# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Electrical Troubleshooting - General</td>
<td>A-1</td>
</tr>
<tr>
<td>B. Electrical Troubleshooting - XL 1200 Sport Ignition</td>
<td>B-1</td>
</tr>
<tr>
<td>C. Electrical Troubleshooting - Fuel Injection</td>
<td>C-1</td>
</tr>
<tr>
<td>D. Electrical Connectors - Service and Repair</td>
<td>D-1</td>
</tr>
</tbody>
</table>

**1998 Wiring Diagrams** ..........................  D-53
### A. ELECTRICAL TROUBLESHOOTING - GENERAL

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery</td>
<td></td>
</tr>
<tr>
<td>XL, FX and FXD Models</td>
<td>A-3</td>
</tr>
<tr>
<td>FL Models</td>
<td>A-5</td>
</tr>
<tr>
<td>Charging System Troubleshooting Flow Chart</td>
<td>A-7</td>
</tr>
<tr>
<td>Charging System Tests</td>
<td></td>
</tr>
<tr>
<td>XL Models</td>
<td>A-8</td>
</tr>
<tr>
<td>FX and FXD Models</td>
<td>A-11</td>
</tr>
<tr>
<td>FL Models</td>
<td>A-14</td>
</tr>
<tr>
<td>Cigarette Lighter - FLHTCU, FLTR Models</td>
<td>A-17</td>
</tr>
<tr>
<td>Cruise Control - FLHTCU Models</td>
<td>A-18</td>
</tr>
<tr>
<td>Evaporative Emissions Control System (California Models Only)</td>
<td>A-35</td>
</tr>
<tr>
<td>Horn</td>
<td>A-40</td>
</tr>
<tr>
<td>Ignition Coil</td>
<td>A-41</td>
</tr>
<tr>
<td>Ignition/Light Key Switch and Fork Lock - FLHT/C/U, FLTR Models</td>
<td>A-42</td>
</tr>
<tr>
<td>Ignition System (Carbureted) - XLH Models</td>
<td>A-43</td>
</tr>
<tr>
<td>Ignition System (Carbureted) - FX, FXD and FL Models</td>
<td>A-51</td>
</tr>
<tr>
<td>Gauges/Instruments</td>
<td>A-58</td>
</tr>
<tr>
<td>Electronic Speedometer</td>
<td>A-62</td>
</tr>
<tr>
<td>Electronic Speedometer/Tachometer Performance Check</td>
<td>A-65</td>
</tr>
<tr>
<td>Premium Sound System - FLHTCU, FLTR Models</td>
<td>A-69</td>
</tr>
<tr>
<td>Spark Plugs/Spark Plug Cables</td>
<td>A-107</td>
</tr>
<tr>
<td>Starter System</td>
<td>A-108</td>
</tr>
<tr>
<td>Turn Signal Module</td>
<td>A-124</td>
</tr>
<tr>
<td>Vacuum Operated Electric Switch (V.O.E.S.)</td>
<td>A-132</td>
</tr>
<tr>
<td>Vehicle Attitude Sensor</td>
<td>A-132</td>
</tr>
</tbody>
</table>
GENERAL
The YTX20L-BS battery is a permanently sealed, maintenance-free, lead/calcium and sulfuric acid battery. Do not remove the cap strip to add water, or when charging the battery.

⚠️WARNING
Batteries contain sulfuric acid which is highly corrosive and can cause chemical burns. Avoid contact with skin, eyes or clothing. Always wear approved eye protection when working around batteries. Battery electrolyte is poisonous. Keep children away from battery.

ANTIDOTE
External – Flush with water.
Internal – Drink large quantities of milk or water, followed by Milk of Magnesia, vegetable oil or beaten eggs. Call doctor immediately.
Eyes – Flush with water, get immediate medical attention.

TESTING
Maintenance-free batteries are shipped pre-charged; however a voltage check should be performed before putting the battery into service.

Voltmeter Test
The voltmeter test provides a general indicator of battery condition. Check the voltage of the battery to make sure it is in a 100% charged condition. If the open circuit voltage reading is below 12.8 V, charge battery and recheck voltage after battery has sat 1-2 hours. If battery reads below 12.8 Volts, after 10 hours of charging using a constant current charger (set at 1.8 amps), replace the battery. Tapered-rate chargers or trickle chargers will require longer charge times.

<table>
<thead>
<tr>
<th>State of Charge</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>13.0 V</td>
</tr>
<tr>
<td>75%</td>
<td>12.8 V</td>
</tr>
<tr>
<td>50%</td>
<td>12.5 V</td>
</tr>
<tr>
<td>25%</td>
<td>12.2 V</td>
</tr>
</tbody>
</table>

Load Test
The load test measures battery performance under full current load and is the best indicator of battery condition.

⚠️CAUTION
Fully charge the battery before testing. If battery is not fully charged, test readings will be incorrect.

Load battery to three times amp hour rating using the load tester. Connect tester leads to battery posts and place induction pickup over negative (black) cable. The Harley-Davidson 18 amp-hour battery should be loaded to three times its amp-hour rating, or 54 amps for 15 seconds. Voltage reading throughout the test should be 9.6V or more at 70°F (21°C).

CHARGING
⚠️WARNING
Always unplug or turn battery charger OFF before connecting or disconnecting charger clamps from battery. Connecting or disconnecting clamps with charger ON could cause a spark and a possible battery explosion. A battery explosion may rupture the battery case and spray sulfuric acid resulting in personal injury.

⚠️CAUTION
Never add water to the maintenance free battery, and never remove the sealed caps on top of the battery. Never allow a battery to stand in a discharged condition.

1. Remove battery from motorcycle and place battery on a level surface.

⚠️CAUTION
Refer to the charging instructions on the top of the battery. Do not reverse the charger connections described in the next step, or the charging system of the motorcycle could be damaged.
2. Connect the red battery charger lead to the positive terminal of the battery and the black charger lead to the negative terminal. With a constant current charge, charge for the recommended times shown below. Tapered-rate chargers or trickle chargers will require longer charge times.

<table>
<thead>
<tr>
<th>State of Charge</th>
<th>Voltage</th>
<th>Charge Period (using a constant current charger @ 1.6 amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>13.0 V</td>
<td>NONE</td>
</tr>
<tr>
<td>75%</td>
<td>12.8 V</td>
<td>3-5 hours</td>
</tr>
<tr>
<td>50%</td>
<td>12.5 V</td>
<td>4-7 hours</td>
</tr>
<tr>
<td>25%</td>
<td>12.2 V</td>
<td>10 hours</td>
</tr>
</tbody>
</table>

3. If battery gets hot, over 110°F (44°C) (warm to the touch), discontinue charging and let battery cool down.
BATTERY - FL MODELS

GENERAL

The battery stores electrical energy for the purposes of starting the motorcycle, operating accessories when the engine is not running, and providing additional current (above that generated by the alternator) when required. The battery will remain in good condition if the current draw is balanced by the current input.

⚠️ WARNING

All batteries contain electrolyte. Electrolyte is a sulfuric acid solution that is highly corrosive and can cause severe chemical burns. Avoid contact with skin, eyes, and clothing. Avoid spillage. Always wear protective face shield, rubberized gloves and protective clothing when working with batteries or electrolyte solution. A warning label is attached to the top of the battery. Never remove the warning label from the battery. Inadequate safety precautions may result in personal injury and/or property damage. The warning label reads as follows:

**POISON/DANGER - CAUSES SEVERE BURNS**
CONTAINS SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES OR CLOTHING.
-ANTIDOTE: EXTERNAL - FLUSH WITH WATER.
INTERNAL - DRINK LARGE QUANTITIES WATER OR MILK.
FOLLOW WITH MILK OF MAGNESIA, BEATEN EGG OR VEG. OIL. CALL PHYSICIAN IMMEDIATELY. EYES: FLUSH WITH WATER FOR 15 MINUTES AND GET PROMPT MEDICAL ATTENTION.
BATTERIES PRODUCE EXPLOSIVE GASES.
KEEP SPARKS, FLAME, CIGARETTES AWAY. VENTILATE WHEN CHARGING OR USING IN ENCLOSED SPACE.
ALWAYS SHIELD EYES WHEN WORKING NEAR BATTERIES.
KEEP OUT OF REACH OF CHILDREN

Testing

1. Remove the battery from the motorcycle. See BATTERY, DISCONNECTION AND REMOVAL, page 9-34 of the 1998 FLT Service Manual. Place the battery on a level surface.
2. Remove the battery cell filler caps (6).
3. If the electrolyte level in any battery cell is below the upper level mark on the battery case, add distilled water as required to bring the electrolyte level back to the upper level mark.
4. Fully charge the battery. See BATTERY, CHARGING, page A-6. Allow the battery to stand at least one hour before testing.
5. Check the Specific Gravity of electrolyte in each battery cell using a HYDROMETER (Part No. HD-96910-35). If the electrolyte temperature is not 80°F (27°C), then the specific gravity readings must be corrected as described in Figure A-3.

The difference in the temperature-corrected specific gravity between the cells with the highest and lowest value must be less than 0.050 specific gravity. Furthermore, a temperature-corrected specific gravity of at least 1.220 must exist in each cell of the fully charged battery. Replace the battery if it does not meet both of these conditions.

6. Install the battery cell filler caps (6).

⚠️ WARNING

Always turn the battery load tester OFF before connecting or disconnecting the tester cables at the battery terminals. Connecting or disconnecting the tester cables with the load tester ON could cause a spark and battery explosion. A battery explosion may rupture the battery case, resulting in a discharge or spray of sulfuric acid causing personal injury and property damage.

⚠️ CAUTION

To avoid load tester and/or battery damage, do not leave the load tester switch turned ON for more than 20 seconds. Load testing a discharged battery can result in permanent battery damage.

7. Fully charge the battery before testing. Load the battery to three times amp hour rating using the load tester. Connect the tester leads to the battery posts and place induction pickup over negative (black) cable. The Harley-Davidson 30 amperes hour battery should be loaded to 90 amperes. Voltage reading after 15 seconds should be 9.6 volts or more.
8. Install the fully charged battery onto the motorcycle. See BATTERY, INSTALLATION AND CONNECTION, in the 1997 FLT Service Manual.

**CHARGING**

1. Remove the battery from the motorcycle. See BATTERY, DISCONNECTION AND REMOVAL, page 8-34 of the 1998 FLT Service Manual. Place the battery on a level surface.

2. Remove the battery cell filler caps (6).

⚠️ **CAUTION**

If the battery electrolyte level is low, add only pure distilled water. Do not add sulfuric acid to an "activated" battery or the electrolyte solution may become too strong, thereby shortening battery life. If the battery is overfilled, some electrolyte solution will be forced out of the vent tube while the battery is charging. Loss of electrolyte will weaken the battery while the discharge may also damage motorcycle parts or other property.

3. Check the electrolyte level in the battery cells once each month. If the electrolyte level in any cell is below the UPPER LEVEL mark on the battery case, add **distilled** water as required to bring the electrolyte level back to the upper level mark. Exercise caution to avoid overfilling.

4. Check the Specific Gravity of electrolyte in each battery cell using a HYDROMETER (Part No. HD-96910-35). If the electrolyte temperature is not 80°F (27°C), then the specific gravity readings must be corrected as described in Figure A-3.

⚠️ **WARNING**

Charge the battery in a well ventilated area. Explosive hydrogen gas escapes from the battery during charging. Keep open flames, electrical sparks and smoking materials away from the battery at all times. Inadequate safety precautions may result in personal injury or property damage.

5. Charge the battery if any of the following conditions exist:
   - Battery cell electrolyte has a temperature-corrected specific gravity value below 1.220.
   - Vehicle lights appear dim.
   - Electric starter sounds weak.
   - Battery has not been used for an extended period of time.

A trickle charger or CHRISTIE charger with a 1 amp charging rate (or less) may be used, although it may take a long time to obtain a full charge. The recommended alternative is a variable/tapered-rate charger with a maximum charging rate of 3 to 8 amps. Charge the battery until the specific gravity increases to 1.260-1.270 at 80°F (27°C). The graph in Figure A-3 shows the relationship between the specific gravity of the battery electrolyte at 80°F (27°C) and the percentage of battery charge.

6. After fully charging the battery, gently tap the battery to dislodge any air bubbles from the cell plates. If the electrolyte level has fallen, add **distilled** water as required to bring the electrolyte level back to the upper level mark and charge an additional 1-2 hours.

7. Install the battery filler caps. Using water, wash off any acid spillage. Wipe the battery dry.

8. Install the battery on the motorcycle. See BATTERY, INSTALLATION AND CONNECTION, page 8-37 of the 1998 FLT Service Manual. Verify that the battery vent tube and positive cable are properly routed.
CHARGING SYSTEM TROUBLESHOOTING - CARBURETED

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

NOTE
Make sure battery was not allowed to discharge or was not drawn down by starting problems before beginning. If either condition exists, recharge battery.

SYMPTOM: BATTERY BECOMES DISCHARGED

Test battery.
Charge or replace as required.
See BATTERY section.

Inspect regulator.
See REGULATOR INSPECTION.

Pass

Test regulator.
See REGULATOR BLEED TEST.

Pass

Perform MILLIAMP DRAW TEST
(If applicable).

Pass

Perform TOTAL CURRENT DRAW TEST.
Record measurement.

Pass

Perform CURRENT OUTPUT TEST.
Record measurement and compare with TOTAL CURRENT DRAW TEST before proceeding.

Pass

Perform VOLTAGE OUTPUT TEST.

Pass

Fail

Replace regulator.

System tests good up to this point.
Suspect:
1. Accessories on for long periods when vehicle is parked and not running.
2. Accessories on when vehicle is ridden very slowly for long periods.
3. Battery self-discharge and/or accessory draw because vehicle was not operated for a long period.

Correct as required.

Fail

Replace regulator.

Isolate damaged component or wiring.

Isolate damaged wiring or excessive accessories.

Fail

Perform STATOR CHECK.

Pass

Perform AC OUTPUT TEST.

Replace open/grounded stator.

Pass

Perform CURRENT OUTPUT TEST.

Replace stator.

Replace rotor.

Fail

Damaged or slipping rotor.
GENERAL

Alternator

The alternator consists of two main components: the rotor which is mounted on the engine sprocket shaft, and the stator, which is bolted to the engine crankcase.

Regulator

The regulator is a series regulator with shunt control. The circuit combines the functions of rectifying and regulating.

TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Special Tools</th>
<th>Torque Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammeter</td>
<td>None</td>
</tr>
<tr>
<td>Load tester</td>
<td></td>
</tr>
<tr>
<td>Ohmmeter</td>
<td></td>
</tr>
<tr>
<td>AC voltmeter</td>
<td></td>
</tr>
</tbody>
</table>

Preliminary Checks

When the charging system fails or does not charge at a satisfactory rate, it is recommended that the following checks be made:

BATTERY

Check for a weak or dead battery. See the BATTERY section. Battery must be fully charged in order to perform any electrical tests.

WIRING

Check for corroded or loose connections in the charging circuit. Refer to wiring diagrams at the back of this book.

Regulator Inspection

The regulator base must have a clean, tight connection for proper grounding. Check by using an ohmmeter with one lead on a known good ground, such as battery ground cable, and the other on the regulator base.

The stator plug on the right frame downtube must be clean and tight.

Regulator Bleed Test

Be sure regulator is connected to battery. Unplug regulator connector at engine crankcase. Use a trouble light and touch one probe to a known good ground and the other to the regulator pins, one at a time. If light glows, replace regulator.

MILLIAMP DRAW TEST

NOTE

Be sure accessories are not wired so they stay on at all times. Check for this by connecting ammeter between negative battery terminal and battery.

See Figure A-4. Connect ammeter between negative battery terminal and battery. With this arrangement, you will also pick up any regulator drain.

![Figure A-4. Milliamp Draw Test](image)

With ignition switch and all lights turned off, current drain must not exceed the limits listed in the table below:

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>MAXIMUM METER READING (Milliamperes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulator</td>
<td>3</td>
</tr>
<tr>
<td>Total Maximum Draw</td>
<td>3</td>
</tr>
</tbody>
</table>

NOTE

Any reading that exceeds the above “Meter reading” values indicates excessive current draw. Check for bad regulator or a short in the interconnecting wiring. Isolate problem by disconnecting suspect components and observe change in meter reading.
Total Current Draw Test

See Figure A-5. If battery runs down during use, the current draw of the motorcycle components and accessories may exceed output of the charging system. To check for this condition, place load tester induction pickup or current probe pickup, over battery negative cable as shown below.

Disconnect the regulator from the stator at the connector on the right front downtube and start the motorcycle. Run engine at 2000 RPM.

With ignition and all continuously running lights and accessories turned on (headlamp on high beam) read the total current draw. Compare this reading to the reading obtained in CURRENT AND VOLTAGE OUTPUT TEST. The current output should exceed current draw by 3.5 amps, minimum. If not, there may be too many accessories for the charging system to handle.

Reconnect the regulator after the test.

Current and Voltage Output Test

1. Connect load tester negative and positive leads to battery terminals and place load tester induction pickup over positive regulator cable as shown in Figure A-6.

2. Run the engine at 2000 RPM and increase the load as required to obtain a constant 13.0 volts.

3. The current output should be 19-23 amps. Make note of measurement.

Voltage Output Test

See Figure A-6. After removing the load, read the load tester voltage meter. Voltage to the battery must not be more than 15 volts. If voltage is higher, regulator is not functioning properly or connections are loose or dirty.

⚠️ CAUTION

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

1. To check for a grounded stator, turn off ignition and disconnect the regulator from the stator at the connector on the right front frame downtube.

2. See Figure A-7. Connect an ohmmeter on the RX1 scale between crankcase and either stator socket. There should be no continuity (= ohms) across either test point. Any other reading indicates a grounded stator which must be replaced.

3. See Figure A-8. Check the resistance using an ohmmeter set on the RX1 scale. Resistance across the stator sockets or pins should be 0.2-0.4 ohms. If the resistance is lower, the stator is damaged and must be replaced.

**AC Output Check**

1. See Figure A-9. To test AC output, disconnect the regulator and connect an AC voltmeter across both stator sockets. Run the engine at 2000 RPM. The AC output should be 38-52 volts AC.

2. If the output is below specifications, charging problem could be a faulty rotor or stator. If output is good, charging problem might be faulty regulator/rectifier. Replace as required.

3. Check the output again as described under CURRENT AND VOLTAGE OUTPUT TEST.
CHARGING SYSTEM TESTS - FX and FXD MODELS

GENERAL

Alternator

The alternator consists of two main components: the rotor which is mounted on the engine sprocket shaft, and the stator, which is bolted to the engine crankcase.

Regulator

The regulator is a series regulator with shunt control. The circuit combines the functions of rectifying and regulating.

TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Special Tools</th>
<th>Torque Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammeter</td>
<td>None</td>
</tr>
<tr>
<td>Load tester</td>
<td></td>
</tr>
<tr>
<td>Ohmmeter</td>
<td></td>
</tr>
<tr>
<td>AC voltmeter</td>
<td></td>
</tr>
</tbody>
</table>

PRELIMINARY CHECKS

When the charging system fails or does not charge at a satisfactory rate, it is recommended that the following checks be made:

Battery

Check for a weak or dead battery. See the BATTERY section. Battery must be fully charged in order to perform any electrical tests.

Wiring

Check for corroded or loose connections in the charging circuit. Refer to wiring diagrams at the back of this book.

Regulator Inspection

The regulator base must have a clean, tight connection for proper grounding. Check by using an ohmmeter with one lead on a known good ground, such as battery ground cable, and the other on the regulator base.

Connector plug at engine crankcase must be clean and tight.

Regulator Bleed Test

Be sure regulator is connected to battery. Unplug regulator connector at engine crankcase. Use a trouble light and touch one probe to a known good ground and the other to the regulator pins, one at a time. If light glows, replace regulator.

Milliamp Draw Test

NOTE

Be sure accessories are not wired so they stay on at all times. Check for this by connecting ammeter between negative battery terminal and battery.

See Figure A-10. Connect ammeter between negative battery terminal and battery. With this arrangement, you will also pick up any regulator drain.

With ignition switch and all lights turned off, current drain must not exceed the limits listed in the table below:

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>MAXIMUM METER READING (Milliamperes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulator</td>
<td>3</td>
</tr>
<tr>
<td>Total Maximum Draw</td>
<td>3</td>
</tr>
</tbody>
</table>

NOTE

Any reading that exceeds the above "Meter reading" values indicates excessive current draw. Check for bad regulator or a short in the interconnecting wiring. Isolate problem by disconnecting suspect components and observe change in meter reading.
Total Current Draw Test

If the battery runs down during use, the current draw of the motorcycle components and accessories may exceed the output of the charging system. To check for this condition, place load tester induction pickup or current probe pickup over battery negative cable as shown on Figure A-11.

Disconnect regulator from stator at the connector on the crankcase and start the motorcycle.

With ignition and all continuously running lights and accessories turned on (headlamp on high beam), read the total current draw. Compare this reading to the reading obtained in CURRENT AND VOLTAGE OUTPUT TEST. The current output should exceed current draw by 3.5 amps, minimum. If not, there may be too many accessories for the charging system to handle. Reconnect regulator when test is complete.

Current and Voltage Output Test

1. Connect load tester negative and positive leads to battery terminals and place load tester induction pickup over positive regulator cable as shown in Figure A-13.

2. Run the engine at 3000 rpm and increase the load as required to obtain a constant 13.0 volts.

See Figure A-12. The current output should be 26-32 amperes. Make note of measurement.

Voltage Output Test

See Figure A-13. After removing the load, read the load tester voltage meter. Voltage to the battery must not be more than 15 volts. If voltage is higher, regulator is not functioning properly or connections are loose or dirty.

CAUTION

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

1. To check for a grounded stator, turn off ignition and disconnect the regulator from the stator at the terminal in the crankcase.

2. See Figure A-14. Connect an ohmmeter on the RX1 scale between crankcase and either stator socket. There should be no continuity (∞ ohms) across either test point. Any other reading indicates a grounded stator which must be replaced.

AC Output Check

1. See Figure A-16. To test AC output, disconnect the regulator and connect an AC voltmeter across both stator sockets. Run the engine at 2000 rpm. The AC output should be between 32-40 AC volts (16-20 per 1000 rpm).

2. If the output is below specifications, charging problem could be a faulty rotor or stator. Replace the rotor or stator as described under ALTERNATOR.

3. Check the output again as described under VOLTAGE OUTPUT TEST given earlier.

Figure A-14. Test for Grounded Stator

Figure A-16. Check AC Output

3. See Figure A-15. Check the resistance using an ohmmeter set on the RX1 scale. Resistance should be 0.1-0.2 ohms across the stator socket. If the resistance is lower, then the stator is damaged and must be replaced.

