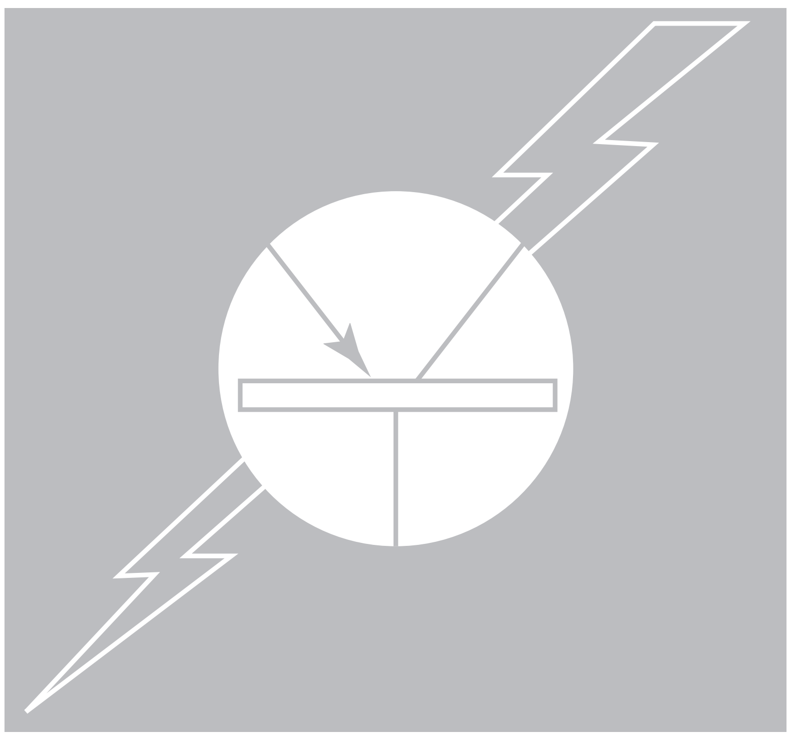
Technical Training

Electrical Systems

688-JAG: Advanced Electrical Systems and Diagnostics



General Information

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ONLINE COURSE EVALUATION

Class participants are encouraged to fill out an online evaluation for this course. The Jaguar evaluation is available at:

- **http://www.fordtechservice.dealerconnection.com/vdirs/training/classsurvey/jagsurvey.asp**

The information provided in the evaluations is kept confidential and will only be used to improve Jaguar training activities. Your prompt response will be appreciated.

Your feedback is extremely important to us!

TRAINING COURSE CONTENT AND OBJECTIVES

Course Content

This course explains the progression and evolution of multiplexed electrical systems since their introduction in 1997. Although early Jaguar models are not covered in detail, they are referenced to show the progression and advancements made in multiplexing and body electrical functions.

With the introduction of the 2007 XK (X150) the electrical system architecture has moved in a new direction with the implementation of smart junction boxes to reduce wiring. CAN bus dependability is improved by branching off modules rather than having them as an internal pass-through for communication. This new electrical system design is carried over to the 2009 XF (X250), and points the way for future models in the Jaguar line.

Course Outline

1. General Information
2. Jaguar Multiplexed Systems
3. Control Module Programming
4. Control Module Locations & Functions
5. Body Systems and Operation
6. X105 Body Electrical Systems
7. X206 Body Electrical Systems
8. X404 Body Electrical Systems
9. X358 Body Electrical Systems
10. X150 Body Electrical Systems
11. X250 Body Electrical Systems
12. Security and Locking Systems
13. Advanced Diagnostics

Course Objectives

At the end of this course technicians will be able to:

- Understand Jaguar multiplexed systems and operation
- Understand the function and effects of software vs. hardware
- Identify the different electrical systems in each Jaguar model
- Be able to diagnose multiplex system concerns using the knowledge and practice gained in this course

MODEL DESIGNATIONS

This publication uses Jaguar internal model designations to refer to specific model ranges and years.

Internal Designation	Model Range	Model Year(s)
X100	XK	1997 – 2002
X103	XK	2003 – 2004
X105	XK	2005 – 2006
X150	XK	2007 Onward
X200	S-TYPE	2000 – 2002
X202	S-TYPE	2003 – 2004
X204	S-TYPE	2005
X206	S-TYPE	2006 – 2008
X250	XF	2009
X308	XJ	1998 – 2003
X350	XJ	2004 – 2005
X356	XJ	2006 – 2007
X358	XJ	2008
X400	X-TYPE	2002 – 2003
X404	X-TYPE	2004 – 2008

ACRONYMS, ABBREVIATIONS AND SYMBOLS

The following acronyms, abbreviations and symbols are used in this course book. The majority of them conform to J1930 standards.

Acronym, Abbreviation or Symbol	Definition or Description
A/CCM	Air Conditioning Control Module
ABS	Anti-Lock Braking
ACP	Audio Control Protocol
AFLS	Adaptive Front Lighting System
AJB	Auxiliary Junction Box
BIW	Body in White
BJB	Battery Junction Box
BMS	Battery Monitor System
BOF	Black Optic Fiber
BPM	Body Processor Module
BSM	Blind Spot Monitor
CAN	Controller Area Network
CARB	California Air Resources Board
CCF	Car Configuration File
CCS	Climate Controlled Seats™
CCSM	Climate Controlled Seat Module
CD	Compact Disc
CJB	Central Junction Box
D2B	Digital Data Bus
DDCM	Driver Door Control Module
DDM	Driver Door Module
DLC	Data Link Connector
DSC	Dynamic Stability Control
DSCM	Driver Seat Control Module
DTC	Diagnostic Trouble Code
DVOM	Digital Volt / Ohm Meter
ECM	Engine Control Module
EMI	Electromagnetic Interference
EPB	Electronic Parking Brake
ETM	Engineering Test Mode

Acronym, Abbreviation or Symbol	Definition or Description
FEM	Front Electronic Module
FET	Field Effect Transistor
GEM	General Electronic Module
GTR	Global Technical Reference
GVIF	Gigabit Video Interface
HID	High Intensity Discharge (Headlights)
HRCM	Head Restraint Control Module
HS (CAN)	High Speed CAN
HSW	Heated Steering Wheel
IC	Instrument Cluster
ICM	Information Control Module, or Infotainment Control Module
IDS	Integrated Diagnostic System
IPO	Inputs, Processing, Outputs
ISO	International Organization for Standardization
KTM	Key Transponder Module
KVM	Keyless Vehicle Module
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
LF	Low Frequency
LH	Left Hand
LHD	Left-Hand Drive
LIN	Local Interconnect Network
MOST®	Media Oriented Transport System
MS (CAN)	Medium Speed CAN
NAV	Navigation System
NTC	Negative Temperature Coefficient
OBT	Optical Bus Tester
OCS	Occupant Classification System
PATS	Passive Anti-Theft System
PCB	Printed Circuit Board

Acronym, Abbreviation or Symbol	Definition or Description
PDCM	Passenger Door Control Module
PDI	Pre-Delivery Inspection
PID	Parameter Identification Data
PIN	Personal Identification Number
POF	Plastic Optical Fiber
PWM	Pulse Width Modulated
RBD	Ring Break Diagnostics
REM	Rear Electronic Module
RF	Radio Frequency
RH	Right Hand
RHD	Right-Hand Drive
RJB	Rear Junction Box
RMM	Rear Memory Module
ROPS	Roll-Over Protection System
RSCM	Rain Sensing Control Module
SCP	Standard Corporate Protocol (Network)
SCU	Start Control Unit
SLCM	Security and Locking Control Module
SRS	Supplemental Restraint System
TC	Traction Control
TCM	Transmission Control Module
TED	Thermoelectric Device
TSD	Touch-Screen Display
ULD	Ultrasonic Leak Detector
VCATS	Vehicle Configuration and Test System
VID (Block)	Vehicle Identification Block
VIN	Vehicle Identification Number

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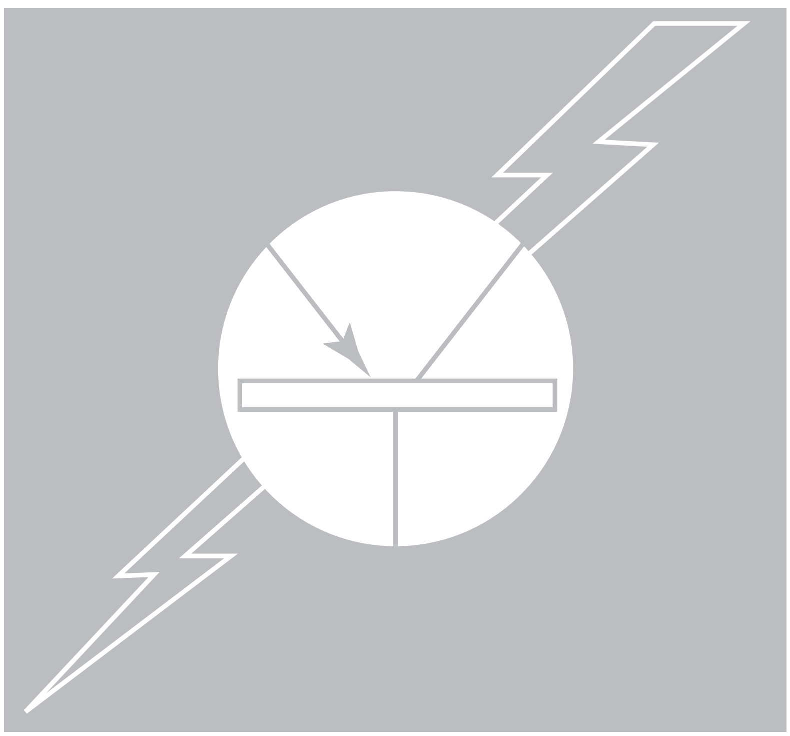

Jaguar Multiplexed Systems

JAGUAR

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NETWORKS AND MULTIPLEXING OVERVIEW

Jaguar vehicles 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 anti-lock brakes and entertainment systems both require vehicle speed information. Jaguar vehicles have been using 'Networks' since 1997 to achieve this communication. A network refers to a group of control modules and wiring that allow information to be sent or received using an electrical or electronic medium. Networks enable multiple modules to act together to perform complex vehicle operations.

Networks provide the following benefits:

- Improved vehicle diagnostic capabilities
- Eliminate redundant sensors and dedicated wires for each function
- Modules share data to allow more complex features and system flexibility
- Lower cost, lower weight, better reliability
- Allow additional features to be added after sale via software upgrades instead of adding modules and wiring

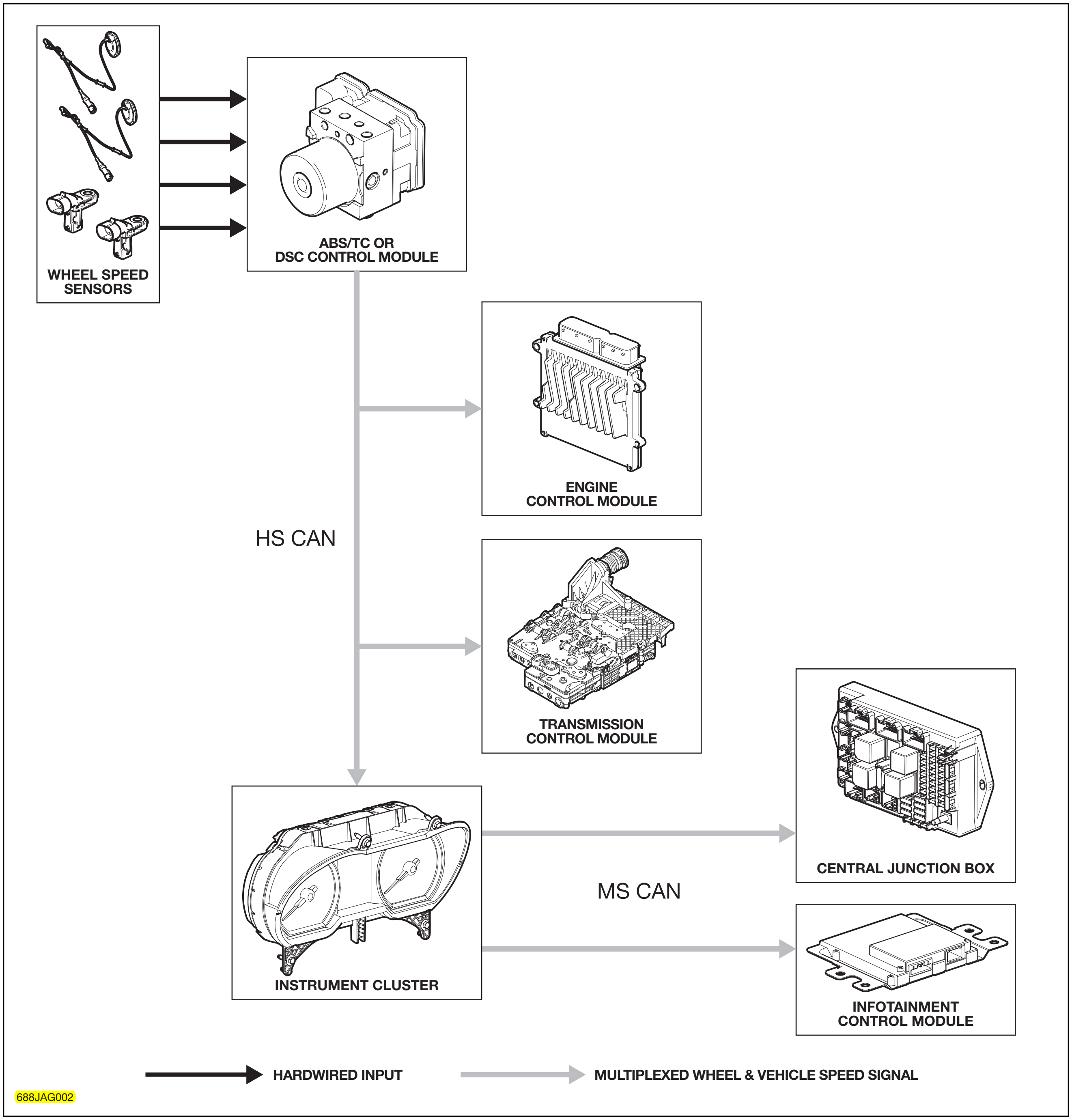
Jaguar vehicles use a total of ten different types of networks depending on the year and model.

- High Speed Controller Area Network (HS CAN)
- Medium Speed Controller Area Network (MS CAN)
- Local Interconnect Network (LIN) Bus
- Standard Corporate Protocol (SCP) Network
- Serial Data Link (ISO 9141)
- Serial and Encoded Data (DATA)
- Audio Control Protocol (ACP) Network
- Digital Data Bus (D2B) Network
- Media Oriented System Transport (MOST®) Ring
- Gigabit Video Interface (GVIF)

Network Application by Model Range and Year

Internal Designation	Model Range and Year(s)	Networks
X100	XK 1997 – 2002	HS CAN, SCP, ISO, DATA, ACP
X103	XK 2003 – 2004	HS CAN, SCP, ISO, DATA, ACP
X105	XK 2005 – 2006	HS CAN, SCP, ISO, DATA, ACP
X150	XK 2007 Onward	HS CAN, MS CAN, ISO, DATA, LIN, MOST, GVIF
X200	S-TYPE 2000 – 2002	SCP, ISO, ACP
X202	S-TYPE 2003 – 2004	HS CAN, SCP, ISO, DATA, D2B
X204	S-TYPE 2005	HS CAN, SCP, ISO, DATA, D2B
X206	S-TYPE 2006 – 2008	HS CAN, SCP, ISO, DATA, D2B, GVIF
X250	XF 2009	HS CAN, MS CAN, ISO, DATA, LIN, MOST, GVIF
X308	XJ 1998 – 2003	HS CAN, SCP, ISO, DATA, ACP
X350	XJ 2004 – 2005	HS CAN, SCP, ISO, DATA, D2B
X356	XJ 2006 – 2007	HS CAN, SCP, ISO, DATA, D2B
X358	XJ 2008	HS CAN, SCP, ISO, DATA, D2B, MOST
X400	X-TYPE 2002 – 2003	HS CAN, SCP, ISO, DATA, D2B
X404	X-TYPE 2004 – 2008	HS CAN, SCP, ISO, DATA, LIN, D2B

Electronic control modules connected to a network enable controllers to communicate quickly and efficiently by sharing input and output information with different vehicle systems to achieve extremely complex vehicle functions. This is known as 'multiplexing'.



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

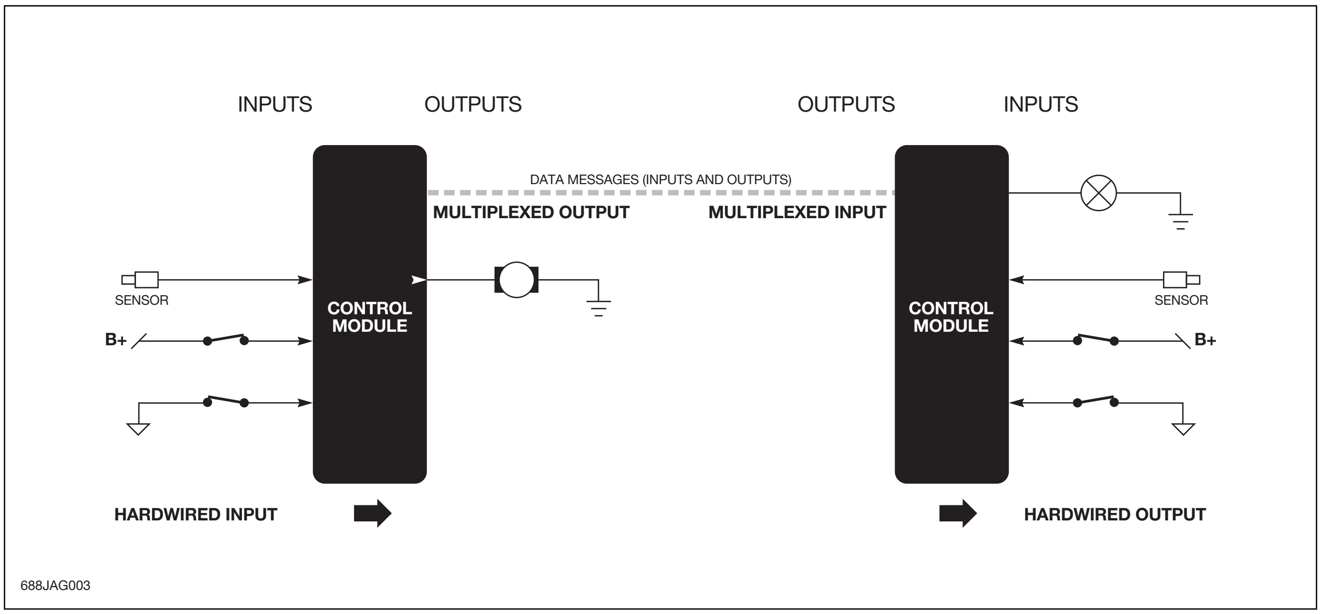
Multiplexed control modules use conventional inputs from the sensors or switches that are directly connected to them (hardwired). The control modules also use data message inputs from other control modules connected to the multiplex circuit.

Processing

Control modules and smart junction boxes have micro-processors that process data based on inputs received from switches, sensors or other control modules. Inputs are typically hardwired to the closest module in the vehicle to reduce wiring and redundant cabling.

Outputs

The control modules can output analog or digital voltage signals (via individual hard wires) to directly control components. Control modules also output data messages to the network to be used by other control modules.



Shared Function Control

Control modules connected to a shared network can transmit data messages to each other and also share control functions. One module can activate a function based on inputs received from one or a number of other modules.

To illustrate this, the following pages compare a traditional non-multiplexed vehicle speed signal distribution, to a modern multiplexed system. 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

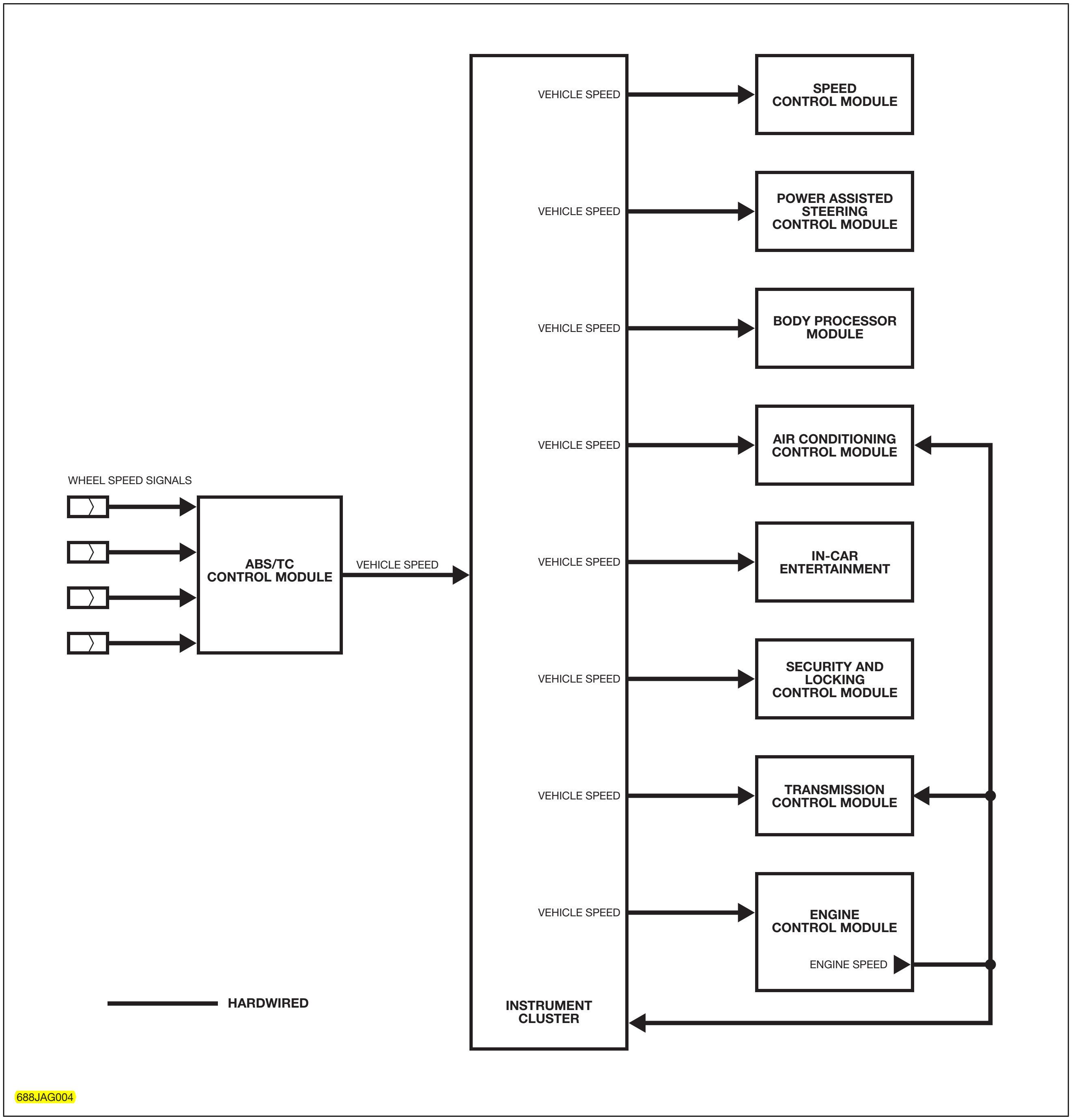
1995 XJ6 vehicle speed distribution is used as an example.

The ABS control module transmits one wheel speed sensor signal to the instrument cluster to be used as the vehicle speed signal for the speedometer. The instrument cluster then distributes the vehicle speed signal to each of the components via a separate hardwired input. If each system could get vehicle speed information from the same INPUT, it would reduce the number of sensors and the amount of wiring on the vehicle.

The chart below lists the 1995 XJ6 control modules that receive speed signal data, and their respective control functions.

Control Module	Function
Instrument Cluster	Speedometer
Transmission Control Module	Transmission shift control
Radio	Automatic volume control
Air Conditioning Control Module	Climate control blower speed
Engine Control Module	Engine control
Power Assisted Steering Control Module	Variable assist steering
Speed Control Module	Cruise control
Body Processor Module	Wiper speed control
Security and Locking Control Module	Locking and security functions

Non-Multiplexed Vehicle Speed Signal Distribution



Multiplexed Signal Distribution

X250 speed signal distribution is used as an example.

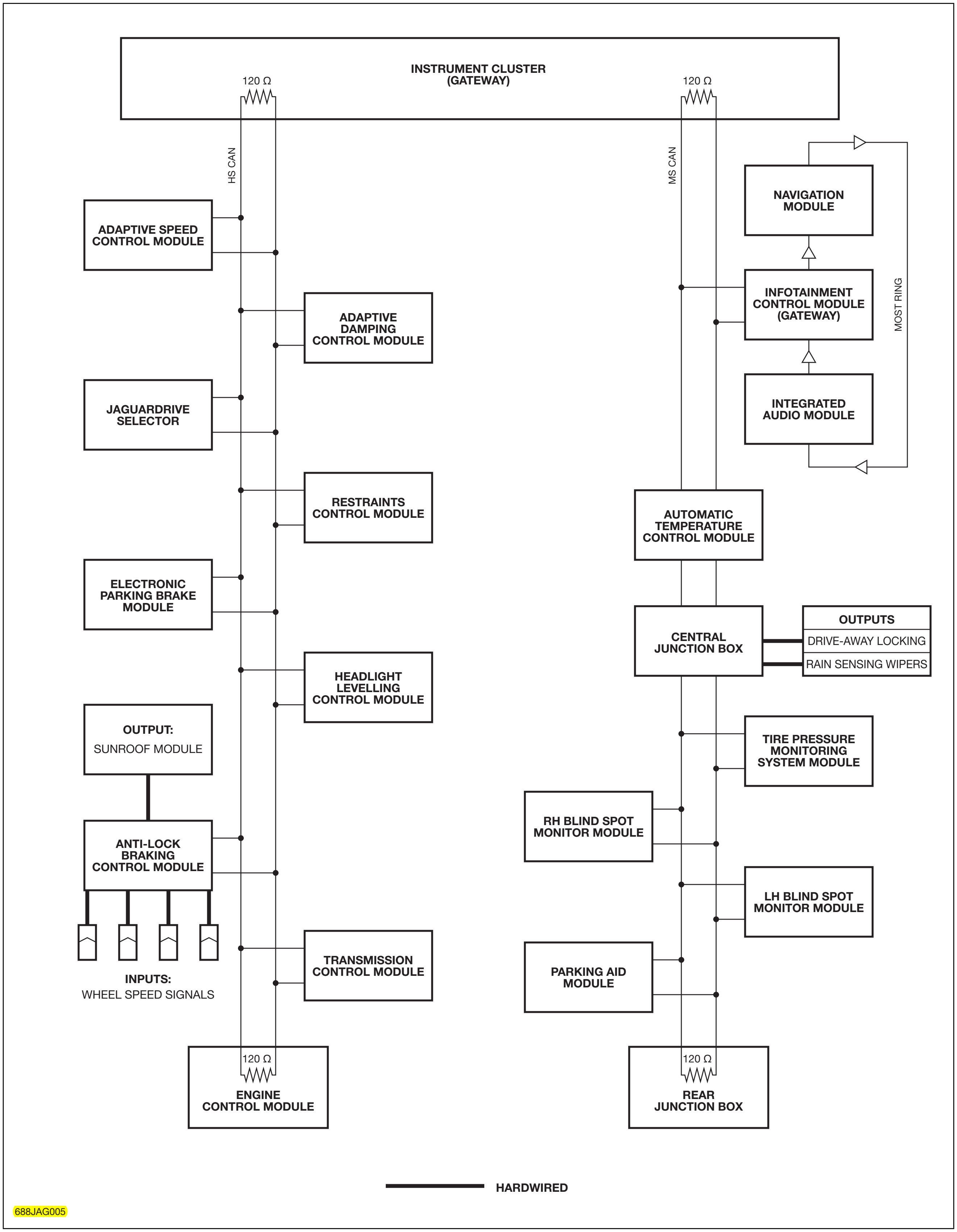
The four wheel speed input signals are used by the ABS/DSC module to provide anti-lock braking and dynamic stability control. The ABS/DSC module transmits wheel and vehicle speed data on the high speed CAN multiplex network. All modules connected to the multiplex circuits share the same message data using only the network wiring and connectors.

The instrument cluster acts as a gateway and converts the vehicle speed data from high speed CAN to medium speed CAN data to be used by the speedometer and other body systems. The information control module also acts as a gateway and converts the vehicle speed data again to be used by the audio system on the MOST® ring. The only module not connected to the network requiring wheel speed data is the sunroof module, which receives the vehicle speed signal via separate hard wire directly from the ABS/DSC module for anti-trap strategy.

The chart below lists the X250 control modules that receive speed signal data, and some examples of their respective control functions.

Control Module	Function
ABS/DSC Module	Anti-lock braking, traction control
Engine Control Module	Engine torque
Transmission Control Module	Shift control, drive modes
JaguarDrive Selector	Gear selection protection
Restraints Control Module	Deployment strategy
Central Junction Box	Body Functions: drive-away locking, wiper speed control, etc.
Instrument Cluster	Speedometer
Blind Spot Monitor Module	Activation/operation strategy
Parking Aid Module	Activation strategy
Adaptive Cruise Control Module	Cruise control strategy
Infotainment Control Module	Automatic volume control
Navigation Module	Speed/location
Adaptive Damping Control Module	Suspension control
Headlight Leveling Control Module	Leveling strategy
Automatic Temperature Control Module	Blower speed
Sunroof Module	Anti-trap strategy

X250 Multiplexed Wheel and Vehicle Speed Signal Distribution



Complex Network Functions

In addition to sharing information, multiplexing has enabled modules to work together to perform complex vehicle functions. The sequence below demonstrates how a network can complete a complex function such as Global Closing using shared logic.

The following example depicts an X250 equipped with Passive Entry. The sequence starts with an operator standing outside of the vehicle (all windows and sunroof open and doors unlocked) with a SmartKey within one meter of the driver's door handle antenna.

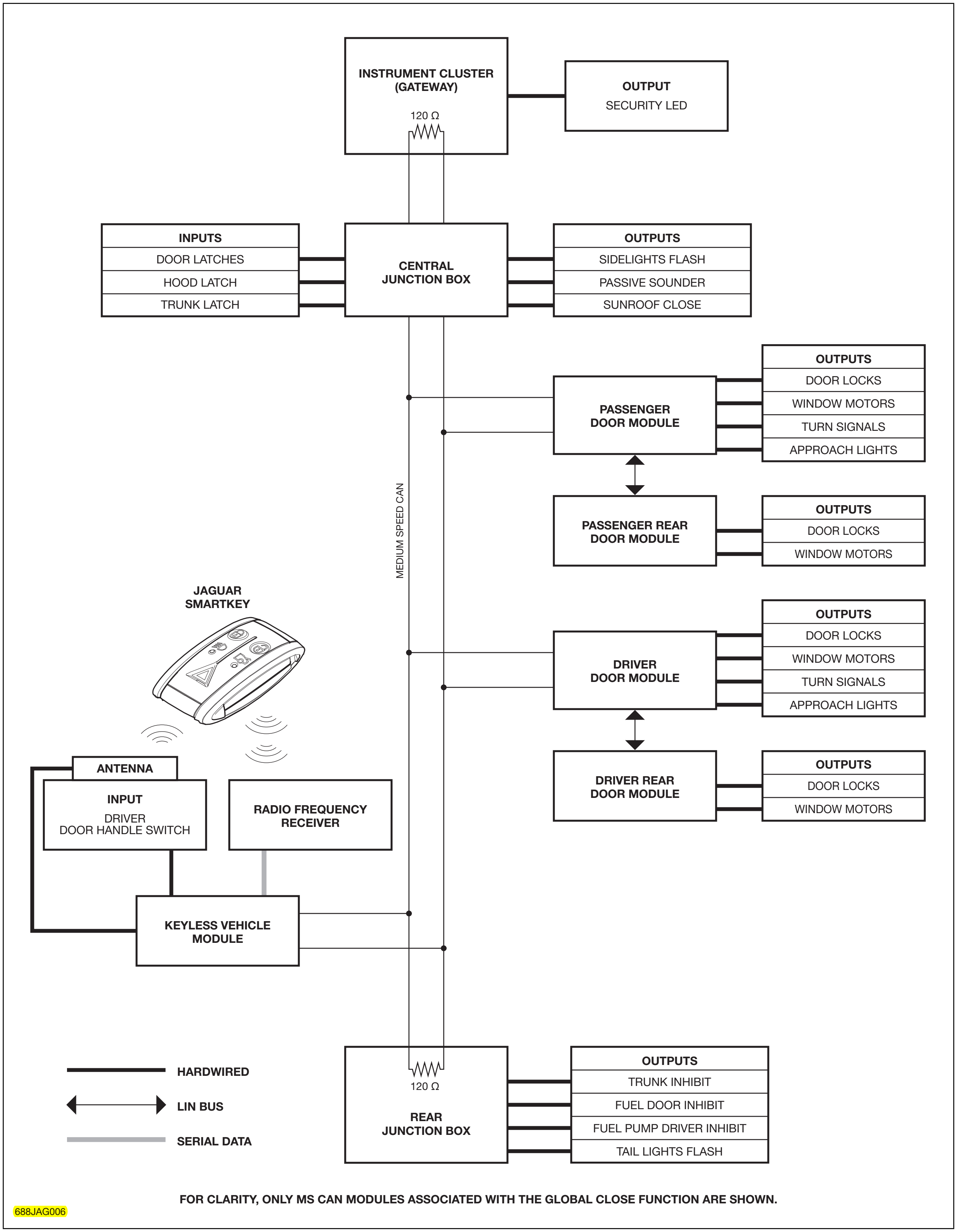
1. Pressing the switch on the driver's door handle provides a hardwired 'lock request' input signal to the keyless vehicle module (KVM).
2. Once the KVM receives the hardwired 'lock request' input signal, the KVM then transmits a low frequency (LF) signal to the driver door handle antenna which activates any SmartKey transmitter within one meter of the handle antenna.
3. The activated SmartKey transmits a radio frequency (RF) 'security code' signal which is received by the RF Receiver.
4. The RF Receiver transmits the 'security code' signal via a dedicated serial data line to the KVM, which checks and validates the security code.
5. Once the security code has been validated by the KVM, the KVM sends the 'lock request' signal to the CJB via MS CAN bus.
6. Upon receiving the 'lock request' signal, the CJB confirms that none of the latches are 'ajar' by monitoring the aperture 'ajar' switch signals, which are a direct hardwired input to the CJB.
7. Once it has confirmed that none of the latches are 'ajar', the CJB sends a 'lock request' followed by a 'security request' over the MS CAN bus.
8. Locking and Security Request Results
   - The front door modules receive the 'lock request' signal via MS CAN. The front doors lock.
   - The front door modules transmit the 'lock request' signal to the rear door modules via LIN bus to lock the rear doors.
   - The RJB receives the 'lock request' signal and inhibits the trunk and fuel door release.
   - Once the vehicle is locked, the CJB automatically enters security mode and sends a 'security request' signal over the MS CAN bus, and flashes the front side lights.
   - The front door modules receive the 'security request' signal via MS CAN and flash the side view mirror turn signal and approach lights.
   - The RJB receives the 'security request' signal and inhibits fuel pump driver module operation and flashes the tail lights.
   - The instrument cluster receives the 'security request' signal and activates the security LED in the sunload sensor on the dashboard.

If the operator releases the lock button now, the car is locked and armed but the windows and sunroof are still open. By continuing to press the lock button for an additional three seconds, the following events occur:

9. The KVM is still receiving the hardwired 'lock request' signal from the driver's door handle and sending it to the CJB via MS CAN. Once the CJB sees the 'lock request' signal for more than three seconds it will send an 'all window close request' signal over the MS CAN bus and a hardwired 'all window close request' to the sunroof module.
10. The front door modules receive the 'all window close request' and close the front windows and transmit the request via LIN bus to the rear door modules to close the rear windows.

NOTE: The windows and sunroof will only globally close if the anti-trap functionality has been enabled through window / sunroof initialization.

X250 Global Close Function w/Passive Entry



MULTIPLEX SYSTEM CLASSIFICATIONS

Automotive multiplex systems are classified as follows:

- Class A transmits up to 10,000 bits of data per second (10 Kbaud)
- Class B transmits up to 125,000 bits of data per second (10 – 125 Kbaud)
- Class C transmits over 125,000 bits of data per second (125 Kbaud)
- Class D transmits over 1,000,000 bits of data per second (1 Mbaud)

Jaguar Network Communication Speed Summary			
Network	**Class**	**Speed**	**Communications**
High Speed Controller Area Network (HS CAN)	C	500 Kbaud	Engine, Transmission, Braking systems, Restraints, etc.
Medium speed Controller Area Network (MS CAN)	B	125 Kbaud	Body systems
Standard Corporate Protocol (SCP) Network	B	41.6 Kbaud	Body systems
Serial Data Link (ISO 9141)	B	10.4 Kbaud	Diagnostics
Serial and Encoded Data	A	9.6 Kbaud	Local; Unidirectional
Local Interconnect Network (LIN) Bus	A	9.6 Kbaud	Local; Point-to-point, Bidirectional
Audio Control Protocol (ACP) Network	A	9.6 Kbaud	Audio system
Digital Data Bus (D2B) Network	D	5.6 Mbaud	Telematics systems
Media Oriented System Transport (MOST®) Ring	D	24 Mbaud	Telematics systems
Gigabit Video Interface (GVIF)	D	1.6 Gbaud	Telematics systems

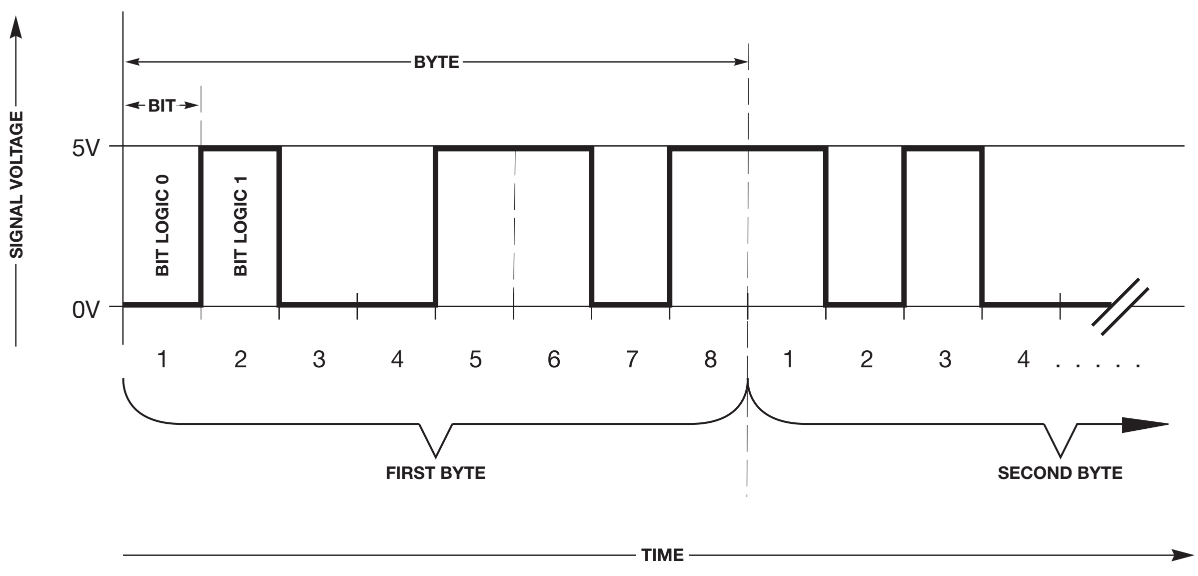
NOTE: To view all network configurations please refer to the Complete Vehicle Networks section in this guide.

DATA MESSAGES

Control modules use data messages to share information and logic on a multiplex bus. Data is transmitted as a series of timed signals called 'typical binary code'. In binary code, each timed unit, or 'bit', is assigned a value of either '0' or '1' based on its voltage.

Each block of eight bits is known as a 'byte'. Bytes of data are grouped together to form data messages.

In the example below, a 0 volt signal is assigned the value of '0' and a 5 volt signal is assigned a value of '1'.



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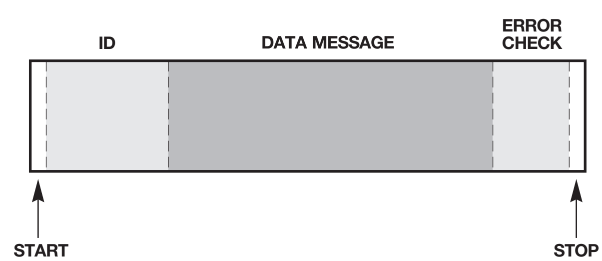
A typical data message contains:

- Start bit – identifies the start of a message
- Data
  - Token data: indicates that the module is alive or active on the network or bus
  - Operation data: contains the information from a control module (ABS data, ECM data etc.)
  - Diagnostic data: a response to an IDS-specific message or command
- Error check
- Stop bit – identifies the end of a message



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CONTROLLER AREA NETWORK (CAN)

The High Speed (HS) Controller Area Network (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). The bus wires are twisted so the opposing high and low voltages cancel any possible electromagnetic interference.

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. Two wires are used so that the module can countercheck the data sent by another control module, and also for purposes of self-monitoring.

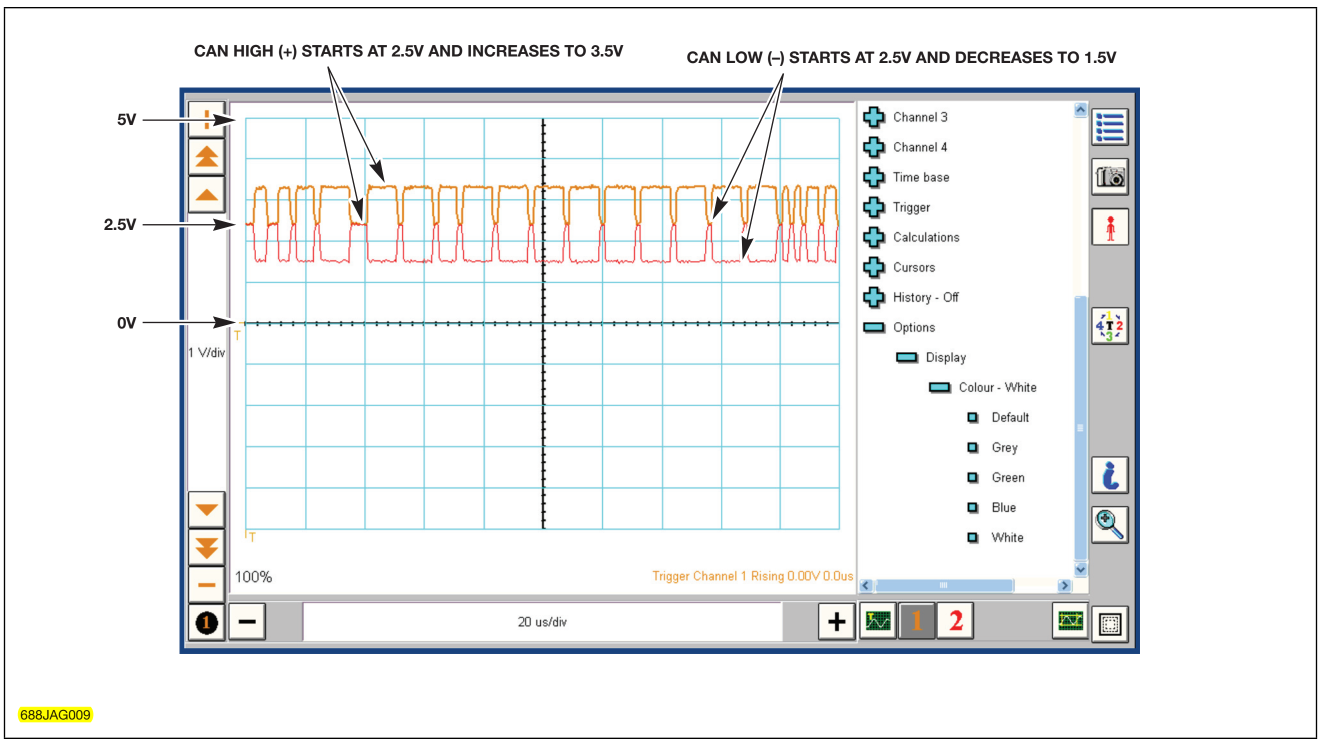
Data Transmission

The data transmitted on the first wire is also transmitted on the second wire at the same time, but is inverted. If the signal on one of the wires fails, it will be detected by the self-diagnosis facility and stored in the control module as a communications error.

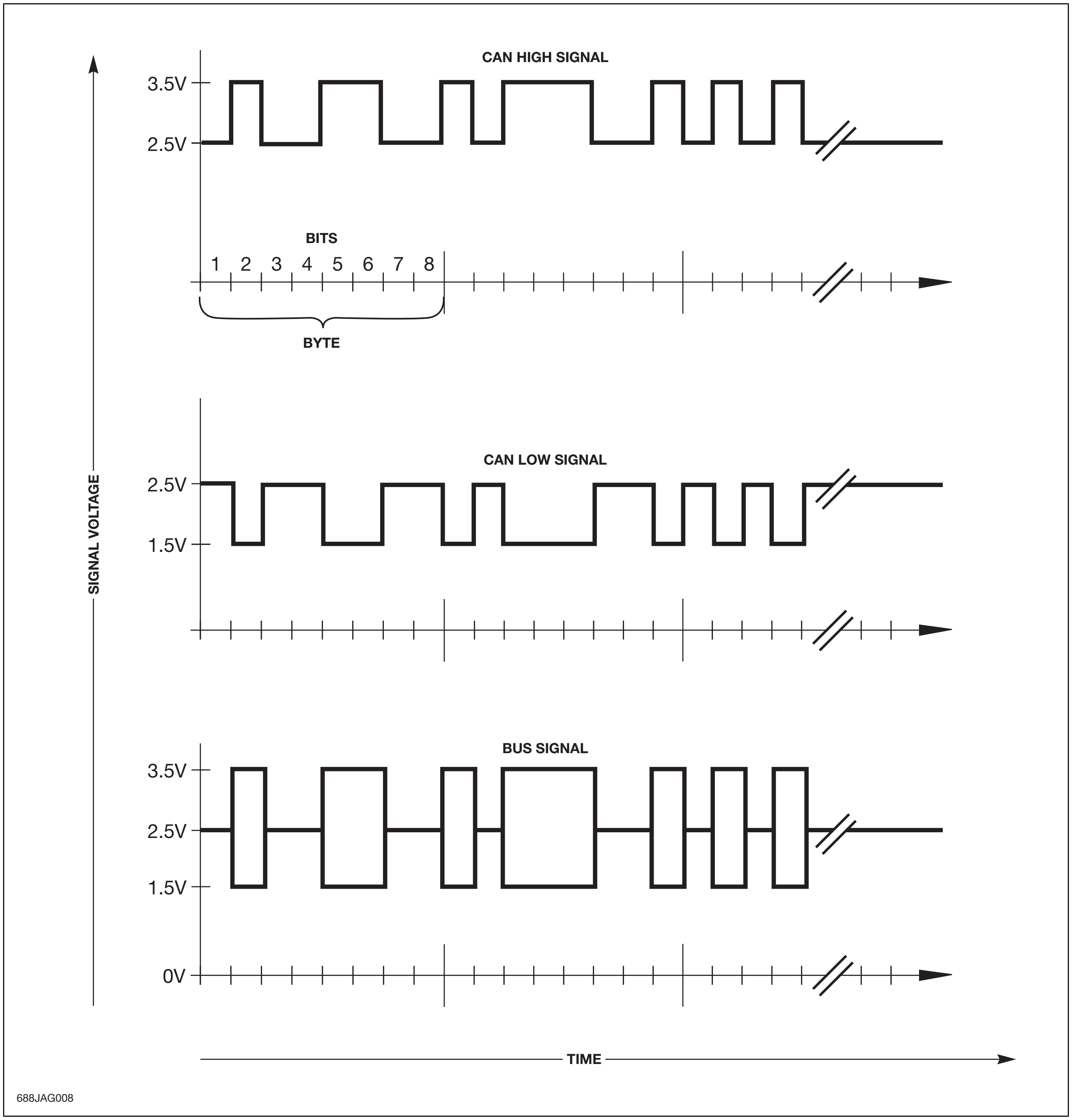
The illustration on the facing page depicts the high and low voltage signals separately for clarity, then combined to illustrate the actual binary data message.

CAN is called ‘real time’ communication because its speed allows extremely fast responses for controlling time critical operations. CAN message frames are transmitted at intervals of 4 to 20ms. The illustration below shows an oscilloscope screen shot of an actual HS CAN message taken at 20 us/div time frame, or 20 millionths of a second, in order to show how a message actually looks in real time.

CAN Oscilloscope Pattern



Oscilloscope Pattern Explanation



Message Prioritization

Due to the speed at which the network operates, each module constantly watches the network message traffic by monitoring voltages on the bus. A module will not begin communication until the bus is clear. If two or more modules attempt communication at the same time a 'method of arbitration' assures the message frame with the highest priority will always be communicated first. The module with the lower priority message will stop transmitting and try again when the bus is clear.

CAN Network Diagnostics Using IDS

The Integrated Diagnostic System (IDS) automatically tests the network integrity and communications before running specific diagnostic routines. IDS establishes communication with the vehicle via the data link connector (DLC). IDS will direct the user to an appropriate test from the menu if the network communication and integrity test fails.

CAN Network Failure Modes

The IDS diagnostic routine tests the network wiring but will not pinpoint an individual module failure. If a network failure is confirmed using IDS, then pinpoint the fault using an electrical guide and a DVOM.

CAN modules will communicate only when the CAN high (+) and CAN low (–) are in an acceptable electrical state.

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 cross the open circuit. Modules will continue to operate by substituting default values for the missing data.

The table below 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.

Wire	Condition	Communication
CAN High (+)	Open circuit	No
CAN High (+)	Short 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

High Speed CAN Failure Symptoms

HS CAN faults can result in a number of different message center warning displays, depending on the vehicle:

- RESTRICTED PERFORMANCE
- DSC NOT AVAILABLE
- CRUISE NOT AVAILABLE
- ENGINE SYSTEM FAULT
- GEARBOX FAULT

In addition the following symptoms may result:

- Gear selector inoperative
- Gear selector state lights inoperative
- No starter operation

If IDS or symptom diagnostics indicate a CAN communication error, the exact nature of and location of the fault can be quickly pinpointed using a DVOM and the appropriate electrical guide.

Medium Speed CAN

Medium speed (MS) CAN was introduced on the 2007 XK (X150). The MS CAN bus replaces the slower-speed SCP network for body system communication.

MS CAN communicates at 125kb and functions in much the same manner as HS CAN, except that MS CAN will remain energized for approximately 40 minutes after the last system message has been transmitted.

STANDARD CORPORATE PROTOCOL (SCP) NETWORK

The Standard Corporate Protocol (SCP) bus is used exclusively for body systems (except on X200). The SCP bus comprises two standard 0.5 mm (0.020 in.) copper wires twisted together with 40 twists per meter (approximately one twist per inch). The wires are twisted to help resist electromagnetic interference. One wire in the bus is designated as SCP high (+), the other as SCP low (–).

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

The network is wired as a 'star' circuit, which 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.

NOTE: Refer to the Complete Vehicle Networks section to view star network configuration.

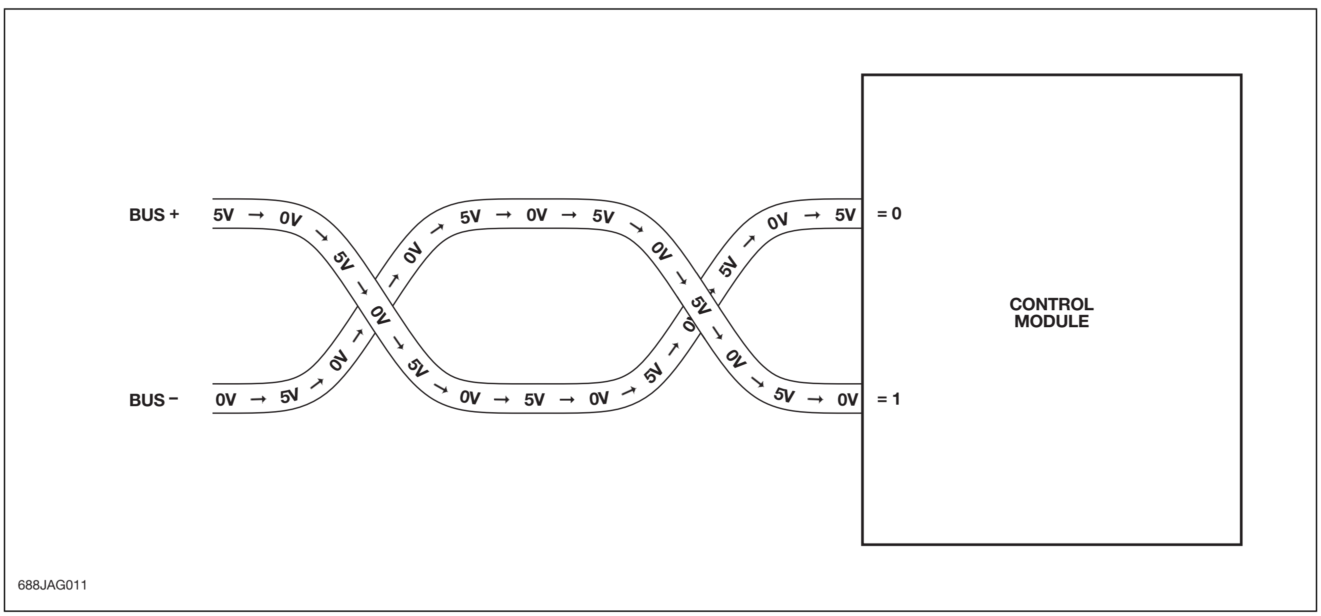
During normal operation, SCP networks allow the electronic control modules linked to the network to exchange information directly with each other. For example, on X358, the Instrument Cluster supplies the A/CCM with engine temperature information, which allows the A/CCM to consider engine temperature when activating the heater blower motor.

The network will remain operational if one of the bus wires is an 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.

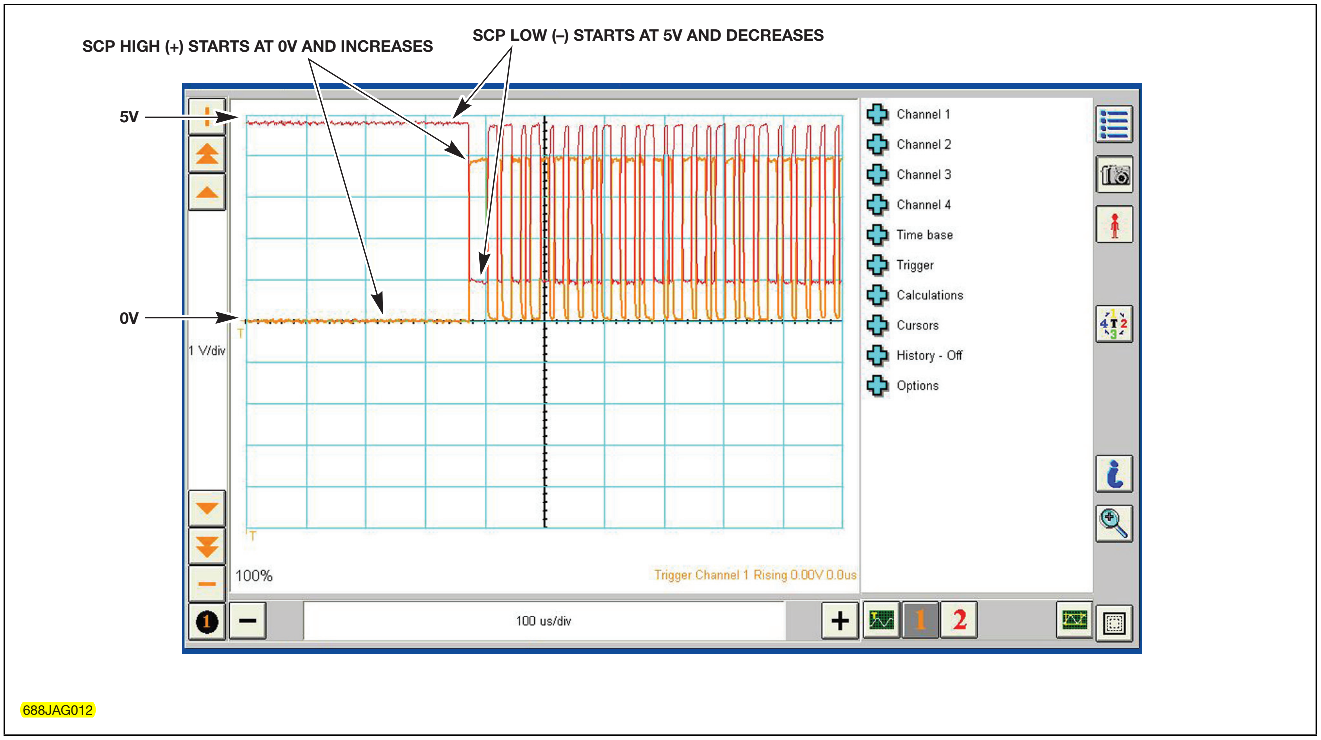
Network Protocol

SCP enables the network to communicate using electric signals over a data bus.

- Data bus wires are designated Bus + and Bus –
- Electrical impulses vary between 5.0 volts and 0 volts to represent a digital logic '1' or '0'
- When there are no messages, Bus – is 5.0 volts and Bus + is 0 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 (–)



SCP Oscilloscope Pattern



NOTE: The illustration above displays an oscilloscope screen capture of an actual SCP message taken at 20 millionths of a second time frame in order to show how a message actually looks in real time.

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.

SCP Network Diagnostics Using IDS

Network Integrity and Communications Tests

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

IDS will test 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 IDS screen during testing. If IDS fails the network, the communications problem is with the last module shown on the IDS screen.

With the ignition OFF, IDS transmits a 'request for identification' message to the first module. If the module response is correct, the next module on the network is tested. If the module response is missing or incorrect, the test is failed and IDS terminates diagnostics, directing the user to an appropriate specific test routine.

When all modules have passed, IDS switches the ignition ON and IDS 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 IDS does not recognize an 'I'm awake' message from each module, the test is failed and IDS terminates diagnostics, directing the user to an appropriate specific test routine. Because the instrument cluster 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, IDS begins the user specified diagnostic routines.

SCP Network Failure Modes

The IDS diagnostic routine tests the network wiring but will not pinpoint an individual module failure. If a network failure is established by IDS, 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, diagnostic equipment (IDS) will not communicate with modules functioning on only one line.

An open circuit or a short 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.

Wire	Condition	Communication
SCP High (+) **or** SCP Low (–)	Open circuit	Yes, if other SCP circuit is still functioning
SCP High (+) **and** SCP Low (–)	Open circuit	Yes, on either side of breaks
SCP High (+) **or** SCP Low (–)	Short circuit to ground or B+ voltage	Yes, if other SCP circuit is still functioning
SCP High (+) **and** SCP Low (–)	Short circuit to ground or B+ voltage	No
SCP High (+)	Short circuit to SCP Low (–)	Yes, unless one is also short circuit to ground

SCP Network Failure Symptoms

Since SCP networks are wired as a 'star' or 'True Parallel Circuit', symptoms will vary – from an individual module not responding to a complete network failure.

If IDS or symptom diagnostics indicate an SCP communication error, the exact nature and location of the fault can be quickly pinpointed using a DVOM and the appropriate electrical guide.

SERIAL AND ENCODED DATA

The Serial and Encoded Data network was used by Jaguar as early as 1997 and is still used on current model year vehicles. Serial and Encoded Data is a local network protocol that transmits unidirectional event-driven messages to single specific modules over a single wire, and operates at a speed of 9.6kb.

The network is used on a variety of electrical systems, such as:

- Denso Climate Control Systems: control panel to module communications
- PATS Security Systems: key transponder module and immobilization communications
- KVM Communications: RF signal to Keyless Vehicle Module

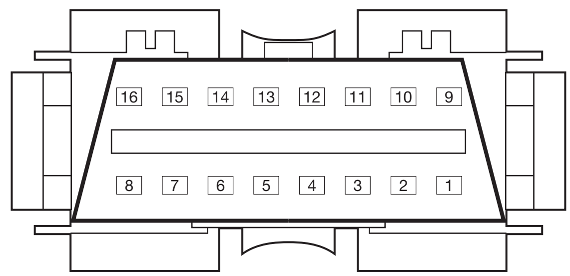
The Serial and Encoded Data network is an early form of LIN bus. The single wire network is 12V at idle and is pulled low when an event is being transmitted. The network is identified in most electrical guides by the symbol D.

SERIAL DATA LINK (ISO 9141)

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

Network Activation

In order to activate the Serial Data Link, IDS must be connected to the 16-pin data link connector (DLC).



688JAG015

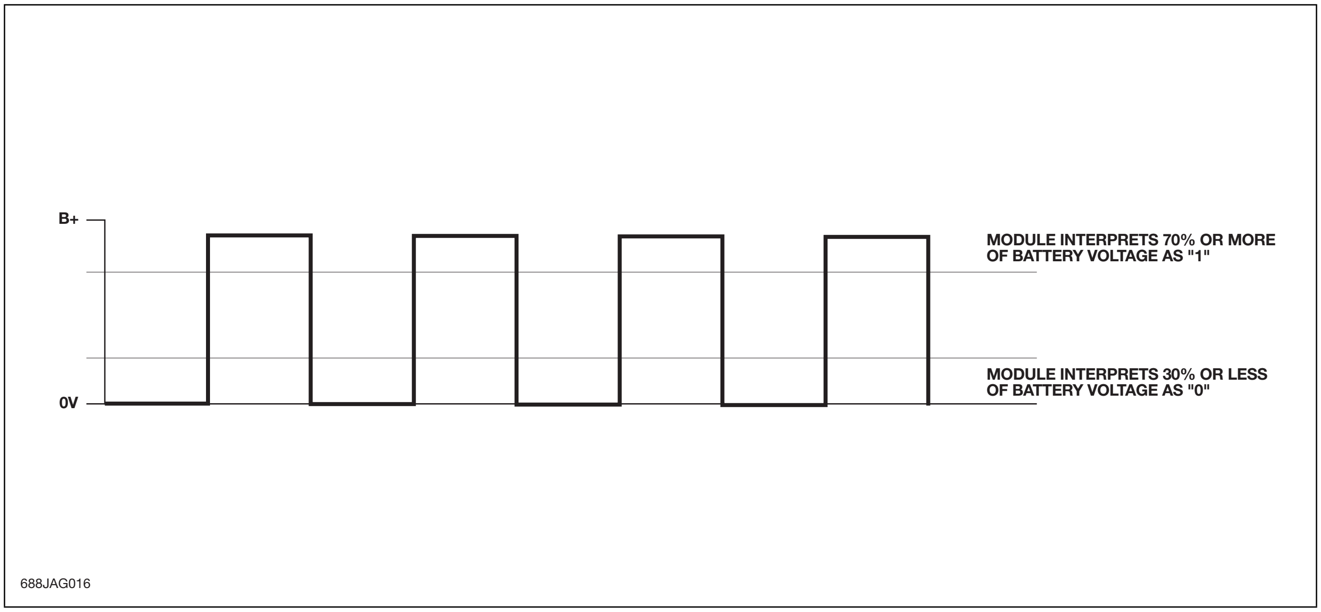
Once connected, IDS can communicate on the network. This allows IDS to perform several functions:

- 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 for communication, which 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 logic '1'. A signal of less than 30% of battery voltage is interpreted as 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 IDS while performing diagnostics. When performing diagnostics on the Serial Data Link be sure to allow time for IDS to display changes in I/O state.

NOTE: For the 2008 model year, the CARB (California Air Resources Board) required the automotive industry to switch from serial data diagnostic communication to the CAN communications standard (ISO 15765-4) no later than the 2008 model year. Certain Jaguar vehicles complied early to the new standard. S-TYPE and XJ complied starting with 2006 model year. 2007 XK was built to the standard, and X-TYPE became compliant in 2008.

LOCAL INTERCONNECT NETWORK (LIN) BUS

The Local Interconnect Network (LIN) Bus is a single wire, class-A protocol communication network used as a CAN subsystem. It is based on an enhanced ISO 9141 protocol, which was previously used as a legislative standard for vehicle diagnostics. The LIN bus operates at a speed of up to 9.6kb and uses a single wire for communication between control modules.

The LIN bus is used to reduce the amount of cabling from switches to various control modules. In order to achieve this, LIN buses are entirely local to each control module and currently adopt a point-to-point communication network between multifunction switches and the associated control modules. However, some of the LIN communication needs to be transmitted around the vehicle, in which case the MS and HS CAN buses are used.

LIN Bus Protocol

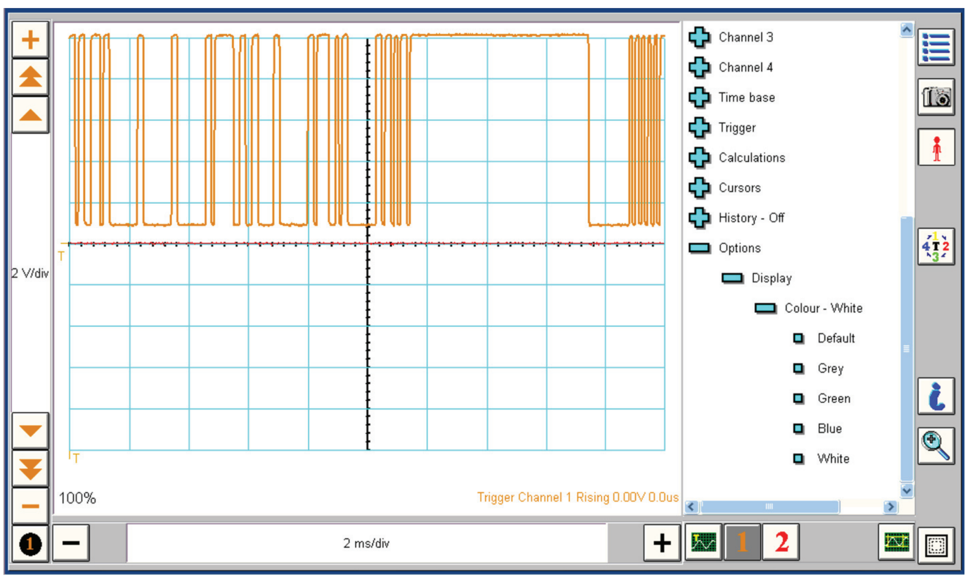
The message format shares commonality with the CAN Bus switching logic ‘1’ and ‘0’, but using 12V.

Logic ‘0’ (Dominant) = 0V

Logic ‘1’ (Recessive) = 12V

The system can be checked for short circuits in the normal manner, with ignition ON, but with no activity (no switch operation). The oscilloscope is capable of measuring bus activity when switches and sensors are operated.

LIN Bus Oscilloscope Pattern



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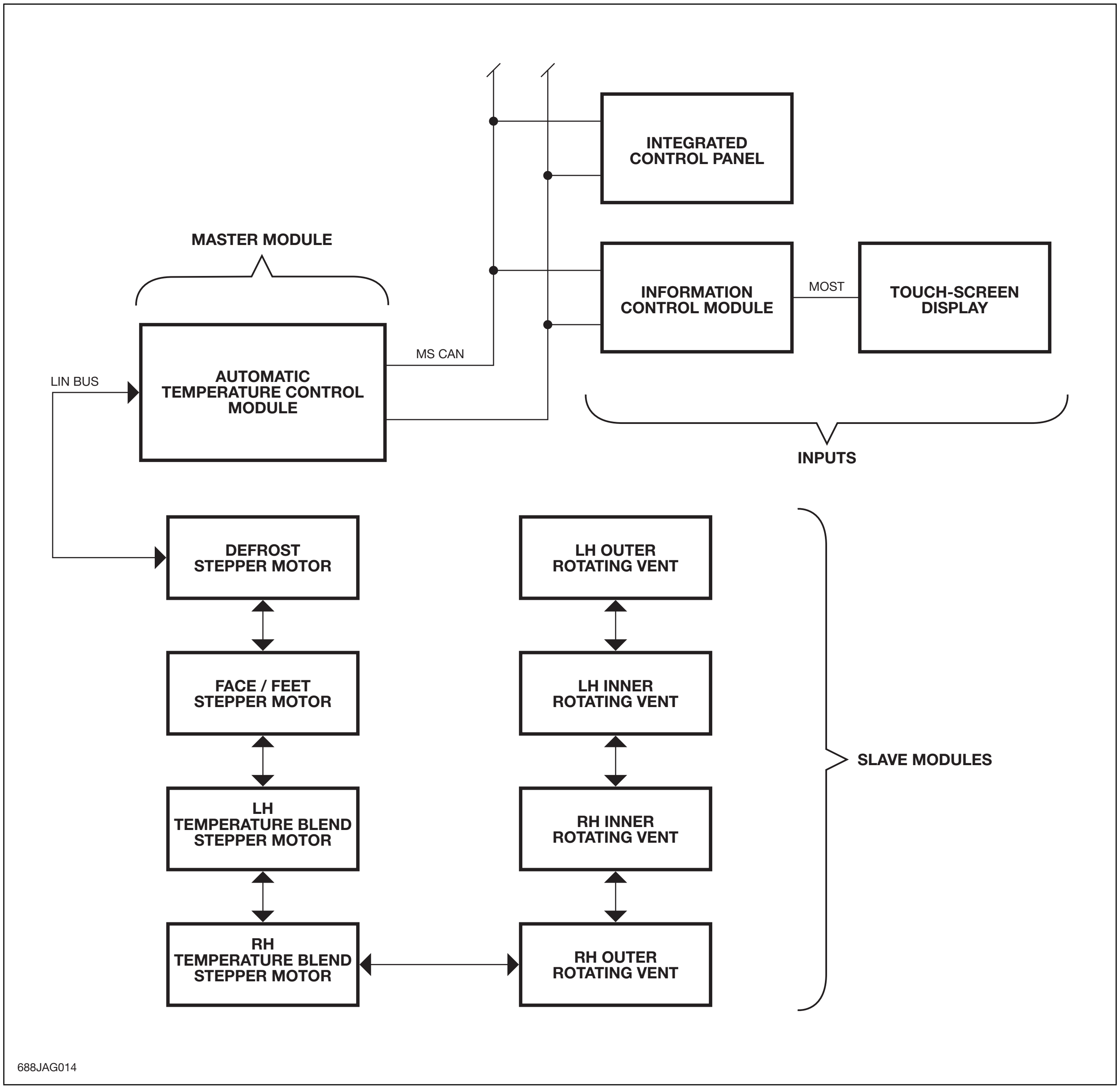
NOTE: The illustration above displays an oscilloscope screen capture of an actual LIN bus communication taken at 2 milliseconds in order to show how an actual LIN message looks in real time.

LIN Bus Operation

The LIN bus operates similar to the CAN networks, as it is used to transmit digital data between modules. However, there is no arbitration (order of priority) for the messages sent on the LIN. LIN messages are sent on the basis of their order in the queue.

Communication in a LIN bus is based on Master/Slave architecture. The network or bus consists of a master module and at least one slave module. In the example below, an input will be received by the climate control module or controlling 'master module'. The controlling module will broadcast a request to a receiving 'slave module' such as a blend door actuator or rotating vent. The receiving module then powers the appropriate actuator and sends the result back to the controlling module.



LIN bus operation can be checked in a similar way to any other communication bus: check the resistance of the wire between control module and slave module (multifunction switch) through a normal continuity check.

AUDIO CORPORATE PROTOCOL (ACP) NETWORK

The Audio Corporate Protocol (ACP) Network is an exclusive early local audio network which consists of a 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.

ACP 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.

ACP Application	
Model	**Year**
X100	1997 – 2002
X103	2002 – 2004
X105	2005 – 2006
X200	2000 – 2002
X308	1998 – 2003

NOTE: Unlike the SCP network, the ACP network will not operate if either of the data bus wires are open or shorted.

NOTE: ACP is not Bluetooth compatible.

DIGITAL DATA BUS (D2B) OPTICAL NETWORK

The Digital Data Bus (D2B) facilitates the transport of data in the form of pulses of light, too fast to be seen by the human eye, at a data bit rate of 5.6 Mbits per second.

The D2B network allows communication between the following devices:

- Audio head units
- CD players
- Voice control units
- Telephones
- Navigation voice guidance (but not map video)

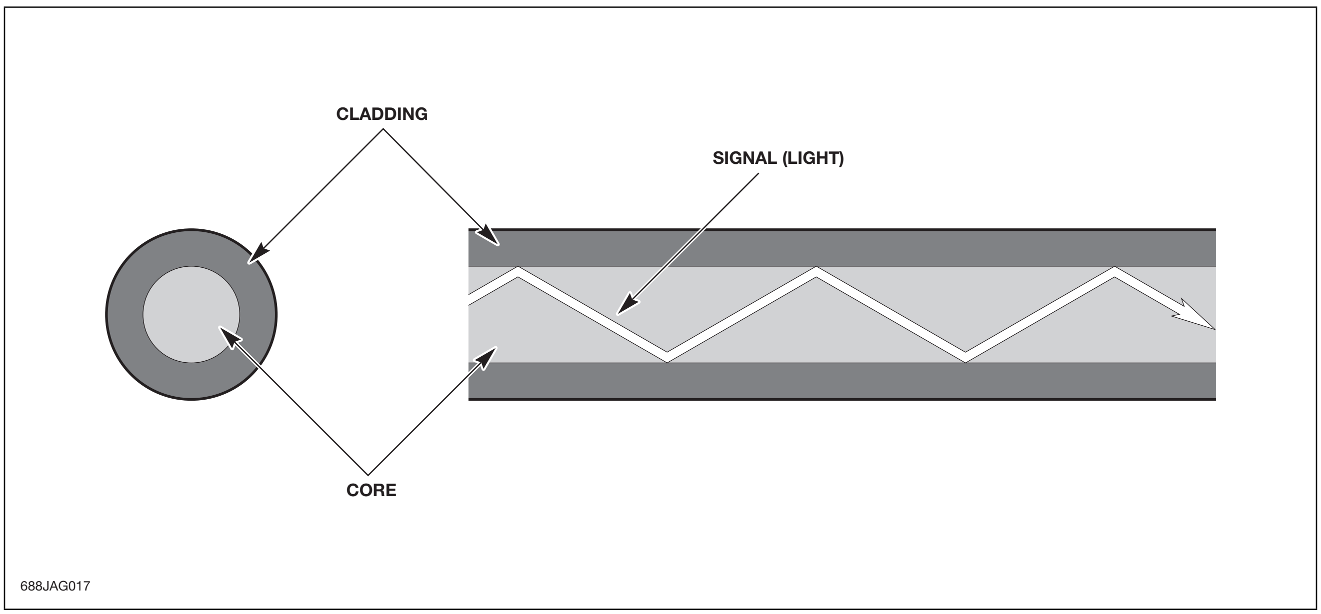
D2B Benefits:

- Enables complex functionalities
- Minimizes electromagnetic interference (EMI) problems
- Decreased weight and cost to the harness
- Achieves a high data rate for fast communication

The D2B 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 the network master module and is the gateway to and from the SCP network.

Fiber Optic Cable

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.

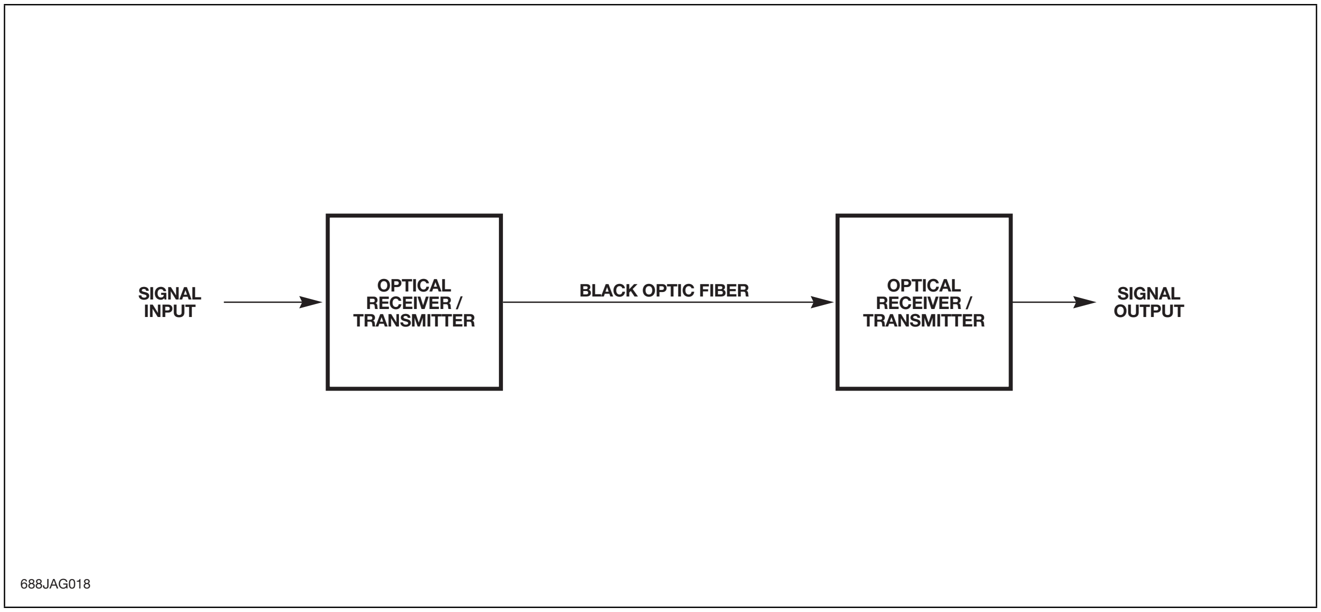


In these cables, measurement data and switching signals can travel at nearly the speed of light. Consequently, modules connected to the ‘D2B’ network can transfer much larger amounts of data in a shorter time than in the CAN bus: up to 5.6 million bits are transmitted per second in the fiber optic cable, 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, enclosed inside protective sleeves consisting of several layers of material, including Kevlar.

Fiber Optic Data Transmission

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.



Working with Optical Fiber

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 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.

CAUTION:

⚠ **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 – kinks and bends can cause immediate system failure, future system failure, impaired system operation
- Avoid excessive force, strain or stress on the fibers and connectors, especially permanent stress after reinstallation

D2B Operation

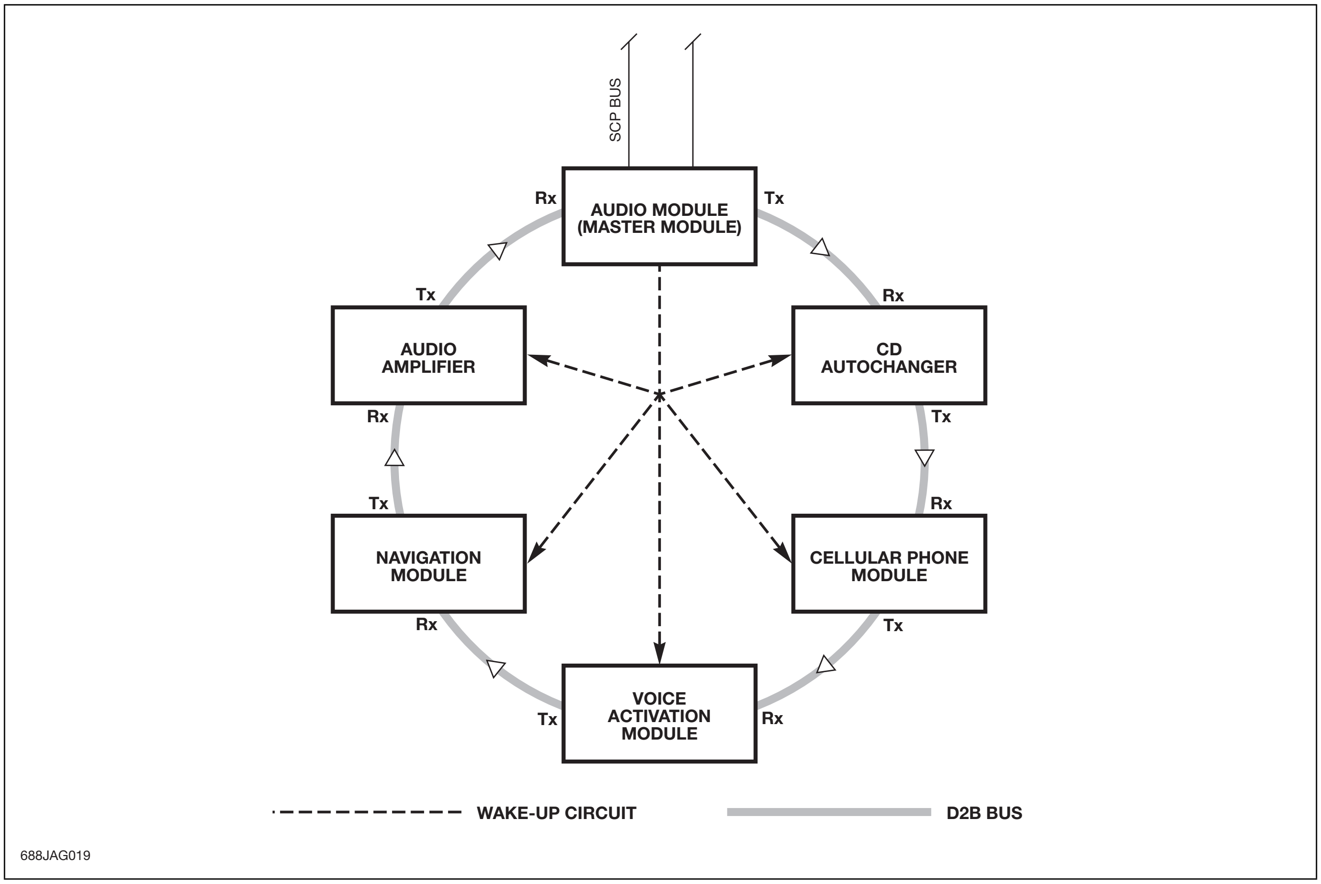
Network Initialization

The network automatically initializes at each key cycle to enter its normal operating state. This initialization is carried out by the Audio module, which sends a hard-wired electrical 'wake-up' pulse to each of the slave modules. The Audio module does this 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 Audio module. The receipt of this signal allows the Audio module to lock the ring.

To complete the initialization the Audio module sends out the following messages:

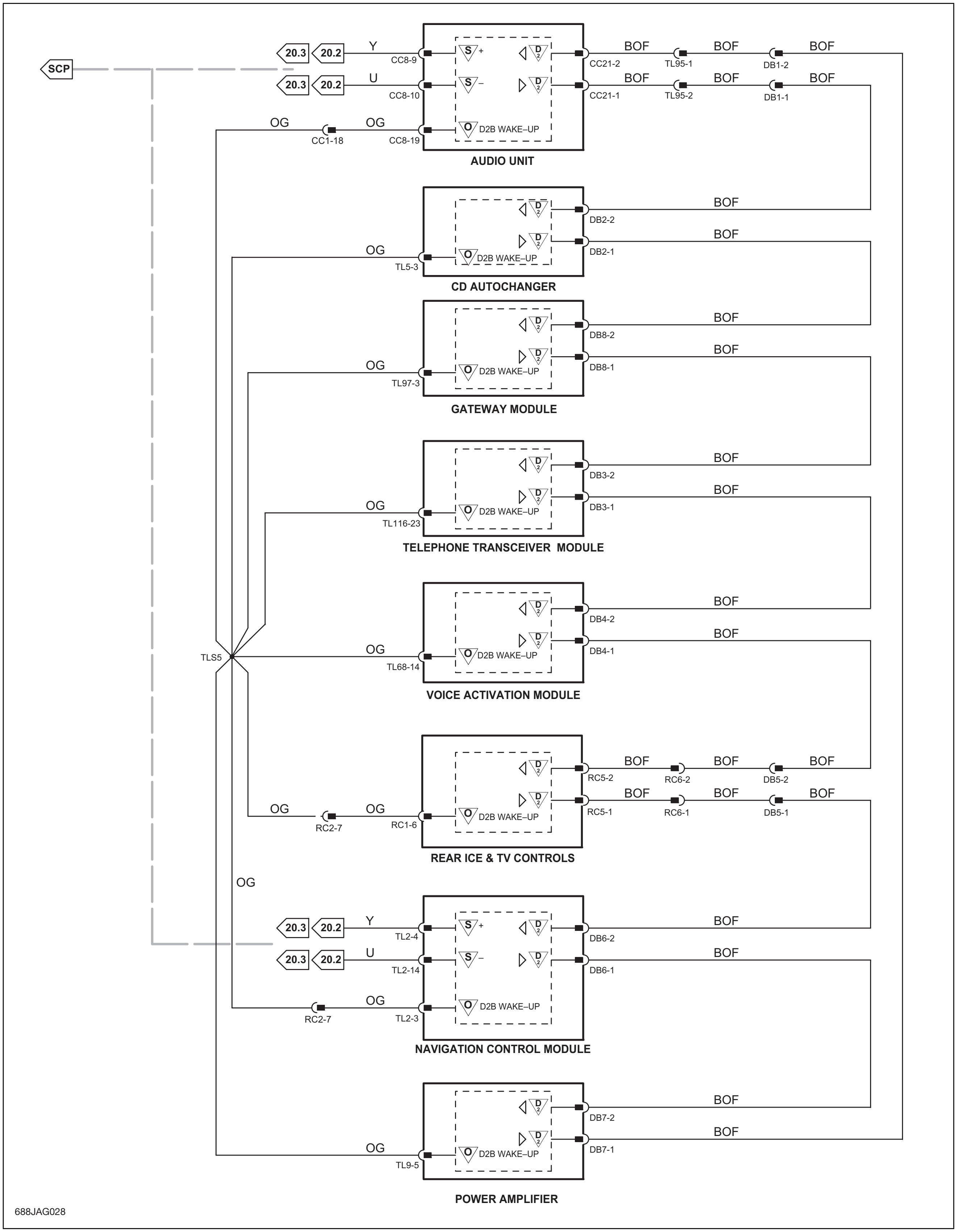
- **Set Position:** The first slave module receives this message, modifies it and transmits it to the next slave. Each slave can see how many times the message has been previously modified and can therefore identify its numerical position in the ring.
- **Report Position:** On receipt of this message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

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



NOTE: Because the D2B network is a directional ring, all modules must be connected in the proper sequence. For ring sequence please refer to the appropriate Electrical Guide.

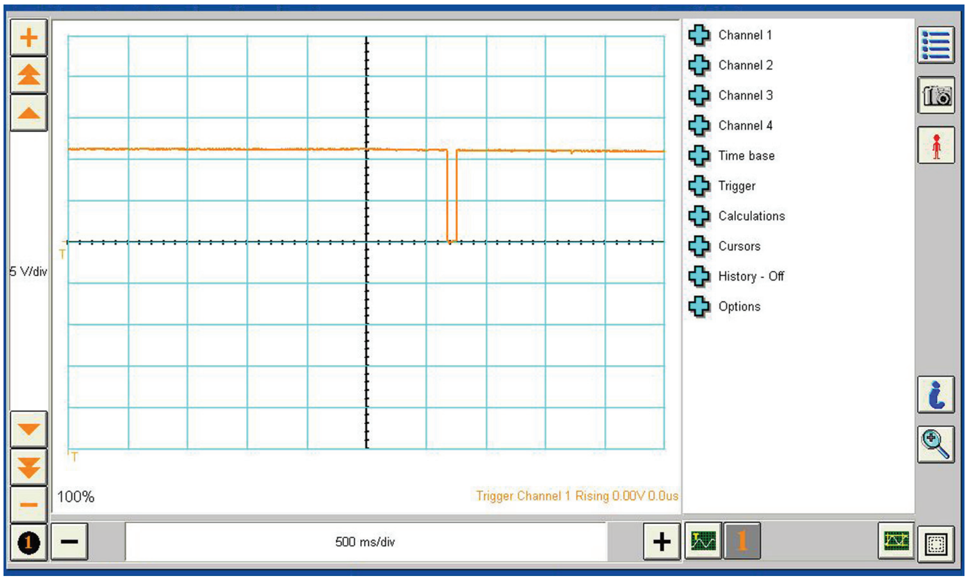
D2B Network


SCP
20.3
20.2
Y
U
OG
CC8-9
CC8-10
CC8-19
CC1-18
S +
S –
D2
O D2B WAKE–UP
AUDIO UNIT
BOF
CC21-2
CC21-1
TL95-1
TL95-2
DB1-2
DB1-1
CD AUTOCHANGER
TL5-3
DB2-2
DB2-1
GATEWAY MODULE
TL97-3
DB8-2
DB8-1
TELEPHONE TRANSCEIVER MODULE
TL116-23
DB3-2
DB3-1
VOICE ACTIVATION MODULE
TLS5
TL68-14
DB4-2
DB4-1
REAR ICE & TV CONTROLS
RC2-7
RC1-6
RC5-2
RC5-1
RC6-2
RC6-1
DB5-2
DB5-1
NAVIGATION CONTROL MODULE
TL2-4
TL2-14
TL2-3
DB6-2
DB6-1
POWER AMPLIFIER
TL9-5
DB7-2
DB7-1
688JAG028

Wake-Up Wire

The master control module pulls the 12V wake-up wire to ground for one pulse lasting 50 – 110ms. This can only be measured with the oscilloscope on IDS.

D2B Wake-up Oscilloscope Pattern



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NOTE: If no modules respond to the first pulse, three more consecutive pulses will occur.

Module Configuration

During the network initialization procedure, the Audio module receives a position report from all the slave modules. This tells the Audio module how many modules are in the ring. The Audio module 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, and a Configuration Error message may be generated.

NOTE: It is important to use IDS to reconfigure the Audio module if any extra systems e.g. telephone, CD or amplifier are fitted or removed at a later date.

D2B 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 IDS via the SCP network.

The following DTCs can be logged by any module.

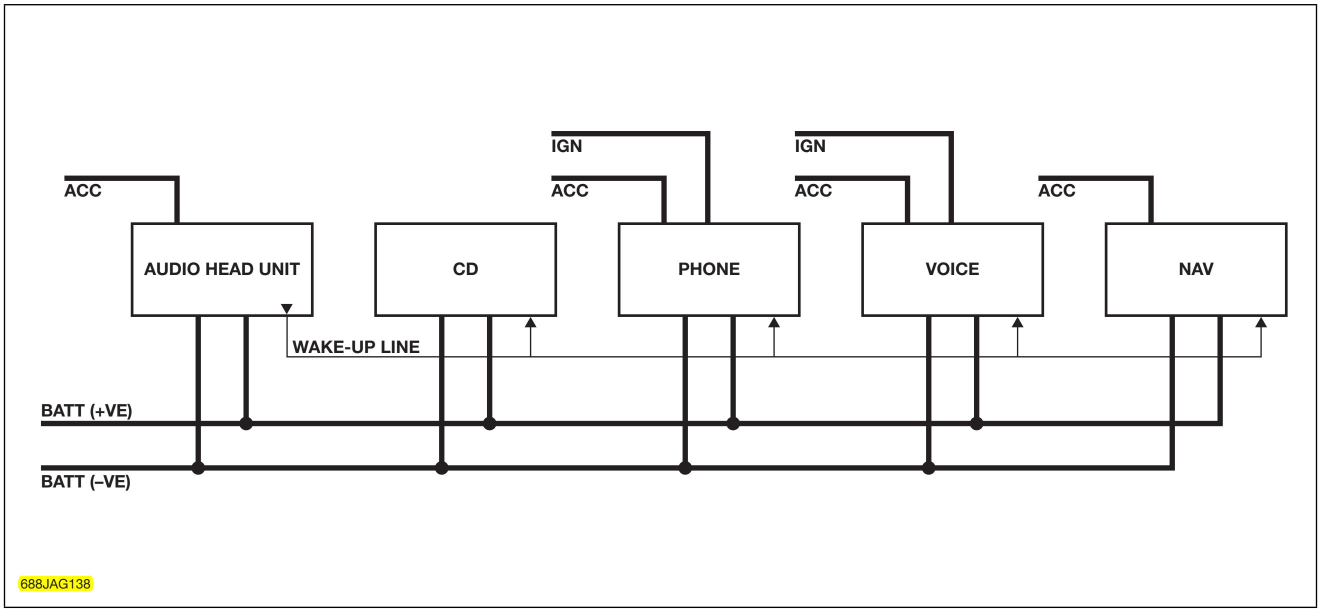
NOTE: The only slave module that doesn't store DTCs is the CD autochanger. Any DTCs relating to the CD autochanger are stored by the Audio Module.

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 Audio Module.

Switch Position I and II and Impact of Loss of Signal

Device Level	Audio	CD	Phone	Voice	NAV
Loss of wake-up signal (device operates in bypass modes)	n/a	No operation	In bypass	In bypass	In bypass
Loss of ACC at engine startup	No operation	n/a	No operation	No effect	No operation
Loss of ACC during operation	n/a	n/a	Power down	No effect	Network ring dies
Loss of IGN at engine startup	n/a	n/a	No effect	No effect	n/a
Loss of IGN during operation	n/a	n/a	No effect	No effect	n/a
Loss of ACC and IGN at engine startup	n/a	n/a	No operation	No operation	n/a
Loss of ACC and IGN 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, 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)
- CD DJ will not function (may display 'not installed')
- Voice button will act as a mute button

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

D2B Optical Bus Tester

The D2B optical bus tester (OBT), tool #415-S003, is used for troubleshooting fiber optic concerns.

The D2B OBT can:

- Confirm proper harness build/connections
- Detect signal loss through cable
- Isolate non-communicating modules by installing OBT in place of module

The OBT can be used as a stand-alone tool, or in conjunction with IDS.

NOTE: Excessive light loss in a fiber will cause a network malfunction. 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 OBT.

MEDIA ORIENTED SYSTEM TRANSPORT (MOST®) RING

The Media Oriented System Transport (MOST®) ring is similar in operation to the D2B network, but operates at higher speeds (up to 24 Mbits/sec). It uses a fiber optic cable to transport data and audio around the information and entertainment system.

The design of the MOST® communication ring does not involve the use of a wake-up signal through a conventional copper wire. As a result the MOST® ring does not require an initialization sequence. The network is constantly transmitting messages and will begin data transfer instantly.

Plastic optical fiber (POF) is arranged in a ring, and the components placed onto the ring form the backbone to the information and entertainment system. Each control module in the ring has a MOST® in (input) and a MOST® out (output) connection.

MOST® is a synchronous network. A timing master supplies the clock and all other devices synchronize their operation to this clock. The timing master for the MOST® network on an X150 is the Infotainment Control module (ICM) and X250 Information Control Module (ICM). The ICM serves as a gateway between MOST® and MS CAN.

MOST® Benefits

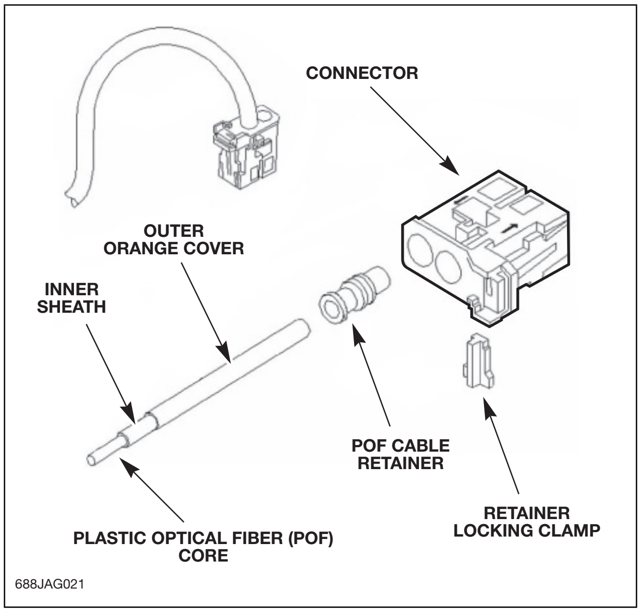
The benefits of using MOST® technology are as follows:

- High data transfer rate
- Support for up to 64 devices
- Supports asynchronous and synchronous data transfer
- System flexibility and reliability
- Reduced electrical interference (noise)
- Reduced cabling
- Simple connectors

MOST® vs. D2B

Network Feature	D2B	MOST®	Units	Summary
Overall Bandwidth	5.64	24	Mbps	4 times faster
Maximum Synchronous Byte Channels (not necessarily used)	12	60	Mbps	
Maximum Network Nodes	24	64	Nodes	MOST® can support 3550 nodes
Synchronous transfer rate	4.23	21.16	Kbps	
Asynchronous transfer rate	Not Available	12	Mbps	Ideal for high speed bursts of data

MOST® Optical Fiber



The POF cable is similar to the D2B cable, and they are almost identical in appearance. However, the connectors and cables are different. As a result, never assume that the cables are the same.

The center core, as with D2B, is 1mm in diameter, surrounded by a reflective sheath of fluoride resin with an outer cladding, giving the cable a total diameter of 2.3mm.

Control modules are connected to the POF ring through a device known as the fiber optical transceiver. There are two optical connections:

- One is sensitive to light and is the Input (Receive; Rx)
- One sources light and is the Output (Transmit; Tx)

The MOST® system works by connecting the output of one fiber optical transceiver to the input of another.

The light is sent in one direction only:

- Electrical signals are converted into current
- Current operates a light-emitting diode (LED)
- The diode transmits light through the fiber optic cable
- Photo-diode detects the light at the opposite end of the fiber optic cable

Handling Optical Fiber

Special care should be taken to avoid damage or contamination when handling or working in the vicinity of fiber optical cables and connectors.

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 – kinks and bends can cause immediate system failure, future system failure, impaired system operation
- Avoid excessive force, strain or stress on the fibers and connectors, especially permanent stress after reinstallation

MOST® Data Transmission

MOST® uses a technique called TDM (time division multiplexing) to split up data and carry it around the POF ring to the control modules. The MOST® bus system operates 16 different data channels. Of these 16 channels one is reserved for the system control and management, which results in 15 channels being available for a wide variety of multimedia data.

Data Channels

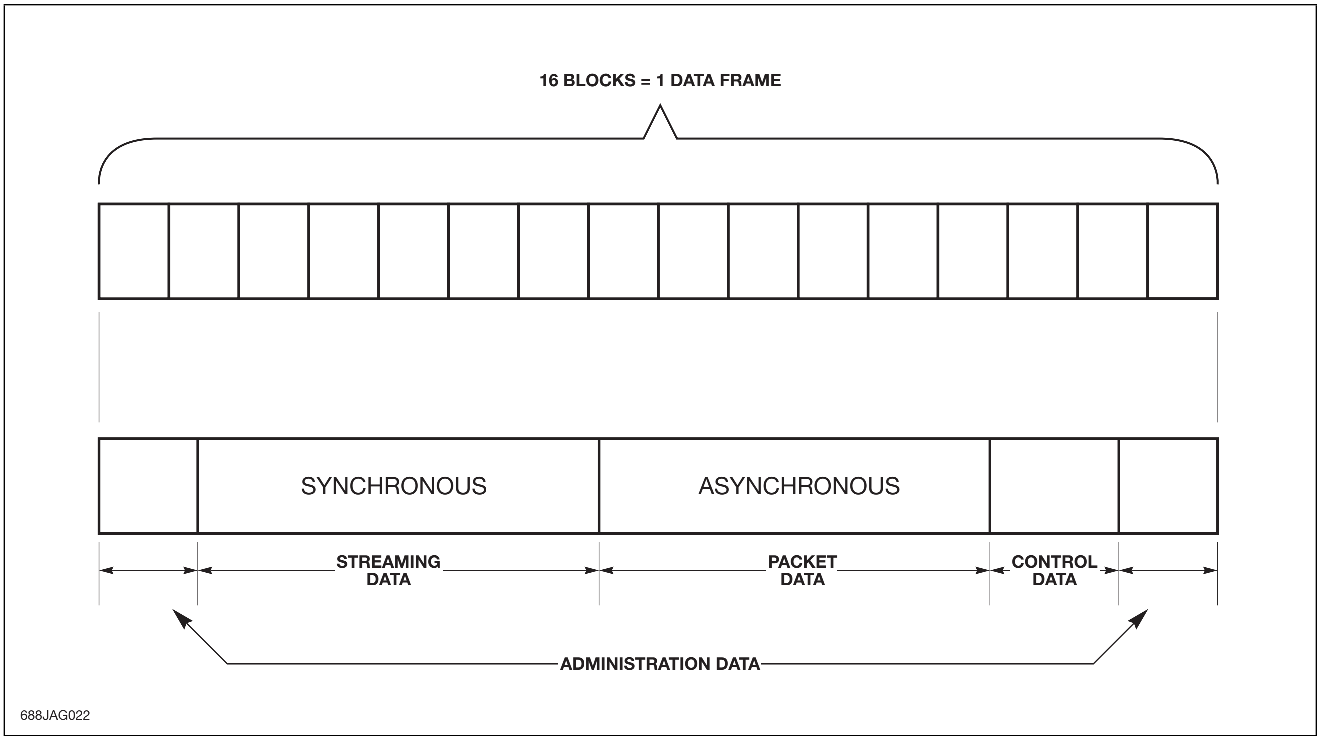
The channels are not restricted to just carrying audio data. By effectively combining the different data channels in a variety of different ways they can carry much more information.

For example:

- Audio
- Video
- Telephone audio and data
- Navigation audio, video and data

Data Frames

In the case of the information and entertainment system, information is picked up in frames.



The frames contain 16 data blocks. Each data frame can contain different types of data.

Streaming data

Streaming data is data that is required in constant flow. This is similar to music or video for example, which is data streaming in synchronous format.

Packet data

Packet data is information that can start and stop in an asynchronous format.

Control data

The function of the control data block is to keep a continuous check on where data is stored within the frame.

Its other function is to inform the destination module the position of data within the frame.

Frames contain a mixed amount of 'streaming' or 'packet data' as required by the system, all controlled by the 'control' data block.

MOST® Ring Operation

For the ring to perform correctly it must first be initialized, through a sequence of 'wake-up'. The wake-up sequence is very complex, but a simplified explanation follows.

1. The information and entertainment control module receives the 'power on' signal. The 'power on' signal can be initiated by the following methods:
   – Remote key fob
   – Ignition on
   – Pressing the touch screen
2. The information and entertainment control module switches the transmit (Tx) LED and passes light to the next module in the ring.
3. The light receiving (Rx) LED in the next module will wake up the module's internal circuits, powering up (if power exists).
   – As long as the control module is operating correctly, it will enter the 'All Bypass – Open' condition (seen on the ring).
   – If the control module is not operating correctly it will enter the 'All Bypass – Closed' condition (not seen on the ring).

   In either condition the light will pass through onto the next control module.
4. Once the information and entertainment control module receives the red light at its Rx LED it will ask all the modules to register themselves onto the ring.
5. Each control module will reply allowing the information and entertainment control module to build up a central registry of responses received. This registry is then compared with the CCF. Any errors will be identified as a DTC.

MOST® Ring Faults

Output Losses

Cable losses can be caused by a number of different problems:

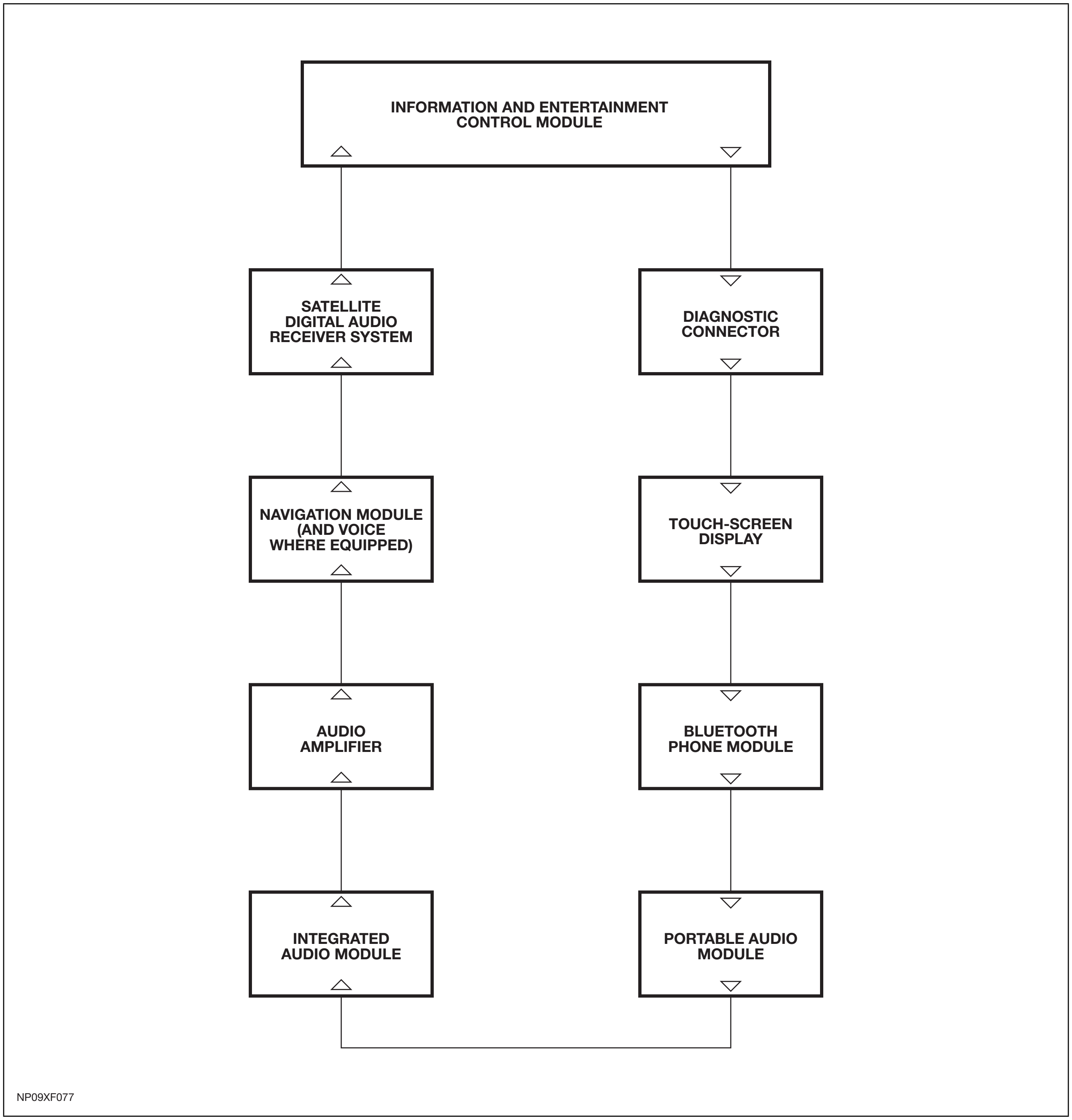
- Connectors not mated correctly
- POF not pushed home within connector
- POF cable damage
- POF ring has too many sharp bends
- POF cable has too sharp a bend
- System has too many connectors

Ring Breaks

Each control module 'wakes-up' in turn (active pass through) until the ring is complete. If any of the configured control modules do not wake up and transmit to the next control module, then ring-lock is deemed unattainable and a ring break will be will be suspected and an error code logged.

