.
- Repeatedly press the "COMP" button until the correct zone number is displayed in the display window (refer to zone map for area number).
- The compass will return to normal compass mode after 10 seconds of no button activity.

Calibration

If "C" is displayed in the compass display window the compass will require calibrating.

The compass re-calibrates itself every 20 minutes in order to remain accurate as the vehicle is travelling. This should reduce the necessity to change the zone setting as the vehicle moves through the zones and also to reduce the possibility of inaccuracy caused by magnetic interference.

The heated front screen is a source of magnetic interference and to reduce the possibility of the compass calibrating itself to this, heated screen operation is timed for four minutes. This ensures that the calibration of the mirror does not coincide with the heated screen operation.

If the mirror calibrates itself to another source other than magnetic north (overhead power lines) and that magnetic source subsequently disappears, the compass will display 'C' in the display window.

To resume normal compass operation the compass must be re–calibrated. This can be done by:

- Continuing to drive the vehicle for a minimum of 20 minutes so that the mirror re–calibrates itself.
- Re entering the correct area Zone into the mirror and following the calibration procedure

Calibration Procedure

Drive the vehicle in a circle below 5 m.p.h. (8 kmh) until the compass displays a compass bearing. The compass should be re–calibrated once the vehicle has completed a full circle.

X350 Side Mirrors: Fold Option

Folding side mirrors are available on the X350 as follows:

- Available as an option
- Auto mirror fold available (can be disabled from the navigation screen menu or WDS)
- Auto fold will not override manual fold activation, but the opposite is true

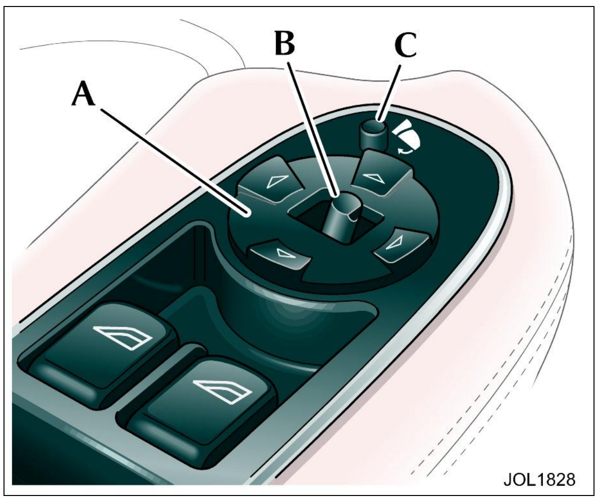


Fig. 124
A. Mirror adjust
B. Mirror select
C. Power fold switch

NOTE:

Refer to the appropriate electrical guide for this system.

X350 Side Mirrors: Reverse 'Dip'

The mirrors on the X350 continue to have the “Reverse Mirror Dip” function as on older models. This strategy is as per the previous XJ model (X308) fitted with this function i.e., the passenger door mirror will 'dip' when reverse gear is selected allowing for better vision when reversing.

The reverse door mirror 'dip' function, was not been enabled during the production process on the early production XJ vehicles (X350). Following customer complaints, this feature was introduced onto the passenger door mirror at VIN G13787.

Upon customer complaint of this feature not working on any vehicle prior to VIN G13787, use WDS to program the reverse dip feature into the passenger door mirror. In addition, this feature at customer request, may also be programmed into the driver's door mirror.

BODY ELECTRICAL SYSTEMS X200 SERIES

Electrical System Architecture

The X200 vehicle electrical system is a supply-side switched system. The ignition switch carries much of the ignition switched power supply load directly. Power supply is provided via three methods: direct battery power supply, ignition switched power supply, and switched system power supply.

The switched system power supply is controlled via the GECM and the RECM from SCP messages. After ignition ON, four relays are activated by either the GECM or the RECM for as long as SCP messages remain on the SCP network. The relays will remain activated after ignition OFF, until all SCP messages are removed.

Engine management and transmission control are combined into a single Powertrain Control Module eliminating the need for a controller area network. The X200 employs an SCP network for all powertrain, chassis and body systems interface/control. An ACP network is employed for audio and communications systems interface/control.

The electrical harness incorporates two hard-wired power distribution fuse boxes: the Front Power Distribution Fuse Box located in the engine compartment and the Rear Power Distribution Fuse Box located in the trunk. A serviceable Primary Junction Fuse Box is located in the front right-hand foot well. All fuses and relays (except the trailer towing accessory kit) are located in the three fuse boxes.

POWER WINDOWS: X200

X200 window lifts feature driver "one-touch" control and rear window isolation (lock out). The window lift circuit combines hardwire control and activation, with SCP network control and hardwire activation. The individual door window lift switches input to their respective control modules, which in turn, activate the window lift motor(s):

- Driver door window switch pack/DDCM/driver door window motor
- Passenger door switch/GECM/passenger door window motor
- LH and RH rear door switches/RECM LH and RH rear door window motors

When controlling windows (other than the driver door) from the driver door switch pack, or using the global close/open central locking function, the DDCM broadcasts SCP Window Open/Close Command to the GECM and the RECM.

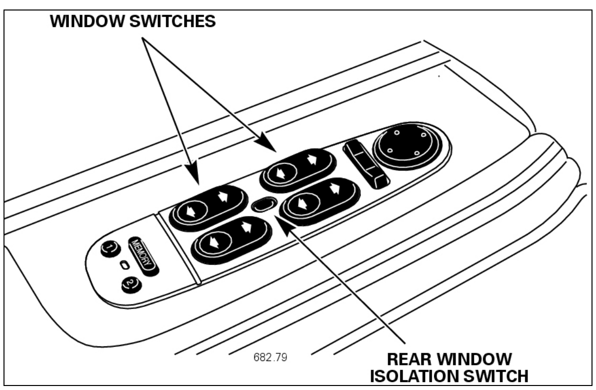


Fig. 125 Driver Door Switch Pack: X200

Driver Door Switch Pack Window Switch Inputs

Window switch signals are provided to the DDCM. All window switch circuits are normally open. When the circuits are completed, B+ is sensed at the control module.

Passenger Window Switch Inputs

Window switch UP/DOWN signals are provided to the GECM. The circuits are normally open. When the circuits are completed, B+ is sensed at the control module.

LH and RH Rear Window Switch Inputs

Window switch UP/DOWN signals are provided to the RECM. The circuits are normally open. When the circuits are completed, B+ is sensed at the control module.

Window Lift Motor Operation — Output

Both B+ and ground are provided by the appropriate control module: DDCM for the driver's door window, GECM for the front passenger window, and RECM for both rear passenger windows.

Sliding Roof

The sliding roof system operates independently from the window lift system, except in the case of global open/close. The sliding roof control module is not part of the SCP network. The RECM signals the sliding roof control module to globally open/close via a hardwired circuit.

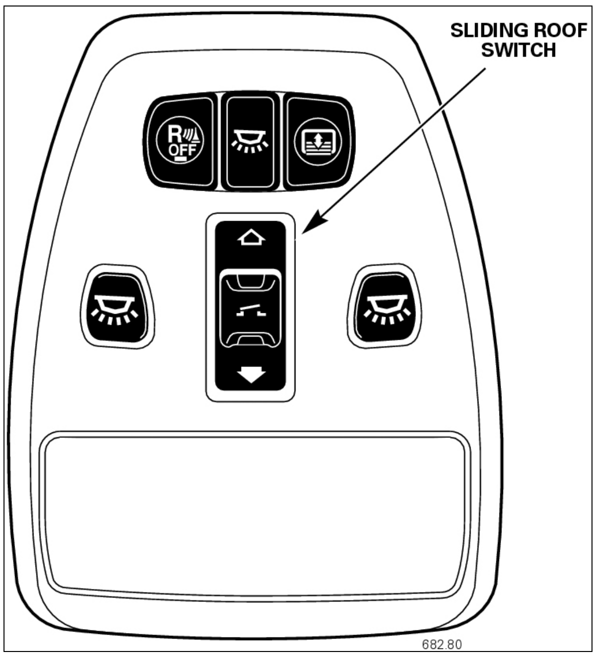


Fig. 126 Roof Console: X200

Global Closing/Opening

- Using the key in the driver's door, lock the vehicle and hold in this position to close all the windows (and sliding roof, if fitted)
- Press and hold the key-ring transmitter unlock button, or use the key to unlock the vehicle and hold in this position to open all the windows (and sliding roof, if fitted).

POWER WINDOWS: X202, X204

Windows and Sunroof

The X202 /X204 power windows provide the following features:

- One touch up/down
- Antitrap sensing and logic
- Thermal overload protections

The X202 power window system uses direct wiring from the switches to each window control module. The power window motor is integral with the control module. The control module monitors an integral hall effect sensor feedback signal to determine when the normal travel of the motor is limited.

When the vehicle power supply is disconnected, the antitrap and one-touch up features will no longer function when the power supply is restored. The initialization procedure must be carried out to restore operation.

Table 33 Global Open / Global Close: X200 Series

	With Key	Functionality With Central Lock	With Remote	Sun Roof
X200	Open/Close	N/A	Open	Open/Close
X202	Open/Close	Open/Close	Open/Close	Open/Close
X204	Open/Close	Open/Close	Open/Close	Open/Close

NOTE:

Refer to the appropriate electrical guide for this system.

INTERIOR LIGHTING: X200

Interior lighting is controlled in multiple ways:

- Manual interior lamp activation
- Automatic interior lamp activation
- Automatic/manual interior lamp activation

Most of these activation modes are controlled by switch inputs to control modules.

Table 34 Interior Lamp Output Control

Lamp	Primary Input	Control Module	Power Supply
Trunk lamps	Trunk switch	REM	Power Relay 4
Glove box lamp	Glove box lamp switch	GEM	Power Relay 3
Sunvisor lamps	Sunvisor lamp switches	GEM	Power Relay 3
Map lamps	Map lamp switches	GEM	Power Relay 3
Courtesy Lamps	Door switches	GEM	Power Relay 3
Fascia Lamps (Footwell)	Door switches	GEM	Power Relay 3
Rear Map Lamps	E post switches	GEM	Power Relay 3

Master Interior Lighting Switch/Instrument Pack

When the master interior light switch, located in the roof console is pressed, the circuit will switch all interior lamps from automatic to ON. When the switch is in the ON position, or if any doors are open, none of the individual interior lamps can be turned OFF. In the automatic position, when the interior lamps have faded off, certain lamps can be switched ON or OFF by pressing the associated individual switch.

The instrument pack outputs SCP message: ALL COURTESY LAMP SWITCH STATUS.

DTC B1246 will be flagged if the switch circuit becomes an open circuit or a short to ground.

Driver and Passenger Door Switches/GECM

The driver and front passenger door switches provide ground inputs to the GECM when the doors are opened. The LH and RH rear door switches and the trunk switch provide ground inputs to the RECM when the doors are opened.

GECM outputs

- SCP — Driver Front Door Ajar Switch Status
- SCP — Passenger Front Door Ajar Switch Status

RECM outputs

- SCP — Driver Rear Door Ajar Switch Status
- SCP — Passenger Rear Door Ajar Switch Status
- SCP — Trunk Lid Door Ajar Switch Status

Switched System Power Supply

All interior lamps are supplied with B+ Voltage from "switched system power supply." This power supply is GECM/RECM controlled as a "battery saver" function. Power is available whenever an SCP network message is present.

For example: Before the ignition is switched ON, when the vehicle is unlocked by the key barrel (SCP message Driver Front Door Lock State Status); after the ignition is switched OFF, SCP messages remain on the network for approximately 40 minutes.

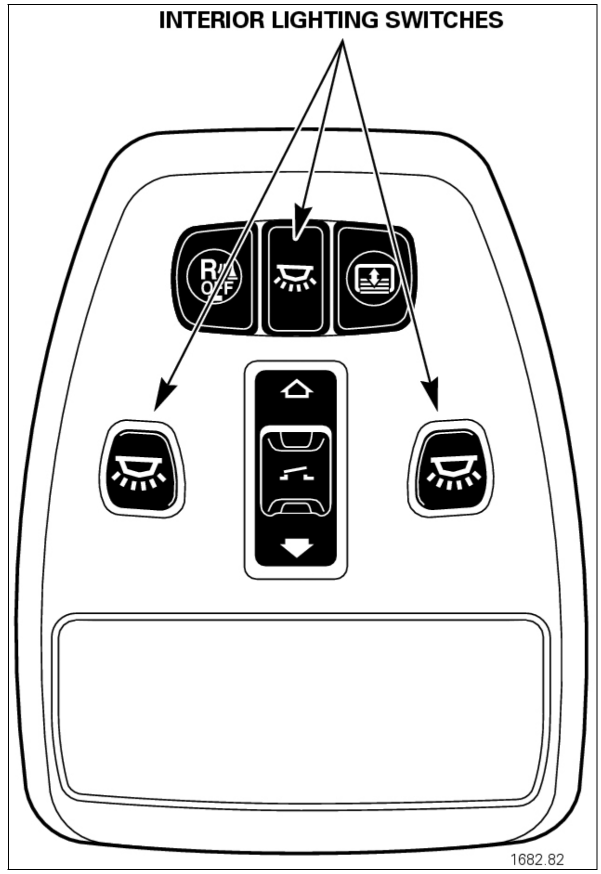


Fig. 127 Interior Lighting: X200

Illuminated Entry/Exit

When the vehicle is unlocked, the fascia courtesy lamps will gradually illuminate, remain on for 20 seconds, and then fade OFF. When the vehicle is locked with the remote or key and the fascia courtesy lamps are ON, they immediately will fade OFF.

Dimmer Controlled Lighting

The instrument pack will illuminate with the lighting switch set to Sidelights ON. Instrument pack decodes the position of the dimmer switch and the lighting switch, and then broadcasts the SCP message: BACKLIGHTING INTENSITY AND DIMMING CURVE WITH HEADLAMPS COMMAND to the following:

- Message Center
- AUDIO (Radio Head Unit)
- A/CCM
- GECM

The message center, radio, and air conditioning control module (climate control panel) illumination are internally switched ON to the correct level when the SCP message is received. Each module converts the SCP message into a PWM drive signal, which is used for vehicle 'locate' illumination (Dimmer Controlled Lighting). The instrument pack illumination "level" is controlled by this input. In the event of a message center warning message being active, the message center display will go to maximum night time brightness. If the dimming level is set to maximum brightness the message center will go into daylight override mode and display everything at full daytime brightness. Also, if the interior lamps master switch (roof console) is switched ON while the message center illumination is dimmed, the display will go to maximum night time brightness.

NOTE:

Refer to the appropriate electrical guide for this system.

Switch Input

The dimmer switch is a variable resistor in the range of 1kΩ to 11kΩ. Both leads connect to the instrument pack in a circuit common with the master interior lighting switch.

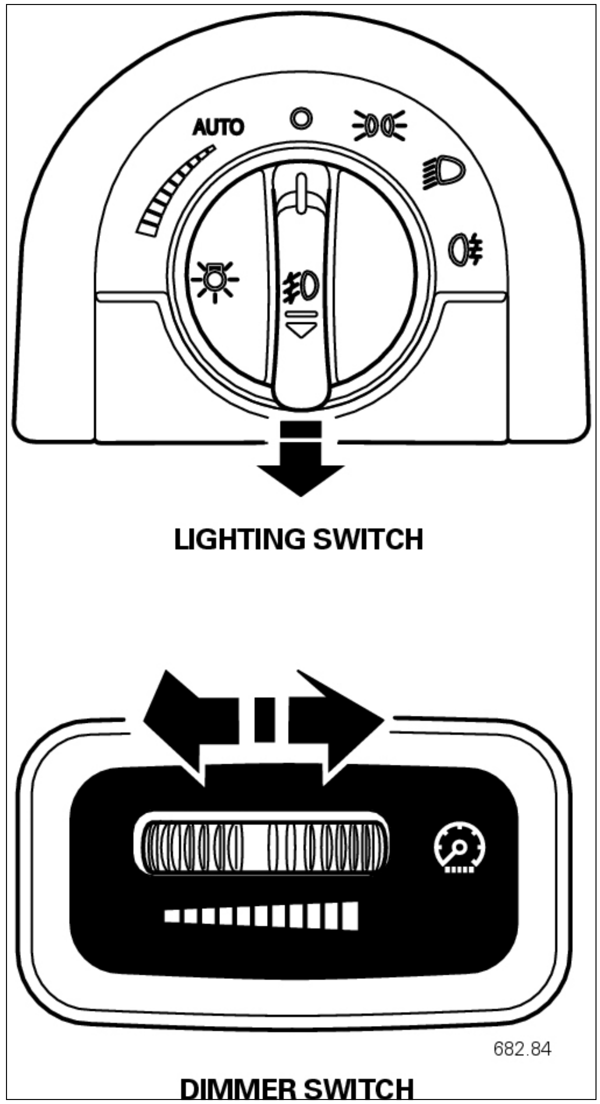


Fig. 128 Lighting and Dimmer Switches: X200

INTERIOR LIGHTING: X202, X204

The interior lighting is common with the X200, but the controlling modules have changed:

Table 35 Interior Lamp Output Control

Lamp	Primary Input	Control Module	Power Supply
Trunk lamps	Trunk switch	REM	Power Relay 4
Glove box lamp	Glove box lamp switch	FECM	Power Relay 3
Sunvisor lamps	Sunvisor lamp switches	FECM	Power Relay 3
Map lamps	Map lamp switches	FECM	Power Relay 3
Courtesy Lamps (Puddle)	Door switches	FECM	Power Relay 3
Fascia Lamps (Footwell)	Door switches	FECM	Power Relay 3
Rear Map Lamps	E post switches	FECM	Power Relay 3

NOTE:

Refer to X202, X204 Electrical Guide for detailed connection information.

Battery Saver

A timer function within the GECM and RECM controls the battery saver feature:

- The timer is initialized when the ignition key is turned to position ‘0' or removed from the ignition barrel.
- After a 40 minute period, the GECM and/or RECM will remove the battery voltage from the interior lighting by deactivating the appropriate relays.

The battery saver feature will be reactivated when:

- The ignition key position is changed.
- Any door (including the luggage compartment door) becomes ajar or is opened.
- An external unlock is activated using either the door lock cylinder or the integrated key transmitter.
- The courtesy lamps' switch is activated.

EXTERIOR LIGHTING: X200

Exterior Lighting Rotary Switch

Exterior lighting is driver controlled by the fascia mounted rotary lighting switch and the steering column left hand stalk switch. The lighting switch has 7 functions:

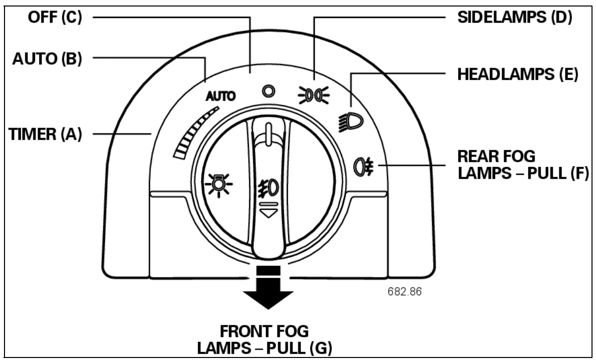


Fig. 129 LIGHTING SWITCH

Off

All exterior lighting OFF (except Canada daytime running lamps)

Autolamps

The autolamp sensor, located on top of the fascia, monitors exterior light levels and automatically switches the side lamps and headlamp dip beams ON or OFF. When light fades to the non-adjustable preset level, the side lamps and headlamps switch ON automatically. As light increases to the preset level, the sidelights and headlamps switch OFF automatically.

Autolamps Delayed Exit

This feature leaves the headlamps turned ON after the ignition has been switched OFF, allowing the driver and passengers increased visibility on leaving the vehicle. The feature is set using the lighting switch to input the desired delay time to the instrument pack. Moving the switch from OFF counterclockwise varies the delay time from 3 seconds up to 3 minutes. After adjustment, the newly set delay time will be displayed on the message center.

Sidelamps

Switches ON: front side marker lamps, tail lamps, license plate lamps. When this position is selected, vehicle “locate” lighting is switched ON.

Headlamps

Switches ON headlamp dipped beams. (Sidelamp function remains ON)

Rear Fog Lamps

Turn the switch to headlamps ON; pull the switch and then turn to position Rear Fog Lamps ON. Turning on the rear fog lamps will also turn on the front fog lamps.

Front Fog Lamps

Pull the switch in positions (A), (B), (D) or (E) to switch ON the front fog lamps. Push to turn OFF. If the rotary switch is turned exterior lamps OFF, the switch will be retracted to its normal position and the fog lamps will be turned OFF.

Daytime Running Lights (Programmable)

Canada daytime running lights (Side lamps and Headlamp dipped beams) are switched ON automatically by the GECM with the following conditions:

- Ignition switch position II
- Lighting switch OFF or Headlamps ON
- Gear selector not in P (automatic transmission)
- Parking brake released

Battery Saver Feature

If the dipped or main beam headlamps are switched ON and the ignition is switched to OFF, the lamps will automatically turn OFF after 10 minutes. The sidelights will remain ON.

Bulb Failure Monitoring

The tail and brake lamp bulbs are monitored for failure and a corresponding message is shown in the message center. For example: LEFT TAIL LAMP FAILED. Additionally, the AMBER secondary warning will be on.

There are two tail lamp bulbs in each tail lamp. The failure message that a tail lamp has failed indicates that both bulbs in that cluster have failed. The message will not be cleared, even after a bulb is replaced, until the next time the bulb is switched on.

Exterior Lighting Control Functions and Diagnostics

All lighting inputs, except the brake switch, are received by the instrument pack from the lighting and column stalk switches, and the autolamp sensor. The instrument pack decodes the state of the hardwired lighting switch and broadcasts SCP messages for exterior lighting activation by the GECM for front exterior lighting, and the RECM for rear exterior lighting.

Exterior Lighting: Front

All circuits, except the fog lamp circuit, are activated by the GECM via direct ground side switching. The front fog lamps are activated via the front fog lamp relay. The GECM completes the relay coil circuit to ground to activate the relay, which switches the supply side of the front fog lamp circuit.

Exterior Lighting: Rear

When the messages are received by the RECM, it activates the specified lighting circuits(s) (except the stop lamp circuits). All circuits are activated by the RECM via direct ground side switching.

EXTERIOR LIGHTING: X202, X204

The X202 had one major changes from the X200 exterior lighting arrangement: the fascia mounted rotary switch was replaced by a left-hand column stalk switch. The X204 added the availability high-intensity discharge headlamps (complete with automatic headlamp leveling).

The exterior lighting is activated by choosing the appropriate option on the main lighting switch assembly (the left-hand column stalk).

Exterior lighting inputs are decoded by the instrument pack and broadcast as SCP messages to the RECM and the GECM. The GECM activates all front exterior lighting circuits.

Main Lighting Switch

The left-hand stalk is a multi-function switch assembly used to activate the following as appropriate:

- Side lamps
- Low-beam headlamp
- High-beam headlamp
- Autolamp
- Turn signal indicator lamps
- Headlamp convenience
- Trip cycle. refer to Odometer, Trip Odometer/Trip Computer.

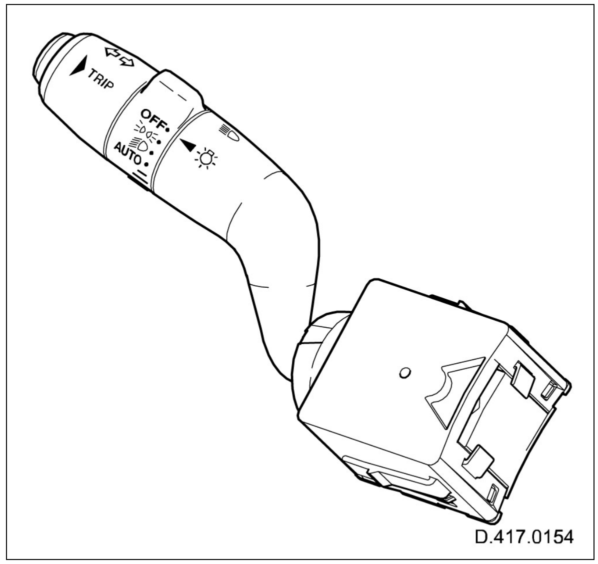


Fig. 130 Main Lighting Switch

Headlamp convenience

The headlamp convenience feature is controlled by the general electronic control module (GECM) and is activated when the headlamp convenience button on the integrated key transmitter is pressed. The main beam will illuminate for (10s, 30s, 2 min) depending on the position of the rotary collar or until the convenience button is pressed again or the ignition key is turned to position 'll'.

NOTE:

The feature does not function when the ignition key has been removed or the rotary collar is set to ‘AUTO'.

Auxiliary Lighting Switch

The auxiliary lighting switch assembly comprises:

- Dimmer control
- Headlamp leveling control (where applicable)
- Trip computer switches
- Front and rear fog switches

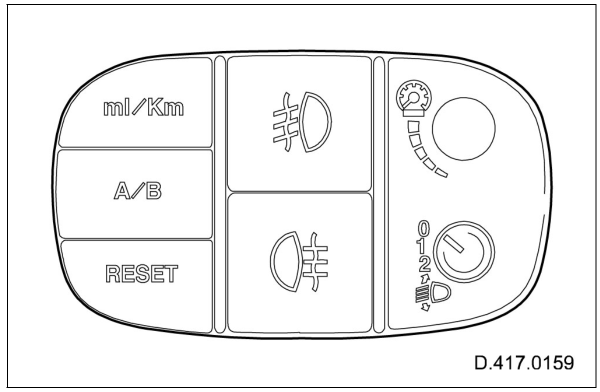


Fig. 131 Auxiliary switch: X202, X204

Autolamp: X202

The operation of the autolamp feature (where applicable) is dependent on ambient light levels, monitored by photo-diodes integrated into the dual sunload-sensor. The sensor provides feedback to the instrument cluster, which responds by supplying control signals on SCP to the GECM and RECM that automatically control the operation of the side lamps and low-beam headlamps where appropriate, providing:

- The ignition key is at position II or III.
- The AUTO option on the main lighting switch is selected.

NOTE:

Since the operation of the lamps depends on the sensor, which is located behind the demist grille of the instrument panel, it is important that the windshield be kept clean and that the sensor is not covered.

The sensor is calibrated to monitor ambient light levels as follows:

- Detection of semi-darkness for 15 continuous seconds will cause the low beam and side lamps to be activated.
- Detection of darkness for 2 seconds continuously will cause the low beam and side lamps to be activated.
- Detection of daylight for 15 seconds continuously will cause the exterior lighting to be extinguished.

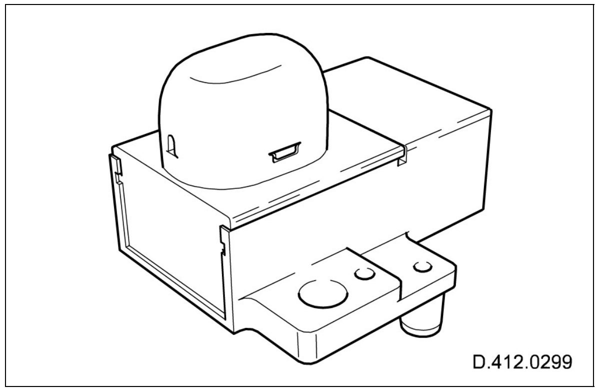


Fig. 132 Autolamp Sensor

Autolamp Mode: X202

Starting with the X202, the autolamp had additional functionality. If the windscreen wipers are switched on in slow or fast modes for more than 20 seconds then the exterior lights will be switched on, if selected to Autolamp mode.

High Intensity Discharge (HID) Headlights: X204

The high-intensity discharge headlamp assembly comprises:

- Low beam lamp (Xenon)
- High beam lamp (halogen)
- Side lamp
- Turn signal lamp
- Xenon lamp control module
- Ignitor
- Headlamp leveling motor

NOTE:

After approximately 5 minutes a noticeable fall in light output may be observed. The effect is due to an alternator voltage boost feature at startup that has timed out.

Vehicles fitted with the high-intensity discharge lighting system use xenon lamps for the low beam instead of standard halogen lamps.

- The functionality of the low beam remains unchanged.
- The high beam, turn signal and side lamps are all conventional lamps.

NOTE:

Due to the ‘warm-up time' experienced with xenon lamps, the low beam lamp is not used for the headlamp flash feature; the high beam is used instead.

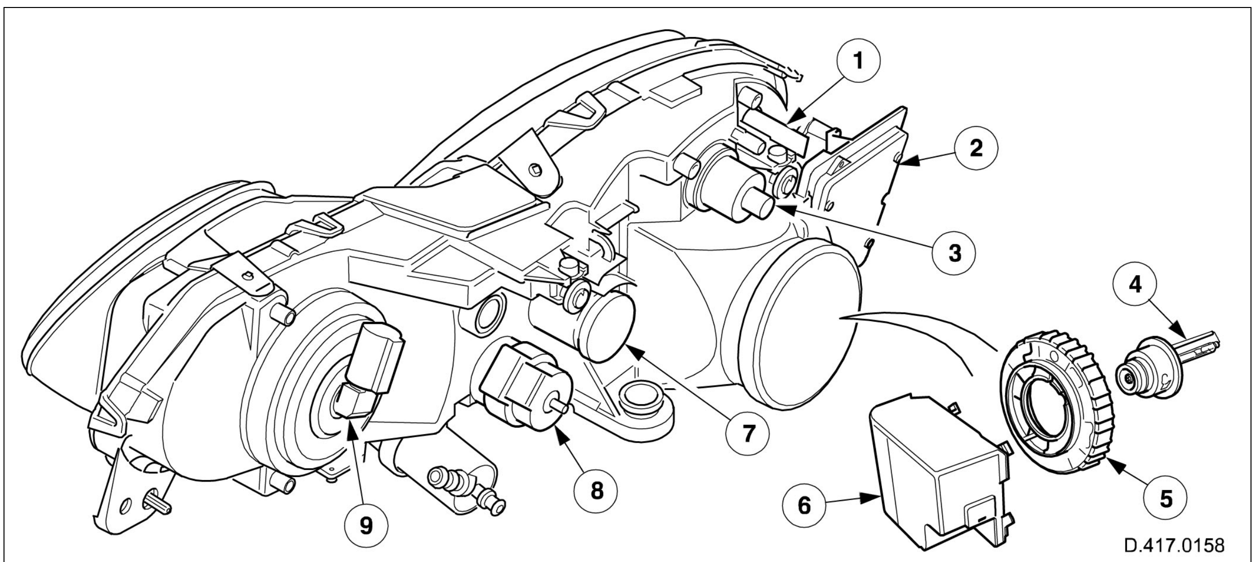


Fig. 133 High-Intensity Discharge Lamp Assembly: X204

1. Side lamp
2. Xenon lamp control module
3. Turn signal lamp
4. Low beam lamp
5. Clamping ring
6. Ignitor
7. Access cover (beam-position lever)
8. Motor (automatic headlamp leveling)
9. High beam lamp

Xenon Lamp Control Module

The module is a complex piece of electronics that in addition to regulating start-up and stabilizing output, provides circuit protection by recognizing malfunction conditions such as:

- Power supply deviations
- Absence of light source
- Short circuits

NOTE:

The high-voltage stage will be deactivated unless all system components are functional and correctly connected.

Headlamp Beam Position

A lever-operated shutter has been incorporated into the headlamp assembly to permit simple switching of the headlamp beam position to meet foreign driving regulations. The lever is located behind the access cover.

NOTE:

Refer to the appropriate electrical guide for this system.

Automatic Headlamp Leveling

Due to national legislation, vehicles equipped with xenon lamps require the installation of Automatic Headlamp Leveling and a Headlamp Cleaning System.

The headlamp leveling system comprises:

- Front-axle level sensor assembly
- Rear-axle level sensor assembly
- Headlamp leveling module
- Left-hand headlamp leveling motor
- Right-hand headlamp leveling motor

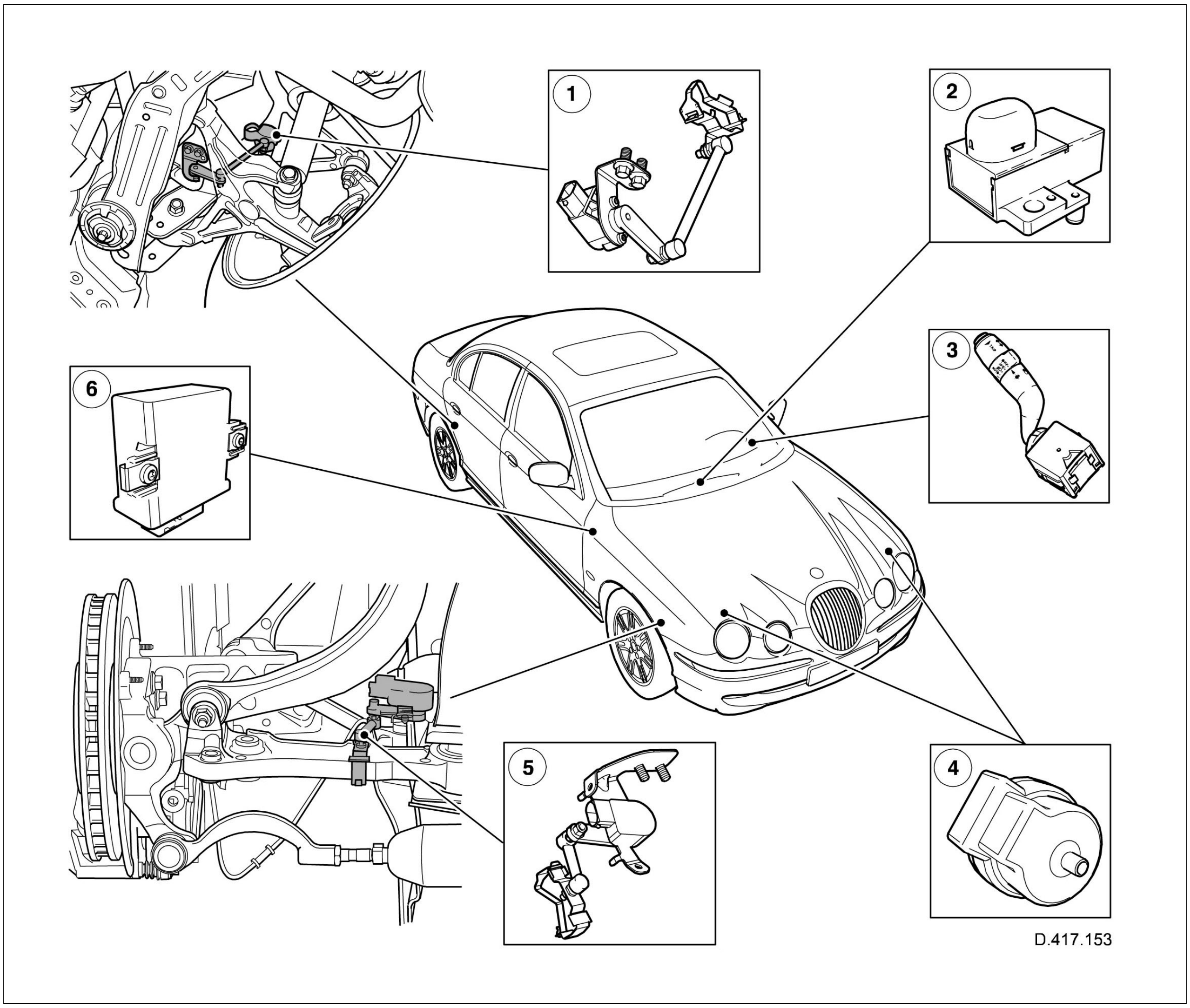


Fig. 134 Headlamp Leveling Features: X202, X204

1. Rear axle level sensor assembly
2. Autolamp sensor
3. Main lighting switch
4. Motor (automatic headlamp leveling)
5. Front-axle level sensor assembly
6. Headlamp leveling control module

Automatic headlamp leveling is operational when the main lighting switch is set to the headlamp, rear fog lamp or autolamp position and the ignition key is at position II.

