Introduction to Multiplexing

The term "multiplexing" describes how the vehicle's electrical system works. Multiplexing is defined as sending multiple electronic messages through the same signal path at the same time—in this case, through the vehicle's wiring.

Multiplexing allows a vehicle's electrical system to simultaneously perform tasks and to monitor components. A multiplexed system uses electronic control units (ECUs) to operate the system. The electrical system components, such as switches and lamps, are connected to the ECUs, which collect and control all information about the components by communicating on the datalink.

A less formal description might be that multiplexing is much like the interstate highway system. Trucks and cars share the roadway, with each vehicle bound for a different destination. Every vehicle travels at different speeds, enters and exits at different places, and the occupants of every vehicle have different objectives. Whether it is a truck driver hauling goods from a factory to a store or a saleswoman heading home from work, highway users are like the electronic signals flashing along the datalink.

Multiplexing was introduced in vehicles in the 1980's with the first electronically controlled engines and the initial use of the J1708/J1587 datalink. The concept was taken a step further in the early 1990's when transmissions were electronically connected to engines in order to control engine speed and torque output during shifting. Multiplexing has now been applied to the entire vehicle.

General Information

The multiplexed electrical system replaces traditional power distribution module (PDM) devices, such as relays and circuit breakers, with electronic devices that communicate over the vehicle datalinks. These electronic devices control power distribution to the vehicle's electric loads. This is done by monitoring inputs (such as sensors and switches) and supplying power to outputs (such as lighting, displays, gauges, and indicators). This distributed approach to handling switch inputs and controlling electrical load outputs sharply reduces the number of wires on a vehicle. Rather than having individual wires transmitting voltage from switches to relays that then supply power to the components, the multiplexed system continuously monitors the status of all switches (input devices) and sends messages over the shared-wire J1939 datalink to control outputs.

The system communicates on two datalinks: the J1939 datalink and the J1708/J1587 datalink. J1939 is the primary datalink and is used for all control messaging and troubleshooting; J1708/J1587 is the secondary datalink and is used for limited troubleshooting. Fault codes are displayed on the instrument cluster display and they may also be viewed on ServiceLink.

The multiplexed system utilizes the following controllers: the Bulkhead Module (BHM), the Chassis Module (CHM), the Switch Hub Module (SHM) with 8-Switch Banks (8SB), the optional Expansion Module (EXM), and the optional Switch Expansion Module (SEM). The most important part of the multiplexed electrical system is the BHM. The BHM is the brain of the entire system, and controls all of the outputs in response to changes in any of the inputs. The CHM, SHM, EXM and SEM are slaves to the BHM and respond to commands from the BHM and broadcast the status of the inputs and outputs connected to them. See **Fig. 1**.

See **Fig. 2** for an example of how the headlamp signal inputs and outputs are handled in the multiplexed system. When the headlamp switch is turned on, the BHM senses the input. The BHM is programmed to know which outputs it should activate for each input signal and where those outputs are located (i.e. on the BHM, CHM, EXM, or other controller). In this example, the outputs for the left headlamp low beam are located on the BHM and the outputs for the right headlamp low beam are located on the CHM. The BHM can directly activate the left headlamp low beam. However, because the right headlamp low beam outputs are located on the CHM, the BHM must send a message over J1939 to the CHM to tell it to activate those outputs. Once the CHM receives the message, it activates the correct outputs and sends a message back to the BHM reporting the new status of the outputs. This fail-safe design allows at least one headlight to work even if the BHM or CHM should fail.

For an example of the flash-to-pass function, see **Fig. 3**. In this case, the input comes from the multifunction (turn signal) switch mounted on the steering column. It goes into the instrument cluster (ICU3-M2) for processing. The instrument cluster sends a message on J1939 to the BHM informing it of the multi-

General Information

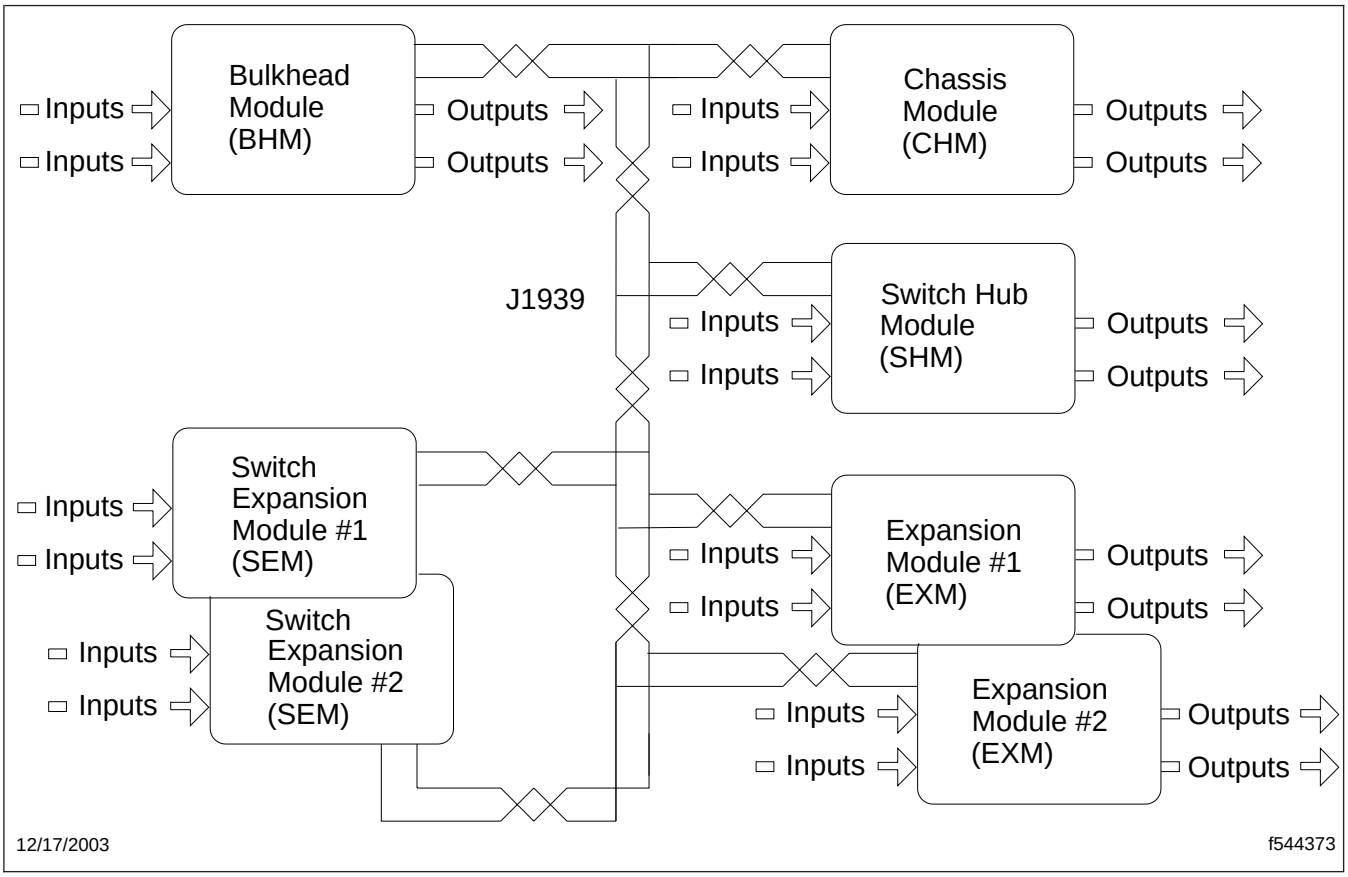

Fig. 1, Multiplexed System Controllers

function switch status. The output for the left headlamp high beam is located on the BHM and the output for the right headlamp high beam is located on the CHM. The BHM directly flashes the left headlamp high beam and sends a message over J1939 to the CHM to tell it to flash the right headlamp high beam. Once the CHM receives the message, it flashes the headlamp high beam and sends a message back to the BHM reporting the new status of the output. To complete the loop, the BHM sends a message over J1939 to the instrument cluster reporting that the command was completed. These messages are transmitted so quickly that the entire process takes only a fraction of a second.

For an example of the entrance door function, see **Fig. 4**. In this case, the input is the entrance door smart switch, mounted in the switch panel at the driver's left elbow. The entrance door smart switch is plugged into an 8-Switch Bank (8SB), located directly behind the switch panel. The 8SB, in turn, is physically connected to the Switch Hub Module (SHM). When the switch is used, the SHM senses it and sends a message on J1939 to the BHM informing it of the switch's status. The BHM then responds to the SHM telling it to illuminate the switch's indicator light. At the same time, the BHM also commands the SHM to activate the appropriate output pins on the SHM that control the entrance door circuit. The activated circuit runs through the cab PDM and out to the entrance door circuit.

The final example is the park brake telltale. See **Fig. 5**. To avoid driving away with the parking brake set, the system is designed to warn the driver. When the driver pulls out the parking brake switch on the dash to set the parking brake, the CHM senses the air pressure input from the parking brake switch in the Air Manifold Unit (AMU). The CHM sends a J1939 message to the BHM, the BHM sends a J1939 message to the ICU, and the ICU turns on the park brake telltale dash light.

