FUNK
MANUFACTURING
COMPANY
Subsidiary of Deere & Company

DF SERIES 150 AND 250 ELECTRONIC CONTROL SYSTEM

SERVICE MANUAL
PN/YZ103052

Introduction

FOREWORD

Component Technical Manuals (CTM) are concise service guides for specific components. Component technical manuals are written as stand-alone manuals covering multiple machine applications.

This manual is written for an experienced technician. Essential tools required in performing certain service work are identified in this manual and are recommended for use.

Live with safety: Read the safety messages in the introduction of this manual and the cautions presented throughout the text of the manual.

This is the safety-alert symbol. When you see this symbol in the manual or on the machine, be alert to the potential for personal injury.

WARNING VEHICLE RUNAWAY HAZARD
Avoid serious or fatal injury. This transmission is not a braking system. Install it only if there is a braking system capable of stopping vehicle with dead engine, disengaged transmission, or loss of hydrostatic retardation. Otherwise, vehicle may roll freely, resulting in loss of control.

Use this component technical manual in conjunction with the machine technical manual. See the machine technical manual for information on component removal and installation, and gaining access to the components.

This manual is divided in three parts; repair, theory of operation, and troubleshooting and tests:

- Repair groups contain necessary instructions to repair the component.
- The theory of operation group describes how the component operates and functions.
- Troubleshooting and test groups help you identify the majority of routine failures quickly and then allows you to perform certain tests.

Information is organized in groups for the various components requiring service instruction. At the beginning of each group are summary listings of all applicable service equipment and tools, other materials needed to do the job, specifications, and torque values.

YZ,CTM84,IFC -19-28APR94

TROUBLE SHOOTING INTRODUCTION

This introduction is written to initiate an understanding of a strategy which can be used toward solving problems in the driveline system. The preferred technique used in solving problems is to exchange components. However, a very important element necessary to the timely and successful conclusion of this activity is the selection of the malfunctioning component. An understanding of the total system and an elimination process leading to the component is absolutely necessary before starting the exchange activity.

The DF transmission system as installed consists of various components linked together to form a functioning system.

- Cab shift handle.
- Wiring harness.
- Electronic control unit.
- Transmission control valve.
- Transmission hydraulic system (pump, relief valves, lines, etc.)
- Transmission mechanical system (clutches, gears, shafts, seals, etc.)

The most desirable strategy in a trouble shooting plan is to reduce the random exchange of components by carefully analyzing the symptoms and then conducting tests which will help determine which of the elements in the system is likely to be the problem. The technician should use the above list as a guide in locating the problem.

As a result of being a new component and unfamiliar to most people, the ECU is usually the first component which is targeted for exchange. However, the malfunction of an ECU is extremely rare and therefore, it should be the last component considered for replacement. In fact the ECU has an internal ability to diagnose itself and the connections which are attached to it. This information can be very helpful in indicating the problem area. Therefore, if the ECU is responding to commands and not giving diagnostics which indicate and internal problem, the likelihood of the problem being internal to the ECU is very remote.

YZ,CTM84,105,1 -19-09SEP94

THEORY OF OPERATION

The purpose of the Funk DF150/250 Electronic Control Unit (ECU) is to control the functions of the transmission. Upshifting, downshifting, and control of the disconnect are the main functions. Other functions are the ability to drive a speedometer, and the capability to communicate with a panel mounted gear/diagnostic indicator. The transmission's performance is determined by the various inputs to the ECU. Based upon these inputs, the ECU commands the transmission so that maximum performance can be achieved under the present operating conditions. All functions of the ECU are under software control. The Engagement Override Valve (EOV) and the Park Brake Solenoid functions are connected to the ECU, however these are not controlled by the ECU or software.

Operation begins when the vehicle's ignition is swithched to the on position, supplying electrical power to the ECU and related system components from the vehicle's power source, through the transient voltage protection (TVP) module. The ECU now begins monitoring all inputs and outputs. If a known conflict in inputs or a fault condition is detected, the ECU will command the transmission to stay in neutral regardless of the shift lever position. A flashing error code will be displayed on the gear/diagnostic indicator, and will remain displayed until the error has been resolved and the shift lever cycled back through the neutral or park position. Whether the shift lever must cycle through the neutral position or the park position depends upon the shift lever that is in the system, and the vehicle manufacturer's specifications.

If no error conditions are detected, the ECU will calculate a speed ratio between the engine RPM (derived from the engine speed MPU signal) and the transmission output RPM (derived from the transmission output speed MPU). Based upon this speed ratio and the combination of inputs from the shift lever and any other applicable inputs, the ECU will select the proper transmission gear (not necessarily the gear as indicated by the shift lever) and command the transmission to shift to this gear. The gear/diagnostic indicator will now show the actual transmission gear.

The DF series of transmissions use electrohydraulic valves to control the operation of the transmission. The solenoids controlling the transmission clutches (solenoids A through D & 1 through 4) are driven by a pulse width modulated (PWM) signal that produces proportional pressure/flow changes. This is achieved by pulsing the solenoid at a constant frequency and varying the "on time" of each cycle. The ratio of "on time" to cycle time is called duty cycle. These transmission solenoids are driven with a maximum duty cycle of 95% when full on. During modulation, the solenoids are started out with a duty cycle considerably less than this and ramped up to full on. The initial duty cycle is dependent upon several factors and is not a preset value. The process of modulating these clutches greatly enhance shift quality.

