2013 Harley-Davidson Sportster Models
Electrical Diagnostic Manual

99495-13

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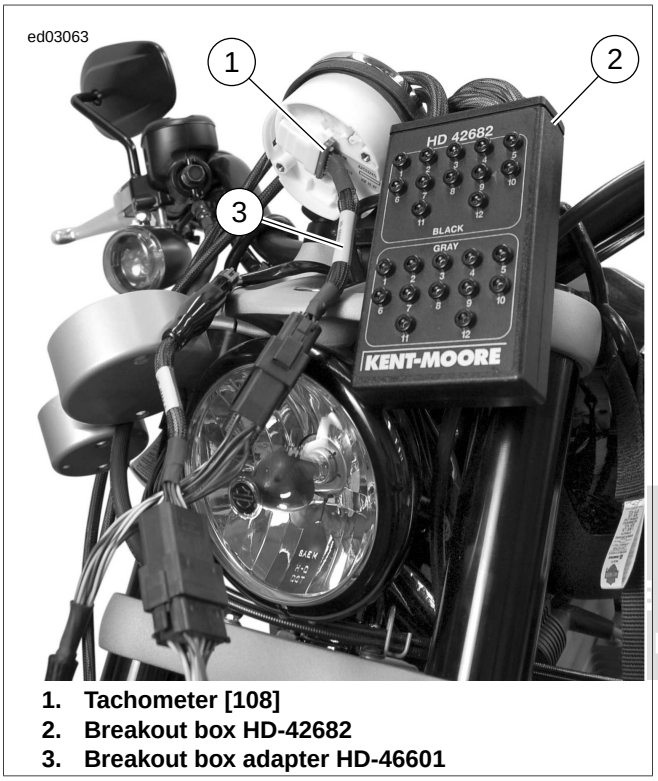
2. See Figure 1-25. Press latch and disconnect speedometer [39B] (XR) or tachometer [108B] (XL).
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39A] and [39B] (XR) or [108A] and [108B] (XL).
4. Attach black connectors from BREAKOUT BOX (Part No. HD-42682) to BREAKOUT BOX ADAPTERS (Part No. HD-46601). All tests will be performed using the black side of the breakout box.
5. When testing is completed, remove the breakout box and jumper harness, and restore connections.



1. **Tachometer [108]**
2. **Breakout box HD-42682**
3. **Breakout box adapter HD-46601**

Figure 1-25. Breakout Box Connection (XR)

HD-42682 Breakout Box (TSM, TSSM or HFSM)

The BREAKOUT BOX (Part No. HD-42682) splices into the main harness. Used in conjunction with a multimeter, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects. Install breakout box in series as follows:

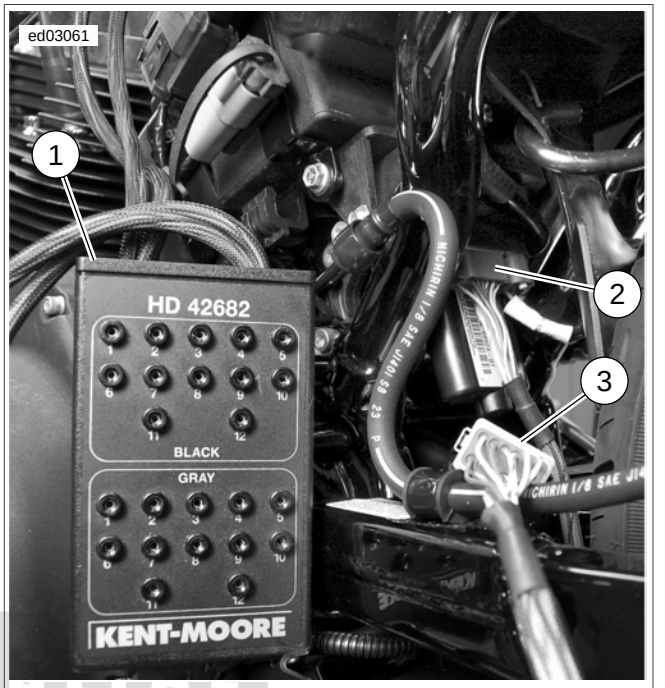
NOTE

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

1. Access TSM, TSSM or HFSM.
2. Disconnect HFSM antenna jumper [208B] and [30B] from TSM, TSSM or HFSM:
   a. **For HFSM:** Press latches and disconnect [208B].
   b. Press latches and disconnect [30B].
3. See Figure 1-26. Connect BREAKOUT BOX (Part No. HD-42682) to connectors.
4. **For HFSM:** Mate antenna [208B] to HFSM.
5. When testing is completed remove the breakout box and restore connections.

NOTE

Vehicle will not start with TSM, TSSM or HFSM disconnected or incorrectly mounted.



1. **Breakout box to harness connection**
2. **Breakout box to TSM, TSSM, HFSM connection**
3. **Breakout box**

Figure 1-26. Breakout Box Connection Point at TSM, TSSM, HFSM (Typical)

HD-43876 Breakout Box (ECM)

The BREAKOUT BOX (Part No. HD-43876) splices into the main harness. Used in conjunction with a multimeter, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects. Install breakout box in series as follows:

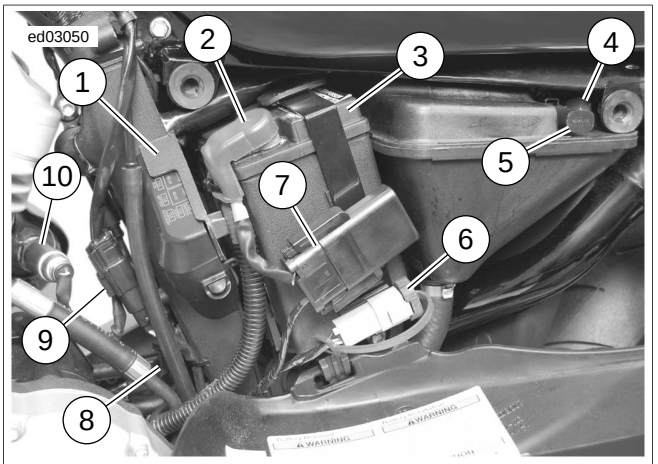
NOTE

See wiring diagrams for ECM terminal functions. ECM is located under passenger seat.

1. Access the ECM.
2. Press latch and disconnect ECM [78B].
3. See Figure 1-27. Connect BREAKOUT BOX (Part No. HD-43876) to connectors.
4. When testing is completed, remove the breakout box and restore connections.

Table 2-2. Diagnostic Trouble Codes (DTCs) and Fault Conditions

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
B1134	56	Start relay output high	5.15 DTC B1134
B1135	19	Accelerometer fault	5.8 DTC B1135, B1136, B1141, B1142
B1136	20	Accelerometer tip-over self-test fault	5.8 DTC B1135, B1136, B1141, B1142
B1141	69	Ignition switch open/low	5.8 DTC B1135, B1136, B1141, B1142
B1142	18	Internal fault	5.8 DTC B1135, B1136, B1141, B1142
B1143	63	Security antenna short-to-ground	5.16 DTC B1143, B1144, B1145
B1144	64	Security antenna short-to-battery	5.16 DTC B1143, B1144, B1145
B1145	65	Security antenna open	5.16 DTC B1143, B1144, B1145
B1154	21	Clutch swith short-to-ground	5.17 DTC B1154, B1155
B1155	22	Neutral switch short-to-ground	5.17 DTC B1154, B1155
P0107	35	MAP sensor open/low	6.4 DTC P0107, P0108
P0108	36	MAP sensor high	6.4 DTC P0107, P0108
P0112	39	IAT sensor voltage low	6.5 DTC P0112, P0113
P0113	40	IAT sensor open/high	6.5 DTC P0112, P0113
P0117	37	ET sensor voltage low	6.6 DTC P0117, P0118
P0118	38	ET sensor open/high	6.6 DTC P0117, P0118
P0122	23	TP sensor open/low	6.7 DTC P0122, P0123
P0123	24	TP sensor high	6.7 DTC P0122, P0123
P0131	50	Front O2 sensor low or engine running lean	6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154
P0132	52	Engine front O2 running rich	6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154
P0134	54	Front O2 sensor open/not responding/high	6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154
P0151	51	Rear O2 sensor low or engine running lean	6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154
P0152	53	Engine rear O2 running rich	6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154
P0154	55	Rear O2 sensor open/not responding/high	6.8 DTC P0131, P0132, P0134, P0151, P0152, P0154
P0261	31	Front injector open/low	6.9 DTC P0261, P0262, P0263, P0264
P0262	33	Front injector high	6.9 DTC P0261, P0262, P0263, P0264
P0263	32	Rear injector open/low	6.9 DTC P0261, P0262, P0263, P0264
P0264	34	Rear injector high	6.9 DTC P0261, P0262, P0263, P0264
P0373	17	CKP sensor intermittent	6.10 DTC P0373, P0374
P0374	16	CKP not detected/cannot synchronize	6.10 DTC P0373, P0374
P0501	43	VSS low	6.11 DTC P0501, P0502
P0502	44	VSS high	6.11 DTC P0501, P0502
P0505	47	Loss of idle speed control	6.12 DTC P0505
P0562	41	ECM voltage low	3.6 DTC B0563, P0562, P0563
P0563	42	ECM voltage high	3.6 DTC B0563, P0562, P0563
P0603	2	ECM EEPROM error	6.13 DTC P0603, P0605
P0605	1	ECM flash error	6.13 DTC P0603, P0605



1. **Fuse block [61]**
2. **Positive battery cable**
3. **Battery**
4. **P&A battery [160]**
5. **Fuel sender resistor assembly [200]**
6. **DLC [91]**
7. **Main fuse [5]**
8. **Rear O2 sensor [137]**
9. **Fuel pump and low fuel switch [141]**
10. **Rear O2 sensor**

Figure 2-9. Under Left Side Cover: XR

COMMUNICATION DTCS AND "BUS ER"

Different issues with the serial data circuit may set different DTCs. A single module that loses communication cannot set DTCs. This causes the other modules to set DTCs indicating a communication failure with the inoperative module.

Diagnostic Tips

Modules must have power and be grounded in order to communicate. Therefore, when checking any communication DTC, verify the power and ground connections on the suspected module. In some cases "Bus Er" will show on the odometer.

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2. Is continuity present?
   a. **Yes.** Replace start relay. If problem is still present, see 3.2 STARTING SYSTEM, Start Relay Clicks. **(5832)**
   b. **No.** Go to Test 10.

10. Start Relay Control Circuit Open Test

1. Turn IGN OFF.
2. Disconnect TSM, TSSM or HFSM [30].
3. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness [30B] and [30A]. See 1.2 DIAGNOSTIC TOOLS.
4. Test continuity between [61B] socket terminal I and BOB terminal 9 (TN/GN) wire.
5. Is continuity present?
   a. **Yes.** Go to Test 11.
   b. **No, without anti-theft tracking module.** Repair open between [61B] socket terminal I and TSM, TSSM or HFSM [30B] terminal 9 (TN/GN) wire. **(5041)**
   c. **No, with anti-theft tracking module.** Go to Test 17.

11. TSM, TSSM or HFSM Ground Test

1. Test continuity between BOB terminal 12 (BK) wire and ground.
2. Is continuity present?
   a. **Yes.** Go to Test 12.
   b. **No.** Repair open between [30B] terminal 12 and GND 1 (BK) wire. **(5041)**

12. Continuity at Neutral Switch Test

1. Verify transmission is in neutral.
2. Test resistance between BOB terminal 4 (TN) wire and ground.
3. Is resistance less than 10 Ohms?
   a. **Yes.** Go to Test 15.
   b. **No.** Go to Test 13.

13. Neutral Switch Ground Circuit Test

1. Disconnect neutral switch jumper [136].
2. Test continuity between BOB terminal 4 and [136B] (TN) wire.
3. Is continuity present?
   a. **Yes.** Go to Test 14.
   b. **No.** Repair open in (TN) wire. **(5041)**

14. Neutral Switch Wire Test

1. Test continuity between [136A] and [131B] (TN) wire.
2. Is continuity present?
   a. **Yes.** Replace neutral switch. **(5157)**
   b. **No.** Repair open between [136A] and [131B] (TN) wire.