Figure A-15. Check for Stator Resistance
CHARGING SYSTEM TESTS - FL MODELS

CHARGING SYSTEM TROUBLESHOOTING

General

Alternator
The alternator consists of two main components: the rotor which is mounted on the engine sprocket shaft, and the stator, which is bolted to the engine crankcase.

Regulator
A series regulator with a circuit that combines the functions of rectifying and regulating.

Troubleshooting

<table>
<thead>
<tr>
<th>Special Tools</th>
<th>Torque Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammeter</td>
<td>None</td>
</tr>
<tr>
<td>Load tester</td>
<td></td>
</tr>
<tr>
<td>Ohmmeter</td>
<td></td>
</tr>
<tr>
<td>AC voltmeter</td>
<td></td>
</tr>
</tbody>
</table>

Preliminary Checks

When the charging system fails or does not charge at a satisfactory rate, it is recommended that the following checks be made:

Battery
Check for a weak or dead battery. See BATTERY in this section. Battery must be fully charged in order to perform any electrical tests.

Wiring
See FL models charging circuit. Check for corroded or loose connections.

Regulator Inspection
The regulator must have a clean, tight ground connection for proper operation. Check by using an ohmmeter with one lead on the battery ground cable and the other on the regulator ground terminal (on left side ground post in front of battery).

Regulator Bleed Test
Be sure regulator is connected to battery. Unplug stator connector. Use a trouble light and touch one probe to a known good ground and the other to the regulator pins, one at a time. If light glows, replace regulator.

Milliamp Draw Test

NOTE
Be sure accessories are not wired so they stay on at all times. Check for this by connecting ammeter between negative battery terminal and battery.

See Figure A-17. Connect ammeter between negative battery terminal and battery. With this arrangement, you will also pick up any regulator drain.

![Figure A-17. Milliamp Draw Test](image)

The limits for these drains are listed in the tabulation below:

Any accessories must be considered and checked for excessive drain.

This condition could drain battery completely if vehicle is parked for a long time.

NOTE

A battery with surface discharge condition or over full could cause a static drain. Correct by lowering levels in cells and cleaning battery case.

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>MAXIMUM METER READING (Milliamperes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM</td>
<td>1</td>
</tr>
<tr>
<td>Regulator</td>
<td>2</td>
</tr>
<tr>
<td>Radio</td>
<td>3</td>
</tr>
<tr>
<td>Total Maximum Draw</td>
<td>6</td>
</tr>
</tbody>
</table>

NOTE

Any reading that exceeds the above “Meter reading” values indicates excessive current draw. Check for bad radio, voltage regulator or a short in the interconnecting wiring. Alarms and customer accessories are also prime suspects. Isolate problem by disconnecting suspect components and observe change in meter reading.

Total Current Draw Test

See Figure A-18. If the battery runs down during use, the current draw of the motorcycle components and accessories may exceed the output of the charging system. To check for this condition, place load tester induction pickup or current probe pickup over battery negative cable as shown below. Disconnect regulator from stator. Start engine and run at 3000 rpm.
exceed current draw by 3.5 amps, minimum. If not, there may be too many accessories for the charging system to handle. Reconnect regulator when test is complete.

**NOTE**

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

**Current and Voltage Output Test**

1. Connect load tester negative and positive leads to battery terminals and place load tester induction pickup over positive regulator cable as shown in Figure A-20.

2. Run the engine at 3000 rpm and increase the load as required to obtain a constant 13.0 volts.

See Figure A-19. The current output should be as follows. Make note of the measurement.

- FLHR, FLHRC-I, FLHT, FLHTC, FLTR
- 38 amp (Low Output) ................. 34-40 amperes
- FLHTC-I, FLHTCU-I, FLTR-I
- 45 amp (High Output) ................. 41-48 amperes

**Voltage Output Test**

See Figure A-20. After removing the load, read the load tester voltage meter. Voltage to the battery must be less than 15 volts. If voltage is higher, regulator is not functioning properly or connections are loose or dirty.

**CAUTION**

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

1. To check for a grounded stator, turn off ignition and disconnect the regulator from the stator.

2. See Figure A-21. Connect an ohmmeter on the RX1 scale between primary cover bolt and either stator socket. Use Harness Connector Test Kit (HD-41404), red pin probes and patch cords. There should be no continuity (∞ ohms) across either test point. Any other reading indicates a grounded stator which must be replaced.

AC Output Check

1. See Figure A-23. To test AC output, disconnect the regulator and connect an AC voltmeter across both stator sockets. Run the engine at 2000 RPM. The AC output should be as follows.

   - FLHR, FLHRC-I, FLHT, FLHTC, FLTR
     36 amp (Low Output) ... 16-20 VAC per 1000 RPM
   - FLHTC-I, FLHTCU-I, FLTR-I
     45 amp (High Output) ... 19-26 VAC per 1000 RPM

2. If the output is below specifications, charging problem could be a faulty rotor or stator. Replace the rotor or stator as described under ALTERNATOR/STATOR.

3. Check the output again as described under CHARGING SYSTEM OUTPUT TEST given earlier.
Ultra models are equipped with a cigarette lighter. The lighter is located on the left side of the inner fairing.

TROUBLESHOOTING

1. Ignition/light key switch must be ON or in ACCESSORY position for lighter operation.

2. If lighter does not work, substitute a known good lighter element.

3. If lighter is still inoperative, check for 12 vdc at center socket contact and ground at outer shell contact.

4. Refer to applicable Wiring Diagram at rear of manual if 12 vdc or ground are not present. Use voltage checks to isolate problem.
CRUISE CONTROL - FLHTCU MODELS

General

The Cruise Control system provides automatic vehicle speed control. The electronics and stepper motor are contained in a control module mounted under the left side cover. The stepper motor actuates the cruise control cable through a gear train and ribbon reel.

System Operation

To engage and disengage the cruise control system, proceed as follows:

1. While riding in fourth or fifth gear, turn the fairing cap Cruise ON/OFF Switch to the ON position. See Figure A-24. A lamp in the switch illuminates to indicate that the system is activated.

   Power (12 vdc) is supplied to the cruise control module through a 15 amp fuse located in the fuse block mounted under the left side cover.

2. With the motorcycle traveling at the desired "cruise" speed (30 mph/48 km/h to 85 mph/137 km/h), momentarily push the Cruise SET/RESUME switch to SET. See Figure A-25.

   The cruise control module "reads" the speedometer output speed signal to establish the desired vehicle speed. The module then sends a signal to the stepper motor which drives the ribbon reel to take up the slack in the cruise cable. The green Cruise Engaged Lamp below the tachometer gauge illuminates to indicate that the cruising speed is locked in. See Figure A-26.

3. The cruise control module monitors both the engine RPM and the speedometer output speed signal. The module signals the stepper motor to open or close the throttle to keep the speedometer output speed signal constant. The engine RPM is monitored to detect engine overspeed, a condition which automatically causes cruise disengagement.

4. The cruise control automatically disengages (stepper motor drives cruise cable to the full-out position) whenever the cruise control module receives one of the following inputs:
   a. Front or rear brake is applied.
   b. Throttle is "rolled back" or closed, thereby actuating idle cable roll-off (disengagement) switch.
   c. Motorcycle clutch is disengaged (module senses too great an increase in RPM).
   d. Fairing cap Cruise ON/OFF Switch placed in the OFF position.
   e. Handlebar mounted Engine Stop Switch placed in the OFF position. (This removes tachometer input signal which results in module disengagement.)
   f. Handlebar mounted Cruise SET/RESUME switch is pushed to SET and held in that position until vehicle speed drops below 30 mph (48 km/h).

NOTE

If the vehicle speed is above 30 mph (48 km/h) when the Cruise SET/RESUME Switch is released, then the cruise system automatically re-engages.

Troubleshooting

The cruise module circuitry provides on-board diagnostics to help isolate any problems that might occur with the cruise system. If the cruise is inoperative or fails to set, begin troubleshooting at CRUISE INOPERATIVE DIAGNOSTICS on the next page. If the cruise seems to disengage or drop out-
CRUISE INOPERATIVE DIAGNOSTICS

NOTE
Perform the following diagnostic procedures in the order presented. If the test sequence is not followed precisely, the diagnostic mode may not be exited at conclusion of the diagnostic routine and the test lamp may continue to flash while the engine is running.

1. To enter the diagnostic mode, turn the Ignition/Light Key Switch to the OFF position and then turn the fairing cap Cruise ON/OFF Switch to ON. See Figure A-24.

2. Push the handlebar mounted Cruise SET/RESUME Switch to SET, and while holding the switch in this position, turn the Ignition/Light Key Switch to IGNITION.

CORRECT FUNCTION – The green cruise lamp will illuminate and remain on as long as the Cruise SET/RESUME switch is held in the SET position.

Continue at Step 3 if function is correct.

INCORRECT FUNCTION – If the green cruise lamp remains illuminated after the switch is released, then either the switch or related wiring is shorted.

If the cruise lamp does not illuminate at all, check for one or more of the following conditions:

for no apparent reason, then see CRUISE DROPOUT DIAGNOSTICS on page A-21. In the diagnostic mode, the green Cruise Engaged Lamp below the tachometer gauge is employed as a test indicator. See Figure A-26.

Figure A-26. Instrument Panel

Figure A-27. Cruise System Diagram
### CRUISE MODULE CONNECTOR [17A]

<table>
<thead>
<tr>
<th>Terminal*</th>
<th>Wire Color</th>
<th>Function and Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Red/Green</td>
<td>ON/OFF switch enable</td>
</tr>
<tr>
<td>B</td>
<td>Blue/Black</td>
<td>SET input from SET/RESUME switch</td>
</tr>
<tr>
<td>C</td>
<td>White/Blue</td>
<td>RESUME input from SET/RESUME switch</td>
</tr>
<tr>
<td>D</td>
<td>Violet/Yellow</td>
<td>Idle cable disengage switch (12 vdc from 15 amp fuse)</td>
</tr>
<tr>
<td>E</td>
<td>Black</td>
<td>Cruise module ground</td>
</tr>
<tr>
<td>F</td>
<td>Orange/Violet</td>
<td>12 vdc power from 15 amp fuse</td>
</tr>
<tr>
<td>G</td>
<td>Red/Blue</td>
<td>Disengage from brake relay (12 vdc)</td>
</tr>
<tr>
<td>H</td>
<td>Pink</td>
<td>Tachometer input</td>
</tr>
<tr>
<td>J</td>
<td>Green/Red</td>
<td>12 vdc from &quot;CRUISE&quot; indicator in instrument panel (Module provides ground)</td>
</tr>
<tr>
<td>K</td>
<td>White/Green</td>
<td>Speedometer reed switch</td>
</tr>
</tbody>
</table>

* Letters are stamped on sides of connector.

(a) SET/RESUME switch faulty or not wired correctly.
(b) Broken or pinched wire to SET switch or cruise module.
(c) Green cruise lamp burned out or miswired. Cruise lamp is turned on by module supplied ground.
(d) Main 10-place connector not plugged into cruise module.
(e) Faulty cruise main switch and associated wiring.
(f) No module ground at Terminal E of 10-place module connector.
(g) Brake light on constantly.
(h) Throttle cables too tight.

**NOTE**

Repeat Steps 1 and 2. If the cruise lamp still does not illuminate, see CHART A CRUISE TROUBLESHOOTING, page A-24. Reference the table above for cruise module connector wire color locations and functions. Repair any problems and recheck by repeating Steps 1 and 2.

3. Push the handlebar mounted Cruise SET/RESUME Switch to RES(UME) and hold in this position.

**CORRECT FUNCTION** – The green cruise lamp will illuminate and remain on as long as the SET/RESUME Switch is held in the RES(UME) position.

Continue at Step 4 if function is correct.

**INCORRECT FUNCTION** – If the cruise lamp does not illuminate at all, check for one or more of the following conditions:
(a) RES(UME) switch not wired correctly.
(b) Broken or pinched wire to RES(UME) switch or cruise module.


4. Next, turn the throttle grip tightly closed to check the throttle grip switch.

**CORRECT FUNCTION** – The green cruise lamp should illuminate when the switch is closed and should be extinguished when the throttle grip returns to its free position.

Continue at Step 5 if function is correct.

**INCORRECT FUNCTION** – If the cruise lamp does not illuminate at all, check for one or more of the following conditions:
(a) Throttle grip switch not wired correctly.
(b) Broken or pinched wire to throttle grip switch or cruise module.
(c) Throttle grip switch not working correctly.

See CHART G CRUISE TROUBLESHOOTING, page A-32.

5. Apply the brake hand lever.

**CORRECT FUNCTION** – The green cruise lamp should illuminate and remain on until the brake is released.

Continue at Step 6 if function is correct.

**INCORRECT FUNCTION** – If the cruise lamp does not illuminate at all, check for one or more of the following conditions:
(a) Front brake switch not wired correctly.
(b) Broken or pinched wire to front brake switch or cruise module.
(c) Front brake switch not working properly.

See CHART F1 or F2 CRUISE TROUBLESHOOTING, pages A-30 and A-31, respectively.

6. Press and hold the brake foot pedal for at least 5 seconds.

**CORRECT FUNCTION** – The green cruise lamp should illuminate. After holding the foot brake for 5 seconds, the lamp will be extinguished. Release the brake switch and the cruise module will momentarily pull the throttle open approximately 20%. This throttle stroke is immediately aborted if the brake is applied.

Continue at Step 7 if function is correct.

**INCORRECT FUNCTION** – The green cruise lamp will not illuminate if any of the following conditions exist:
(a) Rear brake switch not wired correctly.
(b) Broken or pinched wire to rear brake switch or cruise control module.
(c) Rear brake switch not working properly.

The throttle will not open if the following conditions exist:
(d) Cables not adjusted properly.
(e) Faulty cruise control module.

See CHART F1 or F2 CRUISE TROUBLESHOOTING, pages A-30 and A-31, respectively.
7. Roll the vehicle forward and backward to activate the reed switch in the speedometer.

**CORRECT FUNCTION** — The green cruise lamp will flash on and off indicating that the reed switch is wired properly and working correctly.

Continue at Step 8.

**INCORRECT FUNCTION** — The green cruise lamp will not illuminate if any of the following conditions exist:

(a) Broken speedometer cable/drive.
(b) Reed switch not wired correctly.
(c) Broken or pinched wire to reed switch.
(d) Reed switch not working properly.
(e) Reed switch ground wire disconnected.

See CHART H CRUISE TROUBLESHOOTING, page A-33.

8. Turn the fairing cap Cruise ON/OFF Switch to OFF and start the engine.

**CORRECT FUNCTION** — The cruise lamp flashes with tachometer input.

Continue at Step 9.

**INCORRECT FUNCTION** — The cruise lamp does not flash with tachometer input.

See CHART I CRUISE TROUBLESHOOTING, page A-34.

9. To exit the diagnostic mode, just press the Cruise SET/RESUME Switch to the SET position.

To restart or repeat the diagnostic sequence, exit the diagnostic mode and return to Step 1. Twice pressing the Cruise SET/RESUME Switch to the SET position is an alternative method of restarting the diagnostic sequence.

**NOTE**

If the diagnostic sequence deviates from that described, the diagnostic mode may not be exited at conclusion of the diagnostic routine and the test lamp may continue to flash while the engine is running.

---

**Other Malfunctions**

**HARSH ENGAGEMENT**

If the cruise control opens the throttle abruptly or harshly, check for a cruise cable that is too tight. See CABLE LASH INITIALIZATION on page 8-135 of the 1998 FLT Service Manual.

**SPEED VARIATION**

**Loses Speed**

Check for:

- Set switch held too long.

**Gains Speed**

Check for:


**Speed Surges**

Check for:

- Defective reed switch.
- Poor ground at cruise module or reed switch.

**NOTE**

Check for surging with cruise control turned OFF. If surging is still present, a lean fuel mixture may be the cause.

**CRUISE DROPOUT DIAGNOSTICS**

The last eight diagnostic codes for cruise disengagement are stored in memory.

1. To enter the diagnostic mode, turn the engine off and proceed as follows:

   a. Turn the fairing cap Cruise ON/OFF switch to OFF. The light in the rocker switch is extinguished to indicate this condition to the operator.

---

Figure A-28. Cruise Engaged Lamp Dropout Code Timing Diagram

---

Looking at the above transmission, we can see that the dropout code is 122. Referencing the table shown in Figure A-29, the reason for cruise disengagement is identified as application of front or rear brakes.
<table>
<thead>
<tr>
<th>Code</th>
<th>Condition</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>111</td>
<td>Initial State or Cleared Memory (No Codes Recorded)</td>
<td>-</td>
</tr>
<tr>
<td>113</td>
<td>Fairing Cap Cruise Switch Turned OFF</td>
<td>See Chart E, Page A-29.</td>
</tr>
<tr>
<td>121</td>
<td>Short in Wiring Between Set/Resume</td>
<td>See Chart A or Chart B, Pages A-24 or A-26, Respectively.</td>
</tr>
</tbody>
</table>
| 122  | Application of Front or Rear Brakes | See Chart F-1, Page A-30.  
\textit{NOTE}  
-May require inspection of brake levers or front brake light switch mounting. |
| 212  | Speed Drops Below 30 MPH While in Coast (S/C Button Engaged) | See Chart A or Chart H, Pages A-24 or A-33, Respectively. |
| 213  | Speed Drops Below 26 MPH or Exceeds 90 MPH | See Chart H, Page A-33. |
| 221  | Speed Drops 15 MPH Below Set Speed (Such as When Climbing a Steep Hill) | See Chart H, Page A-33. |
| 222  | Speed Decreases Greater than 20 MPH per Second | See Chart H, Page A-33. |
| 223  | No Read Switch Input or Vehicle Speed Sensor Input | See Chart H, Page A-33. |
| 231  | Over 5000 RPM | See Chart I, Page A-34. |
| 232  | Loss of Tachometer Signal | See Chart I, Page A-34. |
| 242  | High Rate of Change of RPM Detected (Such as When Clutch is Pulled In or Contact is Made With Ice Patch or Slippery Surface) | See Chart I, Page A-34. |
| 311  | | |
| 312  | | |
| 313  | | |
| 321  | Internal Failure | |
| 322  | | |
| 323  | | |
| 331  | | |
| 332  | | |
| 333  | | |
| 342  | | |
| 343  | | |
| 351  | | |
| 352  | | |
| 353  | | |
| 361  | Internal Failure | |
| 362  | | |
| 363  | | |
| 371  | | |
| 423  | | |
| 432  | | |
| 777  | | |

**Figure A-29. Cruise Dropout Code Key**

b. Push the Cruise SET/RESUME Switch on the right handlebar to SET and hold.

c. Turn the Ignition/Light Key Switch to IGNITION, but do not start the engine.

d. Release the Cruise SET/RESUME Switch from the SET position while observing the behavior of the green Cruise Engaged Lamp below the tachometer gauge.

2. The system transmits the most recent cruise dropout code. Each dropout code consists of 3 digits and is sent out as a series of flashes.

3. The lamp will begin by flashing one or more times to indicate the first digit of the dropout code. The length of time the lamp is illuminated and the length of time in which it is off are each about 1/4 second in duration. Simply count the number of times the lamp flashes in order to retrieve the first digit of the dropout code.

4. Following transmission of the first digit, there is a one second pause in which the lamp is off. The lamp will then flash one or more times to indicate the second digit of the dropout code. Count the number of times the lamp flashes to retrieve the second digit. See Figure A-28.
5. Following transmission of the second digit, there is another one second pause in which the lamp is off. The lamp will then flash one or more times to indicate the third digit of the dropout code. Again, count the number of times the lamp flashes to retrieve the third digit.

6. Write down the dropout code on a piece of paper. Reference the table shown in Figure A-29 to identify the reason for cruise disengagement. The last column of the table suggests the appropriate corrective action.

7. To verify the dropout code, toggle the Cruise SET/RESUME Switch to RESUME. The transmission of the most recent dropout code is repeated. To continue with the next code, simply toggle the Cruise Switch to SET. All subsequent codes are sent in the same manner as the first, after which the operator may repeat the code or move on to the next in the series.

8. After the eighth (or oldest) dropout code is flashed, the cruise engaged lamp remains illuminated to indicate that the end of the dropout code buffer has been reached.

9. To start the sequence at the beginning, that is, with transmission of the most recent dropout code, momentarily push the Cruise SET/RESUME Switch to SET.

⚠️ CAUTION

While in the diagnostics mode, holding the Cruise Switch at RESUME for a period of 10 seconds or more will clear or erase the dropout code buffer.

10. To exit the diagnostic mode, turn the Ignition/Light Key Switch to OFF.
CHART A CRUISE TROUBLESHOOTING

Remove Left Saddlebag and Sidecover. Is 10-place Connector [17B] Plugged Into Cruise Module? See Figure A-30.

- **YES**
- **NO**

Unplug Connector [17B] from Cruise Module. Plug In Connector [17B].

**SET SWITCH**
Check Continuity Between the O/V Terminal (F) and BE/BK Terminal (B) of Connector [17B]. **Resistance Must Be = Ohms.** Pressing SET/RESUME Switch to SET Should Produce a Reading of Less Than 0.5 Ohms. Are These Your Observations?

- **YES**
- **NO**

Connect a Jumper From the GN/H Terminal (J) to Ground. The Cruise Engaged Lamp Should Illuminate When the Ignition/Light Key Switch is Positioned to IGNITION. Does It?

- **YES**
  - Go to CHART A, 2 of 2.
- **NO**

Remove the Outer Fairing. Locate the 12-Place Connector [22] for Right Handlebar Switch Controls. See Figure A-31. Measure Between the O/V and BE/BK Terminals at Connector [22B]. **Resistance Must Be = Ohms.** Pressing SET/RESUME Switch to SET Should Produce a Reading of Less Than 0.5 Ohms. Are These Your Observations?

- **YES**
- **NO**

Check Continuity on O/V and BE/BK Wires Between Connectors [17B] and [63B]. See Figure A-30 and Figure A-31. Continuity Present?

- **YES**
- **NO**

Replace Cruise SET/RESUME Switch.

- **YES**
  - Repair or Replace Interconnect Harness.
- **NO**
  - Repair or Replace Ultra Overlay Harness.

**After Correction of Problem, Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify Proper Performance.**
From CHART A, 1 of 2.

- YES
  - Place the Positive Probe on the O/V Terminal (F) and the Negative Probe on the BK Terminal (E). With the Ignition/Light Key Switch Positioned to IGNITION, the Meter Should Read Battery Voltage. Does it?
  - YES
    - Place the Positive Probe on the R/GN Terminal (A) and the Negative Probe on the BK Terminal (E). With the Ignition/Light Key Switch Positioned to IGNITION and the Fairing Cap Cruise ON/OFF Switch Positioned to ON, the Meter Should Read Battery Voltage. Does it?
  - NO
    - Refer to Chart C.
  - NO
    - Refer to Chart D.
- NO
  - Refer to Chart E.

