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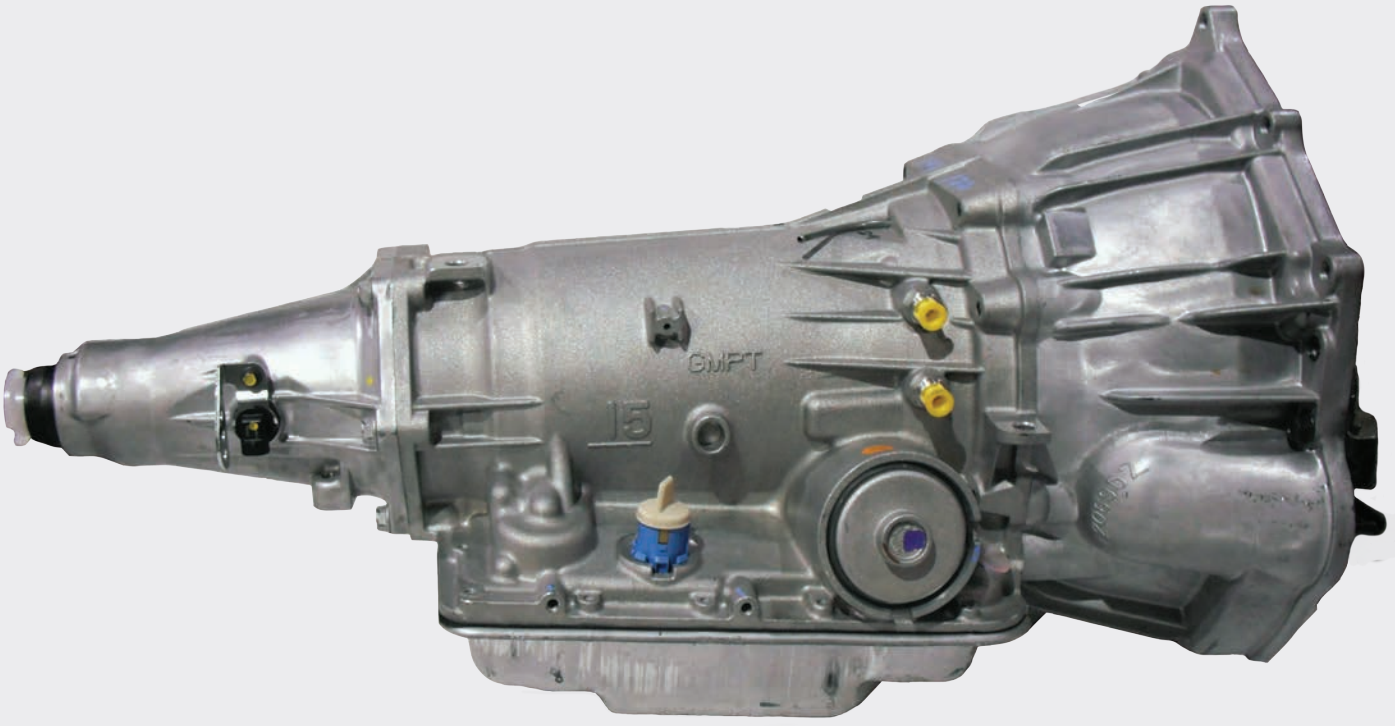
PCS 4LHD/4LHDX TRANSMISSION TECHNICIAN'S GUIDE



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Revision History

8/12/2015 - v1.3: Delphi/GM 2-digit code “23” added for “CAN communications lost.” Reference page 64.
10/30/2015 - v2.0: Section 4: Exploded Views and Part Numbers removed and placed into separate document.
11/29/2018 - v2.1: Section 4: Diagnostic Trouble Codes updated (J1939 codes added for codes 21, 22, and 71)

SECTION 1
OPERATION, MAINTENANCE, AND TROUBLESHOOTING

Section 1: Operation, Maintenance, and Troubleshooting

To shift the transmission into forward, depress the brake pedal and shift the lever into Drive (D) or Forward (F).

To shift the transmission into reverse, depress the brake pedal and shift the lever into Reverse (R).

For transmissions equipped with the PCS Abuse Protection Valve Body:

The PCS Abuse Protection Valve Body prevents engaging Reverse (R) or Drive (D) (or Forward – F, if equipped) when the maneuver will be damaging to the transmission.

To shift into Reverse (R) or Drive (D) or (F), all three of the following conditions must be met:

Throttle position must be less than 25%.

Engine RPM must be less than 1500 RPM.

Vehicle speed must be 0 MPH.

If any of the above conditions are not met, the transmission will be placed into a neutral state until all three conditions are met. This neutral state may slightly drag the forward or reverse clutch, moving the vehicle very slowly and give the impression that the transmission is slipping. To fully engage the desired gear, simply come to a complete stop with the engine at idle.

Neutral Safety

The vehicle should only start when the shift lever is in Park (P) or Neutral (N). If the vehicle starts when the shift lever is in Drive (D) (or Forward – F, if equipped) or Reverse (R), discontinue use of the vehicle until the neutral safety switch circuit can be diagnosed.

The neutral safety circuit is typically implemented using the shift lever, but varies based on the OEM implementation. Refer to the vehicle start system schematics for troubleshooting.

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Section 1.1 - Transmission Fluid Level and Condition Check

This procedure checks the transmission fluid level, as well as the condition of the fluid itself. Caution: Always use the proper automatic transmission fluid listed. Using incorrect automatic transmission fluid may damage the vehicle.

Before checking the fluid level, perform the following:

1. Start the engine and park the vehicle on a level surface. Keep the engine running.
2. Apply the parking brake and place the shift lever in PARK (P) or NEUTRAL(N).
3. Depress the brake pedal and move the shift lever through each gear range if available, pausing for about 3 seconds in each range. Then, move the shift lever back to PARK (P) or NEUTRAL(N).
4. Allow the engine to idle 500–800 RPM for at least 1 minute. Slowly release the brake pedal.
5. Keep the engine running and observe the transmission fluid temperature (TFT) using a scan tool or PCS software.
6. Using the TFT reading, determine and perform the appropriate check procedure. If the TFT reading is not within the required temperature ranges, allow the vehicle to cool, or operate the vehicle until the appropriate TFT is reached.

Cold Check Procedure

NOTE: Use the cold check procedure only as a reference to determine if the transmission has enough fluid to be operated safely until a hot check procedure can be made. The hot check procedure is the most accurate method to check the fluid level. Perform the hot check procedure at the first opportunity. Use this cold check procedure to check fluid level when the TFT is between 27–32°C (80–90°F).

1. Start the engine and locate the transmission dipstick at the rear of the engine compartment, on the passenger's side of the vehicle.
2. Flip the handle up, and then pull out the dipstick and wipe the dipstick end with a clean rag or paper towel.
3. Install the dipstick by pushing it back in the dipstick tube all the way, wait three seconds and then pull it back out again.

NOTE: Always check the fluid level at least twice. Consistent readings are important to maintaining proper fluid level. If inconsistent readings are noted, inspect the transmission vent assembly to ensure it is clean and unclogged.

4. Keep the dipstick pointing down and check both sides of the dipstick, and read the lower level. Repeat the check procedure to verify the reading. **Reference Figure 1.**

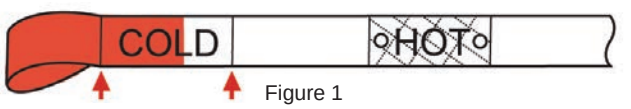

Figure 1

5. Inspect the color of the fluid on the dipstick. Refer to the **Fluid Condition Inspection (p.13)**.

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6. If the fluid level is below the COLD check line, add only enough fluid as necessary to bring the level into the COLD line. It does not take much fluid, generally less than one pint (0.5L). **Do not overfill.**

7. If the fluid level is in the acceptable range, push the dipstick back in all the way, then flip the handle down to lock the dipstick in place.

8. Perform a hot check at the first opportunity after the transmission reaches a normal operating temperature between 82–93°C (180–200°F).

Hot Check Procedure

NOTE: Use this procedure to check the transmission fluid level when the TFT is between 82–93°C (180–200°F). The hot check procedure is the most accurate method to check the fluid level. The hot check should be performed at the first opportunity in order to verify the cold check. The fluid level rises as fluid temperature increases, so it is important to ensure the transmission temperature is within range.

1. Start the engine and locate the transmission dipstick at the rear of the engine compartment, on the passenger side of the vehicle.

2. Flip the handle up, and then pull out the dipstick and wipe the dipstick end with a clean rag or paper towel.

3. Install the dipstick by pushing it back in the dipstick tube all the way, wait three seconds and then pull it back out.

NOTE: Always check the fluid level at least twice. Consistent readings are important to maintaining proper fluid level. If inconsistent readings are noted, inspect the transmission vent assembly to ensure it is clean and unclogged.

4. Keep the dipstick tip pointing down and check both sides of the dipstick. Read the lower level. Repeat the check procedure to verify the reading. **Reference Figure 2.**

Figure 2

5. Inspect the color of the fluid on the dipstick. Refer to **Fluid Condition Inspection (p.7)**.

6. A safe operating fluid level is within the HOT crosshatch band on the dipstick. If the fluid level is not within the HOT band, and the transmission temperature is between 82–93°C (180–200°F), add or drain fluid as necessary to bring the level into the HOT band. If the fluid level is low, add only enough fluid to bring the level into the HOT band.

NOTE: To assist in reaching the correct temperature range of 82–93°C (180–200°F), drive the vehicle in second gear until the desired temperature is reached.

7. If the fluid level is low, add only enough fluid to bring the level into the HOT band. It does not take much fluid, generally less than one pint (0.5L). Do not overfill. Also, if the fluid level is low, inspect the transmission for leaks. **Refer to Fluid Leak Diagnosis (p.9)**.

8. If the fluid level is in the acceptable range, push the dipstick back into the dipstick tube all the way, and then flip the handle down to lock the dipstick in place.

9. If applicable and if the vehicle is equipped, reset the transmission oil life monitor only if the fluid was changed.

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Section 1.2 - Changing Transmission Fluid

Recommended service interval for industrial use is 1,000 hrs/1 year/ 30,000 miles - whichever comes first.

During each service the fluid and filter must be replaced.

The fluid used must be **DEXRON® VI**.

PCS Part #	Description
TRN7090	Includes new transmission filter and transmission pan gasket

Removal Procedure

Disconnect the battery from the vehicle prior to performing this procedure.

WARNING: When the transmission is at operating temperatures, take necessary precautions when removing the pan, to avoid being burned by draining fluid.

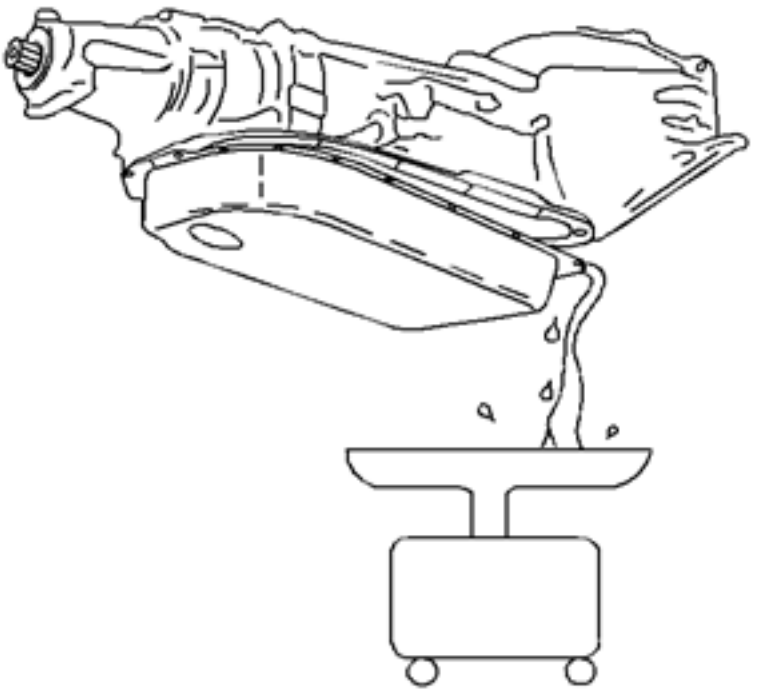

Figure 1

1. Raise and support the vehicle.

NOTE: The fluid can be reused after this procedure unless it smells burnt or is discolored. If a recovery system is available, remove and store the fluid. Remove the pan bolts and skip to step 6.

2. On some vehicles an exhaust heat shield may need to be removed to access the pan bolts. Remove this if necessary.

3. Place a drain pan under the transmission oil pan.

4. Remove the oil pan bolts from the front and sides of the pan only.

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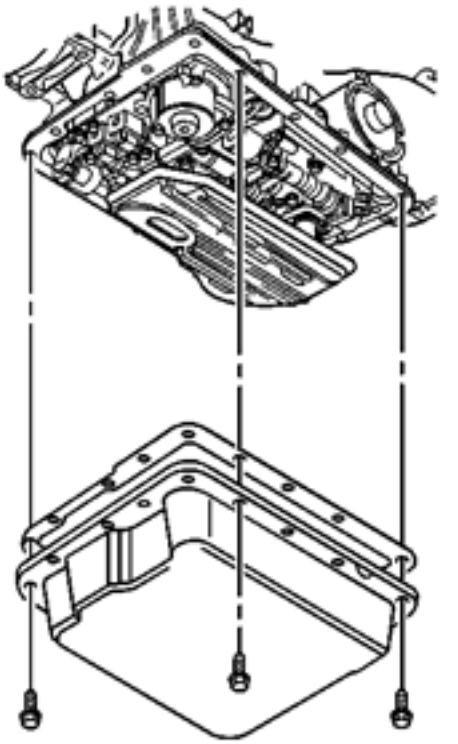
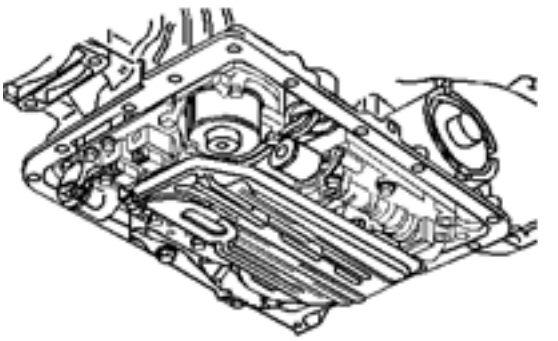


5. Loosen the rear oil pan bolts approximately 4 turns.
6. Lightly tap the oil pan with a rubber mallet in order to loosen the pan to allow the fluid to drain.
7. Remove the remaining oil pan bolts. **Reference Figure 2**.

Figure 2



8. Remove the oil pan and gasket. **Reference Figure 3**.

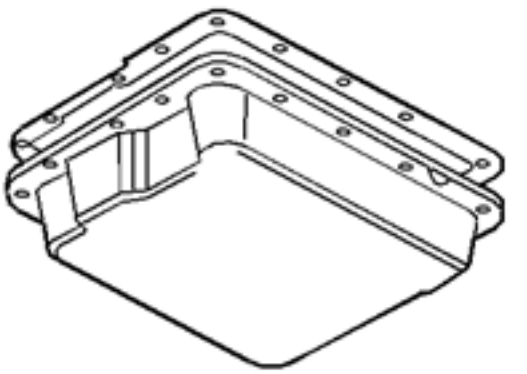


Figure 3

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9. Grasp filter firmly while pulling down with a twisting motion in order to remove the filter. **Reference Figure 4**.

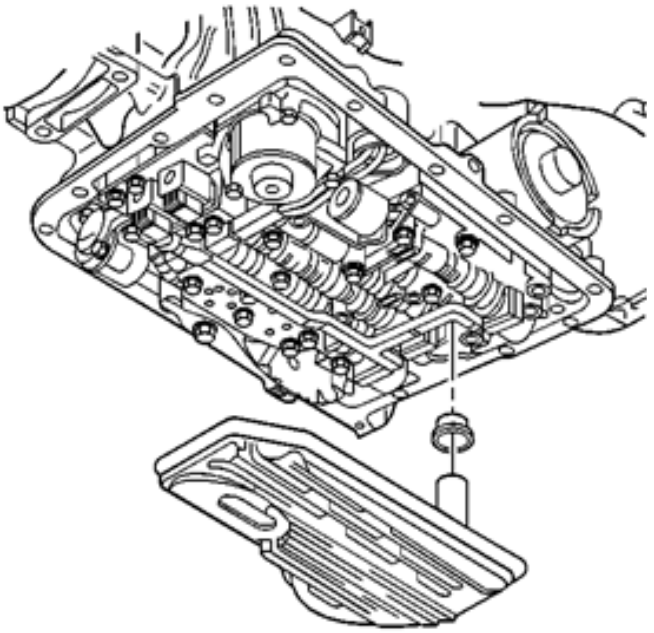

Figure 4

10. If the filter is going to be replaced, remove the filter seal. The filter seal may be stuck in the pump; if necessary, carefully use pliers or another suitable tool to remove the seal. **Reference Figure 5**.

11. Discard the seal.

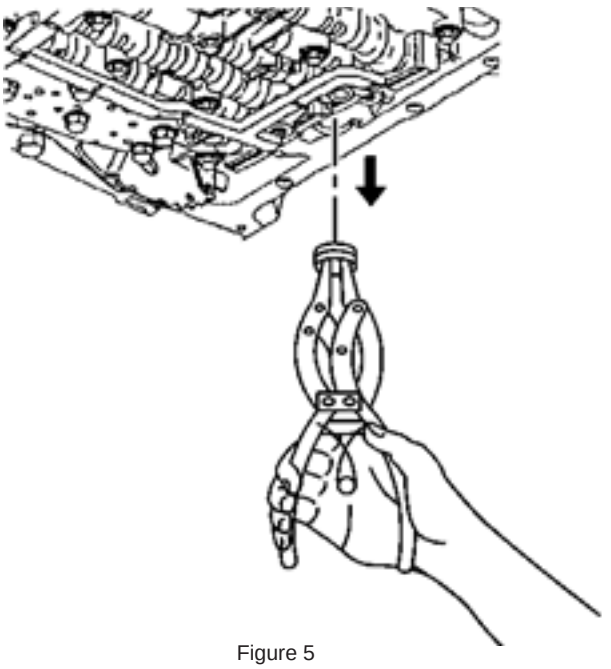

Figure 5

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1. Coat the new filter seal with automatic transmission fluid.

2. Install the new filter seal into the transmission case. Tap the seal into place using a suitable size socket. **Reference Figure 6**.

