

JAGUAR CARS NORTH AMERICA



# 2003 MODEL YEAR XK SERVICE TRAINING TECHNICAL GUIDE



PUBLICATION PART No. T2003XK  
DATE OF ISSUE 09/30/2002  
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PRINTED IN THE USA

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**Jaguar Cars North America Service Training Department**

## PREFACE

The 2003 model year Jaguar XK features the most significant series of changes the model has seen since its launch in 1996. The package of changes has been developed to freshen the appeal of the vehicle and offer significant functional, convenience and dynamic benefits to the customer by introducing a wide range of additional features.

Since the launch of the XK8 in September 1996, the XK range was first enhanced in 1998 with the introduction of the supercharged XKR model, rolled out in North America during the 2000 model year. The 2001 model year XK saw further enhancements as part of a mid cycle freshening program.

The key element of the 2003 MY Program is the powertrain; the introduction of a new 4.2-liter V8 engine for Naturally Aspirated (N/A) and Supercharged (S/C) engines replacing the current 4.0-liter V8 and the introduction of the ZF 6-speed automatic transmission.

For 2003 MY there are 880 new parts versus a 2002 MY vehicle, from a total vehicle parts count of 2400.

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## GENERAL INFORMATION

### VIN

The Vehicle Identification Number (VIN) for the 2003 MY XK range begins at: **A30654**.

### General Specifications

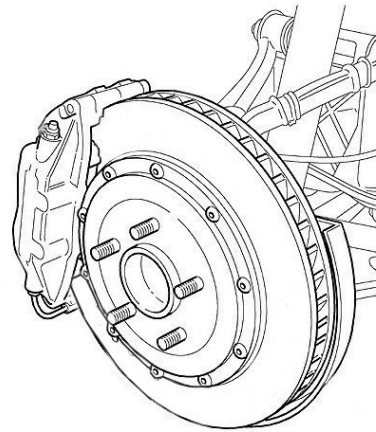
	<b>XK8</b>	<b>XKR</b>
<b>ENGINE</b>	<b>AJ34</b>	
Bore/Stroke (mm)	86/90.3	
Capacity (cc)	4196	
Max. Power (SAE)	293 @ 6000 rpm	390 @ 6100 rpm
Max. Torque (SAE)	303 @ 4100 rpm	399 @ 3500 rpm
Comp. Ratio	11:1	9.1:1
<b>TRANSMISSION</b>	<b>ZF 6HP26 6-Speed Automatic</b>	
Gear Ratios	1 <sup>st</sup> – 4.17:1 2 <sup>nd</sup> – 2.34:1 3 <sup>rd</sup> – 1.52:1 4 <sup>th</sup> – 1.14:1 5 <sup>th</sup> – 0.87:1 6 <sup>th</sup> – 0.69:1 Reverse – 3.40:1	
<b>FINAL DRIVE</b>		
Ratio	3.06:1	
<b>WEIGHTS</b>		
Curb Weight	3714 Lbs. (1685 Kg.)	3825 Lbs. (1735 Kg.)
Gross Veh. Weight	4552 Lbs. (2065 Kg.)	4638 Lbs. (2104 Kg.)

## CHASSIS

### Mechanical Brake System

XKR models use Brembo brakes with non cross-drilled rotors while cross-drilled rotors are available as an option.

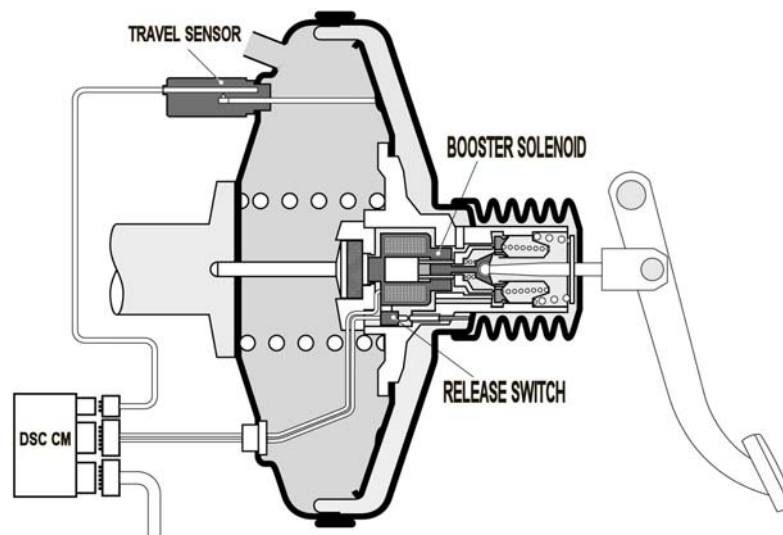
The aluminum 4-piston caliper is now painted silver, featuring the new "Jaguar R" logo. Brembo rotor sizes are 355mm front and 330mm rear. XK8 rotors are unchanged at 325mm front and 305mm rear.



J.206.308

### Panic Brake Assist (PBA)

The PBA system used on the 2003 MY XK uses the same principle of operation as the system used on the 2003 MY S-TYPE. PBA helps the driver in an emergency when it senses maximum braking power isn't being used. Often in emergency braking, the driver does not push the brake pedal hard enough. PBA senses an emergency-braking situation from the speed at which the driver pushes the brake pedal, and at that precise moment, applies maximum available braking power.



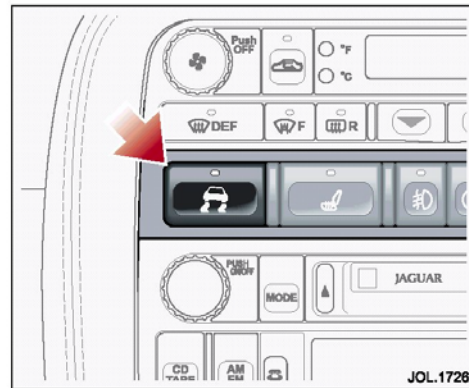
## CHASSIS (Cont.)

### Dynamic Stability Control (DSC)

The DSC system used on the 2003 MY XK uses the same principle of operation as the system used on the 2003 MY S-TYPE. The system incorporates the traction control and ABS capabilities all into a combined ABS + TC + DSC unit.

The DSC system can be switched OFF by pressing the switch on the center console switch pack. A warning light in the instrument cluster will illuminate and a message will be shown to indicate that the system has been switched OFF. When the system is switched ON, the warning light will flash when the system is active.

**NOTE:** If cruise control is engaged, it will automatically disengage when the DSC is active.



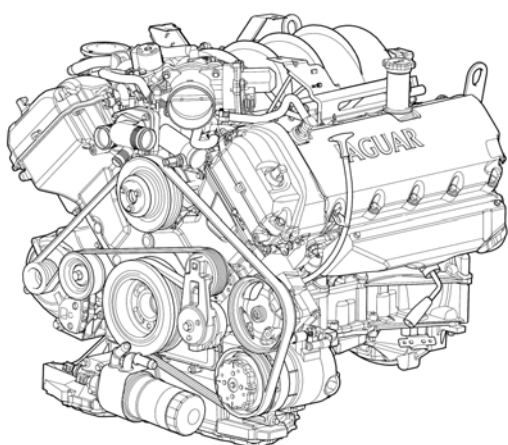
System malfunction is indicated by the message "DSC NOT AVAILABLE" in the instrument cluster message center. In addition, the warning light in the instrument cluster will also illuminate.

**NOTE:** For more information on the system operation of the PBA or DSC systems, refer to the 2003 MY S-TYPE Technical Guide.

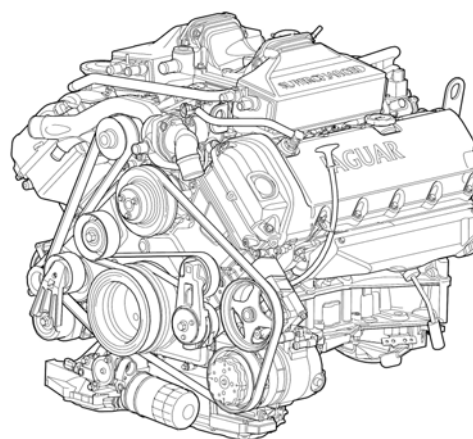
## ENGINES

The XK AJ-V8 4.2-liter (AJ34) engine is a mid-cycle upgrade of Jaguar's outstanding 4.0-liter V8 engine that has been up-rated and improved to provide better performance, economy and refinement. The AJ34 designation on the 4.2-liter engine is due to minor changes such as intake and throttle position and a new oil sump.

Power and torque levels of the 4.2 V8 engine are increased over the 4.0 V8. Power of the naturally aspirated engine increases from 290 to 293 bhp (SAE) and the supercharged engine increases from 370 to 390 bhp (SAE).



**AJ34 N/A ENGINE**

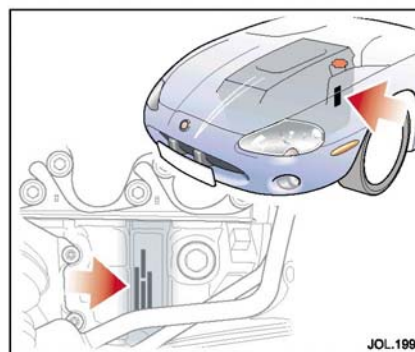


**AJ34 S/C ENGINE**

Mechanical refinement of the new 4.2-liter engine has been improved further by redesigning both the cylinder block and bedplate to increase structural stiffness and to further reduce engine generated noise and vibration.

### Engine number

The character stampings are on the left-hand side of the engine on the "B" bank oil drain channel.



**NOTE: For more information on the 4.2-liter engine, refer to the 2003 MY S-TYPE Technical Guide.**



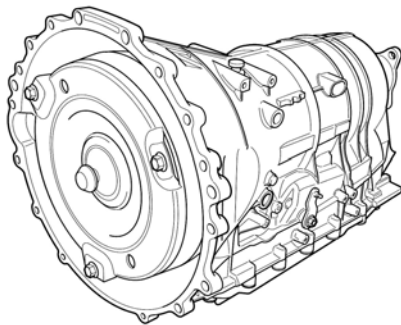
## AUTOMATIC TRANSMISSION

When compared to current production 5-speed automatic transmission, the new 6-speed ZF 6HP26 automatic transmission provides: higher torque capacity, reduced length, reduced weight and improved vehicle performance.

The Mechatronic™ module is the combination of the hydraulic shift unit with transmission control module (TCM) and is integrated in the transmission housing. This design allows more accurate control of signals and pressures resulting in more precise gearshifts. A further advantage is improved reliability due to the reduction in the harnessing and connectors between the transmission and its controller.

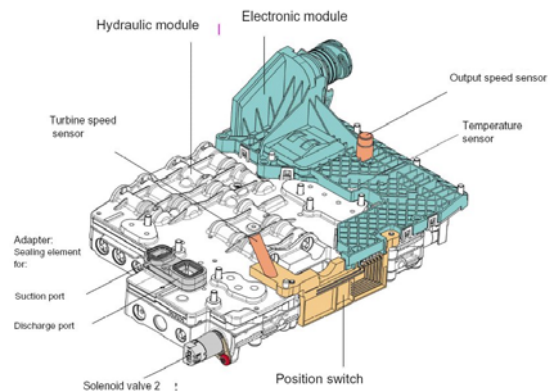
The electronic transmission control system is constantly fed with data about transmission and vehicle operating conditions. As a result, the electronic system provides drive strategies that perfectly match special operating conditions such as cruise control.

Considerable engineering effort has been undertaken in tuning the 4.2-liter engines and new 6-speed transmission to suit the driving characteristics of the XK.



D.307.0038

**6HP26 TRANSMISSION**



**VALVE BODY TCM ASSEMBLY**

### Transmission Number

The number is located on the automatic transmission casing adjacent to the selector level.

**NOTE: For more information on the ZF 6HP26 transmission, refer to the 2003 MY S-TYPE Technical Guide.**

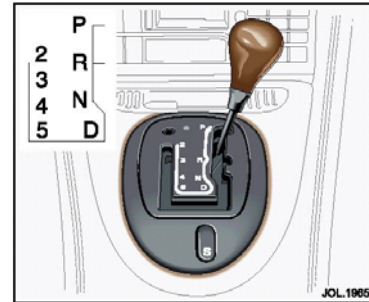
## AUTOMATIC TRANSMISSION (Cont.)

### J-Gate

The J-Gate comprising the linear switch and illumination module as a sub-assembled component is a fully transmitting and receiving node on the 2003 MY XK.

The dual linear switch provides electronic control for the ZF 6HP26 six-speed automatic transmission in the manual selection position 5,4,3 and 2.

The switch has no mechanical link to the transmission from the manual side of the J-Gate. All interface on the manual side is by electronic code generated within the linear switch and then transmitted via the CAN link.



The switch also provides an output signal NEUTRAL, when the gear position neutral is selected. It monitors the mode switch status and provides an output to switch the mode switch status LED in accordance with the mode switch operation strategy.

Gear position selected is indicated by illuminating the corresponding graphic on the illumination module, controlled via a CAN message on the CAN BUS. The illumination of the gear position is sequential, illuminating individually each position. There is no visible lag between the lever and state illumination while moving between all positions on the J-Gate.

Each position is illuminated by one red LED - 50mA maximum. Dimming is not applied to state illumination.

NOTE: only one of these LED's is illuminated at any one time. Gear positions P, R, N and D are illuminated via a CAN message transmitted by the TCM however the code for these positions is generated by the gear position switch located within the transmission. When the gear lever is moved to the manual side, gear positions 5, 4, 3, 2 as selected are illuminated via a CAN message, but the code for this gear positions is generated by the dual linear switch fitted to the J-Gate assembly.

## ENGINE MANAGEMENT

There are substantial changes to the engine management system to support the installation of the 4.2 liter engine which include the following:

- A new Engine Control Module (ECM) approximately 25% smaller and uses new fixing within the cool box.
- A new throttle cable and linkage along with a new throttle body (similar to 2003 MY S-TYPE AJ33 engine) with modifications to the intake elbow to suit the 4.2L application.
- New injectors (similar to 2003 MY S-TYPE AJ33 engine).
- New variable inlet valve camshaft (similar to 2003 MY S-TYPE AJ33 engine).
- The air conditioning control module (ACCM) remains the same however, is now linked to the CAN bus using the instrument cluster as the gateway between the engine management system and the air conditioning control module.
- New pedal position sensor.
- New fuel pump (only one used on S/C models).
- New air cleaner housing assembly with auxiliary air control flap (S/C models only).
- Introduction of EGR valve.

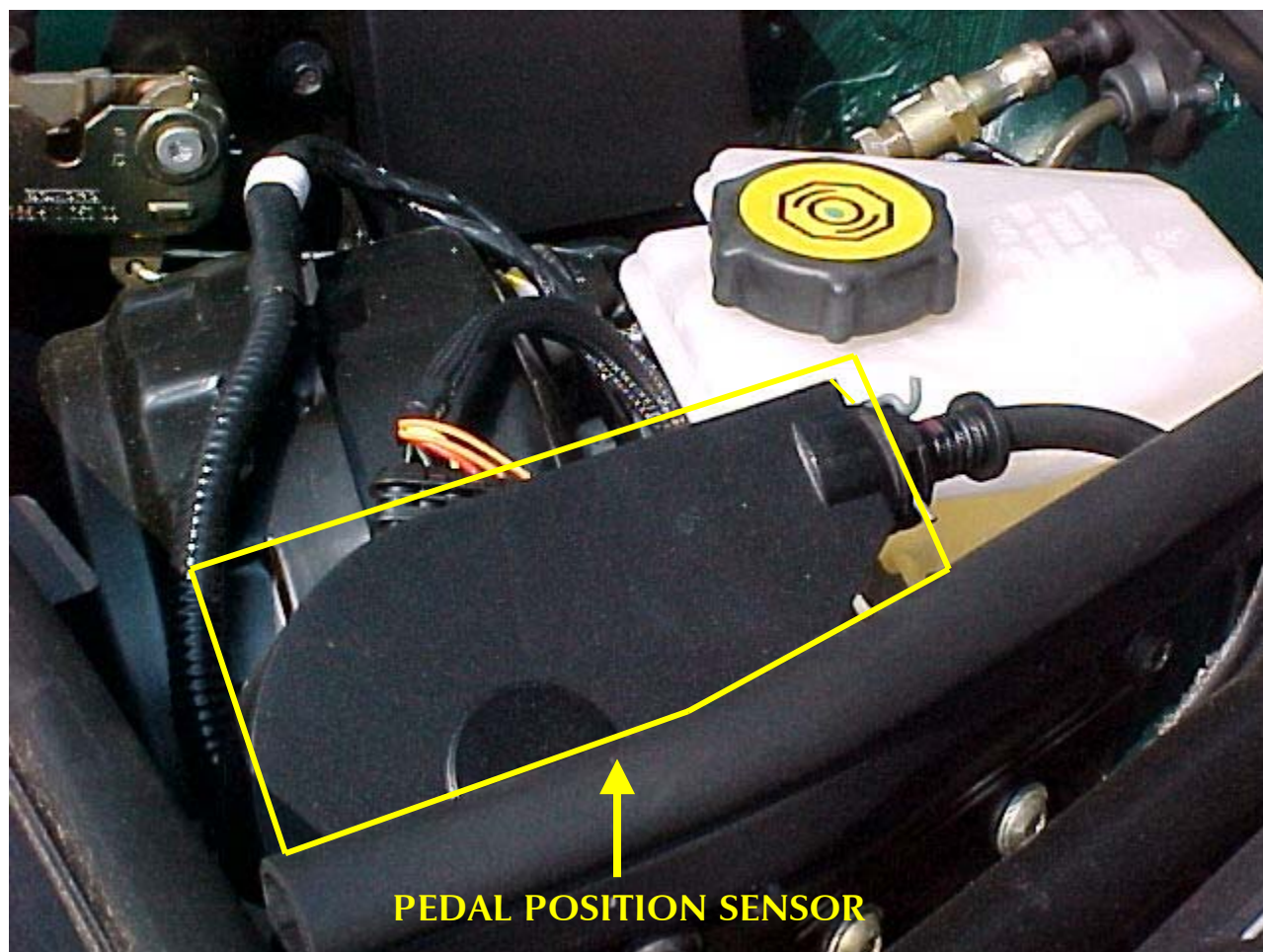
## ENGINE MANAGEMENT (Cont.)

