

2002 Chevrolet Corvette

2002 STARTING & CHARGING SYSTEM Starters - Corvette

2002 STARTING & CHARGING SYSTEM

Starters - Corvette

TORQUE SPECIFICATIONS

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Application	Ft. Lbs. (N.m)
Battery Negative Cable Bolt	12 (16)
Exhaust Muffler Bolts	37 (50)
Exhaust Manifold Nuts	15 (20)
Exhaust Pipe Bolts	37 (50)
Exhaust Pipe Hanger Bolts	37 (50)
Oxygen Sensors	30 (42)
Starter Motor Bolts	37 (50)
INCH Lbs. (N.m)	
Positive Battery Cable Nut	71 (8)
S Terminal Nut	35 (4)

STARTER MOTOR SPECIFICATIONS

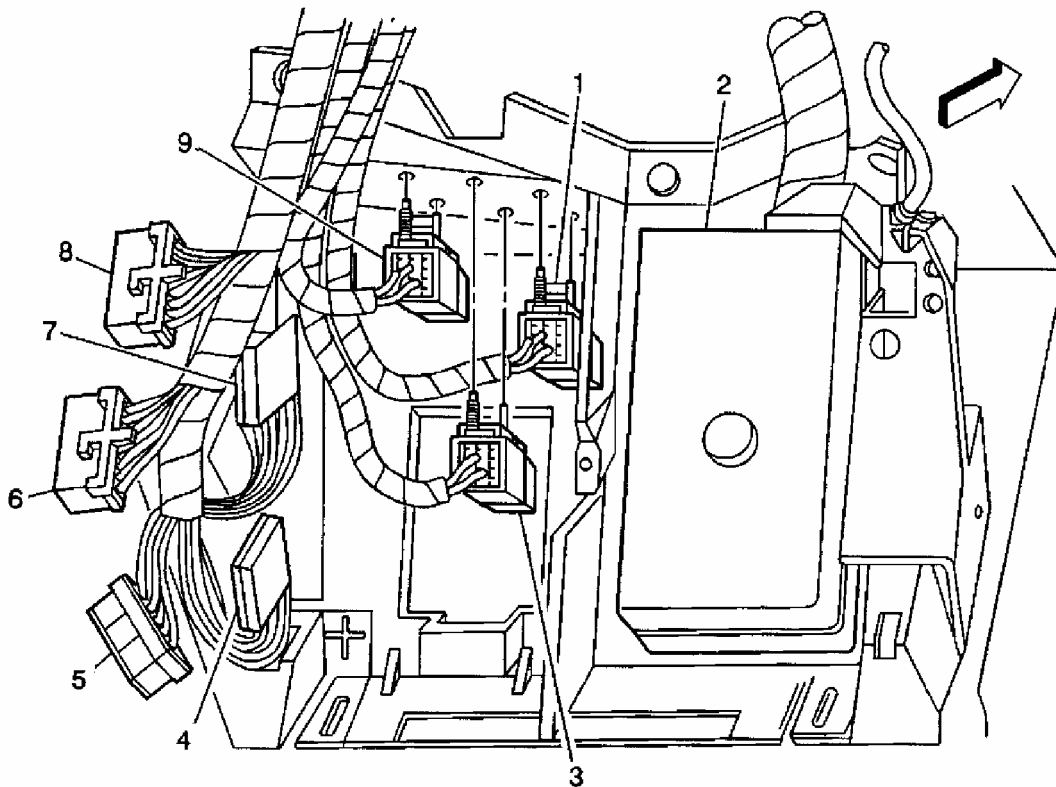
STARTER MOTOR SPECIFICATIONS

Application	Starter Model
LS1	PG-260M

WIRING DIAGRAMS

For starter motor wiring diagrams, see **STARTING/CHARGING** .

COMPONENT LOCATIONS



- (1) Theft Deterrent Relay
- (2) Fuse Block-IP
- (3) Blower Motor Relay
- (4) Star Connector #2
- (5) Body Control Module (BCM) C3
- (6) Body Control Module (BCM) C1
- (7) Star Connector #1
- (8) Body Control Module (BCM) C2
- (9) Steering Column Lock Relay

G00358008

Fig. 1: Locating Underhood Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION

DIAGNOSTIC STARTING POINT - ENGINE ELECTRICAL

Begin the system diagnosis with the **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**. The Diagnostic System Check will provide the following information:

- The identification of the control modules which command the system.

- The ability of the control modules to communicate through the serial data circuit.
- The identification of any stored diagnostic trouble codes (DTCs) and their status.

The use of the Diagnostic System Check will identify the correct procedure for diagnosing the system and where the procedure is located.

DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL

1. Perform the Battery Inspection/Test. See **BATTERY TESTING & INSPECTION** . Does the battery pass the test? If so, go to next step.
2. Install a scan tool. Turn ON the ignition, with the engine OFF. Does the scan tool power up? If so, go to next step. If not, go to **SCAN TOOL DOES NOT POWER UP** .

NOTE: **Lack of communication may be because of a partial malfunction of the class 2 serial data circuit or due to a total malfunction of the class 2 serial data circuit. The specified procedure will determine the particular condition.**

3. Turn ON the ignition, with the engine OFF. Attempt to communicate with each of the following modules on the class 2 serial data circuit:
 - Body Control Module (BCM)
 - Left Door Control Module (LDCM)
 - Right Door Control Module (RDCM)
 - Seat Control Module (SCM)
 - Powertrain Control Module (PCM)

Does the scan tool communicate with all modules on the class 2 serial data circuit? If so, go to next step. If not, go to **SCAN TOOL DOES NOT COMMUNICATE WITH CLASS 2 DEVICE** .

NOTE: **The symptom list in Symptoms will determine the correct diagnostic procedure to use.**

4. Select the DISPLAY DTCS function for each module. (If using a Tech 2, use the CLASS 2 DTC CHECK feature in order to determine which modules have DTCs set). Record all of the displayed DTCs, the DTC status, and the module which set the DTC. Does the scan tool display any DTCs? If so, go to next step. If not, go to **SYMPTOMS - ENGINE ELECTRICAL** .

