Troubleshooting Manual

5000, 6000, 8000, 9000 Series
Off-Highway Transmissions
Commercial Electronic Controls 2 (CEC2)

TS3353EN

GENERAL DESCRIPTION

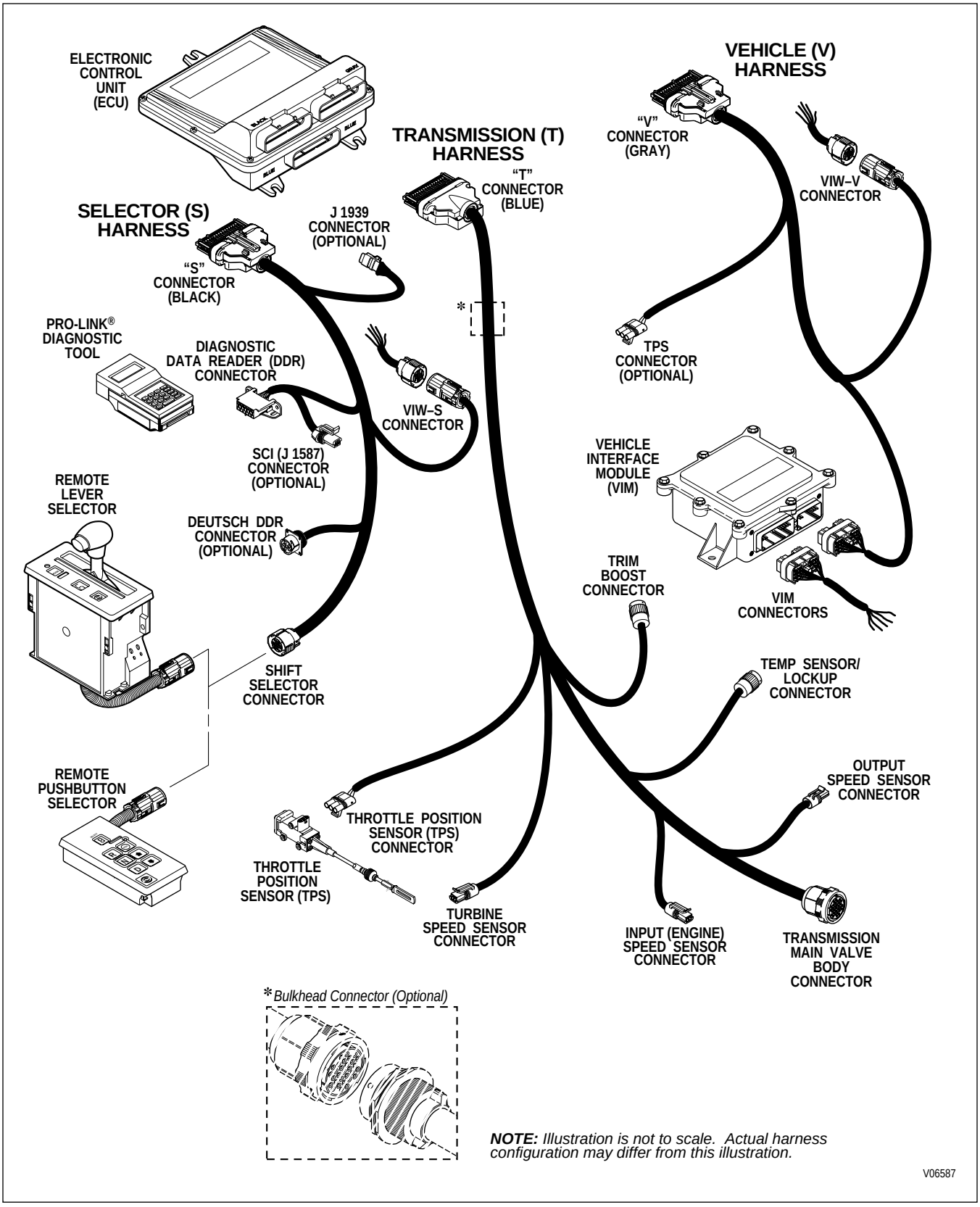


Figure 1–2. CEC 2 Components

DEFINITIONS AND ABBREVIATIONS

NOTE: The new MPC must be used to reprogram CEC 2 systems.