### Pedal Position Sensor

The 2003 MY XK now uses a different type of pedal position sensor. Previous XK models used a pedal position sensor and throttle position sensor assembly located in the throttle body.

The XK now uses a pedal position sensor located next to the brake booster/master cylinder (see picture below). This arrangement has the accelerator pedal connected to a cable that feeds the position of the pedal to the pedal position sensors 1 & 2.

The throttle position sensors and throttle motors remain in the throttle body assembly.



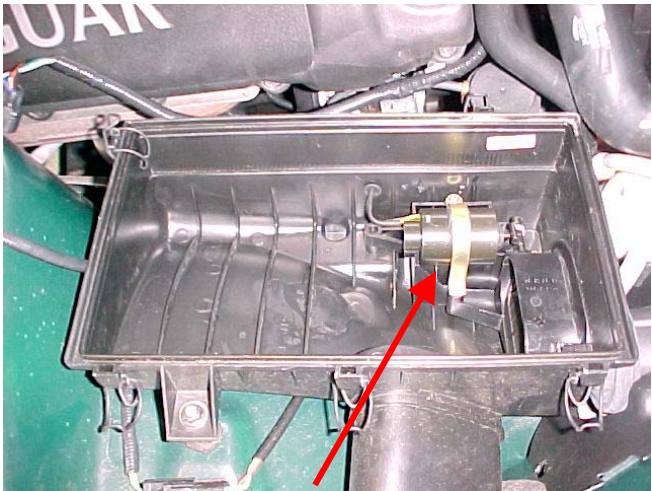


## ENGINE MANAGEMENT (Cont.)

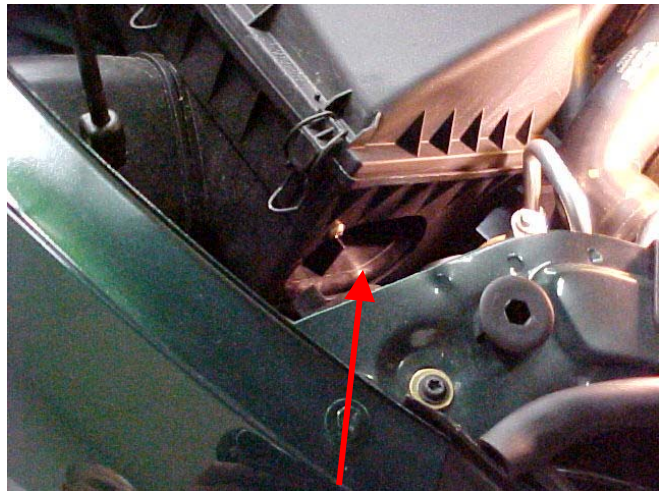
### Auxiliary Air Control Flap

The auxiliary air control flap is a component mounted in the air cleaner housing and is only used on supercharged (S/C) applications. The operation is the same as on the 2003 MY S-TYPE "R" and its primary function is to open a flap (controlled by a solenoid) in the air cleaner housing that allows more air to be inducted and thus more power at high engine speeds.

The solenoid receives a constant 12 volts via fuse F14 (10 A), and is grounded as needed by the ECM. The ECM provides a PWM signal to control the operation of the solenoid.



AIR BOX SOLENOID



HIGH SPEED AIR INLET

### EGR

The 4.2-liter engine is fitted with an EGR valve. The valve contains a 4-pole stepper motor driven by the ECM through a maximum of 60 steps.

## ENGINE MANAGEMENT (Cont.)

### Fuel Pump

To support the installation of the 4.2-liter engines and continuing the drive for fuel consumption benefits, a new fuel system including fuel tank, fuel pump, pipes, breather pipes has been installed.

The XK now benefits from the use of the return-less fuel delivery system very similar to the X-Type and S-TYPE models.

One major change on supercharged (S/C) variants is the use of only one fuel pump instead of the usual two as used on all previous S/C models (XJR, XKR and S-TYPE R).

The fuel pump uses the same principle of operation as the on the X-TYPE where the ECM monitors differential pressure across the fuel injectors and the injector pulse width and duration to accurately calculate the fuel quantity being delivered to the cylinders. It uses this to demand a specific fuel flow rate, which it communicates to a fuel pump driver module located in the right hand side rear wheel arch.

The ECM use a frequency of 150 Hz (PWM) signal during average conditions, varying its duty cycle between 4 and 50% to control fuel delivery rate or turning it to 75% to turn off the pump.



## **IMMOBILIZER SYSTEM**

The immobilizer system on the 2003 MY XK has been extensively modified. The KTM system continues to be used but the system also shares some system operation and architecture with the Passive Anti-Theft System (PATS) used on the X-Type and S-TYPE (2003 MY) models.

The immobilizer function on the 2003 MY XK 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.

### **System Functionality**

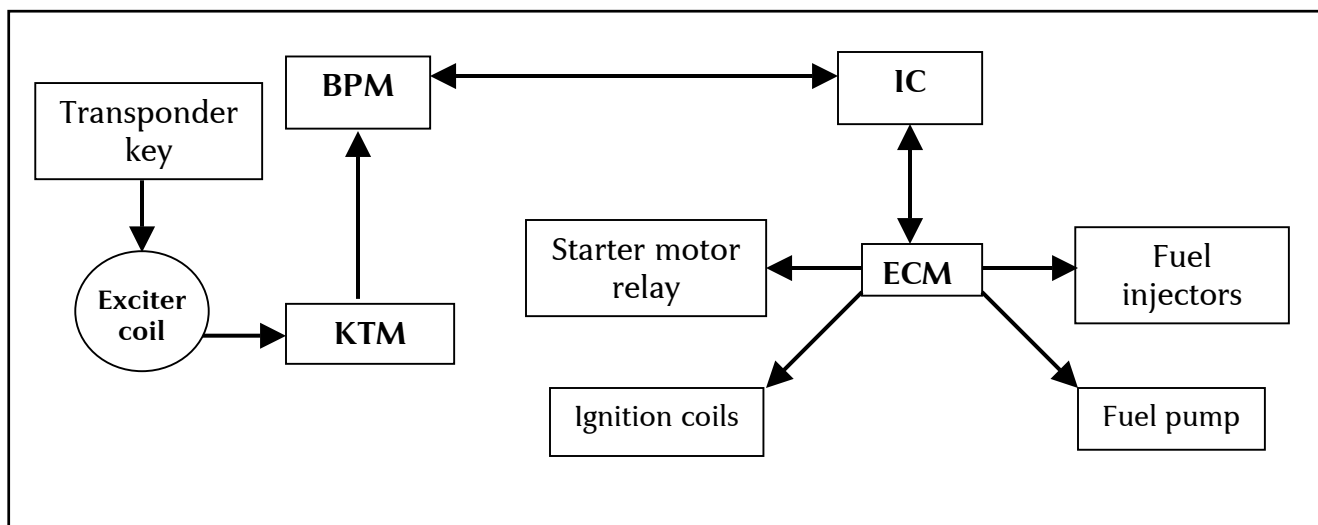
The immobiliser system prevents an unauthorised attempt to start the engine. The Key Transponder Module (KTM) transmits a valid key status only after an authentic data communication has been performed between the KTM and the transponder key.

When the key is turned to the Aux ignition position, the KTM energises the coil, which in turn starts a data transfer with the transponder key. If the code received matches a code stored in the KTM EEPROM, the KTM will perform a challenge / response routine with the key to determine its authenticity. Once the KTM has authenticated the key code received, it will send a "Key Valid" message to the BPM via the dedicated ISO Data link. If the key code does not match one stored in the KTM memory a "Key Invalid" message will be sent to the BPM.

The BPM will transmit the SCP – key valid message containing a unique 3 byte number to the instrument cluster, the cluster upon receipt of this message will compare the data received against the unique number stored in its memory. If the comparison matches the instrument cluster will set a flag to confirm valid key received. If the comparison does not match the instrument cluster will set this flag to Invalid.

If the key is turned to the ignition Run position, the instrument cluster will start the CAN data exchange and start transmitting the idle status. If the key status is valid, and the subsequent challenge / response is verified by the ECM, the ECM will allow the engine to start. Otherwise, starting of the engine is disabled. The ECM controls the following outputs: starter relay, fuel injectors, ignition coils and fuel pump.

## IMMOBILIZER SYSTEM (Cont.)



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 (Cont.)

### System Diagnostics

#### Engine Fails To Crank

- The most regular occurrence for failing to crank is due to the Park & Neutral start switches, that is, gearshift not in Park or Neutral. The starter relay configuration is as follows: low side of relay coil - switched directly from ECM (if conditions correct) high side of relay coil - direct from transmission P/N position.
- Other likely causes maybe that the CAN / SCP network is malfunctioning, i.e., the CAN circuit is open/short. This would mean that the IC/ECM or IC/BPM would be unable to communicate resulting in no authentication being performed to enable the ECM.
- Transponder key may not be programmed, or the KTM has not been taken out of build mode etc.

#### Engine Cranks but will not Start

- If the Engine is cranking it means that the ECM is enabled with respect to the immobilizer function. If the immobilizer had failed validation the ECM would not engage the starter. This could be confirmed by reading DTC from the IC and ECM.
- In this case, the fuel pump circuit should be verified. A fuel pump module, which is controlled by the ECM, supplies the fuel pump.
- In all cases of suspected immobilizer non-start issues, the most logical failure modes should be eliminated first.
- Check all relevant supplies and grounds to the KTM, BPM, IC and ECM, check that the starter relay has a permanent 12V supply, check that the relay has a 12V supply and ground across the coil while the ignition is in the crank position.

## IMMOBILIZER SYSTEM (Cont.)

### Instrument Cluster Related Concerns

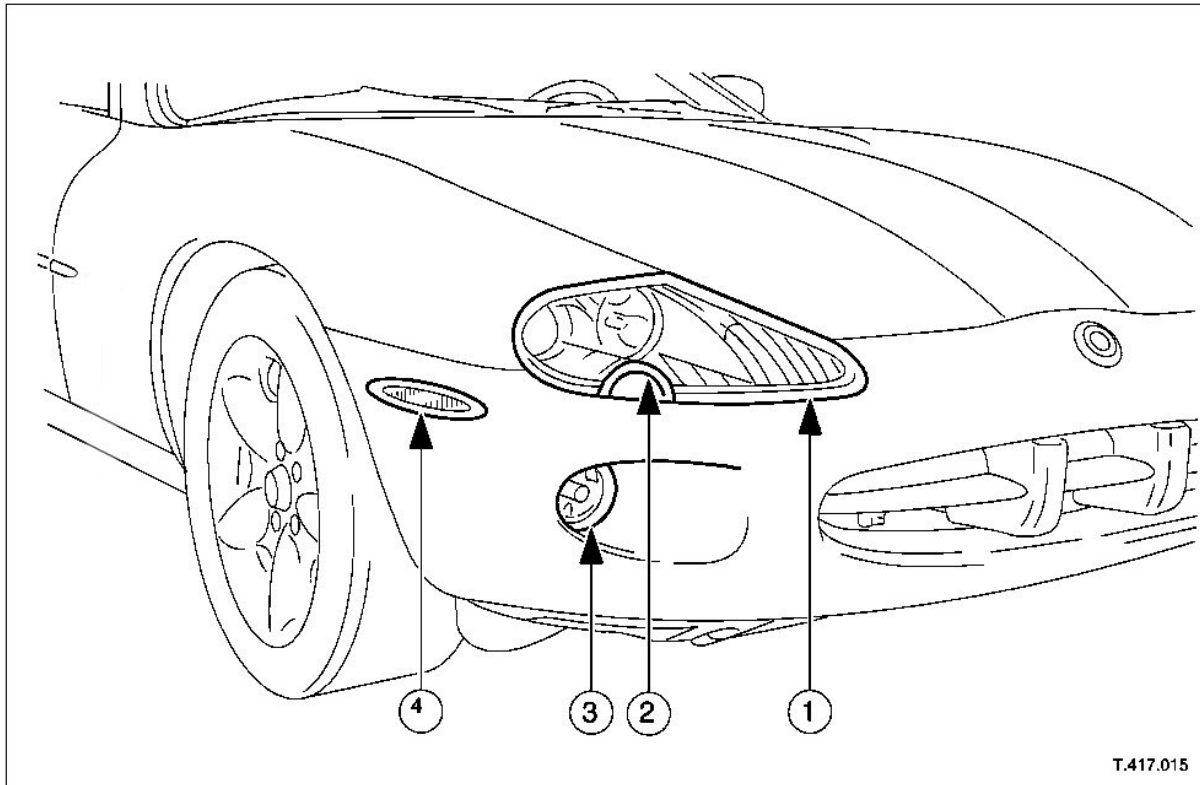
Mode of Operation / Fault	Ign Sw Position	DTC	LED Fault Code	Cause
Missing Key Status	Run / Start	U1147	N/A	The IC has not received the SCP key status msg. The IC will wait 1000mS after ACC ignition position prior to logging this DTC
Code does not match	Run / Start	U1003	N/A	Contained with-in the SCP - key status message is a unique number, the IC compares this number received with its own internal number – if they do not match the IC will log this DTC.
CAN – Challenge Response Error	Run / Start	U2510	N/A	The result of the challenge between the ECM and the IC has failed. This DTC is set after receiving the ECM status.
CAN –IC receives unexpected data from ECM	Run / Start	U2511	N/A	After sending the CAN valid key status, the IC expects the ECM to reflect Enabled. If the IC receives Disabled this DTC is logged.
CAN – Sequence Time Out	Run / Start	U1900	N/A	During the CAN challenge exchange the IC will initiate timers, if any of these timers expire this DTC will be logged.

### Key Transponder Module Related Concerns

Mode of Operation / Fault	Ign Sw Position	LED Fault Code	Cause
Transponder Not Programmed	ACC	N/A	The present transponder key / code cycled in the ignition does not match one that is stored in the KTM.
Exciter Coil	ACC		The exciter coil is O/C or S/C
Transponder Learn Mode	ACC		The attempted key learn has failed due to BPM being armed.

## HIGH INTENSITY DISCHARGE (HID) HEADLIGHTS

HID headlights (also known as Xenon headlights) provide a greater intensity of light and the light projected is whiter in appearance. HID's feature automatic headlight leveling (dipped beam only) and power wash. The leveling of the lights during acceleration, deceleration and terrain variation is fully automatic. An additional benefit of HID's (Xenon) headlights over halogen is the bulb has a greater service life.



- |                      |                     |
|----------------------|---------------------|
| 1. HEADLAMP ASSEMBLY | 2. POWER WASH JET   |
| 3. FOG LAMP          | 4. SIDE MARKER LAMP |

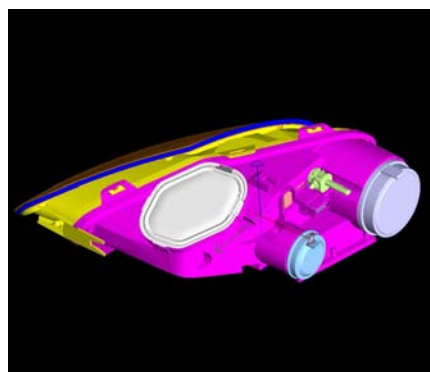
A new feature added to the 2003 MY XK is the "LIGHTS ARE OFF" message on the instrument cluster message center. When this message appears, it means that if autolamps are fitted on the vehicle and the exterior light switch is off, this message informs the driver that the exterior ambient light is low enough for the exterior lamps to be on if autolamps were active.

