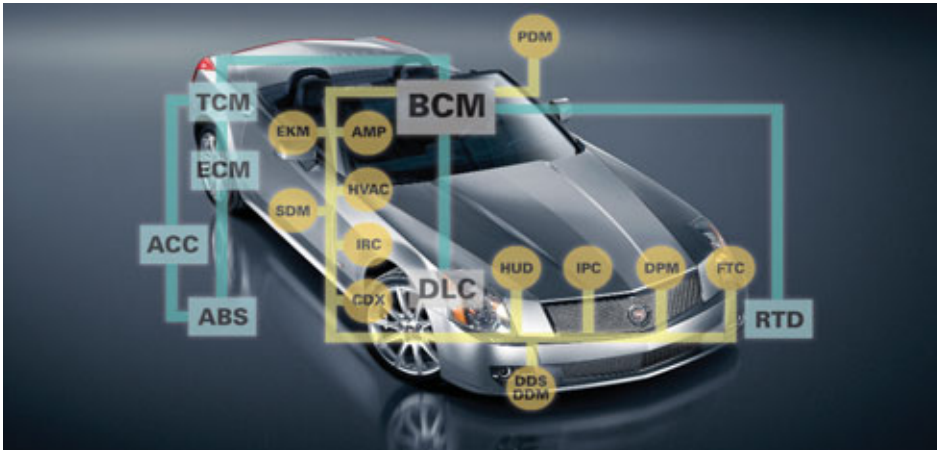


CAN Communication



Power steering control module, vehicle theft deterrent module, radio, HVAC control module, sensing and diagnostic module, digital radio receiver, remote control door lock receiver, sun-roof control module. Wait, there's much more. Heated seat control module, DVD player, garage door opener, body control module, adjustable pedals control module, electronic brake control module, turn signal hazard flasher module. It goes on and on. It's commonplace today to see vehicles with these electronic control units and more.

In order to facilitate all of the new electronics and still keep the amount of hardware, wiring and connectors to a minimum, a wide range of serial data strategies are being used. By using this type of architecture, the total circuitry in a given vehicle can be reduced as much as 75 percent.

Serial Communication

The types of serial communication used by all manufacturers have quickly evolved from low-end, non-emission

general purpose communication (UART) to real-time safety-related and emission systems communication (CAN). Types of serial communication used over the years include:

- UART (Universal Asynchronous Receive-Transmit)
- E&C (Entertainment and Comfort)
- SBI (Simple Bus Interface)
- SPI (Serial Peripheral Interface)
- LIN (Linear Interconnect Network)
- Keyword 81, 82 and 2000
- Class 2
- CAN (Controller Area Network)

continued on page 2

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- Log on to the ACDelco LMS, click on the Resources link

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- C. Provide a comment or ask a question on a recent *TechConnect* article?

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You can visit *TechConnect* Magazine Online two ways: go to the ACDelco Learning Management System and click on the Resources link or go to www.acdelcotechconnect.com and click on the *TechConnect* Magazine link.

