2008 Softail Models Electrical Diagnostics Manual

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http://www.harley-davidson.com

ABOUT THIS MANUAL

GENERAL

This electrical diagnostic service manual has been prepared with two purposes in mind. First, it will acquaint the user with the construction of the Harley-Davidson product and assist in the performance of repair. Secondly, it will introduce to the professional Harley-Davidson Technician the latest field-tested and factory-approved diagnostic methods. We sincerely believe that this manual will make your association with Harley-Davidson products more pleasant and profitable.

HOW TO USE YOUR SERVICE MANUAL

Refer to the table below for the content layout of this manual.

NO.	CHAPTER
1	Starting / Charging
2	Instruments
3	TSM/HFSM
4	Engine Management
A	Appendix A Connector Repair
B	Appendix B Wiring
C	Appendix C Conversions
D	Appendix D Glossary
E	Appendix E TSM/TSSM (Japan/Korea)

Use the TABLE OF CONTENTS (which follows this FOREWORD) and the INDEX (at the back of this manual) to quickly locate subjects. Sections and topics in this manual are sequentially numbered for easy navigation.

For example, a cross-reference shown as **2.1 SPECIFICATIONS** refers to chapter 2 CHASSIS, heading 2.1 SPECIFICATIONS.

For quick and easy reference, all pages contain a section number followed by a page number. For example, **page 3-5** refers to page 5 in section 3.

A number of acronyms and abbreviations are used in this document. See the D.1 GLOSSARY for a list of acronyms, abbreviations and definitions.

PREPARATION FOR SERVICE

⚠WARNING

Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

Good preparation is very important for efficient service work. A clean work area at the start of each job will allow you to perform the repair as easily and quickly as possible, and will reduce the incidence of misplaced tools and parts. A motorcycle that is excessively dirty should be cleaned before work starts. Cleaning will occasionally uncover sources of trouble. Tools, instruments and any parts needed for the job should be gathered before work is started. Interrupting a job to locate tools or parts is a distraction and causes needless delay.

NOTES

- *To avoid unnecessary disassembly, carefully read all relative service information before repair work is started.*
- *In figure legends, the number which follows the name of a part indicates the quantity necessary for one complete assembly.*
- *When servicing a vehicle equipped with the Harley-Davidson Smart Security System (H-DSSS), you must first disarm the security system. Either keep the fob in close proximity to the vehicle, or use Digital Technician to disable the security system while the vehicle is being serviced and re-enable the system after service is completed.*

SERVICE BULLETINS

In addition to the information presented in this Service Manual, Harley-Davidson Motor Company will periodically issue Service Bulletins to Harley-Davidson dealers. Service Bulletins cover interim engineering changes and supplementary information. Consult the Service Bulletins to keep your product knowledge current and complete.

USE GENUINE REPLACEMENT PARTS

⚠WARNING

Do not use aftermarket parts and custom made front forks which can adversely affect performance and handling. Removing or altering factory installed parts can adversely affect performance and could result in death or serious injury. (00001a)

To ensure satisfactory and lasting repairs, carefully follow the Service Manual instructions and use only genuine Harley-Davidson replacement parts. Behind the emblem bearing the words GENUINE HARLEY-DAVIDSON stand more than 100 years of design, research, manufacturing, testing and inspecting experience. This is your assurance that the parts you are using will fit right, operate properly and last longer.

WARNINGS AND CAUTIONS

Statements in this service manual preceded by the following words are of special significance.

⚠WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. (00119a)

⚠CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. (00139a)

CAUTION

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage. (00140a)

NOTE

Refers to important information, and is placed in italic type. It is recommended that you take special notice of these items.

Proper service and repair is important for the safe, reliable operation of all mechanical products. The service procedures recommended and described in this service manual are effective methods for performing service operations.

⚠WARNING

Always wear proper eye protection when using hammers, arbor or hydraulic presses, gear pullers, spring compressors, slide hammers and similar tools. Flying parts could result in death or serious injury. (00496b)

Some of these service operations require the use of tools specially designed for the purpose. These special tools should be used when and as recommended. It is important to note that some warnings against the use of specific service methods, which could damage the motorcycle or render it unsafe, are stated in this service manual. However, please remember that these warnings are not all-inclusive. Inadequate safety precautions could result in death or serious injury.

Since Harley-Davidson could not possibly know, evaluate or advise the service trade of all possible ways in which service might be performed, or of the possible hazardous consequences of each method, we have not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by Harley-Davidson must first thoroughly satisfy himself that neither his nor the operator's safety will be jeopardized as a result. Failure to do so could result in death or serious injury.

PRODUCT REFERENCES

⚠WARNING

Read and follow warnings and directions on all products. Failure to follow warnings and directions can result in death or serious injury. (00470b)

When reference is made in this manual to a specific brand name product, tool or instrument, an equivalent product, tool or instrument may be substituted.

Kent-Moore Products

All tools mentioned in this manual with an "HD", "J" or "B" preface must be ordered through SPX Kent-Moore. For ordering information or product returns, warranty or otherwise, visit www.spx.com.

Loctite Sealing and Threadlocking Products

Some procedures in this manual call for the use of Loctite products. If you have any questions regarding Loctite product usage or retailer/wholesaler locations, please contact Loctite Corp. at www.loctite.com.

PRODUCT REGISTERED MARKS

Allen, Amp Multilock, Bluetooth, Brembo, Delphi, Deutsch, Dunlop, Dynojet, Fluke, G.E. Versilube, Gunk, Hydroseal, Hylomar, Kevlar, Lexan, Loctite, Lubriplate, Keps, K&N, Magnaflux, Marson Thread-Setter Tool Kit, MAXI fuse, Molex, MPZ, Mulitilock, Novus, Packard, Pirelli, Permatex, Philips, PJ1, Pozidriv, Robinair, S100, Sems, Snap-on, Teflon, Threadlocker, Torca, Torco, TORX, Tufoil, Tyco, Ultratorch, Velcro, X-Acto, and XM Satellite Radio are among the trademarks of their respective owners.

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All photographs, illustrations and procedures may not necessarily depict the most current model or component, but are based on the latest production information available at the time of publication.

Since product improvement is our continual goal, Harley-Davidson reserves the right to change specifications, equipment or designs at any time without notice and without incurring obligation.

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GENERAL

The troubleshooting tables contain detailed procedures to solve and correct problems. Follow 1.2 STARTING SYSTEM DIAGNOSIS to diagnose starting system problems. The 1.3 DIAGNOSTICS/TROUBLESHOOTING, Voltage Drop procedure will help you to locate poor connections or components with excessive voltage drops.

STARTER TROUBLESHOOTING

Table 1-1. Starter Does Not Run or Runs at Very Low Speeds

SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
Battery	Voltage drop due to discharged battery.	Charge battery.
	Short-circuited or open between electrodes.	Replace battery.
	Poor contact condition of battery terminal(s).	Clean and retighten.
Wiring	Poor or no connection at either battery positive or negative cable, at either end.	Repair or replace cable(s).
	Cracked or corroded battery cable ends.	Clean, tighten or replace cable(s) as needed.
	Open wire(s) or poor connection at handlebar switch or start relay, especially relay ground wire (grounds through TSM/TSSM/HFSM).	Tighten connections or repair or replace wire(s).
Start switch, clutch switch, engine stop switch or neutral switch	Poor switch contacts or open switch.	Replace switch.
Start relay	Open coil winding.	Replace relay.
	Poor or no continuity at relay points.	Replace relay.
	TSM/TSSM/HFSM has disabled start relay.	Disarm security system.
Solenoid	Poor contact condition caused by burned contact.	Polish contact surface or replace solenoid assembly.
	Pull-in winding open or short-circuited.	Repair or replace solenoid assembly.
	Hold-in winding open or short-circuited.	Repair or replace solenoid assembly.
Starter motor	Brushes worn below specification.	Check brush spring tension. Replace field frame and holder.
	Commutator burned.	Re-face or replace.
	Commutator high mica.	Correct by undercutting.
	Field winding grounded.	Replace starter.
	Armature winding grounded or short-circuited.	Replace armature.
	Free running current draw test out of range.	Replace starter.
	Reduction gears damaged.	Replace starter.
	Insufficient brush spring tension.	Replace starter.
	Disconnected lead wire between solenoid and field windings.	Repair or replace lead wire.
	Ball bearing sticks.	Replace bearing.
Temperature	Incorrect oil for low temperature.	Use recommended viscosity oil for temperature range. Consult owner's manual.

Table 1-2. Pinion Does Not Engage With Ring Gear While Starter is Cranked or Engine Cannot Be Cranked

SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
Battery	Voltage drop due to discharged battery.	Charge battery.
	Short-circuited or open between electrodes.	Replace battery.
	Poor contact condition of battery terminal(s).	Clean and retighten.
Overrunning clutch	Overrunning clutch malfunction (rollers or compression spring).	Replace overrunning clutch.
	Pinion teeth worn out.	Replace starter clutch sub-assembly.
	Pinion does not run in overrunning direction.	Replace overrunning clutch.
	Poor sliding condition of spline teeth.	Remove foreign materials, dirt or replace overrunning clutch or pinion shaft.
	Reduction gears damaged.	Replace overrunning clutch and idler gear.
Gear teeth on clutch shell	Excessively worn teeth.	Replace clutch shell.

Table 1-3. Starter Does Not Stop Running

SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
Start switch or start relay	Unopened contacts.	Replace start switch or start relay.
	Poor return caused by sticky switch or relay contacts.	Replace start switch or start relay.
Gear teeth on clutch shell	Excessively worn teeth.	Replace clutch shell.
Solenoid	Return spring worn.	Replace spring.
	Coil layer shorted.	Replace solenoid.
	Contact plate melted and stuck.	Replace solenoid.

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. See Figure 1-1. Test for voltage drops under 3.12 BREAKOUT BOX: TSM/HFSM.
2. Remove starter motor. Connect jumper wires as described in 1.6 TESTING STARTER ON BENCH, Free Running Current Draw Test.
3. Connect BREAKOUT BOX (Part No. HD-42682) to TSM/TSSM/HFSM as follows:
   a. On models with a TSM/HFSM, see E.11 BREAKOUT BOX: TSM/TSSM.
   b. On models with a TSSM (Japan/Korea), see E.11 BREAKOUT BOX: TSM/TSSM.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) gray terminal socket probe and patch cord.
5. See 1.5 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.
6. See 1.6 TESTING STARTER ON BENCH, Free Running Current Draw Test.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

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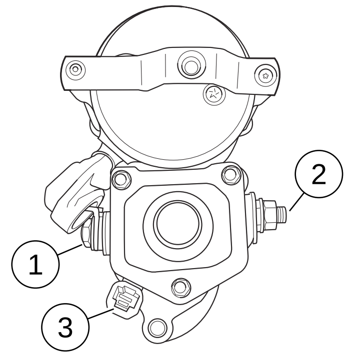


1. **Motor terminal**
2. **Battery terminal**
3. **Relay terminal**

Figure 1-1. Starter Terminals

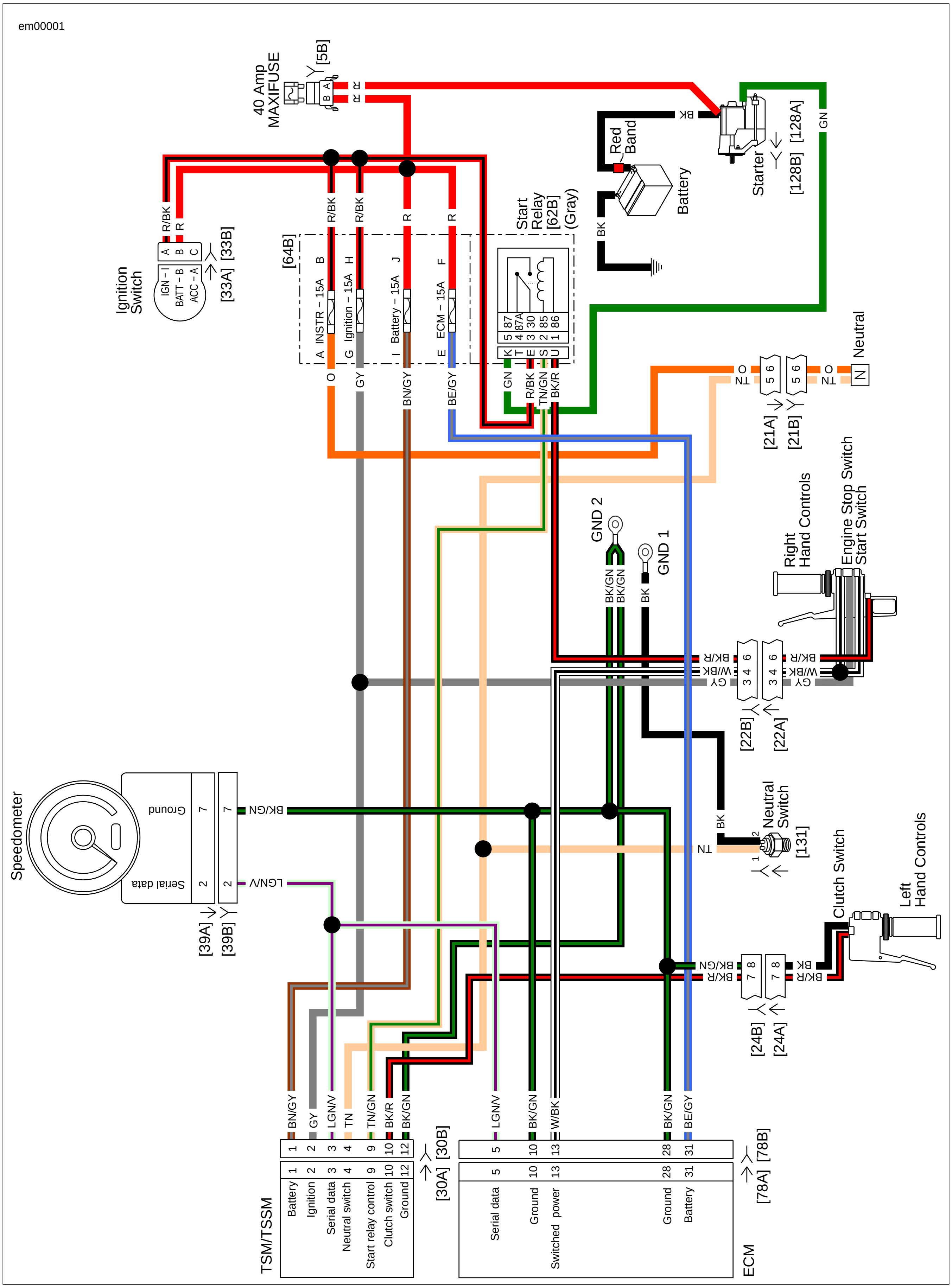


Figure 1-2. Starting Circuit (all except FXCWC)

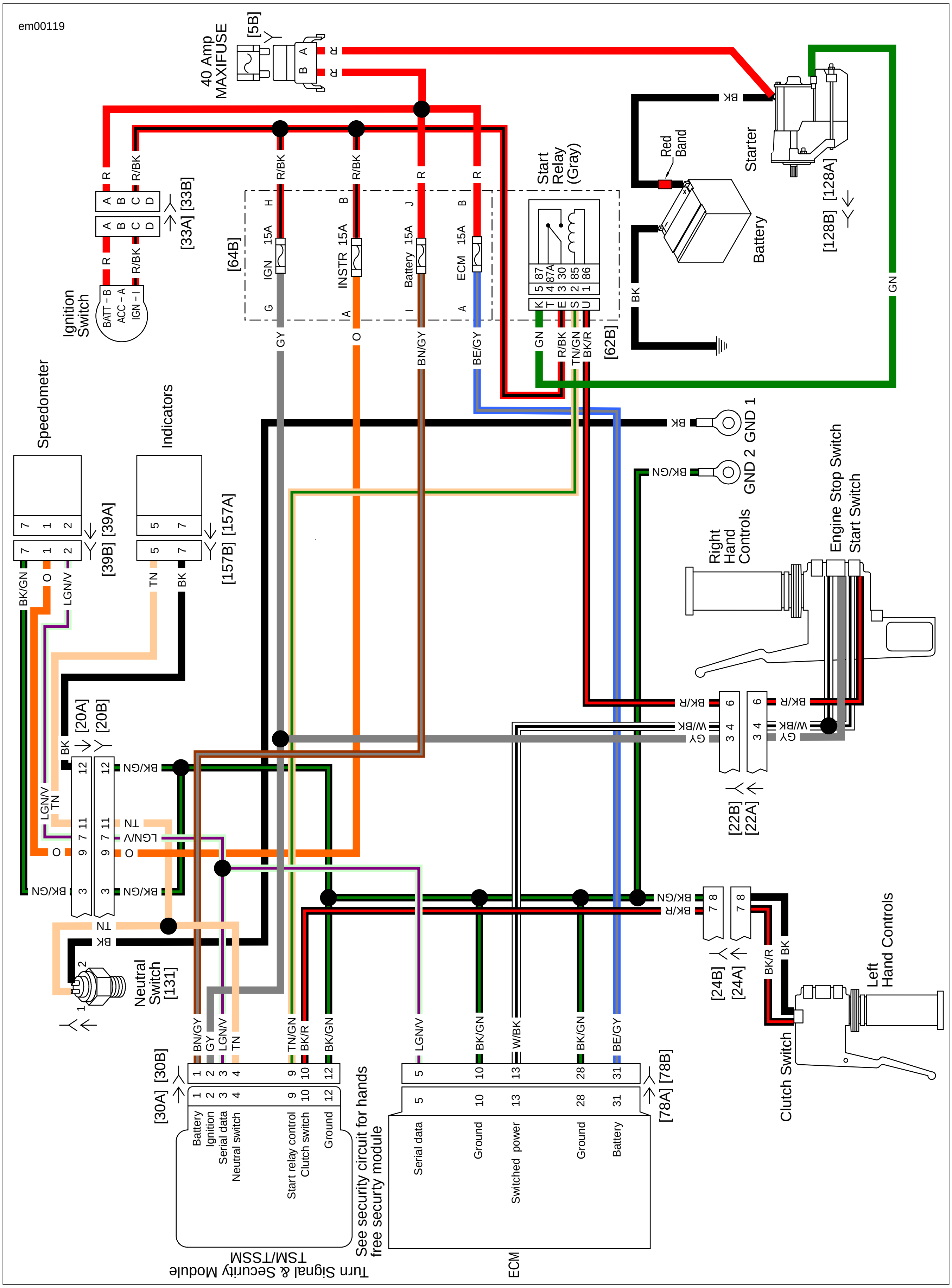
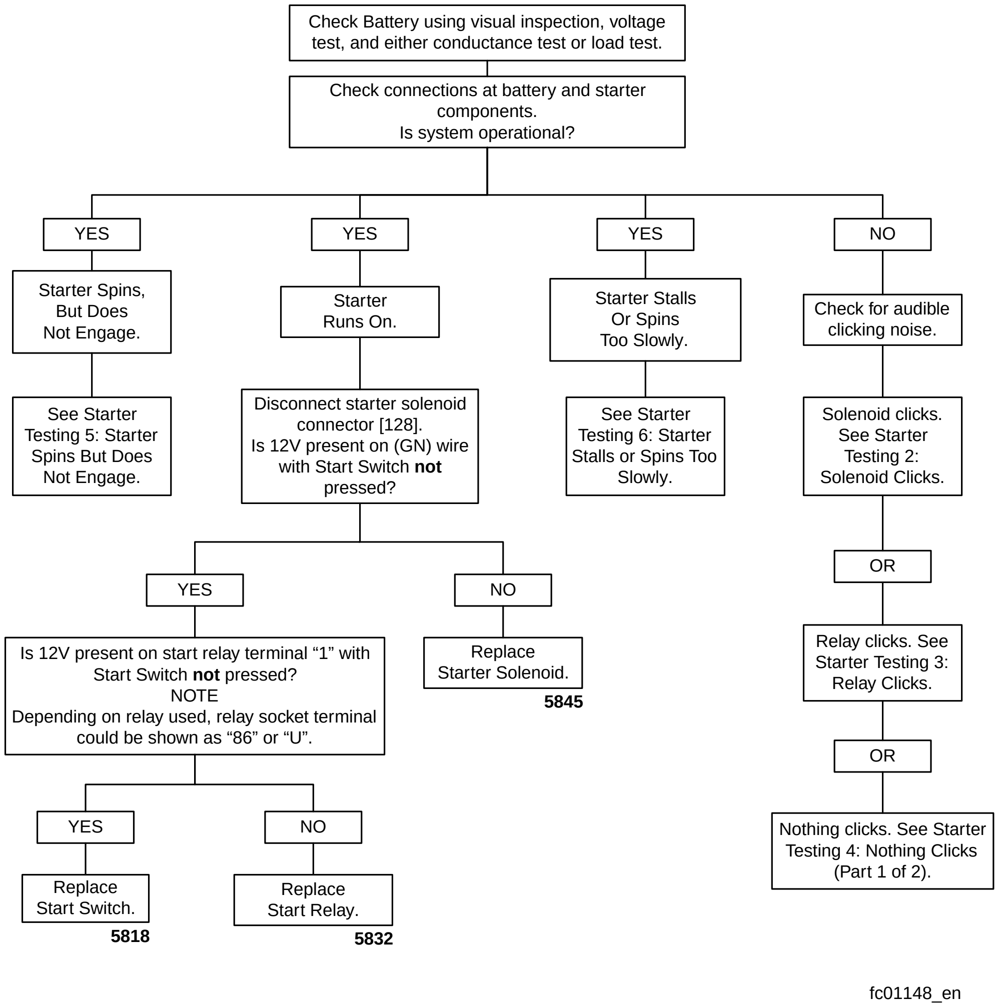
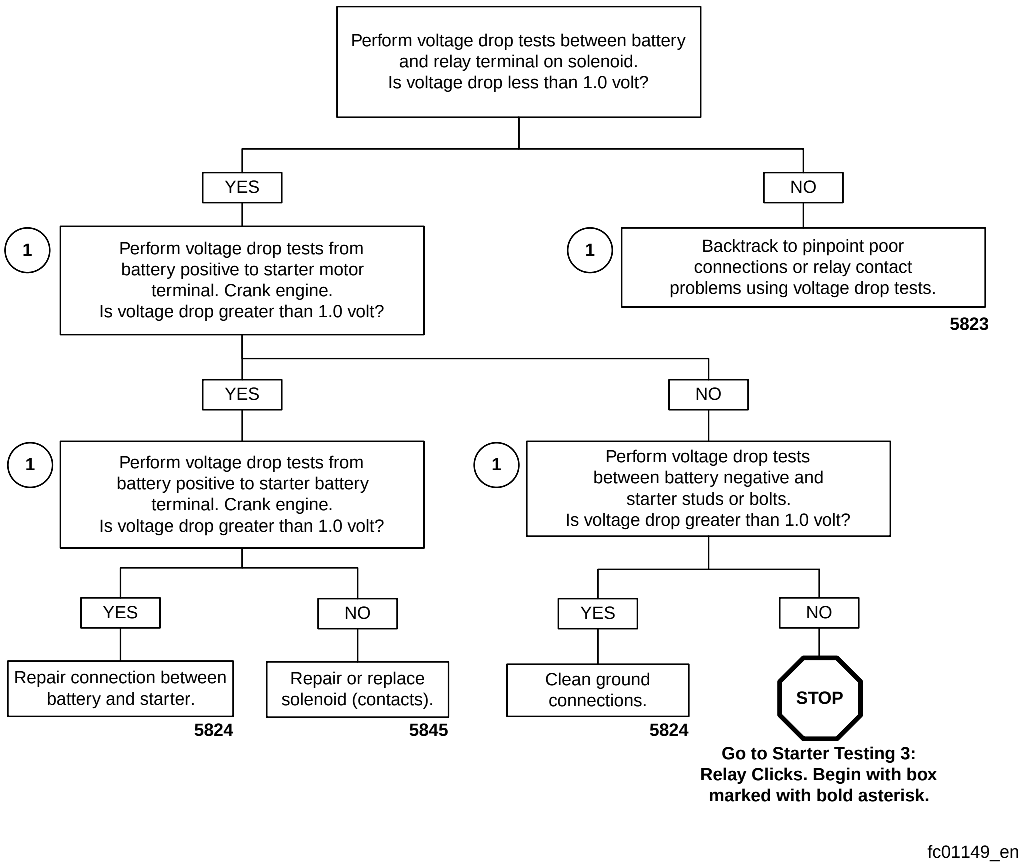


Figure 1-3. Starting Circuit (FXCWC)

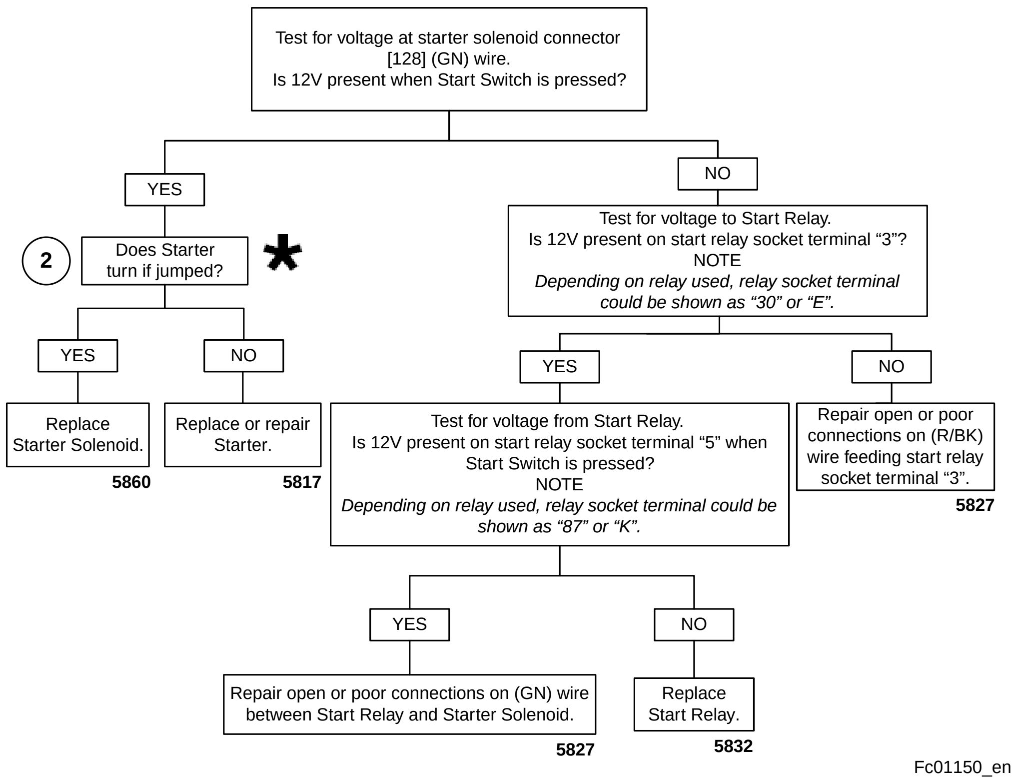
Starter Testing 1



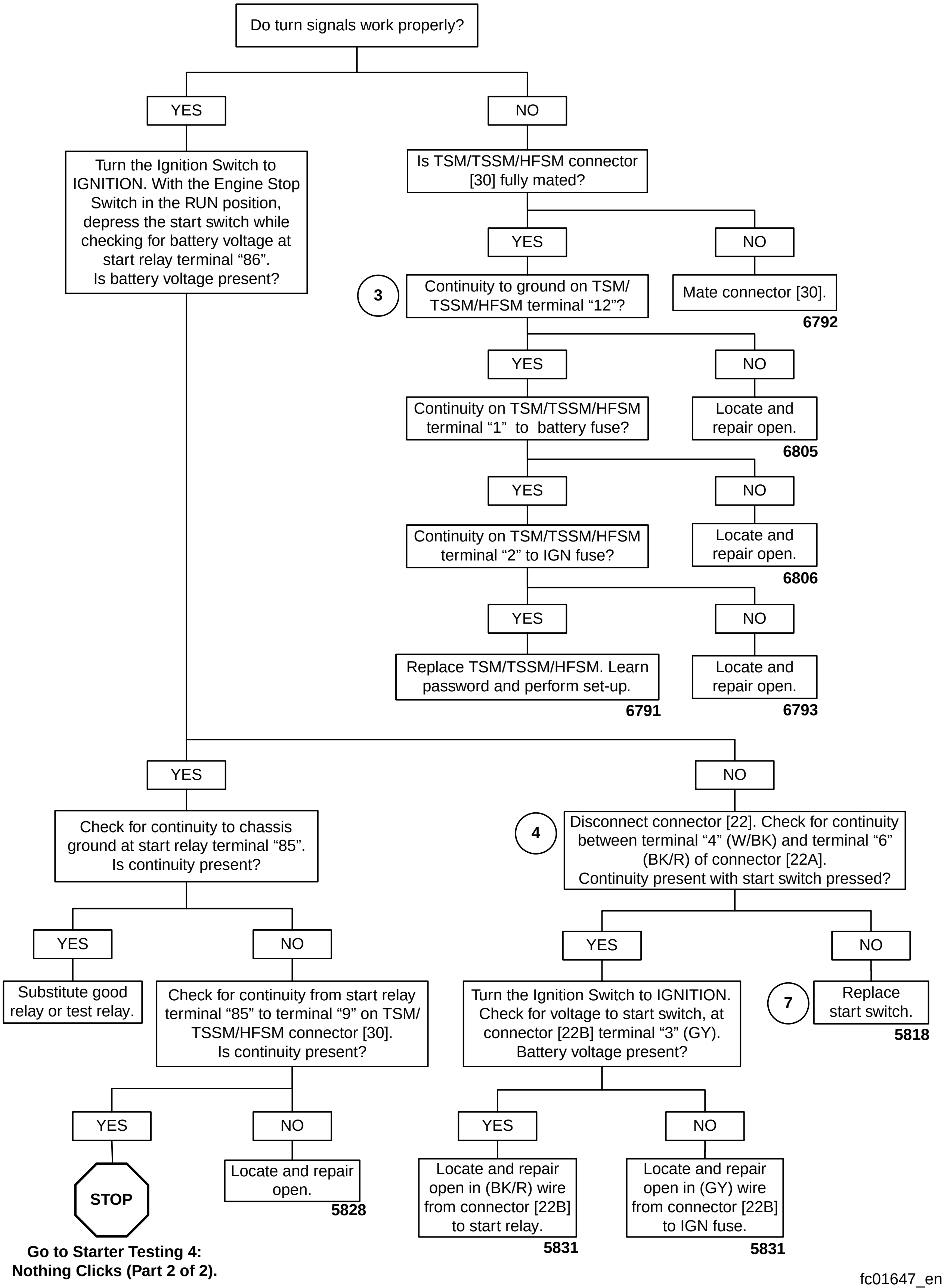
Starter Testing 2: Solenoid Clicks



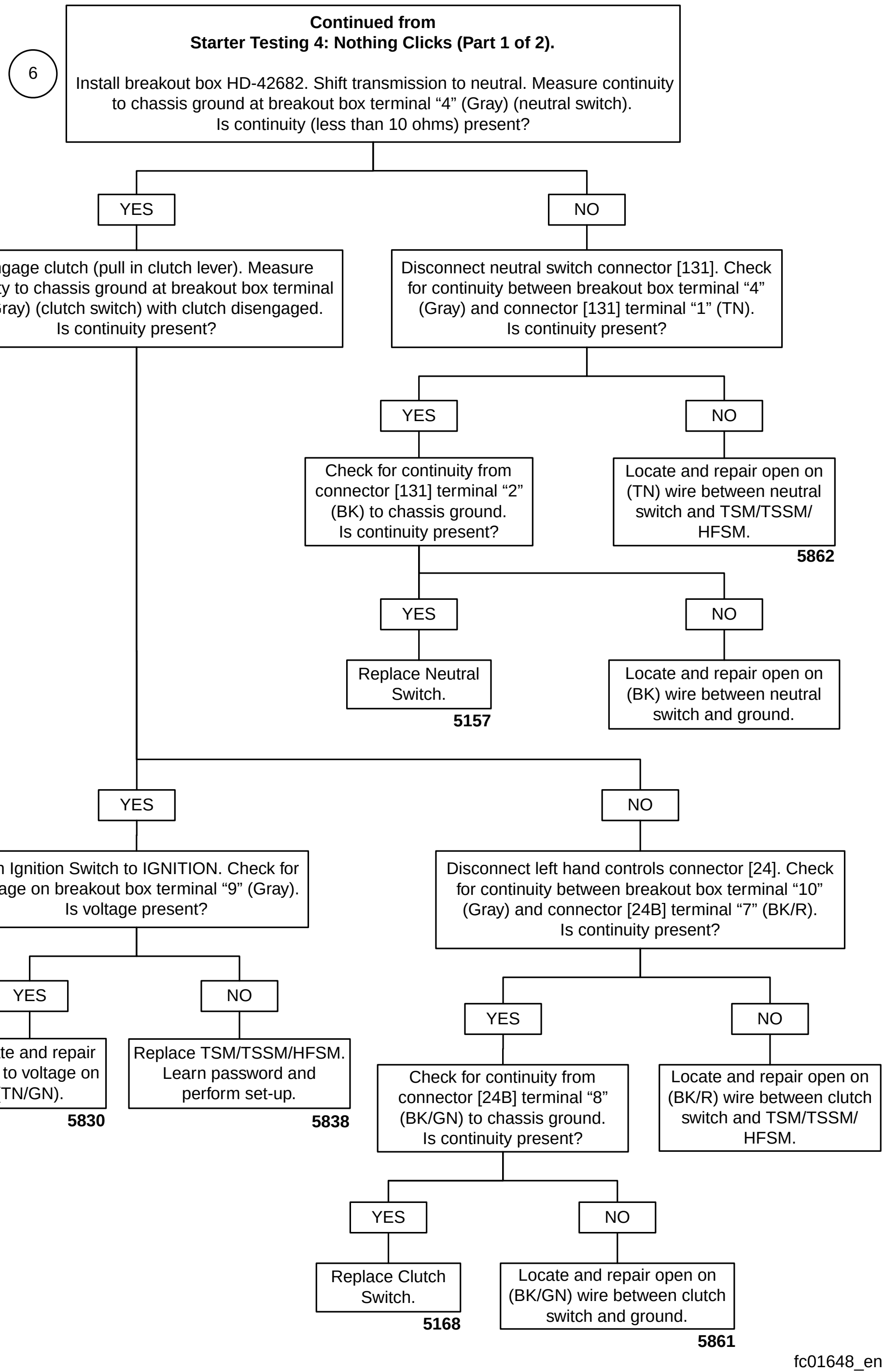
Starter Testing 3: Relay Clicks



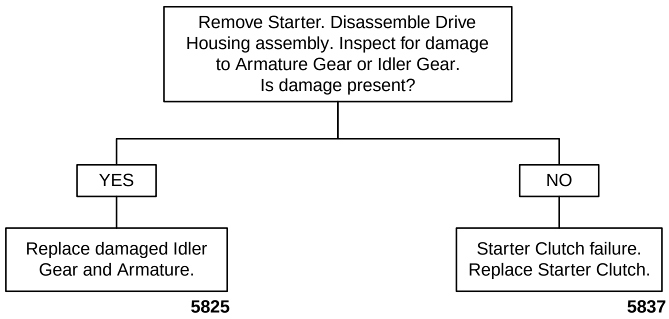
Starter Testing 4: Nothing Clicks (Part 1 of 2)



Starter Testing 4: Nothing Clicks (Part 2 of 2)



Starter Testing 5: Starter Spins But Does Not Engage



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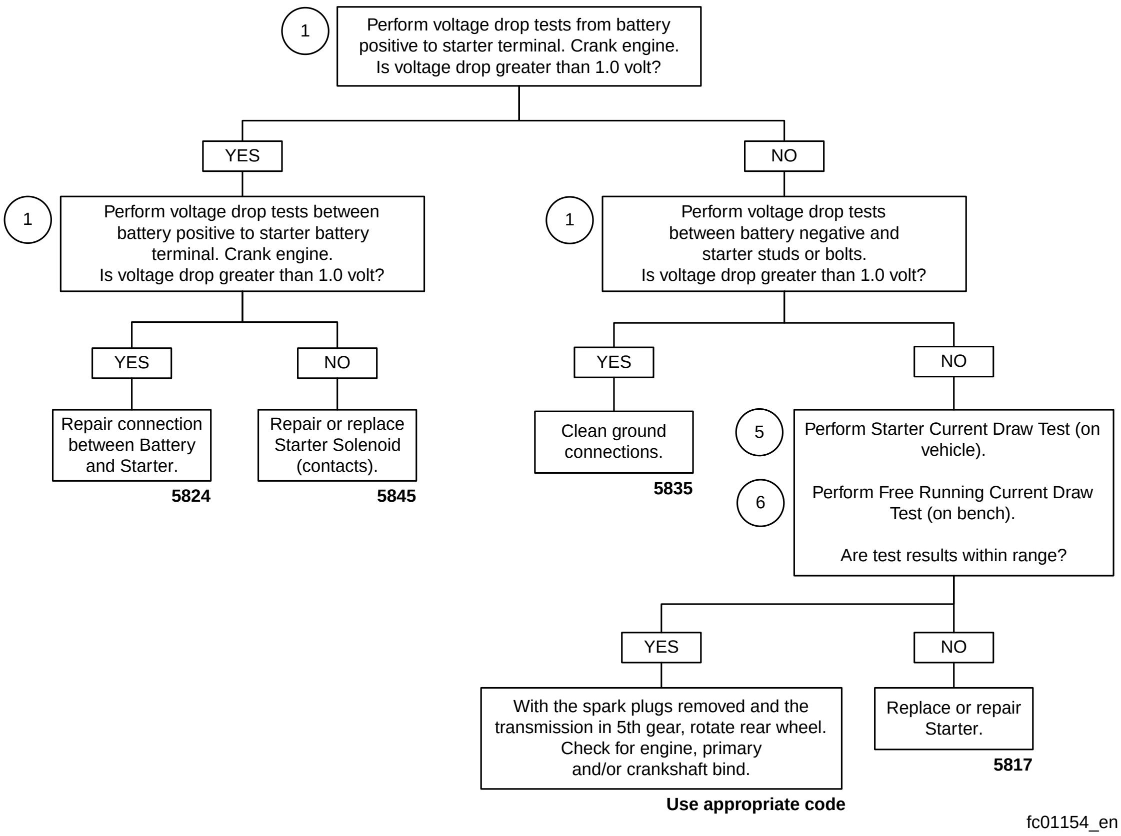
Starter Testing 6: Starter Stalls or Spins Too Slowly



VOLTAGE DROP

Check the integrity of all wiring, switches, fuses and connectors between the source and destination.

The voltage drop test measures the difference in potential or the actual voltage dropped between the source and destination.

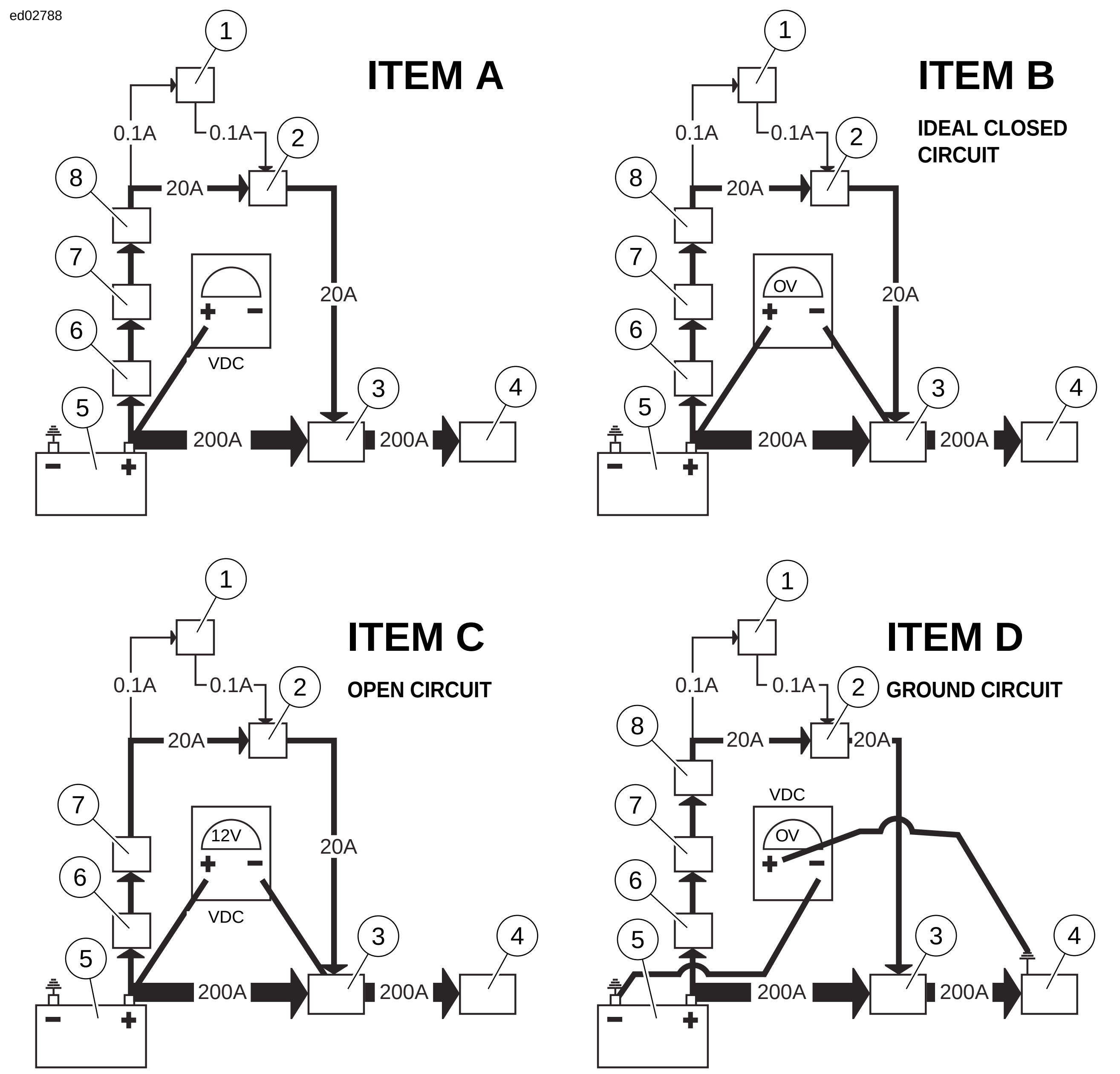
1. See ITEM A in Figure 1-4. Attach your red meter lead to the most positive part of the circuit, which in this case would be the positive post of the battery (5).
2. See ITEM B in Figure 1-4. Attach the black meter lead to the final destination or component in the circuit (solenoid terminal from relay).
3. Activate the starter and observe the meter reading. The meter will read the voltage dropped or the difference in potential between the source and destination. An ideal circuit's voltage drop would be 0 volt or no voltage dropped, meaning no difference in potential.
4. See ITEM C in Figure 1-4. An open circuit should read 12 volts, displaying all the voltage dropped, and the entire difference in potential displayed on the meter.

NOTE

Open circuits on the ground side will read zero.

5. Typically, a good circuit will drop less than 1.0 volt. If the voltage drop is greater, back track through the connections until the source of the potential difference is found. The benefits of doing it this way are speed and accuracy.
   a. Readings are not as sensitive to real battery voltage.
   b. Readings show the actual voltage dropped, not just the presence of voltage.
   c. This tests the system as it is actually being used. It is more accurate and will display hard to find poor connections.
   d. This approach can be used on lighting circuits, ignition circuits, etc. Start from most positive and go to most negative (the destination or component).
6. See ITEM D in Figure 1-4. The negative or ground circuit can be checked as well.
   a. Place the negative lead on the most negative part of the circuit (or the negative battery post). Remember, there is nothing more negative than the negative post of the battery.
   b. Place the positive lead to the ground you wish to check.
   c. Activate the circuit. This will allow you to read the potential difference or voltage dropped on the negative or ground circuit. This technique is very effective for identifying poor grounds due to powdered paint. Even the slightest connection may cause an ohmmeter to give a good reading. However, when sufficient current is passed through, the resistance caused by the powdered paint will cause a voltage drop or potential difference in the ground circuit.

STARTER ACTIVATION CIRCUITS

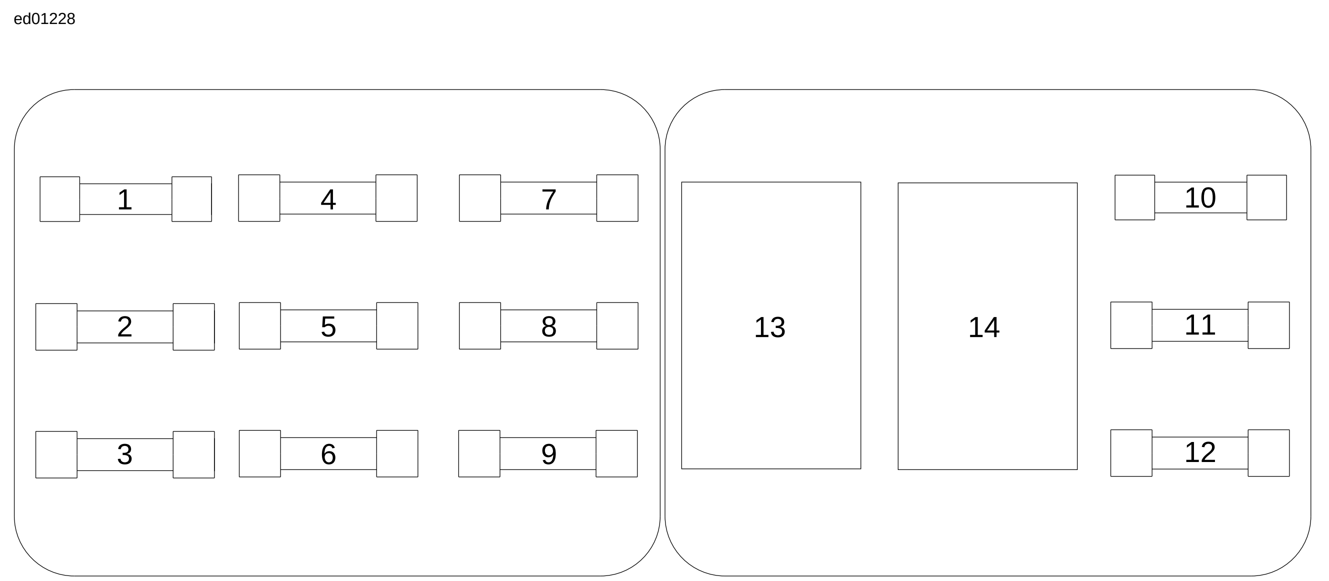


1. **Start switch**
2. **Relay**
3. **Solenoid**
4. **Starter**
5. **Battery**
6. **MAXIFUSE**
7. **Ignition switch**
8. **Ignition fuse**

Figure 1-4. Typical Circuitry. Refer to wiring diagrams for more information.

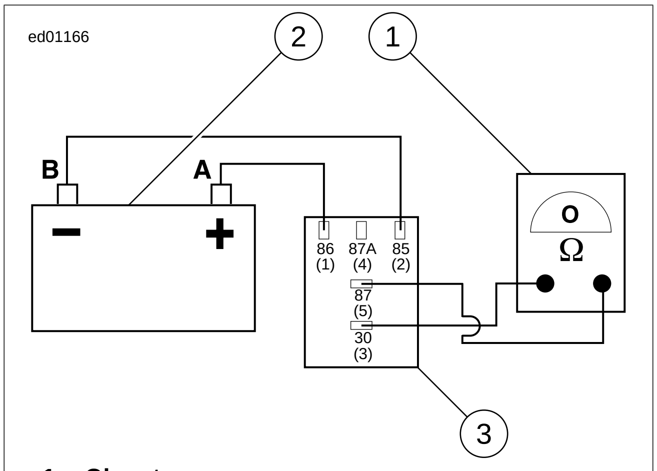
START RELAY TEST

1. See Figure 1-5. Locate start relay under the seat.
2. See Figure 1-6. The start relay can be tested using the motorcycle's 12 volt battery and a multimeter.
   a. Unplug connector from relay.
   b. To energize the relay, connect the negative battery terminal to relay terminal "85" or "2", and relay terminal "86" or "1" to the positive battery terminal. Improper connections will damage the diode connected across the relay windings.
   c. Check for continuity between terminals "30" or "3" and "87" or "5". A good relay shows continuity (continuity tester lamp "on" or a zero ohm reading on the ohmmeter). A malfunctioning relay will not show continuity and must be replaced.
3. If start relay is functioning properly, proceed to 1.5 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.



1. **EMC power**
2. **Engine control**
3. **Headlamp**
4. **P & A (2 Amp Max)**
5. **Battery**
6. **Accessories**
7. **Instruments**
8. **Ignition**
9. **Lights**
10. **Spare**
11. **Spare**
12. **Fuel pump**
13. **Start relay**
14. **System relay**

Figure 1-5. Fuse Block: Top View



1. **Ohmeter**
2. **Battery**
3. **Start relay**

Figure 1-6. Start Relay Test

STARTER CURRENT DRAW TEST

NOTES

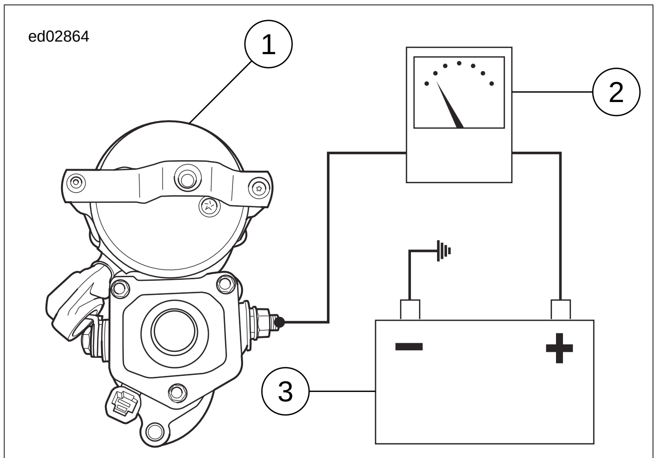
- *Engine temperature should be stable and at room temperature.*
- *Battery should be fully charged.*

See Figure 1-7. Check starter current draw with an induction ammeter before disconnecting battery. Proceed as follows:

1. Verify that transmission is in neutral. Disconnect spark plug wires from spark plug terminals.
2. Clamp induction ammeter over positive battery cable next to starter.
3. With Ignition Switch to IGN, turn engine over by pressing starter switch while reading the ammeter. Disregard initial high current reading which is normal when engine is first turned over.
   a. Typical starter current draw will range from 160 to 200 amperes.
   b. If starter current draw exceeds 250 amperes, the problem may be in the starter or starter drive. Remove starter for further tests. See the Service Manual.

NOTE

A DC current probe may be used if an induction ammeter is not available.



1. **Starter**
2. **Induction ammeter**
3. **Battery**

Figure 1-7. Starter Current Draw Test

FREE RUNNING CURRENT DRAW TEST

1. Place starter in vise, using a clean shop towel to prevent scratches or other damage.
2. See Figure 1-8. Attach one heavy jumper cable (6 gauge minimum).
   a. Connect one end to the starter mounting flange (1).
   b. Connect the other end to the negative (-) terminal of a fully charged battery (2).
3. Connect a second heavy jumper cable (6 gauge minimum).
   a. Connect one end to the positive (+) terminal of the battery (2).
   b. Connect the other end to the battery terminal (4) on the starter solenoid. Place an inductive ammeter (3) over cable.
4. Connect a smaller jumper cable (14 gauge minimum).
   a. Connect one end to the positive (+) terminal of the battery (2).
   b. Connect the other end to the solenoid relay terminal (5).
5. Check ammeter reading.
   a. Ammeter should show 90 amps maximum.
   b. If reading is higher, disassemble starter for inspection. See the Service Manual.
   c. If starter current draw on vehicle was over 200 amps and this test was within specification, there may be a problem with engine or primary drive.

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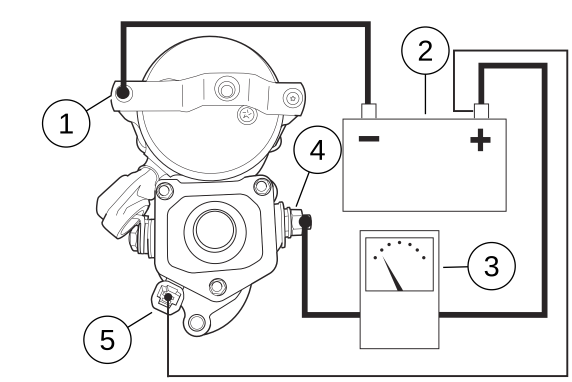

1. **Mounting flange**
2. **Battery**
3. **Induction ammeter**
4. **Battery terminal**
5. **Relay terminal**

Figure 1-8. Free Running Current Draw Test

STARTER SOLENOID

Do not disassemble solenoid. Before testing, disconnect field wire from motor terminal as shown in Figure 1-9.

Each test should be performed for only 3-5 seconds to prevent damage to solenoid.

The solenoid Pull-in, Hold-in, and Return tests must be performed together in one continuous operation. Conduct all three tests one after the other in the sequence given without interruption.

SOLENOID PULL-IN TEST

1. See Figure 1-9. Using a 12 volt battery, connect three separate test leads as follows:
   a. Solenoid housing to negative battery post.
   b. Solenoid motor terminal to negative battery post.
   c. Solenoid relay terminal to positive battery post.
2. Observe starter shaft.
   a. If starter shaft extends strongly, solenoid is working properly.
   b. If starter shaft does not extend strongly, replace the solenoid.

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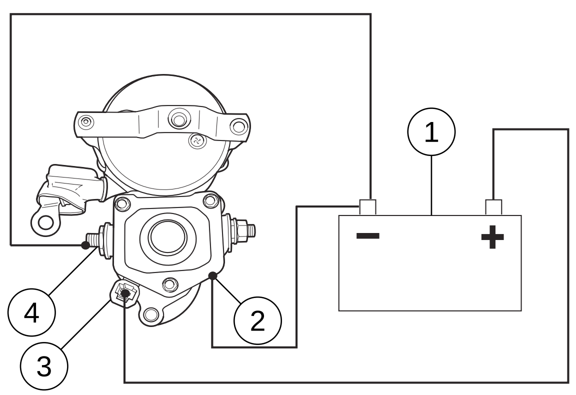


1. **Battery**
2. **Solenoid housing**
3. **Solenoid relay terminal**
4. **Solenoid motor terminal**

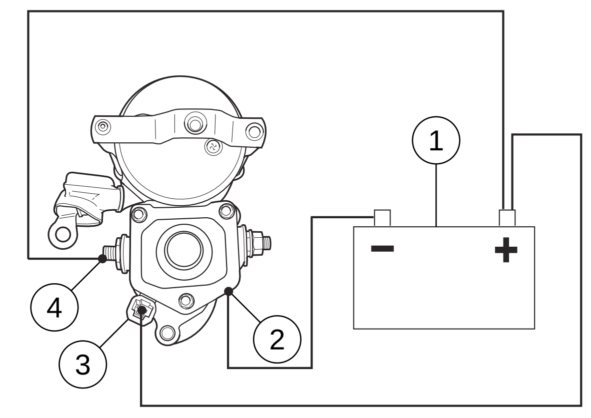
Figure 1-9. Pull-In Test

SOLENOID HOLD-IN TEST

1. See Figure 1-10. With test leads still connected in the manner specified in the previous 1.6 TESTING STARTER ON BENCH, Solenoid Pull-In Test, disconnect solenoid motor terminal/battery negative test lead at negative battery post only; reconnect loose end of this test lead to positive battery post instead.

2. Observe starter shaft.
   a. If starter shaft remains extended, solenoid is working properly.
   b. If starter shaft retracts, replace the solenoid.

ed02867



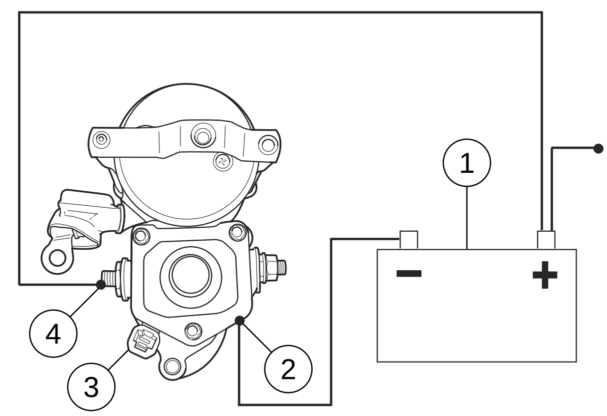
1. **Battery**
2. **Solenoid housing**
3. **Solenoid relay terminal**
4. **Solenoid motor terminal**

Figure 1-10. Hold-In Test

SOLENOID RETURN TEST

1. See Figure 1-11. With test leads still connected in the manner specified at the end of the previous 1.6 TESTING STARTER ON BENCH, Solenoid Hold-In Test, disconnect solenoid relay terminal/positive battery post test lead at either end.
2. Observe starter pinion.
   a. If starter shaft retracts, solenoid is working properly.
   b. If starter shaft does not retract, replace the solenoid.

ed02868



1. **Battery**
2. **Solenoid housing**
3. **Solenoid relay terminal**
4. **Solenoid motor terminal**

Figure 1-11. Return Test

GENERAL

The charging system consists of the alternator and regulator. The charging system circuit is shown in Figure 1-13.

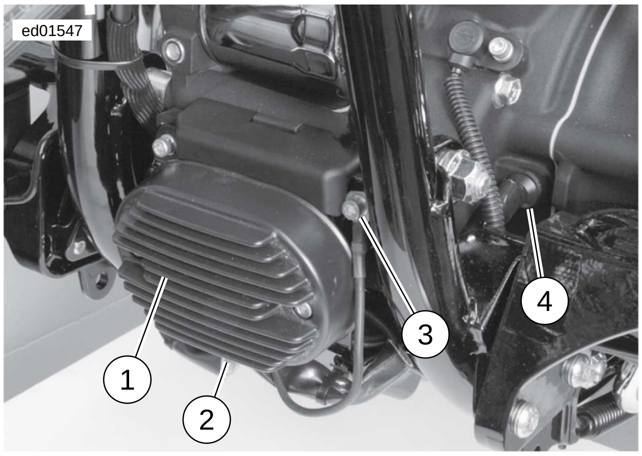
Alternator

The alternator consists of two main components:

- The rotor which mounts to the engine sprocket shaft.
- The stator which bolts to the engine crankcase.

Voltage Regulator

See Figure 1-12. The voltage regulator is a series regulator. The circuit combines the functions of rectifying and regulating.



1. **Voltage regulator**
2. **Connector**
3. **Ground wire**
4. **Stator connector plug**

Figure 1-12. Voltage Regulator

TROUBLESHOOTING

PART NUMBER	TOOL NAME
HD-48053	ELECTRICAL SYSTEM TESTER

When the charging system fails to charge or does not charge at a satisfactory rate, make the following recommended checks.

Battery

Check for a weak or dead battery. See 1.8 BATTERY TESTING for battery testing procedures. Battery must be fully charged in order to perform a load test, or starting or charging tests. However, a partially discharged battery may be tested using the BATTERY TEST function of the ELECTRICAL SYSTEM TESTER (Part No. HD-48053).

Wiring

The stator and battery connector plug and socket connections must be clean and tight.

Check for corroded or loose connections in the charging circuit. See Figure 1-13.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

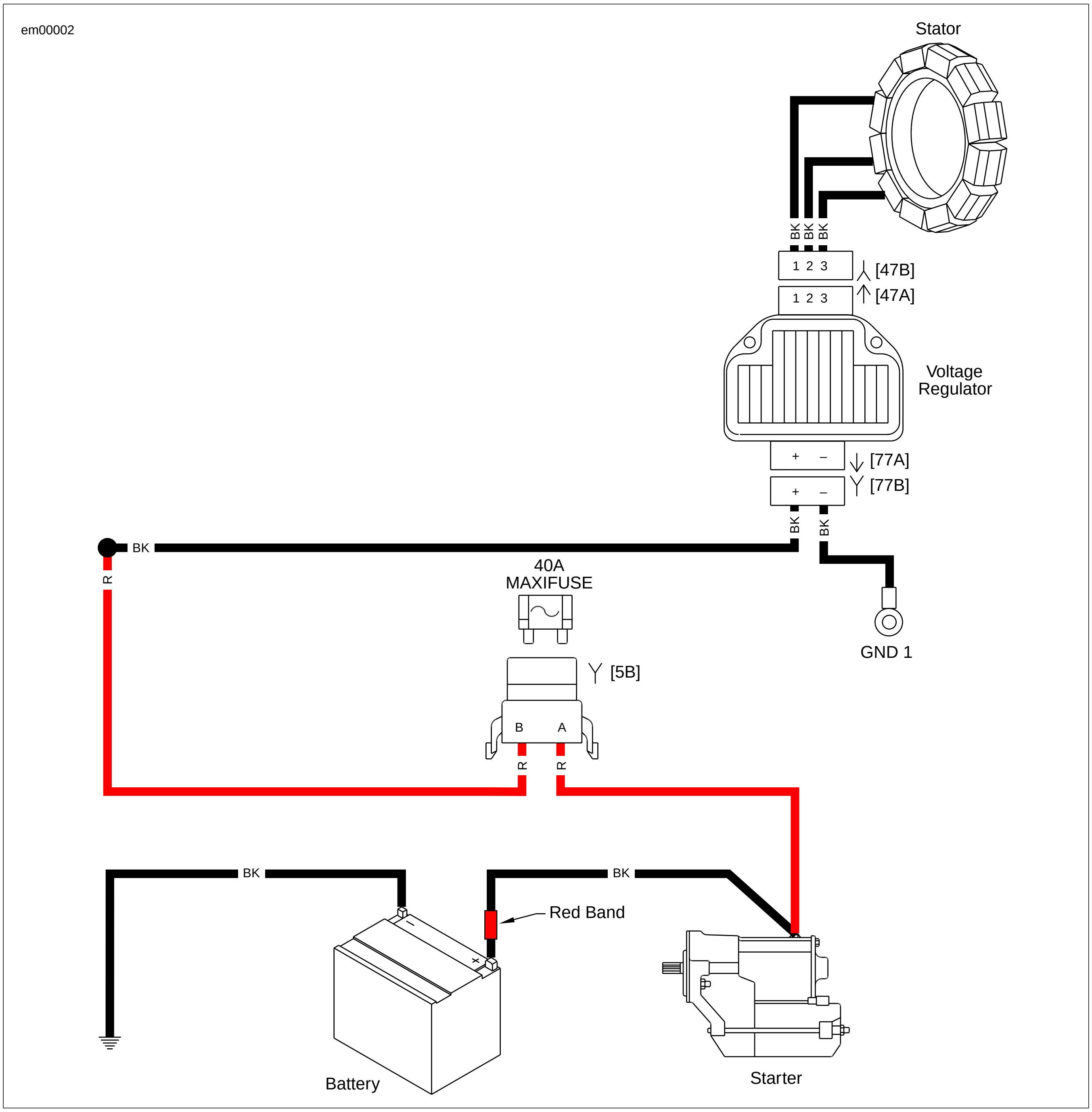
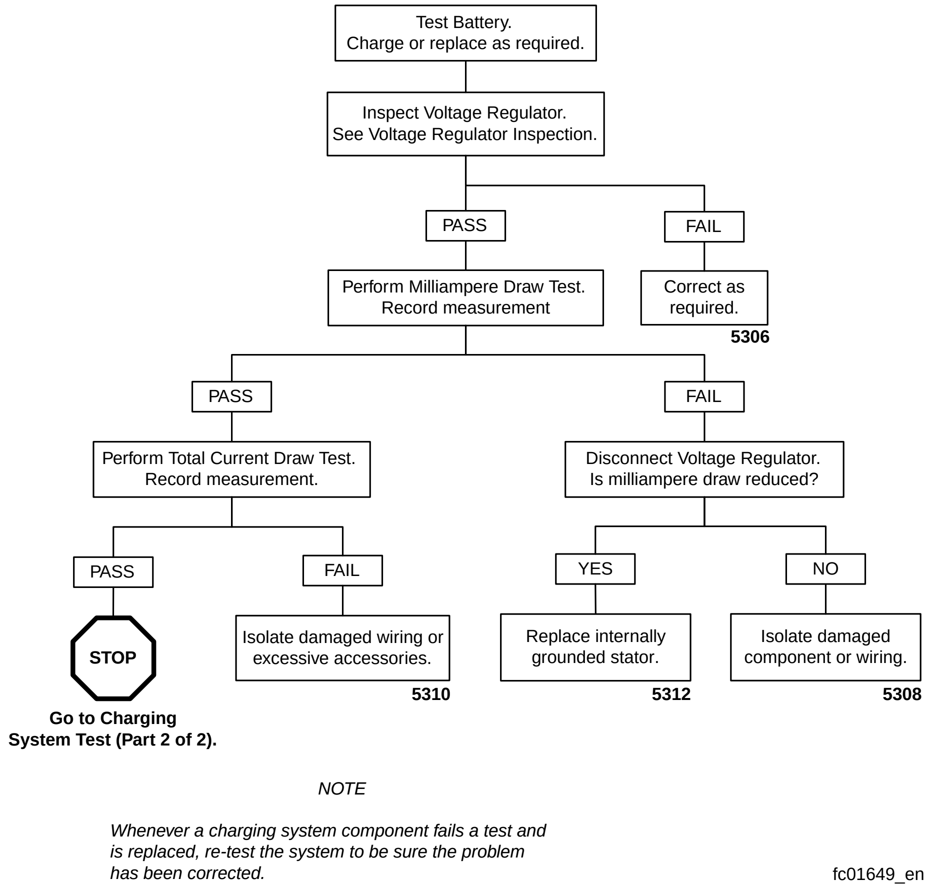
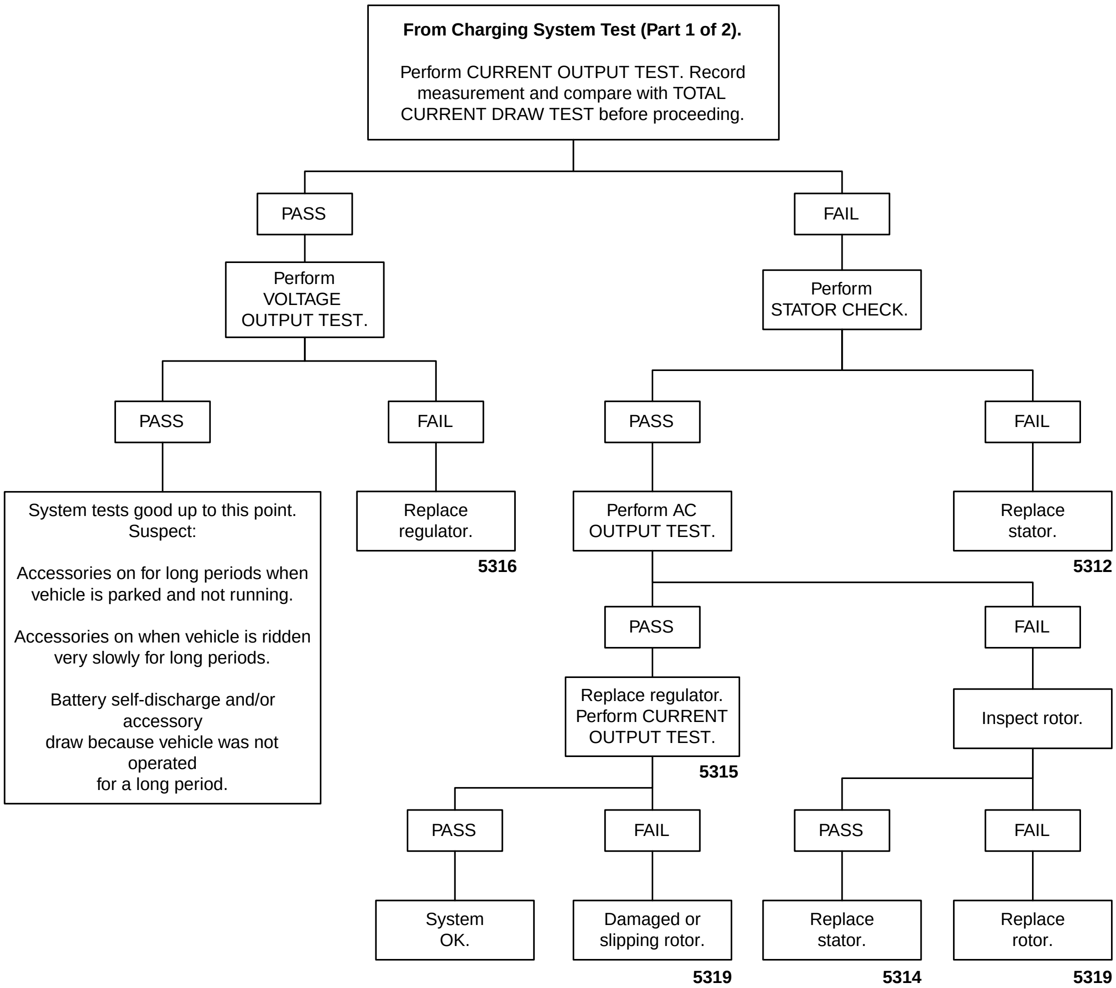


Figure 1-13. Charging System Circuit

Charging System Test (Part 1 of 2)



Charging System Test (Part 2 of 2)



NOTE

Whenever a charging system component fails a test and is replaced, re-test the system to be sure the problem has been corrected.

fc01156_en

TESTING

PART NUMBER	TOOL NAME
HD-48053	ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER

Milliampere Draw Test

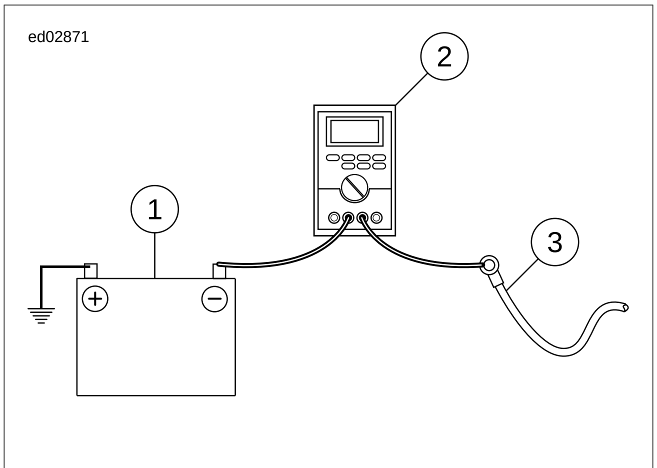
NOTES

- *Be sure accessories are not wired so they stay on at all times. This condition could drain battery completely if vehicle is parked for a long time. Check for this by connecting ammeter between negative battery terminal and battery.*
- *TSM/TSSM/HFSM will continue to draw 16-25 mA for 30 seconds after ignition is turned OFF. Any disruption and reconnection of battery power, such as disconnecting the battery to place a meter in series, will cause TSM/TSSM/HFSM to draw 16-25 mA for 30 seconds.*
- *Disconnect siren during Milliampere Draw Test.*

1. See Figure 1-14. Connect ammeter between negative battery terminal and battery. With this arrangement, you will also pick up any regulator drain.
2. With ignition switch turned to OFF and all lights and accessories off, observe current reading.
   a. Refer to Table 1-4. Add regulator draw to appropriate value for the other components. If sum is less than reading observed on ammeter, draw is within limits.
   b. A higher reading indicates excessive current draw. Any accessories must be considered and checked for excessive drain.

NOTE

A battery with a surface discharge condition could suffer a static drain. Correct by cleaning battery case.



1. **Battery**
2. **Ammeter**
3. **Battery negative cable**

Figure 1-14. Milliampere Draw Test (Ignition turned to OFF)

Table 1-4. Milliampere Draw Test

ITEM	MAXIMUM DRAW IN MILLI-AMPERES
ECM	1.0
Speedometer	1.0
TSM (non security models)	1.0
TSSM (disarmed)	1.0
TSSM (armed)	1.0
TSSM (storage mode)	1.0
HFSM	1.0
Security siren (optional)	20.0*
Voltage regulator	1.0
* Siren will draw for 2-24 hours from time motorcycle battery is connected and 0.05 milliamperes once siren battery is charged. Disconnect siren during milliampere draw test.	

Total Current Draw Test

If battery runs down during use, the current draw of the motorcycle components and accessories may exceed output of the charging system.

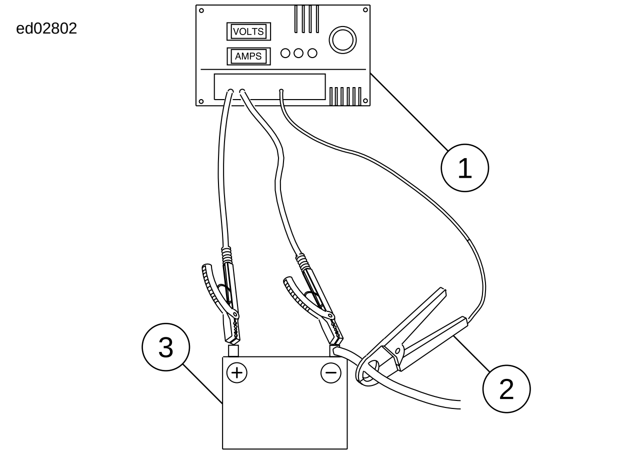
NOTE

If a load tester is unavailable, an ammeter with current probe may be used.

WARNING

Turn battery load tester OFF before connecting tester cables to battery terminals. Connecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00252a)

1. See Figure 1-15. To check for this condition, place load tester induction pickup or current probe pickup over battery negative cable.
2. Disconnect stator plug from voltage regulator. Start the motorcycle and run the engine at 2000 RPM.
3. With ignition and all continuously running lights and accessories turned on (headlamp on high beam), read the total current draw.
4. Compare this reading to the reading obtained after performing the CURRENT AND VOLTAGE OUTPUT TEST.
   a. The current output should exceed current draw by 3.5 amps minimum.
   b. If output does not meet specifications, there may be too many accessories for the charging system to handle.
5. Reconnect voltage regulator after testing.



1. **Load tester**
2. **Induction pickup**
3. **Battery**

Figure 1-15. Check Current Draw (Ignition Switch On)

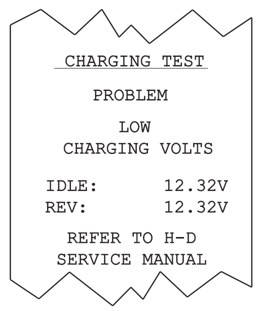


Figure 1-16. Charging System Test Results Printout

Current and Voltage Output Test: Using HD-48053

1. Connect the ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER (Part No. HD-48053) leads to the vehicle battery.
2. Follow the instructions in the analyzer instruction manual to perform a Charging System Test.

See Figure 1-16. The test results will include a decision on the charging system's condition and the measured system voltage at idle and at 3000 RPM. The analyzer printer will provide you with a printout including one of two possible test results:

1. CHARGING SYSTEM NORMAL - No problem found.
2. CHARGING SYSTEM PROBLEM - The analyzer detected a problem and will display one of the three following results:
   a. LOW CHARGING VOLTS - The alternator is not supplying sufficient current for the system electrical loads.
   b. HIGH CHARGING VOLTS - The system voltage exceeds the normal set point of the regulator.
   c. INVESTIGATE VOLT OUTPUT - The rev voltage is lower than the idle voltage.

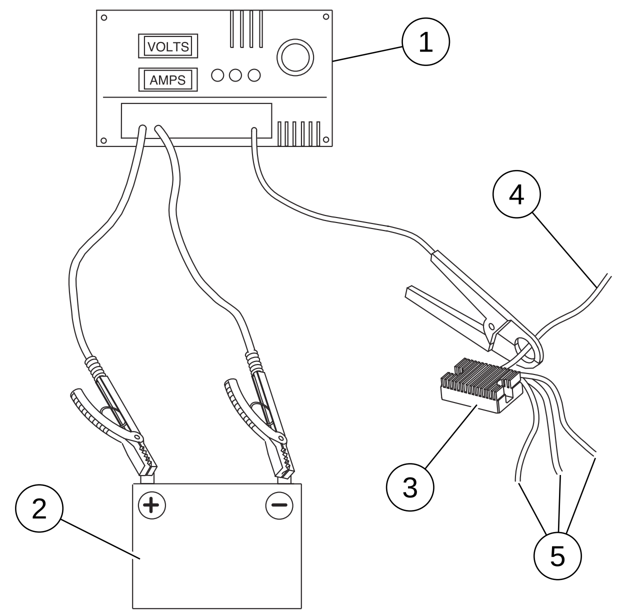
Current and Voltage Output Test: Using Load Tester

1. See Figure 1-17. Connect load tester.
   a. Connect negative and positive leads to battery terminals.
   b. Place load tester induction pickup over positive regulator cable.
2. Run the engine at 3000 RPM. Increase the load as required to obtain a constant 13.0 VDC. Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible.
3. The current output should be 35-50 amps at 13.0 VDC. Make note of measurement for use in TOTAL CURRENT DRAW TEST.

NOTE

Rider's habits may require output test at lower RPM.

4. See Figure 1-17. After removing the load, read the load tester voltage meter.
   a. If voltage to the battery is not more than 15 VDC, voltage output is within specifications. Investigate other possible problems. See Charging System Test.
   b. If voltage is higher, voltage regulator is not functioning properly.



1. **Load tester**
2. **Battery**
3. **Voltage regulator**
4. **To MAXIFUSE (DC output)**
5. **To stator**

Figure 1-17. Current and Voltage Output Test

Stator Check

1. Turn ignition switch OFF.
2. See Figure 1-18. Connect an ohmmeter.
   a. Disconnect voltage regulator connector from alternator stator wiring.
   b. Insert one ohmmeter lead into a stator connector socket.
   c. Attach the other lead to a suitable ground.
3. Test for continuity with ohmmeter set to the ohms scale.
   a. A good stator will show no continuity (open circuit) between any stator sockets and ground.
   b. Any other reading indicates a grounded stator which must be replaced.
4. See Figure 1-19. Check resistance across stator sockets 1-2, 2-3 and 3-1.
5. Test for resistance with ohmmeter set on the ohms scale.
   a. Resistance across all the stator sockets should be 0.1-0.2 ohms.
   b. If the resistance is higher, the stator is damaged and must be replaced.
   c. If lower - could indicate turn to turn short.

NOTE

Verify that meter reads 0 ohms when probes are shorted together. If not, subtract lowest value to resistance value of stator.

Figure 1-18. Test for Grounded Stator (Typical)

Figure 1-19. Check for Stator Resistance (Typical)

AC Output Check

1. See Figure 1-20. Test AC output.
   a. Disconnect voltage regulator connector from alternator stator wiring.
   b. Connect an AC voltmeter across stator connector sockets 1-2.
   c. Run the engine at 2000 RPM. The AC output should be 32-46 volts AC (approximately 16-23 per 1000 RPM).
   d. Repeat test across stator sockets 2-3 and 3-1.
2. Compare test results to specifications.
   a. If the output is below specifications, charging problem could be a faulty rotor or stator.
   b. If output is within specifications, charging problem might be faulty voltage regulator. Replace as required.
3. Check the output again as previously described under Current and Voltage Output Test.

Figure 1-20. Check Stator AC Voltage Output (Typical)

BATTERY TESTING 1.8

GENERAL

Three different procedures may be performed to provide a good indicator of battery condition: a voltage test, a conductance test, or a load test.

A battery may be tested, whether fully charged or not, via conductance test. In order to perform a load test, however, the battery must be fully charged.

VOLTMETER TEST

The voltmeter test provides a general indicator of battery state of charge or condition. Check the voltage of the battery to verify that it is in a 100% fully charged condition. Refer to Table 1-5.

If the open circuit (disconnected) voltage reading is below 12.6V, charge the battery and then recheck the voltage after the battery has set for one to two hours. If the voltage reading is 12.7V or above, perform the LOAD TEST described in this section.

Table 1-5. Voltmeter Test For Battery Charge Conditions

VOLTAGE (OCV)	STATE OF CHARGE
12.7	100%
12.6	75%
12.3	50%
12.0	25%
11.8	0%

CONDUCTANCE TEST

PART NUMBER	TOOL NAME
HD-48053	ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER

Test the battery using the ADVANCED BATTERY CONDUCTANCE AND ELECTRICAL SYSTEM ANALYZER (Part No. HD-48053). Perform a battery test as follows:

1. Connect the HD-48053 analyzer leads to the vehicle battery lead terminal, not to bolt or wire terminal.

NOTE

Connect the tester directly to the lead terminals of the battery, and not the bolts.

2. Follow the instructions in the analyzer instruction manual to perform a battery test.

The test results will include a decision on the battery condition and the measured state of charge.

See Figure 1-21. The analyzer printer will provide you with a printout including one of six possible test results:

- GOOD BATTERY - Return the battery to service.
- GOOD-RECHARGE - Fully charge the battery and return to service.
- CHARGE & RETEST - Fully charge the battery and retest.
- REPLACE BATTERY - Replace the battery.
- BAD CELL-REPLACE - Replace the battery and retest.
- BATTERY NOISE - Remove surface charge from battery and retest.

NOTES

- *A REPLACE BATTERY test result may also mean a poor connection between the battery cables and the vehicle. After disconnecting the battery cables from the battery, retest the battery using the out-of-vehicle test before replacing.*
- *Connect the tester directly to the lead terminals of the battery, and not the bolts.*

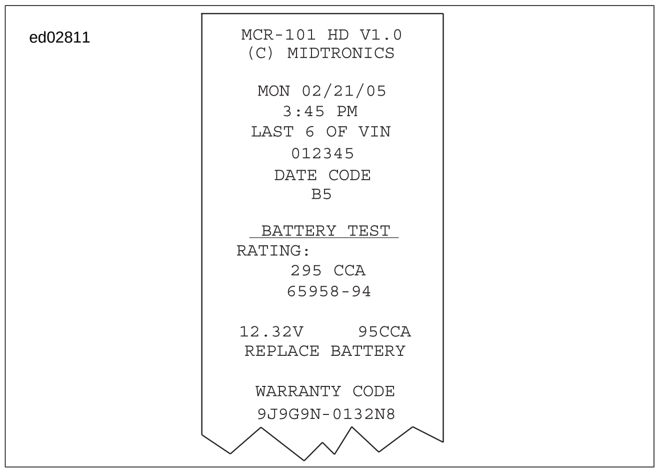


Figure 1-21. Battery Test Results Printout

LOAD TEST

To load test the battery, proceed as follows:

⚠WARNING

Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)

1. Remove battery from motorcycle.
2. Always fully charge the battery before testing or test readings will be incorrect. Load testing a discharged battery can also result in permanent battery damage.
3. After charging, allow battery to stand for at least one hour before testing.

⚠WARNING

Turn battery load tester OFF before connecting tester cables to battery terminals. Connecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00252a)

4. See Figure 1-22. Connect tester leads to battery posts and place induction pickup over negative (black) cable.

NOTE

To avoid load tester and/or battery damage, do not leave the load tester switch turned ON for more than 20 seconds.

5. Refer to Table 1-6. Load battery at 50% of CCA rating using the load tester. Voltage reading after 15 seconds should be 9.6V or more at 70° F (21° C).

⚠WARNING

Turn battery load tester OFF before disconnecting tester cables to battery terminals. Disconnecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00253a)

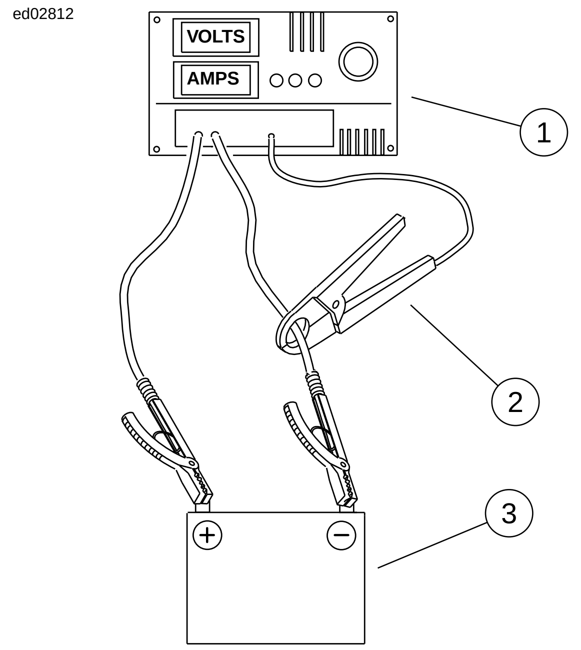
⚠WARNING

Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

CAUTION

Do not over-tighten bolts on battery terminals. Use recommended torque values. Over-tightening battery terminal bolts could result in damage to battery terminals. (00216a)

6. Install the battery in the motorcycle.



1. **Load tester**
2. **Induction pickup**
3. **Battery**

Figure 1-22. Load Test Battery

Table 1-6. Battery Load Test

COLD CRANKING AMPERAGE (CCA)	100%	50%
Softail models	270	135

NOTES

CHECK ENGINE LAMP

See Figure 2-2. To diagnose Electronic Control Module (ECM) system problems, begin by observing the behavior of the check engine lamp (1).

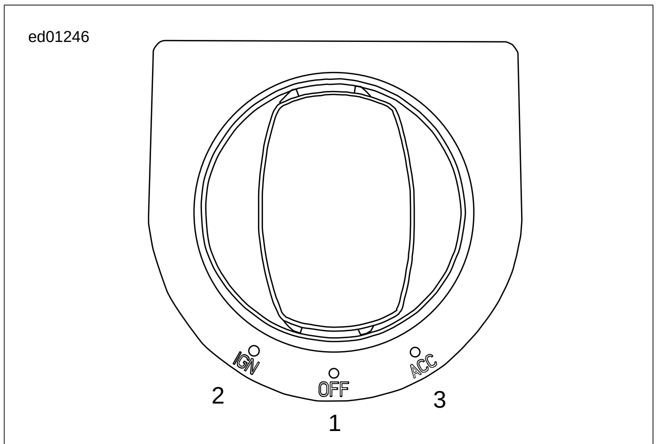
NOTES

- *See Figure 2-1. "Key ON" means that the Ignition Switch is turned to IGNITION (2) and the Engine Stop Switch is set to RUN (although the engine is **not** running).*
- *When the Ignition Switch is turned ON, the check engine lamp will illuminate for approximately four seconds and then turn off.*
- *If the check engine lamp is not illuminated at Ignition Switch ON the problem is likely to be an instrument failure. See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.*
- *If the check engine lamp illuminates late (after 20 seconds), the problem is most likely a serial data bus failure. Test for Diagnostic Trouble Codes (DTCs) using speedometer self diagnostics. See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.*
- *If the check engine lamp fails to turn off after the initial four-second period, see 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.*

1. See Figure 2-3. After the check engine lamp turns off following the first four-second illumination period, one of three events may occur:
   a. The lamp remains off. This indicates there are no current fault conditions or stored DTCs currently detected by the ECM.
   b. The lamp remains off for only four seconds and then illuminates for an eight-second period. This indicates a DTC is stored, but no current DTC exists.
   c. The lamp remains on beyond the eight-second period. This indicates a current DTC exists.
2. See 2.1 CHECKING FOR DIAGNOSTIC TROUBLE CODES, Code Types for a complete description of DTC formats.

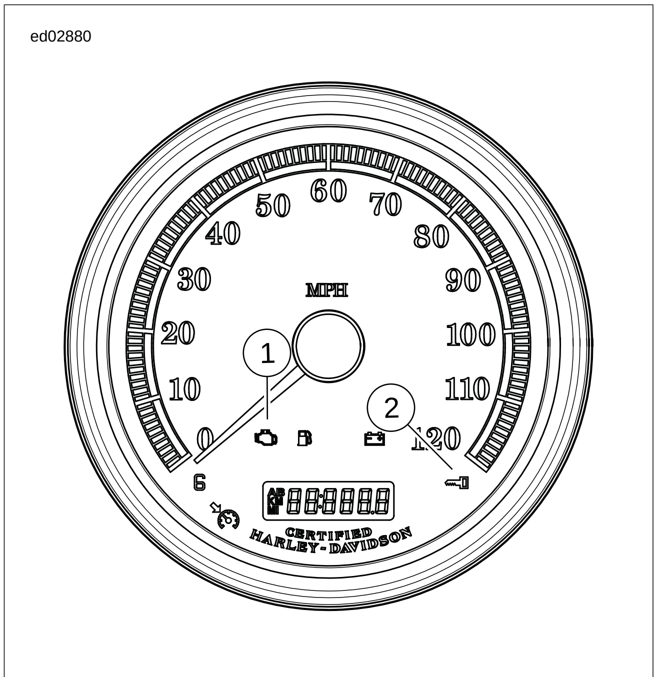
NOTE

Some DTCs can only be fully diagnosed during actuation. For example, a problem with the ignition coil will be considered a current fault even after the problem is corrected, since the ECM will not know of its resolution until after the coil is exercised by the vehicle start sequence. In this manner, there may sometimes be a false indication of the current DTC.



1. **Ignition OFF**
2. **Ignition ON**
3. **Marker Lights (ACC) ON**

Figure 2-1. Ignition Switch



1. **Check engine lamp**
2. **Security lamp (key icon)**

Figure 2-2. Check Engine and Security Lamp

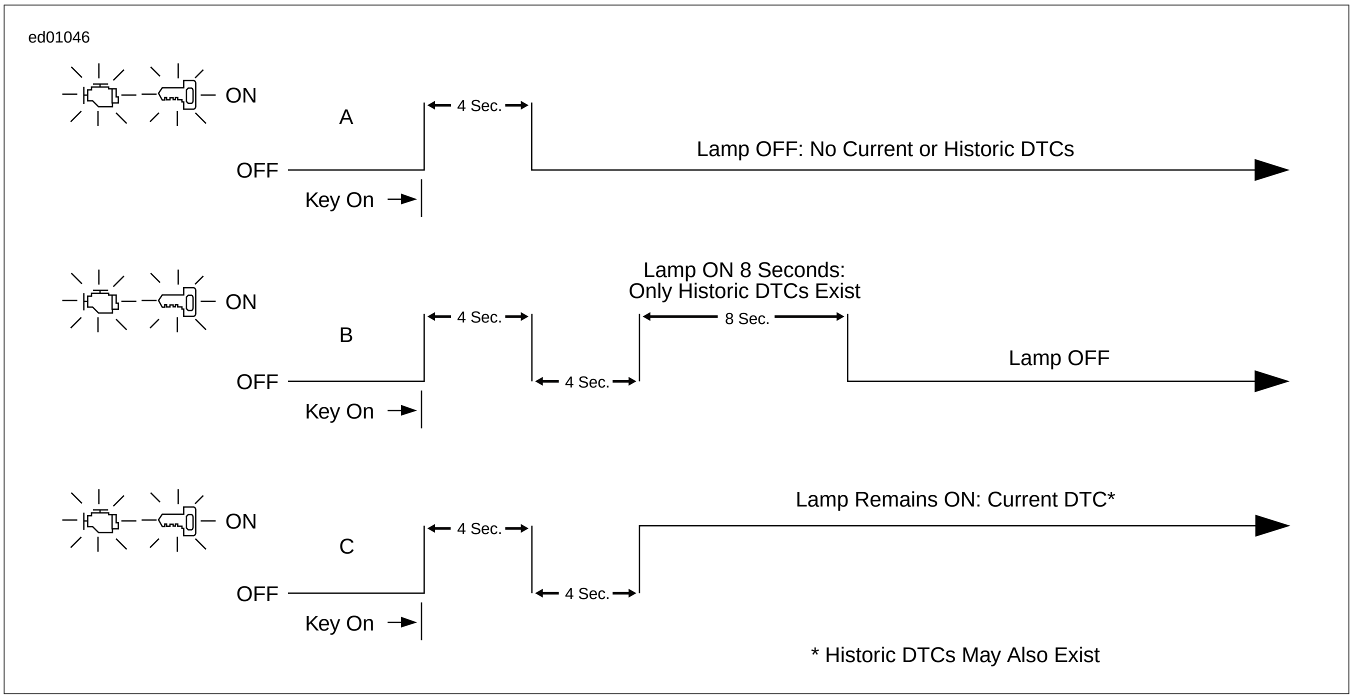


Figure 2-3. Check Engine and Security Lamp Operation

SECURITY LAMP

Turn Signal Module (TSM)

If the turn signals flash six four-way flashes shortly after IGNITION ON, it indicates a Diagnostic Trouble Code (DTC) has been logged sometime in the last three ignition cycles.

Turn Signal Security Module (TSSM) or Hands-Free Security Module (HFSM)

See Figure 2-2. To diagnose Turn Signal Security Module (TSSM) or Hands-Free Security Module (HFSM) system problems, begin by observing the behavior of the security lamp (2).

NOTES

- *To provide an indication of TSSM/HFSM DTCs, the security lamp is enabled on TSSM/HFSM models.*
- *See Figure 2-1. "Key ON" means that the Ignition Switch is turned to IGNITION and the Engine Stop Switch is set to RUN (although the engine is **not** running).*
- *See Figure 2-2. When the Ignition Switch is turned ON, the security lamp will illuminate for approximately four seconds and then turn off.*
- *If the security lamp is not illuminated at Key ON, the problem is likely to be an instrument failure. See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER*
- *If the security lamp illuminates late (after 20 seconds), the problem is most likely a serial data bus failure. Test for DTCs using speedometer self diagnostics. See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.*
- *If the security lamp fails to turn off after the initial four-second period, a problem exists in the instrumentation. See 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.*

1. See Figure 2-3. After the security lamp turns off following the first four-second illumination period, one of three events may occur:
   a. The lamp remains off. This indicates there are no current fault conditions or stored DTCs currently detected by the TSSM/HFSM.
   b. The lamp stays off for only four seconds and then comes back on for an eight-second period. This indicates a DTC is stored, but no current DTC exists.
   c. The lamp remains on beyond the eight-second period. This indicates a current DTC exists.
2. See 2.1 CHECKING FOR DIAGNOSTIC TROUBLE CODES, Code Types for a complete description of DTC formats.

NOTE

Some DTCs can only be fully diagnosed during actuation. For example, a problem with the turn signals will be considered a current fault even after the problem is corrected, since the TSM/TSSM/HFSM will not know of its resolution until after the turn signals are activated. In this manner, there may sometimes be a false indication of the current DTC.

CODE TYPES

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

There are two types of DTCs: current and historic. If a DTC is stored, it can be read using either a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750) or speedometer self diagnostics. See 2.3 SPEEDOMETER SELF DIAGNOSTICS.

NOTES

- *Speedometer self diagnostics will display both current and historic DTCs. To differentiate between current and historic DTCs, a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750) must be employed.*
- *All DTCs reside in the memory of the ECM, TSM/TSSM/HFSM, speedometer or tachometer until the DTC is cleared by use of the speedometer self diagnostics. 2.3 SPEEDOMETER SELF DIAGNOSTICS.*
- *A historic DTC is also cleared after a total of 50 ignition cycles (start and run cycle) have elapsed. After the 50 ignition cycle retention period, the DTC is automatically erased from memory providing that no subsequent faults of the same type are detected in that period.*

Current

Current DTCs are those which presently disrupt motorcycle operation. See the appropriate flow charts for solutions.

Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic DTC rather than a current DTC.

Historic DTCs are stored for 50 ignition cycles after any DTC was last set as current to assist in the diagnosis of intermittent faults. On the 50th cycle, the DTC will clear itself. The security lamp will only indicate the existence of historic DTCs for two ignition cycles.

It is important to note that historic DTCs will exist whenever the system indicates the existence of a current fault. See 2.1 CHECKING FOR DIAGNOSTIC TROUBLE CODES, Multiple Diagnostic Trouble Codes if multiple DTCs are found.

Diagnostic charts are designed for use with current DTCs. As a result, they frequently suggest part replacement. When diagnosing a historic DTC, the charts can be helpful but should not lead to part replacement without verification that the part is faulty.

RETRIEVING DIAGNOSTIC TROUBLE CODES

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

The speedometer supports two levels of diagnostics.

- The most sophisticated mode employs a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750).
- The second mode requires using the speedometer self diagnostics. Speedometer, TSM/TSSM/HFSM, and ECM DTCs can be accessed and cleared. See 2.3 SPEEDOMETER SELF DIAGNOSTICS.

MULTIPLE DIAGNOSTIC TROUBLE CODES

While it is possible for more than one fault to occur and set more than one DTC, there are several conditions which may result in **one** fault setting **multiple** DTCs. For example, serial data DTCs (DTC U1016, U1064, U1097, U1300 and U1301) may be accompanied by other DTCs. **Always** correct the serial data DTCs before resolving other DTCs.

For proper resolution of multiple DTCs, refer to Speedometer/Tachometer Diagnostic Trouble Code (DTC) Priority Chart Table 2-2.

GENERAL

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

Constant power is supplied to the speedometer through terminal "5" of connector [39]. The speedometer turns on when power is applied to terminal "1". The speedometer proceeds through an initialization sequence every time power is removed and re-applied to terminal "1". The visible part of this sequence is the check engine lamp (in "run" mode), security lamp (models with security only), backlighting and odometer and fuel level. Upon key ON, the check engine lamp and security lamp will illuminate for 4 seconds and then (if parameters are normal) go out.

To locate faulty circuits or other system problems, follow the diagnostic flow charts and tests in this section. For a systematic approach, always begin with 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER, Initial Diagnostics. Read the general information and then work your way through the flow chart box by box.

Loss of power on any of the four power inputs will change speedometer behavior. Refer to Table 2-1.

Diagnostic Notes

If a numbered circle appears adjacent to a flow chart box, more information is offered in the diagnostic notes.

Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools, or references to other parts of the manual where information on the location and removal of components may be obtained.

Circuit Diagram/Wire Harness Connector Table

When working through a flow chart, refer to the illustrations, the associated circuit diagram and the wire harness connector table as necessary.

The wire harness connector table for each circuit diagram identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a Breakout Box and a DVOM are required. See 2.5 BREAKOUT BOX: SPEEDOMETER.

To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

Reprogramming ECM

Diagnostic charts frequently suggest ECM replacement. In the event an ECM needs to be replaced, it must be reprogrammed using a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750). See your dealer. Password learn procedure must also be performed. See 3.25 TSM/HFSM: PASSWORD LEARN or E.21 TSM/TSSM: PASSWORD LEARN.

Table 2-1. Speedometer Function Chart-Loss of Input

Terminal 1 (IGN)	Terminal 6 (ACC)	Terminal 7 (GRD)	Terminal 8 and 11 (Reset Switch)
• Will not "WOW". • Turn signals still functiona.l • Speedometer will indicate vehicle speed (zero). • Security lamp still functional. • Check engine lamp and battery lamp non-functional. • Diagnostics absent.	• Speedometer will be non-functional in accessory mode. • Security lamp still performs 4-second bulb check in ignition mode.	• Speedometer completely non-functional. • Diagnostics absent. • Tachometer non-functional.	• No trip odometer reset switch function. • Will not "WOW".

INITIAL DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Tips

- If odometer reads "BUS Er" with the Ignition Switch turned to IGNITION (Engine Stop Switch at RUN with the engine off), check data bus for a short to high, low, ground or battery between data link connector [91A] terminal "3" and ECM connector [78B] terminal "5", TSM/TSSM/HFSM connector [30B] terminal "3", speedometer connector [39B] terminal "2".
- Check for an open data test terminal between data link connector [91A] terminal "3" and TSM/TSSM/HFSM connector [30B] terminal "3". With Ignition Switch turned to IGNITION, serial data bus voltage should be typically 0.6-0.8 volts. The range of acceptable voltage is greater than 0 and less than 7.0 volts.
- To identify intermittents, wiggle wire harness while performing steps in the flow charts.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) and INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) between wire harness connector [39B] and speedometer connector [39A] . See 2.5 BREAKOUT BOX: SPEEDOMETER.

All speedometer Diagnostic Trouble Codes (DTCs) are listed in Table 2-2.

Other Diagnostic Trouble Codes

See 3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM for any DTCs related to the Turn Signal Module (TSM) or the Hands-Free Security Module (HFSM).

See 3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM for any DTCs related to the Turn Signal Security Module (TSSM).

See 4.5 INITIAL DIAGNOSTIC CHECK for any DTCs related to the Electronic Control Module (ECM).

Table 2-2. Speedometer Diagnostic Trouble Codes (DTC) Priority Chart

DTC	RANKING	FAULT CONDITION	SOLUTION
"BUS Er"	1	Serial data bus shorted low/open/high	2.13 DTC U1300, U1301 OR BUS ER
U1300	2	Serial data bus shorted low	2.13 DTC U1300, U1301 OR BUS ER
U1301	3	Serial data bus shorted high	2.13 DTC U1300, U1301 OR BUS ER
U1016	4	Loss of ECM serial data	2.11 DTC U1016, U1255
U1064	5	Loss of TSM/TSSM/HFSM serial data	2.12 DTC U1064, U1255
U1255	6	Missing response from other module (TSM/TSSM/HFSM and/or ECM) at startup	2.12 DTC U1064, U1255
B1007	7	Ignition line overvoltage	2.9 DTC B1006, B1007
B1006	8	Accessory line overvoltage	2.9 DTC B1006, B1007
B1008	9	Reset switch closed	2.10 DTC B1008
B1004	10	Fuel level sending unit low	2.8 DTC B1004, B1005
B1005	11	Fuel level sending unit high/open	2.8 DTC B1004, B1005

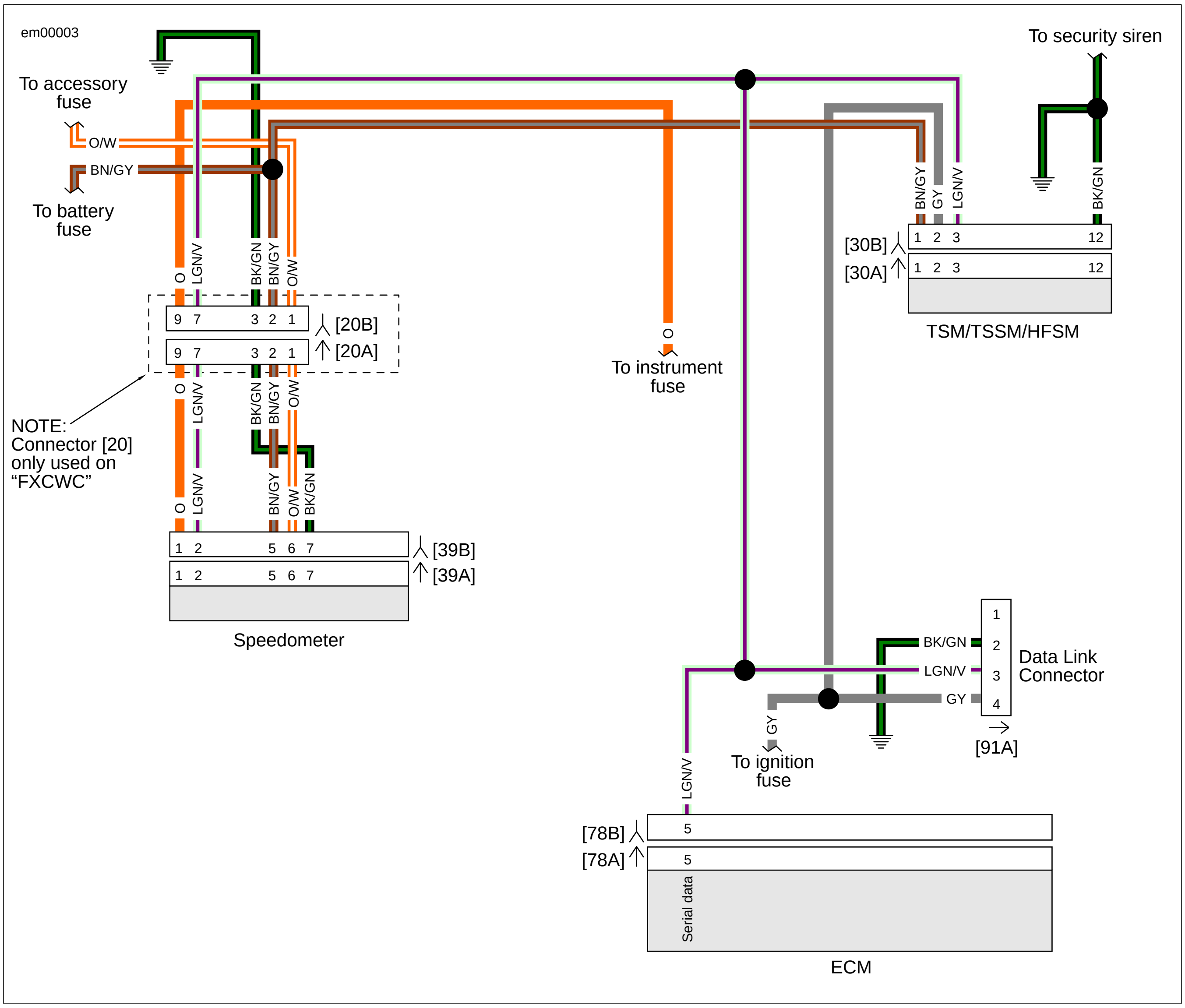
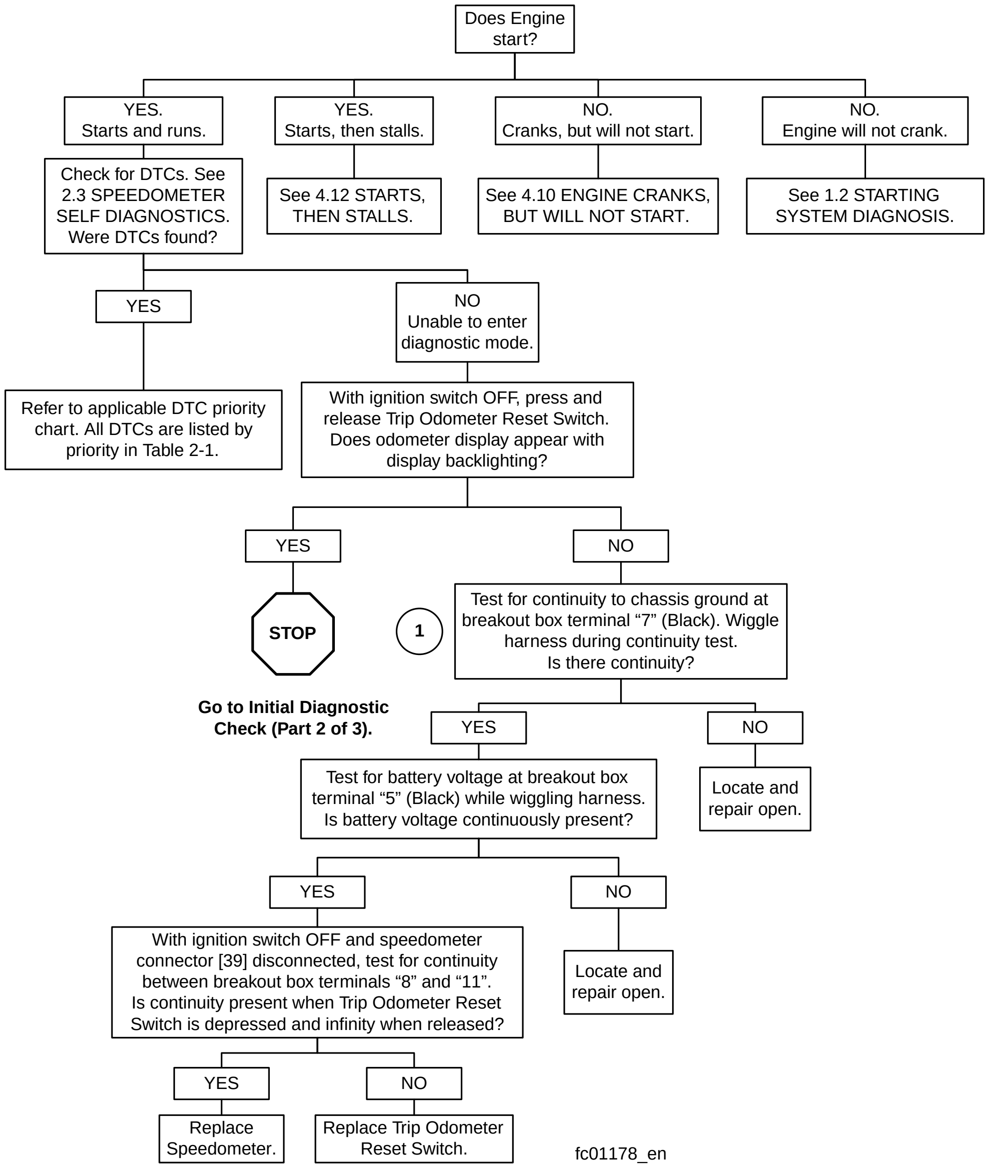


Figure 2-4. Diagnostic Check

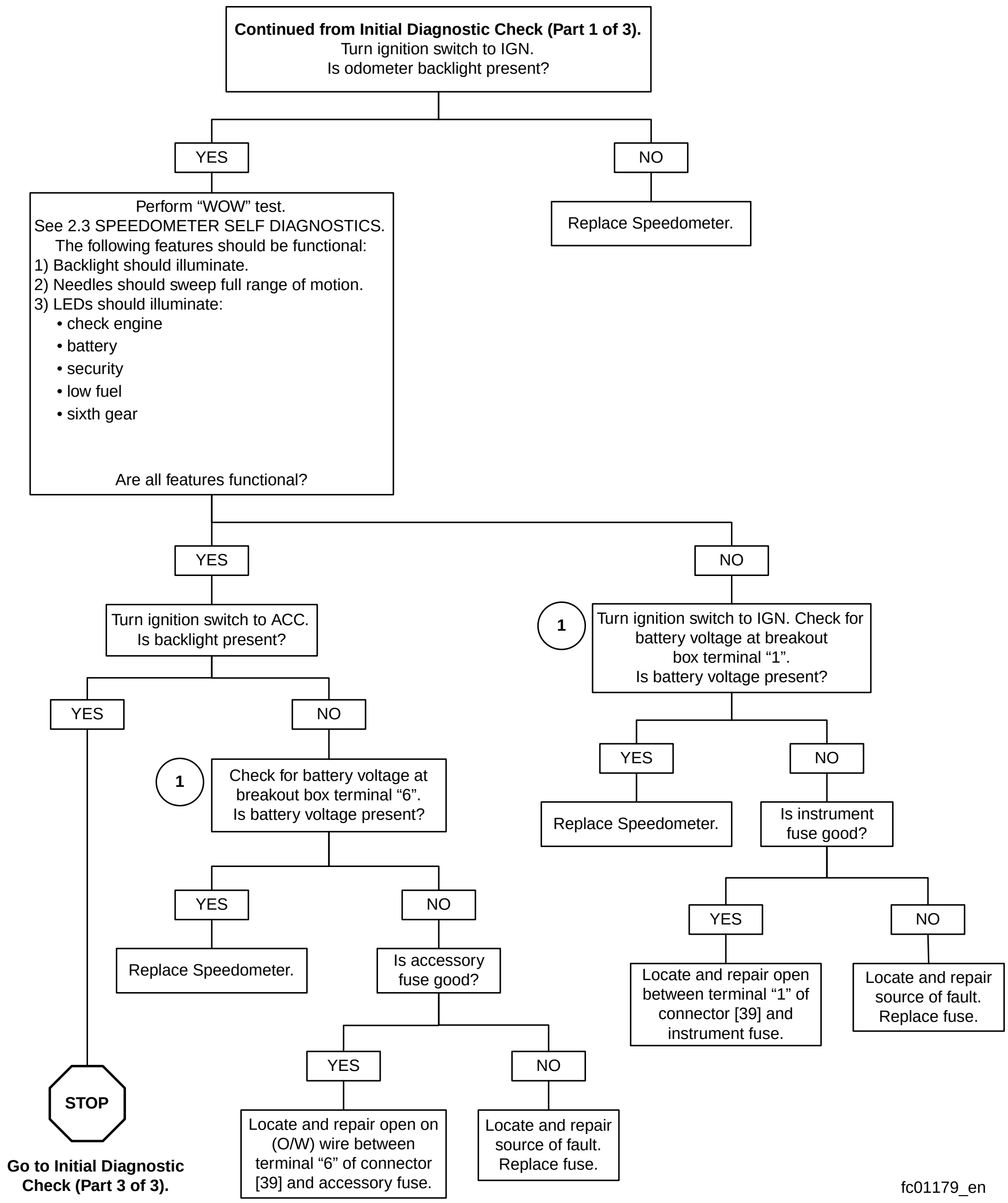
Table 2-3. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat

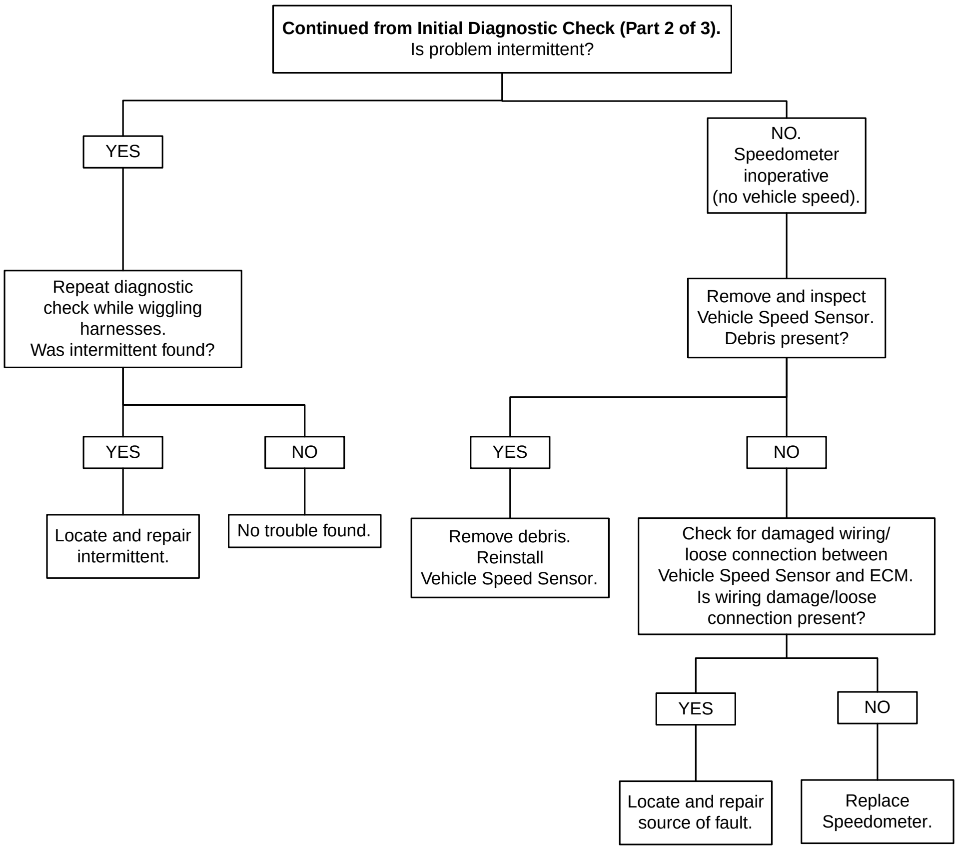
Initial Diagnostic Check (Part 1 of 3)



Initial Diagnostic Check (Part 2 of 3)



Initial Diagnostic Check (Part 3 of 3)



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GENERAL

The speedometer is capable of displaying and clearing speedometer, TSM/TSSM/HFSM, and Electronic Control Module (ECM) Diagnostic Trouble Codes (DTCs) (diagnostic mode).

DIAGNOSTICS

Diagnostic Tips

- For a quick check of speedometer function, a "WOW" test can be performed. Press and hold trip odometer reset switch, then turn ignition switch to IGN. Release trip odometer reset switch. See Figure 2-5. Background lighting should illuminate, speedometer needle should sweep its full range of motion, and indicator lamps (battery, security, low fuel, check engine, sixth gear indicator) should illuminate. All lamps should illuminate, even those not used in normal vehicle operations.
- If speedometer module fails "WOW" test, check for battery, ground, ignition, trip odometer reset switch and accessory wiring to speedometer. If any feature in the speedometer module is non-functional, see 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. To exit diagnostic mode, turn ignition switch OFF.
2. On models with an accessory tachometer, "no rsp" will be displayed during speedometer self diagnostics if tachometer module is chosen because accessory tachometer does not utilize the serial bus.

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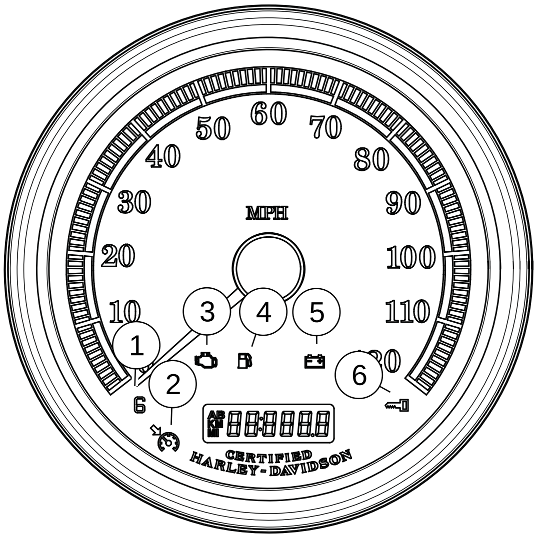
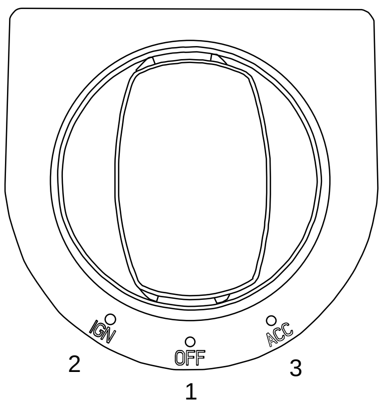


1. **Sixth gear indicator**
2. **Cruise (not used)**
3. **Check engine lamp**
4. **Low fuel lamp**
5. **Battery**
6. **Security lamp (key icon)**

Figure 2-5. Speedometer

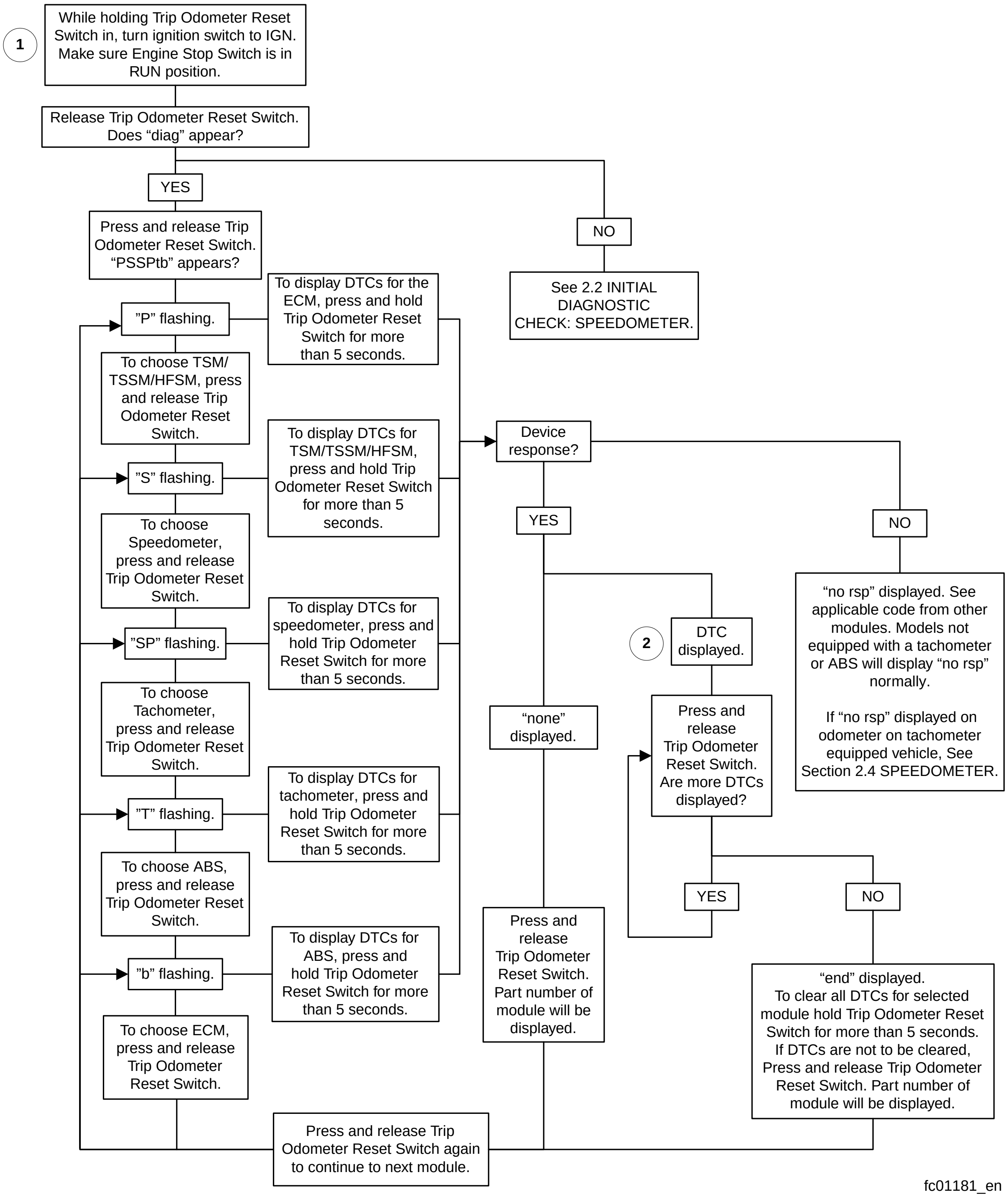
ed01246



1. **Ignition OFF**
2. **Ignition ON**
3. **Marker Lights (ACC) ON**

Figure 2-6. Ignition Switch

Speedometer Self Diagnostics



GENERAL

NOTE

Some icons may illuminate during "WOW" test though the icon has no functionality on that vehicle.

The speedometer consists of a speedometer display and several icons. The icons include: check engine, security, battery, low fuel, and sixth gear indicator.

Trip Odometer Reset Switch

Figure 2-8. Pressing the trip odometer reset switch provides the following capabilities:

- Change the odometer display between mileage trip A and trip B values, and clock (press and immediately release).
- Reset an individual trip odometer (press and hold 2-3 seconds).
- Gain access to the diagnostic mode, clear Diagnostic Trouble Codes (DTCs). See 2.3 SPEEDOMETER SELF DIAGNOSTICS.
- Display odometer while Ignition Switch is OFF. Press and hold trip odometer reset switch while Ignition Switch is OFF and odometer mileage or clock will be displayed.
- On models with dual scale speedometers, toggle between miles/kilometers on odometer and trip odometer display. To toggle display, turn Ignition Switch ON. Press and hold trip odometer reset switch while odometer is displayed. Release switch when change is noted. (If trip odometer reset switch is held while trip odometer is displayed, trip odometer will reset.)

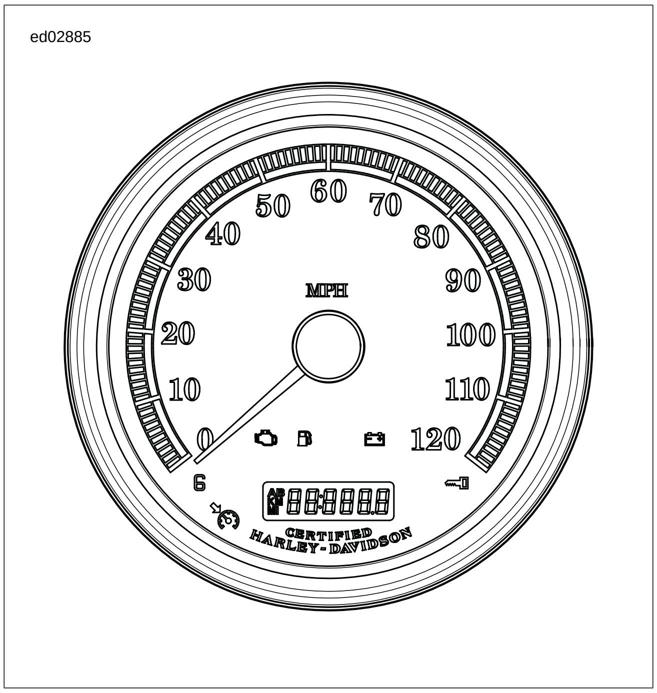


Figure 2-7. Speedometer

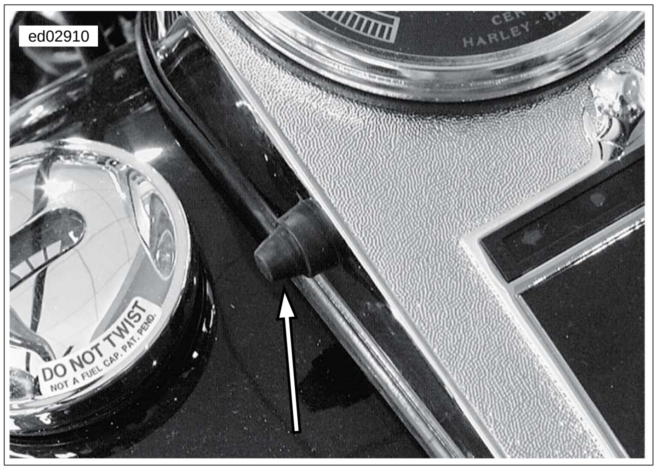


Figure 2-8. Trip Odometer Reset Switch

SPEEDOMETER THEORY OF OPERATION

The speedometer consists of a Vehicle Speed Sensor (VSS), ECM, trip odometer reset switch, and the speedometer. The VSS is mounted on the right side of the transmission case below the starter. The sensor circuitry is that of a Hall-Effect sensor that is triggered by the gear teeth of fifth gear on the transmission mainshaft.

The output from the sensor is a series of pulses that are interpreted by ECM circuitry, converted into serial data inside the ECM, then sent to the speedometer to control the position of the speedometer needle and the odometer Liquid Crystal Display (LCD). The vehicle speed serial data is also transmitted to the TSM/TSSM/HFSM for turn signal cancellation.

The speedometer indicates when vehicle is in sixth gear. Selection of sixth gear is inferred as the system identifies when correct RPM and vehicle speed coincide.

ODOMETER THEORY OF OPERATION

The odometer mileage is permanently stored and will not be lost when electrical power is turned off or disconnected. The trip odometer reset switch allows switching between the odometer, trip odometer A and trip odometer B displays.

To zero the trip odometer, have the desired trip odometer display visible, press and hold the trip odometer reset switch. The trip odometer mileage will be displayed for 2-3 seconds and then the trip mileage will return to zero miles.

The odometer can display six numbers to indicate a maximum of 999999 miles/kilometers. The trip odometer can display six numbers with a tenth of a mile accuracy for a maximum of 9999.9 miles/kilometers.

GENERAL

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

The BREAKOUT BOX (Part No. HD-42682) and INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) connect to the speedometer connector [39]. Used in conjunction with a digital volt/ohmmeter (DVOM), it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects

NOTE

See wiring diagrams for speedometer terminal functions.

INSTALLATION

PART NUMBER	TOOL NAME
HD-46601	HARNESS ADAPTERS

1. See Figure 2-9. Bend back the external latches slightly and remove connector [39B].
2. Connect HARNESS ADAPTERS (Part No. HD-46601) to connectors [39A] and [39B].
3. Attach connectors from Breakout Box to harness adapters.

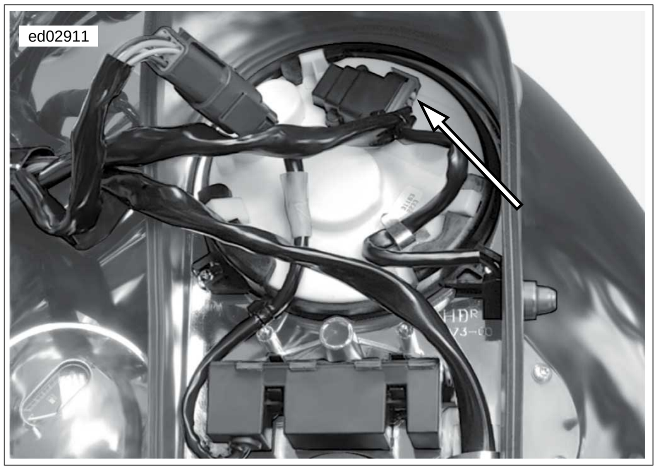


Figure 2-9. Speedometer Connector [39]

REMOVAL

1. Disconnect Breakout Box from harness adapters.
2. Disconnect harness adapters from connectors [39A] and [39B].
3. Install wire harness connector [39B] to speedometer.

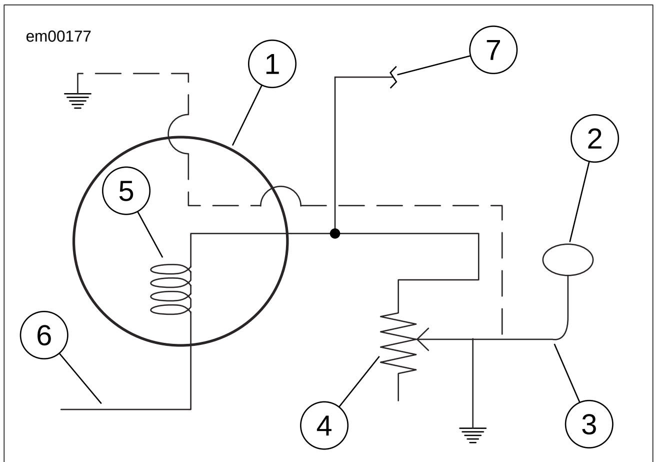
THEORY OF OPERATION

See Figure 2-10. With ignition switch turned to IGNITION, the fuel gauge (1) is connected to 12V. Current flows through the gauge and variable resistor (4) in the fuel gauge sending unit (3) to ground. The sending unit float (2) controls the amount of resistance in the variable resistor.

Inoperative gauges may be caused by several circumstances.

- Sender or fuel gauge not grounded.
- Malfunction in sender or fuel gauge.
- Broken or disconnected wire from ignition switch to fuel gauge.
- Corroded connections at fuel gauge.

Use the 2.6 FUEL GAUGE, Fuel Gauge and Sender Test to test suspect components.



1. **Fuel gauge**
2. **Float**
3. **Sending unit**
4. **Variable resistor**
5. **Gauge winding**
6. **+12 volts wire**
7. **To speedometer**

Figure 2-10. Fuel Gauge Schematic

FUEL GAUGE AND SENDER TEST

PART NUMBER	TOOL NAME
HD-35500	MULTI-METER

NOTES

- *Always refer to the applicable wiring diagram when troubleshooting instruments or gauges.*
- *These steps may set DTC B1004 (fuel level sending unit low/open) and turn on the Low Fuel Warning light.*

1. See Figure 2-11. Remove fuel gauge. Ground (Y/W) wire of fuel gauge sender located at bottom of gauge. Turn ignition switch to IGN.
   a. Fuel gauge must indicate FULL. If fuel gauge indicated FULL, it is functioning correctly. Proceed to step 2.
   b. If fuel gauge did not indicate FULL, proceed to step 3.
2. Set MULTI-METER (Part No. HD-35500) to RX1 scale to measure the resistance of the sending unit. Place one probe on (Y/W) and the other probe on chassis ground.
   a. If fuel tank is full, the reading should be 30-50 ohms. An empty tank should have a 240-260 ohm resistance. A half full tank will be approximately 125-165 ohms.
   b. If a very high resistance or infinity is indicated on the meter, the sender may be "open" or not grounded. Check that sender and fuel tank are grounded by placing one probe of Multi-Meter on sender flange and the other probe on crankcase. Meter must indicate one ohm or less. Replace sender if one ohm or less was present. If a higher resistance is present, check for poor connection on ground wire.
3. Check voltage to (O/W) and (BK) wire of fuel gauge connector [117] if fuel gauge did not indicate FULL.
   a. Correct reading is equivalent to battery voltage.
   b. If battery voltage is not present check for broken or disconnected wire. Replace gauge if wiring problem is not found.

Figure 2-11. Fuel Gauge Connector

GENERAL

See Figure 2-13. All models are equipped with Light Emitting Diode (LED) indicator lamps which must be replaced as a complete assembly with harness. See 2.3 SPEEDOMETER SELF DIAGNOSTICS, Diagnostics for troubleshooting procedures.

Table 2-4. Connector [21] Pins

TERMINAL ON [21]	WIRE COLOR	FUNCTION
1	Violet	Left turn
2	White	High beam
3	Green/Yellow	Oil pressure
4	Brown	Right turn
5	Tan	Neutral
6	Orange	Neutral/oil pressure
7	Black	Left turn/high beam
8	Not used	n/a

Table 2-5. Connector [20] Pins

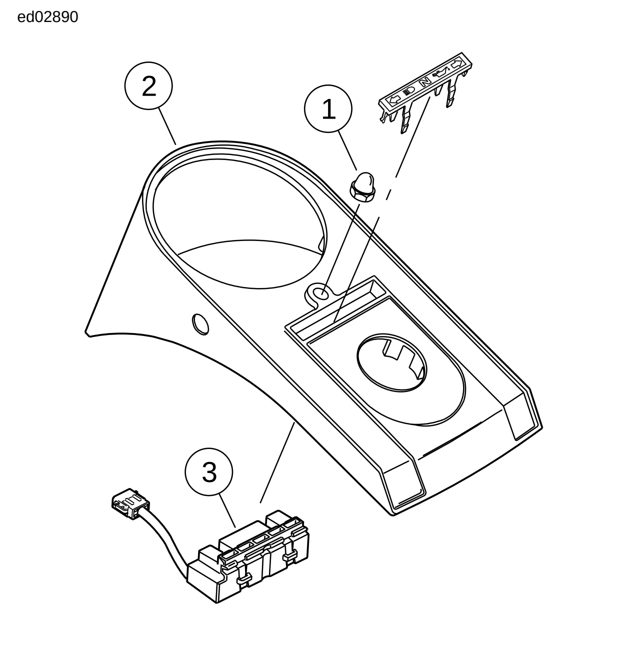
TERMINAL ON [20]	WIRE COLOR	FUNCTION
1	Orange/White	Accessories fuse
2	Brown/Gray	Battery fuse
3	Black/Green	Signal ground
4	Violet	Left turn
5	Brown	Right turn
6	Green/Yellow	Oil pressure
7	Light Green/Violet	DATALINK
8	Yellow/White	Fuel level signal
9	Orange	Instrument fuse
10	White	High beam
11	Tan	Neutral
12	Black [A] Black/Green [B]	Signal ground

Table 2-6. LED Assembly Wiring

INDICATOR LAMP	CONNECTION
Oil pressure	Ground through switch
Neutral	Ground through switch
High beam	12VDC when active
Right/left turn	12VDC when active

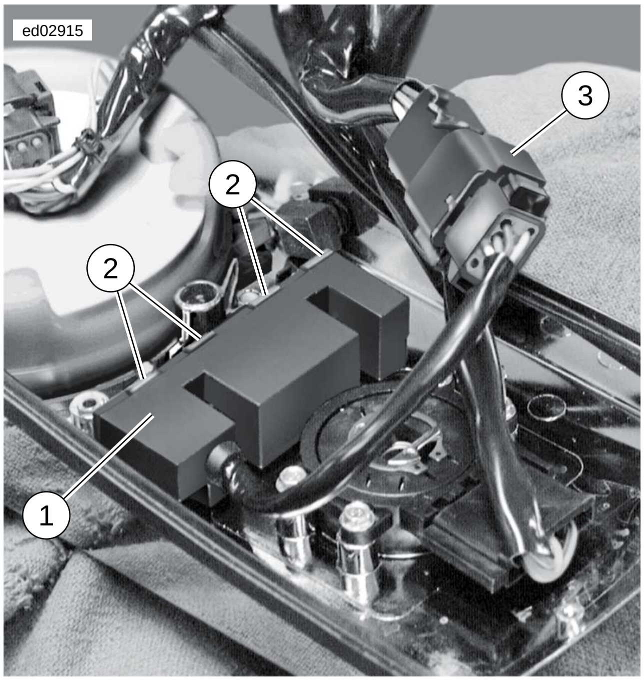
Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.



1. **Nut**
2. **Console**
3. **LED Assembly**

Figure 2-12. Indicator Lamp Assembly



1. **LED assembly**
2. **Clips (2 pair)**
3. **Connector [21]**

Figure 2-13. Connector [21]

DIAGNOSTICS

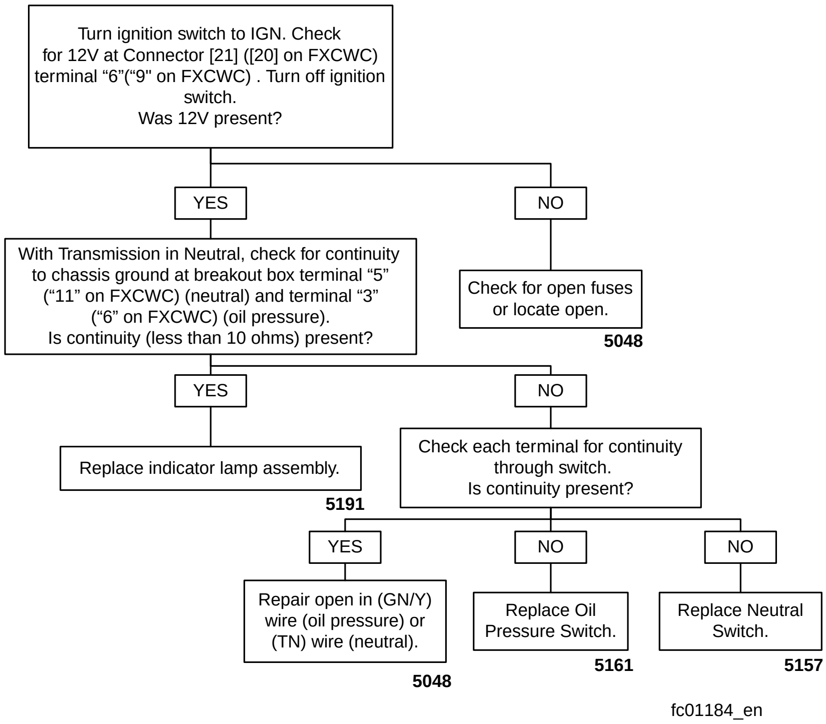
PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

Diagnostic Notes

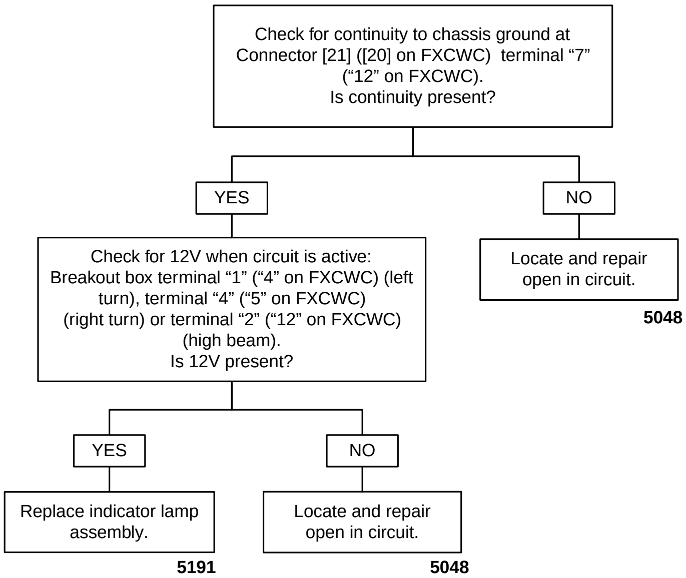
Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (black) between wire harness connector [20A] and instruments connector [20B].
2. When an open circuit is present, a resistance reading of several hundred ohms may be possible due to the neutral lamp (LED).

Oil Pressure or Neutral Indicator Will Not Function



High Beam or R/L Turn Signal Indicator Will Not Function



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GENERAL

See Figure 2-14. The fuel level is monitored by the speedometer terminal "9" of connector [39] (Y/W).

- If the voltage on terminal "9" of connector [39] exceeds the lower limit for greater than or equal to 15 seconds DTC B1004 will set.
- If the voltage on terminal "9" of connector [39] exceeds the upper limit (or is open) for greater than or equal to 15 seconds DTC B1005 will set.

Table 2-7. Code Description

DTC	DESCRIPTION
B1004	Fuel level sending unit low
B1005	Fuel level sending unit high/open

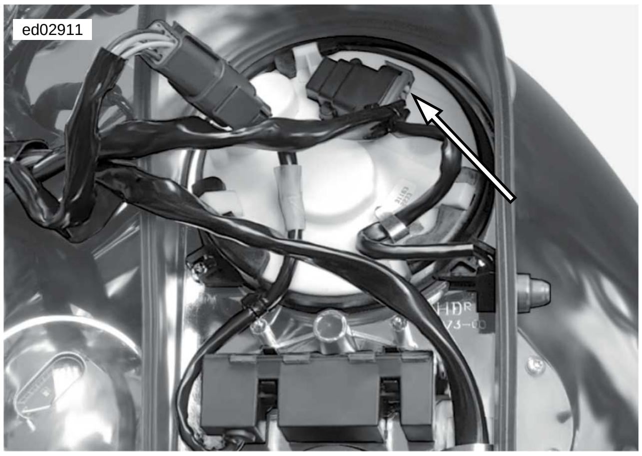


Figure 2-14. Speedometer Connector [39]

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Tips

If fuel gauge is performing erratically (possible false diagnostic trouble codes), inspect for obstructed movement of sender unit arm. Repair or align as necessary.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown pin probe and patch cord.
2. Connect BREAKOUT BOX (Part No. HD-42682) and INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) between wire harness and speedometer.

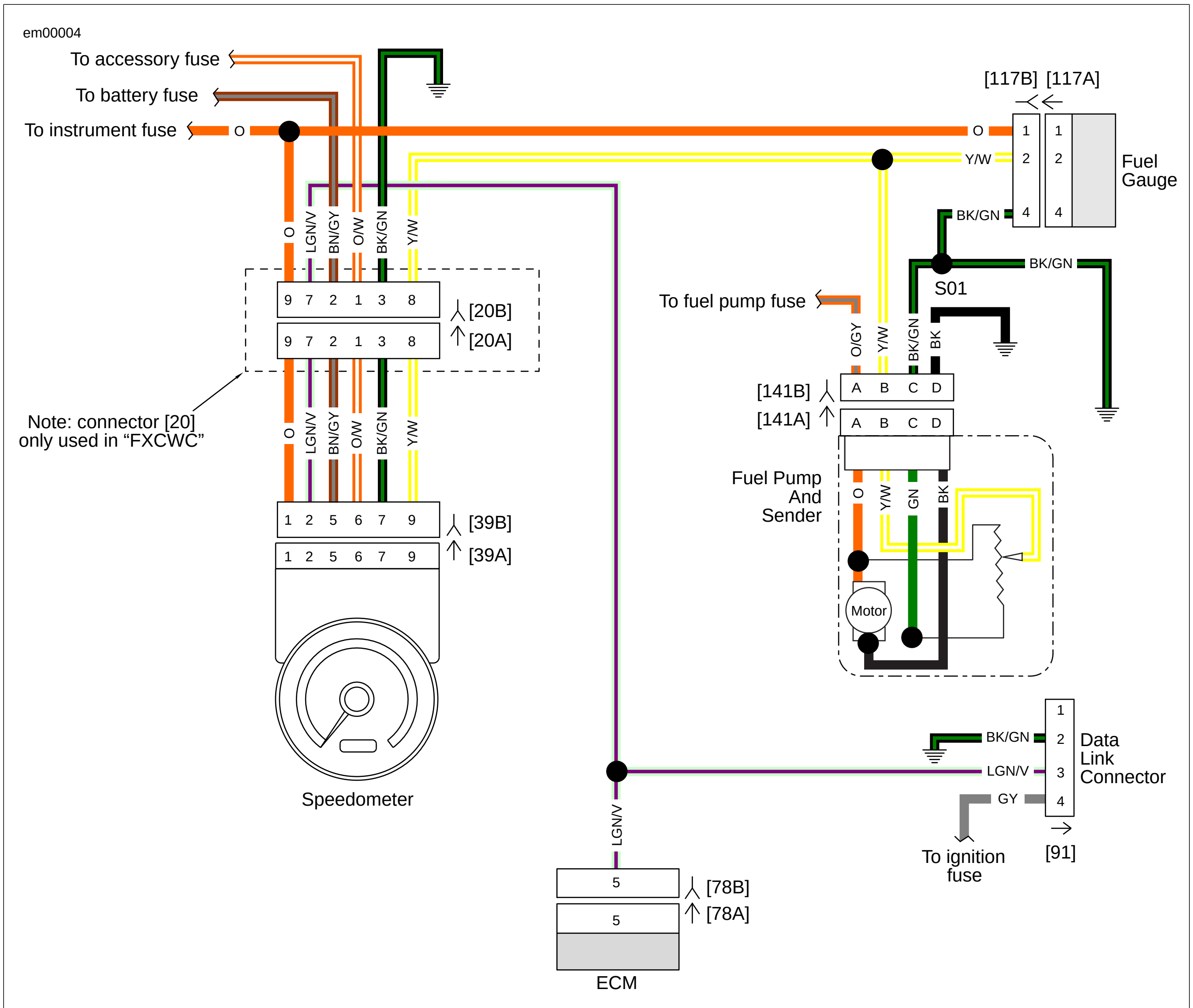
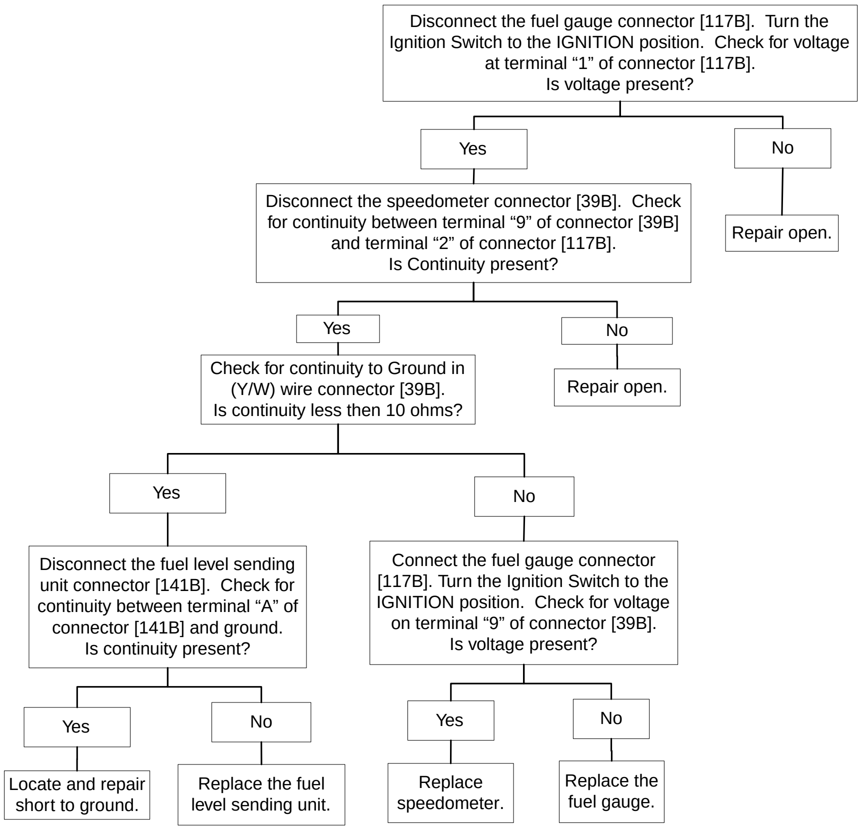


Figure 2-15. Fuel Sender Circuit

Table 2-8. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat
[117]	Fuel gauge	4-place Multilock	Left front side of fuel tank
[141]	Fuel pump and sender	4-place Packard	Top of fuel tank

Fuel Level Sending Unit: DTC B1004



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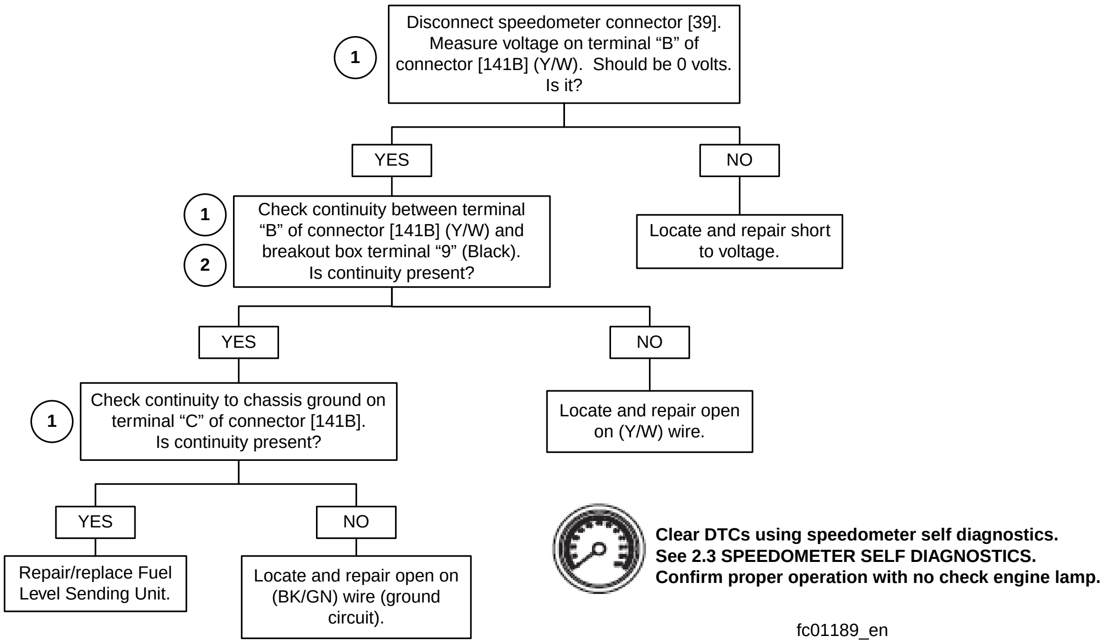
Fuel Level Sending Unit: DTC B1005



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GENERAL

Accessory or Ignition Line Overvoltage

Ignition and accessory voltage is constantly monitored by the speedometer (terminal "1" ignition and terminal "6" accessory). If the battery voltage fails to meet normal operating parameters, a Diagnostic Trouble Code (DTC) is set.