The solenoid controlling the disconnect function is not of the PWM type, but is of an on/off type. This solenoid is not modulated, and is driven by a 95% duty cycle when energized.

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ENGAGEMENT OVERRIDE VALVE (EOV) OPERATION

The EOV is located on the transmission control valve body, and is responsible for blocking hydraulic oil flow from reaching the electrohydraulic control valves until the shift lever has been cycled through neutral. Once hydraulic pressure is present and the shift lever cycled through neutral, the EOV latches on hydraulically and remains on until hydraulic pressure is removed.

Electrical power is present to the EOV only when the shift lever is in the neutral position, and is absent in all other shift lever positions. It is supplied to the EOV by the neutral signal from the shift lever.

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SYSTEM COMPONENTS

The basic transmission control system consists of the transmission along with the following required components:

1. ECU
2. TVP module
3. Engine Speed MPU
4. Transmission Output Speed MPU
5. Shift Lever
6. Wiring harness

Optional system components that may be found on different applications are as follow:

1. Gear/diagnostic indicator
2. Inching pedal or device
3. Throttle Position Sensor (TPS)
4. Speedometer
5. Miscellaneous input function switches
    a. Brake cutoff
    b. Auto/manual mode selection
    c. Park brake

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COMPONENT FUNCTIONS

Basic Components

1. Electronic control unit (ECU)

The ECU is the "brain" of the system. It is responsible for the logic, computation, and decision making processes and the control of the transmission based on these calculations. How the ECU performs is determined by software programmed into the ECU's memory. This software is developed to meet the requirements of the vehicle manufacturer, and is based on a vehicle performance analysis. It is application specific, therefore ECUs from different vehicles are not interchangeable. ECUs can only be interchanged on vehicles which are identical in all ways (same engine/drivetrain combination, same wiring, same shift lever, same vehicle voltage, etc.)

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2. Transient voltage protection (TVP) module

The TVP Module is responsible for supplying electrical power to the system and protecting the systems electrical components. It provides 40 volt limiting during an electrical load dump malfunction and protection from reverse battery connection. Protection is provided only while the ignition switch is on, thus energizing an internal relay which provides an electrical connection between vehicle power and the protection device inside the module.

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3. Engine speed magnetic pickup (MPU)

The engine speed MPU is located in the input housing of the transmission. The MPU provides a signal to the ECU which represents engine speed. This signal is of a sinusoidal nature, varying in amplitude and frequency relative to engine speed. The ECU conditions this signal and converts it into pulses. It then measures the width of these pulses in microseconds, and based on a preprogrammed value in the ECU which represents the number of pulses per revolution of the engine, calculates the engine RPM.

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4. Transmission Output Speed MPU

The transmission output speed MPU is located in the rear housing of the transmission. The MPU provides a signal to the ECU which represents transmission output speed. This signal is of a sinusoidal nature, varying in amplitude and frequency relative to output speed. The ECU conditions this signal and converts it into pulses. It then measures the width of these pulses in microseconds, and based on a preprogrammed value in the ECU which represents the number of pulses per revolution of the transmission output, calculates the output RPM.

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5. Shift Lever

The shift lever, also referred to as the handle or selector, provides the ECU with various inputs regarding the desired vehicles direction of movement and desired gear range as chosen by the operator. Based on these signals along with the calculated speed ratio (output speed divided by engine speed), and the state of other inputs, the ECU commands the transmission to perform accordingly.

NOTE: The actual transmission gear is not always the same gear as being commanded by the shift lever position due to vehicle speed, engine speed, and mode of operation as requested by the vehicle manufacturer at the time of software development.

The shift lever also supplies a neutral signal output for interfacing with the vehicles starting circuit, and a reverse signal output for interfacing with a reverse warning alarm.

The neutral output is used to energize a relay which completes the vehicles starting circuit when the shift lever is only in the neutral position, allowing neutral-only starting capability. The relay is de-energized when the shift lever is in any other position, thus preventing the engine from being started by the key switch when in any out-of-neutral position.

The reverse output is typically used to energize a relay which in turn drives the vehicles reverse warning device. This relay is energized in all reverse positions of the shift lever, and de-energized in all other positions.

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6. Wiring Harness

The wiring harness consists of the various wires needed to provide electrical connections between the components of the system. All connectors in the system are sealed to protect the connections from the environment and to prevent corrosion of the contacts, which would eventually result in a failure.

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OPTIONAL COMPONENTS

1. Gear/diagnostic indicator

A dash mount gear/diagnostic indicator provides the operator with information about the system. Under normal operating conditions the indicator shows the actual forward or reverse transmission gear and the state of the disconnect.

During calibration of the transmission clutches, the indicator shows the status of the calibration process. Displayed is the clutch being calibrated and whether it is in the fill or hold stage of calibration. When clutch calibration has completed, "End" will be displayed.