The headlamp leveling module is located at the right-hand side A-post, above the primary junction box. The axle level-sensors are inductive devices that respond to the vertical position of the vehicle and supply feedback signals to the module. The module processes the data and supplies appropriate signals to the headlamp leveling motors causing the position of the headlamps to be adjusted accordingly; refer to X202 Electrical Guide for detailed information.

NOTE:

After disconnecting any element of the automatic headlamp leveling system, recalibration will be necessary using WDS.

Diagnostics

System malfunctions will cause a DTC to be stored in the ECM. Retrieval of the DTC and subsequent diagnosis of the system should be undertaken using WDS.

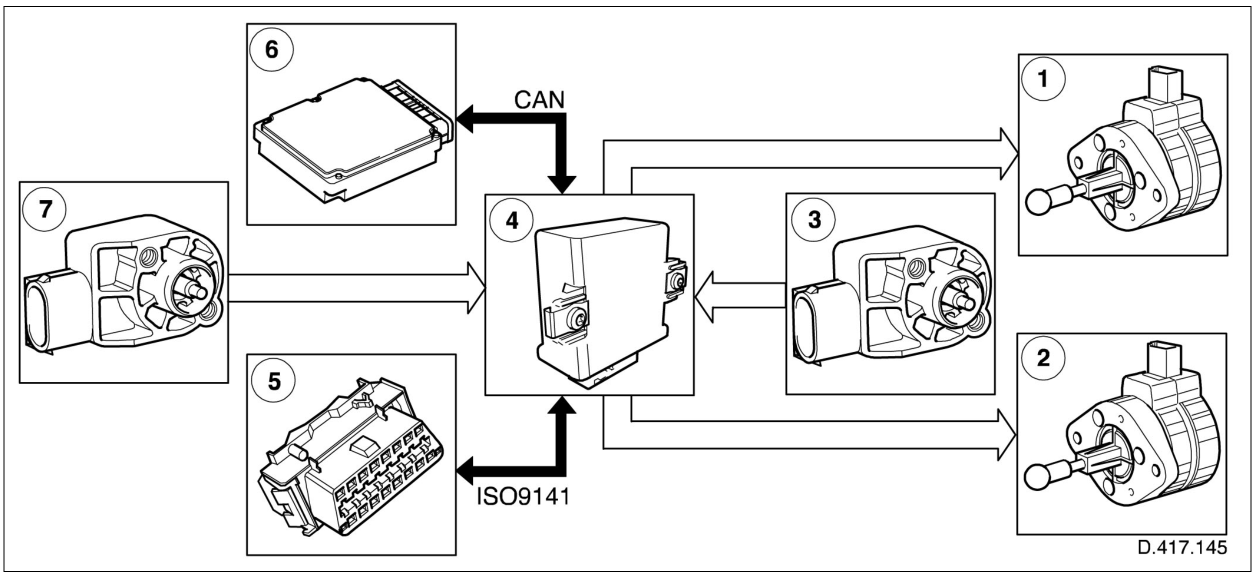


Fig. 135 Automatic Headlamp Leveling System

1. Left-hand headlamp leveling motor
2. Right-hand headlamp leveling motor
3. Front-axle level sensor
4. Headlamp leveling module
5. Diagnostic connector
6. Engine control module
7. Rear-axle level sensor

NOTE:

Refer to the appropriate electrical guide for this system.

REVERSE PARKING AID SYSTEM: X200, X202

X200 and X202 models can be equipped with a Reverse Parking Aid System.

The reverse parking aid system operates through four ultrasonic sensors, located in the rear bumper, that transmit scanning beams covering the area behind the vehicle. These beams are reflected by obstructions behind the vehicle and reflected back to the sensors. The sensors provide input signals to the Parking Aid Control Module (PACM), which processes the signals to calculate the distance to the obstruction.

The sounder is then progressively activated by the PACM to gives an appropriate warning signal starting from an intermittent beep at approximately 0.8 meter (32 inches) up to a continuous STOP tone at approximately 0.2 meter (8 inches).

Reverse parking aid is enabled when the reverse lamps are activated by the RECM via a hardwired parallel circuit. The system can be switched OFF by pressing the switch in the roof console. The indicator in the switch illuminates when the system is switched OFF. The system is reset to ON each time the ignition is cycled.

If a system fault occurs, the switch indicator lamp will be continuously illuminated. Faults are flagged in the PACM as DTCs (B and C Codes) and can be retrieved using WDS.

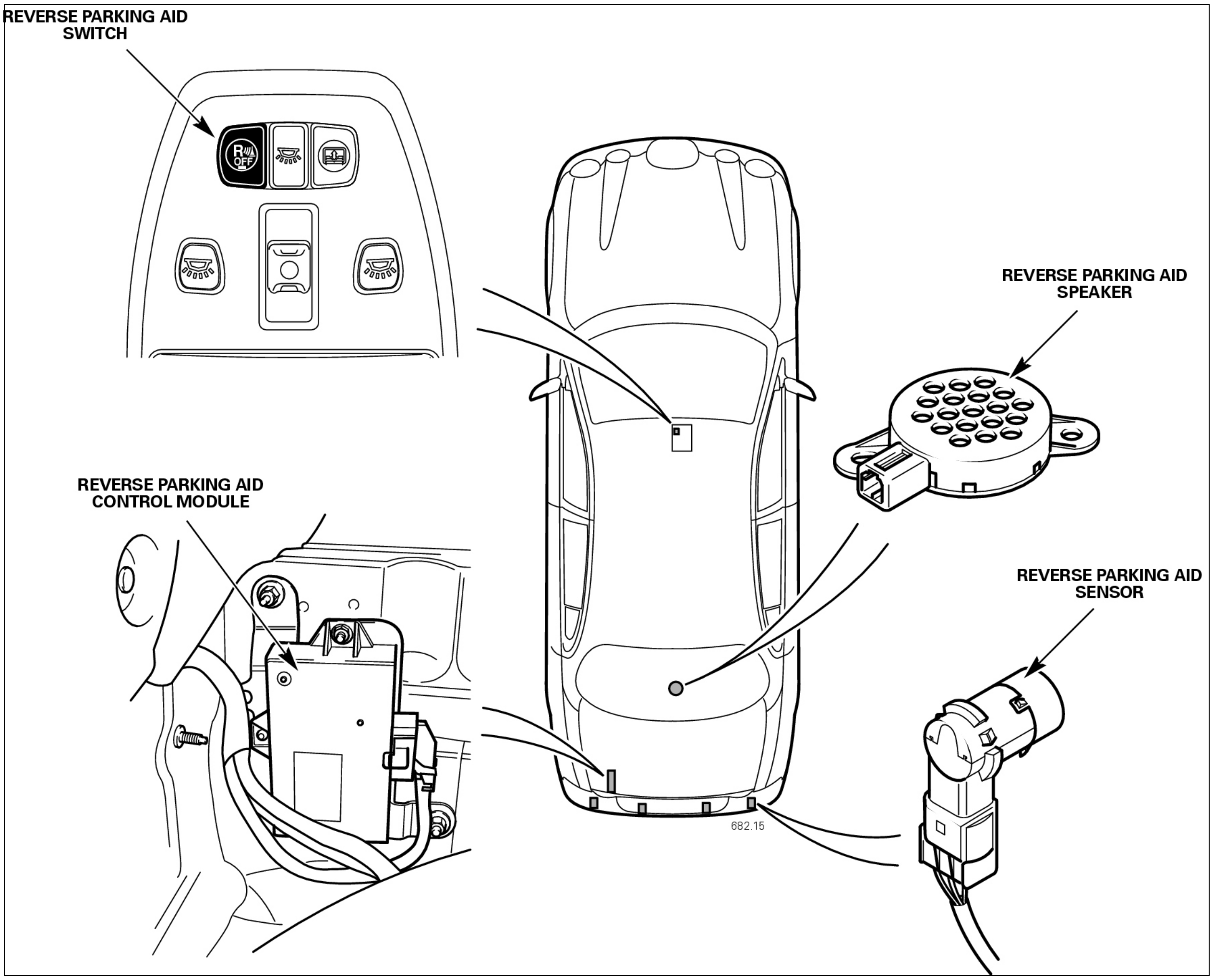


Fig. 136   Reverse Parking Aid Components: X200

NOTE:

Refer to the appropriate electrical guide for this system.

WIPERS: X200

Wash/Wipe System

The wash/wipe system is entirely hardwire controlled and activated. All of the driver controlled inputs are to the GECM from the column stalk switch. The GECM directly activates the wash/wipe components.

Wash/wipe switch inputs

The switch input signals are provided on two circuits and referenced to a common reference circuit. All switch position signals (except WASH) are resistance signals made up from the combination of modes and delay settings. The WASH circuit is normally open, and completed when WASH is selected.

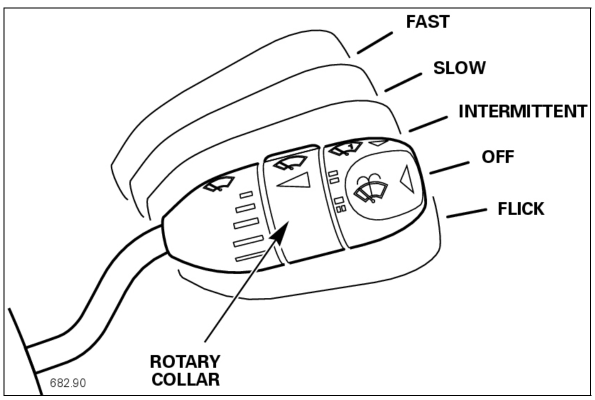


Fig. 137 Wash/Wipe Switch

Intermittent Wipe

Intermittent wipe will normally vary the wiper time delay from approximately 3 to 18 seconds. As the vehicle speed increases, the wipers will operate faster.

Rain Sensing (Optional)

The rain sensing module, located in front of the interior rear view mirror, has a 3-wire circuit in parallel with the column stalk switch circuit. If AUTO and INTERMITTENT are selected on the column stalk switch, the module will activate the windshield wipers when rain falls on the windshield.

FRONT SEATS: X200

Seat Heaters

Seat heaters are powered and controlled via separate circuits incorporating: a seat heater switch with “state” illumination, seat heater control module, and seat heater elements.

Seat Movement

Seat positions are adjusted from the individual seat switch packs. Non memory seats are controlled directly from the B+ and ground drive signals provided from the seat switch packs. The driver memory seat is controlled via the driver seat control module (DSCM). The switch packs and outputs are identical for both the driver and passenger non memory seats and the driver memory seat. The seat position motors are identical for both non memory and memory, except that memory motors have position feedback potentiometer circuits.

Inputs and Outputs (memory seat)

The seat switch pack switches input to the DSCM. The signals are either B+ or ground, depending on the request being made. The DSCM decodes the inputs and then drives the seat motors to achieve the desired positions. Seat movement motors are driven by the DSCM by applying B+ ground to the pairs of seat motor circuits. The motor position feedback potentiometer inputs allow the DSCM to know the seat adjustment positions by measuring the voltage ratios.

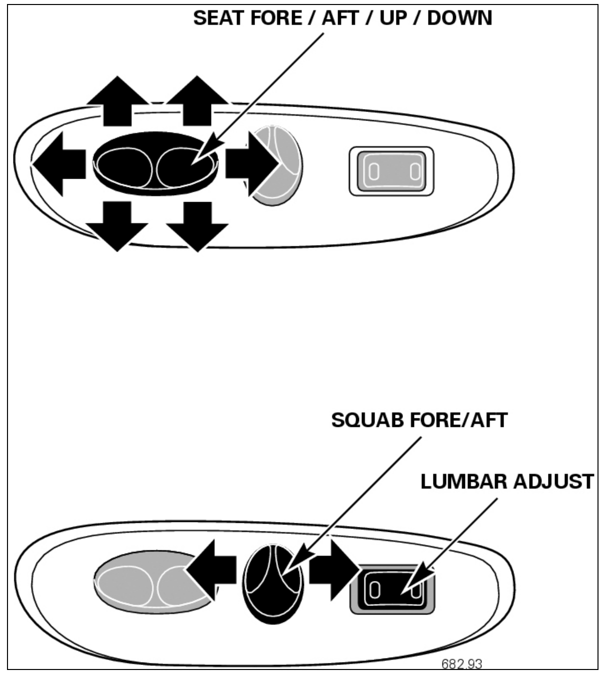


Fig. 138 Seat Switches

FRONT SEATS: X202, X204

WARNING:

Prior to seat removal and before disconnecting the seat harness (which includes air-bag connectors), the vehicle battery should be disconnected and a period of at least 120 seconds allowed to elapse. The same amount of care should be taken when handling and storing these seats, as would be taken when handling and storing vehicle air bags in isolation. Refer to JTIS for detailed Removal and Installation instructions.

All front seats are fitted with the following features as standard:

- Integral side air bags.
- Head restraints.
- Safety belt buckle/pretensioner.
- Anti-whiplash mechanism.

The driver and passenger seats, although almost identical, have some unique components fitted: the driver's seat has a seat-track position sensor and the passenger's seat has a weight-sensing system. In both instances the components form an integral part of the occupant safety system.

NOTE:

Individual components of the passenger seat weight-sensing system, which includes the seat cushion, are not serviceable and must be replaced as a complete cushion-unit; refer to JTIS.

Power Front Seats

The front seats are 8–way electrically adjustable and can be fitted with heated cushions, heated backrests and an electrically adjustable lumbar support where specified. In addition to the standard features, depending upon the market and vehicle specification, the following options may be available as a 16–way upgrade package:

- Electrically adjustable head restraint
- Electrically extendible seat cushion
- Four-position lumbar support

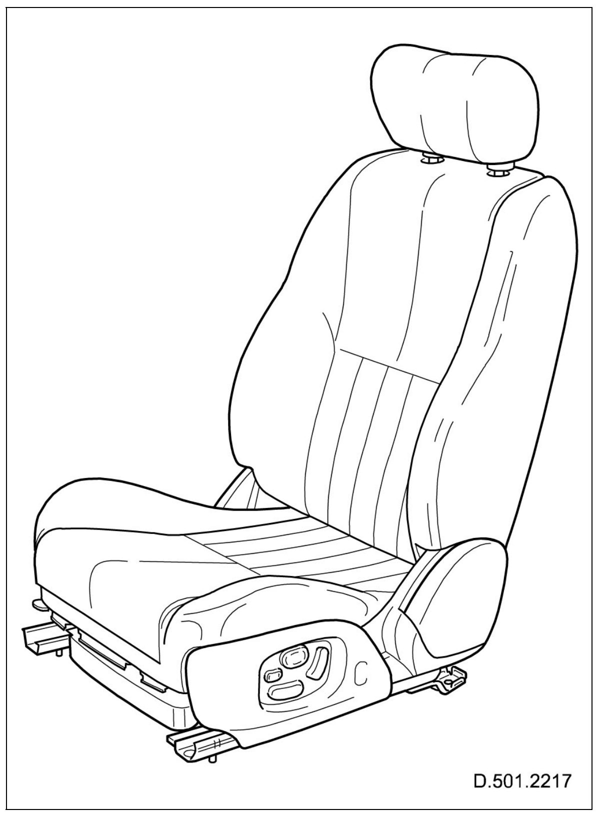


Fig. 139 Power Front Seat (LHD)

Driver seat control module

The driver seat control module (DSCM) is located under the driver seat. In addition to supporting current seat functionality and controlling seat position for personality configurations 1 and 2, the DSCM supports (where applicable) the extra functionality required for the electrically-operated head restraint and the extendible seat-cushion; refer to X202 Electrical Guide for detailed connection information.

NOTE:

Lumbar positions cannot be saved using the memory feature.

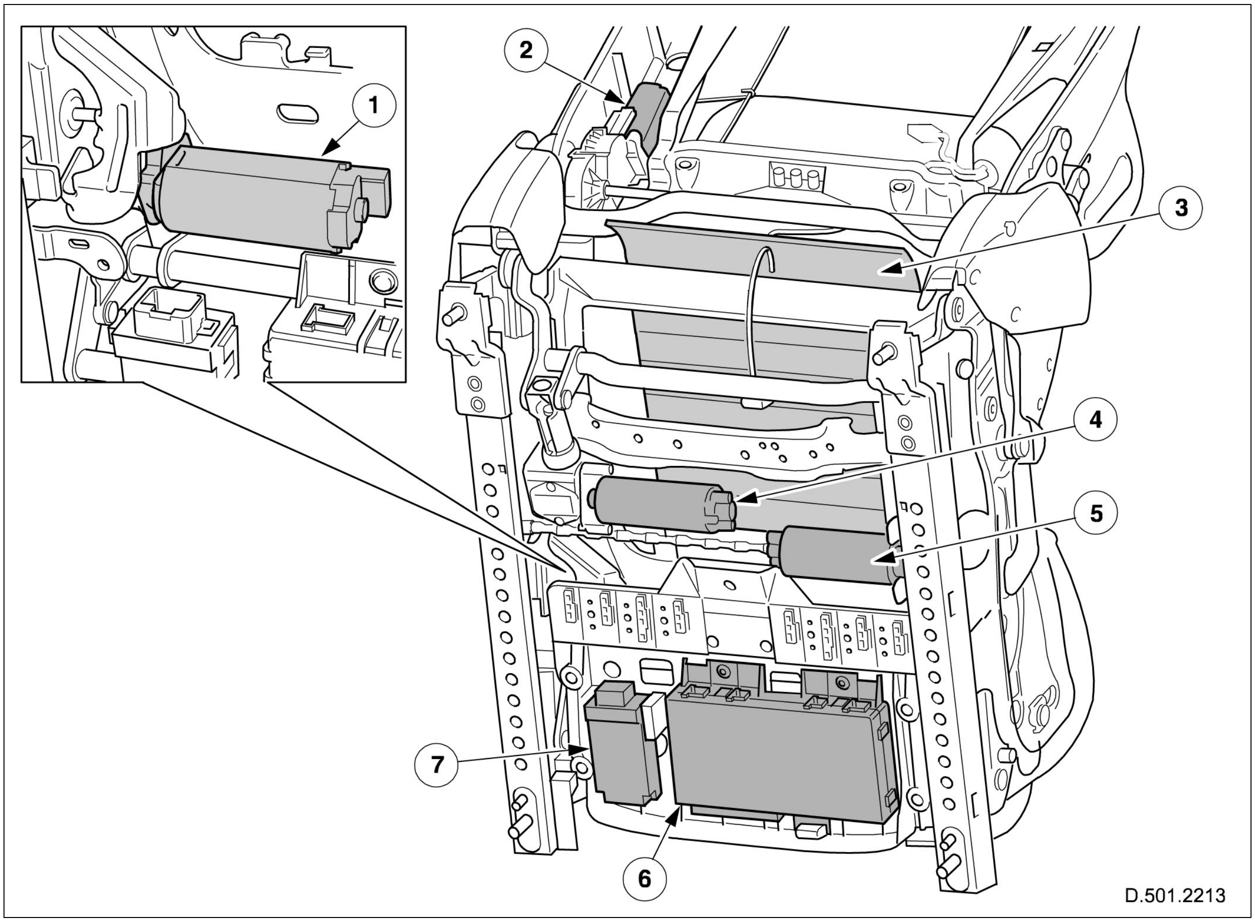


Fig. 140 Driver Power Seat Component Locations: X202

1. Rake adjustment motor (front)
2. Recline adjustment motor
3. Seat cushion heater
4. Height-adjustment motor
5. Fore/aft adjustment motor
6. Driver seat control module
7. Heated seat module

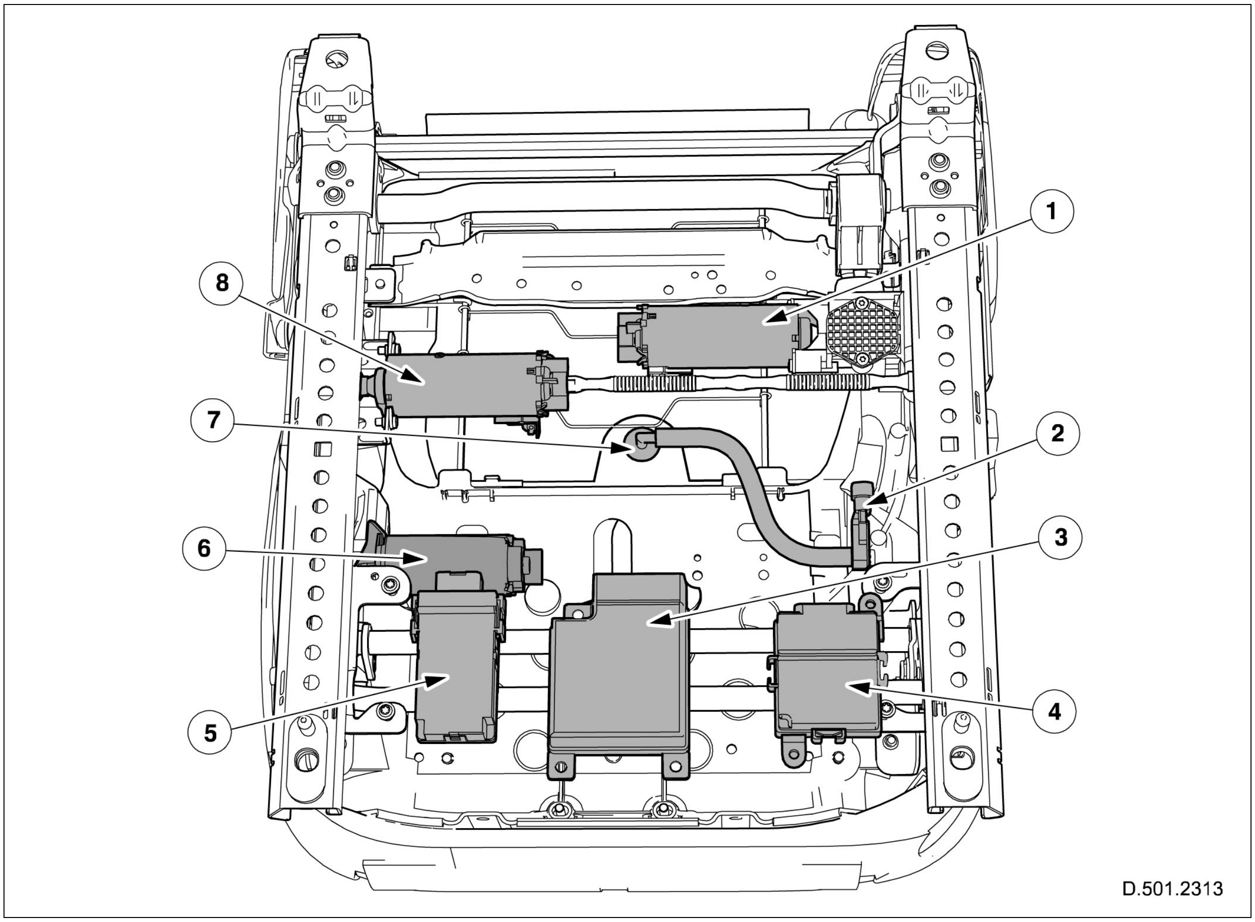


Fig. 141 Passenger Power Seat Component Locations (mounting tray removed): X202

1. Height-adjustment motor
2. Pressure sensor
3. Occupancy sensing module
4. Seat weight-sensing module
5. Heated seat module
6. Rake adjustment motor (front)
7. Silicon bladder connector and pipe
8. Fore/aft adjustment motor

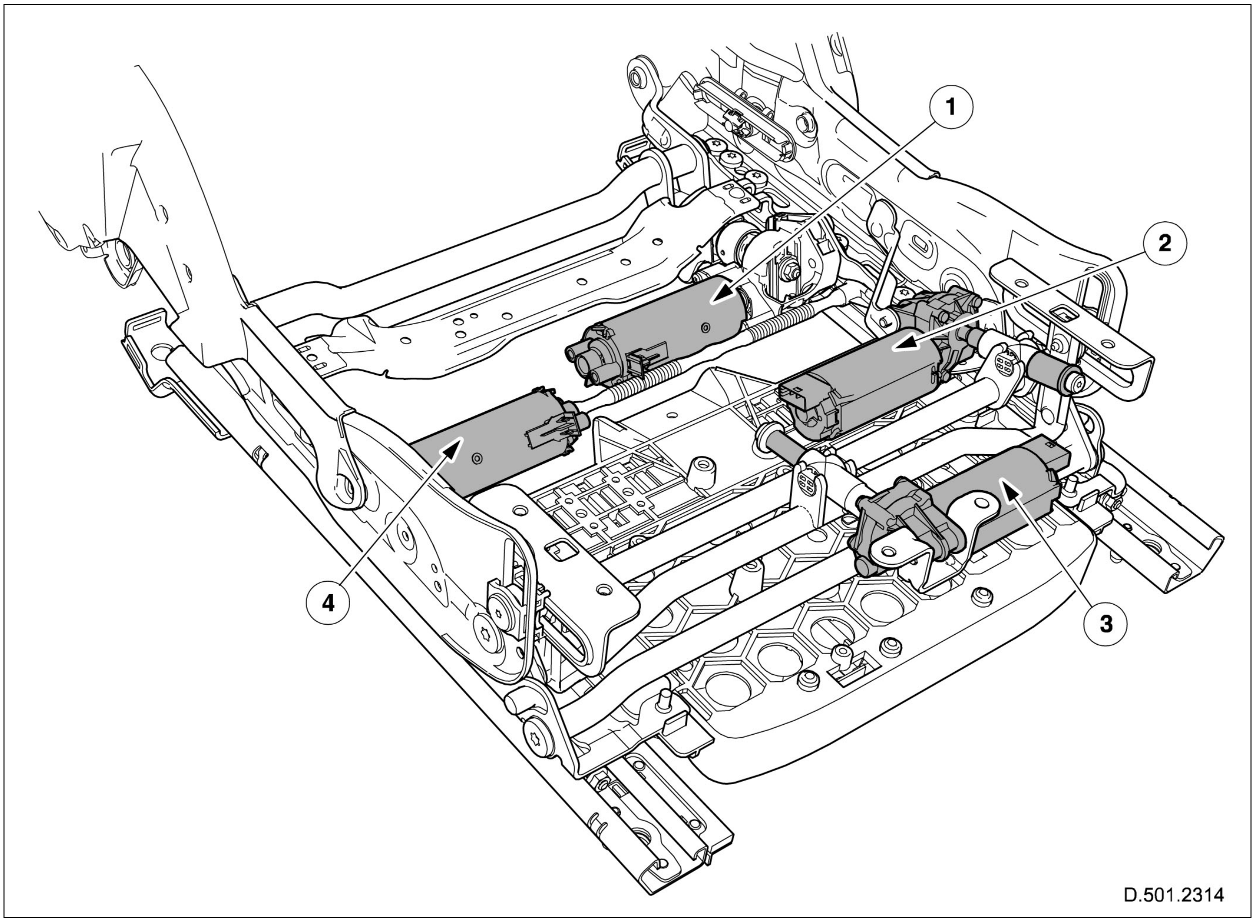


Fig. 142 Power Seat With Extensible Cushion: X202

1. Height-adjustment motor
2. Rake adjustment motor (front)
3. Cushion-extend motor
4. Fore/aft adjustment motor

Electrically-operated head restraint

The electrically-operated head restraint (where applicable) is occupant-controlled from the seat-mounted switch. The driver seat control module (DSCM) responds to the switch position chosen, by providing an output to the respective drive motor; refer to X202 Electrical Guide for detailed connection information.

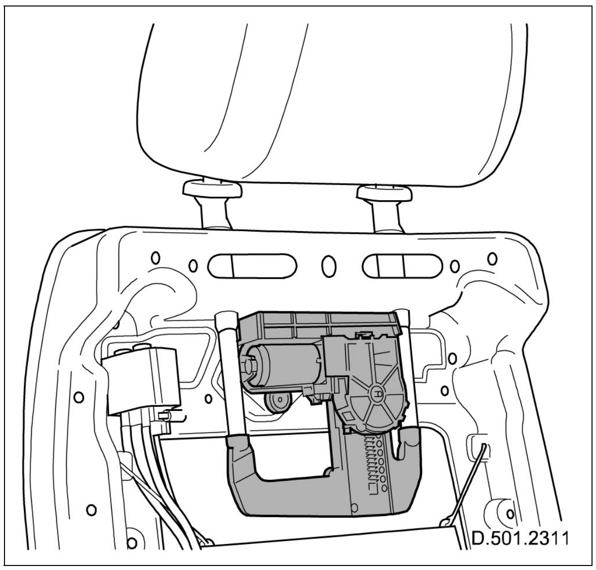


Fig. 143 Electrically operated head restraint: X202

Power lumbar

The 4-position version of the power lumbar (where installed) comprises a single motor-driven pump, which inflates or deflates air cells as required to provide upper and lower lumbar support. The degree of support is determined by the operation of the seat-mounted switch.

Depending on the switch-direction chosen, one of four solenoids housed within the solenoid pack is connected to the pump, which provides lumbar support by adjusting the amount of air in the appropriate cell. Vehicles fitted with the basic power-lumbar, utilize the lower air-cell only and do not need the solenoid pack; refer to X202 Electrical Guide for detailed connection information.

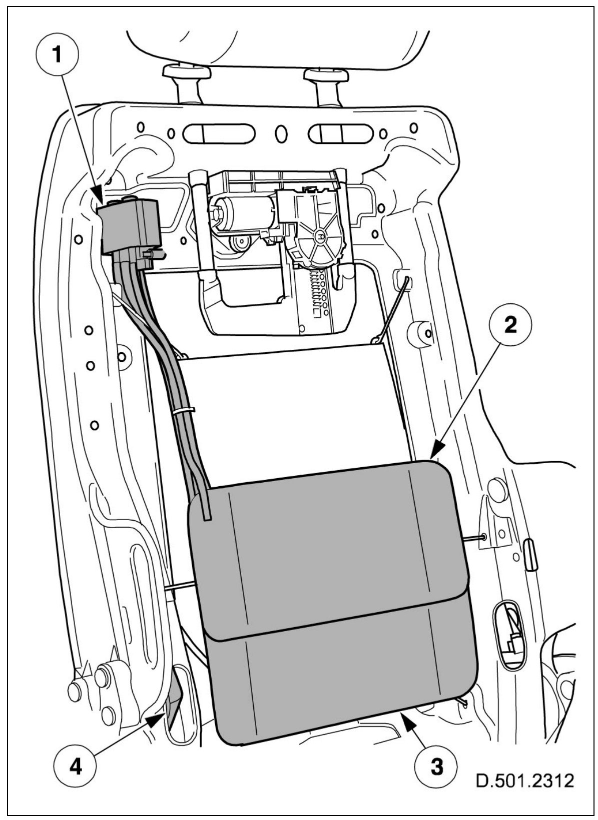


Fig. 144 Power lumbar 4 position version: X202

1. Solenoid pack
2. Upper air-cell
3. Lower air-cell
4. Motor-driven pump

Heated Seats

The heated seat system comprises:

- Heated seat switches.
- Heated seat module.
- Backrest heater element
- Cushion heater element and thermostat

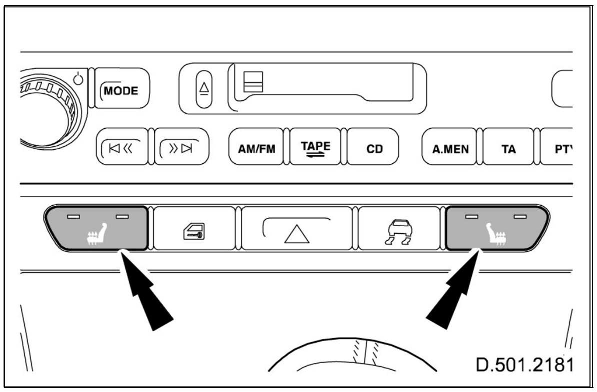


Fig. 145 Heated seat switches

The heated seat function (when selected) permits the electrical heating of the backrest and cushion on the driver and front passenger seats. The heating system for each seat is selected by separate switches located in the center console.

Pressing the appropriate switch facilitates the three stage operation of the heated seat function:

- One press of the switch activates the high setting (providing a seat surface temperature of approximately 42°C).
- A second press of the switch activates the low setting (providing a seat surface temperature of approximately 37°C).
- A third press of the switch deactivates the heating function.

Once the heated seat function has been activated, it will persist until one of the following conditions have been satisfied:

- A fixed period of time has expired (10 minutes)
- The function is deactivated by pressing the switch for a third time.
- The ignition key is not at position ll.
- A malfunction is detected by the heated seat module.

Confirmation that the heated seat function is active is provided by the illumination of the relevant switch:

- a single red light indicates the low temperature setting;
- both red lights indicates the high temperature setting.

NOTE:

The seat heaters are designed to operate at temperatures below a predetermined limit and therefore operation may be inhibited due to: storing the vehicle in a heated garage, body heat or warm ambient temperatures.

Heated seat module

The module is located under the front edge of seat and controls the seat heating function by providing the appropriate response depending on the status of the heated seat switches.

NOTE:

Refer to the appropriate electrical guide for this system.

STEERING COLUMN MOVEMENT: X200

Steering Column Movement

- Instrument Pack (IPK) controls steering column movement
- Control switch is hard wired to IPK
- Motors hard wired to IPK
- 2 motors to control column movement
- Memory recall is held in Drivers door module
- Memory position held in IPK
- Memory messages via SCP network

NOTE:

Refer to the appropriate electrical guide for this system.

Pedal-Adjustment System: X202

The pedal-adjustment system is an optional installation, designed to allow drivers of particular statures to improve their driving-position.

The system provides a range of adjustments up to a maximum of 70mm (2.75 in) and comprises:

- general electronic control module (GECM)
- pedal-adjustment motor
- pedal-adjustment sensor
- pedal-adjustment switch

The general electronic control module (GECM) controls the position of the pedals by providing an electrical output signal to the motor, in response to the:

- current position of the pedal-adjustment position sensor;
- pedal position chosen by the driver (using the pedal-adjustment switch)

Pedal adjustment is enabled by setting the 3-way, rotary switch situated on the left-hand side of the steering column, to the appropriate position. Pedal adjustment is then controlled by operating the switch upwards for pedals "out" and downwards for pedals "in."

NOTE:

Using the driver switchpack, two different pedal-position settings may be stored in the vehicle memory-system; refer to X202 Electrical Guide for detailed information.

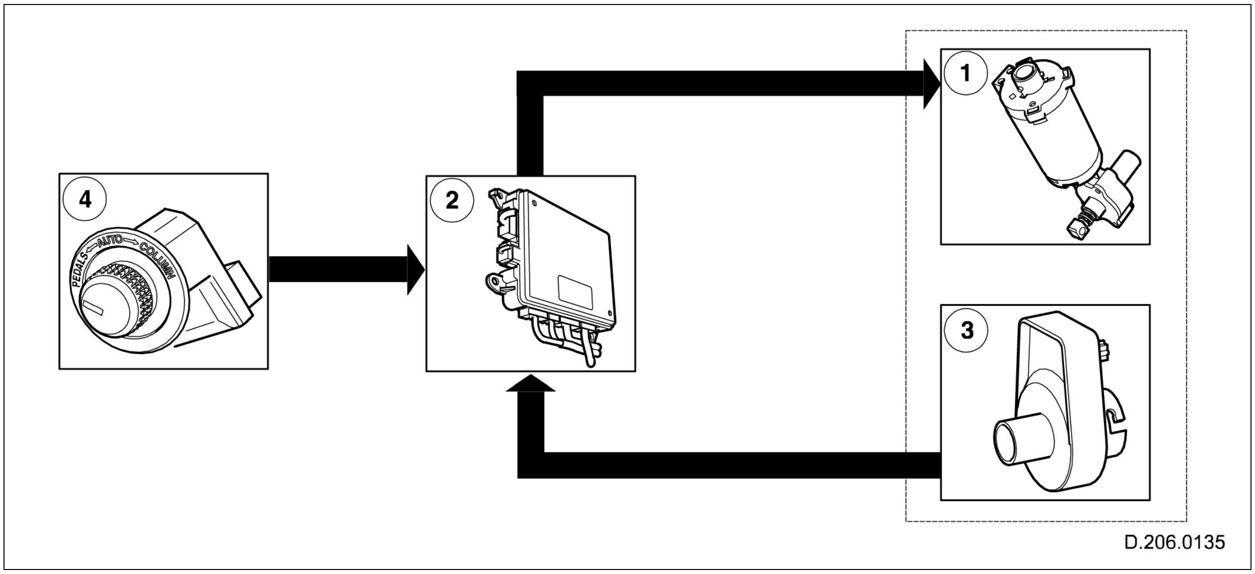


Fig. 146   Pedal adjustment system: X202

1. Pedal adjustment motor
2. GECM
3. Pedal-adjustment position sensor
4. Pedal-adjustment switch

The pedal-adjustment system:

- can be activated when the ignition key is in any position.
- cannot be activated when the ignition key has been removed.
- is inhibited during the operation of the adaptive speed control (where installed).
- requires initialization after any component of the system has been replaced; refer to JTIS.