15. Start Relay Coil Control Circuit Short to Voltage Test

1. Remove start relay and turn IGN ON.
2. Test for battery voltage on breakout box terminal 9.
3. Is battery voltage present?
   a. **Yes.** Repair short to voltage between TSM, TSSM or HFSM [30B] terminal 9 and [62B] socket terminal I on (TN/GN) wire. **(5041)**
   b. **No.** Replace TSM, TSSM or HFSM. **(6757)**

16. Engine Stop Switch Voltage Test

1. Test voltage between [22B] terminal 3 and ground.
2. Is battery voltage present?
   a. **Yes.** Replace engine stop switch. **(5818)**
   b. **No.** Repair open between ignition fuse and [22B] (GY) wire. **(5041)**

17. Relay Enable Circuit Continuity Test

1. Disconnect the anti-theft tracking module.
2. Test continuity between [61B] socket terminal I and anti-theft tracking module [266B] terminal C (TN/GN) wire.
3. Is continuity present?
   a. **Yes.** Go to Test 18.
   b. **No.** Repair open in (TN/GN) wire. **(5041)**

18. Anti-Theft Tracking Module Test

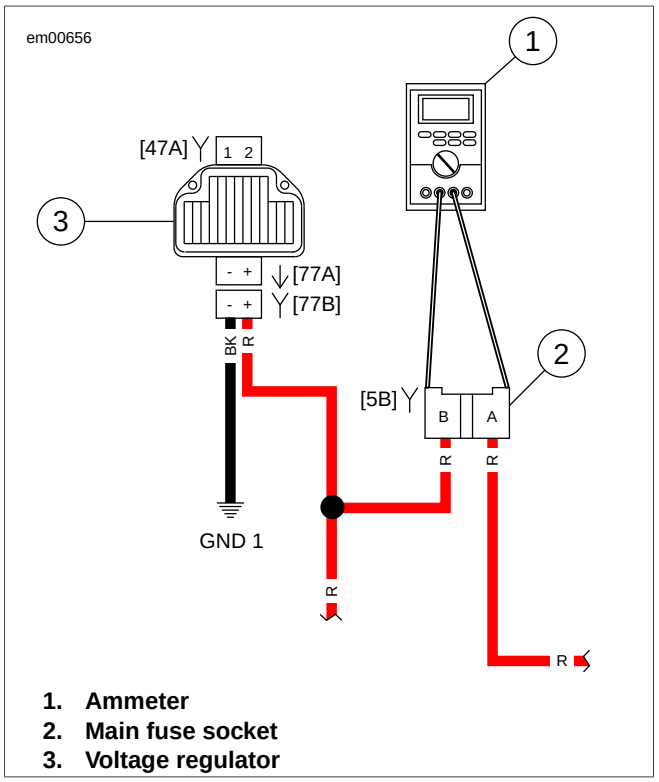
1. Test for continuity between breakout box terminal 9 and [266B] terminal D (TN/GN) wire.
2. Is continuity present?
   a. **Yes.** Replace the anti-theft tracking module. **(6756)**
   b. **No.** Repair open in (GN) wire. **(5041)**

START RELAY CLICKS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 3-8. Start Relay Clicks Diagnostic Faults

POSSIBLE CAUSES
Low battery
Starter solenoid malfunction
Open starter solenoid control circuit
Open starter solenoid ground circuit



1. **Ammeter**
2. **Main fuse socket**
3. **Voltage regulator**

Figure 3-10. Milliampere Draw Test (Ignition Turned to OFF)

Total Current Draw and Output Test

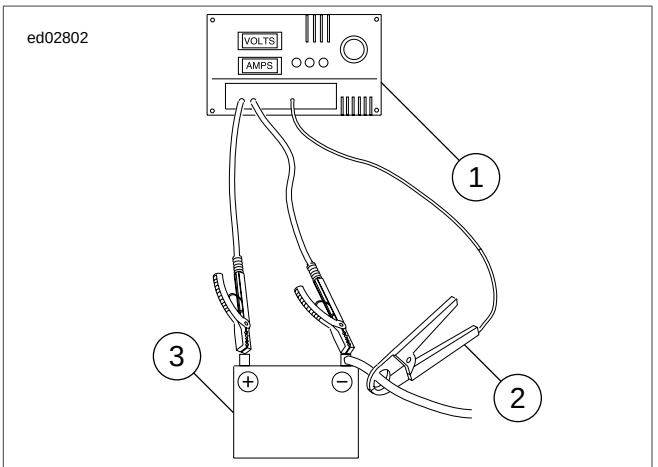
If battery runs down during use, the current draw of the motorcycle components and accessories may exceed output of the charging system.

NOTE

If a load tester is unavailable, use an ammeter with current probe.

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

Figure 3-11. Check Current Draw (Ignition Switch On)

1. See Figure 3-11. Connect load tester.
   a. Connect negative and positive leads to battery terminals.
   b. Place load tester induction pickup over battery negative cable.
2. With IGN OFF, disconnect voltage regulator [77].
3. Start engine.
4. Turn all continuously running lights and accessories ON (headlamp on high beam).
5. Run engine at 3000 rpm and make note of the current draw.
6. Turn engine OFF.
7. With IGN OFF, connect voltage regulator [77].
8. Remove the induction pickup from the battery negative cable.
9. Place induction pickup over positive regulator cable.
10. Start engine and run at 3000 rpm.

NOTE

Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible.

11. Increase the load as required to obtain a constant 13.0V.
12. Current output should be 24-30A. Make note of current output.

NOTE

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

13. Compare both of these readings.
    a. The current output should exceed current draw by 3.5A minimum.
    b. If output does not meet specifications, there may be too many accessories for the charging system to handle.

INSTRUMENTS 4.1

DESCRIPTION AND OPERATION

The instruments on the XL and XR look significantly different but do many of the same functions:

- The XL has only a speedometer, which contains the check engine lamp, low fuel lamp, battery lamp, security lamp and the sixth gear indicator, which is not used.
- The XR has a speedometer that displays vehicle speed in a digital output, and a tachometer. All the functions, including the indicators, the odometer and the trip odometer reset switch, are located in the tachometer.

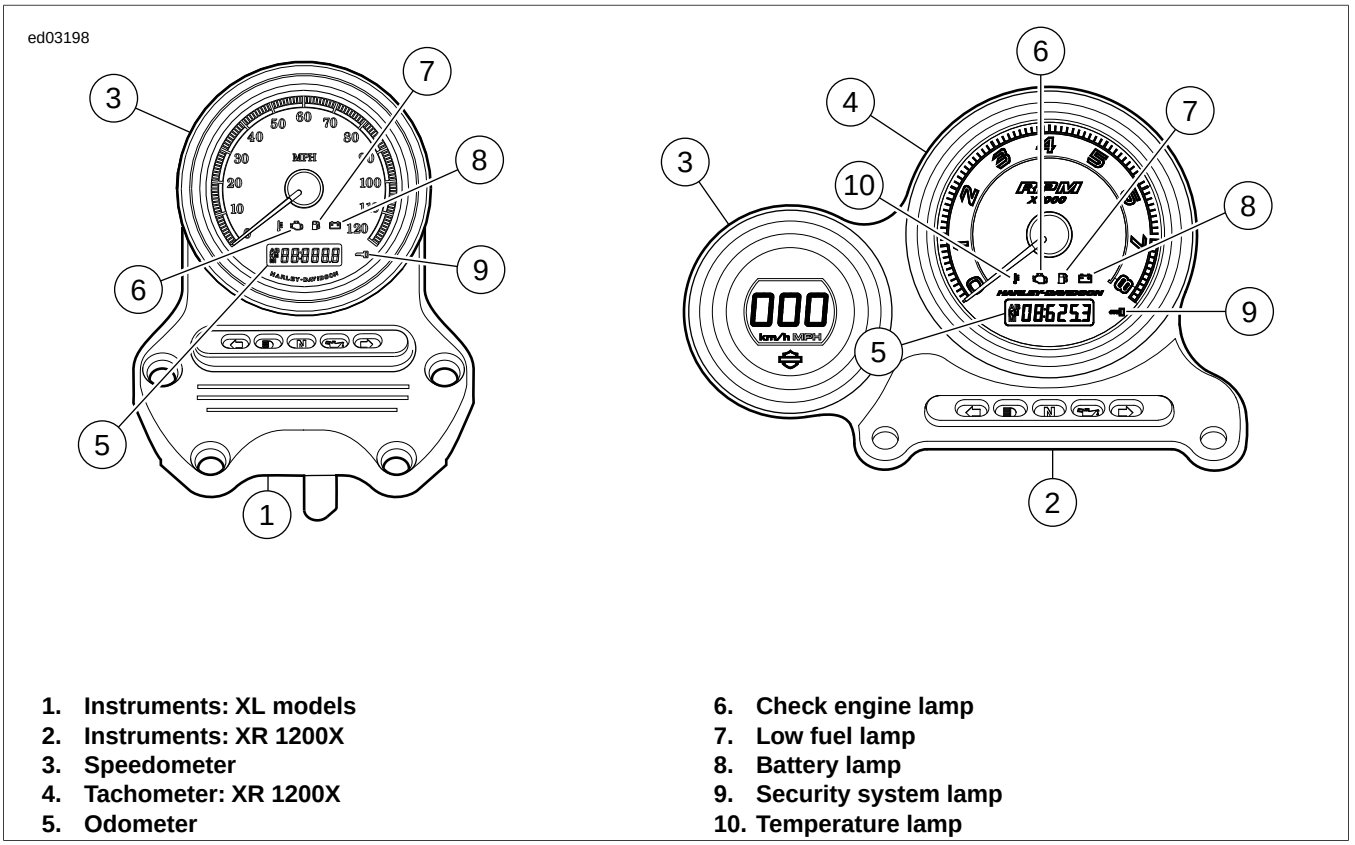
Trip Odometer Reset Switch Operation

Pressing the trip odometer reset switch provides the following capabilities:

- Change the odometer display between mileage, trip and fuel range values (press and immediately release).
- Reset the trip odometer (press and hold 2-3 seconds).
- Gain access to self-diagnostic mode and clear diagnostic codes. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.

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 and fuel range displays.

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



1. **Instruments: XL models**
2. **Instruments: XR 1200X**
3. **Speedometer**
4. **Tachometer: XR 1200X**
5. **Odometer**
6. **Check engine lamp**
7. **Low fuel lamp**
8. **Battery lamp**
9. **Security system lamp**
10. **Temperature lamp**

Figure 4-1. Instruments

Selecting Instrument Units: XR Models

The instrument units can be displayed in miles or kilometers.

1. Turn the ignition switch to the ACC or ON position.
2. Press the trip odometer reset switch to select the odometer display screen.
3. Press and hold the trip odometer reset switch until the units change (miles/kilometers).
4. To change the units again, release trip odometer reset switch, then press and hold until units change again.