When an error has occurred, the indicator will flash an error code indicating that a problem has been detected in the system. This error code will continue to flash until the shift lever has been placed in the neutral or park positions, whichever is applicable for the system. Once the ECU has detected a legal neutral or park condition, the error will clear and "NEU" or "-P-" will be displayed. Once the shift lever is moved out of neutral or park, the error will once more begin to flash. This condition will exist until the error has been corrected and the shift lever cycled through neutral or park once again. If the error is related to the neutral or park signals making it impossible for the ECU to see a legal neutral or park signal, the error will continue to flash even in the neutral or park position until it is resolved.

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2. Inching Pedal

The inching pedal provides the operator with a device for controlling the modulation of the transmission clutches when desired. With the pedal fully depressed, the transmission remains in neutral regardless of shift lever position. With the shift lever in the appropriate out-of-neutral position, as the pedal is released the transmission begins to engage. The more the pedal is released, the more the clutches engage causing the vehicle to 'inch'. When the pedal is fully released, the transmission clutches are fully engaged. This gives a 'foot clutch' type of performance to the vehicle.

The normally closed set of contacts of a switch mechanically linked to the pedal, provides the 'pedal down' signal to the ECU. These contacts open when the pedal is fully depressed (input is passive), and are closed in all other positions of the pedal (input is active).

The 'inching' signal is provided by a 5K ohm potentiometer mechanically linked to the pedal. As the pedal is depressed and released, the combination of the potentiometer and mechanical linkage transforms pedal movement into a varying analog voltage that the ECU measures. This voltage measurement tells the ECU the relative displacement of the inching pedal, and based upon this, a percentage of modulation is used to modulate the transmission clutches.

A 5 volt D.C. reference voltage is supplied out to the 5K ohm potentiometer by the ECU. It is this voltage that the potentiometer alters, relative to pedal position, and feeds back to the ECU. It is then compared against the original reference to determine pedal displacement.

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3. Throttle Position Sensor

The TPS provides a signal to the ECU which is proportional to throttle position.This signal allows the ECU to determine the loading of the vehicle, thus allowing it to adjust the transmission's operational characteristics and adapt it to the current driving conditions.

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4. Speedometer

The ECU provides an output capable of driving a speedometer. This signal is a square wave switching between ground and vehicle voltage (12 or 24 volts). The frequency of the signal is dependent upon the speed of the vehicle. Tire rolling radius and differential ratio determine the number of pulses the ECU will see for one revolution of the tires. A preset value (derived from data provided by the vehicle manufacturer) is preprogrammed into the ECU and is used to determine the proper pulse output to the speedometer for the proper calibration.

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5. Miscellaneous Input Function Switches

These switches provide an input to the ECU by simply switching vehicle voltage on or off to the corresponding ECU input. An input is active at its respective ECU pin when vehicle voltage is present (logic level 1), and is passive when no voltage is present (logic level 0).

a. Brake Cutoff

The brake cutoff input comes from a switch activated by the brake pedal. This switch supplies a passive input to the ECU when the brake pedal is depressed, and an active input when released. As long as this input is passive, the ECU commands the transmission to shift to neutral, allowing high engine speeds without torque converter losses.

b. Auto/manual

The auto/manual input is supplied by a panel mounted toggle switch. The mounting location is dependent upon the vehicle manufacturer's requirements and may be located in various places. This input selects between the automatic mode of transmission operation and the manual mode of operation.

The specific characteristics of the transmission's operation in both the automatic mode and manual mode can vary from one application to another. This is determined by the vehicle manufacturer's specifications at the time of software development.

c. Park brake

Two types of park brakes are available with the DF series of transmissions, a 'wet brake' or a 'disc brake'. The park brake input to the ECU is optional with transmissions using either type of brake.

The input to the ECU is supplied by a switch that is linked to the park brake function. On transmissions equipped with a wet brake, this input is supplied by a pressure switch mounted in the park brake housing. On transmissions equipped with a disc brake, the switch location and operation is determined and installed by the vehicle manufacturer. When used, the park brake input allows the ECU to detect when the park brake is applied, and prohibits the transmission from engaging in any gear. Driving through the park brake is prevented by this means.

Normally the park brake switch supplies an active input to the ECU when then park brake is released, and a passive input when the brake is applied.

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SYSTEM REQUIREMENTS

Voltage

The DF Series ECU and gear/diagnostic indicator are dual voltage in design, and will operate on either 12 or 24 volt vehicle electrical systems. A minimum voltage of 9 volts is required for reliable operation.

The TVP module, transmission solenoid valves, and standard gear selector are voltage specific and are not interchangable between a 12 and a 24 volt system.

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Wiring

Input signals supplied to the ECU via connectors J1 & J2 are very low in current. Due to this, all switch contacts and connections in the wiring associated with inputs on ECU connectors J1 & J2 must use gold plated contact surfaces and all switches must be moisture-proof. This is to prevent corrosion of the contact surfaces which results in a poor connection, and an eventual failure. The use of Packard Weather Pack or equivalent connectors is an exception to the gold plating requirement as they have been designed and tested for this type of application.

Connections in the wiring associated with ECU connector J3, as well as any power and ground connections associated with connectors J1 & J2, can use silver or tin plated contacts due to the higher current levels.

Splicing should be held to a minimum. When splicing is required, AMP Inc. Solistrand terminals and splices, or their equivalent, must be used. Splices must not be made within 50mm of any connector, clamping area, or harness branch. They must not be made within 25mm of any other splice, and not made in any dynamic areas (i.e. where the harness flexes in the application).