3. Install the new filter into the case.

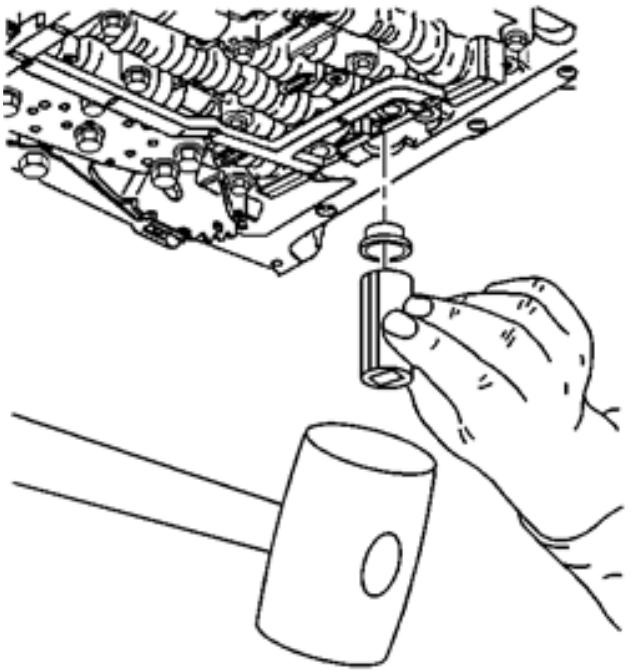

Figure 6

4. Install the oil pan and a new gasket. **Reference Figure 7**.

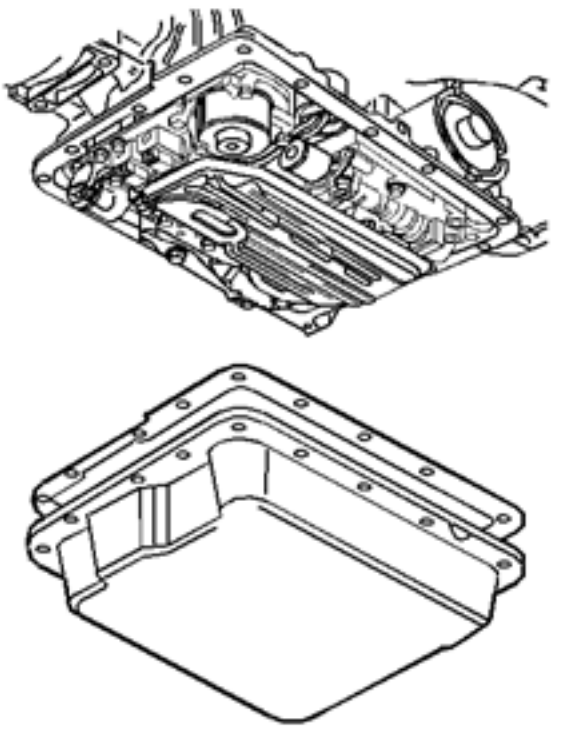

Figure 7

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5. Install the oil pan bolts and tighten alternately and evenly to 11 Nm (97 lb in). **Reference Figure 8**.
6. If previously removed, reinstall the exhaust heat shield.
7. Lower the vehicle.
8. Fill the transmission to the proper level with DEXRON® VI transmission fluid. Refer to **Vehicle Fluid Capacity Specifications**.
9. Check the COLD fluid level reading for initial fill only.
10. Inspect the oil pan gasket for leaks.
11. Test drive vehicle and verify proper transmission operation.
12. Check fluid level when transmission is at operating temperature.

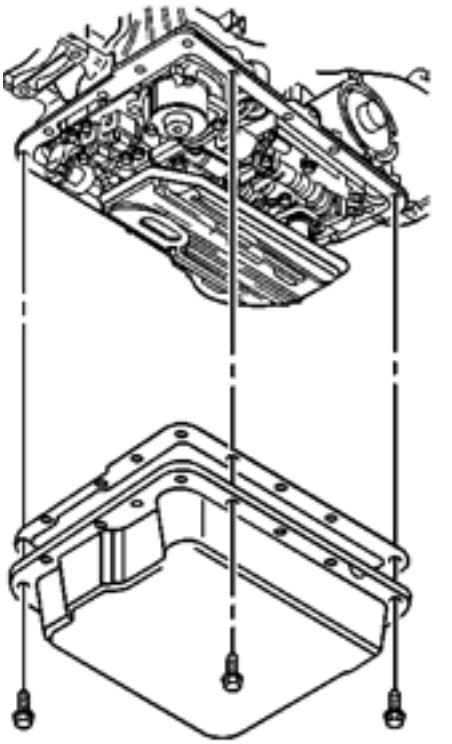

Figure 8

TECHNICIANS NOTE:

To properly check fluid level:

1. Start the engine and operate the vehicle for 15 minutes or until the transmission fluid reaches an operating temperature of 82 - 93°C (180 - 200°F) .
2. Park the vehicle on a level surface.
3. With your foot on the brake, move the shift lever through each gear range. Pause for about 3 seconds in each range, ending in NEUTRAL.
4. Apply the parking brake and let the engine idle for 3 minutes.
5. Remove the transmission fluid level indicator. Wipe the indicator clean. Insert the indicator fully into the tube.
6. Wait 3 seconds and remove the indicator.
7. Read both sides of the indicator. The fluid must be within the hot cross-hatched area using the lowest level reading.

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Section 1.3 - Fluid Leak Diagnosis

General Method

1. Verify that the leak is transmission fluid.

Caution: Do not clean using brake cleaner or other reactive solvents as these solvents can damage rubber gaskets, seals and bushings.

2. Thoroughly clean the suspected leak area using a rag.

NOTE: Do not idle vehicle, this will not actuate transmission systems, and do not drive the vehicle on the freeway as this will splatter oil inhibiting leak diagnosis.

3. Operate the vehicle for 15–20 minutes under city driving conditions until normal operating temperatures are reached.

4. Park the vehicle over clean paper or cardboard.

5. Shut OFF the engine.

6. Look for fluid spots on the paper.

7. Make the necessary repairs.

Powder Method

Caution: Do not clean using brake cleaner or other reactive solvents as these solvents can damage rubber gaskets, seals and bushings.

1. Thoroughly clean the suspected leak area using a rag.

2. Apply an aerosol type leak tracing powder to the suspected leak area.

NOTE: Do not idle vehicle, this will not actuate transmission systems, and do not drive the vehicle on the freeway as this will splatter oil inhibiting leak diagnosis.

3. Operate the vehicle for 15–20 minutes under city driving conditions until normal operating temperatures are reached.

4. Shut OFF the engine.

5. Inspect the suspected leak area.

6. Trace the leak path through the powder in order to find the source of the leak.

7. Make the necessary repairs.

Dye and Black Light Method

A fluid dye and black light kit is available from various tool manufacturers.

1. Follow the manufacturer’s instructions in order to determine the amount of dye to use.

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2. Detect the leak with the black light.

3. Make the necessary repairs.

Find the Cause of the Leak

Pinpoint the leak and trace the leak back to the source. You must determine the cause of the leak in order to repair the leak properly. For example, if you replace a gasket, but the sealing flange is bent, the new gasket will not repair the leak. You must also repair the bent flange. Before you attempt to repair a leak, check for the following conditions, and make repairs as necessary:

Gaskets

- Fluid level/pressure is too high
- Plugged vent or drain-back holes
- Improperly tightened fasteners
- Dirty or damaged threads
- Warped flanges or sealing surface
- Scratches, burrs, or other damage to the sealing surface
- Damaged or worn gasket
- Cracking or porosity of the component
- Improper sealant used, where applicable
- Incorrect gasket

Seals

- Fluid level/pressure is too high
- Plugged vent or drain-back holes
- Damaged seal bore
- Damaged or worn seal
- Improper installation
- Cracks in component
- Manual or output shaft surface is scratched, nicked, or damaged
- Loose or worn bearing causing excess seal wear
- Damaged ISS O-Ring

Possible Points of Fluid Leaks

Transmission Oil Pan

- Incorrectly tightened oil pan bolts
- Improperly installed or damaged oil pan gasket
- Damaged oil pan or mounting face
- Incorrect oil pan gasket

Case Leak

- Damaged or missing fill tube seal
- Mislocated fill tube bracket
- Damaged vehicle speed sensor seal
- Damaged manual shaft seal
- Loose or damaged oil cooler connector fittings
- Worn or damaged propeller shaft oil seal
- Loose line pressure pipe plug
- Warped
- Distorted torque converter housing
- Porous casting

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Leak at the Torque Converter End

- Converter leak in the weld area
- Converter seal lip cut. Check the converter hub for damage
- Converter seal bushing moved forward and damaged
- Converter seal garter spring missing from the seal
- Porous casting of the transmission case or the oil pump

Leak at the Vent Pipe or the Fluid Fill Tube

- Overfilled system
- Water or coolant in the fluid—the fluid will appear milky.
- Transmission case porous
- Incorrect fluid level indicator
- Plugged vent
- Drain-back holes plugged
- Mispositioned oil pump to case gasket, if equipped
- ISS or ISS plug loose
- ISS O-Ring cut or damaged

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Leak Inspection Points

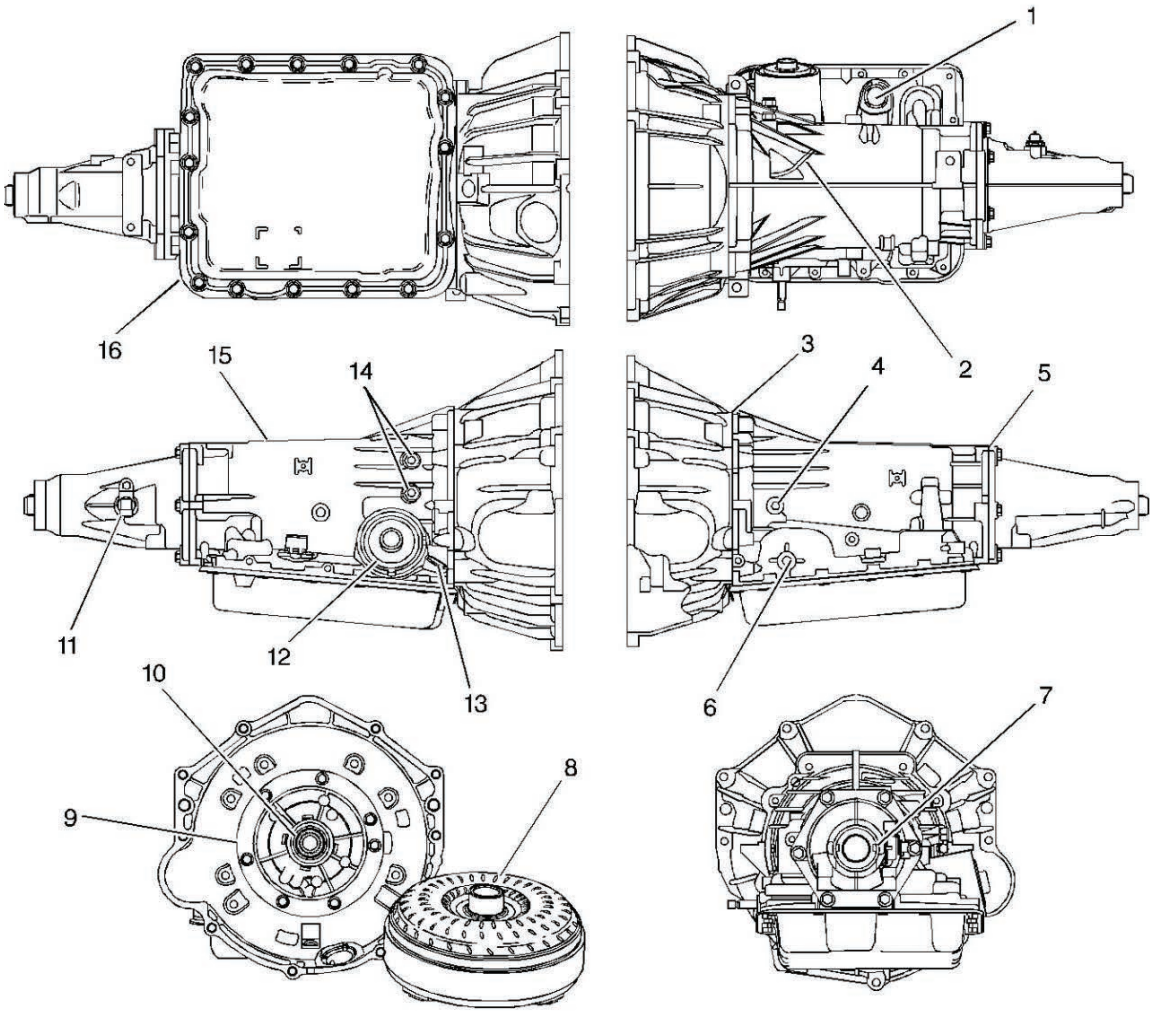

Figure 1

Ref	Description
1	Wiring Harness Pass-Through Connector O-ring Seal
2	Transmission Vent Assembly
3	Converter Housing to Case Joint (Pump to Case Oil Seal)
4	Line Pressure Plug
5	Case Extension to Case Seal
6	Manual Shaft Seal
7	Case Extension Oil Seal Assembly
8	Torque Converter Assembly
9	Pump to Case Oil Seal
10	Pump Oil Seal Assembly
11	Internal Transmission Speed Sensor to Case O-ring Seal– Some Models
12	2-4 Servo Cover O-ring Seal
13	Oil Fill Tube Seal
14	Oil Cooler Pipe Connectors
15	Transmission Case
16	Transmission Pan Gasket

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Section 1.4 - Fluid Condition Inspection

Inspect the fluid color. The fluid should be red or dark brown.

- If the fluid color is very dark or black and has a burnt odor, inspect the fluid and inside of the bottom pan for excessive metal particles or other debris. A small amount of “friction” material in the bottom pan is a “normal” condition. If large pieces and/or metal particles are noted in the fluid or bottom pan, flush the oil cooler and cooler lines and overhaul the transmission. If there are no signs of transmission internal damage noted, replace the fluid filter assembly, repair the oil cooler, and flush the cooler lines.

- Fluid that is cloudy or milky or appears to be contaminated with water indicates engine coolant or water contamination. Refer to **Engine Coolant/Water in Transmission** below.

Section 1.5 - Engine Coolant/Water in Transmission

CAUTION: The antifreeze or water will deteriorate the seals, gaskets and the glue that bonds the clutch material to the pressure plate. Both conditions may cause damage to the transmission.

If antifreeze or water has entered the transmission, perform the following:

1. Disassemble the transmission.
2. Replace all of the rubber type seals (the coolant will attack the seal material which will cause leakage).
3. Replace the composition-faced clutch plate assemblies and the 2–4 band assembly (the facing material may separate from the steel center portion).
4. Replace all of the nylon parts (washers).
5. Replace the torque converter.
6. Thoroughly clean and rebuild the transmission, using new gaskets (bonded and non bonded), and oil filter.
7. Flush the cooler lines after the transmission cooler has been properly repaired or replaced.

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Section 1.6 - Line Pressure Check

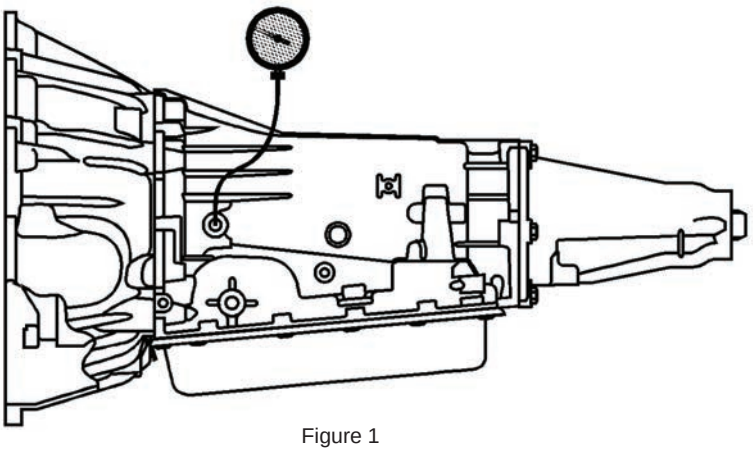

Figure 1

Special Tools

Pressure Gauge

WARNING: Keep the brakes applied at all times in order to prevent unexpected vehicle motion. Personal injury may result if the vehicle moves unexpectedly.

NOTE: Before performing the line pressure check, verify that the transmission pressure control (PC) solenoid is operating correctly.

1. Connect to the vehicle with a scan tool or PCS diagnostic software.
2. Start the engine.
3. Inspect the transmission for the proper fluid levels. Refer to Transmission Fluid Level and Condition Check.
4. Use the scan tool or diagnostic software to inspect for any active or stored diagnostic trouble codes.
5. Inspect the manual linkage at the transmission for proper function.
6. Turn the engine OFF.

NOTE: It may be necessary to remove or disconnect components in order to gain access to the transmission line pressure test port/plug.

7. Remove the pressure plug.
8. Install the pressure gauge.
9. Access the Scan Tool Output Control for the PC Solenoid.
10. Start the engine.

NOTE: In order to achieve accurate line pressure readings, the following procedure must be performed at least three times in order to gather uniform pressure readings. The scan tool is only able to control the PC solenoid in PARK and NEUTRAL with engine speeds below 1500 RPM. This protects the clutches from extreme high or low line pressures. This test must be performed at 1200 RPM, between 38–93°C (100–200°F).

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11. Begin commanding PC Solenoid at 1.0 amp and lower the amperage in one-tenth increments (0.01) until maximum line pressure is achieved.

12. Allow the pressure to stabilize between increments.

13. Compare your pressure readings to the Line Pressure table below.

14. If the pressure readings vary greatly from the line pressure table, refer to **Oil Pressure High or Low (p.12)**.

15. Turn the engine OFF.

16. Remove the pressure gauge .

17. Install the pressure plug. Tighten the pressure plug to **8–14 Y (6–10 lb ft)**.

Line Pressure Table

Pressure Control Solenoid Current (Amp)	Approximate Line Pressure (PSI)
258mm Converter	
0	170–193
0.1	169–192
0.2	168–188
0.3	156–184
0.4	146–176
0.5	135–166
0.6	121–152
0.7	103–136
0.8	84–117
0.9	63–96
1	54–80
1.1	54–62
300mm Converter	
0	198–227
0.1	197–226
0.2	189–221
0.3	181–216
0.4	168–205
0.5	154–193
0.6	137–175
0.7	114–156
0.8	90–132
0.9	64–105
1	53–85

*This test must be performed at 1200 RPM and between 100°F and 200°F.