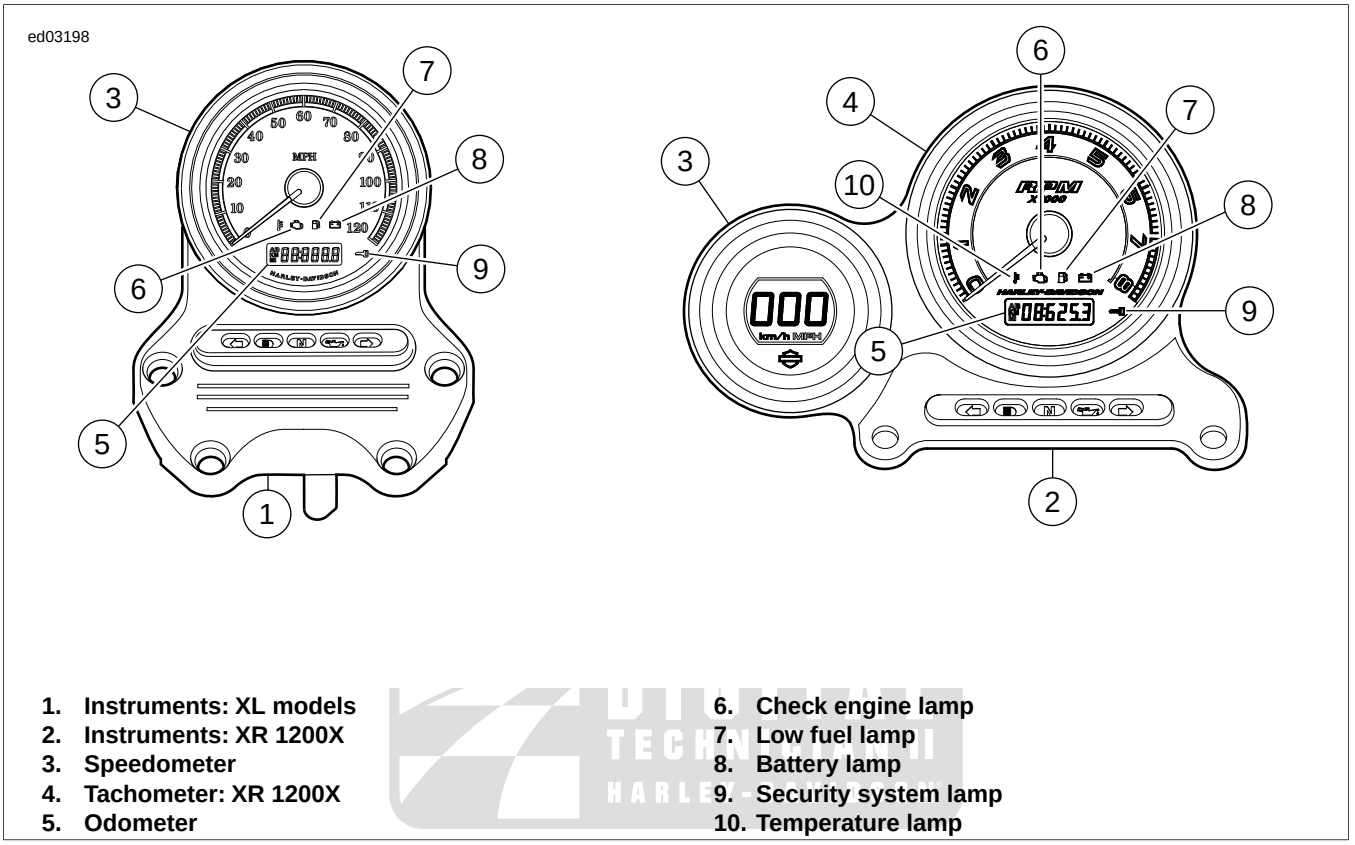
SPEEDOMETER THEORY OF OPERATION

The speed sensor is mounted on the right side of transmission case. The sensor circuitry is a Hall-Effect sensor that is

INDICATOR LAMPS 4.5

DESCRIPTION AND OPERATION

See Figure 4-7. The battery, check engine, security and low fuel indicators are located in the speedometer (XL) or tachometer (XR). The other indicators are located separately from the speedometer or tachometer.



1. **Instruments: XL models**
2. **Instruments: XR 1200X**
3. **Speedometer**
4. **Tachometer: XR 1200X**
5. **Odometer**
6. **Check engine lamp**
7. **Low fuel lamp**
8. **Battery lamp**
9. **Security system lamp**
10. **Temperature lamp**

Figure 4-7. Instruments

Table 4-11. Indicator Lamp Wiring

INDICATOR LAMP	CONNECTION
Check engine	Serial data
Security	Serial data
Battery	Serial data
Oil pressure	Ground through switch
Neutral	Ground through switch
High beam	12V when active
Right/left turn	12V when active
Low fuel	Designated circuit
Temperature (XR)	Serial data

Low Fuel Indicator

The low fuel indicator is controlled at terminal 9 (Y/W) of the speedometer (XL) or tachometer (XR). The speedometer or tachometer sends voltage on the (Y/W) wire to the low fuel switch and the fuel sender resistor pack. When the fuel drops below a given amount, refer to Table 4-12.

Table 4-12. Low Fuel Level Quantity

MODEL	CAPACITY
XR 1200X	0.50 gal (1.89 L)
XL 1200X, XL 1200V	0.65 gal (2.46 L)
XL 883R, XL 883N	0.80 gal (3.03 L)
XL 883L, XL1200C, CP, CA, CB	1.00 gal (3.79 L)

The low fuel switch closes and allows voltage to terminal 2 of the fuel sender resistor pack. This change in resistance in the circuit signals low fuel lamp to illuminate. The low fuel indicator also illuminates when DTC B1004 or B1005 is present.

ACCESSORIES 5.1

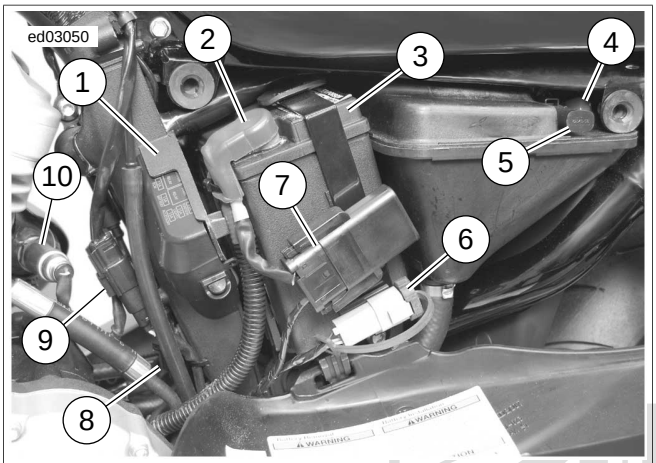
DESCRIPTION AND OPERATION

The P&A battery circuit is connected to battery power after the 30 Amp main fuse. This circuit may supply power to additional systems on the motorcycle.

COMPONENTS

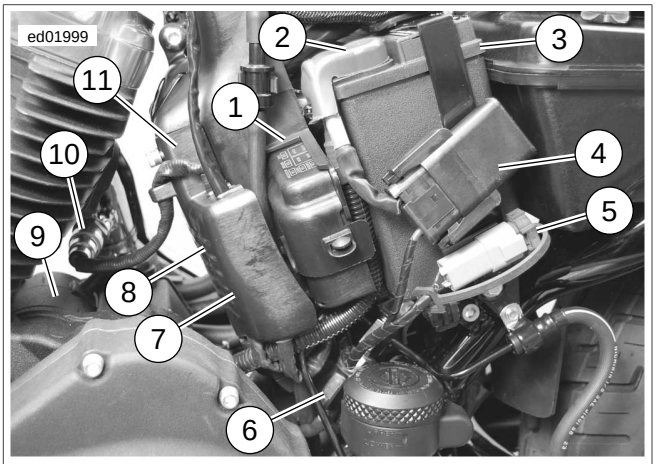
P&A Connector

See Figure 5-1 and Figure 5-2. The P&A battery [160] is located under the left side cover. A cap is plugged into it to keep it from being accidentally exposed.



1. Fuse block [61]
2. Positive battery cable
3. Battery
4. P&A battery [160]
5. Fuel sender resistor assembly [200]
6. DLC [91]
7. Main fuse [5]
8. Rear O2 sensor [137]
9. Fuel pump and low fuel switch [141]
10. Rear O2 sensor

Figure 5-1. Under Left Side Cover: XR



1. Fuse block [61]
2. Positive battery cable
3. Battery
4. Main fuse [5]
5. DLC [91]
6. Rear stop lamp switch (XL models) [121]
7. Fuel pump and low fuel switch [141]
8. Rear O2 sensor [137]
9. Starter
10. Rear O2 sensor
11. ECM

Figure 5-2. Under Left Side Cover: XL

8. Right Turn Signal Short to Voltage Test

1. Release the right turn signal switch.
2. Test for voltage on breakout box (gray) terminal 7.
3. Is battery voltage present?
   a. **Yes.** Repair short to voltage on (W/BN) wire.
   b. **No, without anti-theft tracking module.** Replace the TSM, TSSM or HFSM. **(6791)**
   c. **No, with anti-theft tracking module.** Go to Test 10.

9. Left Turn Signal Short to Voltage Test

1. Release the left turn signal switch.
2. Test for voltage on breakout box (gray) terminal 8.
3. Is battery voltage present?
   a. **Yes.** Repair short to voltage on (W/V) wire.
   b. **No, without anti-theft tracking module.** Replace the TSM, TSSM or HFSM. **(6791)**
   c. **No, with anti-theft tracking module.** Go to Test 10.

10. Anti-Theft Tracking Module Test

1. Disconnect anti-theft tracking module.
2. Press the inoperative turn signal switch.
3. Do the turn signals function properly?
   a. **Yes.** Replace the anti-theft tracking module. **(6791)**
   b. **No.** Replace the TSM, TSSM or HFSM. **(6791)**

ONE TURN SIGNAL LAMP INOPERATIVE, NO DTCS

PART NUMBER	TOOL NAME
HD-34730-2E	FUEL INJECTOR TEST LIGHT
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-7. One Turn Signal Lamp Inoperative, No DTCs Diagnostic Faults

POSSIBLE CAUSES
Open turn signal circuit
Open turn signal ground circuit
Inoperative turn signal

1. Inoperative Signal Location Test

1. With IGN ON, operate the left and right turn signals.
2. Do all the turn signals operate on both sides?
   a. **Yes.** System operating properly.
   b. **No, right front turn signal inoperative.** Go to Test 2.
   c. **No, left front turn signal inoperative.** Go to Test 5.
   d. **No, right rear turn signal inoperative, except XL1200C/CP/CA/CB.** Go to Test 8.
   e. **No, right rear turn signal inoperative, XL200C/CP/CA/CB.** Go to Test 20.
   f. **No, left rear turn signal inoperative, except XL200C/CP/CA/CB.** Go to Test 11.
   g. **No, left rear turn signal inoperative, XL200C/CP/CA/CB.** Go to Test 25.

2. Right Front Turn Signal Bulb Test

1. Remove the right front turn signal bulb.
2. Inspect the bulb.
3. Is the bulb good?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace the bulb. **(6820)**

3. Right Front Turn Signal Circuit Test

1. Disconnect front turn signals [31].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect the FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) to [31A] between terminals 1 and 2.
3. Press the right turn signal switch.
4. Does the test light flash?
   a. **Yes.** Replace the right front turn signal. **(6823)**
   b. **No.** Go to Test 4.

4. Right Front Turn Signal Ground Circuit Test

1. Test for voltage between [31A] terminal 2 and ground.
2. Does the test light flash?
   a. **Yes.** Repair open in (BK) wire between [31A] terminal 1 and ground. **(5041)**
   b. **No.** Repair open in (BN) wire between [31A] terminal 2 and TSM, TSSM or HFSM. **(5041)**

5. Left Front Turn Signal Bulb Test

1. Remove the left front turn signal bulb.
2. Inspect the bulb.
3. Is the bulb good?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace the bulb. **(6820)**

6. Left Front Turn Signal Circuit Test

1. Disconnect front turn signals [31].

STOP LAMP INOPERATIVE

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-9. Stop Lamp Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open fuse
Short in stop lamp circuit
Open power to switch circuit
Open ground circuit
Open stop lamp circuit
Stop lamp malfunction
Rear stop lamp switch malfunction
Front stop lamp switch malfunction

1. Accessory Circuit Test

1. Turn IGN to ACC.
2. Do the instruments illuminate?
   a. **Yes.** Go to Test 8.
   b. **No.** Go to Test 2.

2. Accessories Fuse Test

1. Inspect the ACCY fuse.
2. Is the fuse good?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 5.

3. Accessory Circuit from Ignition Switch Test

1. With IGN in ACC, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between [61B] socket terminal M and ground.
2. Is battery voltage present?
   a. **Yes.** Repair open in (O/W) wire from ACCY fuse. **(5043)**
   b. **No.** Go to Test 4.