NOTE:

Diagnostics should be undertaken using WDS.

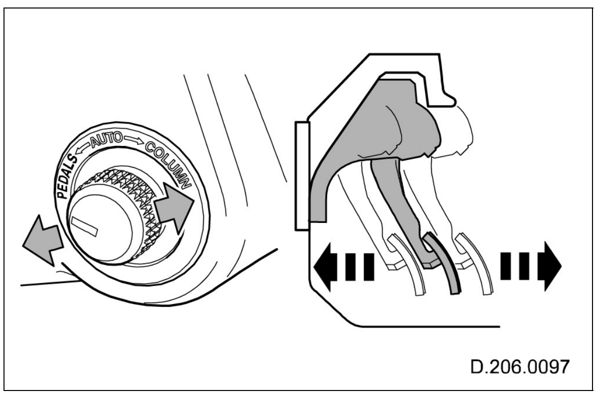


Fig. 147 Pedal adjustment switch

The GECM controls the position of the pedals by providing an output signal to the motor in response to:

- Current position of the pedal position sensor
- Pedal position chosen by the driver

– The adjustable pedal system is only available as part of the memory package (seats, mirrors, steering column).
– The assembly houses all 3 (or 2) pedals
– All pedals move together
– The complete assembly can move 69 mm (2.75 in.)

NOTE:

Refer to the appropriate electrical guide for this system.

MIRRORS: X200

Door mirrors: X200

- Drivers switch pack wired to drivers door module (DDCM)
- Drivers door mirror wired to drivers door module
- GEM wired to Passenger door mirror, commands via SCP network
- DDCM for memory

NOTE:

Refer to the appropriate electrical guide for this system.

Electrochromic Rear View Mirror: X202

- Compass no longer available
- New electrochromic type used
- Where electrochromic door mirrors are fitted they are operated in conjunction with the interior mirror by the same buttons and function in the same manner

POSITION MEMORY SYSTEM: X200

Memory System

The memory system is split into two areas of operation. These are:

- Memory retention
- Memory management

Memory retention is the responsibility of any module controlling a position motor. The DDCM will command all control modules to remember their individual motor positions when the memory set button is depressed.

These memories will then be assigned as position 1 or position 2 depending on driver selection. When the recall button is later pressed, the DDCM will broadcast a generic command to the specific modules to position their individual motors to their remembered positions.

Two-position memory

The positions of the steering column, driver seat, and the door rear view mirrors can be set in memory. Memory positions 1 and 2 are set using the switches on the driver door switch pack. This switch inputs to the DDCM, which broadcasts SCP MEMORY FEATURES MESSAGES.

Memory recall using the key transmitter

The key transmitter will recall a memory position when the Unlock button is pressed, if it has been programmed as follows:

1. Adjust the seat, column and mirrors to the desired positions. Set the memory (1 or 2).
2. Within 5 seconds, press any button on the key transmitter.
3. Press door switch pack memory button 1 or 2.
4. Repeat the process for the remaining memory button.

To cancel:

1. Press the memory button (1 or 2)
2. While the “memory set” indicator is ON, press any button (except the panic button) on the key transmitter.
3. Press the memory button again.

BODY ELECTRICAL SYSTEMS X400 SERIES

Electrical System Architecture: X400, X404

Power Supplies

The X400 and X404 vehicle electrical system is a supply-side switched system. The ignition switch carries much of the ignition switched power supply load directly. Power supply is provided via three methods: direct battery power supply, ignition switched power supply, and “Battery Saver” power supply. The “Battery Saver” power supply circuit is controlled via GEM internal timer circuits.

Fuse Boxes

The electrical harness incorporates a hard-wired Power Distribution Fuse Box in the engine compartment and a serviceable Central Junction Fuse Box in the front left-hand foot well. All fuses and relays (except the trailer towing accessory kit) are located in the two fuse boxes.

The 50 and 80 amp midi-fuses are located underneath the engine compartment fuse box

Some of the relays used are of the Printed Circuit Board (PCB) type. This type of relay is not serviceable and replacement requires the complete fuse box to be serviced.

POWER WINDOWS: X400, X404

The X400 power windows provide the following features:

- One touch up/down
- Antitrap sensing and logic
- Thermal overload protections

Unlike earlier Jaguar designs, the X400 power window system was the first to use direct wiring from the switches to each window control module. The power window motor is integral with the control module. The control module monitors an integral hall effect sensor feedback signal to determine when the normal travel of the motor is limited.

When the vehicle power supply is disconnected, the antitrap and one-touch up features will no longer function when the power supply is restored. The initialization procedure must be carried out to restore operation.

Power Window Initialization

- Lift and hold the window switch in the up direction until the window seats completely. Continue to hold the switch for a further 2 seconds.
- Release the switch and then lift and hold it again for a further 2 seconds. This procedure ensures that the window is fully seated into the seal.
- Press the window switch to lower the window to its fully open position.
- Verify the operation of the antitrap and one-touch up operation.

NOTE:

This procedure can be carried out either from the individual window switches or from the driver's switchpack.

Thermal Overload

The window motors are protected from overheating by a thermal overload feature. If the windows are operated continuously, the thermal overload feature will operate and the window will no longer respond to the operation of the switch. The number of opening/closing cycles required to implement this feature varies depending on temperature, but it should never be less than 7. One touch up and down operation should be possible within 10 seconds with full operation resuming after a brief rest period.

NOTE:

Refer to the appropriate electrical guide for this system.

Ice Mode

The windows have an ice mode feature to facilitate the closing of the windows in the event of the glass run channels being obstructed by ice. This feature is activated by the vehicle occupant as follows:

- Raise the window until the obstruction is reached. The antitrap feature will operate, lowering the window to a minimum of 50 mm (1.97 in) below the point at which reversing was initiated (or at least 200 mm (7.87 in) from the close position).
- Raise the window back up to the obstruction. Again the antitrap feature will operate.
- Within 10 seconds, raise the window a third time to the obstruction. This time the antitrap feature will not operate. Release the switch.
- Lift the switch again within 0.5 seconds. The window motor will now operate at its full force (250 N maximum) for approximately 12 mm (0.47 in) of upward travel. This can be repeated several times provided that each time the switch is activated within 0.5 seconds.
- Should the 250 N force be insufficient to clear the obstruction, this insufficient force will be interpreted as system failure and the one-touch up function will be disabled. To relearn the function, the window initialization procedure will have to be performed.

Sun Roof (Sliding Roof)

The sun roof motor receives input from either the GEM (for global close only) or the switch, integrated into the module assembly. The sun roof motor module monitors an integral hall effect sensor feedback signal to determine when the normal travel of the motor is limited.

The sun roof is not affected by battery disconnection and will not need to be initialized. However, if power is disconnected while the sun roof is actually being operated, then memory will be lost and the following initialization procedure will have to be carried out. This procedure will also have to be carried out if the sun roof motor is changed.

Sun Roof Initialization

- Press the switch in the tilt position until the roof moves to the fully tilt position and stops.
- Release the switch.
- Within 5 seconds, press and hold the switch in the tilt position again. The roof will travel automatically to the fully open position, back to the fully closed position and stop.
- Verify the operation of the antitrap and one-touch features.

To re-initialize without disconnecting the battery, run the roof panel into the tilt position. Release, then press and hold the switch for 20–30 seconds. The roof panel will move up and down signaling memory erasure of the previous initialization.

The roof panel can then be re-initialized as described above.

INTERIOR LIGHTING: X400, X404

The interior lighting comprises:

- Footwell lamps
- Front interior lamp and switch
- Map lamps and switches
- Vanity mirror lamps and switches
- Rear interior lamp and switch
- Puddle lamps
- Luggage compartment lamp and switch
- Glovebox lamp and switch

Except for the glovebox lamp, which receives battery supply voltage only when the main lighting switch is active, all lamps receive battery supply voltage via the battery saver relay (located in the central junction fuse box).

The glovebox lamp and luggage compartment lamp have direct ground returns. The courtesy lamps have a separate ground return via the GEM. All other interior lights receive a ground return via the GEM in the form of a controlled signal that provides progressive illumination and deactivation during normal operation. Refer to the X400 Electrical Guide for detailed connection information.

Battery Saver

A timer function within the GEM controls the battery saver feature:

- The timer is initialized when the ignition key is turned to position ‘0' or removed from the ignition barrel.
- After a 40 minute period, the GEM will remove the battery voltage from the interior lighting by deactivating the appropriate relays.

The battery saver feature will be reactivated when:

- The ignition key position is changed.
- Any door (including the luggage compartment door) becomes ajar or is opened.
- An external unlock is activated using either the door lock cylinder or the integrated key transmitter.
- The courtesy lamps' switch is activated.

Courtesy Lighting

The courtesy lamps are controlled by the general electronic control module in the following circumstances:

- Any of the vehicle's doors are open.
- An external unlock is activated using either the door lock cylinder or the integrated key transmitter.
- The courtesy lamps' switch is activated.

Provided that the courtesy lamps' switch is not activated, the courtesy lighting feature extinguishes the courtesy lamps when all the vehicle's doors are closed and any of the following occurs:

- Twenty seconds have elapsed since either an external unlock or the last door has closed, whichever occurs last.
- The engine is started.
- An external lock is activated using the door lock cylinder or integrated key transmitter.

In addition, the courtesy lighting feature extinguishes the courtesy lamps when the battery saver timer has expired.

During normal operation the courtesy lamps fade up and fade off.

NOTE:

Refer to the appropriate electrical guide for this system.

EXTERIOR LIGHTING: X400, X404

The X400 and X404 only two major deviations from a standard exterior lighting arrangement: autolamp and optional high-intensity discharge headlamps (complete with automatic headlamp leveling). Exterior lighting is activated by the main lighting switch and, where appropriate, the left-hand column switch (high beam).

Switching is via allocated fuses and relays, with the exception of the turn signal lamps/hazard warning lamps, which are controlled by the general electronic control module (GEM).

NOTE:

Daytime running lights are not programmable.

Master Lighting Switch

The master lighting switch assembly comprises:

- Rotary switch
- Dimmer switch
- Trip computer switchpack

The rotary switch is used to activate the following:

- Side lamps
- Headlamps
- Autolamps (except Canada)
- Front fog lamps
  - The lamps are activated when the rotary switch is “pulled” to its first position, provided the side lamp or headlamp position is also selected.

    NOTE:

    The front fog lamps will not operate if main beam is selected.
- Rear fog lamps
  - The lamps are activated when the rotary switch is “pulled” to its second position, provided the rotary switch is not in the OFF position.

NOTE:

The front fog lamps will operate automatically when the rear fog lamps are selected provided main beam is not selected. After approximately 5 minutes, a noticeable fall in light output may be observed. The effect is due to a voltage boost feature that has been introduced.

NOTE:

Refer to the appropriate electrical guide for this system.

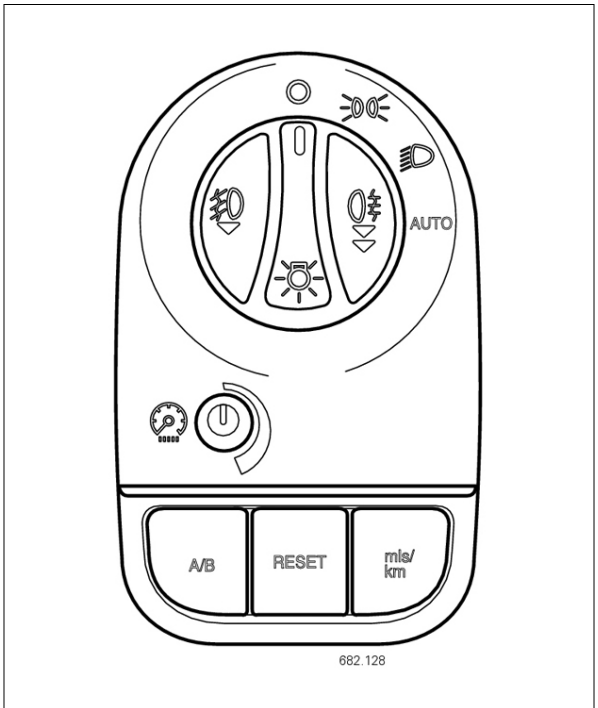


Fig. 148 Master Lighting Switch

Rear Exterior Lighting

Unlike other Jaguar models, the X400 series exterior lighting is wired directly from the master lighting switch, through the passenger junction fusebox, and hard-wired directly to the lamp assemblies.

Turn Signals and Hazard Lights

Turn signals and hazard lights are operated by the GEM. The GEM also creates the audible warning to a speaker within the turn signal switch.

NOTE:

Security acknowledge lamp-flash is also controlled by the GEM. For more information, see the Security Section.

High Intensity Discharge (HID) headlamps: X400, X404

The High Intensity Discharge headlamps (also known as Xenon) technology is currently the most advanced development in the field of motor vehicle headlamp systems.

Xenon has two decisive advantages over the light of conventional light-bulbs: a Xenon light source delivers twice the light output of a modern H7 bulb while consuming only 2/3 of the energy. The improved light output makes the road brighter and illuminates a wider area, the daylight-like quality of the xenon light is welcomed by the human eye. Drivers get tired slower and driving becomes more relaxed. This means an enormous gain in safety and driving comfort.

Because of this level of brightness, an automatic levelling system has to be incorporated, together with automatic headlamp cleaning equipment to avoid dazzling oncoming drivers.

The HID headlamp contains the following:

- Headlamp burner
- HID Control module
- Headlamp levelling servos
- H7 halogen bulb
- Front direction indicator bulb
- Front side lamp bulb

NOTE:

Due to the "warm-up time" experienced with xenon lamps, the low beam lamp is not used for the headlamp flash feature; the high beam is used instead.

System Operation

Each headlamp assembly has a control module attached to the underside of the headlamp unit which operate independently of each other.

The control module contains the ballast module which controls the burner to the correct operating power. The control module can be replaced independent of the headlamp assembly.

Light is produced by burners instead of conventional tungsten filament type bulbs. The burners are made from Quartz glass and contain a mixture of mercury, various metal salts and Xenon gas at high pressure. Two electrodes extend into the burner to provide an electric arc. The ballast module is supplied with battery voltage and applies an electrical charge to the burners. Once this charge is high enough, an electric arc is produced between the two electrodes which ionizes the gas, producing approximately 20% of its continuous light. As the temperature of the gas increases the mercury and the metal salts evaporate, its luminescence increases moving the light produced from the blue spectrum into the white spectrum.

Once the burner is operating, the current required to keep it operating reduces and the power of the burner is regulated to 35W. Voltages as high as 30kV are required to initially operate the burners. Wear to the burners is so minimal that they are designed last the life of the vehicle. The temperature of the burner is lower than that of a conventional halogen bulb since the power is only 35W.

The light produced from the Xenon headlamps is well within the white light spectrum but to the naked eye appears blue when compared to the light produced from a tungsten bulb, which is in fact yellow. The light temperature of the burner is 4100°K (6920°F) compared to a Halogen bulb which has a light temperature of only 3200°K (5300°F).

The standard HID headlamp system uses a conventional H7 halogen bulb for operation of the main beam, although the Xenon burner continues to operate on dipped beam.

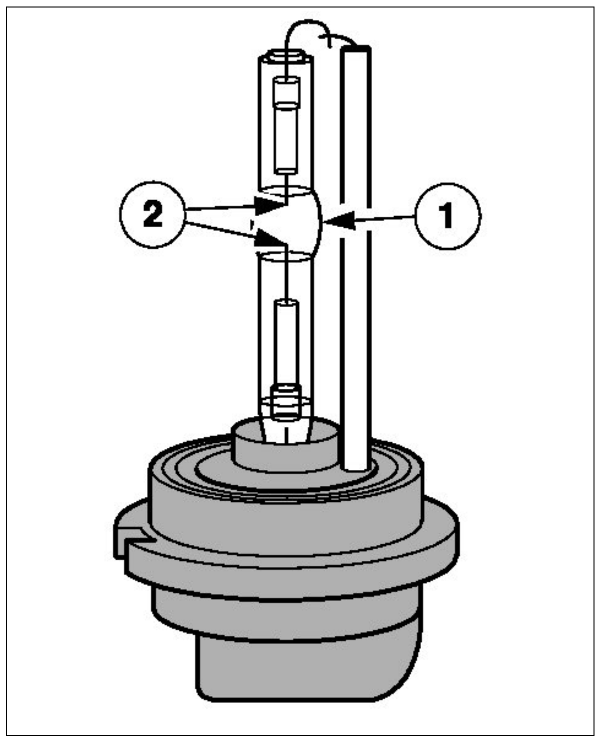


Fig. 149 Xenon Bulb Assembly: X400

1. Gas filled chamber
2. Electrodes

WARNING:

Voltages as high as 30kV may be generated by the HID system. To prevent the risk of personal injury, connections must not be probed or touched while they are operating.

WARNING:

Care should be taken when handling the burners as the internal pressure is between 7 — 100 bar (101.5 — 1450 psi) depending upon the temperature.

NOTE:

Unlike conventional lamps, xenon lamps do not deteriorate and should last the lifetime of the vehicle.

CAUTION:

The glass of the burner should not be touched to avoid contamination.

System Safety

The system is designed to ensure that under normal operation it is not possible to accidentally access or probe any high voltage components or connectors. The high voltage cables and connectors are also screened to prevent electrical noise from interfering with the operation of other electrical systems.

All headlamp functions should be switched off and the headlamp assemblies should be disconnected from the vehicle harness before any attempt is made to work on the system.

WARNING:

Never attempt to probe connectors or components within the headlamp assemblies.

The ballast modules can sense short circuits and will switch off the high voltage circuits accordingly. In the event of a burner being broken, any resulting short circuit between the two electrodes or a short circuit between an electrode and the vehicle ground will be sensed and the high voltage circuits switched off. A short circuit between an electrode and the vehicle battery supply however, could lead to the destruction of the Xenon control system.

NOTE:

Refer to the appropriate electrical guide for this system.

HID Headlight Levelling: X400, X404

The HID headlamp leveling system is composed of the following components:

- Control module: located behind the left-hand fascia panel.
- Front axle sensor: Located on the left hand side of the front suspension cross beam. The front axle sensor receives a 5V supply and ground from the control module and provides a PWM feedback signal to the control module.
- Rear axle sensor: Located on the left hand side of the rear suspension A-frame. The rear axle sensor operates the same as the front sensor.
- Stepper motors: Located in each headlight assembly. The stepper motors are operated by the control module in response to signals received from the front and rear axle sensors. The stepper motors are not individually serviceable.

The sensors send a PWM signal to the headlamps and they react according to that input. When the ignition switch is turned to the ON position, the lamps go through an initialization cycle, which consists of the lamps moving to the most downward position and then moving to the driving position. If any faults are detected the lamps will retreat into a "home" position which is the most downward position.

If the front sensor goes faulty/disconnected the system may operate in a de-rated mode. Failure of the rear sensor makes the system go into a faulty/disconnected mode and the system defaults to the "home" or most downward position.

The leveling system also receives CAN input from the brake pedal and vehicle speed sensors.

REVERSE PARKING AID SYSTEM: X400

Introduction

The system comprises:

- Parking aid control module
- Speaker
- Ultrasonic sensors

The parking aid control module is mounted in the left-hand corner of the luggage compartment near the spare wheel.

- Operation is the same as on other Jaguar models
- Sensor range is 70.9 inches (1.8 m)
- The audible warning will be heard at 7.9 inches (0.2m)
- The range reduces to 23.6 inches (0.6m) as the vehicle corners
- Curbs that are higher than 7 inches (0.18m) will be detected

NOTE:

The module cannot be configured and the system cannot be disabled.

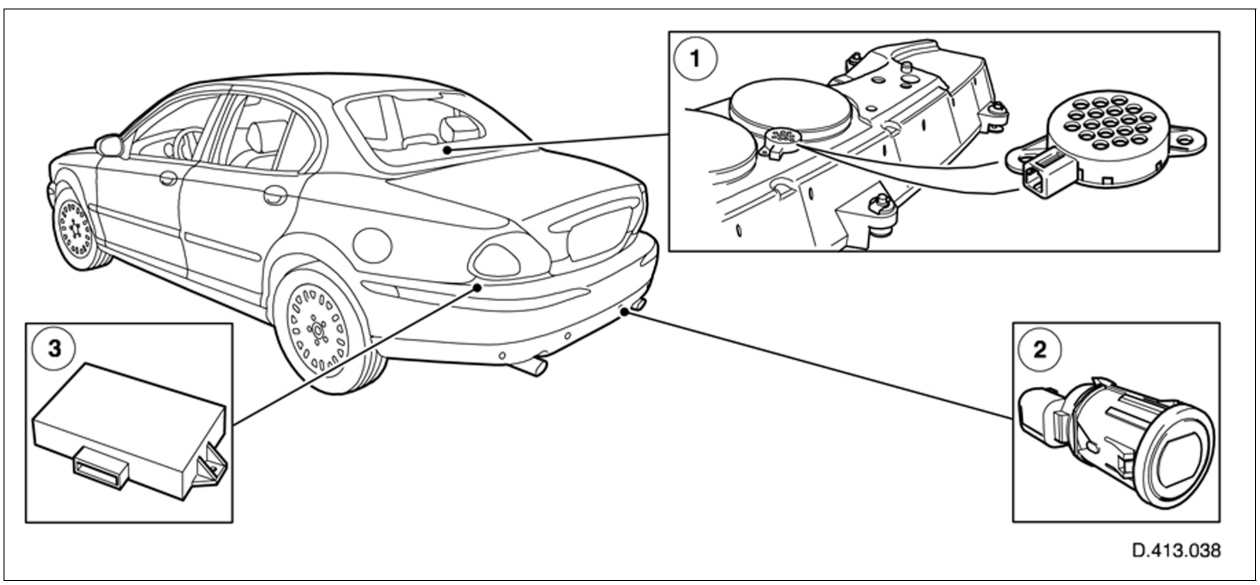


Fig. 150 Parking Aid Components

1. Speaker
2. Ultrasonic Sensor
3. Parking Aid Control Module

Operation

The parking aid system is activated when reverse gear is selected. The ultrasonic sensors are positioned to detect the presence of objects as the vehicle is reversed. Should an object be detected within the sensor range of 1.8 mm (70.9 in.) from the rear of the vehicle, the speaker should emit an intermittent audible warning. As the vehicle moves closer to the object, at a distance of 0.2 m (7.9 in.), the intermittent audible warning should change to a continuous audible warning.

When trying to establish whether the system is behaving correctly, the following points should be taken into account:

- The range reduces to 0.6 m (23.6 in.) at the vehicle corners.
- The vertical range is designed to protect the highest and lowest points at the rear of the vehicle.
- Curbs that are low enough to pass under the vehicle will not be detected.
- Curbs that are higher that 0.18 m (7 in) will be detected.

NOTE:

The system is automatically inhibited when the trailer socket is connected.

System Malfunction

A system malfunction will cause a continuous audible warning to be emitted for 3 seconds after reverse is selected, and a DTC to be stored.

NOTE:

Retrieval of the DTC and subsequent diagnosis of the system should be undertaken using WDS.

NOTE:

Refer to the appropriate electrical guide for this system.

PARKING AID SYSTEM: X404

The installation of the parking aid option features a new configurable module to support either:

- front and reverse parking maneuvers or
- reverse parking maneuvers only

The module is located to the left-hand side of the spare-wheel well.

The reverse parking sensors and speaker are identical to those installed for the introduction of X400.

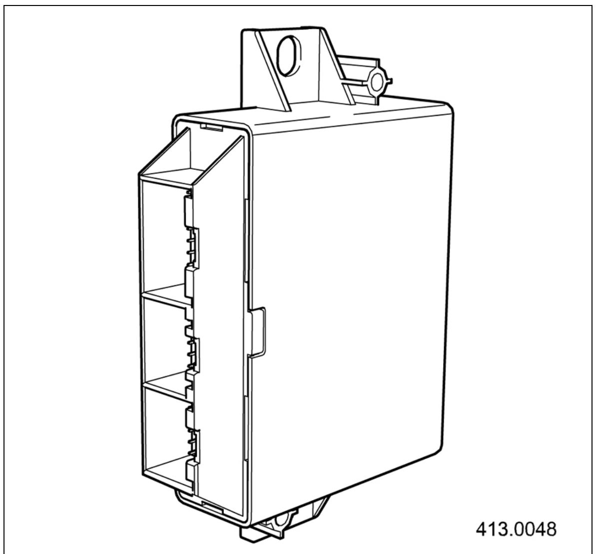


Fig. 151 Parking Aid Module

The front parking aid system, is installed as an option, requires a differently configured parking aid module to that installed for the reverse parking aid system and comprises:

- Parking aid module
- Audible warning speaker (speaker mounted in inst. cluster)
- Ultrasonic sensors
- Deactivation switch

The deactivation switch, located in the overhead console, provides the driver with the option to deactivate the system.

NOTE:

Deactivation applies to both the front and reverse parking aid systems.

A warning lamp, integral to the switch, illuminates to confirm the systems have been deactivated.

NOTE:

Should a malfunction be detected, the system will be automatically deactivated and the warning lamp illuminated.

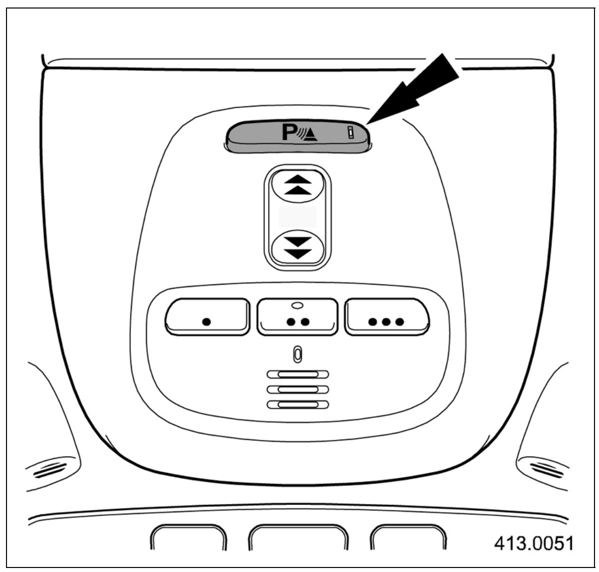


Fig. 152 Parking Aid Deactivation Switch

NOTE:

Refer to the appropriate electrical guide for this system.

WIPERS: X400, X404

Rain Sensing

Where installed, moisture sensitive wiping is controlled using a combination of the GEM, rain sensing module, rain sensor and wiper switch; refer to X400 Electrical Guide for connection details.

The rain sensor is located within the base of the interior rear view mirror on the inner surface of the front window glass. A spring within the base of the mirror holds the sensor against the glass.

The rain sensing module is located on a bracket, forward of the left-hand A-post.

Moisture sensitive wiping will be initiated providing:

- the ignition key is at position II;
- PARK or NEUTRAL gear is not selected (gear engaged for manual vehicles);
- the wiper switch is set to the AUTO position and intermittent wipe is selected.

When the sensor detects the presence of rain or moisture on the window glass, an electrical signal is sent to the rain sensing module. The rain sensing module responds by sending an appropriate output signal to the wiper motor.

Headlamp Cleaning System

A headlamp cleaning systems is a legal requirement for vehicles installed with high-intensity discharge (xenon) headlamps.

The headlamp powerwash feature can be operated if the ignition key is at position ‘ll' and side lamps are selected.

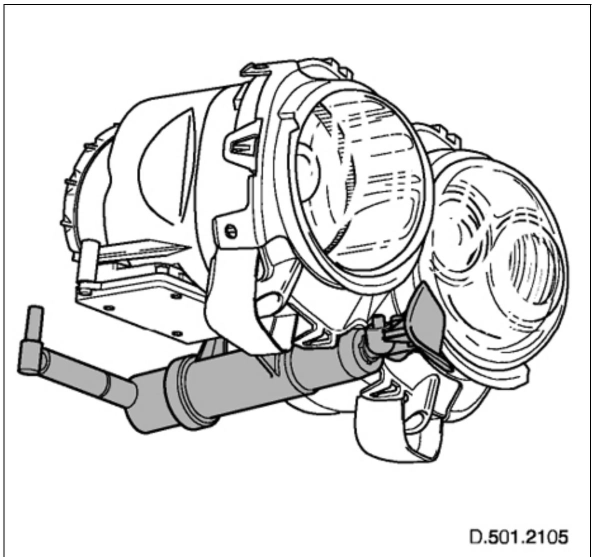


Fig. 153 Telescopic Powerwash

NOTE:

The feature will not operate if the washer fluid level is low.

When the windscreen wash/wipe button is pressed, the headlamp powerwash directs a short burst at the headlamps. If the wash/wipe button is held, the screen wash-cycle will continue for up to 20 seconds. The headlamp powerwash will operate the first time the wash/wipe button is pressed and thereafter every sixth succeeding wash/wipe operation. If the headlamps or ignition are switched OFF and ON again, the powerwash will operate on the next press of the wash/wipe button.

NOTE:

If the washer fluid level is low in the reservoir the wipers will not operate when windscreen wash is selected even though there may be washer fluid remaining in the reservoir and sprayed onto the screen. This is to prevent damage to the blades, or scratching of the glass, or smearing dirt across the screen. Flick wipe should be selected to clear the sprayed fluid from the screen.

The wipers and washers system comprises:

- Wiper motor
- Washer fluid reservoir
- Washer fluid pump
- Mounting arm and pivot shaft
- Telescopic powerwash (where installed)
- Rain sensing module (where installed)
- Rain sensor (where installed)

The system is controlled by the general electronic control module (GEM). The windscreen wipers and screen wash functions are driver-determined by the right-hand column stalk and only operate with the ignition key at position ll.

- Flick wipe
- Programmable intermittent wipe
- Slow wiper operation
- High speed wiper operation
- Moisture sensitive wiping

The wipers automatically return to the park position when the ignition key is turned to position ‘0' or the wiper control switch ‘OFF' position is selected.

NOTE:

Refer to the appropriate electrical guide for this system.

FRONT SEATS: X400

WARNING:

Prior to seat removal and before disconnecting the seat harness (which includes airbag connectors) the vehicle battery should be disconnected and a period of at least 120 seconds allowed to elapse. The same amount of care should be taken when handling and storing these seats as would be taken when handling and storing vehicle airbags in isolation.

The driver and passenger seats, although almost identical, have some unique components fitted: the driver's seat has a seat track position sensor and the passenger seat has a weight-sensing system. In both instances, the components form an integral part of the occupant safety system.

In addition to the standard features, depending on the vehicle specification, one or more of the following options may be available:

- Electrically adjustable seat position
- Heated seat
- Electrically adjustable lumbar support

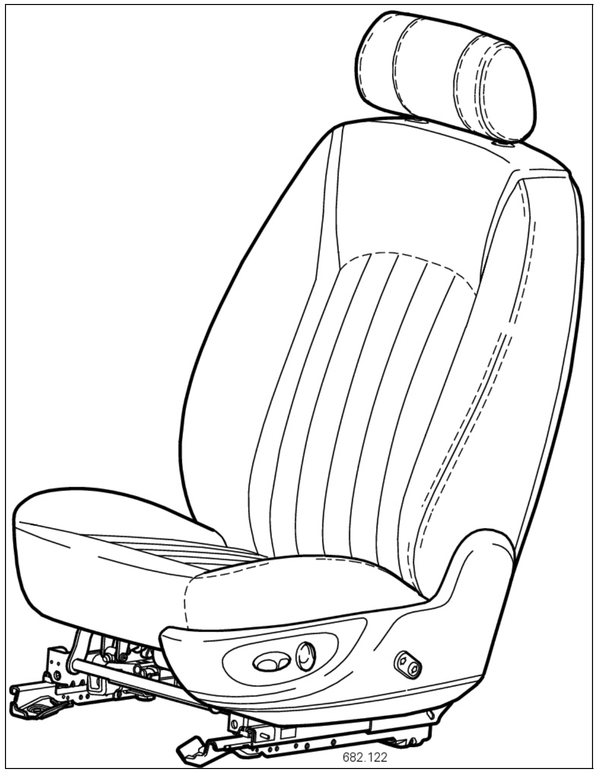


Fig. 154 Power Front Seat

NOTE:

The seat cushion is an integral part of the seat weight-sensing system. Individual components of the seat weight-sensing system are not serviceable and must be replaced as a complete unit.