- Thanks to Mike DeSander

CAN Communication -

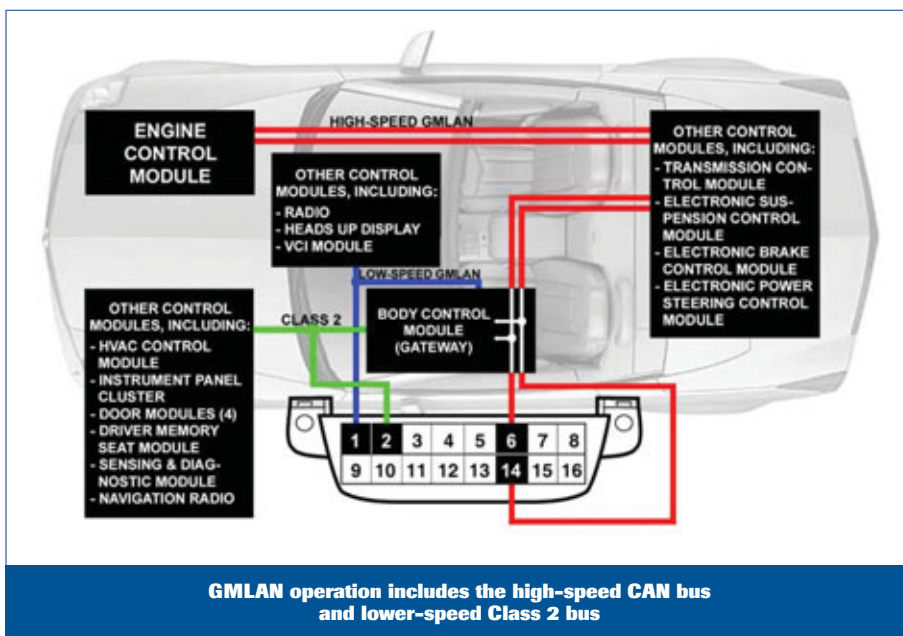
continued from page 1

How CAN Works

GM Local Area Network (GMLAN) communication is the latest serial data protocol on GM vehicles. It is a reliable (less susceptible to interference), cost-effective (less complicated network) and modular (virtual networks) way to handle sharing between different electronic control units in the vehicle through the means of a family of serial communication buses using the Controller Area Network protocol.

The GMLAN supports three separate buses: low-speed (33.33 kilobits per second), mid-speed (95.2 kilobits) and high-speed (500 kilobits). Each bit is 2 microseconds, compared to 5-6 milliseconds on a Class 2 line. High-speed serial data is transmitted on two twisted wires to reduce interference. When active, one line goes high (3.5 volts) and the second line goes low (1.5 volts). Modules that need real-time communication are attached to the high-speed network.

In most vehicles, the BCM is the gateway that translates the serial data messages between the GMLAN high-speed bus and other types of serial data communication.



CAN protocol calls for a label to be assigned to every message, giving it a unique "identifier." The identifier classifies the content of the message, such as engine speed. Each module processes only those messages whose identifiers are stored in the module's acceptance list. This is CAN's form of message filtering.

The identifier labels both the data content and the priority of the message being sent. When more than one module starts to translate simultaneously, the message with the highest priority is assigned first access.

For the Tech 2 scan tool to read GMLAN data, a CANdi (Controller Area Network diagnostic interface) module is needed.

Power Mode Master

In previous communication systems, modules required ignition input to serve as a wake-up. As a way to reduce the amount of wiring, connectors and electrical load on the ignition switch, a node such as the BCM or DIM is assigned as the Power Mode Master (PMM). The role of the PMM is to receive the ignition switch inputs and send messages related to the ignition switch position to other modules on the serial data line. These messages include:

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ACDelco service tips are intended for use by professional technicians, not a "do-it-yourselfer." They are written to inform those technicians of conditions that may occur on some vehicles, or to provide information that could assist in the proper service of a vehicle. Properly trained technicians have the equipment, tools, safety instructions and know-how to do a job properly and safely. If a condition is described, it cannot be assumed that the information applies to all vehicles or that all vehicles will have that condition.

All materials and programs described in this magazine are subject to change. Submission of materials implies the right to edit and publish. Inclusion in the publication is not necessarily an endorsement of the individual or the company.

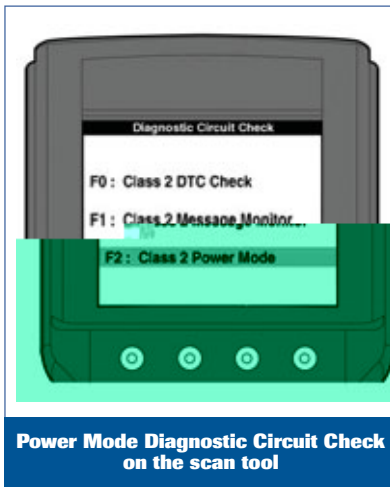
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CAN Communication – continued from page 2

- **Off-Asleep** – No activity on the serial data circuits, modules asleep, minimum power usage
- **Off-Awake** – Activity on the serial data circuits, modules awake, expecting inputs
- **RAP (Retained Accessory Power, if equipped)** – Modules that have functions enabled in RAP are fully operational, other modules in Off-Awake
- **Accessory** – Modules that have functions enabled in Accessory are fully operational, other modules in Off-Awake
- **Run** – All modules are fully functional
- **Crank** – Those modules that have no function critical to engine starting are off to provide maximum power for cranking and starting operation

The best way to check for a power moding problem is to look for DTCs. A DTC set in a module may let you know if there is a problem with a module or a basic power mode circuit fault. Some scan tools have a menu for checking power mode operation: select Diagnostic Circuit Check, then Power Mode.

