



Automate-2 Trouble Shooting Guide

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INTRODUCTION

This guide has been written to assist a field technician in diagnosing and troubleshooting failures encountered with the AutoMate-2™ semi-automatic transmission. If you need further assistance, contact the **TTC Support Line**

SAFETY FIRST

Carefully read this troubleshooting guide before beginning any work on your Spicer transmission.

Throughout this literature, you will see symbols that warn of potential physical dangers or product damage if the accompanying instructions are not followed. Here are the symbols and their meanings:



This symbol indicates a potentially hazardous situation. If the instructions aren't followed, the result could be death or serious injury.



This symbol indicates that you must do something in order for the transmission to function properly.



This symbol indicates that you must NOT do something in order to avoid damaging the transmission.

Be sure you understand all procedures and instructions in this guide before you begin working on your Spicer transmission. If you have any questions, contact your Spicer transmission representative or call the Spicer Support Line.

GENERAL SAFETY PRECAUTIONS



Be sure to set air brakes before beginning any transmission troubleshooting procedure.



Never shift automated gears while the engine is running.

INCLUDED AT THE BACK OF THIS TROUBLESHOOTING GUIDE:

- ▶ QUICK REFERENCE CARD (2370 / SUPPLEMENT B)
- ▶ SOFTWARE DISK (2370 / SUPPLEMENT C)
USE THE DISK WITH AN IBM-COMPATIBLE COMPUTER. SEE PAGE 16 FOR COMPUTER INSTRUCTIONS.

The information in this guide was current at the time of publication. The TTC Support Line (800-401-9866) can advise you of any changes or updates.

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GENERAL INFORMATION

HOW TO SHIFT THE SPICER MODEL AUTOMATE-2™

The AutoMate-2™ is a ten-speed, semi-automatic transmission. The gear ratios, percent steps and torque capacities of each AutoMate-2™ model exactly match those of the corresponding manual transmission.

The first eight gears and reverse are shifted in the same manner as the equivalent manual transmission. The 9th and 10th gears of the AutoMate-2™ are fully automated. When sufficient road speed is attained in 8th gear and the driver selects the "A" (Auto) lever position (Figure 1), the AutoMate-2™ transmission automatically shifts into 9th gear and then into 10th gear.

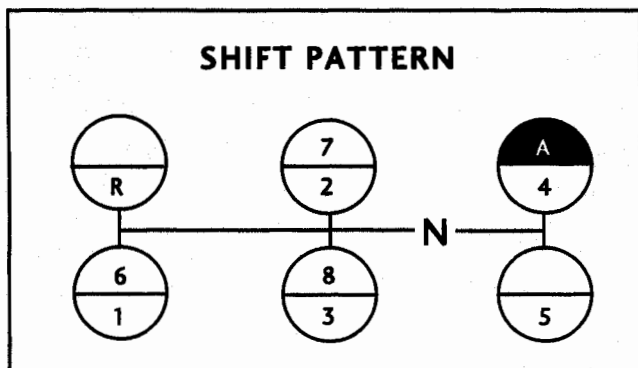


Figure 1

The shift points between 9th and 10th gear are based on the following variables: road speed, engine RPM, throttle position, brake, clutch, and cruise control status. The transmission also automatically downshifts from 10th to 9th gear, according to the variables just mentioned. Automatic shifting is based on software parameters stored in the transmission controller.

Starting the Vehicle From a Stop

1. Place the gear shift lever in neutral, depress the clutch pedal and set the brakes. Start the engine and allow it to build to maximum air pressure.
2. With the clutch pedal fully depressed to engage the clutch brake (See "Trucking Tips: Clutch Brake"), position the range selector to low range (Figure 2). Move the gear shift lever into 1st gear.

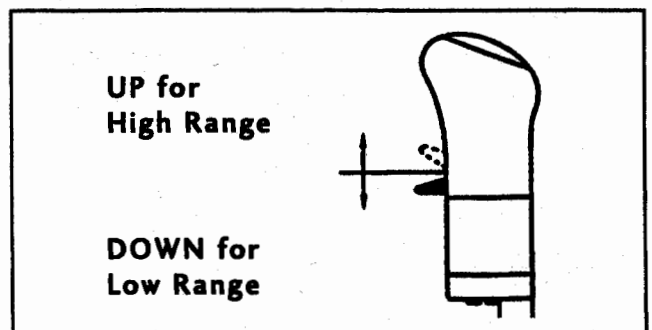


Figure 2

3. Release the tractor parking brakes (and trailer parking brakes, where applicable). Gradually release the clutch pedal to full position and depress the throttle to start the vehicle moving.
4. After attaining optimal speed in 1st gear, depress the clutch pedal. Move the gear shift lever to neutral (See "Double Clutching: Upshifting"). Move the gear shift lever to 2nd gear.
5. Continue the above procedures through 5th gear.
6. To continue upshifting (6th gear through Auto), pre-select high range on the range selector. Depress the clutch pedal and move the gear shift lever from 5th gear to neutral (See "Double Clutching: Upshifting"). Then move the gear shift lever into 6th gear.

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7. After attaining optimal speed in 6th gear, depress the clutch pedal. Move the gear shift lever to neutral (See "Double Clutching: Upshifting") and move the gear shift lever into 7th gear.
8. Repeat for 8th gear.
9. After attaining optimal speed in 8th gear, depress the clutch pedal and move the gear shift lever to neutral. Release the clutch pedal and move the gear shift lever to the Auto position. It is not necessary to depress the clutch pedal when shifting into Auto. All up and down shifting between 9th and 10th gears will now be done automatically.

TRUCKING TIPS

Downshifting

Downshifting is actually just the reverse of upshifting (See "Double Clutching: Downshifting").

Clutch Brake

The clutch brake used with this unit is designed to stop gear rotation so you can shift into 1st and reverse gears. The last 1" of clutch pedal travel activates the clutch brake. On shifts other than 1st or reverse from a stop, depress the clutch pedal only enough to release the clutch. Depressing the pedal to the floorboard will activate the clutch brake and could cause gear hang-up or hard shifting.

When selecting a starting gear if you have a butt-tooth condition, gradually release the clutch so the drive gear can rotate. This will align the gear clutching teeth to complete the shift.

Double Clutching

Upshifting: The normal double clutching technique is suggested. When you want to shift, depress the clutch and move the lever to neutral. Engage the clutch and allow the engine RPM to drop so that the engine speed and driveline speed match. Depress the clutch and move the lever into gear. Engage the clutch and accelerate as conditions permit. Clutching is not required to go from 9th to 10th gear. These gears shift automatically.

Downshifting: Downshifting is the reverse of upshifting. As the engine approaches the shift point (start the downshift approximately 50 - 100 RPM above the shift point), depress the clutch and move the lever to neutral. Engage the clutch and raise the engine RPM until the engine and driveline speeds are equal (normally, governed speed). Depress the clutch and then shift into the next lower gear. Engage the clutch. Clutching is not required when shifting from 10th to 9th gear. These gears shift automatically.

Skip Shifting

Experienced drivers sometimes want to skip some of the ratios. This is acceptable; however, you should do this only when operating conditions allow. Your speed, load, and road type and condition should be considered.

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REMINDERS



Double clutch when shifting. This will help components match speed better during shifts and help ensure proper engagement.



Downshift through all gear speeds when slowing down. Chassis and trailer brake life can be increased by doing this.



Do not force the shift, since this can cause damage to clutch collars and clutching teeth. Use steady force on the shift lever to complete shifts.



Do not coast in neutral. The vehicle could lose RPMs during coasting, and you may not be able to shift back into the proper gear, leading to loss of vehicle control and possible injury or death.



Do not downshift at excessive road speeds. This could prevent proper gear engagement and could damage clutching teeth.



Do not tow vehicles without first pulling the axles or disconnecting the driveshaft. If you tow a vehicle without doing this, you could damage drivetrain components because the system lubrication is inadequate when a vehicle is towed.

OTHER INFORMATION

- ◆ When the transmission is placed in the Auto position, all shifts between the top two gears are automatic and made without using the clutch.
- ◆ It is not necessary to depress the clutch when placing the shift lever in the Auto position.
- ◆ Throttle movement is not necessary to initiate a shift.

- ◆ Cruise control can be used when the shift lever is in the Auto position.
- ◆ Braking can be performed during a shift.
- ◆ If braking occurs when in the top gear, the transmission will downshift at a higher shift point to optimize engine braking. The transmission will not upshift until the throttle is depressed.
- ◆ When climbing a hill, the transmission will downshift if necessary. If the hill is beyond the capability of the top two gears, downshifting out of Auto is necessary.
- ◆ If the gear selector remains in Auto when the vehicle is brought to a stop, the transmission will shift to neutral to prevent the engine from stalling.
- ◆ If the gear selector is removed from Auto and the vehicle is accelerating, the transmission will stay in Auto.
- ◆ If the transmission is in Auto, 9th gear and going downhill, the transmission will upshift only if the accelerator is depressed, or "Resume" is activated on the cruise control.
- ◆ If the transmission is in neutral and the vehicle speed exceeds what would be governed engine speed for the gear directly before Auto, the transmission will shift into the lowest gear in Auto.
- ◆ When the vehicle is first keyed on, the transmission warning light will illuminate like other dash lights for a bulb check and then go out. This also indicates a successful self-diagnostic routine.
- ◆ If the transmission warning light illuminates at other times, a problem or error in operation has been detected. If a fault has been detected, a fault code will be stored in the transmission's computer to aid the service technician. Expect degraded performance and have the transmission serviced as soon as possible.

TROUBLESHOOTING

This guide is divided into sections corresponding to the type of diagnostic method used. Refer to the section of your choice and begin with the basic description of the type of failure you are experiencing.

To properly troubleshoot the AutoMate-2™ transmission, you must take a systems approach. The electronic transmission is part of a total integrated vehicle system that also includes the electronic engine, antilock brake and traction control systems. Information is shared among all systems over the vehicle's J1587 DATA LINK. Engine command messages are sent over the J1922 CONTROL LINK.

As a result of this integrated vehicle system, a malfunction in one part of the system can affect the functioning of other system components. That is why, when diagnosing a transmission problem, it is important to first determine that all other parts of the system are functioning properly.

Check these areas first and make the necessary corrections before proceeding. Listed below are areas that can affect transmission performance:

- ◆ Engine power derate conditions:
 - Low engine oil pressure
 - High engine oil temperature
 - High engine boost air temperature
 - High engine coolant temperature
 - Low engine coolant level
 - Loss of tailshaft signal
- ◆ Brake switch failure
- ◆ Traction control and ABS system failure
- ◆ Clutch switch failure
- ◆ Throttle position sensor failure

Failures of an electrical nature are detected by the transmission's computer and stored as fault codes. Accessing these diagnostic fault codes for troubleshooting is accomplished by one of three methods:

- ◆ Flash code
- ◆ MPSI ProLink diagnostic tool
- ◆ Personal computer using Spicer diagnostic software

All three diagnostic methods give you direct feedback on the stored fault codes. However, only the personal computer method allows you to cycle the shift components and monitor feedback sensors and communication data links to help troubleshoot a transmission problem.