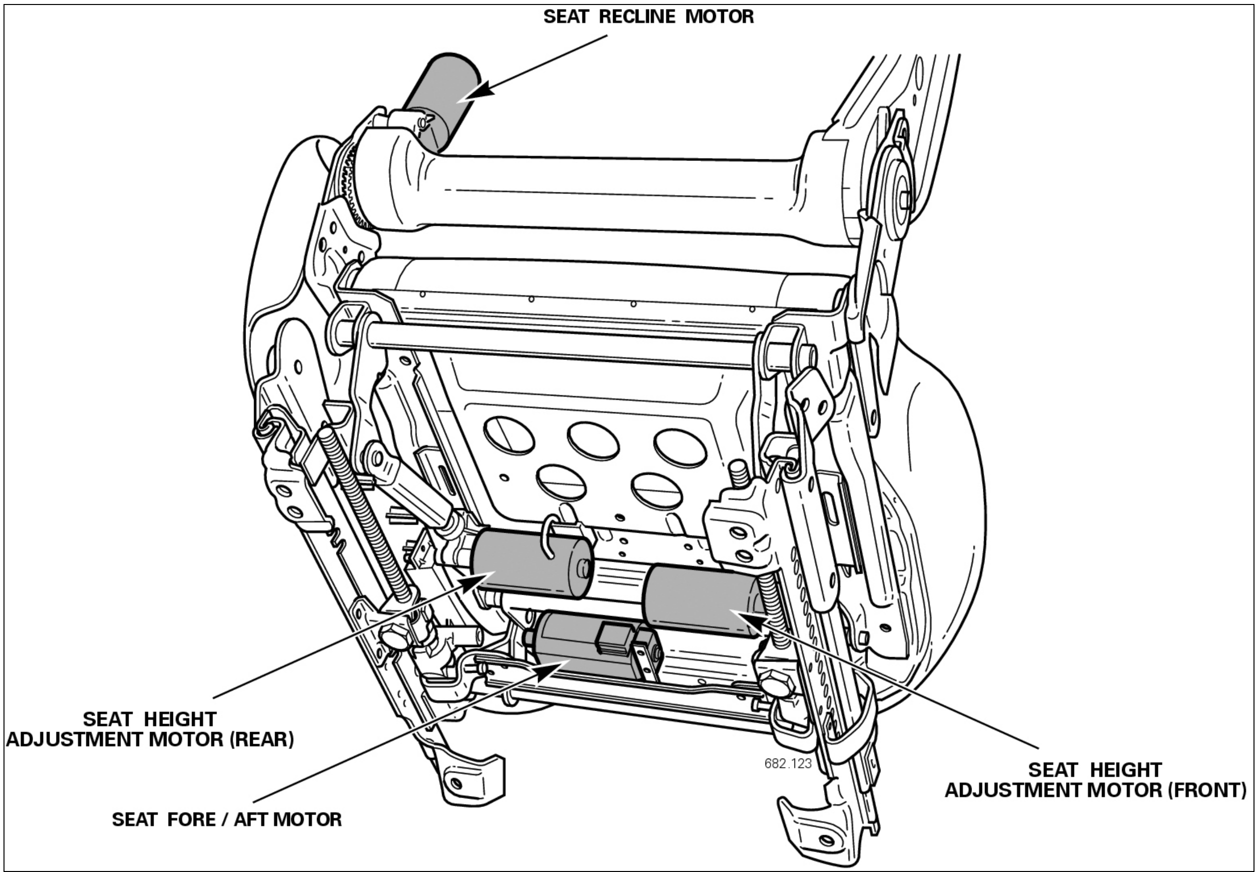


Fig. 155 Power Driver Seat Component Locations

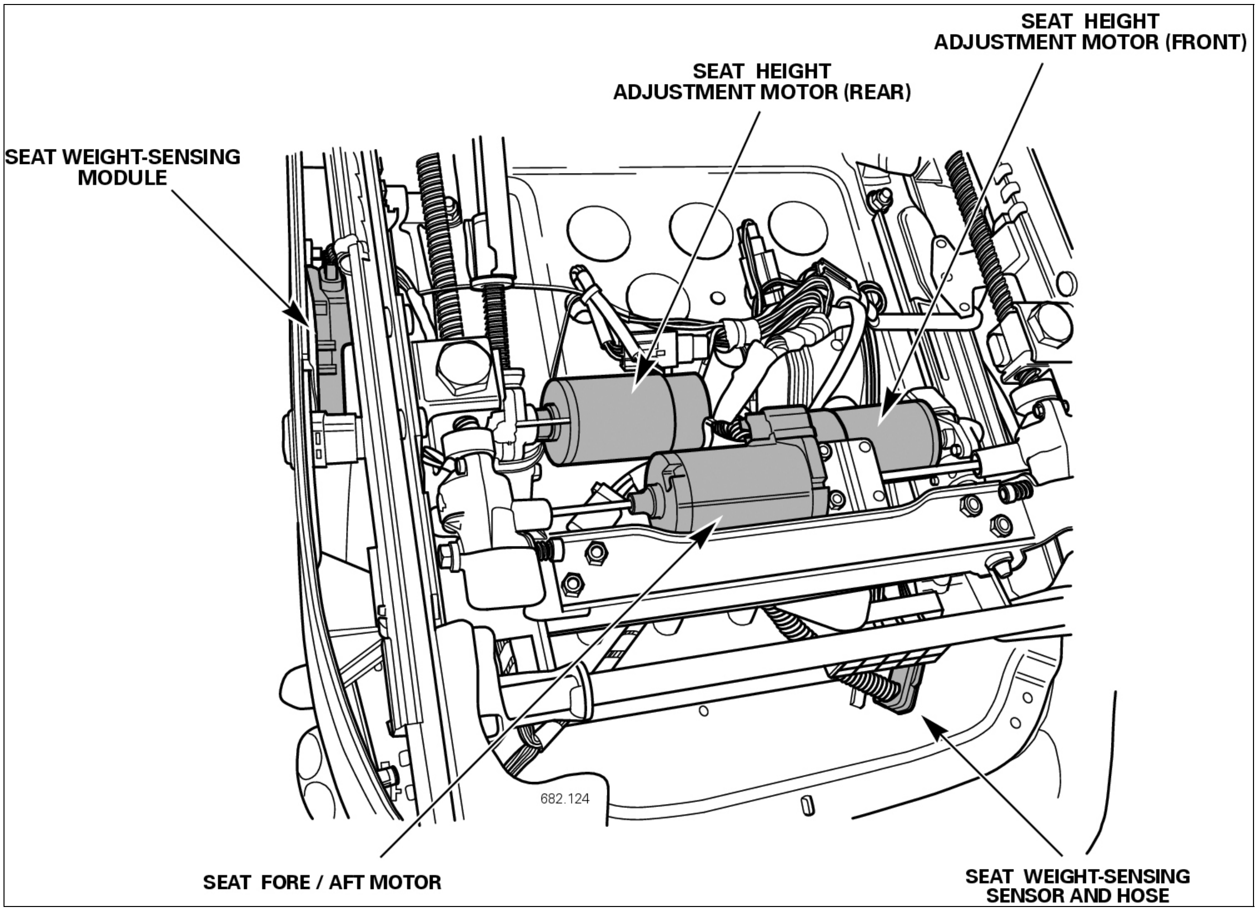


Fig. 156 Power Passenger seat Component Locations

Heated Seats

The heated seat system comprises:

- Heated seat switches
- Heated seat module
- Seat back heater element
- Cushion heater element and thermostat

The heated seat function (when selected) permits the electrical heating of the seat back and cushion on the driver. Pressing the appropriate switch facilitates the two-stage operation of the heated seat function:

- One press of the switch activates the high setting, providing a seat surface temperature of approximately 42°C (107°F)
- A second press of the switch activates the low setting, providing a seat surface temperature of approximately 37°C (98°F)
- A third press of the switch deactivates the heating function passenger seats. The heating system of each seat is selected by separate switches located at the top of the center console

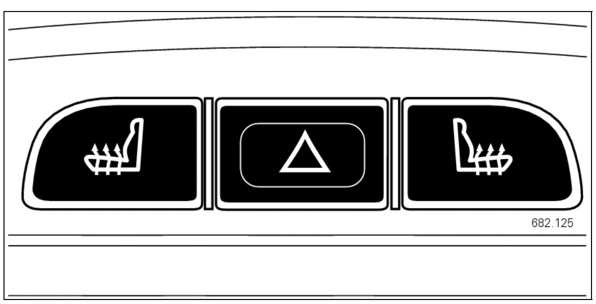


Fig. 157 Heated Seat Switches

Once the heated seat function has been activated, it will persist until one of the following conditions have been satisfied:

- A fixed period of time has expired (10 minutes)
- The function is deactivated by pressing the switch for a third time
- The ignition key is not at position II
- A malfunction is detected by the heated seat module

Confirmation that the heated seat function is active is provided by the illumination of the relevant switch:

- A yellow light indicates the low temperature setting (approximately 37°C (98°F)
- A red light indicates the high temperature setting (approximately 42°C (107°F)

NOTE:

The seat heaters are designed to operate at temperatures below a predetermined limit. Therefore, operation may be inhibited due to storing the vehicle in a heated garage or to body heat or warm ambient temperatures.

Heated Seat Module

The module, located under the front edge of the seat, controls the seat the heating function by providing the appropriate response depending on the status of the heated seat switches. Refer to the X400 Electrical Guide for detailed information.

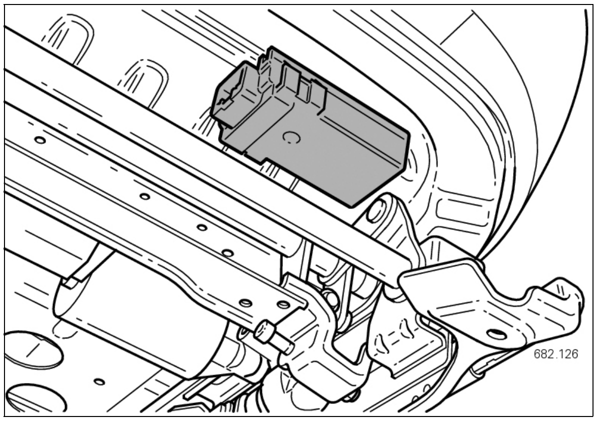


Fig. 158 Heated Seat Module

NOTE:

Refer to the appropriate electrical guide for this system.

Mirrors: X400

- Electric adjustable exterior mirrors
- Mirrors are hard wired to drivers door switch pack
- No memory feature

NOTE:

Refer to the appropriate electrical guide for this system.

MEMORY SYSTEM: X404

Memory System Overview

The 2004 MY X404 now offers a seat memory package as an option. The memory system (if fitted) controls the following:

- Driver Seat
- Side mirrors

Seat memory

The seat memory system offers the driver 3 memory settings with the memory buttons located in the seat adjustment switch pack.

Fig. 159 Seat Memory Switch Pack

Seat memory module

The seat memory module is integrated with the seat adjustment switch pack as shown on the illustration.

NOTE:

In X404 models equipped with a manual transmission, the park brake must be applied for the seat adjustment switch pack to recall the memory seat and mirror positions.

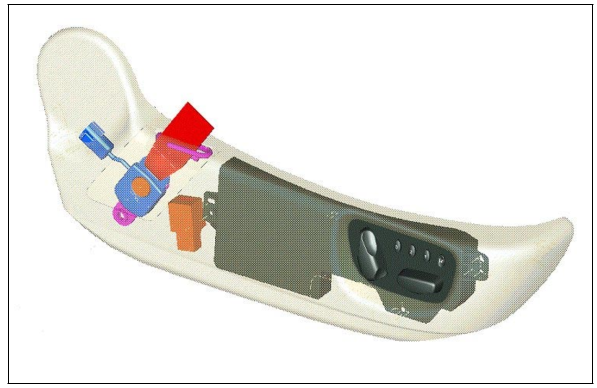


Fig. 160 Seat Memory Module

Mirror movement: X404

- Mirrors wired to seat memory module
- Mirror switch wired to seat memory module
- Memory recall part of seat memory module
- Module is part of drivers seat switch assembly

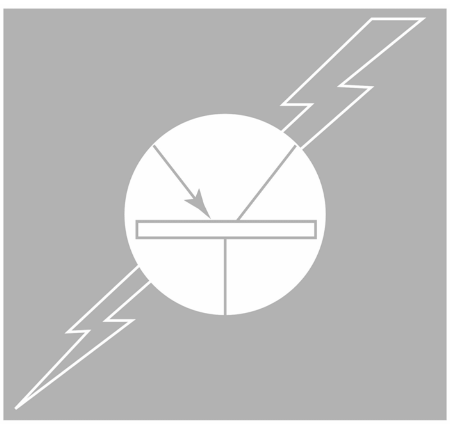
NOTE:

Refer to the appropriate electrical guide for this system.

JAGUAR

TRAINING PROGRAM

JAGUAR ADVANCED ELECTRICAL SYSTEMS



PUBLICATION CODE – 684

SECURITY: X100, X308

Introduction

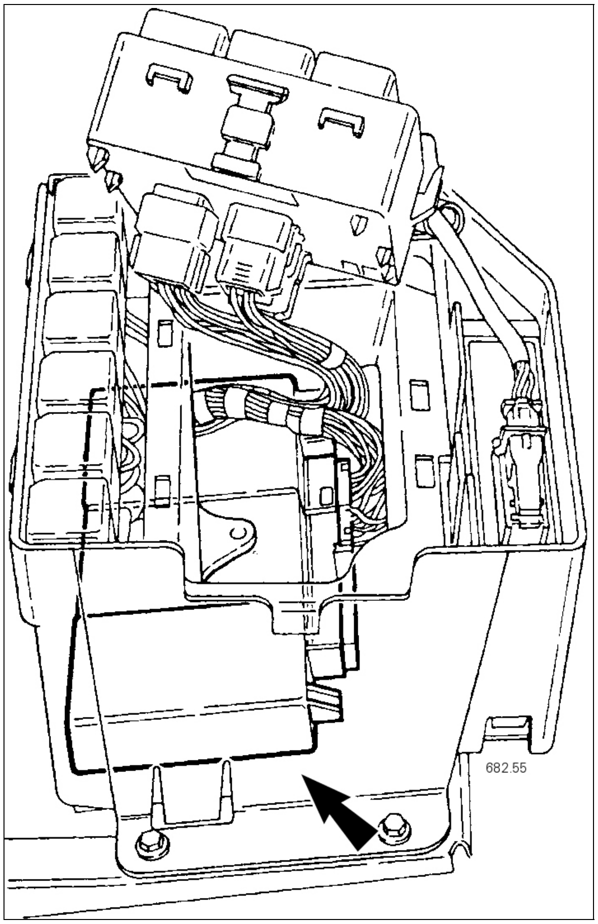


Fig. 161 Security and Locking Control Module

The following security features are available:

- Panic alarm (dealer option)
- Passive arming (dealer option)
- Audible warnings
- Security LED in gear JGate Surround
- Drive away door locking
- Key and remote transmitter locking/unlocking
- Remote headlamp convenience
- Remote trunk open

The security and locking systems involve the SLCM, BPM, DDCM and PDCM all connected via the SCP network.

The SLCM is located in the electrical carrier below the fusebox, in the trunk. The BPM is mounted off the passenger airbag bracket, behind and above the glove box. A door module is fitted to each door.

An inertia switch unlocks the doors when activated.

The in-car audible warning speaker is located in the steering column cowl.

With the transit relay fitted, security cannot be armed during transit and the car must be mechanically locked. The SLCM controls all convertible top movement operations.

Key-Ring Transmitter

A four-button, rolling code, key-ring transmitter gives remote control of the system. Two key-ring transmitters are supplied with each vehicle.

Button functions are as follows (numbers correspond to those in the illustration at right):

1. **Locks and arms the vehicle.**
   One press will lock both doors and the trunk and will set the alarm system. One signal will be heard and the direction indicators will flash once. The LED in the gear selector surround will continually flash whilst the vehicle is armed.
2. **Unlocks and disarms the vehicle.**
   If the car is in a locked state, at the first press of the button the driver's door only unlocks and the interior lights fade on. A second press unlocks the passenger door.
3. **Switches on the headlamps and starts the panic alarm.**
   One press switches on the dipped headlamps which remain on for 25 seconds or until the button is pressed a second time or until the key is inserted in the ignition switch. Three presses within three seconds starts the panic alarm. The alarm will sound for a full period and can only be stopped by inserting the key into the ignition and turning to positions I or II. The transmitter cannot be used to cancel the panic alarm.
4. **Releases the trunk lock.**
   One press releases the trunk lock, without disarming the system.

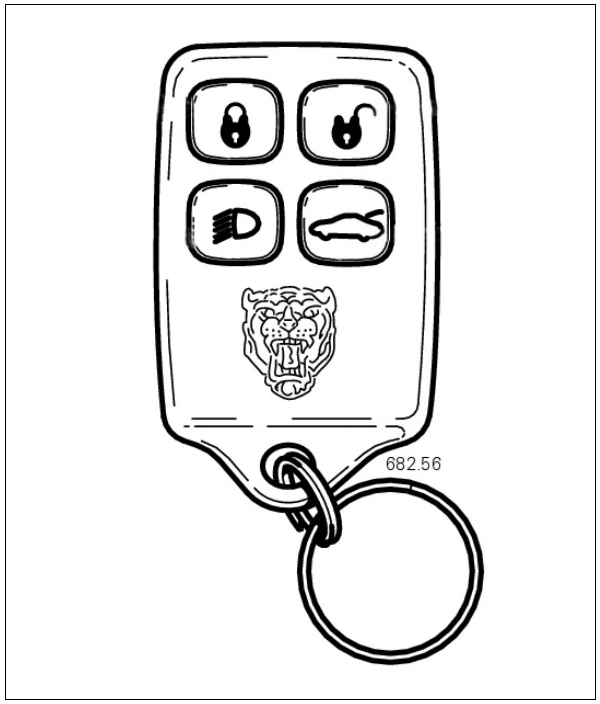


Fig. 162 Key Ring Transmitter: X100, X200, X308

The key-ring transmitter will only work if the vehicle's doors, hood and trunk are closed and the key is not in the ignition. Dealers are required to obtain proof of ownership before issuing a replacement transmitter.

Key Ring Transmitter Programming (Manual Procedure)

- Insert Ignition Key
- Hold Headlamp Stalk Switch active (headlamps ON)
- Turn Ignition Key to position I (Auxiliary)
- Flash Headlamp Switch: 3 times for 1997 MY vehicles or 4 times for 1998 MY vehicles
- Confirmation chirp will sound and LED will flash once to indicate “Learn Mode” has been entered
- Activate each Remote Transmitter by pressing any button on the transmitter once – a chirp will sound for each Remote Transmitter signal received (LED will flash); allow 15 seconds maximum between each press
- Switch ignition off – confirmation chirp will sound to indicate “Learn Mode” has been exited (system will automatically “time out” after 15 seconds)

Central Locking Function

The vehicle can be locked and unlocked by activating the driver door key barrel switch, the driver or passenger interior door locks, or the remote transmitter. If drive away locking is enabled, the doors lock when the gear selector is moved from park to not-in-park for more than 1 second.

If a door lock actuator is driven more than 10 times within 40 seconds, a 20 second time out is set to allow the actuator to cool off. Other key barrel lock functions continue to operate during the lock actuator cool off period.

If the driver door key barrel lock switch is active for more than 30 seconds, the signal is ignored until the switch becomes inactive. Lock actuator protection does not occur if the unlock signal comes from the inertia switch.

If activated, the inertia switch unlocks the doors while the ignition is in position 2. Doors unlocked by inertia switch activation can be relocked by activating central locking.

If one door is locked and the other unlocked, and the inertia switch or key barrel lock/unlock switches are inactive, the locks cycle until both locks are in the same state. Lock cycling is disabled after three cycles, when the inertia switch is active, or when the ignition is switched to position II. When disabled, the locks are left in the last valid locking request position.

Lock/Unlock

The vehicle may be centrally locked or unlocked using the driver door key lock or the remote transmitter. A door key lock global lock/unlock function activates the locks, windows and convertible top or sunroof.

Holding the door key lock in the active position for more than 1.5 seconds when the ignition is not in position II or III activates the global lock/unlock function. The global function activates the locks, windows, and convertible top or sunroof. If the key is released, global open/close operation immediately stops.

Trunk Release

The trunk is opened using the interior trunk release switch, the trunk key lock or the remote transmitter. The interior trunk release switch activates the trunk solenoid under the following conditions:

- Valet mode inactive
- Security disarmed
- Vehicle unlocked or key in the ignition

Valet mode (trunk release inhibit)

Valet mode is activated by pressing the valet switch when the trunk is closed. Valet mode is deactivated by disarming the security system or unlocking with the key.

Security Functions

Locking

Locking the vehicle with the ignition key, if the security door locking function is enabled, or with the remote transmitter activates the security system.

Unlocking the vehicle with the ignition key if the security door locking function is enabled, or with the remote transmitter, disarms the security system.

Two Stage Unlocking

If two stage locking is enabled, one press of the remote transmitter unlocks the driver door and fades up the interior lights. A second press unlocks the passenger door.

Remote Convenience Features

All remote features require that the key not be in the ignition (key not-in-ignition switch inactive).

Remote Headlamp

If remote headlamps are enabled, one press of the remote transmitter headlamp button activates the headlamps for 25 seconds.

Remote Trunk Release

If remote trunk release is enabled, one press of the trunk release button activates the trunk release solenoid.

Remote Panic Alarm

If remote panic alarm is enabled, three presses of the remote transmitter headlamp button within 3 seconds disarms and unlocks the vehicle, and full alarm is activated for one cycle. The alarm is canceled by turning the ignition switch to position I or II.

Security receiver shutdown

To reduce SLCM quiescent drain, the transmitter receiver portion of the security system will shut down 28 days after the body systems enter the sleep state. Any body systems activity, such as unlocking the vehicle with the key, will reactivate the receiver.

Anti-Theft System

Once armed any of the following circumstances will create a full alarm state and the sounder will operate (if fitted):

- Opening a door (after seven seconds)
- Opening the trunk with the key (after seven seconds)
- If the ignition key is turned to position I
- Pressing the key-ring transmitter headlamp button three times - Panic Alarm
- Opening the hood (except X308)

Error Tone

The sounder gives a short, high-pitched warble if an attempt is made to secure the vehicle and one of the following conditions is present:

- The trunk is not closed when an attempt is made to arm the security system
- The key is in the ignition switch when a transmitter button is pressed
- If there is a failure within the alarm system the error tone will sound when the vehicle is disarmed
- If any door or the hood is open when an attempt to arm the security system is made.

Audible Signals

An audible signal will sound when:

- The Valet switch is pressed with the trunk closed, signifying that valet mode is active
- In Valet mode and the interior trunk release switch is pressed
- Opening a door when security is armed (door unlock warning and audible ticking).

Active Arming

Active arming, arm on central lock and key barrel arm are programmable features. If doors, hood, or trunk are closed, the key is not in the ignition and active arming is enabled, the security system can be armed by either the key barrel or remote transmitter. Arming will be prevented if door, hood or trunk lid are open and/or the key is in the ignition; an error tone will sound.

Arming when Centrally Locked

The vehicle will arm when it is centrally locked via the remote transmitter or from the key barrel. If a door, hood or the trunk lid is open an error tone is emitted. On arming the direction indicators give a short flash and a single audible chirp will be emitted, if so programmed. The status LED in the gear selector surround will illuminate and then flash to indicate perimeter sensing. If deadlock and arming occur at the same time then the direction indicators will give a long flash and a second audible chirp.

Active Disarming

The anti-theft system will be disarmed and the alarm stopped if the remote transmitter is used.

Arming and Disarming from the Key Barrel

To arm, the key is turned to the unlocked position and then to the locked position within 3 seconds.

Key Transponder Module (KTM)

The key transponder module forms an integral part of the body system immobilization and security functions. The module is not directly connected to the multiplex network although the functionality requires several signals to be exchanged between the key transponder and BPM. If the key transponder is enabled the system will be disarmed when the key is inserted and the ignition is switched to position I. When disarming the direction indicators give two short flashes and two audible chirps will be heard. The status LED will also be switched off. The engine immobilizer ensures the engine can only be started using a valid ignition key.

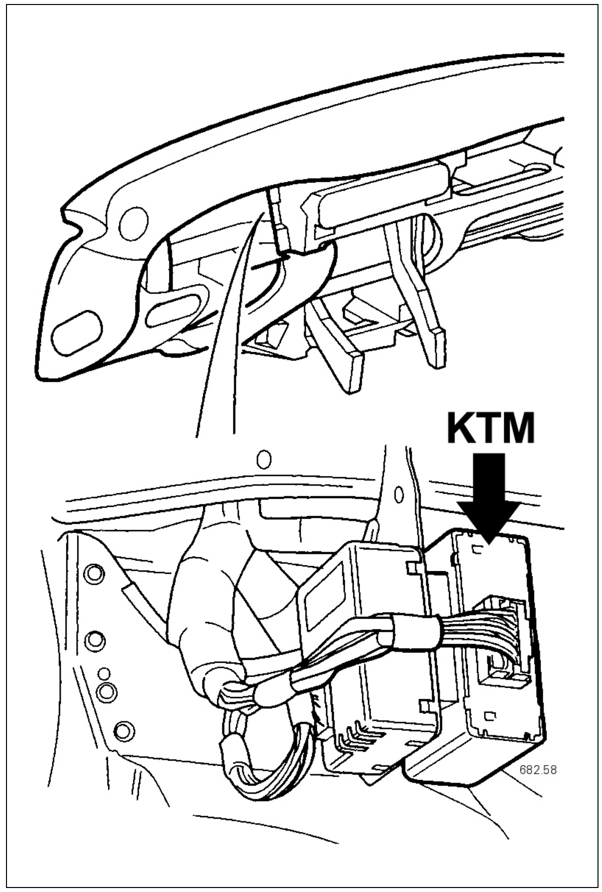


Fig. 163 Key Transponder Module: X308

Passive Arming (Vehicles with KTM)

Engine cranking and starting are controlled by the ignition switch, ECM, BPM, P/N signal, key transponder module, ignition key reader exciter in the ignition switch, ignition key transponder and the gear selector not-in-park switch.

Cranking and starting are accomplished in the following manner: Ignition key switched from the OFF position.

- KTM receives a signal from the ignition switch position I as the key is turned
- KTM energizes the reader/exciter, which causes the key transponder to broadcast its security code
- If the key transponder code matches the programmed KTM code, the KTM outputs an OK TO START signal to the ECM via a serial data link
- ECM receives OK TO START signal and transmission P/N signal (hard wired from transmission), and enables fueling and ignition
- ECM outputs a SECURITY ACKNOWLEDGE signal to the BPM via a serial data link
- BPM receives a park signal from the gear selector not-in-park switch and enables cranking if the security system has been disarmed

- Ignition position III crank signal is received by the BPM
- BPM grounds starter relay coil to energized starter motor
- ECM receives starter relay coil signal and sets engine starting values

Ignition Key Transponder Programming Using WDS

If the KTM is replaced, all keys must be programmed at the same time. No more than 5 keys can be programmed to any one vehicle. If only the ECM is replaced, key transponder programming is not necessary.

- Ensure all of the vehicle's keys are available for this procedure. No more than 5 keys can be programmed to one vehicle.
- Load the latest software for the vehicle into WDS.
- Access Vehicle Setup.
- Select Security System Setup.
- Select Program New Transponders.
- Ensure that only the key being programmed is in the ignition. (Remove key from a ring with other keys. If other Jaguar keys are near the reader exciter, they may also be detected, which will cause the KTM to interpret this condition as an invalid signal.)

Vehicles without Key Transponder Module (KTM)

Engine cranking and starting are controlled by the ignition switch, ECM, BPM, transmission rotary switch P/N switch and the gear selector not-in-park switch.

Cranking and starting are accomplished in the following manner:

Ignition switch to position II

- Ignition position II and transmission P/N signal (hard wired) are received by the ECM
- ECM enables fueling and ignition and outputs a SECURITY ACKNOWLEDGE signal via a serial data link to the BPM
- BPM receives a park signal from the gear selector not-in-park switch and enables cranking if the security system has been disarmed

Ignition switch to position III (CRANK)

- Ignition position III crank signal received by BPM
- BPM grounds starter relay coil to energized starter motor
- ECM receives starter relay coil signal and sets engine starting values

IMMOBILIZER SYSTEM: X103, X105

The immobilizer system on the X103 has been extensively modified. The KTM system continues to be used, but the system also shares some system operation and architecture with the Passive Anti-Theft System (PATS) used on the X100 and X202 models.

The immobilizer function on the X103 is integrated between the Key Transponder Module (KTM), the Body Processor Module (BPM), the Instrument Cluster (IC) and the Engine Control Module (ECM). In order for the vehicle engine to crank and start the KTM must have read a valid key and the correct information flow must have occurred between the BPM, IC and the ECM.

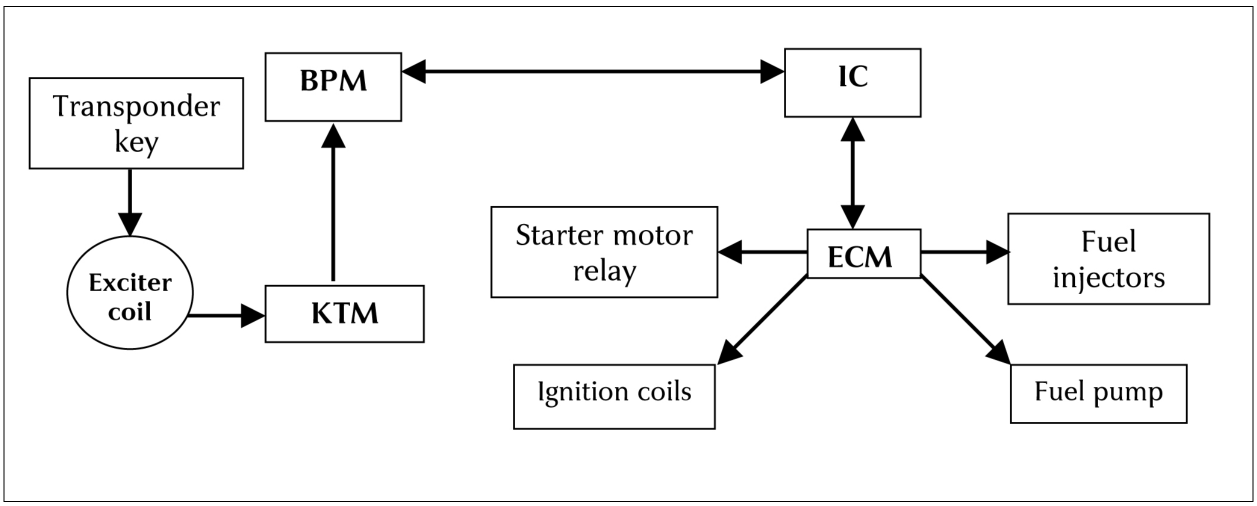


Fig. 164   Immobilizer System: X103

System Functionality

The immobilizer system prevents an unauthorized attempt to start the engine. The Key Transponder Module (KTM) transmits a valid key status only after an authentic data communication has been performed between the KTM and the transponder key.

When the key is turned to the Aux ignition position, the KTM energizes the coil, which in turn starts a data transfer with the transponder key. If the code received matches a code stored in the KTM EEPROM, the KTM will perform a challenge/response routine with the key to determine its authenticity. Once the KTM has authenticated the key code received, it will send a "Key Valid" message to the BPM via the dedicated ISO Data link. If the key code does not match one stored in the KTM memory a "Key Invalid" message will be sent to the BPM.

The BPM will transmit the SCP – key valid message containing a unique 3 byte number to the instrument cluster, the cluster upon receipt of this message will compare the data received against the unique number stored in its memory. If the comparison matches the instrument cluster will set a flag to confirm valid key received. If the comparison does not match the instrument cluster will set this flag to Invalid.

If the key is turned to the ignition Run position, the instrument cluster will start the CAN data exchange and start transmitting the idle status. If the key status is valid, and the subsequent challenge/response is verified by the ECM, the ECM will allow the engine to start. Otherwise, starting of the engine is disabled. The ECM controls the following outputs:

- Starter relay
- Fuel injectors
- Ignition coils
- Fuel pump

The ECM will disable the fuel injectors, ignition coils, fuel pump drive and starter if any of the following conditions apply:

- A theft signal has been received from the IC, i.e. the key code has not been received/code does not match.
- A challenge code has been transmitted to the IC but no response code has been received.
- A challenge code has been transmitted to the IC and an incorrect response received.

If any of the above cases apply, the ECM will log DTC P1260. This DTC is further defined by sub-codes. The sub codes are accessed through freeze frame data. Additionally the IC will log DTCs if the failure was a result of the key transponder exchange.

Immobilizer System Diagnosis

- The most regular occurrence for failing to crank is due to the Park & Neutral start switches, that is, gearshift not in Park or Neutral. The starter relay configuration is as follows: low side of relay coil - switched directly from ECM (if conditions correct) high side of relay coil - direct from transmission P/N position.
- Other likely causes maybe that the CAN/SCP network is malfunctioning, i.e., the CAN circuit is open/short. This would mean that the IC/ECM or IC/BPM would be unable to communicate resulting in no authentication being performed to enable the ECM.
- Transponder key may not be programmed, or the KTM has not been taken out of build mode etc.

Engine Cranks but will not Start

- If the Engine is cranking it means that the ECM is enabled with respect to the immobilizer function. If the immobilizer had failed validation the ECM would not engage the starter. This could be confirmed by reading DTC from the IC and ECM.
- In this case, the fuel pump circuit should be verified. A fuel pump module, which is controlled by the ECM, supplies the fuel pump.
- In all cases of suspected immobilizer non-start issues, the most logical failure modes should be eliminated first.
- Check all relevant supplies and grounds to the KTM, BPM, IC and ECM, check that the starter relay has a permanent 12V supply, check that the relay has a 12V supply and ground across the coil while the ignition is in the crank position.

Instrument Cluster Related Concerns

Table 36 X103, X105

Mode of Operation/Fault	Ign Sw Position	DTC	LED Fault Code	Cause
Missing Key Status	Run/Start	U1147	N/A	The IC has not received the SCP key status msg. The IC will wait 1000mS after ACC ignition position prior to logging this DTC
Code does not match	Run/Start	U1003	N/A	Contained with-in the SCP - key status message is a unique number, the IC compares this number received with its own internal number – if they do not match the IC will log this DTC.
CAN – Challenge Response Error	Run/Start	U2510	N/A	The result of the challenge between the ECM and the IC has failed. This DTC is set after receiving the ECM status.
CAN –IC receives unexpected data from ECM	Run/Start	U2511	N/A	After sending the CAN valid key status, the IC expects the ECM to reflect Enabled. If the IC receives Disabled this DTC is logged.
CAN – Sequence Time Out	Run/Start	U1900	N/A	During the CAN challenge exchange the IC will initiate timers, if any of these timers expire this DTC will be logged.

Key Transponder Module Related Concerns

Table 37

Mode of Operation/Fault	Ign Sw Position	LED Fault Code	Cause
Transponder Not Programmed	ACC	N/A	The present transponder key/code cycled in the ignition does not match one that is stored in the KTM.
Exciter Coil	ACC		The exciter coil is O/C or S/C
Transponder Learn Mode	ACC		The attempted key learn has failed due to BPM being armed.

SECURITY: X350

Locking Functions

The central locking system employs single key access to the driver door, luggage compartment and ignition switch with the exception of the valet key which gives no access to the luggage compartment.