- DTC B1006 is displayed when accessory line voltage is greater than 16.0 volts for longer than 5 seconds.
- DTC B1007 is displayed when ignition line voltage is greater than 16.0 volts for longer than 5 seconds.

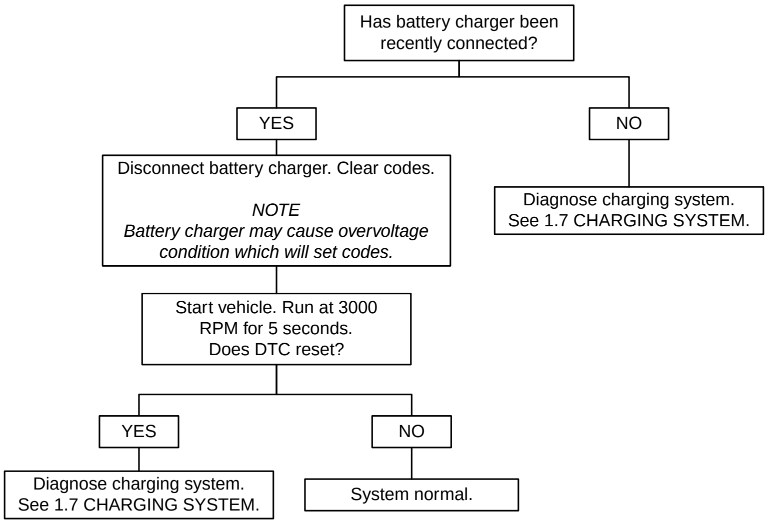
NOTE

ECM or TSM/TSSM/HFSM may also set a battery voltage DTC.

Table 2-9. Code Description

DTC	DESCRIPTION
B1006	Accessory line overvoltage
B1007	Ignition line overvoltage

Accessory or Ignition Line Overvoltage: DTC B1006, B1007



Clear DTCs using speedometer self diagnostics.
See 2.3 SPEEDOMETER SELF DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

fc01190_en

GENERAL

Trip Odometer Reset Switch Closed

Diagnostic Trouble Code (DTC) B1008 will be set if trip odometer reset switch terminals are in a constant shorted state.

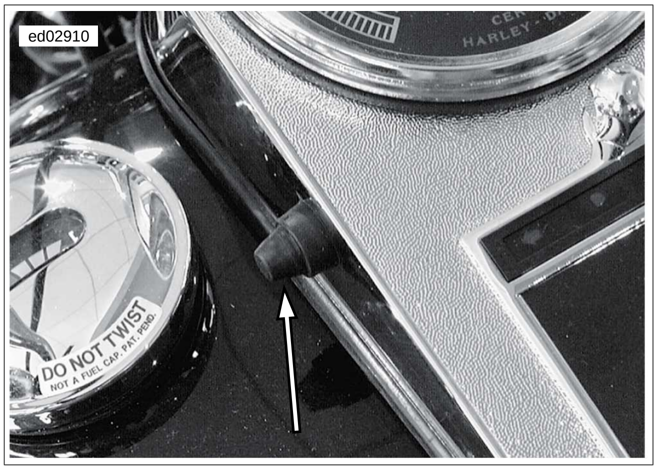


Figure 2-16. Trip Odometer Reset Switch

Table 2-10. Code Description

DTC	DESCRIPTION
B1008	Trip odometer reset switch closed

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) and INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) between wire harness and speedometer, **leaving speedometer disconnected**.

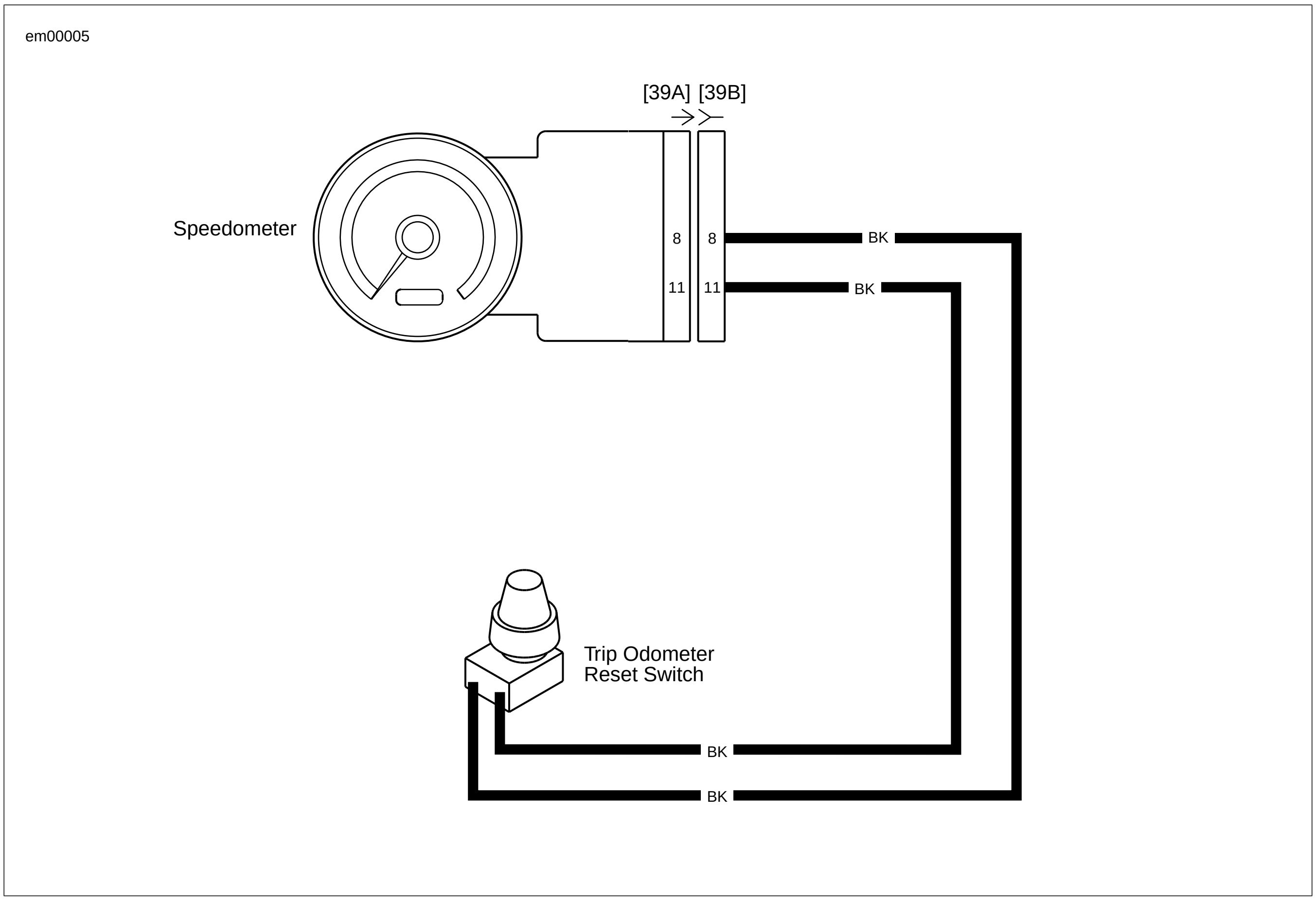
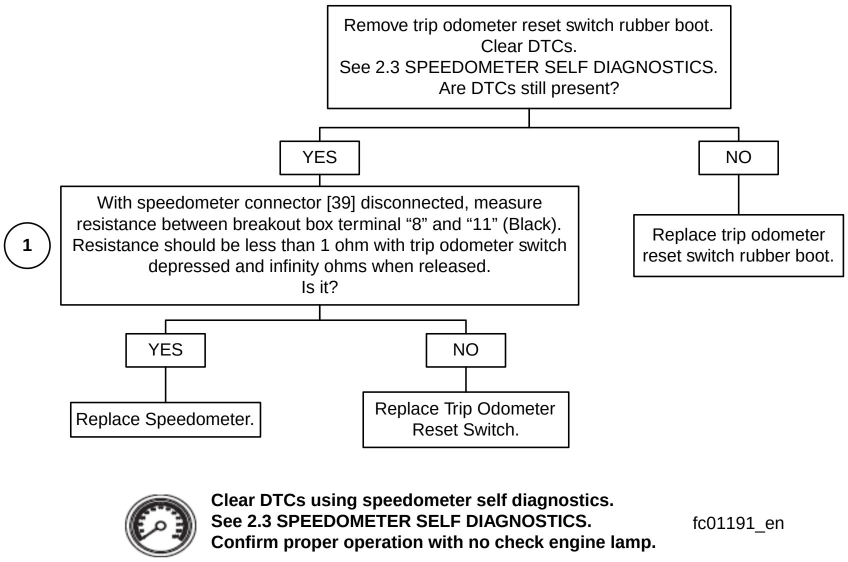


Figure 2-17. Trip Odometer Reset Switch Circuit

Table 2-11. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[39]	Speedometer	12-place Packard	Back of speedometer

Trip Odometer Reset Switch Closed: DTC B1008



GENERAL

Loss of ECM Serial Data

The serial data line provides a means for the Electronic Control Module (ECM), TSM/TSSM/HFSM, and speedometer to communicate their current status. When all operating parameters on the serial data line are within specifications, a state of health message is sent between the components. A Diagnostic Trouble Code (DTC) U1016 indicates that the ECM is not capable of sending this state of health message. A DTC U1255 indicates that no messages were present during power up of the current key cycle. A DTC U1016 indicates that there was communication on the data bus since power up, but communication was lost or interrupted during that key cycle.

Table 2-12. Code Description

DTC	DESCRIPTION
U1016	Loss of all ECM serial data (state of health)
U1255	Serial data error/missing message

DIAGNOSTICS

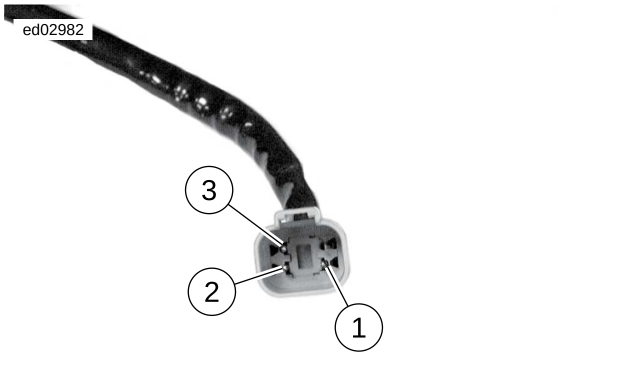
PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/TSSM/HFSM connector [30A] and wire harness connector [30B]. See 3.12 BREAKOUT BOX: TSM/HFSM.

2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.



1. **Terminal 2: ground (BK/GN)**
2. **Terminal 3: serial data (LGN/V)**
3. **Terminal 4: power (GY)**

Figure 2-18. Data Link Connector

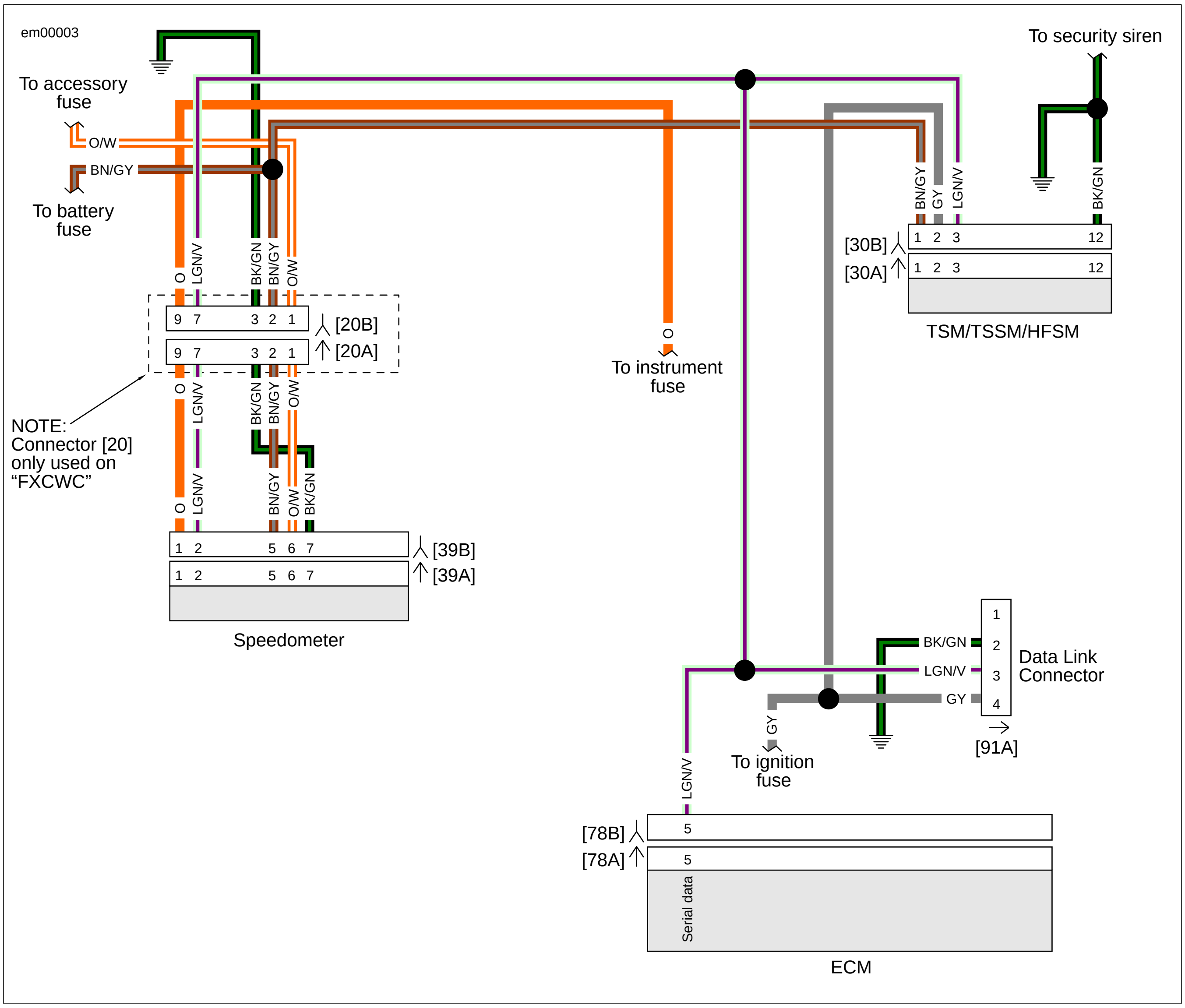
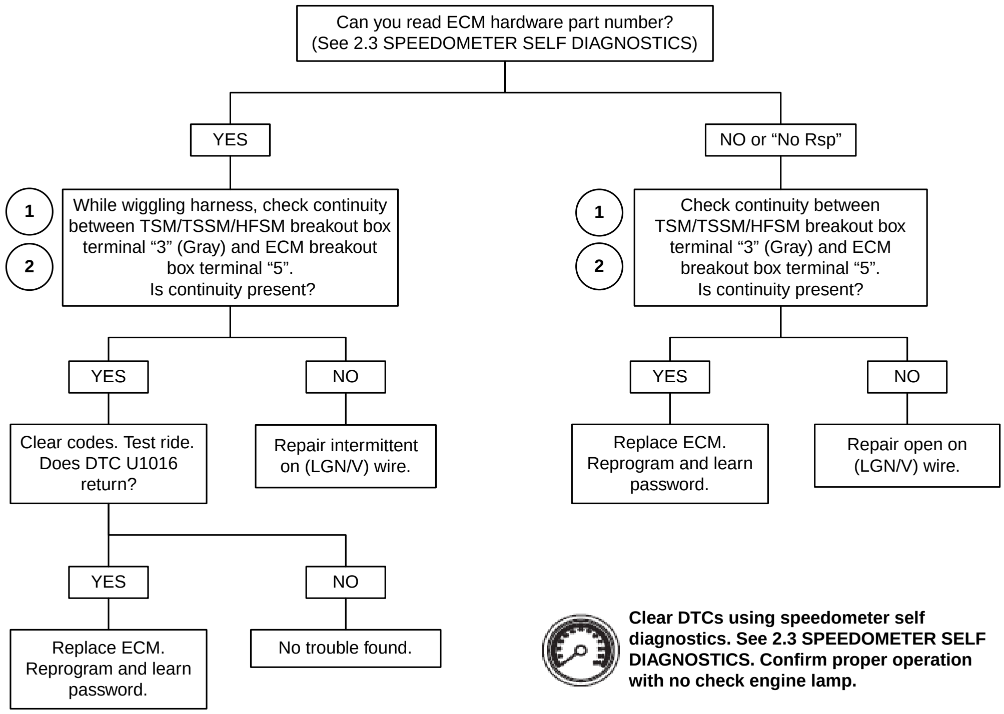


Figure 2-19. Diagnostic Check

Table 2-13. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of right fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat

Loss of ECM Serial Data: DTC U1016



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GENERAL

Loss of TSM/TSSM/HFSM Serial Data

The serial data line provides a means for the Electronic Control Module (ECM), TSM/TSSM/HFSM, and speedometer to communicate their current status. When all operating parameters on the serial data line are within specifications, a state of health message is sent between the components. A Diagnostic Trouble Code (DTC) U1064 indicates that the TSM/TSSM/HFSM is not receiving this state of health message. A DTC U1255 indicates that no messages were present during power up of the current key cycle. A DTC U1064 indicates that there was communication on the data bus since power up, but communication was lost or interrupted during that key cycle.

Table 2-14. Code Description

DTC	DESCRIPTION
U1064	Loss of TSM/TSSM/HFSM serial data
U1255	Serial data error/missing message

sm01275

Figure 2-20. TSM/TSSM/HFSM

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	SPEEDOMETER HARNESS ADAPTER

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) as follows:
   a. Mate black socket housing on Breakout Box with speedometer connector [39] using SPEEDOMETER HARNESS ADAPTER (Part No. HD-46601).
   b. Mate black pin housing on Breakout Box with speedometer wire harness connector [39B] using SPEEDOMETER HARNESS ADAPTERS (Part No. HD-46601).
   c. Mate gray socket housing on Breakout Box with TSM/TSSM/HFSM connector [30A].
   d. Mate gray pin housing on Breakout Box with wire harness connector [30B].

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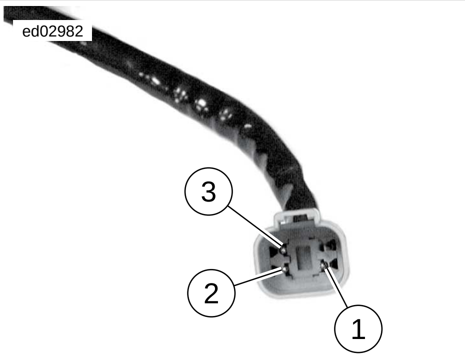


1. **Terminal 2: ground (BK/GN)**
2. **Terminal 3: serial data (LGN/V)**
3. **Terminal 4: power (GY)**

Figure 2-21. Data Link Connector

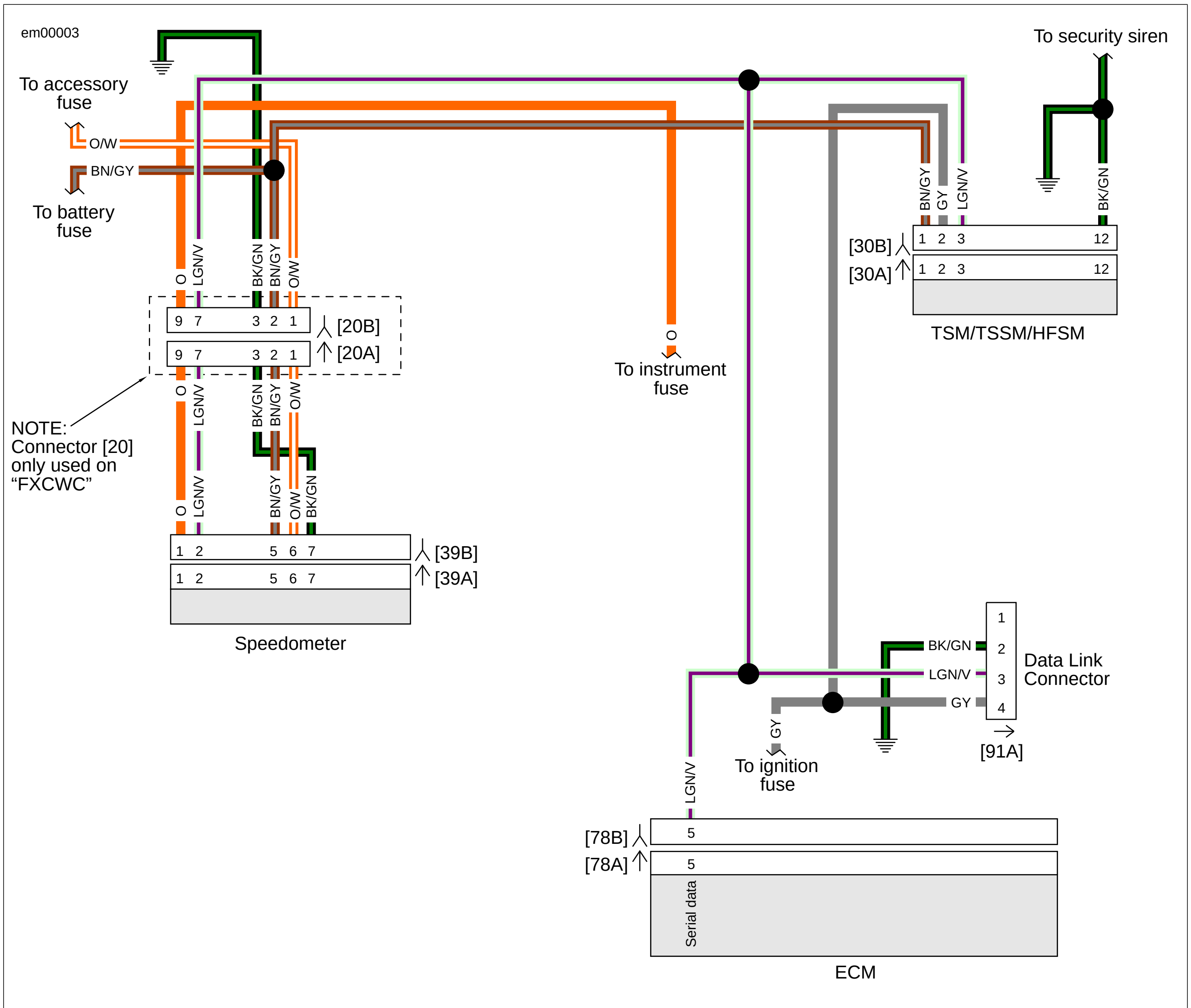
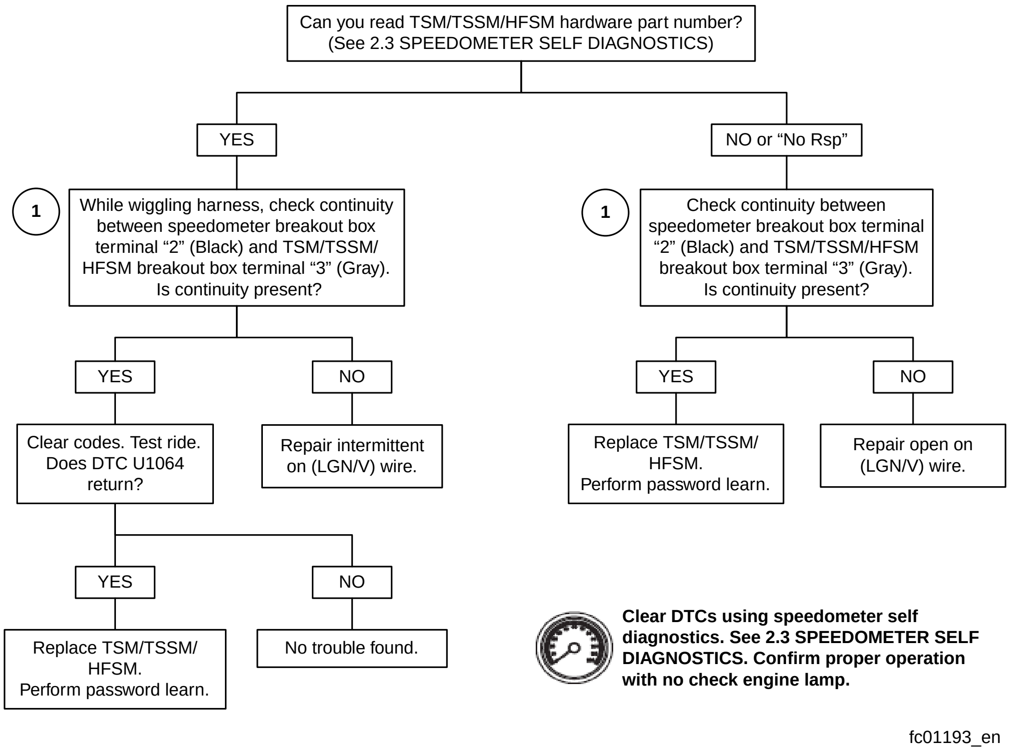


Figure 2-22. Diagnostic Check

Table 2-15. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat

Loss of TSM/TSSM/HFSM Serial Data: DTC U1064, U1255



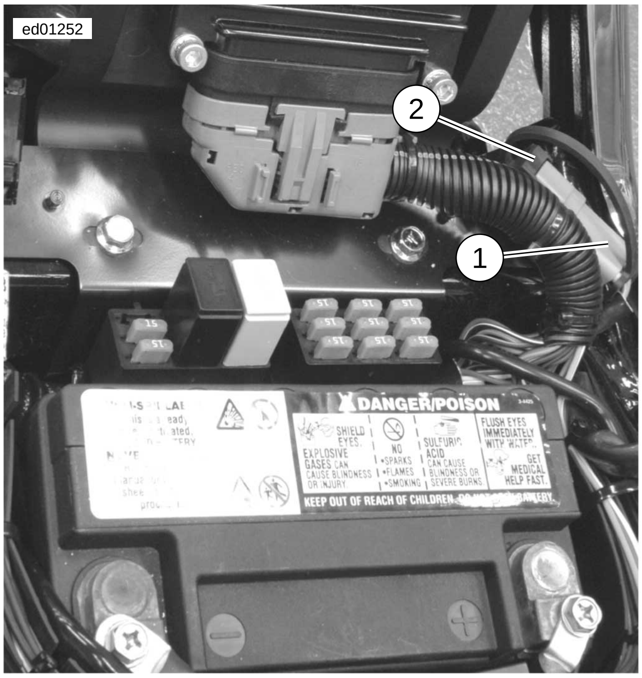
GENERAL

Serial Data Low or Serial Data Open/High

The typical serial data voltage range is 0 volts (inactive) to 7 volts (active). Due to the short pulse, voltages will be much lower on a DVOM. In analog mode, a DVOM reading serial data will show continuous voltage when active, typically 0.6-0.8 volts. The range for acceptable operations is 0-7.0 volts.

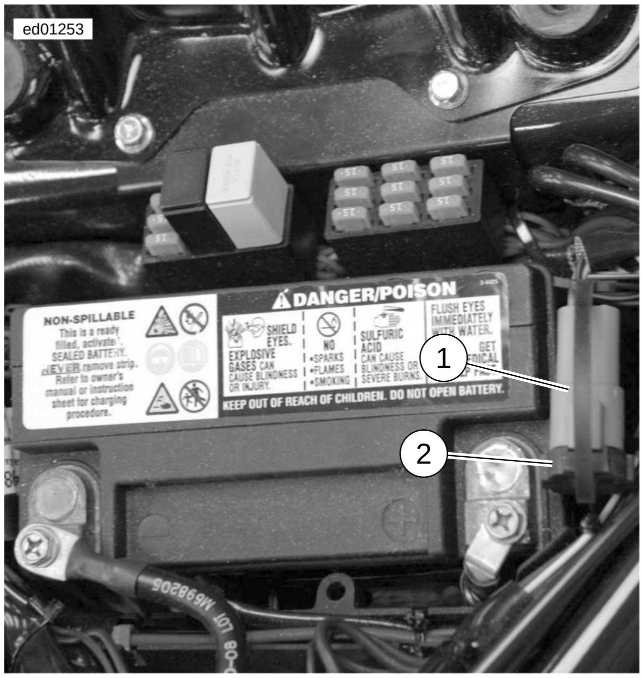
Table 2-16. Code Description

DTC	DESCRIPTION
U1300	Serial data low
U1301	Serial data open/high



1. **Data link connector [91A]**
2. **Protective rubber plug**

Figure 2-23. Data Link Connector [91A]



1. **Data link connector [91A]**
2. **Protective rubber plug**

Figure 2-24. Data Link Connector [91A] (FXCWC)

DIAGNOSTICS

Diagnostic Tips

- If serial data is shorted, these Diagnostic Trouble Codes (DTCs) will automatically cause the check engine lamp to illuminate. The odometer will read "BUS Er" in this condition.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.

Diagnostic Notes

If a U1300, U1301 or "BUS Er" is present, perform diagnostic procedures listed in 4.12 STARTS, THEN STALLS.

NOTES

GENERAL

The Turn Signal Module (TSM) has two major functions:

- Control turn signals.
- Serve as Bank Angle Sensor (BAS).

The optional, factory-installed, Harley-Davidson Smart Security System (**H-DSSS**) includes a Hands-Free Security Module (**HFSM**) which provides the same functions as the TSM, but also includes security and immobilization functions.

SECURITY SYSTEM: JAPAN/KOREA

The security system on motorcycles sold in Japan and Korea meet the regulatory requirements for those countries. The system incorporates a Turn Signal Security Module (**TSSM**). Complete details on operation, troubleshooting, and diagnostics are found in E.1 TSM/TSSM (JAPAN/KOREA) OVERVIEW.

TURN SIGNAL FUNCTIONS

- **Manual turn signal control:** Manual activation/deactivation of left and right turn signal flashing sequences.
- **Automatic turn signal cancellation:** Automatic cancellation of left and right turn signal flashing sequences based on either vehicle speed, vehicle acceleration or turn completion.
- **Hazard warning 4-way flashers:** Four-way left and right turn signal flashing capability.
- **Turn signal lamp diagnostics:** Self-diagnostics for short circuit and open lamp conditions on both left and right turn signal systems. See 3.9 CHECKING FOR DIAGNOSTIC TROUBLE CODES.

NOTE

The turn signals cannot be activated or deactivated when the Ignition Switch is in the ACC position. The turn signals can only be activated or deactivated with the Ignition Switch in the IGNITION position.

MANUAL CANCELLATION

To stop the turn signals from flashing, briefly depress the turn signal switch a second time.

To switch turn direction signals, depress the switch for the opposite turn signal. The first signal is cancelled and the opposite side begins flashing.

AUTOMATIC CANCELLATION

Press the left or right turn switch to activate automatic turn signal cancellation. There is no need to hold the turn switch in when approaching the turn. The TSM/HFSM will not cancel the signal before the turn is actually completed.

- When the directional switch is released, the system starts a 20 count. As long as the vehicle is traveling above 7 MPH (11.3 km/h) the directional will always cancel after 20 flashes if the system does not recognize any other input.
- If the vehicle speed drops to 7 MPH (11.3 km/h) or less, including stopped, the directionals will continue to flash. Counting will resume when vehicle speed reaches 8 MPH (12.9 km/h) and will automatically cancel when the count total equals 20 as stated above.
- The turn signals will cancel within two seconds upon turn completion. A sensor inside the TSM/HFSM cancels the signal after the vehicle has been returned to an upright position.

NOTE

The bank angle cancellation function has an automatic calibration feature. Ride the motorcycle for 0.25 miles (0.4 km) at steady speeds (upright) to calibrate the system. Performance of bank angle function may not be optimal until this calibration is performed. This self-calibration is performed automatically every time the vehicle is started and ridden.

BANK ANGLE FUNCTIONS

- **Emergency engine shutdown:** Will provide engine shutdown when vehicle is tipped over.
- **Emergency outputs disable:** Will disable turn signal lamps and starter motor when vehicle is tipped over.

BANK ANGLE RESTART

The engine will shut off automatically if the vehicle is tipped over. The turn signals, starter motor, Electronic Control Module (ECM), fuel pump and coil will be disabled.

The odometer displays "tIP" when a tip over condition is detected.

To restart the motorcycle after shutdown has occurred:

1. Return the motorcycle to an upright position.
2. Cycle the Ignition Switch OFF-**ON** before restarting the motorcycle.

CLUTCH/NEUTRAL INTERLOCK

- **Disables starter:** Disables starter until either the clutch lever is pulled in or transmission neutral is selected.
- **Diagnostics:** Provides diagnostics for clutch and neutral switch faults.

SECURITY SYSTEM H-DSSS

See 3.2 HARLEY-DAVIDSON SMART SECURITY SYSTEM.

COMPONENTS

The Harley-Davidson Smart Security System (H-DSSS) consists of three components:

- **Hands-Free Security Module:** See Figure 3-1. A electronic module that functions both as the Turn Signal Module (TSM) and as the Hands-Free Security Module (HFSM).
- **Hands-Free Antenna:** See Figure 3-1. Mounted under the seat of the motorcycle.
- **Hands-Free Fob:** See Figure 3-2. A remote control device, intended to be carried by the rider whenever the vehicle is being operated.

NOTE

Do not relocate any of the Security System components.

Figure 3-1. HFSM and Antenna

Figure 3-2. Hands-Free Fob w/Serial Number Label

SECURITY IMMOBILIZATION

The Hands-Free Security System (HFSM) provides security and immobilization functions not found on the Turn Signal Module (TSM). The HFSM will disable the starter and ignition system. Additional functions include the ability to alternately flash the left and right turn signals and sound a siren (if equipped) if a theft attempt is detected.

NOTE

The siren must be in the Chirp Mode for the siren to chirp on arming or disarming. See 3.6 WARNINGS AND ALARMS, Siren Chirp Mode (Confirmation).

Conditions that activate the security system when system is armed include:

- **Detecting tampering of the ignition circuit:** Turn signals flash three times, optional siren chirps once and then turns off. If the tampering continues, a second warning will activate after four seconds. Continued tampering will cause the alarm to activate for 30 seconds and then turn off. The two warnings/alarm cycle is repeated for each tampering incident.
- **Detecting vehicle movement:** Turn signals flash three times, optional siren chirps once and then turns off. If the vehicle is not returned to its original position, a second warning will activate after four seconds. If the vehicle is not returned to its original position, the alarm activates for 30 seconds then turns off. The two warnings/alarm cycle may repeat a maximum of 10 times with a 10 second pause between cycles.
- **Detecting that a battery or ground disconnect has occurred while armed:** Siren, if installed, activates its self-alarm mode. Turn signals will not flash.

See 3.5 ARMING/DISARMING SECURITY SYSTEM for more information.

NOTE

Disconnect the battery to prevent the siren (if installed) from activating within 5 seconds of turning the Ignition Switch to OFF/FORK LOCK. If the HFSM is armed, you must turn the Ignition Switch to IGNITION with a fob within range, again turn the Ignition Switch to OFF/FORK LOCK and remove the MAXIFUSE before the 5-second arming period expires. With the MAXIFUSE removed, the battery can be disconnected.

HFSM FEATURES

The following information applies only to motorcycles equipped with the Hands Free Security System (HFSM).

- **Security lamp:** See Figure 3-3. A lamp (key icon) within the speedometer face tells the rider if the system is armed or disarmed.
- **Personal code disarming:** If the fob is not available, the HFSM allows the rider to disable the security alarm and immobilization functions with a five-digit personal code.
- **Arming confirmation:** When the HFSM is armed, the system provides visual feedback (confirmation) to the rider by flashing the turn signals and an audible "chirp" if equipped with the optional smart siren and chirp mode is enabled.
- **Disarming confirmation:** When the HFSM is disarmed, the system provides an audible "chirp" (confirmation) if equipped with the optional smart siren and chirp mode is enabled.
- **Transport mode:** It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be moved in an immobilized state.
- **Starter/ignition disable:** When armed the starter and ignition system are disabled.
- **Security system alarm:** See Figure 3-4. The system will alternately flash the left and right turn signals and sound an optional Security Siren if a vehicle security condition is detected while the system is armed.
- **Dealer service mode:** This mode allows the dealer to disable security system via DIGITAL TECHNICIAN. Dealer service mode is exited when module detects an assigned fob in range.

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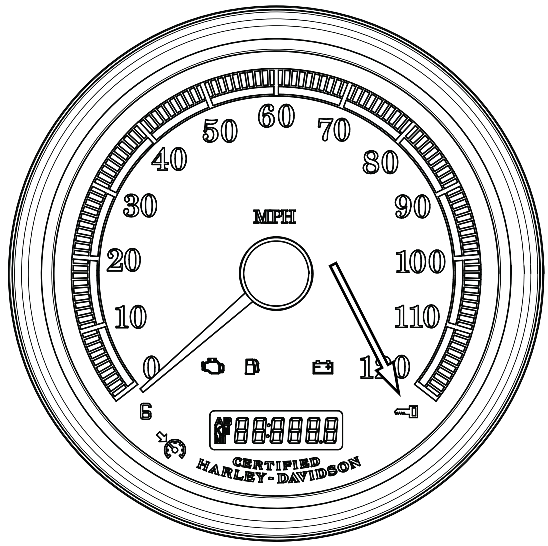

Figure 3-3. Security Lamp (Key Icon)

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Figure 3-4. Security Siren

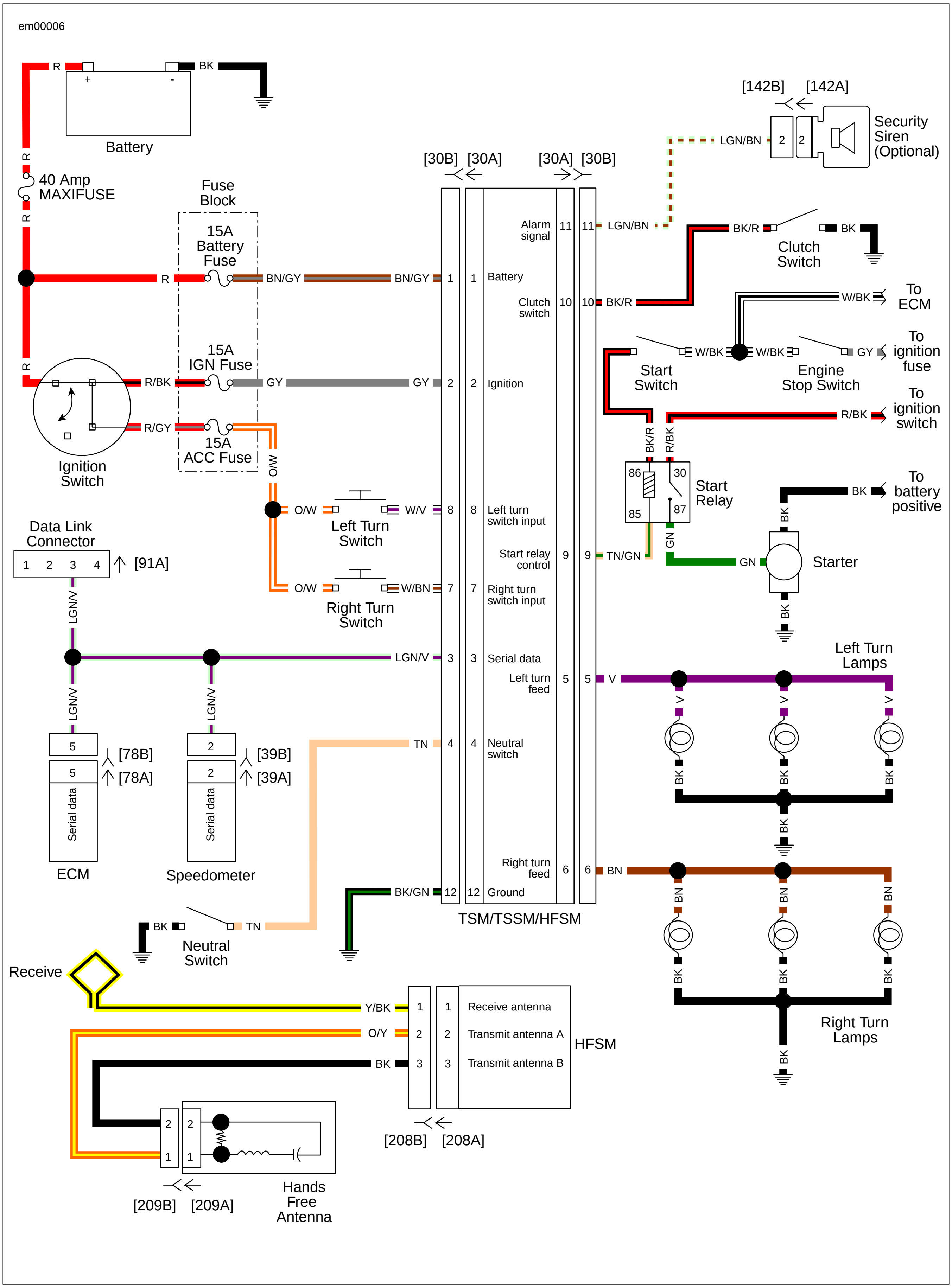

Figure 3-5. Simplified TSM/HFSM Wiring

GENERAL

Setting up a vehicle TSM/HFSM depends on whether the vehicle has a Turn Signal Module (TSM) or the optional Hands-Free Security Module (HFSM) security system installed.

SIDECAR CONFIGURATION

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

All motorcycles ship with the H-DSSS set for use **without** a sidecar installed. If a motorcycle is equipped with a TSM, no further actuation is required.

ACTUATION

Actuation consists of assigning two fobs to the system, and entering an initial Personal Identification Number (PIN). The PIN can be changed by the rider at any time.

1. Configure HFSM motorcycles by assigning **both** fobs to the vehicle.
2. Configure HFSM motorcycles by entering a PIN picked by the owner. The personal code allows the owner to operate the system if the fob is lost or inoperable. Record the PIN in the Owner's Manual and instruct the customer to carry a copy (use the wallet card found in the Owner's Manual). See 3.4 PERSONAL IDENTIFICATION NUMBER (PIN).

Once the system has been activated, it will always "arm" within 5 seconds of turning the Ignition Switch to **OFF** and no motorcycle motion.

FOB ASSIGNMENT

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

Use DIGITAL TECHNICIAN (Part No. HD-44750) to assign both fobs to the H-DSSS. Follow the menu prompts in the Digital Technician display and scan the fob serial number with the bar code reader, or key-in the number from the keyboard. See a Harley-Davidson dealer.

NOTE

Each fob has a unique serial number. The label should be removed from the fob and attached to a blank NOTES page in the Owner's Manual for reference.

POWER DISRUPTION AND CONFIGURING

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

The HFSM will not enter PIN entry mode on the first attempt after battery voltage has been removed from terminal "1". This will occur after any of the following:

- Battery disconnect or power drain.
- Battery fuse removal.
- Connecting BREAKOUT BOX (Part No. HD-42682) to HFSM connector.

Therefore, after all battery reconnects, the configuration sequence must be modified as follows:

1. Set Engine Stop Switch to **OFF**, cycle Ignition Switch **IGNITION-OFF-IGNITION-OFF-IGNITION** and press left turn signal switch **twice**.
2. Repeat steps listed above.
3. Continue with PIN entry sequence listed.

GENERAL

The Personal Identification Number (PIN) consists of five digits. Each digit can be any number from 1-9. There can be no zeros (0) in the PIN. The PIN **must** be used to disarm the security system in case the fob becomes unavailable.

INITIAL PIN ENTRY

To enter a PIN on a motorcycle with no PIN previously installed during HFSM actuation, refer to Table 3-1.

Table 3-1. Entering an Initial PIN: HFSM

STEP	ACTION	CONFIRMATION
1	Select a 5-digit (1 through 9) initial PIN and record in the Owner's Manual and on the wallet card.	
2	With an assigned fob present, set Engine Stop Switch to **OFF.**	
3	Cycle Ignition Switch **IGNITION**-OFF-**IGNITION**-OFF-**IGNITION.**	
4	Press **left** turn signal button **2** times.	Turn signals will flash 3 times.
5	Press **right** turn signal button **1** time.	Five dashes will appear in the odometer window. The first dash will flash.
6	Enter first digit (a) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
7	Press **right** turn signal button **1** time.	The digit (a) will replace the dash in the odometer. The second dash will flash.
8	Enter second digit (b) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
9	Press **right** turn signal button **1** time.	The digit (b) will replace the dash in the odometer. The third dash will flash.
10	Enter third digit (c) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
11	Press **right** turn signal button **1** time.	The digit (c) will replace the dash in the odometer. The fourth dash will flash.
12	Enter fourth digit (d) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
13	Press **right** turn signal button **1** time.	The digit (d) will replace the dash in the odometer. The fifth dash will flash.
14	Enter fifth digit (e) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
15	Press **right** turn signal button **1** time.	The digit (e) will replace the dash in the odometer. The first digit will flash.
16	Turn the Ignition Switch to **OFF.**	

CHANGING THE PIN

To change a PIN, refer to Table 3-2.

Modifying an Existing Pin

If a PIN was previously entered, the odometer will display the equivalent digit. Each additional press of the left turn switch will increment the digit.

Examples:

- To advance from 5 to 6, press and release the left turn switch 1 time.
- To advance from 8 to 2, press and release the left turn switch 3 times (9-1-2).

Table 3-2. Changing the PIN: HFSM

STEP	ACTION	CONFIRMATION	NOTES
1	Select a 5-digit (1 thru 9) personal code and record in the Owner's Manual and on the wallet card.		
2	With fobs present, cycle Ignition Switch **IGNITION**-OFF-**IGNITION**-OFF-**IGNITION.**		
3	Press **left** turn signal button **2** times.	Turn signals will flash 3 times.	
4	Press **right** turn signal button **1** time.	Current PIN will appear in odometer. The first digit will flash.	
5	Enter first digit (a) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
6	Press **right** turn signal button **1** time.	The new digit will replace the current in the odometer. The second digit will flash.	
7	Enter second digit (b) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
8	Press **right** turn signal button **1** time.	The new digit will replace the current in the odometer. The third digit will flash.	
9	Enter third digit (c) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
10	Press **right** turn signal button **1** time.	The new digit will replace the dash in the odometer. The fourth digit will flash.	
11	Enter fourth digit (d) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
12	Press **right** turn signal button **1** time.	The new digit will replace the current in the odometer. The fifth digit will flash.	
13	Enter fifth digit (e) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
14	Press **right** turn signal button **1** time.	The new digit will replace the current in the odometer. The first digit will flash.	
15	Turn the Ignition Switch to **OFF.**		Turning Ignition Switch to OFF stores PIN.

HANDS-FREE FOB

See Figure 3-6. The HFSM's reception range for the Hands-Free Fob signal depends on a specific receiver pattern. The range will be an arm's length.

NOTES

- *Environmental and geographic conditions may affect signal range.*
- *Always have the fob present whenever the motorcycle is operated.*
- *Do not place fob in metal enclosure, and do not place it closer than 3.0 in. (80.0 mm) to the hands-free antenna, cellular phones, PDAs, displays and other electronic devices while operating the motorcycle. That may prevent the fob from disarming the security system.*
- *Fob battery should be replaced every year. See 3.26 HFSM MAINTENANCE.*

Figure 3-6. Hands-Free Fob

SECURITY LAMP (KEY ICON)

Refer to Table 3-3. See Figure 3-7. The security lamp (key icon) in the speedometer face provides feedback to the rider confirming armed or disarmed status.

Table 3-3. Security Lamp Status

LAMP	MODE
Does not flash.	No security system (TSM only), security system not armed.
Flashes every second.	Two minute timeout after failed PIN entry attempt or a battery reconnect has occurred while armed.
Flashes every 2.5 seconds.	Security system armed.
Flashes 4 times a second.	PIN entry mode.
Stays on solid with Ignition Switch OFF.	Arming is starting up. You have 5 seconds before system is armed.
Stays on solid with Ignition Switch ON.	If solid for more than 4 seconds after Ignition Switch is turned to IGNITION, a current DTC is present.

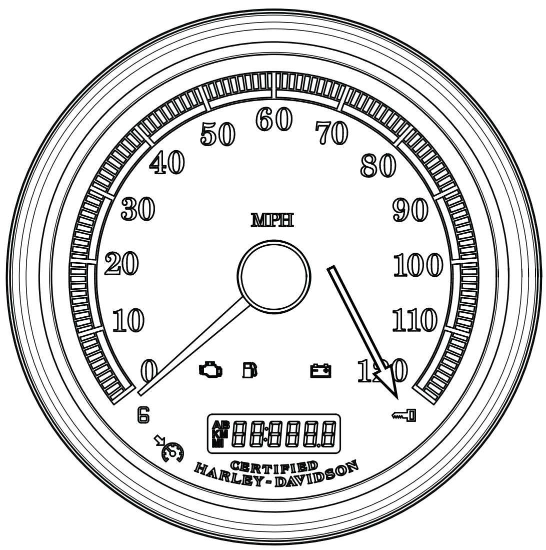

Figure 3-7. Security Lamp (Key Icon)

ARMING

The H-D Smart Security System automatically arms within five seconds when the motorcycle is parked and the Ignition Switch is turned to **OFF** and motion is not detected.

Confirmation: On arming, the turn signals flash twice and the Security Siren will "chirp" twice if chirp function is activated. While armed, the security lamp (key icon) will flash every 2.5 seconds. Refer to Table 3-3.

DISARMING

There are two ways to disarm the H-D Smart Security System:

- Automatic disarming.
- Using the PIN.

Automatic Disarming: Always have the fob present when riding, loading, fueling, moving, parking or servicing the motorcycle. Carry the fob in a convenient pocket. The H-D Smart Security System disarms automatically when the Ignition Switch is turned to IGNITION.

Confirmation: On disarming, the Security Siren will chirp once (if chirp function is activated) and the security lamp (key icon) will turn ON solid for four seconds then go out. Refer to Table 3-3.

DISARMING WITH A PERSONAL IDENTIFICATION NUMBER (PIN)

See 3.4 PERSONAL IDENTIFICATION NUMBER (PIN) to enter an initial PIN to actuate the system.

Refer to Table 3-4. If you make an error while disarming the HFSM using the PIN, the alarm will activate for 30 seconds after the last digit is entered. After a failed attempt, the security lamp will flash once every second for 2 minutes. **During this time, the vehicle will not accept any attempt to enter a PIN.**

Table 3-4. Entering the PIN to Disarm HFSM (Example: 3-1-3-1-3)

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set Engine Stop Switch to **OFF.**		
2	Turn Ignition Switch to **IGNITION.**		
3	Hold **both** turn switches in until confirmation. *	Security lamp blinks at fast rate and "0- - - - " is displayed in the odometer. The first digit will flash.	System is ready for PIN entry.
4	Enter first digit of code (3) by pressing **left** turn switch **3** times.		
5	Press right turn switch **1** time.	The first digit will be displayed and the next dash will flash in the odometer.	Serves as "enter" key.
6	Enter second digit of code (1) by pressing **left** turn switch **1** time.		
7	Press **right** turn switch 1 time.	The first two digits will be displayed and the next dash will flash in the odometer.	Serves as "enter" key.
8	Enter third digit of code (3) by pressing **left** turn switch **3** times.		
9	Press **right** turn switch 1 time.	The first three digits will be displayed and the next dash will flash in the odometer.	Serves as "enter" key.
10	Enter fourth digit of code (1) by pressing **left** turn switch **1** time.		
11	Press **right** turn switch **1** time.	The first four digits will be displayed and the next dash will flash in the odometer.	Serves as "enter" key.
12	Enter fifth digit of code (3) by pressing **left** turn switch **3** times.		
13	Press **right** turn switch **1** time.	Security lamp stops blinking and the odometer displays miles.	System is disarmed.
* This must be done within two seconds of turning the Ignition Switch to IGNITION. If system issues a warning before the security system flashes at a fast rate, then cycle Ignition Switch OFF until security key icon flashes at 2.5 second rate before re-attempting PIN entry.			

WARNINGS

A warning consists of three alternate flashes of the turn signals and chirp from the optional Security Siren. Warnings are issued from an armed HFSM in the following order:

1. **First Warning:** A warning is issued whenever a person without a fob present attempts to move the motorcycle or turns the Ignition Switch to **IGNITION.**
2. **Second Warning:** If the motion continues or the Ignition Switch is not turned back to **OFF**, a second warning is issued within four seconds of the first.
3. **Alarm:** If the motion continues or the Ignition Switch is not turned to **OFF** past the second warning, the Smart Security System will go into full alarm.

ALARM

Activation

In the full alarm state, the turn signals flash alternately, and if equipped with the Security Siren, the siren will sound.

After 30 seconds of alarm, if no further motorcycle motion is detected, the alarm will stop.

NOTE

*Motorcycle must be returned to original parked position with Ignition Switch turned to **OFF**.*

If motorcycle motion continues, the alarm will start again continue for another 30 seconds.

The HFSM will repeat the alarm cycles 10 times for a total of five minutes, with a 10-second pause between alarm cycles.

NOTES

- *During warnings and alarms, the starter motor and the ignition remain disabled.*
- *The alarm will also activate the LED and vibration or audible modes of a Harley-Davidson Security Pager. A pager can operate either in silent or in combination with an optional Smart Siren. The range of the pager can be up to 0.50 mile (0.89 km).*

Deactivation

The alarm cycles can be discontinued at any time by moving an assigned fob to the motorcycle. The presence of the fob will terminate the alarm.

SIREN CHIRP MODE (CONFIRMATION)

Chirpless Mode

In the chirpless mode, the siren does not chirp on arming or disarming.

NOTE

Even when armed in the chirpless mode, the siren still chirps warnings on movement and will activate the alarm through cycles.

Chirp Mode

On arming in the chirp mode, the siren responds with two chirps. When disarming, the siren responds with a single chirp.

Switching Modes

Cycling quickly through two armings and disarmings will switch the system from either the chirpless mode or the chirp mode to its opposite.

1. With the fob present, the Ignition Switch to ON and the system disarmed, turn the Ignition Switch OFF.
2. When the system arms (2 flashes of turn signals), immediately turn the Ignition Switch to ON.
3. Wait until the security lamp goes out, then immediately turn the Ignition Switch OFF.
4. When the system arms (2 flashes of turn signals), immediately turn the Ignition Switch to ON and wait for system to disarm.

TRANSPORT MODE

It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be picked up and moved in an armed state, however, any attempt to start the engine will trigger the alarm.

To Enter Transport Mode

1. Turn the Ignition Switch to IGNITION.
2. Set the Engine Stop Switch to OFF.
3. With an assigned fob within range, turn the Ignition Switch from IGNITION to ACC.
4. Simultaneously press both the left and the right turn signal switches. This must be done within five seconds of turning the Ignition Switch to ACC.
5. After the turn signals flash once, turn the Ignition Switch to OFF and the module is armed.
6. Confirmation: Turn signal blinks three times when armed for one ignition cycle.

To Exit Transport Mode

Return the system to normal operation:

1. With the fob present, turn the Ignition Switch to IGNITION to disarm the HFSM. To cancel the transport mode, set the Engine Stop Switch to RUN.

SERVICE MODE

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

With a fob present, the HFSM can be configured for service by disabling the security system with DIGITAL TECHNICIAN (Part No. HD-44750).

Once disabled, the motorcycle can be operated without an assigned fob present. To maintain the Service Mode, the assigned fobs must be kept out of range. If the fob appears in range, the Service Mode will be exited.

FOUR-WAY FLASHING

If it is necessary to leave a motorcycle parked along side the road, the hazard warning four-way flashers can be turned ON with the Smart Security System armed.

To Arm the HFSM with the Hazard Warning Flashers ON

1. Turn the Ignition Switch to IGNITION.
2. Simultaneously press both left and right turn signal switches to turn the four-way flashers ON. The four-way flashers will continue for two hours.
3. Turn the Ignition Switch to OFF to arm the Smart Security System.

To Disarm the HFSM and Turn the Hazard Warning Flashers OFF

1. With a fob present, turn the Ignition Switch to IGNITION.
2. Simultaneously press the left and right turn signal switches.

TURN SIGNALS (TSM/HFSM)

Verify the operation of the turn signals and the integrity of the fuse protecting the turn signals before further troubleshooting.

SECURITY SYSTEM (HFSM)

If the fob is present, and the security system is issuing "warnings" or "Alarm" when the motorcycle is moved, the reason may be one of the following:

1. Strong electromagnetic interference in the area you have parked.
   a. Verify you have not placed your fob in metal enclosure, or within 3.0 in. (80.0 mm) of the hands-free antenna or other electronic devices.
   b. Place fob next to motorcycle and turn the Ignition Switch ON. After the system disarms, the fob can be placed back in its carrying location.
   c. Try moving the motorcycle approximately 15 feet (4.57 m) away from the current parking spot.
2. The fob battery is dead. Use PIN to disarm the vehicle. Replace fob battery.
3. Fob is damaged. Use PIN to disarm the vehicle. Replace the fob.

DIAGNOSTICS MODE

The TSM/HFSM measures the current when the turn signals are used. If there is a burned out light bulb on one side, the remaining light and the corresponding turn signal indicator flash at double the normal rate starting with the fifth flash.

Other diagnostic conditions monitored include:

- Short circuit in the turn signal wiring.
- Open circuit in the turn signal wiring.
- Stuck turn signal switch.

NOTES

- *A stuck turn signal switch will disable the automatic turn signal cancellation feature.*
- *If a stuck switch is detected, you must hold the left and right turn signal switches in for more than one second to activate the four-way flashers.*

See 3.9 CHECKING FOR DIAGNOSTIC TROUBLE CODES for more information.

TROUBLESHOOTING

To resolve TSM/HFSM faults, follow three basic steps:

1. Retrieve Diagnostic Trouble Codes (DTCs) using speedometer self diagnostics. See 2.3 SPEEDOMETER SELF DIAGNOSTICS.
2. Diagnose system problems. This involves using special tools and the diagnostic flow charts in this section.
3. Correct problems through the replacement and/or repair of the affected components.

After repairs are performed, the work must be validated. This involves clearing the DTCs and confirming proper vehicle operation as indicated by the behavior of the turn signals.

GENERAL

Problems fall into at least one of five categories:

- Turn signal malfunction.
- Bank angle (engine disable).
- Clutch/neutral interlock (starter enable).
- Security lamp problem.
- Security system malfunction.

SECURITY/LAMP DIAGNOSTICS

To diagnose system problems, start by observing the behavior of the security lamp.

NOTES

- *See Figure 3-8. "Key ON" means that the Ignition Switch is turned to IGNITION and the Engine Stop Switch is set to RUN (although the engine is **not** running).*
- *See Figure 3-9. When the Ignition Switch is turned to ON, the security lamp will illuminate for approximately four seconds and then turn off.*
- *If the security lamp is not illuminated at Key ON or if it fails to turn OFF after the initial four-second period, the speedometer may need to be replaced. See 2.3 SPEEDOMETER SELF DIAGNOSTICS. If "BUS Er" is displayed on the odometer, it may take up to twenty seconds for the security lamp to illuminate.*
- *The security lamp will also light for eight seconds after the bulb check if historic Diagnostic Trouble Codes (DTCs) are present. The security lamp will stay on if current DTCs are set. If a historic DTC is present, the security lamp will light for 2 ignition cycles or until the DTC is cleared manually.*

See Figure 3-10. After the lamp turns off after being illuminated for the first four-second period, one of three events may occur:

- The lamp remains off. This indicates there are no current fault conditions or stored historic DTCs currently detected by the HFSM. (A)
- The lamp stays off for only four seconds and then comes back on for an eight-second period. This indicates a historic DTC is stored, but no current DTC exists. (B)
- The lamp remains on beyond the eight-second period. This indicates a current DTC exists. (C)

NOTE

See 3.9 CHECKING FOR DIAGNOSTIC TROUBLE CODES, Code Types for a complete description of DTC formats.

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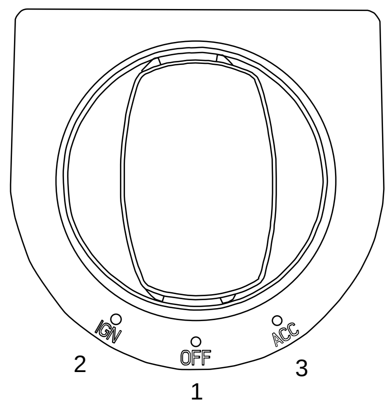

1. **Ignition OFF**
2. **Ignition ON**
3. **Marker Lights (ACC) ON**

Figure 3-8. Ignition Switch

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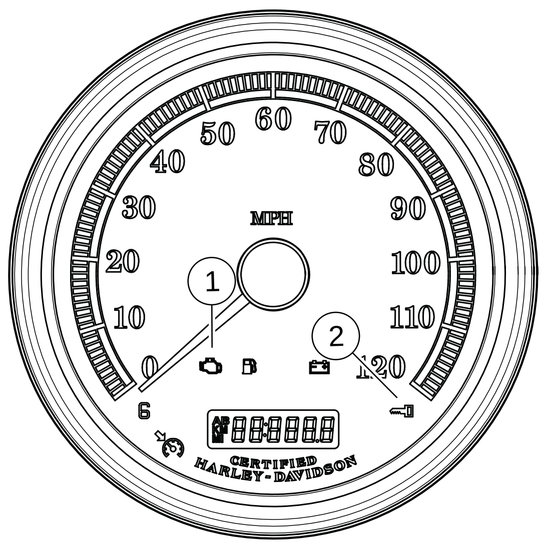


1. **Check engine lamp**
2. **Security lamp (key icon)**

Figure 3-9. Check Engine and Security Lamp

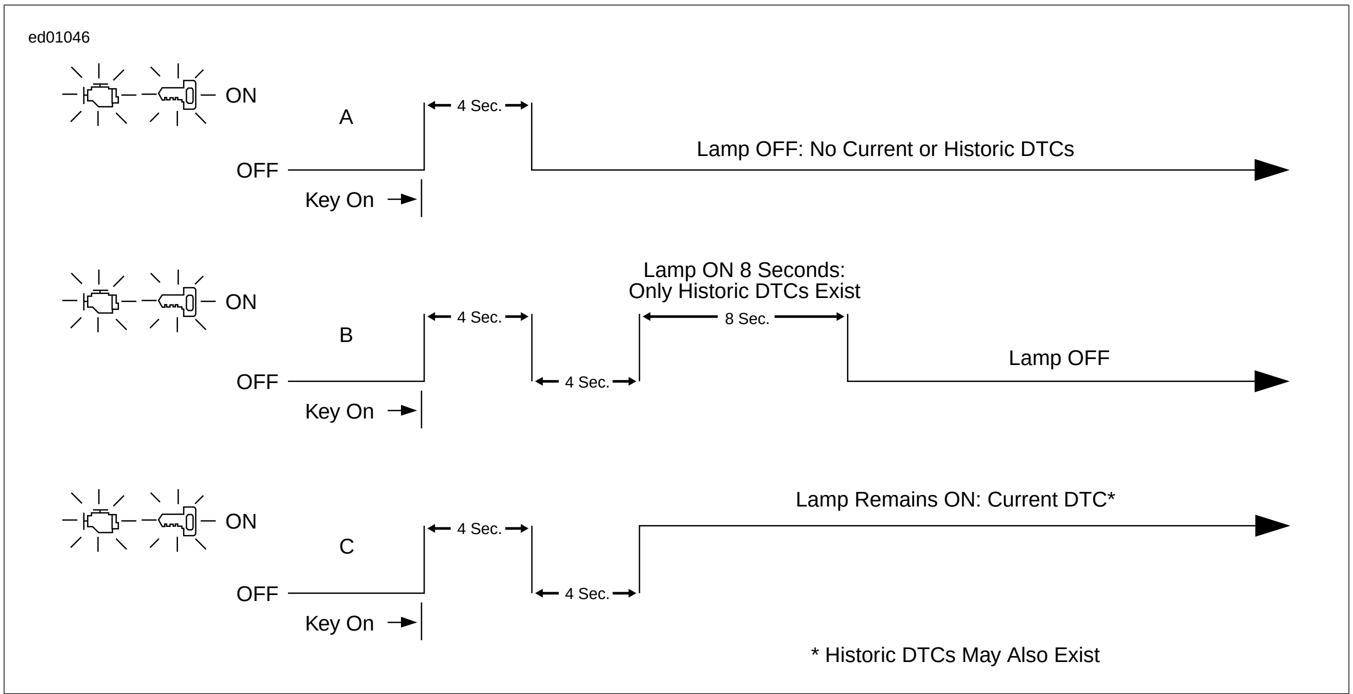


Figure 3-10. Security Lamp Operation

CODE TYPES

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

There are two types of DTCs:

- **Current**
- **Historic**

If a DTC is stored, it can be read using either a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750) or speedometer self diagnostics. See 2.3 SPEEDOMETER SELF DIAGNOSTICS.

NOTES

- *Speedometer self diagnostics will display both current and historic DTCs. To differentiate between current and historic DTCs, a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750) must be employed.*
- *All DTCs reside in the memory of the Electronic Control Module (ECM), TSM/HFSM, speedometer or tachometer until the DTC is cleared by use of the speedometer self diagnostics. See 2.3 SPEEDOMETER SELF DIAGNOSTICS.*
- *A historic DTC is also cleared after a total of 50 ignition cycles has elapsed. After the 50 ignition cycle retention period, the DTC is automatically erased from memory providing that no subsequent faults of the same type are detected in that period.*

Current

Current DTCs are those which are present during the current ignition cycle. See the appropriate flow charts for solutions.

Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic DTC rather than a current DTC. For example, intermittent output shorts can become typical historic DTCs.

Historic DTCs are stored for 50 ignition cycles after any DTC was last set as current to assist in the diagnosis of intermittent faults. On the 50th cycle, the DTC will clear itself. The security lamp will only indicate the existence of historic DTCs for two ignition cycles.

It is important to note that historic DTCs will exist whenever the system indicates the existence of a current fault. See 3.9 CHECKING FOR DIAGNOSTIC TROUBLE CODES, Multiple DTCs/Priority Order if multiple DTCs are found.

Diagnostic charts are designed for use with current DTCs and as a result they frequently suggest part replacement. When diagnosing a historic DTC the charts can be helpful but should not lead to part replacement without verification the part is faulty.

RETRIEVING DTCS

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

The TSM/HFSM supports two levels of diagnostics.

- The most sophisticated mode employs a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750).
- The second mode requires using the speedometer self diagnostics. Speedometer, tachometer (if equipped), TSM/HFSM and ECM DTCs can be accessed and cleared. See 2.3 SPEEDOMETER SELF DIAGNOSTICS.

MULTIPLE DTCS/PRIORITY ORDER

While it is possible for more than one fault to occur and set more than one DTC, there are several conditions which may result in **one** fault setting **multiple** DTCs:

Serial data DTCs (U1016, U1255, U1300 and U1301) may be accompanied by other DTCs. **Always** correct the serial data DTCs before resolving the other DTCs.

Refer to Table 3-5. This table lists the DTCs in priority order. Correct DTCs in priority order.

Table 3-5. TSM/HFSM DTCs and Fault Conditions

PRIORITY	DTC	FAULT CONDITION	DIAGNOSTICS
1	U1300	J1850 Short-to-ground	3.24 DTC U1300, U1301 OR BUS ER.
2	U1301	J1850 Short-to-battery	3.24 DTC U1300, U1301 OR BUS ER.
3	U1016	Loss of serial communications - ECM	3.23 DTC U1016, U1255
4	U1255	Loss of serial communications - General	3.23 DTC U1016, U1255
5	B1142	HFSM2 Internal fault	3.19 DTC B1136, B1142 (HFSM ONLY).
6	B1135	Accelerometer periodic test fault	3.18 DTC B1135.
7	B1136 (HFSM)	Accelerometer tip-over self-test fault	3.19 DTC B1136, B1142 (HFSM ONLY).
8	B1154	Clutch switch input short-to-ground	3.22 DTC B1154, B1155.
9	B1155	Neutral switch input short-to-battery	3.22 DTC B1154, B1155.
10	B1134	Start relay output short-to-battery	3.17 DTC B1134.
11	B1121 (TSM)	Left turn lamp output open circuit	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS.
	B1121 (HFSM)	Left turn lamp output open circuit	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS.
12	B1122 (TSM)	Right turn lamp output open circuit	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS.
	B1122 (HFSM)	Right turn lamp output open circuit	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS.
13	B1123 (HFSM)	Left turn lamp output short-to-ground	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS.
14	B1124 (HFSM)	Right turn lamp output short-to-ground	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS.
15	B1125 (HFSM)	Left turn lamp output short-to-battery	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS.
16	B1126 (HFSM)	Right turn lamp output short-to-battery	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS.
17	B1143 (HFSM)	Security antenna short-to-ground	3.21 DTC B1143, B1144, B1145 (HFSM ONLY).
18	B1144 (HFSM)	Security antenna short-to-battery	3.21 DTC B1143, B1144, B1145 (HFSM ONLY).
19	B1145 (HFSM)	Security antenna open	3.21 DTC B1143, B1144, B1145 (HFSM ONLY).
20	B0563	Battery voltage high	3.14 DTC B0563.
21	B1131 (HFSM)	Alarm output short-to-ground	3.16 DTC B1131, B1132 (HFSM ONLY).
22	B1132 (HFSM)	Alarm output short-to-battery	3.16 DTC B1131, B1132 (HFSM ONLY).
23	B1141 (TSM)	Ignition switch open/low	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS.
24	B1141 (HFSM)	Ignition switch open/low	3.20 DTC B1141 (HFSM ONLY).

GENERAL

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

To locate faulty circuits or other system problems, follow the diagnostic flow charts. For a systematic approach, always begin with INITIAL DIAGNOSTICS. Read the general information and then work your way through the flow chart box by box.

Diagnostic Notes

If a numbered circle appears adjacent to a flow chart box, then more information is offered in the diagnostic notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual where information on the location and removal of components may be obtained.

Circuit Diagram/Wire Harness Connector Table

When working through a flow chart, refer to the illustrations, the associated circuit diagram and the wire harness connector table as necessary. The wire harness connector table for each circuit diagram identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a Breakout Box and a digital volt/ohmmeter (DVOM) are required. See 3.12 BREAKOUT BOX: TSM/HFSM.

To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Job/Time Codes

Some charts may contain warranty job/time codes. Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

Reprogramming ECM

Diagnostic charts frequently suggest Electronic Control Module (ECM) replacement. In the event an ECM needs to be replaced, it must be reprogrammed using a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750). See your dealer. Password learn procedure must also be performed. See 3.25 TSM/HFSM: PASSWORD LEARN.

INITIAL DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Tips

- See Figure 3-11. If odometer reads "BUS Er" with the Ignition Switch turned to IGNITION (Engine Stop Switch at RUN with the engine off), check data bus for an open or short to ground between data link connector [91A] terminal "3" and ECM connector [78B] terminal "5", HFSM connector [30B] terminal "3", speedometer connector [39B] terminal "2" or tachometer (if equipped) connector [108B] terminal "2".
- Check for an open diagnostic test terminal between data link connector [91A] terminal "3" and TSM/HFSM connector [30B] terminal "3". With Ignition Switch turned ON, serial data bus voltage should be typically 0.6-0.8 volts. The range of acceptable voltage is 0-7.0 volts.
- To identify intermittents, wiggle wire harness while performing steps in the diagnostic check charts.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness connector [39B] and speedometer connector [39A] using INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601). See 2.5 BREAKOUT BOX: SPEEDOMETER.
2. Compare TSM/HFSM system behavior to symptoms in Table 3-6.

Table 3-6. Symptoms That May Not Set Diagnostic Trouble Codes

SYMPTOM	SOLUTION
HFSM: Fails to disarm	HFSM Fails to Disarm.
TSM/HFSM: Turn signal will not cancel	Turn Signal Error 1A (Part 1 of 2) Will Not Cancel Upon Turn Completion.
TSM/HFSM: Turn signal cancels erratically	Turn Signal Error 1A (Part 2 of 2) Cancels Erratically.
TSM/HFSM: Turn signal flashes double normal rate, all bulbs good	Turn Signal Error 2A Flash at Double Normal Rate, All Bulbs Work.
TSM: Turn signals will not flash	Turn Signal Error 3A Will Not Flash, 4-Way Flashers Inoperable: DTC B1121, B1122, B1141.
HFSM: Symptom - Will not flash. No codes or DTC B1141	Will Not Flash, No Codes: DTC B1141.

Other Diagnostic Trouble Codes (DTCs)

See 2.5 BREAKOUT BOX: SPEEDOMETER for any DTCs related to the speedometer.

See 4.5 INITIAL DIAGNOSTIC CHECK for any DTCs related to the Electronic Control Module (ECM).

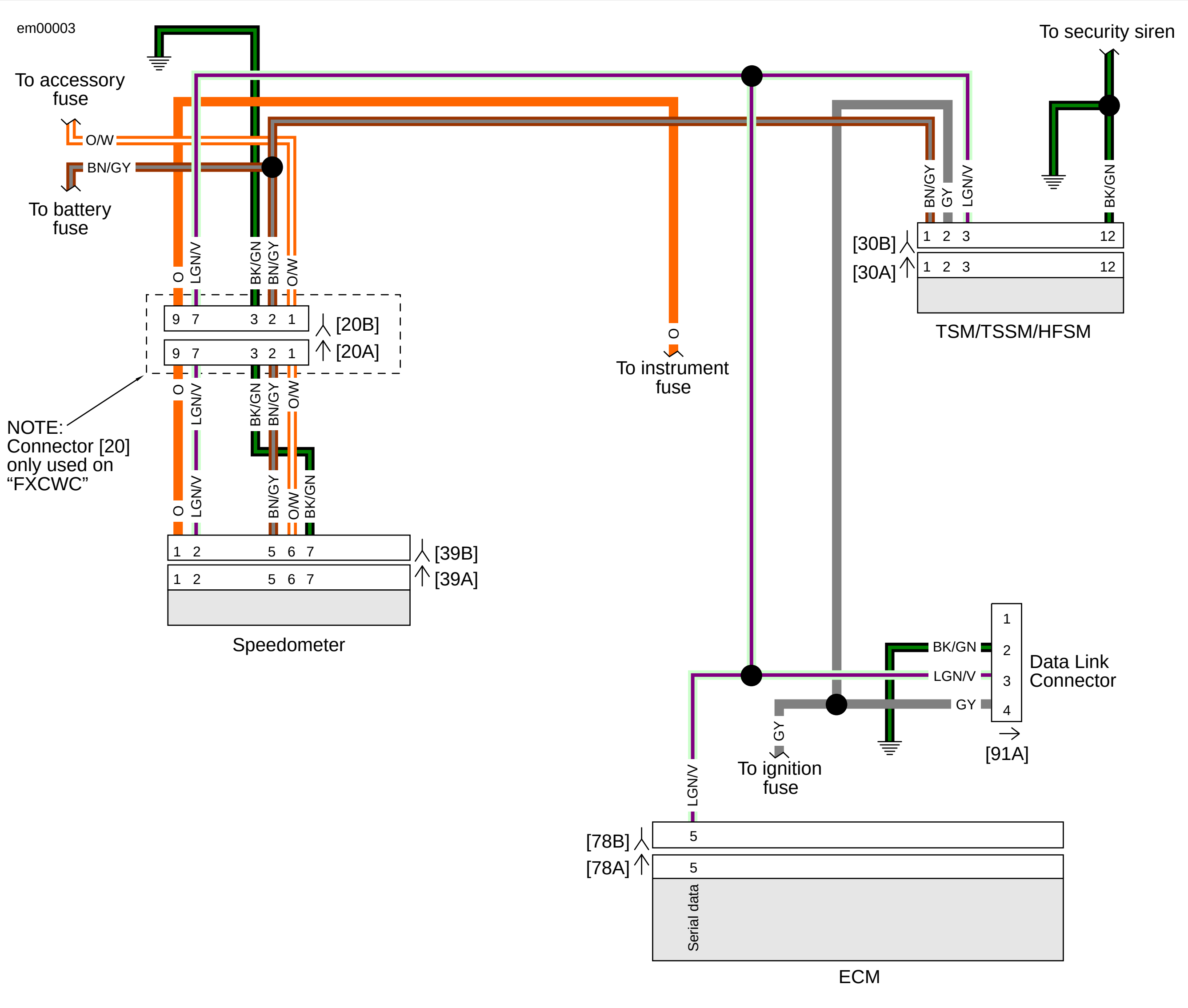
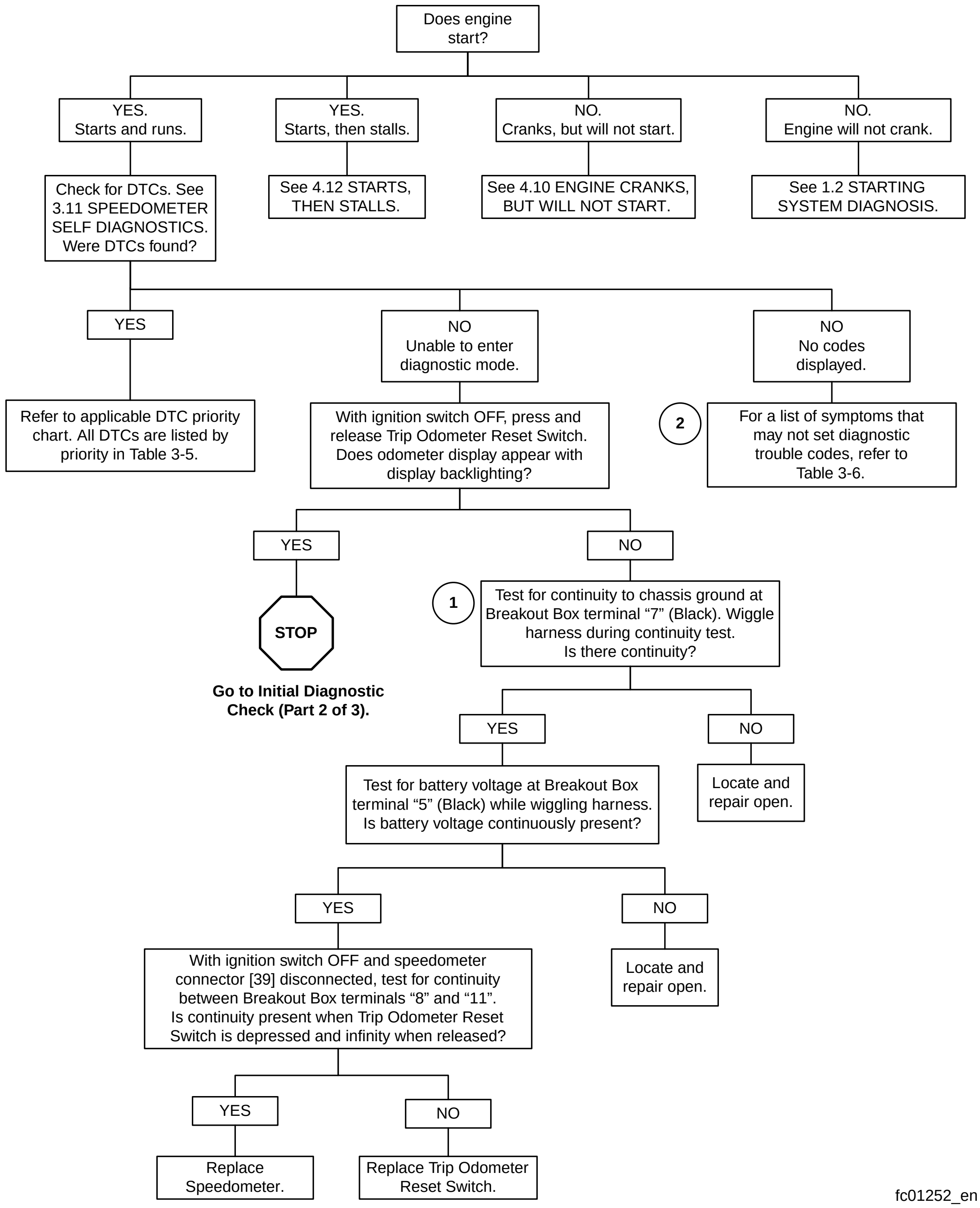


Figure 3-11. Diagnostic Check

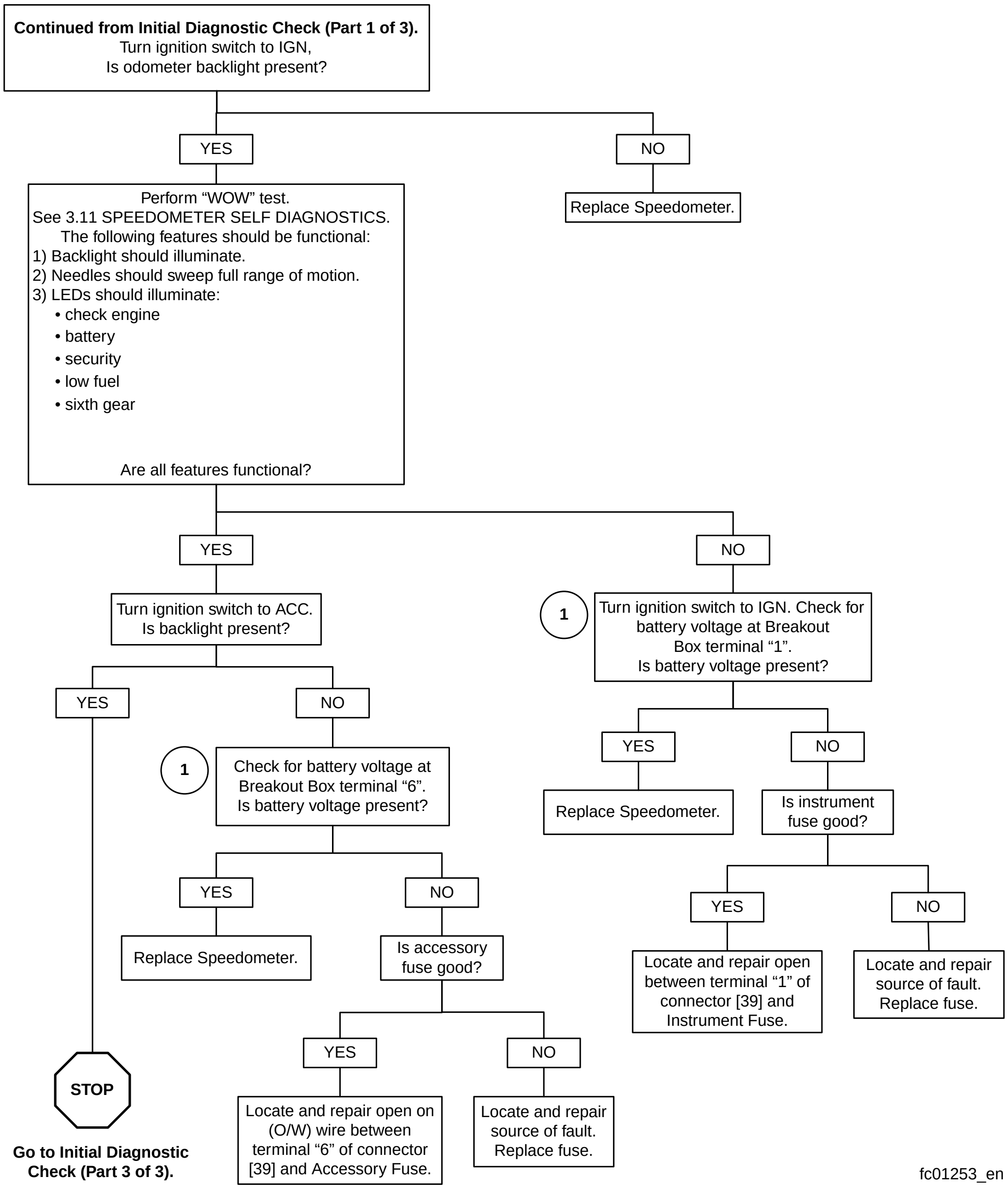
Table 3-7. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat

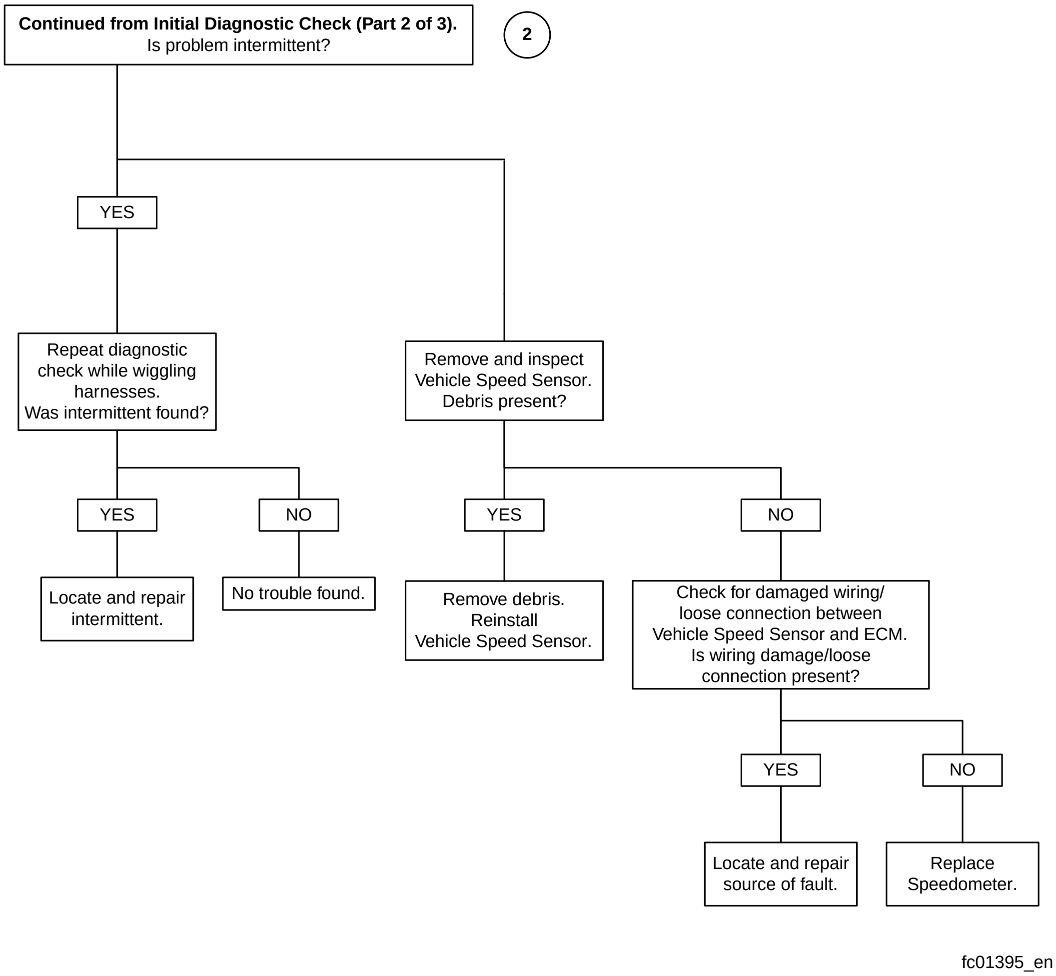
Initial Diagnostic Check (Part 1 of 3)



Initial Diagnostic Check (Part 2 of 3)



Initial Diagnostic Check (Part 3 of 3)



GENERAL

The speedometer is capable of displaying and clearing speedometer, tachometer, TSM/HFSM, and Electronic Control Module (ECM) Diagnostic Trouble Codes (DTCs) (diagnostic mode).

DIAGNOSTICS

Diagnostic Tips

- For a quick check of speedometer function, a "WOW" test can be performed. Press and hold trip odometer reset switch then turn Ignition Switch ON. Release trip odometer reset switch. See Figure 3-12. Background lighting should illuminate, gauge needles should sweep their full range of motion, and indicator lamps (battery, security, low fuel, check engine and sixth gear) should illuminate. All lamps should illuminate, even those not used in normal vehicle operations.
- If speedometer fails "WOW" test, check for battery, ground, ignition, trip odometer reset switch, and accessory wiring to speedometer. If any feature in the speedometer is non-functional, see 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. To exit diagnostic mode, turn Ignition Switch OFF.
2. To clear DTCs for the selected module, press the trip odometer reset switch for more than 5 seconds when a DTC is displayed. This procedure will clear all DTCs for the selected module.

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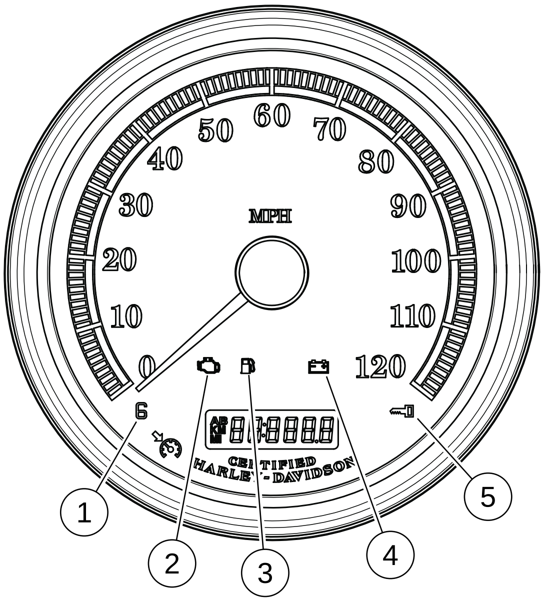

1. **Sixth gear indicator**
2. **Check engine**
3. **Low fuel**
4. **Battery**
5. **Security lamp (key icon)**

Figure 3-12. Speedometer

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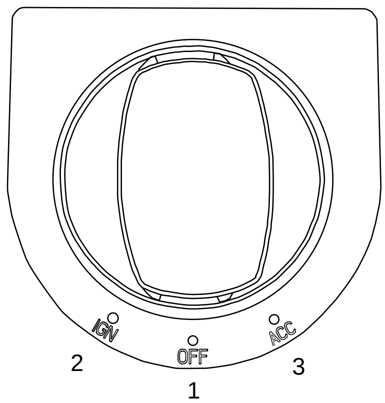
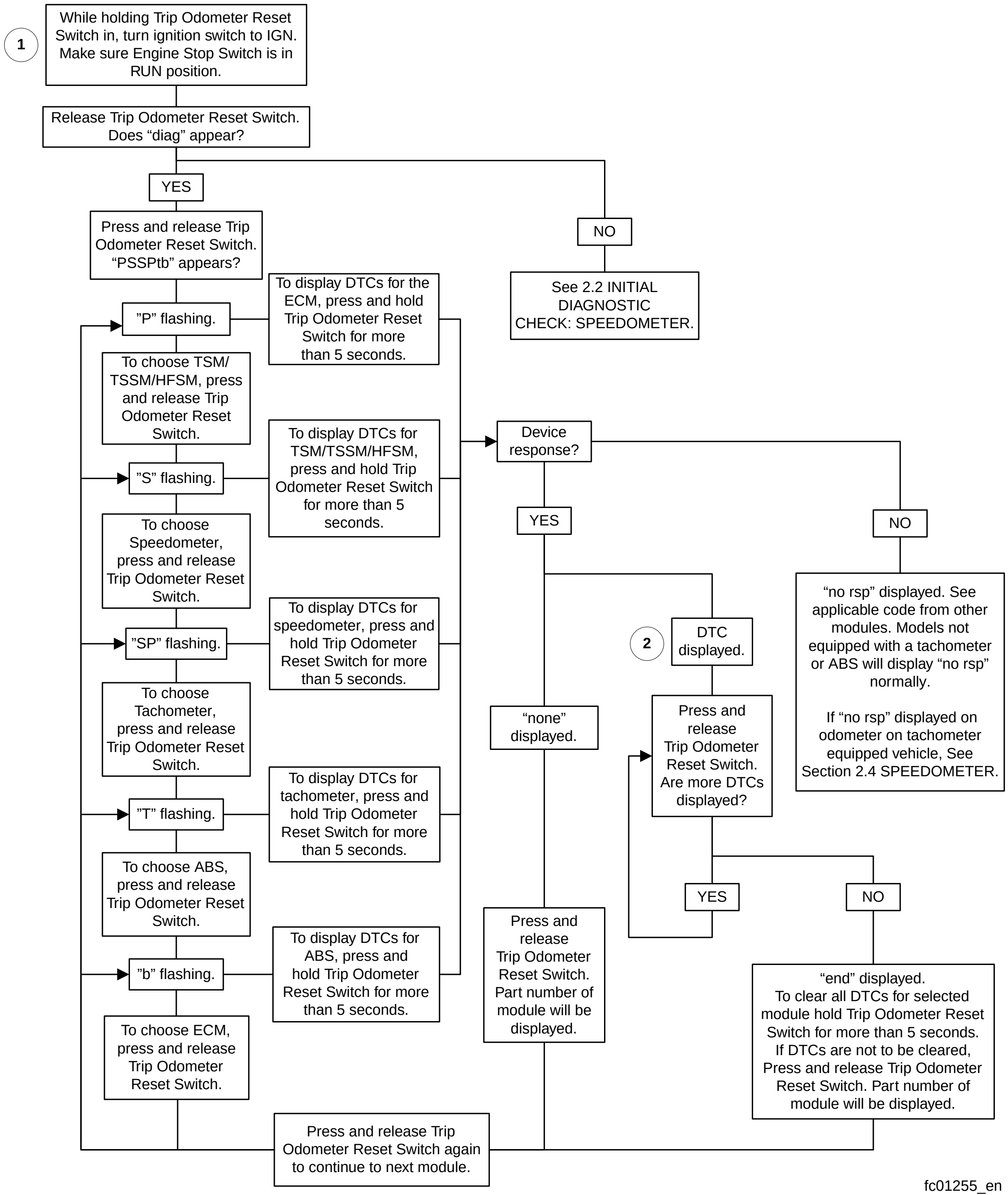


1. **Ignition OFF**
2. **Ignition ON**
3. **Marker Lights (ACC) ON**

Figure 3-13. Ignition Switch

Speedometer Self Diagnostics



GENERAL

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

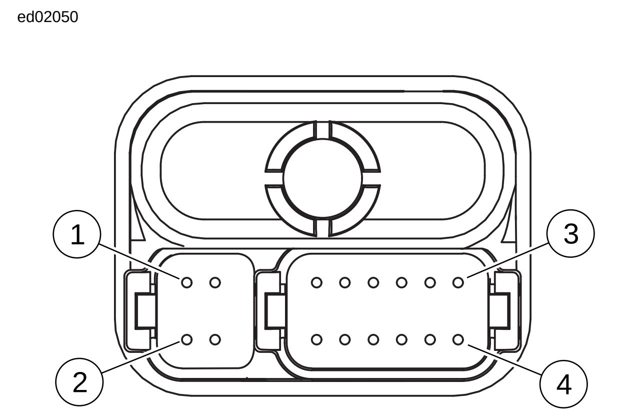
The BREAKOUT BOX (Part No. HD-42682) splices into the main harness. Used in conjunction with a digital volt/ohmmeter (DVOM), it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects.

INSTALLATION

NOTE

For HFSM: Disarm security system, then remove MAXIFUSE while the system remains disarmed.

1. Access TSM/HFSM. See Service Manual.
2. See Figure 3-14. Disconnect harness connector(s) from TSM/HFSM.
   a. **For HFSM:** Depress latches on antenna connector [208B] and remove from antenna connector [208A].
   b. Depress latches on main harness connector [30B] and remove from main connector [30A].
3. Figure 3-14. Attach breakout box to connector.
   a. Mate gray socket housing on Breakout Box with TSM/HFSM connector [30A].
   b. Mate gray pin housing on Breakout Box with vehicle harness connector [30B].
4. **For HFSM:** Route antenna connector [208B] to HFSM.



1. **Connector [208A] terminal 1**
2. **Connector [208A] terminal 4**
3. **Connector [30A] terminal 12**
4. **Connector [30A] terminal 1**

Figure 3-14. TSM/HFSM Terminal Cavity Numbers

REMOVAL

1. See Figure 3-14. **For HFSM:** Depress latches on antenna connector [30B] and disconnect from HFSM antenna connector [208A].
2. Disconnect Breakout Box from vehicle:
   a. Figure 3-14. Depress latches on connector [30B] and detach gray Breakout Box connector from TSM/HFSM connector [30A].
   b. Detach gray Breakout Box connector from TSM/HFSM wire harness connector [30B].
3. **For HFSM:** Mate the antenna connector [208B] before main harness connector [30B].
4. Mate main harness connector [30B] to TSM/ HFSM.
5. Reinstall TSM/HFSM. See Service Manual.
6. Install parts removed for access.

Table 3-8. TSM/HFSM Connector [30B]

TERMINAL	FUNCTION	TERMINAL	FUNCTION
1	Battery	7	Right turn switch input
2	Ignition	8	Left turn switch input
3	Serial Data	9	Start relay control
4	Neutral switch	10	Clutch switch
5	Left turn feed	11	Alarm signal
6	Right turn feed	12	Ground

GENERAL

If the HFSM does not respond or responds weakly (limited range - will not consistently disarm with fob within normal range), follow the flow chart.

Figure 3-15. HFSM and Antenna

JOB/TIME CODES

Dealership technicians filing warranty claims should use the job/time codes printed in **bold text** underneath the appropriate repair.

DIAGNOSTICS

Diagnostic Tips

- Verify that the hands-free antenna or a cell phone is not within 3.0 in. (80.0 mm) of key fob.
- Interference from physical surroundings may affect RF transmission. Place fob next to motorcycle or move motorcycle to a new location and retest.
- See Figure 3-15. Verify that antenna is in OE location and that seat has not been replaced with a metal base seat.
- Check for damage to antenna wire.
- See Figure 3-16. Verify fob battery (1) voltage is at least 2.9 volts. See 3.26 HFSM MAINTENANCE.
- Fob serial number (2) is located inside fob. Open fob by twisting a thin blade in the thumbnail slot between fob halves.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. After a battery disconnect, the HFSM will not enter the configuration mode on the first attempt. All attempts to assign a fob or enter the configuration mode will require at least two attempts.

1. **Battery**
2. **Fob serial number**

Figure 3-16. Open Fob: HFSM

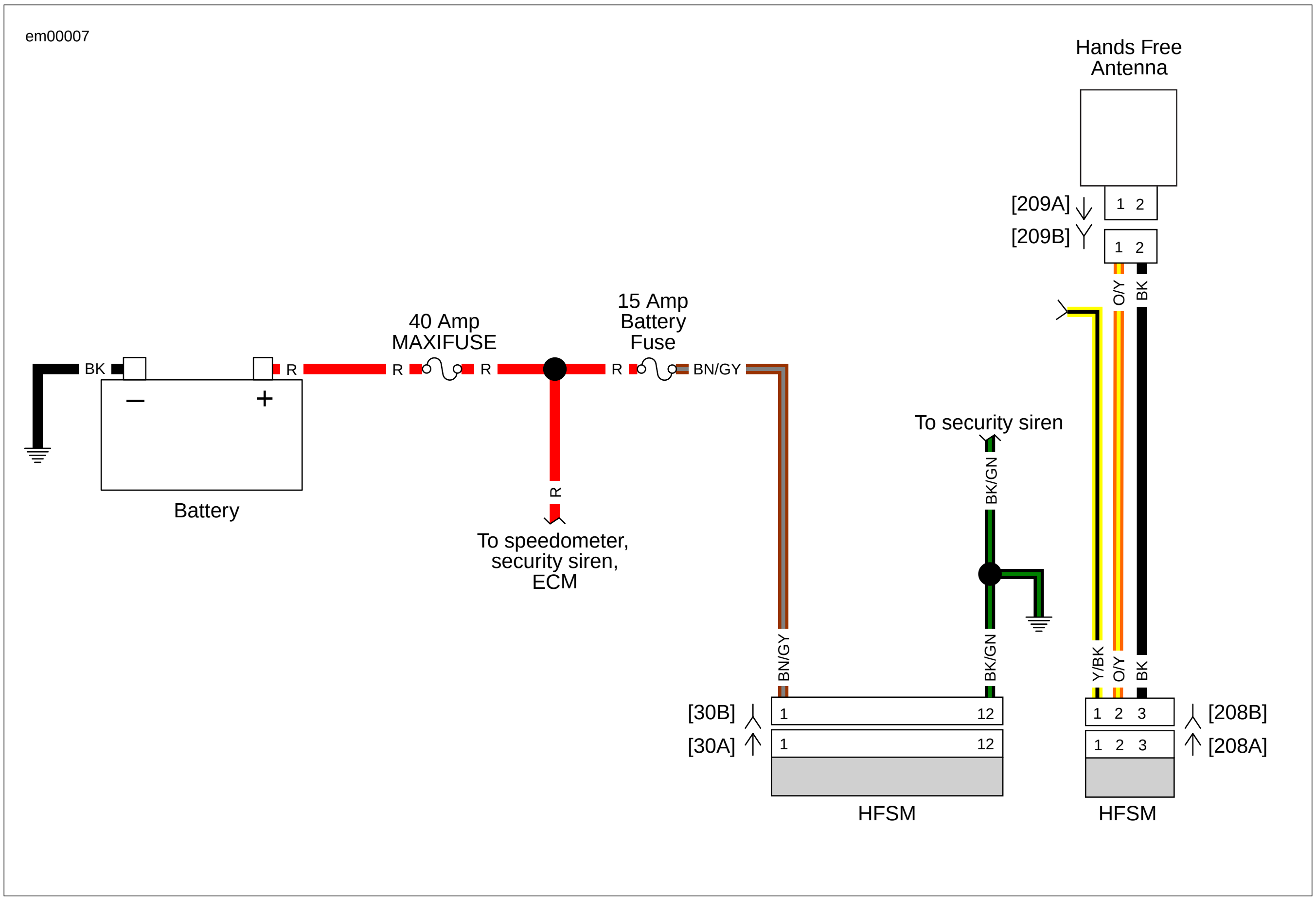
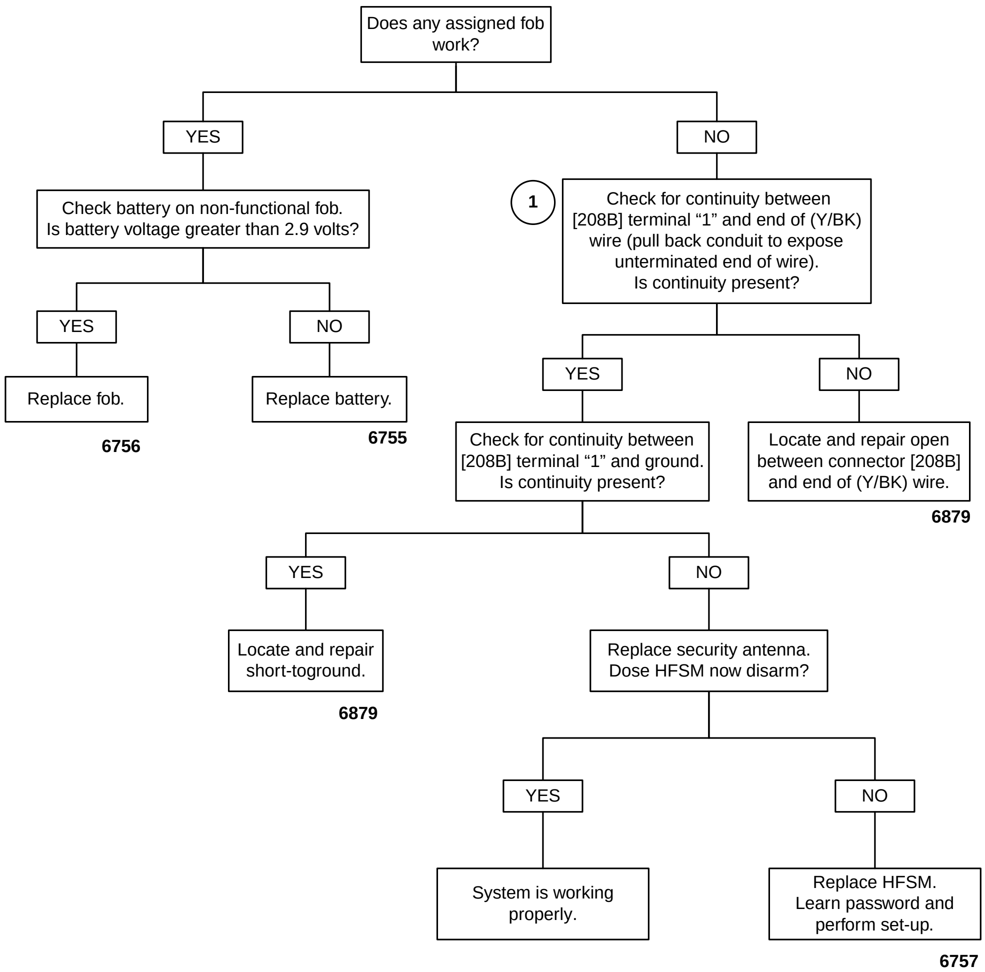


Figure 3-17. Antenna Circuit: HFSM

Table 3-9. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[30]	HFSM	12-place Deutsch	Under battery
[208]	HFSM	4-place Deutsch	Under battery
[209]	Security antenna	2-place Molex	Under seat

HFSM Fails to Disarm



NOTE

The fob for the HFSM must be assigned using Digital Technican. Digital Technician can also validate fob operation when connected to the motorcycle.

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GENERAL

The TSM/HFSM continually checks the battery voltage during IGN/OFF and IGN/RUN power modes. If the voltage exceeds 16.0 volts for more than 5.0 ±0.5 seconds, the TSM/HFSM sets Diagnostic Trouble Code (DTC) B0563.

DIAGNOSTICS

Diagnostic Tips

- This DTC may set when the vehicle is placed on a battery charger, on fast charge, for a long period of time.
- The HFSM does not illuminate the security lamp when this DTC is set.

Diagnostic Notes

See 1.7 CHARGING SYSTEM tests to correct. Problem may be faulty voltage regulator.

GENERAL

The turn signals will automatically cancel either based on the speed/acceleration of the vehicle or based upon turn completion. See 3.1 TURN SIGNAL OVERVIEW.

TSM/HFSM: For turn signal diagnostics based on symptoms, refer to Table 3-10.

TSM DTCs Only: Refer to Table 3-11.

HFSM DTCs Only: Refer to Table 3-12.

Table 3-10. Turn Signal Errors: TSM/HFSM

DTC	SYMPTOM	START WITH FLOW CHART
N/A	Will not cancel on turn completion	Turn Signal Error 1A. (Part 1 of 2) Will Not Cancel Upon Turn Completion
N/A	Cancels erratically	Turn Signal Error 1A. (Part 2 of 2) Cancels Erratically
N/A	Flash at double normal rate while all bulbs are working	Turn Signal Error 2A. Flash at Double Normal Rate, All Bulbs Work

Table 3-11. Turn Signal DTCs: TSM Only

DTC	SYMPTOM	START WITH FLOW CHART
B1121	Turn signals will not flash, 4-way flashers inoperable	Turn Signal Error 3A. Will Not Flash, 4-Way Flashers Inoperable: DTC B1121, B1122, B1141
B1122		
B1141		

Table 3-12. Turn Signal DTCs: HFSM Only

DTC	SYMPTOM	START WITH FLOW CHART
B1121	Left turn signal open	Turn Signal Error 4A. Turn Signal Lamp Open Circuit DTC: B1121 Left/ B1122 Right
B1122	Right turn signal open	
B1123	Left turn signal short-to-ground	Turn Signal Error 5A. Turn Signal Lamp Short-to-Ground DTC: B1123 Left/B1124 Right
B1124	Right turn signal short-to-ground	
B1125	Left turn signal short-to-voltage	Turn Signal Error 6A. Turn Signal Lamp Short-to-Voltage DTC: B1125 Left/B1126 Right
B1126	Right turn signal short-to-voltage	

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT

Job/Time Codes

Dealership technicians filing warranty claims should use the job/time code printed in **bold text** underneath the appropriate repair in the following diagnostic flow charts.

Diagnostic Tips

- **TSM Only:** DTC B1121 and B1122 will illuminate the security lamp. DTC B1141 will **not** illuminate the security lamp.
- **HFSM Only:** DTC B1121, B1122, B1123, B1124, B1125, and B1126 will illuminate the security lamp.
- **TSM/HFSM:** When an over current or short-to-ground condition is detected, it will turn off the turn lamp outputs.

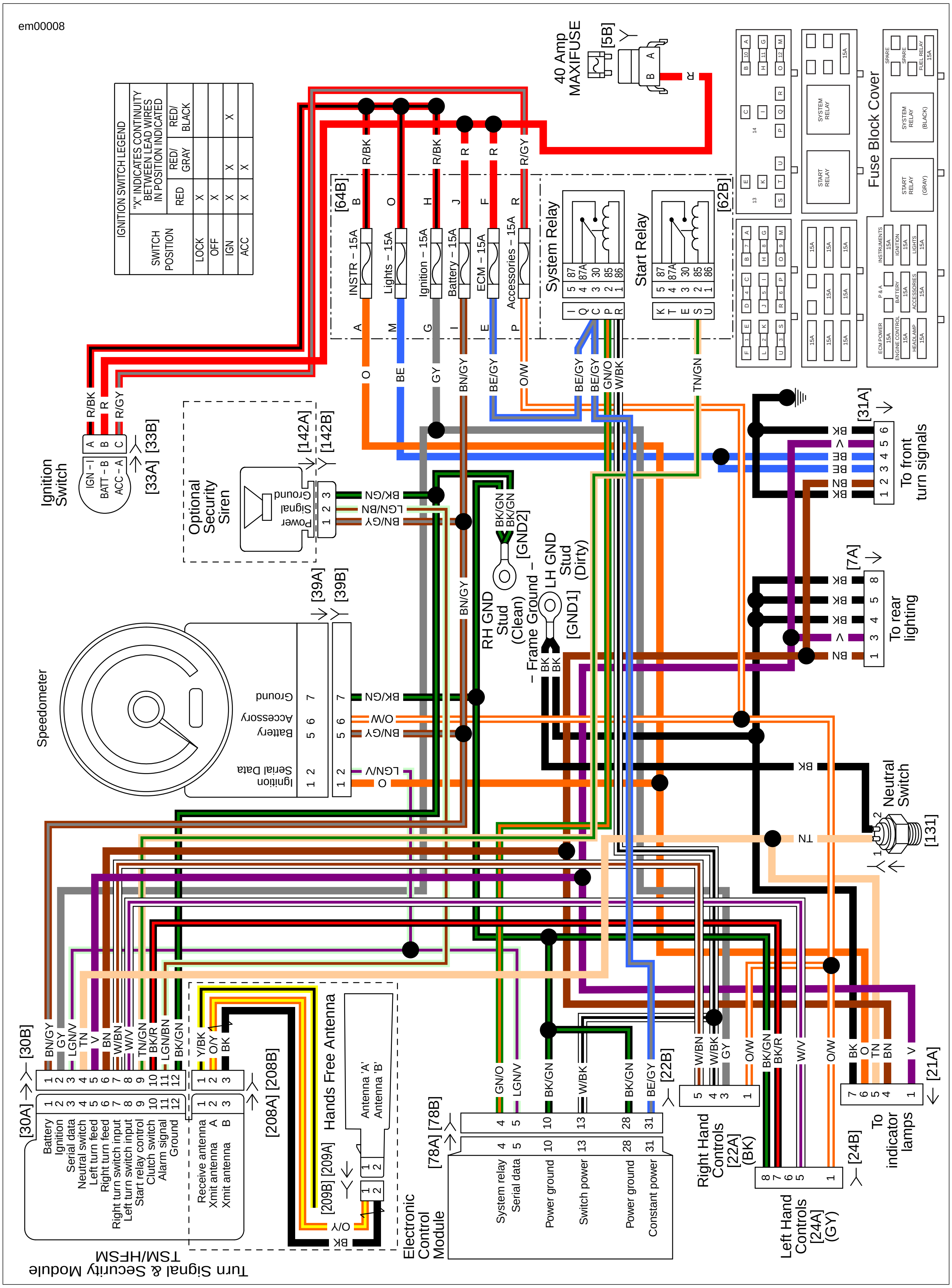


Figure 3-18. Turn Signal Circuit (all except FXCWC)

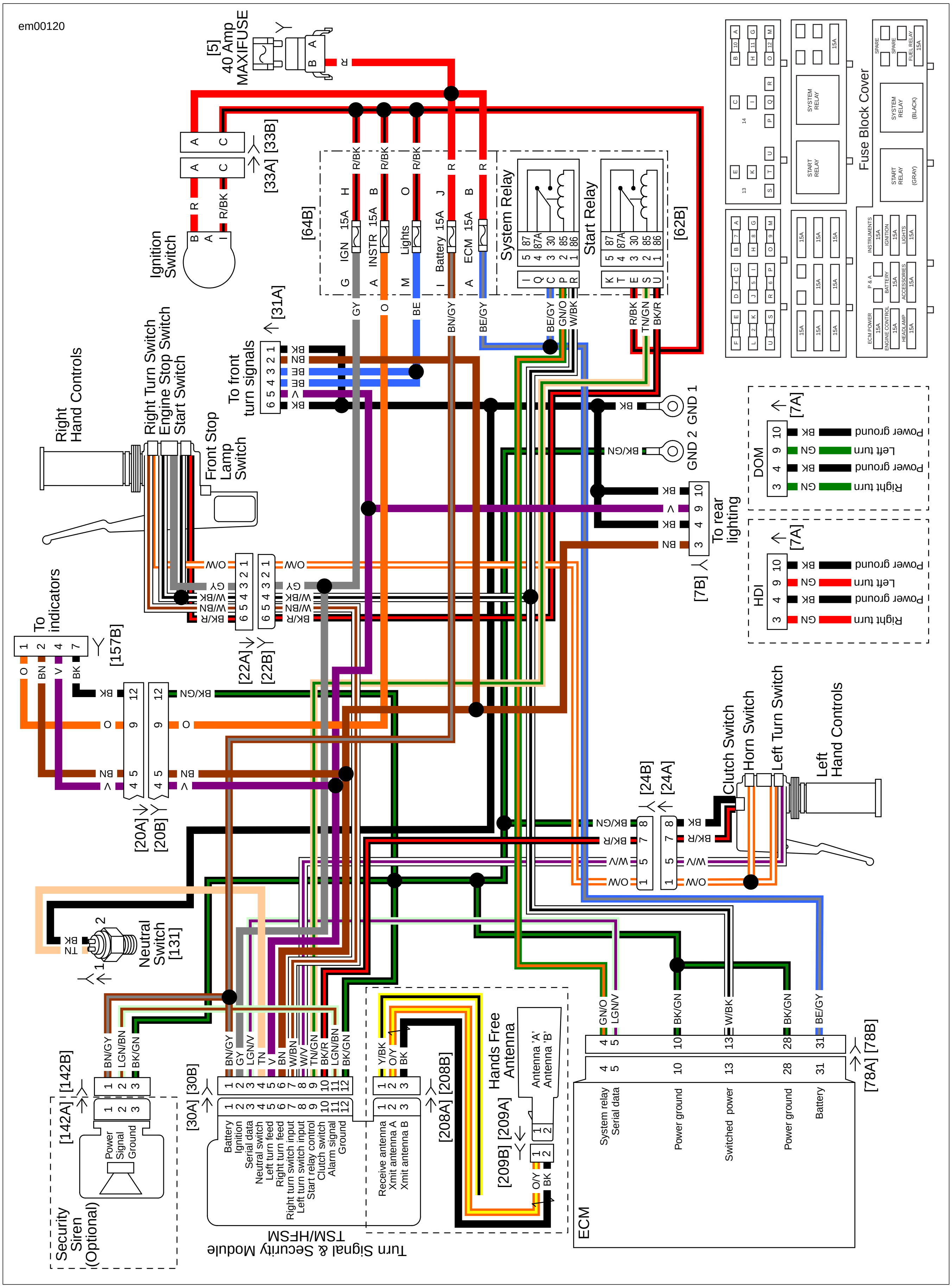


Figure 3-19. Turn Signal Circuit (FXCWC)

Table 3-13. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[5]	MAXIFUSE	Spade terminals	Under seat
[7]	To rear lighting	8-place Multilock	Under seat
[7]	To rear lighting (HDI/DOM)	12-place Multilock	Under seat
[20]	Console harness	12-place Deutsch	Under console
[21]	Indicator lamps	8-place Mini-Deutsch	Under fuel tank console
[22]	Right hand controls	6-place Molex	Under fuel tank, right side
[24]	Left hand controls and horn	8-place Molex	Under fuel tank, left side
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[31]	Front turn signals	6-place Molex	Under fuel tank
[33]	Ignition switch	3-place Packard 4-place Packard (FXCWC)	Under fuel tank console
[39]	Speedometer	12-place Packard	Back of speedometer
[62B]	Fuse block (start relay, system relay)	Spade terminals	Under seat
[64B]	Fuse block	Spade terminals	Under seat
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[131]	Neutral switch	Post terminals	Top of transmission
[142]	Security siren	3-place Delphi	Electrical panel behind fender extension
[157]	Indicator lamps (FXCWC)	8-place Mini-Deutsch	Under fuel tank console
[208]	HFSM antenna harness	4-place Deutsch	Electrical panel behind fender extension
[209]	HFSM antenna	2-place Molex	Under seat

Diagnostic Notes: All Turn Signal Flow Charts

Each reference number below correlates to a circled number on the flow chart(s).

1. Gain access to vehicle's TSM/HFSM, perform the following procedure:
   a. See Figure 3-20. Position TSM/HFSM in same orientation it is mounted on vehicle. Turn Ignition Switch ON. Turn 4-way flashers on by depressing both left and right turn signal switches simultaneously. Turn Ignition Switch OFF; 4-way flashers should continue to flash.
   b. Tilt module greater than 45 degrees to the left.
   c. Repeat step a.
   d. Tilt module greater than 45 degrees to the right.
2. To enable diagnostic mode, see 3.9 CHECKING FOR DIAGNOSTIC TROUBLE CODES.
3. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/HFSM connector [30A] and wiring harness connector [30B]. See 3.12 BREAKOUT BOX: TSM/HFSM
4. Closely inspect handlebar controls for pinched wiring.
5. Connect gray HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) to connector [22] (right) or connector [24] (left).
6. Replace HFSM if DTC is current (lamp ON continuously, cleared codes return during operation). If DTC is historic, check for intermittents.

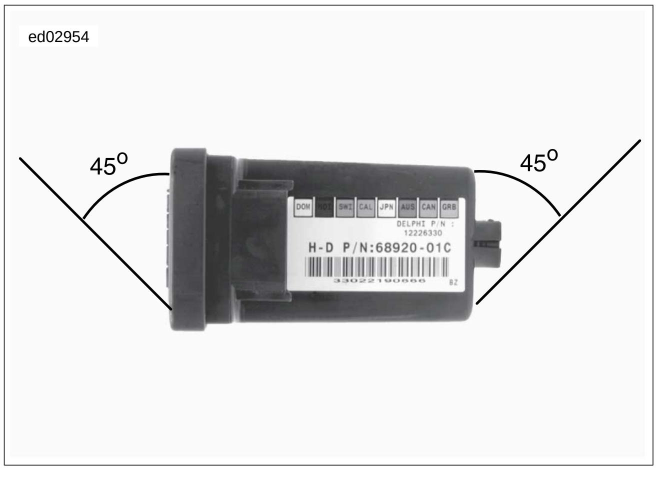
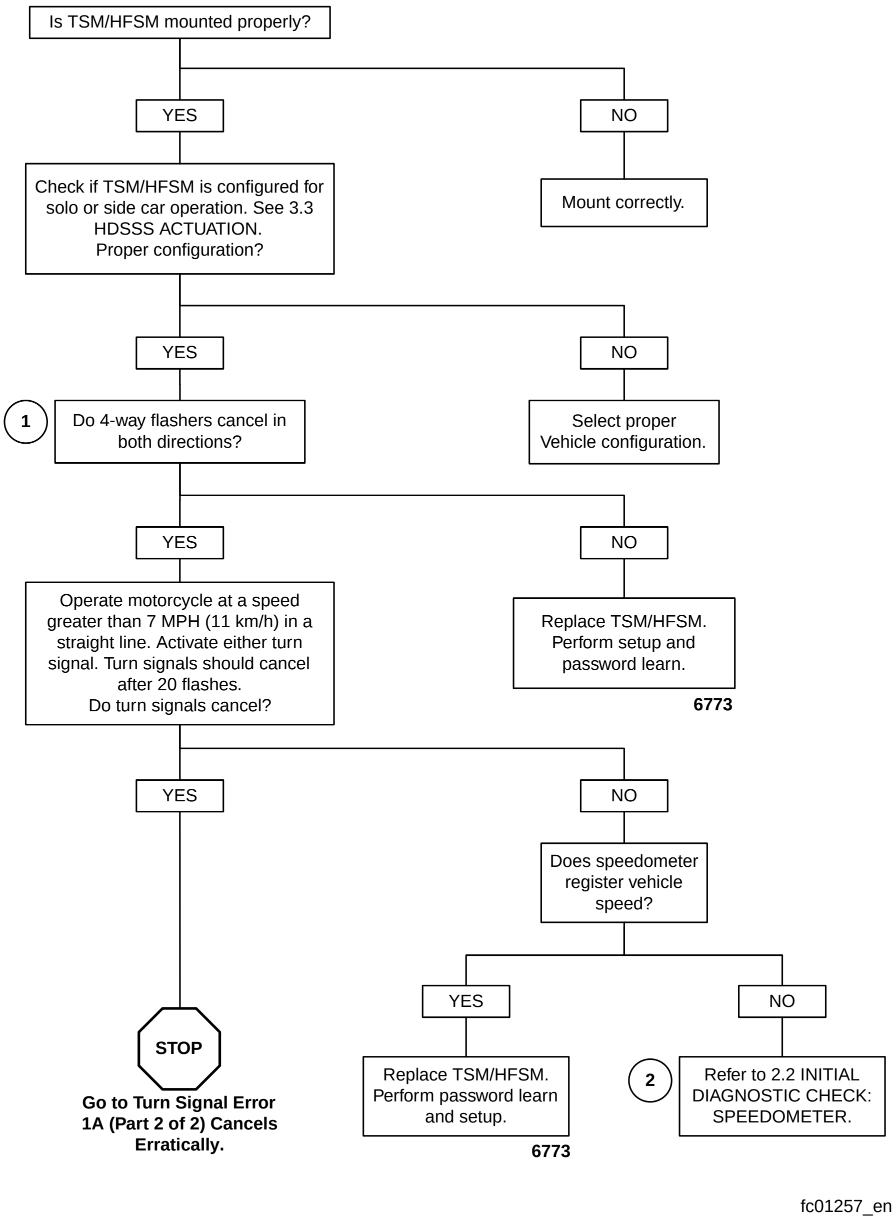


Figure 3-20. Tilting TSM/HFSM

Turn Signal Error 1A (Part 1 of 2), Will Not Cancel Upon Turn Completion



Turn Signal Error 1A (Part 2 of 2), Cancels Erratically

Continued from Turn Signal Error 1A (Part 1 of 2) Will Not Cancel Upon Turn Completion.

3

Check for voltage between Breakout Box terminal “8” (Gray) and ground at Breakout Box terminal “12” (Gray): with left turn signal switch depressed, wiggle harness between TSM/HFSM and left handlebar switches while monitoring for voltage fluctuations or changes in turn signal flash pattern.

Check for voltage between Breakout Box terminal “7” (Gray) and ground at Breakout Box terminal “12” (Gray): with right turn signal switch depressed, wiggle harness between TSM/HFSM and right handlebar switches while monitoring for voltage fluctuations or changes in turn signal flash pattern.

Are voltage fluctuations present?

YES

4

Locate and repair intermittent open.

6855

NO

Check for voltage between Breakout Box terminal “8” (Gray) and ground at Breakout Box terminal “12” (Gray): with left turn signal switch **NOT** depressed, wiggle harness between TSM/HFSM and left handlebar switches while monitoring for voltage fluctuations or turn signal activation.

Check for voltage between Breakout Box terminal “7” (Gray) and ground at Breakout Box terminal “12” (Gray): with right turn signal switch depressed, wiggle harness between TSM/HFSM and right handlebar switches while monitoring for voltage fluctuations or turn signal flash pattern.

Are voltage fluctuations present?

YES

4

Locate and repair intermittent short to voltage.

6856

NO

Turn ignition switch OFF.

Check for continuity between Breakout Box terminal “8” (Gray) and ground at Breakout Box terminal “12” (Gray): with left turn signal switch depressed, wiggle harness between TSM/HFSM and left handlebar switches.

Check for continuity between Breakout Box terminal “7” (Gray) and ground at Breakout Box terminal “12” (Gray): with right turn signal switch depressed, wiggle harness between TSM/HFSM and right handlebar switches.

Is continuity present at any time?

YES

Locate and repair intermittent short to ground.

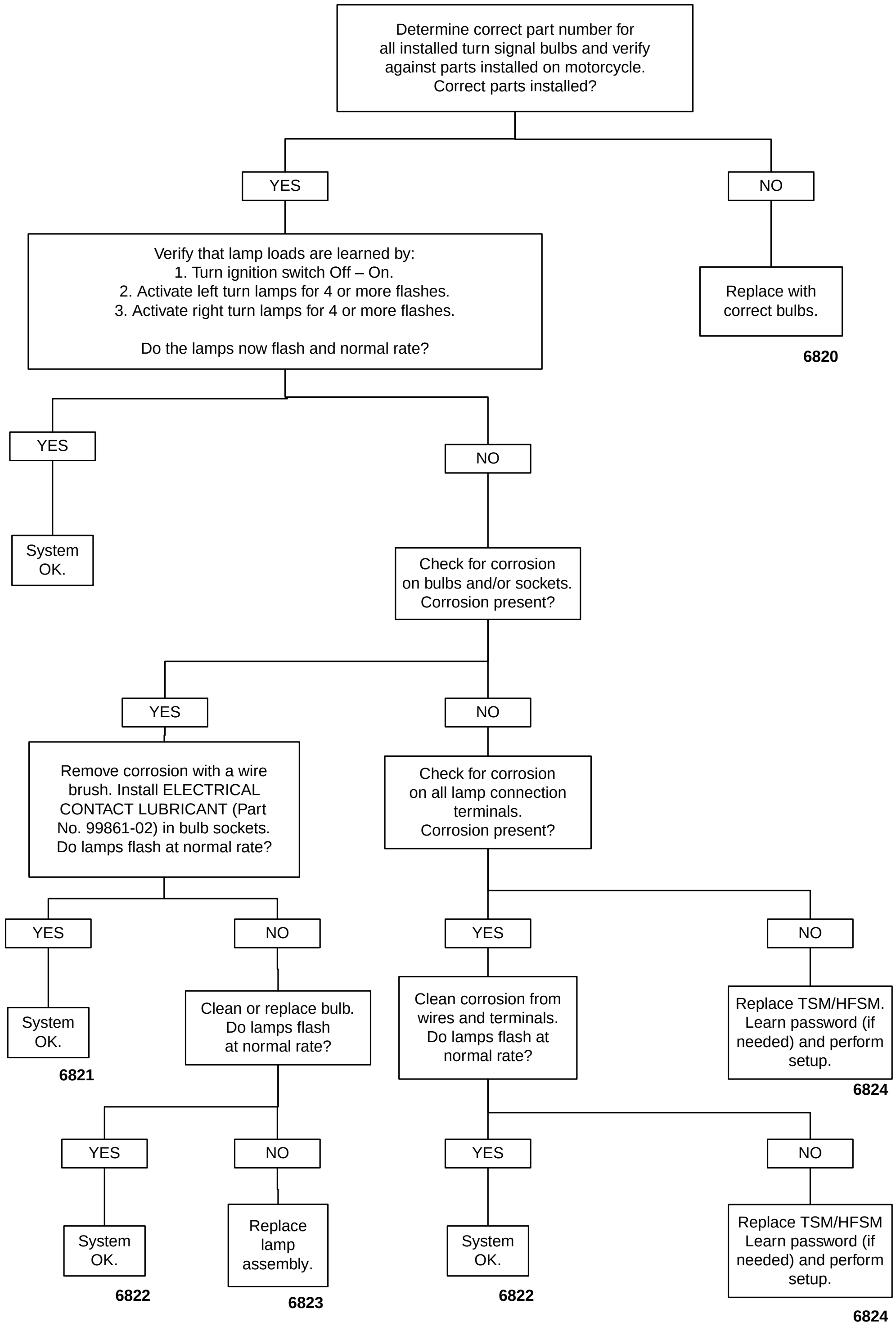
6857

NO

System OK. Review turn signal cancellation function with customer. See AUTOMATIC CANCELLATION under 3.1 TURN SIGNAL OVERVIEW.

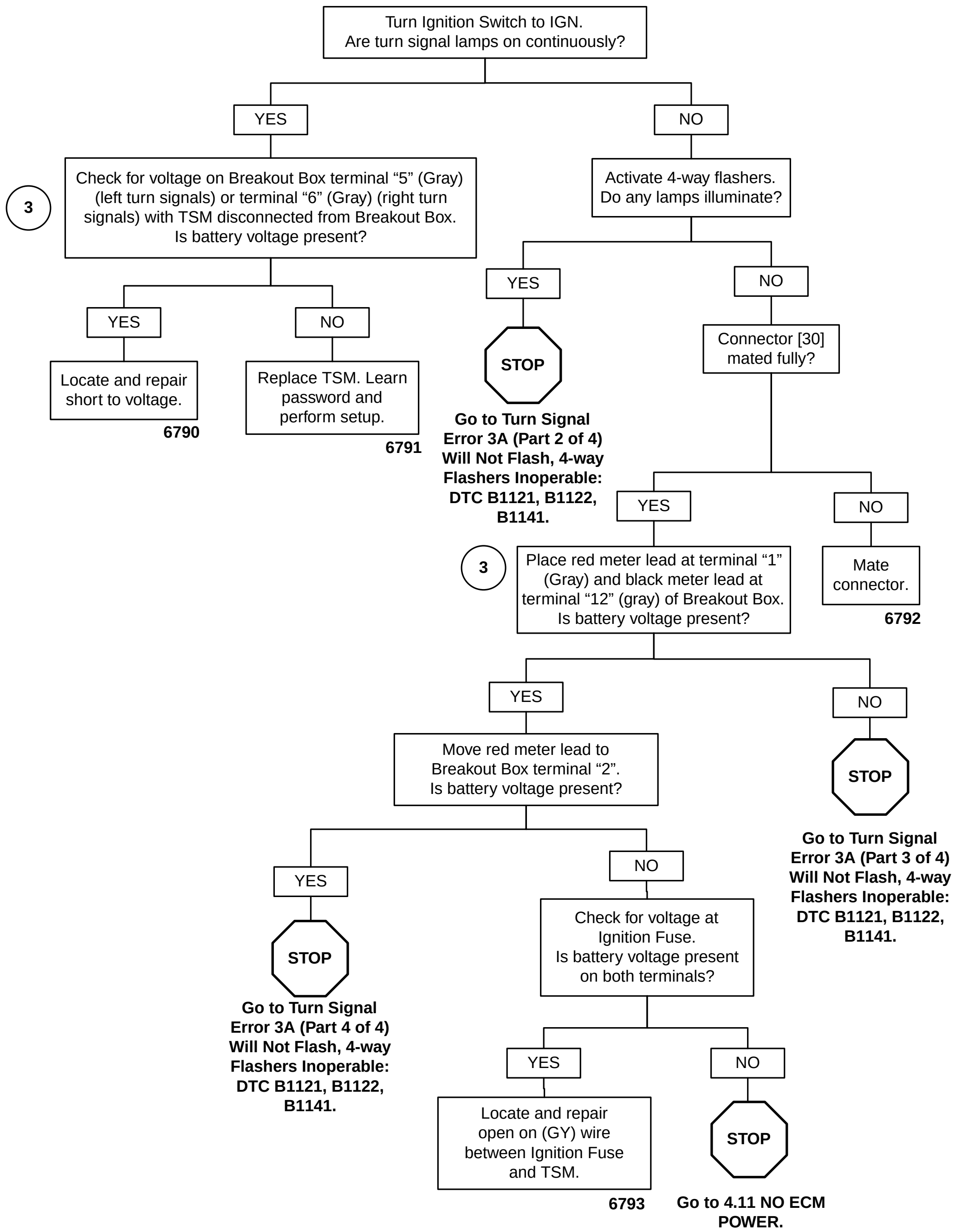
fc01258_en

Turn Signal Error 2A, Flash at Double Normal Rate, All Bulbs Work



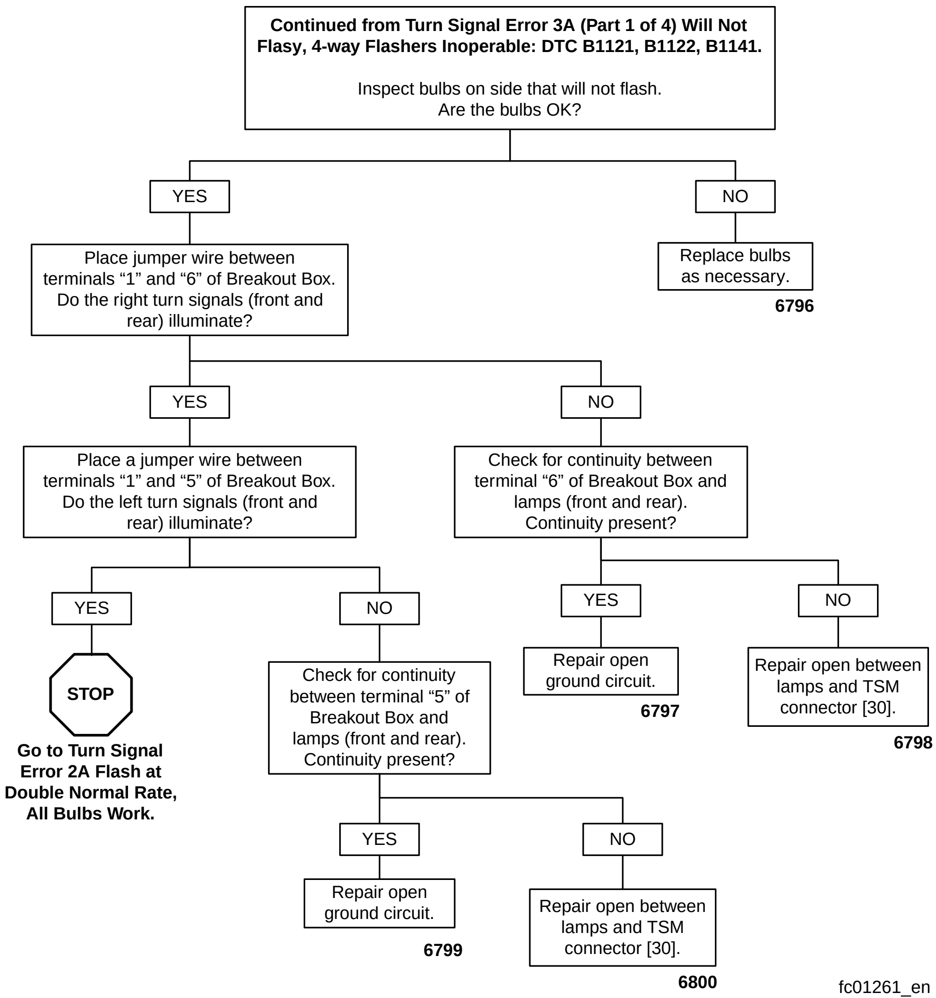
fc01259_en

Turn Signal Error 3A (Part 1 of 4), Will Not Flash, 4-Way Flashers Inoperable: DTC B1121, B1122, B1141

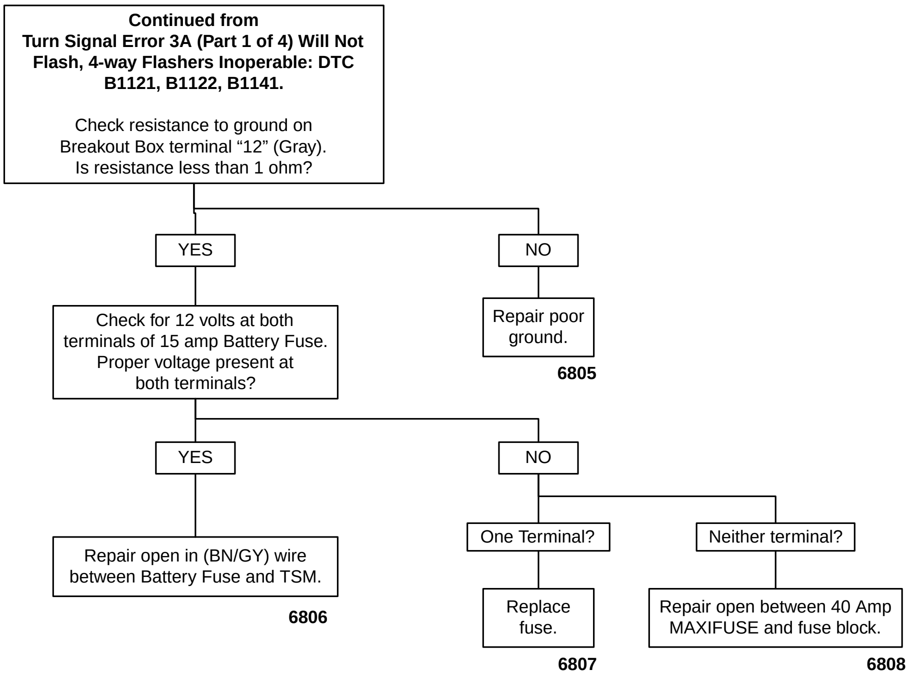


fc01260_en

Turn Signal Error 3A (Part 2 of 4), Will Not Flash, 4-Way Flashers Inoperable: DTC B1121, B1122, B1141

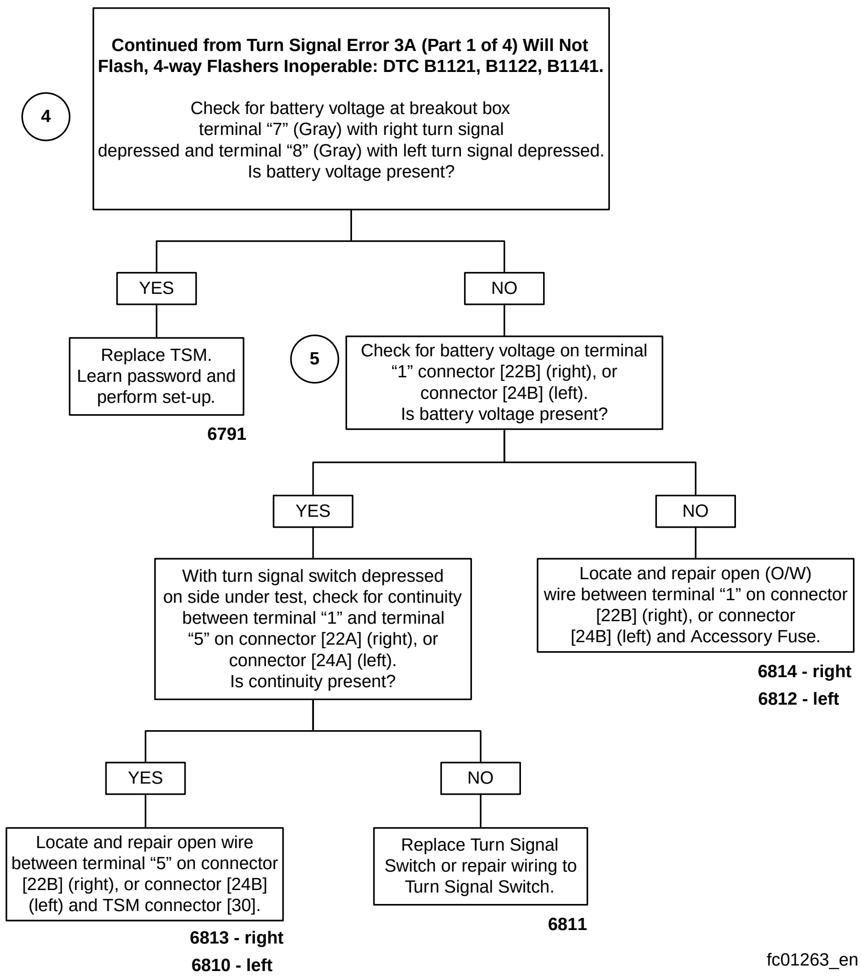


Turn Signal Error 3A (Part 3 of 4), Will Not Flash, 4-Way Flashers Inoperable: DTC B1121, B1122, B1141

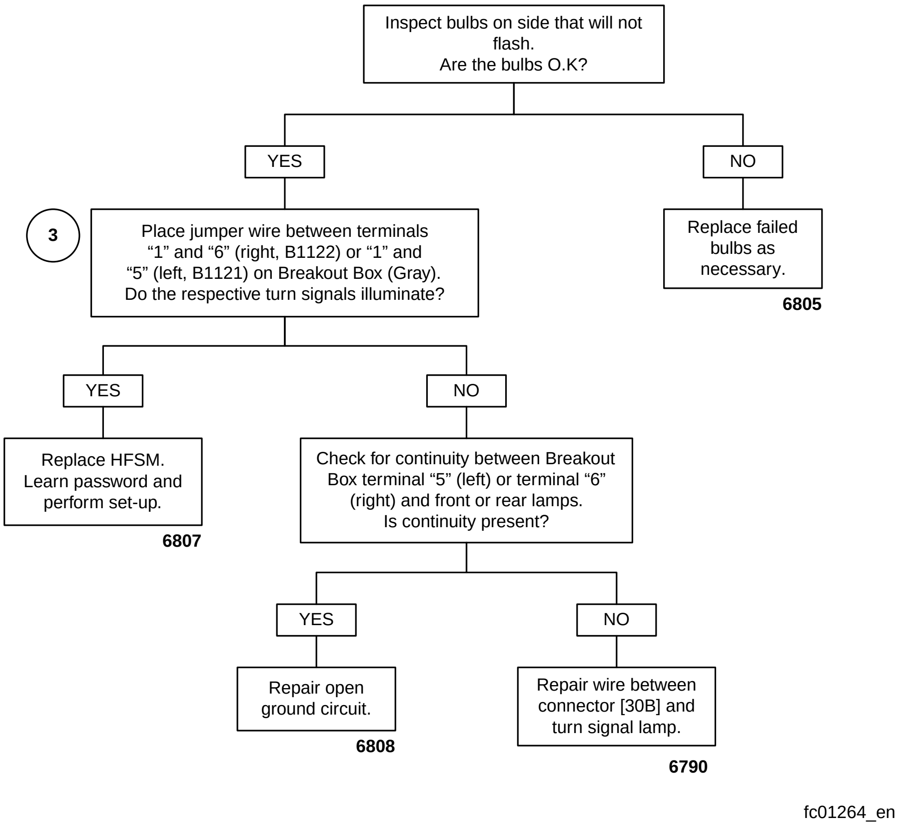


fc01262_en

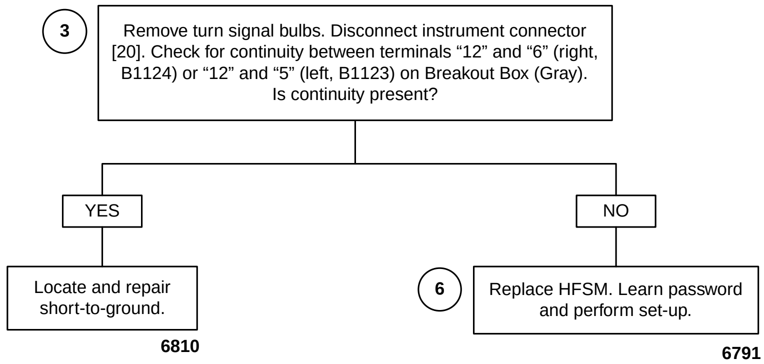
Turn Signal Error 3A (Part 4 of 4), Will Not Flash, 4-Way Flashers Inoperable: DTC B1121, B1122, B1141



Turn Signal Error 4A, Left Turn Signal Lamp Open Circuit: DTC B1121; Right Turn Signal Lamp Open Circuit: DTC B1122

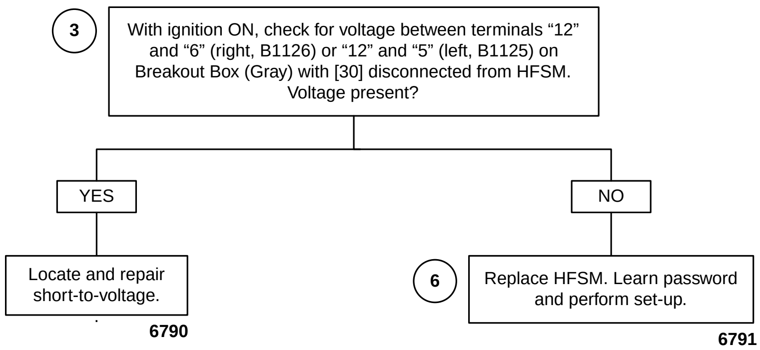


Turn Signal Error 5A, Left Turn Signal Lamp Short-to-Ground: DTC B1123; Right Turn Signal Lamp Short-to-Ground: DTC B1124



fc01265_en

Turn Signal Error 6A, Left Turn Signal Lamp Short-to-Voltage DTC B1125; Right Turn Signal Lamp Short-to-Voltage DTC B1126



fc01266_en

GENERAL

NOTE

This section applies only to those vehicles equipped with the optional security system.