TROUBLESHOOTING TOOLS

Required Tools

- ◆ 12 volt +/- 1 volt DC power source capable of sourcing 2.5 AMP minimum
- ◆ Multimeter and test leads
- ◆ Permanent magnet with indicated north and south poles
- ◆ Pressure gauge capable of accurately reading pressure between 45 and 60 psi.

Optional Tools

These tools are not required for transmission troubleshooting but make it easier to determine problems.

- ◆ IBM-compatible personal computer, RS232 to 485 serial link adapter (Spicer 201-615-4, Kent Moore or equivalent), and Spicer AutoMate-2™ diagnostic software. The computer and software allow access to stored fault codes and make it possible to cycle the shift components and monitor the feedback sensors. This tool may also be used to monitor data link functions.

OR

- ◆ MPSI ProLink diagnostic tool with standard heavy duty cartridge. This allows access to stored fault codes and makes it possible to monitor some feedback systems.

TROUBLESHOOTING WITH FLASH CODES OR MPSI PROLINK PROBLEM - ACTION LIST

Listed below are conditions that may indicate the transmission needs servicing. Following each sign or symptom are appropriate actions to be taken to correct the problem.

After identifying the problem you are experiencing, perform the procedures indicated in the order in which they are listed. If any procedure fails to correct the problem, perform the next procedure listed. If the problem is not corrected after all procedures are performed, call the Spicer Support Line (800-666-8688) for further assistance. The procedures must be performed in the order in which they are listed. Step-by-step instructions for each action are shown later in this guide.

After repairing the transmission, you must also clear the vehicle's internal computer and erase any fault codes that may have been stored in its memory. This is done with an electronic diagnostic tool (MPSI ProLink, Spicer diagnostic software, or the equivalent). Repairing the operational problem will not clear the fault codes from the computer memory; you must do this separately.

Vehicle electrical power must exist in order for the transmission computer to access stored fault codes. If the transmission light does not blink when the key is first turned on, the computer may not be receiving any electrical power. Review the transmission CONTROLLER TO VEHICLE WIRING HARNESS diagram on page 32 to determine the problem.

PROBLEM: TRANSMISSION WILL NOT SHIFT TO 9TH GEAR

ACTION:

- ◆ Check for flash codes on the vehicle's dashboard by turning the key on three times or by hooking up the MPSI ProLink to the diagnostic port on the dashboard and reading the fault codes. Refer to the table on page 9. Perform the repair procedure listed for the appropriate diagnostic code. This may or may not repair the transmission. If it does not, proceed to the next action step, below.

ate diagnostic code. This may or may not repair the transmission. If it does not, proceed to the next action step, below.

- ◆ Confirm proper air pressure from the AIR FILTER REGULATOR - See Procedure #7 (page 13).
- ◆ Confirm proper operation of the AUTO SWITCH - See Procedure #1 (page 10).
- ◆ Confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and 9TH GEAR SHIFT SOLENOID - See Procedure #4 (page 11).
- ◆ Confirm proper operation of the GEAR POSITION SENSOR - See Procedure #2 (page 10).

PROBLEM: TRANSMISSION WILL NOT SHIFT TO 10TH GEAR

ACTION:

- ◆ Check for flash codes on the vehicle's dashboard by turning the key on three times or by hooking up the MPSI ProLink to the diagnostic port on the dashboard and reading the fault codes. Refer to the table on page 9. Perform the repair procedure listed for the appropriate diagnostic code. This may or may not repair the transmission. If it does not, proceed to the next action step, below.
- ◆ Confirm proper air pressure from the AIR FILTER REGULATOR - See Procedure #7 (page 13).
- ◆ Confirm proper operation of the AUTO SWITCH - See Procedure #1 (page 10).
- ◆ Confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and 10TH GEAR SHIFT SOLENOID - See Procedure #3 (page 11).
- ◆ Confirm proper operation of the GEAR POSITION SENSOR - See Procedure #2 (page 10).

TROUBLESHOOTING WITH FLASH CODES OR MPSI PROLINK PROBLEM - ACTION LIST

PROBLEM: TRANSMISSION IS LOCKED IN 9TH GEAR OR 10TH GEAR

ACTION:

- ◆ If the vehicle must be moved for repair, activate emergency override to disable automated shifts - See Procedure #8 (page 13).
- ◆ Check for flash codes on the vehicle's dashboard by turning the key on three times or by hooking up the MPSI ProLink to the diagnostic port on the dashboard and reading the fault codes. Refer to the table on page 9. Perform the repair procedure listed for the appropriate diagnostic code. This may or may not repair the transmission. If it does not, proceed to the next action step, below.
- ◆ Confirm proper air pressure from the AIR FILTER REGULATOR - See Procedure #7 (page 13).
- ◆ Confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and NEUTRAL SHIFT SOLENOID - See Procedure #5 (page 12).
- ◆ Confirm proper operation of the AUTO SWITCH - See Procedure #1 (page 10).
- ◆ Confirm proper operation of the GEAR POSITION SENSOR - See Procedure #2 (page 10).

PROBLEM: TRANSMISSION WILL NOT SHIFT INTO AUTO POSITION

ACTION:

- ◆ Check for flash codes on the vehicle's dashboard by turning the key on three times or by hooking up the MPSI ProLink to the diagnostic port on the dashboard and reading the fault codes. Refer to the table on page 9. Perform the repair procedure listed for the appropriate diagnostic code. This may or may not repair the transmission. If it does not, proceed to the next action step, below.
- ◆ Confirm the power supply and TRANSMISSION CONTROLLER functions - See Procedure #9 (page 14).
- ◆ Confirm the override feature has not been used - See Procedure #10 (page 14).
- ◆ Confirm proper air pressure from the AIR FILTER REGULATOR - See Procedure #7 (page 13).
- ◆ Confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and 9TH and/or 10TH GEAR SHIFT SOLENOID - See Procedure #4 and/or Procedure #3 (page 11).

TROUBLESHOOTING WITHOUT A COMPUTER USING DIAGNOSTIC CODES

Use this table along with the MPSI ProLink or flash codes on the dashboard to diagnose a problem area and to determine the proper troubleshooting procedure.

MPSI PROLINK (HEAVY DUTY STANDARD CARTRIDGE)	FLASH CODE	PROBLEM AREA	TROUBLESHOOTING PROCEDURE
	One Short Flash	None - System is fine	None
1922 SHORTED LOW/HI	One Flash	J1922 Control Link	Confirm proper operation of CONTROL LINK (See Procedure #11)
1587 INTERMITTENT	Two Flashes	J1587 Data Link	Confirm proper operation of DATA LINK (See Procedure #12)
TRANSMISSION OUTPUT SPEED INTERMITTENT	Three Flashes	Speed Sensor	Confirm proper operation of SPEED SENSOR (See Procedure #13)
GEAR SENSOR SHORTED LOW/HI	Four Flashes	Gear Position Sensor	Confirm proper operation of GEAR POSITION SENSOR (See Procedure #2)
SOLENOID #3 INTERMITTENT	Five Flashes	Neutral Shift Solenoid	Confirm proper operation of CONTROLLER TO TRANSMISSION WIRING HARNESS and NEUTRAL SHIFT SOLENOID (See Procedure #5)
SOLENOID #2 INTERMITTENT	Six Flashes	9th Gear Solenoid	Confirm proper operation of CONTROLLER TO TRANSMISSION WIRING HARNESS and 9TH GEAR SHIFT SOLENOID (See Procedure #4)
SOLENOID #1 INTERMITTENT	Seven Flashes	10th Gear Solenoid	Confirm proper operation of CONTROLLER TO TRANSMISSION WIRING HARNESS and 10TH GEAR SHIFT SOLENOID (See Procedure #3)

TROUBLESHOOTING PROCEDURES WITHOUT A COMPUTER

1. CONFIRMING PROPER OPERATION OF AUTO SWITCH

A. Disconnect the 2 pin connector at the AUTO SWITCH. Using suitable test probes, connect an ohm meter across the two pins of the AUTO SWITCH. Place the shift lever in neutral. The meter should read less than 20 ohms.

- ▶ If resistance is greater than 20 ohms, replace the AUTO SWITCH.
- ▶ If resistance is 20 ohms or less, place the shift lever in the Auto position. Resistance should read greater than 100,000 ohms.
 - ▶ If resistance is greater than 100,000 ohms, the AUTO SWITCH is functioning properly.
 - ▶ If resistance is less than 100,000 ohms, replace the AUTO SWITCH.

B. Check the CONTROLLER TO TRANSMISSION WIRING HARNESS by placing a jumper cable between the two pins of the AUTO SWITCH connector and measuring the resistance between pins 17 and 19 of the J5 transmission computer connector. Refer to the CONTROLLER TO TRANSMISSION WIRING HARNESS diagram on page 30 or 31.


- ▶ If resistance is less than 5 ohms, the harness is functioning properly. Proceed to the next action item in the PROBLEM-ACTION LIST (page 7 or 8).
- ▶ If resistance is greater than 5 ohms, replace the CONTROLLER TO TRANSMISSION WIRING HARNESS.

2. CONFIRMING PROPER OPERATION OF GEAR POSITION SENSOR

A. Turn the ignition on. (Do not start the vehicle.) Place the transmission in high range and move the shift lever to

the Auto position. The transmission light on the dashboard should turn on. Remove the lever from the Auto position, and the light should go out. If this does not occur, the AUTO SWITCH system is not working properly. Continue to Step B.

B. Remove the GEAR POSITION SENSOR from the top of the transmission shift tower by removing the screw that secures it. Carefully connect a 12-volt DC power supply between pin A (positive) and pin D (negative) of the sensor connector.

 Supplying voltage to any other terminal will destroy the sensor. Connect an ohm meter positive lead to pin D and a negative lead to pin C.

C. Using a permanent magnet, pass the south pole across the round bottom face of the GEAR POSITION SENSOR.

▶ If the meter reading is less than 30 ohms, the GEAR POSITION SENSOR is functioning properly.

▶ If the meter reading is 30 ohms or greater, replace the GEAR POSITION SENSOR. This should correct the fault.

D. Pass the north pole of the magnet across the bottom of the sensor.

▶ If the meter reading is greater than 100,000 ohms, the GEAR POSITION SENSOR is functioning properly.

▶ If the meter reading is less than 100,000 ohms, replace the GEAR POSITION SENSOR. This should correct the fault.

E. Check the CONTROLLER TO TRANSMISSION WIRING HARNESS (J5). Refer to the electrical schematic and check for open or short circuits.

TROUBLESHOOTING PROCEDURES WITHOUT A COMPUTER

3. CONFIRMING PROPER OPERATION OF CONTROLLER TO TRANSMISSION WIRING HARNESS AND 10TH GEAR SHIFT SOLENOID

A. Disconnect the 19 pin connector of the TRANSMISSION TO CONTROLLER WIRING HARNESS from the TRANSMISSION CONTROLLER.

B. Connect an ohm meter across pins 3 and 14 of the transmission WIRING HARNESS.

► If the reading is greater than 8 ohms but less than 20 ohms, the 10th gear shift circuit is functioning properly. Go to the next action listed in the PROBLEM-ACTION LIST (page 7 or 8).

► If the reading is not between 8 ohms and 20 ohms:

- Disconnect the HI shift valve on the opposite end of the WIRING HARNESS. This connector is located near the piston housing on the right of the transmission and is connected to the 10TH GEAR SHIFT SOLENOID. The solenoid is marked "HI" on the actuator housing near the base of the solenoid and is the solenoid closest to the front of the transmission.