**NOTE: This feature is available on vehicles fitted with either HID or conventional halogen light systems.**

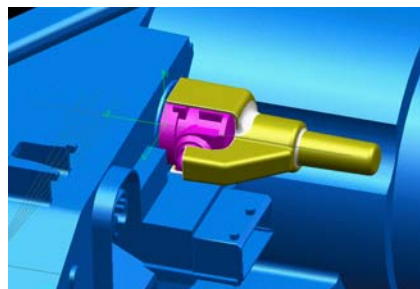
## HIGH INTENSITY DISCHARGE (HID) HEADLIGHTS (Cont.)

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

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



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



## HID HEADLIGHT LEVELING

The leveling system on the 2003 MY XK uses the same headlamp leveling principles as the systems used on the X-TYPE and S-TYPE (2003 MY) models. Nevertheless, there are some differences, which make the system used on the XK unique.

- On the XK system a leveling control module is used on each headlamp, integrated into the headlamp assembly itself. This control module also contains the burner (ballast) for the Xenon lights.
- On the X-TYPE and S-TYPE (2003 MY) there is a single leveling control module located by the A-pillar. The ballasts are separate and contained within each of the headlamps.
- The X-TYPE and S-TYPE systems are more advanced, receiving brake pedal and speed input on CAN. The XK System does not require these inputs.

The headlamp leveling system comprises the following:

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

The sensors send a PWM signal to the headlamps and they react according to that input. When the ignition switch is turned to the ON position, the lamps go through an initialization cycle, which consists of the lamps moving to the most downward position and then moving to the driving position. If any faults are detected the lamps will retreat into a "home" position which is the most downward position.

If the front sensor goes faulty/disconnected the system may operate in a de-rated mode. While failure of the rear sensor makes the system go into a faulty/disconnected mode and the system does go to the "home" position.

## HID HEADLIGHT LEVELING (Cont.)

### Headlamp Leveling System Diagnostic Trouble Codes

DTC	Fault Description	Possible Causes
B1318	Battery voltage out of range – low	Charging system low voltage fault Headlamp leveling (LH or RH) ignition power supply circuit: high resistance
B1342	Control module failure	HLCM (LH or RH) failure
B1470	Lamp (dip beam) failure	HLCM to dip beam (HID lamp) circuit fault Dip beam (HID lamp) failure
B2207	HLCM internal error	HLCM (LH or RH) failure
B2477	CM configuration failure	Reconfigure using WDS
B2609	LH control module to stepper motor drive circuit fault	LH headlamp stepper motor and actuator failure
B2612	RH control module to stepper motor drive circuit fault	RH headlamp stepper motor and actuator failure
B2618	Front axle ride height sensor signal fault	Front axle ride height sensor signal circuit: open circuit, short circuit, high resistance Front axle ride height sensor failure
B2621	Rear axle ride height sensor signal fault	Rear axle ride height sensor signal circuit: open circuit, short circuit, high resistance Rear axle ride height sensor failure
B2626	Auto leveling not calibrated	Calibrate control module auto leveling using WDS
C1756	Front axle ride height sensor circuit fault	Front axle ride height sensor circuit: open circuit, short circuit to ground, short circuit to B+ voltage, high resistance Front axle ride height sensor power supply circuit: open circuit, short circuit to ground Front axle ride height sensor ground circuit fault Front axle ride height sensor failure
C1768	Rear axle ride height sensor circuit fault	Rear axle ride height sensor circuit: open circuit, short circuit to ground, short circuit to B+ voltage, high resistance Rear axle ride height sensor power supply circuit: open circuit, short circuit to ground Rear axle ride height sensor ground circuit fault Rear axle ride height sensor failure

## AUTO HEADLIGHTS WITH WIPERS ON

If the wipers are switched ON via any of the modes, i.e., AUTO, slow or fast, after a delay of 20 seconds then the exterior lights will be switched on. The AUTO headlights mode needs to be selected for this to happen. The exterior headlights will switch off 2 minutes after the wipers are switched off, or will go off straight away if auto lights mode is deselected or the ignition is switched off.

## INTERIOR REAR VIEW MIRROR

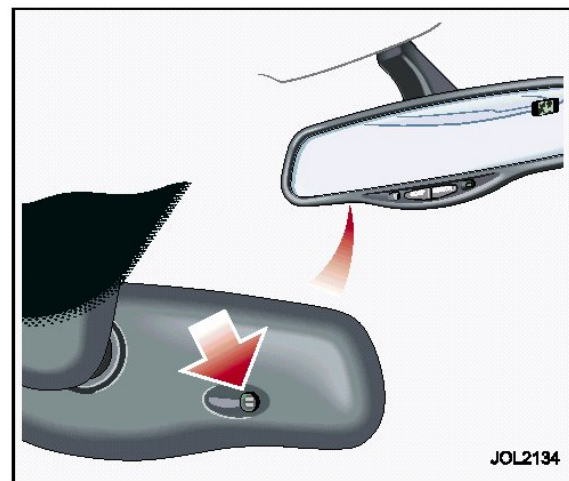
New for the 2003 MY, is the addition of the interior mirror with compass. The compass operation is the same as on the S-TYPE (2000-2002 MY).

The interior rear view mirror is of the electro-chromic type, and is operated by control buttons at the base of the mirror. Where electro-chromic door mirrors are fitted, they are operated in conjunction with the interior mirror by the same controls.



## EZ Pass (Electronic Toll Pass)

If you have an EZ pass (Electronic Toll Pass), it is advisable to mount the transmitter on the windscreen about 1 inch (5mm) from the mirror mount and headlining and to the side of the mirror ensuring that it does not cover the forward facing light sensor (see illustration). This also keeps it away from any metal, which may affect its operation. The forward facing light sensor position changes from the left to the right side of the mirror depending whether a compass is fitted or not. Do not move the tag more often than need be as it can affect the calibration of the compass, if fitted.



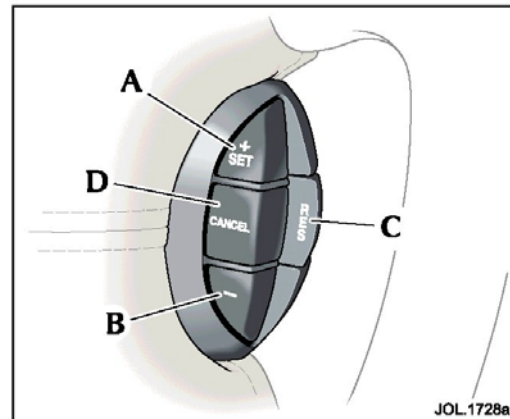


## CONVENTIONAL CRUISE CONTROL

The conventional cruise control used on the XK no longer uses an ON/OFF switch as previously located on in the J-Gate surround area. Pressing the SET (A) button when the desired speed is reached activates the system.

The cruise control system can be used by the driver to maintain a selected vehicle speed above 15 mph (24 km/h) without the driver having to use the accelerator. Switches on the steering wheel allow the driver manual control of the system. Brake operation also influences the cruise control system.

- (A) – SET + to set the speed or accelerate.
- (B) – "-" Decelerate.
- (C) – RES to resume the set speed retained in memory.
- (D) – CANCEL cancels cruise control but



Cruise control will switch off and clear the memory when:

- The ignition is switched to position "0".
- A fault occurs. (the cruise control system will switch OFF and cannot be used until the fault is cleared)
- The parkbrake is applied.
- Maximum vehicle speed is reached.

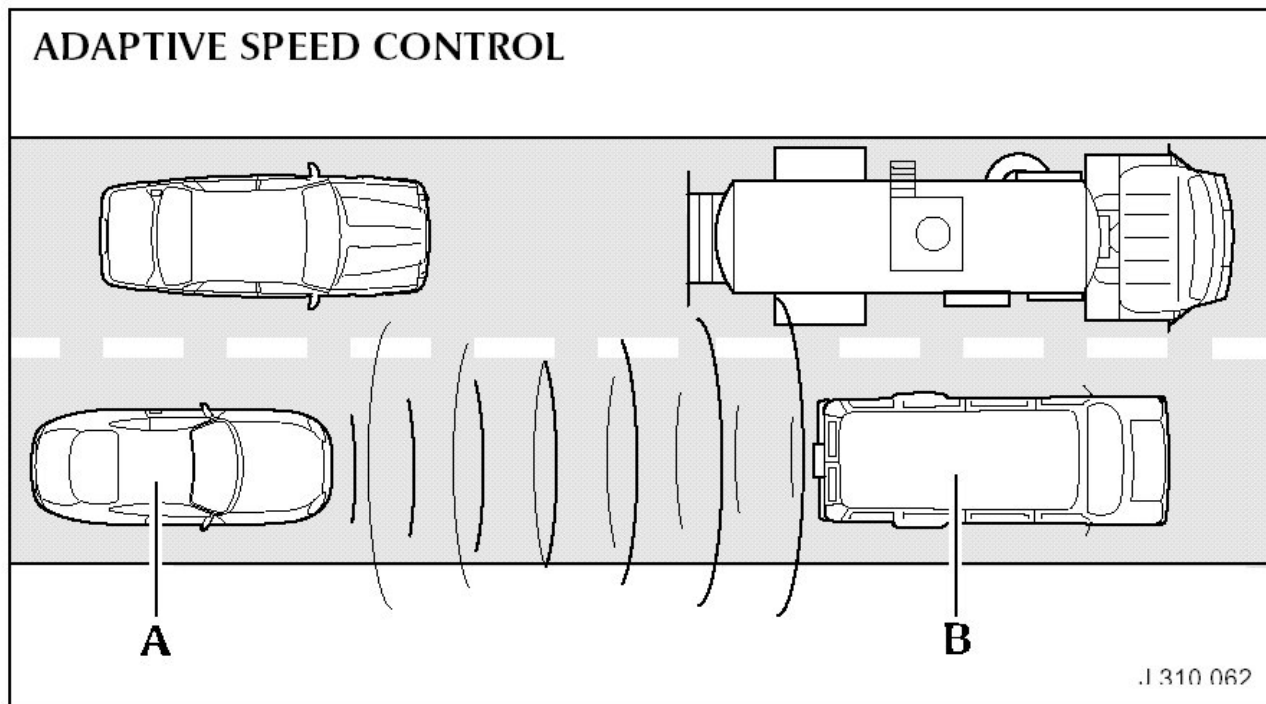
Cruise control will switch off but the set speed will remain in the memory when:

- The CANCEL button is pressed.
- The brake pedal is pressed.
- Speed falls below 15 mph (24 km/h).
- Neutral, Park or Reverse gear positions are selected.
- Traction control or DSC is operating.
- The difference between the actual and set speed is too great.
- When the set speed is above 90 mph (144 km/h); cruise control will disengage automatically after approximately 20 minutes.
- The accelerator pedal is used to accelerate beyond the set speed for too long a period.



## ADAPTIVE SPEED CONTROL (ASC)

Adaptive Speed Control, also known as Adaptive Cruise Control (ACC), is a new technology, which enhances the operation of the conventional cruise control system providing greater convenience and drivability for the driver. Conventional cruise control allows a set speed to be maintained, but must be overridden by the driver if approaching a slower moving vehicle ahead. Periodic driver intervention reduces the convenience of the system and adds to the workload. The ASC system includes the normal cruise control functions but also provides automatic distance keeping reducing driver operations.



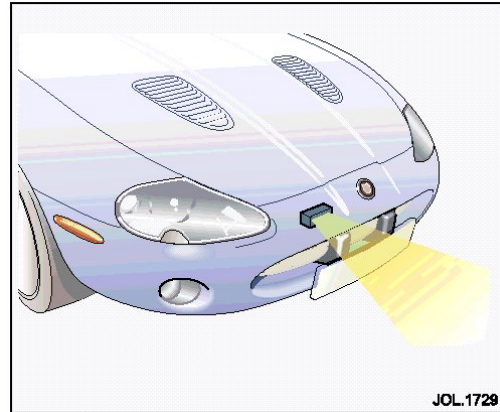
The sensing vehicle (A) will decelerate to below the set speed to maintain a selected distance behind a slower vehicle (B) and will then accelerate to the set (cruise) speed when the way ahead is clear. This distance varies with speed so as to maintain a nominal time gap (driver selected) between the two vehicles.

It is important to note that the system is intended for use in limited driving situations and it does not remove ultimate control and responsibility from the driver, and at all times can be quickly overridden. It is not a collision warning system and will not react to stationary objects. The system does not operate below a minimum speed of approximately 30 km/h (20 mph) since it is unsuitable for use in, for example, cities or traffic congestion.

## ASC (Cont.)

### Principles of Operation

The adaptive speed control system is based on the use of a front mounted radar sensor. This sensor, which transmits a narrow beam, forward of the vehicle and detects the returning signals reflected off other vehicles and objects within the irradiated angle of view. The beam is 1.5° wide and mechanically scans at a rate of 10 sweeps/second across a total arc of 15° centered on the longitudinal axis of the vehicle. The radar operates at millimeter wavelengths (76-77 GHz) and transmits a frequency modulated continuous wave signal at a relatively low power level (no high power pulses).



With the ignition is switched on, the ASC Control Module (CM) is powered up but no radar transmissions are emitted until the vehicle is in motion. The radar sensor detects three primary parameters of objects within the scanned arc.

- Range - the radar sensor detects the presence and ranges of different vehicles and objects within the scanned arc up to a distance of approximately 130 meters ahead. The transmitted signal frequency changes continuously in a cyclic pattern (modulation) so that, in the time taken for the signal wave front at a particular frequency, to travel to and from a target vehicle or other object, the transmission frequency will have changed. The difference between the received signal frequency and the new transmission frequency is proportional to the distance between the transmitting vehicle and the target vehicle.
- Relative speed - when the signal is reflected off a vehicle moving at a different speed (opening or closing gap) an effect known as the "Doppler shift" causes an extra frequency modulation to be imposed on the signal. This Doppler frequency varies with the relative speed of the vehicle being followed, enabling the system to differentiate between vehicles traveling at different speeds and also between moving vehicles and stationary objects.
- Angle of target - using a narrow angle beam to scan horizontally in front enables the system to distinguish, for example, between vehicles in different lanes and between vehicles and roadside objects.

## ASC (Cont.)

### Data Processing

The ASC control module incorporates a yaw rate sensor and receives vehicle speed data from the ABS/DSC/TC system so that the speed control system knows its own vehicle absolute speed and dynamic attitude. By processing this information together with the range, relative speed and azimuth angle of external objects detected by the radar sensor, the system effectively builds a picture of the immediate environment ahead. Knowing the relative speed of the vehicle ahead and the absolute speed of its own vehicle, the system can calculate the actual speed of the other vehicle. Comparing relative target speed and own vehicle speed can also identify stationary objects. Yaw rate inputs and changing vehicle detection angles allow the system to recognize bends in the road (within system limits).

### Follow Mode

A set speed is selected in a similar way to the conventional cruise control system (see page 23) and this speed is maintained until a slower vehicle is encountered in the lane ahead. When the vehicle ahead comes within the effective range of the radar sensor, the system identifies it as a target vehicle and an icon is illuminated on the instrument cluster to indicate that the system is in follow mode. When the distance between the two vehicles closes to a set time gap, the adaptive speed control system closes the throttle and if necessary applies the brakes so as to maintain the separation: follow mode is effectively a closed loop system. If several vehicles are ahead, the closest vehicle is chosen as the target to follow. If the target vehicle moves out of radar range, or if either vehicle changes lane or drops below the minimum operating speed, the system exits follow mode and the follow mode icon switches off.

