

3-Button 4WD Troubleshooting

GM S-Series Trucks

*Note: Everything that follows was “borrowed” from Brian Wolfrom (a/k/a **WolfZR2**) of Tobyhanna, PA. He kindly posted this on the ZR2USA.com discussion forum in February 2009. The source of this info is a GM service manual for his 2003 Chevy ZR2 S-10 pickup truck. I’ve included a few of my own comments here and there, and formatted the troubleshooting tables to my liking (I’m sure these were much prettier in the GM service manual). Nothing in here is guaranteed to be transcribed perfectly from the service manual, and I’m not saying all of this will work for your vehicle. But hey, it’s free info...don’t thank me, thank Brian.*

How to Display the Diagnostic Trouble Codes (DTCs)

The transfer case shift control module is equipped with the ability to store diagnostic information, which is useful to a technician in the event of module, component or wiring failures. This information can be retrieved from the transfer case shift control module by way of flash codes, which are displayed on the three transfer case shift control switch buttons. These buttons are located on the instrument panel to the right of the steering wheel.

Before obtaining DTCs, perform the following transfer case control module (TCCM) Self-Test.

TCCM Self-Test

1. Observe the transfer case shift control switch indicators while turning the ignition switch to RUN. A properly operating system will flash all indicators and then will return to the current gear. If the system is operating normally, then proceed to “Displaying the DTCs.”
2. If the TCCM failed the Self-Test, then test the following circuits:
 - a. Battery Positive Voltage (40 and 1640), and Ignition 3 Voltage for battery voltage.
 - b. Ground Circuit for ground.
 - c. Diagnostic enable circuit for an open or high resistance.
 - d. Transfer case shift control switch connector.
3. If the above circuits are normal but the TCCM still fails the Self-Test, replace the TCCM. Refer to Transfer Case Shift Control Module Replacement.

Displaying the DTCs

1. Turn OFF the ignition for 10 seconds.
2. Connect PIN 13 on the data link cable (DLC) to a ground. The DLC is located in the cab under the instrument panel on the driver's side.
3. Turn ON the ignition, with the engine OFF.

4. Observe the transfer case shift control switch select buttons for flashing codes. Refer to Diagnostic Trouble Code (DTC) List.

Important

- If the transfer case shift control switch buttons all blink only once and then stop, no fault codes are stored in the transfer case shift control module.
- When one DTC is stored in memory, that code will blink that number of times followed by a 3 second pause and then repeat.
- If more than one code is stored, the first code will blink, followed by a 3 second pause and then the second code will blink.
- This sequence will continue until PIN 13 on the DLC is no longer grounded.
- If the TCCM will not communicate the presence or absence of DTCs, test the above circuits in TCCM Self-Test Step 2. If the circuits are complete, then replace the TCCM. Refer to Transfer Case Shift Control Module Replacement.

Diagnostic Trouble Code List

Diagnostic Trouble Code (DTC) 1

When the ignition switch is positioned to RUN, the TCCM test to determine if RAM standby Power (maintained battery power) to the TCCM was lost since the ignition was last turned OFF. When power is interrupted on pin C6 of the TCCM, the TCCM stores a loss of RAM standby power.

Diagnostic Trouble Code (DTC) 2

During electronic shifting, the TCCM checks the transfer case encoder motor (sometimes called the transfer case shift motor) for normal operation. If the encoder motor does not function correctly enough times, the TCCM stores an encoder motor failure DTC 2.

Diagnostic Trouble Code (DTC) 3

The TCCM performs a test each time the transfer case encoder motor is turned ON or OFF. If the motor does not function properly, the TCCM stores a motor circuit failure DTC 3, and the shift select buttons blink in order to inform the driver of a problem.

Diagnostic Trouble Code (DTC) 4

Each time the ignition is turned ON, the TCCM tests the memory, the program, and the internal system in order to ensure that the TCCM is operating properly. If the TCCM detects a fault within the TCCM, the TCCM stores a RAM/ROM memory failure (DTC) 4.

How to Clear the Diagnostic Trouble Codes (DTCs)

Note: this section comes from GM Document ID #642958, in the service manual of a 2003 Chevrolet S10 Pickup (4WD). Certain parts of this document refer to other diagnostic tests that are located elsewhere in the service manual. For those types of references, such as performing a diagnostic system check on the transfer case (i.e. Step 1 on page 5 below), you're on your own. The following only covers DTC codes.