- With the ohm meter still across pins 3 and 14, the meter should read greater than 100,000 ohms.

► If the meter reading is less than 100,000 ohms, replace the WIRING HARNESS. This should correct the fault.

► If the meter reading is greater than 100,000 ohms, short the two pins on the HI connector and again read the resistance between pins 3 and 14. Resistance should read less than 5 ohms.

► If resistance is greater than 5 ohms, replace the WIRING HARNESS. This should correct the fault.

► If resistance is less than 5 ohms, the WIRING HARNESS is functioning properly. Check resistance of the solenoid coil by attaching an ohm meter on two solenoid pins. Resistance in the coil of the 10TH GEAR SHIFT SOLENOID should read between 8 ohms and 20 ohms. If it does not, replace the 10TH GEAR SHIFT SOLENOID by following the instructions to remove or replace SHIFT SOLENOIDS (Procedure #6 in this section).

4. CONFIRMING PROPER OPERATION OF CONTROLLER TO TRANSMISSION WIRING HARNESS AND 9TH GEAR SHIFT SOLENOID

A. Disconnect the 19 pin connector of the CONTROLLER TO TRANSMISSION WIRING HARNESS from the TRANSMISSION CONTROLLER.

B. Connect an ohm meter across pins 4 and 15 (Navistar, pins 4 and 14) of the transmission WIRING HARNESS.

► If the reading is greater than 8 ohms but less than 20 ohms, the 9th gear shift circuit is functioning properly. Go to the next action listed in the PROBLEM-ACTION LIST (page 7 or 8).

► If the reading is not between 8 ohms and 20 ohms:

- Disconnect the low shift valve on the opposite end of the WIRING HARNESS. This connector is located near the piston housing on the right of the transmission and is connected to the HI GEAR SHIFT SOLENOID. The solenoid is marked "LOW" on the actuator housing near the base of the solenoid and is the solenoid closest to the back of the transmission.

- With the ohm meter still across pins 4 and 15 (Navistar, pins 4 and 14), the meter should read greater than 100,000 ohms.

TROUBLESHOOTING PROCEDURES WITHOUT A COMPUTER

- If the meter reading is less than 100,000 ohms, replace the WIRING HARNESS. This should correct the fault.
- If the meter reading is greater than 100,000 ohms, short the two pins on the HI connector and again read the resistance between pins 4 and 15 (Navistar, pins 4 and 14). Resistance should read less than 5 ohms.
 - If resistance is greater than 5 ohms, replace the WIRING HARNESS. This should correct the fault.
 - If resistance is less than 5 ohms, the WIRING HARNESS is functioning properly. Check the resistance of the solenoid coil by attaching an ohm meter on two solenoid pins. Resistance in the coil of the 9TH GEAR SHIFT SOLENOID should read between 8 ohms and 20 ohms. If it does not, replace the 9th gear solenoid by following the instructions to remove or replace SHIFT SOLENOIDS (Procedure #6 in this section).

5. CONFIRMING PROPER OPERATION OF CONTROLLER TO TRANSMISSION WIRING HARNESS AND NEUTRAL SHIFT SOLENOID

- A. Disconnect the 19 pin connector of the TRANSMISSION TO CONTROLLER WIRING HARNESS from the TRANSMISSION CONTROLLER.
- B. Connect an ohm meter across pins 5 and 16 (Navistar, pins 5 and 14) of the transmission WIRING HARNESS.
 - If the reading is greater than 8 ohms but less than 20 ohms, the neutral shift circuit is functioning properly. Go to the next action listed in the PROBLEM-ACTION LIST (page 7 or 8).

- If the reading is not between 8 ohms and 20 ohms:
 - Disconnect the "N" shift valve on the opposite end of the WIRING HARNESS. This connector is located near the piston housing on the right of the transmission and is connected to the NEUTRAL SHIFT SOLENOID. The solenoid is marked "N" on the actuator housing near the base of the solenoid and is the middle solenoid.
 - With the ohm meter still across pins 5 and 16 (Navistar, pins 5 and 14), the meter should read greater than 100,000 ohms.
 - If the meter reading is less than 100,000 ohms, replace the WIRING HARNESS. This should correct the fault.
 - If the meter reading is greater than 100,000 ohms, short the two pins on the neutral connector and again read the resistance between pins 5 and 16 (Navistar, pins 5 and 14). Resistance should read less than 5 ohms.
 - If resistance is greater than 5 ohms, replace the WIRING HARNESS. This should correct the fault.
 - If resistance is less than 5 ohms, the WIRING HARNESS is functioning properly. Check the resistance of the solenoid coil by attaching an ohm meter on two solenoid pins. Resistance in the coil of the NEUTRAL SHIFT SOLENOID should read between 8 ohms and 20 ohms. If it does not, replace the solenoid by following the instructions to remove or replace SHIFT SOLENOIDS (Procedure #6 in this section).

TROUBLESHOOTING PROCEDURES WITHOUT A COMPUTER

6. REMOVING AND REPLACING SHIFT SOLENOIDS

This procedure is used when the coil of the solenoid has been confirmed defective. Perform this procedure for the NEUTRAL SHIFT SOLENOID, as well as the 9TH and 10TH GEAR SHIFT SOLENOIDS because they are nearly identical valves.

- A. Remove the 1/4" OD nylon tubing from the top exhaust port of the shift valve. Use two wrenches to remove the fitting from the valve exhaust port.
- B. Remove the 2 pin electrical connector from the coil of the valve to be replaced.
- C. With a 1 3/8" wrench, turn the valve counterclockwise using the hex at the base of the valve. After the valve is removed, remove the o-rings from the bottom of the valve manifold.
- D. Clean any residual o-ring lubricant and remove all foreign matter from the manifold. New o-rings should be included with the new valve. Liberally coat the new o-rings with Parker o-ring lubricant or the equivalent.
- E. Place o-rings in their respective grooves at the bottom of the valve manifold. Apply Loctite #242 (Spicer part number 545080), or an equivalent thread lock, to threads of the new valve.
- F. Install the new valve by screwing it in clockwise and torquing it to 12 - 15 ft. lbs.
- G. Remove the elbow fitting from the exhaust port of the defective valve and screw the fitting into the exhaust port of the new valve.
- H. Replace nylon tubing to the elbow/tee fitting. Connect the electrical connector to the valve coil connector.
- I. This should correct the fault. If it does not, go to the next action listed in the PROBLEM-ACTION LIST (page 7 or 8).

7. CONFIRMING PROPER AIR PRESSURE FROM THE AIR FILTER REGULATOR

This procedure confirms that the air pressure provided from the AIR FILTER REGULATOR is sufficient to allow proper shifting of the transmission 9/10 air piston. This AIR FILTER REGULATOR is attached to a bracket and mounted to a rear countershaft bearing cap.

Without air pressure to the input of the AIR FILTER REGULATOR, disconnect the output and attach a pressure gauge to the output side of the AIR FILTER REGULATOR. Apply at least 60 psi to the input of the AIR FILTER REGULATOR and read the pressure gauge.

- If pressure is less than 50 psi or greater than 55 psi, replace the AIR FILTER REGULATOR or service it, following the procedures on page 29.
- If pressure is between 50 psi and 55 psi, the AIR FILTER REGULATOR is functioning properly.

8. EMERGENCY OVERRIDE TO DISABLE AUTOMATED SHIFTS

Use this procedure only if the transmission is stuck in 9th or 10th gear, and the driver is unable to use the lower eight manual gears.

The emergency override procedure involves overriding the 9th, neutral and 10th shift solenoids. This override mode completely disables the 9th and 10th gears of the transmission and enables the driver to have manual control of the first eight gears and drive the vehicle to the nearest service facility for repairs.

Again, this is to be used only if the transmission is stuck in 9th or 10th gear, and the driver is unable to use the lower eight manual gears.

TROUBLESHOOTING PROCEDURES WITHOUT A COMPUTER



DANGER

**BEFORE ACTIVATING THE OVERRIDE MODE,
TURN OFF THE ENGINE AND
ACTIVATE THE PARKING BRAKE.**

*Failure to do so would cause the vehicle to move and
could result in serious injury or death.*

- A. Locate the override valve from underneath the vehicle. The valve is located in the 9/10 actuator housing, which is mounted on the right side of the transmission shift tower.
- B. To activate the valve, remove the pin near the center and on top of the piston housing. This will return the transmission to neutral.
- C. Upon completion of corrective maintenance, push the plunger in and replace the pin to reactivate the system.

9. CONFIRMING THE POWER SUPPLY AND TRANSMISSION CONTROLLER FUNCTIONS

- A. Turn the key switch on. (Do not start the vehicle.)
 - If the transmission light comes on and then goes out, this signifies normal operation.
 - If the transmission light does not come on, check the bulb and both fuses. Refer to the appropriate vehicle manufacturer's service manual to locate fuses.
- B. After confirming that the fuses and bulb are in good condition, check the CONTROLLER TO VEHICLE WIRING HARNESS. Unplug the J4 CONNECTOR and check with a multimeter. Check for 12 volts on pins 1 and 8, and check for ground on pins 14 and 15. If these

do not occur, check the CONTROLLER TO VEHICLE WIRING HARNESS for any short or open circuits.

- ⊘ Do not short the specified pins to any other pins.

10. CONFIRMING THE OVERRIDE FEATURE HAS NOT BEEN USED

- A. Check to be sure the pin has not been removed from the override valve on the top of the actuator housing. The pin is located on the actuator housing, which is bolted on top of the transmission.
 - If the pin is missing, replace it.
 - If the pin is in place, perform the next action listed on the PROBLEM-ACTION LIST (page 7 or 8).
- B. For further information on the override feature, refer to Procedure #8 in this section (EMERGENCY OVERRIDE TO DISABLE AUTOMATED SHIFTS).

11. CONFIRMING PROPER OPERATION OF J1922 CONTROL LINK

Inspect the CONTROLLER TO VEHICLE WIRING HARNESS (J4 pins 11 and 18) for short and open circuits. Refer to the diagram shown on page 32. It is sometimes helpful to disconnect each node (controller) one at a time to isolate a controller or data link problem.

- If short or open circuits are found, repair or replace the HARNESS as necessary.
- If no short or open circuits are found and the HARNESS appears to be in working condition, verify that other components using the J1922 CONTROL LINK are not causing CONTROL LINK failure.

TROUBLESHOOTING PROCEDURES WITHOUT A COMPUTER

12. CONFIRMING PROPER OPERATION OF J1587 DATA LINK

Inspect the CONTROLLER TO VEHICLE WIRING HARNESS (J4 pins 11 and 18) for shorts and open circuits. Refer to the diagram on page 32. It is sometimes helpful to disconnect each node (controller) one at a time to isolate a controller or data link problem.

- If short or open circuits are found, repair or replace the HARNESS as necessary.
- If no short or open circuits are found and the HARNESS appears to be in working condition, verify that other components using the J1587 DATA LINK are not causing DATA LINK failure.