4. Ignition Switch Test

1. Inspect for open or damaged wires between the ignition switch and the accessory fuse.
2. Was any damage to the wiring found?
   a. **Yes.** Repair open between [61B] socket terminal M and ignition switch. **(5041)**
   b. **No.** Replace the ignition switch. **(7287)**

5. Accessory Circuit Resistance Test

1. With the accessories fuse removed, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure resistance between [61B] socket terminal O and ground.
2. Is resistance less than 10 Ohms?
   a. **Yes.** Go to Test 6.
   b. **No.** See diagnostic tips. Replace accessories fuse and verify repair. **(6822)**

6. Speedometer Test

1. Disconnect the speedometer [39].
2. Measure resistance between [61B] socket terminal O and ground.
3. Is resistance less than 10 Ohms?
   a. **Yes, without tachometer.** Repair short to ground in accessory circuit (O/W) wire. **(5043)**
   b. **Yes, with tachometer.** Go to Test 7.
   c. **No.** Replace the speedometer. **(6765)**

7. Tachometer Test

1. Disconnect the tachometer [108].
2. Measure resistance between [61B] socket terminal O and ground.
3. Is resistance less than 10 Ohms?
   a. **Yes.** Repair short to ground in accessory circuit (O/W) wire. **(5043)**
   b. **No.** Replace the tachometer. **(6772)**

8. Stop Lamp Switch Test

1. Apply the front stop lamp switch while observing the stop lamp.
2. Apply the rear stop lamp switch while observing the stop lamp.
3. Does the stop lamp illuminate?
   a. **Yes, stop lamp illuminates only with front stop lamp switch applied.** Go to Test 11.
   b. **Yes, stop lamp illuminates only with rear stop lamp switch applied.** Go to Test 13.
   c. **No.** Go to Test 9.

9. Tail Stop Lamp Test

1. Disconnect rear lighting [94] (single stop lamp) or [7] (dual stop lamps).
2. With one of the stop lamp switches applied test for voltage between [94B] (single stop lamp) or [7A] (dual stop lamps) terminals 4 and 6.
3. Is battery voltage present?
   a. **Yes, single stop lamp, except XL1200C, CP, CA, CB.** Go to Test 15.
   b. **Yes, single stop lamp, XL1200C, CP, CA, CB.** Go to Test 20.
   c. **Yes, dual stop lamps.** Go to Test 17.
   d. **No.** Go to Test 10.

DTC B1121: HFSM

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

Table 5-13. DTC B1121 Diagnostic Faults: HFSM

POSSIBLE CAUSES
Open left turn signal circuit

1. Turn Signal Lamp Inspection Test

1. Remove and inspect left side turn signal bulbs.
2. Confirm the turn signal bulbs are the correct part numbers and the sockets are not corroded or damaged.
3. Were any issues found with the lamps?
   a. **Yes.** Repair as needed.
   b. **No.** Go to Test 2.

2. Turn Signal Circuit Open Test

1. With IGN OFF, disconnect HFSM [30].
2. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness connector [30B] leaving HFSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Disconnect front turn signals [31].
4. Test for continuity between breakout box terminal 5 and [31A] terminal 5.
5. Is continuity present?
   a. **Yes.** Replace the HFSM.
   b. **No.** Repair open in (V) wire.

DTC B1121: TSM OR TSSM

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

Table 5-14. DTC B1121 Diagnostic Faults: TSM or TSSM

POSSIBLE CAUSES
Indicator lamp assembly malfunction
Short to voltage on left turn signal circuit
Short to ground on left turn signal circuit
Open left turn signal circuit

1. Operational Test

1. Turn IGN ON.
2. Are the turn signal lamps on continuously?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 4.

2. Indicator Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect the instruments [20].
3. Turn IGN ON.
4. Are the turn signal lamps on continuously?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace indicator lamp assembly.

3. TSM or TSSM Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness connector [30B], leaving the TSM or TSSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. With IGN ON, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, test for voltage between breakout box terminal 5 and ground.
4. Is voltage present?
   a. **Yes.** Repair short to voltage on the (V) wire.
   b. **No.** Replace the TSM or TSSM.

4. Indicator Shorted Test

1. With IGN OFF, disconnect the instruments [20].
2. Turn IGN ON.
3. Operate the left turn signals.
4. Do the turn signals flash?
   a. **Yes.** Replace indicator lamp assembly.
   b. **No.** Go to Test 5.

5. Shorted Turn Signal Circuit Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness connector [30B] leaving TSM or TSSM [30A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Test for continuity between breakout box terminal 5 and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground in (V) wire from terminal 5.
   b. **No.** Go to Test 6.

6. Turn Signal Circuit Open Test

1. Disconnect front turn signals [31].
2. Test for continuity between breakout box terminal 5 and [31A] terminal 5.
3. Is continuity present?
   a. **Yes.** Replace the TSM or TSSM.
   b. **No.** Repair open in (V) wire.

Table 5-26. Key Fob Assignment: TSSM

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set engine stop to **OFF**		Verify the security lamp is not flashing (vehicle is disarmed) This assignment procedure **must** be completed with no pauses between steps greater than 10 seconds
2	Turn ignition/headlamp switch **ON**-OFF-**ON**-OFF-**ON**		
3	Press **left** turn switch **2 times** and release	One to four flashes turn signals and indicators depending on vehicle configuration (See 5.12 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS, Power Disruption and Configuring: TSSM regarding battery disconnects.)	One flash - Worldwide TSM, no security Two 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 IGN OFF		

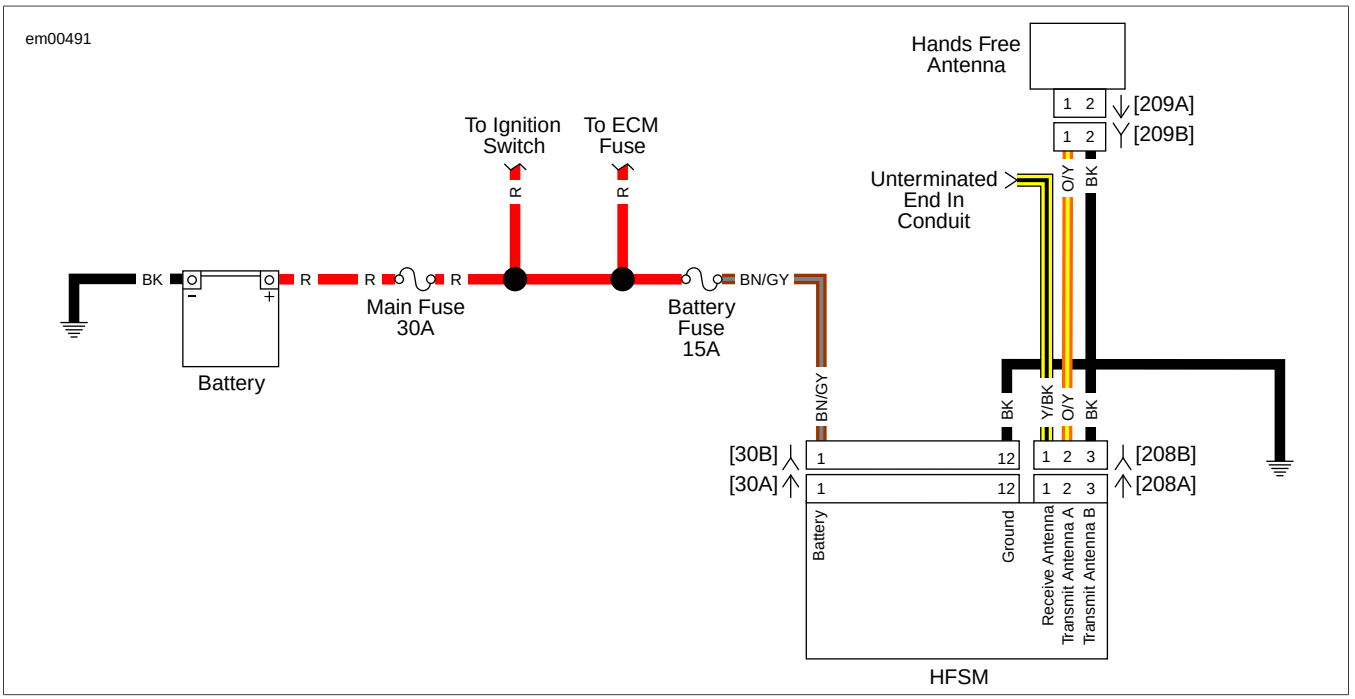
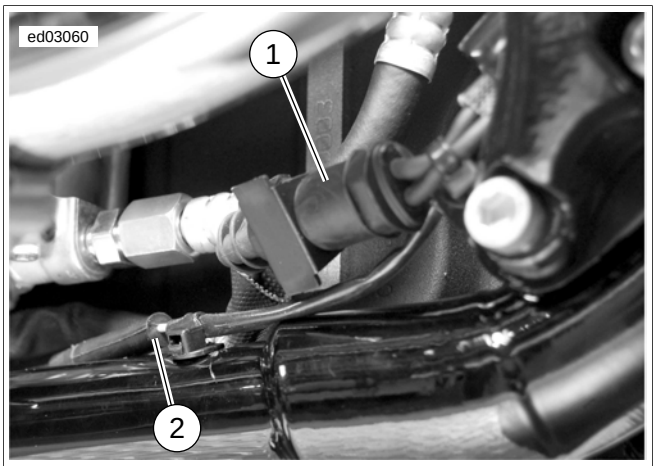


Figure 5-22. Antenna Circuit: HFSM

DTC B1154, B1155 5.17

DESCRIPTION AND OPERATION

The TSM, TSSM or HFSM monitors the clutch and neutral switch circuits to determine whether or not to let the vehicle start. If the TSM, TSSM or HFSM does not see that the clutch switch is closed (lever pulled in) or the neutral switch is closed (transmission in neutral) it will not activate the start relay. The TSM, TSSM or HFSM controls the start relay by supplying the ground circuit to the coil of the start relay.



1. **Voltage regulator to stator [47]**
2. **Neutral switch [136]**

Figure 5-29. Lower Right Front

Diagnostic Tips

DTCs B1154 and B1155 will set when either the clutch switch circuit or neutral switch circuit is shorted to ground at speeds greater than 10 mph (16 km/h) for more than 60 seconds. Refer to Table 5-41.

Table 5-41. Code Description

DTC	DESCRIPTION
B1154	Clutch switch short-to-ground
B1155	Neutral switch short-to-ground

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), including the color of the harness test kit terminal probes, see B.1 CONNECTORS.

O2 Sensor (Front and Rear)

The O2 sensor detects unburned oxygen in the engine exhaust. The output of the sensor is a voltage having a range of about 0-1.0V.

- Output above 0.5V represents a rich mixture.
- Output of 0.5V represents a proper balance between lean and rich.
- Output below 0.5V represents a lean mixture.

The change in output level signals the ECM to modify the air/fuel ratio.

It is important to note the O2 sensor does not operate efficiently until it is at vehicle operating temperature. Therefore, before any troubleshooting takes place, bring the sensor to operating temperature. Leaks in the exhaust system, leaky exhaust valves, misfires or any engine problem allowing unburned oxygen into the exhaust stream could create a DTC indicating a bad sensor. Look for problems related to an improper air/fuel mixture before replacing the sensor.

DRIVERS

The ECM drivers are the output devices or system outputs of the EFI system. Drivers are provided ground by the ECM to pump, inject and ignite the air/fuel mixture in the engine, and to activate relays.

Fuel Pump

The fuel pump, located inside the fuel tank, is provided battery voltage when the system relay is activated.

Ignition Coils and Spark Plugs

The ignition coils create the energy to fire the spark plugs and ignite the air/fuel mixture in the cylinders. Advancing or retarding the spark is controlled by the ECM to suit load and speed conditions of the engine.

See Figure 6-1. Each cylinder has its own ignition coil which is provided power by the system relay. Each coil is controlled independently by the ECM.

Fuel Injectors

The system relay provides battery power to the fuel injectors. The ECM provides the path to ground to trigger the injectors. The fuel injectors are pulse-width modulated solenoids for metering fuel into the intake tract. The pulse-width of the ground path to the injectors is varied by the ECM in response to inputs from the various sensors, thus varying the length of time the injector is open.

Idle Air Control (IAC)

The IAC motor is a stepper-motor used to regulate the amount of air entering the intake manifold during idle. The ECM controls engine idle speed by moving the IAC pintle 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.

Start Relay

Pressing the start switch activates the start relay, sending battery voltage to the starter solenoid. The TSM, TSSM or HFSM controls the ground to the start relay, disabling it during security and tip over conditions.