A break anywhere within the ring will stop communication, causing a DTC in each control module on the network.

MOST® Ring Control (X250 Shown)



MOST® Ring Break Diagnostics

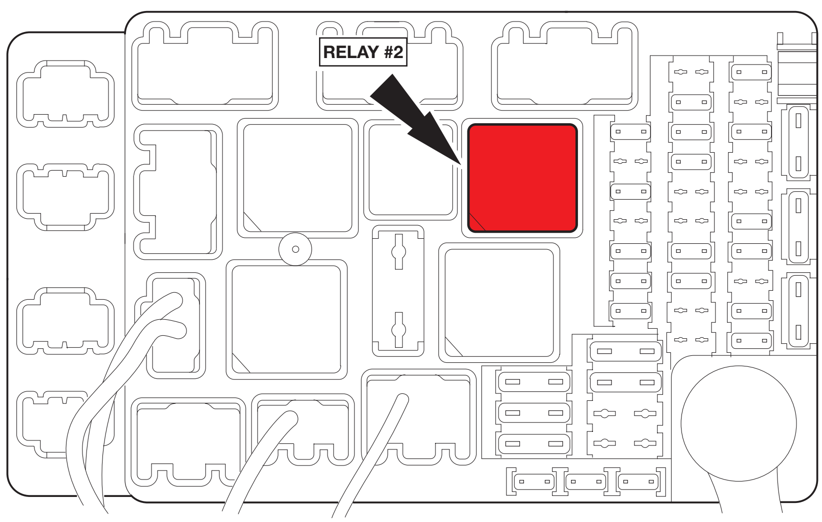
A quick indication of a ring break is shown at the touch screen/display. The system will not operate, and a flashing 'Leaper' or blank screen will be evident.

None of the control modules on the information and entertainment system carry out a system self-check automatically. The MOST® master module, the information and entertainment control module is able to initiate a system check called Ring Break Diagnostics (RBD), a procedure which identifies the section of the network where the ring is broken. RBD is initiated manually by the technician.

X150 Ring Break Diagnostics Initiation

X150 RBD is initiated by removing and then reinserting the #2 relay in the AJB (auxiliary junction box).

The AJB R2 provides power to the entire MOST® system; disruption and restoration of the power supply will initiate RBD in all nodes 30 seconds after power restoration.



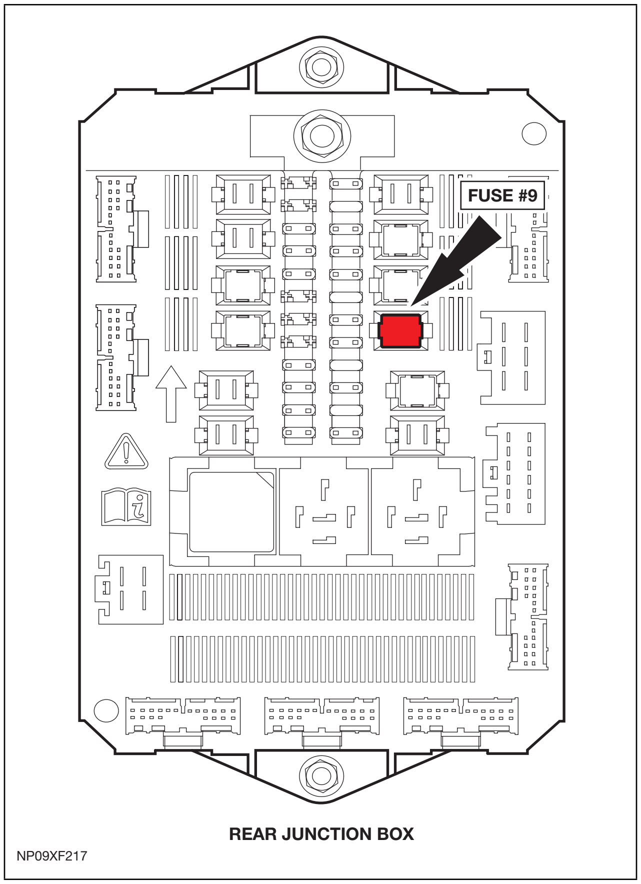
AUXILIARY JUNCTION BOX

688JAG024

X250 Ring Break Diagnostics Initiation

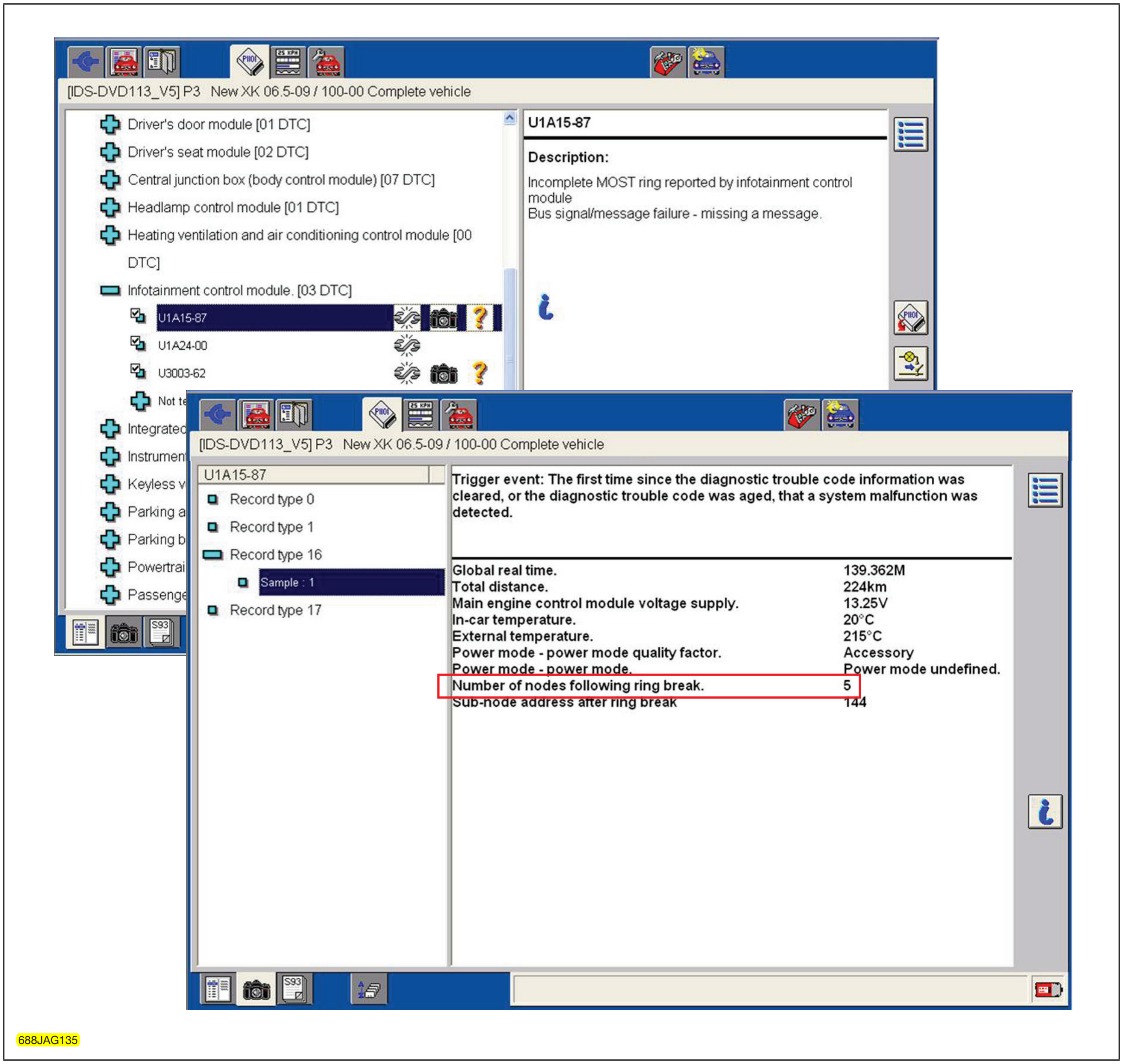
X250 RBD is initiated by removing and then reinserting fuse #9 in the RJB (rear junction box).

The RJB fuse #9 provides power to the entire MOST® system; disruption and restoration of the power supply will initiate RBD in all nodes 30 seconds after power restoration.



Ring Break Diagnostics Procedure

- Remove ring break diagnostic link
- Wait for 3 minutes
- Re-insert ring break diagnostic link
- Switch the ignition ON, engine OFF
- Wait for 30 seconds
- Interrogate ICM for DTC U1A15-87; Highlight the code
- Review freeze-frame data for DTC U1A15-87: Number of nodes following ring break



MOST® Optical Bus Tester

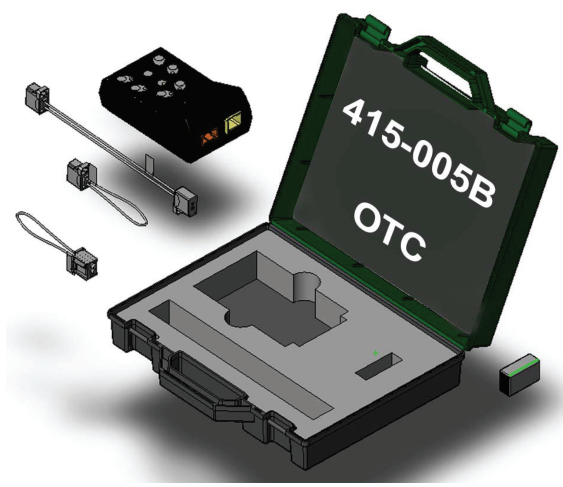
The MOST® optical bus tester (OBT), tool #415-005B, is used for troubleshooting fiber optic concerns.

The MOST® OBT can:

- Confirm proper harness build/connections
- Detect signal loss through cable
- Isolate non-communicating modules by installing OBT in place of module

The OBT can be used as a stand-alone tool, or in conjunction with IDS.

NOTE: Excessive light loss in a fiber will cause a network malfunction. 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 MOST® OBT.



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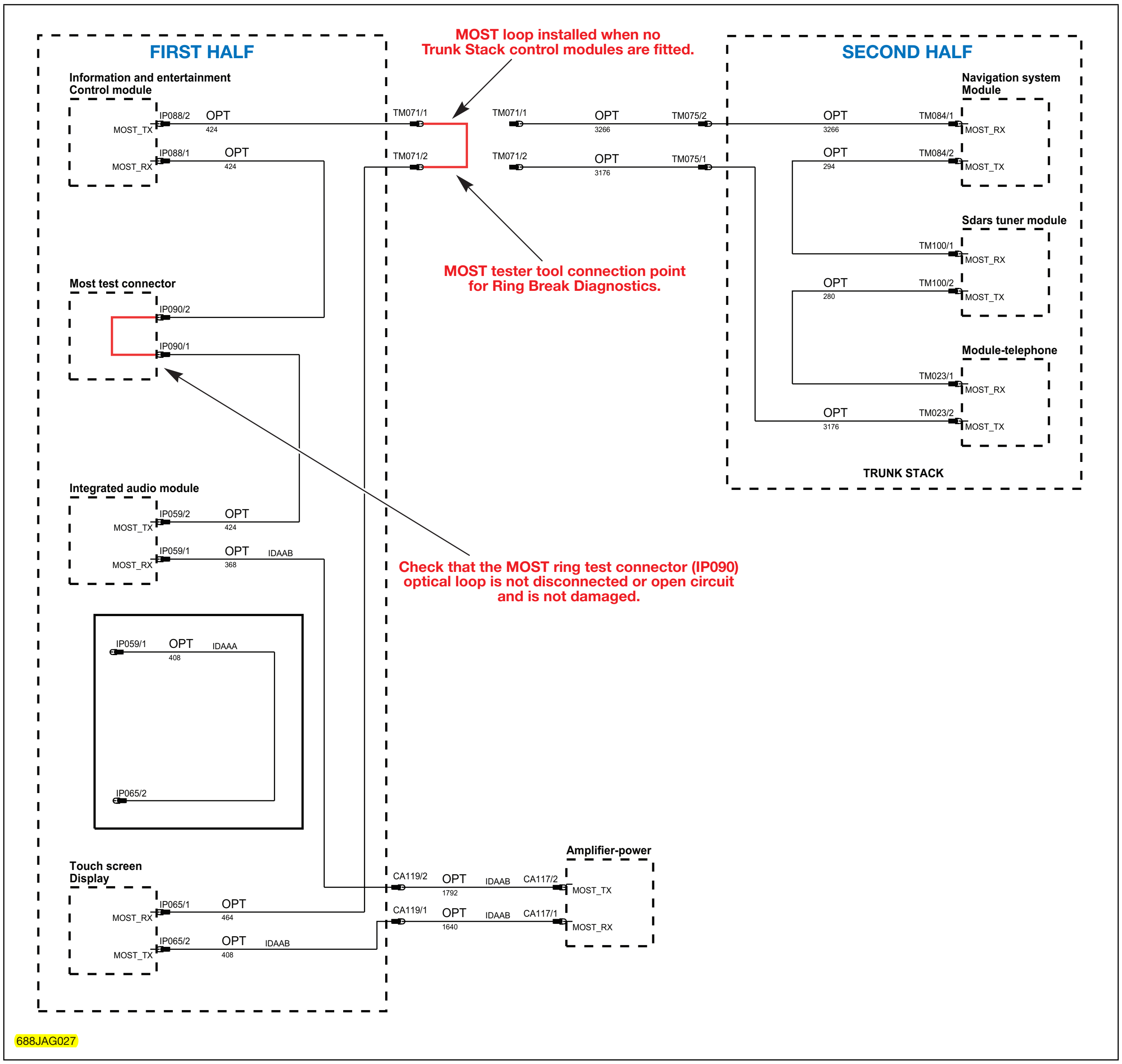
MOST® Circuit Diagram Example

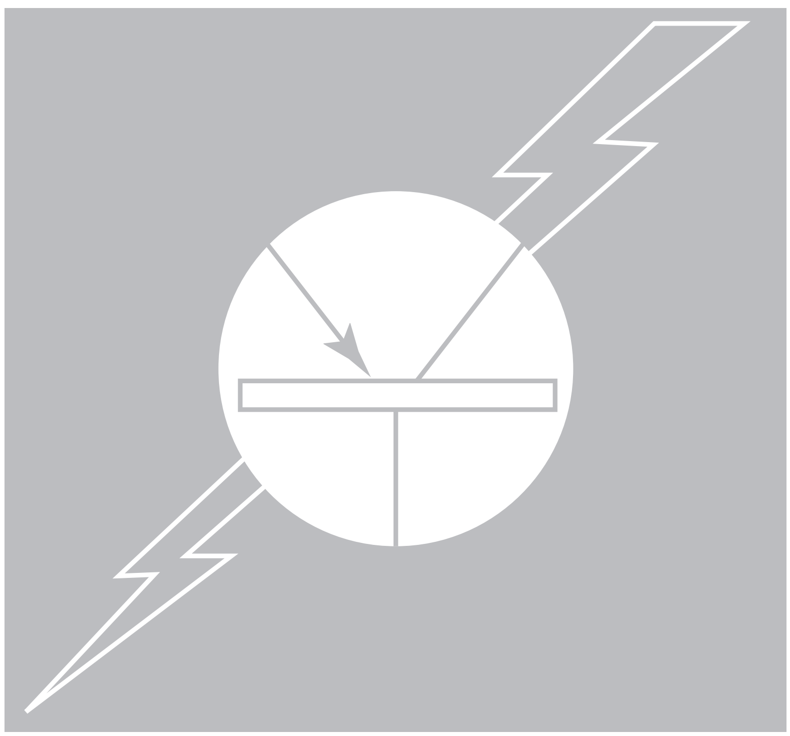
The figure below shows a MOST® network circuit diagram example, modified for training purposes. On high line vehicles with a trunk stack fitted, two loops can be identified either side of the intermediate connector TM071. Connecting the MOST® OBT to the female side of the intermediate connector can isolate a ring fault to either the first or second half of the MOST® network. If the 'Home menu screen' or the 'Leaper' is displayed with the MOST® OBT connected to TM071 and the visible LED selected, the fault is in the second half of the network.

This strategy is reflected in the 'Pinpoint test' – Workshop Manual – Electrical (section 415.00) – Information and Entertainment – MOST® Network Tests. If no ring break fault is found, suspect invalid CCF parameter faults. Check the control modules on the MOST® network for related DTCs and refer to the relevant DTC Index.



Technical Training
Electrical Systems

688-JAG: Advanced Electrical Systems and Diagnostics



Control Module Programming

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OVERVIEW

This section discusses the differences between module configuration and programming, and advancements in the way modules are configured and programmed.

Module Configuration versus Module Programming

Control modules require both data configuration and software programming. The differences are as follows:

Module configuration is data input that allows specific choices to be made and applied to an individual module, depending on vehicle application or customer preferences.

Example: The Blind Spot Monitor (BSM) system on an X250 has left and right hand modules mounted behind the rear bumper fascia. Because all replacement BSM modules are supplied as left hand modules, the right hand module requires configuration using IDS to specify it as the right hand module. Replacement left hand modules do not require configuring.

Module programming depends on software that defines how inputs are processed and outputs are generated. There are times that new programs/software are released for a vehicle which enhance functionality. In such cases, a module will be reprogrammed with a new program/software level.

Example: The Engineering team may develop a revised calibration to eliminate a rough idle concern, in which case the ECM will need to be reprogrammed with updated software.

Data Configuration Modes

There are two modes of data configuration. The first type requires configuration information so that the module can interact with the vehicle correctly. When a module is replaced, this information is transferred to the new module using IDS, so that it will contain the same settings as the old module.

The second type of configuration data is customer preference driven. These are features that the customer may or may not want enabled. Customer preference items (also known as personalization settings) can be toggled on or off using IDS. On X150 and X250 vehicles, personalization settings can also be toggled on/off by using the touch-screen display.

NOTE: When programming or configuring new modules, certain modules may automatically learn the settings by receiving information from existing modules, while others may default to a manufacturer's setting and will need to be manually reconfigured. Prior to installation of a new module, it is recommended that technicians ask the customer which preferences were enabled; these preferences can then be restored after installation.

Configuration and Programming Methods

The methods for module configuration and programming have changed over the years, but the principles remain the same. Depending on model and model year, the following methods may be used:

- Vehicle Configuration and Test System (VCATS)
- Vehicle Identification Block (VID Block)
- Car Configuration File (CCF)

The table below lists the method(s) of configuration used for various models and years.

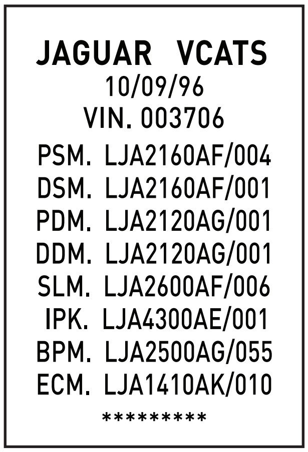
Internal Designation	Year and Model	VCATS	VID Block	CCF
X100	XK 1997 – 2002	X		
X103	XK 2003 – 2004	X	X	
X105	XK 2005 – 2006		X	
X150	XK 2007 Onward			X
X200	S-TYPE 2000 – 2002	X	X	
X202	S-TYPE 2003 – 2004		X	
X204	S-TYPE 2005		X	
X206	S-TYPE 2006 – 2008		X	
X250	XF 2009 Onward			X
X308	XJ 1998 – 2003	X		
X350	XJ 2004 – 2005		X	
X356	XJ 2006 – 2007		X	
X358	XJ 2008 Onward		X	
X400	X-TYPE 2002 – 2003		X	
X404	X-TYPE 2004 – 2008		X	

NOTE: The 2002 model year S-TYPE used a rudimentary VID block configuration in addition to VCATS. The 2003 model year XK was the only vehicle to use both VCATS and full-functioning VID Block configuration information.

VEHICLE CONFIGURATION AND TEST SYSTEM (VCATS)

From 1997 to 2003, Jaguar modules (both original equipment and replacement modules) were programmed at the factory with Vehicle Configuration and Test System information known as VCATS data.

Vehicles with VCATS programmed modules were equipped with an information label located in the trunk. The VCATS label lists the VIN and the part numbers of the programmed modules originally fitted during manufacturing.



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

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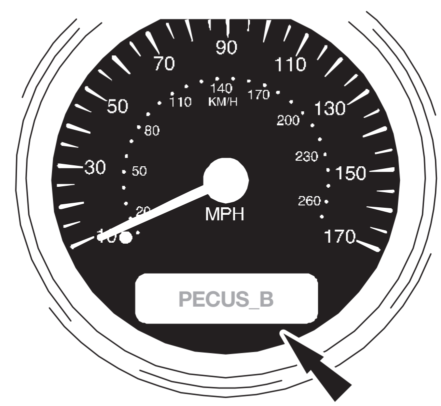
VCATS Label Information

- The last three digits of the part number indicate the software level: LJA2160AF/**004**.
- Label information is required when ordering replacement modules, because configuring and programming of these modules were done at the factory.
- X200 modules were supplied blank (unprogrammed) and were configured during installation using VCATS label information.

PECUS Messages

A Programming Electronic Control Unit System (PECUS) message displayed on the message center indicates that the control module referred to is not programmed correctly. The chart defines the module represented by the character following 'PECUS_' in the message.



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Code	Module
I	Instrument Cluster
R	Driver Rear Door Control Module
S	Security and Locking Control Module
D	Driver Seat Control Module
K	Passenger Rear Door Control Module
DD	Driver Door Control Module
PD	Passenger Door Control Module
P	Passenger Seat Control Module
B	Body Processor Module
E	Engine Control Module
A	ABS Control Module
T	Transmission Control Module

VEHICLE IDENTIFICATION BLOCK (VID BLOCK)

The Vehicle Identification Block (VID Block) was introduced in 2002 and is expected to be used through 2010. VID Block replaced the need to order preprogrammed modules. Vehicles using VID Block can be configured and programmed by the technician via IDS.

VID Block Definition

A VID Block is 256 bytes of complex of digital data stored in a special rewriteable memory location within the Engine Control Module (ECM). This data is programmed to the vehicle on the assembly line when built, using a computer called a VCATS station. VID Blocks are partitioned into two separate areas:

The first 64 bytes contain ECM configuration data vital to the ECM's own functionality.

The last 192 bytes contain stored configuration data for the other configurable modules fitted to the vehicle.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	0	0	53	41	4A	57	41	38	32	43	39	38	54	48	32
16	30	34	33	39	FB	11	9B	FA	0	80	80	9C	0	0	0	0
32	0	0	0	0	2A	0	8	3A	88	0	93	0	D6	78	4E	3B
48	2C	23	AE	0	0	0	0	0	0	0	0	0	0	0	0	0
64	80	80	A0	C4	52	52	B2	0	0	0	2	1	1	0	0	41
80	80	20	83	0	FC	80	0	0	60	A5	E	0	0	0	E0	40
96	20	40	81	C0	0	0	0	0	DD	6C	D2	0	0	FF	FF	FF
112	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	B4	B4	B4	50
128	50	50	50	50	58	58	4C	0	55	19	C	80	24	32	0	A0
144	5	2	3	F	BB	84	32	60	43	99	C2	0	0	0	0	EA
160	60	75	30	0	3	3	1	4E	20	AF	C8	0	C8	0	4B	0
176	0	90	1	10	10	10	10	44	58	14	10	4	4	0	0	57
192	41	38	32	43	39	38	54	31	30	36	30	31	46	48	43	47
208	43	41	43	45	47	4B	44	41	42	43	4A	4A	45	44	42	4B
224	42	46	42	4B	42	47	44	46	41	42	42	42	42	42	41	41
240	41	42	4B	41	30	30	41	41	30	48	32	30	34	33	39	5

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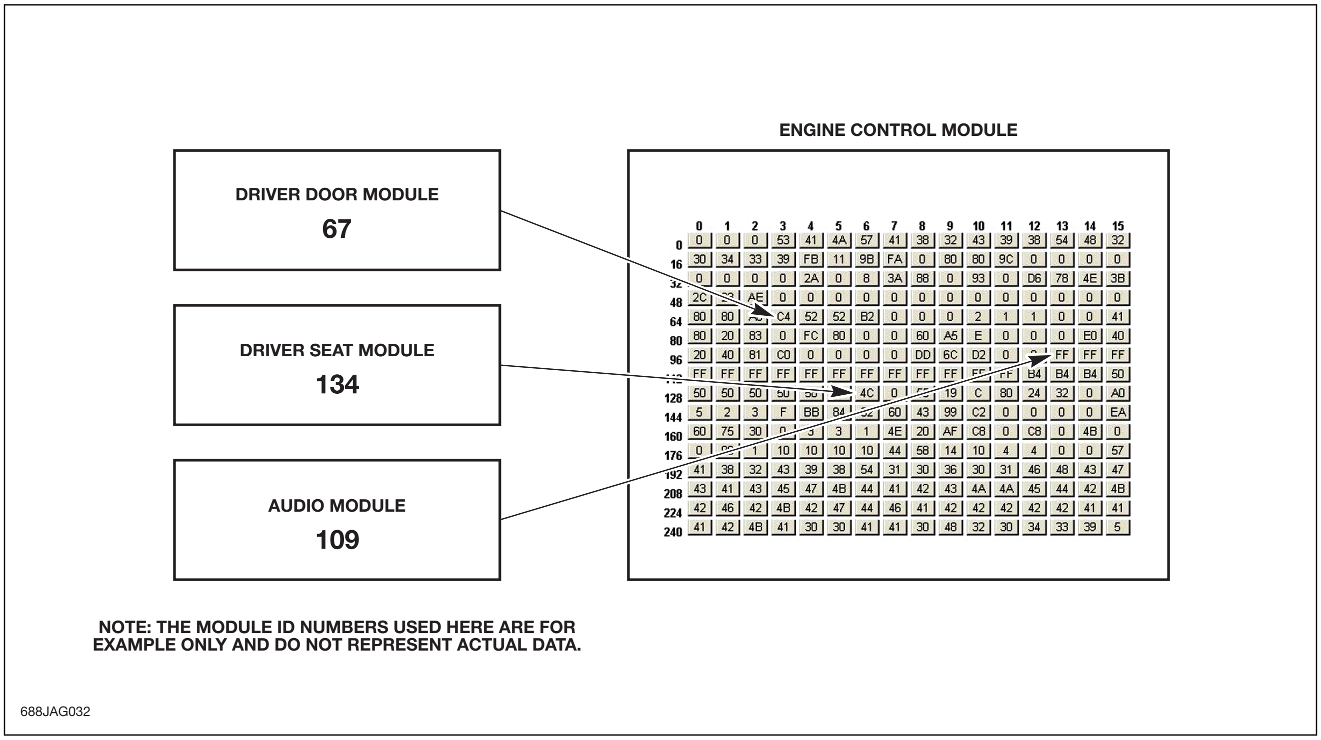
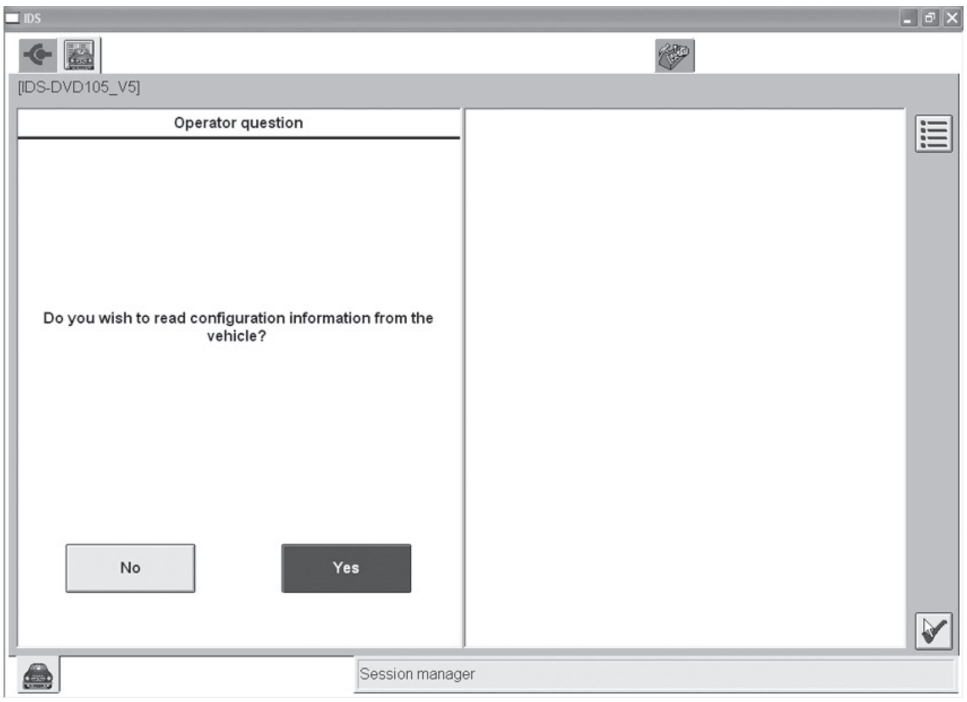
NOTE: Configurable modules store their configuration data within their own memory for use during normal vehicle operation; a copy of this data is mirrored in a location within the ECM VID Block. The mirrored data is used by IDS during the module configuration process, but is not used during normal vehicle operation.

The diagram below illustrates the relationship between data stored in the ECM VID Block and the configurable modules on the vehicle.



Selecting VID Block Data for Configuration

Default VID Block data (referred to as 'As Built' data) is stored within the IDS software. When configuring a module, the technician can choose between the default VID Block data or the customized data stored within the vehicle ECM's VID Block. During the IDS session, after a VIN number has been entered and the correct variant selections have been made, IDS will display the operator question 'Do you wish to read configuration information from the vehicle?'



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If 'Yes' is selected, IDS will read the vehicle configuration from the VID Block stored in the vehicle's ECM. If 'No' is selected, IDS will read the default configuration from the VID Block stored in the IDS software.

The default VID Block data stored in the IDS software is more reliable and is not subject to corruption from poor service practices. However, the default data may not reflect changes made by the dealer (i.e. dealer-installed accessories) using the 'Add and Remove Accessories' option.

Example: If the vehicle for which the VIN was entered has had a CD autochanger installed by the dealer, and the default configuration data is used, the 'Vehicle Configuration Confirmation' screen will display the CD autochanger as 'not fitted'. In this example, the values displayed are incorrect. The user should select 'No' and manually correct the data to show that a CD autochanger has been fitted. This change will only affect the data on IDS for the current session. The vehicle ECM's VID Block is not updated.

The following section describes the process of ECM programming to better illustrate the role VID Block data plays in the ECM and module configuration.

ECM Programming

When an ECM is replaced, the configuration process is different than that for other configurable modules. Because the VID Block in a replacement ECM is not yet programmed, data cannot simply be extracted from the VID Block and downloaded to the new module. When the ECM is programmed as a 'New Module', IDS builds the new VID Block for the vehicle.

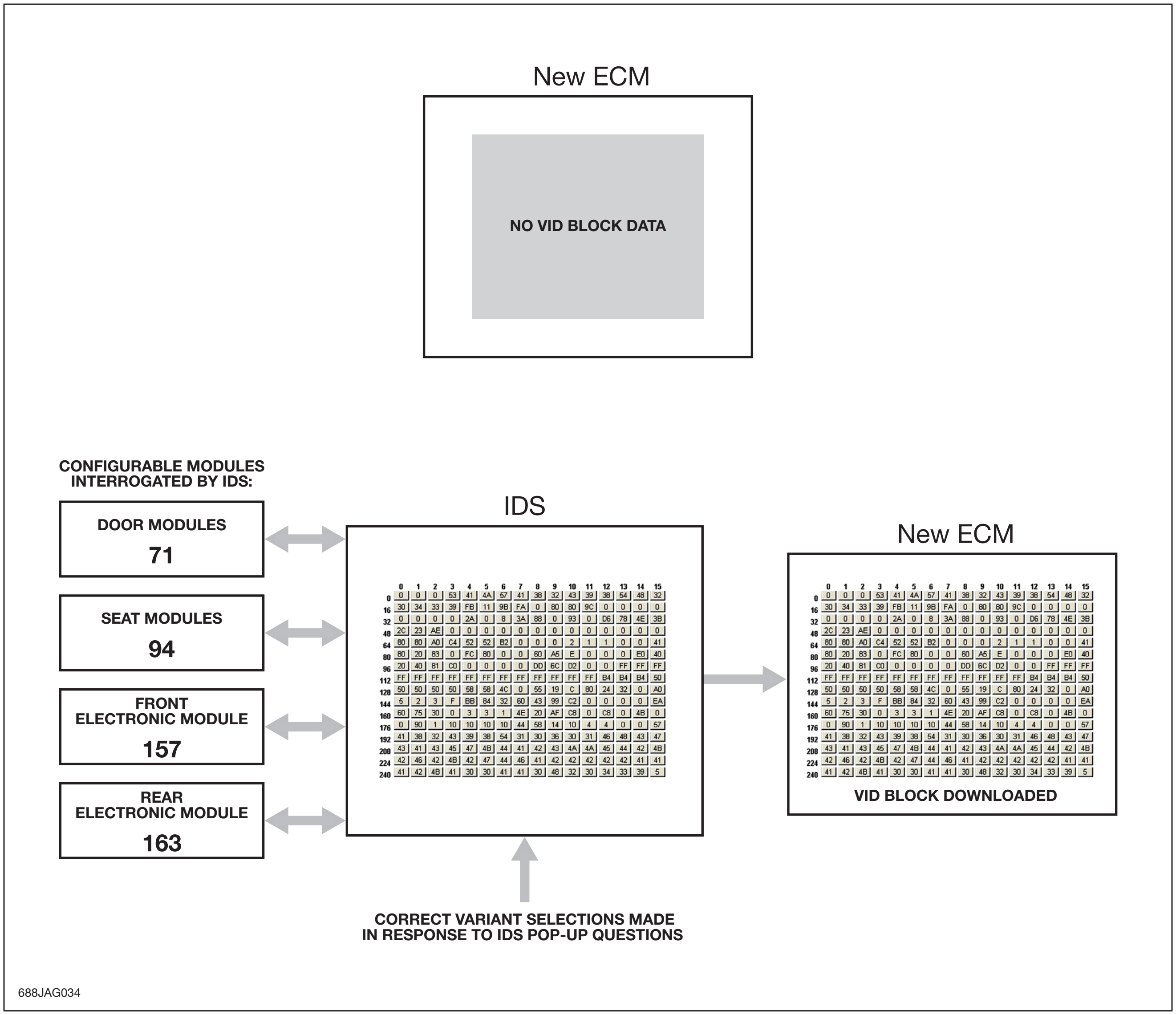
Once the ECM has been selected from the 'New Modules' menu and the VIN verification has been carried out, the following procedure is performed when 'Program ECM as New' is selected:

1. The IDS application will first Flash Program the ECM with the latest appropriate software (identified on the IDS database).
2. When flash programming is completed successfully, IDS will transfer the unique Passive Anti-Theft System Identification (PATS ID) from the ECM to the vehicle's other modules that require the ID. The modules that store the PATS ID vary depending on vehicle specification.

After flash programming and PATS ID transfer are completed, IDS will configure the ECM with its own functionality data.

3. IDS starts building the new VID Block by extracting the VCATS code stored in the IDS database for the VIN entered at the start of the session, and from pop up questions answered by the operator when certain data isn't available from the VCATS Code.
4. The Vehicle Identification Number (VIN) that forms part of the VID Block is copied from the Instrument Cluster.
5. Once the initial part of the VID Block has been built, IDS will interrogate all modules that store a mirrored copy of their configuration data in the ECM VID Block and will construct the remaining part of the VID Block before downloading it to the new ECM.
6. Finally, Diagnostic Trouble Codes are cleared and the whole programming and configuration process for the ECM is complete.

VID Block and ECM Programming



Programming an ECM as 'Existing'

The VID Block is rewritten every time the ECM is 'Programmed as New', even if it is an existing ECM. It is therefore critical NOT to program an **existing** ECM as 'New' (unless directed by the Jaguar Technical Helpline).

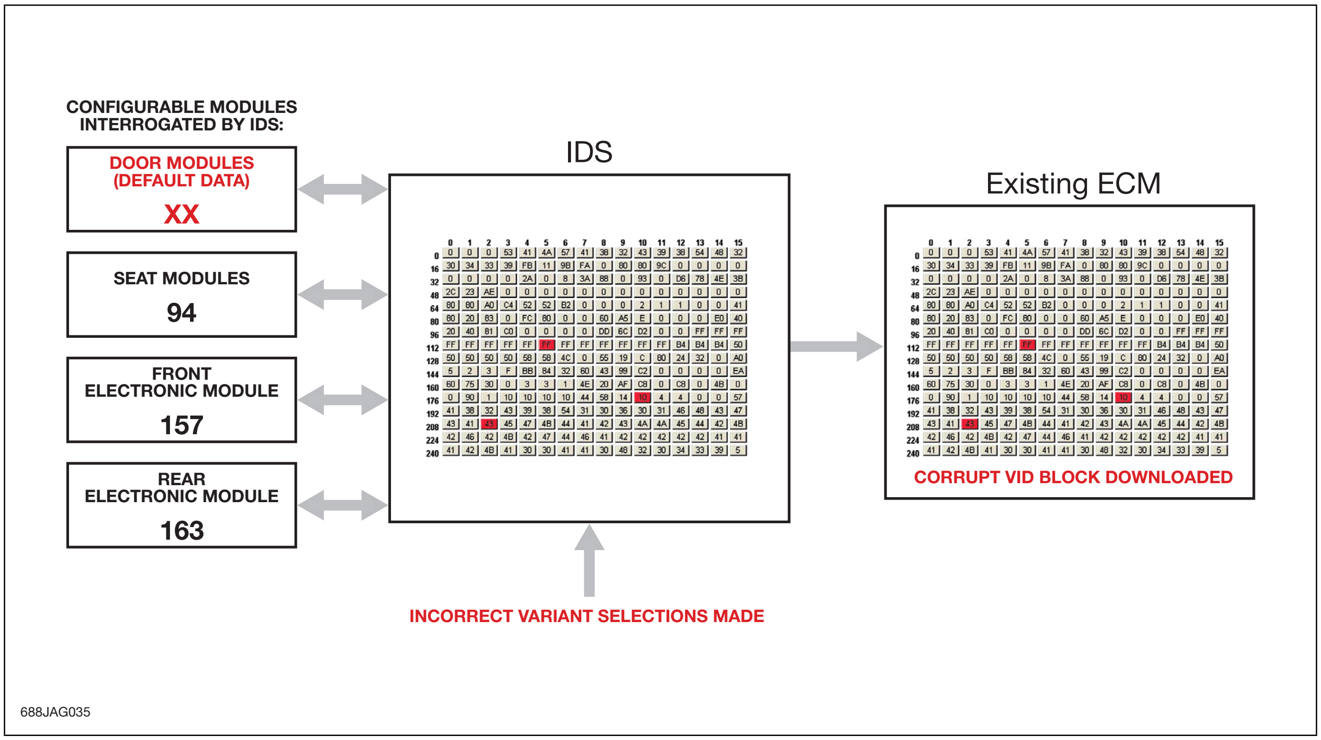
The proper method for programming/updating software on an existing ECM is to select 'Program ECM as Existing'. Only the new software calibrations will be programmed; the VID Block will not be modified. When an existing ECM is programmed correctly, the PATS ID will not be erased nor will immobilization need to be run.

VID Block Corruption

Most VID block errors are introduced this way:

- A module other than the ECM is installed in the vehicle, and has not been configured (i.e. still contains default data).
- 'Program ECM as New' is selected before the new replacement module is configured.
- IDS automatically loads the default data from the module(s) and from the pop up variant questions into the ECM's VID Block.

When this happens, the corrupted VID Block data can function as a software 'virus', causing functionality issues and fault displays on the instrument cluster. Unfortunately, ECMs do not have a VID Block configuration comparison tool to indicate that a potential programming error is about to occur. Understanding this process and its potential for error can be an important diagnostic aid.



Additional safe programming practices can be found later in this section.

NOTE: For more information on Common VID block Issues and Solutions, refer to Administration Bulletin 1-186 and contact the Jaguar Technical Helpline for assistance.

CAR CONFIGURATION FILE (CCF)

Car Configuration Files (CCF) were first introduced on the 2007 MY XK (X150 onwards) and continued with the 2009 MY XF. CCF is the current method of configuration and programming going forward with X150 and X250 models.

CCF replaces what was known as the VID Block on earlier vehicles. The principles of the two are similar, but CCF function and operation is more intuitive and user friendly.

A CCF consists of two parts: Vehicle Module Codes and Vehicle Parameters. Vehicle Module Codes are data used in manufacturing to specify the vehicle and are stored to be used in service. Vehicle Parameters are derived from the vehicle specification and relate to which features are fitted to the vehicle and their market settings.

Examples of CCF Vehicle Parameters are:

- Vehicle type
- Brand
- Model year
- VIN
- Tire dynamic rolling radius
- Brake system type
- Brake rotor size
- Final drive ratio
- Transmission type
- LHD or RHD specification
- MOST® configuration
- Reverse mirror dip
- Auto relocking
- Drive away locking
- Single / dual stage unlocking
- Passive arming

Some of these items fall into the category of Vehicle Personalization. Personalization parameters can be changed by the operator using the Touch Screen Display (TSD) accessed in the vehicle menu.

Within the make up of the Vehicle Parameters Code is an area used for the vehicle VIN. This VIN data is implanted in every module on the vehicle that is capable of accepting it, and locked into each new module when programmed. This has service implications, as it is also a vehicle security feature and will prevent the substitution of existing programmed modules from vehicle to vehicle. When replacing a module on vehicles with CCF, IDS must be used.

The Car Configuration File is held in three locations on the vehicle:

- Auxiliary Junction Box (AJB) or Rear Junction Box (RJB), depending on model
- Central Junction Box (CJB)
- Engine Control Module (ECM)

The AJB and RJB are also referred to as ‘master modules’ because they hold master copies of the CCF. A master CCF is an active copy of the current car configuration with all of the personalization settings and changes that have been made since factory programming of the CCF (‘As-Built’ data).

The AJB/RJB transmits the Vehicle Parameters part of the CCF on the CAN bus. Whenever CAN is active, this data is broadcast onto the networks at regular intervals. The AJB/RJB will monitor the integrity of the memory where CCF information is stored. If a fault is detected, a diagnostic trouble code (DTC) will be logged.

The vehicle’s CCF master module holds the only copy of the CCF file used actively within the vehicle. This information is cyclically broadcast from the master on the vehicle’s communication networks as a reference for any modules that require this data. This is very similar to the way vehicle speed, or transmission gear position data, etc., gets broadcast as a live message on the CAN network.

The ECM and the CJB contain back-up copies of the CCF file. Back-up copies of the CCF are NOT used by any module at any time during vehicle operation. These copies of the CCF are completely static and are only accessed or modified by IDS for service/maintenance procedures. This allows IDS to work with the most current CCF data in the event that the master module needs to be replaced.

As-Built Data

IDS also provides copies of the ‘As-Built’ data from the factory. This data can be used by the operator to restore the vehicle back to its original condition. Any personalization settings set by the customer will have to be restored to the vehicle.

Vehicle coverage of ‘As-Built’ data is typically incremented on most DVD releases. It is very important to use the most current version if IDS when working on vehicles during PDI to ensure most current ‘As-Built’ data coverage.

CCF Editing

CCF tools and editing procedures are continually being improved to enhance the user interface and minimize the opportunity for vehicle information to become corrupted. For the latest information on CCF editing, please refer to the CCF Documents on GTR under > Diagnostics > Enhanced Diagnosis and Testing.

GENERAL PROGRAMMING SUMMARY

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 and what vehicle is being worked on.

For modules other than an ECM, once a module has been fitted and the relevant module selected from the list of new modules in the IDS configuration tool, IDS will carry out a VIN verification check between the VIN entered manually into the IDS at the start of the session and the VIN stored within the VID Block of the ECM or CCF of the Master Module. 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 VIN number read from each module.

The actual programming 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.

NOTE: When programming an existing module, it is vital that 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 recommended that, before a module is replaced, a hard reset and/or reprogramming should be carried out.

Best Programming Practices

- When installing two new control modules, if one is the ECM, always configure the other control module first. IDS will detect that no data is available in the VID block and allow manual selection of the configuration options to program the module. Once this has been carried out, the ECM can be configured.
- If a control module configuration process fails, do not configure the ECM until the problem has been resolved, otherwise VID Block or CCF problems may result.
- Most configuration failures are generally caused by the vehicle battery voltage being low, faulty IDS communications leads or poor connections at the vehicle's J1962 data link connector (DLC).
  - Make sure vehicle battery is fully charged and has passed a Midtronics or diagnostic test with GR1.
  - Make sure the PSC 550 battery maintainer is connected when IDS is connected.
  - Make sure IDS is docked on the base station and plugged in.
  - Make sure the diagnostic cable connector pins are not damaged.
  - Make sure that the vehicle's Data Link Connector is not damaged.
- It is vital when programming an existing control module that the Vehicle Configuration confirmation screen displays the correct configuration for the VIN that was entered at the start of the session, i.e. engine size, engine type, market, speed control type, transmission, etc.
- When resetting the battery (hard reset), disconnect both battery leads and touch them together to fully discharge all control module capacitors.

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.

WARNING:

⚠ **Always disconnect the battery before replacing a control module. If the battery remains connected, the possibility exists for inadvertent uncontrolled operation of these systems, particularly for control modules that control the movement of door windows or power operated convertible tops. This can result in injury to persons working on the vehicle. Reconnect the battery only after module replacement is complete.**

Module Swapping

Module swapping is not recommended.

- This method is not always accurate for diagnosis, because the donor module will operate as it was configured for the donor vehicle.
- Donor Control Modules can 'learn' information from the receiving vehicle. If this occurs, incorrect data will be transferred back to the first vehicle when the Control Module is reinstalled to its original vehicle. This is particularly applicable if an Engine Control Module (ECM) were swapped for diagnosis.
- VID Block data can be corrupted if programmed with a donor module in place.
- CCF Files can immediately become corrupt.

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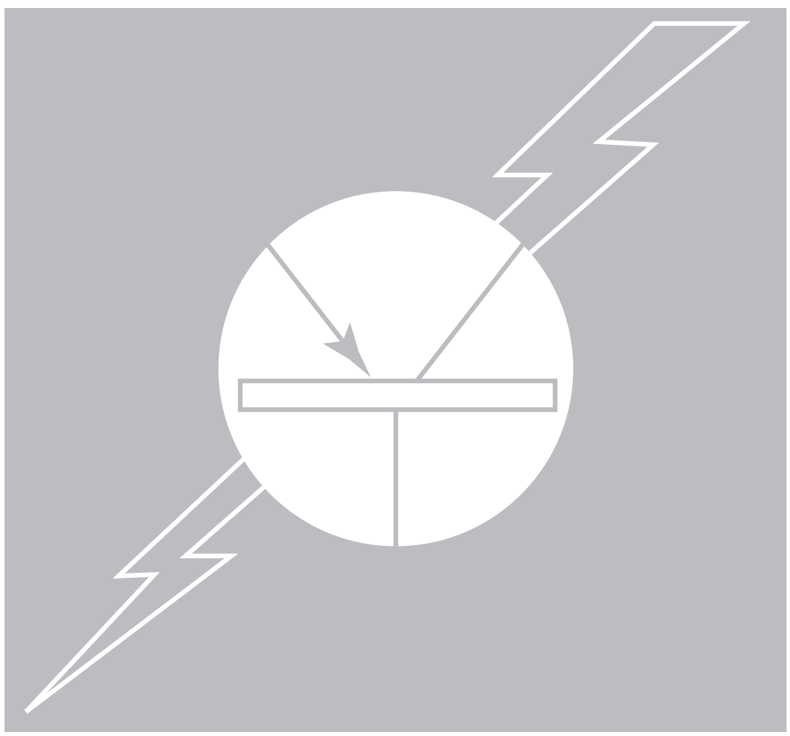

Control Module Locations and Functions

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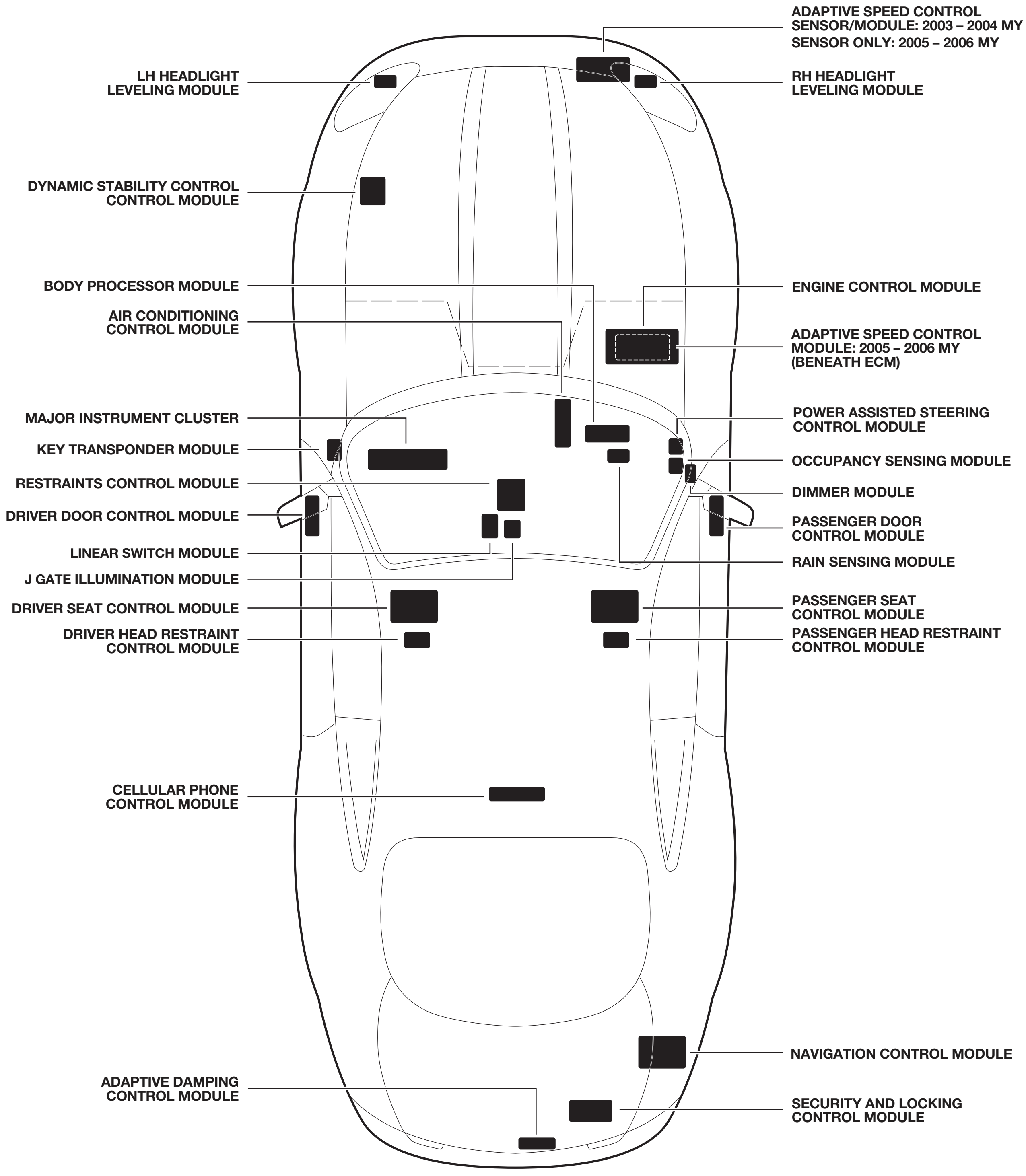
X105 CONTROL MODULES



NOTE: THE TRANSMISSION CONTROL MODULE IS CONTAINED WITHIN THE TRANSMISSION.

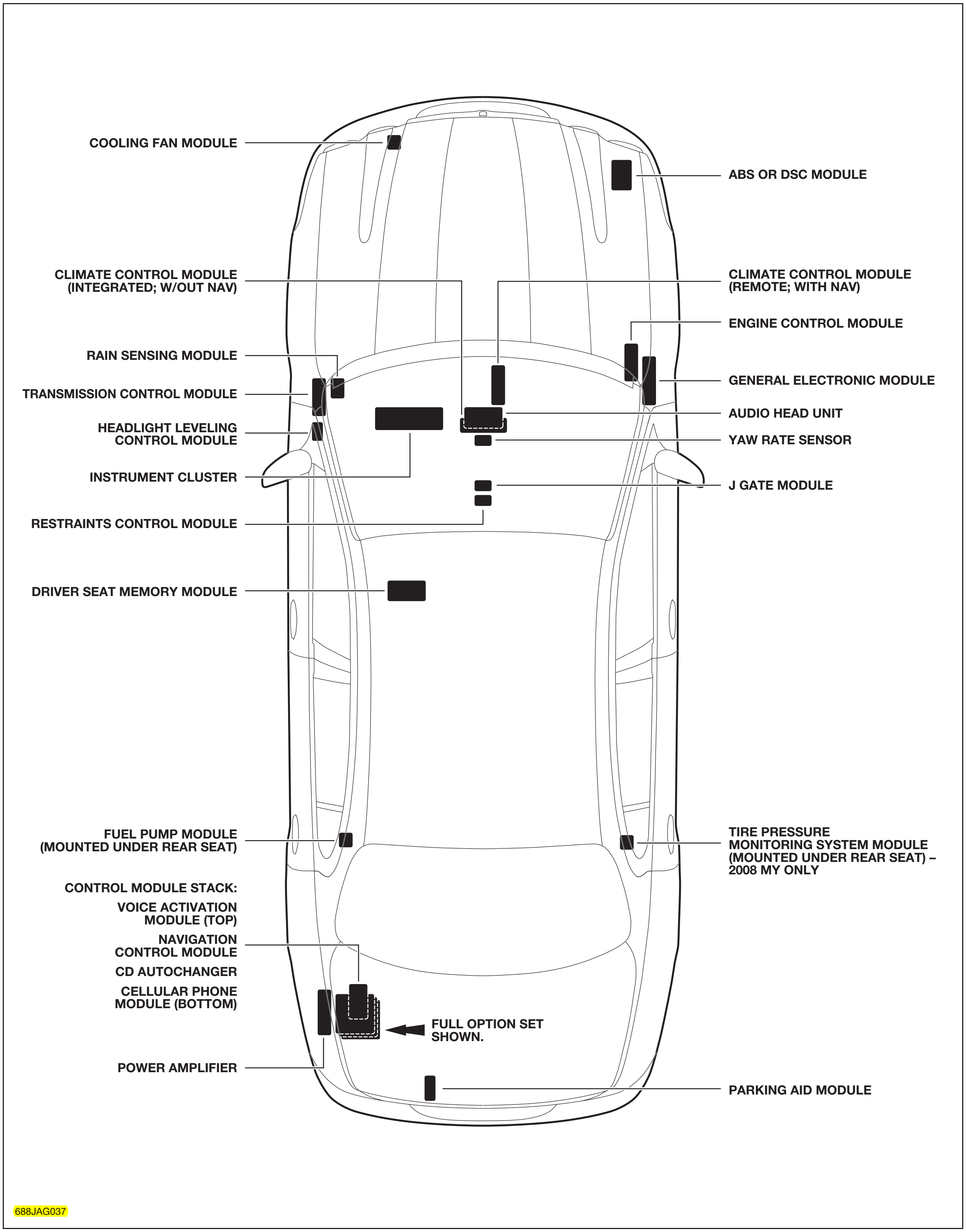
688JAG036

Module	Network	Function	Location
Instrument Cluster	HS CAN SCP	Gateway between HS CAN and SCP	Driver instrument panel
ECM	HS CAN ISO	Controls the engine in response to various sensor inputs	RH Engine compartment
Dynamic Stability Control Control Module	HS CAN	Controls the braking force applied to the road wheels	LH Engine compartment
TCM	HS CAN	Electronic control of the automatic gear change	Transmission sump
Adaptive Speed Control Sensor/Module (2003 – 2004 MY)	HS CAN	Controls vehicle road speed in relation to other vehicles when in speed control mode	Behind RH front bumper 2005 – 2006 MY: Beneath ECM
Adaptive Speed Control Sensor/Module (2005 – 2006 MY)	HS CAN	Controls vehicle road speed in relation to other vehicles when in speed control mode	Beneath ECM
Linear Switch Module	HS CAN	Detects position of selector lever	LH side of J-gate module
J-Gate Illumination Module	HS CAN	Read-only for gear selections LEDs	Top of transmission tunnel
Body Processor Module (BPM)	SCP ISO	Controls body functions	RH side of dashboard behind glove box
Security and Locking Control Module (SLCM)	SCP	Security, locks, drive away locking, audible warnings, headlight convenience	RH rear of trunk
Passenger Door Control Module (PDCM)	SCP	Operates windows, door lights, and locks	Inside passenger door
Driver Door Control Module (DDCM)	SCP	Operates windows, door lights, and locks	Inside driver's door
Passenger Head Restraint Control Module (PHRCM)	SCP	Activates head restraint system	Inside passenger seat back
Passenger Seat Control Module (PSCM)	SCP	Operates seat functions	Under passenger seat
Driver Seat Control Module (DSCM)	SCP	Operates seat functions	Under driver seat
Driver Head Restraint Control Module (DHRCM)	SCP	Activates head restraint system	Inside driver seat back
Restraints Control Module	ISO	Activates airbag restraint system	Top of transmission tunnel
Parking Aid Control Module	ISO	Provides audible proximity warning when reversing	RH spare tire well
Adaptive Damping Control Module	ISO	Matches damping effect with vehicle driving forces	RH spare tire well
LH Headlight Leveling Module	ISO	Controls light function and leveling	Integral with LH headlight assembly
RH Headlight Leveling Module	ISO	Controls light function and leveling	Integral with RH headlight assembly
Key Transponder Module	ISO	Controls security by matching key codes locking	LH outer side of dashboard
Air Conditioning Control Module	ISO	Controls air conditioning system, blower speeds and compressor function	Lower center of dashboard

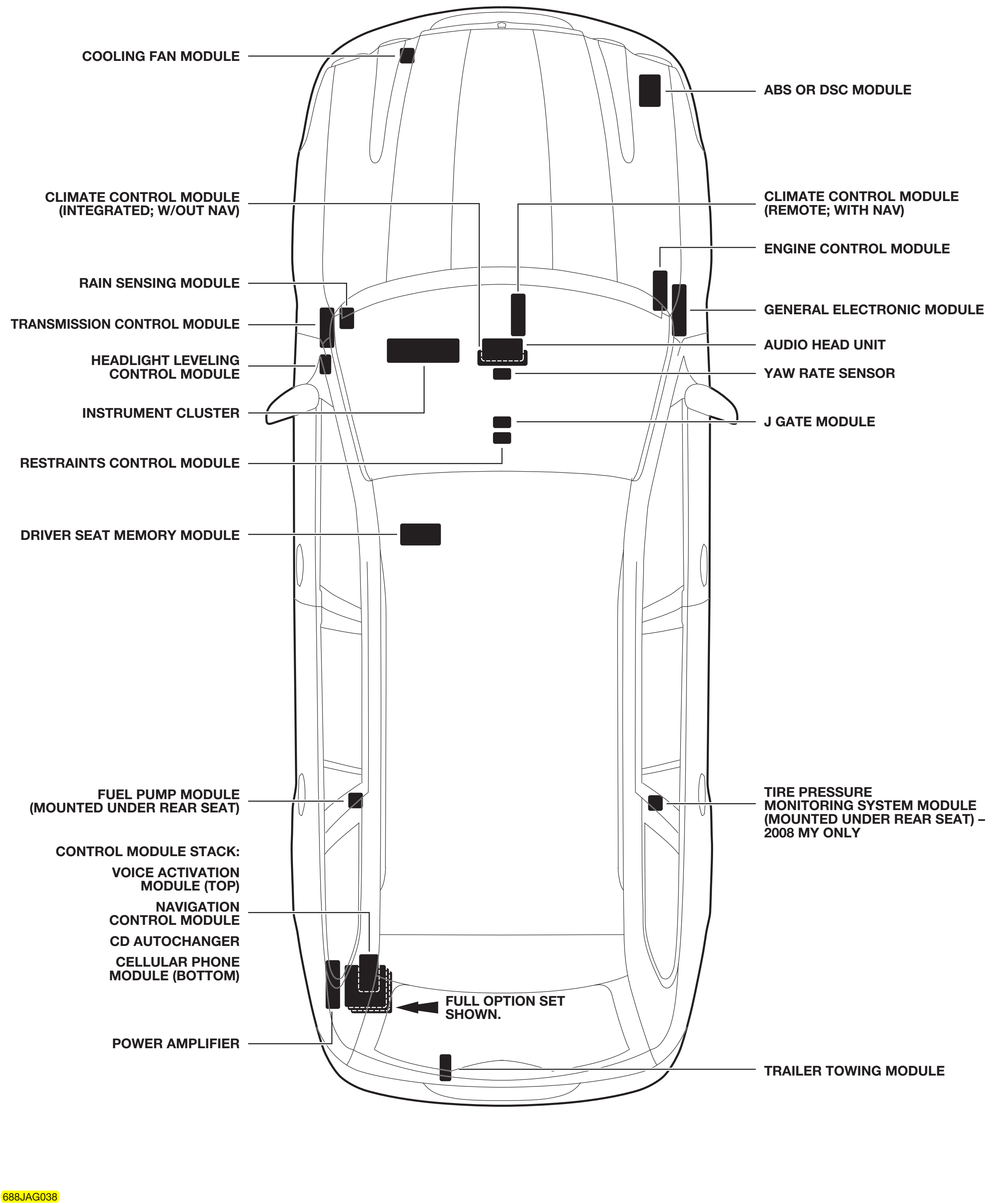
Module	Network	Function	Location
Phone Module	ACP	Phone function	Behind rear seat
Navigation Module	ACP	Navigation function	Below parcel shelf
Navigation Display Module	ACP	Navigation display	Behind Navigation Display
Occupant Sensing Control Module	Local CAN	Monitors passenger seat status	'A' post, RH side of fascia
Passenger Seat Weight Sensing Module	Local CAN	Monitors passenger seat status	Below passenger seat cushion
Power Assisted Steering Control Module	Hardwired	Regulates steering assist	Adjacent to RH side fuse box
Dimmer Module	Hardwired	Regulates interior lights	Adjacent to RH side fuse box

X404 CONTROL MODULES

X404 Sedan

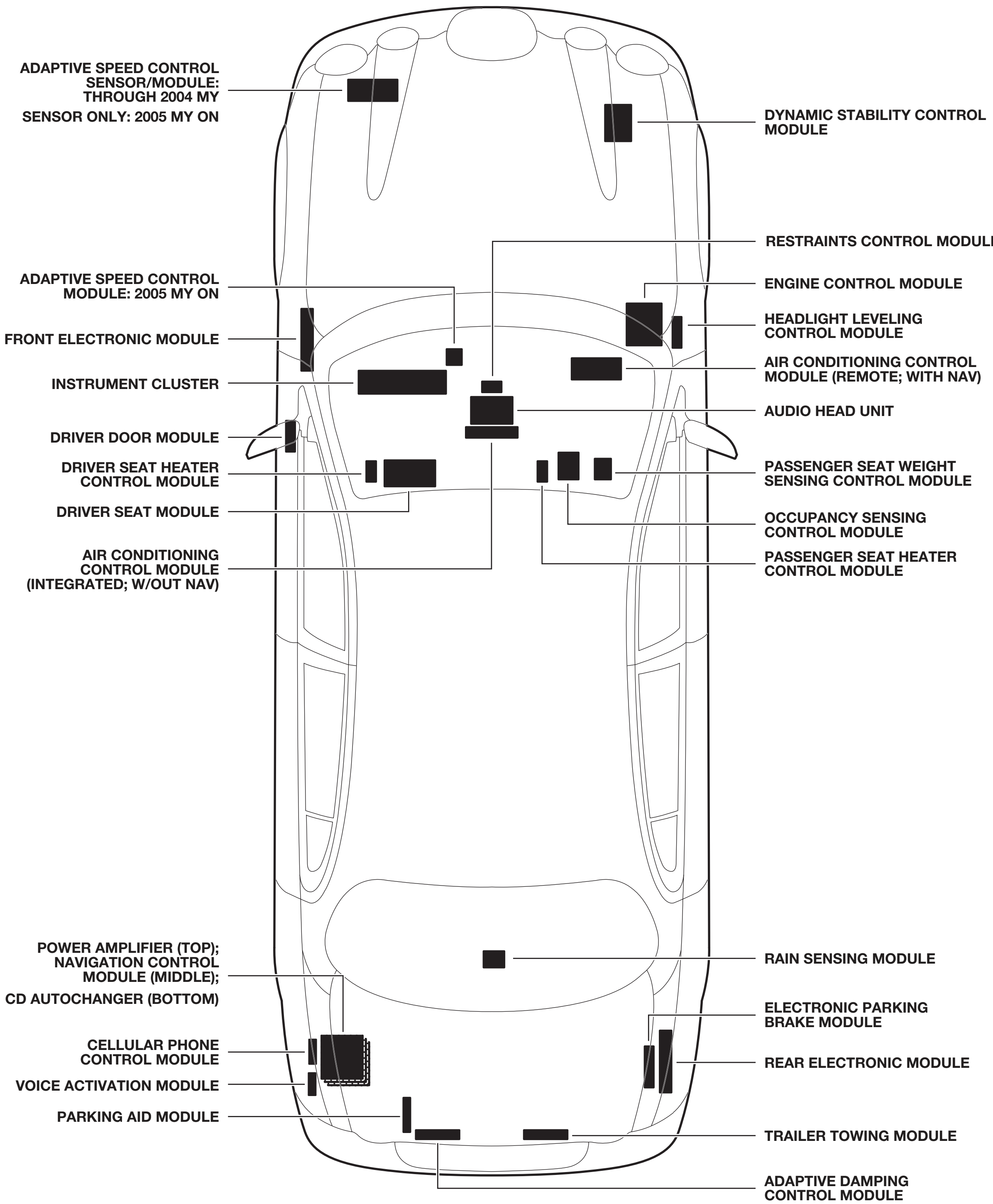


X404 Wagon


COOLING FAN MODULE
ABS OR DSC MODULE
CLIMATE CONTROL MODULE (INTEGRATED; W/OUT NAV)
CLIMATE CONTROL MODULE (REMOTE; WITH NAV)
ENGINE CONTROL MODULE
RAIN SENSING MODULE
GENERAL ELECTRONIC MODULE
TRANSMISSION CONTROL MODULE
AUDIO HEAD UNIT
HEADLIGHT LEVELING CONTROL MODULE
YAW RATE SENSOR
INSTRUMENT CLUSTER
J GATE MODULE
RESTRAINTS CONTROL MODULE
DRIVER SEAT MEMORY MODULE
FUEL PUMP MODULE (MOUNTED UNDER REAR SEAT)
TIRE PRESSURE MONITORING SYSTEM MODULE (MOUNTED UNDER REAR SEAT) – 2008 MY ONLY
CONTROL MODULE STACK:
VOICE ACTIVATION MODULE (TOP)
NAVIGATION CONTROL MODULE
CD AUTOCHANGER
CELLULAR PHONE MODULE (BOTTOM)
FULL OPTION SET SHOWN.
POWER AMPLIFIER
TRAILER TOWING MODULE
688JAG038

Module	Network	Function	Location
Instrument Cluster	HS CAN SCP	Gateway between HS CAN and SCP	Driver instrument panel
ECM	HS CAN ISO	Controls the engine in response to various sensor inputs	RH Engine compartment
Dynamic Stability Control Module	HS CAN	Controls the braking force applied to the road wheels	RH Engine compartment
TCM	HS CAN	Electronic control of the automatic gear change	Transmission sump
Headlight Leveling Module	HS CAN	Controls headlight leveling	Behind instrument panel, LH side
Air Conditioning Control Module (Navigation)	HS CAN	Controls air conditioning system, blower speeds and compressor function	Remote module, RH side of dash-board
Air Conditioning Control Module (w/o Navigation)	HS CAN	Controls air conditioning system, blower speeds and compressor function	Incorporated in the climate con-trol panel
Tire Pressure Monitoring Sys-tem Module (08 MY only)	HS CAN	Monitors tire pressures	Under rear seat RH side
Driver Seat Memory Module	HS CAN	Controls seat and mirror position memory	Under driver seat
J-Gate Module	HS CAN	Provides gear shift selector information	Center console
General Electronic Module	SCP	Controls body functions	Behind instrument panel RH side
Audio Head Unit	SCP D2B	Gateway between SCP and D2B networks	Center of fascia, below touch-screen
Restraints Control Module	ISO	Activates airbag restraint system	Top of transmission tunnel
LH HID Headlight Assembly	ISO	Controls light function	Mounted to bottom of LH light assembly
RH HID Headlight Assembly	ISO	Controls light function	Mounted to bottom of RH light assembly
Navigation Module	D2B SCP	Controls vehicle guidance and location	Trunk LH side stack
Voice Module	D2B	Controls voice operation	Trunk LH side stack
Phone module	D2B	Controls phone operation	Trunk LH side stack
Parking Aid Control Module	Hardwired	Provides audible proximity warning when reversing	Spare tire well
Fuel Pump Module	Hardwired	Controls fuel pump operation	Under rear seat LH side
Trailer Towing Module	Hardwired	Controls exterior trailer lighting	Behind trunk striker panel

X206 CONTROL MODULES



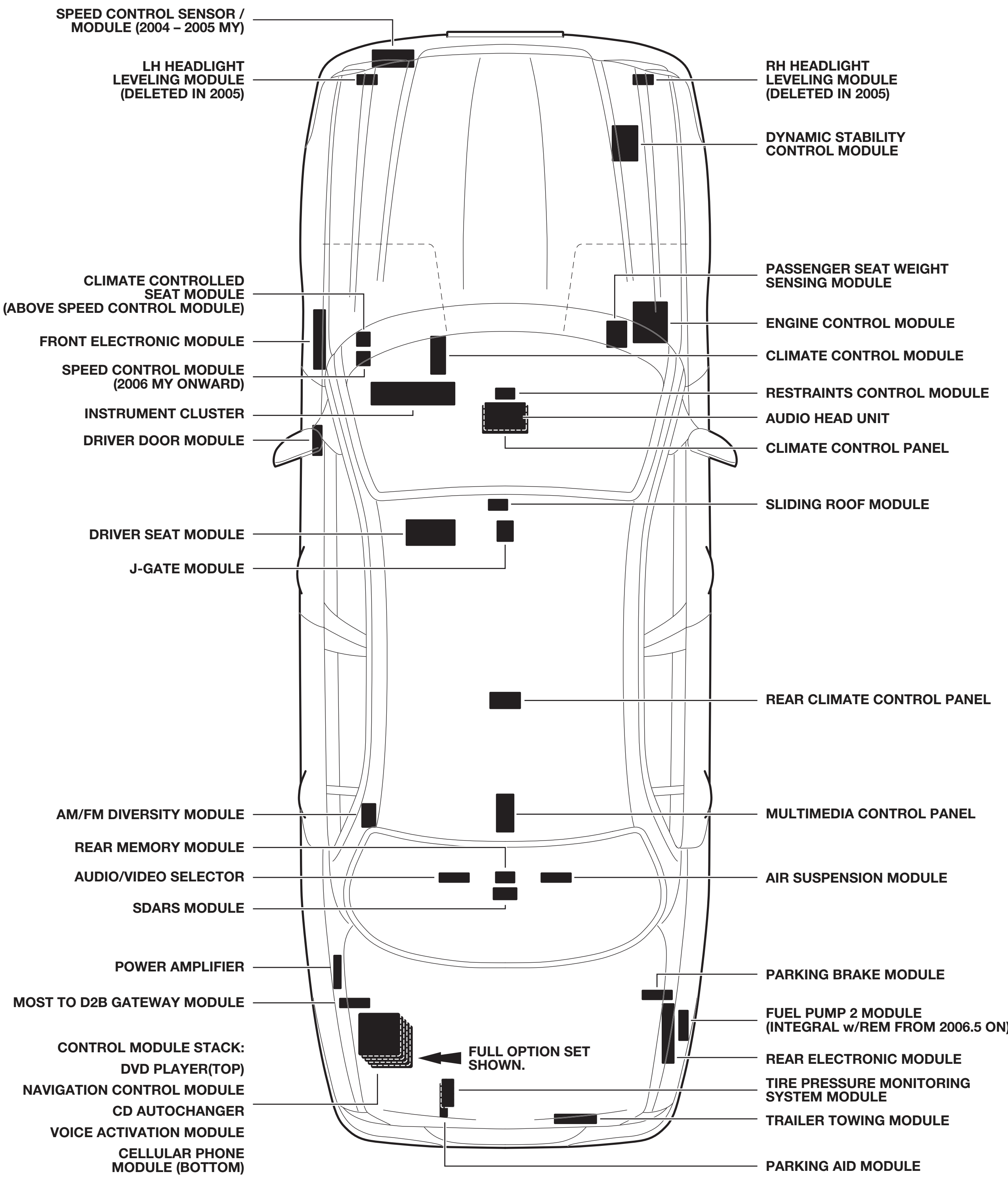
NOTE: THE TRANSMISSION CONTROL MODULE IS CONTAINED WITHIN THE TRANSMISSION.

688JAG039

Module	Network	Function	Location
Instrument Cluster	HS CAN SCP	Gateway between HS CAN and SCP	Driver instrument panel
ECM	HS CAN ISO	Controls the engine in response to various sensor inputs	RH Engine compartment
Dynamic Stability Control Module	HS CAN	Controls the braking force applied to the road wheels	RH Engine compartment
TCM	HS CAN	Electronic control of automatic gear change	Transmission sump
Adaptive Speed Control Sensor/Module (through 2004 MY)	HS CAN	Adaptive speed control	Behind LH front bumper
Adaptive Speed Control Module (2005 MY on)	HS CAN	Adaptive speed control	Instrument panel, RH of cluster
Electronic Park Brake Module	HS CAN (2005 MY on) SCP (2003 – 04 MY)	Controls parking brake functions	RH side of trunk
Air Conditioning Control Module (w/ Navigation)	HS CAN	Controls air conditioning system, blower speeds and compressor function	Remote module, RH side of dashboard
Air Conditioning Control Module (w/o Navigation)	HS CAN	Controls air conditioning system, blower speeds and compressor function	Incorporated in the climate control panel
Headlight Leveling Control Module	HS CAN	Controls headlight leveling	RH ‘A’ post above primary junction fuse box
J-Gate Module	HS CAN	Provides gear shift selector information	Center console
Front Electronic Module	SCP	Controls body functions	LH side of dashboard behind instrument panel
Driver Door Module	SCP	Operates door functions	LH front door
Driver Seat Control Module	SCP	Operates seat functions	Under driver seat
Adaptive Damping Control Module	SCP	Enhances driving stability	LH spare tire well
Rear Electronic Control Module	SCP	Controls rear body functions	RH side of trunk
Audio Head Unit	SCP D2B	Gateway between SCP and D2B networks	Center of fascia, below touch-screen
LH HID Headlight Module	ISO	Controls light function and leveling	Mounted to bottom of LH light assembly
RH HID Headlight Module	ISO	Controls light function and leveling	Mounted to bottom of RH light assembly
Restraints Control Module	ISO	Activates Airbag restraint system	Top of transmission tunnel

Module	Network	Function	Location
Navigation Module	D2B SCP	Control vehicle guidance and location	LH trunk stack, middle
Power Amplifier	D2B	Audio system	LH Trunk stack, top
Cellular Phone Module	D2B	Phone system	LH Trunk stack, middle
Voice Activation Module	D2B	Controls voice command interface	LH Trunk stack, bottom
Passenger Seat Weight Sensing Module	Local CAN	Monitors Seat Weight Classification	Under passenger seat
Occupant Sensing Module	Local CAN	Seat position sensing	Below passenger seat
Parking Aid Control Module	Hardwired	Provides audible proximity warning when parking	Spare tire well
Rain Sensing Module	Hardwired	Provides rain sensing functionality	Above rear parcel shelf

X358 CONTROL MODULES



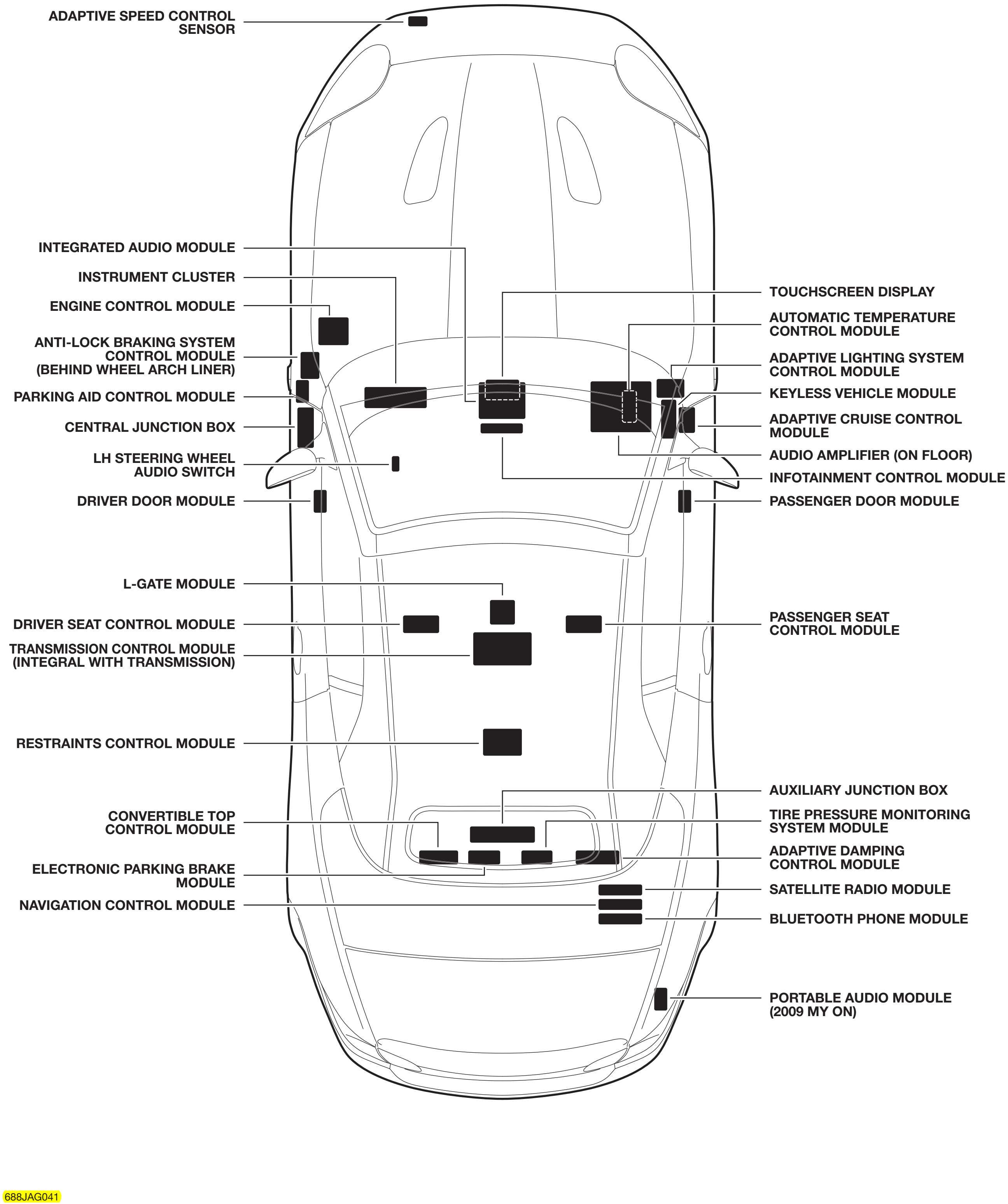
NOTE: THE TRANSMISSION CONTROL MODULE IS CONTAINED WITHIN THE TRANSMISSION.

688JAG040

Module	Network	Function	Location
Instrument Cluster	HS CAN SCP	Gateway between HS CAN and SCP	Driver side instrument panel
J-Gate Module	HS CAN	Provides gear shift selector information	Center console
Air Conditioning Control Module	HS CAN	Controls air conditioning system, blower speeds and compressor function	Lower center of dashboard
Dynamic Stability Control Module	HS CAN	Controls the braking force applied to the road wheels	RH Engine compartment
ECM	HS CAN	Controls the engine in response to various sensor inputs	RH Engine compartment
TCM	HS CAN	Electronic control of the automatic gear change	Transmission sump
Adaptive Speed Control Module	HS CAN	Adaptive speed control	LH instrument panel
Rear Climate Control Panel	HS CAN	Controls rear air conditioning system and blower speeds	Rear of center console
Air Suspension Control Module	HS CAN	Controls air suspending and leveling	Behind rear seat, RH side
Electronic Parking Brake Module	HS CAN (2006 MY on) SCP (2005 – 05 MY)	Controls electronic park bake	Trunk, RH rear
Audio Head Unit	SCP D2B	Gateway module between SCP and D2B network	Center of dashboard below touch screen
Rear Electronic Module	SCP	Controls rear body functions	Trunk, RH rear
Front Electronic Module	SCP	Controls front body functions	LH ‘A’ post
Rear Memory Module	SCP	Controls rear door locks and window operation	Behind rear seat back
Navigation Module	SCP D2B	Controls vehicle guidance and location	Trunk, LH side, second from top in module stack
Driver Door Control Module	SCP	Controls window and lock functions	LH door
Driver Seat Control Module	SCP	Controls seat and memory functions	Under LH front seat
Tire Pressure Monitoring Module	SCP	Monitors tire pressures	LH trunk, above Parking Aid Module
Parking Aid Control Module	ISO	Controls park distance control	Spare tire well
LH HID Headlight Module	ISO	Controls headlight function and leveling	Mounted under LH headlight
RH HID Headlight Module	ISO	Controls headlight function	Mounted under RH headlight

Module	Network	Function	Location
Restraints Control Module	ISO Local CAN	Controls airbag deployment	Under front of center console
Occupancy Sensing Module	Local CAN	Monitors occupant position status for passenger seat	Instrument panel, RH side
Passenger Seat Weight Sensing Module	Local CAN	Monitors seat weight classification	Under RF seat
Voice Activation Module	D2B	Controls voice function	Trunk, LH side, second from bottom in module stack
Compact Disc Changer	D2B	CD changer/player	Trunk, LH side, third from top in module stack
Cellular Phone Module	D2B	Controls phone operation	Trunk, LH side, bottom of module stack
Gateway Module	D2B MOST	Gateway between D2B and MOST	Forward of module stack, LH side
SDARS Module	MOST	Satellite radio module	Behind rear seat center

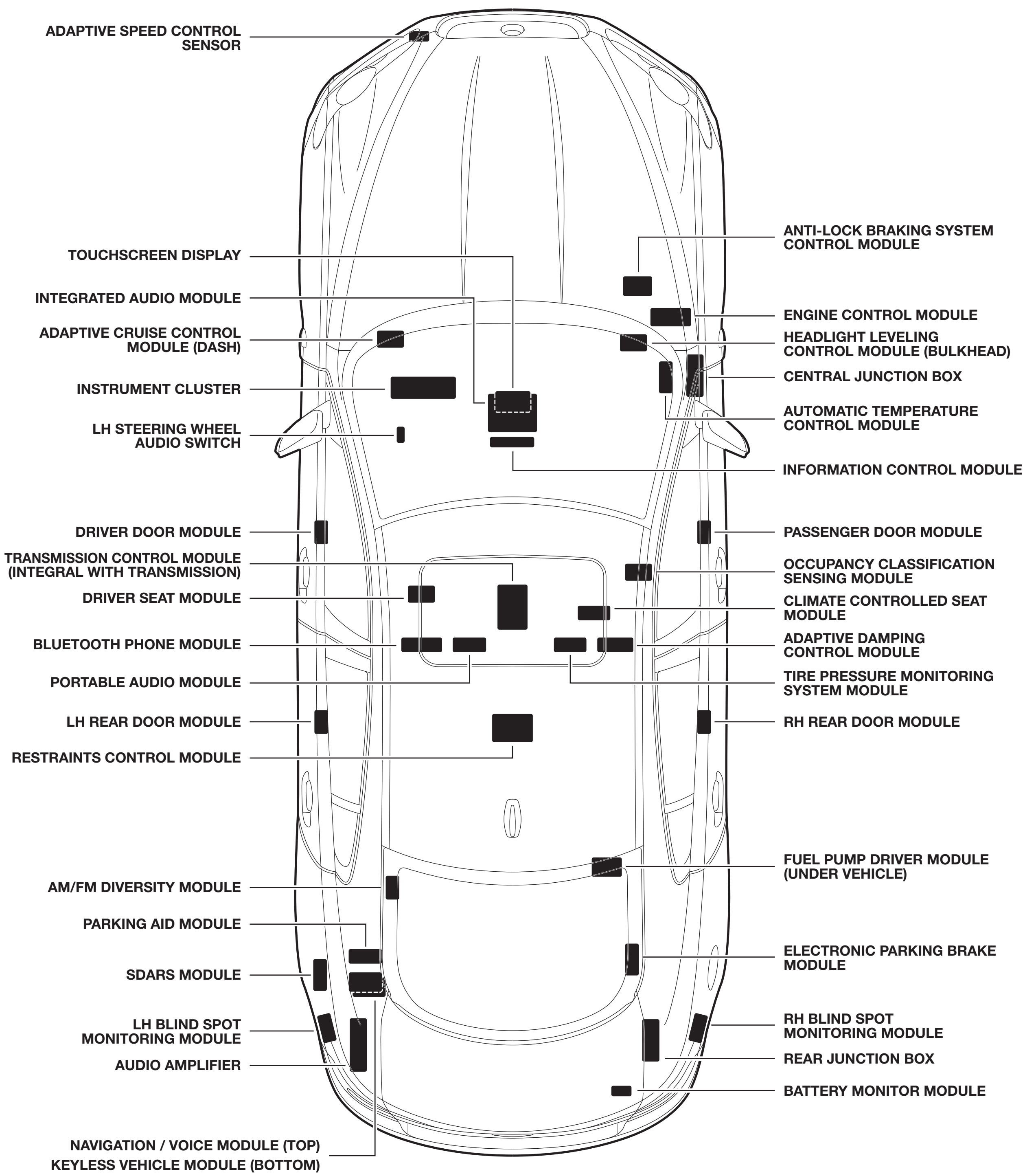
X150 CONTROL MODULES



Module	Network	Function	Location
Instrument Cluster (IC)	HS CAN MS CAN, LIN	Gateway between HS and MS CAN; Gateway between the CAN busses and the LIN bus	Driver's side instrument panel
Adaptive Cruise Control Module	HS CAN	Controls vehicle road speed in relation to other vehicles when in speed control mode	Lower RH 'A' post
Adaptive Damping Control Module (ADCM)	HS CAN	Controls the adjustment of the suspension dampers	Rear passenger compartment bulkhead, behind RH rear seat backrest
Adaptive Front Lighting System Control Module	HS CAN	Controls headlight leveling and adaptive front lighting system	RH footwell, mounted to RH 'A' post
Anti-Lock Braking System Control Module (ABSCM)	HS CAN	Controls the braking force applied to the road wheels	Engine compartment, next to the ECM
Electronic Parking Brake Module	HS CAN	Controls the application and release of the parking brake	Behind the auxiliary junction box
Engine Control Module (ECM)	HS CAN	Controls the engine in response to various sensor inputs	LH front engine compartment, adjacent to bulkhead
Transmission Control Module (TCM)	HS CAN	Electronic control of the automatic gear change	Transmission sump
L-Gate Module	HS CAN	Electronic control of the selected gear/ driving mode	Top of transmission tunnel
Restraints Control Module (RCM)	HS CAN	Controls the deployment of supplemental restraint components	Transmission tunnel, under trim between seats
Automatic Temperature Control Module (ATCM)	MS CAN	Controls the operation of the climate control / air-conditioning system	Attached to side of air conditioning unit
Auxiliary Junction Box (AJB)	MS CAN	Controls body functions and power distribution	Rear passenger compartment bulkhead, behind rear seat center section
Central Junction Box (CJB)	MS CAN	Controls body functions and power distribution	Passenger compartment, LH 'A' post
Driver Door Control Module (DDCM)	MS CAN	Memory/adjustment functions for seats, steering column and mirrors and security functions	Driver's door, behind trim
Driver Seat Control Module	MS CAN	Controls seat positioning and memory seat functions	Beneath driver's seat
Infotainment Control Module	MS CAN MOST	Gateway between the MOST and CAN networks for information and control distribution	Behind the touch-screen display, above the integrated audio unit
Integrated Control Panel	MS CAN	Contains controls for entertainment and air conditioning systems	Center of instrument panel, surrounding touch-screen display

Module	Network	Function	Location
Keyless Vehicle Module	MS CAN	Allows vehicle to be opened and started without the use of a key	RH ‘A’ post
Passenger Door Control Module (PDCM)	MS CAN	Memory/adjustment functions for seats, steering column and mirrors and security functions	Passenger’s door, behind trim
Passenger Seat Control Module	MS CAN	Controls seat positioning and memory seat functions	Beneath front passenger seat
Tire Pressure Monitoring System (TPMS) Module	MS CAN	Monitors the vehicle tires to warn of deflation	Rear passenger compartment bulkhead, next to AJB
Navigation Module	MOST, GVIF	Route guidance output based on driver destination inputs, GPS data and DVD-stored mapping information	Luggage compartment, right of battery
Portable Audio Module (2009 MY)	MOST	Controls auxiliary audio inputs from the portable audio interface	RH rear trunk, behind convertible top hydraulic pump motor (where equipped)
LH Steering Wheel Audio Switch	LIN	LIN bus gateway; converts analog signals from ICE and paddle shifters into digital messages	LH side of steering wheel

X250 CONTROL MODULES



688JAG042

Module	Network	Function	Vehicle Location
Instrument Cluster	HS CAN MS CAN LIN	Receives data from vehicle systems to provide information to the driver. Also functions as the gateway for all three bus systems.	Instrument panel
RCM	HS CAN	Controls deployment of supplementary restraint components	At rear of floor console
TCM	HS CAN	Controls automatic transmission operation	Located inside the transmission and accessible via the fluid pan
ECM	HS CAN	Controls engine management and fuel system operation	Rear of the engine compartment on the bulkhead.
ABS Module	HS CAN	Controls all aspects of the braking system	Rear of engine compartment on the bulkhead
Headlight Leveling Module	HS CAN	Controls the static dynamic headlight leveling function	In the lower instrument panel, behind the glovebox
Occupant Classification System Control Module	HS CAN	Detects when a passenger is in the front passenger seat and can determine their size and weight	Below the front passenger seat
Adaptive Damping Control Module	HS CAN	Controls the adjustment of the dampers	Below the front passenger seat
Electronic Parking Brake Module	HS CAN	Controls the application and release of the Electronic park brake	In the trunk, above the RH wheel arch
Adaptive Cruise Control Module	HS CAN	Controls the vehicle's road speed in relation to other vehicles when in speed control mode.	Behind the instrument panel on the driver's side
JaguarDrive Selector	HS CAN	Allows the driver to electronically select the required automatic transmission mode. Transmits driver selections to the TCM	In the floor console
CJB	MS CAN	Controls body functions and power distribution	On the RH 'A' pillar
Passenger Door Module	MS CAN	Controls window and locking functions	In the front passenger door
Parking Aid Module	MS CAN	Controls parking aid system	In the LH side of the trunk, adjacent to the keyless vehicle module
Driver Seat Module	MS CAN LIN	Controls driver seat positioning and also memory functions of other driver personalized functions	Below the driver seat
Driver Door Module	MS CAN	Controls window and locking functions	In the driver's door
ATC Module	MS CAN	Contains controls for the heating and air conditioning systems	On the end of the air conditioning evaporator and blower assembly
Information Control Module	MS CAN MOST	Contains controls for the entertainment system. Also functions as the gateway between the medium speed CAN and the MOST system	In the instrument panel below the integrated control panel

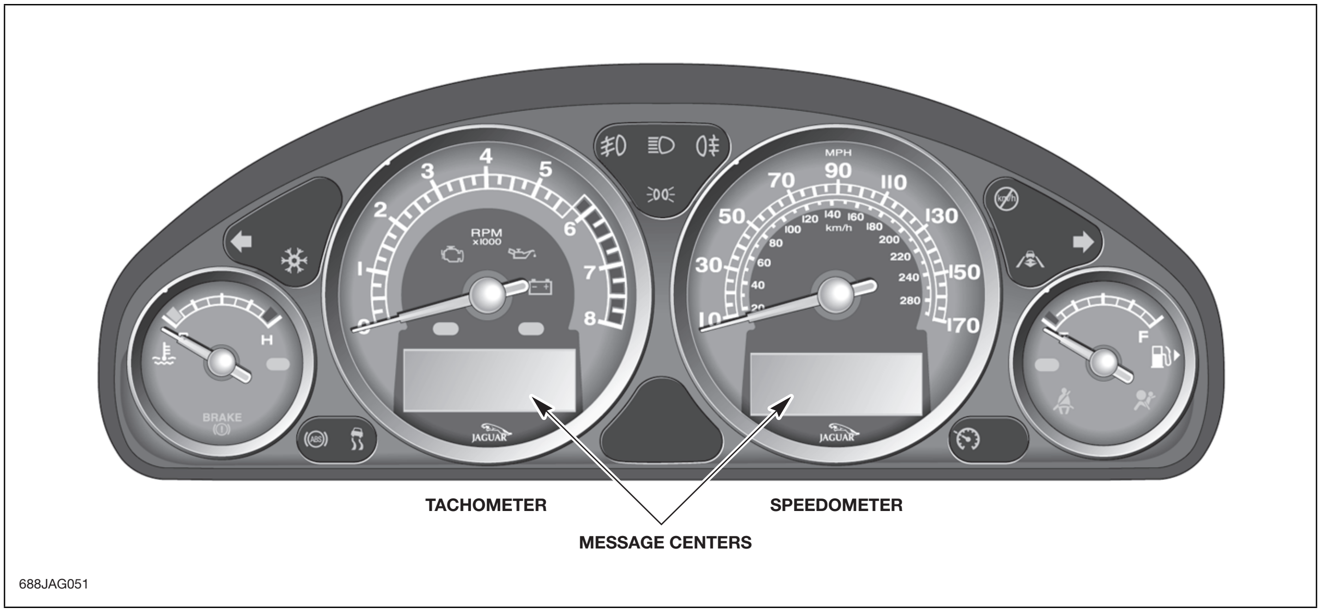
Module	Network	Function	Vehicle Location
Integrated Control Panel	MS CAN	Contains control functions for the entertainment system	In the instrument panel
Climate Controlled Seats Module	MS CAN	Controls the temperature requirements of the driver and passenger front seats.	Below the RH front seat
LH Blind Spot Monitoring Module	MS CAN	Controls the operating parameters of the system and provides driver indications and fault monitoring.	Behind the outer part of the rear bumper, rearward of the rear wheel
RH Blind Spot Monitoring Module	MS CAN	Controls the operating parameters of the system and provides driver indications and fault monitoring.	Behind the outer part of the rear bumper, rearward of the rear wheel
Keyless Vehicle Module	MS CAN	Allows the vehicle to be opened and closed without the use of a key.	In the LH side of the trunk, adjacent to the parking aid module
RJB	MS CAN	Controls body functions and power distribution.	RH side of trunk
Tire Pressure Monitoring System Control Module	MS CAN	Monitors the vehicle tires to warn of deflation.	Below the RH front seat
Driver Side Rear Door Module	LIN	Controls window and locking operation	In the driver’s side rear door
Passenger Side Rear Door Module	LIN	Controls window and locking operation	In the passenger side rear door
Driver Door Module	LIN	Memory/adjustment functions for seat, steering column and mirrors and door security functions.	In the driver’s door
Passenger Door Module	LIN	Memory/adjustment functions for seat, steering column and mirrors and door security functions.	In the passenger door
ECM	LIN	Receives load signal from generator	Located in the engine compartment on the bulkhead
ATC Module	LIN	Controls operation of the climate system functions	Located in the instrument panel
LH Steering Wheel Audio Switch	LIN	LIN bus gateway; converts analog signals from ICE and paddle shifters into digital messages	LH side of steering wheel
Battery Monitor System Module	LIN	Monitors the condition and charge of the vehicle battery	On the vehicle battery negative terminal in the trunk
Rain/Light Sensor	LIN	Detects moisture on the windshield; provides ambient light level input	Located on the inside of the windshield behind the interior rear view mirror
TCM	LIN	Receives selector position information to control transmission operation	Located inside the transmission and accessible by removal of the fluid pan

Module	Network	Function	Vehicle Location
Satellite Digital Audio Receiver System	MOST	Receives digital radio broadcasts	In the LH side of the trunk, above the keyless vehicle module
Telephone Control Module	MOST	Controls the operation of the Bluetooth® phone system	Below the LH front seat, adjacent to the portable audio module
Navigation Module	MOST GVIF	Reads map data from a DVD to calculate and display visual route guidance information via the Touch-screen and audible guidance via the audio system speakers	In the LH side of the trunk
Touch-Screen Display	MOST GVIF	Provides the driver interface to the entertainment, navigation and driver personalization functions	In the center of the instrument panel
Portable Audio Module	MOST	Controls the auxiliary inputs for additional audio inputs via the portable audio interface.	Below the LH front seat, adjacent to the Bluetooth phone module

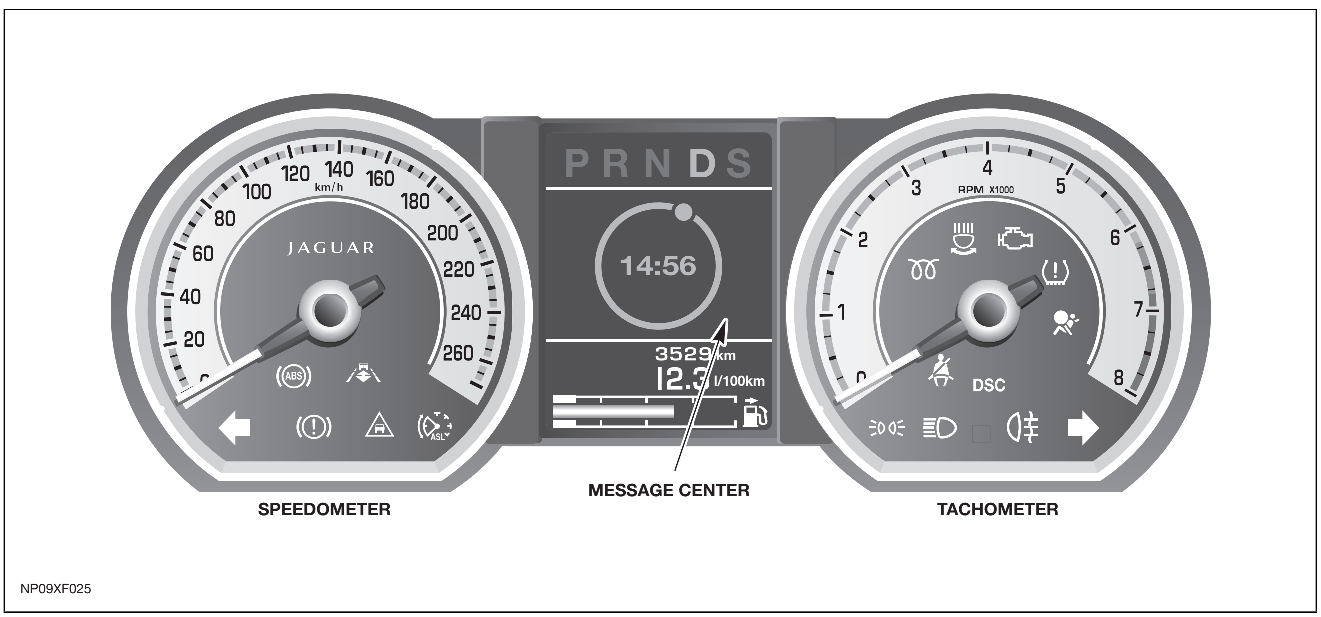
For more specific information about the modules and components on the following pages, please refer to the appropriate workshop manual on GTR.

INSTRUMENT CLUSTER

X206



X250



The primary function of the instrument cluster (IC) is to display current vehicle status through a series of analog gauges, indicator lights, and a liquid crystal display (LCD) message center. In addition, the instrument cluster:

- Acts as a gateway between different networks – HS CAN, MS CAN, SCP, LIN bus (networks vary depending on model and specification)
- Controls operation of the steering column adjust feature
- Acts as an interface for the passive anti-theft system

All instrument clusters prior to the 2007 XK and the 2009 XF needed to be ordered preprogrammed with mileage. Going forward, mileage will be programmed at the dealer with the assistance of the technical helpline and IDS.

The following table displays the various instrument cluster functions for the different models. For more detailed programming information and functions please refer to the appropriate service manual.

Instrument Cluster Functions	X105	X404	X206	X358	X150	X250
Gateway for HS CAN – MS CAN – LIN bus					X	X
Gateway for HS CAN – SCP	X	X	X	X		
Gateway for LIN bus to MS CAN					X	X
Vehicle Identification Block (VID block) Strategy	X	X	X	X		
Car Configuration File (CCF) Strategy					X	X
Internal speaker					X	X
Adjustable steering column control	X		X	X	X	X
Adjustable pedal control			X	X		
Start control unit Communication					X	X
Factory mileage programming and configuration	X	X	X	X		
Dealer mileage programming and configuration					X	X
Servotronic steering control			X	X	X	X
Instrument Pack Self Test / Engineering Test Mode		X	X	X	X	X
Configuration Messages	X	X	X	X		
Passive Anti-Theft System (PATS) functionality		X	X	X		

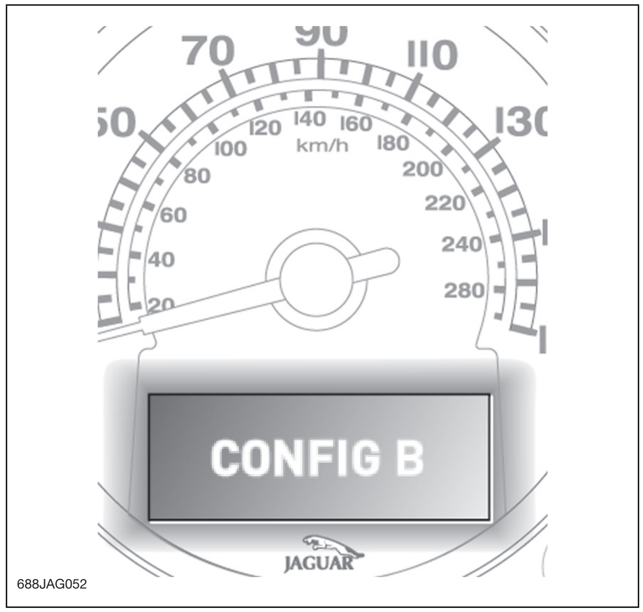
Driver Information Message Center

The message center is a liquid crystal display (LCD) located in a central position in the instrument cluster. The message center receives CAN bus, SCP, LIN bus, and hardwired signals from other vehicle system control modules to display current vehicle status information.

Depending on message importance:

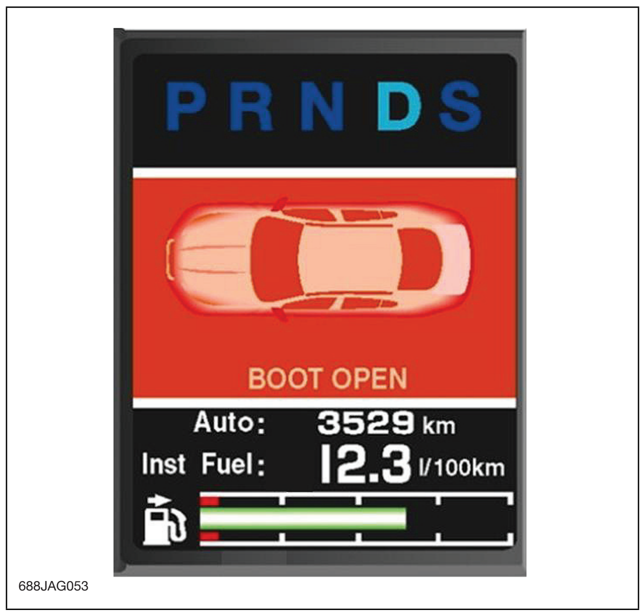
- X202 / X350 / X400 onwards will have amber or red warning lights accompanying some messages
- X150 / X250 onwards will be backlit in white, amber or red

X202 / X350 / X400 Onwards



688JAG052

X150 / X250 Onwards



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Instrument Cluster Configuration Messages

The message center on the X202 / X350 / X400 onwards clusters introduced additional capabilities for displaying module configuration messages when a module has not been properly programmed. The message center will display a message 'CONFIG X', which indicates that module 'X' is exhibiting a concern. For example, if the message center displays the message 'CONFIG B' this means that one of the modules on the D2B network was not properly programmed. In this situation, the best way to identify which module is causing the concern is to retrieve DTCs using IDS.