See Figure 3-21. An alarm cycle is activated when the HFSM is connected, the siren has been armed by the HFSM and a security event occurs. See 3.6 WARNINGS AND ALARMS. Under normal armed operation, the siren input (terminal "B") is driven low by the HFSM to trigger the audible alarm. When the siren input is driven high by the HFSM the audible alarm stops.

Figure 3-21. Security Siren

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX

Diagnostic Tips

- If the siren is armed and the internal siren battery is dead, shorted, disconnected, or has been charging for a period longer than 24 hours, the siren will respond with three chirps on arming instead of two.
- The internal siren battery may not charge if the vehicle's battery is less than 12.5 volts.
- If the siren does not chirp two or three times on a valid arming command from the HFSM, the chirp function has been disabled, the siren is either not connected, not working, or the siren wiring was opened or shorted while the siren was disarmed.
- If the siren enters the self-driven mode where it is powered from the siren internal nine-volt battery, the turn-signal lamps will not alternately flash. If the HFSM activates the siren, the turn-signal lamps will flash. If the siren has been armed and a security event occurs, and the siren is in self-driven mode, the siren will alarm for 20 to 30 seconds and then turn off for 5 to 10 seconds. This alarm cycle will be repeated ten times if the siren is in the self-driven mode.
- If the siren does not stop alarming after it has been armed, then either the HFSM output or siren input may be shorted to ground, or the siren vehicle battery connection is open or shorted to ground, or the siren vehicle ground connection is open, or a security event has occurred. See 3.6 WARNINGS AND ALARMS for a description of alarm functions.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Use BREAKOUT BOX (Part No. HD-42682) and HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord. See 3.12 BREAKOUT BOX: TSM/HFSM.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray socket probe and patch cord.
3. Having the correct multimeter ohm scale is important for this test. Some meters may read infinity for high ohm values. If this is the case, check your ohm scale and retest.

Table 3-14. Siren Alarm Output DTCs

DTC	SYMPTOM	START WITH FLOW CHART
B1131	Alarm output low	Alarm Output Low: DTC B1131, Alarm Output High: DTC B1132
B1132	Alarm output high	

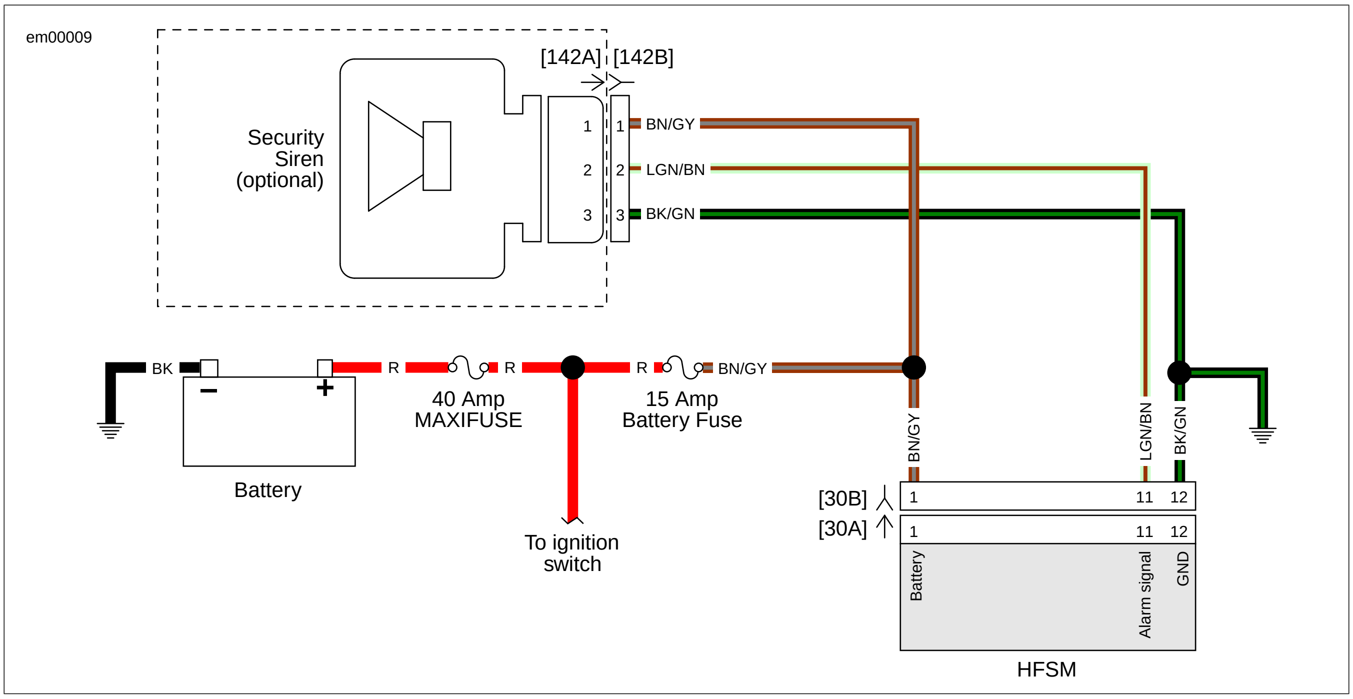
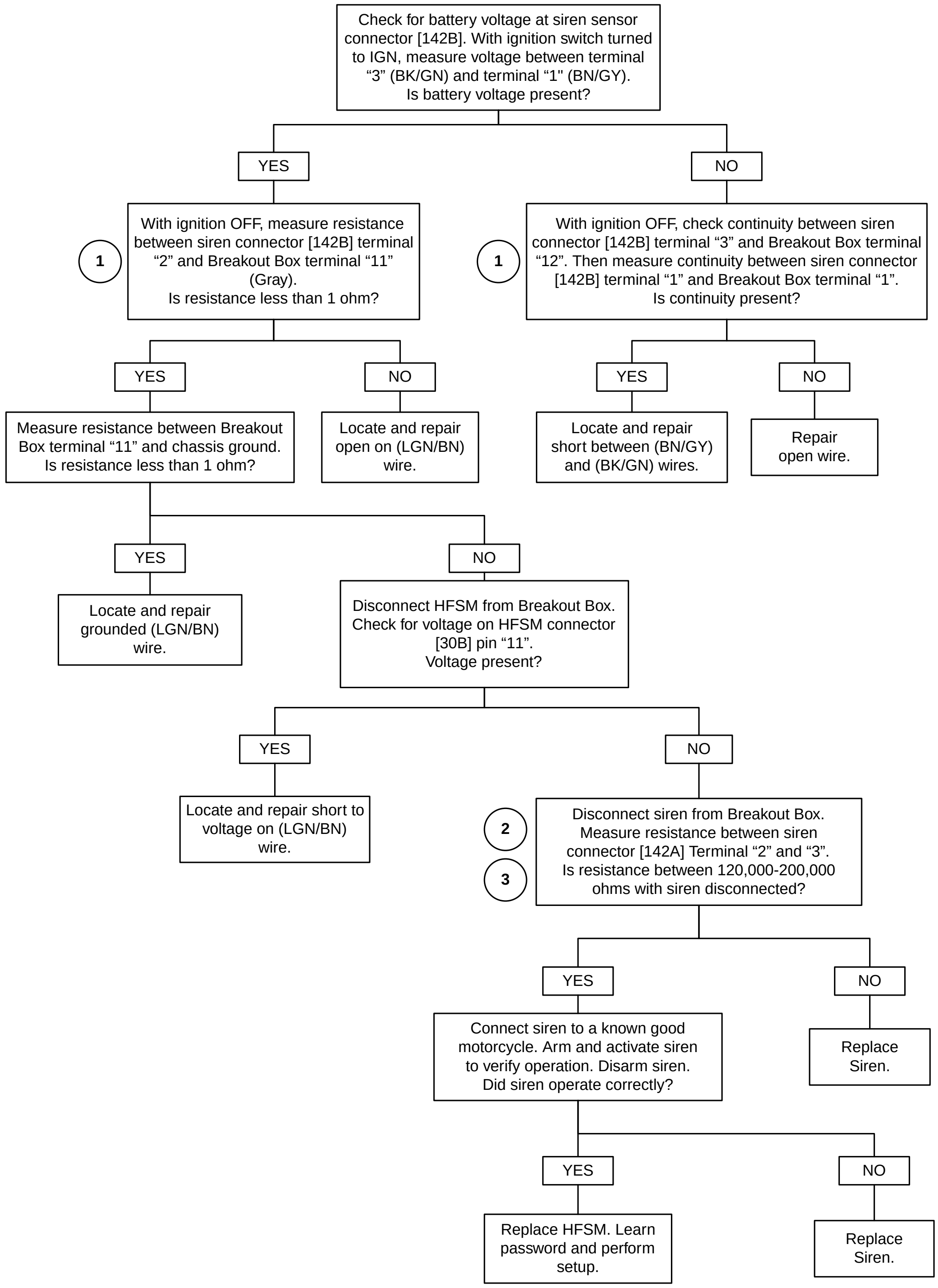


Figure 3-22. Smart Siren Circuit

Table 3-15. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[30]	HFSM	12-place Deutsch	Under battery
[142]	Security siren	3-place Packard	Under frame

Alarm Output Low: DTC B1131; Alarm Output High: DTC B 1132



Clear DTCs using speedometer self diagnostics.
See 3.11 SPEEDOMETER SELF DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

fc01267_en

GENERAL

With the HFSM (if equipped) disarmed, Ignition Switch ON, Engine Stop Switch set to RUN, and the transmission in neutral or the clutch lever pulled in (see Figure 3-23 or Figure 3-24) the start relay is grounded. Battery voltage is applied to the start relay and coil which are grounded through the TSM/HFSM.

DTC B1134: Starter Output High is set when that ground is not established through the TSM/HFSM.

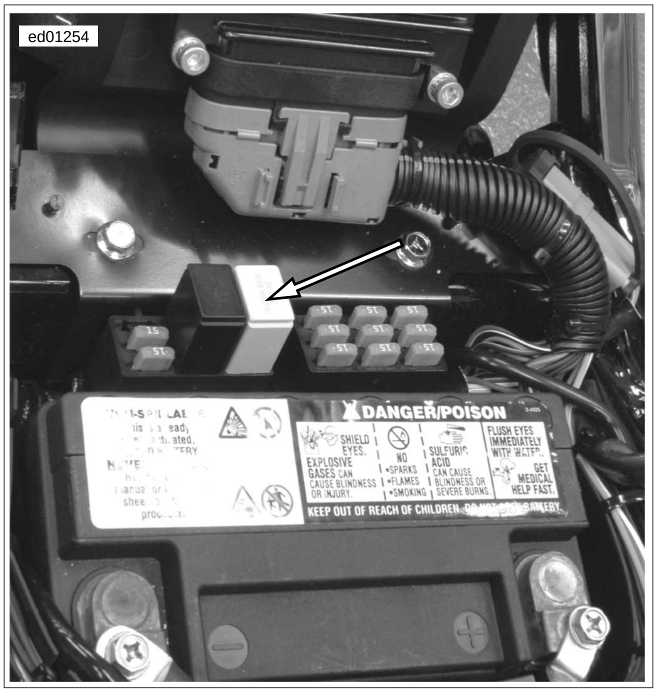


Figure 3-23. Start Relay (all except FXCWC)

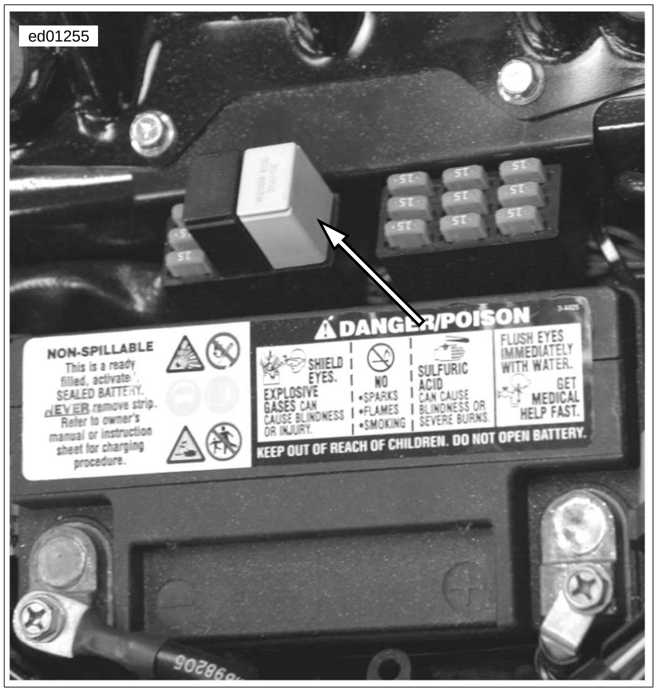


Figure 3-24. Start Relay (FXCWC)

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) to wire harness connector [30] leaving TSM/HFSM disconnected. See 3.12 BREAKOUT BOX: TSM/HFSM.

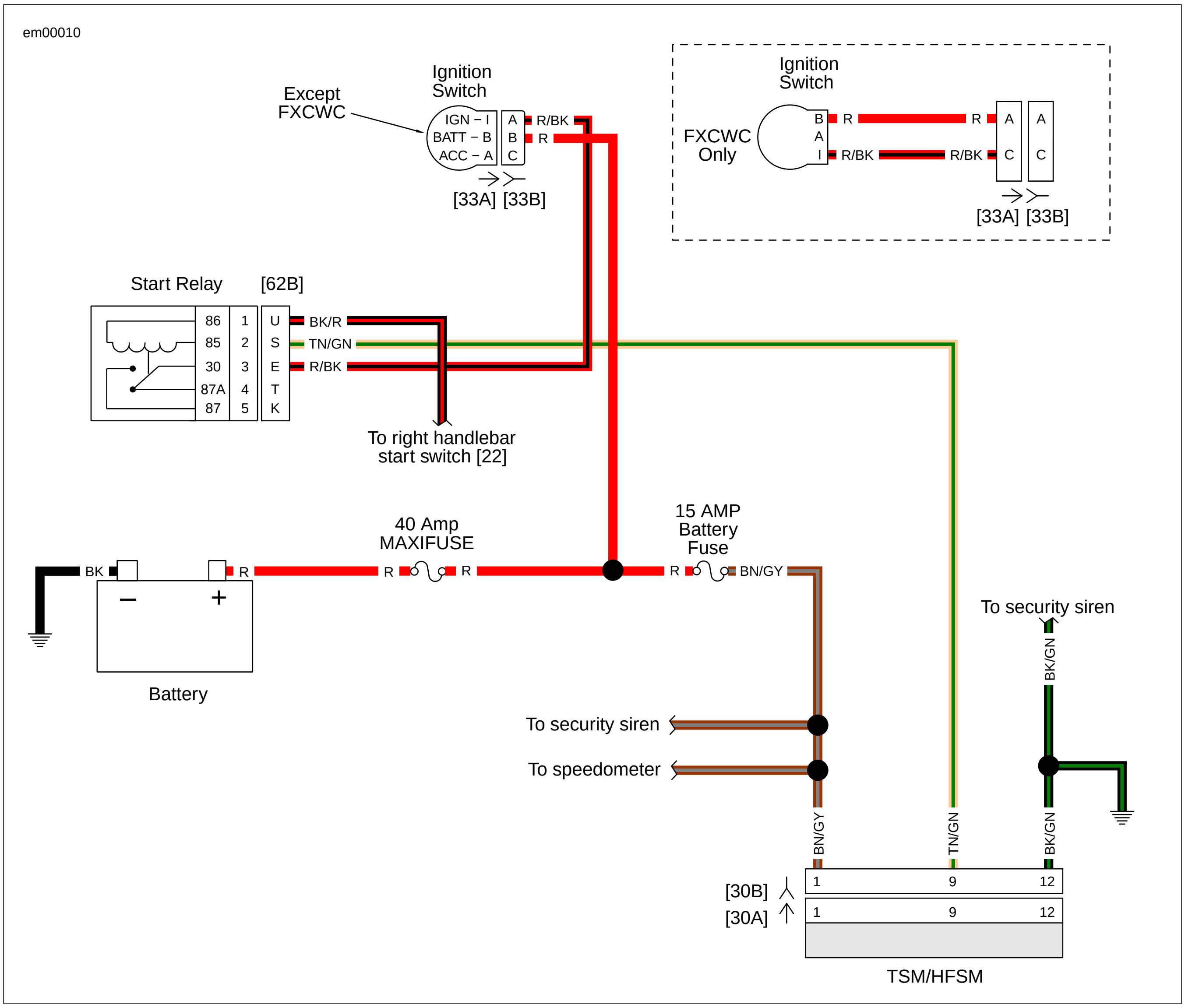
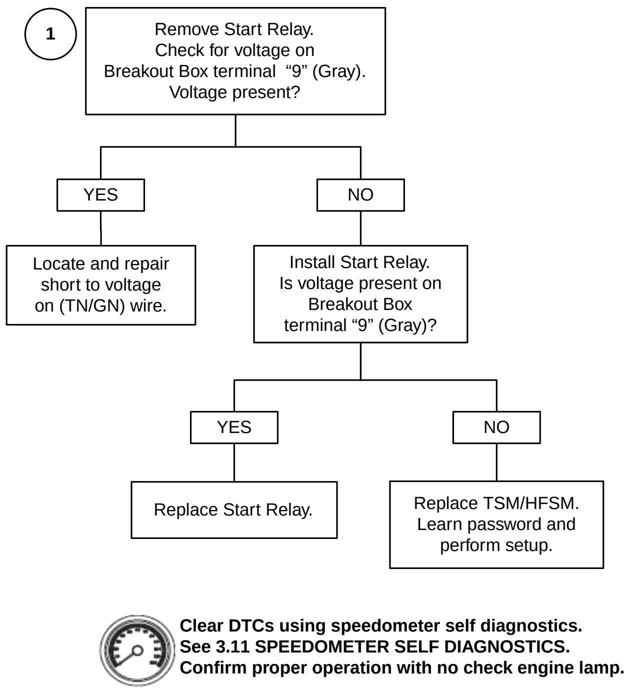


Figure 3-25. Starter TSM/HFSM Circuits

Table 3-16. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Right hand controls	6-place Molex	Under fuel tank, right side
[30]	TSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[62]	Start relay	5-place Amp	Fuse block under seat

Starter Output High: DTC B1134



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DIAGNOSTICS

DTC B1135 Accelerometer Fault

DTC B1135 indicates a failure which requires replacement of the TSM/HFSM.

NOTE

When DTC B1135 is set, the tip-over engine shutdown, HFSM tamper alarm and bank angle sensors are disabled. The security lamp will also illuminate when this code is set.

DIAGNOSTICS

DTC B1136 Accelerometer Tip-Over Self-Test Fault

DTC B1136 indicates a failure which requires replacement of the HFSM.

DTC B1142 Internal Fault

DTC B1142 indicates a failure which requires replacement of the HFSM.

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT

Diagnostic Tips

DTC B1141: Ignition Switch Open/Low or a symptom of Will Not Flash can be diagnosed using the flow charts.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/HFSM connector [30A] and wiring harness connector [30B]. See 3.12 BREAKOUT BOX: TSM/HFSM.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray terminal probe and patch cord.

Figure 3-26. HFSM and Antenna

1. **Battery**
2. **Fob serial number**

Figure 3-27. Open Fob: HFSM

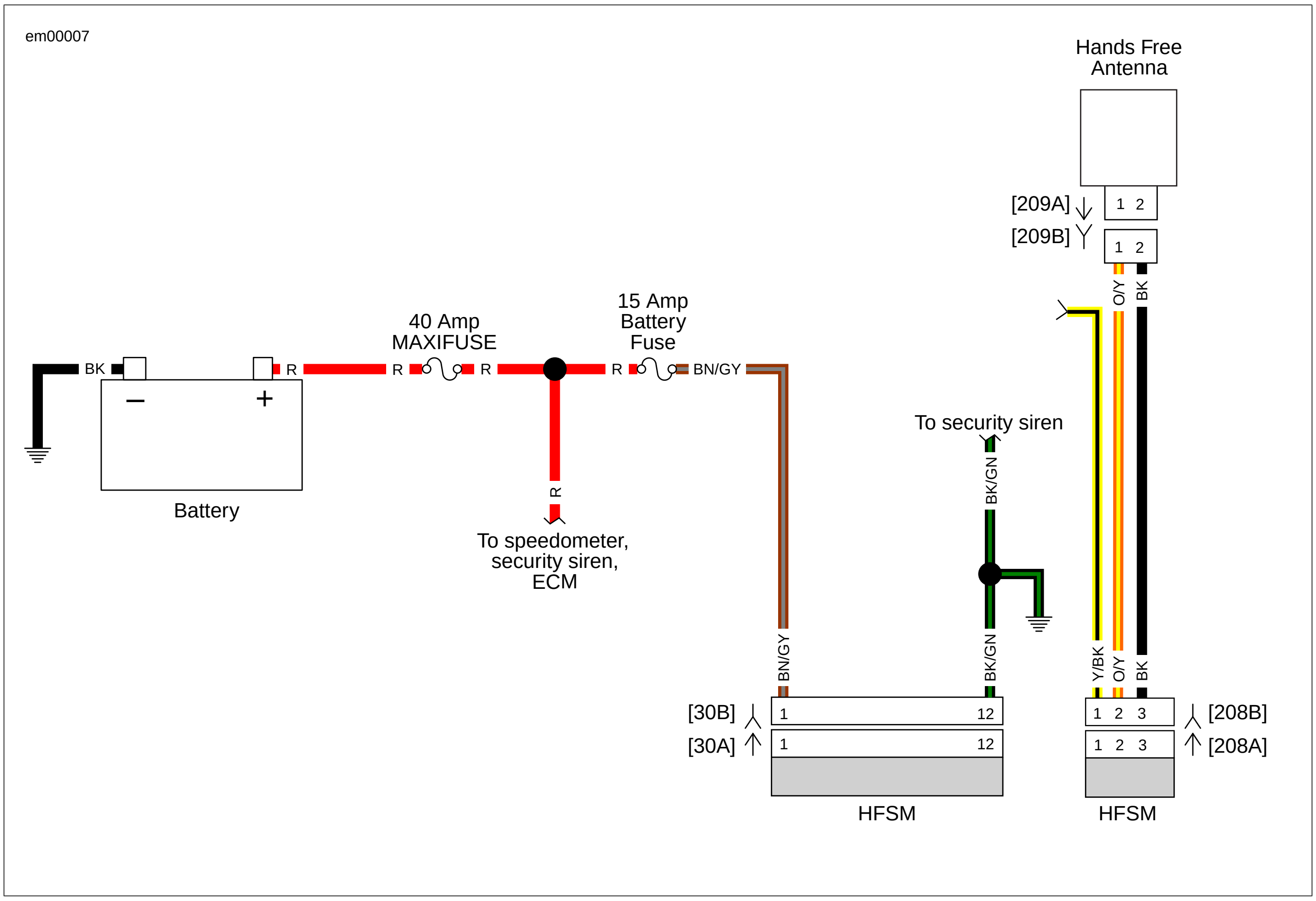
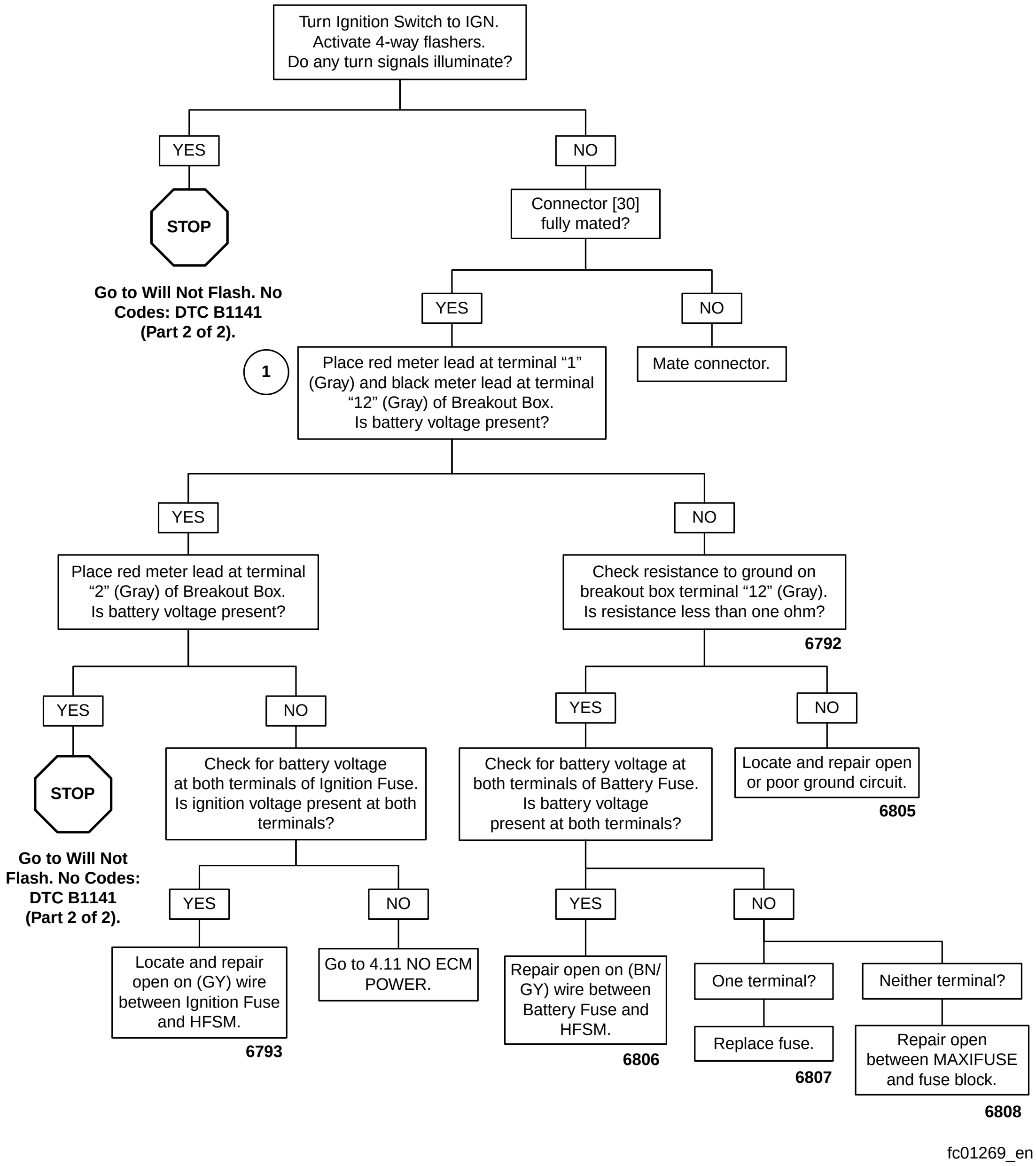


Figure 3-28. Security Antenna Circuit

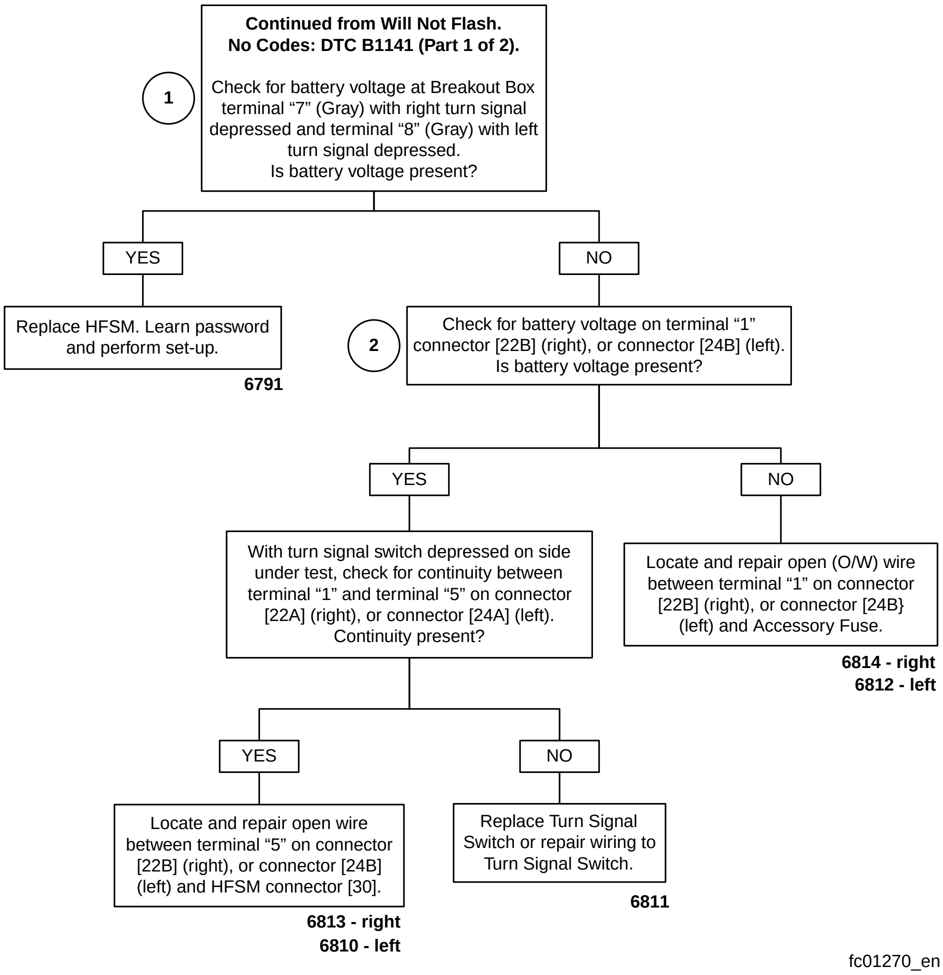
Table 3-17. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[30]	HFSM	12-place Deutsch	Electrical panel behind fender extension
[208]	HFSM	4-place Deutsch	Electrical panel behind fender extension
[209]	Security antenna	2-place Molex	Under seat

Will Not Flash, No Codes: DTC B1141 (Part 1 of 2)



Will Not Flash, No Codes: DTC B1141 (Part 2 of 2)



GENERAL

Diagnostic Trouble Codes (DTCs) B1143, B1144 and B1145 will set when faults occur to the security antenna circuit used to transmit to the fob. Refer to Table 3-18.

Table 3-18. Security Antenna DTCs

DTC	CONDITION	START WITH FLOWCHART
B1143	Security antenna short-to-ground	Security Antenna Short-to-Ground: DTC B1143
B1144	Security antenna short-to-battery	Security Antenna Short-to-Voltage: DTC B1144
B1145	Security antenna open	Security Antenna Open: DTC B1145

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Use black male HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) adapters and patch cords to connector [208B].
2. If DTC is current (lamp on continuously, cleared codes return during operation), replace HFSM. If DTC is historic, check for intermittents.
3. Connect light blue male HARNESS CONNECTOR TEST KIT adapters and patch cords to connector [209B], and black male HARNESS CONNECTOR TEST KIT adapters and patch cords to connector [208B].

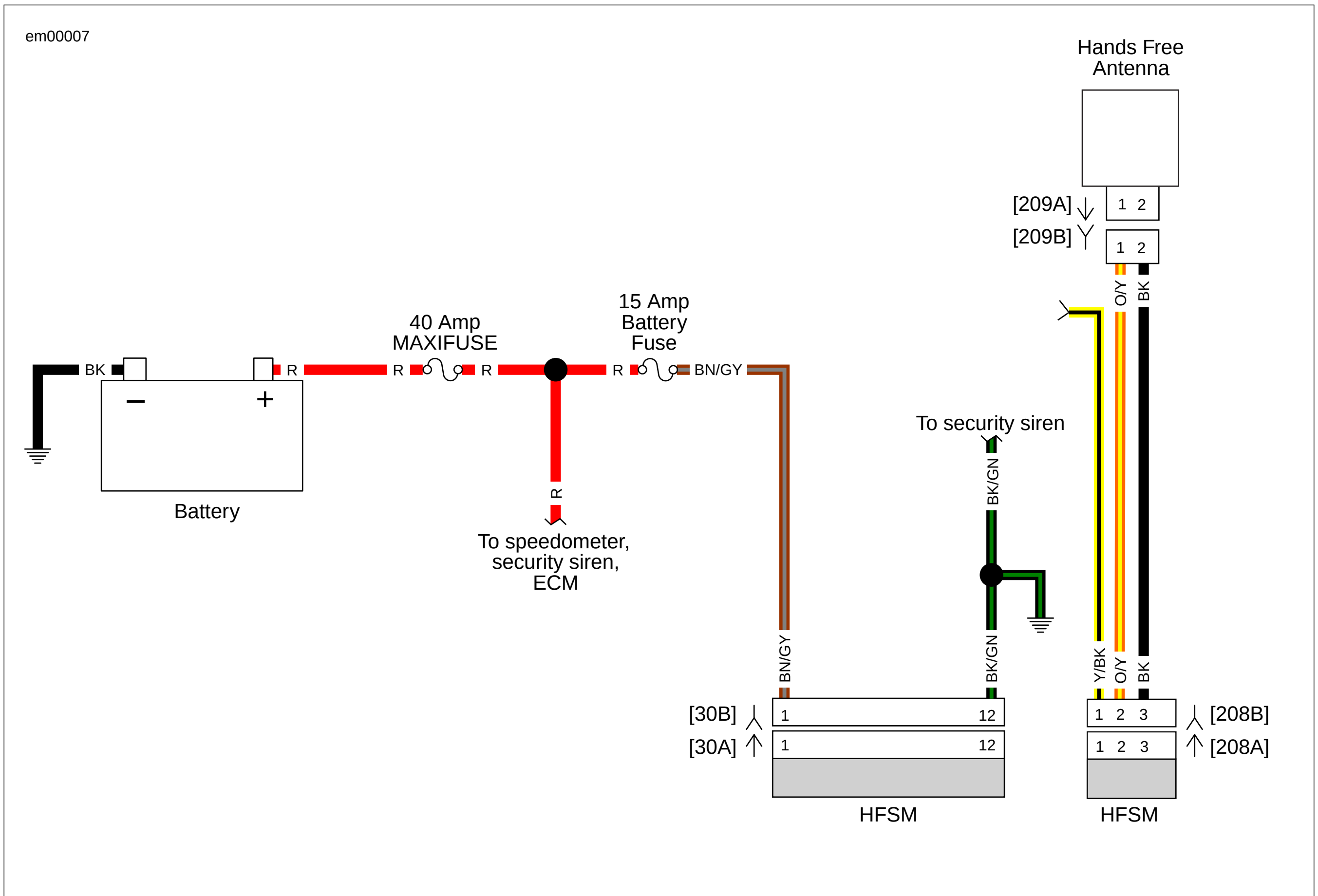
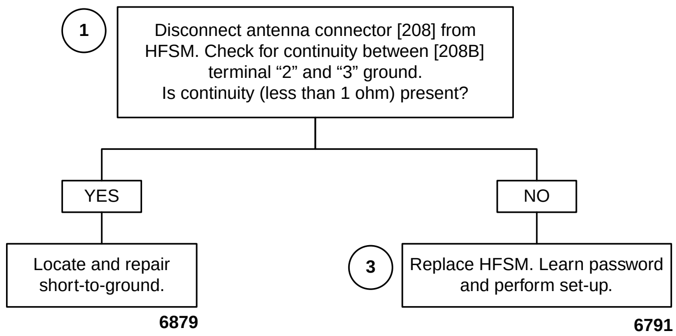


Figure 3-29. Security Antenna Circuit

Table 3-19. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[30]	HFSM	12-place Deutsch	Electrical panel behind fender extension
[208]	HFSM	4-place Deutsch	Electrical panel behind fender extension
[209]	Security antenna	2-place Molex	Under seat

Security Antenna Short-to-Ground: DTC B1143



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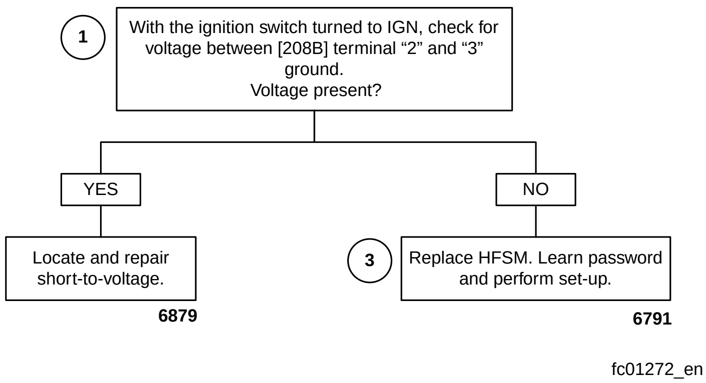
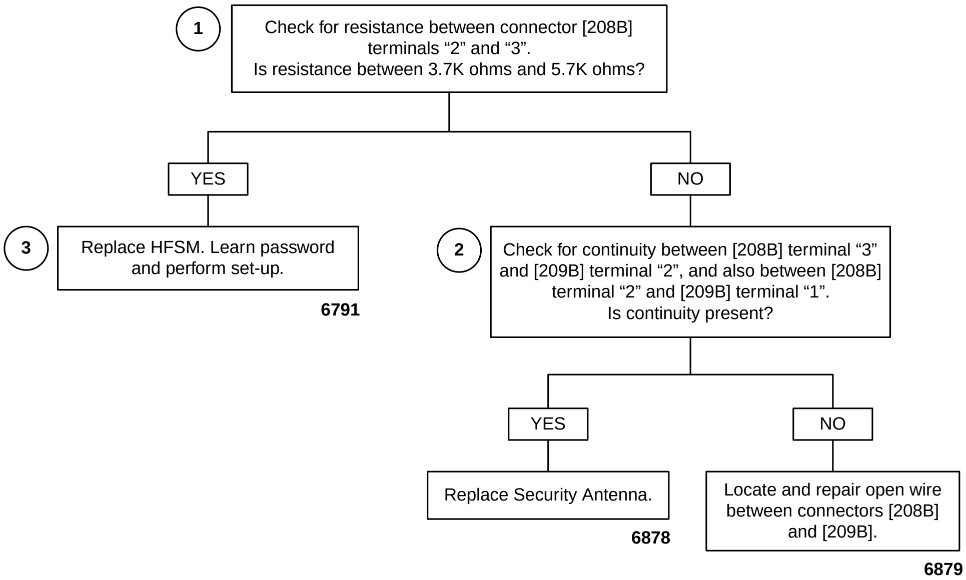
Security Antenna Short-to-Voltage: DTC B1144



Security Antenna Open: DTC B1145



fc01273_en

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

Diagnostic Tips

Diagnostic Trouble Codes (DTCs) B1154 and B1155 will set when either the clutch switch circuit or the neutral switch circuit is shorted to ground at speeds greater than 10 MPH (16 km/h) for more than 60 seconds. Refer to Table 3-20.

Table 3-20. Clutch/Neutral Switch DTCs

DTC	SYMPTOM	START WITH FLOW CHART
B1154	Clutch switch short-to-ground	Clutch Switch Short-to-Ground: DTC B1154
B1155	Neutral switch short-to-ground	Neutral Switch Short-to-Ground: DTC B1155

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) to HFSM. 3.12 BREAKOUT BOX: TSM/HFSM
2. If DTC is current (lamp on continuously, clear codes return during operation), replace HFSM. If DTC is historic, check for intermittents.
3. A reading of several hundred ohms is normal due to the neutral indicator lamp (LED).

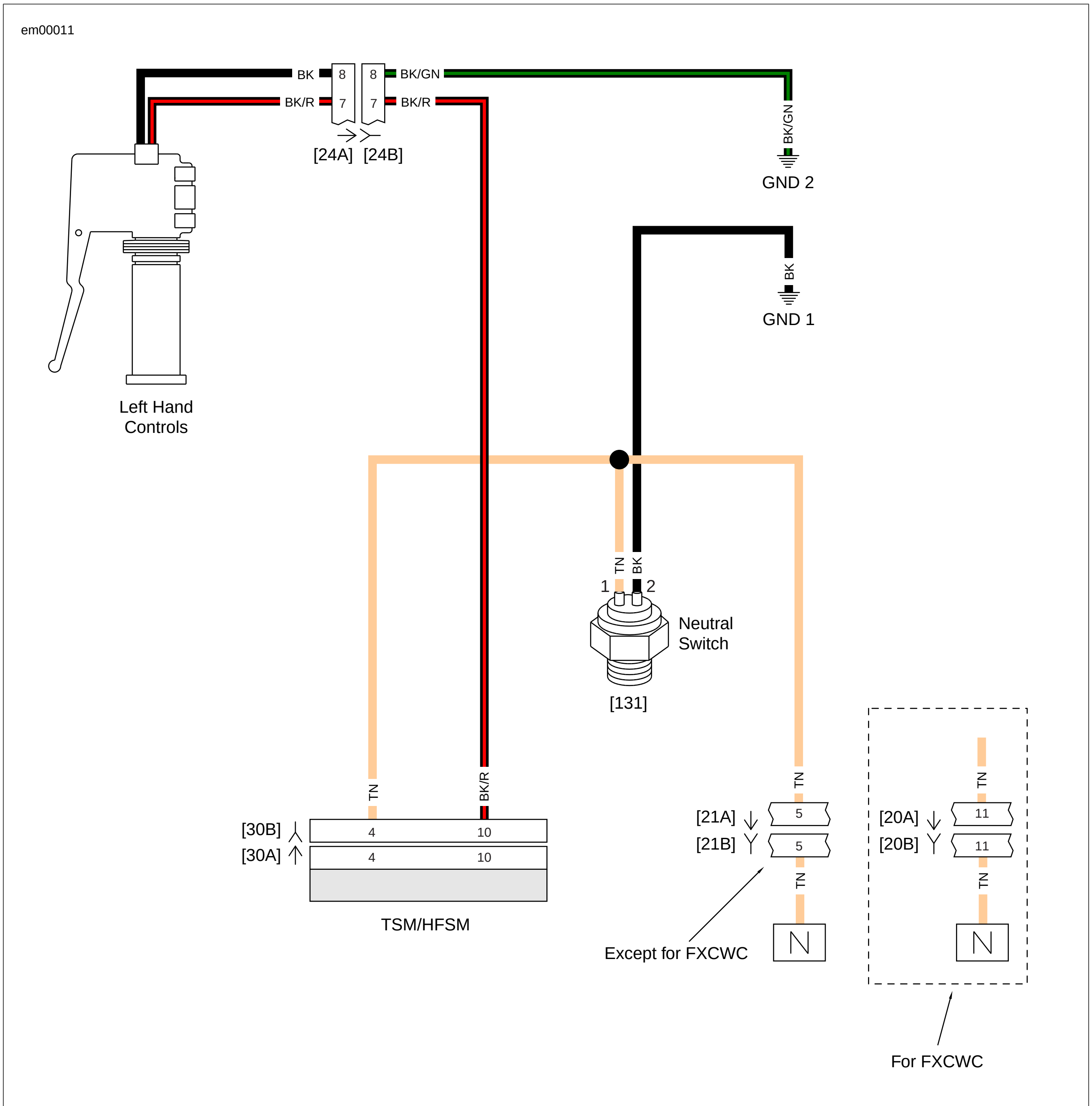


Figure 3-30. Clutch and Neutral Interlock Circuits

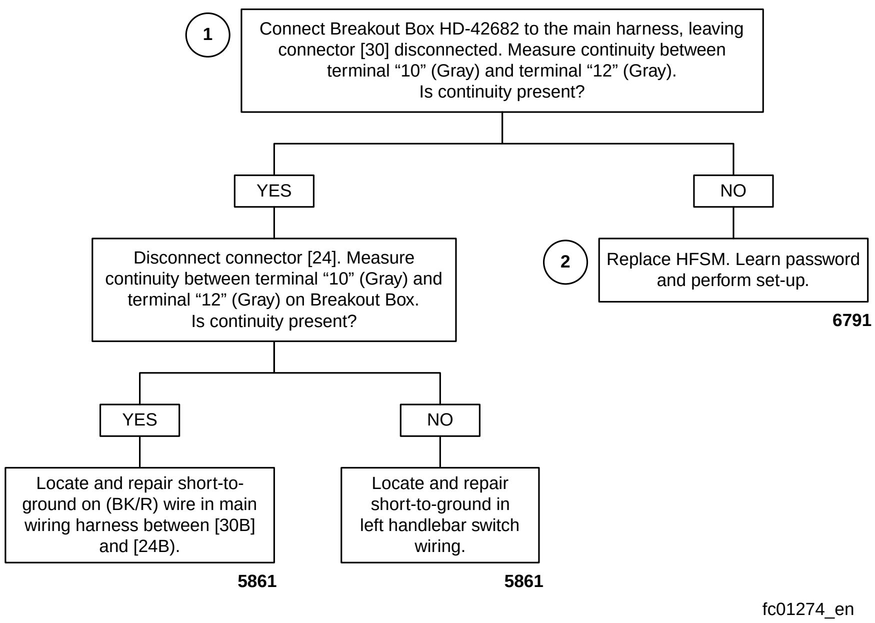
Table 3-21. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Deutsch	Under console
[21]	Indicator lamps	8-place Mini-Deutsch	Under fuel tank console
[24]	Left handlebar controls	8-place Molex	Under fuel tank, left side
[30]	TSM/HFSM	12-place Deutsch	Electrical panel behind fender extension

Clutch Switch Short-to-Ground: DTC B 1154

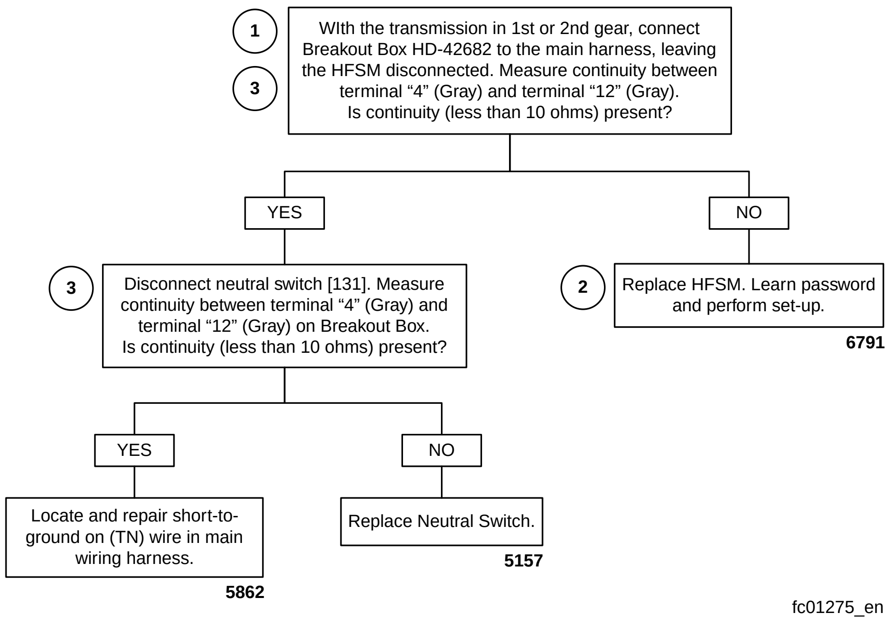
NOTE

This DTC may occur if the vehicle is ridden with clutch disengaged (pulled in) at speeds greater than 10 MPH (16 km/h) for more than 60 seconds (coasting down a long mountain road).



Neutral Switch Short-to-Ground: DTC B1155

NOTE
This DTC may occur if the vehicle is ridden with transmission in neutral at speeds greater than 10 MPH (16 km/h) for more than 60 seconds (coasting down a long mountain road).



DTC U1016, U1255

GENERAL

The serial data connector provides a means for the Electronic Control Module (ECM) (see Figure 3-31 or Figure 3-32), TSM/HFSM, and speedometer to communicate their current status. When all operating parameters on the serial data bus are within specifications, a state of health message is sent between the components. DTC U1016 indicates that the ECM is not capable of sending this state of health message. DTC U1255 indicates that no messages were present during power up of the current key cycle. DTC U1016 indicates that there was communication on the data bus since power up, but communication was lost or interrupted during that ignition cycle.

Table 3-22. Code Description

DTC	CONDITION
U1016	Loss of all ECM serial data (state of health)
U1255	Serial data error/missing message

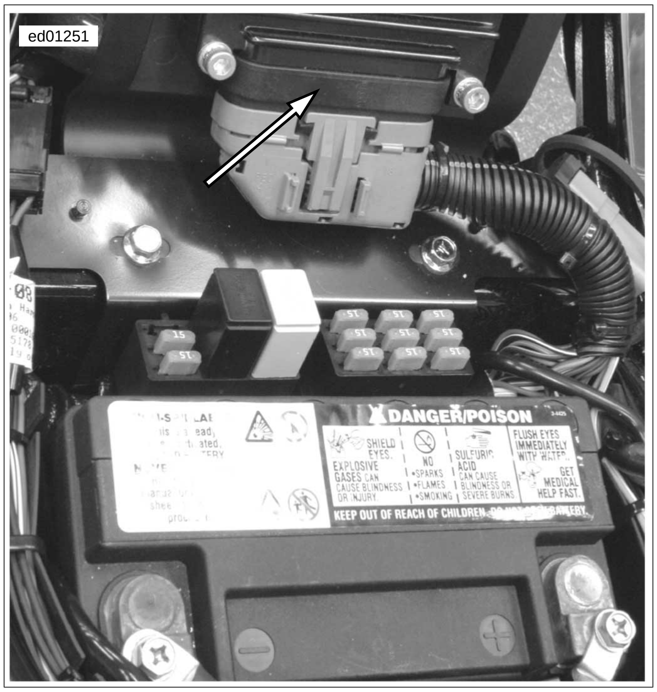


Figure 3-31. ECM Location

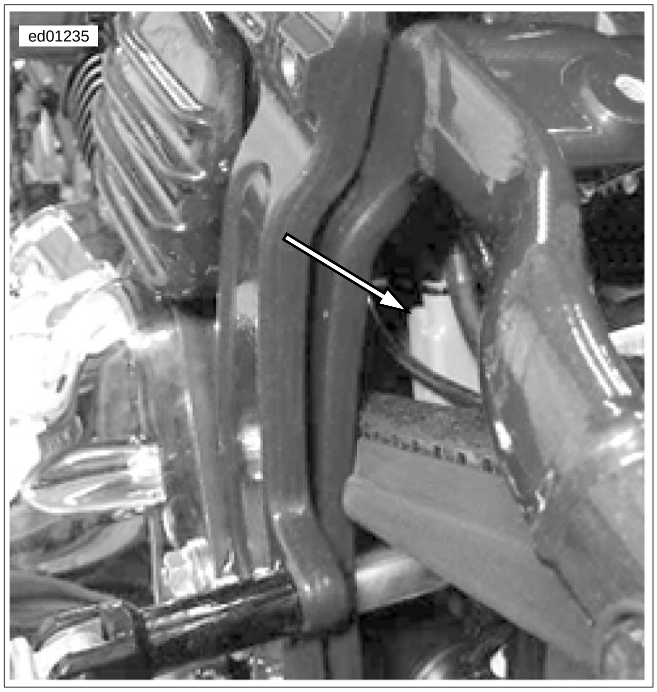


Figure 3-32. ECM Location (FXCWC)

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/HFSM connector [30A] and wire harness connector [30B]. See 3.12 BREAKOUT BOX: TSM/HFSM.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

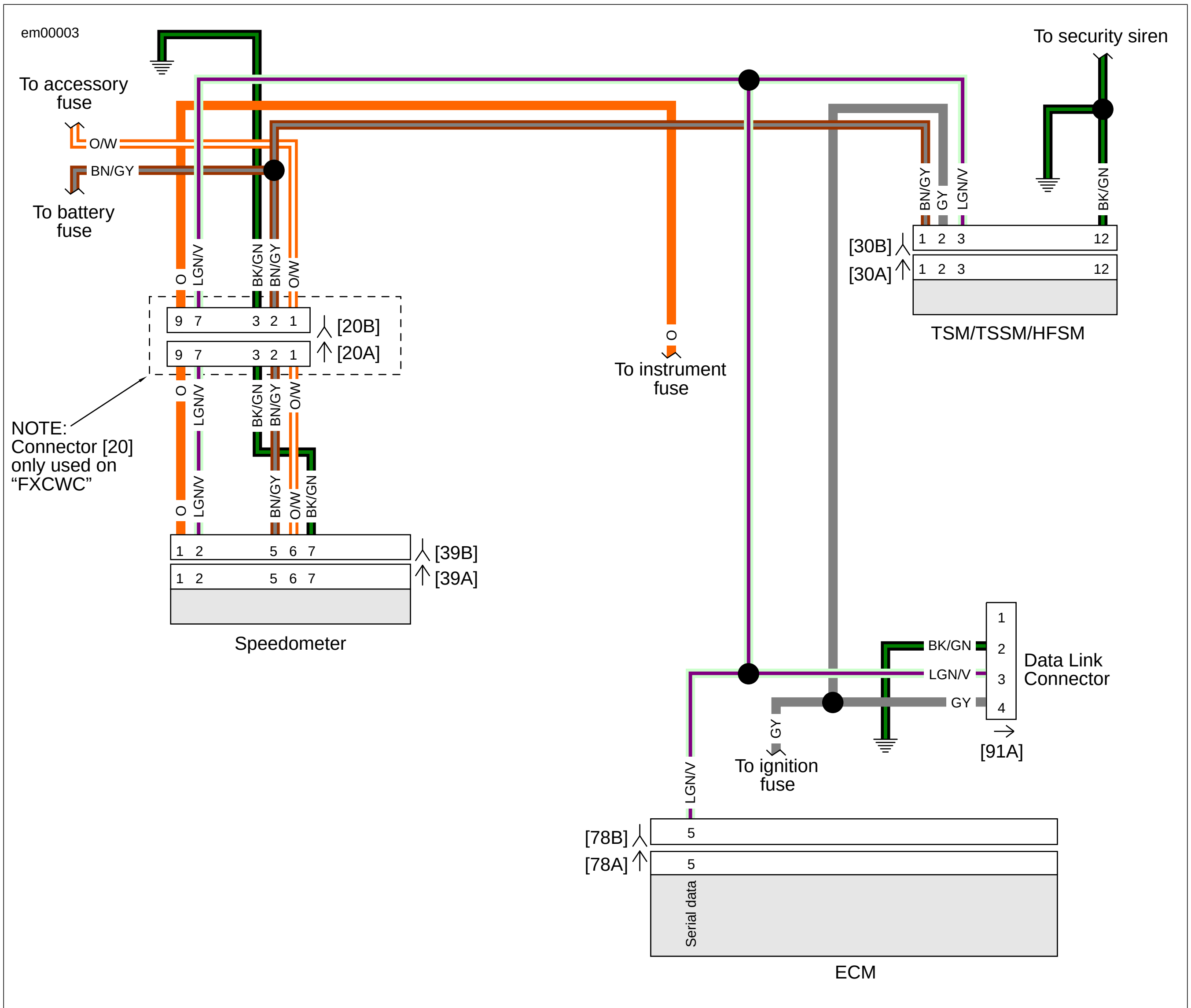
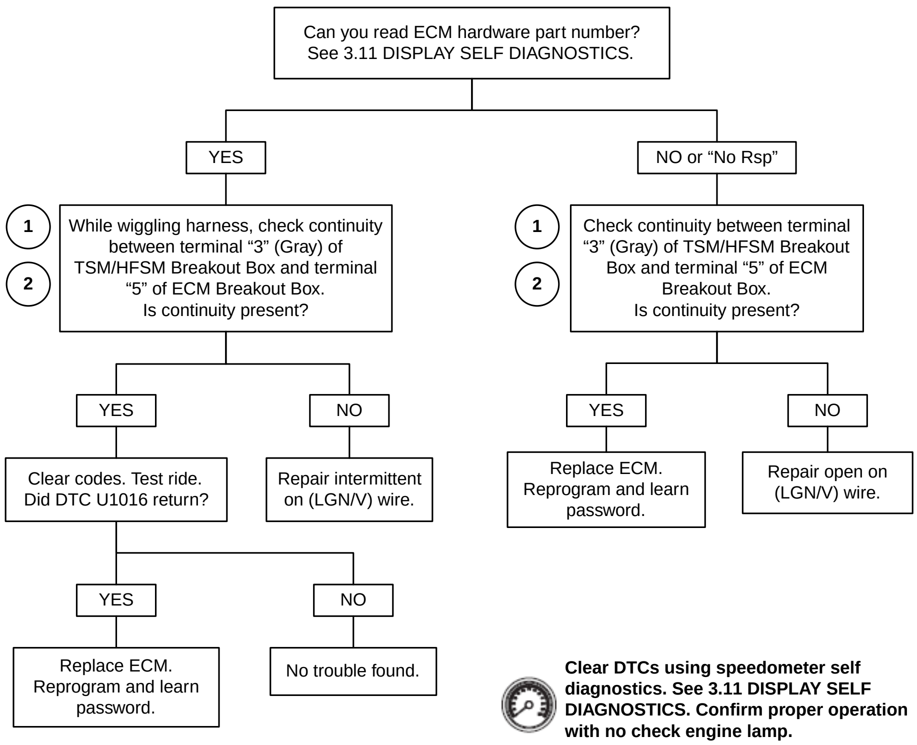


Figure 3-33. Serial Data Circuit

Table 3-23. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat

Loss of ECM Serial Data: DTC U1016, Serial Data Error/Missing Message: DTC U1255



fc01276_en

DIAGNOSTICS

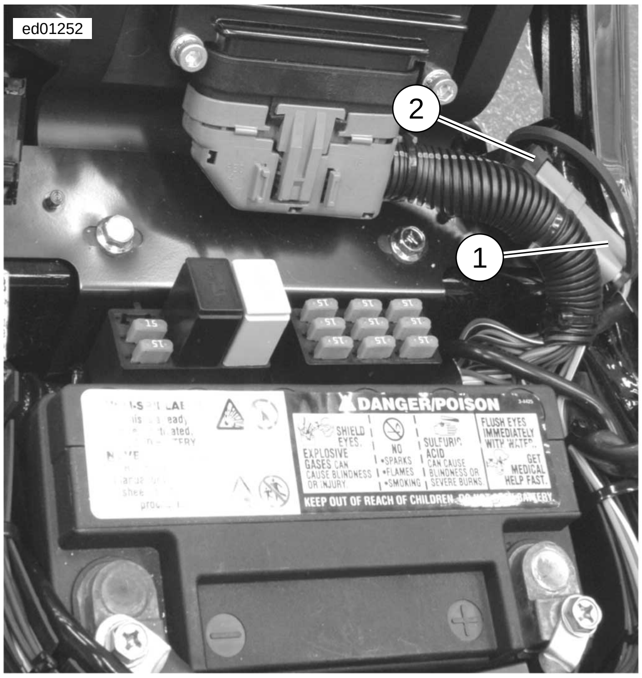
The typical serial data voltage range is 0 volts (inactive) to 7 volts (active). Due to the short pulse, voltages will be much lower on a DVOM. In analog mode, a DVOM reading serial data will show continuous voltage when active, typically 0.6-0.8 volts. The range for acceptable operations is 0-7.0 volts.

Diagnostic Tips

- If serial data is shorted, these Diagnostic Trouble Codes (DTCs) will automatically cause the check engine lamp to illuminate. The odometer will read "BUS Er" in this condition.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.

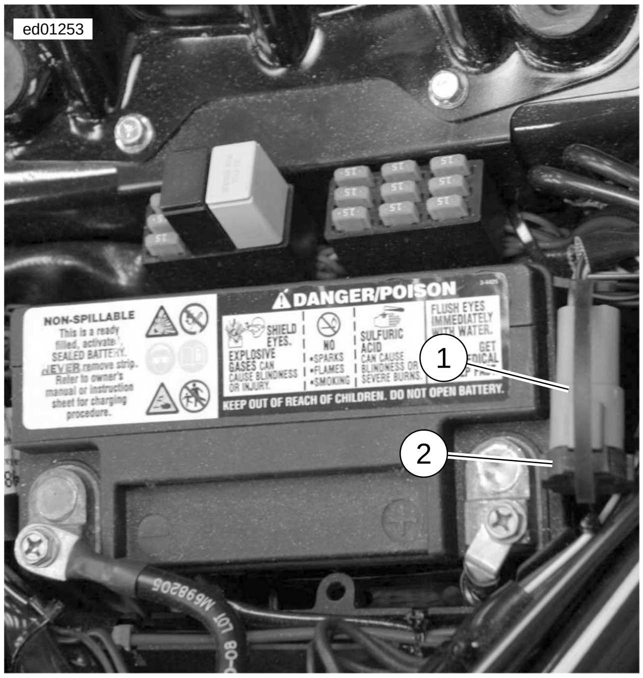
Diagnostic Notes

If a U1300, U1301 or "BUS Er" is present, perform diagnostic procedures listed in 4.12 STARTS, THEN STALLS.



1. **Data link connector [91A]**
2. **Protective rubber plug**

Figure 3-34. Data Link Connector [91A]



1. **Data link connector [91A]**
2. **Protective rubber plug**

Figure 3-35. Data Link Connector [91A] (FXCWC)

GENERAL

If the ECM or TSM/HFSM is faulty, follow the instructions in the Service Manual for ECM or TSM/HFSM replacement. Then, to determine if password learn is necessary, refer to Table 3-24.

Table 3-24. Password Learn

DEVICE REPLACED	IS PASSWORD LEARN NECESSARY?
ECM	Yes
TSM	No *
TSM/HFSM	Yes
* If a TSM has been replaced by a HFSM, or a HFSM has been replaced by a TSM, password learn is necessary.	

PASSWORD LEARNING

To perform password learning procedure, refer to Table 3-25. When finished, continue with all instructions under 3.3 H-DSSS ACTUATION.

Always perform all appropriate instructions under 3.3 H-DSSS ACTUATION after TSM/HFSM replacement or removal.

NOTE

Fob assignment must be performed at an authorized Harley-Davidson dealer using Digital Technician.

Table 3-25. Setting TSM/HFSM and ECM Password

NO.	ACTION	CONFIRMATION	NOTES
	Ignition must be turned off for at least 15 seconds.	With Ignition Switch turned off, Check Engine Lamp and Security Lamp will be off.	
1	Install **new** TSM/HFSM or ECM. Perform all steps under 3.3 H-DSSS ACTUATION.		
2	Set Engine Stop Switch to **RUN.**		
3	Turn Ignition Switch **ON.**	Verify Check Engine Lamp and Security Lamp illuminate and then turn off.	TSM/HFSM enables start relay.
4	Attempt normal start one time.	Engine starts and stalls. Check Engine Lamp illuminates and stays on.	Password has not been learned. ECM sets DTC P1009.
5	Wait ten seconds. Security Lamp will illuminate and stay on.	Security Lamp illuminates.	ECM enters Password Learning mode for ten minutes. Do not cycle Ignition Switch or interrupt vehicle power or Password Learn will be unsuccessful.
6	Wait until Security Lamp turns off.		This takes ten minutes.
7	Quickly (within two seconds) turn Ignition Switch OFF-**ON.**		ECM must not be allowed to shutdown.
8	Wait until Security Lamp turns off.		This takes ten minutes.
9	Quickly (within two seconds) turn Ignition Switch OFF-**ON.**		ECM must not be allowed to shutdown.
10	Wait until Security Lamp turns off.		This takes ten minutes.
11	Quickly (within two seconds) turn Ignition Switch OFF-**ON.**		ECM must not be allowed to shutdown.
12	Turn Ignition Switch **OFF**. Wait 15 seconds before turning Ignition Switch on. Turn Ignition Switch **ON** and start engine to confirm successful Password Learn procedure. Clear DTCs.		
13	Perform all steps under 3.3 H-DSSS ACTUATION.		

GENERAL

The HFSM uses a battery in the fob and siren. These are the only parts requiring periodic maintenance.

HANDS-FREE FOB

Schedule

Replace the fob battery every year.

Battery Replacement

1. See Figure 3-36. Open the fob case.
   a. Place a thin blade in the thumbnail slot (1) between the 2 halves of the case.
   b. Slowly twist the blade.
2. Replace battery (2).
   a. Remove the original battery.
   b. Install a **new** battery with the positive (+) side down. Use a Panasonic® 2032 or equivalent.
3. With O-ring (3) in place, align case halves and snap case halves together.

1. **Thumbnail slot**
2. **Battery (Panasonic 2032)**
3. **O-ring**

Figure 3-36. Open Fob: HFSM

SIREN (IF INSTALLED)

Schedule

The siren's internal 9 volt battery is rechargeable and does not need to be replaced on a regular basis. Battery life under normal conditions is approximately three to six years.

NOTES

See Figure 3-37 and Figure 3-38. Early style siren will work with both TSSM and HFSM. Late style siren will only work with HFSM.

The internal siren battery may not charge if the vehicle's battery is less than 12.5 volts.

Battery Replacement: Early Style Siren

1. Disarm system and remove siren.
2. See Figure 3-37. Remove battery cover.
   a. Place the siren module on a flat and sturdy table with the potted section (area with epoxy covering circuit board) facing up and towards you.
   b. Position a knife blade at a 45 degree angle to the long side of the siren case. Insert the knife blade between the siren case and battery cover at one of the two accessible corners of the battery cover. Keep the blade slightly higher towards the battery cover as this helps keep the blade away from the battery seal.
   c. Slowly twist the blade towards the battery cover and the cover will pop off.

NOTES

- *For protection against corrosion, battery terminals and battery clip are covered with a special grease. Do not wipe away this substance. Apply all available existing grease to terminals on **new** battery.*
- *Only a 9 volt nickel metal hydride battery should be used in the siren.*

3. Replace battery by removing old battery from polarized battery clip. Install a **new** 9 volt nickel metal hydride battery.
4. Reinstall battery cover.
   a. Carefully replace the rubber seal.
   b. Align battery cover with case placing round corners on cover away from connector [142A]. Snap cover into place.
5. Install siren and check operation. If siren is working properly, it will respond with two chirps after receiving the arm command.

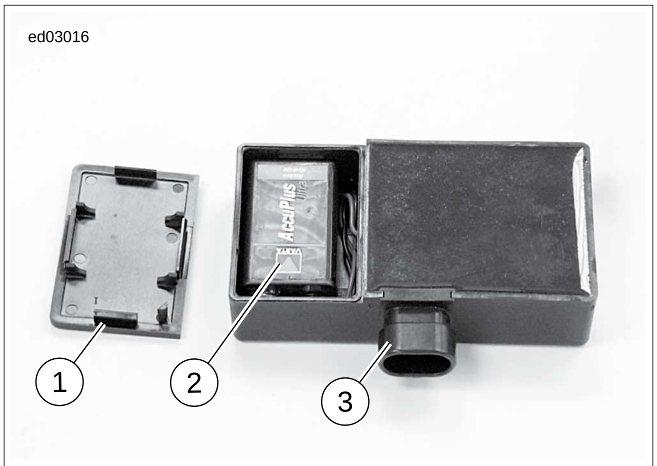
Battery Replacement: Late Style Siren

1. Disarm system and remove siren.
2. See Figure 3-38. With a small screwdriver or pick, push the catches (1) in through the two slots (2) in the end of the siren to release the battery cover (3).

NOTES

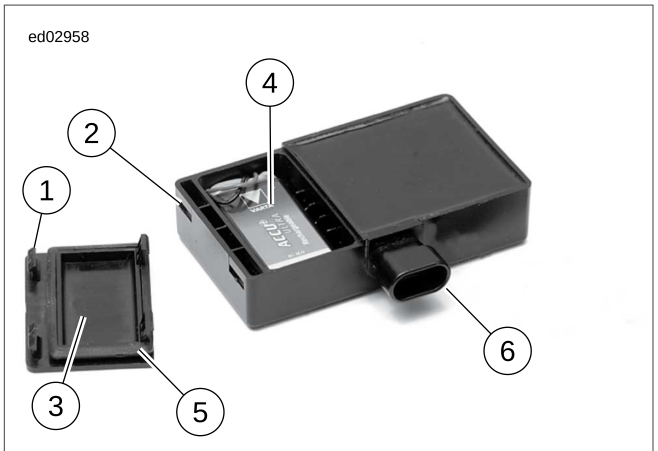
- *For protection against corrosion, battery terminals and battery clip are covered with a special grease. Do not wipe away this substance. Apply all available existing grease to terminals on **new** battery.*
- *Only a 9 volt nickel metal hydride battery should be used in the siren.*

3. Replace battery (4) by removing old battery from polarized battery clip.
4. Recharge and re-install or install a **new** 9 volt nickel metal hydride battery.
5. Reinstall battery cover (3).
    a. Carefully replace the rubber seal (5) on the cover.
    b. Align battery cover with case placing round corners on cover away from connector [142A] (6).
    c. Snap cover into place.
6. Install siren and check operation. If siren is working properly, it will respond with two chirps after receiving the arm command.



1. **Cover**
2. **Battery**
3. **Connector [142A]**

Figure 3-37. Battery Compartment (Early Style Siren)



1. **Catch**
2. **Slot**
3. **Cover**
4. **9 volt battery**
5. **Rubber seal**
6. **Connector [142A]**

Figure 3-38. Siren Battery Compartment (Late Style Siren)

NOTES

SUBJECT **PAGE NO.**

NOTES

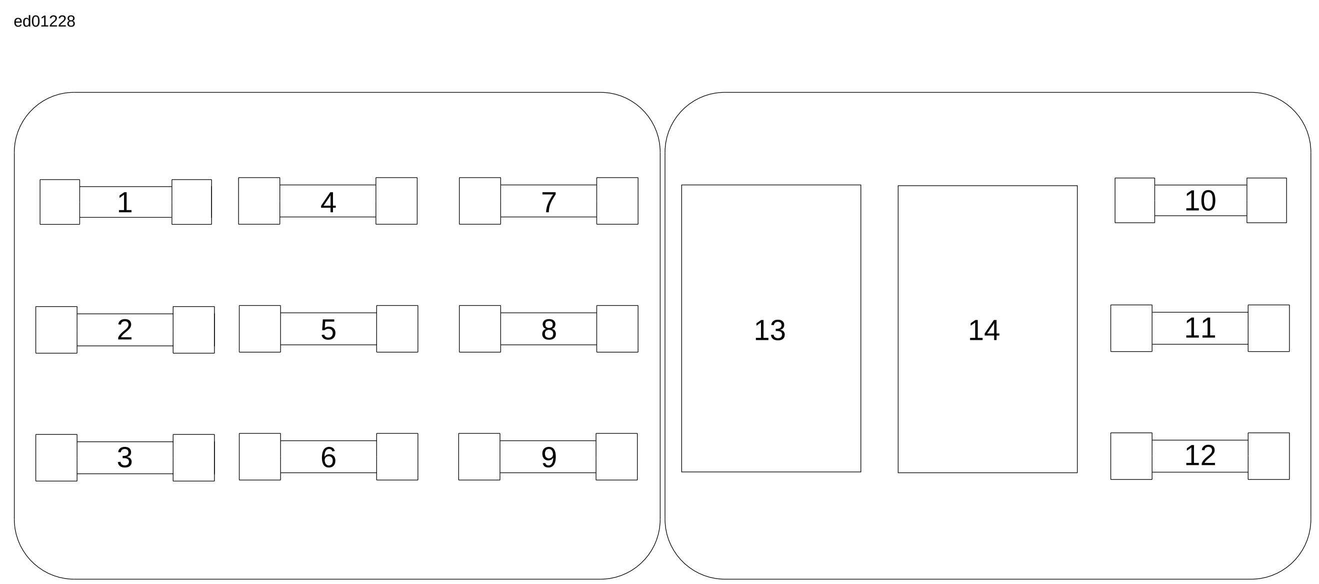
SPECIFICATIONS

Table 4-1. General Specifications

IGNITION	DATA
Idle speed	1000 ± 50 RPM
Spark plug size	12 mm
Spark plug gap	0.038-0.043 in (0.97-1.09 mm)
Spark plug type	Harley-Davidson No. 6R12 (no substitute)
Ignition coil primary resistance at room temperature	0.3-0.5 ohms
Ignition coil secondary resistance at room temperature	2750-3250 ohms

Table 4-2. Fuse Ratings

ITEM	RATING (AMPERES)
Main fuse	40
Ignition fuse	15
Lights fuse	15
Accessory fuse	15
Instruments fuse	15
Battery fuse	15
Fuel pump fuse	15
ECM power fuse	15
Engine control fuse	15
Headlamp fuse	15



1. **EMC power**
2. **Engine control**
3. **Headlamp**
4. **P & A (2 Amp Max)**
5. **Battery**
6. **Accessories**
7. **Instruments**
8. **Ignition**
9. **Lights**
10. **Spare**
11. **Spare**
12. **Fuel pump**
13. **Start relay**
14. **System relay**

Figure 4-1. Fuse Block: Top View

GENERAL

The engine management system consists of the following components:

- Electronic Control Module (ECM).
- Crankshaft Position (CKP) sensor.
- Manifold Absolute Pressure (MAP) sensor.
- Intake Air Temperature (IAT) sensor.
- Engine Temperature (ET) sensor.
- Idle Air Control (IAC).
- Throttle Position (TP) sensor.
- Vehicle Speed Sensor (VSS).
- Turn Signal Module (TSM) or an optional factory-installed turn signal module with integrated security system. Depending on destination, the security module consists of either a Turn Signal Security Module (TSSM) or a Hands-Free Security Module (HFSM). Each of these modules includes an integrated Bank Angle Sensor (BAS).
- Ignition coil.
- Oxygen (O_2) sensors (domestic models only).
- Active intake solenoid (HDI only).
- Active exhaust solenoid (HDI only).
- Jiffy Stand Sensor (HDI only).

The ECM is mounted below the seat. It computes the spark advance for proper ignition timing based on sensor inputs (from CKP, MAP and TP sensors) and regulates the low-voltage circuits between battery and ignition coil.

The ECM contains all of the solid state components used in the ignition system. The dwell time for the ignition coil is also calculated in the microprocessor and is dependent upon battery voltage. The programmed dwell is an added feature to give adequate spark at all speeds. (The ECM has added protection against transient voltages, continuous reverse voltage protection, and damage due to jump starts.) The ECM is fully enclosed to protect it from vibration, dust, water or oil. This unit is a non-repairable item. If it fails, it must be replaced.

The CKP is located in the front left side of the crankcase. The CKP generates an AC signal which is sent to the ECM where it is used to reference engine position (TDC) and speed. It functions by taking readings off the 30 teeth on the left side flywheel (two teeth are missing to establish a reference point).

The MAP sensor is located on top of the intake manifold. The MAP sensor monitors the intake manifold pressure (vacuum) and sends the information to the ECM where the module adjusts the spark and fuel timing advance curve for optimum performance.

The BAS is within the TSM/TSSM/HFSM. The TSM/TSSM/HFSM will shut the engine down if the vehicle is tipped over. Once the sensor is tripped, the motorcycle must be uprighted and turned off and then on again before the engine can be restarted. This is communicated across the data bus.

Front and rear coils fire each spark plug independently (one cylinder at a time - no wasted spark). The coil also has an extra terminal to monitor current on the coil secondary circuit. This is used for knock detection and combustion diagnostics.

The ignition system gives a spark near top dead center for starting. At RPM and loads above this, the system gives a spark advance that varies between 0 and 50.

The IAT, ET and TP sensors are used to provide information to the ECM to fine tune spark and fuel delivery. The VSS is used as an input for idle speed control.

The oxygen sensor (O_2, domestic models only) monitors the exhaust gas for oxygen content. The fuel/air mixture is then adjusted to maintain an optimal air/fuel ratio.

O_2 sensor diagnostic codes may be seen during the vehicle break-in period. The O_2 sensor diagnostic codes will not illuminate the check engine lamp for current or historic codes and will only be indicated by Digital Technician or speedometer self diagnostics. If the diagnostic codes are reported during the break-in period, clear or ignore the codes until the break-in period is completed.

The active intake solenoid (HDI models) opens a valve in the air cleaner to allow more air to enter at speeds greater than 43.5 MPH (70 km/h) with a throttle opening greater than 50%.

The active exhaust system (HDI models) utilizes an actuator valve located in the rear exhaust pipe which is connected to an actuator via a cable. The valve position automatically adjusts to enhance engine performance.

TROUBLESHOOTING

See the diagnostic charts for troubleshooting information.

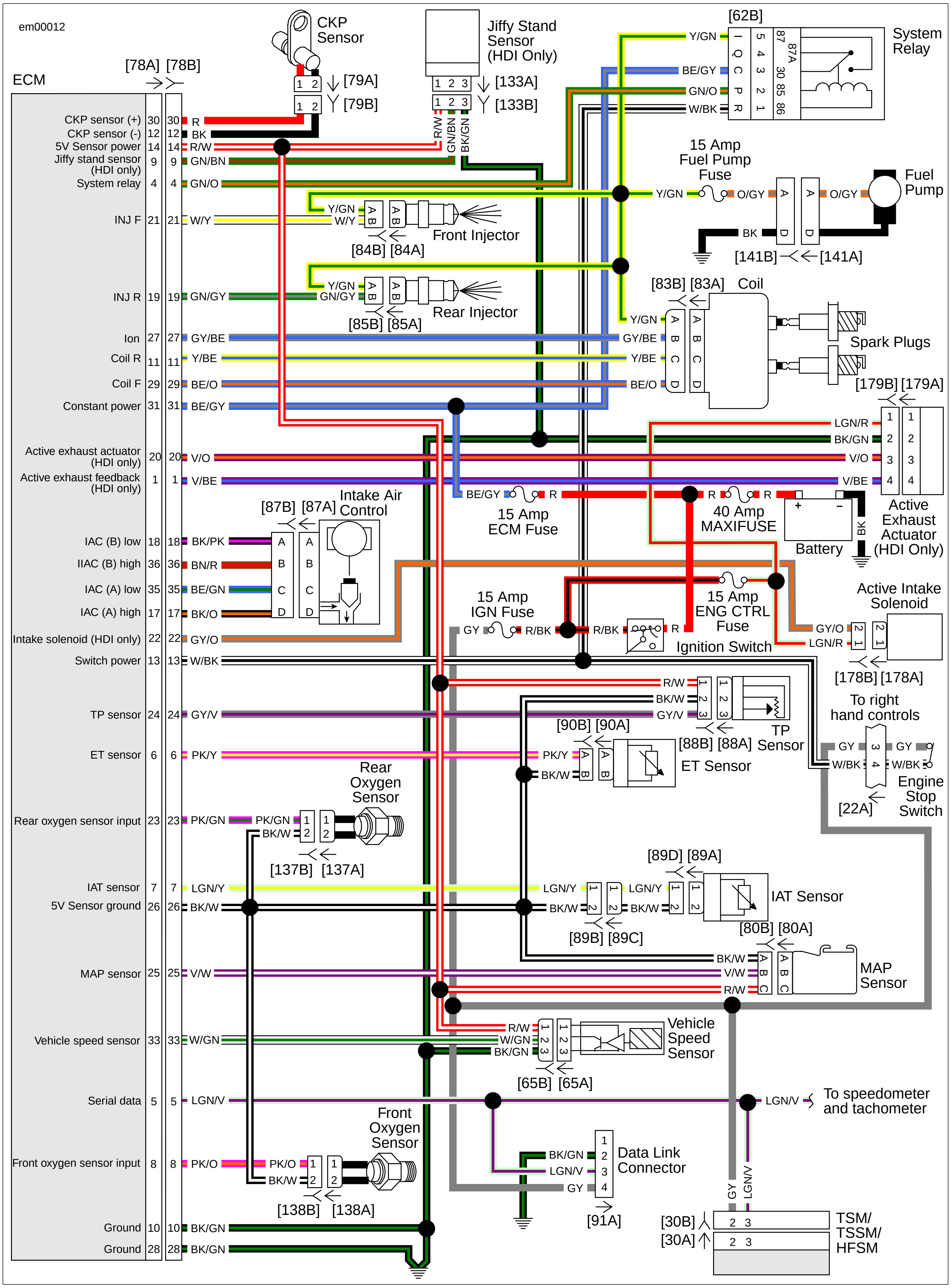


Figure 4-2. EFI System Circuit

Table 4-3. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Right hand controls	6-place Molex	Under fuel tank, right side
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[62]	System relay	5-place Amp	Under seat, in fuse block
[65]	Vehicle Speed Sensor (VSS)	3-place Delphi	Top of transmission
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[79]	Crankshaft Position (CKP) sensor	2-place Mini-Deutsch	Back of voltage regulator bracket
[80]	Manifold Absolute Pressure (MAP) sensor	3-place Packard	Top of manifold
[83]	Ignition coil	4-place Delphi	Back of coil
[84]	Front fuel injector	2-place Delphi	Beneath fuel tank
[85]	Rear fuel injector	2-place Delphi	Beneath fuel tank
[87]	Intake Air Control (IAC)	4-place Packard	Beneath fuel tank
[88]	Throttle Position (TP) sensor	3-place Delphi	Behind air cleaner backing plate
[89]	Intake Air Temperature (IAT) sensor	2-place Delphi	Behind air cleaner backing plate
[90]	Engine Temperature (ET) sensor	2-place Delphi	Back of front cylinder, left side
[91]	Data link connector	4-place Deutsch	Under seat
[133]	Jiffy Stand Sensor (HDI only)	3-place Molex	Left side along frame, toward front of engine
[137]	Rear oxygen sensor	2-place Amp	Under oil tank
[138]	Front oxygen sensor	2-place Amp	Behind voltage regulator
[141]	Fuel pump	4-place Packard	Top of fuel tank
[178]	Active intake solenoid	2-place Amp	Air cleaner backing plate
[179]	Active Exhaust Actuator (AEA)	5-place Amp	Exhaust bracket

SYSTEM PROBLEMS

All system problems fall into at least one of three general categories.

No Start

The engine cranks over freely, but will not start. This does not include situations where the engine will not crank, such as a security disabled starter, dead battery, etc. This condition assumes that all obvious checks (fuel in tank, etc.) have been made.

Poor Performance

The engine starts but there are performance problems. These problems may include poor fuel economy, rough idle, engine misfire, engine hesitation, severe spark knock, etc.

Check Engine Lamp

See Figure 4-3. The check engine lamp indicates the Electronic Control Module (ECM) has determined a fault condition exists. There may also be starting or performance problems.

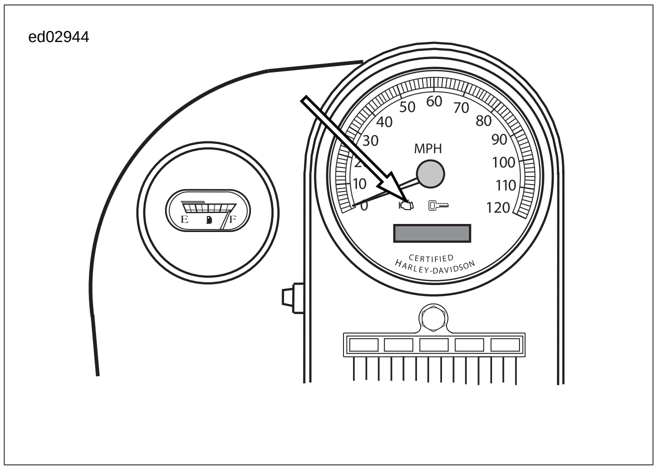


Figure 4-3. Check Engine Lamp

RESOLVING PROBLEMS

To resolve system problems, five basic steps are involved. In order of occurrence, they are:

1. Check for Diagnostic Trouble Codes (DTCs) by using speedometer self diagnostics. See 4.4 CHECKING FOR DIAGNOSTIC TROUBLE CODES: EFI.
2. Retrieve DTCs by using speedometer self diagnostics. See 4.6 SPEEDOMETER SELF DIAGNOSTICS.
3. Diagnose system problems. This involves using special tools and the diagnostic flow charts.
4. Correct problems through the replacement and/or repair of the affected components.
5. After repairs are performed, the work must be validated. This involves clearing the DTCs and confirming proper vehicle operation as indicated by the lack of DTCs.

CHECKING FOR DIAGNOSTIC TROUBLE CODES: EFI 4.4

CHECK ENGINE LAMP

To diagnose system problems, start by observing the behavior of the check engine lamp.

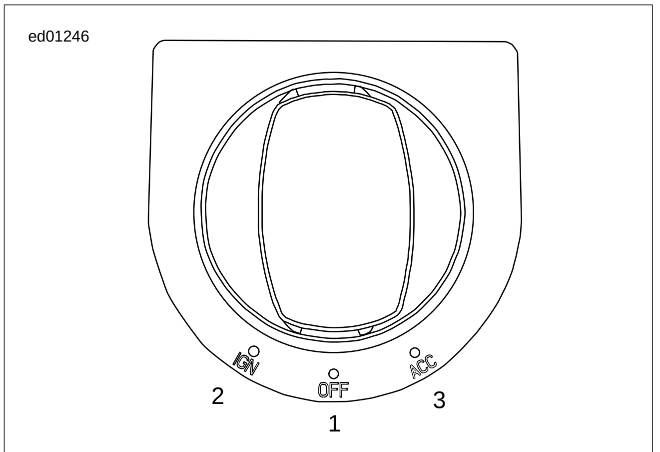
NOTES

- *See Figure 4-4. "Key ON" means that the Ignition Switch is turned to IGNITION and the Engine Stop Switch is set to RUN (although the engine is not running).*
- *When the Ignition Switch is turned ON, the check engine lamp will illuminate for approximately four seconds and then turn off.*
- *If the check engine lamp is not illuminated at Key ON or if it fails to turn OFF after the initial four-second period, then see 4.6 SPEEDOMETER SELF DIAGNOSTICS.*
- *If the check engine lamp comes on late (after 20 seconds), the problem is likely a serial data bus failure. Test for Diagnostic Trouble Codes (DTCs) using speedometer self diagnostics. See 4.6 SPEEDOMETER SELF DIAGNOSTICS.*

1. See Figure 4-5. After lamp turns off after being illuminated for the first four-second period, one of three situations may occur.
   a. The lamp remains off. This indicates there are no current fault conditions or stored DTCs currently detected by the Electronic Control Module (ECM).
   b. The lamp stays off for only four seconds and then comes back on for an eight-second period. This indicates a code is stored, but no current DTC exists.
   c. The lamp remains on beyond the eight-second period. This indicates a current DTC exists.
2. See 4.4 CHECKING FOR DIAGNOSTIC TROUBLE CODES: EFI, Code Types for a complete description of DTC formats.

NOTE

Some DTCs can only be fully diagnosed during actuation. For example, a problem with the ignition coil will be considered a current fault even after the problem is corrected, since the ECM will not know of its resolution until after the coil is exercised by vehicle start sequence. In this manner, there may sometimes be a false indication of the current trouble code.



1. **Ignition OFF**
2. **Ignition ON**
3. **Marker Lights (ACC) ON**

Figure 4-4. Ignition Switch

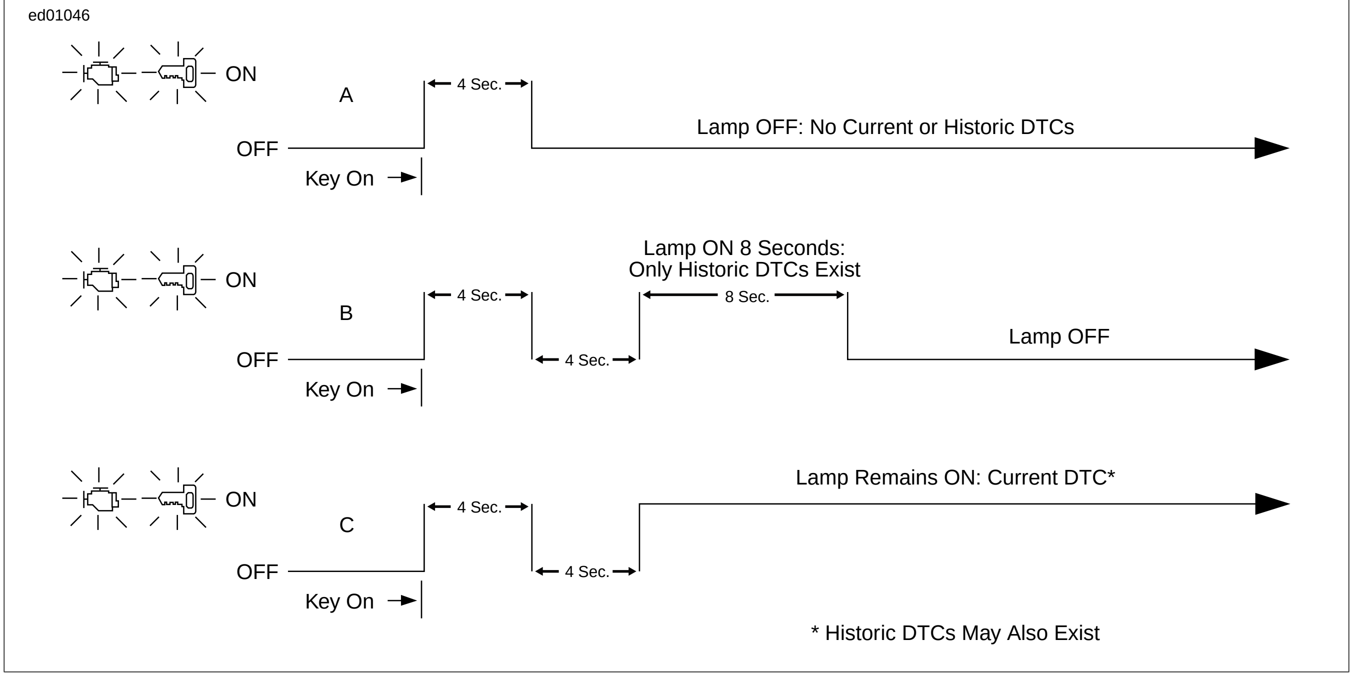


Figure 4-5. Check Engine Lamp Operation

CODE TYPES

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

There are two types of Diagnostic Trouble Codes (DTCs): current and historic. If a DTC is stored, it can be read using either a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750) or speedometer self diagnostics. See 4.6 SPEEDOMETER SELF DIAGNOSTICS.

NOTES

- *To differentiate between current and historic DTCs, a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750) must be employed.*
- *All DTCs reside in the memory of the ECM, TSM/TSSM/HFSM, speedometer or tachometer until the DTC is cleared by use of the speedometer self diagnostics. See 4.6 SPEEDOMETER SELF DIAGNOSTICS.*
- *A historic DTC is also cleared after a total of 50 trips has elapsed. A trip consists of a start and run cycle. After the 50 trip retention period, the DTC is automatically erased from memory providing that no subsequent faults of the same type are detected in that period.*

Current

Current DTCs are those which are present during the current ignition cycle. See the appropriate flow charts for solutions.

Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic DTC rather than a current DTC.

Historic DTCs can only be retrieved using a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750).

Historic DTCs are stored for 50 ignition cycles after any DTC was last set as current to assist in the diagnosis of intermittent faults. On the 50th cycle, the DTC will clear itself. The check engine lamp will not indicate the existence of only historic DTCs.

It is important to note that historic DTCs will exist whenever the system indicates the existence of a current fault. See 4.4 CHECKING FOR DIAGNOSTIC TROUBLE CODES: EFI, Multiple Diagnostic Trouble Codes if multiple DTCs are found.

Diagnostic charts are designed for use with current DTCs and as a result they frequently suggest part replacement. When diagnosing a historic DTC the charts can be helpful but should not lead to part replacement without verification the part is faulty.

RETRIEVING DIAGNOSTIC TROUBLE CODES

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

The engine management system provides two levels of diagnostics.

- The most sophisticated mode employs a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750).
- The second mode requires using the speedometer self diagnostics. Speedometer, tachometer (if equipped), TSM/TSSM/HFSM and ECM DTCs can be accessed and cleared. See 4.6 SPEEDOMETER SELF DIAGNOSTICS.

MULTIPLE DIAGNOSTIC TROUBLE CODES

While it is possible for more than one fault to occur and set more than one DTC, there are several conditions which may result in **one** fault setting **multiple** DTCs:

Serial data DTCs (U1016, U1064, U1097, U1255, U1300 and U1301) may be accompanied by other DTCs. **Always** correct the serial data DTCs before resolving the other DTCs.

Refer to Table 4-8. This table gives most ECM DTCs a priority ranking.

GENERAL

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

To locate faulty circuits or other system problems, follow the diagnostic flow charts in this section. For a systematic approach, always begin with 4.5 INITIAL DIAGNOSTIC CHECK, Initial Diagnostics. Read the general information and then work your way through the flow chart box by box.

Diagnostic Notes

If a numbered circle appears adjacent to a flow chart box, then more information is offered in the diagnostic notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual where information on the location and removal of components may be obtained.

Circuit Diagram/Wire Harness Connector Table

When working through a flow chart, refer to the illustrations, the associated circuit diagram and the wire harness connector table as necessary. The wire harness connector table for each circuit diagram identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a Breakout Box and a digital volt/ohmmeter (DVOM) are required. See 4.7 BREAKOUT BOX: EFI.

To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Reprogramming ECM

Diagnostic charts frequently suggest ECM replacement. In the event an ECM needs to be replaced, it must be reprogrammed using a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750). See your dealer. Password learn procedure must also be performed. See 3.25 TSM/HFSM: PASSWORD LEARN.

INITIAL DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

General Information

The Initial Diagnostic Check is an organized approach to identifying a problem caused by an electronic control system malfunction.

Diagnostic Tips

- If odometer reads "BUS Er" with the Ignition Switch turned ON (Engine Stop Switch at RUN with the engine off), check data bus for an open or short to ground between data link connector [91A] terminal "3" and ECM connector [78B] terminal "5", TSM/TSSM/HFSM connector [30B] terminal "3", speedometer connector [39B] terminal "2" or tachometer (if equipped) connector [108B] terminal "2".
- Check for an open diagnostic test terminal between diagnostic link connector [91A] terminal "3" and TSM/TSSM/HFSM connector [30B] terminal "3". With ignition switch turned ON, serial data bus voltage should be typically 0.6-0.8 volts. The range of acceptable voltage is 0-7.0 volts.
- To identify intermittents, wiggle instrument and/or vehicle harness while performing steps in the Diagnostic Check charts.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Compare engine behavior to symptoms tables.
    a. Starts hard. Refer to Table 4-5.
    b. Hesitates, stumbles, surges, misfires and/or sluggish performance. Refer to Table 4-6.
    c. Engine exhaust emits black smoke or fouls plugs. Refer to Table 4-7.
2. Connect BREAKOUT BOX (Part No. HD-42682) and INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601) between wire harness and speedometer. See 2.5 BREAKOUT BOX: SPEEDOMETER

All EFI DTCs are listed in Table 4-8.

Other Diagnostic Trouble Codes (DTCs)

See 3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM for any DTCs related to the speedometer.

See 3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM for any DTCs related to the TSM/HFSM.

See E.9 INITIAL DIAGNOSTIC CHECK: TSM/TSSM for any DTCs related to the TSSM.

Table 4-4. Typical Scan Values for Engine Data

ITEM	MIN. VALUE	MAX. VALUE	HOT IDLE
MAP sensor	10 kPa	104 kPa	10.3-13.3 in. Hg (35-45 kPa)
	0 Volt	5.1 Volts	
IAT Sensor	3° F (-16° C)	248° F (120° C)	104-140° F (40-60° C)
	0.0 Volts	5.0 Volts	2.0-3.5 Volts
TP sensor	0	100	0%
	0.2 Volt	4.5 Volts	0.2-1.0 Volt
IAC pintle	0	155	20-50 steps
RPM	800	5600	1000
ET sensor	3° F (-16° C)	464° F (240° C)	230-300° F (110-150° C)
	0.0 Volt	5.0 Volts	0.5-1.5 Volts
INJ PW front	0	50 ms	2-4 ms
INJ PW rear	0	50 ms	2-4 ms
Advance front	0	50°	10-15°
Advance rear	0	50°	10-15°
VSS	0	120	0 MPH (km/h)
Battery voltage	10	15	13.4 Volts
ENG RUN	Off	Run	Run
Idle RPM	800	1250	1000

NOTE

Hot idle specifications are with stock exhaust, the engine operating at 1000 RPM and an engine temperature of approximately 260 F (127 C). Idle settings may be changed with the idle set procedure. See the Service Manual.

Table 4-5. Engine Starts Hard

CAUSE	SOLUTION
Battery discharged	1.7 CHARGING SYSTEM, Troubleshooting.
Spark plugs	4.17 MISFIRE AT IDLE OR UNDER LOAD.
Spark plug wires	4.17 MISFIRE AT IDLE OR UNDER LOAD.
Ignition coil	4.17 MISFIRE AT IDLE OR UNDER LOAD.
Valve sticking	See Section 3 in the Service Manual.
Water or dirt in fuel system	Drain and refill with fresh fuel.
Loss of battery power to ECM terminal 31*	4.11 NO ECM POWER.
* Codes will not clear (although they appear to).	

Table 4-6. Engine Performance Problems

CAUSE	SOLUTION
Manifold leak NOTE: When manifold leak is large enough, IAC will close to 0 and DTC P0505 will set.	4.9 INTAKE LEAK TEST A low IAC count may also indicate an air leak.
MAP sensor plugged or not operating properly	4.19 DTC P0107, P0108
Water or dirt in fuel system	Drain and refill with fresh fuel.

Table 4-6. Engine Performance Problems

CAUSE	SOLUTION
Spark plugs	4.17 MISFIRE AT IDLE OR UNDER LOAD
Throttle plate not opening fully	See Throttle Cable Adjustment in the Service Manual.
Low fuel pressure	4.15 FUEL PRESSURE TEST

Table 4-7. Engine Exhaust Emits Black Smoke or Fouls Plugs

CAUSE	SOLUTION
Clogged air filter	See Air Cleaner Filter in the Service Manual.
MAP sensor plugged or not operating properly	4.19 DTC P0107, P0108

Table 4-8. EFI Diagnostic Trouble Codes (DTC) and Fault Conditions

RANKING	DTC	FAULT CONDITION	SOLUTION
1	P0605	ECM flash error	4.28 DTC P0603, P0605
2	P0603	ECM EEPROM error	4.28 DTC P0603, P0605
3	"BUS Er"	Serial data bus shorted low/open/high	4.12 STARTS, THEN STALLS
4	U1300	ECM serial data low	4.12 STARTS, THEN STALLS
5	U1301	ECM serial data open/high	4.12 STARTS, THEN STALLS
6	U1300	TSM/HFSM serial data low	4.12 STARTS, THEN STALLS
7	U1301	TSM/HFSM serial data open/high	4.12 STARTS, THEN STALLS
8	U1300	Speedometer serial data low	4.12 STARTS, THEN STALLS
9	U1301	Speedometer serial data open/high	4.12 STARTS, THEN STALLS
10	U1064	Loss of TSM/HFSM serial data at ECM	4.34 DTC U1064, U1255
11	U1064	Loss of TSM/HFSM serial data at speedometer	4.34 DTC U1064, U1255
12	U1016	Loss of all ECM serial data (state of health) at TSSM/HFSM	3.23 DTC U1016, U1255
		Loss of all ECM serial data (state of health) at speedometer	3.23 DTC U1016, U1255
		Loss of vehicle speed	4.34 DTC U1064, U1255
		Loss of vehicle inhibit motion	4.34 DTC U1064, U1255
		Loss of powertrain security status	3.23 DTC U1016, U1255
13	U1097	Loss of speedometer serial data at TSM/HFSM	4.35 DTC U1097, U1255
14	U1255	Missing response at TSM/HFSM	3.23 DTC U1016, U1255
15	U1255	Missing response at speedometer	4.35 DTC U1097, U1255
16	P1003	System relay contacts open	4.14 SYSTEM RELAY CHECK
17	P1002	System relay coil high/shorted	4.14 SYSTEM RELAY CHECK
18	P1001	System relay coil open/low	4.14 SYSTEM RELAY CHECK
19	P1004	System relay contacts closed	4.14 SYSTEM RELAY CHECK
20	P1009	Incorrect password	4.30 DTC P1009, P1010
21	P1010	Missing password (starts then stalls)	4.30 DTC P1009, P1010
22	P0373	CKP sensor intermittent	4.25 DTC P0373, P0374

Table 4-8. EFI Diagnostic Trouble Codes (DTC) and Fault Conditions

RANKING	DTC	FAULT CONDITION	SOLUTION
23	P0374	CKP sensor synch error	4.25 DTC P0373, P0374
24	P0122	TP sensor open/low	4.22 DTC P0122, P0123
25	P0123	TP sensor high	4.22 DTC P0122, P0123
26	P0107	MAP sensor open/low	4.19 DTC P0107, P0108
27	P0108	MAP sensor high	4.19 DTC P0107, P0108
28	P1501	Jiffy stand sensor low	4.33 DTC P1501, P1502
29	P1502	Jiffy stand sensor high	4.33 DTC P1501, P1502
30	P0117	ET sensor voltage low	4.21 DTC P0117, P0118
31	P0118	ET sensor open/high	4.21 DTC P0117, P0118
32	P0112	IAT sensor voltage low	4.20 DTC P0112, P0113
33	P0113	IAT sensor open/high	4.20 DTC P0112, P0113
34	P1351	Front ignition coil open/low	4.31 DTC P1351, P1352, P1354, P1355
35	P1354	Rear ignition coil open/low	4.31 DTC P1351, P1352, P1354, P1355
36	P1352	Front ignition coil high/shorted	4.31 DTC P1351, P1352, P1354, P1355
37	P1355	Rear ignition coil high/shorted	4.31 DTC P1351, P1352, P1354, P1355
38	P1357	Front cylinder combustion intermittent	4.18 COMBUSTION ABSENT/INTERMITTENT
39	P1358	Rear cylinder combustion intermittent	4.18 COMBUSTION ABSENT/INTERMITTENT
40	P0261	Front injector open/low	4.24 DTC P0261, P0262, P0263, P0264
41	P0263	Rear injector open/low	4.24 DTC P0261, P0262, P0263, P0264
42	P0262	Front injector high	4.24 DTC P0261, P0262, P0263, P0264
43	P0264	Rear injector high	4.24 DTC P0261, P0262, P0263, P0264
44	P0562	Battery voltage low	4.27 DTC P0562, P0563
45	P0563	Battery voltage high	4.27 DTC P0562, P0563
46	P0501	VSS sensor low	4.26 DTC P0501, P0502
47	P0502	VSS sensor high	4.26 DTC P0501, P0502
48	P1356	Rear cylinder no combustion	4.18 COMBUSTION ABSENT/INTERMITTENT
49	P1353	Front cylinder no combustion	4.18 COMBUSTION ABSENT/INTERMITTENT
50	P0505	Loss of idle speed control	4.16 IDLE AIR CONTROL
51	P1475	Exhaust actuation position sensor	4.32 DTC P1475, P1477, P1478
52	P1477	Exhaust actuator open/low	4.32 DTC P1475, P1477, P1478
53	P1478	Exhaust actuator shorted	4.32 DTC P1475, P1477, P1478
54	P0661	Intake solenoid low/open	4.29 DTC P0661, P0662
55	P0662	Intake solenoid high/shorted	4.29 DTC P0661, P0662
56	P0131	Front O_2 sensor low or engine running lean	4.23 DTC P0131, P0132, P0134, P0151, P0152, P0154
57	P0151	Rear O_2 sensor low or engine running lean	4.23 DTC P0131, P0132, P0134, P0151, P0152, P0154
58	P0132	Engine running rich	4.23 DTC P0131, P0132, P0134, P0151, P0152, P0154
59	P0152	Engine running rich	4.23 DTC P0131, P0132, P0134, P0151, P0152, P0154
60	P0134	Front O_2 sensor open/not responding/high	4.33 DTC P1501, P1502
61	P0154	Rear O_2 sensor open/not responding/high	4.33 DTC P1501, P1502

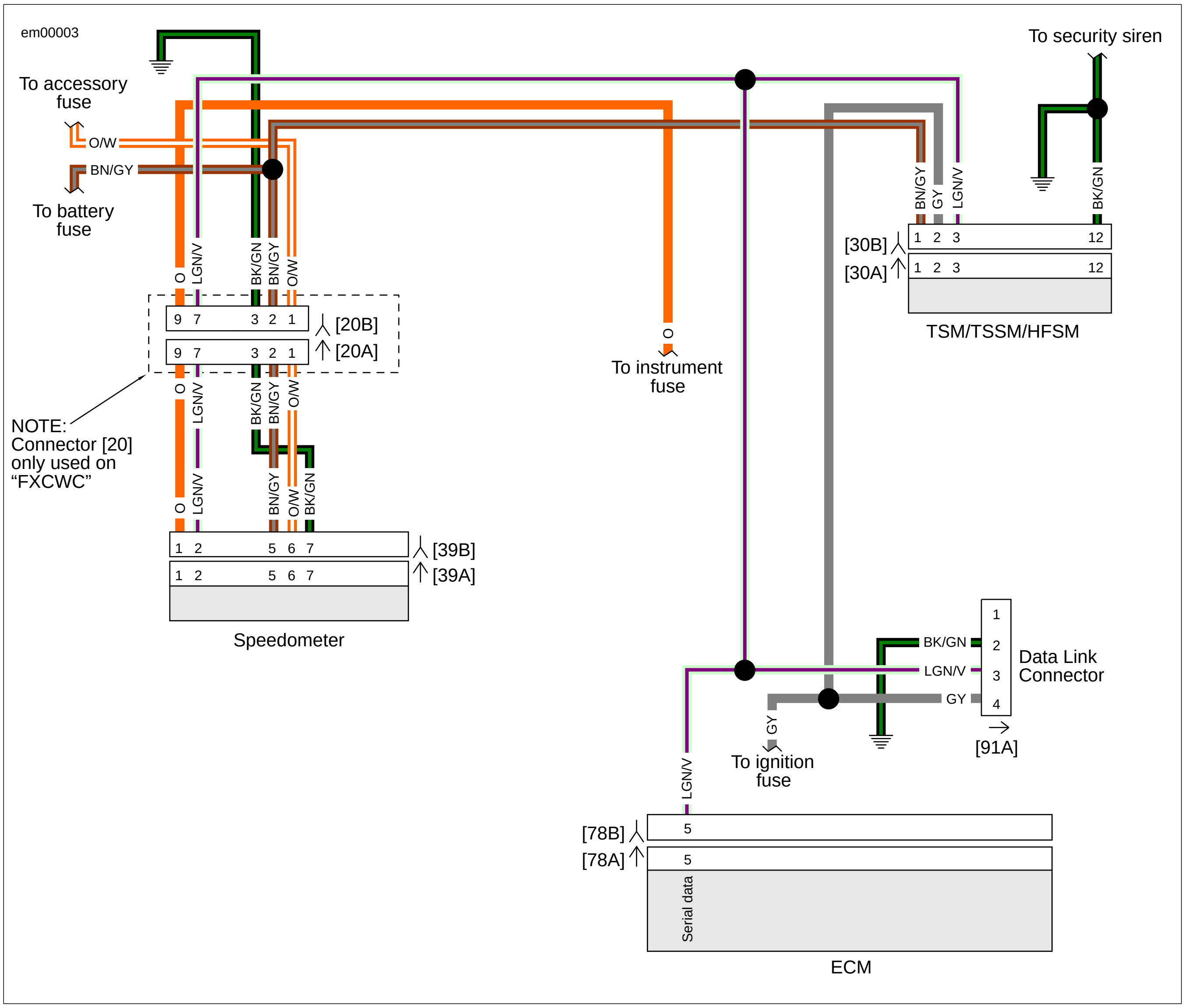
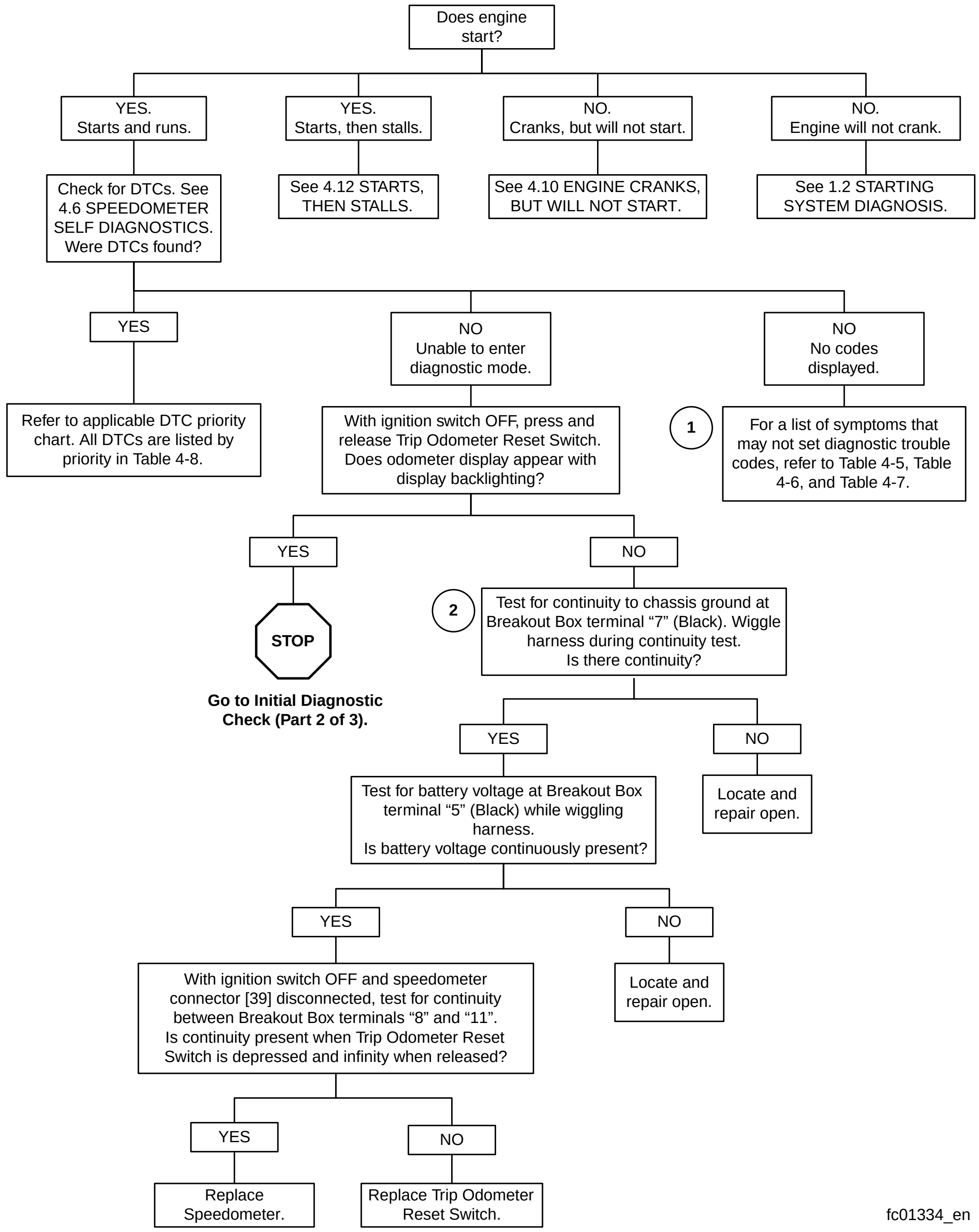


Figure 4-6. Diagnostic Check

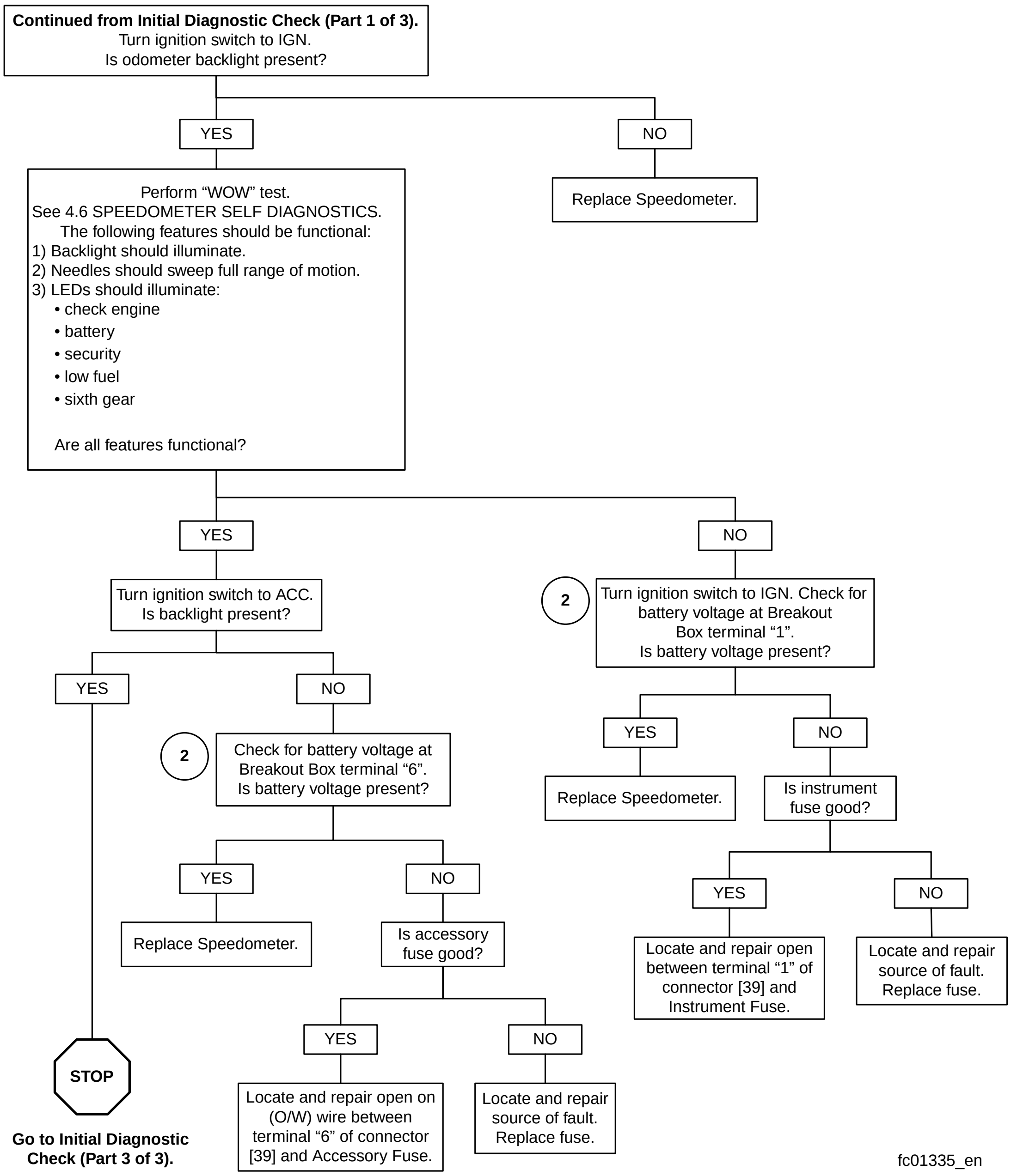
Table 4-9. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat

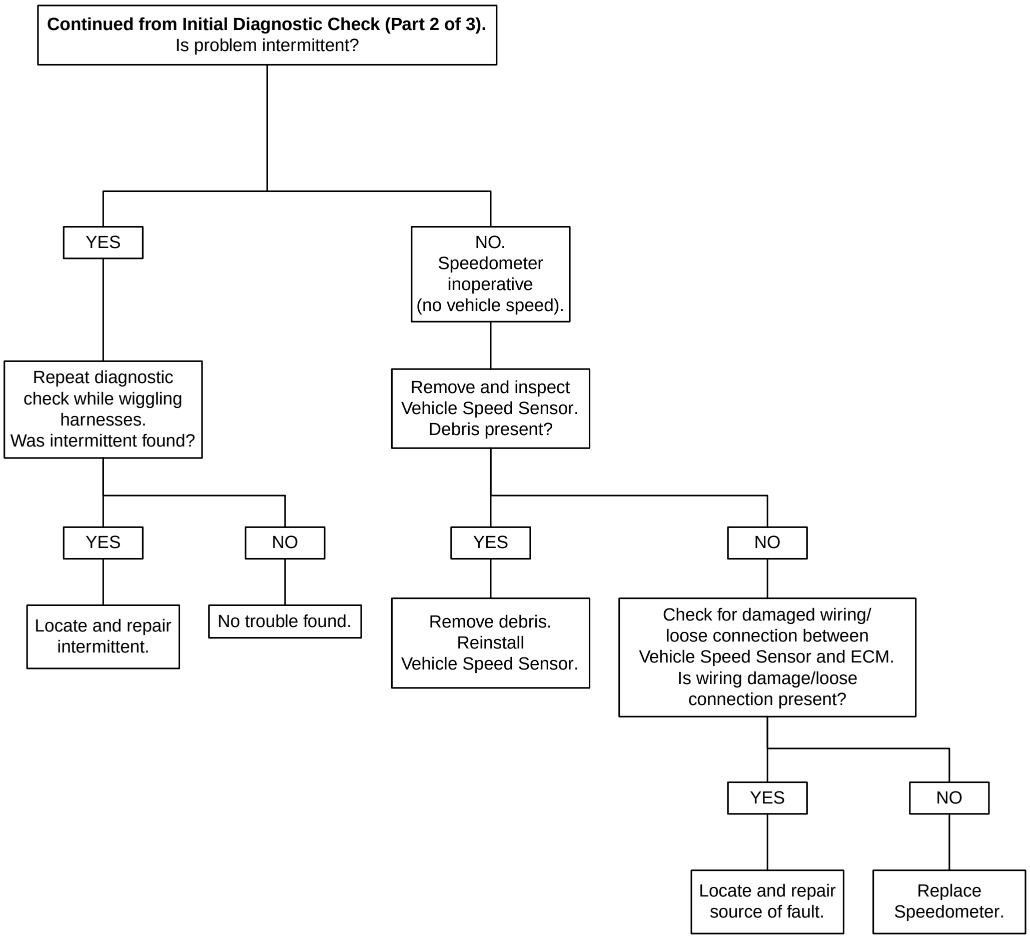
Initial Diagnostic Check (Part 1 of 3)



Initial Diagnostic Check (Part 2 of 3)



Initial Diagnostic Check (Part 3 of 3)



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GENERAL

The speedometer is capable of displaying and clearing speedometer, TSM/TSSM/HFSM, and ECM DTCs (diagnostic mode).

DIAGNOSTICS

Diagnostic Tips

- For a quick check of speedometer function, a "WOW" test can be performed. Press and hold trip odometer reset switch then turn Ignition Switch to IGN. Release trip odometer reset switch. Figure 4-7. Background lighting should illuminate, speedometer needle should sweep its full range of motion, and indicator lamps (battery, security, low fuel, check engine and cruise) should illuminate. Some lamps may illuminate even though they do not apply to the vehicle. For example, the cruise lamp my illuminate although this feature does not apply to Softail models.
- If speedometer fails "WOW" test, check for battery, ground, ignition, trip odometer reset switch and accessory wiring to speedometer. If any feature in the speedometer is non-functional, see 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. To exit diagnostic mode, turn ignition switch OFF.
2. On Softail models with an accessory tachometer, "no rsp" will be displayed during speedometer self diagnostics if tachometer module is chosen, because accessory tachometer does not utilize the serial bus.

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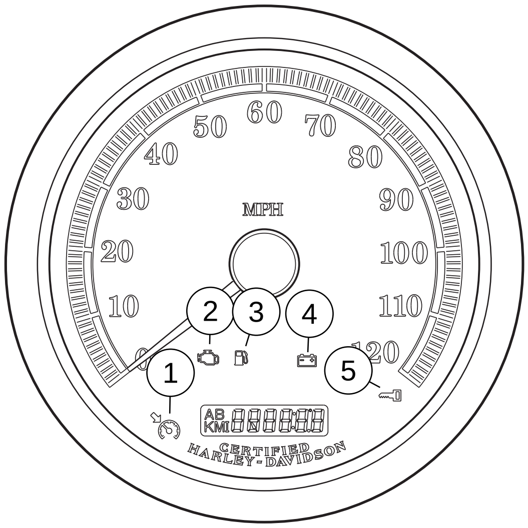
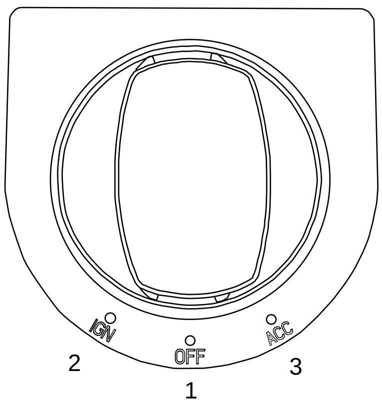


1. **Cruise (not used)**
2. **Check engine lamp**
3. **Low fuel**
4. **Battery**
5. **Security lamp (key icon)**

Figure 4-7. Speedometer

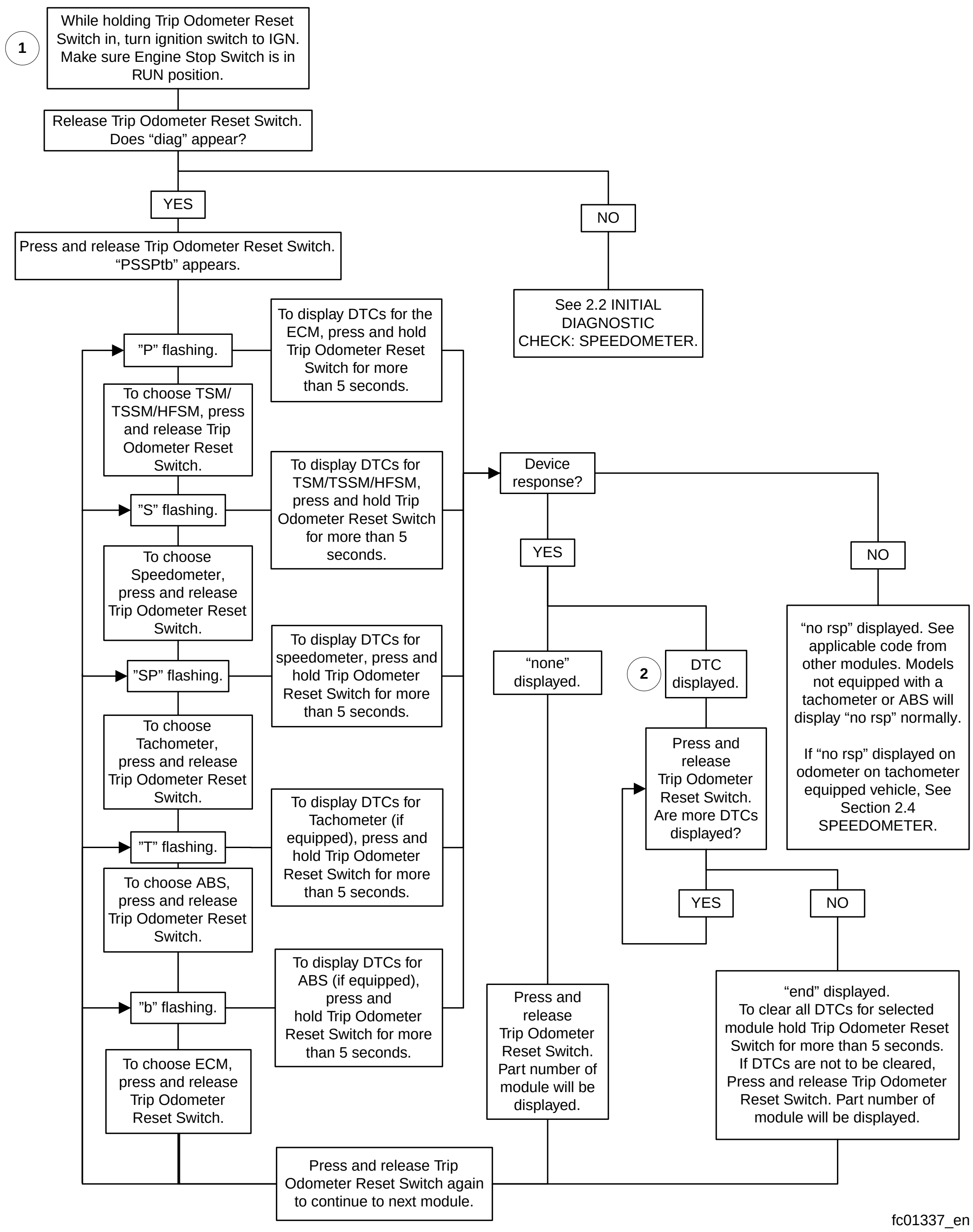
ed01246



1. **Ignition OFF**
2. **Ignition ON**
3. **Marker Lights (ACC) ON**

Figure 4-8. Ignition Switch

Speedometer Self Diagnostics



GENERAL

PART NUMBER	TOOL NAME
HD-43876	BREAKOUT BOX

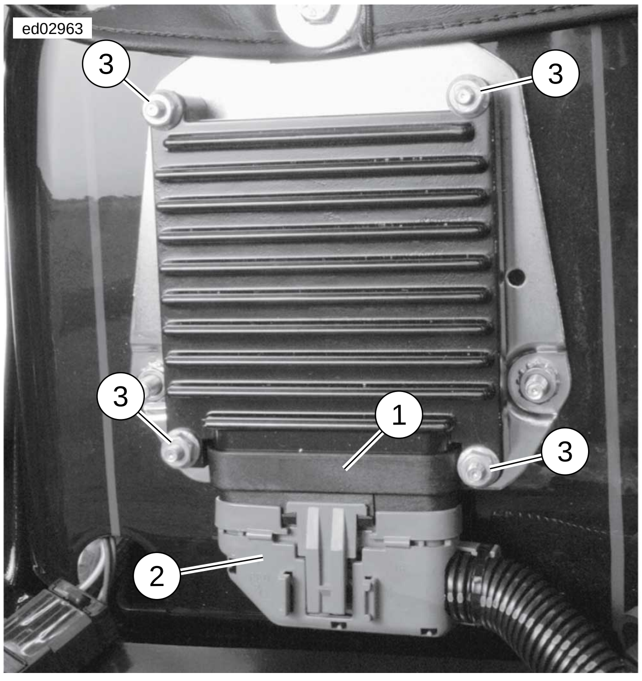
The BREAKOUT BOX (Part No. HD-43876) splices into the main harness. Used in conjunction with a digital volt/ohmmeter DVOM, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects.

NOTE

See wiring diagrams for ECM terminal functions.

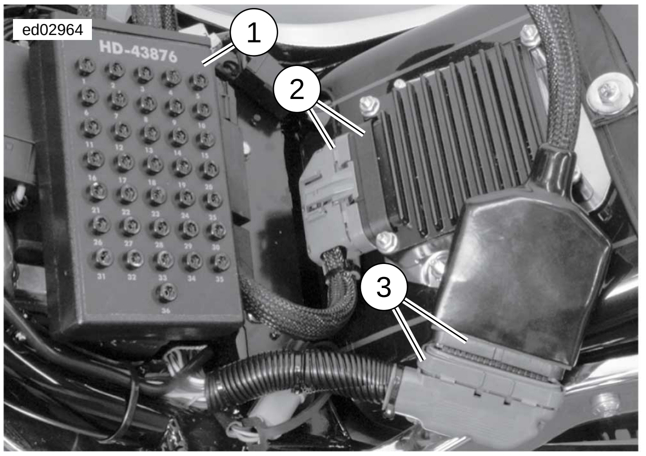
INSTALLATION

1. Remove seat. On FXCWC models, remove rear fender assembly.
2. See Figure 4-9. Remove ECM.
3. Depress latch on connector [78B].
4. See Figure 4-10 or Figure 4-11. Attach Breakout Box (1) to connector.
    a. Attach connector from Breakout Box to ECM connector.
    b. Attach connector from the wiring harness to connector on Breakout Box.



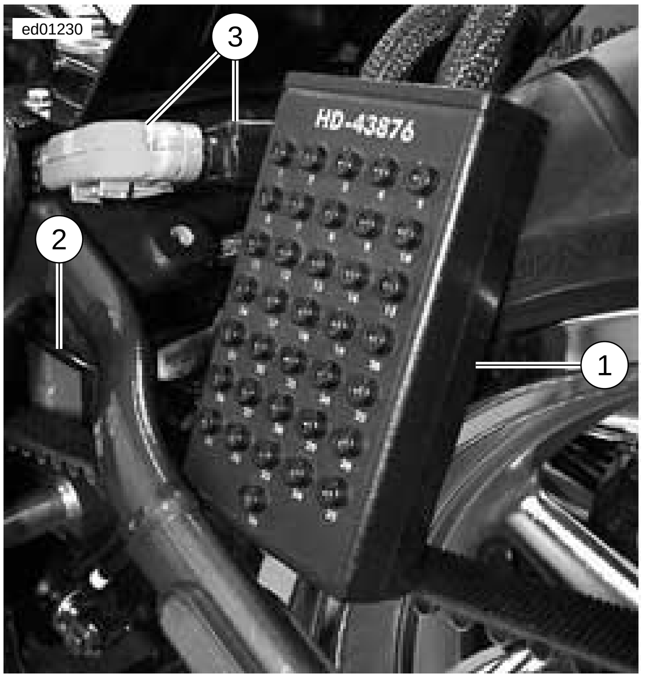
1. **ECM connector [78A]**
2. **ECM connector [78B]**
3. **Fastener (4)**

Figure 4-9. ECM mount



1. **Breakout Box**
2. **ECM connection**
3. **Wiring harness connection**

Figure 4-10. Installed Breakout Box (Softail)



1. **Breakout Box**
2. **ECM connector**
3. **Wiring harness connection**

Figure 4-11. Installed Breakout Box (FXCWC)

REMOVAL

1. See Figure 4-10 or Figure 4-11. Depress latch on ECM connection.
2. Detach Breakout Box connector from ECM connector.
3. Detach Breakout Box connector from wiring harness.
4. Reattach ECM connector to wiring harness.

WARNING

After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

5. Install seat (on FXCWC install rear fender first, then install seat).

GENERAL

The wiggle test indicates the presence of intermittents in a wiring harness.

PROCEDURE

PART NUMBER	TOOL NAME
HD-43876	BREAKOUT BOX

NOTE

When diagnosing Electronic Control Module (ECM) connections, use a BREAKOUT BOX (Part No. HD-43876) to simplify the procedure. See 4.7 BREAKOUT BOX: EFI.

1. See Figure 4-12. Connect digital volt/ohmmeter (DVOM) to wiring harness between the suspect connections. Set DVOM to read voltage changes.
2. Start motorcycle engine and run at idle.
3. Shake or wiggle harness to detect intermittents. If intermittents are present, radical voltage changes will register on the DVOM.

sm00202

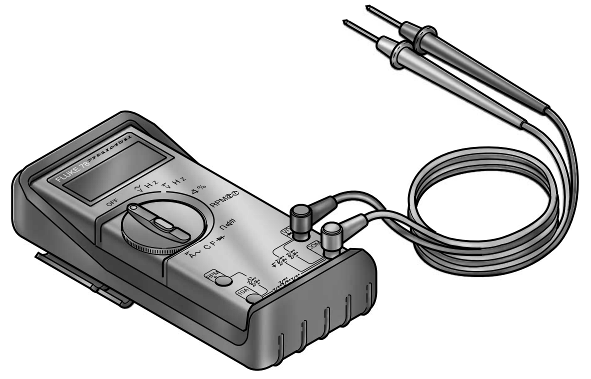


Figure 4-12. Fluke 78 Multimeter (DVOM) (Part No. HD-39978)

GENERAL

⚠WARNING

Do not allow open flame or sparks near propane. Propane is extremely flammable, which could cause death or serious injury. (00521b)

To prevent false readings, keep airbox cover installed when performing test.

Do not direct propane into air cleaner, false readings will result.

LEAK TESTER

PART NUMBER	TOOL NAME
HD-41417	PROPANE ENRICHMENT KIT

Parts List

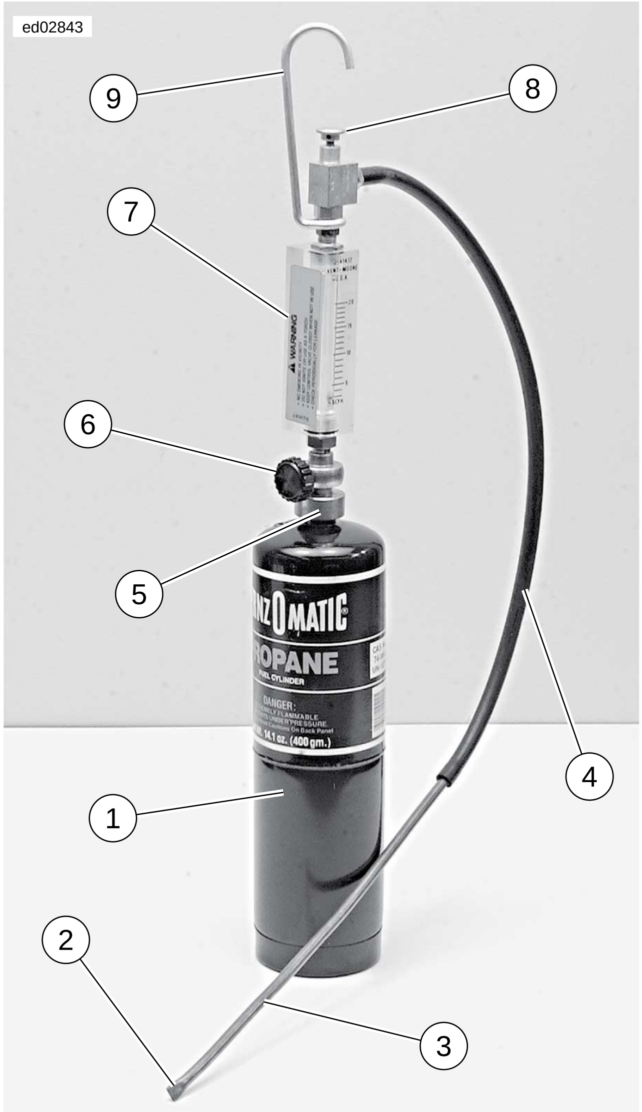
- Standard 14 oz. propane cylinder.
- PROPANE ENRICHMENT KIT (Part No. HD-41417).

Tester Assembly

1. See Figure 4-13. Make sure valve knob (6) is closed (fully clockwise).
2. Screw valve assembly (5) onto propane bottle (1).

Tester Adjustment

1. See Figure 4-13. Press and hold trigger button (8).
2. Slowly open valve knob (6) until pellet in flow gauge (7) rises to between 5 and 10 SCFH on gauge.
3. Release trigger button.



1. **Propane bottle**
2. **Nozzle**
3. **Copper tube**
4. **Hose**
5. **Valve assembly**
6. **Valve knob**
7. **Flow gauge**
8. **Trigger button**
9. **Hanger**

Figure 4-13. Leak Tester

PROCEDURE

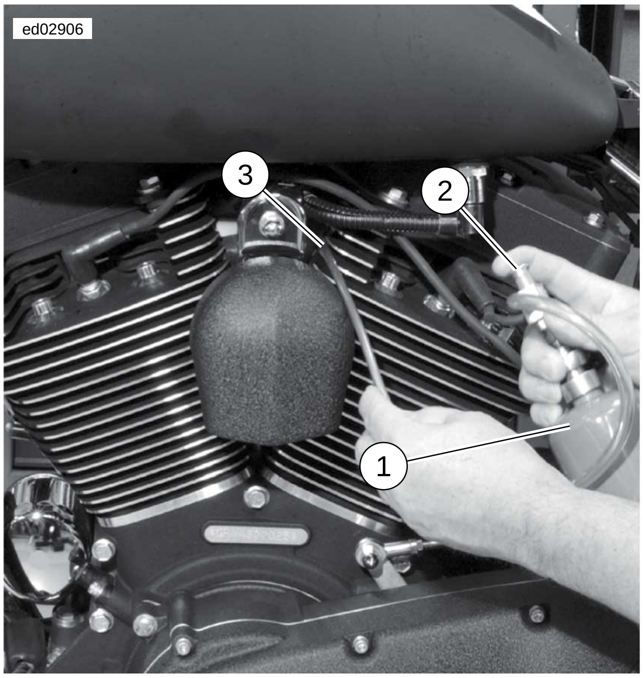
1. Start engine.
2. Warm engine to operating temperature.

NOTE

Do not direct propane stream toward front of engine. If propane enters air cleaner, a false reading will be obtained.

3. See Figure 4-14. Aim nozzle (3) toward possible sources of leak such as intake manifold mating surfaces.

4. Push trigger button (2) to release propane. Tone of engine will change when propane enters source of leak.
5. When test is finished, release trigger button and close valve knob (turn knob fully clockwise).



1. **Propane bottle**
2. **Trigger button**
3. **Nozzle**

Figure 4-14. Checking for Leaks (Softail shown, FXCWC similar)

ENGINE CRANKS, BUT WILL NOT START 4.10

GENERAL

If the starter will not crank the engine, the problem is not EFI related. Refer to CHAPTER 1 - STARTING & CHARGING or CHAPTER 3 - TSM/HFSM.

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-26792	SPARK TESTER
HD-34730-2C	FUEL INJECTOR TEST LAMP
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX
HD-44687	IGNITION COIL CIRCUIT TEST ADAPTER
MCR-101 HD	ELECTRICAL SYSTEM ANALYZER

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Check for Diagnostic Trouble Codes (DTCs). See 4.4 CHECKING FOR DIAGNOSTIC TROUBLE CODES: EFI, Retrieving Diagnostic Trouble Codes.
2. Check the condition of the battery. Perform a voltage test and recharge if below 12.60V. Check battery connections and perform either a conductance test (using ELECTRICAL SYSTEM ANALYZER (Part No. MCR-101 HD)) or load test. Replace the battery if necessary. See Battery in the Service Manual.
3. Connect BREAKOUT BOX (Part No. HD-43876). See 4.7 BREAKOUT BOX: EFI.
4. Remove spark plug cable from spark plug.
   a. Visually check condition of plug.
   b. See Figure 4-15. Attach cable to SPARK TESTER (Part No. HD-26792). Clip tester to cylinder head bolt.
   c. While cranking engine, look for spark. Repeat procedure on other spark plug cables.

NOTE

Engine will not spark with both spark plugs removed. When checking for spark, use SPARK TESTER (Part No. HD-26792) with both plugs installed.

5. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord.
6. See Figure 4-16. Plug IGNITION COIL CIRCUIT TEST ADAPTER (Part No. HD-44687) and FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C) into Breakout Box terminals "13" and "11". Start engine. If lamp flashes, no problem is found. Repeat for Breakout Box terminals "13" and "29".
7. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown socket probe and patch cord.