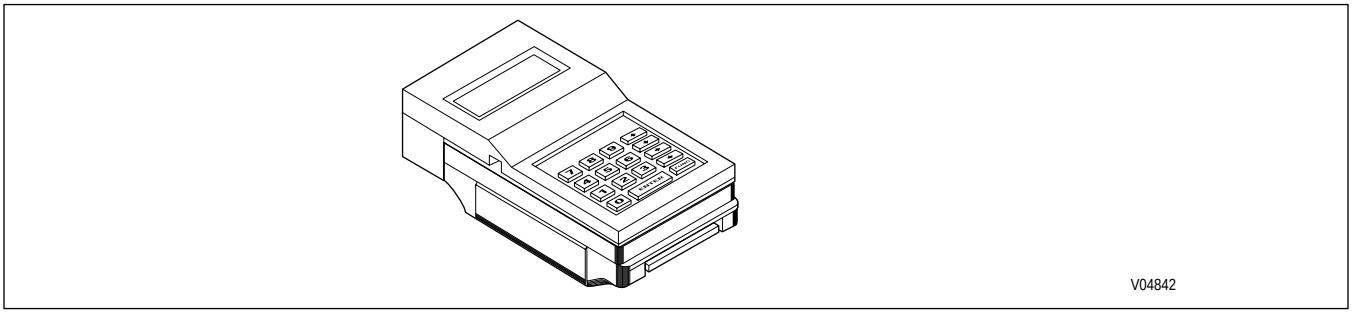


Figure 2–1. Pro-Link® 9000 Diagnostic Tool

2–3. ABBREVIATIONS

A/N	**A**ssembly **N**umber
Amp	Unit of electrical current.
CAN	**C**ontroller **A**rea **N**etwork — A network for all SAE J1939 communications in a vehicle (engine, transmission, etc.)
CEC 1/CEC 2	**C**ommercial **E**lectronic **C**ontrols 1 or 2 — Designation for electronic controls used in off-highway and some older on-highway transmissions.
COP	**C**omputer **O**perating **P**roperly — Hardware protection which causes the ECU to reset if software gets lost.
CT	**C**losed **T**hrottle
DDR	**D**iagnostic **D**ata **R**eader — Diagnostic tool; most current version is the Pro-Link® 9000 made by MicroProcessor Systems, Inc. Used to interrogate the ECU for diagnostic information and for reprogramming I/O packages in a calibration.
DDU	**D**igital **D**isplay **U**nit — Optional means of obtaining diagnostic information.
DNS	**D**O **N**OT **S**HIFT — Refers to the **DO NOT SHIFT** diagnostic response during which the **CHECK TRANS** light is illuminated and the transmission will not shift and will not respond to the Shift Selector.
DVOM	**D**igital **v**olt/**o**hm**m**eter
ECU	**E**lectronic **C**ontrol **U**nit (also commonly referred to as the “computer”)
GPI	**G**eneral **P**urpose **I**nput — Input signal to the ECU to request a special operating mode or condition.
GPO	**G**eneral **P**urpose **O**utput — Output signal from the ECU to control vehicle components (such as PTOs, backup lights, etc.) or allow a special operating mode or condition.
J1587	Engine/transmission serial data communications link.
J1939	High-speed vehicle serial data communications link.
LED	**L**ight-**E**mitting **D**iode — Electronic device used for illumination.

WIRE CHECK PROCEDURES

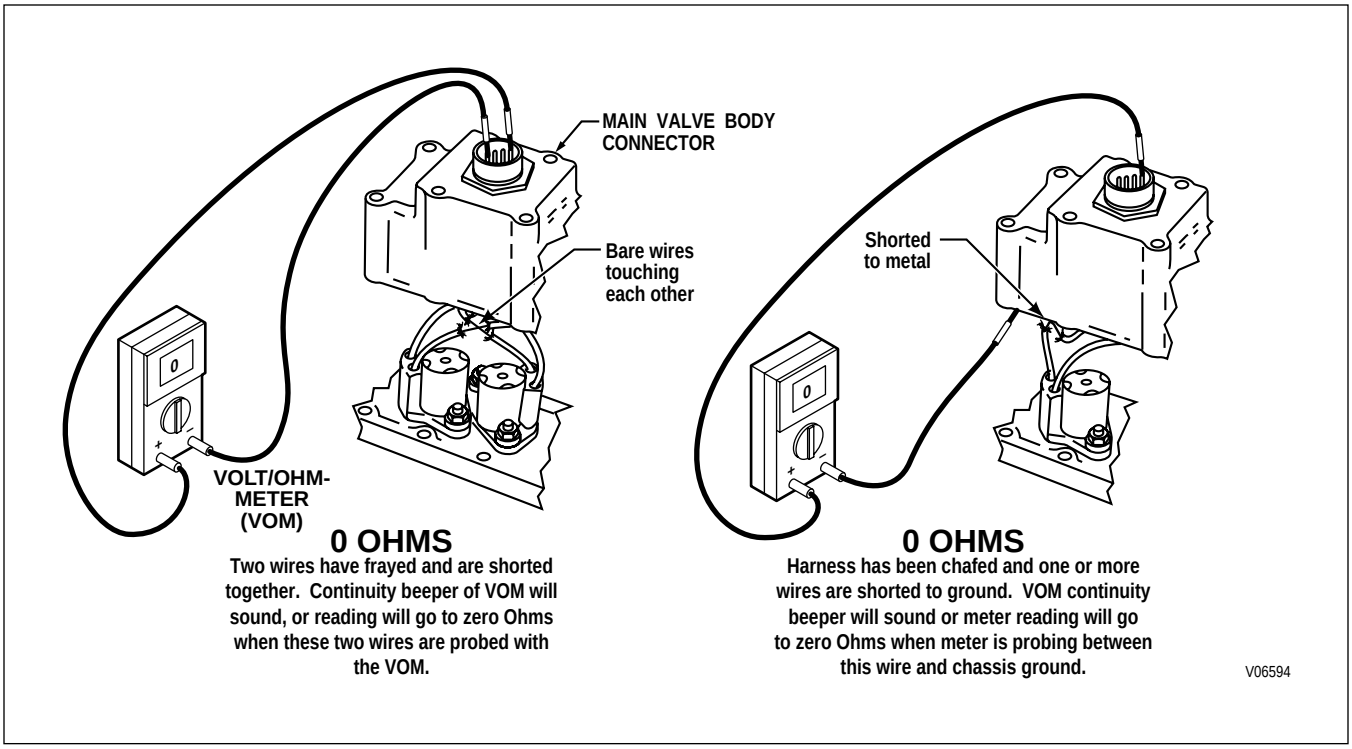


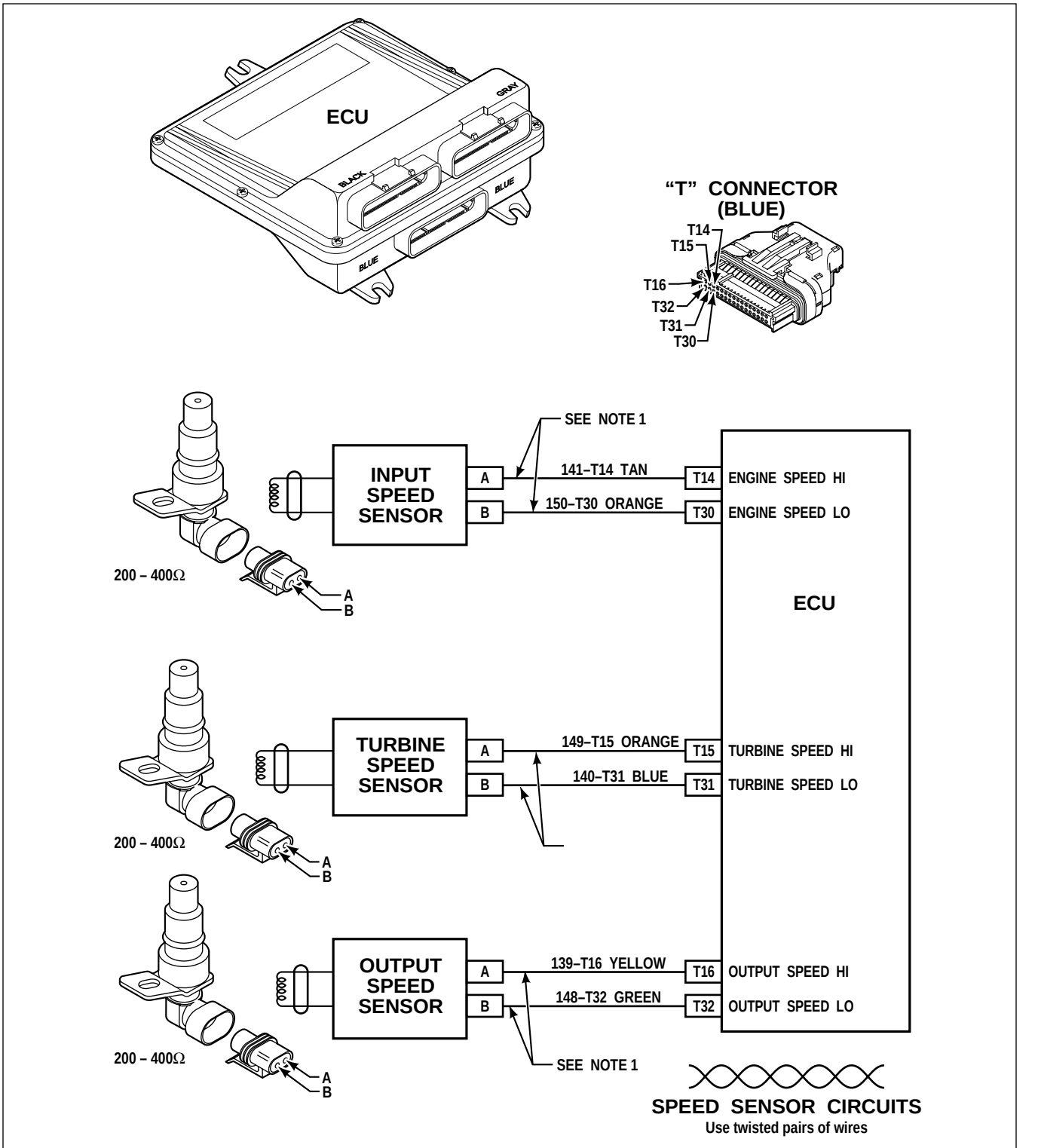
Figure 4–4. Short Between Wires or to Ground

