

2004 Cadillac XLR Systems

Course #10446.55B



Service
Know-How

Caution

In order to reduce the chance of personal injury and/or property damage, carefully observe the following information:

The service manuals of General Motors Corporation are intended for use by professional, qualified technicians. Attempting service procedures without the appropriate training, tools, and equipment could cause personal injury, vehicle damage, or improper vehicle operation. Proper vehicle service is important to the safety of the service technician and to the safe, reliable operation of all motor vehicles. If a replacement part is needed, use the same part number or an equivalent part. Do not use a replacement part of lesser quality.

The service manuals contain effective methods for performing service procedures. Some of the procedures require the use of tools that are designed for specific purposes.

Accordingly, any person who intends to use a replacement part, a service procedure, or a tool that is not recommended by General Motors, must first establish that there is no jeopardy to personal safety or the safe operation of the vehicle.

The service manuals contain Cautions and Notices that must be observed carefully in order to reduce the risk of injury. Improper service may cause vehicle damage or render the vehicle unsafe. The Cautions and Notices are not all-inclusive. General Motors cannot possibly warn of all the potentially hazardous consequences that may result by not following the proper service procedures.

The service manuals cover service procedures for vehicles that are equipped with Supplemental Inflatable Restraints (SIR). Failure to observe all SIR Cautions and Notices could cause air bag deployment, personal injury, or otherwise unneeded SIR repairs. Refer to the SIR component and wiring location views in Restraints before performing a service on or around SIR components or wiring.

If multiple vehicle systems are in need of repair, including SIR, repair the SIR system first to reduce the risk of accidental air bag deployment and personal injury.

2004 Cadillac XLR Systems

Foreword

This manual contains information about the systems found on the 2004 Cadillac XLR. Always refer to the applicable vehicle service information and appropriate Technical Service Bulletins for additional information regarding specific system operation and diagnostic/repair procedures.

When this manual refers to a brand name, a number, or a specific tool, you may use an equivalent product in place of the recommended item.

All information, illustrations and specifications in this manual are based on the latest product information available at the time of publication approval. General Motors reserves the right to make changes at any time without notice.

When technical assistance is required, call the Technical Assistance Center at 1-877-446-8227.

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1. Introduction

The 2004 Cadillac XLR luxury roadster with sports-car roots offers a stunning combination of style, performance and technology (figure 1-1):

- Throttle Actuator Control (TAC)
- Camshaft Position Actuator Control
- Dual Fuel Tanks
- 5L50-E Transmission w/Driver Shift Control (DSC)
- Easy Key
- Indexing Door Glass
- Rear Park Assist
- Power Folding Top
- Adaptive Cruise Control
- Head-Up Display (HUD)
- Heated/Cooled Seats



Figure 1-1, 2004 Cadillac XLR

— IMPORTANT —

The wiring diagrams included in this booklet are provided to enhance your understanding of system functions. Resources were preliminary. When servicing an actual vehicle, refer to latest published service information (SI).

1. Introduction

Scan Tool Communications

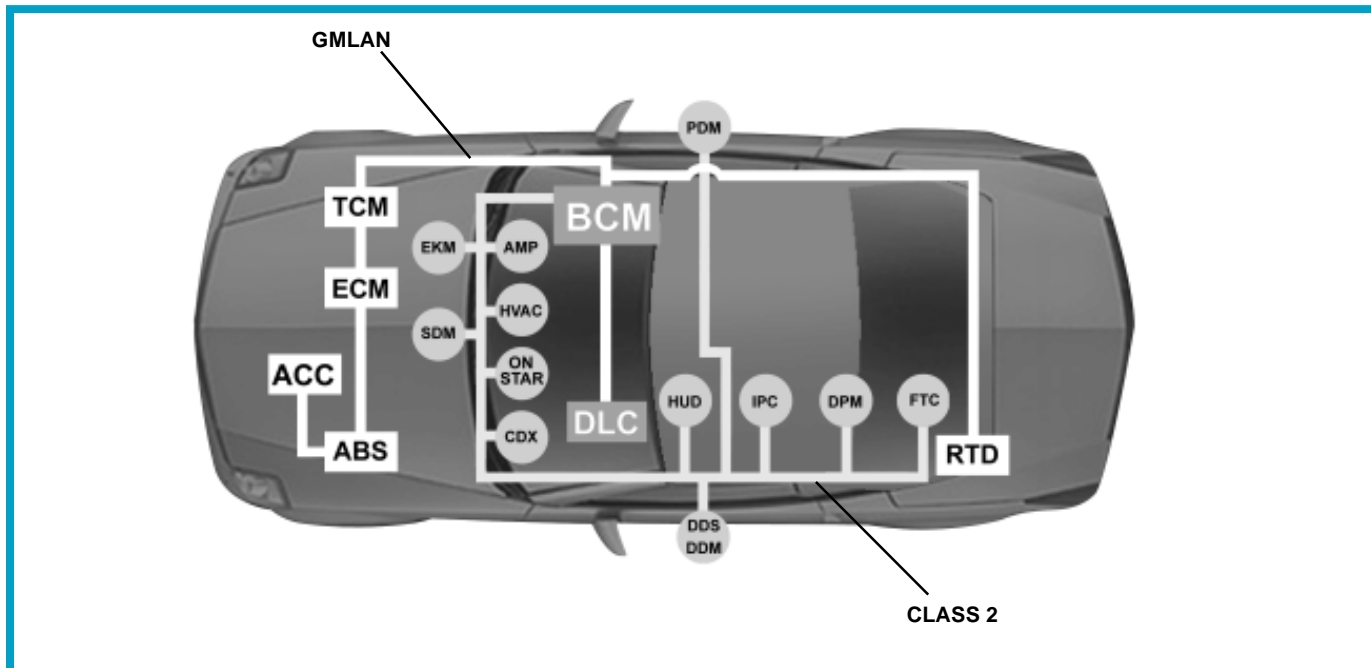


Figure 1-2, XLR Serial Data Buses*



Figure 1-3, CANdi Module

In order to truly understand the XLR vehicle systems, it is important to look at the new way these systems will be examined in the service bay.

As you learned in the Features video, there are two communications buses on the XLR: class 2 and the new high speed GMLAN data bus (figure 1-2). A scan tool, such as the Tech 2, requires a new additional link in your communication with the vehicle. It is called the CANdi module (figure 1-3). CANdi stands for Controller Area Network diagnostic interface. The CANdi module allows the scan tool to have bi-directional communications with both buses.

* Class 2 controllers are actually arranged in a "star" configuration. Layout shown was created to clearly identify both serial data buses and the included controllers.

Functional Diagnostics

Along with GMLAN, a new diagnostic strategy, called “functional diagnostics,” offers more detailed service information and a more direct way to interrogate vehicle systems and their operation.

One of the first things you will notice about functional diagnostics on the Tech 2 is that you only need to build the vehicle once. Then, you can go from vehicle system to vehicle system without re-identifying the vehicle for the tool. Also, the tool menu is divided up into functional areas (figure 1-4).

These functional areas align with the categories in the service information to aid diagnostic effectiveness. Main menu:

- F0 — Vehicle Control Systems
- F1 — HVAC
- F2 — Steering
- F3 — Suspension
- F4 — Brakes
- F5 — Engine
- F6 — Transmission/Transaxle
- F7 — Body & Accessories
- F8 — Restraints



Figure 1-4, Functional Diagnostics Menu

1. Introduction



Figure 1-5, Controller Listing



Figure 1-6, Priority Listing

F0: Vehicle Control Systems

F0: Vehicle Control Systems should be particularly noted. Selecting Computer/Integrating Systems under F0: Vehicle Control Systems and then Vehicle DTC Information, the scan tool individually checks each system module for communications and DTCs. A full chart is constructed as each is listed with the number of DTCs present (figure 1-5).

Once all the controllers have been contacted, the tool re-orders the module list (figure 1-6).

Communications errors and quantity of DTCs determine the order. When each controller is highlighted, the corresponding DLC pins are called out for diagnosing system communication concerns, if necessary.

Inside the various functional areas, there are more targeted data lists for each of the involved controllers. Each controller in the system will have a data list or lists that only concern the input and output parameters that contribute to that controller and its functional features.

DTC Symptom Numbers

As part of functional diagnostics, there is a slight variation to the DTC numbering strategy for most areas, other than powertrain. Powertrain DTCs are governed by OBDII standards.

To help reduce the number of DTCs, but at the same time provide more diagnostic information, there is an additional DTC “symptom” number used with GMLAN control modules. As shown in Figure 1-7, the 03 means an “voltage below threshold.” 07 would identify “voltage above threshold.”

Figure 1-8 lists the full range of possible symptom numbers to support functional diagnostics.

The DTCs for this vehicle include DTC symptoms. A DTC symptom is a 2-digit number which adds additional detail to a DTC. The DTC symptom provides the technician additional information without requiring a large increase in the number of new DTCs.

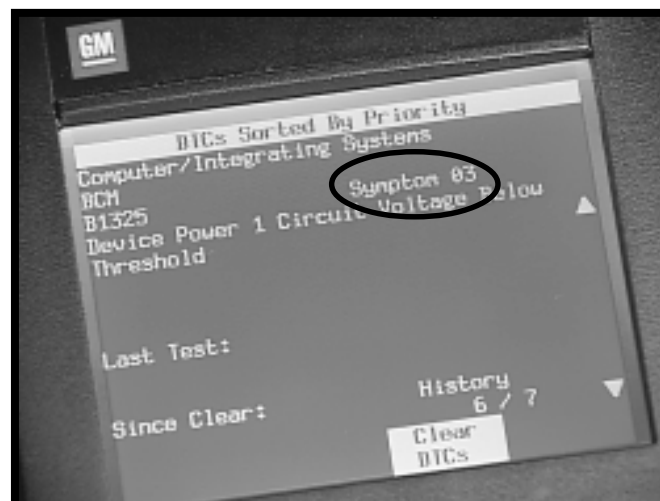


Figure 1-7, DTC with Symptom Number

DTC Symptom Categories

The DTC symptom is made up of 2 alphanumeric digits. The first digit following the DTC indicates the DTC symptom category. There are 16 possible categories available in the range of 0 through the letter F. Currently there are 8 categories in use, 0 through 7. These 8 categories together with their definitions are given below.

DTC Symptom Description

Category #	Category Name	Category Description
0	General Electrical Failures	This category includes standard wiring failure modes, direct current quantities related by Ohm's Law and quantities related to amplitude, frequency or rate of change, and wave shape.
1	Additional General Electrical Failures	This category includes the overflow from the previous category.
2	FM/PWM (Frequency/Pulse Width Modulated) Failures	This category includes faults related to frequency modulated and pulse width modulated inputs and outputs of the ECU. This category also includes faults where position is determined by counts.
3	ECU Internal Failures	This category includes faults related to memory, software, and internal electrical circuitry; requiring ECU replacement.
4	ECU Programming Failures	This category includes faults based related to operational software, calibrations, and options; remedied by programming the ECU.
5	Algorithm Based Failures	This category includes faults based on comparing two or more input parameters for plausibility or comparing a single parameter to itself with respect to time.
6	Mechanical Failures	This category includes fault detected by inappropriate motion in response to an ECU controlled output.
7	Bus Signal/Message Failures	This category includes faults related to bus hardware and signal integrity. This category is also used when the physical input for a signal is located in one ECU and another ECU diagnoses the circuit.
8 - F	Reserved by Document	Not in use at this time.

1. Introduction

DTC Symptom Description

DTC Symptom	DTC Symptom Description
00	no additional information
01	short to battery
02	short to ground
03	voltage below threshold
04	open circuit
05	short to battery or open
06	short to ground or open
07	voltage above threshold
08	signal invalid
09	rate of change above threshold
0A	rate of change below threshold
0B	current above threshold
0C	current below threshold
0D	resistance above threshold
0E	resistance below threshold
11	above maximum threshold
12	below minimum threshold
13	voltage low/high temperature
14	voltage high/low temperature
15	signal rising time failure
16	signal failing time failure
17	signal shape/waveform failure
18	signal amplitude < minimum
1F	intermittent
21	incorrect period
22	low time < minimum
23	low time > maximum
24	high time < minimum
25	high time > maximum
26	frequency too low
27	frequency too high
28	incorrect frequency
29	too few pulses
2A	too many pulses

1. Introduction

DTC Symptom	DTC Symptom Description
2B	missing reference
2C	reference compare error
31	general checksum failure
32	general memory failure
33	special memory failure
34	RAM failure
35	ROM failure
36	EEPROM failure
37	watchdog/safety processor failure
38	supervision software failure
41	operational software/calibration data set not programmed
42	calibration data set not programmed
44	security access not activated
45	variant not programmed
46	vehicle configuration not programmed
47	VIN not programmed
48	theft/security data not programmed
51	calculation failure
52	compare failure
53	temperature low
54	temperature high
55	expected number of transitions/events not reached
56	allowable number of transitions/events exceeded
57	expected reaction after event didn't occur
58	incorrect reaction after event
59	circuit/component protection time-out
61	actuator stuck
62	actuator stuck open
63	actuator stuck closed
64	actuator slipping
65	emergency position not reachable
71	invalid serial data received (signal validity bit indicates failure)
72	alive counter incorrect/not updated
73	parity error
74	value of signal protection calculation incorrect
75	signal above allowable range
76	signal below allowable range

2. Powertrain Systems Overview

Your experience with the previous-version Northstar will definitely contribute to your success on the next-generation Northstar used longitudinally on the rear-wheel drive XLR. Please note that the new Northstar is on initial corporate exchange for analysis of its updated technology. Refer to the service information and bulletins for program details.

Camshaft Position Actuator System

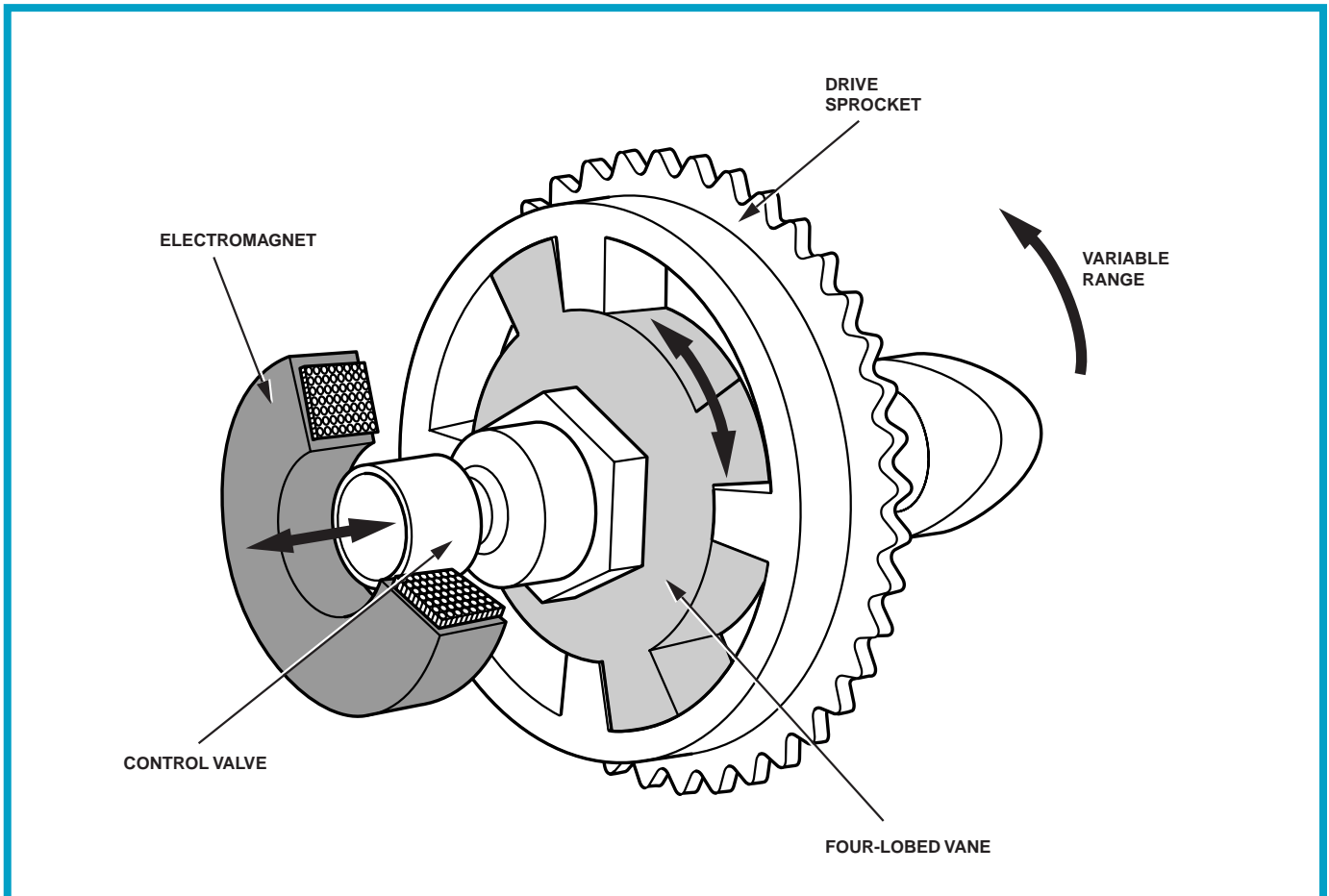


Figure 2-1, Camshaft Position Actuator System

The XLR variable valve timing system (identified as the “camshaft position actuator” system in service information) includes four vane-type camshaft position actuators, with integral control valves and electromagnets (figure 2-1). Because there are four camshaft position actuators, the intake and exhaust camshafts adjust independently of one another.

Cam phasing is continuously variable within a range of 40 degrees for the inlet valve timing and 50 degrees for exhaust valve timing. When the engine is Off or the actuators not commanded, the exhaust actuators are parked at the full advance position, while the intake actuators are parked at the full retard position.

The camshaft position actuators consist of a housing with an integral cam drive sprocket and cam sensor target wheel. Inside the housing is a four-lobed vane with oil pressure chambers on both sides of each lobe. The vane is bolted to the front of the camshaft and controlled by an integral, internal control valve.

2. Powertrain Systems Overview

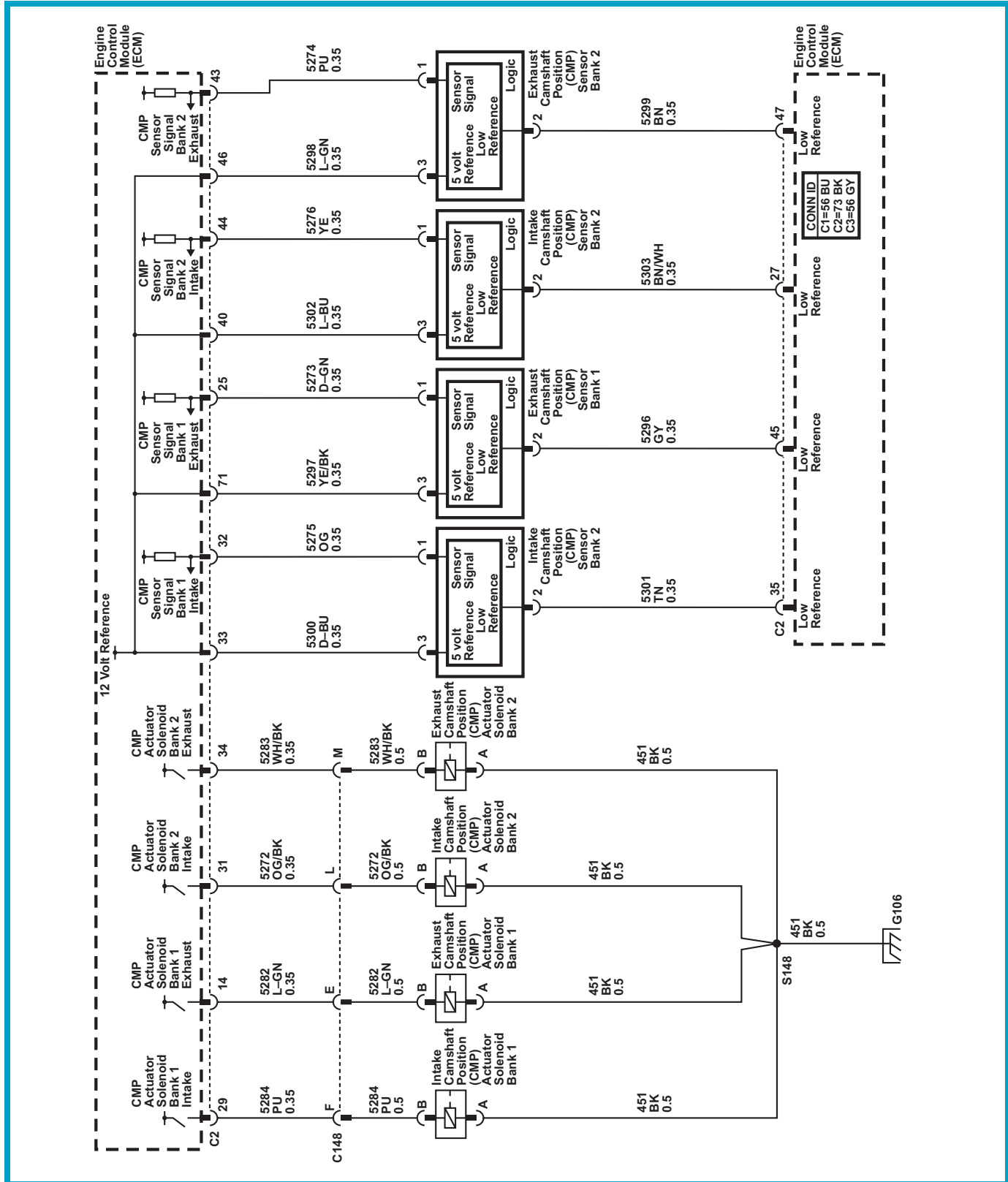


Figure 2-2, Camshaft Position Actuator System

2. Powertrain Systems Overview

The Engine Control Module (ECM) commands an electromagnet to actuate the valve inside the camshaft position actuator (figure 2-2). The ECM sends a 12-volt pulse width modulated (PWM) signal to operate the actuator solenoid when a cam timing change is desired. Control valve movement causes pressurized oil to flow to the chambers on alternate sides of the vane lobes, advancing or retarding the cam. The electromagnets are mounted to the aluminum housings, bolted to the front of the cylinder heads. Because the control valve is internal to the phaser, only one oil pressure feed is required to both advance and retard the camshaft.

The Camshaft Position (CMP) sensors are mounted in the variable valve timing housing (figure 2-3), one per camshaft.

The CMP actuator solenoid uses electromagnetic force to pull on the plunger of the oil control valve. The oil control valve ports the pressurized engine oil to either the advancing or retarding chambers of the CMP actuator to change camshaft position relative to the crankshaft position, as commanded by the ECM:

- With 0% PWM at the solenoids, all of the oil is ported to the advancing chambers of the exhaust CMP actuators and to the retarding chambers of the intake actuators
- At 100% PWM at the solenoids, all of the oil is ported to retarding chambers of the exhaust CMP actuators and to the advancing chambers of the intake actuators
- In operation, the average ECM PWM command is around 45%, which allows oil to port evenly to the advancing and retarding chambers and hold the camshafts in the desired position

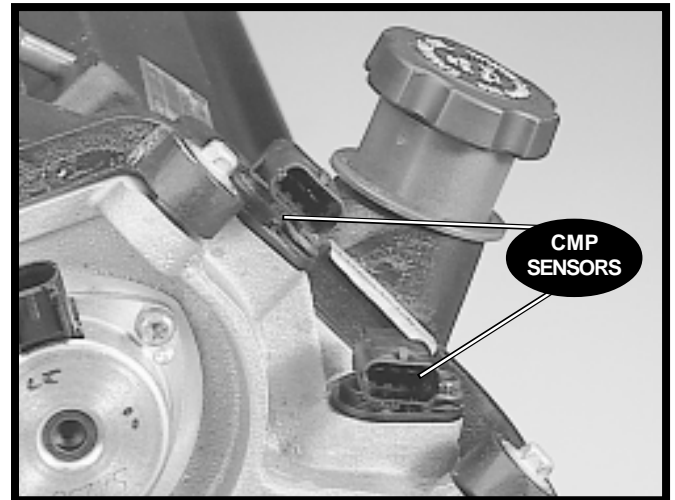


Figure 2-3, Camshaft Position (CMP) Sensors

2. Powertrain Systems Overview

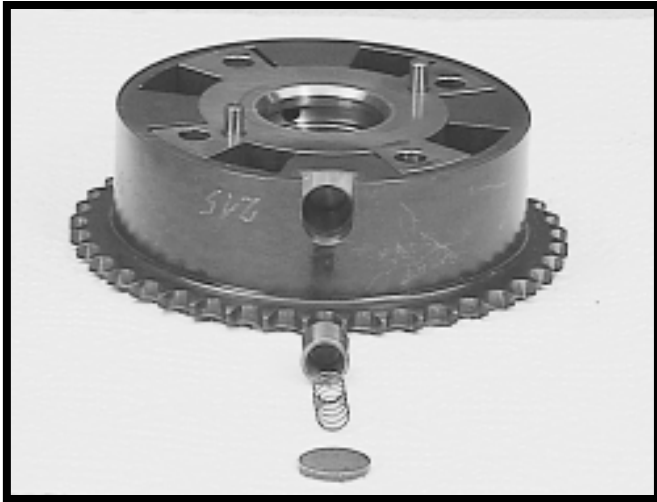


Figure 2-4, Actuator Locking Pin

The ECM calculates optimum camshaft position based on these inputs:

- Engine speed
- Manifold absolute pressure (MAP)
- Throttle position (TP)
- Crankshaft position (CKP)
- Camshaft position (CMP)
- Engine load
- Barometric pressure (BARO)

There is a spring-loaded locking pin (figure 2-4) in the intake actuators to avoid valvetrain noise during engine start-up. The locking pin releases the actuator when engine oil pressure increases to overcome the spring. Each of the exhaust actuators has a return spring that assists the actuator in overcoming valvetrain rotational inertia when returning to a parked position at engine shutdown. The camshaft position angle parameters on the scan tool will indicate 0° with the engine running and both intake and exhaust actuators in the parked position.