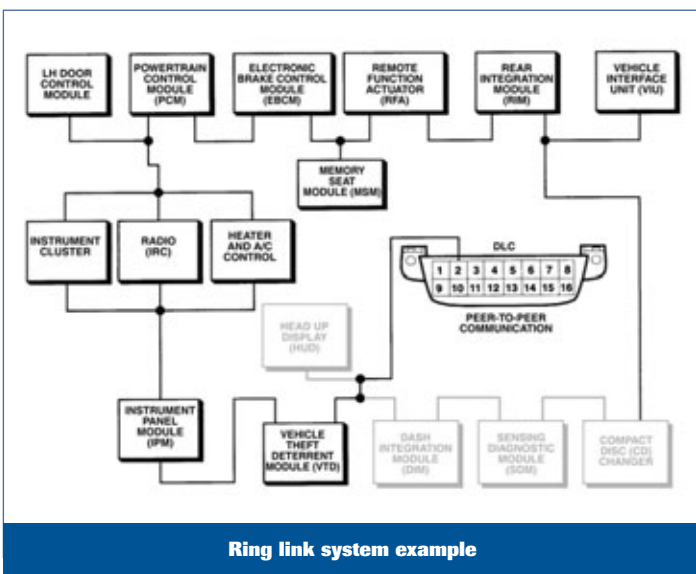


Power Mode Diagnostic Circuit Check on the scan tool

Networking

Networking is also known as multiplexing; a method of transferring data among distributed electronic control modules via a serial data bus. Without networking, dedicated, point-to-point wiring would result in bulky, expensive and even more complex wiring harnesses.

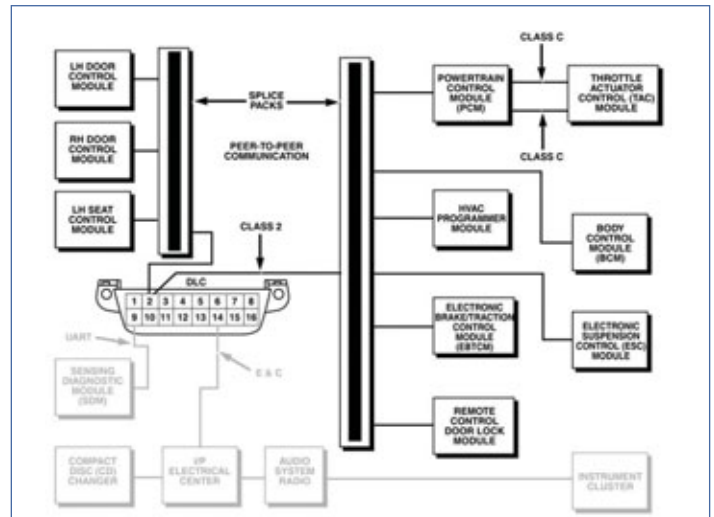
The wiring harnesses of an average-size vehicle is one mile long, weighs 200 pounds, has 300 mating connectors and 2,000 pins.



Ring link system example

One common type of network is a ring link network, which connects each control module to the next in line by a serial data line. To isolate control module faults, each module must be disconnected from the network. Each vehicle has main network connectors that can be disconnected so that the portions of the network can be isolated and checked for faults.

Another common type of network is a star link network. This network has a serial data line that exits from each control module and a serial data line is connected to a central point. The central point is referred to as a splice pack. Some vehicles use two or more splice packs to tie all the modules together. In most applications, the bus bar used in each splice pack can be removed. A special diagnostic tool can be installed in its place, allowing each control module to be isolated and checked for a possible fault.



Star link system example

A third type of network is a ring/star hybrid, which uses both techniques to connect control modules through a serial data line. Knowledge of exactly how each control module connects to the network is necessary to know which technique to use and when to use it.

The next generation of high-speed vehicle communication may be fiber optics. Fiber optic cable is lightweight, very immune to electromagnetic interference and capable of handling data speeds of 25 megabits per second. Some Saab models feature a fiber optic communication system referred to as Media Oriented System Transfer (MOST). The cables are 2-3 millimeters thick. The transparent inner core is approximately one millimeter thick and is the master of the bus in a ring configuration.

When handling and replacing fiber optic cable, the minimum bend radius is 25 millimeters and the flashing light emitted from a disconnected cable should not be viewed at close range.