Active Intake Solenoid (AIS): XR England, Japan

The AIS regulates the amount of air entering the air cleaner. The AIS opens when vehicle speed exceeds 45 mph (70 km/h) with 50% or greater throttle opening. Once open, active intake will close when vehicle speed falls below 40 mph (65 km/h).

Table 6-1. Engine Starts Hard

CAUSE	SOLUTION
Engine temperature circuit	Repair the circuit. If DTC P0117 or P0118 is present, diagnose and correct DTCs.
Fuel or Ignition system fault	Perform misfire diagnostics.
Battery discharged	Charge and test the battery. Perform charging system diagnosis if problem continues.
Crank position sensor circuit	Repair the circuit. If DTC P0373 or P0374 is present, diagnose and correct DTC.
Manifold leak	Perform intake leak test.
Ignition coil circuit/spark plugs	Repair the circuit. If DTC P1351, P1352, P1354 or P1355 is present, diagnose and correct DTCs.
Leaky injectors	Check for mechanical failures of the fuel injectors. If DTC P0261, P0262, P0263 or P0264 is present, diagnose and correct them.
Clogged fuel injectors	Clean or replace fuel injectors.
Valve sticking	Perform compression test.

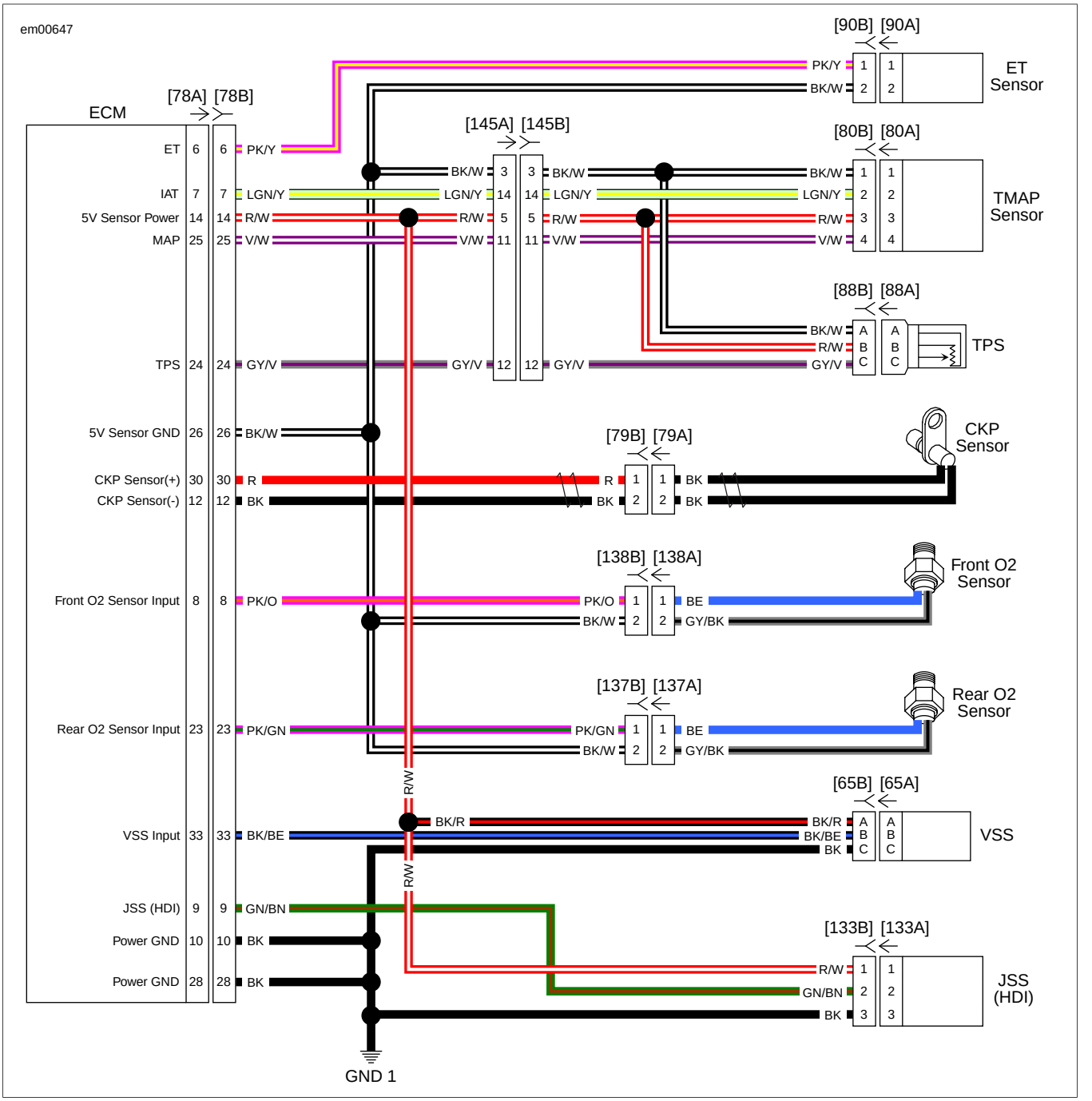


Figure 6-9. Sensor Circuit

DTC P0117

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

Table 6-11. DTC P0117 Diagnostic Faults

POSSIBLE CAUSES
ET sensor malfunction
Short to ground in 5V reference circuit

1. ET Sensor Test

1. Disconnect ET sensor [90].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure the resistance between [90A] terminals 1 and 2.
3. Is the resistance reading between 900-10,000 Ohms with the vehicle and sensor at ambient room temperature?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace ET sensor.

3. Start the engine and allow it to reach operating temperature.
4. With engine speed at a steady rpm, measure voltage between breakout box terminals 23 and 26.
5. Is voltage less than 0.4V?
   a. **Yes.** Replace the ECM.
   b. **No.** Perform fuel pressure test. Look for correct ECM calibration, high fuel pressure, stuck open or leaking injectors. If no issues are found, replace the O2 sensor.

DTC P0154

PART NUMBER	TOOL NAME
HD-43876	HARNESS CONNECTOR TEST KIT

Table 6-22. DTC P0154 Diagnostic Faults

POSSIBLE CAUSES
Rear O2 sensor malfunction
Open or short voltage in signal circuit
Open sensor ground

1. Rear O2 Sensor Signal Wire Short Circuit Voltage Test

1. Disconnect rear O2 sensor [137].
2. Turn IGN ON.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-43876) and a multimeter, measure voltage between rear O2 sensor [137B] terminal 1 to chassis ground.
4. Is voltage greater than 5.5V?
   a. **Yes.** Repair short to voltage on (PK/GN) wire.
   b. **No. (Greater than 4V.)** Go to Test 2.
   c. **No. (Less than 4V.)** Go to Test 3.

2. Rear O2 Sensor Open Sensor Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
3. Test for continuity between rear O2 sensor [137B] terminal 2 (BK/W) and breakout box terminal 26.
4. Is continuity present?
   a. **Yes.** Replace the rear O2 sensor.
   b. **No.** Repair open on (BK/W) wire.

3. Rear O2 Sensor Signal Wire Open Test

1. Test for continuity between rear O2 sensor [137B] terminal 1 (PK/GN) and breakout box terminal 23.
2. Is continuity present?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (PK/GN) wire.

DTC P0501

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

Table 6-32. DTC P0501 Diagnostic Faults

POSSIBLE CAUSES
VSS malfunction
Open or short to ground in signal circuit
Open or short to ground in 5V reference circuit

1. VSS Connections Test

1. With IGN OFF, disconnect VSS [65].
2. Inspect [65] for damaged terminals, backed out or bent terminals. Repair as necessary.
3. Place transmission in neutral, turn IGN ON and engine stop switch to RUN.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure voltage between VSS [65B] terminal A and ground.
5. Is voltage reading approximately 5.0V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 2.

2. VSS Sensor Power Short to Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78].
3. Test continuity between [65B] terminal A and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground on (BK/R) wire.
   b. **No.** Repair open on (BK/R) wire.

3. VSS Signal Wire Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-43876) to wire harness [78B], leaving ECM [78A] disconnected. See 1.2 DIAGNOSTIC TOOLS.
2. Test for continuity between breakout box terminals 33 and 28.
3. Is continuity present?
   a. **Yes.** Repair short to ground on (BK/BE) wire.
   b. **No.** Go to Test 4.

4. VSS Signal Wire Open Test

1. Test for continuity between breakout box terminal 33 and [65B] terminal B.
2. Is continuity present?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open on (BK/BE) wire.

5. VSS Dirty or Damaged Test

1. Remove VSS.
2. Check for debris on the sensor tip.
3. Is debris present?
   a. **Yes.** Clean debris from VSS and install.
   b. **No.** If VSS connections are good, replace VSS.

DTC P0502

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

Table 6-33. DTC P0502 Diagnostic Faults

POSSIBLE CAUSES
VSS malfunction
Short to voltage in signal circuit
Open ground
5V reference shorted to battery voltage

1. VSS Sensor Power Shorted to Voltage Test

1. With IGN OFF, disconnect VSS [65].
2. Inspect [65] for damaged, terminals backed out or bent terminals. Repair as necessary.
3. Place transmission in neutral, turn IGN ON and engine stop switch to RUN.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404) and a multimeter, measure voltage between VSS [65B] terminals A (BK/R) and C (BK).
5. Is voltage greater than 6.0V?
   a. **Yes.** Repair short to voltage on (BK/R) wire.
   b. **No.** Go to Test 2.

2. VSS Signal Wire Short to Voltage Test

1. Measure voltage between VSS [65B] terminal B (BK/BE) and ground.
2. Is voltage above 6.0V?
   a. **Yes.** Repair short to voltage on (BK/BE) wire.
   b. **No.** Go to Test 3.

3. VSS Ground Wire Open Test

1. Test continuity between breakout box terminal 28 and VSS [65B] terminal C (BK).
2. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open on (BK) wire.