NOTE: **The presence of DTCs which begin with "U" indicate some other module is not communicating. The specified procedure will collect all the available information before you perform**

2002 Chevrolet Corvette

2002 STARTING & CHARGING SYSTEM Starters - Corvette

tests.

5. Does the scan tool display any DTCs which begin with a U? If so, go to **SCAN TOOL DOES NOT COMMUNICATE WITH CLASS 2 DEVICE** . If not, go to next step.
6. Does the scan tool display DTC B1000? If so, go to **DIAGNOSTIC TROUBLE CODE (DTC) LIST** . If not, go to **DIAGNOSTIC TROUBLE CODE DEFINITIONS** .

DIAGNOSTIC TROUBLE CODE DEFINITIONS

DIAGNOSTIC TROUBLE CODE DEFINITIONS

DTC	Definition
DTC B0846	Voltage Level Out Of Range
DTC B0851	Voltage Level Out Of Range
DTC B2282	Voltage Level Out Of Range
DTC B2283	Voltage Level Out Of Range
DTC B2284	Voltage Level Out Of Range
DTC B2285	Voltage Level Out Of Range
DTC P0562	Excessively Low System Voltage
DTC P0563	Excessively High System Voltage

DTC B0846

Circuit Description

The LH Seat Control Module (SCM) has two main power feeds (high and low), and one main ground. The low power feed (battery 1) is used to provide power for the SCM logic and internal driver operation. The high power feed (battery 2) is used to provide power for systems that draw higher amounts of current (motors, lights etc.). For most functions, the SCM will operate properly when vehicle system voltage is between 9.0-16.0 volts. The SCM also monitors the voltage level at battery 1 and battery 2 circuits and can determine if the voltage level received is out of range. If the voltage level is out of range in either circuit, then a malfunction is present and a DTC will set.

Conditions for Setting the DTC

- The SCM detects battery 2 voltage range under 8.5 volts or over 16.3 volts.
- Condition must be present for 2 seconds.

Action Taken When the DTC Sets

- Stores a history DTC B0846 in the SCM memory.
- This DTC can only be set as a history code even if the malfunction is current.

2002 Chevrolet Corvette

2002 STARTING & CHARGING SYSTEM Starters - Corvette

- No driver warning message will be displayed for this DTC.

Conditions for Clearing the DTC

- The SCM detects battery 2 voltage range between 8.5-16.3 volts for longer than 2 seconds.
- Use the IPC clearing DTCs feature.
- Using a scan tool.

Testing

1. Did you perform the **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**? If so, go to next step. If not, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**.
2. Install a scan tool. Turn ON the ignition, with the engine OFF. With a scan tool, observe BATTERY 2 parameter in the SCM data list. Does the scan tool indicate that the Battery 2 parameter is within the specified range of 8.5-16.3V? If so, go to **INTERMITTENTS**. If not, go to next step.
3. Turn OFF the ignition. Disconnect the SCM connector C3. Turn ON the ignition, with the engine OFF. Measure the voltage from the battery 2 positive voltage circuit to a good ground. Is the voltage within the specified range of 8.5-16.3V? If so, go to next step. If not, go to step 5.
4. Inspect for poor connections at the harness connector of the SCM and the instrument panel electrical center. Did you find and correct the condition? If so, go to step 7. If not, go to step 6.
5. Repair high resistance in the battery 2 positive voltage circuit. After repair is complete, go to step 7.
6. Replace the SCM. After repair is complete, go to next step.
7. Use the scan tool in order to clear the DTCs. Operate the vehicle within the Conditions for Setting the DTC as specified in the supporting text. See **CONDITIONS FOR SETTING THE DTC**. Does the DTC reset? If so, go to step 2. If not, then system is okay.

DTC B0851

Circuit Description

The LH Seat Control Module (SCM) has two main power feeds (high and low), and one main ground. The low power feed (battery 1) is used to provide power for the SCM logic and internal driver operation. The high power feed (battery 2) is used to provide power for systems that draw higher amounts of current (motors, lights etc.). For most functions, the SCM will operate properly when vehicle system voltage is between 9.0-16.0 volts. The SCM also monitors the voltage level at battery 1 and battery 2 circuits and can determine if the

2002 Chevrolet Corvette

2002 STARTING & CHARGING SYSTEM Starters - Corvette

voltage level received is out of range. If the voltage level is out of range in either circuit, then a malfunction is present and a DTC will set.

Conditions for Setting the DTC

- The SCM detects battery 1 voltage range under 9.0 volts or over 16.3 volts.
- Condition must be present for 2 seconds.

Action Taken When the DTC Sets

- Stores a history DTC B0851 in the SCM memory.
- This DTC can only be set as a history code even if the malfunction is current.
- No driver warning message will be displayed for this DTC.

Conditions for Clearing the DTC

- The SCM detects battery 1 voltage range between 9.0-16.3 volts for longer than 2 seconds.
- Use the IPC clearing DTCs feature.
- Using a scan tool.

Testing

1. Did you perform the **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**? If so, go to next step. If not, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**.
2. Install a scan tool. Turn ON the ignition, with the engine OFF. With a scan tool, observe BATTERY 1 parameter in the SCM data list. Does the scan tool indicate that the Battery 1 parameter is within the specified range of 9.0-16.3V? If so, go to **INTERMITTENTS**. If not, go to next step.
3. Test for a high resistance in the battery 1 positive voltage circuit of the SCM. Did you find and correct the condition? If so, go to step 6. If not, go to next step.
4. Inspect for poor connections at the harness connector of the SCM and the instrument panel electrical center. Did you find and correct the condition? If so, go to step 6. If not, go to next step.
5. Replace the SCM. After replacement is complete, go to next step.
6. Use the scan tool in order to clear the DTCs. Operate the vehicle within the Conditions for setting the DTC as specified in the supporting text. See **CONDITIONS FOR SETTING THE DTC**. Does the DTC reset? If so, go to step 2. If not, then system is okay.