- YES
  - Check Continuity Between the V/Y Terminal (D) and the O/V Terminal (F) With the Ignition/Light Key Switch Positioned to OFF. The Meter Should Read Infinity When the Throttle Switch is in the Relaxed Position, and Continuity When the Throttle Grip is Rolled Forward. Does it?
  - YES
    - Reconnect All Connectors. Restart CRUISE INOPERATIVE DIAGNOSTICS. If Cruise Engaged Lamp has Never Illuminated, if the Lamp Will Not Illuminate When the First Test is Performed Now, Replace the Cruise Module.
  - NO
    - Refer to Chart G.
  - NO
    - Refer to Chart F-1 or F-2.
- NO
  - Refer to Chart G.

After Correction of Problem, Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify Proper Performance.
RESUME SWITCH
Remove Left Saddlebag and Side Cover. Disconnect Connector [17B] from Cruise Module. See Figure A-30. Check Continuity Between the O/V Terminal (F) and the W/BE Terminal (C). Resistance Must Be > 5 Ohms. Pressing SET/RESUME Switch to RESUME Should Produce a Reading of Less Than 0.5 Ohms. Are These Your Observations?

YES
Replace Cruise Module.

NO

Remove the Outer Fairing. Locate the 12-Place Connector [22] for Right Handlebar Switch Controls. See Figure A-31. Measure Between the O/V and W/BE Terminals at Connector [22B]. Resistance Must Be > 5 Ohms. Pressing SET/RESUME Switch to RESUME Should Produce a Reading of Less Than 0.5 Ohms. Are These Your Observations?

YES
Check Continuity on W/BE Wire Between Connectors [17B] and [6B]. See Figure A-30 and Figure A-31. Continuity Present?

NO
Replace Cruise SET/RESUME Switch.

YES
Repair or Replace Interconnect Harness.

NO
Repair or Replace Ultra Overlay Harness.

After Correction of Problem, Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify Proper Performance.
CHART C CRUISE TROUBLESHOOTING

CRUISE LAMP
Remove Left Saddlebag and Side Cover. Disconnect Connector [17B] From Cruise Module. See Figure A-30. Connect a Jumper From the GN/R Terminal (J) to Ground. The Cruise Engaged Lamp Should illuminate When the Ignition/Light Key Switch is Positioned to IGNITION. Does it?

YES
Replace Cruise Module.

NO
Remove the Outer Fairing. Remove GN/R Wire From Connector [108B] and Then Reconnect. See Figure A-31. Connect a Jumper Wire to Ground From the GN/R Wire That Feeds the Tachometer. The Cruise Engaged Lamp Should illuminate When the Ignition/Light Key Switch is Positioned to IGNITION. Does it?

YES
Disconnect Connector [6]. See Figure A-31, Connect a Jumper Wire to Ground From GN/R Wire in Connector [6A]. Cruise Engaged Lamp Should illuminate When Ignition/Light Key Switch is Positioned to IGNITION. Does it?

NO
Replace Tachometer.

YES
Repair or Replace Ultra Overlay Harness.

NO
Repair or Replace Interconnect Harness.

After Correction of Problem, Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify Proper Performance.
CHART D CRUISE TROUBLESHOOTING

CRUISE POWER
Remove Left Saddlebag and Side Cover. Disconnect Connector [17B] From Cruise Module. See Figure A-30. Place the Positive Probe on the O/V Terminal (F) and the Negative Probe on the BK Terminal (E). With the Ignition/Light Key Switch Positioned to IGNITION, the Meter Should Read Battery Voltage. Does It?

![Diagram of CRUISE TROUBLESHOOTING process]

Replace Cruise Module.

Check Continuity Between the BK Terminal (E) and Ground. Continuity Present?

- YES
  - Check for Continuity Between O/V Terminal (F) and the 15 Amp Cruise Fuse. Continuity Present? See Figure A-32.

- NO
  - Correct Open in Ground Wire.

Check for Power at R/GY Wire in Fuse Block. Power Present?

- YES
  - Replace 15 Amp Fuse.

- NO
  - Repair Open Between Cruise Fuse and R/GY Wire of Ignition Switch.

Remove Outer Fairing. Disconnect Connector [1]. See Figure A-34. Check Continuity Between O/V Wire on Connector [1B] and Cruise Fuse. Continuity Present?

- YES
  - Reconnect Connector [1]. Check Continuity Between O/V Wire of Connector [8A] and Cruise Fuse. Continuity Present? See Figure A-34.

- NO
  - Repair or Replace Main Harness.

Repair or Replace Ultra Overlay Harness.

After Correction of Problem, Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify Proper Performance.
CHART E CRUISE TROUBLESHOOTING

CRUISE ENABLE (CRUISE SWITCH)
Remove Left Saddlebag and Side Cover. Disconnect Connector [17B] From Cruise Module. See Figure A-30.
Place Positive Probe on R/GN Terminal (A) and the Negative Probe on the BK Terminal (E). With the Ignition and Cruise Switches On, the Meter Should Read Battery Voltage. Does It?

YES  NO
Replace Cruise Module.  Remove the Ignition/Light Key Switch Knob and Fairing Cap to Access Switch Terminals. With the Ignition/Light Key Switch Positioned to IGNITION and the Fairing Cap Cruise ON/OFF Switch Positioned to ON, the Meter Should Read Battery Voltage on the R/GN Terminal of the Cruise Switch. Does It?

NO

CHECK FOR BATTERY VOLTAGE AT R/GN WIRE OF CONNECTOR [106]. SEE Figure A-34. VOLTAGE PRESENT?

NOTE
It may be necessary to open secondary lock to perform check.

YES

Measure Voltage at O/V Terminal of Switch. Meter Should Read Battery Voltage. Does It?

NO

REPLACE FAIRING CAP CRUISE ON/OFF SWITCH.

YES

REPAIR WIRE BETWEEN SWITCH AND CONNECTOR [105].

NO

DISCONNECT CONNECTOR [106]. SEE Figure A-34. MEASURE VOLTAGE ON O/V WIRE OF CONNECTOR [105A]. VOLTAGE PRESENT?

YES

REPAIR OPEN BETWEEN CRUISE SWITCH AND CONNECTOR [106].

NO

REPAIR OPEN IN INTERCONNECT HARNESS.

After Correction of Problem, Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify Proper Performance.
CHART F-1 CRUISE TROUBLESHOOTING

CONSTANT BRAKE LIGHT INPUT
Verify That Front Brake Light Switch is Properly Positioned Inside Lower Right Switch Housing (Retention Clip in Place). Is It?

YES

NO

Remove Seat. Measure Voltage at R/BE Wire Terminal (86) of the Brake Light Relay. See Figure A-32. Meter Should Read Battery Voltage Only When Brakes are Applied. Does It?

YES

NO

Replace Brake Light Relay.

Remove One of the Spade Terminals From the Rear Brake Light Switch. Are Brake Lights Still Lit?

YES

NO

Replace Front Brake Light Switch. Replace Rear Brake Light Switch.

5166 5176 5141

After Correction of Problem, Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify Proper Performance.

Figure A-32. Fuse Blocks

Figure A-33. Electrical Relays (Under Seat)

NOTE
Since the position of the relays may be reversed, Starter relay can be positively identified by heavy gauge Green wire.
CHART F-2 CRUISE TROUBLESHOOTING

NO FRONT AND/OR REAR BRAKE LIGHTS
Remove Seat to Access Brake Light Relay. See Figure A-33. With Ignition/Light Key Switch Positioned to IGNITION and Brakes Applied, Check for Power on R/BE Wire at Terminal (86) of the Brake Light Relay. Meter Should Read Battery Voltage. Does It?

NO

With Ignition/Light Key Switch Turned to IGNITION and Rear Brake Applied, Check for Power at R/BE Wire of Rear Brake Light Switch. Battery Voltage Present?

NO

With Ignition/Light Key Switch Turned to IGNITION and Front Brake Applied, Check for Power at R/BE Wire of Rear Brake Light Switch. Battery Voltage Present?

YES

With Ignition/Light Key Switch Turned to IGNITION and Rear Brake Light Switch. Battery Voltage Present?

NO

Replace Rear Brake Light Switch.

5141

Repair Open in Main Harness Between Rear Brake Light Switch and Accessory Fuse.

5028

Replace Rear Brake Light Switch.

5141

Repair Open in Main Harness Between Rear Brake Light Switch and Accessory Fuse.

5028

With Ignition/Light Key Switch Turned to IGNITION and Front Brake Applied, Check for Power at R/BE Wire of Connector [22A]. See Figure A-34. Battery Voltage Present?

YES

With Ignition/Light Key Switch Turned to IGNITION, Check for Power at O/W Terminal of Rear Brake Light Switch. Battery Voltage Present?

NO

With Ignition/Light Key Switch Turned to IGNITION, Check for Power at O/W Wire. Battery Voltage Present?

YES

With Ignition/Light Key Switch Turned to IGNITION, Check for Power at O/W Wire. Battery Voltage Present?

NO

Replace Front Brake Light Switch.

5176

Replace Front Brake Light Switch.

5176

After Correction of Problem, Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify Proper Performance.
THROTTLE SWITCH
Remove Left Saddlebag and Side Cover. Disconnect Connector [17B] From Cruise Module. See Figure A-35.
With the Ignition/Light Key Switch Positioned to OFF, Check Continuity Between the VY Terminal (D) and the GV Terminal (F). The Meter Should Read Infinity When the Throttle Switch is in the Relaxed Position and Continuity When the Throttle Grip is Rolled Forward. Are These Your Observations?

**YES**
Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify That Problem is Corrected. If the Cruise Engaged Lamp Will Not Illuminate When This Step is Performed Now, Replace The Cruise Module.

**NO**
Adjust the Idle Throttle Cable and Retest for Continuity. Continuity Present?

**YES**
System OK.

**NO**
Check for Continuity Directly at Throttle Switch. Continuity Should Only be Present When the Throttle is Rolled Forward Under Pressure. Is It?

**YES**
Repair or Replace Ultra Overlay Harness.

**NO**
Replace Idle Throttle Cable.

After Correction of Problem, Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify Proper Performance.

---

Main to Interconnect [2]
Ultra Overlay to Interconnect [6]

Right Handlebar Switch Controls [22]
Speedometer Gauge [20]

Figure A-34. Outer Fairing Removed
CHART H CRUISE TROUBLESHOOTING

SPEEDOMETER INPUT (REED SWITCH)
Remove Left Saddlebag and Side Cover. Disconnect Connector [17B] From Cruise Module. See Figure A-35.
Check for Continuity Between the W/GN Terminal (K) and BK Terminal (E). The Meter Should Alternate Between Continuity and Infinity as the Front Wheel is Rotated. Does It?

YES
Replace Cruise Module.

NO

Remove the Outer Fairing. Check Continuity Between W/GN Terminal (K) of Connector [17B] and W/GN Wire in Connector [20A]. See Figure A-34. Continuity Present?

YES

NO

Check Continuity Between the Black Wire in Connector [20A] and Ground. Continuity Present?

YES
Replace Speedometer.

NO

Check Continuity Between W/GN Wire of Connector [17B] (Terminal K) and Connector [6B]. See Figure A-34. Continuity Present?

YES

NO

Repair Open or Loose Connection to Ground.

Repair or Replace Interconnect Harness.

Repair or Replace Ultra Overlay Harness.

After Correction of Problem, Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify Proper Performance.
TACHOMETER INPUT
Remove Left Saddlebag and Side Cover. Disconnect Connector [17B] From Cruise Module. See Figure A-35.
Place the Positive Probe on the PK Terminal (H) and the Negative Probe on the BK Terminal (E). The Meter Should Read Battery Voltage. If Voltage is Not Present, Momentarily Press the Starter Button Until Voltage is Present. The Meter Should Read a Voltage Fluctuation During Cranking. Are These Your Observations?

YES
Replace Cruise Module.

NO
Remove Right Side Cover. Disconnect Gray 8-Place Connector [8]. See Figure A-36. Check for Continuity Between the PK Terminal (H) and the PK Wire in Connector [8A]. Continuity Present?

YES
Repair Open in PK Wire of Ignition Harness.

NO
Remove Outer Fairing. Check Continuity Between PK Terminal (H) and the PK Wire in Connector [6B]. See Figure A-34. Continuity Present?

YES
Check Continuity Between PK Terminal (H) and the PK Wire in Connector [2A]. See Figure A-34. Continuity Present?

NO
Repair or Replace Ultra Overlay Harness.

YES
Repair Open in Main Harness.

NO
Repair Open in Interconnect Harness.

After Correction of Problem, Restart CRUISE INOPERATIVE DIAGNOSTICS to Verify Proper Performance.
GENERAL

Harley-Davidson motorcycles sold in the state of California are equipped with an evaporative (EVAP) emissions control system. The EVAP system prevents fuel hydrocarbon vapors from escaping into the atmosphere and is designed to meet the California Air Resource Board (CARB) regulations in effect at the time of manufacture.

The EVAP functions in the following manner:

- Hydrocarbon vapors in the fuel tank are directed through the vapor valve and stored in the charcoal canister. If the vehicle is tipped at an abnormal angle, the vapor valve closes to prevent liquid gasoline from leaking out of the fuel tank through the vent hose.

- When the engine is not running and the Ignition Switch is OFF or in the LOCK position, the air cleaner's solenoid-operated butterfly valve is closed to seal the inlet port of the air cleaner backplate. This prevents hydrocarbon vapors emanating from the carburetor throat and from the float bowl overflow (vent) hose from escaping into the atmosphere.

- When the Ignition Switch is ON, the hold-in winding of the air cleaner butterfly valve solenoid is energized with 12 volts DC current. The solenoid will open the butterfly valve when the pull-in winding is energized with 12 volts DC from the Start Switch. The hold-in winding keeps the butterfly valve open until the Ignition Switch is turned OFF.

- When the engine is running, carburetor venturi negative pressure (vacuum) slowly draws off the hydrocarbon vapors from the carbon canister through the canister-to-carburetor purge hose. These vapors pass through the carburetor and are burned as part of normal combustion in the engine. The long, nylon canister-to-air cleaner hose (canister clean air inlet hose) supplies the canister with fresh air from the air cleaner.

**WARNING**

Verify that the evaporative emissions vent hoses do not contact hot exhaust or engine parts. The hoses contain flammable vapors that can be ignited if damaged, thereby resulting in personal injury and/or vehicle damage.

---

**Figure A-37. California Evaporative Emissions Control System Schematic**
TROUBLESHOOTING

The EVAP system has been designed to operate with a minimum of maintenance. Check that all hoses are properly connected, are not pinched or kinked, and are routed properly. The solenoid troubleshooting procedure is shown in the following chart.

### Troubleshooting Solenoid-Operated Butterfly Valve

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
</table>
| 1. Motorcycle acceleration is sluggish and top speed is approximately 40 mph (64 km/h). | 1.1. Butterfly valve is not opening due to electrical malfunction. | 1.1.1 Check that connector is connected. If unplugged, connect and check for proper operation by starting engine. If butterfly valve is still inoperative, proceed to 1.1.2.  
1.1.2 Perform the SOLENOID ELECTRICAL TESTS which follow this troubleshooting chart. |
| 1.2 Rider started engine without using starter by coasting downhill and engaging clutch with transmission in gear. (Bump starting.) | | 1.2.1 Instruct rider to use starter or press start button momentarily with ignition switch ON before starting in the manner described in 1.2. Explain that the start switch input to the starter relay is also required to energize the pull-in winding and open the butterfly valve.  
⚠️WARNING  
Do not bump start with transmission in 1st gear or rear wheel may skid. Do not use more than 1/4 throttle or motorcycle may lurch forward. Both conditions can cause loss of vehicle control resulting in personal injury and/or property damage. |
| 1.3 Butterfly valve is not opening or closing because mechanical linkage connecting butterfly valve to solenoid plunger is broken or missing. A broken solenoid spring will prevent butterfly valve closure. | | 1.3.1 Check that all linkage parts are properly assembled and functioning. A broken solenoid spring will require replacing the solenoid. See REMOVAL AND INSTALLATION, BUTTERFLY VALVE SOLENOID. |
Solenoid Electrical Tests – Air Cleaner Butterfly Valve

See Figure A-38. Fabricate the required solenoid test harness as shown. The harness allows the following tests to be performed without removing the air cleaner backplate.

Winding Resistance Test
1. Unplug 3-place connector from solenoid.
2. See Figure A-39. Connect the test harness to the solenoid as shown.
3. Use an ohmmeter to measure the resistance of the pull-in and hold-in windings. See the following table for probe placement instructions and resistance specifications.

Solenoid Winding Resistance Specifications

<table>
<thead>
<tr>
<th>TEST</th>
<th>POSITIVE PROBE</th>
<th>NEGATIVE PROBE</th>
<th>WINDING RESISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pull-In</td>
<td>Green</td>
<td>Black</td>
<td>4-6 Ohms</td>
</tr>
<tr>
<td>Hold-in</td>
<td>White/Black</td>
<td>Black</td>
<td>21-27 Ohms</td>
</tr>
</tbody>
</table>

4. If the resistance measurements are not within specification, the solenoid must be replaced. Refer to REMOVAL AND INSTALLATION, BUTTERFLY VALVE SOLENOID.

5. If winding resistance measurements are within specification, perform the PULL-IN COIL TEST described below.

Pull-In Coil Test
1. See Figure A-40. Connect a 12-volt battery to the solenoid test harness as shown. The butterfly valve must open.
2. If the butterfly valve opens, but does not open with solenoid connected to motorcycle harness, refer to applicable wiring diagram and check for the following:
   a. A good ground (1 Ohm or less) at the BK wire in the 3-place mating connector (see Figure A-39).
   b. Connect the positive probe of a voltmeter to the GN wire in the 3-place mating connector. Connect the negative probe to a good ground. Press the START switch and verify that 12 VDC is indicated on the voltmeter.
3. If a good ground and/or 12 VDC are not present in the above tests, use continuity or voltage tests to isolate and correct the problem.
4. If both a good ground and 12 VDC are measured in Steps 2a and 2b, check the hold-in coil.

Hold-In Coil Test
1. See Figure A-41. Connect a 12-volt battery to the solenoid test harness as shown.

![Diagram of Solenoid Test Harness]

NOTE
The ring terminals (6) will ensure good connections for test probes. Blade or spade terminals may also be used.

1. Pin housing, Part No. 73103-96BK
2. Pin terminal (4), Part No. 73190-96
3. Green (GN), 18 gauge wire, 6 in. (152 mm) long
4. White/Black stripe, 18 gauge wire, 6 in. (152 mm) long
5. Black (BK), 18 gauge wire, 6 in. (152 mm) long
6. Ring terminal, Part No. 9858 or similar (4)

TEST HARNESS

Figure A-38. Solenoid Test Harness
2. Using a screwdriver, open the butterfly valve by gently pushing inward on the top side of the butterfly plate.

3. The butterfly valve must remain open with the hold-in coil energized.

4. Disconnect the negative battery cable. The butterfly valve should close.

5. If butterfly valve remains open in Step 3 and closes in Step 4, then the hold-in coil is functioning properly.

6. If butterfly valve does not remain open in Step 3, check that a good ground exists on the BK lead of the 3-place mating connector (see Figure A-39).

7. If there is not a good ground at the BK lead, refer to the applicable wiring diagram and correct the high-resistance ground.
8. Using a voltmeter, verify that the W/BK wire at the 3-place mating connector (see Figure A-39) has 12VDC when the Ignition/Light Key Switch is turned to IGNITION.

9. If 12 VDC is not present when the Ignition/Light Key Switch is turned to IGNITION, refer to the applicable wiring diagram and look for a broken wire, corroded connection or other malfunction causing the no power condition. Correct the problem as required.

10. If the solenoid is functioning properly, but butterfly valve is not opening and closing as it should, then refer to 1.3 in the table titled TROUBLESHOOTING SOLENOID-OPERATED BUTTERFLY VALVE.
HORN - ALL MODELS

TROUBLESHOOTING

1. If the horn does not sound or fails to function satisfactorily, check for the following conditions:
   • Discharged battery
   • Loose, frayed or damaged wiring leading to horn terminal

2. If battery has a satisfactory charge and wiring appears to be in good condition, check for the following:
   • Poor ground to frame through mounting hardware or ground wire (see Steps 3-6 below)
   • Inoperative horn switch (see Steps 3-6 below)

3. Disconnect the YELLOW/BLACK wire at the horn. Connect a voltmeter as follows:
   • Positive (+) lead to wire terminal
   • Negative (−) lead to ground

4. Turn ignition switch ON. Depress horn switch. If battery voltage is present, horn or horn grounding is faulty. If battery voltage is not present, either horn switch or wiring to horn is faulty.

5. Connect an ohmmeter across the horn terminals. The resistance measured must be 45-66 ohms. Replace horn if measured resistance is outside range given.

6. If the horn is faulty, then it must be replaced as an assembly. The horn is not repairable. If the horn switch is faulty, replace the switch according to the procedures outlined in Section 8 of the 1997 FLT Service Manual.
IGNITION COIL - ALL MODELS (EXCEPT XL 1200 SPORT)

GENERAL

The ignition coil is a pulse-type transformer. Internally, the coil consists of primary and secondary windings with a laminated iron core. The contents are sealed in a waterproof insulating compound. The ignition coil is not repairable. Replace the ignition coil if it is not functioning properly.

The low-voltage ignition primary circuit consists of the coil primary winding, ignition module and battery. When the circuit is closed, current flows through the coil primary winding creating a strong magnetic field in the iron core of the ignition coil.

When the ignition module receives a signal from the ignition sensor plate and rotor, the ignition module interrupts (opens) the ignition primary circuit, which causes the magnetic field in the coil core to collapse suddenly.

The collapsing magnetic field induces a high-voltage electrical discharge in the ignition secondary circuit, which consists of the coil secondary winding, spark plug cables and spark plugs. The high-voltage discharge produces a spark to bridge the electrode gap of each spark plug.

The ignition coil fires both spark plugs simultaneously. In one spark plug, the spark jumps from the center electrode to the outer electrode, but on the other plug, the spark jumps in the reverse direction (from the outer electrode to the center electrode).

TROUBLESHOOTING

Follow the troubleshooting procedures listed under IGNITION SYSTEM if the engine will not start, is difficult to start or runs roughly. Also check condition of spark plug cables. Insulation on cables may be cracked or damaged allowing high tension current to short to metal parts. This problem is most noticeable when cables are wet.

If poor starting/running condition persists, check resistance of ignition coil primary and secondary windings using an ohmmeter. See Figure A-42. Resistance values should be within the limits shown in the following table:

<table>
<thead>
<tr>
<th>Ignition Coil Winding</th>
<th>Ohmmeter Scale</th>
<th>Normal Resistance Range (in Ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>R x 1</td>
<td>2.5-3.1</td>
</tr>
<tr>
<td>Secondary</td>
<td>R x 1K</td>
<td>10,000-12,500</td>
</tr>
</tbody>
</table>

- A low resistance value indicates a short in the coil winding; replace coil.
- A high resistance value might indicate that there is some corrosion/oxidation of the coil terminals; clean terminals, and repeat resistance test. If resistance is still high after cleaning terminals, replace coil.
- An infinite ohms (no continuity) resistance value indicates an open circuit – a break in the coil winding – replace coil.