13. CONFIRMING PROPER OPERATION OF SPEED SENSOR

- A. Check the gap adjustment of the sensor on the output shaft. The sensor should be softly bottomed against the gear and then backed out 1/2 turn and locked (.031" gap).
- B. After adjusting the sensor correctly, measure the coil resistance between pins A and B on each output connector. Resistance should be a maximum of 1.5K ohms (1,500 ohms).
- C. Check for shorts to the sensor housing case (ground) and between coils. If there are any doubts, replace the sensor and check for proper functioning.
- D. Inspect the CONTROLLER TO TRANSMISSION WIRING HARNESS by placing a jumper across the 2 pin sensor connector and measuring resistance between pins 8 and 9 of the J5 transmission computer connector. Refer to the CONTROLLER TO TRANSMISSION WIRING HARNESS diagram on page 30 or 31.

- If resistance is less than 5 ohms, the CONTROLLER TO TRANSMISSION WIRING HARNESS is functioning properly.
 - If resistance is greater than 5 ohms, replace the CONTROLLER TO TRANSMISSION WIRING HARNESS.
- E. Some engines and vehicles use the speed information that the transmission computer makes available. This information is sent out on the CONTROLLER TO VEHICLE WIRING HARNESS. Check for opens or shorts in this system. For complete troubleshooting information, obtain the specific wiring information for the vehicle being serviced.

COMPUTER TROUBLESHOOTING PROCEDURES

PROBLEM - ACTION LIST

Listed below are common signs that may indicate the transmission needs servicing. Following each sign or symptom are appropriate actions to be taken to correct the problem.

After identifying the problem you are experiencing, perform the procedures indicated in the order in which they are listed. If any procedure fails to correct the problem, perform the next procedure listed. If the problem is not corrected after all procedures are performed, call the Spicer Support Line (800-666-8688) for further assistance. The procedures must be performed in the order in which they are listed. Step-by-step instructions for each action are shown later in this guide.

After repairing the transmission, you must also clear the vehicle's internal computer and erase any fault codes that may have been stored in its memory. This is done with an IBM-compatible computer or MPSI ProLink. Repairing the operational problem will not clear the fault codes from the vehicle's computer memory; you must do this separately.

Vehicle electrical power must exist for the transmission computer to access stored fault codes. If the transmission light does not blink when the key is first turned on, the computer may not be receiving any electrical power. Review the transmission CONTROLLER TO VEHICLE WIRING HARNESS diagram on page 32 to determine the problem.

PROBLEM: TRANSMISSION WILL NOT SHIFT TO 9TH GEAR

ACTION:

- ◆ Connect the IBM-compatible computer to the vehicle's diagnostic port - See page 19.
- ◆ Confirm proper air pressure from the AIR FILTER REGULATOR - See Procedure #7 (page 26).

- ◆ Confirm proper operation of the AUTO SWITCH - See Procedure #1 (page 19).
- ◆ Confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and 9TH GEAR SHIFT SOLENOID - See Procedure #4 (page 22).
- ◆ Confirm proper operation of the GEAR POSITION SENSOR - See Procedure #2 (page 20).

PROBLEM: TRANSMISSION WILL NOT SHIFT TO 10TH GEAR

ACTION:

- ◆ Connect the IBM-compatible computer to the vehicle's diagnostic port - See page 19.
- ◆ Confirm proper air pressure from the AIR FILTER REGULATOR - See Procedure #7 (page 26).
- ◆ Confirm proper operation of the AUTO SWITCH - See Procedure #1 (page 19).
- ◆ Confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and 10TH GEAR SHIFT SOLENOID - See Procedure #3 (page 21).
- ◆ Confirm proper operation of the GEAR POSITION SENSOR - See Procedure #2 (page 20).

PROBLEM: TRANSMISSION IS LOCKED IN 9TH GEAR OR 10TH GEAR

ACTION:

- ◆ If the vehicle must be moved for repair, activate emergency override to disable automated shifts - See Procedure #8 (page 26).
- ◆ Connect the IBM-compatible computer to the vehicle's diagnostic port - See page 19.

COMPUTER TROUBLESHOOTING PROCEDURES

PROBLEM - ACTION LIST

- ◆ Confirm proper air pressure from the AIR FILTER REGULATOR - See Procedure #7 (page 26).
- ◆ Confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and NEUTRAL SHIFT SOLENOID - See Procedure #5 (page 24).
- ◆ Confirm proper operation of the AUTO SWITCH - See Procedure #1 (page 19).
- ◆ Confirm proper operation of the GEAR POSITION SENSOR - See Procedure #2 (page 20).

PROBLEM: **TRANSMISSION WILL NOT SHIFT INTO AUTO POSITION**

ACTION:

- ◆ Connect the IBM-compatible computer to the vehicle's diagnostic port - See page 19.
- ◆ Confirm the power supply and TRANSMISSION CONTROLLER functions - See Procedure #9 (page 26).
- ◆ Confirm the override feature has not been used - See Procedure #10 (page 27).
- ◆ Confirm proper air pressure from AIR FILTER REGULATOR - See Procedure #7 (page 26).
- ◆ Confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and 10TH GEAR SHIFT SOLENOID - See Procedure #3 (page 21).
- ◆ Confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and 9TH GEAR SHIFT SOLENOID - See Procedure #4 (page 22).


TROUBLESHOOTING WITH A COMPUTER USING COMPUTER MESSAGES

Use this table along with computer messages to diagnose a problem area and to determine the proper troubleshooting procedure.

COMPUTER MESSAGE RELATING TO TRANSMISSION PROBLEM	TROUBLESHOOTING PROCEDURE
J1922 SHORTED LOW/HI	Confirm proper operation of J1922 CONTROL LINK (See Procedure #11)
J1587 FAILURE	Confirm proper operation of J1587 DATA LINK (See Procedure #12)
NO OUTPUT SHAFT RPM	Confirm proper operation of SPEED SENSOR (See Procedure #13)
GEAR SENSOR SHORTED LOW/HI	Confirm proper operation of GEAR POSITION SENSOR (See Procedure #2)
NEUTRAL SOLENOID FAILURE	Confirm proper operation of CONTROLLER TO TRANSMISSION WIRING HARNESS and NEUTRAL SHIFT SOLENOID (See Procedure #5)
LOW SOLENOID FAILURE	Confirm proper operation of CONTROLLER TO TRANSMISSION WIRING HARNESS and 9TH GEAR SHIFT SOLENOID (See Procedure #4)
HI SOLENOID FAILURE	Confirm proper operation of CONTROLLER TO TRANSMISSION WIRING HARNESS and 10TH GEAR SHIFT SOLENOID (See Procedure #3)

TROUBLESHOOTING PROCEDURES USING A COMPUTER

CONNECTING THE IBM-COMPATIBLE COMPUTER TO THE VEHICLE'S DIAGNOSTIC PORT

- A. Hook up the serial data adapter between the diagnostic port on the vehicle and the serial port on the computer. The diagnostic port is generally located under the driver's side dashboard. Place the transmission in high range and fourth-hand (Auto) position.
- B. With the key switch on (engine off), and the brakes released on a flat surface, turn on the computer and insert the Spicer/Dana software disk.
 Be sure the vehicle is on a flat surface.
- C. Type "DANA" at the prompt for the drive being used. (An example of a prompt is "A:" or "B:", etc.) Follow the instructions on the screen.
- D. Select "DIAGNOSTIC INFORMATION" and, on the next screen, look for one or more flashing or highlighted fault codes in the "ACTIVE" or "INACTIVE" categories.
- E. Select "HELP" for each flashing or highlighted fault code. The computer will give you step-by-step instructions after that point. The options available on the computer correspond to procedures explained in this guide.

1. CONFIRMING PROPER OPERATION OF AUTO SWITCH

- A. With the key switch on (engine off), select "COMMAND AND CONTROL" on the computer screen.
- B. Place the transmission in high range and fourth-hand (Auto) position. An asterisk should appear next to the word "Auto."

- C. Remove the shift lever from the Auto position, and the asterisk next to the word "Auto" should disappear.
 - ▶ If an asterisk disappears, the AUTO SWITCH is functioning properly. Proceed to the next action shown in the PROBLEM-ACTION LIST (page 16 or 17).
 - ▶ If an asterisk does not disappear or does not appear at all, verify that the CONTROLLER TO TRANSMISSION WIRING HARNESS and the AUTO SWITCH are functioning properly by continuing with Step D.
- D. Disconnect the 2 pin connector at the AUTO SWITCH. The asterisk will appear or remain on the screen.
- E. Connect the CONTROLLER TO TRANSMISSION WIRING HARNESS sockets 1 and 2 together with a jumper cable. The asterisk next to "Auto" should disappear.
 - ▶ If the asterisk does not disappear, continue with Step F.
 - ▶ If the asterisk disappears, confirm proper operation of the AUTO SWITCH, by doing the following:
 - Using suitable test probes, connect an ohm meter to pins 1 and 2 of the AUTO SWITCH.
 - Be sure the shift lever is in neutral. The meter should read less than 20 ohms.
 - ▶ If resistance is greater than 20 ohms, replace the AUTO SWITCH.
 - ▶ If resistance is 20 ohms or less, place the shift lever in Auto. Resistance should read greater than 100,000 ohms.
 - ▶ If resistance is greater than 100,000 ohms, the AUTO SWITCH is functioning properly.
 - ▶ If resistance is less than 100,000 ohms, replace the AUTO SWITCH.

TROUBLESHOOTING PROCEDURES USING A COMPUTER

F. Check the CONTROLLER TO TRANSMISSION WIRING HARNESS by leaving the jumper cable between sockets 1 and 2 of the AUTO SWITCH. Measure the resistance between pins 17 and 19 on the CONTROLLER TO TRANSMISSION WIRING HARNESS. (Refer to the CONTROLLER TO TRANSMISSION wiring diagram on page 31.) Resistance should be less than 5 ohms.

► If resistance is less than 5 ohms, the CONTROLLER TO TRANSMISSION WIRING HARNESS is functioning properly. Proceed to the next action on the PROBLEM-ACTION LIST (page 16 or 17).

► If resistance is greater than 5 ohms, replace the CONTROLLER TO TRANSMISSION WIRING HARNESS.

2. CONFIRMING PROPER OPERATION OF GEAR POSITION SENSOR (GEAR SENSOR SHORTED LOW/HI)

This procedure involves electronically shifting the transmission to determine if the SHIFT SOLENOIDS and GEAR POSITION SENSOR are functioning properly.

A. Be sure the transmission is in high range and fourth-hand (Auto) position.

B. With the key switch on (engine off), and the brakes released on a flat surface, select "COMMAND AND CONTROL" on the computer screen.

C. At the next screen, select LOW gear ("FIRE LOW SOLENOID"). An asterisk will appear on the screen next to the words "LOW SOLENOID" to confirm your selection.

D. Gently roll the vehicle back and forth. It should drop into gear. If the vehicle moves freely, it did not shift into gear.

► If the vehicle does not drop into gear, confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and 9TH GEAR SHIFT SOLENOID (Procedure #4 in this section).

► If the vehicle drops into gear, the 9TH GEAR SHIFT SOLENOID is functioning properly. Continue with Step E.

E. Before continuing, make sure the transmission has shifted into gear. After the vehicle is shifted into gear, an asterisk should appear next to the word "GEAR."

► If an asterisk does not appear, go to Step K.

► If an asterisk appears, continue with Step F.

F. On the computer, select neutral ("FIRE NEUTRAL SOLENOID"). An asterisk will appear on the screen next to the words "NEUTRAL SOLENOID" to confirm your selection.