DTC B2282

Circuit Description

The LH Door Control Module (LDCM) has two main power feeds (high and low), and one main ground. The low power feed (battery 1) is used to provide power for the LDCM logic and internal driver operation. The high power feed (battery 2) is used to provide power for systems that draw higher amounts of current (motors, lights etc.). For most functions, the LDCM will operate properly when vehicle system voltage is between 9.0-16.0 volts. The LDCM also monitors the voltage level at battery 1 and battery 2 circuits and can determine if the voltage level received is out of range. If the voltage level is out of range in either circuit, then a malfunction is present and a DTC will set.

Conditions for Setting the DTC

- The LDCM detects battery 1 voltage range under 9.0 volts or over 16.3 volts.
- Condition must be present for 2 seconds.

Action Taken When the DTC Sets

- Stores a history DTC B2282 in the LDCM memory.
- This DTC can only be set as a history code even if the malfunction is current.
- No driver warning message will be displayed for this DTC.

Conditions for Clearing the DTC

- The LDCM detects battery 1 voltage range between 9.0-16.3 volts for longer than 2 seconds.
- Use the IPC clearing DTCs feature.
- Use a scan tool.

Testing

1. Did you perform the **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**? If so, go to next step. If not, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**.
2. Install a scan tool. Turn ON the ignition, with the engine OFF. With a scan tool, observe BATTERY 1 parameter in the LDCM data list. Does the scan tool indicate that the Battery 1 parameter is within the specified range of 8.5-16.3V? If so, go to **INTERMITTENTS**. If not, go to next step.
3. Test for a high resistance in the battery 1 positive voltage circuit of the LDCM. Did you find and correct the condition? If so, go to step 6. If not, go to next step.
4. Inspect for poor connections at the harness connector of the LDCM and the instrument panel electrical center. Did you find and correct the condition? If so, go to step 6. If not, go to next step.
5. Replace the LDCM. After replacement is complete, go to next step.
6. Use the scan tool in order to clear the DTCs. Operate the vehicle within the Conditions

for setting the DTC as specified in the supporting text. See **CONDITIONS FOR SETTING THE DTC** . Does the DTC reset? If so, go to step 2 . If not, then system is okay.

DTC B2283**Circuit Description**

The RH Door Control Module (RDCM) has two main power feeds (high and low), and one main ground. The low power feed (battery 1) is used to provide power for the RDCM logic and internal driver operation. The high power feed (battery 2) is used to provide power for systems that draw higher amounts of current (motors, lights etc.). For most functions, the RDCM will operate properly when vehicle system voltage is between 9.0-16.0 volts. The RDCM also monitors the voltage level at battery 1 and battery 2 circuits and can determine if the voltage level received is out of range. If the voltage level is out of range in either circuit, then a malfunction is present and a DTC will set.

Conditions for Setting the DTC

- The RDCM detects battery 1 voltage range under 8.5 volts or over 16.3 volts.
- Condition must be present for 2 seconds.

Action Taken When the DTC Sets

- Stores a history DTC B2283 in the RDCM memory.
- This DTC can only be set as a history code even if the malfunction is current.
- No driver warning message will be displayed for this DTC.

Conditions for Clearing the DTC

- The RDCM detects battery 1 voltage range between 8.5-16.3 volts for longer than 2 seconds.
- Use the IPC clearing DTCs feature.
- Use a scan tool.

Testing

1. Did you perform the **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**? If so, go to next step. If not, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL** .
2. Install a scan tool. Turn ON the ignition, with the engine OFF. With a scan tool, observe BATTERY 1 parameter in the RDCM data list. Does the scan tool indicate that the Battery 1 parameter is within the specified range of 9.0-16.3V? If so, go to **INTERMITTENTS** . If not, go to next step.
3. Test for a high resistance in the battery 1 positive voltage circuit of the RDCM. Did

2002 Chevrolet Corvette

2002 STARTING & CHARGING SYSTEM Starters - Corvette

you find and correct the condition? If so, go to step 6 . If not, go to next step.

4. Inspect for poor connections at the harness connector of the RDCM and the instrument panel electrical center. Did you find and correct the condition? If so, go to step 6 . If not, go to next step.
5. Replace the RDCM. After replacement is complete, go to next step.
6. Use the scan tool in order to clear the DTCs. Operate the vehicle within the Conditions for setting the DTC as specified in the supporting text. See **CONDITIONS FOR SETTING THE DTC** . Does the DTC reset? If so, go to step 2 . If not, then system is okay.

DTC B2284

Circuit Description

The LH Door Control Module (LDCM) has two main power feeds (high and low), and one main ground. The low power feed (battery 1) is used to provide power for the LDCM logic and internal driver operation. The high power feed (battery 2) is used to provide power for systems that draw higher amounts of current (motors, lights etc.). For most functions, the LDCM will operate properly when vehicle system voltage is between 9.0-16.0 volts. The LDCM also monitors the voltage level at battery 1 and battery 2 circuits and can determine if the voltage level received is out of range. If the voltage level is out of range in either circuit, then a malfunction is present and a DTC will set.

Conditions for Setting the DTC

- The LDCM detects battery 1 voltage range under 9.0 volts or over 16.3 volts.
- Condition must be present for 2 seconds.

Action Taken When the DTC Sets

- Stores a history DTC B2284 in the LDCM memory.
- This DTC can only be set as a history code even if the malfunction is current.
- No driver warning message will be displayed for this DTC.

Conditions for Clearing the DTC

- The LDCM detects battery 2 voltage range between 9.0-16.3 volts for longer than 2 seconds.
- Use the IPC clearing DTCs feature.
- Use a scan tool.

Testing

1. Did you perform the DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL? If so, go to next step. If not, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE**

ELECTRICAL .