For more information about the latest communication protocols and networking systems, several ACDelco training courses are available. Visit www.acdelcotechconnect.com and click on the Training tab.

– Thanks to Mike Militello

Scan Tool Functional Diagnostics

Scan tool diagnostics began in the mid 1980's on GM vehicles with the introduction of computer-controlled carburetors. Using the now-famous 12-pin ALDL (Assembly Line Diagnostic Link) connector under the driver's side instrument panel, technicians could get a view into what the magic box was seeing and doing to control fuel and spark. As on-board systems progressed, more Electronic Control Units (ECUs) were added to the vehicle, and many were wired to the ALDL so they could be accessed via the scan tool. By the end of the 1980's, most GM vehicles had a PCM, ABS and SRS ECU which could be accessed via the scan tool.

In order to make diagnostic information consistent, systems were classified under the following main groups in the Tech 1A scan tool menu: Powertrain, Chassis and Body. Under those groupings, many new ECUs were added, but the structure has remained in place to this day. Service procedures and training curriculum have been written around this model, and any technician familiar with scan tool usage is intimately familiar with its structure and can navigate the scan tool quickly to access the system being diagnosed. This design is so prevalent that it was adopted by the SAE as part of the DTC definitions in the OBDII standard (P codes, C codes, B codes).

The old adage, "if it ain't broke, don't fix it" may apply here, but there has been a change in the scan tool menu on select models to a design called Functional Diagnostics. Users of the Tech 2 scan tool may have noticed that beginning with the 2006 model year some vehicles do not present the traditional P-C-B selections.

In an effort to bring a unified system diagnostic approach to the technician, the menuing for the Tech 2 is being updated to reflect the way the GM electronic Service Information (SI) is laid out.

These diagnostic procedures assist the technician through a logical sequence of steps to check the entire system, as opposed to focusing on individual components. The real motive behind this strategy comes from the proven

understanding that today's vehicle networks are intimately connected components, and they share data, processing and problems. Although pinpoint diagnostics is used at the end of the flow chart, the high-level system diagnosis is important to make sure that related components and controls are not overlooked. Wasted time in the flow chart may lead to inaccurate diagnosis and lost revenue.

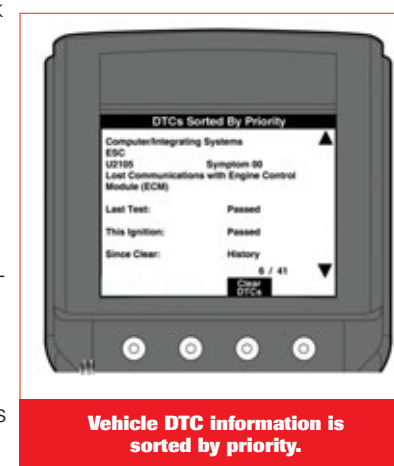
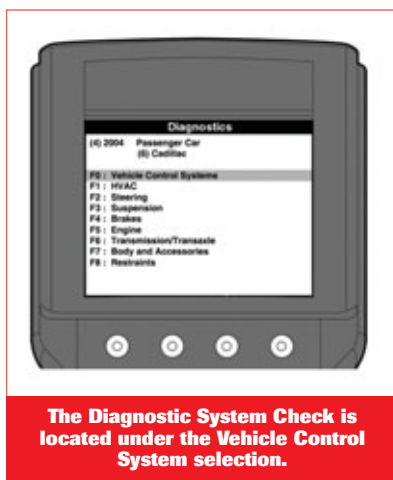
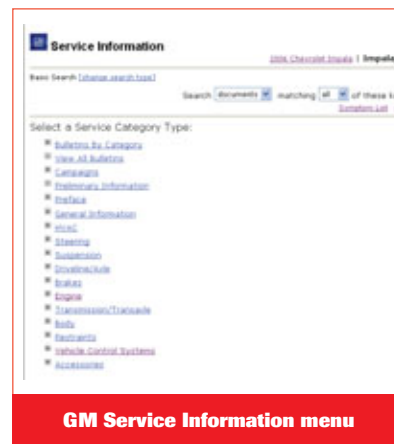
One additional change worth noting is the addition of the Vehicle Control Systems selection on the Tech 2 menu and the SI menu. Although part of the Service Information for some time, it was introduced in the Tech 2 on vehicles with a High-Speed CAN network and replaces the Diagnostic Circuit Check function that has been around since 1998 on the GM Class 2 network. This test allows the technician to "poll" the network and find out which ECUs are present and which ones are not.