If a coil tester is not available, temporarily substitute a new ignition coil by attaching it at any convenient point near old coil (coil will function without being securely grounded). Transfer terminal wires to new coil. See Wiring Diagram.

⚠️ CAUTION

Reversing polarity to the ignition control module will permanently damage the control module.

Attach new spark plug cables to coil and plugs. If ignition trouble is eliminated by the temporary installation of new coil, carefully inspect old coil for damaged cables and insulation. The insulation on cables may be cracked or damaged.
IGNITION/LIGHT KEY SWITCH AND FORK LOCK - FLHT/C/U, FLTR MODELS

TROUBLESHOOTING

Lock and Switch Functions

Replace the Ignition Switch knob if the key cannot be removed in the “Lock” or “Unlock” positions (Domestic models only).

**NOTE**

On International (HDI) models, replace the knob if the key cannot be removed in the “Fork Lock” or “Off” positions.

Perform continuity or voltage checks to determine operation of all switch functions. See the tables below for electrical connections at each switch position.

For example, look at the top row of the Domestic (DOM) table below. If 12 volts is obtained at both the R and BE/R wires with the Ignition Switch in the “Fork Lock” position, then that function is operating correctly.

If any switch function is not operating correctly, inspect the 4-place Packard connector for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals and poor terminal-to-wire connections. See Figure A-43. Repair connections as necessary. Replace the ignition switch housing if all wires and connections are found in good condition.

If continuity or voltage checks show that the Ignition Switch is fit for continued use, then thoroughly inspect the wire harness for damage or poor connections.

---

**WARNING**

DO NOT modify the Ignition/Light Key Switch wiring to circumvent the automatic-on headlamp feature. Poor visibility can result in personal injury and/or vehicle damage.

---

**Ignition Switch Connections (DOM)**

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>Switch Wire Colors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
</tr>
<tr>
<td>FORK LOCK</td>
<td>○</td>
</tr>
<tr>
<td>OFF</td>
<td>○</td>
</tr>
<tr>
<td>IGNITION</td>
<td>○</td>
</tr>
<tr>
<td>ACCESSORY</td>
<td>○</td>
</tr>
</tbody>
</table>

**Ignition Switch Connections (HDI)**

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>Switch Wire Colors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
</tr>
<tr>
<td>FORK LOCK</td>
<td>○</td>
</tr>
<tr>
<td>OFF</td>
<td>○</td>
</tr>
<tr>
<td>IGNITION</td>
<td>○</td>
</tr>
<tr>
<td>ACCESSORY</td>
<td>○</td>
</tr>
</tbody>
</table>

Figure A-43. Ignition Switch Connector Locations
IGNITION SYSTEM (Carbureted) - ALL XLH MODELS

GENERAL (Figures A-44 or A-45)

The vehicle is provided with a breakerless inductive-discharge ignition system. The system has both a primary and secondary circuit. The primary circuit consists of the battery, ignition switch, primary coil winding, computerized ignition timer and associated wiring. The secondary circuit consists of the secondary coil, spark plugs and associated wiring.

The computerized ignition system contains of four assemblies - the computerized ignition module, vacuum-operated electric switch (V.O.E.S.), the bank angle sensor and the rotor.

The ignition module is mounted in the gear case cover. The ignition module has two functions. First, it computes the spark advance for proper ignition timing. Second, it opens and closes the low-voltage circuits between the battery and ignition coil to produce high-voltage discharge to the spark plugs.

The vacuum-operated electric switch (V.O.E.S.) is attached to the top center engine mounting bracket above the intake manifold. The V.O.E.S. senses intake passage vacuum through a carburetor hose connection. The switch is open during acceleration and high engine load conditions (low vacuum) and is closed during deceleration and low engine load conditions (high vacuum). The ignition module is programmed with two spark advance curves to meet varying engine loads.

1. Outer cover rivet (2)
2. Outer timer cover
3. Inner cover screw (2)
4. Inner cover
5. Sensor plate screw (2)
6. Adjusting notch
7. Rotor bolt
8. Rotor
9. Camshaft oil seal
10. Ignition coil
11. Ignition module
12. Spark plug cable (2)
13. V.O.E.S. connector
14. Vacuum-operated electric switch (V.O.E.S.)
15. Bank angle sensor

Figure A-44. Ignition System Components (except 1200S)
The high-vacuum curve, selected for maximum spark
advance under normal light-load cruising conditions, provides
improved fuel economy and performance. The low-vacuum
curve (retarded spark) minimizes spark knock while main-
aining performance under high-load conditions (acceleration and
highway driving).

The ignition module selects the proper curve when it receives
an open or closed electrical signal from the V.O.E.S. This sys-
tem ensures correct timing to suit starting and low- and high-
speed requirements.

The bank angle sensor is attached to the side of the battery
tray. The sensor consists of a magnet that rides in a channel
filled with fluid. If the vehicle lean angle exceeds 55º, the
magnet moves to create an open circuit. The open circuit is
detected by the ignition module and the ignition system is
shut off.

1. Outer cover rivet (2)
2. Outer timer cover
3. Inner cover screw (2)
4. Inner timer cover
5. Sensor plate screw (2)
6. Adjusting notch
7. Cam position sensor
8. Rotor bolt
9. Rotor
10. Camshaft oil seal
11. Connector
12. Ignition coil
13. Spark plug cable (4)
14. Gearcase cover
15. MAP Sensor
16. Spark plug (4)
17. Ignition Module
18. Nut (2)
19. Bank angle sensor

Figure A-45. Ignition System Components - 1200S Sport
A single ignition coil fires both spark plugs simultaneously. The spark plug in the front cylinder fires at the end of that cylinder's compression stroke, thereby igniting the air/fuel mixture. At the same instant, the spark in the rear cylinder fires ineffectually during the end of that cylinder's exhaust stroke. During the next engine revolution, the simultaneous firing of the spark plugs will occur during the middle of the front cylinder's exhaust stroke and at the end of the rear cylinder's compression stroke (thereby igniting the air/fuel mixture in the rear cylinder).

The rotor and cam position sensor (integrated with the Ignition Module) are located in the gearcase cover on the right side of the motorcycle. The rotor is mounted on the camshaft and operates at one-half crankshaft speed. As the rotor turns, slots in its outside diameter break the magnetic field of a Hall-effect device in the ignition module. The output of the Hall-effect device is a logic-type signal that corresponds to the timing information from the spinning rotor. This technique gives accurate timing information down to 0.1 speed.

The ignition system produces a spark near top dead center (TDC) for starting. At rpm's and loads above this, the system produces a spark 0° to 45° before TDC on 883 and 1200 models. The whole timing program can be shifted by mechanical rotation of the cam position sensor. See ADJUSTMENT/TESTING, IGNITION TIMING CHECK.

The ignition module contains all the solid-state components used in the ignition system. The dwell time for the ignition coil is also calculated by the microprocessor and is dependent upon engine speed. The programmed dwell is an added feature to keep battery drain to a minimum and to adequately charge the coil at all speeds. The ignition module has added protection against transient voltages, continuous reverse voltage protection and damage due to jump starts. The system will operate down to 5.7 volts DC. The ignition module is fully enclosed in a "potting" material to protect it from vibration, dust, water and oil. The unit is not repairable—it must be replaced if it fails.

See the wiring diagrams at the end of this section for additional information on ignition system circuits.

1200 Sport

The XL Sport ignition differs from other Sportsters. The ignition system consists of five assemblies, the ignition module, cam position sensor, rotor, Bank angle sensor, and the MAP (Manifold Absolute Pressure) sensor.

The ignition module is located under the seat. It computes the spark advance for proper ignition timing and regulates the low-voltage circuits between battery and ignition coil.

The ignition timer includes a rotor, cam position sensor, ignition module and MAP sensor. A twin coil fires each pair of spark plugs in single fire mode (i.e. both spark plugs fire in one cylinder but not the other - no wasted spark).

The MAP sensor is located on a bracket along the frame backbone under the fuel tank. The sensor monitors the intake manifold pressure and adjusts the advance curve for optimum performance.

The bank angle sensor is attached to the side of the battery tray. The sensor consists of a magnet that rides in a channel filled with fluid. If the vehicle lean angle exceeds 55°, the magnet moves to create an open circuit. The open circuit is detected by the ignition module and the ignition system is shut off.

TROUBLESHOOTING

Perform the following tests if the engine will not start, or if hard starting or missing indicates a faulty operating ignition system.

Check for Ignition Spark

1. Disconnect spark plug cables from spark plugs. Check condition of plugs and cables. Clean or replace as necessary.

2. Insert a conductive adapter into spark plug cable end and establish a 3/16 inch (4.8 mm) gap between adapter and cylinder head. Turn on ignition and "engine stop" switches. With transmission in neutral, press "engine start" button. Check for a spark across plug electrode gap. If a spark is produced, problem is not in electronic system or coil—check carburetion, enricher and spark plugs. If no spark is produced, check battery voltage and battery connection condition. Battery voltage must be 11-13 vdc. Charge battery if voltage is low.

3. Verify that the ground wire from battery to frame is in good condition. If there is still no spark, then perform the tests under NO IGNITION SPARK.

No Ignition Spark

See Figure A-46. To conduct the following tests, it will be necessary to assemble a set of jumper wires. Cut two wires of ample length to reach from a good ground connection to the negative terminal of the coil primary. If a suitable capacitor is not available, use a condenser (such as the type used in earlier breaker point ignition systems). When conducting Steps 3 and 5 of the following spark tests, connect a spare spark plug to one of the plug wires and lay the spark plug on the engine cylinder head. During the testing procedures, check for spark across the spark plug electrodes.
DIAGNOSTIC CHARTS - All XLH Models (Except XL 1200 Sport)
Continuous Or No Spark At Spark Plug

NOTE
To Troubleshoot XL 1200 Sport Models, see Section B.

• Ignition On.
• Multimeter Red Wire To White/black Wire On Coil,
Black Wire To Ground.
• Meter Should Register 12v ± One Volt.

YES

Go To Next Page

NO

Check Ign. Fuse
Is Fuse Ok?

YES

Power To Gray
Wire In Fuseblock?

NO

Replace - Find Source Of Fault

5001

Measure Voltage At Con-
nector [22A] Pin 3 (GY).
Battery Voltage Present?

YES

Check For 12VDC Between
Battery, Main Breaker, Igni-
tion Switch And Fuse Block.
Repair As Necessary.

5001

NO

With Connector [22] Mated And
Ignition On, Measure Voltage At
Connector [22A], Pin 5 (W/BK).
Battery Voltage Present?

YES

Repair Open (GY) Wire
Between [22] and Fuse.

5002

NO

Repair Open (W/BK) Wire
Between Coil and [22A].

5002

Repair / Replace Engine
Stop Switch or Wiring.

5173

Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[22]</td>
<td>RT Handlebar Switch</td>
<td>6 - Place Deutsch (BK)</td>
<td>In Headlight</td>
</tr>
</tbody>
</table>

A-46
Continuous Or No Spark At Spark Plug - All XLH Models (Except XL 1200 Sport)

NOTE
To Troubleshoot XL 1200 Sport Models, see Section B.

• Remove Pink (Module) Wire From Coil Terminal.
• Ignition Switch On.
• Multimeter Red Lead Alternately To White/Black Wire Terminal And To (PK) Wire Terminal.

12VDC at both terminals?

NO

YES

Replace coil.

5010

• Pink (Module) Wire Disconnected.
• Ignition On.
• Jumper Wire – Connect Capacitor Wire To Pink Wire Terminal.*
• Connect Both Wires To Common Ground.
• Momentarily Touch Ground Wire To Pink Wire Terminal.

Is There A Spark At Plug When You Remove The Wire?

*Perform Coil Resistance Check If Capacitor Is Not Available

NO

YES

Replace Coil.

5012

• Reconnect (PK) Wire
• Disconnect 6-pin Connector [10].
• Ignition Switch On.
• Multimeter Red Lead To (W/BK) Wire (Pin 1) Terminal.
• Multimeter Black Lead To BK (Pin 6) On [10B].
• Multimeter Should Register 12VDC ± 1.0 VDC.

NO

YES

Check Continuity Between Pin 1 W/bk [10B] And Coil W/BK Wire. Continuity Present?

NO

Repair Open In W/BK Wire

5003

YES

Repair Open Between [10B] Pin 6 (BK) And Ground

5003

Go To Next Page
Continuous Or No Spark At Spark Plug - All XLH Models (Except XL 1200 Sport)

**NOTE**
To Troubleshoot XL 1200 Sport Models, see Section B.

- Ignition On
- Measure Voltage At Connector [10B] - Multimeter Red Lead To Pin 5 (PK) And Black Lead To Pin 6 (BK)
  Is 12VDC ± 1.0 VDC Present?

  ![Diagram of connector with pins labeled 1 to 6]

  - YES
  - NO

  **Install 6-pin Harness Adapter (HD-42962) and Breakout Box using Black connectors Between Connectors [10A] And [10B]**
  Measure Voltage Between LTGN/GY (Pin 4) And BK (Pin 6).
  Is Voltage 0.6-1.1 VDC?

  ![Diagram showing installation process]

  - YES
  - NO

  **Check Wire Continuity Between Connector [10B] Pin 5 (PK) And Coil Terminal (PK).**
  **Continuity Present?**

  ![Diagram showing continuity check]

  - YES
  - NO

  **Locate And Repair Short To Ground On (PK) Wire**

  ![Diagram showing troubleshooting steps]

  - YES
  - NO

  **Repair Open (PK) Wire**

  ![Diagram showing repair process]

- Remove Timer Cover. Crank Engine.
  Is Led Flashing?

  ![Diagram showing timer cover and LED]

  - YES
  - NO

  **Replace Ignition Module.**

  ![Diagram showing ignition module]

- Is Rotor Cup Rotating?

  ![Diagram showing rotor cup]

  - YES
  - NO

  **Replace Ignition Module.**

  ![Diagram showing replacement process]

- Remove Gearcase Cover. Inspect For Mechanical Failure. Repair.

  ![Diagram showing gearcase and repair steps]

**Breakout Box (HD-42682)**

**Harness Adapters (HD-42962)**
Continuous Or No Spark At Spark Plug - All XLH Models XL (Except 1200 Sport)

NOTE
To Troubleshoot XL 1200 Sport Models, see Section B.

---

**Is Bank Angle Sensor Connected?**

- **YES**
  - See Next Page

- **NO**
  - Reconnect.

---


- **3.0-3.5 VDC**
  - See Next Page

- **11-13 VDC**
  - Repair Short On LT GN/GY Wire.

- **0 VDC**

  - **YES**
    - Repair Open In LT GN/GY Wire.

  - **NO**
    - Repair Open Ground Wire.

---

**Check Continuity To Ground On BK Wire, Socket B, Connector [134B]. Is Continuity Present?**

  - **YES**
    - Repair Short To Ground On LT GN/GY Wire.

  - **NO**
    - Inspect Module Harness For Damage. Repair If Necessary. If Harness Is Not Damaged, Replace Ignition Module.
Continuous Or No Spark At Spark Plug - All XLH Models (Except XL 1200 Sport)

NOTE
To Troubleshoot XL 1200 Sport Models, see Section B.

3.0-3.5 VDC


YES  NO

Is Bank Angle Sensor Correctly Installed?  Repair Open In (GY) Wire Between Bank Angle Sensor And Ignition Fuse

YES  NO

Are Ferrous Metals Located Within 1/4" Of Sides, Face, Or Top Of Bank Angle Sensor?  Install Properly

YES  NO

Return To Original Configuration.  Replace Bank Angle Sensor.
GENERAL (Figure A-47)

The ignition system is a breakerless inductive discharge ignition system. It has two circuits, the primary circuit and the secondary circuit. The primary circuit consists of the battery, ignition switch, primary coil winding, ignition timer and associated wiring. The secondary circuit consists of the secondary coil, the spark plugs and associated wiring.

The computerized ignition system consists of three assemblies, the rotor and cam position sensor, the ignition module, and the vacuum operated electric switch (V.O.E.S.). The rotor and cam position sensor are located in the gearcase cover on the right side of the motorcycle. The ignition module is mounted under the right side cover. The V.O.E.S. is located to the left of the intake manifold. The ignition module has two functions. First, it computes the spark advance for proper ignition timing. Second, it opens and closes the low voltage circuits between the battery and ignition coil to produce high voltage discharge to the spark plugs.

The vacuum operated electric switch (V.O.E.S.) senses intake manifold vacuum through an opening in the carburetor body. The V.O.E.S. is connected to the carburetor with a vacuum hose. The switch is open under acceleration and high engine load conditions (low vacuum) and closed under low engine load conditions (high vacuum).

---

Figure A-47. Ignition System Circuit (Simplified)
The ignition module is programmed with two spark advance curves to meet varying engine loads. The high vacuum curve selected for maximum spark advance under normal light load cruising conditions provides improved fuel economy and performance. The low vacuum curve (retarded spark) minimizes spark knock, while maintaining performance, under high load conditions (acceleration and highway driving).

The ignition module selects the proper curve when it receives an open or closed electrical signal from the V.O.E.S. This system ensures correct timing to suit starting, low and high speed requirements.

The ignition timer includes a rotor, cam position sensor, ignition module and a V.O.E.S. A single ignition coil fires both spark plugs at the same time, but one spark occurs with no effect during a non-compression stroke of one cylinder, while the other spark fires the combustible gasses in the other cylinder to produce the power stroke.

The rotor is bolted on to the camshaft and operates at one-half crankshaft speed. As the rotor turns, slots in its external edge break the magnetic field of a Hall-effect device mounted on the cam position sensor plate. The output of the Hall-effect device is a logic-type signal that corresponds to the timing information from the spinning rotor. This technique gives accurate timing information down to 0-speed.

A vehicle attitude sensor is also provided at this location. See Figure A-48. The sensor consists of a magnetic disc that rides in a V-shaped channel filled with fluid. If the vehicle is inclined at an angle that is equal to or less than 10° from the road surface, the disc moves up the channel to create an open circuit within the cam position sensor. The open circuit is immediately detected by the ignition module, which shuts off the ignition system. Once the sensor is tripped, the motorcycle must be uprighted before the engine can be restarted.

The ignition system gives a spark near Top Dead Center (TDC) for starting. At rpm's and loads above this, the system gives a spark advance that varies between 0° and 42.5°. The whole timing program can be shifted by mechanical rotation of the cam position sensor. See Advance Timing.

The ignition module contains all of the solid state components used in the ignition system. The dwell time for the ignition coil is also calculated in the ignition module and is dependent upon engine speed. The programmed dwell is an added feature to keep battery drain to a minimum and yet gives adequate spark duration at all speeds. (The ignition module has added protection against transient voltages, continuous reverse voltage protection, and damage due to jump starts.) The system will operate down to 5.7 volts DC. The ignition module is fully enclosed in a polyurethane material to protect it from vibration, dust, water or oil. The unit is a non-repairable item. If it fails, it must be replaced.

TROUBLESHOOTING
When the engine will not start, or when hard starting or missing indicates a faulty ignition system, proceed with the following tests.

Check for Engine Spark
1. Disconnect spark plug cables from spark plugs. Check condition of plugs and cables. Clean or replace as necessary.

2. Insert a conductive adapter into spark plug cable nipple and establish a 3/16 in. (4.76 mm) gap between adapter and cylinder head. Turn on ignition and engine stop switches. Crank engine. Check to see if a spark is obtained across the gap. If a spark is obtained, the problem is not in the electronic system or coil. Check carburetion, choke and spark plugs.

3. If no spark is obtained, check battery voltage and battery connection condition. Battery voltage must be 11-13 vdc.
   Check specific gravity of battery electrolyte with hydrometer. Specific gravity must be 1.250 (temperature corrected) or higher. If voltage and specific gravity are low, charge battery.

4. Check to make sure that ignition module ground (black lead) is securely fastened to the frame and that the ground wire from the battery to the frame is in good condition. The ground bolt is located on the frame cross member above the starter. If there is still no spark at engine proceed to the tests under No Spark at Engine, page A-53.

Figure A-48. Vehicle Attitude Sensor (Cross Sectional View)

Figure A-49. Test Jumper
No Spark at Engine

To conduct all the procedures in the test (beginning on page A-54), it is necessary to assemble a set of jumper wires as shown in Figure A-49.

Cut two lengths of wire of ample length in order to reach from a good ground connection to the negative terminal of the coil primary. Use a known good condenser such as used in earlier breaker point ignition systems if a suitable capacitor is not readily available.

When conducting the spark tests (steps 3 and 5), use a spare plug and connect it to one of the plug wires or remove one of the engine spark plugs and lay it on the engine cylinder head with the plug wire connected. The spark is then checked jumping across the plug electrodes.
CONTINUOUS OR NO SPARK AT SPARK PLUG

1. A. Ignition switch on.
   B. Multimeter red wire to white/black wire terminal, black wire to ground.
   C. Meter should register 12V ± one volt.

   No Power

   Power

   Yes

   Check Circuit breaker, loose wires, switches.

2. A. Remove pink (ignition module) wire from coil terminal.
   B. Ignition switch on.
   C. Multimeter red wire alternately to white/black wire terminal and to pink wire terminal.
   D. Meter should register 12V ± one volt at both terminals.

   No Power

   Power

   Yes

   Replace coil.

3. A. Pink (ignition module) wire disconnected.
   B. Ignition switch on.
   C. Jumper wire - connect capacitor wire to pink wire terminal.
   D. Connect both wires to common ground.
   E. Momentarily touch ground wire to pink wire terminal. When you remove the wire, there should be a spark at plug.

   Spark

   No

   Replace coil.

   Yes

4. A. Reconnect pink wire to coil.
   B. Ignition switch on.
   C. Disconnect cam position sensor connector [14].
   D. Connector from ignition module - multimeter red wire to red/white wire socket and multimeter black wire to black/white pin. Should register 8-12 volts.

   Power

   No

   Power

   Yes

   Check ignition module ground and power wire to ignition module for loose connections. See RESISTANCE TEST which follows. Check spark, Step 5.
**INTERMITTENT IGNITION PROBLEM – VIBRATION**

A. Check battery connections. Disconnect module ground (scrape black paint, add star washer).

B. Disconnect white wire at coil terminal (not module feed).

C. Connect 16 gauge jumper wire from battery positive terminal to white/black wire terminal of coil.

D. Operate vehicle to see if problem is eliminated. If it is, wiggle wires and use voltage drop tests to identify broken primary circuit wires, poor connections, or defective switches or circuit breakers.

If problem is not eliminated, look for broken wires or poor connections on ignition module and cam position sensor wiring.