The transfer case shift control module is equipped with the ability to store diagnostic information which is useful to a technician in the event of a module, component, or wiring failure. DTCs should not be cleared from the transfer case shift control module until these codes have been recorded or servicing the system has lead you to a repair and directed you to perform the "Clearing Flash Codes" operation. The following steps provide an easy way of clearing the flash codes properly.

Note from the copyright infringer: don't do these next steps until you've figured out what DTCs are stored in the TCCM!!

1. Turn OFF the ignition.
2. Remove the 10 amp CTSY LP fuse from the IP fuse block.

Important: Replacing the fuse before the specified time may result in not clearing the DTCs.

3. Wait a minimum of 60 seconds before replacing the fuse. Once the fuse is replaced, DTC 1 will be set in the transfer case shift control module.
4. Cycle the ignition switch from the OFF position to the RUN and back OFF five times in order to clear DTC 1 from the transfer case shift control module memory.
5. Verify that the DTCs have all been cleared. Refer to "Displaying the DTCs" on page 1.

Diagnostic Trouble Code 001

Loss of RAM Standby Power

Circuit Description

The transfer case shift-control module (TCCM) normally has battery voltage supplied through the battery positive voltage circuit (CKT 40) at all times. When the ignition is ON, the transfer case shift control module conducts a self-test. This self-test determines if the current memory is the same memory that was retained when the ignition was last turned OFF. This self-test indicates whether the RAM standby power-supply to the transfer case shift control module pin C6 was interrupted. If the power is interrupted, the DTCs would be cleared from memory. If the self-test fails, the transfer case shift-control module sets DTC 1.

Conditions for Clearing the DTC

This DTC will clear when the voltage supply failure has been corrected and the ignition switch has been cycled 5 times.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

Step 2: Inspects the CTSY LP fuse for an open.

Step 3: Tests the battery positive voltage circuit, CKT 40, for an open or high resistance.

Step 4: Rechecks the CTSY LP fuse for an open.

Step 5: Tests the battery positive voltage circuit, CKT 40, for a short to ground.

Important: Check the transfer case shift control module for DTCs. The transfer case shift control module is not a class 2 device. DTCs are displayed on the transfer case shift control switch. Refer to the “Displaying the DTCs” procedure on page 1.

DTC 1 - RAM Standby Power Loss

Schematic Reference: Transfer Case Control Schematics

Step	Action	Value	Yes	No
1	<i>Did you perform the Diagnostic System Check-Transfer Case?</i>	--	Go to Step 2	Go to Diagnostic System Check - Transfer Case
	Note: this system check is described elsewhere in the service manual.			
2	Important: This code can get set falsely due to the improper clearing of DTCs or replacement of a blown CTSY LP fuse.	--	Go to Step 4	Go to Step 3
	Inspect the CTSY LP fuse for an open.			
	<i>Was there a problem found?</i>			
3	1. Test the battery positive voltage circuit, CKT 40, for an open or high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems.	--	Go to Step 7	Go to Step 6
	2. Cycle the ignition 5 times. Check to see if DTC 001 has cleared.			
	<i>Has DTC 001 cleared?</i>			
4	1. Replace the fuse.	--	Go to Step 5	Go to Step 7
	2. Drive the vehicle under various road conditions and retest the fuse.			
	<i>Did the fuse blow again?</i>			
5	Test the battery positive voltage circuit, CKT 40, for a short to ground. Refer to Circuit Testing, and to Wiring Repairs in Wiring Systems.	--	Go to Step 7	Go to Step 6
	<i>Did you find and correct the condition?</i>			
6	Replace the transfer case shift control module. Refer to Transfer Case Shift Control Module Replacement.	--	Go to Step 7	Then get your ass to work, ya lazy melon farmer!
	<i>Did you complete the replacement?</i>			
7	1. Clear all DTCs from memory. Refer to Diagnostic Trouble Code Clearing (page 3).	--	Go to Step 2	System OK!
	2. Operate the vehicle while pressing each of the buttons on the transfer case shift control switch.			
	<i>Does the DTC reset?</i>			

Diagnostic Trouble Code 002

Encoder Motor Failure

Circuit Description

The transfer case encoder motor is an assembly which houses 4 separate channels. These channels are used to indicate to the TCCM the present gear position of the transfer case or if the transfer case is in transition between gears. The encoder motor assembly consists of an electronically conductive inner ground ring in contact with a 3-legged wiper arm. Each leg's length is such that it makes contact with the conductive regions of the 4 channels. When any leg of the wiper arm is making contact with the conductive area of any channel, the encoder provides a path to ground to the inner ground ring.