NOTE: ***When conducting circuit checks that include the external harness, add one (1) Ohm to the values shown.***

DIAGNOSTIC CODES

NOTES

CODE 22 XX — SPEED SENSOR/CIRCUITRY FAULT



See Appendix B For Detailed Terminal Location.

NOTE 1: *These wires may pass through a bulkhead connector.*

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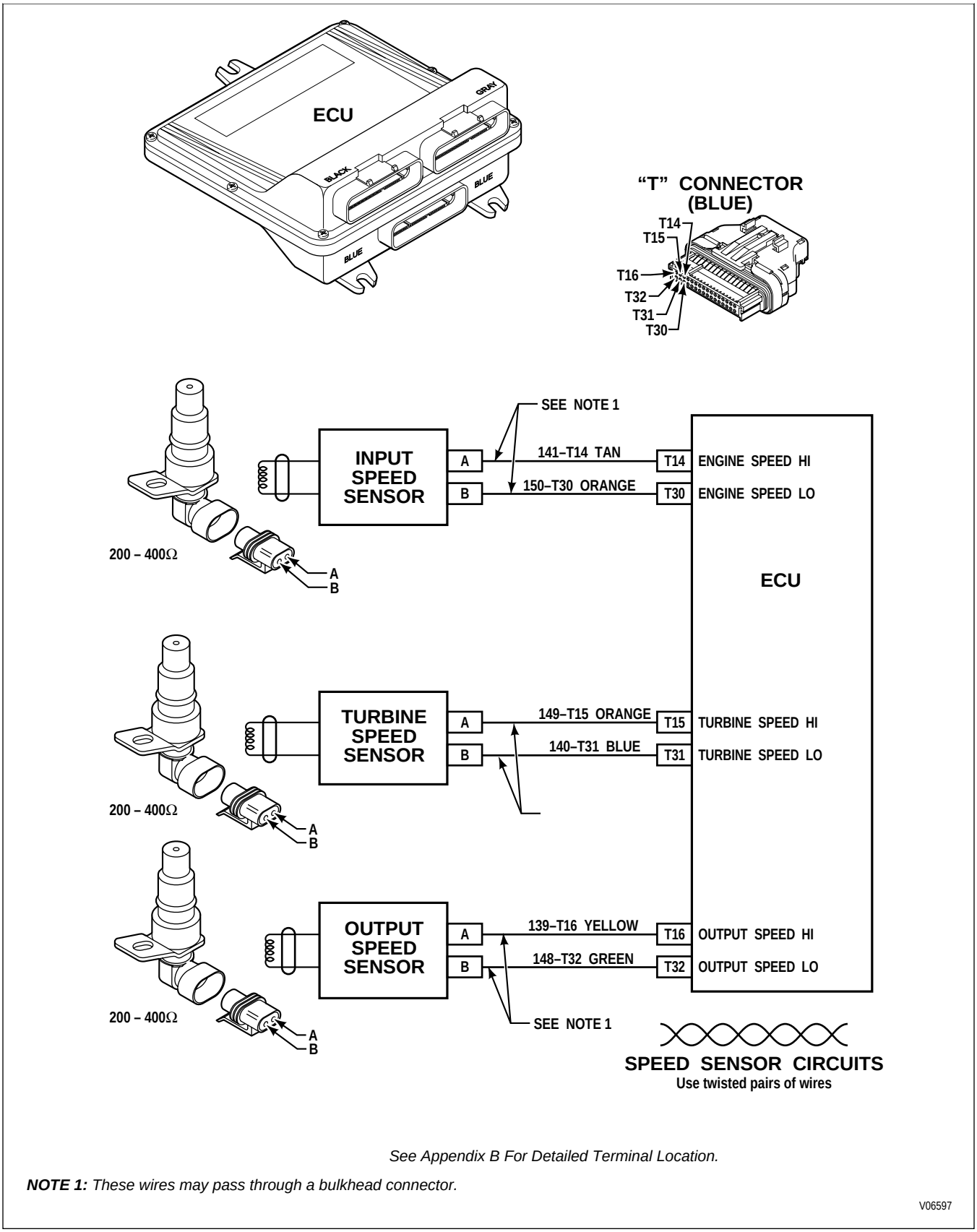
Figure 5–3. Code 22 Schematic Drawing

CODE 25 XX — OUTPUT SPEED SENSOR, DETECTED AT ZERO SPEED, X RANGE



See Appendix B For Detailed Terminal Location.