G. Confirm that the transmission is in neutral by rolling the vehicle back and forth. An asterisk should not be present next to the word "GEAR."

► If the asterisk is not present, continue with Step H.

► If the asterisk is present, proceed to Step K.

H. On the computer, select high gear ("FIRE HI SOLENOID"). An asterisk will appear on the screen next to the words "HI SOLENOID" to confirm your selection.

NOTE: You must shift to neutral before selecting high gear. Shifting directly from low to high or high to low could give a false shift indication.

I. Gently roll the vehicle back and forth. It should drop into gear. If the vehicle moves freely, it did not shift into gear.

TROUBLESHOOTING PROCEDURES USING A COMPUTER

- If the vehicle does not drop into gear, confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and 10TH GEAR SHIFT SOLENOID (Procedure #3 in this section).
- If the vehicle drops into gear, the 10TH GEAR SHIFT SOLENOID is functioning properly. Continue with Step J.
- J. After the vehicle is shifted into gear, an asterisk should appear next to the word "GEAR."
 - If an asterisk does not appear, go to Step K.
 - If an asterisk appears, the gear sensing system is functioning properly.
- K. If the transmission shifts into gear but an asterisk does not appear next to the word "GEAR," disconnect the 4 pin connector on the CONTROLLER TO TRANSMISSION WIRING HARNESS. Connect sockets C and D together with a jumper cable. An asterisk should appear next to the word "GEAR."
 - If the asterisk does not appear, check for open or short circuits in the harness between the transmission controller and the 4 pin connector. Refer to the CONTROLLER TO TRANSMISSION wiring diagram on page 30 or 31.
 - If the asterisk appears, replace the GEAR POSITION SENSOR.
- 3. CONFIRMING PROPER OPERATION OF CONTROLLER TO TRANSMISSION WIRING HARNESS AND 10TH GEAR SHIFT SOLENOID (HI SOLENOID FAILURE)
 - A. Be sure the transmission is in high range and fourth-hand (Auto) position.
 - B. With the key switch on (engine off), and the brakes released on a flat surface, select "COMMAND AND CONTROL" on the computer screen.
 - C. At the next screen, select HI gear ("FIRE HI SOLENOID"). An asterisk will appear on the screen to confirm your selection.
 - D. Gently roll the vehicle back and forth. It should drop into gear. If the vehicle moves freely, it did not shift into gear.
 - If the vehicle drops into gear, the 10TH GEAR SHIFT SOLENOID is functioning properly. Proceed to Step E.
 - If the vehicle does not drop into gear:
 - Disconnect the 19 pin connector of the CONTROLLER TO TRANSMISSION WIRING HARNESS from the transmission controller.
 - Connect an ohm meter across pins 3 and 14 of the transmission wiring harness.
 - If the meter reading is greater than 8 ohms but less than 20 ohms, the HI gear shift circuit is functioning properly. Proceed to the next action on the PROBLEM-ACTION LIST (page 16 or 17).
 - If the meter reading is not between 8 ohms and 20 ohms:
 - Disconnect the HI shift valve on the opposite end of the WIRING HARNESS. This connector is located near the piston housing on the right of the transmission and is connected to the HI GEAR SHIFT SOLENOID. The solenoid is closest to the front of the transmission and is marked "HI" on the actuator housing near the base of the solenoid.

This procedure involves electronically shifting the transmission to determine if the SHIFT SOLENOIDS and GEAR POSITION SENSOR are functioning properly.

TROUBLESHOOTING PROCEDURES USING A COMPUTER

- With the ohm meter across pins 3 and 14, the meter should read greater than 100,000 ohms.
 - If the meter reading is less than 100,000 ohms, replace the WIRING HARNESS.
 - If the meter reading is greater than 100,000 ohms, short the two pins on the HI connector and again read the resistance between pins 3 and 14.
 - If resistance is less than 5 ohms, resistance in the coil of the HI GEAR SHIFT SOLENOID should read between 8 ohms and 20 ohms. Replace the HI GEAR SHIFT SOLENOID by following instructions for removing and replacing solenoids (Procedure #6 in this section).
 - If resistance is greater than 5 ohms, replace the WIRING HARNESS.
- E. After the vehicle is shifted into gear, an asterisk should appear next to the word "GEAR."
- If an asterisk does not appear, confirm proper operation of the GEAR POSITION SENSOR (Procedure #2 in this section).
 - If an asterisk appears, continue with Step F.
- F. On the computer, select neutral ("FIRE NEUTRAL SOLENOID"). An asterisk will appear on the screen next to the words "NEUTRAL SOLENOID" to confirm your selection. An asterisk should not be present next to the word "GEAR." Confirm that the transmission is in neutral by rolling the vehicle.
- If the vehicle does not shift to neutral, confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and NEUTRAL SHIFT SOLENOID (Procedure #5 in this section). If the asterisk remains on the screen next to the word "GEAR," confirm proper operation of the GEAR POSITION SENSOR (Procedure #2 in this section).
 - If the vehicle shifts to neutral, the NEUTRAL SHIFT SOLENOID is functioning properly. Perform the next action in the PROBLEM-ACTION LIST (page 16 or 17).
- #### 4. CONFIRMING PROPER OPERATION OF CONTROLLER TO TRANSMISSION WIRING HARNESS AND 9TH GEAR SHIFT SOLENOID (LOW SOLENOID FAILURE)
- This procedure involves electronically shifting the transmission to determine if the SHIFT SOLENOIDS and GEAR POSITION SENSOR are functioning properly.
- A. Be sure the transmission is in high range and fourth-hand (Auto) position.
 - B. With the key switch on (engine off), and the brakes released on a flat surface, select "COMMAND AND CONTROL" on the computer screen.
 - C. At the next screen, select LOW gear ("FIRE LOW SOLENOID"). An asterisk will appear on the screen next to the words "LOW SOLENOID" to confirm your selection.
 - D. Gently roll the vehicle back and forth. It should drop into gear. If the vehicle moves freely, it did not shift into gear.
 - If the vehicle drops into gear, the 9TH GEAR SHIFT SOLENOID is functioning properly. Continue to Step E.
 - If the vehicle does not drop into gear:
 - Disconnect the 19 pin connector of the CONTROLLER TO TRANSMISSION WIRING HARNESS from the transmission controller.

TROUBLESHOOTING PROCEDURES USING A COMPUTER

- Connect an ohm meter across pins 4 and 15 (for Navistar, pins 4 and 14) of the transmission wiring harness.
 - If the meter reading is greater than 8 ohms but less than 20 ohms, the LOW gear shift circuit is functioning properly. Proceed to the next action in the PROBLEM-ACTION LIST (page 16 or 17).
 - If the meter reading is not between 8 ohms and 20 ohms:
 - Disconnect the LOW shift valve on the opposite end of the WIRING HARNESS. This connector is located near the piston housing on the right of the transmission and is connected to the LOW GEAR SHIFT SOLENOID. The solenoid is marked "LOW" on the actuator housing near the base of the solenoid and is the solenoid closest to the back of the transmission.
 - With the ohm meter across pins 4 and 15 (for Navistar, pins 4 and 14), the meter should read greater than 100,000 ohms.
 - If the meter reading is less than 100,000 ohms, replace the WIRING HARNESS. This should correct the fault.
 - If the meter reading is greater than 100,000 ohms:
 - Short the two pins on the LOW connector and again read the resistance between pins 4 and 15 (for Navistar, pins 4 and 14). Resistance should be less than 5 ohms.
 - If resistance is greater than 5 ohms, replace the WIRING HARNESS.
 - If resistance is less than 5 ohms, resistance in the coil of the LOW GEAR SHIFT SOLENOID should read between 8 ohms and 20 ohms. Replace the LOW GEAR SHIFT SOLENOID by following the instructions for removing and replacing solenoids (Procedure #6 in this section).
- E. After the vehicle is shifted into gear, check to see that an asterisk appears next to the word "GEAR."
 - If an asterisk does not appear, confirm proper operation of the GEAR POSITION SENSOR (Procedure #2 in this section).
 - If an asterisk appears, continue to Step F.
- F. On the computer, select neutral ("FIRE NEUTRAL SOLENOID"). An asterisk will appear on the screen to confirm your selection. An asterisk should not be present next to the word "GEAR." Confirm that the transmission is in neutral by rolling the vehicle.
 - If the vehicle does not shift to neutral, confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and NEUTRAL SHIFT SOLENOID (Procedure #5 in this section). If the asterisk remains on screen, confirm proper operation of the GEAR POSITION SENSOR (Procedure #2 in this section).
 - If the vehicle shifts to neutral, the NEUTRAL SHIFT SOLENOID is functioning properly. Perform the next action shown in the PROBLEM-ACTION LIST (page 16 or 17).

TROUBLESHOOTING PROCEDURES USING A COMPUTER

5. CONFIRMING PROPER OPERATION OF CONTROLLER TO TRANSMISSION WIRING HARNESS AND NEUTRAL SHIFT SOLENOID (NEUTRAL SOLENOID FAILURE)

This procedure involves electronically shifting the transmission to determine if the SHIFT SOLENOIDS and GEAR POSITION SENSOR are functioning properly.

- A. Be sure that the transmission is in high range and fourth-hand (Auto) position.
- B. With the key switch on (engine off) and the brakes released on a flat surface, select "COMMAND AND CONTROL" on the computer screen.
- C. At the next screen, select either LOW or HI gear ("FIRE LOW/HI SOLENOID"). An asterisk will appear on the screen next to the words "LOW OR HI SOLENOID" to confirm your selection.
- D. Gently roll the vehicle back and forth. It should drop into gear. If the vehicle moves freely, it did not shift into gear.
 - If the vehicle drops into gear, the 9TH or 10TH GEAR SHIFT SOLENOID is functioning properly. Continue to Step E.
 - If the vehicle does not drop into LOW or HI GEAR:

Confirm proper operation of the CONTROLLER TO TRANSMISSION WIRING HARNESS and 10TH GEAR SHIFT SOLENOID (Procedure #3 in this section) or 9TH GEAR SHIFT SOLENOID (Procedure #4 in this section).
- E. After the vehicle is shifted into gear, check to see that asterisks appear next to the words "Gear" and "Auto."
 - If an asterisk does not appear, confirm proper operation of the GEAR POSITION SENSOR (Procedure #2 in this section).

➤ If an asterisk appears, the SOLENOID and GEAR POSITION SENSOR are functioning properly. Continue to Step F.

F. On the computer, select neutral ("FIRE NEUTRAL SOLENOID"). An asterisk will appear on the screen next to the words "NEUTRAL SOLENOID" to confirm your selection. An asterisk should not be present next to the word "GEAR." Confirm that the transmission is in neutral by rolling the vehicle.

➤ If the vehicle drops into neutral, the NEUTRAL SHIFT SOLENOID is functioning properly. Proceed to Step G.