2. Powertrain Systems Overview

Throttle Actuator Control (TAC)

Similar to the CTS, the electronic “drive-by-wire” Throttle Actuator Control (TAC) system (figure 2-5) receives inputs for power demands from the driver via the pedal position sensor assembly at the accelerator pedal. There are actually two redundant sensors within the assembly for safety and accuracy. The accelerator pedal position sensor assembly supplies force feedback (or pedal feel) to the driver.

The throttle assembly incorporates the throttle actuator motor, throttle plate, and throttle position sensors in a common housing. The throttle is an 80-mm diameter, straight bore type. It is mounted on the coolant crossover, which heats and protects the throttle body from icing.

The throttle blade is positioned by the actuator motor according to ECM commands. There is no mechanical link between the accelerator pedal and the throttle. The ECM appropriately commands the throttle opening to regulate intake air.

Actual control is influenced by engine control sensors, cruise control commands, traction control events, and transmission shift energy commands as seen by the ECM.



Figure 2-5, Throttle Actuator Control (TAC) Throttle Body

2. Powertrain Systems Overview

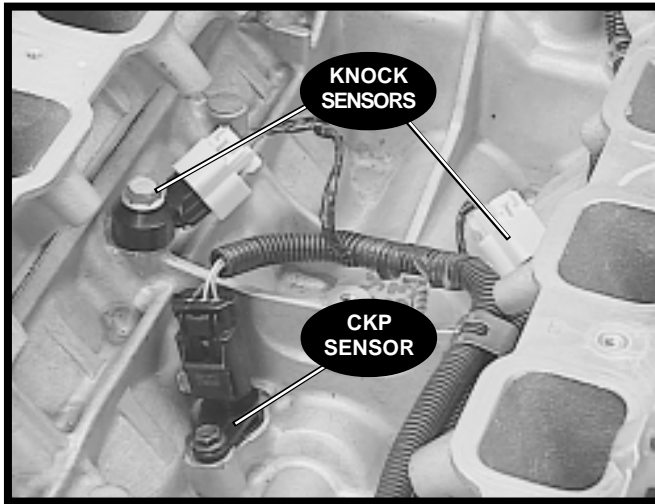


Figure 2-6, Crankshaft Position (CKP) Sensor

Crankshaft Position (CKP) Sensor

The Crankshaft Position (CKP) sensor is found under the intake manifold in the engine valley, rearward of the Knock Sensors (KS) (figure 2-6).

The reluctor for the CKP sensor is cast into the middle of the crankshaft for improved misfire accuracy. It has 58 evenly spaced teeth with a two-tooth timing gap. There is a unique pattern corresponding to each pair of cylinders that are TDC at the same time. This pulse-width encoding allows the ECM to more quickly determine cylinders at TDC.

Also note that with the four camshaft position sensors covered earlier (see figure 2-2), there is no need for a dual CKP arrangement as used on the previous Northstar.

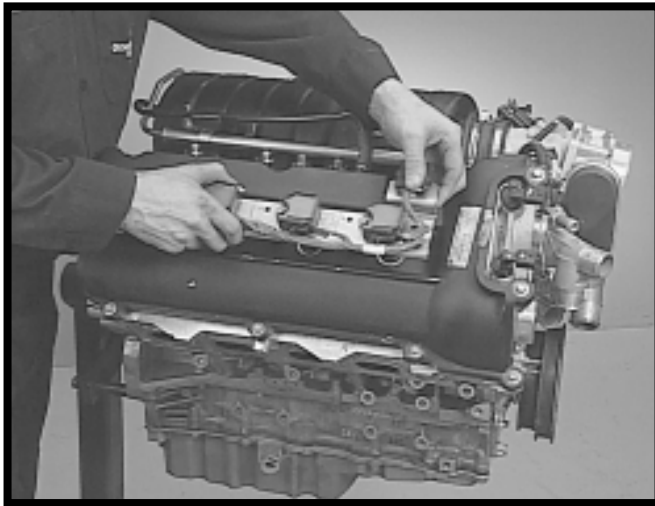


Figure 2-7, Coil-On-Plug Ignition

Ignition

The next-generation Northstar ignition utilizes a coil-on-plug arrangement (figure 2-7), which is a change from the current coil cassette module. Now, four pencil coils connect directly to the spark plugs at each cylinder head.

2. Powertrain Systems Overview

Wide-Band HO2S

The next-generation Northstar in the XLR uses wide-band heated oxygen sensors (HO2S) (figure 2-8) to measure pre-catalyst exhaust oxygen content. This new design combines a “pump cell” with the standard Zirconia Oxide sensor. With the pump cell, the sensor can more accurately handle extreme rich and lean conditions by adding or subtracting oxygen. This effect is factored into the output signal for the ECM.

There are six wires at the oxygen sensor connector (figure 2-9). Two circuits handle the heater function, while four are required for the wide-range pump cell monitoring.

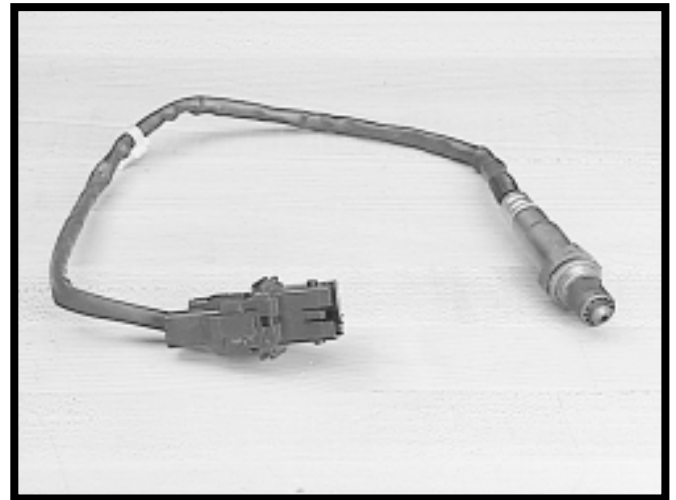


Figure 2-8, Heated Oxygen Sensor (HO2S)

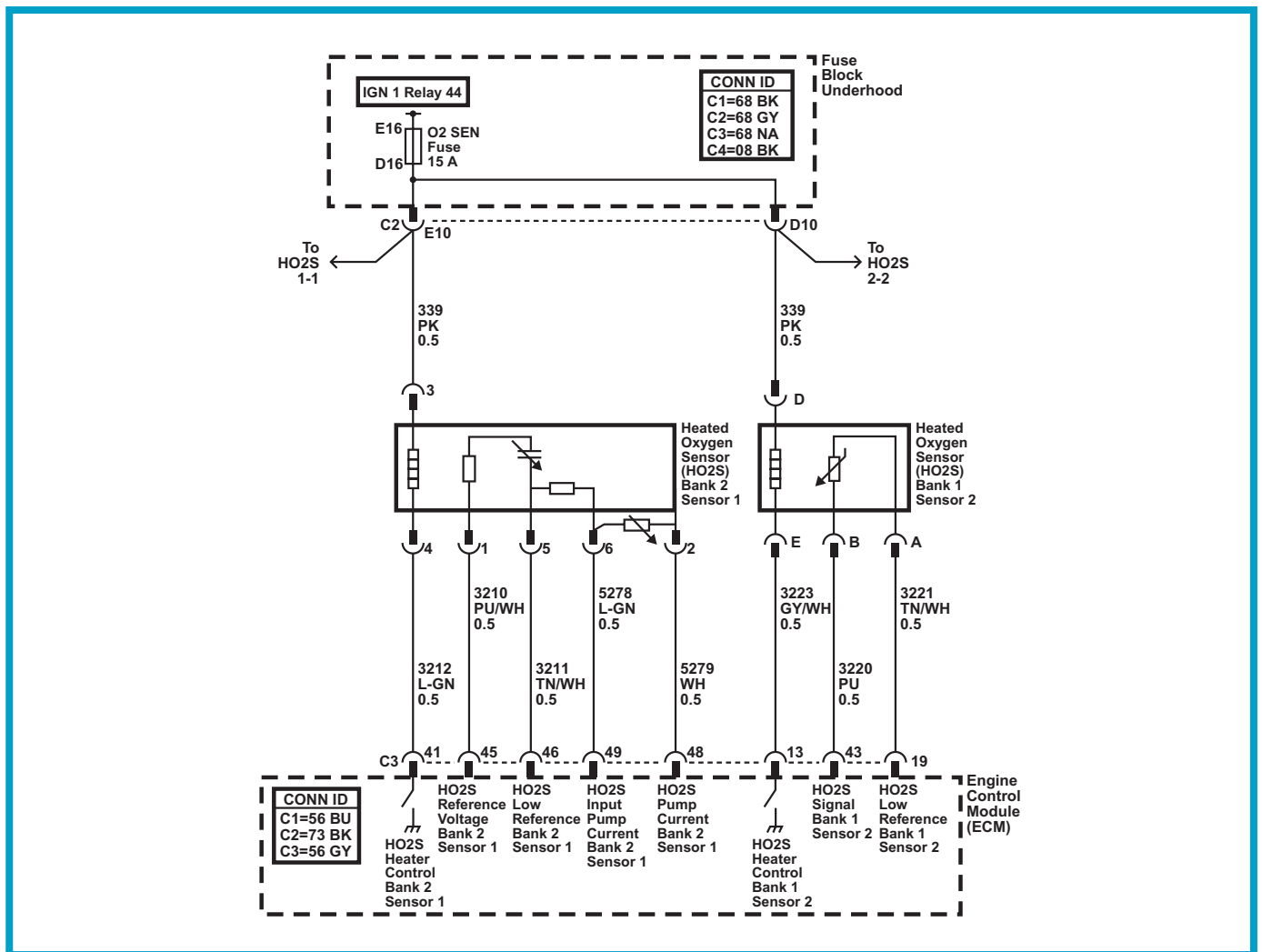


Figure 2-9, HO2S Circuits

2. Powertrain Systems Overview

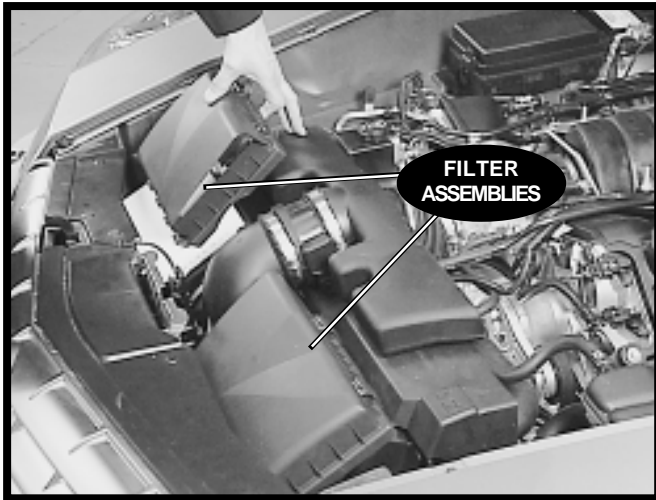


Figure 2-10, Twin Air Filters

Air Intake

The XLR features twin air filters that feed the single throttle body (figure 2-10). There are no air filter capacity indicators as found on other models. To protect the customer, always check the maintenance records. Verify air filter change intervals were addressed.

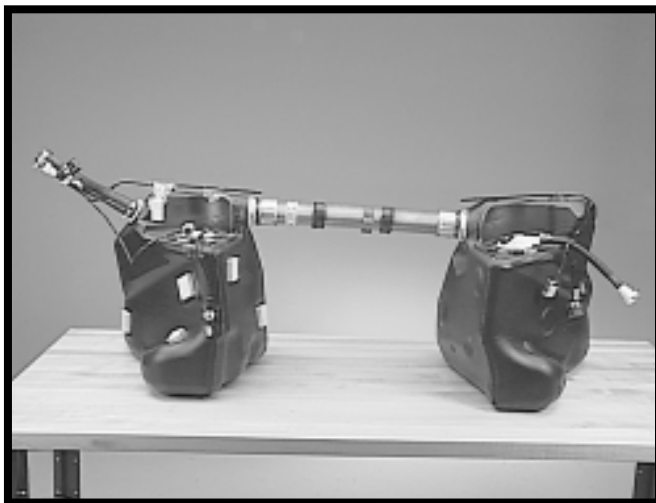


Figure 2-11, Dual Fuel Tanks

Fuel Supply System

The XLR features a returnless on-demand fuel system design with dual tanks (figure 2-11).

2. Powertrain Systems Overview

Fuel Pump Speed Control Module

The system uses a Fuel Pump Speed Control Module (FPSCM) for quieter operation and greater reliability. The fuel pump speed control module is mounted on the left rear inner wheel housing forward of the tire (figure 2-12). The inner splash panel must be removed to access the module.

The FPSCM runs the pump at a lower voltage and speed in low fuel usage conditions. Pump voltage is limited to a maximum of 16 volts. Overall, the module runs the pump at a lower duty cycle during the life of the vehicle.

The FPSCM varies the voltage level to the fuel pump based on a 128 Hz PWM signal from the ECM, which is read as the commanded voltage value. In turn, the control module adjusts the voltage to the pump. The module supplies both power and ground to the pump, which allows for enhanced pump diagnostics. Shorts, open circuits, intermittent operation and over voltage can be identified.

When the ignition switch is first turned On, the pump speed control module turns On the fuel pump to full power (figure 2-13). The fuel pump delivers fuel to the fuel rail and injectors. The fuel pressure regulator in each tank controls fuel pressure by allowing excess fuel to remain in the fuel tank. The regulators are only serviceable as part of the sender assembly.

The ECM alters pump speed by varying the duty cycle at the FPSCM. Under normal conditions, pump speed control operates between 10% to 90%. At vehicle idle, the control module sets voltage potential to the in-tank fuel pump to 9.5 volts. When higher fuel volume is required, the module increases to 100% of the available vehicle battery voltage to the in-tank fuel pump.



Figure 2-12, Fuel Pump Speed Control Module (FPSCM)

2. Powertrain Systems Overview

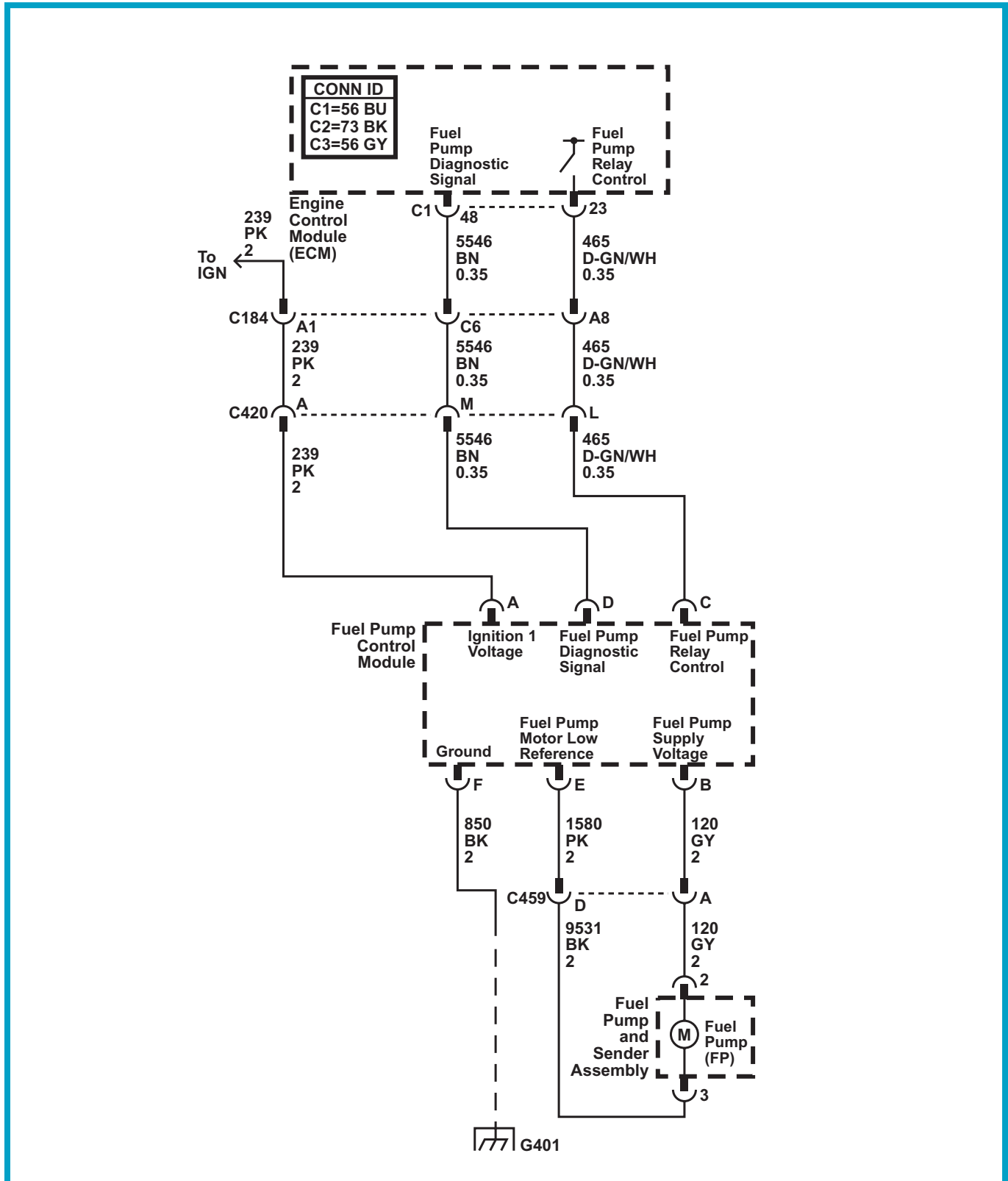


Figure 2-13, FPSCM Operation

2. Powertrain Systems Overview

Dual Fuel Tanks

Regarding the dual tank system on the XLR, anyone with Corvette experience will recognize similarities between the vehicles.

The fuel fill hose feeds into the left-side tank. The primary fuel sender assembly is also in the left tank.

The two fuel tanks are connected by a stainless steel crossover hose that houses the auxiliary fuel feed from the left tank to the right and the fuel return lines from the right tank (figure 2-14).

There are two fuel sender/sensor assemblies, one for each tank. The fuel level sensors and float arms are similar to those on other systems and are serviceable.

The electric turbine-style fuel pump is located in the fuel tank module reservoir inside the left tank. Fuel is drawn into the reservoir by a venturi pump powered by the electric pump. The electric pump draws fuel from the reservoir.

The fuel pump sends high-pressure fuel through the fuel filter in the upper part of the tank module and on through the fuel feed pipe to the fuel injection system.

A line from the filter directs fuel to the primary fuel pressure regulator, which is also part of the left fuel tank module assembly. This primary regulator maintains the correct fuel pressure to the fuel injection system. The filters, like the regulators, are serviced with the sender assemblies.

As the fuel pump operates, it also supplies a small amount of pressurized fuel to an integral venturi jet tube that attaches to the bottom of the left fuel sender assembly (figure 2-15). The function of the jet tube is to fill the fuel sender reservoir. The pressurized fuel from the fuel feed pipe creates a venturi action inside a siphon pump in the right fuel sender assembly. The siphon action causes the fuel to be drawn out of the right fuel tank. The fuel transfers from the right fuel tank to the left fuel tank through the auxiliary fuel return pipe. This transfer process does not ensure both tanks are equal. The end of the pipe feeds returning fuel from the right tank directly into the left tank reservoir and is held in position by a plastic clip.

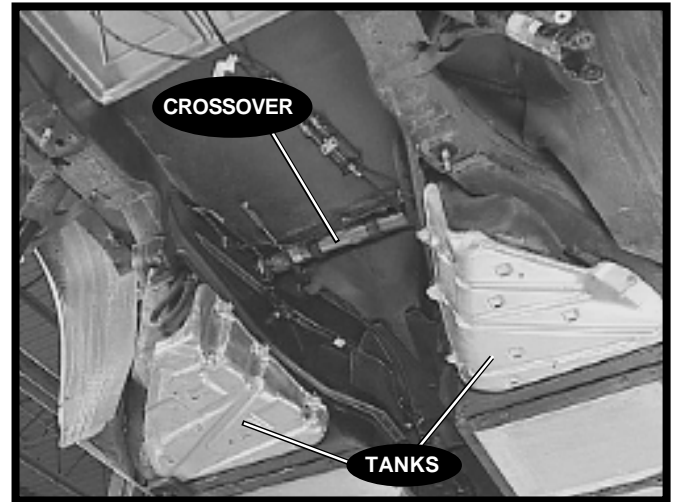


Figure 2-14, Fuel Tanks' Crossover

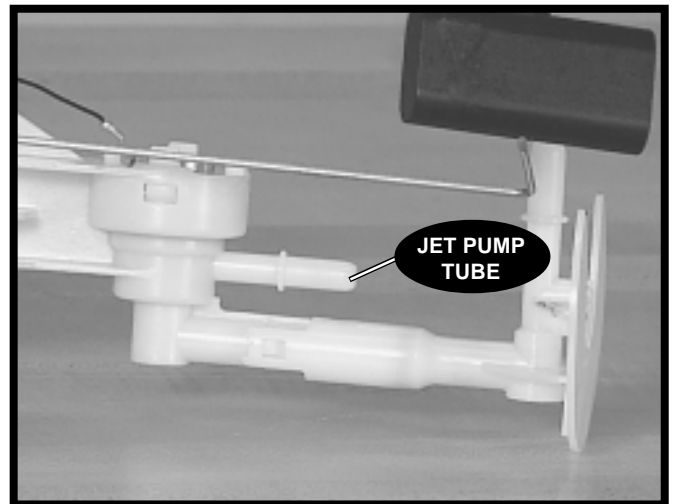


Figure 2-15, Jet Pump Tube

2. Powertrain Systems Overview

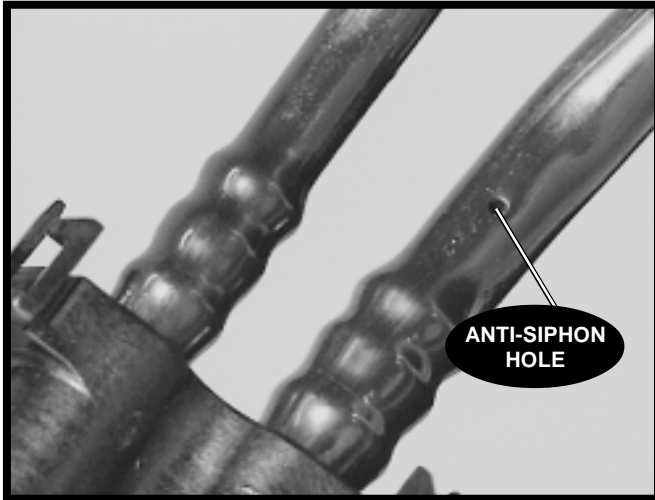


Figure 2-16, Auxiliary Fuel Return Pipe

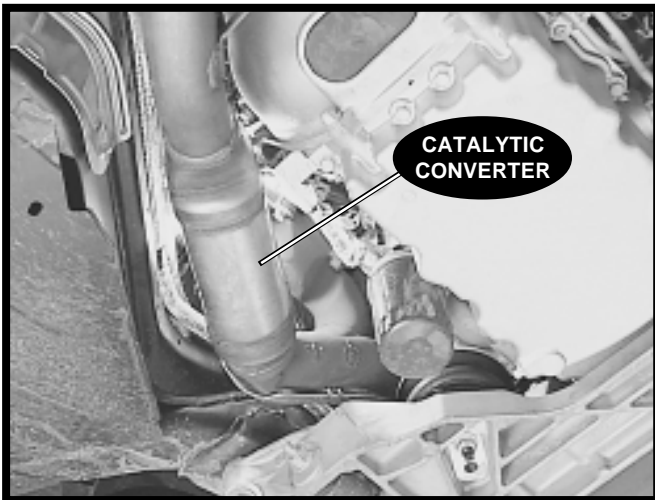


Figure 2-17, Integral Catalytic Converter

The auxiliary fuel return pipe contains an anti-siphon hole where it enters the left tank (figure 2-16). This helps prevent fuel from siphoning from the left fuel tank into the right.