During electronic shifting, the TCCM monitors the transfer case encoder circuit for the proper operating sequence. If at any time during a shift, the encoder changes from one position to any position other than the next possible position, an error counter in the TCCM increments by 4. After the counter reaches 32, the transfer case shift control module set a DTC 2, a permanent "encoder fault," and reverts to a 2HI to 4LO or a 4LO to 2HI shift pattern only. To guard against a transient, random encoder fault due to vibration, dirt, electrical noise, etc., the fault counter reduces by one each time the TCCM detects a valid encoder value. The encoder must intermittently fail 25 percent of the time for the transfer case shift control module to consider it faulty and store DTC 2. It is imperative that the technician test-drive the vehicle and request several shifts in order for this code to properly be set.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present and a momentary loss of battery power at the battery positive voltage circuit, CKT 40.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

Step 2: Measures the voltage between the transfer case encoder circuit channels P, A, B, and C to ground.

Step 3: Tests the suspect circuit for an open, short to power, or short to ground.

Step 4: Tests the encoder signal ground circuit for an open or high resistance.

Important: Check the transfer case shift control module for DTCs. The transfer case shift control module is not a class 2 device. DTCs are displayed on the transfer case shift control switch. Refer to the "Displaying the DTCs" procedure on page 1.

DTC 2 - Encoder Fault

Schematic Reference: Transfer Case Control Schematics

Step	Action	Value	Yes	No
1	<i>Did you perform the Diagnostic System Check-Transfer Case?</i>	--	Go to Step 2	Go to Diagnostic System Check - Transfer Case
2	1. Disconnect the connector at the encoder motor.	4.8-5.1 V	Go to Step 4	Go to Step 3
	2. Turn ON the ignition, with the engine OFF.			
	3. Measure the voltage between the transfer case encoder circuit channels P, A, B, and C to ground.			
	<i>Does the voltage measure near the specified value?</i>			
3	Test the suspect circuit for an open, short to power, or short to ground. Refer to Circuit Testing and Wiring Repairs in Wiring Systems.	--	Go to Step 7	Go to Step 6
	<i>Did you find and correct the condition?</i>			
4	1. Turn the ignition switch OFF.	--	Go to Step 7	Go to Step 5
	2. Test the encoder signal ground circuit for an open or high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems.			
	<i>Did you find and correct the condition?</i>			
5	Replace the transfer case encoder motor. Refer to Transfer Case Motor/Encoder Replacement.	--	Go to Step 7	What are you waiting for, numbnuts?
	<i>Did you complete the replacement?</i>			
6	Replace the transfer case shift control module. Refer to Transfer Case Shift Control Module Replacement.	--	Go to Step 7	Put down the beer. Grab some tools.
	<i>Did you complete the replacement?</i>			
7	1. Clear all DTCs from memory. Refer to Diagnostic Trouble Code Clearing (page 3).	--	Go to Step 2	System OK!
	2. Operate the vehicle while pressing each of the buttons on the transfer case shift control switch.			
	<i>Does the DTC reset?</i>			

Diagnostic Trouble Code 003

Encoder Circuit Failure

Circuit Description

This code indicates that the transfer case encoder motor circuits are not functioning properly. One of the following conditions may exist:

- One of the internal power relays in the TCCM is not energizing or de-energizing.
- An open exists in the Battery Positive Voltage, Ground, Motor Control A or Motor Control B circuits.
- A short to ground exists in the Battery Positive Voltage, Motor Control A or Motor Control B circuits.
- A short exists within the motor or TCCM.

The transfer case encoder motor has a bi-directional, permanent magnet, D.C. motor. When a shift request is made by the TCCM, voltage will be applied through one of the motor control circuits and the TCCM will provide the ground through the other motor circuit. When a shift is requested in the opposite direction, the TCCM will reverse polarity on these two circuits. The motor, through a series of gears, rotates a shaft which moves the mode and range forks to shift the transfer case between gears.