➤ If the vehicle does not drop into neutral:

- Disconnect the 19 pin connector of the CONTROLLER TO TRANSMISSION WIRING HARNESS from the transmission controller.
- Connect an ohm meter across pins 5 and 16 (for Navistar, pins 5 and 14) of the transmission WIRING HARNESS.
 - If the meter reading is greater than 8 ohms but less than 20 ohms, the shift circuit is functioning properly. Proceed to the next action in the PROBLEM-ACTION LIST (page 16 or 17).
 - If the meter reading is not between 8 ohms and 20 ohms:
 - Disconnect the NEUTRAL shift valve on the opposite end of the WIRING HARNESS. This connector is located near the piston housing on the right of the transmission and is connected to the NEUTRAL SHIFT SOLENOID. The solenoid is marked "N" on the actuator housing near the base of the solenoid and is the middle solenoid.

TROUBLESHOOTING PROCEDURES USING A COMPUTER

- With the ohm meter across pins 5 and 16 (for Navistar, pins 5 and 14), the meter should read greater than 100,000 ohms.
 - If the meter reading is less than 100,000 ohms, replace the WIRING HARNESS. This should correct the fault.
 - If the meter reading is greater than 100,000 ohms, short the two pins on the NEUTRAL connector and again read the resistance between pins 5 and 16 (for Navistar, pins 5 and 14). Resistance should be less than 5 ohms.
 - If resistance is less than 5 ohms, resistance in the coil of the NEUTRAL SHIFT SOLENOID should read between 8 ohms and 20 ohms. Replace the NEUTRAL SHIFT SOLENOID by following the instructions for removing and replacing solenoids (Procedure #6 in this section).
 - If resistance is greater than 5 ohms, replace the WIRING HARNESS.

G. After the vehicle has shifted into neutral, the asterisk next to the word "GEAR" should disappear.

- If the asterisk does not disappear, confirm proper operation of the GEAR POSITION SENSOR (Procedure #2 in this section).
- If the asterisk disappears, perform the next action in the PROBLEM-ACTION LIST (page 16 or 17).

6. REMOVING AND REPLACING SHIFT SOLENOIDS

This procedure is necessary when the coil of the solenoid has been confirmed defective. Perform this procedure for the NEUTRAL SHIFT SOLENOID, as well as the 9TH and 10TH GEAR SHIFT SOLENOIDS because they are nearly identical valves.

- A. Remove the 1/4" OD nylon tubing from the top exhaust port of the shift valve. Use two wrenches to remove the fitting from the valve exhaust port.
- B. Remove the 2 pin electrical connector from the coil of the valve to be replaced.
- C. With a 1 3/8" wrench, turn the valve counterclockwise using the hex at the base of the valve. After the valve is removed, remove the o-rings from the bottom of the valve manifold.
- D. Clean any residual o-ring lubricant and remove all foreign matter from the manifold. New o-rings should be included with the new valve. Liberally coat the new o-rings with Parker o-ring lubricant or the equivalent.
- E. Place o-rings in their respective grooves at the bottom of the valve manifold. Apply Loctite #242 (Spicer part number 545080), or an equivalent thread lock, to threads of the new valve.
- F. Install the new valve and torque to 12 - 15 ft. lbs.
- G. Remove the elbow fitting from the exhaust port of the defective valve and screw it into the exhaust port of the new valve.
- H. Replace nylon tubing to the elbow/tee fitting. Connect the electrical connector to the valve coil connector.
- I. This should correct the fault. If it does not, go to the next action in the PROBLEM-ACTION LIST (page 16 or 17).

TROUBLESHOOTING PROCEDURES USING A COMPUTER

7. CONFIRMING PROPER AIR PRESSURE FROM THE AIR FILTER REGULATOR

This procedure confirms that the air pressure provided from the AIR FILTER REGULATOR is sufficient to allow proper shifting of the transmission 9/10 air piston. The AIR FILTER REGULATOR is attached to a bracket and mounted to a rear countershaft bearing cap.

- A. Without air pressure to the input of the AIR FILTER REGULATOR, disconnect the output and attach a pressure gauge to the output side of the AIR FILTER REGULATOR. Apply at least 60 psi to the input of the AIR FILTER REGULATOR and read the pressure gauge.
 - If the pressure is less than 50 psi or greater than 55 psi, replace the AIR FILTER REGULATOR or service it, following procedures on page 29.
 - If the pressure is between 50 psi and 55 psi, the AIR FILTER REGULATOR is functioning properly.
- B. This should correct the fault. If it does not, go to the next action in the PROBLEM-ACTION LIST (page 16 or 17).

8. ACTIVATING EMERGENCY OVERRIDE TO DISABLE AUTOMATED SHIFTS

Use this procedure only if the transmission is stuck in 9th or 10th gear, and the driver is unable to use the lower eight manual gears.

The emergency override procedure involves overriding the 9th, neutral and 10th shift solenoids in the case of one or more failures. The override mode completely disables the 9th and 10th gears of the transmission and enables the driver to have manual control of the first eight gears to drive the vehicle to the nearest service facility for repairs.

Again, this is to be used only if the transmission is stuck in 9th or 10th gear, and the driver is unable to use the lower eight manual gears.



DANGER

**BEFORE ACTIVATING THE OVERRIDE MODE,
TURN OFF THE ENGINE AND
ACTIVATE THE PARKING BRAKE.**

Failure to do so would cause the vehicle to move and could result in serious injury or death.

- A. Locate the override valve from underneath the vehicle. The valve is located in the 9/10 actuator housing, which is mounted on the right side of the transmission shift tower.
- B. To activate the valve, remove the pin near the center and on top of the piston housing. This will return the transmission to neutral.
- C. Upon completion of corrective maintenance, push the plunger in and replace the pin to reactivate the system.

9. CONFIRMING THE POWER SUPPLY AND TRANSMISSION CONTROLLER FUNCTIONS

- A. Turn the key switch on. (Do not start the vehicle.)


➤ If the transmission light comes on, one quick flash indicates normal operation.

➤ If the transmission light does not come on, check the bulb and both fuses. Refer to the appropriate vehicle manufacturer's service manual to locate fuses.

- B. If the fuses and bulb are in good condition, check the **CONTROLLER TO VEHICLE WIRING HARNESS**. Unplug the J4 CONNECTOR and check with a multi-

TROUBLESHOOTING PROCEDURES USING A COMPUTER

meter. Check for 12 volts on pins 1 and 8, and check for ground on pins 14 and 15. If these do not occur, check the CONTROLLER TO VEHICLE WIRING HARNESS for any short or open circuits.

 Do not short the specified pins to any other pins.

10. CONFIRMING THE OVERRIDE FEATURE HAS NOT BEEN USED

A. Check to be sure the pin has not been removed from the override valve on the top of the actuator housing. The pin is located on the actuator housing, which is bolted on top of the transmission.


B. For further information on the override feature, refer to the steps to activate the emergency override to disable automated shifts (Procedure #8 in this section).

➤ If the pin is missing, replace it.

➤ If the pin is in place, perform the next action in the PROBLEM-ACTION LIST (page 16 or 17).

11. CONFIRMING PROPER OPERATION OF J1922 CONTROL LINK (J1922 SHORTED LOW/HI)

A. While sitting in the driver's seat, test the CONTROL LINK by commanding the engine to increase or decrease engine speed.

 **WARNING:** Be sure the brakes are set and the transmission is in neutral before increasing or decreasing engine speed.

B. Select "COMMAND AND CONTROL" on the computer screen.

C. Select either "INCREASE SPEED" or "DECREASE SPEED." It is necessary to hit "Escape" to abort the command and release control of the engine.

➤ If the engine responds properly, verify that other vehicle components using the J1922 CONTROL LINK are not causing CONTROL LINK failure. Then refer to the next action in the PROBLEM-ACTION LIST (page 16 or 17).

➤ If the engine does not respond properly, continue with Step D.

D. Inspect the CONTROLLER TO VEHICLE WIRING HARNESS (J4 pins 11 and 18) for short and open circuits. Refer to the diagram on page 32. It is sometimes helpful to disconnect each node (controller) one at a time to isolate a controller or data link problem.

➤ If short or open circuits are found, repair or replace the WIRING HARNESS as necessary.

➤ If no short or open circuits are found and the WIRING HARNESS appears to be in working condition, verify that other vehicle components using the J1922 CONTROL LINK are not causing CONTROL LINK failure.

12. CONFIRMING PROPER OPERATION OF J1587 DATA LINK (J1587 INOPERATIVE)

A. Inspect the CONTROLLER TO VEHICLE WIRING HARNESS (J4 pins 12 and 19) for short and open circuits. Refer to the diagram on page 32. It is sometimes helpful to disconnect each node (controller) one at a time to isolate a controller or data link problem.

➤ If short or open circuits are found, repair or replace the WIRING HARNESS as necessary.

➤ If no short or open circuits are found and the WIRING HARNESS appears to be in working condition, verify that other components using the J1587 DATA LINK are not causing DATA LINK failure.

B. Monitor the DATA LINK with a J tool. Bus contention is the hardest problem to identify. Messages are either incomplete or missing.

TROUBLESHOOTING PROCEDURES USING A COMPUTER

13. CONFIRMING PROPER OPERATION OF SPEED SENSOR (NO OUTPUT SHAFT RPM)

- A. Check the gap adjustment of the SPEED SENSOR on the output shaft. The sensor should be softly bottomed against the gear and then backed out 1/2 turn and locked (.031" gap).
- B. After adjusting the SPEED SENSOR correctly, measure the coil resistance between pins A and B on each output connector. Resistance should be a maximum of 1.5K ohms (1,500 ohms).
- C. Check for shorts to the sensor housing case (ground) and between coils. If there are any doubts, replace the SPEED SENSOR and check for proper functioning.
- D. Check the CONTROLLER TO TRANSMISSION WIRING HARNESS by placing a jumper across the 2 pin sensor connector and measuring resistance between pins 8 and 9 of the J5 transmission computer connector. Refer to the CONTROLLER TO TRANSMISSION WIRING HARNESS diagram on page 30 or 31.
 - ▶ If resistance is less than 5 ohms, the WIRING HARNESS is functioning properly.
 - ▶ If resistance is greater than 5 ohms, replace the CONTROLLER TO TRANSMISSION WIRING HARNESS.
- E. Some engines and vehicles use the speed information that the transmission computer makes available. This information is sent out on the CONTROLLER TO VEHICLE WIRING HARNESS. Check for open or short circuits in this system. For complete troubleshooting information, obtain the specific wiring information for the vehicle being serviced.

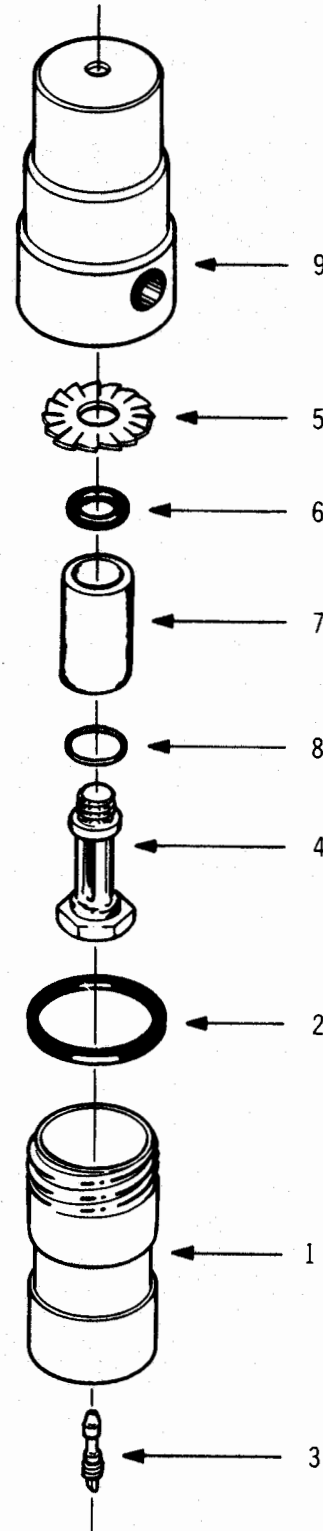
SERVICING THE AIR FILTER REGULATOR

The AutoMate-2™ uses an air filter regulator preset at 50 - 55 lbs.