The following table describes the CONFIG display characters:

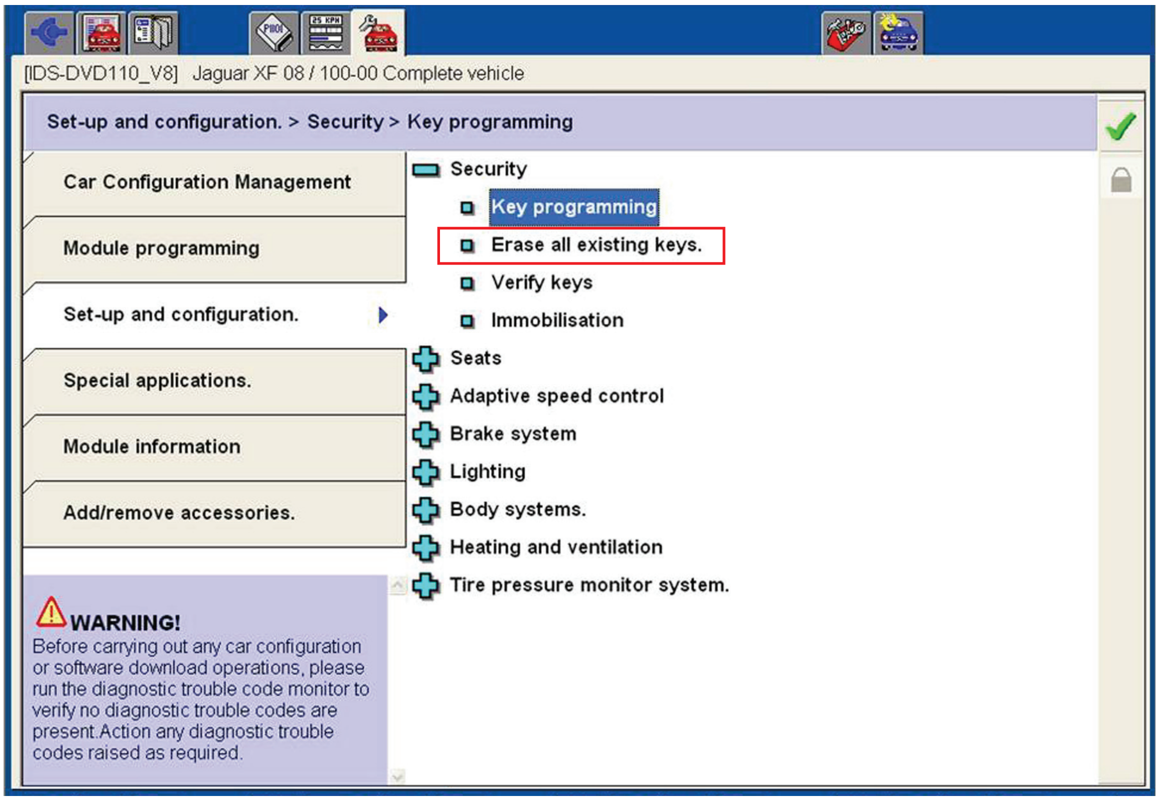
Character	Module / Bus
A	DSC
B	Telematics Bus
C	ACC
D	DDM
E	ECM
F	FEM
I	IC
M	RMM
R	REM
S	DSM
T	TCM

Instrument Cluster Renewal X150 / X250

On X150 / X250 vehicles, the instrument cluster is the master module of the transponder side of the immobilization system. Always refer to the removal and installation procedure in the workshop manual before removing or installing the instrument cluster.

CAUTION:

Before removing the original instrument cluster from the vehicle, the 'Erase Keys' procedure must be carried out using IDS. Failure to carry out this procedure will prevent the customer vehicle keys being programmed to the new instrument cluster.



688JAG137

NOTE: If the original instrument cluster has failed electrically and will not communicate with IDS, new keys will be required for programming when the new instrument cluster is installed.

Instrument Cluster Diagnostics

Instrument clusters can be diagnosed two ways: with IDS, and through self-diagnostics using Engineering Test Mode (ETM). ETM provides additional diagnostic procedures to resolve instrument cluster concerns. ETM can display the status of Instrument Cluster inputs as well as providing a number of other useful features.

When in ETM, the right-hand message center or the single LCD displays internal data that can be cycled through; the left-hand message center functionality remains unaffected (with some exceptions) during ETM.

For specific instrument cluster diagnostics using Engineering Test Mode (ETM) refer to bulletins:

- # JTB00014 for:
  - S-TYPE: VIN M45255 2003 MY onward
  - X-TYPE: VIN C00344 2002 MY onward
  - XJ: VIN G00442 2004 – 2007 MY
- #JTB00017 for:
  - XK: VIN B00001 2007 MY onward

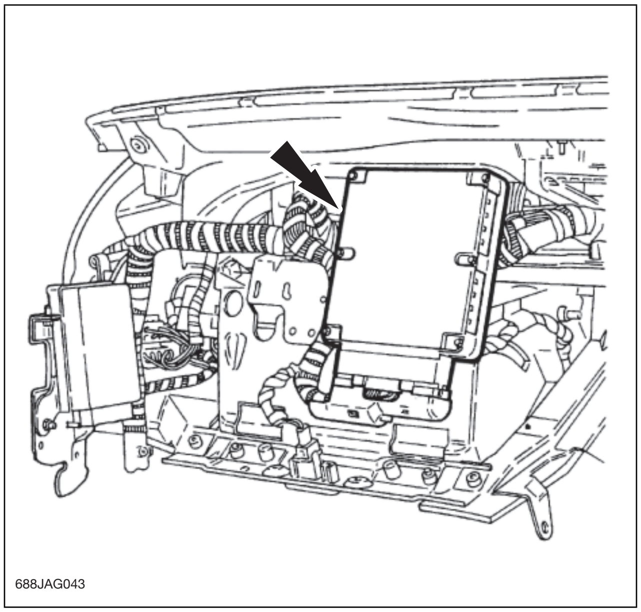
BODY CONTROL MODULES

Advancements in technology have increased module processing power and network architecture. This has had a great impact on control module functions and capabilities within just a few years. With these advancements in technology, the module names and systems have changed, although their basic function remains the same. The table below lists the terminology changes for the main body control modules. The following pages describe their individual functions.

Module Terminology	X105	X404	X206	X358	X150	X250
Body Processor Module (BPM)	X					
Security Locking Control Module (SLCM)	X					
General Electronic Module (GEM)		X				
Front Electronic Module (FEM)			X	X		
Rear Electronic Module (REM)			X	X		
Central Junction Box (CJB)					X	X
Auxiliary Junction Box (AJB)					X	
Rear Junction Box (RJB)						X

Body Processor Module: X105

The body processor module (BPM) is located in the fascia, mounted on the passenger airbag/SRS bracket, behind and above the glove box.



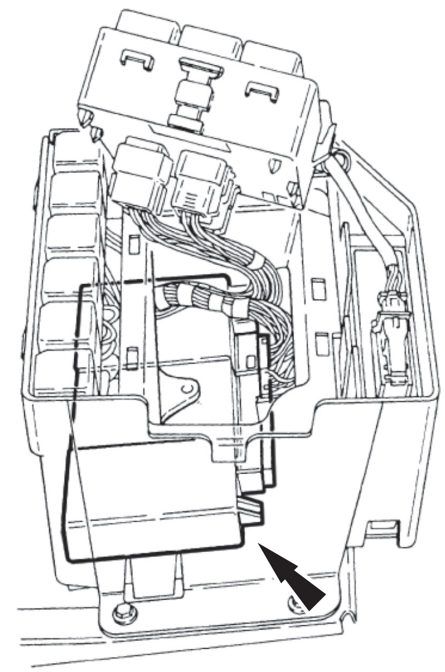
BPM functions include (depending on specification):

- Interior and exterior lighting, except for the door puddle lights and the rear light bulb failure
- Windshield wash/wipe and headlight 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.

The BPM is also known as a Multifunction Electronic Module.

Security and Locking Control Module: X105

The security and locking control module (SLCM) is located in the electrical carrier below the fuse box, in the trunk.



688JAG044

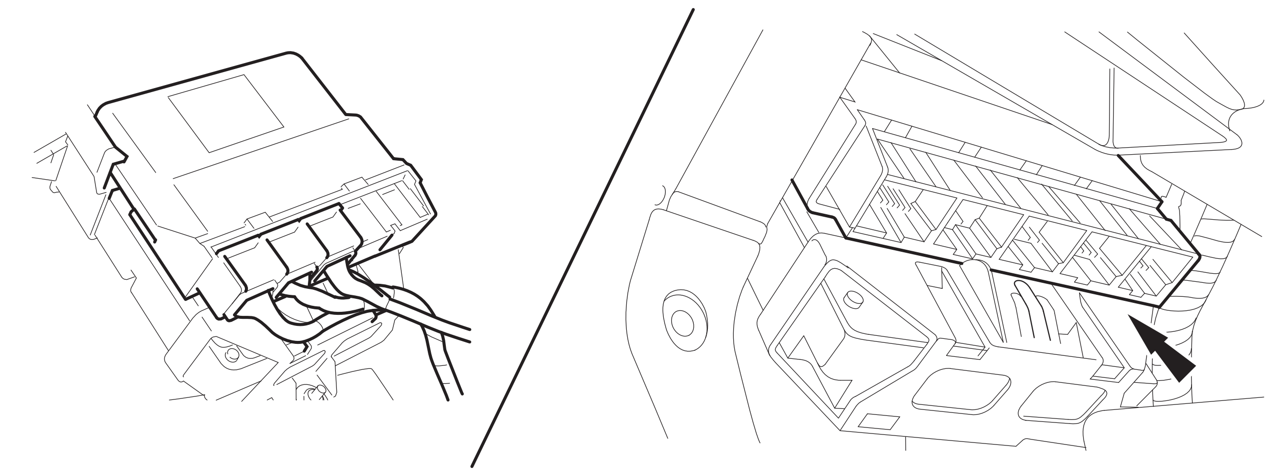
Functions controlled by the SLCM include:

- Security system
- Drive away door locking
- Key and remote transmitter locking/unlocking
- Remote headlight convenience
- Remote trunk open
- Rear lights

The security and locking systems comprise the SLCM, BPM, DDCM and PDCM, all connected via the SCP network.

General Electronic Module: X404

The general electronic module (GEM) is mounted in the upper dash, close to the right-hand 'A' post on top of the engine control module.



688JAG045

Functions controlled by the GEM include:

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

Warning Devices

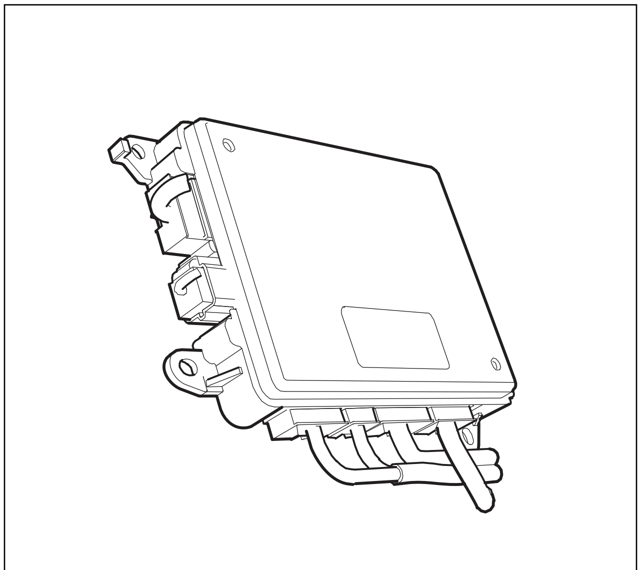
The warning device system uses the GEM to control audible and visual warnings for the benefit of the driver and occupants. The driver audible warnings sounder is integral to the GEM.

Warnings are associated with the following:

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

Front Electronic Module: X206, X358

The front electronic module (FEM) is located at the base of the left-hand side 'A' post. The FEM communicates via the SCP network, and can be configured for specific market options.

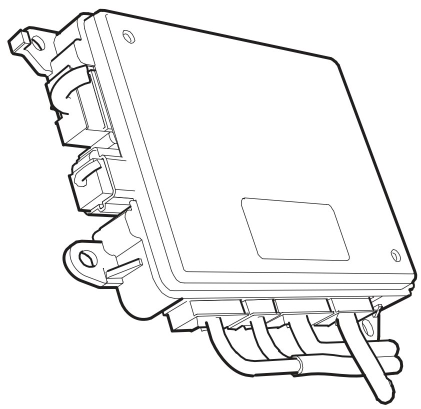


The table below lists some of the functions controlled by the FEM:

FEM Function	X206	X358
Internal circuit protection	X	X
Switched system power control	X	X
Zonal partitioned (front of vehicle)	X	X
Easy entry-easy exit lighting	X	X
Courtesy/demand lighting	X	X
Front exterior lighting	X	X
Battery saver (interior lights)	X	X
Turn signals and hazard warning lamps	X	X
Wiper control and Rain sensing when fitted	X	X
Low oil pressure input	X	
Memory functions	X	X
Day-time running lamps	X	X
Security	X	X
Variable Assist Power Steering (VAPS) solenoid control	X	
Passenger exterior mirror	X	X
Electrochromic control all mirrors	X	X
Passenger door lock	X	X
Passenger door window	X	X
Front seat heater control		X
Steering wheel heater		X
Adjustable pedal control	X	X

Rear Electronic Module: X206, X358

The rear electronic module (REM) is located on the right-hand side of the trunk, behind a trim panel. The REM communicates via the SCP network, and can be configured for specific market options.

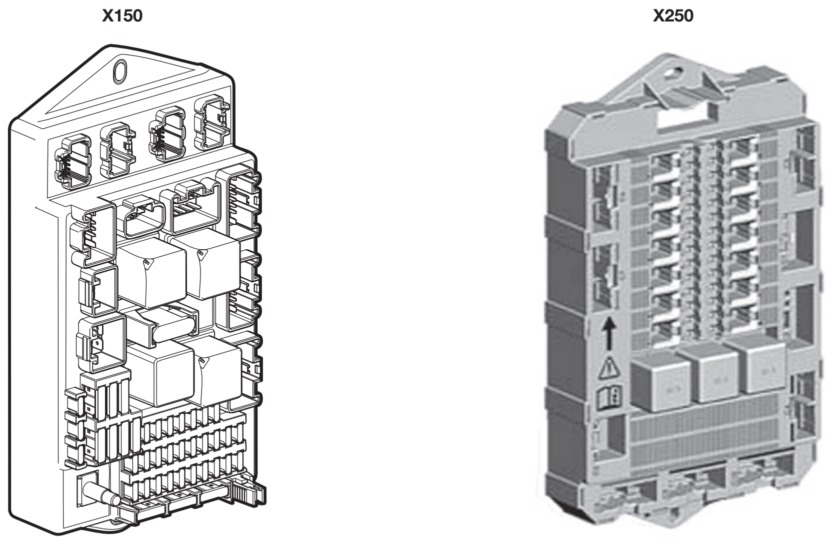

688JAG046

The table below lists some of the functions controlled by the REM:

REM Functions	X206	X358
Internal Circuit Protection	X	X
Switched system power control	X	X
Zonal partitioned (Rear of vehicle)	X	X
Rear exterior lighting	X	X
Battery saver (interior lights)	X	X
Trunk latch	X	X
Rear heated seat control		X
Reverse input for chromatic rear view mirror	X	X
Security	X	X
Fuel pump, inertia switch and sender control	X	X
Rear parking aid reverse input	X	X
Rear door locks	X	X
Rear door window isolate	X	X
Rear window defogger	X	X

Central Junction Box: X150, X250

The central junction box (CJB) is mounted at the base of the LH 'A' post, behind the LH trim panel in the footwell below the LH side of the instrument panel.



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The CJB receives battery power from the battery junction box (BJB) via a megafuse (175A for X150, 250A for X250). A second power supply lead daisy chains off the CJB to provide electrical power to the engine compartment fuse box.

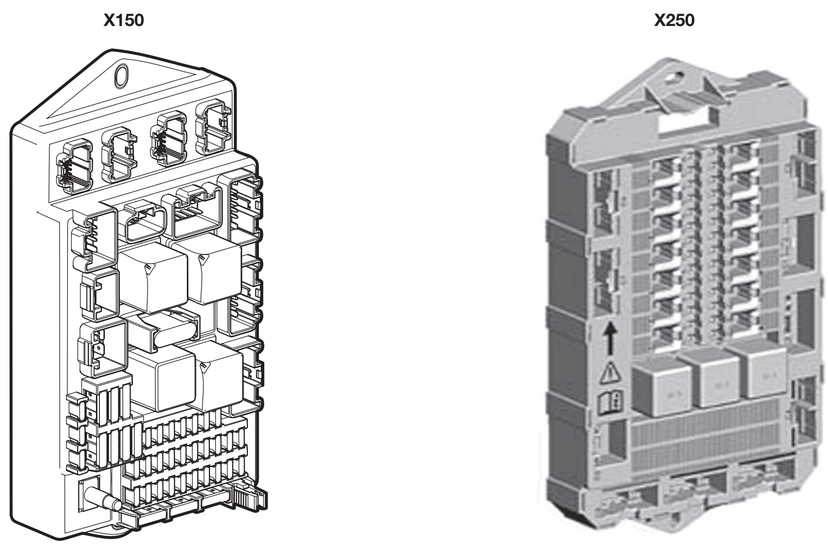
The CJB replaces the FEM technology used on previous vehicles and is combined with a power junction box, which is why it is also known as the front smart junction box (FSJB). This combination reduces vehicle wiring and allows systems to operate faster and more efficiently.

The table below lists some of the functions controlled by the CJB.

CJB Functions	X150	X250
Internal circuit protection	X	X
Switched system power control	X	X
Power distribution	X	X
Zonal partitioned (Front of vehicle)	X	X
Contains back-up copy of CCF file	X	X
Instrument cluster and panel illumination	X	X
Interior and exterior lighting systems	X	X
Passive and active anti-theft systems	X	X
Passive starting	X	X
Heated seats	X	X
Wipers and washers (rain sensing when fitted)	X	X
Diagnostics	X	X

Auxiliary Junction Box (X150) / Rear Junction Box (X250)

The auxiliary junction box (AJB) and the rear junction box (RJB) are the same modules and perform similar functions but are named differently for X150 and X250.



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The X150 uses the AJB, mounted on the passenger compartment rear bulkhead, behind the rear seat center section. Battery power is supplied from the battery junction box (BJB) via a 175A megafuse.

The X250 uses the RJB, located behind an access panel on the RH side of the trunk. Battery power is supplied from the BJB via a 250A megafuse.

The AJB/RJB replaces the REM technology used on previous vehicles and is combined with a power junction box, which is why it is also known as the rear smart junction box (RSJB). This combination reduces vehicle wiring and allows systems to operate faster and more efficiently.

The AJB/RJB is also known as the 'Master' module because it contains and broadcasts the Car Configuration File (CCF) with all of the current personalization settings.

The table below lists some of the function controlled by the AJB/RJB for X150 and X250:

AJB/RJB Functions	X150	X250
Internal circuit protection	X	X
Switched system power control	X	X
Power distribution	X	X
Zonal partitioned (Rear of vehicle)	X	X
Contains Master copy of CCF file	X	X
Rear interior and exterior lighting systems	X	X
Passive and active anti-theft systems	X	X
Trunk release	X	X
Fuel door release	X	X
Diagnostics	X	X

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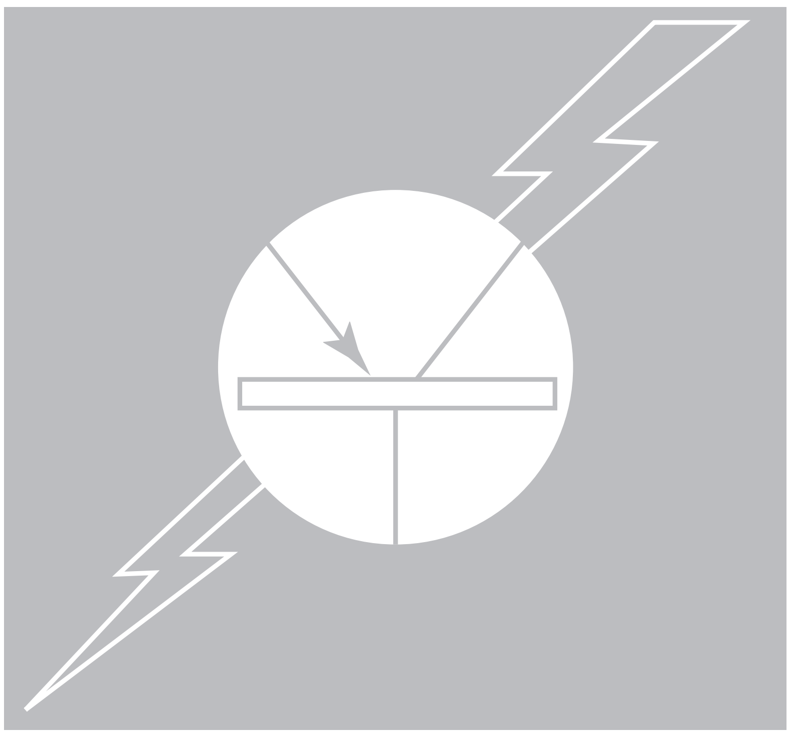
Technical Training

Electrical Systems

688-JAG: Advanced Electrical Systems and Diagnostics



Body Systems and Operation

JAGUAR

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HIGH INTENSITY DISCHARGE (HID) HEADLIGHTS

High Intensity Discharge (HID) headlights, also known as Xenon headlights, are the most advanced development in the field of motor vehicle headlight systems.

Xenon headlights do not have a high or low beam setting. Instead, the system uses a conventional halogen bulb for high-beam operation. The Bi-Xenon headlight system achieves low and high beam operation with a built in solenoid controlled shutter used to change the beam projection between low and high beam.

NOTE: Due to the 'warm-up' time experienced with Xenon lamps, the high beam halogen bulbs are used for the high beam flash feature. Because the Bi-Xenon system has no separate halogen high beam bulb, the Bi-Xenon shutter is used.

Xenon lights have two distinct advantages over the light of conventional H7 halogen bulbs: a Xenon light source delivers twice the light, while consuming only two-thirds of the energy. The improved light output makes the road brighter and illuminates a wider area. Due to the level of illumination intensity, there is a legal requirement that Xenon lights use an automatic leveling system to avoid dazzling oncoming drivers.

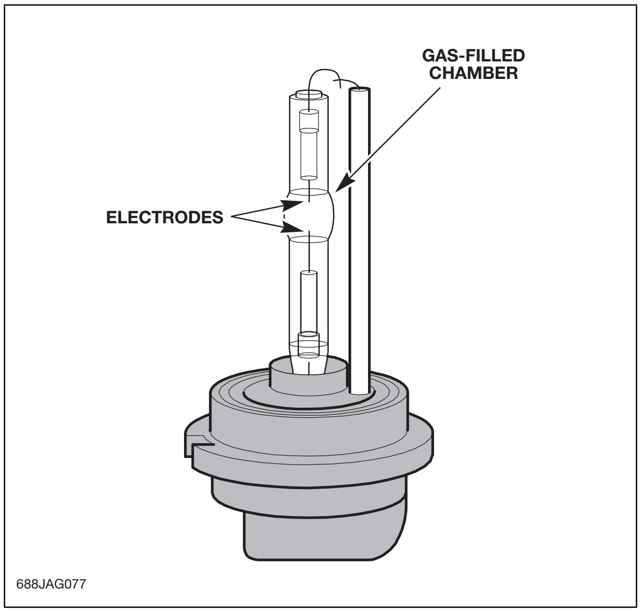
HID headlights comprise the following:

- Headlight burner
- HID control module
- Shutter & solenoid (Bi-Xenon only)
- Headlight leveling stepper motors

System Operation

Each headlight assembly has an integral control module; the LH and RH headlights operate independently of each other. The control module contains the ballast module (which controls the lamp burner to the correct operating power) and can be replaced independent of the headlight 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.

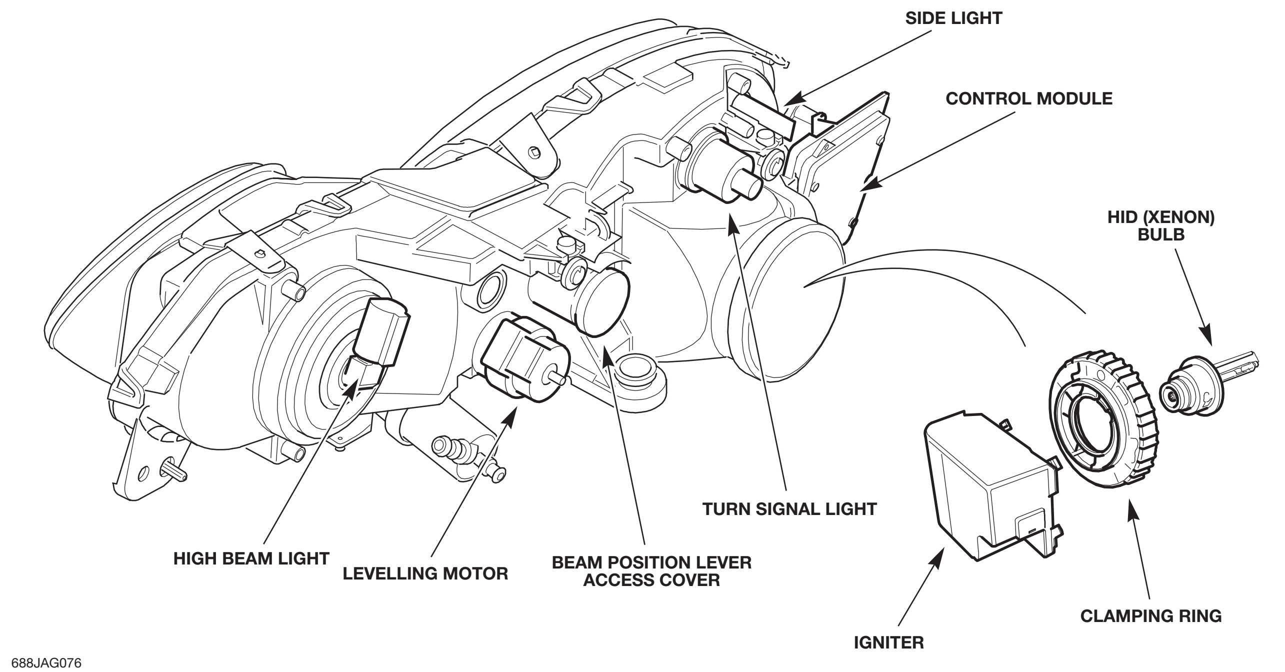


The ballast module is supplied with battery voltage and applies an electrical charge to the burners. Once this charge is high enough, an electric arc is produced between the two electrodes which ionize the gas, producing approximately 20% of its continuous light. As the temperature of the gas increases the mercury and the metal salts evaporate and its luminescence increases, moving the light produced from the blue spectrum into the white spectrum.

An initial arc-strike of up to 30,000 volts is required to operate the burners; when the burner is fully functional, the current required to maintain operation reduces and the power of the burner is regulated to 35W.

The light produced from the Xenon headlights is well within the white light spectrum, but to the naked eye it appears blue when compared to the yellow light produced from a tungsten bulb. 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).

HID Headlight Assembly: X202 shown



The standard HID headlight system uses a conventional H7 halogen bulb for operation of the high beam, although the Xenon burner continues to operate on low beam.

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.

WARNING:

- ⚠ **Never attempt to probe connectors or components within the headlight assemblies.**
- ⚠ **Care should be taken when handling the burners (bulbs) as the internal pressure is between 7 - 100 bar (101.5 - 1450 psi) depending upon the temperature. Goggles and gloves are recommended.**
- ⚠ **To avoid contamination, the glass of the burner should not be touched.**
- ⚠ **All headlight functions should be switched off and the headlight assemblies should be disconnected from the vehicle harness before any attempt is made to work on the system.**
- ⚠ **Used burners (lamps) should be disposed of as hazardous waste.**

Circuit Protection

X206 / X358 / X404

The ballast modules sense short circuits and will switch off the high voltage circuits accordingly. In the event of a broken burner, 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: Additional protection is provided by fuse-protected serviceable relays.

X150 / X250

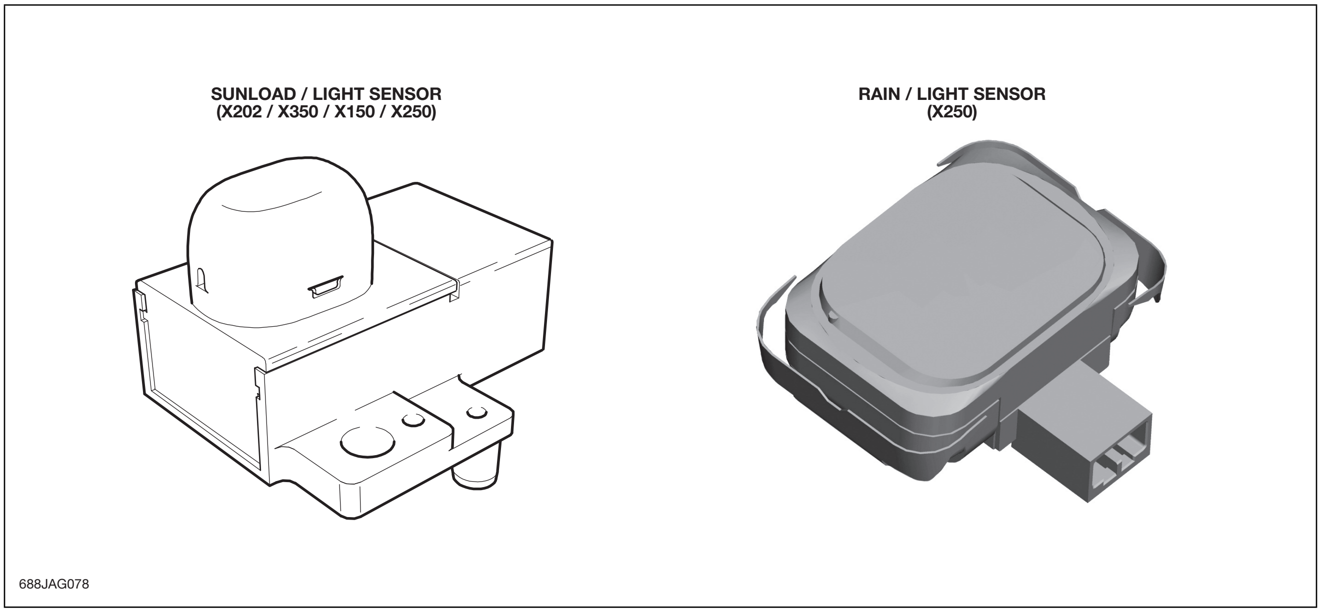
The auxiliary junction box (AJB) and the central junction box (CJB) provide circuit protection for all exterior lighting circuits, which are protected by Field Effect Transistors (FETs). FETs respond to heat generated by increased current flow and can detect overloads and short circuits that on a conventional fuse-protected circuit would cause the fuse to blow. The FETs respond to the heat increase and disconnect the power supply to the affected circuit. When the fault is rectified or the FET has cooled, the FET will reset and operate the circuit normally. If the fault persists, the FET will cycle, disconnecting and reconnecting the power supply.

The CJB and the AJB/RJB store fault codes, which can be retrieved using IDS. The fault code will assist with fault detection by identifying a fault on a particular output.

Autolamps

The Autolamp feature provides automatic operation of the headlights, dependent on ambient light levels as sensed by photo-diodes integrated into a light sensor. The sensor provides feedback to the instrument cluster, which responds by supplying control signals on a network bus to the relevant module to automatically control operation of the side lights and low-beam headlights as appropriate, provided that:

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



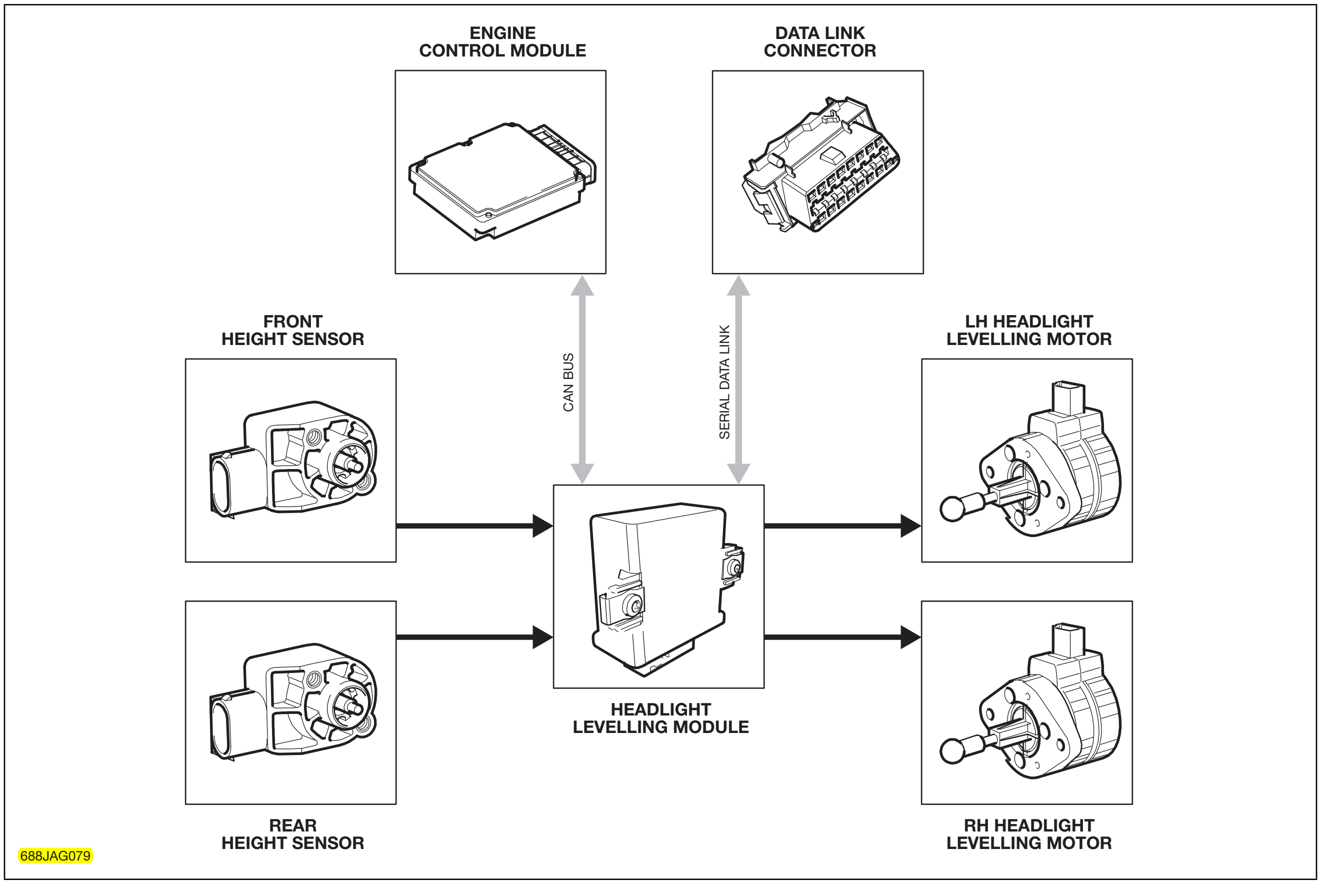
The Autolamp system has additional functionality for operation in conjunction with the wipers. If the wipers are switched on in slow or fast modes for more than 20 seconds when Autolamp mode is selected, the exterior lights will be switched on.

NOTE: The sunload / light sensor on X250 controls the message center and dash illumination levels and the rain / light sensor controls the autolamp feature in response to ambient light levels.

Automatic Headlight Leveling

Automatic headlight leveling is standard with HID headlight systems. Leveling modules receive information from height sensors and adjust headlight levels accordingly.

Automatic Headlight Leveling Operation: X202 Shown



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

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 headlight leveling motors causing the position of the headlights to be adjusted accordingly.

NOTE: After disconnecting any element of the automatic headlight leveling system, recalibration will be necessary using IDS.

Autolamps / Headlight Leveling Summary

Model	Input Control	Autolamp Sensor Location	Output Module	Height Sensor Location	Leveling Module Location
X105	Switch to BPM	Rear view mirror	BPM	Front and rear axle	Integral to headlight assemblies
X404	None; hardwired to switch	Rear view mirror	None	Front and rear axle	LH ‘A’ post
X206	Switch to IC	Dash: sunload/light sensor	FEM	Front and rear axle	RH ‘A’ post
X358*	Switch to IC	Dash: sunload/light sensor	FEM	Front and rear axle	Air Suspension Module
X150	Switch to IC	Dash: sunload/light sensor	CJB	Front and rear axle	RH ‘A’ post
X250	Switch to IC	Windshield: rain/light sensor	CJB	Front and rear axle	Bulkhead, under glove box

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

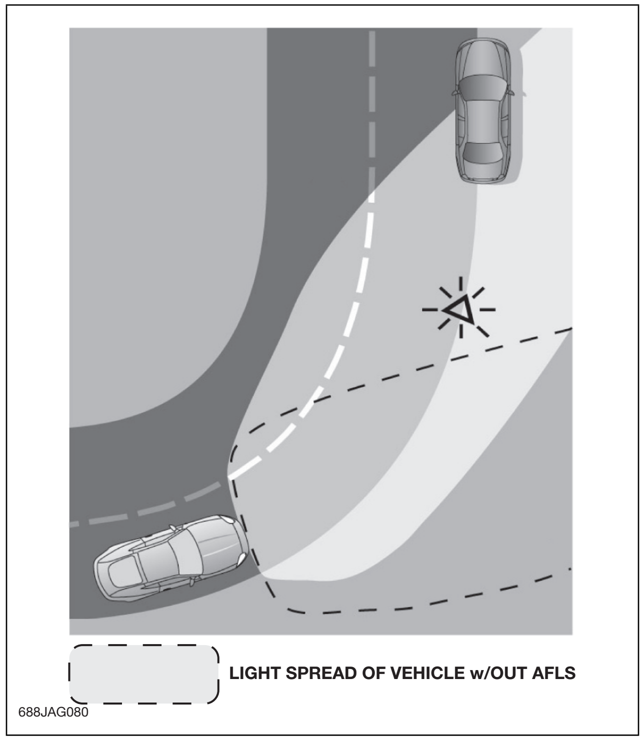
Diagnostics

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

ADAPTIVE FRONT LIGHTING SYSTEM (X150 ONLY)

The Adaptive Front Lighting System (AFLS) is designed to give the driver improved visibility under varying driving conditions. The main light source consists of bi-functional (high and low beam) xenon projector units that swivel left or right to improve the light spread on bends in the road. The projector units also react dynamically in the vertical plane to the vehicle's braking or acceleration to maximize headlight performance.

The illustration compares the light spread of a vehicle fitted with AFLS with that of a vehicle with conventional headlights.



The projector units operate when the engine is running and the master lighting switch is set to headlights, or AUTO (if the ambient light has fallen below a preset level). When the engine is started, the headlights will swivel for a few seconds as they initiate a self-calibration cycle.

The system takes inputs from the vehicle's road speed and steering angle to determine the amount of horizontal swivel. The amount of swivel is highest at low and maneuvering speeds and reduces as speed increases.

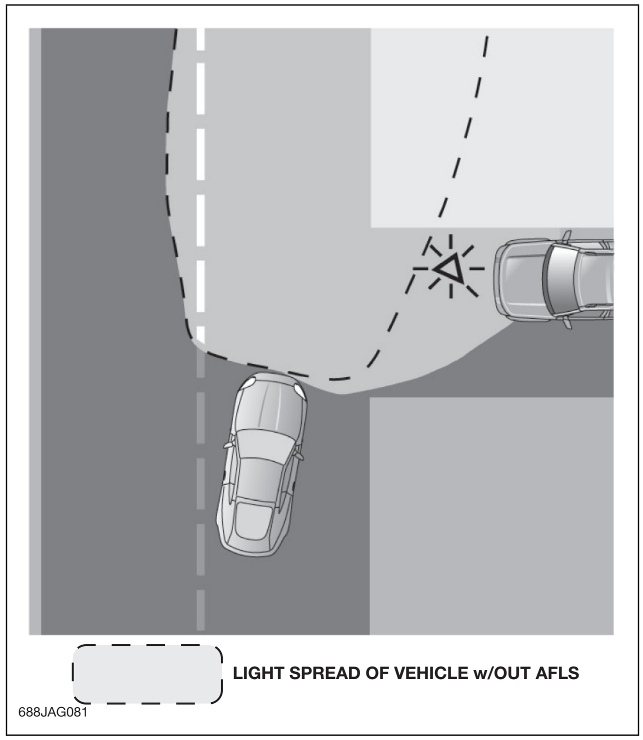
If reverse gear is selected, the lights return to the central position and the unit's swiveling capability is disabled.

Static Bending Lights

Additional lighting comes from the cornering (static bending) lights, which angle outwards from the centerline of the vehicle to broaden the beam of the headlights when cornering during normal night driving.

The illustration compares the light spread of a vehicle fitted with static bending lights with that of a vehicle with conventional headlights.

The system switches on the light on receipt of an input from the vehicle's direction indicator cancel switch, activated by the turning of the steering wheel. The light is switched on regardless of whether the direction indicator is active or not. Only the light on the same side as the direction of the turn will illuminate. The lights only operate when the ignition is ON.



Headlight Calibration

Headlight calibration errors can be caused by:

- Replacement of a headlight unit
- Switching on the headlights with the steering wheel rotated to the locked position
- Excessive rotation of the steering wheel when the ignition is switched OFF

The lights are automatically recalibrated within 30 seconds of the start of a drive cycle.

PARKING AID SYSTEM

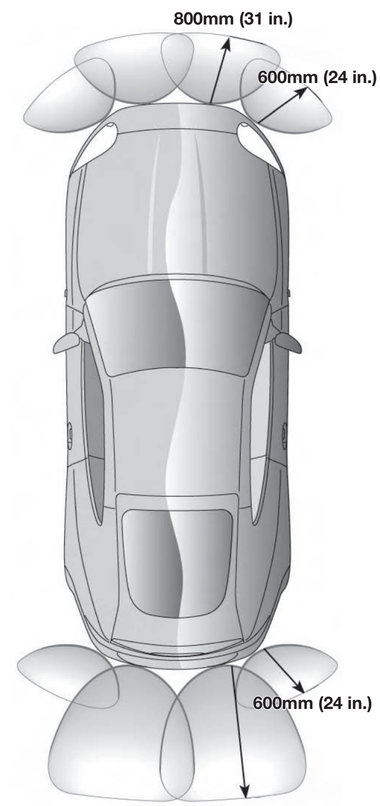
The parking aid system provides an audible warning to the driver when obstacles are detected in the path of the vehicle during a forward (if front sensors fitted) or reversing maneuver. The purpose of the system is to assist the driver when parking or maneuvering in restricted space. It is not designed as a crash avoidance system or a replacement for visual interpretation by the driver.

The parking aid system uses ultrasonic signals which are transmitted by sensors mounted in the front and rear bumpers. The reflected echo from this output is received by the sensors and used by the parking aid module to calculate the distance from an object.

System Operation

The front parking aid sensors will detect objects up to a range of 800 mm (31 inches) along the front width of the bumper while the detection distance at the corners of the front bumper is reduced to approximately 600 mm (24 inches).

The rear sensors will detect objects up to a range of 1800 mm (71 inches) along the width of the bumper while the detection distance at the corners of the rear bumper is reduced to 600 mm (24 inches).



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The system will detect curbs with a minimum height of 177mm (7 in.). Curbs below this height will allow the vehicle to pass over them and so will not be detected by the system.

Due to the curvature of the front bumper, the bumper is shaped to enable the face of the sensor to be positioned vertically to the vehicle axis. This will ensure that the beams from the front 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 mph (15 km/h)

The rear parking aid sensors are active when reverse gear is selected.

The system is deactivated when vehicle speed exceeds 9 mph (15 km/h) and becomes active again when vehicle speed falls below 6 mph (10 km/h).

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

688JAG073

NOTE: The deactivation switch is only fitted to vehicles with front parking aid sensors.

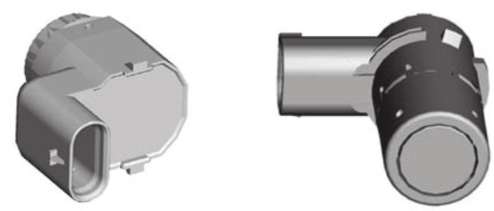
Pressing the switch deactivates the front and rear parking assist completely. On X150 and X250, the system will be reactivated during the same ignition cycle whenever reverse is selected.

CAUTION:

⚠ **Deactivation applies to both the front and reverse parking aid systems.**

Component Description

Parking Aid Sensors



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Four sensors are positioned in the rear bumper and four in the front bumper (if fitted). The front sensor housings are glued into position; the rear sensor housings are welded into position. The sensor bodies are then clipped into the housings from the rear.

NOTE: Sensor mounting may vary depending on model.

Each sensor contains a piezoelectric disc, which resonates at a frequency of approximately 50 kHz, producing an ultrasonic signal output. The disc also receives the reflected echo signal.

Each sensor has 2 modes of operation: combined transmitter and receiver mode, or receiver mode only. The control module controls the operating mode of each sensor by the output of a digital signal on the signal line.

When an obstacle is detected the system provides a warning tone, broadcast through a sounder or the vehicle's audio speakers (depending on model). The tone consists of a series of beeps, timed closer together as the vehicle moves closer to the obstacle. When the distance to the obstacle is less than 8 inches (20cm) the warning tone is continuous. Warnings for obstacles in front of the vehicle are broadcast through the front sounder/speakers; warnings for obstacles in back of the vehicle are broadcast through the rear sounder/speakers.

NOTE: For sounder/speaker locations refer to the table at the end of this section.

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

Touch-Screen Display

On X150 and X250 models a parking aid screen is automatically displayed in the Touch-Screen Display (TSD).

NOTE: If the vehicle is equipped with a rear view camera, the camera display is automatically displayed in the TSD in preference to the parking aid alert display. To switch from camera view to the parking aid sensor display, a single touch of the TSD screen will remove the camera image display and show the parking aid alert display. A second touch of the TSD screen will cancel the 'Parking Aid Alert' display.

688JAG075

Parking Aid Summary

Model	Module Location	Network	Front Sounder	Rear Sounder	TSD Display	Rear View Camera
X105	Spare wheel well	Serial Data	N/A	Rear of center console	No	No
X404	Spare wheel well	Serial Data	Instrument panel, center	Parcel shelf (sedan), LH quarter trim (wagon)	No	No
X206	Trunk, LH rear	Serial Data	Instrument cluster	Parcel shelf	No	No
X358	Trunk, LH rear	Serial Data	Instrument panel, LH side	Parcel shelf	No	No
X150	LH 'A' post	MS CAN, MOST	Front audio speakers	Rear audio speakers	Yes	No
X250	Trunk, LH rear	MS CAN, MOST	Front audio speakers	Rear audio speakers	Yes	Yes

Diagnostics

When the ignition is in the run position, the system will carry out a self-check. If a fault is 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 are performed using IDS. In addition, there are two non-IDS methods that can be used to diagnose faulty sensors.

NOTE: When monitoring parking aid sensors with Datalogger, with system deactivated, sensors default to 2.55m (8.5 ft.).

Method Number 1:

The Jaguar Ultrasonic Leak Detector (ULD) can be used to check for sensor operation. The ULD consists of an enhanced listening device that plugs into a pair of earphones. While the tester is used primarily for diagnosing OBDII-related emission leaks, the end of the detector can be placed on or near the suspected sensor to listen for its operation. A functioning sensor emits clicking noises when the vehicle is in reverse; a non-functioning sensor can be easily identified if it is silent.

The ULD, Jaguar Part # 134-00056J, is also available from the manufacturer, K Line Industries, Part # KL3633.

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.

REAR VIEW CAMERA (X250 ONLY)

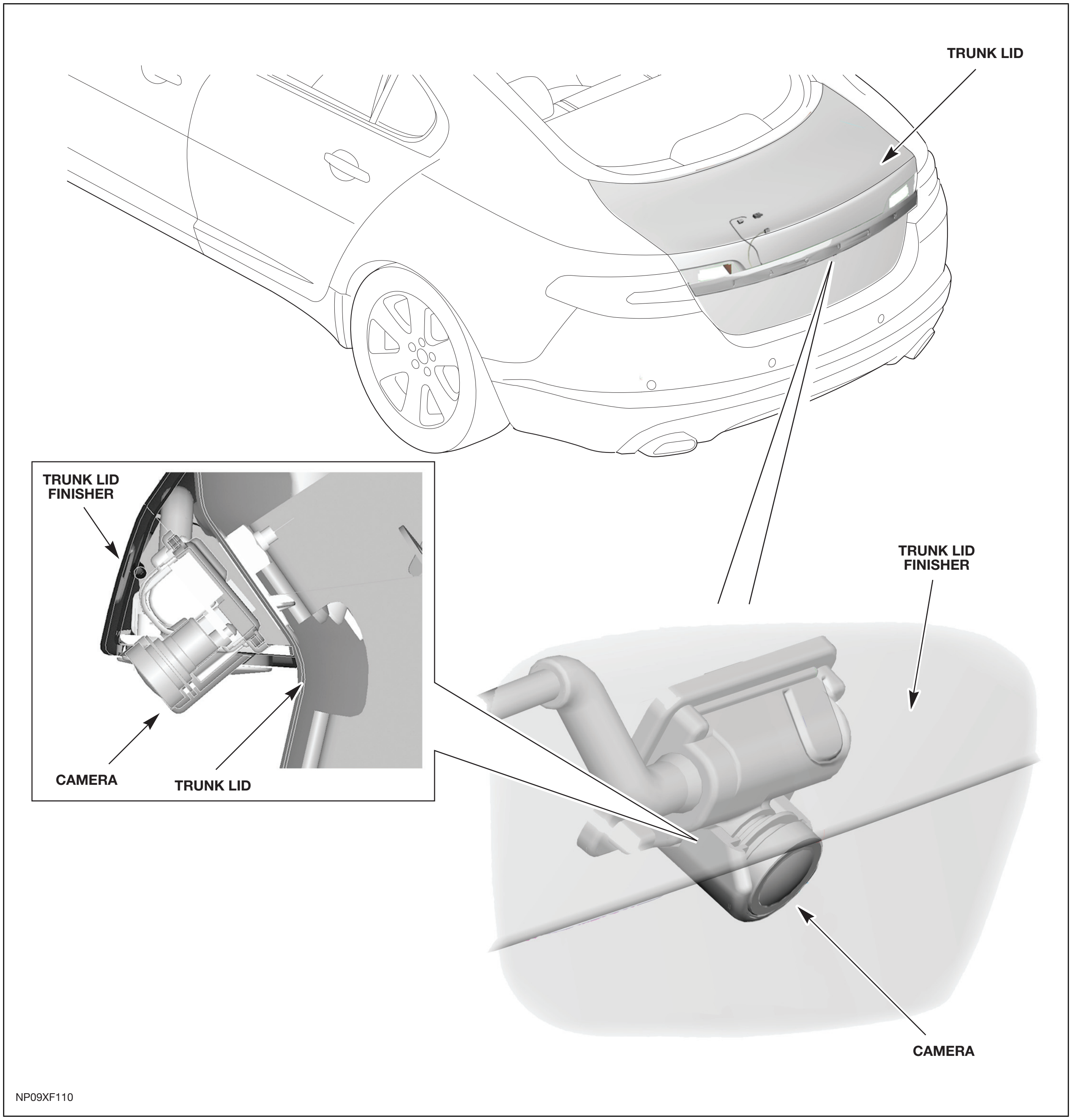
Some vehicles may also be fitted with a rear view camera, which supplements the information provided by the parking aid system by providing the driver with a visual display of the area directly behind the vehicle.

The rear view camera system combines a rear-facing digital video camera and electronic control unit. Rear view camera images are displayed on the Touch-screen. Although the camera is digital, the system produces an analog output for compatibility with the Touch-screen display. The video signal is sent via micro-coaxial cable.

The camera produces an image in an aspect ratio of 4:3, but it is displayed at an aspect ratio of 16:9, producing a slight broadening of the image for a better presentation of the view without distortion. As the camera does not have a pre-set focal length, objects remain in focus to infinity and the orientation is deliberately set to give a natural 'horizon', which makes the image easier to interpret. The camera output resolution is 640 x 480 pixels, which is a conventional value for automotive applications and gives good results with the Touch-screen display.

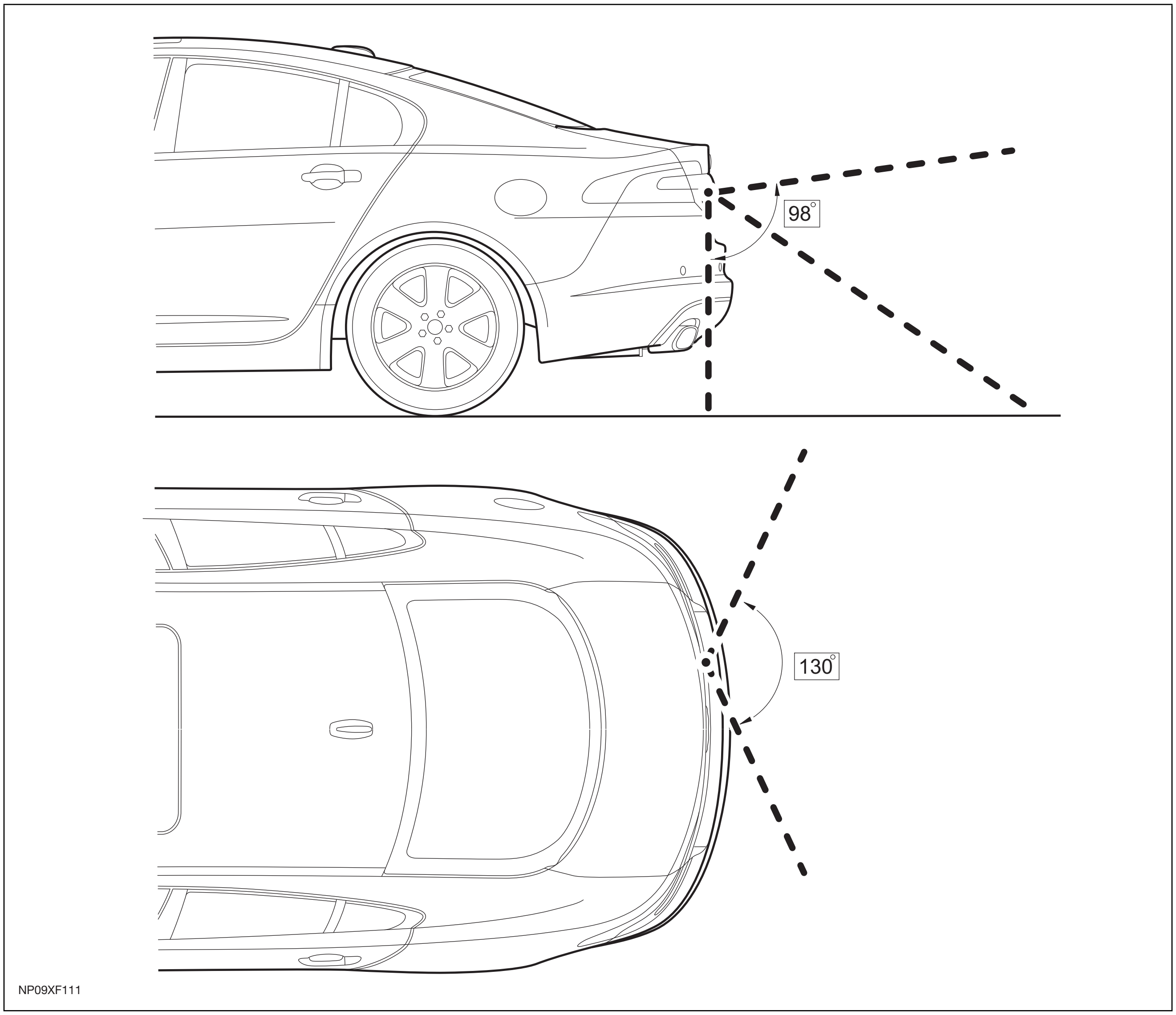
The camera assembly is fitted into the trunk trim finisher above the license plate recess, retained by a bayonet clip. The lens is located to the right of the manual trunk opening button and is robust enough to tolerate occasional contact by hand.

The camera contains a very small volume of air, incorporating an airtight seal to prevent water ingress or misting without the need for any desiccant in the housing. The lens also sits in a relatively clean airflow area, which minimizes problems with spray or road dirt.


TRUNK LID
TRUNK LID FINISHER
TRUNK LID FINISHER
CAMERA
TRUNK LID
CAMERA
NP09XF110

The camera lens projects slightly below the trim finisher and sits approximately 880mm above the road surface. It gives a wide, 130° horizontal field of view and a 98° vertical field of view, mostly below the horizontal.

The camera functions in full color to light levels as low as 2 LUX, with monochromatic functions at levels below this threshold.

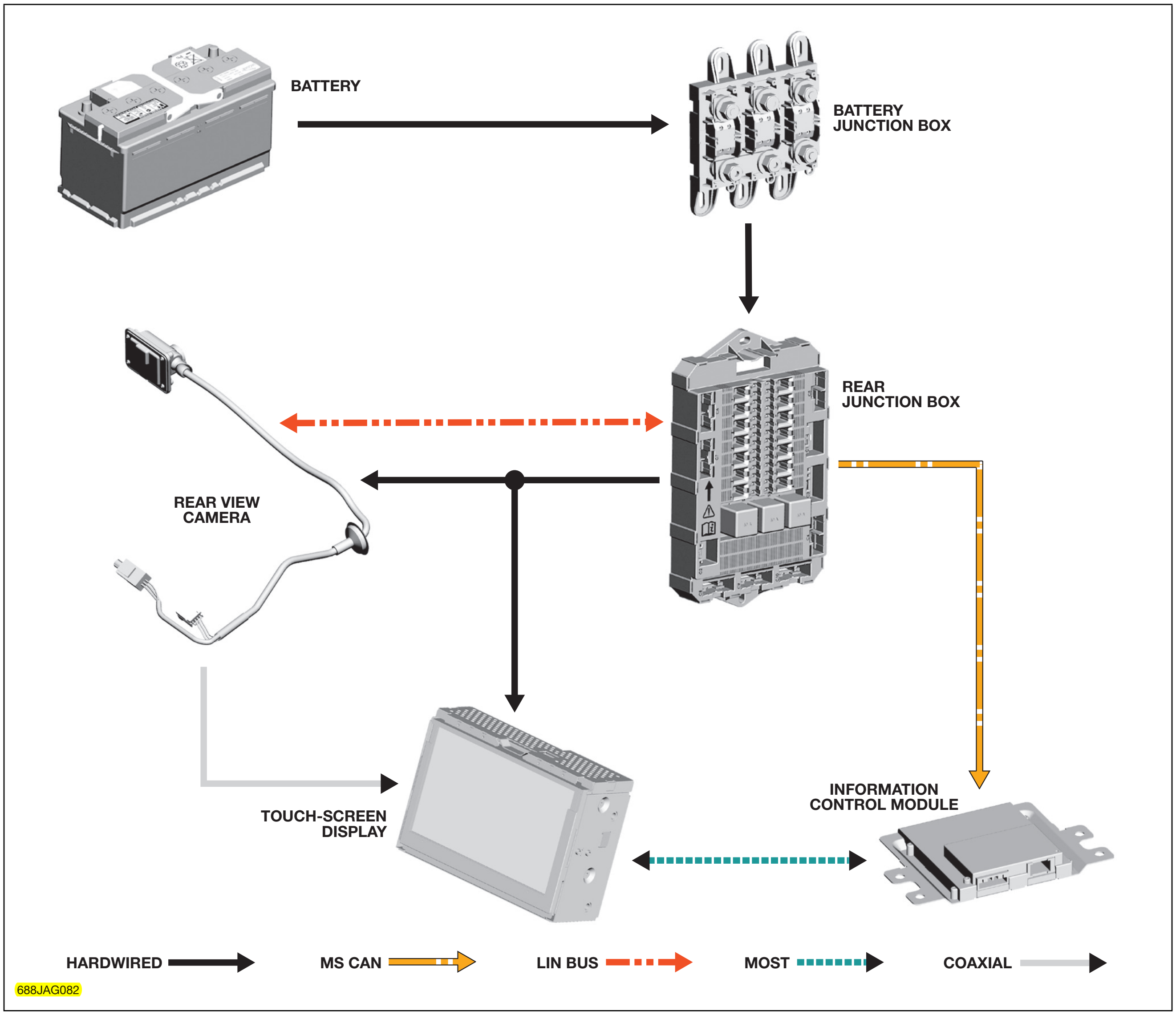


When 'reverse gear selected' information is received from the network, the image is displayed on the Touch-screen. The image overrides any current display (audio, navigation, climate control, etc.); when the vehicle is taken out of reverse, the Touch-screen reverts to its previous display. If the Touch-screen is switched off, it will automatically switch on to display the image when reverse gear is selected and will switch off again when reverse is deselected. The image is turned off if vehicle speed exceeds 10 mph (16 km/h).

The rear view camera function can be manually turned off by touching any part of the Touch-screen. This option is for a one-use cycle only; the rear view camera function automatically reappears when reverse is selected again.

Failure of the rear view camera generates DTCs that are stored in the RJB.

NOTE: The camera is not a serviceable item; if the unit fails, it requires replacing. No configuration procedure is required if the camera is replaced and there is no option to calibrate the rear view camera system using IDS.



POWER WINDOWS

Power window systems can use either multiplex messaging or hardwired inputs. Depending on the model and year, window systems may communicate on one of the following networks:

- Standard Corporate Protocol (SCP) Network
- Medium Speed Controller Area Network (CAN)
- Local Interconnect Network (LIN) bus

Window system operation is virtually the same for all models. All window systems:

- Feature anti-trap functionality
- Feature one-touch up/down operation
- Require initialization if battery power is lost
- Operate via switch to a control module

NOTE: Convertible models (X105, X150) also feature window-drop entry.

Anti-Trap Protection

Window position is monitored by an integral window position 'Hall effect' sensor feedback signal to determine normal travel of the window motor. If current requirements increase during a glass closing operation, an initialized window motor will assume an obstruction and reverse the glass travel.

Resetting Anti-Trap Protection (Initialization)

If the battery is disconnected, the anti-trap protection feature is lost and must be reset using the following procedure:

1. Ensure that the respective door is closed and, if fitted, the convertible top is closed.
2. Fully close the window, then release the switch.
3. Pull the switch again to close the window and hold for 5 seconds.
4. Open the window fully and release the switch.
5. Press the switch again to open the window and hold for 5 seconds.
6. Check to confirm the operation by opening the window and then use one-touch operation to close the window.
7. Repeat for the opposite window.

NOTE: For X206/X358/X404, skip steps 4 and 5.

Anti-Trap Protection Override (Ice Mode)

The anti-trap feature may also be activated by winter ice build-up or distortion in the window guide channels. In this situation, the anti-trap feature can be overridden by repeated operation of the close switch; on the third operation of the switch, the anti-trap feature will be disabled.

- After the initial attempted window closing with anti-trap activation, operate the close switch a second time within ten seconds. The window will attempt to close again and the anti-trap will activate.
- Operating the window close switch a third time will override the anti-trap feature. Each subsequent press of the window switch will operate the window motor at full power and should overcome the window obstruction.

NOTE: The anti-trap feature will be lost and must be reset after the blockage has been cleared.

This procedure can be carried out from either the individual window switches or the driver door switch pack.

WARNING:

Ensure that there are no additional obstacles to window closing when overriding the anti-trap feature.

Thermal Overload

If the windows are repeatedly opened and closed, a protection system will deactivate window operation for up to 20 seconds to prevent overheating of the window motors.

Global Open / Global Close Summary

Model	With Key	Exterior Door Handle Lock Button	With Central Locking Switch	With Remote	Convertible Top	Sunroof
X404	Close	N/A	None	Close	N/A	Close
X206	Open/Close	N/A	Open/Close	Open/Close	N/A	Open/Close
X358	Open/Close	N/A	Open/Close	Open/Close	N/A	Open/Close
X105	Open/Close	N/A	None	None	Open/Close	N/A
X150	None	Close	None	Door windows, open only	None	N/A
X250	None	Close	Open/Close	Open	N/A	Open/Close

Rear Window Isolation (X356 / X358 Super V8 only)

The rear window isolation switch inhibits the following when activated:

- Rear window operation
- Rear power seat function EXCEPT lumbar pumps
- Front passenger seat movement from rear passenger seat switch
- Rear window switch illumination

Rear Window Power Sunblind

Where fitted, the sunblind is operated through a switch in the roof console. The sunblind motor is located beneath the rear parcel shelf and is supplied as a sealed unit with the sunblind and sunblind mechanism.

NOTE: On X250 vehicles, if the battery is disconnected or a replacement sunblind is fitted, the motor will require recalibrating.

To recalibrate the motor, the sunblind should be powered through 2 full cycles of movement.

ROOF OPENING PANEL

The sunroof motor receives input from the FEM, GEM or CJB depending on model and year (for global operation) or the roof panel switch, which is integrated into the roof console. The sunroof motor module monitors the integral 'Hall Effect' sensor feedback signal to determine the normal travel of the motor.

The sunroof motor is not affected by battery disconnection and will not need to be initialized. However, if power is disconnected while the sunroof is being operated or with the sunroof partially open, then the memory will be lost and the following initialization procedure must be carried out. This procedure will also need to be carried out if the sunroof motor is changed.

Sunroof Initialization:

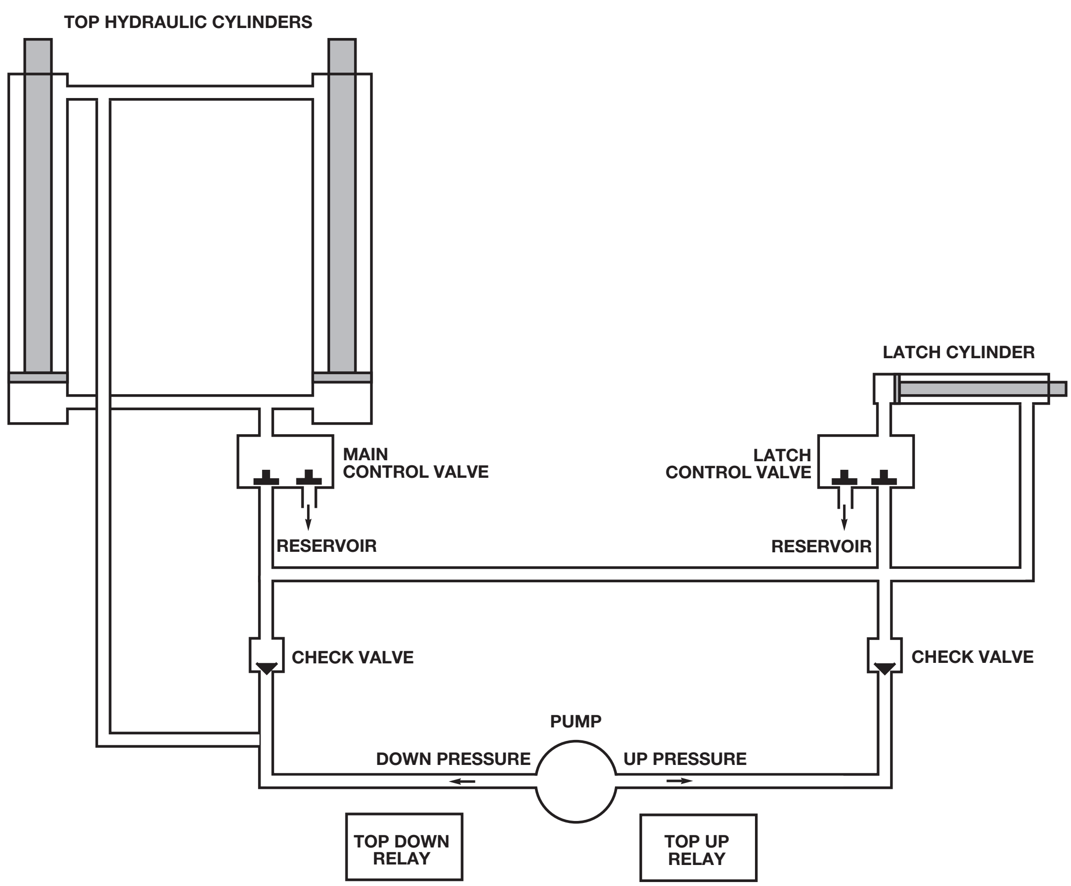
- Press the roof panel tilt switch and run the roof panel *into the tilt position*.
- Release, then press and hold the switch *in the tilt position* for 20 – 45 seconds. The roof panel will move up and down, which indicates memory erasure of the previous initialization. Release switch.
- Within 5 seconds, press and hold 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 anti-trap and one touch operation features.

CONVERTIBLE TOP

X105 Convertible Top and Quarter Windows

The convertible top is hydraulically raised and lowered and incorporates a hydraulically-operated header latch. An electric motor provides the hydraulic power. The body processor module (BPM) and the security and locking control module (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.

Convertible Top Microswitches			
Switch	**Inputs To**	**Location**	**Signal Indicates**
Top raised switch	BPM	Top of hydraulic cylinder	Top is raised over center
Top ready-to-latch switch	BPM	Header rail	Top is in contact with latch
Top latch closed switch	BPM	Header rail	Top is engaged in latch
Top closed switch	BPM	Header rail	Top is closed and fully latched
Top down switch	SLCM	Bottom of hydraulic cylinder	Top is fully down



688JAG055

Convertible Top Operation

The top is operated by the convertible top switch when the ignition is in position I or II and vehicle speed is below 10 mph (16 km/h). The 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.

NOTE: For additional Convertible Top Electrical System, Component Description & Diagnostic information please refer to Technical bulletin 501-11.

Top Opening Sequence

When the convertible top switch is held active, or when global open is activated, the BPM transmits a HOOD OPEN (convertible top open) SCP message. The following actions take place in sequence:

– BPM opens the quarter windows

– BPM activates the convertible top audible warning

– If closed, door windows drop 12 mm (0.47 in.)

– SLCM opens the latch control valve and activates the top up relay supplying power to the top hydraulic pump

– Top pump hydraulic pressure opens the header latch

– The top closed microswitch opens followed by the top latch closed microswitch

– SLCM deactivates the top up relay and activates the top down relay reversing top hydraulic pump polarity

– Top pump hydraulic pressure begins to open the top

– The top ready-to-latch and top raised microswitches open

– When the top is fully open, the top down microswitch activates

– BPM activates the convertible top warning

– Door windows return to their previous positions

– SLCM closes the latch control valve and activates the top up relay to supply hydraulic pressure to close the latch

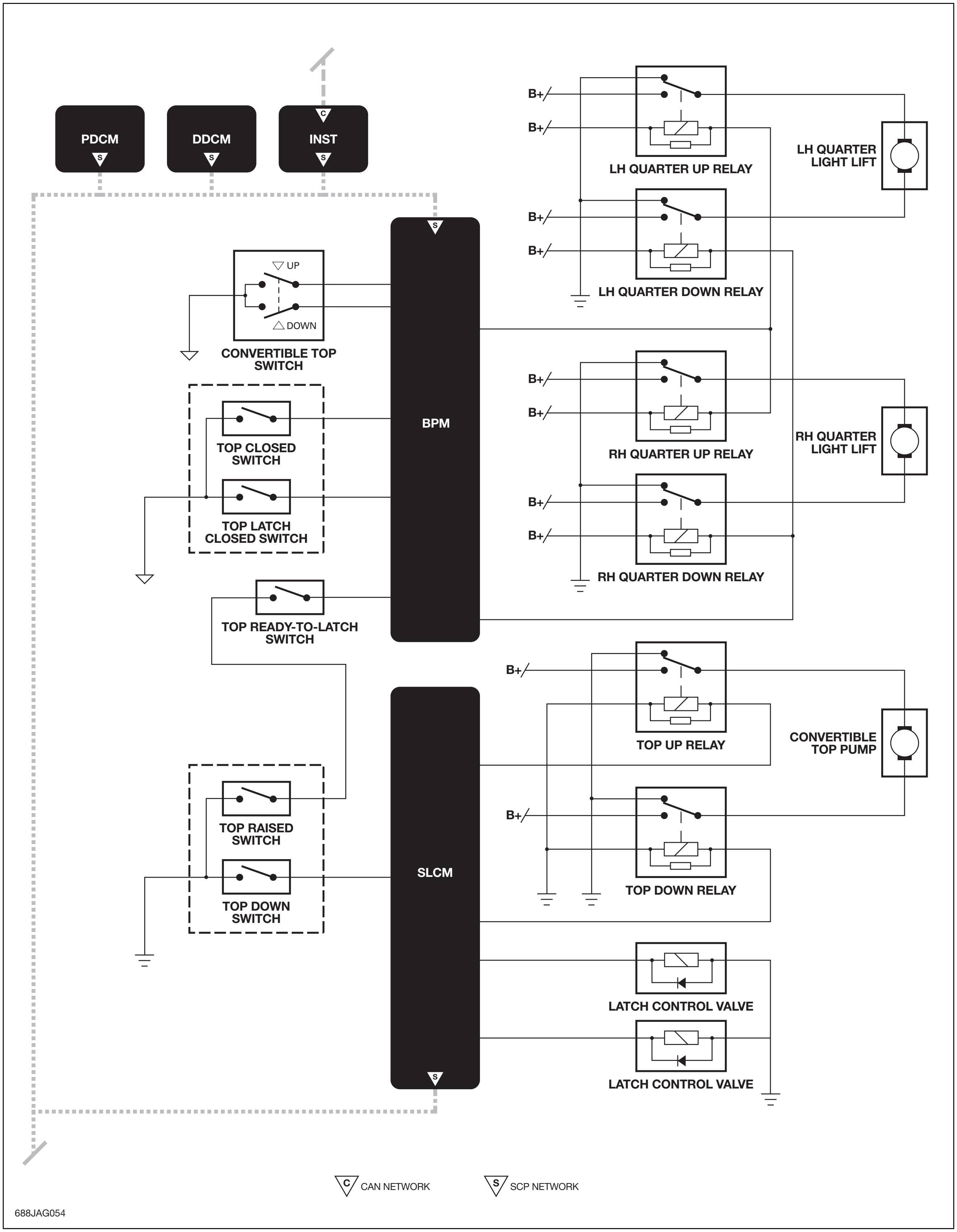
– When the top latch closed microswitch is active, the SLCM deactivates the top down relay

If vehicle speed exceeds 10 mph (16 km/h), the top open or close cycle will stop. Wind pressure will force the top back to the open position. If the convertible top switch remains active, the open or close cycle continues when vehicle speed drops to less than 10 mph (16 km/h).

If the convertible top switch becomes inactive or the key switch becomes inactive while operating under global open or close, the top operating cycle immediately stops.

Rear Quarter Window Operation

To set rear quarter windows at a position other than fully open, first open the windows all the way. Then activate the switch to close the windows and press the switch a second time to stop the windows at the desired position.


PDCM
DDCM
INST
C
S
BPM
SLCM
CONVERTIBLE TOP SWITCH
UP
DOWN
TOP CLOSED SWITCH
TOP LATCH CLOSED SWITCH
TOP READY-TO-LATCH SWITCH
TOP RAISED SWITCH
TOP DOWN SWITCH
B+
LH QUARTER UP RELAY
LH QUARTER DOWN RELAY
LH QUARTER LIGHT LIFT
RH QUARTER UP RELAY
RH QUARTER DOWN RELAY
RH QUARTER LIGHT LIFT
TOP UP RELAY
TOP DOWN RELAY
CONVERTIBLE TOP PUMP
LATCH CONTROL VALVE
LATCH CONTROL VALVE
CAN NETWORK
SCP NETWORK
688JAG054

X150 Convertible Top

The power-operated convertible top consists of a fabric canopy with a 'Thinsulate' inner liner, which is fitted to a steel frame with cast linkages.

The fully automatic flush-mounted aluminum tonneau panel conceals the stowed top and incorporates the Roll-Over Protection System (ROPS) doors in its trim panel. The top has a low-stack height of 200 mm (7.9 in) and manual roller blind luggage separator to optimize the trunk volume. The open and close time of the top is approximately 17 seconds depending on ambient temperature and battery voltage.

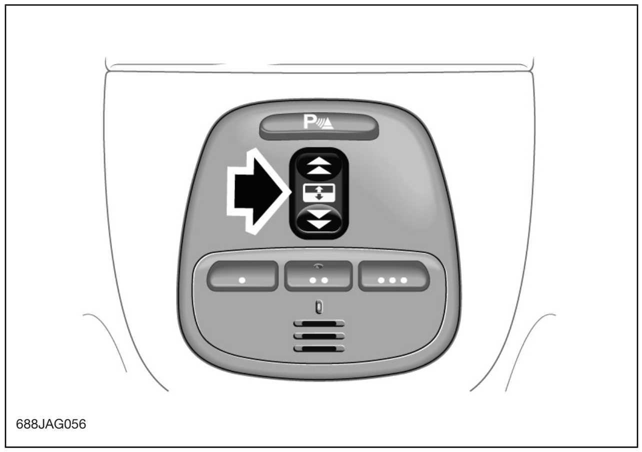
A heated glass backlight is high-frequency welded to the canopy and is not serviceable separately.

A pump motor and valve block provides hydraulic power to open and close the top, while an electric motor controls a tension bow system to latch and unlatch the top. A single hold-down switch located in the roof console operates the top. This switch also operates the rear quarter windows.

In the event that the top cannot be powered to the raised or lowered position, provision is made for manual operation.

Convertible Top Operation

The power-operated convertible top and rear quarter windows are controlled by the switch located on the overhead console.



The convertible top will only operate when the ignition is ON. It should only be opened or closed when the vehicle is stationary; however, for convenience it may be operated at speeds below 16 km/h (10 mph). If this speed is exceeded during top opening/closing, top movement will continue to operate to the open or closed position (depending on its direction of travel). The top latches and unlatches automatically.

WARNING:

Do not place items on the tonneau panel or over the Roll-over Protection Device covers.

CAUTION: :

⚠ **Before opening the convertible top, ensure that the luggage separator is correctly located in the deployed position in the trunk.**

⚠ **Check that there is nothing in the rear area which could interfere with the top when folded down, specifically items which could damage the glass rear window.**

⚠ **Top opening/closing can only be initiated at speeds below 16 km/h (10 mph). If this speed is exceeded, the top will continue to move to the requested position, but there is a risk of damage to the convertible top.**

⚠ **Do not attempt to operate the convertible top at temperatures below -15°C (5°F), as this may cause damage to the fabric.**

Opening the Convertible Top

1. Ensure that the ignition is ON.
2. Ensure that the luggage separator in the trunk is in the fully deployed position; if it is not positioned correctly the proximity switches will not operate and the convertible top will not open.
3. Press and hold the rear of the overhead console switch (do not release the switch until the top is fully open.)
   – The rear quarter windows open, an audible warning sounds, and the top unlatches and starts to move, the tonneau closing panel opens. If the front windows are fully closed, they will open partially; the door window switch is then required to return the front windows to the fully closed position.
   – When the top is fully open, the audible warning sounds again. The tonneau closing panel is fully automated and encloses the convertible top in the stowed position.
4. Release the overhead console switch.

NOTE: If the overhead console switch is released at any time during the convertible top opening sequence, all movement of the convertible top will cease.

Closing the Convertible Top

1. Ensure that the ignition is ON.
2. Press and hold the front of the overhead console switch.
   – As the convertible top starts to move the audible warning will sound. If the front windows are in any other position than fully down, they will retract to the fully down position on activation of the switch.
   – When the top is fully closed and latched, the audible warning sounds again. The rear quarter windows will fully close, followed by the front door windows.
3. Once the convertible top is fully closed and latched, the rear quarter windows and front door windows are fully closed, release the switch.

NOTE: If the overhead console switch is released at any time during the convertible top closing sequence, all movement of the convertible top will cease.

WARNING:

⚠ **There is no anti-trap functionality associated with convertible top operation. When opening and closing the convertible top, ensure that hands, fingers, loose clothing, etc., are clear of the convertible top linkage area, tonneau closing panel, windshield frame, door windows and rear quarter windows.**

System Operation

The convertible top is opened and closed using four hydraulic cylinders. Two main bow cylinders in the top frame - fixed to the Body in White (BIW) - lift the complete top assembly into and out of the stowage area. Two cylinders in the top open and close the tension bow allowing the aluminum tonneau cover to open when retracting the top and sealing the rear of the top with the aluminum tonneau cover when the top is raised.

The top and rear quarter windows are operated using a hold-down switch located in the overhead console.

The convertible top will only open if:

- Vehicle speed is below 16 km/h (10 mph)
- Trunk lid is closed
- Luggage separator is in position

The front windows must be programmed for one-touch operation in order for the convertible top to operate.

Window Programming

– Ensure that the respective door is closed and, if fitted, the convertible top is closed.

– Fully close the window, then release the switch.

– Pull the switch again to close the window and hold for 5 seconds.

– Open the window fully and release the switch.

– Press the switch again to open the window and hold for 5 seconds.

– Check to confirm the operation by opening the window and then use one-touch operation to close the window.

– Repeat for the opposite window.

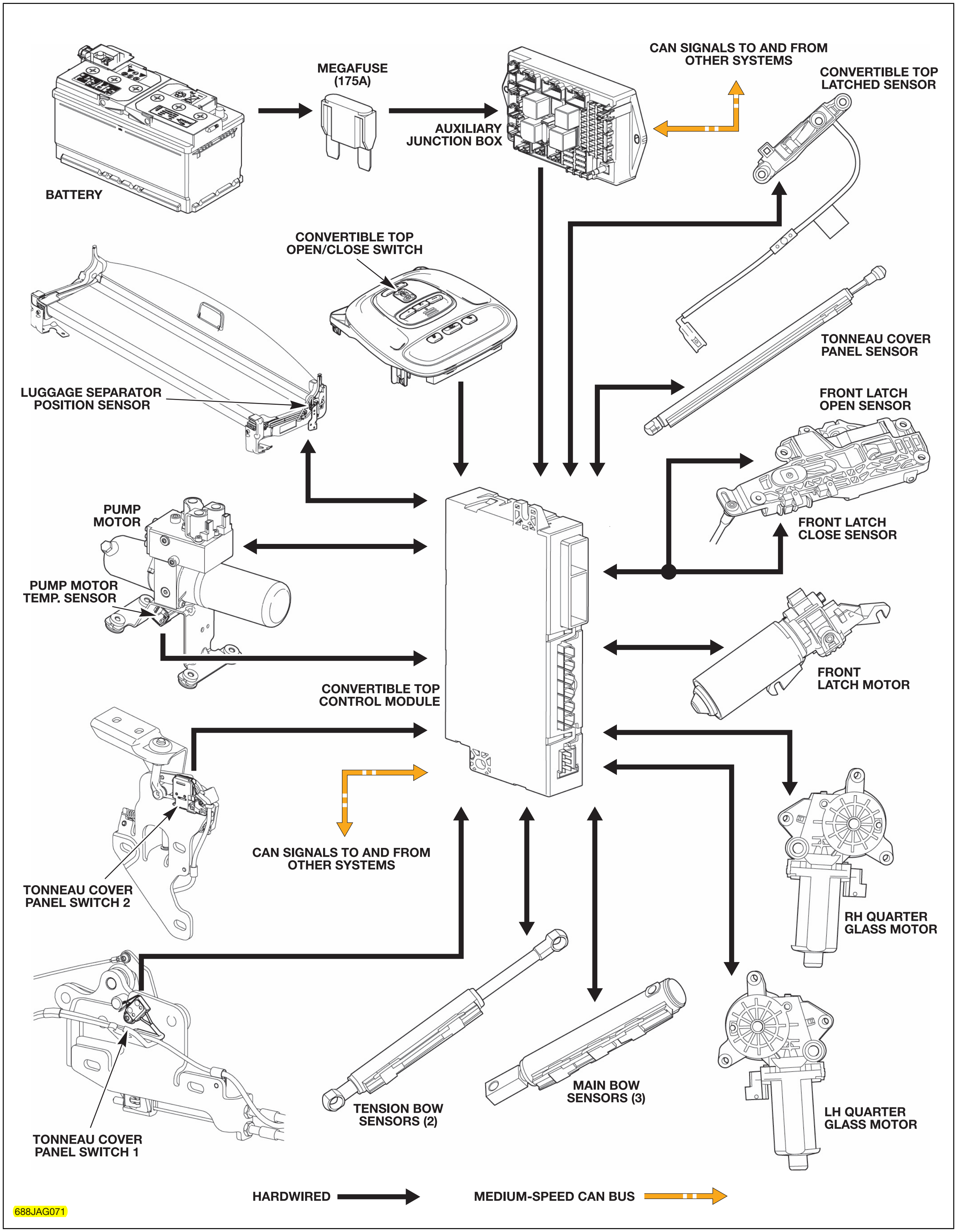
A trunk separator prevents items from moving into the area in which the convertible top is stowed when open. The luggage separator incorporates a Hall-effect proximity switch which prevents the convertible top from lowering unless the separator is in the fully deployed position.

The aluminum tonneau cover is secured in the closed position by a mechanically controlled cable-operated latching system. The cables are tensioned using a mechanical lever assembly operated by the movement of the tonneau cover hydraulic cylinder. The latches are released by spring tension when the tonneau cover hydraulic cylinder releases the tension in the cables.

The tonneau cover is raised and lowered hydraulically by a single cylinder.

The convertible top incorporates a fully-automatic latch/unlatch tension rod system which uses an electric motor with a gearbox and flexible shafts to latch/unlatch the top. Failure of a tension rod, motor gearbox or latch motor will prevent the top from unlatching. In the event of either of these failures it is possible to release each of the top latches manually.

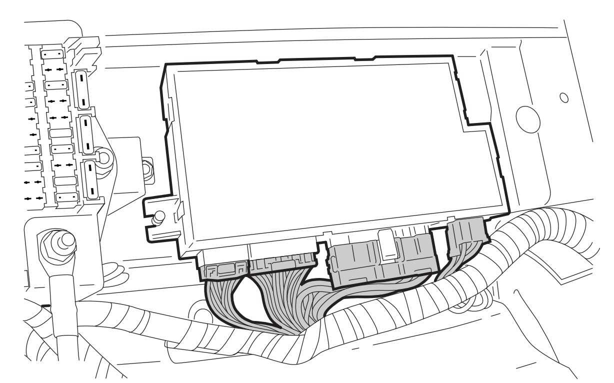
NOTE: In the event that the top cannot be powered to the raised or lowered position, provision is made for manual operation.


BATTERY
MEGAFUSE (175A)
AUXILIARY JUNCTION BOX
CAN SIGNALS TO AND FROM OTHER SYSTEMS
CONVERTIBLE TOP LATCHED SENSOR
CONVERTIBLE TOP OPEN/CLOSE SWITCH
LUGGAGE SEPARATOR POSITION SENSOR
TONNEAU COVER PANEL SENSOR
FRONT LATCH OPEN SENSOR
PUMP MOTOR
FRONT LATCH CLOSE SENSOR
PUMP MOTOR TEMP. SENSOR
FRONT LATCH MOTOR
CONVERTIBLE TOP CONTROL MODULE
CAN SIGNALS TO AND FROM OTHER SYSTEMS
TONNEAU COVER PANEL SWITCH 2
RH QUARTER GLASS MOTOR
MAIN BOW SENSORS (3)
TENSION BOW SENSORS (2)
LH QUARTER GLASS MOTOR
TONNEAU COVER PANEL SWITCH 1
HARDWIRED
MEDIUM-SPEED CAN BUS
688JAG071

System Components

Convertible Top Control Module

The convertible top control module is located behind the LH rear seat and LH Roll-Over Protection System (ROPS) unit. The control module operates the top based on data received on the CAN bus and from the hard-wired components described in this section.

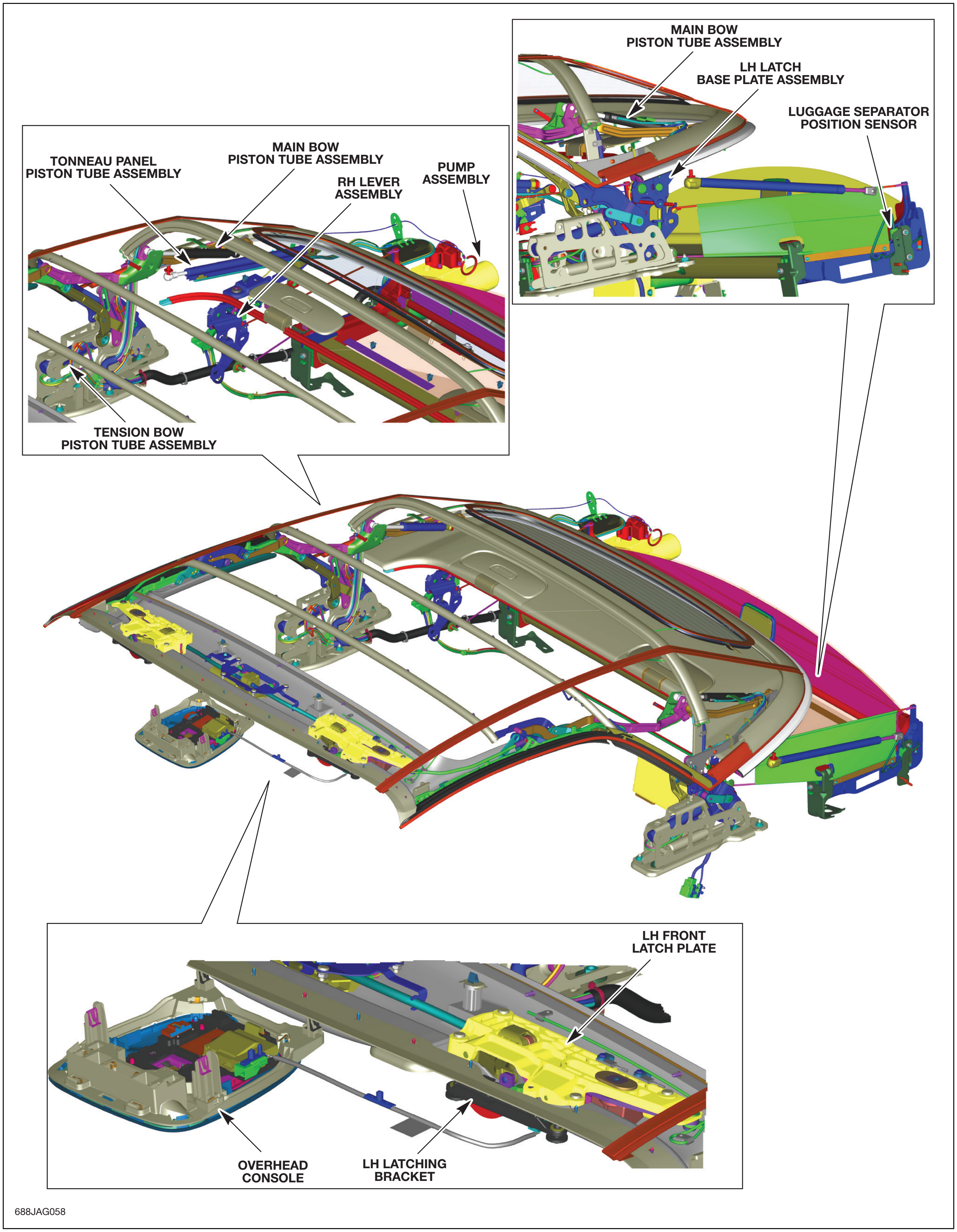


688JAG057

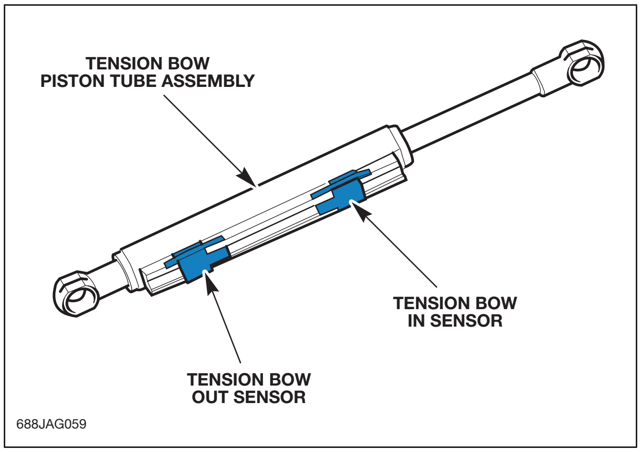
NOTE: Please refer to the workshop manual for ROPS unit removal procedures before attempting access to the convertible top module.

Convertible Top Assembly

The convertible top frame, actuation levers and main bow hydraulic cylinder assembly are accurately located on the vehicle body using a steel adjuster plate, which is fixture-set to the Body In White (BIW) using adjustable shims.

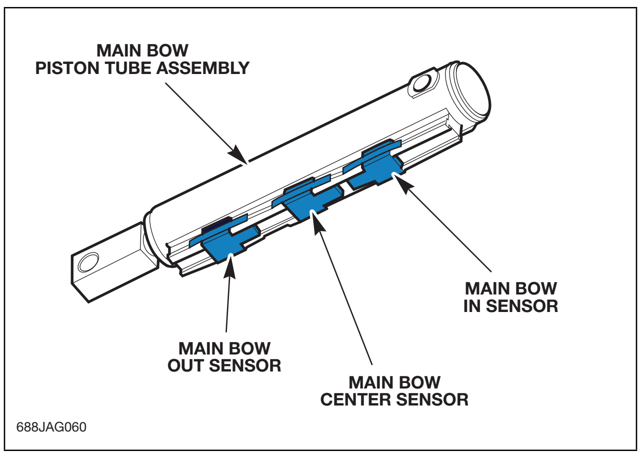

MAIN BOW
PISTON TUBE ASSEMBLY
LH LATCH
BASE PLATE ASSEMBLY
LUGGAGE SEPARATOR
POSITION SENSOR
TONNEAU PANEL
PISTON TUBE ASSEMBLY
MAIN BOW
PISTON TUBE ASSEMBLY
RH LEVER
ASSEMBLY
PUMP
ASSEMBLY
TENSION BOW
PISTON TUBE ASSEMBLY
LH FRONT
LATCH PLATE
OVERHEAD
CONSOLE
LH LATCHING
BRACKET
688JAG058

Tension Bow Sensors



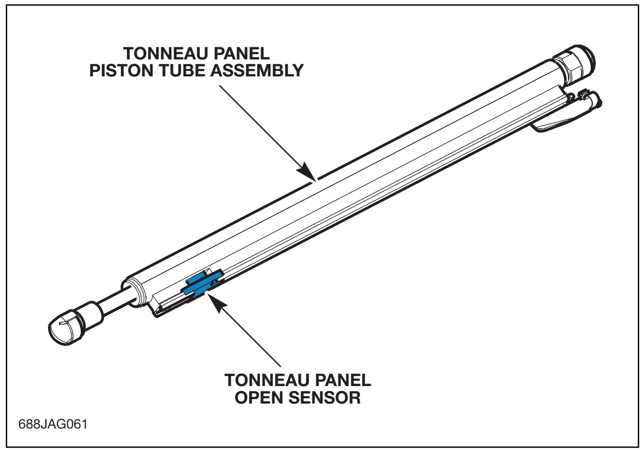
The tension bow sensors are Hall effect sensors located in the tension bow piston tube assembly (which is located next to the LH tension bow linkage). These sensors supply the control module with the position of the convertible top tension bow assembly.

Main Bow Sensors



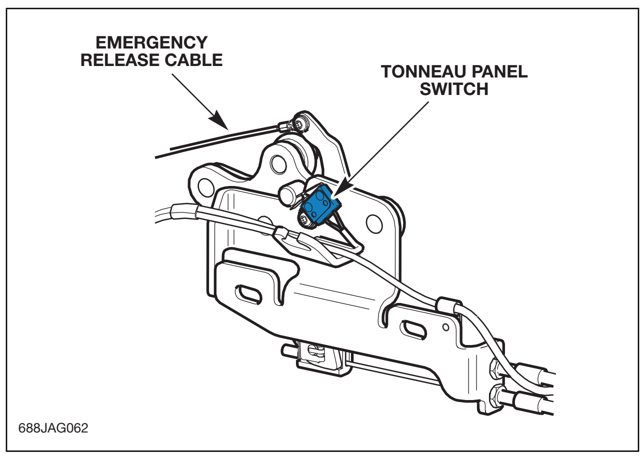
The main bow sensors are Hall effect sensors located in the main bow piston tube assembly (which is located on the RH main bearing bracket assembly). These sensors sense the position of the main bow piston so the control module knows the exact position of the convertible top.

Tonneau Panel Open Sensor



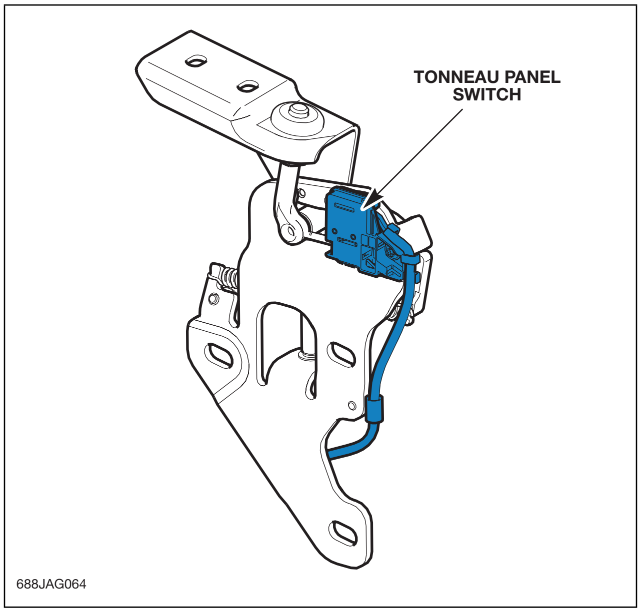
The tonneau panel open sensor is a Hall effect sensor located in the tonneau panel piston tube assembly (which is located between the RH base latch plate and the lever assembly). This sensor informs the control module when the tonneau panel is in the open position so the convertible top can be stowed.

Tonneau Panel Switch 1



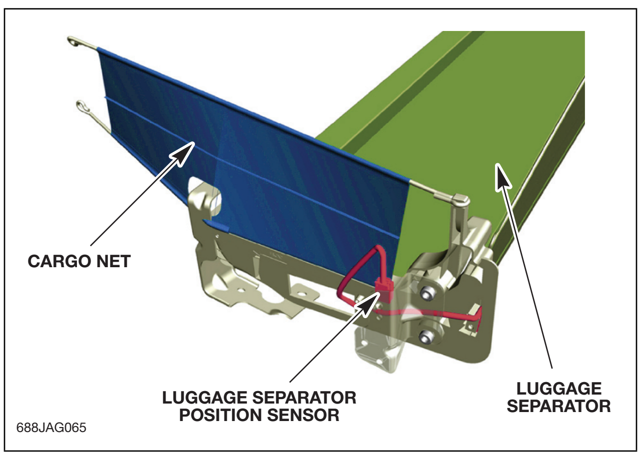
Tonneau panel switch 1 is located on the RH lever assembly. This switch is a normally open microswitch that, when switched to ground, informs the control module that the RH side of the tonneau panel is closed.

Tonneau Panel Switch 2



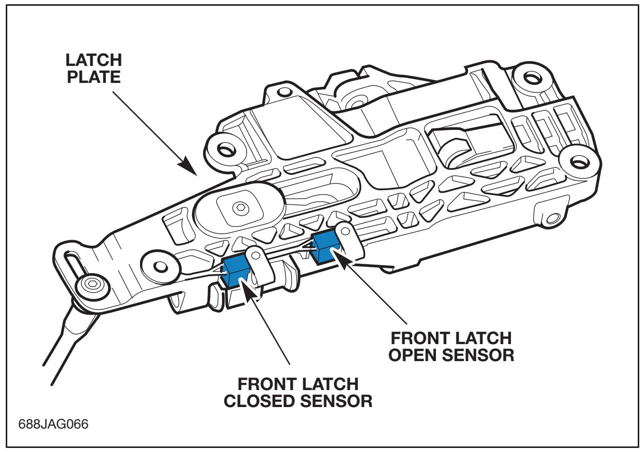
Tonneau panel switch 2 is located on the LH latch base plate assembly. This switch is a normally open microswitch that, when switched to ground, informs the control module that the LH side of the tonneau panel is closed.

Luggage Separator Position Sensor



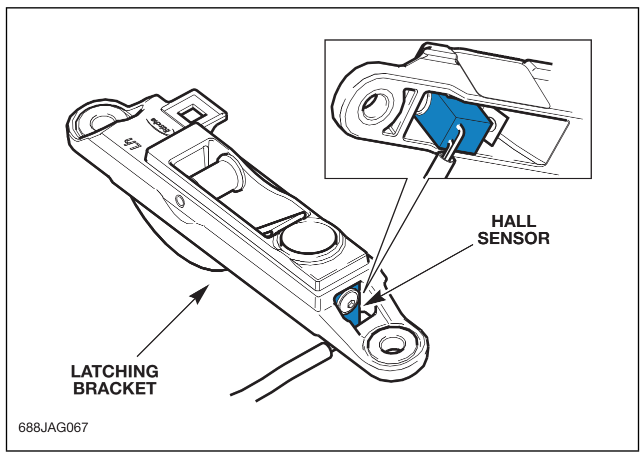
The luggage separator position sensor is a Hall effect sensor located on the LH luggage separator housing bracket. The sensor informs the control module when the separator is in the correct position. When the separator is in the correct position there is enough space in the trunk to stow the convertible top when open.

Front Latch Open and Close Sensors



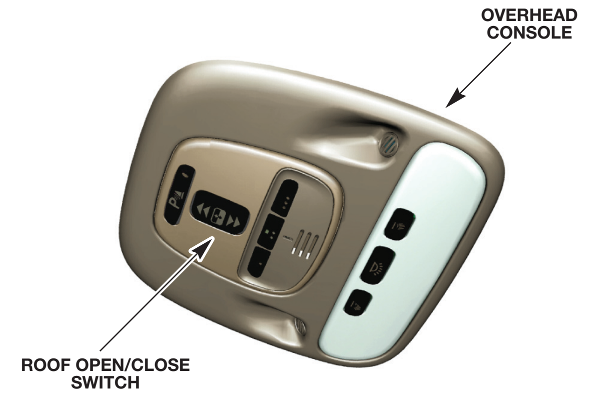
The front latch open and closed sensors are Hall effect sensors located in the LH front latch plate. These sensors inform the control module when the latch is in the open or closed position.

Convertible Top Latched Sensor



The convertible top latched sensor is a Hall effect sensor located in the LH latching bracket. The sensor informs the control module when the convertible top is in the closed position.

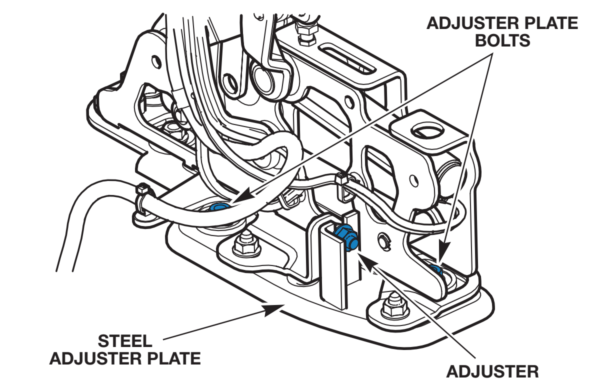
Convertible Top Open and Close Switch



688JAG068

The convertible top open and close switch is located in the overhead console. The switch is a momentary switch that is normally open. When switched to ground, the convertible top will start its open or close sequence (depending on which operation has been requested).

Adjuster Plate

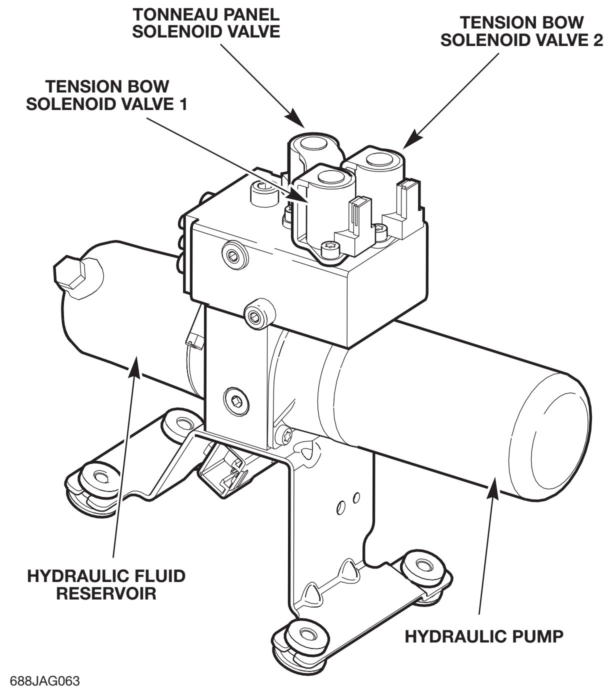


688JAG069

CAUTION: :

⚠ **The top steel adjuster plates are set and adjusted to the body during manufacture, providing an accurate location for the convertible top frame. If the top steel adjuster plates need to be released, specific adjustment is required. Adjustment procedures in the workshop manual must be followed.**

Pump Motor Assembly



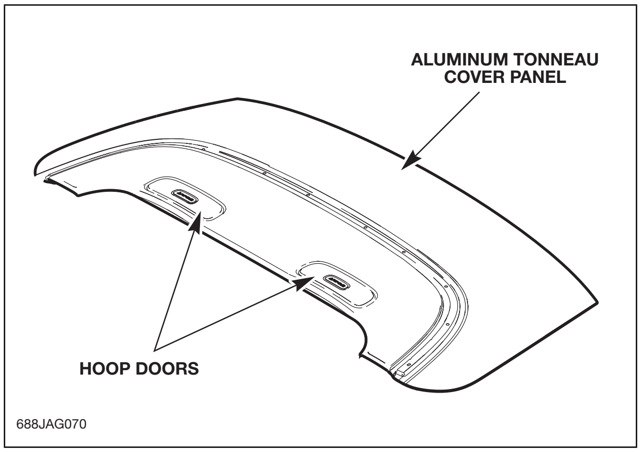
688JAG063

The hydraulic pump, motor and valve block assembly is located in the RH luggage area. The fluid reservoir is filled with Pentosin hydraulic oil. Two fluid levels are marked on the pump reservoir body: the upper mark denotes the fluid level when the top is fully lowered and the lower mark denotes the level when the top is fully raised. The hydraulic pump supplies a maximum pressure of approximately 140 bar during convertible top operation. When the pump is idle the system pressure is approximately 0.1 bar

The hydraulic fluid temperature sensor is a Negative Temperature Coefficient (NTC) sensor, which is integral to the pump assembly. The sensor supplies the control module with the temperature of the hydraulic fluid. If the fluid temperature exceeds a predetermined value, the control module will stop pump operation to prevent the valve block from overheating. Once the fluid temperature decreases below the predetermined value, the control module will resume pump operation.