Action Taken When the DTC Sets

The TCCM utilizes an error counting system when setting this code. When the TCCM detects a circuit error, the counter will log a count of 4. When the system operates correctly, the counter will reduce by a count of 1. A total count of 32 must be reached in order for DTC 003 to be set. The system must malfunction at least 25 percent of the time in order for a DTC 003 to be set. It is imperative that the technician test drive the vehicle and request several shifts in order for this code to be properly logged.

In the event that one of the internal TCCM power relays is stuck in the energized state, the TCCM will energize the other motor control circuit to keep the motor from running. All of the transfer case control switch indicators will flash continuously to prompt the driver that service is required. The transfer case system will be disabled and the TCCM power relays will remain energized even with the ignition in the OFF position. This may cause the battery to discharge. Any other condition that sets a DTC 003 will not follow this routine but a fault code will be stored.

Conditions for Clearing the DTC

The condition for setting the DTC is no longer present and a momentary loss of battery power at the battery positive voltage circuit.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

Step 2: Tests the power control relays inside the TCCM.

Step 3: Tests for voltage to the ATC/4WD fuse.

Step 4: Tests the ATC/4WD fuse.

Step 5: Tests for a voltage polarity change at the motor.

Step 6: Tests for voltage at circuit 16 Battery Positive Voltage.

Step 7: Tests for continuity to ground at circuit Ground.

Step 8: Tests for continuity on motor control A and B circuits.

Step 9: Tests for a grounded or shorted motor.

Step 10: Tests for a short to ground on circuit 16 Battery Positive Voltage.

Step 11: Tests for a short to ground on circuits Motor Control A and Motor Control B.

Important: Check the transfer case shift control module for DTCs. The transfer case shift control module is not a class 2 device. DTCs are displayed on the transfer case shift control switch. Refer to the “Displaying the DTCs” procedure on page 1.

DTC 3 – Encoder Circuit Failure

Schematic Reference: Transfer Case Control Schematics

Step	Action	Value	Yes	No
1	<i>Did you perform the Diagnostic System Check-Transfer Case?</i>	--	Go to Step 2	Go to Diagnostic System Check - Transfer Case
2	1. Start the vehicle.	--	Go to Step 17	Go to Step 3
	2. Request a mode shift between 2HI and 4HI.			
	3. Observe the transfer case shift control indicator lamps. <i>Are all of the lamps flashing together?</i>			
3	Test the voltage to the ATC fuse.	--	Go to Step 4	Go to Step 15
	<i>Does the test light illuminate?</i>			
4	1. Remove the fuse.	--	Go to Step 9	Go to Step 5
	2. Observe the fuse element.			
	<i>Is the fuse open?</i>			
5	1. Disconnect the motor harness connector.	+Battery Voltage/- Battery Voltage	Go to Step 16	Go to Step 6
	2. Turn the ignition switch RUN with engine OFF.			
	3. Put the transmission in Neutral.			
	4. Connect a DMM between Motor Control A and Motor Control B circuits.			
	5. Have a helper request changes by alternately pressing 4HI and 4LOW. <i>Does the polarity change according to the specified value?</i>			
6	1. Turn the ignition switch to OFF.	--	Go to Step 7	Go to Step 12
	2. Disconnect the TCCM harness connector.			
	3. Test for voltage at both of the Battery Positive Voltage circuits at the TCCM. <i>Did the test light illuminate on both tests?</i>			
7	Test for continuity to ground at the ground circuits at the TCCM. <i>Did you have continuity on both tests?</i>	--	Go to Step 8	Go to Step 13
8	Test for continuity on Motor Control A and B circuits. <i>Did you have continuity on both tests?</i>	--	Go to Step 17	Go to Step 14

DTC 3 – Encoder Circuit Failure, continued.