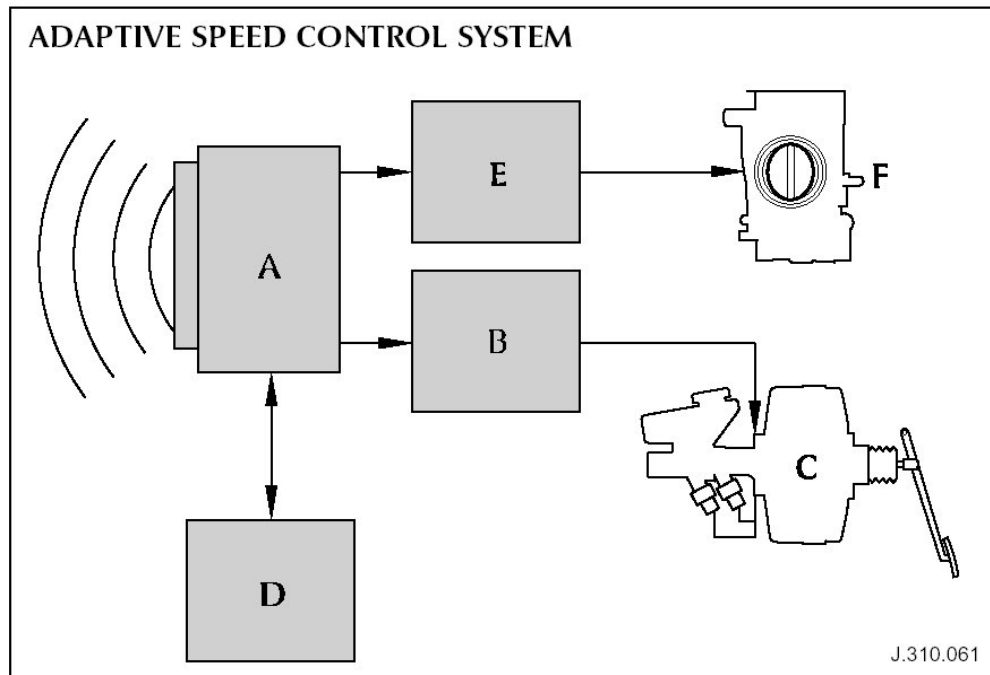
Driver operation of the foot brake or control switches will immediately cancel adaptive speed control.

## ASC (Cont.)

The adaptive speed control system includes the following components:

- The adaptive speed control module (A), which incorporates the radar sensor, yaw, rate sensor and provides system control functions.
- The adaptive speed control booster control module (B).
- The adaptive speed control booster (adaptive SCB) (C) which is an assembly consisting of the brake booster and master cylinder with pressure sensors.
- Driver controls and indicators (D).

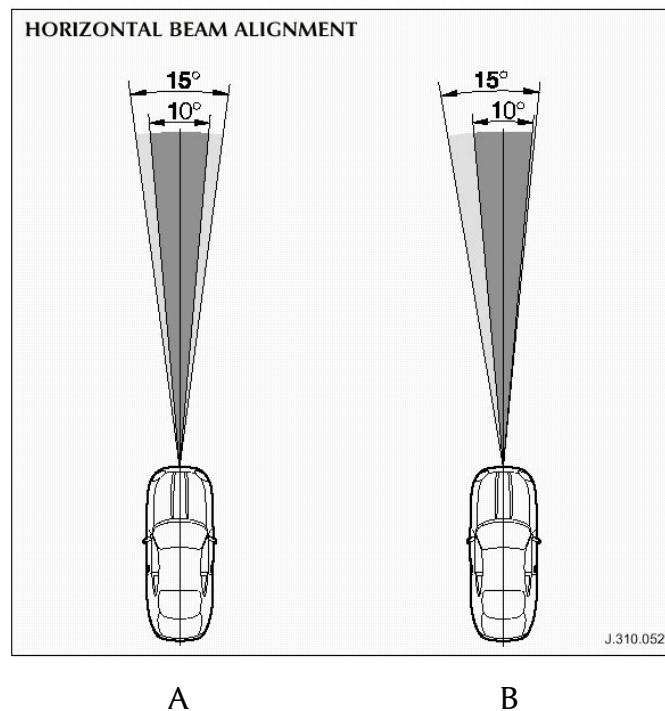
The engine control module (ECM) (E) and throttle body (F) also form part of the adaptive speed control system. Except for some software changes to the ECM to enable adaptive speed control operation, the ECM, throttle body and throttle control are unchanged. The ASC CM, speed control booster CM and ECM are interconnected via the CAN bus.



## ASC (Cont.)

### Beam Alignment

The ASC control module is mechanically aligned in the vertical plane but in operation, the beam is self-aligning in the horizontal plane. The narrow beam scans an arc of  $15^\circ$  of which the system utilizes a  $10^\circ$  sector for vehicle detection and automatic following (A). This arrangement allows for any slight physical misalignment (up to  $2.5^\circ$ ) between the bore sight (center line) of the adaptive SCCM and the direction of travel. Roadside objects (posts, barriers) are identified by the system because they are at or near the edge of the scanned arc, are stationary and have an appropriately changing angle to the vehicle axis as they are approached.

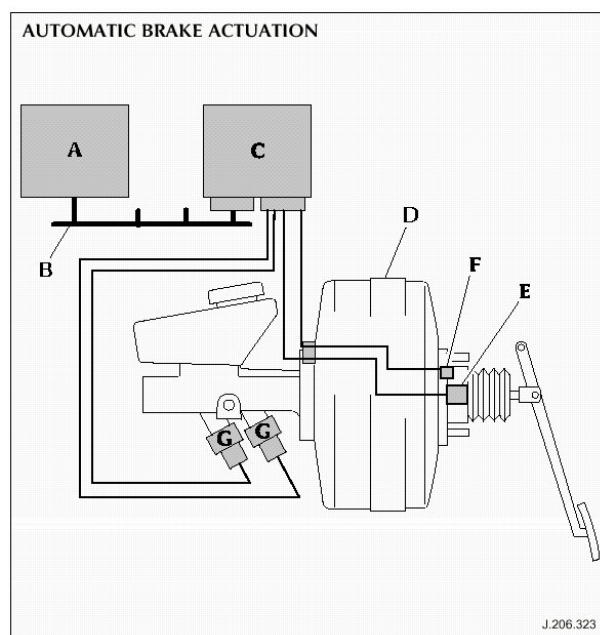


By identifying these peripheral features and the angular positions of detected vehicles, the system can determine, for example, that the centerline of the beam is misaligned to the left (B) and correct for it. Self-alignment is a continuous process during the driving cycle and provides relatively fine beam adjustment. If a new ASC control module is fitted during service, a short driving period is required to allow the system to acquire and process data to make an initial, larger, coarse adjustment. Reference must be made to the appropriate JTIS service information.

## ASC (Cont.)

### Speed Control

Under adaptive speed control, vehicle speed is regulated by automatic control of the throttle and brakes. The throttle is controlled by the ECM in the same way as for the standard (conventional) cruise control system, but with demand signals sent via the CAN bus from the ACC control module to the ECM.

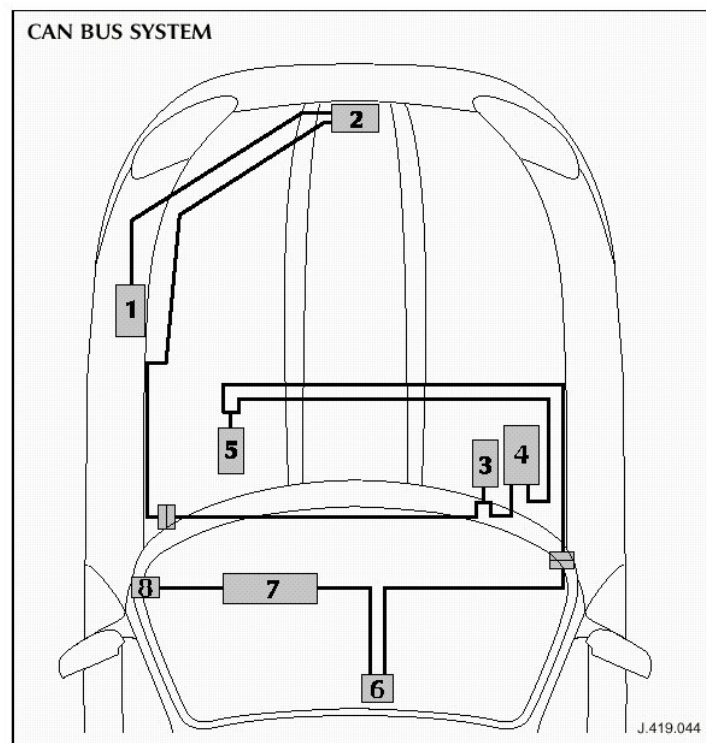


The Adaptive Speed Control Booster (SBC) and Adaptive Speed Control Booster Control Module (SCBCM) provide a closed loop control system for automatic brake actuation, which is limited to approximately 20% of full pressure (0.2G). Brake pressure demand signals are sent from the ASC CM (A) via the CAN bus (B) to the adaptive SCBCM (C). The adaptive SCB (D) includes a modified vacuum brake booster, which contains a solenoid operated air control valve (E), and driver brake release sensor (F).

When the brake pedal is operated by the driver, the air control valve is opened in the normal way to introduce air to the rear chamber of the booster and create the necessary pressure differential across the diaphragm to generate the servo boost. When braking is demanded in follow mode, the air control valve is opened by a solenoid, which simulates pressure applied at the pedal. Note that solenoid actuation of the air control valve results in movement of the brake pedal, causing the rear brake lights to illuminate.

## ASC (Cont.)

A release sensor (F) detects the braking force applied to the pedal by the driver (greater than the effect on the pedal caused by solenoid actuation), and sends a signal to cancel adaptive speed control. Two pressure sensors (G) are fitted to the master cylinder and provide closed loop feedback signals, indicating actual hydraulic pressure, to the adaptive SCBCM. The solenoid current is then adjusted as necessary to establish the required hydraulic pressure level: the solenoid drive signal is pulse width modulated (PWM) to provide continuously variable control. The pressure sensors are identical and two are fitted for redundancy.



CAN BUS INTERCONNECTIONS (LHD)

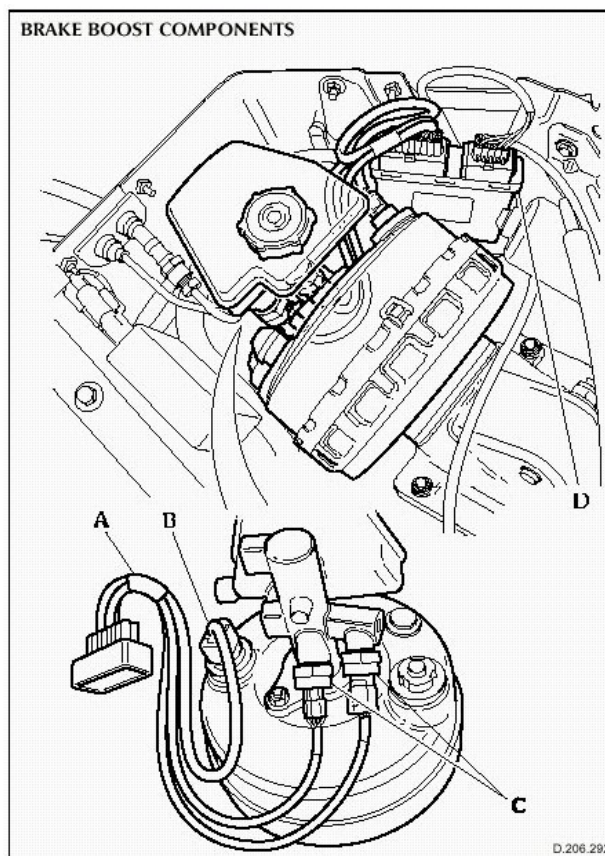
- |               |                       |
|---------------|-----------------------|
| 1. ABS/DSC/TC | 5. ADAPTIVE SCBCM     |
| 2. ASC CM     | 6. J-GATE             |
| 3. TCM        | 8. DLC CONNECTOR      |
| 4. ECM        | 7. INSTRUMENT CLUSTER |



## ASC (Cont.)

### Brake Booster Components

The adaptive SCB is fitted to the brake pedal box via four studs. The booster unit, master cylinder and pressure sensors are removable for service operations as for non-adaptive cruise control components. A single electrical harness assembly (A) connects the booster (B) and pressure sensors (C) to the adaptive SCBCM (D). Note that the pressure sensors are interchangeable.

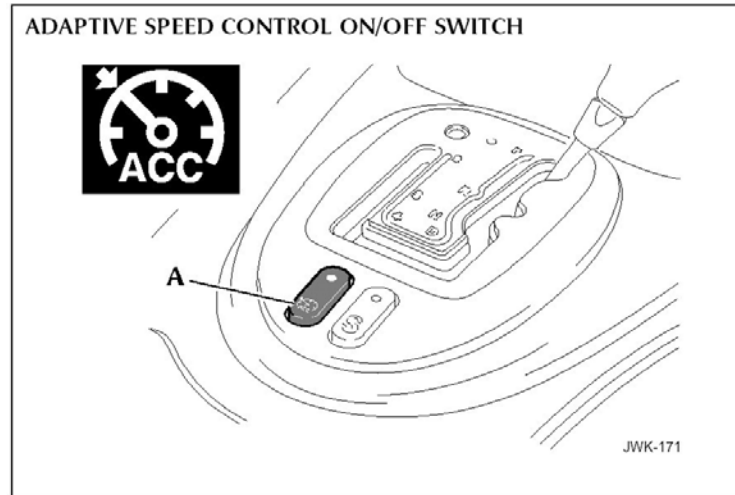




## ASC (Cont.)

### Master Control Switch

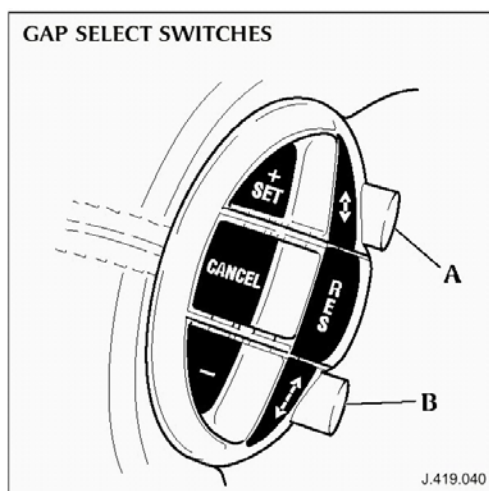
The adaptive speed control master ON/OFF switch (A) is located near the J-Gate as on the previous non-adaptive system, i.e., conventional models (2000-2002 MY). The switch is a push-on/push-off type and in the on position a red LED is illuminated.



## ASC (Cont.)

### Steering Wheel Switches

A new steering wheel switch pack is fitted for adaptive speed control. The standard (conventional) switch pack does not function with the system and must not be used as a replacement. Note also that the new switch pack must not be used with the conventional system.



The steering wheel switches include CANCEL and RESume, which have the same functions as on the conventional cruise control system. The cruise speed is set by pressing and holding the "SET +" or "—" buttons until the required speed is shown on the message center. Two round shaped switches are added to the switch pack to allow the driver to change the gap between vehicles in follow mode. Four gap settings are available to the driver and in each drive cycle, the system defaults to the widest gap. The actual distance corresponding to each gap setting varies with the vehicle speed. Pressing the top switch (A) selects a closer gap and pressing the lower switch (B) selects a larger gap.

### Resuming the set speed/follow mode

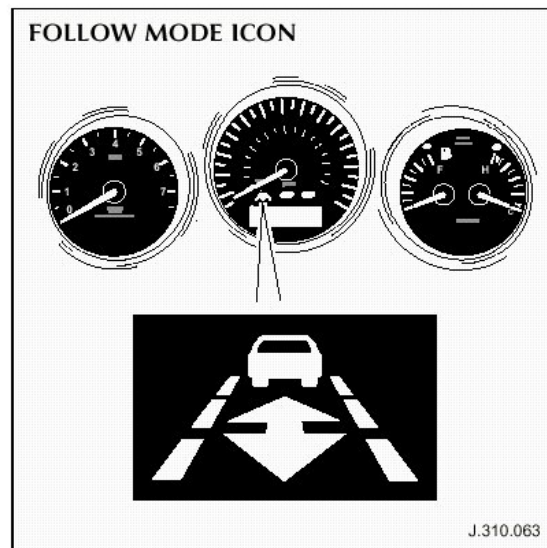
By pressing the resume button after the adaptive speed control has been cancelled, for example, after braking, the adaptive speed control will become active again, provided that the set speed memory has not been erased. The set speed will be displayed and the original set speed will be resumed, unless a vehicle ahead causes the follow mode to become active.

**CAUTION: RESUME should only be used if the driver is aware of the set speed and intends to return to it.**

## ASC (Cont.)

### Follow Mode Indication

Whenever the radar identifies a target vehicle, an amber icon is illuminated on the instrument cluster to indicate the system is in follow mode. When the target vehicle is lost, the icon is extinguished.



