Module communications makes controlling multiple electrical devices and accessories easier by utilizing simple low-current switches to signal another module, which does the actual switching of the current to the device.

A network allows all modules to communicate with other modules.

Figure 49-1

Figure 49-2
Figure 49-3 A ring link network reduces the number of wires it takes to interconnect all of the modules.

Figure 49-4 In a star link network, all of the modules are connected using splice packs.

FREQUENTLY ASKED QUESTION

What Is a BUS?

A BUS is a term used to describe a communications network. Therefore, there are connections to the BUS and BUS communications, both of which refer to digital messages being transmitted among electronic modules or computers.
**Frequently Asked Question:** What Is a Protocol?

A **protocol** is a set of rules or a standard used between computers or electronic control modules. Protocols include the type of electrical connectors, voltage levels, and frequency of the transmitted messages. Protocols, therefore, include both the hardware and software needed to communicate between modules.
Figure 49-7  The E & C serial data is connected to the data link connector (DLC) at pin 14.

Figure 49-8  Class 2 serial data communication is accessible at the data link connector (DLC) at pin 2.

Figure 49-9  Keyword 82 operates at a rate of 8,192 bps, similar to UART, and keyword 2000 operates at a baud rate of 10,400 bps (the same as a Class 2 communicator).
Figure 49-10  GMLAN uses pins at terminals 6 and 14.

**FREQUENTLY ASKED QUESTION**

**Why Is a Twisted Pair Used?**
A twisted pair is where two wires are twisted to prevent electromagnetic radiation from affecting the signals passing through the wires. By twisting the two wires about once every inch (9 to 16 times per foot), the interference is canceled by the adjacent wire. **SEE FIGURE 49–11.**

Figure 49-11  A twisted pair is used by several different network communication protocols to reduce interference that can be induced in the wiring from nearby electromagnetic sources.
Figure 49-12 A CANdI module will flash the green LED rapidly if communications is detected.

Figure 49-13 A Ford OBD-I diagnostic link connector showing that SCP communication uses terminals in cavities 1 (upper 487) and 3 (lower left).

Figure 49-14 A scan tool can be used to check communications with the SCP BUS through terminals 2 and 10 and to the other modules connected to terminal 7 of the data link connector (DLC).
FREQUENTLY ASKED QUESTION

What Are U Codes?
The U diagnostic trouble codes were at first “undefined” but are now network-related codes. Use the network codes to help pinpoint the circuit or module that is not working correctly.
Figure 49-17 The differential voltage for the CCD BUS is created by using resistors in a module.

Figure 49-18 Many Chrysler vehicles use both SCI and CCD for module communication.

Figure 49-19 CAN uses a differential type of module communication where the voltage on one wire is the equal but opposite voltage on the other wire. When no communication is occurring, both wires have 2.5 volts applied. When communication is occurring, CAN H (high) goes up 1 volt to 3.5 volts and CAN L (low) goes down 1 volt to 1.5 volts.
Figure 49-20 A typical (generic) system showing how the CAN BUS is connected to various electrical accessories and systems in the vehicle.

Figure 49-21 A DLC from a pre-CAN Acura. It shows terminals in cavities 4, 5 (ground), 7, 10, 14, and 16 (B+).

Figure 49-22 A Honda scan display showing a B and two U codes, all indicating a BUS-related problem(s).
FREQUENTLY ASKED QUESTION: How Do You Know What System Is Used?

Use service information to determine which network communication protocol is used. However, due to the various systems on some vehicles, it may be easier to look at the data link connector to determine the system. All OBD-II vehicles have terminals in the following cavities.

- Terminal 4: chassis ground
- Terminal 5: computer (signal) ground
- Terminal 16: 12 V positive

The terminals in cavities 6 and 14 mean that this vehicle is equipped with CAN as the only module communication protocol available at the DLC. To perform a test of the BUS, use a breakout box (BOB) connected to this connector. A breakout box (BOB) can often be used to gain access to module BUS information.

SEE FIGURE 49–24 for a typical OBD-II connector breakout box.
This Honda scan tool allows the technician to turn on individual lights and operate
individual power switches and other accessories that are connected to the BUS system.

Modules used in a General Motors vehicle can be "pinged" using a Tech 2 scan tool.

Checking the terminating resistors using an ohmmeter at the DLC.
Use front-probe terminals to access the data link connector. Always follow the specified back-probe and front-probe procedures as found in service information.

TECH TIP: No Communication? Try Bypass Mode.

If a Tech 2 scan tool shows "no communication," try using the bypass mode to see what should be on the data display. To enter bypass mode, perform the following steps.

STEP 1 Select tool option (F3).
STEP 2 Set communications to bypass (F5).
STEP 3 Select enable.
STEP 4 Input make/model and year of vehicle.
STEP 5 Note all parameters that should be included, as shown. The values will not be shown.

REAL WORLD FIX: The Radio Caused No-Start Story

A 2005 Chevrolet Cobalt did not start. A technician checked with a subscription-based helpline service and discovered that a fault with the Class 2 data circuit could prevent the engine from starting. The advisor suggested that a module should be disconnected (one at a time) to see if one of them was taking the data line to ground. The two most common components on the Class 2 serial data lines that have been identified to cause a lack of communication and become shorted (i.e., taking the data line to ground) are the radio and electronic brake control module (EBCM). The first component the technician disconnected was the radio. The engine started and ran. Apparently, the Class 2 serial data line was shorted to ground inside the radio, which took the entire data circuit to ground and prevented the PCM from energizing the fuel pump, ignition, or fuel injectors so the engine would not start. The radio was replaced to solve the no-start condition.
**FREQUENTLY ASKED QUESTION**

**Frequently Asked Question: Which Module Is the Gateway Module?**

The gateway module is responsible for communicating with other modules and acts as the main communications module for scan tool data. Most General Motors vehicles use the body control module (BCM) or the instrument panel control (IPC) module as the gateway. To verify which module is the gateway, check the schematic and look for one that has voltage applied during all of the following conditions:

- Key on, engine off
- Engine cranking
- Engine running

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**Figure 49-29 (a)**

Data is sent in packets, so it is normal to see activity then a flat line between packets.

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**Figure 49-29 (b)**

A CAN BUS should show voltages that are opposite when there is normal communications. CAN H (high) circuit should go from 2.5 volts at rest to 3.5 volts when active. The CAN L (low) circuit goes from 2.5 volts at rest to 1.5 volts when active.
Figure 49-30 A 16 pin OBD-II DLC with terminals identified. Scan tools use the power pin (16) and ground pin (4) for power so that a separate cigarette lighter plug is not necessary on OBD-II vehicles.

Figure 49-31 This schematic of a Chevrolet Equinox shows that the vehicle uses a CAN BUS (DLC pins 6 and 14), plus a Class 2 (pin 2) and UART.