2. Install a scan tool. Turn ON the ignition, with the engine OFF. With a scan tool, observe BATTERY 1 parameter in the LDCM data list. Does the scan tool indicate that the Battery 1 parameter is within the specified range of 9.0-16.3V? If so, go to **INTERMITTENTS** . If not, go to next step.
3. Test for a high resistance in the battery 1 positive voltage circuit of the LDCM. Did you find and correct the condition? If so, go to step 6 . If not, go to next step.
4. Inspect for poor connections at the harness connector of the LDCM and the instrument panel electrical center. Did you find and correct the condition? If so, go to step 6 . If not, go to next step.
5. Replace the LDCM. After replacement, go to next step.
6. Use the scan tool in order to clear the DTCs. Operate the vehicle within the Conditions for setting the DTC as specified in the supporting text. See **CONDITIONS FOR SETTING THE DTC** . Does the DTC reset? If so, go to step 2 . If not, then system is okay.

DTC B2285**Circuit Description**

The RH Door Control Module (RDCM) has two main power feeds (high and low), and one main ground. The low power feed (battery 1) is used to provide power for the RDCM logic and internal driver operation. The high power feed (battery 2) is used to provide power for systems that draw higher amounts of current (motors, lights etc.). For most functions, the RDCM will operate properly when vehicle system voltage is between 9.0-16.0 volts. The RDCM also monitors the voltage level at battery 1 and battery 2 circuits and can determine if the voltage level received is out of range. If the voltage level is out of range in either circuit, then a malfunction is present and a DTC will set.

Conditions for Setting the DTC

- The RDCM detects battery 1 voltage range under 9.0 volts or over 16.3 volts.
- Condition must be present for 2 seconds.

Action Taken When the DTC Sets

- Stores a history DTC B2285 in the RDCM memory.
- This DTC can only be set as a history code even if the malfunction is current.
- No driver warning message will be displayed for this DTC.

Conditions for Clearing the DTC

- The RDCM detects battery 2 voltage range between 9.0-16.3 volts for longer than 2 seconds.

2002 Chevrolet Corvette

2002 STARTING & CHARGING SYSTEM Starters - Corvette

- Use the IPC clearing DTCs feature.
- Use a scan tool.

Testing

1. Did you perform the DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL? If so, go to next step. If not, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL** .
2. Install a scan tool. Turn ON the ignition, with the engine OFF. With a scan tool, observe BATTERY 1 parameter in the RDCM data list. Does the scan tool indicate that the Battery 1 parameter is within the specified range of 9.0-16.3V? If so, go to **INTERMITTENTS** . If not, go to next step.
3. Test for a high resistance in the battery 1 positive voltage circuit of the RDCM. Did you find and correct the condition? If so, go to step 6 . If not, go to next step.
4. Inspect for poor connections at the harness connector of the RDCM and the instrument panel electrical center. Did you find and correct the condition? If so, go to step 6 . If not, go to next step.
5. Replace the RDCM. After replacement is complete, go to next step.
6. Use the scan tool in order to clear the DTCs. Operate the vehicle within the Conditions for setting the DTC as specified in the supporting text. Does the DTC reset? If so, go to step 2 . If not, then system is okay.

DTC P0562

Circuit Description

The PCM checks the system voltage to make sure that the voltage stays within the proper range. Damage to components, and incorrect input can occur when the voltage is out of range. The PCM monitors the system voltage over an extended length of time. If the PCM detects an excessively low system voltage, DTC P0562 will set.

Conditions for Running the DTC

- Engine speed above 1500 RPM.
- System voltage between 9.5 and 18 volts.
- Vehicle speed is above 5 mph.

Conditions for Setting the DTC

The PCM detects a system voltage below 10 volts for 5 seconds.

Action Taken When the DTC Sets

- The PCM will command a message to be displayed.

2002 Chevrolet Corvette

2002 STARTING & CHARGING SYSTEM Starters - Corvette

- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Fail Records data only.

Conditions for Clearing the DTC

- The PCM will command the message OFF after one trip in which the diagnostic test has been run and passed.
- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

Testing

1. Did you perform the **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**? If so, go to next step. If not, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**.
2. Install a scan tool. Turn ON the ignition, with the engine OFF. With a scan tool, observe the IGNITION 1 SIGNAL parameter in the PCM data list. Does the scan tool indicate that the Ignition 1 Signal parameter is greater than the specified range of 10.5V? If so, go to step 6. If not, go to next step.
3. Measure the voltage at the battery and compare it with the Ignition 1 Signal parameter in the PCM data list. Are the battery voltage and PCM Ignition 1 readings different by more than the value specified of 0.5V? If so, go to next step. If not, go to **TEST A: CHARGING SYSTEM TEST**.
4. Test the battery positive voltage circuit of the PCM for a high resistance. Did you find and correct the condition? If so, go to step 7. If not, go to next step.
5. Inspect for poor connections at the harness connector of the PCM. Did you find and correct the condition? If so, go to step 7. If not, go to next step.
6. Replace the PCM. See **POWERTRAIN CONTROL MODULE**. After replacement is complete, go to next step.
7. Review and record the scan tool Fail Records data. Use the scan tool in order to clear the DTC. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. See **CONDITIONS FOR RUNNING THE DTC**. Using the scan tool, observe the SPECIFIC DTC INFORMATION for DTC P0562 until the test runs. Does the scan tool indicate that DTC P0562 failed this ignition? If so, go to step 2. If not, then system is okay.

DTC P0563

Circuit Description

The PCM checks the system voltage to make sure that the voltage stays within the proper

2002 Chevrolet Corvette

2002 STARTING & CHARGING SYSTEM Starters - Corvette

range. Damage to components, and incorrect input can occur when the voltage is out of range. The PCM monitors the system voltage over an extended length of time. If the PCM detects an excessively high system voltage, DTC P0563 will set.

Conditions for Running the DTC

- Engine speed above 1500 RPM.
- System voltage between 9.5 and 18 volts.
- Vehicle speed is above 5 mph.

Conditions for Setting the DTC

The PCM detects a system voltage above 16 volts for less than 1 second.

Action Taken When the DTC Sets

- The PCM will command a message to be displayed.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Fail Records data only.