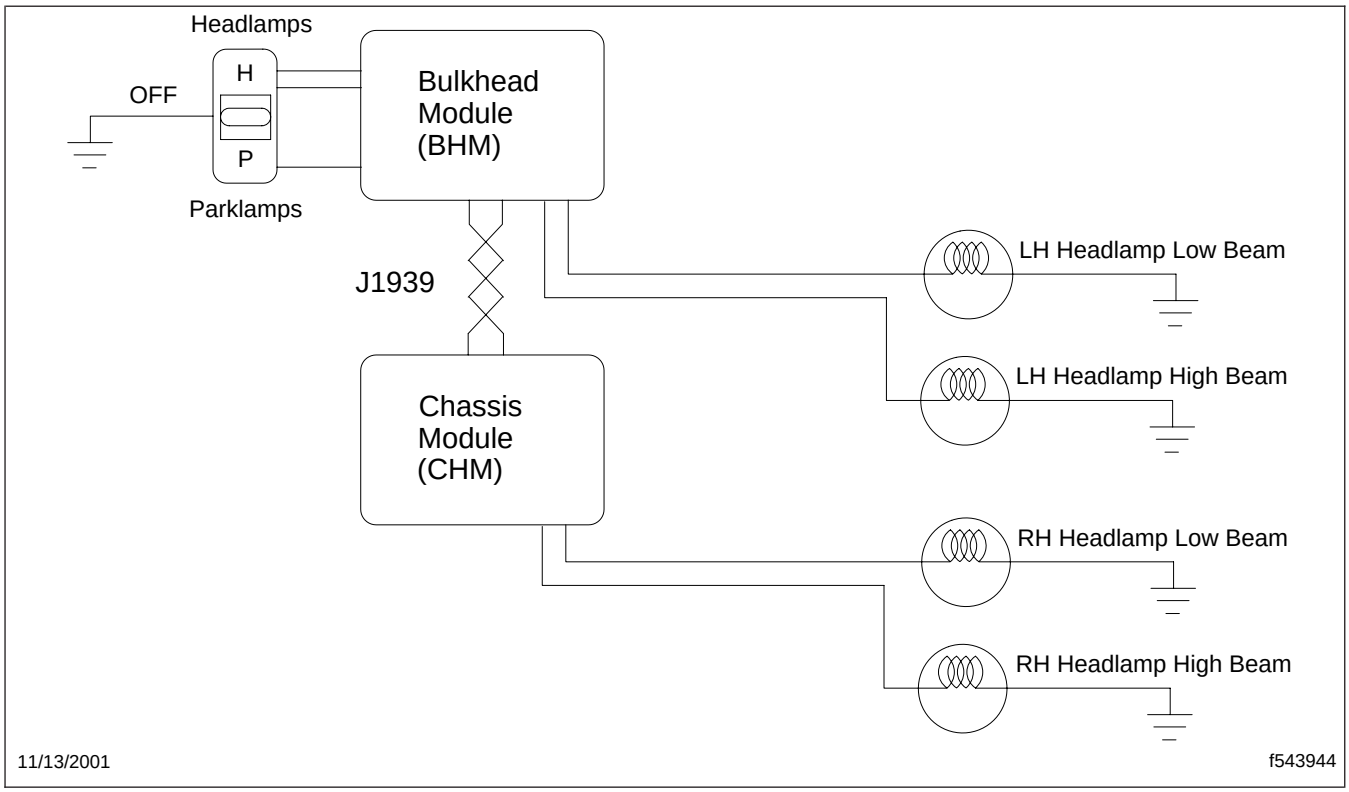

Fig. 2, Headlamp Switch Example

General Information

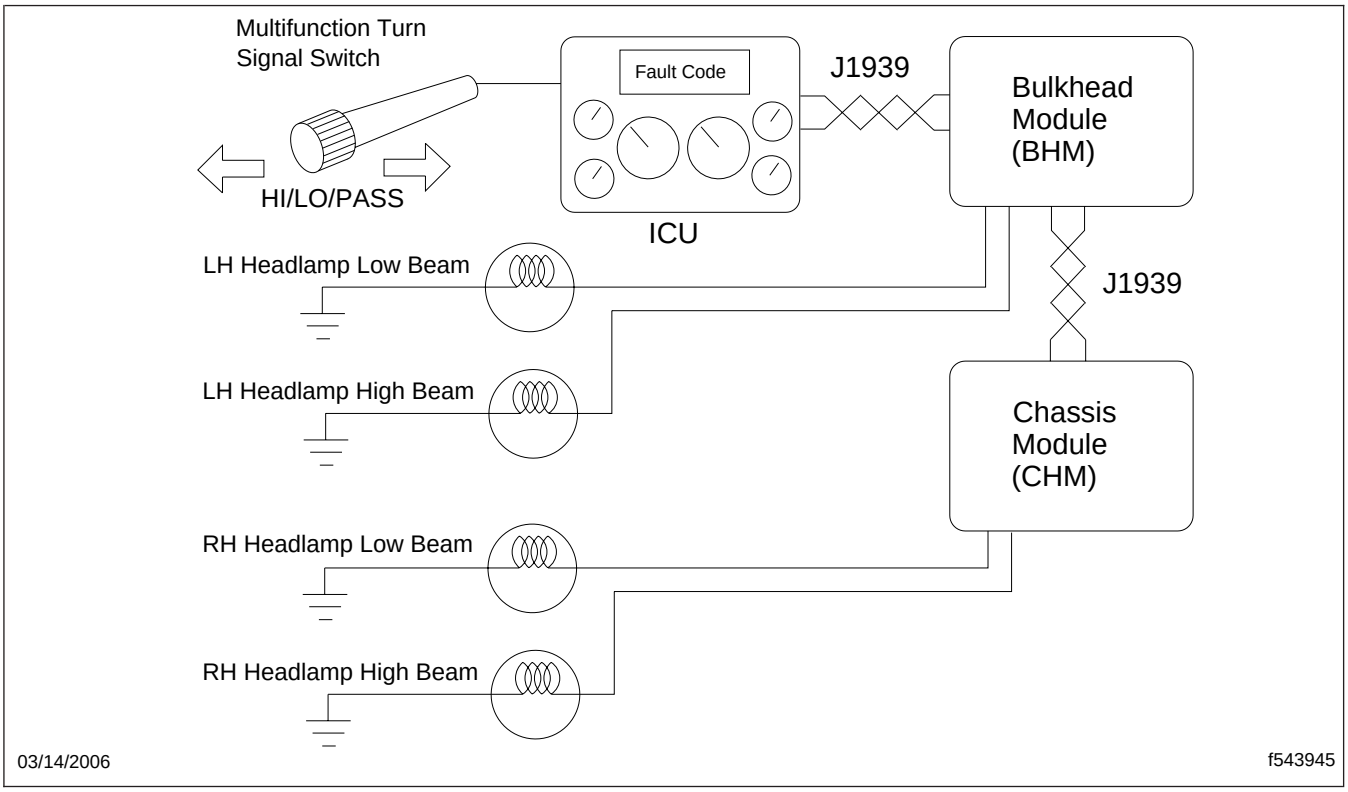

Fig. 3, Flash-To-Pass Example

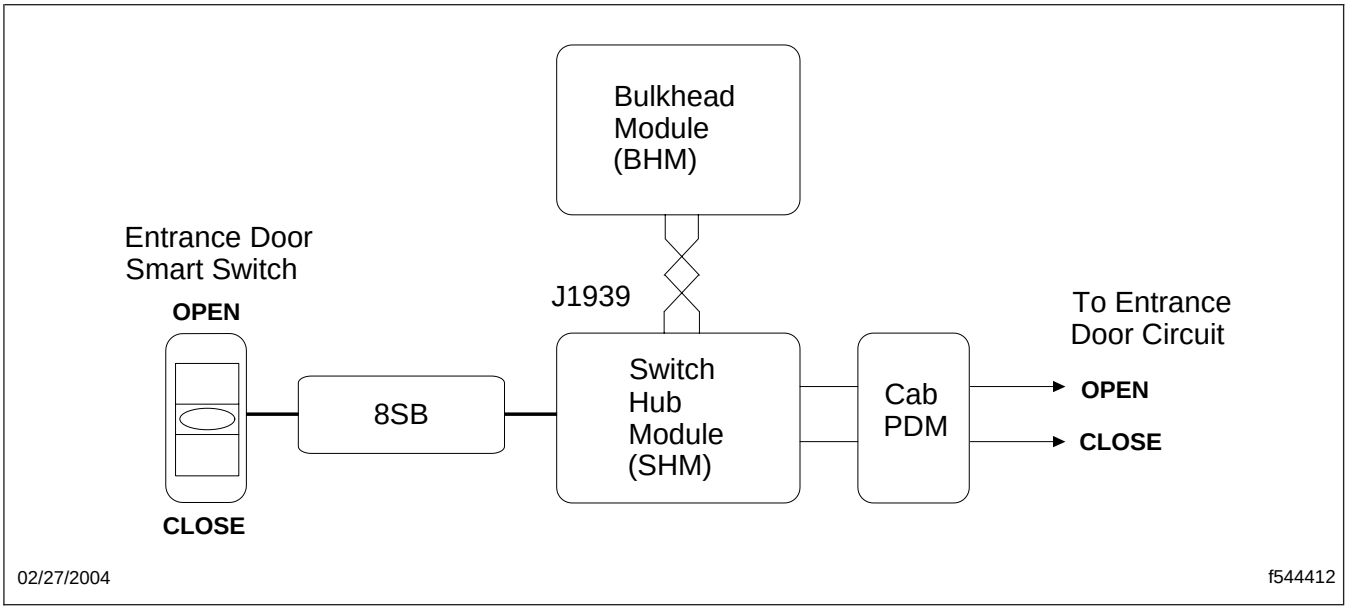

Fig. 4, Entrance Door Function Example

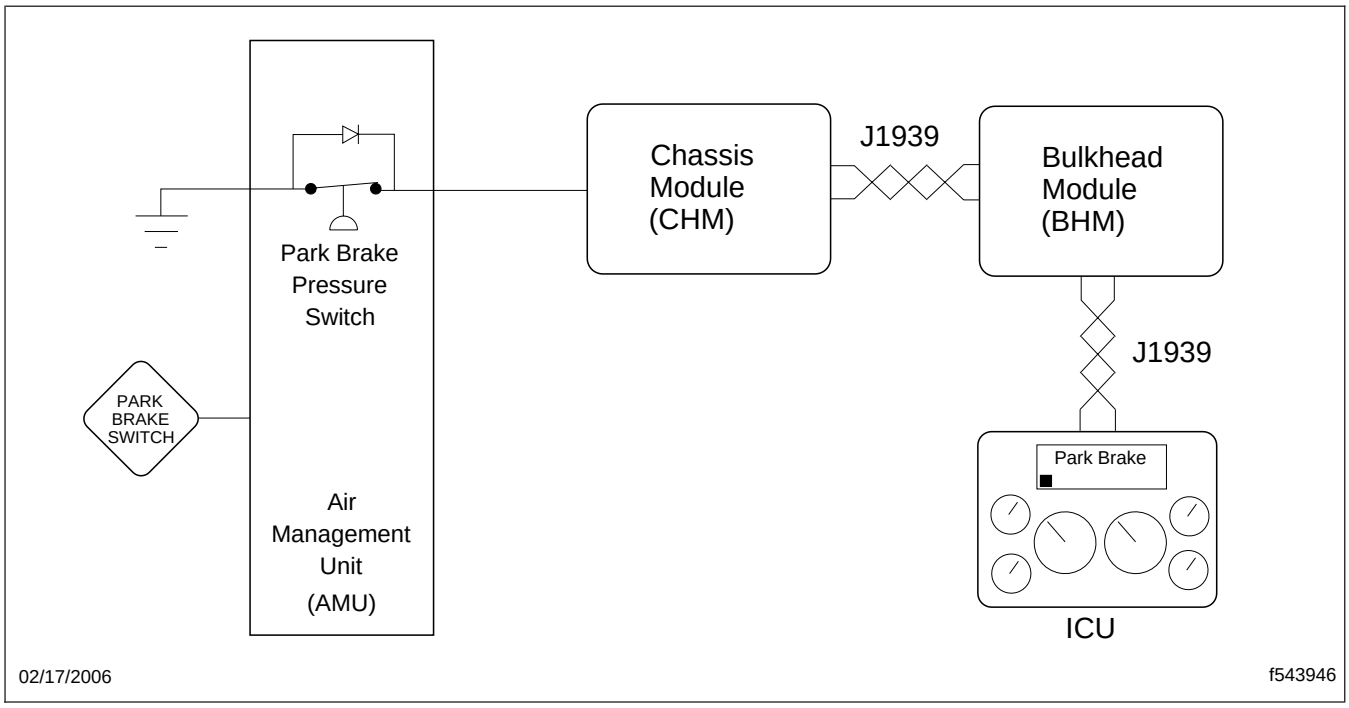

Fig. 5, Park Brake Telltale Example

Definition of Terms

Refer to the following terms for a better understanding of the electrical system.

8SB 8-Switch Bank.Connects Smart Switches to the Switch Hub Module (SHM).

ABS Antilock Braking System

Activate To begin operating.

Address A unique location code for a device or data.

AMU Air Manifold Unit

API Application Programming Interface

ATC Automatic Traction Control

BHM Bulkhead Module

CAN Controller Area Network

CHM Chassis Module

Configure To set up a program or system for a particular device or set of devices.

Data Bus A collection of wires connecting system components through which data is transmitted.

DRL Daytime Running Lights

DTC Diagnostic Trouble Code

ECU Electronic Control Unit, a device that communicates on a data bus.

EEPROM Electrically Erasable Programmable Read-Only Memory

EMC Electromagnetic Compatibility

EMI Electromagnetic Interference

EOL End of Line

ESD Electrostatic Discharge

EXM Expansion Module

Fault Code A limited set of alphanumeric characters representing a corresponding error message. Fault codes are limited to a maximum number of characters by the display output and cross-referenced to a more descriptive message. On J1939, fault codes are made up of a SA, SPN, and FMI. On J1708/J1587, fault codes are made up of a MID, PID/SID, and FMI.

FMEA Failure Mode Effects Analysis

FMI Failure Mode Indicator. The part of a J1708/J1587 or J1939 fault code that identifies how a part of or item on a device failed.

FMVSS Federal Motor Vehicle Safety Standard

HSD High Side Driver

HVAC Heating, Ventilation, and Air Conditioning

ICU Instrumentation Control Unit

Input A device that feeds a signal into the system, or signal that feeds a message into the system.

J1708/1587 An older vehicle communications network protocol intended to provide simple information exchange, including diagnostic data between electronic control devices.

J1939 A high speed vehicle communications network using the CAN protocol, which permits any device to transmit a message on the network when the data bus is idle. Each message includes an identifier that defines the message priority, who sent it, and what data is contained within it. Collisions are avoided due to the arbitration process that occurs while the identifier is transmitted, permitting high priority messages to get through with minimal delay.

LCD Liquid Crystal Display

LCL Low Coolant Level

LED Light Emitting Diode

Legend The icon, symbol or text on a warning light cover illuminated by a telltale lamp.

LSD Low Side Driver

MID Message Identifier. Identifies any device that communicates on J1708/J1587.

Multiplexing The process of combining several messages for transmission over the same signal path.

Output The signal or message that comes out of a system component or device.

Parameter A predetermined variable in a set, each of which restricts or defines the specific capabilities of the system as a whole. Used to customize the configuration of the system.

Pass-through Inputs and outputs on a device capable of allowing data to be transmitted through it without affecting the message or the device.

PCB Printed Circuit Board

Definition of Terms

PID Parameter Identifier. The part of a J1708/J1587 fault code that identifies what part of or item on a device that failed. PIDs are not MID specific.

PRD Product Requirements Document

PWM Pulse Width Modulation

SA Source Address. Identifies any device that communicates on J1939.

SAE Society of Automotive Engineers

SEM Switch Expansion Module

SHM Switch Hub Module

SID Subsystem Identifier. The part of a J1708/J1587 fault code that identifies what part of or item on a device that failed. SIDs are MID specific.

Smart Switch Configurable input device, called "smart" because it is recognized by the system not by its position or physical characteristics but by its resistance value.

SPN Suspect Parameter Number. The part of a J1939 fault code that identifies what part of or item on a device that failed.

Status Condition, position, or relative position of an input or output at a specific time.

TDS Technical Development Specifications

Telltale Any of a number of colored warning lights on the ICU instrument cluster that illuminates an icon, symbol or text covering it.

UL Underwriters Laboratory

VCU Vehicle Control Unit

Reference Parameters

Reference Parameters program the BHM to know which outputs to activate for each input and where those outputs are located. The two types of reference parameters are default and optional. Every vehicle has one default reference parameter and zero to any number of optional reference parameters.

The default reference parameter programs the BHM with features that come standard on each vehicle, such as headlights. Optional reference parameters program the BHM for vehicle-specific features, such as heated mirrors.

Each reference parameter is given a part number just like any other hardware part on the vehicle. A reference parameter only programs the parameters of the BHM.