Vehicle wiring used in ECU connectors J1, J2, & J3 is limited to a maximum of 16 gauge and a minimum of 20 gauge wire, with a cable diameter range of .080" to .095". Packard Metri-pack part numbers are 12034398 for J1, 12040921 for J2, and 12048455 for J3. Plated pins for these connectors are Packard number 12047680, and the crimp tool is Packard number 12039500. These special connectors do not require gold plated pins. Unused pin cavities in these connectors must be filled with Packard Metri-pack 150 Series seal plugs, number 12034413.

Wire sizes for the Packard Weather Pack connectors depend upon the pins used. Pins 12010182 and 12089305 take 14 or 16 gauge wire, while pins 12089188 and 12089040 are limited to 18 or 20 gauge wire. Wiring seals for these connectors are 12015323 for cable diameters of .087" to .110", 12010293 for cable diameters of .111" to .137", and 12015193 for cable diameters of .138" to .166". Unused pin cavities in these connectors must be filled with Packard Weather Pack cavity plugs number 12010300.

Wiring for ECU power, main power, solenoid valves, and ECU ground must be no smaller than 18 gauge due to the high current carried in these lines. Excessive runs of the main power line (greater than 10 feet), no smaller than 16 gauge wire must be used. Wiring for the digital inputs and magnetic pickups can be of the smaller size wire, if desired, since they carry only low current signals.

Wiring from the mag pickups to the ECU must be twisted shielded cable to avoid false triggering of these inputs by electrical noise. The cable shields must be grounded at the ECU.

ECU and main power must come from the TVP module to protect against severe voltage transients. These two lines must be separate. A ground wire is required from battery negative to the ECU. Grounding the ECU through the vehicle chassis only is not acceptable. In general, all wiring must be kept close to or inside of shields or other metallic structures.

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ECU Mounting

The ECU must be mounted inside the vehicle cab or other enclosed area that will not exceed ambient temperature range (-40 to +85 C). It must be mounted to ensure good electrical grounding between the ECU and the vehicle chassis, although a ground wire from battery negative to the ECU is required. It must not be mounted by any method that would isolate the ECU from the vehicle chassis. If rubber mounted for shock protection, a grounding strap must be utilized to ensure proper grounding.

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GLOSSARY

Active: The high voltage (+12V / +24V) state of a digital input. Dependent upon vehicle system voltage.

Actual Gear: The actual physical gear of the transmission, regardless of shift lever position or controller operation.

Bus: Serial communications link which interconnects intelligent electronic modules.

Come-Home: A hardware function which allows limited vehicle motion in the event of failure of certain components.

Commanded Gear: The gear selected by the combination of the shift lever position and the state of the Forward, Reverse, Neutral, and Not Neutral inputs. The 'destination' gear.

Current Gear: The gear the controller is currently attempting to drive the transmission into by the application of commands to the valves.

Downshift Inhibit: The prohibiting of downshifting, by the ECU, to prevent harsh and abrupt shifts or possible over speed conditions of the engine. The downshift will be inhibited until the current speed ratio will permit the shift to take place.

Fault: An abnormal condition which results in a perceived performance change or in a loss of function which may result in performance loss or system damage.

Intershift Pause Time: The minimum time delay between shifts. A value preprogrammed into the ECU.

Neutral Recoverable: The process where a detected fault is maintained and displayed by the ECU until the shift lever is cycled to neutral (park on some systems) and the ECU detects the proper combination of inputs for a legal neutral (park) condition, at which time the diplayed fault will be cleared. The fault code will still be maintained in ECU memory for future recall.

Next Gear: The next gear the controller plans to enter. The next gear will become the current gear if no faults are detected and all conditions for entering the neat gear are met.

Nonvolatile Memory: Memory that retains its data even though power to the system has been removed.

Passive: The low voltage (0V) state of a digital input.

Preselecting: The act of moving the shift lever in a lateral motion to signal an upshift or a downshift while still in the neutral position, thus selecting the desired gear to which the transmission will shift directly once the shift lever is moved out of neutral. (Bump shift lever only.)

Previous Direction: The direction of vehicle motion before a shuttle shift is initiated.

Previous Gear: The previous current gear.

Sequence Shift: The type of shift which consists of shifting from a gear to an adjacent gear.

Sequential Shifting: Multiple sequence shifts with no delay between shifts other than the programmed intershift pause time.

Shift Sequence: The execution of a shift command plus any "wait" time after which another shift command may be executed.

Shuttle Shift: A shift to a gear in the opposite direction of vehicle travel made by moving the shift lever between the Forward and Reverse positions without hesitation in the Neutral position long enough for the controller to obtain a legal neutral condition.

Speedmatch: The process where the ECU determines the proper gear to shift to based upon the current speed ratio.

Speed Ratio: The ratio of the vehicles engine speed to that of the transmission output speed (vehicle speed indirectly) as calculated by the ECU from the engine speed MPU signal and the transmission output speed MPU signal. Speed ratio equals output speed divided by engine speed.

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SYSTEM ERRORS

The ECU has the ability to detect various discrepancies in the system. These discrepancies are classified as one of three types of errors: mismatch, solenoid, and decode.