### Message Center Messages

- In follow mode or when selecting a time gap, one of four (4) symbols appears on the message center for four (4) seconds:
  - <----->: Maximum (default) gap
  - <---->: Intermediate gap
  - <--->: Intermediate gap
  - <->: Minimum gap
- SET SPEED XXX km/h (or mph): this message is displayed when using the SET + or — buttons or when a set speed is resumed.
- DRIVER INTERVENE: this message is displayed if, in adaptive speed control, maximum braking level is reached, the vehicle speed falls below the minimum or a system failure has occurred. The IC red warning lamp is also illuminated and an audible warning sounded.

## ASC (Cont.)

- **CRUISE OVERRIDE:** this message is displayed if the accelerator is pressed when in adaptive speed control, causing the system to be overridden and preventing automatic braking: releasing the accelerator will cause a return to adaptive speed control.
- **CRUISE NOT AVAILABLE:** this message is displayed and the amber warning lamp on the IC is illuminated if a fault occurs in the adaptive speed control system when the system is not activated.
- **CRUISE CANCELLED:** this message appears when the driver applies the brakes or presses the CANCEL switch: also if traction control is operating.

## System Restrictions

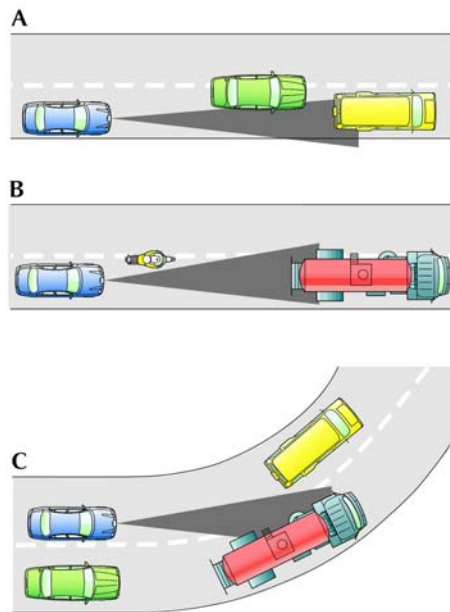
The adaptive speed control system is only intended to provide enhanced cruise control as described above in certain restricted conditions.

The following points should be noted:

- Automatic braking is limited to approximately 20% of full pressure (0.2G) and is intended to provide a smooth, gradual deceleration in follow mode conditions. Harsh braking by the target vehicle or following the target vehicle down to very low speeds or to a halt will require driver override of the brakes.
- While the radar sensor detects moving and stationary targets for assessment of the environment ahead, the system does not react to or provide any control in situations other than follow mode conditions. Stationary or slow moving vehicles (below 10 km/h - 6 mph), pedestrians, objects on the road and oncoming vehicles in the same lane are not recognized. It must be emphasized that the adaptive speed control system is not a collision warning or avoidance system and that, other than the limited conditions of follow mode, intervention is necessary.

## ASC (Cont.)

- In follow mode, some situations may cause target ambiguities for the detection system. These situations include: the nearby presence of a third vehicle when driving on a line slightly offset to the target vehicle (A): vehicles edging into the lane ahead which are not detected by the system until they have moved into the radar beam (B). On the approach to, or exit from a bend, a target vehicle may be lost or a new target acquired as vehicles ahead change their angular position with respect to the radar sensor (C). On a straight road, if the sensing vehicle is in follow mode below its selected set speed, losing the target vehicle will cause the sensing vehicle to accelerate to this set speed. This acceleration is undesirable either on, or entering a bend when the target is suddenly lost, and in this situation the system inhibits the resumption of the set speed.



JOL\_1617

- The adaptive speed control system compares vehicle speed data from the ABS system with the relative speed of an external object as detected by the radar sensor to ascertain whether the object is stationary or not. If tires are fitted which are different in diameter from those specified for the vehicle, the vehicle speed calculated by the ABS will not be the true road speed. This situation may cause stationary objects to be falsely identified as moving vehicles and result in automatic deceleration on a clear road.

## ASC (Cont.)

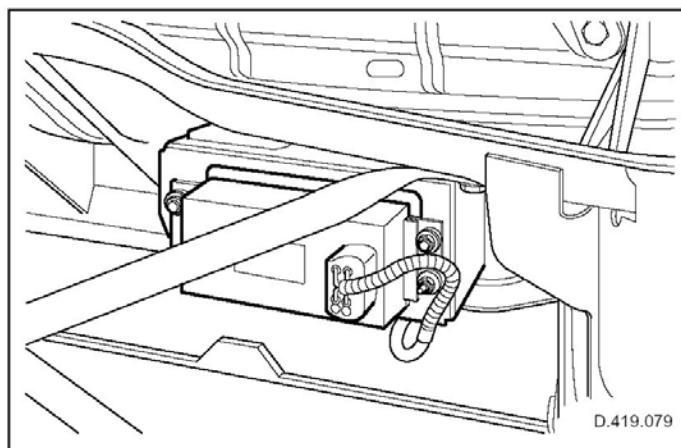
### Module Location

The ASC control module is mounted on the body upper front cross-member just behind the front bumper. The bumper offers minimal attenuation to electromagnetic waves and the system will function with normal road grime on the bumper. Excessive dirt, mud, snow or ice should be removed, and metal badges or other accessories must not be fitted in front of the module. If a damaged bumper is repaired, care must be taken to avoid a build up of plastic material or paint, which may have a possible effect on signal propagation. Refer to the Body and Paintwork repair information including any relevant service bulletins.

### ASC CM Vertical Alignment

The service alignment detects misalignment of the radar due to replacement of the unit at a dealership or sudden physical misalignment of the sensor on the vehicle. If the need for service alignment is detected, ASC fail code will be flagged. This is indicated by “CRUISE NOT AVAILABLE” on the IC message display. The red light on the cruise master On/Off switch will not be lit and the driver will be unable to engage ASC. The driver will need to drive 10 - 15 minutes in light/moderate traffic on the highway at more than 64 km/h (40 mph) until the “CRUISE NOT AVAILABLE” message clears. The driver will be able to engage ASC. The driver will need to clear all fault codes after the aligning drive in order to clear historical fault 5292h from memory. Although “CRUISE NOT AVAILABLE” will be cleared after 10 - 15 minutes of driving, additional time may be required to absolutely fine-tune the automatic alignment angle. During this period of fine-tuning, some adjacent lane targets may be possible

If a replacement module is fitted, it must be aligned in the vertical plane so that the centerline of the radar beam is parallel with the ground. This alignment is carried out with the vehicle on level ground.



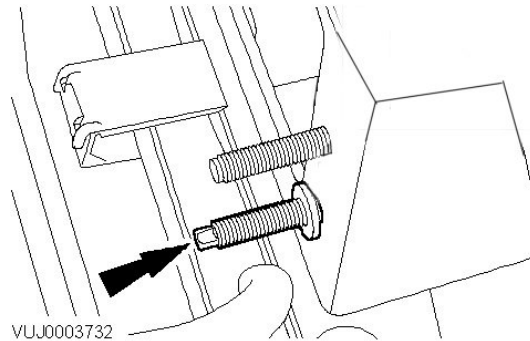
## ASC (Cont.)

### ASC Control Module Alignment

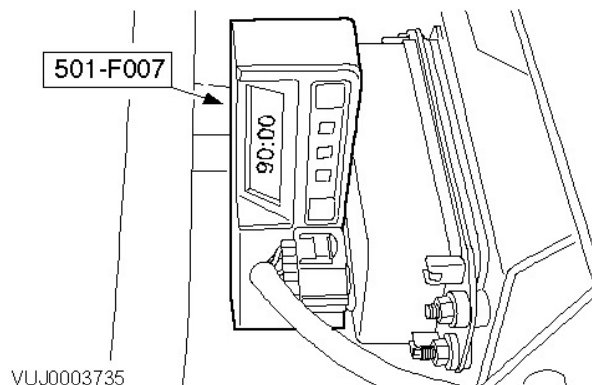
Special tool: Inclinometer 501-F007 (part of the 2000-2002 MY S-TYPE beam alignment kit) is needed to perform this operation.

NOTE: Make sure the vehicle is positioned on level ground such as the headlight alignment area.

1. Using the special tool, check the speed control module vertical alignment.
2. Align the speed control module.
  - A) Loosen the speed control module alignment bolt lock nut.



- B) Align the speed control module.
  - Rotate the speed control module alignment bolt to achieve a reading of  $90^{\circ} \pm 0.75^{\circ}$ .



3. Tighten the speed control module alignment bolt lock nut.
  - A) Prevent the speed control module alignment bolt from rotating.
  - B) Tighten the speed control module alignment bolt lock nut. Tighten to 5 Nm.
4. Using the special tool, re-check the speed control module vertical alignment.
5. If necessary, re-align the speed control module.

## ASC (Cont.)

### ASC CM Malfunction

If a malfunction occurs during operation in the cruise/follow mode, the system will switch OFF and cannot be used until the problem is cleared. A red warning light and the message DRIVER INTERVENE appears briefly, before being replaced by an amber warning light and the message CRUISE NOT AVAILABLE.

If a system malfunction is detected at any other time, an amber warning light will be displayed accompanied by the message, CRUISE NOT AVAILABLE. It will not be possible to activate the adaptive speed control system in any mode. Obstructions such as dirt on the front of the module or snow or ice on the bumper may inhibit system operation. If this occurs in the cruise/follow mode, the red warning light is displayed, an alarm sounds and the message, DRIVER INTERVENE appears briefly.

The amber warning light and the message ACC SENSOR BLOCKED replace these warnings and the system ceases to be active. Clearing the obstruction allows the system to return to normal operation. If the obstruction is present when the system is inactive, for example: on initial starting or with the system switched off, the amber warning light will be displayed with the message ACC SENSOR BLOCKED.

NOTE: Fitting tires, other than those recommended by Jaguar may affect the correct operation of the adaptive speed control.



ASC (Cont.)

ASC General Specifications

Item	Specification		
ASC control module vertical alignment	90° +/- 0.75°		
<b>Torque specifications</b>			
	<b>Nm</b>	<b>Lb/Ft</b>	<b>Lb/In</b>
ASC control module retaining nuts	5	N/A	44
ASC control module alignment bolt lock nut	5	N/A	44
Steering wheel retaining bolt	40	30	

## ASC (Cont.)

### ASC Diagnostic Trouble Codes

DTC	CM	Fault Description	Possible Causes
B1231	ABS/DSC/TC CM	Longitudinal acceleration threshold exceeded (Monitored by Adaptive Speed Control System)	Brake booster vacuum low Brake booster failure Brake pressure sensor failure Brake hydraulic unit failure Adaptive speed control module failure
C1777		ABS/DSC/TC CM internal vacuum pressure circuit fault	ABS/DSC/TC CM failure Active brake booster failure
C1997		Pressure control failure	Brake pressure sensor signal circuit: open circuit, short circuit to ground, short circuit to B+ voltage, high resistance Brake pressure sensor failure Booster solenoid circuit: open circuit, short circuit to ground, short circuit to B+ voltage, high resistance Booster solenoid failure Active brake booster failure
B1342	ASC CM	Control module failure	ASC CM failure
B2477		CM configuration failure	Reconfigure using WDS
C1291		ASC CM sensor temperature out of range	ACC CM sensor too warm or too cold Normal operating temperature: -40 °C – 70 °C (-40 °F – 158 °F)
C1292		ASC CM sensor blocked	Remove blockage from front of sensor
C1293		ASC CM sensor alignment out of range	ASC CM sensor alignment incorrect Mechanically realign sensor Perform complete service alignment
C1294		Active speed or vehicle speed out of range	Other control module (ECM, ABS/DSC/TC CM, IC, TCM) ACC vehicle speed related fault ASC CM failure
C1459		Forward alert switch and ASC indicator circuit fault	Forward alert switch and ASC indicator circuit: open circuit, short circuit to B+ voltage
C1748		Forward alert switch and ASC indicator circuit fault	Forward alert switch and ASC indicator circuit: short circuit to ground

## ASC (Cont.)

### ASC Instrument Cluster Messages

The following messages and associated warning lights will only appear if adaptive speed control (ASC) is fitted and active.		
Message	Priority Indicator	Meaning
FWD ALERT ON (or OFF)	None	Forward alert on (or off).
FWD ALERT < - - >	None	Forward alert sensitivity adjustment.
SET SPEED XXX MPH	None	Adaptive speed control set speed.
GAP < - - - >	None	Adaptive speed control set distance (time gap).
DRIVER INTERVENE	Red	Driver intervention required.
CRUISE NOT AVAILABLE	Amber	Adaptive speed control malfunction.
CRUISE CANCELLED	None	Adaptive speed control has been deactivated.
CRUISE OVERRIDE	None	Driver is pressing the accelerator pedal.
ACC SENSOR BLOCKED	Amber	Adaptive speed control sensor field of view is obstructed.

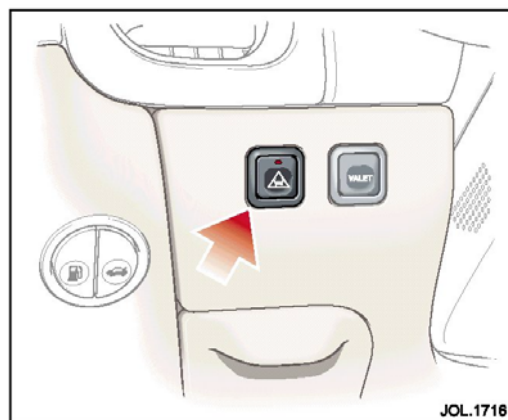
### ACC Audible Warnings

Hazard or condition	Remedy/Chime or Tone
ACC Driver intervene.	Action is required by the driver to apply the brakes.

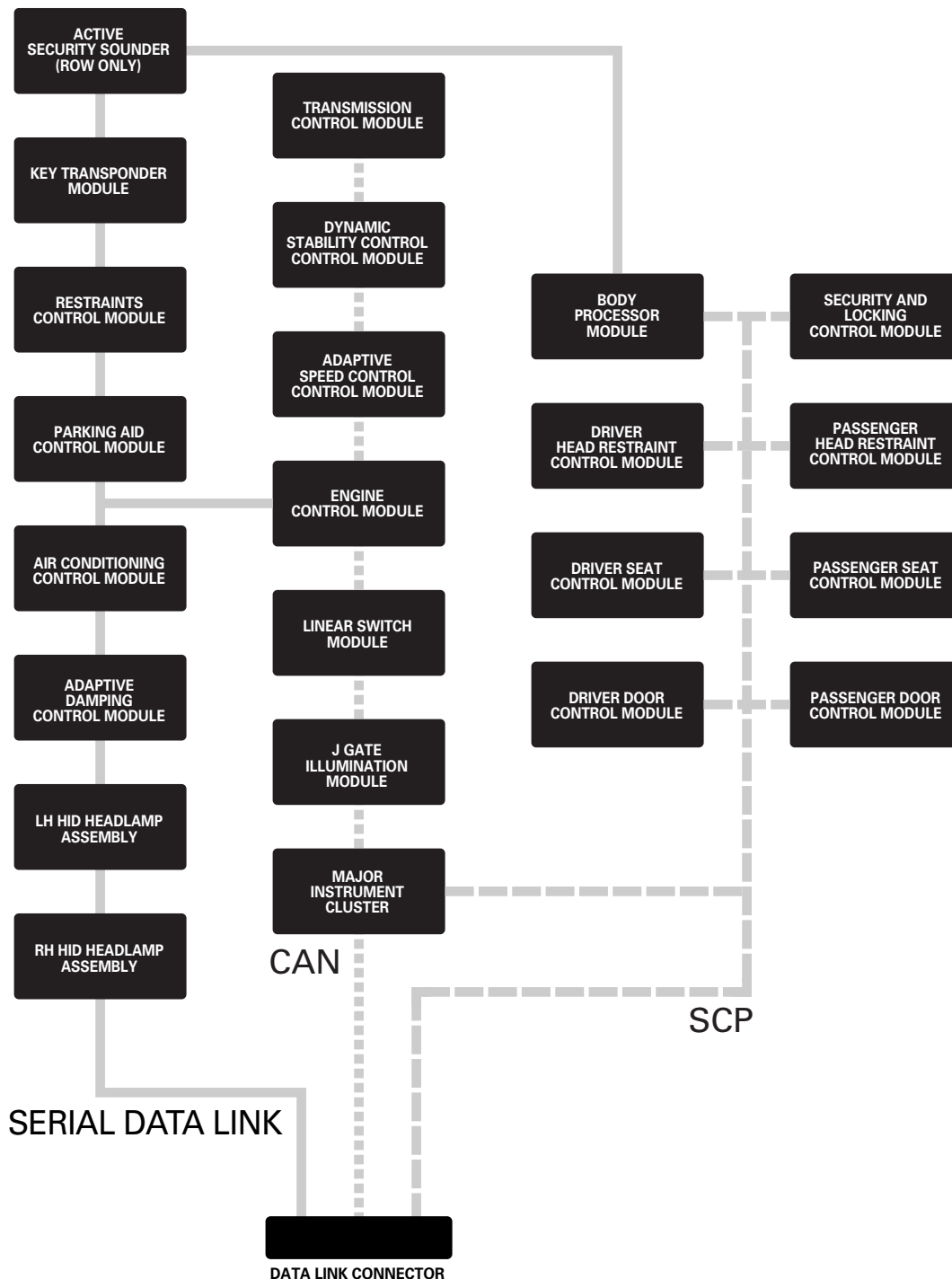
## FORWARD ALERT

Forward Alert is only available when the ASC system is ordered and is only available on XKR models.