**NOTE**

Vehicle no longer has an engine stop switch. Engine must be stopped by removing jumper wire.

**INTERMITTENT IGNITION PROBLEM – TEMPERATURE**

A. Remove outer timing cover.

B. Remove inner timing cover and gasket.

C. Start engine.

D. Spray front of cam position sensor with refrigerant (obtainable at electronic supply houses) to see if engine stalls.

E. With engine hot, at operating temperature and cover off, apply heat (blow dryer) to front of cam position sensor and see if engine stalls.

F. Apply heat to ignition module (blow dryer) and see if engine stalls.

**Problem is temperature sensitive cam position sensor or ignition module. Replace cam position sensor or ignition module.**
## Resistance Test

### IGNITION RESISTANCE TEST

#### IGNITION MODULE

<table>
<thead>
<tr>
<th>TEST</th>
<th>METER SETTING</th>
<th>PROBE 1</th>
<th>PROBE 2</th>
<th>METER READING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check for grounds</td>
<td>RX1</td>
<td>To black/white wire on sensor connector</td>
<td>To chassis ground</td>
<td>Module</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[14B]</td>
<td></td>
<td>0-1 ohm Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>More than 1 ohm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Check harness for opens. See next page.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>If harness checks OK, replace ignition module.</td>
</tr>
</tbody>
</table>

![Wiring Diagram](image)

**NOTE**

Simplified wiring diagram shown. See the WIRING DIAGRAMS in Section D of this book for more detailed information.

**CAUTION**

If a resistance test is performed on a "live" circuit, the multimeter will be damaged. Turn off the ignition and disconnect the battery before conducting a resistance test.
Resistance Test

IGNITION MODULE HARNESS

TEST CONDITIONS: Engine stop switch on right handlebar must be in OFF position and 8-place ignition module connector and 3-place cam position sensor connector must be disconnected for these tests. Shake or wiggle the harness to detect any breaks in the wiring.

<table>
<thead>
<tr>
<th>TEST</th>
<th>METER SETTING</th>
<th>PROBE 1</th>
<th>PROBE 2</th>
<th>METER READING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check for grounds</td>
<td>RX1</td>
<td>To pin 7 on connector [10A].</td>
<td>To chassis ground</td>
<td>Harness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0-1 ohm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Repair/clean ground connection.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Infinity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Locate and repair short to ground.</td>
</tr>
<tr>
<td>Check for grounds</td>
<td>RX1</td>
<td>All pins except 7 on connector [10A]</td>
<td>To chassis ground</td>
<td>Harness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0-1 ohm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Repair broken wire or loose/dirty connection.</td>
</tr>
<tr>
<td>Continuity</td>
<td>RX1</td>
<td>All pins except 7 on connector [10A]</td>
<td>Opposite end of each of the 6 leads</td>
<td>Harness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0-1 ohm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Repair broken wire or loose/dirty connection.</td>
</tr>
</tbody>
</table>

**Connector [10A]**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Code</td>
<td>W/BK</td>
<td>BK/W</td>
<td>R/W</td>
<td>PK</td>
<td>GN/W</td>
<td>V/W</td>
<td>BK</td>
<td>open</td>
</tr>
</tbody>
</table>

1. Cam position sensor
2. Ignition module
3. Ignition coil
4. Spark plug (2)
5. Vacuum operated electric switch (V.O.E.S.)

NOTE
Simplified wiring diagram shown. See the WIRING DIAGRAMS in Section D of this book for more detailed information.
GAUGES/INSTRUMENTS

General

Use the troubleshooting tables on the following pages to diagnose and locate problems with malfunctioning or inoperative instruments and gauges. See Figure A-50 for wire connections at rear of gauges. Refer to the applicable wiring diagram at the back of this book for further assistance.

FUEL LEVEL GAUGE

See Figure A-51. When the Ignition/Light Key Switch is turned to IGNITION, the fuel gauge is connected to +12 vdc. Current flows through the gauge and variable resistor in the fuel gauge sending unit to ground. The sending unit float controls the amount of resistance in the variable resistor.

FUEL LEVEL GAUGE SENDING UNIT TEST

1. See the following chart and “ground” the applicable test point.
2. Turn the Ignition/Light Key Switch to IGNITION. If gauge indicated FULL, gauge is functioning correctly. Proceed to step 3. If gauge did not indicate FULL, proceed to step 4.

<table>
<thead>
<tr>
<th>GAUGE LOCATION</th>
<th>TEST POINT &amp; LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument panel</td>
<td>Yellow/White wire at sending unit connector under seat.</td>
</tr>
</tbody>
</table>

3. With the Multi-Meter, Part No. HD-35500A, set on the RXI scale, measure the resistance of the sending unit. Place one probe on the center terminal and the other probe on a good ground.

The meter must indicate approximately 7-95 ohms on FLHT/C/U and FLTR models, 27-260 ohms on FLHR/C and FXD models. If the fuel tank is full, the reading should be approximately 7-14 ohms on FLHT/C/U and FLTR models, 27-40 ohms on FLHR/C and FXD models. An empty tank should have a 74-95 ohm resistance on FLHT/C/U and FLTR models, 240-260 ohm resistance on FLHR/C and FXD models.

---

Figure A-51. Fuel Gauge Schematic

---

Figure A-50. Connections for Gauges

NOTE
All gauges are shown as viewed from rear.

Color Code:
BK- Black
BN/GN-Brown/Green
O-Orange
If a very high resistance or infinity is indicated on the meter, the sender may be "open" or not grounded. Verify that the 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. For removal and installation instructions, see FUEL LEVEL GAUGE SENDING UNIT, page 8-115 of the 1998 FLT Service Manual. If a higher resistance is present, refer to applicable wiring diagram at rear of this manual and check sender ground circuit.

4. If gauge did not indicate FULL, use Multi-Meter (Part No. HD-35500A) to verify that 2-7 vdc is present at sender. If 2-7 vdc is not present, check for broken or disconnected wire or an open winding in fuel gauge. Replace gauge if winding is open. See REMOVAL/INSTALLATION, 2 INCH DIAMETER GAUGES, FLHT/ C/U, page 8-102, or FLTR, page 8-104, of the 1998 FLT Service Manual.

---

**FUEL GAUGE - FLHR/C**

**Problem:** Gauge Faulty

Perform resistance checks to determine if fuel gauge is faulty. Disconnect the gauge, remove the bulb and check for resistance as follows:

- 441 +/- 20 ohms between the "S" and "G" studs
- 102 +/- 5 ohms between the "S" and "I" studs

---

**LOW FUEL LEVEL LAMP - FLHTCU, FLTR**

**Problem:** Fuel low level lamp does not illuminate when fuel level is low.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of power.</td>
<td>Check for power (12 vdc or battery voltage) between pins 1 (positive) and 6 (negative). All checks are made at Low fuel module connector [106].</td>
</tr>
<tr>
<td>No ground.</td>
<td>Check for continuity to ground on pin 6.</td>
</tr>
<tr>
<td>Lamp defective or wiring broken.</td>
<td>Ground pin 2. If lamp illuminates, then LED is functional and wiring is OK.</td>
</tr>
<tr>
<td>Defective module, insufficient voltage to module.</td>
<td>LED should illuminate when voltage at pin 4 exceeds 3.7 vdc.</td>
</tr>
</tbody>
</table>

---

**LOW FUEL LEVEL LAMP - FLHR/C**

**Problem:** Gauge Faulty

Perform all checks at the gauge. Allow up to 30 seconds for the delay feature (both FLHR/C and FLHTCU). Orange is 12 volts DC. Pink is the sender. Black is ground. Pink to Black readings are listed below.

<table>
<thead>
<tr>
<th>Key On</th>
<th>Key Off (Sender Disconnected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full</td>
<td>3 Volts</td>
</tr>
<tr>
<td>1/4</td>
<td>6.4 Volts</td>
</tr>
<tr>
<td>Empty</td>
<td>7.3 Volts</td>
</tr>
<tr>
<td></td>
<td>35 Ohms</td>
</tr>
<tr>
<td></td>
<td>153 Ohms (Low Light On)</td>
</tr>
<tr>
<td></td>
<td>215 Ohms</td>
</tr>
</tbody>
</table>
**OIL PRESSURE GAUGE AND INDICATOR LIGHT**

**Problem:** Low oil pressure light remains on with engine running above idle and/or oil pressure gauge does not work.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
</table>
| No oil pressure due to lack of oil or faulty oil pump. | **CAUTION** Running engine when OIL pressure light remains on and gauge indicates low pressure will result in engine damage.  
1. Check oil level. Add oil if low.  
2. Restart engine and verify that oil pressure light goes off and gauge indicates pressure. If problem still exists, refer to OIL PUMP in Section 3.  
3. If the oil pressure gauge indicates pressure but the low oil pressure light remains on, proceed as follows:  
   a. Disconnect wire from terminal WK. Place one ohmmeter probe on WK terminal, place the other probe on the crankcase. Meter must read zero ohms.  
   **CAUTION** Disconnect wire from terminal WK before performing ohmmeter check. The ohmmeter may be damaged if connected to 12 vdc.  
   b. Start the engine and run at a fast idle. The ohmmeter must read infinity.  
   c. Replace the sending unit if the above meter readings are not obtained.  
4. If the low oil pressure light functions correctly, but the pressure gauge does not, then proceed as follows:  
   a. Remove wire from G terminal on sending unit. Turn the Ignition/Light Key Switch to IGNITION. The gauge must read full scale 70 PSI.  
   b. Ground wire to crankcase. The gauge must read zero.  
   c. Replace the sending unit if the above gauge readings are obtained. If the gauge readings are not obtained, then replace the pressure gauge. |
| Contacts in pressure sending unit not opening to shut off light. Variable resistor in sender is shorted to ground. | **Light WK Terminal G/Y Wire**  
**Gauge G Terminal BN/G Wire**  
**Rubber Boot**  
**Figure A-52. Oil Pressure Sending Unit**  

No power to gauge. | See Voltmeter. |
## AMBIENT AIR TEMPERATURE GAUGE

**Problem:** Gauge inoperative.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor not grounded or open between sensor and gauge.</td>
<td>Test for continuity between pin 1 and ground and pin 3 and gauge. Repair if open.</td>
</tr>
<tr>
<td>Broken or disconnected power or ground wire to gauge.</td>
<td>Check for 12 vdc between pins 1 and 3 at connector [115A]. Replace gauge if voltage is present. See REMOVAL/INSTALLATION, 2 INCH DIAMETER GAUGES, FLHT/C/U, page 8-102, or FLTR, page 8-104, of the 1998 FLT Service Manual. Use voltage drop tests and continuity checks to isolate if voltage is not present.</td>
</tr>
<tr>
<td>Malfunction in gauge or sensor.</td>
<td>Measure resistance between pins 1 and 3 at 65° to 85° F. Resistance should be 43-31 ohms. Replace sensor if out of range, replace gauge if within range.</td>
</tr>
</tbody>
</table>

## VOLTMETER

**Problem:** Meter inoperative.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
</table>
| Broken or disconnected leads to meter or open meter winding. | 1. With Ignition/Light Key Switch turned to IGNITION, verify that 12 vdc is present at "±" terminal on voltmeter. With switch turned to OFF, check ground terminal for continuity to ground.  
2. Replace the voltmeter if 12 vdc is present and ground terminal is grounded. See REMOVAL/INSTALLATION, 2 INCH DIAMETER GAUGES, FLHT/C/U, page 8-102, or FLTR, page 8-104, of the 1998 FLT Service Manual.  
3. If 12 vdc is not present, trace wiring until disconnected or broken wire is found and repair as necessary. If ground terminal is not grounded, refer to wiring diagram and repeat procedure given for 12 vdc lead. |

## SPEEDOMETER

**Problem:** Gauge inoperative.

For electronic speedometers (FLHR/C only), see ELECTRONIC SPEEDOMETER TROUBLESHOOTING, page A-63. Removal and installation instructions are also provided.


## TACHOMETER

**Problem:** Gauge inoperative.

See SPEEDOMETER/TACHOMETER PERFORMANCE CHECK on page A-65. If replacement is necessary, see REMOVAL/INSTALLATION, 4 INCH DIAMETER GAUGES, FLHT/C/U, page 8-103, or FLTR, page 8-104, of the 1998 FLT Service Manual.
GENERAL

NOTE

The performance (proper operation and sweeping action) of the speedometer and tachometer can be evaluated using the Speedometer Tester (HD-41354). Before removing and replacing these instruments, see SPEEDOMETER/TACHOMETER PERFORMANCE CHECK on page A-65.

See Figure A-53. The electronic speedometer consists of a speed sensor, function switch and speedometer unit.

The Hall-Effect speed sensor circuitry is triggered by the teeth of the transmission mainshaft 4th gear. The sensor output is a series of pulses that are interpreted by the speedometer circuitry to control the position of the speedometer needle and the odometer’s liquid crystal display (LCD). The odometer mileage is permanently stored and is not lost when electrical power is turned off or disconnected.

By momentarily pressing the function switch, the user is able to toggle between the odometer and trip odometer displays. To zero the trip odometer, depress and hold the function switch while the odometer display is visible. The trip odometer mileage will then appear for approximately 2-3 seconds, after which time the recorded figure is zeroed.

The odometer can display seven numbers to indicate a maximum of 999999.9 miles. The trip odometer can display five numbers for a maximum of 9999.9 miles.

NOTE

Circuitry in the speedometer also conditions the sensor input to provide an input to the turn signal canceler. The turn signal canceler input was supplied by the reed switch in mechanical speedometers.

TROUBLESHOOTING

See the flow charts starting on page A-63.

---

**Figure A-53. Electronic Speedometer**

- Function Switch
- 12 VDC Input
- Speedometer
- Connector [65A&B]
- Sensor Leads:
  - R-Red: +12 VDC
  - W-White: Output Signal (Square Wave)
  - BK-Black: Ground
- White/Green Wire to Turn Signal Canceler
Speedometer Troubleshooting

Chart 1: Odometer, Trip Odometer and Reset Switch

Problem #1: Odometer Inoperable, Trip Odometer Inoperable

Turn Ignition On.

Does Odometer Display Consist of Correct Numbers?

YES

Press Trip Reset Switch. Does LCD Display on Speedometer Toggle Between Trip and Odometer Modes?

YES

Verify Trip Display Consists of Correct Numbers. Are Correct Numbers Displayed?

YES

Proceed to Diagnosis of Chart 2.

NO

Replace Speedometer.

NO

Replace Speedometer.

NO

Replace Speedometer.

NO

Replace Speedometer.

NO

Replace Speedometer.
**Speedometer Troubleshooting**

**Chart 2: Inoperative, Inaccurate or Erratic Speedometer**

**DIAGNOSTIC NOTES**

The reference numbers below correlate with those on the diagnostic flow chart.

1. Remove seat.
2. Test results may be inaccurate if tester battery is low.
4. Sensor can also be tested with Speedometer Tester (HD-41354) and Test Harness. See Speedometer Sensor Test, page A-67.
5. Remove sensor and check for accumulation of debris on sensor; if debris is not present, replace sensor. If debris is present, clean sensor and repeat test. Replace if necessary.
ELECTRONIC SPEEDOMETER/TACHOMETER
PERFORMANCE CHECK - ALL MODELS

GENERAL

The performance (proper operation and sweeping action) of the speedometer and tachometer (if equipped) can be evaluated with the Speedometer Tester, HD-41354. For the purpose of checking the speedometer operation, the tester generates a signal that simulates the input normally received from the speedometer sensor.

Similarly, when testing tachometer performance (on carbureted models only), the tester is used to send a frequency to the ignition module to simulate the signal received from the cam position sensor.

Finally, the signal generated by the Speedometer Tester can be employed to simulate engine running conditions for ignition system troubleshooting. See IGNITION SYSTEM for more information.

NOTE

Use the following procedures in conjunction with the manual supplied with the speedometer tester.

SPEEDOMETER TESTS
Electronic Speedometers Only

NOTE

See Figure A-54. The speedometer tester does not verify the calibration of a speedometer nor will it verify the speedometer’s function to support legal proceedings. Its purpose is to verify speedometer function when performing service diagnosis or repair, and to assist in determining if speedometer replacement is necessary.

Frequency Input Test

1. Disconnect the speedometer sensor connector [65] located under the seat (3-place Deutsch). Mate the Speedometer Tester and speedometer sensor [65B] connectors. See Figure A-55.

2. Place the Speedometer Tester Power Signal Switch in the “OUT” position. Place the Power Switch in the “ON” position. Turn the Ignition/Light Key Switch to “ON.”

3. When the Speedometer Tester displays “P. _ _ 1”, press “1” on the keypad followed by the “ENTER” button. A series of three dashes is displayed on the tester LCD.

4. Referring to the appropriate table on page A-66, enter a selected frequency and press the “ENTER” button again.

NOTE

If the entered frequency is 0 or more than 19,999, then the message “FAIL” will appear on the LCD display and the unit will return to the frequency select prompt.

5. Look at the needle of the speedometer gauge to verify that it corresponds to the speed printed at the top of the frequency column.

6. To change the frequency, press the “CLEAR” button on the keypad to cancel the operation, enter a new frequency and then press the “ENTER” button to begin.

NOTE

Speedometers are calibrated to be 0 to plus 4 mph (6.4 kph) fast. Certified speedometers (FLHP and FLHR models only) are calibrated to be plus or minus 2 mph (3.2 kph).

Needle Sweep Test

The sweep function of the Speedometer Tester moves the needle on the speedometer gauge through its full operating range. Observe the movement of the needle and take note of any hesitancy or sticking. Proceed as follows:
### Tester Frequency Tables

#### XL MODELS

<table>
<thead>
<tr>
<th>Model (units)</th>
<th>Tester Frequency (in Hz) Corresponding to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 mph (30 kph)</td>
</tr>
<tr>
<td>1200 Domestic/ Great Britain (mile/kilo)</td>
<td>408</td>
</tr>
<tr>
<td>1200 HDI* (kilo)</td>
<td>381</td>
</tr>
<tr>
<td>883 Domestic/ Great Britain (mile/kilo)</td>
<td>439</td>
</tr>
<tr>
<td>883 HDI* (kilo)</td>
<td>409</td>
</tr>
</tbody>
</table>

* Includes Japan (1997), Canada (1997) and Swiss (1997)

#### FXD MODELS

<table>
<thead>
<tr>
<th>Model (units)</th>
<th>Tester Frequency (in Hz) Corresponding to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 mph (30 kph)</td>
</tr>
<tr>
<td>Domestic (mile)</td>
<td>471</td>
</tr>
<tr>
<td>Great Britain (mile/kilo)</td>
<td>471</td>
</tr>
<tr>
<td>HDI* (kilo)</td>
<td>440</td>
</tr>
</tbody>
</table>

* Includes Japan (1997), Canada (1997) and Swiss (1997)

#### FX MODELS

<table>
<thead>
<tr>
<th>Model (units)</th>
<th>Tester Frequency (in Hz) Corresponding to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 mph (30 kph)</td>
</tr>
<tr>
<td>Domestic (mile)</td>
<td>431</td>
</tr>
<tr>
<td>Great Britain (mile/kilo)</td>
<td>431</td>
</tr>
<tr>
<td>HDI* (kilo)</td>
<td>402</td>
</tr>
</tbody>
</table>

* Includes Japan (1997), Canada (1997) and Swiss (1997)

#### FLHR MODELS

<table>
<thead>
<tr>
<th>Model (units)</th>
<th>Tester Frequency (in Hz) Corresponding to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 mph (30 kph)</td>
</tr>
<tr>
<td>Domestic (mile)</td>
<td>464</td>
</tr>
<tr>
<td>Great Britain (mile/kilo)</td>
<td>464</td>
</tr>
<tr>
<td>HDI* (kilo)</td>
<td>433</td>
</tr>
</tbody>
</table>

* Includes Japan (1997), Canada (1997) and Swiss (1997)

### NOTE

If the Speedometer Tester was just used to perform the Operation Test, turn the Power Switch OFF and then ON to reset the device.

1. With the tester connected as described in Frequency Input Test, place the Speedometer Tester Power Switch in the “ON” position. Place the Power Signal Switch in the “OUT” position.
2. Turn the Ignition/Light Key Switch to “ON”.
3. When the Speedometer Tester displays “P__–1”, press “0” on the keypad followed by the “ENTER” button. The tester will scan for two seconds and then put out 1 Hz.
4. Use the 2, 5, and 8 keys to select one of three ranges:
   - LO (1-20 Hz)
   - CEN (21-999 Hz)
   - HI (1000-20,000 Hz)

5. Next, use the corresponding arrow keys to accelerate through the selected range. For example, keys 1 and 3 move through the LO range. As you move through the speed range, check for smooth needle movement. Replace any speedometer that sweeps erratically up or down.

### Speedometer Needle Sweep Test

<table>
<thead>
<tr>
<th>THESE BUTTONS</th>
<th>THESE BUTTONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DECREASE BY</strong></td>
<td><strong>INCREASE BY</strong></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

A-66
SPEEDOMETER SENSOR TEST  
Electronic Speedometers Only

If the speedometer is inoperative, but the backlighting and odometer work, then the speedometer sensor may be faulty.

To test the speedometer sensor as described below, as well as the cam position sensor test using the tachometer tester (described in IGNITION SYSTEM), a test harness is required.

1. Fabricate the test harness by splicing together two Deutsch 3-place socket housings (72113-94BK) and one Deutsch 3-place pin housing (72103-94BK). See Figure A-56. Use six inch lengths of 18 gage wire.

2. Install the test harness at the cam position sensor connector [14].

3. Test for voltage to the sensor by checking for 8-12 VDC on Red wire in connector [65B]. Next, check for continuity to ground on the Black wire in connector [65B].

   **NOTE**

   The following test will only work if voltage and proper ground are present at the speedometer sensor.

4. To diagnose the speedometer sensor proceed as follows:
   a. Install the test harness between the speedometer sensor connectors [65A & 65B].
   b. Turn the Power Switch to "ON" and place the Signal Switch in the "IN" position.
   c. Plug the Speedometer Tester into the test harness and turn the Ignition/Light Key Switch to "ON."
   d. Press ENTER on the tester keypad.
   e. Rotate the motorcycle’s rear wheel. The numbers on the speedometer tester readout should change with changes in wheel speed. If the readout does not change, then the speedometer sensor is suspect.

f. Install a known, good speedometer sensor and test again for proper operation.

TACHOMETER TEST  
Carbureted Models Only

Operation Test

1. Connect the speedometer tester to the cam position sensor Deutsch socket housing [14B]. The tester frequency you enter will now travel to the ignition module and the module will open and close circuits to fire the spark plugs. This allows you to simulate engine running and generate tachometer readings.

2. Because tester frequency is in Hertz, and you will be interested in measuring rpm on the tachometer being tested, convert the tachometer reading you want to Hz, then enter the frequency just as you did in the speedometer operation test above.