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Oil Pressure High or Low

Checks	Causes
DTCs are set	Some DTC's will command maximum line pressure to protect the transmission.
Oil Pump Assembly	• Pressure regulator valve stuck • Pressure regulator valve spring • Rotor guide omitted or misassembled • Rotor cracked or broken • Reverse boost valve or sleeve stuck, damaged or incorrectly assembled • Orifice hole in pressure regulator valve plugged • Sticking slide or excessive rotor clearance
Oil Filter	• Intake pipe restricted by casting flash • Cracks in filter body or intake pipe • O-ring seal missing, cut or damaged • Wrong grease used on rebuild
Control Valve Body	• Manual valve scored or damaged • Spacer plate or gaskets incorrect, misassembled or damaged • Face not flat • 2-3 Shift valve stuck • Check balls omitted or misassembled
Pressure Control Solenoid	Damage to electrical terminals
Transmission Fluid Pressure Manual Valve Position Switch	• Contamination • Damaged seals
Case	Case to control valve body face not flat
System Voltage	• 12 volts not supplied to transmission • Electrical short (pinched solenoid wire) • Solenoid not grounded

Section 1.7 - Range Performance Diagnosis

This category contains the following topics:

- Drives in Neutral
- No Park
- No Reverse
- No Drive
- No engine braking
- Shift selector indicator does not match transmission gear range
- Lack of Power or Hesitation

Transmission range errors are most commonly related to shift lever linkage misalignment. The first step when troubleshooting a range error is to verify the shift lever is putting the shift arm on the transmission into the proper detent. Disconnect the shift cable and move the shift arm into the detent and then check the alignment with the cable. Adjust as necessary.

The current transmission range can also be verified with PCS software.

NOTE: Shift linkage misalignment will damage a transmission.

Drives in Neutral

Checks	Causes
Forward Clutch	The clutch does not release.
Manual Valve Link	Disconnected
Case	• The face is not flat • Internal leakage exists

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No Park (May not apply - check application)

Checks	Causes
Parking Lock Actuator Linkage (85–90)	• Actuator rod assembly bent or damaged • Actuator rod spring binding or improperly crimped • Actuator rod not attached to inside detent lever • Parking lock bracket damaged or not torqued properly • Inside detent lever not torqued properly • Parking pawl binding or damaged

No Reverse or Slips in Reverse

Checks	Causes
Input Housing Assembly	• 3-4 apply ring stuck in applied position • Forward clutch not releasing • Turbine shaft seals missing, cut or damaged
Manual Valve Link	Disconnected
Valve Body Assembly	• 2-3 shift valve stuck • Manual linkage not adjusted • Spacer plate and gaskets incorrect, mispositioned or damaged • Lo overrun valve stuck • Orificed cup plug restricted, missing or damaged
Reverse Input Clutch Assembly	• Clutch plate worn • Reverse input housing and drum assembly cracked at weld • Clutch plate retaining ring out of groove • Return spring assembly retaining ring out of

No Drive in All Ranges

Checks	Causes
Low Transmission Fluid Level	Transmission or cooler line leak
Oil Pump	Damaged oil pump rotor (212)
Torque Converter	• The converter is not bolted to flex plate. • Damaged pump drive • The stator roller clutch is not holding

No Drive in Drive Range

Checks	Causes
Oil Pump	• Damaged vanes • Missing slide spring • Oil pump screen assembly plugged or damaged • Oil pump rotor guide omitted or misassembled • Oil pump rotor cracked or broken • Porosity in fluid pump • Oil pump surfaces not flat • Excessive oil pump rotor clearance
Forward Sprag Clutch Assembly	• Damaged sprag • Worn or pitted inner race

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No Overrun Braking - Manual 3-2-1

Checks	Causes
External Linkage	Not adjusted properly
Valve Body Assembly	• 4-3 sequence valve stuck • Check ball mispositioned • Spacer plate and gaskets incorrect, damaged or mispositioned
Overrun and Forward Clutch Assembly	• Turbine shaft oil passages plugged or not drilled • Turbine shaft seal rings damaged • Turbine shaft sealing balls loose or missing • Porosity in forward or overrun clutch piston • Overrun piston seals cut or damaged • Overrun piston check ball not sealing

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Section 1.8 - Shift Quality (Feel) Diagnosis

This category contains the following topics:

- Harsh, soft or slipping shifts
- Harsh, soft or delayed engagement

Shift shudder, flare or tie-ups

Harsh Shifts

Checks	Causes
Throttle Position Sensor	Open or shorted circuit
Vehicle Speed Sensor (36) or Input Speed Sensor (250)	Open or shorted circuit
Trans Fluid Temperature Sensor (Part of 66)	Open or shorted circuit
Engine Coolant Temperature Sensor	Open or shorted circuit
Pressure Control Solenoid (377)	• Damage to electrical terminals • Contamination

Slipping or Harsh 1-2 Shift

Checks	Causes
Valve Body Assembly (60)	• Mislocated valve body to spacer plate check ball or check balls. • 1-2 shift valve train stuck due to sediment • Gaskets or spacer plate incorrect, mis-positioned or damaged • 1-2 accumulator valve stuck or damaged • Face not flat • 4-3 sequence valve stuck or damaged • #1 or #8 check ball missing or mis-located • 1-2 accumulator valve bushing rotated 180°
2-4 Servo Assembly (13–28)	• Apply pin too long or too short • 2nd servo apply piston seal missing, cut or damaged • Restricted or missing oil passages • Servo bore in case damaged
2nd Accumulator (55–57, 104)	• Porosity in 1-2 accumulator cover or piston • Piston seal or groove damaged • Nicks or burrs in 1-2 accumulator housing • Missing or restricted oil passage • 1-2 accumulator piston spring not seated • Rough finish in 1-2 accumulator bore in case • A cracked 1-2 accumulator piston – allowing fluid to leak by
2-4 Band (602)	Worn or mispositioned

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No 2-3 Shift or 2-3 Shift Slips, Rough or Hunting

Checks	Causes
Oil Pump (4)	Stator shaft bushings scored or off location
Valve Body Assembly (60)	• 2-3 shift valve train stuck • Gaskets or spacer plate incorrect, mispositioned or damaged • 2-3 accumulator valve stuck • Face not flat • Chips in servo feed oil, orifice #7 in spacer plate • Mislocated valve body to spacer plate check ball or check balls
Input Housing Assembly (620–621, 646–655)	• 3-4 clutch or forward clutch plates worn • Excessive clutch plate travel • Cut or damaged 3-4 clutch or forward clutch piston seals • Porosity in input clutch housing or piston • 3-4 clutch piston checkball stuck, damaged or not sealing • Restricted apply passages • Forward clutch piston retainer and ball assembly not seating • Sealing balls loose or missing • Input housing (621) cracked or broken
Case (103)	3rd accumulator retainer and ball assembly not seating

No 3-4 Shift, Slips or Rough 3-4 Shift

Checks	Causes
Oil Pump Assembly (4)	• Pump cover retainer and ball assembly omitted or damaged • Faces not flat

Valve Body Assembly (60)	• Valves stuck
	  o 2-3 Shift valve train
	  o Accumulator valve
	  o 1-2 Shift valve train
	• Spacer plate or gaskets incorrect, mispositioned or damaged

2-4 Servo Assembly (13–28)	• Incorrect band apply pin • Missing or damaged servo seals • Porosity in piston, cover or case • Damaged piston seal grooves • Plugged or missing orifice cup plug
Case (103)	• 3rd Accumulator retainer and ball assembly leaking • Porosity in 3-4 accumulator piston or bore • 3-4 accumulator piston seal or seal grooves damaged • Plugged or missing orifice cup plug • Restricted oil passage
Input Housing Assembly (621)	Refer to No 2-3 Shift or 2-3 Shift Slips, Rough or Hunting.
2-4 Band Assembly (602)	Worn or misassembled

Harsh Garage Shift

Checks	Causes
Valve Body Assembly (60)	• Orifice cup plug missing • Check ball missing

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Delay in Drive and Reverse

Checks	Causes
Forward Clutch Piston (630)	Cut or damaged piston seals
Low and Reverse Clutch Piston (695)	Cut or damaged inner, outer or center clutch seals
Reverse Input Clutch Piston Assembly (607)	Cut or damaged inner or outer clutch seals

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Section 1.9 - Shift Pattern

This category contains the following topics:

- One forward gear only
- Two forward gears only
- Gear missing or slipping
- No upshift or slipping upshift
- No downshifts

First Gear Range Only - No Upshift

Checks	Causes
Control Valve Body (60)	• The 1-2 shift valve is sticking • The spacer plate or gaskets are mispositioned or damaged
Case (103)	The case to valve body face is damaged or is not flat
Shift Solenoid Valves (366/368)	• Stuck or damaged • Faulty electrical connection
2-4 Servo Assembly (13–28)	• The apply passage case is restricted or blocked • Nicks or burrs on the servo pin or on the pin bore in the case • Fourth servo piston is installed backwards
2-4 Band Assembly (602)	• The 2-4 band is worn or damaged • The band anchor pin is not engaged

Third Gear Only

Checks	Causes
System Voltage	• 12 volts not supplied to transmission • Electrical short (pinched solenoid wire) • Solenoid not grounded

Second/Third Gear Only or First/Fourth Gear Only

Checks	Causes
1-2 Shift Solenoid Valve (367A)	• Sediment is in the valves • Electrical connection is faulty • Damaged seal

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Slips in First Gear

Checks	Causes
Forward Clutch Assembly (646–651)	• Clutch plates worn • Porosity or damage in forward clutch piston • Forward clutch piston inner and outer seals missing, cut or damaged • Damaged forward clutch housing • Forward clutch housing retainer and ball assembly not sealing or damaged
Forward Clutch Accumulator (353–358)	• Piston seal missing, cut or damaged • Piston out of its bore • Porosity in the piston or valve body • Stuck abuse valve
Input Housing and Shaft Assembly (621)	Turbine shaft seals missing, cut or damaged
Valve Body (60)	• 1-2 Accumulator valve stuck • Face not flat, damaged lands or interconnected passages • Spacer plate or gaskets incorrect, mispositioned or damaged
Low Roller Clutch (678)	• Damage to lugs to inner ramps • Rollers not free moving • Inadequate spring tension • Damage to inner splines • Lube passage plugged
Torque Converter (1)	Stator roller clutch not holding
1-2 Accumulator Assembly (55–57, 104)	• Porosity in piston or 1-2 accumulator cover and pin assembly • Damaged ring grooves on piston • Piston seal missing, cut or damaged • Valve body to spacer plate gasket at 1-2 accumulator cover, missing or damaged • Leak between piston and pin • Broken 1-2 accumulator spring
Line Pressure	Refer to Oil Pressure High or Low.
2-4 Servo Assembly (13–28)	4th servo piston in backward

Slipping or Harsh 1-2 Shift

Checks	Causes
Valve Body Assembly (60)	• Mislocated valve body to spacer plate check ball or check balls. • 1-2 shift valve train stuck due to sediment • Gaskets or spacer plate incorrect, mis-positioned or damaged • 1-2 accumulator valve stuck or damaged • Face not flat • 4-3 sequence valve stuck or damaged • #1 or #8 check ball missing or mis-located • 1-2 accumulator valve bushing rotated 180°
2-4 Servo Assembly (13–28)	• Apply pin too long or too short • 2nd servo apply piston seal missing, cut or damaged • Restricted or missing oil passages • Servo bore in case damaged
2nd Accumulator (55–57, 104)	• Porosity in 1-2 accumulator cover or piston • Piston seal or groove damaged • Nicks or burrs in 1-2 accumulator housing • Missing or restricted oil passage • 1-2 accumulator piston spring not seated • Rough finish in 1-2 accumulator bore in case • A cracked 1-2 accumulator piston – allowing fluid to leak by
2-4 Band (602)	Worn or mispositioned
Oil Pump Assembly (4) or Case (103)	Faces not flat

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No 2-3 Shift or 2-3 Shift Slips, Rough or Hunting

Checks	Causes
Oil Pump (4)	Stator shaft bushings scored or off location
Valve Body Assembly (60)	• 2-3 shift valve train stuck • Gaskets or spacer plate incorrect, mispositioned or damaged • 2-3 accumulator valve stuck • Face not flat • Chips in servo feed oil, orifice #7 in spacer plate • Mislocated valve body to spacer plate check ball or check balls
Input Housing Assembly (620–621, 646–655)	• 3-4 clutch or forward clutch plates worn • Excessive clutch plate travel • Cut or damaged 3-4 clutch or forward clutch piston seals • Porosity in input clutch housing or piston • 3-4 clutch piston checkball stuck, damaged or not sealing • Restricted apply passages • Forward clutch piston retainer and ball assembly not seating • Sealing balls loose or missing • Input housing (621) cracked
Case (103)	3rd accumulator retainer and ball assembly not seating

No 3-4 Shift/Slipping or Rough 3-4 Shift (disabled on most units)

Checks	Causes
Oil Pump Assembly (4)	• Pump cover retainer and ball assembly omitted or damaged • Faces not flat
Valve Body Assembly (60)	Valves stuck o 2-3 Shift valve train o Accumulator valve o 1-2 Shift valve train • Spacer plate or gaskets incorrect, mispositioned or damaged
2-4 Servo Assembly (13–28)	• Incorrect band apply pin • Missing or damaged servo seals • Porosity in piston, cover or case • Damaged piston seal grooves • Plugged or missing orifice cup plug
Case (103)	• 3rd Accumulator retainer and ball assembly leaking • Porosity in 3-4 accumulator piston or bore • 3-4 accumulator piston seal or seal grooves damaged • Plugged or missing orifice cup plug • Restricted oil passage
Input Housing Assembly (621)	Refer to No 2-3 Shift or 2-3 Shift Slips, Rough or Hunting.
2-4 Band Assembly (602)	Worn or misassembled

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No Part Throttle or Delayed Downshifts

Checks	Causes
Input Housing Assembly (621)	• 3-4 apply ring stuck in applied position • Forward clutch not releasing • Turbine shaft seals missing, cut or damaged
Manual Valve Link (89)	Disconnected
Valve Body Assembly (60)	• 2-3 shift valve stuck • Manual linkage not adjusted • Spacer plate and gaskets incorrect, mispositioned or damaged • Lo overrun valve stuck • Orificed cup plug restricted, missing or damaged
Reverse Input Clutch Assembly (606–614)	• Clutch plate worn • Reverse input housing and drum assembly cracked at weld • Clutch plate retaining ring out of groove • Return spring assembly retaining ring out of groove • Seals cut or damaged • Restricted apply passage • Porosity in piston • Belleville plate installed incorrectly • Excessive clutch plate travel • Oversized housing
Lo and Reverse Clutch (694–696	• Clutch plates worn • Porosity in piston • Seals damaged • Return spring assembly retaining ring mispositioned • Restricted apply passage

Second Gear Start

Checks	Causes
Signal Noise on Vehicle Speed Sensor (VSS) Circuit	Chassis vibrations, incorrect harness routing, owner installed electronic components creating electrical interference
Diagnostic Trouble Code (DTC)	Electrical or mechanical 1-2 Shift Solenoid Valve (367) malfunction
Leaking Actuator Feed Limit (AFL) Circuit	Spacer plate (48), spacer plate gaskets (47 or 52), control valve body (60), mispositioned, damaged or poor sealing/mating surface exist
Blocked or restricted Valve Body Spacer Plate (48) Spacer Plate to Case Gasket (47) or Spacer Plate to Valve Body Gasket (52)	Trapped sediment or metal particles
Stuck 1-2 Shift Valve (366)	• Trapped sediment or metal particles • Binding shift valve or worn valve body bore

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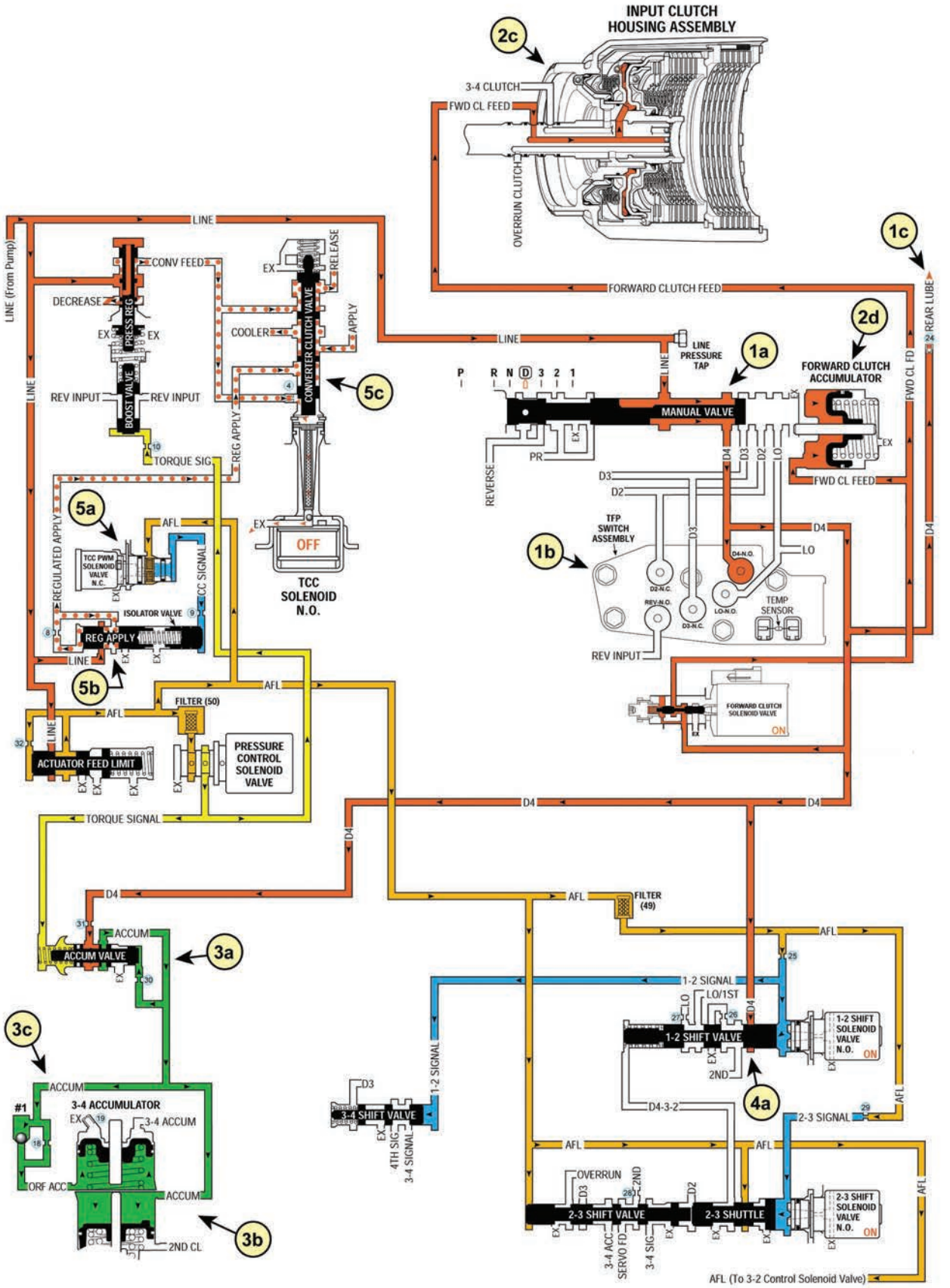
SECTION 2
HYDRAULIC OVERVIEW