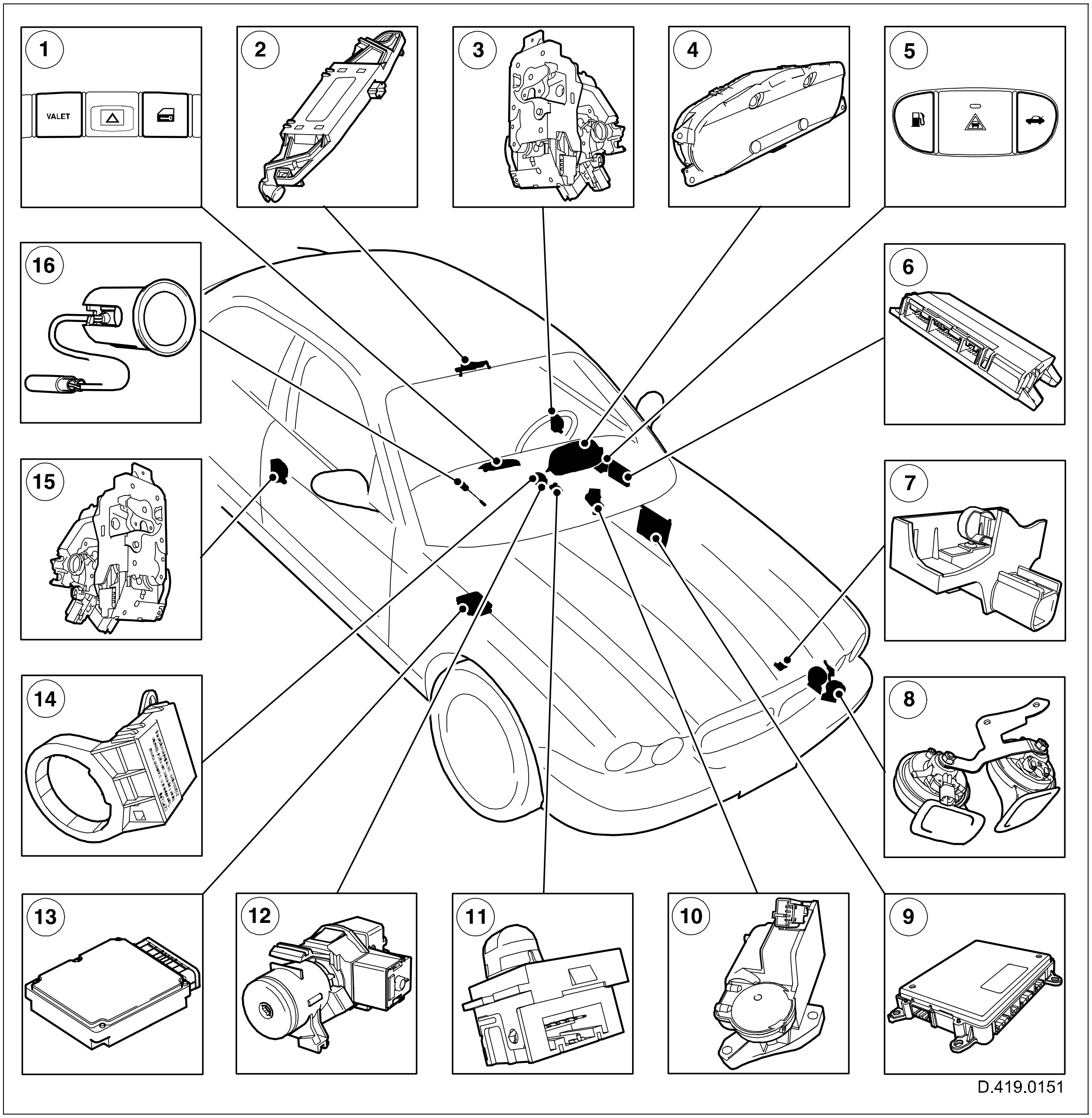


Fig. 165 Security and locking system front: X350

1. Valet Mode and Master Lock Switch
2. Intrusion Sensors (not for NAS)
3. Driver Door Ajar Switch
4. Instrument Cluster
5. Fuel Filler and Luggage Release Switch
6. Drivers Door Module
7. Hood Ajar Switch
8. Vehicle Horns
9. Front Electronics Module
10. Steering Column Lock Module (not for NAS)
11. Security LED

12. Ignition Switch
13. ECM
14. PATS Transceiver Coil
15. Passenger Door Ajar Switch
16. Glove Compartment Switch

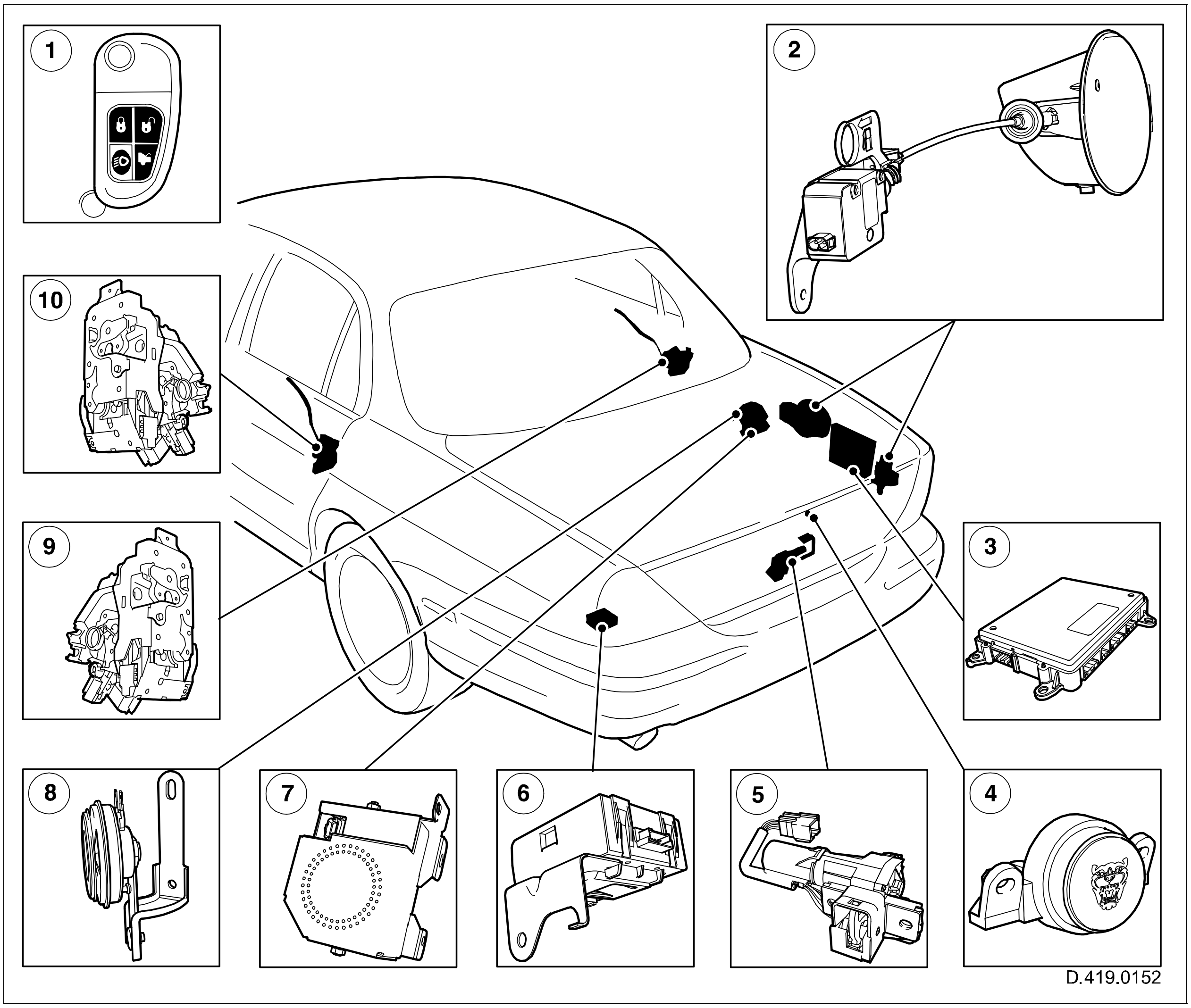


Fig. 166 Security and locking system rear: X350

1. Integrated key transmitter
2. Fuel filler flap release assembly
3. Rear electronic module
4. Ext. luggage compartment lid release switch
5. Luggage compartment switch
6. Inclination sensor (Not NAS vehicles)
7. Battery backed sounder (Not NAS vehicles)
8. Passive sounder
9. RH rear door ajar switch
10. LH rear door ajar switch

Central Locking

The central locking locks all the doors so that they cannot be opened from outside the vehicle. The central locking feature can be activated when one of the following occurs, and all the doors are closed:

- The drivers door lock cylinder is rotated to the lock position
- The lock button on the remote keyhead is pressed once (key must be out of the ignition and doors, luggage compartment, and the hood must be closed)
- Interior locking paddles (driver and passenger front doors only)
- Central door locking switch, located on the fascia.

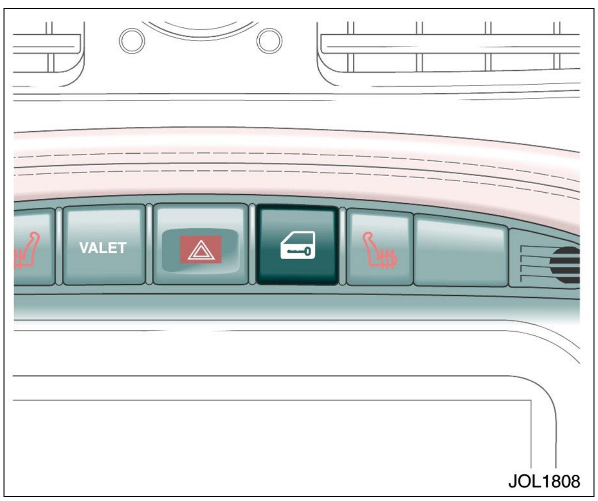


Fig. 167 Central locking switch: X350

Central unlocking

The central unlocking feature unlocks all of the doors upon any of the following requests:

1. Unlock from driver door lock cylinder
2. Unlock button on the integrated key
3. Unlock from either of the front interior handles or paddles
4. Unlock from the master locking (CDL) switch on the fascia

NOTE:

To unlock the rear doors, first the minor lever has to be activated to the unlock position, followed by the major lever to unlock the rear door.

Two stage unlocking

The two stage unlocking feature will unlock only the drivers door on an unlock request from either the drivers door lock cylinder (turned to the unlock position) or the unlock button on the integrated key. A further unlock request from either the integrated key or the lock cylinder (turned to the unlock position) will unlock all the remaining doors, unless another unlocking or locking action (from the master switch or interior paddles) has been requested.

NOTE:

The customer can change between central unlocking and single door unlocking (and back again when necessary) by pressing the lock and unlock buttons on the integrated key simultaneously for four seconds. Acknowledgement is provided by two flashes of the direction indicators (DI). This can also be achieved via the navigation unit selection menu no DI flashes will be given when changed via the navigation screen selection.

Drive away locking

With the ignition key at position II (RUN) and all the doors closed, all doors will lock when the gear selector is moved from position P or N. The gear selector has to be moved out of park or neutral and into a different gear position for greater than one second (should a front door be opened during this one second period it will cancel the drive away locking operation).

If the vehicle is stopped and a door is opened and closed, the doors will lock again when the gear selector is moved from position P or N (The gear selector has to be moved out of park or neutral and into a different gear position for greater than one second). If the vehicle is stopped and a door is opened and subsequently closed, but the gear selector is not moved from position P or N, the doors will remain unlocked.

All vehicles have the drive-away door-locking feature installed during manufacture. This feature can be disabled or reinstated by a Jaguar dealer if required.

Door unlock strategy

When in centrally locked and armed state, the vehicle can only be unlocked following a successful authentication between the DDM and REM.

Remote unlock press: When the remote unlock button is pressed the normal challenge communications take place with the Drivers Door Module (DDM) via a radio frequency. Once established as the correct key fob, the DDM will transmit an SCP message to the REM requesting to unlock all doors or the drivers door, the REM will challenge the unlock request for correct authentication.

If the subsequent challenge response matches the expected one calculated by the REM, all doors will be unlocked or only the drivers door.

Key barrel unlock: On detecting a key barrel unlock, the DDM will transmit an SCP message to the REM requesting to unlock all doors or the local door. The REM will challenge the unlock request for correct authentication.

If the subsequent challenge response matches the expected one calculated by the REM, all doors will be unlocked or only the drivers.

Remote luggage compartment Open: When the remote luggage compartment button is pressed the normal challenge communications take place with the Drivers Door Module (DDM) via a radio frequency. Once established as the correct key fob, the DDM will transmit an SCP message to the REM requesting to open the luggage compartment. The REM will challenge the unlock request for correct authentication.

If the subsequent challenge response matches the expected one calculated by the REM, the luggage compartment will be unlocked and opened, and the vehicle security system remains armed (perimeter sensing). If the remote unlock button is now pressed the sequence above would apply.

CAUTION:

If fitting a new DDM, FEM or REM, the modules must be configured using WDS to allow for communications and identification transfer to take place. Never exchange these modules from car to car.

System diagnostics: The doors will not be unlocked if any of the following conditions apply:

- The key fob is not recognized as valid by the DDM i.e. the transmitter code has not been authenticated
- A challenge code has been transmitted to the DDM but no response code has been received
- A challenge code has been transmitted to the DDM and an incorrect response received.

In all cases the REM or DDM will not log any DTC's until all retries have been completed.

Potential causes of the doors and luggage compartment not unlocking and opening

1. Power and Ground supplies to REM or DDM
2. Invalid transmitter code determined by the DDM. Transmitter not programmed (Radio frequency interference)
3. SCP network fault (no communication possible between DDM and REM)

Internal door handle

If the drivers door is ajar when the central locking feature is activated via the drivers door locking paddle, all the doors will lock and then centrally unlock.

If the passenger door is ajar when the central locking feature is activated via the passengers door locking paddle, all the doors will lock and then centrally unlock.

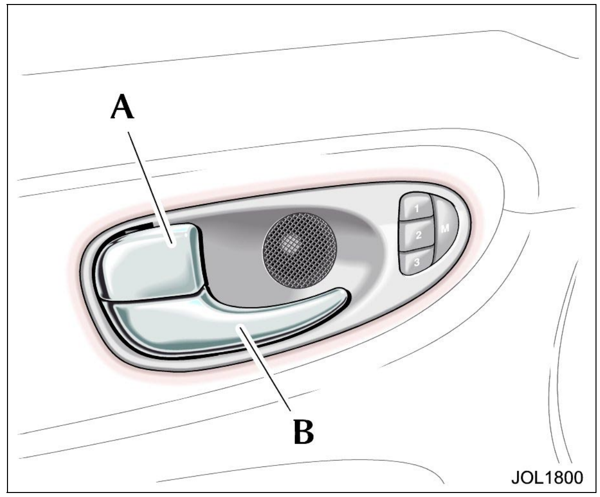


Fig. 168 Door paddles

A. Lock paddle (minor)
B. Open paddle (major)

If any of the rear doors are open when the central locking feature is activated via either of the locking paddles on the front doors, all the doors will lock and then centrally unlock. If however any of the rear doors are open when the rear door locking feature is activated via the rear door locking paddles, then that door will lock and remain locked, no central lock or unlock will occur.

If the hood or the luggage compartment is open when the central locking feature is activated via either of the locking paddles on the front doors, all the doors will lock.

Key barrel operation

If any of the doors are ajar when the central locking feature is activated via the drivers door lock cylinder (arm the security system), all the doors will lock and two audible warning chirps will be emitted (or the directional indicators will flash five times if enabled) to indicate that a door is open.

If the luggage compartment or hood is ajar, when the central locking feature is activated via the drivers door lock cylinder (arms the security system), all the doors will lock and two audible warning chirps will be emitted (or the directional indicators will flash five times if enabled) to indicate that the luggage compartment or hood is ajar.

If the key is in the ignition when the central locking feature is activated via the drivers door lock cylinder (the security system will not arm), all the doors will lock and two audible warning chirps will be emitted (or the directional indicators will flash five times if enabled) to indicate that the key is in the ignition.

Remote transmitter

If any of the doors are ajar when the central locking feature is activated via the remote lock button on the integrated key (the security system will not arm), the vehicle will not lock and two audible warning chirps will be emitted (or the directional indicators will flash five times if enabled) to indicate that a door is open.

If the luggage compartment or hood is ajar when the central locking feature is activated via the remote lock button on the integrated key (the security system will not arm), the vehicle will not lock and two audible warning chirps will be emitted (or the directional indicators will flash five times if enabled) to indicate that the luggage compartment or hood is ajar.

If the key is in the ignition when the central locking feature is activated via the remote lock button on the integrated key (the security system will not arm), the vehicle will not lock and two audible warning chirps will be emitted (or the directional indicators will flash five times if enabled) to indicate that the key is in the ignition.

Master lock switch

If any door is open and the master lock button is pressed to centrally lock the vehicle, no doors will lock. If the hood or luggage compartment is open and the master lock button is pressed to centrally lock the vehicle all the doors will lock. Note: the ignition key has to be in position I or II.

NOTE:

Operating the locks more than 15 times in 20 seconds will cause the central locking to be inhibited for 20 seconds. If required the locks may be operated individually during the 20 second waiting period.

Mirror fold function (auto mirror fold) (if enabled)

Fold in: Press remote lock button twice within three seconds. This can be for a double lock or at any time if the lock button is pressed twice within three seconds.

Fold out (if enabled): Any unlock command or pressing the mirror fold switch (the mirrors will not fold out when using the transmitter if the mirrors have been folded flat using the manual mirror fold switch).

Manual mirror fold

Fold in : Press mirror fold switch.

Fold out : Press mirror fold switch.

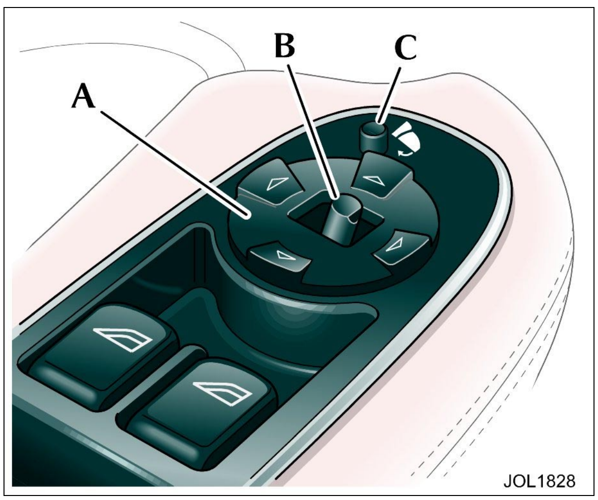


Fig. 169
A. Mirror adjust
B. Mirror select
C. Power fold switch

NOTE:

Auto mirror fold flat is available in all markets, but the default is to disable the function. A customer with the navigation screen can enable the function using the vehicle setting on the navigation screen.

A dealer must configure a vehicle without navigation.

Valet mode

The valet mode inhibits interior and exterior luggage compartment release switch operation and the glove box release switch operation. In addition, the green headed valet key cannot open the luggage compartment or glove box. Valet mode is active when the valet switch is pressed, a valet mode chime plus a valet mode message is displayed (message only displayed in ignition position RUN), when either the valet switch is pressed again or either the interior or exterior boot release or glove box switches are pressed.

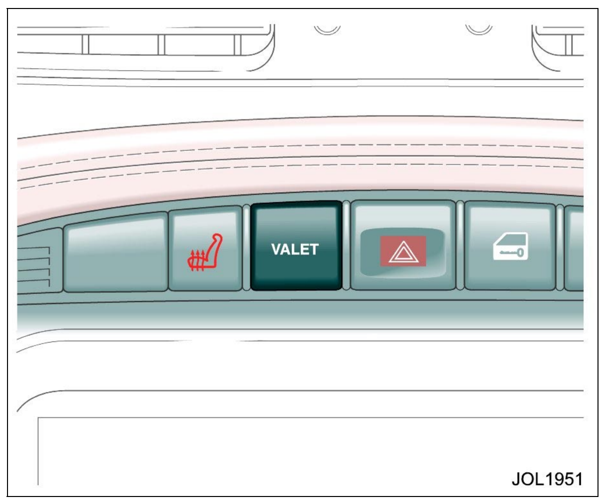


Fig. 170 Valet mode switch

Headlamp convenience

When the integrated key transmitter headlamp convenience button is pressed with the ignition key out, the headlamps will be driven until either 25 seconds has expired, or the headlamp convenience button is pressed again or the ignition key is inserted into the ignition barrel.

Panic button

Three presses in three seconds of the headlight convenience button on the integrated key will activate the panic alarm. To disable the panic alarm a valid key must be inserted into the ignition and turned to position II (RUN).

Global opening

Global opening of the windows and sunroof can be initiated from the driver's door key lock or the integrated key transmitter (with the key out of the ignition) or via the master lock switch.

To initiate global opening, the operator will have to turn the key in the driver's door lock to the 'Unlock' position and hold it for longer than two seconds, proportional control operation. The windows and sunroof will then begin their opening operation Note: the vehicle has to be in a disarmed state.

Remote global opening will be initiated from the integrated key when the 'unlock' button is pressed and held for longer than two seconds, one shot operation. To stop global opening before the windows or sunroof are fully open, press any button on the integrated key.

Global opening can be initiated from the master locking switch. To initiate global opening from the master locking switch, the operator must turn the key in the ignition switch to run position and press the master locking switch, holding it for longer than two seconds, proportional control operation. The doors will centrally unlock and the windows and sunroof will start to open. Global opening will cease if the switch is released.

Global closing

Global closing of windows and sunroof can be initiated from the driver's door lock cylinder or the integrated key transmitter (with the key out of the ignition) or the master lock switch. To initiate global closing, the operator will have to turn the key in the driver's door lock to the 'Lock' position and hold it for longer than two seconds, proportional control operation. The windows and sunroof will then begin their closing operation.

To stop global closing turn the key to either the neutral position or to the unlock position.

Remote global closing can be initiated from the integrated key when the 'lock' button is pressed and held for longer than two seconds, one shot operation. To stop global closing before the windows and sunroof are fully closed, press any button on the integrated key.

Global closing can be initiated from the master locking switch. To initiate global closing from the master locking switch, the operator will need to turn the key in the ignition to run and press the master locking switch, holding it for longer than two seconds, proportional control operation. The vehicle will centrally lock and the windows and sunroof will start to close. Global closing will cease if the switch is released.

For Global Close the windows may need to be initialized if a power disconnection has occurred.

Luggage Compartment Latch

The luggage compartment lid latch is new and features power closing, which is new to Jaguar.

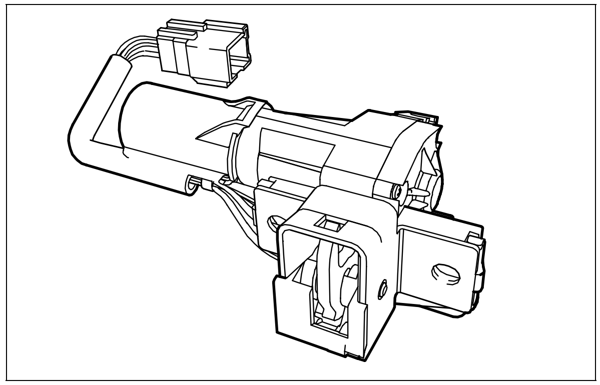


Fig. 171 Power closing luggage compartment latch assembly

The luggage compartment lid latch assembly contains the following:

- Latch mechanism
- Luggage Compartment latch release cable (from key barrel)
- Luggage Compartment entrapment release cable
- Rotary switch
- 12V motor
- Protective cover for the motor.

As the luggage compartment lid is closed the striker which is attached to the body will engage with the latch mechanism.

When the luggage compartment lid is 10 mm from the fully closed position, the latch will come into contact with the release plunger. At approximately 5 mm from the fully closed position, the latch will be mechanically latched and the internal rotary switch will be operated.

The rotary switch position signal is received by the REM which now applies 12V to the power closing motor causing the latch to be rotated to its limit of travel, thus fully closing the luggage compartment lid.

As the luggage compartment lid is closed the release plunger will become compressed.

When the luggage compartment lid release switch is operated, the REM applies 12V to the latch motor in the opposite direction which releases the latch mechanism. The compressed luggage compartment lid release plunger is sufficiently strong enough to raise the lid 10 mm from the fully closed position.

The preferred method of closing the luggage compartment lid is to close it to a height of 150 to 200 mm (6 to 8 in), and then allow its own weight to close itself. The inertia of the closing lid is high enough to initiate the power closing cycle as the latch engages with the striker. Closing the luggage compartment lid using this method will prevent unnecessary cosmetic damage to the surface of the lid (caused by the use of excessive force) and will also prevent it from being "slammed" shut.

The luggage compartment lid latch and motor is supplied as a complete assembly without the release cables.

CAUTION:

Applying excessive force to the luggage compartment lid when closing it, may cause damage to the surface of the lid.

The luggage compartment lid can be opened by operation of:

- The luggage compartment lid release button located in the instrument panel (A)
- The luggage compartment lid release button located on the security key fob (B)
- The luggage compartment lid release button located on the luggage compartment lid (D)
- The luggage compartment lid key barrel (C)
- The luggage compartment lid release cable inside the luggage compartment

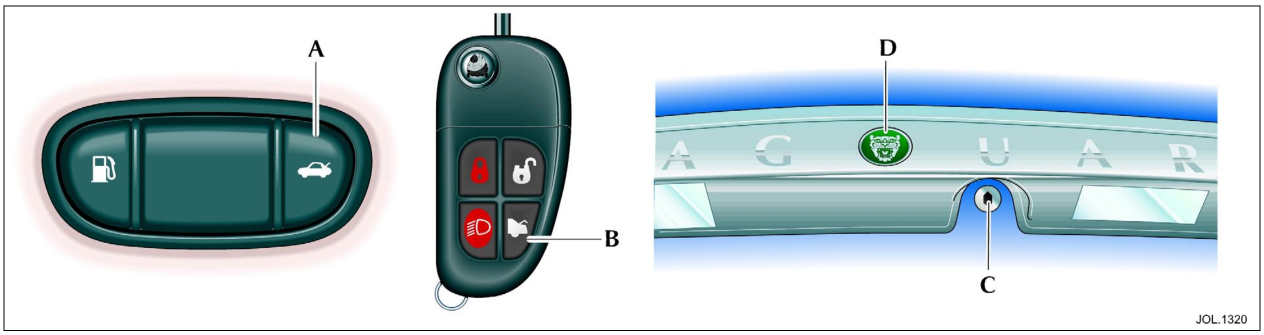


Fig. 172 Luggage Compartment Release

A. Fascia switchpack luggage compartment release
B. Key transmitter luggage compartment release button
C. Luggage compartment key cylinder lock
D. Luggage compartment release button

NOTE:

The luggage compartment lid entrapment release cable (Federal requirement on all models) fitting is angled at 15°. It is important that the cable is installed with the cable angled towards the latch assembly.

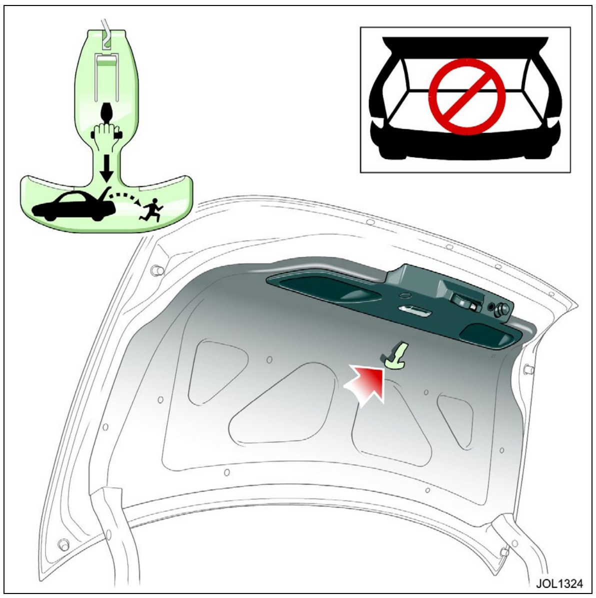


Fig. 173 Internal trunk release (all models)

NOTE:

The luggage compartment lid latch cannot be operated when the valet key is used.

CAUTION:

When installing the luggage compartment lid latch assembly it is important to use the correct fixing bolts. If the right hand fixing bolt is too long then the gearbox of the power closing motor assembly will be damaged.

Glove Box

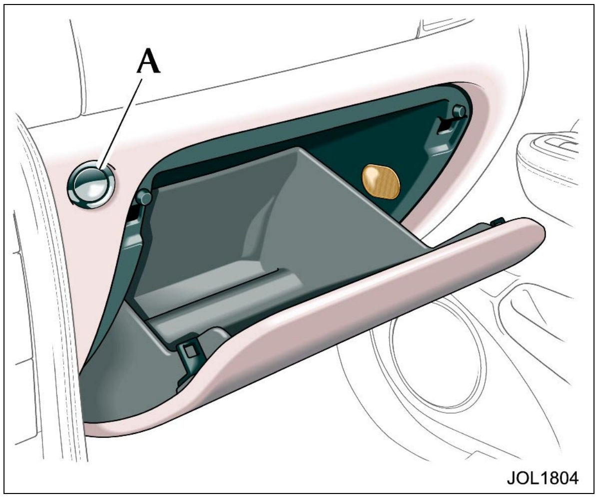


Fig. 174
A. Glove box open button

The glove box door has no release handle, it is opened automatically when the release switch (A) is operated. The release switch is located in the instrument panel between the glove box door and the center console, enabling easy access by the driver and front seat passenger.

The glove box latch is released by a 12V motor which is operated by the glove box release switch.

The motor and latch assembly is supplied as a complete module. The switch is a separate serviceable item.

The module has three connections:

- Pin 1 (Orange) – 12V supply from fuse F10 (10A) from PJB
- Pin 2 (Black) – ground
- Pin 3 (Green/Blue) – Unlock ground from FEM

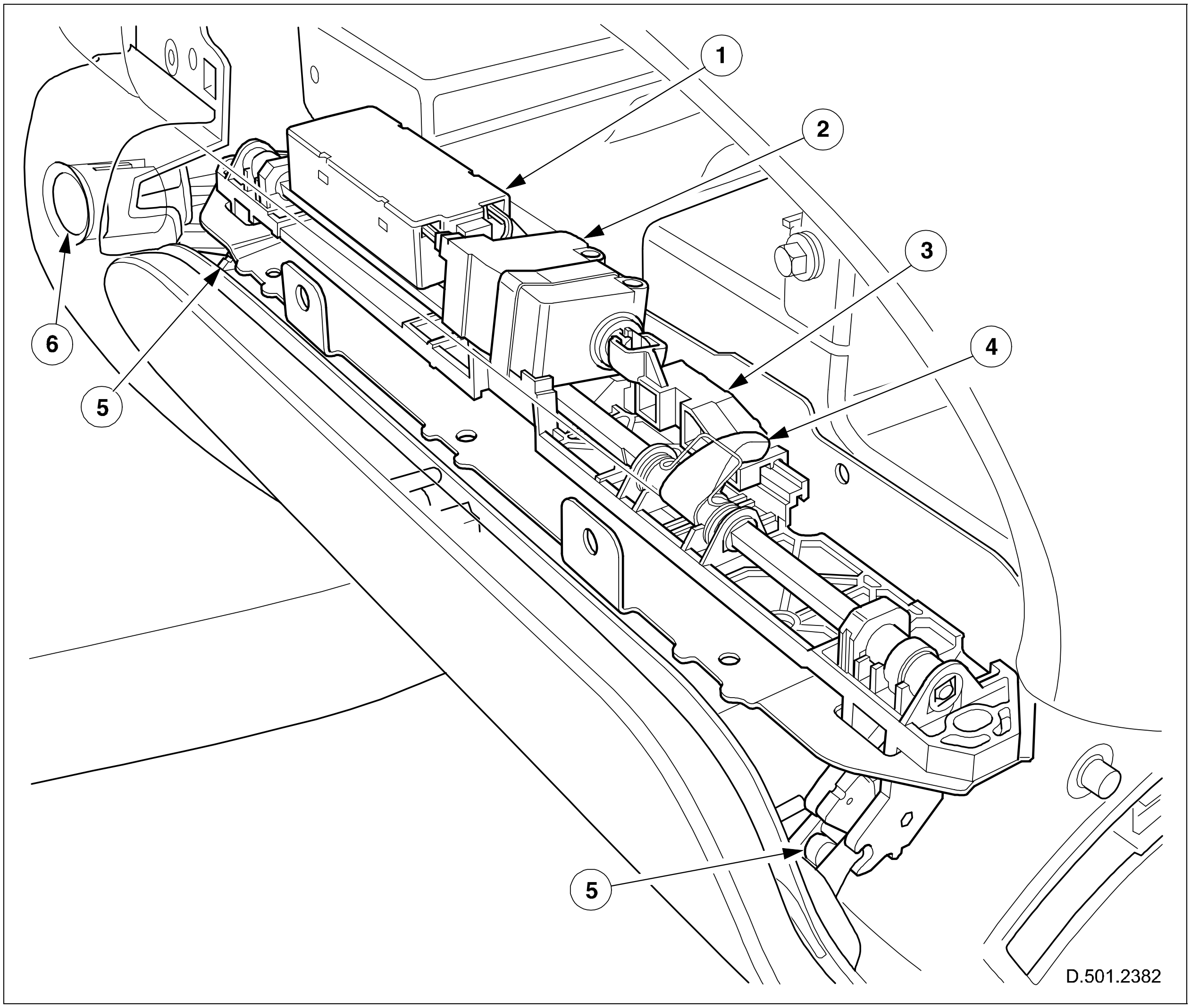


Fig. 175 Glove compartment door release mechanism

1. Control electronics
2. Motor
3. Actuating slide
4. Release lever
5. Latch
6. Switch

Glovebox Operation

With the ignition key in the ignition switch, operating the glove box release switch will supply a ground signal to the FEM. The FEM will then supply a ground to the glove box latch motor for two seconds causing the motor to wind fully back to release the glove box latch. The glove box door will open automatically once the latch is released.

After the ground signal has been removed by the FEM the motor will then wind fully forward ready to latch the glove box when it is closed again.

The glove box release switch is deactivated immediately after setting the security system.

If the security system has not been set the glove box release switch is also deactivated:

- 40 minutes after removing the ignition key from the ignition switch (providing the door has not been opened and closed).
- 30 minutes after removing the ignition key from the ignition switch and opening and closing the driver's door.

NOTE:

The glove box latch cannot be operated when the vehicle is in valet mode.

Vehicle Alarm System

The security system is based around the Body system control modules.

The security system functionality is contained in the Front Electronic Module (FEM), Driver Door Module (DDM), Rear Electronic Module (REM), and the Instrument Cluster (IC).

- **The Rear Electronics Module (REM)** enables security and controls all peripheral devices such as passive siren (anti theft horn) for full alarm, rear direction indicators, tail lights. The REM also enables and disables passive arming and the panic function. The rear electronics module controls all locking functions for the passenger doors and controls the luggage compartment release operation. The REM also has the sense inputs from the FEM, DDM and the fuel filler flap actuator.
- The **Drivers Door Module (DDM)** houses the receiver module or receiver interface where required and controls all locking functions for the driver's door (i.e. central locking and two stage unlocking). The DDM has the configuration bits for remote global open, close, remote panic alarm, remote headlamp convenience, and remote two-stage unlock.
- **The Front Electronics Module (FEM)** controls various inputs, such as the hood input, valet switch, glove compartment, front DI, front lighting and interior lighting. Radio sense, front navigation screen sense for alarm triggers, interior boot release and fuel filler flap switch.
- **The Instrument Cluster (IC)** controls the security LED operation, Passive anti-theft (PATS).

The base perimeter alarm consists of:

- 4 doors, luggage compartment and hood ajar switches (all normally closed)
- Radio sense line
- FEM and DDM sense lines
- Valid key sense (communicated by the Immobilizer system)
- Vehicle horn and separate passive alarm horn
- Visual feedback from the Direction Indicators (DIs) on arm, disarm, alarm and error flashes
- Second press chirp - optional
- Arm and disarm chirp
- Security LED (located on the Instrument pack)
- Audible tone - Error tone
- Navigation screen sense line

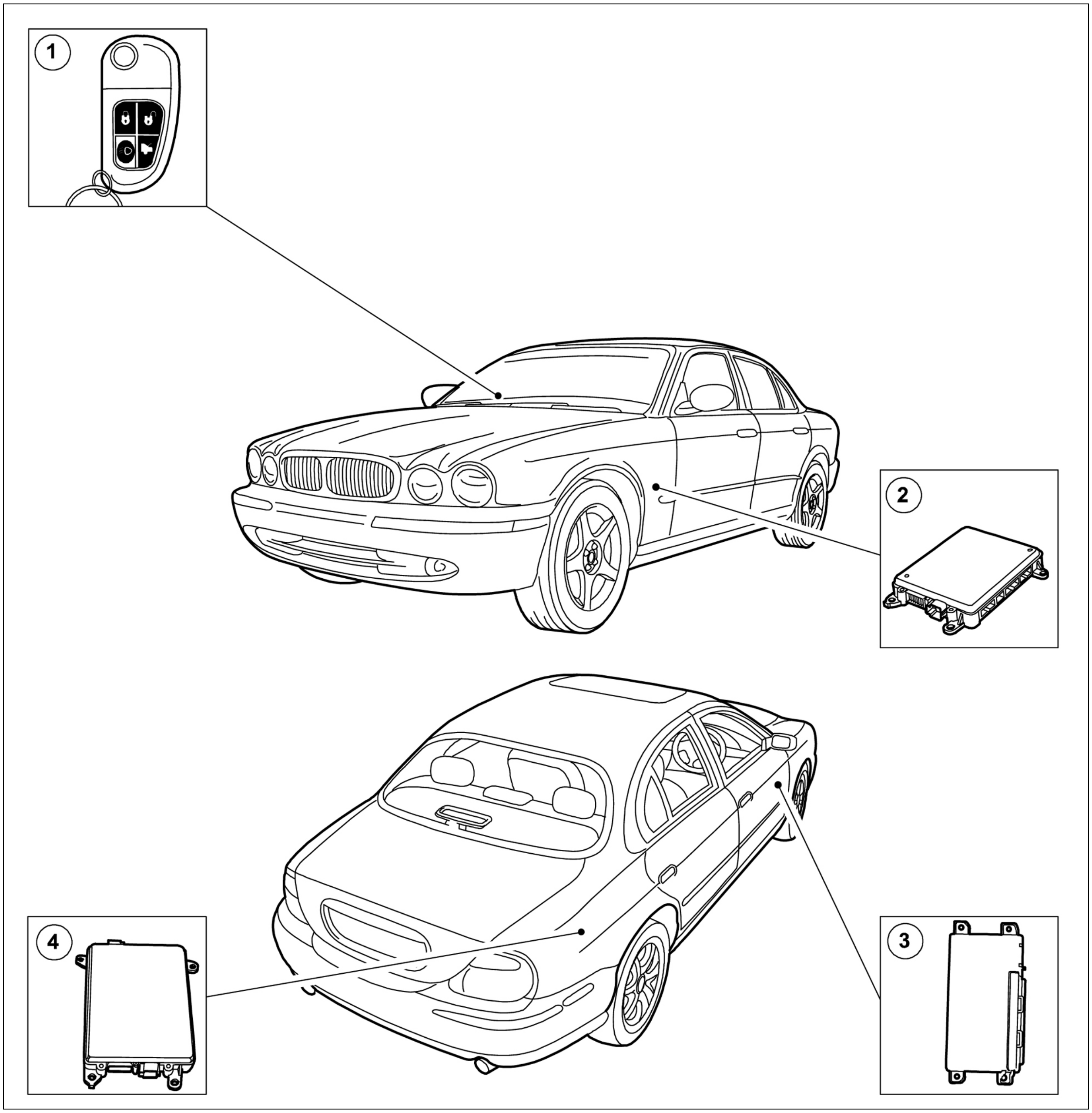


Fig. 176 Security system components: X350

1. Transmitter
2. Front Electronics Module (FEM)
3. Drivers Door Module (DDM)
4. Rear Electronics Module (REM)

Direction indicator unlock alerts

The exterior direction indicators (DI) give two flashes as unlocking takes place.