Once the module has responded, it can display if there is communication and the number of DTCs stored. In addition, once all modules have responded, the list is reorganized based on the priority of the problems reported. No communication will take priority and the ECUs with the most DTCs come next.

The DTC information displayed includes symptom numbers that identify the type of failure, such as lost communication.

Symptom numbers reduce the number of DTCs for each vehicle. For example, symptom 03 may indicate a short to ground and symptom 07 may indicate an open or short to voltage.

– Thanks to Bob Augustine



GM VIN Cards

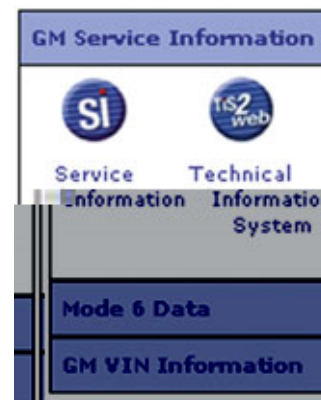
Starting with the 2009 model year, GM no longer will print Vehicle Identification Number (VIN) cards. The information to decipher the VIN codes for all GM vehicles is provided electronically both in the Service Information and on the web at www.acdelcotechconnect.com.

To access the VIN information, go to www.acdelcotechconnect.com and click on the GM VIN Information link on the left side of the home page.

The VIN information is available without any password or login requirements.

GM VIN information ranging from the current model year back to 1972 is available by clicking on the desired model year from the displayed list. The electronic information is presented in the same format as the familiar VIN card. The information can be printed or saved to your computer hard drive.

– Thanks to Mike DeSander



Emission System Testing Tips

Before the government mandated On-Board Refueling Vapor Recovery (ORVR) to combat hydrocarbons (passenger cars in 1998, light trucks in 2003 and heavier trucks in 2006), there was no good way to test for a leak at the cap-to-filler neck interface because of a check valve on the end of the filler neck. So, an adapter had to be used.

Since the introduction of ORVR, there is now a vapor recirculation tube that connects the vapor dome at the top of the tank to the upper end of the filler neck. The vapor recirculation tube allows the entire EVAP system to be leak tested from the front of the vehicle at the service port. This eliminates the need for installing the adapter to the cap for leak testing.

This test is more meaningful because it tests the actual cap-to-filler neck interface seal, rather than testing to see if the cap seals against an adapter surface.

Evaporative Emission System Tester

The best way to test the fuel cap is to leave it on the vehicle while using an Evaporative Emission System Tester (EEST), connected at the service port. By doing so, the critical cap-to-filler neck interface is tested for leakage. It is inappropriate to use a tool such as a fuel tank cap adapter (examples for GM vehicles include GE-41415-50 and GE-41415-50A) to test fuel caps on many of today's vehicles.

Follow the Service Information instructions specific to the vehicle being worked on when connecting an Evaporative Emission System Tester.

Fuel Tank Cap Adapter

The fuel tank cap adapter cannot be used to test the cap on some vehicles because it may falsely show a leak at the cap. For these vehicles, a leaking cap on the test adapter does not necessarily indicate that the cap will leak on the filler neck. Use the adapter only when called out in the Service Information instructions.



Part of the adapter — the filler neck end of the tool — is still needed when testing for a restriction in the diagnostic for P0455 on certain vehicles. This is fully explained in the Service Information procedure for P0455.

The fuel tank cap adapter is also needed when there is a check-valve in the purge line; i.e., on some turbocharged vehicles.

– Thanks to Bill Coleman

When 4-Wheel Drive Fails

With winter weather in full swing in much of the country, your customers with automatic 4x4 vehicles might be asking, “What happened to my four-wheel drive?”

After months of sitting idle and exposed on the vehicle underbody, some transfer cases and actuator/encoder motors that do the heavy lifting in shifting from two-wheel drive to four-wheel drive don't answer the bell. When they don't, it usually means it's time for a new actuator motor, or in some cases, a new transfer case.

In either instance, GM Parts has the best answer for GM light trucks and SUVs equipped with switch-activated four-wheel drive — whether it's a new actuator/encoder motor or a new or remanufactured transfer case.