Overdrive First Gear Normal



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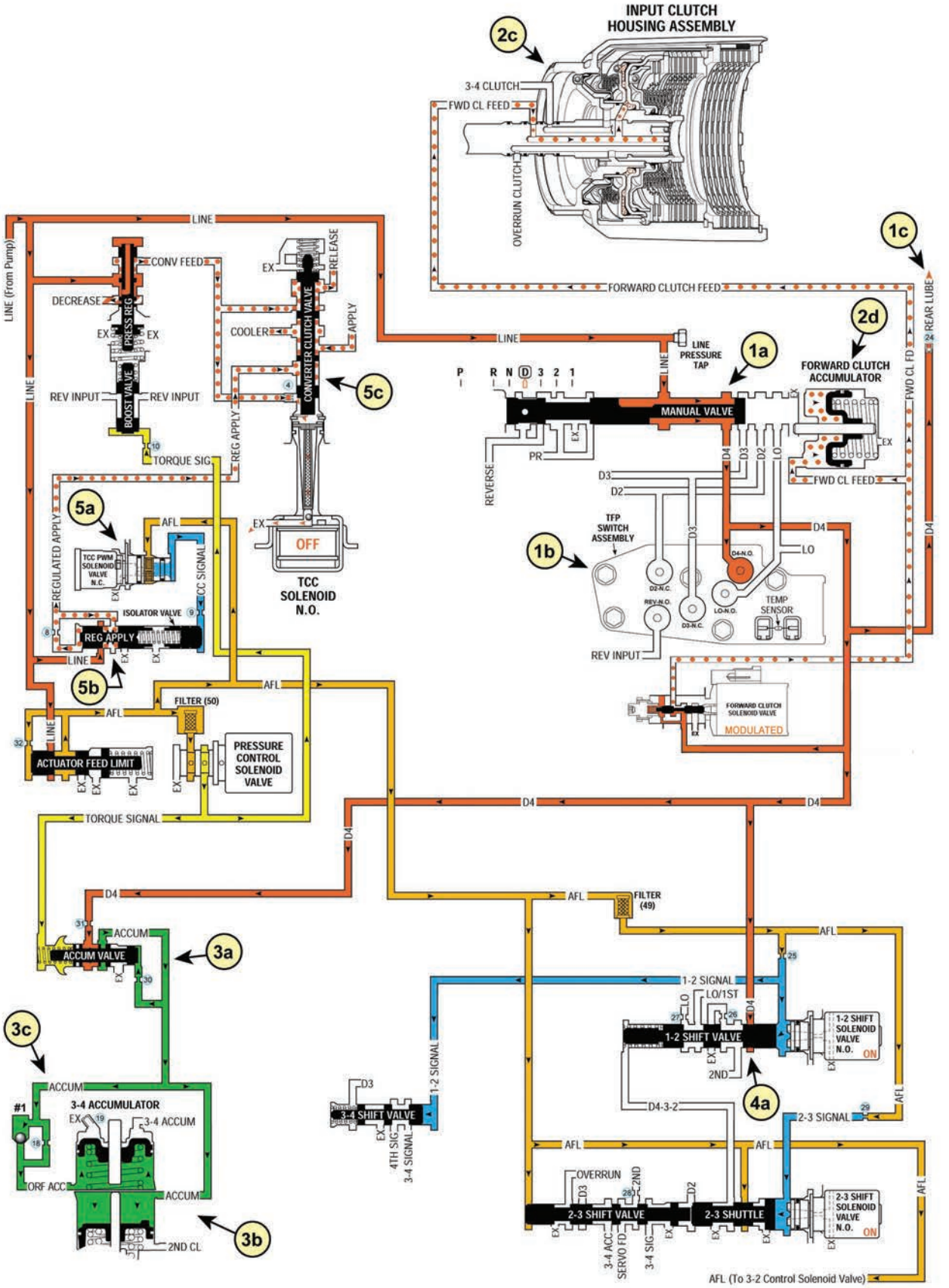
Overdrive First Gear Neutral Idle



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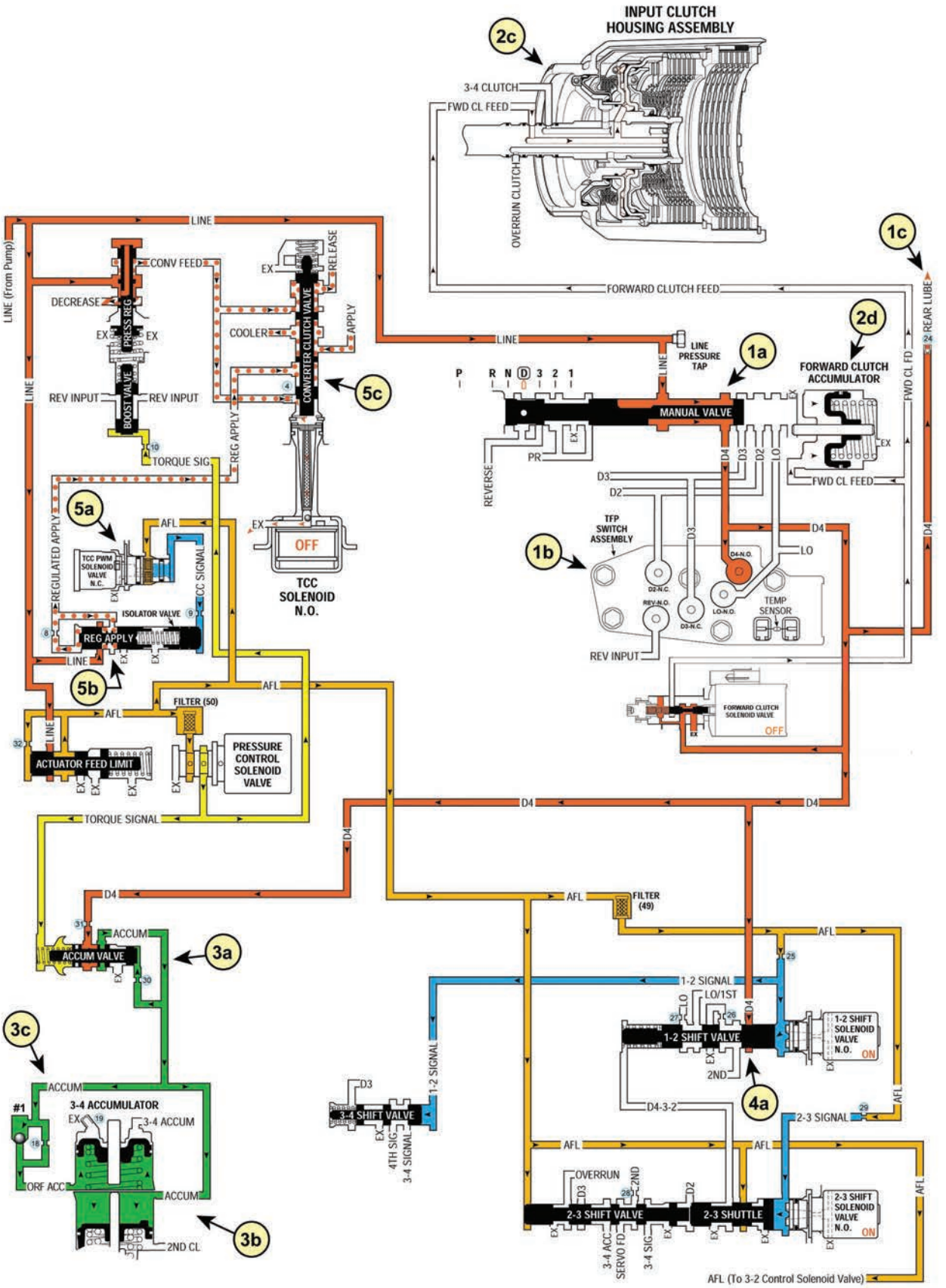
Overdrive First Gear Forward Lockout



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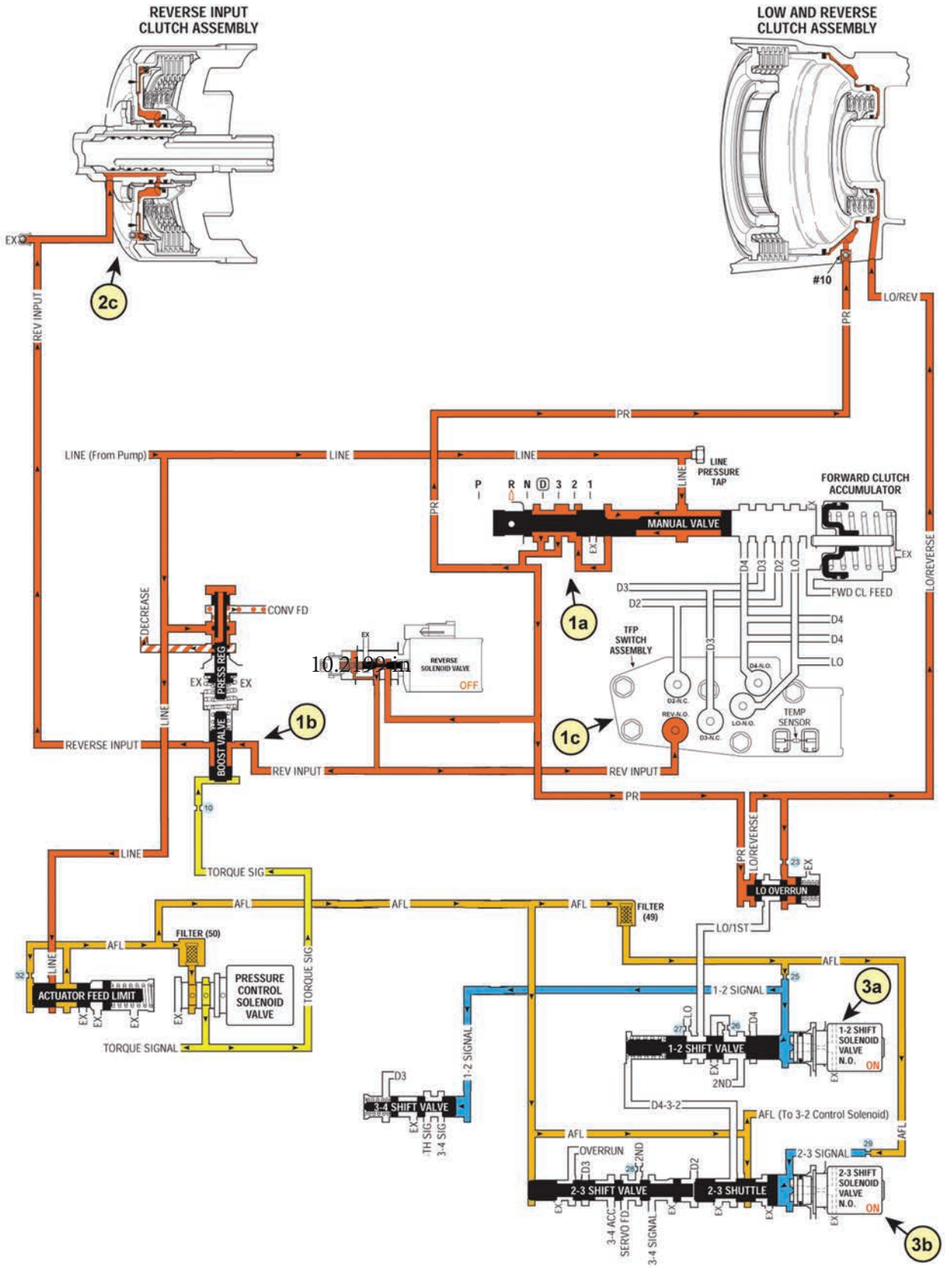
Reverse Normal



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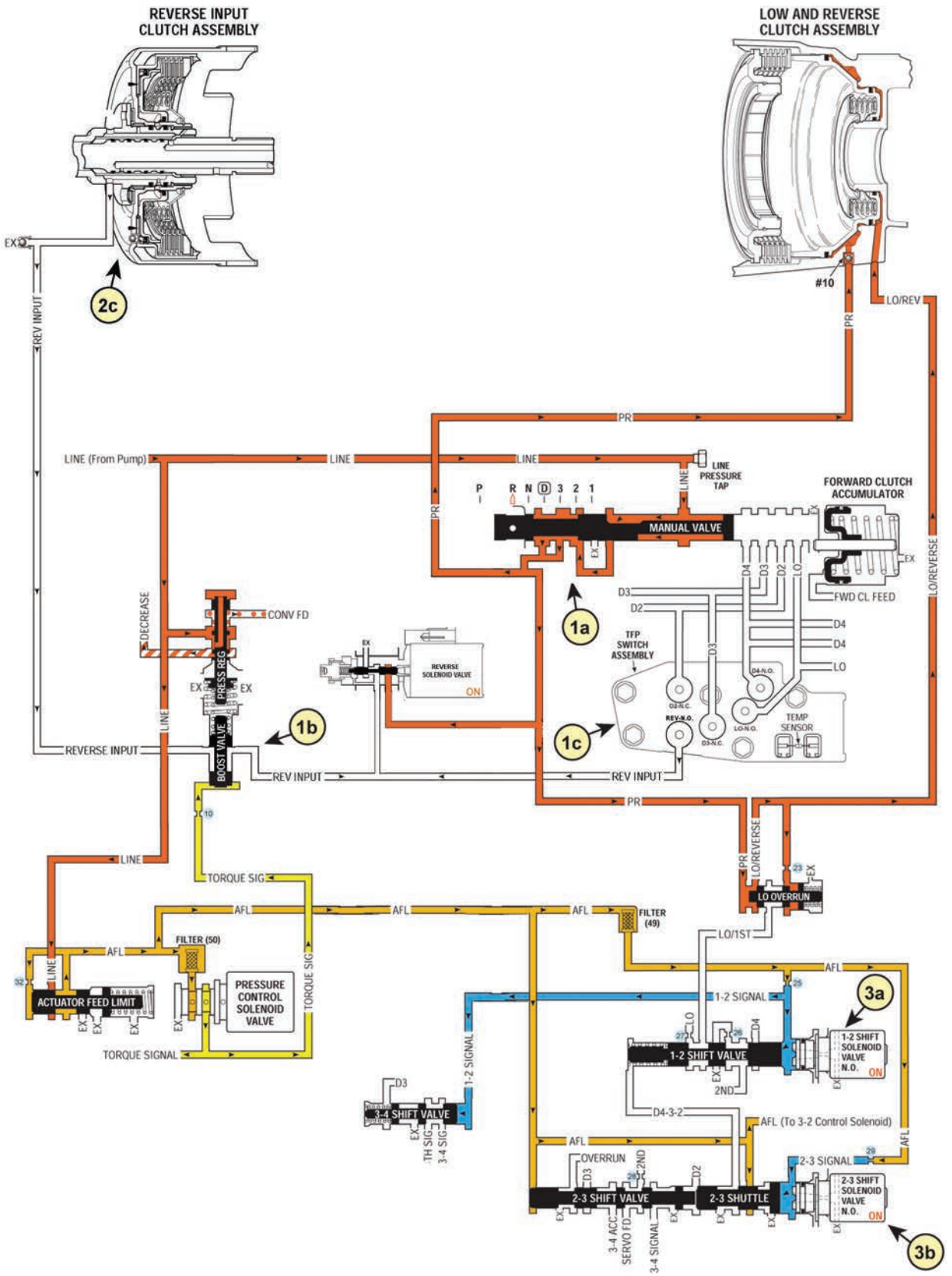
Reverse Lockout



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SECTION 3
ELECTRICAL OVERVIEW

Section 3.1 - TCM Specifications

Physical	
Weight	0.82 lb
Dimensions (L x W x H inches)	5.3 x 3.7 x 1.5
Case Material & Finish	Aluminum Black Anodized

Operating Conditions	
Voltage Range	8-18 VDC standard (24 VDC models available)
Current (device only, not including outputs)	On: 100 mA Quiescent: 9 mA
Operating Temperature	-50 to 125°C
Storage Temperature	-55 to 150°C
Reverse/Transient Protections	Yes
Ingress Protection	IP68
Harness Interface	Molex 56-pin
EMI Immunity	All modules are designed for robust EMI immunity. PCS offers certification testing for the desired controller/ transmission package as a cost option.