Reflashing or reprogramming the software is separate from programming the parameters, just as it is in an engine controller.

Changing Features and Options

Features can be changed with ServiceLink from the Features screen under the Bulkhead Module (BHM) Icon. The Features screen displays the features that are installed in the BHM by listing the reference parameter numbers and their descriptions. From this screen, the user can reload all the currently installed features or make changes to the vehicle by entering new reference parameters.

Troubleshooting

With the multiplexed electrical system, traditional multimeter-based current, voltage, and resistance measurements are supplemented, or in some cases replaced, by software tools that can read and control the electronic signals and devices of the system. ServiceLink is the tool that is used to troubleshoot the vehicle electrical system.

The modules of the multiplexed electrical system communicate on both J1939 and J1708/J1587. The primary datalink for the electrical system is J1939, and is used for all control messaging and troubleshooting. J1708/J1587 is the secondary datalink and is used for limited troubleshooting. Fault codes are displayed on the instrument cluster, and can also be viewed with ServiceLink.

Since the modules of the electrical system communicate on both J1939 and J1708/J1587, each icon in ServiceLink shows information for both datalinks. Although each module connected to the multiplexed electrical system is represented by an icon in ServiceLink, the Bulkhead Module (BHM) Icon is the main icon for troubleshooting the system. This is because the Bulkhead Module (BHM) is the main controller of the multiplexed system. The other icons are secondary and contain generic screens.

The following generic screens can be accessed under the icon for any Electronic Control Unit (ECU) on the datalink.

- **General Info**—Displays information about the module such as Make, Model, Hardware Version, and Software Version.
- **Faults**—BHM icon will contain all active and historic faults for the entire multiplexed electrical system. The other control modules, Chassis Module (CHM), Expansion Module (EXM), Switch Hub Module (SHM) and Switch Expansion Module (SEM), will show only generic faults.
- **Templates**—Gives a directory of datalink monitor templates available for troubleshooting the multiplexed electrical system. These templates allow the user to monitor and manipulate the inputs and outputs of the electrical system.
- **Configuration**—Displays the pin-out for that particular module compared to the host.

  This screen can be accessed under all the control modules — the BHM, the CHM, the SHM and the EXM.
- **Flashing**—Allows the user to update or reflash the software of the module.

  This screen can be accessed under the icons for the reflashable modules - BHM, the SHM and the SEM.
- **Smart Switches**—Allows the user to view data about Smart Switches connected to these ECUs.

  This screen can be accessed under the icons for SHM and SEM.

  NOTE: This information is NOT available for Smart Switches that are connected to the BHM.
- **Features**—Displays the features that are installed in the BHM. From this screen the user can reload all the currently installed features, or make changes to the vehicle by entering new reference parameters.

  This screen can be accessed under the BHM icon only.

NOTE: For more specific information about the Bulkhead Module see **Section 54.01**. For more specific troubleshooting information see **Subject 300** in Section 54.01.

Troubleshooting the J1939 Datalink

The J1939 datalink always has two 120 ohm terminating resistors, one at each end of the backbone. The purpose of the terminating resistors is to minimize the reflection of data on the datalink. Collision of reflected data can cause J1939 messages to become partially or completely lost. Data collision can also cause the data to be erratic. Terminating resistors prevent this from occurring. Although the J1939 datalink may function with a missing or failed terminating resistor, data collision can occur and cause problems.

Since the resistors are in parallel with one another, their total resistance equals 60 ohms. What this means is if you remove a terminating resistor and check its resistance, it should be 120 ohms. How-

ever, with both resistors installed in the circuit there should be 60 ohms measured at any two points between J1939+ and J1939– in the circuit (for example between pins C and D of the diagnostic connector).

NOTE: This only applies when the batteries are disconnected.

Use the following four basic steps in the order given to successfully locate J1939 datalink problems. Do not skip steps or tests unless directed to do so.

Step 1: J1939 Resistance Test

This test checks whether or not both terminating resistors are installed and it ensures that there is at least a complete circuit from the diagnostic connector through the backbone loop. It does not ensure that branch circuits to each ECU are working correctly.

IMPORTANT: The batteries must be disconnected prior to any J1939 resistance tests. Failure to do so will result in incorrect resistance measurements.