But your first task is to diagnose the vehicle condition. Rather than just assuming the problem is a damaged transfer case, check the motor, which is easily removed from the transfer case. If it's faulty, it can be quickly replaced with a new GM Parts motor, which is a less expensive option than replacing the entire transfer case/motor assembly. If the problem does lie with the transfer case, the damage is typically the result of heavy use and maintenance neglect that results in “grenading.” In most cases, a GM Parts remanufactured transfer case that often incorporates engineering updates from the original is the most cost-effective solution. GM Parts also supplies new transfer case assemblies.

The OE Advantage

Whichever repair is needed, GM Parts products designed for GM applications offer significant advantages over aftermarket competition.

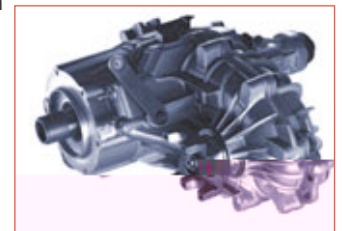
In the case of the actuator/encoder motor, GM original equipment removes a lot of uncertainty. Unlike remanufactured or reverse-engineered new motors supplied by the aftermarket, GM actuator motors meet rigorous OE design and construction standards. Plus, unlike remanufactured units, they don't carry a core charge.

The remanufactured units of GM transfer cases are designed to fit more than 85 percent of GM model year 1995-2006 vehicles. They typically incorporate a range of new generation components spanning from snap rings, bearings and seals to pump tube connectors, chains and synchronizer rings.

The reman transfer cases also yield a simpler replacement solution, with more mandatory replacement parts than aftermarket products. They all come with encoder motors so it's not necessary to buy the motor separately.

Devoted four-wheel drive vehicle owners aren't ones to settle for half a solution. So, when they roll into your shop looking for the other half of their four-wheel drive, choose the competitively priced, technologically superior GM Parts solution.

– Thanks to Michael Henk



40,000 and Counting

- **Chrysler Engine Performance (S-EP08-21.01ILT)** – Explore diagnostic strategies for troubleshooting Chrysler engine performance issues using the Chrysler Starmobile® diagnostic scan tool.
- **High Voltage System Safety (S-EL06-42.01WBT)** – Covers high voltage system safety practices and precautions as well as personal protective equipment that must be used when working on high voltage systems.

As the number of advanced propulsion and alternative fuel vehicles on the road continues to grow, ACDelco also will soon launch a number of new courses covering a variety of hybrid vehicles to help keep technicians informed on the latest technology. Look for these new hybrid courses and the new powertrain and heating and cooling courses on the ACDelco Learning Management System.

Go to www.acdelcotechconnect.com and click on the Training tab for more information about ACDelco technical training.

– Thanks to Greg St. Aubin

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The TSS Q&A provides answers to common questions received by the ACDelco Customer Support Center.

Q: How do I check my exclusively yours® rewards program points balance?

A: To check your exclusively yours points balance online:

- Go to www.acdelcotechconnect.com
- Click on the Rewards link (in the ACDelco Incentives box on the left side of the home page) and log in using your Incentives User ID
- Select Reports to view any of your Personal Reports, including the Performance Report, which lists the amount of points earned year-to-date

To check your current points balance over the phone, call 1-800-833-4866. You must have your exclusively yours card available when calling.

If you have any questions about the TSS program or any current ACDelco activities, contact the Customer Support Center at 1-800-825-5886, prompt 0.

The following technical tips provide repair information about specific conditions on a variety of vehicles. If you have a tough or unusual service repair, the **TSS Technical Assistance Hot Line** can help. Call **1-800-825-5886, prompt #2**, to speak with a technical expert with the latest OEM information.

Remote Keyless Entry Inoperative

1995-1998 Saab 900, 1999-2002 Saab 9-3 Sedan, 2003 Saab 9-3 Convertible, and 1999-2008 Saab 9-5

The Remote Keyless Entry (RKE)/central locking may be intermittently inoperative or the radio may not turn off when removing the key. This concern may be difficult to duplicate and no DTCs are set.

If the B+ (plunger) switch in the ignition switch sticks in/on when removing the ignition key, these conditions will be present. When B+ voltage is present, it supplies fuse 5 in panel 22a. This fuse supplies DICE and TWICE a key-in ignition signal, disabling RKE.

This condition is often caused by liquids or debris entering into the lock cylinder, causing the cylinder not to fully release upon key removal. The center portion of the cylinder should pop up when the key is removed.