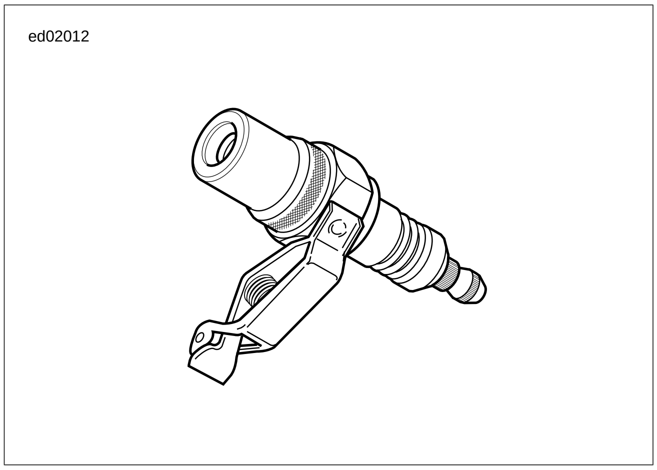


Figure 4-15. Spark Tester

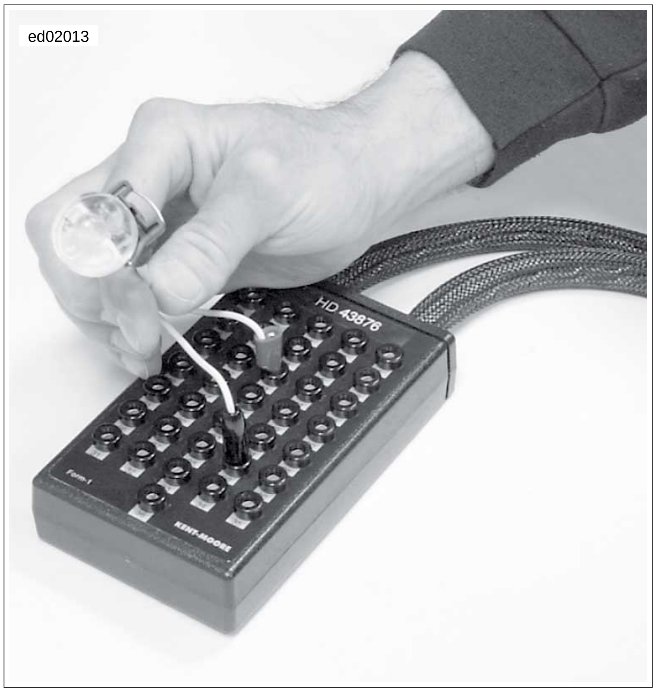


Figure 4-16. Ignition Coil Circuit Test

Diagnostic Tips

Check TP sensor value with a digital volt/ohmmeter (DVOM). If TP sensor is equal to or greater than 3.8 volts, system is in "clear flood" mode and engine will not start. While spark is present, fuel is shut off. Problem can be mechanical, such as throttle cables stuck

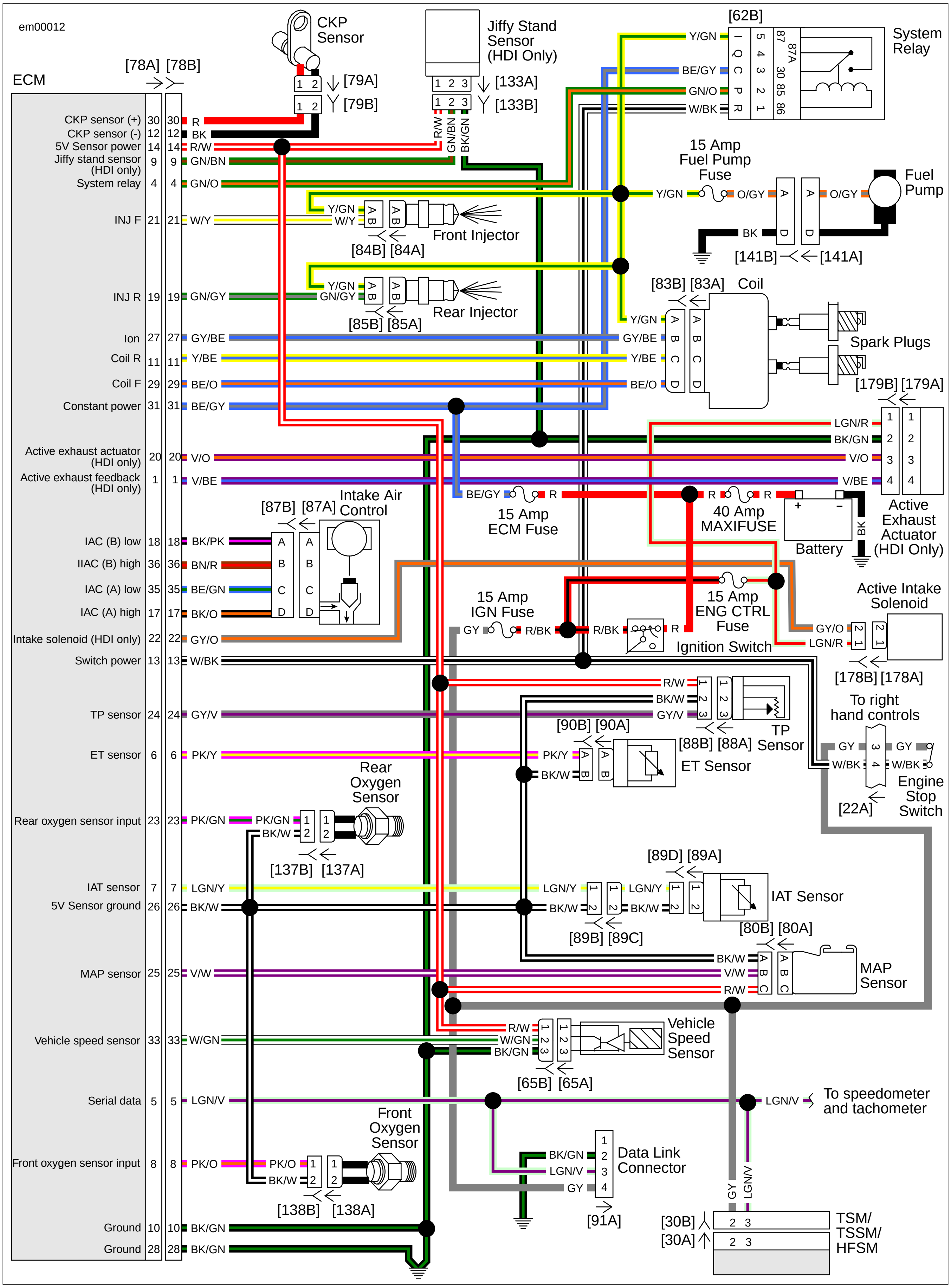
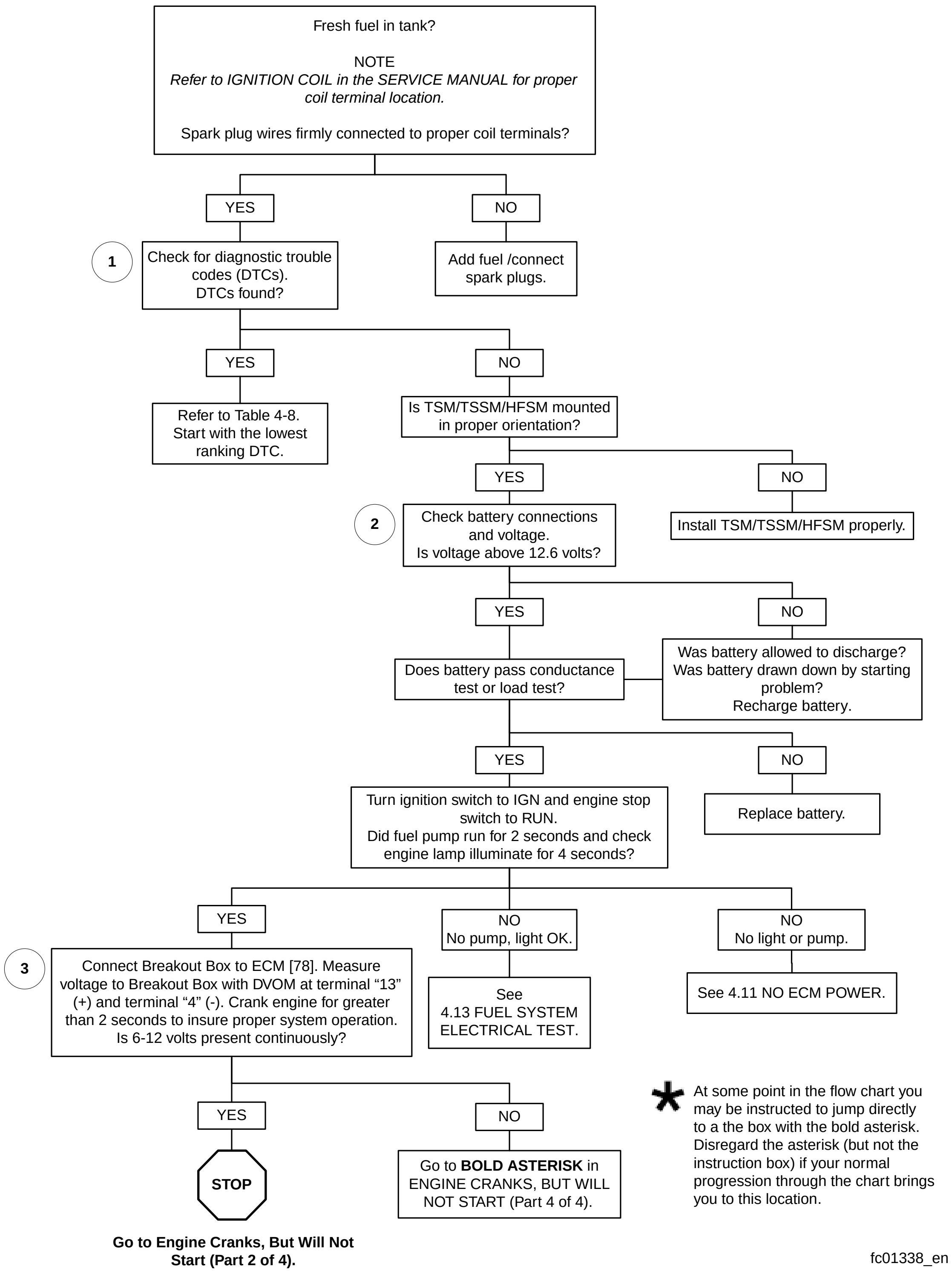


Figure 4-17. EFI Circuit Diagram

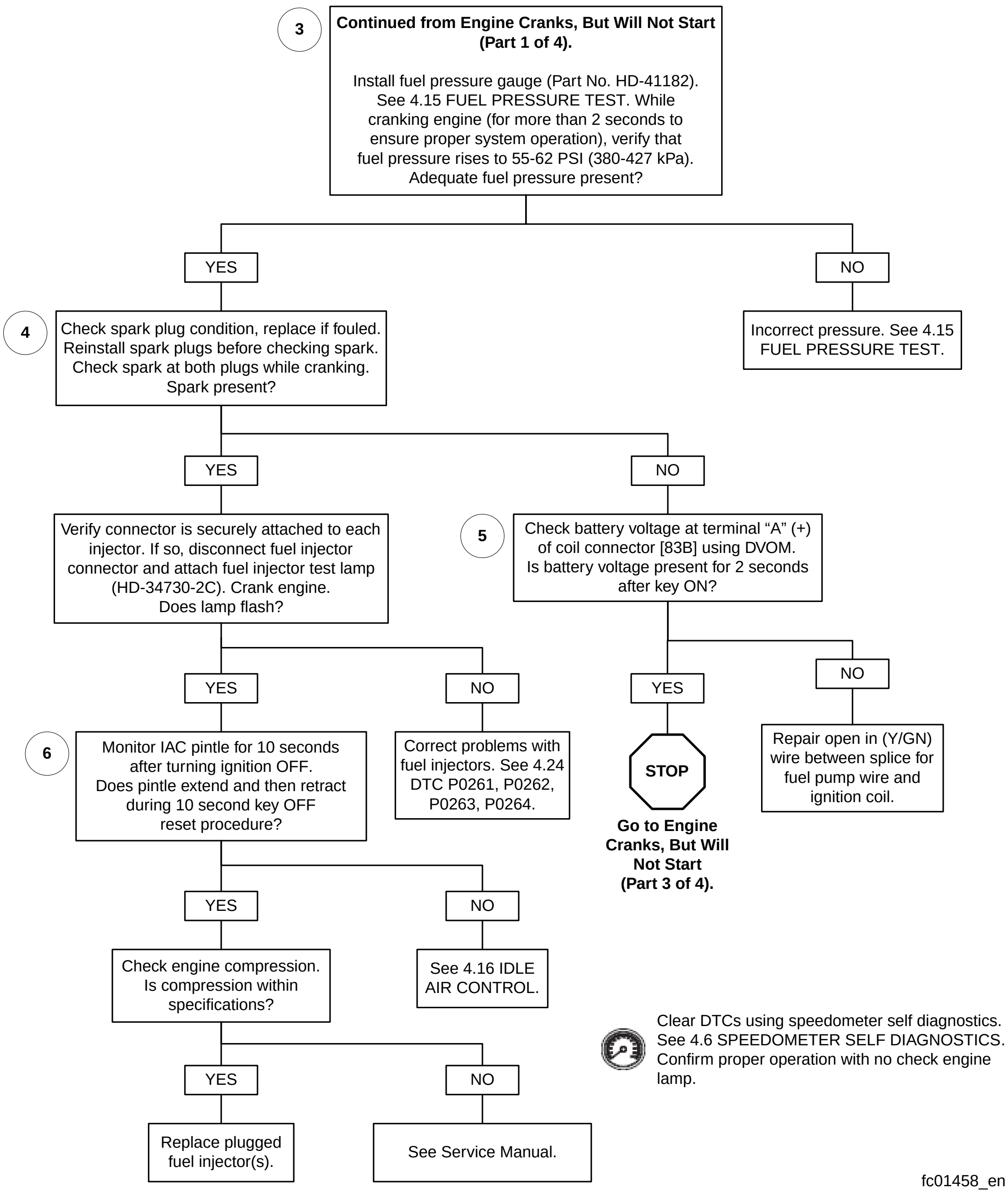
Table 4-10. Wire Harness Connectors

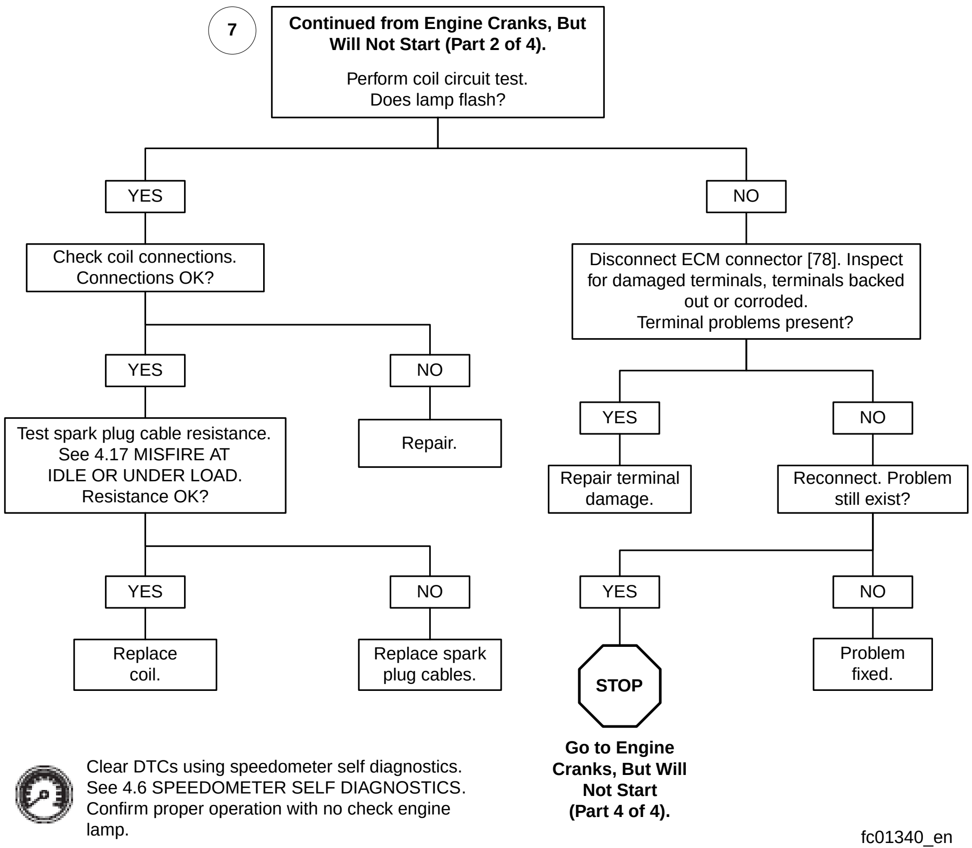
NO.	DESCRIPTION	TYPE	LOCATION
[22]	Right hand controls	6-place Molex	Under fuel tank, right side
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[62]	System relay	5-place Amp	Under seat, in fuse block
[65]	Vehicle Speed Sensor (VSS)	3-place Delphi	Top of transmission
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[79]	Crankshaft Position (CKP) sensor	2-place Mini-Deutsch	Back of voltage regulator bracket
[80]	Manifold Absolute Pressure (MAP) sensor	3-place Packard	Top of manifold
[83]	Ignition coil	4-place Delphi	Back of coil
[84]	Front fuel injector	2-place Delphi	Beneath fuel tank
[85]	Rear fuel injector	2-place Delphi	Beneath fuel tank
[87]	Intake Air Control (IAC) sensor	4-place Packard	Beneath fuel tank
[88]	Throttle Position (TP) sensor	3-place Delphi	Behind air cleaner backing plate
[89]	Intake Air Temperature (IAT) sensor	2-place Delphi	Behind air cleaner backing plate
[90]	Engine Temperature (ET) sensor	2-place Delphi	Back of front cylinder, left side
[91]	Data link connector	4-place Deutsch	Under seat
[133]	Jiffy Stand Sensor	3-place Molex	Left side along frame, toward front of engine
[137]	Rear oxygen sensor	2-place Amp	Under oil tank
[138]	Front oxygen sensor	2-place Amp	Behind voltage regulator
[141]	Fuel pump	4-place Packard	Top of fuel tank
[178]	Active intake solenoid	2-place Amp	Air cleaner backing plate
[179]	Active Exhaust Actuator (AEA)	5-place Amp	Exhaust bracket

Engine Cranks, But Will Not Start (Part 1 of 4)

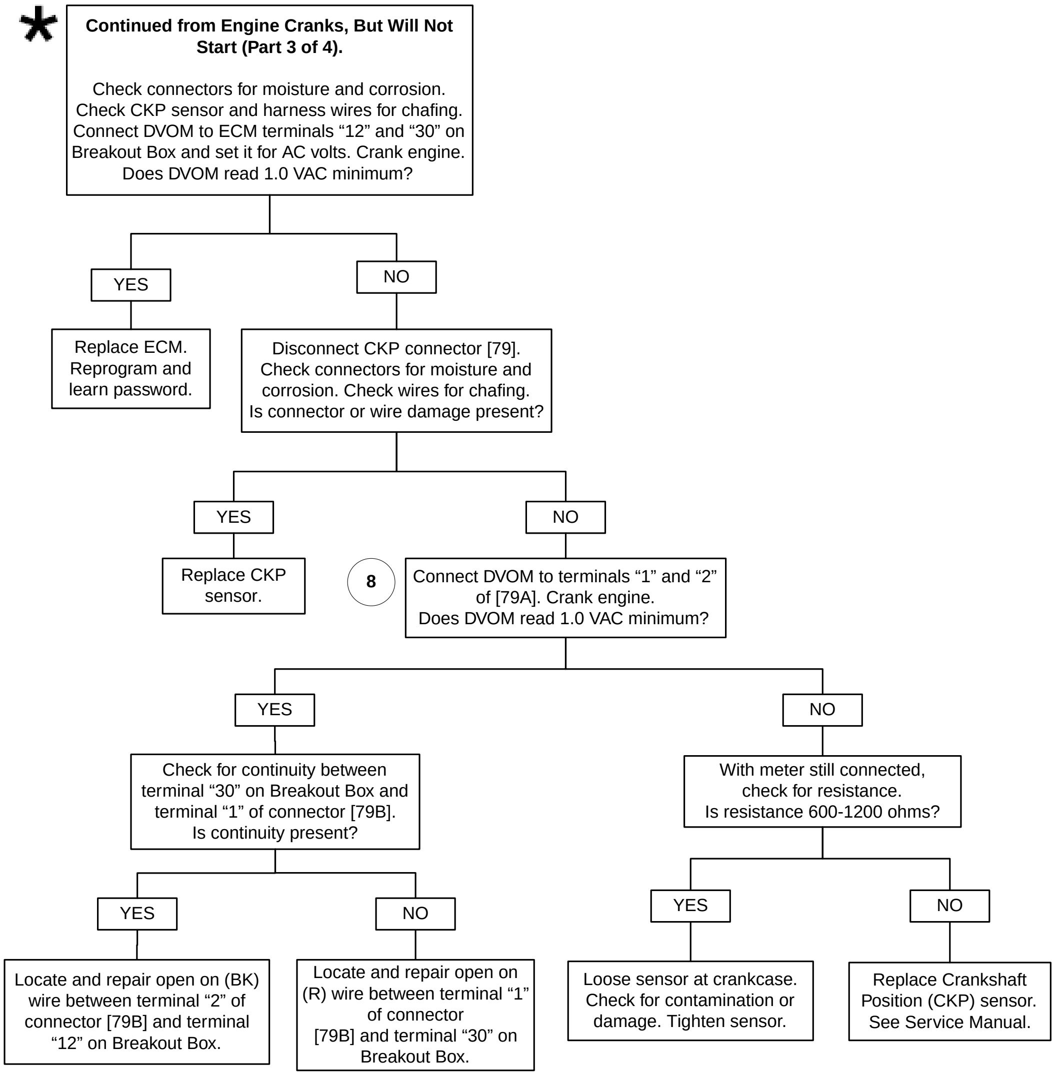


Engine Cranks, But Will Not Start (Part 2 of 4)




7
Continued from Engine Cranks, But Will Not Start (Part 2 of 4).
Perform coil circuit test.
Does lamp flash?
YES
Check coil connections.
Connections OK?
YES
Test spark plug cable resistance.
See 4.17 MISFIRE AT IDLE OR UNDER LOAD.
Resistance OK?
YES
Replace coil.
NO
Replace spark plug cables.
NO
Repair.
NO
Disconnect ECM connector [78]. Inspect for damaged terminals, terminals backed out or corroded.
Terminal problems present?
YES
Repair terminal damage.
NO
Reconnect. Problem still exist?
YES
STOP
Go to Engine Cranks, But Will Not Start (Part 4 of 4).
NO
Problem fixed.
Clear DTCs using speedometer self diagnostics. See 4.6 SPEEDOMETER SELF DIAGNOSTICS. Confirm proper operation with no check engine lamp.
fc01340_en

Engine Cranks, But Will Not Start (Part 4 of 4)



Clear DTCs using speedometer self diagnostics.
See 4.6 SPEEDOMETER SELF DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

fc01459_en

GENERAL

No Spark/No Check Engine Lamp at Key On

Constant power is supplied to the ECM through terminal "31". The ECM turns on when power is applied to terminal "13" of connector [78]. The ECM goes through an initialization sequence every time power is removed and re-applied to terminal "13". The only visible part of this sequence is the check engine lamp. Upon starting, the check engine lamp will illuminate for 4 seconds and then (if parameters are normal) go out.

If battery power is absent at ECM terminal "31":

- DTCs cannot be cleared. Tool will show them as cleared but will be present next time Ignition Switch is cycled.
- ECM cannot be re-flashed.
- Vehicle will start but IAC pintle will not reset at Ignition Switch OFF. Eventually pintle will be out of position causing performance problems.

NOTE

The Ignition Switch ON sequence also activates the IAC motor. If power from terminal "31" is disrupted (blown fuse, etc.) always turn the Ignition Switch OFF, wait 10 seconds, then turn the Ignition Switch ON to reset the motor to the default position.

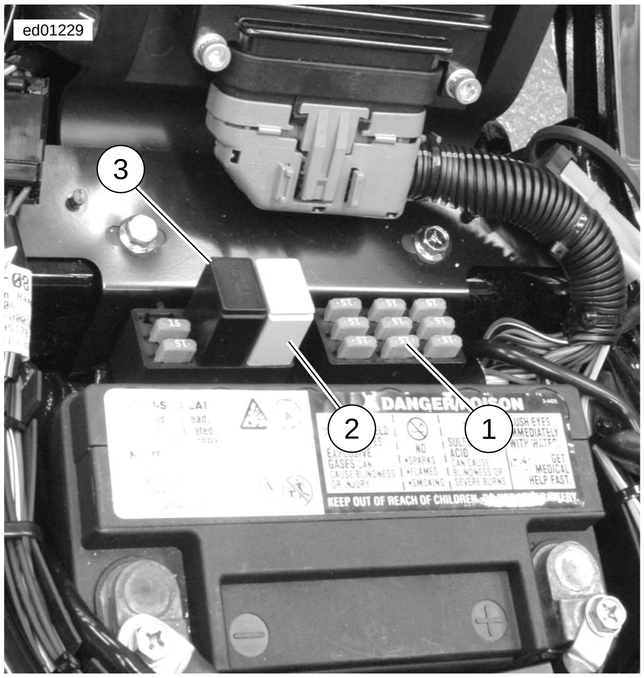
DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Notes

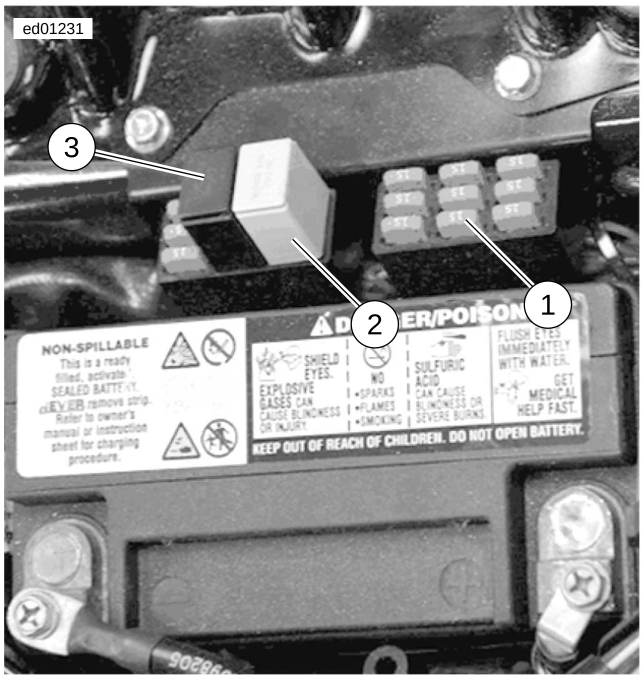
Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-43876). See [4.7 BREAKOUT BOX: EFI](#).
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B); gray probes and patch cords.



1. **Fuse block**
2. **Starter relay**
3. **System relay**

Figure 4-18. Fuse Holder and Relays



1. **Fuse block**
2. **Starter relay**
3. **System relay**

Figure 4-19. Fuse Holder and Relays (FXCWC)

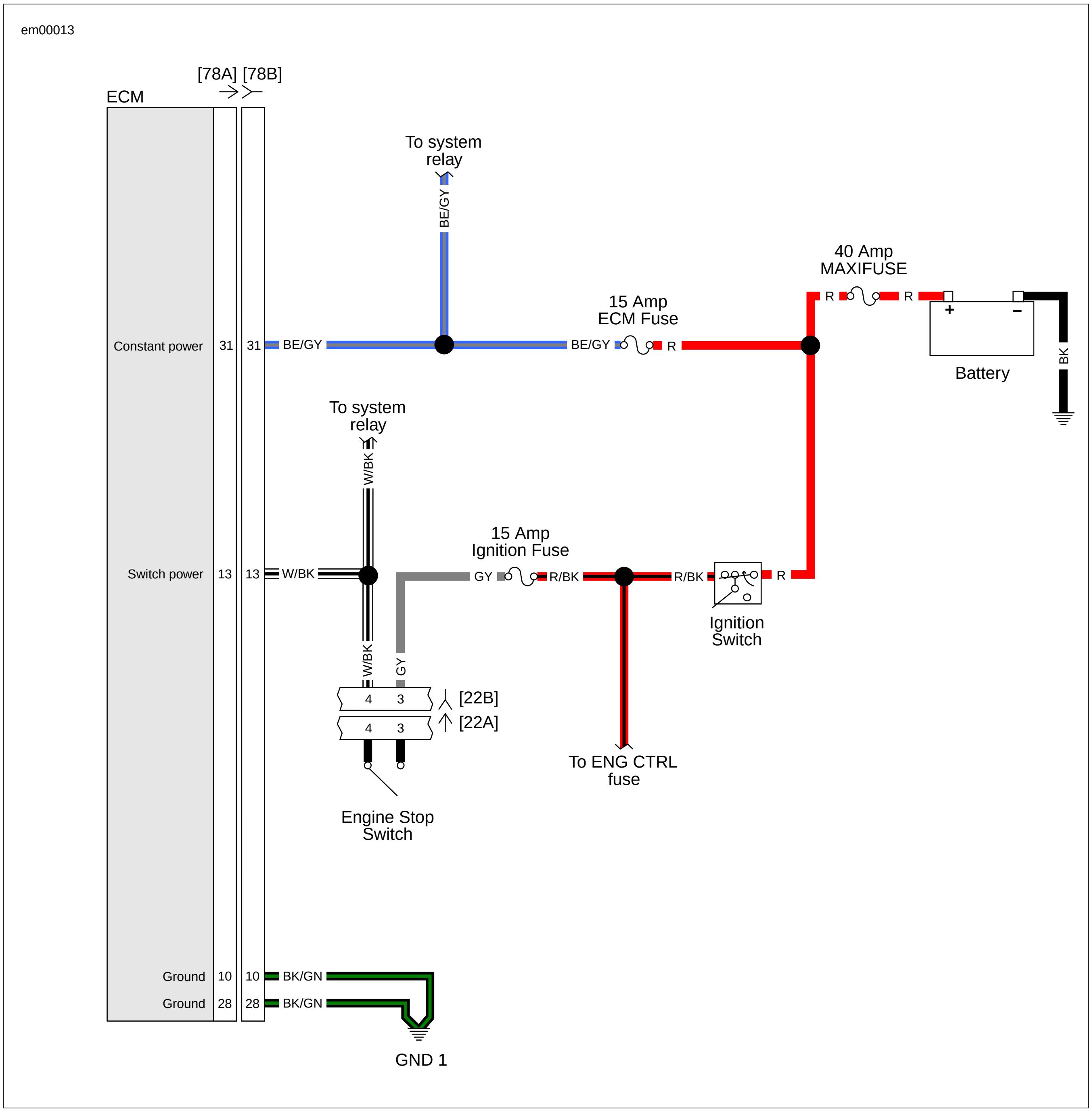
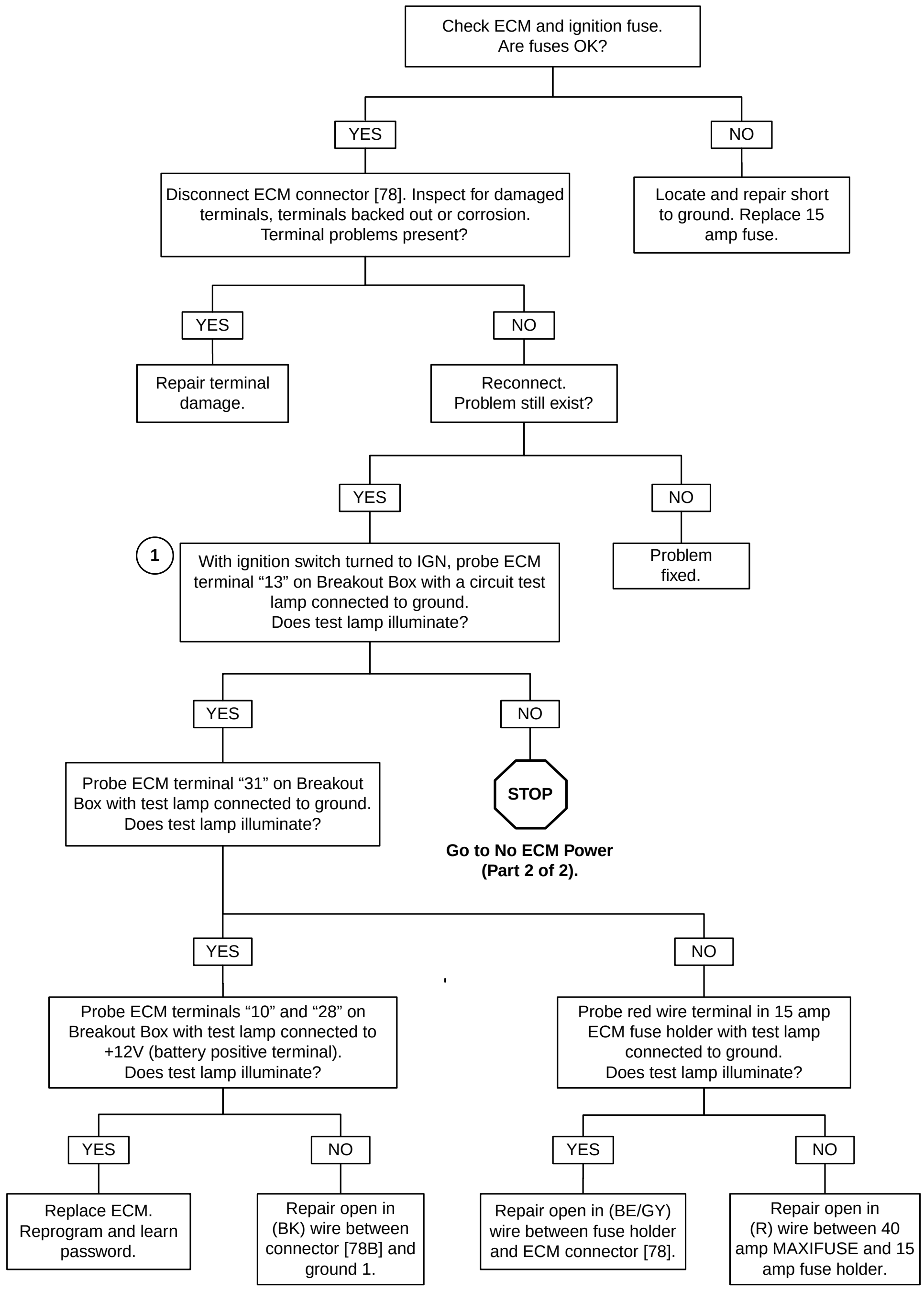


Figure 4-20. ECM Power Circuit Diagram

Table 4-11. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Right hand controls	6-place Molex	Under fuel tank, right side
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[GND 1]	ECM ground	Ring terminal	Under seat

No ECM Power (Part 1 of 2)



fc01342_en

No ECM Power (Part 1 of 2)

2

Continued from No ECM Power (Part 1 of 2).
With ignition switch turned to IGN, measure voltage at terminal "3" (GY) of connector [22B].
Is battery voltage present?

YES

With ignition switch OFF and Engine Stop Switch in RUN position, measure resistance at terminals "3" and "4" of connector [22A].
Resistance less than one ohm?

YES

Repair open circuit on (W/BK) wire between ECM and connector [22A].

NO

Repair/Replace engine stop switch or wiring.

NO

Repair open (GY) wire between connector [22] and fuse.

Clear DTCs using speedometer self diagnostics.
See 4.6 SPEEDOMETER SELF DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

fc01343_en

GENERAL

Diagnostic Trouble Codes U1300, U1301, or BUS ER

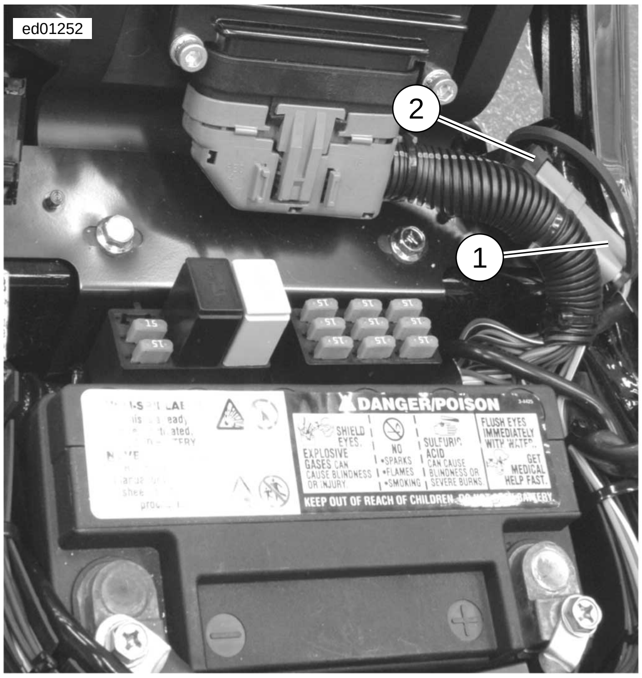
See Figure 4-21 or Figure 4-22. The typical serial data voltage range is 0 volt (inactive) to 7 volts (active). Due to the short pulse, voltages will be much lower on a DVOM. In analog mode, a DVOM reading serial data will show continuous voltage when active, typically 0.6-0.8 volt. The range for acceptable operations is greater than 0 and less than 7.0 volts.

NOTE

Problems in the fuel system or idle air control system may also create this symptom.

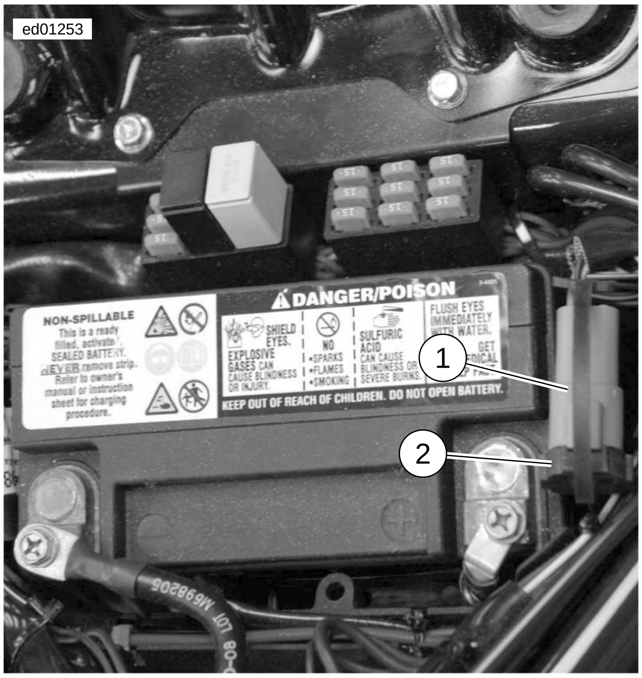
Table 4-12. Code Description

DTC	DESCRIPTION
U1300	Serial data low
U1301	Serial data open/high



1. **Data link connector [91A]**
2. **Protective rubber plug**

Figure 4-21. Data Link Connector [91A]



1. **Data link connector [91A]**
2. **Protective rubber plug**

Figure 4-22. Data Link Connector [91A] (FXCWC)

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT

Diagnostic Tips

- If serial data is shorted, these codes will automatically trip the check engine light.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Unplug the neutral switch connector [131]. Using a DVOM, test for continuity between terminals "A" and "B" of the Neutral Switch. When the transmission is in neutral, continuity should exist. When transmission is in gear, there should not be continuity through the Neutral Switch.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), black socket probes and patch cord.

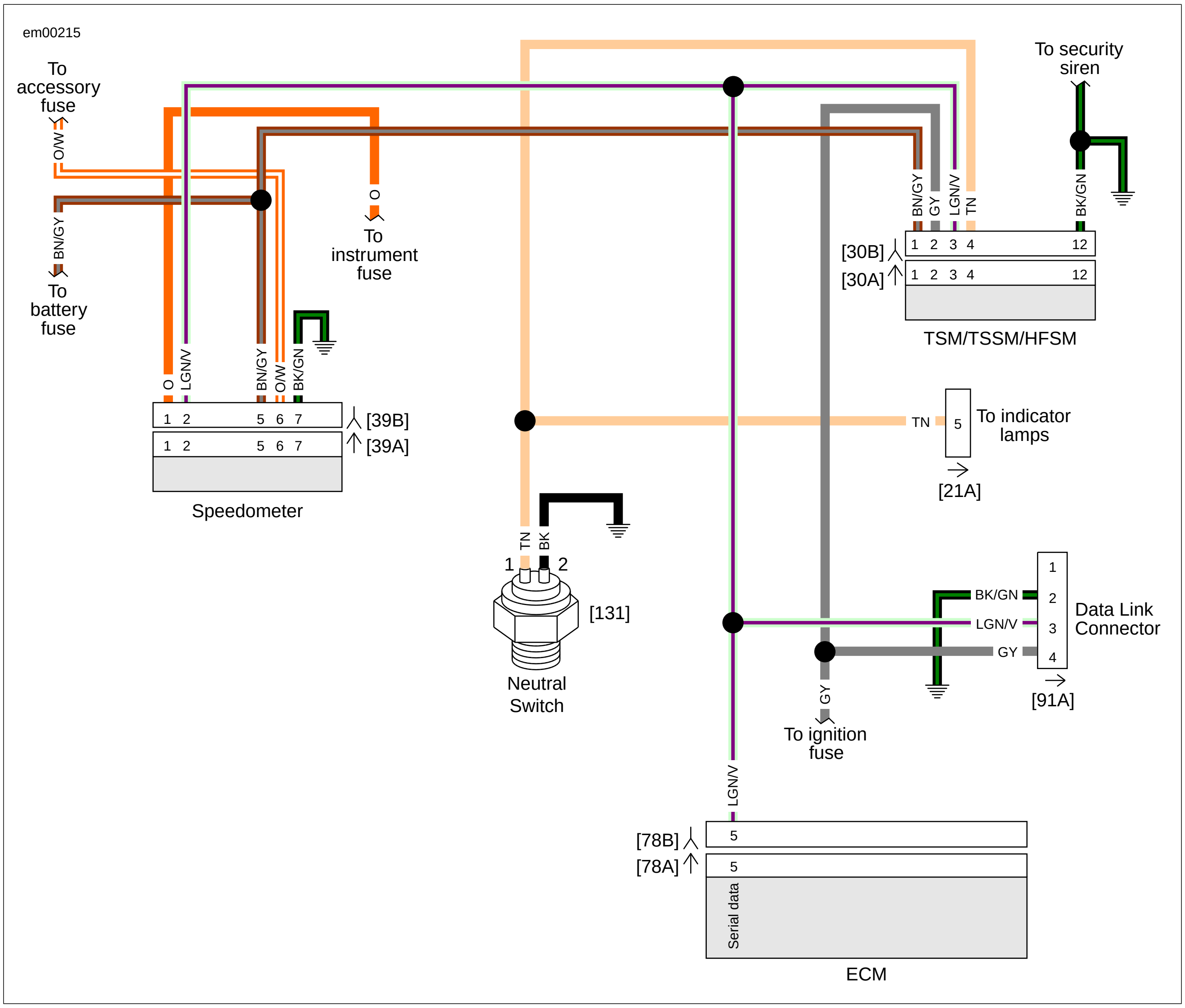


Figure 4-23. Serial Data Circuit (all except FXCWC)

Table 4-13. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[21A]	Indicator lamps	8-place Mini-Deutsch	Under fuel tank console
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat
[131]	Neutral switch	Post terminals	Top of transmission

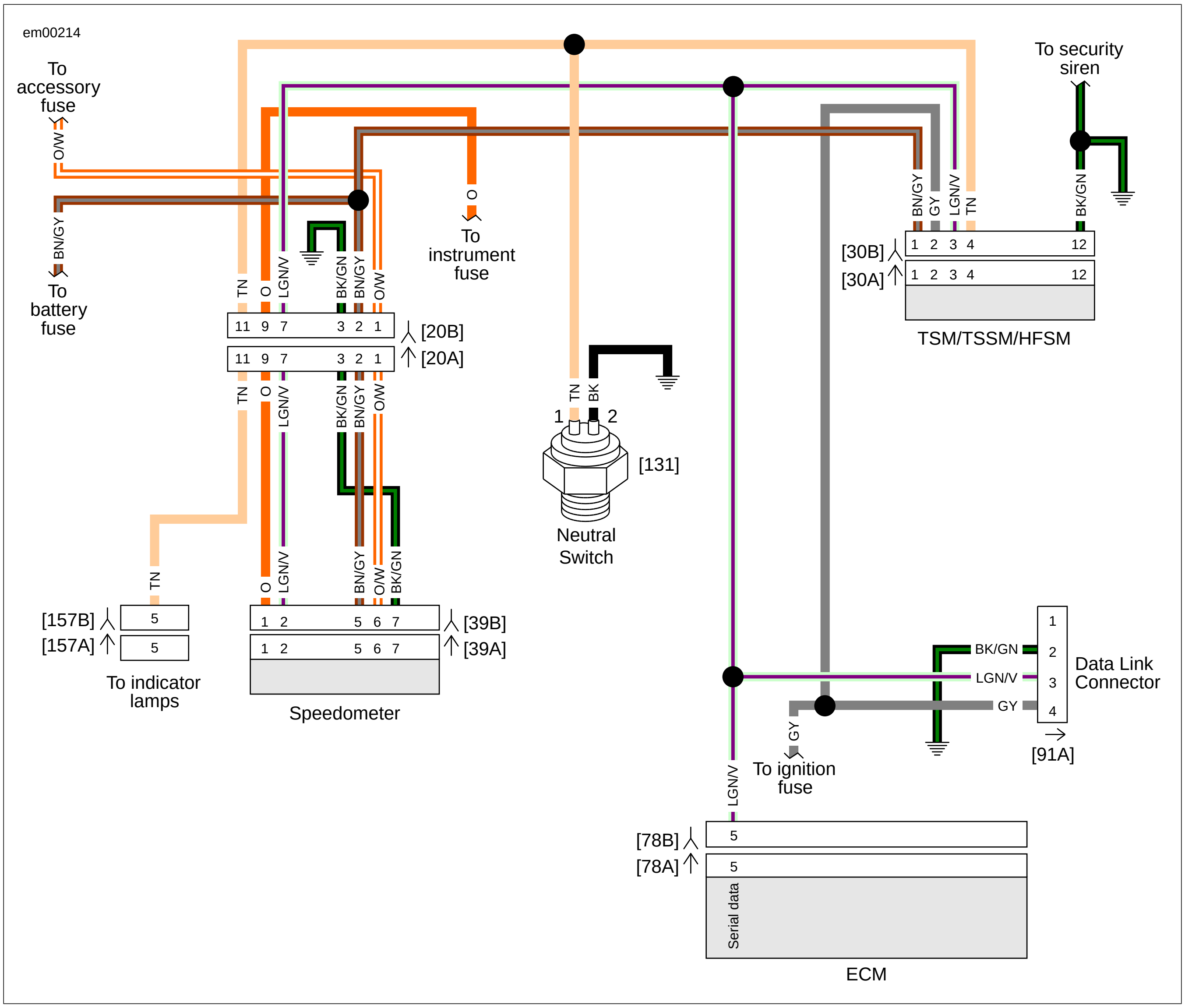
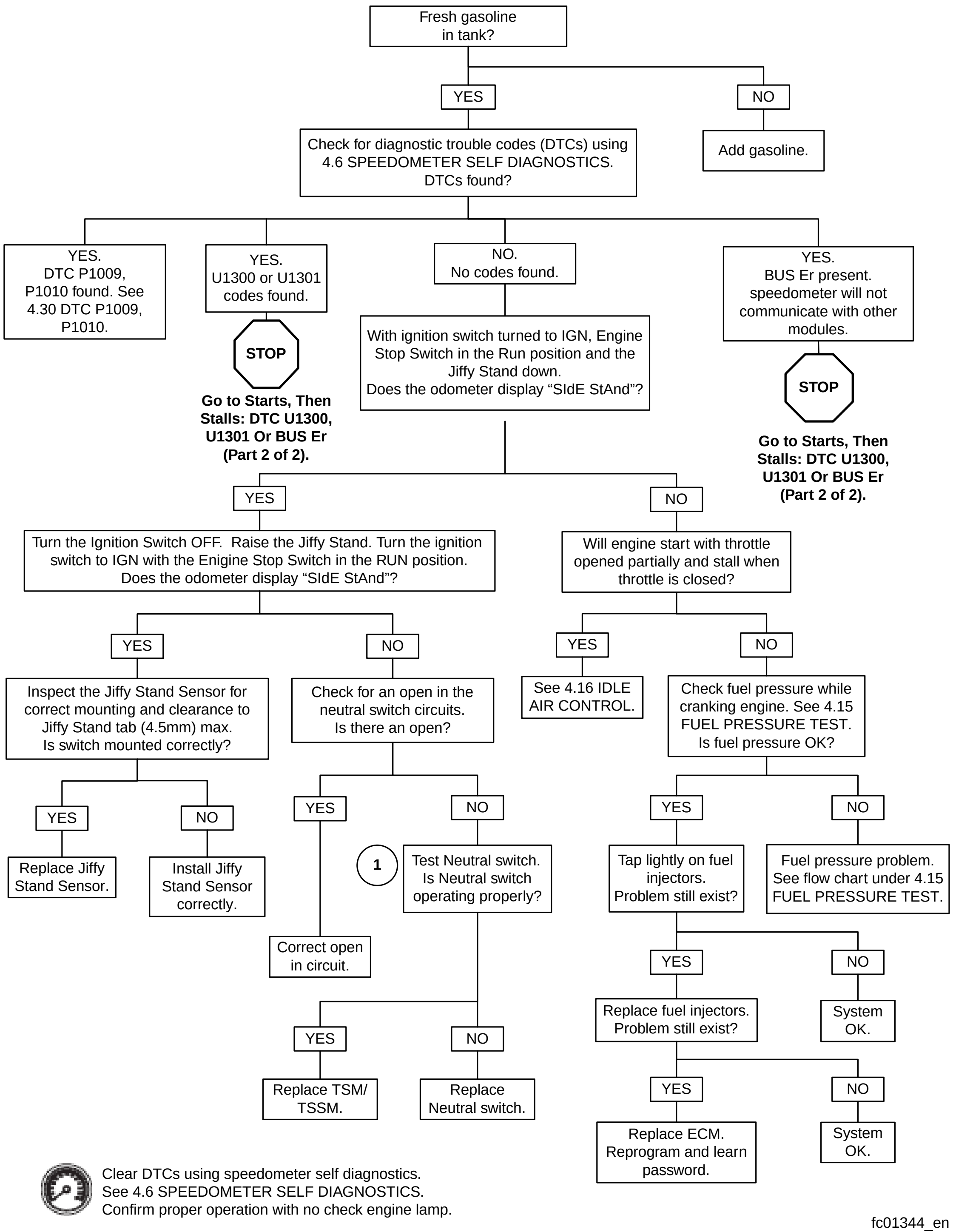


Figure 4-24. Serial Data Circuit (FXCWC)

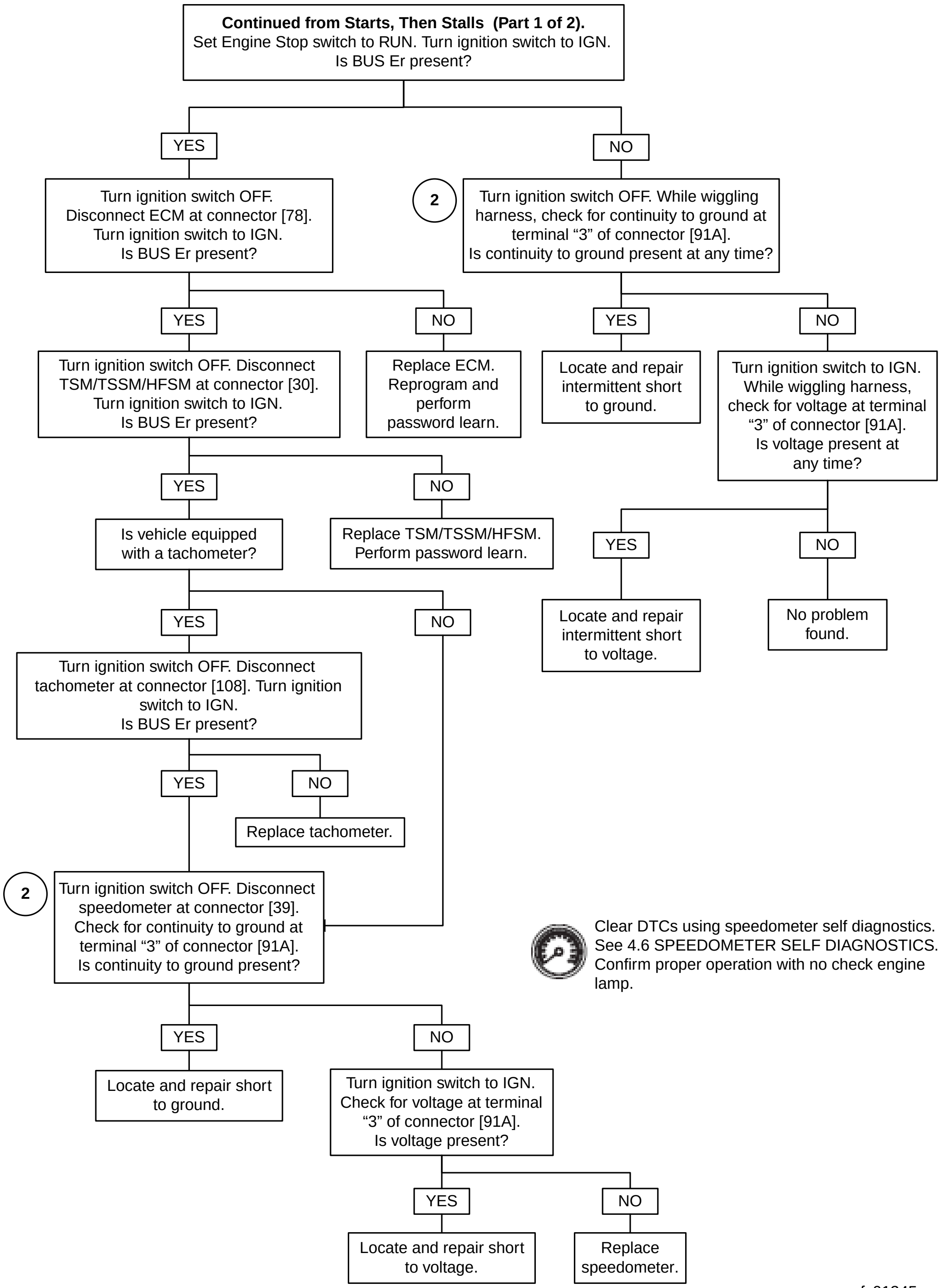
Table 4-14. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat
[131]	Neutral switch	Post terminals	Top of transmission
[157]	Indicator lamps (FXCWC)	8-place Mini-Deutsch	Under fuel tank console

Starts Then Stalls: DTC U1300, U1301, or BUS Er (Part 1 of 2)



Starts Then Stalls: DTC U1300, U1301, or BUS Er (Part 2 of 2)



fc01345_en

GENERAL

With the Ignition Switch turned to IGN and the Engine Stop Switch at RUN, the ECM will energize the system relay to complete the circuit to the in-tank fuel pump. It will remain on as long as the engine is cranking or running, and the ECM is receiving ignition reference pulses from the CKP sensor. If there are no reference pulses, the ECM will de-energize the system relay within 2 seconds after Ignition Switch is turned to IGN or engine has stalled, or immediately after the ignition is shut off.

The fuel pump delivers fuel to the injectors. The pressure regulator is where the system pressure is controlled. Excess fuel flow is bypassed into the fuel tank through the pressure regulator. When the engine is stopped, the pump can be turned on by applying battery voltage and ground to the fuel pump connector [141]. See Figure 4-25. The fuel pump connector is located forward of the fuse blocks. Improper fuel system pressure may contribute to one or all of the following symptoms.

- Engine cranks, but won't run.
- Engine cuts out (may feel like ignition problems).
- Hesitation, loss of power and poor fuel economy.

NOTE

After turning Ignition Switch to OFF, you must wait 10 seconds before turning the Ignition Switch back to IGN to get the fuel pump to reprime. This time out period is necessary for the fuel pump and IAC to reset.

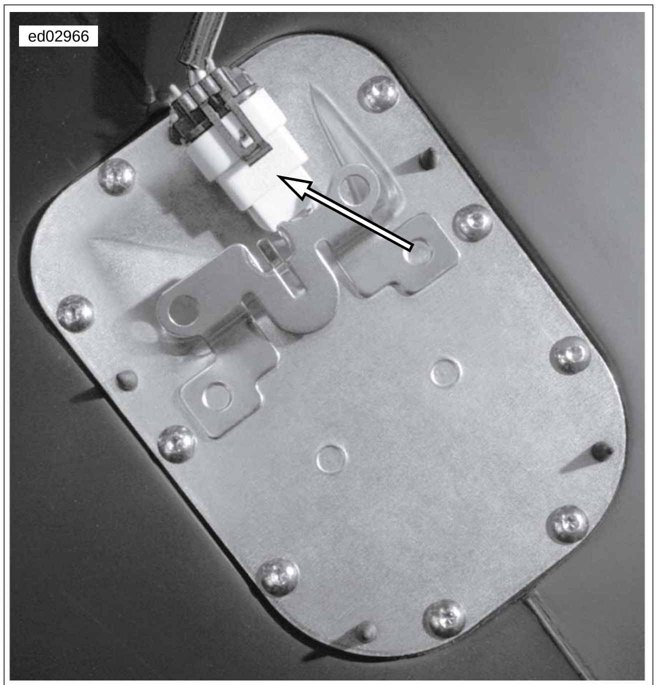


Figure 4-25. Fuel Pump Connector [141] (typical)

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Turns on fuel pump if wiring is OK. If pump runs, problem is in basic fuel delivery.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown pin probe and patch cord.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord.
4. Connect BREAKOUT BOX (Part No. HD-43876). See 4.7 BREAKOUT BOX: EFI.

Figure 4-26. System Relay

Figure 4-27. System Relay (FXCWC)

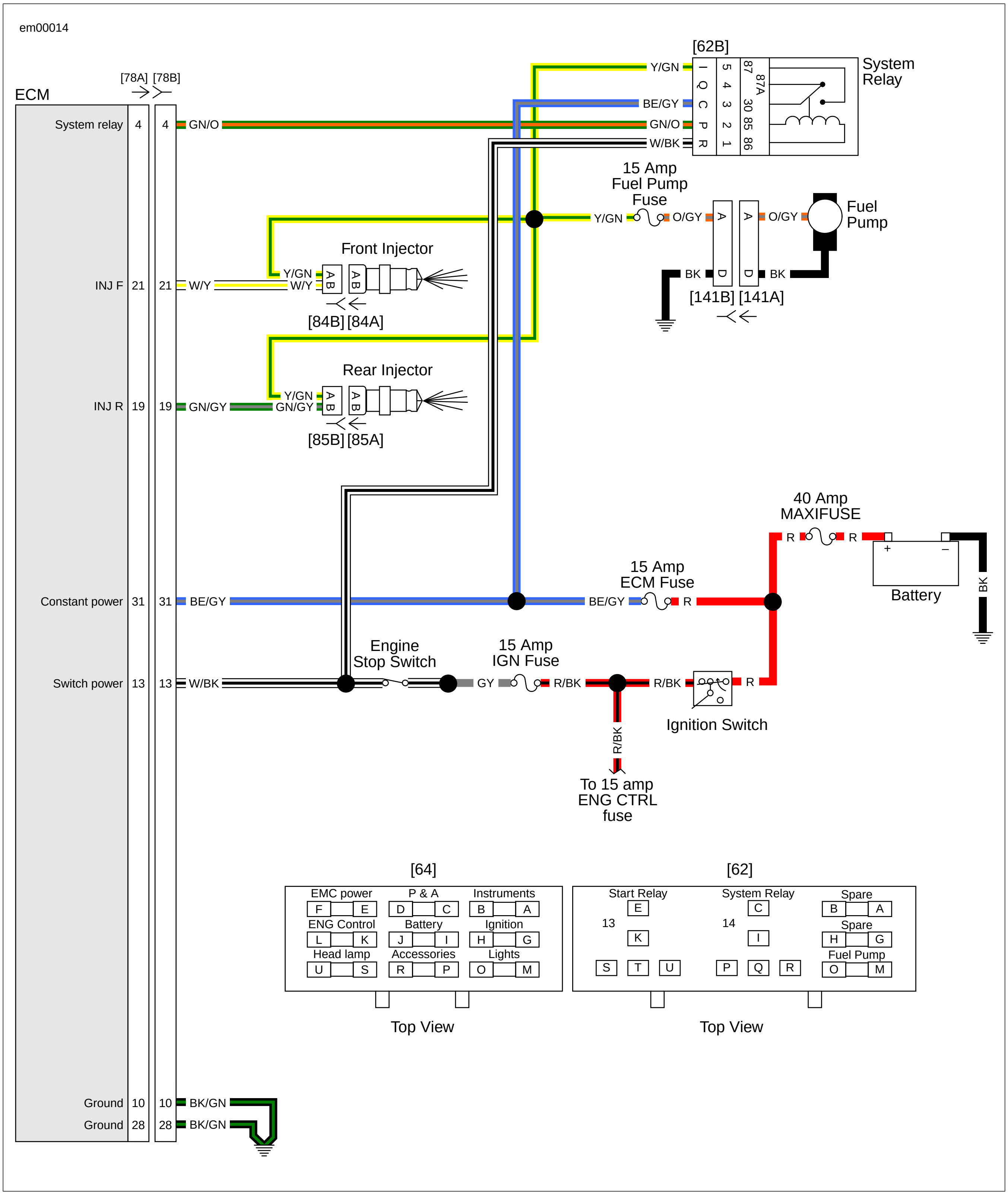
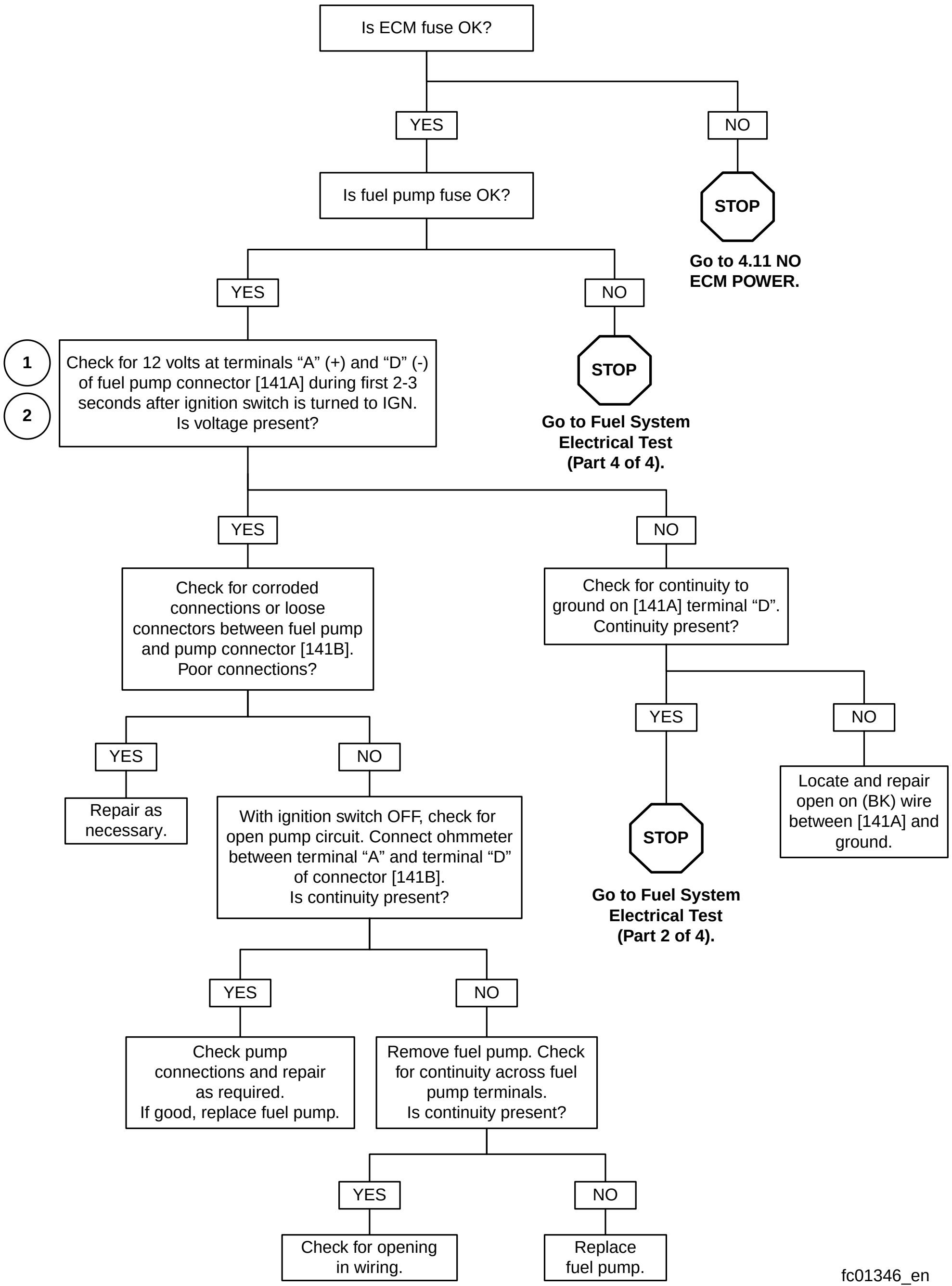


Figure 4-28. Fuel Pump Circuit

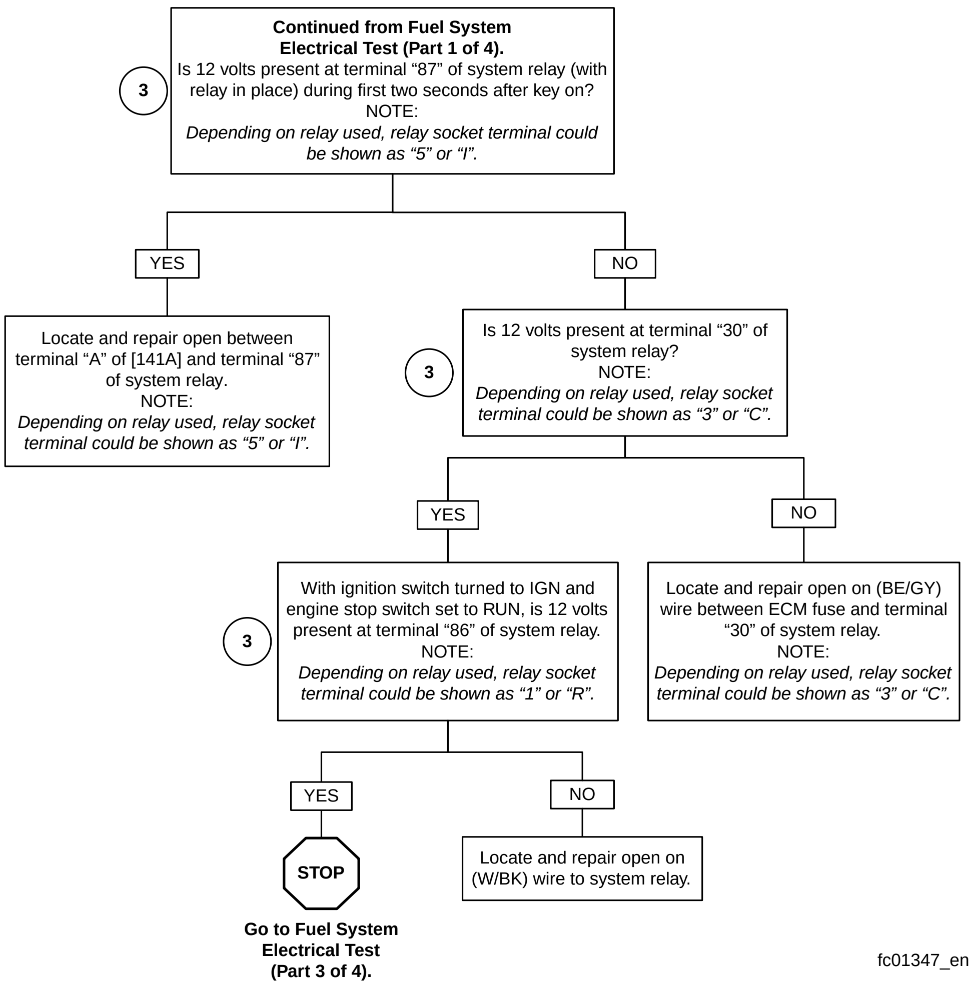
Table 4-15. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[62]	System relay	5-place Amp	Under seat, in fuse block
[64]	ECM - IGNITION fuses		Under seat, in fuse block
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[84]	Front fuel injector	2-place Delphi	Beneath fuel tank
[85]	Rear fuel injector	2-place Delphi	Beneath fuel tank
[141]	Fuel pump	4-place Packard	Top of fuel tank

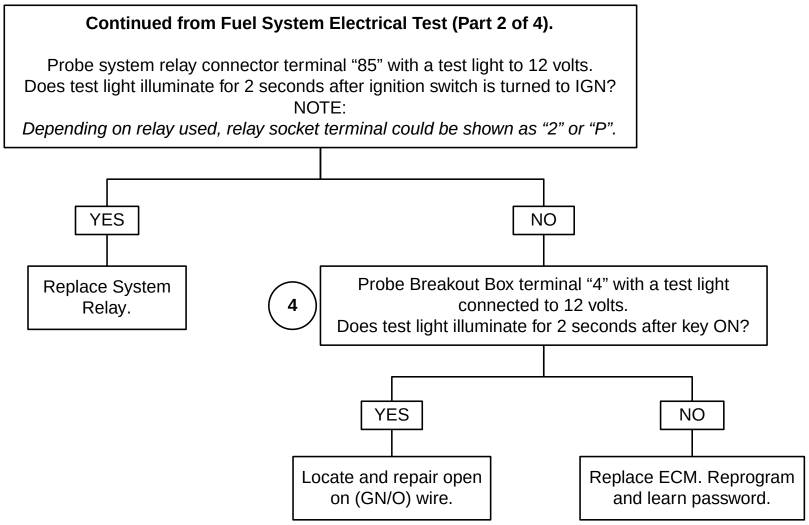
Fuel System Electrical Test (Part 1 of 4)



Fuel System Electrical Test (Part 2 of 4)

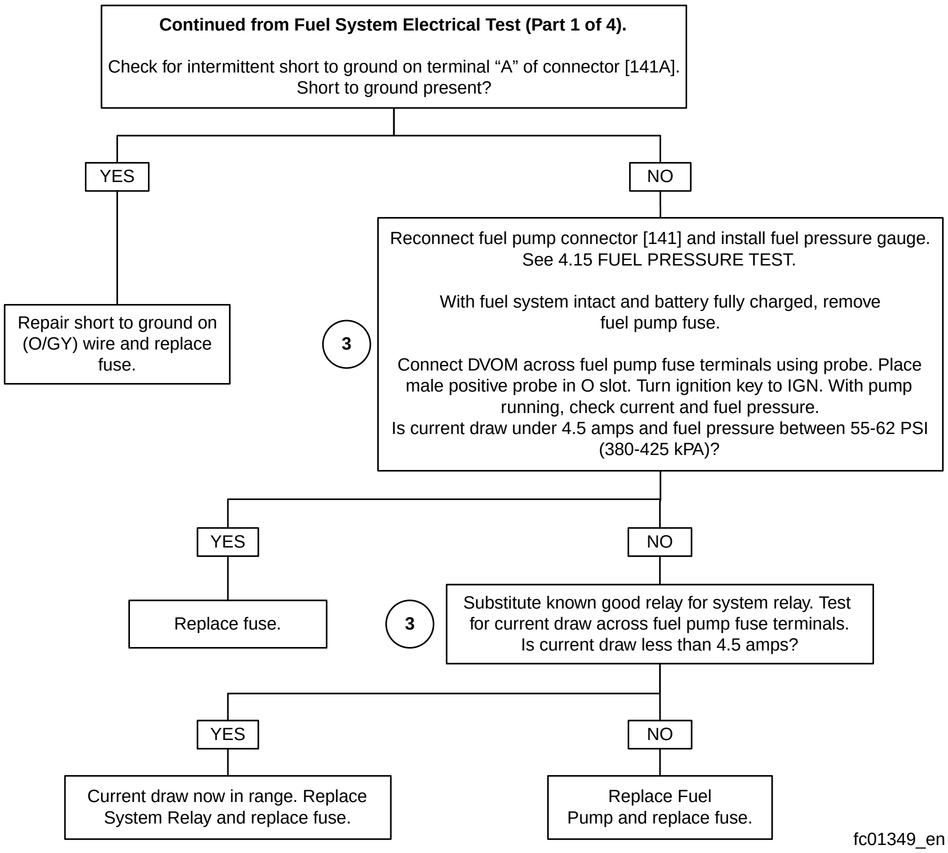


Fuel System Electrical Test (Part 3 of 4)



fc01348_en

Fuel System Electrical Test (Part 4 of 4)



GENERAL

System Relay

See Figure 4-29 or Figure 4-30. With the Ignition Switch turned to IGN and the Engine Stop Switch at RUN, the ECM will energize the system relay to complete the circuit to the in-tank fuel pump, ignition coil, and fuel injectors. They will remain powered as long as the engine is cranking or running, and the ECM is receiving ignition reference pulses from the CKP sensor. If there are no reference pulses, the ECM will de-energize the system relay within 2 seconds after Ignition Switch is turned to IGN or engine has stalled, or immediately after the ignition is shut off.

Table 4-16. Code Description

DTC	DESCRIPTION
P1001	System relay coil open/low
P1002	System relay coil high/shorted
P1003	System relay contacts open
P1004	System relay contacts closed

Figure 4-29. System Relay

Figure 4-30. System Relay (FXCWC)

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord.
2. Connect BREAKOUT BOX (Part No. HD-43876) to ECM. See 4.7 BREAKOUT BOX: EFI.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord.

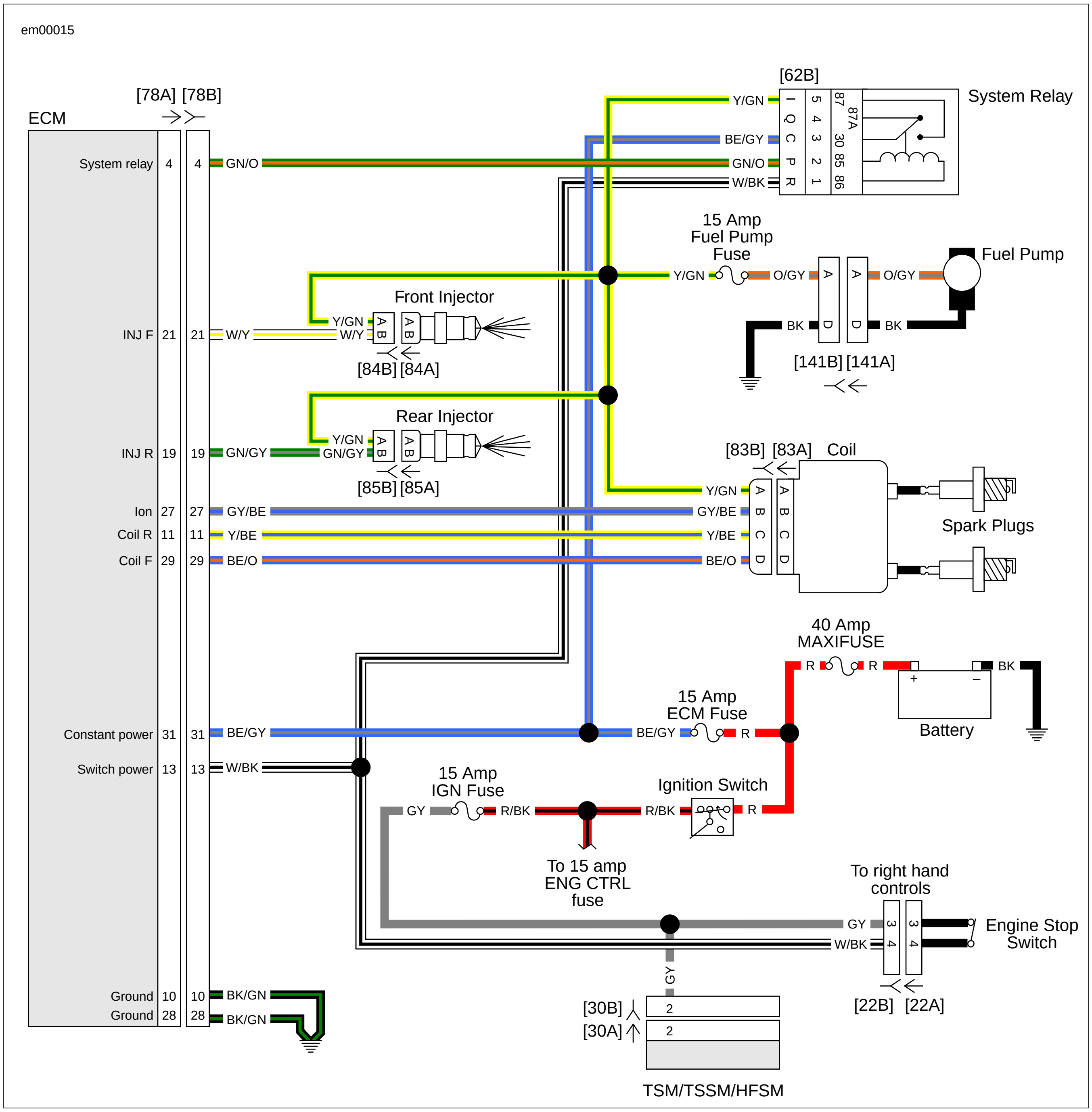


Figure 4-31. System Relay Circuit

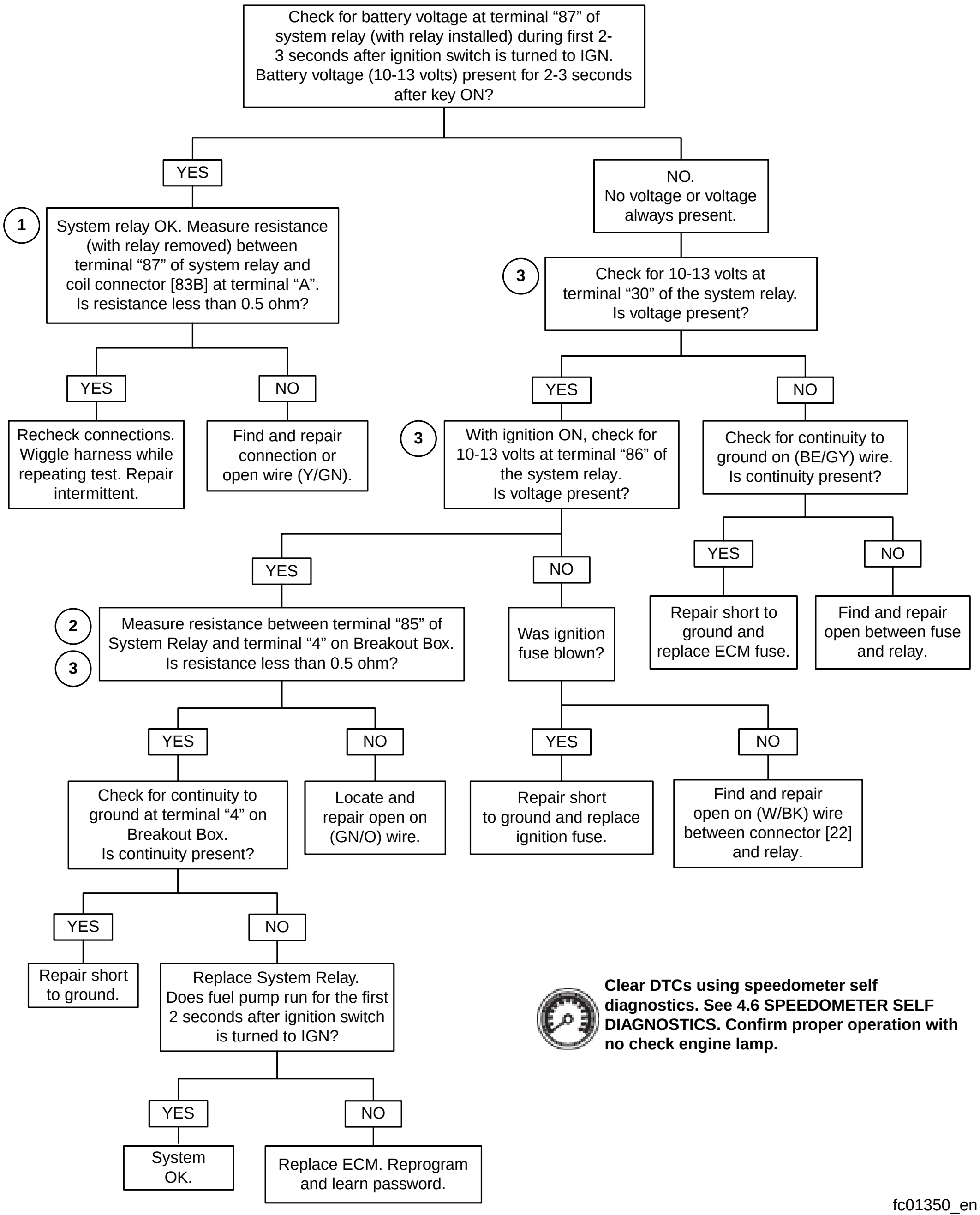
Table 4-17. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Right hand controls	6-place Molex	Under fuel tank, right side
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[62]	System relay	5-place Amp	Under seat, in fuse block
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[83]	Ignition coil	4-place Delphi	Back of coil
[84]	Front fuel injector	2-place Delphi	Beneath fuel tank

Table 4-17. Wire Harness Connectors

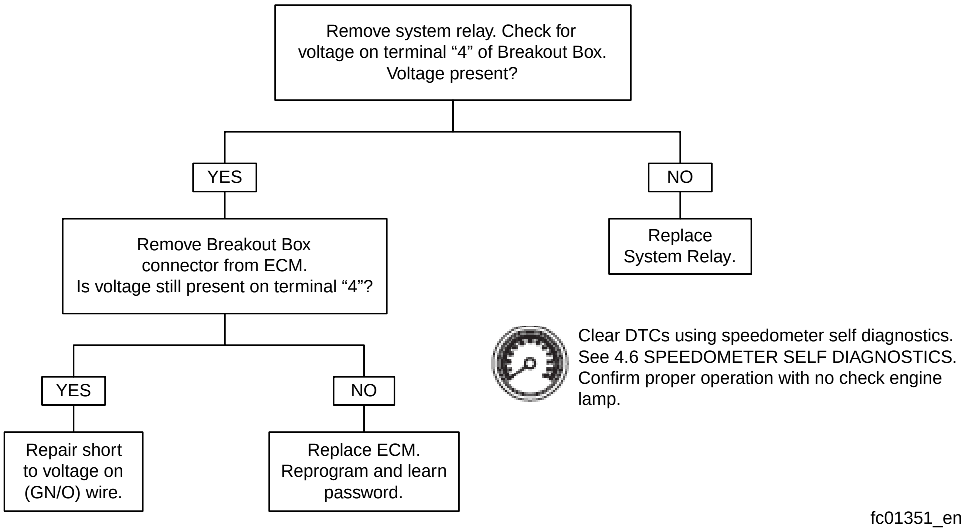
NO.	DESCRIPTION	TYPE	LOCATION
[85]	Rear fuel injector	2-place Delphi	Beneath fuel tank
[141]	Fuel pump	4-place Packard	Top of fuel tank

System Relay (Part 1 of 3): DTC P1001, P1003



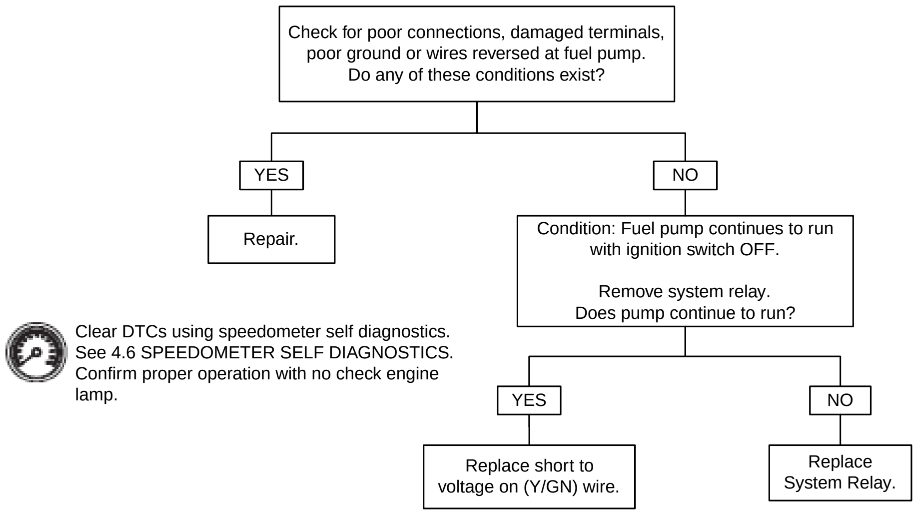
fc01350_en

System Relay (Part 2 of 3): DTC P1002



fc01351_en

System Relay (Part 3 of 3): DTC P1004



fc01352_en

GENERAL

The fuel pump delivers fuel to the fuel line, to a cavity in the induction module that supplies the fuel injectors and to the pressure regulator, where the system pressure is controlled. Excess fuel pressure is bypassed to the fuel tank through the pressure regulator.

See Figure 4-32. The fuel pump fuse is located on the relay/ fuse block behind the left side cover. The fuel pump can be turned on by applying battery voltage to the fuel pump fuse.

Improper fuel system pressure may contribute to one of the following conditions:

- Cranks, but won't run.
- Cuts out (may feel like ignition problem).
- Hesitation, loss of power or poor fuel economy.

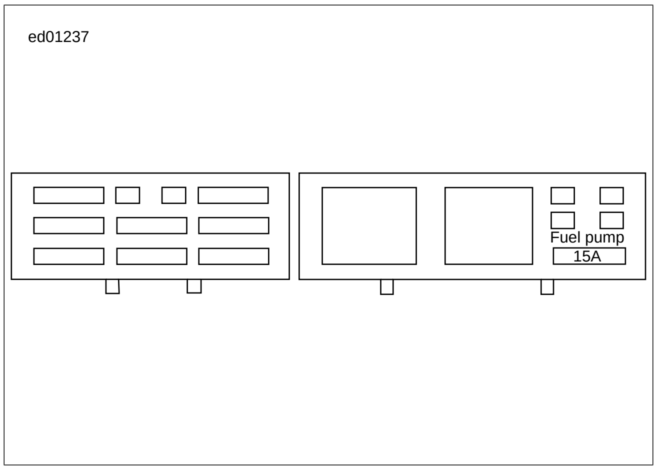


Figure 4-32. Fuel Pump Fuse: View from Top

TESTING

PART NUMBER	TOOL NAME
HD-41182	FUEL PRESSURE GAUGE
HD-44061	FUEL PRESSURE GAUGE ADAPTER

The fuel pressure gauge allows for fuel injector and fuel system pressure diagnosis. A special adapter allows the gauge to be attached to the external fuel supply line.

1. Remove seat.

⚠WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

2. Purge fuel supply line of high pressure fuel.
   a. See Figure 4-32. Disconnect the fuel pump fuse from the fuse block.
   b. Start the engine and allow the vehicle to run.
   c. When engine stalls, operate the starter for 3 seconds to remove any remaining fuel from fuel lines.

⚠WARNING

Gasoline can drain from quick-connect fitting when removing fuel line. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00267a)

3. Pull up on chrome sleeve of quick-connect fitting (fitting on left side of fuel tank) and pull down on fuel supply line to disconnect.

⚠WARNING

Do not twist fuel line fitting, as fuel line can crack causing a fuel leak. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00274a)

4. Attach fuel line to gauge assembly.
   a. See Figure 4-33. Install a second adapter in series with the first.
   b. See Figure 4-34. Pull up on chrome sleeve of fuel tank quick-connect fitting and insert neck of FUEL PRESSURE GAUGE ADAPTER (Part No. HD-44061) into fuel supply line.
   c. While pushing up on bottom of adapter, pull down on chrome sleeve until it "clicks" into the locked position. Tug on adapter to be sure that it will not come free.
   d. See Figure 4-35. In the same manner, install neck of second fuel supply line fitting into quick-connect fitting on fuel tank. Tug on fuel supply line to be sure that it will not come free.

⚠WARNING

To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)

5. Verify that fuel valve and air bleed petcock on FUEL PRESSURE GAUGE (Part No. HD-41182) are closed.
6. Remove protective cap from free end of fuel pressure gauge adapter. Connect fuel pressure gauge to Schroeder valve.
7. Install fuel pump fuse.
8. Start and idle engine to pressurize fuel system. Open fuel valve to allow the flow of fuel down the hose of the pressure gauge.

9. Position clear air bleed tube in a suitable container. Open and close air bleed petcock to purge gauge and hose of air. Repeat this step several times until only solid fuel (without bubbles) flows from air bleed tube. Close petcock.
10. Open and close throttle to change engine speed. Note pressure gauge reading. Fuel pressure should remain steady at 55-62 psi (380-425 kPa).
11. Turn engine off. Position air bleed tube in a suitable container. Open air bleed petcock to relieve fuel system pressure and purge pressure gauge of gasoline.

⚠WARNING

Gasoline can drain from the adapter when gauge is removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00254a)

12. Remove fuel pressure gauge from the adapter. Install protective cap over Schroeder valve.

⚠WARNING

Gasoline can drain from the fuel line and adapter when removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00255a)

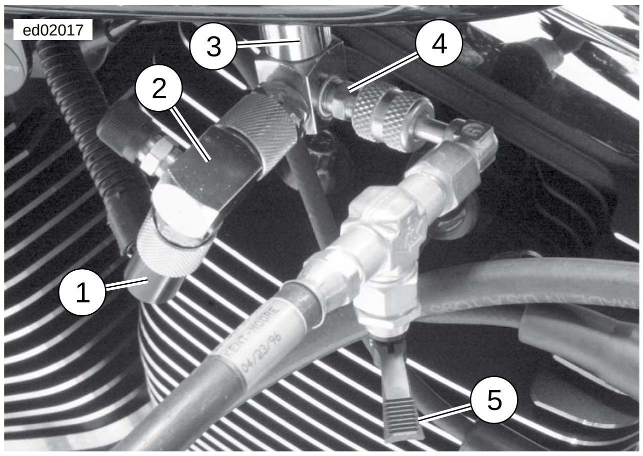
13. Pull up on sleeve of quick-connect fitting and remove fuel supply line from fuel pressure gauge adapter. Release adapter from fuel tank in the same manner.
14. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of tank) and insert neck of fuel supply line fitting. While pushing up on bottom of fuel supply line fitting, pull down on chrome sleeve until it "clicks" into the locked position. Tug on fuel supply line to be sure that it will not come free.

⚠WARNING

After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

15. Install seat.

Figure 4-33. Fuel Pressure Gauge Adapters



1. **Fuel supply line**
2. **Adapter to fuel line**
3. **Adapter to fuel tank**
4. **Pressure adapter/Schroeder valve union**
5. **Fuel valve (closed position)**

Figure 4-34. Fuel Line

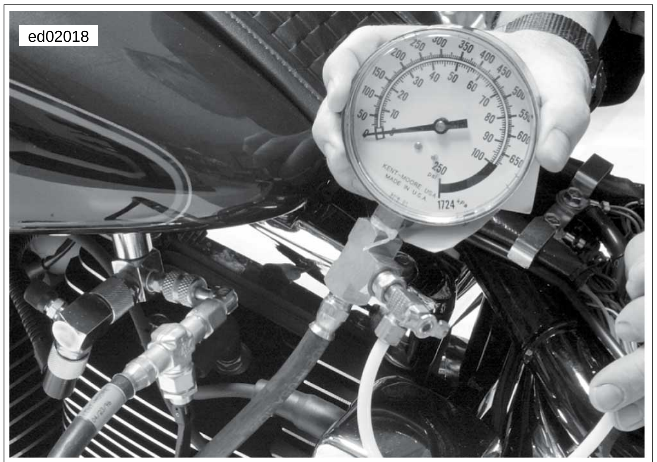


Figure 4-35. Fuel Pressure Gauge Installed

Figure 4-36. Fuel Pressure Regulator

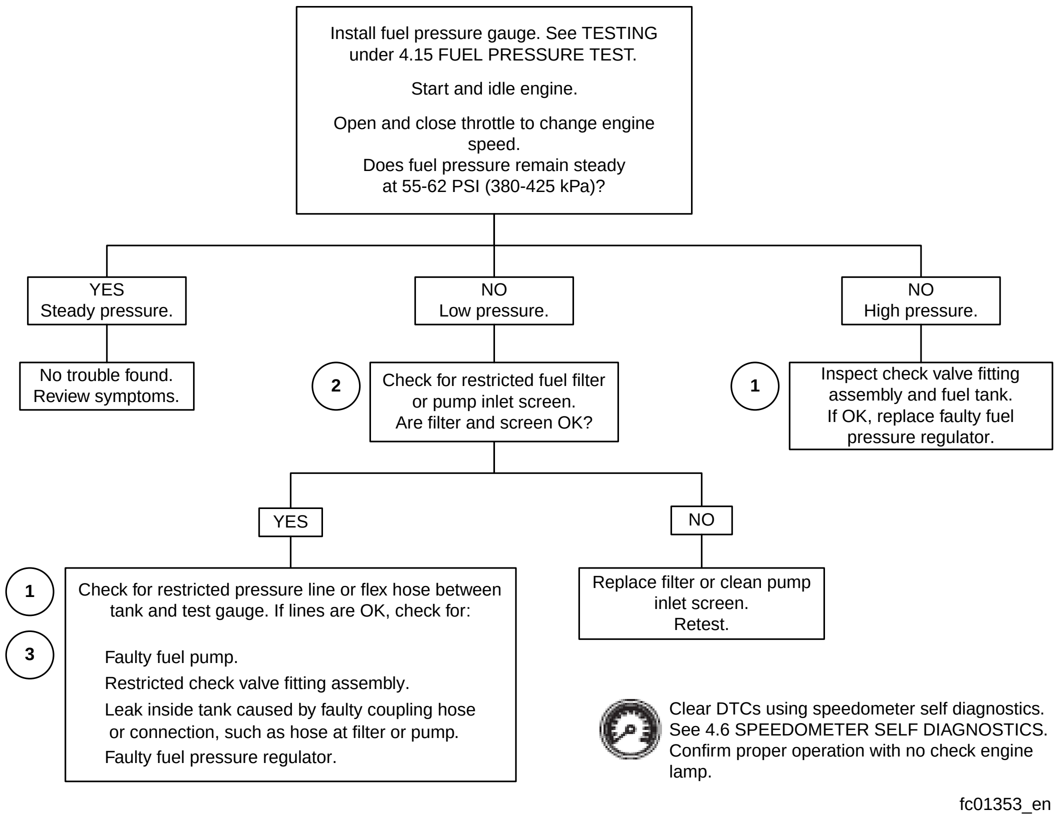
DIAGNOSTICS

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. If the regulator is faulty, see Service Manual.
2. If fuel system has pressure, but it is less than specification, check for the following conditions.
   a. The amount of fuel to the injectors is within limits, but pressure is too low. Also, hard starting cold and overall poor performance condition may exist.
   b. Restricted fuel flow causing pressure drop. However, if pressure drop occurs only when driving, engine may surge and lose power as pressure begins to drop rapidly.
3. This condition may be identified when the fuel level is low and the fuel pump turned on for the first 2 seconds after ignition switch is turned to IGN. A metallic ringing sound can be heard as the high pressure fuel is sprayed against the inside wall of the fuel tank.

Fuel Pressure Test



GENERAL

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

IAC Operation

The ECM controls engine idle speed by moving the Idle Air Control (IAC) to open or close a passage around the throttle plate. It does this by sending voltage pulses to the proper motor winding of the IAC. This causes the pintle to move in or out of the IAC a given distance for each pulse received.

- To increase idle speed, the ECM retracts the pintle, allowing more air to flow through the throttle body.
- To decrease idle speed, the ECM extends the pintle, allowing less air to flow through the throttle body.

The IAC position is measured in steps. This can be done only by using the DIGITAL TECHNICIAN (Part No. HD-44750).

- A high number of steps represents a retracted pintle and open passage around throttle plate. This correlates with an increase in the amount of air flowing through the throttle body.
- Zero steps represents a fully extended pintle. A zero reading indicates an abnormal condition in which the pintle has been fully extended and has consequently closed the passage around throttle plate.

Each time the ignition is turned off, the ECM resets the IAC by sending enough pulses to extend the pintle and effectively close the throttle body. The fully extended value is the ECM reference point. A given number of steps are then calculated by the ECM for use in setting the proper idle speed and IAC position.

NOTE

Warm idle speed is controlled by the ECM and can be adjusted only by using the DIGITAL TECHNICIAN (Part No. HD-44750).

Diagnostic Trouble Code P0505: Loss of Idle Speed Control

Loss of idle speed control will result if the idle RPM is 200 from preset idle speed and IAC motor is at zero or maximum for greater than 5 seconds. This code may occur with others for a multiple code situation. Resolve the other codes first to correct.

Table 4-18. Code Description

DTC	DESCRIPTION
P0505	Loss of idle speed control

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Tips

Engine idle speed can be adversely affected by the following:

- A loss of idle speed control does not necessarily imply the IAC actuator or wiring has failed. It can be caused by a number of conditions such as an intake air leak, improperly adjusted throttle stop (factory set) or a misfiring cylinder.
- Leaking injectors will cause fuel imbalance and poor idle quality due to different air/fuel ratios in each cylinder. To check for leaky injectors, first remove the air cleaner. See Air Cleaner in the Service Manual. Then, with the throttle wide open, turn Ignition Switch to IGN for 2 seconds and then turn the Ignition Switch to OFF for 2 seconds five consecutive times. Replace the fuel injector if there is any evidence of raw fuel in the bores. See Fuel Injectors in the Service Manual.
- Vacuum leaks. To check for vacuum, see 4.9 INTAKE LEAK TEST.
- Contaminated fuel.
- Excessive oil in the crankcase (oil sumping).
- TP sensor reading of greater than 1% (possible throttle cable misadjustment) or battery voltage reading of less than 9 volts or a Vehicle Speed Sensor (VSS) greater than 0 will disable idle speed control.
- If there is a loss of battery power at ECM terminal "31", vehicle will start but IAC pintle will not reset when Ignition Switch is turned to OFF. Eventually pintle will be out of position causing performance problems.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. When the engine is stopped, the IAC pintle extends and then retracts to a fixed "Park" position for increased airflow and idle speed during the next engine start sequence. This Ignition Switch OFF reset procedure takes 10 seconds to perform.

2. Test lamp behavior may follow two patterns. The color of the lights is not relevant to IAC operation.
   a. **Normal behavior:** At Ignition Switch turned to IGN, test lights will alternately flash and then remain steady on to confirm ECM signals. At Ignition Switch turned to OFF lights alternately flash and go out after 10 second reset procedure.
   b. **Problem indicated:** One or more lights fail to illuminate during Ignition Switch turned to IGN/Ignition Switch turned to OFF cycle.

NOTE

There is a remote possibility that one of the circuits is shorted to voltage which would have been indicated by a steady light. Disconnect ECM and turn the Ignition Switch to IGN. Probe terminals to check for this condition.

3. Connect BREAKOUT BOX (Part No. HD-43876) to EFI wire harness only, leaving ECM disconnected. See 4.7 BREAKOUT BOX: EFI.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord.
5. Repair faulty ECM connection or replace ECM. If ECM requires replacement, see ECM in the Service Manual.

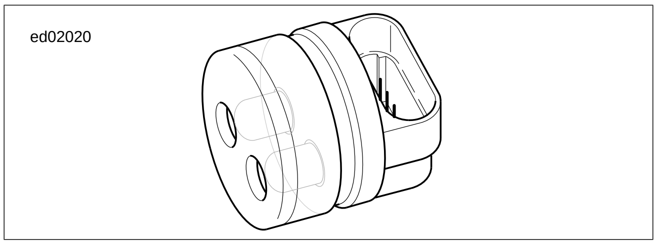


Figure 4-37. IAC Test Lamp (Part No. HD-41199-3)

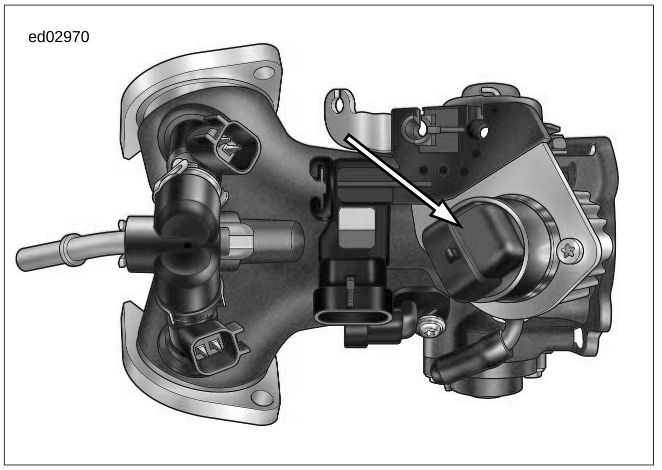


Figure 4-38. IAC Connector

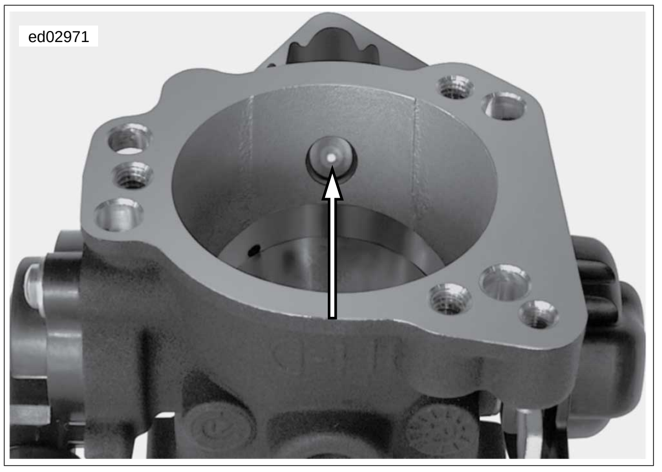


Figure 4-39. IAC Pintle

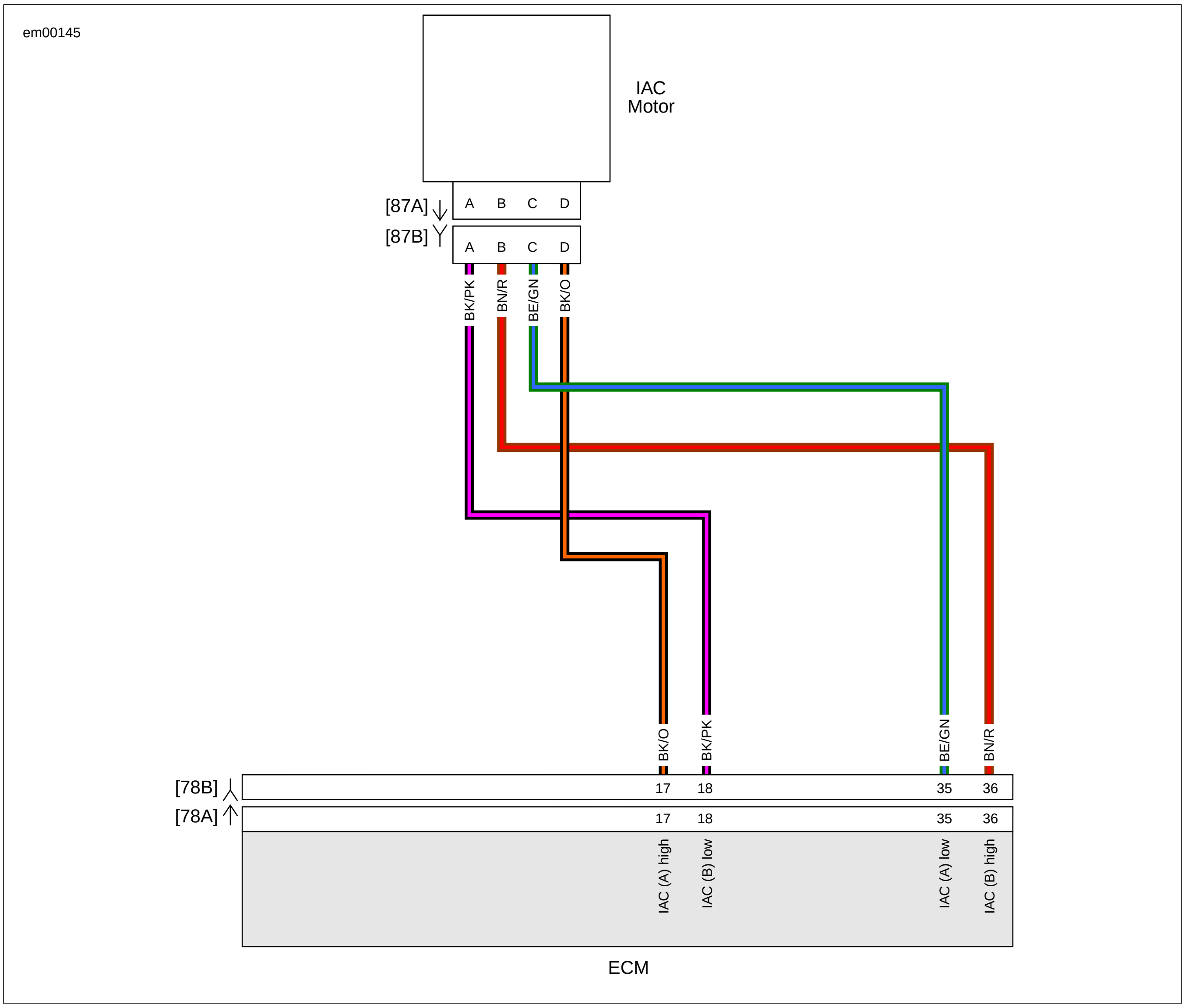
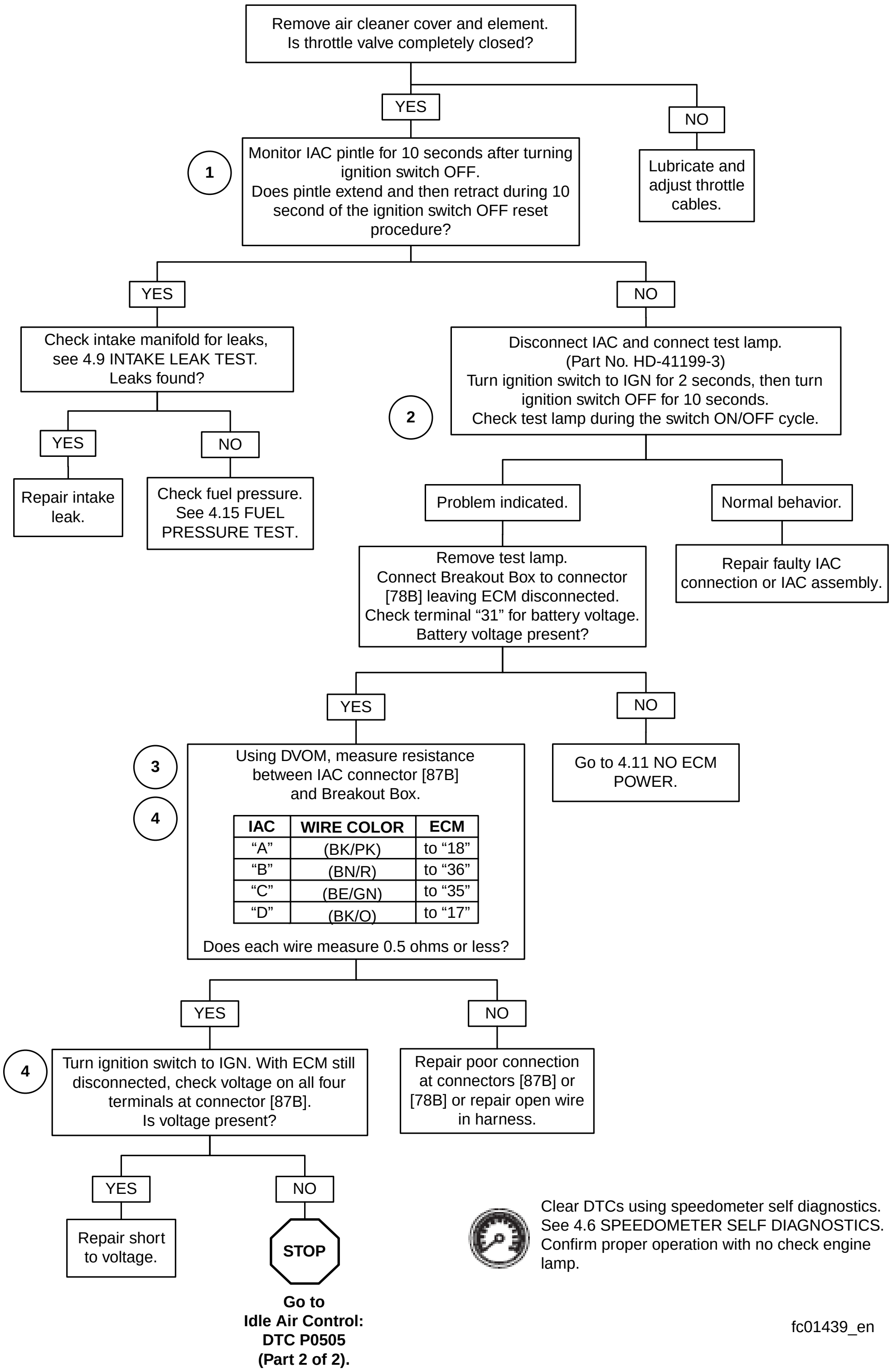


Figure 4-40. IAC Circuit

Table 4-19. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[87]	Idle Air Control (IAC)	4-place Packard	Beneath fuel tank


Remove air cleaner cover and element.
Is throttle valve completely closed?
YES
NO
Lubricate and adjust throttle cables.
1
Monitor IAC pintle for 10 seconds after turning ignition switch OFF.
Does pintle extend and then retract during 10 second of the ignition switch OFF reset procedure?
YES
NO
Check intake manifold for leaks, see 4.9 INTAKE LEAK TEST.
Leaks found?
YES
NO
Repair intake leak.
Check fuel pressure. See 4.15 FUEL PRESSURE TEST.
2
Disconnect IAC and connect test lamp.
(Part No. HD-41199-3)
Turn ignition switch to IGN for 2 seconds, then turn ignition switch OFF for 10 seconds.
Check test lamp during the switch ON/OFF cycle.
Problem indicated.
Normal behavior.
Repair faulty IAC connection or IAC assembly.
Remove test lamp.
Connect Breakout Box to connector [78B] leaving ECM disconnected.
Check terminal “31” for battery voltage.
Battery voltage present?
YES
NO
Go to 4.11 NO ECM POWER.
3
4
Using DVOM, measure resistance between IAC connector [87B] and Breakout Box.

IAC	WIRE COLOR	ECM
“A”	(BK/PK)	to “18”
“B”	(BN/R)	to “36”
“C”	(BE/GN)	to “35”
“D”	(BK/O)	to “17”

Does each wire measure 0.5 ohms or less?
YES
NO
Repair poor connection at connectors [87B] or [78B] or repair open wire in harness.
4
Turn ignition switch to IGN. With ECM still disconnected, check voltage on all four terminals at connector [87B].
Is voltage present?
YES
NO
Repair short to voltage.
STOP
Go to Idle Air Control: DTC P0505 (Part 2 of 2).
Clear DTCs using speedometer self diagnostics. See 4.6 SPEEDOMETER SELF DIAGNOSTICS. Confirm proper operation with no check engine lamp.
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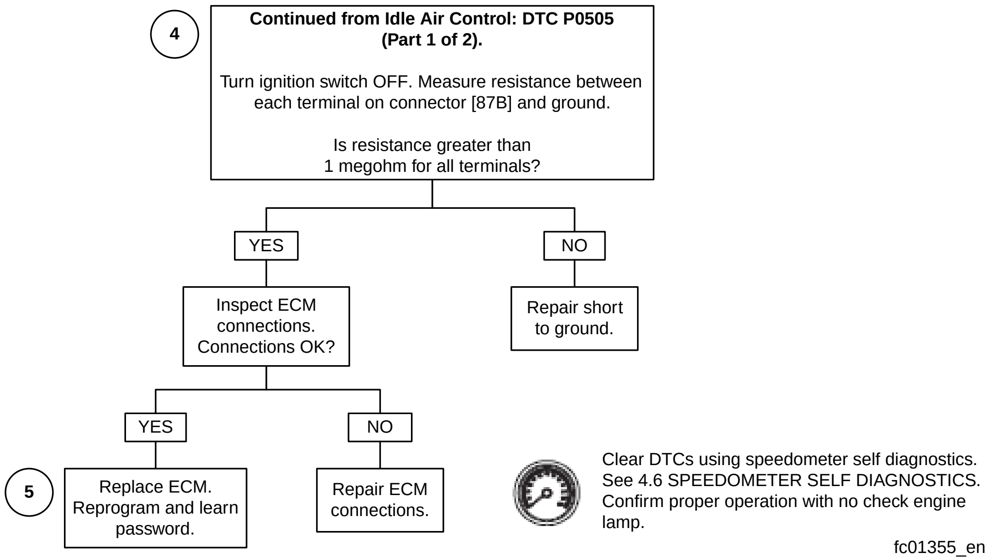
Idle Air Control: DTC P0505 (Part 2 of 2)



GENERAL

Misfire at Idle or Under Load

- Battery condition and connections may also cause misfires. See Battery in the Service Manual for more information.
- Fuel system problems may also cause misfires. Consult 4.15 FUEL PRESSURE TEST and then see symptom tables under 4.5 INITIAL DIAGNOSTIC CHECK.
- Mechanical problems with the engine may cause misfires. See Service Manual for more information.
- Vehicle modifications including intake and exhaust may cause misfires.

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-26792	SPARK TESTER
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

⚠WARNING

Wipe up spilled fuel and dispose of rags in a suitable manner. An open spark around gasoline could cause a fire or explosion, resulting in death or serious injury. (00518b)

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

NOTE

Engine will not spark with both spark plugs removed. When checking for spark, use SPARK TESTER (Part No. HD-26792) with both plugs installed.

2. See Figure 4-41. A SPARK TESTER (Part No. HD-26792) must be used to verify adequate secondary voltage (25,000 volts) at the spark plug.
   a. Turn Ignition Switch OFF.
   b. Remove spark plug cable from spark plug. Visually check plug condition.
   c. Attach cable to SPARK TESTER. Clip tester to cylinder head bolt.
   d. While cranking engine, watch for spark to jump tester gap on leads.
   e. Reinstall and repeat procedure on other spark plug cable.

Table 4-20. Spark Plug Cables (all except FXCWC)

SPECIFICATION	FRONT	REAR
Length in.	19.0-19.25	7.25-7.50
Length mm	482.6-489.0	184.2-190.5
Resistance-ohms	4750-11,230	1812-4375

Table 4-21. Spark Plug Cables (FXCWC only)

SPECIFICATION	FRONT	REAR
Length in.	7.375-7.625	7.375-7.625
Length mm	187.33-193.68	187.33-193.68
Resistance-ohms	1840-5084	1840-5084

3. Perform spark plug cable resistance test.
   a. Remove spark plug cable from spark plug and ignition coil. For best results, use a needle nose pliers for removal/installation on coil. Gently grasp cable as close to terminals as possible.
   b. Using an ohmmeter, touch probes to terminals on each end plug cable.
   c. Compare resistance values to Table 4-20 or Table 4-21. Replace cables not meeting specifications. Reinstall and repeat procedure on other spark plug cable.
4. If carbon tracking is evident on outside of coil towers, replace ignition coil and inspect spark plug cables. Cables must be clean and tight. Excessive cable resistance or faulty connections can cause coil damage.
5. This test can also be performed by substituting a known good coil for one causing the no spark condition. The coil does not require full installation to be functional. Verify faulty coil by performing resistance test. See Ignition Coil in the Service Manual.
6. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) , red pin probe and patch cord to relay and gray pin probe and patch cord to the coil connector [83B].

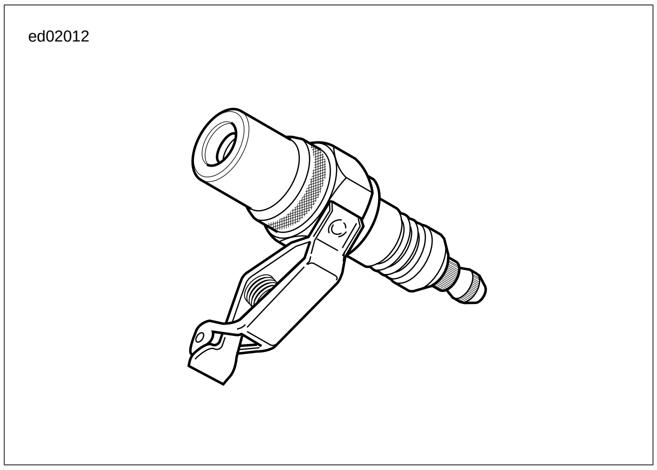


Figure 4-41. Spark Tester

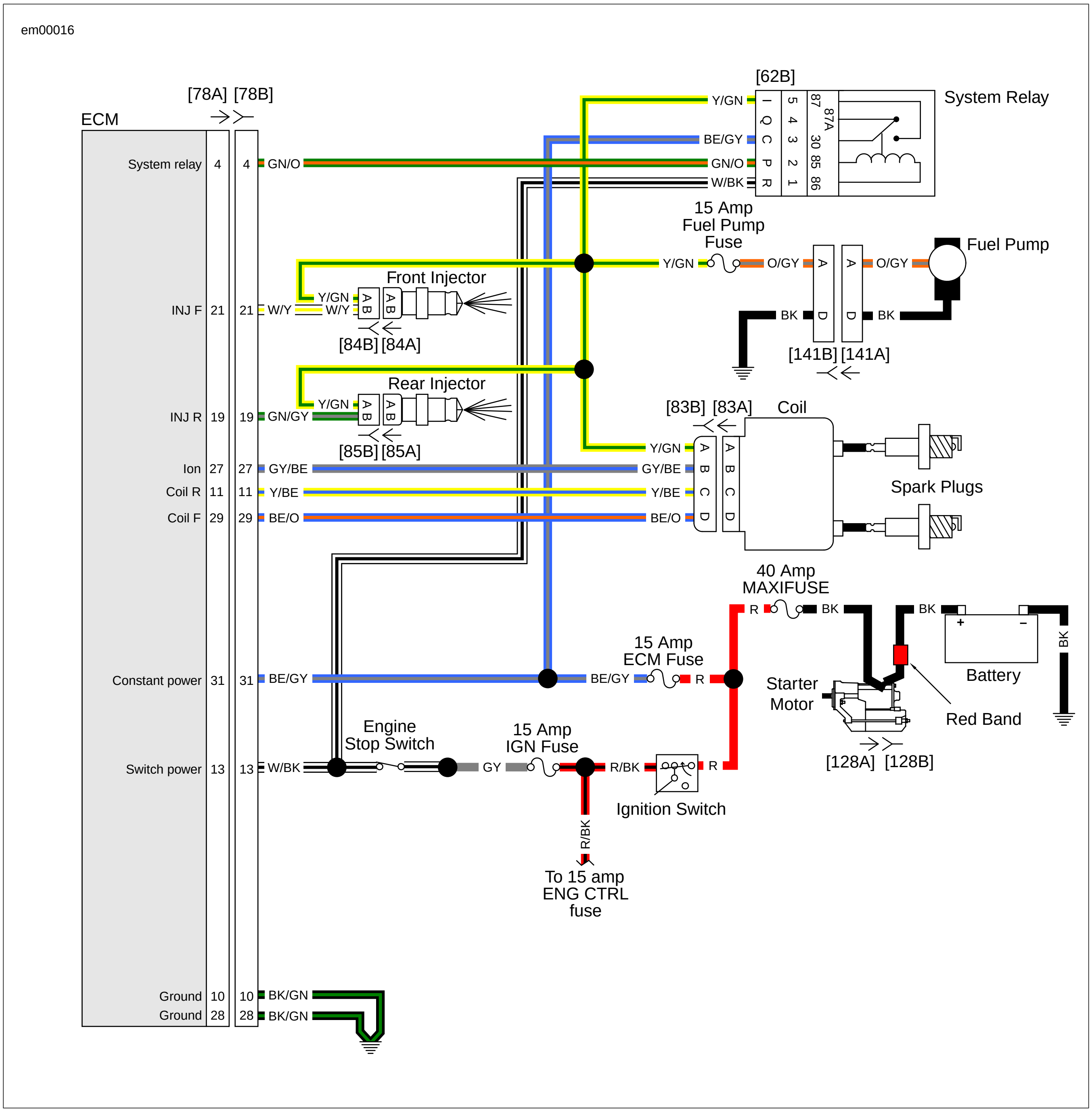


Figure 4-42. Ignition Coil Circuit Diagram

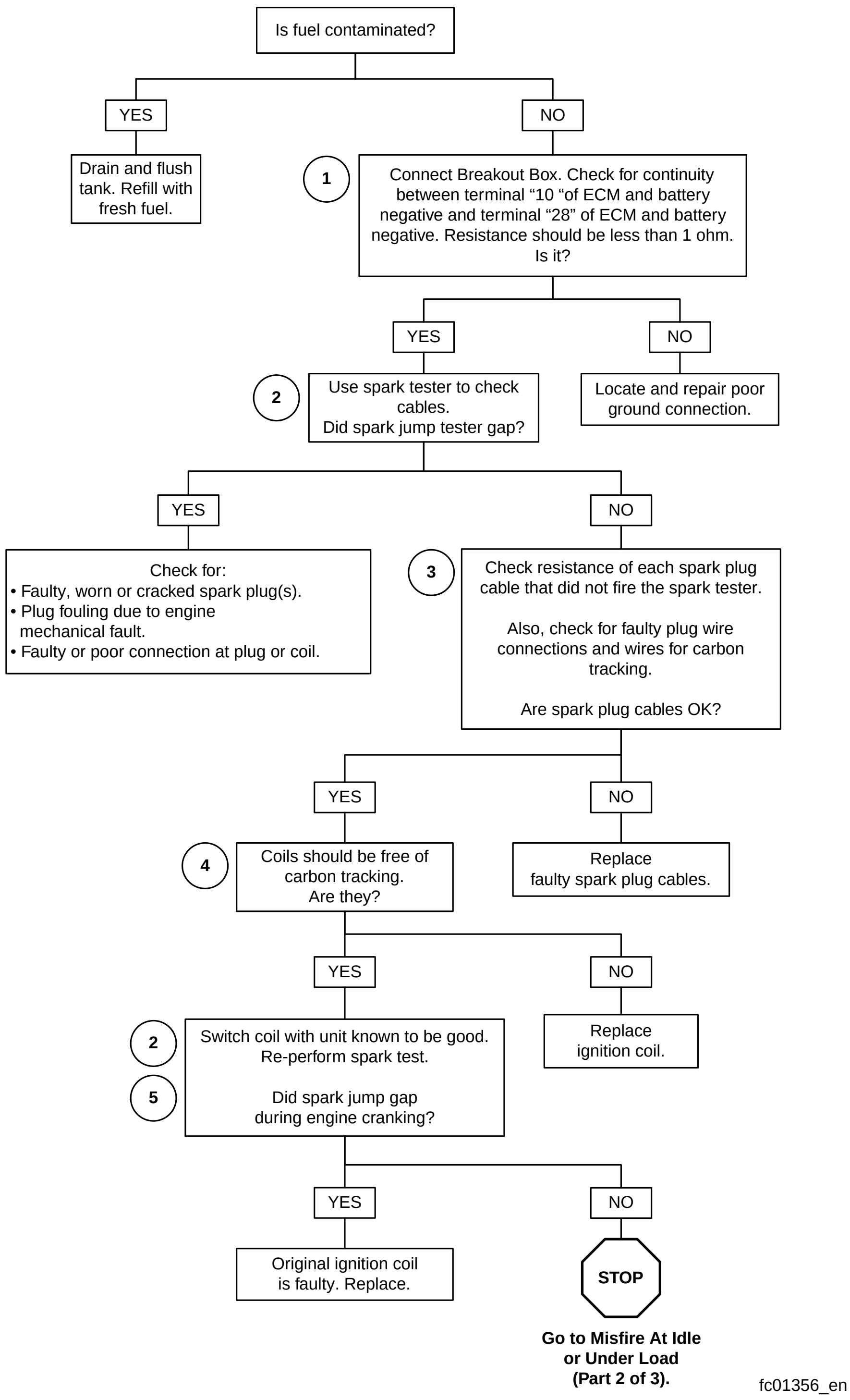
Table 4-22. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[62]	System relay	5-place Amp	Under seat, in fuse block
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[83]	Ignition coil	4-place Delphi	Back of coil
[84]	Front fuel injector	2-place Delphi	Beneath fuel tank
[85]	Rear fuel injector	2-place Delphi	Beneath fuel tank

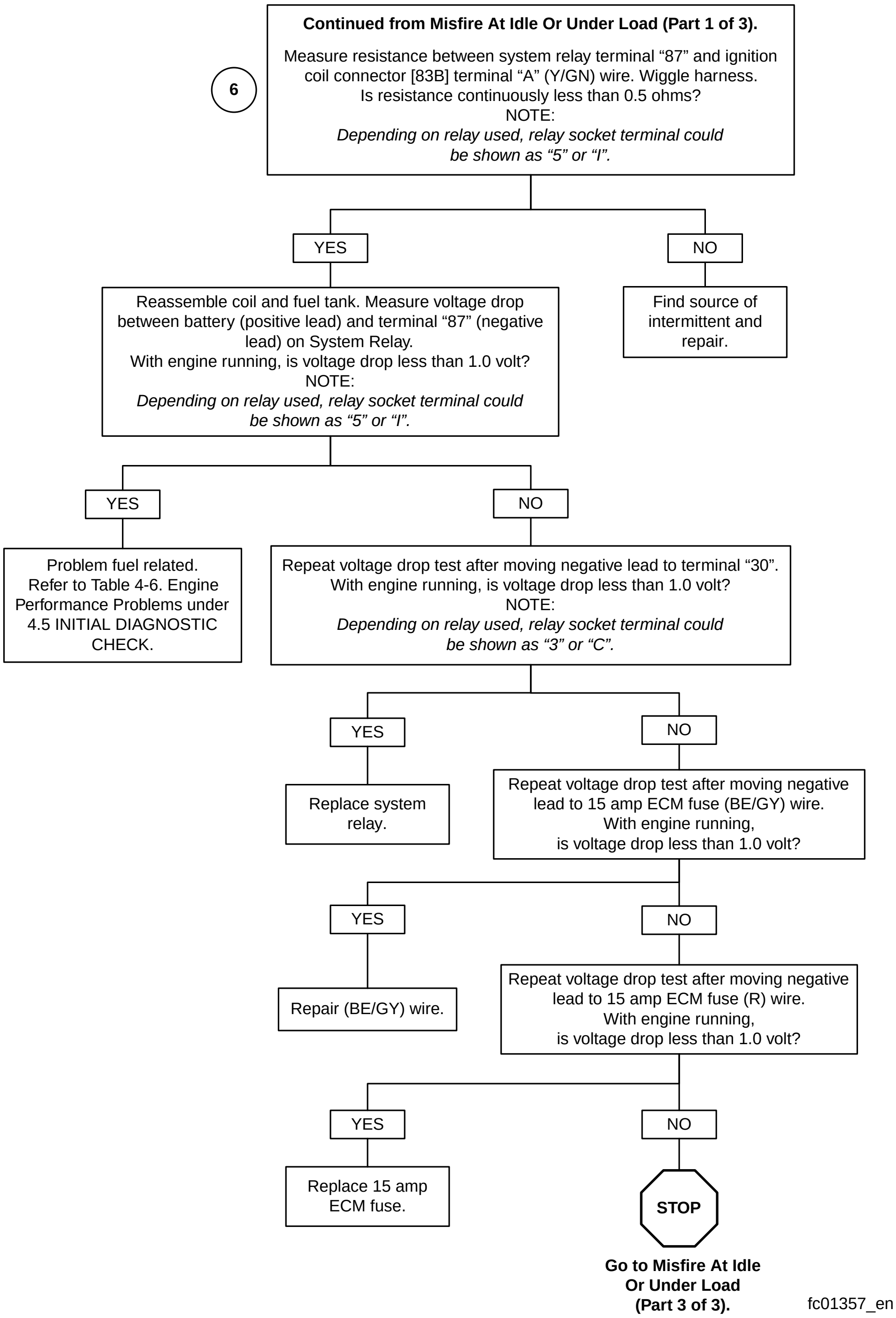
Table 4-22. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[128]	Starter solenoid	Spade terminals	Top of starter
[141]	Fuel pump and sender	4-place Packard	Top of fuel tank

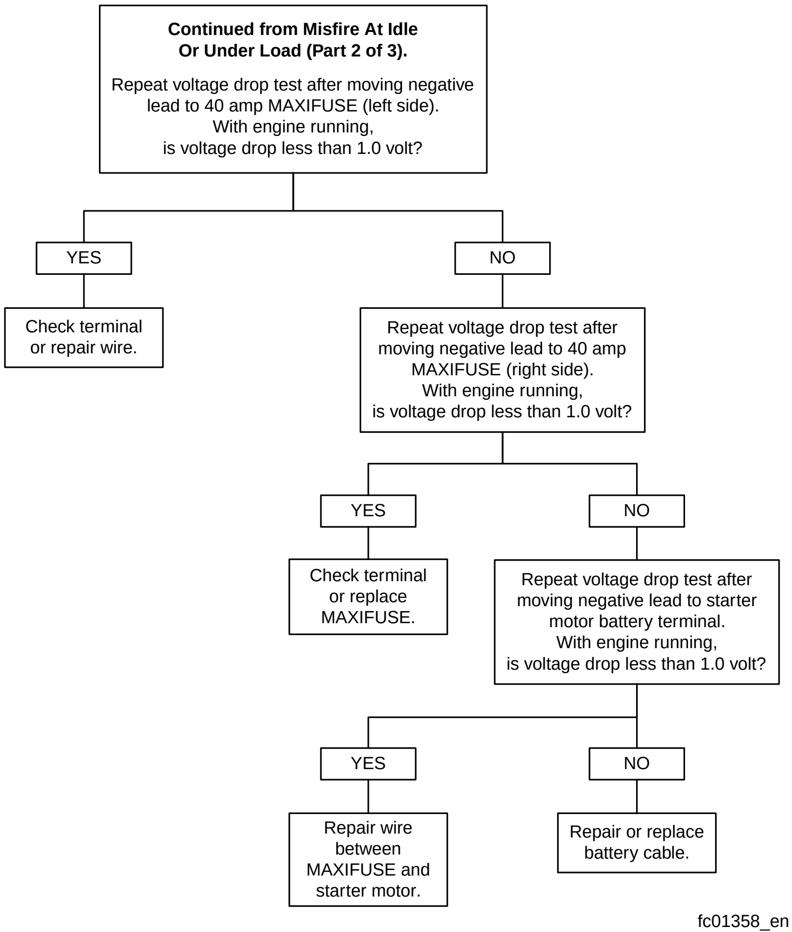
Misfire at Idle or Under Load (Part 1 of 3)



Misfire at Idle or Under Load (Part 2 of 3)



Misfire at Idle or Under Load (Part 3 of 3)



GENERAL

Diagnostic Trouble Codes P1353, P1356, P1357, P1358: No Combustion

See Figure 4-43. A feedback voltage signal in the secondary ignition circuit detects the presence of combustion each time a cylinder fires on ECM terminal "27". For diagnostic purposes, this signal is only analyzed at high speed and load where it may be easily measured. Failure to detect combustion at high speed and load means one of following conditions is true.

- Cylinder is truly misfiring.
- There is a lack of continuity in the ignition coil secondary circuit.

Table 4-23. Code Description

DTC	DESCRIPTION
P1353	Front cylinder no combustion
P1356	Rear cylinder no combustion
P1357	Front cylinder combustion intermittent
P1358	Rear cylinder combustion intermittent

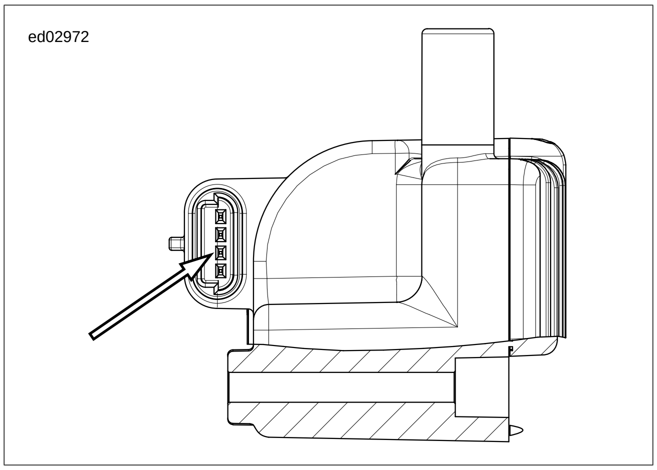


Figure 4-43. Feedback Signal Pin B

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
2. Resistance values will only be correct if using the Harley-Davidson spark plugs specified for that vehicle.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) , gray pin probes and patch cords.
4. Perform spark plug cable resistance test.
   a. Remove spark plug cable from spark plug and ignition coil. For best results, use a needle nose pliers for removal/installation on coil. Gently grasp cable as close to terminals as possible.
   b. Using an ohmmeter, touch probes to terminals on each end plug wire.
   c. Compare resistance values to Table 4-24 or Table 4-25. Replace cables not meeting specifications. Reinstall and repeat procedure on other spark plug cable.

Table 4-24. Spark Plug Cables (all except FXCWC)

SPECIFICATION	FRONT	REAR
Length in.	19.0-19.25	7.25-7.50
Length mm	482.6-489.0	184.2-190.5
Resistance-ohms	4750-11,230	1812-4375

Table 4-25. Spark Plug Cables (FXCWC only)

SPECIFICATION	FRONT	REAR
Length in.	7.375-7.625	7.375-7.625
Length mm	187.33-193.68	187.33-193.68
Resistance-ohms	1840-5084	1840-5084

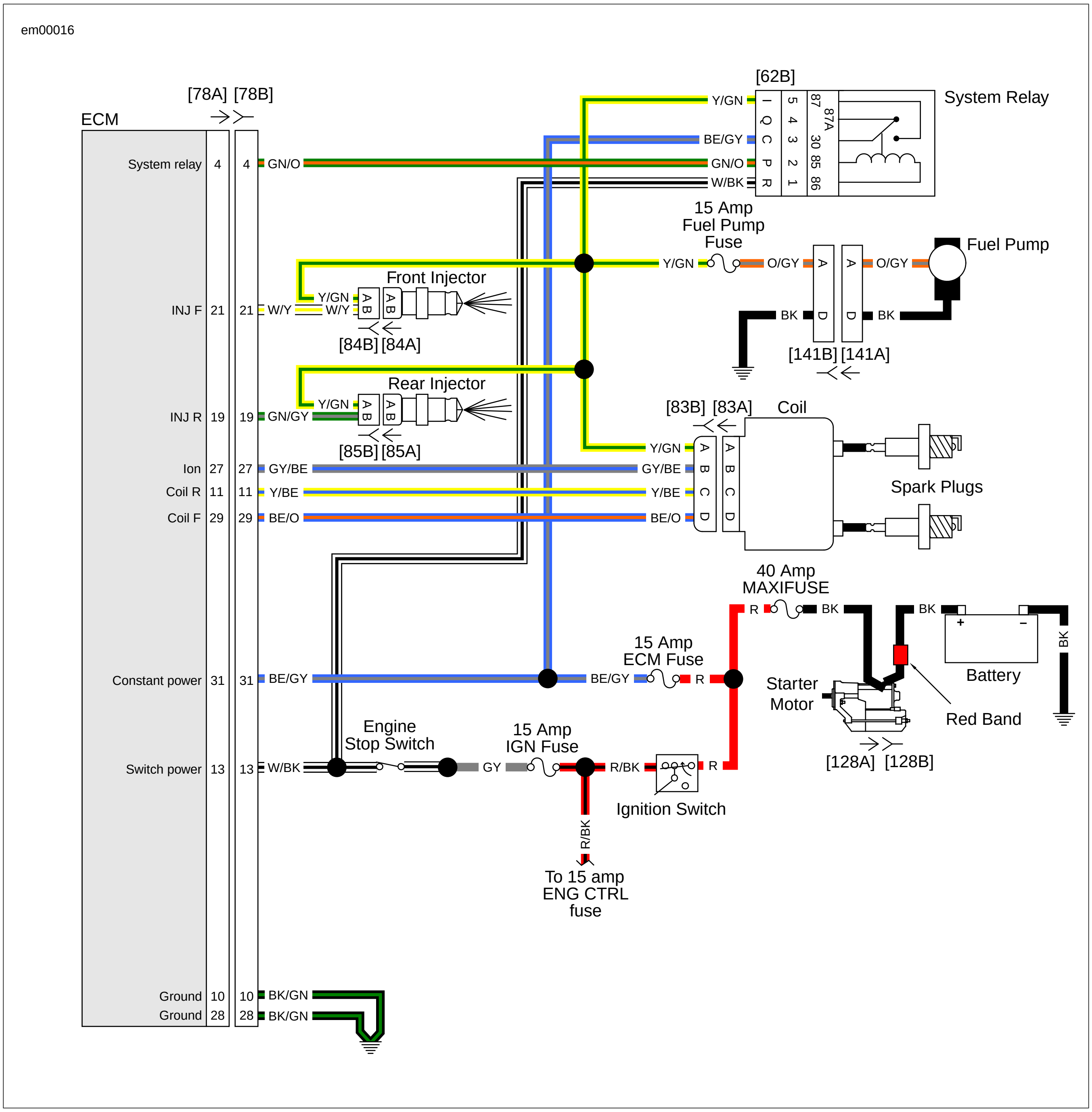


Figure 4-44. Secondary Ignition Circuit Diagram

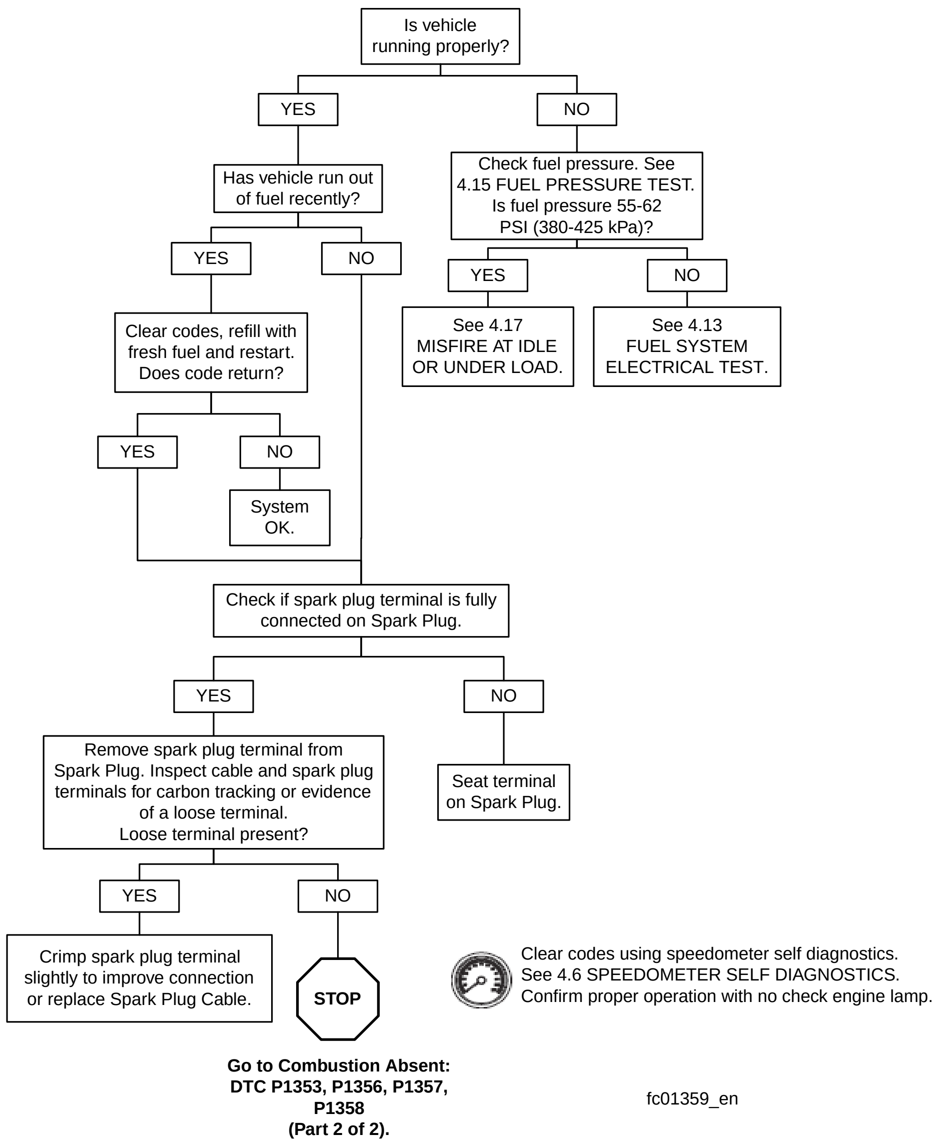
Table 4-26. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[62]	System relay	5-place Amp	Under seat, in fuse block
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[83]	Ignition coil	4-place Delphi	Back of coil
[84]	Front fuel injector	2-place Delphi	Beneath fuel tank
[85]	Rear fuel injector	2-place Delphi	Beneath fuel tank

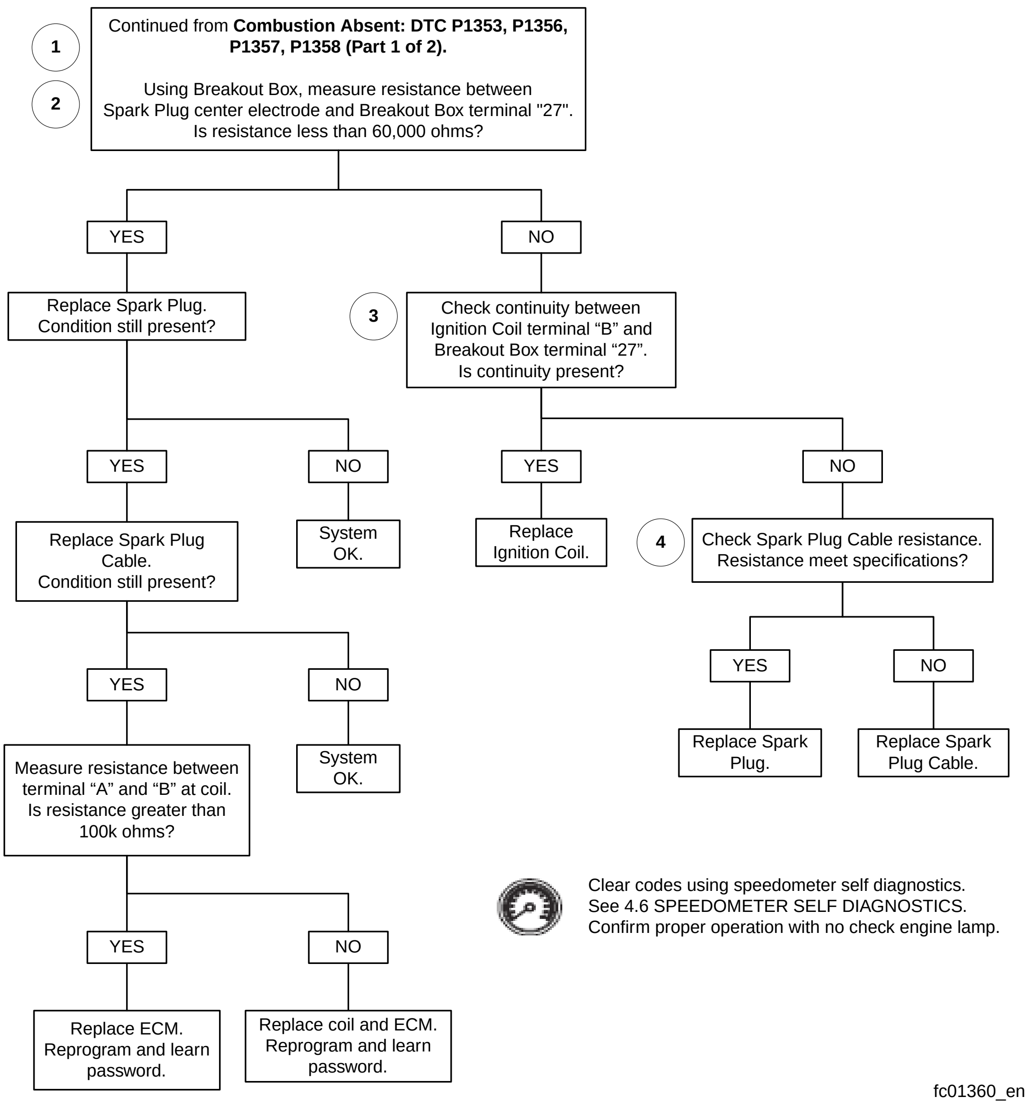
Table 4-26. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[128]	Starter solenoid	Spade terminals	Top of starter
[141]	Fuel pump and sender	4-place Packard	Top of fuel tank

Combustion Absent: DTC P1353, P1356, P1357, P1358 (Part 1 of 2)



Combustion Absent: DTC P1353, P1356, P1357, P1358 (Part 2 of 2)



GENERAL

MAP Sensor

See Figure 4-45. The MAP sensor is supplied 5 volts from the ECM (terminal "14") and sends a signal back to ECM (terminal "25"). This signal varies in accordance with engine vacuum and atmospheric barometric pressure. Changes in barometric pressure are influenced by weather and altitude.

Table 4-27. Code Description

DTC	DESCRIPTION
P0107	MAP sensor open/low
P0108	MAP sensor high

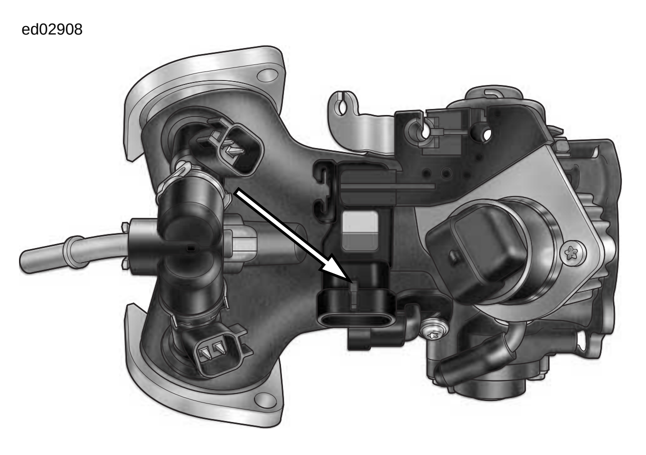


Figure 4-45. MAP Sensor

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-23738	VACUUM PUMP
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Tips

- These codes will set if the MAP sensor signal is out of range. Code P0108 can only be detected with the engine running.
- MAP sensor output check. Using the VACUUM PUMP (Part No. HD-23738), apply a vacuum to the pressure port of the MAP sensor. The signal voltage should lower as the vacuum is applied.
- The MAP, TP, Jiffy Stand, and VSS sensors are connected to the same reference line (+5V Vref). If the reference line goes to ground or open, multiple codes will be set (DTC P0107, P0108, P0122, P0123).

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probes and patch cords.

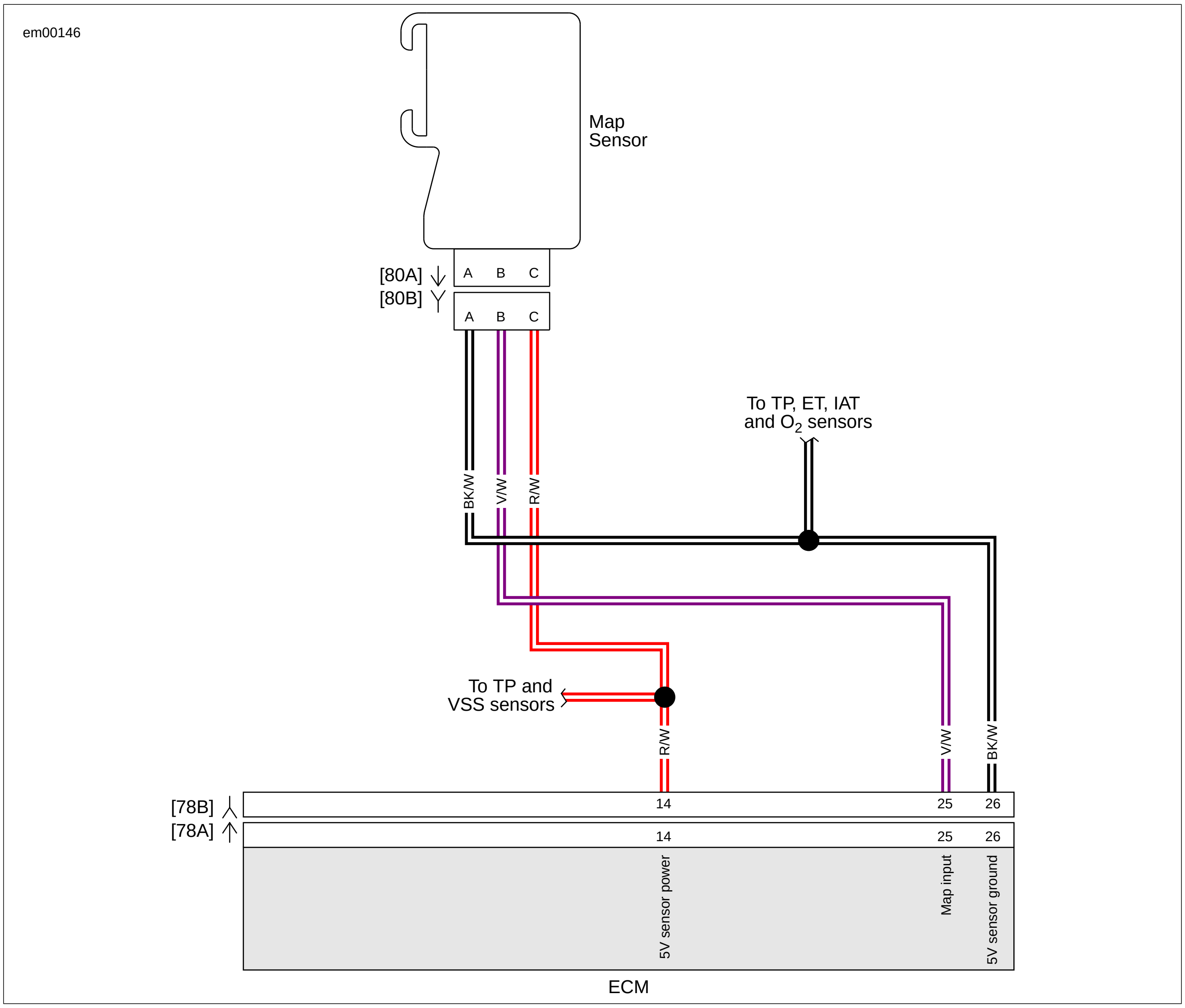
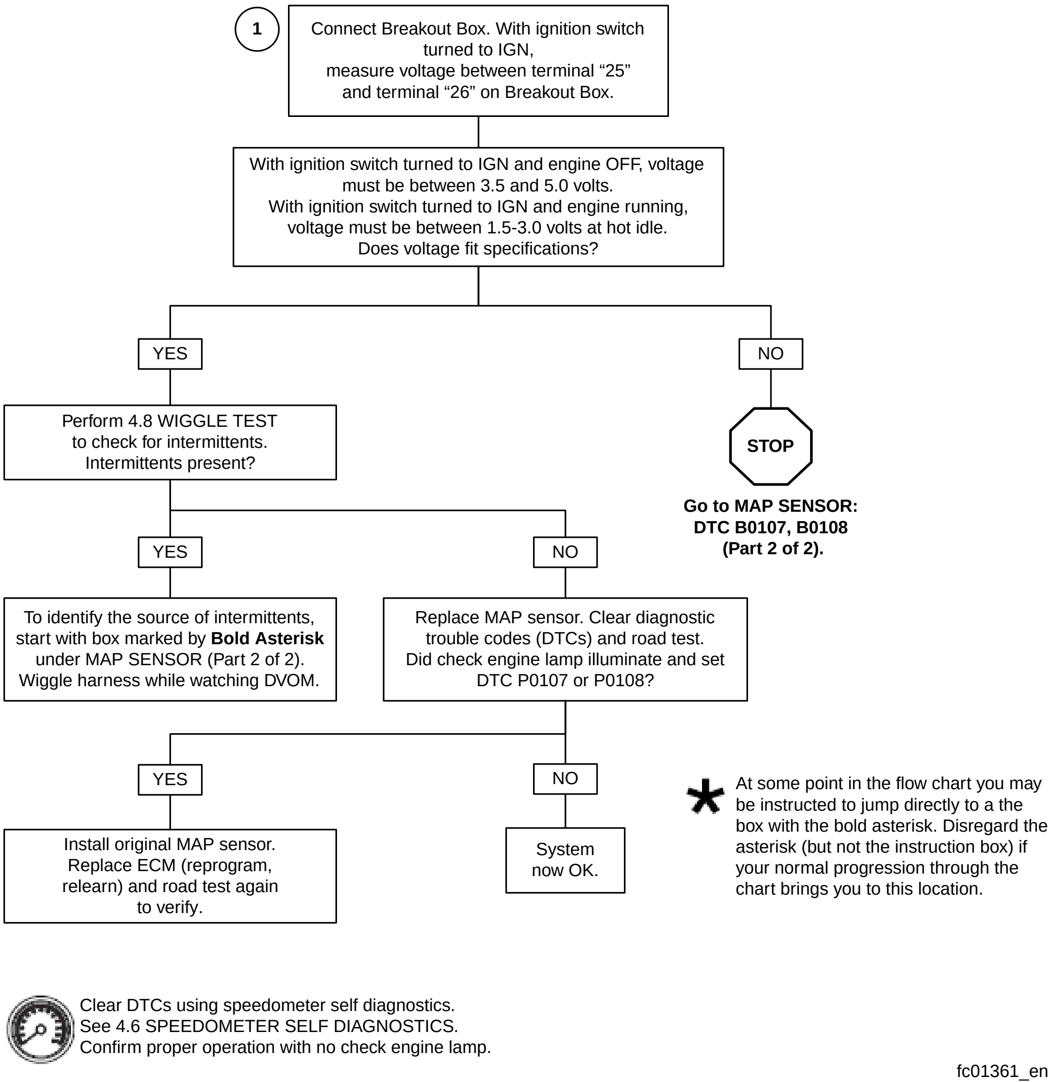


Figure 4-46. MAP Sensor Circuit

Table 4-28. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[80]	Manifold Absolute Pressure (MAP) sensor	3-place Packard	Top of manifold

MAP Sensor: DTC B0107, B0108 (Part 1 of 2)



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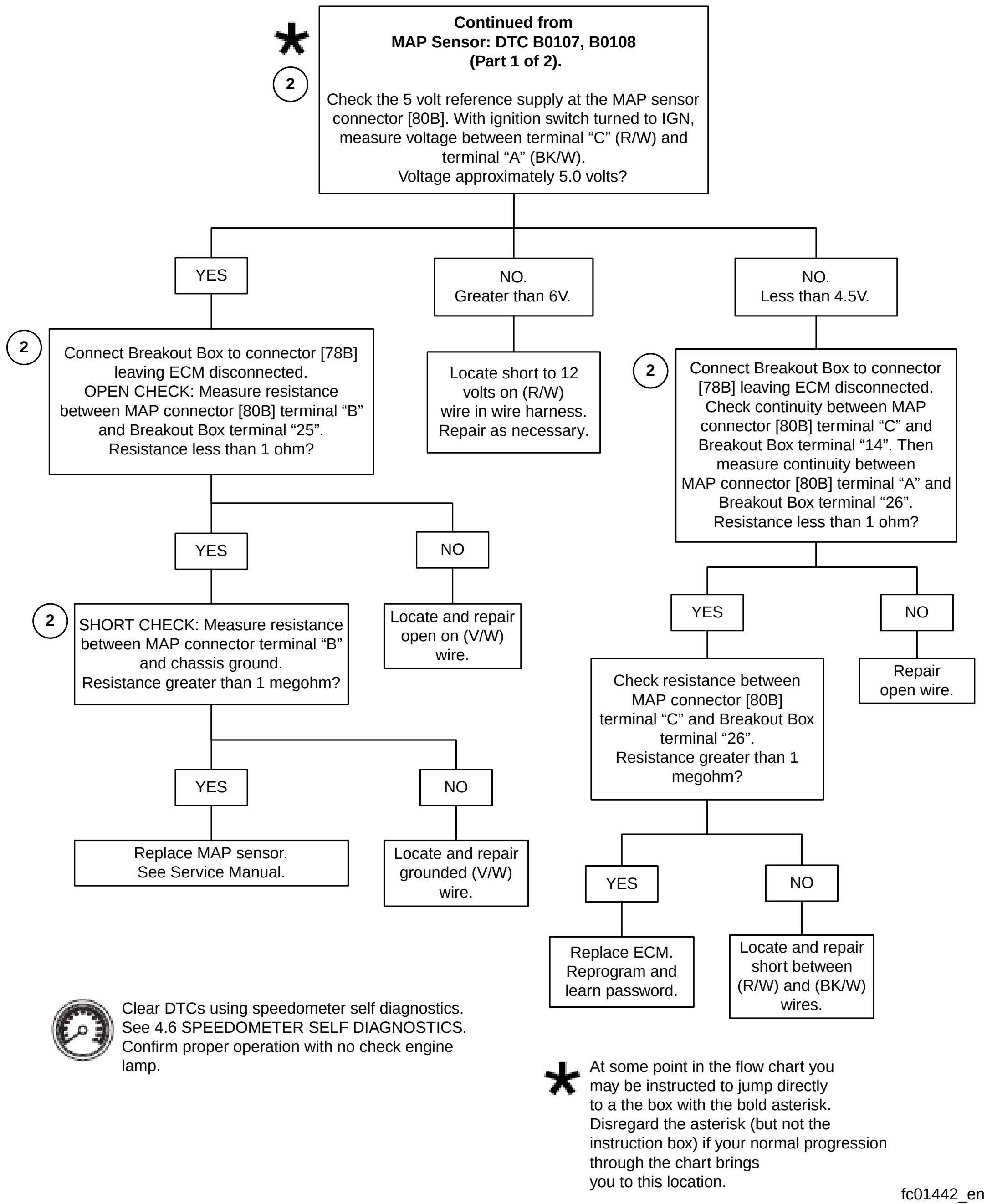
MAP Sensor: DTC B0107, B0108 (Part 2 of 2)



GENERAL

IAT Sensor

The ECM supplies and monitors a voltage signal (terminal "7") to one side of the IAT sensor. The other side of the IAT sensor is connected to a common sensor ground, which is also connected to the ECM (terminal "26").