Conditions for Clearing the DTC

- The PCM will command the message OFF after one trip in which the diagnostic test has been run and passed.
- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

Testing

1. Did you perform the **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**? If so, go to next step. If not, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**.
2. Install a scan tool. Turn ON the ignition, with the engine OFF. With a scan tool, observe the IGNITION 1 SIGNAL parameter in the PCM data list. Does the scan tool indicate that the Ignition 1 Signal parameter is less than the specified range of 16.0V? If so, go to step 4. If not, go to next step.
3. Measure the voltage at the battery and compare it with the Ignition 1 Signal parameter in the PCM data list. Are the battery voltage and PCM Ignition 1 readings different by more than the value specified of 0.5V? If so, go to next step. If not, go to **TEST A: CHARGING SYSTEM TEST**.
4. Replace the PCM. See **POWERTRAIN CONTROL MODULE**. After replacement is complete, go to next step.

5. Review and record the scan tool Fail Records data. Use the scan tool in order to clear the DTC(s). Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. See **CONDITIONS FOR RUNNING THE DTC** . Using the scan tool, observe the SPECIFIC DTC INFORMATION for DTC P0563 until the test runs. Does the scan tool indicate that DTC P0563 failed this ignition? If so, go to step 2 . If not, then system is okay.

SYMPTOMS - ENGINE ELECTRICAL

The following steps must be completed before using the symptom tables.

1. Perform **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL** before using the Symptom Tables in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control modules can communicate via the serial data link.
2. Review the system descriptions and operations in order to familiarize yourself with the system functions. See **DESCRIPTION & OPERATION** .

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the Starting and Charging Systems.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittents

Intermittent faulty electrical connections or wiring may be the cause of intermittent conditions. Check for loose, bent or corroded terminals and terminal tension. Check for cut, bare or pinched wiring. Simulate the condition that is potentially causing the intermittent connection, either by wiggling the connections or the wiring, test driving or performing other operations while observing scan tool, DVOM or other testing equipment.

Symptom List

- **STARTER SOLENOID DOES NOT CLICK**
- **STARTER SOLENOID CLICKS, ENGINE DOES NOT CRANK**
- **ENGINE CRANKS SLOWLY**
- **STARTER MOTOR NOISE DIAGNOSIS**

STARTER SOLENOID DOES NOT CLICK

1. Did you perform the DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL? If so, go to next step. If not, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE**

ELECTRICAL .

2. Turn the ignition switch to the START position. Does the engine crank? If so, go to **INTERMITTENTS** . If not, go to next step.
3. Turn the ignition switch to the START position. Does the Theft Deterrent relay click? If so, go to step 7 . If not, go to next step.
4. Disconnect the Theft Deterrent relay. Connect a test light from the supply voltage circuit of the theft deterrent relay coil circuit to ground. With the transmission in park, or clutch pedal depressed, turn the ignition switch to the start position. Does the test light illuminate? If so, go to next step. If not, go to step 6 .
5. Connect a test light from the supply voltage circuit of the Theft Deterrent relay coil circuit to the control circuit of the Theft Deterrent relay coil circuit. With the transmission in park, or clutch pedal depressed, turn the ignition switch to the start position. Does the test light illuminate? If so, go to step 13 . If not, go to step 10 .
6. Turn OFF the ignition. Disconnect the Park Neutral Position (PNP) switch or Clutch Pedal Position (CPP) switch. Turn ON the ignition, with the Engine OFF. Connect a 10 amp fused jumper between the Theft Deterrent relay coil control circuits of the PNP switch or Clutch Pedal Position switch. With the transmission in park, or clutch pedal depressed, turn the ignition switch to the start position. Does the test light illuminate? If so, go to step 14 . If not, go to step 11 .
7. Turn OFF the ignition. Disconnect the Theft Deterrent relay. Connect a test light between the battery positive voltage circuit of the Theft Deterrent relay switch circuit and a good ground. Does the test light illuminate? If so, go to next step. If not, go to step 18 .
8. Connect a 30 amp fused jumper between the battery positive voltage circuit of the Theft Deterrent relay switch circuit and the supply voltage circuit of the starter solenoid. Does the engine crank? If so, go to step 13 . If not, go to next step.
9. Does the fuse in the jumper open? If so, go to step 19 . If not, go to step 12 .
10. Test the control circuit of the Theft Deterrent relay for an open or high resistance. Did you find and correct the condition? If so, go to step 25 . If not, go to step 15 .
11. Test the supply voltage circuit of the Theft Deterrent relay coil circuit for an open or high resistance. Did you find and correct the condition? If so, go to step 25 . If not, go to step 16 .
12. Test the supply voltage circuit of the starter solenoid for an open or high resistance. Did you find and correct the condition? If so, go to step 25 . If not, go to step 17 .
13. Inspect for poor connections at the Theft Deterrent relay. Did you find and correct the condition? If so, go to step 25 . If not, go to step 20 .
14. If equipped with an Automatic Transmission Inspect for poor connections at the PNP switch harness connector. If equipped with a Manual Transmission inspect for poor connections at the Clutch Pedal Position switch harness connector. Did you find and correct the condition? If so, go to step 25 . If not, go to step 21 .
15. Inspect for poor connections at the BCM harness connector. Did you find and correct

the condition? If so, go to step 25 . If not, go to step 22 .