Communication	
Interface	2 x CAN 2.0b, 1 x RS-232, 1 x J1850
Real-time tuning and data logging with a PC	Yes
Real-time tuning and data logging with PCS hand-held interface	Yes
In-Field Flash Upgradable	Yes

Inputs	
Frequency (Range 0-10 kHz)	4
Programmable Trigger Levels and Filtering for Frequency Inputs	2 Channels
Analog Voltage (0-5 VDC)	2 total 1 with 1kΩ 5V pull-up
Programmable Input Parameters	Yes
Failure Diagnostics for each Analog Input	Yes
Digital (programmable active high or low)	16
Over Voltage Protection for Each Input	Yes

Outputs	
PWM	7
Digital	1
PWM & Digital Maximum Current	3.5 Amp
Short Circuit, Over Current & Thermal Protection	Yes
User Selectable Output Drive Type (Battery Voltage or Ground)	Ground Only
Programmable Output Type/Parameter for PWM and Digital Outputs	Yes
Output Channel Current Monitoring	4 PWM Channels

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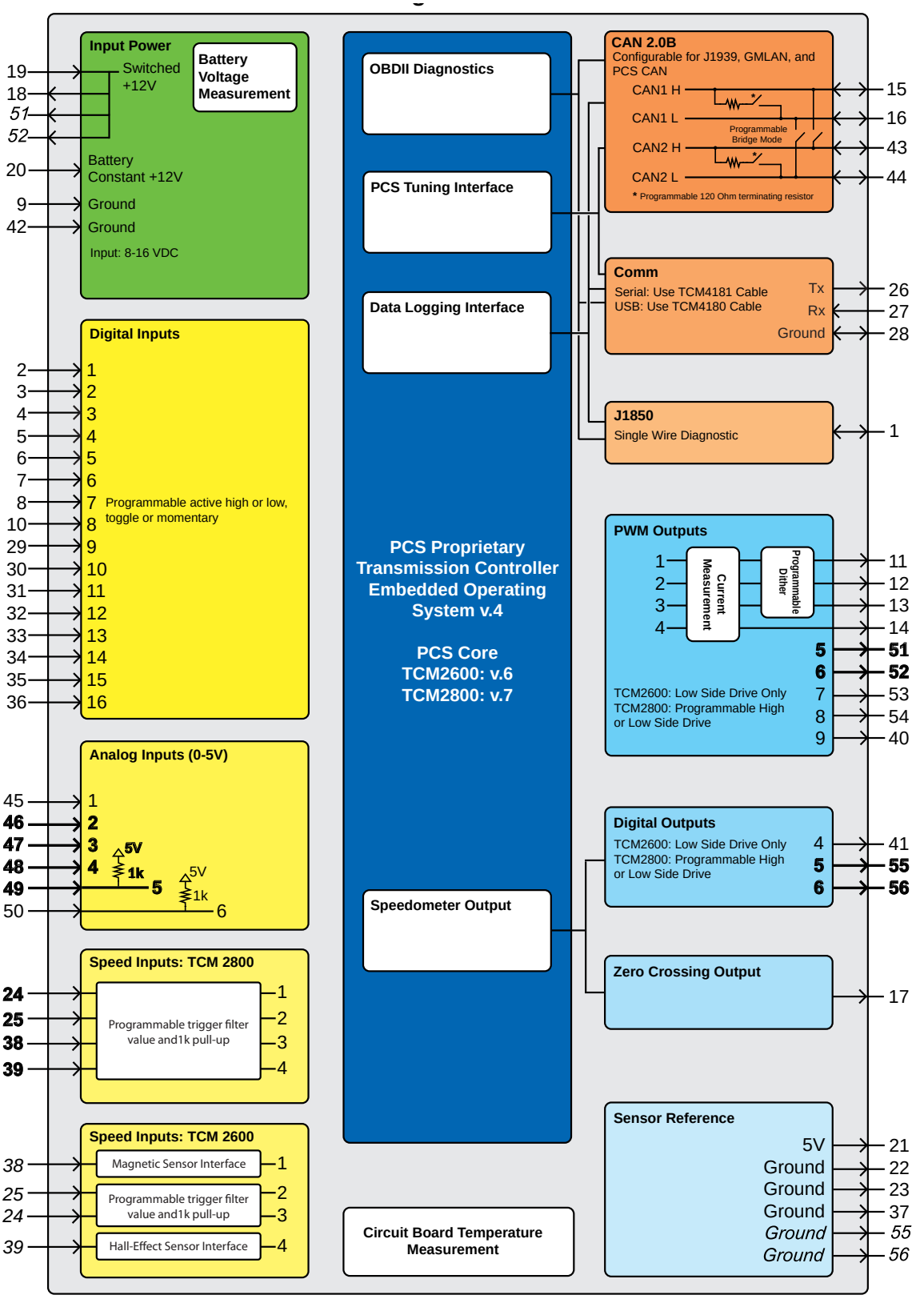
Section 3.2 - TCM Block Diagram



*TCM2600 Only | ***TCM2800 Only**

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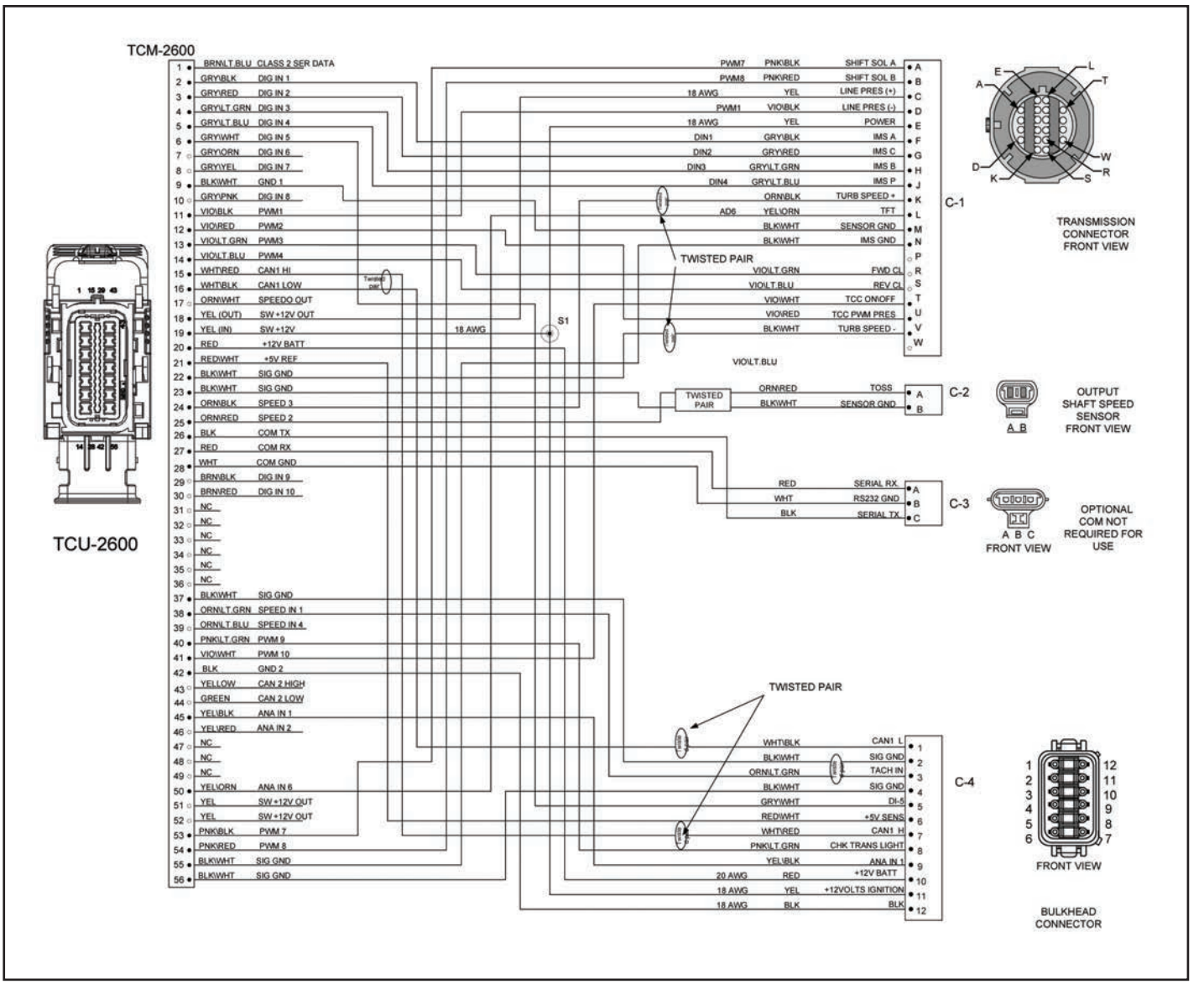
Section 3.3 - TCM2600 Wiring Harness



PCS Part #	Description
TCM4635	4L70E 2010+ Special Transmission Mounted to TCU TCM-2600

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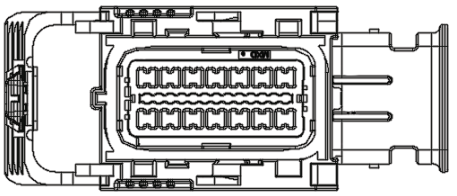
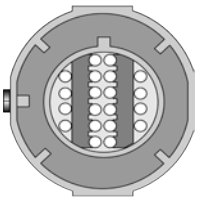


TCM2600 Connector

PCS Part #	MFR Part #	Description	Qty
CON1202	34576-1903	Connector	1
CON1203	34575-0003	Dress Cover	1
CON1205	33467-0006	Terminals (18-22 AWG)	34
CON1204	34586-0001	Grommet Seal Plugs	22



4L70 Transmission Connector

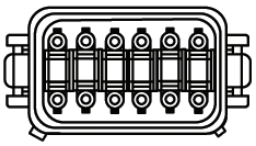
PCS Part #	MFR Part #	Description	Qty
CON1202	34576-1903	Connector	1
CON1203	34575-0003	Dress Cover	1
CON1205	33467-0006	Terminals (18-22 AWG)	34
CON1204	34586-0001	Grommet Seal Plugs	22

Output Shaft Speed Sensor

PCS Part #	MFR Part #	Description	Qty
CON1070	15449028	Connector	1
CON1084	15326266	Terminals (20 AWG)	2
CON1093	15366022	Cable Seal (Green)	2
CON1072	15305024	TPA (Grey)	1

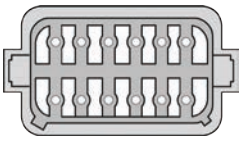
Optional COM Connector

PCS Part #	MFR Part #	Description	Qty
CON3416	12110293	Connector	1
CON1038	12084200	Terminals	3
CON3417	12052845	TPA (Cream)	1
CON1027	15324976	Cable Seals (White)	3



Bulkhead Connector

PCS Part #	MFR Part #	Description	Qty
CON5542	DT06-125A	Connector	1
CON5504	0462-201-16141	Terminals	9
CON5525	W125	Wedge (Orange)	1



Bulkhead Connector Mate

PCS Part #	MFR Part #	Description	Qty
CON5543	DTO4-12PA	Connector	1
CON5544	W12P	Terminals	9
CON5510	0460-202-16141	Wedge (Orange)	1

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Section 3.4 - Servicing Connectors

Transmission Connector

Depinning/Pinning Connector

1. Remove the conduit clip by unlatching the latch features on both sides. A small screwdriver or similar tool can be used to release the latches. **Reference Figure 1**.

Figure 1

2. Remove TPA (Terminal Position Assurance) Clip. **Reference Figure 2**.

Figure 2

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3. Using a extraction tool, release the terminal by pressing the terminal locking tab away from the terminal. Keep pressing the terminal locking tab away from terminal until terminal is completely removed. **Reference Figure 3**.

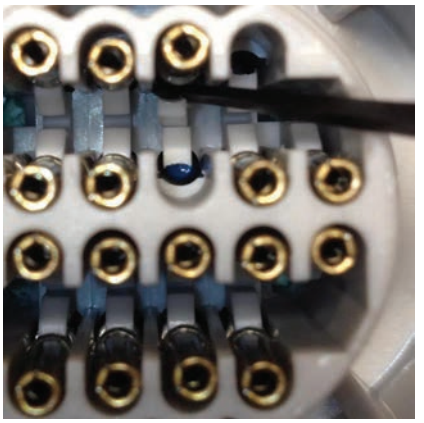

Figure 3

*To completely remove the connector for replacement, follow these steps until all terminals have been removed.

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Bulkhead Connector

Depinning/Pinning the Connector

1. Remove the orange wedge lock. A small screwdriver or similar tool can be used to release the latches. **Reference Figure 1**.

Figure 1

2. Using a extraction tool, release the terminal by pressing the terminal locking tab away from the terminal. Keep pressing the terminal locking tab away from terminal until terminal is completely removed. **Reference Figure 2**.

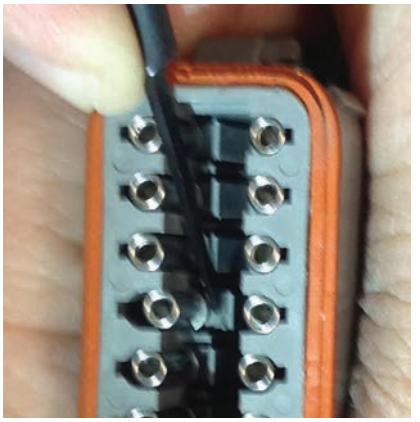

Figure 2

*To completely remove the connector for replacement, follow these steps until all terminals have been removed.

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Communication Connector

Depinning/Pinning the Connector

1. Remove COM connector dust cap by lifting the lock. **Reference Figure 1**.

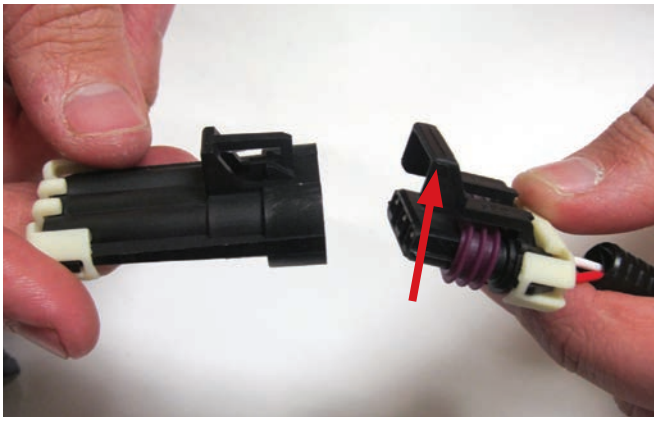

Figure 1

2. Remove the TPA (Terminal Position Assurance) by unlatching the latch features on both sides. small screwdriver or similar tool can be used to release the latches. **Reference Figure 2**.

Figure 2

3. Using a extraction tool, release the terminal by pressing the terminal locking tab away from the terminal. Keep pressing the terminal locking tab away from terminal until terminal is completely removed. **Reference Figure 3**.

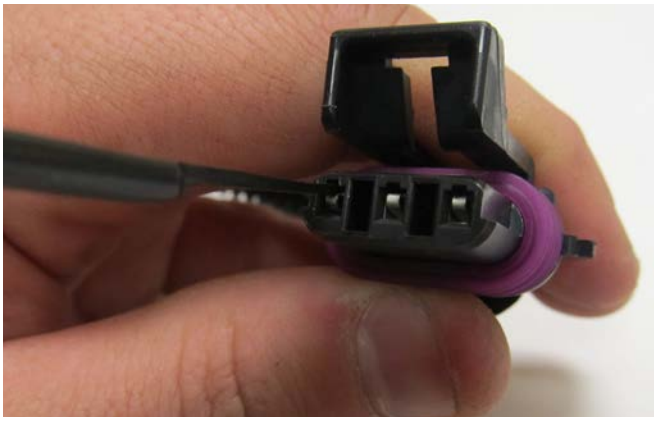

Figure 3

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4. If the terminal will not stay in position when reinserting, the tang may have been bent downward in the removal process. Using a small screwdriver slightly bend the tang back up. **Reference Figure 4**.

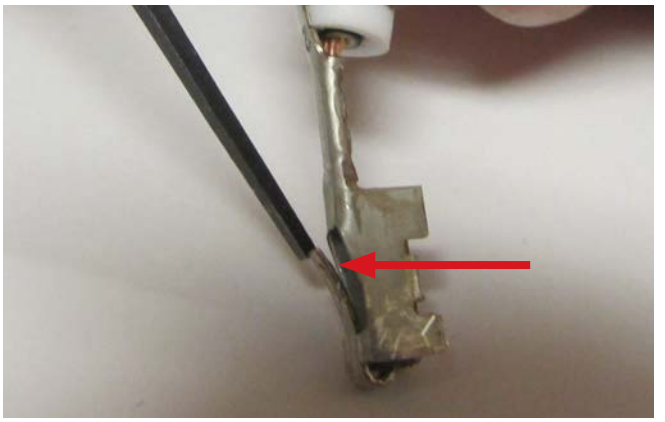

Figure 4

*To completely remove the connector for replacement, follow these steps until all terminals have been removed.

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TCM Connector

Unmating the Connector

1. To un-mate the harness connector from the controller, push the CPA (Connector Postion Assurance) away from the wire bundle. Depress the primary latch on the top of the harness connector so the lever arm releases. **Reference Figure 1**.

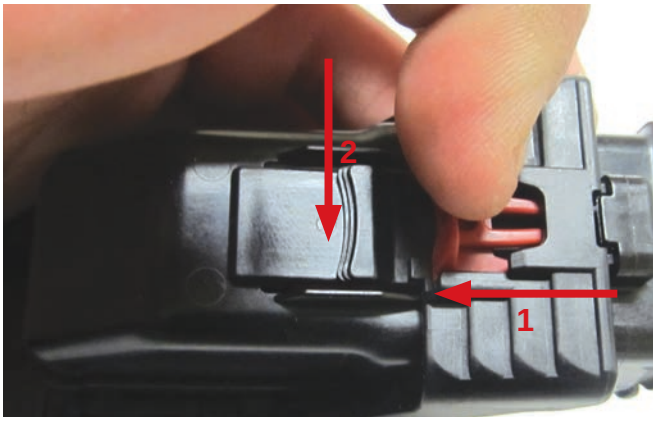

Figure 1

2. Push the top of the lever arm away from the wire bundle using the palm of your hand until the connector lifts into pre-lock position. **Reference Figure 2**.

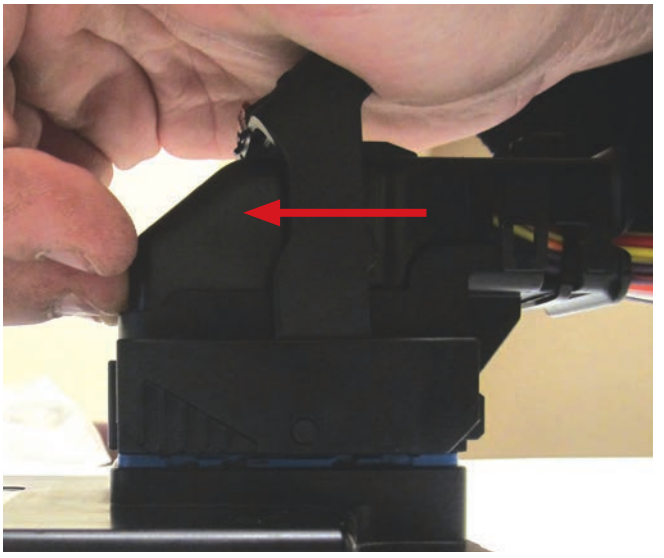

Figure 2

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3. While pushing forward on the lever, grip the back of the harness and pull upwards and away from the module. **Reference Figure 3**.

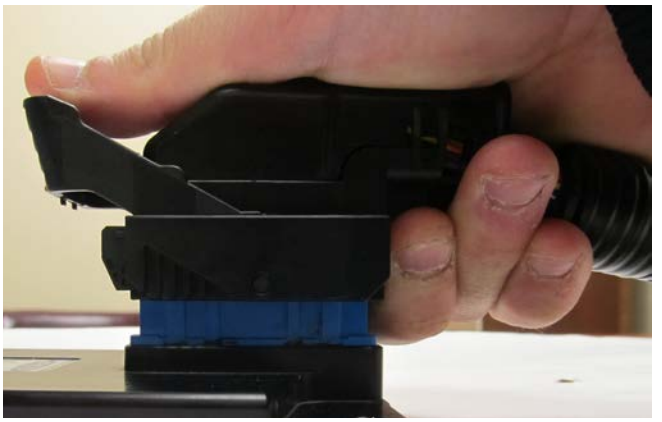

Figure 3

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Depinning/Pinning Connector

1. Unlatch the dress cover latch features on each side of the dress cover guide. A small screwdriver or similar tool can be used to release the latches. **Reference Figure 1**.