NOTE: The convertible top hydraulic system is self-bleeding and does not require action to expel any trapped air.

Tonneau Panel Cover



A fully automatic flush-mounted aluminum tonneau cover panel protects the stowed top.

The aluminum tonneau cover panel trim also incorporates the Roll-Over Protection System (ROPS) hoop doors. The ROPS is deployed through the hoop doors and rear window in the event of a vehicle roll-over situation.

NOTE: For additional information on the ROPS, refer to the Airbag Supplemental Restraint System (SRS) on GTR.

CAUTION: :

⚠ **Special care must be taken when carrying out maintenance in the area underneath the aluminum tonneau cover. After approximately five minutes, the hydraulic pressure is lost due to the release of the spool valves to prevent the valves overheating. A suitable support must be used to prevent the aluminum tonneau cover from falling when the hydraulic pressure is released.**

Component Summary

Component	Description
Convertible top latched sensor	Indicates when the convertible top is in the closed position
Front latch open and closed sensors	Indicates whether the latches are open or closed
Main bow sensors	Indicates when the main bow piston is in the 'out', 'centre' or 'in' position
Tension bow sensors	Indicates when the tension bow piston is in the 'in' or 'out' position
Aluminum tonneau cover panel switches	When switched to ground they indicate that the aluminum tonneau cover panel is closed and locked
Aluminum tonneau cover panel open sensor	Indicates when the aluminum tonneau cover panel is completely open
Pump motor temperature sensor	Indicates the pump motor temperature
Luggage separator position sensor	Indicates whether the luggage separator is in the correct position
Convertible top close switch	When switched to ground the convertible top starts the close sequence
Convertible top open switch	When switched to ground the convertible top starts the open sequence

Diagnosis and Testing

Inspection and Verification

- Verify the customer concern
- Visually inspect for obvious signs of damage
- Verify system integrity.
- If an obvious cause for an observed or reported concern is found, correct the cause if possible.
- If the cause is not evident, verify the symptom and refer to the Symptom Chart. Alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Visual Inspection

- Mechanical:
  - Luggage separator position
  - Trunk lid is closed
  - Latching assemblies / mechanisms
- Electrical:
  - Fuses
  - Wiring harness
  - Correct engagement of electrical connectors, Loose or corroded connections

Symptom Chart		
Symptom	**Possible Cause**	**Action**
Rear quarter window glass is not fully closed/raised when convertible top close cycle is complete	Glass sticking in seals	Press and hold convertible top switch in close position. The door window glass will be driven down, then the rear quarter window glass will be driven up for 4 seconds, followed by the door window glass to fully closed.
	Battery voltage low	Check battery is in fully charged and serviceable condition. Refer to the battery care manual
Glass will not raise after the convertible top has been raised manually	Latched signal is not being seen	Manually latch the convertible top compartment lid by pushing the lid cylinder forward until the latch has traveled over center
Glass will not raise	Latched signal is not being seen	Carry out the convertible top compartment lid latch over center bracket setting procedure
Excessive gap between front edge of convertible top and windshield header when manually closed	Convertible top header latch not in fully open position when latched with convertible top	Manually open the latch when pushing the front of the convertible top upwards until the fork is seen to locate on the pin; the top can then be relatched manually
Convertible top module memory lost	Ignition set to OFF when convertible top is mid cycle	Move convertible top to fully open position (this is recognized by the module as a safe start position which will allow cycle to be restarted)

Convertible Top Switches and Sensor Signals		
Datalogger Signal	**Status: Top Up**	**Status: Top Down**
Luggage compartment position sensor	Active	Active
Convert. top latched sensor	Active	Inactive
Convert. top lid compartment cover piston out sensor	Inactive	Inactive
Front latch close sensor	Active	Inactive
Front latch open sensor	Inactive	Active
Main bow piston center out sensor	Inactive	Inactive
Main bow piston in sensor	Active	Inactive
Main bow piston out sensor	Inactive	Active
Tension bow piston in sensor	Inactive	Active
Tension bow piston out sensor	Active	Inactive
Convert. top lid compartment cover latch status	On	On

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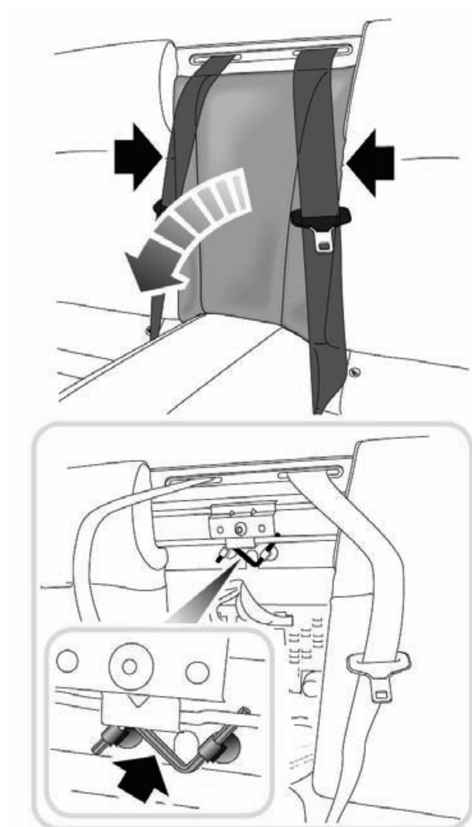
MANUAL PROCEDURES

Closing the Convertible Top Manually

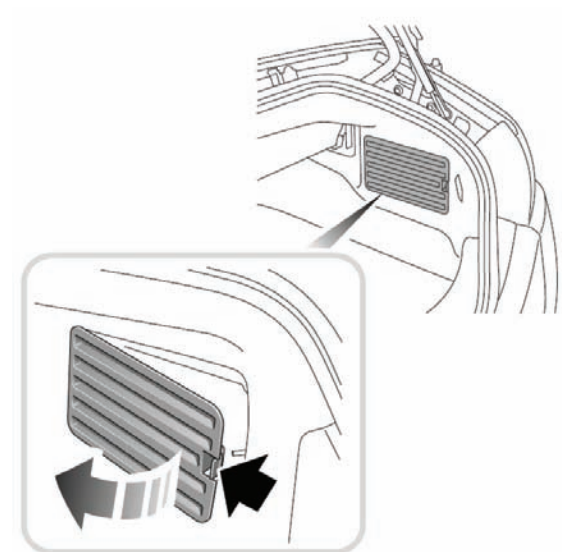
If necessary, the convertible top can be closed manually using the following procedure:

Remove the rear seat center section, as shown: grasp the sides of the section and pull sharply. Remove the Allen key from its stowed position.



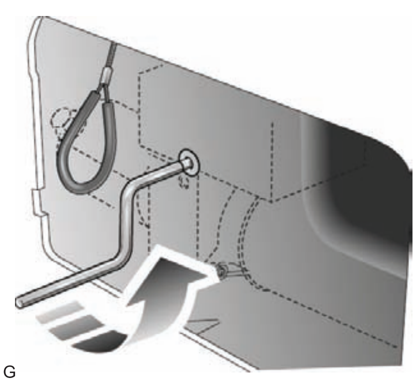
E71598 G

From inside the luggage compartment, remove the vent screen to access the convertible top operating pump and the tonneau release cable.



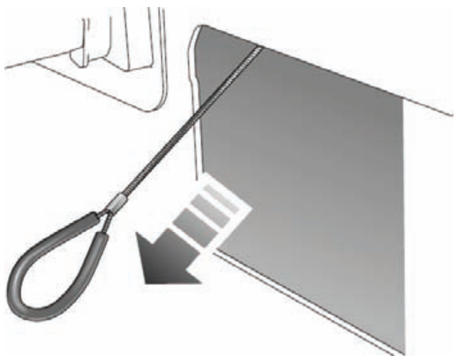
E71599 G

Insert the Allen key into the pump and turn counter-clockwise (approximately one turn) to release the hydraulic pressure in the system.



E71600 G

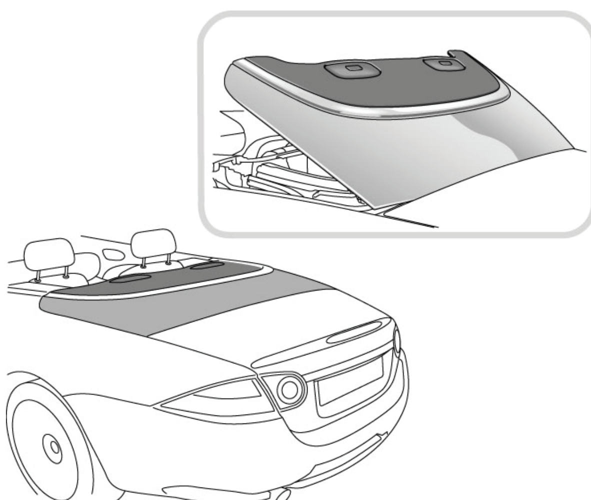
Pull the tonneau release cable until fully extended. Close the luggage compartment lid.



E71601 G

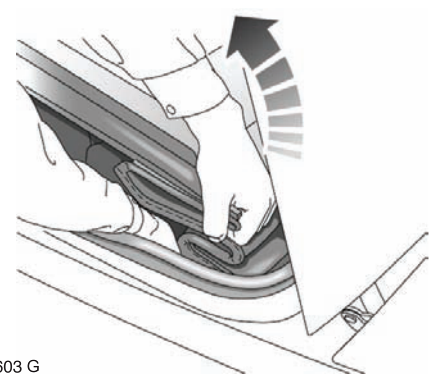
NOTE: Do not pull the release cable unless hydraulic pressure has been released in previous step.

Fully open the tonneau panel; it will self-support when fully opened.



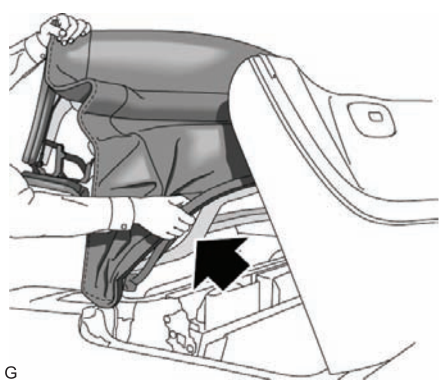
E71602 G

From the left-hand side of the vehicle, place your right hand down the side of the folded convertible top. Ensure that the bottom of the convertible top, which includes the tension bow, is securely held. Securely hold the convertible top header assembly with your left hand. With both hands pull the whole of the convertible top up and forward.



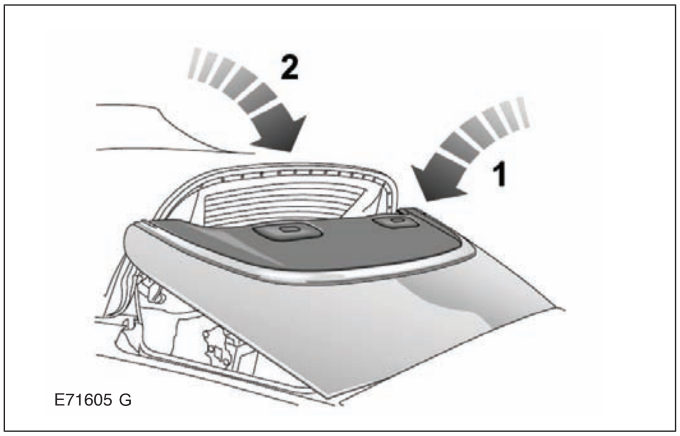
E71603 G

Ensure that the tension bow is fully raised.

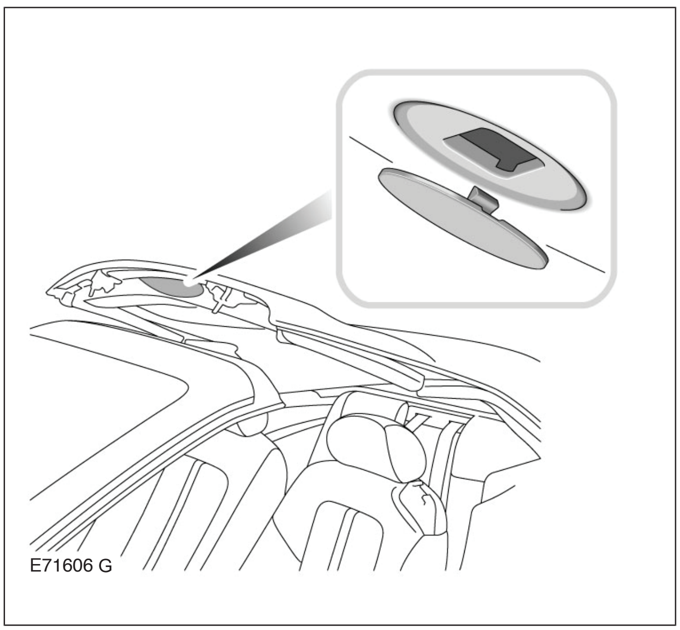


E71604 G

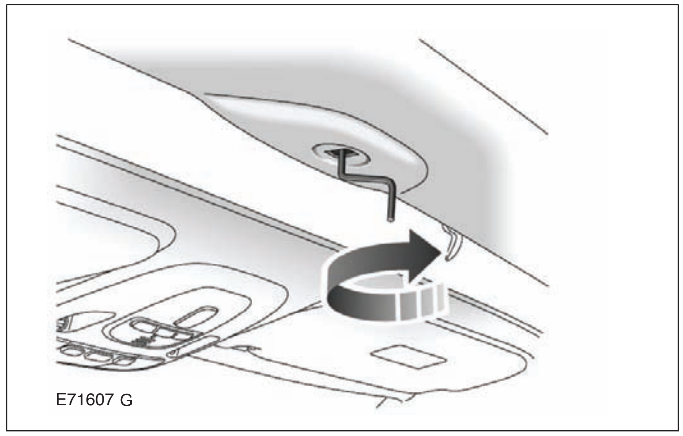
Supporting the tension bow, lower the tonneau panel (1). Then lower the tension bow (2) onto the tonneau panel.



Remove the plug from the convertible top header trim.



Support the front header. Insert the Allen key into the header panel key slot and wind clockwise until the top is securely latched and resistance is felt.



Return the Allen key to its stowed position. Refit the rear seat center section, the luggage compartment vent screen and the convertible top header trim plug.

Opening the Convertible Top Manually

The following procedure should only be used to reset the system.

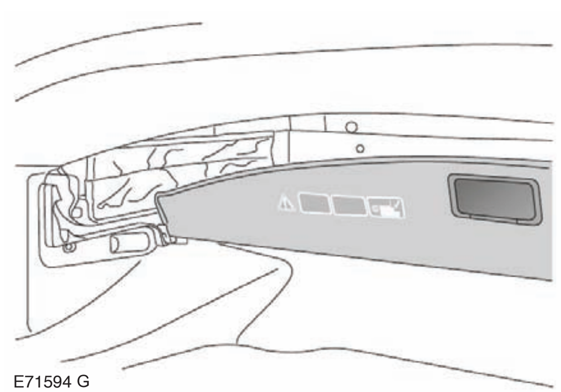
1. From inside the luggage compartment, remove the vent screen to access the convertible top operating pump and the tonneau release cable.
2. Insert the Allen key into the pump and turn counter-clockwise (approximately one turn) to release the hydraulic pressure in the system.
3. Pull the tonneau cover manual release cable.
4. Remove the access cover from the header trim to gain access to the convertible top motor.
5. Insert the Allen key into the motor and wind counter-clockwise to release the latches. When the latches are disengaged from the header, lift the front of the convertible top up and free of the header and continue winding the motor just until resistance is felt. This ensures that the latches have reached their final position. Continuing to wind the motor beyond this point may break the drive cable within the convertible top.
6. The convertible top can now be stowed: lift the front of the top fully up, then lift the rear of the top (glass area) fully up. Open the tonneau panel and carefully lower the top into the stowage area while supporting the rear of the top (do not allow the top to drop into the stowage area).
7. Lower the tonneau panel on top of the stowed top; the tonneau does not need to be latched.
8. In the trunk, turn the Allen key clockwise (approximately one turn) in the manual pump release just until resistance is felt. Do not over-tighten.

Convertible Top Compartment Lid Latch, Over-Center Bracket Setting Procedure

1. Set hydraulic pump to manual override.
2. Set ignition status to OFF.
3. Open the convertible top compartment lid to access the top fixing nut of the latch bracket on the right hand wheelhouse and slacken the nut.
4. Slacken the two lower fixing nuts of the latch bracket on the right hand wheel house (these can be accessed through the luggage compartment).
5. Position the mechanism to the fully over-center position, then push the bracket forward until the cylinder is at its shortest length, then release.
6. Tighten the two lower fixing nuts to 9Nm, open the convertible top compartment lid and tighten the top fixing nut to 9Nm.

LUGGAGE SEPARATOR

A luggage separator is located in the luggage compartment to prevent items from moving into the area in which the convertible top is stowed when opened. The convertible top will not open unless the luggage separator is deployed.



E71594 G

When the convertible top is closed, the normal position for the luggage separator is in the retracted position with the partition positioned vertically.

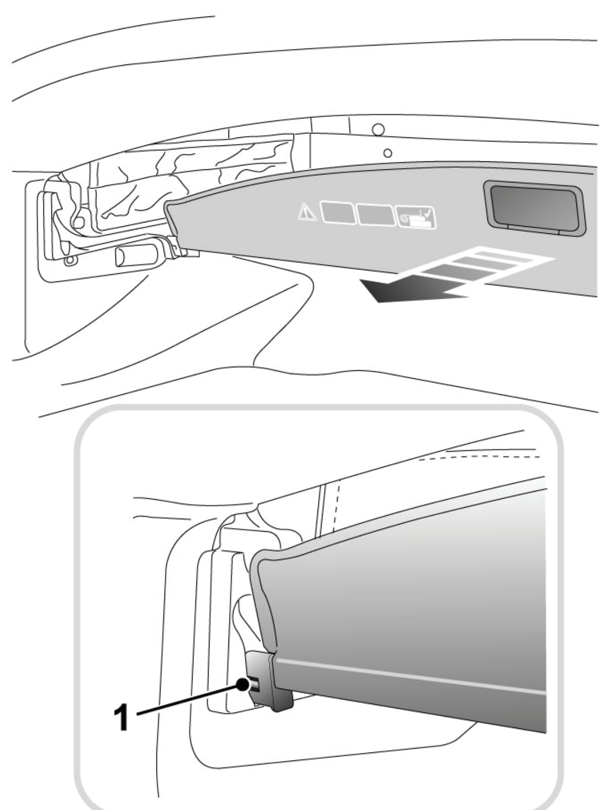
CAUTIONS:

⚠ **Do not place large objects forward or on top of the luggage separator as this could cause damage to the separator.**

⚠ **Do not place large objects underneath the luggage separator when deployed, as this could cause damage to the convertible top.**

Deploying the Luggage Separator

Pull the handle on the luggage separator towards you. There is a lug on either side of the luggage separator; slide the lugs into the sliders on either side of the luggage compartment. The luggage separator will positively locate in the vertical position.

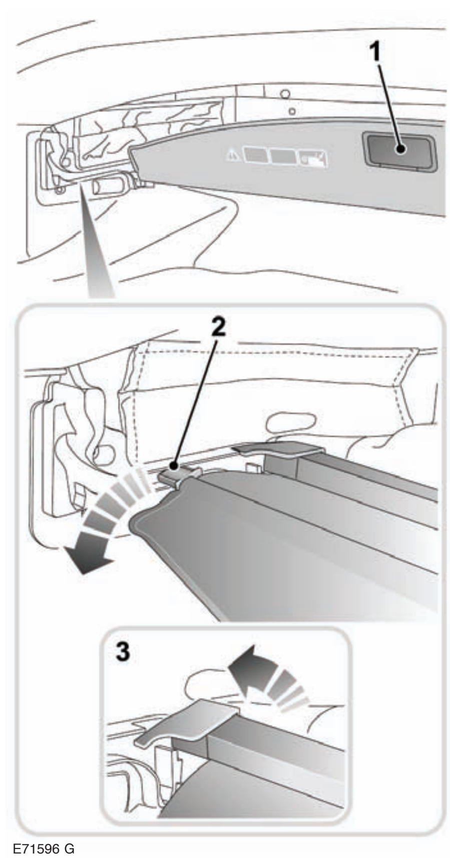


E71595 G

A proximity switch (1) is located in the separator assembly so that the convertible top will not open and retract until the separator is in the fully deployed position. If the convertible top does not open when activated, the positioning of the luggage separator should be checked.

Removing the Luggage Separator

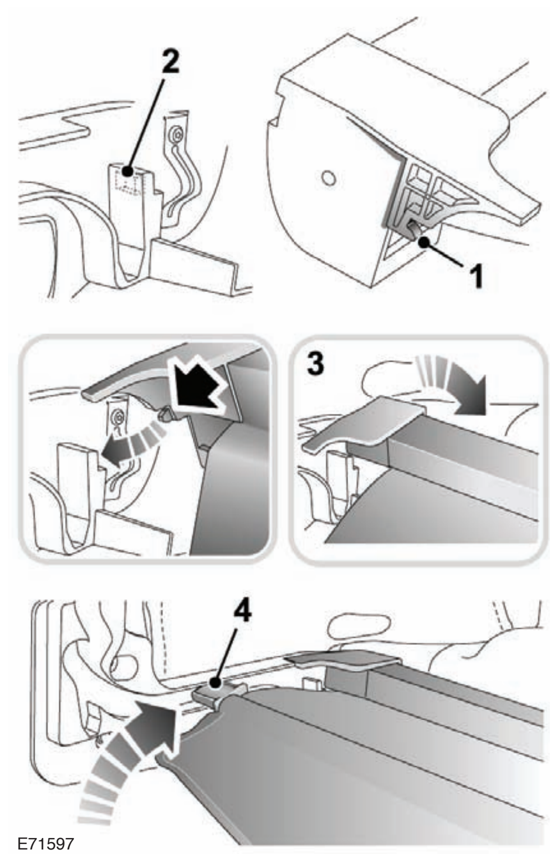
With the luggage separator in the normally stowed position, pull the handle towards you (1) and disengage the lugs from the sliders (2).



Holding the center of the main body of the luggage separator, rotate upwards (3), disengaging the main body of the luggage separator from the support brackets. Remove the luggage separator and retract the withdrawn partition section into the main body.

Installing the Luggage Separator

With the partition slightly extracted, position the luggage separator up to the support brackets with the front edge raised, ensuring that – for both sides – the catch (1) will engage in the locating slot (2).



Rotate the main body of the luggage separator (3) so that it sits down into the support brackets. Fit the partition lugs into the sliders (4) and retract the luggage separator partition into the normal stowage position.

MAINTENANCE

Winter Preparation

Before the onset of winter, it is advisable to coat the convertible top seals and respective body seals with a silicone spray to aid operation in freezing conditions. This should be done annually.

⚠ **CAUTION: Do not allow the silicone spray to contact the convertible top material, as it may cause damage.**

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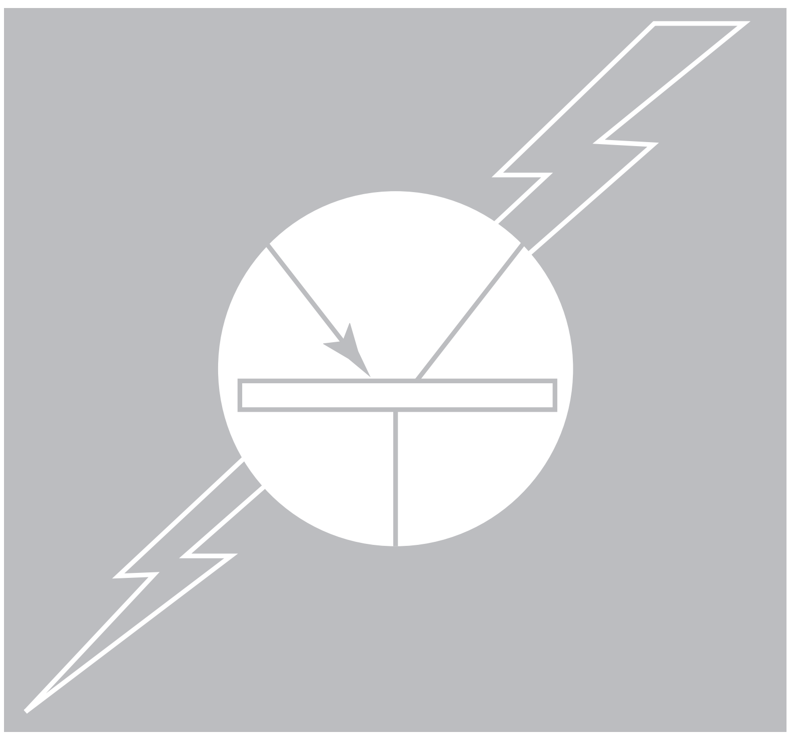
Technical Training
Electrical Systems

688-JAG: Advanced Electrical Systems and Diagnostics



X105 Body Electrical Systems

688-JAG 09/2008
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ELECTRICAL SYSTEM ARCHITECTURE

The X105 series vehicle electrical system is a ground-side switched system. The ignition switch completes ground path to activate various relays. 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.

INTERIOR LIGHTING

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

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

Interior Lighting Output Control			
Light	**Primary Input**	**Output Module**	**Output Circuit**
Trunk lights	Trunk switch	BPM	Illumination enable
Glove box light	Glove box light switch	BPM	Illumination enable
Vanity lights	Vanity light switches	BPM	Illumination enable
Map lights	Map light switches	BPM	Illumination enable
Courtesy lights	Door switches	BPM	Fade 1
Footwell lights	Door switches	BPM	Fade 1
Reading lights	‘E’ post switches	BPM	Fade 2
Puddle lights	Door switches	Door modules	Puddle light

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 15 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 Lights

The door puddle lights are controlled by the door control modules with input from the door switches. When a door is opened, its puddle light 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.

EXTERIOR LIGHTING

Exterior Lighting Output Control				
Light	**Primary Input**	**Output Module**	**Output Circuit**	**Light Monitoring**
Headlights	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 lights	Fog light switch	BPM	#2 relay, engine compartment	No
Brake lights	Brake switch	SLCM/BPM	Direct	Yes – SLCM
High-mounted brake light	Brake switch	Trunk fuse box	#5 relay, trunk	No
Reverse lights	Transmission range switch	SLCM	Direct	Yes – SLCM
Rear side markers	Lighting stalk	BPM	#3 relay, trunk	Yes – SLCM
Tail lights	Lighting stalk	SLCM/BPM	Direct	Yes – SLCM
License plate lights	Lighting stalk	SLCM	#3 relay, trunk	Yes – SLCM

Headlights, Side Markers, and Front Fog Lights

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

Brake Lights, Rear Side Markers, Tail and License Plate Lights

All rear lights are power-controlled by the SLCM. If the SLCM detects a brake, side, tail, or license plate bulb failure, it transmits the rear bulb fail data message on the SCP network.

Reverse Lights

Reverse light power is supplied directly from the SLCM. The SLCM activates the reverse lights when the instrument cluster REVERSE GEAR SELECTED SCP message is on the network. The instrument cluster determines reverse gear selection from CAN data provided by the TCM. The transmission rotary switch provides the hardwired gear position signal to the TCM.

Front Fog Lights

The BPM activates the front fog relay when the side markers or dip beams are active and the fog light 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 lights at 75 cycles per minute via hardwired connections. The instrument cluster directional signal indicators are also operated by the BPM via SCP data messages to the instrument cluster. If the BPM detects a bulb failure, it operates the instrument cluster directional signal indicator at 144 cycles per minute. The exterior indicator lights continue to operate at 75 cycles per minute. The directional indicator audible warning is a BPM-generated audio signal to the column switchgear speaker. The audible warning tone cycles with the instrument cluster indicator lights.

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

WIPERS AND HEADLIGHT POWERWASH

Windshield Wash/Wipe

Wash/wipe functions are controlled by the wash/wipe stalk in the column switchgear with input from the lighting stalk switch for headlight powerwash. Control inputs are hardwired to the BPM, which directly operates the windshield washer pump. The powerwash 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 wiper 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 for one pass at slow speed, pause in the park position for the selected delay period, then operate again (for one pass). This cycle continues until the wipers are switched off, switched to another mode or ignition position II becomes inactive.

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

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 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.

NOTE: If windshield washer fluid level is low, programmed wash/wipe is inhibited.

Autolamps with Wipers On

The Autolamp system has additional functionality for operation in conjunction with the wipers. If the wipers are switched on in slow or fast modes for more than 20 seconds when Autolamp mode is selected, the exterior lights will be switched on.

Headlight Powerwash

Headlight powerwash is activated by the wash/wipe switch when the headlights are on dip (low) beam.

When the switch is held active for more than 48 milliseconds, the headlight powerwash 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, powerwash is inhibited for the next 5 wash/wipe operations.

NOTE: If the windshield washer fluid level is low, headlight powerwash is inhibited.

Rain Sensing

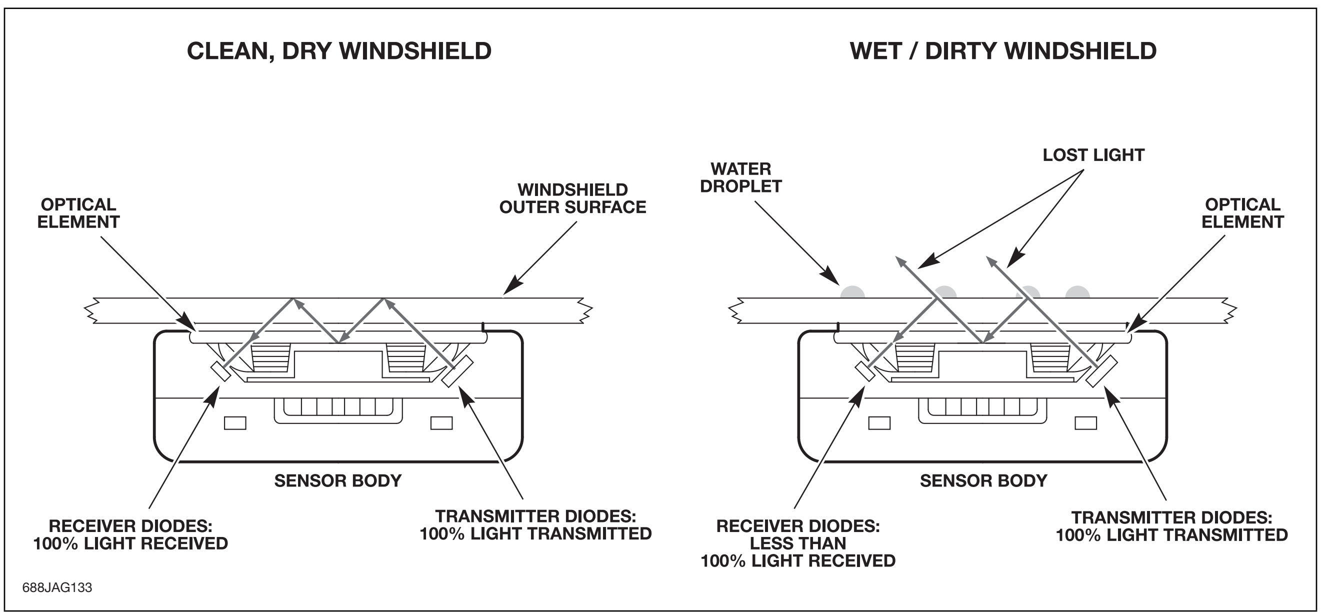
The rain sensing system provides an automatic wiper operation when rain is detected on the windshield. Different amounts of rain can be detected, causing a corresponding variation in wiper speed from slow intermittent to maximum continuous rate. The facility is selected on the wiper stalk by the driver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

The system consists of the wiper stalk selector switch, the rain sensor, and a separate rain sensing control module (RSCM).

System 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 facing outwards through the glass. The sensor elements consist of two groups of light emitting diodes (LEDs), 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.

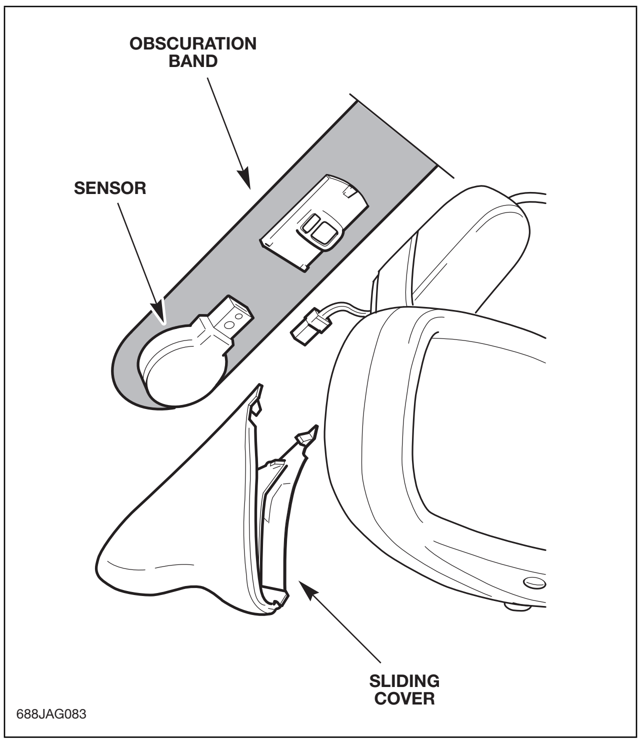
Any rain drops falling on the sensing area of the windshield cause some of the light to be refracted and scattered via the droplets and produce a reduction and imbalance in the light received by the photodiode. These signals are analyzed in the sensor and output as a pulsed signal. Pulse duration is a measure of droplet size and number of pulses is related to the number of droplets. The output from the rain sensor is transmitted 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 BPM. The BPM therefore does not recognize the difference in wiper speed requests between the manual controls and the rain sensor signals.

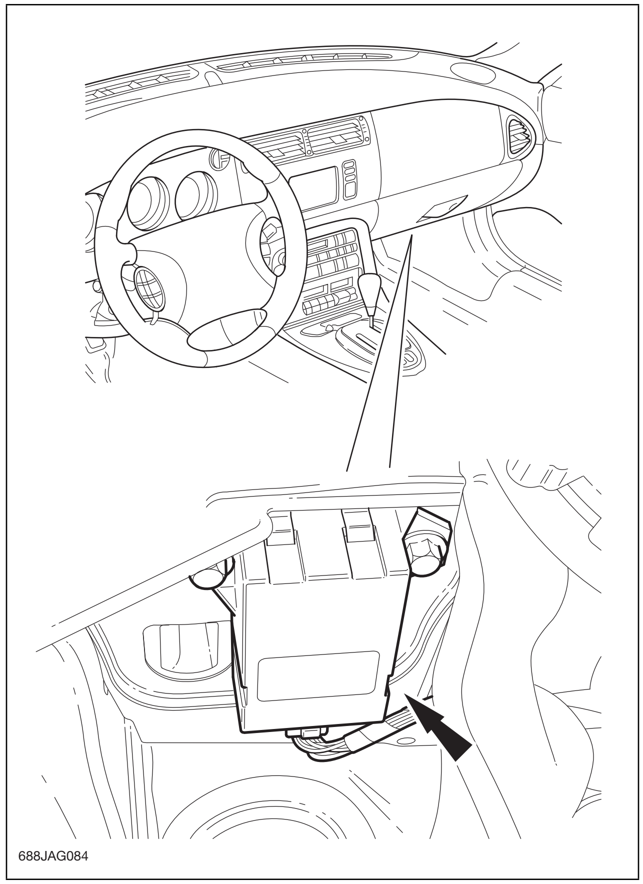
NOTE: Because a dirty windshield appears the same as a wet windshield to the rain sensor, unexpected wiper action on a dry windshield is possible and is not a fault. Before performing any repairs for customer concerns of unintended wiper movement, ensure that the wipers were not on 'AUTO' when the event occurred.

Rain Sensor



The rain sensor is fixed to the windshield by adhesive but can be easily removed for replacement. The sensor must be located within the clear circle in the obscuration band. The mirror assembly has a sliding cover to enclose the rain sensor.

Rain Sensing Control Module



The rain sensing control module (RSCM) is a non-serviceable electronic unit with connections to the rain sensor and the BPM. The module is mounted on the passenger side dash panel.

POWER SEATS

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 hardwired to the DSCM. When the driver seat belt activates the seat belt switch, the DSCM transmits an SCP seat belt telltale ON or OFF message to the instrument cluster, and an SCP seat belt chime ON or OFF to the BPM.

Adjustable Head Restraint System

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.

STEERING COLUMN MOVEMENT

Steering column movement is provided by two motors (tilt and reach) that are driven by the BPM. The driver's side fuse box supplies power to the column switchgear joy stick. Four switches route the joystick 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 ('Lazy Entry'). 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).

Entry/Exit Feature (Lazy Entry)

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: Seat does not move.

DOOR MIRRORS

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 which mirror should 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 hardwired 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.

MEMORY CONTROL

Mirror memory positions are stored in the respective door modules. Driver seat memory positions are stored in the DSCM 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

Memory recall is available from the driver's door switch pack only.

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Technical Training
Electrical Systems

688-JAG: Advanced Electrical Systems and Diagnostics

X206 Body Electrical Systems

JAGUAR

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ELECTRICAL SYSTEM ARCHITECTURE

The X206 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
- Switched system power supply

Whenever SCP messages are present, all 4 switched system relays are activated by the front electronic module (FEM) and rear electronic module (REM) and will stay energized for approximately 45 minutes after the last message has been sent.

The electrical harness incorporates three 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.

INTERIOR LIGHTING

Interior Light Output Control			
Light	**Primary Input**	**Control Module**	**Power Supply**
Trunk lights	Trunk switch	REM	Switched system relay 4
Glove box light	Glove box light switch	FEM	Switched system relay 3
Sunvisor lights	Sunvisor light switches	FEM	Switched system relay 3
Map lights	Map light switches	FEM	Switched system relay 3
Courtesy lights (puddle)	Door switches	FEM	Switched system relay 3
Footwell lights	Door switches	FEM	Switched system relay 3
Rear map lights	‘E’ post switches	FEM	Switched system relay 3

Switched System Power

A timer function within the FEM and REM controls the switched system power. 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 FEM and/or REM will remove the battery voltage from the interior lighting by deactivating the appropriate relays.

Switched system power will be reactivated when:

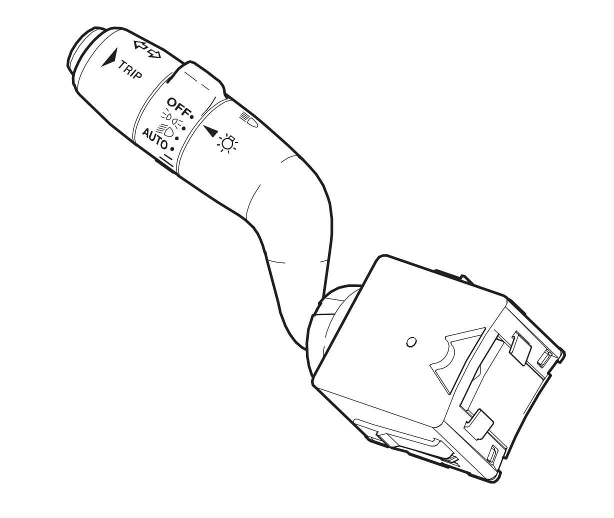
- The ignition key position is changed.
- Any door (including the luggage compartment door) becomes ajar or is opened.
- An external unlock is activated using either the door lock cylinder or the integrated key transmitter.
- The courtesy light switch is activated.

EXTERIOR LIGHTING

Exterior lighting is activated by the main lighting switch assembly (the left-hand column stalk).

Exterior lighting inputs are decoded by the instrument cluster and broadcast as SCP messages to the REM and the FEM. The FEM activates all front exterior lighting circuits.

Main Lighting Switch



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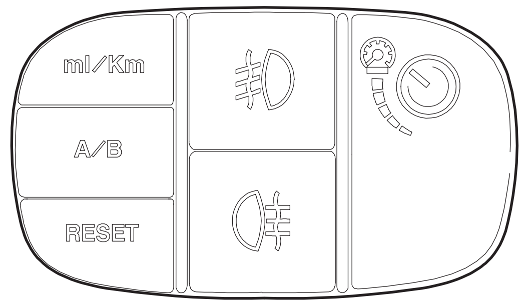
The left-hand column stalk is a multifunction switch assembly used to activate the following as appropriate:

- Side lights
- Low-beam headlight
- High-beam headlight
- Autolamps
- Turn signal indicator lights
- Exit delay

The LH column stalk switch also includes controls for the trip computer.

NOTE: The X206 has optional high-intensity discharge HID headlights, complete with automatic headlight leveling. For more information on this system, refer to the HID Headlights section.

Auxiliary Lighting Switch



688JAG087

The auxiliary lighting switch assembly comprises:

- Dimmer control
- Front and rear fog switches

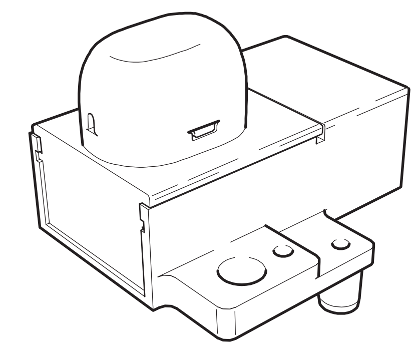
The auxiliary lighting switch also includes controls for the trip computer.

NOTE: To change the language setting in the instrument pack:

– Press and hold the ml/Km button while turning ignition to accessory position, then release button
– Press the TRIP button on the LH column stalk to scroll through language settings
– To exit, turn ignition off

Autolamps

The operation of the autolamps feature (where applicable) is dependent on ambient light levels, monitored by photo-diodes integrated into the sunload/light sensor.



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The sensor provides feedback to the instrument cluster, which responds by supplying control signals on SCP to the FEM and REM that automatically control the operation of the side lights and low-beam headlights where appropriate, provided that:

- The ignition key is at position II or III
- The main lighting switch is set to the AUTO position

Since the autolamps operation depends on the sensor (which is located behind the defrost grill 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 lights to be activated.
- Detection of darkness for 2 seconds continuously will cause the low beam and side lights to be activated.
- Detection of daylight for 15 seconds continuously will cause the exterior lighting to be extinguished.

The Autolamp system has additional functionality for operation in conjunction with the wipers. If the wipers are switched on in slow or fast modes for more than 20 seconds when Autolamp mode is selected, the exterior lights will be switched on.

Exit Delay

The exit delay feature is controlled by the FEM and is activated when the ignition is switched off. The dip beam will remain illuminated for 10s, 30s, or 2 min, (depending on the position of the main lighting switch) or until the ignition key is turned to position 'II' (or the headlight convenience button on the keyhead transmitter is pressed).

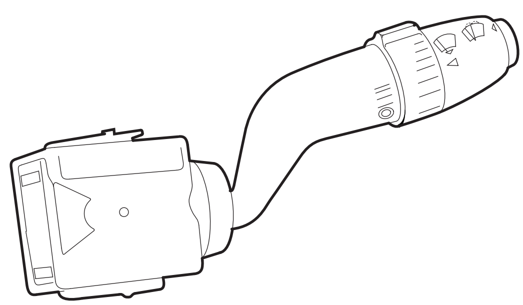
NOTE: The feature will not function if the main lighting switch is set to AUTO.

WIPERS

Wash/Wipe System

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

Wash/Wipe Switch Inputs



688JAG095

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.

Intermittent Wipe

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

Rain Sensing (Optional)

The rain sensing module, located above the rear parcel shelf, has a 3-wire circuit in parallel with the RH column stalk switch circuit. If AUTO and INTERMITTENT are selected on the column stalk switch, the module will activate the windshield wipers when rain is sensed on the windshield.

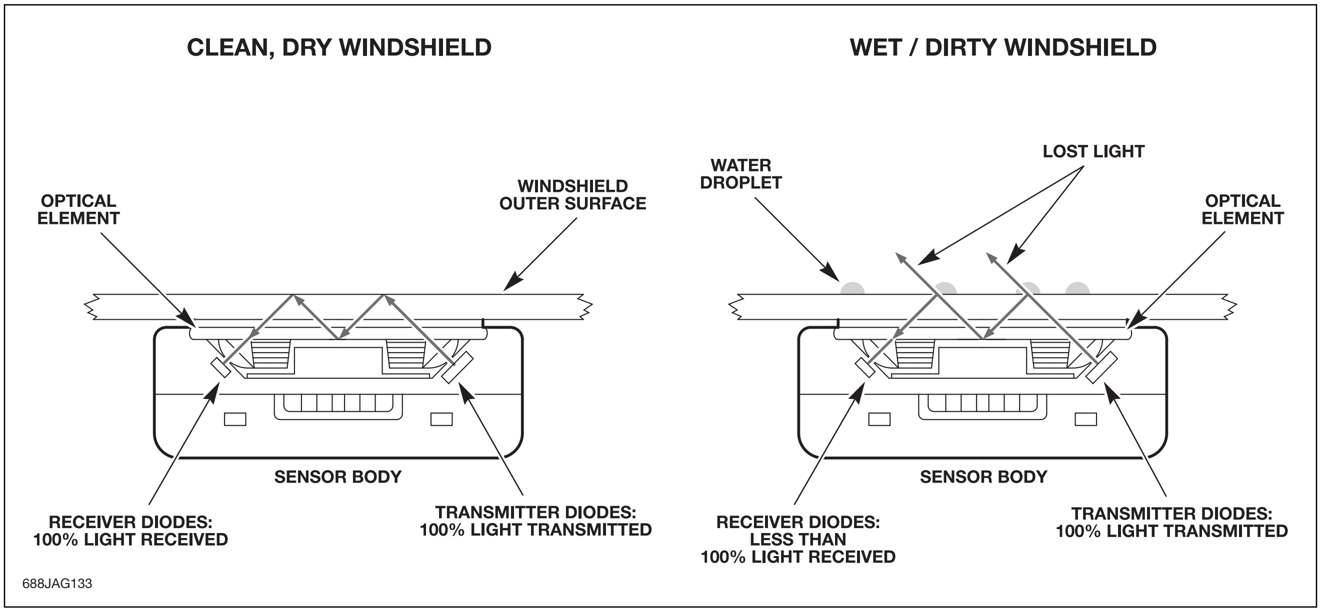
The rain sensing system provides an automatic wiper operation when rain is detected on the windshield. Different amounts of rain can be detected, causing a corresponding variation in wiper speed from slow intermittent to maximum continuous rate. The facility is selected on the wiper stalk by the driver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

The system consists of the wiper stalk selector switch, the rain sensor, and the Front Electronic Module (FEM).

System 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 facing outwards through the glass. The sensor elements consist of two groups of light emitting diodes (LEDs), 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 transmitted to the FEM.



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 FEM. The FEM therefore does not recognize the difference in wiper speed requests between the manual controls and the rain sensor signals.

NOTE: Because a dirty windshield appears the same as a wet windshield to the rain sensor, unexpected wiper action on a dry windshield is possible and is not a fault.

Before performing any repairs for customer concerns of unintended wiper movement, ensure that the wipers were not on ‘AUTO’ when the event occurred.

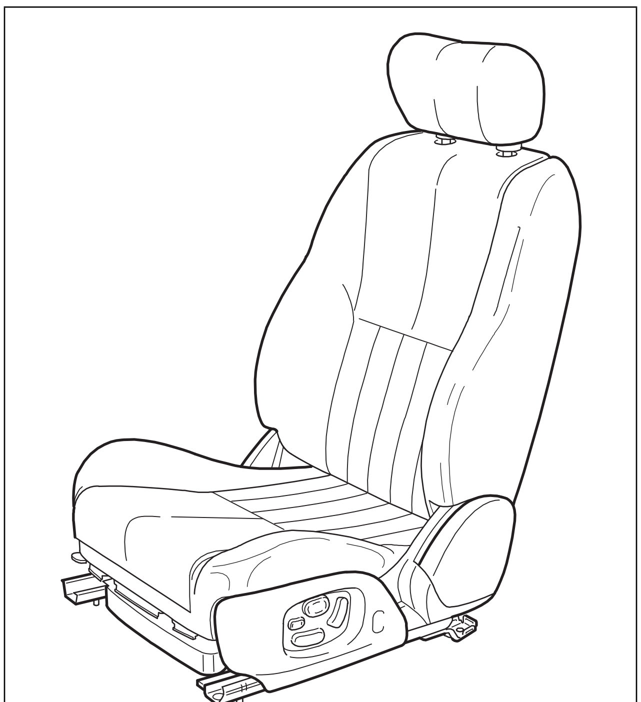
POWER FRONT SEATS

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 airbags in isolation. Refer to GTR for detailed Removal and Installation instructions.

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

- Integral side air bags
- Head restraints
- Seat belt buckle pretensioner
- Anti-whiplash mechanism



The front seats are 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

The driver and passenger seats are nearly identical except that the driver seat has a seat-track position sensor and the passenger seat has a weight-sensing system. These components form an integral part of the occupant safety system.

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 GTR.

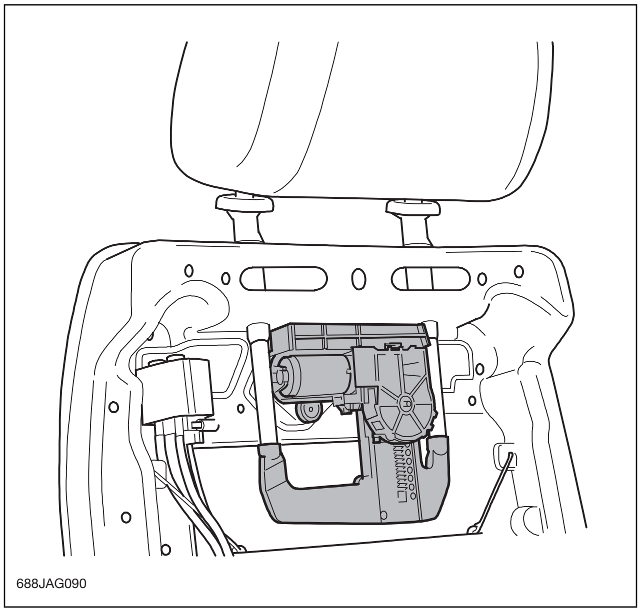
Driver Seat Control Module

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.

NOTES: Lumbar positions cannot be saved using the memory feature.

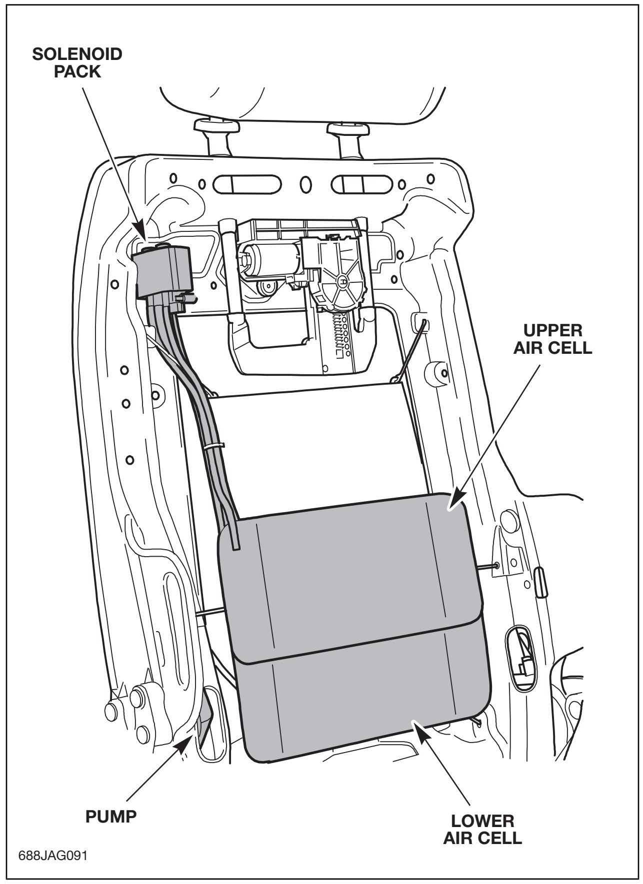
Electrically-Operated Head Restraint

The electrically-operated head restraint (where equipped) 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.



Power Lumbar

The 4-position version of the power lumbar (where equipped) 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 selected setting, 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 adjustment use the lower air cell only and do not need the solenoid pack.

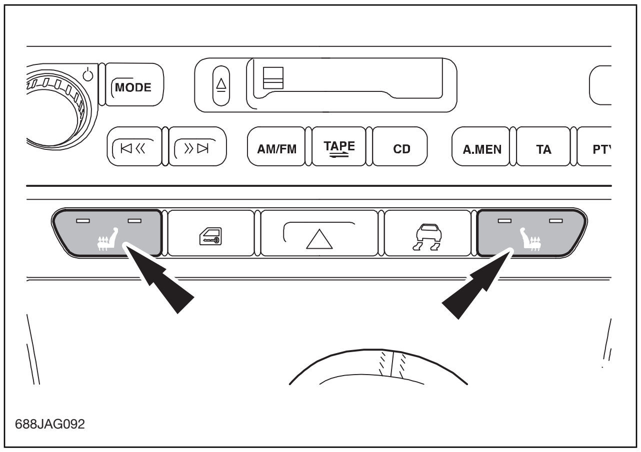
Heated Seats

The heated seat system comprises:

- Heated seat switches
- Heated seat module
- Backrest heater element
- Cushion heater element and thermostat

Heated Seat Switches

The heated seat function provides electrical heating of the backrest and cushion on the driver and front passenger seats. Heating for each seat is selected separately using 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.

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

Once the heated seat function has been activated, it will remain active until:

- A fixed period of time has expired (10 minutes)
- The function is deactivated by pressing the switch for a third time
- A malfunction is detected by the heated seat module

NOTE: The heated seat function is designed to operate at temperatures below a predetermined limit and operation may be inhibited by a heated garage, body heat or warm ambient temperatures.

Heated Seat Module

The heated seat module is located under the front edge of the seat and controls the seat heating function by providing the appropriate response depending on the status of the heated seat switches.

STEERING COLUMN MOVEMENT

The instrument cluster (IC) controls steering column movement.

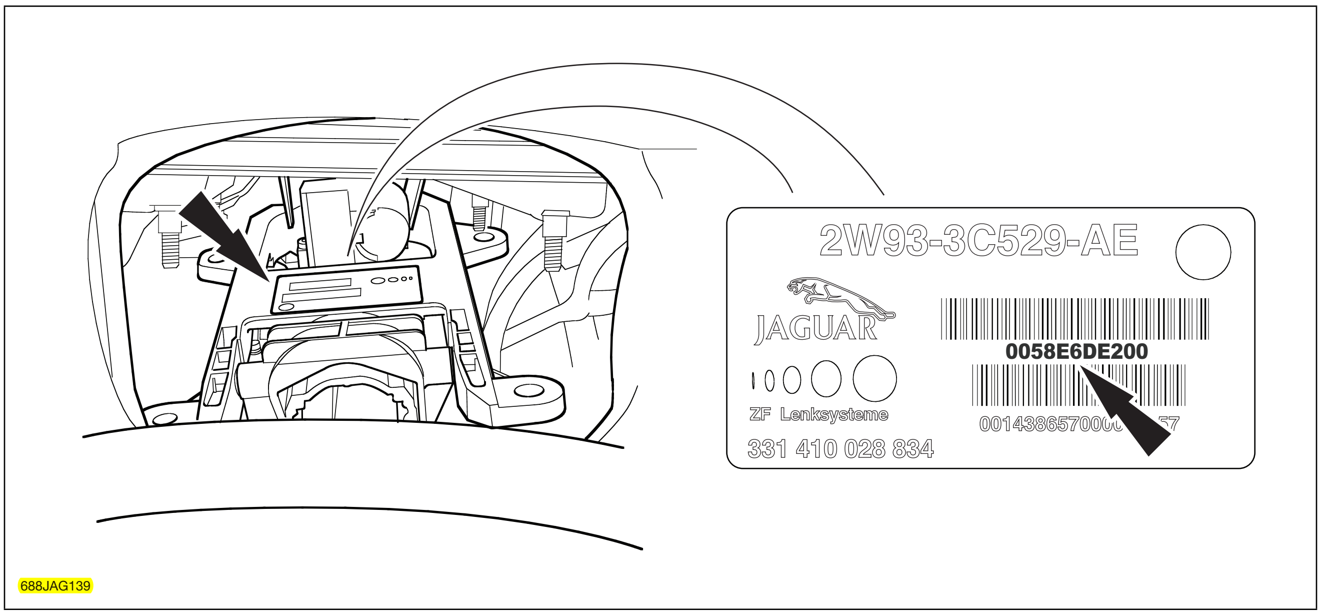
- Control switch is hardwired to IC
- Column movement is controlled by one motor and two solenoids, all hardwired to the IC
- Memory recall is held in driver door module
- Memory position held in IC
- Memory messages via SCP network

Steering Column Replacement

Column replacement or instrument cluster replacement/ programming requires digits from the 11-digit steering column barcode. Digits 3 – 10 of the code are used.

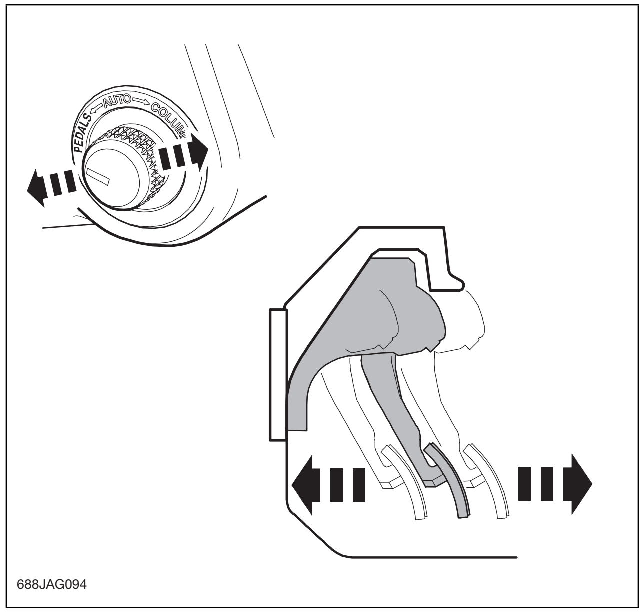
On vehicles from VIN N04842, the barcode is located on a label affixed to the RH wheel well wall panel under the trunk floor trim. On vehicles earlier than this VIN, the barcode is on the steering column; removal of the column is required to access the barcode.

When installing a replacement column, affix the new barcode label (supplied with the column) on the RH wheel well, covering the old one.



PEDAL ADJUSTMENT SYSTEM

The pedal adjustment system is designed to allow drivers to improve their driving position. It is only available as part of the memory package (seats, mirrors, steering column). The system provides a range of adjustments up to a maximum of 70mm (2.75 in) and controls all of the pedals together (2 or 3, depending on specification).

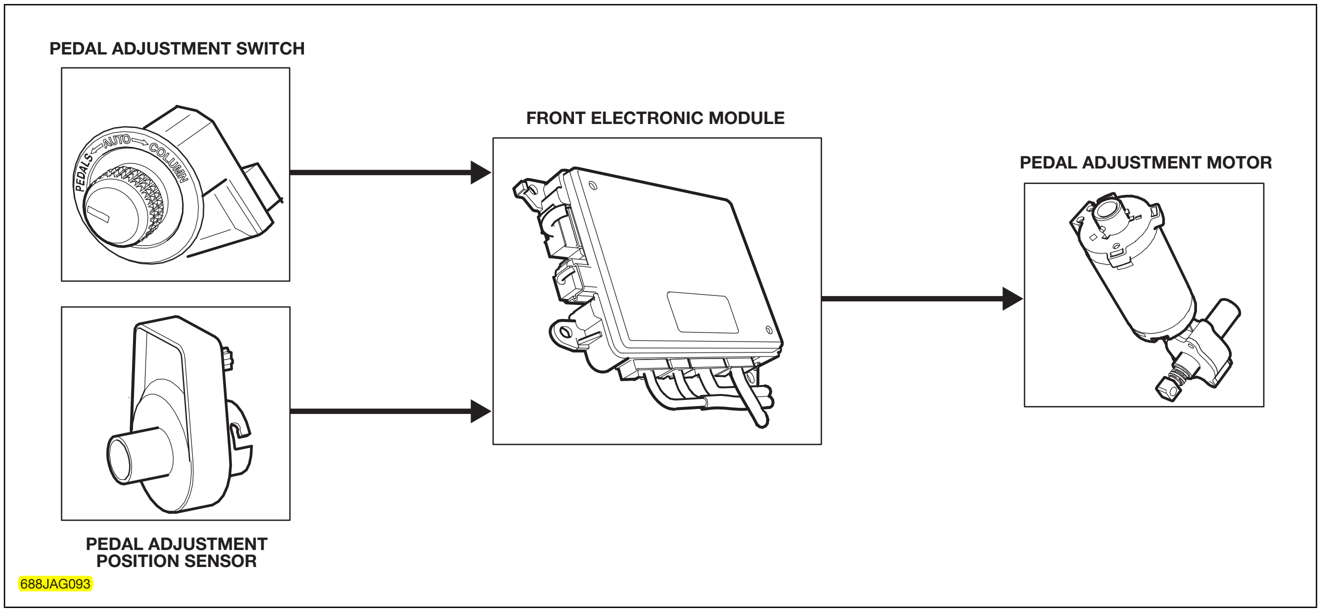


The pedal adjustment system comprises:

- Front electronic module (FEM)
- Pedal adjustment motor
- Pedal position sensor
- Pedal adjustment switch

Pedal adjustment is enabled by setting the 3-way rotary 'joystick' switch (located on the LH 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.



The FEM 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)

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 speed control operation.
- Requires initialization after any component of the system has been replaced; refer to GTR.

NOTE: Diagnostics should be performed using IDS.

DOOR MIRRORS

- Driver switchpack wired to driver door module (DDCM)
- Driver door mirror wired to driver door module
- Passenger door mirror wired to FEM, commands via SCP network
- DDCM for memory
- Where electrochromic door mirrors are fitted, they operate in conjunction with the interior mirror by the same buttons and function in the same manner

POSITION MEMORY SYSTEM

The memory system has two distinct areas of operation:

- Memory retention
- Memory management

Memory retention is the responsibility of any module that controls a position motor. The DDCM will command all control modules to remember their individual motor positions when the memory 'Set' button is depressed.

These settings will then be assigned as Position 1 or Position 2, depending on driver selection. When the recall button is pressed, the DDCM will broadcast a generic command to the specific modules to position their individual motors to their remembered positions.

The positions of the steering column, driver seat, pedals, and the door 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.

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Technical Training
Electrical Systems

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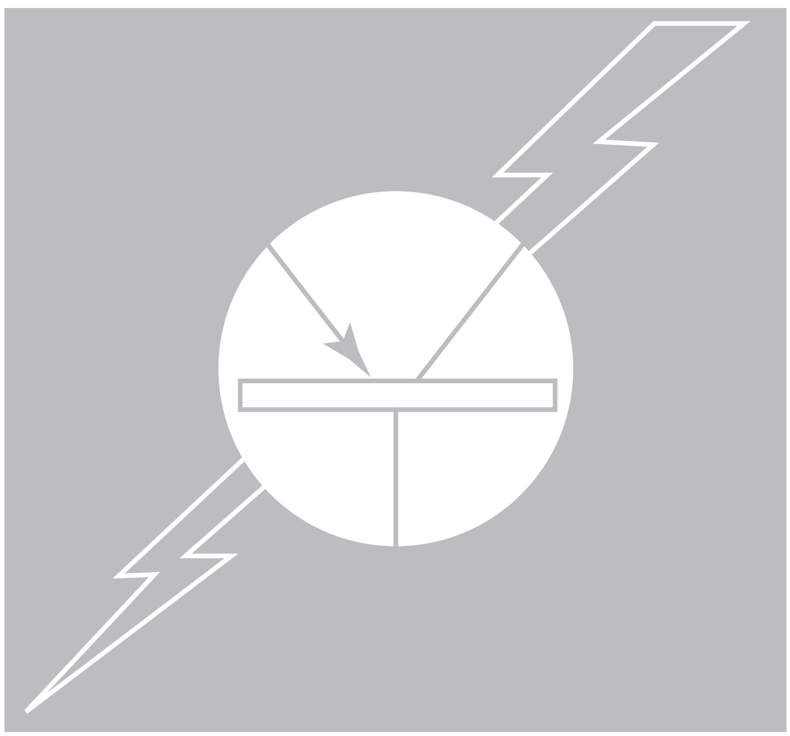


X404 Body Electrical Systems

JAGUAR

688-JAG 09/2008
Printed in USA

ELECTRICAL SYSTEM ARCHITECTURE

Power Supplies

The 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' relay power supply. The 'Battery Saver' relay 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 within the engine compartment fuse box

Some of the relays used are of the printed circuit board (PCB) type. PCB relays are not serviceable and require replacement of the entire fuse box.

INTERIOR LIGHTING

The interior lighting comprises:

- Footwell lights
- Front interior light and switch
- Map lights and switches
- Vanity mirror lights and switches
- Rear interior light and switch
- Puddle lights
- Luggage compartment light and switch
- Glovebox light and switch

Battery Saver Relay Power Supply

A timer function within the general electronic module (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 30-minute period, the GEM will remove the battery voltage from the interior lighting by deactivating the battery saver relay.

The battery saver relay will be reactivated when:

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

Courtesy Lighting

The courtesy lights are controlled by the GEM in the following circumstances:

- Any of the vehicle’s doors are opened
- An external unlock is activated using either the door lock cylinder or the integrated key transmitter
- The courtesy lights switch is activated

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

- 20 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 lights when the battery saver timer has expired.

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

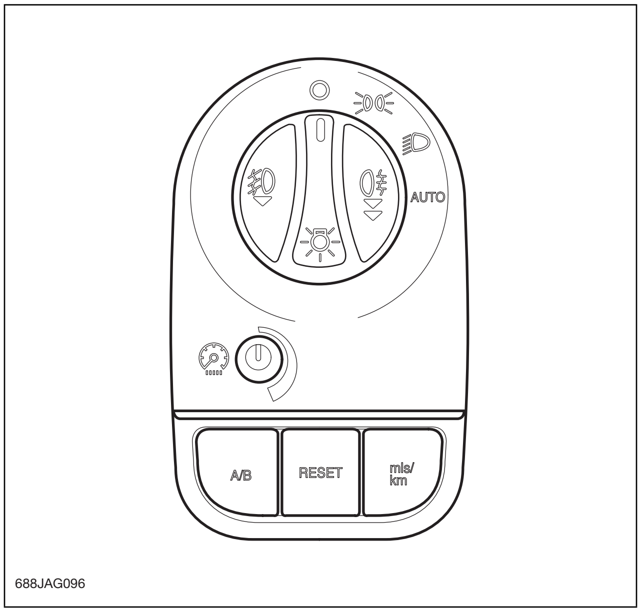
EXTERIOR LIGHTING

The X404 exterior lighting system features autolamps and optional high-intensity discharge (HID) headlights (complete with automatic headlight leveling). Exterior lighting is activated by the master lighting switch and, where appropriate, the LH column stalk switch (high beam).

Switching is via allocated fuses and relays, with the exception of the turn signal / hazard warning lights, which are controlled by the general electronic 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 lights
- Headlights
- Autolamps (except Canada)

Front Fog Lights

The lights are activated when the rotary switch is 'pulled' to its first position, provided the side light or headlight position is also selected.

NOTE: The front fog lights will not operate if main beam is selected.

Rear Fog Lights

The lights 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 lights will operate automatically when the rear fog lights 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.

Turn Signals and Hazard Lights

Turn signals and hazard lights are operated by the GEM. The GEM also creates the audible tick-tock through a speaker within the turn signal switch.

Security acknowledge headlight flash is also controlled by the GEM. For more information, see the Security Section.

Rear Exterior Lighting

Unlike other Jaguar models, the X404 series exterior lighting is wired directly from the master lighting switch, through the passenger junction fuse box, and hardwired directly to the light assemblies.

WIPERS AND HEADLIGHT POWERWASH

Wipe/Wash System

The wipe/wash system comprises:

- Wiper motor
- Washer fluid reservoir
- Washer fluid pump
- Mounting arm and pivot shaft
- Telescopic powerwash (when fitted)
- Rain sensing module (when fitted)
- Rain sensor (when fitted)

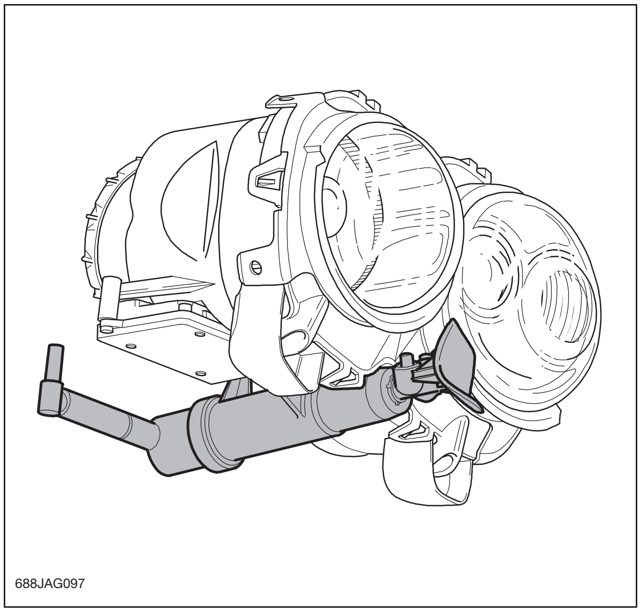
The system is controlled by the GEM. The windshield wiper and washer functions are initiated by the driver using the RH column stalk switch, and only operate with the ignition key at position ll. The settings are as follows:

- Flick wipe
- Programmable intermittent wipe
- Slow speed wiper operation
- High speed wiper operation
- Rain sensing

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.

Headlight Powerwash System

The X404 uses a telescoping powerwash jet. The powerwash feature can be operated if the ignition key is at position ‘II’ and side lights are selected.



When the windshield wash/wipe button is pressed, the headlight powerwash directs a short blast of fluid at the headlights. If the wash/wipe button is held, the wash/wipe cycle will continue for up to 20 seconds. The headlight powerwash will operate the first time the wash/wipe button is pressed and thereafter every sixth succeeding wash/wipe operation. If the headlights or ignition are switched OFF and ON again, the powerwash will operate on the next press of the wash/wipe button.

NOTE: When the washer fluid reservoir level is low, the wipers will not operate when windshield wash is selected, even though there may be a small amount of washer fluid remaining in the reservoir and sprayed onto the screen. This is to prevent damaging the blades, scratching the glass, or smearing dirt across the windwhiels. Flick wipe should be selected to clear the sprayed fluid from the glass.

Rain Sensing

Where installed, rain sensing is controlled using a combination of the GEM, rain sensing module, rain sensor and wiper switch.

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 LH 'A' post.

Rain sensing will be initiated provided that:

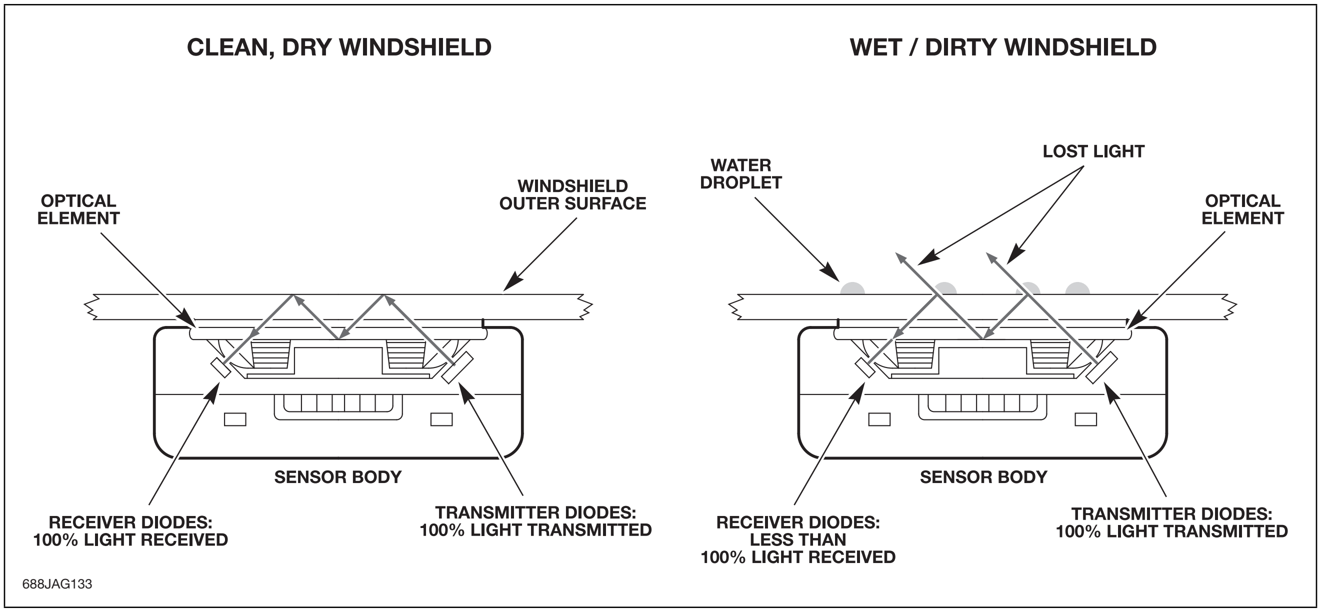
- Ignition key is at position II
- Wiper switch is set to the AUTO position and intermittent wipe is selected

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.

System 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 facing outwards through the glass. The sensor elements consist of two groups of light emitting diodes (LEDs), 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 transmitted to the rain sensing 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 GEM. The GEM therefore does not recognize the difference in wiper speed requests between the manual controls and the rain sensor signals.

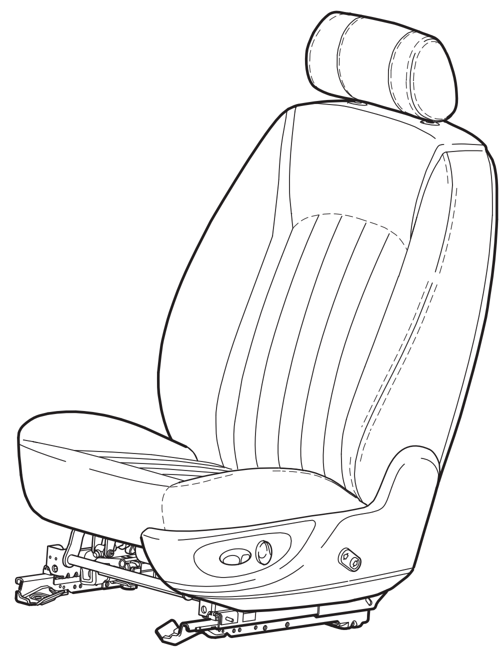
NOTE: Because a dirty windshield appears the same as a wet windshield to the rain sensor, unexpected wiper action on a dry windshield is possible and is not a fault.

Before performing any repairs for customer concerns of unintended wiper movement, ensure that the wipers were not on 'AUTO' when the event occurred.

POWER FRONT SEATS

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 airbags in isolation. Refer to GTR for detailed Removal and Installation instructions.



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In addition to the standard features, one or more of the following options may be available (depending on vehicle specification):

- Electrically adjustable seat position
- Heated seat
- Electrically adjustable lumbar support
- Memory

The driver and passenger seats are nearly identical except that the driver seat has a seat-track position sensor and the passenger seat has a weight-sensing system. These components form an integral part of the occupant safety system.

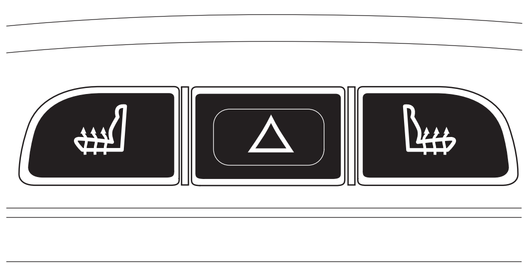
NOTE: The seat cushion is an integral part of the seat weight sensing system. Individual components of the seat weight sensing system are not serviceable and must be replaced as a complete unit.

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 provides heating of the seat back and cushion. Seat heating is selected by separate driver/passenger switches located at the top of the center console.



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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

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)

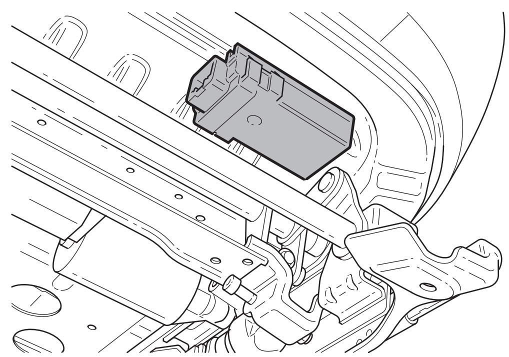
Once the heated seat function has been activated, it will remain active until:

- A fixed period of time has expired (10 minutes)
- The switch is pressed a third time
- A malfunction is detected by the heated seat module

The heated seat function is designed to operate at temperatures below a predetermined limit and operation may be inhibited by a heated garage, body heat or warm ambient temperatures.

Heated Seat Module

The heated seat module, located under the front edge of the seat, controls the seat heating function by providing the appropriate response depending on the status of the heated seat switches.



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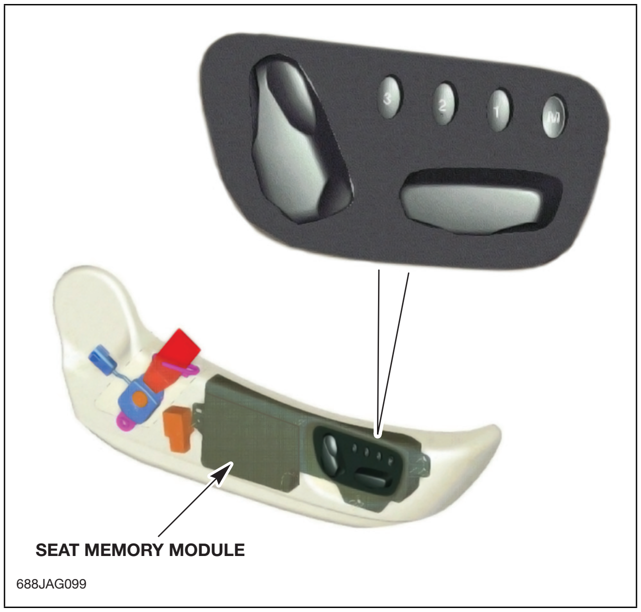
MEMORY SYSTEM

The X404 has an optional memory system package. The memory system (if fitted) controls the following:

- Driver seat
- Side mirrors

Seat Memory

The seat memory system allows for 3 memory settings using the memory buttons located in the seat adjustment switch pack. In order to set memory, the ignition must be in position II.



The seat memory module is integrated with the seat adjustment switch pack as shown in the illustration.

Mirror Movement

Mirror memory is part of the seat memory module. The mirrors and mirror switch are hardwired to the module.

NOTE: On X404 models equipped with a manual transmission, the parking brake must be applied for the seat adjustment switch pack to recall the memory seat and mirror positions.

Technical Training
Electrical Systems

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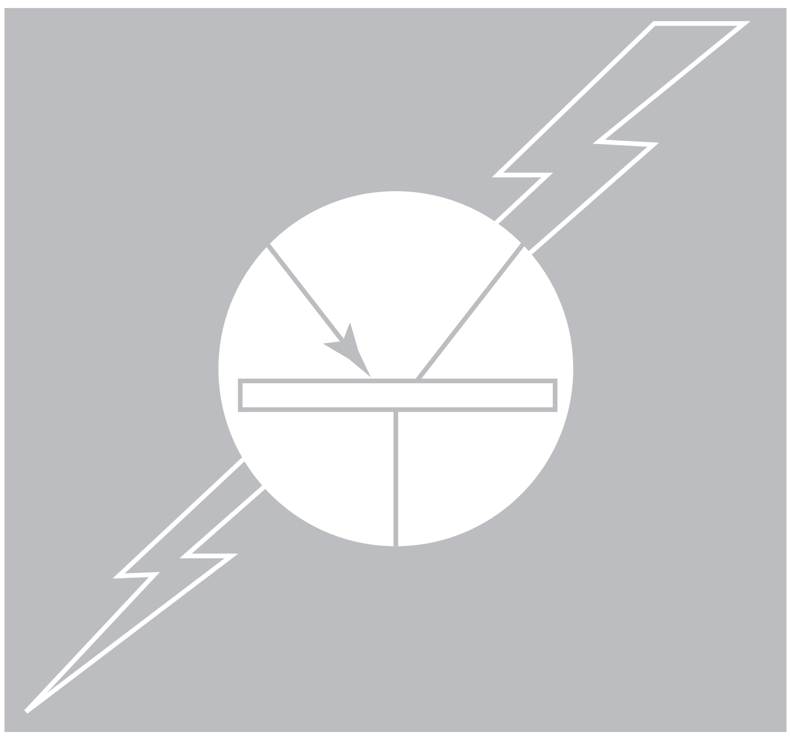


X358 Body Electrical Systems

JAGUAR

688-JAG 09/2008
Printed in USA

ELECTRICAL SYSTEM ARCHITECTURE

Power Supplies

The X358 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 front electronic module (FEM) and the rear electronic module (REM).

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 RH footwell. 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. PCB relays are not serviceable and require replacement of the entire fuse box.

INTERIOR LIGHTING

Interior Lighting Output Control			
Light	Primary Input	Output Module	Power Supply
Trunk lights	Trunk switch	REM	Switched System Relay 3
Glove box light	Glove box light switch	Hardwired	Switched System Relay 1
Vanity lights	Vanity light switches	REM	Switched System Relay 2
Map lights	Map light switches	REM	Switched System Relay 2
Courtesy lights	Door switches	REM	Switched System Relay 4
Front footwell lights	Door switches	FEM	Switched System Relay 1
Rear footwell lights	Door switches	REM	Switched System Relay 4
Rear map lights	Integral light switch	REM	Switched System Relay 4
Driver door puddle and approach lights	Door switches	DDM	DDM
Passenger door puddle and approach lights	Door switches	FEM	FEM
Rear door puddle lights	Door switches	REM	REM

Switched System Power

A timer function within the FEM and REM controls the switched system power:

- 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 FEM and/or REM will remove the battery voltage from the interior lighting by deactivating the appropriate relays.

Switched system power will be reactivated when:

- The ignition key position is changed
- Any door (including the trunk lid) becomes ajar or is opened
- An external unlock is activated using either the door lock cylinder or the integrated key transmitter
- The courtesy light switch is activated

Courtesy Lighting

The courtesy lights are controlled by the REM 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 light switch is not activated, the courtesy lighting feature extinguishes the courtesy lights when all the vehicle’s doors are closed and any of the following occurs:

- 20 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 lights when the battery saver timer has expired.

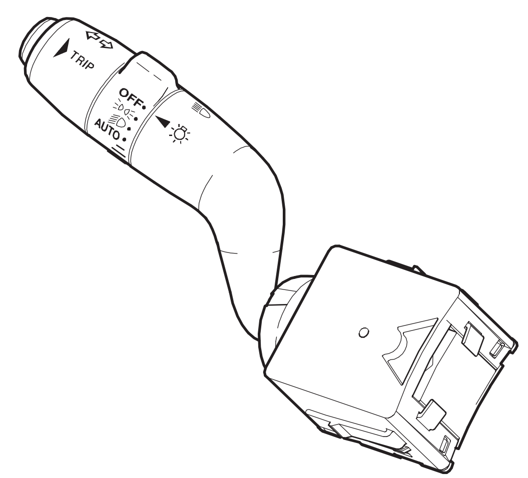
During normal operation the courtesy lights fade up and fade off.

EXTERIOR LIGHTING

Exterior lighting is activated by the main lighting switch assembly (the left-hand column stalk).

Exterior lighting inputs are decoded by the instrument cluster and broadcast as SCP messages to the REM and the FEM. The FEM activates all front exterior lighting circuits.

Main Lighting Switch



688JAG086

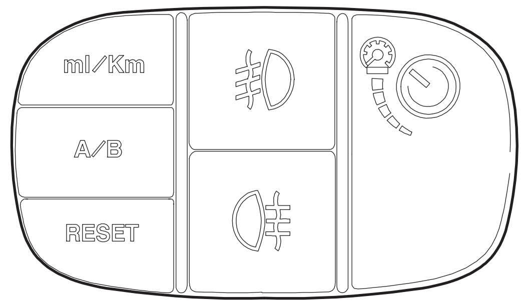
The left-hand column stalk is a multifunction switch assembly used to activate the following as appropriate:

- Side lights
- Low-beam headlight
- High-beam headlight
- Autolamps
- Turn signal indicator lights
- Exit delay

The LH column stalk switch also includes controls for the trip computer.

NOTE: The X206 has optional high-intensity discharge HID headlights, complete with automatic headlight leveling. For more information on this system, refer to the HID Headlights section.

Auxiliary Lighting Switch



688JAG087

The auxiliary lighting switch assembly comprises:

- Dimmer control
- Headlight leveling control (where applicable)
- Front and rear fog switches

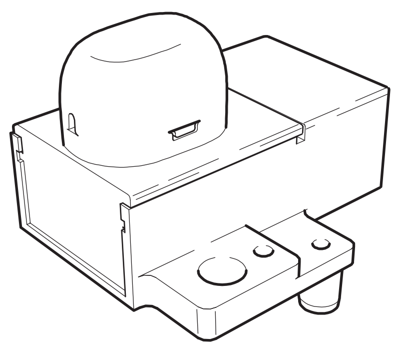
The auxiliary lighting switch also includes controls for the trip computer.

NOTE: To change the language setting in the instrument pack:

– Press and hold the ml/Km button while turning ignition to accessory position, then release button
– Press the TRIP button on the LH column stalk to scroll through language settings
– To exit, turn ignition off

Autolamps

The operation of the autolamps feature (where applicable) is dependent on ambient light levels, monitored by photo-diodes integrated into the sunload/light sensor.


688JAG088

The sensor provides feedback to the instrument cluster, which responds by supplying control signals on SCP to the FEM and REM that automatically control the operation of the side lights and low-beam headlights where appropriate, provided that:

- The ignition key is at position II or III
- The main lighting switch is set to the AUTO position

Since the autolamps operation depends on the sensor (which is located behind the defrost grill 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 lights to be activated.
- Detection of darkness for 2 seconds continuously will cause the low beam and side lights to be activated.
- Detection of daylight for 15 seconds continuously will cause the exterior lighting to be extinguished.

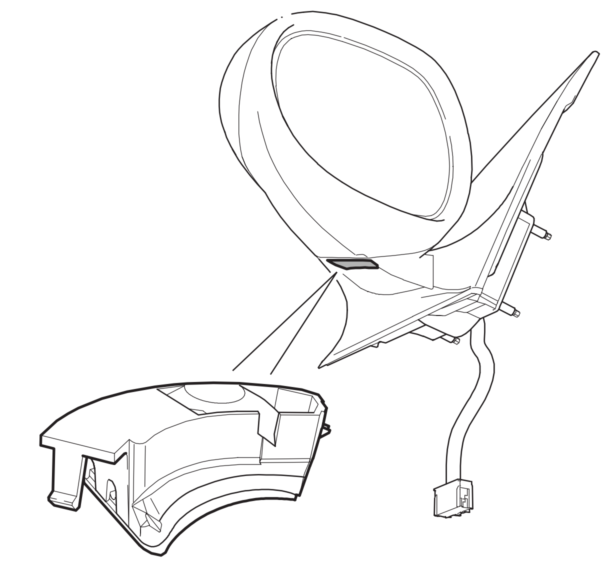
The Autolamp system has additional functionality for operation in conjunction with the wipers. If the wipers are switched on in slow or fast modes for more than 20 seconds when Autolamp mode is selected, the exterior lights will be switched on.

Exit Delay

The exit delay feature is controlled by the FEM and is activated when the ignition is switched off. The dip beam will remain illuminated for 10s, 30s, or 2 min, (depending on the position of the main lighting switch) or until the ignition key is turned to position ‘II’ (or the headlight convenience button on the keyhead transmitter is pressed).

NOTE: The feature will not function if the main lighting switch is set to AUTO.

Approach Lights


688JAG103

Approach lights are integrated in the exterior mirrors to provide ground illumination for the area around the front doors.

The approach lights 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 lights are activated when:

- Vehicle is unlocked using the key, the key transmitter or the master locking switch
- Headlight convenience button on the key transmitter is pressed
- Reverse is selected

Illumination is provided by a 5W bulb which is replaced as a complete light assembly. The lights are ‘handed’ accordingly to the relevant side of the vehicle.

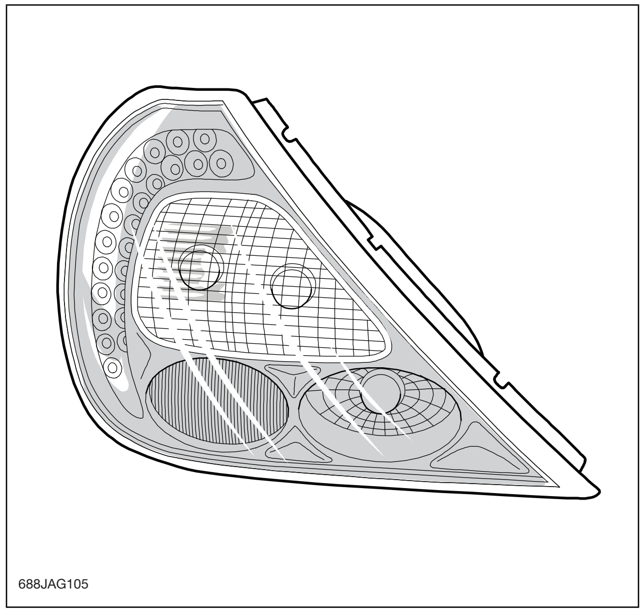
Removal of the light is carried out by first folding out the mirrors. The lower trim cover of the mirror is then removed with the ground illumination light. The light connector is ‘trapped’ between the mirror harness and the body of the mirror. Access to the connector is gained by repositioning the mirror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

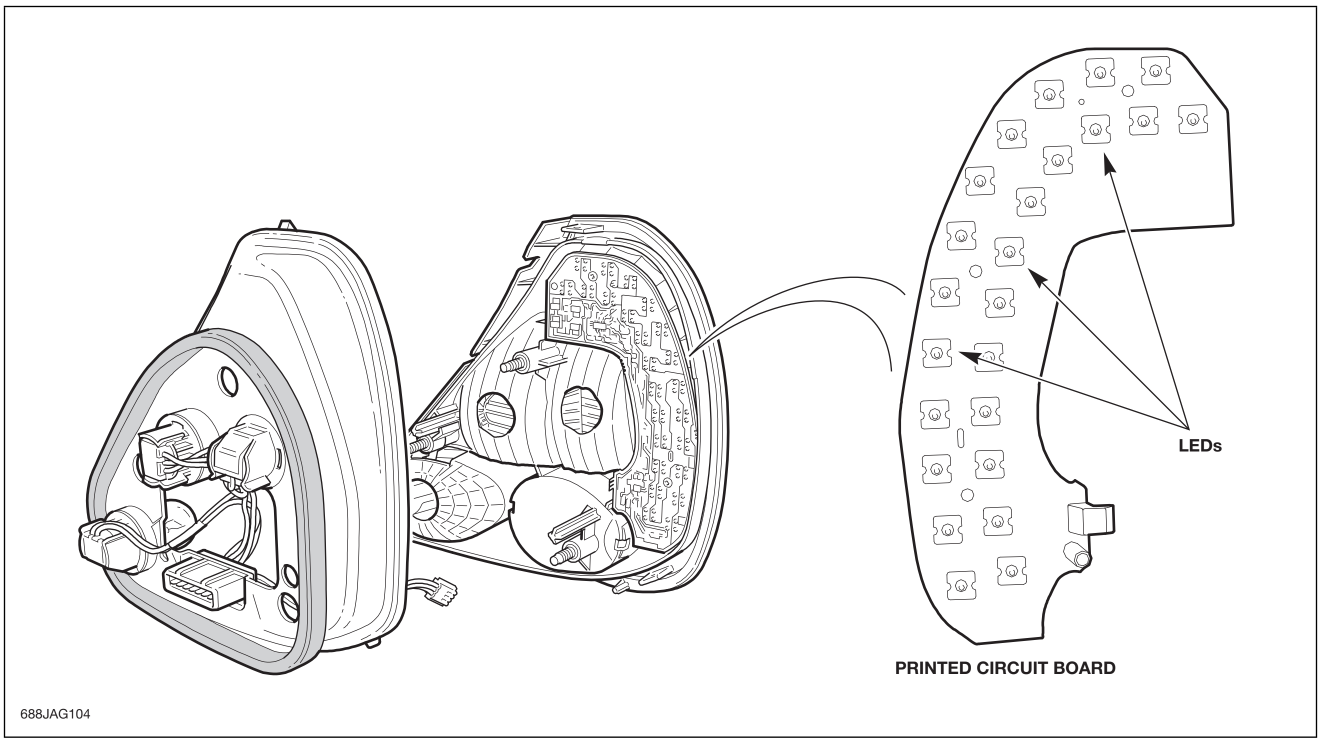
Rear Lights

The rear light assembly uses conventional tungsten bulbs for the turn signal, fog, and reversing lights. The tail and brake lights use a cluster of 24 light-emitting diodes (LEDs) mounted on a printed circuit board (PCB) in the light assembly.

Using LEDs instead of conventional tungsten filament bulbs provides the following advantages:

- Lower energy consumption
- Reduction in heat generated (allowing the distance between the lens and the light source to be reduced)
- Increased reliability and longer service life
- Constant light intensity over the life of the LEDs
- A faster operational response time – approximately 130ms for the LEDs compared with 210ms for a conventional bulb



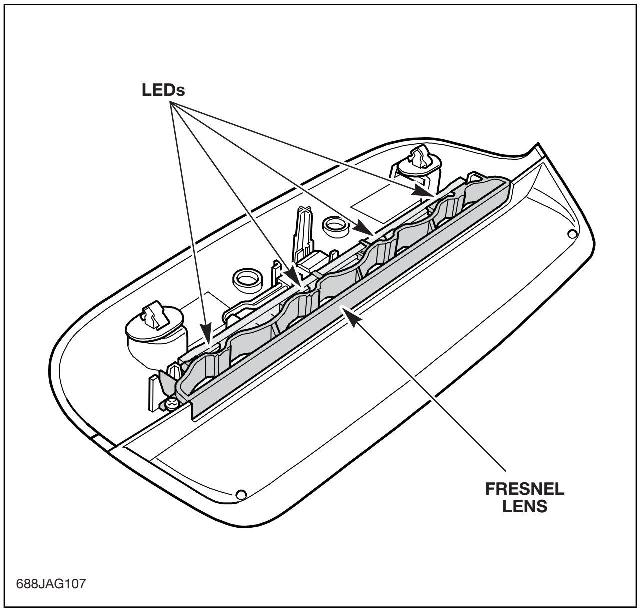


NOTE: The LEDs can be replaced only as a complete PCB assembly. The LEDs are arranged in 6 banks of 4 each; when one bank of 4 fails to operate, the PCB must be replaced.

All 24 of the LEDs illuminate for operation of the tail and brake lights, with the intensity of the LEDs varied to distinguish between the two. During operation of the tail lights, the LEDs are supplied with reduced power, so that they illuminate at a reduced intensity. During brake light operation, the LEDs are supplied with increased power and operate at a higher intensity.

High Mounted Brake Light

The high mounted brake light also uses LEDs and operates in synchronization with the brake lights.



Daytime Running Lights

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

- The ignition is in the RUN position
- The headlight 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 headlights are illuminated by a pulse width modulated (PWM) signal, on the vehicles fitted with halogen headlights (when the average voltage exceeds 14V). Vehicles with high intensity discharge (HID) headlights operate the dip beam at normal supply voltage.

The front park lights (including front side markers) and low beam lights are illuminated from the FEM; the rear park lights (including the rear side markers and the license plate lights) are illuminated by the REM.

The daytime running lights 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 lights interact with the following components:

- Instrument cluster
- FEM
- REM
- Electronic parking brake (EPB).

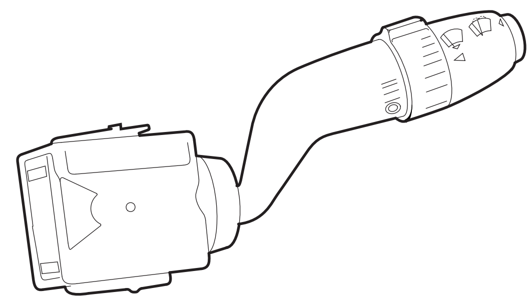
NOTE: On Canadian specification vehicles, DRLs are not touch-screen programmable. On all other NAS vehicles, the DRLs can be programmed using the touch-screen.

WIPERS

Wash/Wipe System

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

Wash/Wipe Switch Inputs



688JAG095

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.

Intermittent Wipe

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

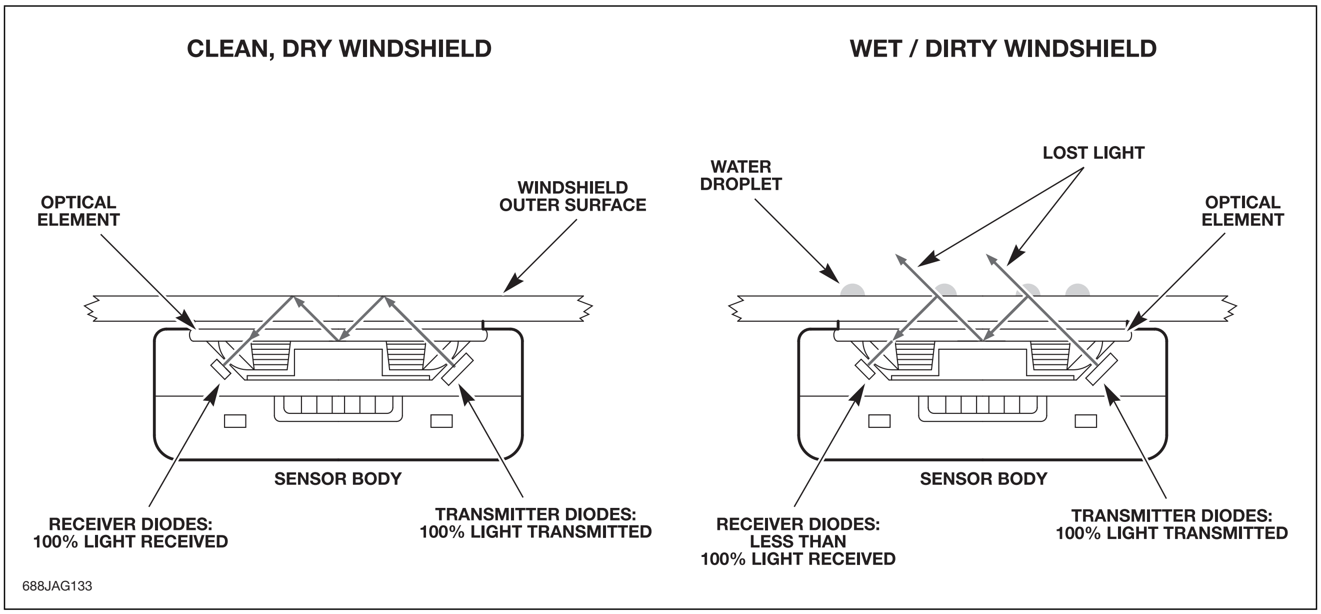
Rain Sensing (Optional)

The rain sensing module, located in the center of the windshield, has a 3-wire circuit in parallel with the RH column stalk switch circuit. If AUTO and INTERMITTENT are selected on the column stalk switch, the module will activate the windshield wipers when rain is sensed on the windshield.

System 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 facing outwards through the glass. The sensor elements consist of two groups of light emitting diodes (LEDs), 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 transmitted to the FEM.



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 FEM. The FEM therefore does not recognize the difference in wiper speed requests between the manual controls and the rain sensor signals.

NOTE: Because a dirty windshield appears the same as a wet windshield to the rain sensor, unexpected wiper action on a dry windshield is possible and is not a fault.

Before performing any repairs for customer concerns of unintended wiper movement, ensure that the wipers were not on ‘AUTO’ when the event occurred.

POWER FRONT SEATS

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 airbags in isolation. Refer to GTR for detailed Removal and Installation instructions.

Two variants of driver and passenger seat are available: 12-way sports and 16-way luxury, each available in 3 trim styles: Comfort, R and VDP. The front seats are equipped with the following:

- Seat control switches (seat mounted)
- Front seat cushion front height adjustment
- Front seat cushion rear height adjustment
- Front seat backrest adjustment
- Front seat head restraint adjustment
- Lumbar adjustment
- Front seat forward and backward adjustment
- Side airbag module
- Front seat backrest heating
- Front seat cushion heating
- Extendible seat-cushion (luxury variant only)
- Seat memory switches (door mounted)
- Seat heating and cooling (X358 only)

In addition to the standard front seat functionality the 16-way high level front seat incorporates:

- A 4-way lumbar support assembly
- An extendible seat cushion
- Head restraints with video display (optional)

The driver and passenger seats are nearly identical except that the driver seat has a seat-track position sensor and the passenger seat has a weight-sensing system. These 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 unit; refer to GTR.

NOTE: For more information about Occupant Protection and Occupant Classification Systems please refer to the appropriate service manual on GTR.

The electrical functions can be operated by the front seat control switch. The driver seat memory position is stored by the driver door module (DDM) using the memory switch pack mounted in the driver door trim. The driver seat can be programmed for up to three different driver seat memory configurations. The seat memory switch located in the driver door trim, can also be used to retrieve the programmed memory configurations.

NOTE: The DDM communicates with the driver seat module for seat memory operation via SCP network.

Seat Memory Function

The DDM can store up to three different driver seating, mirror and steering column positions. The three, numbered memory and single memory store switches control memory storage and recall operations. Each switch is a momentary action push switch.

Memory Recall

Memory recall has three memory positions stored for the seats, steering column, pedals and exterior mirrors. The switches for this function are located within driver's door trim panel. Pressing the appropriate numbered memory switch allows the seat to start moving to the position appropriate to that memory.

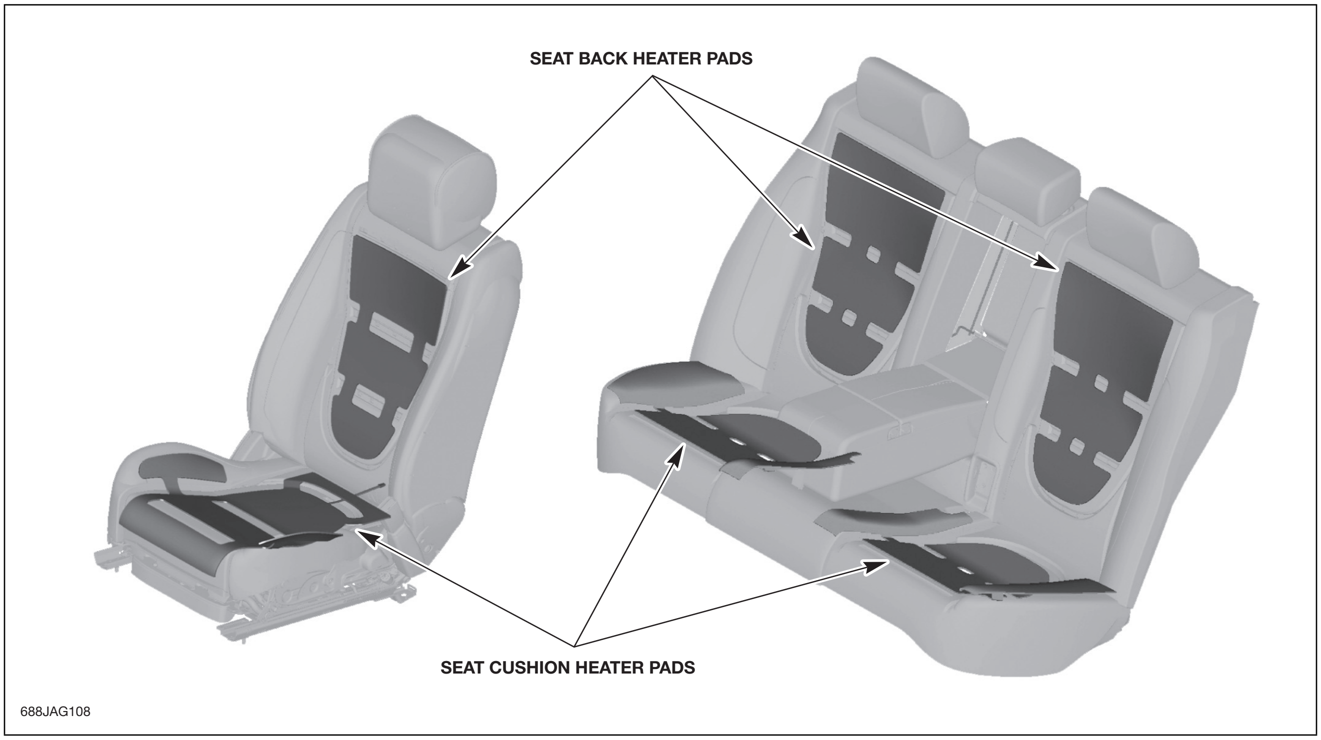
The following procedure will store a memory position:

– Ensure the ignition key is in
– Ensure reverse gear is not engaged
– Manually adjust the seat to the desired position, using the seat switches
– Press and release the 'memory store' switch
– Press and release the desired numbered memory switch within 5 seconds

A single chime will be emitted from the instrument cluster to indicate that the store operation has been successful.

Heated Seats

The heated seat system is available on all the seats except standard rear seats.