The IAT sensor is a thermistor device, meaning that at a specific temperature, it will have a specific resistance across its terminals. As this resistance varies, so does the voltage on terminal "7".

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on terminal "7".
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5 volts.

The ECM monitors this voltage to compensate for various operating conditions.

Table 4-29. Code Description

DTC	DESCRIPTION
P0112	IAT sensor voltage low
P0113	IAT sensor open/high

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Tips

Check the following conditions:

- **Poor connection:** Inspect ECM and harness connector [78] for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal- to-wire connection and damaged harness.
- **Perform** 4.8 WIGGLE TEST **to locate intermittents:** If connections and harness check out OK, use a DVOM to check the IAT sensor voltage reading while moving related connectors and wiring harness. If the failure is induced, the IAT sensor voltage reading will change.
- **Shifted sensor:** Refer to Table 4-30. This table may be used to test the IAT sensor at various temperature levels in order to evaluate the possibility of a shifted (out-of-calibration) sensor which may result in driveability problems.
- An intermittent may be caused by a poor connection, rubbed through wire insulation, or a wire broken inside the insulation.

NOTE

All voltage and resistance values are approximate (20%). Measure IAT sensor resistance between ECM terminal "7" and system ground (ECM terminal "26").

Table 4-30. IAT Sensor Table

TEMP °C	RESISTANCE	VOLTAGE	TEMP °F
-20	29121	4.9	-4
-10	16599	4.8	14
0	9750	4.6	32
10	5970	4.3	50
20	3747	4.0	68
25	3000	3.8	77
30	2417	3.6	86
40	1598	3.1	104
50	1080	2.6	122
60	746	2.2	140
70	526	1.7	158
80	377	1.4	176
90	275	1.1	194
100	204	0.9	212

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-43876) to EFI wire harness only (leave ECM disconnected). See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probes and patch cords.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray socket probes and patch cords.
4. Replace IAT sensor. See Service Manual.

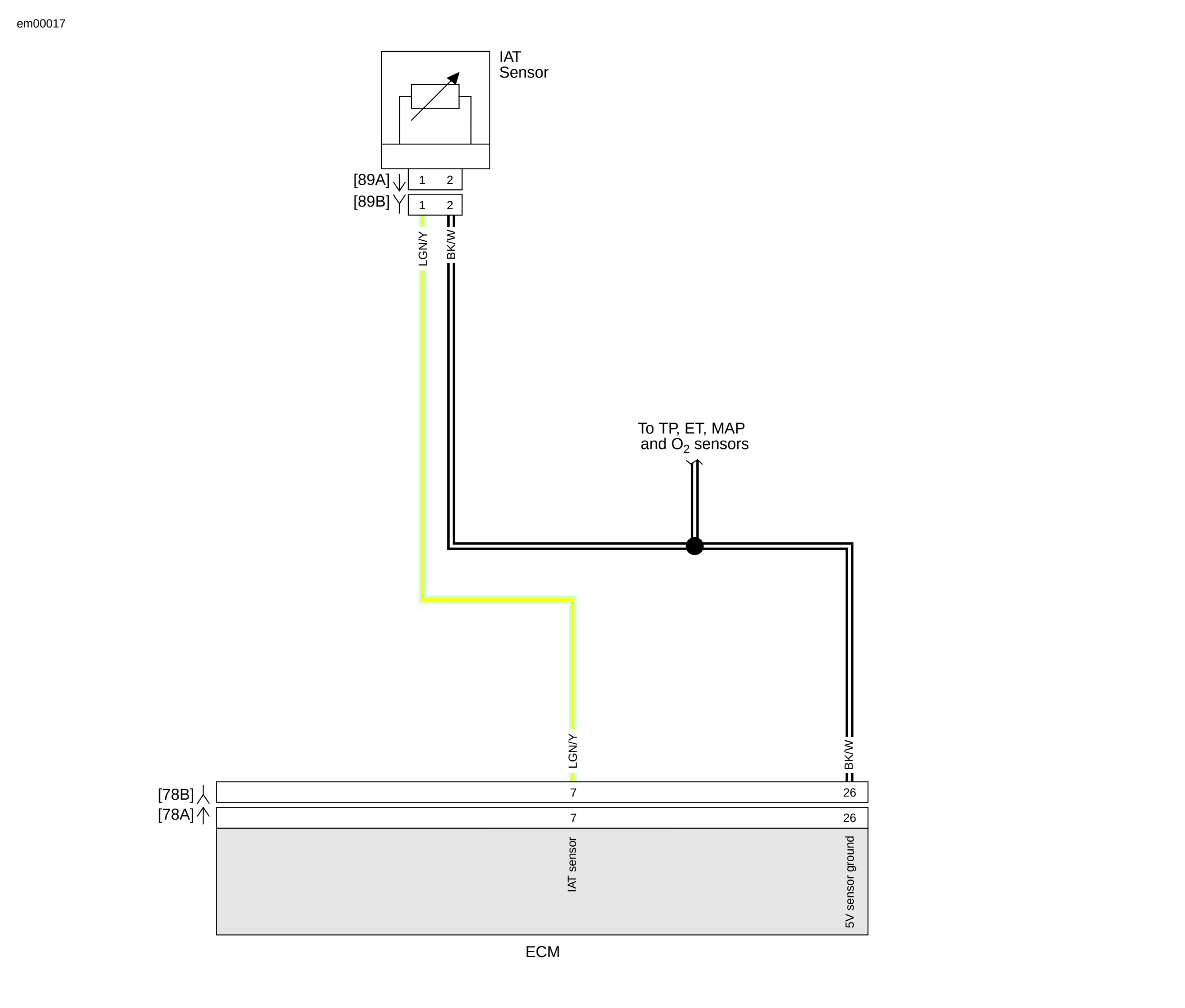
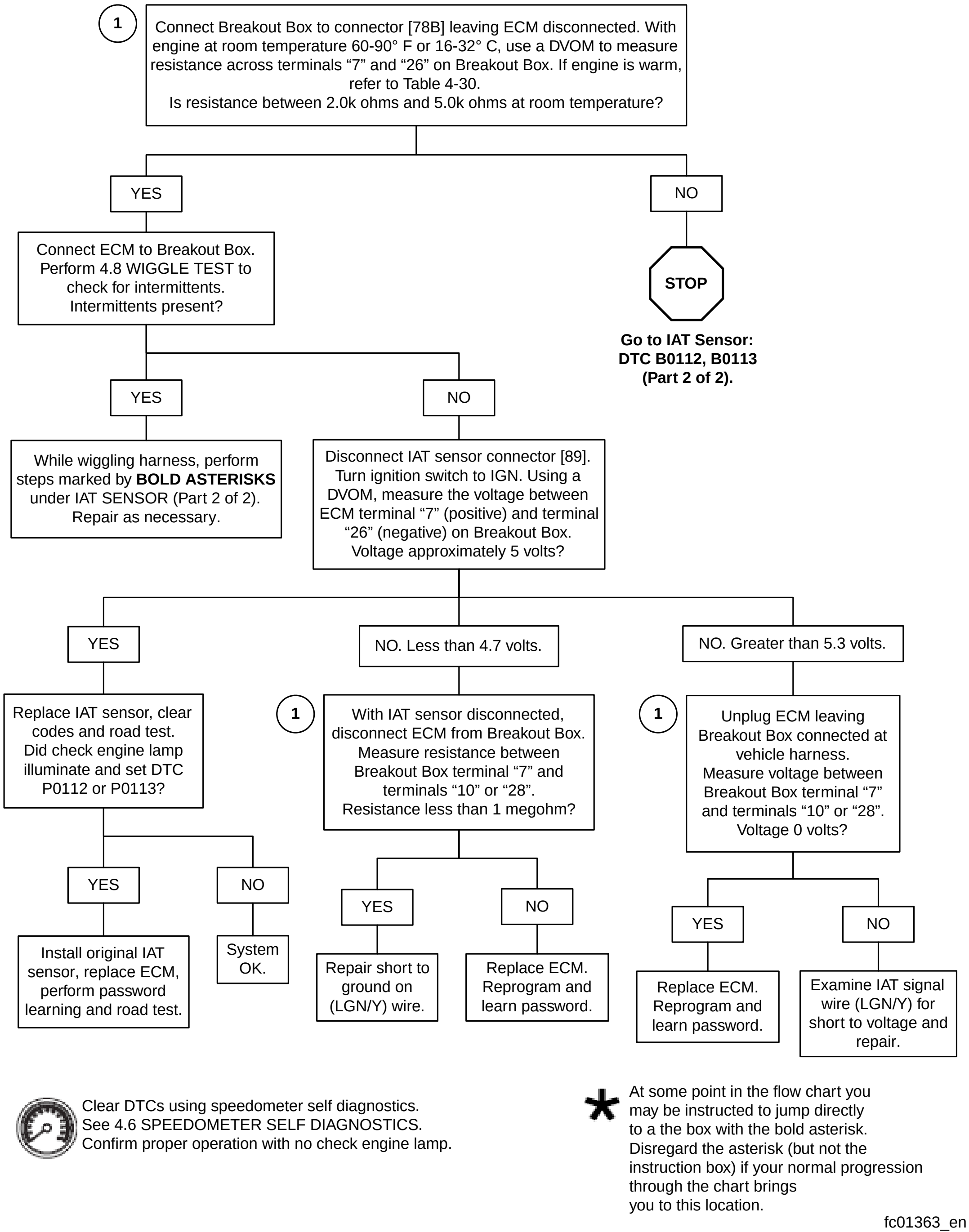


Figure 4-47. IAT Sensor Circuit

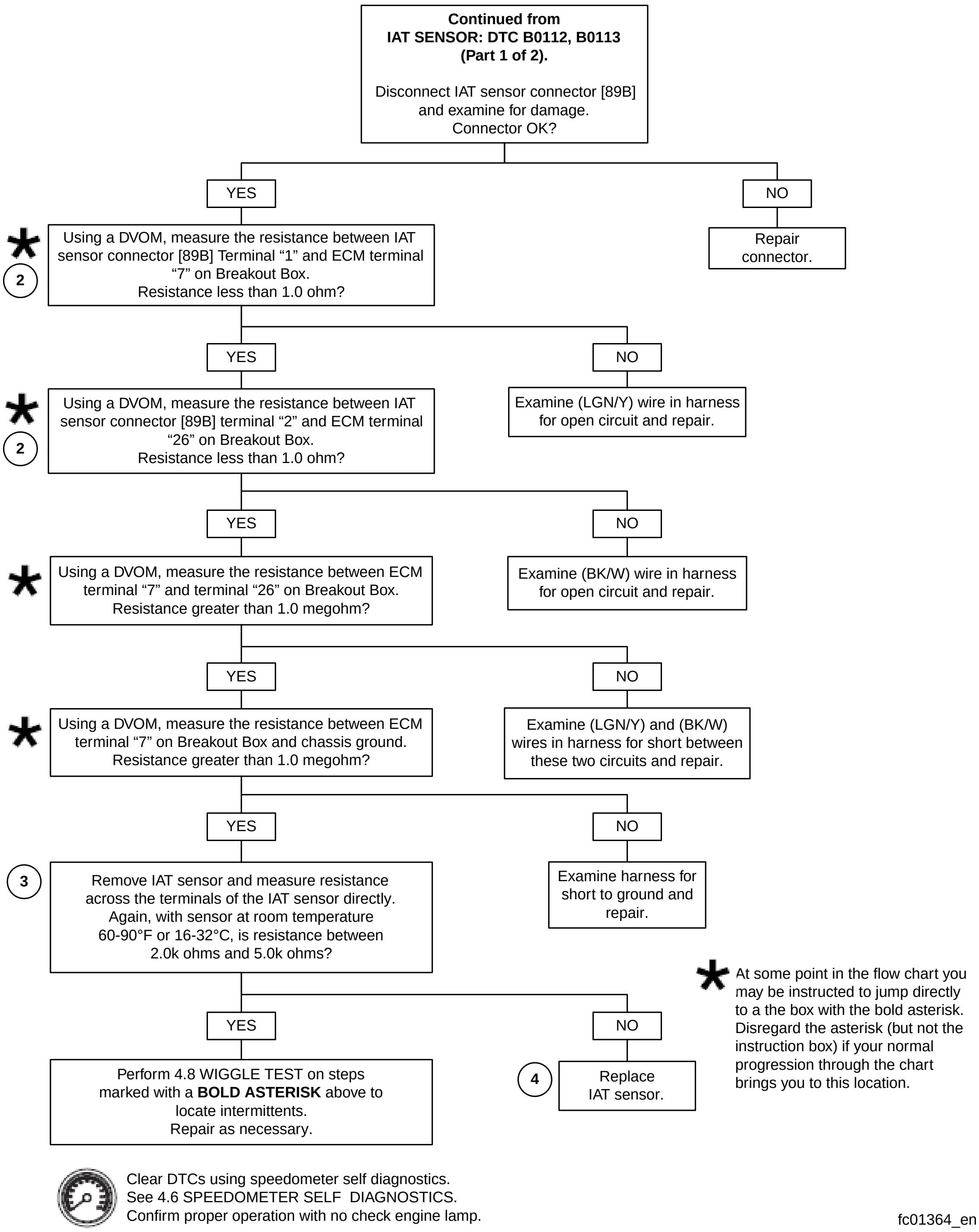
Table 4-31. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[89]	Intake Air Temperature (IAT) sensor	2-place Delphi	Behind air cleaner backing plate

IAT Sensor: DTC B0112, B0113 (Part 1 of 2)



IAT Sensor: DTC B0112, B0113 (Part 2 of 2)



GENERAL

ET Sensor

The ECM supplies and monitors a voltage signal (terminal "6") to one side of the Engine Temperature (ET) sensor. The other side of the ET sensor is connected to a common sensor ground (terminal "26") of the ECM.

The ET sensor is a thermistor device, which means that at a specific temperature it will have a specific resistance across its terminals. As this resistance varies, so does the voltage (terminal "6").

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on terminal "6".
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5 volts.

The ECM monitors this voltage to compensate for various operating conditions. The ECM also uses the sensor input as a reference for determining IAC pintle position.

Table 4-32. Code Description

DTC	DESCRIPTION
P0117	ET sensor voltage low
P0118	ET sensor open/high

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-43876	BREAKOUT BOX

Diagnostic Tips

Once the engine is started, the ET voltage should rise steadily.

Check the following conditions:

- **Poor connection:** Inspect ECM and harness connector [78] for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Perform** 4.8 WIGGLE TEST **to locate intermittents:** If connections and harness check out OK, use a DVOM to check the engine temperature sensor voltage reading while moving related connectors and wiring harness. If the failure is induced, the engine temperature sensor voltage reading will change.
- **Shifted sensor:** Refer to Table 4-33. This table may be used to test the engine temperature sensor at various temperature levels in order to evaluate the possibility of a shifted (out-of-calibration) sensor which may result in driveability problems.
- An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation.

NOTE

All voltage and resistance values are approximate (20%). Measure ET sensor resistance between ECM terminal "6" and system ground (ECM terminal "26").

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-43876) to EFI wire harness only (leave ECM disconnected). See 4.8 WIGGLE TEST.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probes and patch cords.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray socket probes and patch cords.
4. Replace ET sensor. See Service Manual.

Table 4-33. ET Sensor Table

TEMP °C	RESISTANCE	VOLTAGE	TEMP °F
-20	28144	4.4	-4
-10	15873	4.0	14
0	9255	3.5	32
10	5571	3.0	50
20	3457	2.4	68
25	2750	2.1	77
30	2205	1.8	86
40	1442	1.3 or 4.1 *	104
50	965	1.0 or 3.7 *	122
60	661	3.3	140
70	462	2.9	158
80	329	2.5	176
90	238	2.1	194
100	175	1.7	212
*Between 40-50°C the ECM changes scaling. Voltages for ET sensor will shift scales in the range. This provides proper sensor resolution for all temperatures.			

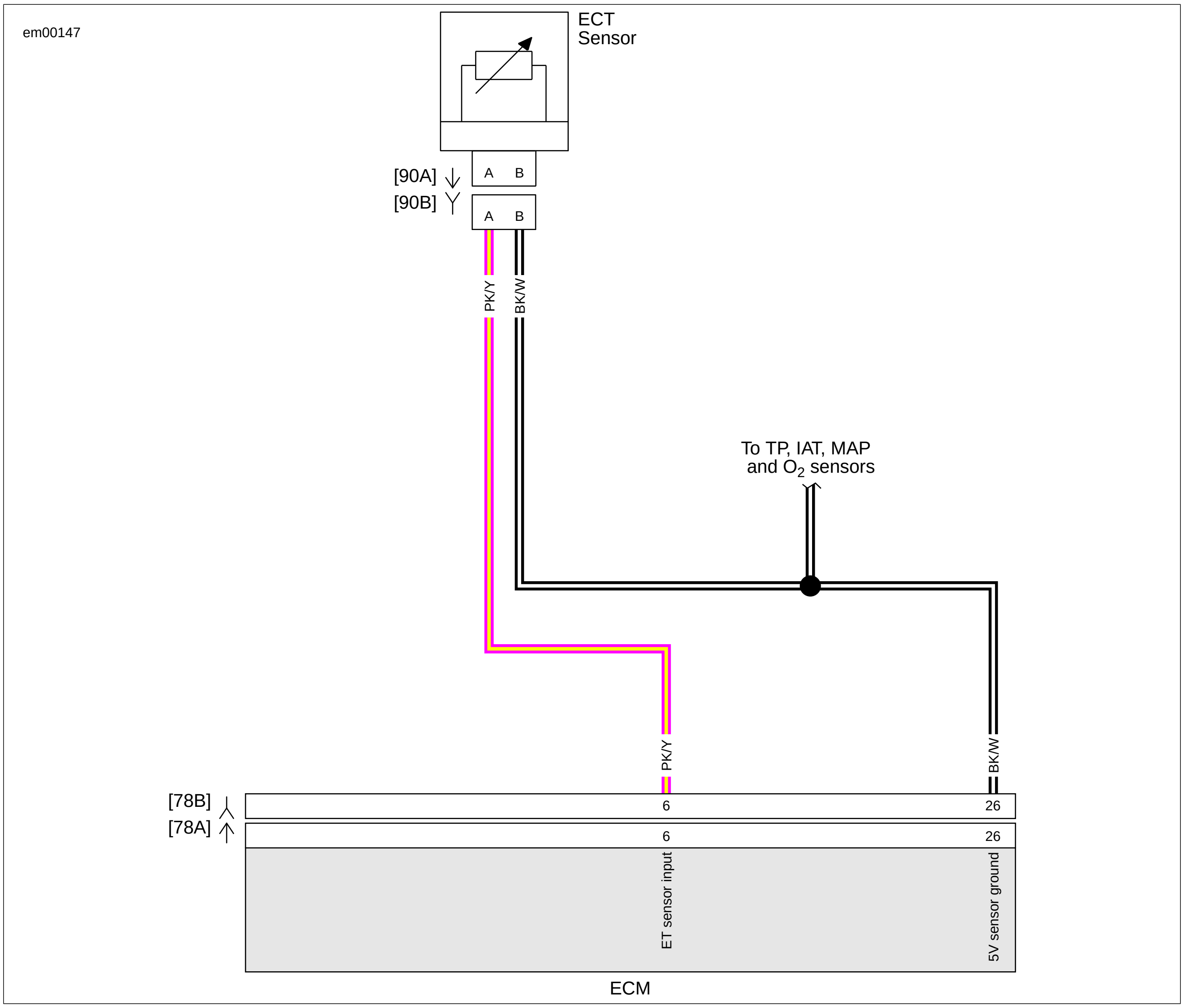
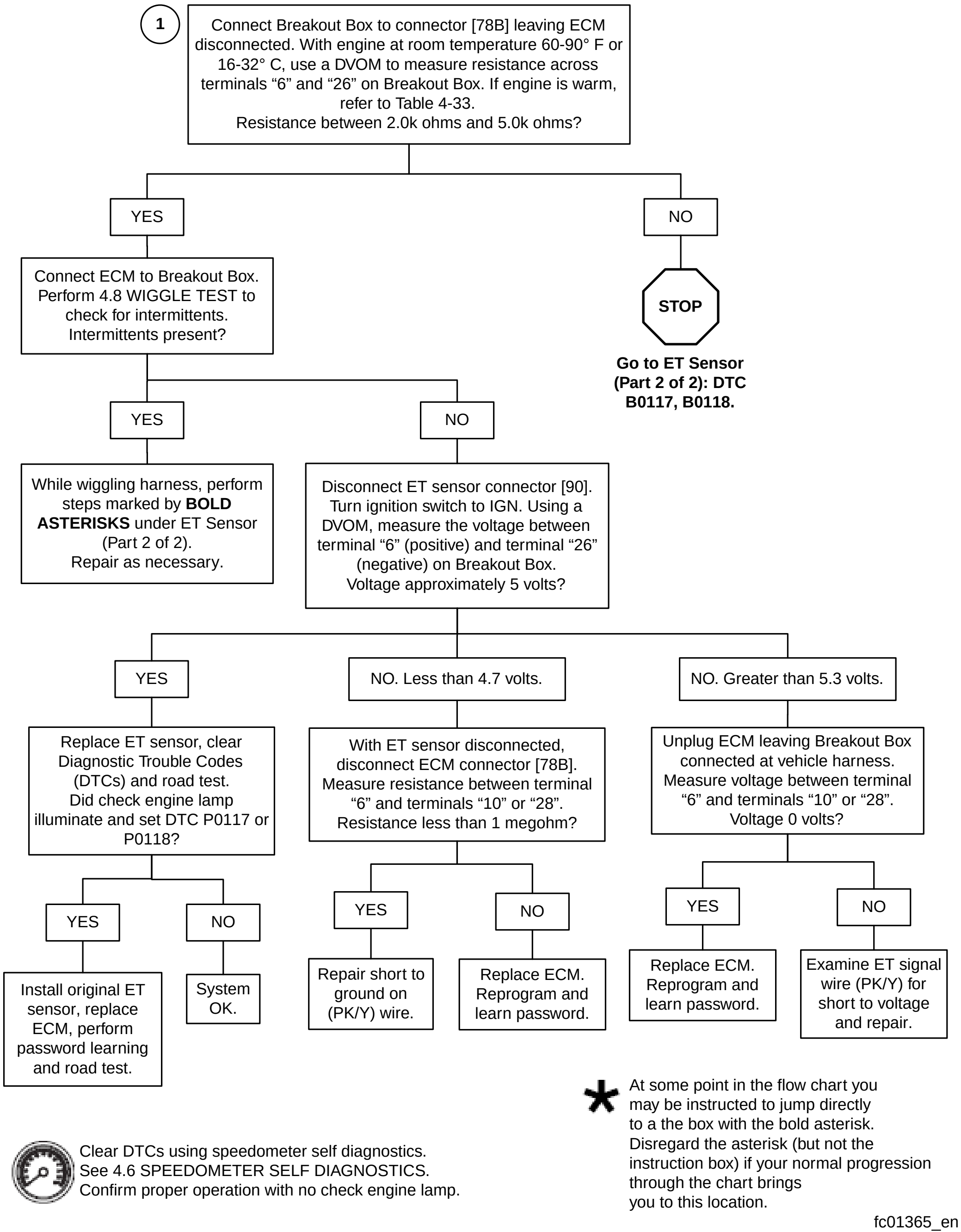


Figure 4-48. ET Sensor Circuit

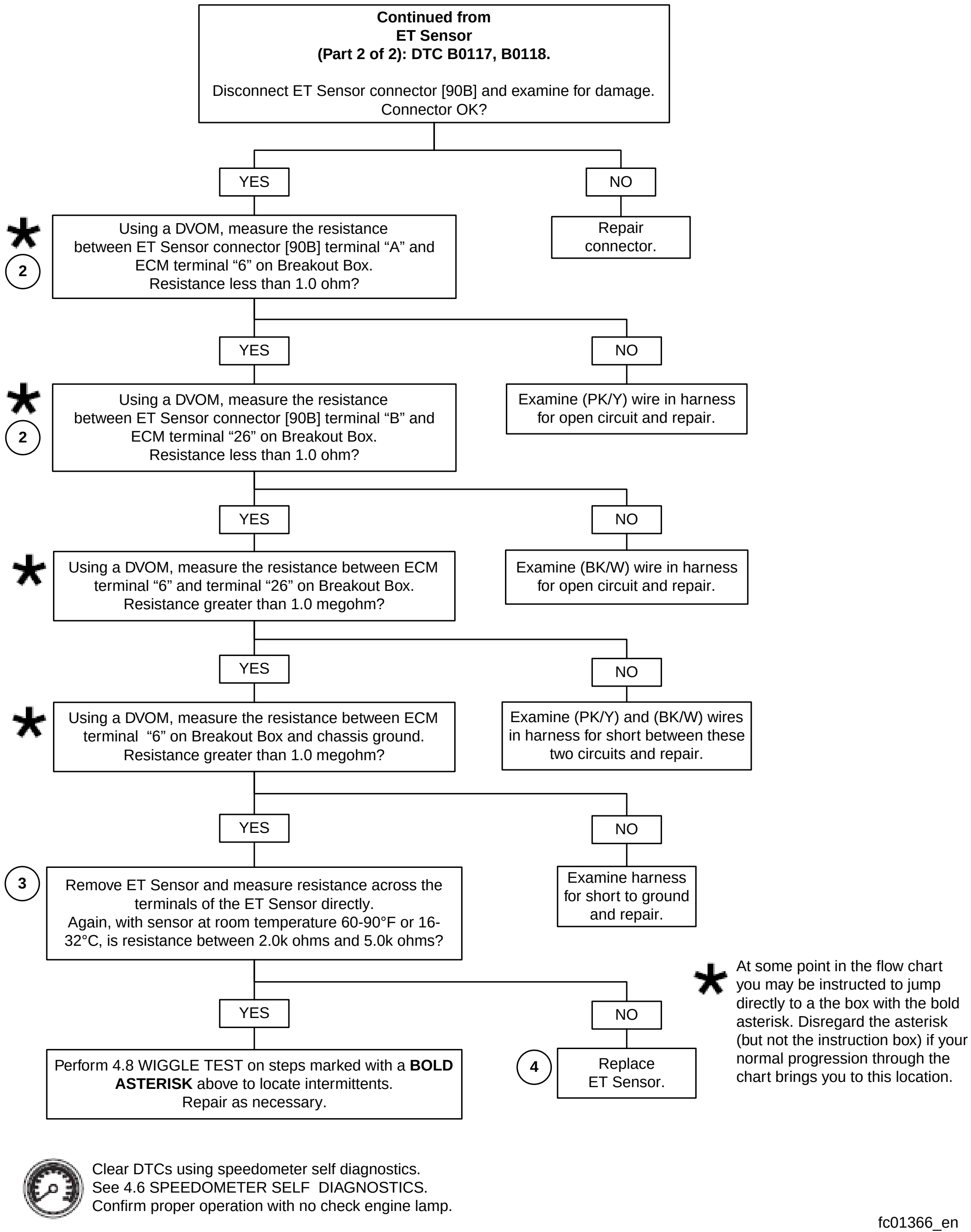
Table 4-34. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[90]	Engine Temperature (ET) sensor	2-place Delphi	Back of front cylinder, left side

ET Sensor (Part 1 of 2): DTC B0117, B0118



ET Sensor (Part 2 of 2): DTC B0117, B0118



GENERAL

TP Sensor

The ECM supplies a 5 volt signal (terminal "14") to the Throttle Position (TP) sensor. The TP sensor sends a signal back to the ECM (terminal "24"). The returned signal varies in voltage according to throttle position.

- At idle (closed throttle), the signal is typically in the range of 0.20-0.80 volts.
- At wide open throttle, the signal is normally 4.0-4.9 volts.

A code P0122 or P0123 will set if the TP sensor voltage signal does not fall within the acceptable range.

Table 4-35. Code Description

DTC	DESCRIPTION
P0122	TP sensor open/low
P0123	TP sensor high

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT

Diagnostic Tips

The DVOM reads throttle position in volts. Voltage should increase at a steady rate as the throttle is moved from idle to wide open. A short to ground or open on the (GY/V) or (R/W) wires also will result in a DTC P0122. A short to ground or open on the (R/W) wire (+5V REF) sets multiple codes as described below.

NOTE

The MAP, TP, Jiffy Stand and VSS sensors are connected to the same reference line (+5V REF). If the reference line goes to ground or open, multiple codes will be set (DTC P0107, P0108, P0122, P0123, P0501, P0502). Start with the trouble code having the lowest ranking value.

Check for the following conditions:

- **Poor Connection:** Inspect ECM and harness connector [78B] for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal- to-wire connection and damaged harness.
- **Perform** 4.8 WIGGLE TEST **to locate intermittents:** If connections and harness check out OK, monitor TP sensor voltage using a DVOM while moving related connectors and wiring harness. If the failure is induced, the TP sensor voltage reading will change.
- **TP sensor scaling:** Observe the TP sensor voltage display while opening the throttle with engine stopped and Ignition Switch turned to IGN. Display should vary from closed TP sensor voltage (when throttle is closed) to greater than 4.0 volts (when throttle is held wide open). As the throttle is **slowly** moved, the voltage should change gradually without spikes or low voltages being observed.
- Check TP sensor voltage reading with DVOM. If TP sensor is equal to or greater than 3.8 volts then the system is in "clear flood" mode and engine will not start. While spark is present, fuel is shut off. Problem can be mechanical, such as stuck throttle cables.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect a BREAKOUT BOX (Part No. HD-43876) between EFI wire harness and ECM before measuring voltage. See 4.7 BREAKOUT BOX: EFI. Using a DVOM to measure voltage, take reading across terminal "24" (positive lead) and terminal "26" (negative lead) on Breakout Box.
2. Replace TP sensor. See Service Manual.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probes and patch cords.

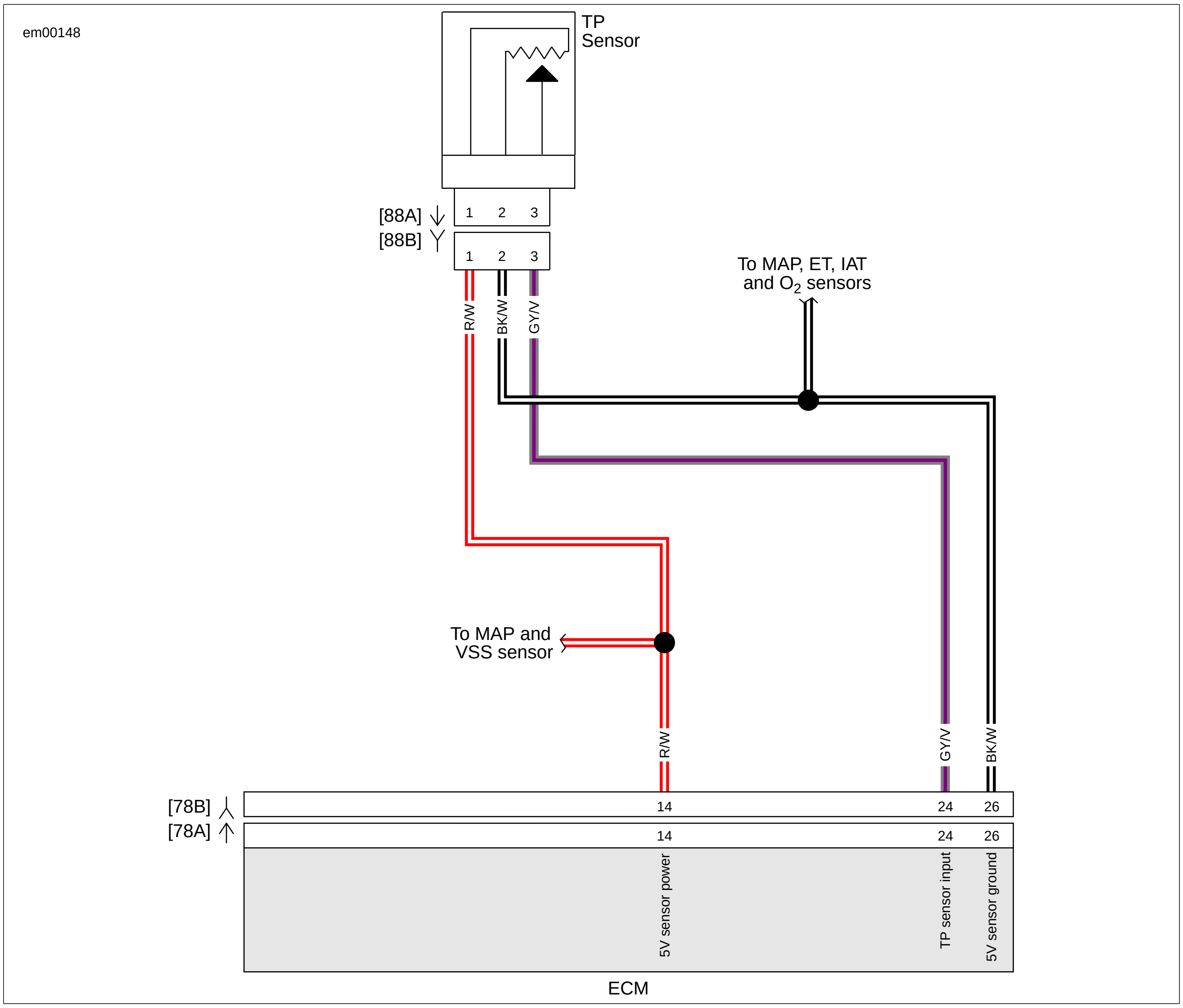
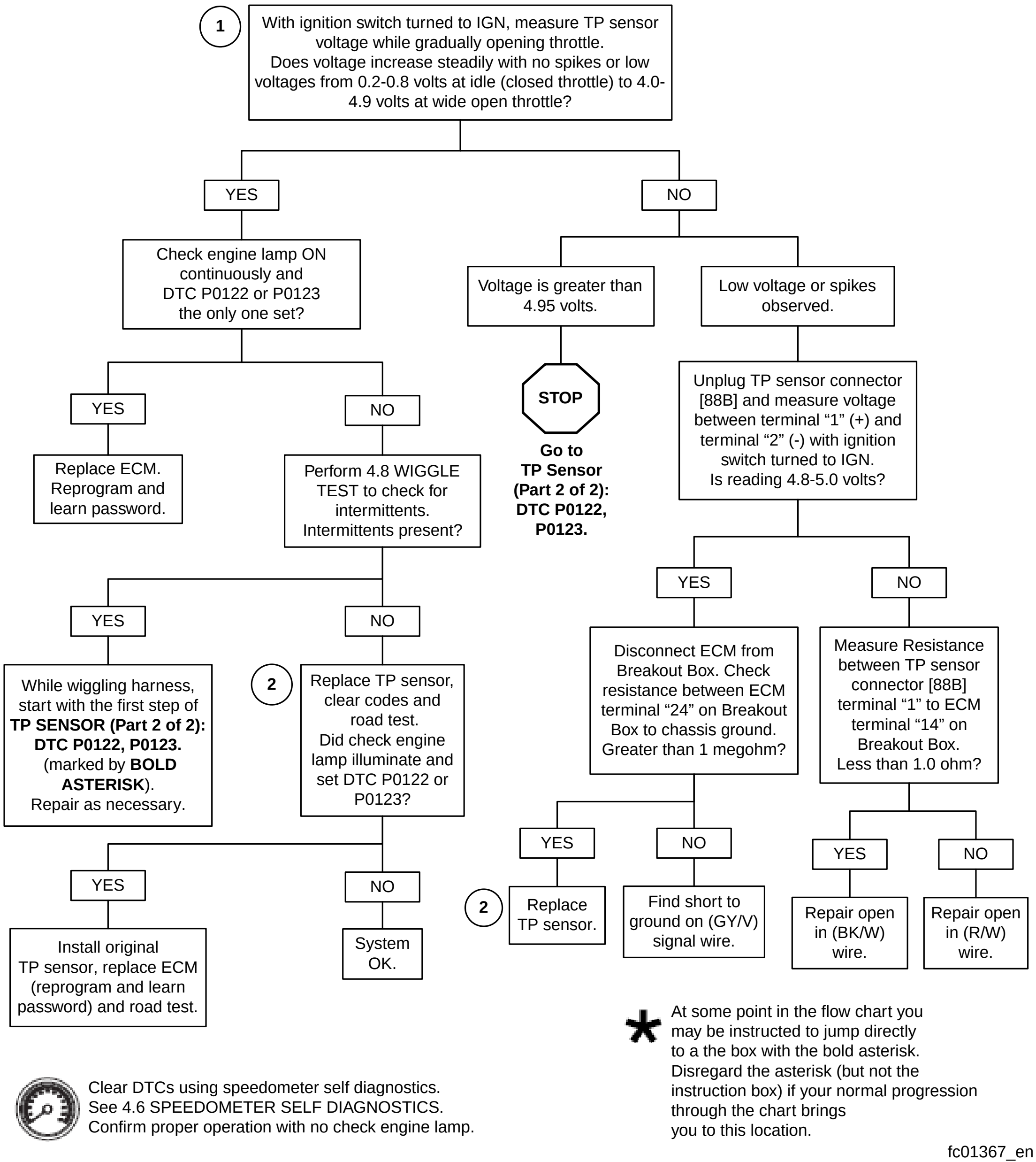


Figure 4-49. TP Sensor Circuit

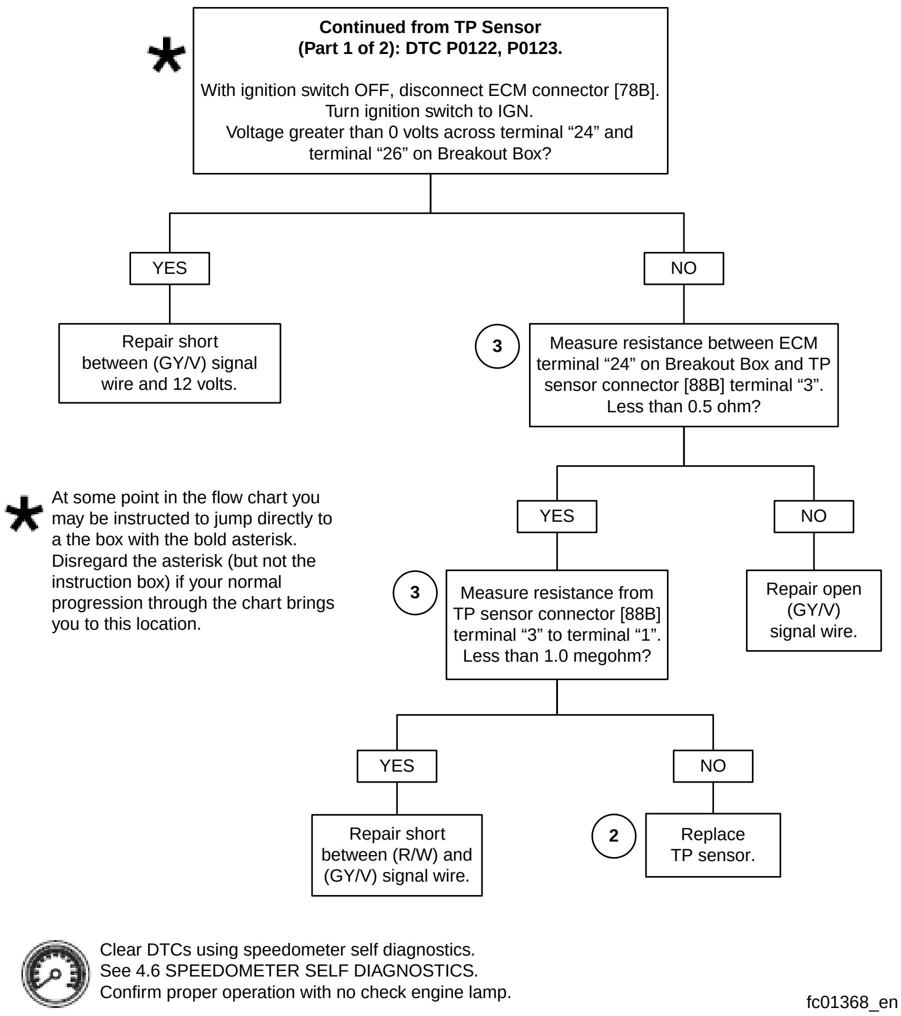
Table 4-36. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[88]	Throttle Position (TP) sensor	3-place Delphi	Behind air cleaner backing plate

TP Sensor (Part 1 of 2): DTC P0122, P0123



TP Sensor (Part 2 of 2): DTC P0122, P0123



GENERAL

Oxygen Sensor

See Figure 4-50. The Oxygen (O_2) sensor provides a signal to the ECM which indicates whether the engine is running rich or lean.

- A DTC P0131 (front) or P0151 (rear) is set when the ECM detects an excessively lean condition for a specified length of time. DTCs may also set if O_2 sensor fails.
- A DTC P0132 (front) or P0152 (rear) is set when the ECM detects an excessively rich condition for a specified length of time. DTCs may also set if O_2 sensor fails.
- A DTC P0134 is set when the front O_2 sensor circuit is open or sensor is too cold to respond. A DTC P0154 is set when the rear O_2 sensor circuit is open or sensor is too cold to respond.

When the air/fuel mixture is ideal, approximately 14.6 parts air to 1 part fuel, the voltage will be approximately 0.45V.

Table 4-37. Code Description

DTC	DESCRIPTION
P0131	Front O_2 sensor low or engine running lean
P0132	Engine running rich
P0134	Front O_2 sensor open/not responding/high
P0151	Rear O_2 sensor low or engine running lean
P0152	Engine running rich
P0154	Rear O_2 sensor open/not responding/high

Figure 4-50. Oxygen Sensor

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-43876	BREAKOUT BOX

Diagnostic Tips

Oxygen sensor DTCs may be seen during the vehicle break-in period. The oxygen sensor DTCs will not illuminate the check engine lamp for current or historic codes and will only be indicated by Digital Technician or speedometer self diagnostics. If the DTCs are reported during the break-in period, clear or ignore the DTCs until the break-in period is completed.

The DVOM displays the signal from the O_2 sensor in volts. This voltage will have an average value tending towards lean, rich or ideal value depending on operating temperature of the engine, engine speed and throttle position. An open/short to voltage or short to ground in the (PK/O) wire (front) and (PK/GN) wire (rear) will cause the engine to run rich (short to ground) or lean (short to voltage) until fault is detected. Once fault is detected, vehicle will run in open loop.

Check for the following conditions:

- **Poor connection.** Inspect the ECM harness connector [78], fuel injector connectors [137, 138] and O_2 sensor connector wiring for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Dirty/stuck open injectors.** The motorcycle may run lean (dirty/clogged injectors) or rich (stuck open injectors) if there is an injector problem. This could also cause poor fuel economy and performance.
- **Loose O2 sensor.** If the O_2 sensor is loose, engine performance may be affected. This could also show up as a slow changing O_2 sensor voltage.
- **Loose/leaking exhaust.** This can cause a poor ground connection for sensor or allow fresh air into the exhaust system. If fresh air enters exhaust system, the O_2 sensor will read a lean condition, causing the system to go rich.
- **Engine misfire.** See 4.17 MISFIRE AT IDLE OR UNDER LOAD.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect a BREAKOUT BOX (Part No. HD-43876) between EFI wire harness and ECM before measuring voltage. See 4.7 BREAKOUT BOX: EFI.
2. See 4.9 INTAKE LEAK TEST.

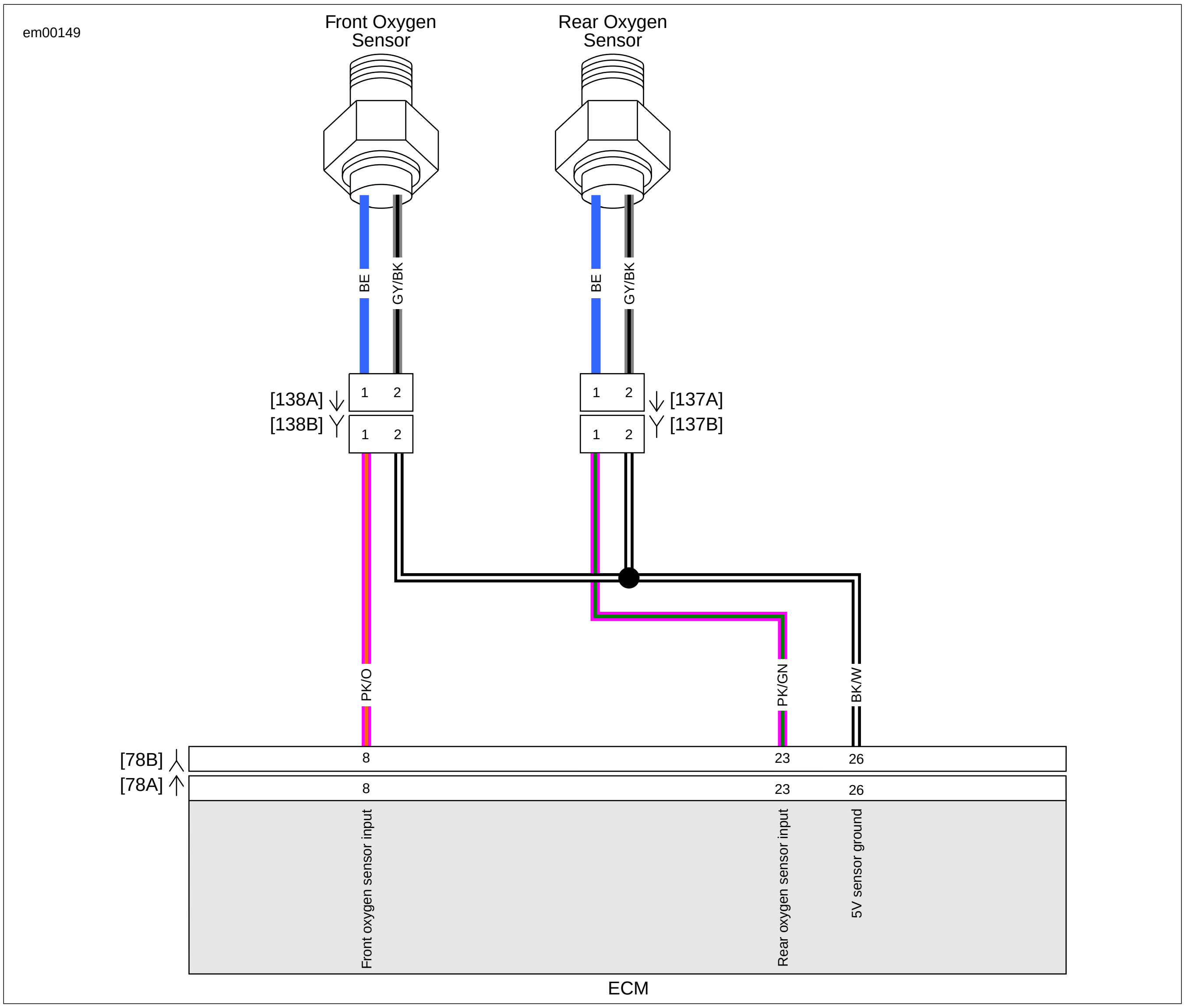
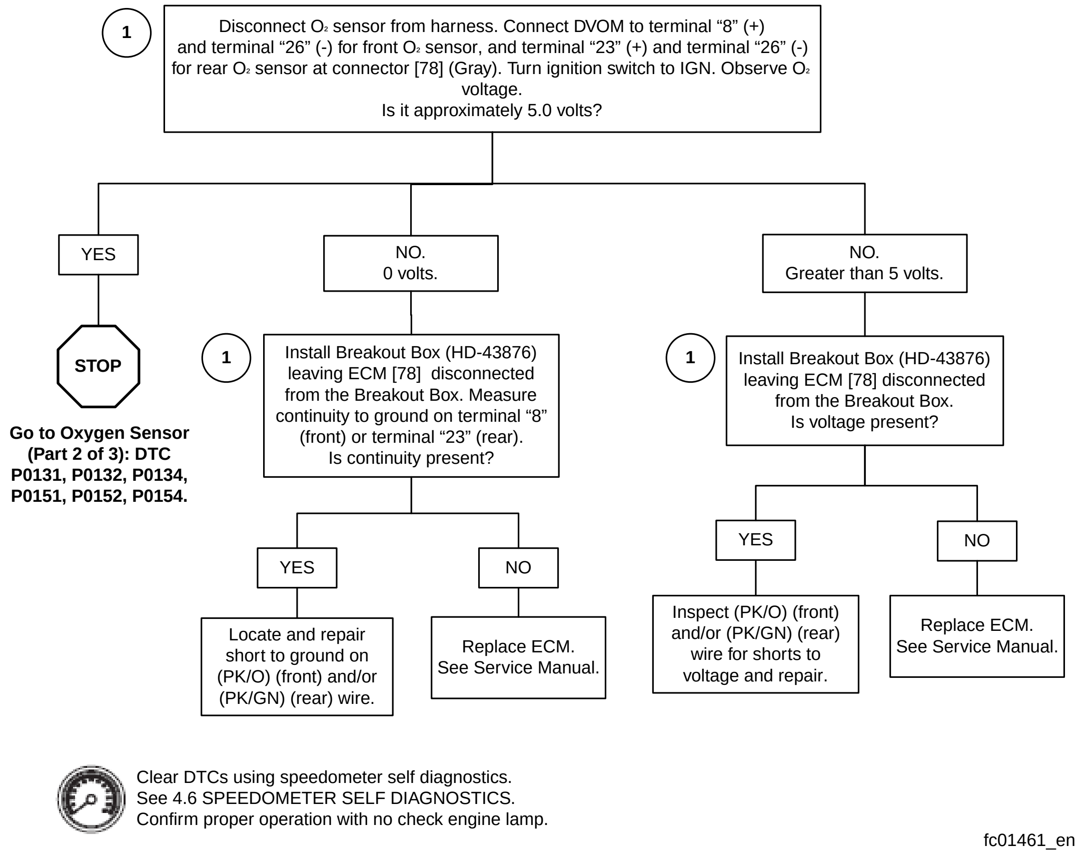


Figure 4-51. Oxygen Sensor Circuit

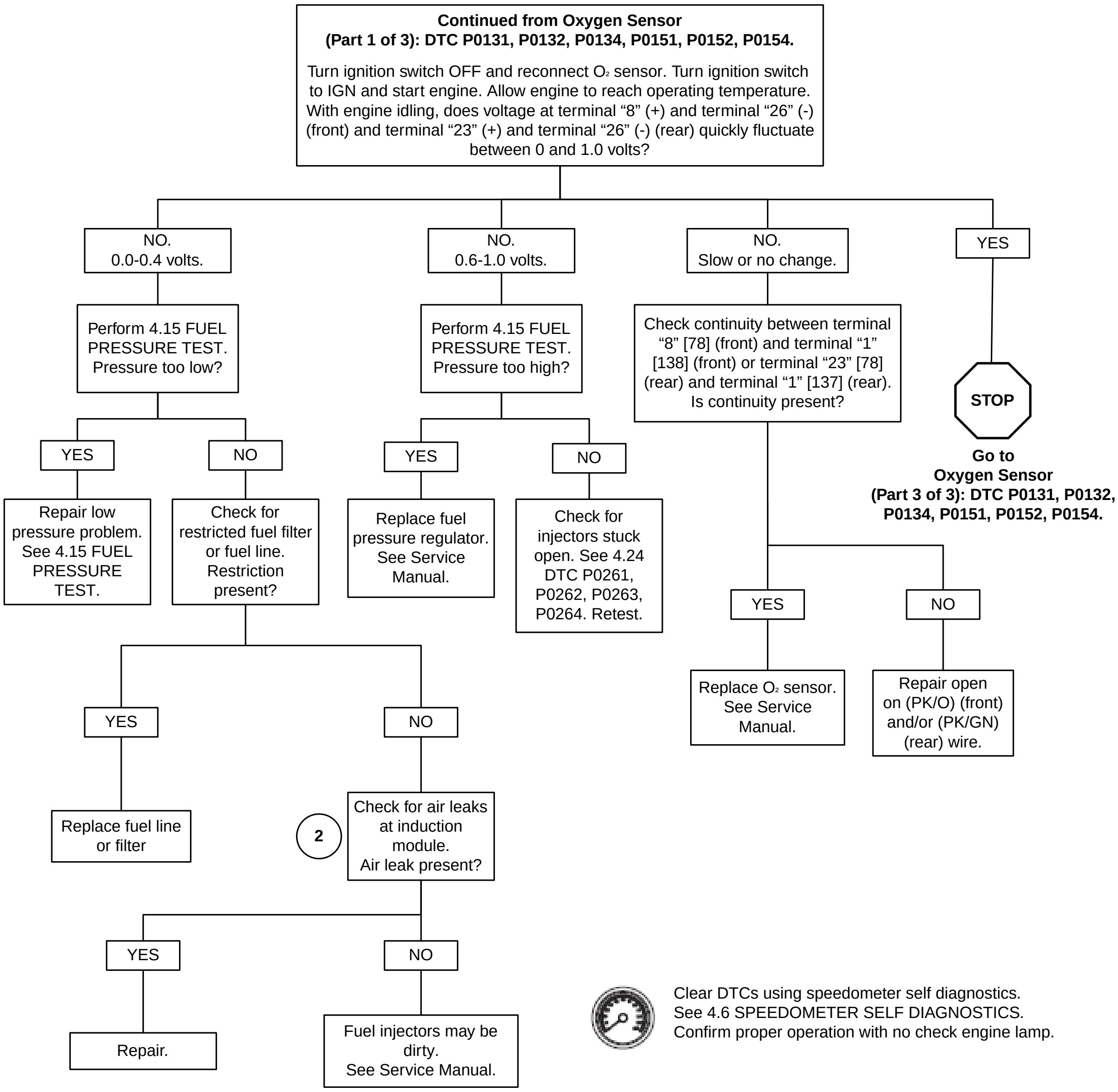
Table 4-38. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[137]	Rear oxygen sensor	2-place Amp	Under oil tank
[138]	Front oxygen sensor	2-place Amp	Behind voltage regulator

Oxygen Sensor (Part 1 of 3): DTC P0131, P0132, P0134, P0151, P0152, P0154



Oxygen Sensor (Part 2 of 3): DTC P0131, P0132, P0134, P0151, P0152, P0154



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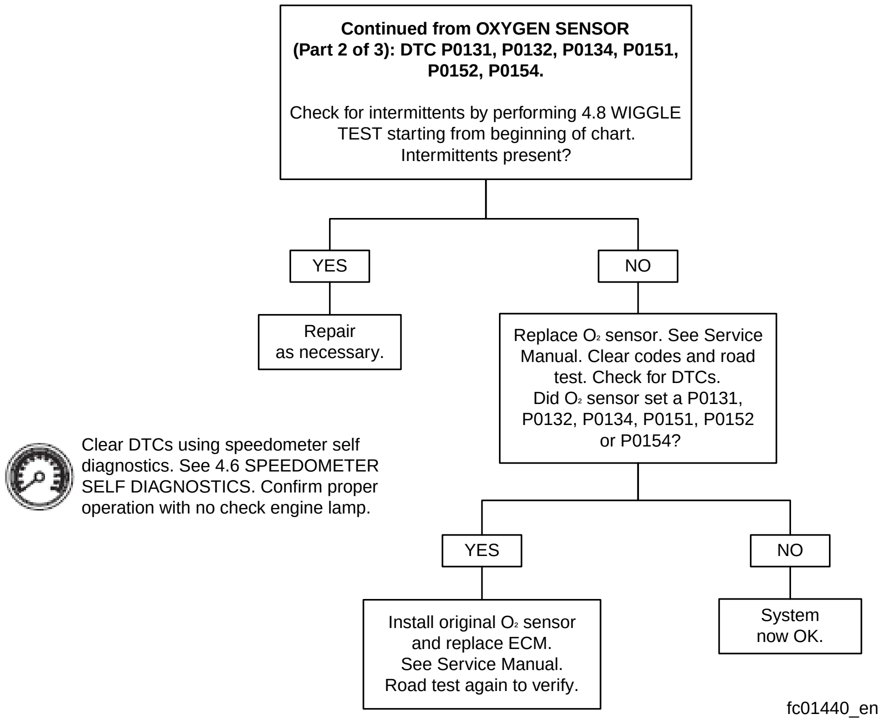
Oxygen Sensor (Part 3 of 3): DTC P0131, P0132, P0134, P0151, P0152, P0154



GENERAL

Fuel Injectors

The fuel injectors are solenoids that allow pressurized fuel into the intake tract. The injectors are timed to the engine cycle and triggered sequentially. The power for the injectors comes from the system relay. The system relay also provides power for the fuel pump and the ignition coil. The ECM provides the path to ground to trigger the injectors.

NOTE

ECM fuse and system relay failures or wiring harness problems will cause 12 volt power to be lost to both injectors, ignition coils and fuel pump.

Table 4-39. Code Description

DTC	DESCRIPTION
P0261	Front injector open/low
P0262	Front injector high
P0263	Rear injector open/low
P0264	Rear injector high

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. See Service Manual for all service information.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), purple pin probe and patch cord.
3. Connect a BREAKOUT BOX (Part No. HD-43876) between EFI wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

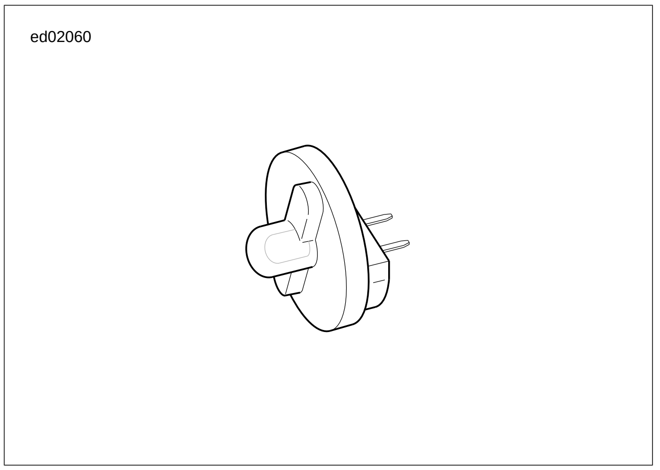


Figure 4-52. Fuel Injector Test Lamp (Part No. HD-34730-2C)

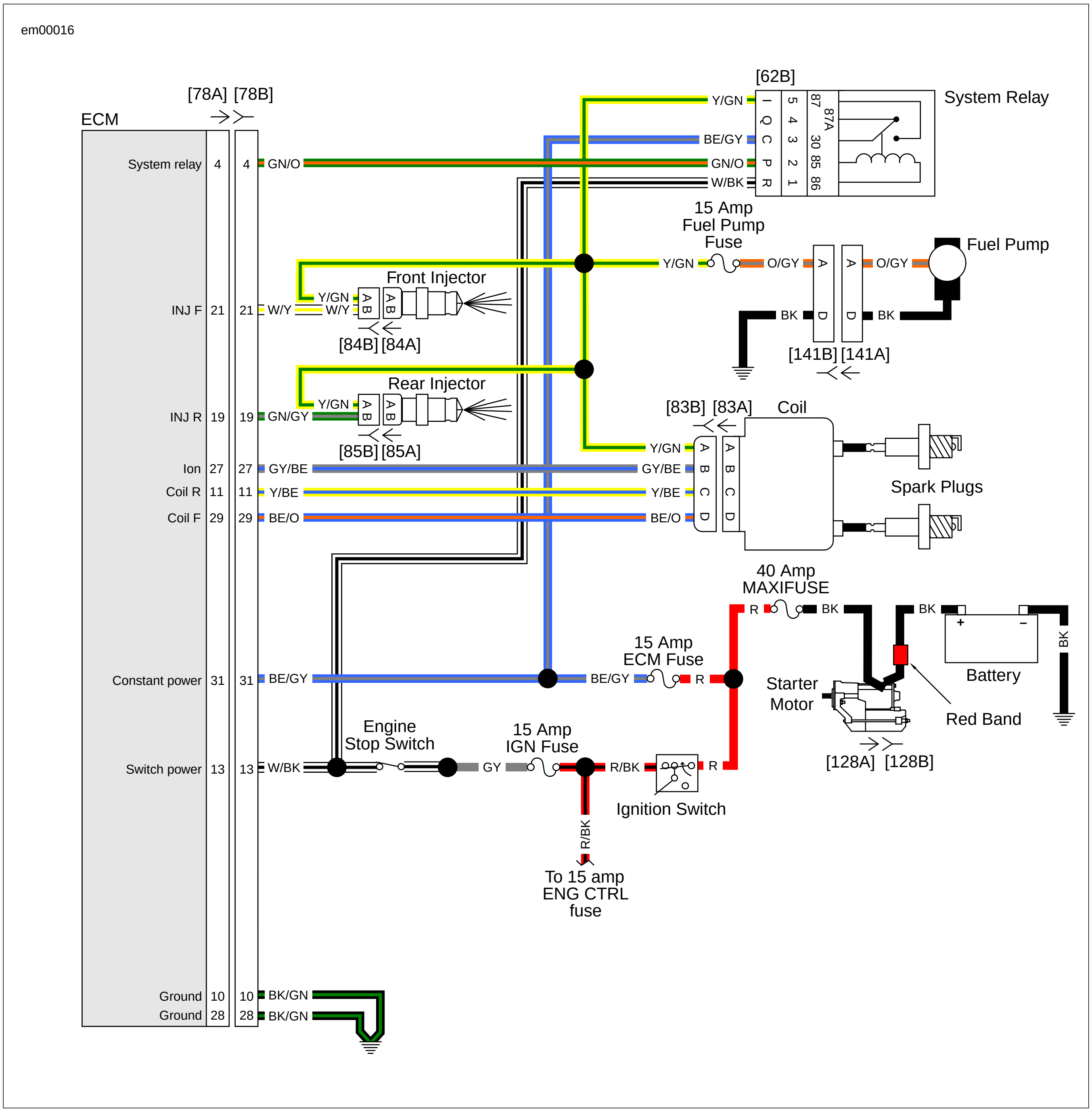


Figure 4-53. Fuel Injectors Circuit

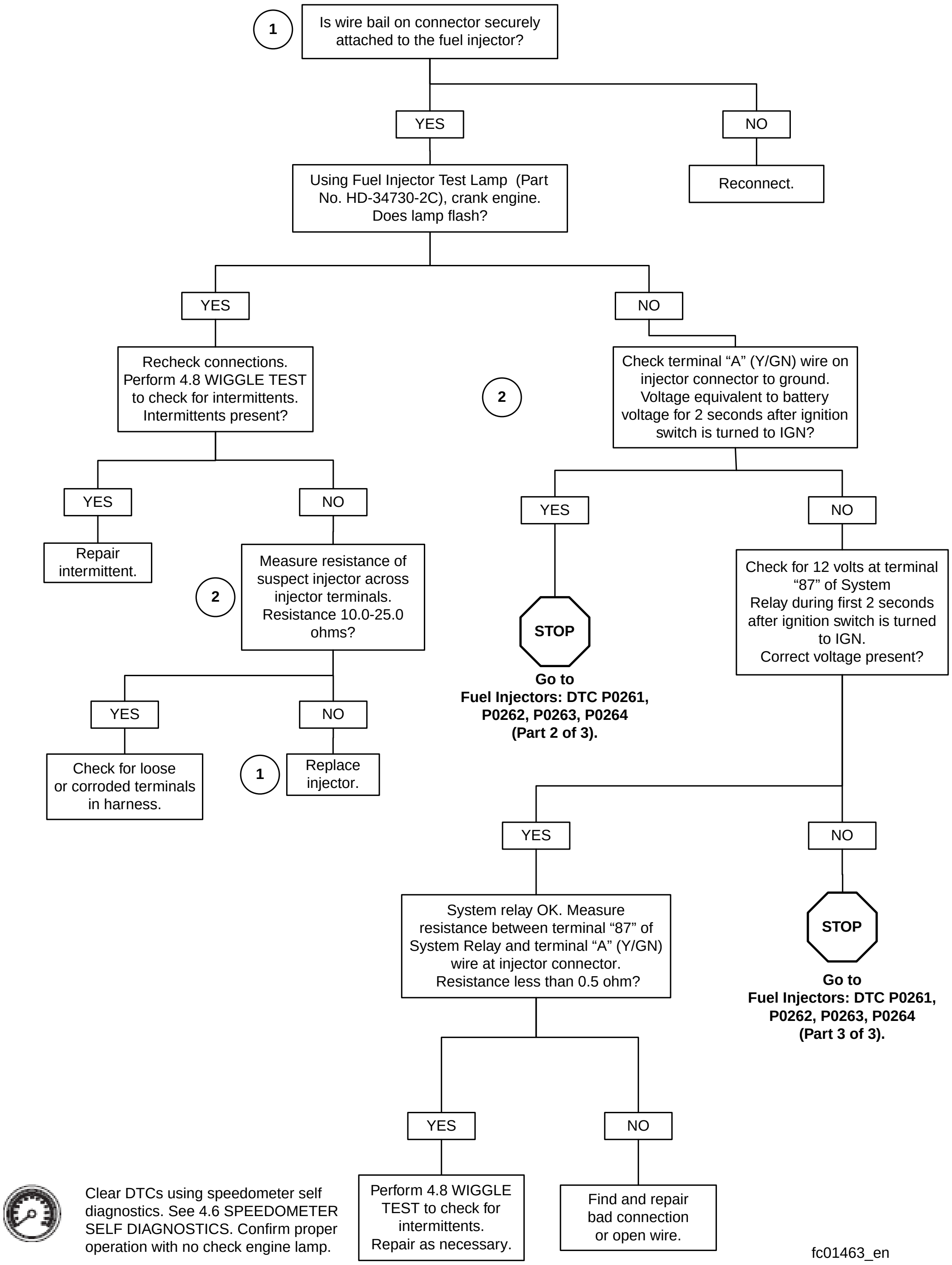
Table 4-40. Wire Harness Connectors

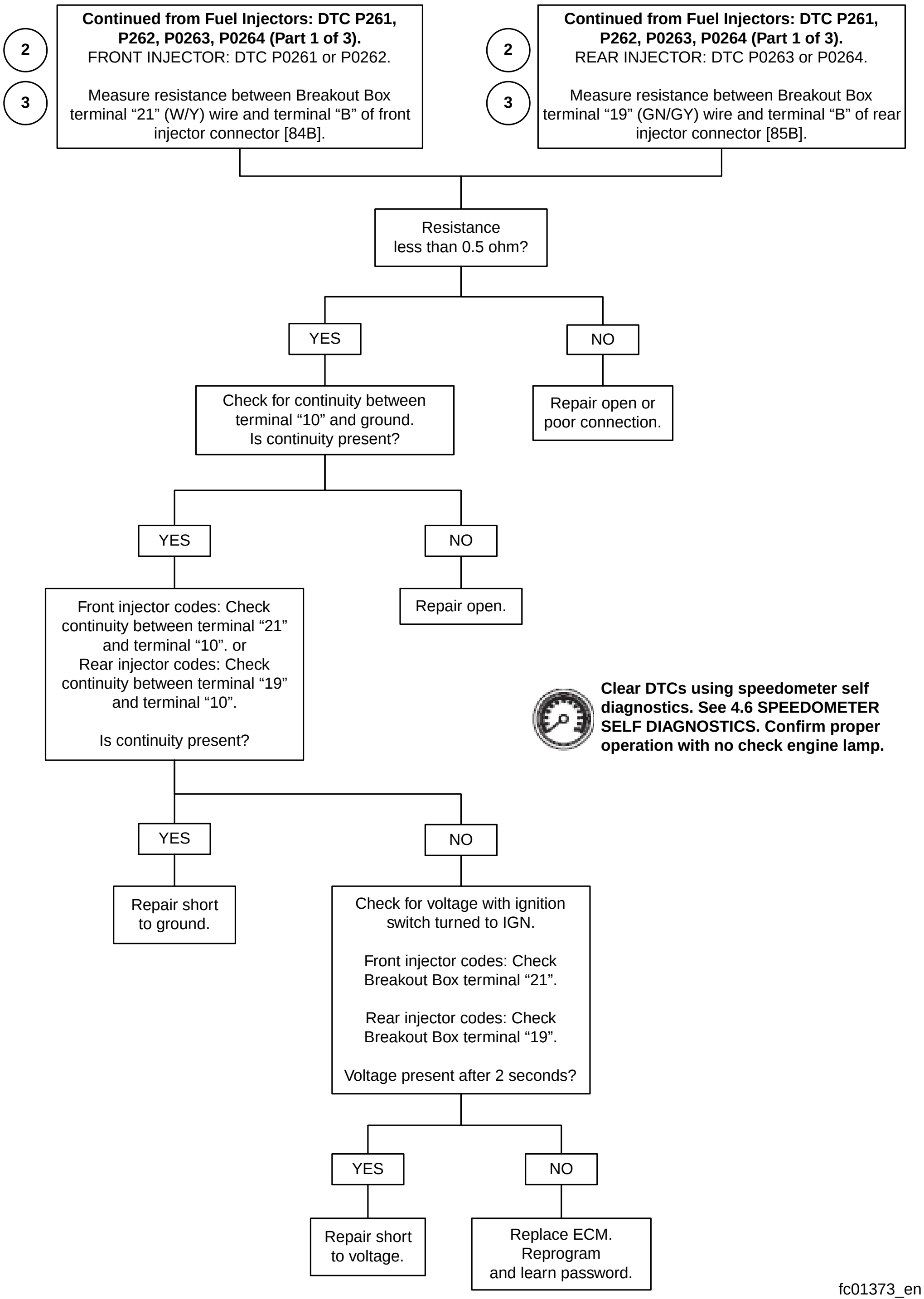
NO.	DESCRIPTION	TYPE	LOCATION
[62]	System relay	5-place Amp	Under seat, in fuse block
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[83]	Ignition coil	4-place Delphi	Back of coil
[84]	Front fuel injector	2-place Delphi	Beneath fuel tank
[85]	Rear fuel injector	2-place Delphi	Beneath fuel tank

Table 4-40. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[128]	Starter solenoid	Spade terminals	Top of starter
[141]	Fuel pump and sender	4-place Packard	Top of fuel tank

Fuel Injectors: DTC P0261, P0262, P0263, P0264 (Part 1 of 3)




2
3
Continued from Fuel Injectors: DTC P261, P262, P0263, P0264 (Part 1 of 3).
FRONT INJECTOR: DTC P0261 or P0262.
Measure resistance between Breakout Box terminal “21” (W/Y) wire and terminal “B” of front injector connector [84B].
2
3
Continued from Fuel Injectors: DTC P261, P262, P0263, P0264 (Part 1 of 3).
REAR INJECTOR: DTC P0263 or P0264.
Measure resistance between Breakout Box terminal “19” (GN/GY) wire and terminal “B” of rear injector connector [85B].
Resistance less than 0.5 ohm?
YES
NO
Check for continuity between terminal “10” and ground. Is continuity present?
Repair open or poor connection.
YES
NO
Front injector codes: Check continuity between terminal “21” and terminal “10”. or Rear injector codes: Check continuity between terminal “19” and terminal “10”.
Is continuity present?
Repair open.
Clear DTCs using speedometer self diagnostics. See 4.6 SPEEDOMETER SELF DIAGNOSTICS. Confirm proper operation with no check engine lamp.
YES
NO
Repair short to ground.
Check for voltage with ignition switch turned to IGN.
Front injector codes: Check Breakout Box terminal “21”.
Rear injector codes: Check Breakout Box terminal “19”.
Voltage present after 2 seconds?
YES
NO
Repair short to voltage.
Replace ECM. Reprogram and learn password.
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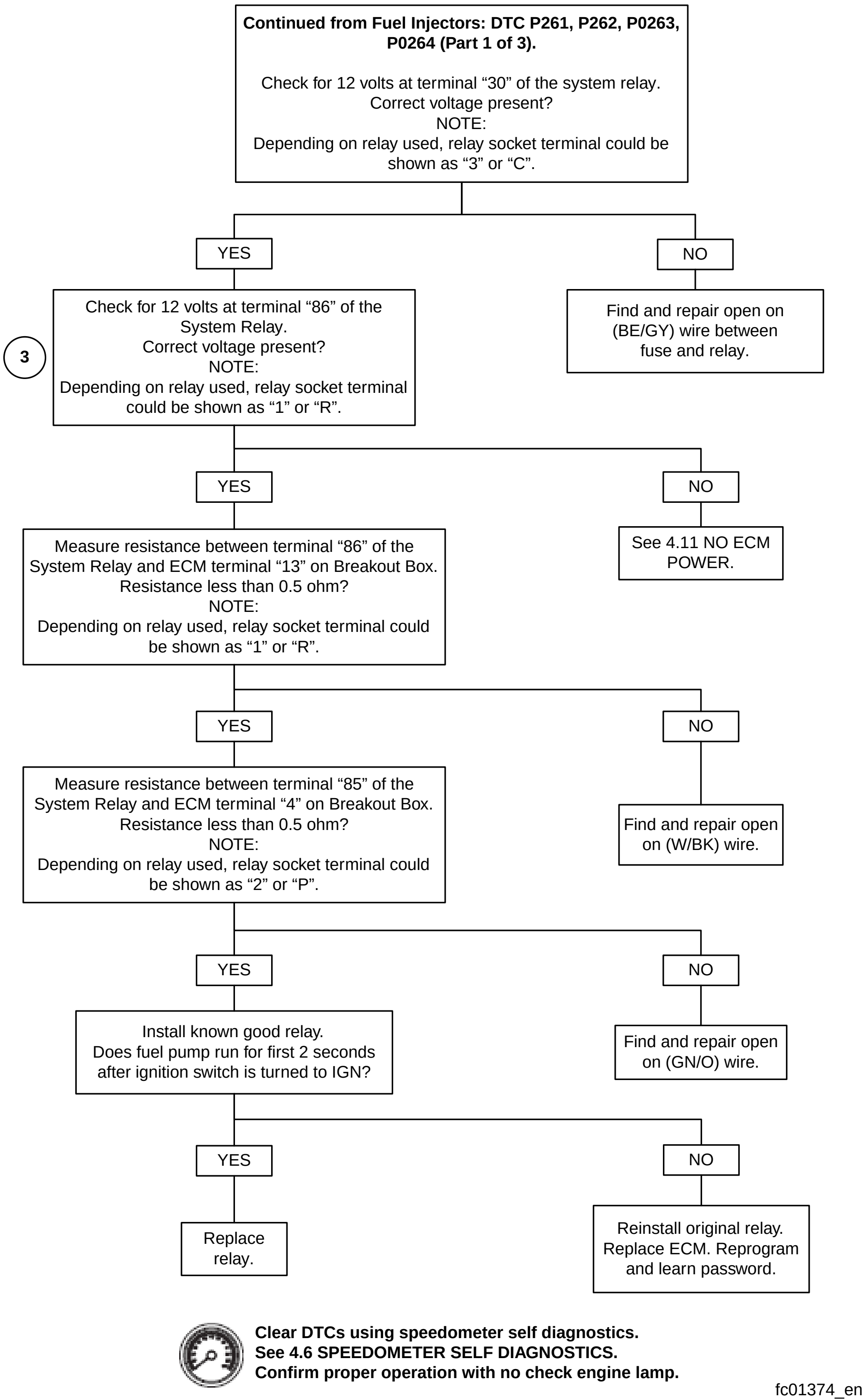
Fuel Injectors: DTC P0261, P0262, P0263, P0264 (Part 3 of 3)



GENERAL

CKP Sensor

If the CKP sensor signal is weak or absent, DTC P0373 or P0374 will be set.

NOTE

If signal is not detected or cannot synchronize (DTC P0374), engine will not start.

Table 4-41. Code Description

DTC	DESCRIPTION
P0373	CKP sensor intermittent
P0374	CKP sensor synch error

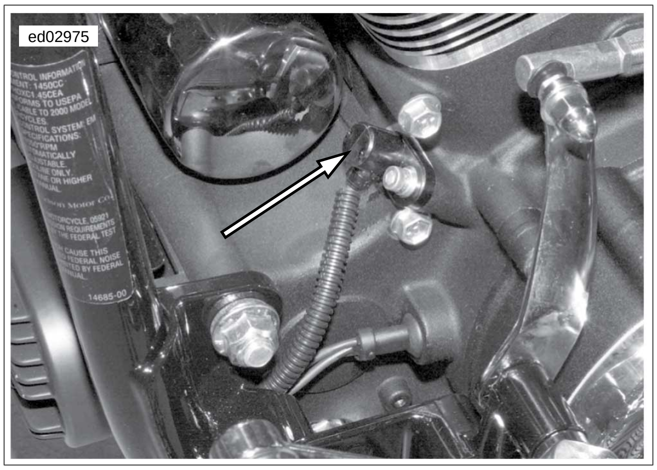


Figure 4-54. CKP Sensor

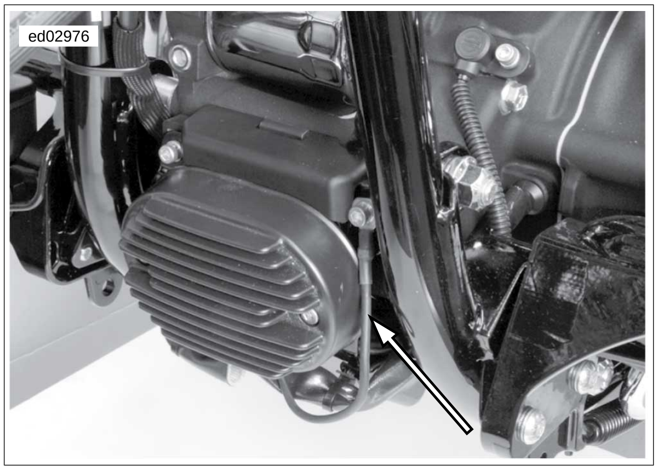


Figure 4-55. CKP Sensor Connector [79] Approximate Location

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT

Diagnostic Tips

- Engine must be cranked for more than five seconds without CKP signal to set code.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-43876) to ECM wire harness only (leave ECM disconnected). See 4.7 BREAKOUT BOX: EFI.
2. One megohm is very high resistance.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), brown socket probes and patch cords.
4. For testing purposes, install sensor without running wiring along normal path. Disconnect and route wiring properly if system is now OK.

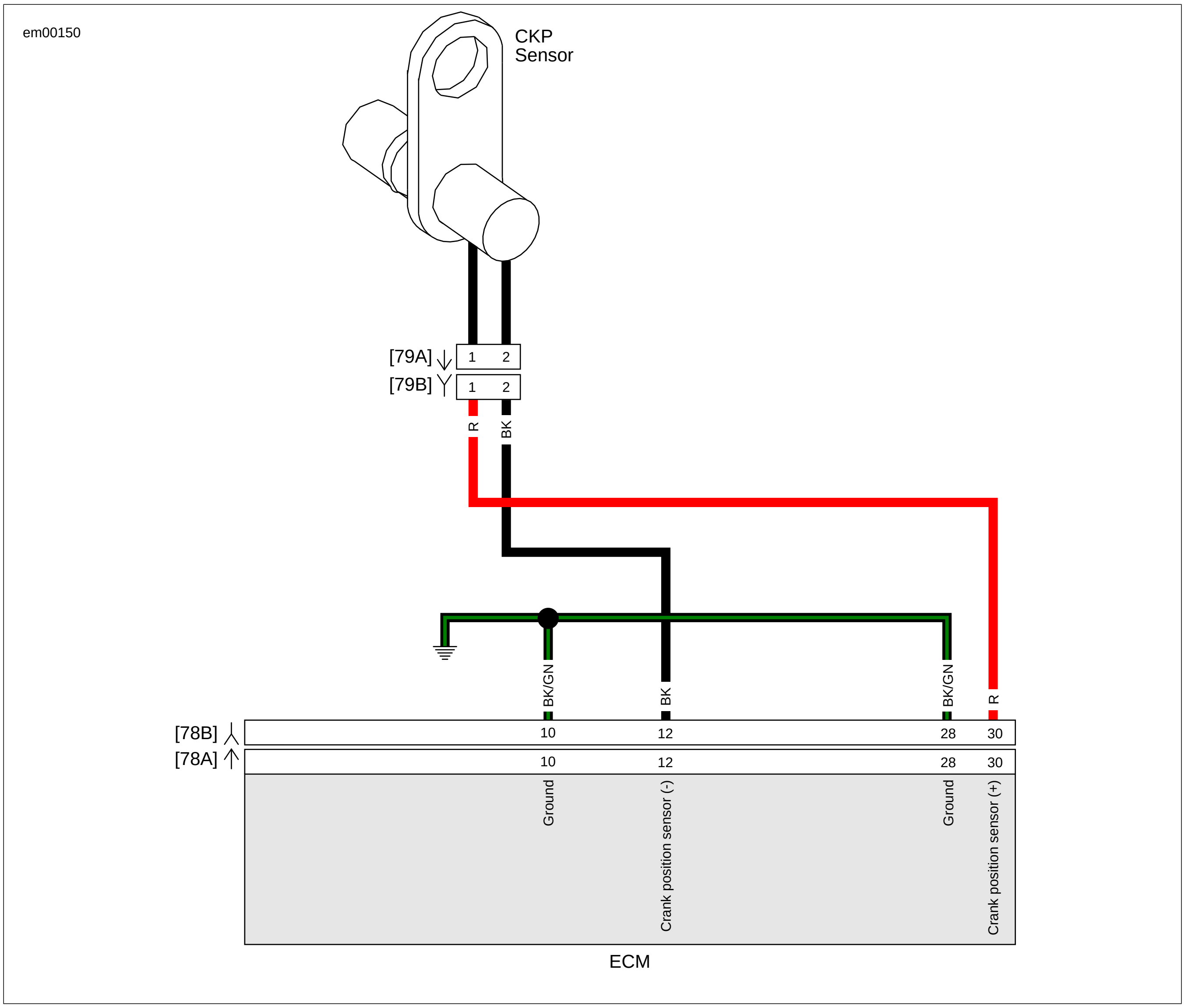
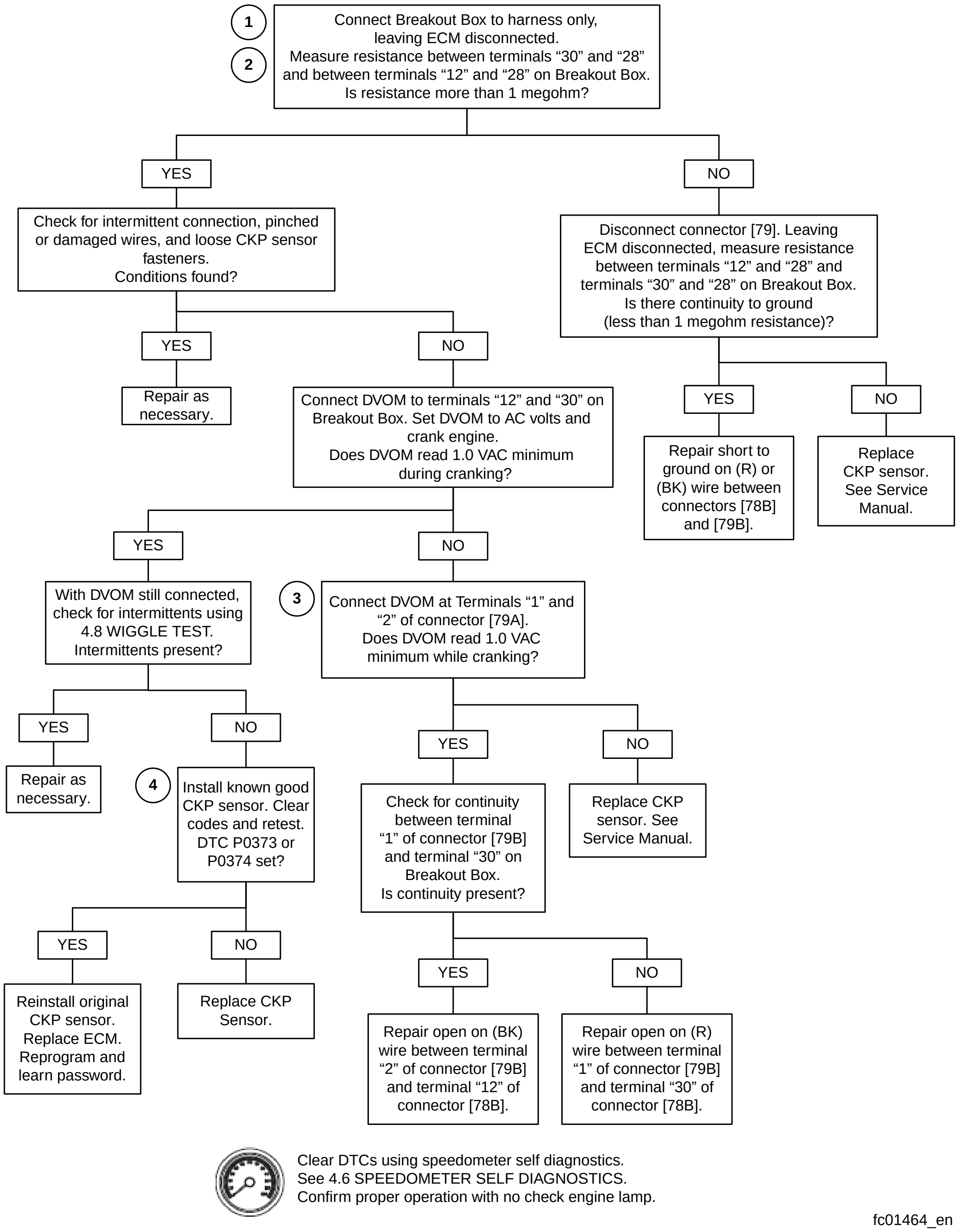


Figure 4-56. CKP Circuit

Table 4-42. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[79]	Crankshaft Position (CKP) sensor	2-place Mini-Deutsch	Back of voltage regulator bracket


1
2
Connect Breakout Box to harness only, leaving ECM disconnected. Measure resistance between terminals "30" and "28" and between terminals "12" and "28" on Breakout Box. Is resistance more than 1 megohm?
YES
Check for intermittent connection, pinched or damaged wires, and loose CKP sensor fasteners. Conditions found?
YES
Repair as necessary.
NO
Connect DVOM to terminals "12" and "30" on Breakout Box. Set DVOM to AC volts and crank engine. Does DVOM read 1.0 VAC minimum during cranking?
YES
With DVOM still connected, check for intermittents using 4.8 WIGGLE TEST. Intermittents present?
YES
Repair as necessary.
NO
4
Install known good CKP sensor. Clear codes and retest. DTC P0373 or P0374 set?
YES
Reinstall original CKP sensor. Replace ECM. Reprogram and learn password.
NO
Replace CKP Sensor.
NO
3
Connect DVOM at Terminals "1" and "2" of connector [79A]. Does DVOM read 1.0 VAC minimum while cranking?
YES
Check for continuity between terminal "1" of connector [79B] and terminal "30" on Breakout Box. Is continuity present?
YES
Repair open on (BK) wire between terminal "2" of connector [79B] and terminal "12" of connector [78B].
NO
Repair open on (R) wire between terminal "1" of connector [79B] and terminal "30" of connector [78B].
NO
Replace CKP sensor. See Service Manual.
NO
Disconnect connector [79]. Leaving ECM disconnected, measure resistance between terminals "12" and "28" and terminals "30" and "28" on Breakout Box. Is there continuity to ground (less than 1 megohm resistance)?
YES
Repair short to ground on (R) or (BK) wire between connectors [78B] and [79B].
NO
Replace CKP sensor. See Service Manual.
Clear DTCs using speedometer self diagnostics.
See 4.6 SPEEDOMETER SELF DIAGNOSTICS.
Confirm proper operation with no check engine lamp.
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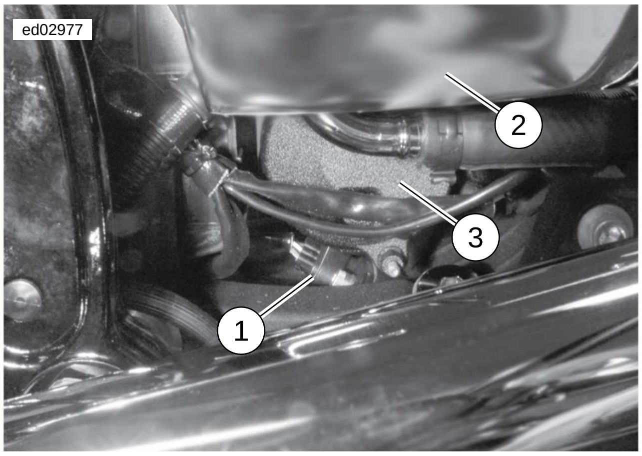
GENERAL

Vehicle Speed Sensor (VSS)

See Figure 4-57. The VSS is powered and monitored by the ECM. The ECM processes the vehicle speed signal and transmits this signal to the TSM/TSSM/ HFSM and speedometer through serial data.

Table 4-43. Code Description

DTC	DESCRIPTION
P0501	VSS low
P0502	VSS high/open



1. **Vehicle speed sensor**
2. **Oil tank**
3. **Starter**

Figure 4-57. Vehicle Speed Sensor

NOTE

The MAP, TP, Jiffy Stand, and VSS sensors are connected to the same reference line (+5V Vref). If the reference line goes to ground or open, multiple codes will be set (DTC P0107, P0108, P0122, P0123, P0501, P0502, P01501, P01502). Start with the trouble code having the lowest ranking value.

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. The speedometer has a built-in diagnostic mode. See 2.3 SPEEDOMETER SELF DIAGNOSTICS.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), black pin probe and patch cord.
3. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

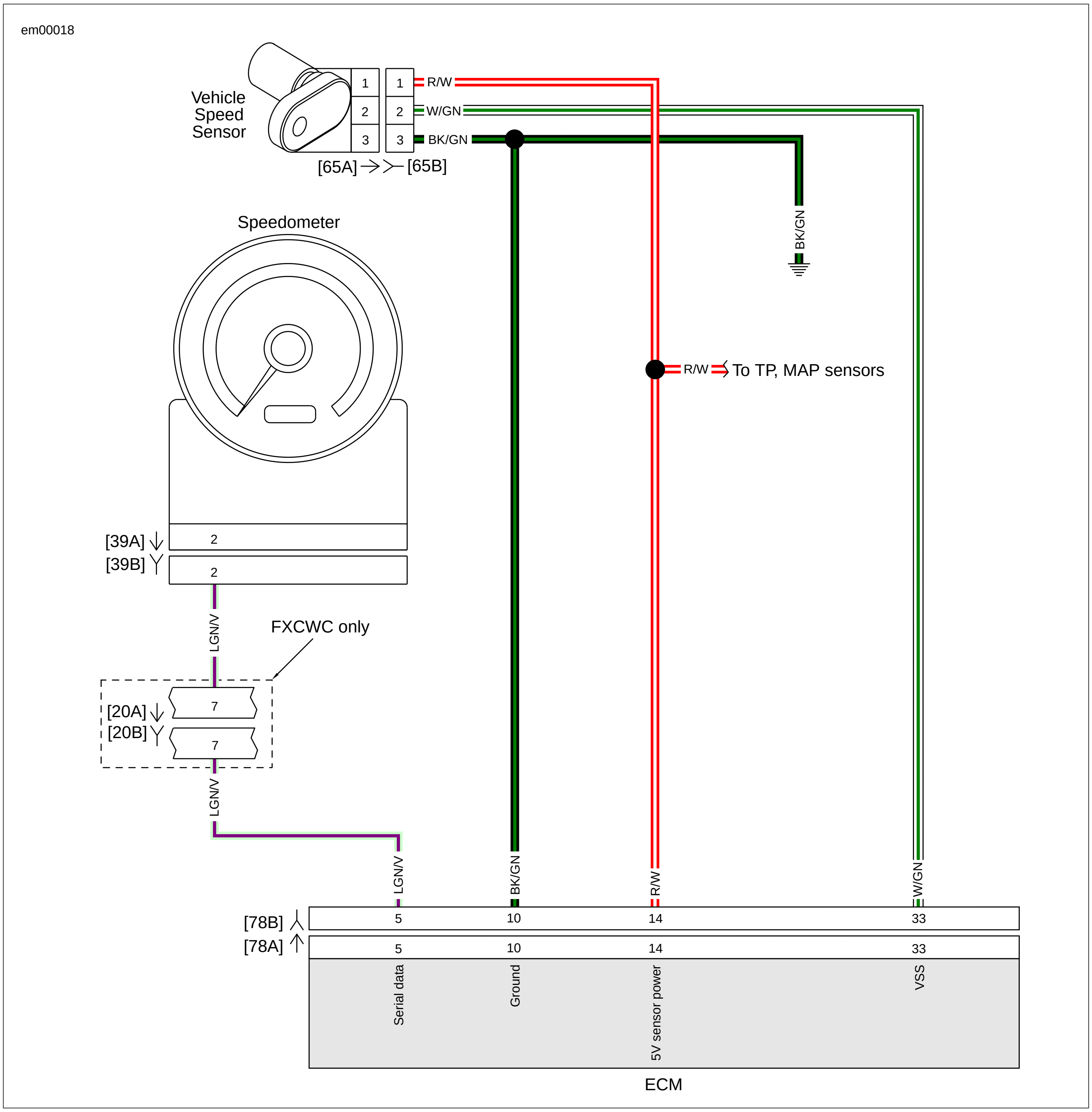
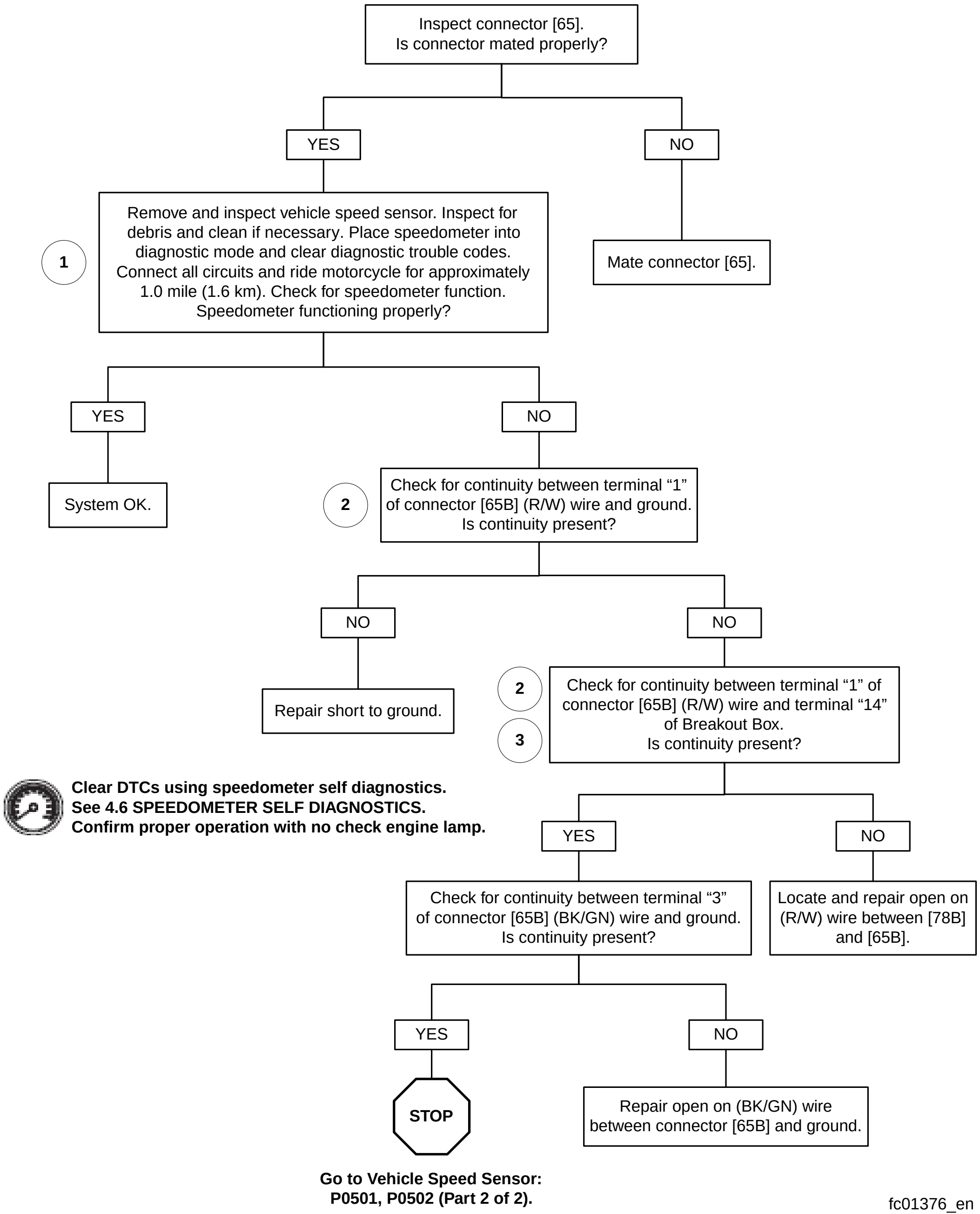


Figure 4-58. Vehicle Speed Sensor Circuit

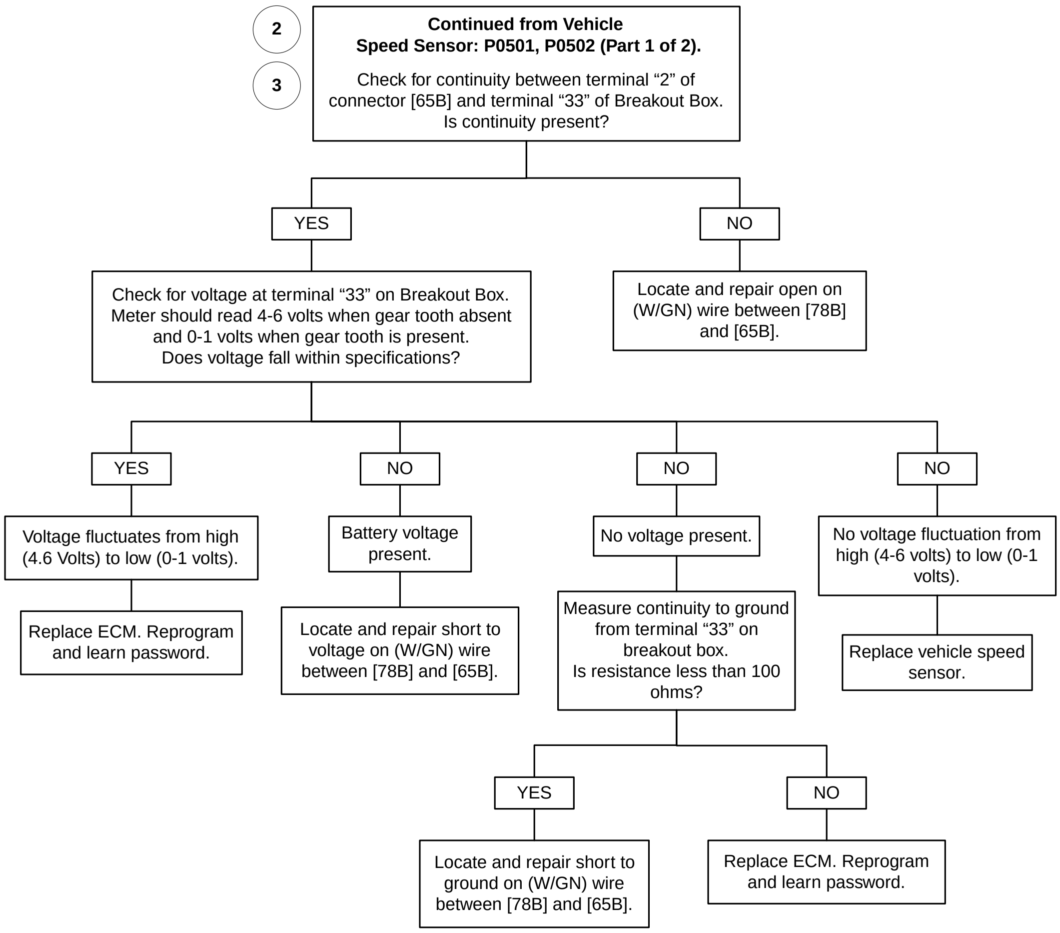
Table 4-44. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[39]	Speedometer	12-place Packard	Back of speedometer
[65]	Vehicle Speed Sensor (VSS)	3-place Delphi	Top of transmission case
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)

Vehicle Speed Sensor: DTC P0501, P0502 (Part 1 of 2)



Vehicle Speed Sensor: DTC P0501, P0502 (Part 2 of 2)



Clear DTCs using speedometer self diagnostics.
See 4.6 SPEEDOMETER SELF DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

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GENERAL

Battery Voltage

See Figure 4-59 or Figure 4-60. Battery voltage is monitored by the ECM (terminal "13"). If the battery voltage fails to meet normal operating parameters, a DTC is set.

NOTE

When either DTC P0562 or P0563 is set, the battery icon in the speedometer will illuminate.

DTC P0562 is displayed when battery voltage is less than 12.2 volts at idle and voltage does not increase when engine speed is greater than 2000 RPM.

DTC P0563 is displayed when battery positive voltage is greater than 15.0 volts for more than 4 seconds.

NOTES

- *Warm idle speed will be automatically increased if battery voltage is low at idle.*
- *TSSM/HFSM problems may also set a DTC P0562 or P0563.*

Table 4-45. Code Description

DTC	DESCRIPTION
P0562	Battery voltage low
P0563	Battery voltage high

Figure 4-59. System Relay

Figure 4-60. System Relay (FXCWC)

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT

Diagnostic Tips

- Low voltage generally indicates a loose wire, corroded connections, battery and/or a charging system problem.
- A high voltage condition may be caused by a faulty voltage regulator.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Was battery allowed to discharge? Was battery drawn down by a starting problem?
   a. Yes. Charge battery.
   b. No. See 1.7 CHARGING SYSTEM, Troubleshooting.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
3. Use DVOM with RPM Pick-up to check RPM on vehicles without tachometers.
4. This checks for voltage drops in the ECM circuit.
   a. Place (+) probe to battery positive terminal.
   b. Place (-) probe to (W/BK) terminal on Breakout Box.
5. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) gray terminal probes and patch cords
6. Problem is most likely the ground connection at the frame.

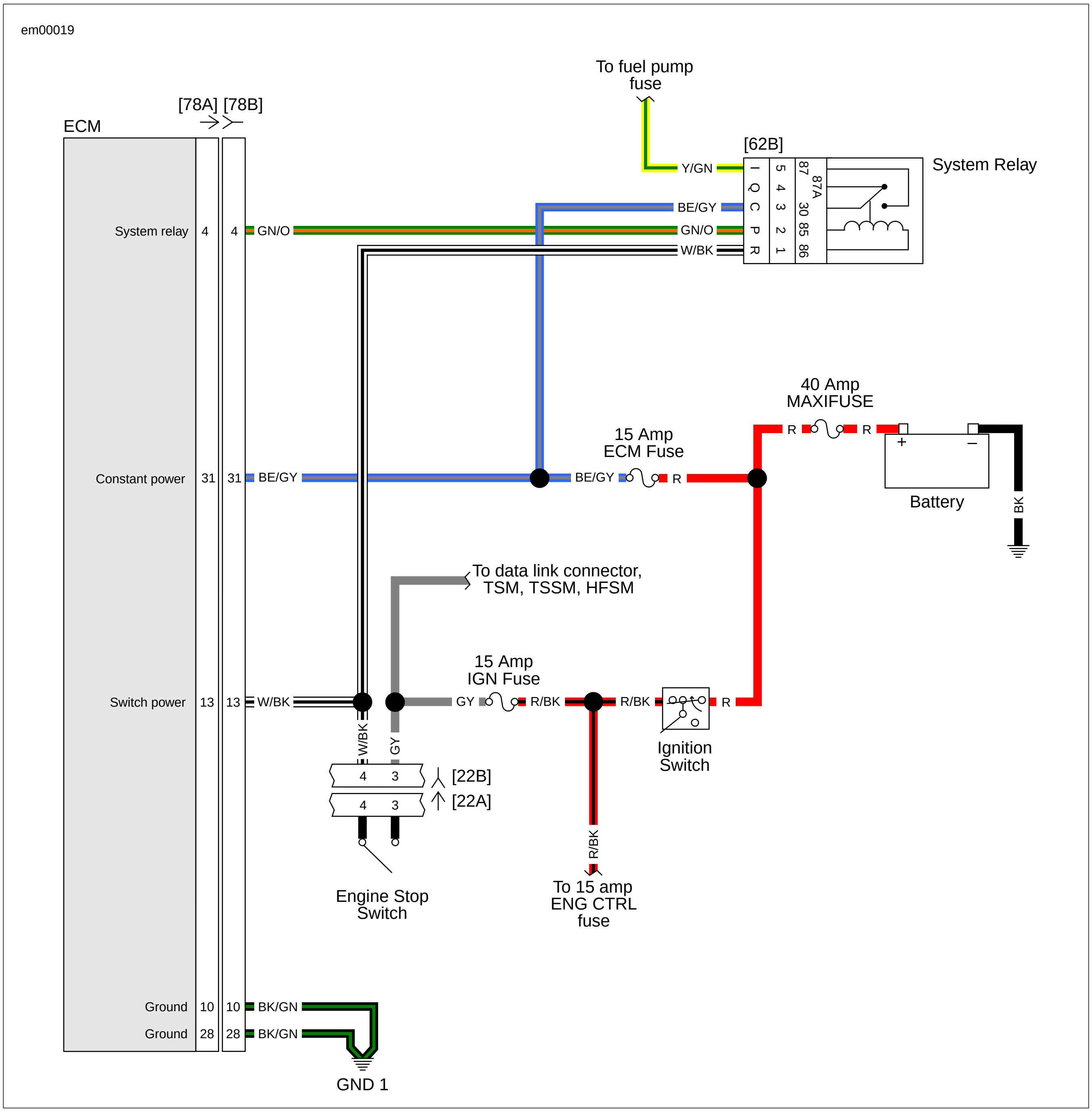
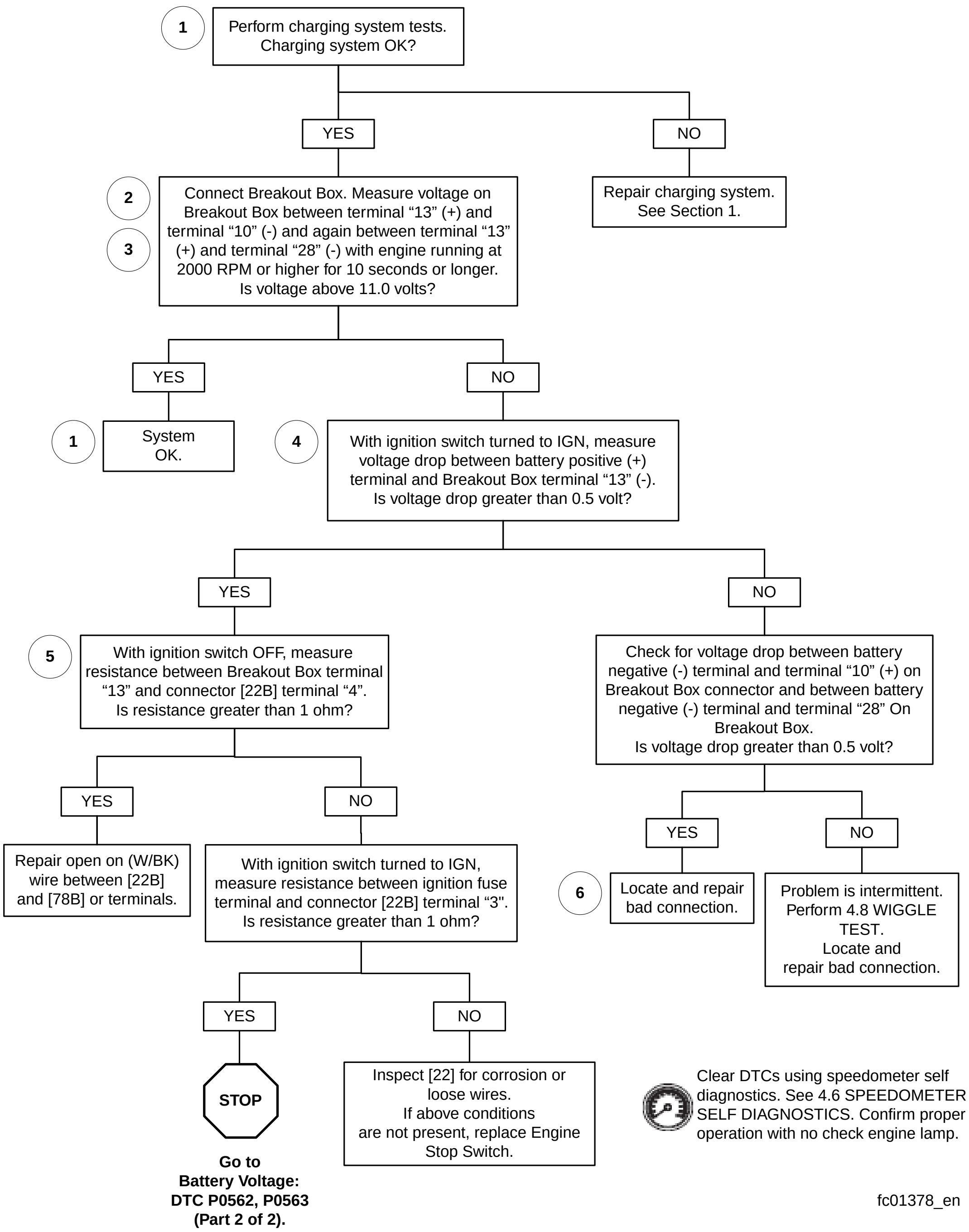


Figure 4-61. Battery Voltage Circuit Diagram

Table 4-46. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Right hand controls	6-place Molex	Under fuel tank, right side
[62]	System relay	5-place Amp	Under seat, in fuse block
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)

Battery Voltage: DTC P0562, P0563 (Part 1 of 2)



Battery Voltage: DTC P0562, P0563 (Part 2 of 2)

Continued from Battery Voltage: DTC P0562, P0563 (Part 1 of 2).

With ignition switch turned to IGN, measure voltage drop between battery positive (+) terminal and (GY) terminal on 15 amp ignition fuse (-).
Is voltage drop greater than 0.5 volt?

- YES: With ignition switch turned to IGN, measure voltage drop between battery positive (+) terminal and (R/BK) terminal at 15 amp ignition fuse.
Is voltage drop greater than 0.5 volt?
  - YES: With ignition switch turned to IGN, measure voltage drop between battery positive (+) and MAXIFUSE terminal “A” (-).
Is voltage drop greater than 0.5 volt?
    - YES: With ignition switch turned to IGN, measure voltage drop between battery positive (+) terminal and MAXIFUSE terminal “B” (-).
Is voltage drop greater than 0.5 volt?
      - YES: High resistance between MAXIFUSE and battery. Replace wire or terminals.
      - NO: Replace MAXIFUSE.
    - NO: Replace ignition switch or terminals.
  - NO: Replace fuse or fuse terminals.
- NO: Replace (GY) wire or terminals.

Clear DTCs using speedometer self diagnostics.
See 4.6 SPEEDOMETER SELF DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

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GENERAL

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

ECM Failure

Refer to Table 4-47. The DTCs listed indicate a failure which requires replacement of the ECM. See the Service Manual for replacement information.

NOTE

After replacing ECM, reprogram, perform password learning procedure and clear codes. ECM must be reprogrammed using the DIGITAL TECHNICIAN (Part No. HD-44750). See your dealer. Password learn procedure must also be performed. See 3.25 TSM/HFSM: PASSWORD LEARN.

Table 4-47. Code Description

DTC	DESCRIPTION
P0603	ECM EEPROM error
P0605	ECM flash error

DIAGNOSTICS

These codes are set under two conditions.

- If DTC P0603 or P0605 occur during normal operation, replace ECM. Reprogram and learn password.
- If DTC P0603 or P0605 occur during or after reprogramming, perform the following:

DTC P0603

1. Clear DTCs.
2. Power down the vehicle. Wait 10 seconds.
3. Turn ignition ON.
4. Replace ECM if codes reappear.

DTC P0605

1. Clear DTCs.
2. Power down the vehicle.
3. Attempt to reprogram ECM using correct calibration.
4. Restart vehicle. If code reappears, replace ECM.

GENERAL

Active Intake Solenoid (HDI Models Only)

The active intake solenoid regulates the amount of air that enters the air cleaner. The active intake solenoid opens when vehicle speed exceeds 45 MPH (65 km/h) with 50% or greater throttle opening. Once open, active intake will close when vehicle speeds fall below 40 MPH (65 km/h). The power for active intake solenoid comes from the engine control fuse. The ECM provides the path to ground to trigger the active intake solenoid.

Table 4-48. Code Description

DTC	DESCRIPTION
P0661	Active intake solenoid open/low
P0662	Active intake high/shorted

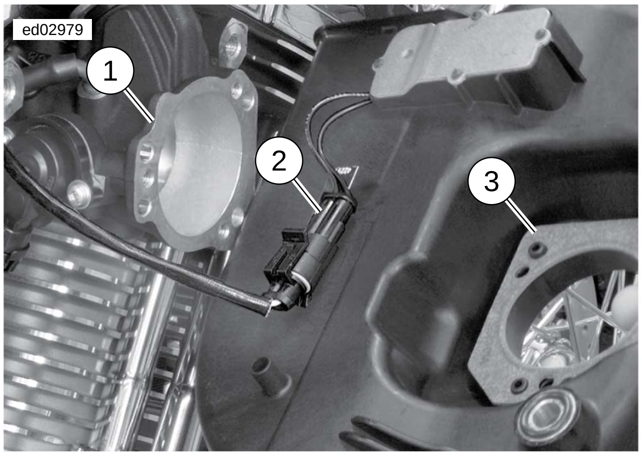
DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. See Service Manual for all service information.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray terminal probe and patch cord.



1. **Intake module**
2. **Intake solenoid connector [178]**
3. **Air cleaner backing plate**

Figure 4-62. Intake Solenoid Connector Location

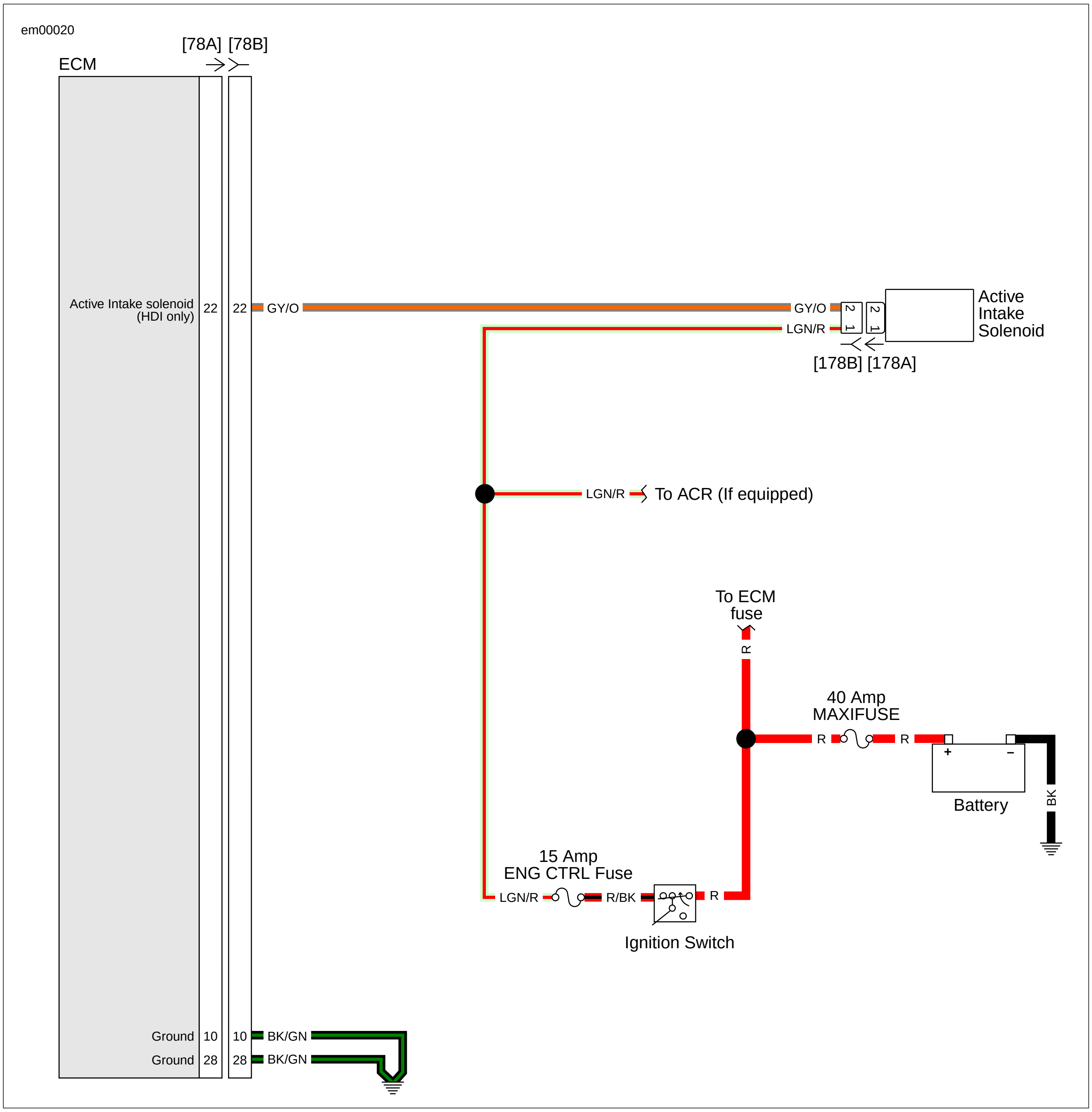
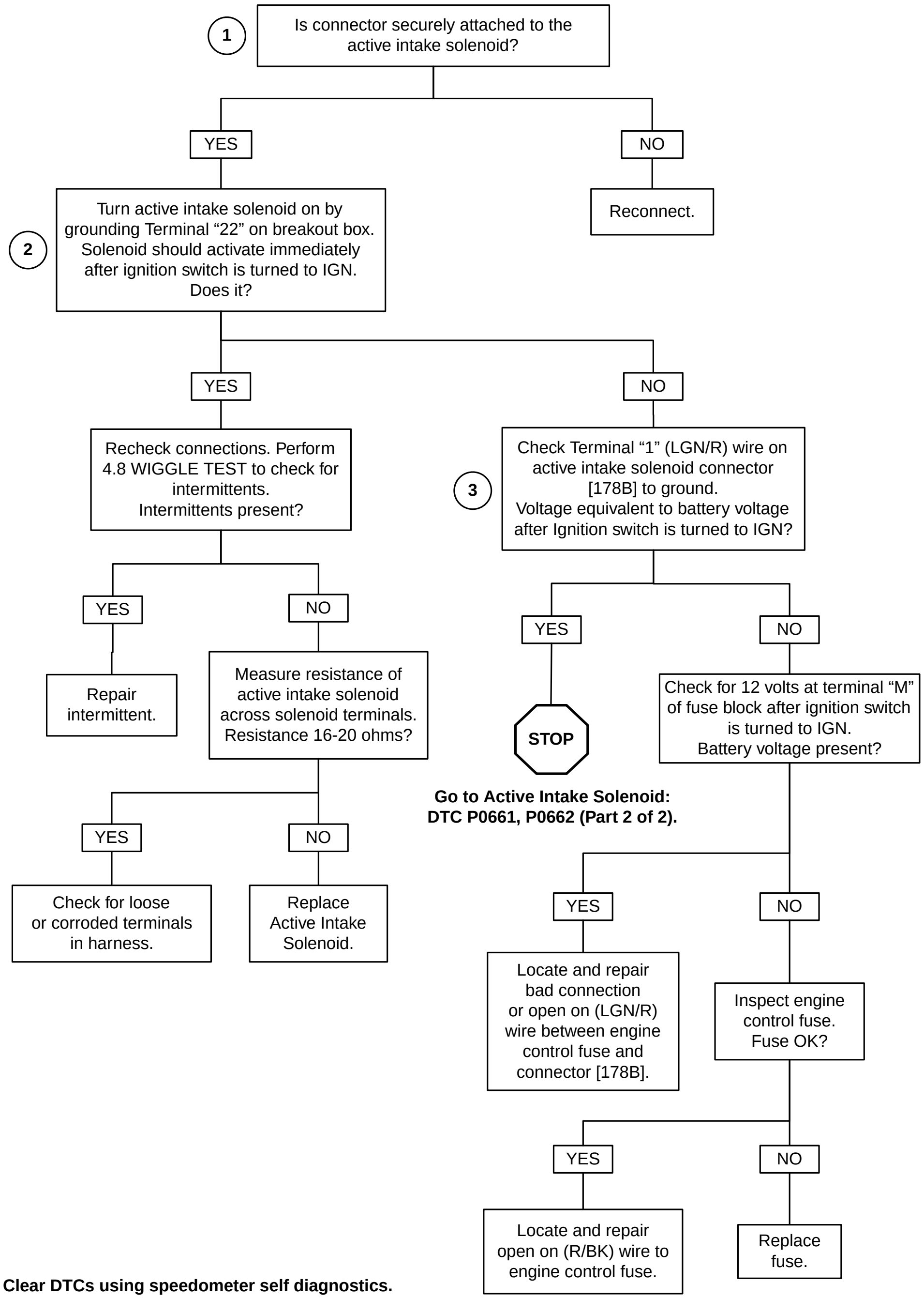


Figure 4-63. Active Intake Solenoid Circuit

Table 4-49. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[178]	Active intake solenoid	2-place Amp	Air cleaner backing plate

Active Intake Solenoid: DTC P0661, P0662 (Part 1 of 2)



Clear DTCs using speedometer self diagnostics.
See 4.6 SPEEDOMETER SELF DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

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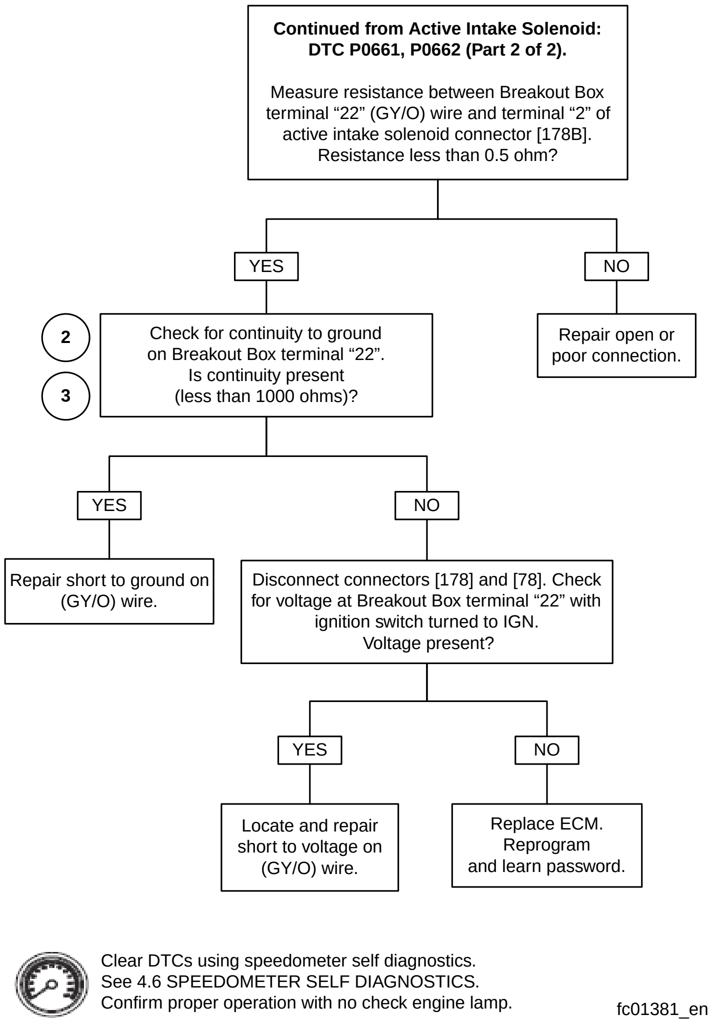
Active Intake Solenoid: DTC P0661, P0662 (Part 2 of 2)



GENERAL

Password Problem

The ECM, TSM/TSSM/HFSM and speedometer exchange passwords during operation. An incorrect password or missing password will set a diagnostic code.

NOTE

If the TSM/TSSM/HFSM is not connected to the wiring harness, the vehicle will not start.

Table 4-50. Code Description

DTC	DESCRIPTION
P1009	Incorrect password
P1010	Missing password

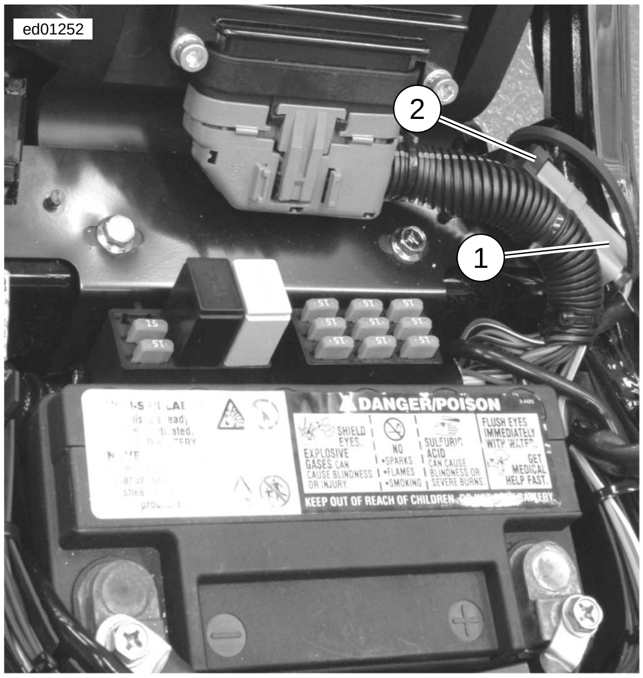
DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Notes

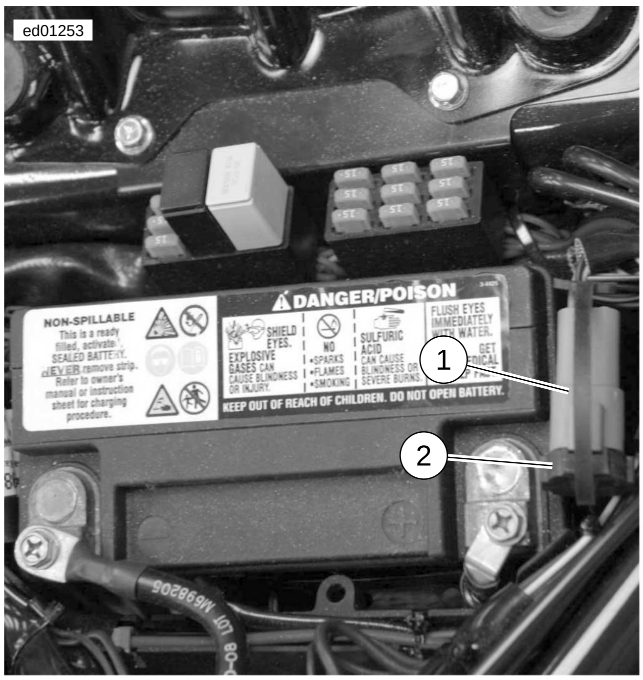
Each reference number below correlates to a circled number on the flow chart(s).

1. DTC P1009 may be set if a recent ECM or TSM/TSSM/HFSM replacement did not follow the correct password assignment procedure. See 3.25 TSM/HFSM: PASSWORD LEARN for details.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), black socket probes and patch cord.
3. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
4. Historic codes DTC U1300 or DTC U1301 would also have been set. Clear codes.
5. See the Service Manual for TSM/TSSM/HFSM replacement. See 3.25 TSM/HFSM: PASSWORD LEARN, Password Learning for the password learning procedure.



1. Data link connector [91A]
2. Protective rubber plug

Figure 4-64. Data Link Connector [91A]



1. Data link connector [91A]
2. Protective rubber plug

Figure 4-65. Data Link Connector [91A] (FXCWC)

Figure 4-66. TSM/TSSM/HFSM

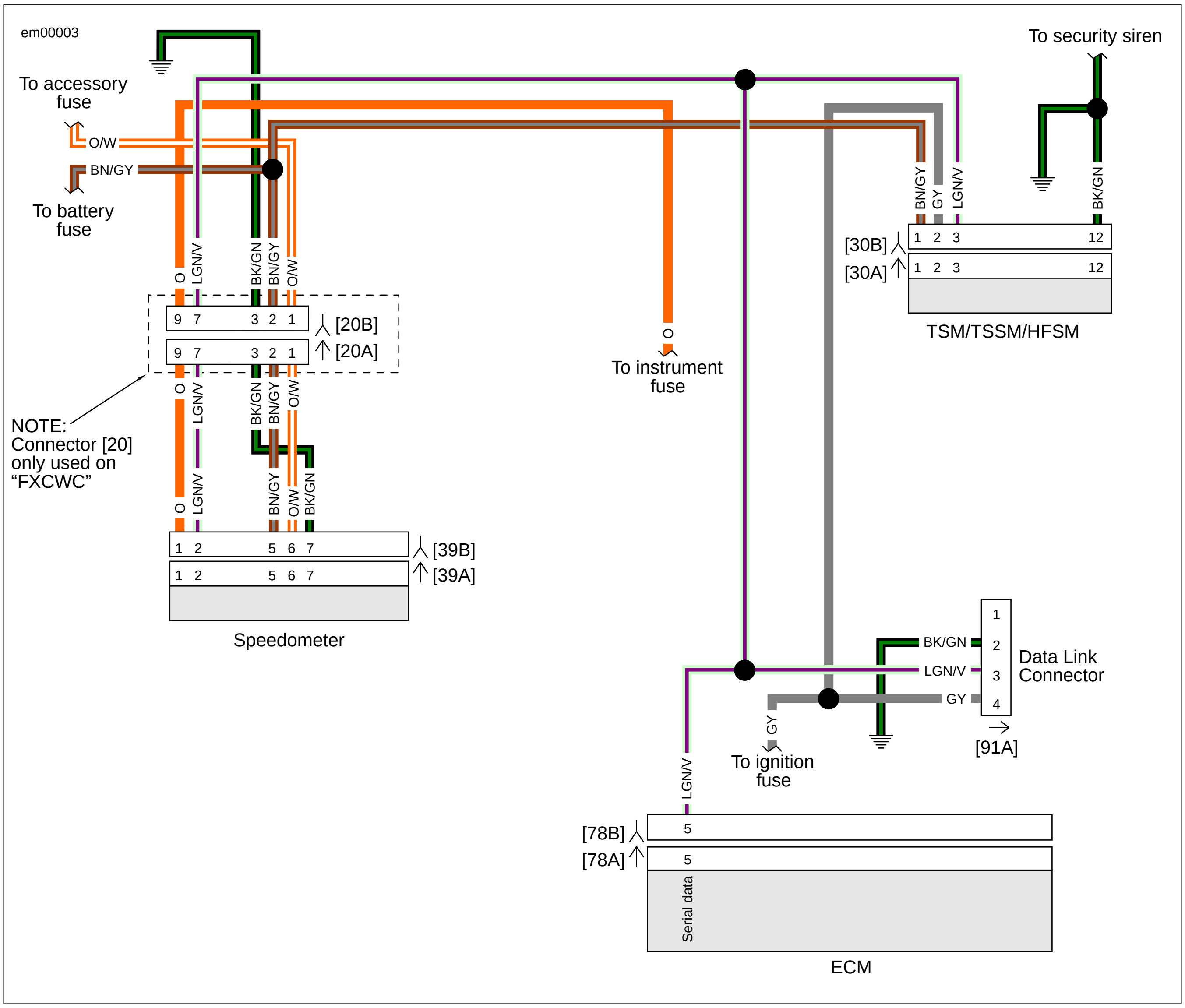
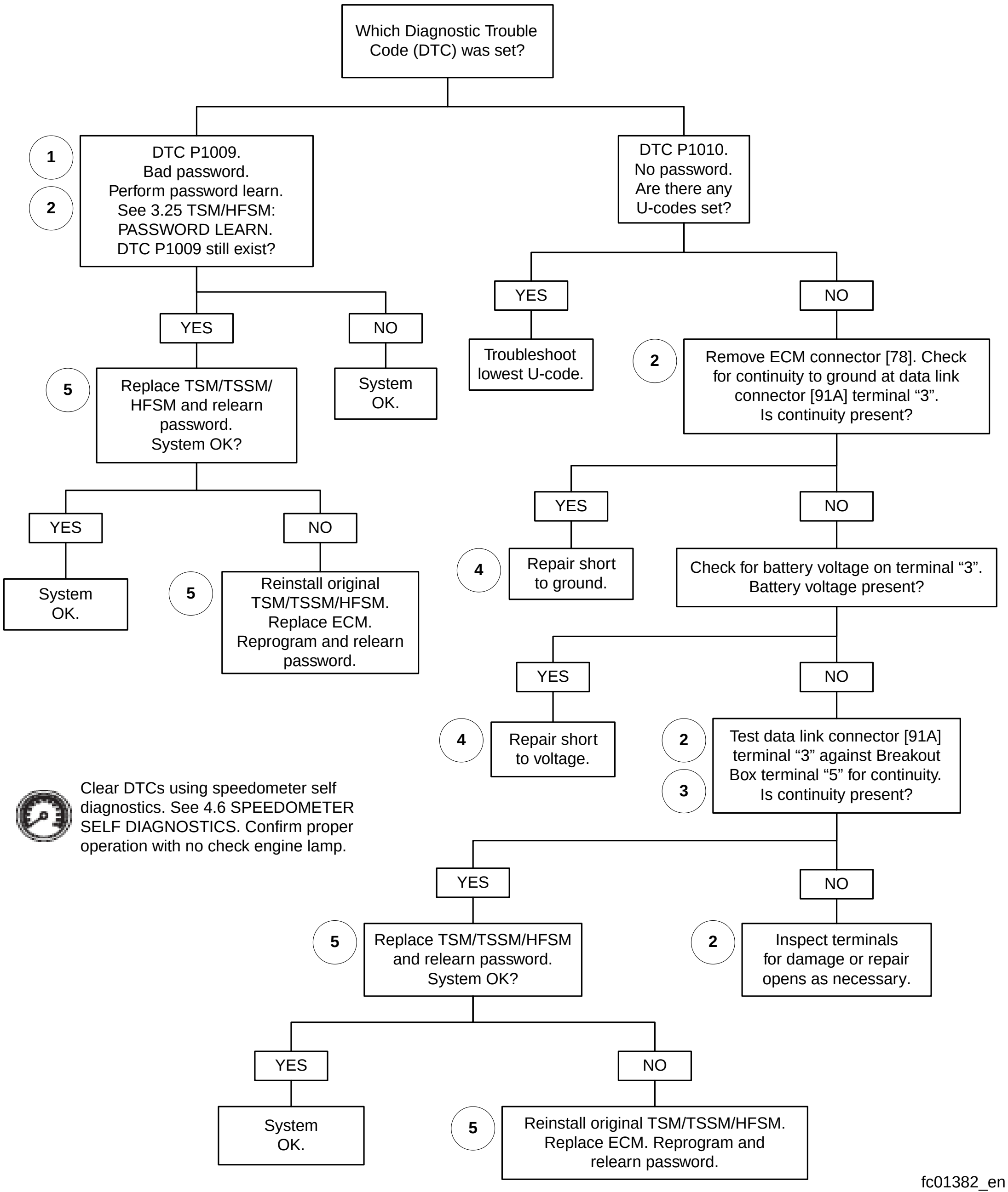


Figure 4-67. ECM, TSM/TSSM/HFSM and Speedometer Circuit

Table 4-51. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat

Password Problem: DTC P1009, P1010



GENERAL

Ignition Coil

Ignition coil DTCs will set if the ignition coil primary voltage is out of range. This could occur if there is an open coil or loss of power to the coil. If front and rear DTCs are set simultaneously, it is likely a coil power failure or a coil failure.

The coil receives power from the system relay at the same time that the fuel pump and injectors are activated. The system relay is active for the first 2 seconds after the ignition switch is turned ON and then shuts off until RPM is detected from the CKP sensor, at which time it is reactivated. The ECM is responsible for turning on the system relay by providing the ground to activate the relay, which in turn powers the coil.

Table 4-52. Code Description

DTC	DESCRIPTION
P1351	Front ignition coil open/low
P1352	Front ignition coil high/shorted
P1354	Rear ignition coil open/low
P1355	Rear ignition coil high/shorted

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-34730-2C	FUEL INJECTOR TEST LAMP
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX
HD-44687	IGNITION COIL CIRCUIT TEST ADAPTER

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probes and patch cord.

NOTE

Gently connect test lamp to connector [83B]. Forcefully inserting test lamp will result in ignition connector terminal damage.

2. See Figure 4-68. Plug IGNITION COIL CIRCUIT TEST ADAPTER (Part No. HD-44687) and FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C) into Breakout Box. Note that cranking the engine with test lamp in place of the ignition coil can sometimes cause a DTC P1351, P1352, P1354 or P1355. This condition is normal and does not by itself indicate a malfunction. DTCs must be cleared if this condition occurs.
3. Connect BREAKOUT BOX (Part No. HD-43876) between EFI wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray socket probes and patch cord.

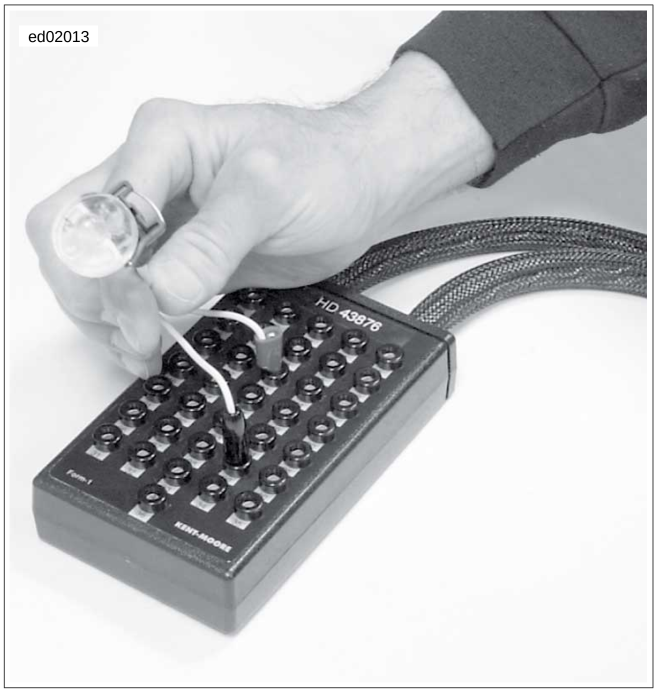
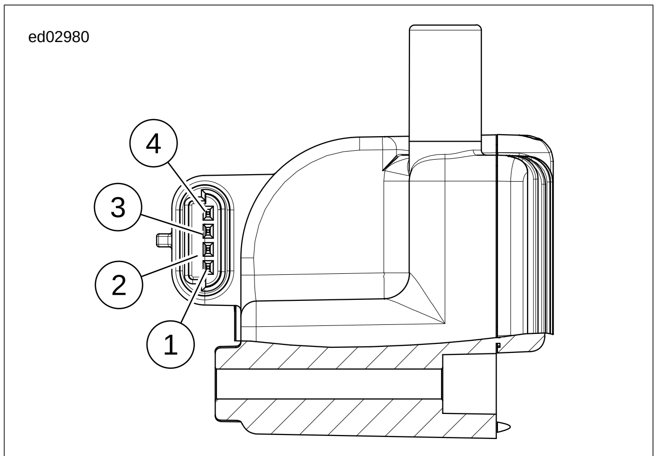


Figure 4-68. Ignition Coil Circuit Test



1. **Power**
2. **Feedback signal pin**
3. **Rear coil**
4. **Front coil**

Figure 4-69. Ignition Coil Connector Terminals

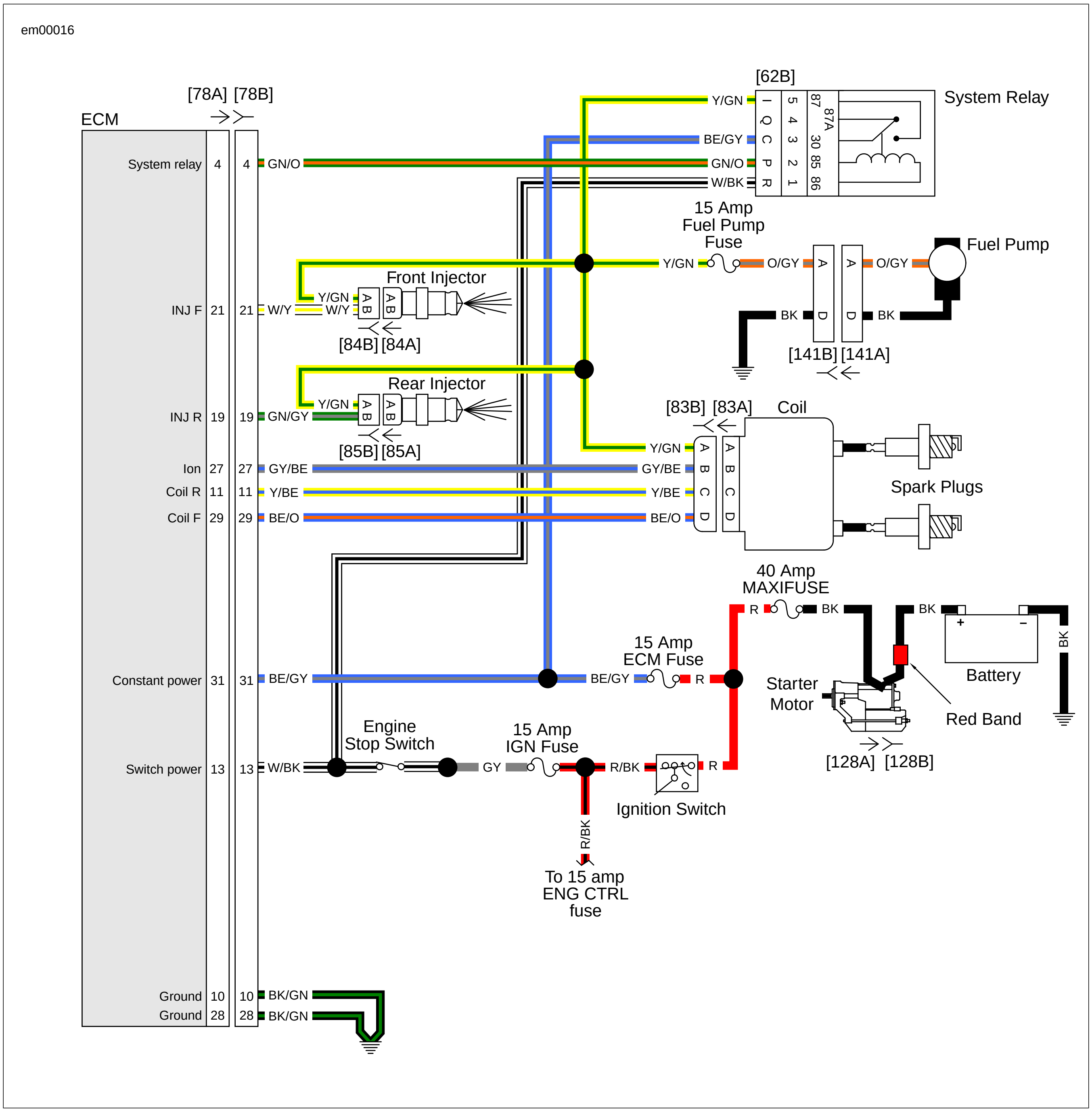


Figure 4-70. Ignition Coil Circuit Diagram

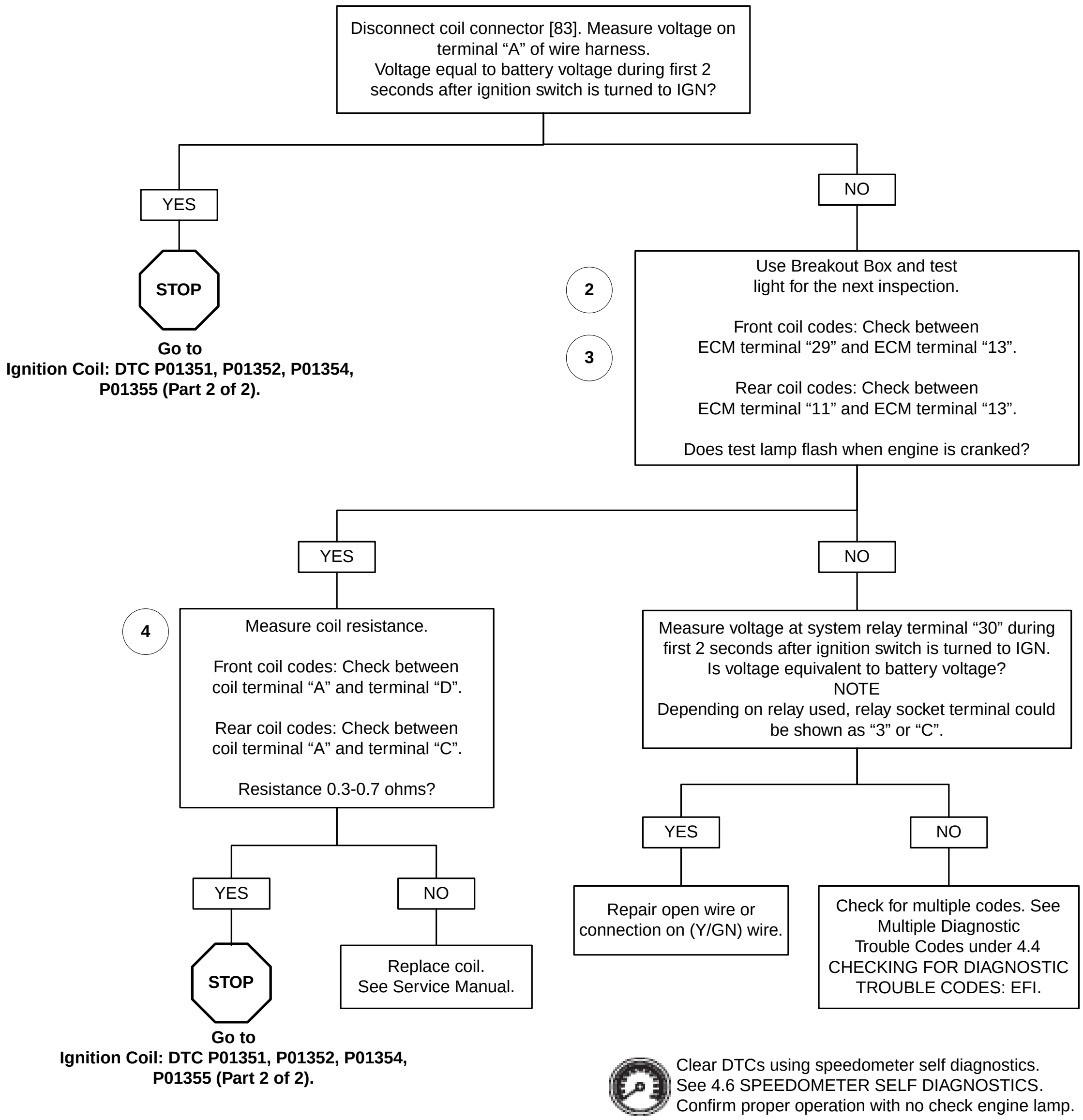
Table 4-53. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[62]	System relay	5-place Amp	Under seat, in fuse block
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[83]	Ignition coil	4-place Delphi	Back of coil
[84]	Front fuel injector	2-place Delphi	Beneath fuel tank
[85]	Rear fuel injector	2-place Delphi	Beneath fuel tank

Table 4-53. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[128]	Start solenoid	Spade terminals	Top of starter
[141]	Fuel pump	4-place Packard	Top of fuel tank

Ignition Coil: DTC PP01351, P01352, P01354, P01355 (Part 1 of 2)



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Ignition Coil: DTC PP01351, P01352, P01354, P01355 (Part 2 of 2)

1

3

Continued from Ignition Coil: DTC P01351, P01352, P01354, P01355 (Part 1 of 2).