Mismatch errors occur when the ECU detects a disagreement between inputs. Example: The neutral input active at the same time the not neutral input is active. The ECU detects this condition and knows that only one of these inputs should be active at any given time, so an error is generated.

Solenoid errors occur when a solenoid circuit has failed. This can be either a short or an open in the circuit. Some possible causes of these errors are pinched or broken wiring, shorted or open coils, bad connections, and shorted wiring (to either ground or vehicle voltage.) Errors 176 -178 are internal ECU errors (related to the solenoid circuitry) which may be generated by software, hardware, or a combination of both.

Decode errors occur from mag pickup sensor failures, temperature or engine/output speed discrepancies that occur while attempting to calibrate, and internal ECU errors. Decode errors occurring from internal ECU errors, are illegal values for program variables generated during software execution. All errors are neutral recoverable, unless the condition causing the error prevents the ECU from detecting a legal neutral condition (park on some systems). After a neutral recovery, the shift lever may be placed back into a legal forward or reverse position. If the condition causing the error still exist, the error will again be detected and displayed. If not, the ECU will continue operating in a normal manner.

How the ECU handles errors depends upon what type and which error has occurred. In general, the ECU will immediately shift the transmission to neutral in the event of an error. The transmission will then remain in neutral until the error has been resolved and the shift lever cycled to neutral and back to the desired position.

The ECU retains the last eight non-repeating error codes in nonvolatile memory in the order in which they have occurred. These codes are available for future retrieval to aid in the diagnosing of the system.

Following is a list of the errors that are detectable, their type and description, and any condition(s) which can cause the error. Not all errors listed pertain to each and every system.

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ERROR CODES

NOTE: Not all error codes pertain to each and every application.

Diagnostic code: ECU

Error type: Special (Gear/diagnostic indicator only)

Error: ECU not communicating with indicator.

Conditions:

- The communications link between the ECU and the indicator has been broken.
- The ECU has lost power to pin J1-a1.
- The ECU has lost ground to pin J1-a3.
- The programming input at pin J1-h3 is active.
- The ECU is defective.

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Diagnostic code: 16

Error type: Mismatch

Error: Handle signal is out of tolerance.

Conditions: The ECU has detected a signal from the shift lever that is not a legal pulse width, or has detected no signal at all.

Diagnostic code: 17

Error type: Mismatch

Error: Handle signal is park, but park input is passive.

Conditions: The ECU has detected a legal park position from the shift lever, but cannot detect the park input at pin J1-f2.

Diagnostic code: 18

Error type: Mismatch

Error: Handle signal is park, but not park input is active.

Conditions: The ECU has detected a legal park position from the shift lever, and has also detected the not park input at pin J1-b2.

Diagnostic code: 19

Error type: Mismatch

Error: Handle signal is park, but neutral input is passive.

Conditions: The ECU has detected a legal park position from the shift lever, but cannot detect the neutral input at pin J2-a2.

Diagnostic code: 20

Error type: Mismatch

Error: Handle signal is park, but not neutral input is active.

Conditions: The ECU has detected a legal park position from the shift lever, and has also detected the not neutral input at pin J1-f1.

Diagnostic code: 21

Error type: Mismatch

Error: Handle signal is park, but forward input is active.

Conditions: The ECU has detected a legal park position from the shift lever, and has also detected the forward input at pin J1-d3.

Diagnostic code: 22

Error type: Mismatch

Error: Handle signal is park, but reverse input is active.

Conditions: The ECU has detected a legal park position from the shift lever, and has also detected the reverse input at pin J1-d2.

Diagnostic code: 23

Error type: Mismatch

Error: Handle signal is neutral, but park input is active.

Conditions: The ECU has detected a legal neutral position from the shift lever, and has also detected the park input at pin J1-f2.

Diagnostic code: 24

Error type: Mismatch

Error: Handle signal is neutral, but not park input is passive.

Conditions: The ECU has detected a legal neutral position from the shift lever, but cannot detect the not park input at pin J1-b2.

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Diagnostic code: 25

Error type: Mismatch

Error: Handle signal is neutral, but neutral input is passive.

Conditions: The ECU has detected a legal neutral position from the shift lever, but cannot detect the neutral input at pin J2-a2.

Diagnostic code: 26

Error type: Mismatch

Error: Handle signal is neutral, but not neutral input is active.

Conditions: The ECU has detected a legal neutral position from the shift lever, and has also detected the not neutral input at pin J1-f1.

Diagnostic code: 27

Error type: Mismatch

Error: Handle signal is neutral, but forward input is active.

Conditions: The ECU has detected a legal neutral position from the shift lever, and has also detected the forward input at pin J1-d3.

Diagnostic code: 28

Error type: Mismatch

Error: Handle signal is neutral, but reverse input is active.

Conditions: The ECU has detected a legal neutral position from the shift lever, and has also detected the reverse input at pin J1-d2.

Diagnostic code: 29

Error type: Mismatch

Error: Handle signal is not neutral or not park, but park input is active.

Conditions: The ECU has detected a legal forward or reverse selector position from the shift lever, and has also detected the park input at pin J1-f2.

Diagnostic code: 30

Error type: Mismatch

Error: Handle signal is not neutral or not park, but not park input is passive.