The heated seat system comprises:

- Heated seat switches
- Backrest heater pad
- Cushion heater pad and thermostat
- FEM
- REM heated rear seats when fitted)

The FEM controls the seat heating function by providing the appropriate response depending on the status of the heated seat switches. The heated seat functionality is constantly monitored by the electronic load management system (ELMS). The ELMS dictates that in circumstances where the generated electrical power is less than the electrical consumption, selected systems may be inhibited or operated using reduced power for as long as is necessary.

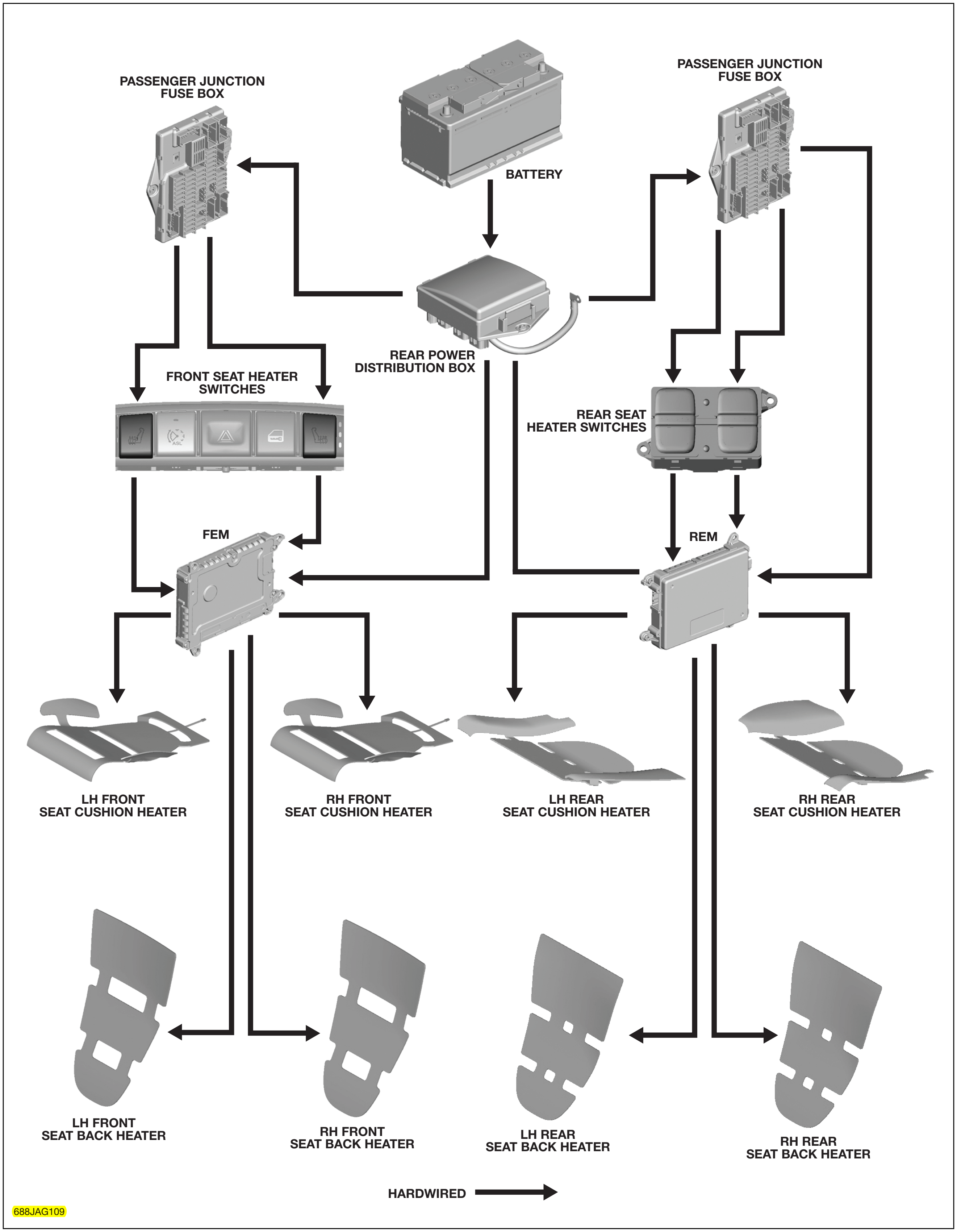
With the ignition in the 'ON' position, pressing a heated seat switch will select the maximum heat setting for the chosen seat and is confirmed by three illuminated light emitting diodes (LED) next to the switch. A second press selects the intermediate heat setting and two LEDs are illuminated next to the switch. A third press selects the lowest heating setting, and one LED is illuminated. A fourth press will deactivate the heated seat.

If the heated seat function has been activated, it will continue to operate until one of the following conditions is met:

- A fixed period of time has expired (10 minutes)
- The function is deactivated by pressing the heated seat switch for a fourth time
- The ignition key is turned to the 'ON' position
- A malfunction is detected by the FEM

The heated seat function is designed to operate at temperatures below a predetermined limit and operation may be inhibited by a heated garage, body heat or warm ambient temperatures.

Heated Seats Control Diagram

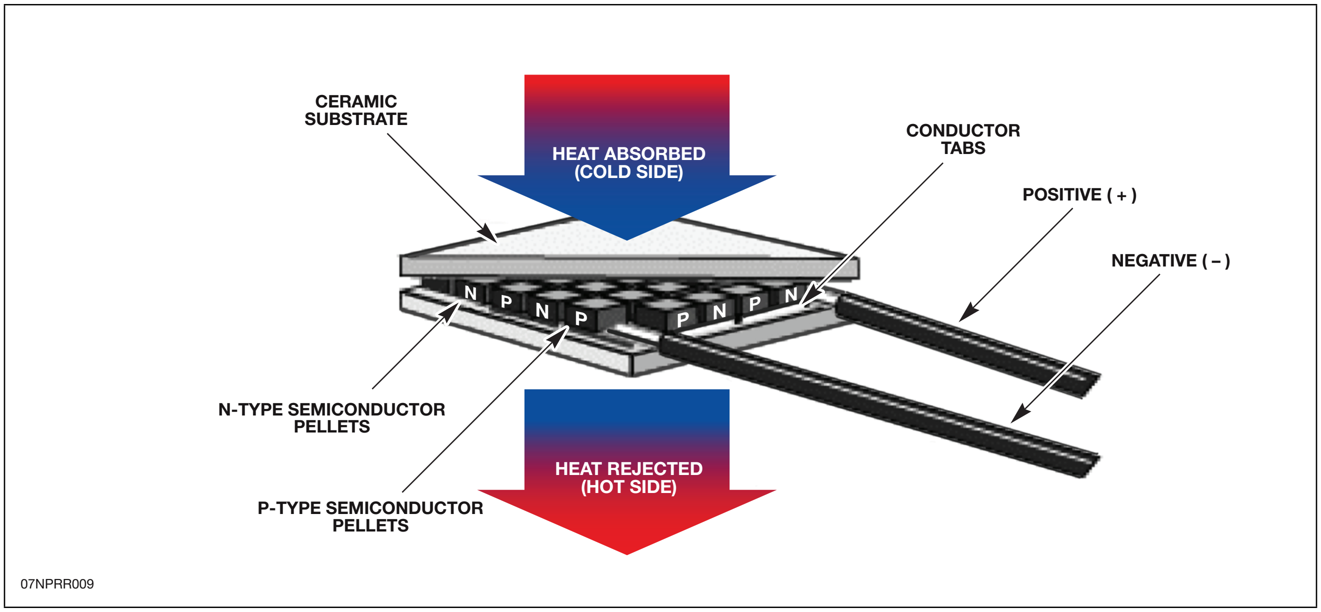


Climate Controlled Seat™ System

Vehicles fitted with the optional Climate Controlled Seat™ (CCS) System significantly improve the comfort level of the occupants by focusing the cooling directly on the passenger through the seat. The CCS system uses a Peltier cell, also known as a proprietary thermoelectric device (TED), to provide individual heating and cooling to the front seat assemblies. Named for Jean Peltier, who discovered the thermoelectric cooling effect in 1834, the Peltier effect occurs when an electrical current is passed through a junction formed by two dissimilar conductors, creating a heat pump. A heat pump absorbs heat from one side of the system, causing it to cool, and then transfers the heat to the other side, causing it to warm.

The 2008 MY XJ uses a solid-state Peltier cell that consists of a number of semiconductor elements, sandwiched between two substrates and connected in series and parallel. When voltage is applied in one direction, one side absorbs heat (creating a cooling effect) while the other the cell rejects heat. Switching polarity between the circuits creates the same effect but in the opposite direction.

Peltier Cell Operation



The operation is similar to a conventional air conditioning system; one cell acts as the evaporator and absorbs heat while the other cell is the condenser which rejects the heat. The pump is replaced by an electrical charge and the heat energy is transported by the cell's metal construction rather than by a refrigerant.

It is important to understand the operation and limitations of the Peltier cell. A Peltier cell has an efficiency of only 5 – 10%, compared to a conventional air conditioning system with an efficiency of 40%. The cell is capable of cooling the incoming air by approximately 8°C (12.4°F), which means that temperature output will depend on the ambient temperature inside the vehicle.

Example: If the temperature in the vehicle is the same as or exceeds the heat rejection side of the cell, poor cooling will be the result. If the temperature is colder than the heat absorption rate, the cell may start to ice up

Benefits of using Peltier cells:

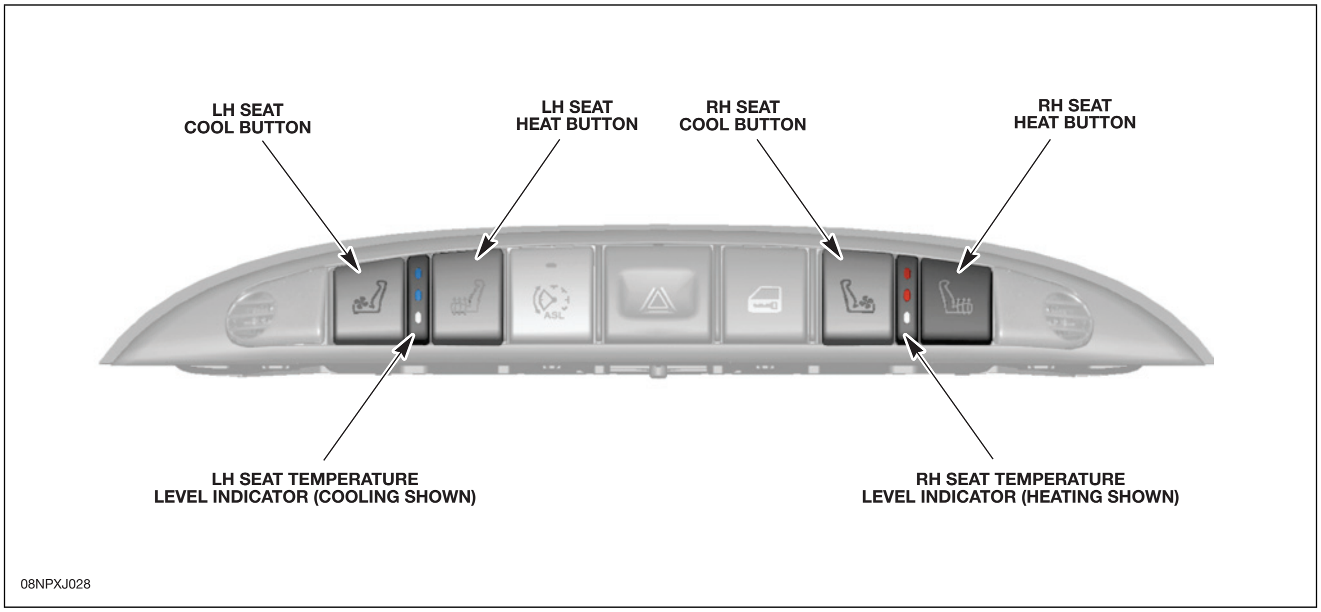
- Ability to cool or heat by simply reversing current flow
- Solid-state device, no moving parts
- Rugged, highly reliable
- Quiet, small & lightweight
- Pulse width modulated with feedback for accuracy
- Environmentally safe

Component Description

Temperature Control Switches

CCS adds additional temperature control switches located in the instrument panel switch pack above the touch screen display (TSD). There are separate switches for heating or cooling.

The switches are momentary contact non-latching. The electronics in the switch pack capture switch presses and step through the three levels of heating or cooling. The temperature level indicators light up either red or blue to show the selected level of heating or cooling. The internal electronics in the switch pack then output a steady PWM signal representing the selected heating or cooling level to the Climate Control Seat Module (CCSM).

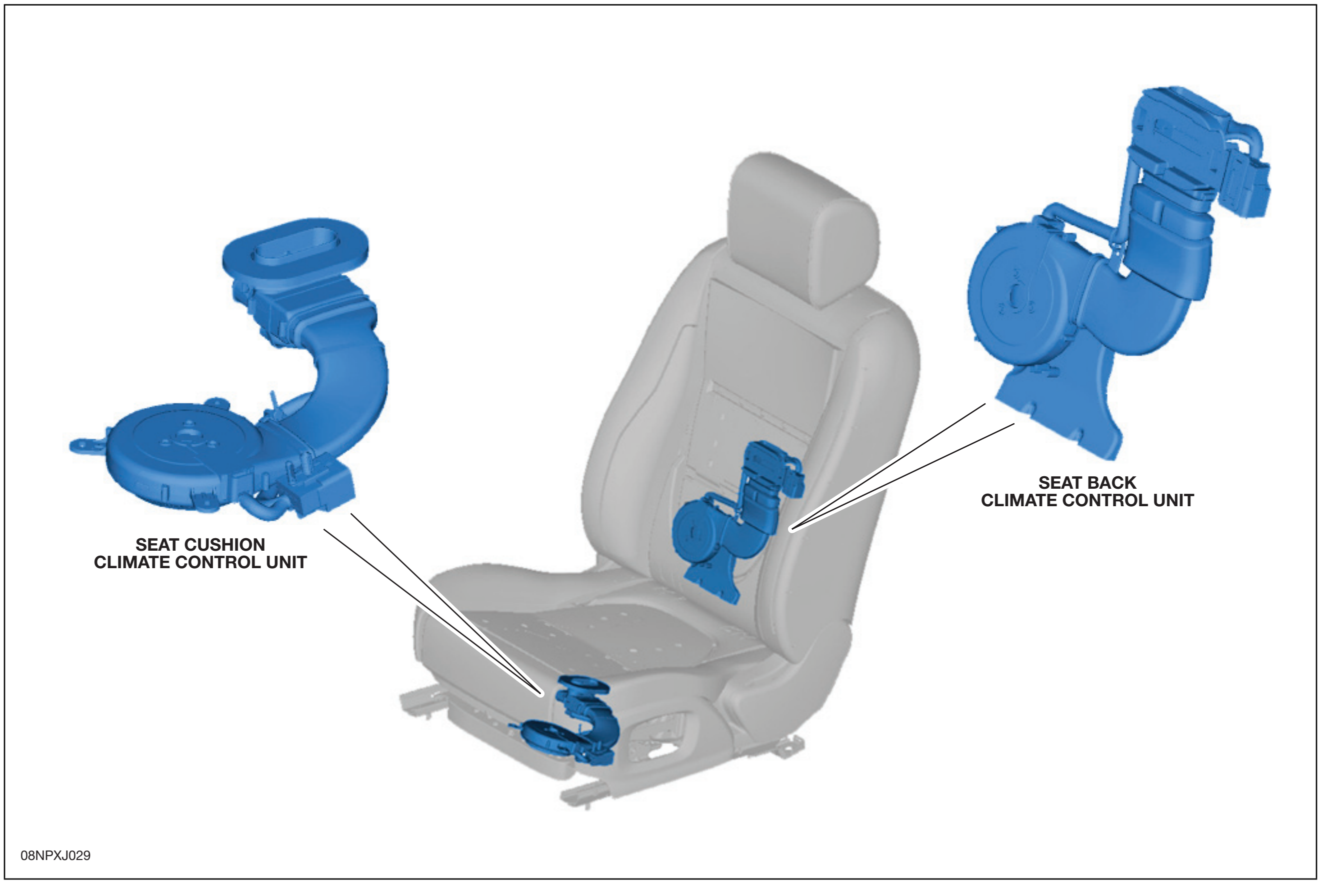


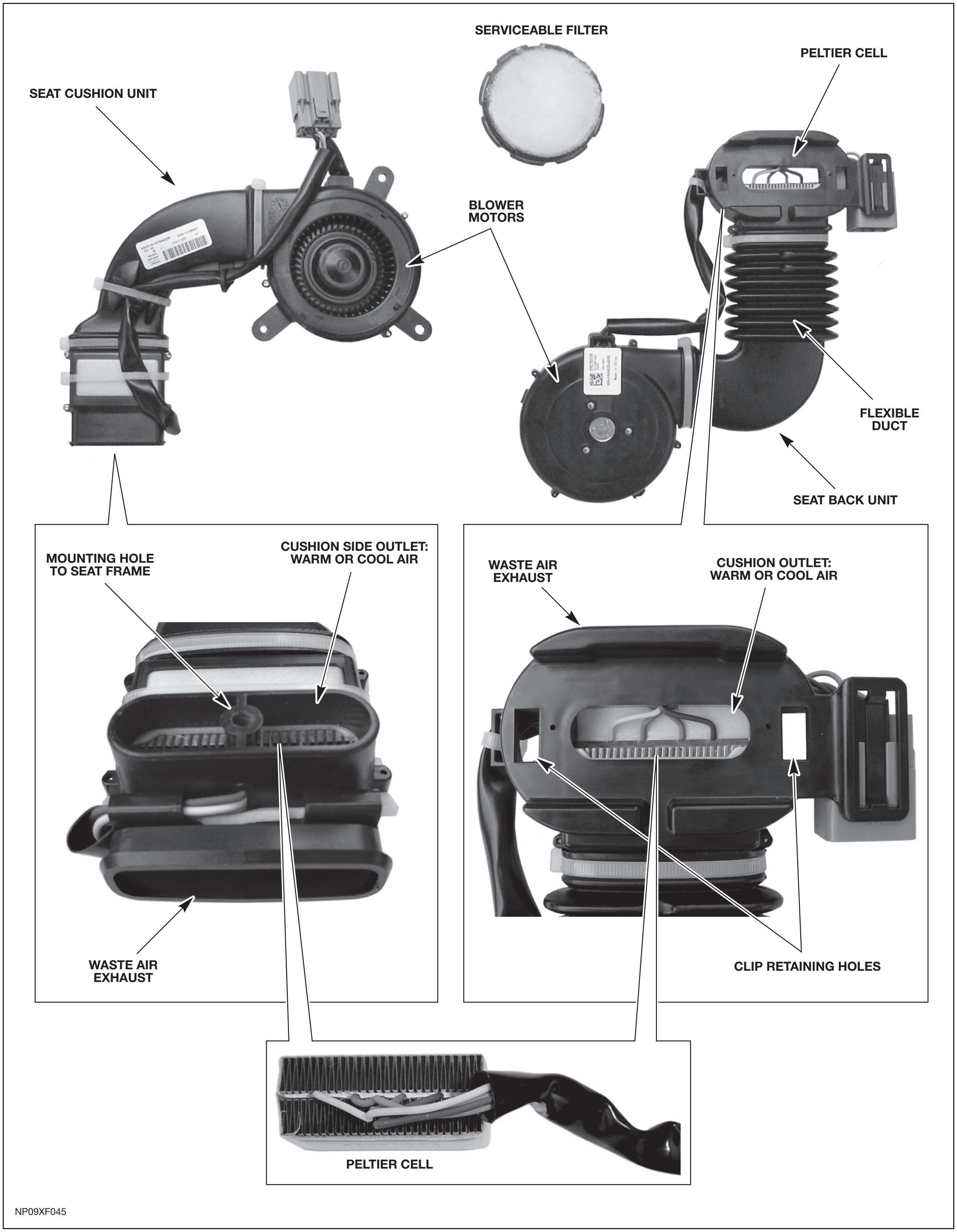
When one of the heating or cooling settings is selected, filtered ambient air is circulated by a fan, forcing the air through a Peltier cell, where it is thermally conditioned.

Due to electrical loads, if the CCS system is activated with the key on / engine off, the lights will illuminate on the dash, but the system will not operate.

Climate Units

Each seat contains two climate units, one located in the seat back and the other in the seat cushion. Each contains a filter, blower fan, Peltier cell and an air duct. They are serviced as a complete unit with the exception of the separately serviceable filter. Ported channels in the foam cushions evenly direct the flow of conditioned air through breathable perforated leather seat covers to the occupant. Both the cushion and seat back cool or heat at the same time and cannot be controlled independently.




SERVICEABLE FILTER
PELTIER CELL
SEAT CUSHION UNIT
BLOWER MOTORS
FLEXIBLE DUCT
SEAT BACK UNIT
MOUNTING HOLE TO SEAT FRAME
CUSHION SIDE OUTLET: WARM OR COOL AIR
WASTE AIR EXHAUST
CUSHION OUTLET: WARM OR COOL AIR
WASTE AIR EXHAUST
CLIP RETAINING HOLES
PELTIER CELL

NP09XF045

Principles of Operation

The CCS system is completely independent of the heating and air conditioning system. The existing automatic temperature control module does not control any aspect of CCS operation; the controlling software is contained within the Climate Controlled Seat Module (CCSM) located behind the left side of the instrument panel above the adaptive cruise control module (when fitted).

The CCSM is on the high speed (HS) CAN network, as it requires information from other modules for operation, such as engine RPM. The CCSM requires an 'Engine Running' message to allow system operation as well as an 'enable' message from the Engine Control Module (ECM).

In order to preserve battery and electrical system functionality, the ECM will reduce or even disable system operation based on total vehicle electrical loads. For example, when a request is made for cooling or heating, the ECM uses an electrical load management strategy to determine the available current and regulates power to the cells as it becomes available. During a high demand or electrical load (rear defroster, A/C, wipers, etc.) the ECM will regulate the power to the Peltier cells to prevent potential overloading of the electrical system. The CCSM uses a PWM signal to regulate the temperature of the Peltier cells and a variable-voltage for the speed of the blower fans in order to maintain the selected temperature. Fan speed may increase or decrease slightly while on a specific setting as the controller regulates system output temperature.

The CCSM logic applies a series of steps when the system receives a command. The steps vary depending on the mode selected and whether the cells are hot or cold. The CCSM powers up the cells with minimum air flow to set the cell temperature, and then the module steps up the blower speed to ensure the correct temperature is achieved quickly.

Heat Mode Operation

The CCSM operates in a closed loop control mode, using the feedback from the system thermistor. In heat mode, the Peltier cells are wired in parallel with nearly full battery voltage across each cell when first turned on. The CCSM monitors the NTC fin temperature sensors and adjusts the PWM duty cycle to the Peltier cells while also varying voltage to the blowers to achieve and maintain the temperature set point. The air flow from the blower is split over both sides of the cell, half going into the seat cushions and the other half released as waste. If either blower fails or the cells start to overheat, the CCSM will shut down both assemblies in that individual seat for protection.

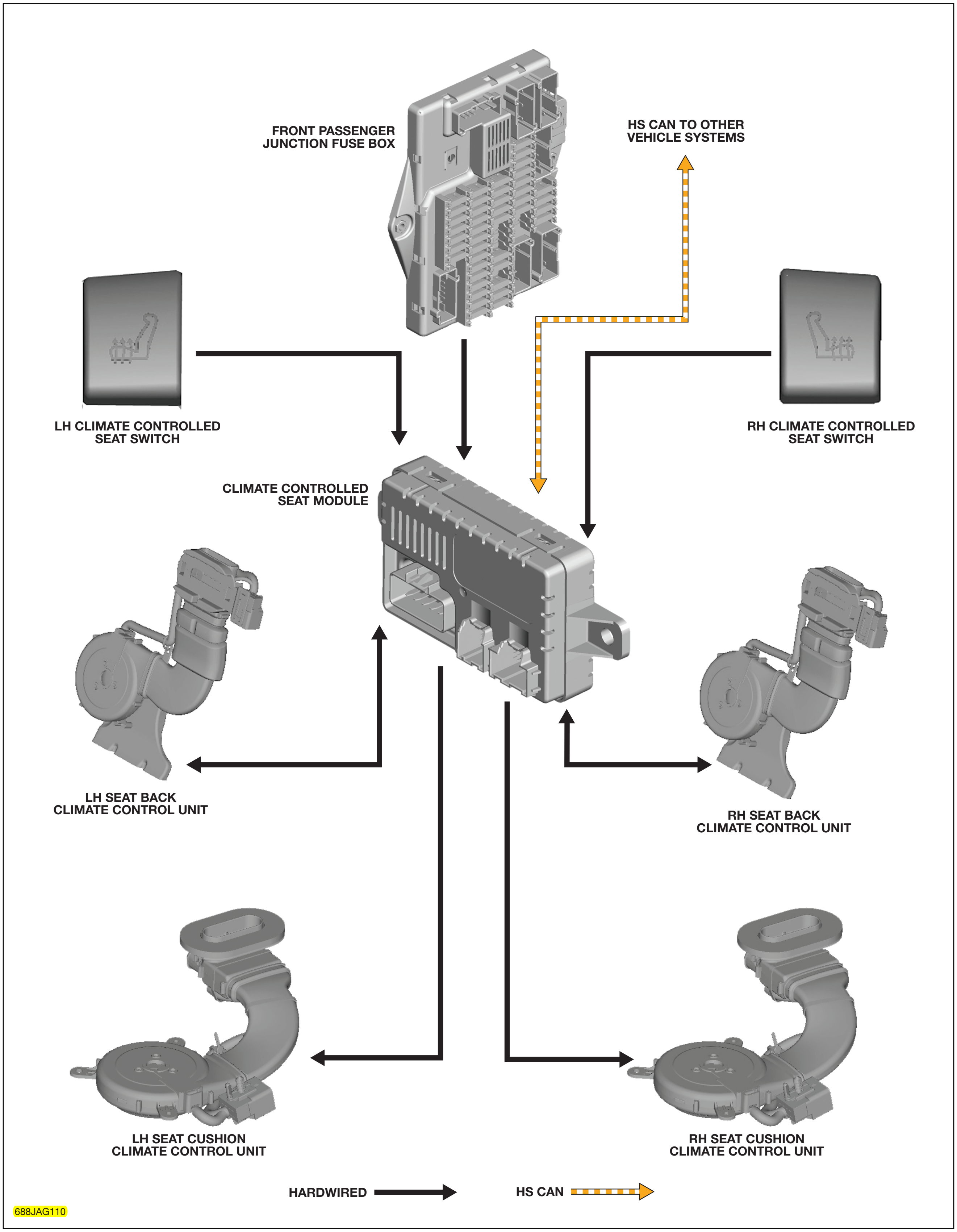
Cool Mode Operation

The CCSM operates in an open loop mode. In cool mode, the Peltier cells are wired in series, with each cell supplied with half the battery voltage during initial startup.

The difference between heat and cool modes is in the way the system is controlled. The CCSM monitors the fin temperature to ensure that the system is working properly with no PWM adjustments to the Peltier cells.

For example, if the CCSM sees the fin temperature on the cells getting very cold to a potential ice up condition, it will turn off the cells for approximately 4 seconds, until the temperature stabilizes, then restart. During this process the blower speed will cycle from low to high, which may be noticeable to the user. This is considered normal operation if there are no codes stored in the CCSM.

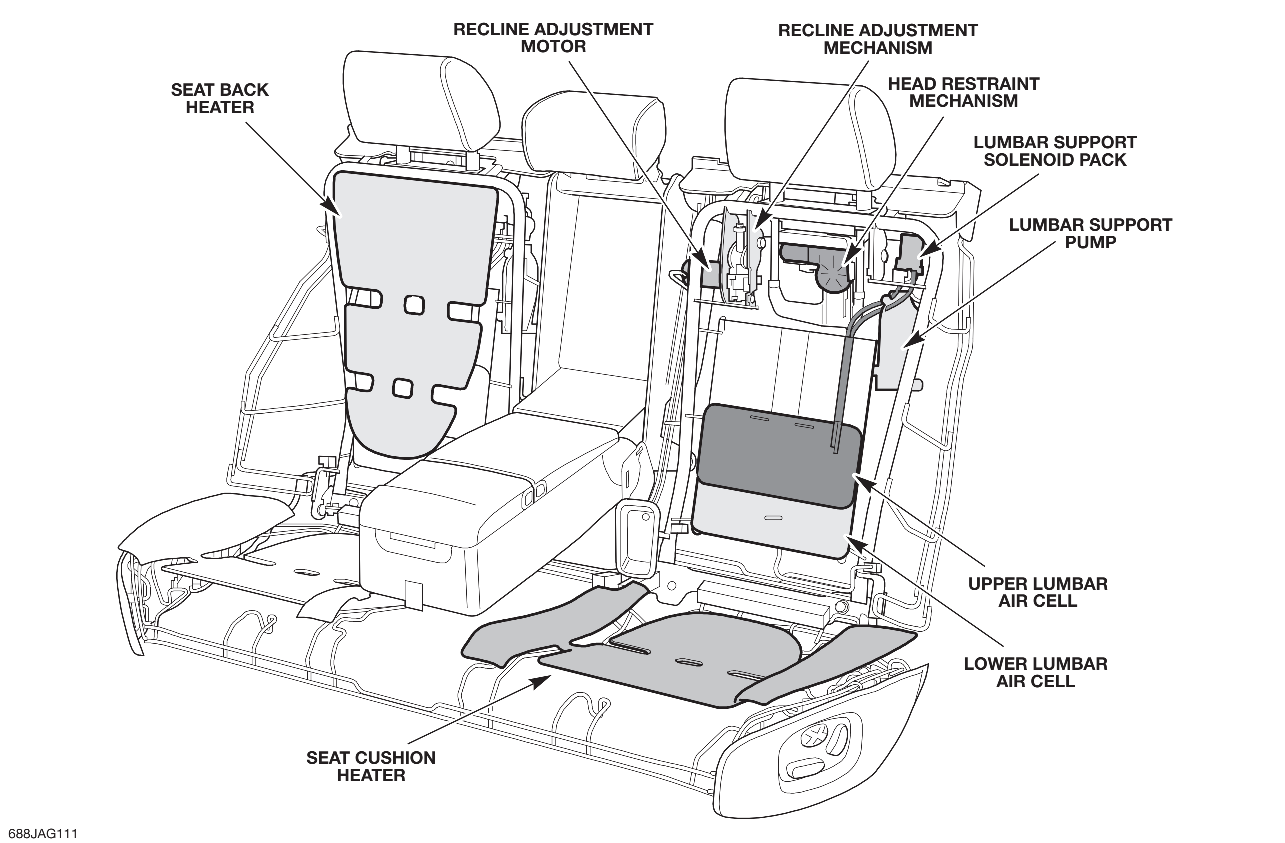
Climate Controlled™ Seats Control Diagram

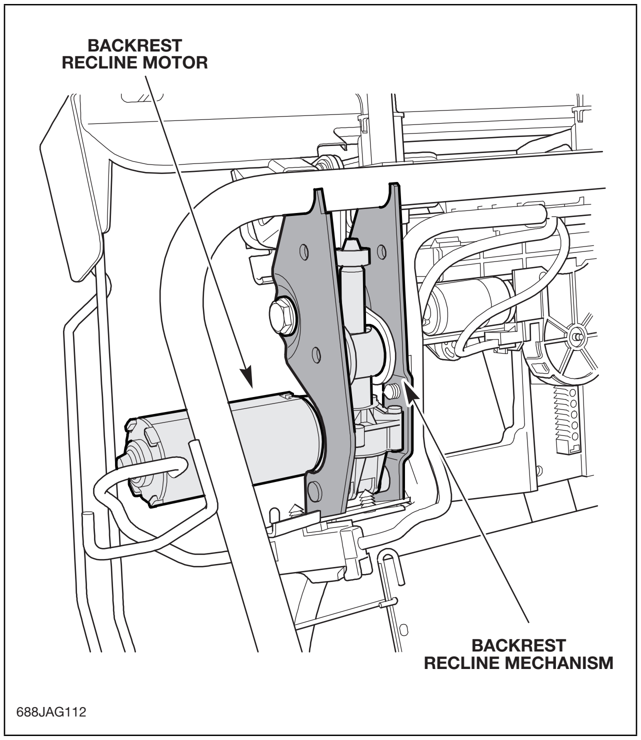


POWER REAR SEATS

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

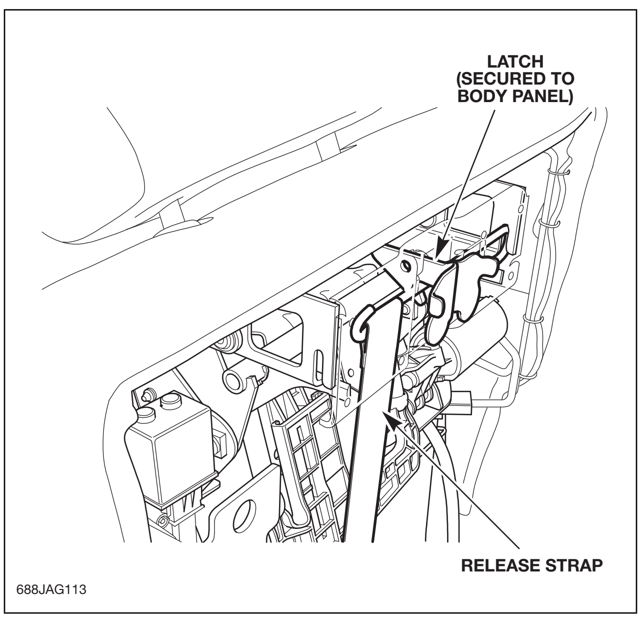
The adjustment functions can be operated by the rear seat control switches, and the rear outer seat backrest memory positions can be stored by the rear memory module (RMM), located behind the rear seat back. The rear outer seat backrest/headrest can be programmed for up to three different seat memory configurations. The seat memory switch located within the rear door trim panel can be used to retrieve the programmed memory configurations.





Backrest Release Mechanism

Access for service purposes is achieved by unlatching the backrest using a release strap. The strap is accessible once the seat cushion has been removed.

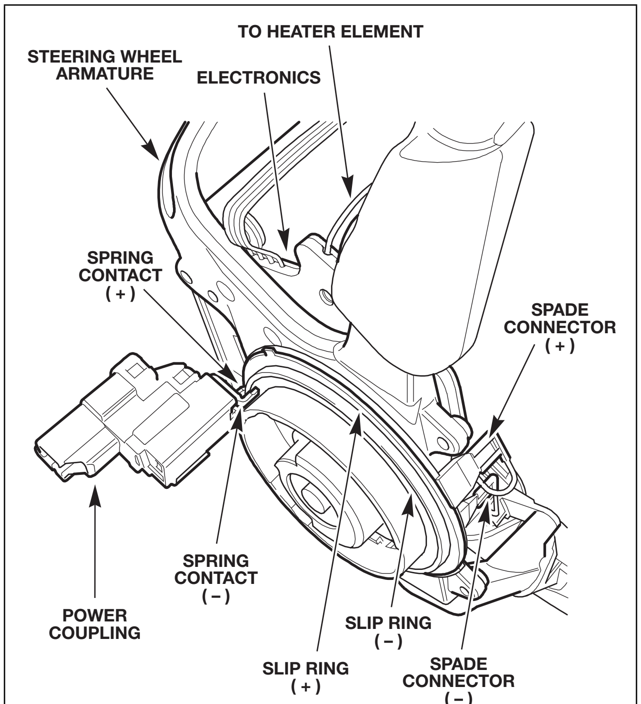


ELECTRICALLY HEATED STEERING WHEEL

The steering wheel heater, where installed, is activated when the driver seat heater switch is operated. The switch provides an input to the front electronic module (FEM), which responds by supplying an output signal via the clockspring contacts to the heated steering wheel (HSW) electronics.

The HSW electronics receive supply voltage via the power coupling and slip rings. The power coupling, which attaches to the clockspring, comprises two spring contacts that interface with the HSW electronics, to ensure power and ground connections are maintained.

The HSW electronics control the operation of the heating element in response to a thermostat within the steering wheel to maintain a surface temperature of approximately 30°C (86°F).



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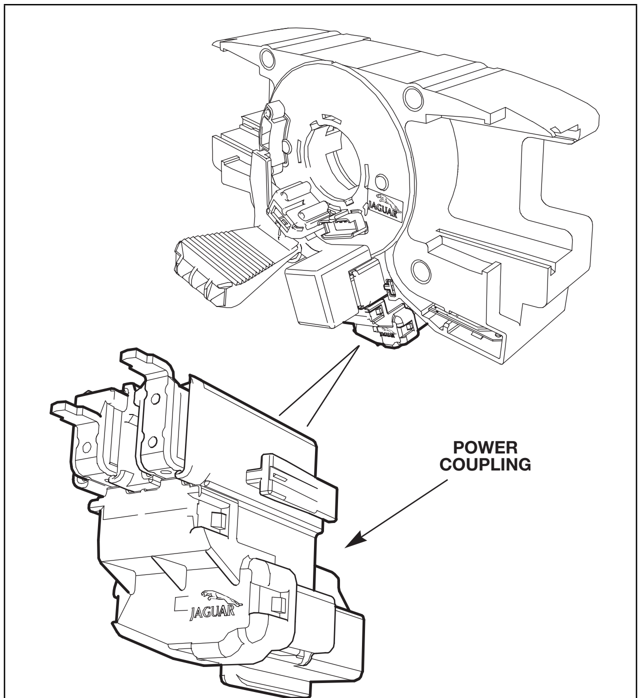


688JAG115

STEERING COLUMN MOVEMENT

The instrument cluster (IC) controls steering column movement.

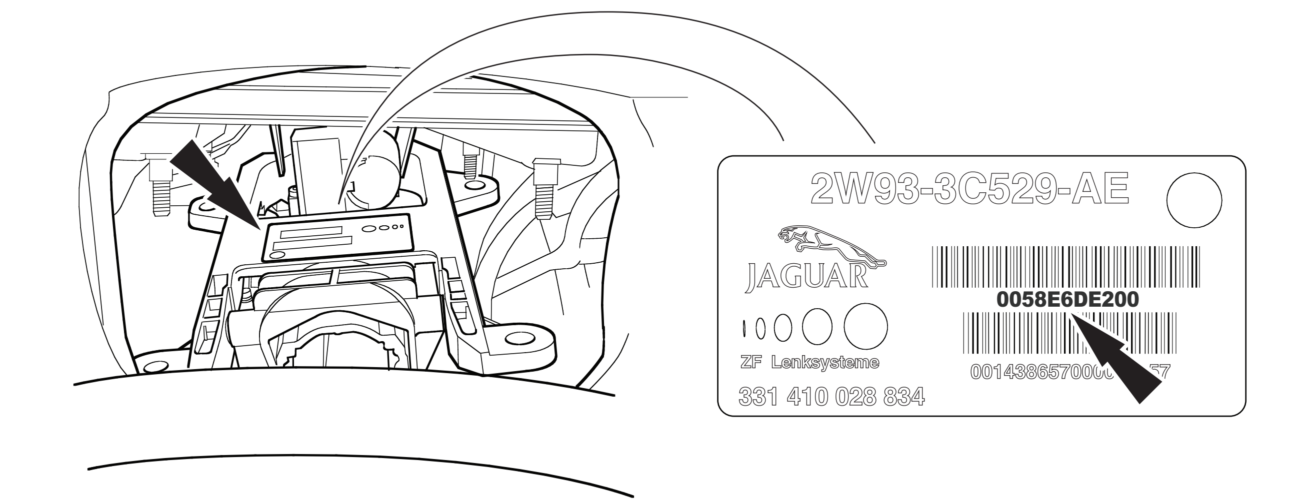
- Control switch is hardwired to IC
- Column movement is controlled by one motor and two solenoids, all hardwired to the IC
- Memory recall is held in driver door module
- Memory position held in IC
- Memory messages via SCP network

Steering Column Replacement

Column replacement or instrument cluster replacement/ programming requires digits from the 11-digit steering column barcode. Digits 3 – 10 of the code are used.

On vehicles from VIN G30286, the barcode is located on a label affixed to the RH wheel well wall panel under the trunk floor trim. On vehicles earlier than this VIN, the barcode is on the steering column; removal of the column is required to access the barcode.

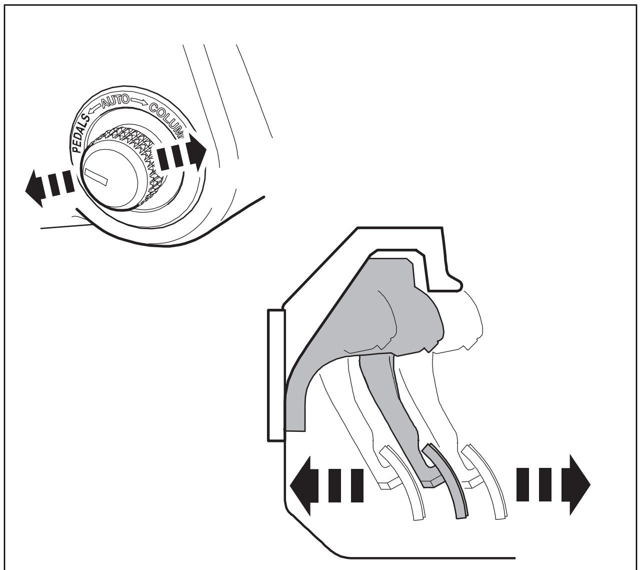
When installing a replacement column, affix the new barcode label (supplied with the column) on the RH wheel well, covering the old one.



688JAG139

PEDAL ADJUSTMENT SYSTEM

The pedal adjustment system is an optional installation, designed to allow drivers to improve their driving position. It is only available as part of the memory package (seats, mirrors, steering column). The system provides a range of adjustments up to a maximum of 70mm (2.75 in) and controls all of the pedals together (2 or 3, depending on specification).



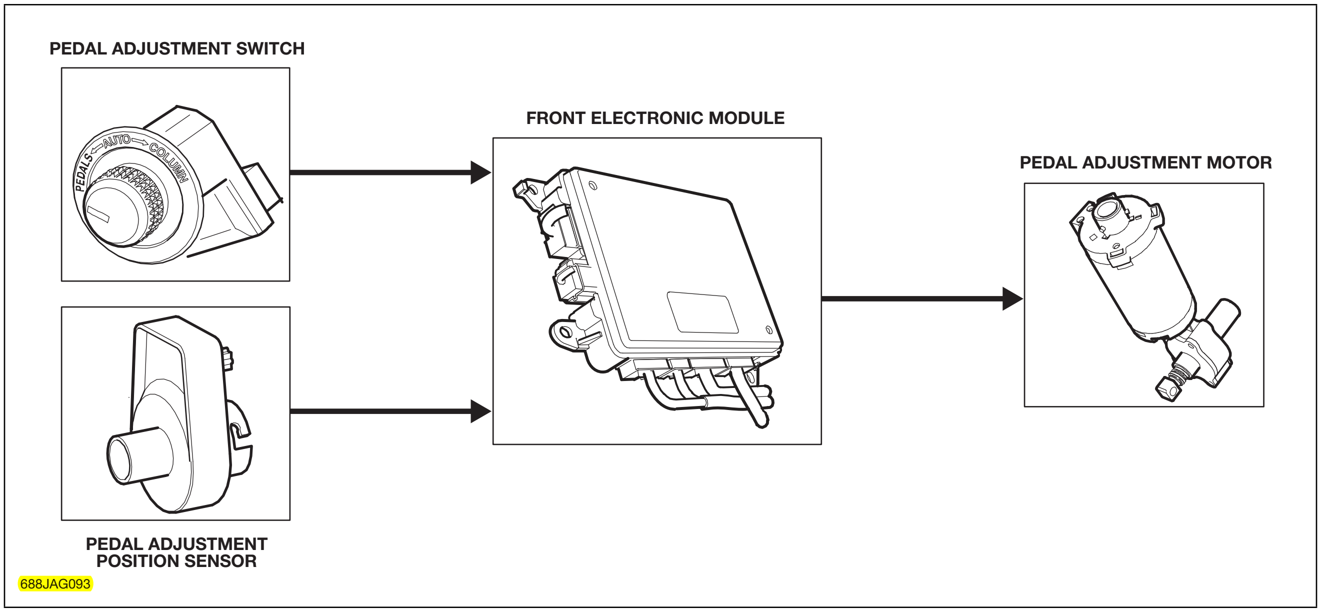
688JAG094

The pedal adjustment system comprises:

- Front electronic module (FEM)
- Pedal adjustment motor
- Pedal position sensor
- Pedal adjustment switch

Pedal adjustment is enabled by setting the 3-way rotary ‘joystick’ switch (located on the LH 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.



The FEM 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)

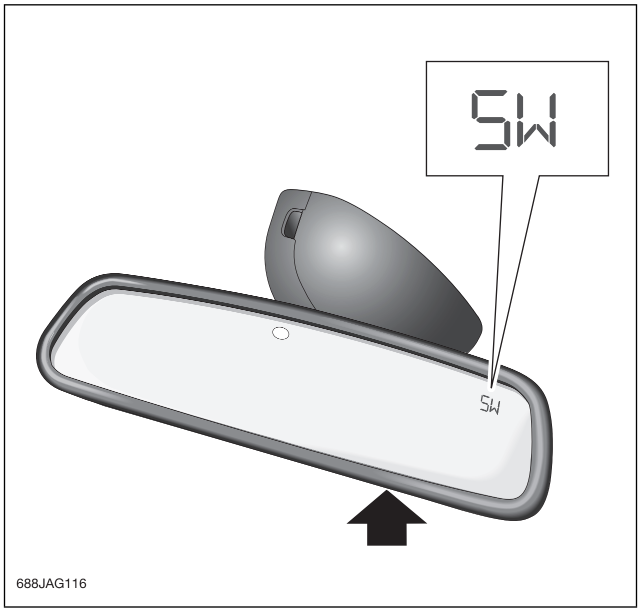
The pedal adjustment system:

- 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 GTR.

NOTE: Diagnostics should be performed using IDS.

MIRRORS

Rear View Mirror with Compass



- Compass not available with navigation
- 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

NOTE: If ‘C’ is displayed in the compass display window, the compass will require calibrating.

The compass recalibrates itself every 20 minutes in order to remain accurate as the vehicle is traveling. This should reduce the necessity to change the zone setting as the vehicle moves through the zones and also reduces the potential inaccuracy caused by magnetic interference.

The heated front windshield is a source of magnetic interference. To reduce the possibility of the compass calibrating itself to this, heated windshield operation is timed for four minutes. This ensures that the calibration of the mirror does not coincide with the heated windshield 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 recalibrated. This can be done by:

- Continuing to drive the vehicle for a minimum of 20 minutes so that the mirror recalibrates itself.
- Reentering the correct area Zone into the mirror and following the calibration procedure

Calibration Procedure

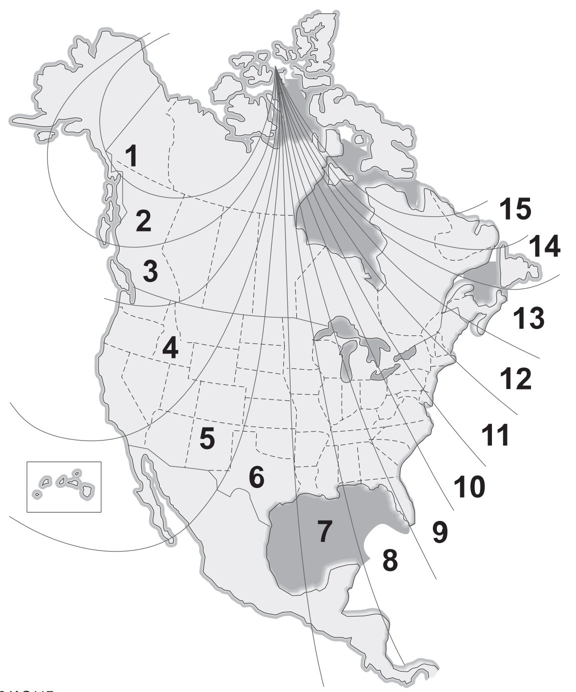
Drive the vehicle in a circle below 5 mph (8 km/h) until the compass displays a compass bearing. The compass is recalibrated once the vehicle has completed a full circle.

Zone Setting

If the wrong zone has been entered, the compass may display the wrong compass bearing. To manually change the area zone:

– Press and hold the 'COMP' button (indicated by the arrow in the illustration) for 3 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.

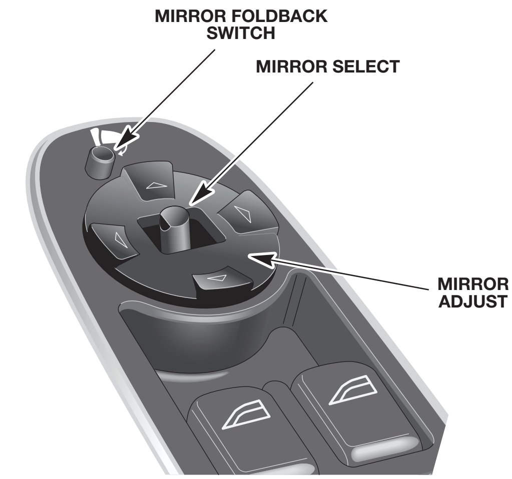


688JAG117

Fold Out Mirrors

Folding side mirrors are available on the X358 as follows:

- Available as an option
  – Control switch in driver door switch pack



688JAG118

- Auto mirror fold available (can be disabled from the navigation screen menu or IDS)

Side Mirror Reverse 'Dip'

The passenger door mirror will 'dip'.when reverse gear is selected, allowing for better visibility when reversing.

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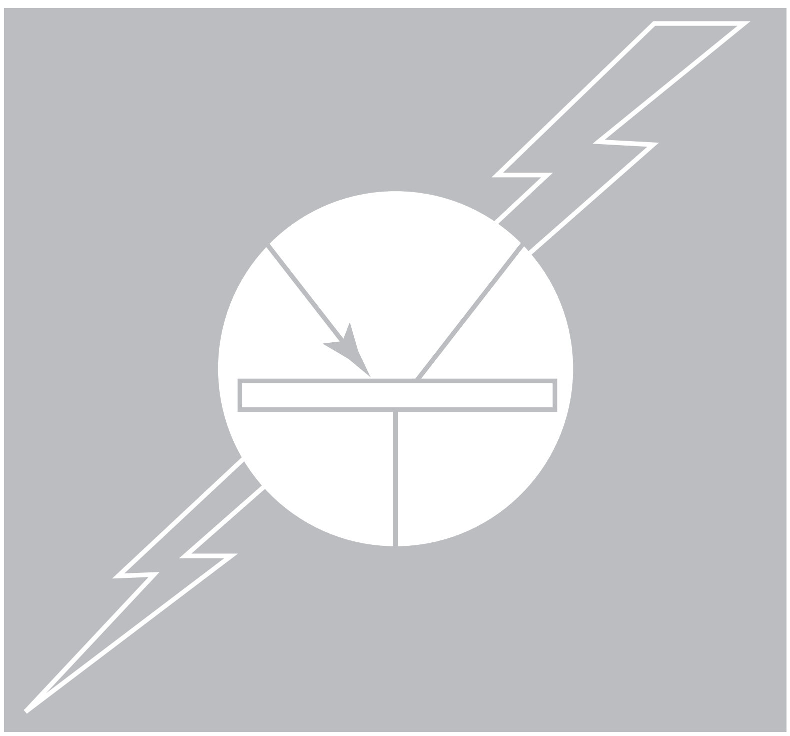
Technical Training
Electrical Systems

688-JAG: Advanced Electrical Systems and Diagnostics



X150 Body Electrical Systems

JAGUAR

688-JAG 09/2008
Printed in USA

ELECTRICAL SYSTEM ARCHITECTURE

Power Supplies

The X150 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
- Switched system power supply

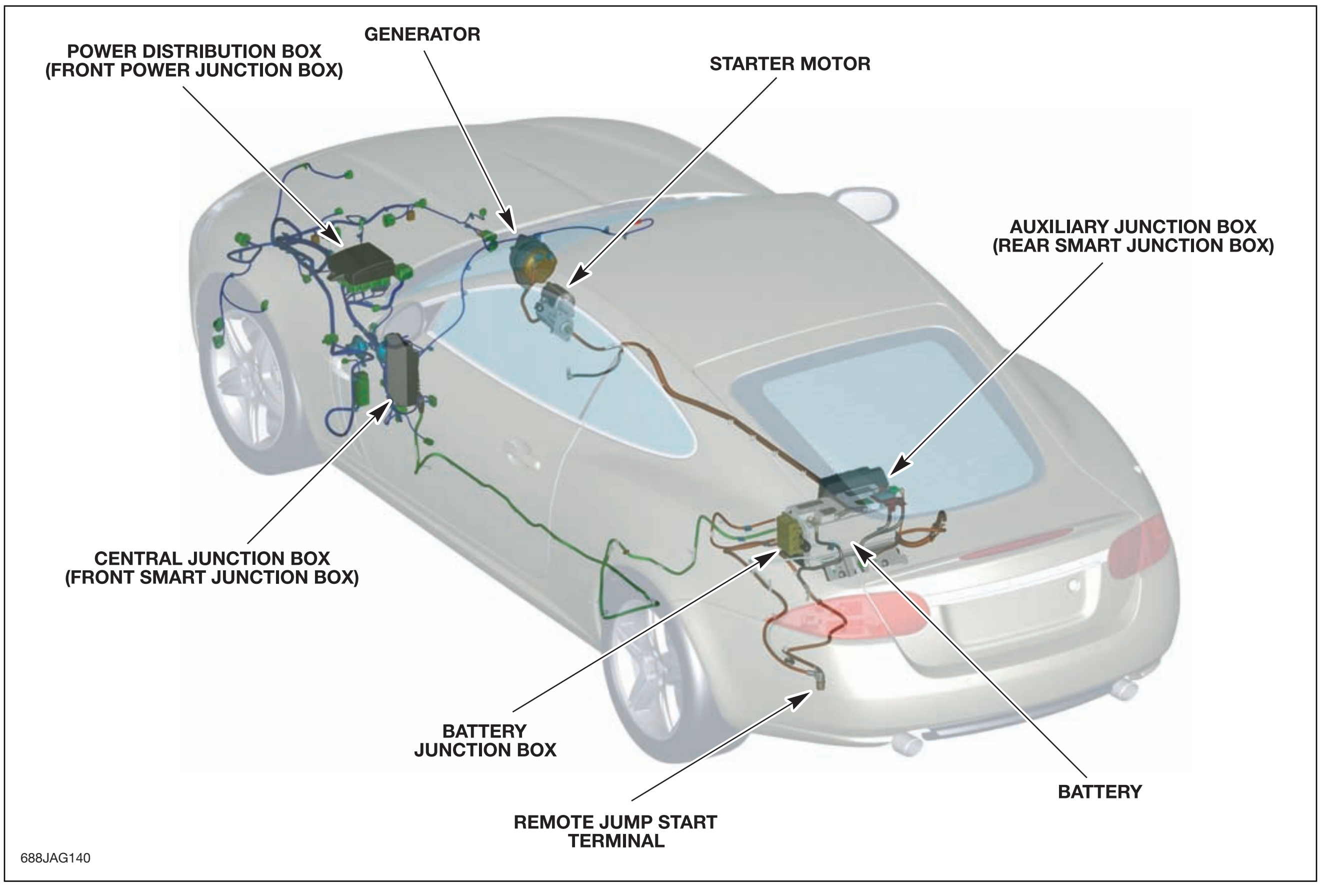
The 'Switched System Power Supply' circuit is controlled via the CJB and the AJB. In addition to providing power to the vehicle the CJB and AJB contain software to control a number of vehicle systems.

Battery Junction Box

The battery junction box (BJB) is mounted on the LH side of the battery. The BJB contains 3 megafuses which deliver battery power to the:

- Starter motor (400A)
- AJB (175A)
- CJB (175A)

Power Distribution Components



INTERIOR LIGHTING

Interior Lighting Output Control			
Light	Primary Input	Output Module	Power Supply
Trunk lights	Trunk latch switch	AJB	AJB internal relay
Glove box light	Glove box light switch	CJB	CJB internal relay
Vanity lights	Vanity light switches	CJB	CJB internal relay
Map lights	Map light switches	CJB	CJB internal relay
Courtesy lights	Door switches	AJB	AJB internal relay
	Remote unlock signal	AJB	AJB internal relay
	Roof Console switch	CJB	CJB internal relay
Front footwell lights	Door switches	AJB	AJB internal relay
	Remote unlock signal	AJB	AJB internal relay
	Roof Console switch	CJB	CJB internal relay
Puddle lights	Door switches	DDM	CJB internal relay

Switched System Power

A timer function within the CJB and the AJB controls the switched system power via internal relays. The timer is initialized when the ignition is switched off.

Switched system power will be reactivated when:

- CJB receives an unlock signal from the Smart Key via KVM
- Either door is opened including the trunk lid
- Ignition position is changed from run or accessory to off

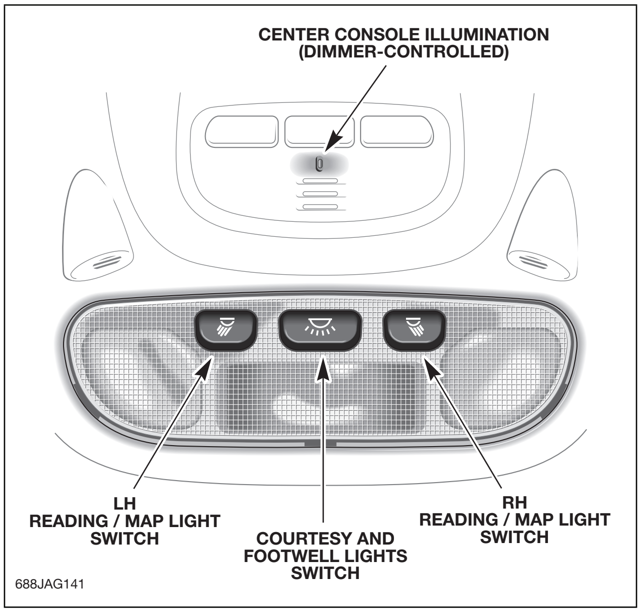
Battery Saver

In order to conserve battery power, after approximately 15 minutes with the ignition off the CJB and AJB will remove battery voltage from the interior lighting circuits by deactivating the appropriate internal relays.

2009 MY vehicles have an added battery saver feature. If the ignition is left on when exiting the vehicle with the SmartKey, the ignition will turn off immediately once the driver's door is closed.

Interior Lighting Switches

The interior lighting switches are located in the roof console. Center console illumination is active when the sidelights are on, and is controlled by the dimmer switch.



The interior lights have 2 modes of operation: Manual and Automatic.

Manual Mode

Courtesy and map lights can be operated manually by the roof console switch.

Automatic Mode

The courtesy light functionality is controlled by the CJB and the AJB and reacts to the vehicle being locked or unlocked and opening the vehicle doors. To deactivate or activate automatic illumination, touch the front courtesy light for approximately 2 seconds.

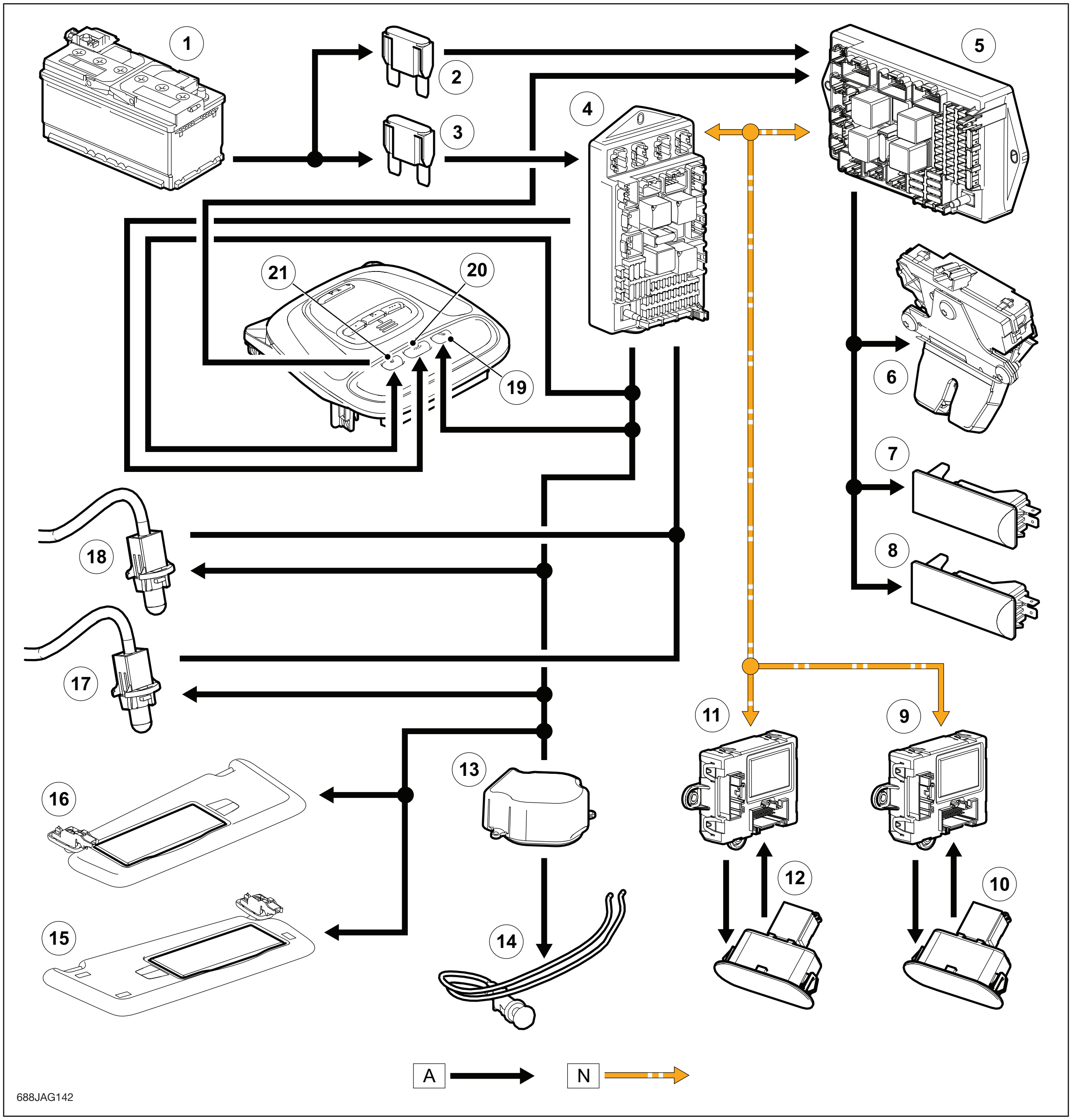
The interior lights gradually illuminate when a door is opened and will go out approximately 30 seconds after the engine is started or the last door is closed. If a door is left open and the engine is not started, the lights will fade off approximately 15 minutes after the vehicle exits convenience mode to power OFF.

The courtesy lights will illuminate at maximum brightness on unlocking of the vehicle. The lights will go out after approximately 30 seconds if no door is opened.

If a door is opened while the engine is running, all interior lights will illuminate. The lights will go out immediately after the last door is closed. Automatic function of the interior courtesy lights (including the luggage compartment light) can be deactivated by pressing the center switch and holding for more than 2 seconds. Automatic function is restored by pressing and holding the switch again.

The driver’s and passenger door puddle lights are controlled by the driver’s and the passenger door modules upon receipt of MS CAN signals from the CJB.

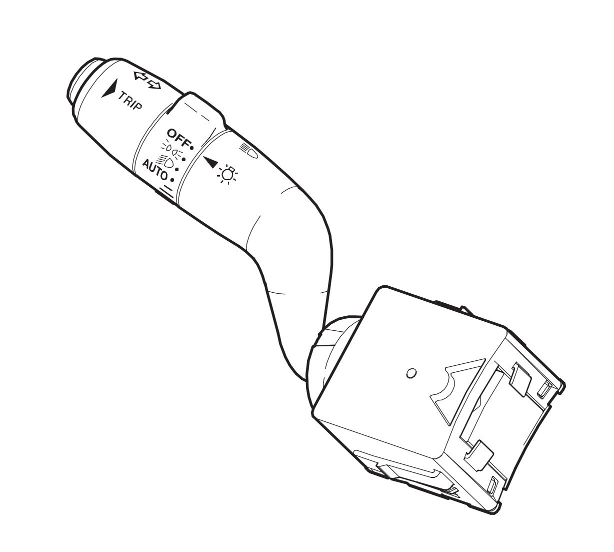
Interior Lighting Control Diagram



A	Hardwired	7	Trunk light	15	Driver's vanity mirror
N	MS CAN	8	Trunk light	16	Passenger vanity mirror
1	Battery	9	Passenger door module	17	Driver's footwell light
2	Megafuse (175)	10	Passenger puddle light	18	Passenger footwell light
3	Megafuse (175)	11	Driver's door module	19	Driver map light
4	CJB	12	Drivers puddle light	20	Passenger map light
5	AJB	13	Glove box light switch	21	Courtesy lights
6	Trunk switch	14	Glove box light		

EXTERIOR LIGHTING

Main Lighting Switch



688JAG086

The left-hand column stalk is a multifunction switch assembly used to activate the following functions:

- Side lights
- Low-beam headlight
- High-beam headlight
- Autolamps
- Turn signal indicator lights
- Exit delay
- Trip computer

The main lighting switch activates exterior lighting.

The instrument cluster supplies power and ground to the switch assembly. Each switch position is connected to the ground return via resistors which vary the return voltage to the instrument cluster. The instrument cluster senses the voltage returning and determines the switch position selected. The instrument cluster then generates an applicable message which is sent to the AJB and the CJB on the medium speed CAN bus for activation of the selected exterior lights.

NOTE: The X150 has an optional Adaptive Front Lighting (AFL) system. For more information, please refer to the 'Body Systems and Operation' section of this book.

Daytime Running Lights

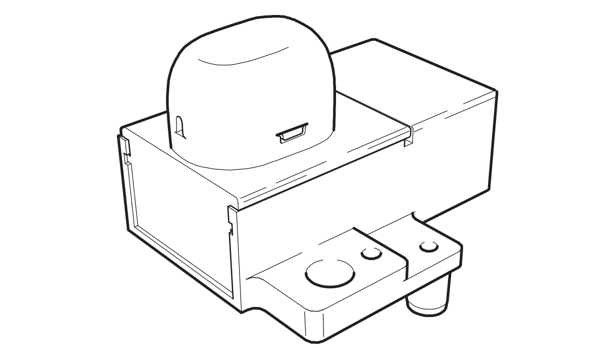
When daytime running lights (DRL) are enabled, dipped headlights, sidelights, tail, license plate and (where equipped) side marker lights will switch on automatically when the lighting switch is in the OFF position, provided that:

- The ignition system is ON
- The vehicle gear selector is out of Park
- The parking brake is not applied

Daytime running lights are enabled via IDS.

Autolamps

The operation of the autolamps feature is dependent on ambient light levels, monitored by photodiodes integrated into the sunload/light sensor.



688JAG088

The sensor provides feedback to the instrument cluster, which responds by supplying control signals on MS CAN to the CJB and AJB that automatically control the operation of the side lights and low-beam headlights where appropriate, provided that:

- The ignition key is at position II or III
- The main lighting switch is set to the AUTO position

Since the autolamps operation depends on the sensor (which is located behind the defrost grill of the instrument panel), it is important that this part of the instrument panel be kept clear so 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 lights to be activated.
- Detection of darkness for 2 seconds continuously will cause the low beam and side lights to be activated.
- Detection of daylight for 15 seconds continuously will cause the exterior lighting to be extinguished.

Windshield Wiper Detection

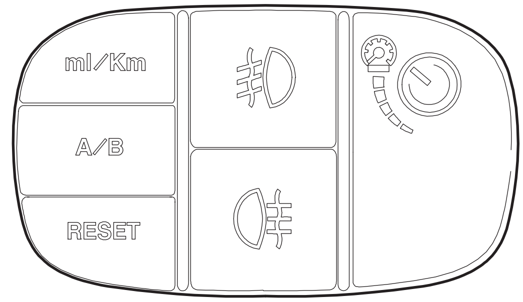
When the autolamp setting is selected, the headlights and sidelights will switch ON automatically if the windshield wipers are switched ON for 20 seconds or more. The headlights and sidelights will automatically switch OFF after two minutes once the windshield wipers are switched OFF.

Exit Delay

The exit delay feature is controlled by the CJB via inputs from the instrument cluster and is activated when the ignition is switched off. The dip beam will remain illuminated for 10s, 30s, or 2 min, (depending on the position of the main lighting switch) or until the ignition is turned to position 'II' (or the headlight convenience button on the Smart Key is pressed).

NOTE: The feature will not function if the main lighting switch is set to AUTO.

Auxiliary Lighting Switch



688JAG087

The auxiliary lighting switch comprises:

- Dimmer control
- Front and rear fog light switches
- Forward alert when equipped (not shown)
- Trip computer controls

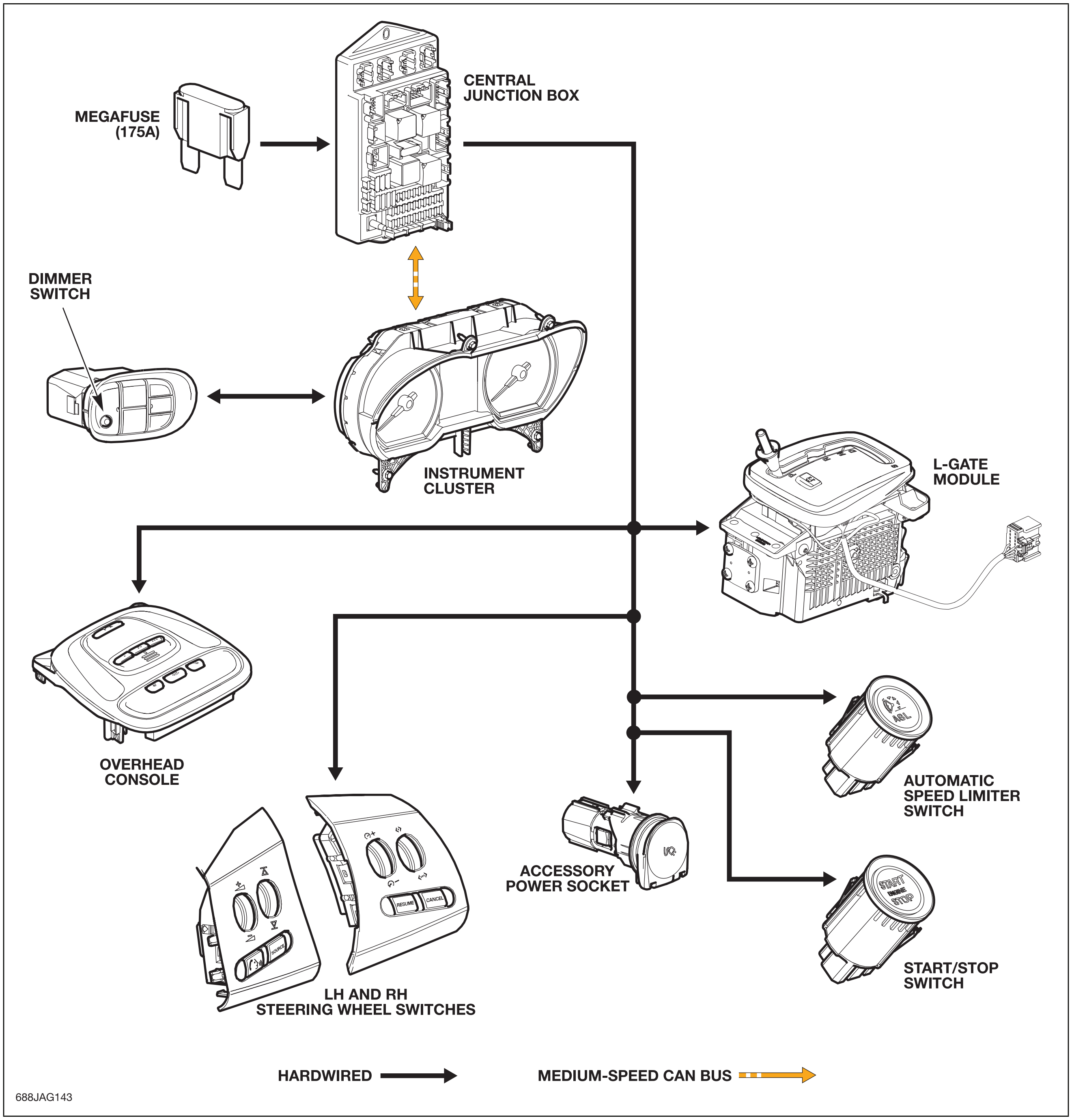
The auxiliary lighting switch is connected to the instrument cluster. Each switch position is connected to the ground return via a series of resistors which vary the supply voltage from the instrument cluster. The instrument cluster senses the voltage and determines the switch position selected. The instrument cluster then generates an applicable message which is sent to the AJB and the CJB on the medium speed CAN bus for activation of the selected function.

Dimmer Control

Instrument cluster and panel illumination is achieved through a series of LEDs located throughout the interior of the vehicle. The intensity of illumination can be controlled by the driver through the rotary control integral with the auxiliary lighting switch.

The rotary control is a variable resistor, which is used as a potential divider to provide a high or low voltage according to its set position. The voltage returned to the instrument cluster is converted into a dimmer control positional message and transmitted to the CJB over the MS CAN bus. The CJB converts the illumination intensity message into a pulse width modulated (PWM) signal, which it supplies to the instrument panel and switch illumination LED.

Dimmer Control Diagram



Fog Lights

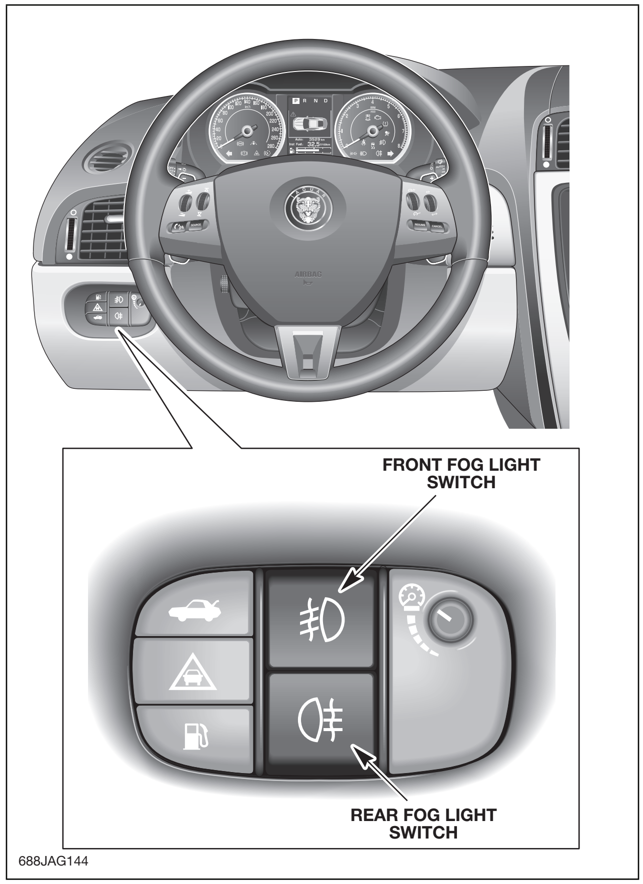
The fog light switches are part of the auxiliary lighting switch.

The fog lights can only be activated when the ignition system is ON, engine running, with the lighting switch in sidelight or dip position.

Both front fog lights and the single rear fog light will be turned off when the ignition system is turned OFF; they will not be ON when the ignition system is turned on again.

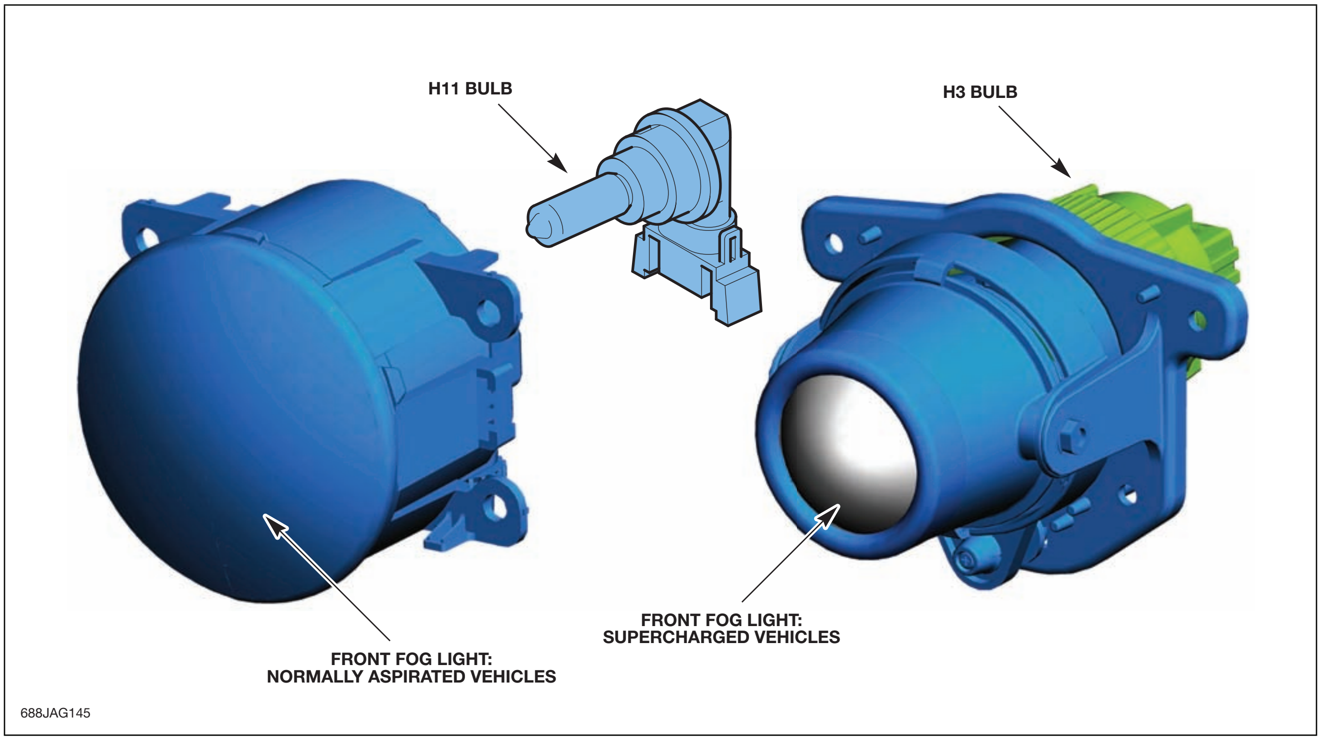
If the low beam headlights and the front fog lights are on at the same time, when the high beam headlights are switched on, the front fog lights will be automatically switched off. When the high beam headlights are subsequently switched off, the front fog lights will be switched back on automatically.

NOTE: The front fog lights will also be switched off if the high beam 'flash' function is operated.



Front Fog Lights

Normally aspirated (NA) and supercharged (SC) vehicles each use a different front fog light design.



NA Vehicles

The front fog lights are a conventional design with a clear lens and smooth surface reflector. A H11 55W halogen bulb is located at the rear of the fog light.

SC Vehicles

The front fog lights use a projector module, similar in design to the projector module used in the xenon headlight. A halogen H3 bulb is located in the rear of the fog light.

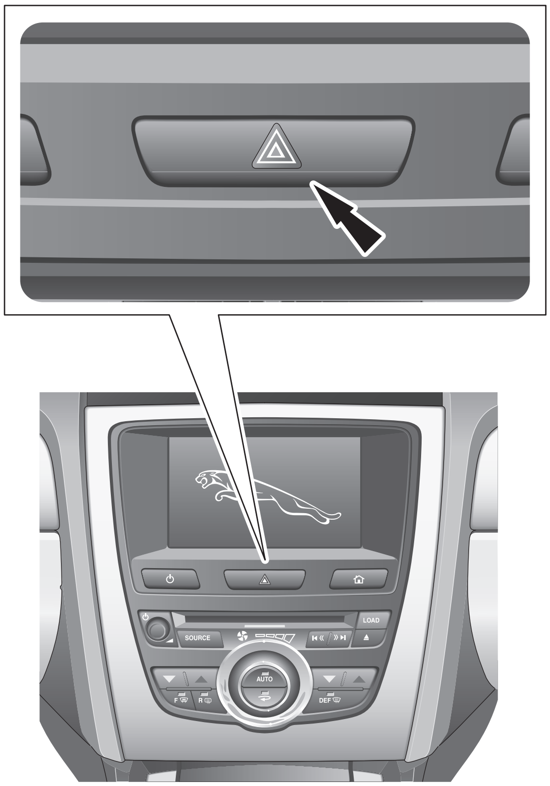
Rear Fog Light

Only one rear fog light is fitted, located in the inner LH rear lighting assembly. The fog light uses 3 LEDs.

NOTE: There is also only one reverse light, located in the inner RH rear lighting assembly.

Hazard Warning Flashers

The hazard warning switch is part of the integrated control panel located in the center console below the touchscreen and operates with the ignition ON or OFF.



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The hazard switch input is hardwired directly to the AJB. Hazard function is controlled by the AJB via the internal printed circuit board (PCB) relay assembly. Once activated the hazard message is transmitted via MS CAN to the instrument cluster (IC). The IC controls the green instrument cluster direction indicator lights and audible ticking. The hazard switch icon flashes in unison with the indicators via the same internal AJB PCB relay.

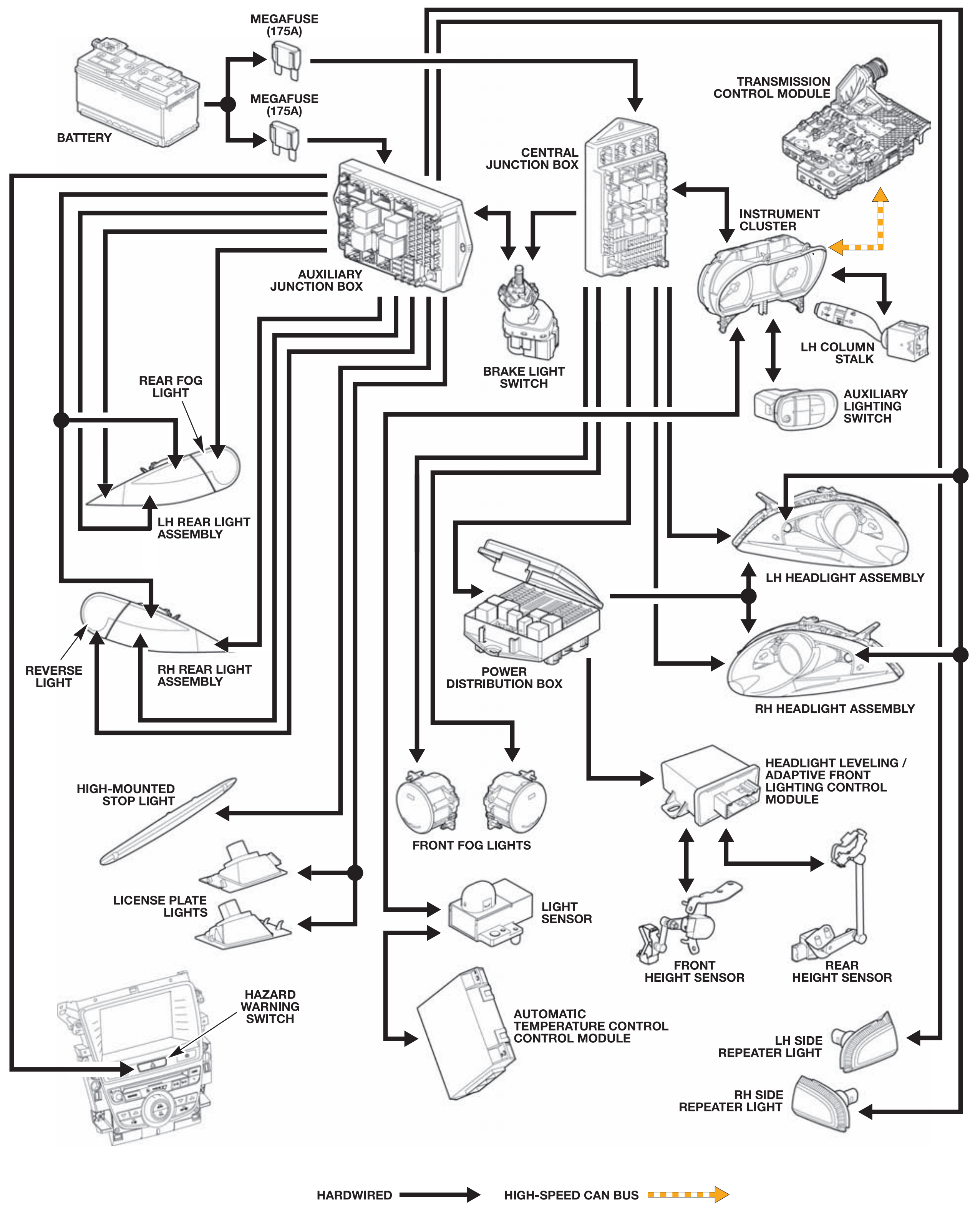
Circuit Protection

The AJB and the CJB provide circuit protection for all exterior lighting circuits. The exterior lighting circuits are protected by Field Effect Transistors (FETs). Operation of the exterior lighting circuits is protected by the FETs which can detect overloads and short circuits. The FETs respond to heat generated by increased current flow caused by a short circuit.

On a normal circuit this would cause the fuse to blow. The FETs respond to the heat increase and disconnect the power supply to the affected circuit. When the fault is rectified or the FET has cooled, the FET will reset and operate the circuit normally. If the fault persists the FET will cycle, disconnecting and reconnecting the power supply.

The CJB and the AJB store fault codes which can be retrieved using IDS. The fault code will identify that there is a fault on a particular output which will assist with fault detection.

Exterior Lighting Control Diagram



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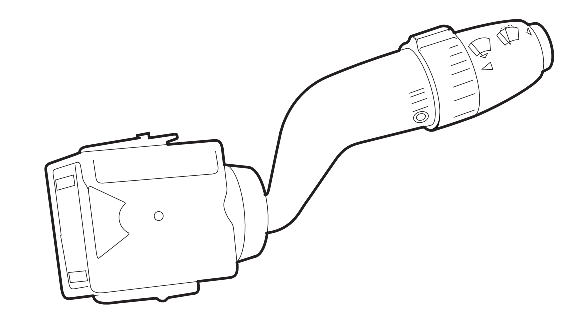
WASH/WIPE SYSTEM

Wash/Wipe Switch



688JAG095

The wipers have 5 operational states:

- Flick wipe
- Auto wipe
- Slow wipe
- Fast wipe
- Wash wipe

The wiper switch assembly is connected to the instrument cluster. The instrument cluster supplies power and ground to the switch assembly. Each switch position is connected to the ground return via resistors which vary the return voltage to the instrument cluster. The instrument cluster senses the voltage returning and determines the switch position selected. The instrument cluster then generates an applicable message which is sent to the CJB on the MS CAN bus for activation of the wipers. The CJB receives the message and controls the operation of the wipers and washers in response to driver inputs and signals from the rain sensor.

The 'Auto' function requires an input from the rain sensor. If continuous wipe is selected for more than 20 seconds with the headlight switch in auto, headlight low beam will be activated. If the wiper/washer control switch is consequently moved to the auto or off position, headlight low beam will continue to operate for a further 120 seconds.

Wiper Service Position

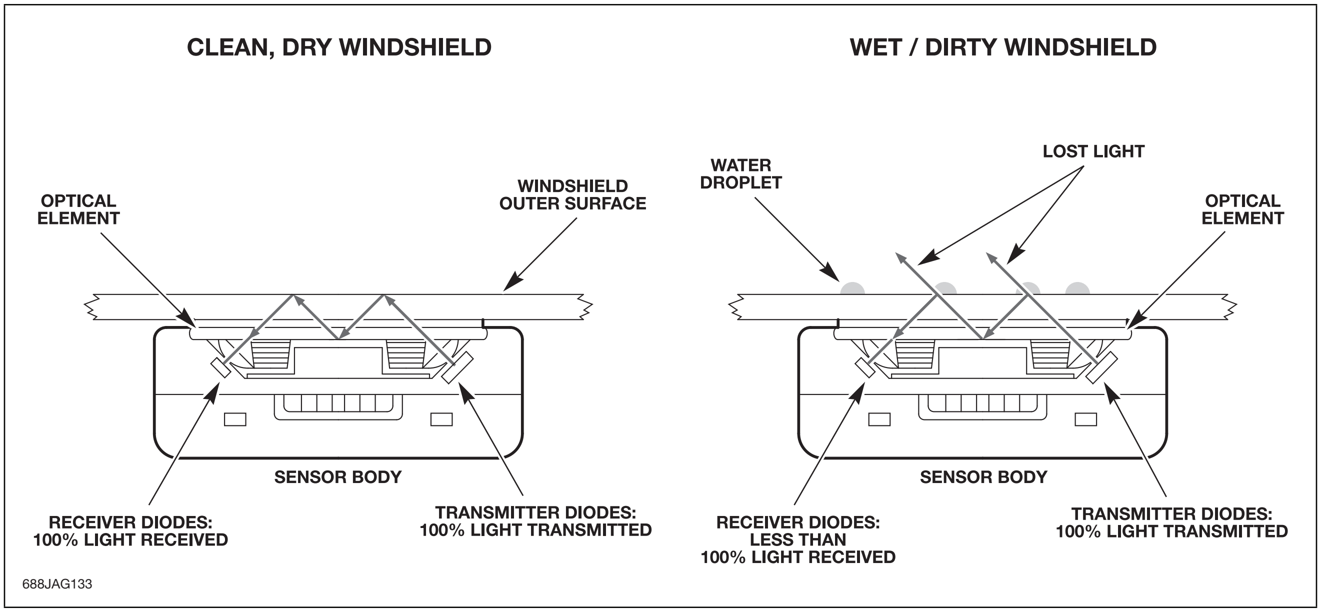
The wiper service position allows the wipers to be parked in a position to allow easy access to the wiper blades for replacement. The service position is initiated by pulling the RH steering column multifunction switch towards the steering wheel and pressing the start/stop button to switch on the ignition. The wipers will move and stop in a vertical position on the windshield.

The RH steering column multifunction switch can be released and the ignition switched off. The service position is terminated at the next ignition on cycle and the wipers return to their normal park position.

Rain Sensing

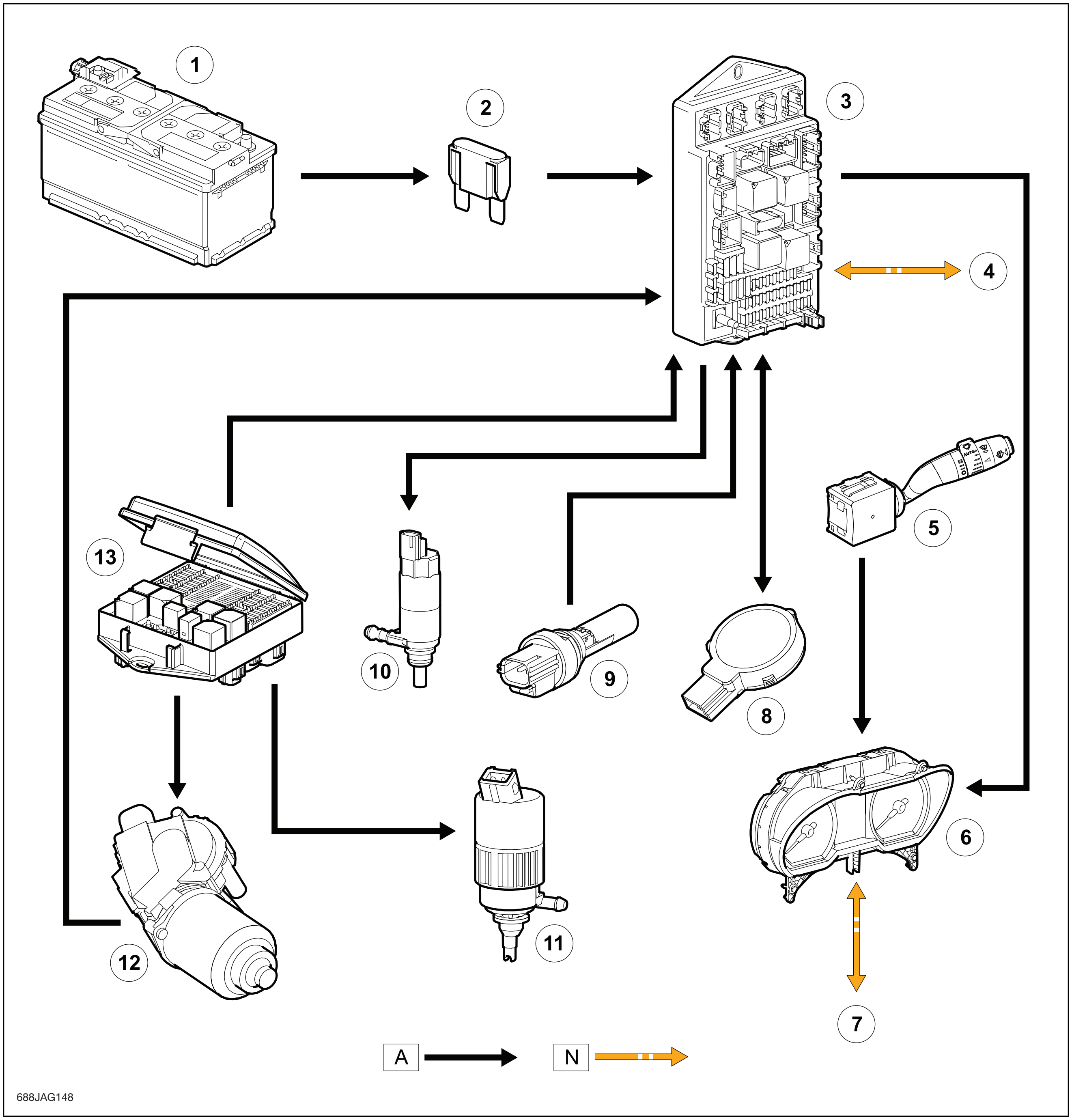
The rain sensor is an optical transducer, which senses changes to infrared light caused by the refractive effects of water droplets on the windshield. The sensor is fixed to the inside of the windshield with the sensing elements facing outwards through the glass. The sensor elements consist of two groups of light emitting diodes (LEDs), 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 rain sensor transmits a voltage value based on pulses to the CJB via direct hardwire.



NOTE: Because a dirty windshield appears the same as a wet windshield to the rain sensor, unexpected wiper action on a dry windshield is possible and is not a fault. Before performing any repairs for customer concerns of unintended wiper movement, ensure that the wipers were not on ‘AUTO’ when the event occurred.

Wash/Wipe Control Diagram



A	Hardwired	4	CAN signals to and from various systems	9	Reservoir fluid level sensor
N	MS CAN	5	Column switch	10	Windshield washer pump
1	Battery	6	Instrument cluster	11	Headlight washer pump
2	Megafuse (175)	7	CAN signals to and from various systems	12	Wiper motor
3	CJB	8	Rain sensor	13	Power distribution box

SEATS

Two variants of driver and passenger seat are available: 10-way sports and 16-way luxury. The front seat frames are common to both the coupe and convertible and are equipped with the following:

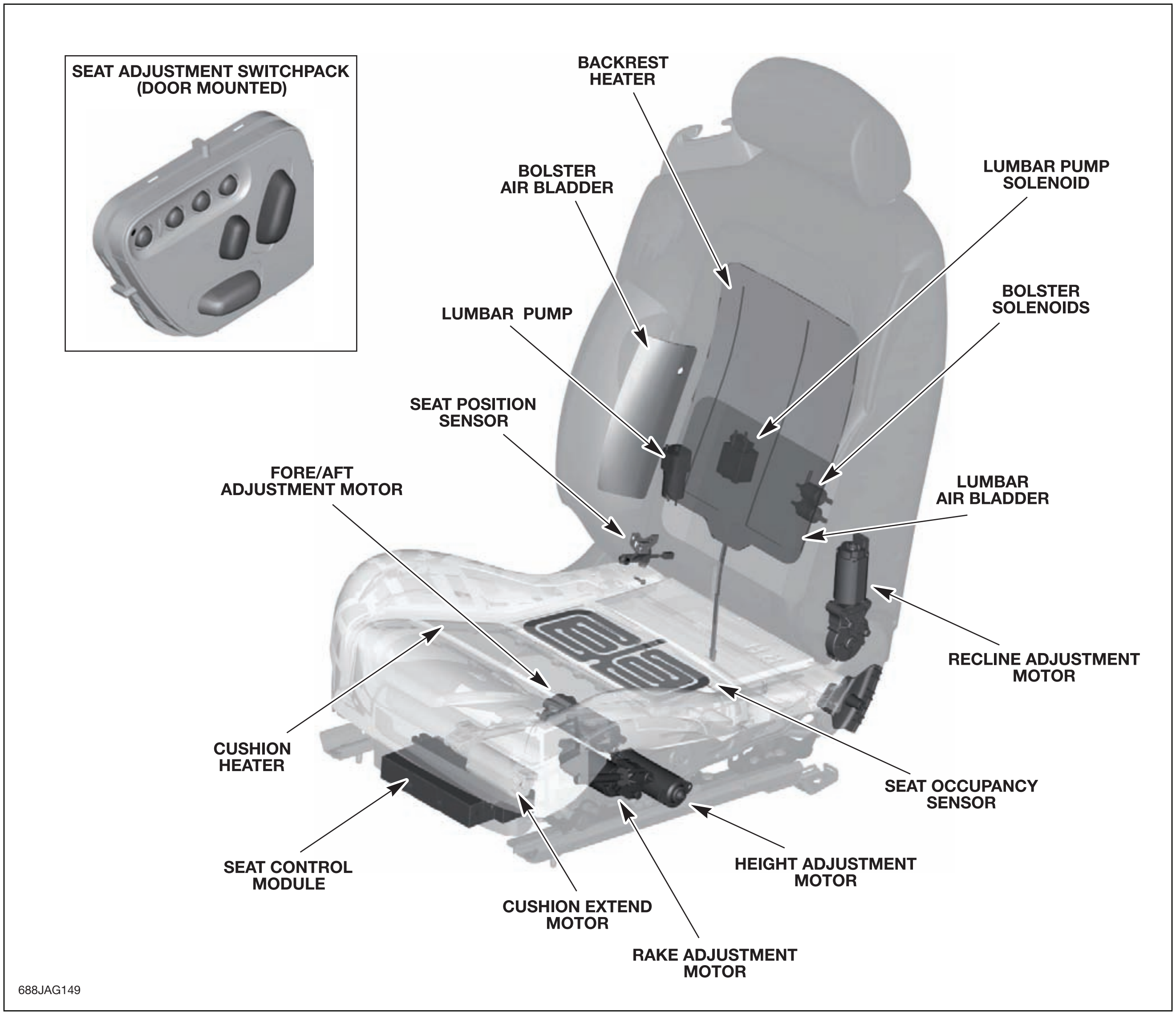
- Seat control switches (door mounted)
- Front seat cushion front height adjustment
- Front seat cushion rear height adjustment
- Front seat backrest adjustment
- Front seat head restraint adjustment
- Lumbar adjustment
- Front seat forward and backward adjustment
- Side air bag module
- Front seat backrest heating
- Front seat cushion heating
- Extendible seat-cushion (luxury variant only)
- Adjustable side bolsters (luxury variant only)

NOTE: The driver and passenger front seats, although almost identical, have some unique components. The front driver seat has a seat position sensor and the front passenger seat has an Occupancy Classification System (OCS). In both instances the components form an integral part of the airbag Supplemental Restraint System (SRS).

WARNING:

Prior to removal of the front seats and before disconnecting the front seat wiring harness electrical connectors (which includes the side airbag module electrical connectors), the battery ground cable should be disconnected and a period of at least 1 minute allowed to elapse. The same amount of care should be taken when handling and storing the front seats as would be taken when handling and storing airbag modules.

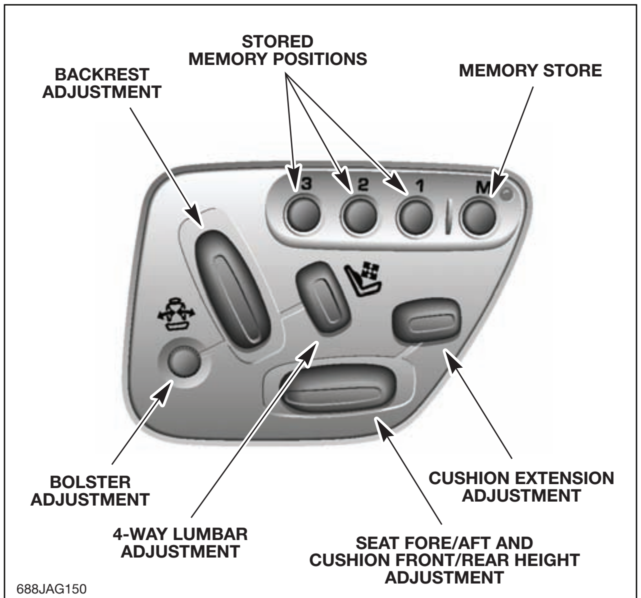
Front Seat Components (prior to VIN B09097; Sport variant shown)



NOTE: The Occupant Classification System (OCS) was added as a running change during the 2007 MY, after VIN B09097, and is now standard on all vehicles. Previous vehicles were fitted only with Occupant Detection for the seat belt system. Please refer to the Workshop Manual for more information about the OCS system.

Seat Memory

Seat memory is standard on both driver and passenger seats. Each seat can be configured for three personal memory positions, which are set using the seat memory switch and stored in the individual seat module.



688JAG150

The switches for adjusting the seats are wired directly to their individual seat control modules via LIN bus, which controls the movement of the seat via hardwired connections.

NOTE: The seat modules provide illumination to the seat switch assemblies. The lighting and dimmer control signals are an MS CAN message from the CJB to the individual seat modules which are received via LIN bus to each switch.

Clash Avoidance

Seat position is monitored by the individual seat modules using seat track position Hall sensors incorporated into the motors. This prevents the seat from being adjusted to a position that will contact the surrounding interior trim, or a rear seat passenger (causing injury).

As part of the Pre-Delivery Inspection (PDI), each seat is subjected to a clash avoidance check. This procedure ensures there is no contact between the seat trim and rear quarter casing. If there is any contact, the seat must be recalibrated using the seat calibration routine on IDS.

NOTES: For more PDI information, refer to the appropriate PDI manual.

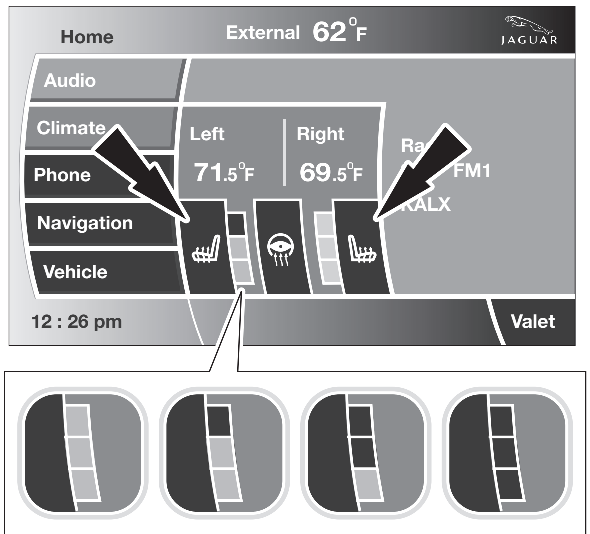
Flylead


688JAG151

In the event of a control module failure, a flylead behind the seat valance can be used to connect a power source directly to the seat slide motor. This enables the seat to be moved to gain access to the front and rear seat fixings. The seat can then be removed from the vehicle in order to access the control module.

Seat Heaters

Heating requests are generated using the soft buttons on the TSD. These requests are transmitted to the information control module (ICM) over the MOST® ring. The ICM forwards these requests to the ATC module over the MS CAN bus.



NP09XF040

Once the request is received the ATC module provides a hardwired 12 V supply to the 3 heater elements contained within each seat. The 3 heater elements, 2 in the seat cushion and 1 in the seat squab, are wired in series.

The ATC module monitors seat temperature using a temperature sensor located in each seat cushion. The ATC module provides the temperature sensors with a 5 V supply. The level of the returned voltage is proportional to the seat temperature. The value of the return signal is broadcast to the module over the MS CAN bus which it then converts into a temperature value to allow it to control seat temperature to the required level.