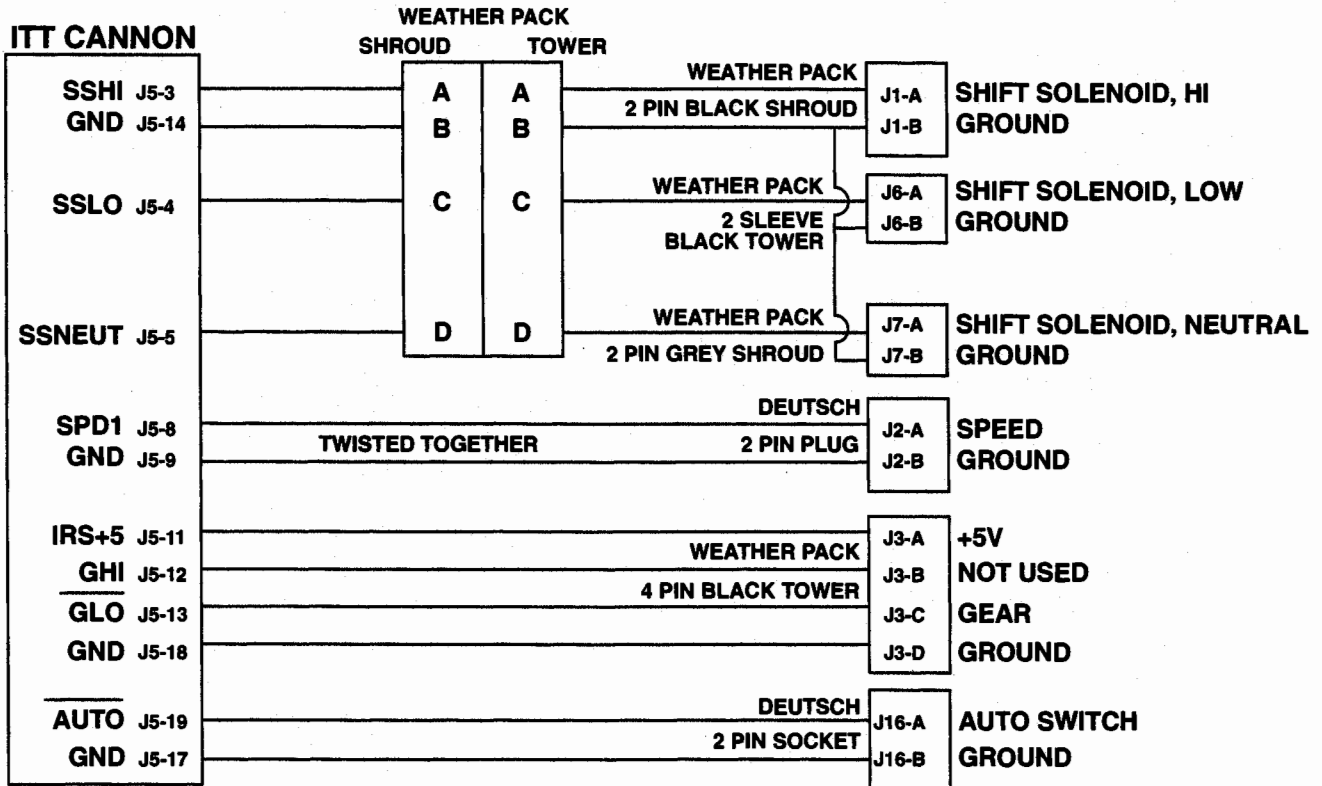
1. Clean or replace the filter element (7) every 6 to 12 months, or whenever slow shifting is encountered. Replace the element after three cleanings. If a regulator malfunction is indicated, replace the entire unit.
2. To service the filter, shut off air pressure. Unscrew the bowl (1) and remove the o-ring (2). Unscrew the stud (4). Remove the louver (5), upper gasket (6), filter element (7), and lower gasket (8) from the stud (4). Do not disassemble the regulator section (9).
3. Clean and inspect the parts carefully. Replace any damaged parts.
4. Reassemble the unit by first installing the filter element (7) on the stud (4), so that the large end of the internal taper (thinnest wall section) is toward the hex on the stud. Torque the stud to 5 - 10 lbs. inch.
5. Apply a wipe coat of Dow Corning DC7 silicone grease, or the equivalent, to the o-ring (2) seating surfaces on the regulator (9) and bowl (1). Apply a light, even coat of Molykote G, or an equivalent lithium-based grease, to bowl threads and torque the bowl to 5 - 10 lbs. inch. If the drain valve (3) was removed, reinstall it and torque to 10 - 15 lbs. inch.

REMINDERS

- ⚠ Use only petroleum-based solvents to clean parts. Other types of solvents could damage filter components and affect proper operation.
- ⚠ Blow air through the filter (inside and outside) to dislodge surface contaminants. Otherwise, these contaminants could affect proper filter operation and lead to equipment damage.
- ⊘ Do not disassemble the regulator section (9); it is not field-repairable. If it is damaged, replace it.



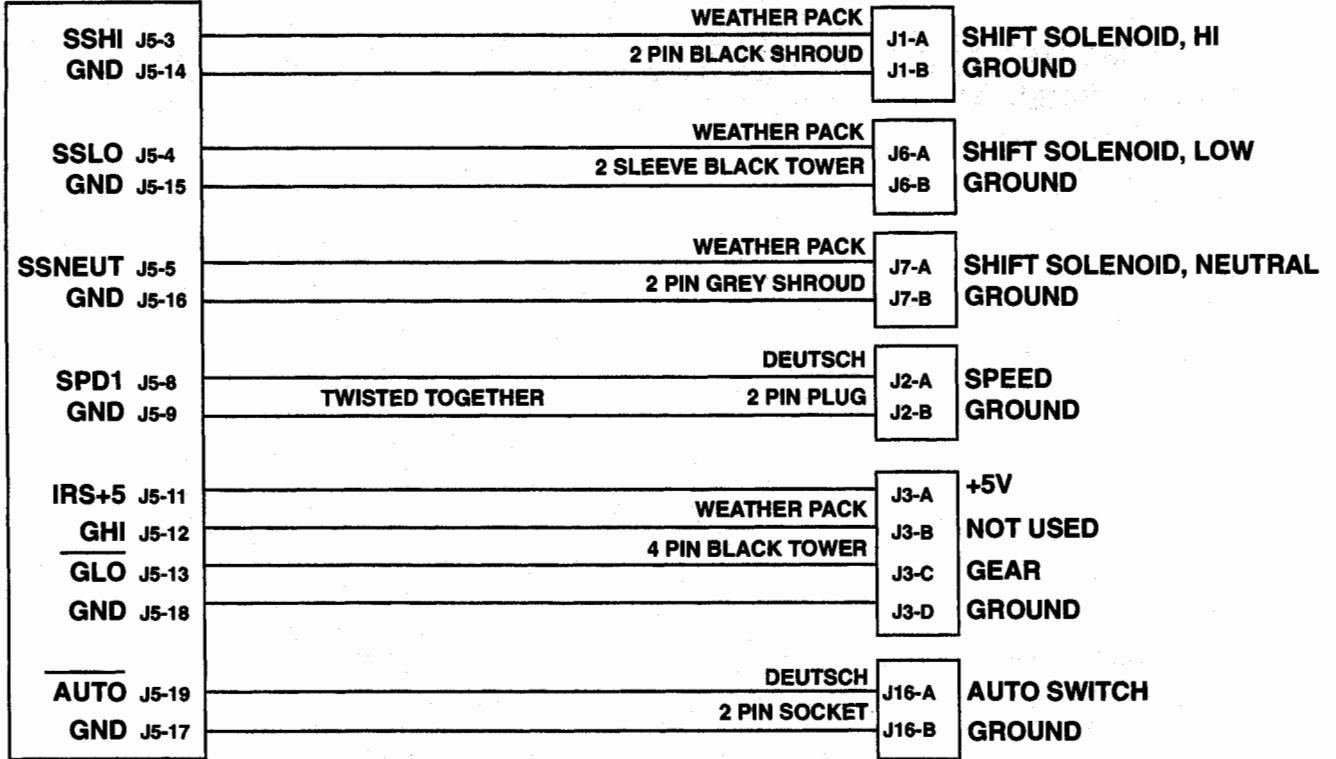
CONTROLLER TO TRANSMISSION WIRING DIAGRAM (NAVISTAR ONLY)



"Z" POLARIZATION
CANNON CONNECTOR
AS VIEWED FROM PIN ENDS

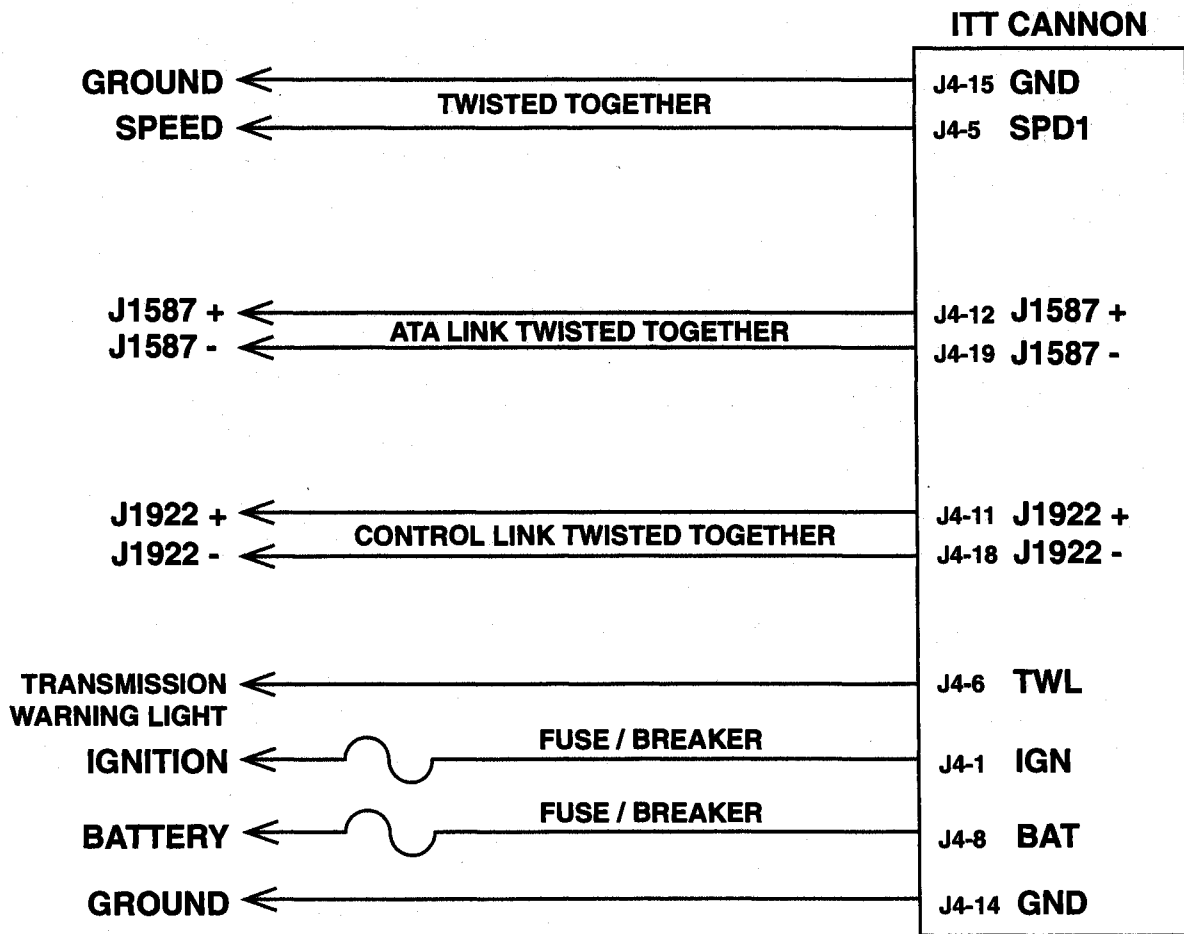
CONTROLLER TO TRANSMISSION WIRING DIAGRAM