   For example:

   \[
   \text{2000 rpm (tachometer reading)} \div 60
   = 33.3 \text{ (enter 33 into tester)}
   \]

   In this example, entering 33 Hz into the tester should result in an rpm reading of 2000 on the tachometer. Test the tachometer at several different rpm readings to verify proper operation.

<table>
<thead>
<tr>
<th>Tachometer Accuracy Tolerances</th>
<th>at 68-77° F (20-25° C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication (rpm)</td>
<td>2000</td>
</tr>
<tr>
<td>Tolerance (rpm)</td>
<td>± 100</td>
</tr>
</tbody>
</table>

**Needle Sweep Test**

Variable frequency signals can be generated by the speedometer tester to help verify proper tachometer sweep operation. With the speedometer tester installed at the cam position sensor connector [14B], perform the tachometer needle sweep test following the steps outlined under Speedometer Needle Sweep Test.
SYMPTOMS

The radio diagnostics for the new 1998 Premium Sound System is symptom based. Simply locate the apparent problem from the list of 15 symptoms listed in the table in Figure A-57. Take note of the page number and turn to the section that addresses the problem.

NOTE
If the problem is not listed or is intermittent, locate the most relative symptom and inspect connectors for moisture or corrosion. Also look for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.

At the beginning of the section, follow the SETUP instructions and then review the FUNCTIONALITY description to determine whether the system is operating as intended. If it appears that the system is not working correctly, validate the problem by performing the flow chart under SOFTWARE DIAGNOSIS. (See DIAGNOSTIC MODE OVERVIEW to gain a general understanding of how the on-board diagnostics work.)

If the Diagnostic Mode indicates that a malfunction exists, refer to the flow chart under HARDWARE DIAGNOSIS for correction of the problem.

Work your way through each flow chart box by box. If a numbered circle appears adjacent to a box, then more information is offered in the Diagnostic Notes. Many Diagnostic Notes contain supplemental information, helpful tips or references to other parts of the manual.

When working through a flow chart, refer to the illustrations, and the Wire Harness Connector table as necessary. The wire harness connector table identifies the connector number, description, type and general location.

After correction of the problem, refer back to SETUP and FUNCTIONALITY to verify proper operation.

DIAGNOSTIC MODE OVERVIEW

Push any two of four Preset buttons on the front panel of the radio. See Figure A-58. With the buttons depressed, turn the Ignition/Light Key Switch to IGNITION. Diagnostic Group 1, the first of five diagnostic screens, appears on the LCD display, as indicated by the "d1" in the lower portion.

The upper portion of the display shows a line of input bits which correlate to a particular set of switch functions. Whether the display shows a "0," a "1" or is able to toggle between "0" and "1" indicates whether or not the switch is working.

Push the LO/DX button on the front panel to sequence from Diagnostic Group 1 to Diagnostic Group 2. Press the button again to advance to Diagnostic Group 3. After all modes have been accessed, the final push of the LO/DX button will cause the system to revert back to normal radio operation.

Since we are only concerned with Diagnostic Groups 1 and 2 (Diagnostic Groups 3, 4 and 5 being for factory use only), the Diagnostic Mode can be exited at any time by simply turning the Ignition/Light Key Switch to OFF.
Diagnostic Mode Group 1

When the Diagnostic Mode is first accessed, a line of five input bits appears in the upper portion of the front panel LCD display. See Figure A-59.

For explanatory purposes, assume that the REAR VOLUME UP control is inoperative. Referencing the matrix at the top of Figure A-60, note that this switch function is found at the intersection of the C3 and R0 lines. The matrix indicates that the problem either involves the O/BK or the PK/W wires.

Operate the switch while observing the input bit. The input bit to watch correlates with the position of the switch in the matrix. Therefore, the REAR VOLUME UP control is the second bit from the left hand side. If the input bit toggles between “1” and “0” at a one second rate while the switch is depressed, then the switch is functioning normally. However, if the switch is locked on “1” or “0” and fails to toggle, then a problem exists.

Now assume that the input bit of the REAR VOLUME UP control is locked on “1.” Review the text below the matrix in Figure A-60. From this information, we see that when the input bit is locked on “1,” then either the O/BK or the PK/W wires are shorted to +12 volts.

To further pinpoint the problem, exercise the MODE UP or FAST FORWARD functions, or any other switch function on the R0 line, which also utilize the PK/W wire. If the input bit toggles, then one can conclude that the PK/W wire is alright and the problem involves the O/BK lead. Now operate the REAR VOLUME DOWN switch to verify the conclusion. As seen from the matrix, this switch function also utilizes the O/BK wire. If the input bit is still locked on “1” then the O/BK wire is confirmed as the source of the problem. Operation of the PTT and PRESET 4 buttons (the remaining switch functions on the C3 line) would serve to confirm the same conclusion.

On the other hand, if all other switch functions on the C3 line toggle between “1” and “0” at a one second rate, indicating that the switch is functioning normally, then an open exists on the R0 line. Conversely, if all other switch functions on the R0 line toggle between “1” and “0” at a one second rate, then an open exists on the C3 line.

Figure A-60. Diagnostic Mode Group 1 Matrix

- If Cx and Rx are normal, input bit on LCD display toggles between “1” and “0” at a one second rate while button is depressed.
- If Cx is shorted to ground, input bit on LCD display appears as “0” whether switch is open or closed. See Figure A below.
- If Cx is shorted to +12 volts, input bit on LCD display appears as “1” whether switch is open or closed. See Figure B below.
- If Rx is shorted to ground, input bit on LCD display appears as “1” when switch is open and “0” when switch is closed (depressed), but does not toggle at a one second rate as occurs when switch is normal. See Figure C below.
- If Rx is shorted to +12 volts, input bit on LCD display appears as “1” whether switch is open or closed. See Figure D below.
- If all other switch functions on the Cx and Rx lines toggle between “1” and “0,” then an open is indicated. See Figure E and Figure F below.

\[ Cx = C0 \text{ thru } C4, \quad Rx = R0 \text{ thru } R3. \]

1. \( Cx \) is shorted to ground.
2. \( Cx \) is shorted to +12 volts.
3. \( R0 \) is shorted to ground.
4. \( R0 \) is shorted to +12 volts.
5. \( C3 \) is open.
6. \( R0 \) is open.

\[ [1/0] = \text{Displays “1” when open, “0” when button is depressed.} \]
\[ (1/0) = \text{Toggles between “1” and “0” while button is depressed.} \]
Therefore, a continuous "0" is a short to ground, while a continuous "1" is a short to +12 volts, but ONLY if all other switch functions on that respective Cx or Rx line are also locked on "0" or "1," respectively. If all other switch functions on the Cx and Rx lines toggle between "1" and "0," then an open is indicated.

**Diagnostic Mode Group 2**

When the radio Diagnostic Mode is first accessed, Diagnostic Group 1 appears on the LCD display, as indicated by the "d1" in the lower portion. Push the LO/DX button on the front panel to sequence to Diagnostic Group 2. See Figure A-61.

The upper portion of the Diagnostic Group 2 display shows a line of eight input bits each of which correlates to a particular switch function. The characters "d2" appear in the lower portion.

Operate the switch while observing the input bit. The input bit to watch correlates with the position of the switch in the line.

For example, the INTERCOM OFF/ON SWITCH is the fifth input bit from the left hand side. If the input bit toggles between "1" and "0" as the console mounted rocker switch is turned ON and then OFF, respectively, then the switch is functioning normally. However, if the switch is locked on "1" or "0," then a problem exists.

Unlike the Diagnostic Group 1 input bits, whether the problem is a short to ground, a short to +12 volts or an open is not so readily apparent. See Figure A-62 for further explanation of the Diagnostic Group 2 input bits and then refer to the appropriate flow chart under SOFTWARE DIAGNOSIS.

---

<table>
<thead>
<tr>
<th>0=PTT</th>
<th>0 or 1</th>
<th>1=Break</th>
<th>1=ON</th>
<th>1=ON</th>
<th>10=Headset</th>
<th>11=Speaker</th>
<th>01=Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAND-HELD MIC. PTT</td>
<td>AVC REED SWITCH</td>
<td>VOX BREAK</td>
<td>CB SQUELCH BREAK</td>
<td>INTERCOM OFF/ON SWITCH</td>
<td>CB OFF/ON SWITCH</td>
<td>SPEAKER SWITCH &quot;B&quot;</td>
<td>SPEAKER SWITCH &quot;A&quot;</td>
</tr>
<tr>
<td>7 (BE/Y)</td>
<td>6 (W/GN)</td>
<td>5 Internal</td>
<td>4 Internal</td>
<td>3 (W/V)</td>
<td>2 (W/R)</td>
<td>1 (BN/O)</td>
<td>0 (V/O)</td>
</tr>
</tbody>
</table>

Diagnostic Mode 2, which displays the logic states of various signals, functions as follows (left to right):

- **Handheld Microphone PTT**: Input bit on LCD appears as "1" when PTT button is not depressed, "0" when button is depressed. (This should not be confused with the handlebar mounted PTT Switch.)

- **AVC Reed Switch**: Input bit normally toggles between "1" and "0" as the front wheel is rotated. The rate at which it toggles is proportional to the speed of the wheel.

- **VOX Break**: When the microphone signal is strong enough to exceed threshold (set in Intercom Set Up Mode), input bit on LCD appears as "1." When VOX is not broken, display appears as "0."

- **CB Squelch Break**: When CB receives signal strong enough to exceed threshold (set by squelch level setting), input bit on LCD appears as "1." When CB Squelch is not broken, display appears as "0."

- **Intercom OFF/ON**: When switch is ON, input bit on LCD display appears as "1." When switch is OFF, display appears as "0."

- **CB OFF/ON**: When switch is ON, input bit on LCD appears as "1." When switch is OFF, display appears as "0."

- **Speaker Switch A, Speaker Switch B**: When fairing cap rocker switch is in the HEADSET position, input bits on LCD display appears as "10." Display is "11" in the SPEAKER position and "01" in the Center position.

* CB or Intercom must be turned on and VOX or Squelch settings must be established before entering diagnostic mode.
1. AUDIO CONTROL INOPERATIVE SOFTWARE DIAGNOSIS

SETUP
- Press the POWER button to turn on the radio.
- Turn console mounted Intercom and CB Switches to OFF.
- Set fairing mounted Headset/Speaker Switch to SPEAKER.

FUNCTIONALITY
Locate the Audio Control Switch on the left handlebar. Push the switch in to sequence to Bass, Treble, Fader and then back to Volume. The front panel LCD display indicates the function selected.

Momentarily push the switch upward (+) to raise the volume, downward (-) to lower the volume. The front panel LCD annunciates volume level through a horizontal bar graph display and stereo audio should be present in all four speakers (front speakers on non-Ultra). The display reverts to the time of day approximately two seconds after the switch is released.

Are these your observations?
Yes - System is OK. See SPEAKERS INOPERATIVE.
No - See Software Flow Chart below.

SOFTWARE DIAGNOSTIC NOTES
The reference numbers below correlate with those on the diagnostic flow chart.

This also may be an open. First go to SHORT TO VOLTAGE in Hardware Chart.

![Switch Matrix](image)

**Figure A-63. Diagnostic Mode Group 1 Switch Matrix**

**Figure A-64. LCD Display Audio Control Switch Input Bits**

**FLHC/T/J Wire Harness Connectors**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[24]</td>
<td>Interconnect Harness to Left Handlebar Controls</td>
<td>12 - Place Deutsch (Gray)</td>
<td>Inner Fairing - Left Fairing Support Brace</td>
</tr>
<tr>
<td>[27]</td>
<td>Radio</td>
<td>23 - Place Amp (Black)</td>
<td>Back of Radio (Right Side)</td>
</tr>
</tbody>
</table>
1. AUDIO CONTROL INOPERATIVE HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

2. Revalidate failure. Reconnect all connectors. If problem still exists, replace radio. If problem is gone, look for intermittents.

<table>
<thead>
<tr>
<th>From (+)</th>
<th>To Terminal (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 (PK/W)</td>
<td>8 (BN/BK)</td>
</tr>
<tr>
<td>6 (PK/W)</td>
<td>10 (GN/BE)</td>
</tr>
<tr>
<td>11 (GY/GN)</td>
<td>23 (GN/BE)</td>
</tr>
</tbody>
</table>

Is Voltage Present?

YES

With Key ON, Check for Power at Connector [24B].

<table>
<thead>
<tr>
<th>From (-)</th>
<th>To Terminal (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 (BN/BK)</td>
<td>9 (PK/W)</td>
</tr>
<tr>
<td>10 (GN/BE)</td>
<td>11 (GY/GN)</td>
</tr>
</tbody>
</table>

Is Voltage Present?

YES

Disconnect Connector [27]. With Switch Depressed, Check for Continuity at Connector [27B].

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>From Terminal</th>
<th>To Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio +</td>
<td>3 (PK/W)</td>
<td>23 (GN/BE)</td>
</tr>
<tr>
<td>Audio -</td>
<td>3 (PK/W)</td>
<td>22 (GY/GN)</td>
</tr>
<tr>
<td>Audio In</td>
<td>3 (PK/W)</td>
<td>8 (BN/BK)</td>
</tr>
</tbody>
</table>

Each Wire Pair Should be Less than 0.5 Ohms While Switch is Depressed and Infinity While Switch is Open. Is It?

YES

Replace Radio.

NO

Repair Short in Handlebar Harness.

6551

6531

Replace Switch.

6501

With Switch Depressed, Check for Continuity at Connector [24B].

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>From Terminal</th>
<th>To Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio +</td>
<td>9 (PK/W)</td>
<td>10 (GN/BE)</td>
</tr>
<tr>
<td>Audio -</td>
<td>9 (PK/W)</td>
<td>11 (GY/GN)</td>
</tr>
<tr>
<td>Audio In</td>
<td>9 (PK/W)</td>
<td>8 (BN/BK)</td>
</tr>
</tbody>
</table>

Each Wire Pair Should be Less than 0.5 Ohms While Switch is Depressed and Infinity While Switch is Open. Is It?

YES

Repair or Replace Interconnect Harness.

6532

NO

Replace Audio Switch or Repair Switch Wiring.

6186

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.
2. MODE CONTROL INOPERATIVE 
SOFTWARE DIAGNOSIS

SETUP
- Press the POWER button to turn on the radio.
- Turn console mounted Intercom and CB Switches to OFF.

FUNCTIONALITY
Locate the Mode Select Switch on the right handlebar. Momentarily push the switch in to sequence between the AM, FM and WB bands. The LCD display indicates the band selected.

Momentarily push the Mode Select Switch in an upward direction (UP) to cause the receiver to increment one step on the frequency scale. Similarly, push the Mode Select Switch in a downward direction (DN) to cause the receiver to decrement one step on the frequency scale.

NOTE
In Intercom Setup Mode (Ultra models only), the UP and DN functions adjust the VOX sensitivity level. Press UP to increase microphone sensitivity, press DN to decrease sensitivity. In CB Setup Mode, UP and DN allow for channel selection.

Are these your observations?
Yes - System is OK. See Owner's Manual.
No - See Software chart below.
2. FRONT MODE CONTROL INOPERATIVE
HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES
The reference numbers below correlate with those on the diagnostic flow chart.

2. To eliminate Rear Mode Control Switch from diagnosis, disconnect Connector [28]. If problem is eliminated, see REAR MODE CONTROL INOPERATIVE. If problem remains, continue with present flow chart.

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.
2. REAR MODE CONTROL
INOPERATIVE
HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES
The reference numbers below correlate with those on the diagnostic flow chart.

2. Revalidate failure. Reconnect all connectors. If problem still exists, replace radio. If problem is gone, look for intermittents.

---

### SHORT to VOLTAGE

Remove Outer Fairing. Disconnect Connector [28], With Key ON, Check for Power at Connector [28B].

<table>
<thead>
<tr>
<th>From (-)</th>
<th>To Terminal (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td>13 (PK/W)</td>
</tr>
<tr>
<td></td>
<td>6 (GY/W)</td>
</tr>
<tr>
<td></td>
<td>14 (V/BK)</td>
</tr>
<tr>
<td></td>
<td>5 (BN/W)</td>
</tr>
</tbody>
</table>

Is Voltage Present?

- **YES**: Repair Short in Ultra Overlay Harness.
- **NO**: OPEN

### SHORT to GROUND

Remove Outer Fairing. With Key OFF, Check for Continuity to Ground at Connector [28B].

<table>
<thead>
<tr>
<th>From (-)</th>
<th>To Terminal (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td>13 (PK/W)</td>
</tr>
<tr>
<td></td>
<td>6 (GY/W)</td>
</tr>
<tr>
<td></td>
<td>14 (V/BK)</td>
</tr>
<tr>
<td></td>
<td>5 (BN/W)</td>
</tr>
</tbody>
</table>

Any Continuity Present?

- **YES**: Repair Short in Ultra Overlay Harness.
- **NO**: Replace Radio.

### FLHTCU Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[28]</td>
<td>Radio</td>
<td>23 - Place Amp (Gray)</td>
<td>Back of Radio (Left Side)</td>
</tr>
<tr>
<td>[42]</td>
<td>Ultra Overlay Harness to Rear Left Passenger Controls</td>
<td>6 - Place Mini-Deutsch (Black)</td>
<td>Rear Left Speaker Box</td>
</tr>
</tbody>
</table>

---

### Switch Position

**Switch Position**
- Mode Up
- Mode Down
- Mode In

**From Terminal**
- 5 (BN/W)
- 13 (PK/W)
- 6 (GY/W)
- 14 (V/BK)
- 3 (V/BK)

**To Terminal**
- 4 (BN/W)
- 1 (PK/W)
- 2 (GY/W)

Each Wire Pair Should be Less than 0.5 Ohms While Switch is Depressed and Infinity While Switch is Open. Is It?

- **YES**: Disconnect Connector [42], With Switch Depressed, Check for Continuity at Connector [42B].
- **NO**: Replace Radio.

---

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.
2. SIDECAR MODE CONTROL
INOPERATIVE
HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

2. Mode Control Switch is integral part of sidecar amplifier. Replace sidecar amplifier if switch fails.

---

**Disconnect Connectors [42B] and [42C]. With Key ON, Check for Power at Connector [42B].**

<table>
<thead>
<tr>
<th>From (-)</th>
<th>To Terminal (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td>1 (PK/W)</td>
</tr>
<tr>
<td></td>
<td>2 (GY/W)</td>
</tr>
<tr>
<td></td>
<td>3 (V/BK)</td>
</tr>
<tr>
<td></td>
<td>4 (BN/W)</td>
</tr>
</tbody>
</table>

Is Voltage Present?

**Disconnect Connector [42B] and [42C]. With Key OFF, Check for Continuity to Ground at Connector [42C].**

<table>
<thead>
<tr>
<th>From</th>
<th>To Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td>1 (PK/W)</td>
</tr>
<tr>
<td></td>
<td>2 (GY/W)</td>
</tr>
<tr>
<td></td>
<td>3 (V/BK)</td>
</tr>
<tr>
<td></td>
<td>4 (BN/W)</td>
</tr>
</tbody>
</table>

Any Continuity Present?

**Disconnect Connector [42]. With Sidecar Mode Switch Depressed, Check for Continuity at Connector [42C].**

**FLHTCU Wire Harness Connectors**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[28]</td>
<td>Radio</td>
<td>23 - Place Amp (Gray)</td>
<td>Back of Radio (Left Side)</td>
</tr>
<tr>
<td>[42]</td>
<td>Ultra Overlay Harness to Rear Left Passenger Controls</td>
<td>6 - Place Mini-Deutsch (Black)</td>
<td>Rear Left Speaker Box</td>
</tr>
</tbody>
</table>

**Reconnect Connector [42]. Remove Outer Fairing and Disconnect Connector [28], With Switch Depressed, Check for Continuity at Connector [28B].**

**Remove Sidecar Speaker Console, Disconnect Connector [149] From Sidecar Speaker Amplifier. Check Continuity as Follows:**

<table>
<thead>
<tr>
<th>FROM Connector Position</th>
<th>FROM Terminal</th>
<th>TO Connector Position</th>
<th>TO Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode Up</td>
<td>5 (BN/W)</td>
<td>15</td>
<td>1 (PK/W)</td>
</tr>
<tr>
<td>Mode Dn</td>
<td>5 (BN/W)</td>
<td>23</td>
<td>2 (GY/W)</td>
</tr>
<tr>
<td>Mode In</td>
<td>5 (BN/W)</td>
<td>22</td>
<td>3 (V/BK)</td>
</tr>
<tr>
<td></td>
<td>14 (V/BK)</td>
<td>17</td>
<td>4 (BN/W)</td>
</tr>
</tbody>
</table>

Continuity Present?

---

Replace Sidecar Audio Harness or Locate and Repair Short to Voltage.

Replace Sidecar Speaker Console, Disconnect Connector [149] From Sidecar Speaker Amplifier. Replace Sidecar Audio Harness.

Replace Radio. Repair Ultra Overlay Harness.

Replace Sidecar Speaker Amplifier. Repair or Replace Sidecar Audio Harness.

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.
3. NO SOUND IN ONE OR MORE SPEAKERS/SIDECAR SPEAKERS
SOFTWARE DIAGNOSIS

SETUP

- Press the POWER button to turn on the radio.
- Turn console mounted Intercom and CB Switches to OFF.
- Set fairing mounted Headset/Speaker Switch to SPEAKER (red lamp illuminated).
- Set radio frequency to known strong station.
- Set Volume and Fader to Middle position on horizontal bar graph display.
- If performing sidecar diagnosis, rotate sidecar volume control clockwise to middle or full volume position.

FUNCTIONALITY
Sound should be audible in all speakers. Is it?

Yes - System is OK.
No - See Software Flow Chart below.

SOFTWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. See Figure A-68 for input bit location.
2. If both motorcycle speakers and sidecar speakers are inoperative, first go to Hardware Chart "No Sound in One or More Speakers."

![Diagram](image)

Figure A-67. Speaker Switch B and Speaker Switch A Input Bits

![Table](image)

Figure A-68. Diagnostic Mode Group 2
3. NO SOUND IN ONE OR MORE SPEAKERS
HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES
The reference numbers below correlate with those on the diagnostic flow chart.

1. Perform following:
   a. Impedance Check: With ohmmeter set on R x 1, measure impedance or resistance of the speaker voice coil. Place probes of ohmmeter on the speaker terminals and observe the reading. Reading must be 6-10 ohms. Replace the speaker if any other reading is observed.

2. Assumes Speaker Switch B input bit displays "0."


After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.