Conditions: The ECU has detected a legal forward or reverse selector position from the shift lever, but cannot detect the not park input at pin J1-b2.

Diagnostic code: 31

Error type: Mismatch

Error: Handle signal is not neutral or not park, but neutral input is active.

Conditions: The ECU has detected a legal forward or reverse selector position from the shift lever, and has also detected the neutral input at pin J2-a2.

Diagnostic code: 32

Error type: Mismatch

Error: Handle signal is not neutral or not park, but not neutral input is passive.

Conditions: The ECU has detected a legal forward or reverse selector position from the shift lever, but cannot detect the not neutral input at pin J1-f1.

Diagnostic code: 33

Error type: Mismatch

Error: Both forward and reverse inputs are active.

Conditions: The ECU has detected the forward input on pin J1-d3, and the reverse input on pin J1-d2.

Diagnostic code: 34

Error type: Mismatch

Error: Handle signal is not neutral or not park, but both forward and reverse inputs are passive.

Conditions: The ECU has detected a legal forward or reverse selector position from the shift lever, but cannot detect either the forward input on pin J1-d3 or the reverse input on pin J1-d2.

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Diagnostic code: 35

Error type: Mismatch

Error: Internal ECU error.

Diagnostic code: 36

Error type: Mismatch

Error: Handle signal is not neutral or not park, but valve power is less than 18 volts.

Conditions: The ECU has detected a legal forward or reverse selector position, and has also detected that valve power is below the normal operating range due to probable low system voltage at pin J3-a1.

Diagnostic code: 37

Error type: Mismatch

Error: Handle signal is not neutral or not park, but valve power is greater than 30 volts.

Conditions: The ECU has detected a legal forward or reverse selector position, and has also detected that valve power is above the normal operating range due to probable high system voltage at pin J3-a1.

Diagnostic code: 38

Error type: Mismatch

Error: Handle signal is park, but park brake solenoid is energized. (Energizing solenoid releases brake.)

Conditions: The ECU has detected a legal park position from the shift lever, and has also detected that the park brake pressure switch input at pin J1-j3 is passive.

Diagnostic code: 39

Error type: Mismatch

Error: Handle signal is not park, but park brake solenoid is not energized. (De-energizing solenoid sets brake.)

Conditions: The ECU has detected a legal forward, neutral, or reverse selector position from the shift lever, and has also detected that the park brake pressure switch input at pin J1-j3 is active.

Diagnostic code: 40

Error type: Mismatch

Error: Park and not park inputs are both active.

Conditions: The ECU has detected the park input at pin J1-f2, and has also detected the not park input at pin J1-b2.

Diagnostic code: 41

Error type: Mismatch

Error: Park input is active, but neutral input is passive.

Conditions: The ECU has detected the park input at pin J1-f2, but cannot detect the neutral input at pin J2-a2.

Diagnostic code: 42

Error type: Mismatch

Error: Park and not neutral inputs are both active.

Conditions: The ECU has detected the park input at pin J1-f2, and has also detected the not neutral input at pin J1-f1.

Diagnostic code: 43

Error type: Mismatch

Error: Park and forward inputs are both active.

Conditions: The ECU has detected the park input at pin J1-f2, and has also detected the forward input at pin J1-d3.

Diagnostic code: 44

Error type: Mismatch

Error: Park and reverse inputs are both active.

Conditions: The ECU has detected the park input at pin J1-f2, and has also detected the reverse input at pin J1-d2.

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Diagnostic code: 45

Error type: Mismatch

Error: Park and not park inputs are both passive.

Conditions: The ECU cannot detect either the park input at pin J1-f2 or the not park input at pin j1-b2.

Diagnostic code: 46

Error type: Mismatch

Error: Neutral and not neutral inputs are both active.

Conditions: The ECU has detected the neutral input at pin J2-a2, and has also detected the not neutral input at pin J1-f1.

Diagnostic code: 47

Error type: Mismatch

Error: Neutral and forward inputs are both active.

Conditions: The ECU has detected the neutral input at pin J2-a2, and has also detected the forward input at pin J1-d3.

Diagnostic code: 48

Error type: Mismatch

Error: Neutral and reverse inputs are both active.

Conditions: The ECU has detected the neutral input at pin J2-a2, and has also detected the reverse input at pin J1-d2.

Diagnostic code: 49

Error type: Mismatch

Error: Neutral and not neutral inputs are both passive.

Conditions: The ECU cannot detect either the neutral input at pin J2-a2, or the not neutral input at pin J1-f1.

Diagnostic code: 50

Error type: Mismatch

Error: Not neutral input is active, but both forward and reverse inputs are also active.

Conditions: The ECU has detected the not neutral input at pin J1-f1, and has also detected both the forward input at pin J1-d3 and the reverse input at pin J1-d2.

Diagnostic code: 51

Error type: Mismatch

Error: Not neutral input is active, but both forward and reverse inputs are passive.

Conditions: The ECU has detected the not neutral input at pin J1-f1, but cannot detect either the forward input at pin J1-d3 or the reverse input at pin J1-d2.

Diagnostic code: 52

Error type: Mismatch

Error: Upshift and downshift inputs are both active.

Conditions: The ECU has detected the upshift input at pin J1-g2, and has also detected the downshift input at pin J1-e3.