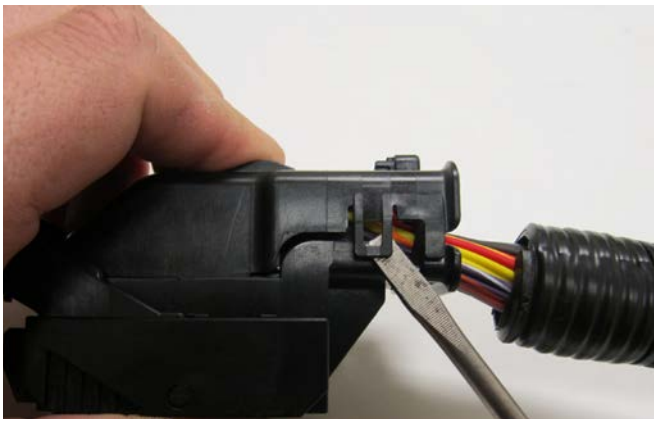

Figure 1

2. With the dress cover latch features unlatched, insert your finger into dress cover and pull up and away from the wire bundle. The dress cover can now be completely removed. **Reference Figure 2**.

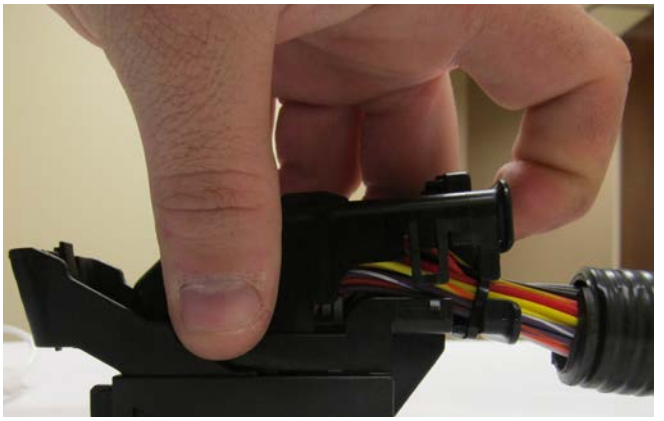

Figure 2

3. The zip-tie can now be removed from the wire bundle for easier access to the wire to be serviced. **Reference Figure 3**.

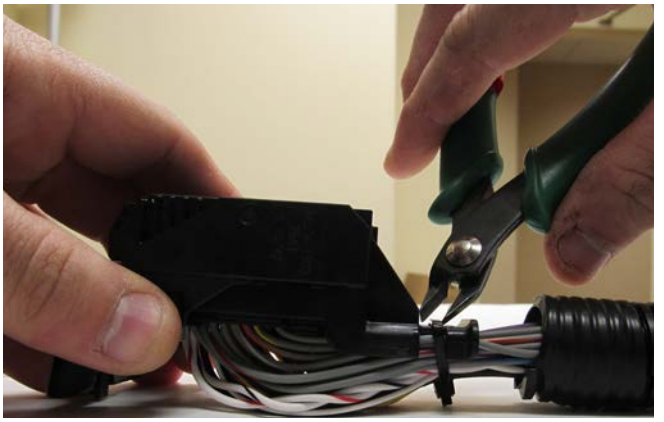

Figure 3

NOTE: Be careful not to damage/cut any wires in the process.

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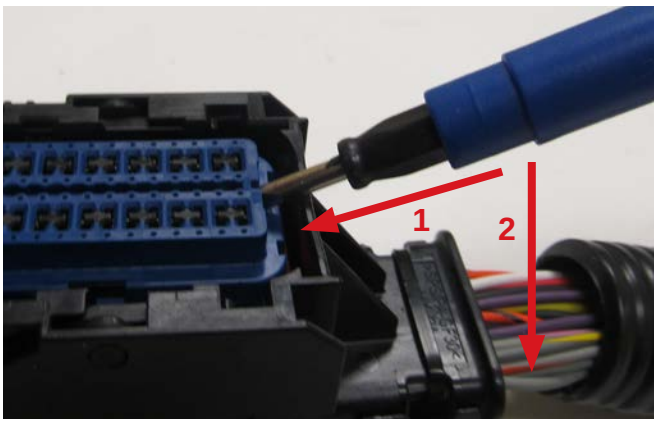
4. Insert a small flat blade screwdriver into the TPA service hole and pry up. Repeat for the opposite side. At this point the TPA should be at its pre-lock position. **Reference Figure 4**.



NOTE: TPA should never be removed from the connector.

Figure 4

5. Ensure TPA is in pre-locked position. **Reference Figures 5.**

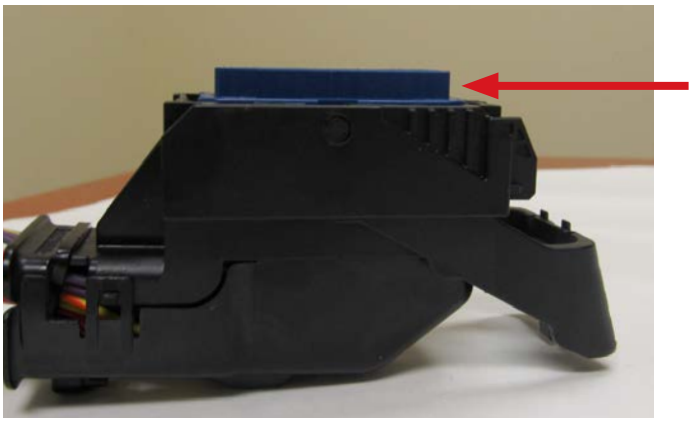


Figure 5

6. Insert tip of the 0.64mm service tool (Molex part no. 63813-1400 or alternate GM part no. J-38125-213) into the terminal service hole adjacent to the terminal to be serviced. After first pushing the wire/terminal forward, use your index finger to push the service tool until a large amount of resistance is felt. This wedges the service tool between the terminal and the lock finger, therefore deflecting the lock finger. **Reference Figure 6**.

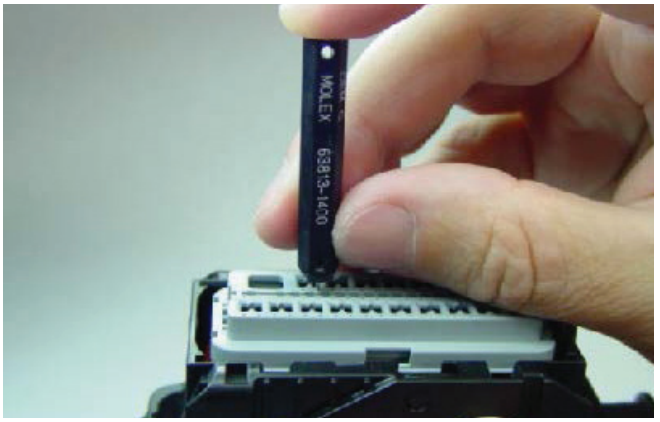


Figure 6

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7. **Figure 7a** shows proper insertion of the service tool. Avoid inserting the service tool into the terminal opening (**Figure 7b**) as this may damage the terminal.

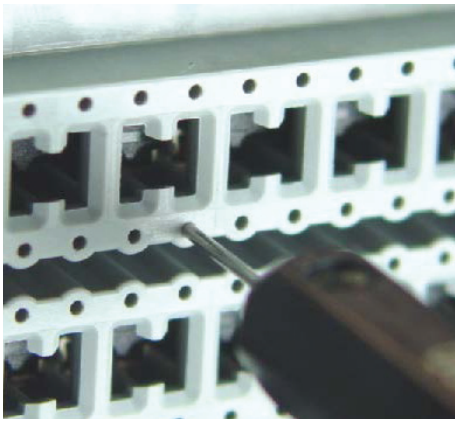

Figure 7a

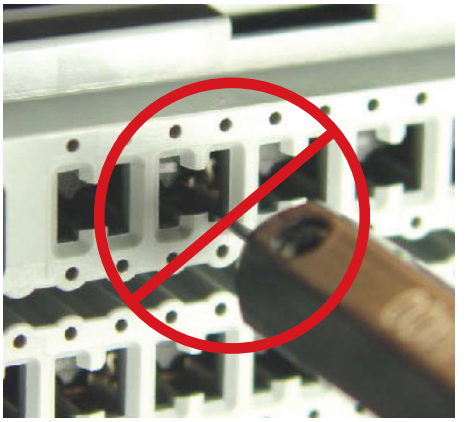

Figure 7b

8. Once the terminal lock finger has been disengaged, transfer middle finger and thumb to connector housing, while maintaining the index finger pressure on the the tool. Pull on the wire to remove the terminal. **Reference Figure 8**.

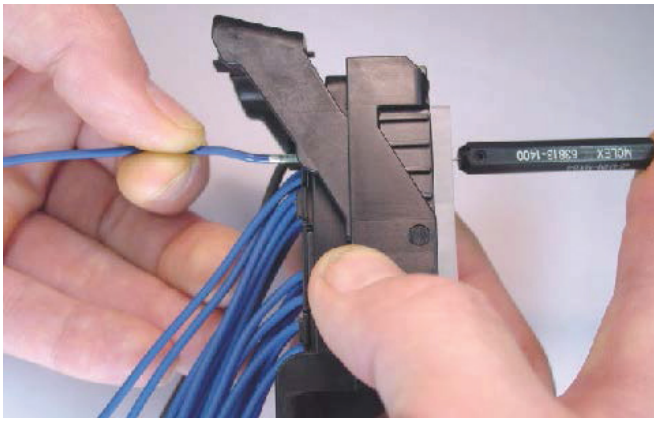

Figure 8

NOTE: Using excessive force can damage the lock finger.

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Mating the Connector

1. Correctly orient the harness connector (align keying features) onto the controller connector. Grip the top of the harness connector and evenly push the connector downward until the lever moves slightly forward. **Reference Figure 1**.

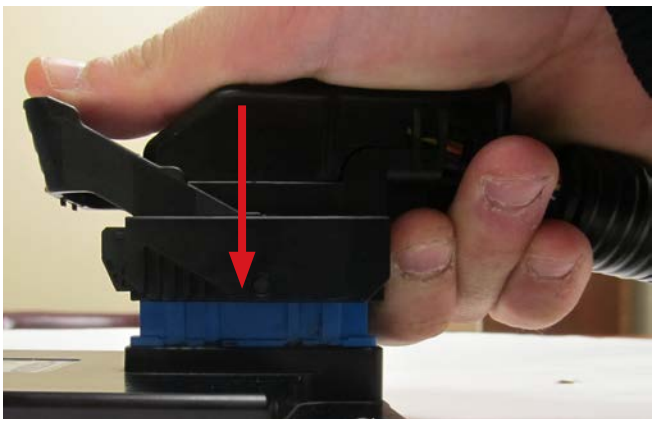

Figure 1

NOTE: Installing the harness connector at an extreme angle may result in seal “scrooping” creating an environment for fluid ingress. Damage to the header or connector is possible if excessive force is used.

2. To begin mating the harness connector to the controller, place the palm of your hand on the face of the lever. Push back the connector lever towards the wire bundle to engage the harness connector to the controller header. Mating force should be smooth and continuous, If not remove the connector and repeat. **Reference Figure 2**

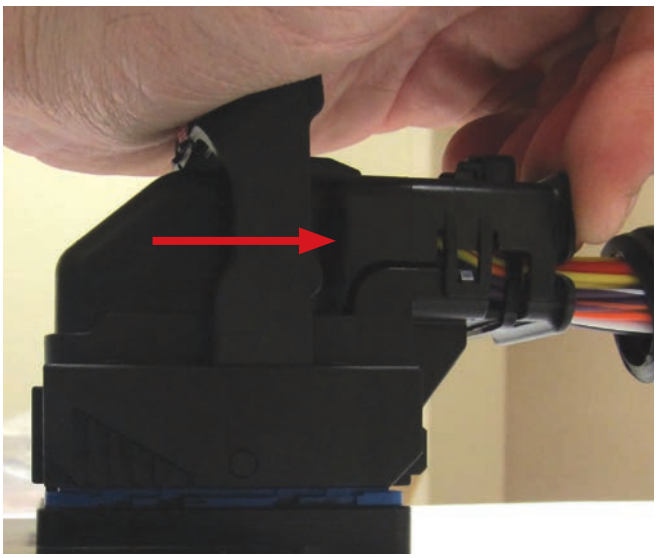

Figure 2

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3. Continue to rotate the lever until you hear the primary latch click into the final lock over dress primary cover primary latch. **Reference Figure 3**.

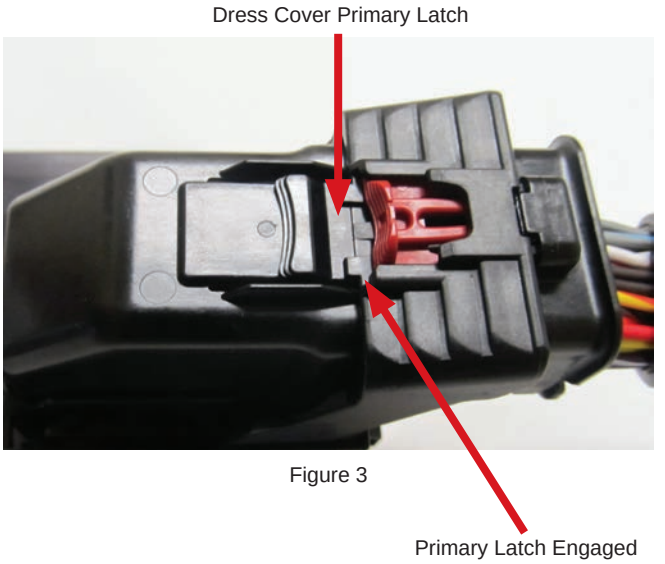

Figure 3

4. With the connector lever arm in its latched position, the CPA (Connector Position Assurance) can now be engaged. Push the CPA toward the wire bundle. until it clicks into its final locked position. **Reference Figure 4**.

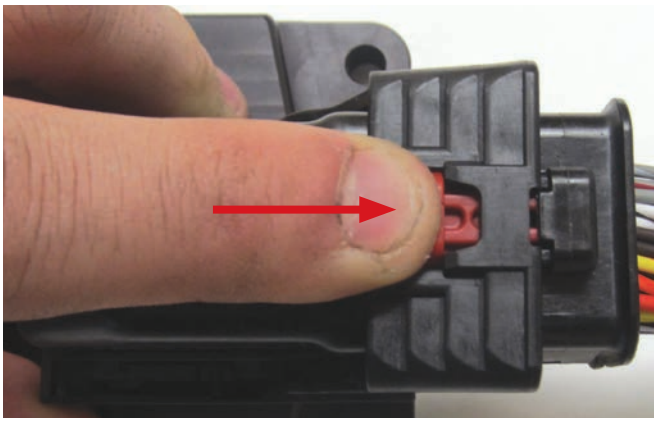

Figure 4

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Output Shaft Speed Sensor Connector

Depinning/Pinning the Connector

1. Unlatch the TPA (Terminal Position Assurance) by depressing the latch features on each side. A small screwdriver or similar tool can be used to release the latches. **Reference Figure 1**.

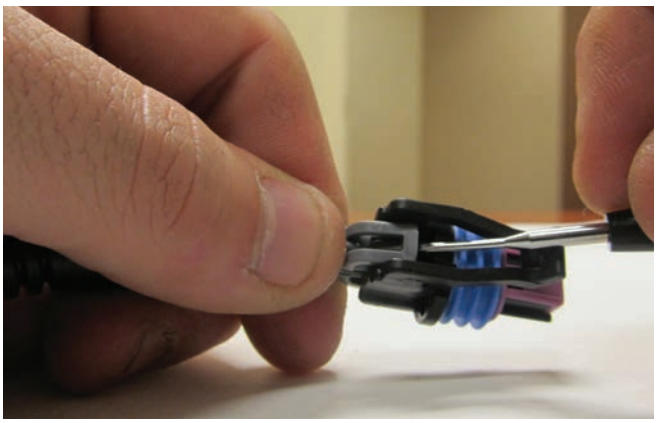

Figure 1

2. Using a extraction tool, release the terminal by pressing the terminal locking tab away from the terminal. Keep pressing the terminal locking tab away from terminal until terminal is completely removed. **Reference Figure 2a**.

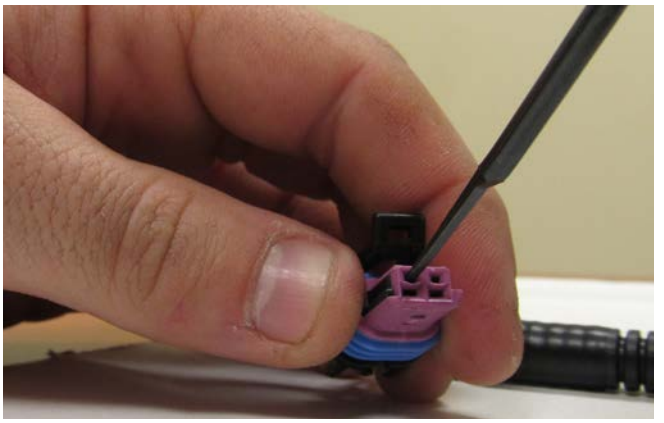

Figure 2a

To better understand releasing the terminal locking tabs, **reference Figure 2b**.

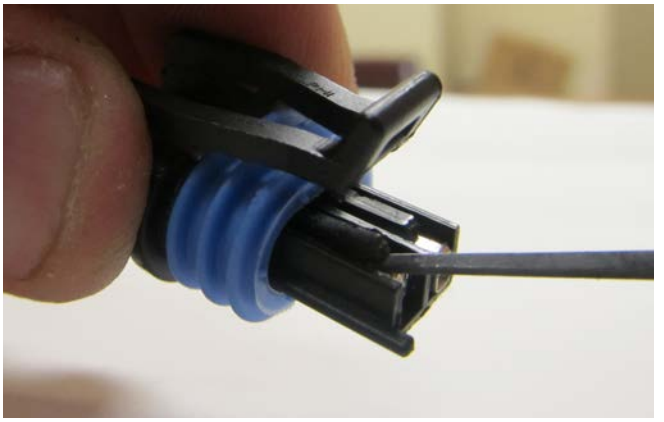

Figure 2b

NOTE: Do not remove the purple cap. Doing so may damage it.

*To completely remove the connector for replacement, follow these steps until all terminals have been removed.

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SECTION 4
DIAGNOSTIC TROUBLE CODES

Section 4: Diagnostic Trouble Codes

How to Read Diagnostic Codes

There are two ways to read diagnostic trouble codes (DTC's).

One way to read DTC's is using the PCS Diagnostic Software as described in **Section 6**.

The other way to read DTC's is using the check transmission light installed on the dash. Note - Some vehicle manufacturers may choose to not install a check transmission light. Refer to the vehicle operating instructions for location of the check transmission light.

If a DTC is active and the engine is running, the check transmission light will be on solid to indicate there is an active code. When the ignition is turned on, but the engine is not running, the light will flash a pattern so the DTC can be read. The flashing will indicate both active and stored codes.

The codes consist of two numbers. The first number is flashed at one second intervals, then a one second pause and the second number is flashed at 350ms. There is a three second pause in between trouble codes.

For instance, code 24 consists of two slow flashes followed by four quick flashes. **Reference Figure 1**.