16. Inspect for poor connections at the ignition switch harness connector. Did you find and correct the condition? If so, go to step 25 . If not, go to step 23 .
17. Inspect for poor connections at the starter solenoid. Did you find and correct the condition? If so, go to step 25 . If not, go to step 24 .
18. Repair the open or high resistance in the battery positive voltage circuit of the Theft Deterrent relay switch circuit. After repair is complete, go to step 25 .
19. Repair the short to ground in the supply voltage circuit of the starter solenoid. After repair is complete, go to step 25 .
20. Replace the Theft Deterrent relay. See **Fig. 1** for relay location. After replacement is complete, go to step 25 .
21. Replace the Park/Neutral Position Switch. See **PARK/NEUTRAL POSITION SWITCH** . Replace the Clutch Pedal Position Switch. See **CLUTCH PEDAL POSITION SWITCH** . After replacement is complete, go to step 25 .
22. Replace the BCM. See **BODY CONTROL MODULE REPLACEMENT** . After replacement is complete, go to step 25 .
23. Replace the Ignition Switch. See **IGNITION SWITCH** . After replacement is complete, go to step 25 .
24. Replace the starter. See **STARTER MOTOR** . After replacement is complete, go to next step.
25. Operate the system for which the symptom occurred. Did you correct the condition? If so, then system is okay. If not, go to step 2 .

STARTER SOLENOID CLICKS, ENGINE DOES NOT CRANK

1. Did you perform the DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL? If so, go to next step. If not, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL** .
2. Turn the ignition to the START position. Did the starter solenoid click? If so, go to **STARTER SOLENOID DOES NOT CLICK** . If not, go to next step.
3. Inspect the engine and belt drive system for mechanical binding (seized engine, seized generator). Does the engine move freely? If so, go to next step. If not, go to **ENGINE WILL NOT CRANK - CRANKSHAFT WILL NOT ROTATE** .
4. Test the battery positive cable between the underhood fuse block and starter motor for an open or high resistance. Did you find and correct the condition? If so, go to step 8 . If not, go to next step.
5. Test the ground circuit of the starter motor between the battery and the starter motor for a high resistance. Did you find and correct the condition? If so, go to step 8 . If not, go to next step.
6. Inspect for poor connections at the starter motor. Did you find and correct the condition? If so, go to step 8 . If not, go to next step.

7. Replace the Starter Motor. See **STARTER MOTOR** . After replacement, go to next step.
8. Operate the system in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 2 .

ENGINE CRANKS SLOWLY

Inspect the following items:

1. Perform the Battery Inspection/Test. See **BATTERY TESTING & INSPECTION** .
2. Inspect the wiring for damage. Inspect all connections to the starter motor, the solenoid, the battery, and all ground connections.
3. Verify that the engine is not seized.
4. If the battery, the wiring, and the engine are functioning properly, and the engine continues to crank slowly, replace the starter motor. See **STARTER MOTOR** .

STARTER MOTOR NOISE DIAGNOSIS**Diagnostic Aids**

- Inspect the flywheel ring gear for damage or unusual wear.
- Shim the starter as required.
- In order to add pinion to ring gear clearance a full size shim must be used. Do not shim only one starter mounting bolt. There are three shims available in different shapes, for clearance, all are 0.039" (1 mm) thick.

Testing

1. Did you perform the **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL**? If so, go to next step. If not, go to **DIAGNOSTIC SYSTEM CHECK - ENGINE ELECTRICAL** .
2. Start the engine. Does the starter operate normally? If so, go to **INTERMITTENTS** . If not, go to next step.
3. Start the engine while listening to the starter motor turn. Is there a loud "whoop" (it may sound like a siren if the engine is revved while the starter is engaged) after the engine starts, but while the starter is still held in the engaged position? If so, go to step 6 . If not, go to next step.
4. Do you hear a "rumble", a "growl", or, in some cases, a "knock" as the starter is coasting down to a stop after starting the engine? If so, go to step 7 . If not, go to next step.
5. When the engine is cranked, do you hear a high-pitched whine after the engine cranks and starts normally? (This is often diagnosed as a starter drive gear hang-in or a weak solenoid.) If so, go to step 8 . If not, go to step 7 .

2002 Chevrolet Corvette

2002 STARTING & CHARGING SYSTEM Starters - Corvette

6. Inspect the flywheel ring gear for chipped gear teeth, missing gear teeth and milled teeth. Is the flywheel bent, or does it have damaged teeth? If so, go to step 9 . If not, go to step 10 .
7. Remove the starter motor. See **STARTER MOTOR** . Inspect the starter motor bushings and clutch gear. Does the clutch gear have chipped or milled teeth or worn bushings? If so, go to step 10 . If not, go to step 9 .
8. Shim the starter motor away from the flywheel by adding shims between the starter motor and the engine block one at a time. Flywheel runout may make this noise appear to be intermittent. After repair is complete, go to step 11 .
9. Replace the flywheel. Refer to **ENGINE FLYWHEEL REPLACEMENT** . After repair is complete, go to step 11 .
10. Replace the starter motor. See **STARTER MOTOR** . After repair is complete, go to next step.
11. Operate the system in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 3 .