Security System Function

The anti-theft feature provides an audible and visual alarm at the exterior of the vehicle when the system is armed. When unauthorized access to the vehicle via the doors, hood or luggage compartment is detected, the radio is removed, or the ignition transitions to run or start without a valid PATS key, a full alarm will be generated. The visual alarm consists of the vehicle's exterior side and tail flash with DI's.

The audible alarm consists of the vehicle horn in all markets where an alarm is fitted.

Once triggered, the alarm will shut off automatically after 60 seconds. The system will then reset to an armed state and will trigger again if another trigger occurs and the repeat triggers will be activated.

Functionality of the alarm system includes such features as:

- Arming the security system
- Disarming the alarm system
- Alarm activation
- Passive arming (dealer programmable only)
- Luggage compartment disabled via the remote transmitter (transmitter lock operation)
- Passive anti-theft sounder
- Auto relock and arm - dealer option only

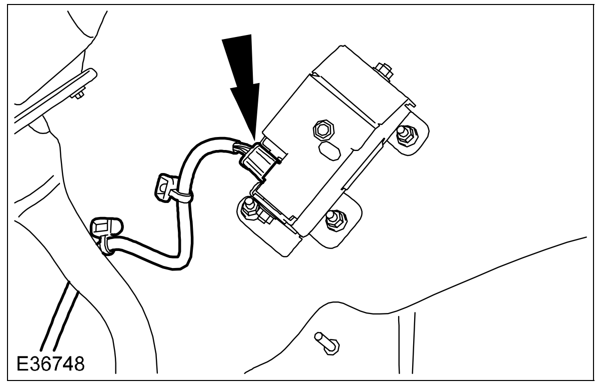


Fig. 177 Passive anti-theft sounder

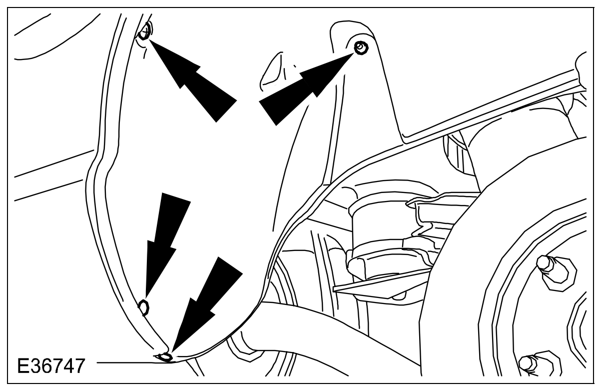


Fig. 178 Passive Anti theft sounder location

Auto-relocking (Dealer programmable)

This feature automatically centrally locks and arms the vehicle (if security is enabled) if the vehicle has been unlocked with the key transmitter (previously locked via transmitter or key barrel):

- And no door, hood or luggage compartment has been opened for 45 seconds or,
- If the ignition remains off for 45 seconds

Passive arming (Dealer programmable)

The vehicle alarm system will fully arm after 30 seconds if:

- No door, hood or luggage compartment has been opened for 30 seconds or,
- If the ignition remains off for 30 seconds

Keys

Vehicles are supplied with three keys; two integrated transmitter keys and one green-headed valet key.

Integrated transmitter key

The integrated transmitter key is comprised of the key body, which is integrated with a remote transmitter. The key operates all the locks on the vehicle.

The integrated transmitter key remote control is operational when the key is removed from the ignition. The remote control feature allows the customer to activate a number of vehicle features remotely, including:

- Unlocking the vehicle doors (single or central unlock).
- Locking the vehicle doors (central locking).
- Trunk lid release.
- Panic button.
- Headlight convenience feature.

Green-headed valet key

The green-headed valet key is not integrated with a remote transmitter. The key operates the driver's door lock and the ignition switch, but does not operate the luggage compartment lock.

Black-headed key

The black-headed key is not integrated with a remote transmitter, but it does operate all the locks and the ignition switch on the vehicle.

NOTE:

The black-headed key is not supplied with the vehicle.

Key number label

The key number is recorded on an adhesive label, which is affixed to the rear of the integrated transmitter keys. It is important that this label is removed from the keys and affixed in the space provided, in the service/warranty handbook.

Master locking switch (Central Door Locking CDL)

The master switch can be used to prevent uninvited entry when the vehicle is stationary, e.g. at road junctions or traffic lights. With the ignition switch in either position I (ACC) or II (RUN) and all the doors closed and unlocked, one press of the switch will lock all of the doors and the luggage compartment. If the vehicle is unlocked, press and hold the switch for more than two seconds to centrally lock the vehicle and close all the windows and sunroof (if fitted). Releasing the switch will halt the operation of the windows and sunroof (if fitted).

If the vehicle is locked, press and hold the switch for more than two seconds to unlock the vehicle and open all of the windows and sunroof (if fitted). Releasing the switch will halt the operation of the windows and sunroof (if fitted).

NOTE:

All windows must be initialized for this function to operate.

If the central locking switch is pressed when the ignition switch is not in position I (ACC) or II (RUN) the security systems tilt and intrusion sensors (if fitted) will not operate for one arming period. The security LED will flash for 5 seconds to indicate that this has occurred.

Error audible signal (Dealer programmable)

Two audible signals will be heard from the passive horn whenever the following conditions are present:

- If any door is open when an attempt is made to lock the vehicle
- The luggage compartment or the hood is not properly closed when an attempt is made to lock the vehicle
- A key is present in the ignition switch and an attempt is made to lock the vehicle.

Error flash signal (Dealer programmable)

If the direction indicator flash option is enabled then the error audible signal should be disabled.

The direction indicators will flash five times whenever one of the following conditions apply:

- If any door is open when an attempt is made to lock the vehicle
- The luggage compartment or the hood is not properly closed when an attempt is made to lock the vehicle
- A key is present in the ignition switch and an attempt is made to lock the vehicle

Audible signals

An audible signal will sound when:

- The 'Valet' switch is pressed with the luggage compartment closed
- The vehicle is in 'Valet mode' and the interior/exterior luggage compartment release button, or glove compartment switch is pressed.

Remote transmitter and receiver frequencies

- 315 MHz

Programming new radio frequency transmitters

Up to eight keys (transponders) can be programmed to the vehicle of which up to five can be remote locking key fobs.

There are two methods of programming transmitters:

- Manual method
- Using WDS

Garage door opener transceiver

The garage door opener transceiver (where fitted) is located in the roof console. The transceiver can be programmed to transmit the radio frequencies of up to three different transmitters used to activate garage doors, gates, home lighting, security systems, or other radio frequency operated devices.

Memory recall using integrated key

The integrated key will recall a memory position when the unlock button is pressed when set as follows:

1. Adjust the seat, steering column, pedals and exterior view mirrors to the desired position.
2. With the ignition key in the ignition, press the memory set button (M). The red LED will illuminate for a five second period.
3. Press memory button 1, 2 and 3, upon which a chime is heard. Press any button on the integrated key, a further confirmation chime is heard. All button presses must occur while the red LED is illuminated.
4. Repeat for the other integrated key using the remaining memory buttons.

To cancel the integrated key memory recall:

1. With ignition key in the ignition, press the memory set button (M), the red LED will illuminate for a five second period.
2. Press any integrated key button twice upon which two chimes will be heard. Integrated key button presses must occur within the five second LED illumination period.

Passive Anti-Theft System (PATS): X350

The Immobilizer system is standard on the new X350 range. The system is based around the Instrument Cluster (IC) and Engine Control Module (ECM). In brief the functionality comprises:

- Key in ignition
- Data transfer between Instrument Cluster and key transponder to confirm valid key
- Ignition turned to run position
- 'key valid' message sent to ECM from the Instrument Cluster
- Data transfer between the ECM and Instrument Cluster to confirm encrypted code correct
- Engine start

System components

- **Engine control module** - Mounted through the bulkhead on the passenger side. Controls the starter relay, fuel injectors, ignition coils and fuel pump driver module.
- **Instrument cluster** - Gateway for SCP and CAN. Drives the security LED, drives the PATS transceiver coil, communicates with the ECM and key transponder (stores PATS key codes).
- **Integrated key** - Contains PATS transponder with over 34 billion combinations of encrypted codes. In excess of 2000 key cut code combinations.
- **Transceiver coil** - The transceiver coil is effectively an antenna surrounding the ignition key barrel. It is controlled and read by the instrument cluster.

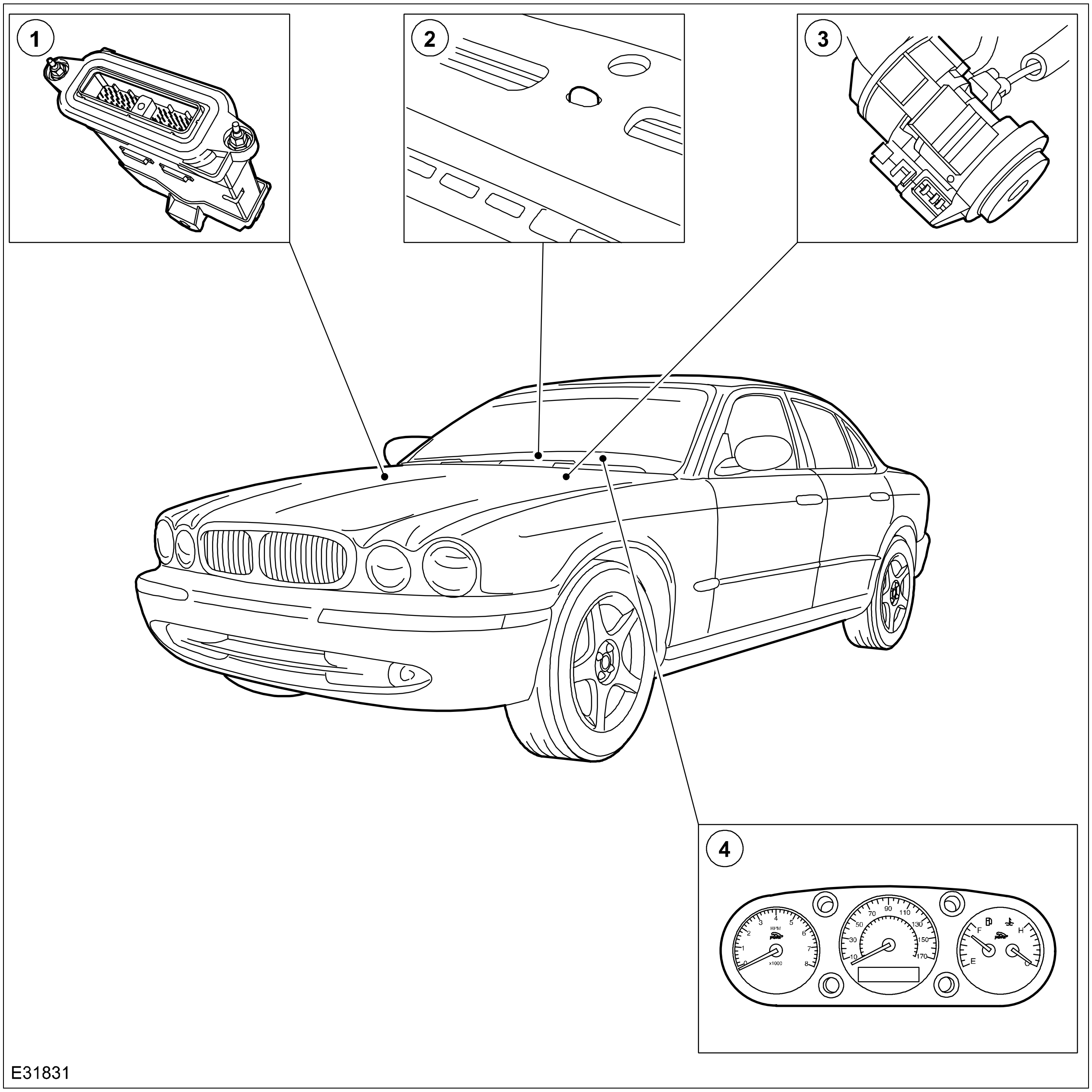


Fig. 179 PATS system components: X350

1. ECM
2. LED
3. PATS transceiver module
4. Instrument cluster

PATS Functionality

When a key is inserted in the ignition barrel, a hard-wired input is supplied to the Instrument Cluster (IC) from the key-in switch. This triggers the IC to read the PATS keycode stored in the key and compare it with one that has been previously stored. If the ignition key is subsequently turned to the run position the result of this comparison is transmitted to the ECM via the CAN network.

Assuming the key status message received from the IC is OK. the ECM will send a challenge code to the IC. The IC will, after encryption, send a response code. If this response code matches one that the ECM has calculated, the fuel injectors, ignition coils, fuel pump drive and starter will be enabled.

In addition, on the X350 the REM will also be required to issue a key status challenge/response message via the SCP.

If any of the following conditions apply. The ECM will disable the fuel injectors, ignition coils, fuel pump and starter:

- A theft signal has been received from the IC. i.e. The key code has not been authenticate
- A challenge code has been transmitted to the IC, but no response code has been received
- A challenge code has been transmitted to the IC and an incorrect response received.

If any of the above cases apply the ECM will log DTC P1260 and freeze frame data. Additionally the IC will log DTC's if the failure was a result of key read.

PATS System Diagnostics

Normal PATS operations are complete within 400 ms of the ignition switch transition from Off to Run or Start. Worst case for ECM communication problems will be <2 seconds. If PATS is not complete during the 2 seconds, the ECM will terminate PATS and await the next ignition run/start event. During this time, if a valid key is used the indicator will be in prove-out mode. PATS faults will be indicated via the LED as soon as possible and will terminate the LED prove-out. At Key Off, all previous flashing will cease and the perimeter theft system will control the LED when the vehicle is locked and armed.

Engine Fails To Crank

If a PATS fault is detected, the LED will flash for 60 seconds at 4Hz with a 50% duty cycle. At the end of this period, the LED will flash a two digit code. This code is repeated 10 times.

The most regular occurrence for failing to crank is due to the park and neutral start switches, i.e. gearshift not in park or neutral. The start circuit is as follows: low side of relay coil - switched directly from ECM (if conditions correct) high side of relay coil - direct from ignition start position.

Another likely cause of the engine failing to crank maybe that the CAN network is malfunctioning, i.e. the CAN circuit is open or short circuit. This would mean that the cluster and ECM would be unable to communicate resulting in no challenge being performed to enable the ECM.

Engine Cranks but will not Start

If the engine is cranking it means that the ECM is enabled with respect to PATS, if PATS was disabled the ECM would not engage the starter.

PATS operation can be confirmed by verifying the PATS LED prove out (illuminated solid for three seconds) or by reading DTC's from the IC and ECM.

If the PATS checks out as operating, the fuel pump circuit should be verified. The REM controls the fuel pump when commanded by the ECM.

In all cases of suspected PATS non-start issues, the most logical failure modes should be eliminated first.

Check all relevant supplies and grounds to the cluster and ECM.

Check that the starter relay has a permanent 12v supply.

Check that the relay has a 12v supply and ground across the coil whilst the ignition is in the crank position.

Table 38 PATS fault codes: X350

DTC	LED FAULT CODE	FAULT	WHEN LOGGED
B1681	11	Transceiver not connected (no diagnostic byte received)	Key read
B2103	12	Bad diagnostic byte received	Key read
B1600	13	Key problem. No code received or without transponder.	Key read
B1602	14	Key transceiver problem. Partial code received. Checksum error.	Key read
B1601	15	Keycode not stored in memory (also due to having 8 keycodes already stored in memory). Signature mismatch.	Key read and diagnostic test
U2511/U1900	16	Problem with CAN link (ECM verify data does not match key status - 00, 01, 80 or FF in data verify message). Or vehicle security system status message missing.	ECM CAN Comms.
B1213	21	Less than 2 keys programd in the system	Assembly or Dealer
B2141	22	No initialization after part replacement or EOL. No ECM ID	Assembly or Dealer
U2510	23	PATS control and target modules not configured. ECM ID does not match	Challenge response
B2431	13	Transponder programming failure	Key programming
B2492	None	key already programmed	Diagnostic test
N/A	None	Key erase	—

Manual process for programming additional PATS keys

To enter the programming process you will require all of the customer's keys (minimum of two). If there is only one available, a new key will be required. Because of this you can only add keys using WDS.

- Insert the 1st customer key and turn to run (position II) for a maximum of five seconds. Turn to off and remove key.
- Within 10 seconds of removing the 1st key insert the 2nd customer key and turn to run for a maximum of five seconds. Then turn to off and remove key.
- To program the 3rd key insert the new key and turn to run within 20 seconds of removing the 2nd key. Allow the PATS LED to prove out for the three seconds to confirm storage of the new key and then turn to off and remove it.

WDS security options

1. **Program new transponder:** (If a key is lost) This application will erase all present keys and program at least 2 new ones.
2. **Program additional transponder:** This will erase all keys stored apart from the 2 used to enter the routine.
3. **Program new keyfob transmitter:** For remote entry transmitter.
4. **Clear lost keyfob:** To program up to five transmitters.
5. **Immobilization set up** : This application should be used following the ECM, Cluster, REM, or the DDM being replaced.
6. **Last alarm causes:** Records the alarm causes.

SECURITY: X200

Locking Functions

The central door locking system incorporates the door latch assemblies and multiple SCP network modules and inputs.

Exterior inputs

The system can be locked/unlocked from the exterior by either the driver door key lock (barrel) switches or the remote transmitter. The DDCM incorporates the antenna and receiver for remote operation.

Interior inputs

The system can be centrally locked/unlocked from either the front driver or passenger door latches. Pressing/pulling the lock/unlock lever activates the lock status switches. The system will also lock/unlock automatically with the “drive away door locking” function.

All inputs from the door latches to the DDCM, the GECM, and the RECM are ground inputs.

Vehicle Locking and Unlocking

To lock the vehicle and set alarm:

- Press the lock button on the key-ring transmitter, or
- Put the key in the driver’s door lock, turn the key towards the rear of the vehicle and release. The turn signals will flash once, the security indicator will start flashing and, after 20 seconds, the alarm will be set. If a door, the hood or the trunk lid are open and an attempt is made to lock the vehicle, the turn signals will flash 5 times as a warning that the vehicle is not secure.

To unlock the vehicle and disarm the alarm system using a key-ring transmitter:

- Press the unlock button on the key-ring transmitter. This action unlocks, after two presses, all doors and trunk and turns on the interior lights for 20 seconds. The turn signals give two flashes as unlocking takes place.

To unlock the vehicle using a key:

- Put the key in the driver’s door lock, turn the key towards the front of the vehicle and release. NOTE: Unlocking with the key does not disarm the security system. After unlocking the vehicle with a key, if any door other than the driver’s door is opened, the vehicle will immediately sound the alarm.

Global closing/opening

- Using the key in the driver’s door, lock the vehicle and hold in this position to close all the windows (and sliding roof, if fitted).
- Press and hold the key-ring transmitter unlock button, or use the key to unlock the vehicle and hold in this position to open all the windows (and sliding roof, if fitted).

Internal door locking and unlocking

To centrally lock all doors, press the lever on the driver’s or front passenger’s door. To lock a rear door, press the lock lever. To unlock a front door, pull the release handle or the lever. To unlock a rear door, pull the lock lever. The driver’s or front passenger’s door lock lever will unlock all doors.

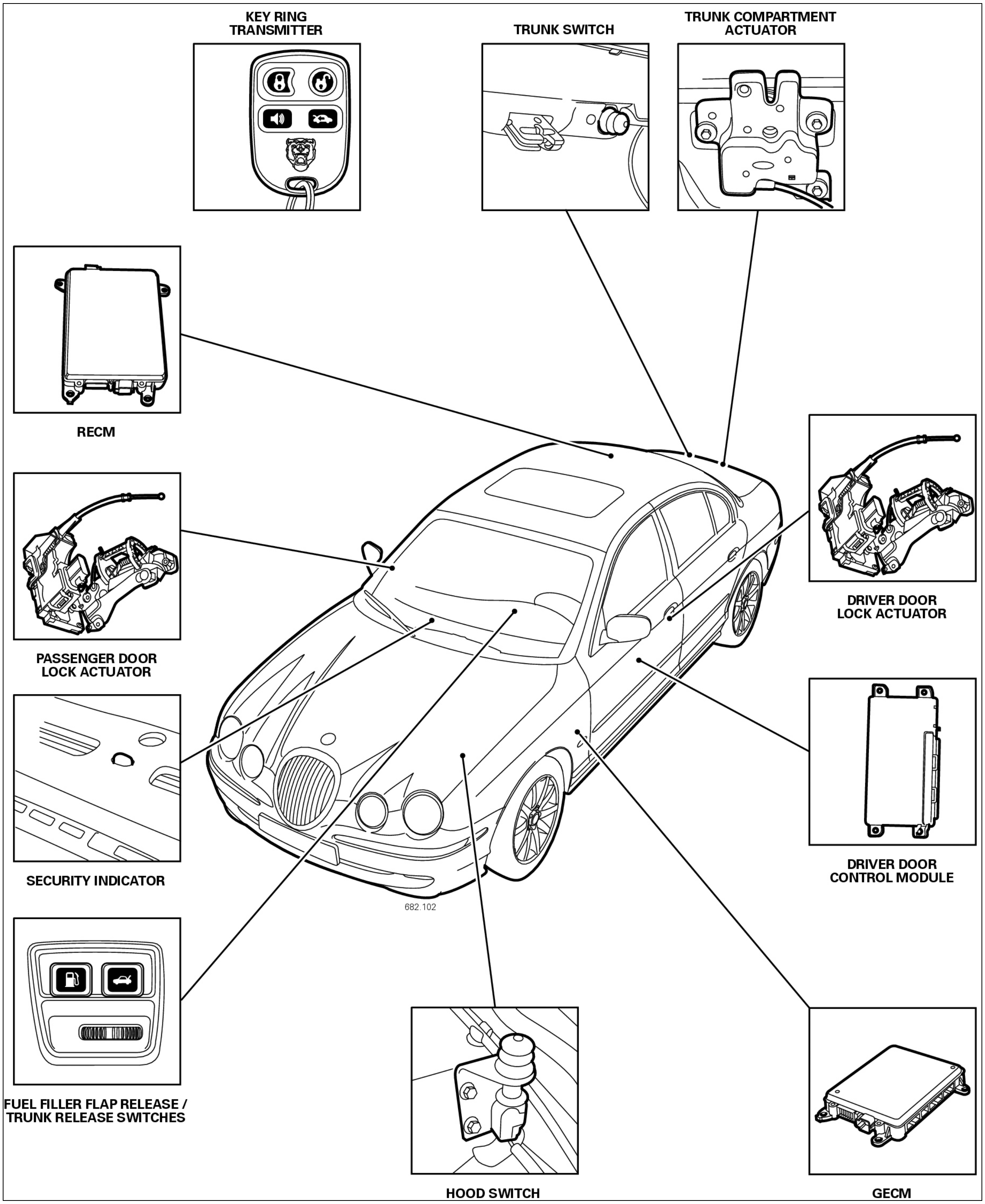


Fig. 180 Central Door Locking Components: X200

Vehicle Locking and Unlocking (Smart Locking)

If the driver's door is open and an attempt is made to lock the doors using the driver door interior locking lever, all doors will lock and the driver's door only, will then become unlocked. If the front passenger door locking lever is used to lock the doors then all doors will become locked and then unlocked. The vehicle can then be locked using the key in the driver's door lock or a key-ring transmitter.

Drive-away door locking

For this feature to operate, the ignition switch must be in position 'II', the gear selector lever moved out of the 'P' or 'N', and the vehicle moving forward at a speed above 3 mph (5 km/h).

The doors will remain locked, even when the vehicle is stopped unless the driver or front passenger unlocks a door. If a door is opened during a journey, the doors will automatically lock again when the vehicle starts to move. This feature can be disabled or reinstated using WDS.

Trunk locking/unlocking

To open the trunk:

- Press the trunk lid release switch on the fascia switch pack or,
- Press the trunk button on the key-ring transmitter or,
- With the vehicle unlocked, press the release button on the compartment lid.

NOTE:

An ignition key can be used to open the trunk lid release lock, (turn clockwise to release), but opening with the key when the vehicle is armed will cause the alarm to sound.

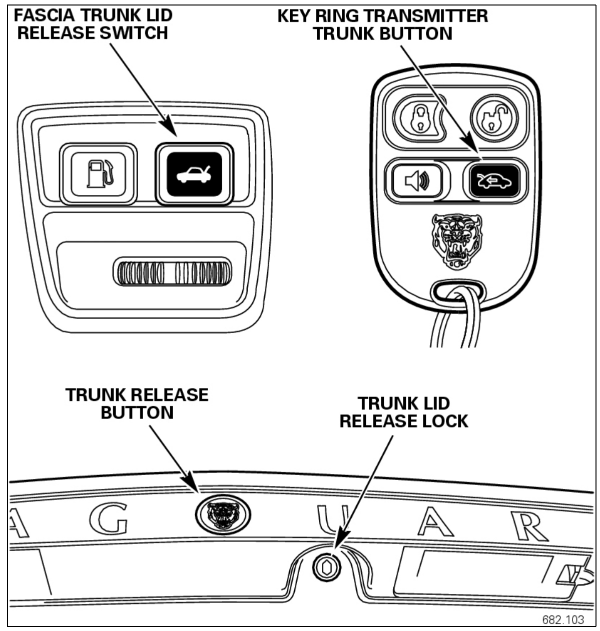


Fig. 181 Trunk Locking/Unlocking: X200

Use a transmitter, or place the key in the ignition and turn to position 'II', to turn the alarm off if it sounds as a result of opening with a key. If the vehicle alarm system is armed and the trunk is opened using the key-ring transmitter the alarm will not sound. The system will be rearmed when the lid is closed, provided the vehicle has not been disarmed. Neither the trunk lid release switch on the fascia switch pack nor the lid release button will operate when the vehicle is armed.

NOTE:

Refer to the appropriate electrical guide for this system.

Anti-Theft System

The anti-theft system is a vehicle perimeter security system separate from the passive anti-theft system (PATS). In addition to premier security, the system features limited internal component security monitoring. As with the central locking system, the security system incorporates multiple SCP network modules and inputs.

Battery reconnection

If the battery is disconnected, the alarm system will automatically re-arm as the battery is reconnected. Ensure that a key-ring transmitter or key is available to disarm the alarm system when reconnecting the battery.

Error Signal

The turn signals will flash 5 times whenever one of the following conditions is present:

- If any door is open when an attempt to ‘arm’ the security system is made.
- The trunk or the hood is not properly closed when an attempt to ‘arm’ the security system is made.

Full alarm

Once armed, any of the following circumstances will create a full alarm state, sound the horns and flash the turn signals:

- Opening a door, trunk lid (except with transmitter) or hood.
- Using a key in the ignition switch which is not programmed to the vehicle.

Panic Alarm

When in or near the vehicle, the alarm can be set off to deter a possible offender. For this feature to operate, the key must not be in the ignition switch. Pressing the panic button on the key-ring transmitter will activate the ‘Panic Alarm’. The Panic Alarm will sound for the normal full alarm period. Putting the key into the ignition switch and turning to position 'II' stops the alarm. The key-ring transmitter can be used to cancel the Panic Alarm by pressing either the panic button or the unlock button.

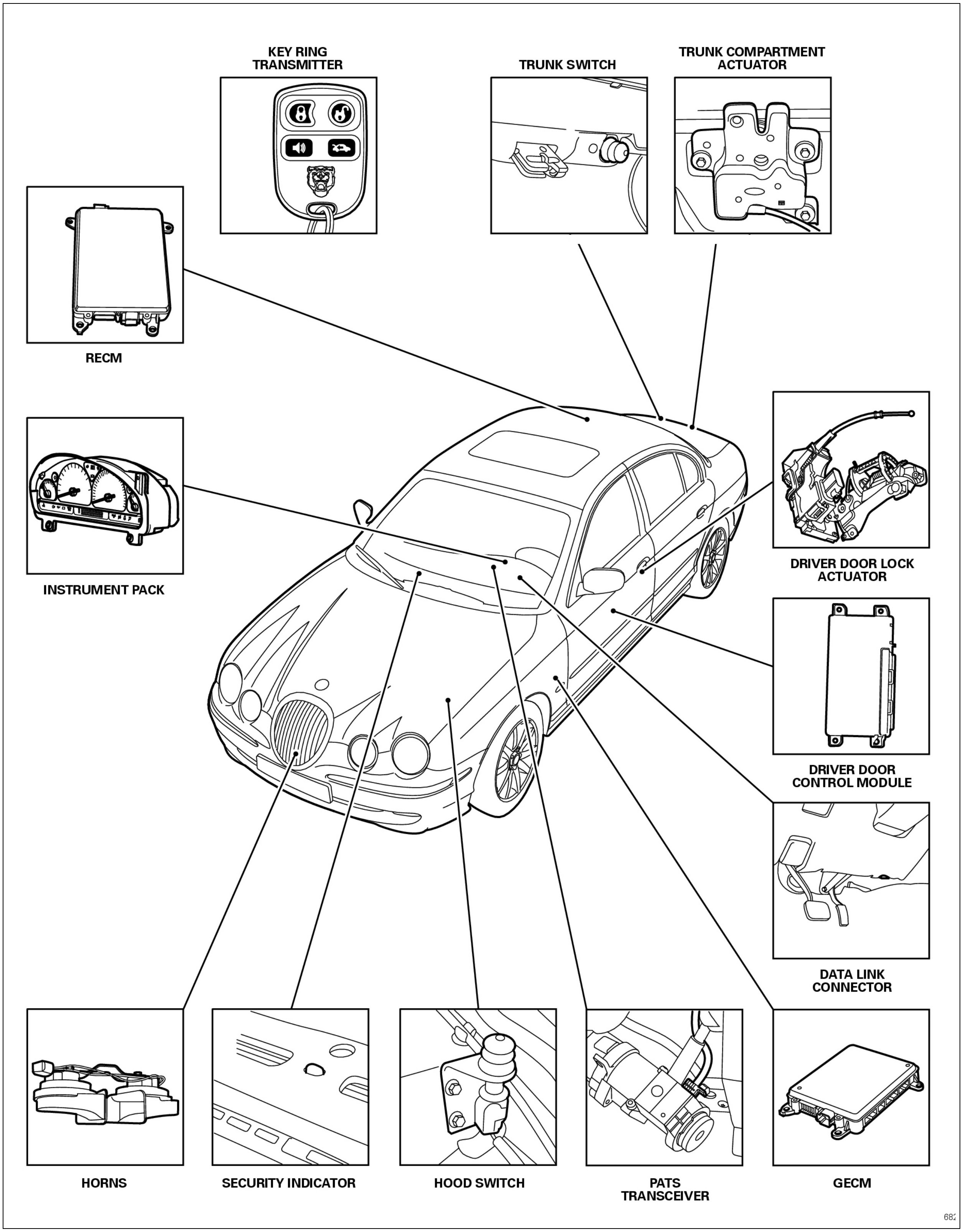


Fig. 182 Anti-Theft System Components: X200

The anti-theft system uses hardwired inputs to the DDCM, the GECM and the RECM for security monitoring. Communication between the control modules occurs on the SCP network.

DDCM Inputs

The DDCM receives the door latch ground inputs identical to the central locking system.

GECM Inputs

The GECM receives switched ground inputs from:

- the driver and passenger door latch door switches
- the hood switch.

In addition, the GECM monitors two components for “presence in the vehicle” (ground sensing):

- the radio presence by a dedicated hardwire ground sensing circuit
- the RECM presence by a dedicated hardwire ground sensing circuit.

If either of these components are removed from the vehicle while the alarm system is armed, the system will be activated.

RECM Inputs

The RECM receives switched ground inputs from:

- the LH and RH rear door latch door switches and
- the trunk switch.

Outputs

When the system is armed, the instrument pack activates the security indicator. When the alarm system is activated while armed:

- the GECM activates the horn circuit
- the GECM and the RECM activate the turn signal circuits

NOTE:

Refer to the appropriate electrical guide for this system.

Passive Anti-Theft System (PATS): X200

The Passive Anti-Theft Module integral with the instrument pack interfaces with the PATS Transceiver to deter vehicle theft.

If a valid ignition key is not read by the instrument pack (PATS) before the key is transitioned to ON, the vehicle will be immobilized from driving away.

Immobilization is accomplished in two ways:

- The instrument pack will not activate the starter relay, preventing engine cranking.
- The PCM will not enable fuel pump operation or fuel injection.

Instrument pack PATS communication to the transceiver is via a serial communication protocol. The PATS transceiver is grounded via the instrument pack. The instrument pack completes this circuit to ground to activate the starter relay.

PATS Communication to the PCM is accomplished via SCP.

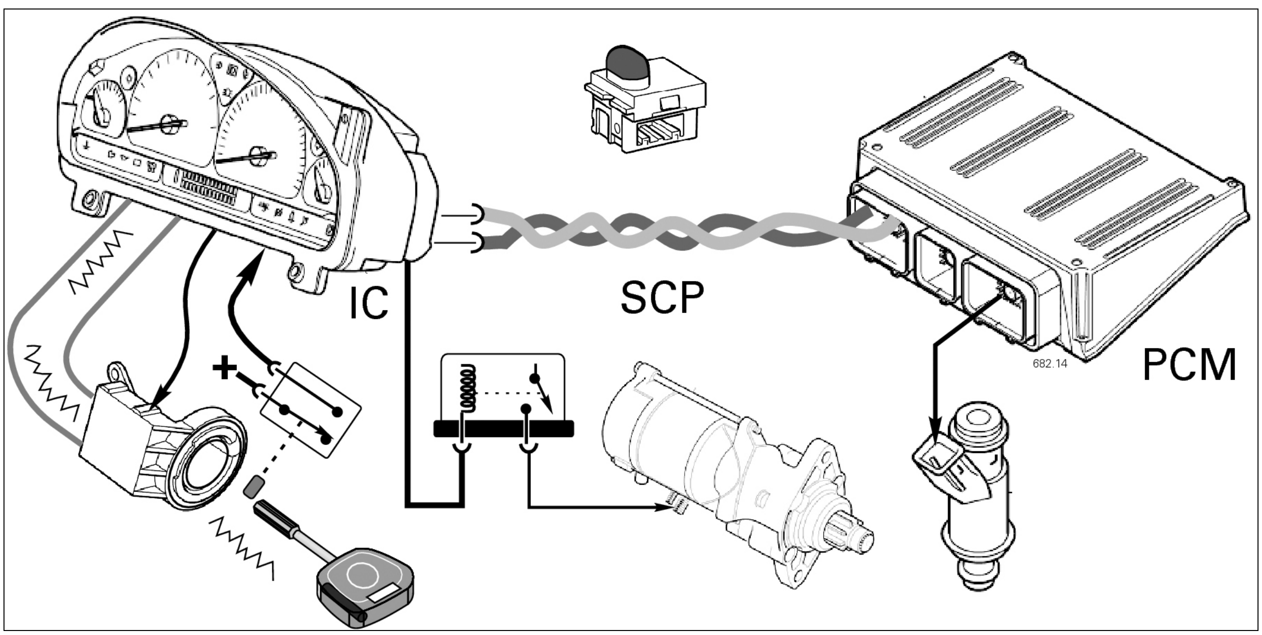


Fig. 183 Passive Anti-Theft System Components: X200

The Passive Anti-Theft System (PATS) function is split between the instrument pack and the PCM. In order for the engine to crank and start, the instrument pack must have read a valid ignition key code, and the correct information flow must have occurred between the instrument pack and the PCM.