Both the auxiliary fuel feed pipe and the auxiliary fuel return pipe run through the convoluted stainless steel crossover hose that connects the tanks.

A secondary fuel pressure regulator, located in the right fuel sender assembly, keeps fuel available to the siphon jet pump at a regulated pressure. The secondary fuel pressure regulator has a lower set-point than the primary regulator to allow fuel to flow to the right-hand jet pump. When the engine is shut off, the pressure in the feed lines immediately drops to the secondary regulator set-point. This ceases siphon jet pump operation and, in turn, prevents the equalization of the left and right fuel tanks.

The fuel pump contains a reverse flow check valve. This valve and the two pressure regulators maintain fuel pressure in the fuel feed pipe and the fuel rail in order to prevent long cranking times.

The fuel system incorporates On-board Refueling Vapor Recovery (ORVR).

Integral Catalytic Converters

Exhaust manifolds direct exhaust gas flow to the integral catalytic converters with minimal loss in exhaust energy (figure 2-17). Exhaust manifolds are cast from high silicon/molybdenum ferritic nodular iron. The exhaust manifolds also have triple layer heat shields.

2. Powertrain Systems Overview

Variable Speed Cooling Fan Control

The engine cooling fan is a variable speed fan (figure 2-18). The ECM controls the fan speed by sending a PWM signal to the cooling fan control module. The module varies the voltage drop across the engine cooling fan motor in relation to the PWM signal. This control strategy parallels the Fuel Pump Speed Control Module (FPSCM) covered earlier in this booklet.

Cooling fan speed is effected by many different conditions and can be adjusted from 10% to 90% duty cycle (PWM), 90% is considered high-speed fan. When multiple cooling fan speed requests are received, the ECM uses the highest cooling fan speed of all the requests. The ECM commands the cooling fan On under the following conditions:

- Cooling fan duty cycle starts when engine coolant temperature reaches approximately 86° C (187° F) and reaches high speed at temperatures above 113° C (235° F)
- Cooling fan duty cycle starts when A/C pressure reaches approximately 600 kPa (87 psi) and reaches high speed at A/C pressures above 2480 kPa (360 psi)
- At engine oil temperatures above approximately 150° C (302° F), the cooling fan duty cycle will be commanded to high speed
- At transmission oil temperatures above approximately 132° C (270° F), the cooling fan duty cycle will be commanded to high speed
- After the vehicle is shut Off, if the engine coolant temperature at Key-Off is greater than 113° C (235° F) or the A/C pressure is greater than 1720 kPa (249 psi), the cooling fan duty cycle is set to 50% (low speed). If the coolant temperature drops below 110° C (230° F) and the A/C pressure drops below 1660 kPa (241 psi), the fan will shut Off. The fans will automatically shut Off after 2 minutes, regardless of coolant temperature

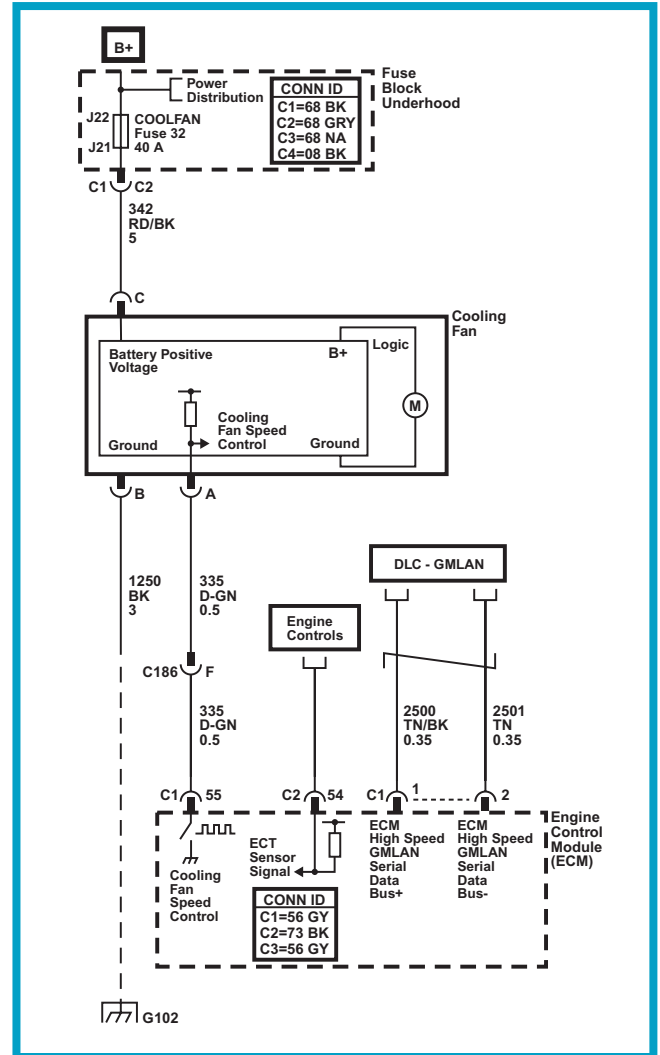


Figure 2-18, Variable-Speed Engine Cooling Fan

2. Powertrain Systems Overview

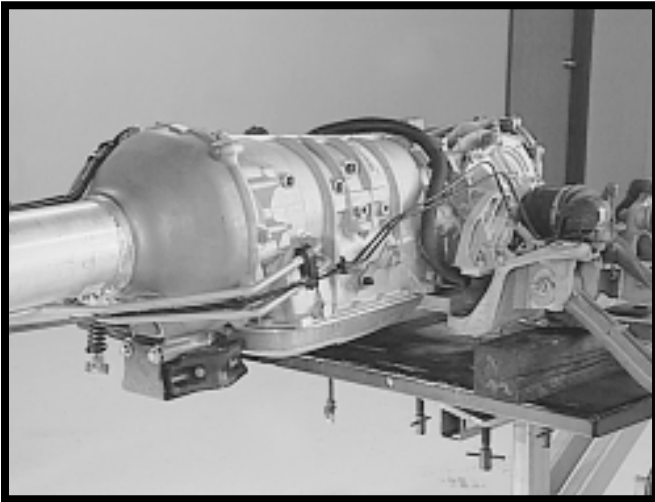


Figure 2-19, 5L50-E

5L50-E Automatic Transmission

The XLR uses a 5L50-E automatic transmission mounted at the rear, mated to a differential assembly (figure 2-19). All shift decisions are made through a Transmission Control Module (TCM) (figure 2-20).

The manual-style “tap-up/tap-down” function of the Driver Shift Control (DSC) system interfaces with the TCM as well as other vehicle controllers via serial data (figure 2-21).

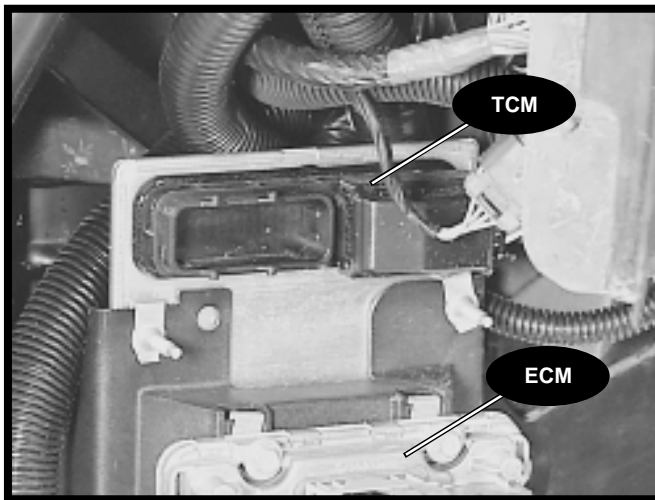


Figure 2-20, Transmission Control Module (TCM)

2. Powertrain Systems Overview

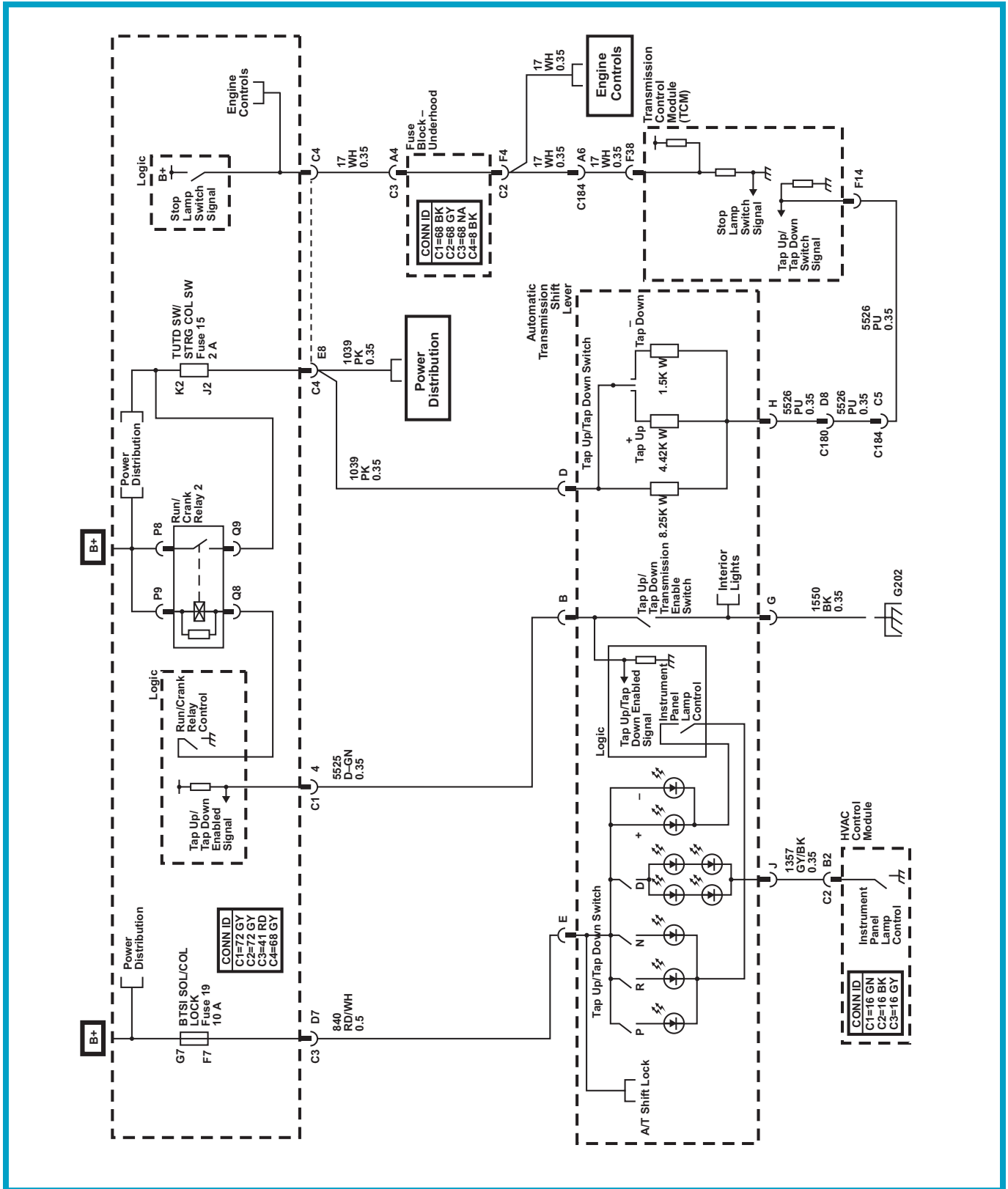


Figure 2-21a, 5L50-E Transmission Control (1 of 2)

2. Powertrain Systems Overview

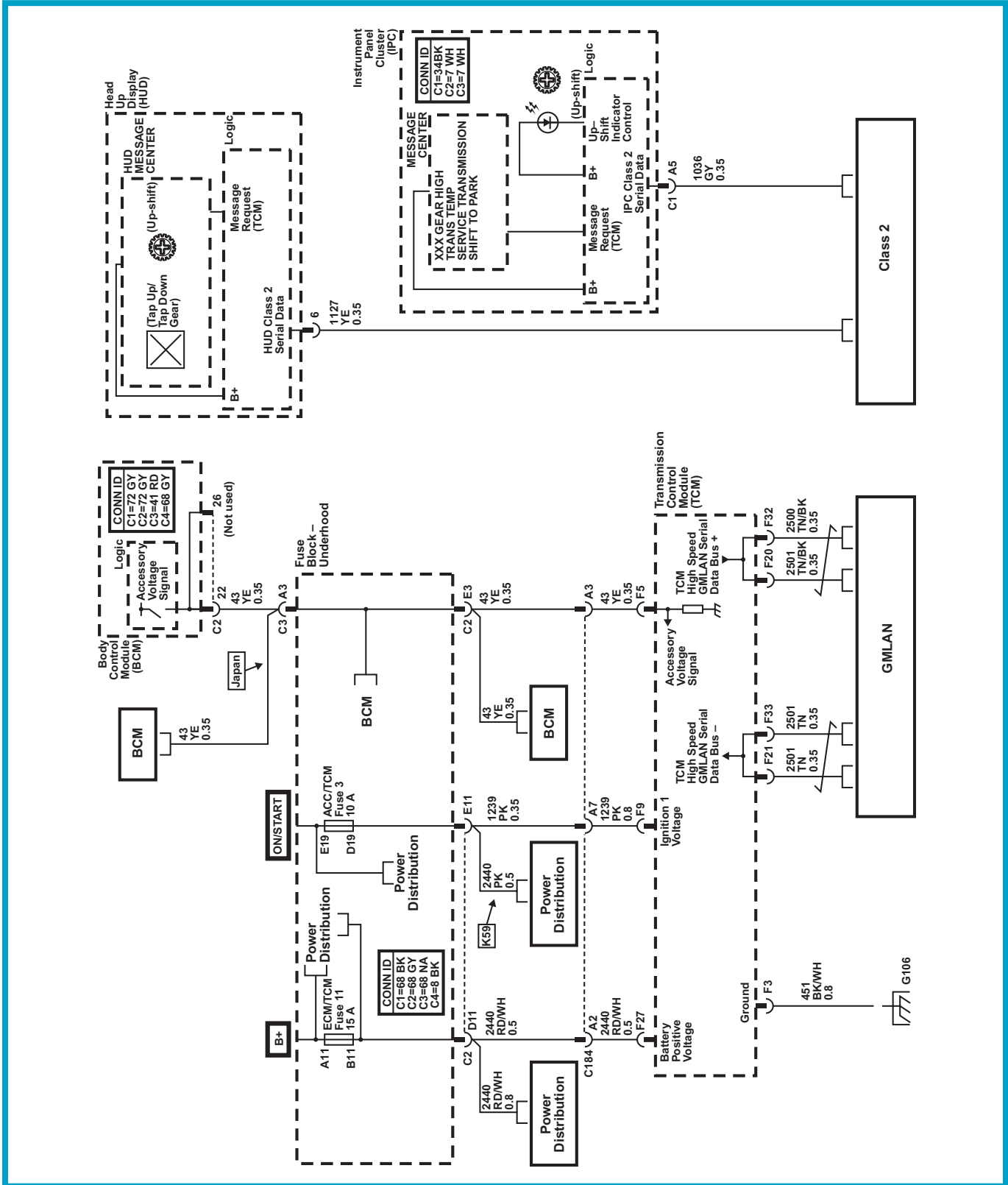


Figure 2-21b, 5L50-E Transmission Control (2 of 2)

2. Powertrain Systems Overview

Two important items are worth noting on the 5L50-E:

- The 5L50-E's TCM is on exchange for the XLR introduction. Be sure to reference service information for details
- If a 5L50-E SRTA unit is required, remember that the output shaft connecting the transmission to the final drive cannot be removed. The shaft is retained by a blind snap ring. Therefore, the old shaft must remain with the old unit and a new output shaft and snap ring must be ordered (figure 2-22). The new shaft and snap ring will not come with the SRTA

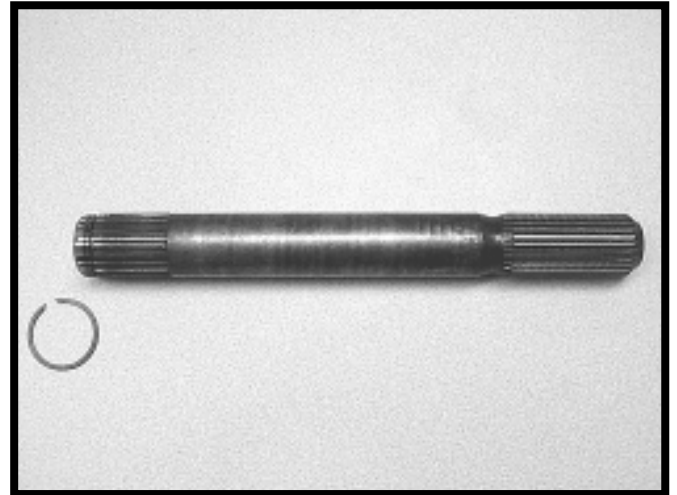


Figure 2-22, 5L50-E Output Shaft and Snap Ring

3. Exterior Systems Overview

Easy Key — Vehicle Entry

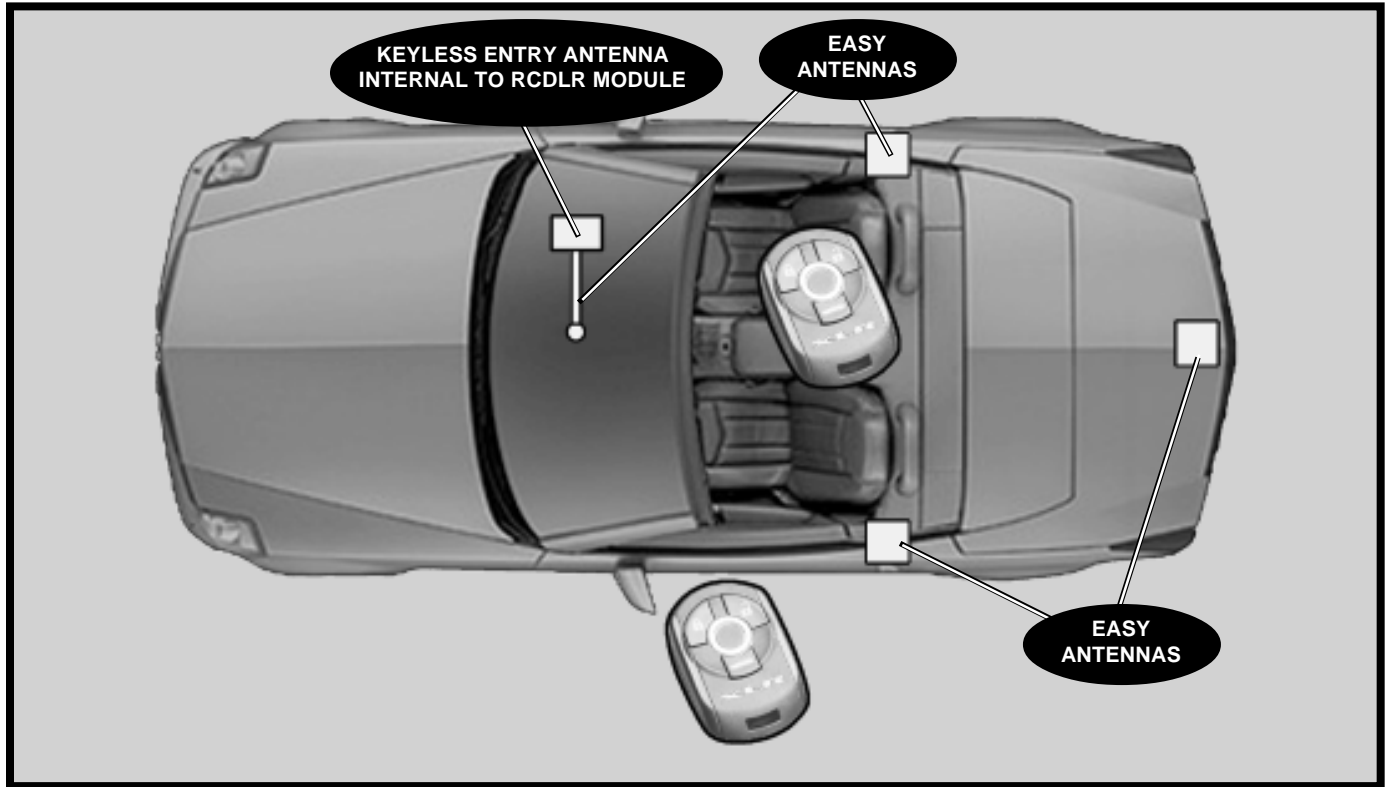


Figure 3-1, Easy Key

With Easy Key, you only need to have the fob in your possession within one meter of the vehicle and you can press the handle switch and open the door (figure 3-1). This same concept also applies when opening the trunk with the button located on the outside of the vehicle.

Within a 100-meter radius, you also may choose to use the fob to unlock the vehicle or open the trunk before reaching the vehicle, similar to other keyless entry systems.

Control Module

The Easy Key module, referred to as the Remote Control Doorlock Receiver (RCDLR) in SI, is located in the instrument panel, behind the upper portion of the center console (figures 3-2 and 3-3). Entry and starting commands are handled via serial data. The system will act as back-up power mode master in the event of a BCM failure or one that would cause the BCM to not be able to perform its power mode master functions.