NOTE 1: *These wires may pass through a bulkhead connector.*

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Figure 5–7. Code 25 Schematic Drawing

DIAGNOSTIC CODES

NOTES

CODE 65 00 — ENGINE RATING HIGH

Main code 65 indicates the vehicle's engine horsepower/governor speed rating is too high. This code is set only when computer-controlled engines are used. Code 65 means the engine computer is able to tell the transmission, the engine horsepower and/or governor speed is beyond the transmission rating or does not match the transmission shift calibration.

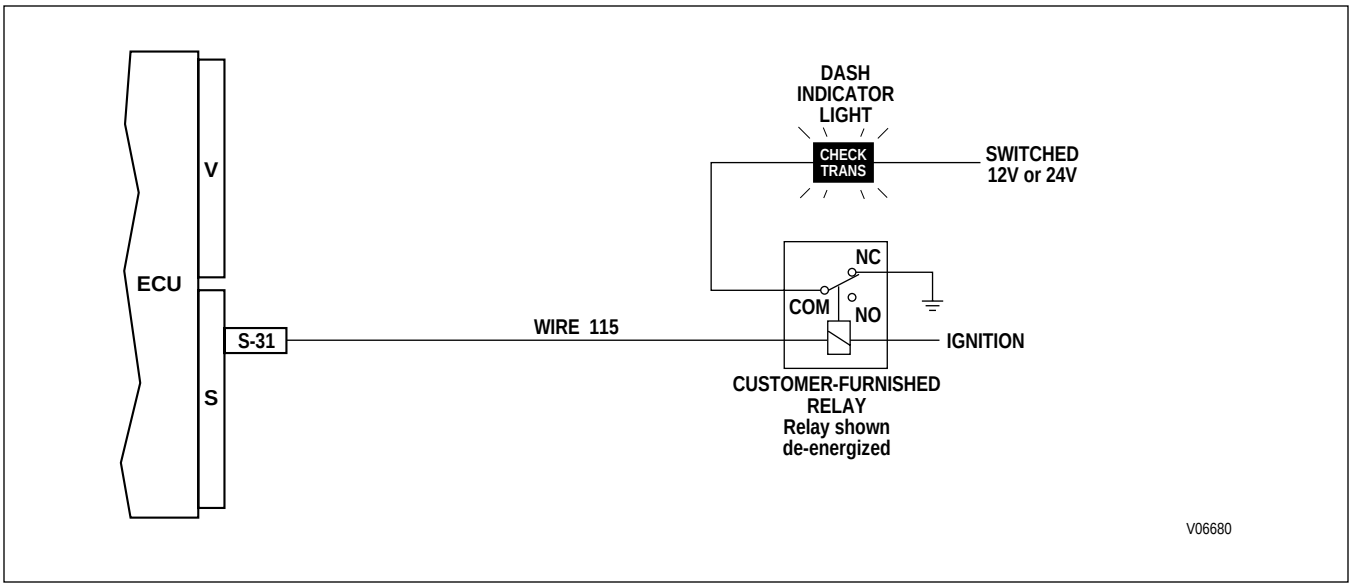
When a code 65 is set, no shifts out of neutral are allowed. It is possible the transmission calibration selected for this engine is improper. Contact Allison Transmission for assistance in selecting a proper calibration.

If the engine is beyond transmission ratings, contact the vehicle OEM for correction.

This code cannot be cleared until the proper level engine is installed or the transmission is properly calibrated.

VEHICLE INTERFACE WIRING

6–6. CHECK TRANS LIGHT



Wire 115 goes from ground to open when the ECU senses a major transmission problem.

- An external relay is required if the current is 0.5 amps or greater.
- Do not use this signal in a vehicle shut-down system.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints

Problem	Probable Cause	Suggested Remedy
SHIFT SELECTOR DISPLAYS "CATEYE" AND VEHICLE IS NOT OPERABLE	No communication between the ECU and a remote shift selector	Refer to code 23 XX troubleshooting procedure
SHIFT SELECTOR DISPLAY IS BLANK	VIM Fuse is blown	Replace VIM fuse
	Fuse blown in OEM substitute	Replace fuse for VIM
	Failed SDL (Serial Data Link)	Should change to "cateye" within 12 seconds (see Code 23 16)
SHIFT SELECTOR NOT LIGHTED AT NIGHT (WHEN HEADLIGHTS ARE ON)	Wires 186, 187, or 188 are not connected or are improperly connected.	Find wires 186, 187, and 188 and connect them or install wires, if necessary.
VEHICLE WILL NOT START (ENGINE WILL NOT CRANK)	Lever shift selector not in neutral	Select **N** (Neutral) and restart
	Dead battery	Recharge battery
	Disconnected battery	Reconnect battery
	Faulty starter circuit	Repair vehicle starter circuit
	Faulty neutral start relay	Replace neutral start relay
	Faulty wiring in neutral start circuit	Repair wiring
	Voltage to ECU too low	Check battery and charging system voltage. Refer to Code 13 12 troubleshooting procedure.
	Faulty ignition wire (146)	Repair wire 146
	Faulty lever shift selector	Replace lever shift selector. Refer to Code 23 XX troubleshooting procedure.
	Lack of battery voltage on Circuit 123 from ECU when in neutral	Repair Circuit 123 or replace the ECU
All display segments of display lighted	No calibration installed in ECU. Voltage to ECU too low	Load Calibration Check battery and charging system voltage. Refer to Code 35 00 troubleshooting procedure.

APPENDIX B — WIRE/CONNECTOR CHART

Table B–1. Appendix B Abbreviation Guide *(cont'd)*

Termination Point Abbreviation	Connector Name
TPS	Throttle Position Sensor
VIM	Vehicle Interface Module
VIWS	Vehicle Interface Wiring — ECU Selector (S) Harness
VIWV	Vehicle Interface Wiring — ECU Vehicle (V) Harness

NOTE: ***Detail information related to each connector end view in this appendix was taken from the CEC 2 System Wiring Schematic in Appendix G. Consult the wiring schematic for the relationship of each connector to other system components.***