1. Turn the ignition OFF and disconnect the batteries.
2. Connect the leads of a digital multimeter (DMM) to pins C and D of the 9-pin diagnostic connector. Set the DMM to read in ohms.
3. Measure the resistance. See **Table 1** for test results and possible causes.
4. Connect the batteries.

J1939 Resistance Test	
Test Result	**Possible Cause(s)**
60Ω ± 6Ω	The J1939 datalink backbone is intact and both terminating resistors are installed. Go to step 2.
120Ω ± 12Ω	Either of the following: • One of the terminating resistors is missing. • One of the terminating resistors is open.
40Ω ± 4Ω	Three terminating resistors have been installed; one must be removed. There must be one terminating resistor at each end on the backbone for a total of two.
0Ω to 5Ω	J1939+ and J1939– are shorted together somewhere in the datalink.
Greater than 1000Ω	Either of the following: • An open in the circuit between the diagnostic connector and the J1939 backbone. • Both terminating resistors are missing or open.
Any other readings	Any of the following: • Incorrect terminating resistor resistance. • Poor or corroded connections. • Short circuit to ground or an open circuit somewhere on the datalink. Go to step 2 to pinpoint the problem.

Table 1, J1939 Resistance Test

Step 2: ECU Communication Test Using Datalink Monitor Template

The following series of tests check for communication with each ECU connected to the J1939 datalink. If one fails to communicate, pinpoint whether the problem is wiring or an ECU. If all ECUs communicate as they should, J1939 is probably not the problem.

Test 1: Check Whether Each ECU Connected to the J1939 Datalink Responds

1. Connect ServiceLink to the vehicle.
2. Open the "C2 J1939 Test" datalink monitor template.
3. Following the instructions in the template, check whether each ECU that is supposed to be connected to the datalink responds. See **Table 2** for test results and possible causes.

Test 2: Check the J1939 Datalink Wiring to the ECU that Does Not Respond

IMPORTANT: The batteries must be disconnected prior to any J1939 resistance tests. Failure to do so will result in incorrect resistance measurements.

1. Disconnect the batteries.
2. Locate the connector at the ECU in Step 2, Test 1 that did not respond, and disconnect it.
3. Locate the pins for J1939+ and J1939– (refer to appropriate wiring diagrams if necessary).
4. Check to make sure the J1939+ and J1939– polarity is correct at the component before proceeding. If reversed, correct the wiring and verify that this corrected the problem.
5. Using a digital multimeter set to read ohms, measure the resistance across the two J1939 datalink pins at the connector to the suspect ECU (harness side).
6. Connect the batteries when the test is completed. See **Table 3** for test results and possible causes.

Check Whether Each ECU Connected to the J1939 Datalink Responds	
Test Result	**Possible Cause(s)**
All ECUs respond	The J1939 datalink is probably not the problem.
One ECU fails to respond	Go to test 2.
No ECUs respond	Any of the following: • The polarity of J1939+ and J1939– at the diagnostic connector may be reversed. • There may be a problem with the computer to vehicle communications adapter or cables. • The entire datalink may be down due to a short to power or short to ground. Go to step 3 to pinpoint the problem.

Table 2, Check Whether Each ECU Connected to the J1939 Datalink Responds

Check the J1939 Datalink Wiring to the ECU that Does Not Respond	
Test Result	**Possible Cause(s)**
60Ω ± 6Ω	The datalink itself is probably not the problem. Make sure there is power and ground to the suspect ECU. Go on to Test 3 after ECU power and ground connections have been confirmed.
Not 60Ω ± 6Ω	There is a problem with the J1939 wiring between the ECU connector and its connection to the J1939 backbone. Repair as necessary.

Table 3, Check the J1939 Datalink Wiring to the ECU that Does Not Respond

Test 3: Install a Test ECU to Confirm the Problem

1. Install a test ECU.
2. Connect ServiceLink to the vehicle.
3. Open the "C2 J1939 Test" datalink monitor template.
4. Following the instructions contained in the template, check whether each ECU that is supposed to be connected to the datalink responds. See **Table 4** for test results and possible causes.

Step 3: Testing J1939 for Circuit Faults (Shorts to Power and Ground)

This test checks for shorts to power and shorts to ground on the J1939 datalink.

NOTE: All tests are performed using a digital multimeter (DMM) set to read voltage.

Before proceeding, verify that battery voltage (approximately +12 VDC) is available at pin B of the diagnostic connector. With the ignition on, use a DMM to test for voltage at pin B by placing the positive (+) lead on pin B and the negative (–) lead on a good chassis ground.

Test 1: Test J1939+ for Shorts to Power and Ground

1. Turn the ignition ON.
2. Touch the positive (+) lead to pin B (+12 VDC) and the negative (–) lead to pin C (J1939+) of the diagnostic connector. See **Table 5** for test results and possible causes.

Test 2: Test J1939– for Shorts to Power and Ground

1. Turn the ignition ON.
2. Touch the positive (+) lead to pin B (+12 VDC) and the negative (–) lead to pin D (J1939–) of the diagnostic connector. See **Table 6** for test results and possible causes.

Step 4: Pinpointing Short Circuits on the J1939 Datalink

These tests pinpoint shorts to power and shorts to ground on the J1939 datalink. The tests will indicate which side of the cab/engine interface that the problem exists. It will also indicate whether the problem is in the wiring outside or inside the cab.

NOTE: All tests are performed using a DMM set to read voltage.

Before proceeding, verify that battery voltage (approximately +12 VDC) is available at pin B of the diagnostic connector. With the ignition on, use a DMM to test for voltage at pin B by placing the positive (+) lead on pin B and the negative (–) lead on a good chassis ground.

Test 1: Pinpoint J1939+ Short to Power or Ground

NOTE: Perform this test only if directed here in Step 3, Test 1.

1. Disconnect the 76-pin cab to engine bulkhead connector that contains J1939 wiring.
2. Turn the ignition ON.
3. Touch the positive (+) lead to pin B (+12 VDC) and the negative (–) lead to pin C (J1939+) of

the diagnostic connector. See **Table 7** for test results and possible causes.

Test 2: Pinpoint J1939– Short to Power or Ground

NOTE: Perform this test only if directed here in Step 3, Test 2.

1. Disconnect the 76-pin cab to engine bulkhead connector that contains J1939 wiring.
2. Turn the ignition ON.
3. Touch the positive (+) lead to pin B (+12 VDC) and the negative (–) lead to pin D (J1939–) of the diagnostic connector. See **Table 8** for test results and possible causes.

Install a Test ECU to Confirm the Problem	
Test Result	**Possible Cause(s)**
All ECUs respond	The ECU was faulty and the test ECU confirmed this. Replace the ECU.
The ECU still does not respond	The problem has not been confirmed. Carefully repeat all the diagnostics. If the ECU still does not respond, contact the Customer Assistance Center.

Table 4, Install a Test ECU to Confirm the Problem

Test J1939+ for Shorts to Power and Ground	
Test Result	**Possible Cause(s)**
0 VDC	J1939+ is shorted to power. Go to Step 4, Test 1.
12 VDC (battery voltage)	J1939+ is shorted to ground. Go to Step 4, Test 1.
Any other reading	J1939+ is neither shorted to power or ground. Go to Step 3, Test 2.

Table 5, Test J1939+ for Shorts to Power and Ground

Test J1939- for Shorts to Power and Ground	
Test Result	**Possible Cause(s)**
0 VDC	J1939– is shorted to power. Go to Step 4, Test 2.
12 VDC (battery voltage)	J1939– is shorted to ground. Go to Step 4, Test 2.
Any other reading	J1939– is neither shorted to power or ground. There may be a problem with the computer to vehicle communications adapter or cables. The datalink itself appears to be okay.

Table 6, Test J1939- for Shorts to Power and Ground

Pinpoint J1939+ Short to Power or Ground	
Test Result	**Possible Cause(s)**
0 VDC	J1939+ is shorted to power inside the cab. Locate and repair the short.
12 VDC (battery voltage)	J1939+ is shorted to ground inside the cab. Locate and repair the short.

Pinpoint J1939+ Short to Power or Ground	
Test Result	**Possible Cause(s)**
Any other reading	J1939+ is shorted to power or ground outside of the cab. Locate and repair the short.

Table 7, Pinpoint J1939+ Short to Power or Ground

Pinpoint J1939– Short to Power or Ground	
Test Result	**Possible Cause(s)**
0 VDC	J1939– is shorted to power inside the cab. Locate and repair the short.
12 VDC (battery voltage)	J1939– is shorted to ground inside the cab. Locate and repair the short.
Any other reading	J1939– is shorted to power or ground outside of the cab. Locate and repair the short.

Table 8, Pinpoint J1939– Short to Power or Ground

Troubleshooting the J1587 Datalink

J1587 is a low-speed vehicle datalink that can communicate information between ECUs on the vehicle. The J1587 datalink is also referred to as J1708. J1708 refers to the Society of Automotive Engineers (SAE) standard for the physical part of the datalink, meaning the wiring and electronic component requirements. J1587 refers to the SAE standard for the messaging protocol that communicates on the J1708 network. In the context of vehicle repair, the terms J1708 and J1587 are used synonymously.

Symptoms of a Malfunctioning J1587 Datalink

Possible symptoms of a malfunctioning J1587 datalink include the following:

- Gauges are not working
- ICU displays "noJ1587", "no Eng", or "no Abs"
- Warning lamp(s) on (ABS, Check Engine)
- Cannot retrieve fault codes from an ECU
- ServiceLink will not connect to the vehicle
- One or more ECUs do not show up in the ServiceLink ECU list

See **Table 9** for diagnosing the J1587 datalink.