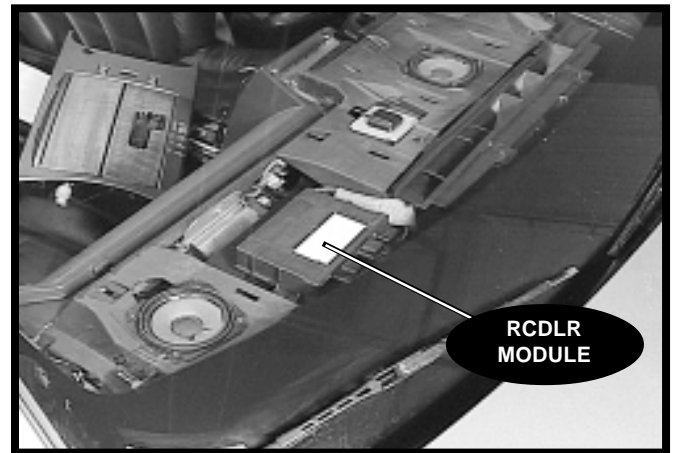


Figure 3-2, Easy Key Module

3. Exterior Systems Overview

Antennas

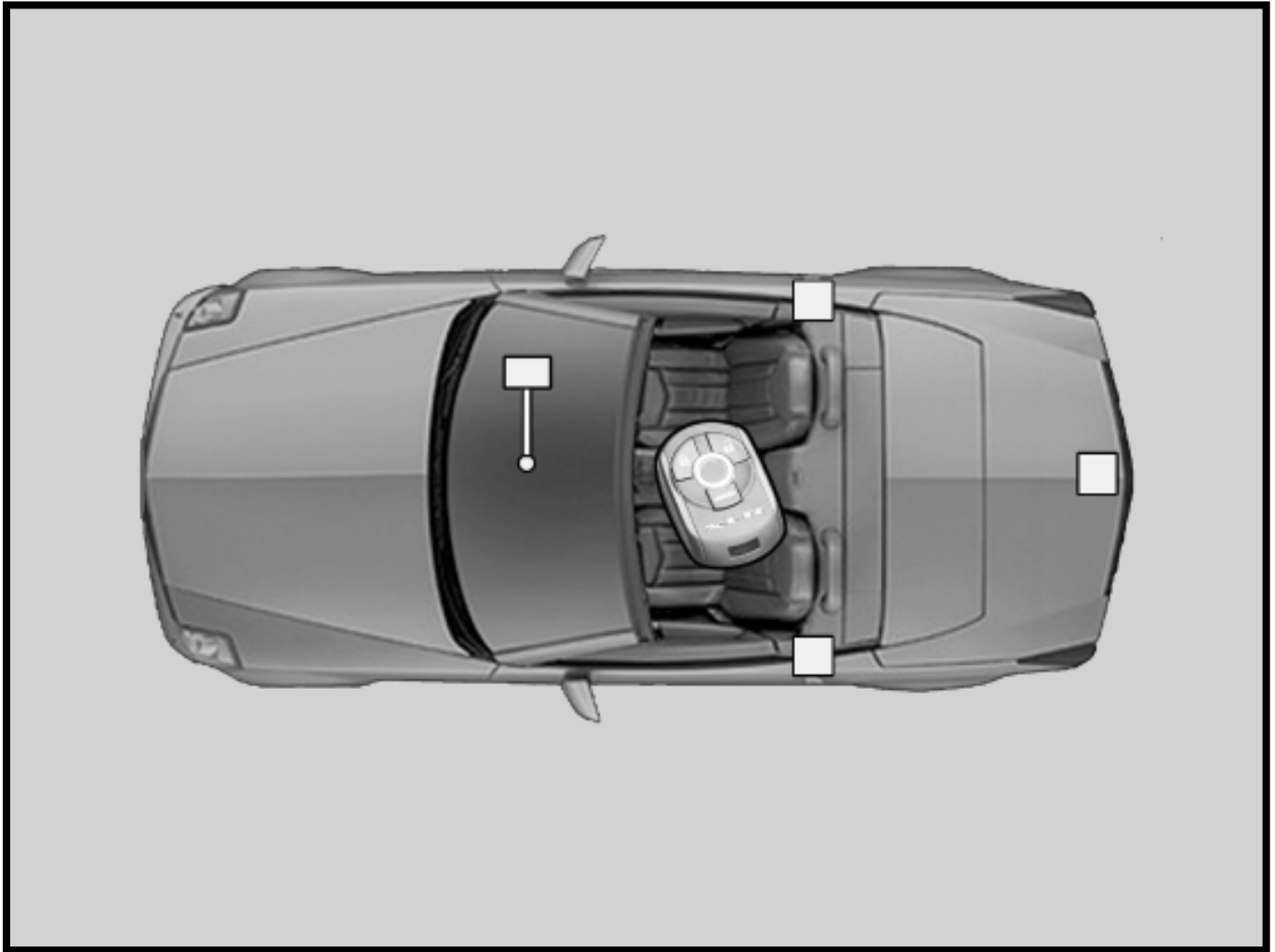


Figure 3-4, Easy Key Antennas

There are four ferrite stick antennas located in the vehicle (figure 3-4): There is one in the trunk, one in each B-pillar at door height, and one in the glovebox. These antennas are used to determine whether the fob is in (or out of) the vehicle. When a certain action is performed, the Easy Key module polls all the antennas at 125 kHz to determine fob location.

All remote commands (such as remote unlocking/locking/trunk/panic) are RF transmissions that are received at 315 MHz by a fifth antenna that's internal to the Easy Key module.

The antenna in the glove box is a limp-home (back-up) antenna. This antenna not only helps determine fob position, but also provides a low frequency coupling to the fob in the event that the fob battery goes dead or the RF transmissions are being jammed. There is a pocket for the fob inside the glovebox, placing the fob in the pocket allows the XLR to be started in an Easy Key system limp-home mode. Do not confuse Easy Key limp-home with a typical limp-home mode that can occur with a powertrain-related default.

The push-button start portion of the Easy Key system is covered in more detail in the Interior Systems section of this booklet.

3. Exterior Systems Overview

Door Functions

Along with actuating all door and window functions, the Passenger Door Module (PDM) (figure 3-5) and Driver Door Module (DDM) interface with the Door Lock/Unlock switches to determine whether either switch is opened or closed (figure 3-6). This status is reported on the class 2 data bus.

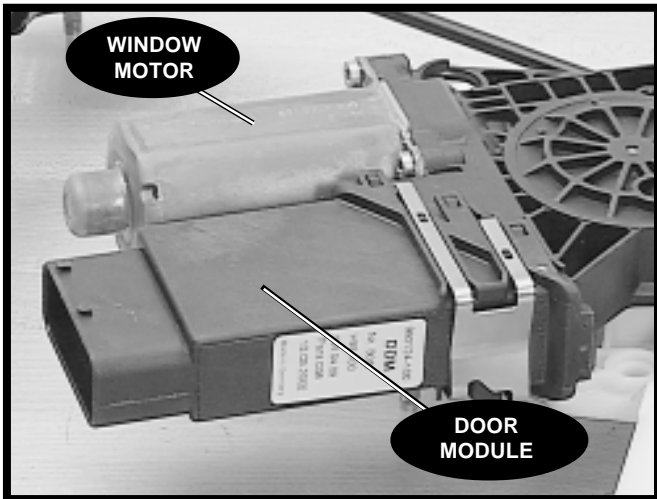


Figure 3-5, Door Module

3. Exterior Systems Overview

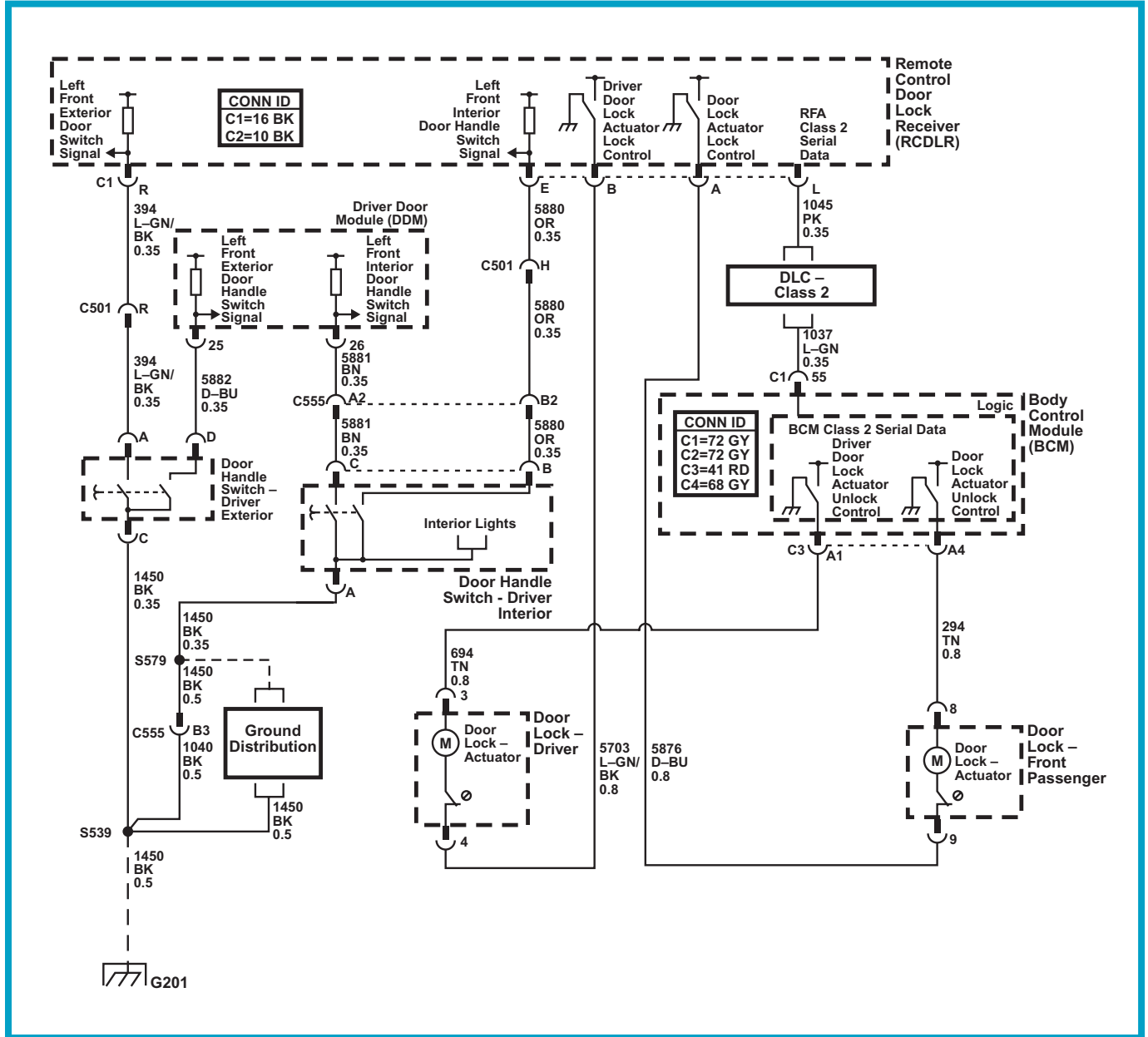


Figure 3-6a, Door System Operation (1 of 2)

3. Exterior Systems Overview

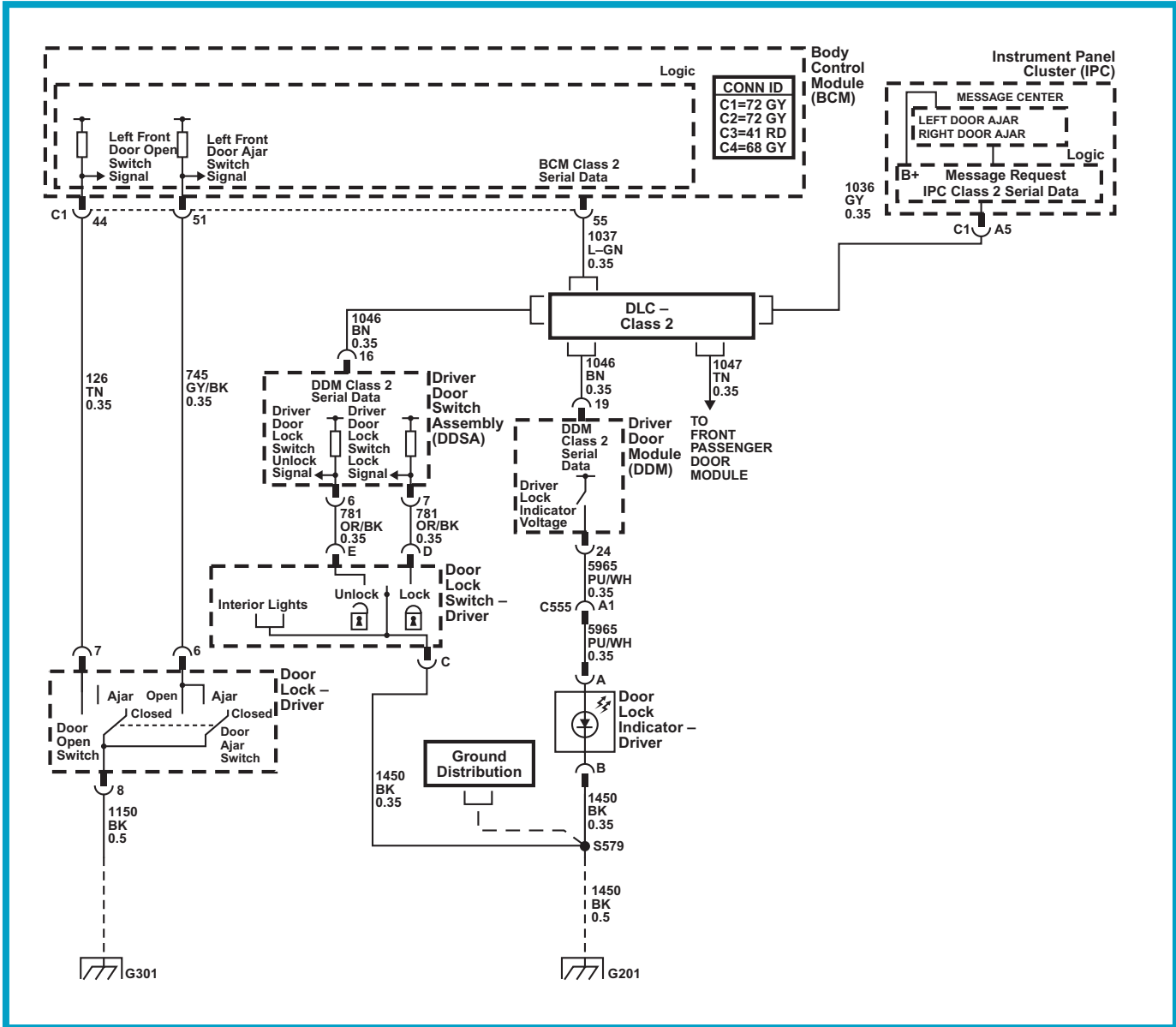


Figure 3-6b, Door System Operation (2 of 2)

3. Exterior Systems Overview

Each window regulator is integral with its door module. Both are serviced as one assembly.

Instead of door handle buttons, the XLR uses a “bladder-type” press switch just inside the top outside edge of the door (figure 3-7).

There are door switches mounted on the inner trim panel where you would expect to find the typical handle mechanism.

The door modules store lock/unlock status for the driver door and passenger door in normal lock/unlock operation after a battery disconnect condition.

Each door module provides display of lock/unlock status via the corresponding red LED at the top edge of the door (figure 3-8):

- When the door is closed, there are two short flashes per second if the door is unlocked. When the closed door is locked, the LED shows one long flash for three seconds
- While a door is open and unlocked, the LED shows short continuous flashes during a 1-second period. If the open door is locked, the LED is ON solid

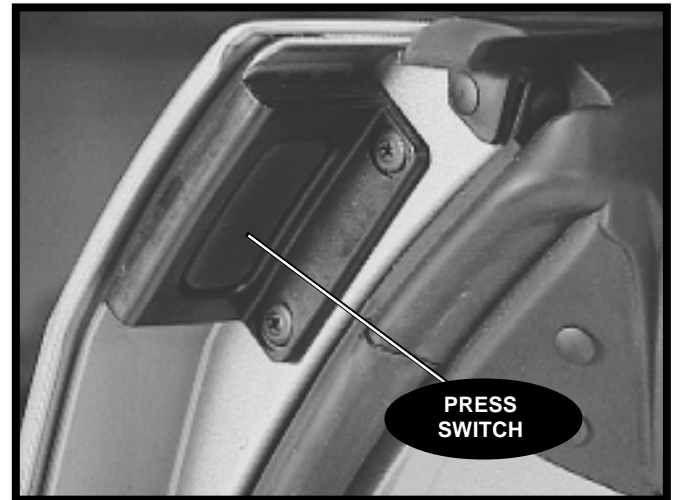


Figure 3-7, Outside Door Switch

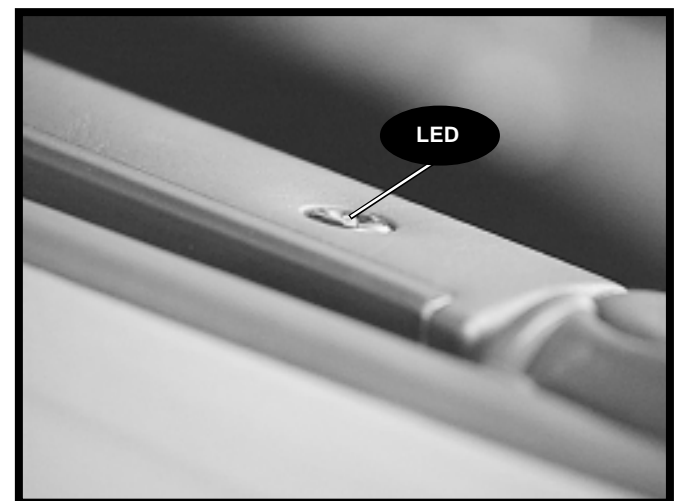


Figure 3-8, Door Lock LED

3. Exterior Systems Overview



Figure 3-9, Inside Door Release



Figure 3-10, Manual Door Release Handle in Trunk

Loss of Power

Manually opening the doors when power is lost was covered in the XLR Features video/booklet release. This could also be an issue during diagnosis when the battery must be disconnected:

- If inside the car, merely pull the manual door release handle up to unlatch the door (figure 3-9)
- If you are outside the car, first gain mechanical access to the trunk. Open the access door using the loop handle. Inside the door, pull the plastic tab connected to the release cable (figure 3-10)

Realize that door opening and closing effort will increase, since the door glass will not index without battery power.

3. Exterior Systems Overview

Indexing Door Glass

The door glass on the XLR has an indexing feature during door operation as well as top operation. This ensures a tight seal to minimize the chance of wind noise and water leaks.

Whenever either door is opened according to a door switch, the corresponding window will “index” to a lower position (figure 3-11). Upon shutting the door, the door controller will express close that window up into the weatherstrip (figure 3-12).

The express close function from the door module will not occur if:

- A door switch is pressed
- A door is open
- A door is ajar
- The window is already at or above the index position
- The passenger or driver had lowered the window below the index level

Express window operation also occurs at the beginning and end of a folding top cycle.



Figure 3-11, Indexed Door Glass

3. Exterior Systems Overview

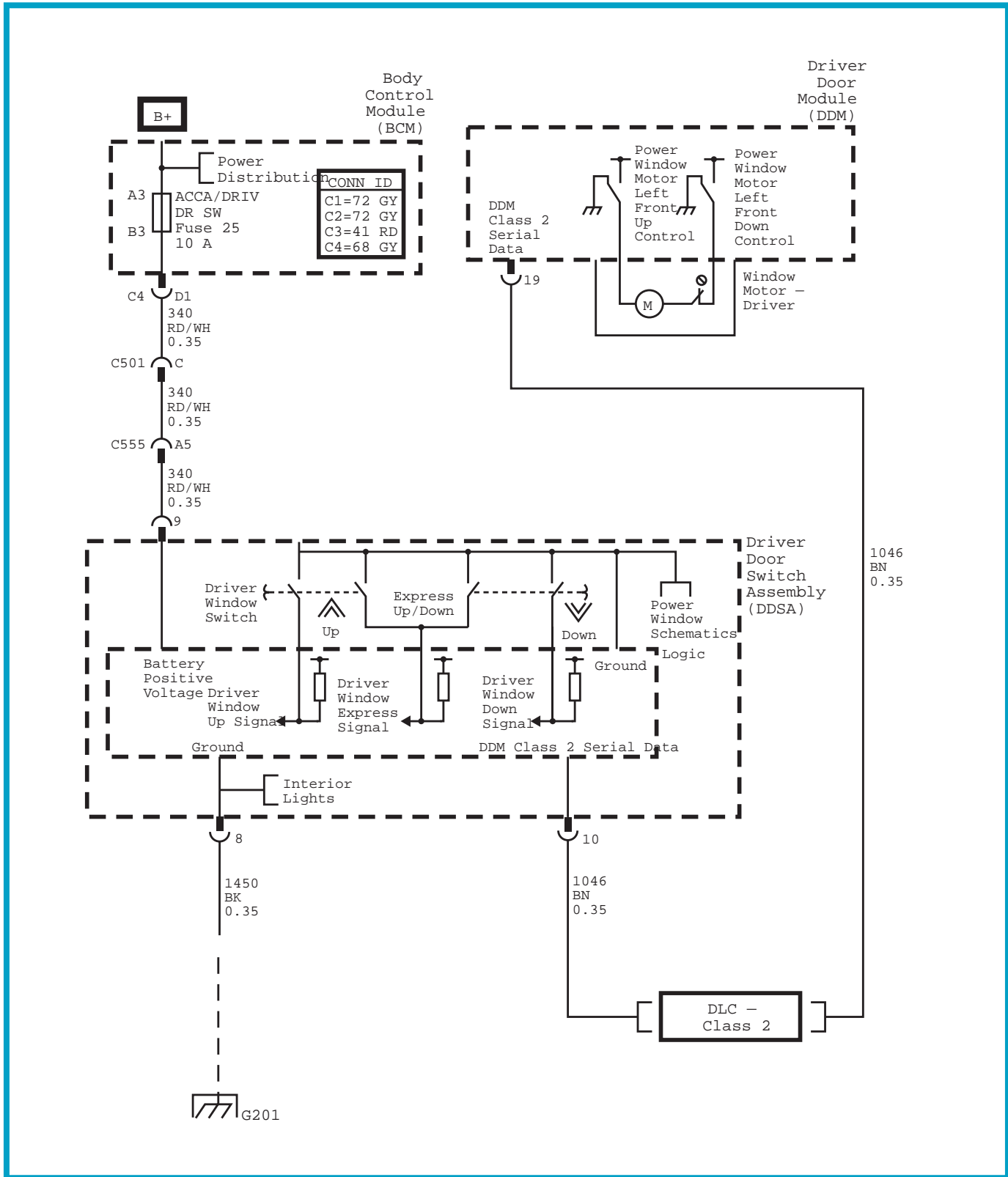


Figure 3-12, Door Window Operation

3. Exterior Systems Overview

Folding Top

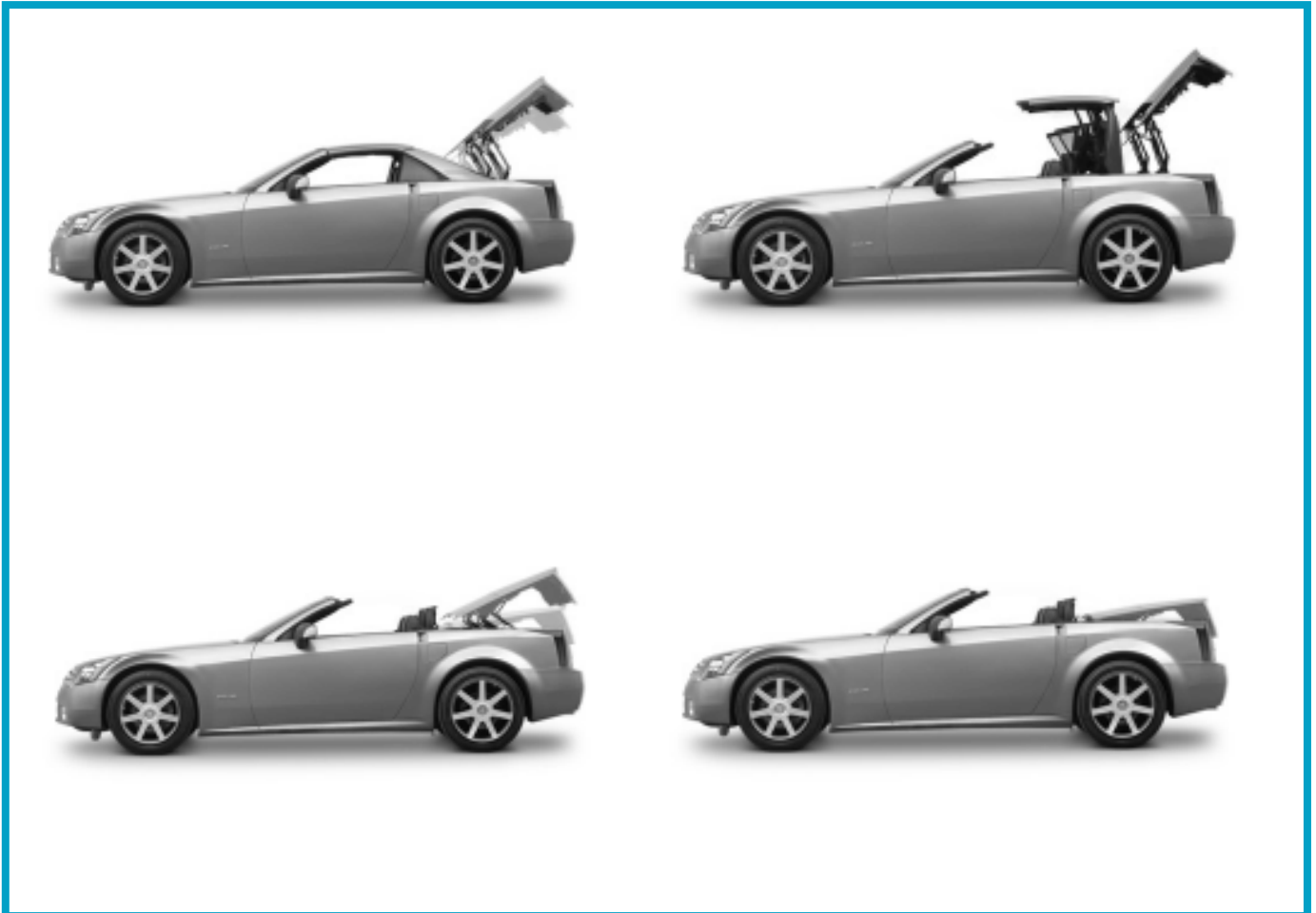


Figure 3-13, Folding Top Operation

The XLR features an electronically-controlled, hydraulically actuated folding top (figure 3-13). When the top control switch is pushed and held, beginning with the folding top up and latched:

- The door windows are disabled and the glass is lowered all the way
- The system unlatches the rear compartment lid (decklid)
- The system opens the front folding top storage compartment closeout panel (front tonneau) and the top unlatches from the header
- The decklid raises
- The top opens and stows (the top's side glass folds in for storage at this time as well)
- The rear folding top storage compartment panel (rear tonneau) extends
- The front tonneau closes and the header latch closes
- The decklid with positioned rear tonneau closes
- The decklid latches
- The windows are enabled

The trunk on the XLR is also power-operated for Open and Close and is part of the folding top system.