The ATC module will suspend or disable operation of the seat heaters if any of the following occur:

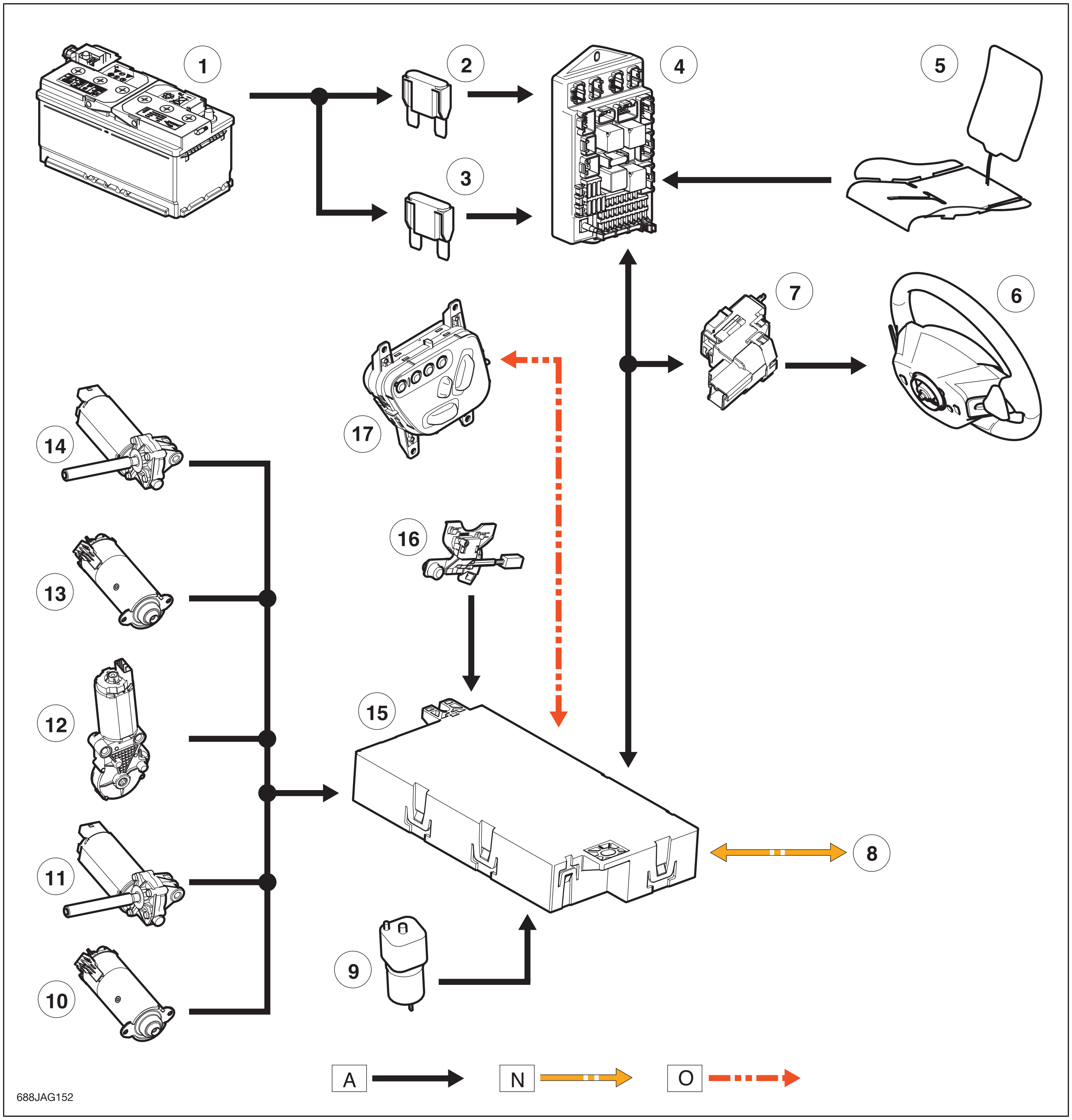
- Battery voltage exceeds 16.5 ± 0.3 V for more than 5 seconds; eat heating is re-enabled when battery voltage decreases to 16.2 ± 0.3 V
- If a short or open circuit is detected
- If the seat heat temperature rises significantly above the target temperature setting.

Steering Wheel Heater

The steering wheel heater has 1 heat setting and can be turned on and off by pressing the soft button located on the TSD screen. When the ignition is switched off, the heater will reset to off.

Power for the heater element is supplied by the on receipt of a request from the module over the medium speed CAN bus. Temperature control for the heater element is provided by the steering wheel heater control module which receives a temperature feedback signal from a thermistor located within the steering wheel.

Driver Seat Movement and Heating Control Diagram



A	Hardwired	5	Heating elements	12	Driver recline adjustment motor
N	MS CAN	6	Heated steering wheel	13	Driver height adjustment motor
O	LIN bus	7	Heated steering wheel module	14	Driver rake adjustment motor
1	Battery	8	CAN input/output signals from various modules	15	Driver seat module
2	Megafuse (175A)	9	Driver lumbar pump	16	Seat position Hall sensor
3	Megafuse (175A)	10	Driver cushion extend motor	17	Driver seat switchpack
4	CJB	11	Driver fore/aft adjustment motor		

STEERING COLUMN

The electric steering column is standard equipment on all models. The upper column assembly contains electrical adjustment for steering wheel reach and rake and the steering angle sensor.

Steering adjustment memory positions are stored in the driver's seat module. The column also features an entry/exit mode function which moves the steering column away from the driver to allow easier exit and entry to the vehicle.

Column adjustment is provided by a single motor for both reach and rake adjustment. Operation of the column adjustment is controlled by a 4-way joystick switch located in the column lower shroud. Column adjustment is an integral part of the driver position memory system.

Steering Column Adjustment

Power for the column adjustment motor is supplied by the CJB via the instrument cluster, which controls the power application to the motor.

The column adjust switch is hardwired to the instrument cluster. Up/down and in/out selections on the switch are each passed through a resistor of differing values to the instrument cluster. The cluster monitors the output value from the switch and operates the motor in the required direction, while simultaneously energizing the required solenoid for rake or reach adjustment.

When the applicable solenoid is energized, a clutch is engaged and located on a lead screw. The motor rotates the lead screw and the rotational drive of the screw is transferred into linear movement of the applicable clutch to move either the rake or reach adjustment. For reach adjustment, the lead screw drives the outer housing in or out as required. For rake adjustment the lead screw drives a rake lever which moves the column up or down as required.

The position of the column is monitored by potentiometers which are connected to the instrument cluster. The cluster monitors the output signal from the potentiometers to precisely control the positioning of the column in each plane.

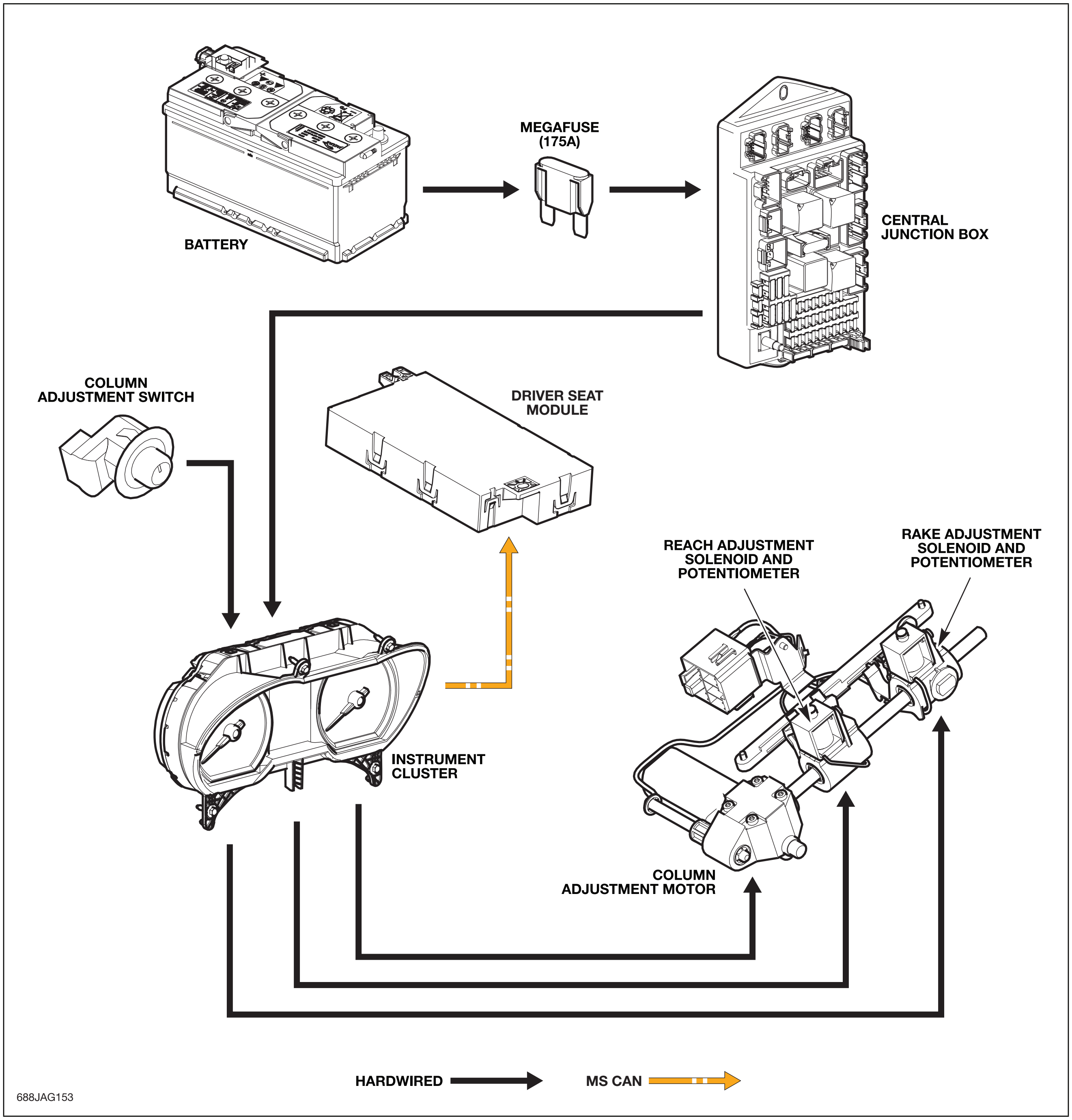
The instrument cluster provides the memory positioning of the column via a medium speed CAN bus connection to the driver's seat module. The driver's seat module receives information from the instrument pack and stores the stop bit locations which can be programmed and recalled along with mirror and seat positions from the seat memory settings.

NOTE: Column replacement or instrument cluster replacement/programming requires steering column barcode digits 3-10 to be accessed from 11-digit barcode label. The label is located on the steering column and under trunk floor trim on RHS tire well wall panel.

Entry/Exit Feature

When the joystick switch is rotated to the 'auto' position, the entry/exit feature is enabled. The steering column will adjust to the uppermost rake position when the ignition is switched off, and will readjust to the position corresponding to the memory position when the ignition is switched on.

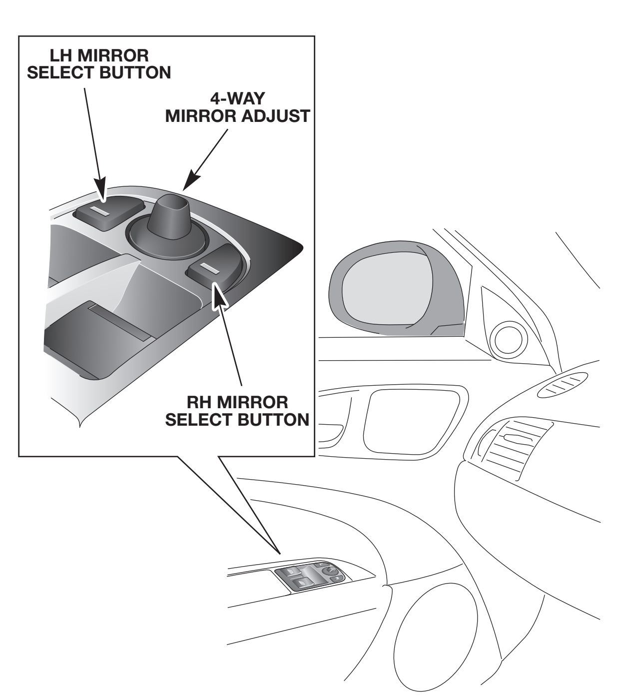
Steering Column Control Diagram



MIRRORS

Exterior Door Mirrors

Both door mirrors are adjusted from the driver's door switchpack.



688JAG154

The 4-way adjustment button moves the mirrors to the required position. The select buttons select the mirror to be moved: the button on the left for the LH side mirror and the one on the right for the RH side mirror.

Door mirror movement commands are transmitted to the driver's door module via LIN bus. The driver's door module transmits any passenger mirror movement commands to the passenger door module over the MS CAN bus.

Movement of the door mirrors is carried out by the respective door module. The door modules provide supply and ground paths to the mirror motors and monitor mirror position via potentiometers located in the mirror housings.

NOTE: The mirror housings are designed to pivot against the vehicle upon impact; reposition non-powerfold mirrors manually. If powerfold mirrors are fitted, reposition electrically by holding both 'L' and 'R' buttons at the same time.

Mirror Heating

The door mirrors have heating elements that operate automatically based on the external ambient temperature of the vehicle. The mirror heater will clear all ice from the mirror surface.

CAUTION:

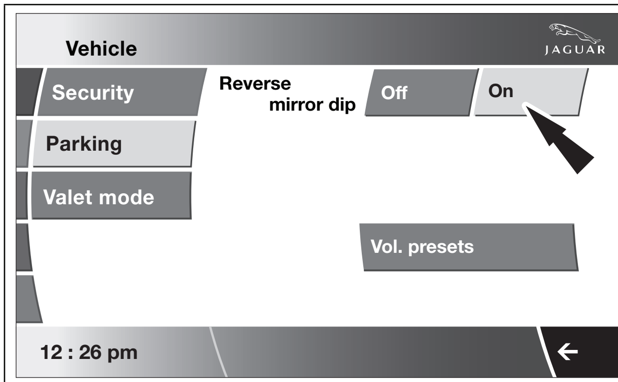
⚠ **Do not use a scraper to remove ice from the mirrors as this will damage the surface.**

Reverse Mirror Dip

When reverse mirror dip is enabled and reverse gear is selected, the passenger mirror rotates downward to provide a close-up view of the rear side area. When the gear selector is moved out of reverse, the mirror will return to its original position.

Reverse mirror dip is enabled via the touch-screen:

– From the touch-screen main 'Home' menu, select 'Vehicle'.
– Select 'Veh. Settings'; the 'Security' button is selected automatically as the default
– Select 'Parking'
– Select 'Reverse mirror dip' ON



688JAG155

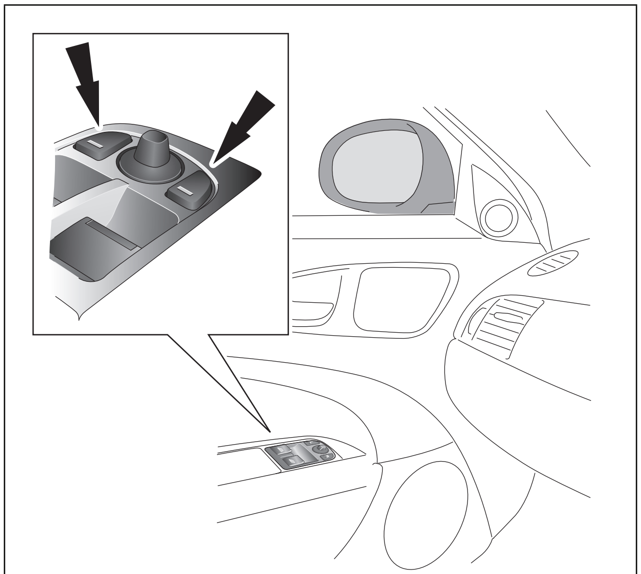
The reverse mirror dip alignment can be adjusted by using the 4-way adjustment button when the gear selector is in reverse.

Mirror Powerfold

Power mirror foldback is a standard feature starting with the 2009 model year. Mirror foldback can be operated manually or automatically when the vehicle is stationary or moving at a speed of 20 km/h (12 mph) or less.

Manual Operation

Mirror foldback is initiated by pressing then releasing the Left and Right mirror select buttons at the same time.

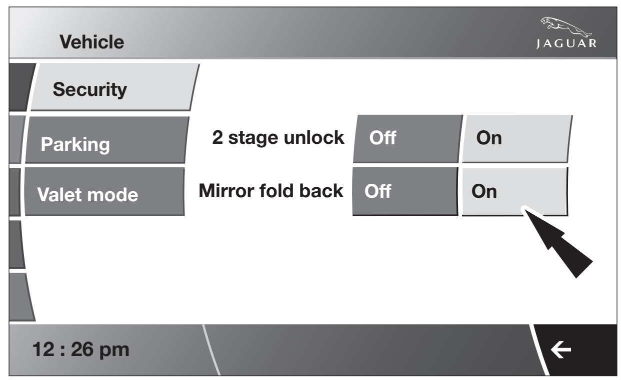


688JAG156

The first press of the mirror select buttons causes the two door mirrors to turn inwards to the folded position and stop. A further press of the mirror select buttons causes the door mirrors to turn outwards to the unfolded position and stop. If the mirror select buttons are pressed while the door mirrors are moving, they stop and reverse direction until they reach their original position. If one of the door mirrors has been manually folded, the two door mirrors can be resynchronized by an inward and outward operating cycle.

Automatic Operation

Mirror foldback is selected and deselected from the 'Vehicle' menu of the Touch-Screen Display (TSD).



688JAG155

Automatic operation is synchronized with the exterior locking and unlocking of the vehicle (it does not work with interior locking and drive-away locking). If automatic operation is selected, the door mirrors fold when the vehicle is locked and unfold when the vehicle is unlocked.

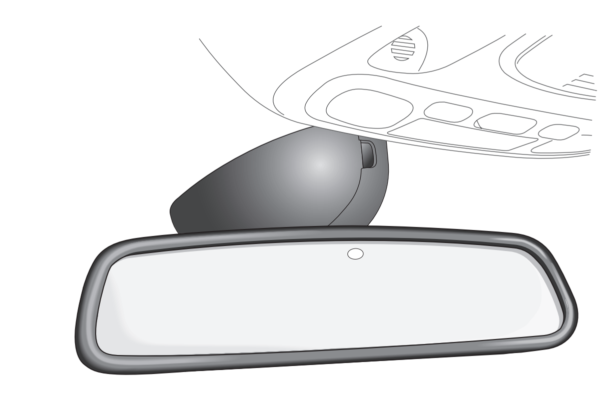
NOTE: If the door mirrors have been folded manually, they will not unfold automatically even though automatic mode is selected on the TSD.

Thermal Cut-Out

A thermal cut-out feature is incorporated to protect the mirror foldback motors. Thermal cut-out only occurs with the door mirrors in the unfolded position, and resets after 5 minutes.

Automatic Mirror Dimming

During nighttime driving, the interior rear and side view mirrors will darken automatically in proportion to the amount of glare detected from a following vehicle's headlights.

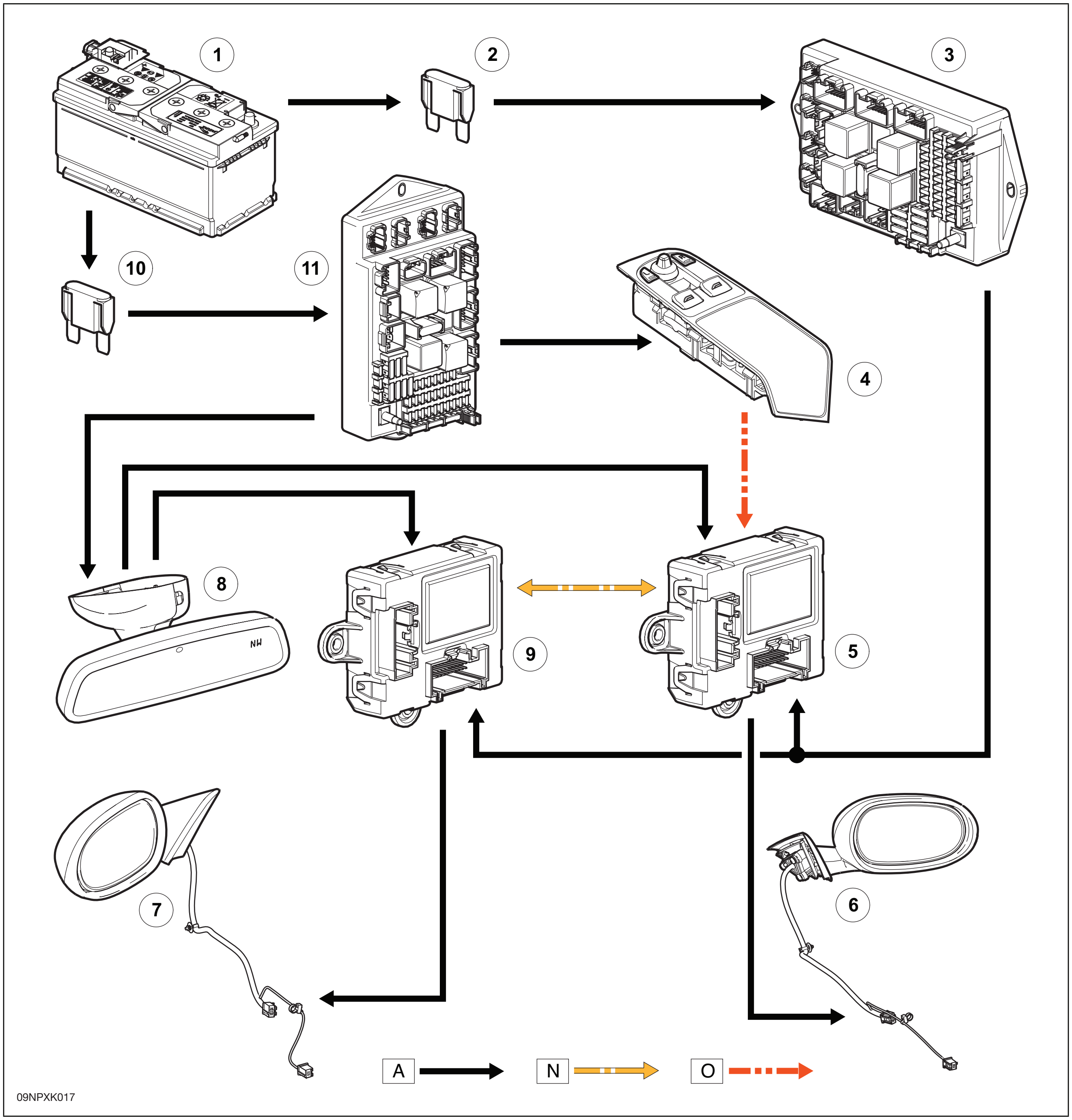


688JAG158

The automatic darkening mirror, also known as an electrochromic mirror, contains a forward and a rearward facing light sensor. The light sensors control the auto dimming feature of the mirrors by measuring and comparing oncoming light levels to light levels from behind. When the comparison identifies a higher level of light from behind, a supply signal is provided by the interior mirror to both door modules, which then initiate the mirror auto-dimming sequence.

If the gear selector lever is shifted into reverse, the mirror dimming feature will be cancelled automatically to allow for a clearer view while reversing. The darkening feature is only operational when the ignition is ON.

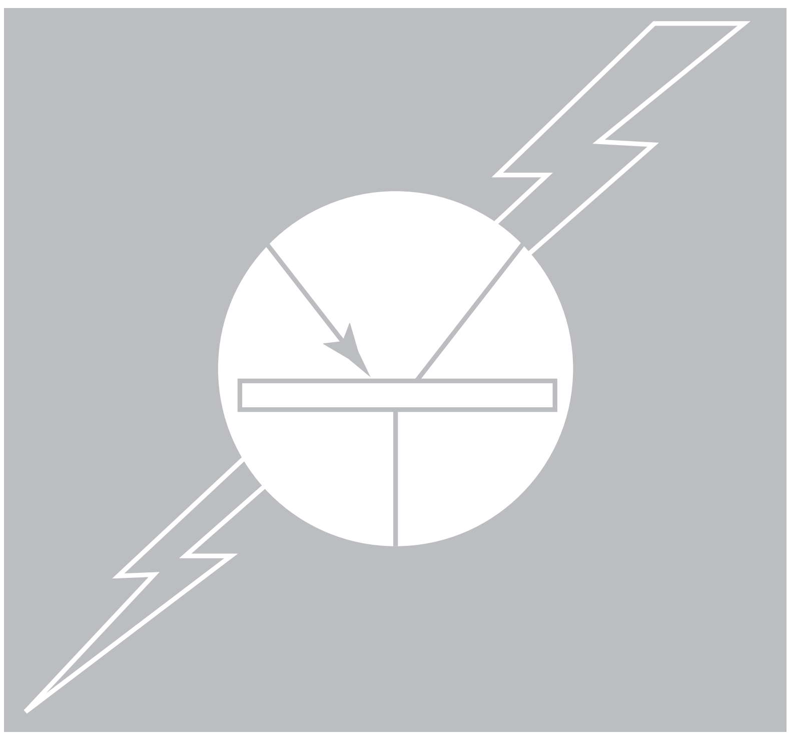
Mirror Control Diagram



A	Hardwired	3	Auxiliary junction box	8	Interior rearview mirror
N	MS CAN bus	4	Door mirror switches	9	Passenger door module
O	LIN bus	5	Driver door module	10	Megafuse
1	Battery	6	Driver door mirror	11	Central junction box
2	Megafuse (175A)	7	Passenger door mirror		

Technical Training
Electrical Systems

688-JAG: Advanced Electrical Systems and Diagnostics



X250 Body Electrical Systems

JAGUAR

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Printed in USA

ELECTRICAL SYSTEM ARCHITECTURE

Power Supplies

The X250 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
- Switched system power supply

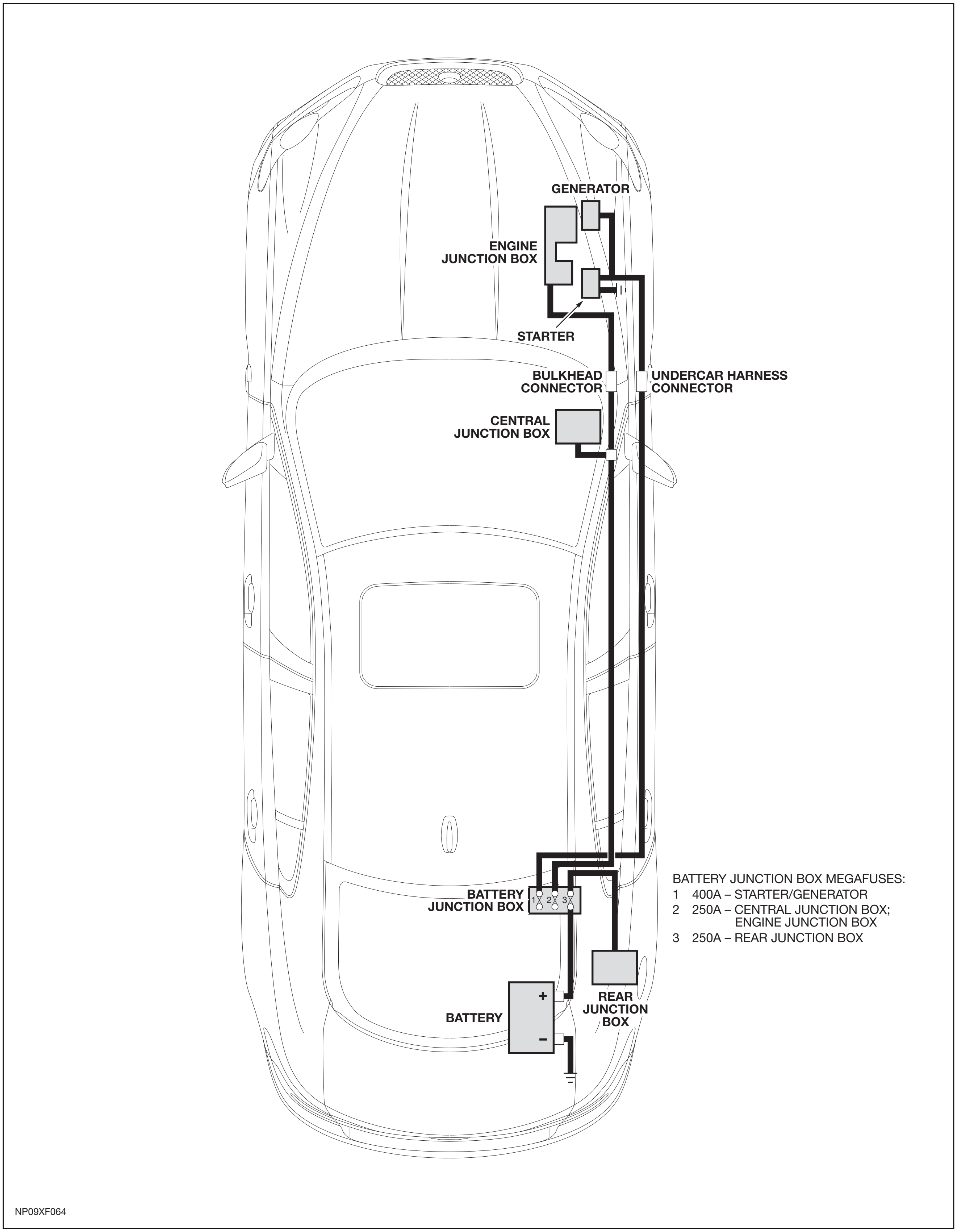
The 'Switched System Power Supply' circuit is controlled via the CJB and the RJB. In addition to providing power to the vehicle, the CJB and RJB contain software to control a number of vehicle systems.

Battery Junction Box

The battery junction box (BJB) is mounted on the RH side of the trunk. The BJB contains 3 megafuses which deliver battery power to the:

- Starter motor (400A)
- CJB & EJB (250A)
- RJB (250A)

Power Distribution



BATTERY MONITOR SYSTEM

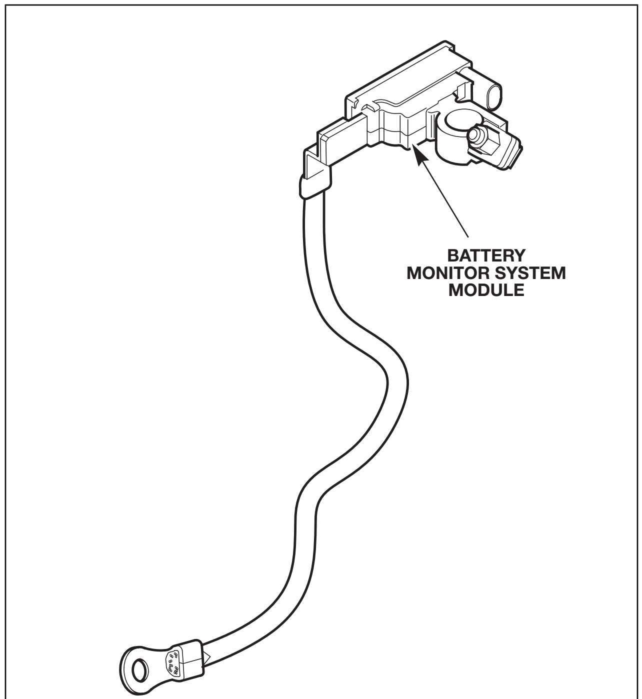
The Battery Monitor System (BMS) is new to Jaguar and introduced on the 2009 XF. The BMS module is mounted to the negative battery terminal and is integral to the negative battery cable. The BMS module communicates with the engine control module (ECM) via LIN and CAN bus networks.

NOTE: When using a Jaguar approved battery charger or maintainer, connect the charger to the recommended ground point to ensure the charge flows through the BMS module instead of the negative battery terminal. Failure to observe this will set a diagnostic trouble code (DTC) and incorrect battery condition information will be retained by the BMS module due to unmonitored current flow into the battery. However, the system will recognize and compensate for the change in the battery status after a period of time.

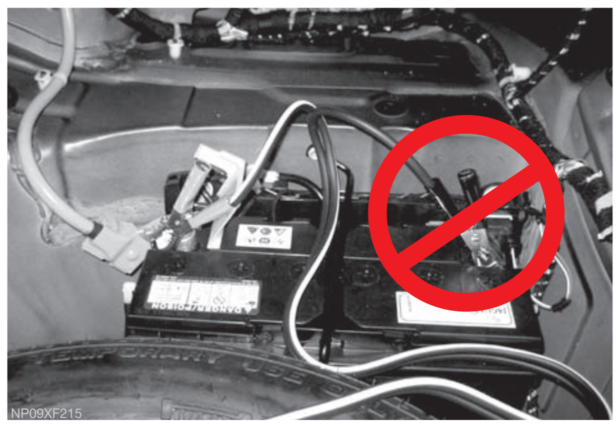
If a new battery is fitted to the vehicle, the BMS module will require recalibrating to the new battery parameters using IDS. Replacing the BMS module requires no action as the system will self-calibrate

CAUTION:

⚠ **To avoid damaging the BMS module, always use a suitable body ground point rather than the battery negative terminal when jump-starting the vehicle. The recommended ground connection for jump-starting is the spare wheel securing bracket.**



NP09XF065



NP09XF215

Principles of Operation

The BMS module measures battery voltage and current which provides information about the battery state of charge (SOC) and state of health (SOH). SOH measurements provide an indication of battery condition. The BMS compares this information to new and used stored battery values.

Battery information is then communicated to the rear junction box (RJB) over a LIN bus connection. The RJB transmits the battery information to the instrument cluster via the MS CAN bus.

The instrument cluster displays battery charge warning messages to indicate generator or BMS faults. The instrument cluster also acts as a gateway between the MS CAN and HS CAN bus networks to transmit battery condition information to the ECM from other modules (audio and climate control, for example).

Based on the information received from the BMS module, the ECM will control the output from the generator via LIN bus. The ECM can also request the switching off or reducing of power to electrical loads if necessary and override the BMS signals if a fault is detected.

The BMS also monitors battery status with the engine switched off, sending a signal to switch off the infotainment system if necessary to protect the battery condition. Once triggered, the engine must be run for at least 5 minutes to charge the battery before the infotainment system will be allowed to operate with the engine switched off for a second time.

Calibration

Periodically the BMS module will instigate a self-calibration routine. To self-calibrate, the BMS first charges the battery to its full condition.

Once the battery is fully charged, the BMS will discharge the battery to approximately 75% of its full state of charge, but never lower than 12.2 V. The time taken to complete this part of the routine is dependent on the electrical load on the vehicle and the length of time the vehicle is used.

When the second part of the routine has been successfully completed, the BMS will return the battery to its optimum level of charge. The optimum level of charge will be between 12.6 V and 15 V, depending on battery condition, temperature and electrical loading. This process is run approximately twice a year.

NOTE: If the vehicle is only driven for short periods the self-calibration and charging process could take a number of days to complete.

CAUTION:

⚠ **Due to the self-calibration routine, it is recommended that all power supply diagnostic testing is carried out using IDS rather than a digital multi-meter.**

Diagnostics

BMS DTCs are stored in the RJB and ECM. These DTCs help diagnose battery or generator power supply issues and can be read using IDS. Part of the BMS diagnostic process includes an automated power supply diagnostic procedure. This feature provides a menu -driven test to locate the fault in a logical sequence. The test procedure uses the capability of the BMS and generator's LIN bus controlled functions to provide current flow information and will detect if the generator and/or BMS are functioning correctly.

NOTE: Results of the automated power supply diagnostic procedure will be required prior to replacement of components.

The battery positive terminal is directly connected to the BMS module via a 5-amp fusible link. This should prevent any potential voltage drop in the circuit which would result in incorrect information being received by the BMS.

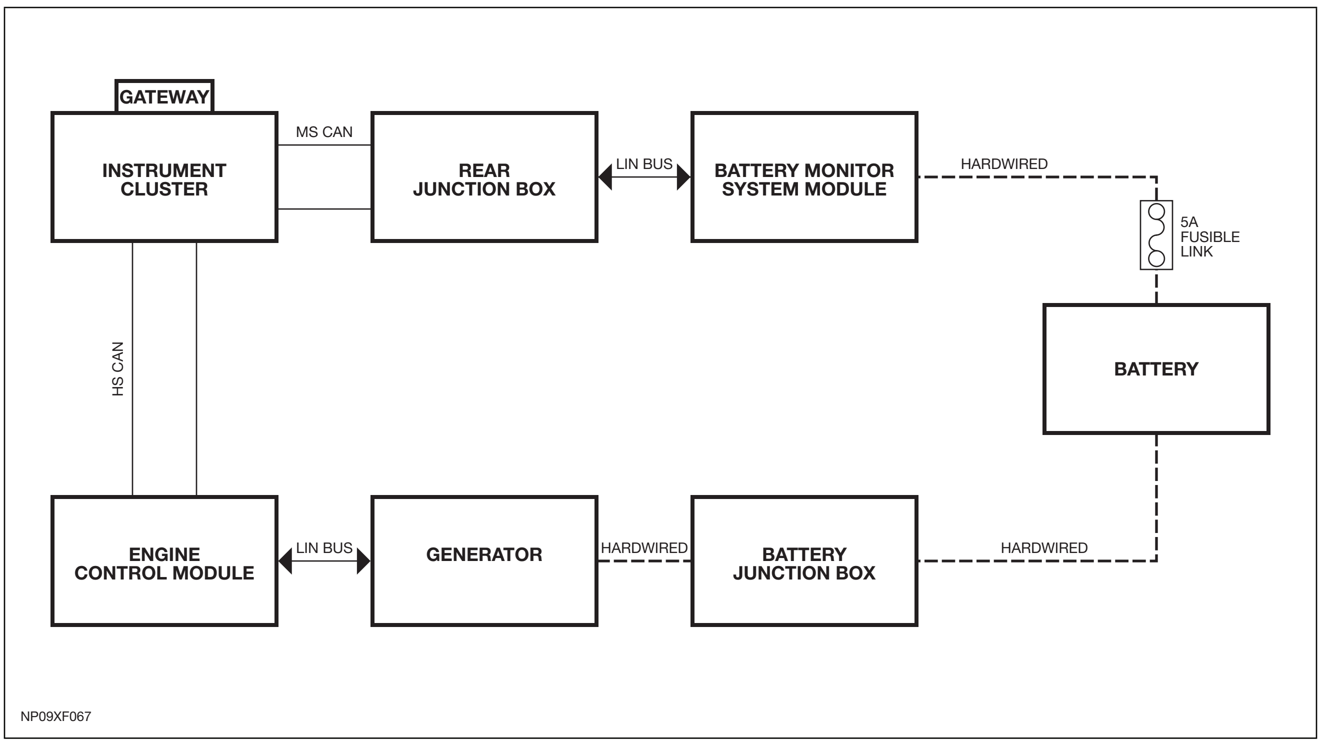
If the fusible link becomes an open circuit, the RJB would detect communication loss with the BMS. The battery warning lamp would be shown in the instrument cluster message center, the system would default to a fixed charging voltage of 13.7 volts and a DTC would be set. The same would occur if the LIN circuit was open or short circuit.

If the fusible link has corrosion or high resistance, causing a high voltage drop, the BMS would interpret this as a low battery charge condition.

The generator/regulator communicates with the BMS via the following networks:

- Generator/regulator to ECM via a LIN bus
- ECM to instrument cluster via the HS CAN bus
- Instrument cluster to the RJB via the MS CAN bus
- RJB to the BMS via a LIN bus

Battery Monitor System Control Diagram



INTERIOR LIGHTING

Interior Lighting Output Control			
Light	Primary Input	Output Module	Power Supply
Trunk lights	Trunk latch switch	RJB	RJB internal relay
Glove box light	Glove box light switch	CJB	CJB internal relay
Vanity lights	Vanity light switches	CJB	CJB internal relay
Front map lights	JaguarSense map lights	CJB	CJB internal relay
Rear map lights	Rear map switches	CJB	CJB internal relay
	Remote unlock signal	RJB	RJB internal relay
	Door switches	RJB	RJB internal relay
Courtesy lights	Door switches	RJB	RJB internal relay
	Remote unlock signal	RJB	RJB internal relay
	JaguarSense	CJB	CJB internal relay
Front footwell lights	Door switches	RJB	RJB internal relay
	Remote unlock signal	RJB	RJB internal relay
	JaguarSense	CJB	CJB internal relay
Puddle lights	Door switches	DDM	CJB internal relay

Switched System Power

A timer function within the CJB controls the switched system power via internal relays and the RJB provides a controlled ground for the fade on and off function. The timer is initialized when the ignition is switched off.

Switched system power will be reactivated when:

- CJB receives an unlock signal from the Smart Key via KVM
- Either door or the trunk is opened
- Ignition position is changed from run or accessory to off

Battery Saver

In order to conserve battery power, after approximately 15 minutes with the ignition off the CJB and RJB will remove battery voltage from the interior lighting circuits by deactivating the appropriate internal relays.

JAGUARSENSE SYSTEM

JaguarSense is an electronic control system, based on capacitive sensor technology, which uses touch or proximity operation to control the manual switching on/off of the front overhead interior lighting and opening of the glovebox.

Within the proximity sensor, a charge is transferred onto an electrode and measured through a sampling capacitor. The capacitance of the electrode changes when an object nears the sensing surface. This is reflected in a change to the charge accumulated at the sampling capacitor. If the change is great enough and crosses a preset detection threshold value, detection will be reported.

The reported detection is received by the JaguarSense module (there are separate modules for the lighting and glovebox functions) switching the light on/off or sending a signal to release the glovebox electromechanical latch.

JaguarSense Interior Lighting Control

JaguarSense front interior lighting control allows either the driver or front passenger to independently turn the front overhead console lights on or off by moving their finger(s) near to the surface of each light lens. Because the overhead interior light sensor function operates through the CJB, other courtesy light functions such as illumination on door opening are not affected.

The front overhead console lights are operated directly by the proximity sensor switches. The lights turn on and off and do not fade up or down when operated from the interior light unit. The center courtesy light only fades on and off when opening or closing the door. With all illumination switched off, the maximum power consumption of the JaguarSense system is 20mA.

The proximity sensors are mounted behind each lens, with the JaguarSense control components within the overhead console lighting unit. There is no longer any separate switch panel. For each light, the JaguarSense function is operated by a single finger or more than one finger touching anywhere on the lens, and it can be used while wearing gloves up to a thickness of 3mm. There is no specific icon or area to touch. The function will be activated when the user’s finger(s) comes within less than 20mm of the surface of the lens. It will toggle between on and off with successive touches, but it will not respond to a second touch until the finger has been removed to a distance of between 10 and 30mm after the first touch.

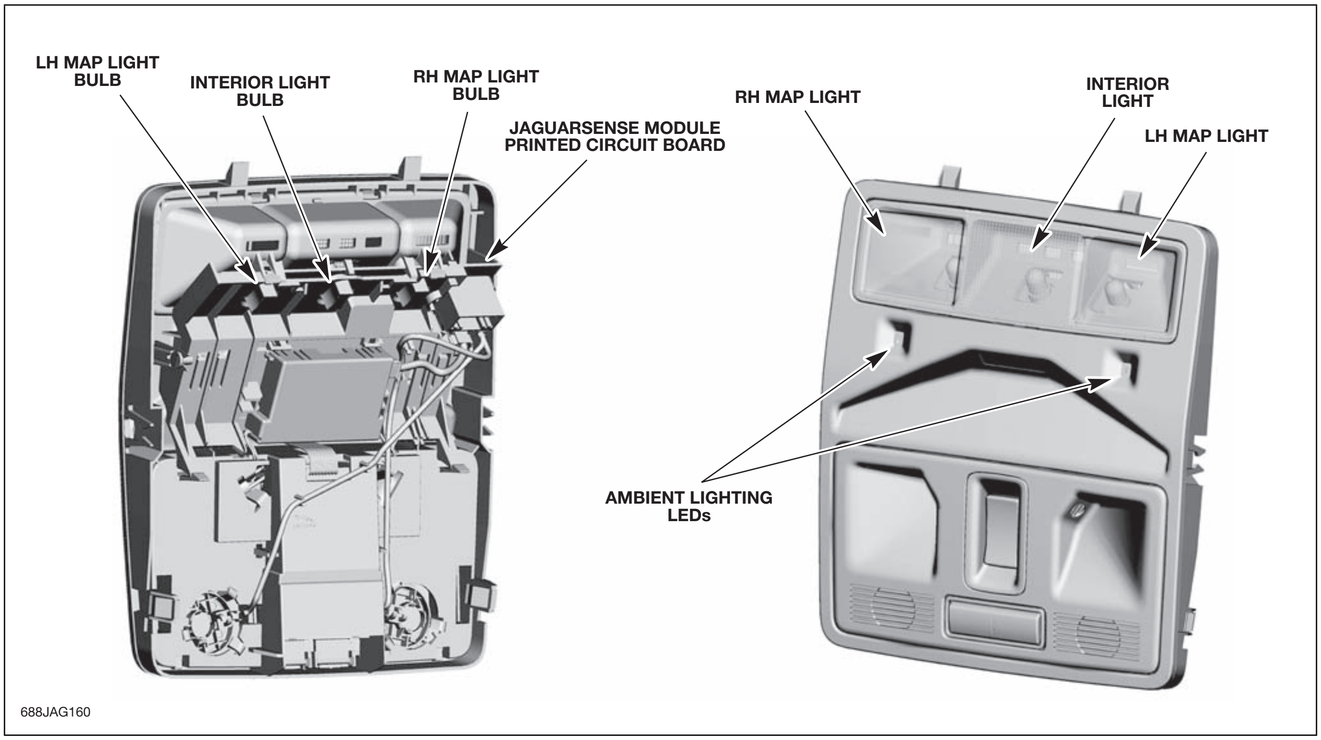
The required proximity to the sensor is calculated to avoid false responses to the user adjusting the interior mirror or sun visors. The sensing distance is calibrated into the module during manufacture and cannot be altered in service. If two adjacent lenses are touched at the same time, only the first to be touched will respond. The other lens must be touched again to operate the function.

The interior lights have 2 modes of operation: manual and automatic.

Manual Operation

Courtesy and map lights can be operated manually by the JaguarSense system.

Front Overhead Console



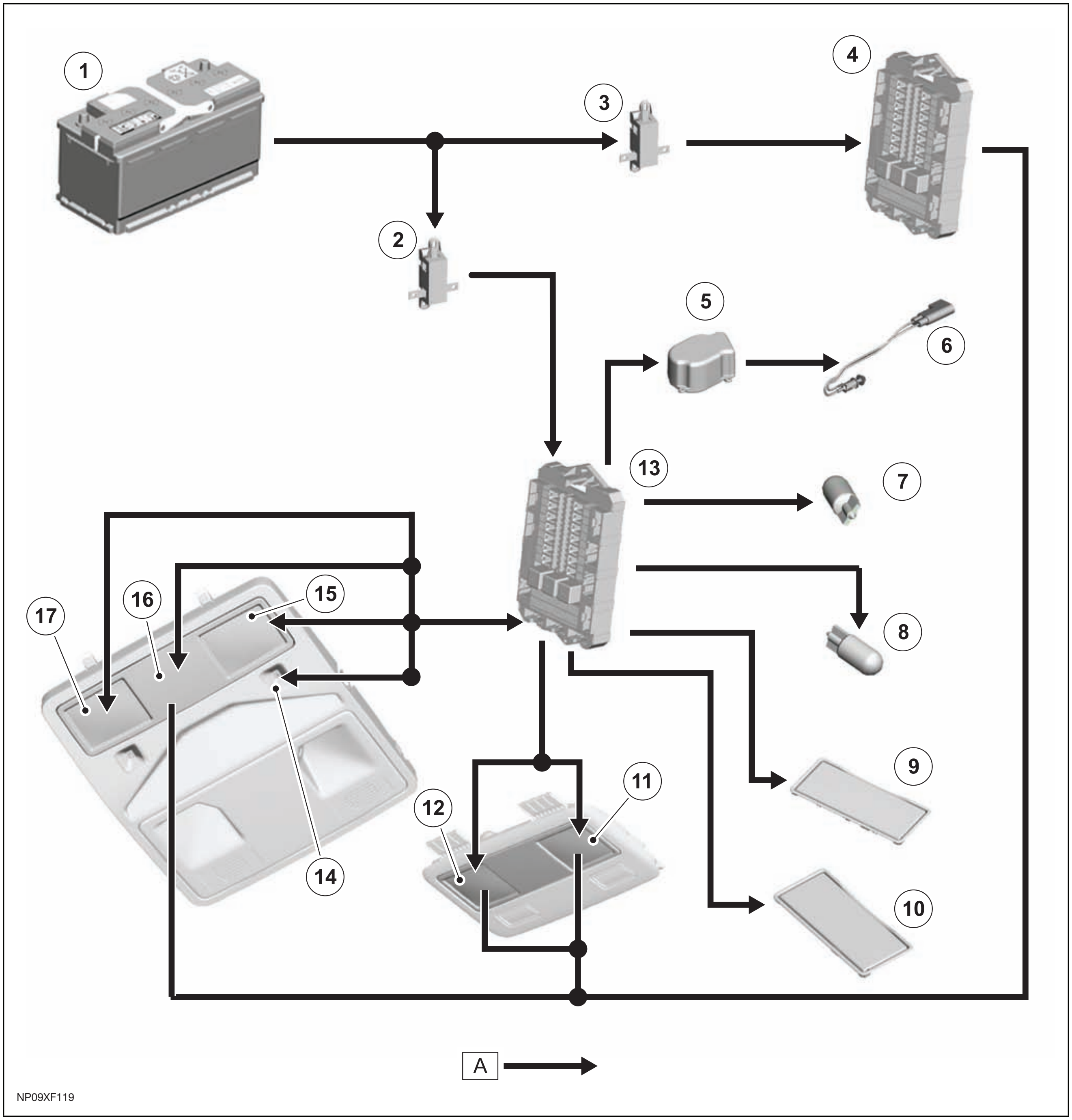
Automatic Operation

The courtesy light functionality is controlled by the CJB and the RJB and reacts to the vehicle being locked or unlocked and opening the vehicle doors. To deactivate or activate automatic illumination, touch the front courtesy light for approximately 2 seconds.

NOTE: The 2 white ambient lighting LEDs are active when the side lights or headlights are selected on and create the ‘ambience’ lighting feature to gently illuminate the vehicle interior.

NOTE: The rear overhead console interior lights have conventional switches

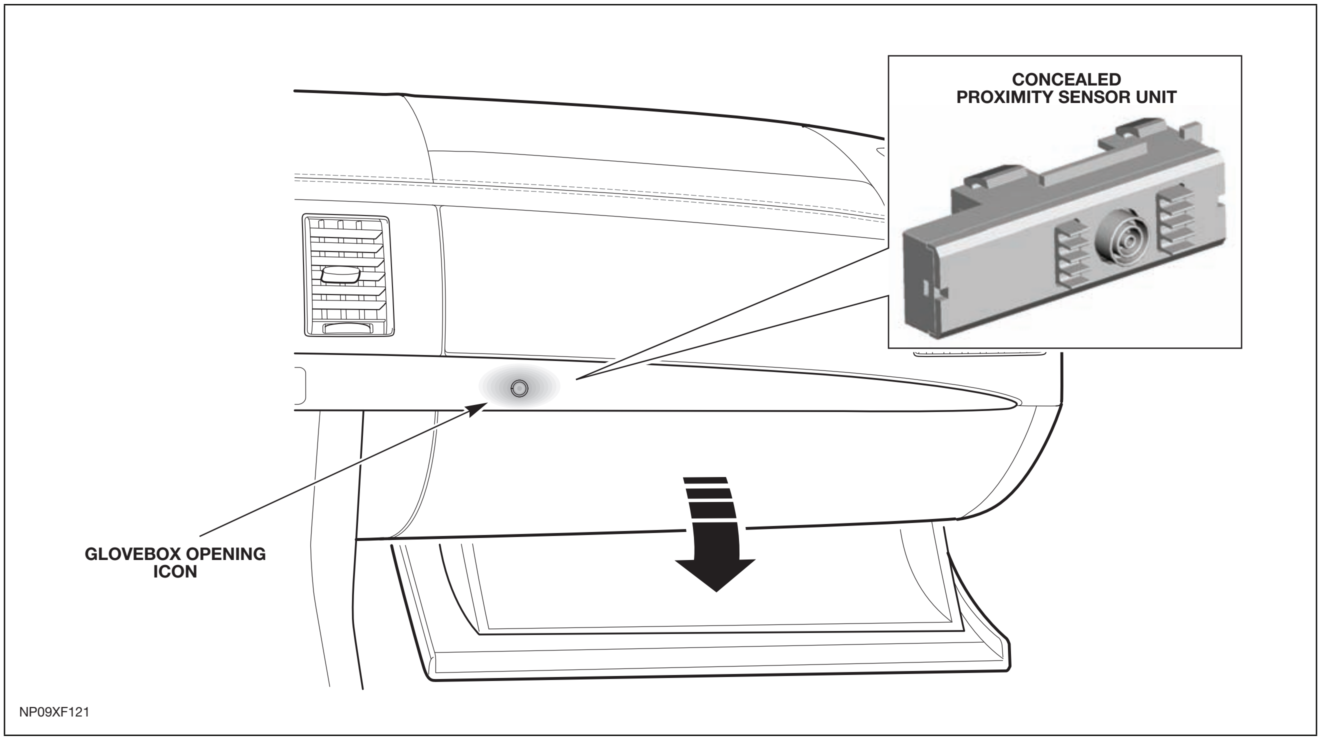
Interior Lighting Control Diagram



A	Hardwired	9	LH vanity mirror
1	Battery	10	RH vanity mirror
2	Battery junction box (BJB) – Megafuse	11	LH rear interior light
3	Battery junction box (BJB) – Megafuse	12	RH rear interior light
4	Rear junction box (RJB)	13	Central junction box (CJB)
5	Glovebox light	14	Ambience lighting LEDs
6	Glovebox light switch	15	RH map reading light
7	LH footwell light	16	Courtesy light
8	RH footwell light	17	LH map reading light

JaguarSense Glovebox Control

JaguarSense eliminates the physical switch or button and allows the user to open the glovebox by touching an icon located on the instrument panel veneer close to the glovebox lid. The icon indicates the position of the concealed proximity sensor, which sends a signal to the CJB to activate the glovebox electromechanical latch release mechanism. The functionality of the glovebox locking mechanism adds additional features such as allowing the glovebox to be locked in valet mode.



NOTE: The glovebox proximity sensor and release mechanism will only operate in Convenience Mode or when the ignition is switched on.

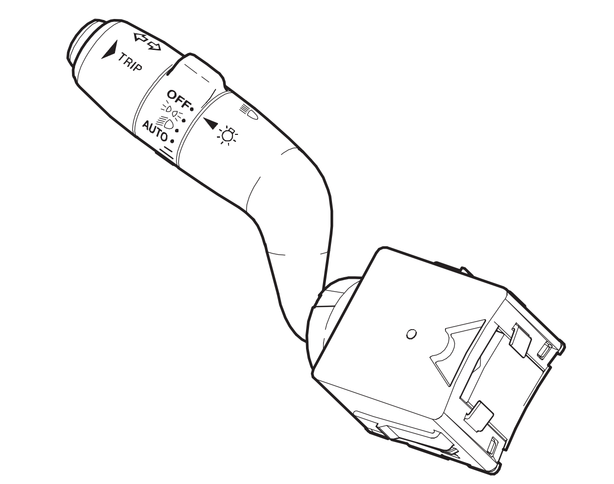
When the vehicle alarm is armed or valet mode is selected, the touch sensor is disabled, preventing the glove box from being opened. The glovebox opening function is designed to operate by the touch, or very close proximity (approximately 5mm) of a finger. The function can be used while wearing gloves up to a thickness of 3mm but is not activated by the touch of a flat palm, the close proximity of a knee or other items such as a shopping bag placed near to the proximity sensor. The system is not triggered by the user cleaning the instrument panel veneer and wiping over the release icon with a cloth.

The proximity sensor is mounted in contact with the back of the instrument panel veneer substrate with no air gap between the sensor and substrate. An additional proximity sensor is mounted either side of the main sensor which operates an ‘anti-wipe’ function and inhibits the main sensor if either secondary sensor is touched first. The 3 proximity sensors are located in a single electronic module and have a maximum power consumption of less than 20mA.

A fault in the JaguarSense system does not generate any DTCs. If a JaguarSense unit is replaced, no configuration procedure is necessary.

EXTERIOR LIGHTING

Main Lighting Switch



688JAG086

The left-hand column stalk is a multifunction switch assembly used to activate the following functions:

- Side lights
- Low-beam headlight
- High-beam headlight
- Autolamps
- Turn signal indicator lights
- Exit delay
- Trip computer

Exterior lighting is activated by the main lighting switch assembly (left hand column stalk).

The instrument cluster supplies power and ground to the switch assembly. Each switch position is connected to the ground return via resistors which vary the return voltage to the instrument cluster. The instrument cluster senses the voltage returning and determines the switch position selected. The instrument cluster then generates an applicable message which is sent to the RJB and the CJB on the medium speed CAN bus for activation of the selected exterior lights.

Daytime Running Lights

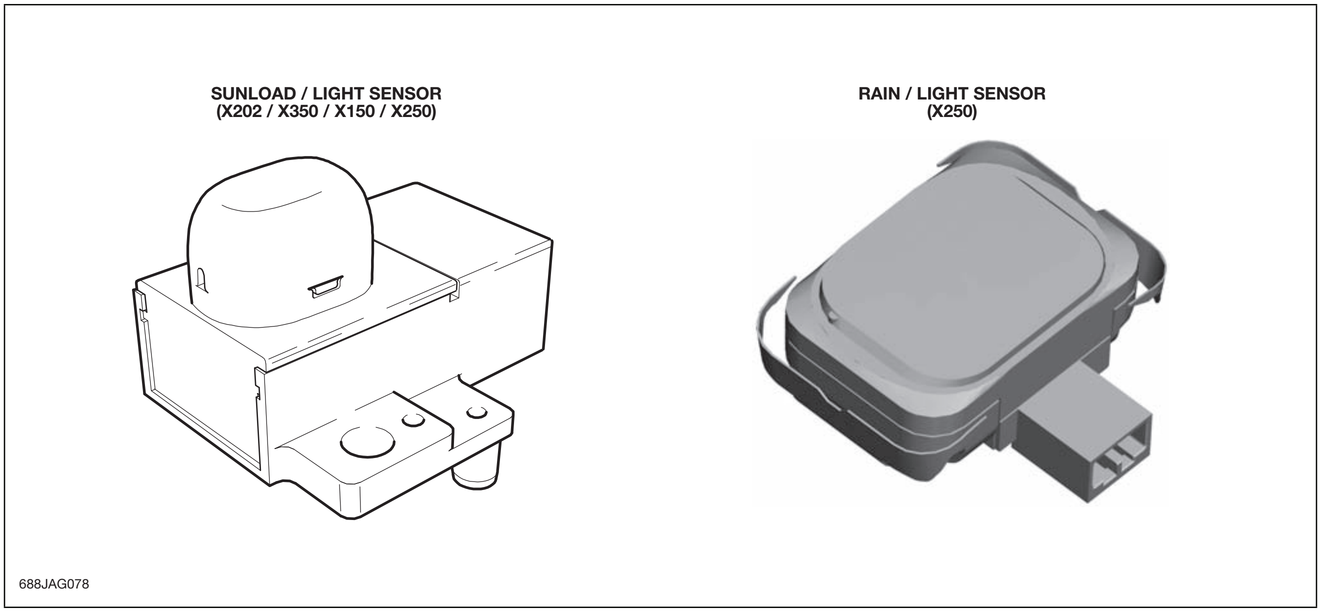
When daytime running lights (DRL) are enabled, dipped headlights, sidelights, tail, license plate and (where fitted) side marker lights will switch on automatically when the lighting switch is in the OFF position, provided that:

- The ignition system is ON
- The vehicle JaguarDrive selector is out of Park
- The parking brake is not applied

Daytime running lights are enabled via IDS.

Autolamps

The operation of the autolamps feature is dependent on ambient light levels, monitored by photodiodes integrated into the sunload/light sensor and the rain/light sensor



The sunload/light sensor provides input to the instrument cluster, which responds by supplying control signals on MS CAN to the CJB for message center and dash illumination level.

The rain/light sensor provides input to the CJB and RJB which automatically controls the operation of the side lights and low-beam headlights.

Sensors require the ignition key to be at position II or III and the main lighting switch set to the AUTO position for operation.

NOTE: Obstruction of the sunload/light sensor will affect instrument panel illumination only.

The sensors are calibrated to monitor ambient light levels as follows:

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

Windshield Wiper Detection

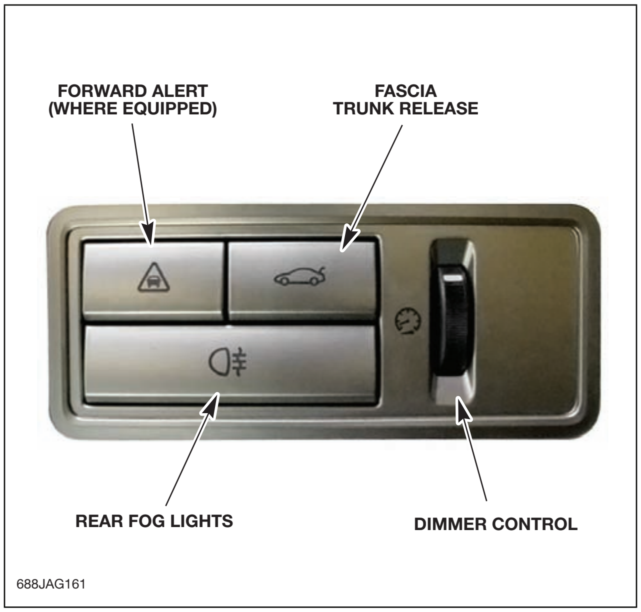
When the Autolamp setting is selected, the headlights and sidelights will switch ON automatically if the windshield wipers are switched ON for 20 seconds or more. The headlights and sidelights will automatically switch OFF after two minutes once the windshield wipers are switched OFF.

Exit Delay

The exit delay feature is controlled by the CJB via inputs from the instrument cluster and is activated when the ignition is switched off. The dip beam will remain illuminated for 10s, 30s, or 2 min, (depending on the position of the main lighting switch) or until the ignition is turned to position ‘II’ (or the headlight convenience button on the SmartKey is pressed).

NOTE: The feature will not function if the main lighting switch is set to AUTO.

Auxiliary Lighting Switch



The auxiliary lighting switch comprises:

- Dimmer control
- Rear fog light switch
- Forward alert (when equipped)

The auxiliary lighting switch is connected to the instrument cluster. Each switch position is connected to the ground return via a series of resistors, which vary the supply voltage from the instrument cluster. The instrument cluster senses the voltage and determines the switch position selected. The instrument cluster then generates an applicable message which is sent to the CJB and the RJB on the medium speed CAN bus for activation of the selected function.

Rear Fog Lights

The rear fog lights can only be activated when the ignition system is ON, engine running with the lighting switch in sidelight or dip position.

Dimmer Control

Instrument cluster and panel illumination is achieved through a series of LEDs located throughout the interior of the vehicle. The intensity of illumination can be controlled by the driver through the rotary control integral with the auxiliary lighting switch.

The rotary control is a variable resistor which is used as a potential divider to provide a high or low voltage according to its set position. The voltage returned to the instrument cluster is converted into a dimmer control positional message and transmitted to the CJB over the MS CAN bus. The CJB converts the illumination intensity message into a Pulse Width Modulation (PWM) signal which it supplies to the instrument panel and switch illumination LED.

Hazard Warning Flashers

The hazard warning switch is part of the integrated control panel located in the center console below the touchscreen and operates with the ignition ON or OFF.

688JAG162

The hazard switch input is hardwired directly to the RJB. Hazard function is controlled by the RJB via the internal printed circuit board (PCB) relay assembly. Once activated the hazard message is transmitted via MS CAN to the instrument cluster (IC). The IC controls the green instrument cluster direction indicator lights and audible ticking. The hazard switch icon flashes in unison with the indicators via the same internal RJB PCB relay.

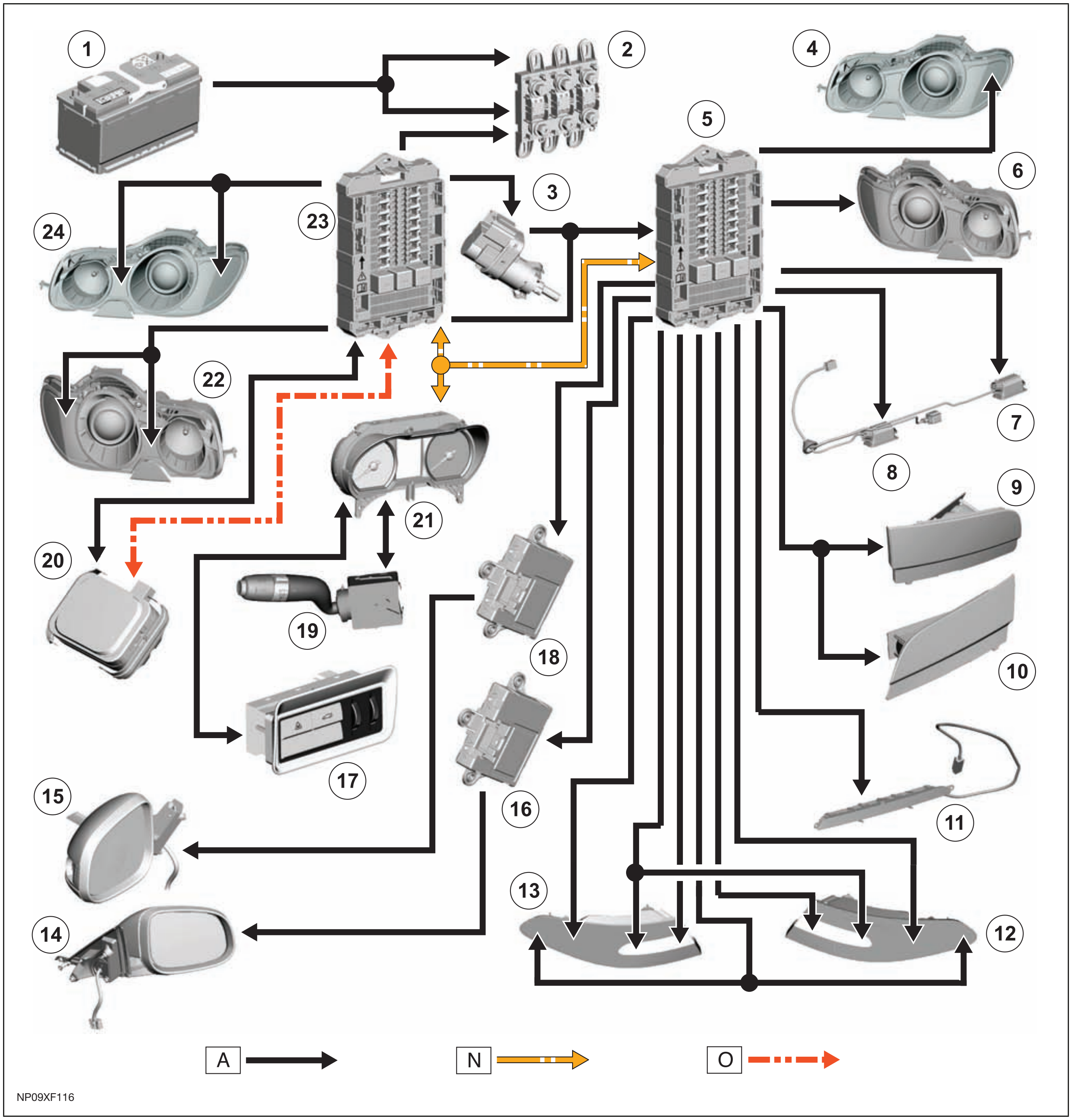
Circuit Protection

The CJB and the RJB provide circuit protection for all exterior lighting circuits. The exterior lighting circuits are protected by Field Effect Transistors (FETs). Operation of the exterior lighting circuits is protected by the FETs which can detect overloads and short circuits. The FETs respond to heat generated by increased current flow caused by a short circuit.

On a normal circuit this would cause the fuse to blow. The FETs respond to the heat increase and disconnect the power supply to the affected circuit. When the fault is rectified or the FET has cooled, the FET will reset and operate the circuit normally. If the fault persists the FET will cycle, disconnecting and reconnecting the power supply.

The CJB and the RJB store fault codes which can be retrieved using IDS. The fault code will identify that there is a fault on a particular output which will assist with fault detection.

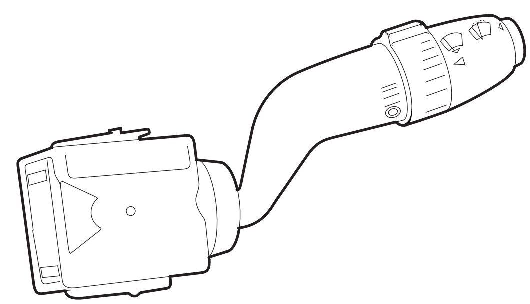
Exterior Lighting Control Diagram



A	Hardwired	7	RH licence plate light	16	RH front door module
N	MS CAN	8	LH licence plate light	17	Auxiliary lighting switch
O	LIN Bus	9	LH fog light	18	LH front door module
1	Battery	10	RH fog light	19	Light switch – LH steering column multifunction switch
2	BJB – Megafuse	11	High mounted stop light	20	Rain/light sensor
3	Brake light switch	12	RH tail light assembly	21	Instrument cluster
4	LH turn signal indicator	13	LH tail light assembly	22	RH headlight assembly
5	Rear junction box (RJB)	14	RH door mirror side repeater	23	Central junction box (CJB)
6	RH turn signal indicator	15	LH door mirror side repeater	24	LH headlight assembly

WASH/WIPE SYSTEM

Wash/Wipe Switch



688JAG095

The wipers have 5 operational states:

- Flick wipe
- Auto wipe
- Slow wipe
- Fast wipe
- Wash wipe

The wiper switch assembly is connected to the instrument cluster. The instrument cluster supplies power and ground to the switch assembly. Each switch position is connected to the ground return via resistors which vary the return voltage to the instrument cluster. The instrument cluster senses the voltage returning and determines the switch position selected. The instrument cluster then generates an applicable message which is sent to the CJB on the MS CAN bus for activation of the wipers. The CJB receives the message and controls the operation of the wipers and washers in response to driver inputs and signals from the rain sensor.

The ‘Auto’ function requires an input from the rain sensor. If continuous wipe is selected for more than 20 seconds with the headlight switch in auto, headlight low beam will be activated. If the wiper/washer control switch is consequently moved to the auto or off position, headlight low beam will continue to operate for a further 120 seconds.

Wiper Service Position

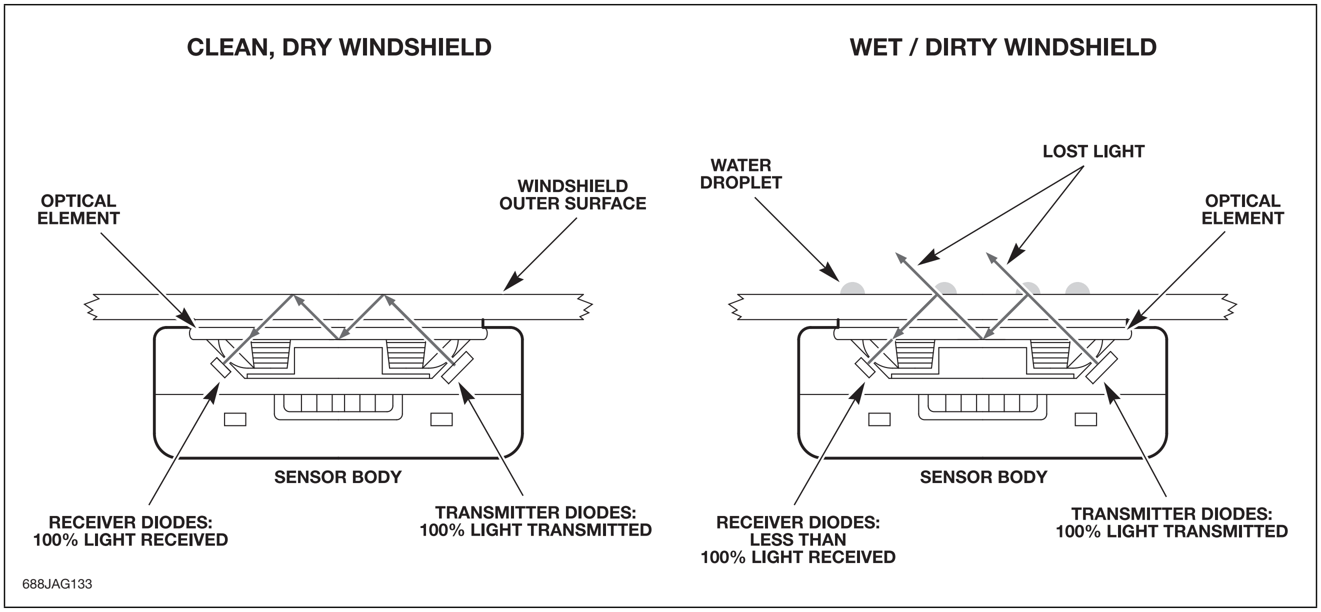
The wiper service position allows the wipers to be parked in a position to allow easy access to the wiper blades for replacement. The service position is initiated by pulling the RH steering column multifunction switch towards the steering wheel and pressing the start/stop button to switch on the ignition. The wipers will move and stop in a vertical position on the windshield.

The RH steering column multifunction switch can be released and the ignition switched off. The service position is terminated at the next ignition on cycle and the wipers return to their normal park position.

Rain Sensing

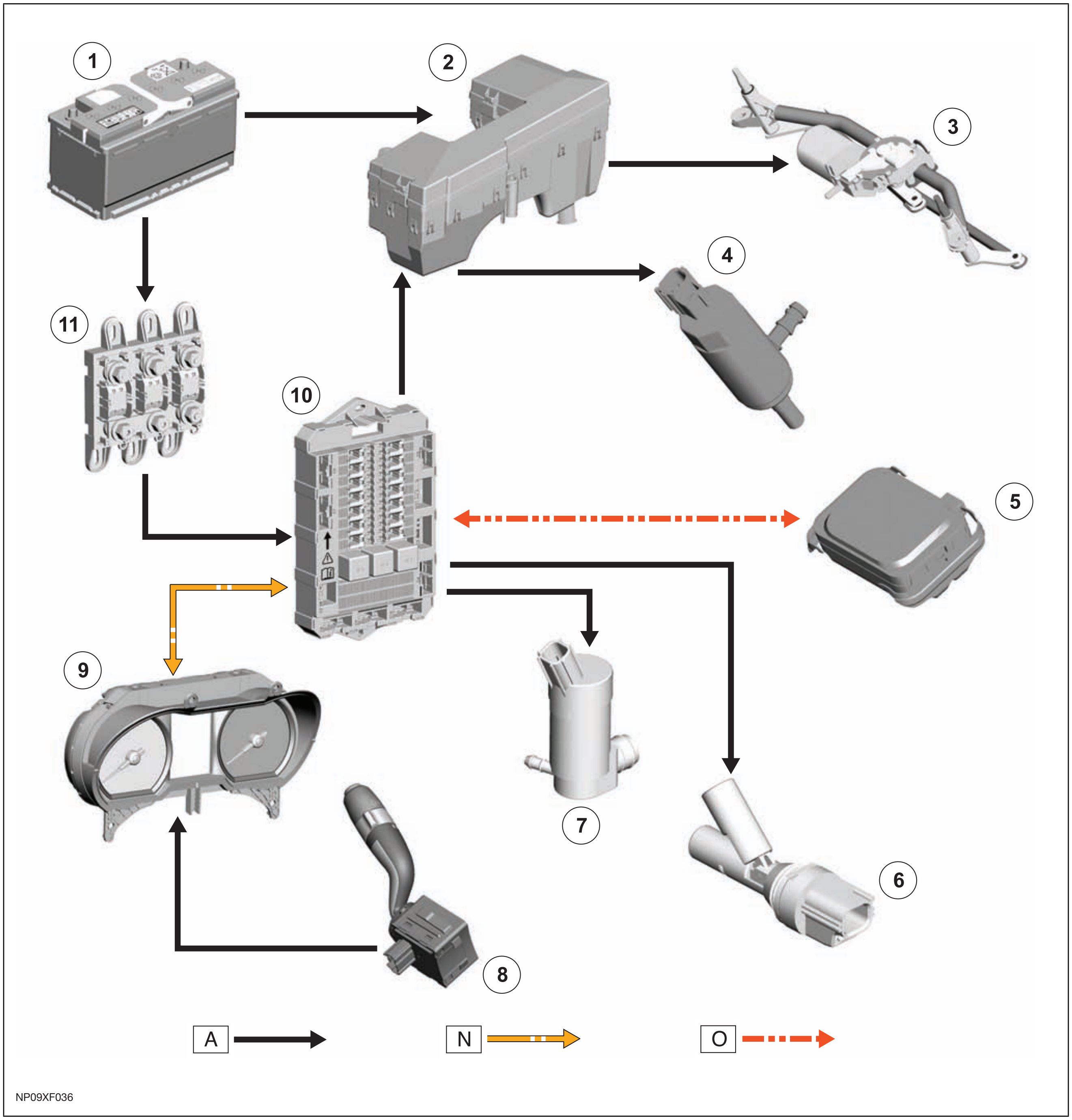
The rain sensor is an optical transducer, which senses changes to infrared light caused by the refractive effects of water droplets on the windshield. The sensor is fixed to the inside of the windshield with the sensing elements facing outwards through the glass. The sensor elements consist of two groups of light emitting diodes (LEDs), 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 rain sensor transmits a voltage value based on pulses to the CJB via direct hardwire.



NOTE: Because a dirty windshield appears the same as a wet windshield to the rain sensor, unexpected wiper action on a dry windshield is possible and is not a fault. Before performing any repairs for customer concerns of unintended wiper movement, ensure that the wipers were not on 'AUTO' when the event occurred.

Wash/Wipe Control Diagram



A	Hardwired	5	Rain/Light sensor
N	Medium speed CAN bus	6	Washer reservoir fluid level switch
O	LIN bus	7	Windshield washer pump
1	Battery	8	Wiper/Washer switch – RH steering column multifunction switch
2	EJB (engine junction box)	9	Instrument cluster
3	Wiper motor	10	CJB
4	Headlight washer pump	11	BJB

SEATS

The X250 offers a number of front seating options. All variants start with a 10-way electrically adjustable driver seat, which is complemented by an 8-way electrically adjustable front passenger seat. The SV8 offers a 16-way electrically adjustable driver seat, which is complemented by a 12-way electrically adjustable front passenger seat. The controls for adjustment are on the seats, with the memory buttons in the door.

The following tables highlight the features available for each seating option:

Driver Seat

Seat Type	Non-Heated	Heated	Heated and Cooled	Lumbar Support	Memory
10-way	Yes	Optional	Optional	2-way	Yes
16-way	No	No	Yes	4-way	Yes

Passenger Seat

Seat Type	Non-Heated	Heated	Heated and Cooled	Lumbar Support	Memory
10-way	Yes	Optional	Optional	2-way	No
12-way	No	No	Yes	4-way	No

NOTE: Climate Controlled Seats™ (CCS) provide both heating and cooling and are equipped with perforated leather to allow conditioned air to circulate. To maintain consistent interior styling, rear seats will also include perforated leather in vehicles with the CCS option, but cooled seating will only be available for the front seats.

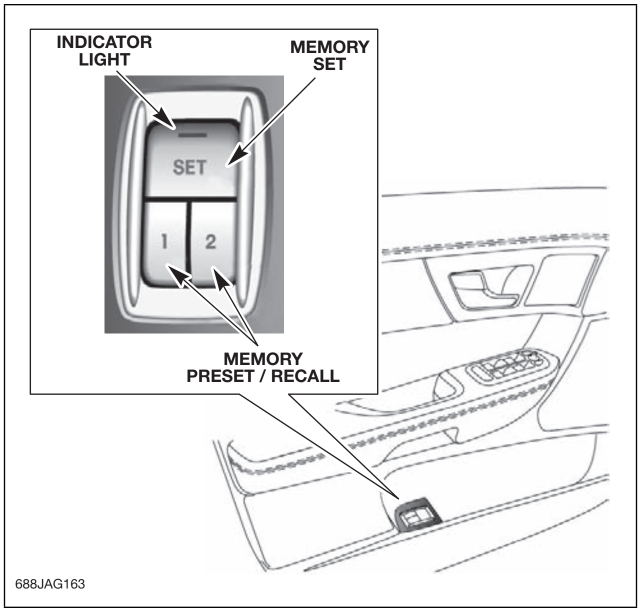
NOTE: The driver and passenger front seats, although almost identical, have some unique components. The front driver seat has a seat position sensor and the front passenger seat has an Occupancy Classification System (OCS). In both instances the components form an integral part of the airbag Supplemental Restraint System (SRS).

WARNING:

Prior to removal of the front seats and before disconnecting the front seat wiring harness electrical connectors (which includes the side airbag module electrical connectors), the battery ground cable should be disconnected and a period of at least 1 minute allowed to elapse. The same amount of care should be taken when handling and storing the front seats as would be taken when handling and storing airbag modules.

Seat Movement / Memory

The driver's seat switch pack is connected to the driver's seat module by a LIN bus. Any seat movement selection generates a message which is passed via the LIN to the driver's seat module. The seat module processes the request and operates the applicable seat function.



Each seat motor contains a hall position sensor. The sensor sends a feedback signal to the driver's seat module. The signal is used for memory store and recall functions.

Memory Operation

The memory switch communicates with the driver's seat module via the LIN bus in the driver's seat switch pack. The memory store switch has two buttons: 1 and 2 to allow two separate memory positions to be stored and 'set' button with integral LED. The seat, door mirror and steering column motors have position sensors which provide feedback to driver's seat module.

Once the driver's seat, steering column and exterior mirrors have been adjusted, the vehicle is able to memorize these settings for future use by using the following procedure with the ignition on:

Push the memory 'SET' button, the LED in the switch will illuminate

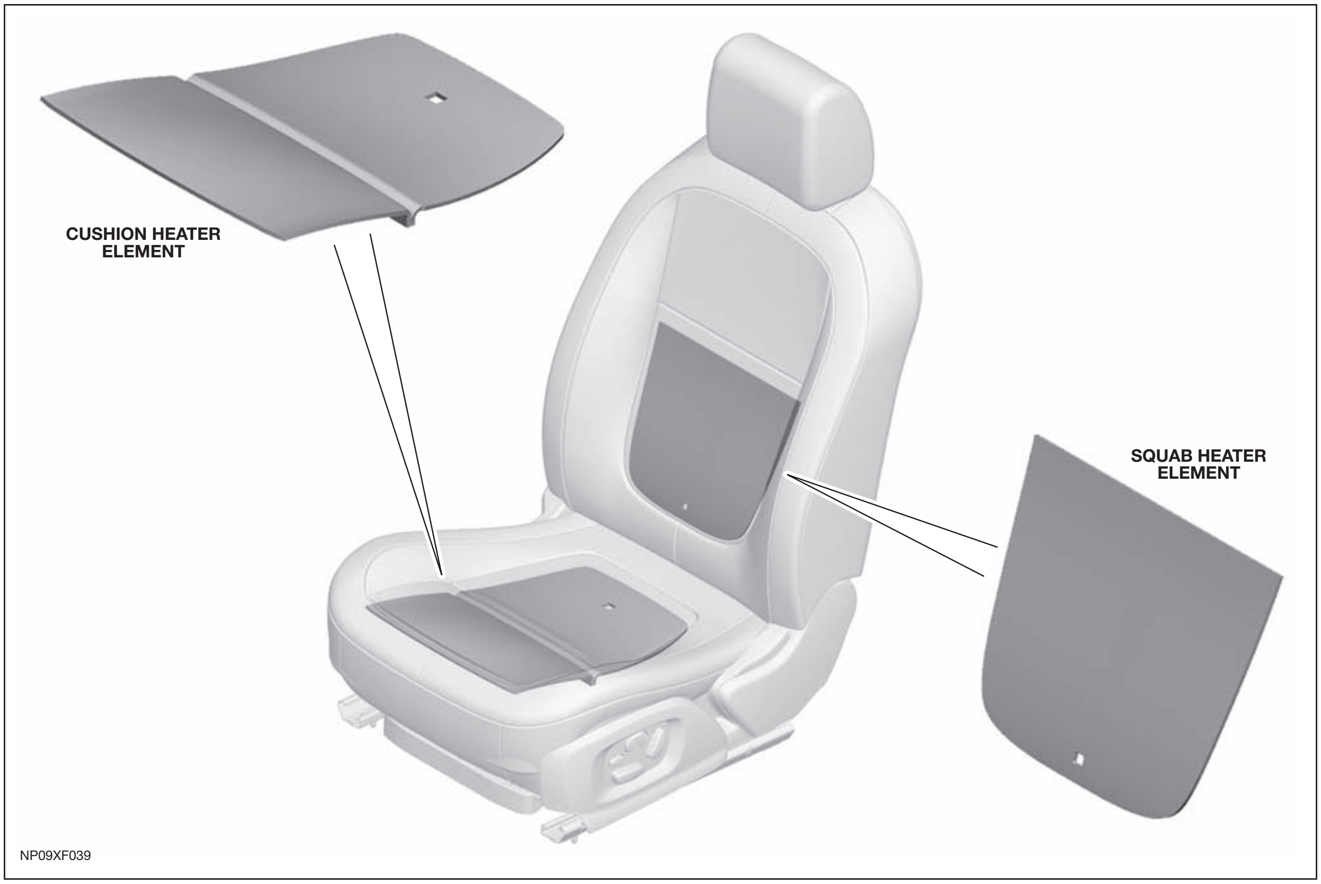
Press the memory button 1 or 2 to memorize the current settings. The LED will extinguish, a chime will sound to confirm that the settings have been memorized and the message center will display a confirmation message.

The positions can be recalled by pressing the applicable button 1 or 2.

Heated Seats

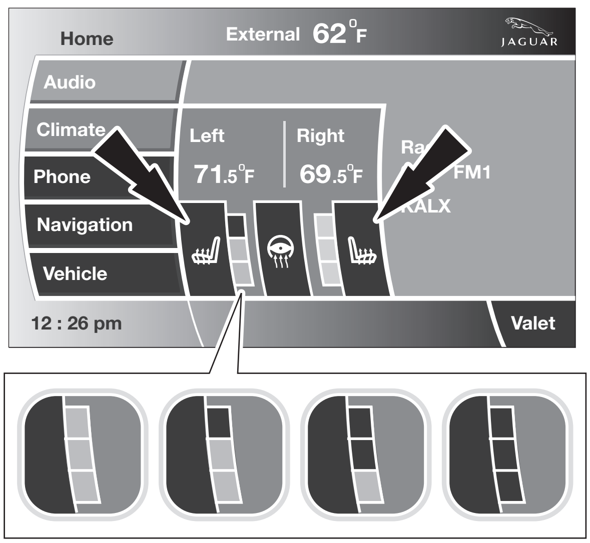
Mat-type heated front seats are optional on Luxury models and standard on Premium Luxury models. Vehicles fitted with the 3-stage heated front seat option also feature a heated steering wheel.

The 3-stage heated front seats feature 2 heater elements, one located in the seat back and one located in the seat cushion.



Heating requests are generated using the soft buttons on the TSD. These requests are transmitted to the information control module (ICM) over the MOST® ring. The ICM forwards these requests to the automatic temperature control (ATC) module via the MS CAN bus; seat heating is controlled by the ATC module via the CJB.

The CJB provides a power supply to the heating elements and also monitors the temperature of the front seats using a negative temperature coefficient (NTC) sensor located in each seat cushion. The CJB transmits the temperature readings back to the ATC module to provide closed loop control.



NP09XF040

Steering Wheel Heater

The steering wheel heater has 1 heat setting and can be turned on and off by pressing the soft button located on the TSD screen. When the ignition is switched off, the heater will reset to off.

Power for the heater element is supplied by the on receipt of a request from the module over the medium speed CAN bus. Temperature control for the heater element is provided by the steering wheel heater control module which receives a temperature feedback signal from a thermistor located within the steering wheel.

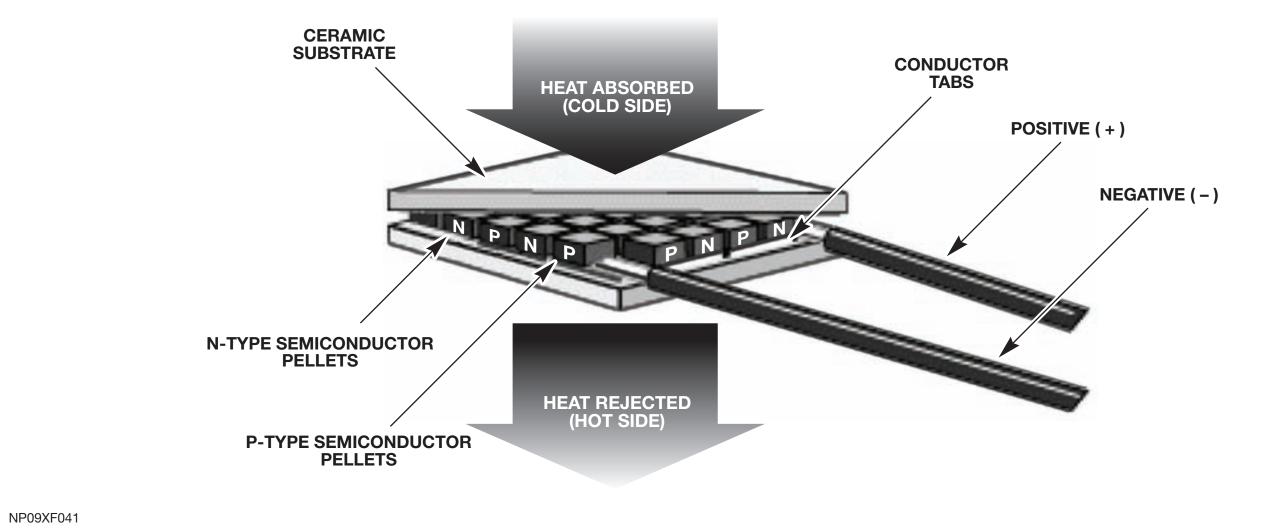
Climate Controlled Seat™ System

Vehicles fitted with the optional Climate Controlled Seat™ system (CCS) significantly improve the comfort level of the occupants by focusing the cooling directly on the passenger through the seat. The CCS system uses a Peltier cell, also known as a proprietary thermoelectric device (TED), to provide individual heating and cooling to the front seat assemblies. Named for Jean Peltier, who discovered the thermoelectric cooling effect in 1834, the Peltier effect occurs when an electrical current is passed through a junction formed by two dissimilar conductors, creating a heat pump. A heat pump absorbs heat from one side of the system, causing it to cool, and then transfers the heat to the other side, causing it to warm.

The 2008 MY XJ and 2009 MY XF use a solid-state Peltier cell that consists of a number of semiconductor elements, sandwiched between two substrates and connected in series and parallel. When voltage is applied in one direction, one side absorbs heat (creating a cooling effect) while the other the cell rejects heat. Switching polarity between the circuits creates the same effect but in the opposite direction.

The operation is similar to a conventional air conditioning system; one cell acts as the evaporator and absorbs heat while the other cell is the condenser which rejects the heat. The pump is replaced by an electrical charge and the heat energy is transported by the cell's metal construction rather than by a refrigerant.

Peltier Cell Operation



It is important to understand the operation and limitations of the Peltier cell. A Peltier cell has an efficiency of only 5-10%, compared to a conventional air conditioning system with an efficiency of 40%. The cell is capable of cooling the incoming air by approximately 8°C (12.4°F), which means that temperature output will depend on the ambient temperature inside the vehicle.

Example: If the temperature in the vehicle is the same as or exceeds the heat rejection side of the cell, poor cooling will be the result. If the temperature is colder than the heat absorption rate, the cell may start to ice up.

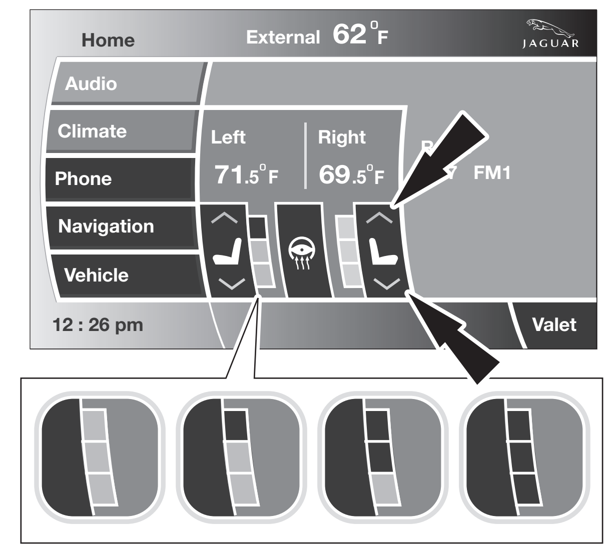
Benefits of using Peltier cells:

- Ability to cool or heat by simply reversing current flow
- Solid-state device, no moving parts
- Rugged, highly reliable
- Quiet, small & lightweight
- Pulse width modulated with feedback for accuracy
- Environmentally safe

Component Description

Touch Screen Display

CCS adds additional temperature control selections to the TSD from either the Climate menu or Home menu.



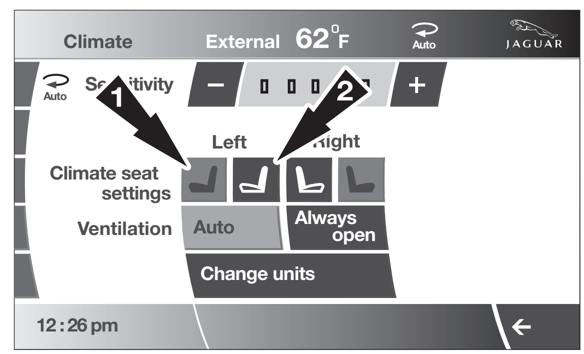
NP09XF042

Heating and cooling requests are generated using the soft buttons on the TSD. The TSD captures switch presses and steps through the three levels of heating or cooling. The temperature level indicators light up either red or blue to show the selected level of heating or cooling.

Backrest Only Ventilation

'Backrest only ventilation' allows the user to set the seat ventilation so that only the seat backrest is ventilated. Backrest only ventilation is selected using the touch-screen from the Climate control settings menu.

For the left or right front seat select the appropriate icon:



1 FULL SEAT VENTILATION 2 BACKREST ONLY

NP09XF043

When one of the heating or cooling settings is selected, filtered ambient air is circulated by a fan, forcing the air through a Peltier cell, where it is thermally conditioned.

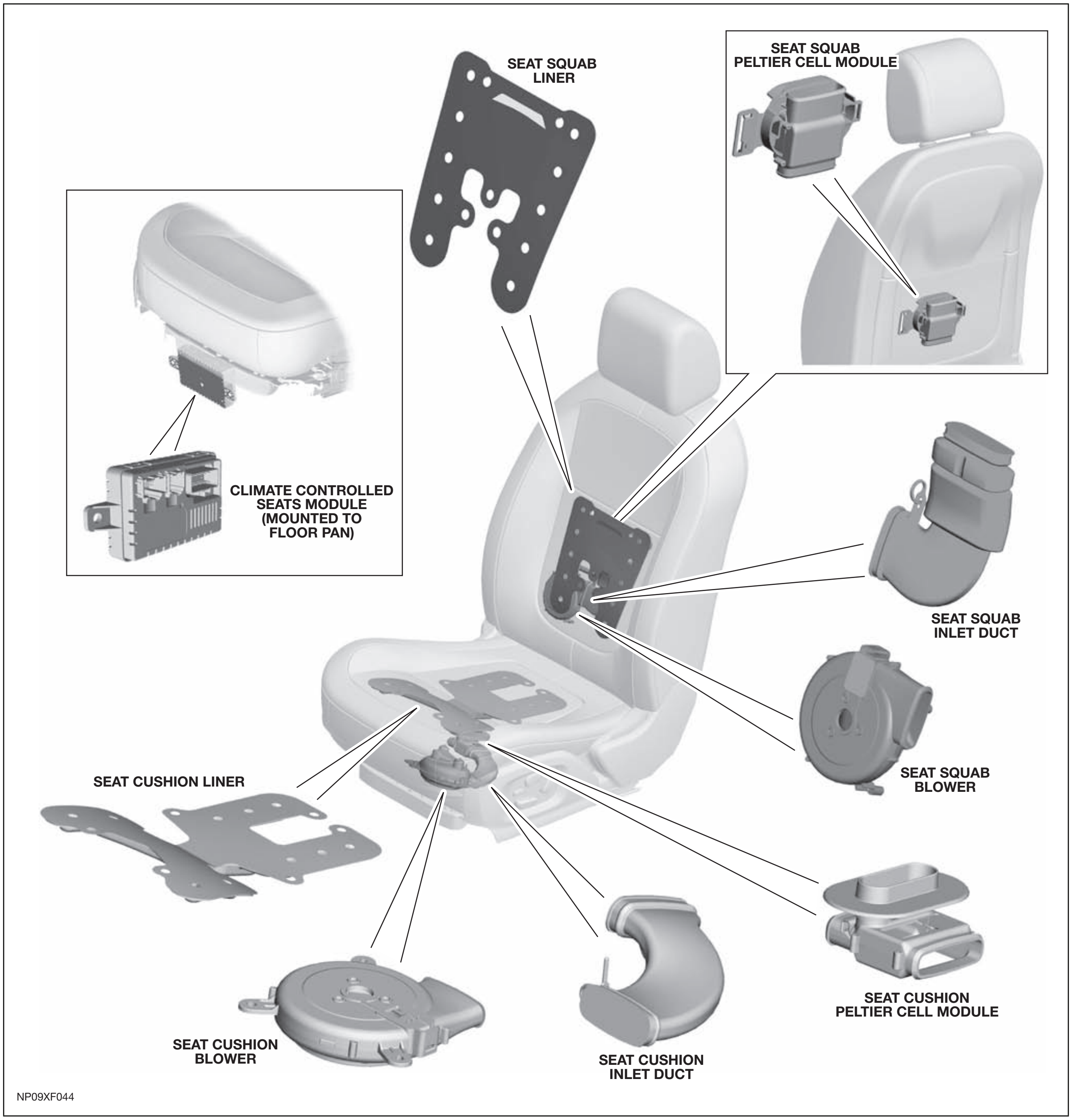
NOTE: Due to electrical loads, if the CCS system is activated with the key on / engine off, the system will not operate.

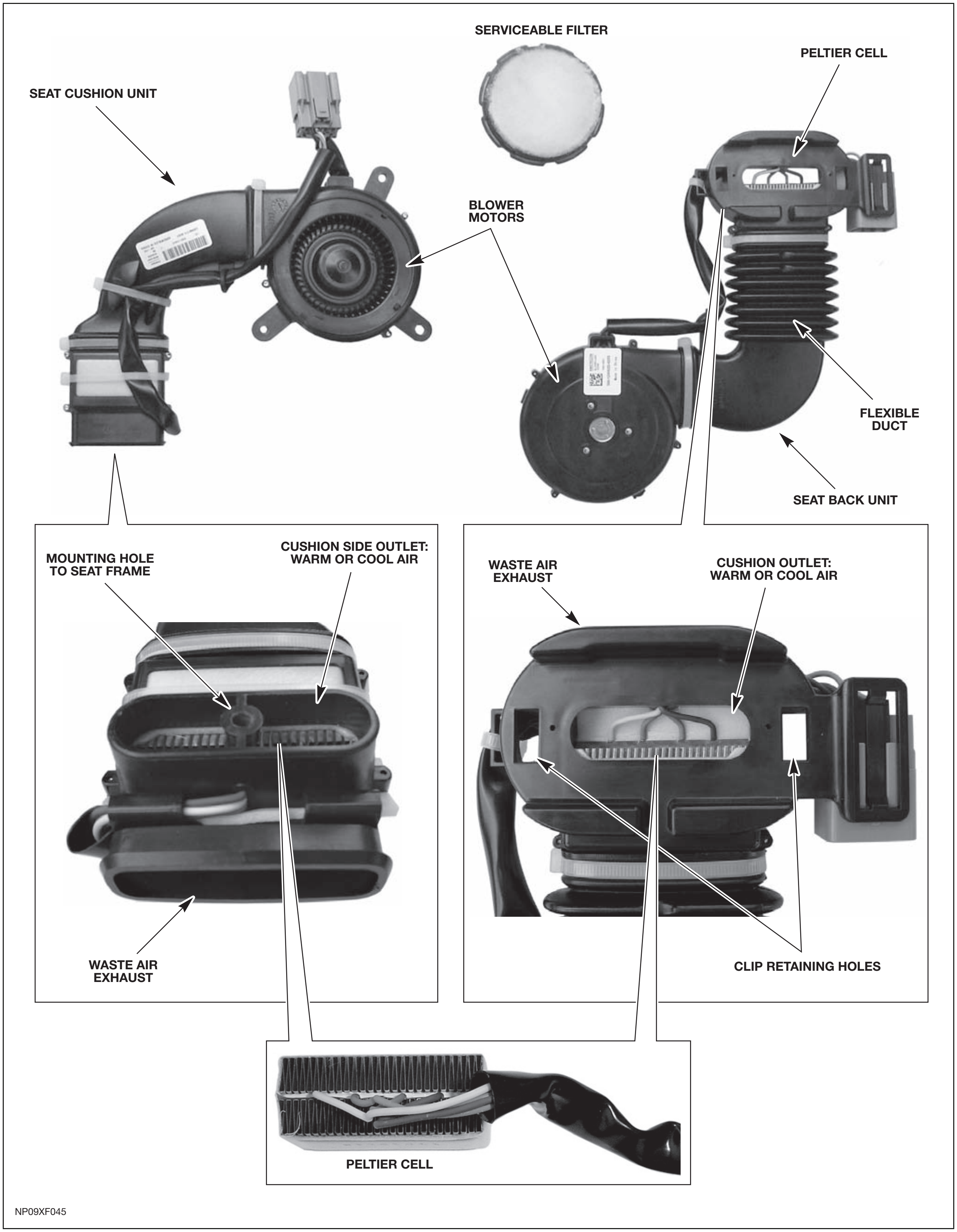
Climate Units

Each seat contains two climate units, one located in the seat back and the other in the seat cushion. Each contains a filter, blower fan, Peltier cell and an air duct. They are serviced as a complete unit with the exception of the separately serviceable filter. Ported channels in the foam cushions evenly direct the flow of conditioned air through breathable perforated leather seat covers to the occupant.

NOTE: Climate modules are serviced as complete units.

Component Location: Climate Controlled Seats™




SERVICEABLE FILTER
PELTIER CELL
SEAT CUSHION UNIT
BLOWER MOTORS
FLEXIBLE DUCT
SEAT BACK UNIT
MOUNTING HOLE TO SEAT FRAME
CUSHION SIDE OUTLET: WARM OR COOL AIR
WASTE AIR EXHAUST
CUSHION OUTLET: WARM OR COOL AIR
WASTE AIR EXHAUST
CLIP RETAINING HOLES
PELTIER CELL

NP09XF045

Principles of Operation

The CCS system is completely independent of the heating and air conditioning system. The existing automatic temperature control module does not control any aspect of CCS operation; the controlling software is contained within the Climate Controlled Seat Module (CCSM) located under the right front seat when fitted.

The CCSM is on the MS CAN network, as it requires information from other modules for operation (such as engine rpm). The CCSM requires an 'Engine Running' message to allow system operation as well as an 'enable' message from the Engine Control Module (ECM).

Temperature requests are transmitted to the information control module (ICM) over the MOST ring. The ICM forwards these requests to the CCSM (located under the passenger front seat) over the MS CAN bus.

In order to preserve battery and electrical system functionality, the Battery Monitor System (BMS) communicates with the ECM to reduce or even disable system operation based on total vehicle electrical loads. For example, when a request is made for cooling or heating, the ECM uses an electrical load management strategy to determine the available current and regulates power to the cells as it becomes available. During a high demand or electrical load (rear defroster, A/C, wipers, etc.) the ECM will regulate the power to the Peltier cells to prevent potential overloading of the electrical system.

The CCSM uses a PWM signal to regulate the temperature of the Peltier cells and a variable-voltage for the speed of the blower fans in order to maintain the selected temperature. Fan speed may increase or decrease slightly while on a specific setting as the controller regulates system output temperature.

The CCSM logic applies a series of steps when the system receives a command. The steps vary depending on the mode selected and whether the cells are hot or cold.

The CCSM powers up the cells with minimum air flow to set the cell temperature, and then the module steps up the blower speed to ensure the correct temperature is achieved quickly.

Heat Mode Operation

The CCSM operates in a closed loop control mode, using the feedback from the system thermistor. In heat mode, the Peltier cells are wired in parallel with nearly full battery voltage across each cell when first turned on. The CCSM monitors the NTC fin temperature sensors and adjusts the PWM duty cycle to the Peltier cells while also varying voltage to the blowers to achieve and maintain the temperature set point. The air flow from the blower is split over both sides of the cell, half going into the seat cushions and the other half released as waste. If either blower fails or the cells start to overheat, the CCSM will shut down both assemblies in that individual seat for protection.

Cool Mode Operation

The CCSM operates in an open loop mode. In cool mode, the Peltier cells are wired in series, with each cell supplied with half the battery voltage during initial startup. If the seat is switched from cushion and seat back to just seat back, the seat back now receives full voltage.

The difference between heat and cool modes is in the way the system is controlled. The CCSM monitors the fin temperature to ensure that the system is working properly with no PWM adjustments to the Peltier cells. For example, if the CCSM sees the fin temperature on the cells getting very cold to a potential ice up condition, it will turn off the cells for approximately 4 seconds, until the temperature stabilizes, then restart. During this process the blower speed will cycle from low to high, which may be noticeable to the user. This is considered normal operation if there are no codes stored in the CCSM.

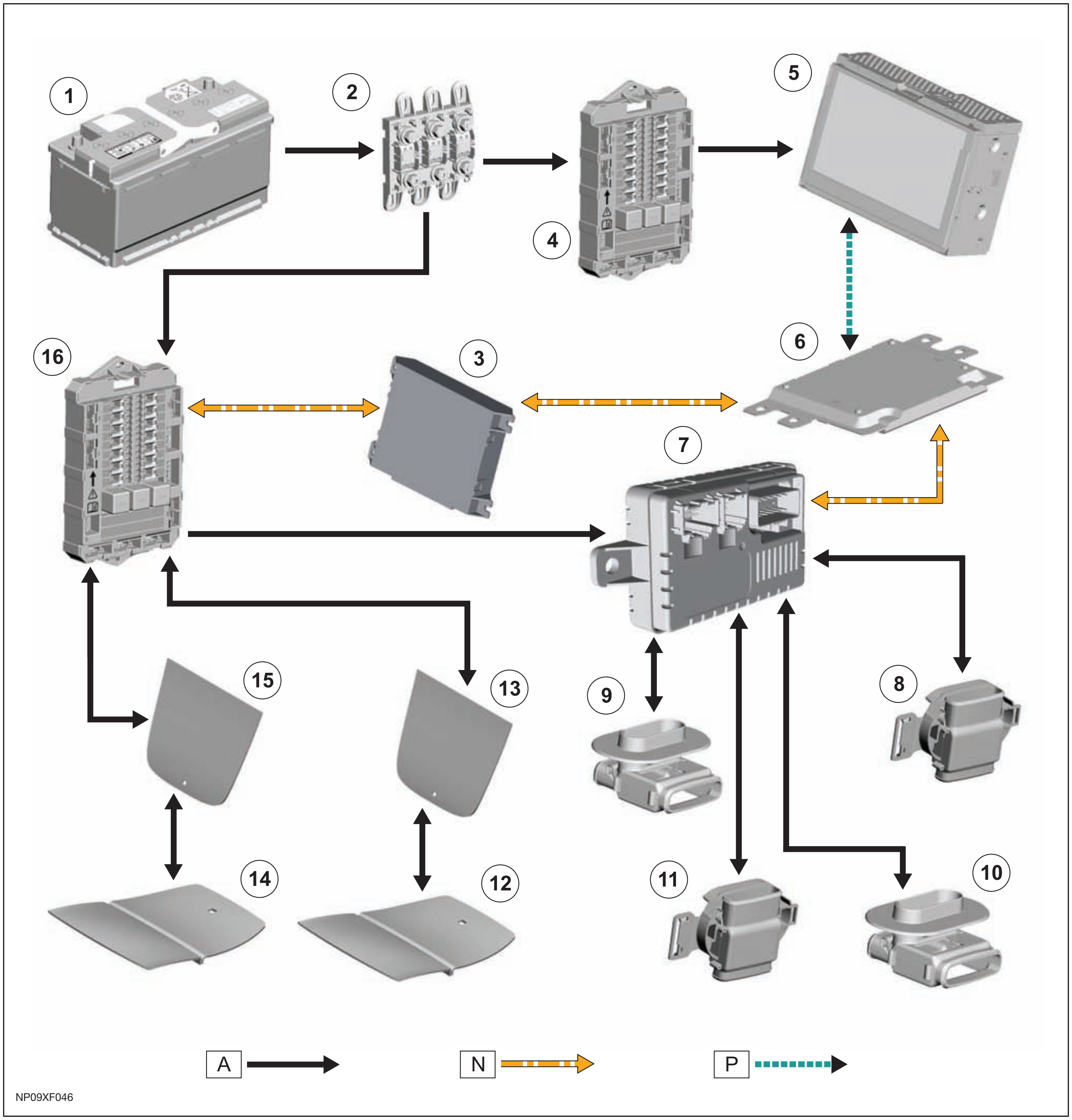
NOTES: The Peltier cells will not operate unless the engine is running.