Diagnosing the J1587 Datalink			
Test	**Test Description**	**Result**	**Action**
1.	Attempt to connect ServiceLink and refresh the ECU list. If ServiceLink connects to the J1587 datalink, the ECU list will say "J1708--Detected" and some or all ECUs will show up in white under the J1708 ECU list. Will ServiceLink connect to the J1587 datalink?	Yes	Go to test 9.
		No	Go to test 2.
2.	Repeat test 1 on another vehicle with a known good J1587 datalink. Will ServiceLink connect to the other vehicle?	Yes	Go to test 3.
		No	Check the cables between the computer and the vehicle. Check the vehicle interface adapter and the computer settings. Repair as necessary.
3.	Make sure the park brake is set. Turn the ignition on. Does the ICU display "noJ1587"?	Yes	Go to test 5.
		No	Go to test 4.
4.	Is the power light illuminated on the vehicle interface adapter?	Yes	Check the J1587 datalink wiring between the diagnostic connector and the dash junction block for shorts. Repair as necessary.
		No	Check the power and ground supply to the diagnostic connector. If it is okay, check the computer cable and interface device. Repair as necessary.
5.	Disconnect BHM connector B1. Attempt to connect ServiceLink and refresh the ECU list. If ServiceLink connects to the J1587 datalink, the ECU list will say "J1708--Detected" and the ICU, BHM, and other ECUs (depending on vehicle configuration) will show up in white under the J1708 ECU list. Does ServiceLink connect to the J1587 datalink?	Yes	There is a problem in the J1587 wiring outside of the cab between the BHM connector B1 and the ABS and CHM. Locate the source of trouble and repair as necessary.
		No	Go to test 6.
6.	Check if the vehicle is equipped with any of the following: • Non M-B engine (CAT, etc.) • Allison transmission	Yes	Go to test 7.
		No	Go to test 8.

Diagnosing the J1587 Datalink			
Test	**Test Description**	**Result**	**Action**
7.	Disconnect the BHM connector C2. Attempt to connect ServiceLink and refresh the ECU list. If ServiceLink connects to the J1587 datalink, the ECU list will say "J1708--Detected" and the ICU, BHM, CHM, and other ECUs (depending on vehicle configuration) will show up in white under the J1708 ECU list. Does ServiceLink connect to the J1587 datalink?	Yes	There is a problem in one of the following J1587 circuits: • Between the BHM and engine (non M-B only) • Between the BHM and the transmission (Allison only) Repair as necessary.
		No	Go to test 8.
8.	Locate the J1587 junction block behind the center dash panel. Follow the steps below: 1. Disconnect one of the J1587 connectors on the junction block. 2. Attempt to connect ServiceLink and refresh the ECU list. Does either the ICU or the BHM now show up in the ECU list (in white)? If it does, stop and follow the "yes" test result action in the column to the right. If not, continue to step 3. 3. Plug the connector back into the junction block. 4. Unplug the connector on the J1587 junction block that has not yet been disconnected. 5. Refresh the ServiceLink ECU list. Does either the ICU or the BHM now show up in the ECU list (in white)? If it does, stop and follow the "yes" test result action in the column to the right. If not, continue to step 6. 6. Are there any remaining connectors on the junction block that have not yet been disconnected? If so, go to step 3. If not, follow the "no" test result action in the column to the right.	Yes	The J1587 circuit that was just disconnected from the junction block is shorted or the ECU on that circuit is faulty. Repair as necessary.
		No	There is a short between the J1587 junction block and the diagnostic connector.

Diagnosing the J1587 Datalink			
Test	**Test Description**	**Result**	**Action**
9.	With ServiceLink connected, look at the ECU list and determine which ECU(s) do NOT show up in white: CASE 1: All ECUs show up. CASE 2: The BHM, CHM, and all other outside-of-cab ECUs. CASE 3: The ICU or one of the other inside-of-cab ECUs. CASE 4: One of the outside cab ECUs. CASE 5: All ECUs except the CHM.	CASE 1	There is no problem found.
		CASE 2	Check the J1587 wiring between the BHM and the J1587 junction block for an open circuit. Repair as necessary.
		CASE 3	Check the J1587 wiring between the ECU that does not show up and the J1587 junction block for an open circuit. Check the power and ground circuits to the missing ECU and the ECU itself.
		CASE 4	Check the J1587 wiring between the ECU that does not show up and the BHM for an open circuit. Check the power and ground circuits to the missing ECU and the ECU itself.
		CASE 5	Check the power and ground supply to the BHM. Check the BHM itself.

Table 9, Diagnosing the J1587 Datalink

General Information

This subject contains information on all proprietary Bulkhead Module (BHM) fault codes for J1587 and J1939 data bus protocols, how to view these codes, and what they mean. Each fault code contains three distinct pieces of information, as described below.

NOTE: References such as BHM B1.A (beginning with SID 050 in **Table 1**) indicate that the fault is sensed to be coming from the Bulkhead Module, connector B1, pin A. Similarly, CHM indicates the Chassis Module, and EXM1-5 indicates the first through fifth Expansion Modules on a vehicle.

J1587 fault codes consist of the following, in this order:

- Module Identifier (MID) – Identifies which Electronic Control Unit (ECU) the fault is coming from. The J1587 MID identifying all Bulkhead Information Module faults is 164.
- Subsystem Identifier (SID) – Indicates what function on the ECU has failed. All J1587 SIDs for the BHM are listed in **Table 1**.
- Failure Mode Indicator (FMI) – Indicates in what way the function failed.

J1939 faults consist of the following, in this order:

- Source Address (SA) – Identifies which ECU the fault is coming from. The J1939 SA identifying all Bulkhead Module faults is 33.
- Suspect Parameter Number (SPN) – Indicates what function on the ECU has failed. All J1939 SPNs for the BHM are listed in **Table 2**.
- Failure Mode Indicator (FMI) – Indicates in what way the function failed.

Also included is a reference table of all FMIs for both data bus protocols. See **Table 3**.

NOTE: In ServiceLink, J1587 fault codes are shown under J1708. J1587 and J1708 are essentially the same data bus protocol.

NOTE: As the SAE J1939 subcommittee approves new SPNs for use in J1939 messaging on a continual basis, J1939 SPNs used for diagnostic messages could change when the Bulkhead Module part changes. These changes could impact any diagnostic message with an SPN value of 6915 or higher.

J1587 SIDs for Bulkhead Module (BHM) MID 164

SID	Description	Possible FMI
000	Backlighting Dimmer Switch Fault	7
001	Clutch Switch Fault	7
002	Reserved for Future Use	—
003	Headlamp Switch Disagreement - Both Park and On Inputs are CLOSED	7
004	Stalk Switch High Beam Input Fault	2
005	Ignition Switch Fault	7
006	Marker Interrupt Switch Fault	7
007	Stalk Switch Disagreement - Both Wiper High and Wiper Low Inputs are ON	2
008	Stalk Switch Disagreement - Wiper On/Off Input is OFF and Wiper High or Low Input is ON	2
009	Wiper Park Input Fault	7
010	ICU3-M2 Hazard Switch CAN Feedback Error	2
011	Stalk Switch Left Turn Signal Input Fault	2

Fault Code Information

J1587 SIDs for Bulkhead Module (BHM) MID 164		
SID	**Description**	**Possible FMI**
012	Stalk Switch Right Turn Signal Input Fault	2
013	Stalk Switch Washer Switch Input Fault	2
014	Stalk Switch Wiper On/Off Input Fault	2
015	Stalk Switch Wiper Low Input Fault	2
016	Stalk Switch Wiper High Input Fault	2
017	Wheel Based Vehicle Speed CAN Message Error	2
018	Wake up Hardware Fault (modules are kept awake)	7
019	Unknown Keep Awake Fault (modules are kept awake)	7
020	Extra Smart Switch	7
021	Duplicate Smart Switch	7
022	Missing Smart Switch	7
023	Fifth Wheel Solenoid Unexpected Pressure Feedback	7
024	Fifth Wheel Solenoid No Pressure Feedback	7
025	End of Frame Air Unexpected Pressure Feedback	7
026	End of Frame Air No Pressure Feedback	7
027	Axle Lift Unexpected Pressure Feedback	7
028	Axle Lift No Pressure Feedback	7
029	Suspension Dump Unexpected Pressure Feedback	7
030	Suspension Dump No Pressure Feedback	7
031	Suspension Proportioning Unexpected Pressure Feedback	7
032	Suspension Proportioning No Pressure Feedback	7
033	Cigar Lighter Output Fault	7
034	BHM / ICU3-M2 Ignition Mismatch	7
035	BHM / ICU3-M2 Hazard Switch Mismatch	2
036	BHM / ICU3-M2 Wiper Park Mismatch	2
037	Missing Transmission CAN Message	9
038	Missing Chassis Module CAN Message	9
039	Remote Bucket Switch Stuck Fault	7
040	Axle Lift 2 Feedback Fault	7
041	Axle Lift 2 No Feedback Fault	7
042	PTO 1 Feedback Fault	7
043	PTO 1 No Feedback Fault	7
044	PTO 2 Feedback Fault	7
045	PTO 2 No Feedback Fault	7
046-049	Reserved for Future Use	—

J1587 SIDs for Bulkhead Module (BHM) MID 164		
SID	**Description**	**Possible FMI**
050	BHM B1.A	3,4
051	BHM B1.F, B1.P, B2.K, B2.L, B6.A8	5,6
052	BHM B1.J	3,4
053	BHM B1.K, B5.C	5,6
054	BHM B1.L	5,6
055	BHM B1.N	3,4
056	BHM B1.R	5,6
057	BHM B2.M	5,6
058	BHM B3.D	3,4
059	BHM B3.E	3,4,5,6
060	BHM B3.F	5,6
061	BHM B3.G	5,6
062	BHM B3.H	5,6
063	BHM B4.B	5,6
064	BHM B4.E, B4.F	3,4,5,6
065	BHM B4.G	3,4
066	BHM B4.K	3,4
067	BHM B4.M, B5.E	3,4,5,6
068	BHM B5.A, B7.A12	5,6
069	BHM B6.A9, B6.A10	5,6
070	BHM B5.B	5,6
071	BHM B5.D	5,6
072	BHM B5.F	3,4,5,6
073	BHM B5.G	3,4,5,6
074	BHM B5.H, B7.A1	3,4,5,6
075	CHM C1.A, C1.H, C1.J	5,6
076	CHM C1.G, C2.H, C3.N	5,6
077	CHM C1.L	5,6
078	CHM C1.N	5,6
079	CHM C1.P, C2.E, C3.R	5,6
080	CHM C2.A	3,4
081	CHM C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
082	CHM C3.A	3,4,5,6
083	CHM C3.C, C3.D	5,6
084	CHM C3.E	3,4