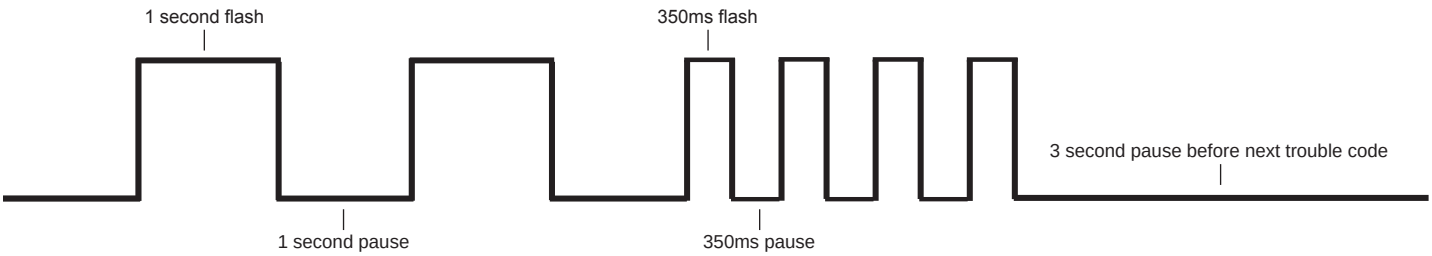

Figure 1

Delphi/ GM 2-Digit Code	OBDII 3-Digit DTC	J1939 SPN	Description	Fail Conditions	Action Taken	Reason for Actions	Clear Conditions
21		522499	Throttle Position high	Throttle Position High Throttle position voltage has been above 4.9 Volts for more than 1 second.	Maximum line pressure. Shift points fixed at 35% throttle.	Assumes fixed shift points. Goes to maximum pressure because engine load is unknown.	Throttle position below 4.9 volts for more than 1 second.
22		522500	Throttle Position Low	TPS voltage is less than 0.20 volts for more than 1 second.	Maximum line pressure. Shift points fixed at 35% throttle.	Assumes fixed shift points. Goes to maximum pressure because engine load is unkown.	Throttle position above 0.20 volts for more than 1 second.
23	U0001	522731	CAN communications lost	No CAN communications for greater than 5 seconds.	Maximum line pressure. Shift points fixed at 35% throttle. Inhibit 4th and TCC.	Assumes fixed shift points. Goes to maximum pressure because engine load is unknown.	

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Delphi/ GM 2-Digit Code	OBDII 3-Digit DTC	J1939 SPN	Description	Fail Conditions	Action Taken	Reason for Actions	Clear Conditions
24	P0722	522741	Output Speed Sensor	No Code 21, 22, U0001. Sets when not in Park or Neutral, Engine RPM greater than 3000, Input shaft speed greater than 10%, Output speed less than 200. All conditions met for 3 seconds.	Calculate output shaft speed from input shaft speed and commanded gear, Maximum line pressure.	Calculates output shaft speed to determine shift points. Assumes maximum pressure because transmission slippage cannot be measured.	Key Cycle
28	P1810	522751	Range Pressure Switch/Lever Position Error	Sets when TCM sees one of two illegal combinations from pressure switch manifold for 2 seconds.	Maximum pressure. Assume Overdrive 4 is selected. Inhibit 4th and TCC.	Assumes D4 so that performance of the vehicle is not limited.Inhibits 4th and TCC because actual selector position is unknown.	Key Cycle
37	P0719	522740	Brake Switch Stuck Off	Sets when Brake is not pressed, Vehicle speed is below 5mph for greater than 6 seconds, then Vehicle speed is greater than 20 mph for greater than 6 seconds, for a total of 7 times.	Inhibit TCC	Inhibits TCC to prevent engine stalling in panic brake situation.	Key Cycle or when Brake Pedal is pressed
38	P0724	522743	Brake Switch Stuck On	Sets when Brake is pressed, Vehicle speed is below 5mph for greater than 6 seconds, then Vehicle speed is greater than 20 mph for greater than 6 seconds, for a total of 7 times.	Inhibit TCC	Inhibits TCC to prevent engine stalling in panic brake situation.	Key Cycle or When Brake Pedal is pressed
39	P0741	522744	TCC Stuck OFF	TCC slip is greater than 65 RPM for 3 seconds when TCC is commanded on in 2nd or 3rd.	Inhibit TCC and 4th gear	Inhibits TCC and 4th gear because code could be tripped by slipping 4th clutch.	Key Cycle
51	P0601	522736	Transmission Control Module	Sets when Internal memory writes/reads fail, COP stops operating or processor executes an Illegal Opcode.	2nd Gear, Maximum line pressure, Inhibit TCC		Key Cycle
52	P0560	522733	System Voltage High Long	Sets when system voltage is greater than 16 volts for 30 minutes.	2nd Gear, Maximum line pressure, Inhibit TCC	Turns off all solenoids to protect them from overheating/overcurrent.	Key Cycle or when system voltage drops below 15V.
53	P0561	522734	System Voltage High	Sets when system voltage is greater than 19.5 volts for 5 seconds.	2nd Gear, Maximum line pressure, Inhibit TCC	Turns off all solenoids to protect them from overheating/overcurrent.	Key Cycle or when system voltage drops below 18V.
58	P0712	522737	Trans Temp High or TFT circuit low	Sets when Transmission Temperature Is above 151°C (304°F).	Inhibit 4th and TCC	Transmission temperature is unknown.	When transmision temperature drops below 148°C for 5 second.

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Delphi/ GM 2-Digit Code	OBDII 3-Digit DTC	J1939 SPN	Description	Fail Conditions	Action Taken	Reason for Actions	Clear Conditions
59	P0713	522738	Trans Temp Low or TFT Circuit High	Transmission Temperature Is Below -37°C (-34°F) for 1 second.	Inhibit 4th and TCC	Transmission Temperature is unknown.	When transmission temperature goes above -35°C for 5 seconds.
63			Reserved. Only Flashes through diagnostic light on Military Humvee	None	None	Is Barometric Pressure code on older Delphi Modules.	
68	P1870	522753	Component Slipping / TCC or 4th Clutch Slipping	No 28, 71, 74, U0001. Throttle Position is greater than 25%, Engine speed is 200 rpm or more than input speed for 6 seconds when in 4th gear and TCC engaged.	Maximum line pressure, Inhibit 4th	Inhibits 4th because either TCC or 4th clutch could be slipping. Goes to maximum pressure to attempt to stop the slippage. If TCC slippage continues in 3rd code 39 will activate.	Key Cycle
69	P0742	522745	TCC Stuck On	No DTC 21, 22, 71, 74, U0001 Sets when TCC slip is between -25 and 25 rpm, TCC solenoid is commanded off, TPS is greater than 25% for 4 seconds.	TCC Commanded on, Maximum Line Pressure	Commands TCC on in case of partial TCC pressure being applied.	Key Cycle
71		522501	Engine Speed Circuit Low	Sets when Engine speed is less than 50 rpm, transmission range is R, D4, D3, D1 for 2 seconds.	Inhibit 4th and TCC	Inhibits 4th and TCC because slippage of either clutch cannot be measured.	When Engine RPM goes above 300 RPM
72	P0723	522742	Intermittent Output Shaft Speed	No DTC 21, 22, 28, 71, 74, U0001. Sets when Engine RPM is greater than 300, range is D4, D3, D2, or D1, Throttle position is greater than 25% and Output shaft speed changes more than 500 rpm in one measurement period.	Maximum line pressure. Calculate TOSS from TISS and commanded Gear.	Calculates output shaft speed to determine shift points. Assumes maximum pressure because transmission slippage cannot be measured. Inhibits TCC to prevent inadvertent stalling at low speeds.	Key Cycle
73	P0748	522746	Pressure Control Circuit	Force motor current is more than 0.16 Amps different than commanded current for 2 seconds.	Maximum line pressure.	Commands maximum pressure because pressure control circuit performance is not expected.	Key Cycle
74	P0717	522739	Input Speed Sensor Circuit	No DTC 28. Sets when Range is not park or neutral, engine speed greater than 300rpm, Output speed greater than 200rpm, Input speed less than 50 rpm, for 2 seconds.	Maximum line pressure. Inhibit 4th and TCC.	Commands maximum pressure because transmission slippage cannot be measured. Inhibits 4th and TCC because TCC slippage cannot be measured.	When Input Speed goes above 75rpm for 2 seconds.

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<table>
<tr><th>Delphi/ GM 2-Digit Code</th><th>OBDII 3-Digit DTC</th><th>J1939 SPN</th><th>Description</th><th>Fail Conditions</th><th>Action Taken</th><th>Reason for Actions</th><th>Clear Conditions</th></tr>
<tr><td>75</td><td>P0562</td><td>522735</td><td>System Voltage Low</td><td>Sets when the ignition is on, voltage is less than the following conditions:
-40°F (-40°C) = 7.3V
194°F (90°C) = 10.3V
302°F (150°C) = 11.7V
Engine Speed is greater than 300 rpm for 4 seconds.</td><td>2nd Gear with Maximum pressure. Inhibit TCC.</td><td>Turns off all solenoids because the TCM cannot properly control them.</td><td>Clears when system voltage is greater than the following conditions for 4 seconds:-
40°F (-40°C) = 7.3V
194°F (90°C) =10.3V
302°F (150°C) = 11.7V</td></tr>
<tr><td>79</td><td>P0218</td><td>522732</td><td>Transmission Fluid Overtemp</td><td>No DTC 58 sets when transmission fluid temperature is greater than 270°F (132°C), for 5 minutes.</td><td>None.</td><td></td><td>When Temperature falls below 266°F (130°C) for 5 seconds.</td></tr>
<tr><td>81</td><td>P0758</td><td>522750</td><td>2-3 Shift Solenoid Circuit Fault - Shift Solenoid “B” Electrical</td><td>Battery Voltage above 10V TCM detects an open circuit, short to battery, short to ground, or over-current condition on the shift solenoid “B” circuit for 2 seconds.</td><td>2nd or 3rd gears only. Maximum Line Pressure.</td><td>Turns off all solenoids. Depending on the Fault 2nd
or 3rd gear is possible.</td><td>When Fault condition removed for 2 seconds.</td></tr>
<tr><td>82</td><td>P0753</td><td>522748</td><td>1-2 Shift Solenoid Circuit Fault - Shift Solenoid “A” Electrical</td><td>Battery Voltage above 10V TCM detects an open circuit, short to battery, short to ground, or over-current condition on the shift solenoid “A” circuit for 2 seconds.</td><td>2nd and 3rd gears only or 1st and 4th gear only. Maximum line pressure.</td><td>Turns off all solenoids. Depending on the Fault 2nd and 3rd gear or 1st and 4th is possible.</td><td>When Fault condition removed for 2 seconds.</td></tr>
<tr><td>83</td><td>P1860</td><td>522752</td><td>TCC Solenoid Circuit Fault</td><td>Battery Voltage above 10V. TCM detects
an open circuit, short to battery, short to ground, or over-current condition on the TCC solenoid circuit.</td><td>Inhibit TCC. Inhibit 4th when in Hot mode.</td><td>Turns off the TCC output to prevent damage to the driver</td><td>When Fault condition removed for 2 seconds.</td></tr>
<tr><td>85</td><td>P1871</td><td>522754</td><td>Undefined Ratio Error</td><td>No DTC
21, 22, 24, 28, 71, 72, U0001 sets when RPM is greater than 300 RPM, TPS is greater than 25%, VSS is greater than 7mph, ratio falls out of the following table for 6 seconds.
<table><tr><th>Gear</th><th>Low/High Limit</th></tr><tr><td>1</td><td>2.38/2.63</td></tr><tr><td>2</td><td>1.43/1.58</td></tr><tr><td>3</td><td>.95/1.05</td></tr><tr><td>REV</td><td>1.97/2.17</td></tr></table></td><td>2nd gear with maximum line pressure, Inhibit TCC.</td><td>Turns off all solenoids in an
attempt to protect the transmission.</td><td>Key Cycle</td></tr>
</table>

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Delphi/ GM 2-Digit Code	OBDII 3-Digit DTC	J1939 SPN	Description	Fail Conditions	Action Taken	Reason for Actions	Clear Conditions
86	P0756	522749	Low ratio error (Shift solenoid “B” stuck on)	No DTC 21, 22, 24, 28, 71, 72, 74, 85, U0001 sets when RPM is greater than 300 RPM, TPS is greater than 25%, VSS is greater than 7mph, transmission ratio matches 4th when 1st is commanded or 3rd gear when 2nd gear is commanded, for 6 seconds.	2nd gear with maximum line pressure, Inhibit TCC.	Turns off all solenoids in an attempt to protect the transmission.	Key Cycle
87	P0751	522747	High ratio error (Shift solenoid “B” stuck off)	No DTC 21, 22, 24, 28, 71, 72, 74, 85, U0001 sets when RPM is greater than 300 RPM, TPS is greater than 25%, VSS is greater than 7mph, transmission ratio matches 1st when 4th is commanded or 2nd gear when 3rd gear is commanded, for 6 seconds.	2nd gear with maximum line pressure, Inhibit TCC.	Turns off all solenoids in an attempt to protect the transmission.	Key Cyle
91			Non-idle inch	TPS greater than 15% or RPM greater than 800 RPM during inching.	Transmission locked	Hold vehicle	Key Cycle
92			Movement not commanded	Output shaft movement detected when not commanded.	Transmission locked	Hold vehicle	Key Cycle
93			Inching past target	Output shaft movement detected past desired stopping point.	Transmission locked	Hold vehicle	Key Cycle
94			Forward Clutch Solenoid Circuit Fault	Forward clutch current is more than 0.16 Amps different than commanded current for 2 seconds.	Transmission commanded to neutral; however an electrical failure of the clutch solenoid could result in unpredictable vehicle movement.	Neutral state to prevent vehicle movement.	Key Cycle
95			Reverse Clutch Solenoid Circuit Fault	Reverse clutch current is more than 0.16 Amps different than commanded current for 2 seconds.	Transmission commanded to neutral; however an electrical failure of the clutch solenoid could result in unpredictable vehicle movement.	Neutral state to prevent vehicle movement.	Key Cylce

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SECTION 5
SOFTWARE

Section 5: Software

Section 5.1 - Connecting to your TCM

1. Locate the communication cable. **Reference Figure 1**.

Figure 1

2. Connect the USB end of the cable to a free usb port on your computer. **Reference Figure 2**.

Figure 2

3. Connect communication cable connector into harness connector. **Reference Figure 3**.

Figure 3

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4. Open the software.
    - Once the software opens, it will attempt to connect to the TCU. **Reference Figure 4**.
    - After the TCU has connected, the calibration will then be loaded. **Reference Figure 5**.

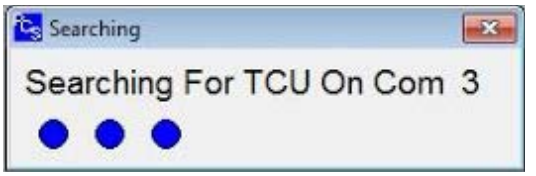

Figure 4

Figure 5

6. Once TCU has been connected the "Monitor" screen will appear. **Reference Figure 6**.

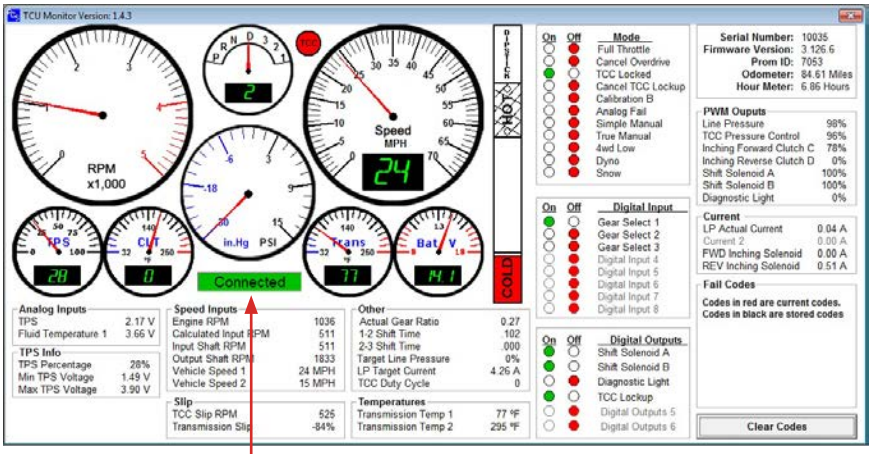

Figure 6

Displays whether the TCU is connected or disconnected.

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Section 5.2 - Edit Software Settings

COM Port Settings

COM port settings are automatically scanned and set by default. If the auto scan fails or takes longer than necessary of time you may need to edit your COM port settings.