3. Exterior Systems Overview

Folding Top Control (FTC) Module

The brain of the folding top system is the Folding Top Control (FTC) module (figure 3-14). The FTC module is located in a well in the driver-side rear of the trunk. The FTC module is the black controller in the well. The silver-metallic controller in this area, just behind the FTC module, is for the electronic Real Time Damping (RTD) suspension system.

The FTC module receives input from switches, micro switches and potentiometers to monitor and control all folding top operations (figure 3-15). The module also has outputs to control system hydraulics via a pump and valve control solenoids.

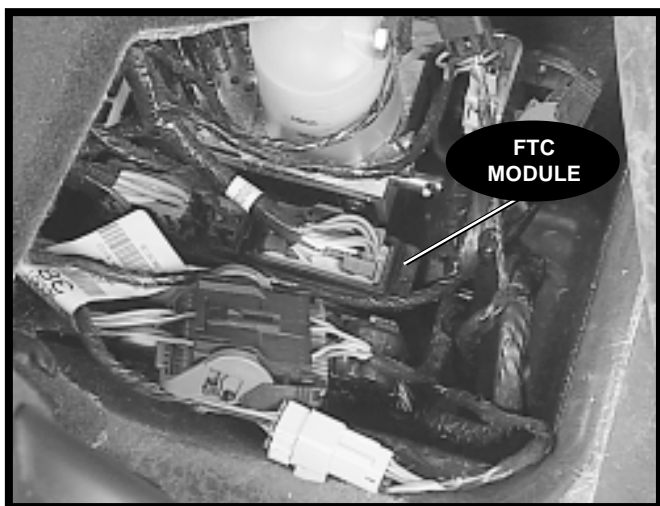


Figure 3-14, Folding Top Control (FTC) Module

3. Exterior Systems Overview

Hydraulics

The hydraulic pump and motor assembly is located in the well, just forward of the FTC module. The unit consists of a pump/motor assembly, a hydraulic manifold, a fluid reservoir, and a block of five solenoids. Each of the solenoids controls a hydraulic valve (figure 3-16):

- One solenoid controls the windshield header latch and front tonneau
- Two solenoids control the decklid
- Two solenoids control the top itself
- The rear tonneau is driven directly by the bi-directional pump

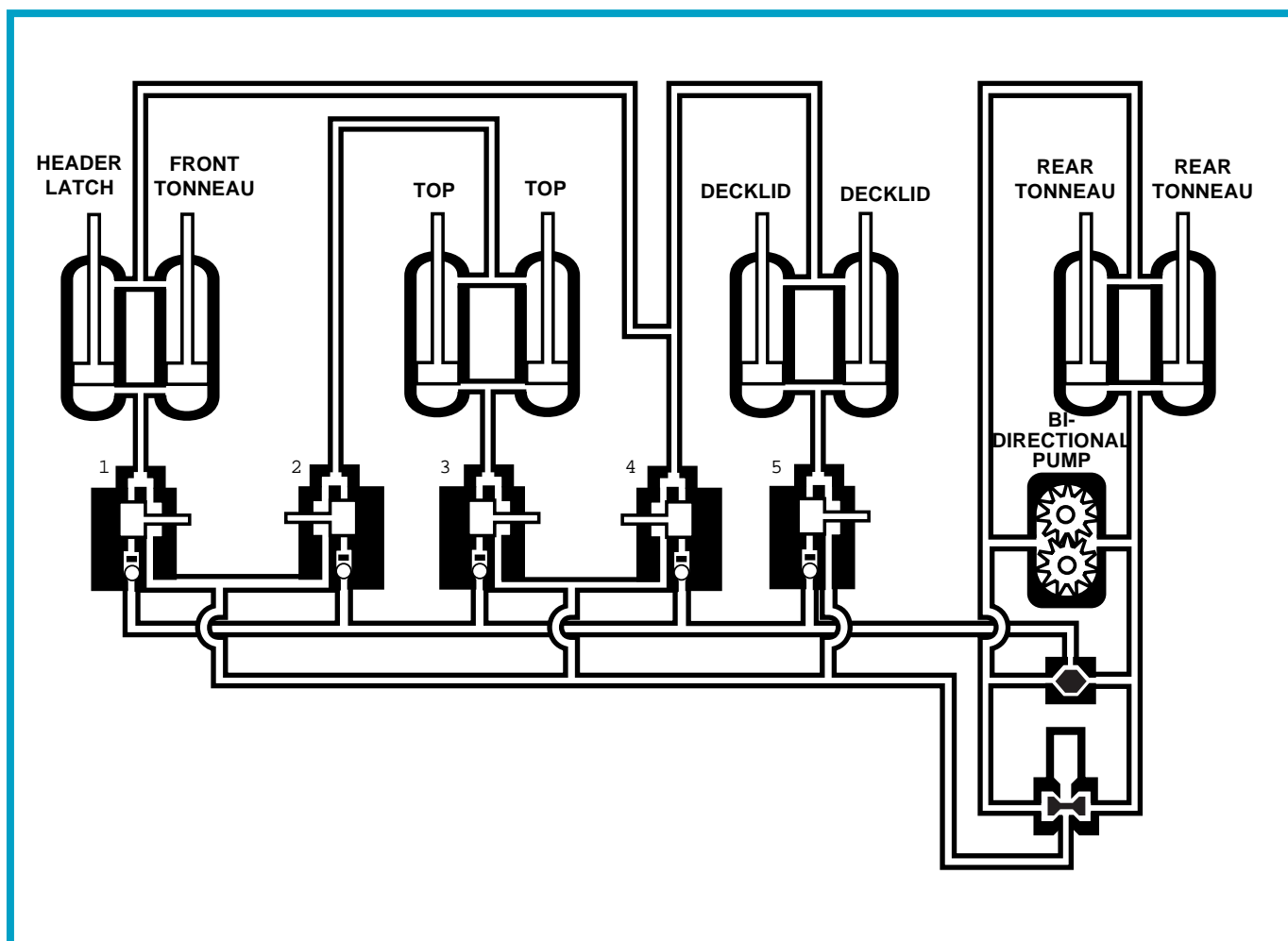


Figure 3-16, Folding Top Hydraulics

3. Exterior Systems Overview

The bypass for manual operation of the top is accomplished by unscrewing the “T” on the valve block (figure 3-17).

There are a total of eight hydraulic cylinders utilized in top operation:

- One cylinder operates the windshield header latch
- One cylinder operates the front tonneau
- Two cylinders operate the top itself
- Two cylinders operate the rear tonneau
- Two cylinders operate the decklid

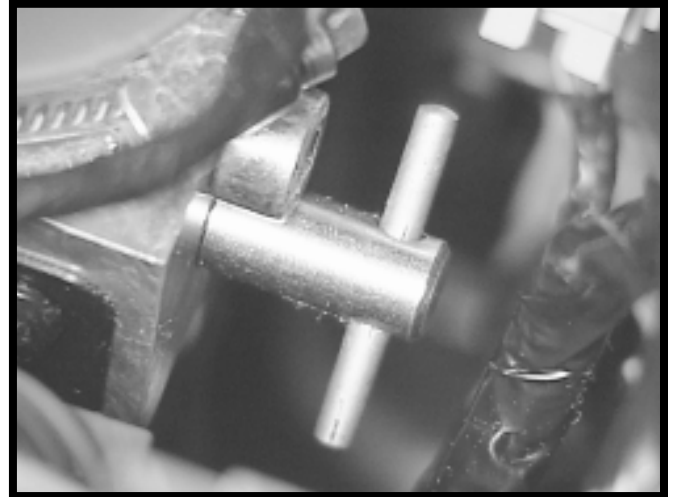


Figure 3-17, “T” for Manual Operation

There are a total of 16 hydraulic lines in the folding top system: two lines for every hydraulic cylinder. Each is numbered for identification (figure 3-18).

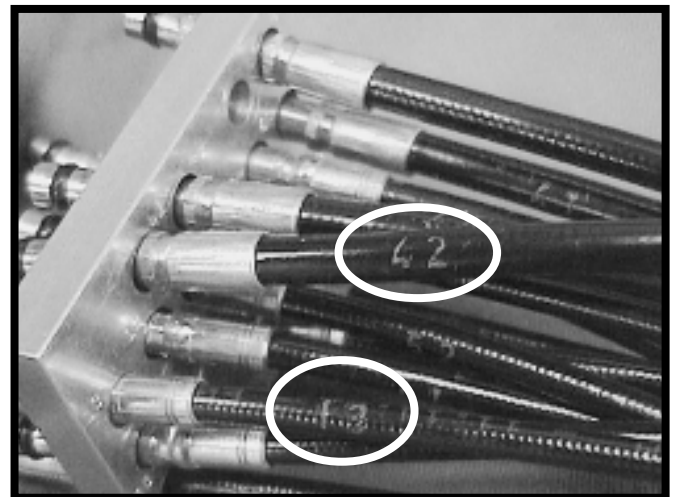


Figure 3-18, Numbered Hydraulic Lines

3. Exterior Systems Overview

System Inputs

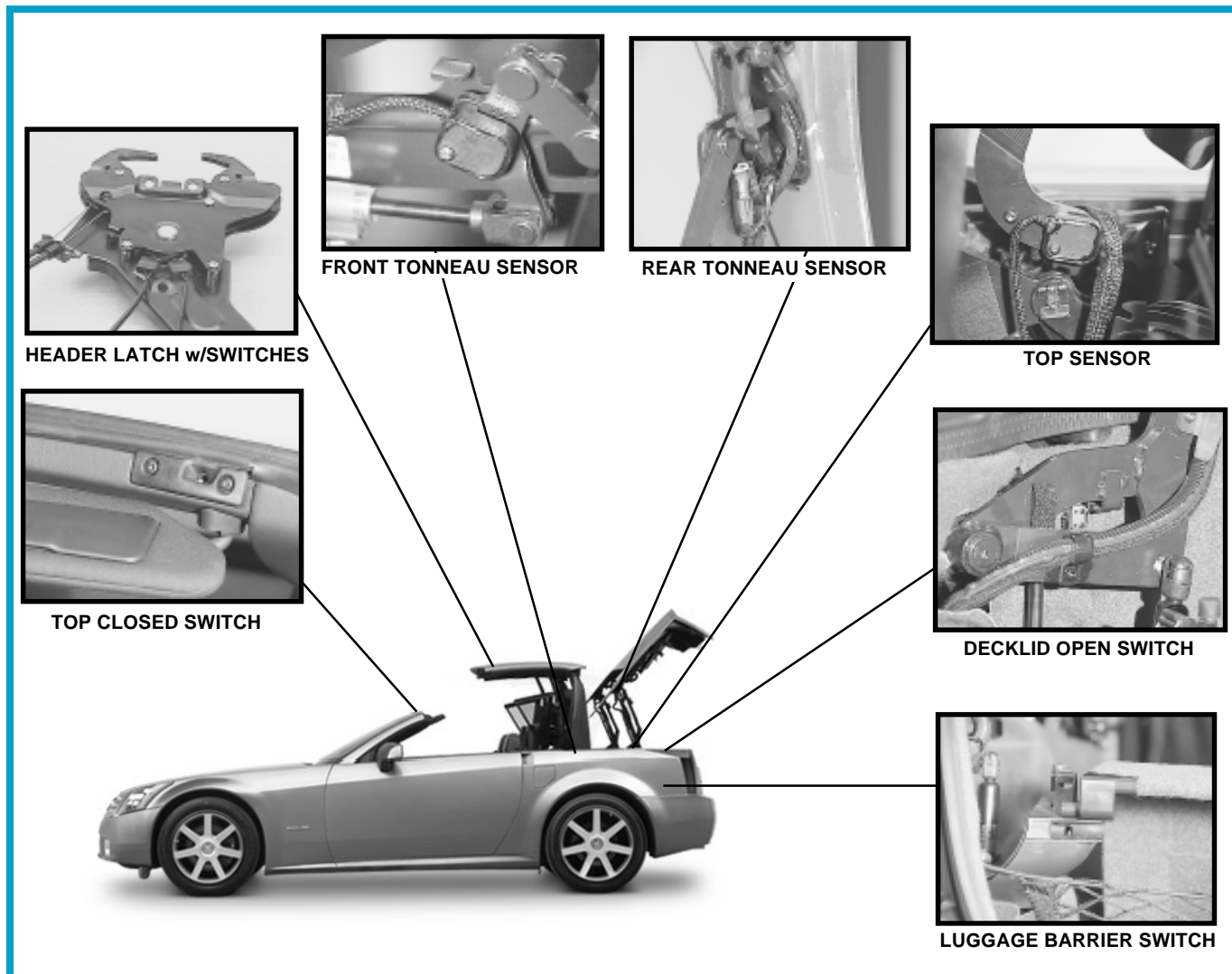


Figure 3-19, Folding Top Inputs

Five limit switches determine the position state of various folding top system components (figure 3-19):

- There are “header latched” and “header unlatched” switches located at the header latch. These switches are between the mechanism and inner roof, so they cannot be seen until the mechanism is removed
- There is a “decklid open” switch on the left-hand decklid linkage
- A “top closed switch” is located at the right hand header pin receiver
- A “luggage barrier in place” switch is located on the left side of the luggage compartment trim

There are also three position sensors used to “sense” component position during operation. These potentiometers are attached to the linkages for measuring the changing angles as the top moves:

- The position sensor for the front tonneau
- There’s is a position sensor for the rear tonneau
- The third position is for the top itself

3. Exterior Systems Overview

Other Vehicle Antennas

The Easy Key antennas were presented earlier in this booklet. Several additional antennas are required for other XLR functions.

FM reception is handled by the ground plane within the decklid (figure 3-20). The small wires on the rear side of the decklid trim function as the antenna and provide FM reception.

The XLR uses a diversity antenna system. The primary antennas (AM and FM1) are attached to the right side of the decklid liner assembly. The secondary antenna (FM2) is on the left side of the decklid liner assembly. The antennas in the XLR are unique due to the use of stranded wires as the antenna elements to capture the RF signals. These elements are attached to the decklid liner assembly and are serviced as an assembly.

The antenna modules are attached to the top side of the antenna ground plate. The module on the left is the match module and only receives FM signals. The module on the right is the Active Reception System (ARS) module and receives both AM and FM signals. When FM is selected, the two ARS FM signals are superimposed and phase aligned to create one strong signal to be sent to the radio.

The Global Positioning System (or GPS) antenna that serves the OnStar system is located inside the OnStar antenna mounted to the windshield, just to the right of the inside rearview mirror (figure 3-21).

The GPS antenna for the navigation radio is mounted at the top of the I/P next to the center stack (figure 3-22).

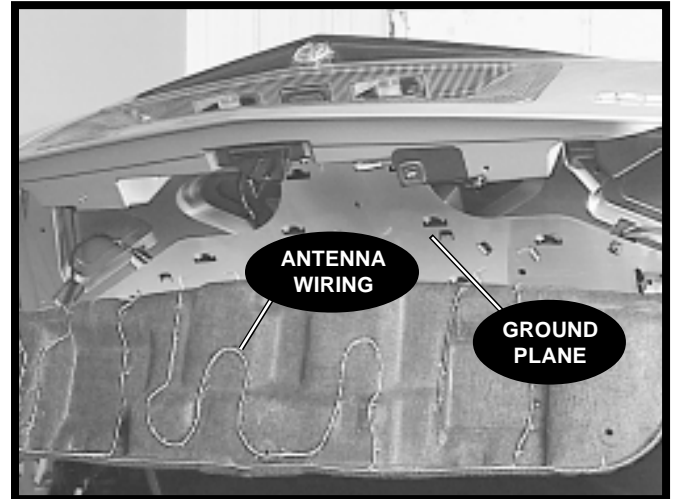


Figure 3-20, Ground Plane and Antennas for FM Reception

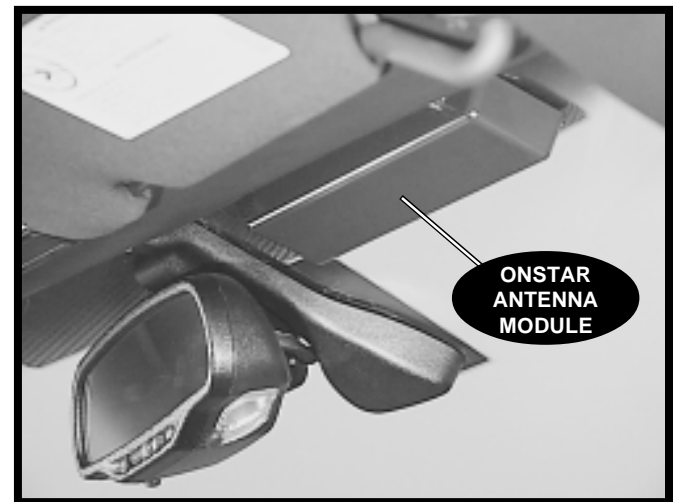


Figure 3-21, OnStar Antenna Module

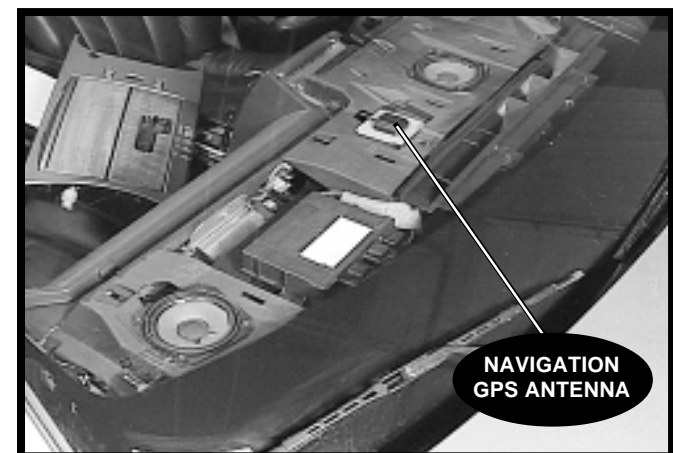


Figure 3-22, Navigation GPS Antenna

3. Exterior Systems Overview

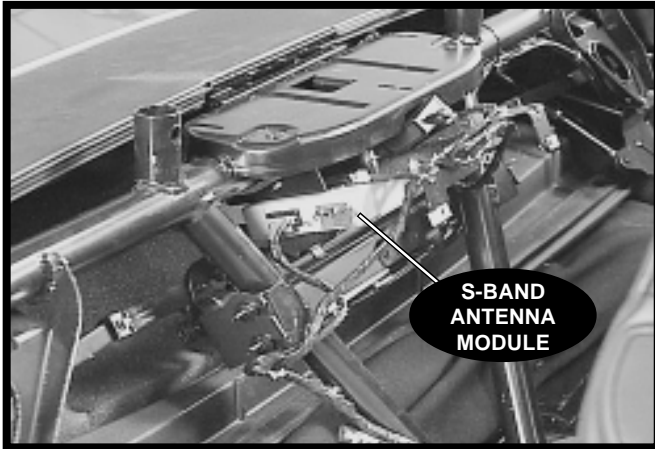


Figure 3-23, S-Band Antenna Module

The S-Band (XM) antenna is dealer-installed and mounted to the decklid. The module for the S-Band antenna is mounted to the body behind the seats (figure 3-23).



Figure 3-24, Underhood Bussed Electrical Center (UBEC)

Underhood Bussed Electrical Center (UBEC)

The Underhood Bussed Electrical Center (UBEC) is located on the passenger side, in front of the battery (figure 3-24). It contains the mini-fuses, maxi-fuses and relays necessary to power most of the engine and chassis-related electrical/electronic systems.

4. Chassis Systems Overview

While the XLR physical chassis is very similar to the Corvette, the vehicle control systems parallel other Cadillac models, particularly the Seville and DeVille.

Body Structural Overview

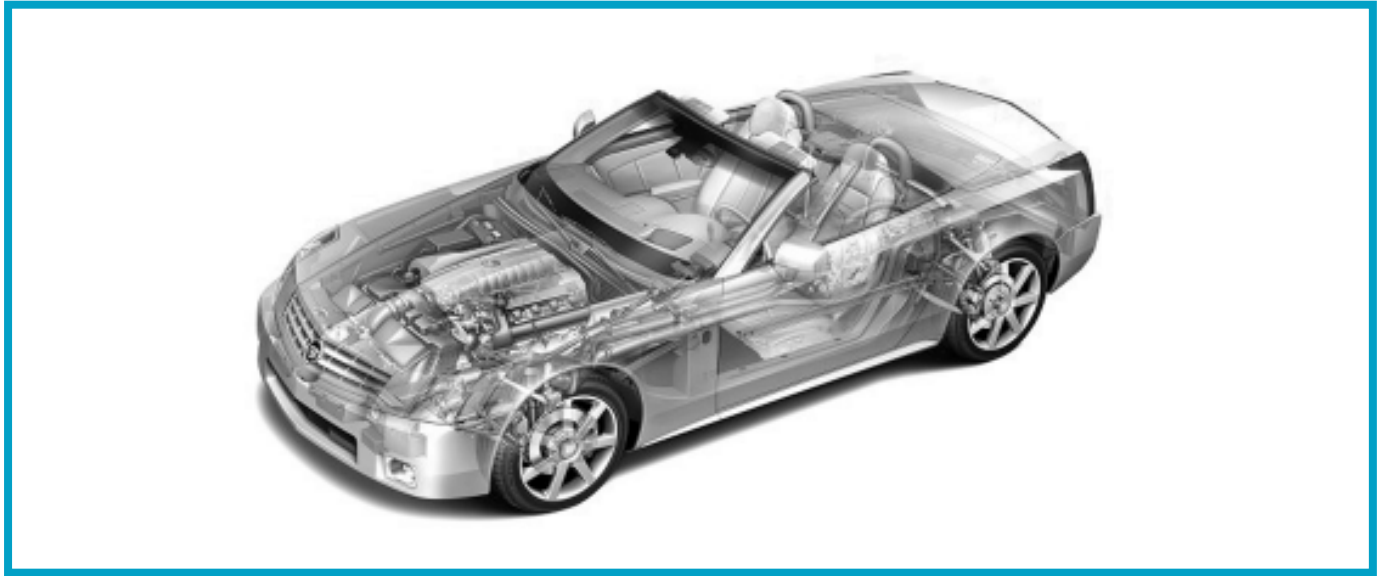


Figure 4-1, XLR Structure

The XLR features uses hydroformed frame rails (figure 4-1). The hydroforming process uses a single die and high-pressure fluid resulting in frame rails that are boxed, rather than U-channel with reduced weight, but higher strength.

The alignment and repair of hydroformed frame rails requires the proper use of an approved alignment table and holding fixtures, including the J 42058 anchoring tool.

Related to body and collision repair, note that the XLR reverses the typical door latch/striker configuration (figure 4-2). On the XLR, the striker is on the door and the latch is mounted on the body.



Figure 4-2, Door Latch in Body

4. Chassis Systems Overview



Figure 4-3, Electronic Brake Control Module (EBCM)

Chassis Electronics

All vehicle stability-related functions are controlled through the Delphi 7.2 system Electronic Brake Control Module (EBCM) (figure 4-3). The EBCM relies on other controllers and their systems via the GMLAN data bus for the various functions.

Chassis-control via the EBCM relates to the following functions:

The Anti-Lock Brake System (ABS) controls wheel slip during braking to improve stability, steerability, and stopping distance.

Dynamic Rear Proportioning (DRP) provides variable rear brake proportioning.

Engine Drag Control (EDC) commands the ECM to add torque if the drive wheels begin to skid. If the ECM gets this torque increase request, it will open the throttle plate for a short time until the wheels stop skidding. This could happen during transition events such as coming down a mountain and hitting a patch of ice.

Magnetic Speed Variable Assist (MSVA), known as Magnasteer II, adjusts power steering assist by commanding the MSVA actuator in the steering rack. Power steering assist decreases as vehicle speed increases.