APPENDIX B — WIRE/CONNECTOR CHART

REMOTE SHIFT SELECTOR CONNECTOR — SECONDARY SELECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Orange	190-S21	Secondary Shift Selector, Data Bit 1	ECU-S21
B	Green	191-S22	Secondary Shift Selector, Data Bit 2	ECU-S22
C	Blue	192-S23	Secondary Shift Selector, Data Bit 4	ECU-S23
D	Yellow	193-S24	Secondary Shift Selector, Data Bit 8	ECU-S24
E	Tan	194-S25	Secondary Shift Selector, Parity	ECU-S25
F				
G				
H				
J				
K				
L	Orange	176-S15	General Purpose Output 6 or 31	VIWS-L, PSS-L, ECU-S15
M	Green	175-S10	Shift Selector Mode Input	PSS-M, ECU-S10
N	Pink	124-S3	Sensor Power	PSS-N, ECU-S3
P	Gray	143-S32	Signal Return	VIWS-P, PSS-P, DDRP-A, DDRD-E, ECU-S32
R	Pink	136-S16	Battery Power	PSS-R, ECU-S16
S	Blue	180-S14	Shift Selector Display	PSS-S, ECU-S14
T	Blue	186	Chassis Return (12V) or Output From 12V Dimmer (24V)	PSS-T, VIWS-T
U	Red	187	Selector Backlighting/Feed (12V) or Not Used (24V)	PSS-U, VIWS-U
V	White	188	Selector Backlighting/Return (12V and 24V)	PSS-V, VIWS-V
W				

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX B — WIRE/CONNECTOR CHART

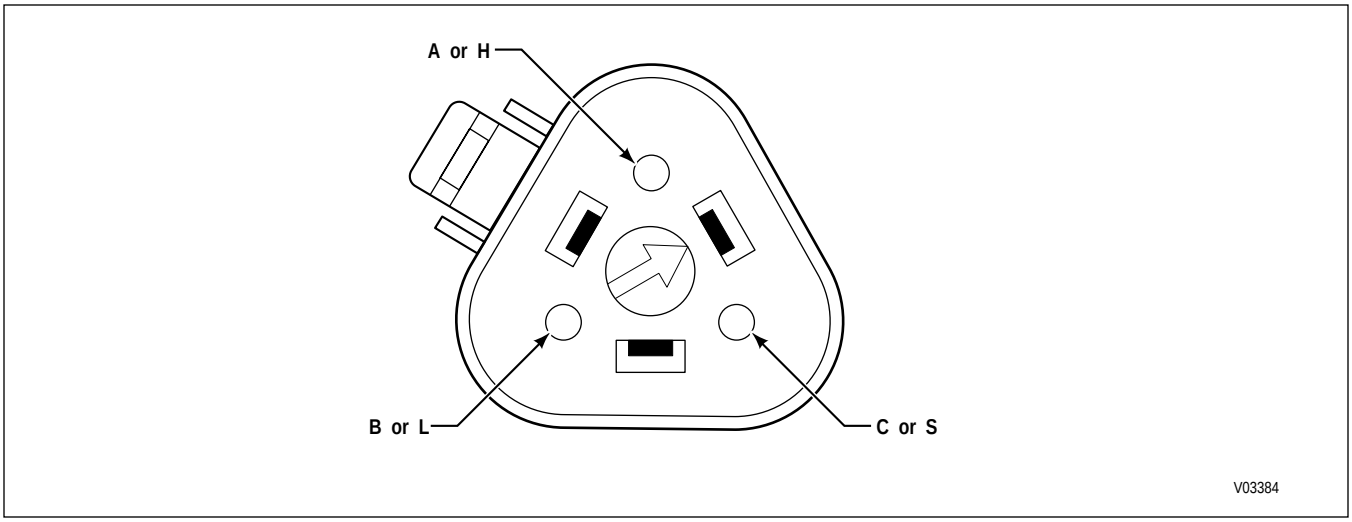


Figure B–17. J1939 Interface Connector

J1939 INTERFACE CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A or H	Red	183-S13	J1939 Controller, Hi	ECU-S13
B or L	Gray	184-S29	J1939 Controller, Lo	ECU-S29
C or S	Green	182-S12	J1939 Shield	ECU-S12

* For clarification of terminal number and termination point(s), refer to ECU INTERFACE SCHEMATIC in Appendix G.

APPENDIX C — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping — VIM And Speed Sensor Terminals (Standard Crimping Tool)

1. If a spare wire is used, the wire should be pushed through the proper hole in the strain relief (if used), through the wire seal, and out the other side of the connector before stripping.
2. Carefully strip insulation 0.18 ± 0.02 inch (4.5 mm ± 0.5 mm). Unless insulation crimp is over-tight, Automatic Wire Stripper J 35615 will remove insulation and crimp from old terminal without damaging wire.
3. Place core crimp portion of terminal on bed of anvil “E” and squeeze crimper enough to keep terminal from dropping (Figure C–2, View B).
4. Position wire core in terminal and squeeze crimper tool to complete the core crimp. **Be sure to orient the terminal so that it is properly aligned with the terminal cavity in the connector.** The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).
5. Position insulation crimp of terminal on anvil “C” so that the entire insulation crimp area and a portion of the terminal between the core and insulation crimp areas are supported by the anvil. Complete the insulation crimp.
6. Be sure lock tang is lifted to allow proper reseating of the terminal.
7. Pull on the wire to pull the terminal completely into the cavity. (A click will be heard and the terminal should stay in place if the wire is pushed.)

D. Terminal Crimping Using Alternate Tool J 35123

1. If a spare wire is used, the wire should be pushed through the proper hole in the strain relief (if used) and the wire seal, and out the other side of the connector prior to stripping.
2. Insert remover tool in front side of connector to release locktab and push terminal out front of connector. Pull the terminal and wire out the front of the connector to complete Steps (3) through (7).
3. Push open the terminal holder on the crimper tool J 35123 and insert a terminal into the opening marked 18–16 (Figure C–2, View C) so that the crimp ends point up. Release the terminal holder.
4. Slightly close the crimping tool (close until one click is heard) but do not start to crimp the terminal. Place the terminal on the wire so it is in the same position as it will be when pulled back into the connector. The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).
5. Insert the wire into the terminal until the wire contacts the holder. (By doing this, the core and insulation should be properly positioned for the core and insulation crimp wings.)
6. Squeeze the crimper fully until it opens when released.
7. Open the terminal holder and remove the wire and terminal from the crimping tool.
8. Pull on the terminal to assure a tight crimp.
9. Be sure lock tang is lifted to allow proper reseating of the terminal.
10. Pull on the wire to pull the terminal completely into the cavity. (A click will be heard and the terminal should stay in place if the wire is pushed.)

APPENDIX C — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping Using Crimping Tool J 38125-6 *(cont'd)*

12. Insert the terminal into the connector. The terminal will "click" into place and should not pull out.
13. Secure the secondary lock. Both sides of the connector must be latched.