Using Breakout Box, measure resistance between ECM and coil terminals as follows.

DTC	COIL TERMINAL	BREAKOUT BOX TERMINAL
P1351/ P1352	"D" (BE/O) wire	"29"
P1353/ P1354	"C" (Y/BE) wire	"11"

Resistance less than 0.5 ohms?

YES

Perform 4.8 WIGGLE TEST to check for intermittents. Intermittents present?

YES

Repair intermittent.

NO

Check for continuity to ground.

Front coil codes: Check Breakout Box terminal "29".

Rear coil codes: Check Breakout Box terminal "11".

Is continuity present?

YES

Repair short to ground.

NO

Check for voltage.

Front coil codes: Check Breakout Box terminal "29".

Rear coil codes: Check Breakout Box terminal "11".

Voltage present?

YES

Repair short to voltage.

NO

Replace ECM. Reprogram and learn password.

NO

Repair open wire or connection.

Clear DTCs using speedometer self diagnostics. See 4.6 SPEEDOMETER SELF DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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GENERAL

Active Exhaust Actuator (HDI Models Only)

The active exhaust system utilizes an actuator valve located in the rear exhaust pipe which is connected to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance.

Table 4-54. Code Description

DTC	DESCRIPTION
P1475	Exhaust actuation position error
P1477	Exhaust actuator open/low
P1478	Exhaust actuator high

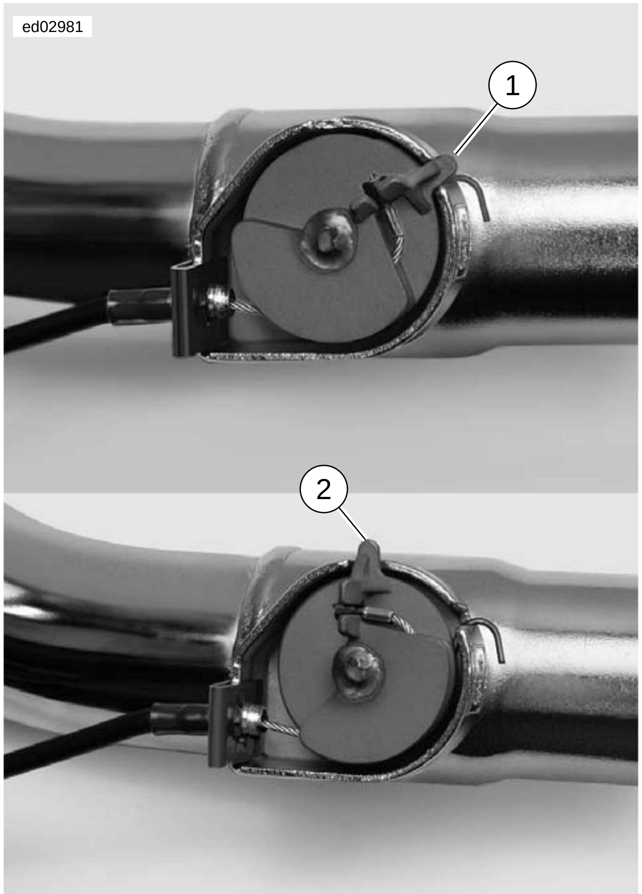
DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-43876) between EFI wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) gray pin probe and patch cord.



1. **Open position**
2. **Closed position**

Figure 4-71. Bellcrank

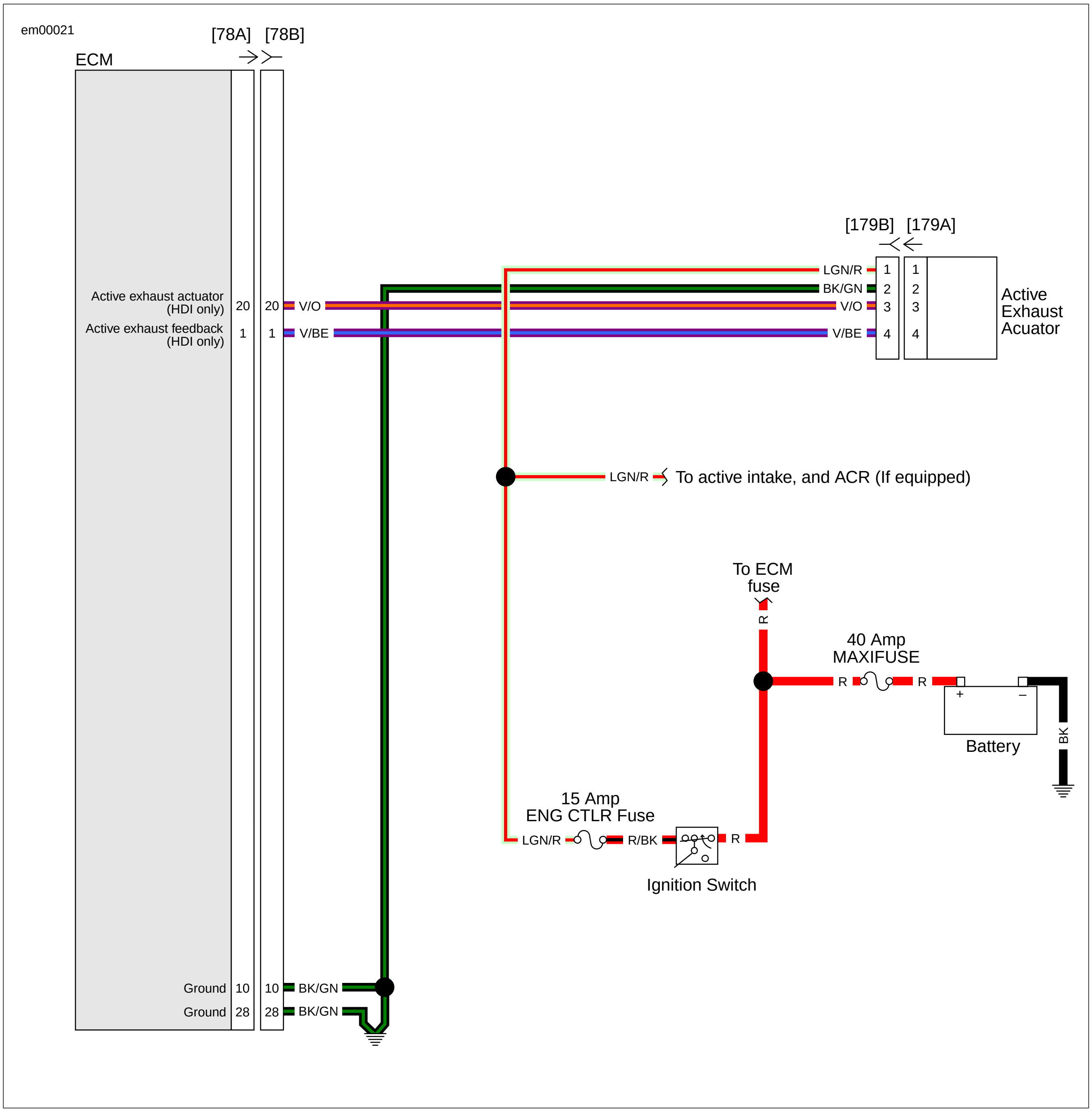
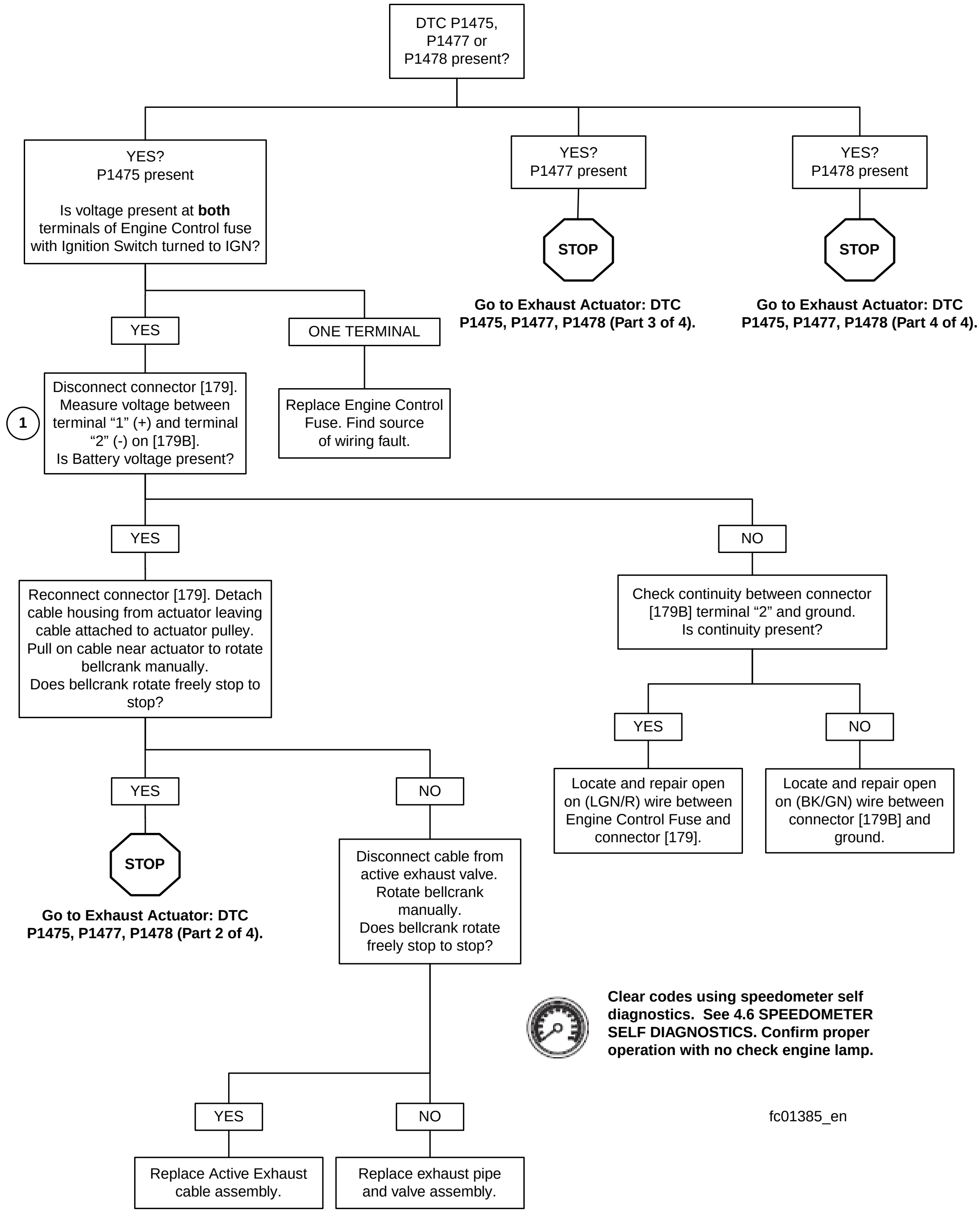


Figure 4-72. Exhaust Actuator Circuit

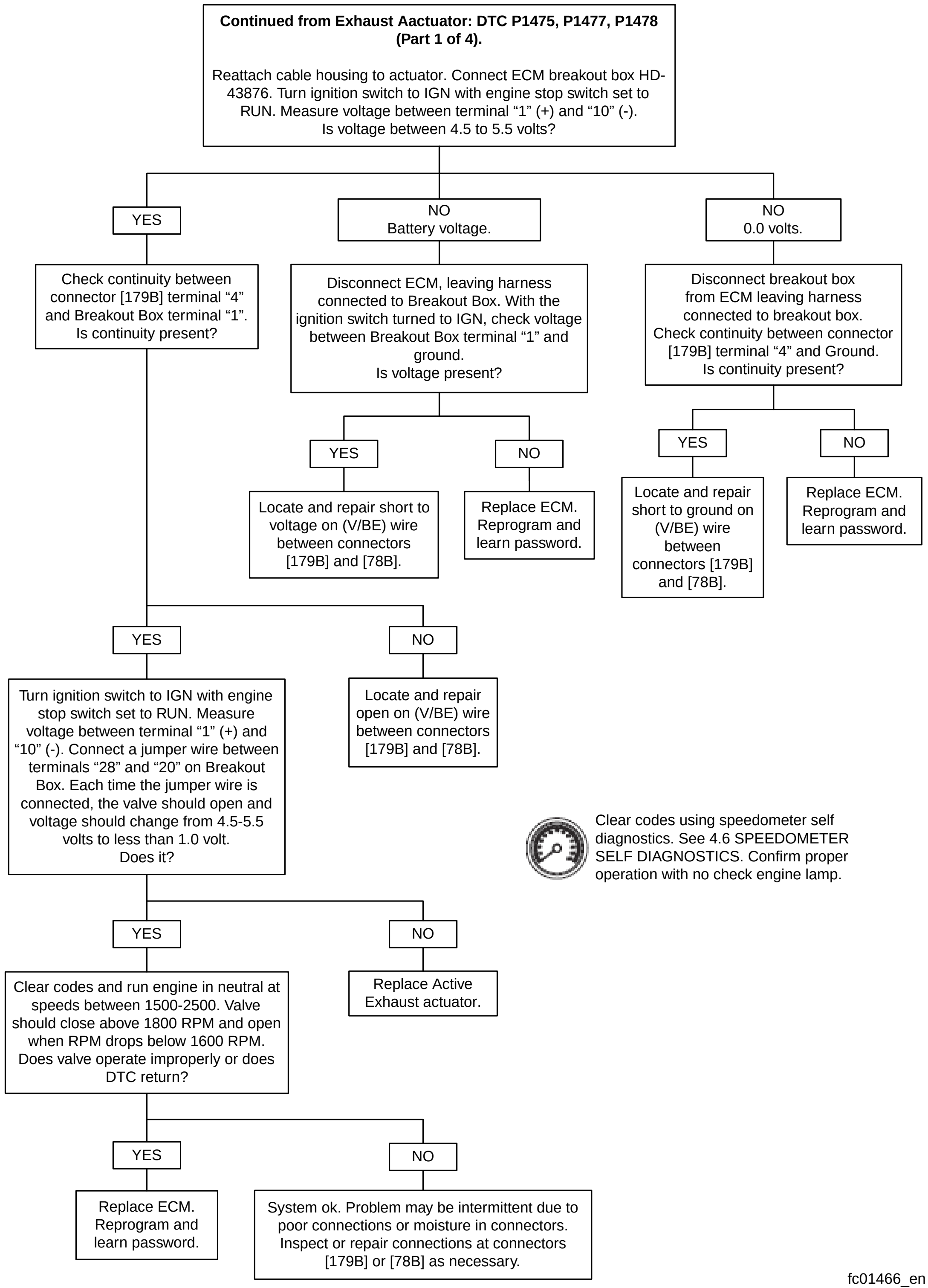
Table 4-55. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[179]	Active exhaust	5-place Amp	Exhaust bracket

Exhaust Actuator: DTC P1475, P1477, P1478 (Part 1 of 4)



Exhaust Actuator: DTC P1475, P1477, P1478 (Part 2 of 4)



Exhaust Actuator: DTC P1475, P1477, P1478 (Part 3 of 4)

Continued from Exhaust Actuator: DTC P1475, P1477, P1478 (Part 1 of 4).

Connect ECM Breakout Box to harness leaving ECM disconnected. Disconnect connector [179]. Measure continuity between Breakout Box terminal “20” and connector [179] terminal “3” while wiggling harnesses.
Is continuity present?

- NO: Locate and repair open on (V/O) wire between connectors [179B] and [78B].
- YES:

2 Connect Breakout Box to ECM connector [78]. Measure continuity between terminal “3” and chassis ground while wiggling harnesses.
Is continuity present?

- NO: Replace ECM. Reprogram and learn password.
- YES:

Disconnect Connector [179]. Measure continuity between terminal “20” and chassis ground at Breakout Box while wiggling harnesses.
Is continuity present?

- YES: Locate and repair short to ground on (V/O) wire between connectors [179B] and [78B].
- NO: Replace Active Exhaust Control Module.

Clear codes using speedometer self diagnostics.
See 4.6 SPEEDOMETER SELF DIAGNOSTICS.
Confirm proper operation with no check engine lamp.

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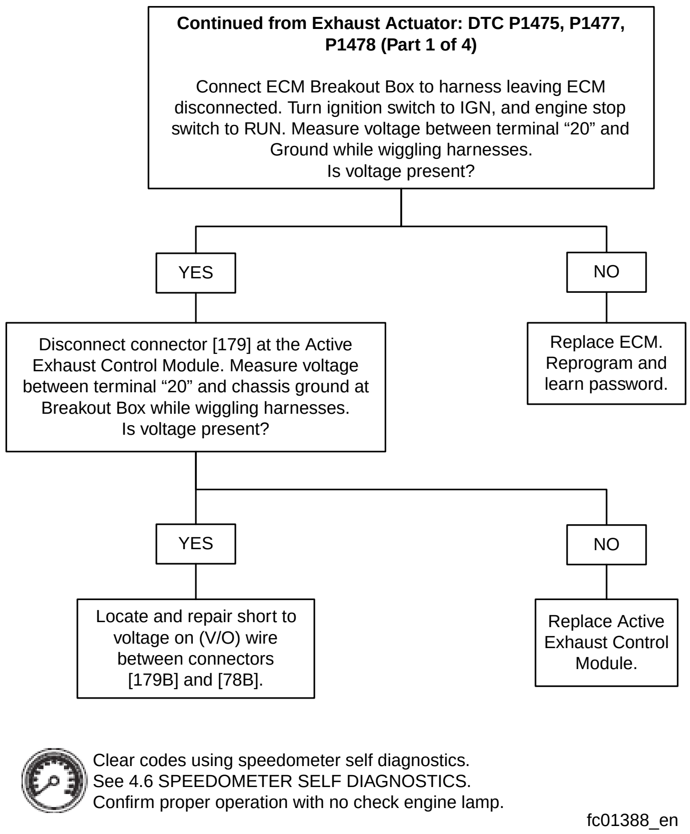
Exhaust Actuator: DTC P1475, P1477, P1478 (Part 4 of 4)



GENERAL

Jiffy Stand Sensor (HDI Models Only)

The Jiffy Stand Sensor utilizes a Hall-effect sensor to monitor Jiffy Stand position. When the Jiffy Stand is fully retracted the sensor picks up the presence of the metal tab mounted to the Jiffy Stand. The metal tab is moved away from the sensor as the Jiffy Stand is extended. When the Jiffy Stand is extended the engine will start and run only if the TSM/TSSM/HFSM determines the transmission is in neutral. Otherwise the engine will start and stall. This is done by monitoring the neutral switch input to the TSM/TSSM/HFSM and communicating that input over the serial data circuit to the Electronic Control Module (ECM).

See Figure 4-73. The Jiffy Stand Sensor is powered and monitored by the ECM. The ECM (terminal "14") supplies the 5V reference to the Jiffy Stand Sensor connector [133] (terminal "1"). The Jiffy Stand Sensor (terminal "2") sends a signal back to the ECM (terminal "9"). This signal is how the ECM determines if the Jiffy Stand is retracted or extended. The Jiffy Stand Sensor (terminal "3") is grounded through the chassis ground [GND 1].

The Jiffy Stand Sensor also has a Fail Enable Mode. This mode allows the engine to start and run if the system recognizes a problem with the Jiffy Stand Sensor circuit. If a problem exists or if the transmission is put in gear with the Jiffy Stand extended the odometer will display "SIdE Stand". Code P1501 or P1502 will set if the Jiffy Stand Sensor circuits are out of range.

NOTE

The ECM supplies not only the Jiffy Stand Sensor but also the Vehicle Speed Sensor, the Throttle Position (TP) Sensor, and the Manifold Air Pressure (MAP) Sensor with a 5V reference signal from terminal "14".

Table 4-56. Code Description

DTC	DESCRIPTION
P1501	Jiffy stand sensor low
P1502	Jiffy stand sensor high

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Unplug the Neutral Switch connector [131]. Using a DVOM, test for continuity between terminals "A" and "B" of the Neutral Switch. When the transmission is in NEUTRAL, continuity should exist. When the transmission is in gear, there should not be continuity through the Neutral Switch.
2. See the Service Manual for TSM/TSSM/HFSM replacement. See 3.25 TSM/HFSM: PASSWORD LEARN, Password Learning for the password learning procedure.
3. When the Jiffy Stand is retracted, voltage on terminal "9" should be approximately 1.5 to 2.0 volts. When the Jiffy Stand is extended, the voltage on terminal "9" should be approximately 4.0 to 4.5 volts. (Retracted=1.65-2.47V; Extended=2.94-4.41V.)
4. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.
5. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probes, socket probes and patch cords.

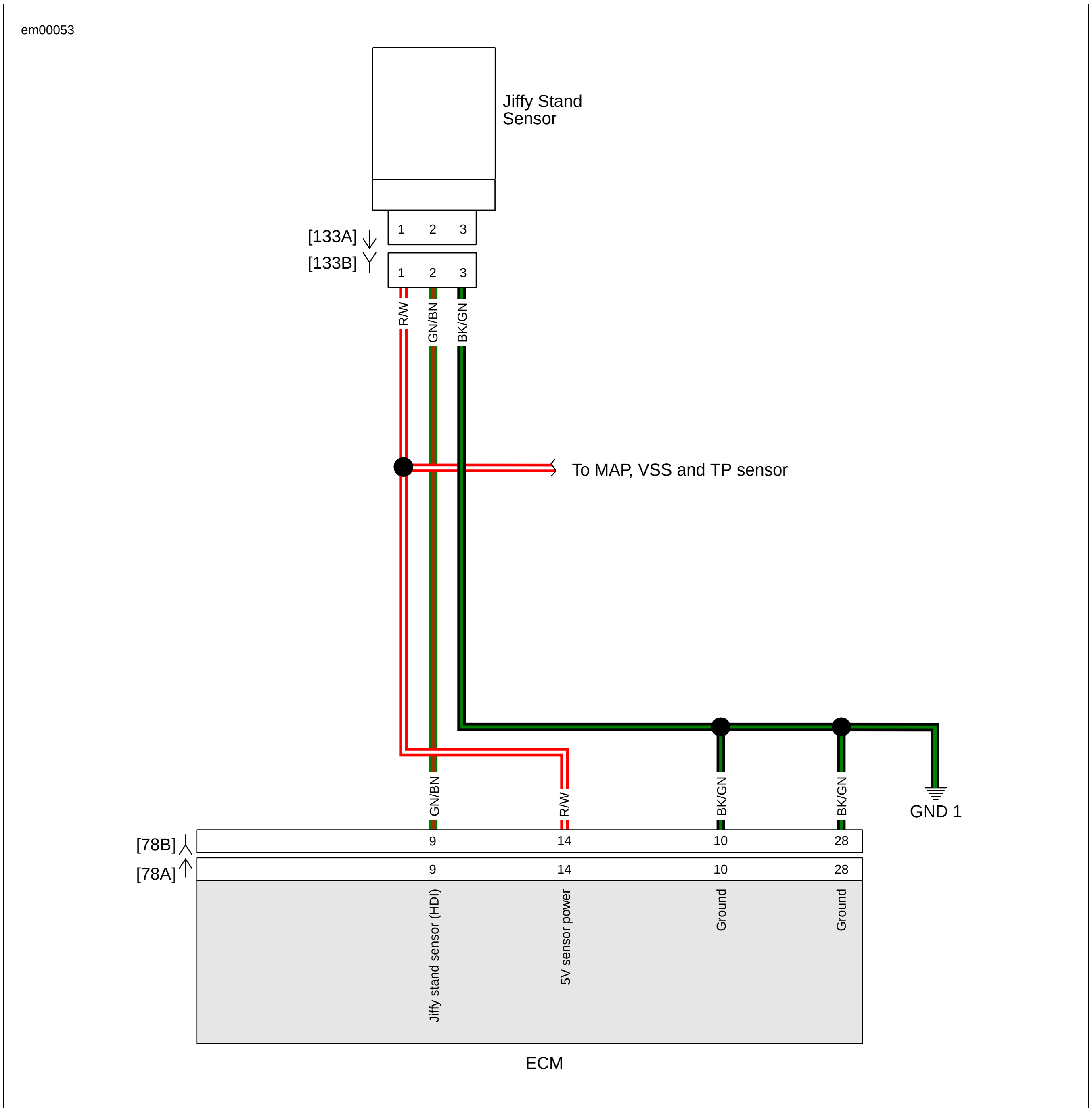
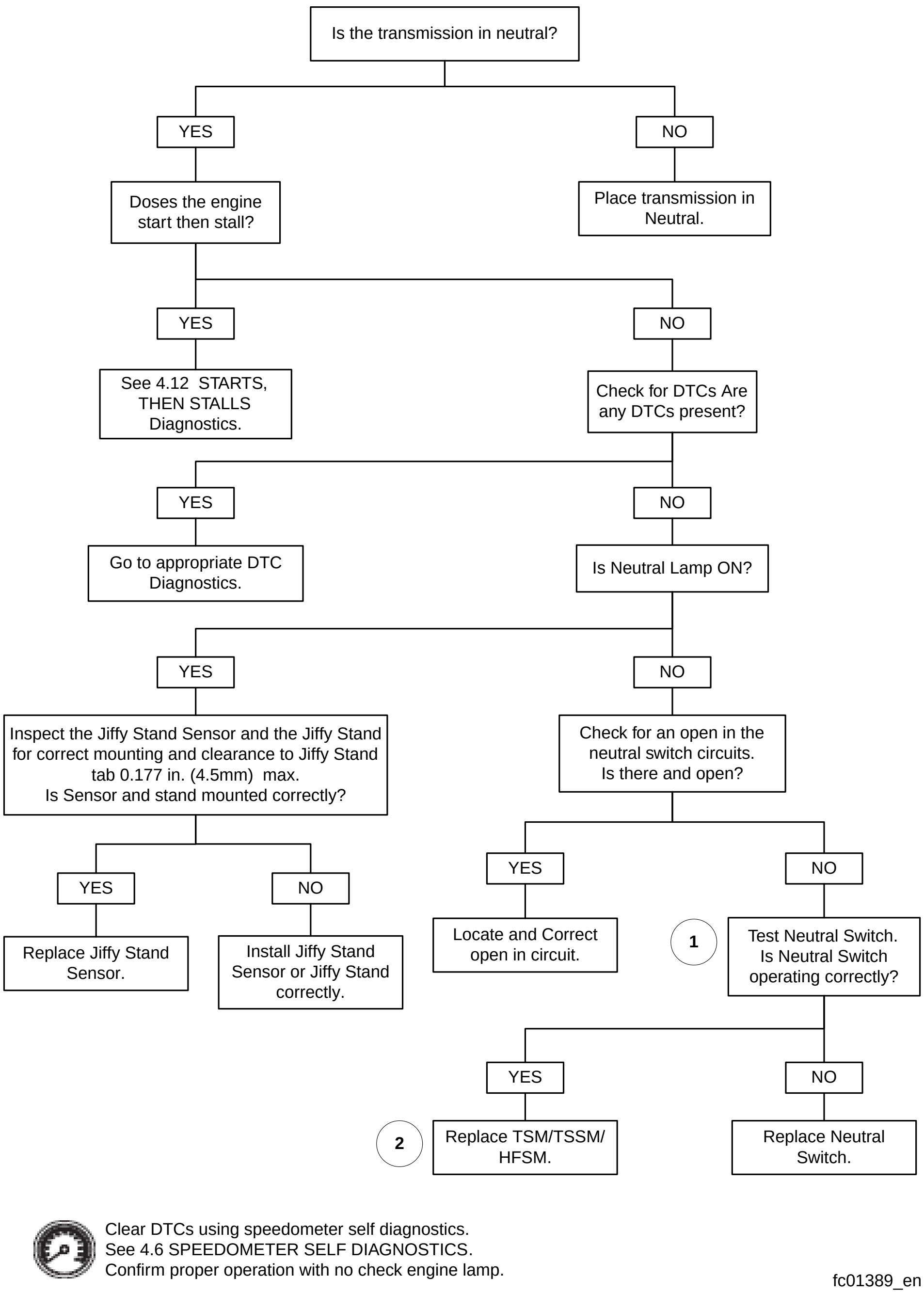


Figure 4-73. Jiffy Stand Sensor Circuit

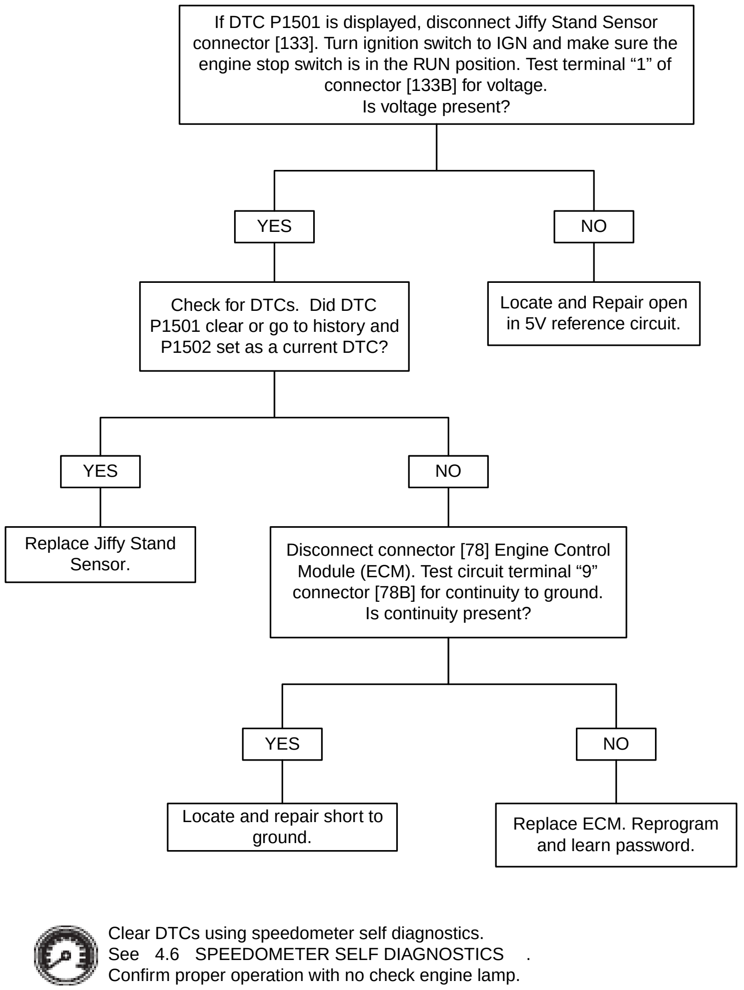
Table 4-57. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[133]	Jiffy stand sensor	3-place Molex	Left side along frame, toward front of engine

Side Stand Dispayed on Odometer



Jiffy Stand Sensor: DTC P1501



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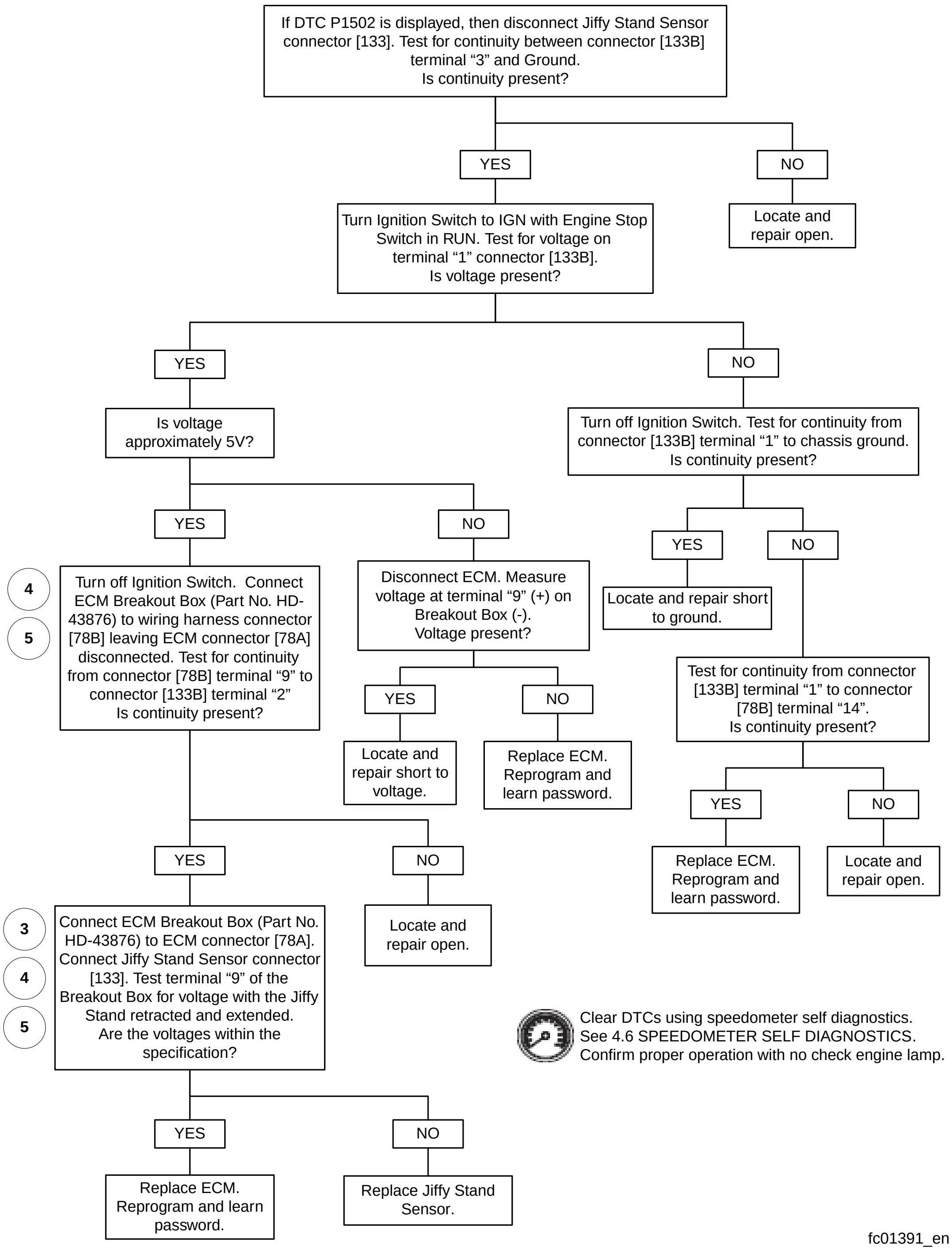
Jiffy Stand Sensor: DTC P1502



GENERAL

Loss of TSM/TSSM/HFSM Serial Data

The serial data connector provides a means for the Electronic Control Module (ECM), TSM/TSSM/HFSM and speedometer to communicate their current status. When all operating parameters on the serial data link are within specifications, a state of health message is sent between the components. A Diagnostic Trouble Code (DTC) U1064 indicates that the TSM/TSSM/HFSM is not receiving this state of health message. A DTC U1255 indicates that no messages were present during power up of the current key cycle. A DTC U1064 indicates that there was communication on the data bus since power up, but communication was lost or interrupted during that key cycle.

Table 4-58. Code Description

DTC	DESCRIPTION
U1064	Loss of TSM/TSSM/HFSM serial data
U1255	Serial data error/missing message

DIAGNOSTICS

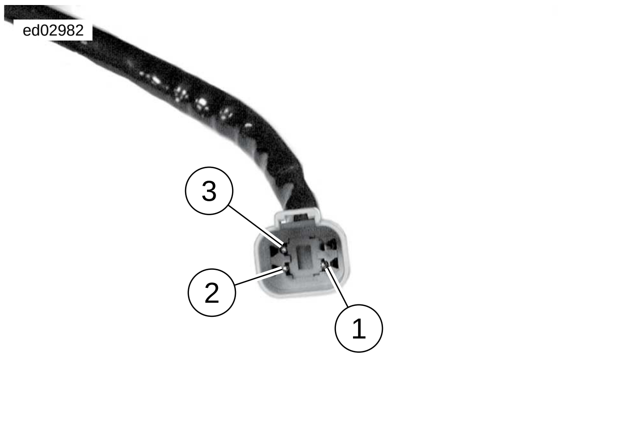
PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	SPEEDOMETER HARNESS ADAPTER

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) as follows:
   a. Mate black socket housing on Breakout Box with speedometer connector [39A] using SPEEDOMETER HARNESS ADAPTER (Part No. HD-46601).
   b. Mate black pin housing on Breakout Box with speedometer harness connector [39B] using SPEEDOMETER HARNESS ADAPTER (Part No. HD-46601).
   c. Mate gray socket housing on Breakout Box with TSM/TSSM/HFSM connector [30A].
   d. Mate gray pin housing on Breakout Box with harness connector [30B].

Figure 4-74. TSM/TSSM/HFSM



1. **Terminal 2: ground (BK/GN)**
2. **Terminal 3: serial data (LGN/V)**
3. **Terminal 4: power (GY)**

Figure 4-75. Data Link Connector

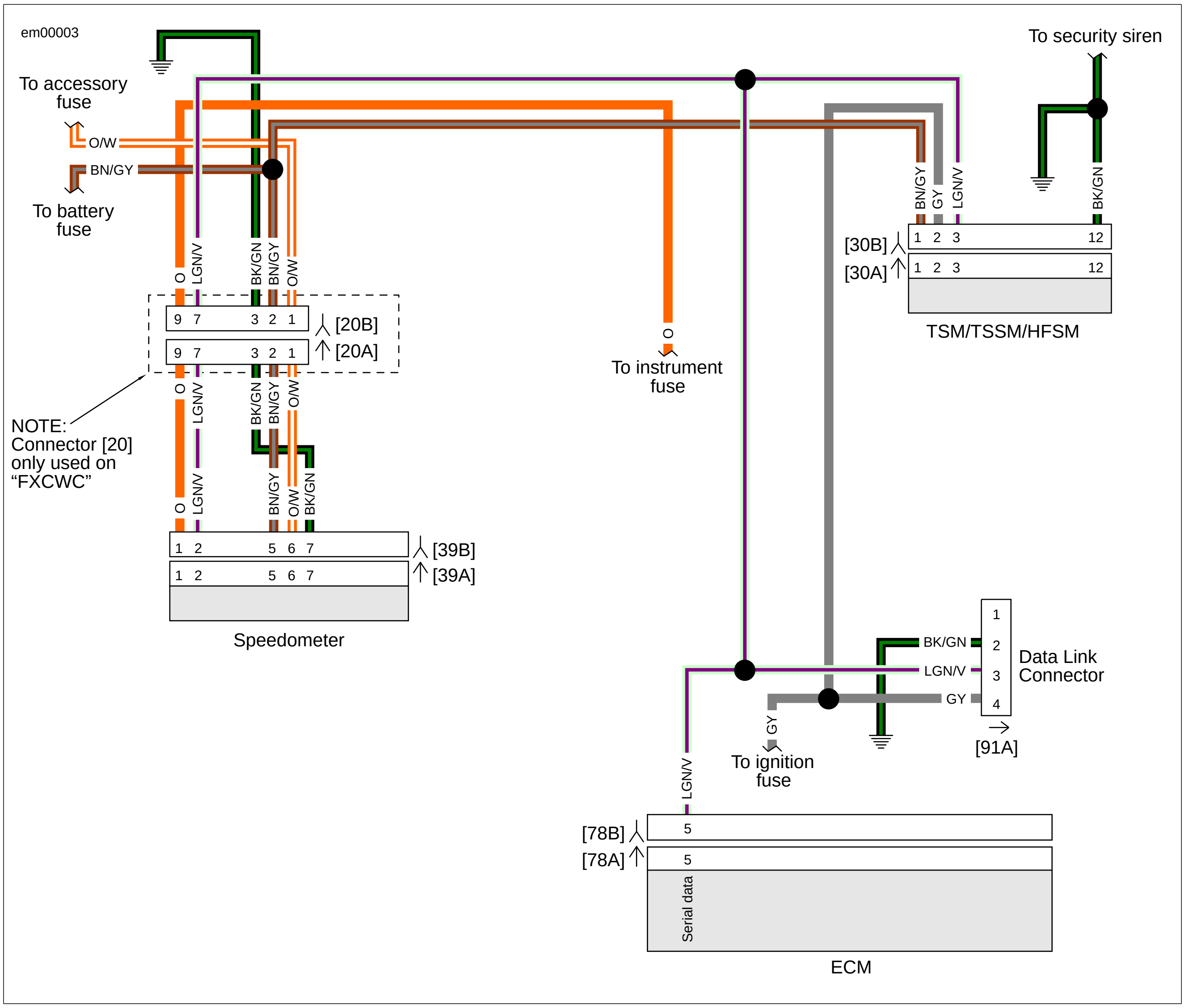
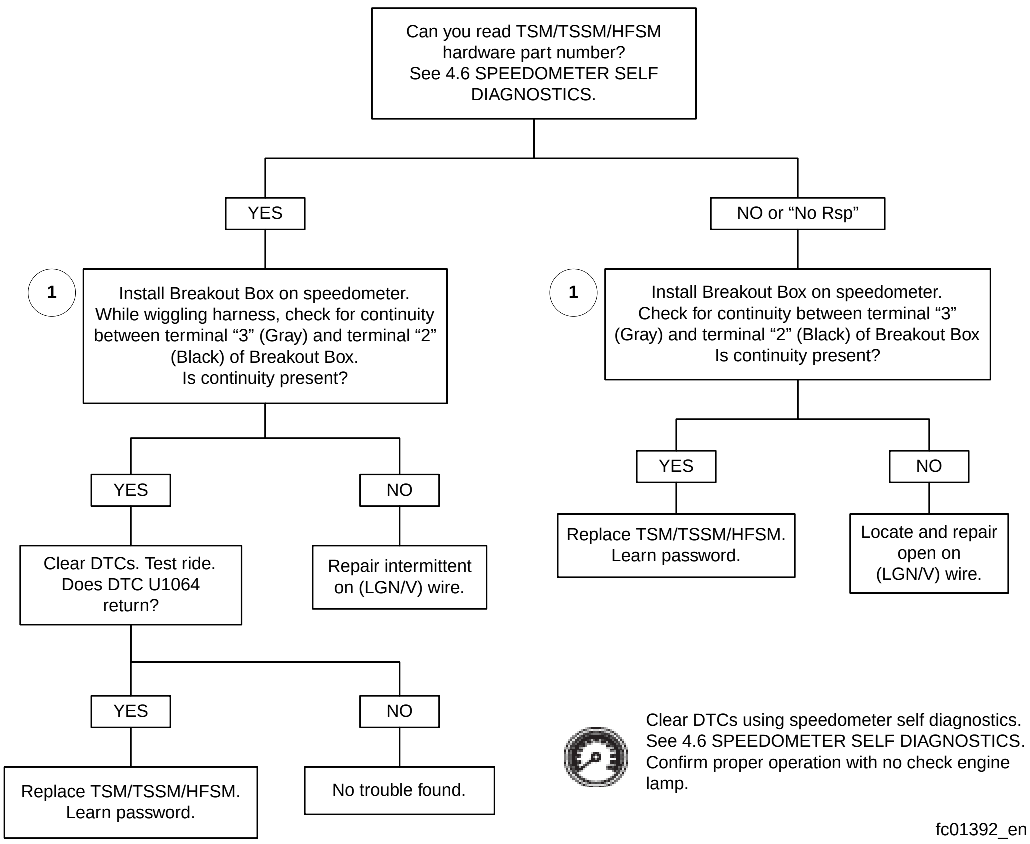


Figure 4-76. Serial Data Circuit

Table 4-59. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat

Loss of TSM/TSSM/HFSM Serial Data: DTC U1064, U1255



GENERAL

Loss of Speedometer Serial Data

The serial data connector provides a means for the speedometer, Electronic Control Module (ECM) and TSM/TSSM/HFSM to communicate their current status. When all operating parameters on the serial data link are within specifications, a state of health message is sent between the components. A Diagnostic Trouble Code (DTC) U1097 indicates that the speedometer is not capable of sending this state of health message. A DTC U1255 indicates that no messages were present during power up of the current key cycle. A DTC U1097 indicates that there was communication on the data bus since power up, but communication was lost or interrupted during that key cycle.

Table 4-60. Code Description

DTC	DESCRIPTION
U1097	Loss of all speedometer serial data (state of health)
U1255	Missing message at speedometer

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-43876	BREAKOUT BOX
HD-46601	SPEEDOMETER HARNESS ADAPTER

NOTE

If DTC is historic and not current, wiggle wire harness while performing voltage and continuity tests to identify intermittents.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness connector [78B]. Leave ECM [78A] disconnected. See 4.7 BREAKOUT BOX: EFI.

2. Connect BREAKOUT BOX (Part No. HD-42682) (black) to wire harness connector [39B] using SPEEDOMETER HARNESS ADAPTER (Part No. HD-46601). Leave speedometer [39A] disconnected. See 2.5 BREAKOUT BOX: SPEEDOMETER.

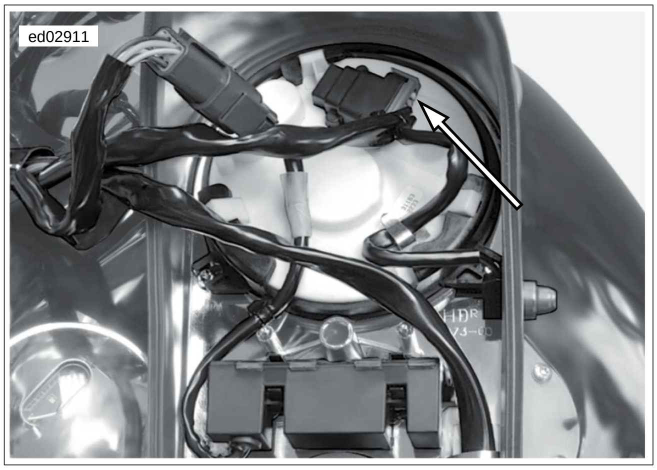


Figure 4-77. Speedometer Connector [39]

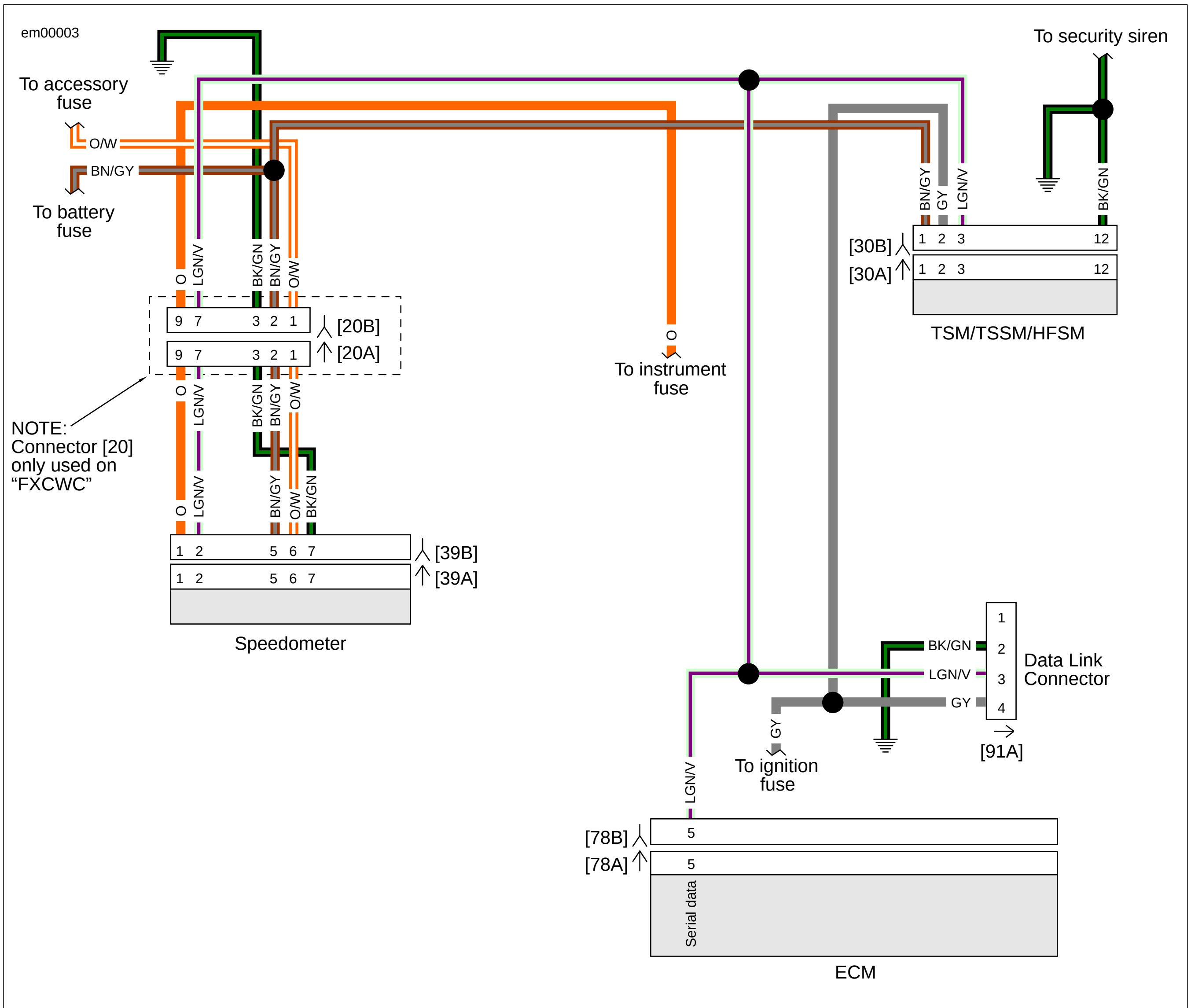
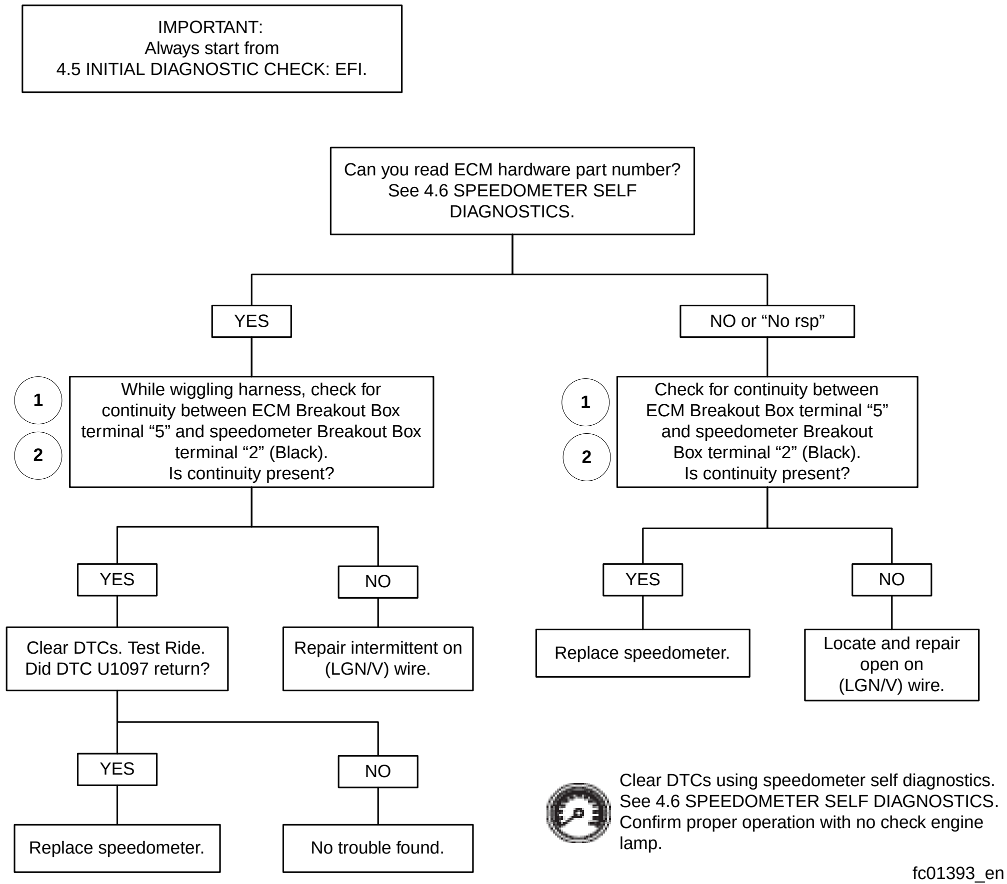


Figure 4-78. Serial Data Circuit

Table 4-61. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat

Loss of Speedometer Serial Data: DTC U1097, U1255



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NOTES

SUBJECT **PAGE NO.**

NOTES

AMP 1-PLACE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-38125-7	PACKARD TERMINAL CRIMPER
HD-39621-27	SOCKET TERMINAL TOOL
HD-39621-28	PIN TERMINAL REMOVER

General

Obtain the necessary tools to repair the connector or terminals.

For terminal crimping, use the PACKARD TERMINAL CRIMPER (Part No. HD-38125-7).

Separating Pin and Socket Housings

Bend back the ears on the pin housing slightly and separate the pin and socket halves of the connector.

Mating Pin and Socket Housings

Push the pin and socket halves of the connector together until the latches click.

Removing Socket Terminals

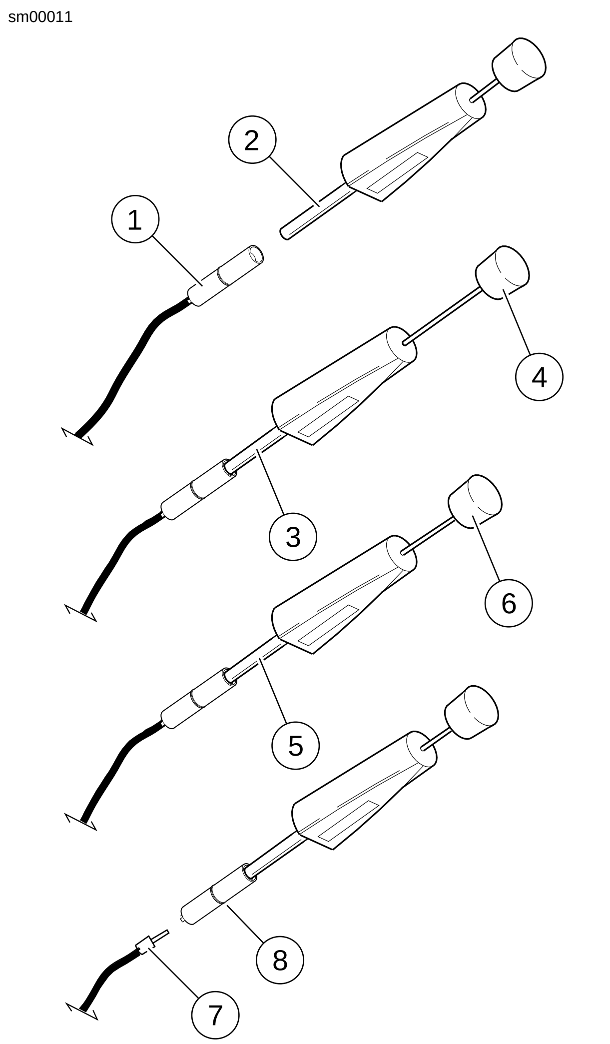
1. See Figure A-1. Grasp the lead on the wire end of the socket housing (1) and push the terminal forward toward the mating end of the connector until it stops. This will disengage the locking tang from the groove in the connector.
2. Fit the barrel (2) of the SOCKET TERMINAL TOOL (Part No. HD-39621-27) over the socket.
3. While rotating the tool slightly, push until it bottoms (3) in the socket housing.
4. Allow the plunger (4) to "back out" of the handle.
5. Holding the socket housing while keeping the tool firmly bottomed (5), depress the plunger (6). The terminal (7) pops out the wire end of the connector.

NOTE

If the terminal is not released from the socket housing, then the terminal was not pushed forward far enough before placement of the tool or the tool was not bottomed in the connector housing.

Installing Socket Terminal

1. Note the lip at the middle of the socket housing. One side of the lip is flat while the other side is tapered. Insert the wire terminal into the socket housing on the flat (lip) side.
2. Push the lead into the socket housing until it stops. A click is heard when the terminal is properly seated.
3. Gently tug on the lead to verify that the terminal is locked in place.



1. Socket housing
2. Barrel
3. Barrel bottomed in connector
4. Plunger "backed out"
5. Hold barrel bottomed
6. Plunger pressed
7. Socket terminal
8. Connector lip

Figure A-1. Socket Terminal Tool (HD-39621-27)

Removing Pin Terminal

1. Grasp the lead on the wire end of the pin housing and push the terminal forward toward the mating end of the connector until it stops. This will disengage the locking tang from the groove in the connector.

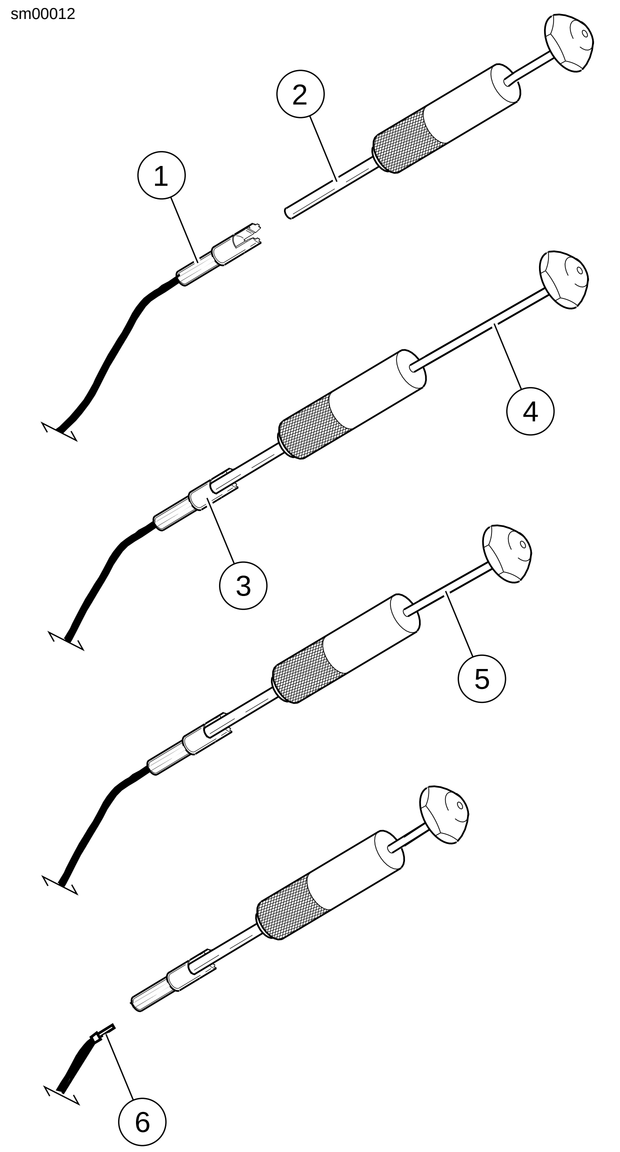
2. See Figure A-2.
   a. Fit the barrel of the PIN TERMINAL REMOVER (Part No. HD-39621-28) over the pin, and while rotating the tool slightly, push until it bottoms in the housing. Allow the plunger to "back out" of the handle.
   b. Holding the pin housing while keeping the tool firmly bottomed, depress the plunger. The terminal pops out the wire end of the connector.

NOTE

If the terminal is not released from the pin housing, then the terminal was not pushed forward far enough before placement of the tool or the tool was not bottomed in the connector housing.

Installing Pin Terminal

1. Push the lead into the pin housing until it stops. A click is heard when the terminal is properly seated.
2. Gently tug on the lead to verify that the terminal is locked in place.



1. **Pin housing**
2. **Barrel**
3. **Barrel bottomed in connector**
4. **Plunger backed out of the handle**
5. **Depressed plunger**
6. **Pin terminal**

Figure A-2. AMP Pin Terminal Remover (HD-39621-28)

AMP MULTILOCK CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41609	AMP MULTILOCK CRIMPER

General

AMP Multilock connectors are found between wire harnesses and component wiring and may be either floating or anchored to the frame with attachment clips.

See Figure A-3. Attachment clips (1) on the pin housings are fitted to T-studs on the motorcycle frame. The T-studs identify OE connector locations. To maintain serviceability, always return connectors to OE locations after service.

Obtain the necessary tools to repair the connector and terminals.

NOTE

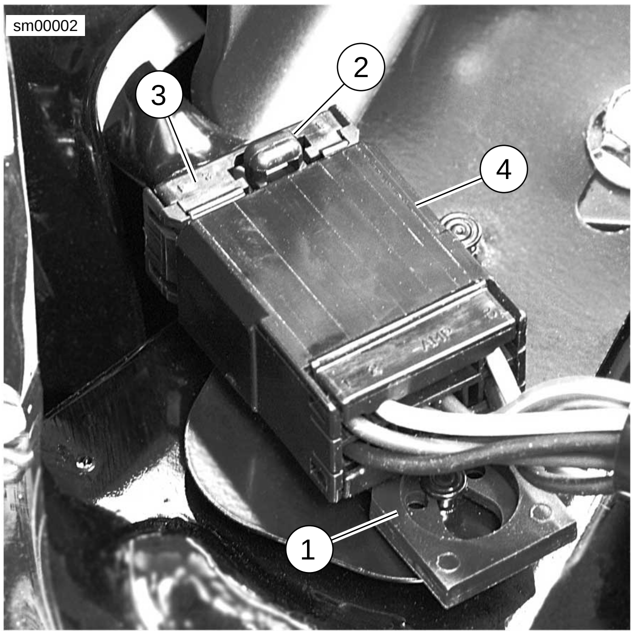
For terminal crimping use the AMP MULTILOCK CRIMPER (Part No. HD-41609).

Separating Pin and Socket Housings

1. If necessary, slide connector attachment clip T-stud to the large end of the opening.
2. See Figure A-3. Depress the release button (2) on the socket terminal side of the connector and pull the socket housing (3) out of the pin housing (4).

Mating Pin and Socket Housings

1. Hold the housings to match wire color to wire color.
2. Insert the socket housing into the pin housing until it snaps in place.
3. If OE location is a T-stud, fit large opening end of attachment clip over T-stud and slide connector to engage T-stud to small end of opening.



1. **Attachment clip**
2. **Release button**
3. **Socket housing**
4. **Pin housing**

Figure A-3. AMP Multilock Connector

Removing Terminals from Housing

1. See Figure A-4. Bend back the latch (1) to free one end of secondary lock (2) then repeat on the opposite end. Hinge the secondary lock outward.
2. Look in the terminal side of the connector (opposite the secondary lock) and note the cavity next to each terminal.
3. Insert a pick or pin into the terminal cavity until it stops.

NOTE

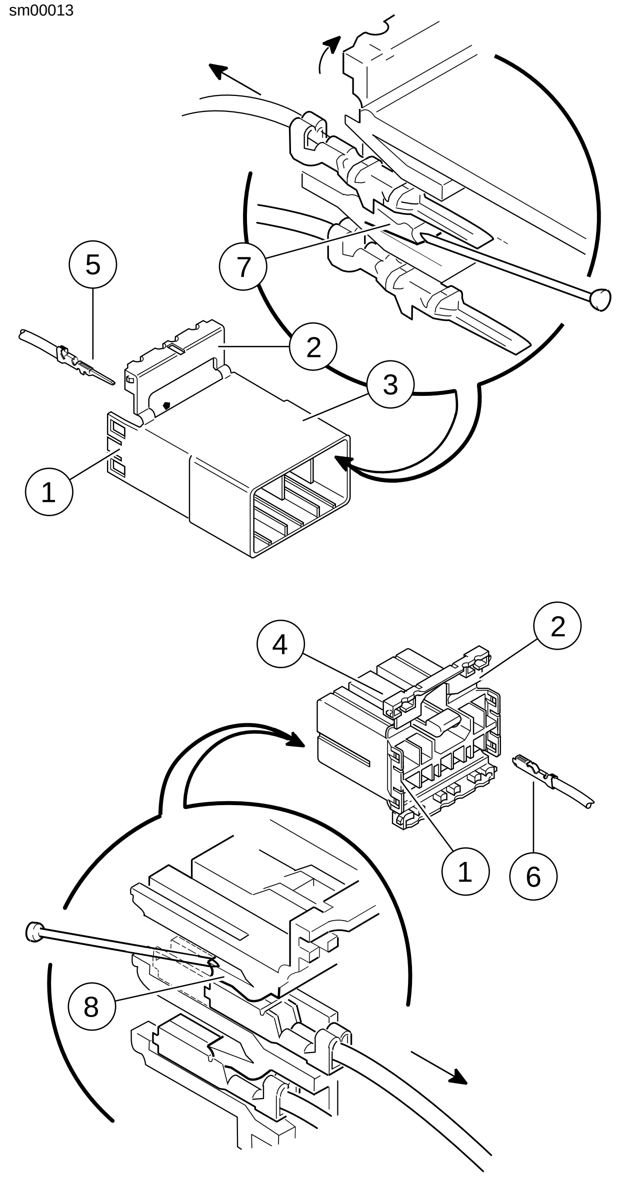
If socket/pin terminal tool is not available, a push pin/safety pin or a Snap-on pick (Part No. TT600-3) may be used.

4. Press the tang in the housing to release the terminal.
   a. **Socket:** Lift the socket tang (8) up.
   b. **Pin:** Press the pin tang (7) down.

NOTE

A "click" is heard if the tang is released.

5. Gently tug on wire to pull wire and terminal from cavity.



1. **Latch**
2. **Secondary lock open**
3. **Pin housing**
4. **Socket housing**
5. **Pin terminal**
6. **Socket terminal**
7. **Tang (pin)**
8. **Tang (socket)**

Figure A-4. AMP Multilock Connector: Socket and Pin Housings

Inserting Terminals into Housing

NOTE

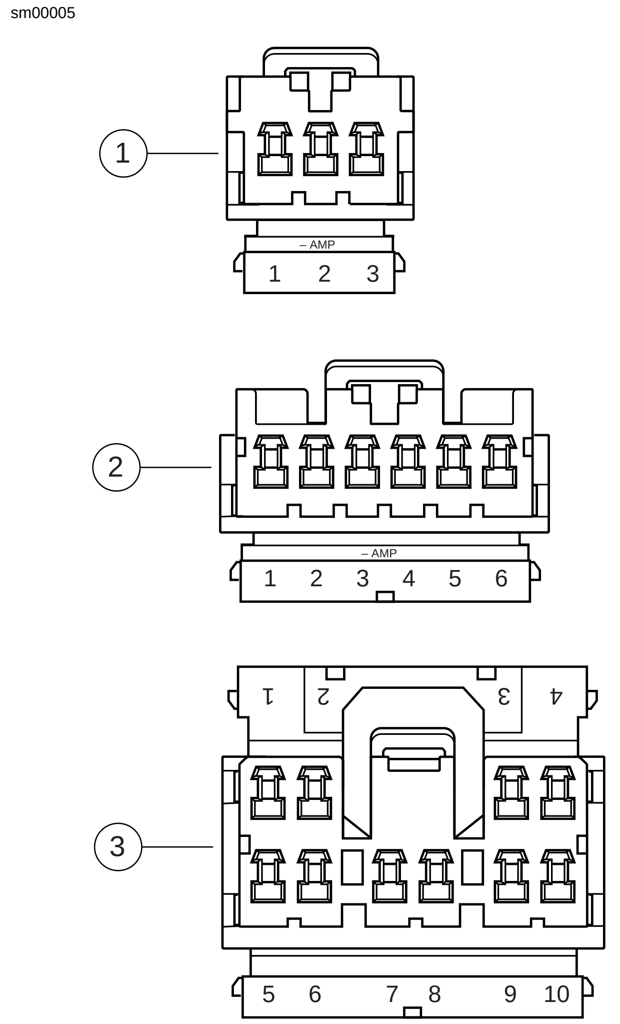
See Figure A-5. Cavity numbers are stamped into the secondary locks of both the socket and pin housings. Match the wire color to the cavity number found on the wiring diagram.

1. Hold the terminal so the catch faces the tang in the chamber. Insert the terminal into its numbered cavity until it snaps in place.

NOTES

- *Up and down can be determined by the position of the release button, the button is the top of the connector.*
- *On the pin side of the connector, tangs are positioned at the bottom of each cavity, so the slot in the pin terminal (on the side opposite the crimp tails) must face downward.*
- *On the socket side, tangs are at the top of each cavity, so the socket terminal slot (on the same side as the crimp tails) must face upward.*

2. Gently tug on wire end to verify that the terminal is locked in place.
3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.



1. **3-place housing**
2. **6-place housing**
3. **10-place housing**

Figure A-5. AMP Multilock Connector: Cavity Numbers on Secondary Locks (Socket Housings Shown)

Preparing Wire Leads for Crimping

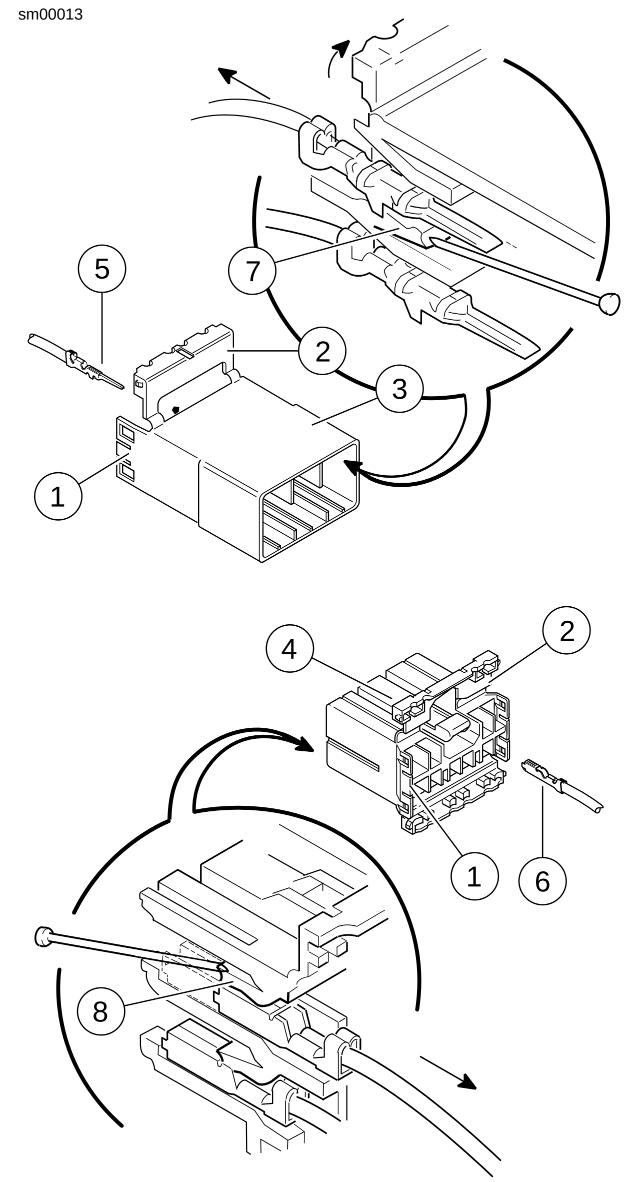
1. Strip 5/32 in. (4.0 mm) of insulation from the wire lead.

2. See Figure A-4 and Figure A-7. Select the pin/socket terminals from the parts catalog and identify the insulation crimp tails (1) and the wire crimp tails (2) and the groove for the crimp tool locking bar (3).

3. Identify the wire lead gauge and the corresponding crimper tool and nesting die. Refer to Table A-1.

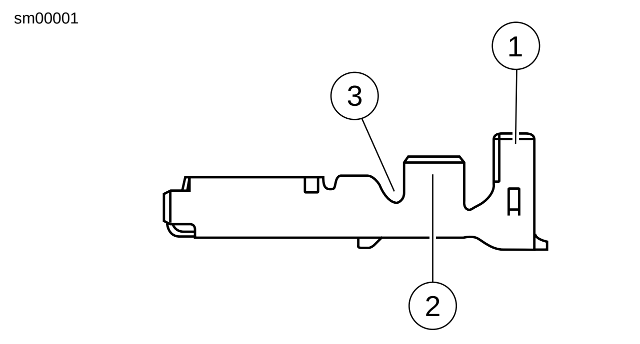
Table A-1. AMP Multilock Connector: Crimp Tool Wire Gauge/Nest

WIRE GAUGE	NEST
20	Front
16	Middle
18	Rear



1. **Latch**
2. **Secondary lock open**
3. **Pin housing**
4. **Socket housing**
5. **Pin terminal**
6. **Socket terminal**
7. **Tang (pin)**
8. **Tang (socket)**

Figure A-6. AMP Multilock Connector: Socket and Pin Housings



1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

Figure A-7. AMP Multilock Connector: Socket Terminal

Crimping Terminals to Leads

NOTE

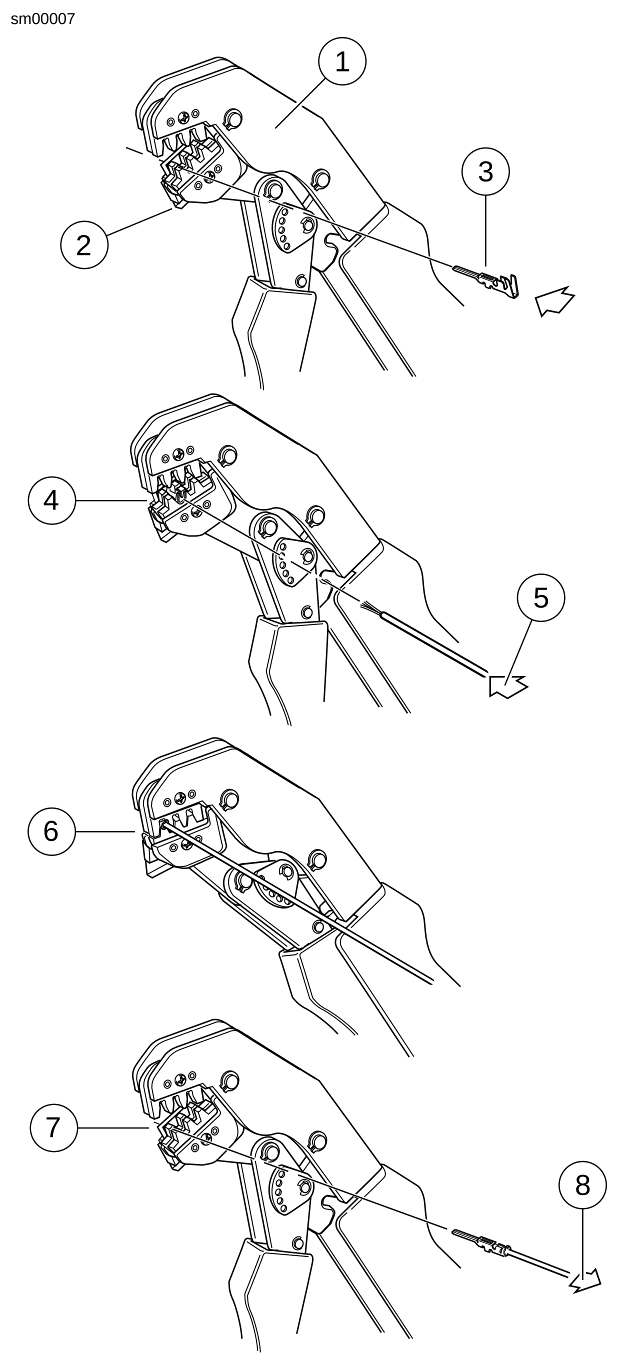
Crimping with an Amp Multilock tool is a one step operation. One squeeze crimps both the wire core and the insulation tails.

1. See Figure A-8. Squeeze the handles to cycle the AMP MULTILOCK CRIMPER (Part No. HD-41609) to the fully open position (1).
2. Raise locking bar by pushing up on bottom flange (2).

NOTE

See Figure A-4 and Figure A-7. Hold the terminal with the insulation crimp tail (1) facing up. The tool will hold the terminal by the locking bar groove (3) and crimp the wire crimp tail (2) around the bare wire of the stripped lead and the insulation crimp tail around the insulation.

3. See Figure A-8. With the insulation crimp tail facing upward, insert terminal (pin or socket) (3) through the locking bar, so that the closed side of the terminal rests on the nest of the crimp tool.
4. Release locking bar to lock position of contact (4). When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
5. Insert stripped end of lead (5) until ends make contact with locking bar.
6. Verify that wire is positioned so that wire crimp tails squeeze bare wire strands, while insulation crimp tails fold over the wire lead insulation.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
8. Raise up locking bar (8) and remove crimped terminal.

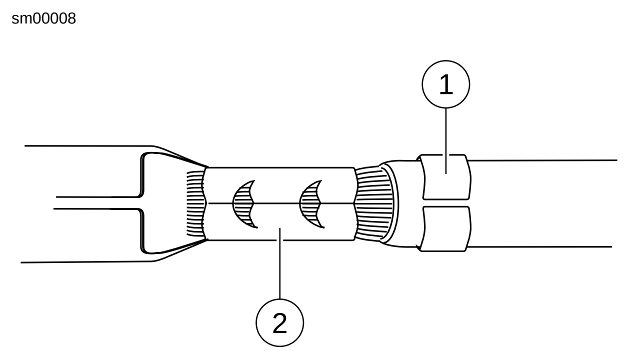


1. **Open position**
2. **Locking bar flange**
3. **Insert contact**
4. **Release locking bar**
5. **Insert lead**
6. **Squeeze**
7. **Raise locking bar**
8. **Remove crimped terminal**

Figure A-8. AMP Multilock Connector: Terminal Crimping Procedure

Inspecting Crimped Terminals

See Figure A-9. Inspect the wire core crimp (2) and insulation crimp (1). Distortion should be minimal.



1. **Insulation crimp**
2. **Wire core crimp**

Figure A-9. AMP Multilock Connector: Terminal Crimp

DELPHI CONNECTOR REPAIR

General

Delphi connectors are embossed with the brand name, Delphi, on the housing latch.

Separating Pin and Socket Housings

See Figure A-10. Bend back the external latch(es) slightly and separate pin and socket halves of connector.

Mating Pin and Socket Housings

Push pin and socket halves of connector together until external latch(es) engage.

Removing Socket Terminals

NOTE

Although the parts of the different Delphi connectors vary in appearance, the instructions which follow will work for all. The only exception is the oil pressure sender connector [139B], the terminals of which are removed like the Packard push-to-seat connectors. Therefore, see A.10 150 METRI-PACK CONNECTORS to remove/install terminals in this connector.

1. See Figure A-11. If present, free one side of wire lock (1) from ear on wire end of socket housing, then release the other side. Release wires from channels in wire lock and remove from socket housing.
2. Use a fingernail to pry colored terminal lock (2) loose and then remove from mating end of socket housing.
3. Using a thin flat blade, like the unsharpened edge of a hobby knife, gently pry tang (3) outward away from terminal, and then tug on wire to back terminal out wire end of chamber. Do not pull on wire until tang is released or terminal will be difficult to remove.

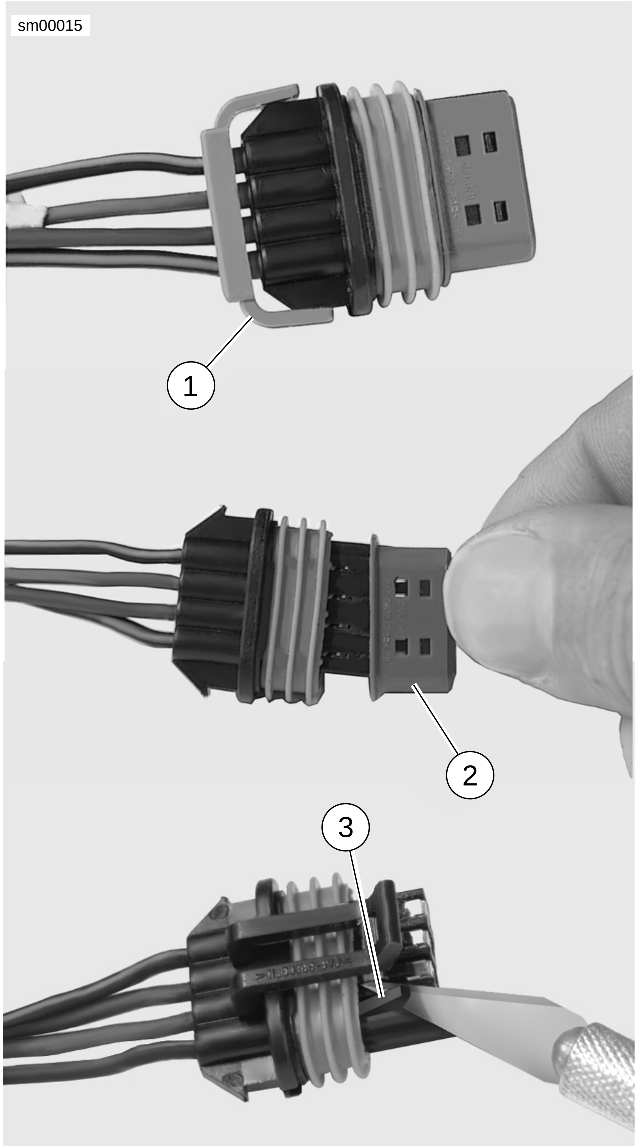
Installing Socket Terminals

NOTE

For wire location purposes, alpha or numeric characters are stamped into the wire end of each socket housing.

1. Gently push tang on socket housing inward toward chamber. With the open side of the terminal facing the tang, push terminal into chamber at wire end of socket housing.
2. Gently tug on wire to verify that terminal is locked and will not back out of chamber. If necessary, use fingernail to push tang into engagement with terminal.
3. Install colored terminal lock onto mating end of socket housing.
4. If present, seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.

Figure A-10. Delphi Connector: Socket Housing Latch



1. **Remove wire lock**
2. **Remove terminal lock**
3. **Pry tang outward**

Figure A-11. Delphi Connector: Removing Socket Terminals

DEUTSCH 1-PLACE CONNECTOR REPAIR

Separating Pin and Socket Housings

Depress external latch and separate the pin and socket housings of the Deutsch one place connector found on voltage regulators.

Mating Pin and Socket Housings

Orient the housings so the latch faces the catch and push the housings together until it clicks.

Removing Socket Terminals

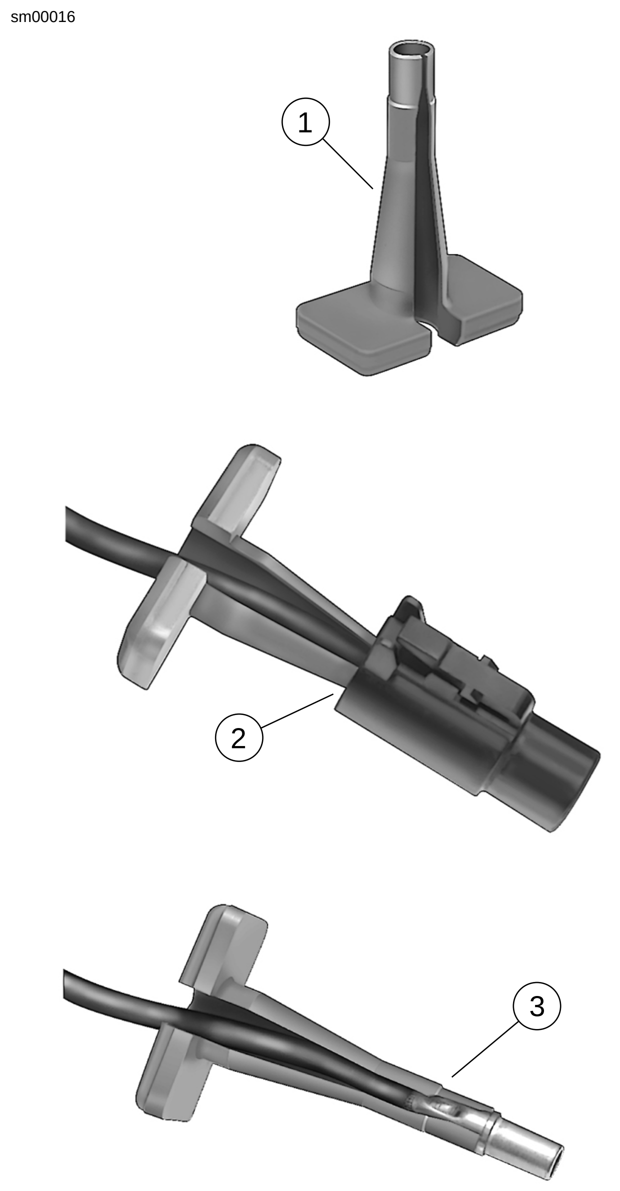
NOTE

Rough handling or careless storage can result in tool damage. Exercise care to avoid cracking or breaking the thin plastic construction.

1. Pull rear wire seal from back of housing and slide down voltage regulator cable to move out of the way.
2. See Figure A-12. Using terminal pick tool (Deutsch® 114008) (1), install tool onto voltage regulator cable so that the tapered end is in the wire end of the housing (2).
3. Push tool into wire end of housing until it bottoms. Gently tug on housing to pull from terminal (3).
4. Remove tool from voltage regulator cable.

Installing Socket Terminals

1. Insert terminal into wire end of housing until it "clicks" in place. Verify that terminal will not back out of housing. A slight tug on the voltage regulator cable will confirm that it is properly locked in place.
2. Fit rear wire seal into back of housing.



1. Deutsch terminal pick tool (114008)
2. Tool installed in housing
3. Terminal removed from housing

Figure A-12. Deutsch 1-Place Connector: Remove Socket/Pin Housing

DEUTSCH CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41475	DEUTSCH CONNECTOR SERVICE KIT
HD-41475-100	FLAT BLADE L-HOOK

General

Deutsch connectors are colored coded for location purposes. Those connectors associated with **left** side accessories, such as the front and rear **left** turn signals, are **gray**. All other connectors, including those associated with right side accessories, are **black**.

NOTE

A DEUTSCH CONNECTOR SERVICE KIT (Part No. HD-41475) contains a selection of wire seals, internal seals, seal plugs, secondary locking wedges, attachment clips and socket/pin terminals. Also included is a compartmented storage box, carrying case and a FLAT BLADE L-HOOK (Part No. HD-41475-100) is used for the removal of all types of locking wedges.

Separating Pin and Socket Housings

See Figure A-12. To separate the connector halves, depress the external latch(es) (1) on the socket housing (2) while rocking the pin (3) and socket housings.

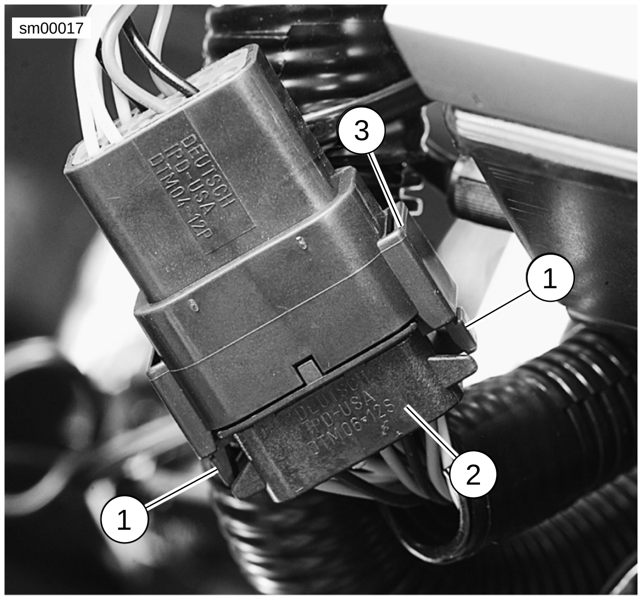
NOTES

- *Generally, the socket housing is found on the accessory side, while the pin housing is plumbed to the wiring harness.*
- *Two-, three-, four- and six-place Deutsch connectors have one latch on the connector.*
- *Eight- and twelve-place connectors have a latch on each side. Simultaneously press both latches to separate the connector.*

Mating Pin and Socket Housings

1. Align the connectors to match the wire lead colors.
   a. **For One External Latch:** Two-, three-, four- and six-place Deutsch connectors have one external latch on the socket half of the connector. To fit the halves of the connector together, the latch on the socket side must be aligned with the latch cover on the pin side.
   b. **For Two External Latches:** (8-place and 12-place) Align the tabs on the socket housing with the grooves on the pin housing.
2. Insert socket housing into pin housing until it snaps or clicks into place.

   For Two External Latches: (8-place and 12-place) If latches do not click (latch), press on one side of the connector until that latch engages, then press on the opposite side to engage the other latch.
3. If necessary, fit the attachment clip to the pin housing.
4. Place large end of slot on attachment clip over T-stud on frame. Push assembly forward to engage small end of slot.



1. **External latch**
2. **Socket housing**
3. **Pin housing**

Figure A-13. Deutsch Connector

Removing Socket Terminals

1. See Figure A-14. Insert a small screwdriver between the socket housing and locking wedge in-line with the groove (in-line with the pin holes if the groove is absent). Turn the screwdriver 90 degrees to pop the wedge up and remove the secondary locking wedge.
2. See Figure A-17. Use a pick or small screwdriver to depress terminal latches inside socket housing and back out sockets through holes in rear wire seal.

NOTE

*If wire leads require **new** terminals, see the instructions for crimping terminals.*

Installing Socket Terminals

1. Match wire lead color to connector cavity.
2. See Figure A-16. Fit rear wire seal (1) into back of socket housing (2), if removed.
3. Grasp wire lead (3) approximately 1.0 in. (25.4 mm) behind the socket terminal. Gently push socket through hole in wire seal into its chambers until it "clicks" in place.
4. A tug on the wire will confirm that it is properly locked in place.

NOTE

Seal plugs (6) are installed through the wire seals of unused chambers. If removed, seal plugs must be replaced to seal the connector.

5. Install internal seal (4) on lip of socket housing, if removed.

6. Insert tapered end of secondary locking wedge (5) into socket housing and press down until it snaps in place. The wedge fits into the center groove within the socket housing and holds the terminal latches tightly closed.

NOTES

- *See Figure A-15. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (1) pointing toward the external latch.*
- *If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the socket housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.*

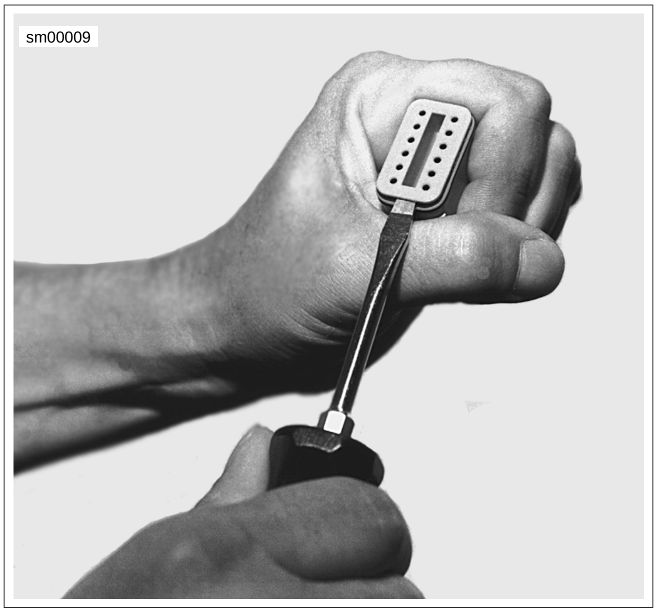
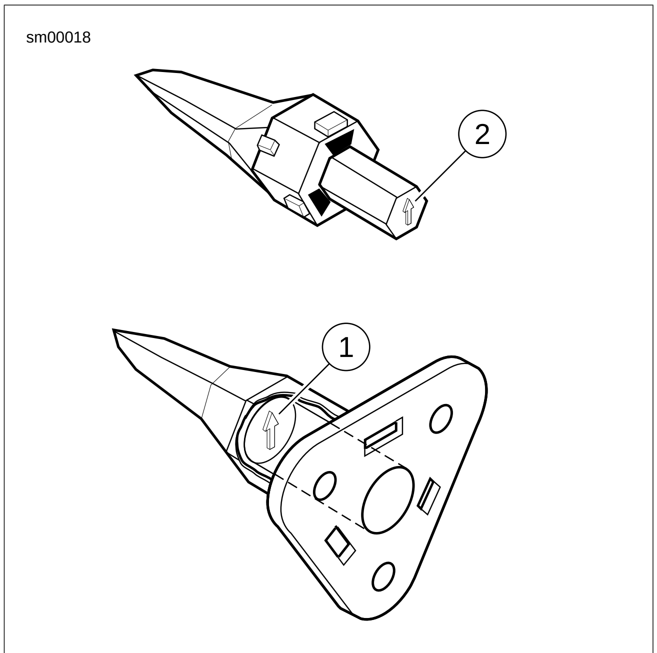
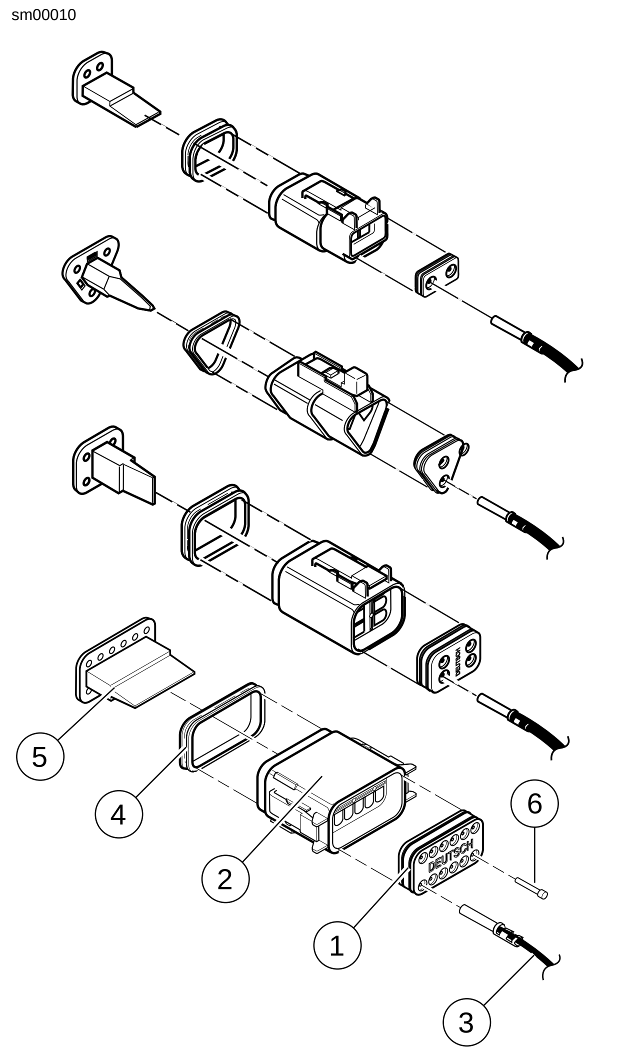


Figure A-14. Deutsch Connector: Remove Secondary Locking Wedge



1. **Arrow on socket locking wedge**
2. **Arrow on pin locking wedge**

Figure A-15. Deutsch Connector: 3-Place Locking Wedges



1. **Wire seal**
2. **Socket housing**
3. **Wire lead**
4. **Internal seal**
5. **Secondary locking wedge**
6. **Seal plug**

Figure A-16. Deutsch Connector: 2, 3, 4 and 12-Place Socket Housings

Removing Pin Terminals

1. Use the hooked end of a stiff piece of mechanics wire, a needle nose pliers or the FLAT BLADE L-HOOK (Part No. HD-41475-100) to remove the secondary locking wedge.
2. Gently depress terminal latches inside pin housing and back out pins through holes in wire seal.

NOTES

- *If wire leads require **new** terminals, see the instructions for crimping terminals.*
- *If it should become necessary to replace a pin or socket housing, please note that the 8-place and 12-place gray and black connectors are not interchangeable. Since location of the alignment tabs differ between the black and gray connectors, plugs or receptacles must be replaced by those of the same color.*
- *When replacing both socket and pin housings, then the black may be substituted for the gray, and vice versa. The socket and pin housings of all other connectors are interchangeable, that is, the black may be mated with the gray, since the alignment tabs are absent and the orientation of the external latch is the same.*

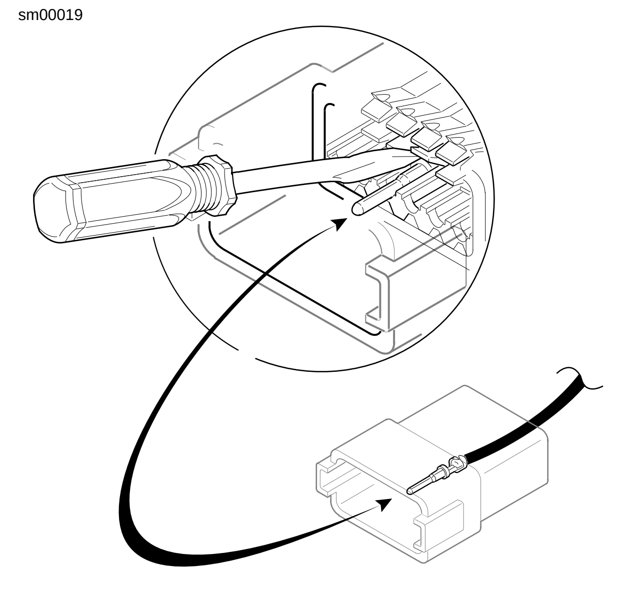


Figure A-17. Deutsch Connector: Depress Terminal Latch and Back Out Pin

Installing Pin Terminals

1. See Figure A-18. Fit wire seal (1) into back of pin housing (2).
2. Grasp wire lead approximately 1.0 in. (25.4 mm) behind the pin terminal (3). Gently push pin through holes in wire seal into its respective numbered chamber until it "clicks" in place.

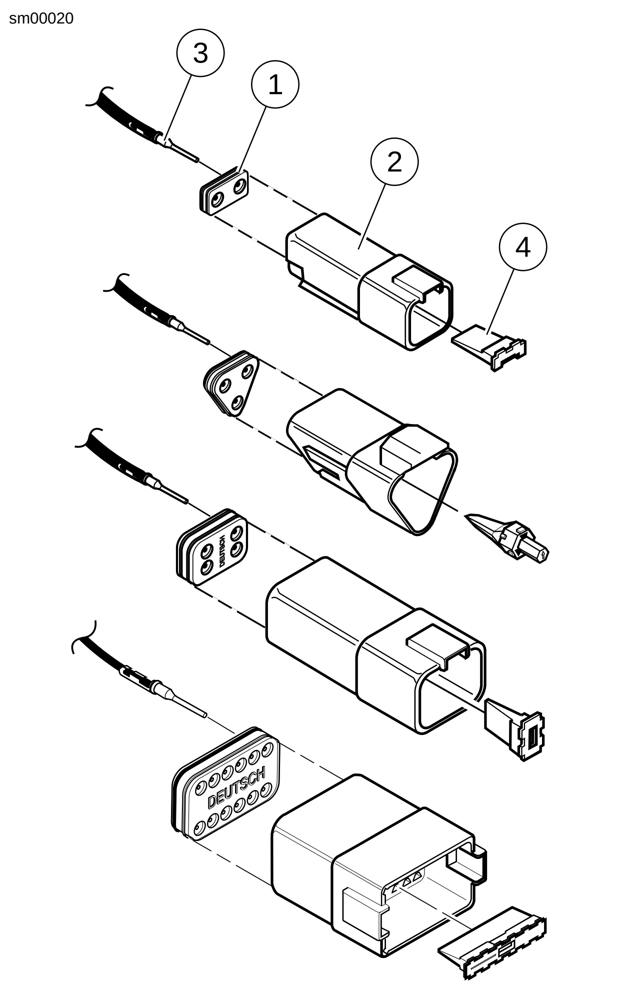
NOTE

A tug on the wire lead will confirm that a pin is locked in place.

3. Insert tapered end of secondary locking wedge (4) into pin housing and press down until it snaps in place.

NOTES

- *The wedge fits in the center groove of the pin housing and holds the terminal latches tightly closed.*
- *See Figure A-15. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (2) pointing toward the external latch.*
- *If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the pin housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.*



1. **Wire seal**
2. **Pin housing**
3. **Pin terminal**
4. **Locking wedge**

Figure A-18. Deutsch Connector: 2, 3, 4 and 12-Place Pin Housings

Crimping Terminals

Identify which of the types of Deutsch terminals are used with the connector and follow the corresponding crimping instructions. Refer to Table A-2.

Table A-2. Deutsch Connector: Terminal Crimping Instructions

TYPE	CRIMPING INSTRUCTIONS
Standard (with crimp tails)	A.6 DEUTSCH STANDARD TERMINALS
Mini Terminal (solid barrel)	A.8 DEUTSCH SOLID BARREL TERMINALS
Mini Terminal (with crimp tails)	A.7 DEUTSCH MINI-TERMINAL CRIMPS

DEUTSCH STANDARD TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL

Preparing Wire Leads for Crimping

1. Use a shop gauge to determine gauge of wire lead.
2. Strip lead removing 5/32 in. (4.0 mm) of insulation.

Crimping Terminal to Lead

1. See Figure A-19. Squeeze the handles of the DEUTSCH TERMINAL CRIMP TOOL (Part No. HD-39965-A) to open the jaws. Push the locking bar (1) up.
2. Insert (2) terminal (socket/pin) through hole of the locking bar, so that the rounded side of the contact barrel rests in the nest (concave split level area) with the crimp tails facing upward. To match the wire gauge to the crimp tool die, refer to Table A-3.
3. Release locking bar to lock terminal in die.

NOTE

If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the terminal so that the tails face straight upward. When positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.

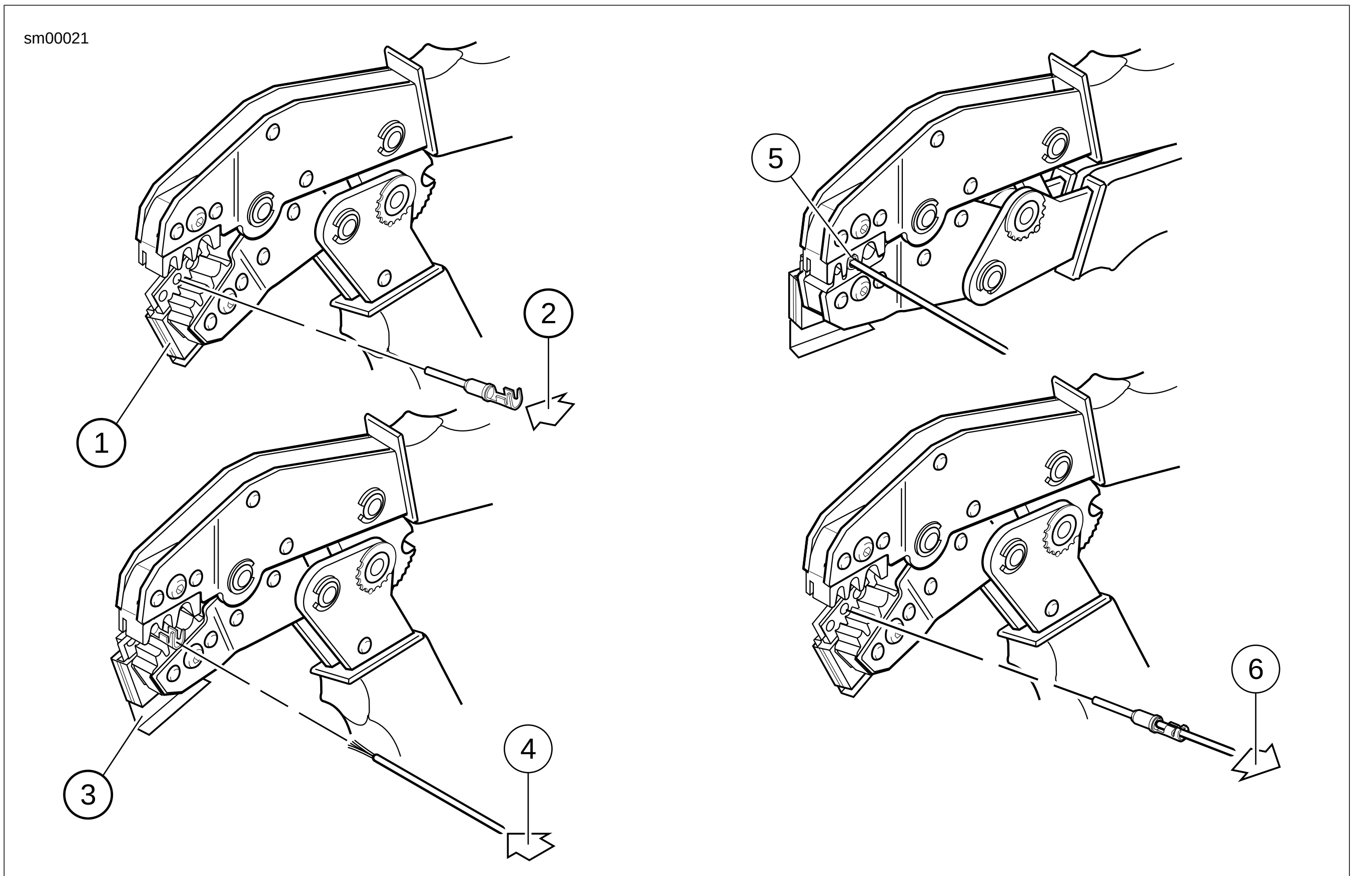
4. Insert stripped wire core between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over the insulation.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens after the terminal is crimped.
6. Raise locking bar up and remove wire lead and terminal.

Inspecting Crimps

Inspect the wire core and insulation crimps. Distortion should be minimal.

Table A-3. Deutsch Standard Terminal Crimp: Wire Gauge To Die

WIRE GAUGE (AWG)	CRIMP TOOL DIE
20	Front
16-18	Middle



1. **Open jaws and raise locking bar**
2. **Insert terminal in locking bar**
3. **Release locking bar to lock terminal in die**
4. **Insert stripped lead**
5. **Squeeze crimper**
6. **Raise locking bar and remove terminal**

Figure A-19. Crimping a Deutsch Standard Terminal

DEUTSCH MINI TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-7	PACKARD TERMINAL CRIMPER

Preparing Wire Leads for Crimping

Strip wire lead removing 5/32 in. (4.0 mm) of insulation.

Crimping a Mini Terminal to Wire Lead

1. See Figure A-20. Compress the handles of PACKARD TERMINAL CRIMPER (Part No. HD-38125-7) until the ratchet (2) automatically opens.

NOTE

Always perform core crimp before insulation crimp.

2. Position the core crimp on die E (1) of the crimper. Be sure the core crimp tails are facing the forming jaws.
3. Gently apply pressure to handles of tool until crimpers just secure the core crimp tails.
4. Insert stripped wire core stands between crimp tails. Position wire so that short pair of crimp tails squeeze bare wire strands, while long pair squeeze over the insulation.
5. Squeeze handle of crimper until tightly closed. Tool automatically opens when the crimping sequence is complete.

NOTE

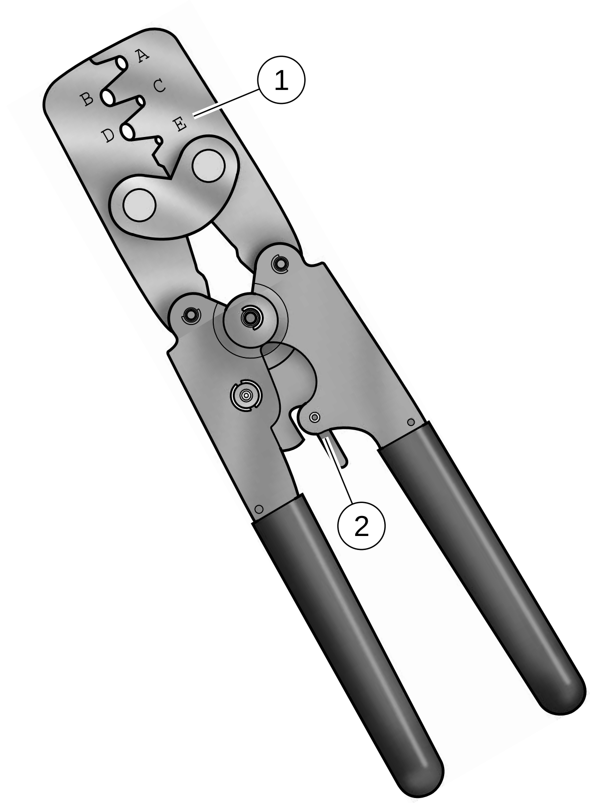
If the crimper does not open, it can be opened by squeezing the ratchet trigger (2).

6. Position the insulation crimp on nest C of the crimper. Be sure the insulation crimp tails are facing the forming jaws.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

Inspecting Crimps

Inspect the core and insulation crimps. Distortion should be minimal.

sm00022



1. **E die**
2. **Crimper ratchet trigger**

Figure A-20. Packard Terminal Crimper (HD-38125-7)

DEUTSCH SOLID BARREL TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-42879	ELECTRICAL CRIMPER TOOL

Preparing Wire Leads For Crimping

For size 20, 16 and 12 contacts, wire ranges 26-12 AWG.

Strip wire lead removing 1/4 in. (6.4 mm) of insulation.

Adjusting Crimper Tool

1. See Figure A-21. Squeeze the ELECTRICAL CRIMPER TOOL (Part No. HD-42879) handles to cycle the crimp tool to open.
2. Remove locking pin (1) from selector knob (2).
3. Raise selector knob and rotate until selected wire size stamped on wheel is aligned with "SEL. NO." arrow (3).
4. Loosen knurled locknut (4) and turn adjusting screw (5) clockwise (in) until it stops.

Crimping a Barrel Contact To Wire Lead

1. See Figure A-22. Turn tool over and drop contact barrel (1) into indentor cover (2) hole with the wire end out.
2. Turn adjusting screw counterclockwise (out) until contact is flush with bottom of depression in indentor cover. Tighten knurled locknut.
3. Slowly squeeze handles of crimp tool until contact is centered between the four indentor points (3).
4. Insert bare wire core strands of stripped wire lead (4) into contact barrel. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
5. Remove wire lead with crimped contact from indentor.

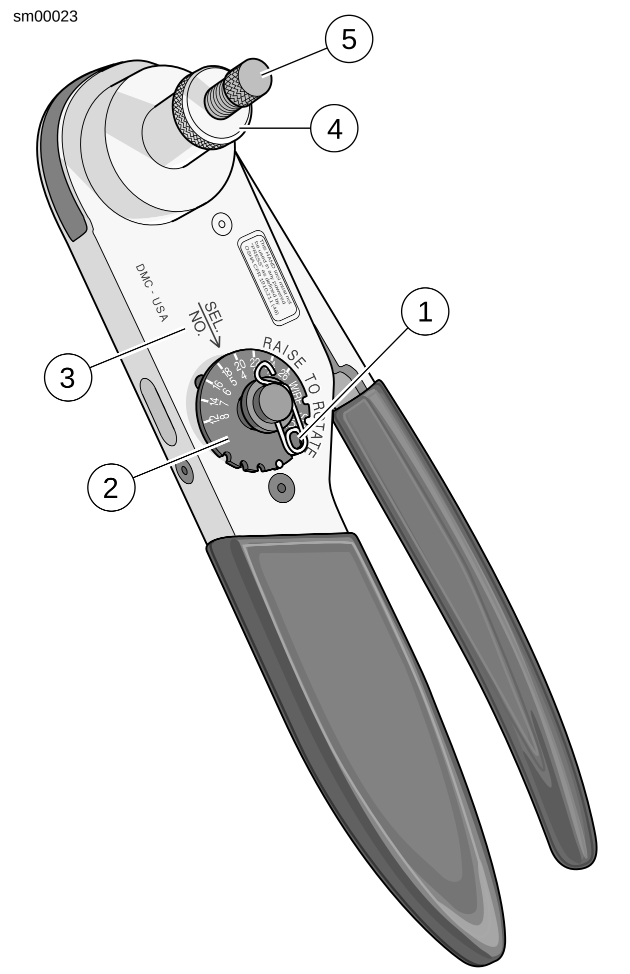
NOTE

Tool must be readjusted when changing contact size/type.

6. Install pin to lock selector knob.

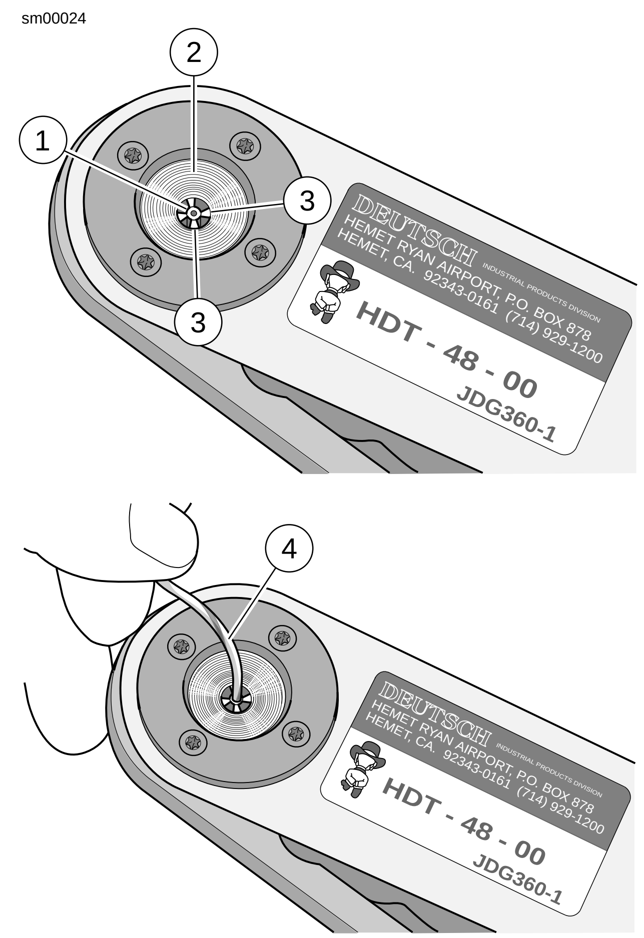
Inspecting Crimps

Inspect the crimp. All core wire strands are to be crimped in the barrel.



1. **Locking pin**
2. **Selector knob**
3. **SEL. NO. arrow**
4. **Knurled locknut**
5. **Adjusting screw**

Figure A-21. Electrical Crimper Tool (HD-42879)



1. **Contact barrel**
2. **Indentor cover**
3. **Indentor point**
4. **Stripped wire lead**

Figure A-22. Deutsch Solid Barrel

FUSE BLOCK REPAIR

Removing Socket Terminals

1. See Figure A-23. To remove secondary locks, insert end of small flat blade screwdriver (1) under lip of locking wedge (2) and gently pry up secondary lock.

NOTE

For best results, start with locking wedge on outboard side of secondary lock.

2. Looking into chamber at top of fuse block, note the tang next to each socket terminal.
3. Using a thin flat blade, like that on a hobby knife, gently push tang away from terminal, and then tug on wire to back terminal out.

Installing Socket Terminals

1. Match the wire lead color to the fuse block terminal cavity.

NOTES

- *Refer to the main harness wiring diagram for wire lead color codes.*
- *See Figure A-24. The main fuse block terminal cavity is identified as alpha (1) and numeric (2) coordinates. Refer to the main harness wiring diagram for fuse block terminal cavity coordinates.*

2. With the open side of the socket terminal facing the tang, push lead into chamber at the wire end of the fuse block. A click is heard when the terminal is properly engaged.
3. Gently tug on the wire to verify that the terminal is locked in place and will not back out of the chamber.
4. Install the secondary locks. With the locking wedges positioned above the tangs in each chamber, slide flat side of secondary lock into slot (between rows), and push down until it bottoms.

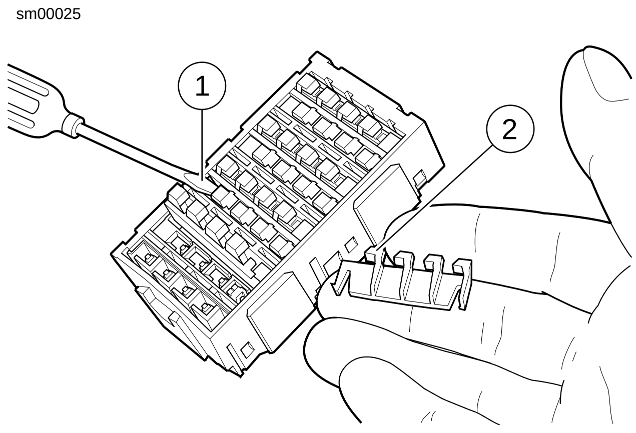
Crimping Terminals

Terminals are crimped twice; once over the wire core and a second time over the insulation/seal.

A correctly crimped terminal may require different crimping dies found on separate crimpers.

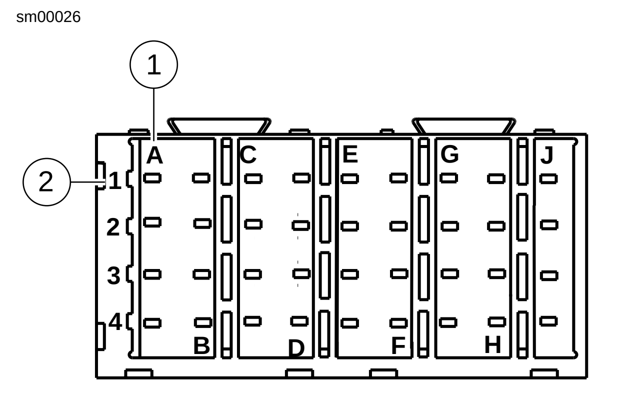
NOTE

The wiring diagram indicates when one socket terminal is be crimped to two wire leads.



1. **Pry up secondary lock**
2. **Lip of locking wedge**

Figure A-23. Fuse Block: Remove Secondary Locks



1. **Alpha**
2. **Numeric**

Figure A-24. Fuse Block: Coordinates (typical)

150 METRI-PACK CONNECTOR REPAIR

General

Metri-Pack connectors are embossed with the initials (P.E.D.).

There are two types of connectors in this series:

- Pull-to-Seat
- Push-to-Seat

Separating Pin and Socket Housings

Bend back the external latch slightly and separate the pin and socket halves of the connector.

Mating Pin and Socket Housings

Align the wire colors and push the pin and socket halves of the connector together.

Removing Socket Terminal

1. See Figure A-25 for pull-to-seat connector or Figure A-26 for push to seat connector. Remove wire lock (1) from wire end of socket housing on push-to-seat type connectors.

NOTE

For best results, free one side of wire lock first and then release the other side.

2. Find the locking tang in the mating end of the connector.

NOTE

The tangs are always positioned in the middle of the chamber and are on the same side as the external latch.

3. Gently insert a safety pin into the chamber about 1/8 in. (3.2 mm).
   a. **For pull-to-seat:** Stay between the terminal and the chamber wall and pivot the end of the pin toward the terminal body.
   b. **For push-to-seat:** There is a small opening for the pin.
4. When a click is heard, remove the pin and repeat the procedure.

NOTE

The click is the sound of the tang returning to the locked position as it slips from the point of the pin.

5. Pick at the tang until the clicking stops and the pin seems to slide in deeper than it had previously. This is an indication that the tang has been depressed.

NOTE

On those terminals that have been extracted on multiple occasions, the click may not be heard, but pivot the pin as if the click was heard at least 3 times.

6. Remove the pin.
   a. **For pull-to-seat:** Push on the lead to extract the terminal from the mating end of the connector.
   b. **For push-to-seat:** Pull on the lead to draw the terminal out the wire end.

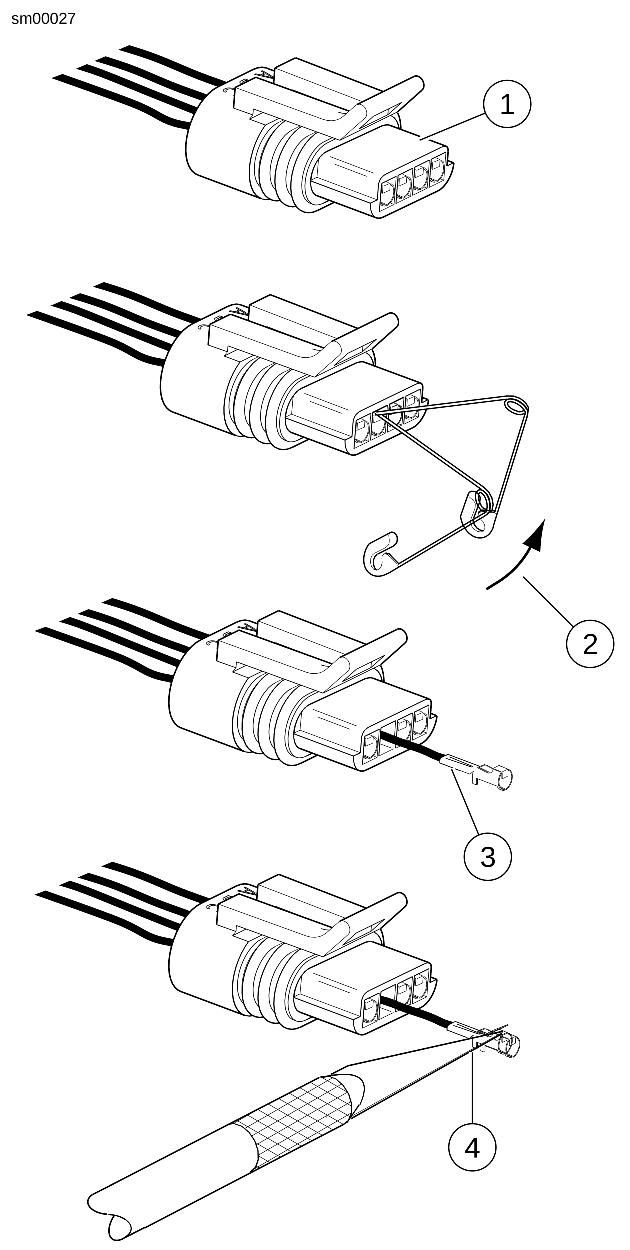
Inserting Socket Terminal

NOTE

For wire location purposes, alpha characters are stamped into the socket housings.

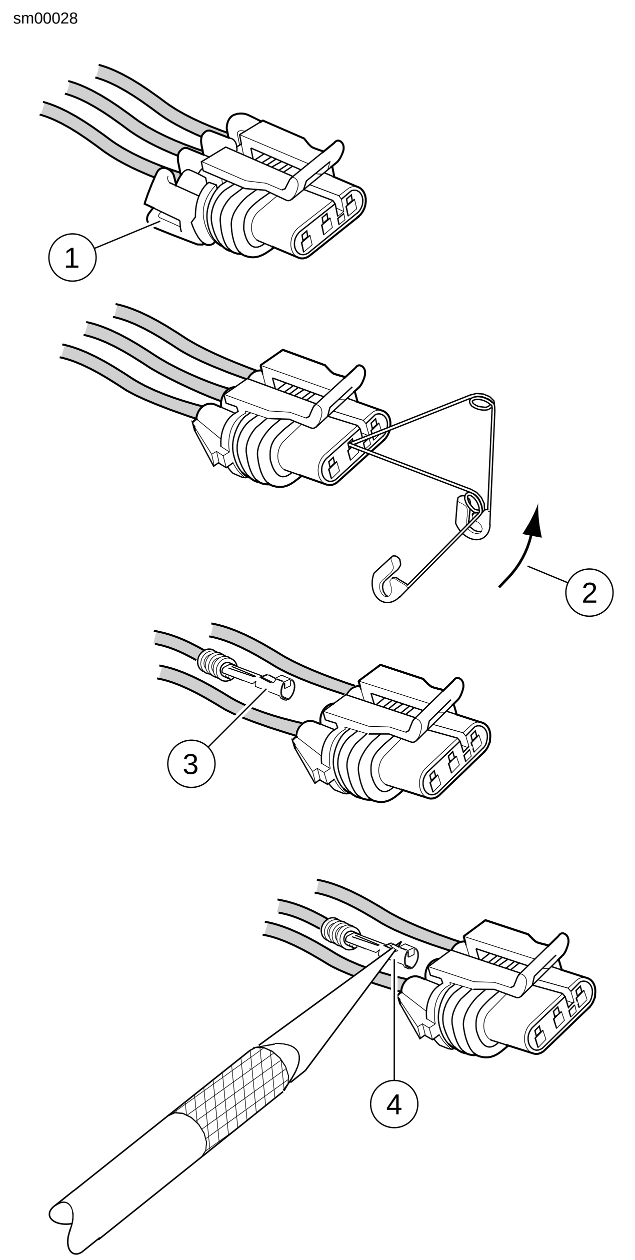
1. See Figure A-25 for pull-to-seat connector or Figure A-26 for push to seat connector. Using a thin flat blade, like that on a hobby knife, carefully bend the tang outward away from the terminal body.
2. Gently pull or push on the lead to install the terminal back into the chamber. A click is heard when the terminal is properly seated.
3. Gently pull or push on the lead to verify that the terminal is locked in place.

   For push-to-seat: See Figure A-26. Seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.



1. **Locate tang in chamber**
2. **Pivot pin to depress tang**
3. **Push to remove**
4. **Raise tang to install**

Figure A-25. 150 Metri-Pack Connector: Pull-to-Seat



1. **Remove wire lock**
2. **Pivot pin to depress tang**
3. **Pull to remove**
4. **Raise tang to install**

Figure A-26. 150 Metri-Pack Connector: Push-to-Seat

280 METRI-PACK CONNECTOR REPAIR

General

See Figure A-27. Called Packard connectors, Metri-Pack series connectors are embossed with the initials (P.E.D.)

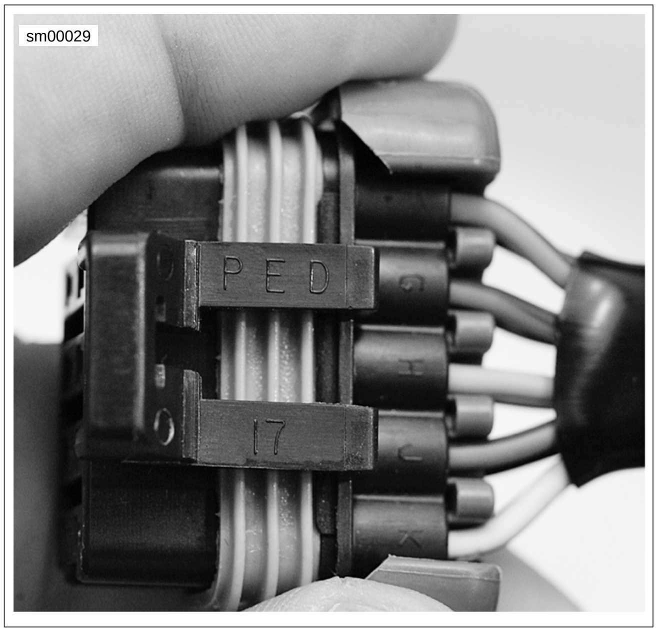


Figure A-27. 280 Metri-Pack Connector (P.E.D.)

Separating Pin and Socket Housings

Depress the wireform and use a rocking motion to detach the socket connector half.

Mating Pin and Socket Housings

Align the groove in the socket housing with the tab in the pin housing. Push the pin and socket halves of the connector together until the latch clicks.

Removing Socket Terminals

1. See Figure A-28. Pry rubber seal from wire end of connector and move seal down wires (1) toward conduit. Hold the connector so that the wireform is facing down.
2. Looking into the wire end of the connector, insert the point of a safety pin (2) between the top of the terminal and the inside chamber wall.
3. Push safety pin completely into chamber while watching terminal on mating end of connector. When terminal is observed moving forward slightly, tang is depressed. Remove safety pin.

NOTE

Repeat as necessary until the terminal can be pushed out of the connector.

4. Push on wire end of the lead to extract the terminal from the mating end of the connector.
5. If necessary, crimp new terminals on wires. See A.15 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps.

Installing Socket Terminals

NOTE

Terminal cavities are lettered on the socket housing. To match the wire lead colors to the terminal cavity, refer to the wiring diagram.

1. See Figure A-28. Using a thin flat blade, like an X-Acto knife (4), carefully bend the tang outward away from the terminal body.
2. Gently pull on the wire lead (5) to draw the terminal back into the chamber. The tang faces opposite the wireform as it enters the chamber.

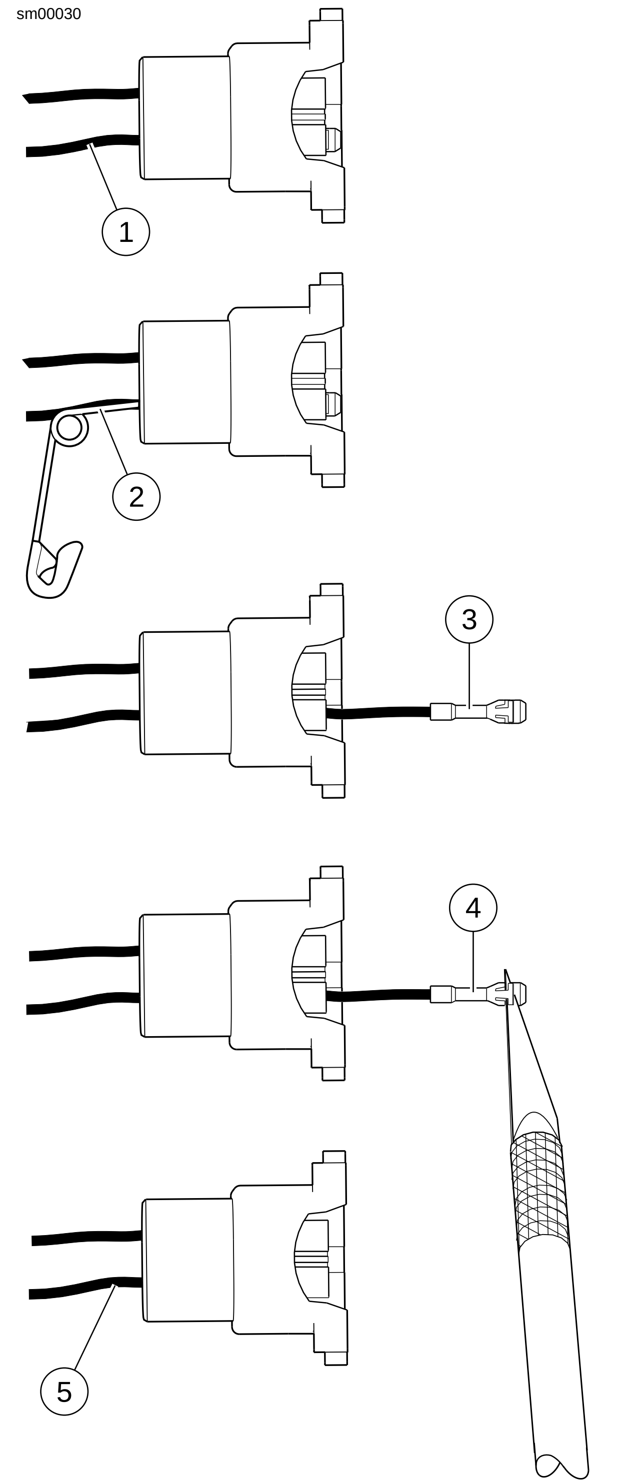
NOTE

A "click" is heard when the terminal is properly seated.

3. Push on lead to verify that terminal is locked in place.
4. Fit rubber wire seal back into wire end of connector.

Crimping Terminals

If necessary, crimp new terminals on the wire leads. Refer to A.15 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps.



1. Pry rubber seal from connector
2. Insert safety pin to depress tang
3. Push on lead to remove terminal
4. Raise tang with X-Acto knife
5. Pull on lead to draw terminal into chamber

Figure A-28. 280 Metri-Pack Connector: Remove/Install Socket Terminal

480 METRI-PACK CONNECTOR REPAIR

General

A 480 Metri-Pack (P.E.D.) connector is frequently used for the B+ (battery voltage) connector to power P&A accessories.

Referred to as Packard connectors, Metri-Pack connectors are embossed with the initials P.E.D.

Separating Pin and Socket Housings

NOTE

Cut any cable strap anchoring the wire conduits of the pin (accessory connector housing) and the socket (B+) housing.

See Figure A-29. Using small flat blade screwdriver, depress button (1) on pin housing (red wire) side of the connector and pull apart the pin and socket housings.

Mating Pin and Socket Housings

Orient the latch on the socket housing to the button catch on the pin housing and press the housings together.

Removing Socket Terminals

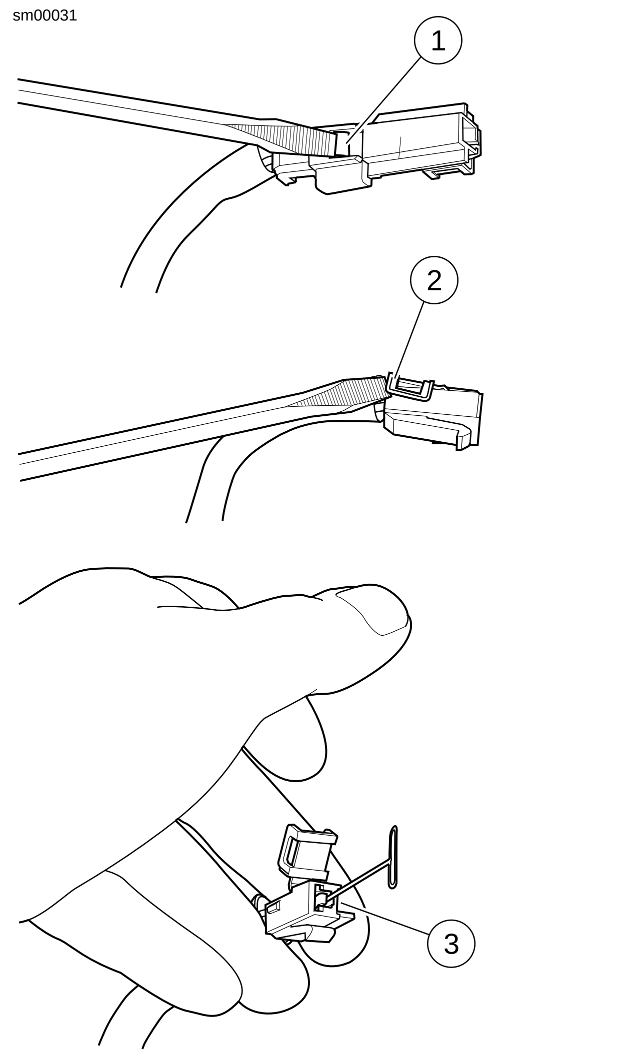
1. See Figure A-29. Bend back the latch (2) slightly and free one side of secondary lock, then repeat to release the opposite side. Rotate the secondary lock outward on hinge to access terminal in chamber of connector housing.
2. On the mating end of the connector, note the tang in the square shaped opening centered next to the terminal. Gently insert the point of a stick pin or large safety pin into the opening (3) between the tang and the chamber wall until it stops.
3. Pivot the end of the pin toward the terminal body to depress the tang.
4. Remove the pin and then pull terminal out of the wire end of connector housing.
5. If necessary, crimp **new** terminals on wires. See A.15 METRI-PACK TERMINALS.

Installing Socket Terminals

1. Carefully bend the tang outward away from the terminal body.
2. With the tang on the same side as the square shaped opening in the mating end of the connector housing, feed terminal into wire end of connector housing until it "clicks" in place.
3. Verify that terminal will not back out of the chamber. A slight tug on the cable will confirm that it is locked.
4. Rotate the hinged secondary lock inward until latches fully engage tabs on both sides of connector housing.

NOTE

If removed, install ***new*** *anchored cable strap in O.E. location. Tighten cable strap to capture conduit of both accessory connector and B+ connector approximately 1.0 in. (25.4 mm) from housings.*



1. **Button on pin housing**
2. **Secondary lock latch**
3. **Opening between tang and chamber wall**

Figure A-29. 480 Metri-Pack Connector: Remove Socket Terminal

630 METRI-PACK CONNECTOR REPAIR

PART NUMBER	TOOL NAME
TT600-3	SNAP-ON PICK

General

Referred to as Packard connectors, Metri-Pack 630 series connectors are embossed with the initials P.E.D.

Separating Pin and Socket Housings

NOTE

If necessary, remove connector from barbed anchor or other retaining device.

Bend back the external latch slightly and separate pin and socket halves of the connector.

Mating Pin and Socket Housings

Orient the latch to the catch and push the pin and socket halves of the connector together until the latch "clicks".

NOTE

If removed, install connector on barbed anchor or other OE retaining device.

Removing Socket Terminal

1. Bend back the latch slightly and free one side of the secondary lock. Repeat the step to unlatch the other side.
2. Rotate the secondary lock outward on hinge to view the terminals in the chambers of the connector housing. The locking tang is on the side opposite the crimp tails and engages a rib in the chamber wall to lock the terminal in place.
3. Moving to the mating end of the connector, take note of the small opening on the chamber wall side of each terminal.
4. Insert SNAP-ON PICK (Part No. TT600-3) into opening until it stops. Pivot the end of the pick toward the terminal to depress the locking tang.
5. Remove the pick and gently tug on the wire to pull the terminal from the wire end of the connector. Repeat steps if the terminal is still locked in place.
6. If necessary, crimp **new** terminals on wires. Refer to A.15 METRI-PACK TERMINALS.

Installing Socket Terminal

NOTE

Refer to the wiring diagrams to match wire lead colors to alpha characters molded into the secondary locks of each connector housing.

1. Using a thin flat blade, like that of a hobby knife, carefully bend the tang outward away from the terminal body.
2. With the tang facing the chamber wall, push the lead into the chamber at the wire end of the connector. A click is heard when the terminal is properly seated.
3. Gently tug on the wire end to verify that the terminal is locked in place and will not back out of the chamber.
4. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.

DELPHI MAXI-FUSE HOUSING REPAIR

General

A Delphi Maxi-fuse connector completes the circuit through the main fuse (Maxi-fuse).

Removing Maxi-Fuse

1. See Figure A-30. Depress latches on Maxi-fuse cover (1) and then slide cover off of connector (2).
2. Holding the connector (fuse holder), pull the Maxi-fuse out of the connector.

Installing Maxi-Fuse

1. Insert the blade terminals of the Maxi-fuse into the sockets of the connector and press the Maxi-fuse into the connector.
2. Slide the cover over the fuse until the cover clicks into place.

NOTE

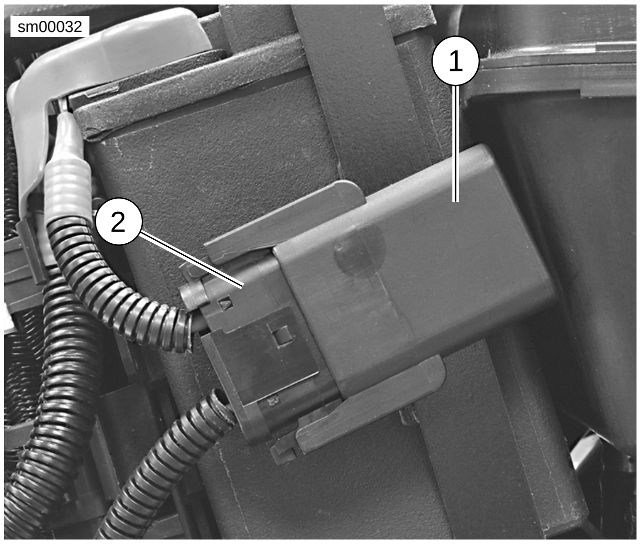
If removed from an OE attachment such as a grooved fuse block cover, engage cover and slide into place.

Removing Socket Terminals

1. See Figure A-31. Gently pull socket housing to disengage slots (1) on secondary lock (2) from tabs (3) on socket housing. Free secondary lock from cables and set aside.
2. Take note of the opening on one side of the socket terminal. Gently insert flat blade of pick (Snap-On TT600-5) or small screwdriver into opening (4) until it stops. Pivot the pick toward the terminal body and hold in position.
3. Tug on cable to pull socket from wire end of socket housing. A firm tug is necessary to overcome the resistance of the rubber seal.
4. Repeat to remove remaining socket terminal.

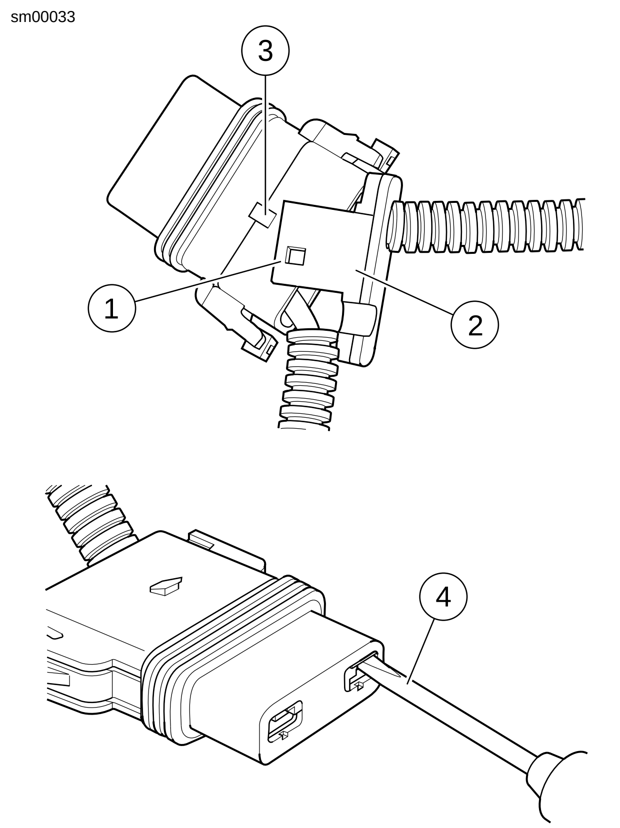
Installing Socket Terminals

1. See Figure A-32. Carefully bend tang outward away from the terminal body.
2. Feed socket into wire end of socket housing until it clicks in place. Verify that socket will not back out of chamber. A slight tug on the cable will confirm that it is locked.
3. Push rubber seal into wire end of socket housing.
4. Repeat to install remaining socket terminal.
5. Install secondary lock onto cables and then push onto wire end of socket housing until slots engage tabs on sides of socket housing.



1. **Maxi-fuse cover**
2. **Delphi Maxi-fuse housing**

Figure A-30. Delphi Connector Housing: Maxi-Fuse



1. **Secondary lock slot**
2. **Secondary lock**
3. **Tab**
4. **Insert flat blade into opening**

Figure A-31. Delphi Maxi-Fuse Housing: Remove Socket Terminals

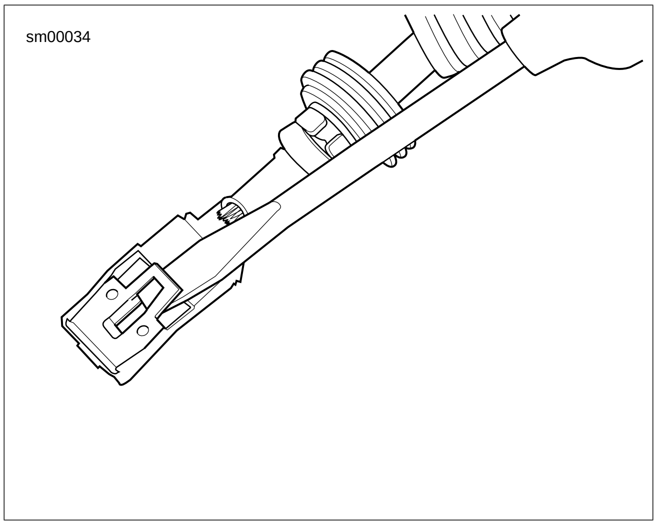


Figure A-32. Delphi Maxi-Fuse Housing: Bend Tang

METRI-PACK TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-6	PACKARD TERMINAL CRIMP TOOL
HD-38125-7	PACKARD TERMINAL CRIMPER
HD-38125-8	PACKARD CRIMPING TOOL

Matching Terminal To Crimper

Metri-Pack connectors embossed with the initials P.E.D. require Packard crimp tools to crimp terminals to wire leads.

Terminals are crimped twice to a wire lead, once over the wire core and a second time over the insulation/seal.

See Figure A-33. A completed crimp may require two different crimping dies found on PACKARD TERMINAL CRIMP TOOL (Part No. HD-38125-6) and/or PACKARD TERMINAL CRIMPER (Part No. HD-38125-7). The terminal (pin or socket) and the wire lead gauge will determine the core crimp die and the insulator/seal die.

NOTE

The PACKARD CRIMPING TOOL (Part No. HD-38125-8) will also crimp sealed splice connectors in wire gauge sizes 18-20, 14-16 and 10-12.