<table>
<thead>
<tr>
<th>FLHCU Wire Harness Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No.</strong></td>
</tr>
<tr>
<td>[27]</td>
</tr>
<tr>
<td>[105]</td>
</tr>
</tbody>
</table>
3. NO SOUND IN ONE OR MORE SIDECAR SPEAKERS
HARDWARE DIAGNOSIS

Check for Continuity Between Each Speaker Terminal and Connector [149B] as Follows:

<table>
<thead>
<tr>
<th>FROM</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaker</td>
<td>Amplifier Input/Output</td>
</tr>
<tr>
<td>Left +</td>
<td>OUT</td>
</tr>
<tr>
<td>Left -</td>
<td>OUT</td>
</tr>
<tr>
<td>Right +</td>
<td>OUT</td>
</tr>
<tr>
<td>Right -</td>
<td>OUT</td>
</tr>
<tr>
<td>Left +</td>
<td>IN</td>
</tr>
<tr>
<td>Left -</td>
<td>IN</td>
</tr>
<tr>
<td>Right +</td>
<td>IN</td>
</tr>
<tr>
<td>Right -</td>
<td>IN</td>
</tr>
</tbody>
</table>

[149B]

Check for Power on [149B] at Terminal 21 (+) and Terminal 20 (-). With Ignition Switch ON, Measure Voltage. Is Battery Voltage Present?

YES

NO

Check for Continuity Between Connector [149B] and Rear Speaker Connectors [41] and [42] as Follows:

<table>
<thead>
<tr>
<th>FROM</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaker/ Connector</td>
<td>Terminal</td>
</tr>
<tr>
<td>Left +</td>
<td>[42D]</td>
</tr>
<tr>
<td>Left -</td>
<td>[42D]</td>
</tr>
<tr>
<td>Right +</td>
<td>[41D]</td>
</tr>
<tr>
<td>Right -</td>
<td>[41D]</td>
</tr>
</tbody>
</table>

[149B]


YES

NO

Locate and Repair Open or Replace Sidecar Audio Harness.

YES

NO

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.
4. AUTOMATIC VOLUME CONTROL (AVC) INOPERATIVE SOFTWARE DIAGNOSIS

SETUP

- Press the POWER button to turn on the radio.
- Turn console mounted CB and Intercom switches to OFF.
- Set fairing mounted Headset/Speaker Switch to SPEAKER (red lamp illuminated).
- Set radio frequency to known strong station.
- Set Volume and Fader to Middle position on horizontal bar graph display.

FUNCTIONALITY

To compensate for higher background noise, volume should increase with increasing motorcycle speed (most evident above 40 mph). Does it?

Yes - System is OK.

No - See Software Flow Chart below.

![Flow Chart Diagram](image)

Figure A-69. LCD Input Bit Display

![Mode Group 2 Diagram](image)

Figure A-70. Diagnostic Mode Group 2

NOTE

Since AVC function in 1998 models is not as obtrusive as that seen in previous model years, providing a very smooth transition from no AVC effect up to full AVC effect, it may be most easily observed in the headsets.
4. AUTOMATIC VOLUME CONTROL (AVC) INOPERATIVE HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.


2. Disconnect speedometer cable from front wheel speedometer drive. Chuck cable into an air drill. Run drill in reverse direction and observe speedometer needle and radio volume. Volume should begin to increase around 40 MPH and further increase as indicated speed increases above 40 MPH.

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.

FLHTC/U Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Cruise Module</td>
<td>10 - Place Packard</td>
<td>Under Left Side Cover</td>
</tr>
<tr>
<td>20</td>
<td>Speedometer</td>
<td>3 - Place Multilock</td>
<td>Inner Fairing - Above Radio</td>
</tr>
<tr>
<td>27</td>
<td>Radio</td>
<td>23 - Place Amp (Black)</td>
<td>Back of Radio (Right Side)</td>
</tr>
<tr>
<td>31</td>
<td>Front Turn Signals</td>
<td>6 - Place Multilock</td>
<td>Inner Fairing - Inboard of Left Fairing Bracket</td>
</tr>
</tbody>
</table>
5. POOR STEREO RECEPTION

SETUP

- Press the POWER button to turn on the radio.
- Select AM mode.
- Set LO/DX Switch to LO(CAL).
- Select SEEK function and use MODE CONTROL SWITCH to select station with strong signal.

FUNCTIONALITY

Radio should lock onto strong station. Does it?

Yes - System is OK.

No - See Radio Antenna Test on this page.

RADIO ANTENNA TEST

See Figure A-71. A faulty antenna can cause poor reception. Check it in three steps after cleaning the mast. Step one: set your ohmmeter to the X 1 scale, and connect the leads as shown in the drawing. A reading of more than 1 ohm means you should replace the antenna or cable. If less than 1 ohm, proceed to Step 2. Using the same scale, connect the leads as shown. If the reading is greater than 1 ohm, replace the antenna or cable. If it is less than 1 ohm, proceed to Step 3. Set the meter to the X 1,000 scale, and connect the leads as shown. If the reading is not infinite, replace the antenna or cable. If replacement parts are necessary, retest after installation of new parts.
6. NO POWER SOFTWARE DIAGNOSIS

SETUP

- Turn the Ignition/Light Key Switch to IGNITION.

FUNCTIONALITY

The radio LCD should illuminate. The LCD should display the time or an operational mode (radio, tape, etc.), depending on

the last state of the POWER button on the radio front panel. The radio should toggle between the time display and an operational mode when the POWER button is repeatedly pushed. Does it?

**Yes** - System is OK.

**No** - See Software Flow Chart below.

---

**Flow Chart:**

- **Does LCD Lighting Illuminate?**
  - **YES**
    - **Does Time Display Appear in LCD?**
      - **YES**
        - Push Power Button on Radio Front Panel. Did Radio Display Change to Operational Mode (i.e., Radio, Tape, CD, Etc.)?
          - **YES**
            - Power OK.
          - **NO**
            - Access Radio Diagnostic Mode 1. Were You Successful?
              - **YES**
                - With No Switches Active, Are All Five Input Bits in LCD Displayed as "1.0"?
              - **NO**
                - Replace Radio.
      - **NO**
        - Do Other Lights Illuminate?
          - **YES**
            - Go to Hardware Chart "No Power to Radio."
          - **NO**
            - Check Battery. Charge or Replace.

- **NO**
  - **Replace Radio.**

---

**Table:**

<table>
<thead>
<tr>
<th>Push Switch</th>
<th>LCD Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1/0) OK</td>
<td>0 = Short to Ground</td>
</tr>
<tr>
<td>Cx Line</td>
<td>Hardware Chart</td>
</tr>
<tr>
<td>C0, C1, C2</td>
<td>Audio Control Inoperative</td>
</tr>
<tr>
<td>C3</td>
<td>Rear Headset Volume/PTT Inoperative</td>
</tr>
<tr>
<td>C4</td>
<td>Mode Control Inoperative (if Front Mode Control OK, See Rear)</td>
</tr>
</tbody>
</table>

**Input Bit on Cx Line Displaying "0" in LCD is Grounded. See Short to Ground in Associated Hardware Chart.**

**Push Each of the Switches in the Left Hand Column While Observing the LCD Display. Match Your Observations to the Table Below.**

<table>
<thead>
<tr>
<th>Push Switch</th>
<th>LCD Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode Up</td>
<td>R0</td>
</tr>
<tr>
<td>Rear Vol. -</td>
<td>R1</td>
</tr>
<tr>
<td>SQ -</td>
<td>R2</td>
</tr>
<tr>
<td>Audio -</td>
<td>R0 or R0</td>
</tr>
<tr>
<td>Audio +</td>
<td>R0 or C0</td>
</tr>
</tbody>
</table>

Do the Switches Work OK?

- **YES**
  - Replace Radio.
- **NO**
  - Go to Corresponding Hardware Chart for Switch That is Inoperative.

---

A-84
6. NO POWER
HARDWARE DIAGNOSIS

The reference numbers below correlate with those on the diagnostic flow chart.

2. Perform tests to ensure that battery is fully charged.

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.

**FLHTCU Wire Harness Connectors**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>Main to interconnect harness</td>
<td>12 - Place Deutsch (Black)</td>
<td>Inner Fairing - Right Fairing Bracket</td>
</tr>
<tr>
<td>[27]</td>
<td>Radio</td>
<td>23 - Place Amp (Black)</td>
<td>Back of Radio (Right Side)</td>
</tr>
</tbody>
</table>

**Figure A-72. Fuse Blocks (Under Left Side Cover)**
7. TAPE WILL NOT EJECT
SOFTWARE DIAGNOSIS

SETUP

- Press the POWER button to turn on the radio.

FUNCTIONALITY

Tape cassette should eject when EJECT button is pushed while radio is in either tape or radio mode. Does it?

Yes - System is OK.

No - See Software Flow Chart below.

[Diagram of software flow chart is present here.]

A-86
7. TAPE WILL NOT EJECT
HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

2. A tape that cannot be ejected by using the Eject button can be removed manually with the aide of a small long shank allen wrench. Turn radio off and insert the wrench into the tape door until it engages the right angle of the tape carrier mechanism as shown in Figure A-73 below. Gently push against the right angle until the tape is moved up and out. If manual ejection does not work, contact your Radio Sound representative. DO NOT FORCE MECHANISM OR RADIO DAMAGE WILL OCCUR.

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.

Figure A-73. Manually Eject Tape
8. NO SOUND IN ONE OR MORE HEADSETS/MICROPHONE INOPERATIVE SOFTWARE DIAGNOSIS

SETUP
- Press the POWER button to turn on the radio.
- Set fairing mounted Headset/Speaker Switch to HEADSET.
- Turn console mounted CB and Intercom switches to OFF.
- Set Front and Rear Volume Control to Middle position on horizontal bar graph display.
- Set radio frequency to known strong station.

FUNCTIONALITY
Sound should be audible in all headsets. Is it?
Yes - System is OK.
No - See Software Flow Chart below.

Diagram:

Does Any Headset Work?

- YES
  - Replace Inoperative Headset With Known Working Headset. Does It Work?
  - YES
    - Replace Headset.
  - NO
    - Go to Hardware Chart "Front or Rear Headset/Microphone Inoperative."
- NO
  - Enter Diagnostic Mode 2 by Holding Any Two Proset Buttons and Turning Ignition Switch to ON. Then Push LO/DX Button Once to Obtain "d2" in LCD. Are Speaker Switch B and Speaker Switch A Displayed in LCD as "10"?
  - YES
    - Is Handheld Microphone PTT Displayed in LCD as "17"?
    - YES
      - Go to Hardware Chart "No Sound in One or More Headsets/Microphone Inoperative."
    - NO
      - Go to Hardware Chart "Handheld Microphone PTT Inoperative."
  - NO
    - Is Intercom ON/OFF Switch Displayed in LCD as "07"?
    - YES
      - Go to Hardware Chart "Intercom Inoperative."
    - NO
      - Go to Hardware Chart "CB Receiver Inoperative."

Not Applicable to Classic Models

Table:

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[15]</td>
<td>Main to Interconnect Harness</td>
<td>4 - Place Packard</td>
<td>Top Fork Bracket</td>
</tr>
<tr>
<td>[27]</td>
<td>Radio</td>
<td>23 - Place Amp (Black)</td>
<td>Back of Radio (Right Side)</td>
</tr>
<tr>
<td>[28]</td>
<td>Radio</td>
<td>23 - Place Amp (Gray)</td>
<td>Back of Radio (Left Side)</td>
</tr>
<tr>
<td>[106]</td>
<td>Fairing Cap Switches</td>
<td>12 - Place Multilock</td>
<td>Beneath Radio (Right Side)</td>
</tr>
</tbody>
</table>
8. NO SOUND IN ONE OR MORE HEADSETS/MICROPHONE INOPERATIVE
HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. BE/Y Wire for Handheld PTT is also part of front Interconnect Harness.

---

Figure A-75. 7-Place DIN Connector (Socket Side)

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.
9. REAR HEADSET VOLUME/PTT INOPERATIVE OR SIDECAR PTT INOPERATIVE SOFTWARE DIAGNOSIS

SETUP
- Press the POWER button to turn on the radio.
- Set fairing mounted Headset/Speaker Switch to HEADSET.
- Turn console mounted CB and Intercom switches to OFF.
- Set radio frequency to known strong station.

FUNCTIONALITY
Adjust the volume with the Audio Control Switch on the rear right speaker box. Stereo audio should be present in the headset. Push the switch upward (+) to raise the volume, downward (-) to lower the volume. The front panel LCD annunciates rear volume level through a horizontal bar graph display. The display reverts to the time of day approximately two seconds after the switch is released. Pressing PTT while CB is OFF activates Intercom microphone. Pressing PTT while CB is ON activates CB transmitter.

Are these your observations?
Yes - System is OK.
No - See Software Flow Chart below.

---

Enter Diagnostic Mode by Pressing Any Two Preset Buttons While Turning Ignition Switch to On.

Lock at Input Bit C3 in LCD Display. See Figure A-77. Does the Input Bit Display "0" With the Switches Open?

YES

Move to Hardware Chart to Find Short to Ground on Wire Where Corresponding Input Bit Displays "0" (With No Switches Depressed).

Rear Headset Volume/PTT
Switch Position Input Bit Wire Color
Vol + Vol - PTT C3 O/BK

Sidecar PTT
Switch Position Input Bit Wire Color
PTT C3 O/BK

NO

Exercise All Three Positions of REAR VOLUME/PTT SWITCH or Single Position of SIDECAR PTT SWITCH. Does the Corresponding Input Bit Toggle Between "1" and "0" For Each Switch Position?

YES

Switch and Wiring are OK. Replace Radio.

NO

Is it a "0" or a "1" While Switch Position is Activated?

Move to Hardware Chart to Find Short to Ground on Wire Where Corresponding Input Bit Displays "0."

Rear Headset Volume/PTT
Switch Position Input Bit Wire Color
Vol + Vol - PTT C3 PKW GyW V/BK

Sidecar PTT
Switch Position Input Bit Wire Color
PTT C3 V/BK

---

FLHTCU Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>Radio</td>
<td>23 - Place Amp (Gray)</td>
<td>Back of Radio (Left Side)</td>
</tr>
<tr>
<td>41</td>
<td>Ultra Overlay Harness to Rear Right Passenger Controls</td>
<td>6 - Place Mini-Deutsch (Black)</td>
<td>Rear Right Speaker Box</td>
</tr>
</tbody>
</table>

---

Figure A-76. Diagnostic Mode Group 1 Switch Matrix

Figure A-77. LCD Display Rear Headset Volume/PTT Switch Input Bit

---

Not Applicable to Classic Models

---

A-90
9. REAR HEADSET VOLUME/PTT INOPERATIVE HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

2. Revalidate failure. Reconnect all connectors. If problem still exists, replace radio. If problem is gone, look for intermittents.

SHORT to VOLTAGE

Remove Outer Fairing. Disconnect Connector [28]. With Key ON, Check for Power at Connector [28B].

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Terminal (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td>13 (PK/W)</td>
<td>6 (GY/W)</td>
</tr>
<tr>
<td></td>
<td>14 (V/BK)</td>
<td>12 (O/BK)</td>
</tr>
</tbody>
</table>

Is Voltage Present?

YES

Repair Short in Ultra Overlay Harness.

NO

OPEN

* At some point in the Software flow chart you may be instructed to jump directly to the box marked by the asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

With Switch Depressed, Check for Continuity at Connector [28B].

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>From Terminal</th>
<th>To Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol. Up</td>
<td>12 (O/BK)</td>
<td>13 (PK/W)</td>
</tr>
<tr>
<td>Vol. Dn</td>
<td>12 (O/BK)</td>
<td>6 (GY/W)</td>
</tr>
<tr>
<td>PTT</td>
<td>12 (O/BK)</td>
<td>14 (V/BK)</td>
</tr>
</tbody>
</table>

Each Wire Pair Should be Less than 0.5 Ohms While Switch is Depressed and Infinity While Switch is Open. Is It?

YES

NO

2. Replace Radio.

* After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.

SHORT to GROUND

Remove Outer Fairing, With Key OFF, Check for Continuity to Ground at Connector [28B].

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Terminal (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td>13 (PK/W)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14 (V/BK)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12 (O/BK)</td>
<td></td>
</tr>
</tbody>
</table>

Any Continuity Present?

YES

Replace Short in Ultra Overlay Harness.

NO

OPEN

2. Replace Radio.

Repair or Replace Ultra Overlay Harness.
9. SIDECAR PTT INOPERATIVE HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

2. Revalidate failure. Reconnect all connectors. If problem still exists, replace radio. If problem is gone, look for intermittents.

---

At some point in the Software flow chart you may be instructed to jump directly to the box marked by the asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.
10. INTERCOM INOPERATIVE SOFTWARE DIAGNOSIS

SETUP

- Press the POWER button to turn on the radio.
- Set fairing mounted Headset/Speaker Switch to HEADSET.
- Turn console mounted CB OFF/ON switch to OFF.
- Turn console mounted INTERCOM OFF/ON switch to ON (Setup Mode).
- Use Mode Select Switch to adjust VOX sensitivity to a value greater than "10."
- Set Front and Rear Volume Control to Middle position on horizontal bar graph display.

FUNCTIONALITY

Speak into Intercom. Voice should be heard in all headsets. Is it?

Yes - System is OK.
No - See Software Flow Chart below.
10. INTERCOM INOPERATIVE HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.


After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.

**FLHTCU Wire Harness Connectors**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>Main to Interconnect Harness</td>
<td>12 - Place Deutsch (Black)</td>
<td>Inner Fairing - Right Fairing Bracket</td>
</tr>
<tr>
<td>[6]</td>
<td>Ultra Overlay to Interconnect Harness</td>
<td>12 - Place Deutsch (Black)</td>
<td>Inner Fairing - Left Fairing Support Brace</td>
</tr>
<tr>
<td>[28]</td>
<td>Radio</td>
<td>23 - Place Amp (Gray)</td>
<td>Back of Radio (Left Side)</td>
</tr>
<tr>
<td>[53]</td>
<td>Ultra Overlay to Console Pod</td>
<td>12 - Place Mini-Deutsch (Black)</td>
<td>Rear of Battery Box (Under Seat)</td>
</tr>
</tbody>
</table>
11. CB RECEIVER INOPERATIVE SOFTWARE DIAGNOSIS

SETUP
- Press the POWER button to turn on the radio.
- Turn console mounted Intercom Switch to OFF.
- Set fairing mounted Headset/Speaker Switch to SPEAKER.
- Set Volume Control to Middle position on horizontal bar graph display.
- Turn console mounted CB Switch from OFF to ON.

FUNCTIONALITY
See Software Flow Chart below.

SOFTWARE DIAGNOSTIC NOTES
The reference numbers below correlate with those on the diagnostic flow chart.

1. Antenna check is found in Hardware Chart, “Transceiver Inoperative.”

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0=PTT</td>
<td></td>
</tr>
<tr>
<td>0 or 1</td>
<td></td>
</tr>
<tr>
<td>1=Break</td>
<td></td>
</tr>
<tr>
<td>1=ON</td>
<td></td>
</tr>
<tr>
<td>1=ON</td>
<td></td>
</tr>
<tr>
<td>10=Headset</td>
<td></td>
</tr>
<tr>
<td>11=Speaker</td>
<td></td>
</tr>
<tr>
<td>01=Center</td>
<td></td>
</tr>
</tbody>
</table>

Figure A-78. Diagnostic Mode Group 2

Figure A-79. LCD Input Bit Display
11. CB RECEIVER INOPERATIVE HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.


**FLHTCU Wire Harness Connectors**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>Main to Interconnect Harness</td>
<td>12 - Place Deutsch</td>
<td>Inner Fairing - Right</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Black)</td>
<td>Fairing Bracket</td>
</tr>
<tr>
<td>[8]</td>
<td>Ultra Overlay to Interconnect</td>
<td>12 - Place Deutsch</td>
<td>Inner Fairing - Left</td>
</tr>
<tr>
<td></td>
<td>Harness</td>
<td>(Black)</td>
<td>Fairing Support Brace</td>
</tr>
<tr>
<td>[28]</td>
<td>Radio</td>
<td>23 - Place Amp</td>
<td>Back of Radio (Left Side)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Gray)</td>
<td></td>
</tr>
<tr>
<td>[53]</td>
<td>Ultra Overlay to Console Pod</td>
<td>12 - Place Mini-Deutsch</td>
<td>Rear of Battery Box</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Black)</td>
<td>(Under Seat)</td>
</tr>
</tbody>
</table>
12. CB TRANSMITTER INOPERATIVE SOFTWARE DIAGNOSIS

SETUP
- Press the POWER button to turn on the radio.
- Turn console mounted Intercom Switch to OFF.
- Set fairing mounted Headset/Speaker Switch to SPEAKER.
- Set Volume Control to Middle position on horizontal bar graph display.
- Turn console mounted CB Switch from OFF to ON.

FUNCTIONALITY
Depressing any PTT switch will change the radio display to reflect CB mode and cause the transmitter to transmit. To verify transmission, use another CB receiver tuned to the same channel. In CB Setup mode, the squelch display will disappear when PTT is depressed. Are these your observations?

Yes - System is OK.
No - See Software Flow Chart below.

Figure A-80. Diagnostic Mode Group 2

<table>
<thead>
<tr>
<th>Did Radio Enter CB Setup Mode?</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
</tr>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Does Unit Under Test Receiver Work OK?</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
</tr>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Does Display Change When PTT is Depressed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
</tr>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chart</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear Headset Volume/PTT</td>
<td>A-90</td>
</tr>
<tr>
<td>Sidecar PTT</td>
<td></td>
</tr>
<tr>
<td>PTT/Squelch</td>
<td>A-102</td>
</tr>
<tr>
<td>Handheld Microphone/PTT</td>
<td>A-104</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diagnose Other Symptom.</th>
<th>Replace Radio.</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>
12. CB TRANSMITTER INOPERATIVE
HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. Remove outer fairing. Disconnect antenna connector from CB and replace it with a dummy load, that is, the lamp included with tool HD-39448.

The lamp acts as a load that allows the CB to be operated and provides a means of checking relative power output and modulation.

To use the load, screw the dummy load onto the antenna jack of the CB. Depress the PTT switch. If the CB is transmitting a carrier wave, the lamp should illuminate. Speaking into the microphone should cause the lamp to flicker. It should get brighter and dimmer depending on how loud your voice is. A change in lamp brilliance means the CB is modulating.

CB ANTENNA TEST

A faulty CB antenna can cause poor reception and transmitting range. Check the antenna system as follows:

1. Remove outer fairing. Remove antenna cable from back of radio. Using clip-on test leads, connect one lead of ohmmeter to center pin in antenna lead and other lead to antenna mast. Meter must read 1 ohm or less. Wiggle or flex mast while observing meter. If resistance is more than 1 ohm or varies when mast is wiggled, replace mast. Inspect connections at base of loading coil and at mounting bracket.

NOTE

It is normal to observe a reading of less than one ohm between the center conductor and ground due to the configuration of the loading coil.

2. Check SWR adjustment.


SWR ADJUSTMENT

CAUTION

Do not press PTT switches with antenna and SWR meter disconnected. Transceiver damage could result.