1. Select “Settings” from the menu bar then select “COM Port Settings” from the drop down menu. **Reference Figure 1**.

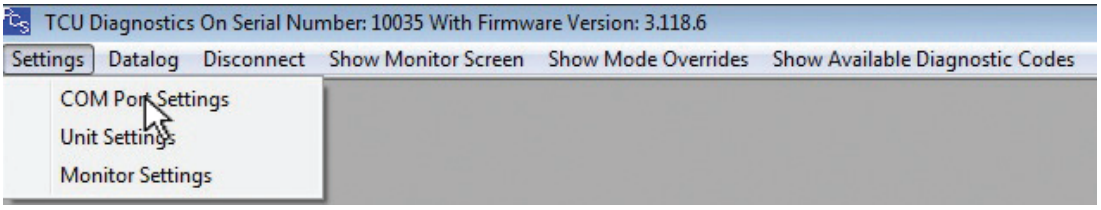

Figure 1

2. The “COM Port Settings” dialog box will be shown. **Reference Figure 2**.

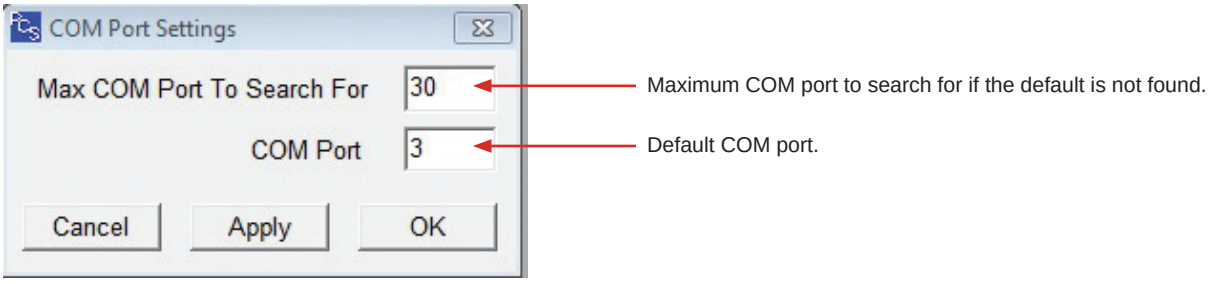

Figure 2

3. To save your settings, click “Apply”. Click “OK” to exit.

Unit Settings

1. Select “Settings” from the menu bar then select “Unit Settings” from the drop down menu. **Reference Figure 1**.

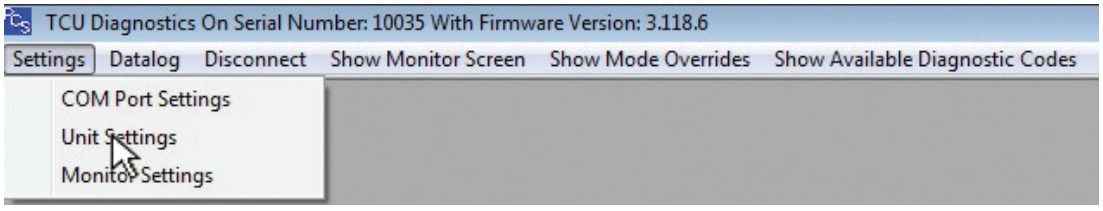

Figure 1

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2. The "Unit Settings" dialog box will be shown. **Reference Figure 2.**

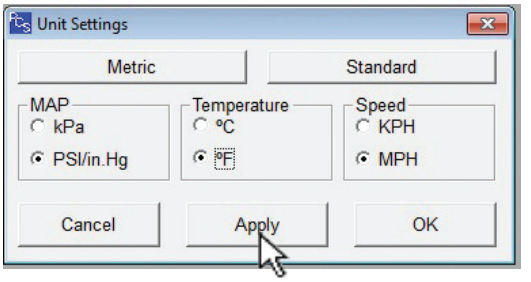

Figure 2

3. To save your settings, click "Apply". Click "OK" to exit.

Monitor Settings

1. Select "Settings" from the menu bar then select "Monitor Settings" from the drop down menu. **Reference Figure 1**.

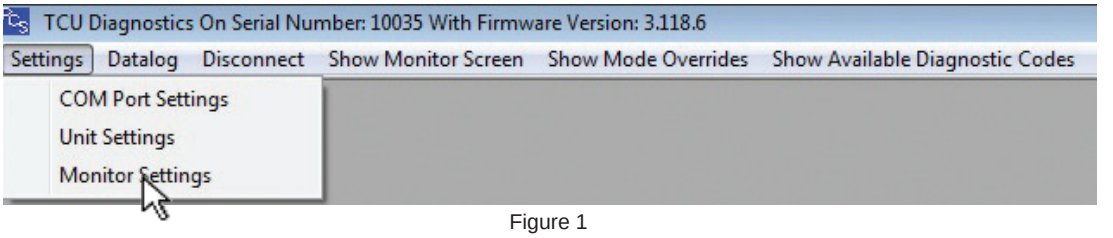

Figure 1

2. The "Monitor Settings" dialog box will be shown. **Reference Figure 2.**

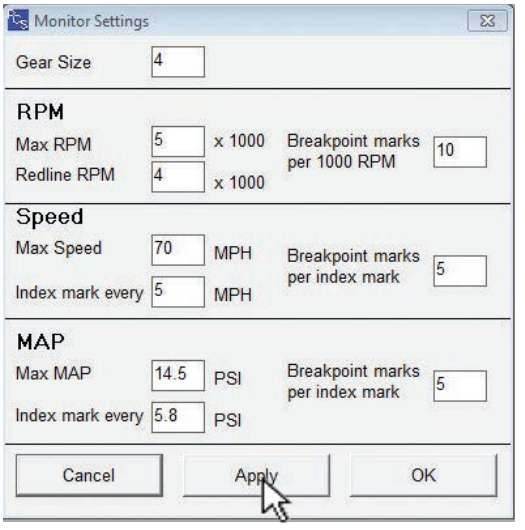

Figure 2

3. To save your settings, click "Apply". Click "OK" to exit.

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Section 5.3 - Datalogging

1. To start a datalog, select “Datalog” from the menu bar. **Reference Figure 1**.

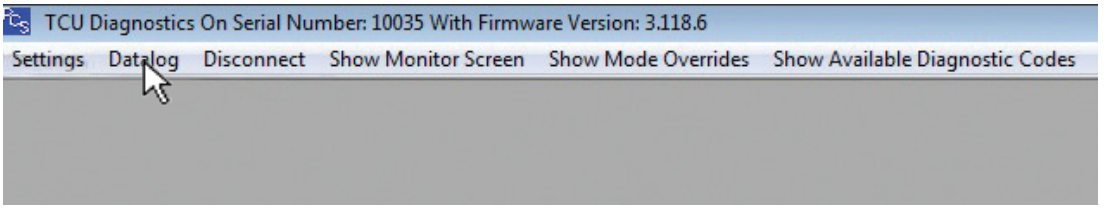

Figure 1

2. The datalog form will display and show the default save location (Cannot be changed at this time). Select “Start Logging” to begin the data log. **Reference Figure 2**.

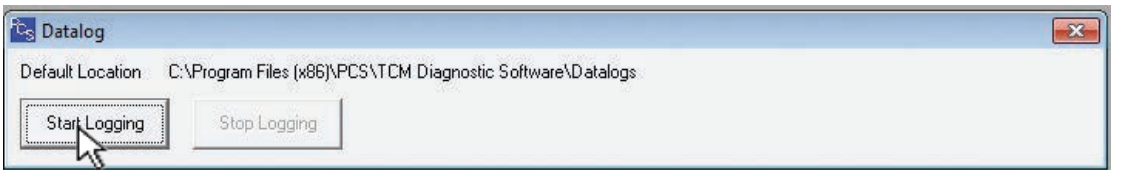

Figure 2

3. Once logging begins, the Stop Logging button will be enabled. To stop logging, select “Stop Logging.”

Section 5.4 - Disconnecting the TCU

1. Select “Disconnect” from the menu bar to properly disconnect the TCU. **Reference Figure 1**.

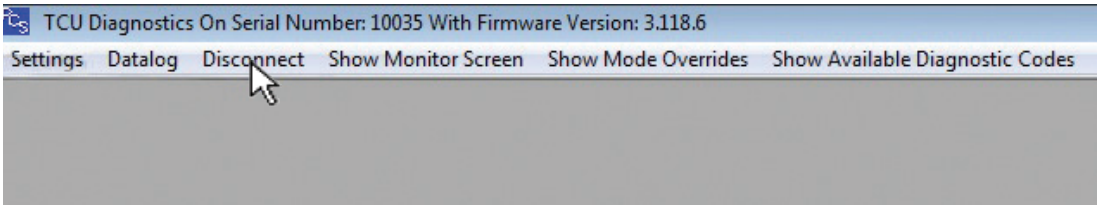

Figure 1

2. Once disconnected the menu bar text will change from “Disconnect” to “Connect”. The monitor screen will also display the TCU as disconnected.

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Section 5.5 - Show Monitor Screen

1. Select "Show Monitor Screen" to view the monitor screen if not already present. **Reference Figure 1**.

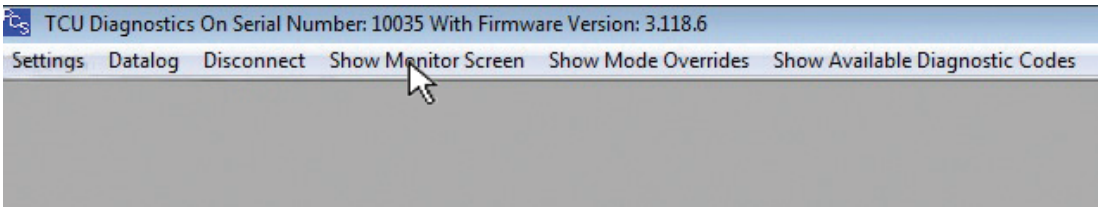

Figure 1

2. The "Monitor" screen will be shown. **Reference Figure 2**.

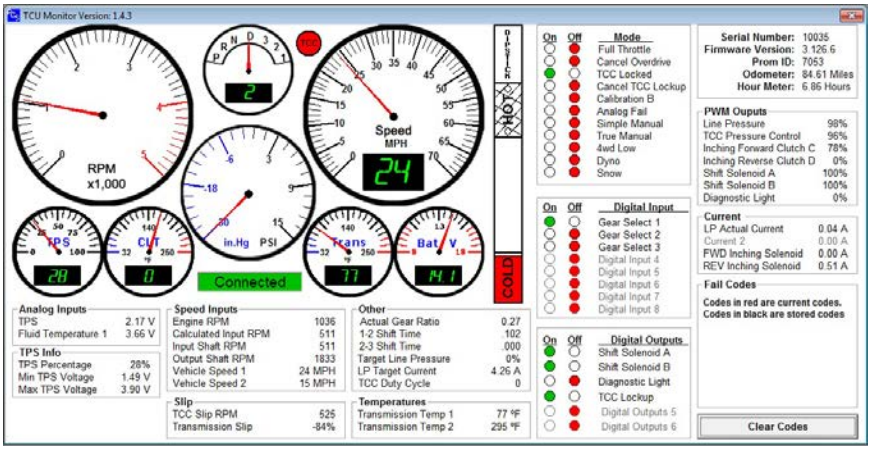

Figure 2

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Section 5.6 - Show Mode Overrides

1. Select “Show Mode Overrides” from the menu bar. **Reference Figure 1**.

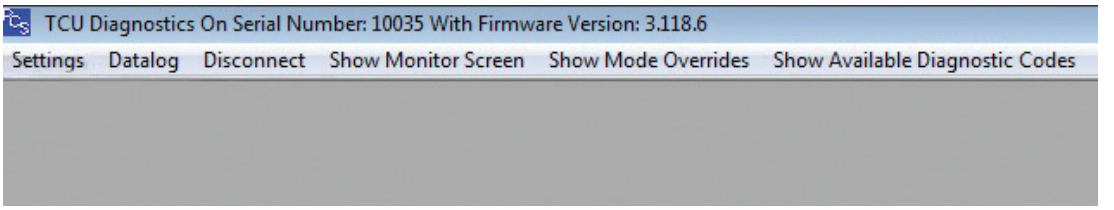

Figure 1

2. The “Overrides” form box will be shown. **Reference Figure 2.**

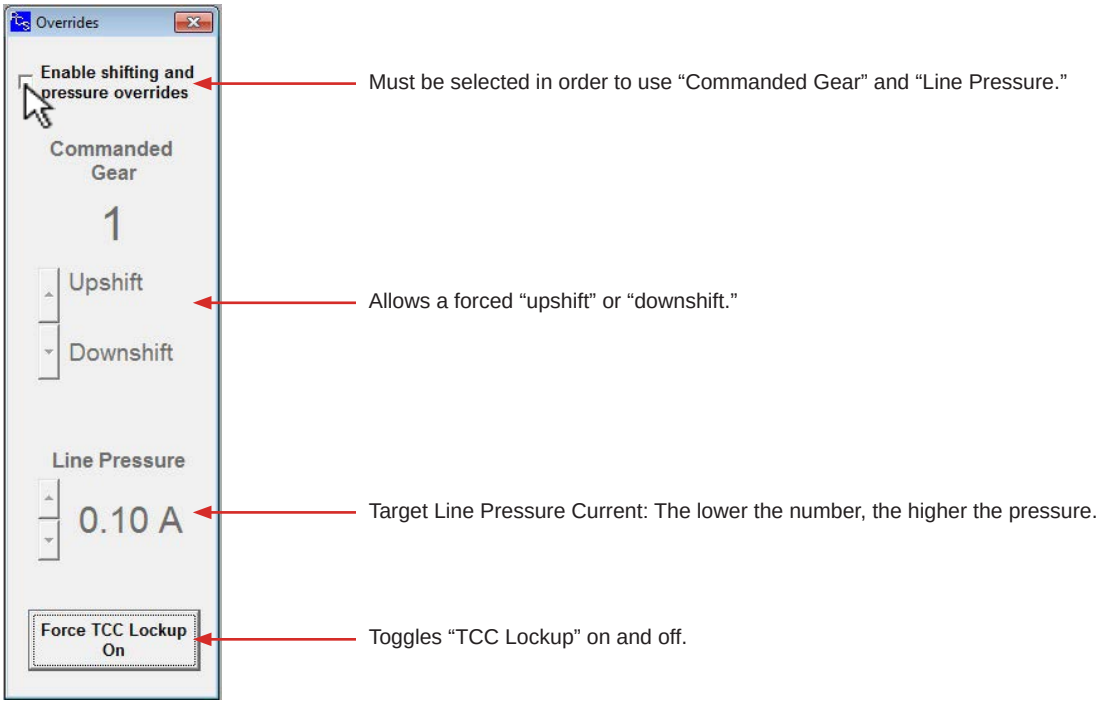

Figure 2

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Section 5.7 - Viewing Active Trouble Codes

Trouble Codes will appear in the lower right hand corner of the "Monitor" screen. **Reference Figure 1**.

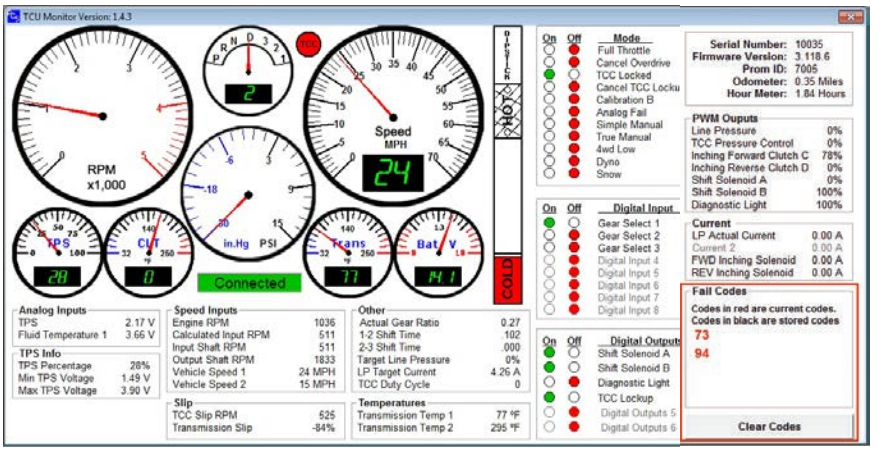

Figure 1

1. To view a trouble, click the corresponding code number. **Reference Figure 2**.

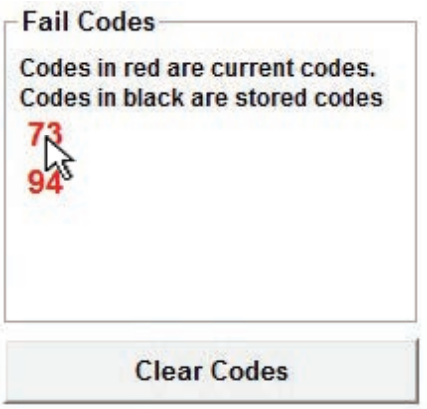

Figure 2

2. Once the trouble code number is clicked, a code description will appear. **Reference Figure 3**.

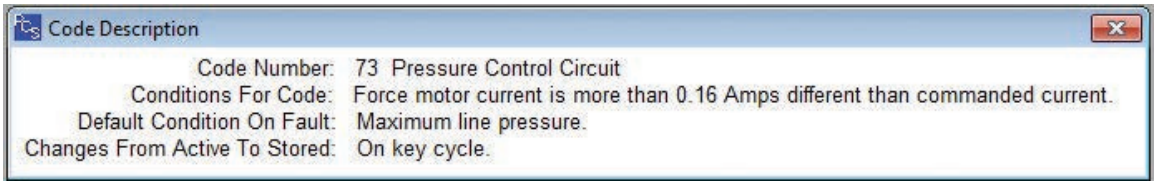

Figure 3

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Section 5.8 - Clearing Trouble Codes

1. To clear trouble codes, click the “Clear Codes” button in the “Fail Codes” section. **Reference Figure 1**.

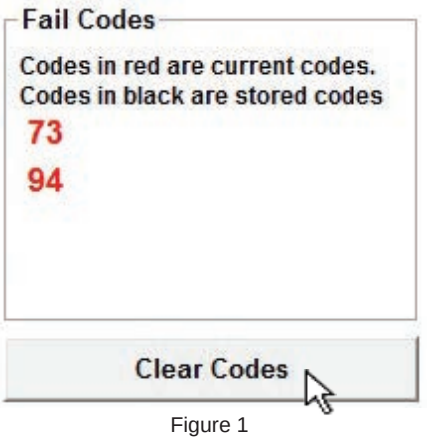

Figure 1

Section 5.9 - Viewing Monitored Trouble Codes

The TCM can monitor all of the codes listed in the DTC list in this document. However, based on the vehicle configuration, mission, and other factors, the vehicle manufacturer may choose not to monitor all available trouble codes.

The list of currently monitored trouble codes can be viewed as described below.

1. Select “Show Available Diagnostic Codes” from the menu bar. **Reference Figure 1**.

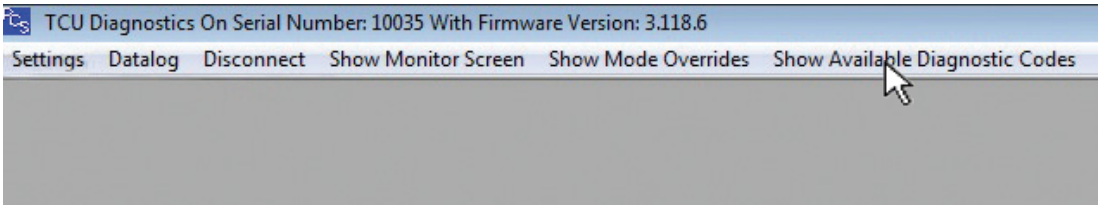

Figure 1

2. The “Available Diagnostic Codes” list will appear . Reference Figure 2.

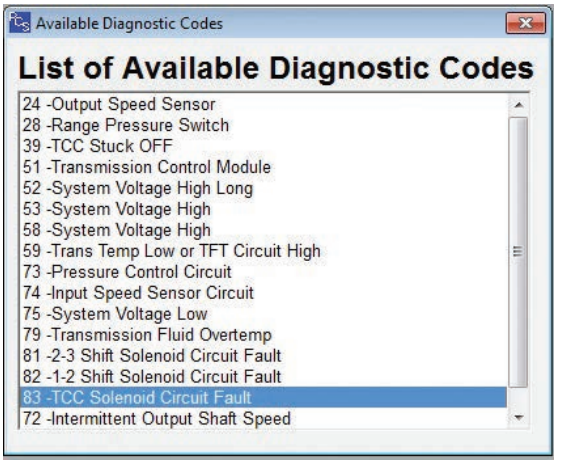

Figure 2

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Section 5.10 - Software Ordering Information

PCS Part #	Description	Contents
TCM4640	Diagnostic USB Cable and Software CD for TCM2600	Software Disc & USB COM Cable

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