To repair this condition, carefully remove the immobilizer antenna (if equipped) from around the ignition switch to check for evidence of spilled liquids. If residue is found, remove the ignition lock cylinder and inspect the cylinder and switch for binding. It may be possible to clean the key cylinder by soaking it in warm, soapy water; then blow it out with compressed air. Lube the lock cylinder with light machine oil before re-installing. If the cylinder still binds, it should be replaced. If residue is found in the switch, it must be replaced. The key cylinders can be ordered keyed to the vehicle.

The antenna for the RKE is mounted in the center console by the rear ashtray.

A/C, Cruise Control, A/T Shift Position Indicator Inoperative

2003 Honda Accord V6

At least one of these intermittent symptoms may occur: A/C does not work, cruise control does not work, the automatic transmission shift position indicator in the instrument cluster does not work.

When this problem occurs, all of these symptoms are present, but the customer may not notice all of them.

The probable cause is a communication problem between the F-CAN (Controller Area Network) and the PCM. An update of the PCM is required.

Blower Motor Slows When Using Navigation Voice Control

2004 Acura TSX with the navigation system

In models with the navigation system, owners may comment that the fan speed drops when the navigation voice control switch is pressed. This is a normal operation that was added to the system during the 2004 model year.

The blower motor fan speed drops to its lowest setting (1) as soon as the steering wheel-mounted voice control switch is pressed and released. This feature keeps air from the center vent from blowing onto the microphone in the ceiling and reducing the voice recognition capability.

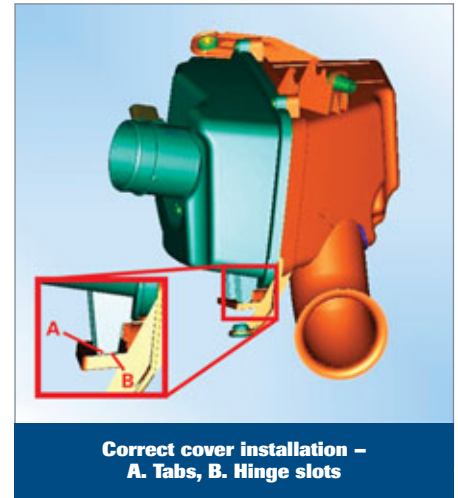
Owners of TSX models built before the VIN cutoff will receive this feature if the updated disc is purchased from the Acura website.

Air Cleaner Cover Installation

2004-09 Cadillac SRX, 2005-09 Cadillac STS (except V Series), and 2004-07 Cadillac CTS (except V Series)

If replacing only the air filter element, the air cleaner (outlet side) cover does NOT need to be completely removed from the housing. The cover will pivot to allow for removal and installation of the filter element.

The air cleaner (outlet side) cover can be difficult to reinstall in the proper position if it has been fully removed from the housing. The tabs must be correctly aligned with the hinge slots in the (inlet side) housing. It is possible to incorrectly reassemble the cover to the housing without the cover seated properly at the hinge.



When viewed from the top, there may not be a visual indication that the box is not properly sealed.

To reduce the risk of an improperly sealed air cleaner assembly and dirty air entering the engine, verify that the cover is seated correctly in the housing before reinstalling the cover bolts.

To check that the cover is properly seated once the cover bolts have been torqued down, gently pull up on the cover/MAF Sensor adapter. This gives a positive indication that the tabs of the cover are seated in the hinge slots.

Diagnostic Assistance

For free technical diagnostic assistance and product information regarding specific ACDelco products, contact these toll-free information hotlines staffed by ASE-certified technicians:

- Brakes – 1-888-701-6169 (prompt #1)
- Chassis – 1-888-701-6169 (prompt #2)
- Clutches – 1-888-725-8625
- Lift Supports – 1-800-790-5438
- Shocks – 1-877-466-7752
- Starters and Alternators – 1-800-228-9672
- Steering – 1-866-833-5567
- Wiper Blades – 1-800-810-7096

Training UPDATE

How to Take ACDelco Training

Go to www.acdelcotechconnect.com and click on the **Training** tab to log on to the ACDelco Learning Management System (LMS).

- To enroll in an **Instructor-Led Training (ILT)** course, click on the Enrollment link or the Instructor-Led Courses link.
- To launch a **Web-Based Training (WBT)** course, click on the Web-Based Courses link to view the catalog and select a specific course.
- To launch a **TechAssist (TAS)** course, click on the TechAssists link to view the catalog and select a specific course.
- To launch a **Simulation (SIM)**, click on the Simulations link to view the catalog and select a diagnostic challenge simulation.