Limited detection and warning of objects ahead is provided during ACC operation by the ASC "DRIVER INTERVENE" warning. The forward alert feature additionally provides these warnings while ASC is not engaged; if an object is detected close ahead, then the warning message and tone will be issued. The brakes will not be applied.



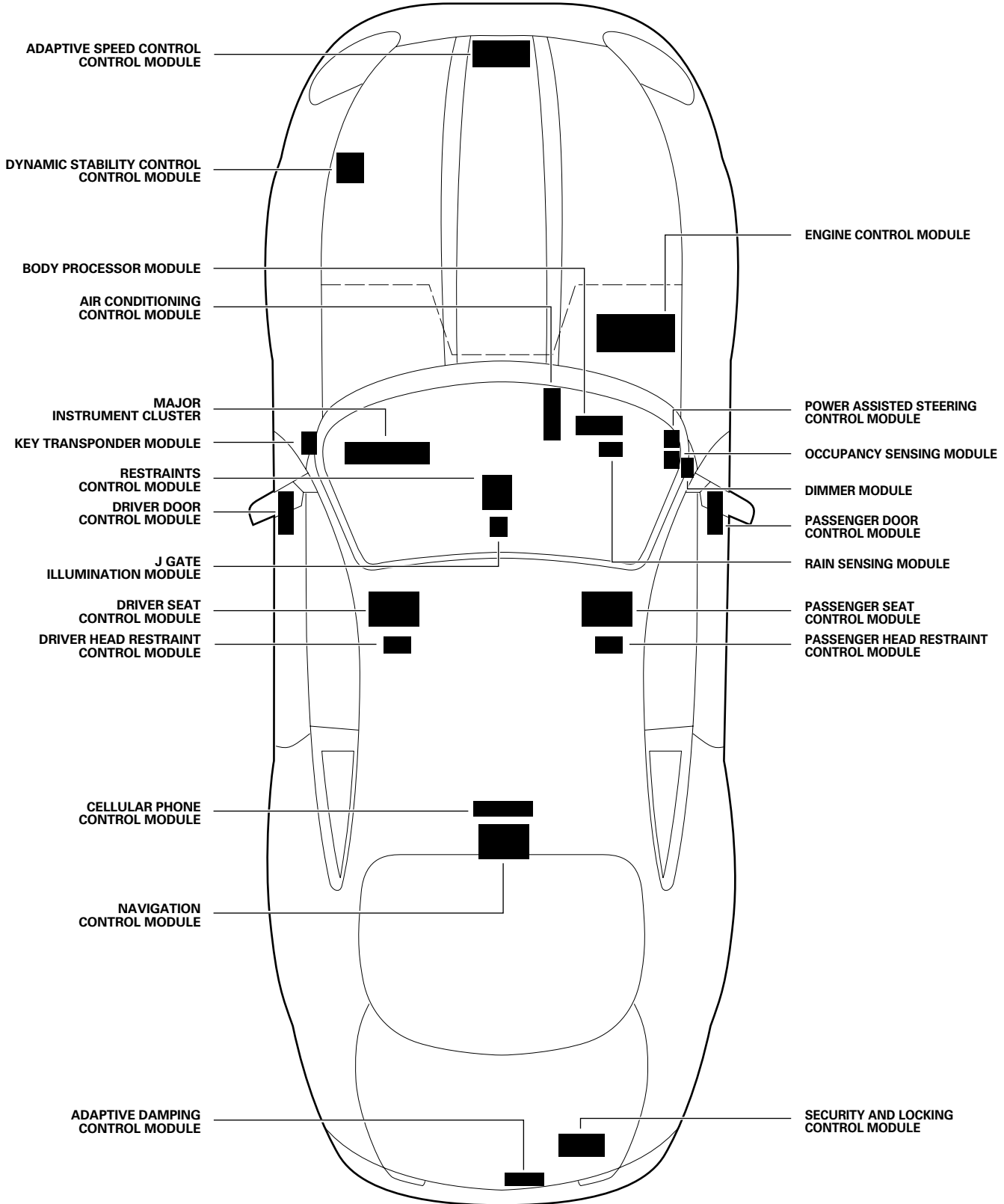
This additional feature may be switched on or off using the forward alert switch in the lower outboard knee bolster switch pack.



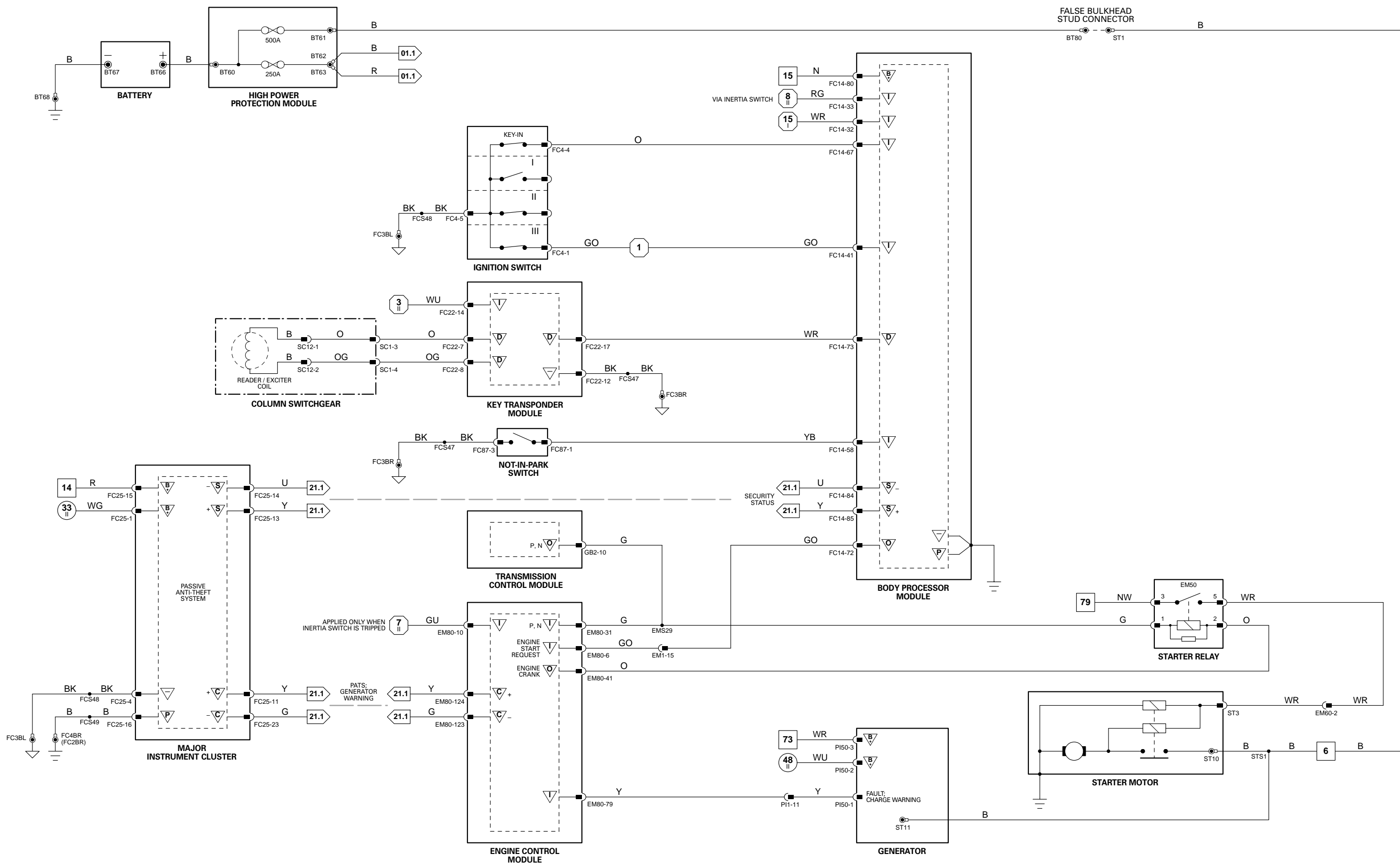
NOTE: TYPICAL XK-TYPE NETWORK CONFIGURATION (FULL OPTION SET). REFER TO FIGURES 21.1 AND 21.2 FOR CIRCUIT DETAILS.



# LHD



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



FALSE BULKHEAD STUD CONNECTOR  
BT80 ST1

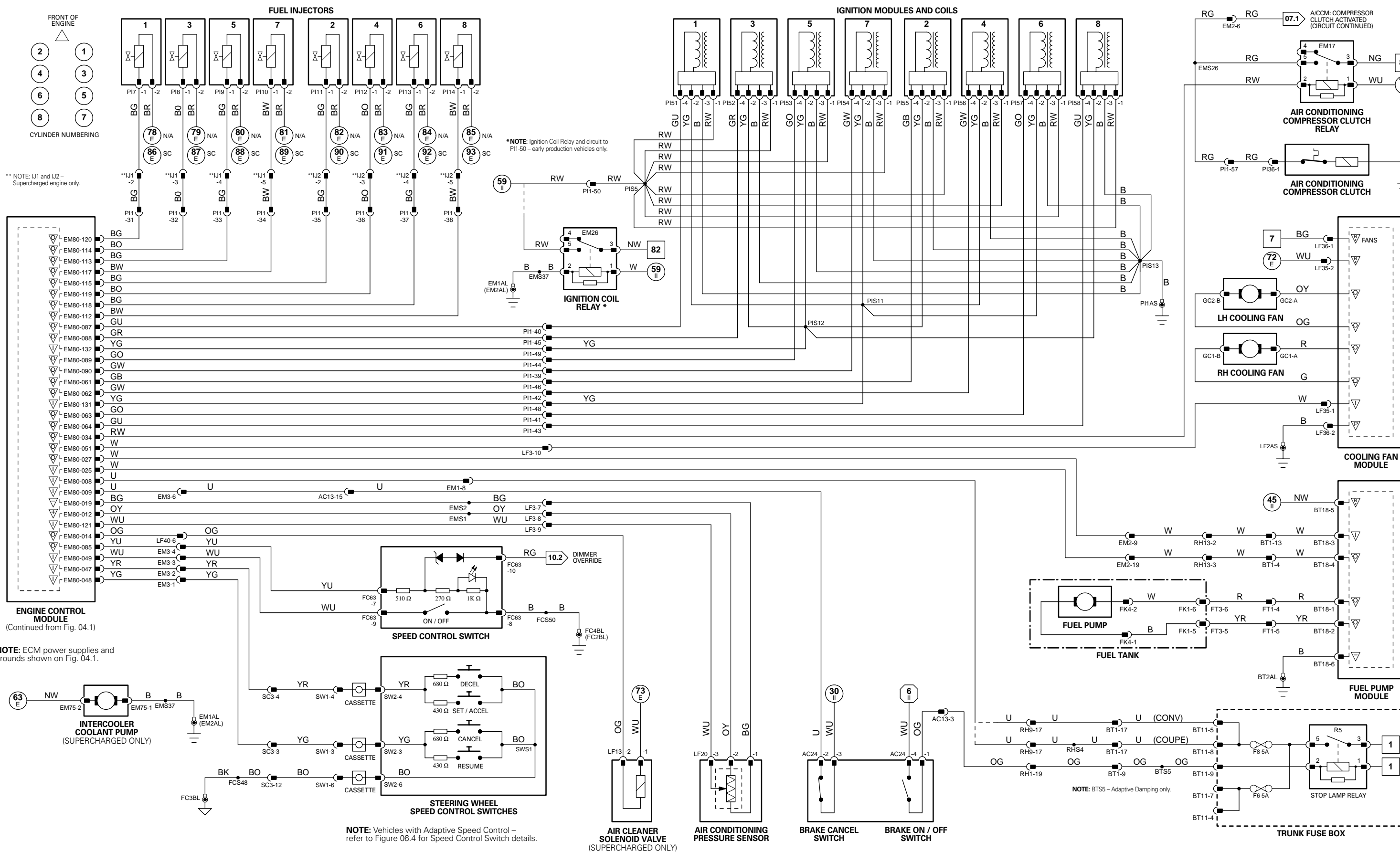
1	8	Fig. 01.1	9	52	Fig. 01.2	6	18	Fig. 01.4	61	93	Fig. 01.6
1	5	Fig. 01.1	53	87	Fig. 01.3	19	60	Fig. 01.5	1	17	Fig. 02.1

▽	Input	B	Battery Voltage	▽	Sensor/Signal Supply V	▽	ACP	S	SCP
▽	Output	P	Power Ground	▽	Sensor/Signal Ground	▽	CAN	D	Serial and Encoded Data

VARIANT: All Vehicles  
VIN RANGE: All  
DATE OF ISSUE: June 2002 (PROVISIONAL)