The Traction Control System (TCS) controls wheel slip during acceleration. The ECM applies engine torque management and the EBCM handles brake apply.

Tire Pressure Monitor (TPM) uses pressure sensors at each wheel to monitor individual tire inflation pressures.

The Vehicle Stability Enhancement System (VSES), known as StabiliTrak, assists the driver in controlling the vehicle. The closed loop yaw control integrates suspension damping, individual brake apply and powertrain torque management.

Adaptive Cruise Control (ACC) is covered in detail later in this booklet. However, the ABS system's EBCM is responsible for the braking portion of ACC.

4. Chassis Systems Overview

StabiliTrak

The Vehicle Stability Enhancement System (VSES), known as StabiliTrak, monitors the vehicle's dynamic state through the use of the following sensors:

- The hand wheel sensor is located near the bottom of the steering column, within the Magnasteer assembly (figure 4-4)
- The combination lateral acceleration/vehicle yaw rate sensor is located behind the center console (figure 4-5)
- There is a wheel speed sensor at each brake
- The brake pressure sensor is mounted on the hydraulic block of the Delphi 7.2 EBCM assembly (figure 4-6)
- The brake pedal travel sensor is a potentiometer and replaces the previously-seen brake switch. Now, brake pedal application and force can be monitored
- And, as seen before, the brake low fluid reservoir switch is at the reservoir

StabiliTrak calculates the desired yaw rate based on the hand wheel steering angle and vehicle speed. When the actual vehicle yaw rate exceeds a threshold beyond the desired yaw rate, the system applies brake pressure to a specific wheel or wheels to assist in reducing the yaw rate error.

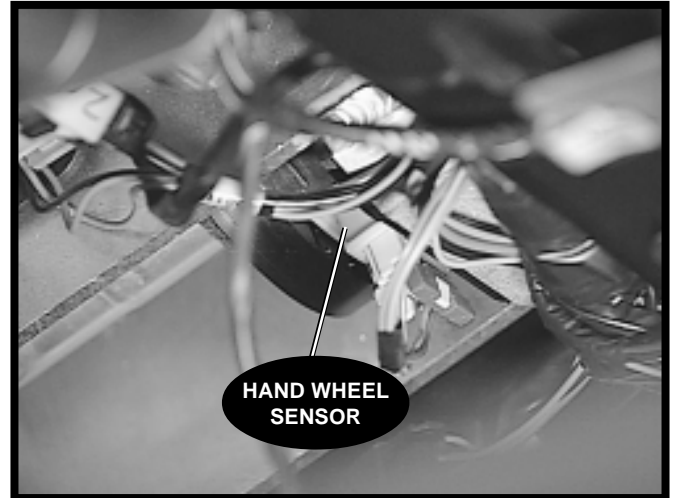


Figure 4-4, Hand Wheel Sensor



Figure 4-5, Lateral Acceleration/Yaw Rate Sensor

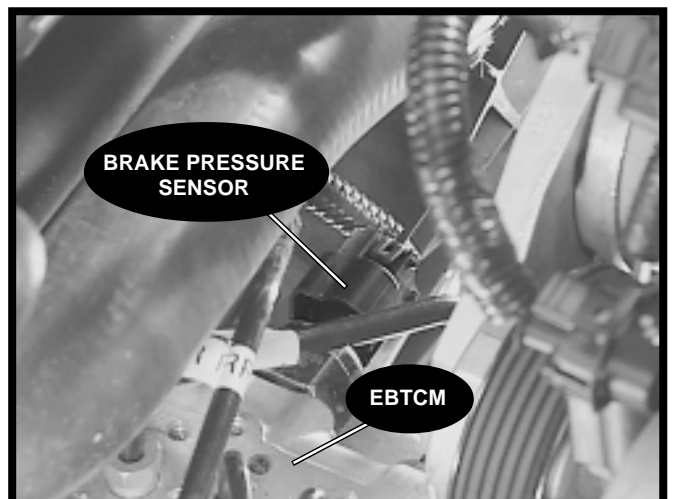


Figure 4-6, Brake Pressure Sensor

4. Chassis Systems Overview

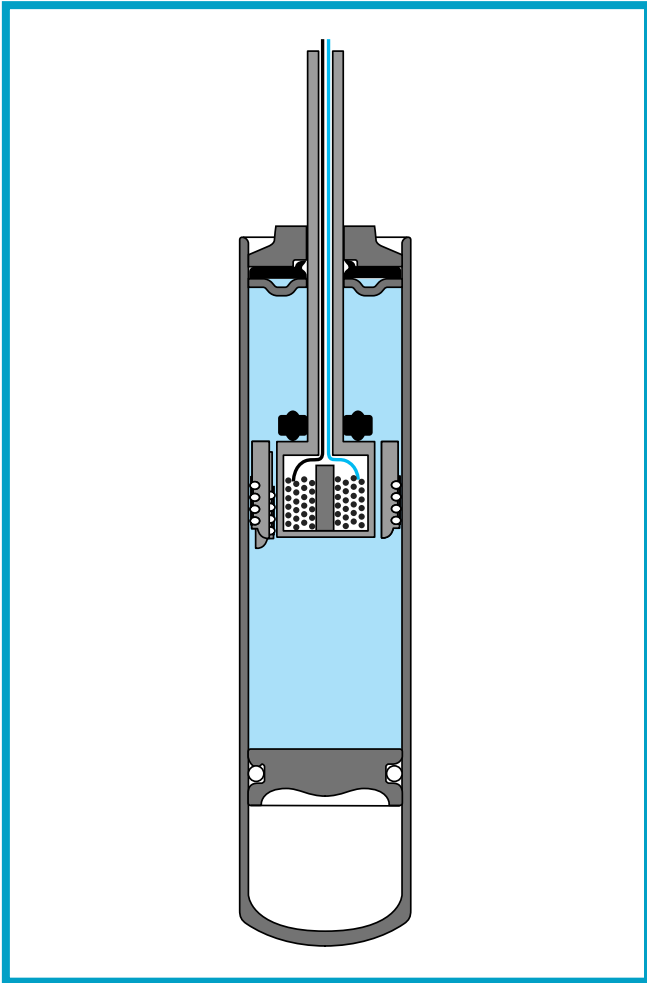


Figure 4-7, Magnetic-Rheological Shock

MagnaRide Suspension

The XLR features a MagnaRide Real Time Damping (RTD) suspension. Magnetic-rheological shocks (figure 4-7) at each wheel can vary damping based on driving conditions. At higher vehicle speeds and during high road surface variance, voltage is applied to magnetic-rheological fluid in the shock and it thickens for firmer action. These adjustments occur in milliseconds.

The XLR comes shipped with stuffers for the magnetic-rheological shock absorbers (figure 4-8). These must be removed as part of the vehicle prep procedures.



Figure 4-8, Shock Stuffer

5. Interior Systems Overview

The XLR interior offers a significant number of innovations (figure 5-1). Coverage here will concentrate on what is new to Cadillac service technicians. There are totally new items, such as adaptive cruise control and heated/cooled seats. Other systems, such the HVAC and the infotainment navigation radio system, have similarities with other models.

Easy Key — Ignition Functions

The first step for using the Easy Key system push-button start function is to have the fob in the vehicle. The Easy Key Module uses four antennas to determine that, indeed, the fob is in the vehicle. With the brake applied and the transmission range selector in PARK or NEUTRAL, pressing the “ON” push-button portion of the rocker switch (figure 5-2) starts the vehicle.

The Easy Key module requests starting functions from the BCM and ECM (figure 5-3). The antenna system and door handle switches are the only hard-wired inputs to the Easy Key module.

Turning Ignition On

Diagnostic procedures often require the ignition to be in the On or Run position without the engine running for testing. On the XLR, holding the ACC switch down for 5 seconds powers everything up without starting the engine.



Figure 5-1, XLR Interior



Figure 5-2, XLR Ignition Rocker Switch

5. Interior Systems Overview

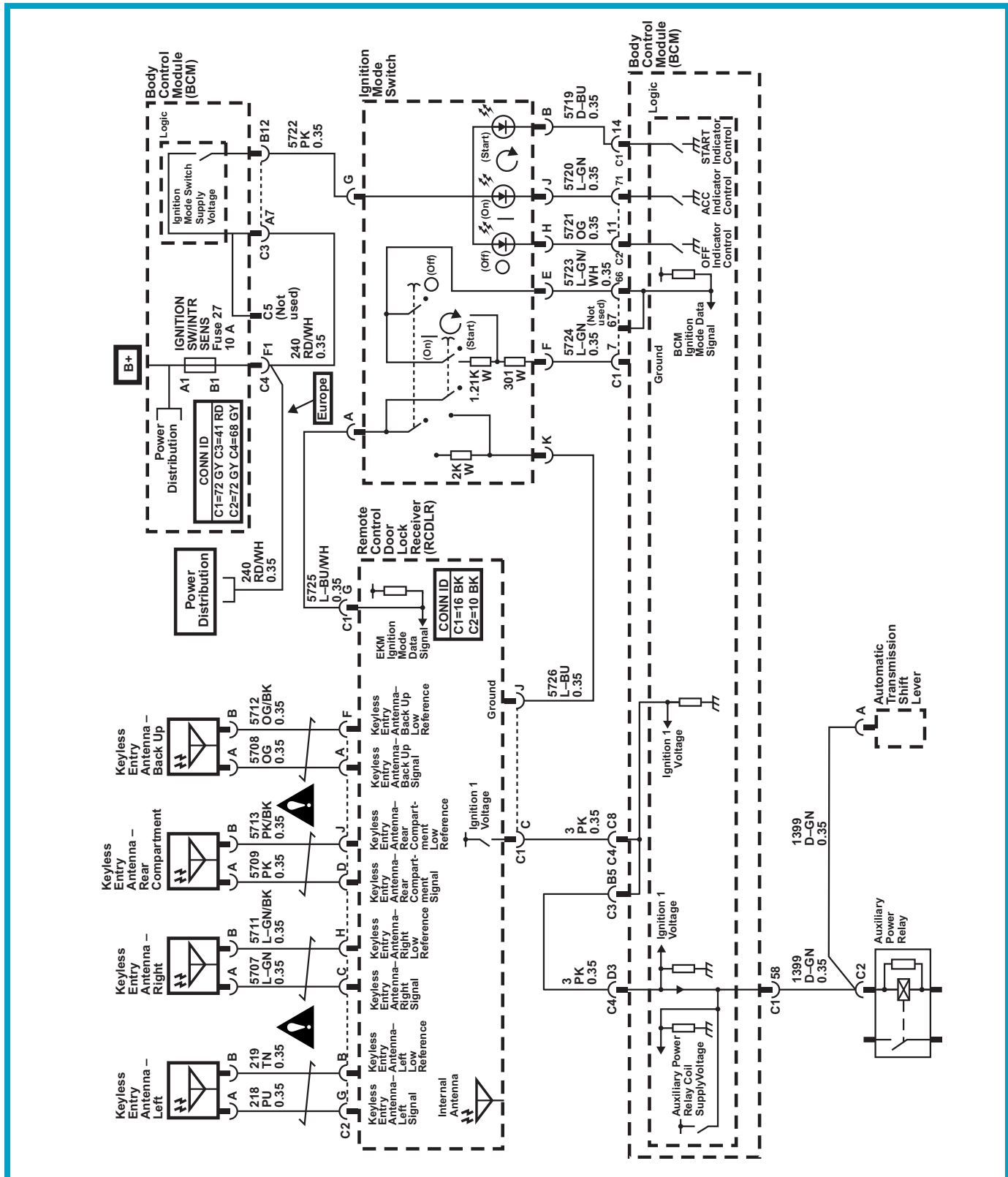


Figure 5-3, Easy Key Vehicle Start System

5. Interior Systems Overview

Low Battery/RF Interference Start-Up

A tip for the customer and the service technician is the procedure for starting the vehicle when the fob battery is dead:

1. Place the fob in the fob pocket located in the glovebox with the button side of the fob facing right (figure 5-4). This places the back of the fob next to the limp-home antenna in the glovebox.
2. A foot must be on the brake.
3. The transmission must be placed in PARK or NEUTRAL.
4. Press the "START" switch. The vehicle should start in an Easy Key system "limp home" operation mode.

The fob battery should be changed as soon as possible. The DIC will show "Low Fob Battery" to verify status. This fob pocket for low battery conditions may also come in handy if a start attempt occurs in an environment that might jam the RF transmissions used by the Easy Key system.

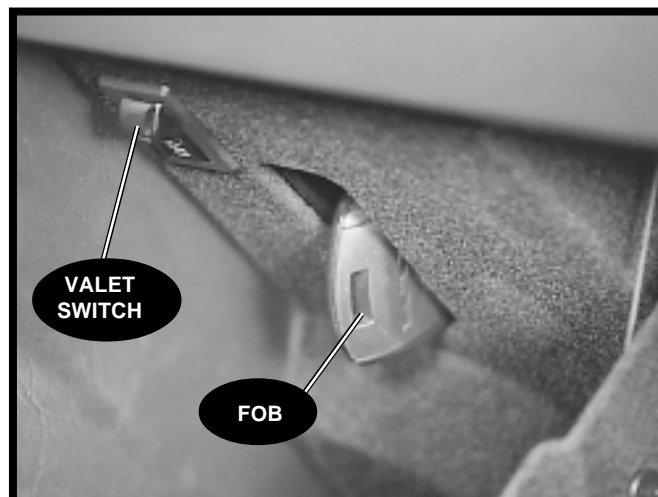


Figure 5-4, Glove Box Pocket for Fob

5. Interior Systems Overview

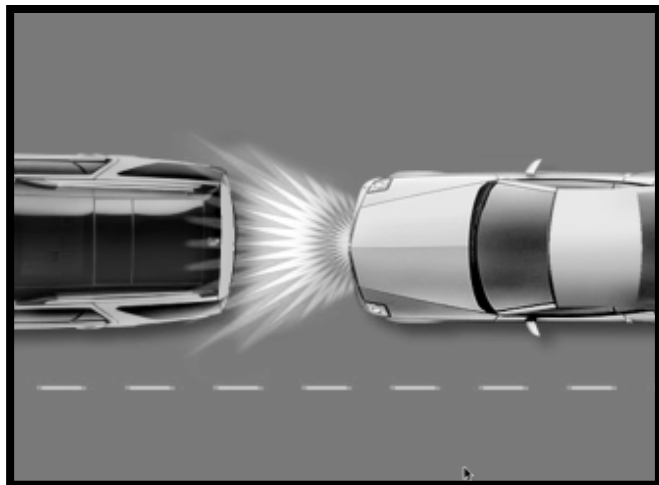


Figure 5-5, Adaptive Cruise Control

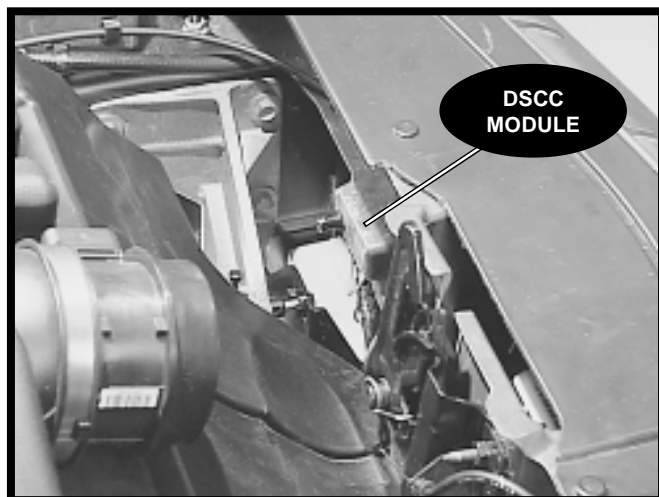


Figure 5-6, Distance Sensing Cruise Control (DSCC) Module

Adaptive Cruise Control

The Adaptive Cruise Control (ACC) system's controller is called the Distance Sensing Cruise Control (DSCC) module. Note this nomenclature for service information usage.

The ACC system allows the vehicle to operate at, or below, the driver-selected set speed depending on traffic conditions. The system uses radar to detect in-path objects and then slows the vehicle depending on the object's range and closing-rate (figure 5-5).

The Distance Sensing Cruise Control (DSCC) module consists of the "forward looking" radar sensor and the DSCC controller (figure 5-6). It uses the radar to identify and classify objects in the road ahead of the vehicle. If the radar detects objects within its specified field of view, the DSCC controller makes throttle and/or brake commands via GMLAN to the ECM and EBCM to control vehicle acceleration or deceleration as needed (figure 5-7).

The DSCC module is supplied by Delphi and uses 76 gigahertz radar. The DSCC module is packaged behind the front fascia on the driver's side of the vehicle. The module mounts to a bracket that attaches to the left-hand frame rail near the front bumper beam. When the radar is operating, it radiates through the plastic lens on the front fascia.

5. Interior Systems Overview

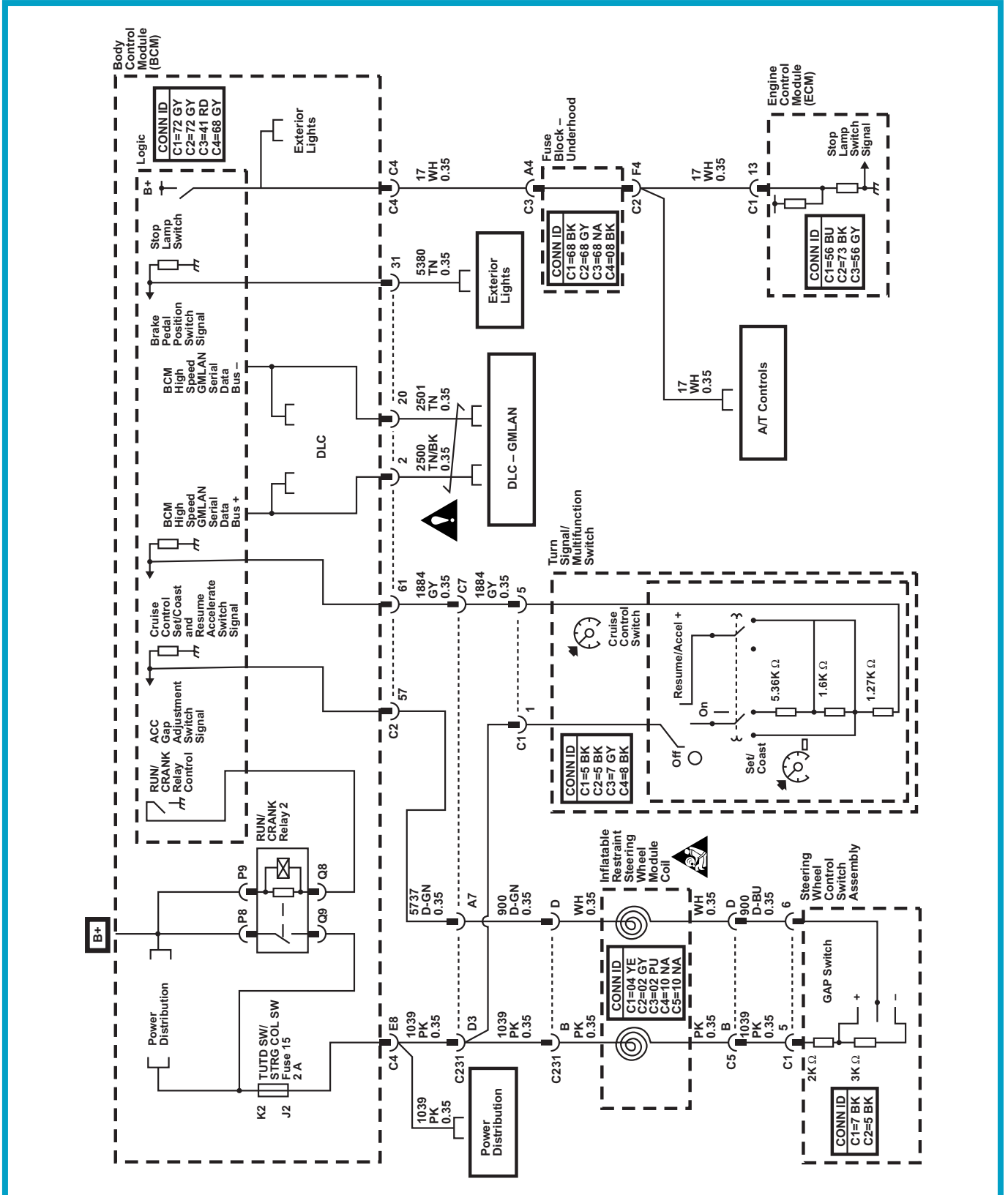


Figure 5-7a, Adaptive Cruise Control Operation (1 of 2)

5. Interior Systems Overview

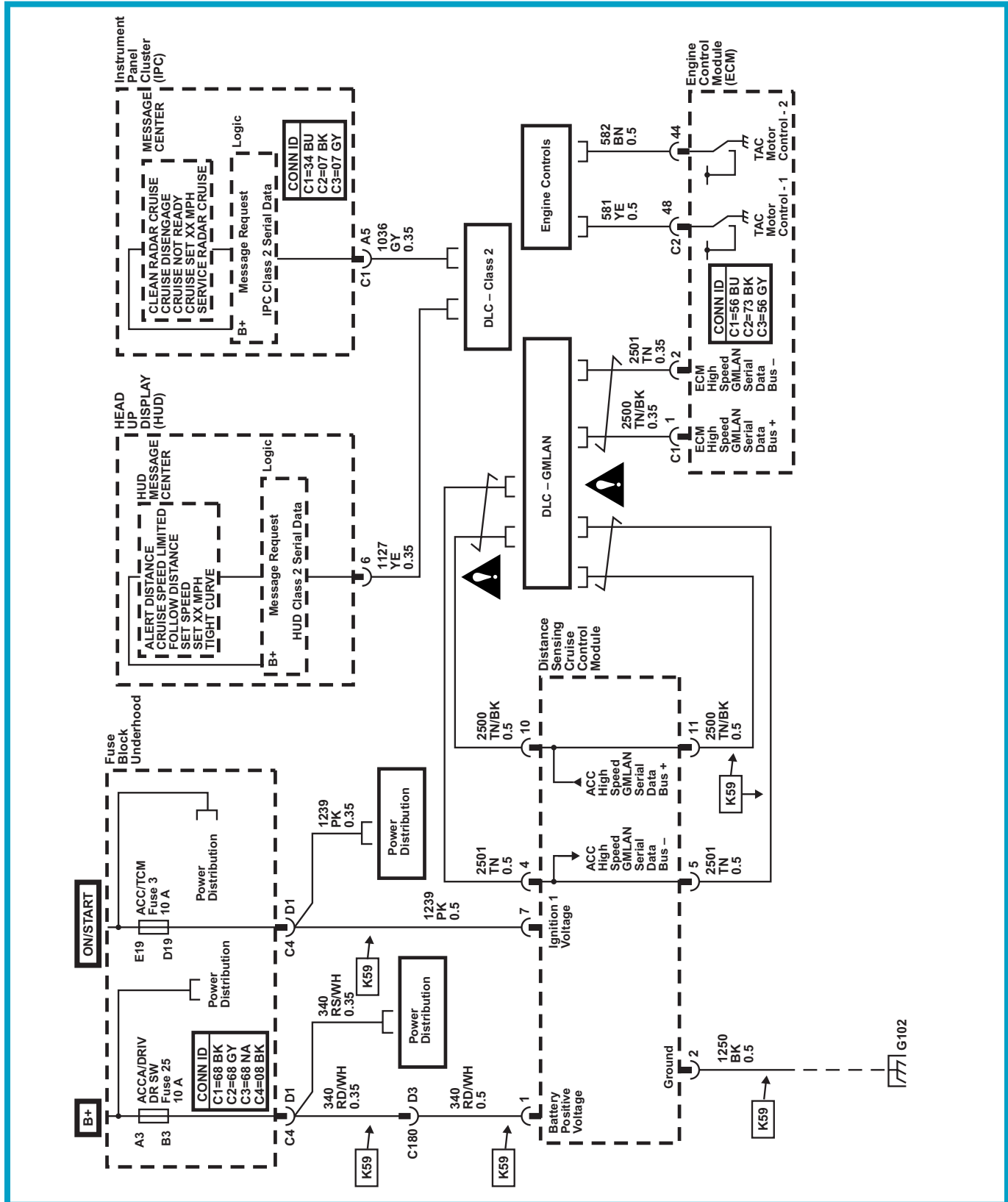


Figure 5-7b, Adaptive Cruise Control Operation (2 of 2)

5. Interior Systems Overview

The DSCC module performs ACC state processing automatically. The ACC system operates in two states: Cruise and Follow. The normal operating state is Cruise, where the vehicle speed is controlled to match the driver selected Set Speed.