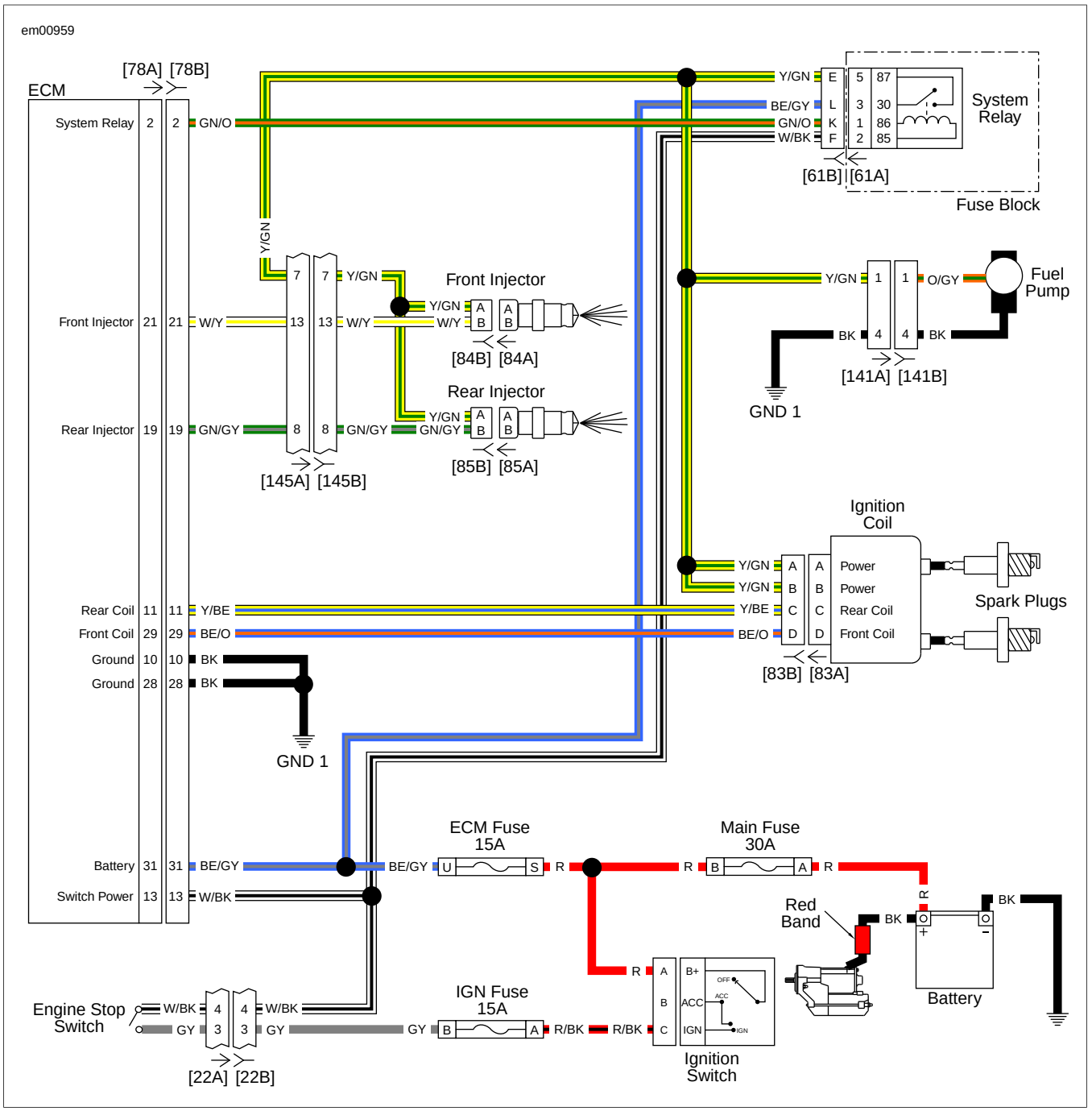


Figure 6-29. Ignition Circuit

1. Starts, Then Stalls Test

1. Check for DTCs and diagnose them first.
2. Does the engine start and stall?
   a. **Yes.** See 6.22 STARTS, THEN STALLS.
   b. **No.** Go to Test 2.

2. Neutral Test

1. Verify the transmission is in neutral.
2. Is the neutral indicator on?
   a. **Yes.** Go to Test 3.
   b. **No.** See 4.5 INDICATOR LAMPS.

3. JSS Clearance Test

1. Inspect the JSS and the jiffy stand for correct mounting and clearance to the jiffy stand tab.
2. Is the clearance less than 0.18 in (4.5 mm)?
   a. **Yes.** Replace the JSS.
   b. **No.** Install the JSS and jiffy stand correctly.

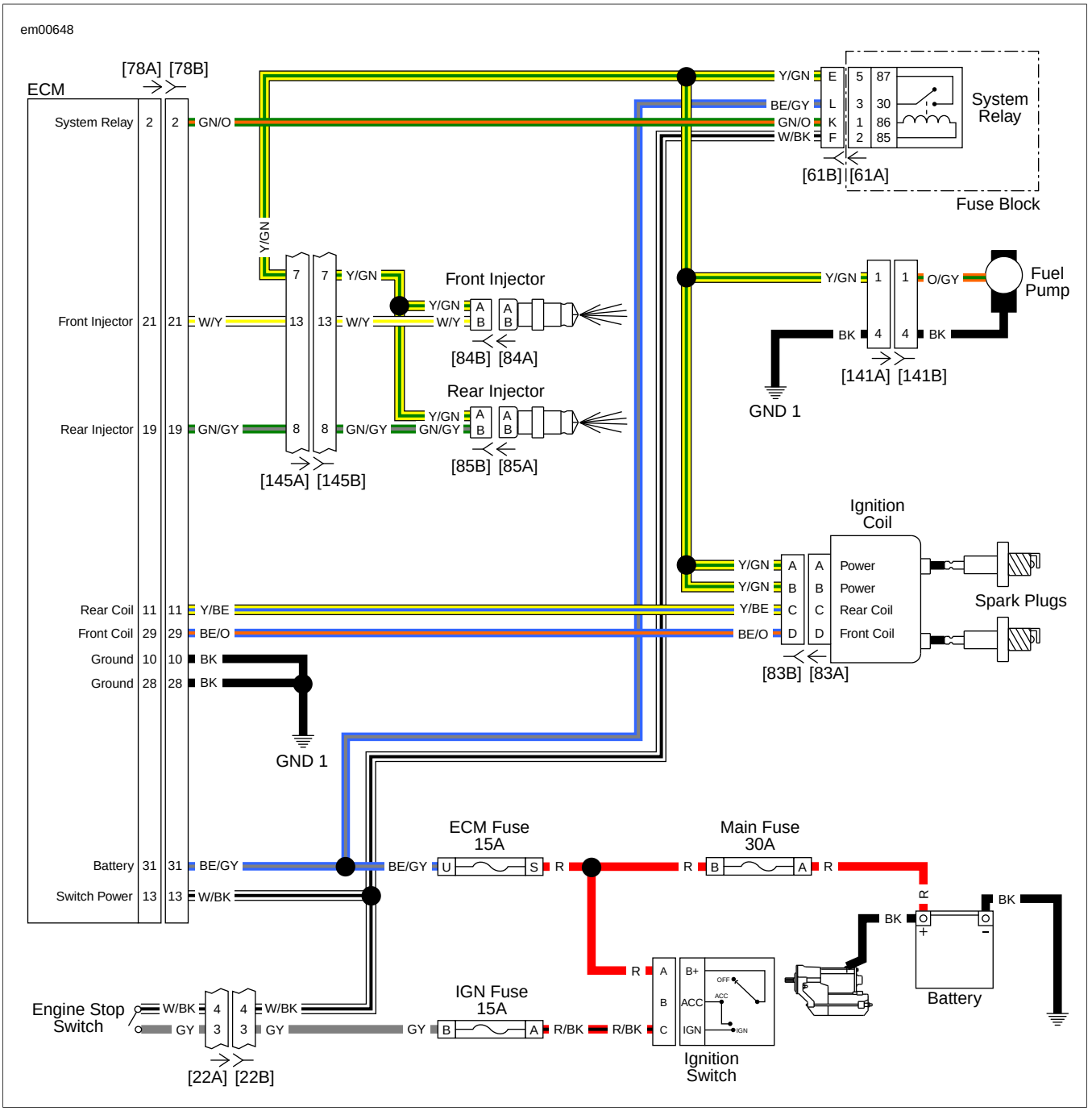


Figure 6-44. Ignition Circuit

HESITATION, LOSS OF POWER TEST

PART NUMBER	TOOL NAME
HD-26792	SPARK TESTER

Table 6-60. Hesitation, Loss of Power Test Diagnostic Faults

POSSIBLE CAUSES
Loss of engine compression
Fuel system issues

1. Preliminary Engine Tests

1. Verify battery connections are in good condition.
2. Verify there are no blown fuses.
3. Verify fuel in the tank is fresh and not contaminated.
4. Verify spark plug wires are firmly connected the coil and plugs.
5. Verify fuel injectors are not clogged.
6. Check for DTCs. See 2.1 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics. If DTCs are present, see the appropriate DTC procedure.

DELPHI 100W MICRO-PACK SEALED CONNECTOR A.3

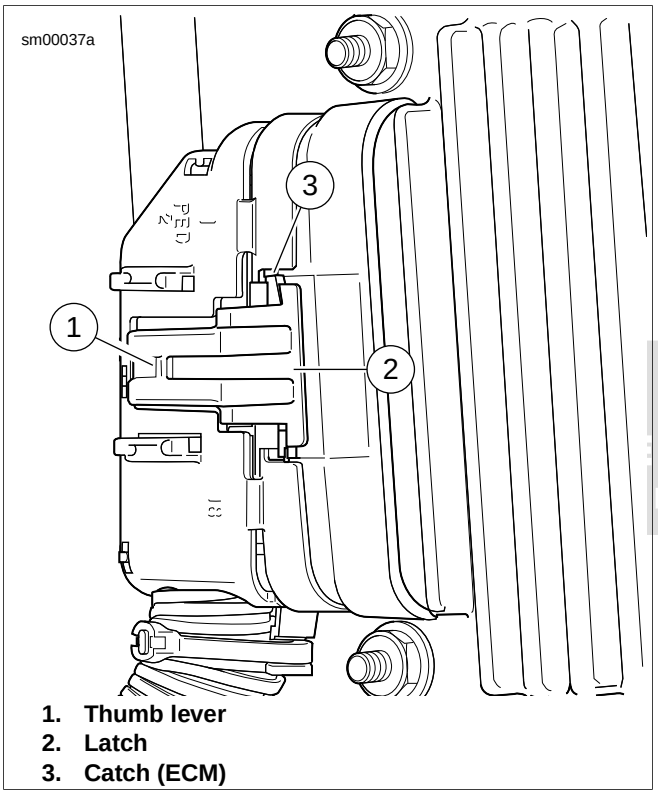
DELPHI 100W MICRO-PACK SEALED CONNECTOR REPAIR

General

A Delphi 100W Micro-Pack Sealed connector connects the electronic control module (ECM) to the main harness.

Separating Socket Housing From ECM

See Figure A-6. 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.

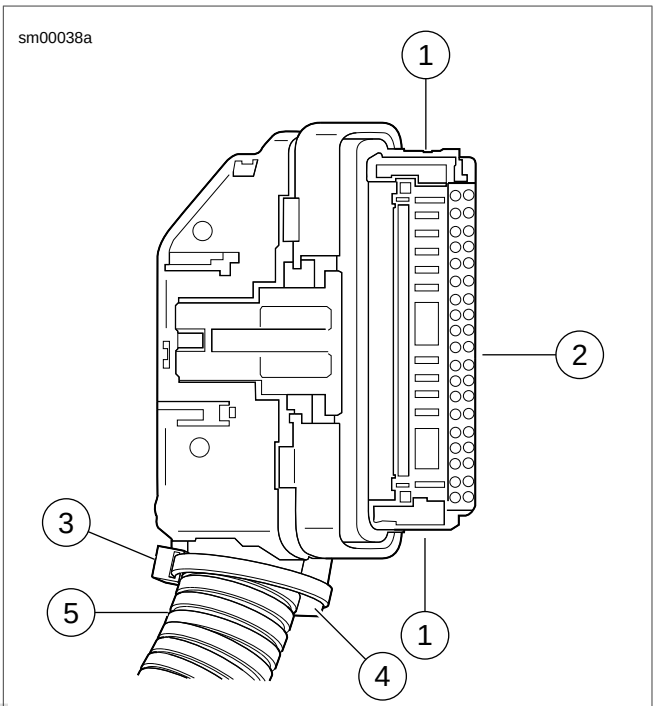


1. **Thumb lever**
2. **Latch**
3. **Catch (ECM)**

Figure A-6. Delphi 100W Micro-Pack Sealed Connector to ECM

Mating Socket Housing To ECM

Push the connector into the ECM until the latch is captured by the catch on the ECM.



1. **Latch**
2. **Secondary lock**
3. **Cable strap**
4. **Strain relief collar**
5. **Conduit**

Figure A-7. Delphi 100W Micro-Pack Sealed Connector

Removing Socket Terminal

1. See Figure A-7. To remove, gently press latch (1) on each side of the clear plastic secondary lock (2). 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-8. 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.

DELPHI MICRO 64 SEALED CONNECTORS A.10

DELPHI MICRO 64 SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-45928	TERMINAL REMOVER
HD-45929	TERMINAL CRIMPER

General

Delphi Micro 64 Sealed connectors are frequently found on speedometers, tachometers and the ECM of Touring Models.

Separating Pin and Socket Housings

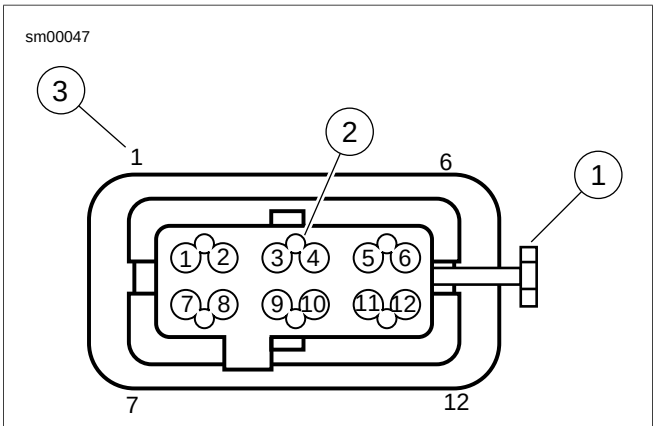
Bend back the external latches slightly and separate the pin and socket housings.