Diagnostic code: 53

Error type: Mismatch

Error: Handle signal is not neutral or not park, but valve power is less than 9 volts.

Conditions: The ECU has detected a legal forward or reverse selector position, and has also detected that valve power is below the normal operating range due to probable low system voltage at pin J3-a1.

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Diagnostic code: 54

Error type: Mismatch

Error: Handle signal is not neutral or not park, and valve power is greater than 16 volts.

Conditions: The ECU has detected a legal forward or reverse selector position, and has also detected that valve power is above the normal operating range due to probable high system voltage at pin J3-a1.

Diagnostic code: 55

Error type: Mismatch

Error: Inching pedal signal is not inching, but pedal down input is active.

Conditions: The ECU has detected the inching pedal down input at pin J1-k2, but cannot detect any inching signal at pin J2-f1.

Diagnostic code: 56

Error type: Mismatch

Error: Analog inching voltage is too low.

Conditions: The ECU has detected an inching voltage that is less than the normal operating range for inching at pin J2-f1.

Diagnostic code: 57

Error type: Mismatch

Error: Analog inching voltage is too high.

Conditions: The ECU has detected an inching voltage that is greater than the normal operating range for inching at pin J2-f1.

Diagnostic code: 58

Error type: Mismatch

Error: Calibration in progress, but park brake is not applied.

Conditions: The ECU has detected that the calibration input on pin J1-k3 is active, and has detected that the park brake pressure switch input on pin J1-j3 is passive.

Diagnostic code: 59

Error type: Mismatch

Error: Calibration in progress, but front wheel drive is turned on.

Conditions: The ECU has detected that the calibration input on pin J1-k3 is active, and has also detected that the front wheel drive input on pin J1-h1 is active.

Diagnostic code: 60

Error type: Mismatch

Error: Auto and manual inputs are both active.

Conditions: The ECU has detected the auto input at pin J1-g3, and has also detected the manual input at pin J1-e2.

Diagnostic code: 61

Error type: Mismatch

Error: Auto and manual inputs are both passive.

Conditions: The ECU cannot detect either the auto input at pin J1-g3 or the manual input at pin J1-e2.

Diagnostic code: 62

Error type: Mismatch

Error: Illegal 5 bit selector code.

Conditions: The ECU has detected an illegal 5 bit selector code from the shift lever.

Diagnostic code: 63

Error type: Mismatch

Error: 5 bit selector code is neutral, but forward input is active.

Conditions: The ECU has detected a legal 5 bit selector code for the neutral shift lever position, and has also detected the forward input at pin J1-d3.

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Diagnostic code: 80

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 81

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 82

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 83

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 84

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 85

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 86

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 87

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 88

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 89

Error type: Decode

Error: Engine speed MPU signal missing or frequency is too low.

Conditions: The ECU cannot detect any signal from the engine speed mag pickup.

Diagnostic code: 90

Error type:

Error: Transmission output speed MPU signal missing or frequency is too low.

Conditions: The ECU cannot detect any signal from the transmission output speed mag pickup.

Diagnostic code: 91

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 92

Error type: Decode

Error: No load engine speed too high during calibration.

Conditions: The ECU has detected a signal from the engine speed mag pickup indicating that no load engine speed was too high during calibration.

Diagnostic code: 94

Error type: Decode

Error: Output speed present during calibration.

Conditions: The ECU has detected a signal from the transmission output speed mag pickup while attempting to perform the calibration.

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Diagnostic code: 95

Error type: Decode

Error: Engine speed too low during calibration.

Conditions: The ECU has detected a signal from the engine speed mag pickup indicating that loaded engine speed was pulled too low during calibration.

Diagnostic code: 96

Error type: Decode

Error: No load engine speed too low during calibration.

Conditions: The ECU has detected a signal from the engine speed mag pickup indicating that no load engine speed was too low during calibration.

Diagnostic code: 97

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 98

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 99

Error type: Decode

Error: Transmission temperature too high for calibration.

Conditions: The ECU has detected a transmission temperature in excess of 195 degrees Fahrenheit. Temperature must be below 195 degrees to perform calibration of the transmission clutches.

Diagnostic code: 100

Error type: Decode

Error: Internal ECU error.

Diagnostic code: 112

Error type: Mismatch

Error: Inching is not available. Input on J1-k2 is passive. This input must be jumpered to J3-d1 at the ECU, or a jumper installed between pins E & F at connector T11.

Conditions: The ECU has determined that the inching function is not available with this ECU, but cannot detect an active input at pin J1-k2. This input must be tied to vehicle voltage on applications not utilizing the inching function.

Diagnostic code: 113

Error type: Mismatch

Error: Brake cutoff is not available. Input on J1-f3 is passive. This input must be jumpered to J3-b2 at the ECU, or a jumper installed between pins A & B at connector T10.

Conditions: The ECU has determined that the brake cutoff function is not available with this ECU, but cannot detect an active input at pin J1-f3. This input must be tied to vehicle voltage on applications not utilizing the brake cutoff function.

Diagnostic code: 114

Error type: Mismatch

Error: 5-bit selector code is neutral, but reverse input is active.

Conditions: The ECU has detected a legal 5 bit selector code for the neutral shift lever position, and has also detected the reverse input at pin J1-d2.