Step	Action	Value	Yes	No
9	1. Turn the ignition switch to OFF.	--	Go to Step 16	Go to Step 10
	2. Disconnect the motor harness.			
	3. Set the DMM for continuity.			
	4. Connect the DMM to the body of the motor and pin 6 on the motor.			
	5. Connect the DMM to the body of the motor and pin 7 on the motor.			
	6. Connect the DMM across pins 6 & 7 at the motor.			
	Test the voltage to the ATC fuse.			
	<i>Did you measure continuity, 0 Ohms, on any of the three tests?</i>			
10	Important: Make sure you do not contact the positive side of the fuse terminal. Sending power to the DMM when checking continuity may damage the meter.	--	Go to Step 12	Go to Step 11
	1. Remove harness connector from the TCCM.			
	2. Remove the ATC fuse.			
	3. Connect one lead of a DMM to a known ground and the other lead to the ground side of the ATC fuse terminal.			
	<i>Do you have continuity?</i>			
11	1. Disconnect the motor connector.	--	Go to Step 14	Go to Step 17
	2. Test for a short to ground on the Motor Control A and Motor Control B circuits.			
	<i>Do you have continuity on either test?</i>			
12	Repair the Battery Positive Voltage circuit for an open, high resistance or short to ground. Refer to Circuit Testing and Wiring Repairs in Wiring Systems.	--	Go to Step 18	Lunch is out of the question. Get back to work.
	<i>Did you complete the repair?</i>			
13	Repair the ground circuit for an open or high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems.	--	Go to Step 18	Christ, you're a lazy sack of manure.
	<i>Did you complete the repair?</i>			

DTC 3 – Encoder Circuit Failure, continued.

Step	Action	Value	Yes	No
14	Repair Motor Control A or Motor Control B circuits for an open, high resistance or short to ground. Refer to Circuit Testing and Wiring Repairs in Wiring Systems.	--	Go to Step 18	Come on, it's not that hard. Get on it.
	<i>Did you complete the repair?</i>			
15	Repair the open circuit to the ATC fuse. Refer to Circuit Testing and Wiring Repairs in Wiring Systems.	--	Go to Step 18	Ready to sell this POS truck yet?
	<i>Did you complete the repair?</i>			
16	Replace the transfer case encoder motor. Refer to Transfer Case Motor/Encoder Replacement.	--	Go to Step 18	Betty White could do this quicker.
	<i>Did you complete the repair?</i>			
17	Replace the transfer case control module. Refer to Transfer Case Shift Control Module Replacement.	--	Go to Step 18	On the bright side, not much more to fix.
	<i>Did you complete the repair?</i>			
18	1. Connect all of the connectors.	--	Go to Step 01	System OK!
	2. Install a new ATC fuse.			
	1. Clear all DTCs from memory. Refer to Diagnostic Trouble Code Clearing (page 3).			
	4. Operate the vehicle while requesting mode and range shifts.			
	<i>Does the DTC reset?</i>			

Diagnostic Trouble Code 004

RAM/ROM Memory Failure

Circuit Description

At each power up the transfer case shift control module runs a self test on the following:

- EEPROM Checksum
- ROM Checksum
- RAM Checksum
- RAM Malfunction

Conditions for Running the DTC

- Critical operational parameters stored in EEPROM have failed Checksum test indicating invalid data.
- Masked ROM code has failed Checksum test indicating that masked ROM data is not valid.
- ROM code has failed Checksum test indicating that ROM data is not valid.
- One or more ROM locations have failed operational test indicating that some portions of RAM are not functional.

Conditions for Clearing the DTC

The condition for setting the DTC is not present and a momentary loss of battery power at the battery positive voltage circuit, CKT 40.

Test Description

The number below refers to the step number on the diagnostic table.

Step 2: Replaces the transfer case shift control module.

Important: Check the transfer case shift control module for DTCs. The transfer case shift control module is not a class 2 device. DTCs are displayed on the transfer case shift control switch. Refer to the “Displaying the DTCs” procedure on page 1.

DTC 4 - RAM/ROM Failure

Schematic Reference: Transfer Case Control Schematics

Step	Action	Value	Yes	No
1	<i>Did you perform the Diagnostic System Check-Transfer Case?</i>	--	Go to Step 2	Go to Diagnostic System Check - Transfer Case
	Note: this system check is described elsewhere in the service manual.			
2	Replace the transfer case shift control module. Refer to Transfer Case Shift Control Module Replacement.	--	Go to Step 3	Only takes time and a little money.
	<i>Did you complete the replacement?</i>			
3	1. Clear all DTCs from memory. Refer to Diagnostic Trouble Code (DTC) Clearing.	--	Go to Step 2	System OK!
	2. Operate the vehicle while pressing each of the buttons on the transfer case shift control switch.			
	<i>Does the DTC 004 reset?</i>			