Mating Pin and Socket Housings

Orient the wire lead colors. Align pin and socket housings. Push the pin and socket housings of the connector together until the latches click.

Removing Terminal

1. See Figure A-18. 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.



1. **Secondary lock**
2. **Pin hole**
3. **Stamped number**

Figure A-18. Delphi Micro-64 Sealed Connector: Housing

4. See Figure A-19. Obtain the TERMINAL REMOVER (Part No. HD-45928).
5. See Figure A-20. 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-19. Terminal Remover (HD-45928)

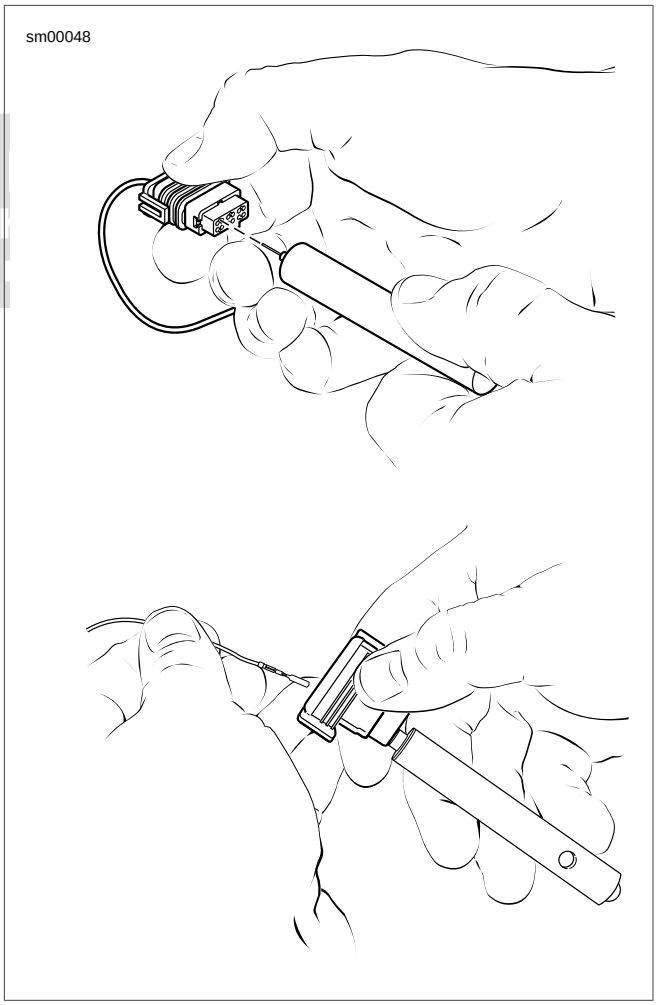
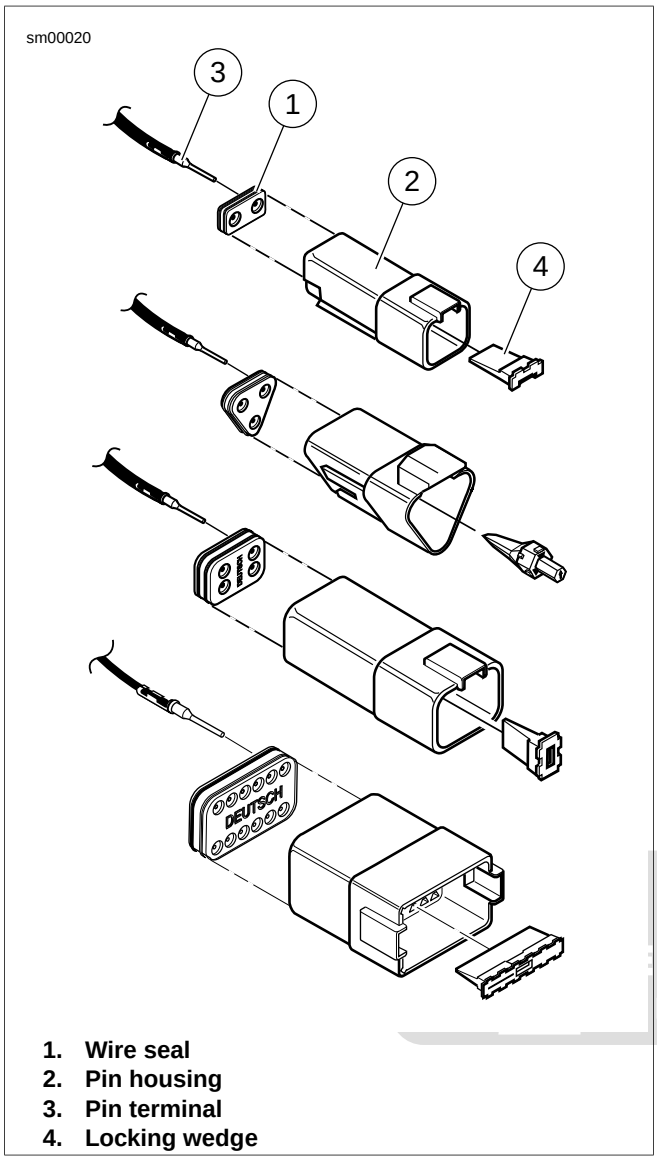


Figure A-20. Delphi Micro-64 Sealed Connector: Insert Tool and Remove Terminal



1. **Wire seal**
2. **Pin housing**
3. **Pin terminal**
4. **Locking wedge**

Figure A-34. Deutsch DT Sealed Connector: 2, 3, 4 and 12-Place Pin Housings

Crimping Terminals

Identify which of the types of Deutsch terminals are used with the connector. Follow the corresponding crimping instructions. Refer to Table A-2.

Table A-2. Deutsch Connector: Terminal Crimping Instructions

TYPE	CRIMPING INSTRUCTIONS
DT Sealed (with crimp tails)	A.14 DEUTSCH DT SEALED TERMINAL REPAIR
DTM Mini Sealed Terminal (solid barrel)	A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR
DTM Mini Sealed Terminal (with crimp tails)	A.15 DEUTSCH DTM SEALED MINI TERMINAL REPAIR

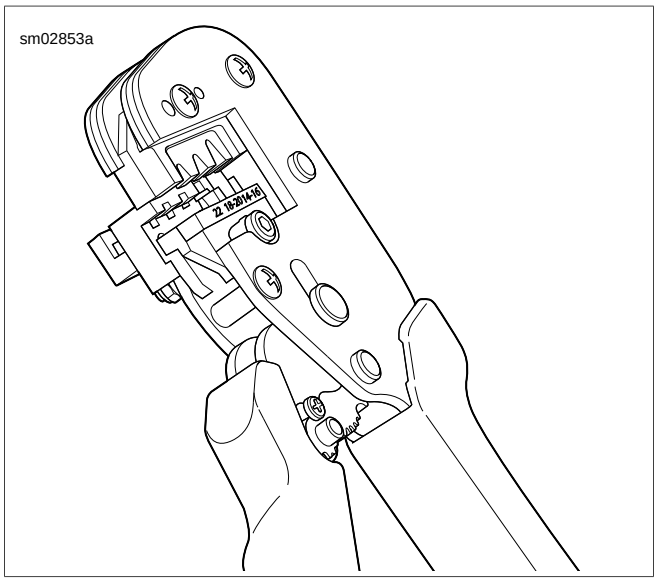
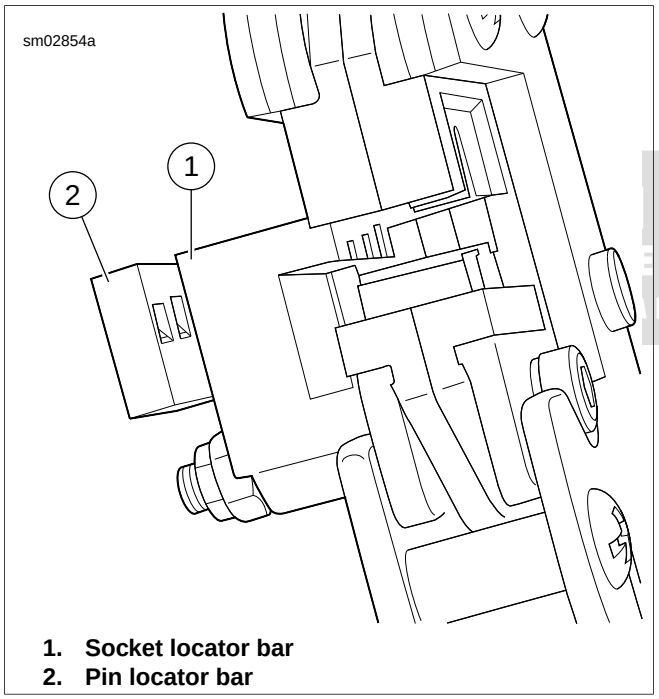


Figure A-51. Open Terminal Crimper (HD-48119) at 45 Degrees



1. **Socket locator bar**
2. **Pin locator bar**

Figure A-52. Terminal Locator Bars

Position Terminal in the Punch/Die

1. See Figure A-53. With the crimp tails up, place the terminal through the punch/die into the square opening in the socket locator bar.
   a. **Socket Terminal:** See Figure A-52. A socket terminal stops against the back face of the socket locator bar (1).
   b. **Pin Terminal:** See Figure A-54. The tip of a pin terminal passes through the socket locator bar and stops in the notch in the face of the pin locator bar.
2. See Figure A-55. Ratchet the handles together until the crimp tails are held in vertical alignment between the punch and the die.

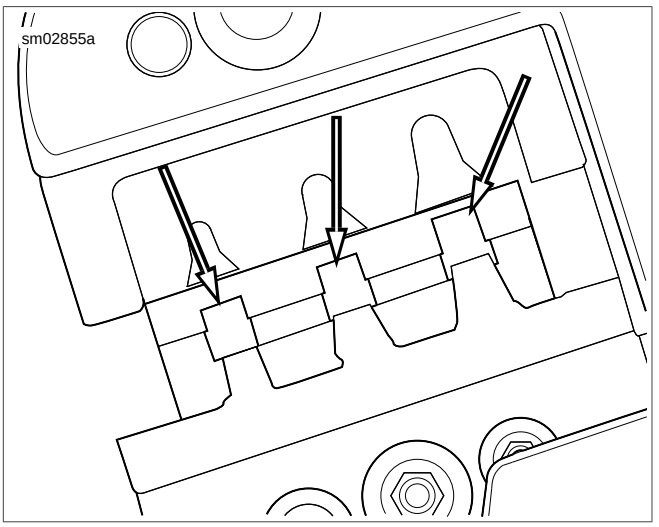


Figure A-53. Square Openings in Socket Locator Bar

Insert Stripped Lead

See Figure A-56. Insert the stripped end (wire core) between the crimp tails at an up angle until the wire core touches the face of the socket locator bar above the square opening.

NOTES

- *The insulation must extend through the insulation crimp tails.*
- *Insert the wire with little or no pressure. Pressing on the lead will bend the wire core.*

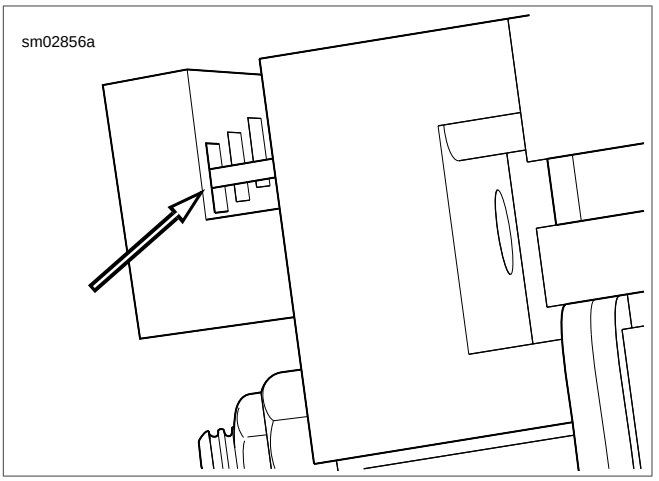


Figure A-54. Pin Terminal against Pin Locator Bar

SEALED SPLICE CONNECTORS A.23

SEALED SPLICE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-25070	HEAT GUN
HD-38125-8	PACKARD CRIMPING TOOL
HD-39969	ULTRA TORCH
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

When splicing adjacent wires, stagger the splices that the sealed splice connectors will not touch each other.