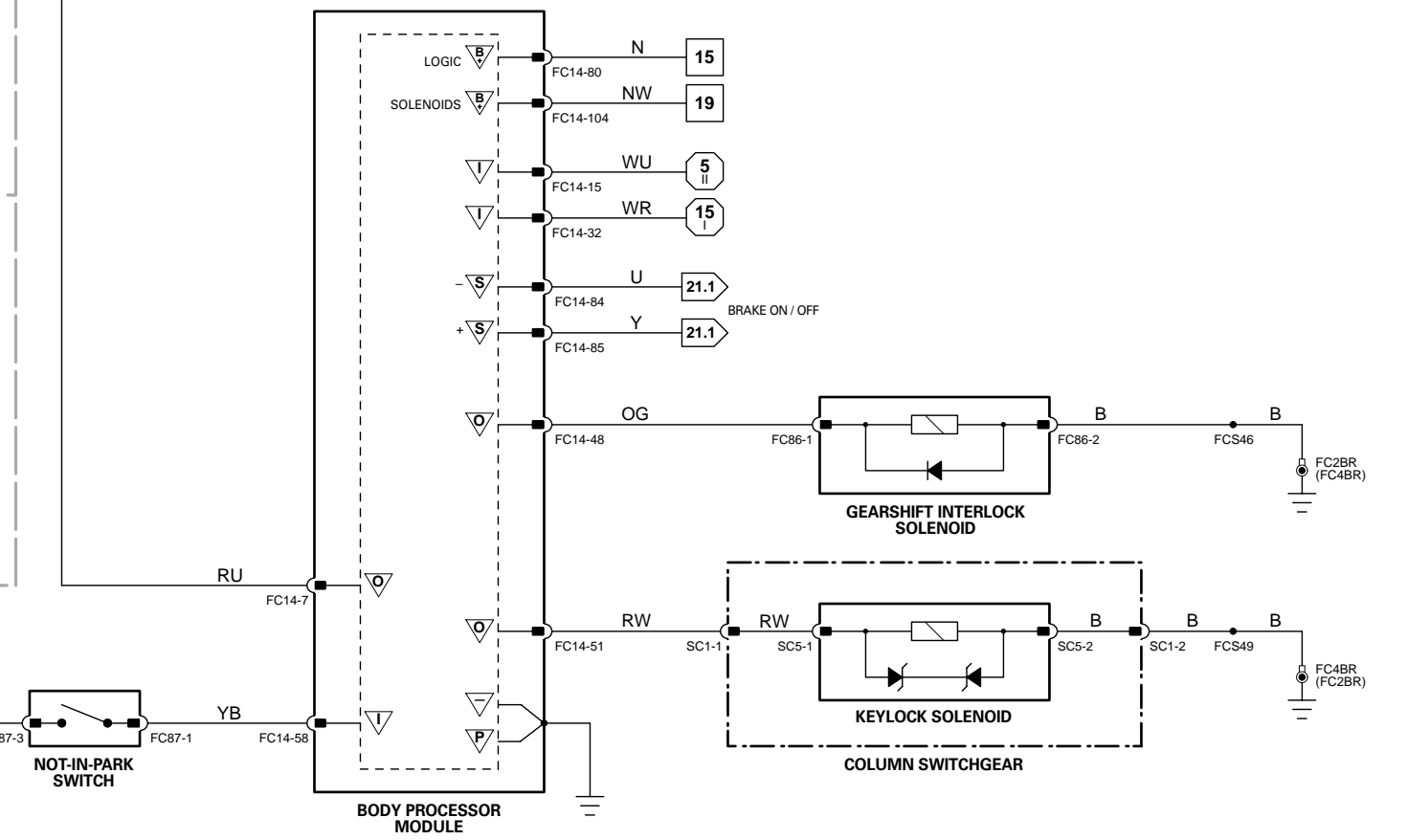
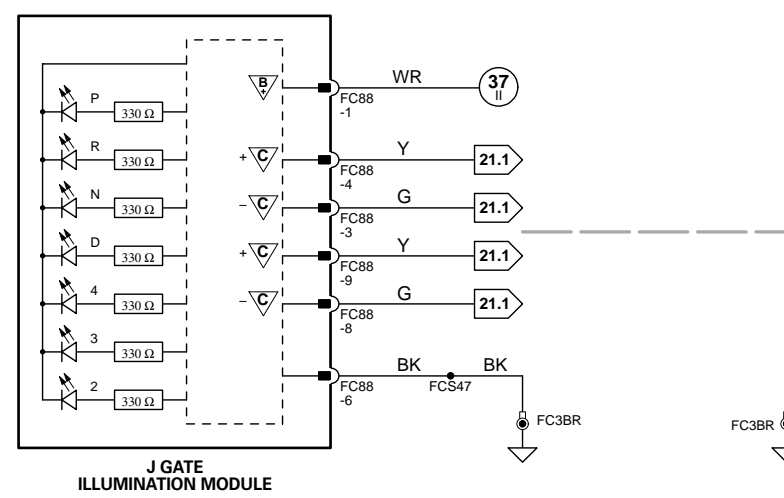
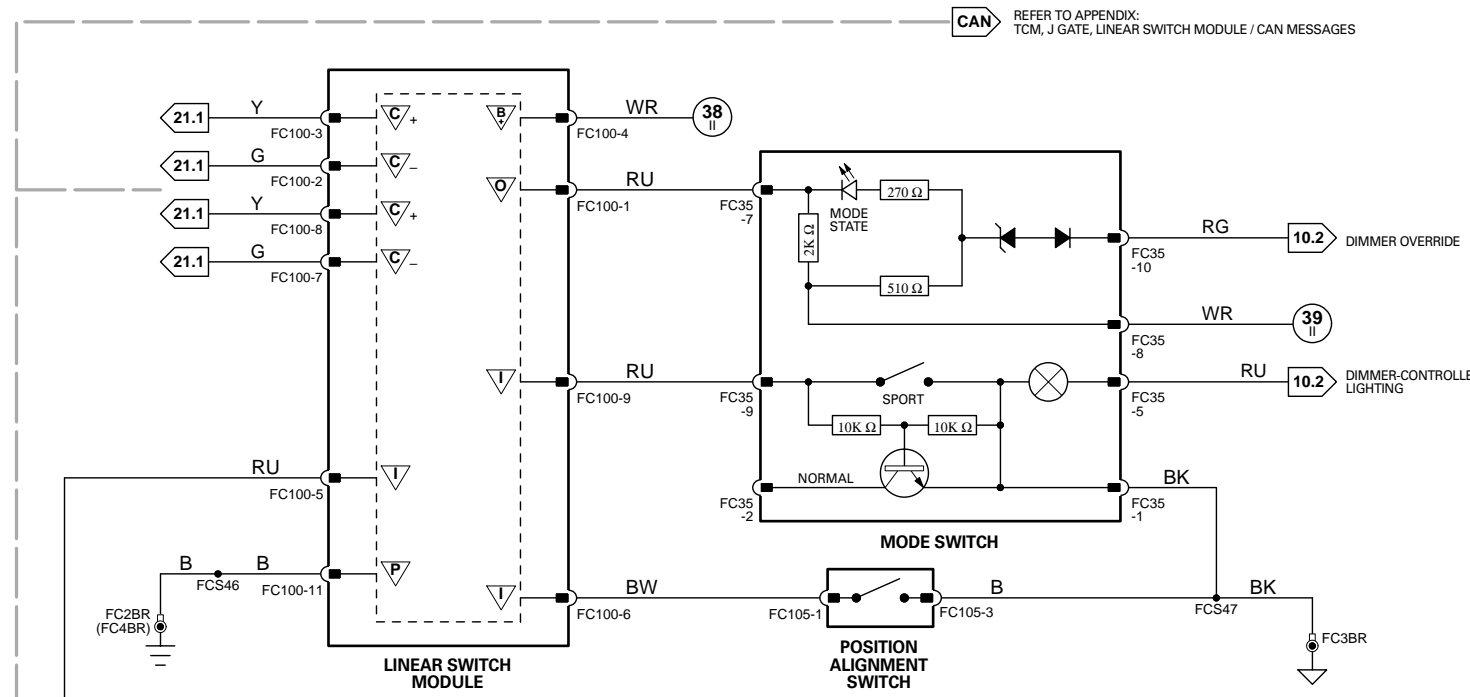
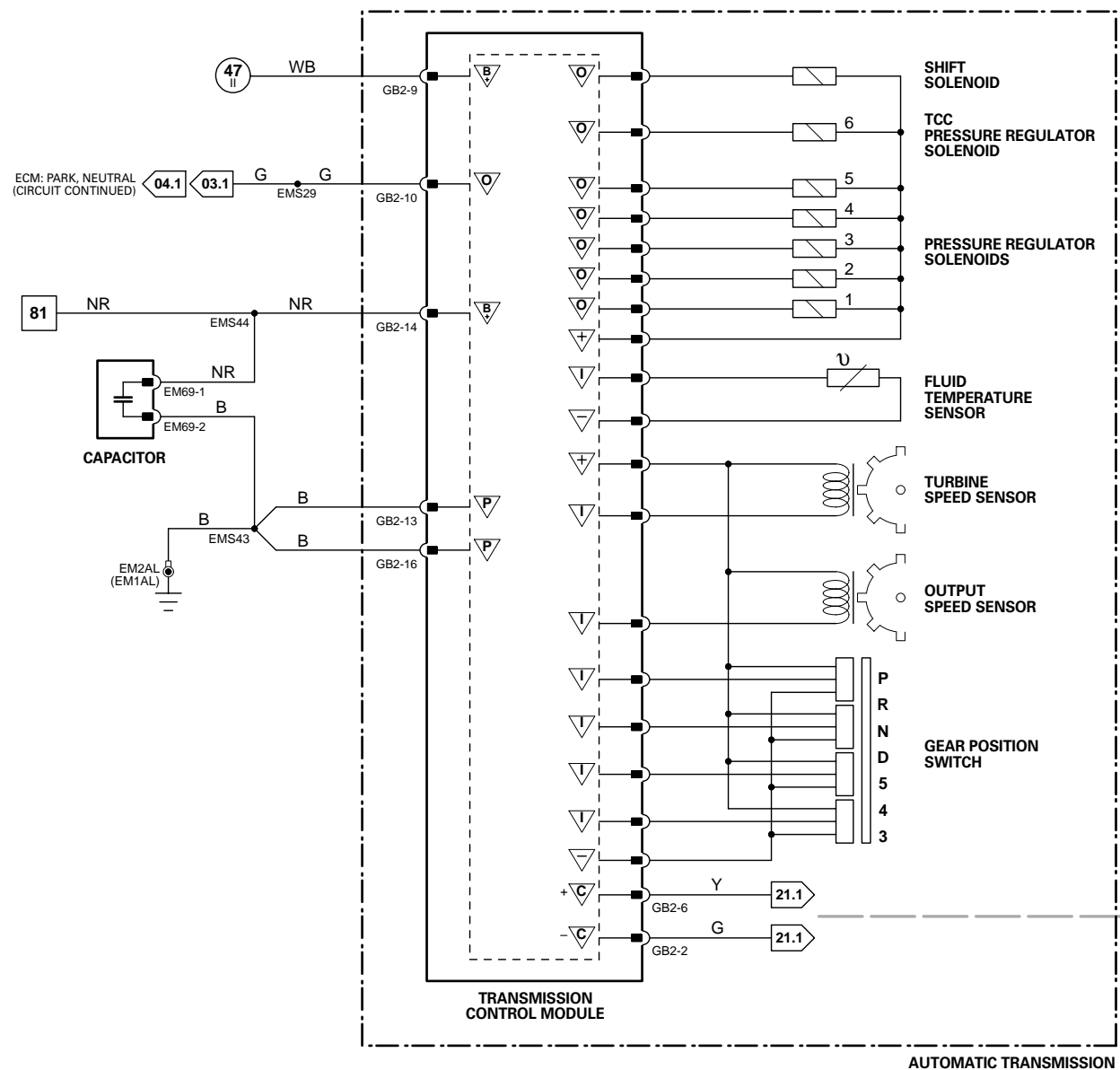






1 → 8 Fig. 01.1	9 → 52 Fig. 01.2	6 → 18 Fig. 01.4	61 → 93 Fig. 01.6
1 → 5 Fig. 01.1	53 → 87 Fig. 01.3	19 → 60 Fig. 01.5	1 → 17 Fig. 02.1

VARIANT: All Vehicles  
VIN RANGE: All  
DATE OF ISSUE: June 2002 (PROVISIONAL)

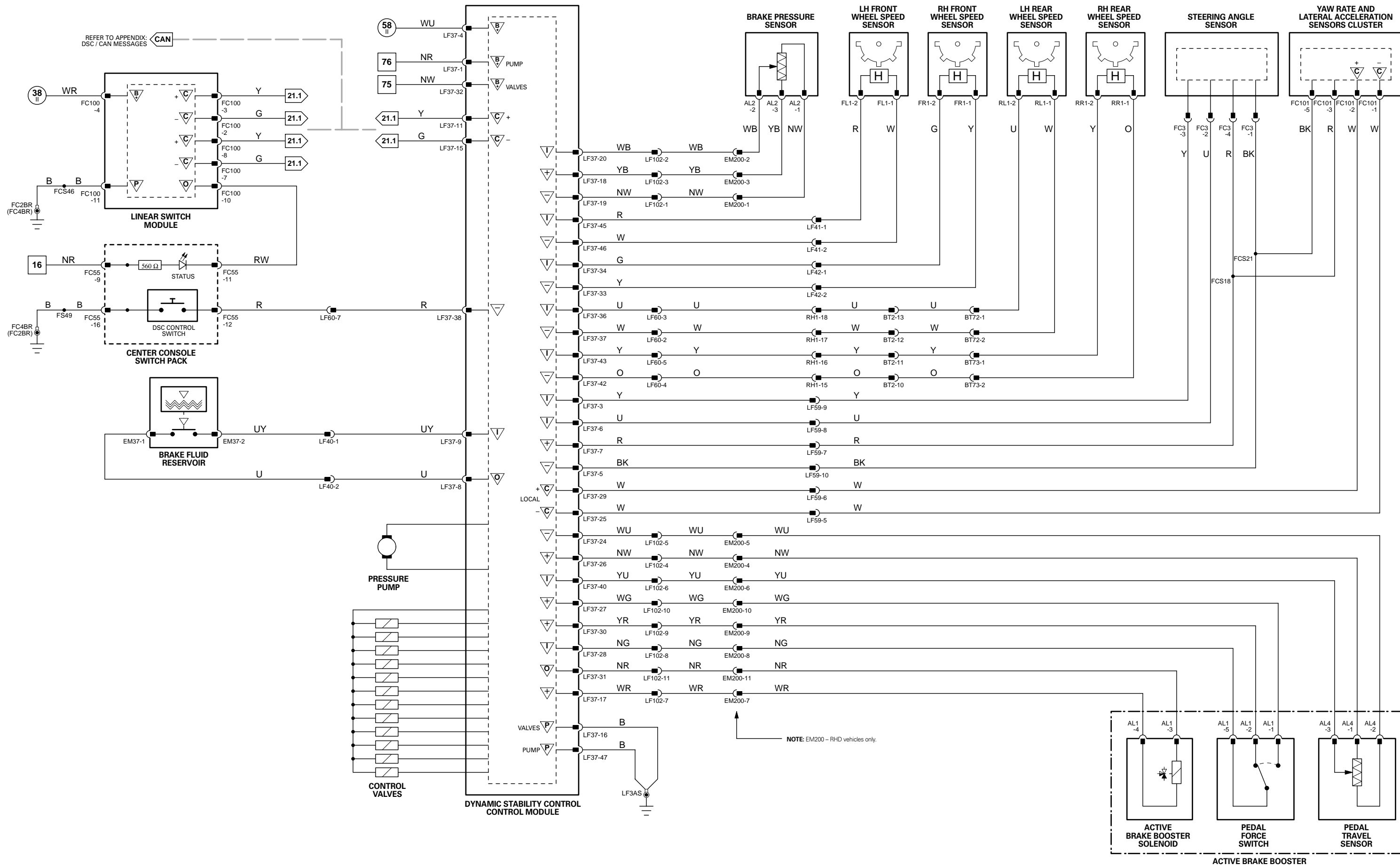


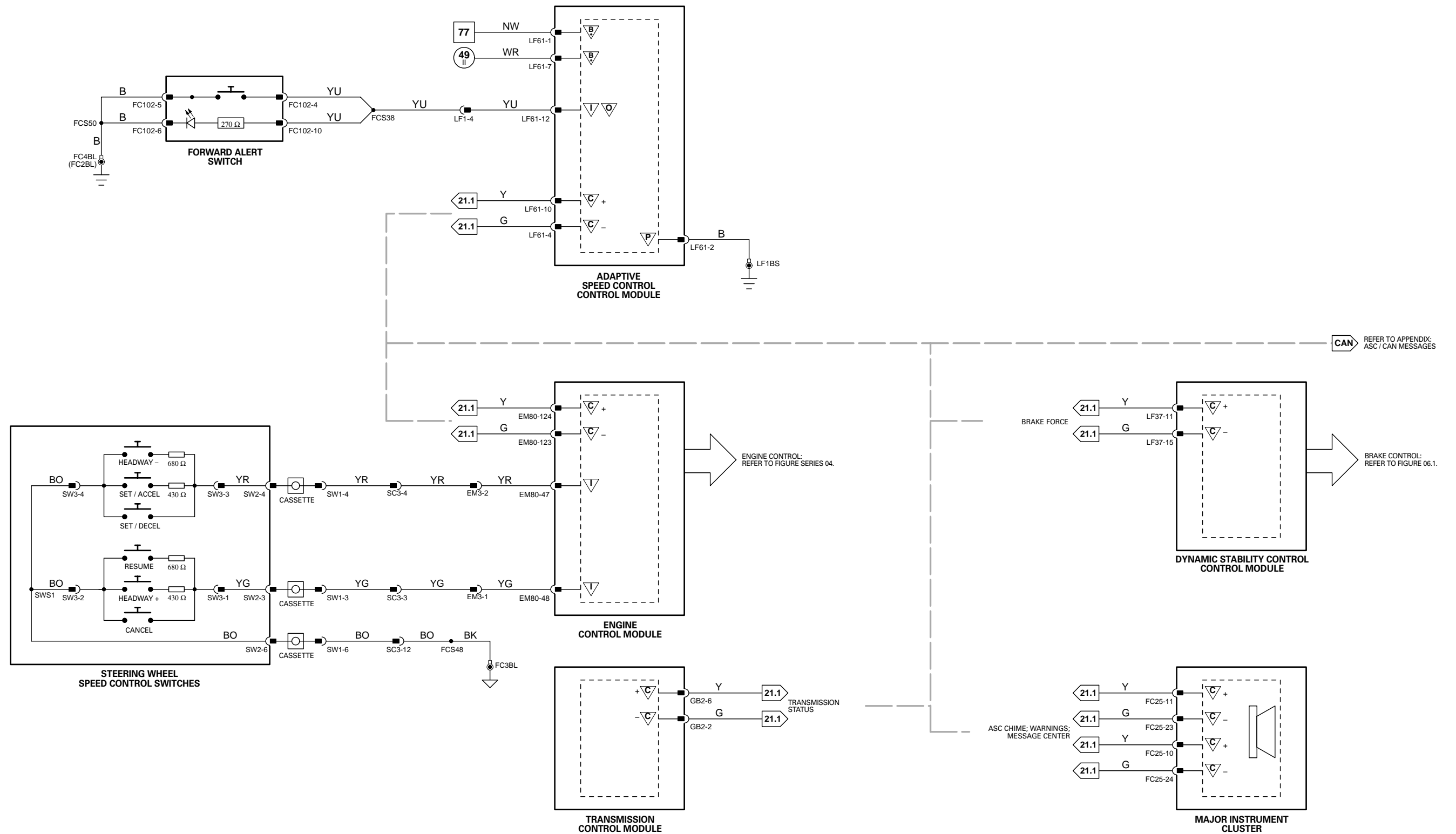
NOTE: J Gate Illumination Module – CAN "listen only" node for gear selector position indicators.