D. Terminal Crimping Using Alternate Crimper Pliers J 35606 or J 38852

1. Place the wire seal onto the wire before stripping the wire (Figure C–5, View C).
2. Strip wire to 0.24 ± 0.01 inch (6.0 ± 0.25 mm).
3. Insert terminal into crimping tool J 35606 (Figure C–6, View A), opening marked 18–20.
4. Position the terminal so the crimp wings are pointing up from the bottom jaw of the crimper and are properly positioned.
5. Slightly close the crimping tool to hold the terminal steady.
6. Slide the wire seal to the edge of the insulation and insert the wire and seal into the terminal (Figure C–6, View B).
7. Position the wire and seal and squeeze the crimping tool until it opens when released.
8. Tug on terminal to be sure the crimp is tight.
9. Insert terminal into connector. The terminal will "click" into place and should not pull out.
10. Relatch the secondary lock. Both sides of the connector must be latched.

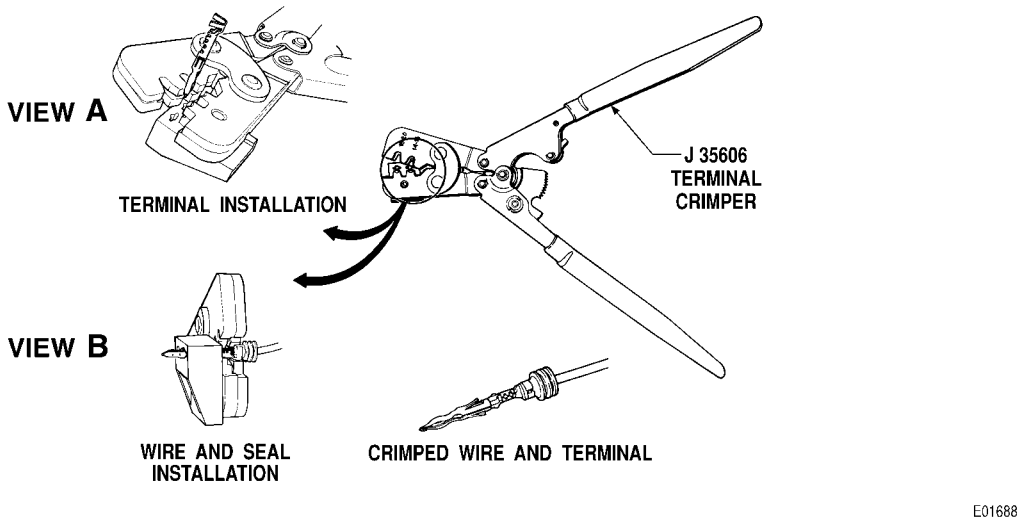


Figure C–6. Terminal Crimping With Tool J 35606

APPENDIX C — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

D. Soldering Wire Into Terminal *(cont'd)*

4. Mount the connector in a holding fixture at a 45 degree angle. Hold the solder in the terminal cup and apply heat to the side of the cup until the solder flows. If a new connector is being used, begin soldering at the bottom center connection and work up and out from there.

5. Slowly feed solder into the cup until it is half-full. When the cup is half-full, remove the solder supply before removing the soldering iron. Half-fill all cup terminals that are to have wires inserted.

NOTE: Feed solder slowly enough to prevent a flux gas pocket from forming. A gas pocket prevents sufficient solder from flowing into the cup — a false fill. Correct a false fill by reheating the cup and adding solder.

6. Start at the lowest cup and apply heat to the side of the cup until the solder melts.

NOTE: Do not overheat the connector while soldering. If the connector gets too hot, stop work until it cools.

7. Carefully insert the stripped end of the wire into the cup until the wire bottoms in the cup. The wire's insulation should be approximately 0.0625 inch (1.59 mm) above the solder.

8. Maintain heat until the solder has flowed in the cup and onto the wire. Overheating can cause the solder to wick up the stranded wire.

NOTE: Indications of a good solder connection are:

- ***A minimum amount of solder showing***
- ***Wire strands are clearly outlined in the joint***
- ***The joint is completely covered with solder***
- ***Fillets have a smooth even contour***
- ***Edges are feathered***
- ***The joint is bright, smooth, and appears clean***

Too little solder is better than too much. If the solder wicks up the wire, the wire may break at the point at which the solder stops.

9. After soldering and inspecting all connections, remove flux residue with a contact cleaner.

10. Slide the grommet into place and screw on the backshell.

APPENDIX D — THROTTLE POSITION SENSOR ADJUSTMENT

to counts which can be viewed with a diagnostic tool. The ECU determines percent throttle by the equation:

$$\% \text{ Throttle} = \frac{\text{Current Count} — \text{Idle Count}}{\text{Full Throttle Count} — \text{Idle Count}} \times 100$$

Where:

Idle Count = Count on diagnostic tool when engine is idling.

Current Count = Count on diagnostic tool at the present throttle position.

Full Throttle Count = Count on diagnostic tool at wide open throttle.

NOTE: Refer to Appendix J for DDR information.

5. The throttle position sensor is self-calibrating within its normal operating range. Each time the vehicle is started and the ECU is initialized, the idle counts that are used for closed throttle are increased by 15 counts from its previous lowest reading. Also, the wide open throttle counts are reduced by 15 counts from its previous highest reading. Once new counts are read from the current sensor position, the idle and wide open throttle count set points are continually readjusted to the lowest and highest counts, respectively. This compensates for fuel control system wear or previous mechanical adjustment. One area of particular concern is when the throttle sensor extends into the error zone. This indicates a TPS misadjustment to the ECU and 100 percent throttle is assumed until readjustment is performed. Simply clearing the code 21 XX will not resolve the 100 percent (WOT) shifting situation.