ENGINE WILL NOT CRANK - CRANKSHAFT WILL NOT ROTATE

Cause	Correction
Seized accessory drive system component	<ol style="list-style-type: none">1. Remove the accessory drive belts.2. Confirm that the engine will rotate. Rotate the crankshaft by hand at the crankshaft balancer or flywheel location.3. Repair or replace the components as required.
Seized driveline/propshaft assembly - Corvette automatic transmission application	<ol style="list-style-type: none">1. Separate the engine flywheel from the input shaft of the propshaft.2. Confirm that the engine will rotate. Rotate the crankshaft by hand at the crankshaft balancer or flywheel location.3. Repair or replace the components as required.
Seized automatic transmission torque converter	<ol style="list-style-type: none">1. Remove the torque converter-to-flywheel bolts.2. Confirm that the engine will rotate. Rotate the crankshaft by hand at the crankshaft balancer or flywheel location.3. Repair or replace the components as required.
Seized manual transmission	<ol style="list-style-type: none">1. Disengage the clutch by depressing the clutch pedal.2. Confirm that the engine will rotate. Rotate the crankshaft by hand at the crankshaft balancer or flywheel location. Refer to Transmission/Transaxle Unit Repair Manual.
Broken timing chain	<ul style="list-style-type: none">• Inspect the timing chain and gears.• Repair or replace the components as required.
Seized timing chain or timing gears	<ul style="list-style-type: none">• Inspect the timing chain and gears for foreign material or a seized chain.• Repair or replace the components as required.
Seized or broken camshaft	<ul style="list-style-type: none">• Inspect the camshaft and the camshaft bearings.• Repair or replace the components as required.
Bent valve in the cylinder head	<ul style="list-style-type: none">• Inspect the valves and the cylinder heads.• Repair or replace the components as required.
Seized oil pump	<ul style="list-style-type: none">• Inspect the oil pump assembly.• Repair or replace as required.
Hydraulically locked cylinder <ul style="list-style-type: none">• Coolant/antifreeze in the cylinder• Oil in the cylinder• Fuel in the cylinder	<ol style="list-style-type: none">1. Remove the spark plugs and check for fluid in the cylinder. When rotating the engine with the spark plugs removed, the piston, on compression stroke, will push fluid from the combustion chamber.2. Inspect for failed/broken head gaskets.3. Inspect for a cracked engine block or cylinder head.4. Inspect for a sticking fuel injector.5. Repair or replace the components as required.
Material in the cylinder <ul style="list-style-type: none">• Broken valve• Broken piston rings• Piston material• Foreign material	<ul style="list-style-type: none">• Inspect the cylinder for damaged components and/or foreign materials.• Repair or replace the components as required.
Seized crankshaft or connecting rod bearings	<ul style="list-style-type: none">• Inspect crankshaft and connecting rod bearings.• Repair or replace the components as required.
Bent or broken connecting rod	<ul style="list-style-type: none">• Inspect the connecting rods.• Replace the piston, pin and connecting rod as an assembly, as required.
Broken crankshaft	<ul style="list-style-type: none">• Inspect the crankshaft.• Repair or replace the components as required.

Fig. 2: Engine Will Not Crank Symptom Table
Courtesy of GENERAL MOTORS CORP.

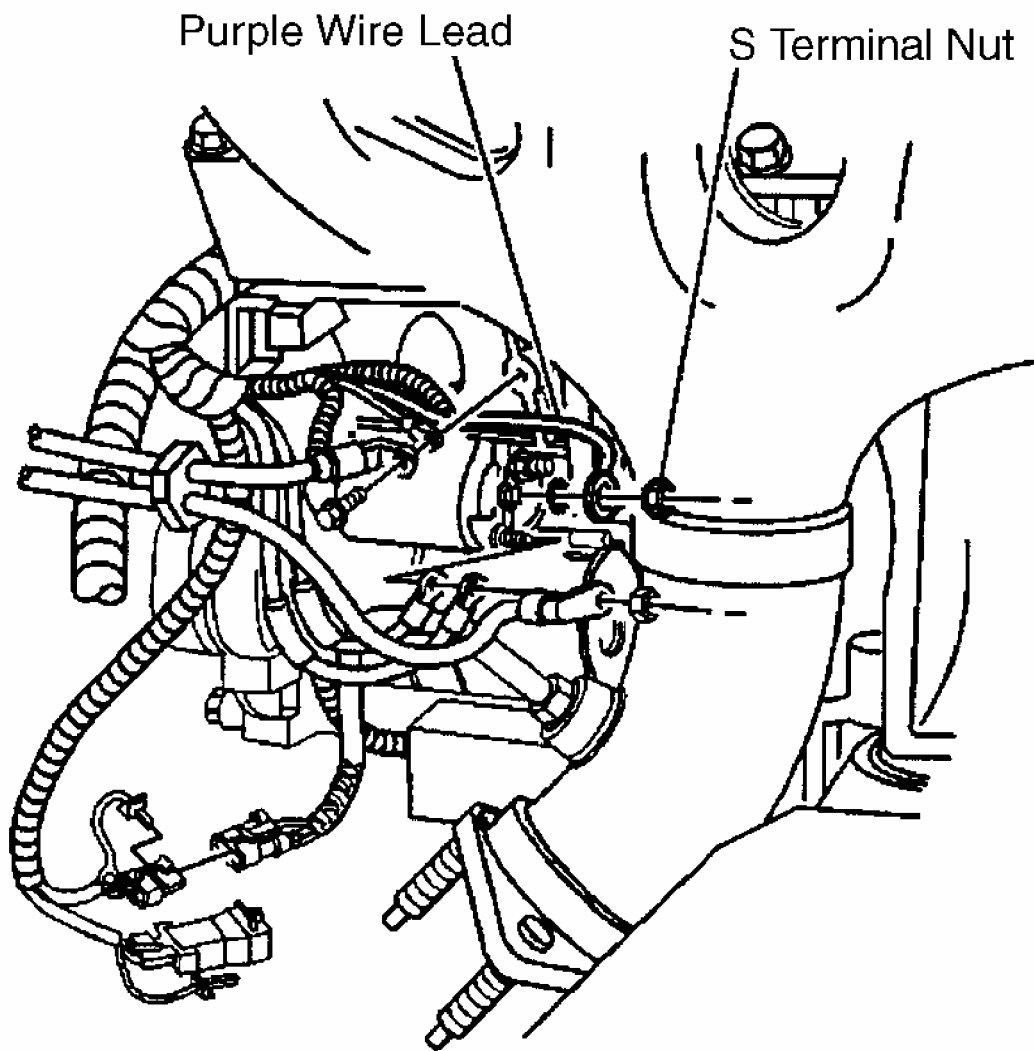
REPLACEMENT PROCEDURES

CAUTION: Before servicing any electrical component, the ignition key must be in the OFF or LOCK position and all electrical loads must be OFF, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect the negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