1 → 8 Fig. 01.1	9 → 52 Fig. 01.2	6 → 18 Fig. 01.4	61 → 93 Fig. 01.6
1 → 5 Fig. 01.1	53 → 87 Fig. 01.3	19 → 60 Fig. 01.5	1 → 17 Fig. 02.1

▽ Input	B Battery Voltage	▽ Sensor/Signal Supply V	▽ ACP	S SCP
▽ Output	P Power Ground	▽ Sensor/Signal Ground	C CAN	D Serial and Encoded Data

VARIANT: All Vehicles  
 VIN RANGE: All  
 DATE OF ISSUE: June 2002 (PROVISIONAL)

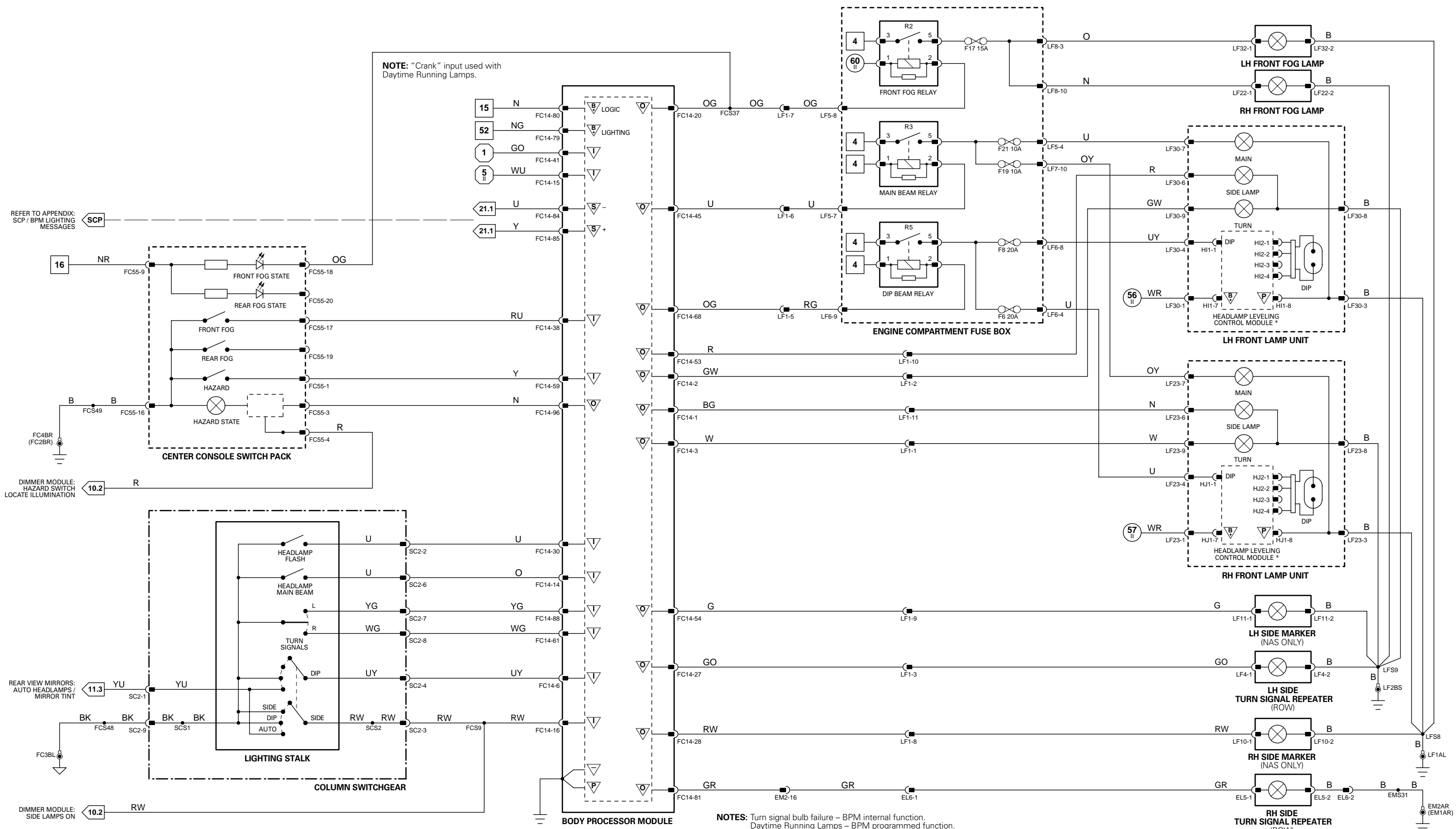




1	8	Fig. 01.1	9	52	Fig. 01.2	6	18	Fig. 01.4	61	93	Fig. 01.6
1	5	Fig. 01.1	53	87	Fig. 01.3	19	60	Fig. 01.5	1	17	Fig. 02.1

▽	Input	B	Battery Voltage	▽	Sensor/Signal Supply V	▽	ACP	S	SCP
▽	Output	P	Power Ground	▽	Sensor/Signal Ground	▽	CAN	D	Serial and Encoded Data

VARIANT: Adaptive Speed Control Vehicles  
 VIN RANGE: All  
 DATE OF ISSUE: June 2002 (PROVISIONAL)



REFER TO APPENDIX: SCP / BPM LIGHTING MESSAGES

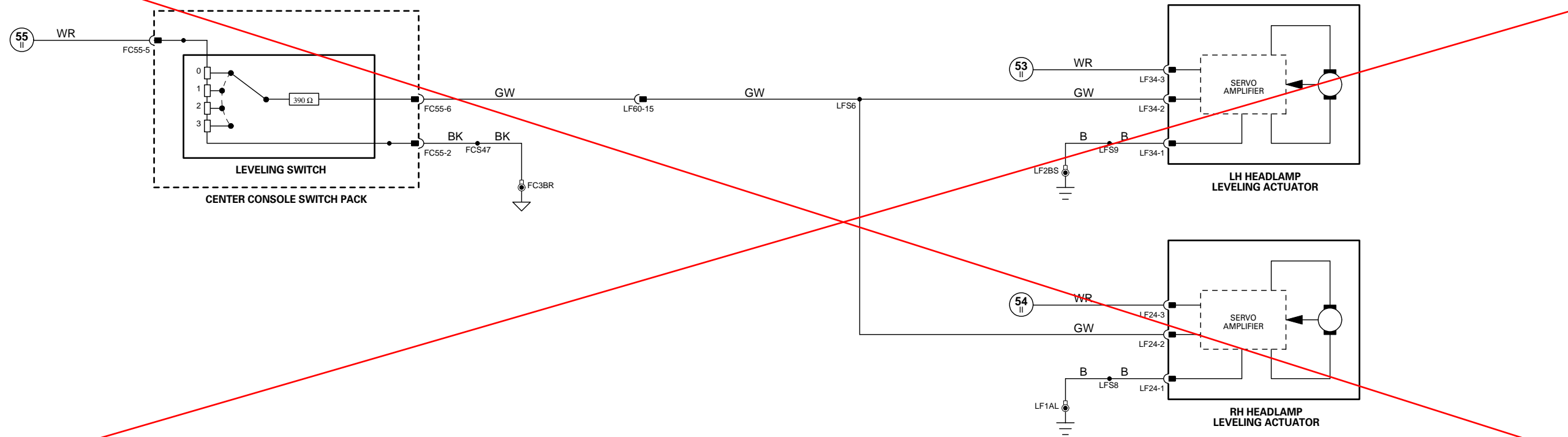
DIMMER MODULE: HAZARD SWITCH LOCATE ILLUMINATION

REAR VIEW MIRRORS: AUTO HEADLAMPS / MIRROR TINT

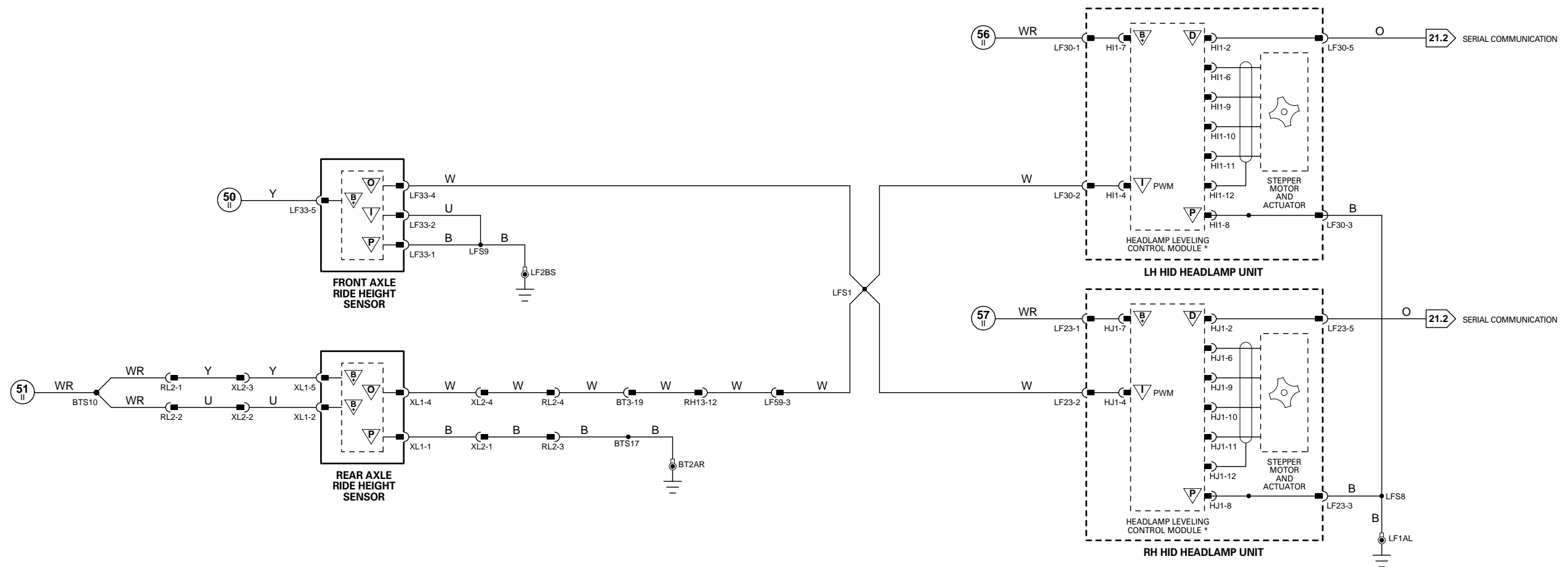
DIMMER MODULE: SIDE LAMPS ON

1 → 8 Fig. 01.1	9 → 52 Fig. 01.2	6 → 18 Fig. 01.4	61 → 93 Fig. 01.6	▽ Input	B Battery Voltage	▽ Sensor/Signal Supply V	▽ ACP	▽ SCP
1 → 5 Fig. 01.1	53 → 87 Fig. 01.3	19 → 60 Fig. 01.5	1 → 17 Fig. 02.1	▽ Output	P Power Ground	▽ Sensor/Signal Ground	▽ CAN	▽ Serial and Encoded Data

VARIANT: HID Headlamp Vehicles  
VIN RANGE: All  
DATE OF ISSUE: June 2002 (PROVISIONAL)



DRIVER-CONTROLLED HEADLAMP LEVELING



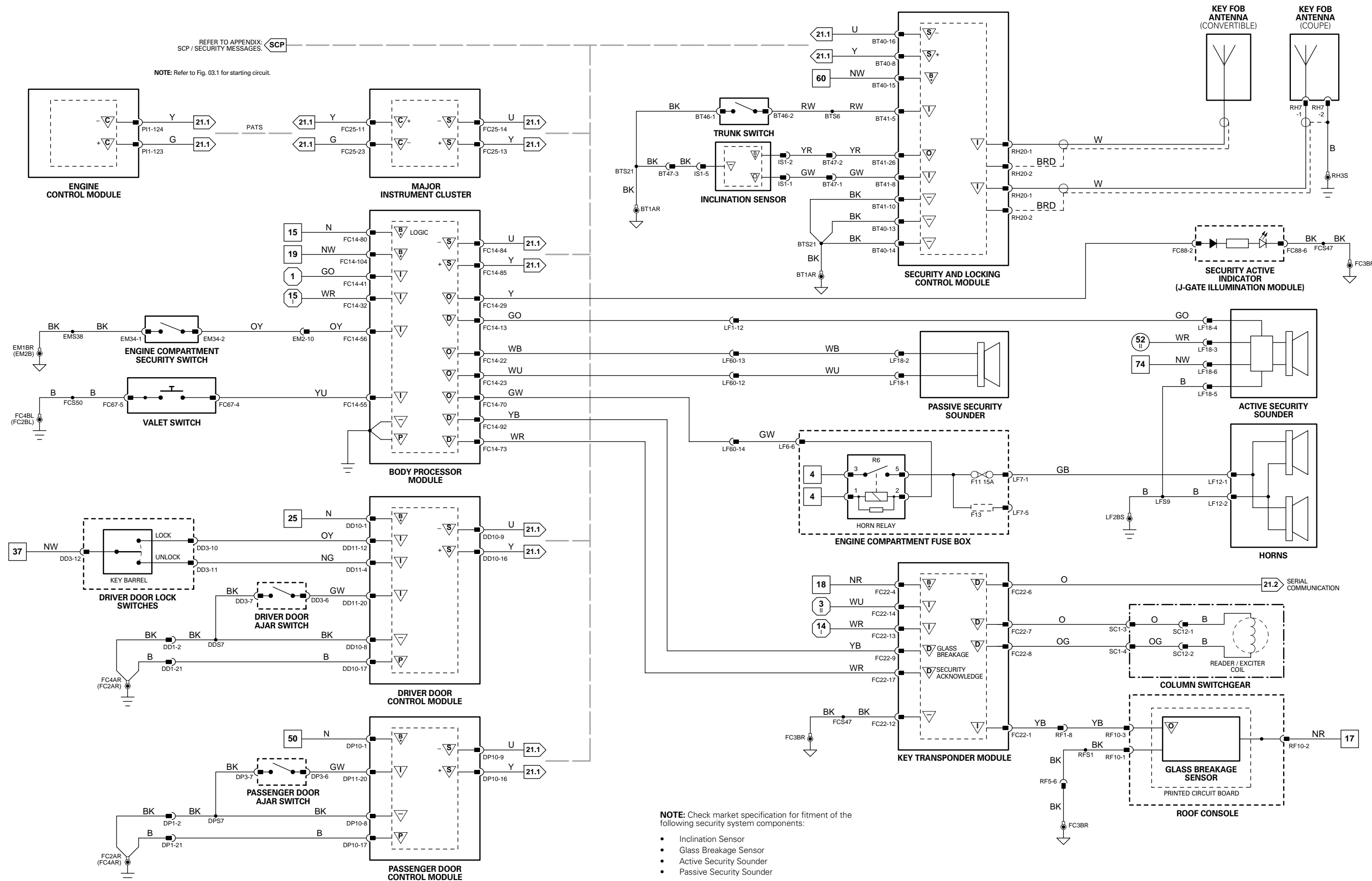
AUTOMATIC HEADLAMP LEVELING (HID HEADLAMPS)

\* NOTE: Refer to Fig. 09.2 for Headlamp Leveling Control Module exterior lighting details.

1 → 8 Fig. 01.1	9 → 52 Fig. 01.2	6 → 18 Fig. 01.4	61 → 93 Fig. 01.6	▽ Input	⌚ Battery Voltage	▽ Sensor/Signal Supply V	⌚ ACP	⌚ SCP
1 → 5 Fig. 01.1	53 → 87 Fig. 01.3	19 → 60 Fig. 01.5	1 → 17 Fig. 02.1	▽ Output	⌚ Power Ground	▽ Sensor/Signal Ground	⌚ CAN	⌚ Serial and Encoded Data

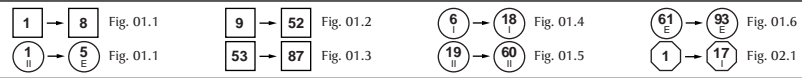
VARIANT: Headlamp Leveling Vehicles  
 VIN RANGE: All  
 DATE OF ISSUE: June 2002 (PROVISIONAL)





NOTE: Check market specification for fitment of the following security system components:

- Inclinometer Sensor
- Glass Breakage Sensor
- Active Security Sounder
- Passive Security Sounder



VARIANT: All Vehicles  
 VIN RANGE: All  
 DATE OF ISSUE: June 2002 (PROVISIONAL)



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