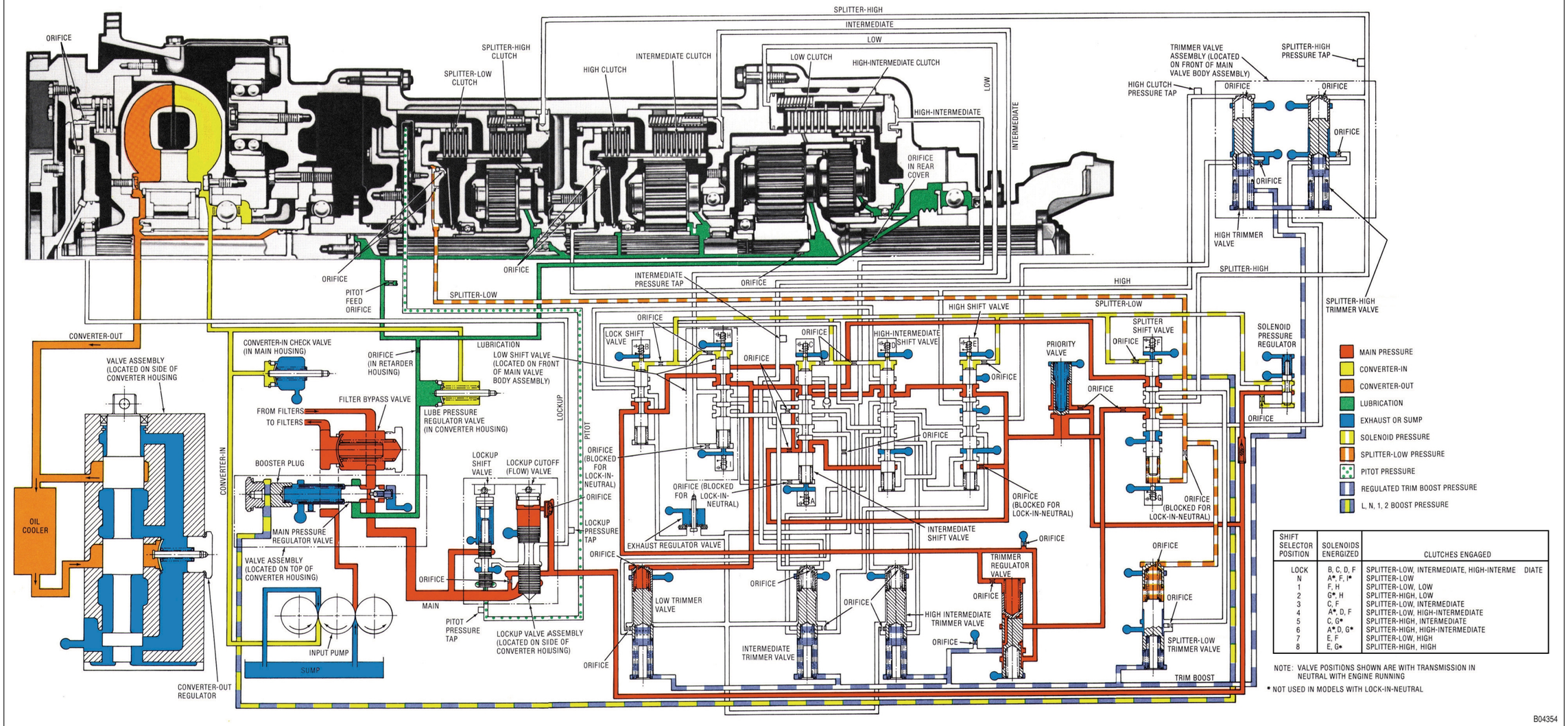
NOTE: After replacing or adjusting the throttle position sensor linkage, the technician should use the diagnostic tool to clear the throttle calibration. Go to the DDR selection menu and locate ACTION REQUESTS. Select RESET THROTTLE CALIBRATION and ENTER to set the 0 percent throttle counts. After the idle counts are established, the throttle should be moved to the Full position to establish the full or Wide Open Throttle (WOT) position (100 percent). The full throttle counts will be the same as the idle counts until the throttle is moved. The full throttle counts are set when maximum travel is reached so stopping before actual full throttle will set the 100 percent point artificially low. Refer to Figure D–2 for proper counts and percentage. Refer to Figure D–3 for illustration of throttle position adjustment.

B. Throttle Position Sensor (TPS) Adjustment

When properly installed by the equipment manufacturer, the TPS should not require adjustment. Confirm that the throttle sensor is installed to manufacturer specifications before adjusting the throttle position sensor. The idle count should be 50 or higher and full throttle count 200 or lower. The TPS is self-calibrating meaning there is no optimum closed throttle or wide open throttle count value. As long as the counts are within the 50 to 200 range, the TPS is set properly. Total stroke of 85–130 counts must be maintained. Watch the movement of the throttle sensor as the controls move it through its full stroke. Be sure there is no misalignment or obstruction to smooth movement through the full stroke. Make certain the idle and full throttle positions are not in the error zones (refer to Figure D–2). The error zones occur when the idle position is less than 14 counts, or when the full throttle position is more than 233 counts. When idle or wide open throttle positions are in the error zones, codes 21 12 and 21 23 occur, respectively. These codes cause the transmission to shift as if the throttle is fully depressed (100 percent throttle) affecting shift quality and causing decreased fuel efficiency. Code 21 XX may be caused by a short or open circuit in the chassis harness or by incorrect voltages. If this occurs, refer to code 21 XX chart.

NOTE: Use Test Harness J 41339 for measuring voltages.

APPENDIX F — HYDRAULIC SCHEMATICS



SHIFT SELECTOR POSITION	SOLENOIDS ENERGIZED	CLUTCHES ENGAGED
LOCK	B, C, D, F	SPLITTER-LOW, INTERMEDIATE, HIGH-INTERME DIATE
N	A*, F, I*	SPLITTER-LOW
1	F, H	SPLITTER-LOW, LOW
2	G*, H	SPLITTER-HIGH, LOW
3	C, F	SPLITTER-LOW, INTERMEDIATE
4	A*, D, F	SPLITTER-LOW, HIGH-INTERMEDIATE
5	C, G*	SPLITTER-HIGH, INTERMEDIATE
6	A*, D, G*	SPLITTER-HIGH, HIGH-INTERMEDIATE
7	E, F	SPLITTER-LOW, HIGH
8	E, G*	SPLITTER-HIGH, HIGH

NOTE: VALVE POSITIONS SHOWN ARE WITH TRANSMISSION IN NEUTRAL WITH ENGINE RUNNING

* NOT USED IN MODELS WITH LOCK-IN-NEUTRAL

Figure F–4. S 9810 Models — Hydraulic Schematic

APPENDIX J — PRO-LINK® 9000 DIAGNOSTIC DATA READER INFORMATION

NOTES

APPENDIX K — WIRING SCHEMATICS SPECIFIC INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