If another vehicle is detected ahead by the sensor, the ACC system will automatically transition into the Follow Speed state to provide proper lane spacing behind the target vehicle in front. The ACC Follow Speed Limit will ensure that acceptable headway is maintained with relation to the preceding vehicle.

Other functions of the DSCC module include:

- Determining the Follow Speed Limit for throttle control by the ECM
- Determining Acceleration Request command to the ECM
- Arbitration of the ACC system brake and throttle control between the EBCM and the ECM
- Requesting brake light activation for automatic braking
- Processing gap adjustment switch information
- Providing operational feedback to the vehicle driver

For example, the DSCC module sends signals for telltales and messages to be displayed on the Head-Up Display or the DIC. These messages come via the BCM. Additionally, the DSCC module will provide audible feedback to the driver, which also comes via the BCM.

The DIC, Head-Up Display and TCM are integral components that affect the ACC system. If any of these modules are not present, the ACC system will not work.

Gap Switch

The customer can adjust the gap setting using the steering wheel-mounted Plus/Minus gap switch while cruise control is engaged (figure 5-8).



Figure 5-8, Gap Switch

5. Interior Systems Overview

Default Operation

If any ACC-related components have failed or engagement requirements are not satisfied, the system will not operate. Additionally, the radar must be mechanically aligned to the vehicle in order for the system to work correctly.

Braking Fault — When the EBCM detects a failure that should inhibit ACC operation, it will set the appropriate DTC and an ACC Automatic Braking Failed signal is sent on GMLAN.

BCM Fault — If the BCM detects an ACC-related failure, it will set the appropriate DTC and a Cruise Control Cancel Request signal is sent on GMLAN.

ECM/TCM Fault — If the ECM or TCM detects a failure affecting the ACC, it will set the appropriate DTC and not allow ACC to engage and communicate via GMLAN.

ACC Fault — If a current failure is detected in the DSCC module that prevents system engagement, the SERVICE RADAR CRUISE message is displayed at the DIC. However, if the fault is from another sub-system, this message is disabled with the other fault taking priority for display.

Radio Amplifier Fault — When the radio amplifier detects a fault that should inhibit ACC operation, it will set the appropriate DTC and communicate on class 2.

RADAR NOT READY — If temporary conditions prevent ACC system engagement, a RADAR NOT READY message is displayed. Causes include overheated brakes, an over-temperature RF transceiver in the DSCC module, system voltage out of range, or the radar is not detecting an object during the current ignition cycle.

Alignment

This system has an automatic alignment function and the sensor is continuously corrected and adjusted as necessary during ACC vehicle operation. The distance the vehicle must be driven to achieve complete automatic alignment depends on the number of stationary objects encountered on the road. The more objects, the quicker complete alignment will occur. The scan tool is equipped to display the automatic alignment status as well as the degree of DSCC module sensor alignment error (skew).

Sometimes automatic alignment cannot be achieved using the automatic alignment procedure. When this occurs, the DSCC module will set DTC C1002, which signals an out of alignment diagnostic. This DTC sets when the degree of error (skew) is 3.9° or more.

When necessary, mechanical alignment of the DSCC sensor can be achieved using the special alignment tool, J 45442. An out of alignment condition may be the result of tampering or damage to the module mounting structures or brackets and the adjuster settings. An out of alignment condition may also be a result of front-end damage to the vehicle, or simply as a result of wear and tear.

When performing a wheel alignment on an ACC-equipped vehicle, change the DSCC “Auto Alignment Learn Status” on the scan tool to “Not Aligned.” This is important because the sensor has to automatically align to the new wheel alignment setting. After completing wheel alignment service, drive the vehicle in an area with several stationary objects to automatically align DSCC sensor.

5. Interior Systems Overview

Heated/Cooled Seats

Both the driver and passenger seat have a heating/cooling function. Functions for each seat are controlled by separate switches at the HVAC control head (figure 5-9). Both heating and cooling can be cycled through HI, LO and OFF settings with switch presses.

Heat/Cool Seat Module

The climate-controlled seats use separate heated-cooled seat cushion ventilation and heated-cooled seat back ventilation modules to supply heating or cooling to each seat cushion and seat back (figure 5-10). Operation of each seat is controlled by a Climate Controlled Seat (CCS) module under the respective seat. A blower and ducting network circulates air treated by the heat-cool seat modules through the seat.

This technology makes use of a heat transfer process. To heat the seat, polarity of the heat-cool seat module transfers heat to the side near the seat cover. To cool, polarity is reversed and heat is taken away from the seat cover side of the seat module. The circulating air is the medium used to transfer the heat from one surface to the other.

The heat-cool seat module technology is capable of making a temperature differential for cooling or a differential for heating mode. Typically, this technology takes some time to have noticeable results. For example, on cold days, the seat heating may take up to 12 minutes (this is a longer period than grid-type seat heaters).



Figure 5-9, Seat Heating/Cooling Controls at HVAC Control Head

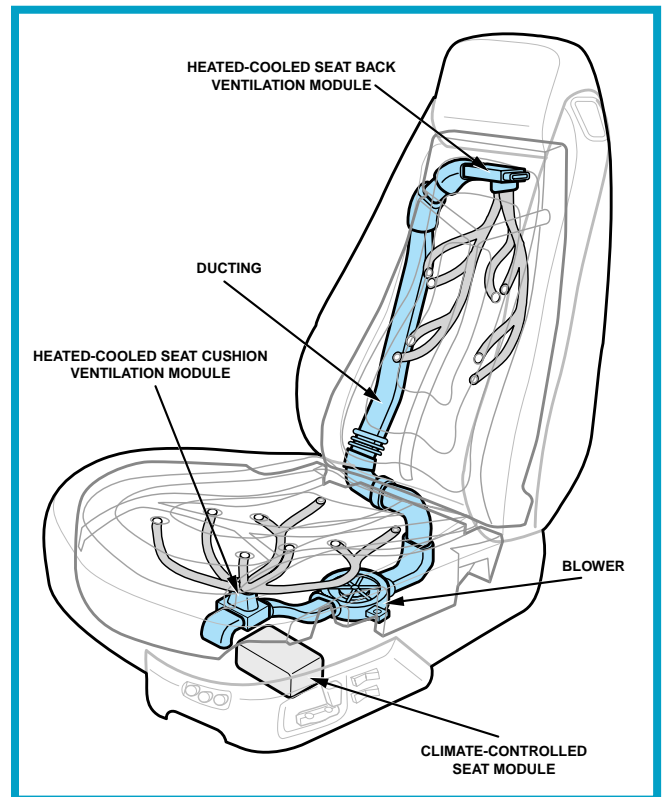


Figure 5-10, Heated/Cooled Seat

5. Interior Systems Overview

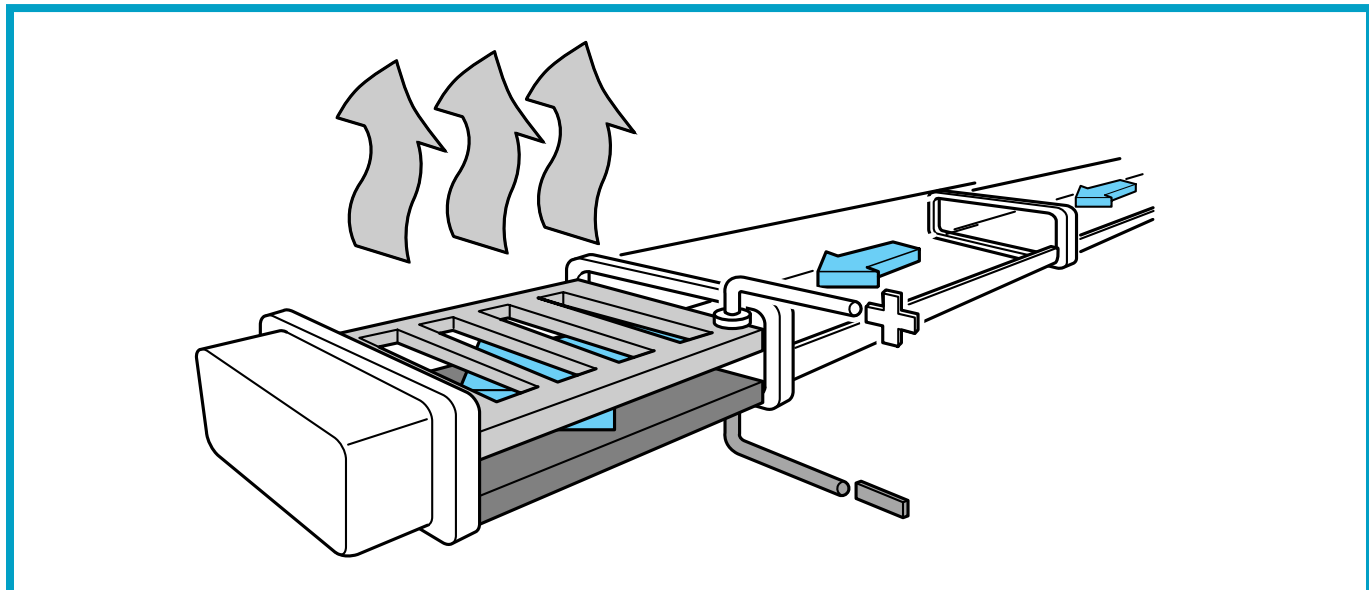


Figure 5-12, Heated-Cooled Seat Ventilation Module

The CCS modules receive power from both battery positive voltage and ignition 1 voltage (figure 5-11).

Each heat-cool seat ventilation module consists of a circuit of positive and negative connections sandwiched between two ceramic plates (figure 5-12).

The internal seat temperature sensors are thermistors, which are attached directly to each heat-cool seat module. The CCS module supplies a 5-volt reference and ground. As the temperature of the heat-cool seat module changes, the resistance of the thermistor varies changing the feedback voltage of the temperature sensor signal circuit. This voltage ranges from 0.5 volts to 4.0 volts.

The CCS module monitors this voltage to determine the heat-cool seat module temperature and adjusts the seat temperature to the selected switch input at the HVAC control head. This is a PWM signal, which varies according to the switch setting.

There are four circuits from the CCS control module to the seat fan. They are for logic power, motor speed control, blower tach signal and the blower low side.

During heated seat operation when HI HEAT is requested, the CCS module transitions to the heat state. The module applies a pre-determined voltage to the heat side of the heat-cool seat module and ground to the cool side. At the same time, a pre-determined voltage is also applied to the blower motor. Based upon time and feedback from the thermistor, voltage to the heat-cool seat module and blower are adjusted to maintain the selected heating level. These voltages are updated by the CCS module once every second. Cooling seat operation parallels heating operation with the polarity of the ceramic plates in the heat-cool seat module reversed.

5. Interior Systems Overview

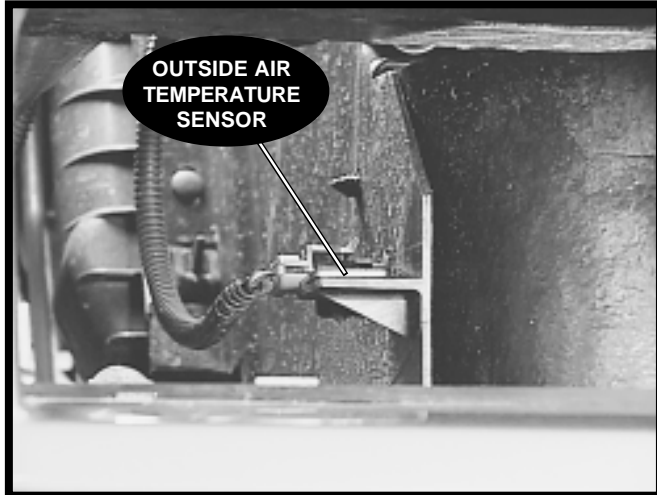


Figure 5-13, Outside Air Temperature Sensor

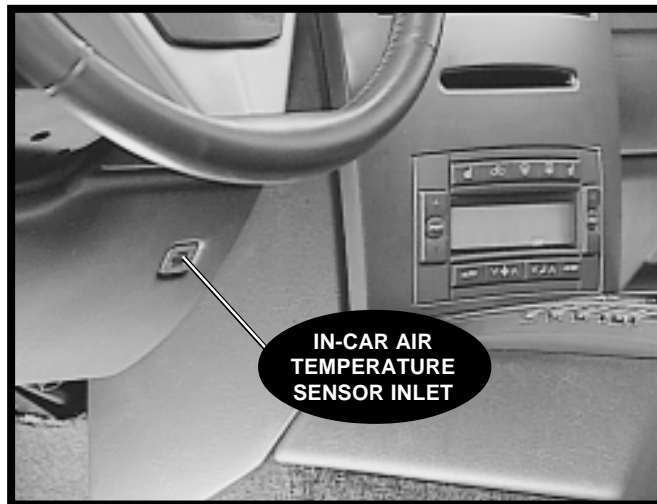


Figure 5-14, In-Car Air Temperature Sensor Inlet

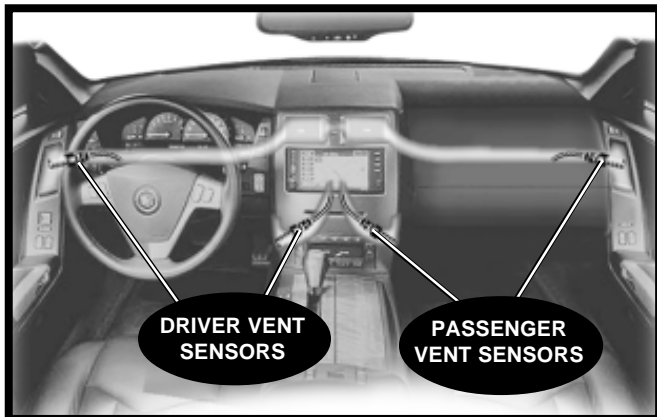


Figure 5-15, Vent Temperature Sensors

Heating, Ventilation & Air Conditioning (HVAC)

The XLR uses the RPO CJ2 dual automatic climate control system to automatically and manually control the climate inside the vehicle. The system uses several inputs for air flow and temperature outputs. These inputs and software combine to determine blower speed, mode positions, and discharge temperature automatically:

- The outside air temperature sensor is at the front fascia (figure 5-13)
- The in-car air temperature sensor is in the instrument panel with a small internal fan that brings air to the sensor (figure 5-14)
- The sun load sensor is on the top of the instrument panel. This sun load sensor is also used for twilight sentinel functions
- The selection made at the control head is an input as well

The CJ2 control head uses four sensors (figure 5-15) within the driver and passenger upper and lower vents to allow dual zone performance. There are two temperature actuators that provide the dual zone airflow control.

5. Interior Systems Overview

“Rolling Film” Mode Doors

Rather than a traditional mode control door, the XLR uses a “rolling film” system (figure 5-16) for HVAC airflow management.

Other Features

There are six blower speeds used on the CJ2 system for manual and automatic operation. While the system uses a delay to go from the third speed to the sixth speed in automatic, all speed variations are available instantly in manual mode.

The ECM will not allow compressor clutch operation below 37° F according to the outside air temperature sensor. The CJ2 control head sends an A/C request class 2 message to the ECM. The ECM monitors the status of many class 2 messages related to compressor clutch operation. If the class 2 messages are in normal operating range, the ECM will allow compressor clutch operation.

Rear defog is only enabled when the FTC module reports the top is closed and latched. Selecting defog also requests the driver and passenger door modules to turn ON the heated side mirrors.

Also note that the CJ2 control head controls dimming at the memory seat switch, power folding top switch, hazard switch, transmission range indicator and traction control switch. Diagnosing a lighting condition at these switches may involve the HVAC control head.

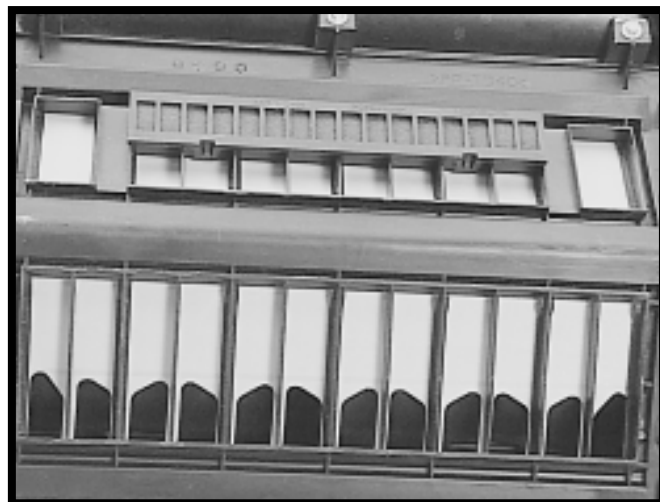


Figure 5-16, “Rolling Film” Mode Control

5. Interior Systems Overview



Figure 5-17, Infotainment Navigation Radio

Infotainment System

The navigation radio system includes a navigation unit with internal DVD as well as a front loading six-disc CD changer (figure 5-17). With the DVD regional maps, the infotainment system provides both visual and verbal route guidance for the selected destination from a database of information. The system combines GPS technology, dead reckoning and map matching to determine vehicle location. The navigation radio uses data from other vehicle subsystems to improve the navigation's route guidance accuracy and functionality.

The CD changer is the main audio source gateway (figure 5-18). For example, the navigation radio generates the left and right audio channels to the CD changer, which outputs these same signals to the seven-channel amplifier.

The CD changer also accepts the left, right and common stereo lines from the S-Band receiver.

Furthermore, the voice "in" and "return" lines from the OnStar Module for voice recognition are channeled through the navigation radio. These signals use the microphone pass-through circuit from the OnStar unit.

On a related note, the CD changer accepts inputs from the steering wheel control switches, which include volume, preset seeking, and other functions.

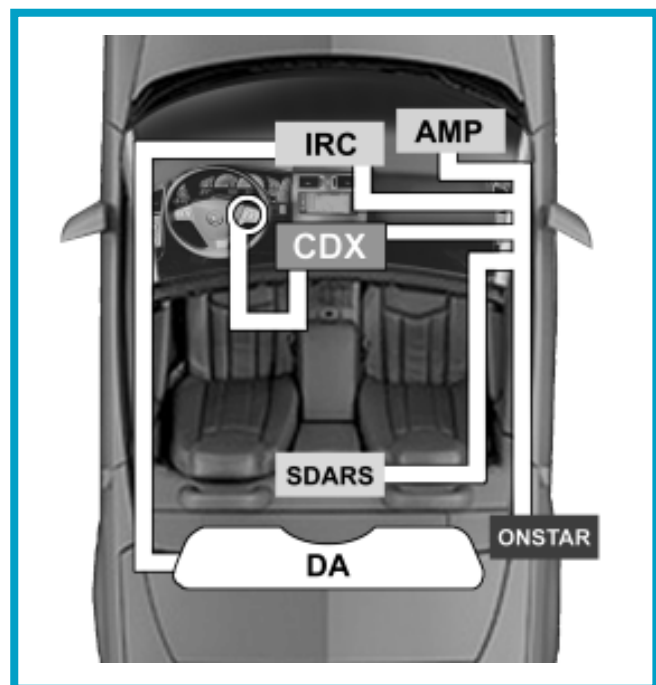


Figure 5-18, Audio Output Control

5. Interior Systems Overview

Integrated Body Control Module (BCM)

The XLR uses an integrated Body Control Module (BCM), located under the toe board in the passenger-side floor (figure 5-19). The term “integrated” refers to its dual function as both a body controller and power distribution bussed electrical center. As an integrated electrical center, the BCM contains six relays (three of which are serviceable) and 22 fuses to handle power for the many components it controls (figure 5-20).

Run Crank Relay

One relay should be noted. The Run Crank relay controls power to the fuses for several important components and systems:

- Heated/cooled seats
- All the devices on the GMLAN network (such as the ECM and SDM for SIR)
- Steering column controls
- Fuse for HVAC control head and inside rearview mirror

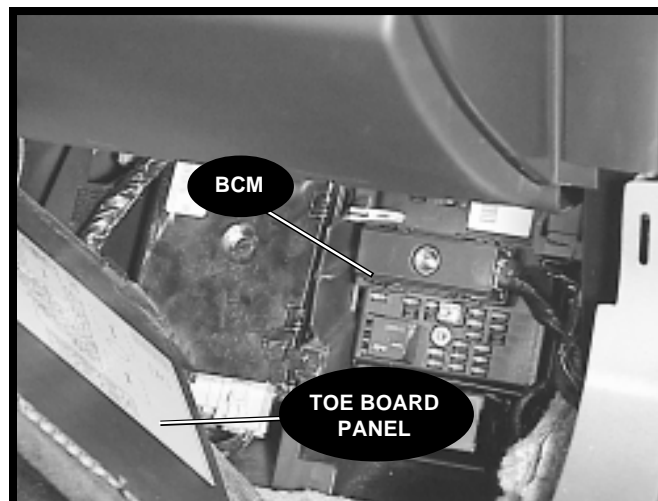


Figure 5-19, Body Control Module (BCM)

5. Interior Systems Overview

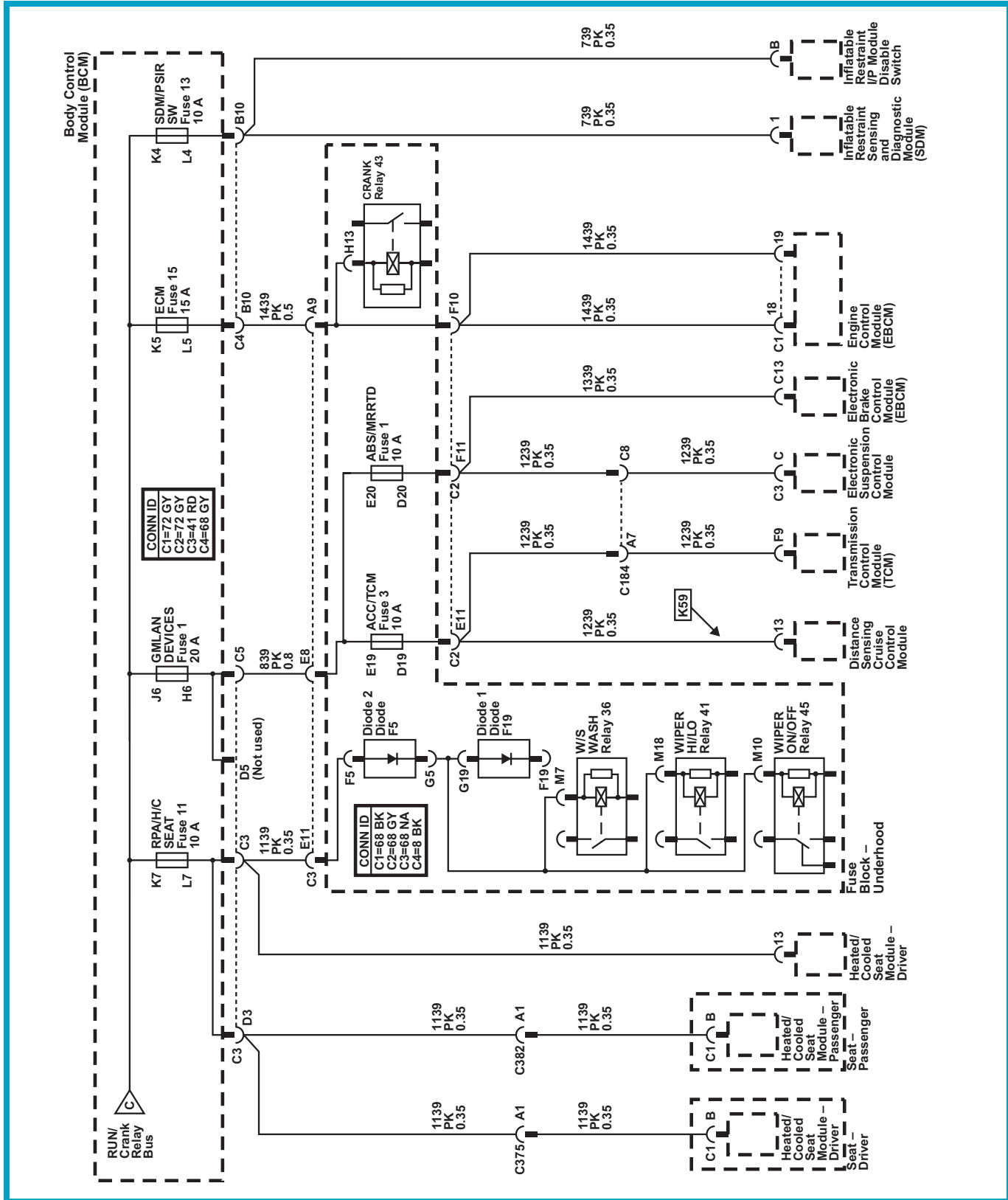


Figure 5-20a, Body Control Module Circuits/Components (1 of 3)

5. Interior Systems Overview

GMLAN/Class 2 Gateway

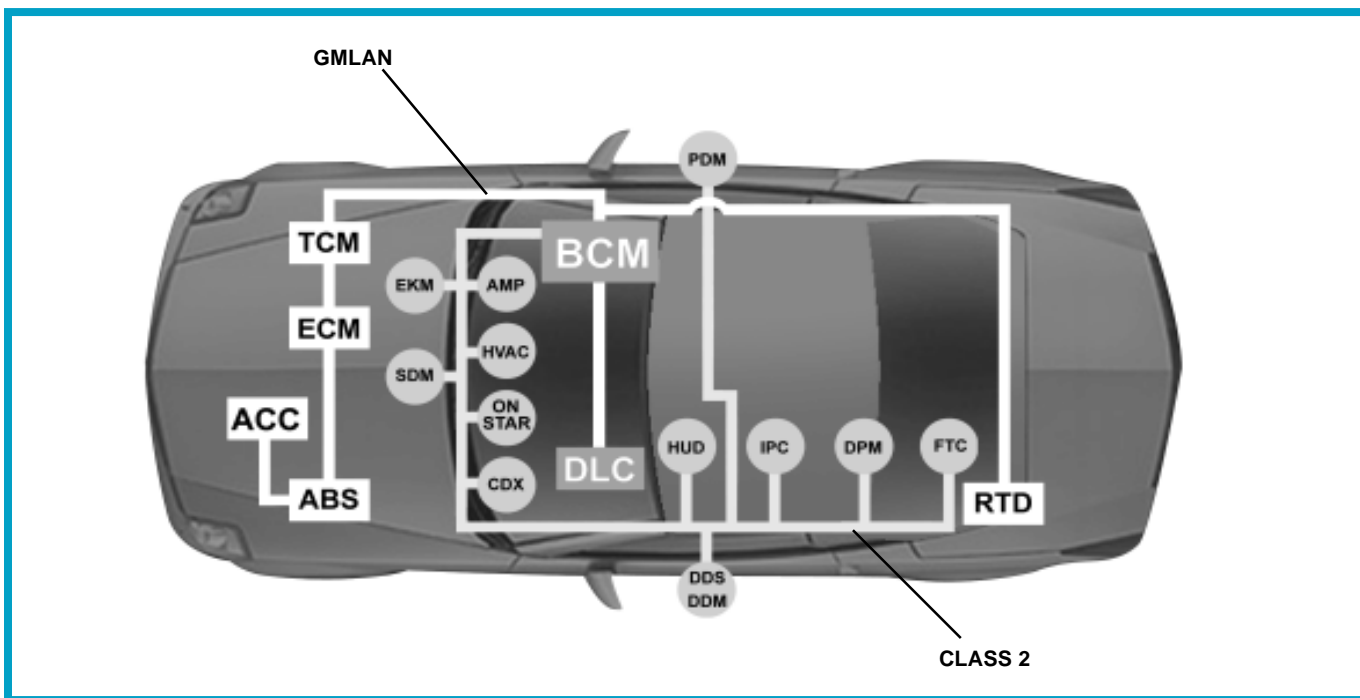


Figure 5-21, XLR Serial Data Buses*

Another essential function provided by the integrated BCM is its status as the gateway between the lower-speed class 2 and the high-speed GMLAN communications data buses (figure 5-21). The integrated BCM communicates both of these protocols and provides translation between them for all the controllers.