Fault Code Information

J1587 SIDs for Bulkhead Module (BHM) MID 164		
SID	**Description**	**Possible FMI**
085	CHM C3.F	3,4
086	CHM C3.J	3,4
087	CHM C3.K	5,6
088	CHM C3.L	5,6
089	CHM C4.F	5,6
090	CHM C4.J	3,4
091	CHM C4.K	5,6
092	CHM C4.P	3,4
093	CHM C5.A	3,4
094	CHM C5.B	3,4
095	CHM C5.F	3,4
096	CHM C5.G	3,4
097	CHM C5.H	3,4
098	CHM C5.J	3,4
099	CHM C5.L	3,4
100	CHM C5.M	3,4
101	EXM1 C1.A, C1.H, C1.C	5,6
101	EXM1 C4.K	5,6
101	EXM1 C3.L	5,6
101	EXM1 C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
101	EXM1 C1.N	5,6
101	EXM1 C1.L	5,6
101	EXM1 C1P, C2.E, C3.R	5,6
101	EXM1 C1.G, C2.H, C3.N	5,6
101	EXM1 C2.A	3,4
101	EXM1 C3.A	3,4,5,6
101	EXM1 C3.C, C3.D	5,6
101	EXM1 C3.K	5,6
101	EXM1 C4.F	5,6
101	EXM1 C5.H	3,4
101	EXM1 C5.C	3,4
101	EXM1 C5.L	3,4
101	EXM1 C5.M	3,4
101	EXM1 C3.E	3,4
101	EXM1 C3.F	3,4

J1587 SIDs for Bulkhead Module (BHM) MID 164		
SID	**Description**	**Possible FMI**
101	EXM1 C3.C	3,4
101	EXM1 C4.C	3,4
101	EXM1 C4.P	3,4
101	EXM1 C5.A	3,4
101	EXM1 C5.B	3,4
101	EXM1 C5.F	3,4
101	EXM1 C5.G	3,4
102	EXM2 C1.A, C1.H, C1.C	5,6
102	EXM2 C4.K	5,6
102	EXM2 C3.L	5,6
102	EXM2 C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
102	EXM2 C1.N	5,6
102	EXM2 C1.L	5,6
102	EXM2 C1P, C2.E, C3.R	5,6
102	EXM2 C1.G, C2.H, C3.N	5,6
102	EXM2 C2.A	3,4
102	EXM2 C3.A	3,4,5,6
102	EXM2 C3.C, C3.D	5,6
102	EXM2 C3.K	5,6
102	EXM2 C4.F	5,6
102	EXM2 C5.H	3,4
102	EXM2 C5.C	3,4
102	EXM2 C5.L	3,4
102	EXM2 C5.M	3,4
102	EXM2 C3.E	3,4
102	EXM2 C3.F	3,4
102	EXM2 C3.C	3,4
102	EXM2 C4.C	3,4
102	EXM2 C4.P	3,4
102	EXM2 C5.A	3,4
102	EXM2 C5.B	3,4
102	EXM2 C5.F	3,4
102	EXM2 C5.G	3,4
103	EXM3 C1.A, C1.H, C1.C	5,6
103	EXM3 C4.K	5,6

Fault Code Information

J1587 SIDs for Bulkhead Module (BHM) MID 164		
SID	**Description**	**Possible FMI**
103	EXM3 C3.L	5,6
103	EXM3 C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
103	EXM3 C1.N	5,6
103	EXM3 C1.L	5,6
103	EXM3 C1P, C2.E, C3.R	5,6
103	EXM3 C1.G, C2.H, C3.N	5,6
103	EXM3 C2.A	3,4
103	EXM3 C3.A	3,4,5,6
103	EXM3 C3.C, C3.D	5,6
103	EXM3 C3.K	5,6
103	EXM3 C4.F	5,6
103	EXM3 C5.H	3,4
103	EXM3 C5.C	3,4
103	EXM3 C5.L	3,4
103	EXM3 C5.M	3,4
103	EXM3 C3.E	3,4
103	EXM3 C3.F	3,4
103	EXM3 C3.C	3,4
103	EXM3 C4.C	3,4
103	EXM3 C4.P	3,4
103	EXM3 C5.A	3,4
103	EXM3 C5.B	3,4
103	EXM3 C5.F	3,4
103	EXM3 C5.G	3,4
104	EXM4 C1.A, C1.H, C1.C	5,6
104	EXM4 C4.K	5,6
104	EXM4 C3.L	5,6
104	EXM4 C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
104	EXM4 C1.N	5,6
104	EXM4 C1.L	5,6
104	EXM4 C1P, C2.E, C3.R	5,6
104	EXM4 C1.G, C2.H, C3.N	5,6
104	EXM4 C2.A	3,4
104	EXM4 C3.A	3,4,5,6
104	EXM4 C3.C, C3.D	5,6

J1587 SIDs for Bulkhead Module (BHM) MID 164		
SID	**Description**	**Possible FMI**
104	EXM4 C3.K	5,6
104	EXM4 C4.F	5,6
104	EXM4 C5.H	3,4
104	EXM4 C5.C	3,4
104	EXM4 C5.L	3,4
104	EXM4 C5.M	3,4
104	EXM4 C3.E	3,4
104	EXM4 C3.F	3,4
104	EXM4 C3.C	3,4
104	EXM4 C4.C	3,4
104	EXM4 C4.P	3,4
104	EXM4 C5.A	3,4
104	EXM4 C5.B	3,4
104	EXM4 C5.F	3,4
104	EXM4 C5.G	3,4
105	EXM5 C1.A, C1.H, C1.C	5,6
105	EXM5 C4.K	5,6
105	EXM5 C3.L	5,6
105	EXM5 C2.F, C4.C, C4.D, C4.L, C4.M	3,4,5,6
105	EXM5 C1.N	5,6
105	EXM5 C1.L	5,6
105	EXM5 C1P, C2.E, C3.R	5,6
105	EXM5 C1.G, C2.H, C3.N	5,6
105	EXM5 C2.A	3,4
105	EXM5 C3.A	3,4,5,6
105	EXM5 C3.C, C3.D	5,6
105	EXM5 C3.K	5,6
105	EXM5 C4.F	5,6
105	EXM5 C5.H	3,4
105	EXM5 C5.C	3,4
105	EXM5 C5.L	3,4
105	EXM5 C5.M	3,4
105	EXM5 C3.E	3,4
105	EXM5 C3.F	3,4
105	EXM5 C3.C	3,4

Fault Code Information

J1587 SIDs for Bulkhead Module (BHM) MID 164		
SID	**Description**	**Possible FMI**
105	EXM5 C4.C	3,4
105	EXM5 C4.P	3,4
105	EXM5 C5.A	3,4
105	EXM5 C5.B	3,4
105	EXM5 C5.F	3,4
105	EXM5 C5.G	3,4
106	Reserved for Future Use	—
107	SHM J1.A, J1.E	6
108	SHM J3.G (PWM)	6
109	SHM J3.M (PWM)	6
110	SHM J3.F	5,6
111	SHM J3.K	5,6

Table 1, J1587 SIDs for Bulkhead Module (BHM) MID 164

J1939 SPNs for Bulkhead Module (BHM) SA 33		
SPN	**Description**	**Possible FMI**
70	Parking Brake Switch	2
80	Washer Fluid Level	2
84	Wheel Based Vehicle Speed	19
96	Fuel Level	19
97	Water In Fuel Indicator	19
163	Transmission Current Range	12,19
177	Transmission Oil Temperature Sensor	3,4
523	Transmission Current Gear	12,19
524	Transmission Selected Gear	12,19
597	ABS Service Brake Switch	2
598	Clutch Switch	7
879	Front Left Turn Signals Output Fault	5,6
880	Trailer Stop Lamp Relay Output Fault	4
881	Front Right Turn Signals Output Fault	5,6
882	Park / Marker Lights Output Fault	4,5,6
973	Engine Retarder Selection	19
1487	Backlighting Dimmer Switch Fault	7
1550	A/C Clutch Output Fault	5,6
2003	Missing Transmission CAN Message	9

J1939 SPNs for Bulkhead Module (BHM) SA 33		
SPN	**Description**	**Possible FMI**
2071	Missing Chassis Module CAN Message	9
6891	ID/Marker/Clearance Lamps - HW Override Output Fault	5,6
6892	Upper Right Tail Lamp Output Fault	5,6
6893	Upper Left Tail Lamp Output Fault	5,6
6894	Rear Passenger Dome Lamp Output Fault	6
6895	Front Passenger Dome Lamp Output Fault	6
6896	Right Side Air/Electric Entrance Door - Close - Output Fault	6
6897	Right Side Air/Electric Entrance Door - Open - Output Fault	6
6898	Right Side Turn Signal Output Fault	5,6
6900	Left Side Turn Signal Output Fault	5,6
6901	Stepwell Lights Output Fault	5,6
6902	Left Upper Backup Lamp Output Fault	5,6
6903	Right Upper Backup Lamp Output Fault	5,6
6904	Rear Right Turn Signal Output Fault	5,6
6905	Rear Left Turn Signal Output Fault	5,6
6906	PTO 2 No Feedback Fault	7
6907	PTO 2 Feedback Fault	7
6908	PTO 1 No Feedback Fault	7
6909	PTO 1 Feedback Fault	7
6910	Axle Lift 2 No Feedback Fault	7
6911	Axle Lift 2 Feedback Fault	7
6912	Remote Bucket Switch Stuck Fault	7
6915	Lamp and Gauge Ignition Output Fault	4,5,6
6916	BHM / ICU3-M2 Wiper Park CAN Message Mismatch	2
6917	BHM / ICU3-M2 Hazard Switch CAN Message Mismatch	2
6918	Missing Smart Switch	7
6919	Duplicate Smart Switch	7
6920	Extra Smart Switch	7
6921	Unknown Keep Awake Fault (modules are kept awake)	7
6922	Wake up Hardware Fault (modules are kept awake)	7
6923	Wiper Parked Input Fault	7
6924	Stalk Switch Disagreement - Wiper On/Off Input is OFF and Wiper High or Low Input is ON	2
6925	Stalk Switch Disagreement - Both Wiper High and Wiper Low Inputs are ON	2
6926	Marker Interrupt Switch Fault	7