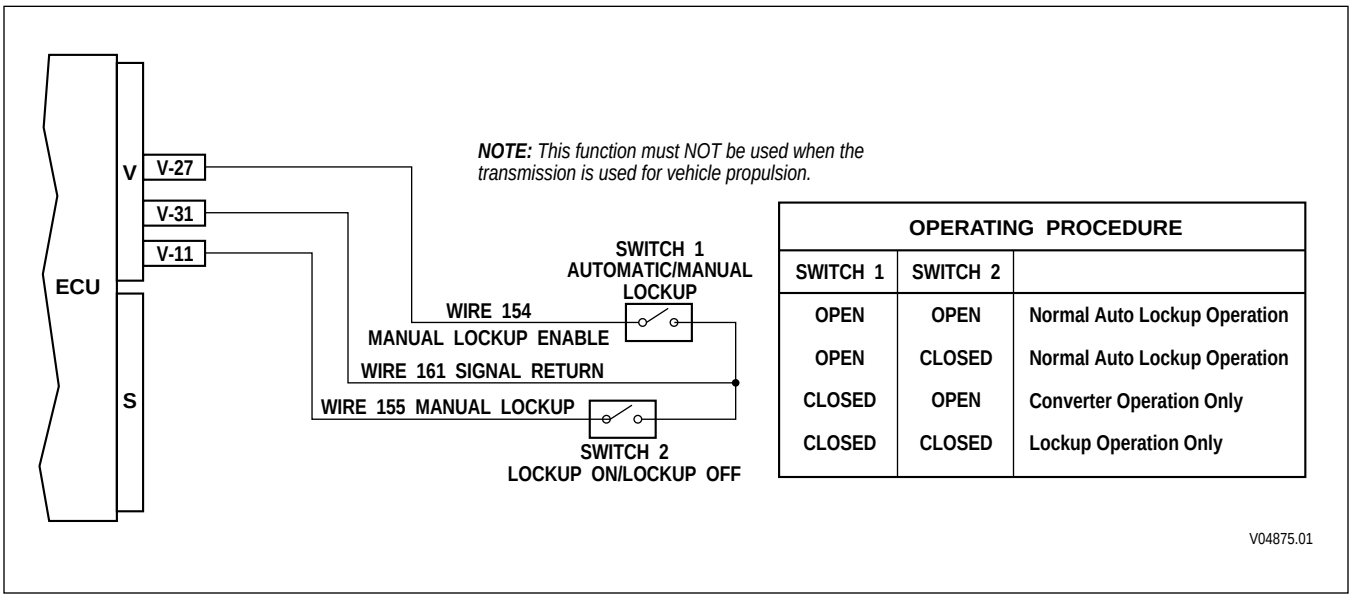
29. MANUAL LOCKUP ENABLE (ALSO SHOWN: INPUT 14, MANUAL LOCKUP)

USES: Provides for the manual application of the lockup clutch for non-roading applications. Uses two inputs; one to select manual versus automatic lockup shift mode, and the second as the switching mechanism to command the lockup clutch on and off.

VARIABLES TO SPECIFY: None

VOCATIONS: Oil field pumping, mud pumps, hoists, drilling, trenchers

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**



OPERATING PROCEDURE		
SWITCH 1	SWITCH 2	
OPEN	OPEN	Normal Auto Lockup Operation
OPEN	CLOSED	Normal Auto Lockup Operation
CLOSED	OPEN	Converter Operation Only
CLOSED	CLOSED	Lockup Operation Only

Figure K–10. Manual Lockup Enable

APPENDIX K — WIRING SCHEMATICS SPECIFIC INPUT/OUTPUT FUNCTIONS

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4. RANGE COMMANDED INDICATOR

USES: Used with auxiliary vehicle systems to permit operation only in specified transmission range(s).

VARIABLES TO SPECIFY: Range or ranges to be indicated

VOCATIONS: Various

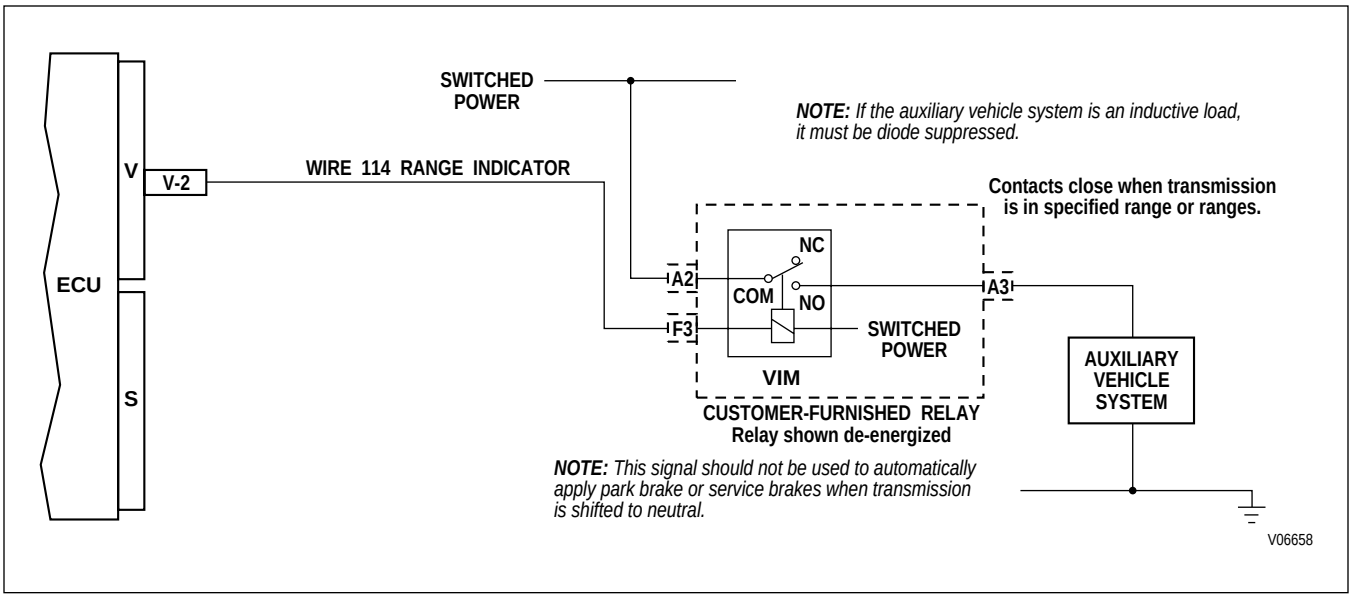

Figure K–20. Range Commanded Indicator