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-11.
3. Strip insulation off the the wire lead. Refer to Table A-11.

Table A-11. Sealed Splice Connectors

WIRE GAUGE	COLOR	PART NO.	STRIP LENGTH	
			in	mm
18-20 (0.5-0.8 mm)	Red	70585-93	3/8	9.5
14-16 (1.0-2.0 mm)	Blue	70586-93	3/8	9.5
10-12 (3.0-5.0 mm)	Yellow	70587-93	3/8	9.5

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-77. The connector is crimped on one side and then the other.

1. See Figure A-76. 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. Insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure A-77. 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. 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 electrical system component that is not being serviced.
- Always keep hands away from tool tip area and heat shrink attachment.

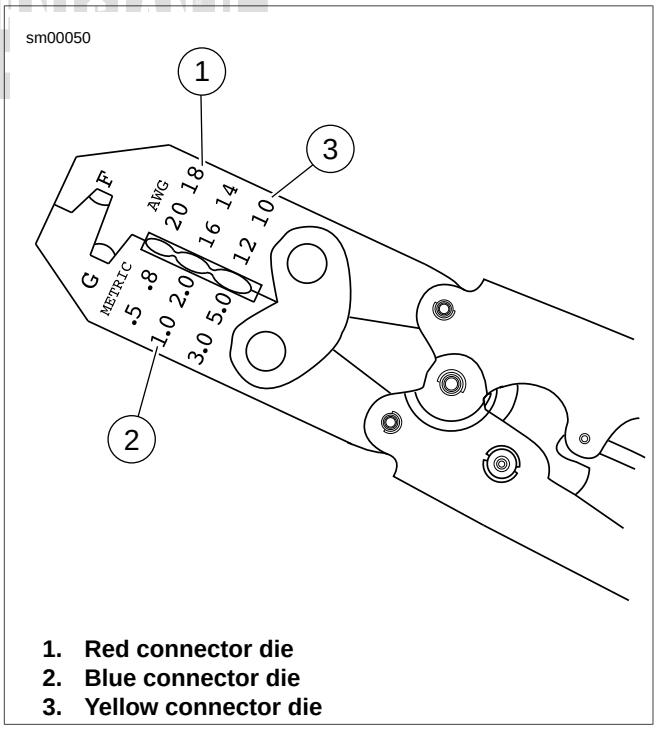
7. Use an ULTRA TORCH (Part No. HD-39969), or a HEAT GUN (Part No. HD-25070) with a HEAT SHIELD ATTACHMENT (Part No. HD-41183), to heat the connector from the center of the crimp (3) out to each end.

NOTE

It is acceptable for the splice to rest against the heat shrink tool attachment.

Inspecting Seals

See Figure A-77. 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-76. Packard Crimping Tool (HD-38125-8)

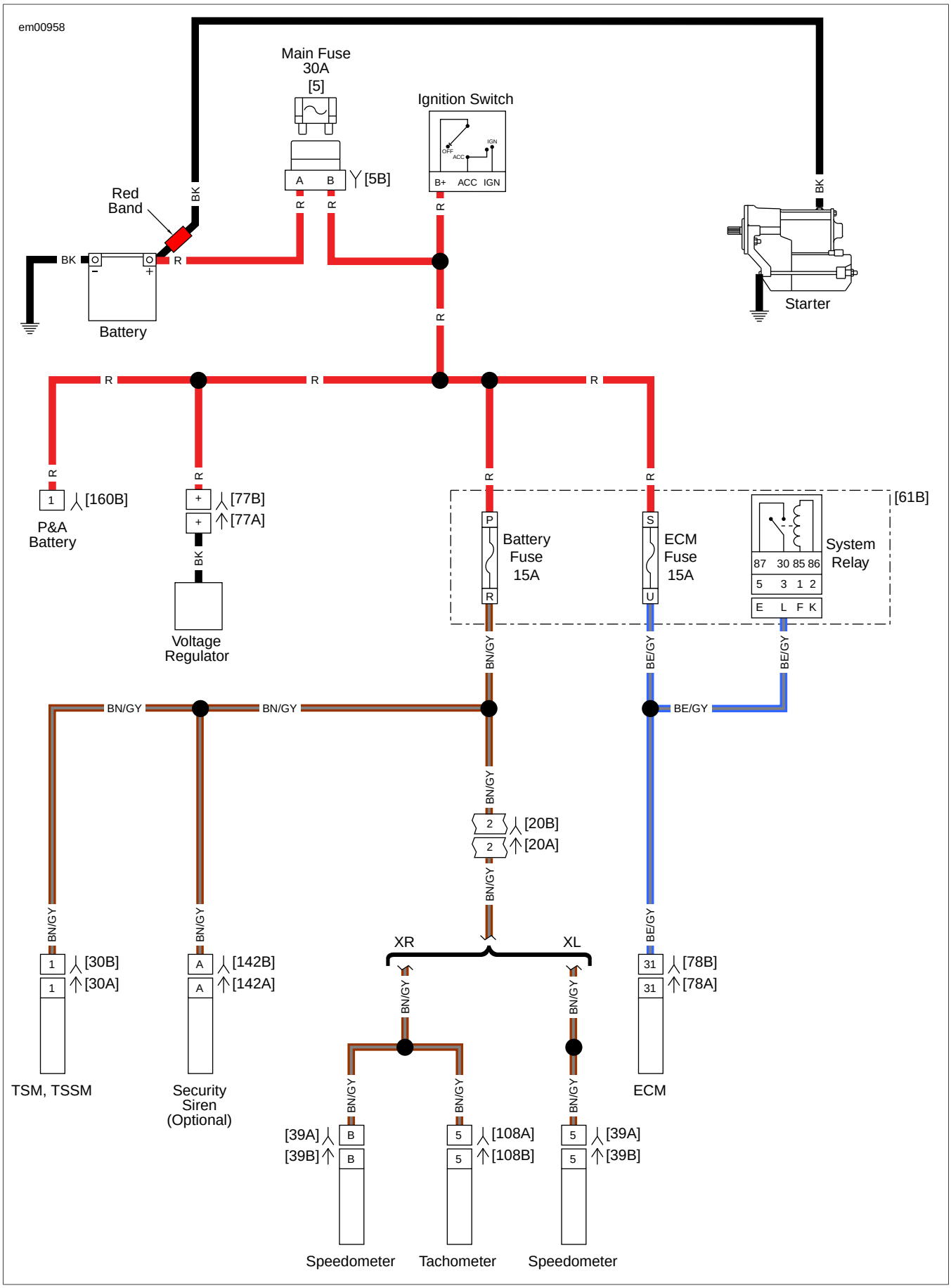


Figure B-3. Battery Power

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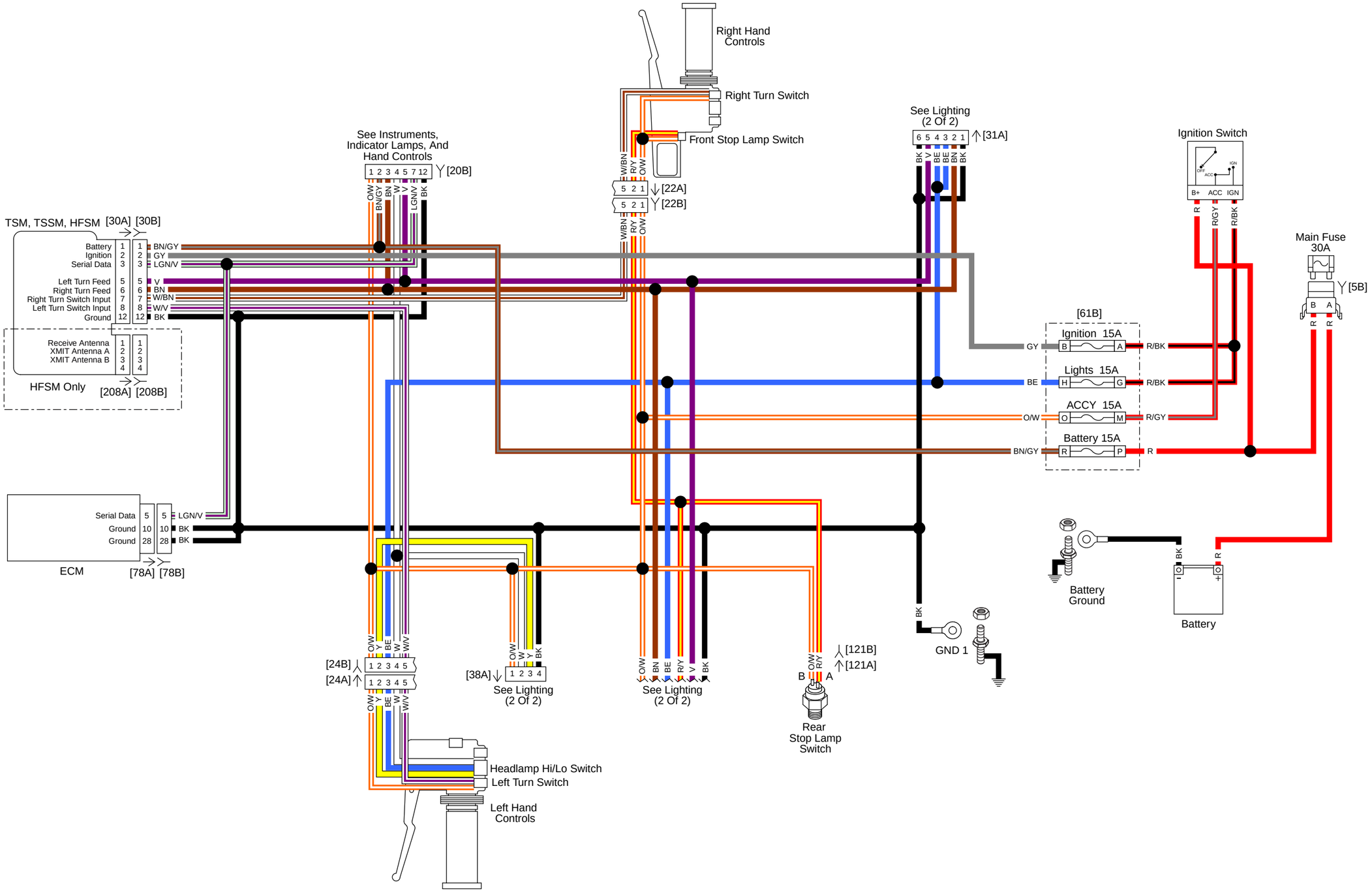

Figure B-10. Lighting (1 of 2): 2013 Sportster

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Table D-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
mA	Milliampere
MAP	Manifold absolute pressure
max	Maximum
mi	Mile
min	Minimum
mL	Milliliter
mm	Millimeter
mph	Miles per hour
ms	Millisecond
Nm	Newton-meter
NIM	Navigation interface module
NiMH	Nickel metal hydride
N/A	Not applicable
O2	Oxygen
OD	Outside diameter
OEM	Original equipment manufacturer
oz	Ounce
P&A	Parts and Accessories
Part No.	Part number
PIN	Personal identification number
psi	Pounds per square inch
PWM signal	Pulse width modulated signal
qt	Quart
RCM	Reverse control module
RES	Reserve mark on fuel supply valve
RH	Right hand
RHCM	Right hand control module
rpm	Revolutions per minute
RT	Right
s	Seconds
SCFH	Cubic feet per hour at standard conditions
SDARS	Satellite digital audio radio service
SPDO	Speedometer
SPKR	Speaker
STT	Stop/tail/turn
TCA	Throttle control actuator
TDC	Top dead center
TGS	Twist grip sensor
TPS	Throttle position sensor
TSM	Turn signal module
TSSM	Turn signal/security module
V	Volt
VAC	Volts of alternating current