Fault Code Information

J1939 SPNs for Bulkhead Module (BHM) SA 33		
SPN	**Description**	**Possible FMI**
6927	Utility Lamp Output Fault	3,4,5,6
6928	Suspension Proportioning No AMU Pressure Feedback	7
6929	Suspension Proportioning Unexpected AMU Pressure Feedback	7
6930	Suspension Proportioning Solenoid Output Fault	3,4,5,6
6931	Suspension Dump No AMU Pressure Feedback	7
6932	Suspension Dump Unexpected AMU Pressure Feedback	7
6933	Suspension Dump Solenoid Output Fault	3,4,5,6
6934	Spotlights Output Fault	3,4,5,6
6935	Snow Plow Relay Output Fault	3,4,5,6
6936	Rear 2 Differential Lock AMU Pressure Feedback Fault	7
6937	Rear 2 Differential Lock Solenoid Output Fault	3,4,5,6
6938	Rear 1 Differential Lock AMU Pressure Feedback Fault	7
6939	Rear 1 Differential Lock Solenoid Output Fault	3,4,5,6
6940	Optional Feature Output Fault	3,4,5,6
6941	Heated Mirrors Output Fault	3,4,5,6
6942	Interaxle AMU Pressure Feedback Fault	7
6943	Interaxle Solenoid Output Fault	3,4,5,6
6944	Fuel Water Separator Heater Output Fault	4,5,6
6945	Front Differential Lock AMU Pressure Feedback Fault	7
6946	Front Differential Lock Solenoid Output Fault	3,4,5,6
6947	Fog Lamp Output Fault	5,6
6953	5th Wheel Slide Solenoid Output Fault	3,4,5,6
6954	End of Frame Air No AMU Pressure Feedback	7
6955	End of Frame Air Unexpected AMU Pressure Feedback	7
6956	End of Frame Air Solenoid Output Fault	3,4,5,6
6957	Daytime Running Lights (DRL) Output Fault	5,6
6958	Brake Line Air Dryer Output Fault	3,4,5,6
6959	Axle Shift AMU Pressure Feedback Fault	7
6960	Axle Shift Solenoid Output Fault	3,4,5,6
6961	Axle Lift No AMU Pressure Feedback	7
6962	Axle Lift Unexpected AMU Pressure Feedback	7
6963	Axle Lift Solenoid Output Fault	3,4,5,6
6964	Air Horn Solenoid Output Fault	5,6
6965	BHM VBAT 5 Input Fault	3,4
6966	BHM VBAT 4 Input Fault	3,4

J1939 SPNs for Bulkhead Module (BHM) SA 33		
SPN	**Description**	**Possible FMI**
6967	BHM VBAT 3 Input Fault	3,4
6968	BHM VBAT 2 Input Fault	3,4
6969	BHM VBAT 1 Input Fault	3,4
6970	Wiper High Output Fault	5,6
6971	Wiper Low Output Fault	5,6
6972	Stalk Switch Wiper High Input Fault	2
6973	Stalk Switch Wiper Low Input Fault	2
6974	Stalk Switch Wiper On/Off Input Fault	2
6975	ICU3-M2 Wiper Park CAN FeedbackError	2
6976	Washer Pump Output Fault	5,6
6977	Stalk Switch Washer Switch Input Fault	2
6978	Stalk Switch Right Turn Signal Input Fault	2
6979	Stalk Switch Left Turn Signal Input Fault	2
6980	Right Stop Lamp Output Fault	5,6
6981	Left Stop Lamp Output Fault	5,6
6982	Wake up Hardware Fault	5,6
6983	Starter Relay (Mag Switch) Output Fault	5,6
6984	Ignition System, Accessory Power Outputs Fault	5,6
6985	Ignition System, Ignition Power Outputs Fault	2,5,6
6986	Ignition Switch Fault	7
6987	Tail / Clearance / License Plate Lights Output Fault	5,6
6988	Left Low Beam Output Fault	5,6
6989	Right Low Beam Output Fault	5,6
6990	Left High Beam Output Fault	5,6
6991	Right High Beam Output Fault	5,6
6992	Stalk Switch High Beam Input Fault	2
6993	Headlamp Switch Disagreement - Both Park and On Inputs are CLOSED	7
6994	ICU3-M2 Hazard Switch CAN Feedback Error	19
6995	Horn Output Fault	3,4,5,6
6996	Dome Lamps Switched Power Output Fault	5,6
6997	Cigar Lighter Output Fault	3,4,5,6
6998	Dome Lamps Battery Power Output Fault	5,6
6999	Backup Lamps / Alarm Output Fault	5,6
7000	Panel Lamp Backlighting PWM Output Fault	3,4,5,6

Table 2, J1939 SPNs for Bulkhead Module (BHM) SA 33

Fault Code Information

Failure Mode Identifiers		
FMI	**J1939 Description**	**J1587 Description**
00	Data valid but above normal operational range - Most severe level	Data valid but above normal operational range (engine overheating)
01	Data valid but below normal operational range - Most severe level	Data valid but below normal operational range (engine oil pressure too low)
02	Data erratic, intermittent, or incorrect	Data erratic, intermittent, or incorrect
03	Voltage above normal or shorted high	Voltage above normal or shorted high
04	Voltage below normal or shorted low	Voltage below normal or shorted low
05	Current below normal or open circuit	Current below normal or open circuit
06	Current above normal or grounded circuit	Current above normal or grounded circuit
07	Mechanical system not responding or out of adjustment	Mechanical system not responding properly
08	Abnormal frequency, pulse width, or period	Abnormal frequency, pulse width, or period
09	Abnormal update rate	Abnormal update rate
10	Abnormal rate of change	Abnormal rate of change
11	Root cause not known	Failure mode not identifiable
12	Bad intelligent device or component	Bad intelligent device or component
13	Out of Calibration	Out of Calibration
14	Special Instructions	Special Instructions
15	Data valid but above normal operational range - Least severe level	Reserved for future assignment by the SAE Subcommittee
16	Data valid but above normal operational range - Moderately severe level	—
17	Data valid but below normal operational range - Least severe level	—
18	Data valid but below normal operational range - Moderately severe level	—
19	Received network data in error	—
20	Reserved for SAE Assignment	—
21	Reserved for SAE Assignment	—
22	Reserved for SAE Assignment	—
23	Reserved for SAE Assignment	—
24	Reserved for SAE Assignment	—
25	Reserved for SAE Assignment	—
26	Reserved for SAE Assignment	—
27	Reserved for SAE Assignment	—
28	Reserved for SAE Assignment	—
29	Reserved for SAE Assignment	—
30	Reserved for SAE Assignment	—

Failure Mode Identifiers		
FMI	**J1939 Description**	**J1587 Description**
31	Not available or condition exists	—

Table 3, Failure Mode Identifiers

Viewing Fault Codes in ServiceLink

Both J1587 and J1939 fault codes can be viewed in ServiceLink. To do so:

1. Connect to the vehicle using an approved communication device.
2. Open ServiceLink in either online or offline mode.
3. Turn the vehicle's ignition to the ON position.
4. Click on the Connect button in ServiceLink.

NOTE: The J1587 Message Identifier (MID) for the BHM is 164, and the J1939 Source Address (SA) for the BHM is 33, shown in the far left column of the main window in **Fig. 1**, and **Fig. 2**.

5. From this point, either:
   - Click on the Faults tab from the main ECU List screen to display all faults present on the vehicle. See **Fig. 1**. Or,
   - Click on the Bulkhead Module icon first, then on the Faults tab to display faults coming from the BHM only. See **Fig. 2**.

Viewing Fault Codes on the Instrument Cluster

Fault codes for both data bus protocols (J1939 and J1587) can be viewed on the dash message center of the ICU3-M2 instrument cluster. See **Section 54.04**, Subject 410, for Mode/Reset Switch Functions and how to use the mode/reset switch on the ICU3-M2 to display fault information.

The following is one example using the ICU3-M2 dash message center to view a J1587 fault.

1. In this example, during an active fault the first screen shows "SYS 164". See **Fig. 3**. This indicates the fault is coming from the BHM, which has a J1587 MID of 164.

NOTE: The Bulkhead Module (BHM) will appear on the dash message center as "SYS 164." Be aware that the "SYS" looks like the numbers "545" on the digital display, as shown in **Fig. 3**.

2. Pressing the mode/reset switch displays the second fault screen, which shows "SID 022". See **Fig. 4**.
3. Next, find the description for SID 22 in **Table 1**, which lists the description as "Missing Smart Switch."
4. Press the mode/reset button again and the third ICU screen displays "Fail 07". See **Fig. 5**.
5. Next, find FMI 07 in in the J1587 Description column. See **Table 3**. It indicates "Mechanical system not responding properly."

   In this example, the fault indicates that the mechanical system is not responding properly because the BHM senses that a Smart Switch is missing from the vehicle. There can be various possibilities for the cause of each fault.