ITT CANNON



"Z" POLARIZATION
CANNON CONNECTOR
AS VIEWED FROM PIN ENDS

CONTROLLER TO VEHICLE WIRING DIAGRAM



**"X" POLARIZATION
CANNON CONNECTOR**

AS VIEWED FROM PIN ENDS

ELECTRICAL SPECIFICATIONS

TRANSMISSION E.C.U.

Power Supply: 9 to 16 volts @ 5 amps

SHIFT SOLENOIDS

Coil Resistance: 8 to 20 ohms

Power Requirements: 9.6 volts @ 0.7 amps

Torque (12 to 16 ft. lbs.)

VEHICLE SPEED SENSOR

16 Tooth (1/2 turn gap)

Ground Isolation: > 10M ohms

Coil Resistance: 1.5K ohms maximum

Torque (25 to 35 ft. lbs.)

GEAR POSITION SENSOR

Hall Effect (Magnetic Field Actuated)

Power Supply: 5 volts

Resistance Pins C to D: South Pole: <30 ohms

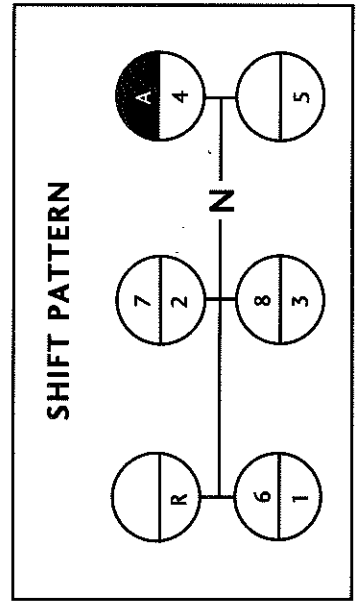
North Pole: >100K ohms

AUTO SWITCH

Normally Open

Open in Auto Position Only

Torque (25 to 30 ft. lbs.)

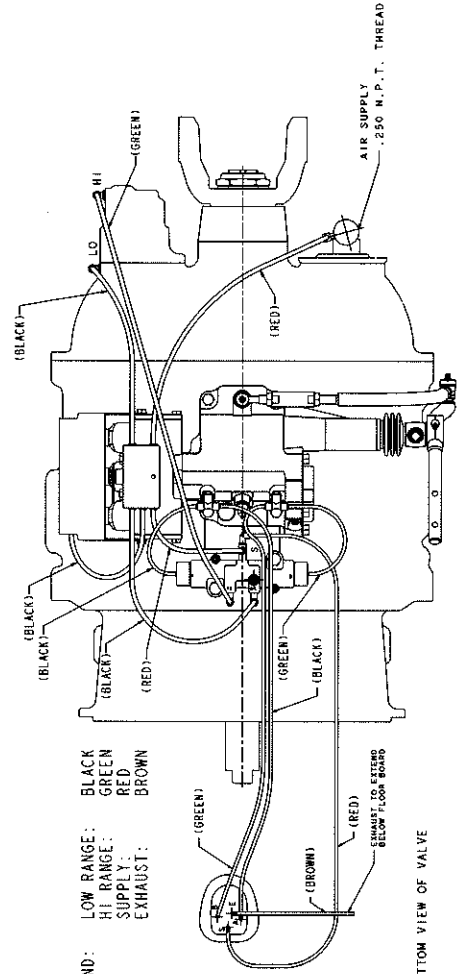


FAULT CODE INFORMATION

One flash of the transmission light when the ignition is turned on signifies that the transmission E.C.U. has been powered on. Continuous illumination of the transmission light is the result of an active failure. The ignition must be keyed on three times to initiate fault code information at the transmission light.

Flash Code # of Flashes	MPSJ Pro Link (Heavy Duty Cartridge)	Problem Area	Procedure
One	J1922 Shorted Low/Hi	J1922 Control Link	Confirm proper operation of Control Link
Two	J1587 Intermittent	J1587 Data Link	Confirm proper operation of Data Link
Three	Transmission Output Speed Intermittent	Speed Sensor	Confirm proper operation of Speed Sensor
Four	Gear Sensor Shorted Low/Hi	Gear Position Sensor	Confirm proper operation of Gear Position Sensor
Five	Solenoid #3 Intermittent	Neutral Shift Solenoid	Confirm proper operation of Controller to Transmission Wiring Harness and Neutral Shift Solenoid
Six	Solenoid #2 Intermittent	9th Gear Solenoid	Confirm proper operation of Controller to Transmission Wiring Harness and 9th Gear Shift Solenoid
Seven	Solenoid #1 Intermittent	10th Gear Solenoid	Confirm proper operation of Controller to Transmission Wiring Harness and 10th Gear Shift Solenoid

LEGEND:
 LOW RANGE: BLACK
 HI RANGE: GREEN
 SUPPLY: RED
 EXHAUST: BROWN

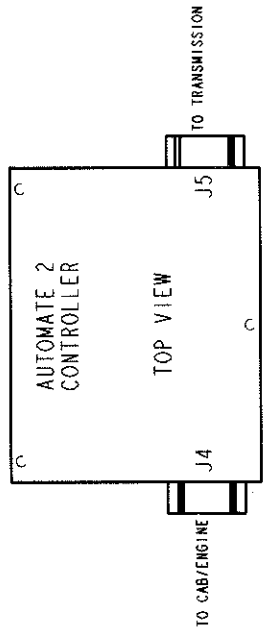
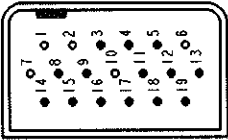


TYPICAL CONFIGURATION - REMOTE CONTROL

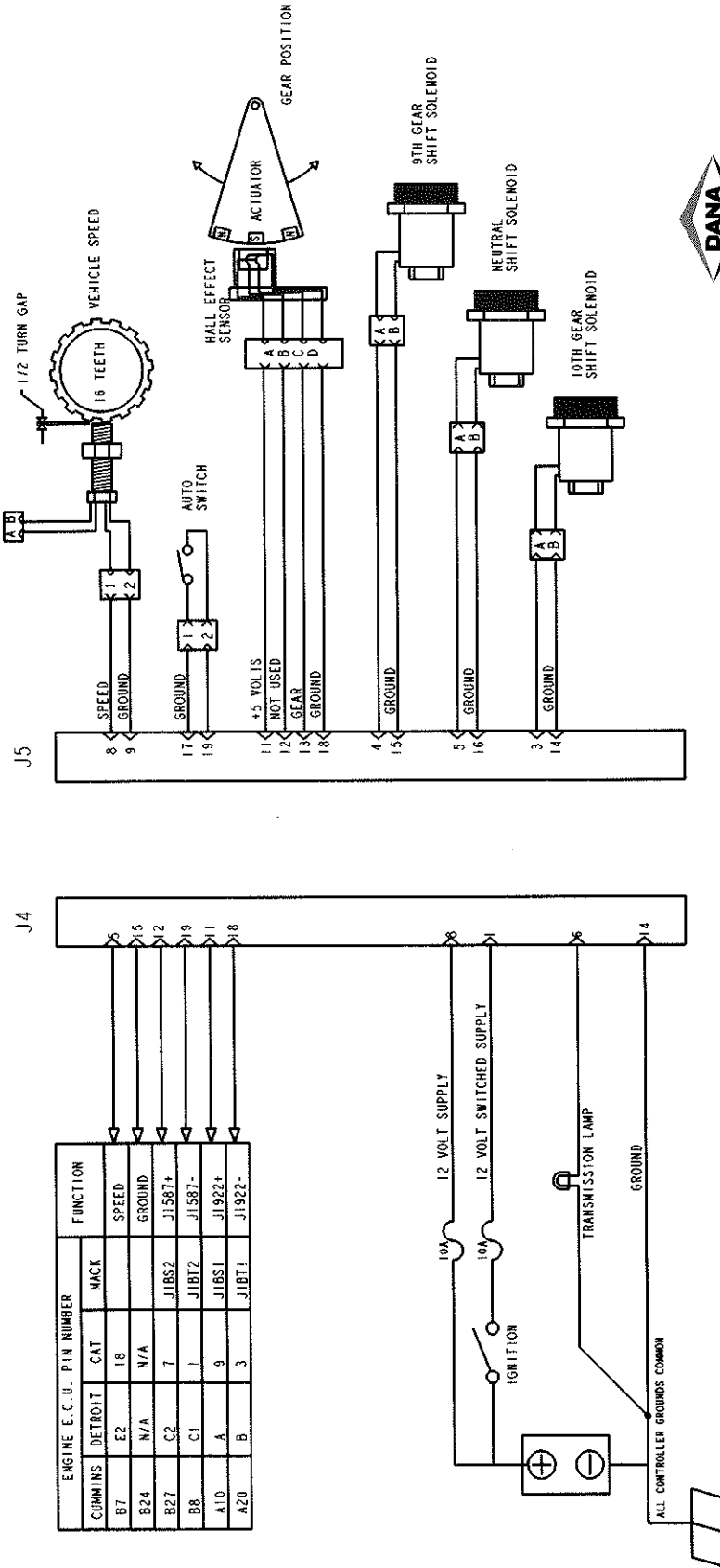
CAB/ENGINE
HARNESS CONNECTOR



TRANSMISSION
HARNESS CONNECTOR



ENGINE	E.C.U.	PIN NUMBER	FUNCTION
CUMMINS	DETROIT	CAT	MAK
B7	E2	18	SPEED
B24	N/A	N/A	GROUND
B27	C2	7	J18S2
B8	C1	1	J18T2
A10	A	9	J18S1
A20	B	3	J18T1



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SPICER TRANSMISSION DIVISION

SPICER SUPPORT LINE
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AUTOMATE-2™ WIRING DIAGRAM

Bulletin No. 2370 / Supplement B

Rev. 1 8/95



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