After the ignition is switched off, the CCSM will retain the current temperature settings for approximately 15 minutes. After this period, the seats will be set to 'off' when the ignition is switched back on.

CCSM Fuses

The CCSM is powered by two 20amp fuses located in the CJB. These are separate circuits, but once inside the CCSM they are joined together. Due to current load, if one fuse blows, the other may also.

Seat Heating / Cooling Control Diagram



A	Hardwired
N	Medium speed CAN bus
P	MOST ring
1	Battery
2	BJB
3	ATC module
4	RJB (rear junction box)
5	TSD
6	Information control module
7	Climate controlled seat module
8	Passenger seat squab climate module
9	Driver seat cushion climate module
10	Passenger seat cushion climate module
11	Driver seat squab climate module
12	Passenger seat cushion heater element
13	Passenger seat squab heater element
14	Driver seat cushion heater element
15	Driver seat squab heater element
16	CJB

STEERING COLUMN

The electric steering column is standard equipment on all models. The upper column assembly contains electrical adjustment for steering wheel reach and rake and the steering angle sensor.

Steering adjustment memory positions are stored in the driver's seat module. The column also features an entry/exit mode function which moves the steering column away from the driver to allow easier exit and entry to the vehicle.

Column adjustment is provided by a single motor for both reach and rake adjustment. Operation of the column adjustment is controlled by a 4-way joystick switch located in the column lower shroud. Column adjustment is an integral part of the driver position memory system.

Steering Column Adjustment

Power for the column adjustment motor is supplied by the CJB via the instrument cluster, which controls the power application to the motor.

The column adjust switch is hardwired to the instrument cluster. Up/down and in/out selections on the switch are each passed through a resistor of differing values to the instrument cluster. The cluster monitors the output value from the switch and operates the motor in the required direction, while simultaneously energizing the required solenoid for rake or reach adjustment.

When the applicable solenoid is energized, a clutch is engaged and located on a lead screw. The motor rotates the lead screw and the rotational drive of the screw is transferred into linear movement of the applicable clutch to move either the rake or reach adjustment. For reach adjustment, the lead screw drives the outer housing in or out as required. For rake adjustment the lead screw drives a rake lever which moves the column up or down as required.

The position of the column is monitored by potentiometers which are connected to the instrument cluster. The cluster monitors the output signal from the potentiometers to precisely control the positioning of the column in each plane.

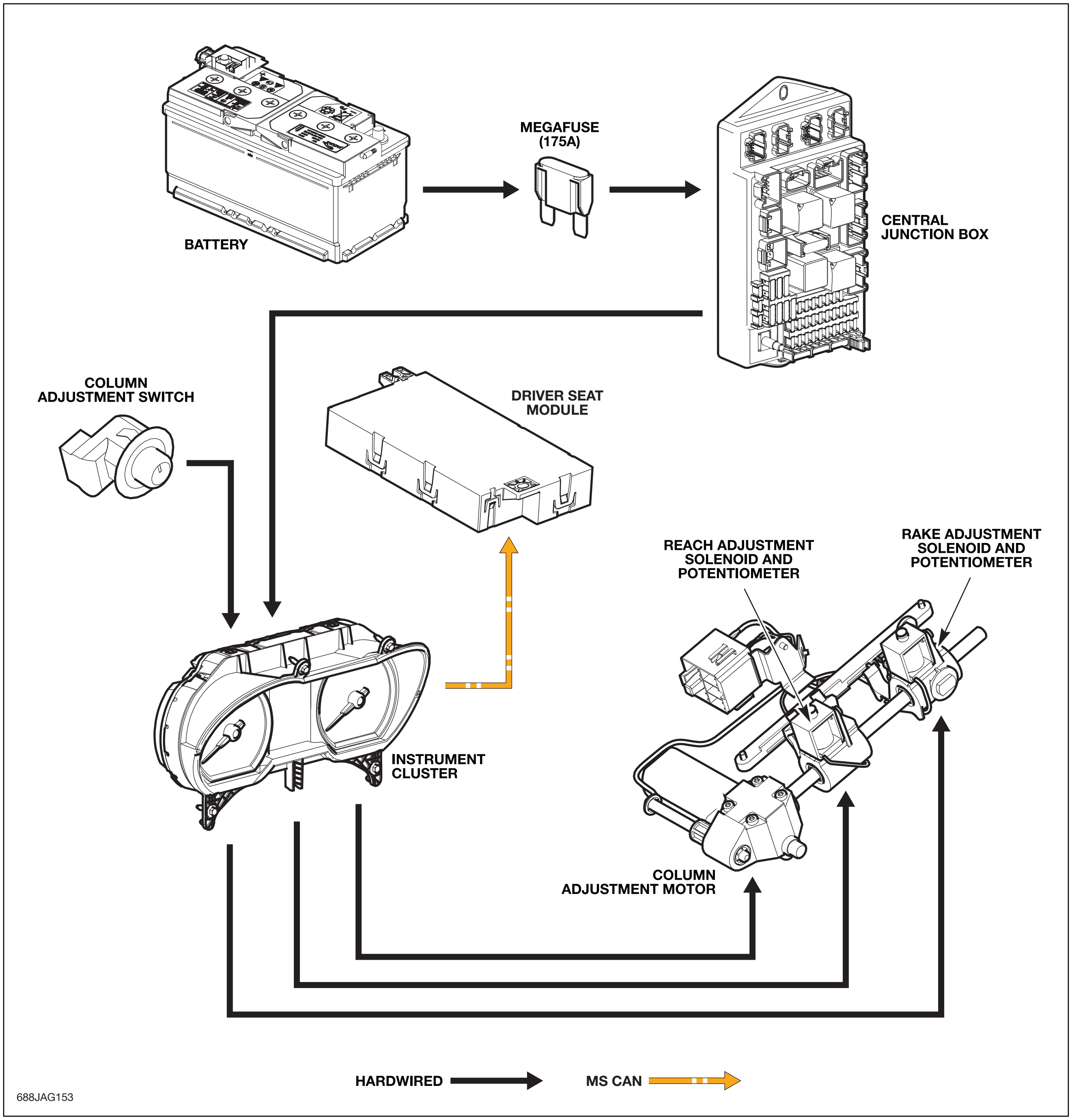
The instrument cluster provides the memory positioning of the column via a medium speed CAN bus connection to the driver's seat module. The driver's seat module receives information from the instrument pack and stores the stop bit locations which can be programmed and recalled along with mirror and seat positions from the seat memory settings.

NOTE: Column replacement or instrument cluster replacement/programming requires steering column barcode digits 3-10 to be accessed from 11-digit barcode label. The label is located on the steering column and under trunk floor trim on RHS tire well wall panel.

Entry/Exit Feature

When the joystick switch is rotated to the 'auto' position, the entry/exit feature is enabled. The steering column will adjust to the uppermost rake position when the ignition is switched off, and will readjust to the position corresponding to the memory position when the ignition is switched on.

Steering Column Control Diagram

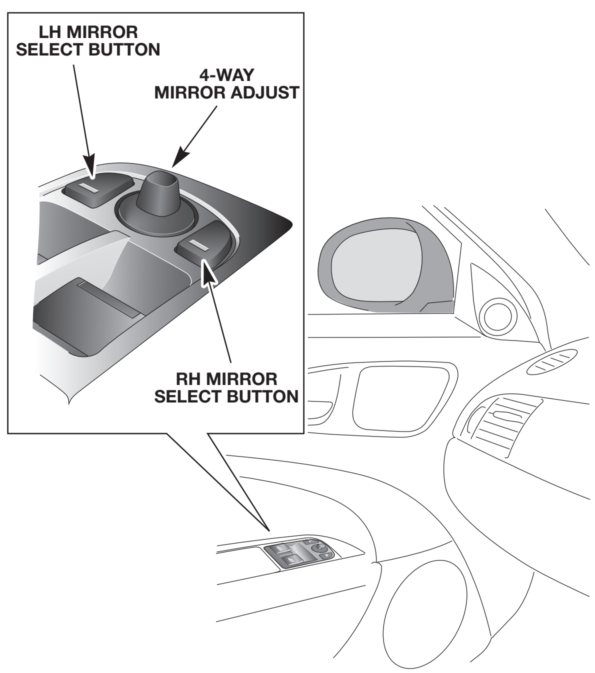


MIRRORS

The exterior mirrors incorporate the following:

- Blind spot monitoring indicator (when equipped)
- Auto dimming function
- Turn signal indicators
- Approach lights
- Exterior temperature sensor (LH mirror only)
- Automatic reverse mirror dip (RH only)

Movement of the door mirrors is controlled from a switch pack located on the driver door. The switch pack contains 2 non-latching mirror select buttons labeled ‘L’ and ‘R’ and a 4-way mirror movement switch.

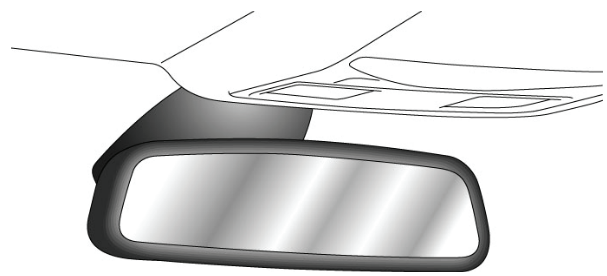


688JAG154

Door mirror movement commands are transmitted to the driver door module over the LIN bus. The driver’s door module transmits any mirror movement commands to the passenger door module over the MS CAN bus.

Movement of the door mirrors is carried out by the respective door module. The door modules provide supply and ground paths to the mirror motors and monitor mirror position via potentiometers located in the mirror housings.

Auto Dimming

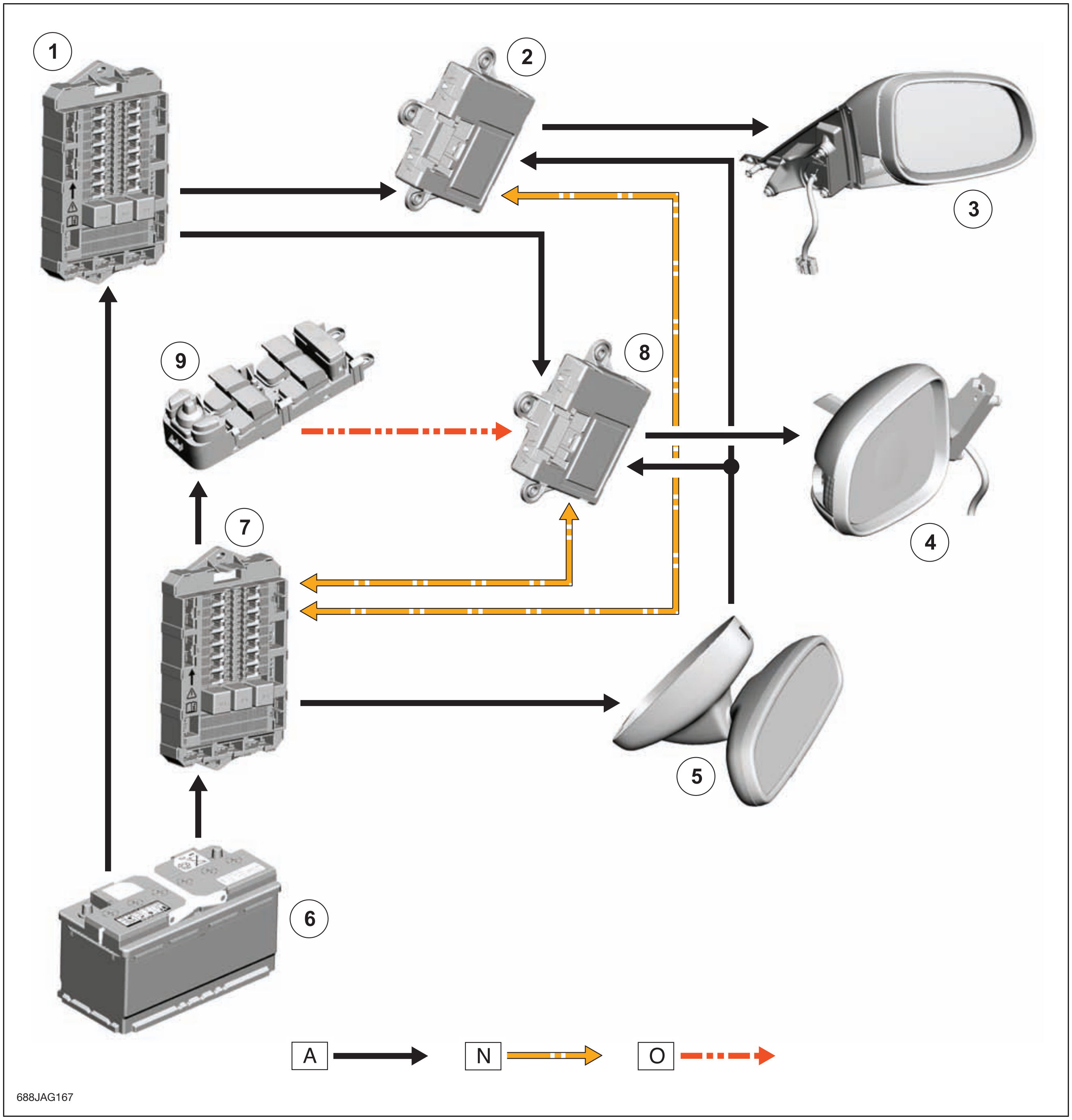


688JAG166

Both exterior door mirrors and the interior mirror feature an auto dimming function. The interior rear view mirror contains one forward and one rearward facing light sensor. The light sensors control the auto dimming feature of the interior mirror to reduce glare from the headlights of following vehicles.

When auto-dimming of the interior mirror is required, a supply is provided by the interior mirror to both door mirrors to initiate the door mirror auto-dimming sequence.

Mirror Control Diagram



A	Hardwired	4	LH Door mirror
N	MS CAN	5	Interior mirror
O	LIN bus	6	Battery
1	RJB	7	CJB
2	RH Door module	8	LH Door module
3	RH Door mirror	9	Mirror control switch

BLIND SPOT MONITORING SYSTEM

The Blind Spot Monitoring System uses two radar modules operating at a frequency of 24 GHz and each combining the radar face and electronic module in a single unit. The modules are located behind the rear bumper surface, symmetrically, one on each side of the car behind the rear wheels. They are side facing and inclined rearwards at an angle of 16 degrees, which is dictated by the shape at the rear of the vehicle. Each module is calibrated to detect a vehicle in the driver's blind spot. Once a vehicle is detected the module illuminates an amber warning 'alert icon' lighted electric diode (LED) in the relevant exterior door mirror. If there is a fault or blockage with the blind spot monitoring system an amber warning indicator 'status dot' LED is displayed in the exterior mirror and the message 'blind spot monitoring not available' is displayed in the instrument cluster message center.

When the system initiates, it performs a self-check, during which the warning icons in the mirrors illuminate alternately for a short period of time. Each module does a left/right determination check when the ignition is switched on. Each mirror has a different circuit configuration so that the modules can determine which mirror they are connected to. If a module detects the wrong mirror it will go into a fault condition.

The blind spot monitoring modules receive vehicle speed on the MS CAN and are inactive until the vehicle reaches 16km/h (10mph).

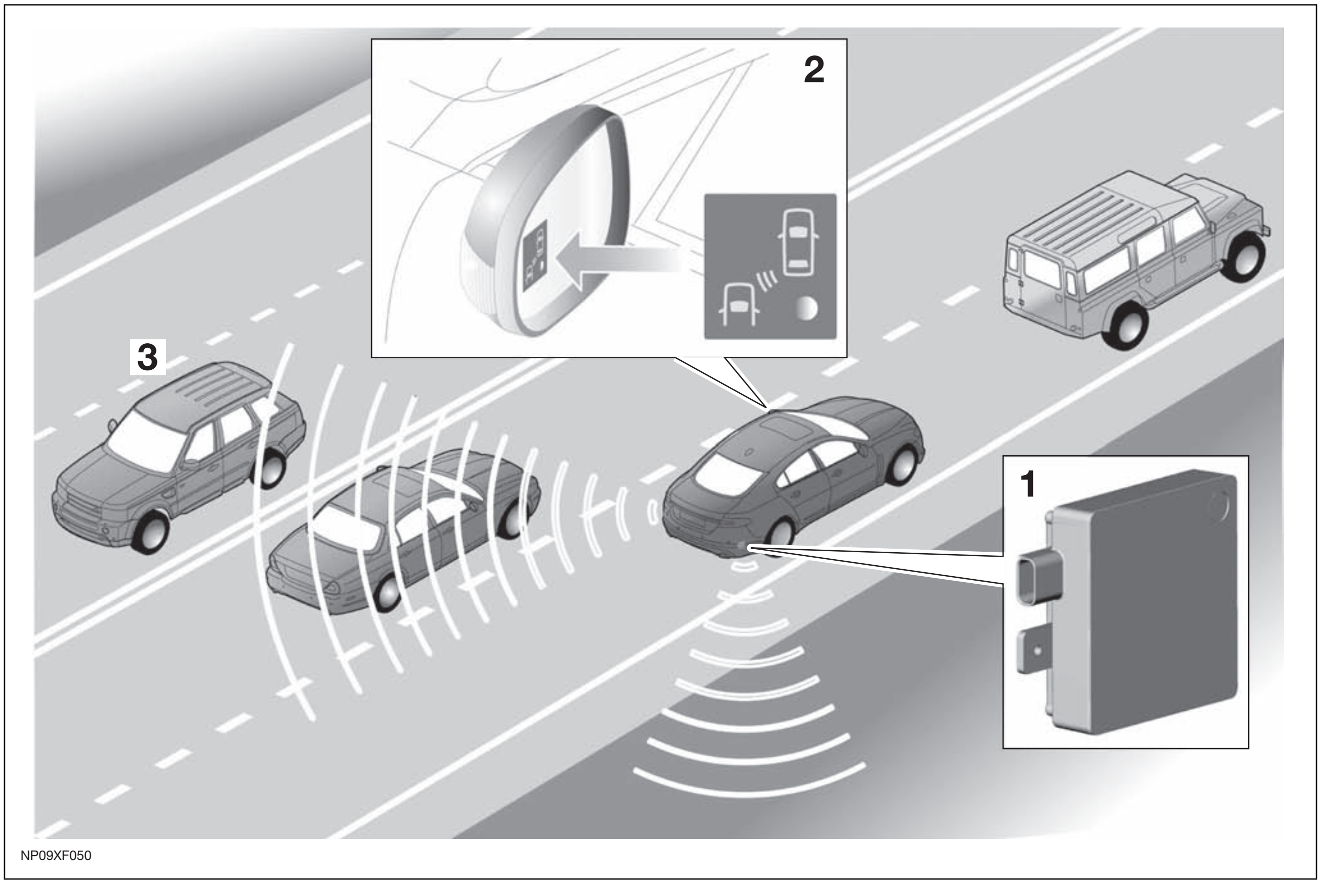
Each blind spot monitor module emits a radar field greater than the blind spot area. The actual blind spot area is calibrated into the module during its manufacture.

CAUTION:

⚠ **The blind spot monitoring system is designed as a driver aid, not a safety device. The driver should always exercise due care and attention while driving.**

Principles of Operation

Bumper mounted radar sensors/modules **(1)** detect all moving vehicles in the blind spots. The blind spot monitoring system calculates the position, distance and speed of these vehicles. When a vehicle is a potential danger, the amber alert LED light is displayed in the exterior rear view mirror **(2)**. Oncoming vehicles **(3)** are recognized but not reported.

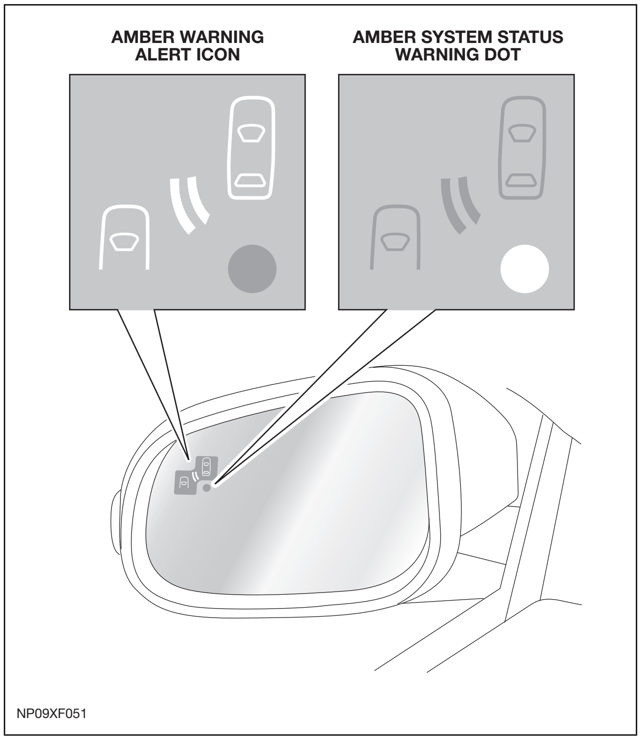


The blind spot monitoring system will detect an object moving with a positive velocity relative to the radar module, on either side of the vehicle, at a distance of up to 2.5 meters laterally and in an area from the door mirror up to 7.0 meters behind the module. This criteria identifies an overtaking vehicle within the blind-spot area within a typical highway lane width, while eliminating other objects that are not relevant, either because of their position, they are stationary, traveling in the opposite direction, or being overtaken. A vehicle is classed as a heavy goods vehicle, car or motorcycle. A motorcycle is defined as a minimum size of 2.0m long, 0.8m wide (widest point) and 1.1m high. The system is not affected by the mass of the overtaking vehicle providing all identification criteria, including relative velocity of 16km/h (10mph) or above, is met.

The system emits radar pulses and analyses the reflections, identifying anything that moves into the blind spot zone. Having detected another vehicle in the defined blind spot zone it alerts the driver by illuminating the amber alert icon located in the appropriate exterior mirror.

NOTE: If an overtaking vehicle is detected on both sides of the vehicle simultaneously, the warning alert icons in both mirrors will illuminate.

The light lens is shaped to minimize the visibility to other drivers. The LED's are located towards the outside extremity of the mirror face, within the peripheral view of the driver but not in any area of the mirror where they could obscure or distract from the image.



The LED lighting sequence is as follows:

- Amber alert LED icon permanently lit – system operational, vehicle detected in blind spot area
- No LEDs lit – system active no vehicle detected in blind spot area
- Amber status LED permanently lit – system not active or faulty (sensor blocked)

The system has operating limitations and is automatically turned off under certain operating conditions. During these operating conditions the amber status LED is permanently lit.

The system operating limitations are as follows:

- The area surrounding the radar face of the module must be clear of metallic items
- The system is inactive until vehicle speed is greater than 16km/h (10mph) – amber status LED permanently lit
- The system is inactive if an approved trailer is connected to the vehicle (amber status LED permanently lit)
- The system is inactive when reverse gear or park is selected (amber status LED permanently lit)

If either of the radar signals are blocked or distorted, for example by water, the radar face of the module is covered in mud, sleet or snow the system may detect this and be disabled with the amber status LED permanently lit together with a 'BLIND SPOT MONITORING BLOCKED' message displayed in the instrument cluster message center. The system is disabled until the blockage is cleared.

If there is a fault in the system the amber status LED is permanently lit and a 'BLIND SPOT MONITORING NOT AVAILABLE' message displayed in the instrument cluster message center. The system is disabled until the fault is rectified.

System fault and blockage warnings are as follows:
The system is disabled when the radar module signal is blocked (amber status LED permanently lit and instrument cluster message)

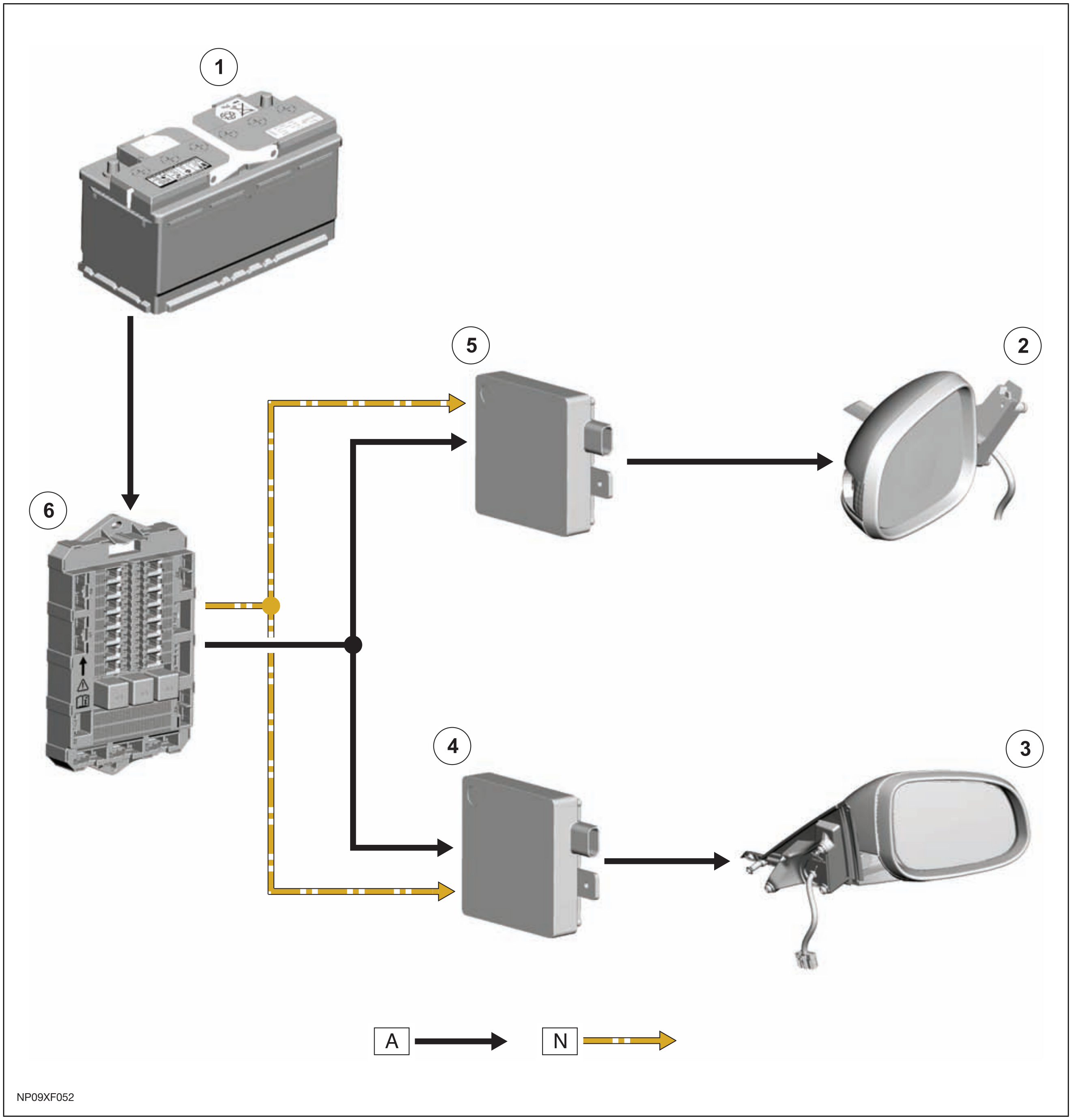
The system is disabled by a fault (amber status LED permanently lit and instrument cluster message)

If there is a failure in the communication network and the warning LEDs cannot be displayed in the mirror, a failure message will be displayed in the instrument cluster message center.

When any faults are present in the system, Diagnostic Trouble Codes (DTCs) are stored in both blind spot monitoring modules appropriate to each module. Replacement of modules requires the right hand module to be configured using IDS. Due to the fact that all modules are supplied as left hand modules the replacement left hand modules do not require configuring.

Blind spot monitoring module software can be updated using IDS.

Blind Spot Monitoring Control Diagram



A	Hardwired	3	RH door mirror
N	Medium speed CAN bus	4	RH blind spot monitoring module
1	Battery	5	LH blind spot monitoring module
2	LH door mirror	6	RJB

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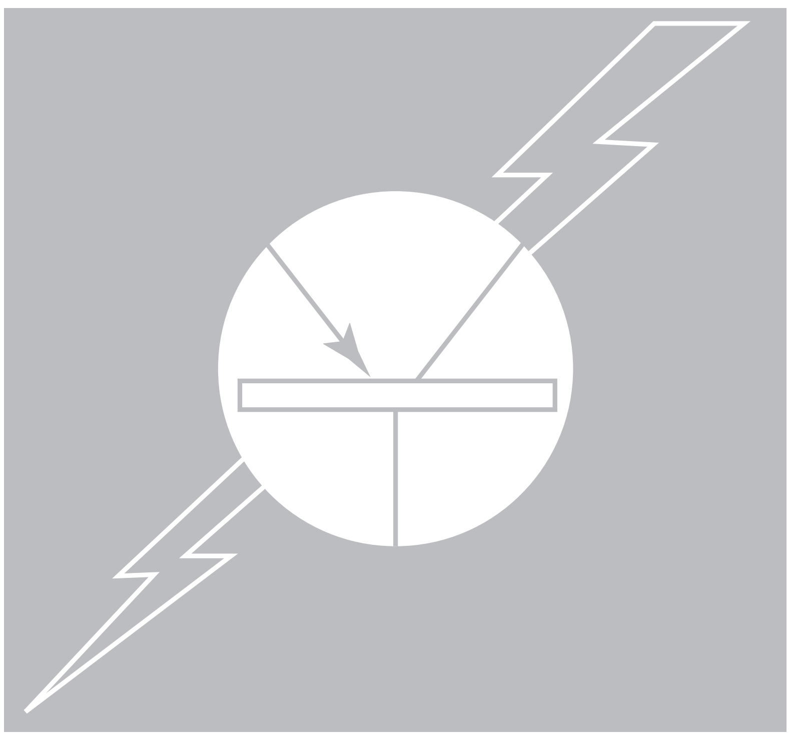
Technical Training
Electrical Systems

688-JAG: Advanced Electrical Systems and Diagnostics



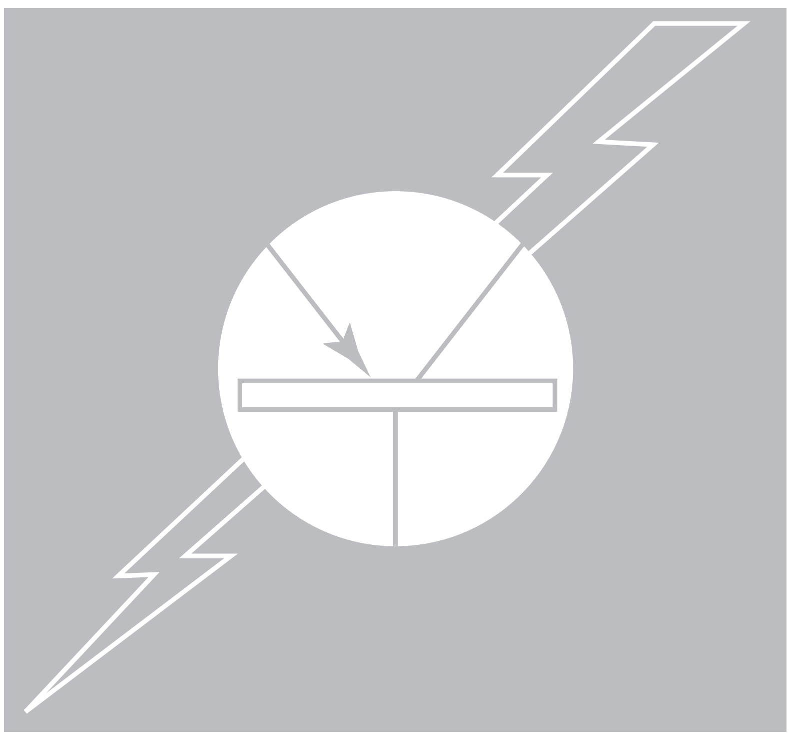
Advanced Diagnostics

JAGUAR

688-JAG 09/2008
Printed in USA

Technical Training
Electrical Systems

688-JAG: Advanced Electrical Systems and Diagnostics



Security and Locking Systems

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X105 SECURITY AND LOCKING

The following security features are available:

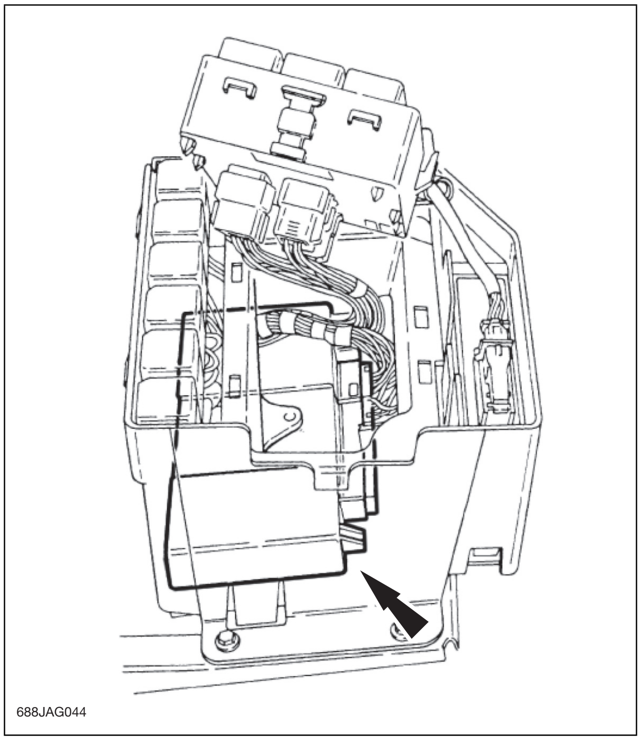
- Panic alarm (dealer option)
- Passive arming (dealer option)
- Audible warnings (dealer option)
- Security LED (in J-gate surround)
- Drive away door locking (dealer option)
- Key and remote transmitter locking/unlocking
- Remote headlight convenience (dealer option)
- Remote trunk open (dealer option)

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.

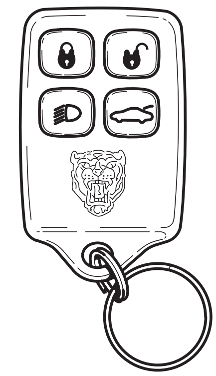
Security and Locking Control Module



Key-Ring Transmitter

Key-Ring Transmitter Programming (Manual Procedure)

- Hold headlight stalk switch in Flash-to-Pass position
- Turn Ignition Key to position I (Auxiliary)
- Flash headlight stalk switch 4 times
- 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)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Remote Convenience Features

Remote features only operate when the key is not in the ignition.

Remote Headlight	If remote headlights are enabled, one press of the remote transmitter headlight button activates the headlights 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 headlight 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.

Central Locking

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.

NOTE: 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.

Inertia Switch Activation

If activated, the inertia switch unlocks the doors while the ignition is in position II. 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 with the remote transmitter or opening the trunk with the key.

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.

Security and Locking Functions	
Activation	Locking the with the ignition key or with the remote transmitter
Deactivation	Unlocking with the ignition key or with the remote transmitter

Anti-Theft System

Once armed, any of the following circumstances will create a full alarm state and the sounder will operate:

- Opening a door (after 7 seconds)
- Opening the trunk with the key (after 7 seconds)
- If an invalid ignition key is turned to position I
- Pressing the key-ring transmitter headlight button three times (Panic Alarm)
- Opening the hood

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.

Arming and Disarming from the Key Barrel

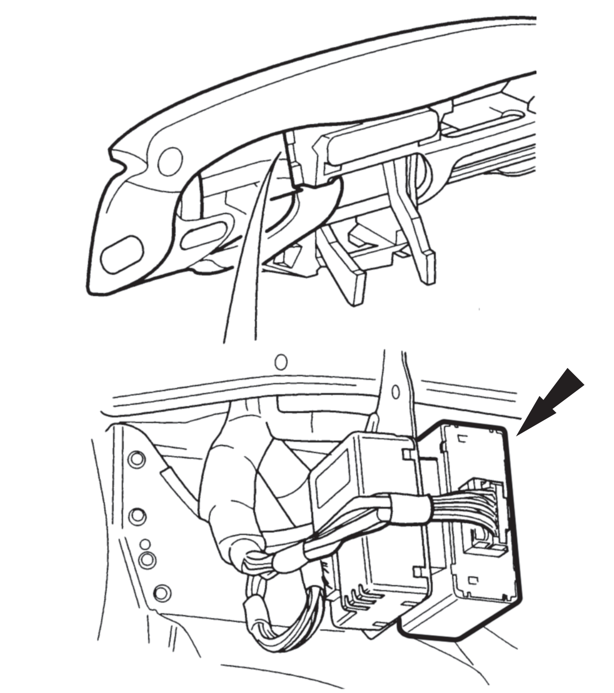
To arm, turn the key to the locked position; to disarm, turn the key to the unlocked position.

Active Disarming

The anti-theft system will be disarmed and the alarm stopped if the remote transmitter is used.

Key Transponder Module

The key transponder module (KTM) is 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 are emitted. The status LED will also be switched off. The engine immobilizer ensures the engine can only be started using a valid ignition key.



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Ignition Key Transponder Programming Using IDS

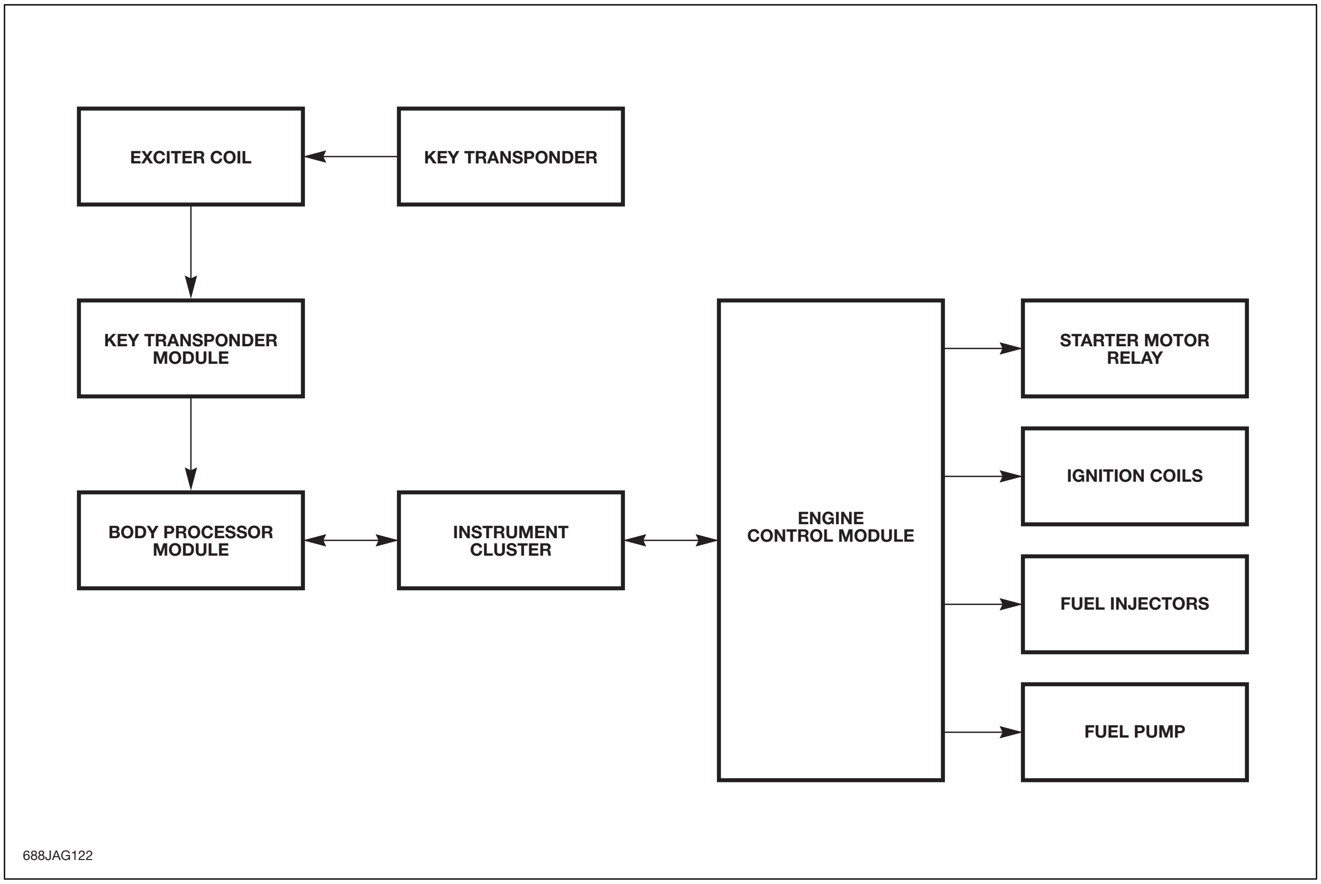
If the KTM is replaced, all keys must be programmed at the same time. A maximum of 5 keys can be programmed to any one vehicle. If only the ECM is replaced, key transponder programming is not necessary.

Ensure all of the vehicle's keys are available for this procedure. A maximum of 5 keys can be programmed to one vehicle.

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.)

Immobilizer System

The immobilizer function 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.



Principles of Operation

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. Once the KTM has authenticated the key code received, it will send a 'Key Valid' message to the BPM via the serial and encoded data line. 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. On receipt of this message, the instrument cluster 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 Faults

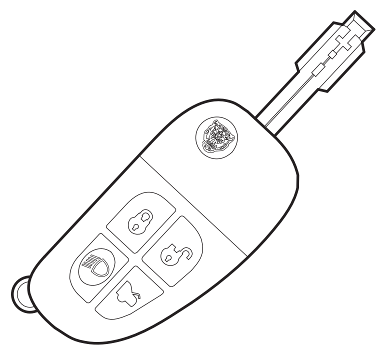
Instrument Cluster Related Faults				
Mode of Operation/Fault	**Ignition Position**	**DTC**	**LED Fault Code**	**Cause**
Missing key status	Run/Start	U1147	N/A	The IC has not received the SCP key status msg. The IC will wait 1000mS after ACC ignition position prior to logging this DTC
Code does not match	Run/Start	U1003	N/A	Contained within 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 Faults			
Mode of Operation/Fault	**Ignition 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**	**N/A**	The exciter coil is open or short circuit
Transponder Learn Mode	**ACC**	**N/A**	Transponder Learn Mode

X206 / X404 / X358 REMOTE TRANSMITTER

The radio frequency (RF) remote keyhead transmitter allows remote activation of a number of vehicle features, including:

- Unlocking the vehicle doors (single or central unlock).
- Locking the vehicle doors (central locking)
- Trunk lid release
- Headlight convenience
- Panic alarm



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The remote keyhead transmitter is operational when the key is removed from the ignition.

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's battery will not affect its operation.

Headlight Convenience

When the headlight convenience button is pressed with the ignition off, the high beam will be switched on for 30 second or until the headlight convenience button is pressed again.

Panic Alarm

When the 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 alarm is activated.

The alarm will be cancelled when:

- The headlight convenience button is pressed again 3 times within 3 seconds, or
- The ignition key is turned to Run/Start, or
- The unlock button on the remote transmitter is pressed, or
- The alarm cycle is completed

X358 Auto Mirror Fold

On X358 vehicles, the remote transmitter can be used to operate the folding mirrors. Auto-fold is available in all markets, but the function is disabled as the default setting. The function can be enabled using the Vehicle Settings on the navigation screen, or configured u sing IDS on non-NAV vehicles.

When the function is enabled:

To fold mirrors in (flat), press the remote keyhead lock button twice within 3 seconds. This can be for a double lock or at any time.

To fold out, use any unlock command. If the mirrors were folded flat using the manual mirror fold switch, the switch must be used for fold-out operation (the mirrors will not fold out using the transmitter).

Manual Programming of RF Transmitters

X206 Programming

There is no manual procedure for programming X206 transmitters. Use IDS.

X404 Programming Procedure

– To enter Programming Mode, cycle the key in the ignition in the following sequence:
  – Key-in … Pos. 2 … Pos. 1 … Pos. 2 … Pos. 1 … Pos. 2 … Pos. 1 … Pos. 2 … Pos. 1.
  – The GEM 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 GEM 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 GEM.

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 GEM 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 GEM.

X358 Programming Procedure

– Open the driver door (door must remain open throughout programming)
– Hold headlight stalk switch in Flash-to-Pass position
– Turn Ignition Key to position I (Auxiliary)
– Flash headlight stalk switch 4 times
– 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)

X206 / X358 LOCKING FUNCTIONS

Central Locking

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 is pressed once (Key must be out of the ignition)
- Interior locking paddles are operated
- Central door locking switch is operated

Central Locking Strategy	
Action	**Result**
Driver’s door is ajar when the central locking feature is activated via the driver’s door locking paddle	All doors will lock and driver’s door will then unlock. There will be 7 flashes (5 + 2) of the direction indicators to indicate that the door is open.
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.
One or both rear doors are open when the central locking feature is activated via either of the locking paddles on the front doors	All doors will lock
Any of the doors are ajar when the central locking feature is activated via the driver’s door lock cylinder	All doors will become locked. There will be 5 flashes of the direction indicators to indicate that a door is open and an audible mis-lock warning of 2 horn chirps will also be given (if enabled).
Hood or trunk are open when the central locking feature is activated via the drivers door lock cylinder	All doors will lock and the direction indicators will flash 5 times to indicate that either the hood or the trunk is open (no error tone warning will be given).
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 mis-lock warning of 2 horn chirps will also be given (if enabled).
Hood or trunk are open when the central locking feature is activated via the remote lock button on the integrated key	All doors will lock. There will be 5 flashes of the direction indicators to indicate that the hood or trunk are open (no error tone warning will be given).
Any door is open and the master lock button is pressed to centrally lock the vehicle	No doors will lock. If the hood or trunk is open and the master lock button is pressed to centrally lock the vehicle all the doors will lock.

Drive-Away Locking

On X206 vehicles, the drive-away locking feature (Auto-locking) operates when vehicle speed exceeds 3 mph (5 km/h). This feature is the same for manual and automatic transmission vehicles.

On X358 vehicles, drive-away locking operates 1 second after the gearshift is moved out of the Park position.

Central Unlocking

The central unlocking feature unlocks all of the doors upon any of the following requests:

- Unlock from driver door lock cylinder
- Unlock button on the remote keyhead
- Unlock from either of the front interior handles or paddles
- Unlock from the master switch on the fascia

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 remote keyhead. 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 turn signal lights.

Trunk Release

The trunk 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 trunk release button is disabled. When the vehicle is armed, both the interior and exterior trunk release buttons are disabled. Opening the trunk with the key when the vehicle is armed will cause a full alarm.

Valet Mode: X206

When the valet button (located in the glove compartment) is pressed to the latched position (button down), the trunk cannot be opened via the fascia-mounted or trunk-mounted release buttons.

Once the valet button has been pressed, the glove compartment should be locked with the black-headed remote-control key to prevent unauthorized deactivation of valet mode.

NOTE: Deactivation of valet mode is achieved by pressing the valet switch located in the glove compartment.

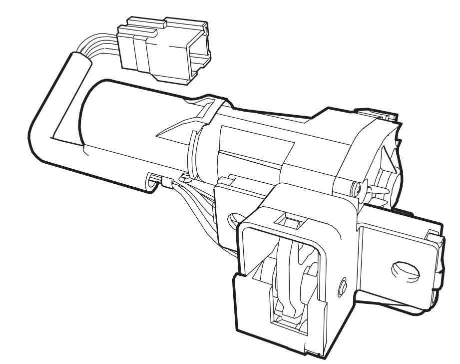
Valet Mode: X358

The valet mode inhibits interior and exterior trunk release switch operation and the glove box release switch operation. In addition, the green headed valet key cannot open the trunk 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 trunk release or glove box switches are pressed.

NOTE: Valet mode is deactivated by disarming the security system with the remote transmitter or by opening the trunk with the key.

X358 Trunk Latch

The X358 trunk lid latch features power closing



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The latch assembly contains the following:

- Latch mechanism
- Trunk latch release cable (from key barrel)
- Trunk entrapment release cable
- Rotary switch
- 12V motor
- Protective cover for the motor.

As the trunk lid is closed, the striker (which is attached to the body) will engage with the latch mechanism. When the lid is 10 mm (0.4 in.) from the fully closed position, the latch will come into contact with the release plunger. At approximately 5 mm (0.2 in.) 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 applies 12V to the power closing motor causing the latch to be rotated to its limit of travel, thus fully closing the trunk lid.

As the trunk lid is closed, the release plunger is compressed. When the trunk lid release switch is operated, the REM applies 12V to the latch motor in the opposite direction, which releases the latch mechanism. The compressed release plunger will raise the lid 10 mm (0.4 in.) from the fully closed position.

The preferred method for closing the trunk 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 it. The inertia of the closing lid is high enough to initiate the power closing cycle as the latch engages with the striker. Closing the trunk 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 trunk lid latch and motor is supplied as a complete assembly, without the release cables.

CAUTION:

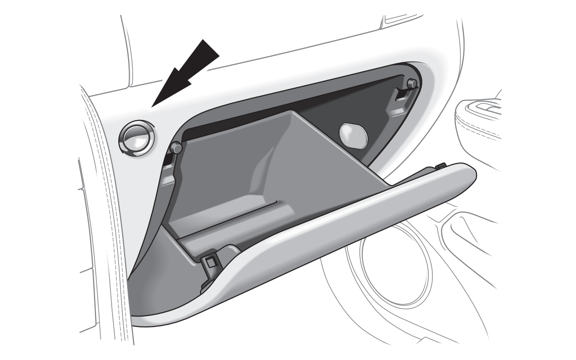
⚠ **Applying excessive force to the trunk lid when closing may cause damage to the surface of the lid.**

X358 Glovebox Release Switch

The X358 glove box door has no release handle. It is opened automatically when the release switch is pressed. 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.



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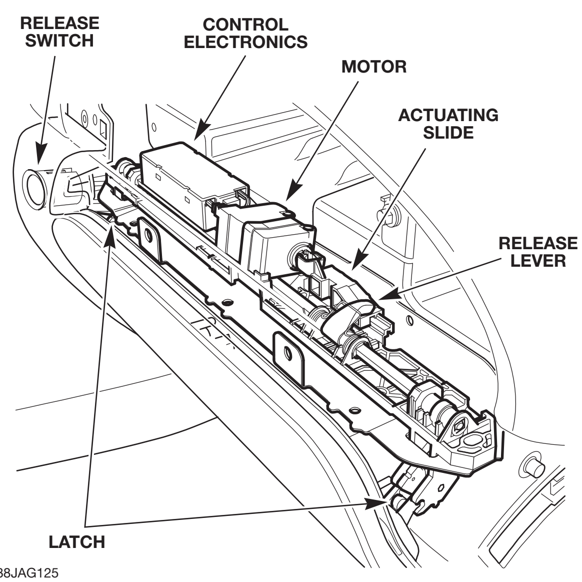

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Glovebox Operation

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 arming the security system. If the security system has not been armed, 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.

X404 LOCKING FUNCTIONS

Central Locking

The central locking feature is 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 unlock. 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 lock. 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 or trunk 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 will only auto lock the car again after:

- Ignition is turned off and on again, or
- A door is opened and closed.

This feature is the same for manual and automatic transmission vehicles.

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.

Security System Configuration	
Feature	**Configuration Method**
Two-stage unlocking	Customer programmable to single-stage
Horn chirp confirmation	Standard; Dealer-programmable using IDS
Drive-away locking	Standard; Dealer-programmable using IDS
Auto relocking	Optional; Dealer-programmable using IDS

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 km/h (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 km/h (5 mph).

NOTE: There is no valet mode.

X404 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 lights (direction indicators). The audible alarm utilizes the vehicle horn.

The anti-theft system features the following functions:

- Arming
- Disarming
- Alarm activation
- Security status indicator/PATS
- Security horn

NOTES:

– 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. The information can be accessed using IDS, from the Set Up and Configuration tab: Security System.

– 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 'pre-arm' 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 pre-arm 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 pre-arm 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 option).

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 of the turn signal indicators and two short horn chirps).

Disarming

When pre-armed, armed, or active, the security system will disarm when one of the following events occur:

- The remote keyhead unlock 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).

NOTE: The interior door paddles will not disarm the anti-theft system.

Trunk Lid Disarm

If the trunk lid is released via the remote keyhead trunk release button, the trunk ajar input to the security system will be suspended. The trunk must be closed and the 20 second pre-arm timer expired before the trunk input and system become armed and again ready to trigger the alarm. When the trunk is released in this way, 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 when, any door, the trunk, or the hood becomes ajar (except as described in trunk disarm).

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.

X206 / X404 / X358 ALARM SYSTEM

The alarm system is based around the body system control modules. Security system functions are carried out by the:

- Front electronic module (FEM): X206, X358
- General electronic module (GEM): X404 only
- Driver door module (DDM): X206, X358
- Rear electronic module (REM): X206, X358
- Instrument cluster (IC): X206, X404, X358

Front or General Electronic Module

The GEM/FEM enables security and controls all peripheral devices such as horn for full alarm and turn signal indicator flash. The GEM/FEM also enables and disables passive arming and the panic function.

Driver Door Module

The DDM houses the receiver module or receiver interface where required and controls all locking functions for the driver's door (i.e. central locking, double locking, 2 stage unlocking). The DDM also controls locking and error chirps and warnings.

Rear Electronic Module

The REM controls all locking functions for the passenger doors and controls the trunk release operation.

Instrument Cluster

The IC controls the security LED operation, Passive anti-theft and the steering column lock module.

The base perimeter alarm consists of:

- 4 doors, trunk 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 on arm, disarm, alarm and error
- Security LED (located on the Instrument cluster)

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 flashing of the vehicle's exterior turn signal indicators.

Functionality of the alarm system includes such features as:

- Arming the security system
- Passive arming disarming the alarm system
- Trunk lid disarm
- Alarm activation

NOTE: The cause of the last eight full alarms are stored in a non-volatile memory for diagnostic purposes. The information can be accessed using IDS, from the Set Up and Configuration tab: Security System.

X206 / X404 / X358 PASSIVE ANTI-THEFT SYSTEM

The passive anti-theft immobilizer system (PATS) is standard for X206, X404, and X358 vehicles. The system is based around the Instrument Cluster (IC) and Engine Control Module (ECM).

In brief, the functionality sequence is as follows:

– 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

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, and communicates with the ECM and key transponder (stores PATS key codes).

Integrated Remote Keyhead

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.

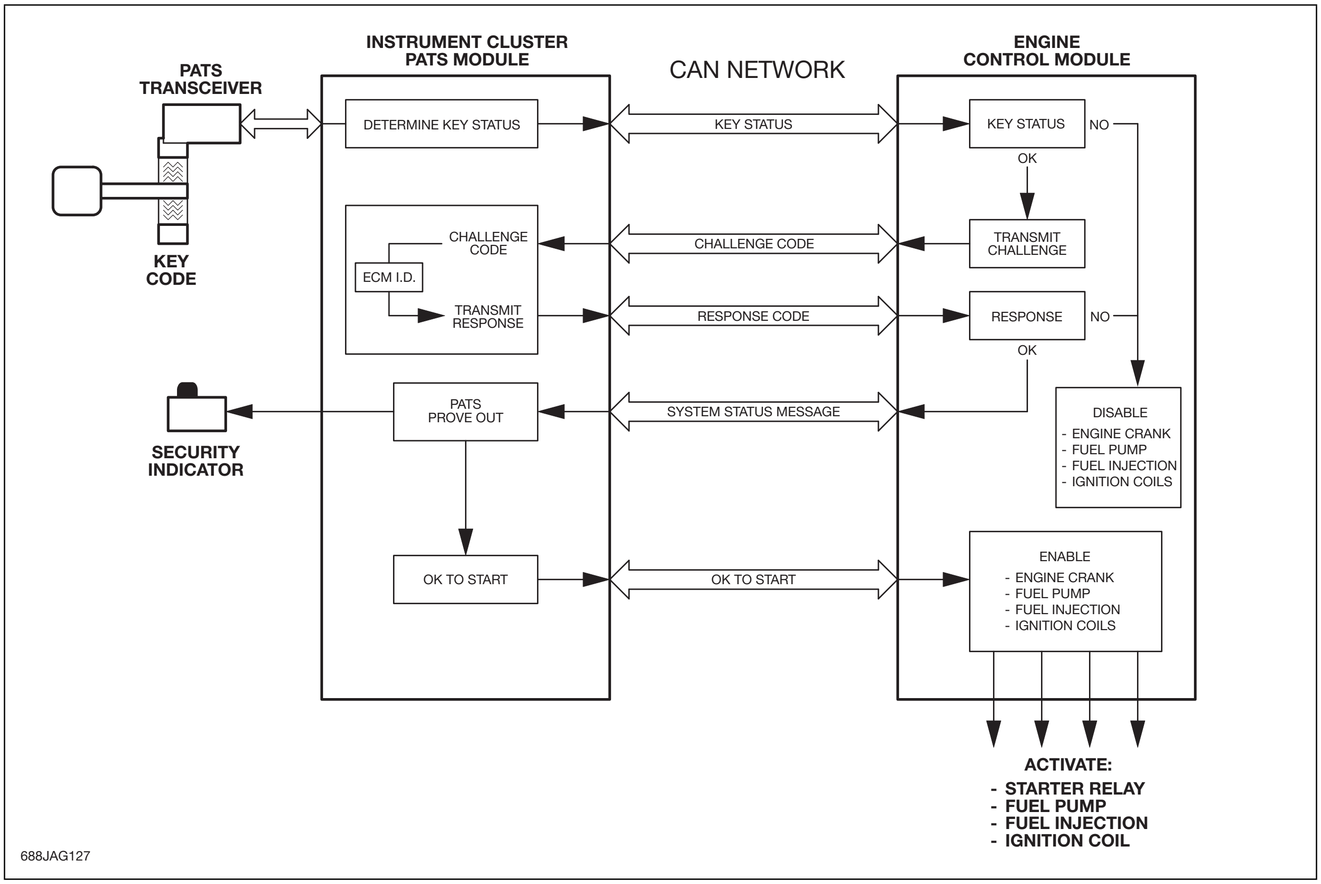
Principles of Operation

When a key is inserted in the ignition barrel, a hardwired input is supplied to the Instrument Cluster (IC) from the key-in switch. This triggers the IC to read the PATS key-code 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, the REM (X206, X358) or the GEM (X404) will 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 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 theses conditions apply, the ECM will log DTC P1260 and freeze frame data. Additionally, the IC will log DTCs 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. If PATS is not complete within 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.

NOTE: The X404 LED may remain illuminated for 60 seconds before flashing the 2-digit code. Refer to X404 PATS diagnostic summary table for details.

The most common cause for failure 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 for failure to crank may be that the CAN network is malfunctioning, i.e. the CAN circuit is open or short circuit. This would mean that the instrument cluster and ECM would be unable to communicate, resulting in no challenge being performed to enable the ECM.

X206 / X358 PATS Fault Codes

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 communication
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	—

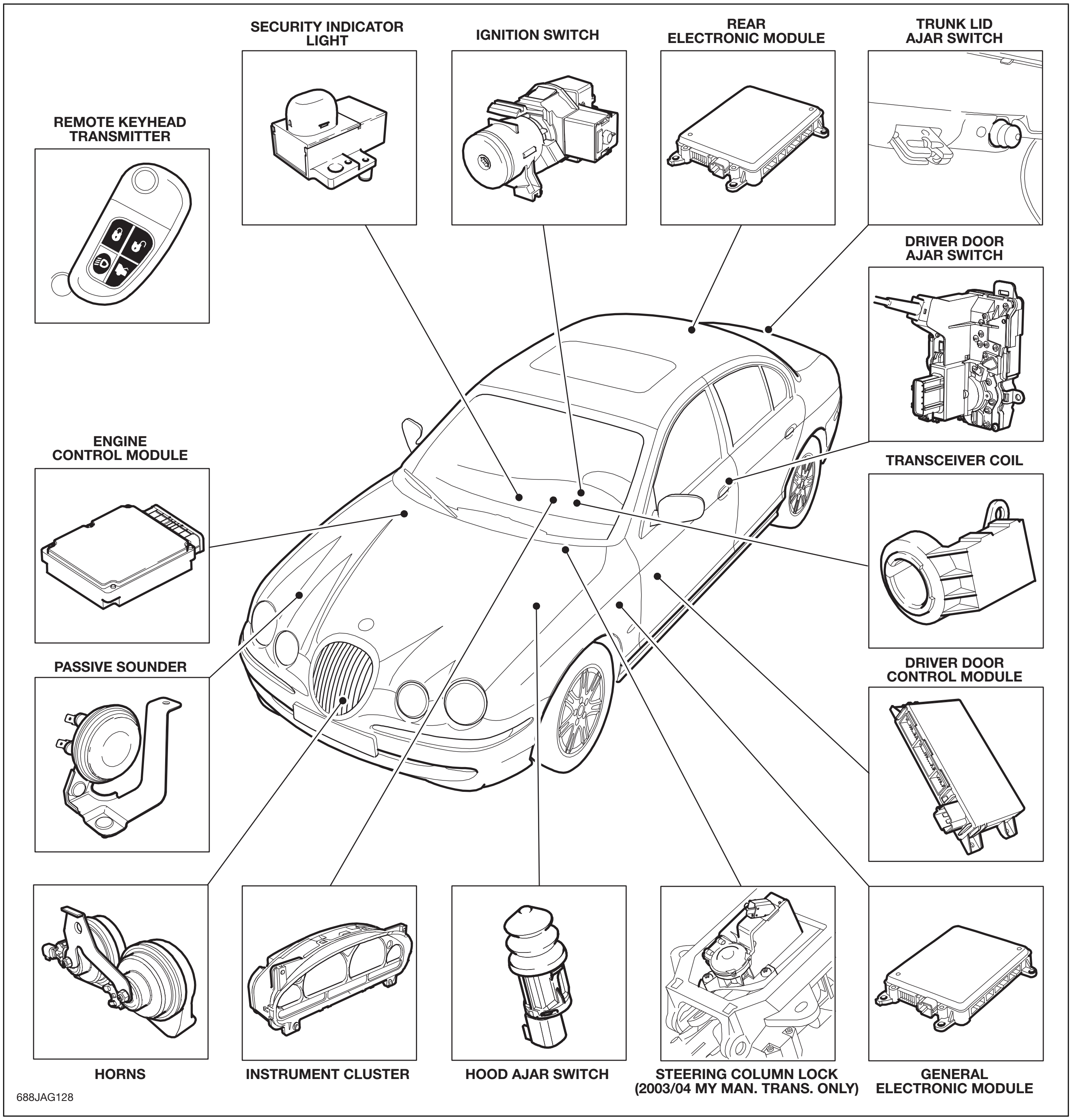
X404 PATS Diagnostic Summary

Mode of Operation / Fault	When Logged	Ign. Switch Position	ETM DTC	IDS DTC	LED Fault Code	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	11	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	12	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	13	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	14	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 mismatch	Key Read / Diag. test	Run / Start	9601	B1601	15	60 seconds of 4 Hz flashing at 50% duty cycle followed by fault code flashing 10 times.

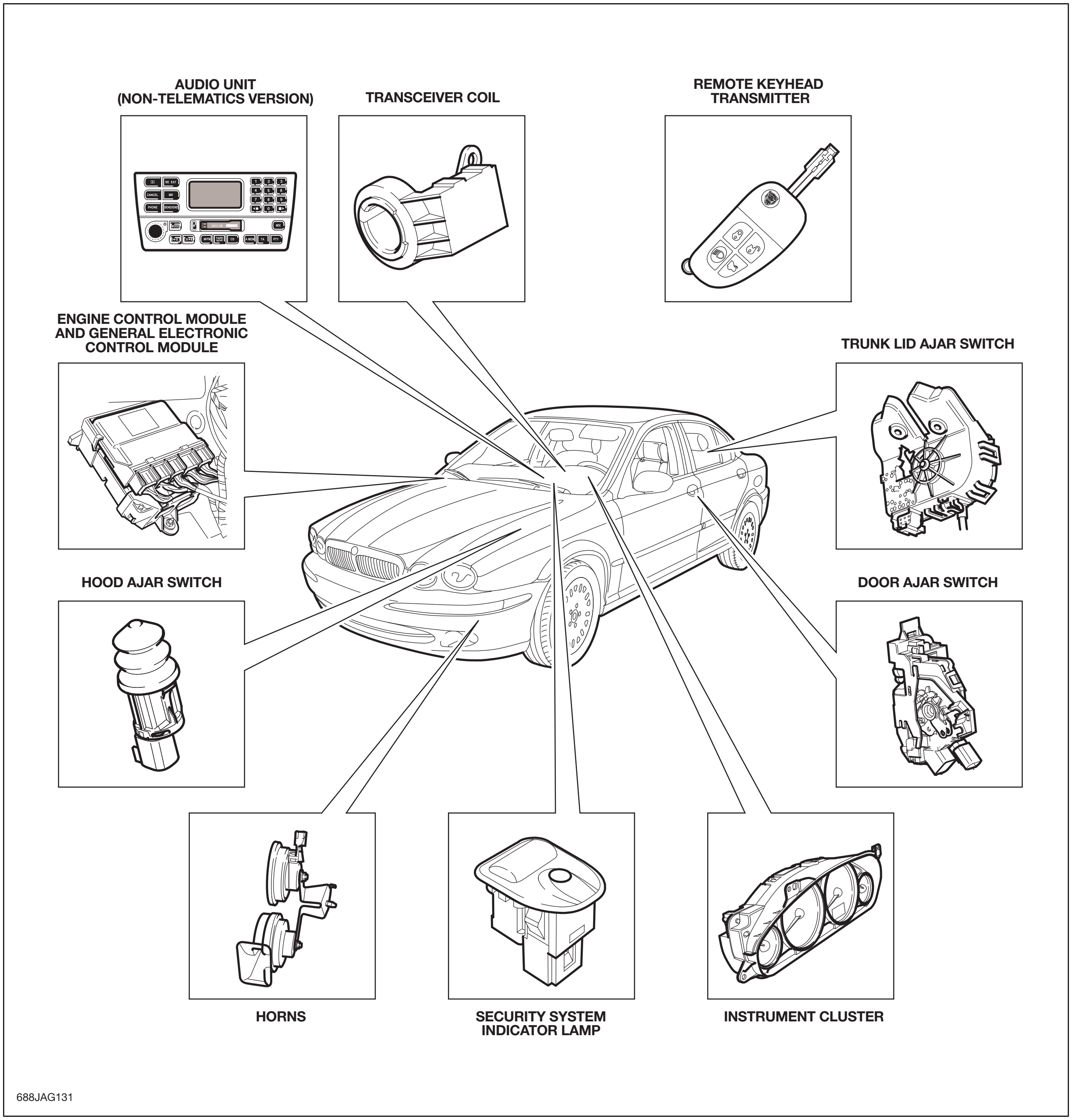
Mode of Operation / Fault	When Logged	Ign. Switch Position	ETM DTC	IDS DTC	LED Fault Code	Indication
Problem with CAN link (ECM verify does not match key status – 00, 01, 80 or FF in data verify message)	B & A / Dealer	Run / Start	E511	U2511	16	60 seconds of 4 Hz flashing at 50% duty cycle followed by fault code flashing 10 times.
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 initialization 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 / Star	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 2.5V	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

X206 / X404 / X358 COMPONENT LOCATIONS

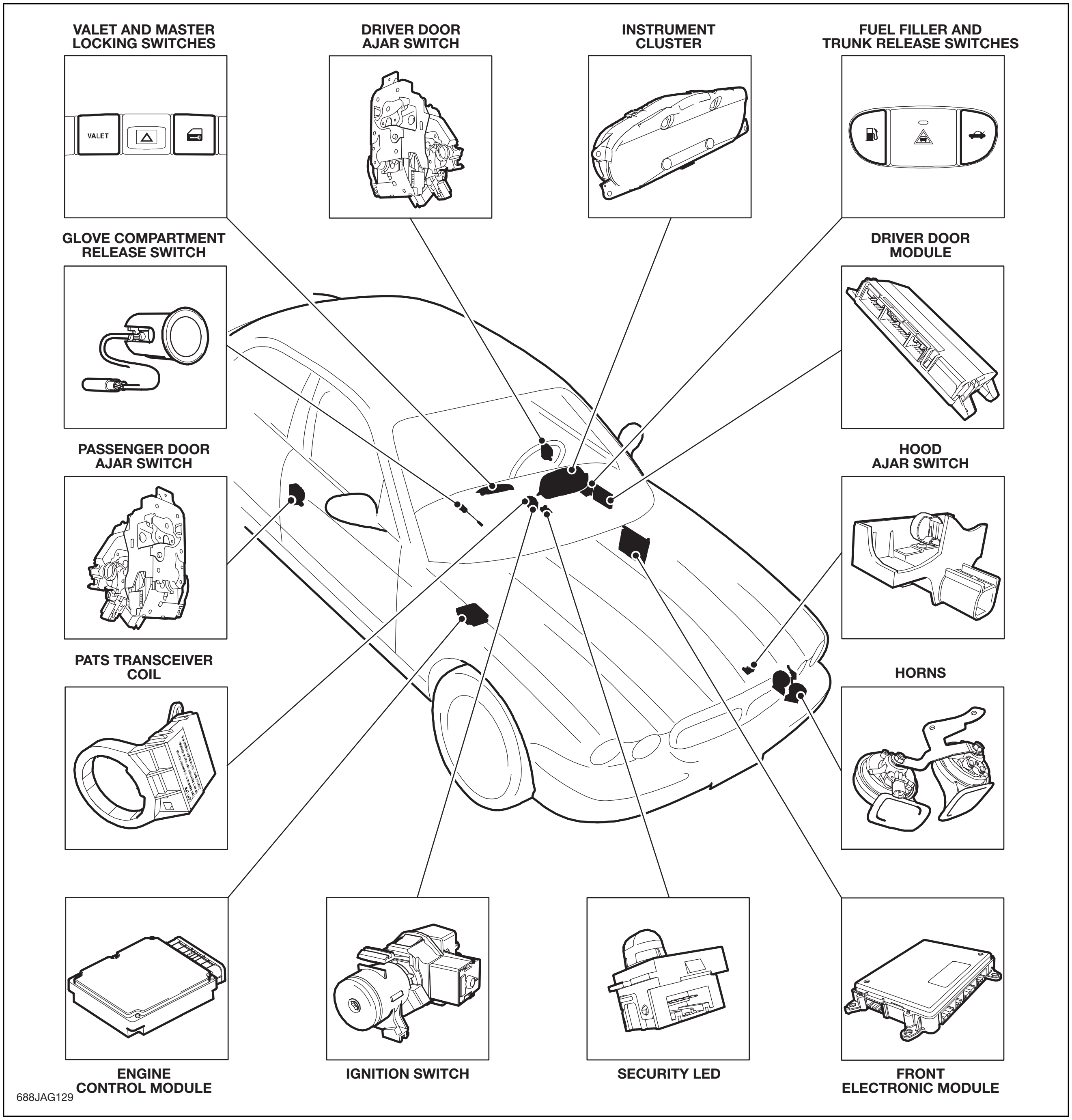
X206 Security and Locking Components



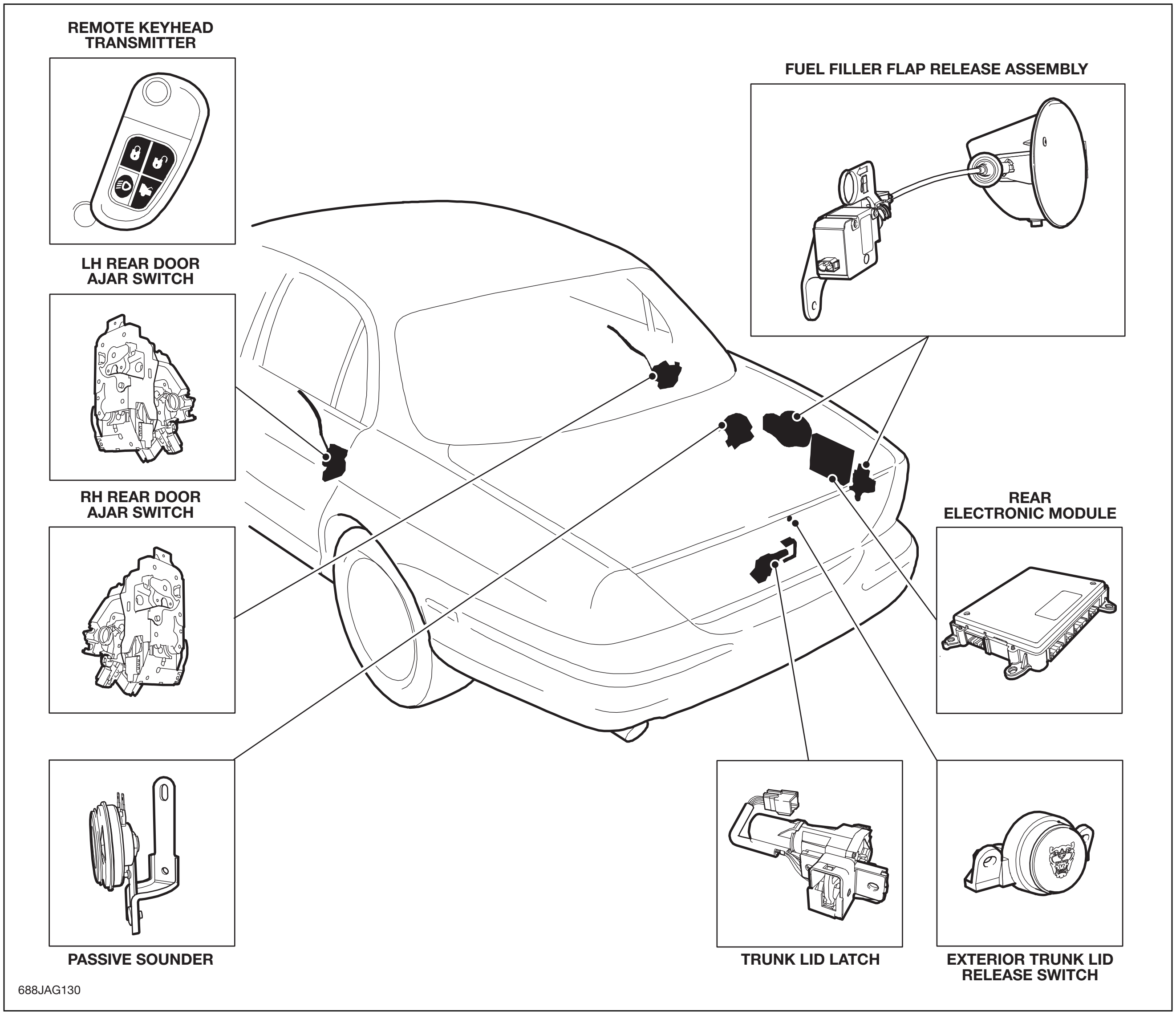
X404 Security and Locking Components



X358 Security and Locking Components: Front

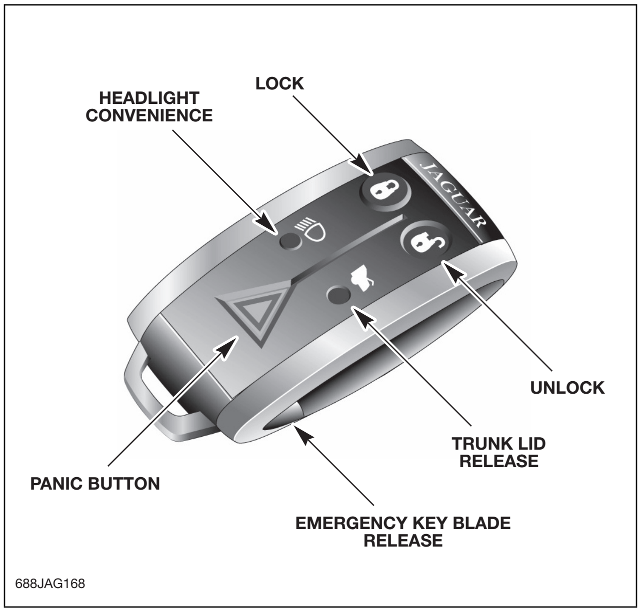


X358 Security and Locking Components: Rear



X150 / X250 REMOTE HANDSET

X150 and X250 vehicles use the Jaguar SmartKey, which provides remote locking/unlocking and security features, in addition to Passive Entry (when equipped) and Keyless Starting (standard, all models).



Lock Button

A single press of the LOCK button will lock all doors and the trunk, and arm the security system. The direction indicators will flash once for confirmation and a single chirp will be emitted.

If door mirror power fold is enabled (when equipped), mirrors will fold when the LOCK button is pressed.

Unlock Button

The vehicle can be programmed for single-stage or two-stage unlocking. To change from single-stage to two-stage unlocking, or vice versa, press the LOCK and UNLOCK buttons simultaneously and hold for 4 seconds. The direction indicators will flash twice to confirm that the change has been programmed.

Single-Stage Unlocking

A single press of the UNLOCK button will unlock all doors and the trunk. The direction indicators will flash twice as confirmation.

Two-Stage Unlocking

A single press of the UNLOCK button will unlock the driver's door and the trunk. A second press is required to unlock the remaining passenger doors.

NOTE: Single or Two-Stage unlocking can also be programmed via the touch-screen.

If door mirror power fold is enabled (when equipped), mirrors will unfold when UNLOCK is pressed.

NOTE: Mirrors will not unfold if they have been manually folded.

Global Open / Global Close

Global Open

Press and hold the UNLOCK button for more than 3 seconds. The security system is disarmed, all doors and the trunk are unlocked, and all windows and the sunroof (when equipped) are opened.

Global Close

Press and hold the LOCK button for more than 3 seconds. The security system is armed, all doors and the trunk are locked, and all windows and the sunroof (when equipped) are closed.

Global open/close can be enabled /disabled from the touch-screen display under Vehicle Settings: Security.

NOTE: X150 Convertible top does not have global open / close feature.

Headlight Convenience

A single press of the headlight convenience button will switch on the headlights. The headlights will remain on for 25 seconds or until the button is pressed again, or until the engine Start/Stop switch is pressed.

Trunk Release

A single press of the trunk release button will unlock the trunk only. The doors will remain locked and the security system will remain armed.

Panic Alarm

To activate the panic alarm, press and hold the panic button for longer than 3 seconds, or press the button 3 times in succession within 3 seconds.

To cancel the panic alarm, press and hold the button again, or press 3 times in quick succession. The panic alarm can also be cancelled from inside the vehicle by pressing the engine Start/Stop switch (when in convenience mode) or by inserting the Jaguar SmartKey in the start control unit.

NOTE: The panic alarm cannot be cancelled within the first 5 seconds after activation.

Maintenance

The Jaguar SmartKey remote handset should be handled with care and should not be exposed to extremes of heat, dust, or humidity or come in contact with fluids. The handset should not be left exposed to direct sunlight.

Erratic Handset Behavior

High levels of electrical or RF interference may cause the handset functions to operate erratically. Once the interference is removed, the handset should operate normally.

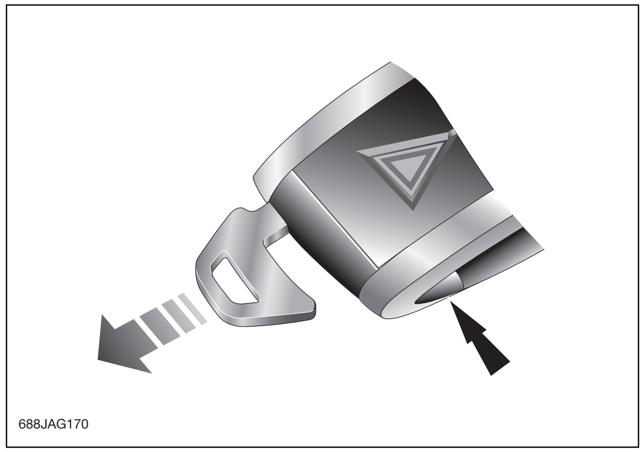
If there is a significant decrease in the effective range of the transmitter, the internal battery voltage may be low and the battery should be replaced. The message SMART KEY BATTERY LOW will be displayed in the message center.

NOTE: All components of handset are serviceable except the printed circuit board.

Emergency Key Blade

An emergency key blade is stored in the handset. To extract the key blade, press and hold the release button while withdrawing the blade.

To return the key blade to storage, press and hold the button while pushing the blade into the handset housing. The emergency key blade operates the lock barrels on the driver's door and the trunk lid. On X150 vehicles, the emergency key blade also opens the glove compartment.

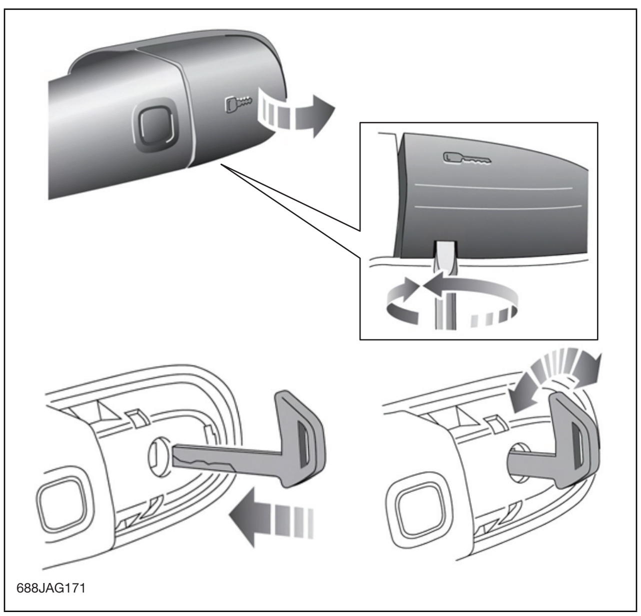


Emergency Key Operation

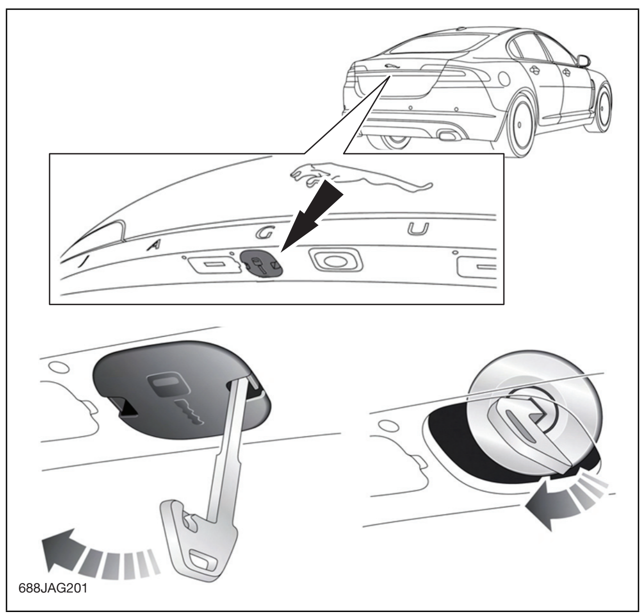
Emergency access to the vehicle using the emergency key blade is provided by two concealed key barrels: one located in the driver's door handle and one located on the underside of the trunk lid finisher. The key barrels are protected by a plastic cover, which can be removed by inserting the blade of the emergency key into a slot in the cover.

NOTE: X150 trunk key barrel is not concealed.

Door Handle Emergency Key Barrel (X250 shown; X150 similar)



Trunk Emergency Key Barrel (X250 shown; X150 similar)



Operation of either key barrel unlocks the vehicle but does not disarm the alarm system. The following locking and unlocking conditions apply when using the emergency key in the door key barrel:

- Alarm is not armed, the vehicle can be centrally unlocked
- Alarm is armed, the door only can be opened and the alarm will be triggered
- The alarm system cannot be armed using the emergency key
- Opening the trunk with the emergency key blade cancels valet mode and will not disarm the alarm

Programmable Features

The Jaguar SmartKey remote handset and various features of the vehicle security system can be programmed using the touch-screen display.

- Programmable features are as follows:
- Single- or two-stage unlocking
- Drive-away locking
- Global open or global close
- Valet mode
- Passive arming (X250)
- Automatic relock and arm (X250)

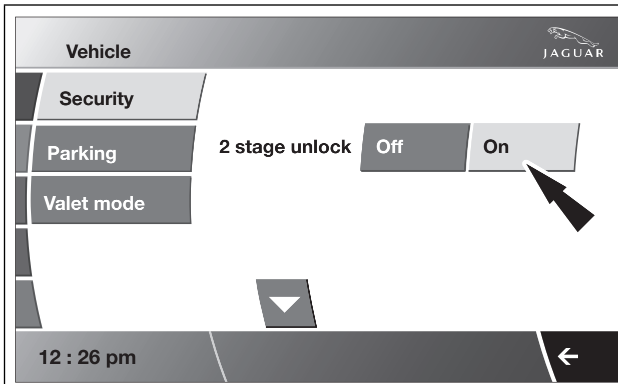
All of these features are programmed from the 'Security' menu on the touch-screen.

To access the 'Security' menu:

– From the main 'Home' touch-screen menu, select 'Vehicle'
– Select 'Veh. settings'
– 'Security' is the default selection under 'Veh. settings'.

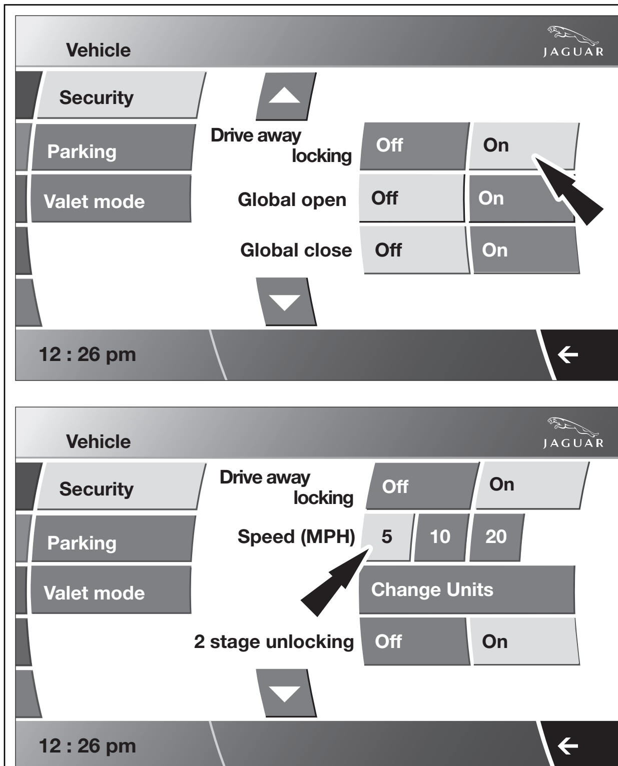
The features described are accessed by scrolling down in the 'Security' menu.

Single or Two-Stage Locking



688JAG172

Drive-Away Locking; Global Open / Close



688JAG173

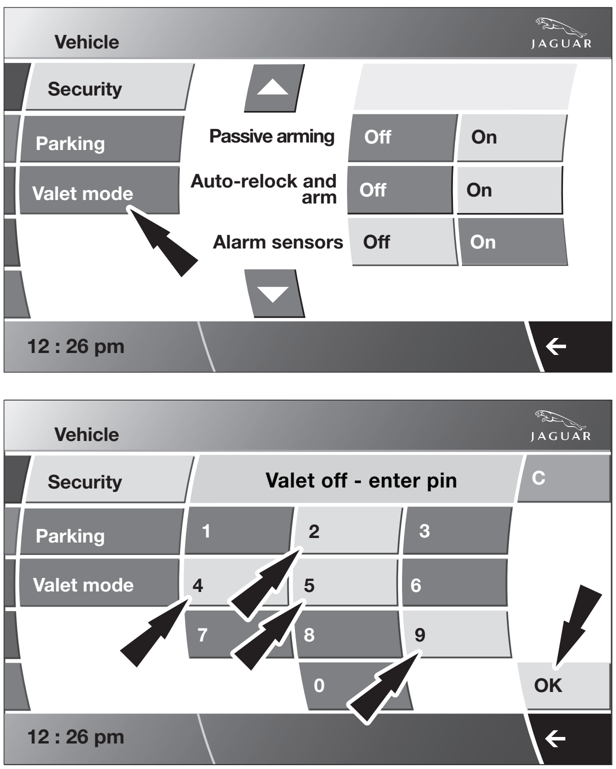
Drive-Away Door Locking

This feature automatically locks all doors and the trunk when the selector is moved out of the 'Park' position and vehicle speed exceeds the speed selected. If a door is subsequently unlocked, re-locking will occur when a further gear selection is made and the set speed exceeded.

Valet Mode

NOTE: On X150 vehicles, first lock the glove compartment using the key blade.

– From the main ‘Home’ touch-screen menu, select ‘Vehicle’
– Select ‘Veh. settings’
– Select ‘Valet mode’
– Enter the 4-digit PIN (4259 is used as an example) using the digit screen pad, and then touch the ‘OK’ button. (Touch the ‘C’ button at any time while entering the PIN if an error is made or to cancel.)

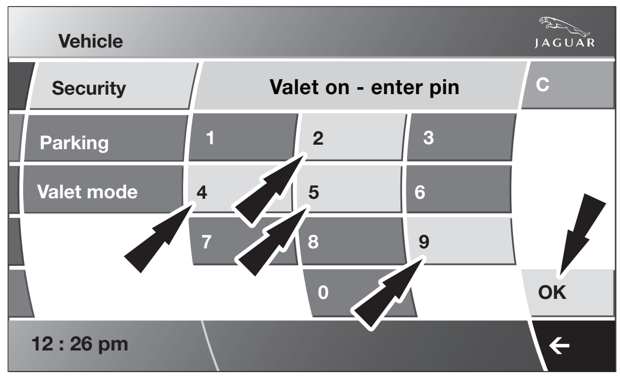


688JAG177

The screen shows confirmation by displaying ‘Valet on’.

To cancel Valet Mode:

– Enter the 4-digit PIN (when ‘Valet on’ is displayed) and touch the ‘OK’ button. The screen shows confirmation by displaying ‘Valet off’.



688JAG178

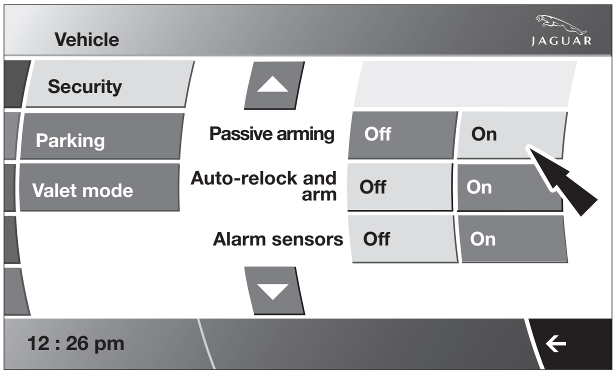
When Valet Mode is enabled, the Jaguar SmartKey can only be used to lock and unlock the vehicle doors and to start and drive the vehicle. Access to the glove compartment (X250), trunk and touch-screen functions is inhibited. Also, all functions of the audio system are locked except audio volume via volume knob.

When in Valet Mode, if any of the trunk release buttons or the glove box button (X250 only) are pressed, an audible warning is emitted and the message ‘Valet Mode’ is displayed in the message center (the trunk and glove box will remain locked).

NOTE: Using the emergency key blade to open the trunk disables ‘Valet Mode’. The emergency key blade should be removed from the Jaguar SmartKey before the handset is presented to a valet attendant.

Passive Arming (X250)

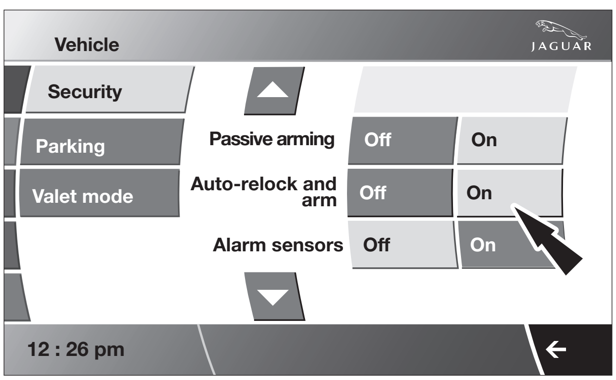
With passive arming enabled, the vehicle will automatically arm the security system without locking the vehicle.



688JAG175

Automatic Relocking (X250)

If a door or the trunk is not opened within 1 minute of unlocking the vehicle, the doors will lock again and re-arm the alarm automatically.



688JAG176

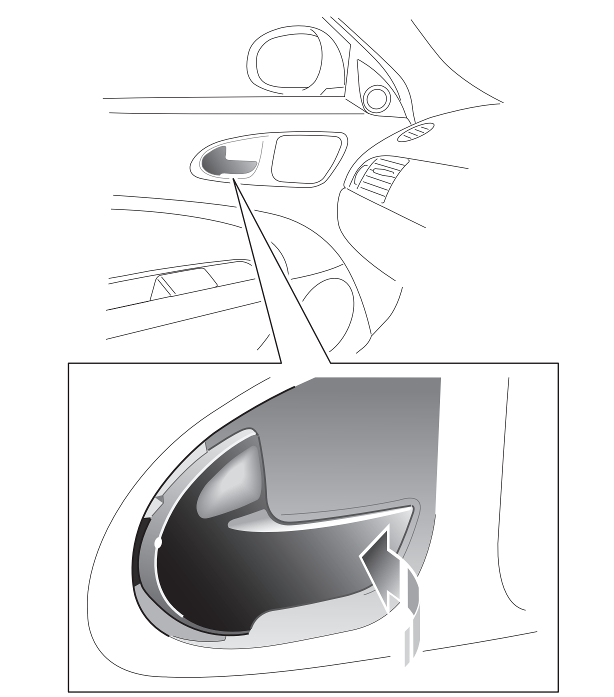
X150 / X250 CENTRAL LOCKING

Locking and Unlocking from Inside the Vehicle

X150

The X150 interior door release levers incorporate a locking/unlocking mechanism known as a paddle switch.

Press the lever inwards toward the door panel to lock both doors and the trunk and arm the security system. Pull the lever to unlock and disarm the vehicle.

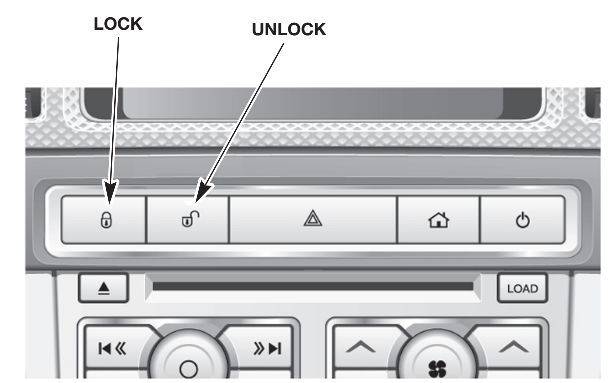


688JAG179

When the lock handle is pressed or pulled, a ground is connected from a microswitch in the latch assembly to the Driver Door Module (DDM). The DDM sends a signal to the CJB to lock or unlock motors in the door and trunk latches. The doors and trunk will only respond to the paddle switch lock/unlock command when they are fully closed. If a door is ajar the central locking feature is inhibited. The operator will be notified of a 'mislock' by two audible chirps and a light flash.

X250

The X250 central locking switches are located above the center console. The buttons lock and unlock all doors and the trunk. The switches are non-latching and allow all the vehicle entry points to be centrally locked or unlocked from inside the vehicle. Pressing and holding the buttons will operate the global open/close function. The windows and sunroof will stop opening if the button is released.



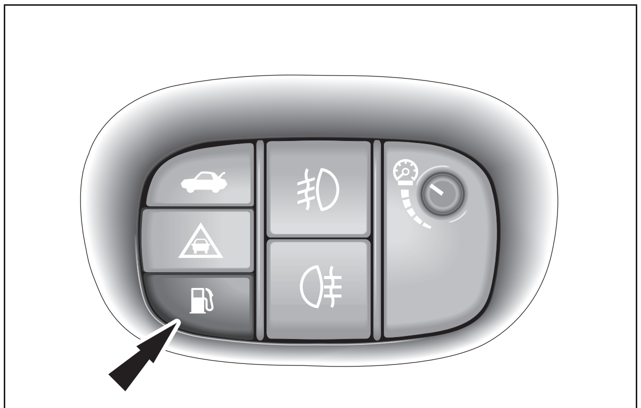
688JAG180

When the central lock or unlock switch is pressed, a ground is connected to the CJB sending a signal to the lock or unlock motors in the door and trunk latches. The doors and trunk will only respond to the central lock/unlock command when they are fully closed. If a door is ajar the central locking feature is inhibited. The operator will be notified of a 'mislock' by two audible chirps and a light flash.

Fuel Filler Door

X150

The fuel filler flap release is located in the auxiliary switch pack located in the LH knee bolster below the fascia.

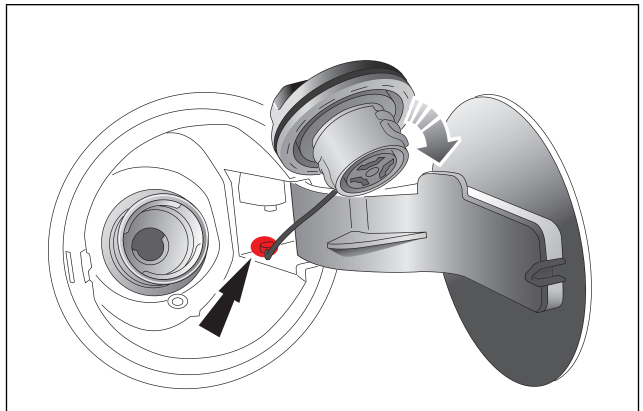

688JAG181

The switch pack is hardwired to the instrument cluster (IC). When the fuel release is pressed, an MS CAN signal is sent from the IC to the AJB to release the fuel door.

Fuel door operation is inhibited if the vehicle locked and armed.

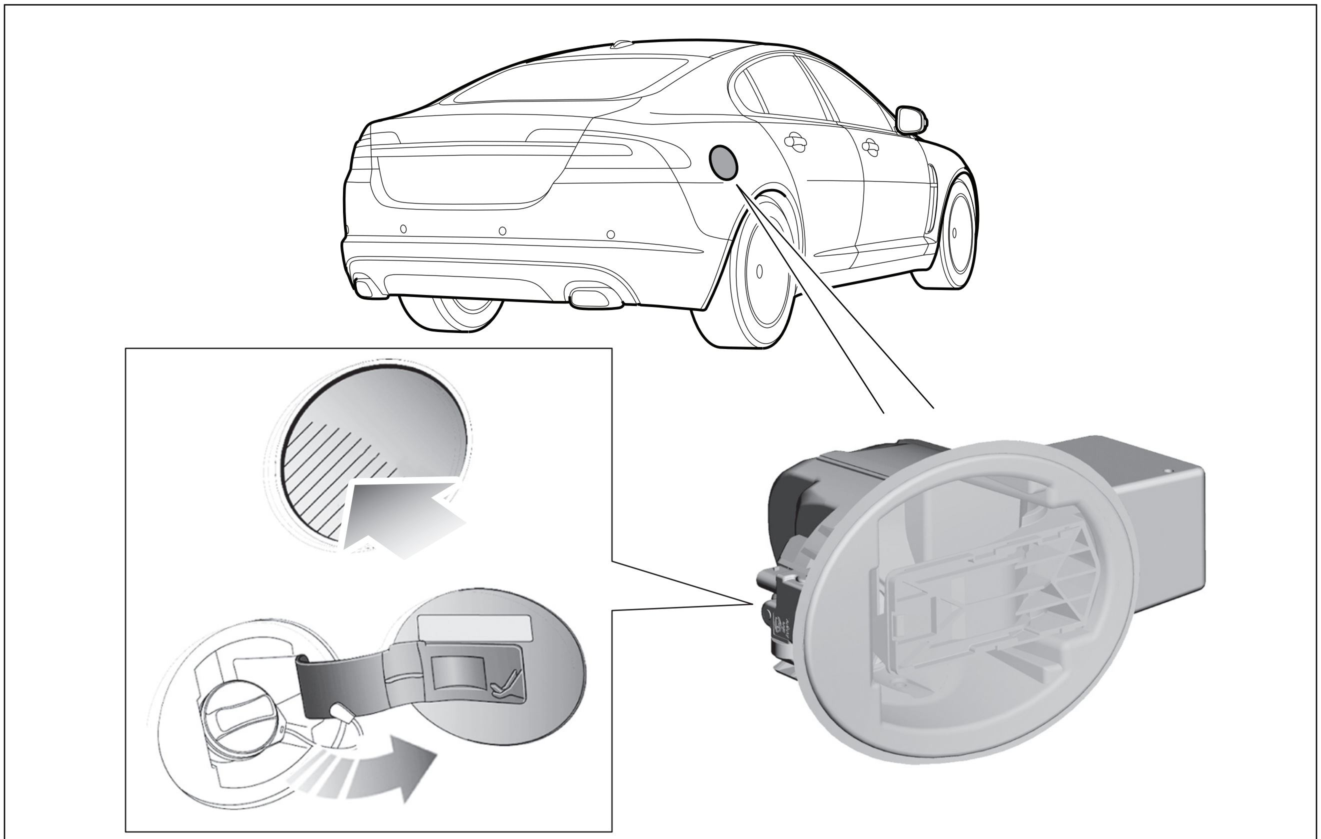
A fuel flap emergency release can be accessed by removing the rear wheelarch liner. Once the liner is removed, insert a small screwdriver into the access hole (see illustration) to raise the solenoid plunger and release the flap.

Emergency Release


688JAG182

X250

The fuel filler door is electrically locked / unlocked by a motor and latch assembly located on the fuel door housing. The fuel filler door motor is hardwired to the RJB.



688JAG183

When the vehicle is unlocked, the fuel filler door is opened by gently pushing the filler door in towards the tank filler neck. This action activates a hardwired 'soft touch' signal to the RJB which activates the door motor releasing latch mechanism. When the vehicle is locked and armed this function is inhibited, preventing the opening of the filler flap.

NOTE: There is no interior function or emergency release built into the fuel filler door locking mechanism.

Trunk Release

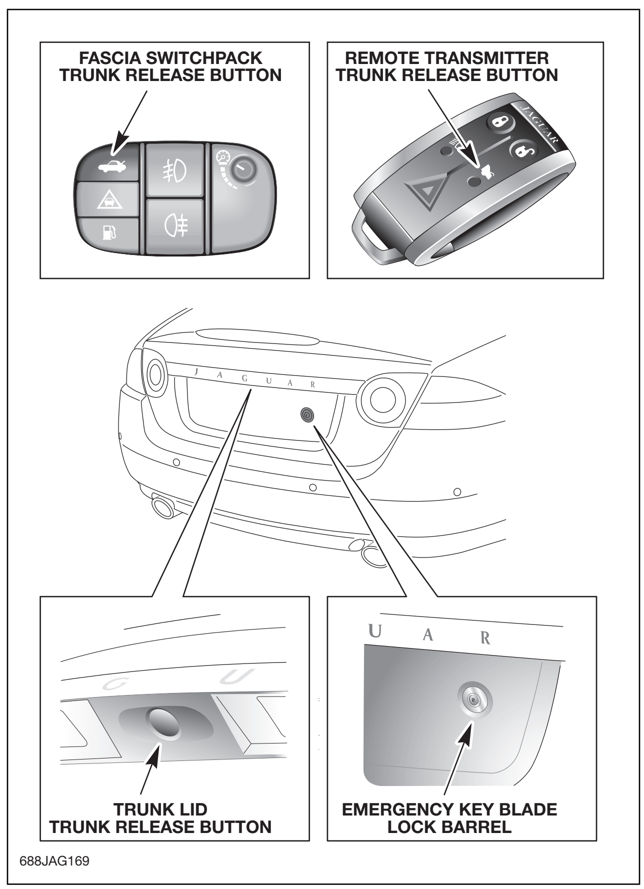
Pressing the fascia trunk release button (located in the auxiliary lighting switch pack) opens the trunk. The release signal is hardwired to the instrument cluster. The signal is transmitted via a MS CAN bus signal to the AJB/RJB to operate the trunk release motor. This function is inhibited when the vehicle speed exceeds 3 mph (5 km/h).

Trunk Release (X150 shown; X250 similar)

The trunk can also be opened by:

- A single press of the trunk release button on the remote handset
- A single press of the trunk release button on the trunk lid
- Using the emergency keyblade

NOTE: Each of these options unlocks the trunk only; the alarm system will remain armed and the doors will remain locked.