Training Locations

ACDelco offers numerous hands-on Instructor-Led Training (ILT) courses at many convenient locations around the country. Following are the ACDelco training locations.

ACDelco Instructor-Led Training Locations	City	State
South Central Region		
Pulaski Technical College	Little Rock	AR
Iowa Western Community College	Council Bluffs	IA
Johnson County Community College	Overland Park	KS
Wichita Area Technical College	Wichita	KS
Longview Community College	Lee's Summit	MO
Ozarks Technical Community College	Springfield	MO
St. Louis Training Center	St. Louis	MO
Hinds Community College Career Center	Raymond	MS
Tulsa Tech Lemley Campus	Tulsa	OK
Southwest Tennessee Community College	Memphis	TN
Austin Community College	Austin	TX
Del Mar College West Campus	Corpus Christi	TX
GM Training Center	Garland	TX
North Harris College	Houston	TX
San Jacinto College	Pasadena	TX
South Texas Community College CAAT Center	McAllen	TX
St. Philips College	San Antonio	TX
Tarrant County College	Fort Worth	TX
West Texas Training Center	San Angelo	TX
Southeast Region		
J.F. Drake State Technical College	Huntsville	AL
Lawson State Community College	Bessemer	AL
Trenholm State Technical College	Montgomery	AL
Florida Community College	Jacksonville	FL
Sarasota County Technical Institute	Sarasota	FL
Seminole Community College	Sanford	FL
Sheridan Technical College	Hollywood	FL
Albany Technical College	Albany	GA
GM Training Center	Alpharetta	GA
Ivy Tech Community College	Evansville	IN
Central Kentucky Technical College	Lexington	KY
Central Piedmont Community College	Matthews	NC
Forsyth Technical Community College	Winston Salem	NC
Wayne Community College	Goldsboro	NC
GM Service Technical College	Spring Hill	TN
J. Sargeant Reynolds, Western Campus	Goochland	VA

ACDelco Instructor-Led Training Locations	City	State
Western Region		
University of Alaska	Anchorage	AK
Glendale Community College	Glendale	AZ
American River College	Sacramento	CA
Cuyamaca College	San Diego	CA
Fresno City College	Fresno	CA
GM Training Center	Burbank	CA
Las Positas Community College	Livermore	CA
Arapahoe Community College	Littleton	CO
Denver Training Center	Denver	CO
Leeward Community College	Pearl City	HI
College of Southern Idaho	Twin Falls	ID
MSU - Billings College of Technology	Billings	MT
Central New Mexico Community College	Albuquerque	NM
Community College of Southern Nevada	N. Las Vegas	NV
Truckee Meadows Community College	Reno	NV
Portland Community College	Portland	OR
Weber State University	Ogden	UT
Renton Technical College	Renton	WA
Shoreline Community College	Seattle	WA
North Central Region		
Des Moines Area Community College	Ankeny	IA
GM Training Center	Hinsdale	IL
Ivy Technical State College	Indianapolis	IN
Delta College	Saginaw	MI
GM Training Center	Warren	MI
Grand Rapids Community College	Grand Rapids	MI
Michigan Technical Education Center	Traverse City	MI
Dunwoody College of Technology	Minneapolis	MN
Minnesota State Community & Technical College	Moorhead	MN
Bismarck State College	Bismarck	ND
Cincinnati State Community College	Cincinnati	OH
Columbus Automotive Dist Warehouse	Columbus	OH
Cuyahoga Community College	Parma	OH
Sinclair Community College	Dayton	OH
Stark State College – Auto Tech Center	N. Canton	OH
South East Technical Institute	Sioux Falls	SD
Fox Valley Technical College	Appleton	WI
Waukesha County Community College	Pewaukee	WI
Northeast Region		
GM STC Training Center	Newark	DE
Mass Bay Community College	Ashland	MA
Montgomery College	Rockville	MD
Lakes Region Community College	Laconia	NH
Erie Community College	Orchard Park	NY
GM Training Center	Ardsley	NY
Hudson Valley Community College	Troy	NY
Community College of Allegheny County	Oakdale	PA
Harrisburg Area Community College	Harrisburg	PA
Slippery Rock University	Cranberry Twp.	PA