Correct PATS operation can be determined by observing the security LED indicator "flash code". The security indicator, situated on top of the fascia, will also flash fault code information.

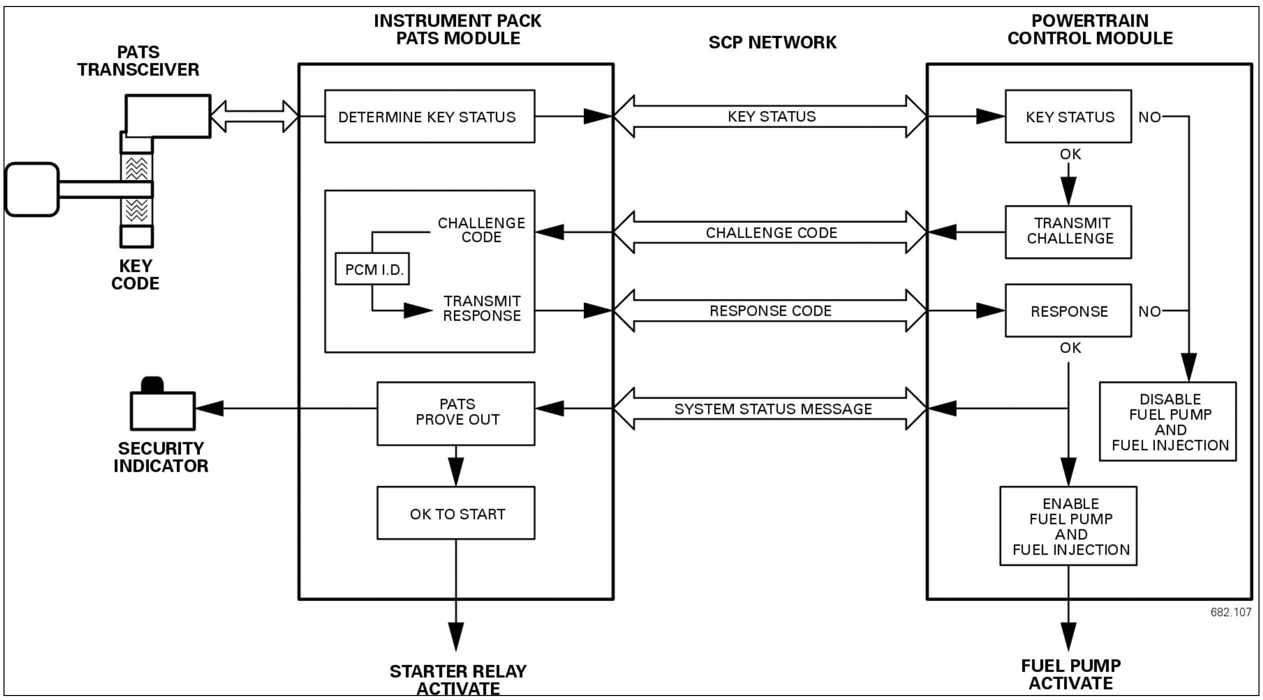


Fig. 184 Passive Anti-Theft System: X200

PATS Operation

When the driver inserts the ignition key into the ignition switch key barrel, the Key-In switch closes and applies B+ voltage to the instrument pack. This signal causes the instrument pack to read the PATS key transponder code stored in the ignition key and compare it with those stored in memory.

The result of this comparison is transmitted to the PCM via the SCP network. If the key code is OK, the PCM will send a challenge code to the instrument pack. If the correct response to the challenge code is received within one second, the PCM will enable fuel pump operation and fuel injection. Simultaneous with the PCM challenge, if the key code is OK, the instrument pack will complete the starter relay coil circuit to ground when the ignition switch is moved to position III (START).

The PCM will not enable fuel pump operation or fuel injection if any of the following conditions exist:

- The ignition key code is not recognized (theft signal).
- A response to a challenge code has not been received within one second.
- An incorrect response to a challenge code has been received.

If any of the three conditions occur, DTC P1260 will be flagged. Additionally, an incorrect challenge code response will cause the PCM to apply an anti-scan strategy whereby the PCM delays 20 seconds before accepting another challenge response from the instrument pack.

PATS Diagnostics

Correct PATS operation can be confirmed by observing the security indicator as the ignition key is inserted. The LED should illuminate for 3 seconds when the key is inserted and moved to position II (RUN), then switched OFF. This action will validate all PATS functions:

- The key transponder code matches the key code stored in memory.
- The challenge/response sequence between the instrument pack and the PCM has been successful.
- The fuel pump and fuel injection have been enabled.

Normal PATS communications are completed within 1.4 seconds after key-in or the ignition switch transition from 0 to II or III. If PCM communication problems exist, the time duration can be as long as 2 – 3 seconds and still provide a functional prove out.

If PATS faults are detected during the maximum 3 second period and a valid ignition key has been used, the security indicator will exit its prove out mode and start to flash. When the ignition key is moved to 0 (OFF), the flashing will terminate and control of the security indicator will shift to the vehicle security system.

PATS Faults

If a PATS fault is detected, the security indicator LED will flash for 60 seconds at 4 Hz with a 50% duty cycle. At the end of this period, the LED will flash a two digit flash code, repeated 10 times. As a general rule, flash codes numbered 15 or less will prevent engine cranking while codes numbered 16 and above result in the engine cranking but not starting (fuel pump and fuel injection disabled).

Flash Codes

Each digit of the two digit code is represented by a series of flashes followed by a slight pause. A longer pause indicates the end of the code. For example, flash code 21 is represented by: flash flash (pause) flash (longer pause)...repeat.

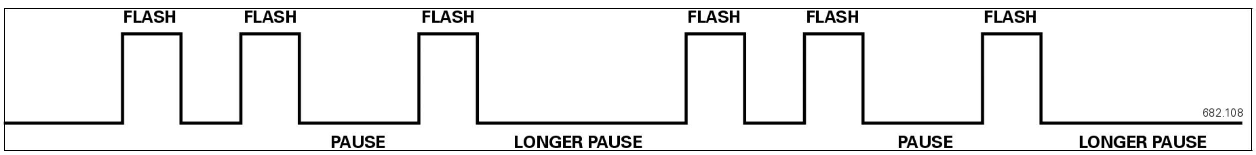


Fig. 185 Flash Code 21

Engine fails to crank

If the engine fails to crank, ensure that the gear selector is in P or N. If OK, verify the condition of the starter relay and circuits. Move the ignition key to III (START) to apply voltage to the starter relay coil. Refer to the applicable Electrical Guide and check the following:

- Starter relay condition
- Starter relay battery power supply circuit
- Starter relay coil supply circuit from the ignition switch, fuse, range sensor P, N switch
- Starter relay coil ground circuit to the instrument pack and the instrument pack ground

Engine cranks but will not start

In this case, the PATS has read a valid key code and has enabled the starter relay. However the PCM has disabled the fuel pump and fuel injection. If the PCM or the instrument pack has been replaced, ensure that module configuration has been carried out using WDS. If configuration has been carried out, refer to the applicable Electrical Guide and check the following:

- Fuel pump control circuit between the PCM and the RECM
- Fuel pump relay supply and control circuits
- RECM to fuel pump drive circuits
- Fuel injector ignition switched power supply circuit

Table 39 PATS Diagnostics Summary: X200

Mode of Operation/Fault	When logged	Ignition Switch position	DTC	Flash Code
Prove-out	n/a	0 (OFF) to II (RUN)/III (START)	n/a	3 seconds – on
Perimeter theft control	n/a	0 (OFF)	n/a	Steady flashing
Anti-scan – Incode	Security access	II (RUN)/III (START)	n/a	None
Transceiver not connected/open circuit (no diagnostic byte received)	Key read	II (RUN)/III (START)	B1681	11
Corrupted diagnostic byte received from transceiver	Key read	II (RUN)/III (START)	B2103	12
Ignition key transponder signal not received	Key read	II (RUN)/III (START)	B1600	13
Ignition key transponder signal invalid	Key read	II (RUN)/III (START)	B1602	14
Ignition key code incorrect	Key read/diagnostic test	II (RUN)/III (START)	B1601	15
SCP Network fault: PCM verify does not match key status	PCM/SCP communications	II (RUN)/III (START)	U1147	16
SCP Network fault: security system status message missing	PCM/SCP communications	II (RUN)/III (START)	U1262	16
Less than 2 keys programmed	Before & after/dealer	II (RUN)/III (START)	B1213	21
PCM ID not in instrument pack non-volatile memory	Before & after/dealer	II (RUN)/III (START)	B2141	22
PCM ID does not match instrument pack	Challenge/response	II (RUN)/III (START)	B2139	23
Transponder programming failure	Key prog.	II (RUN)/III (START)	B2431	13

Ignition Key Programming

Manual key programming is as follows:

1. Insert the first key and switch the ignition to II (RUN). Remove the key within 5 seconds from switching to II.
2. Within 5 seconds from the first key removal, insert the second key and switch the ignition to II (RUN). Remove the key within 5 seconds from switching to II.
3. If additional keys are to be programmed, insert the remaining keys within 10 seconds from the proceeding key removal. Switch the ignition to II (RUN). Remove the key within 5 seconds from switching to II.

WDS Key Programming

All vehicle keys should be available as this operation will clear any previously programmed keys from the instrument pack memory.

After connecting WDS, select Guided Diagnostics from the Main Menu followed by Vehicle Set Up and Vehicle CM Set Up/Configuration. Follow the onscreen prompts for key programming.

NOTE:

During this operation, the Message Center language can also be changed. Message Center language change can also be accomplished manually using the trip computer buttons in X100 series, and X308.

SECURITY: X202, X204

Locking Functions

Central Locking

The Central locking locks all the doors so that they cannot be opened from outside the vehicle. The central locking feature can be activated when one of the following occurs, and all the doors are closed:

- The driver's door lock cylinder is rotated to the Lock position
- The Lock button on the remote keyhead is pressed once (Key must be out of the ignition)
- Interior locking paddles
- Central door locking switch

If the drivers door is ajar when the central locking feature is activated via the drivers door locking paddle, all the doors will lock and the drivers door will then unlock. There will be 7 flashes (5 + 2) of the direction indicators to indicate that the door is open.

If the passenger door is ajar when the central locking feature is activated via the passengers door locking paddle, all the doors will lock and then all the doors will unlock. There will be 7 flashes (5 + 2) of the direction indicators to indicate that the door is open.

If any of the rear doors are open when the central locking feature is activated via either of the locking paddles on the front doors, then all the doors will lock.

If the hood or the luggage compartment is open when the central locking feature is activated via either of the locking paddles on the front doors, all the doors will lock.

If any of the doors are ajar when the central locking feature is activated via the drivers door lock cylinder, then all the doors will become locked. There will be 5 flashes of the direction indicators to indicate that a door is open and an audible mislock warning of 2 horn chirps will also be given (if enabled).

If the hood or luggage compartment are open when the central locking feature is activated via the drivers door lock cylinder, all the doors will lock and the direction indicators will flash 5 times to indicate that either the hood or the luggage compartment is open (no error tone warning will be given)

If any of the doors are ajar when the central locking feature is activated via the remote lock button on the integrated key, no doors will lock and there will be 7 flashes (5 + 2) of the direction indicators to indicate that a door is open, and an audible mislock warning of 2 horn chirps will also be given (if enabled).

If the hood or luggage compartment are open when the central locking feature is activated via the remote lock button on the integrated key, all the doors will lock. There will be 5 flashes of the direction indicators to indicate that the hood or luggage compartment are open (no error tone warning will be given).

If any door is open and the master lock button is pressed to centrally lock the vehicle, no doors will lock. If the hood or luggage compartment is open and the master lock button is pressed to centrally lock the vehicle all the doors will lock.

Drive away locking

The drive away locking feature (Auto locking) operates when the vehicle speed exceeds 5 km/h.

This feature is the same for manual and automatic transmission vehicles.

Central unlocking

The central unlocking feature unlocks all of the doors upon any of the following requests:

1. Unlock from driver door lock cylinder
2. Unlock button on the integrated key
3. Unlock from either of the front interior handles or paddles
4. Unlock from the master switch on the facia

Two Stage unlocking

The two stage unlocking feature will unlock only the drivers door on an unlock request from either the drivers door lock cylinder or the unlock button on the integrated key. A further unlock request from either the key or the lock cylinder will unlock all the remaining doors, unless another unlocking or locking action (from the master switch or interior paddles) has been requested.

NOTE:

The customer can change between Single Stage and Two Stage Unlocking (and back again when necessary) by pressing the Lock and Unlock buttons on the integrated key simultaneously for 4 seconds, acknowledgement is provided by 2 flashes of the direction indicators.

Luggage compartment release

The luggage compartment can be released by using the interior and exterior trunk release buttons or by pressing the release button on the integrated key.

NOTE:

When the vehicle is locked the exterior release button will be disabled. When the vehicle is armed both the interior and exterior luggage compartment release buttons will be disabled. Opening the luggage compartment with the key when the vehicle is armed will cause a full alarm.

Valet mode

Activating the valet switch inhibits interior and exterior luggage compartment release switch operation. A green headed key is provided which cannot open the luggage compartment or glove box.

Integrated key transmitter

The remote control is integrated into the key housing, or keyhead, with a 4 button design: Lock, Unlock, Trunk Release, and Headlamp / panic. The key transmits a rolling code at 315 MHz.

Global opening

Global opening of the windows and sunroof can be initiated from the driver's door key lock or the integrated key transmitter with the key out of the ignition. To initiate Global open, the operator will turn the key in the driver's door lock to the 'Unlock' position and hold it for longer than 2 seconds. The windows and sunroof will then begin their opening operation.

To stop global opening turn the key back to the neutral position or to the lock position. Remote Global open will be initiated from the integrated key when the 'unlock' button is pressed and held for longer then 2 seconds. To stop Global open before the windows or sunroof are fully open, press any button again on the integrated key.

Global opening can be initiated from the master lock switch. To initiate global open the operator will need to turn the key in the ignition to run and press the master lock switch, holding it for longer than 2 seconds

Global closing

Global closing of windows and sunroof can be initiated from the driver's door lock cylinder or the integrated key transmitter with the key out of the ignition. To initiate Global Close, the operator will turn the key in the driver's door lock to the 'Lock' position and hold it for longer than 2 seconds. The windows and sunroof will then begin their closing operation. To stop global closing turn the key to the neutral position or to the unlock position. Remote Global Close can be initiated from the integrated key when the 'lock' button is pressed and held for longer than 2 seconds to initiate Global Close. To stop Global Close before the windows and sunroof are fully closed, press any button again on the integrated key.

Global closing can be initiated from the master lock switch.

Vehicle Alarm System

The system is based around the body system control modules.

The security system functions are carried out by the Front Electronic Module (FEM), Driver Door Module (DDM), Rear Electronic Module (REM), and the Instrument Cluster (IC)

- The front electronics module (GECM/FEM) enables security and controls all peripheral devices such as the intrusion sensors, inclination (tilt) sensor, horn for full alarm, battery backed sounder, direction indicators. The GECM/FEM also enables and disables passive arming and the panic function
- The drivers door module houses the receiver module or receiver interface where required and controls all locking functions for the drivers door (i.e. central locking, double locking, 2 stage unlocking). The DDM also controls locking and error chirps and warnings.
- The rear electronics module controls all locking functions for the passenger doors and controls the luggage compartment release operation
- The instrument cluster controls the security LED operation, Passive anti-theft and the steering column lock module.

The base perimeter alarm consists of:

- 4 doors, luggage compartment and hood ajar switches (all normally closed)
- Radio sense line
- Valid key sense (communicated by the Immobilizer system)
- Vehicle horn and separate passive alarm horn (Depending on market)
- Visual feedback from the Direction Indicators (DIs) on arm, disarm, alarm and error
- Security LED (located on the Instrument pack)

Higher levels of alarm can be added to the vehicle for specific market requirements:

- Inclination (Tilt) sensor

Security System Function

The anti-theft feature provides an audible and visual alarm at the exterior of the vehicle while the system is armed and when unauthorized access to the vehicle via the doors, hood or trunk is detected, the radio is removed, or the ignition transitions to run or start without a valid PATS key. The visual alarm consists of the vehicle's exterior turn/hazard lamps (direction indicators).

The audible alarm consists of the vehicle horn in all markets where an alarm is fitted. In some markets there is an additional security horn, separate to the vehicle horn but hidden and driven at the same time during an alarm. In some markets the security horn is replaced by a Battery Backed Sounder, which continues to provide the audible alarm even if the power wires to the sounder are sabotaged.

Functionality of the alarm system is very similar to X200 operation including such features as:

- Arming the security system
- Passive arming
- disarming the alarm system
- Trunk lid disarm
- Alarm activation
- Interior scanning
- Battery backed sounder
- Inclination sensor

Programming new Radio Frequency Transmitters: X200

As with Previous X200 models, it will require the use of WDS to add additional transmitters.

Up to 4 transmitters can be assigned to the vehicle.

Passive Anti-Theft System (PATS): X202, X204

Overview

The Immobilizer system is standard on the entire X200 vehicle range. It is based around the Instrument Cluster and Engine Control Module (ECM).

Steering column lock module (X202 manual transmission only)

The steering column lock system is partitioned between the instrument cluster, SCLM (Steering Column Lock Module), GECM/FEM (Front Electronics Module) and REM (Rear Electronics Module). In order for the steering column to unlock, the cluster must have read a valid key, the GECM/FEM and REM supplied power to the SCLM and the correct information flow must have occurred between the cluster and the SCLM.

SCLM power modes

The FEM and REM will enable power to the SCLM when commanded to do so by the cluster. The cluster will transmit the enable command on receipt of the following events:

1. Key-In
2. Key-Run (If the IC could not confirm the SCL status at Key-In)
3. All guard conditions have been met, (Vehicle and engine speed are zero).

The GECM/FEM and REM will disable power to the SCLM from the following events:

1. Disable command received from the IC
2. Vehicle and engine speed are present on the SCP network
3. FEM and REM have entered Sleep mode (SSP timed out)

Unlock - Key in

When a key is inserted in the ignition barrel a Key-In switch signal is supplied to the IC. This triggers the IC to transmit an SCP command to the GECM/FEM and REM. On receipt of this command the GECM/FEM (Ground) and REM (12V) will supply power to the SCLM.

Additionally, the key-in switch triggers the IC to read the PATS key code stored in the key and compare it with one that has been previously stored (Fixed Serial number only). Once the key has been verified, the IC will transmit the unlock command to the SCLM.

The SCLM will challenge this unlock command for correct authentication. If the challenge response matches the expected one calculated by the SCLM. The motor will be driven to the unlocked position. When the SCLM confirms unlocked-ok, the cluster will transmit an SCP command to the FEM and REM to disable power to the SCLM.

If the final status returned by the SCLM is unlocked-ok and the full encryption of the key transponder passes, a valid key status will be transmitted via SCP. Additionally, if the Key is turned to run a valid key status will be transmitted on CAN to the ECM. This is to allow a data exchange to occur with the ECM to authenticate start.

Lock - Key out

Upon the IC receiving the key out signal (Ignition not in ACC, RUN or Start), the IC will transmit an SCP command to the GECM/FEM and REM, on receipt of this command the GECM/FEM (Ground) and REM (12V) will supply power to the SCLM.

Following this the cluster will transmit the lock command to the SCLM, on receipt of this message the SCL will drive its motor to the locked position. Once complete, the cluster will transmit an SCP command to the FEM and REM to disable power to the SCLM.

SCLM system diagnostics

The SCLM will not unlock the column if any of the following conditions apply

1. A theft signal has been received from the IC, i.e. the key code has not been authenticated.
2. A challenge code has been transmitted to the IC but no response code has been received.
3. A challenge code has been transmitted to the IC and an incorrect response received.
4. The GECM/FEM or REM have not enabled power to the SCLM
5. Vehicle and engine speed are present on the networks

In all cases the SCL or cluster will not log any DTC's until all retries have been completed.

If the Unlock Routine is unsuccessful at Key-In, the Cluster will perform another attempt at Key-Run. If the Cluster is still unsuccessful at confirming the Lock Status, a warning shall be displayed on the Message center. A DTC will be logged accordingly to identify the error.

Potential causes of SCL not unlocking

1. GECM/FEM or REM unable to power SCLM, Fuse located in rear power distribution box (Supply for REM SCLM internal relay), Logic Fuse for REM and GECM/FEM (Controls the SCL logic for determining power mode).
2. Invalid Key determined by the Cluster. No 12V supply to PATS transceiver (Fuse located in primary junction box, which in turn is supplied from RPDB (Switch system power relay). Key not programmed to Cluster.
3. SCP network fault (No communication possible between IC, GECM/FEM, REM and SCLM).

Table 40 PATS control module fault codes: X202

DTC	LED FAULT CODE	FAULT	WHEN LOGGED
B1691	11	Transceiver not connected (no diagnostic byte received)	Key read
B2103	12	Bad diagnostic byte received	Key read
B1600	13	Key problem, no code received or without transponder.	Key read
B1602	14	Key transceiver problem, partial code received, checksum error	Key read
B1601	15	Keycode not stored in memory (also due to having 8 keycodes already stored in memory) Signature mismatch.	Key read and diagnostic test
U2511/U1900	16	Problem with CAN link (ECM verify data does not match key status - 00, 01, 80 or FF in data verify message). Or vehicle security system status message missing.	ECM CAN Comms.
B1213	21	Less than 2 keys programmed in the system	Assembly or Dealer
B2141	22	No initialization after part replacement or EOL. No ECM ID	Assembly or Dealer
U2510	23	PATS control and target modules not configured. ECM ID does not match	Challenge response
B2431	13	Transponder programming failure	Key programming
B2492	None	key already programmed	Diagnostic test
N/A	None	Key erase	—

Manually Programming Additional PATS keys

To enter the programming process you will require all the customer's keys (minimum of 2). If there is only one available, a new key will be required, because of this you can only add keys using WDS.

- Insert the 1st customer key and turn to run (Position II) for a maximum of 5 seconds, turn to off and remove Key
- Within 10 seconds of removing the 1st key insert the 2nd customer key and turn to run for a maximum of 5 seconds, then turn to off and remove key
- To program the 3rd key insert the new key and turn to run within 20 seconds of removing the 2nd key, allow the PATS LED to prove out for the 3 seconds to confirm storage of the new key and then turn to off and remove the key.

SECURITY: X400, X404

Locking Functions

Central Locking

The central locking locks all the doors so that they cannot be opened from outside the vehicle. The central locking feature can be activated when one of the following events occurs when the ignition key is out and all the doors are closed:

- The driver's door lock cylinder is rotated to the lock position.
- The lock button on the remote keyhead is pressed once. (The key must be out of the ignition.)

Central locking can also be activated by pushing the front interior door handle (paddle) to the lock position, independent of the ignition switch position.

If one of the doors is ajar when the central locking feature is activated via the interior door handle, then all doors will become unlocked. If one of the doors is ajar when the central locking feature is activated via the driver's door lock cylinder, then all doors will become locked. No locking/unlocking occurs if a door is ajar and the remote control is used. Five flashes of the direction indicators and 2 horn chirps will signal that a door, trunk, or door is ajar.

NOTE:

If the door latches are activated more than 16 times in a 20 second period, or the trunk latch is activated more than 8 times in a 20 second period, all power locking will cease for 20 seconds to prevent latch overheating.

Auto Locking (Drive-Away Locking)

The auto locking feature automatically central locks the vehicle if the ignition is in run or start. All doors must be closed and the vehicle speed must exceed 7 km/h (3.4 mph) (via CAN and SCP) for the feature to operate. If the customer unlocks the car this feature would only auto lock the car again after:

- Ignition was turned off and on again, or
- A door is opened and closed.

This feature is the same for manual and automatic transmission vehicles.

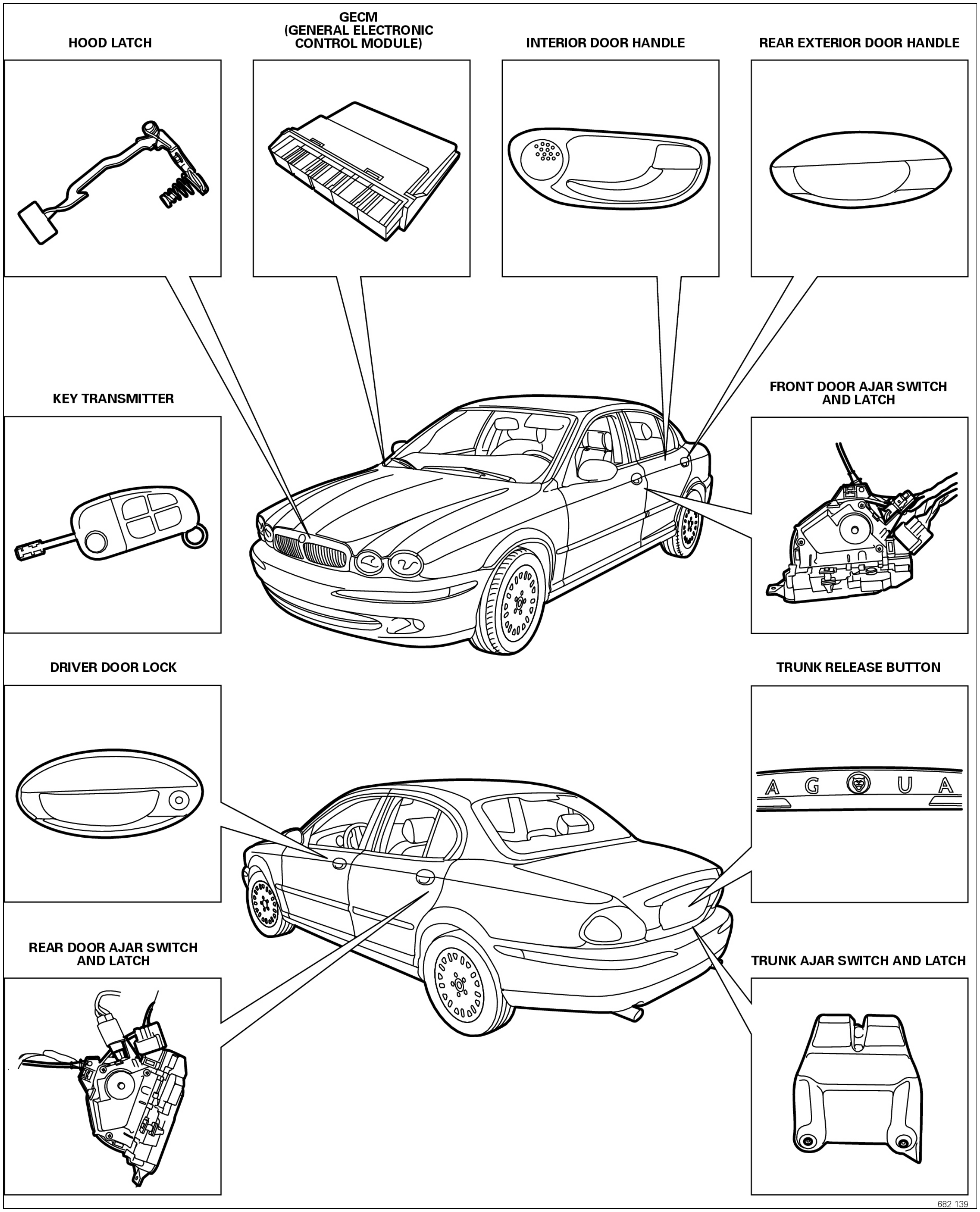


Fig. 186 Locking Components: X400

Central Unlocking

The central unlocking feature automatically unlocks all of the vehicle's doors when the following occurs:

- The door lock cylinder is rotated to the unlock position twice, if single door unlocking is enabled or once, if single door unlocking is disabled.
- The unlock button on the remote keyhead is pressed twice within 3 seconds, if single door unlocking is enabled, or once if single door unlocking is disabled.
- A front interior door handle is pulled to the unlock position, only if the vehicle was central locked.

NOTE:

If a rear door handle is pulled, the vehicle is not centrally unlocked; only that door is unlocked.

NOTE:

The customer can change between single stage and two stage unlocking (and back again when necessary) by pressing the lock and unlock buttons on the remote keyhead simultaneously for 4 seconds. Acknowledgment is provided by 2 flashes of the turn signal indicators.

Auto Relocking

The system automatically central locks the vehicle (and consequently arms the antitheft feature) following a remote control unlock if no door was opened or if the ignition remained in the off position for 45 seconds.

Table 41 Security System Configuration

Feature	Note
2–stage unlocking	Customer programmable to 1–stage
Horn chirp confirmation	Standard-Dealer programmable using WDS
Drive-away locking	Standard-Dealer programmable using WDS
Auto relocking	Optional-Dealer programmable using WDS

Trunk Lid Release

The trunk can be released by using the exterior trunk release button or the release button on the remote control keyhead when:

- The remote keyhead trunk release button is pressed twice (only with ignition in off or accessory) when the vehicle speed is less than 7 kph (5 mph).
- The exterior trunk release button on the trunk lid is pressed when the car is unlocked, security is disarmed and the vehicle speed is less than 7 kph (5 mph).

There is no valet mode.

Remote Control Keyhead

The remote control keyhead is operational when the key is removed from the ignition. The remote control feature allows the customer to activate a number of vehicle features remotely, including:

- Unlocking the vehicle doors (single or central unlock).
- Locking the vehicle doors (central locking).
- Trunk lid release.
- Panic button.
- Headlight convenience feature.

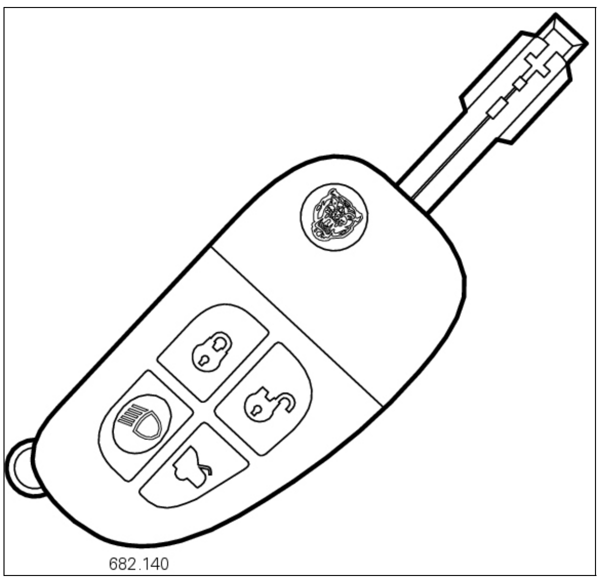


Fig. 187 Remote Control Keyhead

The radio frequency (RF) operation is suspended 22 days after the last valid RF signal is received. This is reactivated by the change of state of any of the latch switches (for example, door ajar, lock/unlock, and so on). After 22 days the customer can not use any RF feature until the RF operation is reactivated.

NOTE:

Changing the remote control's battery will not affect its operation.

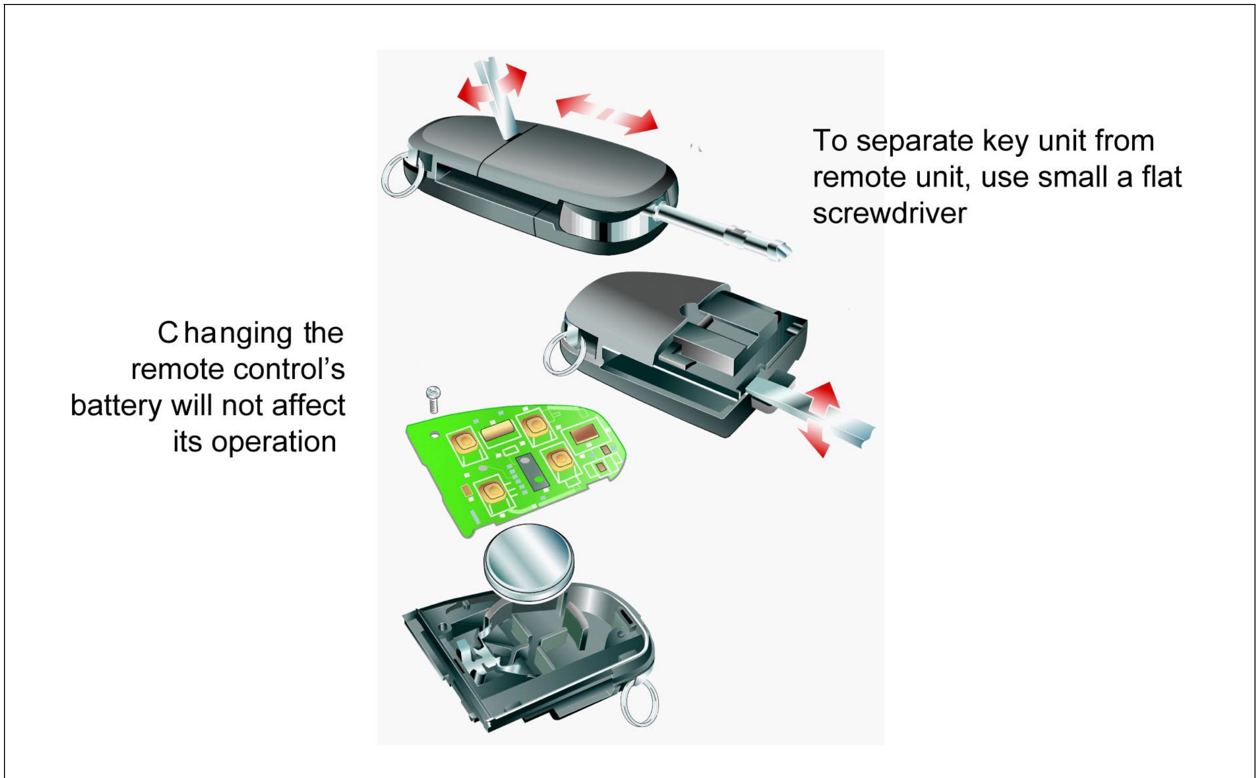


Fig. 188 Remote Control Keyhead Battery Replacement: X400, X404

Panic Button

When the remote keyhead transmitter headlight convenience button is pressed 3 times within 3 seconds, with the ignition off, the vehicle alarm will trigger giving audible and visual warnings. The vehicle alarm will continue until the normal alarm cycle has been completed.

NOTE:

The vehicle doors will not automatically unlock, if previously locked, when the panic button is activated.

If the headlight convenience button is pressed again 3 times within 3 seconds, the ignition key is turned to Run/Start or the unlock button on the remote transmitter is pressed, or the sounding period is completed, the alarm will cease.

Headlight Convenience

When the remote keyhead transmitter headlight convenience button is pressed with the ignition off, the high beam will be driven until either 30 seconds has passed or the headlamp convenience button is pressed again.

Global/Remote Closing

Global closing of windows and sunroof (sunroof) will be initiated from the driver's door lock and the remote keyhead with the key out of the ignition. To initiate global close, the operator will turn the key in the driver's door lock to the "lock" position and hold it for longer than 1.5 seconds. The windows and sunroof will then begin their closing operation.

The global close operation will continue until:

- The operator releases the key in the driver's door lock from the lock position or moves the key to the unlock position.
- A stall or pinch condition is detected, causing the affected window/sunroof to cease movement.

During a global close operation, should a window/sunroof fully close or an obstacle be detected, power will be removed from the window/sunroof, causing movement to cease. The remaining windows/sunroof will continue to close.

Remote global close will be initiated from the key fob where the "lock" button should be pressed and held for 1.5 seconds to initiate global close. To stop global close before the windows/sunroof are fully closed, release and press the lock button again.

Global/Remote Opening: X400, X404

This function is not available.

NOTE:

Windows must be initialized for correct global close function.

Anti-Theft System

The anti-theft feature provides an audible and visual alarm at the exterior of the vehicle when unauthorized access to the vehicle via the doors, hood, or trunk is detected, the radio is removed, or the ignition transitions to run or start without a valid PATS key, while the system is armed. The visual alarm consists of the vehicle's exterior turn/hazard lamps (direction indicators). The audible alarm utilizes the vehicle horn.