Preparing Wire Lead

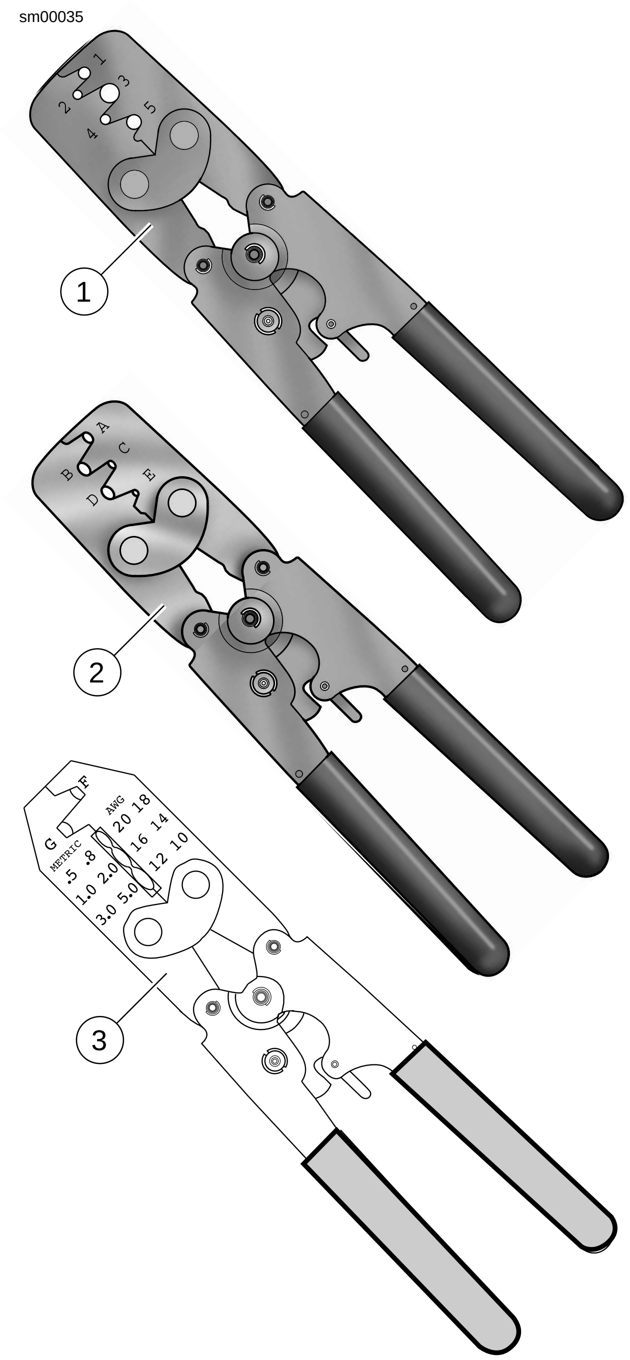
Use a wire striper to strip off the insulation and expose 5/32 in. (4.0 mm) of wire core.

Crimping Wire Core

NOTE

*Metri-Pack terminal crimps require two steps. Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. Squeeze and release handles until ratchet automatically opens.
2. Identify the corresponding sized nest for the core crimp.
3. Position the core crimp in the die. Be Sure the core crimp tails are facing the forming jaws.
4. Gently squeeze the handles until crimpers just secure the core crimp tails.
5. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze core wire strands, while long pair is positioned over the insulation or seal material.
6. Squeeze handles tightly closed. Release grip and the tool will automatically open.



1. **HD-38125-6 sealed terminals**
2. **HD-38125-7 non-sealed terminals**
3. **HD-38125-8 non-sealed terminals**

Figure A-33. Metri-Pack Terminal Crimp Tools

Crimping Insulation/Seal

NOTE

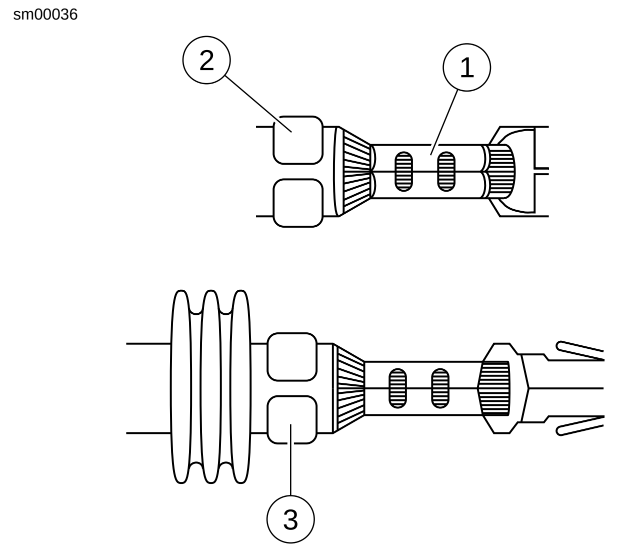
*Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. See Figure A-34. Identify the correct die for the insulation/seal crimp (2).

2. Position the insulation/seal crimp in the nest. Be sure the insulation/seal crimp tails are facing the forming jaws.
3. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimp is complete.

Inspecting Crimps

1. See Figure A-34. Inspect the wire core crimp (1). The tails should be folded in on the wire core without any distortion or excess wire strands.
2. Inspect the insulation (2) or seal (3) crimp. The tails of the terminal should be wrapped around the insulation without distortion.



1. **Wire core crimp**
2. **Insulation crimp**
3. **Seal crimp**

Figure A-34. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps

MOLEX CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER

Separating Pin and Socket Housings

See Figure A-35. Depress the latch while pulling the pin and socket housings apart.

Mating Pin and Socket Housings

1. Orient the latch on the pin housing to the latch pocket on the socket housing so the rails on the outside of the pin housings lines up with the tunnels on the socket housing.
2. Press the housings together until the latch clicks.

Removing Terminals

1. Pull the secondary lock up, approximately 3/16 in. (4.8 mm), until it stops.
    a. **Socket Housing:** See Figure A-36. Use a small screwdriver in the pry slot. The slot next to the external latch provides a pivot point.
    b. **Pin Housing:** See Figure A-37. Use needle nose pliers to engage the D-holes in the center of the secondary lock.

NOTE

Do not remove the secondary lock from the connector housing.

2. See Figure A-38. Insert MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER (Part No. HD-48114) into the pin hole next to the terminal until the tool bottoms.
    a. **Socket Housing:** The pin holes are inside the terminal openings.
    b. **Pin Housing:** The pin holes are outside the pins.
3. Pressing the terminal remover to the bottom of the pin hole, gently pull on the wire to remove wire terminal from its cavity.

Installing Terminals

1. See Figure A-39. From the wiring diagram, match the wire color to its numbered terminal cavity.

NOTE

Cavity numbers (1) are stamped on the housing at the ends of the cavity rows. The cavity number can be determined by counting the cavities up or down along the row from each stamped number.

2. Orient the terminal so that the tang (2) opposite the open crimp engages the slot (3) in the cavity.
3. Push the terminal into the cavity.
4. Gently tug on wire to verify that the terminal is captured by the secondary lock.
5. With all terminals installed, push the secondary lock into the socket housing to lock the wire terminals into the housing.

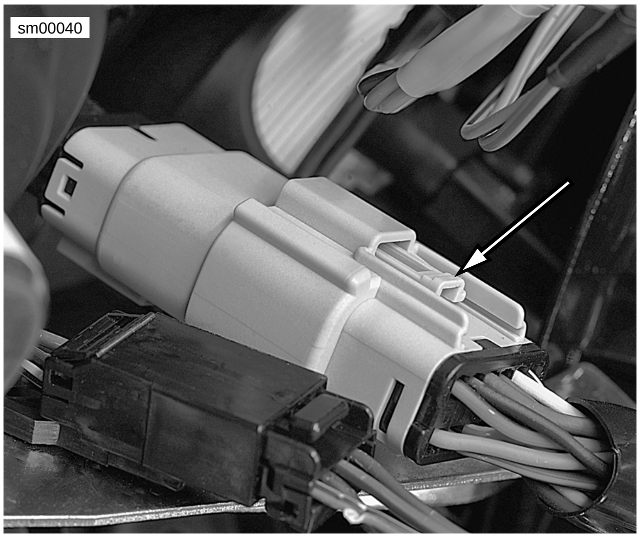


Figure A-35. Molex Connector: Latch

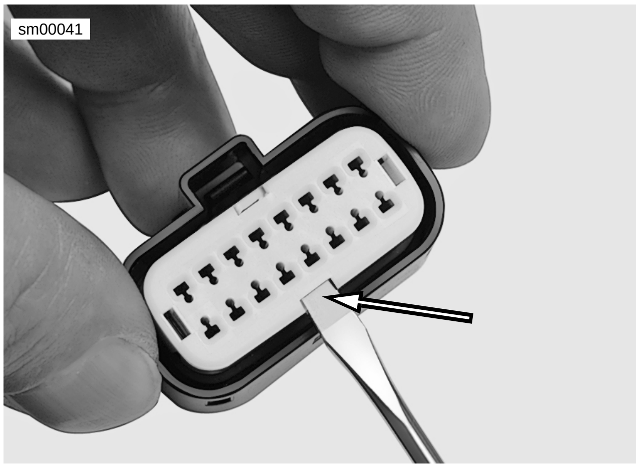


Figure A-36. Molex Connector: Secondary Lock Pry Slot (Socket Housing)

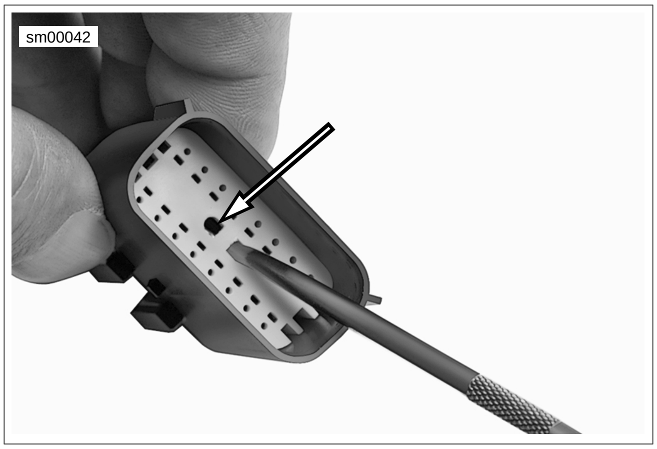


Figure A-37. Molex Connector: Secondary Lock D-Holes (Pin Housing)

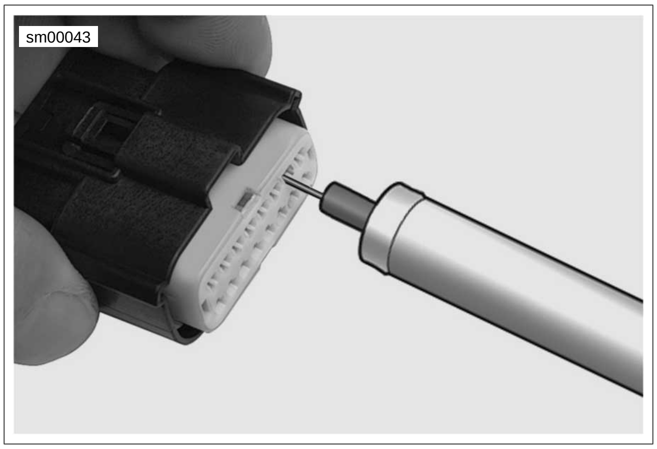
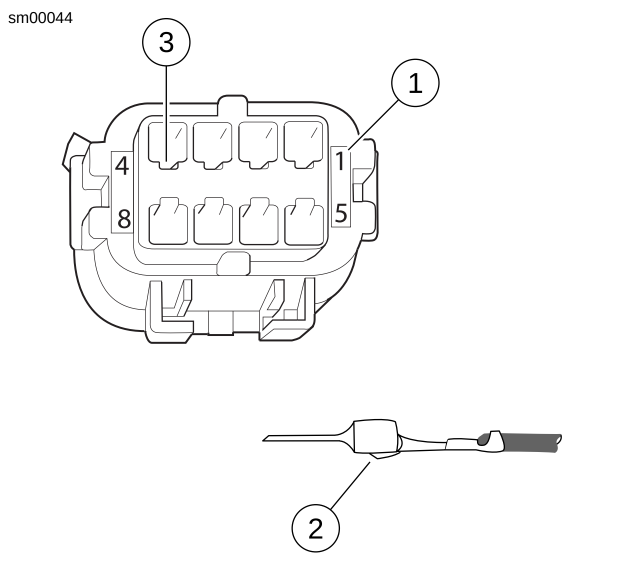


Figure A-38. Molex Connector: Terminal Remover (HD-48114)



1. Cavity number
2. Tang
3. Cavity slot

Figure A-39. Molex Connector: Pin Cavities and Wire Terminal

PACKARD 100W CONNECTOR REPAIR

General

A Packard 100W connector connects the the electronic control module (ECM) to the main harness.

NOTE

For vehicles with 73-pin connectors, see A.18 PACKARD MICRO-64 CONNECTORS and A.15 METRI-PACK TERMINALS.

Separating Socket Housing From ECM

See Figure A-40. While pressing the connector into the ECM, press the thumb lever (1) against the connector until the latch (2) pops out of the catch (3) on the ECM.

Mating Socket Housing To ECM

Push the connector into the ECM until the latch is captured by the catch on the ECM.

Removing Socket Terminal

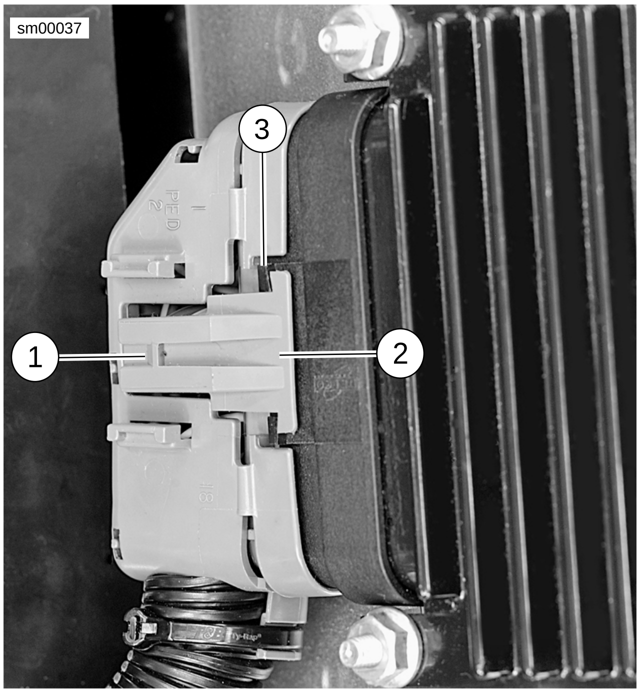
1. See Figure A-41. Gently depress latch (1) on each side of the clear plastic secondary lock (2) and remove. For best results, release one side at a time.
2. Carefully cut cable strap (3) to free strain relief collar (4) from conduit (5).
3. See Figure A-42. Using a thin blade, gently pry at seam at back of socket housing to release three plastic pins (1) from slots in housing. Separate and spread halves of socket housing.
4. Push on wire lead to free terminal from chamber.

Installing Socket Terminal

1. From inside socket housing, gently pull on wire to draw terminal into chamber.
2. Exercising caution to avoid pinching wires, press halves of socket housing together until three plastic pins fully engage slots in housing.
3. Install **new** cable strap in groove of strain relief collar capturing cable conduit.
4. With the two ribs on the secondary lock on the same side as the external latch, install over terminals until latches lock in place.

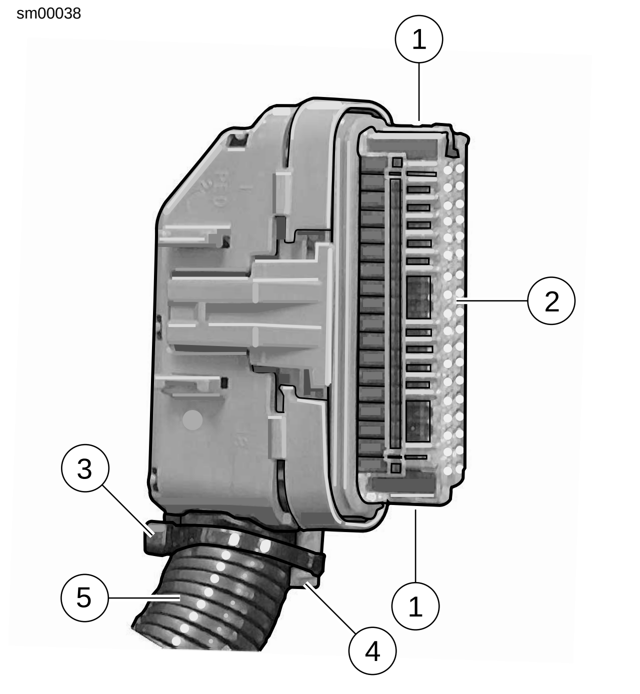
Crimping Terminals

If necessary, crimp new terminals on wire leads. See A.15 METRI-PACK TERMINALS.



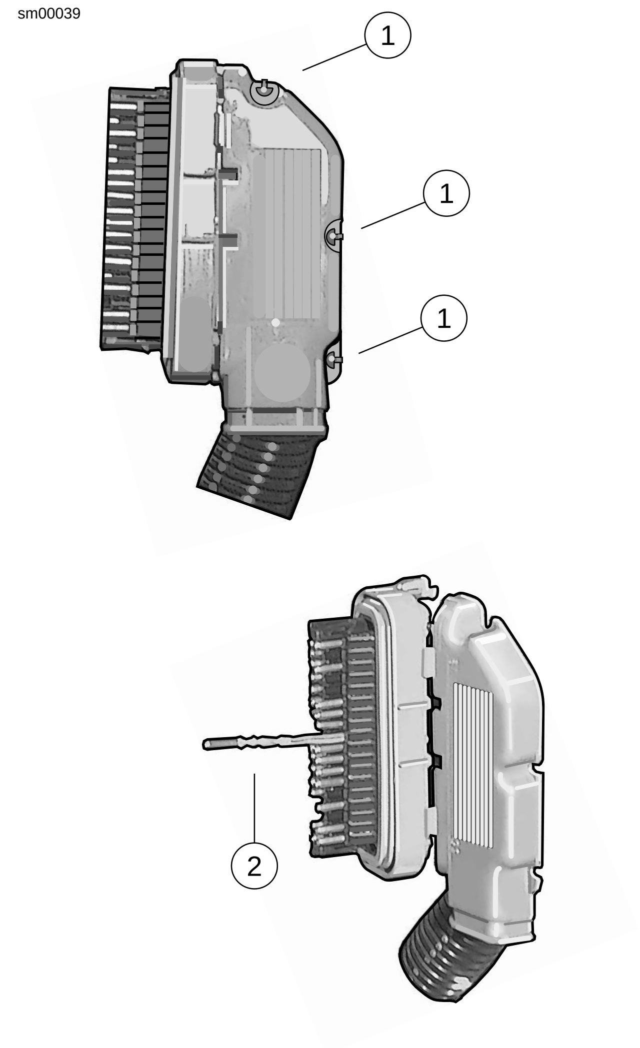
1. **Thumb lever**
2. **Latch**
3. **Catch (ECM)**

Figure A-40. Packard 100W to ECM (Typical)



1. **Latch**
2. **Secondary lock**
3. **Cable strap**
4. **Strain relief collar**
5. **Conduit**

Figure A-41. Packard 100W Connector



1. **Pins**
2. **Socket terminal**

Figure A-42. Packard 100W Connector: Separate Halves of Socket Housing

PACKARD MICRO-64 CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-45928	PACKARD MICRO-64 TERMINAL REMOVER
HD-45929	PACKARD MICRO-64 TERMINAL CRIMPER

General

Packard Micro-64 connectors are frequently found on speedometers, tachometers and the ECM of Touring Models. For pin 73 of these ECMs, see A.10 150 METRI-PACK CONNECTORS.

Separating Pin and Socket Housings

Bend back the external latches slightly and separate the pin and socket housings.

Mating Pin and Socket Housings

Orient the wire lead colors and push the pin and socket housings of the connector together until the latches click.

Removing Terminal

1. See Figure A-45. Locate the head of the secondary lock (1) on one side of the connector housing.
2. Insert the blade of a small screwdriver between the center ear of the lock and the connector housing and gently pry out lock. When partially removed, pull lock from connector housing.
3. Locate pin hole (2) between terminals on mating end of connector.
4. See Figure A-46. Obtain the PACKARD MICRO-64 TERMINAL REMOVER (Part No. HD-45928).
5. See Figure A-44. Push the adjacent terminals all the way into the connector housing and then insert tool into hole until it bottoms.
6. Leaving the tool installed, gently tug on wires to pull either one or both terminals from wire end of connector. Remove tool.

Figure A-43. Packard Micro 64 Terminal Remover (HD-45928)

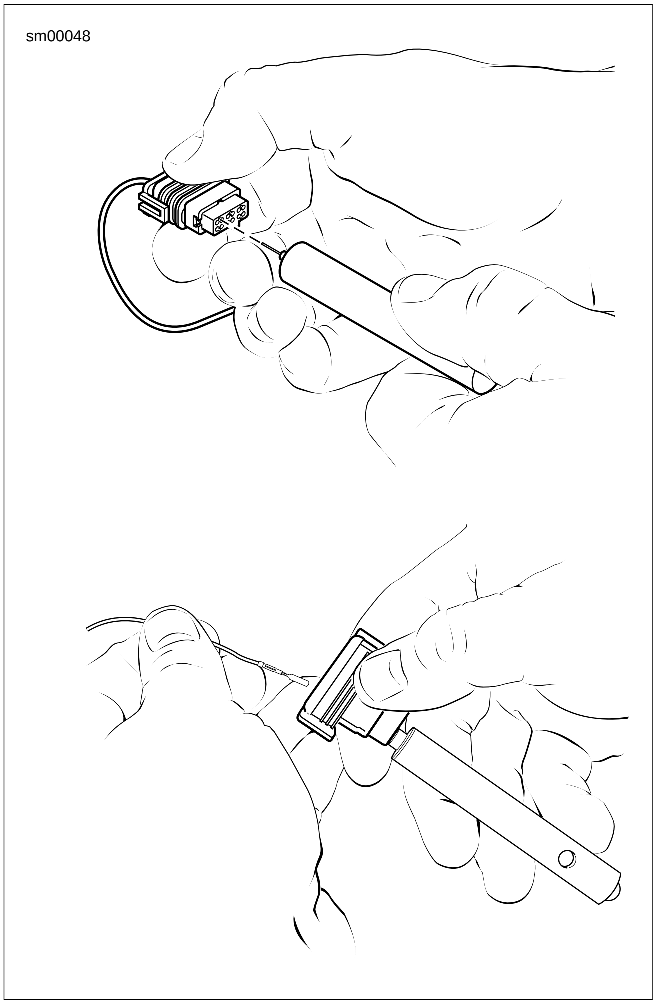


Figure A-44. Packard Micro 64 Connector: Insert Tool and Remove Terminal

Installing Terminal

1. Insert terminal into its respective numbered chamber on wire end of connector. No special orientation of the terminal is necessary.

NOTE

See Figure A-45. For wire location purposes, the corners of the socket housing are stamped (3) with the numbers 1, 6, 7 and 12, representing terminals 1-6 on one side, and 7-12 on the other.

2. Bottom the terminal in the chamber and then gently tug on the wire to verify that it is locked in place.

NOTE

Once the terminal is removed it may not lock in place when first reinstalled. Until the lock engages, move the terminal back and forth slightly while wiggling the lead.

3. Since the terminal remover tool releases two terminals simultaneously, repeat step 2 on the adjacent terminal even if it was not pulled from the connector housing.

4. With the center ear on the head of the secondary lockpin facing the mating end of the connector, push secondary lock in until head is flush with the connector housing.

Preparing Wire Leads for Crimping

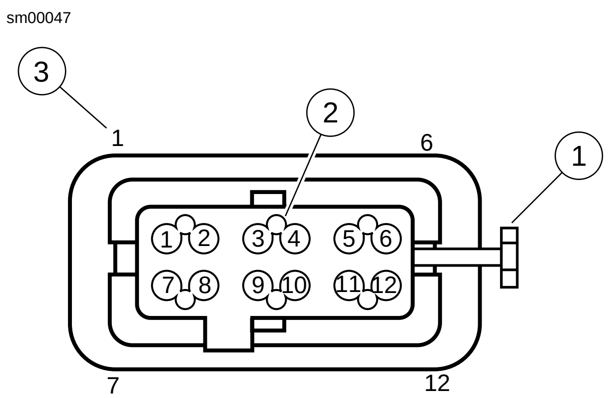
Strip lead removing 1/8 in. (3.0 mm) of insulation.

Crimping Terminals

1. Inspect **new** socket terminal for bent or deformed contact and crimp tails. Replace as necessary.
2. See Figure A-47. Squeeze the handles of the PACKARD MICRO-64 TERMINAL CRIMPER (Part No. HD-45929) to cycle the tool to the fully open position (1).
3. Raise locking bar and barrel holder by pushing up on bottom tab with index finger (2).
4. With the crimp tails facing upward, insert terminal through locking bar into front hole in barrel holder (20-22 gauge wire) (3).
5. Release locking bar to lock position of contact. When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails and the closed side of the terminal rests on the outer nest of the crimp tool.
6. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that wide pair of crimp tails squeeze bare wire strands, while the narrow pair folds over the insulation material.
7. Squeeze handle of crimp tool until tightly closed (4). Tool automatically opens when the crimping sequence is complete.
8. Raise locking bar and barrel holder to remove contact.

Inspecting Crimps

Inspect the quality of the core and insulation crimps. Distortion should be minimal.



1. **Secondary lock**
2. **Pin hole**
3. **Stamped number**

Figure A-45. Packard Micro 64 Connector: Housing

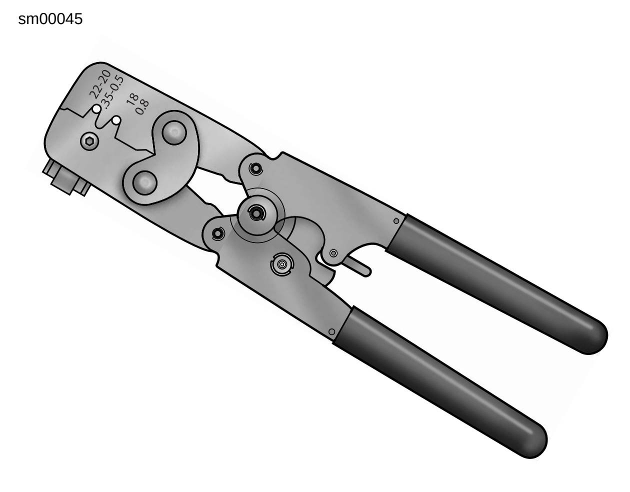
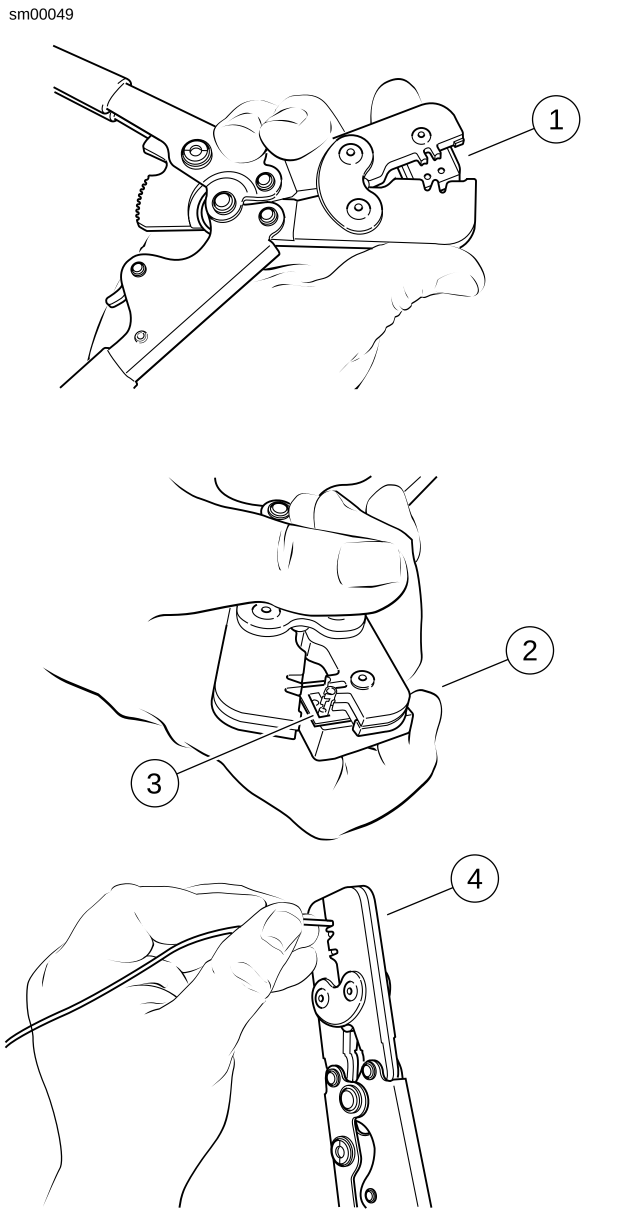


Figure A-46. Packard Micro 64 Terminal Crimper (HD-45929)



1. **Open position**
2. **Raising locking bar**
3. **Insert terminal**
4. **Crimp terminal**

Figure A-47. Packard Micro 64 Connector: Terminal in Crimper

SEALED SPLICE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-38125-8	PACKARD CRIMPING TOOL
HD-39969	ULTRA-TORCH UT-100
HD-41183	HEAT SHIELD ATTACHMENT

General

Splice connectors and several OE ring terminal connectors use heat shrink covering to seal the connection.

Preparing Wire Leads

NOTE

If adjacent wires are to be spliced, stagger the splices so that the sealed splice connectors will not touch each other but are located at different positions along the length of the wires.

1. Using a shop gauge, identify the gauge of the wire.
2. Match the wire gauge to a sealed splice connector by color and part number. Refer to Table A-4.
3. Using a wire stripper, cut and strip a length of insulation off the wire ends. Refer to Table A-4 for the strip length.

Table A-4. Sealed Splice Connectors

WIRE GAUGE	CONNECTOR COLOR	CONNECTOR PART NO.	STRIP LENGTH
18-20 (0.5-0.8 mm)	Red	70585-93	3/8 in. (9.5 mm)
14-16 (1.0-2.0 mm)	Blue	70586-93	3/8 in. (9.5 mm)
10-12 (3.0-5.0 mm)	Yellow	70587-93	3/8 in. (9.5 mm)

NOTE

If any copper wire strands are cut off of the wire core, trim the end and strip the wire again in a larger gauge stripper.

Splicing Wire Leads

NOTE

See Figure A-49. The connector is crimped twice - one side and then the other.

1. See Figure A-48. Open the PACKARD CRIMPING TOOL (Part No. HD-38125-8) ratchet by squeezing the handles closed.
2. Match the connector color to the wire gauge crimp die in the jaws and insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure A-49. Feed the stripped end of a wire into the connector until the wire stops inside the metal insert (1).
5. Squeeze the handles tightly closed to crimp the lead in the insert (2). The tool automatically opens when the crimping is complete.
6. Slide the connector to the other half of the metal insert. Insert the stripped wire lead (1) until it stops, and crimp the lead in the insert (2).

⚠WARNING

Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

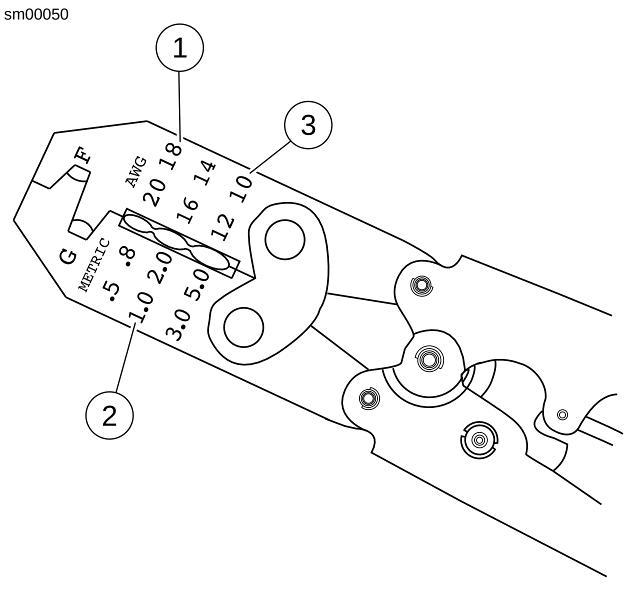
7. Use an ULTRA-TORCH UT-100 (Part No. HD-39969), or a ROBINAIR HEAT GUN (Part No. HD-25070) with a HEAT SHIELD ATTACHMENT (Part No. HD-41183), to heat the connector from the center of the crimp (3) out to each end.

NOTE

It is acceptable for the splice to rest against the heat shrink tool attachment.

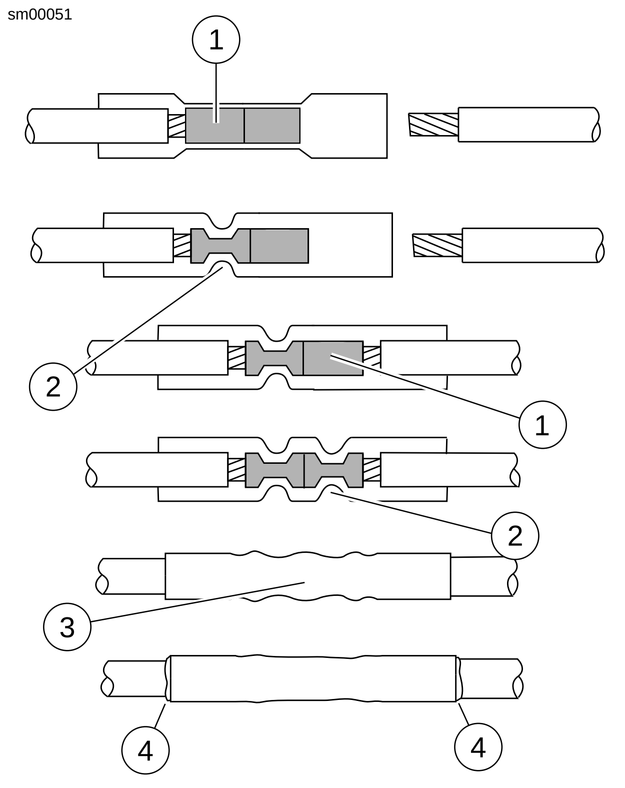
Inspecting Seals

See Figure A-49. Allow the splice to cool and inspect the seal. The insulation should appear smooth and cylindrical. Melted sealant will have extruded out the ends (4) of the insulation.



1. **Red connector die**
2. **Blue connector die**
3. **Yellow connector die**

Figure A-48. Packard Crimping Tool (HD-38125-8)



1. **Wire lead in metal insert**
2. **Crimp metal insert**
3. **Center of crimp**
4. **Melted sealant**

Figure A-49. Sealed Splice Connector

SUBJECT **PAGE NO.**

NOTES

CONNECTOR LOCATIONS

Function/Location

Refer to Table B-1. On the motorcycle, a connector can be identified by its function and location.

Place and Color

The place (number of wire cavities of a connector housing) and color of the connector can also aid identification.

Connector Number

On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets.

Repair Instructions

The repair instructions in this Service Manual are by connector type. Refer to Table B-1.

Table B-1. Softail Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[5]	MAXIFUSE	Spade terminals	Under seat
[7]	Tail lamp harness to main harness	8-place Multilock 12-place Molex (FXCWC)	Under seat
[18]	Right rear turn signal	2-place Multilock	Inside tail lamp lens
[19]	Left rear turn signal	2-place Multilock	Inside tail lamp lens
[20]	Console harness	12-place Molex	Under console
[21]	Indicator lamps (except FXCWC)	8-place Mini-Deutsch	Under fuel tank console
[22]	Right hand controls	6-place Molex	Under fuel tank, right side
[24]	Left hand controls and horn	8-place Molex	Under fuel tank, left side
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[31]	Front turn signals	6-place Multilock	Inside top frame tube
[32]	Front fender tip lamp	2-place Multilock	Under fuel tank, left side
[33]	Ignition switch	3-place Packard 4-place Packard (FXCWC)	Under fuel tank console
[38]	Headlamp	4-place Multilock	Under fuel tank, left side
[39]	Speedometer	12-place Packard	Back of speedometer
[40]	Tail lamp power in	6-place Multilock	Inside tail lamp lens
[45]	Rear fender tip lamp	3-place Multilock	Inside tail lamp lens
[47]	Voltage regulator to stator	3-place Packard	Back of voltage regulator
[62]	Fuse block (start relay, system relay)	Spade terminals	Under seat
[64]	Fuse block	Spade terminals	Under seat
[65]	Vehicle Speed Sensor (VSS)	3-place Delphi	Top of transmission case
[73]	Passing lamps	2-place Multilock	Behind headlamp
[77]	Voltage regulator	2-place Deutsch	Back of voltage regulator
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat
[79]	Crankshaft Position (CKP) sensor	2-place Mini-Deutsch	Back of voltage regulator bracket
[80]	Manifold Absolute Pressure (MAP) sensor	3-place Packard	Top of manifold
[83]	Ignition coil	4-place Delphi	Back of coil
[84]	Front injector	2-place Delphi	Beneath fuel tank
[85]	Rear injector	2-place Delphi	Beneath fuel tank
[87]	Idle Air Control (IAC)	4-place Delphi	Beneath fuel tank
[88]	Throttle Position (TP) sensor	3-place Delphi	Behind air cleaner backing plate
[89]	Intake Air Temperature (IAT) sensor	2-place Delphi	Behind air cleaner backing plate
[90]	Engine Temperature (ET) sensor	2-place Delphi	Back of front cylinder, left side
[91]	Data link connector	4-place Deutsch	Under seat
[93]	Tail lamp	4-place Multilock	Inside tail lamp lens

Table B-1. Softail Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[109]	Passing lamp switch	Spade terminals	Behind headlamp
[117]	Fuel gauge	4-place Multilock	Left front side of fuel tank
[121]	Rear stop lamp switch	Spade terminals	Behind transmission
[122]	Horn	Spade terminals	Between cylinders, left side
[128]	Starter solenoid	Spade terminals	Top of starter
[131]	Neutral switch	Post terminals	Top of transmission
[133]	Jiffy stand sensor	3-place Molex	Back of voltage regulator bracket
[137]	Rear oxygen sensor	2-place Amp	Under oil tank
[138]	Front oxygen sensor	2-place Amp	Behind voltage regulator
[139]	Oil pressure switch	Post terminals	Front right crankcase
[141]	Fuel pump and sender	4-place Packard	Top of fuel tank
[142]	Security siren (optional)	3-place Delphi	Electrical panel behind fender extension
[143]	Front fender tip lamp	2-place Multilock	Under front fender tip lamp bracket
[154]	Trip odometer reset switch	-	Under fuel tank console
[157]	Indicator lamps (FXCWC)	8-place Mini-Deutsch	Under fuel tank console
[160]	B+ connector	1-place Packard	Under seat
[178]	Active intake solenoid	2-place Amp	Air cleaner backing plate
[179]	Active exhaust	5-place Amp	Exhaust bracket
[208]	Hands-Free Security Module (HFSM) antenna harness	4-place Deutsch	Electrical panel behind fender extension
[209]	Hands-Free Security Module (HFSM) antenna	2-place Molex	Under seat
[GND1] [GND2]	Harness grounds (2)	Ring terminals	Under seat

WIRING DIAGRAM INFORMATION

Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table B-2.

For Solid Color Wires: See Figure B-1. The alpha code identifies wire color (3).

For Striped Wires: The code is written with a slash (/) between the solid color code and the stripe code (4). For example, a trace labeled GN / Y is a green wire with a yellow stripe.

Wiring Diagram Symbols

See Figure B-1. On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets (1). The letter (2) inside the brackets identifies whether the housing is a socket or pin housing.

A=Pin: The letter A after a connector number and the pin symbol (6) identifies a pin housing.

B=Socket: The letter B after a connector number and the socket symbol (5) identifies a socket housing.

Other symbols found on the wiring diagrams include the symbol for a diode (7), a symbol for a wire-to-wire connection (8), a symbol that verifies that no connection (9) between two wire traces exists and a symbol identifying two wires that are twisted together (10).

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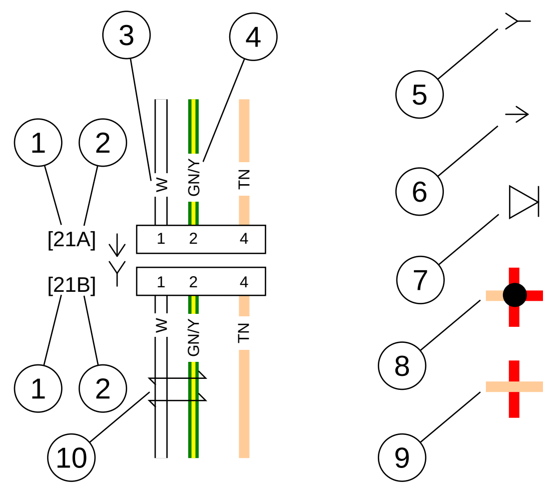


1. **Connector number**
2. **Terminal code (A=pin, B=socket)**
3. **Solid wire color**
4. **Striped wire color**
5. **Socket symbol**
6. **Pin symbol**
7. **Diode**
8. **Connection**
9. **No connection**
10. **Twisted pair**

Figure B-1. Connector/Wiring Diagram Symbols (typical)

Table B-2. Wire Color Codes

ALPHA CODE	WIRE COLOR
BE	Blue
BK	Black
BN	Brown
GN	Green
GY	Grey
LGN	Light Green
O	Orange
PK	Pink
R	Red
TN	Tan
V	Violet
W	White
Y	Yellow

Refer to the table below for wiring diagram information.

Wiring Diagram List

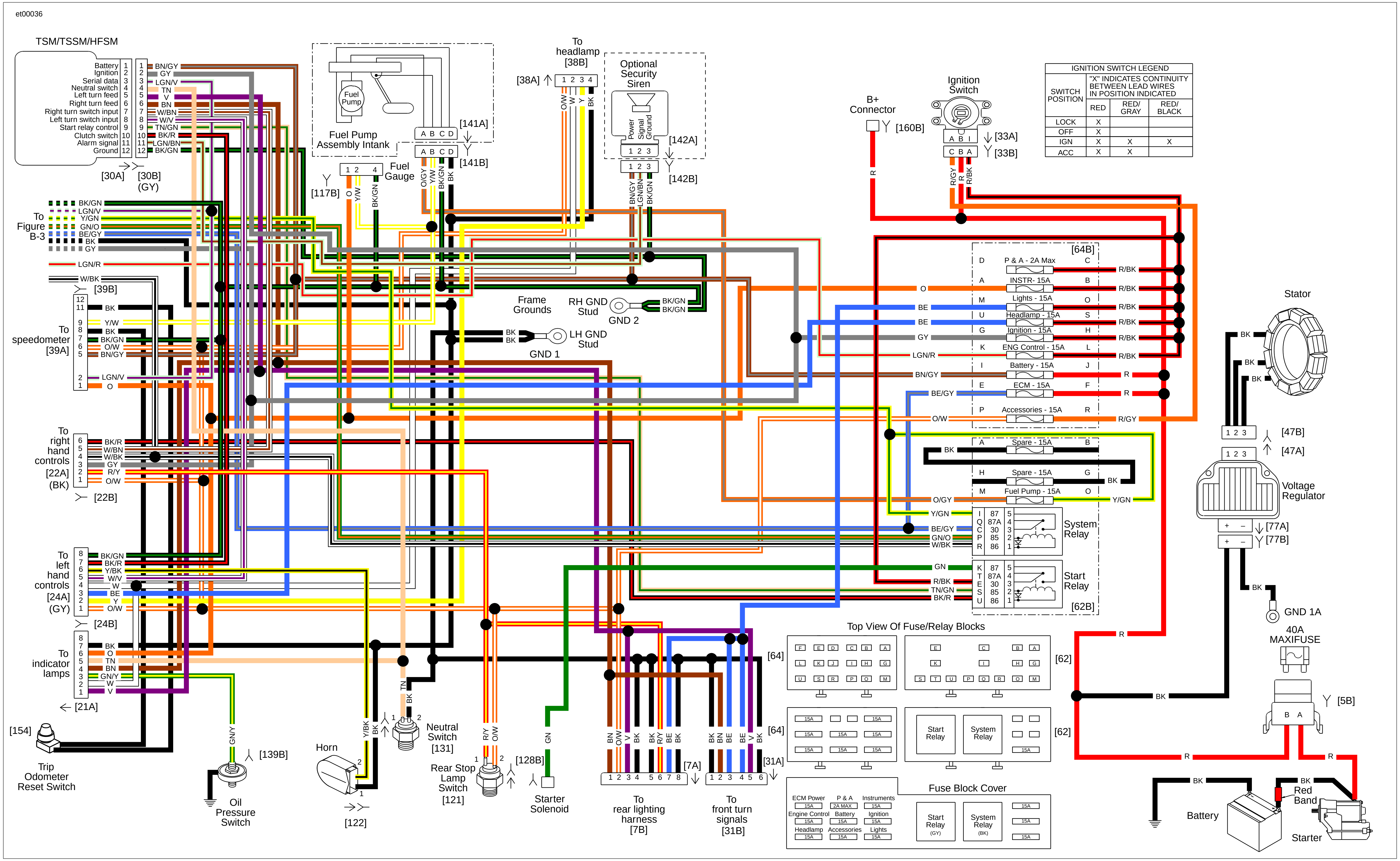


Figure B-2. 2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), MAIN HARNESS

Figure B-2.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), MAIN HARNESS

Figure B-2.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), MAIN HARNESS

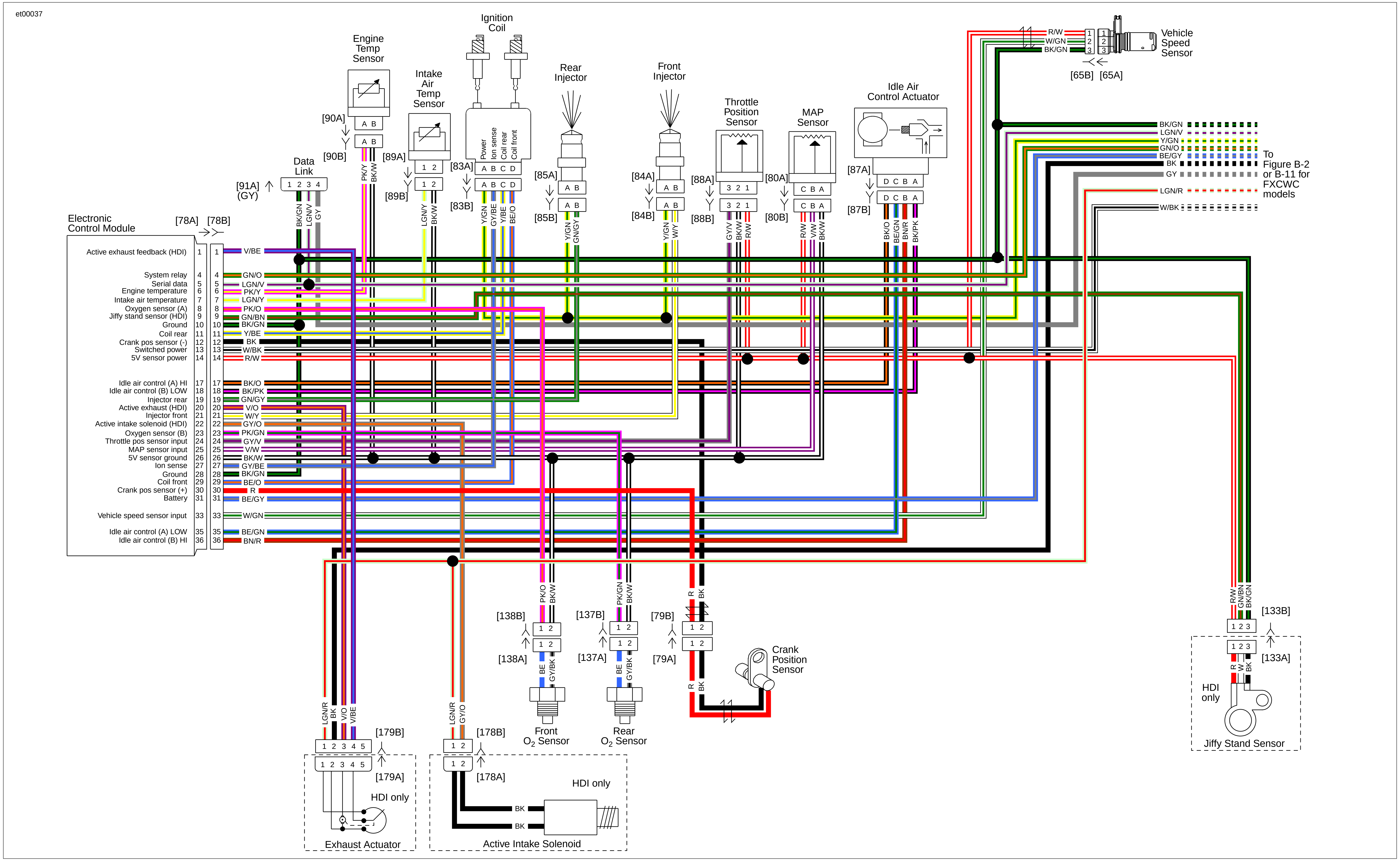


Figure B-3. 2008 ALL SOFTAIL DOM. and INT. MODELS (INCLUDING FXCWC), MAIN HARNESS

Figure B-3.
2008 ALL SOFTAIL DOM. and INT. MODELS (INCLUDING FXCWC), MAIN HARNESS

Figure B-3.
2008 ALL SOFTAIL DOM. and INT. MODELS (INCLUDING FXCWC), MAIN HARNESS

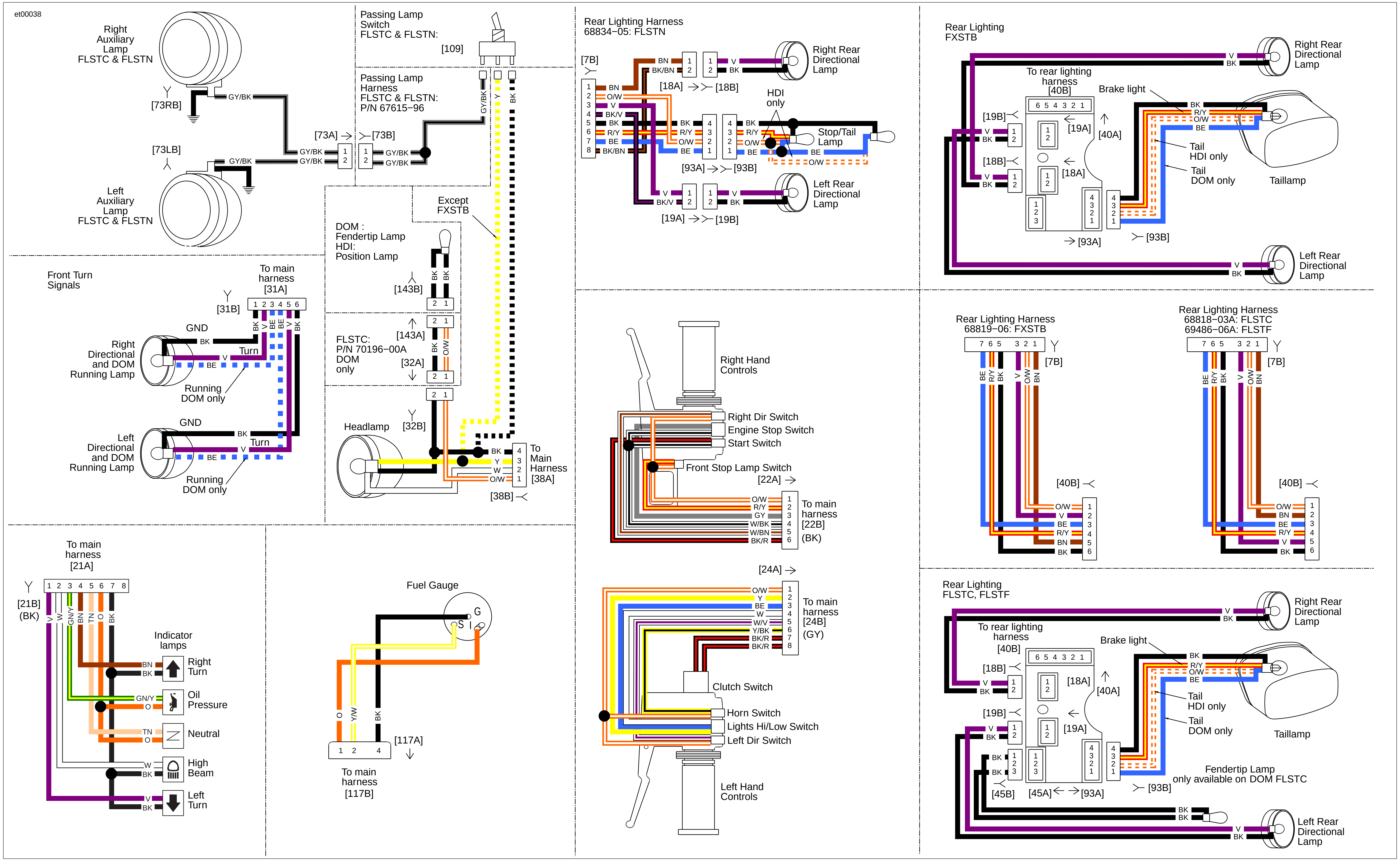


Figure B-4. 2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC) HANDLEBAR SWITCHES, INDICATORS AND LIGHTING)

Figure B-4.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC)
HANDLEBAR SWITCHES, INDICATORS AND LIGHTING)

Figure B-4.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC)
HANDLEBAR SWITCHES, INDICATORS AND LIGHTING)

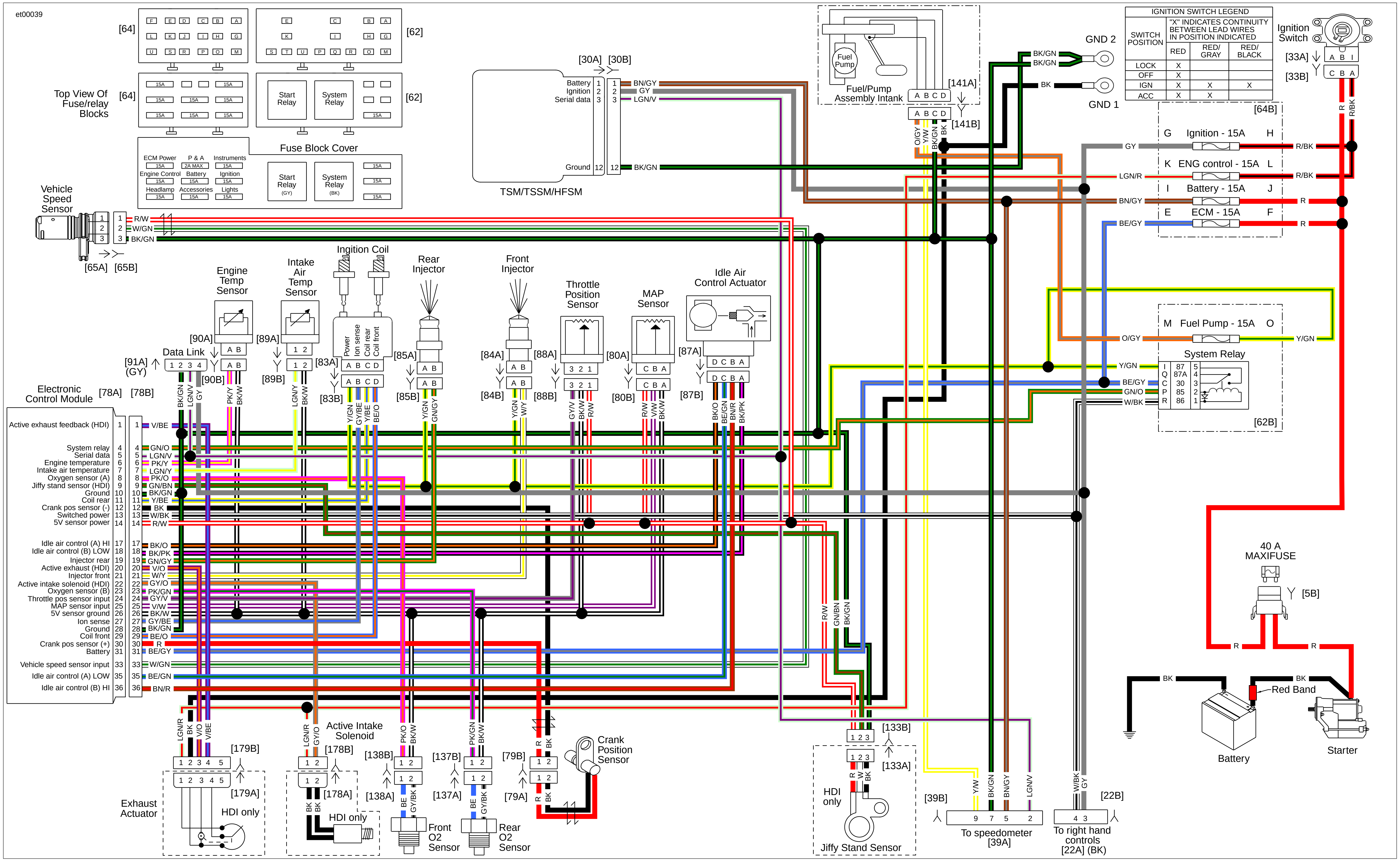


Figure B-5. 2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), IGNITION CIRCUIT

Figure B-5.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), IGNITION CIRCUIT

Figure B-5.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), IGNITION CIRCUIT

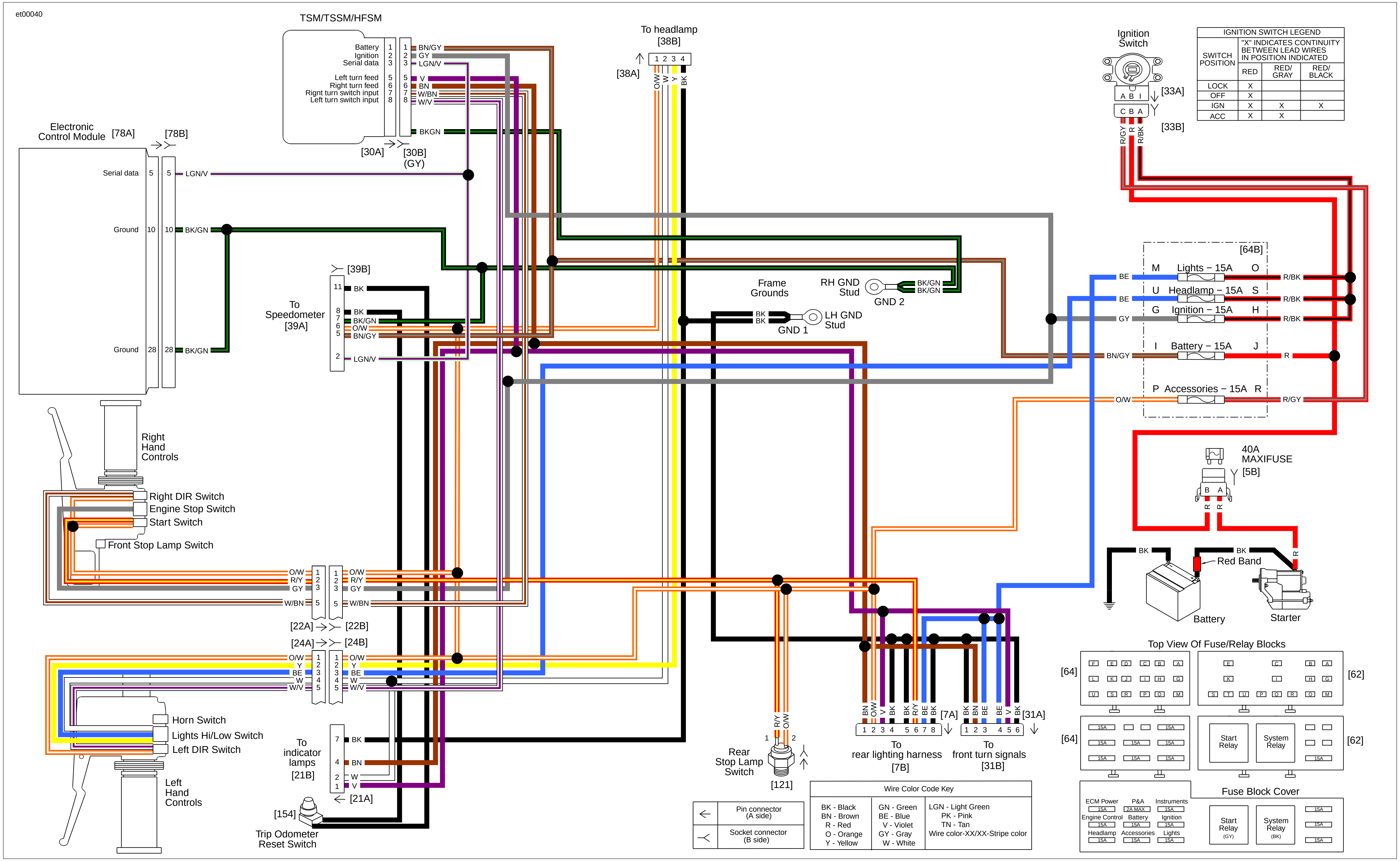


Figure B-6. 2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), LIGHTING CIRCUIT

Figure B-6.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), LIGHTING CIRCUIT

Figure B-6.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), LIGHTING CIRCUIT

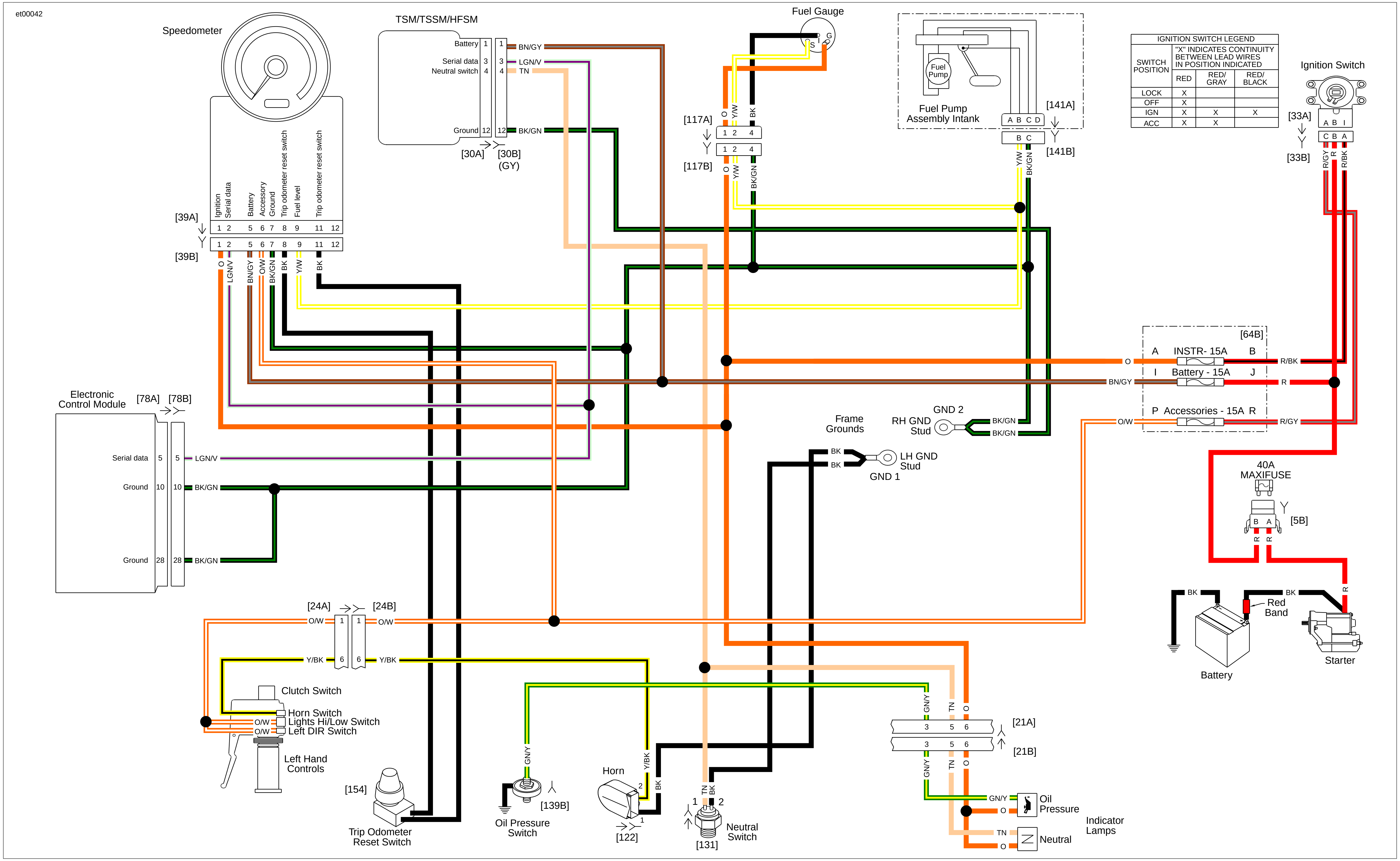


Figure B-7. 2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), HORN & INSTRUMENTS

Figure B-7.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), HORN & INSTRUMENTS

Figure B-7.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), HORN & INSTRUMENTS

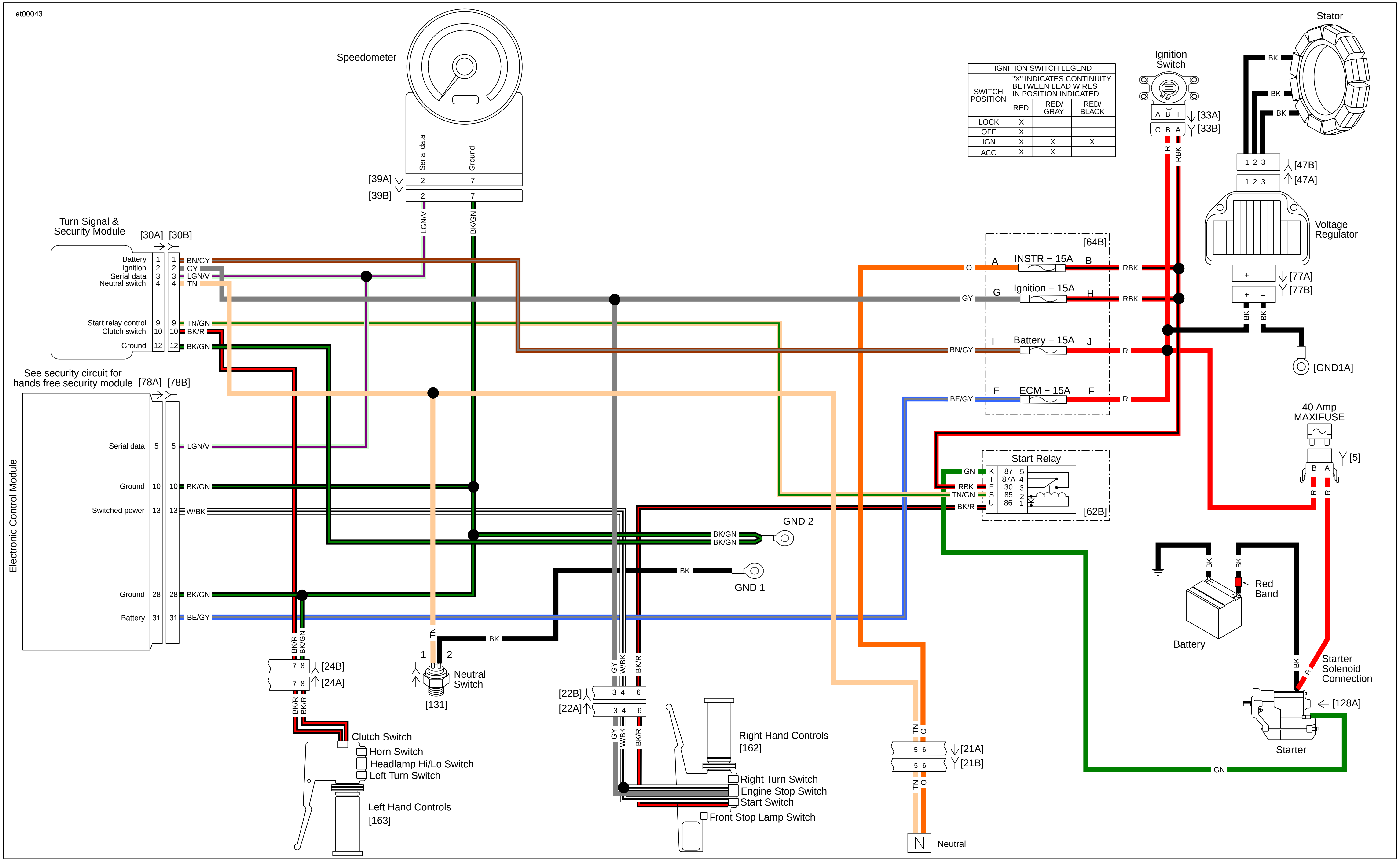


Figure B-8. 2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), STARTING AND CHARGING CIRCUITS

Figure B-8.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), STARTING AND CHARGING CIRCUITS

Figure B-8.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), STARTING AND CHARGING CIRCUITS

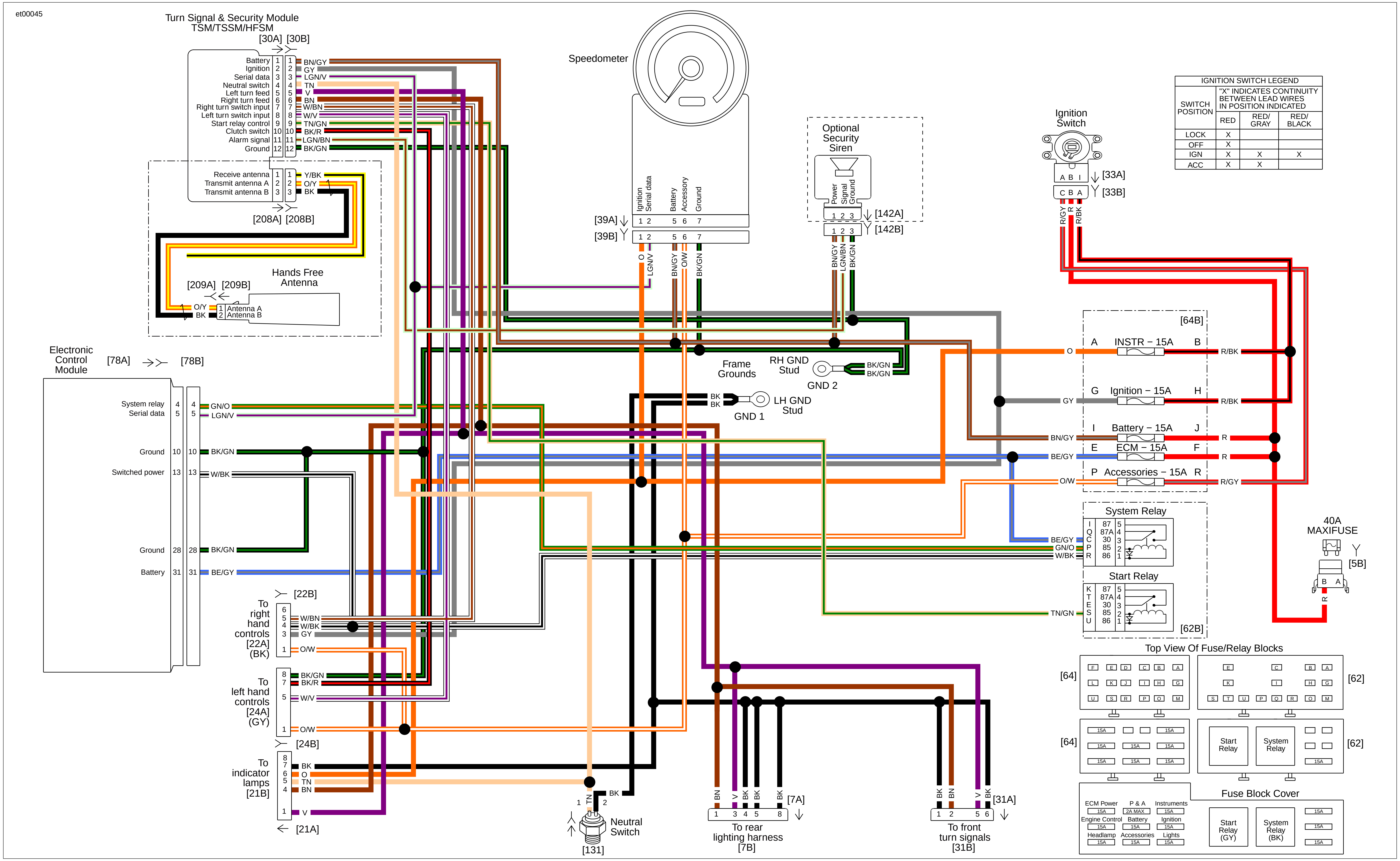


Figure B-9. 2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), SECURITY CIRCUIT: 1 OF 2

Figure B-9.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), SECURITY CIRCUIT: 1 OF 2

Figure B-9.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), SECURITY CIRCUIT: 1 OF 2

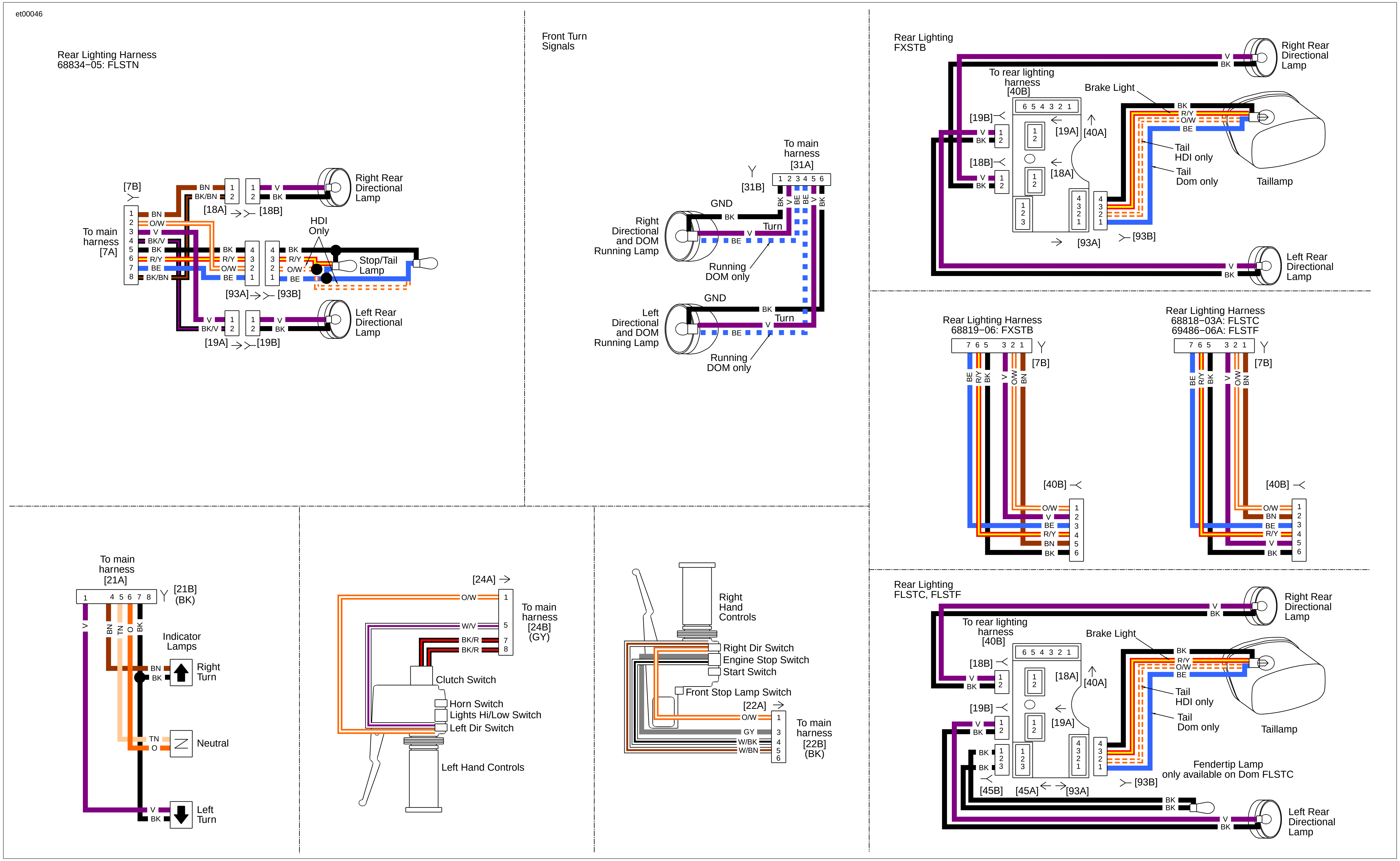


Figure B-10. 2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), SECURITY CIRCUIT: 2 OF 2

Figure B-10.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), SECURITY CIRCUIT: 2 OF 2

Figure B-10.
2008 ALL SOFTAIL DOM. and INT. MODELS (EXCEPT FXCWC), SECURITY CIRCUIT: 2 OF 2

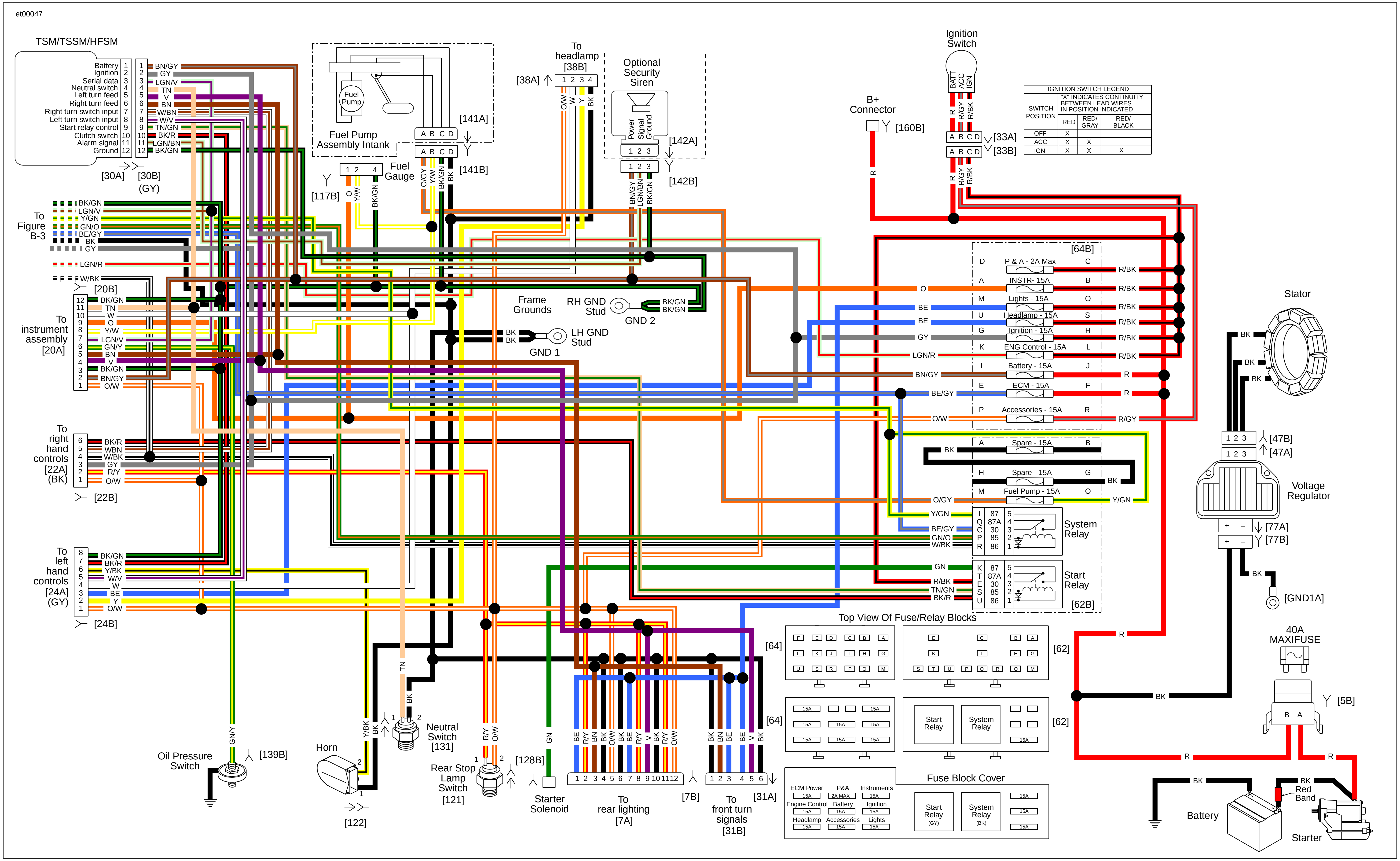


Figure B-11. 2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, MAIN HARNESS

Figure B-11.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, MAIN HARNESS

Figure B-11.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, MAIN HARNESS

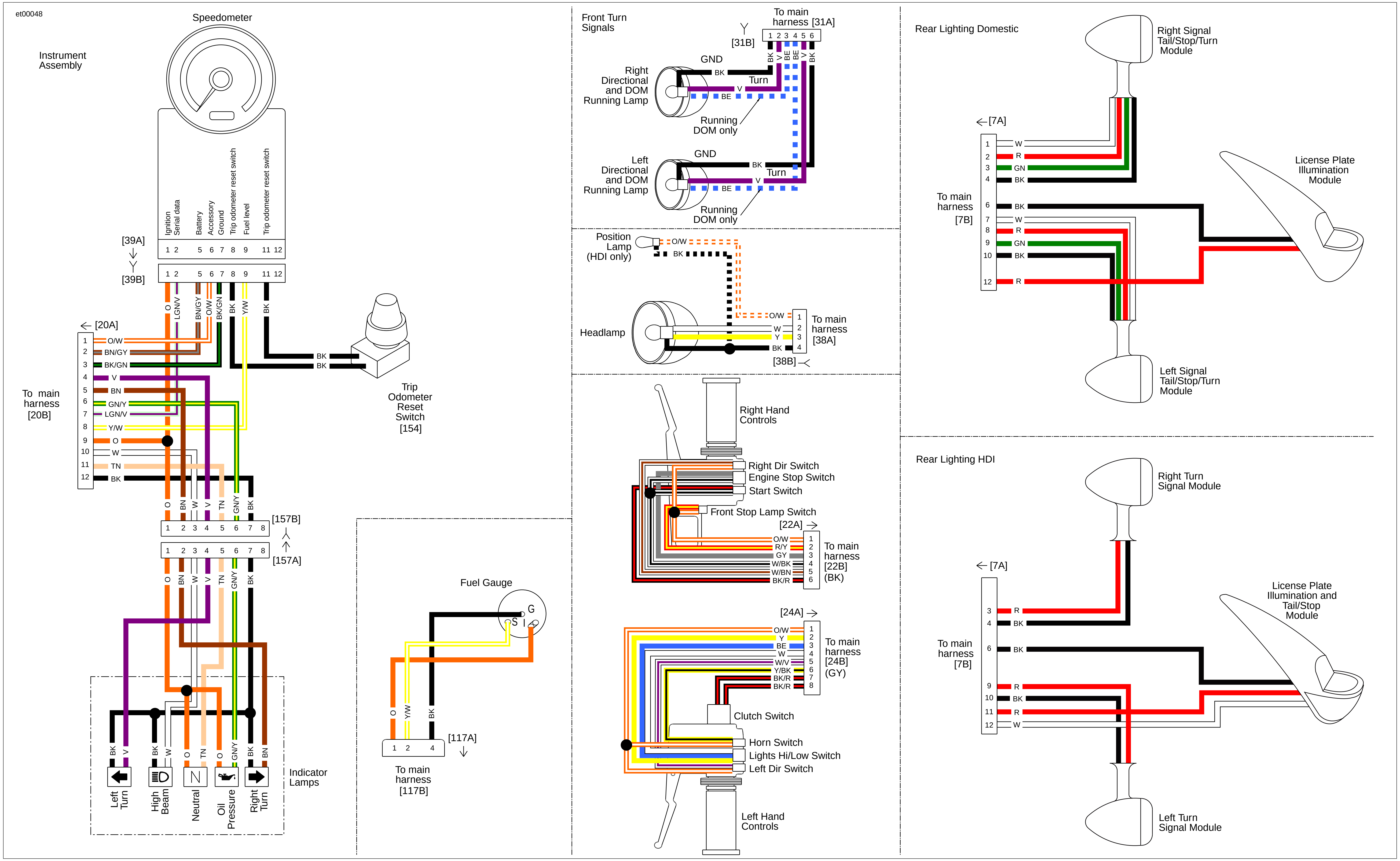


Figure B-12. 2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, HANDLEBAR SWITCHES, INDICATORS AND LIGHTING

Figure B-12.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS,
HANDLEBAR SWITCHES, INDICATORS AND LIGHTING

Figure B-12.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS,
HANDLEBAR SWITCHES, INDICATORS AND LIGHTING

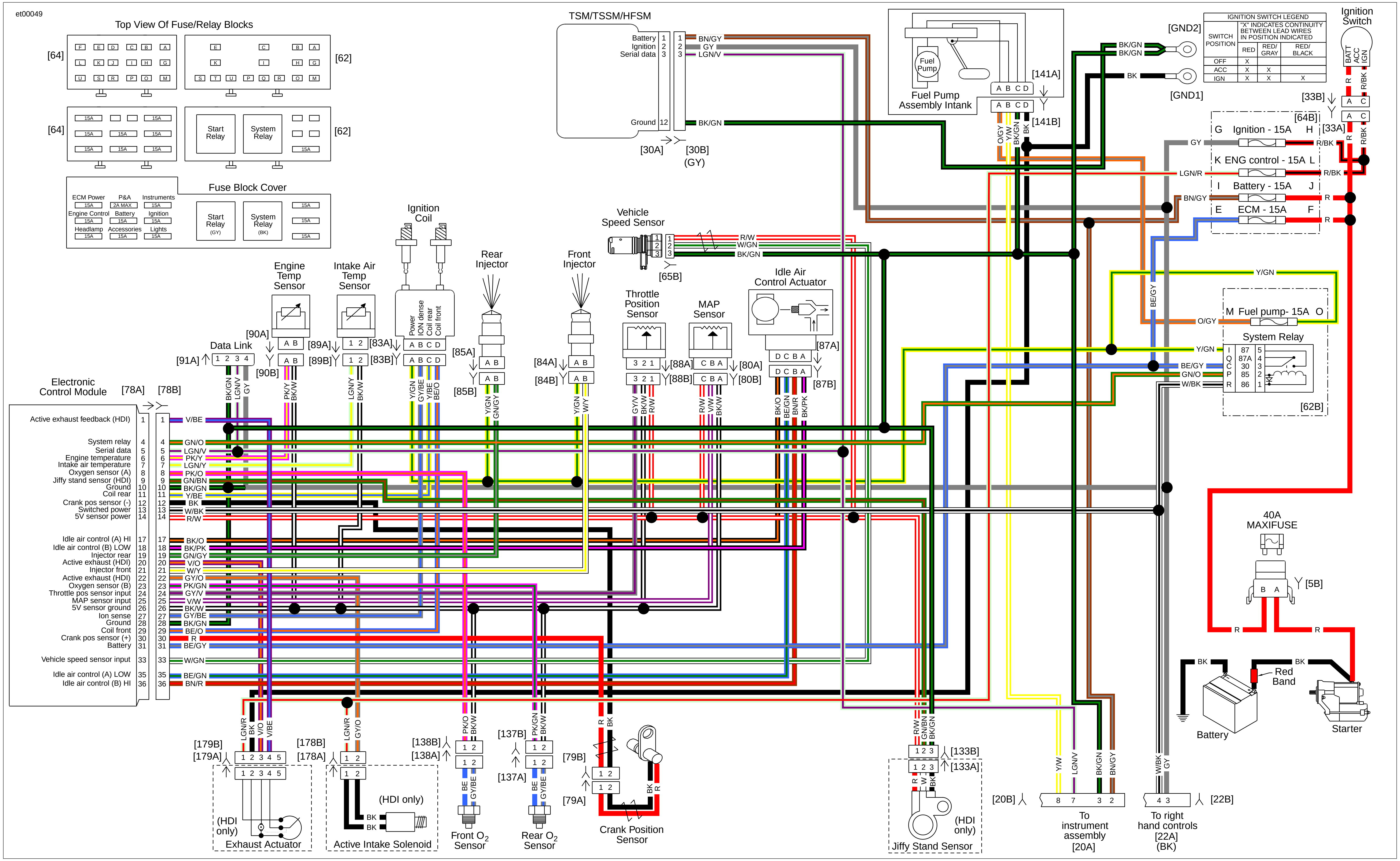


Figure B-13. 2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, IGNITION CIRCUIT

Figure B-13.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, IGNITION CIRCUIT

Figure B-13.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, IGNITION CIRCUIT

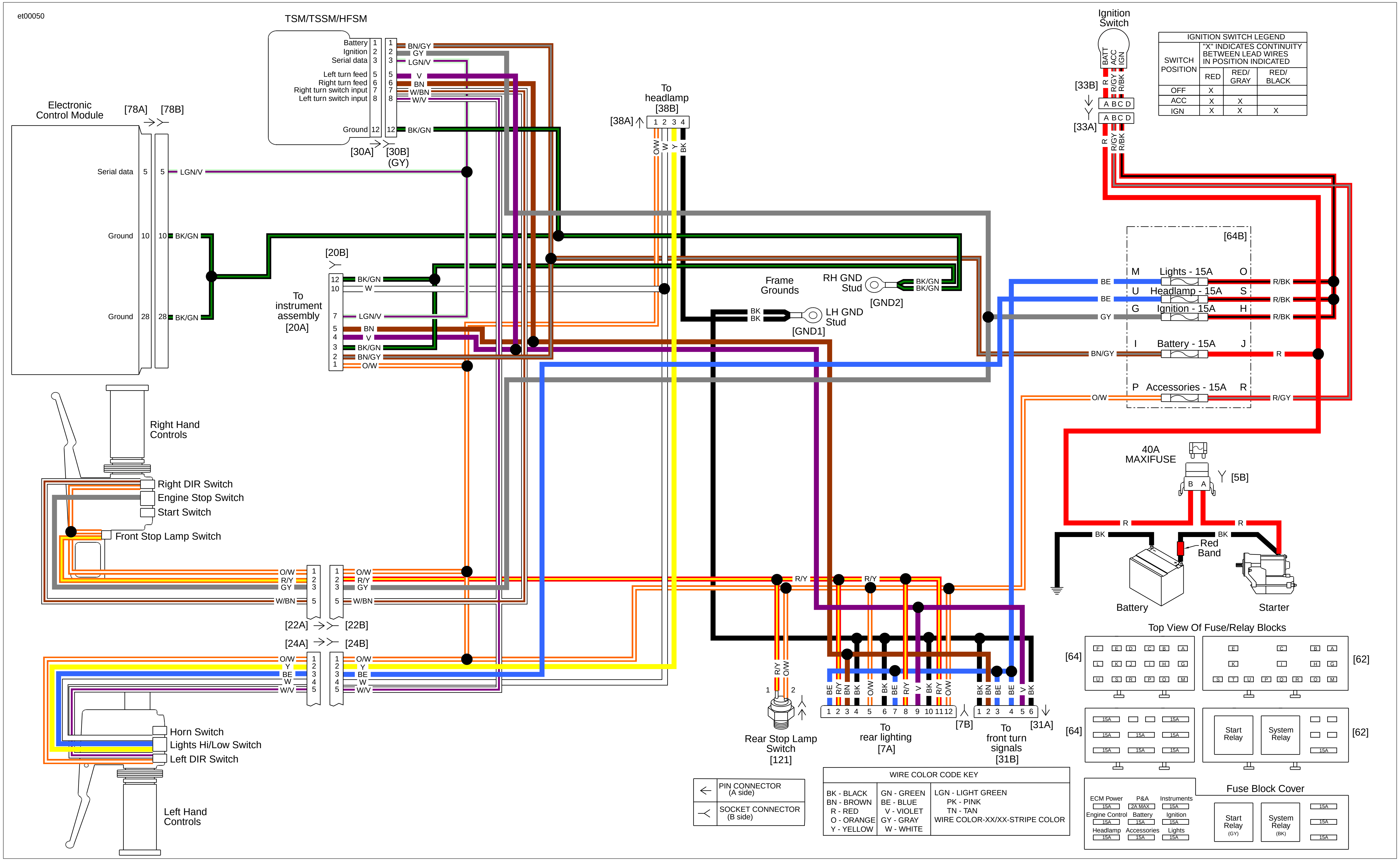
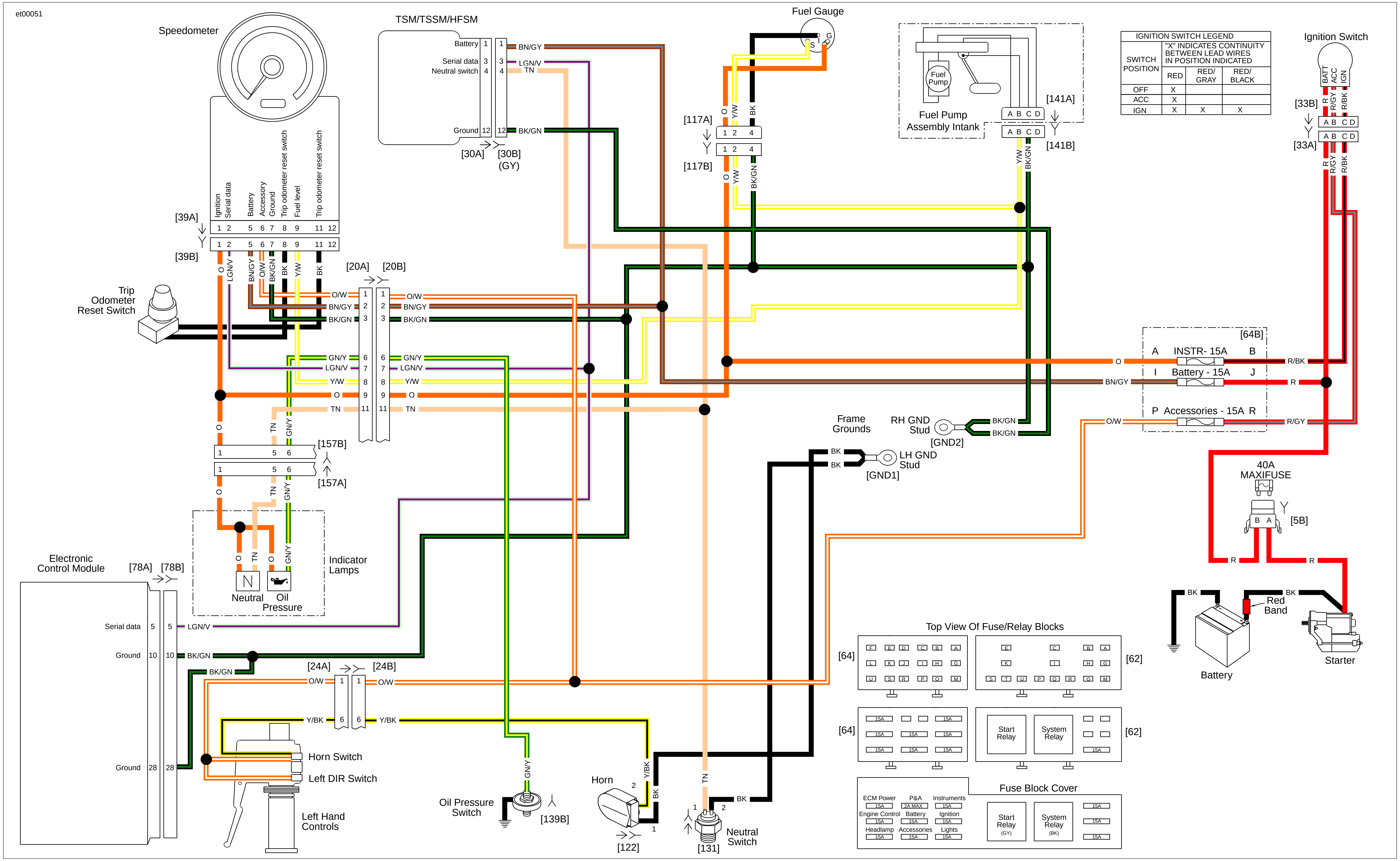


Figure B-14. 2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, LIGHTING CIRCUIT

Figure B-14.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, LIGHTING CIRCUIT

Figure B-14.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, LIGHTING CIRCUIT



SWITCH POSITION	RED	RED/ GRAY	RED/ BLACK
OFF	X		
ACC	X		
IGN	X	X	X

"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED

Figure B-15. 2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, HORN & INSTRMENTS

Figure B-15.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, HORN & INSTRMENTS

Figure B-15.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, HORN & INSTRMENTS

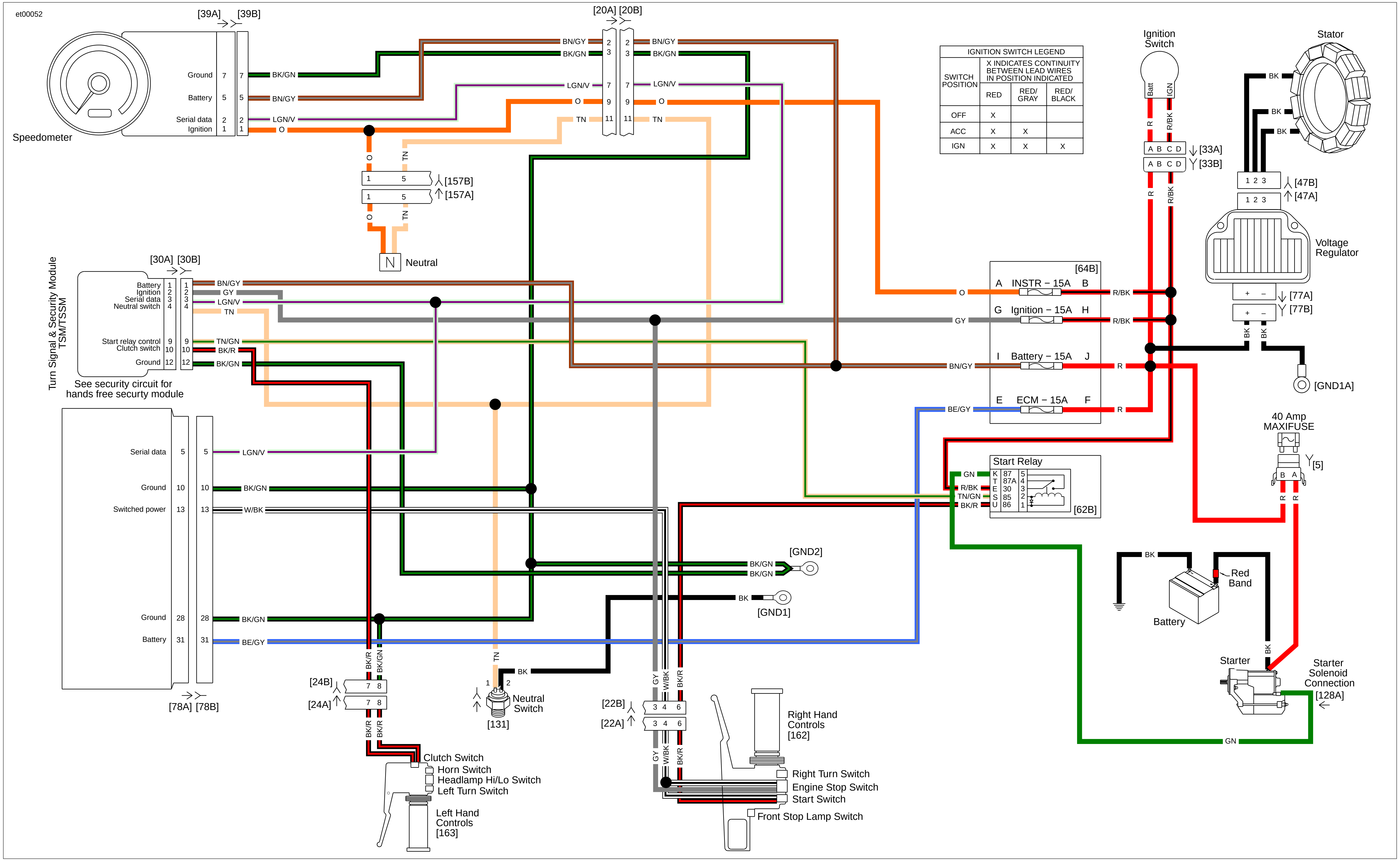


Figure B-16. 2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, STARTING AND CHARGING CIRCUITS

Figure B-16.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, STARTING AND CHARGING CIRCUITS

Figure B-16.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, STARTING AND CHARGING CIRCUITS

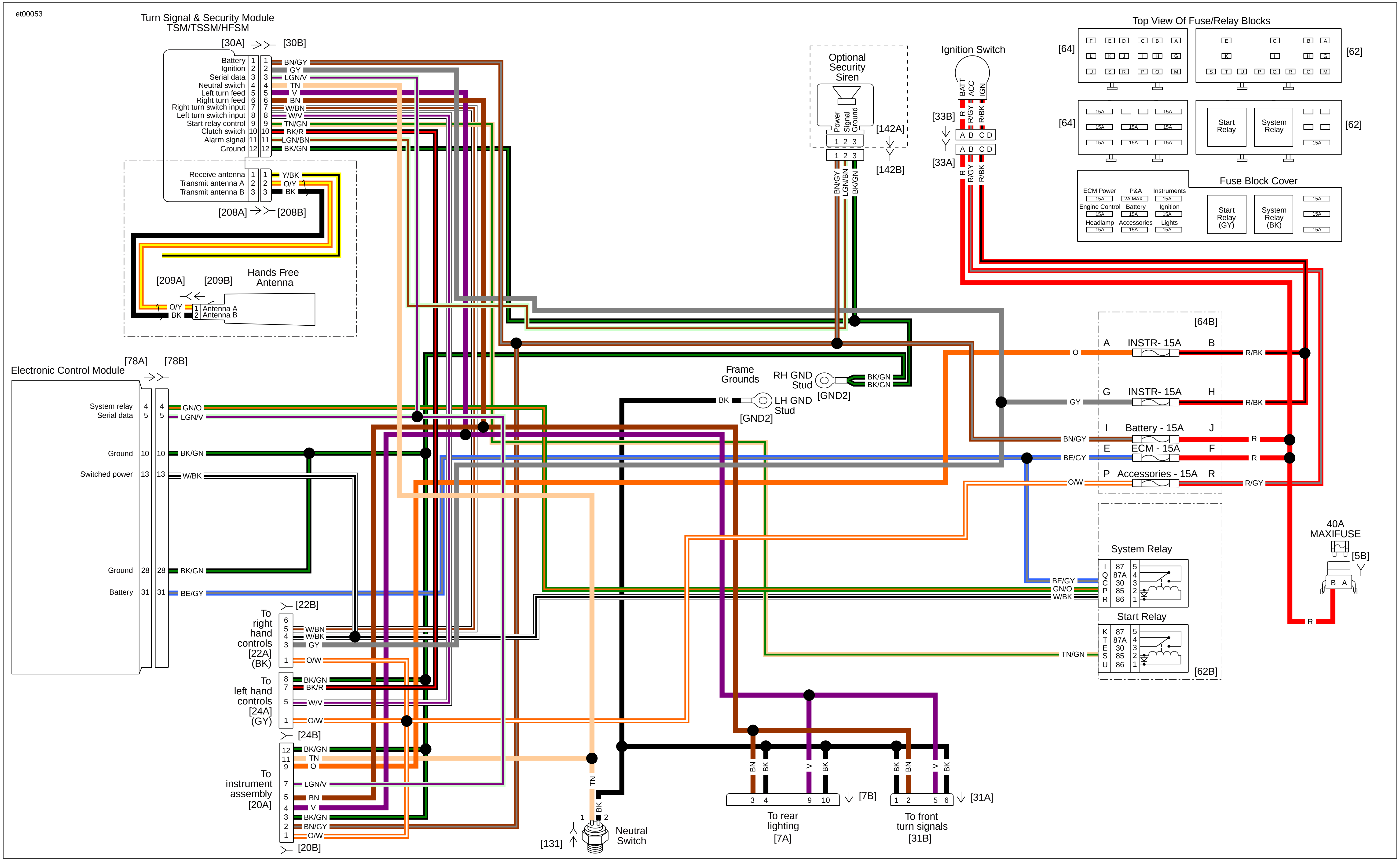


Figure B-17. 2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, SECURITY CIRCUIT: 1 OF 2

Figure B-17.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, SECURITY CIRCUIT: 1 OF 2

Figure B-17.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, SECURITY CIRCUIT: 1 OF 2

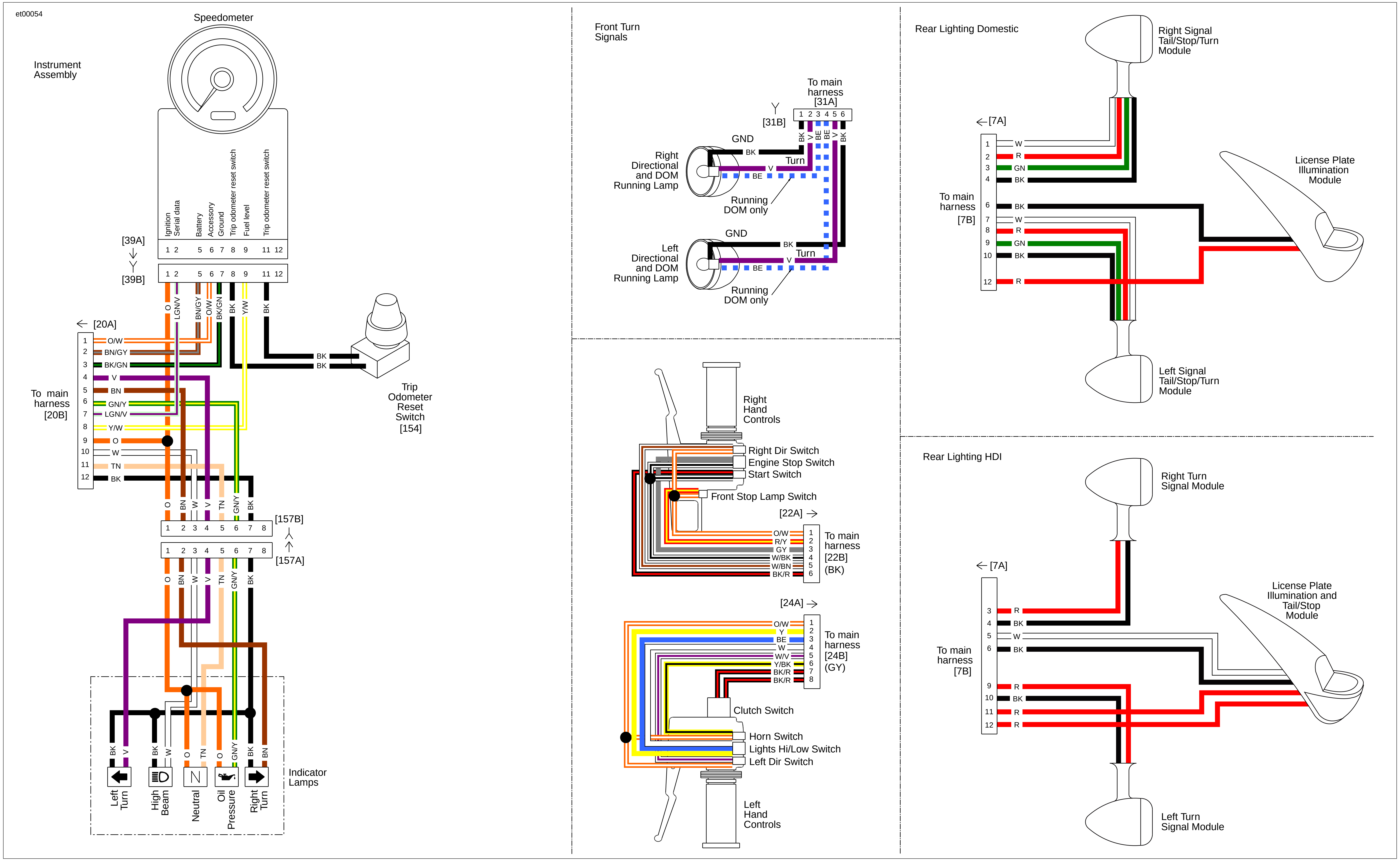


Figure B-18. 2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, SECURITY CIRCUIT: 2 OF 2

Figure B-18.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, SECURITY CIRCUIT: 2 OF 2

Figure B-18.
2008 ALL FXCWC SOFTAIL DOM. and INT. MODELS, SECURITY CIRCUIT: 2 OF 2

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NOTES

CONVERSION TABLE

Table C-1. Metric Conversions

MILLIMETERS to INCHES (MM x 0.03937 = IN.)								INCHES to MILLIMETERS (IN. x 25.40 = MM)							
MM	IN.	MM	IN.	MM	IN.	MM	IN..	IN.	MM	IN.	MM	IN.	MM	IN.	MM
.1	.0039	25	.9842	58	2.283	91	3.582	.001	.025	.6	15.240	1-15/16	49.21	3-5/16	84.14
.2	.0078	26	1.024	59	2.323	92	3.622	.002	.051	5/8	15.875	2	50.80	3-3/8	85.72
.3	.0118	27	1.063	60	2.362	93	3.661	.003	.076	11/16	17.462	2-1/16	52.39	3.4	86.36
.4	.0157	28	1.102	61	2.401	94	3.701	.004	.102	.7	17.780	2.1	53.34	3-7/16	87.31
.5	.0197	29	1.142	62	2.441	95	3.740	.005	.127	3/4	19.050	2-1/8	53.97	3-1/2	88.90
.6	.0236	30	1.181	63	2.480	96	3.779	.006	.152	.8	20.320	2-3/16	55.56	3-9/16	90.49
.7	.0275	31	1.220	64	2.519	97	3.819	.007	.178	13/16	20.638	2.2	55.88	3.6	91.44
.8	.0315	32	1.260	65	2.559	98	3.858	.008	.203	7/8	22.225	2-1/4	57.15	3-5/8	92.07
.9	.0354	33	1.299	66	2.598	99	3.897	.009	.229	.9	22.860	2.3	58.42	3-11/16	93.66
1	.0394	34	1.338	67	2.638	100	3.937	.010	.254	15/16	23.812	2-5/16	58.74	3.7	93.98
2	.0787	35	1.378	68	2.677	101	3.976	1/64	.397	1	25.40	2-3/8	60.32	3-3/4	95.25
3	.1181	36	1.417	69	2.716	102	4.016	.020	.508	1-1/16	26.99	2.4	60.96	3.8	96.52
4	.1575	37	1.456	70	2.756	103	4.055	.030	.762	1.1	27.94	2-7/16	61.91	3-13/16	96.84
5	.1968	38	1.496	71	2.795	104	4.094	1/32	.794	1-1/8	28.57	2-1/2	63.50	3-7/8	98.42
6	.2362	39	1.535	72	2.834	105	4.134	.040	1.016	1-3/16	30.16	2-9/16	65.09	3.9	99.06
7	.2756	40	1.575	73	2.874	106	4.173	.050	1.270	1.2	30.48	2.6	66.04	3-15/16	100.01
8	.3149	41	1.614	74	2.913	107	4.212	.060	1.524	1-1/4	31.75	2-5/8	66.67	4	101.6
9	.3543	42	1.653	75	2.953	108	4.252	1/16	1.588	1.3	33.02	2-11/16	68.26	4-1/16	102.19
10	.3937	43	1.693	76	2.992	109	4.291	.070	1.778	1-5/16	33.34	2.7	68.58	4.1	104.14
11	.4331	44	1.732	77	3.031	110	4.331	.080	2.032	1-3/8	34.92	2-3/4	69.85	4-1/8	104.77
12	.4724	45	1.772	78	3.071	111	4.370	.090	2.286	1.4	35.56	2.8	71.12	4-3/16	106.36
13	.5118	46	1.811	79	3.110	112	4.409	.1	2.540	1-7/16	36.51	2-13/16	71.44	4.2	106.68
14	.5512	47	1.850	80	3.149	113	4.449	1/8	3.175	1-1/2	38.10	2-7/8	73.02	4-1/4	107.95
15	.5905	48	1.890	81	3.189	114	4.488	3/16	4.762	1-9/16	39.69	2.9	73.66	4.3	109.22
16	.6299	49	1.929	82	3.228	115	4.527	.2	5.080	1.6	40.64	2-15/16	74.61	4-5/16	109.54
17	.6693	50	1.968	83	3.268	116	4.567	1/4	6.350	1-5/8	41.27	3	76.20	4-3/8	111.12
18	.7086	51	2.008	84	3.307	117	4.606	.3	7.620	1-11/16	42.86	3-1/16	77.79	4.4	111.76
19	.7480	52	2.047	85	3.346	118	4.645	5/16	7.938	1.7	43.18	3.1	78.74	4-7/16	112.71
20	.7874	53	2.086	86	3.386	119	4.685	3/8	9.525	1-3/4	44.45	3-1/8	79.37	4-1/2	114.30
21	.8268	54	2.126	87	3.425	120	4.724	.4	10.160	1.8	45.72	3-3/16	80.96	4-9/16	115.89
22	.8661	55	2.165	88	3.464	121	4.764	7/16	11.112	1-13/16	46.04	3.2	81.28	4.6	116.84
23	.9055	56	2.205	89	3.504	122	4.803	1/2	12.700	1-7/8	47.62	3-1/4	82.55	4-5/8	117.47
24	.9449	57	2.244	90	3.543	123	4.842	9/16	14.288	1.9	48.26	3.3	83.82	4-11/16	119.06

UNITED STATES SYSTEM

Unless otherwise specified, all fluid volume measurements in this Service Manual are expressed in United States (U.S.) units-of-measure. See below:

- 1 pint (U.S.) = 16 fluid ounces (U.S.)
- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.) = 4 quarts (U.S.) = 128 fl. oz. (U.S.)

METRIC SYSTEM

Fluid volume measurements in this Service Manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). Should you need to convert from U.S. units-of-measure to metric units-of-measure (or vice versa), refer to the following:

- fluid ounces (U.S.) x 29.574 = milliliters
- pints (U.S.) x 0.473 = liters
- quarts (U.S.) x 0.946 = liters
- gallons (U.S.) x 3.785 = liters
- milliliters x 0.0338 = fluid ounces (U.S.)
- liters x 2.114 = pints (U.S.)
- liters x 1.057 = quarts (U.S.)
- liters x 0.264 = gallons (U.S.)

BRITISH IMPERIAL SYSTEM

Fluid volume measurements in this Service Manual do not include the British Imperial (Imp.) system equivalents. The following conversions exist in the British Imperial system:

- 1 pint (Imp.) = 20 fluid ounces (Imp.)
- 1 quart (Imp.) = 2 pints (Imp.)
- 1 gallon (Imp.) = 4 quarts (Imp.)

Although the same unit-of-measure terminology as the U.S. system is used in the British Imperial (Imp.) system, the actual volume of each British Imperial unit-of-measure differs from its U.S. counterpart. The U.S. fluid ounce is larger than the British Imperial fluid ounce. However, the U.S. pint, quart, and gallon are smaller than the British Imperial pint, quart, and gallon, respectively. Should you need to convert from U.S. units to British Imperial units (or vice versa), refer to the following:

- fluid ounces (U.S.) x 1.042 = fluid ounces (Imp.)
- pints (U.S.) x 0.833 = pints (Imp.)
- quarts (U.S.) x 0.833 = quarts (Imp.)
- gallons (U.S.) x 0.833 = gallons (Imp.)
- fluid ounces (Imp.) x 0.960 = fluid ounces (U.S.)
- pints (Imp.) x 1.201 = pints (U.S.)
- quarts (Imp.) x 1.201 = quarts (U.S.)
- gallons (Imp.) x 1.201 = gallons (U.S.)

UNITED STATES SYSTEM

The U.S. units of torque, foot pounds and inch pounds, are used in this service manual. To convert units, use the following equations:

- foot pounds (ft-lbs) X 12.00000 = inch pounds (**in-lbs**).
- inch pounds (**in-lbs**) X 0.08333 = foot pounds (ft-lbs).

METRIC SYSTEM

All metric torque specifications are written in Newton-meters (Nm). To convert metric to United States units and United States to metric, use the following equations:

- Newton meters (Nm) X 0.737563 = foot pounds (ft-lbs).
- Newton meters (Nm) X 8.85085 = inch pounds (**in-lbs).**
- foot pounds (ft-lbs) X 1.35582 = Newton meters (Nm).
- inch pounds (**in-lbs**) X 0.112985 = Newton meters (Nm).

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ACRONYMS AND ABBREVIATIONS

Table D-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
A	Amperes
AC	Alternating Current
ACC	Accessory
ACR	Automatic Compression Release
AGM	Absorbed Glass Mat (battery)
AMP	Ampere
AWG	American Wire Gauge
B+	Battery Voltage
BAS	Bank angle sensor
BTDC	Before Top Dead Center
C	Celsius (Centigrade)
CA	California
CAL	Calibration
CC	Cubic Centimeters
CCA	Cold Cranking Amps
CKP	Crankshaft Position
cm	Centimeter
DC	Direct Current
DLC	Data Link Connector
DOM	Domestic
DTC	Diagnostic Trouble Code
DVOM	Digital Volt Ohm Meter
ECM	Electronic Control Module
ECT	Engine Coolant Temperature
EEPROM	Electrically Erasable Programmable Read Only Memory
EFI	Electronic Fuel Injection
ET	Engine Temperature
EVAP	Evaporative Emissions Control System
F	Fahrenheit
ft-lbs	Foot-Pounds
fl oz.	Fluid Ounce
g	Gram
GAL	Gallon
GAWR	Gross Axle Weight Rating
GND	Ground (electrical)
GVWR	Gross Vehicle Weight Rating
HDI	Harley-Davidson International
H-DSSS	Harley-Davidson Smart Security System
HFSM	Hands Free Security Module
Hg	Mercury
IAC	Idle Air Control

Table D-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
IAT	Intake Air Temperature
ID	Inside Diameter
IGN	Ignition Light/Key Switch
IM	Instrument Module
In.	Inch
INJ PW	Injector Pulse Width
in-lbs	Inch-Pounds
Kg	Kilogram
Km	Kilometer
kPa	Kilopascal
km/hr	Kilometers Per Hour
L	Liter
LCD	Liquid Crystal Display
LED	Light Emitting Diode
mA	Milliampere
MAP	Manifold Absolute Pressure
ml	milliliter
mm	millimeter
MPH	Miles Per Hour
ms	millisecond
Nm	Newton-Meter
N/A	Not Applicable
no.	Number
O2	Oxygen
OD	Outside Diameter
OEM	Original Equipment Manufacturer
oz	Ounce
P&A	Parts and Accessories
PN	Part Number
PSI	Pounds per Square Inch
RES	Reserve
RPM	Revolutions Per Minute
SCFH	Cubic Feet per Hour at Standard Conditions
TDC	Top Dead Center
TGS	Twist Grip Sensor
TP	Throttle Position
TMAP	Intake Air Temperature/Manifold Absolute Pressure
TSM	Turn Signal Module
TSSM	Turn Signal/Security Module
V	Volt
VAC	Volts of Alternating Current
VDC	Volts of Direct Current
VIN	Vehicle Identification Number
VSS	Vehicle Speed Sensor

NOTES

GENERAL

TSM

The Turn Signal Module (TSM) has two major functions:

- Control turn signals.
- Serve as Bank Angle Sensor (BAS).

TSSM

See Figure E-1. The optional, factory-installed, Harley-Davidson Factory Security System (**H-DFSS**) includes a Turn Signal Security Module (**TSSM**) which provides the same functions as the TSM, but also includes security and immobilization functions.

Figure E-1. TSSM (Japan/Korea)

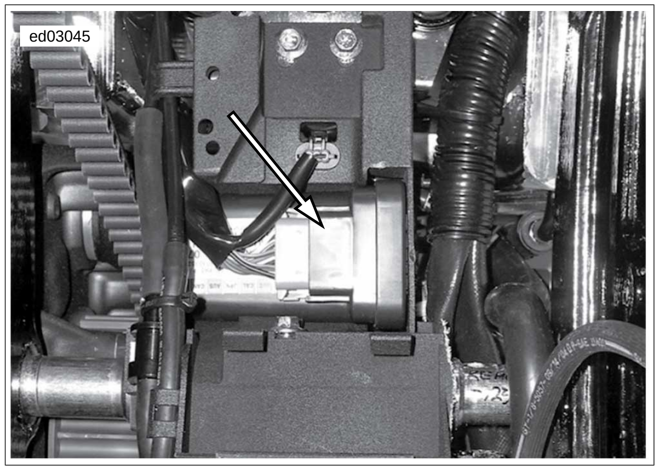


Figure E-2. TSSM (Japan/Korea)

TROUBLESHOOTING

Problems fall into at least one of five categories:

- Turn signal malfunction.
- Bank angle (engine disable).
- Clutch/neutral interlock (starter enable).
- Security lamp problem.
- Security system malfunction.

To resolve TSM/TSSM problems, four basic steps are involved. In order of occurrence, they are:

1. Retrieve Diagnostic Trouble Codes (DTCs) using speedometer self diagnostics. See E.10 SPEEDOMETER SELF DIAGNOSTICS.
2. Diagnose system problems. This involves using special tools and the diagnostic flow charts in this section.
3. Correct problems through the replacement and/or repair of the affected components.
4. After repairs are performed, the work must be validated. This involves clearing the DTCs and confirming proper vehicle operation as indicated by the behavior of the turn signals.

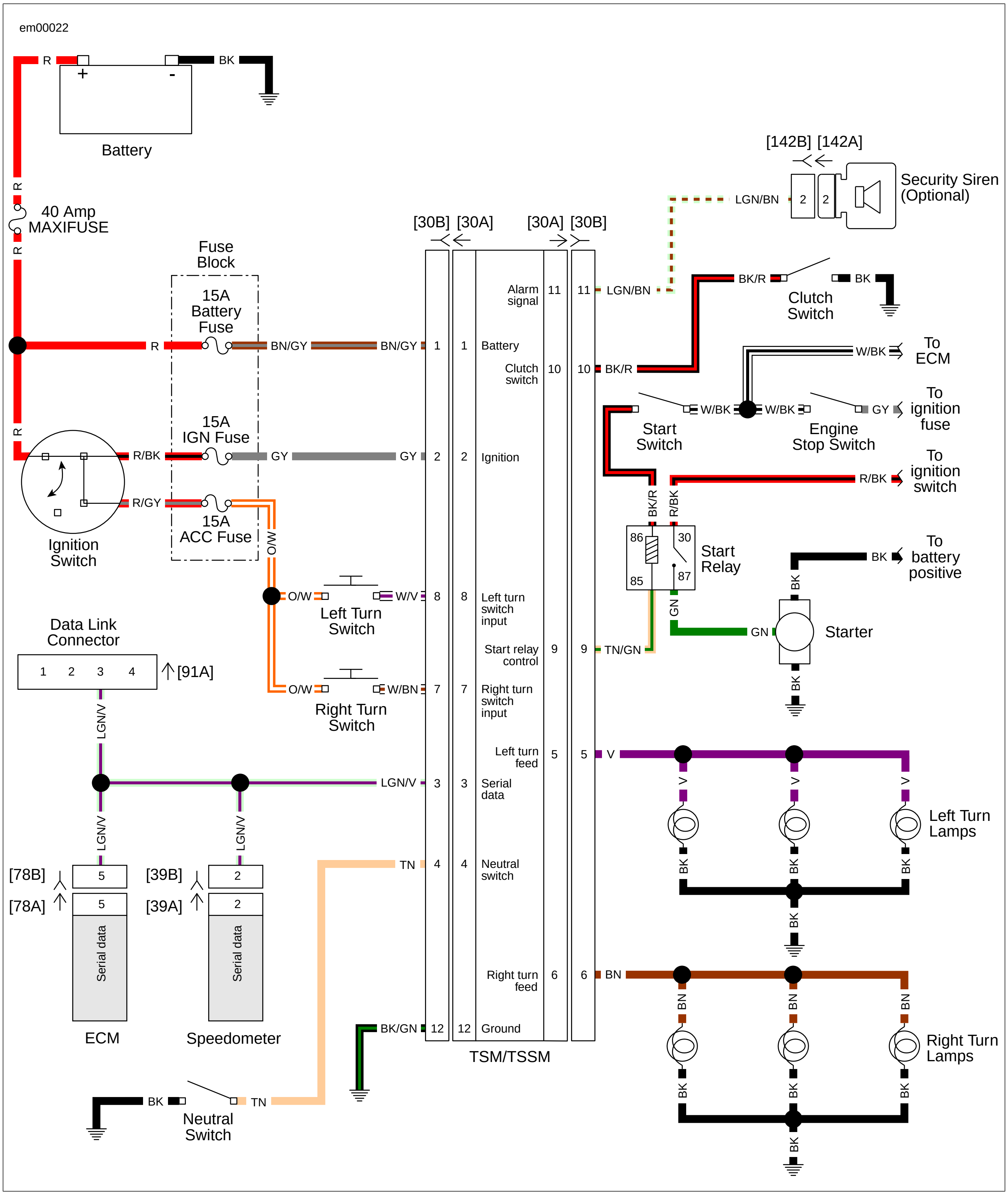


Figure E-3. Simplified TSM/TSSM Wiring

GENERAL

The Turn Signal Module (TSM) and the Turn Signal Security Module (TSSM) provide the following capabilities.

TURN SIGNAL FUNCTIONS

TSSM/TSSM Features

See E.4 TURN SIGNAL FUNCTIONS for complete details.

- **Manual turn signal control:** Manual activation/deactivation of left and right turn signal flashing sequences.
- **Automatic turn signal cancellation:** Automatic cancellation of left and right turn signal flashing sequences based on either vehicle speed, vehicle acceleration or turn completion.
- **Emergency flashers:** Four-way left and right turn signal flashing capability.
- **Turn signal lamp diagnostics:** Self-diagnostics for short circuit and open lamp conditions on both left and right turn signal systems.

BANK ANGLE FUNCTION

See E.5 BANK ANGLE FUNCTION for complete details.

- **Emergency engine shutdown:** Will provide engine shutdown when vehicle is tipped over.
- **Emergency outputs disable:** Will disable turn signal lamps and starter motor when vehicle is tipped over.

CLUTCH/NEUTRAL INTERLOCK FUNCTIONS

TSM/TSSM Features

- **Disables starter:** Disables starter until either the clutch lever is pulled in or transmission neutral is selected.
- **Diagnostics:** Provides diagnostics for clutch and neutral switch faults.

SECURITY ALARM AND IMMOBILIZATION FUNCTIONS

TSSM Feature

The following information applies only to motorcycles with the security option (TSSM). See E.6 SECURITY SYSTEM FUNCTIONS (TSSM ONLY) for more information.

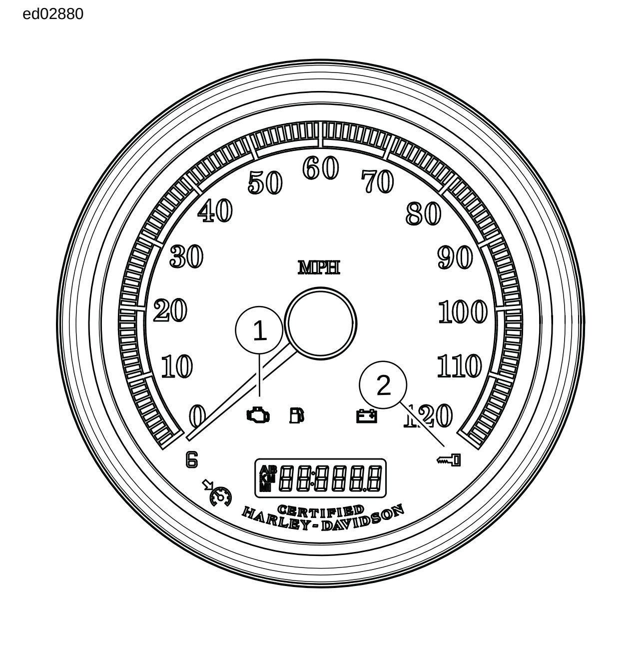
- **Remote arming/disarming:** See Figure E-4. Owners may enable and disable security alarm and immobilization functions with a personally carried transmitter. This transmitter is referred to as a **key fob**. Remote arming/disarming is a function of the TSSM (Japan/Korea) only.
- **Security lamp (key icon):** See Figure E-5. A lamp within the speedometer face tells the rider if the system is armed or disarmed.
- **PIN disarming:** If a key fob is not available, the TSSM allows the rider to disable the security alarm and immobilization functions if the rider knows the previously entered personal identification number (PIN).
- **Arming/disarming confirmation:** When the TSSM is armed, the system provides visual feedback to the rider by flashing the turn signals and sounding the optional Smart Siren.
- **Auto-arming:** Automatically enables the security alarm and immobilization functions within 30 seconds after the Ignition Switch is switched OFF.

NOTE

Motorcycles sold with a TSSM have auto-arming disabled, but it can be activated. See E.3 VEHICLE DELIVERY.

- **Transport mode:** It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be moved in an immobilized state.
- **Starter/ignition disable:** Should the security alarm and immobilization functions be triggered by a vehicle security condition, the starter and ignition system will be disabled.
- **Security system alarm:** See Figure E-6. The system will alternately flash the left and right turn signals and sound an optional Security Siren if a vehicle security condition is detected while the system is armed.

Figure E-4. Key Fob: TSSM



1. **Check engine lamp**
2. **Security lamp (key icon)**

Figure E-5. Security Lamp (Key Icon)

Figure E-6. Security Siren

GENERAL

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

Setting up a vehicle TSM/TSSM depends on whether the vehicle has a Turn Signal Module (TSM) or the optional Turn Signal Security Module (TSSM) installed.

All motorcycles ship with the TSM/TSSM set for use **without** a sidecar installed. If a motorcycle is equipped with a TSM, no further configuration is required.

However, if a motorcycle has an optional security system (TSSM) installed, perform the following steps as necessary.

1. Configure TSSM motorcycles by assigning both key fobs to the vehicle. See E.3 VEHICLE DELIVERY, Key Fob Assignment: TSSM.
2. Configure TSSM motorcycles by entering a Personal Identification Number (PIN) picked by the owner. The PIN allows the owner to operate the system if the key fob is lost or inoperable. Record this PIN in the Owner's Manual and instruct the customer to carry a copy.

CONFIGURING A TSSM

NOTE

Do not forget to enter a Personal Identification Number (PIN) for TSSM motorcycles. If a PIN is not assigned and both key fobs are lost or damaged while the motorcycle is armed, the TSSM must be replaced.

Changes to TSSM settings are made by a series of programming operations involving the ignition switch, left/right turn signal switches and key fob (security systems).

At certain steps in the programming sequence, the motorcycle may provide confirmation of settings by flashing the turn signals, turn signal indicators and/or security lamp. In addition, when programming a PIN into a TSSM system, the odometer displays the PIN to the user and dynamically updates it as the code is entered or changed.

All programming operations are listed in table format. Follow the numbered steps to configure the system. If a confirmation response is listed, wait for the confirmation before continuing to the next step. Important information pertaining to certain actions will be found in the NOTES column.

SIDECAR CONFIGURATION

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

POWER DISRUPTION AND CONFIGURING

The TSM/TSSM will not enter configuration mode on the first attempt after battery voltage has been removed from terminal "1". This will occur after any of the following situations:

- Battery disconnect or power drain.
- Battery fuse removal.
- Connecting Breakout Box to TSM/TSSM connector.

Therefore, after all battery reconnects, the configuration sequence must be modified as follows.

1. Set Engine Stop Switch to **OFF**, cycle Ignition Switch **ON**-OFF-**ON**-OFF-**ON** and press left turn signal switch twice.
2. Repeat step listed above.
3. Continue with configuration sequence listed.

KEY FOB ASSIGNMENT: TSSM

Refer to Table E-1 to assign a key fob to a motorcycle equipped with a TSSM.

The key fob on TSSM motorcycles must be set so it will operate the alarm system on the vehicle. This assignment **must** be completed with no pauses between steps greater than 10 seconds. Turn the Ignition Switch to OFF after all key fobs have been assigned. The programming mode will also exit after 60 seconds has elapsed without detecting any fob sign-up messages or turn signal switch activity.

Two key fobs may be assigned to the TSSM. The first successful attempt to program a fob will disable all previously assigned fobs. If a second fob is to be programmed, it must be done in the same programming sequence as the initial fob.

Table E-1. Key FOB Assignment: TSSM

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set Engine Stop Switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed). This assignment procedure must be completed with no pauses between steps greater than 10 seconds.
2	Cycle the Ignition Switch **IGN** - OFF - **IGN** - OFF - **IGN**.		

Table E-1. Key FOB Assignment: TSSM

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
3	Press **left** turn switch **2** times and release.	One to four flashes turn signals and indicators depending on vehicle configuration (See E.3 VEHICLE DELIVERY regarding battery disconnects.)	1 flash - Worldwide TSM, no security. 2 flashes - Japan/Korea configuration TSSM.
4	Press **right** turn switch **1** time and release.	One flash turn signals and indicators	
5	Press **left** turn switch **1** time and release.	Two flashes turn signals and indicators	
6	Press and hold **key fob** button until confirmation is received.	Two flashes turn signals and indicators	This may take 10-25 seconds.
7	If you have two key fobs, press and hold button on second **key fob** until confirmation is received.	Two flashes turn signals and indicators	Optional step.
8	Turn Ignition Switch to **OFF**.		

PIN ENTRY: TSSM

NOTE

Do not forget to enter a Personal Identification Number (PIN) for TSSM vehicles. If a PIN is not assigned and the key fob is lost or damaged while the vehicle is armed, the TSSM must be replaced.

The TSSM PIN consists of five digits. Each digit can be any number from 1-9. There can be no zeros (0) in the PIN. The PIN **must** be used to disarm the security system in case the key fob becomes unavailable.

Refer to Table E-2 to enter an initial PIN with no PIN previously installed. The procedure listed uses 3-1-3-1-3 as the desired PIN.

NOTE

For better security, do not use 3-1-3-1-3 as a PIN. It is shown as an example only.

Decide what five-digit PIN the owner would like to use. The code will be programmed using the turn signal switches and key fob. Keep a record of the PIN in a secure place such as your wallet or the Owner's Manual.

- When programming the PIN, the security lamp flashes to provide feedback when entering each digit. The odometer also displays the PIN and the change dynamically.
- The number of security lamp flashes corresponds to the number currently selected for a given digit. Therefore, the lamp may flash 1-9 times depending on the number entered. The five-digit PIN will change in the odometer window and the active digit will blink.
- Press the left turn switch one time to increment each digit.
- Quickly press the key fob button twice to advance to the next digit.

NOTE

The programming mode exits upon turning the Ignition Switch to OFF, or if no turn signal switch/key fob button activity occurs for 60 seconds. No data is saved for partial configuration attempts if entering a PIN for the first time. If a PIN has previously been entered, the user can change any digit or group of digits.

Table E-2. Entering an Initial TSSM PIN (Example: 3-1-3-1-3) with No PIN Previously Entered

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set Engine Stop Switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed). This assignment procedure **must** be completed with no pauses between steps greater than 10 seconds.
2	Cycle the Ignition Switch **ON**-OFF-**ON**-OFF-**ON**.		

Table E-2. Entering an Initial TSSM PIN (Example: 3-1-3-1-3) with No PIN Previously Entered

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
3	Press **left** turn switch **2** times and release.	One to four flashes turn signals and indicators depending on vehicle configuration (See E.3 VEHICLE DELIVERY regarding battery disconnects).	One flash - Worldwide TSM, no security. Two flashes - Japan/Korea configuration TSSM.
4	Quickly press **key fob** button **2 times** and release.	One flash turn signals and indicators Odometer displays current five-digit PIN (five dashes if no code entered), first digit blinks.	Vehicle is in PIN entry mode ready to enter or modify first digit.
5	Press **left** turn switch **1 time** and release.	Security lamp flashes 1 - 9 times if code was previously entered.	A lack of confirmation flashes indicates no digit is entered.
6	Press and release **left** turn switch to advance through the digits. In this example, you will press and release three times.	Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected. In this example, the blinking digit displayed is 3 and the security lamp will flash three times.	You have selected 3 as a number for the first digit.
7	Quickly press **key fob** button **2 times** and release.	Two flashes turn signals and indicators second digit in odometer display blinks.	You have confirmed 3 as a number for the first digit and have advanced to entering the second digit.
8	Press **left** turn switch **1 time** and release.	None	A lack of confirmation flashes indicates no digit is entered.
9	Press and release **left** turn switch to advance through the digits. In this example, you will perform this step one time.	Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected. In this example, the blinking digit displayed is 1 and the security lamp will flash one time.	You have selected 1 as a number for the second digit.
10	Quickly press **key fob** button **2** times and release.	Three flashes turn signals and indicators third digit in odometer display blinks.	You have confirmed 1 as a number for the second digit and have advanced to entering the third digit.
11	Press **left** turn switch **1** time and release.	None	A lack of confirmation flashes indicates no digit is entered.
12	Press and release **left** turn switch to advance through the digits. In this example, you will repeat this step three times.	Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected. In this example, the blinking digit displayed is 3 and the security lamp will flash three times.	You have selected 3 as a number for the third digit.
13	Quickly press key fob button **2 times** and release.	Four flashes turn signals and indicators fourth digit in odometer display blinks.	You have confirmed 3 as a number for the third digit and have advanced to entering the fourth digit.
14	Press **left** turn switch **1** time and release.	None	A lack of confirmation flashes indicates no digit is entered.
15	Press and release **left** turn switch to advance through the digits. In this example, you will perform this step one time.	Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected. In this example, the blinking digit displayed is 1 and the security lamp will flash one time.	You have selected 1 as a number for the fourth digit.
16	Quickly press **key fob** button **2 times** and release.	Five flashes turn signals and indicators fifth digit in odometer display blinks.	You have confirmed 1 as a number for the fourth digit and have advanced to entering the fifth digit.

Table E-2. Entering an Initial TSSM PIN (Example: 3-1-3-1-3) with No PIN Previously Entered

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
17	Press **left** turn switch **1 time** and release.	None	A lack of confirmation flashes indicates no digit is entered.
18	Press and release **left** turn switch to advance through the digits. In this example, you will repeat this step three times.	Blinking digit in odometer display increments, security lamp flashes to indicate each digit selected. In this example, the blinking digit displayed is 3 and the security lamp will flash three times.	You have selected 3 as a number for the fifth digit.
19	Quickly press **key fob** button **2 times** and release.	One flash turn signals and indicators first digit in odometer display blinks.	You have confirmed 3 as a number for the fifth digit and have gone back to the first digit.
20	Turn Ignition Switch to OFF.		
21	Write down code in Owner's Manual.		
22	Arm the security system and attempt to disarm using PIN entry. Refer to Table E-2.		

CHANGING THE PIN: TSSM

If a PIN has been previously entered, the security lamp will flash the equivalent digit, and the odometer will display the existing PIN with the active digit blinking. Each additional press of the left turn switch will increment the digit.

- To advance from 5 to 6, press and release the left turn switch 1 time.
- To advance from 8 to 2, press and release the left turn switch 3 times (9-1-2).

TURN SIGNAL FUNCTIONS

GENERAL

The TSM/TSSM turn signal feature has several modes:

- Automatic cancellation.
- Manual cancellation.
- Four-way flashing.
- Diagnostics mode.

The turn signals cannot be activated or deactivated when the Ignition Switch is in the ACC position. The turn signals can only be activated or deactivated with the Ignition Switch in the IGNITION position.

WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

AUTOMATIC CANCELLATION

Press the left or right turn switch to activate automatic turn signal cancellation. There is no need to hold the turn switch in when approaching the turn. The TSM/TSSM will not cancel the signal before the turn is actually completed.

- When the directional switch is released, the system starts a 20 count. As long as the vehicle is traveling at more than 7 MPH (11 km/h), the directional will always cancel after 20 flashes, if the system does not recognize any other input.
- If the vehicle speed drops to 7 MPH (11 km/h) or less, including stopped, the directionals will continue to flash. Counting will resume when vehicle speed reaches 8 MPH (12 km/h) and will automatically cancel when the count total equals 20 as stated above.
- The turn signals will cancel within two seconds upon turn completion. A sensor inside the TSM/TSSM cancels the signal after the vehicle has been returned to an upright position.

NOTE

The bank angle cancellation function has an automatic calibration feature. Ride the motorcycle for 0.25 mile (0.4 km) at steady speeds (upright) to calibrate the system. Performance of bank angle function may not be optimal until this calibration is performed. This self-calibration is performed automatically every time the vehicle is started and ridden.

MANUAL CANCELLATION

If you want to stop the turn signals from flashing, briefly depress the turn signal switch a second time.

If you are signalling to turn in one direction and you depress the switch for the opposite turn signal, the first signal is cancelled and the opposite side begins flashing.

FOUR-WAY FLASHING

Use the following method to activate the four-way flashers:

1. With the Ignition Switch ON and the security system disarmed (models with security only), press the left and right turn signal switches at the same time.
2. Turn the Ignition Switch OFF and arm the security system if present and desired. The four-way flashers will continue for two hours.
3. To cancel four-way flashing, disarm the security system if necessary, turn the Ignition Switch ON and press the left and right turn signal switches at the same time.

This system allows a stranded vehicle to be left in the four-way flashing mode and secured until help is found.

If the security system is disarmed while the four-way flashers are active, the lights will flash as follows:

1. TSSM stops four-way flashing mode. Motorcycle sits for 1 second with turn signals off.
2. TSSM performs disarming confirmation (1 flash).
3. Motorcycle sits for 1 second with turn signals off.
4. Motorcycle restarts four-way flashing mode.

DIAGNOSTICS MODE

The TSM/TSSM measures the current when the turn signals are used. If there is a burned out light bulb on one side, the remaining light and the corresponding turn signal indicator flash at double the normal rate starting with the fifth flash.

Other diagnostic conditions monitored include:

- Short circuit in the turn signal wiring.
- Open circuit in the turn signal wiring.
- Stuck turn signal switch.

NOTES

- *A stuck turn signal switch will disable the automatic turn signal cancellation feature.*
- *If a stuck switch is detected, you must hold the left and right turn signal switches in for more than one second to activate the four-way flashers.*

See E.8 DIAGNOSTIC TROUBLE CODES (DTC) for more information.

BANK ANGLE FUNCTION

GENERAL

The turn signals, starter motor, ECM, fuel pump, and ignition coil will be disabled in the event the vehicle is tipped over.

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

OPERATION

The engine will shut off automatically if the vehicle is tipped over. The odometer displays "tIP" when a tip over condition is detected.

To restart the motorcycle after shutdown has occurred:

1. Return the motorcycle to an upright position.
2. Cycle the Ignition Switch OFF-**IGN** before restarting.

GENERAL

Security System Operation

The TSSM provides security and immobilization functions not found on the TSM. The TSSM will disable the starter and ignition system. Additional functions include the ability to alternately flash the left and right turn signals and sound a siren (if equipped) if a theft attempt is detected.

Conditions that activate the security system when system is armed include:

- **Detecting tampering of the ignition circuit:** Turn signals flash three times, optional siren chirps once and then turns off. If the tampering continues, a second warning will activate after four seconds. Continued tampering will cause the alarm to activate for 30 seconds and then turn off. The two warnings/alarm cycle is repeated for each tampering incident.
- **Detecting vehicle movement:** Turn signals flash three times, optional siren chirps once and then turns off. If the vehicle is not returned to its original position, a second warning will activate after four seconds. If the vehicle is not returned to its original position, the alarm activates for 30 seconds then turns off. The two warnings/alarm cycle may repeat a maximum of 10 times with a 10 second pause between alarm cycles.
- **Detecting that a battery or ground disconnect has occurred while armed:** Siren, if installed, activates its self-alarm mode. Turn signals will not flash.

See E.7 ARMING/DISARMING (TSSM ONLY) for more information.

NOTE

Always disarm the TSSM before removing or disconnecting the battery to prevent the siren (if installed) from activating. If the TSSM is in auto-arming mode, you must disarm the system and disconnect the battery or remove the battery fuse before the 30 second arming period expires.

Security System Options: TSSM

The following options are only available on the TSSM unit: alarm sensitivity, auto-arming feature, and storage mode.

Default settings for the TSSM include:

- Solo vehicle configuration.
- Medium motion sensitivity on alarm sensitivity.
- All vehicles are shipped with auto-arming disabled.
- Storage mode set to 10 days.

ALARM SENSITIVITY: TSSM

Sensitivity

The TSSM has four sensitivity settings: extremely low, low, medium or high. The selection picked controls the sensitivity of the security system in regards to motion detection.

To set alarm sensitivity, refer to Table E-3.

Table E-3. TSSM Alarm Sensitivity

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set RUN/OFF Switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed).
2	Cycle the Ignition Switch **ON**-OFF-**ON**-OFF-**ON**.		
3	Press **left** turn switch **2** times and release.	Two flashes turn signals & indicators depending on vehicle configuration (See E.3 VEHICLE DELIVERY regarding battery disconnects).	Two flashes - Japan/Korea configuration TSSM
4	Press and hold **key fob** button until confirmation is received.	One flash turn signals and indicators.	
5	Press **left** turn switch **1** time and release.	Turn signals and indicators flash to indicate option selected.	One flash - extremely low Two flashes - low sensitivity Three flashes - medium sensitivity Four flashes - high sensitivity
6	Press and release **left** turn switch to advance through options.	Turn signals and indicators flash to indicate option selected.	One flash - extremely low Two flashes - low sensitivity Three flashes - medium sensitivity Four flashes - high sensitivity
7	Turn Ignition Switch to OFF.		

Transport Mode

It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be picked up and moved in an armed state. In this mode, any attempt to hot-wire the vehicle will trigger the security system.

- To enter the transport mode, refer to Table E-4.
- To exit from transport mode and return the system to normal operation/functions, disarm the system using either the key fob or Personal Identification Number (PIN).

NOTE

Transport mode is especially useful when working on the motorcycle. If it is not used, the alarm will activate under many typical service activities.

Table E-4. Transport Mode: TSSM

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set Engine Stop Switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed).
2	Turn Ignition Switch to **ON**.		
3	Press and hold **key fob** button until confirmation is received.	Three flashes turn signals & indicators.	
4	Turn Ignition Switch to OFF.		
5	Press and hold **key fob** button until confirmation is received.	Three flashes turn signals & indicators.	The vehicle can be moved without tripping the alarm.

AUTO-ARMING FUNCTION: TSSM

Auto-arming causes the system to automatically arm itself (no key fob needed) within 30 seconds after the Ignition Switch is turned OFF. During this period, the security lamp stays on solid to indicate auto-arming is starting up.

The vehicle may be moved during these 30 seconds without triggering the alarm. However, any motion after that period will trigger the security alarm. Upon expiration of the auto-arming period, the turn signals flash twice, the security lamp begins to flash and the siren (if equipped) chirps twice.

The TSSM allows remote arming via the key fob at any time. However, if the system is remotely disarmed (with the key fob) but the Ignition Switch is not turned ON within 30 seconds, the system will rearm itself when auto-arming is enabled.

Japan and Korea motorcycles have auto-arming disabled by default. However, the feature may be enabled if the customer desires.

When auto-arming is disabled, the key fob must be used to arm the security system. To set the auto-arming function, refer to Table E-5.

Table E-5. Selecting TSSM Auto-Arming Function

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set Engine Stop Switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed).
2	Cycle the Ignition Switch **IGN**-OFF-**IGN**-OFF-**IGN**.		
3	Press **left** turn switch **2 times** and release.	Two flashes turn signals and indicators (See E.3 VEHICLE DELIVERY regarding battery disconnects).	Two flashes - Japan/Korea configuration TSSM
4	Press and hold key fob button until confirmation is received.	One flash turn signals and indicators.	
5	Press and hold **key fob** button until confirmation is received.	Two flashes turn signals and indicators.	
6	Press **left** turn switch **1 time** and release.	Turn signals and indicators flash to indicate option selected.	One flash - auto-arming disabled Two flashes - auto-arming enabled
7	Press and release **left** turn switch to advance through options.	Turn signals and indicators flash to indicate option selected.	
8	Turn Ignition Switch to OFF.		

STORAGE MODE: TSSM

The TSSM has a special mode for long term storage. This mode prevents the security system from draining the battery after a period of days (10, 20, 60 or infinite) without any Ignition Switch activity.