STARTER MOTOR

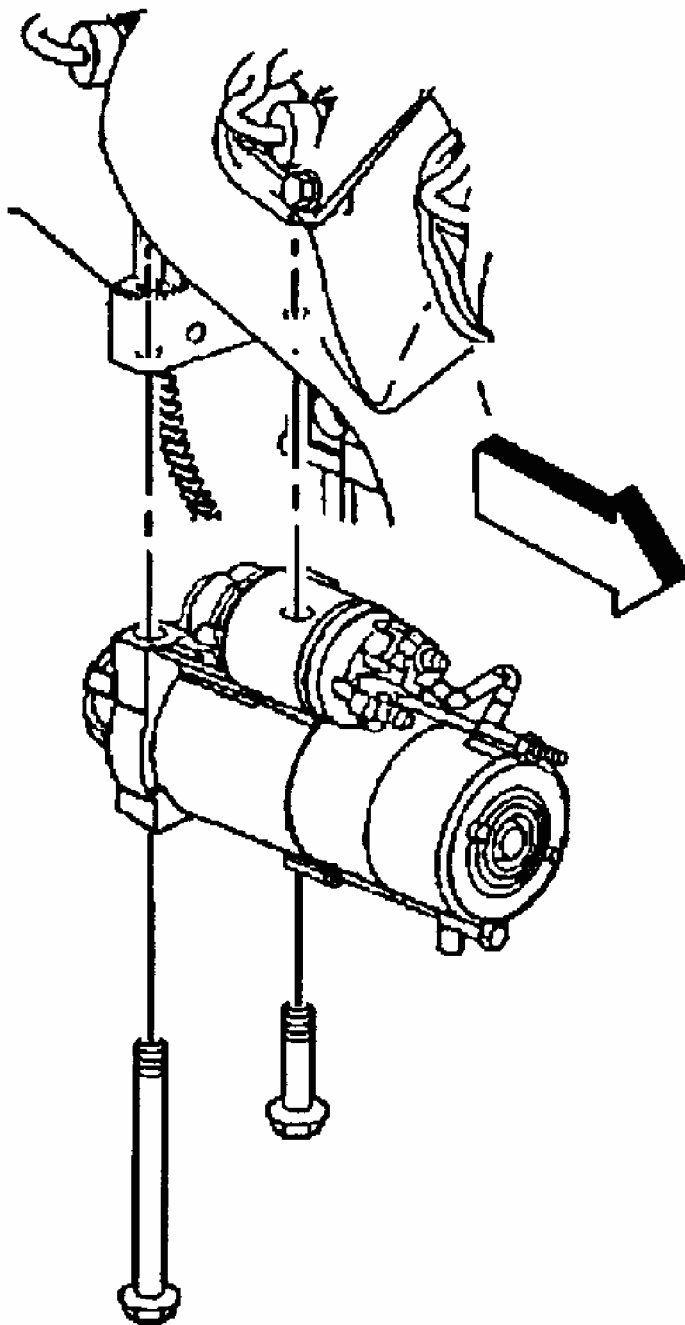
Removal

1. Disconnect the negative battery cable. Remove the catalytic converter.
2. Remove the positive battery cable nut. Remove the positive battery cable terminal and the engine harness leads from the solenoid. Remove the S terminal nut. See **Fig. 3** . Remove the purple wire lead and washer from the solenoid.
3. Support the starter motor. Remove the starter motor bolts. See **Fig. 4** . Remove the starter motor.



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Fig. 3: Identifying Starter Motor Electrical Leads
Courtesy of GENERAL MOTORS CORP.



G00358011

Fig. 4: Identifying Starter Motor
Courtesy of GENERAL MOTORS CORP.

Installation

1. Position the starter motor to the block. See **Fig. 4** . Install the starter motor bolts. Tighten the starter motor bolts to specifications. See **TORQUE SPECIFICATIONS** .

NOTE: Orient the purple lead wire to the 10:00 position when installing.

2. Install the starter motor S terminal washer and purple lead wire. See **Fig. 3** . Install the S terminal nut. Tighten the S terminal nut to specifications. See **TORQUE SPECIFICATIONS** .

NOTE: Orient gray and rust harness leads to the 6:00 and 7:00 position.

3. Install the gray and rust harness leads to the solenoid. Install the positive battery cable terminal to the solenoid. Install the positive battery cable nut. Tighten the positive battery cable nut to specifications. See **TORQUE SPECIFICATIONS** .
4. Install the catalytic converter. Tighten all bolts and fasteners to specifications. See **TORQUE SPECIFICATIONS** . Connect the negative battery cable. Tighten cable to specifications. See **TORQUE SPECIFICATIONS** .

DESCRIPTION & OPERATION

STARTER

The PG starter motors are non-repairable starter motor. They have pole pieces that are arranged around the armature. Both solenoid windings are energized. The pull-in winding circuit is completed to the ground through the starter motor. The windings work together magnetically to pull and hold in the plunger. The plunger moves the shift lever. This action causes the starter drive assembly to rotate on the armature shaft spline as it engages with the flywheel ring gear on the engine. Moving at the same time, the plunger also closes the solenoid switch contacts in the starter solenoid. Full battery voltage is applied directly to the starter motor and it cranks the engine.

As soon as the solenoid switch contacts close, current stops flowing thorough the pull-in winding because battery voltage is applied to both ends of the windings. The hold-in winding remains energized; its magnetic field is strong enough to hold the plunger, shift lever, starter drive assembly, and solenoid switch contacts in place to continue cranking the engine. When the engine starts, pinion overrun protects the armature from excessive speed until the switch is opened.

When the ignition switch is released from the START position, the START relay opens and battery voltage is removed from the starter solenoid S terminal. Current flows from the motor contacts through both windings to the ground at the end of the hold-in winding. However, the direction of the current flow through the pull-in winding is now opposite the direction of the current flow when the winding was first energized. The magnetic fields of the pull-in and hold-in windings now oppose one another. This action of the windings, along with the help of the return spring, causes the starter drive assembly to disengage and the

2002 Chevrolet Corvette

2002 STARTING & CHARGING SYSTEM Starters - Corvette

solenoid switch contacts to open simultaneously. As soon as the contacts open, the starter circuit is turned off.

Circuit Description

Moving the ignition switch to the START position sends a 12 V signal to the PCM Ignition Crank Sense. The PCM verifies that the transmission is in the PARK or NEUTRAL position. The PCM then grounds the control circuit of the START relay. When the START relay is energized it allows voltage to the starter solenoid S terminal.