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Diagnostic code: 115

Error type: Mismatch

Error: 5-bit selector code is neutral, but neutral input is passive.

Conditions: The ECU has detected a legal 5 bit selector code for the neutral shift lever position, but cannot detect the neutral input at pin J2-a2.

Diagnostic code: 116

Error type: Mismatch

Error: 5-bit selector code is neutral, but not neutral input is active.

Conditions: The ECU has detected a legal 5 bit selector code for the neutral shift lever position, and has also detected the not neutral input at pin J1-f1.

Diagnostic code: 117

Error type: Mismatch

Error: 5-bit selector code is not neutral, but neutral input is active.

Conditions: The ECU has detected a legal 5 bit selector code for a forward or reverse shift lever position, and has also detected the neutral input at pin J2-a2.

Diagnostic code: 118

Error type: Mismatch

Error: 5-bit selector code is not neutral, but not neutral input is passive.

Conditions: The ECU has detected a legal 5 bit selector code for a forward or reverse shift lever position, but cannot detect the not neutral input at pin J1-f1.

Diagnostic code: 119

Error type: Mismatch

Error: 5-bit selector code is not neutral, but forward and reverse inputs are both active.

Conditions: The ECU has detected a legal 5 bit selector code for a forward or reverse shift lever position, and has also detected the forward input at pin J1-d3 and the reverse input at pin J1-d2.

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Diagnostic code: 120

Error type: Mismatch

Error: Selector code is not neutral, but park brake input is active.

Conditions: The ECU has detected a legal forward or reverse selector position from the shift lever, and has also detected the park input at pin J1-f2.

Diagnostic code: 121

Error type: Mismatch

Error: Carrier cab and upper cab inputs are both active.

Conditions: The ECU has detected the carrier cab input at pin J1-h2, and has also detected the upper cab input at pin J1-j1.

Diagnostic code: 122

Error type: Mismatch

Error: Carrier cab and upper cab inputs are both passive.

Conditions: The ECU cannot detected either the carrier cab input at pin J1-h2, or the upper cab input at pin J1-j1.

Diagnostic code: 123

Error type: Mismatch

Error: Handle code not neutral while switching cab modes.

Conditions: The ECU cannot detected a not neutral handle condition from one of the cab selector handles while changing between carrier cab and upper cab modes.

Diagnostic code: 124

Error type: Mismatch

Error: Upper cab mode selected, but transmission gear is not a legal gear range for upper cab mode.

Conditions: The ECU has detected the upper cab mode input active at pin J1-j1, and has determined the transmission gear range is not a legal gear for the upper cab mode. Legal gear ranges for upper cab mode are neutral, forward first, and reverse first.

Diagnostic code: 144

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-j1. Transmission solenoid associated with this circuit is Solenoid 4.

Diagnostic code: 145

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-g1. Transmission solenoid associated with this circuit is Solenoid 3.

Diagnostic code: 146

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-h1. Transmission solenoid associated with this circuit is Solenoid 2.

Diagnostic code: 147

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-f1. Transmission solenoid associated with this circuit is Solenoid 1.

Diagnostic code: 148

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-k1. Transmission solenoid associated with this circuit is Solenoid A.

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Diagnostic code: 149

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-f2. Transmission solenoid associated with this circuit is Solenoid B.

Diagnostic code: 150

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-g2. Transmission solenoid associated with this circuit is Solenoid C.

Diagnostic code: 151

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-h2. Transmission solenoid associated with this circuit is Solenoid D.

Diagnostic code: 152

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-j2.

Diagnostic code: 153

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-k2.

Diagnostic code: 154

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-f3.

Diagnostic code: 155

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-g3.

Diagnostic code: 156

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-h3.

Diagnostic code: 157

Error type: Solenoid

Error: Open circuit or short to positive vehicle voltage on ECU pin J3-j3.

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Diagnostic code: 160

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-j1. Transmission solenoid associated with this circuit is Solenoid 4.

Diagnostic code: 161

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-g1. Transmission solenoid associated with this circuit is Solenoid 3.

Diagnostic code: 162

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-h1. Transmission solenoid associated with this circuit is Solenoid 2.

Diagnostic code: 163

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-f1. Transmission solenoid associated with this circuit is Solenoid 1.

Diagnostic code: 164

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-k1. Transmission solenoid associated with this circuit is Solenoid A.

Diagnostic code: 165

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-f2. Transmission solenoid associated with this circuit is Solenoid B.

Diagnostic code: 166

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-g2. Transmission solenoid associated with this circuit is Solenoid C.

Diagnostic code: 167

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-h2. Transmission solenoid associated with this circuit is Solenoid D.

Diagnostic code: 168

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-j2.

Diagnostic code: 169

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-k2.

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Diagnostic code: 170

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-f3.

Diagnostic code: 171

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-g3.

Diagnostic code: 172

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-h3.

Diagnostic code: 173

Error type: Solenoid

Error: Output shorted to ground on ECU pin J3-j3.

Diagnostic code: 176

Error type: Solenoid

Error: Internal ECU error.

Diagnostic code: 177

Error type: Solenoid

Error: Internal ECU error.

Diagnostic code: 178

Error type: Solenoid

Error: Internal ECU error.

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