Trunk Release Operation

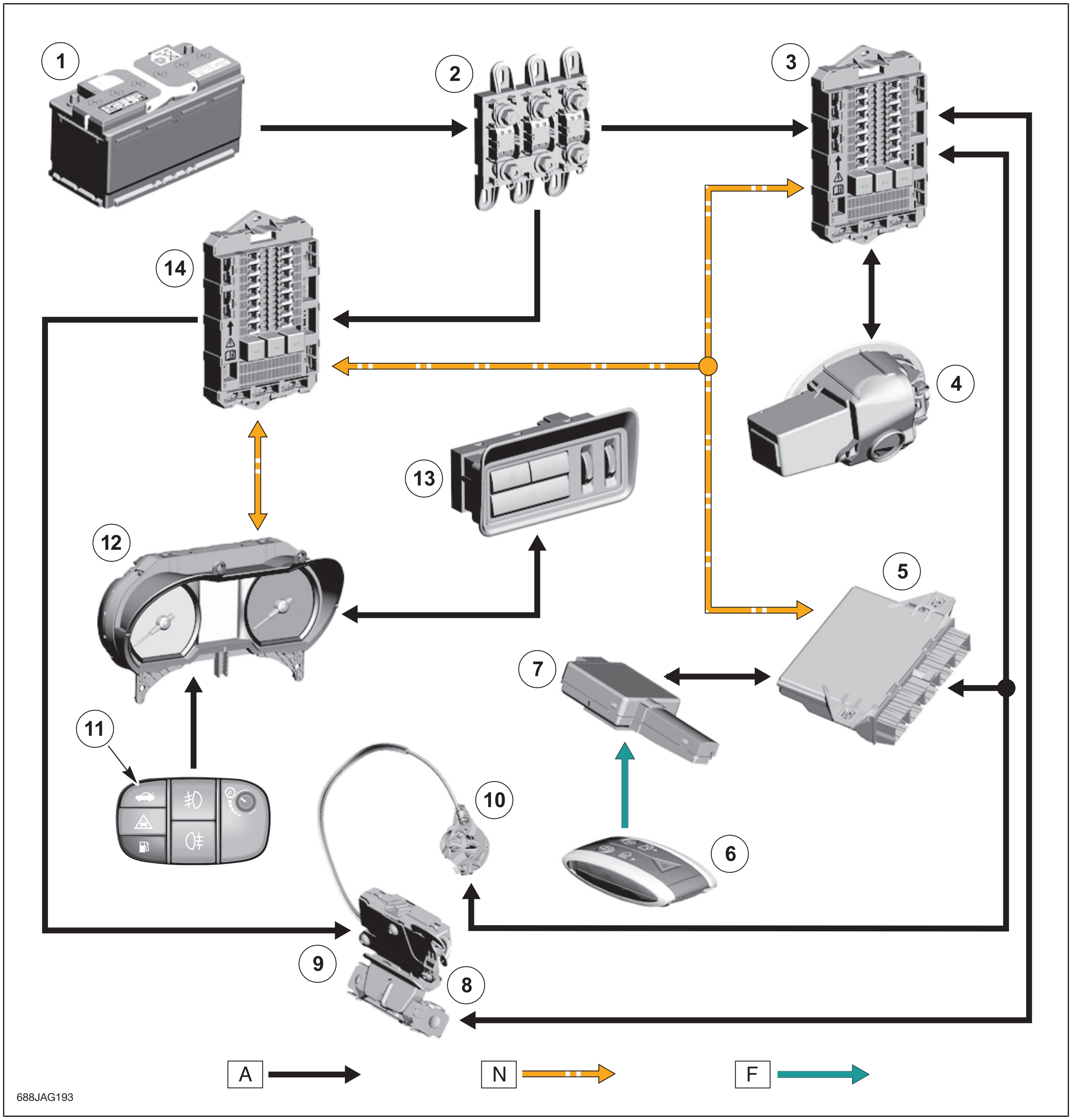
Trunk release from the Jaguar SmartKey:

- The Jaguar SmartKey transmits a 315 MHz RF signal containing its authorization code to the RF receiver
- The RF receiver relays the code via serial data line to the KVM, which checks and approves the code as valid. The KVM will only respond if the RF signal produced is from a valid Jaguar SmartKey for the vehicle.
- The KVM transmits the release signal request to the CJB via the medium speed CAN bus.
- The signal is passed from the CJB to the AJB/RJB via the medium speed CAN.
- On receipt of the signal, the AJB/RJB drives the latch motor, releasing the latch, and opening the trunk lid.

Trunk release from the lid switch, vehicle unlocked:

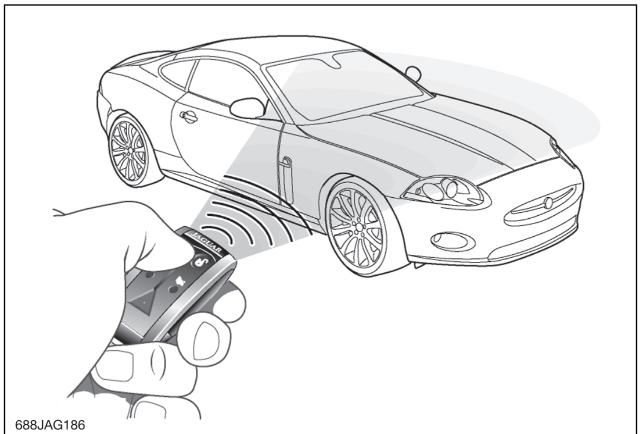
- The switch is hardwired directly to the AJB/RJB.
- On receipt of the release signal request the AJB/RJB drives the latch motor, releasing the latch, and opening the trunk lid.

Trunk and Fuel Filler Door Locking Control Diagram



A	Hardwired	4	Fuel door locking motor	10	Trunk lid release switch
N	MS CAN bus	5	Keyless vehicle module	11	Fascia trunk lid release switch – X150
F	RF transmission	6	Jaguar SmartKey	12	Instrument cluster
1	Battery	7	RF receiver	13	Fascia trunk lid release switch – X250
2	Megafuse (250 A)	8	Trunk lid release latch	14	CJB
3	RJB	9	Trunk lid ajar switch		

Remote Central Locking



688JAG186

Each Jaguar SmartKey features a unique identification code that is programmed within the remote handset. The RF signal produced by the remote handset contains the unique security identification code and also a rolling code.

During vehicle production, the unique security identification codes of the valid Jaguar SmartKeys are programmed into the Keyless Vehicle Module (KVM) and the Instrument Cluster (IC), and the rolling codes are also synchronized with the KVM.

Vehicle unlocking operates as follows:

- When the Jaguar SmartKey UNLOCK button is pressed, an RF signal containing its authorization code is transmitted to the RF receiver.
- The RF receiver relays the code via a serial data line to the KVM, which checks and approves the code as valid. The KVM will only respond if the RF signal produced is from a valid Jaguar SmartKey for the vehicle.
- The KVM transmits the unlock request to the CJB via the medium speed CAN bus.
- The CJB confirms and sends the request, via the medium speed CAN bus, to the front door modules.
- The front door modules respond with the following simultaneous actions:
  - The front door modules drive the motors to unlock the **front** doors
  - The front door modules transmit the door unlock request via the LIN to the rear door modules
- The rear door modules drive the motors to unlock the **rear** doors.

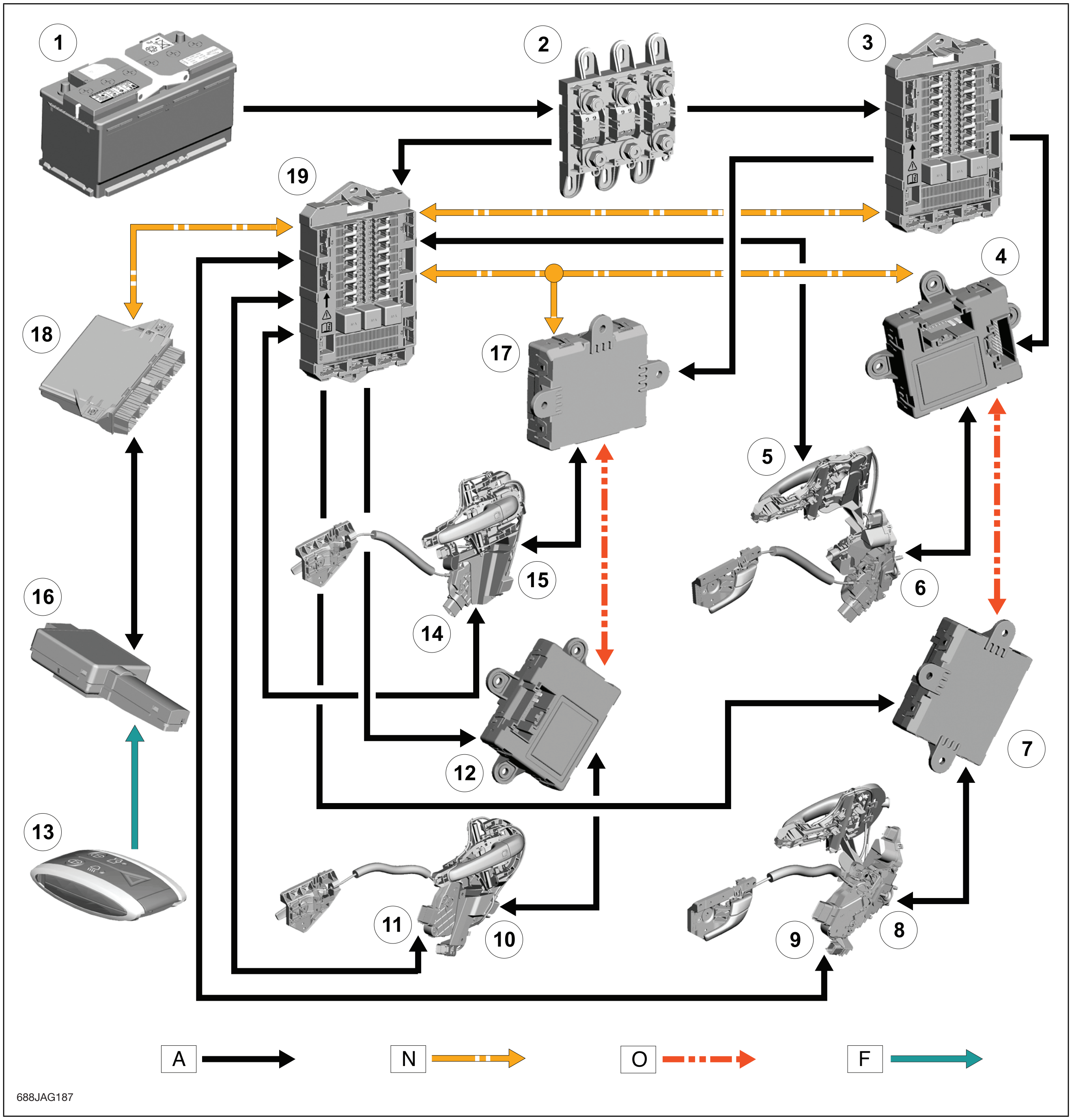
Locking of the vehicle is performed by pressing the LOCK button on the Jaguar SmartKey. Thereafter the system procedure is identical for locking as for unlocking the vehicle.

If a door, hood or the trunk lid is ajar when an attempt to lock the vehicle is made, an error tone is emitted and no locking action will occur.

A total of 8 'slots' are available in the KVM software to allow for replacement or addition of Jaguar SmartKey handsets. In service, IDS is used to communicate with the KVM for the following:

- Identification of Jaguar SmartKey allocations within the KVM
- Enabling of new Jaguar SmartKey handsets
- Disabling of existing Jaguar SmartKey handsets

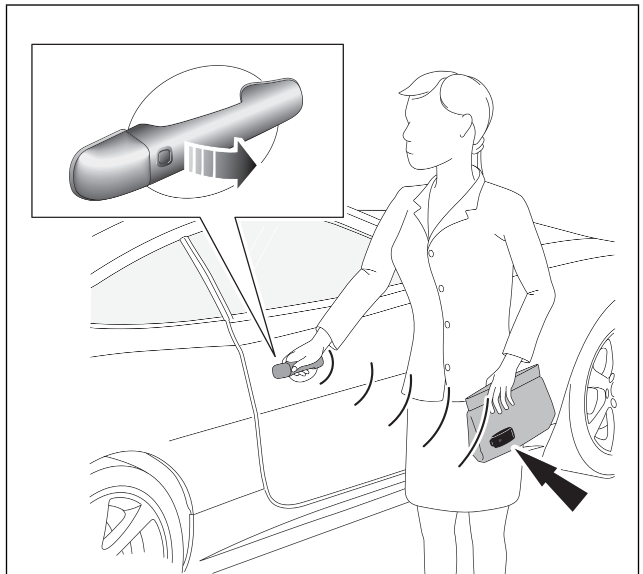
Remote Central Locking Control Diagram



A	Hardwired	5	Passenger door ajar switch	13	Driver door ajar switch
N	MS CAN bus	6	Passenger door latch	14	Driver door latch
O	LIN bus	7	RH rear door module	15	LH rear door ajar switch
F	RF transmission	8	RH rear door latch	16	RF receiver
1	Battery	9	RH rear door ajar switch	17	Driver door module
2	Megafuse (250A)	10	LH rear door latch	18	Keyless vehicle module
3	RJB	11	LH rear door module	19	CJB
4	Passenger door module	12	Jaguar SmartKey		

X150 / X250 PASSIVE ENTRY SYSTEM

The passive (keyless) entry system is based around the Jaguar SmartKey. Each Jaguar SmartKey for a given vehicle is programmed uniquely to that vehicle. Passive entry and the associated passive start system allow the driver to unlock and start the vehicle without using a vehicle key in a door lock or ignition switch. The passive entry system is a standard feature on X150 and optional on X250 (the passive start system is a standard feature on all vehicles).



688JAG188

The passive entry system has an active transmission zone of 1.0m (3.3 ft.). Provided the Jaguar SmartKey is within range of the desired point of entry (vehicle door, trunk), it need only be on the driver's person (in a pocket, handbag, or briefcase, for example) to provide access to the vehicle.The driver simply pulls any door handle (or presses the trunk release button); no further driver intervention is required. The vehicle unlocks according to the current security setting (either single-point or multi-point entry).

Placing the Jaguar SmartKey in a metallic container or metal briefcase may hinder its operation.

Passive Entry Components

The passive entry system consists of:

- Keyless vehicle module (KVM)
- Low-frequency (LF) transmitting antennas
  - 3 antennas for X150
  - 5 antennas for X250
- Radio frequency (RF) receiver antenna
- Jaguar SmartKey

Keyless Vehicle Module

The KVM interfaces with the central locking RF receiver and collects RF signal information which is transmitted from the Jaguar SmartKey.

This information is translated into commands which are passed on the medium speed CAN bus to the:

- CJB
- AJB/RJB
- Front door modules and onto the rear door modules via a LIN bus connection
- Instrument cluster

The KVM also monitors:

- 2 interior antennas (passive start)
- 1 trunk antenna (passive start)
- Rear bumper antenna (passive entry, if equipped)
- Door handle antennas (passive entry, if equipped)

On vehicles with passive entry, additional fast latch motors (auto latch release motors) are located within each latch assembly to provide smooth door release operation. These fast latch motors are also controlled via the KVM. The fast latch status is passed to the CJB on the medium speed CAN bus.

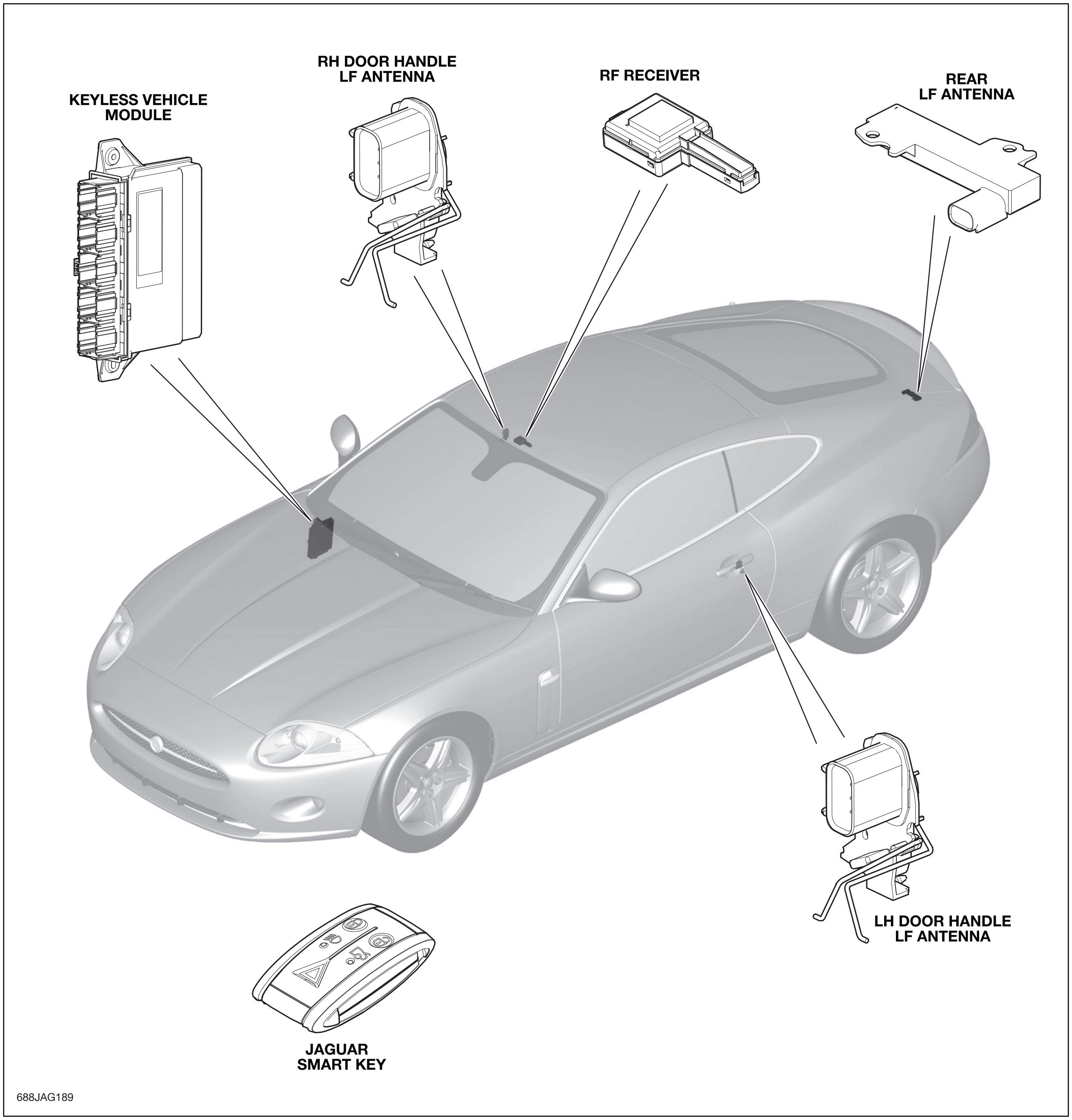
RF Receiver

The RF receiver is installed above the headlining – to the rear of the vehicle on X250 and above the center console on X150. The receiver provides functionality for the remote central locking and passive entry systems.

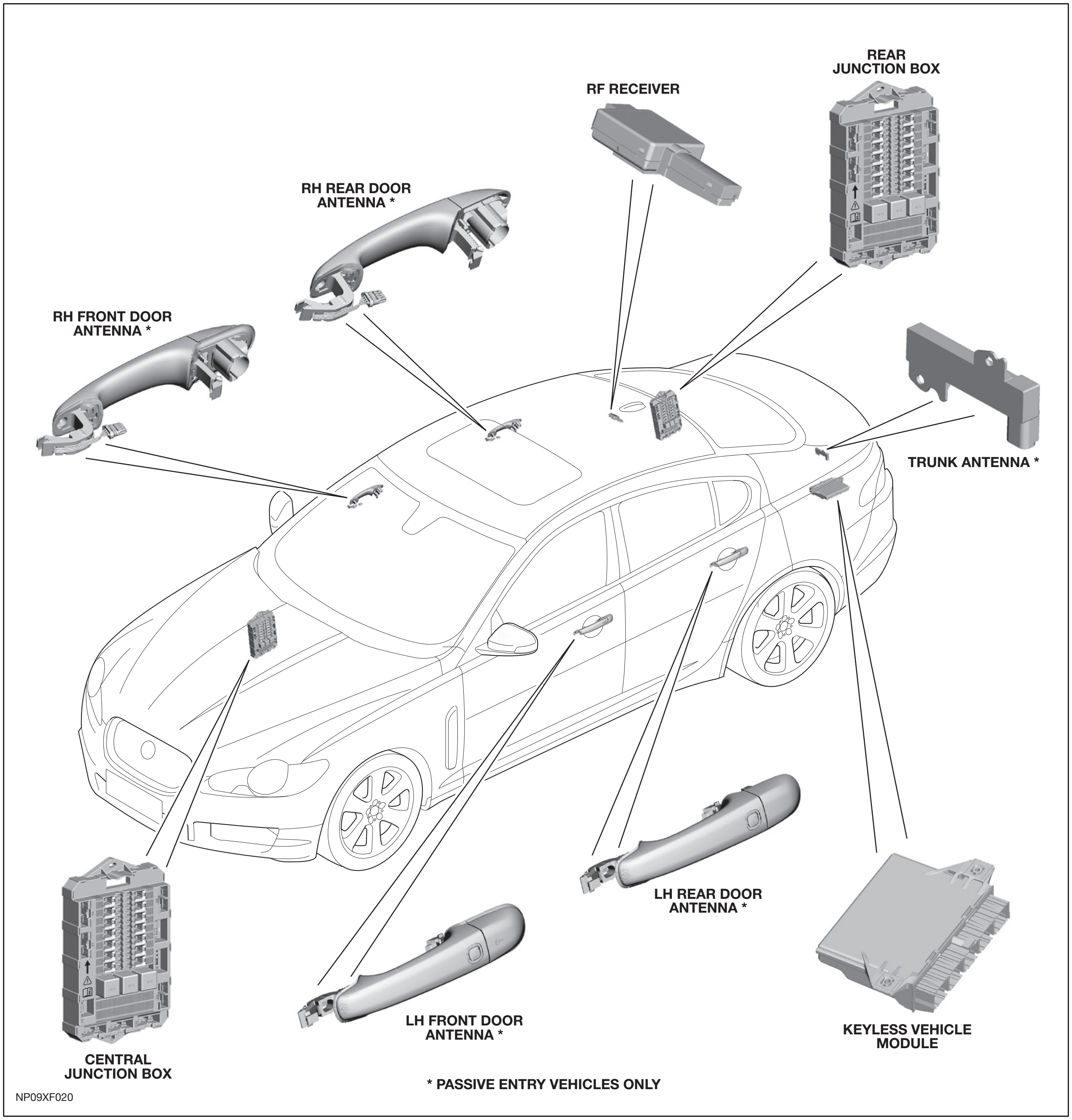
The operating frequency of the RF receiver is 315 MHz.

The RF receiver converts the signals transmitted by the Jaguar SmartKey into digital messages, and then transmits the message on a serial data line to the KVM for Jaguar SmartKey authorization. The CJB provides a permanent power feed to the RF receiver.

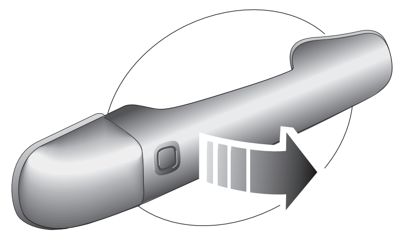
X150 Passive Entry System Components



X250 Passive Entry System Components



Passive Entry System Operation



688JAG190

On vehicles equipped with the passive entry system, the vehicle can be unlocked / locked without the use of a key or pressing buttons on the Jaguar SmartKey. The Jaguar SmartKey is a functional component of the passive entry system in addition to the passive start system.

The passive entry system is controlled by the KVM and several LF antennas (3 for X150; 5 for X250). There is one antenna located in each door handle and one antenna located behind the rear bumper cover.

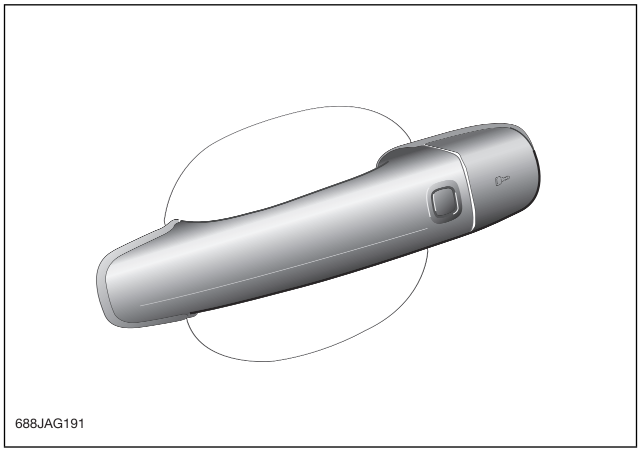
Vehicle Unlocking Sequence:

- With the Jaguar SmartKey within 1.0m (3.3 ft.) of the approached door, the handle is pulled to the first 10 percent of its travel. This action closes and grounds the unlock pull switch (within the operated handle) sending a hardwired switched signal to the KVM which responds with the following simultaneous actions:
  – The KVM energizes the low frequency antenna in the door handle, which transmits a 125KHz signal to the Jaguar SmartKey.
- On receipt of the LF signal the Jaguar SmartKey transmits a 315 MHz RF signal containing its authorization code to the RF receiver.
- The RF receiver relays the code, via a serial data line, to the KVM which checks and approves the code as valid. The KVM will only respond if the RF signal produced is from a valid Jaguar SmartKey for the vehicle.
- The KVM transmits the unlock request to the CJB via the medium speed CAN bus.
- The CJB confirms and sends the request, via the medium speed CAN bus, to the front door modules.
- The front door modules respond with the following simultaneous actions:
  – The front door modules drive the motors to unlock the **front** doors.
  – The front door modules transmit the door unlock request via a LIN to the rear door modules.
- The rear door modules drive the motors to unlock the **rear** doors.
- When the door handle reaches 80 percent of its travel the handle clutch switch is closed and grounded, sending a hardwired switched signal to the KVM.
- The KVM drives the fast latch (auto) release motors in the door latch assemblies releasing the door latches.

As the approached door handle is pulled through its full travel, the applicable door can opened.

Passive Locking and Arming

There is no automatic passive locking of the vehicle. To 'passively' lock the vehicle, press the button on the exterior door handle once with the SmartKey within a 1.0 meter (3.3 ft.) of the handle being operated.



When the exterior door handle button is pressed:

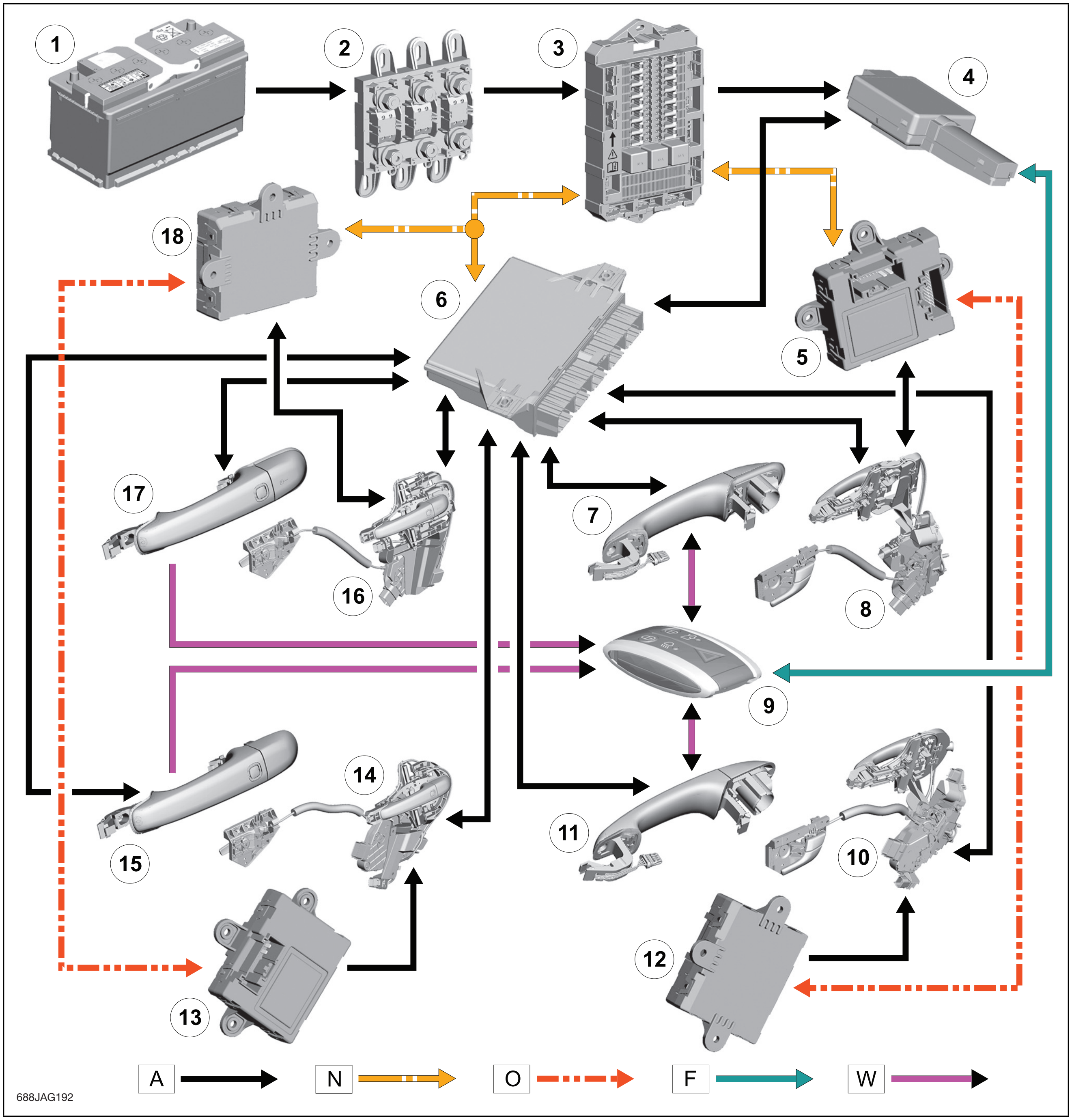
- A hardwired 'lock request' input signal is sent to the keyless vehicle module (KVM).
- Once the KVM receives the hardwired 'lock request' input signal, the KVM transmits an LF signal to the driver door handle antenna, which activates any SmartKey transmitter within one meter of the handle antenna.
- The activated SmartKey transmits an RF 'security code' signal to the RF Receiver.
- The RF Receiver transmits the 'security code' signal via a dedicated serial data line to the KVM, which checks and validates the security code.
- Once the security code has been validated by the KVM, the KVM sends the 'lock request' signal to the CJB via the MS CAN bus.
- Upon receiving the 'lock request' signal, the CJB confirms that none of the latches are 'ajar' by monitoring the aperture 'ajar' switch signals, which are a direct hardwired input to the CJB.
- Once it has confirmed that none of the latches are 'ajar', the CJB sends a 'lock request' followed by a 'security request' over the MS CAN bus.

Locking and Security Request Results:

- The front door modules receive the 'lock request' signal via MS CAN. The front doors lock.
- The front door modules transmit the 'lock request' signal to the rear door modules via LIN bus to lock the rear doors.
- The AJB/RJB receives the 'lock request' signal and inhibits the trunk and fuel door release.
- Once the vehicle is locked, the CJB automatically enters security mode and sends a 'security request' signal over the MS CAN bus, and flashes the front side lights.
- The front door modules receive the 'security request' signal via MS CAN and flash the side view mirror turn signal and approach lights.
- The AJB/RJB receives the 'security request' signal and inhibits fuel pump driver module operation and flashes the tail lights.
- The instrument cluster receives the 'security request' signal and activates the security LED in the sunload/ light sensor on the dashboard.

If a door, hood or the trunk lid is ajar when an attempt to lock the vehicle is made, an error tone is emitted and no locking action will occur.

Passive Entry System Control Diagram



A	Hardwired	4	RF receiver	12	RH rear door module
N	MS CAN bus	5	Passenger door module	13	LH rear door module
O	LIN bus	6	Keyless vehicle module	14	LH rear door latch – fast latch
F	RF transmission	7	Passenger door handle, lock/unlock switch and antenna	15	LH rear door handle, lock/unlock switch and antenna
W	LF transmission	8	Passenger door latch — fast latch	16	Driver door latch – fast latch
1	Battery	9	Jaguar Smart Key	17	Driver door handle, lock/unlock switch and antenna
2	Megafuse (250A)	10	RH rear door latch — fast latch	18	Driver door module
3	CJB	11	RH rear door handle, lock/unlock switch and antenna		

Passive Trunk Opening

Trunk release switch from lid switch, vehicle locked with Jaguar SmartKey within range (passive entry vehicles only):

- The switch is hardwired directly to the KVM (as well as the AJB/RJB).
- On receipt of the release signal request from the switch the KVM energizes the LF antenna in the trunk, which transmits a 125KHz signal to the Jaguar SmartKey.
- On receipt of the LF signal the Jaguar SmartKey transmits a 315 MHz RF signal containing its authorization code to the RF receiver.
- The RF receiver relays the code, via a serial data line, to the KVM which checks and approves the code as valid. The KVM will only respond if the RF signal produced is from a valid Jaguar SmartKey for the vehicle.
- The KVM transmits the release request to the CJB via the medium speed CAN bus.
- The signal is passed from the CJB to the RJB via medium speed CAN.
- On receipt of the signal the RJB drives the latch motor, releasing the latch and opening the trunk lid.

When opening the trunk lid while the vehicle is locked and armed, all doors remain locked and the security system remains armed.

When the trunk is closed, the hazard warning lights will flash after a few seconds to confirm that the vehicle has rearmed the full alarm system.

NOTE: The SmartKey is monitored for position external to the vehicle. If the trunk lid is closed with the SmartKey inside it, the system will not re-arm: the trunk lid will re-open automatically and a warning tone will sound.

X150 / X250 ACTIVE ANTI-THEFT SYSTEM

The active anti-theft (alarm) system is a perimeter monitoring system that also verifies the Jaguar SmartKey validity. The system is controlled by software in the CJB and AJB/RJB.

When perimeter mode is active, the CJB monitors the panel ajar switches in the latch mechanisms of the hinged panels, which include:

- All doors
- Trunk lid
- Engine compartment lid

If the security systems detect a fault with one of the security sensors, two error tones will sound from the passive sounder after the vehicle is unlocked and disarmed.

The passive sounder takes the form of a horn located in the engine compartment RH side on X150, rear LH side on X250.

Principles of Operation

The engine is passively (automatically) immobilized when the Jaguar SmartKey is removed from the vehicle. The alarm system is armed when the lock button on the Jaguar SmartKey is pressed or the button on the exterior door handle is pressed (passive entry system) with a valid Jaguar SmartKey in close proximity. The hazard lights flash to indicate that the alarm is armed.

An alarm trigger is indicated:

- Audibly, via the vehicle horn and a passive sounder
- Visually, via flashing of the direction indicators

Monitoring of front door lock status is carried out using switches located in the door latch mechanisms. The condition of the switches is monitored by the front door modules and transmitted to the CJB over the MS CAN bus.

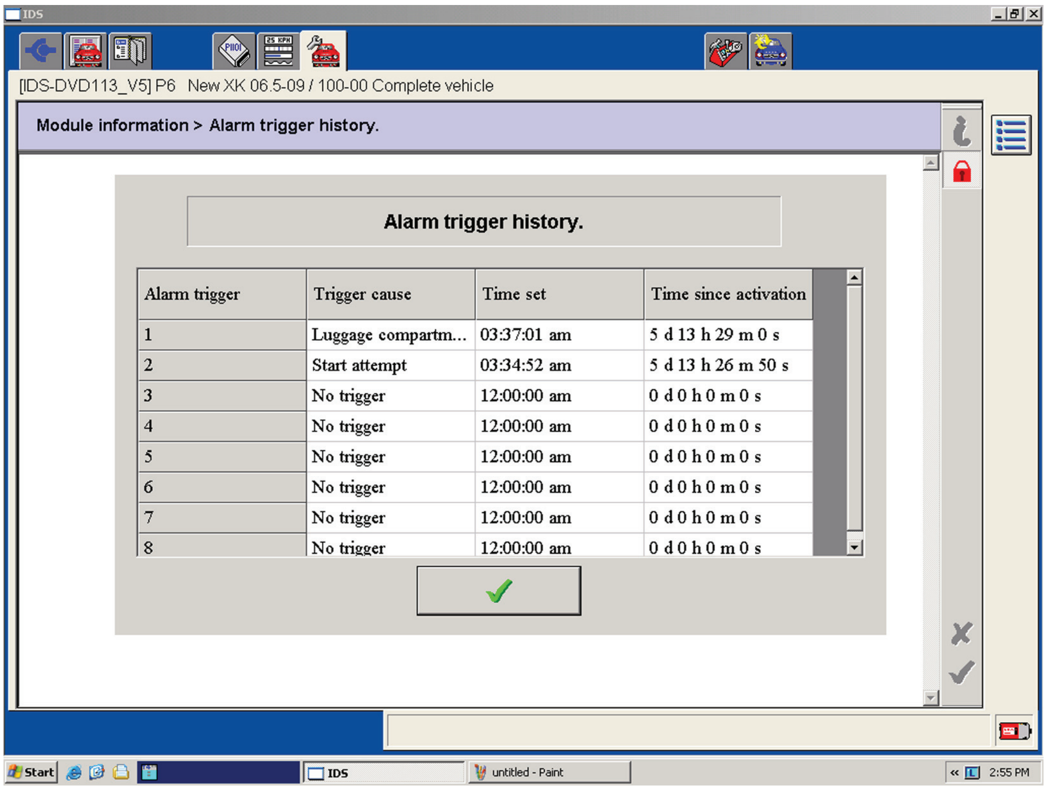
When armed, the active anti-theft system can be triggered in one of the following ways:

- Door ajar switch indicates a door has been opened
- Hood or trunk lid ajar switches indicate that either hood or trunk has been opened
- Either front door latch mechanism indicates a door has been unlocked
- Emergency key blade is used to open either the driver door or the trunk
- CJB or RJB are disconnected (this may result in only a partial trigger)
- Attempt to start the engine without a valid signal from the SmartKey

Alarm Trigger History

Alarm trigger activations can be viewed via touch screen display within the 'Security' menu. Only the most recent trigger will be displayed.

Detailed alarm trigger history with activation time stamps can be viewed and cleared via IDS within Set Up and Configuration: Module information tab.



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Disarming the Alarm

When the vehicle is unlocked using the Jaguar Smart-Key or by valid passive entry, the alarm is automatically disabled. The hazard lights flash twice to indicate that the alarm is disabled.

If the unlocking function fails to operate, the vehicle can be unlocked as follows:

– Unlock the driver door using the emergency key blade
– Dock the Jaguar SmartKey into the start control unit (SCU)

NOTE: When the driver door is unlocked using the key blade, the alarm will sound until the Jaguar SmartKey is docked.

If the alarm has been triggered, it can be deactivated using one of the following methods:

– Press the unlock button on the Jaguar SmartKey
– Dock the Jaguar SmartKey into the SCU
– Open a door using passive (keyless) entry
– Press the Start/Stop button with a valid Jaguar Smart-Key present

Passive Arming (X250 only)

The vehicle is fitted with a passive arming feature that will, if enabled, automatically arm the anti-theft system. Passive arming will automatically arm the system 30 seconds after the driver's door is closed, provided all doors, hood and trunk are closed, the ignition is switched off and there are no valid Jaguar SmartKeys inside the vehicle.

Passive arming does not lock the vehicle, although access to the trunk via the interior or exterior release buttons is inhibited and the fuel filler flap is locked. The passive arming function is enabled using the Touch-screen.

Automatic Relocking and Re-Arming of the Alarm

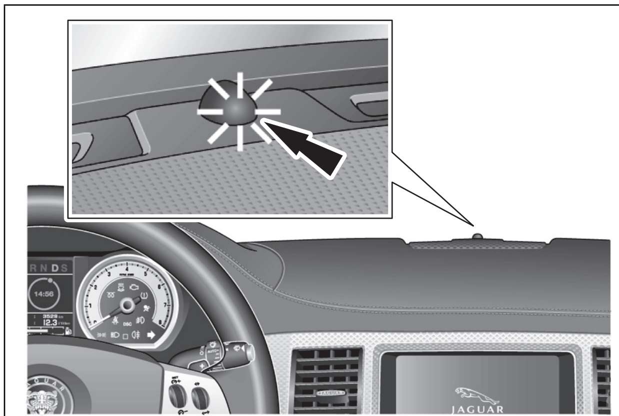
The automatic relock and re-arm feature will, if enabled, automatically relock the vehicle and arm the anti-theft system.

If the vehicle is in a locked and armed state and the Jaguar SmartKey UNLOCK button is pressed, but none of the doors or the trunk are opened within 45 seconds, the vehicle automatically relocks all the doors and the trunk and re-arms the alarm system.

This function relocks the vehicle to a centrally locked state and arms the alarm. This function is enabled using the Touch-screen on X250 and can only be enabled on X150 via IDS.

Alarm Indicator LED

The alarm indicator is an LED located in the body of the sunload/light sensor. When the ignition is off, the LED gives a visual indication that the alarm system is active or not active. Operation of the alarm indicator is controlled by the instrument cluster which varies the flash rate of the LED to indicate the system status of the alarm and the immobilization systems.



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Alarm status is indicated by the LED as follows:

- LED off: alarm disarmed
- LED flashes once per second: alarm is armed and engine immobilized.

When the ignition is on, the LED gives a visual indication of the status of the passive anti-theft (engine immobilization) system. If the immobilization system is operating correctly, the LED will be illuminated for 3 seconds at ignition on and then extinguish. If a fault exists in the immobilization system, the LED will either be permanently illuminated or flashing for 60 seconds. This indicates that a fault exists and a fault code has been recorded. After the 60-second period, the LED will flash at different frequencies to indicate the nature of the fault.

X150 / X250 PASSIVE ANTI-THEFT SYSTEM

The passive anti-theft system (PATS) prevents unauthorized starting of the vehicle by immobilization of the:

- Engine cranking system
- Fuel system
- Ignition system

Immobilization is achieved through the use of a uniquely coded Jaguar SmartKey and an encoded data exchange between multiple control modules. The system is automatic and requires no input from the driver. The engine start system is initiated when the encoded data between the Jaguar SmartKey and vehicle control modules is verified. The engine can be started when the JaguarDrive selector is in the 'Park' position and the start/stop switch and brake pedal are pressed simultaneously.

The system relies on the Jaguar SmartKey for vehicle access and starting. If a valid Jaguar SmartKey is not detected, starting is inhibited. If replacement Jaguar SmartKeys are required, they must be programmed to the vehicle using IDS. Any module involved in the Jaguar SmartKey authorization process will require programming if replaced.

System Components

The PATS system uses the following components:

- Jaguar SmartKey
- LF keyless antennas
- RF receiver
- KVM
- Start control unit
- JaguarDrive selector module / engine Start/Stop switch
- TCM
- CJB
- Alarm LED indicator
- Instrument cluster
- AJB/RJB
- ECM
- ABS module

Keyless Vehicle Module (controls Passive Starting)

The keyless vehicle module (KVM) controls signal transmissions to and from the Jaguar SmartKey and provides authorization to allow the vehicle to be started passively. The module has a medium speed CAN connection to the CJB for authorizing the security code and a data connection hardwire for communication with the RF receiver.

The KVM energizes the interior low frequency antennas on receipt of either 'driver door closed' or 'start button pressed' signals from the CJB.

NOTE: The LF antennas are activated after driver door closed signal entry in anticipation of start request.

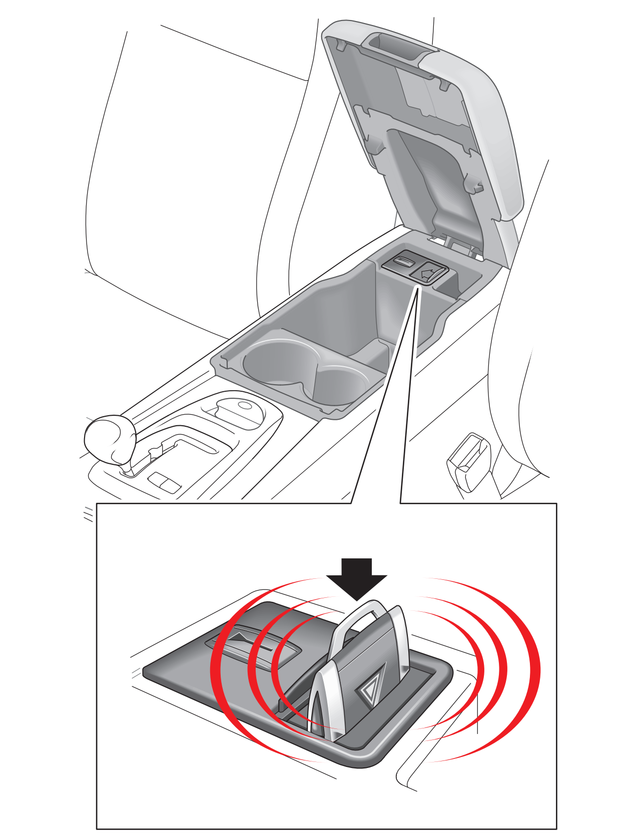
Start Control Unit (controls Active Starting)

The start control unit (SCU) is used if the KVM is unable to authorize the Jaguar SmartKey.

If the KVM is unable to identify the Jaguar SmartKey – for example, if the Jaguar SmartKey battery voltage is low or there is local RF interference – the transponder within the Jaguar SmartKey can be read in the conventional manner. The driver will be alerted to this by a chime and a message in the instrument cluster message center 'SMART KEY NOT FOUND PLEASE INSERT IN SLOT'.

The Jaguar SmartKey is inserted into the SCU with the key fob loop trailing. The start control module is motorized and will draw the remote handset into the slot once inserted.

X150 Start Control Unit



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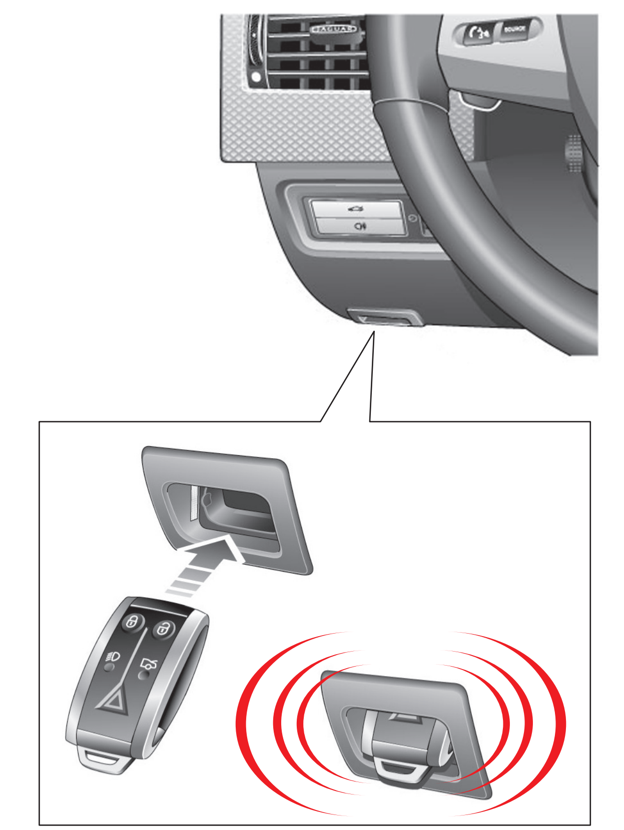
X250 Start Control Unit



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After inserting the Jaguar SmartKey:

- SCU energizes the transponder within the Jaguar SmartKey
- Transponder information is read by the SCU and the key identity (security code) is passed to the instrument cluster over the LIN bus.
- The instrument cluster checks the key identity and compares it with the identity of the keys stored within the instrument cluster.
- If the key identity is valid, the instrument cluster initiates a challenge response to the key.
- If the response from the key is correct, the key will be classed as a valid key and start authorization will be allowed.
- The instrument cluster also initiates a challenge response to the SCU to confirm it is correct for the vehicle. If it is not, then start authorization will not proceed.

NOTE: If the Jaguar SmartKey is not valid, the SmartKey will be ejected from the start control unit.

NOTE: Inserting the Jaguar SmartKey into the start control unit will not charge the Jaguar SmartKey battery. The battery is not rechargeable and must be replaced if run down or defective.

A message ‘REMOVE SMART KEY’ will be displayed if the Jaguar SmartKey is still in the start control unit and the driver’s door is opened.

The Jaguar SmartKey can be removed by pushing down or in on the key fob loop and releasing. The start control unit motor will drive the Jaguar SmartKey out from the slot (if the ignition is off and ‘Park’ is selected).

CAUTION:

⚠ **Do not use force to remove the Jaguar SmartKey as this may cause damage to the start control unit.**

⚠ **Do not attempt to hold an invalid key in the start control unit in an attempt to prevent it from being ejected.**

JaguarDrive Selector Module (X250)

Prior to start authorization, the JaguarDrive selector module outputs a hardwired Park/Neutral signal to the CJB and ECM. This information is determined from its own selector position and information from the TCM.

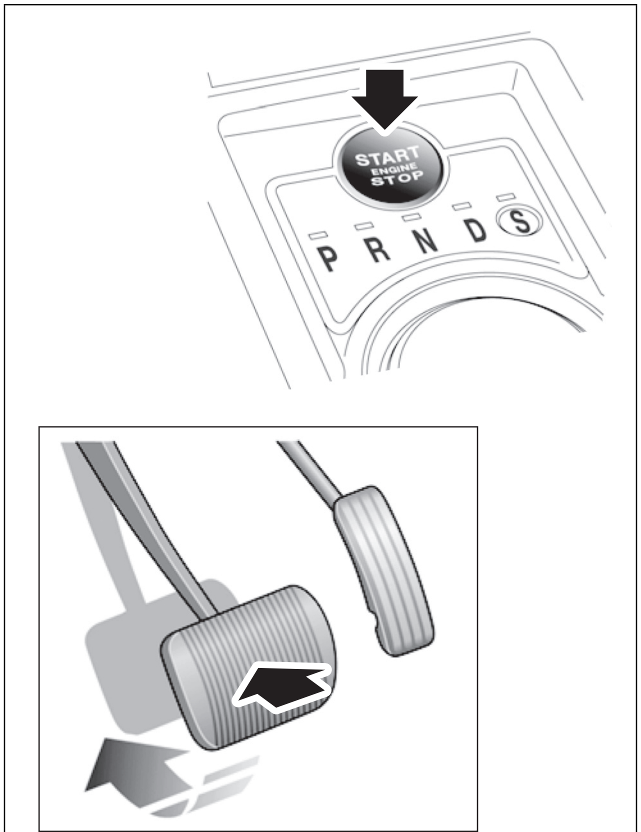
The X250 Start/Stop switch is integrated into the JaguarDrive selector module.

NOTE: The X150 Start/Stop switch is separate from the L-Gate and is hardwired directly to the CJB and AJB.

The switch contains two analog circuits, both outputs from the JaguarDrive selector module to the CJB. Either output can trigger a Jaguar SmartKey search resulting in one of two options:

- Ignition on / engine start
- Ignition off / engine off

The two analog circuits provide diagnostic and redundancy features. For example, if a circuit fails (open circuit, etc.), a warning is triggered to the vehicle user and a DTC is logged. With one circuit intact the vehicle will function as normal. One of the Start/Stop switch analog circuits provides an input to the AJB/RJB. This feature is required to support a hardwired reset from limp home mode: for example, if the AJB/RJB loses a CAN bus communication, certain functions are maintained. Pressing the Start/Stop switch will allow the hardware to be reset.



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Transmission Control Module

The transmission control module (TCM) provides a hardwired 'Park Position Only' signal to the JaguarDrive selector module. The signal is activated by the TCM when 'Park Position' is confirmed (parking pawl locked in place). This information has back up data via the HS CAN bus, providing TCM selector position display and / or TCM start enable. Additionally the TCM and JaguarDrive selector modules have a private LIN bus to exchange data.

Central Junction Box

The CJB has the following PATS functions:

- Medium speed CAN communication with the instrument cluster and KVM providing start authorization data exchange
- Inputs from:
  – JaguarDrive selector module: Start/Stop switch status and Park/Neutral signals
  – Driver's door latch assembly: door closed signal
- Power outputs to:
  – Start control unit (transponder operation)
  – PATS LED indicator

Instrument Cluster

The instrument cluster has the following PATS functions:

- Medium speed CAN communication with the following:
  – CJB (start authorization data exchange)
  – AJB/RJB (start authorization data exchange)
- High speed CAN communication with the following:
  – ECM (start authorization data exchange)
  – ABS (brake pressure signal)
  – JaguarDrive Selector module and TCM (gear selector position back up data)
- LIN communication with the SCU (transponder operation)
- Operation of the security LED indicator is controlled by the instrument cluster, which varies the flash rate of the LED to indicate system status of the immobilization system

Auxiliary Junction Box/Rear Junction Box

The AJB/RJB:

- Controls the power output to the fuel pump driver module (FPDM) on receipt of a start authorization signal from the instrument cluster.
- Receives a hardwired Start/Stop status signal – from the JaguarDrive selector module (X250) or Start/Stop switch (X150) – to support a hardwired reset from limp home mode

Engine Control Module

After confirmation of start authorization data exchange with the instrument cluster, the ECM controls the cranking, ignition and fuelling functions.

ABS Control Module

The ABS control module provides a brake pressure signal to the instrument cluster via the high speed CAN.

Principles of Operation

The vehicle starting sequence proceeds as follows:

- When the CJB receives a hardwired 'start button pressed' signal, a valid key request message is sent from the CJB to the KVM via the MS CAN bus.
- The KVM activates all 3 interior LF antennas to output LF signals, which activates the Jaguar SmartKey (in the vehicle).
- The activated Jaguar SmartKey transmits an RF security code signal to the RF receiver.
- The RF receiver transmits the security code signal via dedicated serial data line to the KVM.
- The KVM checks and validates the security code and communicates a 'SmartKey validated' message to the CJB via MS CAN.
- The CJB sends an immobilization deactivation request to the instrument cluster via MS CAN.
- The instrument cluster deactivates immobilization and simultaneously performs an encrypted data exchange with:
  - The ECM via HS CAN to authorize Fueling and Ignition
  - The AJB/RJB via MS CAN to activate the B+ power supply to the FPDM

Before the CJB can send a 'crank request' signal to the ECM, it requires:

- A 'brake pressure rise' signal from the ABS control module via MS CAN from the instrument cluster (which receives the HS CAN signal from the ABSCM)
- A hardwired 'Park/Neutral' signal

Once the required signals are received, the CJB outputs a hardwired 'crank request' signal to the ECM

Before the ECM can authorize 'OK to Start', it requires:

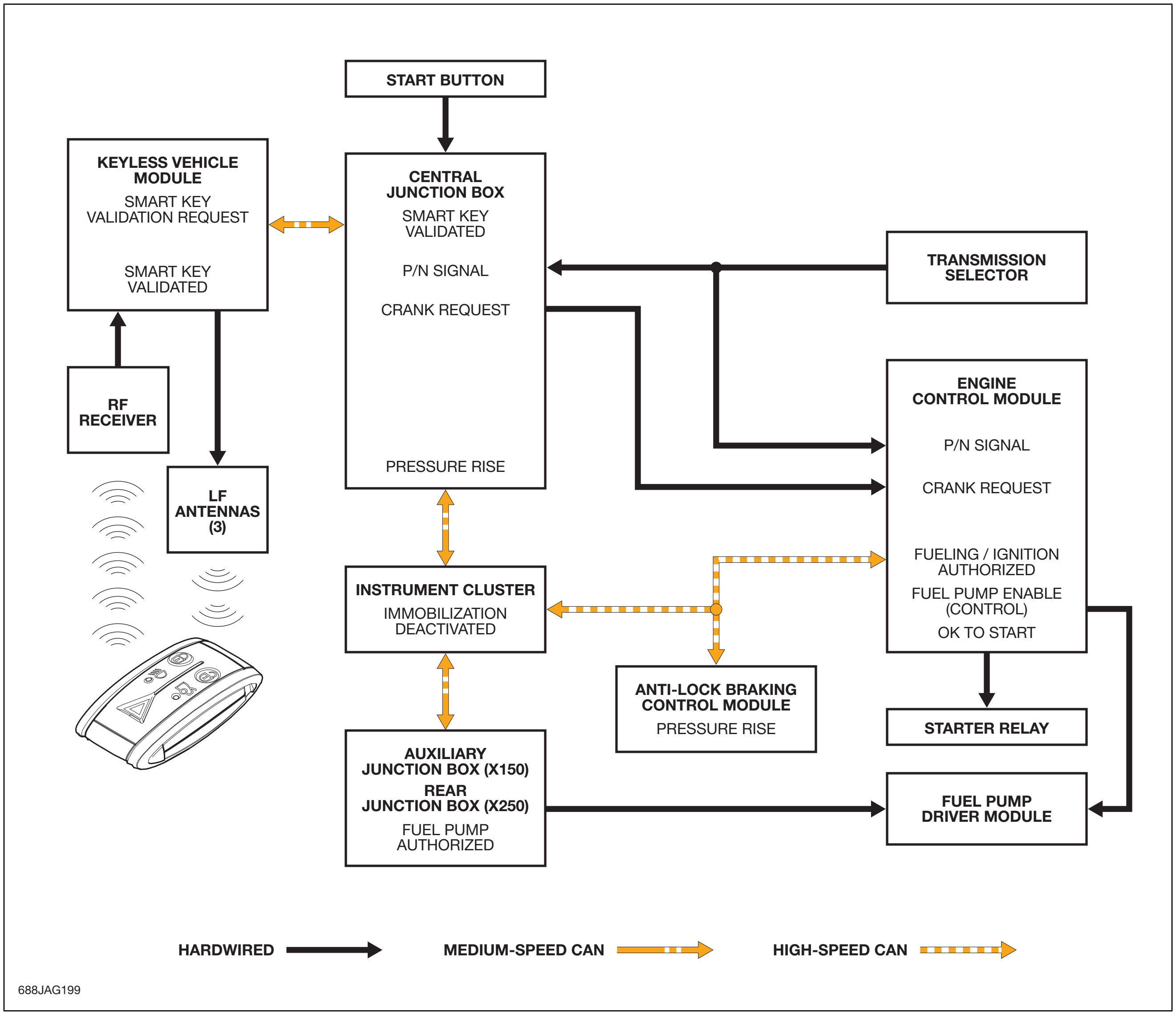
- A hardwired 'Park/Neutral' signal:
  - from the TCM (X150), or
  - from the JaguarDrive selector (X250)
- An 'Immobilization Disabled' message (encrypted data exchange with instrument cluster)

NOTE: the ECM also uses an HS CAN TCM 'Start Enable' signal as a redundancy in case the hardwired 'Park/Neutral' signal is missing.

Once the required signals are received, the ECM activates the starter relay and enables fuel pump driver.

NOTE: When the vehicle is delivered from the factory, the passive start (and entry) function is inhibited. In this condition, the vehicle can only be started by placing the Jaguar SmartKey in the start control unit. The system should be switched on during the PDI (pre-delivery inspection) using IDS.

Passive Starting Sequence



Diagnostics

Checking the operation of the PATS LED confirms the operating status of the system.

If the PATS is operating correctly, the LED will be illuminated for 3 seconds at ignition on and then extinguish. This check validates that all PATS functions were successful (including the Jaguar SmartKey key code matching and the challenge/response authorization sequence between system modules), resulting in the ECM being enabled.

The following examples are a guide to possible fault scenarios and basic checks/tests:

Ignition Fails to Operate

- Check that the Jaguar SmartKey is located within the vehicle interior, and is a valid key for the vehicle. Insert the Jaguar SmartKey into the SCU, as this is an alternative method to allow Ignition On/Engine Start.
- Check that the CAN bus is not malfunctioning (open or short circuit, for example), as this would inhibit communication between the KVM, CJB and instrument cluster.
- Check that the start button circuit(s) to the CJB are not open circuit or short circuit to battery positive.

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; the code is repeated 10 times. As a general rule a fault code of 16 or less will cause the vehicle not to crank. This indicates that a fault exists and a DTC has been recorded. IDS should be used to check for DTCs stored in the instrument cluster, CJB and ECM.
- One potential cause for the engine failing to crank could be that the Not in Park switch input to the CJB, or the P/N start switch input to the ECM, is not present.
- Check that the HS CAN bus is not malfunctioning (open or short circuit, for example), which could inhibit communication between the instrument cluster and ECM – resulting in no challenge/response authorization sequence being performed to enable the ECM. A DTC is stored in the instrument cluster, supported by the LED permanently illuminated for 60 seconds followed by fault code 24 flashing 10 times.
- Check that the engine crank request output from the CJB to the ECM is not open circuit or short circuit to ground.
- Check the starter circuit relay operation. It is important to note that, due to the smart start function, both sides of the relay coil are switched directly from the ECM.

Engine Cranks, No Start

The engine cranking confirms the ECM has passed the authorization required for mobilization from the required modules. If the authorization had failed, the ECM would not engage the starter relay.

Passive vs. Active Functionality Review

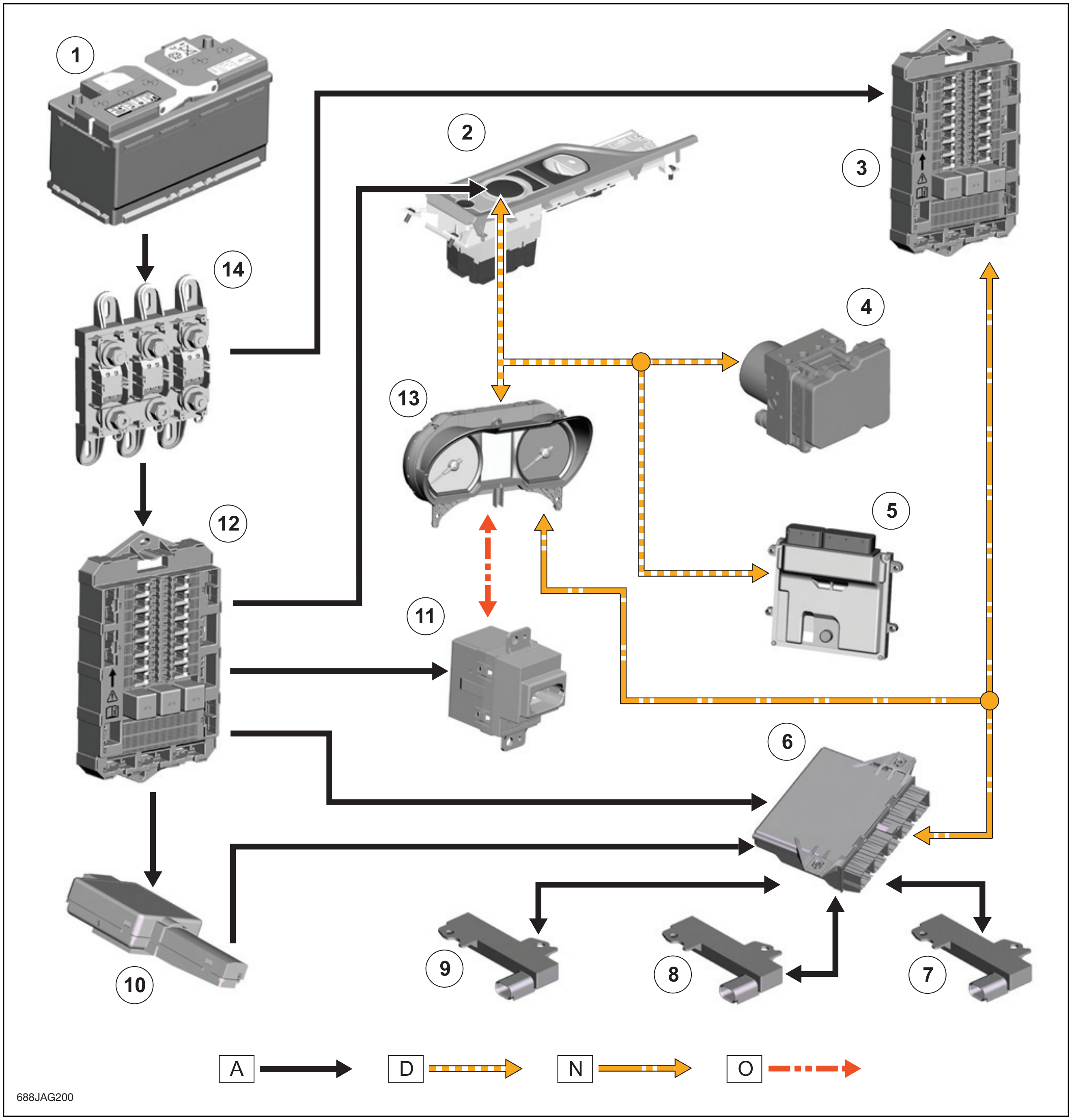
There are many functions that are associated with either 'passive' or 'active' key functions. For diagnostic purposes, it is important to understand the differences of between passive and active starting (as well as passive and active entry to the vehicle), as they are two independent systems that work together. Some components are only linked to the vehicle immobilization strategy, while other components serve as agents in more than one of these processes. The table below is an overview of these modules and their relationship to SmartKey entry, starting and immobilization functions.

Module / Component	Remote Entry	Passive Entry	Passive Start	Active Start	Immobilization
SmartKey	Y	Y	Y	Y	N*
RF Antenna	Y	Y	Y	N	N*
External LF Antennas	N	Y	N	N	N*
Internal LF Antennas	N	N	Y	N	N*
Door Handle Switch	N	Y	N	N	N
Door Ajar Switch	N	N	Y	N	N
Start Control Unit	N	N	N	Y	Y
Instrument Cluster	N	N	N	Y	Y
KVM	Y	Y	Y	N	Y
ECM	N	N	N	N	Y
CJB	Y	Y	Y	Y	Y
AJB/RJB	N	N	N	N	Y
ABS Module	N	N	Y*	Y*	N
TCM	N	N	Y*	Y*	N

N* These components are only involved with key validation, NOT vehicle immobilization.

Y* These components only provide brake pressure and gear position status to CJB via CAN bus messages to enable engine cranking independent of any security /immobilization requirements.

Anti-Theft System Control Diagram (X250 Shown; X150 similar)



A	Hardwired	3	RJB	9	Rear RF antenna
D	HS CAN bus	4	ABS control module	10	RF receiver
N	MS CAN bus	5	ECM	11	Start control module
O	LIN bus	6	KVM	12	CJB
1	Battery	7	Front RF antenna	13	Instrument cluster
2	JaguarDrive selector	8	Center RF antenna	14	BJB

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 IDS 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. Measurements that are not consistent with the expected value should always double checked to make sure 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.
en performing measurements. Using incorrect adapters or probing connectors may damage the plating on the contacts, causing corrosion and increased resistance.

Diagnosing Multiplex Problems

IDS functions as a diagnostic aid and a DVOM. Each time IDS runs a multiplex component diagnostic routine it automatically tests multiplex circuit integrity to determine if the circuit is capable of communicating a data message. IDS will most often help you to pinpoint the cause of the failure. Because IDS diagnostics are software driven, its efficiency in any diagnostic mode depends on the design of the software that it uses. Most IDS 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 IDS diagnostic function.

Multiplex Symptom 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 cause of the fault:

- 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 because of a faulty electrical system or battery.

Network Faults

Network failure may result in a customer concern. 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 circuit

Hard Reset Instructions

A 'hard reset' restores the control modules to their base conditions assuring that network communications are synchronized.

CAUTION:

⚠ **Be sure to retrieve DTCs before disconnecting the battery.**

All Vehicles except X105, X150

- Disconnect the negative cable of the battery for at least 120 seconds
- Reconnect the battery negative cable
- Perform window initialization

X105, X150 Vehicles

Due to the window drop entry feature, the following procedure should be followed to prevent door seal damage.

- 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

NOTE: If a hard reset is performed on a vehicle with a sunroof / roof opening panel and the roof is open at the time of the hard reset, the sunroof initialization procedure must be performed.

SERVICING NETWORK COMPONENTS

All networks basically consist of electronic control modules, connectors, the Data Link Connector (DLC), and data bus circuit wiring. The only repairs that can be performed are wire repair, connector repair, and module replacement.

NOTE: Always reconfigure/refresh a module's software before condemning/replacing the module – 'Software before Hardware'. Remember, the hardware physically or electrically operates mechanical devices, and the software processes information.

Network Service Tips

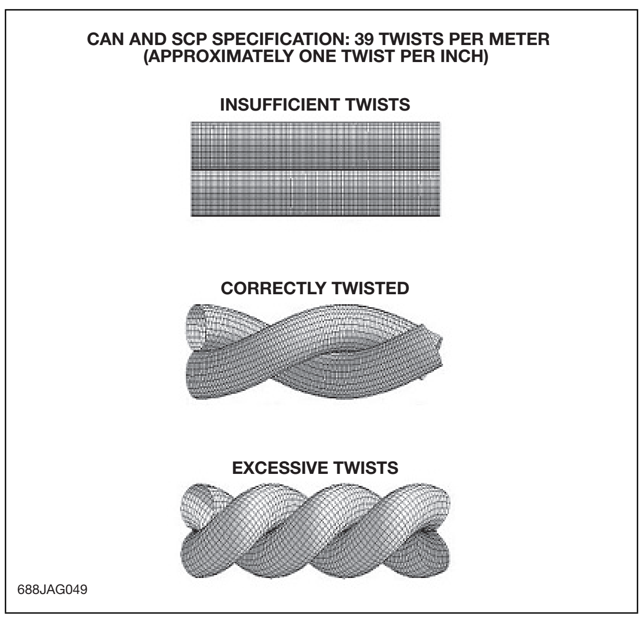
- NEVER condemn a module until ground and power circuits have been checked using a digital multimeter
- Use proper wire repair/replacement methods as specified in the Workshop Manual
- Always refer to GTR for specific information
- Use only approved replacement electrical connectors

Repairing Network Wiring (Twisted Pairs)

Network harnesses consisting of twisted pairs of wires (CAN bus, for example) can be repaired as required. When repairing a twisted pair of wires, do not unwind the existing wires any more than necessary. Before completing the repair, replicate as closely as possible the original twisting pattern on any new wiring.

The following points should be observed when repairing a network harness:

- All wire pairs must have at least one twist per inch (to resist electromagnetic interference) and must be twisted to within 10cm (4 in.) 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.
- Only make crimp wire repairs. Solder repairs are UNACCEPTABLE.
- Use correct gauge of wire
- Use only Jaguar supplied connectors when connector replacement is required. This will ensure the correct fit and help prevent excess resistance in the circuit.
- In some cases it is unavoidable that a repair to a twisted pair harness, using crimped connections, will leave an unwound length of wire. The repair length should not exceed 40mm (1.6 in).



CIRCUIT FAILURE TESTING

Intermittent Faults

Intermittent failures can be the most difficult to diagnose because the failure is not always present. 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.

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.

WARNING:

NEVER perform the 'wiggle test' when testing airbag or airbag-related circuits.

DIAGNOSTIC STRATEGY

Diagnosing problems 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 IDS 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.

CAN DIAGNOSTICS

Tracing a CAN 'Fault Chain'

Complex vehicle systems such as ABS (anti-lock braking system) or DSC (dynamic stability control) use input signals from sensors that are hardwired directly into the control module, and also from messages (signals) on the CAN bus. These same systems also transmit messages on the CAN bus to other modules (ECM or instrument cluster, for example) for use in other systems.

Many of control modules on the vehicle are therefore dependent on other control modules. This dependency may cause a 'hard' fault in one control module to shut down the functionality in a second control module. The loss of functionality in the second control module may in turn inhibit the correct operation of a third control module. This is known as a 'Fault Chain'.

The DTCs in the third control module may point only to faulty or missing CAN data in the second control module. In order to determine the root cause of the problem, however, the chain must be traced back to the first control module. The first control module should contain DTCs indicating a hard fault, or it may have shut down completely (which would be identified as a communication error when establishing communication with IDS).

Using the appropriate Electrical Guide network circuit diagrams will help in tracing the chain.

Diagnostic Procedure for CAN Faults

NOTE: IDS contains useful tools such as 'Network Integrity Tests' and 'Sorted DTC Display Tool' which may help to resolve CAN issues.

NOTE: The electrical circuits section of GTR contains Module Communications Network circuit diagrams which will help identify the control modules, connectors and wires in the vehicle's CAN bus.

NOTE: Always make a note of any DTCs and snap shot data at all stages during the diagnosis. You will need this information if you later seek help from the Technical Helpline.

Always start by identifying whether the fault is related to:

- Missing CAN data
- CAN data indicating a fault
- CAN related plausibility fault

Missing CAN Data

When a control module detects that CAN signals are not being transmitted from another control module, this is reported as 'Missing Can Data'. Signals may be identified as missing from a particular system, or a general CAN bus failure may be identified. If specific signals are missing, the DTC description identifies the missing signals and the associated system.

A general CAN bus failure can be caused by a problem with a control module, but is usually an indication of a problem with the CAN bus wiring.

Diagnosing Missing CAN Data

If a control module reports 'Missing CAN Data', it is not an indication of a fault with the reporting module. It is an indication that the module has detected that another control module has stopped sending CAN messages.

In this case the diagnosis should concentrate on tracing which control module(s) have stopped sending messages. It may be necessary to follow the CAN 'Fault Chain' to get to the root cause. It may also help to look for common patterns in the DTCs stored by the other control modules. For example, if several control modules are reporting missing CAN data from the transmission, then the TCM should be suspected as the origin of the fault.

If a control module is missing from the CAN bus it may be because:

- The control module has an internal failure or is damaged
- There is a problem with the power supply or grounds to the control module
- There is a problem with the CAN wiring to the control module

NOTE: If the vehicle's battery condition is poor, DTCs relating to missing CAN Data may be logged at ignition ON or during engine cranking. Environmental conditions that put extra strain on the battery (such as cold weather) may make these faults more likely to occur. Ignition ON/cranking faults of this type occur because low voltage causes a mismatch in communication timing between control modules when powering up and putting signals on the CAN bus. Before diagnosing missing CAN data, test the vehicle battery condition and verify that it meets manufacturer's specifications.

NOTE: Please refer to the Battery Care Manual on GTR for proper battery testing procedures and specifications.

NOTE: When supported, battery voltage can be viewed in the snapshot data of IDS.

When diagnosing missing CAN data, the diagnostic procedure should therefore be:

1. Ensure the vehicle's battery condition is good
2. Check all control modules on the vehicle CAN bus for DTCs. Identify the control module that fails to transmit data on the CAN bus

NOTE: If a control module is 'missing' from the CAN bus, it will not be possible to read DTCs from that control module, as this is done via the CAN network.

3. Check the powers and grounds on the suspect control module
4. Check the integrity of the CAN bus with regard to the suspect control module

CAN Data Indicating Fault

When a control module receives a CAN signal that is out of the specified range for that signal, the signal is either invalid or indicates a fault condition. The module will report ‘CAN data indicates a fault’. This type of data error occurs because of a specific fault with the originating system.

Diagnosing CAN Data Indicating Fault

If a module reports ‘CAN data indicates a fault’, it is not an indication of a fault with the reporting module. It is an indication that the module has detected a fault from another control module or vehicle system.

The diagnostic investigation should therefore concentrate on identifying the control module that is transmitting faulty data. It is likely that the transmitting control module will contain DTCs that indicate a fault with a sensor or other part of its dependent system. That is most likely to be the root cause of the problem. It may be necessary to trace the CAN ‘Fault Chain’ to find the originating module.

NOTE: The main principle to remember when diagnosing CAN data indicating a fault is to find the control module that is reporting a hard fault with a sensor or other part of its system. Fix the hard faults that could relate to the faulty CAN data before moving on to any further diagnosis.

CAN Related Plausibility Faults

The vehicle systems use a variety of sensors located around the vehicle. The systems rely on these sensors to carry out plausibility checks, to monitor the ‘health’ of the system.

For example, the health of a brake pedal switch may be monitored by checking the brake master cylinder pressure increase when the brake pedal switch operates.

Often plausibility checks compare a sensor signal to another signal being sent via a message on the CAN bus.

A plausibility fault is not a CAN fault, but in order to trace a plausibility fault it may be necessary to be aware that CAN issues could have contributed to the fault being raised. If a system shows a plausibility fault, it is therefore necessary to check all sensors relating to the plausibility and the CAN communication between the relevant control modules.

Diagnosing CAN Related Plausibility Faults

As sensor or vehicle system plausibility tests are sometimes carried out using CAN signals, plausibility faults can be logged due to CAN issues. When diagnosing plausibility faults, carry out the following checks:

- Ensure the vehicle battery condition is good
- Check the sensor which relates directly to the plausibility fault (the DTC will identify the sensor)
- Check particularly that the sensor is correctly and securely mounted
- If there are any DTCs relating to CAN communication between control modules, resolve these issues

Checking the Integrity of the CAN Bus

The integrity of the CAN bus should be checked if:

- DTC analysis indicates that one or more control modules is missing from the CAN bus.
- DTC analysis indicates 'CAN bus off' faults.
- It is not possible to establish diagnostic communication with any of the control modules on the vehicle (but it has been proven that the diagnostic tool is not faulty).

The following procedure should be used to check the integrity of the CAN bus:

1. If DTC analysis has identified a 'suspect control module', the diagnostic routine should start with this control module.
2. With the ignition 'OFF', unplug a control module from the CAN bus.
3. Some ABS/DSC modules are connected to the vehicle CAN bus and to a separate 'private CAN bus' that goes only to the vehicle's Yaw/lateral acceleration sensor. Check the circuit diagram to ensure you have correctly identified the vehicle CAN bus.
4. Identify the CAN pins in the unplugged control module connector. The unplugged control module connector will have either two or four CAN bus pins (depending on how it is linked into the CAN bus). If there are four pins they will be grouped as two pairs. CAN pins into a control module connector are always grouped as pairs, known as CAN high (+) and CAN low (–). Each pair of CAN pins can normally be identified by the wires to them being twisted together.
5. Measure the resistance across each pair of CAN pins. The resistance value should be either 60 (± 5) or 120 (± 5). Whether the value is 60 or 120 depends on where the control module is located in the CAN bus relative to other control modules but for this test it does not matter which value is recorded as long as it is one or the other.
6. With the connector still unplugged, but this time with ignition switched 'ON', measure the voltage between CAN high (+) and ground. The reading should be 2.7V. Now measure the voltage between CAN low (–) and ground; the reading should be 2.3V.
7. Switch the ignition 'OFF' and re-connect the connector to its control module. Select another control module on the CAN bus and repeat tests 4 and 5.

If, in the 7-step procedure above, no unexpected readings are taken, the integrity of the CAN bus is good.

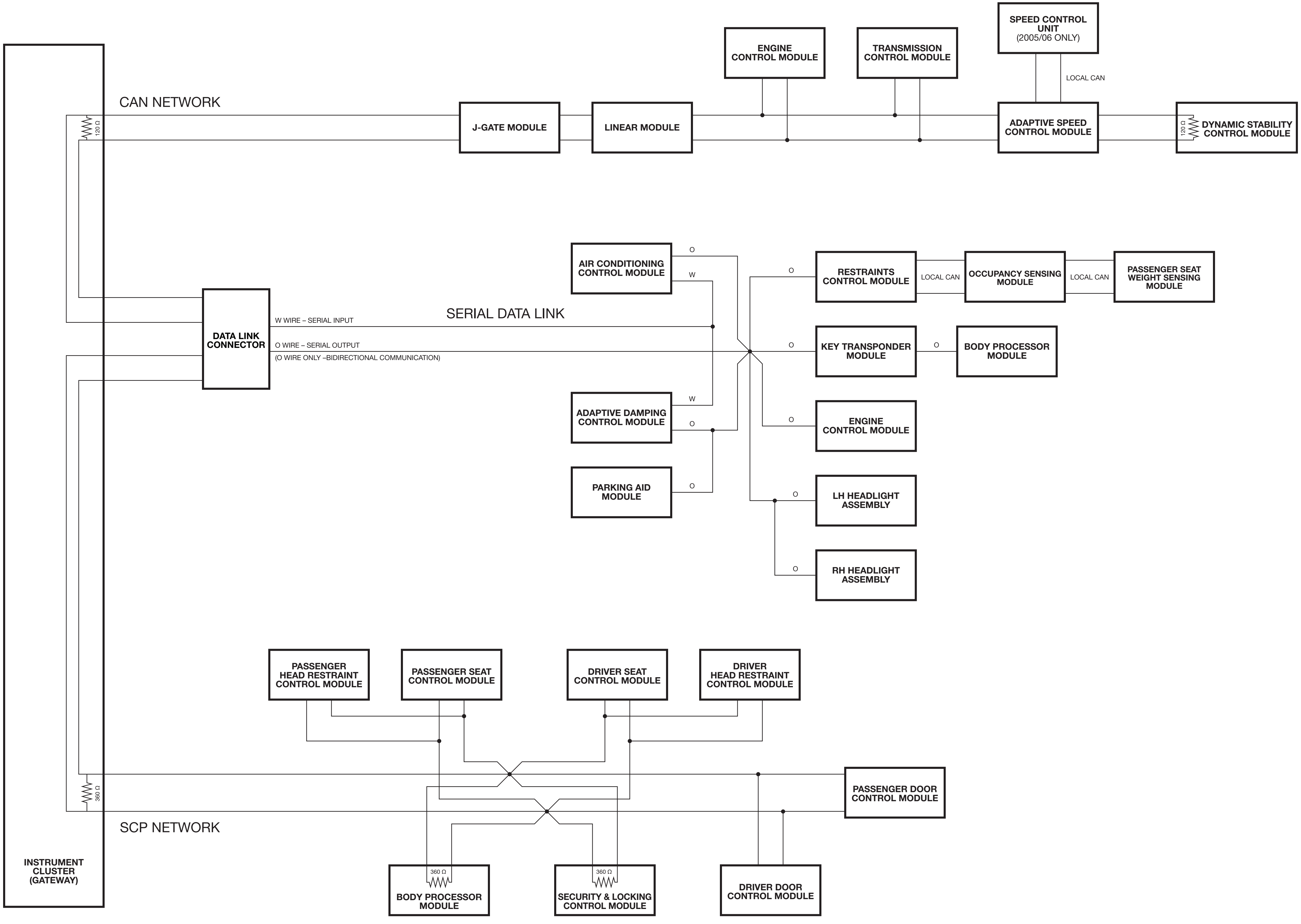
It should be noted, however, that intermittent faults can exist. If the nature of the fault is intermittent, the cable harnesses should be 'wiggled' where possible while carrying out these tests. Also, connectors to all control modules on the CAN bus should be disconnected and re-connected as this is often enough to clean up light corrosion which can cause intermittent connectivity.

If, in the 7-step procedure above, an unexpected reading is recorded, it will be necessary to test each section of the CAN bus to identify the fault location. Do this in the following way:

In order to isolate a faulty control module, carry out tests 3, 4 and 5 from each control module on the CAN bus.

In order to isolate a wiring fault it may be necessary to check the integrity of the CAN bus wiring between control module connectors, checking for open circuits and/or shorts to power or ground.

NOTE: If no definite cause was found for a CAN issue after following the procedures, but all DTCs have been cleared and have not returned after a test drive of at least10 miles, the vehicle can be returned to the customer.



XK (X103 – X105) 2003 – 2006 MY (FULL OPTION SET SHOWN)

Complete Vehicle Networks: XK (X103 – X105) 2003 – 2006 MY

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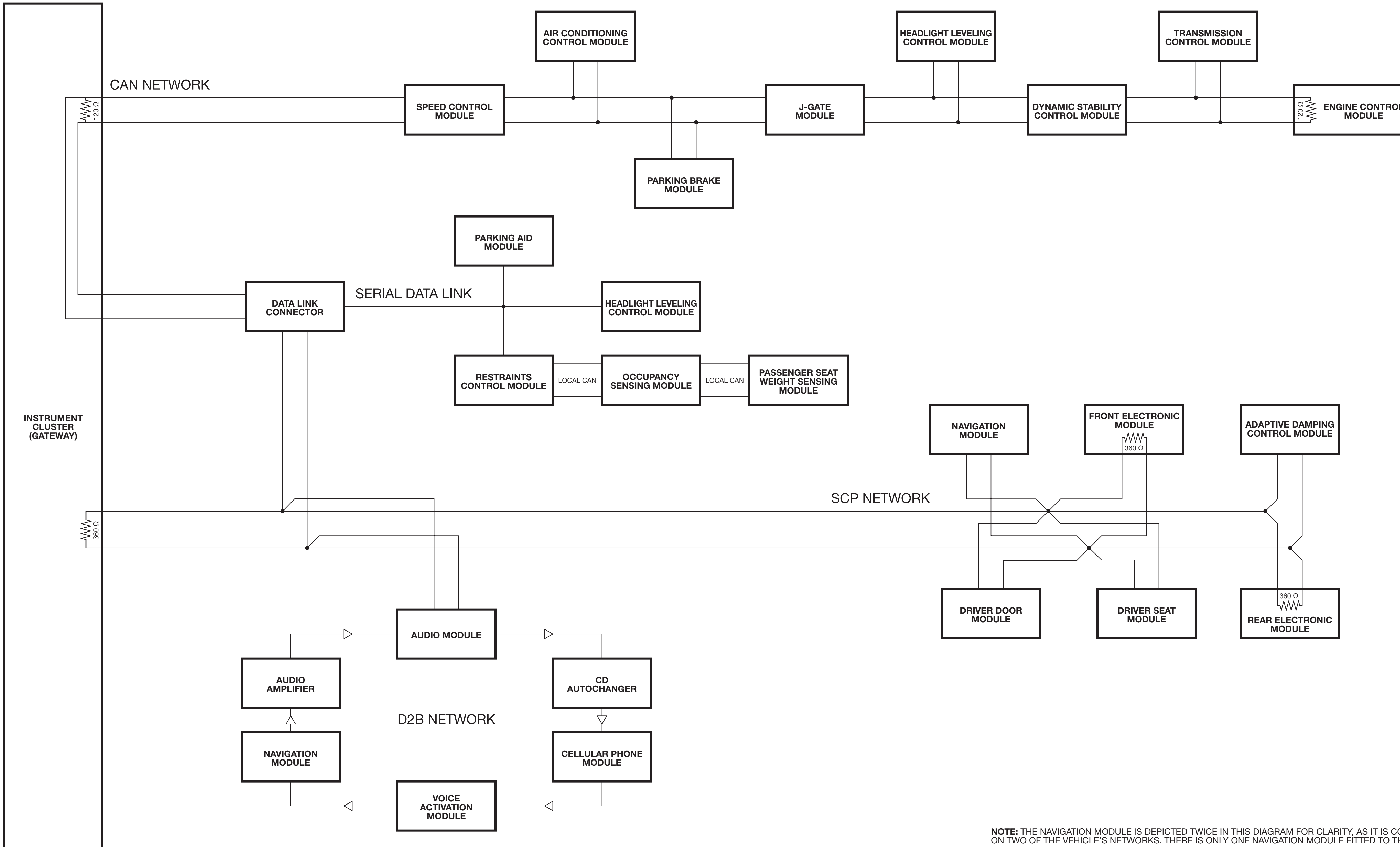

NOTE: THE NAVIGATION MODULE IS DEPICTED TWICE IN THIS DIAGRAM FOR CLARITY, AS IT IS CONNECTED ON TWO OF THE VEHICLE'S NETWORKS. THERE IS ONLY ONE NAVIGATION MODULE FITTED TO THE VEHICLE.

S-TYPE (X204 – X206) 2006 MY (FULL OPTION SET SHOWN)

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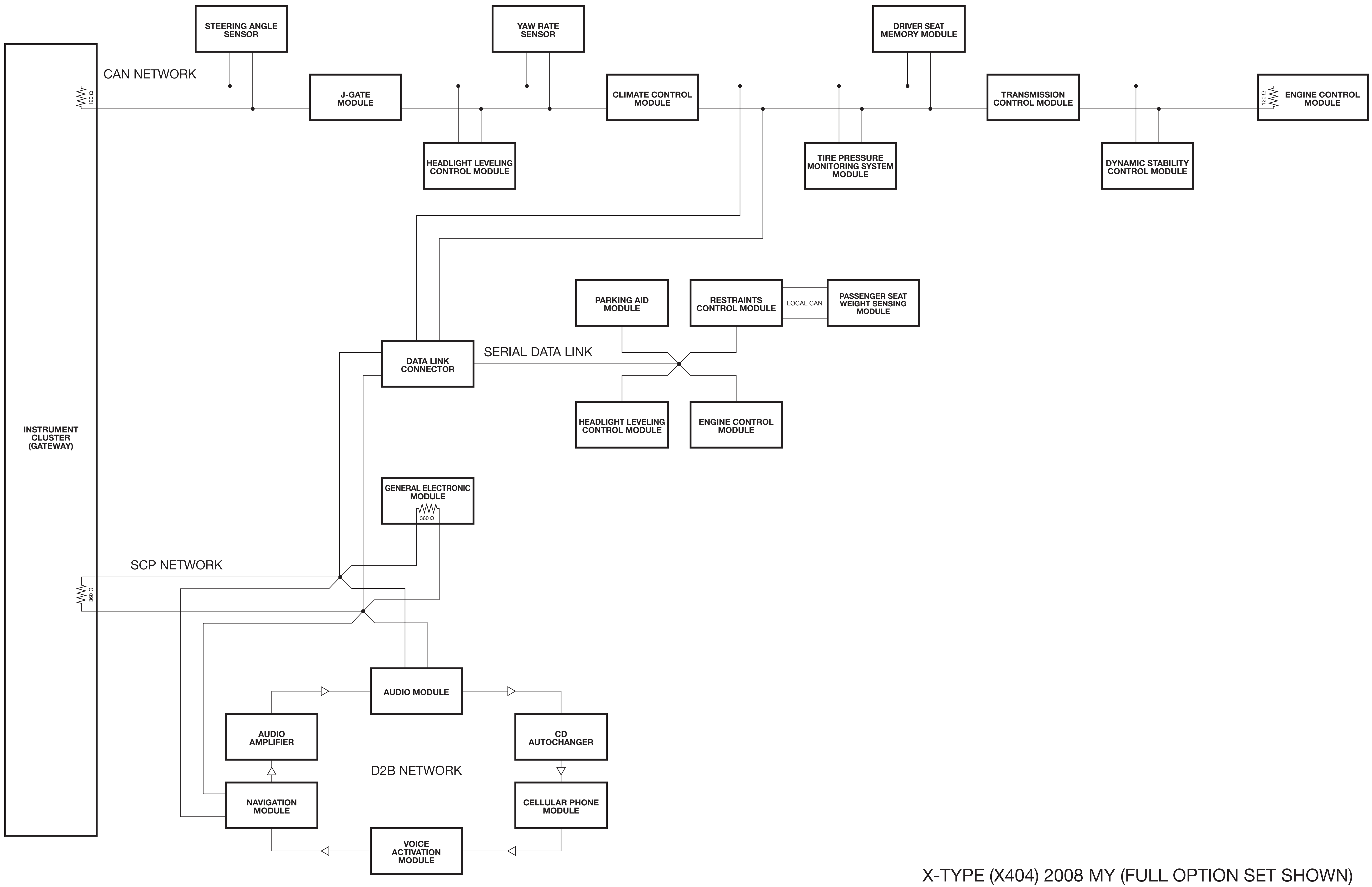

X-TYPE (X404) 2008 MY (FULL OPTION SET SHOWN)

Complete Vehicle Networks: X-TYPE (X404) 2008 MY

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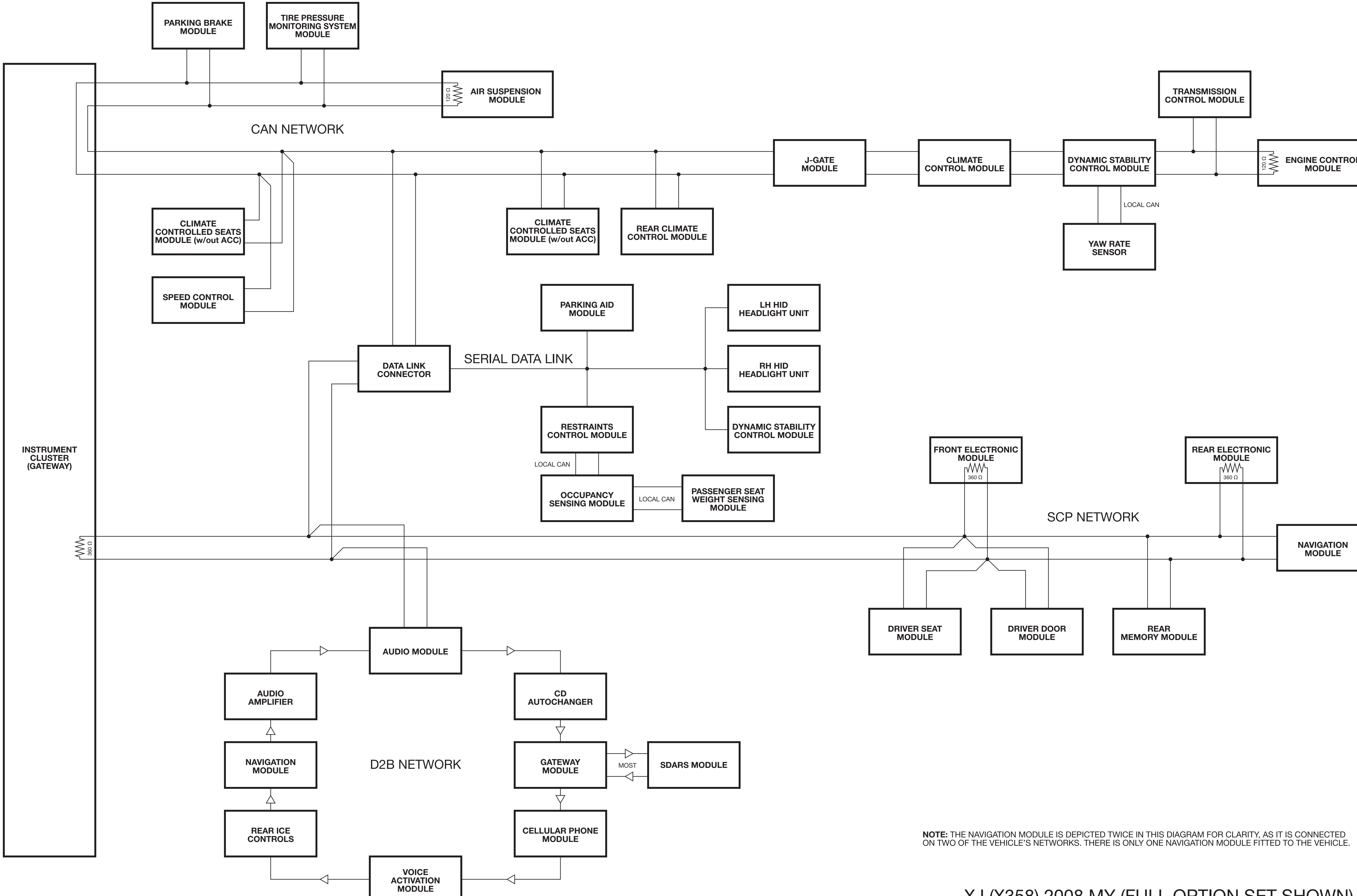

NOTE: THE NAVIGATION MODULE IS DEPICTED TWICE IN THIS DIAGRAM FOR CLARITY, AS IT IS CONNECTED ON TWO OF THE VEHICLE'S NETWORKS. THERE IS ONLY ONE NAVIGATION MODULE FITTED TO THE VEHICLE.

XJ (X358) 2008 MY (FULL OPTION SET SHOWN)

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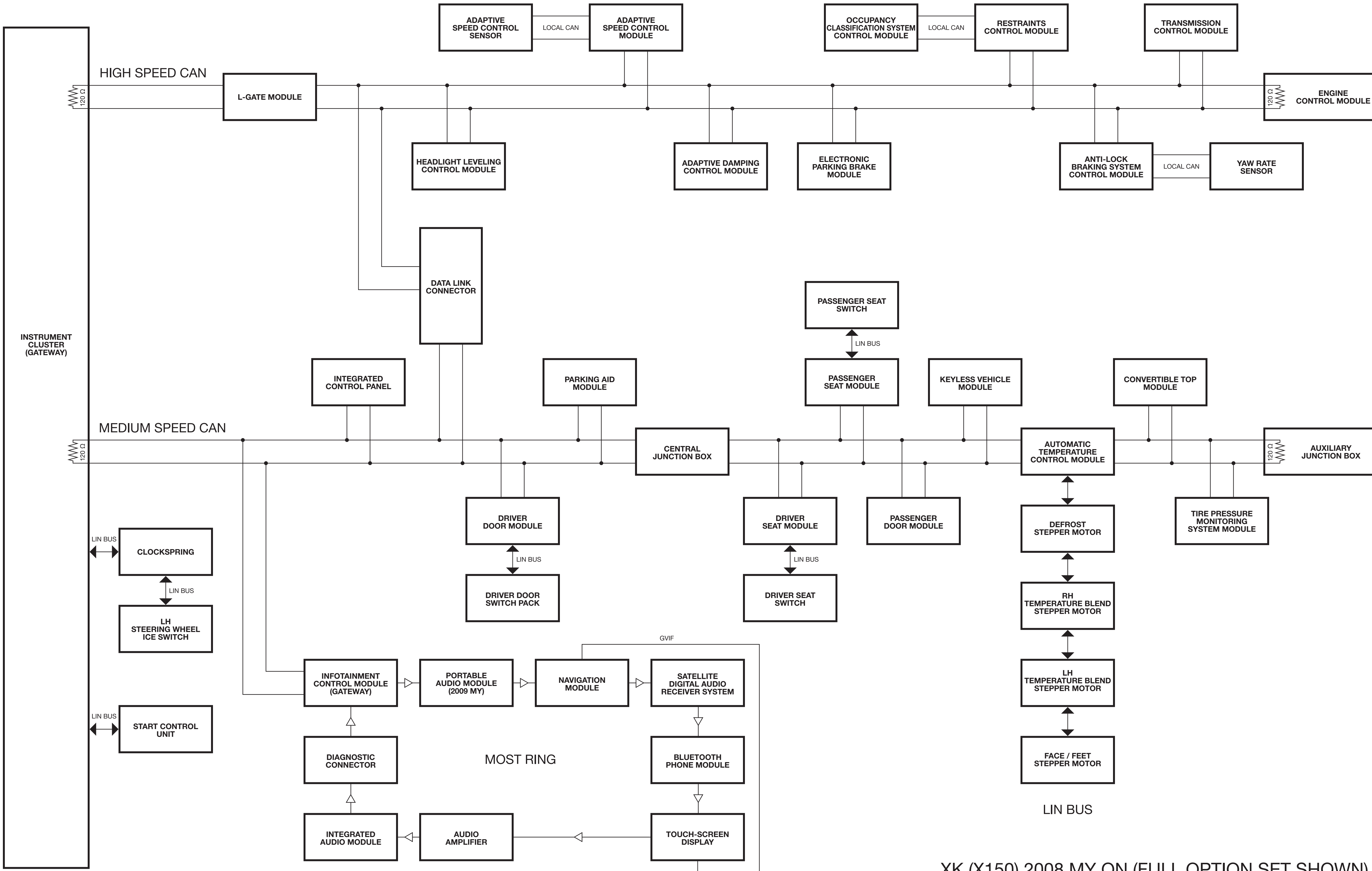
HIGH SPEED CAN
MEDIUM SPEED CAN
120 Ω
INSTRUMENT CLUSTER (GATEWAY)
L-GATE MODULE
ADAPTIVE SPEED CONTROL SENSOR
LOCAL CAN
ADAPTIVE SPEED CONTROL MODULE
OCCUPANCY CLASSIFICATION SYSTEM CONTROL MODULE
RESTRAINTS CONTROL MODULE
TRANSMISSION CONTROL MODULE
ENGINE CONTROL MODULE
HEADLIGHT LEVELING CONTROL MODULE
ADAPTIVE DAMPING CONTROL MODULE
ELECTRONIC PARKING BRAKE MODULE
ANTI-LOCK BRAKING SYSTEM CONTROL MODULE
YAW RATE SENSOR
DATA LINK CONNECTOR
PASSENGER SEAT SWITCH
LIN BUS
PASSENGER SEAT MODULE
INTEGRATED CONTROL PANEL
PARKING AID MODULE
KEYLESS VEHICLE MODULE
CONVERTIBLE TOP MODULE
CENTRAL JUNCTION BOX
AUTOMATIC TEMPERATURE CONTROL MODULE
AUXILIARY JUNCTION BOX
DRIVER DOOR MODULE
DRIVER SEAT MODULE
PASSENGER DOOR MODULE
DEFROST STEPPER MOTOR
TIRE PRESSURE MONITORING SYSTEM MODULE
CLOCKSPRING
LH STEERING WHEEL ICE SWITCH
DRIVER DOOR SWITCH PACK
DRIVER SEAT SWITCH
RH TEMPERATURE BLEND STEPPER MOTOR
LH TEMPERATURE BLEND STEPPER MOTOR
FACE / FEET STEPPER MOTOR
GVIF
INFOTAINMENT CONTROL MODULE (GATEWAY)
PORTABLE AUDIO MODULE (2009 MY)
NAVIGATION MODULE
SATELLITE DIGITAL AUDIO RECEIVER SYSTEM
START CONTROL UNIT
DIAGNOSTIC CONNECTOR
MOST RING
BLUETOOTH PHONE MODULE
INTEGRATED AUDIO MODULE
AUDIO AMPLIFIER
TOUCH-SCREEN DISPLAY
XK (X150) 2008 MY ON (FULL OPTION SET SHOWN)

Complete Vehicle Networks: XK (X150) 2008 MY Onwards

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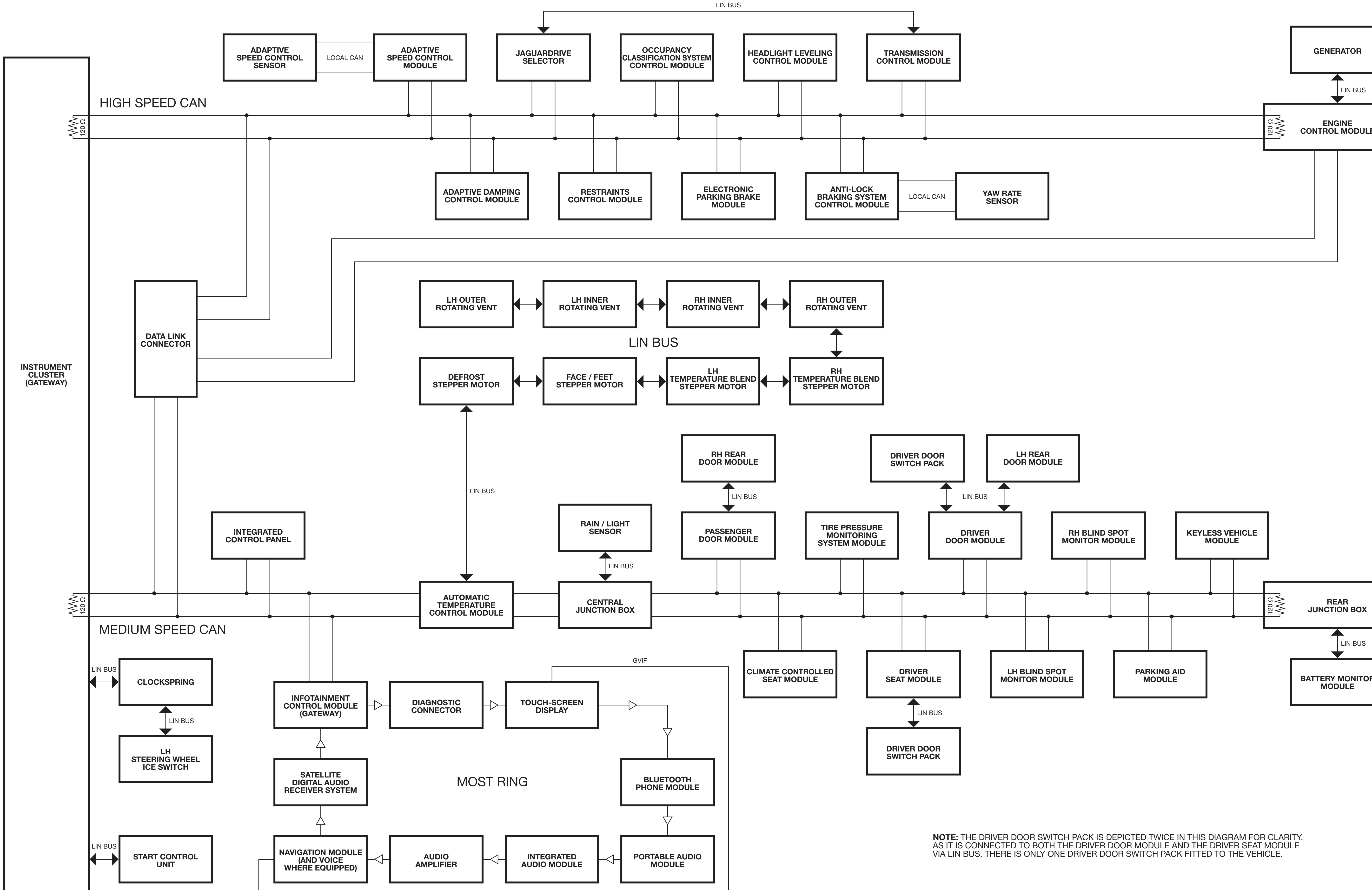

NOTE: THE DRIVER DOOR SWITCH PACK IS DEPICTED TWICE IN THIS DIAGRAM FOR CLARITY, AS IT IS CONNECTED TO BOTH THE DRIVER DOOR MODULE AND THE DRIVER SEAT MODULE VIA LIN BUS. THERE IS ONLY ONE DRIVER DOOR SWITCH PACK FITTED TO THE VEHICLE.

XF (X250) 2009 MY (FULL OPTION SET SHOWN)

Complete Vehicle Networks: XF (X250) 2009 MY

Fold page out to view diagram.