* Class 2 controllers are actually arranged in a “star” configuration. Layout shown was created to clearly identify both serial data buses and the included controllers.

5. Interior Systems Overview

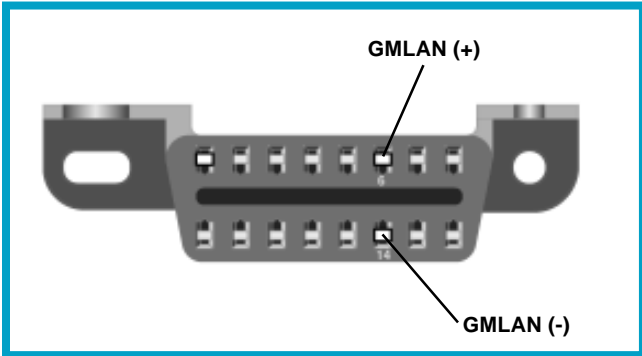


Figure 5-22, XLR DLC

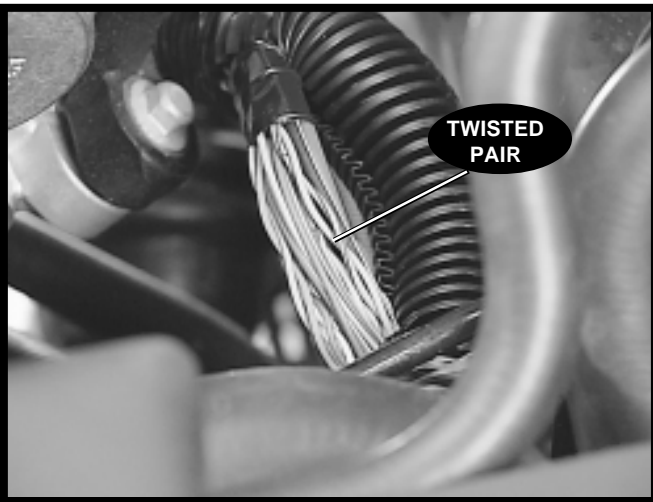


Figure 5-23, “Twisted Pair” GMLAN Wiring

The two networks function so that the bulk of the messages will remain locally on their own network. As a general rule, the high speed GMLAN network is for the controllers that contribute to vehicle performance and critical safety, where decisions require a split-second advantage. Class 2 is used for the technology that supports comfort and security.

Some messages will be transferred between each local network. The BCM is the gateway between the two networks. DLC Pins 6 and 14 are connected to the GMLAN serial data bus (figure 5-22).

The only standalone controller is the rear park assist controller.

All GMLAN serial data wiring uses a twisted pair configuration (figure 5-23) to minimize the effects of electromagnetic interference (or EMI). With the significant number of controllers on the XLR, this is an important design consideration.

5. Interior Systems Overview

Supplemental Inflatable Restraint (SIR) System

Air bag technology on the XLR parallels, for the most part, what you've seen on the other Cadillac models. The XLR is equipped with driver and passenger dual stage air bags. It also has side air bags located on the outboard side of the seat back, as you've seen before. Along with these side air bags, seat belt pretensioners supplement the occupants' seat belt system.

On the XLR, you'll find the side impact sensors located near the top of the door, under the door panel (figure 5-24). The right and left frontal sensors are located behind the front fascia under the twin air cleaner inlets.

Of special note is the seat position switch located within the bottom of the each seat's track (figure 5-25). These seat position switches are used to determine the proximity of a driver or passenger seat position with respect to the front air bags. In the event of a frontal collision, the SDM can determine whether the driver and passenger air bags should be deployed with a "shunted" or "non-shunted" stage. The deployment level is determined based on position information from the seat position sensors and impact energy from the frontal sensors (figure 5-26).

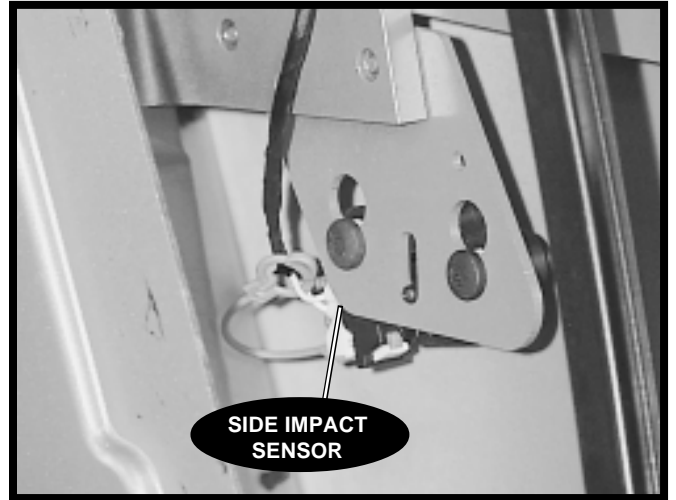


Figure 5-24, Side Impact Sensor

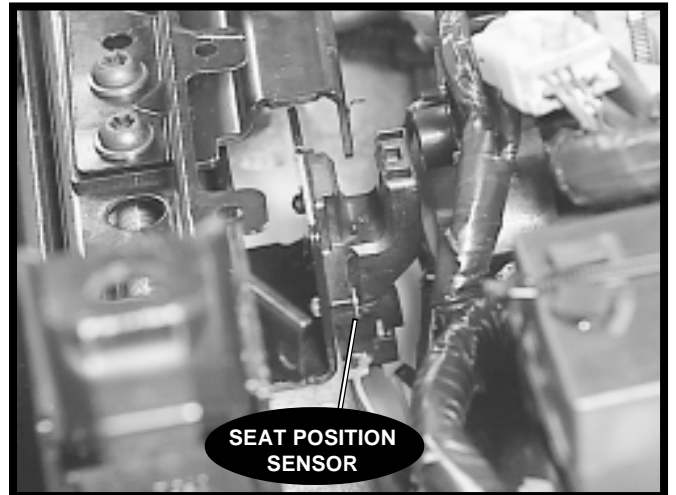


Figure 5-25, Seat Position Sensor

5. Interior Systems Overview

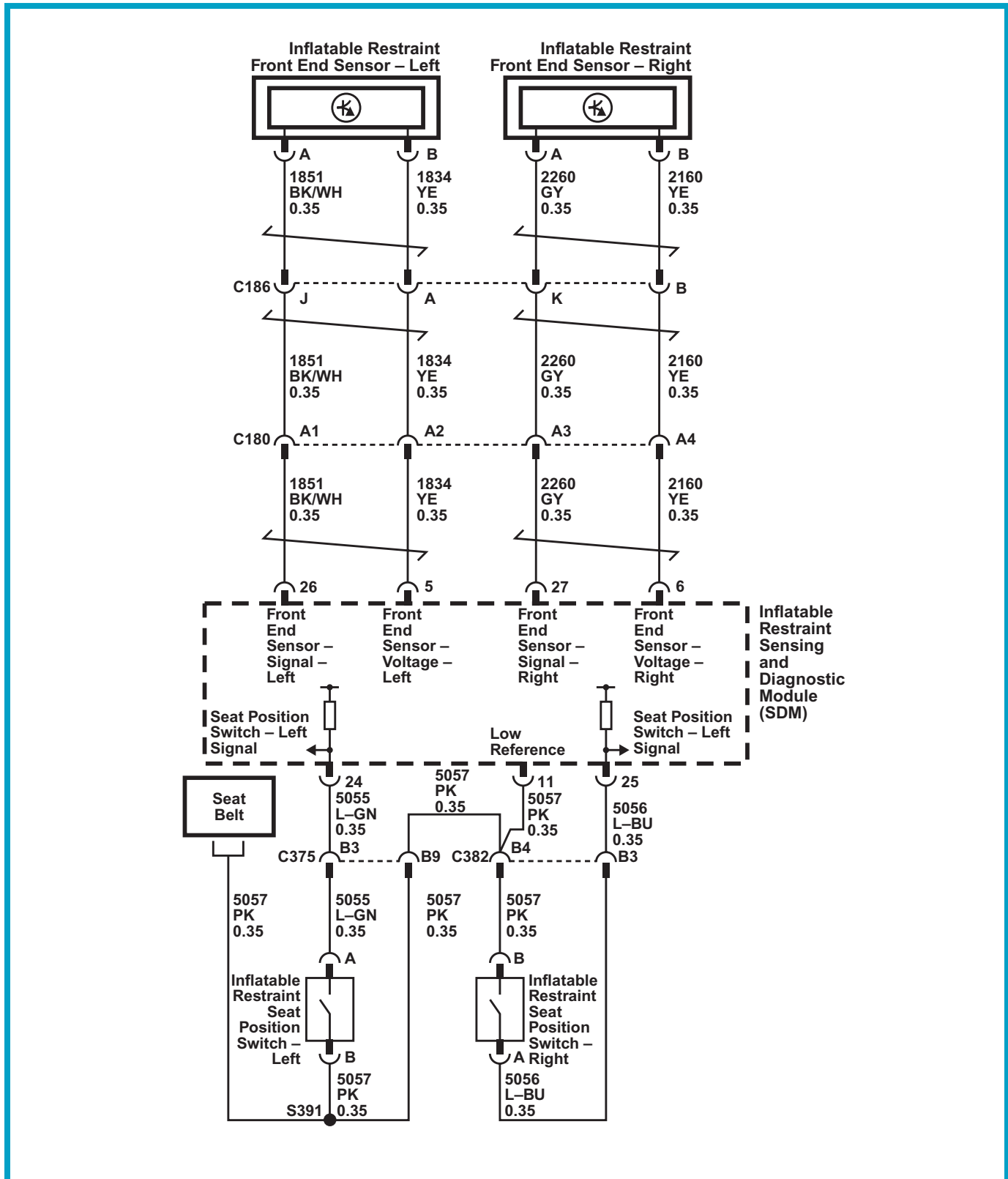


Figure 5-26a, SIR Seat Position Sensor Operation (1 of 2)

5. Interior Systems Overview

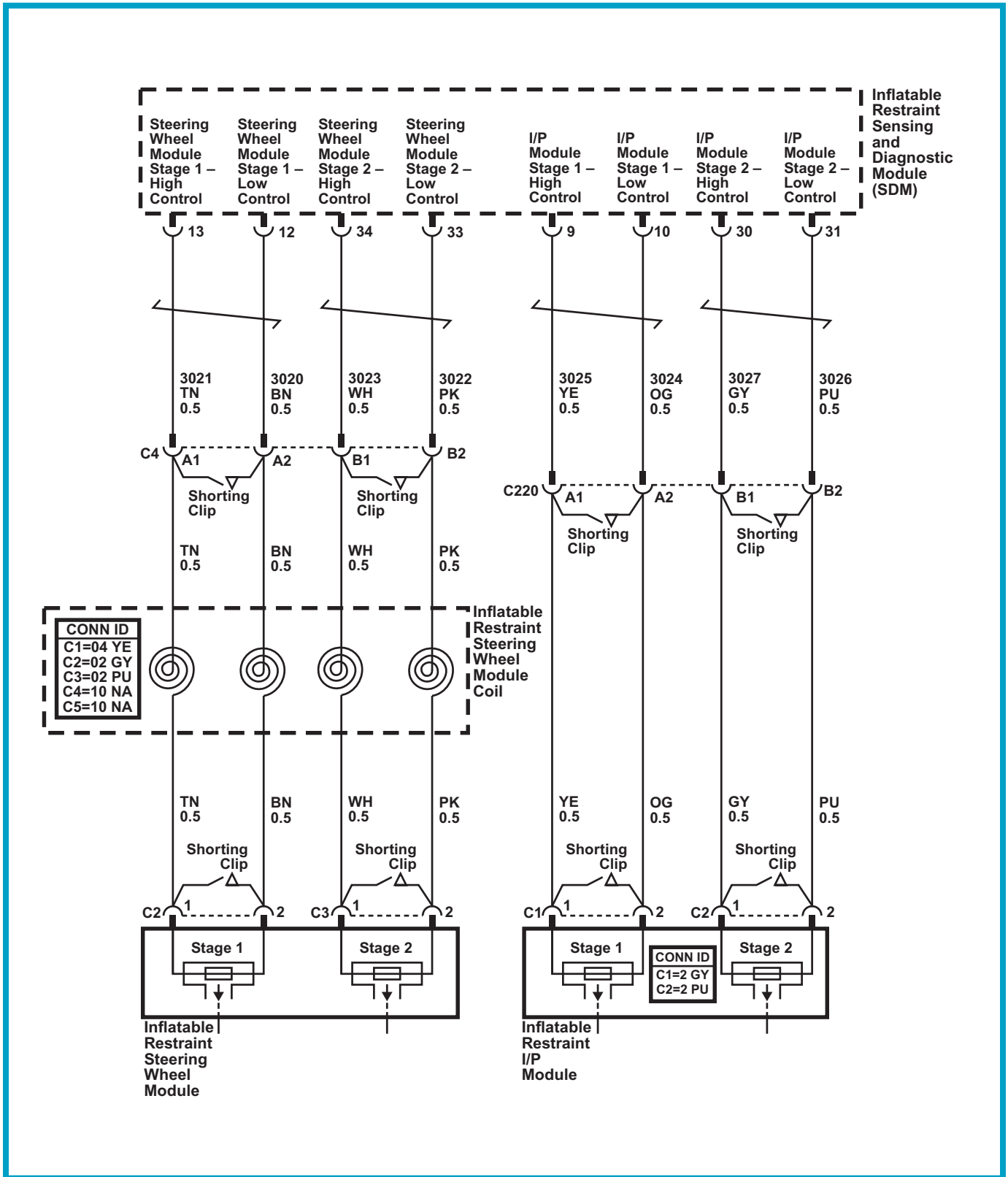


Figure 5-26b, SIR Seat Position Sensor Operation (2 of 2)

6. Service Tools

Essential

Tool Number	Description
J 42743	Trim Height Adjustment Tool
J 42854	Trim Height Measurement Gauge
J 44214	Flywheel Holder
J 45289	CANdi Module
J 45442	Adaptive Cruise Control Sensor Alignment
J 45930	Crank Seal Installer
J 46327, J 46328	Timing Chain Holding Tools
J 28685	Rear Bushing Remover and Installer
J 33432-A	Transverse (leaf) Spring Compressor
J 38197-A	Crankshaft Balancer Remover (3 Ear)
J 41712	Oil Pressure Sensor Socket
J 41816	Crankshaft Balancer Remover
J 41816-2	Crankshaft End Protector
J 42128	Axle Shaft Remover
J 42129	Rear Hub Spindle Remover
J 42188-A	Ball Joint Separator
J 42203	Driveline Support
J 43059	Valve Retainer Remover/Installer
J 43631	Ball Joint Remover
J 43822	Shock Remover and Installer
J 28467-81	Engine Support Fixture
J 46588	Axle Seal Crimp Tool
J 42055-7	Trans Support Plate
J 35589-A	Master Cylinder Bleeder Adapter
J 39232	Wiper Link Separator
J 39529	Wiper Link Installer
J 42058	Frame Anchor Clamps

Essential Getrag

Tool Number	Description
J 29369-2	Left Output Shaft Bearing Remover
J 36797	Output Shaft Seal Installer
J 42155	Differential Housing Lifting Tool
J 42157	Left Output Shaft Bearing Installer
J 42159	Differential Side Bearing Remover
J 42162	Side Gear Compressor
J 42164	Pinion Gear Holder
J 42166	Front Pinion Bearing Remover
J 42168	Shim Selection Tool
J 42170	Bearing Race Installer (combined w/J 42160)
J 42172	Bearing Race Installer (combined w/J 42163)
J 42173	Holding Fixture
J 42194	Bearing Race Remover
J 44678	Getrag Axle Tool Video
J 44616	Storage Case for Getrag Axles Tools

6. Service Tools

Recommended

Tool Number	Description
J 42055	Transmission Support Fixture
J 29794	Axle Shaft Remover Extension
J 21177-A	Drum To Brake Shoe Clearance Gauge
J 21474-5	Control Arm Bushing Receiver
J 21867	Pressure Gauge & Hose Adapter
J 24460-A	Radiator Pressure Tester
J 2619-01	Slide Hammer Assembly
J 28662	Brake Pedal Effort Gauge
J 29789	Piston Ring Compressor 3-3/8" to 3-5/8" (pliers)
J 35314	Exhaust Back Pressure Tester
J 38185	MUBEA Hose Clamp Pliers
J 38606	Valve Spring Compressor (head on engine)
J 39570	Chassis Ears
J 39580	Engine Support Table
J 41013	Rotor Resurfacing Kit
J 42220	Universal 12V Leak Detector
J 6125-1B	Slide Hammer
J 7872	Magnetic Base Dial Indicator
J 8001	Dial Indicator Set
J 8037	Piston Ring Compressor 2-1/8" to 5" (band style)
J 8062	Valve Spring Compressor (head off engine)
J 8089	Carbon Removal Brush
J 8433	Pully Puller
J 8433-1	Puller Body
J 8520	Dial Indicator Adapter
J 9666	Valve Spring Tester

Q. Final Test Questions

Questions 1 through 20 must be completed for credit on the Know-How release.

1. The SIR system uses _____ to determine “shunted” or “non-shunted” deployment.
 - a. seat position and frontal sensors
 - b. vehicle speed and frontal sensors
 - c. vehicle speed and wheel speed
 - d. seat position and vehicle speed
2. The _____ is the GMLAN/class 2 data communications gateway.
 - a. ECM
 - b. FPSCM
 - c. BCM
 - d. EBTCM
3. The _____ is the main audio source gateway.
 - a. radio head
 - b. CD changer
 - c. OnStar module
 - d. amplifier
4. Rather than mode control doors, the XLR uses _____ for HVAC airflow management.
 - a. rolling film
 - b. direct venting
 - c. separate modules
 - d. sliding baffles
5. The heated-cooled seat cushion or back ventilation module heats or cools by _____.
 - a. refrigerant
 - b. reversing polarity
 - c. changing amperage
 - d. switching elements
6. Which of the following will NOT cause adaptive cruise control default operation?
 - a. Braking fault
 - b. ECM fault
 - c. Suspension fault
 - d. BCM fault
7. A “dead battery” fob is placed in the glove box pocket because the pocket next to the _____.
 - a. Easy Key module
 - b. RKE antenna
 - c. valet antenna
 - d. limp-home antenna
8. To put the XLR in ignition On without the engine running, _____.
 - a. press the fob’s Start button without the brake applied
 - b. push the rocker switch On button with a door open
 - c. select this power mode through the DIC
 - d. press and hold the ACC switch for 5 seconds
9. The MagnaRide shock’s magnetic-rheological fluid is thickened based on road surface variation and _____.
 - a. road energy heat variance
 - b. higher vehicle speeds
 - c. reduced speed sensor frequency
 - d. extreme yaw sensor output voltage
10. The brake pressure sensor is mounted on the _____.
 - a. EBTCM assembly
 - b. master cylinder
 - c. front-left caliper
 - d. proportioning valve

Q. Final Test Questions

11. The XLR frame uses _____ frame rails.
- hydroformed U-channel
 - hydroformed boxed
 - solid steel
 - composite C-channel
12. The actual FM antenna is _____.
- within the OnStar GPS antenna
 - next to the navigation GPS antenna
 - on the rear side of the decklid interior trim
 - part of the diversity windshield antenna
13. Which of the following folding top components uses a potentiometer for position identification?
- rear tonneau
 - decklid open
 - header latched
 - header unlatched
14. The folding top rear tonneau cover is operated by _____ hydraulic cylinder(s).
- one
 - two
 - three
 - four
15. Which of the following actions is the earliest in a folding top going down sequence?
- Unlatches decklid
 - Opens rear tonneau
 - Windows enabled
 - Side glass folds for storage
16. If a door is closed, but unlocked, the LED will _____.
- be on continuously
 - show short flashes continuously
 - show two short flashes per second
 - flash in three second intervals
17. The Door Modules report switch status _____.
- on the GMLAN bus
 - on the class 2 bus
 - via analog signals
 - by altering reference voltage
18. Easy Key antennas poll at _____ kHz to determine fob location.
- 12.5
 - 125
 - 225
 - 315
19. Fuel pump speed is varied based on _____.
- vehicle speed
 - ECM commands to the FPSCM
 - pressure regulator feedback
 - open loop software
20. At 0% PWM to a cam actuator solenoid, the plunger would force oil to _____.
- retard both the intake and exhaust camshafts
 - advance both the intake and exhaust camshafts
 - advance the intake and retard the exhaust camshafts
 - advance the exhaust and retard the intake camshafts

Course Completion Procedure

All testing for the GM Service Know-How program is now accomplished through the GM Service Technical College web site.

To receive credit for the course, please contact the GM Service Technical College web site at www.gmcommontraining.com and select "Training Management" from the menu. This will take you to the Training Management System. A valid user name and password are required for this portion of the site.

Once you have been granted access to the system, select:

- Testing
- Service Technical
- Know-How Videos

From there you will be presented a list of available tests. Select the test you wish to take and follow the prompts.

This testing procedure provides immediate results at the completion of the test and is linked to the GM Service Technical College Training Management System.

Course Survey

Your opinions and suggestions are welcome as a way to improve future GM Service Know-How releases. A survey form is available at the end of the course test.

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