Fault Code Information

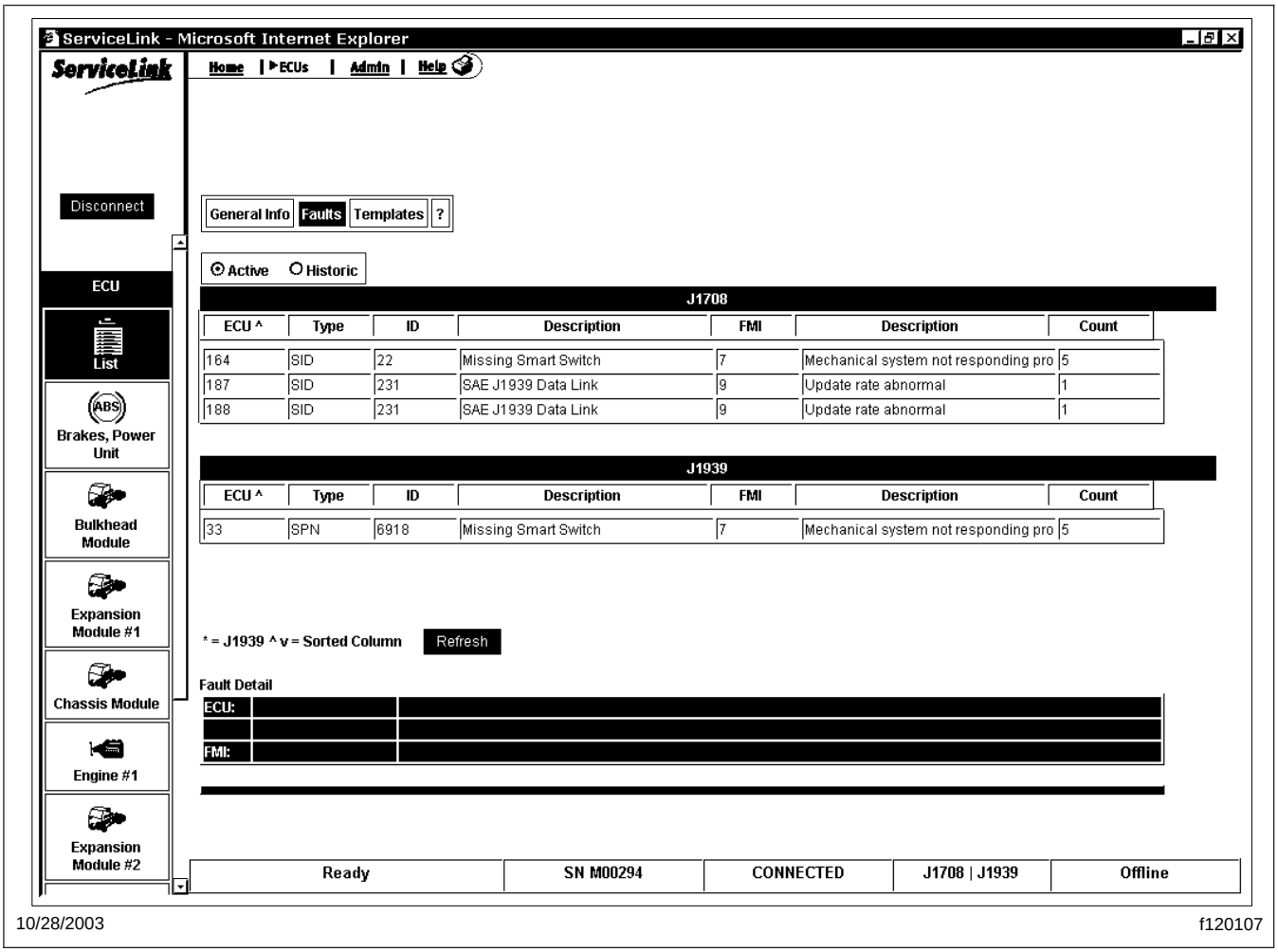

Fig. 1, ServiceLink Faults Screen for All ECUs on the Vehicle

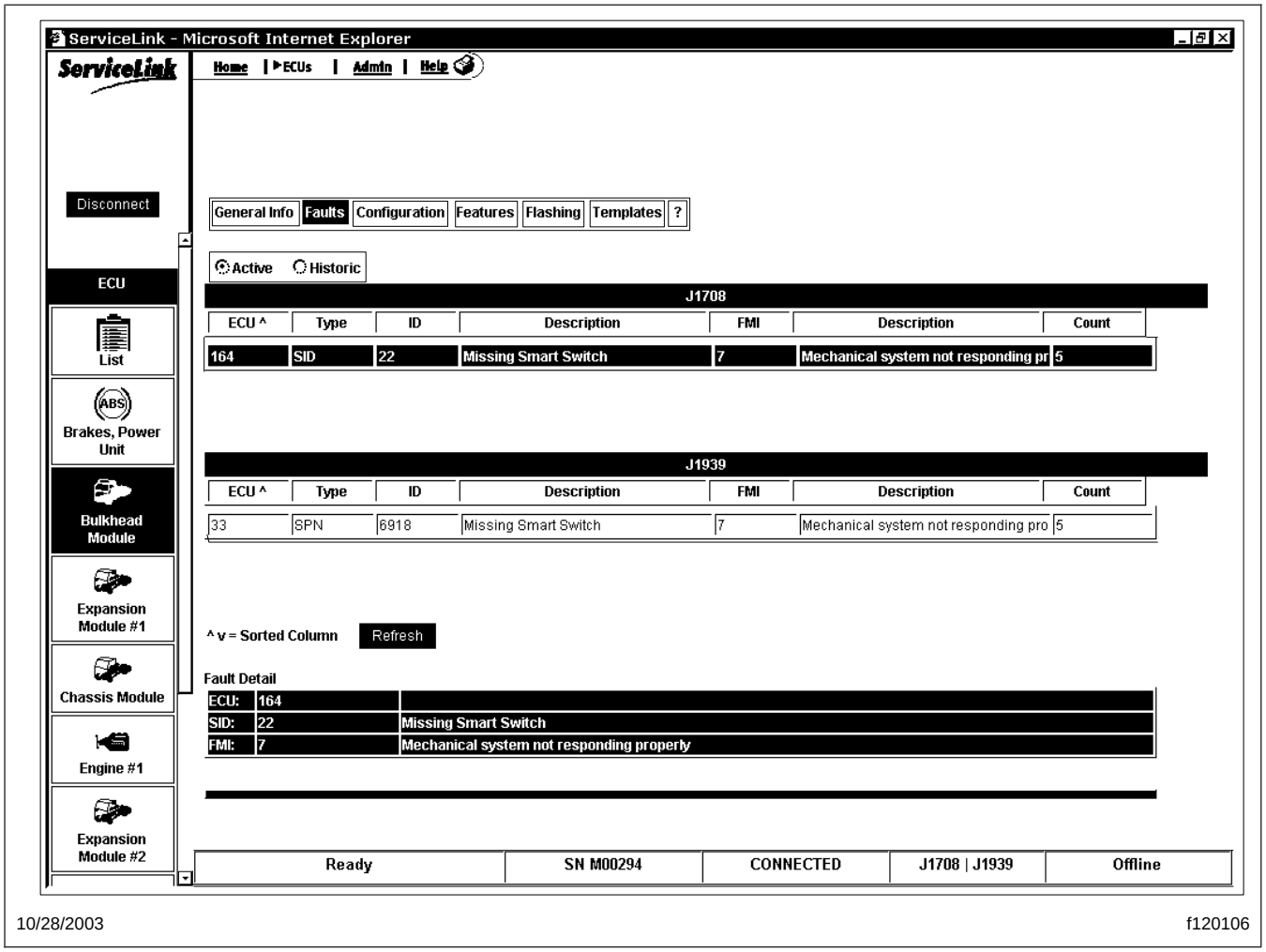

Fig. 2, ServiceLink Faults screen for the BHM only

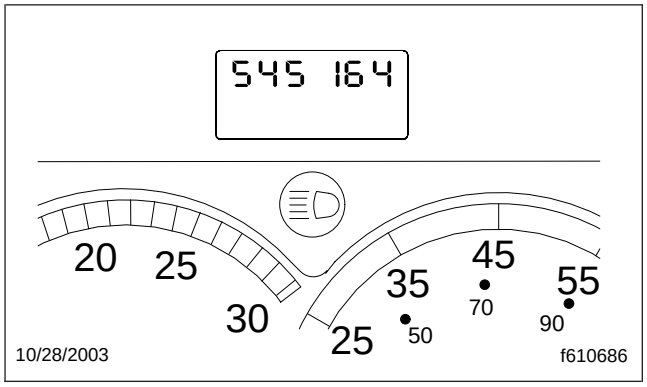

Fig. 3, J1587 Fault Code "SYS 164"

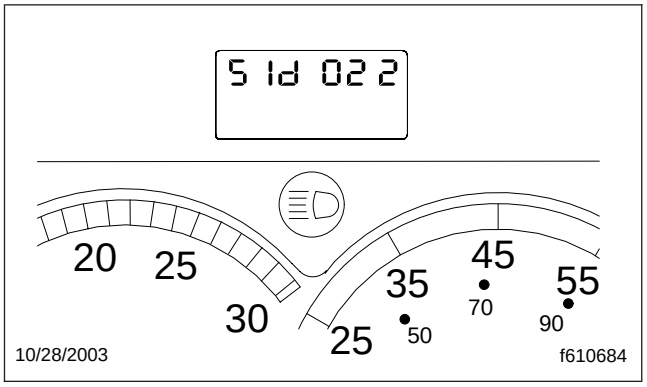

Fig. 4, J1587 Fault Code "SID 022"

Fault Code Information

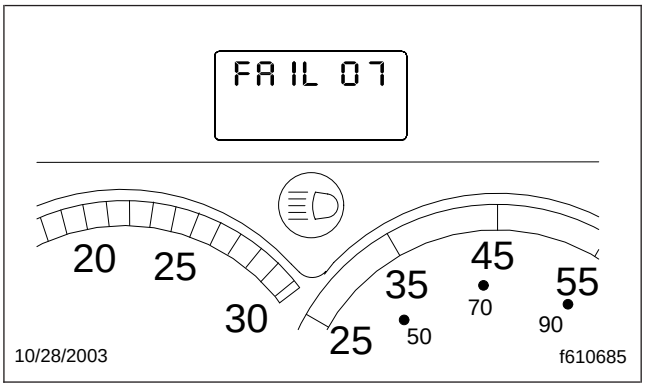

Fig. 5, Fault Code FMI 07

Device Communications

For information on cross-referencing a J1587 Message Identifier (MID) and a J1939 Source Address (SA), see **Table 1**.

Device Communications on J1587 and J1939		
Device Description	**J1587 MID***	**J1939 SA†**
Engine	128	0
Transmission	130	3
Anti-Lock Brakes	136	11
Instrument Cluster	140	23
Vehicle Security Unit (VSU)	163	–
Data Logging Unit (DLU)	179	251
Collision Avoidance System (Headway Controller)	219	42
Bulkhead Module	164	33
Chassis Module	249	71
Expansion Module #1	170	235
Expansion Module #2	187	236
Expansion Module #3	188	237
Expansion Module #4	178	238
Expansion Module #5	240	239
Switch Hub Module	221	49
Switch Expansion Module #1	n/a	128
Switch Expansion Module #2	n/a	129
Switch Expansion Module #3	n/a	130
Switch Expansion Module #4	n/a	131

* Message Identifier

† Source Address

Table 1, Device Communications on J1587 and J1939