The anti-theft system contains the following functions:

- Arming the anti-theft system
- Disarming the anti-theft system
- Alarm activation
- Security status indicator/PATS
- Security horn

General Requirements

If a full alarm is in progress and an additional alarm trigger becomes "active," it will be ignored.

The cause of the last eight full alarms are stored in a non-volatile memory for diagnostic purposes (via WDS).

When the battery is connected (or it is disconnected then reconnected), the anti-theft system immediately enters the armed state that it was in when the battery was disconnected and assumes normal functionality.

Arming

If the anti-theft system is in normal operation mode, the anti-theft system will enter a "prearm" phase if the ignition is not in the Run or Start position and the vehicle is locked either via the door key barrel or the RF transmitter.

The prearm phase is a 20 second delay period that allows the customer time to open and close any door, hood, or trunk lid without triggering an alarm.

The anti-theft system will fully arm after the prearm phase. At this point, each input that is in the secure state (for example, driver's door closed) is armed and capable of triggering an alarm. Any input (doors, trunk, hood) which is NOT in the secure state (for example, passenger door is ajar) will be suspended and will not be capable of activating an alarm. Once a suspended input returns to its secure state (for example, passenger door transitions from ajar to closed), it becomes armed and ready to trigger the alarm.

Audible and visual feedback is provided to the customer on arming of the anti-theft system, depending on the security status.

If the vehicle is central locked (vehicle doors, trunk, hood, radio, and ignition switch are the only active alarm triggers), the turn signal indicators will flash on for 250 ms. If the lock button of the transmitter is pressed a second time, there will be a short chirp from the vehicle horns (this feature is dealer selectable).

If any closure (door, trunk or hood) is ajar when the anti-theft system arms, then the security arm error visual indications will be generated (5 short flashes – 250 ms – of the turn signal indicators and two short horn chirps). Subsequently, when the last closure is closed, the security arm flash will be generated to indicate a secure vehicle, as it did previously.

The security LED will flash at 0.6 Hz (5% duty cycle) when the anti-theft system is prearmed or armed.

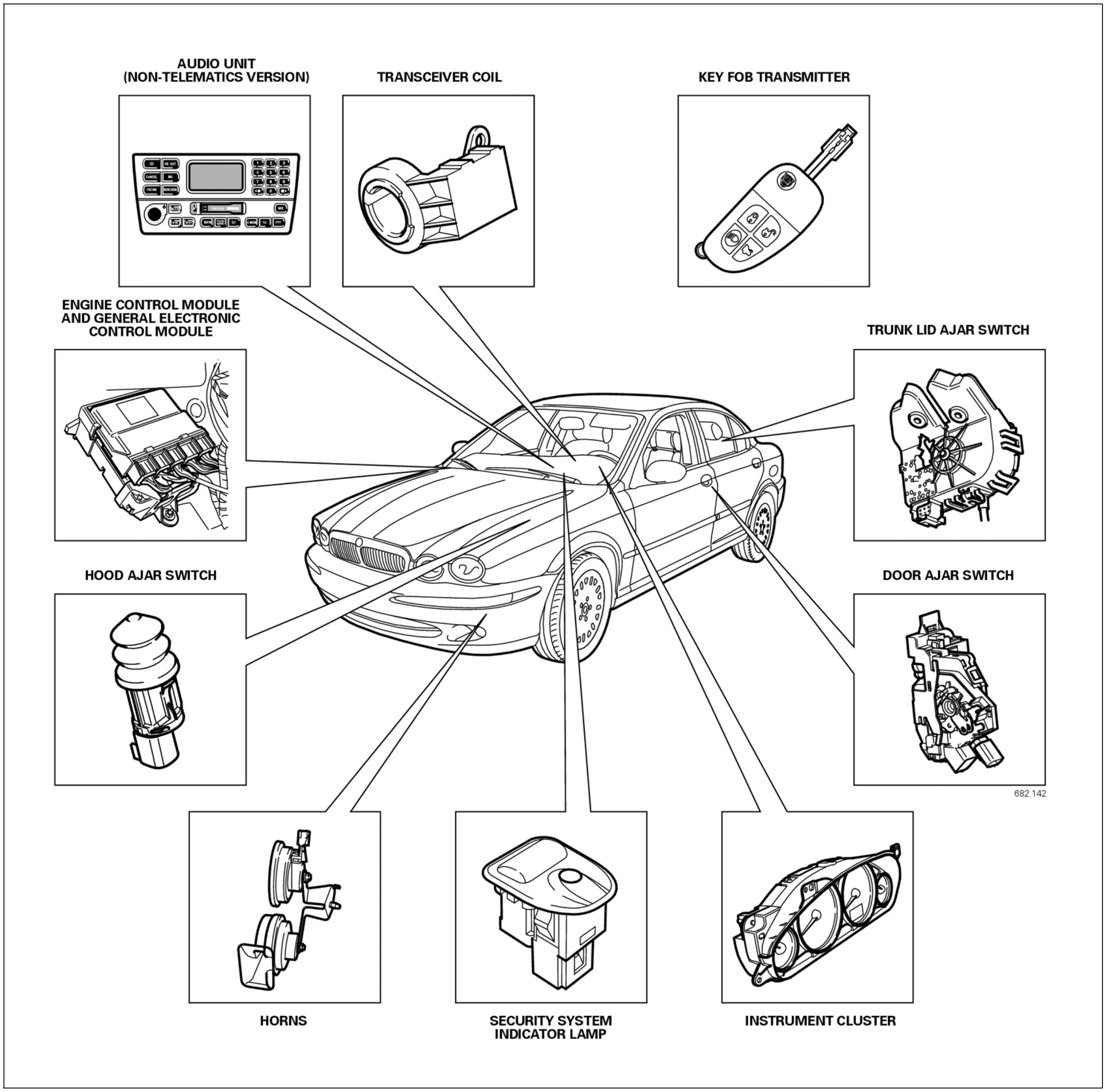


Fig. 189 Anti-theft System Components: X400

Disarming

When prearmed, armed, or active, the security system will disarm when one of the following events occur:

- The RF transmitter unlocked button is pressed to unlock at least one door.
- A valid PATS transponder is read in the ignition barrel when the key is turned to the Run position.
- A door key barrel requests at least one door to unlock (if door barrel disarming is enabled).

The interior door paddles will not disarm the anti-theft system. Upon disarming, any audible or visual warning associated with full alarm or panic alarm will be stopped and the security LED will stop flashing. When the anti-theft system is disarmed, all the turn signals will give two short flashes.

Trunk Lid Disarm

If the trunk lid is released via the RF transmitter trunk release button, the trunk ajar input to the security system will be suspended. The trunk must be closed and the 20 second prearm timer expired before the trunk input and system become armed and again ready to trigger the alarm. When the trunk is released in this fashion, the security LED functionality will not be affected.

Alarm Activation

When the anti-theft system is in the armed state, it will generate a full alarm sequence when one of the following alarm causes becomes active:

- Any door, the trunk, or the hood becomes ajar (except as described in trunk disarm).
- The radio is removed; that is, radio sense changes from radio present to radio not present.
- A valid PATS transponder is not read within one second of the ignition position becoming RUN.
- Diagnostic access is attempted.

If the same alarm cause is active when the full alarm period completes, then the anti-theft system will generate repeated full alarm cycles separated with a pause of ten seconds.

The maximum number of successive repeats that can be generated for a maintained cause is nine (ten full alarms in total). If the alarm cause becomes inactive during a repeat full alarm, then that full alarm cycle will run to conclusion, unless the anti-theft system is disarmed, and no further repeats will be generated from that particular event. If the cause becomes inactive during a ten second pause, then the repeat sequence will cease.

If another alarm cause becomes active during the repeat alarm sequence, it will be ignored, even if it remains active after the nine repeats conclude. This definition is an extension to the requirement to ignore additional alarm causes when a full alarm is in progress.

An exception to this definition exists when the option for Door Key Barrel Disarming is disabled from the security options. In this case there is a 15 second delay from the time that the driver's door is opened before the full alarm is generated if the vehicle was unlocked via the driver's door key barrel. During the 15 seconds, the anti-theft system can be disarmed via the remote entry device or a valid read of the PATS transponder.

If any passenger door is opened before the driver's door, after the driver's key barrel is used to unlock the vehicle, then the alarm will sound immediately. During the 15 seconds, an entry delay audible warning will sound.

When the PANIC feature is activated, the audible and visual alarms will both be driven a full alarm cycle. Disarming or operating the PANIC feature for a second time will stop the panic alarm.

Programming a Radio Frequency Transmitter

The ignition key must be cycled in the following sequence: Key-in – Pos.2 – Pos.1 - Pos.2 – Pos.1 - Pos.2 – Pos.1 - Pos.2 – Pos.1. The GECM emits an audible chime to indicate entry into the programming mode. Turn the key to Pos.0 (off) and remove the key from the ignition. After the key is removed, push any button on the RF transmitter within ten seconds.

If the RF transmitter has been accepted, the GECM emits a chime. To program further RF transmitters, press any button on the RF transmitter concerned within 10 seconds of the previous entry. Up to 4 RF transmitters can be programmed to the GECM.

The programming mode is terminated when any of the following occurs:

- The ignition is switched to Run.
- No further RF transmitters are programmed within 10 seconds.
- An attempt is made to program more than 4 RF transmitters.

Once the GECM has dropped out of RF transmitter programming mode, restarting the process and programming another RF transmitter will erase all previous RF transmitters programmed to the GECM.

NOTE:

Refer to the appropriate electrical guide for this system.

Passive Anti-Theft System (PATS): X400, X404

The Passive Anti-Theft System (PATS) prevents the vehicle from being driven away by unauthorized persons. PATS consists of electronically coded ignition keys, a transceiver device by the ignition switch, and a control unit interface to the engine control module (ECM).

The PATS system is standard on the entire X400 vehicle range. It is based around the instrument cluster and engine control module (ECM). The immobilizer system functionality is described briefly here, as follows:

- Key in ignition, turned to the accessory position.
- Data transfer between instrument cluster and key transponder to confirm valid key.
- Ignition turned to Run position.
- “Key valid” message sent to the ECM from the instrument cluster.
- Data transfer between the ECM and instrument cluster to confirm encrypted code correct.
- Engine start.

On the X400, data transfer between the ECM and instrument cluster will take place over the CAN network.

Instrument Cluster: X400, X404

- Contains gateway for SCP/CAN networks
- Drives Security LED
- Drives PATS transceiver coil.
- Communicates with the ECM and key transponder (stores PATS key codes)

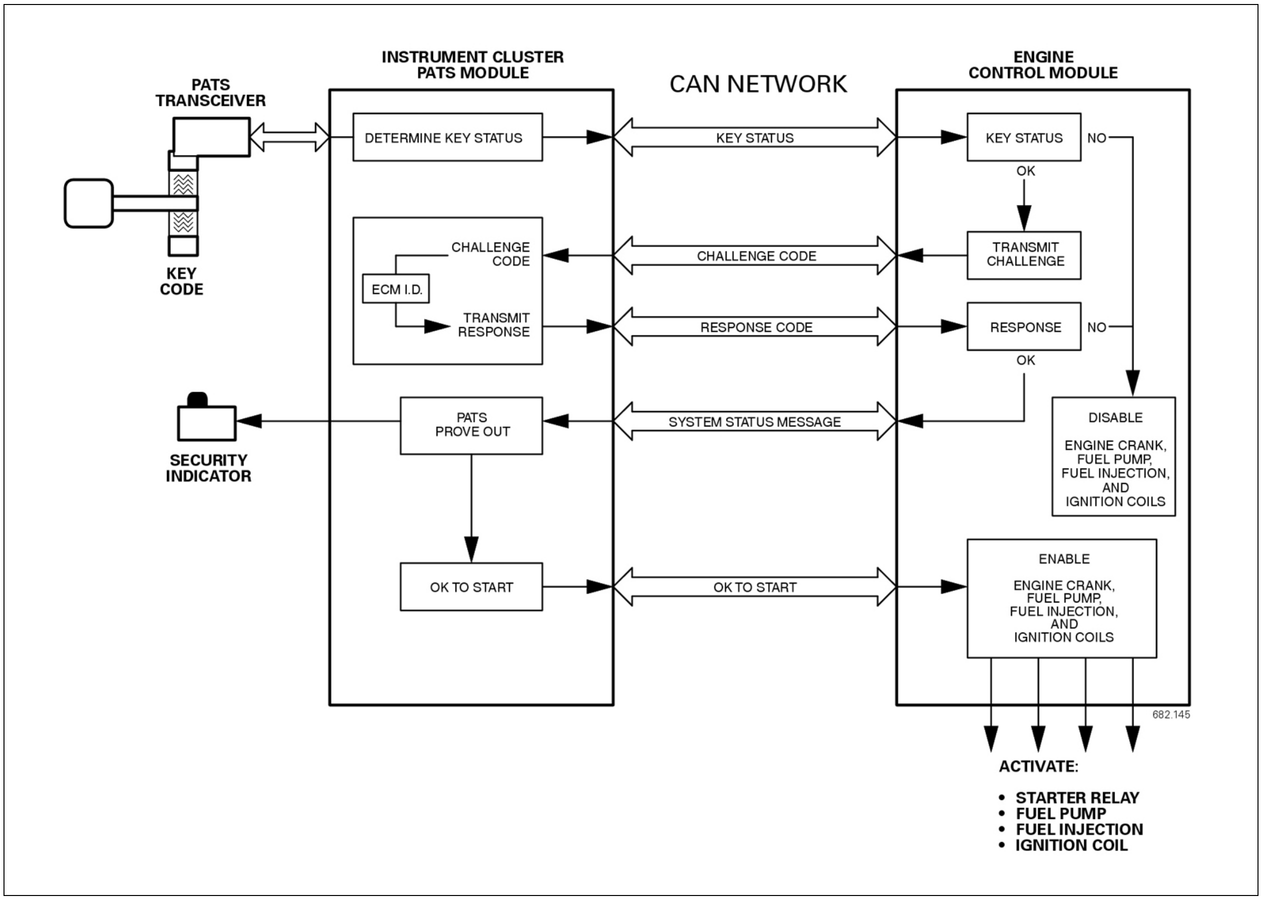


Fig. 190 Passive Anti-theft system: X400

PATS Operation

The PATS function is split between the instrument cluster (IC) and the engine control module (ECM). In order for the vehicle engine to crank and start, the IC must have read a valid key and the correct information flow must have occurred between the IC and the ECM.

When a key is inserted in the ignition barrel and turned to the Accessory position, a hardwired input is supplied to the IC. This action triggers the IC to read the PATS keycode stored in the key and compare it with one that has been previously stored. If the ignition key is subsequently turned to the Run position, the result of this comparison is transmitted to the ECM via the CAN network.

Assuming the key status message received from the IC is valid, the ECM will send a challenge code to the IC. The IC will, after encryption, send a response code. If this response code matches one that the ECM has calculated, the fuel injectors, ignition coils, fuel pump drive, and starter will be enabled.

The ECM will disable the fuel injectors, ignition coils, fuel pump driver, and starter if any of the following conditions apply:

- A theft signal has been received from the IC; that is, the keycode has not been authenticated.
- A challenge code has been transmitted to the IC, but no response code has been received.
- A challenge code has been transmitted to the IC, and an incorrect response has been received.

If any of these conditions apply, the ECM will log DTC P1260. Additionally, the IC will log DTCs if the failure was a result of the key read.

System Diagnostics

The best method to confirm the correct operation of PATS is to check the LED (located in the DSC switch, behind the J-gate). The LED should illuminate solid for 3 seconds when the key is turned to Ignition Run position and then extinguish. This action validates all PATS functions; that is, the key transponder matches a keycode stored; the challenge/response sequence between the IC and ECM was successful, resulting in the ECM being enabled.

Engine Fails to Crank

If a PATS fault is detected, the LED will flash for 60 seconds at 4Hz with a 50% duty cycle. At the end of this period, the LED will flash a 2 digit code. This code is repeated 10 times. The meaning of these fault codes, along with the frequency of flashing, is given in the accompanying table. As a general rule a fault code of 16 or less will cause the vehicle not to crank. Additionally, WDS should be used to check the DTC stored in the IC.

The most regular occurrence for failing to crank is due to the P & N start switches; that is, gearshift not in Park or Neutral. The Start circuit is as follows: Low side of relay coil - Switched directly from the ECM (if conditions are correct). High side of relay coil - Direct from ignition start position.

Another likely cause may be that the CAN network is malfunctioning; that is, the CAN circuit is open/short. This situation would mean that the cluster and ECM would be unable to communicate, resulting in no challenge being performed to enable the ECM.

On manual vehicles the additional of a clutch switch has been included in the starting circuit (direct input to ECM). This switch takes the place of the Park/Neutral switch (automatic transmission). The switch activates at end of travel (clutch fully depressed).

Engine Cranks but Will Not Start

If the Engine is cranking, it means that the ECM is enabled with respect to PATS. If PATS was disabled, the ECM would not engage the starter. This situation could be confirmed by verifying the PATS LED prove out (illuminated solid for 3 seconds) or by reading DTCs from the IC and ECM.

In this case, the fuel pump circuit should be verified. The fuel pump module which is controlled by the ECM, supplies power to the actual fuel pump.

In all cases of suspected PATS non-start issues, the most logical failure modes should be eliminated first.

Check all relevant supplies and grounds to the cluster and ECM. Check that the starter relay has a permanent 12 V supply. Check that the relay has a 12 V supply and ground across the coil while the ignition is in the Crank position.

NOTE:

The ECM supplies the ground for the starter relay. If the inertia switch has tripped, the starter relay coil will not receive its ground and the engine will not crank.

PATS Diagnostics Summary: X400, X404

The PATS LED will be commanded on as shown under “indication.” Normal PATS operations are complete within 400 ms of the ignition switch transition from Off to Run or Start. Worst case for ECM communication problems will be <2 seconds. If PATS is not complete during the 2 seconds, the ECM will terminate PATS and await the next ignition run/start event. During this time, if a valid key is used the indicator will be in prove-out mode. PATS faults will be indicated via the LED as soon as possible and will terminate the LED prove-out. At Key Off, all previous flashing will cease and the perimeter theft system will control the LED when the vehicle is locked and armed.

Table 42 PATS Diagnostics Summary: X400

Mode of Operation/Fault	When logged	Ignition Switch position	DTC	Flash Code
Prove-out	n/a	0 (OFF) to II (RUN)/III (START)	n/a	3 seconds – on
Perimeter theft control	n/a	0 (OFF)	n/a	Steady flashing
Anti-scan – Incode	Security access	II (RUN)/III (START)	n/a	None
Transceiver not connected/open circuit (no diagnostic byte received)	Key read	II (RUN)/III (START)	B1681	11
Corrupted diagnostic byte received from transceiver	Key read	II (RUN)/III (START)	B2103	12
Ignition key transponder signal not received	Key read	II (RUN)/III (START)	B1600	13
Ignition key transponder signal invalid	Key read	II (RUN)/III (START)	B1602	14
Ignition key code incorrect	Key read/di-agnostic test	II (RUN)/III (START)	B1601	15
CAN Network fault:ECM verify does not match key status	ECM/CAN communi-cations	II (RUN)/III (START)	U2511	16
CAN Network fault: security system status message missing	ECM/CAN communi-cations	II (RUN)/III (START)	U1900	16
Less than 2 keys programmed	Before & after/dealer	II (RUN)/III (START)	B1213	21
ECM ID not in instrument pack non-volatile memory	Before & after/dealer	II (RUN)/III (START)	B2141	22
ECM ID does not match instrument pack	Chal-lenge/re-sponse	II (RUN)/III (START)	U2510	23
Transponder programming failure	Key prog.	II (RUN)/III (START)	B2431	13
Key already programmed	Diagnostic test	II (RUN)/III (START)	B2492	None

Table 43 PATS Diagnostic Summary: X404

Mode of Operation / Fault	When Logged	Ign Sw Position	DTC	View DTC	LED Fault	Indication
Prove-Out	N/A	Off to Run / Start	N/A	N/A	Code	3 Seconds of steady illumination
Perimeter Theft Control	N/A	Off	N/A	N/A	N/A	Off or 0.5 Hz Flash, 5 % duty cycle +/- 20 % until not Off
Anti Scan - Incode	Security Access	Run / Start	N/A	N/A	N/A	None
Transceiver Not Connected (No Diagnostic Byte Received)	Key Read	Run / Start	9681	B1681	None	60 seconds of 4 Hz flashing at 50 % duty cycle followed by fault code flashing 10 times.
Bad Diagnostic Byte received	Key Read	Run / Start	A103	B2103	11	60 seconds of 4 Hz flashing at 50 % duty cycle followed by fault code flashing 10 times.
Key problem, No code received or with-out transponder	Key Read	Run / Start	9600	B1600	12	60 seconds of 4 Hz flashing at 50 % duty cycle followed by fault code flashing 10 times.
Key / Transceiver problem, partial code received, checksum error	Key Read	Run / Start	9602	B1602	13	60 seconds of 4 Hz flashing at 50 % duty cycle followed by fault code flashing 10 times.
Key code not stored in memory (also due to having 8 key codes already stored in memory) / Signature mis-match.	Key Read / Diag test	Run / Start	9601	B1601	14	60 seconds of 4 Hz flashing at 50 % duty cycle followed by fault code flashing 10 times.
Problem with CAN link (ECM verifydoes not match key status - 00, 01, 80 or FF in data verify message)	B & A / Dealer	Run / Start	E511	U2511	15	60 seconds of 4 Hz flashing at 50 % duty cycle followed by fault code flashing 10 times.

Mode of Operation / Fault	When Logged	Ign Sw Position	DTC	View DTC	LED Fault	Indication
Or Challenge Query / vehicle security system status message time out expired.	ECM CAN Comm	Run / Start	D900	U1900	16	60 seconds of 4 Hz flashing at 50 % duty cycle followed by fault code flashing 10 times.
Less than 2 keys programmed in the system	B & A / Dealer	Run / Start	9213	B1213	21	60 seconds of steady indication followed by fault code flashing 10 times.
No initialisation after part replacement or EOL, No ECM ID	B & A / Dealer	Run / Start	A141	B2141	22	60 seconds of steady indication followed by fault code flashing 10 times.
CAN not configured, ECM ID does not match (81 in data verify message)	Challenge / Response	Run / Start	E510	U2510	23	60 seconds of steady indication followed by fault code flashing 10 times.
IC has not received the Idle message from the ECM with-in 2 seconds of Ignition Run.	Idle message missing	Run / Start	A141	U2141	24	60 seconds of steady indication followed by fault code flashing 10 times.
Transponder Programming Failure	Key Prog	Run / Start	A431	B2431	13	60 seconds of 4 Hz flashing at 50 % duty cycle followed by fault code flashing 10 times.
Key already programmed	Diag Test	Run / Start	A492	B2492	None	None

Manually Programming Additional PATS Keys

To enter the programming process you need all the customer’s keys (minimum of 2). If there is only one available, you can only add keys using WDS.

- Insert first key, turn to Run (Position II) for a maximum of 5 seconds, turn to Off, and remove key.
- Within 10 seconds of removing the first key, insert the second key, turn to Run for a maximum of 5 seconds, turn to Off, and remove the key.
- To program the third key, insert and turn to Run within 20 seconds of removing the second key, leave the key in the run position and allow the PATS LED to prove out (solid for 3 seconds); this procedure will confirm successful storage.

For programming subsequent keys – 8 in total:, you will need to have turned 2 valid keys to Run and to Off as above prior to programming the fourth and fifth keys, and so on. You can use any 2 valid keys.

To program the fourth key, follow the sequence as above.

- After removing the third key, insert key 1 or 2 and turn through Run and back to Off, then remove.
- Insert the fourth key, turn through Run and back to Off and remove.

To program the fifth key:

- After removing the fourth key, insert key 1, 2 or 3 and turn through Run to Off and remove.

This process can be repeated until a maximum of 8 keys have been programmed.

NOTE:

If the time scale is not adhered to, the process will terminate and you will need to start the process again (a DTC may also be logged).

WORKSHEET – REVIEW QUESTIONS

1. Which X404 security and immobilizer component is visibly the same as X400?

a. The LED

b. The Integrated Key

c. The Instrument Pack

d. The battery backed sounder

2. Which of the following methods can be used to change from two stage unlocking to single stage locking?

a. Use WDS to program

b. The DDM will require replacement

c. Hold the lock and unlock buttons for four seconds

d. Turn the key in the door lock and press the unlock button

3. Which modules control the steering column lock?

a. REM and FEM

b. REM, FEM and IC

c. IC and ECM

d. ECM, REM and GEM

4. To program a new radio frequency transmitter you:

a. Turn the ignition on and then off four times

b. Turn the ignition on and then off two times

c. Press the lock and unlock buttons in the correct sequence

d. Must use WDS

5. How is the driver informed of a PATS system fault?

a. Indicators flash on locking

b. LED flashing

c. Message on the instrument cluster

d. Horn chirp on unlocking

WORKSHEET – X350 ELECTRONIC GLOVE BOX RELEASE

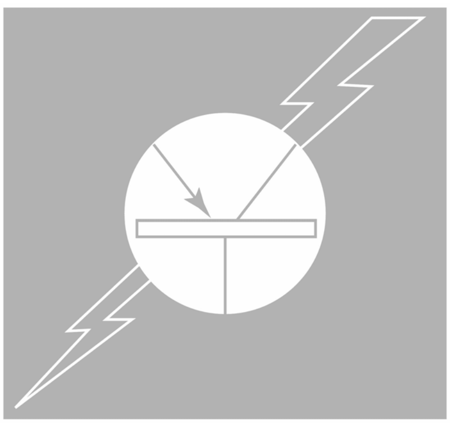
This worksheet is provided in order to enable the glove box to be opened in the event of an electrical failure with the system.

1. Insert the ignition key into the ignition switch.
2. Operate the glove box release switch. Did the glove box open?_________
3. Remove the passenger air bag veneer. Refer to JTIS.
4. Operate the glove box release switch and observe the operation of the glove box release mechanism.
5. Close the glove box.
6. Open the glove box by manually operating the release mechanism.
7. Which part of the release mechanism did you move to open the glove box?____________________

JAGUAR

TRAINING PROGRAM

JAGUAR ADVANCED ELECTRICAL SYSTEMS



PUBLICATION CODE – 684

MULTIPLEX DIAGNOSTICS

Overview

By following the Jaguar five-step Diagnostic Strategy and applying knowledge of the Jaguar multiplexing systems, a multiplex controlled circuit fault can often be easier to diagnose.

A number of methods and tools are available to test for problems that may occur, including WDS and a DVOM. The test methods chosen depend on the vehicle symptoms, the physical layout of the circuits, and the accessibility of test points.

Professional Electrical Practices

When testing electrical circuits it is important to access the circuits carefully to avoid damaging insulation, conductors, contacts or components. Measurements should be performed carefully, ensure that the tester is connected to the correct pins. If measurements are not consistent with the expected values, always double check that the tester is correctly connected.

- Back probing sealed electrical connectors will damage the seal allowing moisture or other contaminants to enter the connector causing corrosion.
- Piercing the insulation of conductors when performing measurements will damage the conductor, increase the conductor resistance, and allow moisture or other contaminants to enter the connector causing corrosion.
- Circuit powered or self-powered test lights or circuit testers may cause damage to sensitive components. The best rule is to use only a high impedance digital multimeter when measuring any electrical circuit in the vehicle.
- Periodically calibrate test equipment and check the resistance of the test leads and adapters to assure that measurements are accurate.
- Use the correct testing adapters when performing measurements. Using incorrect adapters or probing connectors may damage the plating on the contacts, causing corrosion and increased resistance.

Testing a Multiplex Problem

WDS functions as a diagnostic aid and a DVOM. Each time WDS runs a multiplex component diagnostic routine it automatically tests multiplex circuit integrity to determine if the circuit is capable of communicating a data message. WDS will most often help you to pinpoint the cause of the failure. Because WDS diagnostics are software driven, its efficiency in any diagnostic mode depends on the design of the software that it uses. Most WDS diagnostic modes are excellent. However, a technician with knowledge of the system being tested, an Electrical Guide and a DVOM, can often diagnose a problem as efficiently as the WDS diagnostic function.

Multiplex Symptoms Analysis

Any action controlled through a multiplex system requires the following:

- A hard-wired input to a module on the multiplex system
- A data message transmitted by a module on the multiplex system
- A data message received by a module on the multiplex system

- An output to a function

The symptoms of a particular multiplex failure cannot always be accurately predicted. Symptoms that may seem unrelated to the failure can occur depending on the state of the modules and the data being transmitted at the time of the failure. It is important to concentrate on the primary failure symptoms to help isolate the fault i.e.

- A bad module
- Loss of power or ground to a module
- Short circuit to power or ground on the bus

Carefully observe the symptoms while performing functional tests. If the symptoms appear to change while testing, perform a “hard reset” of the control modules. A “hard reset” clears any “false” symptoms that might result from testing. Also, perform a “hard reset” after a repair is completed. Then, perform functional tests of the original failed function to verify the repair. Finally, perform a functional test of related functions, looking for any remaining symptoms. All microprocessors have minimum and maximum voltage requirements. Be sure that your electrical system is operating to specification. Many false symptoms are created and repairs are performed because of a faulty electrical system or battery.

Network Faults

In the event a failure of the network occurs, a customer concern may result. The causes of network failure include:

- Data Bus Wires shorted together
- Either Data Bus Wire shorted to ground
- Either Data Bus Wire shorted to power
- Either Data Bus Wire open

Hard Reset Instructions

A "hard reset" restores the control modules to their base conditions assuring that network communications are synchronized.

All vehicles (except X100 series)

WARNING:

Be sure to retrieve DTCs before disconnecting the battery.

- Disconnect the negative cable of the battery for at least 120 seconds
- Reconnect the Battery negative cable
- Perform window initialization

X100, X103 vehicles

- Open one window fully or open a door
- Disconnect the negative cable of the battery for at least 120 seconds
- Reconnect the Battery negative cable
- Reset the window position memory for the passenger and driver door windows

Network Wiring Repairs

- All wire pairs must have at least one twist per inch (to resist electromagnetic interference) and must be twisted to within ten inches of the connected modules.
- Always use correct gauge wire when performing data bus repairs. High resistance in the data bus circuit could result in network concerns.
- Always make crimp wire repairs. Solder repairs are UNACCEPTABLE.
- Use only Jaguar supplied connectors when connector replacement is required. This will ensure the correct fit and help prevent excess resistance in the circuit.

Network Component Servicing

All networks basically consist of electronic control modules, connectors, Data Link Connector (DLC) and data bus circuit(s). The only repair that can be performed is wire repair, connector repair or module replacement.

NOTE:

Always reconfigure/refresh before replacing a module "Software Before Hardware." Remember, the hardware physically or electrically operates mechanical devices, and the software processes information.

Whenever wire or connector repair is required, always perform the repair using the methods specified in the vehicle workshop manual. NEVER condemn a control module until all of the module's power and ground circuits have been checked. Identify the module power and ground circuits, then check them using a digital multimeter.

NOTE:

If an SCP Circuit is repaired or replaced without following the proper repair procedure, the operation of the network will be degraded.

Both SCP wires must be twisted at a rate of 40 twists per meter (approx one twist per inch) anytime replacement of either circuit is required. The twist must be within 10 centimeters (4.9 inches) of any connector termination point.

The conductor for the SCP Network must be 0.5 mm (0.020 in.) diameter wire.

Network Service Tips

- Use correct gauge wire.
- Never condemn a module until ground and power circuits have been checked
- Twisted wire pairs require minimum of one twist per inch to within ten inches of modules.
- Use proper wire repair/replacement methods.
- Always refer to JTIS for specific information
- Use only approved replacement electrical connectors

Circuit Failure Testing (Consumer/Function Operates Intermittently)

Because the failure is not always present, intermittent failures can be the most difficult to diagnose. If the system is electronically controlled and its control module is capable of storing DTCs, extract any DTCs as a guide to diagnosis.

It is also vital to gather the following information about any intermittent failure:

- When does the function fail?
- Are any other functions affected?
- Were any other functions in operation at the time of failure?
- Is the failure related to a vibration or bump occurrence?
- Does the failure occur at any specific temperature, time of day, engine or transmission operating condition?

Try to recreate the failure by operating the vehicle under the conditions reported. If the failure can be recreated, follow the general diagnostic procedures.

WARNING:

When performing the "wiggle test," be sure the circuit being tested is not related to an airbag circuit.

If the failure cannot be recreated, apply the reported failure conditions to the symptoms in order to determine the probable causes of the failure. Then, carefully examine each of the probable causes. Start with the circuit areas or system components that are the most probable causes of the failure and thoroughly test each one. Apply the "wiggle" test while following the general diagnostic procedures.

Diagnostic Strategy

Problem diagnosis can be time consuming and sometimes frustrating. However, the job will be easier if you apply a logical approach to the task, called a Diagnostic Strategy. The following outlines a Diagnostic Strategy that will help ensure that none of the information necessary for accurate diagnosis is overlooked.

1. Verify the complaint
   - Check the accuracy and detail of information on the repair order.
   - Confirm the complaint. Gather information about the complaint.
   - Identify all of the symptoms – what is working and what isn't, check for MILs, warning lights and driver information display messages.
   - Look for additional symptoms.
2. Analyze the system(s) and identify probable causes.
   - Determine what controls the faulty function.
   - Determine if the failure is in the multiplex network or if an input/output to the network failed.
   - Determine the data messages that control the function and establish which modules transmit and which modules use the messages.
   - Determine if any of the messages are required for other functions. Perform functional tests to eliminate probable causes.

3. Inspect, test and pinpoint the fault.
    - Visually inspect the vehicle and look for obvious faults first.
    - Test the circuits and components using WDS or a DVOM as appropriate. Start with the circuits or components that are the most likely cause and the easiest to test.
    - Be aware that intermittent faults or symptoms may require recreating the fault conditions while testing: hot condition, cold condition, or "wiggle" test.
4. Perform the repair.
    - Follow the recommended service procedures.
    - To avoid a repeat failure, ensure that wiring, connectors, and grounds are in good condition before fitting new components.
    - Replace defective components.
5. Evaluate the results.
    - Verify that the customer complaint is resolved and that all of the original symptoms have disappeared.
    - Confirm that no new conditions were created by performing operational tests of any other systems that are related to the complaint or that were disturbed during the repair.

WORKSHEET – DIAGNOSING AND REPAIRING A CUSTOMER CONCERN

Vehicle type____________________ VIN____________________ Model Year:_____________

Customer Concern:______________________________

1. What DTCs were present (if instructor deems applicable to check)

____

____

2. What does the root cause appear to be? (Network malfunction, short, open, etc.)

____

____

3. List the diagnostic steps you plan to take, based on the symptoms:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

4. Based on results from the above steps, what additional steps are required?

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

5. And the problem is ???

____

____

6. Recheck Customer Concern: Verify your repair fixed the symptom the customer was concerned about.

____

____

WORKSHEET – SYSTEM MEASUREMENTS

Give yourself/team an "Action Plan" of how you are going to attack this problem. Using the information available and with the aid of the correct wiring diagram, check circuits using WDS or a DVOM and compare results with information on the Data page of the Electrical Guide Figure. Write in all information gathered from vehicle and look at wiring diagram to determine fault area.

Before working on the vehicle explain to the instructor your team's plan of action.

1.

Table 44

CM connector #, PIN # I/O	How and where measured?	Expected values (V, A, HZ, %, etc.)	Actual values (V, A, HZ, %, etc.)

WORKSHEET – NETWORK MESSAGES

Using the Electrical Guide Figures and the assigned vehicle, fill in the following table for the indicated systems.

Table 45

Driver's demand input	**Control module hardwire to input**	**Network message is sent to/through (include network)**
Brake Switch application for brake light activation		
Right front window down switched at driver's door		
Rear fog lights ON requested on X202 by activating rear fox switch		
Left turn signal on X350 requested by pushing down on turn stalk		
Traction control OFF		