- If the TSSM is set to infinite, the system will not go into storage mode.
- Vehicles will enter storage mode whether the security system is armed or disarmed.
- If set to 20 days or greater, the customer must use an approved trickle charger to keep the battery from discharging.

In storage mode, all alarm functions remain active but the receiver is shut down and will not respond to the key fob. The vehicle is immobilized because the starter motor and Electronic Control Module (ECM) are disabled. When the storage mode is entered, the security lamp stops flashing to conserve power.

To wake up the TSSM from storage mode, the Ignition Switch must be turned ON. This will trigger a warning/alarm if the system was previously armed. You must use the key fob or PIN to disarm the system and stop the alarm.

To set the storage mode preferences, refer to Table E-6.

Table E-6. Storage Mode Preferences: TSSM

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set Engine Stop Switch to **OFF**.		Verify the security lamp is not blinking (vehicle is disarmed).
2	Cycle the Ignition Switch **IGN**-OFF-**IGN**-OFF-**IGN**.		
3	Press **left** turn switch **2 times** and release.	Two flashes turn signals and indicators depending on vehicle configuration (See E.3 VEHICLE DELIVERY regarding battery disconnects).	Two flashes - Japan/Korea configuration TSSM
4	Press and hold **key fob** button until confirmation is received.	One flash turn signals and indicators.	
5	Release and then hold **key fob** button until confirmation is received.	Two flashes turn signals and indicators.	
6	Release and then hold **key fob** button until confirmation is received.	Three flashes turn signals and indicators.	
7	Press **left** turn switch **1 time** and release.	Turn signals and indicators flash to indicate option selected.	One flash - 10 days Two flashes - 20 days Three flashes - 60 days Four flashes - Infinite
8	Press **left** turn switch to advance through options.	Turn signals and indicators flash to indicate option selected.	One flash - 10 days Two flashes - 20 days Three flashes - 60 days Four flashes - Infinite
9	Turn Ignition Switch to OFF.		

GENERAL

There are two methods to arm the security system:

- Using the key fob.
- Using auto-arming. See E.6 SECURITY SYSTEM FUNCTIONS (TSSM ONLY).

NOTE

The vehicle cannot be armed with the Ignition Switch turned to IGN.

There are two ways to disarm the system:

- Using the key fob. This method works in all situations **except** before turning Ignition Switch to IGN when TSSM storage mode is activated.
- Using a Personal Identification Number (PIN).

SECURITY LAMP

Refer to Table E-7. The security lamp within the speedometer provides feedback to the rider confirming armed or disarmed status.

Table E-7. Security Lamp Status: TSSM

LAMP	MODE
Does not flash.	No security system (TSM), security system not armed or storage mode active.
Flashes every second.	Ten minute timeout after failed PIN entry attempt or a battery reconnect has occurred while armed.
Flashes every 2 seconds.	Security system armed.
Flashes 4 times a second.	PIN entry mode.
Stays on solid with Ignition Switch turned OFF.	Auto-arming is starting up. You have 30 seconds before system is armed.
Stays on solid with Ignition Switch turned to IGN.	If solid for more than 4 seconds after Ignition Switch is turned to IGN, a current DTC is present.

USING KEY FOB: TSSM

General

The TSSM reception range for the key fob signal depends on a specific receiver pattern.

NOTE

Environmental and geographic conditions may affect signal range.

Arming the System

1. Hold key fob horizontal at waist level.
2. Point key fob at the front of the vehicle.
3. Hold down the key fob button until the system responds with two turn signal flashes.

Disarming the System

1. Hold key fob horizontal at waist level.
2. Point key fob at the front of the vehicle.
3. Quickly press the key fob button twice. The system will respond with one turn signal flash.

NOTE

*Disarming function may require practice. The key fob button **must** be pressed twice within 1.5 seconds to send the disarm command. The action is very similar to double-clicking a computer mouse. Light quick taps work best; very hard or very slow taps are less likely to work.*

Troubleshooting

If the key fob button has been pressed numerous times while away from the vehicle, the fob may fall out of synchronization with the TSSM. If this happens, the TSSM might fail to recognize the key fob's commands.

To solve this problem, press and hold the key fob button for 10-15 seconds until the security system responds with two turn signal flashes. After confirmation, you may resume normal fob operation.

USING THE PIN

General

The Personal Identification Number (PIN) consists of five digits entered using the left and right turn signal switches. Each digit can be any number from 1-9. The PIN is intended to be used to disarm the motorcycle in case the key fob becomes unavailable or inoperable.

See E.3 VEHICLE DELIVERY to set a PIN.

Disarming the System

Refer to Table E-8. If you make an error while disarming the TSSM using a PIN, the alarm will activate for 30 seconds after the last digit is entered. After a failed attempt, the security lamp will flash once every second for 10 minutes. **During this time, the vehicle will not accept any attempt to enter a PIN.**

Table E-8. Disarming TSSM with the PIN (Example: 3-1-3-1-3)

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set Engine Stop Switch to **OFF**.		
2	Turn Ignition Switch to **ACC**.		

Table E-8. Disarming TSSM with the PIN (Example: 3-1-3-1-3)

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
3	Hold **both** turn switches in until confirmation.	Security lamp blinks at fast rate.	System is ready for PIN entry.
4	Enter first digit of code (3) by pressing **left** turn switch **3 times**.		
5	Press **right** turn switch **1 time**.		Serves as "enter" key for first digit.
6	Enter second digit of code (1) by pressing **left** turn switch **1 time**.		
7	Press **right** turn switch **1 time**.		Serves as "enter" key for second digit.
8	Enter third digit of code (3) by pressing **left** turn switch **3 times**.		
9	Press **right** turn switch **1 time**.		Serves as "enter" key for third digit.
10	Enter fourth digit of code (1) by pressing **left** turn switch **1 time**.		Serves as "enter" key for fourth digit.
11	Press **right** turn switch **1 time**.		
12	Enter fifth digit of code (3) by pressing **left** turn switch **3 times**.		System is disarmed. You may use the vehicle or program another key fob.
13	Press **right** turn switch **1 time**.	Security lamp stops blinking.	

TSM/TSSM

To diagnose system problems, start by observing the behavior of the security lamp.

NOTES

- *See Figure E-7. "Key ON" means that the Ignition Switch is turned to IGNITION and the Engine Stop Switch is set to RUN (although the engine is not running).*
- *See Figure E-8. When the Ignition Switch is turned to IGN, the security lamp will illuminate for approximately four seconds and then turn off.*
- *If the security lamp is not illuminated at Key ON or if it fails to turn OFF after the initial four-second period, the speedometer may need to be replaced. See E.10 SPEEDOMETER SELF DIAGNOSTICS. If "BUS Er" is displayed on the odometer, it may take up to twenty seconds for the security lamp to illuminate.*
- *The security lamp will also light for eight seconds after the bulb check if historic DTCs are present. The security lamp will stay on if current DTCs are set. If a historic DTC is present, the security lamp will light for 2 ignition cycles or until the DTC is cleared manually.*

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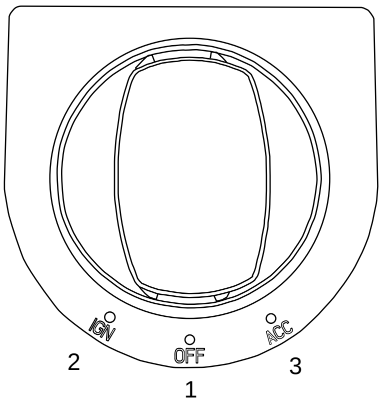

1. **Ignition OFF**
2. **Ignition ON**
3. **Marker Lights (ACC) ON**

Figure E-7. Ignition Switch

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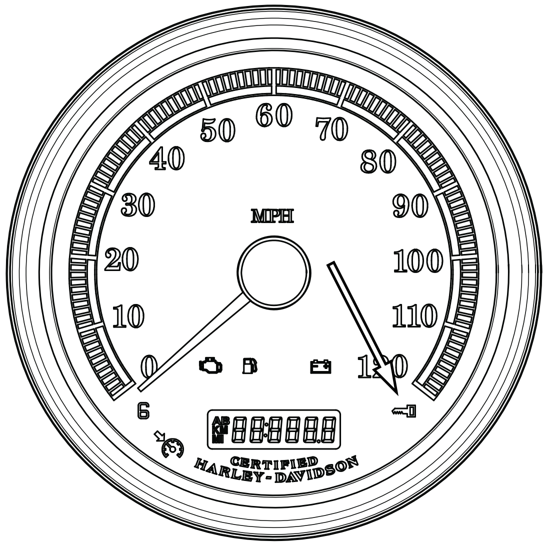


Figure E-8. Security Lamp (Key Icon)

1. See Figure E-9. After the lamp turns off after being illuminated for the first four-second period, one of three events may occur:
   a. The lamp remains off. This indicates there are no current fault conditions or stored historic DTCs currently detected by the TSSM.
   b. The lamp stays off for only four seconds and then comes back on for an eight-second period. This indicates a historic DTC is stored, but no current DTC exists.
   c. The lamp remains on beyond the eight-second period. This indicates a current DTC exists.
2. See E.8 DIAGNOSTIC TROUBLE CODES (DTC), Code Types for a complete description of DTC formats.

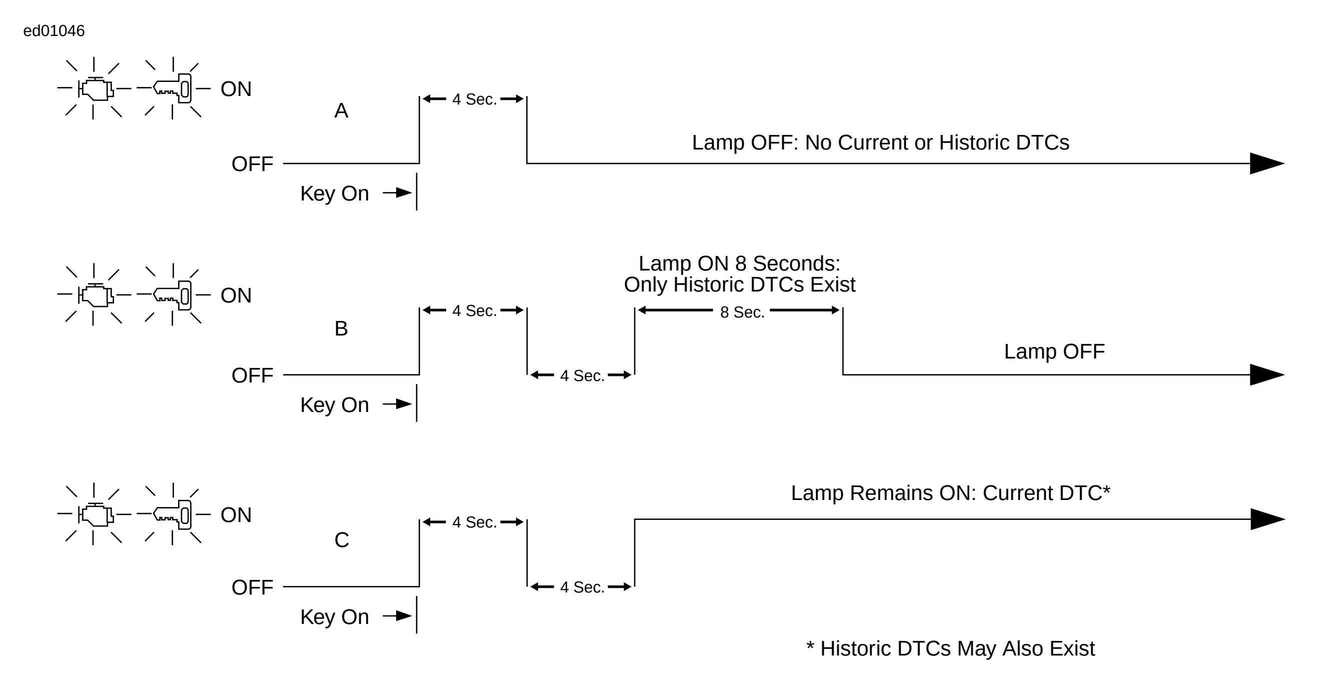


Figure E-9. Security Lamp Operation

CODE TYPES

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

There are two types of Diagnostic Trouble Codes (DTCs): current and historic. If a DTC is stored, it can be read using either a computer based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750) or speedometer self diagnostics. See E.10 SPEEDOMETER SELF DIAGNOSTICS.

NOTES

- *Speedometer self diagnostics will display both current and historic DTCs. To differentiate between current and historic DTCs, a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750) must be employed.*
- *All DTCs reside in the memory of the ECM, TSM/TSSM, speedometer or tachometer until the DTC is cleared by use of the speedometer self diagnostics. See E.10 SPEEDOMETER SELF DIAGNOSTICS.*
- *A historic DTC is also cleared after a total of 50 ignition cycles has elapsed. After the 50 ignition cycles retention period, the DTC is automatically erased from memory providing that no subsequent faults of the same type are detected in that period.*

Current

Current DTCs are those which are present during the current ignition cycle. See the appropriate flow charts for solutions.

Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic DTC rather than a current DTC. For example, intermittent output shorts can become typical historic DTCs.

Historic DTCs are stored for 50 ignition cycles after any DTC was last set as current to assist in the diagnosis of intermittent faults. On the 50th cycle, the DTC will clear itself. The security lamp will only indicate the existence of only historic DTCs for two ignition cycles.

It is important to note that historic DTCs will exist whenever the system indicates the existence of a current fault. See E.8 DIAGNOSTIC TROUBLE CODES (DTC), Multiple Diagnostic Trouble Codes if multiple DTCs are found.

Diagnostic charts are designed for use with current DTCs and as a result they frequently suggest part replacement. When diagnosing an historic DTC the charts can be helpful but should not lead to part replacement without verification the part is faulty.

RETRIEVING DIAGNOSTIC TROUBLE CODES

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

The TSM/TSSM supports two levels of diagnostics.

- The most sophisticated mode employs a computer-based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750).
- The second mode requires using speedometer self diagnostics. Speedometer, tachometer (if equipped), TSM/TSSM and ECM DTCs can be accessed and cleared. See E.10 SPEEDOMETER SELF DIAGNOSTICS.

MULTIPLE DIAGNOSTIC TROUBLE CODES

While it is possible for more than one fault to occur and set more than one DTC, there are several conditions which may result in **one** fault setting **multiple** DTCs:

Serial data DTCs (U1016, U1255, U1300 and U1301) may be accompanied by other DTCs. **Always** correct the serial data DTCs before resolving the other DTCs.

Refer to Table E-9. This table gives most TSM/TSSM DTCs a priority ranking.

Table E-9. TSM/TSSM Diagnostic Trouble Codes (DTC) and Fault Conditions

PRIORITY	DTC	FAULT CONDITION	DIAGNOSTICS
1	U1300	J1850 short-to-ground	E.20 DTC U1300, U1301 OR BUS ER.
2	U1301	J1850 short-to-battery	E.20 DTC U1300, U1301 OR BUS ER.
3	U1016	Loss of serial communications - ECM	E.19 DTC U1016, U1255.
4	U1255	Loss of serial communication - general	E.19 DTC U1016, U1255.
5	B1135	Accelerometer fault	E.17 DTC B1135.
6	B1151	Bank angle short-to-ground	Sidecar Service Manual.
7	B1152	Bank angle short-to-battery	Sidecar Service Manual.
8	B1153	Bank angle high	Sidecar Service Manual.
9	B1154	Clutch switch input short-to-ground	E.18 DTC B1154, DTC B1155.
10	B1155	Neutral switch input short-to-ground	E.18 DTC B1154, DTC B1155.
11	B1134	Start relay output short-to-ground	E.16 DTC B1134.
12	B1121	Left turn lamp output fault	E.13 TURN SIGNAL ERRORS: B1121, B1122, B1141.
13	B1122	Right turn lamp output fault	E.13 TURN SIGNAL ERRORS: B1121, B1122, B1141.
14	B0563	Battery voltage high	E.14 DTC B0563.
15	B1131	Alarm output short-to-ground	E.15 DTC B1131, B1132.
16	B1132	Alarm output short-to-ground	E.15 DTC B1131, B1132.
17	B1141	Ignition switch input short-to-ground or open	E.13 TURN SIGNAL ERRORS: B1121, B1122, B1141.

GENERAL

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

To locate faulty circuits or other system problems, follow the diagnostic flow charts. For a systematic approach, always begin with E.9 INITIAL DIAGNOSTIC CHECK: TSM/TSSM, Initial Diagnostics. Read the general information and then work your way through the flow chart box by box.

Diagnostic Notes

If a numbered circle appears adjacent to a flow chart box, then more information is offered in the diagnostic notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual where information on the location and removal of components may be obtained.

Circuit Diagram/Wire Harness Connector Table

When working through a flow chart, refer to the illustrations, the associated circuit diagram and the wire harness connector table as necessary. The wire harness connector table for each circuit diagram identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a Breakout Box and a DVOM are required. See E.21 TSM/TSSM: PASSWORD LEARN or E.11 BREAKOUT BOX: TSM/TSSM.

To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Job/Time Code Values

Some charts may contain warranty job/time codes. Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

Reprogramming ECM

Diagnostic charts frequently suggest ECM replacement. In the event an ECM needs to be replaced, it must be reprogrammed using a DIGITAL TECHNICIAN (Part No. HD-44750). See your dealer. Password learn procedure must also be performed. See E.21 TSM/TSSM: PASSWORD LEARN.

INITIAL DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	INSTRUMENT HARNESS ADAPTERS

Diagnostic Tips

- If speedometer reads "BUS Er" with the Ignition Switch turned to IGN (Engine Stop Switch at RUN with the engine off), check data bus for an open or short to ground between data link connector [91A] terminal "3" and ECM connector [78B] terminal "5", TSSM connector [30B] terminal "3", speedometer connector [39B] terminal "2" or tachometer (if equipped) connector [108B] terminal "2".
- Check for an open diagnostic test terminal between data link connector [91A] terminal "3" and TSM/TSSM connector [30B] terminal "3". With Ignition Switch turned to IGN, serial data bus voltage should be typically 0.6-0.8 volt. The range of acceptable voltage is 0-7.0 volts.
- To identify intermittents, wiggle vehicle harness while performing steps in the flow charts.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness connector [39B] and speedometer connector [39A] using INSTRUMENT HARNESS ADAPTERS (Part No. HD-46601). See 2.5 BREAKOUT BOX: SPEEDOMETER.
2. Compare TSM/TSSM system behavior to symptoms in Table E-10.

All TSM/TSSM DTCs are listed in Table E-9.

Table E-10. Symptoms That May Not Set Diagnostic Trouble Codes

SYMPTOM	SOLUTION
Fails to disarm	E.12 FAILS TO DISARM (TSSM ONLY).
Turn signal will not cancel or cancels erratically	E.13 TURN SIGNAL ERRORS: B1121, B1122, B1141.
Turn signal flashes double normal rate, all bulbs good	E.13 TURN SIGNAL ERRORS: B1121, B1122, B1141.

Other Diagnostic Trouble Codes (DTCs)

See 2.5 BREAKOUT BOX: SPEEDOMETER for any DTCs related to the speedometer.

See 4.5 INITIAL DIAGNOSTIC CHECK for any DTCs related to the Electronic Control Module (ECM).

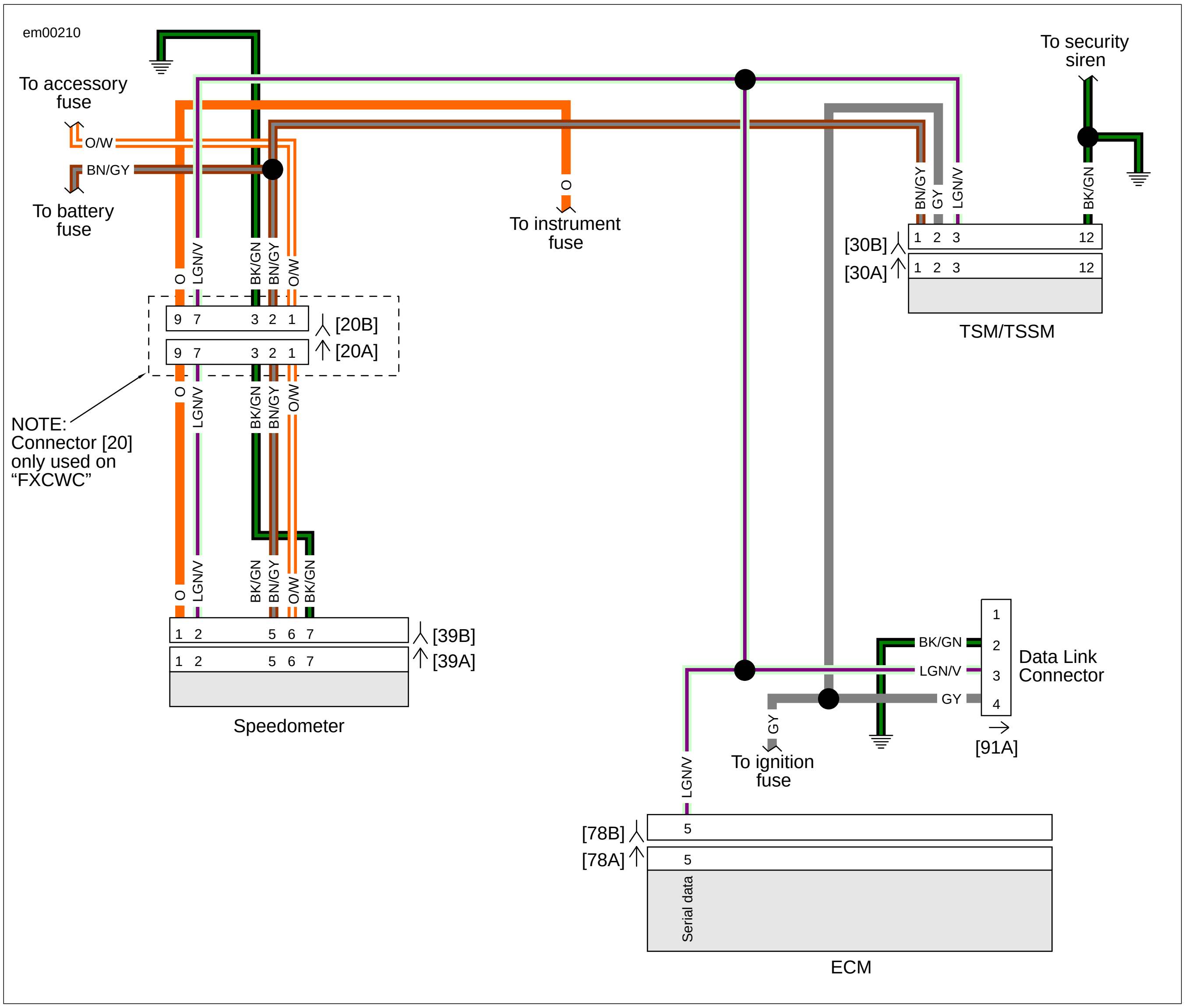
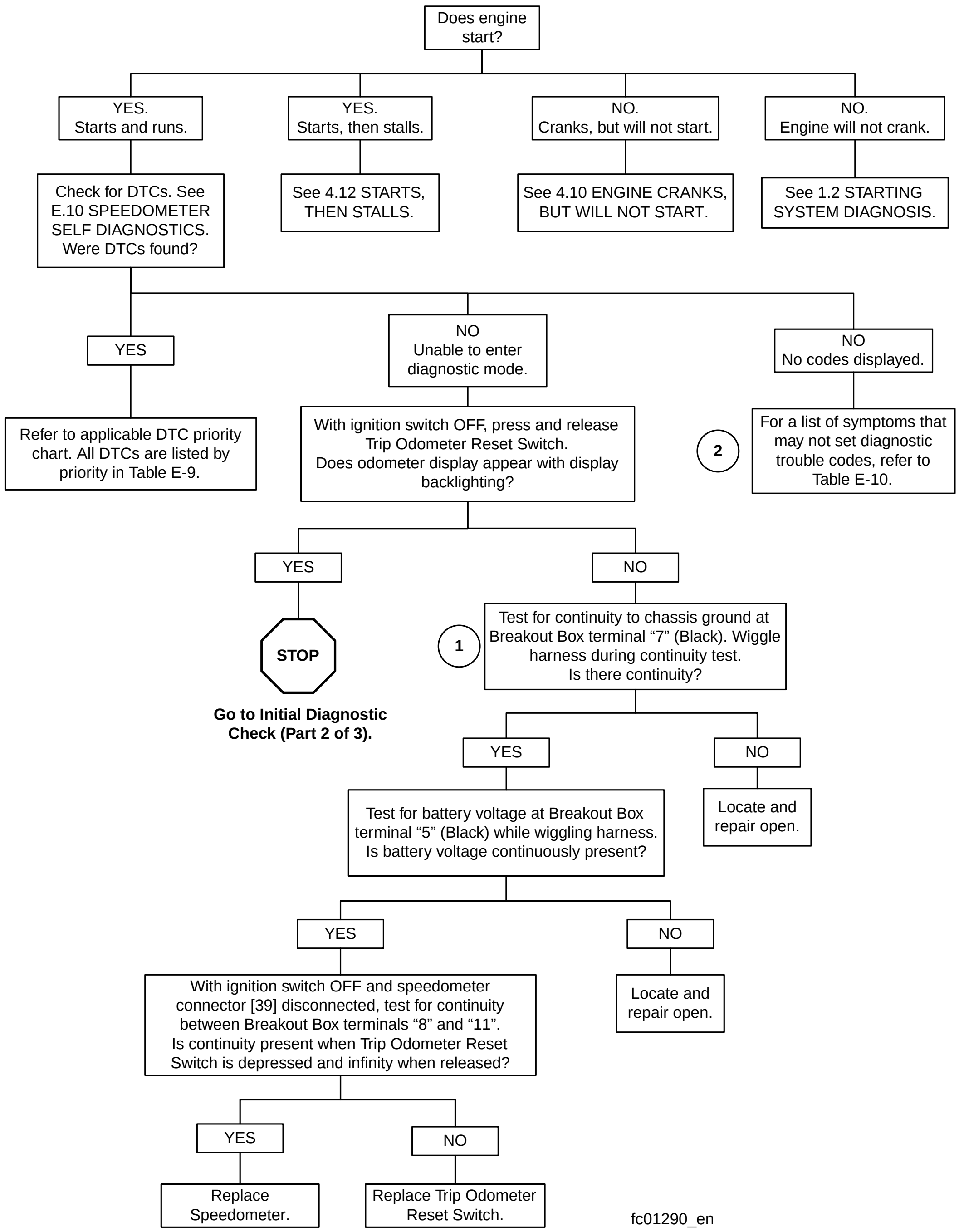


Figure E-10. Diagnostic Check

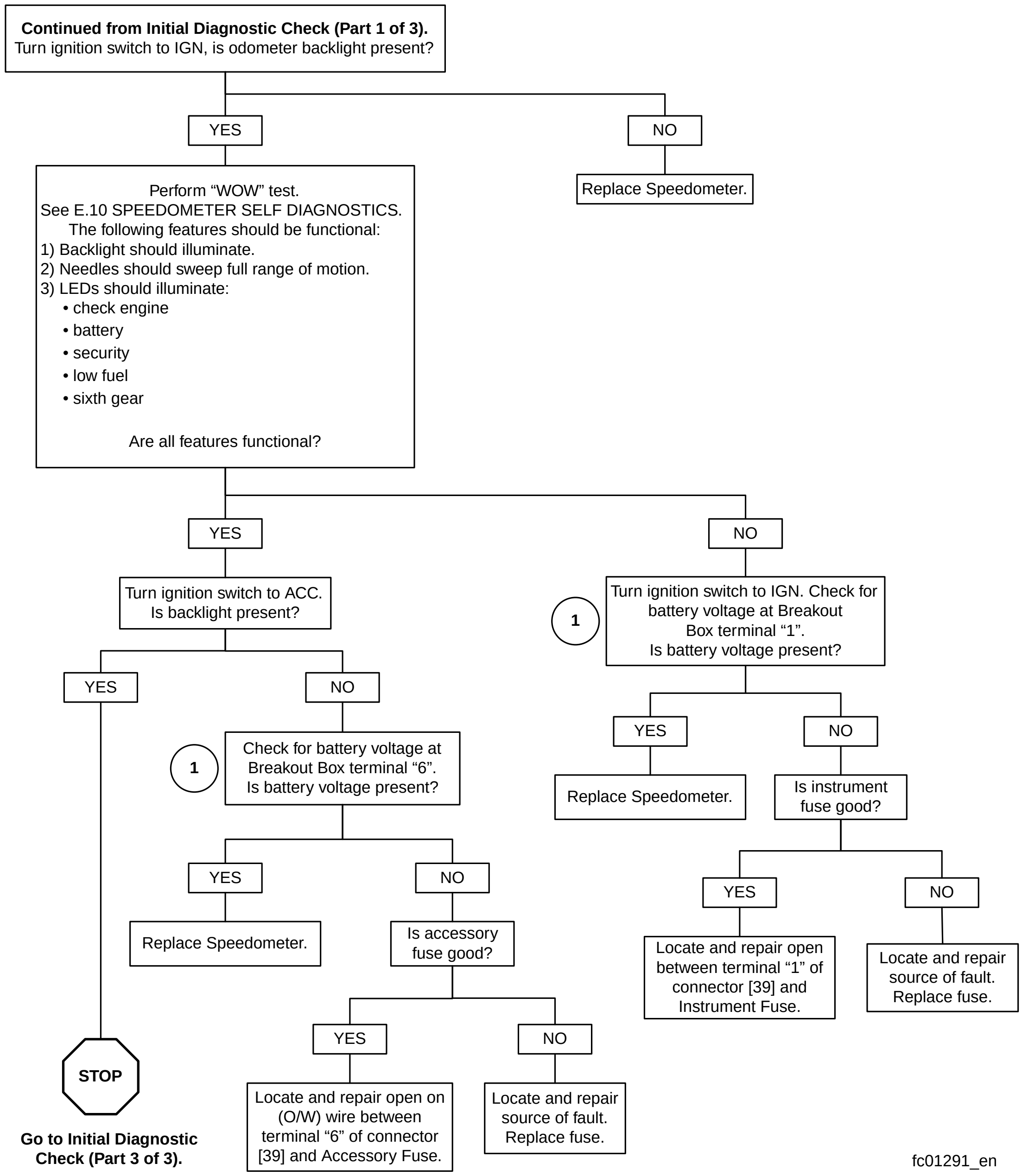
Table E-11. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat

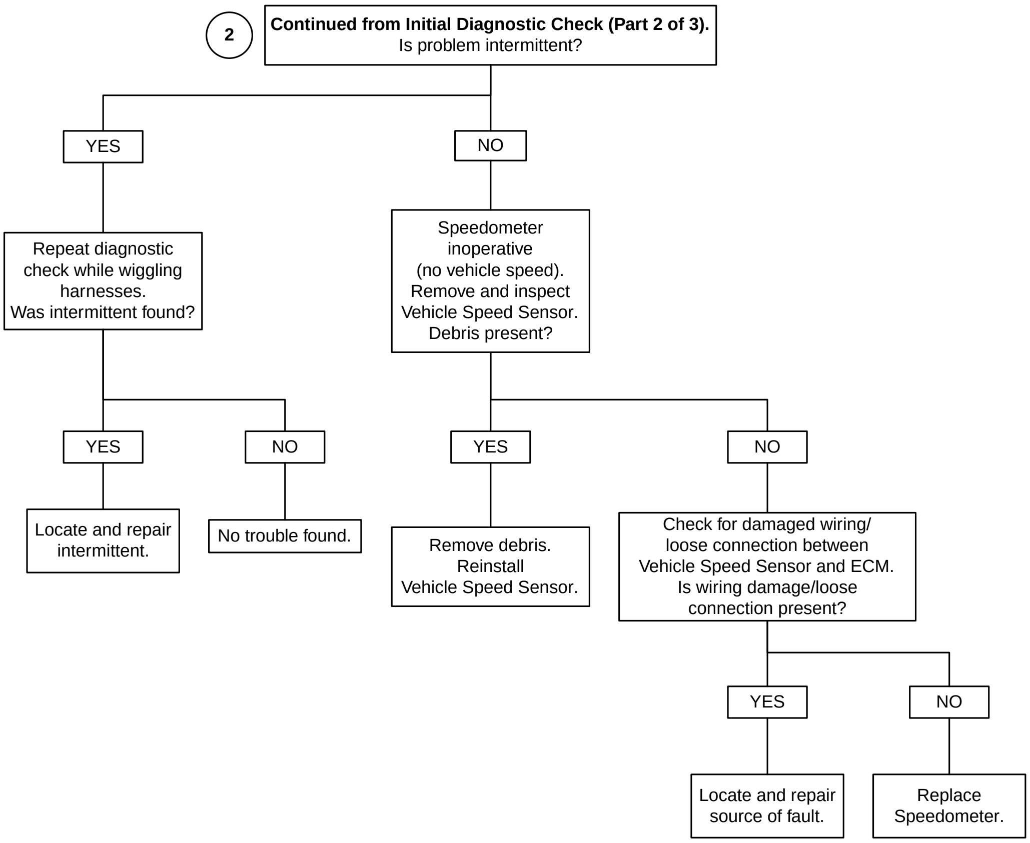
Initial Diagnostic Check (Part 1 of 3)



Initial Diagnostic Check (Part 2 of 3)



Initial Diagnostic Check (Part 3 of 3)



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GENERAL

The speedometer is capable of displaying and clearing speedometer, tachometer, TSM/TSSM, and Electronic Control Module (ECM) Diagnostic Trouble Codes (DTCs) (diagnostic mode).

DIAGNOSTICS

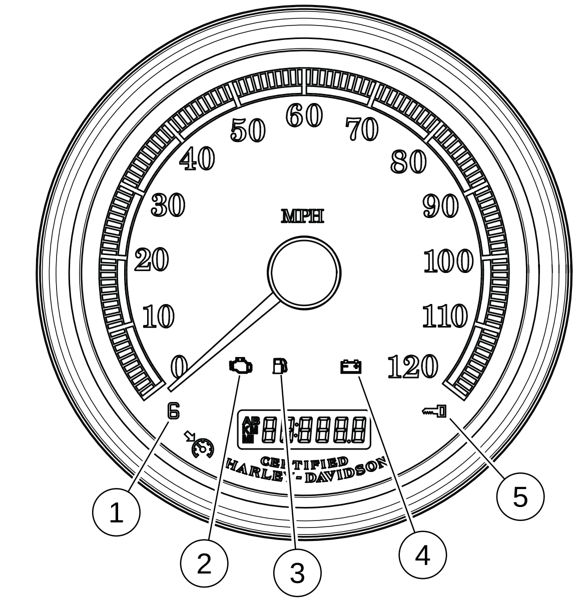
Diagnostic Tips

- For a quick check of speedometer function, a "WOW" test can be performed. Press and hold trip odometer reset switch then turn Ignition Switch ON. Release trip odometer reset switch. See Figure E-11. Background lighting should illuminate, gauge needles should sweep their full range of motion, and indicator lamps (battery, security, low fuel, and check engine) should illuminate. All lamps should illuminate, even those not used in normal vehicle operations.
- If speedometer fails "WOW" test, check for battery, ground, ignition, trip odometer reset switch and accessory wiring to speedometer. If any feature in the speedometer is non-functional, see 2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER.

Diagnostic Notes

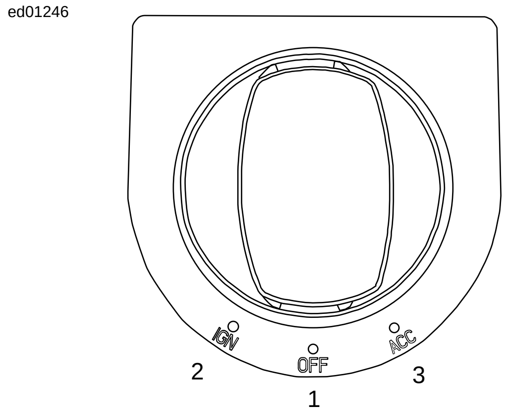
Each reference number below correlates to a circled number on the flow chart(s).

1. To exit diagnostic mode, turn Ignition Switch OFF.
2. To clear DTCs for the selected module, press the trip odometer reset switch for more than 5 seconds when a DTC is displayed. This procedure will clear all DTCs for the selected module.



1. **Sixth gear indicator**
2. **Check engine**
3. **Low fuel**
4. **Battery**
5. **Security lamp (key icon)**

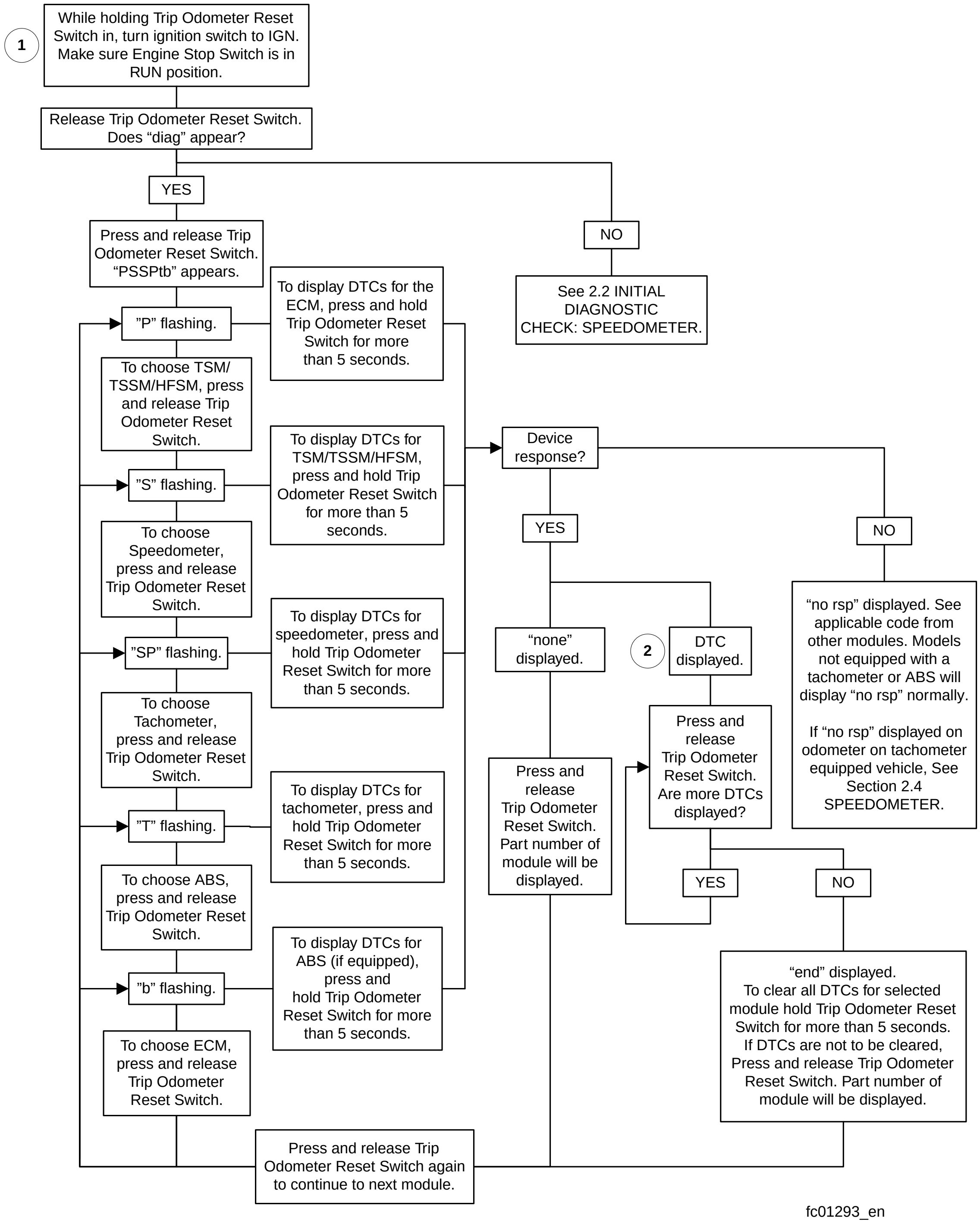
Figure E-11. Speedometer



1. **Ignition ON**
2. **Ignition OFF**
3. **Marker Lights (ACC) ON**

Figure E-12. Ignition Switch

Speedometer Self Diagnostics



GENERAL

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

The BREAKOUT BOX (Part No. HD-42682) splices into the main harness. Used in conjunction with a digital volt/ohmmeter (DVOM), it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects.

INSTALLATION

1. Disarm security system (if installed).
2. Gain access to TSM/TSSM. See the Service Manual.
3. Depress latches on connector [30B].
4. Attach Breakout Box to connector.
   a. Mate gray socket housing on Breakout Box with TSM/TSSM connector [30A].
   b. Mate gray pin housing on Breakout Box with wire harness connector [30B].

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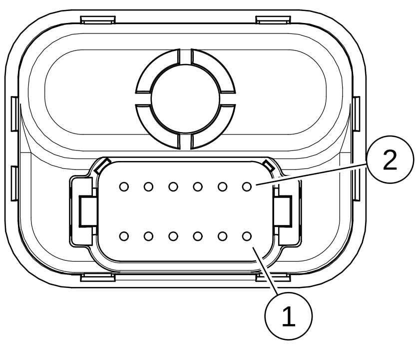

1. **Terminal 1**
2. **Terminal 12**

Figure E-13. TSM/TSSM Connector Pins

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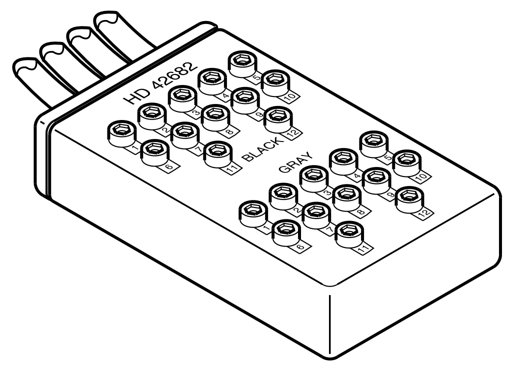


Figure E-14. Breakout Box: TSSM

REMOVAL

1. Depress latches on connector [30B].
2. Detach gray Breakout Box connector from TSM/TSSM connector [30A].
3. Detach gray Breakout Box connector from wire harness connector [30B].
4. Reinstall TSM/TSSM. See the Service Manual.
5. Install parts removed for access.

NOTE

Vehicle will not start with TSM/TSSM disconnected or incorrectly mounted.

Table E-12. TSM/TSSM Connector [30B]

TERMINAL	FUNCTION	TERMINAL	FUNCTION
1	Battery	7	Right turn switch input
2	Ignition	8	Left turn switch input
3	Serial data	9	Start relay control
4	Neutral switch	10	Clutch switch
5	Left turn feed	11	Alarm signal
6	Right turn feed	12	Ground

GENERAL

Security Equipped Vehicles Only

This section applies only to those vehicles equipped with the optional Turn Signal Security Module (TSSM).

NOTE

*Disarming function may require practice. The key fob button **must** be pressed twice within 1.5 seconds to send the disarm command. The action is very similar to double-clicking a computer mouse. Light quick taps work best; very hard or very slow taps are less likely to work.*

The key fob sends a RF signal to activate all remote TSSM functions. The left front turn signal switch wire serves as the vehicle's antenna. If the TSSM does not respond (no confirmation at arming/disarming system) or responds weakly (limited range, won't consistently arm/disarm or synchronize), follow the flow chart.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

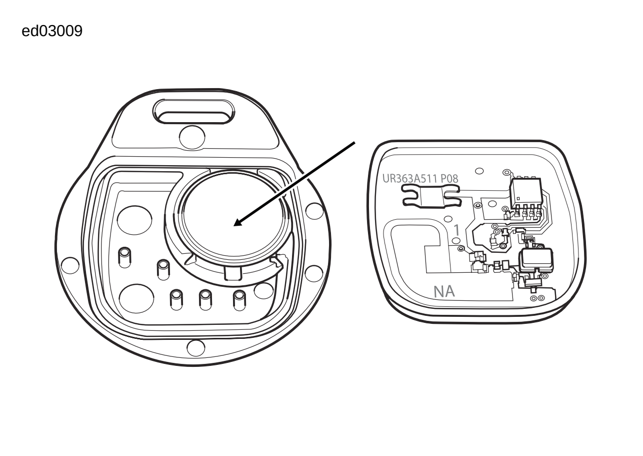


Figure E-15. Key Fob Battery: TSSM

DIAGNOSTICS

Diagnostic Tips

- Verify key fob battery voltage is at least 2.9 volts. See E.22 TSSM MAINTENANCE.
- Interference from physical surroundings may affect RF transmission. Place fob next to left handgrip and disarm with two clicks or move motorcycle to a new location and retest.
- Check for damage to antenna wire. Does left turn signal work?

NOTE

See E.7 ARMING/DISARMING (TSSM ONLY). Use only the proper key fob for your market and TSSM package.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. After a battery disconnect, the TSSM will not enter the configuration mode on the first attempt. All attempts to assign a fob or enter the configuration mode will require at least two attempts.

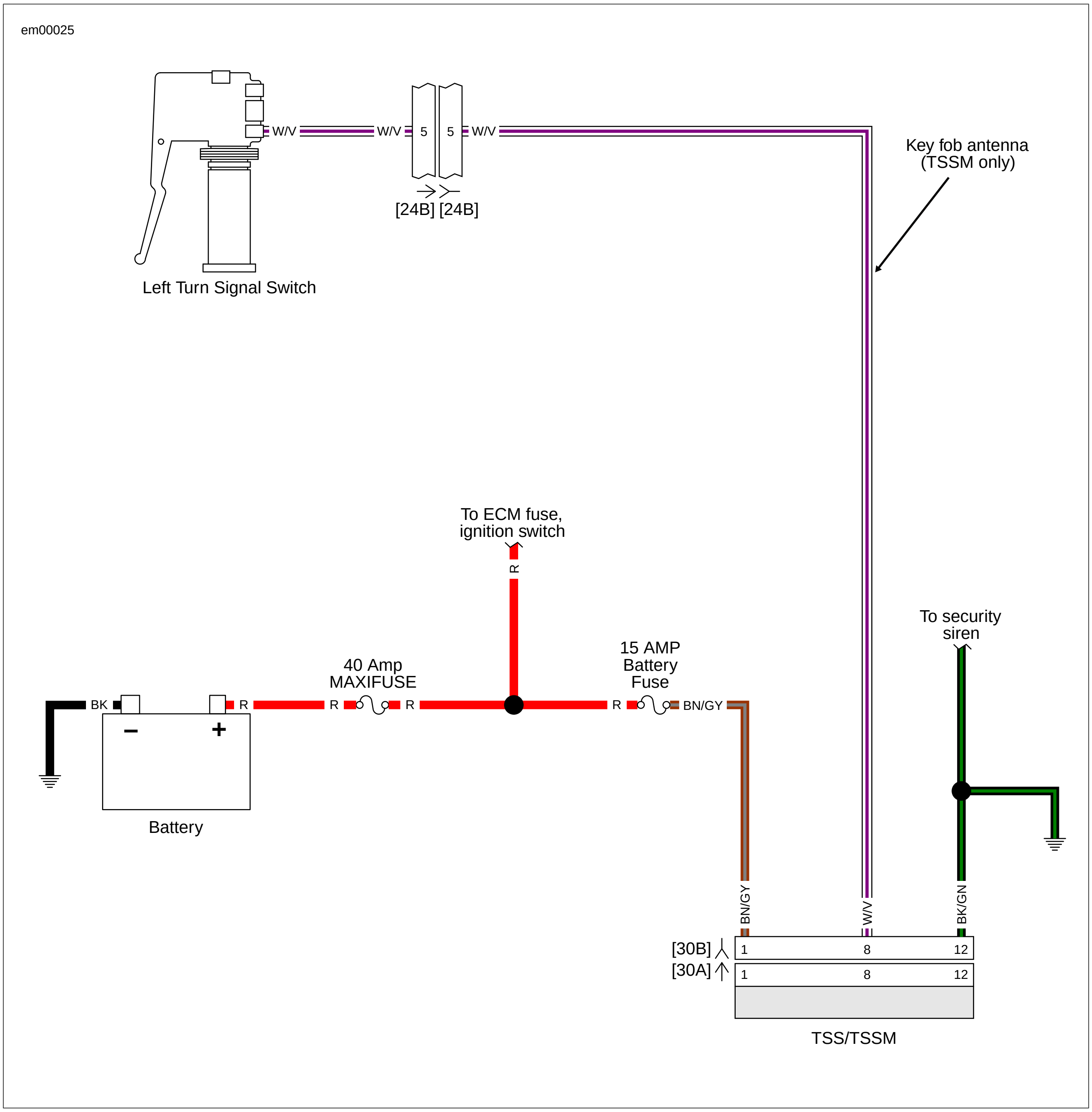
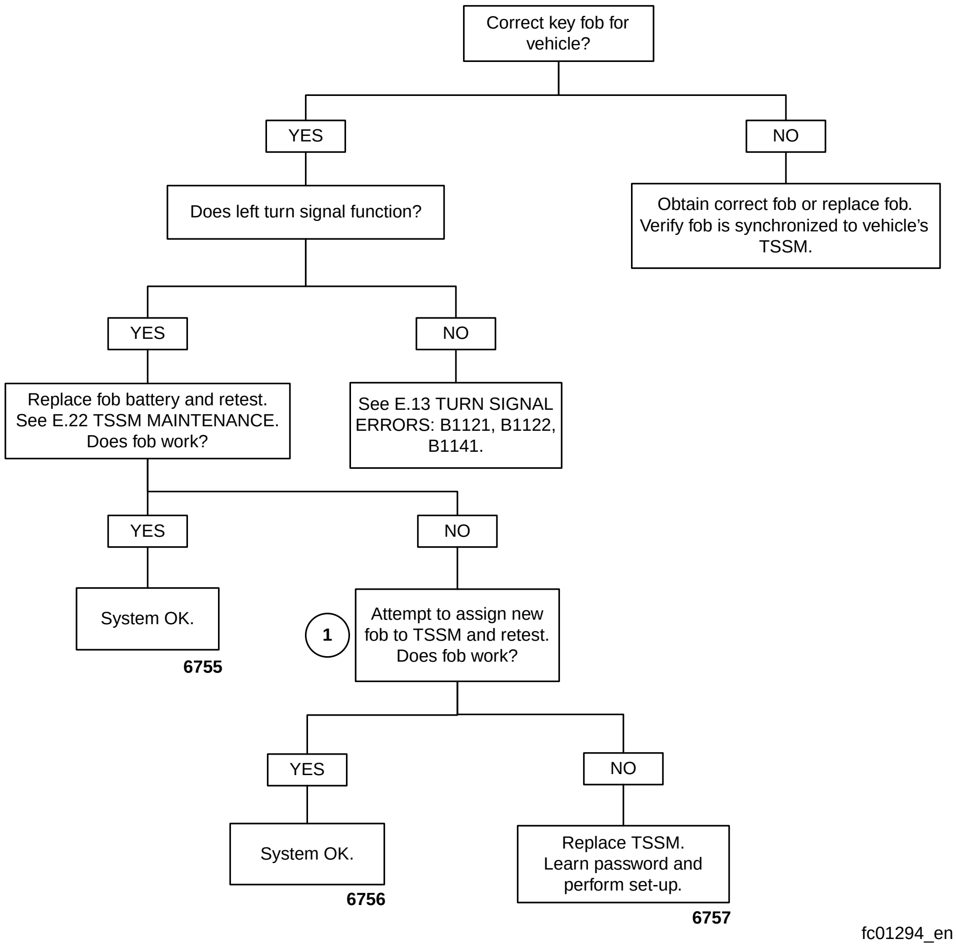


Figure E-16. Security Antenna Circuit

Table E-13. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[24]	Left hand controls and horn	8-place Molex	Under fuel tank, left side
[30]	TSM/TSSM	12-place Deutsch	Electrical panel behind fender extension

Fails to Disarm



GENERAL

The turn signals will automatically cancel based on either the speed/acceleration of the vehicle or upon turn completion. See E.4 TURN SIGNAL FUNCTIONS.

For turn signal diagnostics, refer to Table E-14.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.

Figure E-17. TSM/TSSM

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT

Diagnostic Tips: All

- DTC B1121 and B1122 will illuminate the security lamp.
- DTC B1141 will not illuminate the security lamp.
- When the TSM/TSSM is in 4-way flasher mode, a fault on either the left or right turn lamp output will not cause either DTC B1121 and DTC B1122 to be set. If fault occurs on both left and right outputs, then both DTC B1121 and DTC B1122 will be set.
- When the TSM/TSSM detects an over current or short to ground condition, it will turn off the turn lamp outputs. The outputs will be automatically reactivated once the fault is removed.

Table E-14. Turn Signal Errors: TSM/TSSM

DTC	SYMPTOM	START WITH FLOW CHART
N/A	Turn signals cancel erratically.	Turn Signal Error 1A (Part 2 of 2) Cancels Erratically
B1121 B1122 B1141	Turn signals will not flash, 4-way flashers inoperable.	Turn Signal Error 2A, Will Not Flash, 4-Way Flashers Inoperable: DTC B1121, B1122, B1141
N/A	Turn signals will not cancel upon turn completion.	Turn Signal Error 1A (Part 1 of 2) Will Not Cancel Upon Turn Completion
N/A	Left or right turn signals flash at double the normal rate while all bulbs are working.	Turn Signal Error 3A, Flash at Double Normal Rate, All Bulbs Working

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Gain access to vehicle's TSM/TSSM. Perform the following procedure:
   a. See Figure E-18. Position TSM/TSSM in same orientation it is mounted on vehicle. Turn Ignition Switch on. Turn 4-way flashers on by depressing both left and right turn signal switches simultaneously. Turn Ignition Switch off. The 4-way flashers should continue to flash.
   b. Tilt TSM/TSSM greater than 45 degrees to the left.
   c. Repeat step a.
   d. Tilt TSM/TSSM greater than 45 degrees to the right.
2. To enable diagnostic mode, see E.10 SPEEDOMETER SELF DIAGNOSTICS.
3. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/TSSM connector [30A] and wiring harness connector [30B]. See E.11 BREAKOUT BOX: TSM/TSSM.
4. Closely inspect handlebar controls for pinched wiring.
5. Connect gray HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B) adapters and patch cords to connector [22] (right) or connector [24] (left).

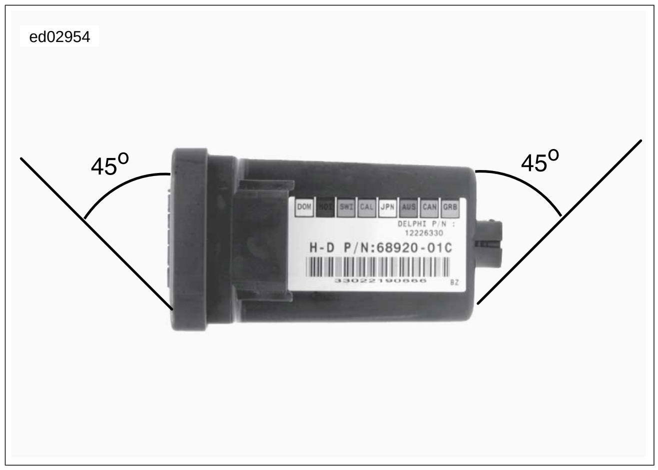


Figure E-18. Tilting TSM/HFSM

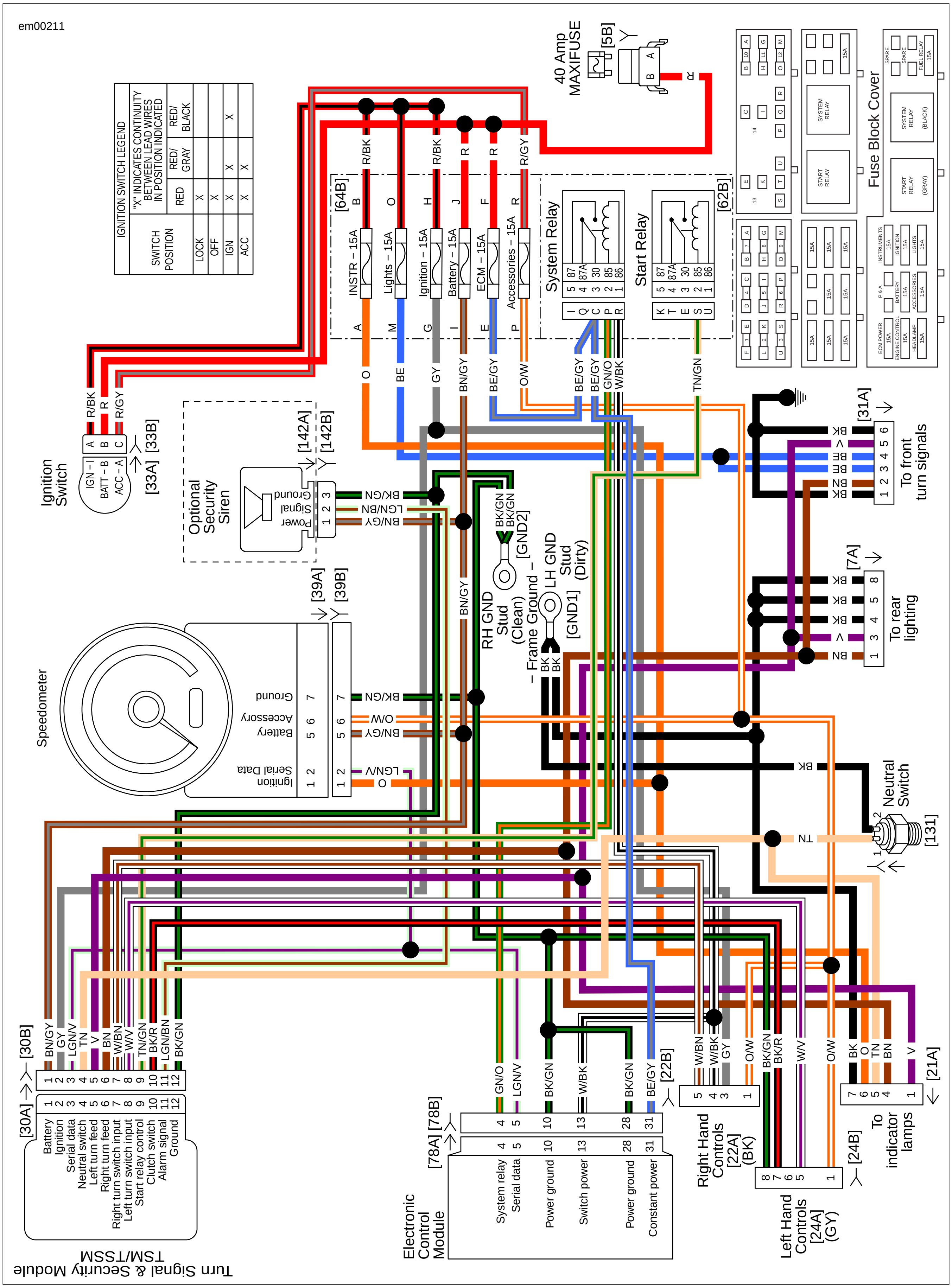


Figure E-19. Turn Signal Circuit (all except FXCWC)

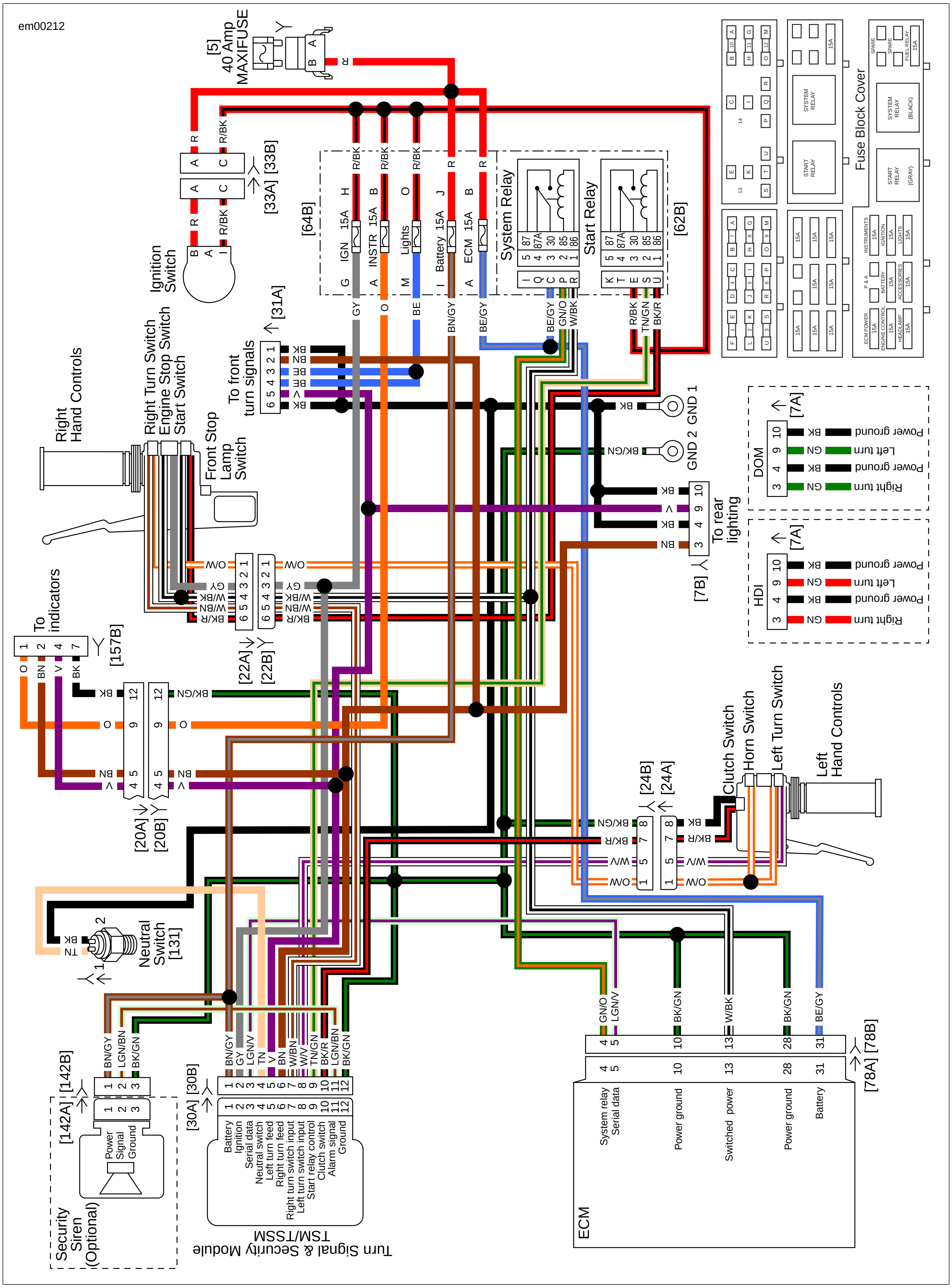
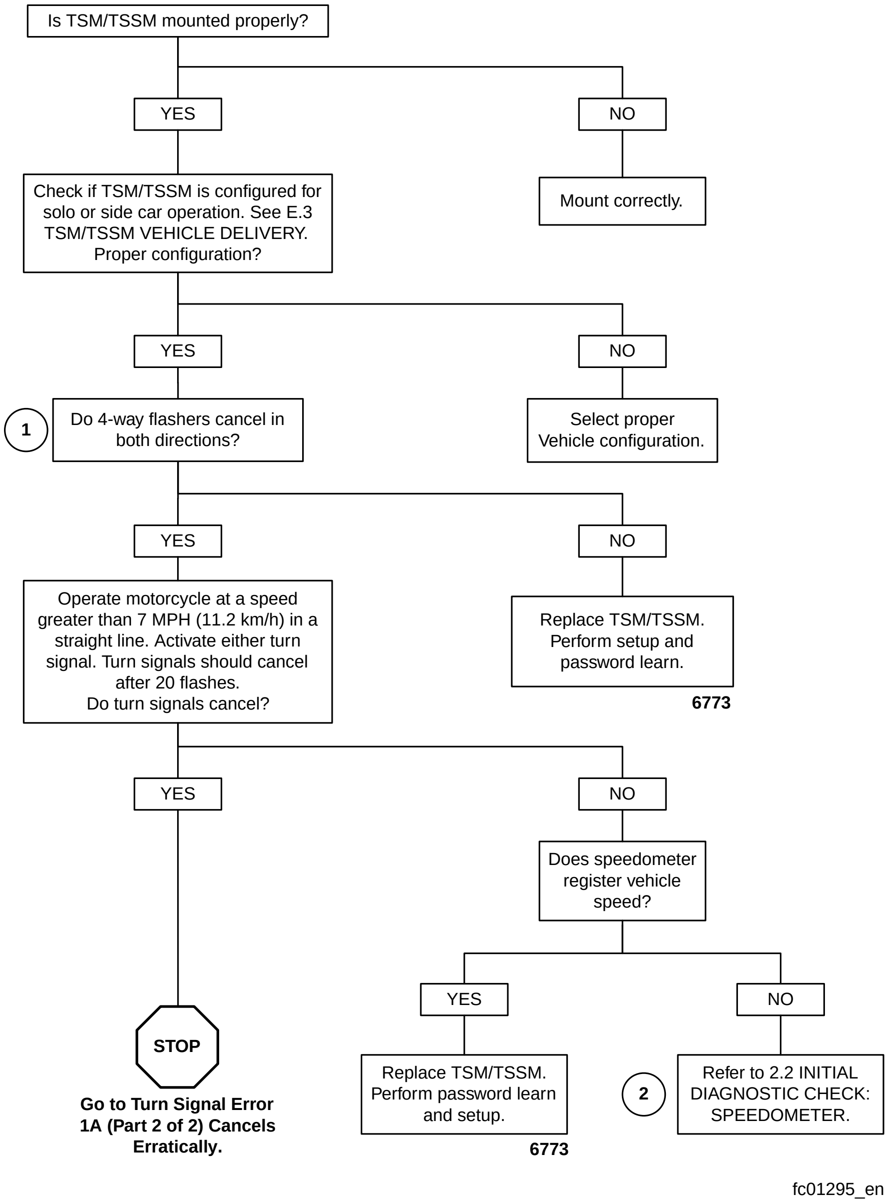


Figure E-20. Turn Signal Circuit (FXCWC)

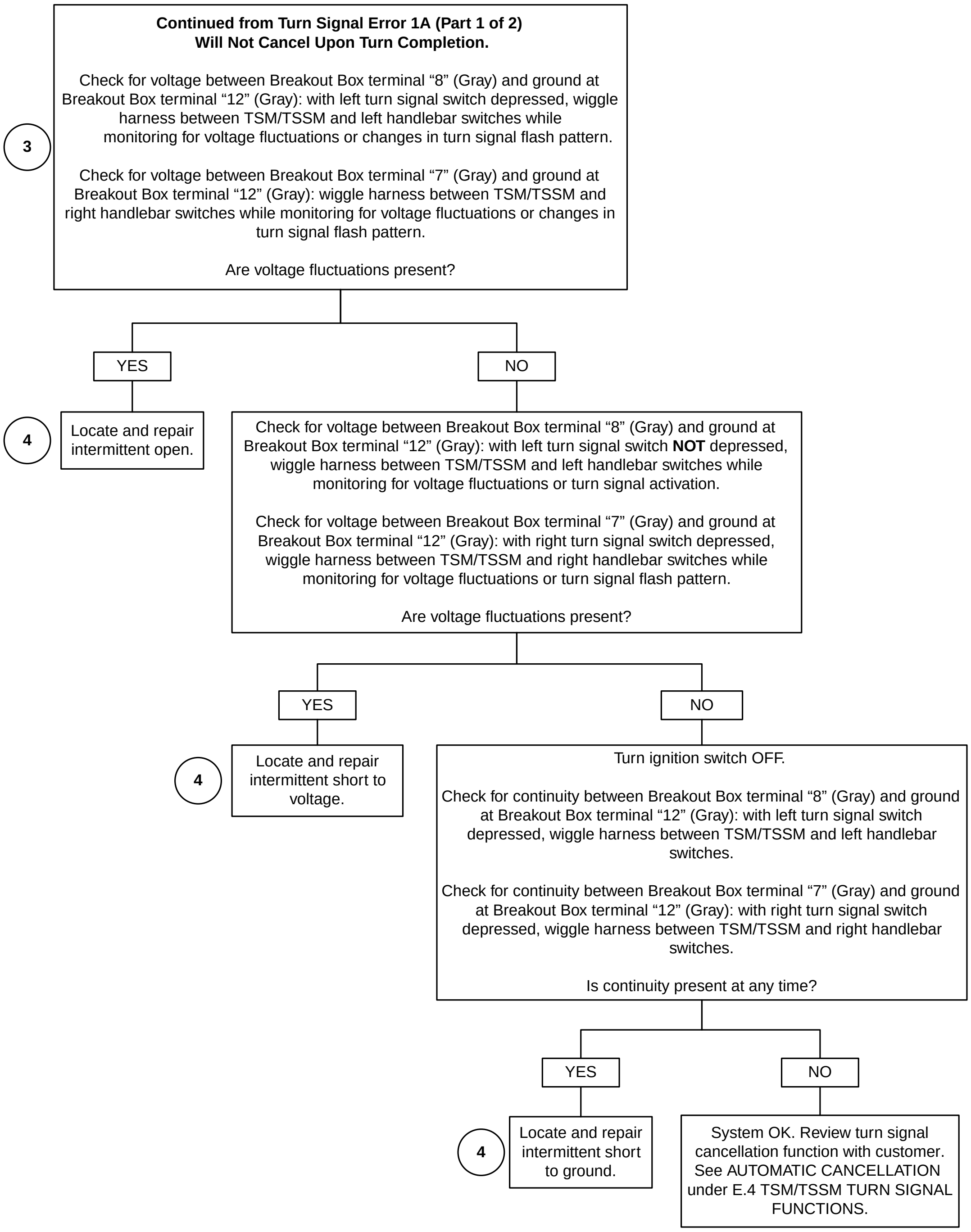
Table E-15. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[18]	Left rear turn signal	2-place Multilock	Inside tail lamp lens
[19]	Right rear turn signal	2-place Multilock	Inside tail lamp lens
[20]	Console harness	12-place Molex	Under console
[21]	Indicator lamps	8-place Mini-Deutsch	Under fuel tank console
[22]	Right hand controls	6-place Molex	Under fuel tank, right side
[24]	Left hand controls	8-place Molex	Under fuel tank, left side
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[31 L]	Front turn signals (left)	3-place Multilock	Inside top frame tube
[31 R]	Front turn signals (right)	3-place Multilock	Inside top frame tube
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)

Turn Signal Error 1A (Part 1 of 2) Will Not Cancel Upon Turn Completion



Turn Signal Error 1A (Part 2 of 2) Cancels Erratically



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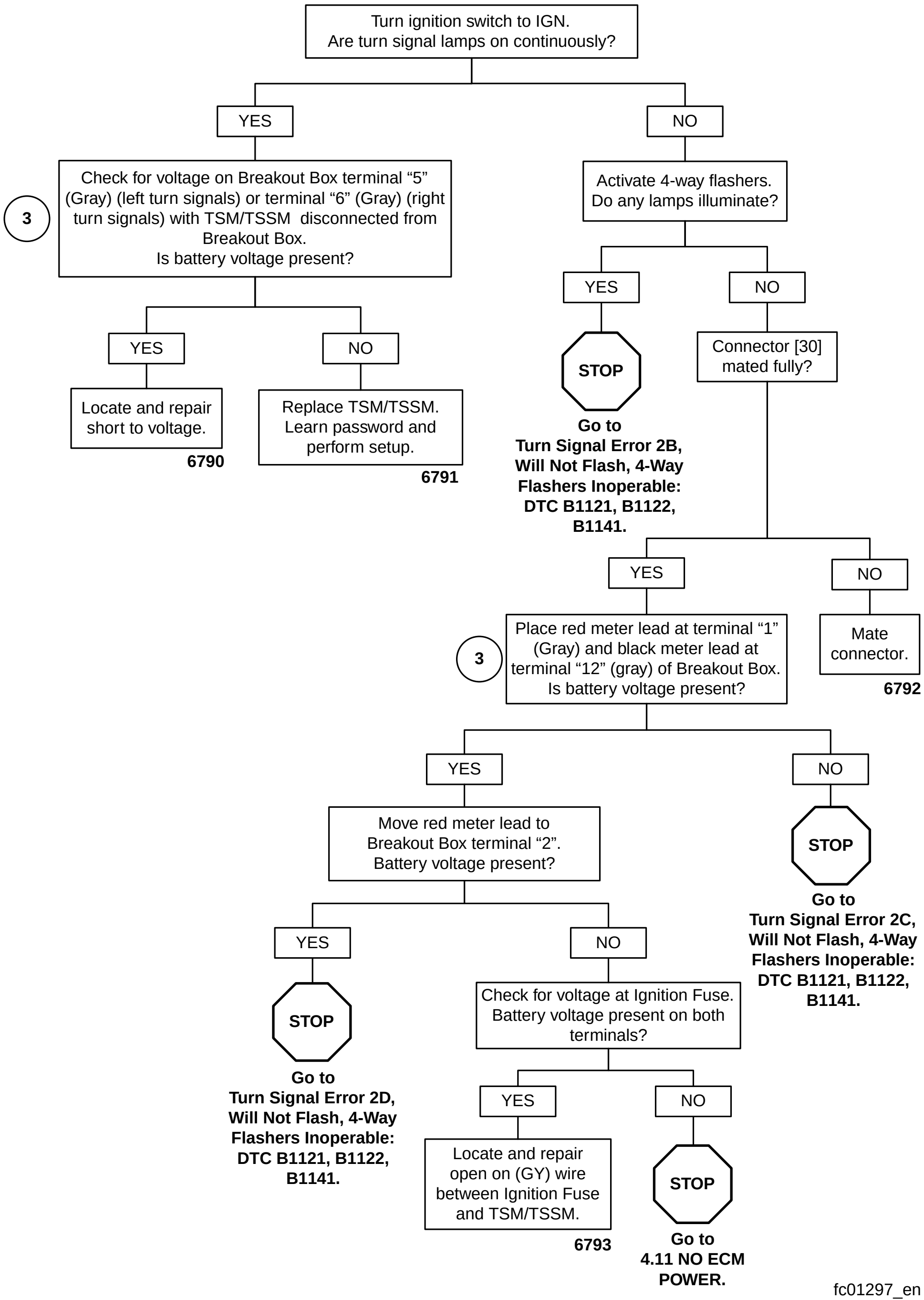
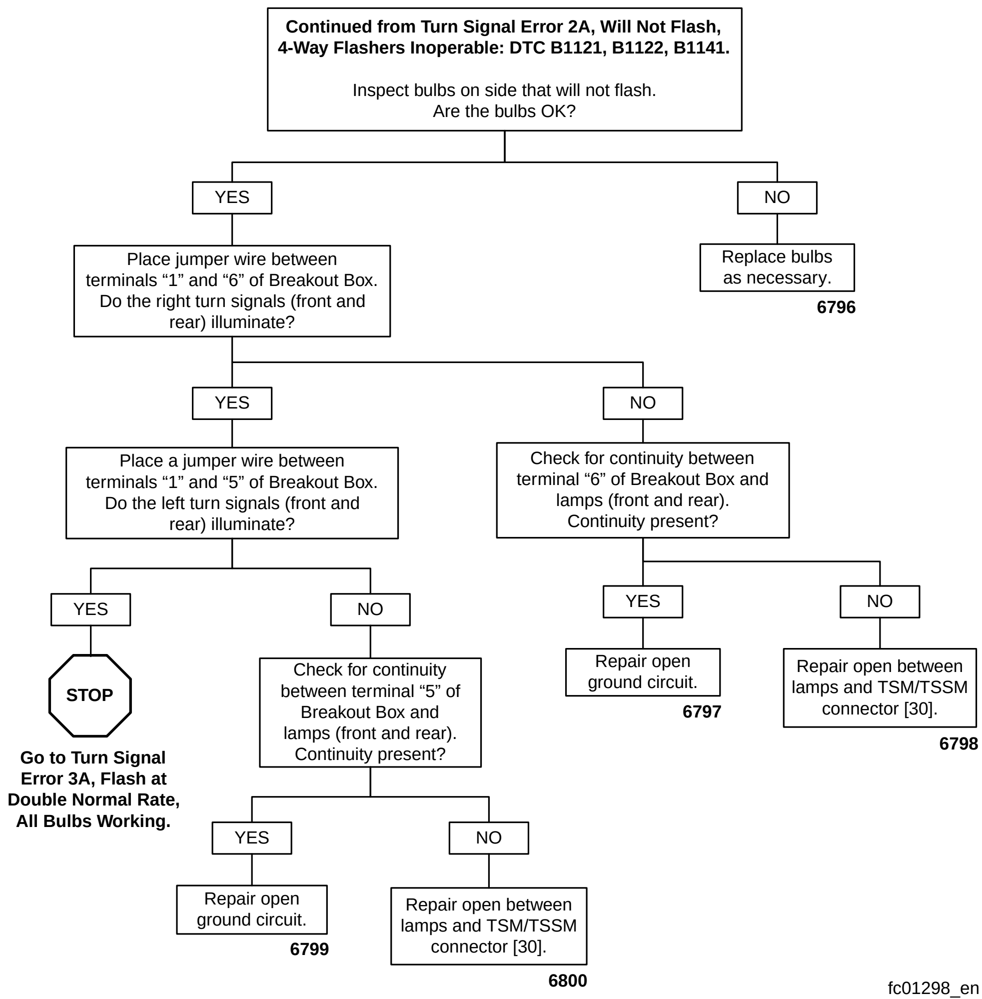
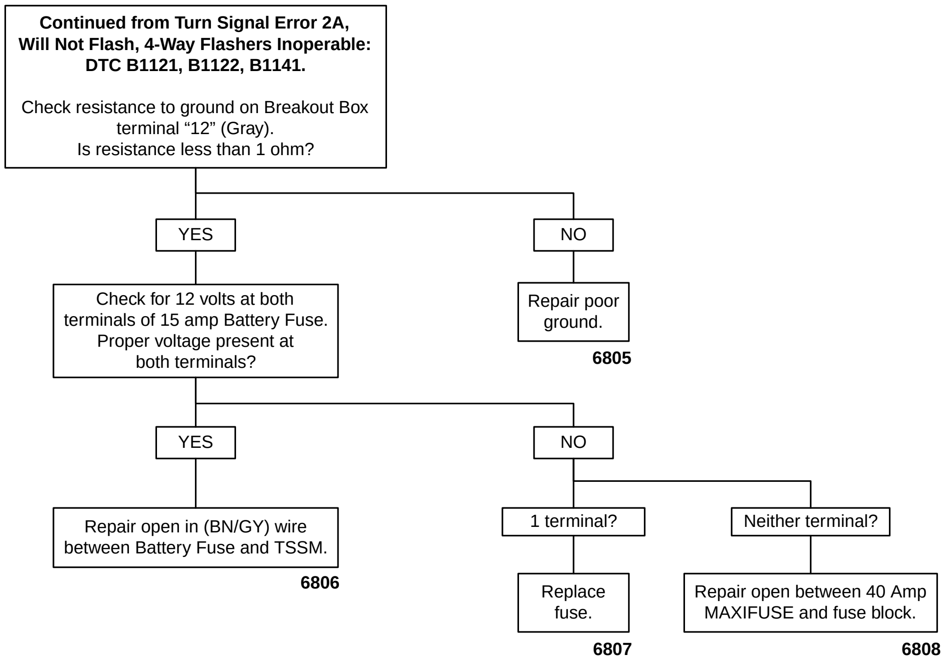
Turn Signal Error 2A, Will Not Flash, 4-Way Flashers Inoperable: DTC B1121, B1122, B1141



Turn Signal Error 2B, Will Not Flash, 4-Way Flashers Inoperable: DTC B1121, B1122, B1141



Turn Signal Error 2C, Will Not Flash, 4-Way Flashers Inoperable: DTC B1121, B1122, B1141



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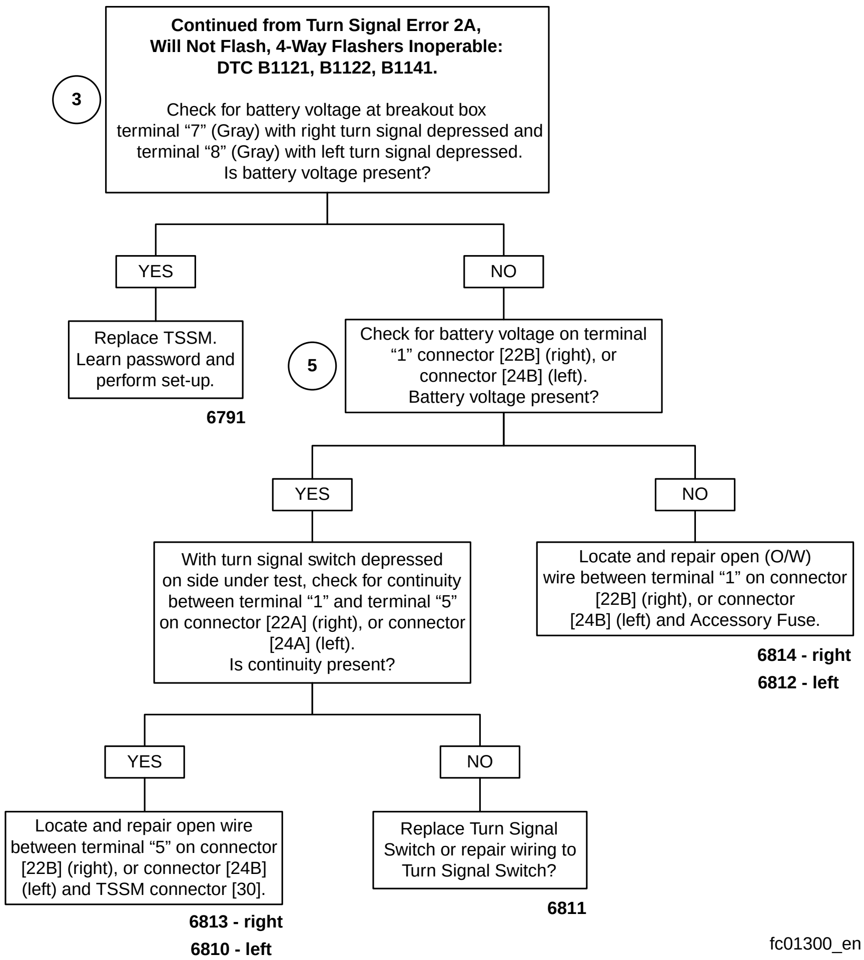
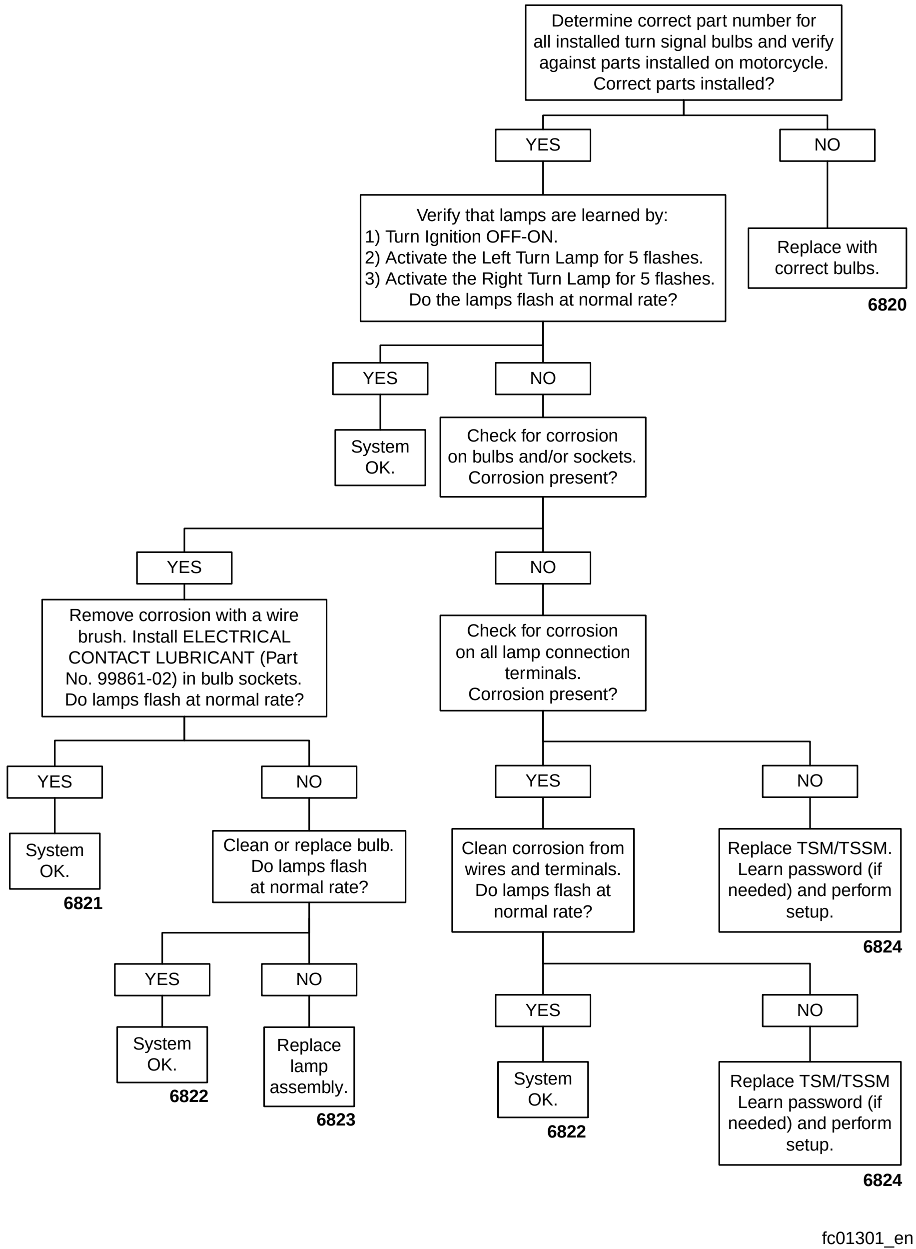
Turn Signal Error 2D, Will Not Flash, 4-Way Flashers Inoperable: DTC B1121, B1122, B1141



Turn Signal Error 3A, Flash at Double Normal Rate, All Bulbs Working



GENERAL

Battery Voltage High

The TSM/TSSM continually checks the battery voltage when Ignition Switch is OFF and when the Ignition Switch is in the IGNITION power modes. If the voltage exceeds 16.0 volts for more than 5.0±0.5 seconds, the TSM/TSSM sets DTC B0563.

DIAGNOSTICS

Diagnostic Tips

- This DTC may set when the vehicle is placed on a battery charger, on fast charge, for a long period of time.
- The TSSM does not illuminate the security lamp when this DTC is set.

Diagnostic Notes

See 1.7 CHARGING SYSTEM tests to correct. Problem may be faulty voltage regulator.

GENERAL

NOTE

This section applies only to those vehicles equipped with the optional security system.

Alarm Output Low (DTC B1131) or Alarm Output High (DTC B1132)

See Figure E-21. An alarm cycle is activated when the TSSM is connected, the siren has been armed by the TSSM and a security event occurs. See E.6 SECURITY SYSTEM FUNCTIONS (TSSM ONLY). Under normal armed operation, the siren input (terminal "2") is driven low by the TSSM to trigger the audible alarm. When the siren input is driven high by the TSSM the audible alarm stops.

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Figure E-21. Security Siren

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-41404-B	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX

Diagnostic Tips

- If the siren is armed and the internal siren battery is dead, shorted, disconnected, or has been charging for a period longer than 24 hours, the siren will respond with three chirps on arming instead of two.
- The internal siren battery may not charge if the vehicle's battery is less than 12.5 volts.
- If the siren does not chirp two or three times on a valid arming command from the TSSM, the siren is either not connected, not working, or the siren wiring was opened or shorted while the siren was disarmed.
- If the siren enters the self-driven mode where it is powered from the siren internal nine-volt battery, the turn-signal lamps will not alternately flash. If the TSSM activates the siren, the turn-signal lamps will flash. If the siren has been armed and a security event occurs, and the siren is in self-driven mode, the siren will alarm for 20 to 30 seconds and then turn off for 5 to 10 seconds. This alarm cycle will be repeated ten times if the siren is in the self-driven mode.
- If the siren does not stop alarming after it has been armed, then either the TSSM output or siren input may be shorted to ground, or the siren vehicle battery connection is open or shorted to ground, or the siren vehicle ground connection is open, or a security event has occurred. See E.6 SECURITY SYSTEM FUNCTIONS (TSSM ONLY) for a description of alarm functions.

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Use BREAKOUT BOX (Part No. HD-42682) and HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray pin probe and patch cord. See E.11 BREAKOUT BOX: TSM/TSSM.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404-B), gray socket probe and patch cord.
3. Having the correct multimeter ohm scale is important for this test. Some meters may read infinity for high ohm values. If this is the case, check your ohm scale and retest.

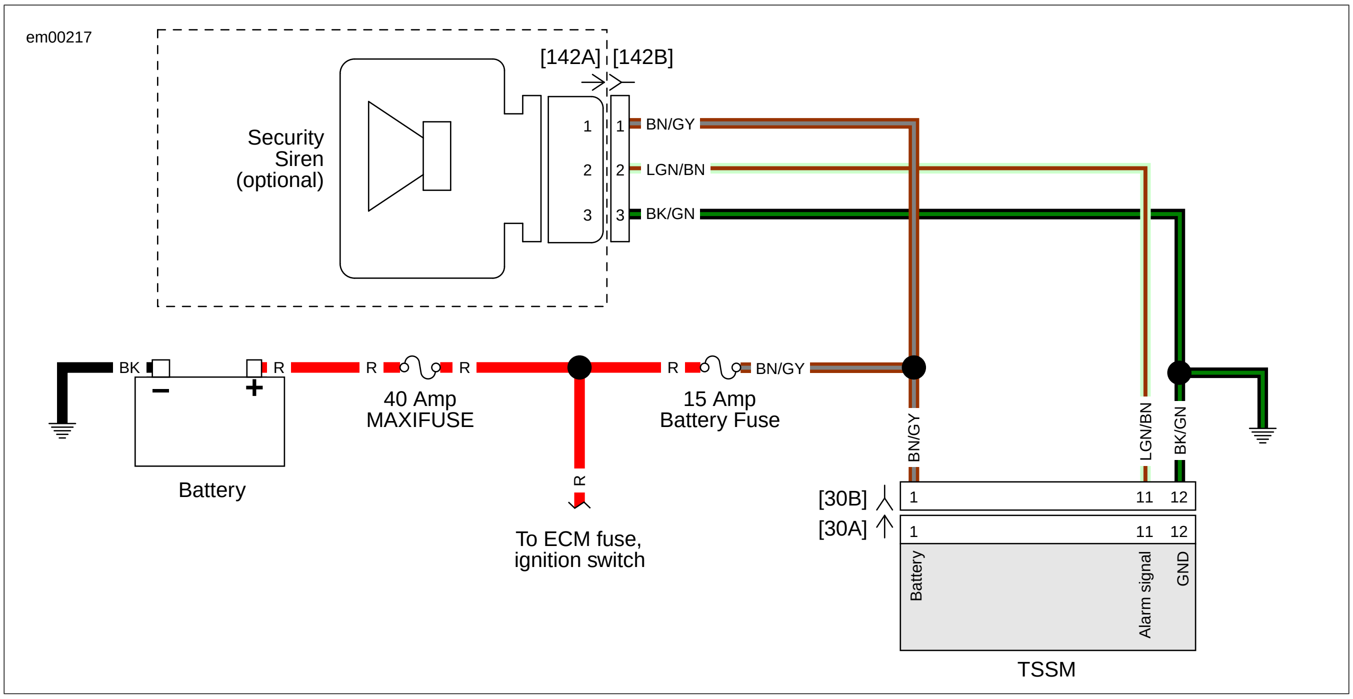
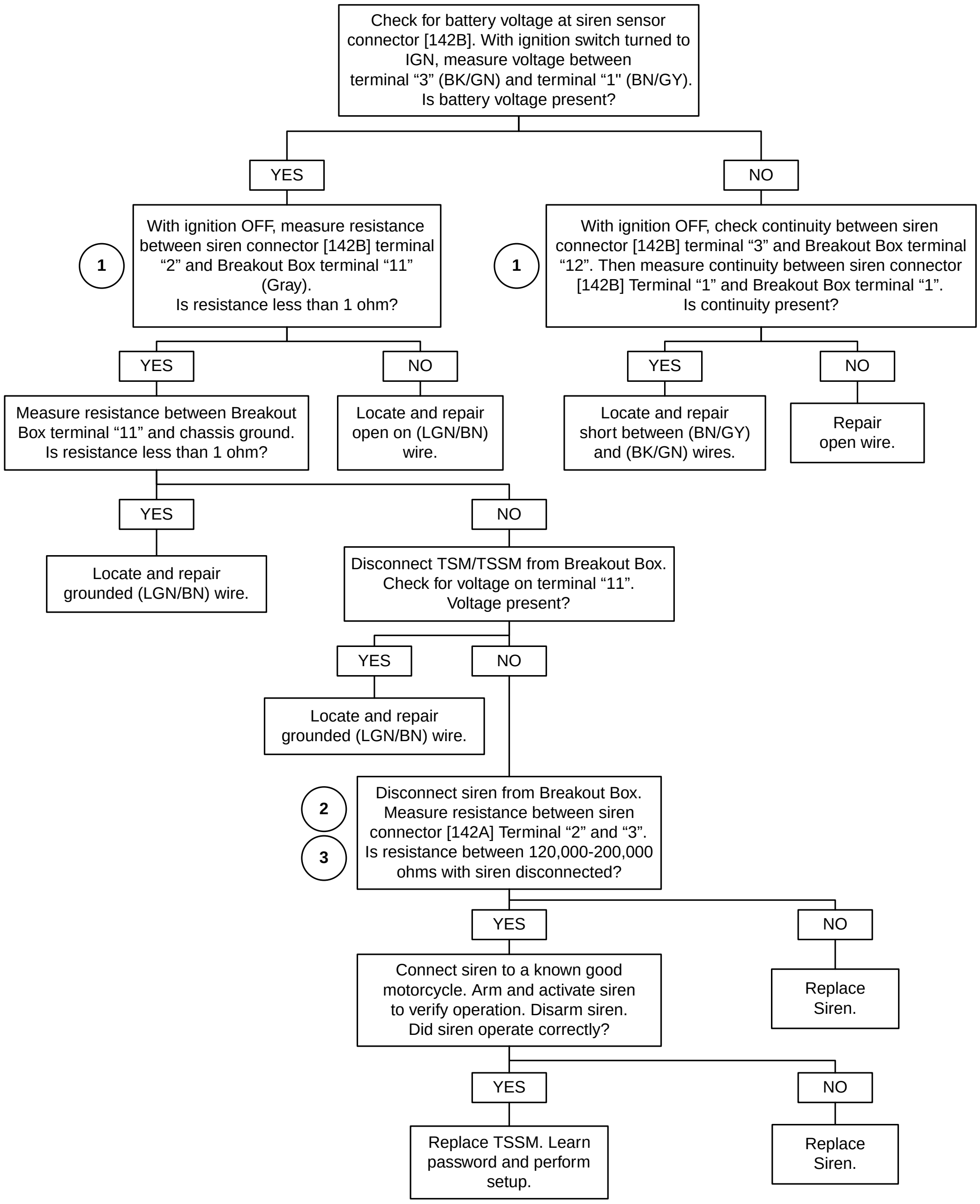


Figure E-22. Siren Circuit

Table E-16. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[30]	TSSM	12-place Deutsch	Electrical panel behind fender extension
[142]	Security siren (optional)	3-place Packard	Electrical panel behind fender extension

Alarm Output: DTC B1131, B1132



Clear DTCs using speedometer self diagnostics. See E.10 SPEEDOMETER SELF DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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GENERAL

Starter Output High

With the TSM/TSSM disarmed, Ignition Switch ON, Engine Stop Switch set to RUN, and transmission in neutral or clutch lever pulled in, the start relay is grounded. Battery voltage is applied to the start relay and coil which are grounded through the TSM/TSSM. This DTC is set when that ground is not established through the TSM/TSSM.

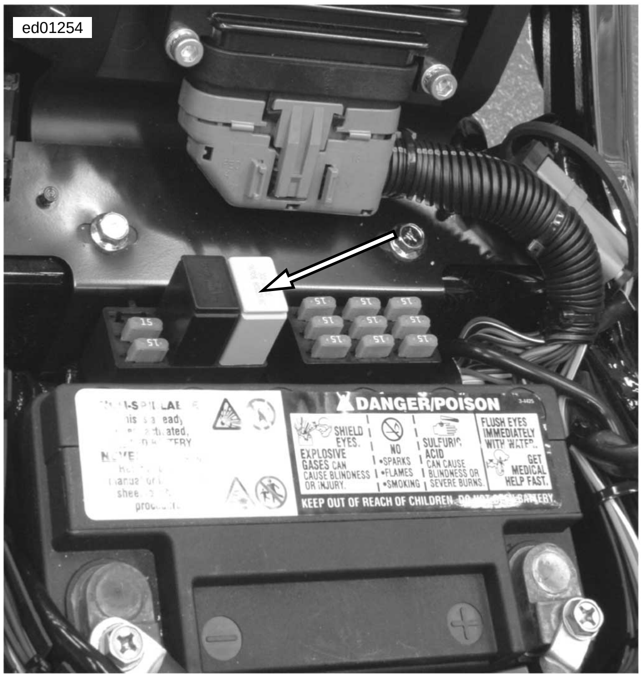


Figure E-23. Start Relay

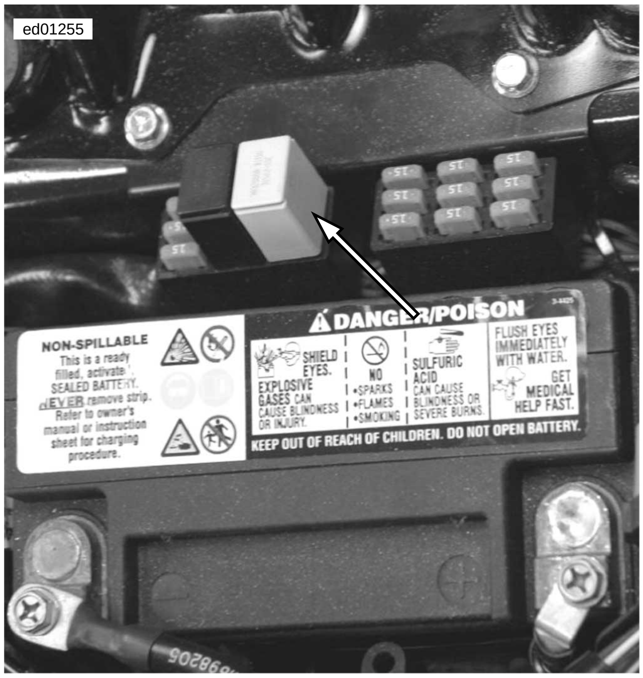


Figure E-24. Start Relay (FXCWC)

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) to wire harness connector [30] leaving TSM/TSSM disconnected. See E.11 BREAKOUT BOX: TSM/TSSM.

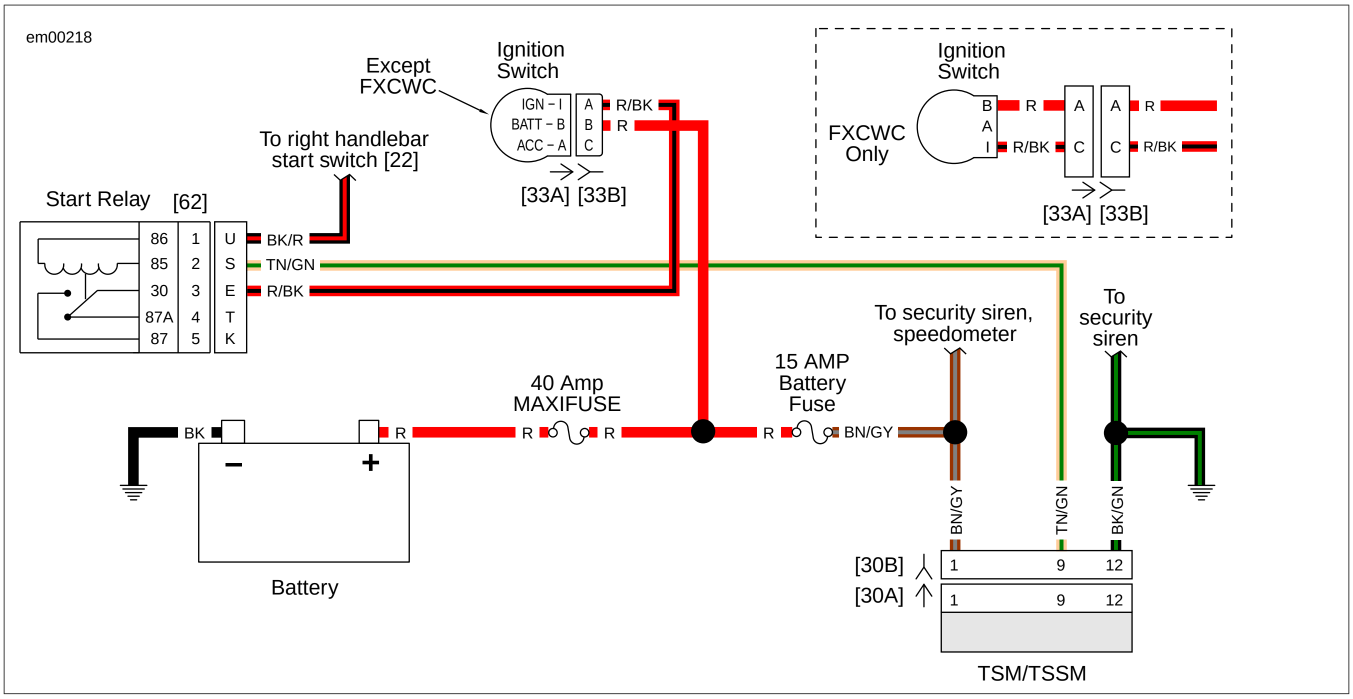
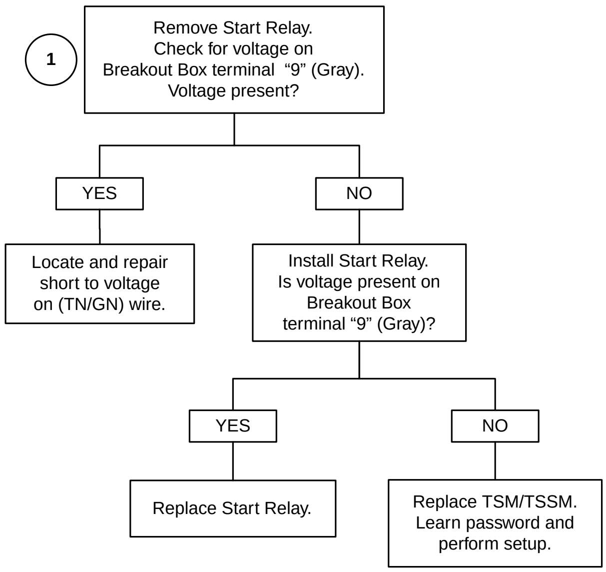


Figure E-25. Starter TSM/TSSM Circuits

Table E-17. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Right hand controls	6-place Molex	Under fuel tank, right side
[30]	TSM/TSSM	12-place Deutsch	Electrical panel behind fender extension
[33]	Ignition switch	3-place Molex 4-place Packard (FXCWC)	Under fuel tank console
[62]	Start relay	5-place Amp	Under seat, in fuse block

Starter Output High: DTC B1134



Clear DTCs using speedometer self diagnostics. See E.10 SPEEDOMETER SELF DIAGNOSTICS. Confirm proper operation with no check engine lamp.

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GENERAL

Accelerometer Fault: B1135

Diagnostic Trouble Code (DTC) B1135 indicates a failure which requires replacement of the TSM/TSSM.

NOTE

When DTC B1135 is set, the tip-over engine shutdown, TSSM tamper alarm and bank angle sensors are disabled. The security lamp will also illuminate when this code is set.

DTC B1154, DTC B1155

GENERAL

DTC B1154 may occur if the motorcycle is ridden with the clutch pulled at speeds greater than 10 MPH (16 km/h) for more than 60 seconds (as in coasting down a long mountain road).

DIAGNOSTIC NOTES

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) to TSSM. See E.11 BREAKOUT BOX: TSM/TSSM.
2. If DTC is current (lamp on continuously), clear codes. If the code returns during operation, replace TSSM. If DTC is historic, check for intermittents
3. A reading of several hundred ohms is normal due to the neutral indicator lamp (LED).

Table E-18. Clutch/Neutral Switch DTCs

DTC	SYMPTOM	START WITH FLOW CHART
B1154	Clutch switch short-to-ground	Clutch Switch Short-to-Ground: DTC B1154
B1155	Neutral switch short-to-ground	Neutral Switch Short-to-Ground: DTC B1155

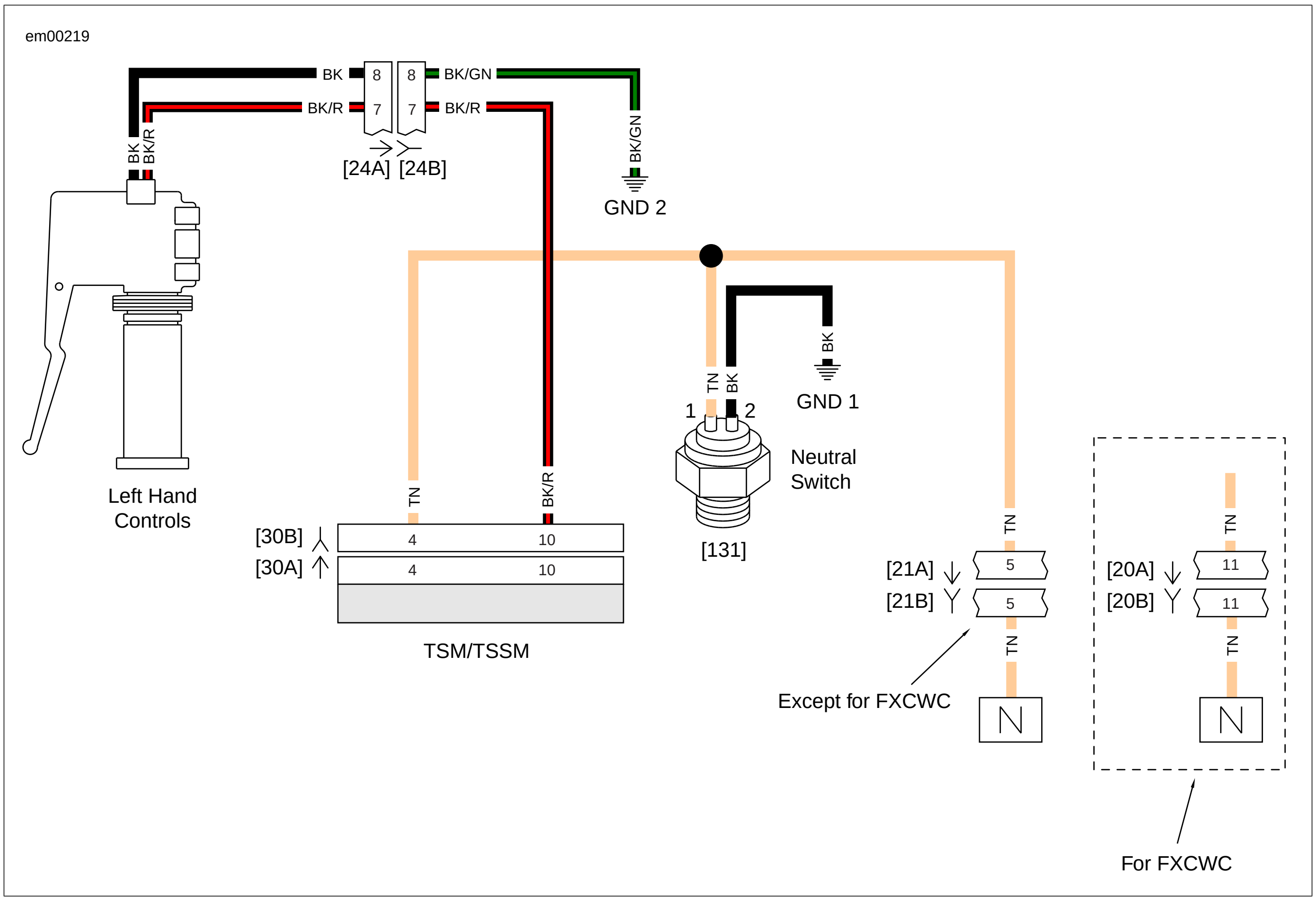


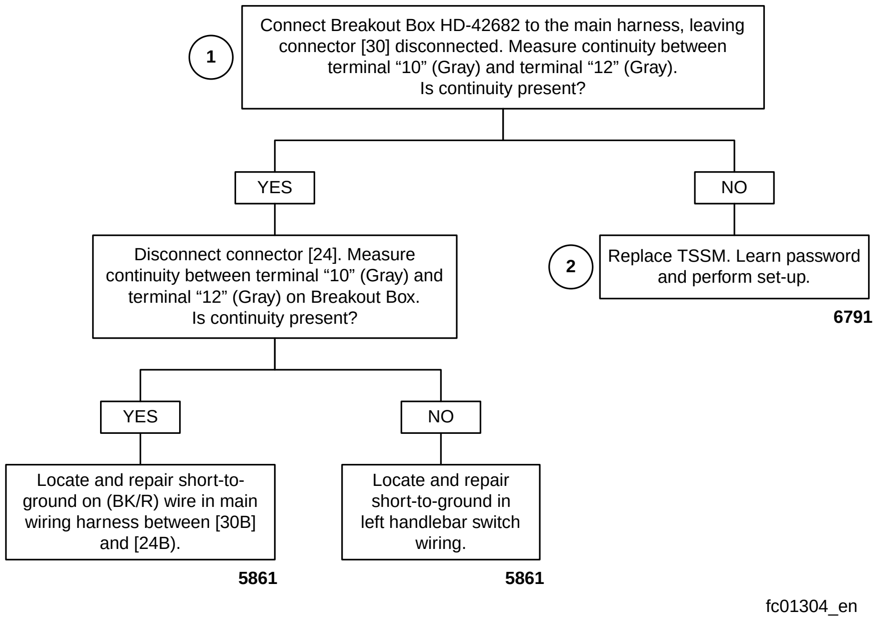
Figure E-26. Clutch and Neutral Interlock Circuits

Table E-19. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Deutsch	Under console
[21]	Indicator lamps	8-place Mini Deutsch	Under fuel tank console
[24]	Left hand controls and horn	8-place Molex	Under fuel tank, left side
[30]	TSM/TSSM	12-place Deutsch	Electrical panel behind fender extension
[131]	Neutral switch	Post terminals	Top of transmission

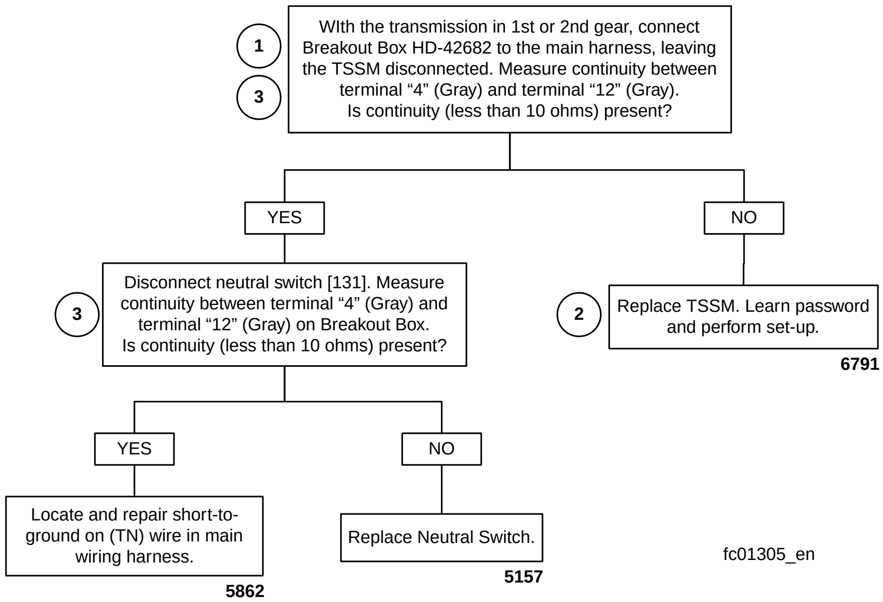
Clutch Switch Short-to-Ground: DTC B1154 (Part 1 of 2)

NOTE:
This DTC may occur if the vehicle is ridden with clutch disengaged (pulled in) at speeds greater than 10 MPH (16 km/h) for more than 60 seconds (coasting down a long mountain road).



Neutral Switch Short-to-Ground: DTC B1155 (Part 2 of 2)

NOTE:
This DTC may occur if the vehicle is ridden with transmission in neutral at speeds greater than 10 MPH (16 km/h) for more than 60 seconds (coasting down a long mountain road).



GENERAL

Loss of ECM Serial Data

The serial data connector provides a means for the Electronic Control Module (ECM), TSM/TSSM, and speedometer to communicate their current status. When all operating parameters on the serial data bus are within specifications, a state of health message is sent between the components. Diagnostic Trouble Code (DTC) U1016 indicates that the ECM is not capable of sending this state of health message. DTC U1255 indicates that no messages were present during power up of the current key cycle. DTC U1016 indicates that there was communication on the data bus since power up, but communication was lost or interrupted during that key cycle.

Table E-20. Code Description

DTC	DESCRIPTION
U1016	Loss of all ECM serial data (state of health)
U1255	Serial data error/missing message

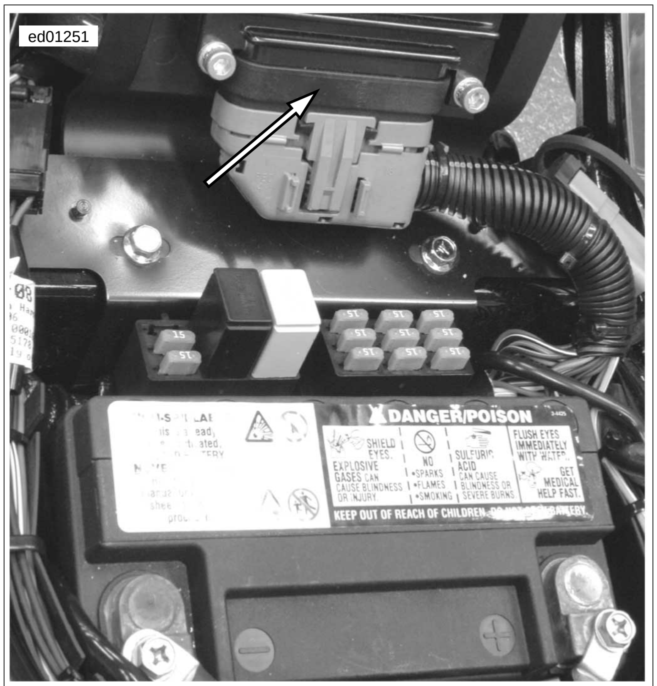


Figure E-27. ECM Location

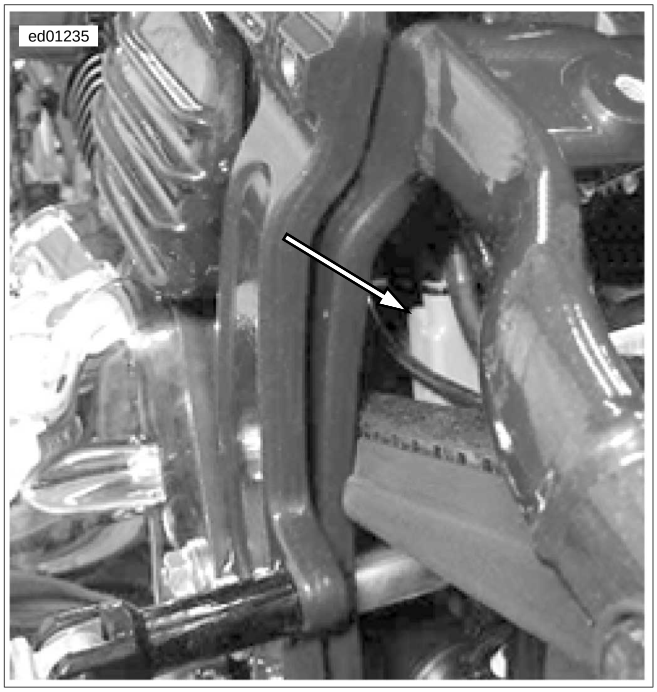


Figure E-28. ECM Location (FXCWC)

DIAGNOSTICS

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-43876	BREAKOUT BOX

Diagnostic Notes

Each reference number below correlates to a circled number on the flow chart(s).

1. Connect BREAKOUT BOX (Part No. HD-42682) (gray) between TSM/TSSM connector [30A] and wire harness connector [30B]. See E.11 BREAKOUT BOX: TSM/TSSM.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See 4.7 BREAKOUT BOX: EFI.

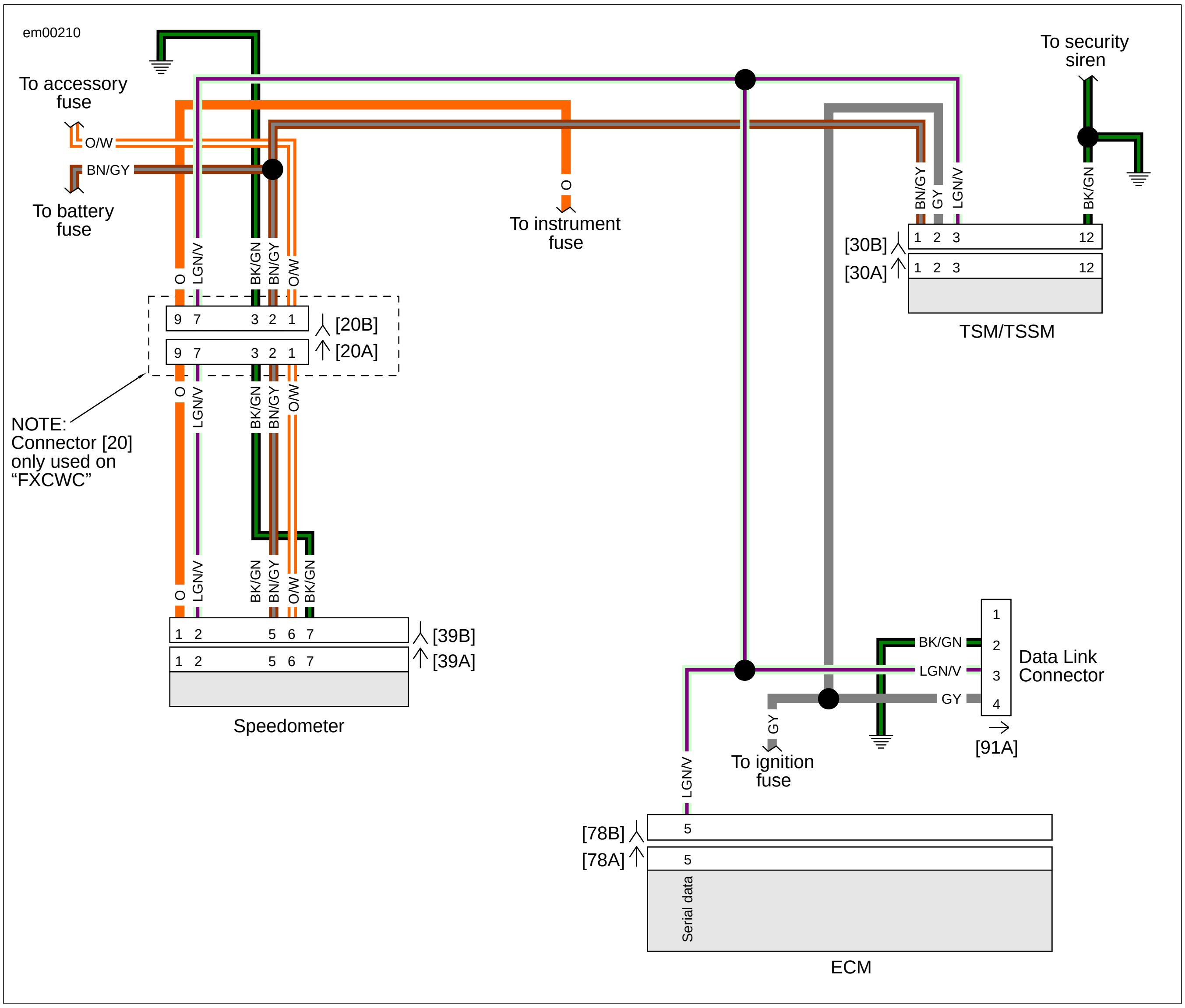
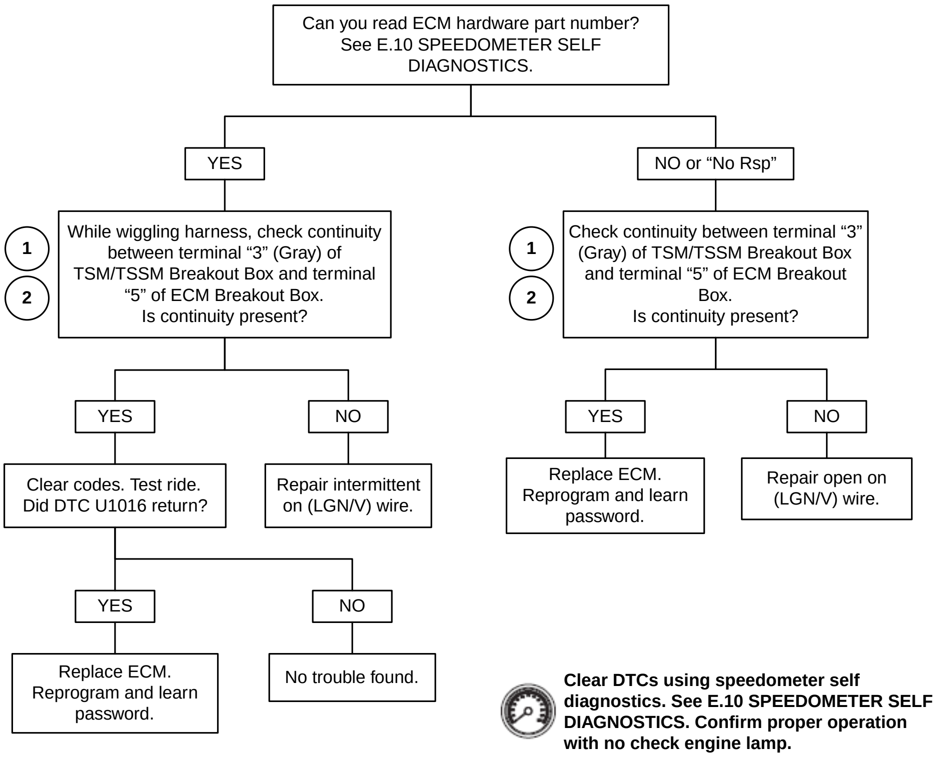


Figure E-29. Serial Data Circuit

Table E-21. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[20]	Console harness	12-place Molex	Under console
[30]	TSM/TSSM	12-place Deutsch	Electrical panel behind fender extension
[39]	Speedometer	12-place Packard	Back of speedometer
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[91]	Data link connector	4-place Deutsch	Under seat

Loss of ECM Serial Data: DTC U1016



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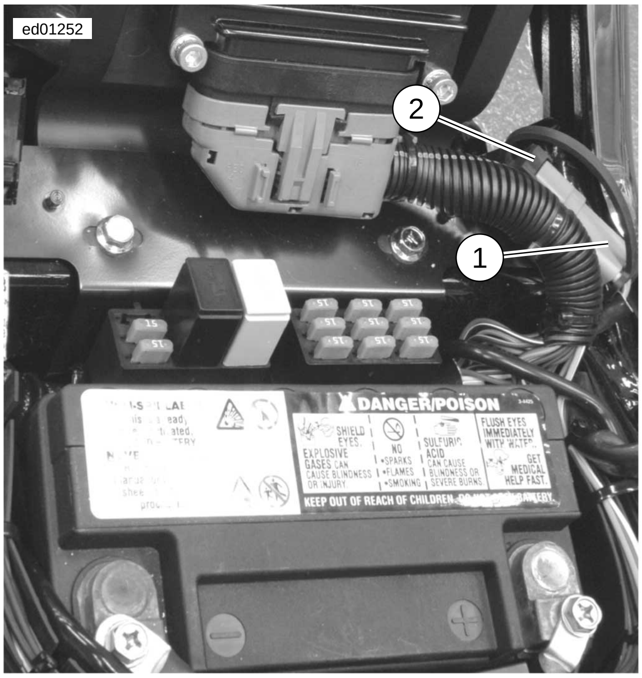
GENERAL

Serial Data Low or Serial Data Open/High

The typical serial data voltage range is 0 volts (inactive) to 7 volts (active). Due to the short pulse, voltages will be much lower on a digital/voltmeter (DVOM). In analog mode, a DVOM reading serial data will show continuous voltage when active, typically 0.6-0.8 volts. The range for acceptable operations is 0-7.0 volts.

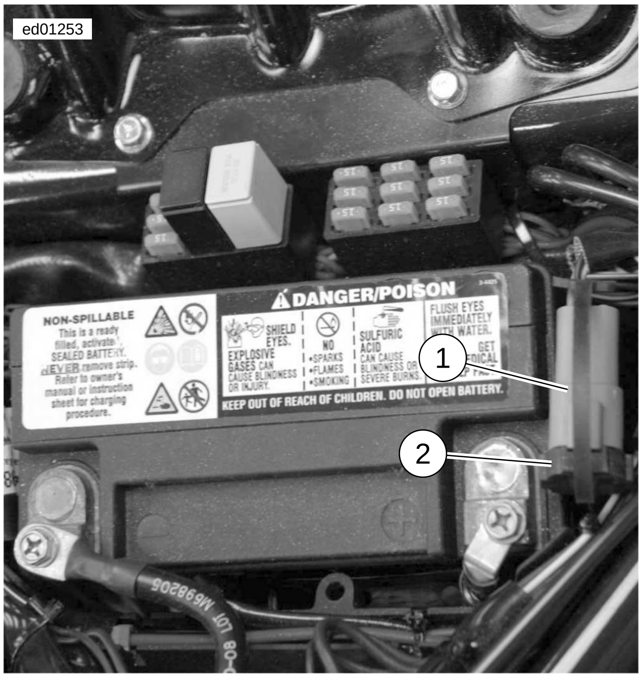
Table E-22. Code Description

DTC	DESCRIPTION
U1300	Serial data low
U1301	Serial data open/high



1. **Data link connector [91A]**
2. **Protective rubber plug**

Figure E-30. Data Link Connector [91A]



1. **Data link connector [91A]**
2. **Protective rubber plug**

Figure E-31. Data Link Connector [91A] (FXCWC)

DIAGNOSTICS

Diagnostic Tips

- If serial data is shorted, these Diagnostic Trouble Codes (DTCs) will automatically cause the check engine lamp to illuminate. The odometer will read "BUS Er" in this condition.
- DTCs P1009 and P1010 may accompany DTCs U1300 and U1301.

Diagnostic Notes

If a U1300, U1301 or "BUS Er" is present, perform diagnostic procedures listed in 4.12 STARTS, THEN STALLS.

GENERAL

If the ECM or TSM/TSSM is faulty, follow the instructions in the Service Manual for ECM or TSM/TSSM replacement. Then, to determine if password learn is necessary, refer to Table E-23.

Table E-23. Password Learn

DEVICE REPLACED	IS PASSWORD LEARN NECESSARY?
ECM	Yes
TSM	No *
TSSM	Yes
* If a TSM has been replaced by a TSSM, or a TSSM has been replaced by a TSM, password learn is necessary.	

PASSWORD LEARNING

To perform password learning procedure, refer to Table E-24. When finished, continue with all instructions under E.3 VEHICLE DELIVERY.

Always perform all appropriate instructions under E.3 VEHICLE DELIVERY after TSM/TSSM replacement or removal.

NOTE

Do not forget to enter a Personal Identification Number (PIN) for TSSM vehicles. If a code is not assigned and the key fob is lost or damaged while the vehicle is armed, the TSSM must be replaced.

Table E-24. Setting TSM/TSSM and ECM Password

NO.	ACTION	CONFIRMATION	NOTES
	Ignition must be turned off for at least 15 seconds.	With ignition turned off, Check Engine Lamp and Security Lamp will be off.	
1	Install new TSM/TSSM or ECM. Perform all steps under E.3 VEHICLE DELIVERY.		
2	Set Engine Stop Switch to RUN.		
3	Turn Ignition Switch ON.	Verify Check Engine Lamp and Security Lamp illuminate and then turn off.	TSM/TSSM enables starter relay.
4	Attempt normal start one time.	Engine starts and stalls. Check Engine Lamp illuminates and stays on.	Password has not been learned. ECM sets DTC P1009.
5	Wait ten seconds. Security lamp will illuminate and stay on.	Security Lamp illuminates.	ECM enters Password Learning mode for ten minutes. Do not cycle Ignition Switch or interrupt vehicle power or Password Learn will be unsuccessful.
6	Wait until Security Lamp turns off.		This takes ten minutes.
7	Quickly (within one second) turn Ignition Switch OFF-ON.		ECM must not be allowed to shutdown.
8	Wait until Security Lamp turns off.		This takes ten minutes.
9	Quickly (within one second) turn Ignition Switch OFF-ON.		ECM must not be allowed to shutdown.
10	Wait until Security Lamp turns off.		This takes ten minutes.
11	Quickly (within one second) turn Ignition Switch OFF-ON.		ECM must not be allowed to shutdown.
12	Turn Ignition Switch OFF. Wait 15 seconds before turning Ignition Switch ON. Turn Ignition Switch ON and start engine to confirm successful Password Learn procedure. Clear diagnostic trouble codes (DTCs).		
13	Perform all steps under E.3 VEHICLE DELIVERY.		

GENERAL

The TSSM system uses batteries in the key fob and siren. These are the only parts requiring periodic maintenance.

KEY FOB

Schedule

Replace the key fob battery every 2 years.

Battery Replacement

1. See Figure E-32. Open the key fob case.
   a. Place a thin blade between the 2 halves of the case.
   b. Slowly twist the blade.
2. Replace battery (1).
   a. Remove the original battery.
   b. Install a **new** battery with the positive (+) side down. Use a Panasonic® 2032 or equivalent.
3. Align case and circuit board (3) as shown. Snap case halves together.
4. While standing next to the motorcycle, press and hold the key fob button for 10-15 seconds until the security system responds with two turn signal flashes/siren chirps.

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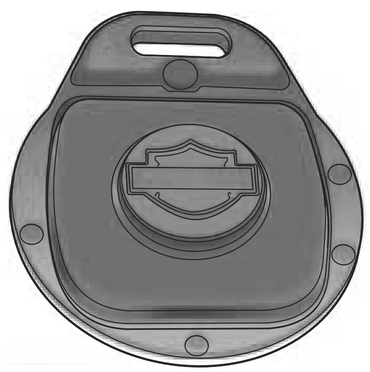

Figure E-32. Key Fob Assembly: TSSM

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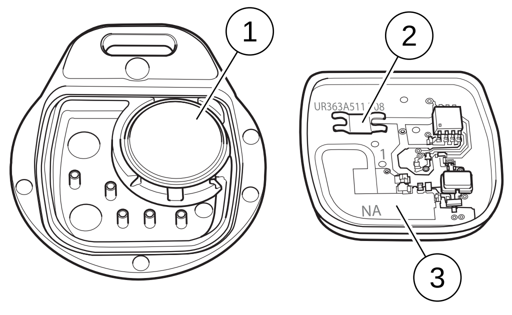


1. **Battery**
2. **Battery Contact**
3. **Circuit Board**

Figure E-33. Open Key Fob: TSSM

SIREN (IF INSTALLED)

Schedule

The siren's internal 9 volt battery is rechargeable and does not need to be replaced on a regular basis. Battery life under normal conditions is approximately three to six years.

NOTES

- *See Figure E-34 and Figure E-35. Early style siren will work with both TSM and HFSM. Late style siren will only work with HFSM.*
- *The internal siren battery may not charge if the vehicle's battery is less than 12.5 volts.*

Battery Replacement: Early Style Siren

1. Disarm system and remove siren.
2. See Figure E-34 or Figure E-35. Remove battery cover (1).
   a. Place the siren module on a flat and sturdy table with the potted section (area with epoxy covering circuit board) facing up and towards you.
   b. Position a knife blade at a 45 degree angle to the long side of the siren case. Insert the knife blade between the siren case and battery cover at one of the two accessible corners of the battery cover. Keep the blade slightly higher towards the battery cover as this helps keep the blade away from the battery seal.
   c. Slowly twist the blade towards the battery cover and the cover will pop off.

NOTES

- *For protection against corrosion, battery terminals and battery clip are covered with a special grease. Do not wipe* *away this substance. Apply all available existing grease to terminals on **new** battery.*

- *Only a 9 volt nickel metal hydride battery should be used in the siren.*

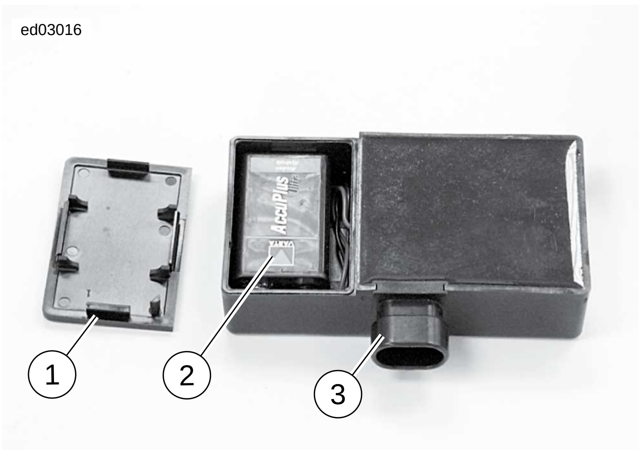
3. See Figure E-34 or Figure E-35. Replace battery by removing old battery from polarized battery clip. Install a **new** 9 volt nickel metal hydride battery. See the Parts Catalog for correct part number.

4. See Figure E-34 or Figure E-35. Reinstall battery cover (1).

   a. Carefully replace the rubber seal.

   b. Align battery cover (1) with case placing round corners on cover away from connector [142A]. Snap cover into place.

5. Install siren and check operation. If siren is working properly, it will respond with two chirps after receiving the arm command.



1. **Cover**
2. **Battery**
3. **Connector [142A]**

Figure E-34. Siren Battery Compartment (Early Style Siren)

Battery Replacement: Late Style Siren

1. Disarm system and remove siren.

2. See Figure E-34 or Figure E-35. With a small screwdriver or pick, push the catches (1) in through the two slots (2) in the end of the siren to release the battery cover (3).

NOTES

- *For protection against corrosion, battery terminals and battery clip are covered with a special grease. Do not wipe away this substance. Apply all available existing grease to terminals on **new** battery.*

- *Only a 9 volt nickel metal hydride battery should be used in the siren.*

3. Replace battery (4) by removing old battery from polarized battery clip.

4. Recharge and reinstall, or install a **new** 9 volt nickel metal hydride battery. See Parts Catalog for correct part number.

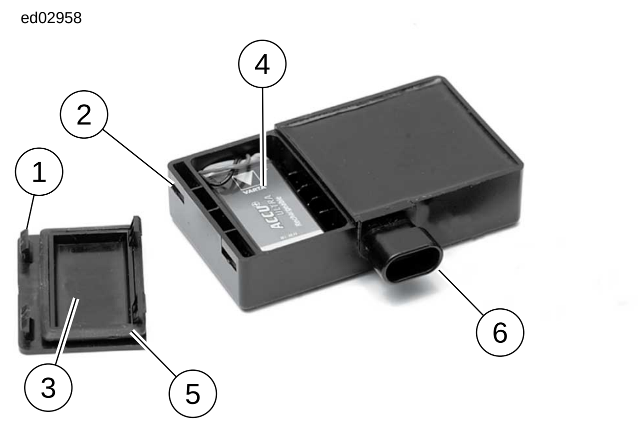
5. Reinstall battery cover.

   a. Carefully replace the rubber seal (5) on the cover.

   b. Align battery cover with case placing round corners on cover away from connector [142A] (6).

   c. Snap cover into place.

6. Install siren and check operation. If siren is working properly, it will respond with two chirps after receiving the arm command.



1. **Cover**
2. **9 volt battery**
3. **Connector [142A]**
4. **Potted section**

Figure E-35. Siren Battery Compartment (Late Style Siren)

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-23738	VACUUM PUMP	4.19 DTC P0107, P0108, Diagnostics
HD-25070	ROBINAIR HEAT GUN	A.19 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-26792	SPARK TESTER	4.10 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
HD-26792	SPARK TESTER	4.17 MISFIRE AT IDLE OR UNDER LOAD, Diagnostics
HD-34730-2C	FUEL INJECTOR TEST LAMP	4.10 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
HD-34730-2C	FUEL INJECTOR TEST LAMP	4.31 DTC P1351, P1352, P1354, P1355, Diagnostics
HD-35500	MULTI-METER	2.6 FUEL GAUGE, Fuel Gauge and Sender Test
HD-38125-6	PACKARD TERMINAL CRIMP TOOL	A.15 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.1 AMP 1-PLACE CONNECTORS, AMP 1-Place Connector Repair
HD-38125-7	PACKARD TERMINAL CRIMPER	A.7 DEUTSCH MINI-TERMINAL CRIMPS, Deutsch Mini Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.15 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.15 METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.19 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-39621-27	SOCKET TERMINAL TOOL	A.1 AMP 1-PLACE CONNECTORS, AMP 1-Place Connector Repair
HD-39621-28	PIN TERMINAL REMOVER	A.1 AMP 1-PLACE CONNECTORS, AMP 1-Place Connector Repair
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL	A.6 DEUTSCH STANDARD TERMINALS, Deutsch Standard Terminal Crimps
HD-39969	ULTRA-TORCH UT-100	A.19 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41182	FUEL PRESSURE GAUGE	4.15 FUEL PRESSURE TEST, Testing
HD-41183	HEAT SHIELD ATTACHMENT	A.19 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41404-B	HARNESS CONNECTOR TEST KIT	1.2 STARTING SYSTEM DIAGNOSIS, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	2.8 DTC B1004, B1005, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	3.15 TSM/HFSM: TURN SIGNAL ERRORS AND DTCS, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	3.16 DTC B1131, B1132 (HFSM ONLY), Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	3.20 DTC B1141 (HFSM ONLY), Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.10 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.10 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.11 NO ECM POWER, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.14 SYSTEM RELAY CHECK, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.14 SYSTEM RELAY CHECK, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.16 IDLE AIR CONTROL, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.17 MISFIRE AT IDLE OR UNDER LOAD, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.18 COMBUSTION ABSENT/INTERMITTENT, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.19 DTC P0107, P0108, Diagnostics

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.20 DTC P0112, P0113, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.22 DTC P0122, P0123, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.24 DTC P0261, P0262, P0263, P0264, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.25 DTC P0373, P0374, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.27 DTC P0562, P0563, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.29 DTC P0661, P0662, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.31 DTC P1351, P1352, P1354, P1355, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.31 DTC P1351, P1352, P1354, P1355, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.33 DTC P1501, P1502, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	E.13 TURN SIGNAL ERRORS: B1121, B1122, B1141, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	E.15 DTC B1131, B1132, Diagnostics
HD-41404-B	HARNESS CONNECTOR TEST KIT	4.32 DTC P1475, P1477, P1478, Diagnostics
HD-41417	PROPANE ENRICHMENT KIT	4.9 INTAKE LEAK TEST, Leak Tester
HD-41475	DEUTSCH CONNECTOR SERVICE KIT	A.5 DEUSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41475-100	FLAT BLADE L-HOOK	A.5 DEUSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41609	AMP MULTILOCK CRIMPER	A.2 AMP MULTILOCK CONNECTORS, AMP Multilock Connector Repair
HD-42682	BREAKOUT BOX	1.2 STARTING SYSTEM DIAGNOSIS, Diagnostics
HD-42682	BREAKOUT BOX	2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER, Initial Diagnostics
HD-42682	BREAKOUT BOX	2.5 BREAKOUT BOX: SPEEDOMETER, General
HD-42682	BREAKOUT BOX	2.7 INDICATOR LAMPS, Diagnostics
HD-42682	BREAKOUT BOX	2.8 DTC B1004, B1005, Diagnostics
HD-42682	BREAKOUT BOX	2.10 DTC B1008, Diagnostics
HD-42682	BREAKOUT BOX	2.11 DTC U1016, U1255, Diagnostics
HD-42682	BREAKOUT BOX	2.12 DTC U1064, U1255, Diagnostics
HD-42682	BREAKOUT BOX	3.3 H-DSSS ACTUATION, Power Disruption and Configuring
HD-42682	BREAKOUT BOX	3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM, Initial Diagnostics
HD-42682	BREAKOUT BOX	3.12 BREAKOUT BOX: TSM/HFSM, General
HD-42682	BREAKOUT BOX	3.16 DTC B1131, B1132 (HFSM ONLY), Diagnostics
HD-42682	BREAKOUT BOX	3.17 DTC B1134, Diagnostics
HD-42682	BREAKOUT BOX	3.22 DTC B1154, B1155, Diagnostics
HD-42682	BREAKOUT BOX	4.5 INITIAL DIAGNOSTIC CHECK, Initial Diagnostics
HD-42682	BREAKOUT BOX	4.34 DTC U1064, U1255, Diagnostics
HD-42682	BREAKOUT BOX	E.9 INITIAL DIAGNOSTIC CHECK: TSM/TSSM, Initial Diagnostics
HD-42682	BREAKOUT BOX	E.11 BREAKOUT BOX: TSM/TSSM, General
HD-42682	BREAKOUT BOX	E.15 DTC B1131, B1132, Diagnostics
HD-42682	BREAKOUT BOX	E.16 DTC B1134, Diagnostics

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-42682	BREAKOUT BOX	4.35 DTC U1097, U1255, Diagnostics
HD-42879	ELECTRICAL CRIMPER TOOL	A.8 DEUTSCH SOLID BARREL TERMINALS, Deutsch Solid Barrel Terminal Crimps
HD-43876	BREAKOUT BOX	2.11 DTC U1016, U1255, Diagnostics
HD-43876	BREAKOUT BOX	3.23 DTC U1016, U1255, Diagnostics
HD-43876	BREAKOUT BOX	4.7 BREAKOUT BOX: EFI, General
HD-43876	BREAKOUT BOX	4.10 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
HD-43876	BREAKOUT BOX	4.11 NO ECM POWER, Diagnostics
HD-43876	BREAKOUT BOX	4.13 FUEL SYSTEM ELECTRICAL TEST, Diagnostics
HD-43876	BREAKOUT BOX	4.14 SYSTEM RELAY CHECK, Diagnostics
HD-43876	BREAKOUT BOX	4.16 IDLE AIR CONTROL, Diagnostics
HD-43876	BREAKOUT BOX	4.17 MISFIRE AT IDLE OR UNDER LOAD, Diagnostics
HD-43876	BREAKOUT BOX	4.18 COMBUSTION ABSENT/INTERMITTENT, Diagnostics
HD-43876	BREAKOUT BOX	4.19 DTC P0107, P0108, Diagnostics
HD-43876	BREAKOUT BOX	4.20 DTC P0112, P0113, Diagnostics
HD-43876	BREAKOUT BOX	4.21 DTC P0117, P0118, Diagnostics
HD-43876	BREAKOUT BOX	4.23 DTC P0131, P0132, P0134, P0151, P0152, P0154, Diagnostics
HD-43876	BREAKOUT BOX	4.24 DTC P0261, P0262, P0263, P0264, Diagnostics
HD-43876	BREAKOUT BOX	4.26 DTC P0501, P0502, Diagnostics
HD-43876	BREAKOUT BOX	4.29 DTC P0661, P0662, Diagnostics
HD-43876	BREAKOUT BOX	4.30 DTC P1009, P1010, Diagnostics
HD-43876	BREAKOUT BOX	4.31 DTC P1351, P1352, P1354, P1355, Diagnostics
HD-43876	BREAKOUT BOX	4.32 DTC P1475, P1477, P1478, Diagnostics
HD-43876	BREAKOUT BOX	4.33 DTC P1501, P1502, Diagnostics
HD-43876	BREAKOUT BOX	4.35 DTC U1097, U1255, Diagnostics
HD-43876	BREAKOUT BOX	E.19 DTC U1016, U1255, Diagnostics
HD-44061	FUEL PRESSURE GAUGE ADAPTER	4.15 FUEL PRESSURE TEST, Testing
HD-44687	IGNITION COIL CIRCUIT TEST ADAPTER	4.10 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
HD-44687	IGNITION COIL CIRCUIT TEST ADAPTER	4.31 DTC P1351, P1352, P1354, P1355, Diagnostics
HD-44750	DIGITAL TECHNICIAN	2.1 CHECKING FOR DIAGNOSTIC TROUBLE CODES, Code Types
HD-44750	DIGITAL TECHNICIAN	3.3 H-DSSS ACTUATION, Fob Assignment
HD-44750	DIGITAL TECHNICIAN	3.7 SERVICE/EMERGENCY FUNCTIONS, Service Mode
HD-44750	DIGITAL TECHNICIAN	4.4 CHECKING FOR DIAGNOSTIC TROUBLE CODES: EFI, Code Types
HD-44750	DIGITAL TECHNICIAN	4.16 IDLE AIR CONTROL, General
HD-44750	DIGITAL TECHNICIAN	4.28 DTC P0603, P0605, General
HD-44750	DIGITAL TECHNICIAN	E.8 DIAGNOSTIC TROUBLE CODES (DTC), Code Types
HD-45928	PACKARD MICRO-64 TERMINAL REMOVER	A.18 PACKARD MICRO-64 CONNECTORS, Packard Micro-64 Connector Repair

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-45929	PACKARD MICRO-64 TERMINAL CRIMPER	A.18 PACKARD MICRO-64 CONNECTORS, Packard Micro-64 Connector Repair
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.2 INITIAL DIAGNOSTIC CHECK: SPEEDOMETER, Initial Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.5 BREAKOUT BOX: SPEEDOMETER, General
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.8 DTC B1004, B1005, Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	2.10 DTC B1008, Diagnostics
HD-46601	SPEEDOMETER HARNESS ADAPTER	2.12 DTC U1064, U1255, Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	3.10 INITIAL DIAGNOSTIC CHECK: TSM/HFSM, Initial Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	4.5 INITIAL DIAGNOSTIC CHECK, Initial Diagnostics
HD-46601	SPEEDOMETER HARNESS ADAPTER	4.34 DTC U1064, U1255, Diagnostics
HD-46601	SPEEDOMETER HARNESS ADAPTER	4.35 DTC U1097, U1255, Diagnostics
HD-46601	INSTRUMENT HARNESS ADAPTERS	E.9 INITIAL DIAGNOSTIC CHECK: TSM/TSSM, Initial Diagnostics
HD-48053	ELECTRICAL SYSTEM TESTER	1.7 CHARGING SYSTEM, Troubleshooting
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER	A.16 MOLEX CONNECTORS, Molex Connector Repair
MCR-101 HD	ELECTRICAL SYSTEM ANALYZER	4.10 ENGINE CRANKS, BUT WILL NOT START, Diagnostics
TT600-3	SNAP-ON PICK	A.13 630 METRI-PACK CONNECTORS, 630 Metri-Pack Connector Repair

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FASTENER	TORQUE VALUE	NOTES
No torque values were found in this manual.		

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