Standing wave ratio (SWR) is a technical term for the procedure that checks how well the CB transmitter and antenna are matched. The SWR should be 2:1 or below on channel 20. A SWR of 1:1 is optimum.

To check SWR, a SWR meter or bridge is required. Your Harley-Davidson dealer will either have a SWR meter or direct you to a CB repair shop for a SWR check. Since the operating procedures for SWR meters vary, be sure you carefully follow the operating instructions for the SWR meter being used.

1. Locate motorcycle outdoors or in a building with a ceiling of 11 ft. (3.4 m) minimum above floor. Also, there must be 8 ft. (2.4 m) of radial clearance around motorcycle. Adjusting the SWR in an area with a lower ceiling and/or less radial clearance may result in an inaccurate adjustment.
2. Remove the outer fairing. Remove the antenna cable and connect the SWR meter to the radio. Connect the antenna cable to the SWR meter. The SWR meter is connected in series with the antenna cable so the antenna will be connected to the SWR meter.

3. Check that the antenna loading coil bracket in Tour-Pak is tight and that antenna cable is tightly connected to loading coil.

4. Check that antenna mast is threaded securely on to base and set screw is tight.

5. Before measuring the SWR, the SWR meter must be calibrated. Follow the instructions for the meter being used. The following procedure is the general calibration most meter instructions specify.

6. With ignition and CB switches ON, the SWR meter set on “FWD”, Channel 20 selected, press either PTT switches. Hold the PTT switch and rotate the calibration (CAL) control until the meter needle aligns with the “CAL” mark.

**CAUTION**

Do not touch the antenna or meter during calibration or SWR measurement. Move CAL knob and then move your hand away from meter while calibrating.

7. Release the PTT switch and move the FWD/REF switch to “REF” (reflected).

8. Press and hold either PTT switch. The meter reading is the SWR.

**CAUTION**

Do not touch the antenna or meter during calibration or SWR measurement. Move CAL knob and then move your hand away from meter while calibrating. Do not press PTT switches with antenna and SWR meter disconnected. Transceiver damage could result.

9. If SWR is more than 3:1, remove antenna cable from transceiver under Tour-Pak. Using clip-on test leads, connect one lead of ohmmeter to center pin in antenna lead and other lead to antenna mast. Meter must read 1 ohm or less. Wiggle or flex mast while observing meter. If resistance is more than 1 ohm or varies when mast is wiggled, replace mast. Inspect connections at base of loading coil and at mounting bracket. If the SWR is less than 3:1, loosen antenna set screw and change mast length.

**NOTE**

It is normal to observe a reading of less than one ohm between the center conductor and ground due to the configuration of the loading coil.

10. Repeat Step 8. If SWR became higher, adjust antenna mast in opposite direction. Continue adjusting antenna until the minimum SWR is achieved. If you cannot obtain an SWR of 2:1 or less by adjusting the antenna length, make the mast shorter to improve the SWR. Remove mast and use grinder to shorten mast (grind in small increments).

11. After SWR is adjusted on channel 20, check SWR on channels 1 and 40. Adjust the mast length to obtain a balance between channels 1 and 40.

**NOTE**

Check the SWR if a luggage rack is installed on the Tour-Pak cover. Be sure that the Tour-Pak cover is closed when the check is performed. Accessories mounted on the Tour Pak may affect the SWR reading and broadcast range, so the luggage rack should be mounted as far forward as possible. The Ultra Tour-Pak chrome accent rail also can adversely affect SWR.
13. PTT/SQUELCH CONTROL INOPERATIVE SOFTWARE DIAGNOSIS

SETUP
- Press the POWER button to turn on the radio.
- Turn console mounted Intercom Switch to OFF.
- Turn console mounted CB Switch to ON.
- Set fairing mounted Headset/Speaker Switch to SPEAKER.

FUNCTIONALITY
Depressing any PTT switch will change the radio display to reflect CB mode and cause the transmitter to transmit. Pressing the Squelch Control in either direction will cause the horizontal bar graph display to change. Are these your observations?

Enter Diagnostic Mode by Pressing Any Two Preset Buttons While Turning ignition Switch to On.

Look at Input Bits C1, C2 and C3 in LCD Display, See Figure A-81. Do Any of the Input Bits Display "0"?

Move to Hardware Chart to Find Short to Ground on Any Wire Where Corresponding Input Bit Displays "0".

Switch Position  Input Bit  Wire Color
Squelch +      C1        GY/GN
Squelch -      C2        BN/BK
PTT            C3        O/BK

Exercise All Three Positions of PTT/SQUELCH CONTROL SWITCH. Do All of the Corresponding Input Bits Toggle Between "1" and "0"?

Switch and Wiring are OK. Replace Radio.

Activate Switch Where Corresponding Input Bit Does Not Toggle Between "1" and "0"? Is it a "0" or a "1" While Switch is Activated?

Move to Hardware Chart to Find Short to Voltage on Wire Where Corresponding Input Bit Displays "1" (With No Switches Depressed).

FLHTCU Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[24]</td>
<td>Interconnect Harness to Left Handlebar Controls</td>
<td>12 - Place Deutsch (Gray)</td>
<td>Inner Fairing - Left Fairing Support Brace</td>
</tr>
<tr>
<td>[27]</td>
<td>Radio</td>
<td>23 - Place Amp (Black)</td>
<td>Back of Radio (Right Side)</td>
</tr>
</tbody>
</table>
13. PTT/SQUELCH CONTROL
INOPERATIVE
HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES
The reference numbers below correlate with those on the diagnostic flow chart.

1. What Did Software Diagnosis Indicate?

SHORT TO VOLTAGE

Remove Outer Fairing. Disconnect Connector [27B]. With Key ON, Check for Power at Connector [27B].

<table>
<thead>
<tr>
<th>From</th>
<th>To Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>()</td>
<td>(+)</td>
</tr>
</tbody>
</table>
| Ground | 5 (V/BK)  
|       | 7 (O/BK)   
|       | 8 (BN/BK)  
|       | 22 (GY/GN) |

Is Voltage Present?

YES

With Key ON, Check for Power at Connector [24B].

<table>
<thead>
<tr>
<th>From</th>
<th>To Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>()</td>
<td>(+)</td>
</tr>
</tbody>
</table>
| Ground | 7 (V/BK)  
|       | 8 (BN/BK)  
|       | 11 (GY/GN) 
|       | 12 (O/BK)  |

Is Voltage Present?

YES

Repair Short in Handlebar Harness. 6551

NO

Repair Short in Interconnect Harness. 6531

SHORT TO GROUND

Remove Outer Fairing. Disconnect Connector [27B]. With Key OFF, Check for Continuity to Ground at Connector [27B].

<table>
<thead>
<tr>
<th>From</th>
<th>To Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>()</td>
<td>(+)</td>
</tr>
</tbody>
</table>
| Ground | 5 (V/BK)  
|       | 7 (O/BK)   
|       | 8 (BN/BK)  
|       | 22 (GY/GN) |

Any Continuity Present?

YES

With Key OFF, Check for Continuity to Ground at Connector [24B].

<table>
<thead>
<tr>
<th>From</th>
<th>To Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>()</td>
<td>(+)</td>
</tr>
</tbody>
</table>
| Ground | 7 (V/BK)  
|       | 8 (BN/BK)  
|       | 11 (GY/GN) 
|       | 12 (O/BK)  |

Any Continuity Present?

YES

Replace Radio. 6601

NO

With Switch Depressed, Check for Continuity at Connector [24B].

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>From</th>
<th>To Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Terminal</td>
<td>Terminal</td>
</tr>
<tr>
<td>Squeich +</td>
<td>7 (V/BK)</td>
<td>11 (GY/GN)</td>
</tr>
<tr>
<td>Squeich -</td>
<td>7 (V/BK)</td>
<td>8 (BN/BK)</td>
</tr>
<tr>
<td>PTT</td>
<td>7 (V/BK)</td>
<td>12 (O/BK)</td>
</tr>
</tbody>
</table>

Each Wire Pair Should be Less than 0.5 Ohms While Switch is Depressed and Infinity While Switch is Open. Is It?

YES

Replace Radio. 6601

NO

Repair Short in Handlebar Harness. 6551

Repair Short in Interconnect Harness. 6531

Repair or Replace Interconnect Harness. 6632

Replace PTT/Squelch Control Switch or Repair Switch Wiring. 5184

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.
14. HANDHELD MICROPHONE PTT INOPERATIVE SOFTWARE DIAGNOSIS

SETUP

- Press the POWER button to turn on the radio.
- Turn console mounted Intercom Switch to OFF.
- Turn console mounted CB Switch to ON.
- Set fairing mounted Headset/Speaker Switch to SPEAKER.

FUNCTIONALITY

Depressing handheld PTT switch will change the radio display to reflect CB mode and cause the transmitter to transmit. In CB Setup mode, the squelch display will disappear when PTT is depressed. Are these your observations?

Yes - System is OK.

No - See Software Flow Chart below.
14. HANDHELD MICROPHONE PTT INOPERATIVE HARDWARE DIAGNOSIS

HARDWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

2. Use Harness Connector Test Kit (HD-41404), black pin probes and patch cords.

Check for Continuity as Follows:

<table>
<thead>
<tr>
<th>FROM</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
<td>Terminal</td>
</tr>
<tr>
<td>[27B]</td>
<td>2 (BE/Y)</td>
</tr>
<tr>
<td>[28B]</td>
<td>2 (Y/BK)</td>
</tr>
</tbody>
</table>

Each Wire Should Be Less Than 0.5 Ohms. Is It?

6615 6616 6660

Replace Pod Headset Harness.
Repair Ultra Overlay Harness.

After Correction of Problem, Refer to SETUP and FUNCTIONALITY to Verify Proper Operation.

FLHTCU Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>Radio</td>
<td>23 - Place Amp (Black)</td>
<td>Back of Radio (Right Side)</td>
</tr>
<tr>
<td>28</td>
<td>Radio</td>
<td>23 - Place Amp (Gray)</td>
<td>Back of Radio (Left Side)</td>
</tr>
<tr>
<td>53</td>
<td>Ultra Overlay to Console Pod</td>
<td>12 - Place Mini-Deutsch (Black)</td>
<td>Rear of Battery Box (Under Seat)</td>
</tr>
</tbody>
</table>
15. NO CB AUDIO IN HEADSET IN CENTER POSITION
SOFTWARE DIAGNOSIS

SETUP
- Press the POWER button to turn on the radio.
- Turn console mounted Intercom Switch to OFF.
- Turn console mounted CB Switch to ON.
- Set fairing mounted Headset/Speaker Switch to CENTER position.
- Set Volume Control to Middle position on horizontal bar graph display.
- Set Squelch Control to receive incoming CB signals.

SOFTWARE DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. If the lamp is missing or the filament is broken, Speaker B, Speaker A input bits are displayed in LCD as “11” with the Headset/Speaker Switch in the center position. In other words, the system functions as though the switch is in the SPEAKER position.

FUNCTIONALITY
CB audio should be heard in headset and stereo audio should be heard in fairing speakers. Is it?

**Yes** - System is OK.

**No** - See Software Flow Chart below.
SPARK PLUGS/SPARK PLUG CABLES - ALL MODELS

SPARK PLUGS
Spark plugs must be checked at 5000 miles (8000 km) and replaced at 10,000 miles (16,000 km).

The number 5R6A plug is supplied as original equipment and is the only plug that should be used.

The resistor plug reduces radio interference created by the ignition system and will not affect performance or fuel economy.

Inspection (Figure A-83)
Examine plugs as soon as they have been removed. The deposits on the plug base are an indication of the plug efficiency and are a guide to the general condition of rings, valves, carburetor and ignition system.

A. A wet black and shiny deposit on plug base, electrodes and ceramic insulator tip indicate an oil fouled plug. The condition may be caused by worn rings and pistons, loose valves or seals, weak battery or faulty ignition.

B. A dry fluffy or sooty black deposit indicates a too rich carburetor air-fuel mixture or long periods of engine idling. Excessive use of the enrichener may also cause this condition.

C. An overheated plug can be identified by a light brown, glassy deposit. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes. This condition is caused by too lean an air-fuel mixture, a hot running engine, valves not seating or improper ignition timing. The glassy deposit on the spark plug is a conductor when hot and may cause high speed misfiring.

A plug with eroded electrodes, heavy deposits or a cracked insulator should be replaced.

D. A plug with white, yellow or light tan to rusty brown powdery deposit indicates balanced combustion. The deposits may be cleaned off at regular intervals if desired.

Adjustment
Use only a wire-type gauge. Bend the outside electrode so only a slight drag on the gauge is felt when passing it between electrodes. Never make adjustments by bending the center electrode. Set gap on all plugs at 0.038-0.043 in. (0.97-1.09 mm).

Installation
1. Before installing spark plugs, check condition of threads in cylinder head and on plug. If necessary soften deposits with penetrating oil and clean out with a thread chaser.

2. Install spark plug finger tight and then torque to 18-22 ft-lbs (24-30 Nm).

3. Check engine idle speed, and adjust if necessary. Idle speeds and adjustment are listed in the FUEL section of the 1997 FLT Service Manual.

SPARK PLUG CABLES
Resistor-type high-tension cables have a carbon-impregnated fabric core (instead of solid wire) for radio noise suppression and improved reliability of electronic components. Use the exact replacement cable for best results.

Removal

⚠ WARNING
Never disconnect a spark plug cable with the engine running or a potentially fatal electric shock may be received from the ignition system.

⚠ CAUTION
When disconnecting each spark plug cable from its spark plug terminal, always grasp and pull on the rubber boot at the end of the cable assembly (as close as possible to the spark plug terminal). Do not pull on the cable portion itself. Pulling on the cable will damage the cable's carbon core.

Disconnect spark plug cables from ignition coil and spark plug terminals.
Inspection

Check cables for cracks or loose terminals.

Check spark plug cable resistance with an ohmmeter. Resistance must be as follows:

<table>
<thead>
<tr>
<th>Spark Plug Cable Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cable Length</strong></td>
</tr>
<tr>
<td>(250-582 Ohms per inch)</td>
</tr>
<tr>
<td>19 Inches (483 mm)</td>
</tr>
</tbody>
</table>

Replace cables that are worn or damaged, or that do not meet resistance specifications. Check cable boots/caps for cracks or tears. Also check for loose fit on ignition coil and spark plugs. Replace boots/caps if defects are noted.

Installation

Connect spark plug cables to ignition coil and spark plugs. Make sure boots/caps are secured properly; this will provide the necessary moisture-proof environment for the ignition coil and spark plug terminals.

---

**STARTER SYSTEM - ALL MODELS**

**GENERAL**

The starter is made up of an armature, field winding assembly, solenoid, drive assembly, idler gear, and drive housing.

The starter motor torque is increased through gear reduction. The gear reduction consists of the drive pinion on the armature, an idler gear, and a clutch gear in the drive housing. The idler gear is supported by rollers and the clutch gear is part of the overrunning clutch/drive assembly.

The overrunning clutch is the part which engages and drives the clutch ring gear. It also prevents the starter from overrunning. The field windings are connected in series with the armature through brushes and commutator segments.

The starter relay is a non-repairable part and must be replaced if it malfunctions.

**Operation (Figure A-84)**

When the starter switch is pushed, the starter relay is activated and battery current flows into the pull-in winding and the hold-in winding, to ground.

The magnetic forces of the pull-in and hold-in windings in the solenoid, pull the plunger and cause it to shift to the left, so that the pinion gear is engaged with the clutch ring gear. At the same time, the main solenoid contacts are closed and battery current flows directly through the field windings to the armature and to ground. Simultaneously, the pull-in winding is opened.

The current continues flowing through the hold-in winding, keeping the main solenoid contacts closed. At this point the starter begins to crank the engine.

After the engine has started, the pinion gear turns freely on the pinion shaft through the action of the overrunning clutch which prevents the armature overrunning by the rotation of the clutch ring gear.

When the starter switch is released, the current of the hold-in winding is fed through the main solenoid contacts and the direction of the current in the pull-in winding is reversed. The solenoid plunger is returned to its original position by the return spring, disengaging the pinion gear from the clutch ring gear.
STARTER AT MOMENT STARTER SWITCH IS CLOSED

Field winding
Armature
Brush
Idler gear
Ball bearing

Pinion gear
Clutch ring gear

Overrunning clutch
Hold-In winding
Plunger
Main contacts
Start circuit. See wiring diagram.

Battery

STARTER DURING CRANKING

Field winding
Armature
Brush
Idler gear
Ball bearing

Pinion gear
Clutch ring gear

Overrunning clutch
Hold-In winding
Pull-In winding
Plunger
Main contacts
Start circuit. See wiring diagram

Battery

Figure A-84. Starter Operation
RUN-ON

Disconnect "Relay" Terminal from Solenoid. Is 12V Present at GN Wire Terminal with Starter Button NOT Pressed?

YES

Is 12V Present on Starter Relay Terminal 66 with Starter Button NOT Pressed?

YES

Replace Starter Button. 5818

NO

Replace Starter Relay. 5832

STARTER SPINS, BUT DOES NOT ENGAGE

Remove and Disassemble Starter Jackshaft Assembly. Is Jackshaft Properly Assembled?

YES

Remove Starter, Disassemble Drive Housing Assembly. Inspect for Damage to Armature Gear or Idler Gear. Damage Present?

YES

Replace Damaged Idler Gear and Armature. 5825

NO

Assemble Jackshaft Properly. 5850

NO

STARTER STALLS OR SPINS TOO SLOWLY

Perform Voltage Drop Tests from Battery (Pos. +) to Starter "Motor" Terminal. Crank Engine. Is Voltage Greater than 1 Volt?

YES

Perform Voltage Drop Tests from Battery (Pos. +) to Starter "Battery" Terminal. Crank Engine. Is Voltage Greater than 1 Volt?

YES

Repair Connection Between Battery and Starter. 5824

NO

Perform Voltage Drop Test Between Battery (Neg. -) and Starter Studs or Bolts. Is Voltage Greater than 1 Volt?

YES

Clean Ground Connections. 5835

NO

Perform Starter Motor Current Draw Test (on Vehicle).

YES

Perform Starter Motor Free Draw Bench Test. Are Test Results in Range?

YES

Remove Spark Plugs While in 5th Gear. Rotate Rear Wheel. Check for Engine, Primary and/or Crankshaft Bind.

NO

Repair or Replace Starter Motor. 5817

NOTES

1. Remove starter motor and connect jumper wires as described in Free Running Current Draw Test.
2. See Troubleshooting/Diagnostics- Voltage drops.
4. See Free Running Current Draw Test.
GENERAL

Follow the STARTING SYSTEM DIAGNOSIS chart to diagnose starting system problems. The VOLTAGE DROPS procedure will help you to locate poor connections or components with excessive voltage drops. The TROUBLESHOOTING charts contain detailed procedures to solve and correct problems.

VOLTAGE DROPS

OBJECTIVE: To check the integrity of all wiring, switches, circuit breakers 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 Figure A on the opposite page. 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.

2. See Figure B. 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.

4. An ideal circuit's voltage drop would be 0 volts or no voltage dropped, meaning no difference in potential.

5. See Figure C. An open circuit should read 12 volts, displaying all the voltage dropped, and the entire difference in potential displayed on the meter.

6. Typically, a good circuit will drop less than 1 volt (unless advised otherwise).

7. If the voltage drop is greater, back track through the connections until the source of the potential difference is found.

The benefit of doing it this way is speed.

A. Your readings aren't as sensitive to real battery voltage.

B. Your 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).

8. See Figure D. The negative or ground circuit can be checked as well. 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. Place the positive lead to the ground you wish to check.

9. Activate the circuit. This will allow you to read the potential difference or voltage dropped on the negative or ground circuit. This 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.
Typical Circuitry. Refer to wiring diagrams for specific vehicles.
# TROUBLESHOOTING

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOURCE OF PROBLEM</th>
<th>PROBABLE CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Starter does not run, or runs at very low speeds.</td>
<td>1.1 Battery.</td>
<td>1.1.1 Voltage drop due to discharged battery. 1.1.2 Worn or defective battery. 1.1.3 Corroded battery terminal(s).</td>
<td>1.1.1 Charge battery. 1.1.2 Replace battery. 1.1.3 Clean and retighten.</td>
</tr>
<tr>
<td>1.2 Wiring.</td>
<td>1.2.1 Poor or no connection at either battery positive or negative cable, at either end. 1.2.2 Cracked or corroded battery cable ends. 1.2.3 Open wire(s) or poor connection at handlebar switch or starter relay, especially relay ground wire.</td>
<td></td>
<td>1.2.1 Repair or replace cable(s). 1.2.2 Clean, tighten or replace cable(s) as needed. 1.2.3 Tighten connections or repair or replace wire(s).</td>
</tr>
<tr>
<td>1.3 Handlebar start switch.</td>
<td>1.3.1 Poor switch contacts or open switch.</td>
<td></td>
<td>1.3.1 Replace switch.</td>
</tr>
<tr>
<td>1.4 Starter relay.</td>
<td>1.4.1 Open coil winding. 1.4.2 Poor or no continuity at relay points.</td>
<td></td>
<td>1.4.1 Replace relay. 1.4.2 Replace relay.</td>
</tr>
<tr>
<td>1.5 Solenoid.</td>
<td>1.5.1 Poor contact condition caused by burnt contact. 1.5.2 Pull-in winding open or short-circuited. 1.5.3 Hold-in winding open or short circuited.</td>
<td></td>
<td>1.5.1 Rebuild solenoid assembly. See NOTE below. 1.5.2 Repair or replace solenoid assembly. 1.5.3 Repair or replace solenoid assembly.</td>
</tr>
<tr>
<td>1.6 Starting motor.</td>
<td>1.6.1 Brushes worn below specification. 1.6.2 Poor contact condition of brushes. 1.6.3 Commutator burned. 1.6.4 Commutator mica is too high. 1.6.5 Field winding grounded. 1.6.6 Armature winding grounded or short circuited. 1.6.7 Reduction gears damaged. 1.6.8 Insufficient brush spring tension. 1.6.9 Lead wire disconnected between solenoid and field windings. 1.6.10 Ball bearing sticks.</td>
<td></td>
<td>1.6.1 Replace brushes. 1.6.2 Check brush spring tension. 1.6.3 Correct on lathe or replace armature. 1.6.4 Correct by undercutting. 1.6.5 Replace field winding. 1.6.6 Replace armature. 1.6.7 Replace reduction gears. 1.6.8 Replace brush spring. 1.6.9 Repair or replace lead wire. 1.6.10 Replace bearing.</td>
</tr>
<tr>
<td>1.7 Starter jackshaft assembly.</td>
<td>1.7.1 Jackshaft binding or sticking. 1.7.2 Jackshaft binding at primary case seal because of corrosion.</td>
<td></td>
<td>1.7.1 Replace jackshaft bushing. 1.7.2 Repair or replace jackshaft assembly.</td>
</tr>
</tbody>
</table>

**NOTE**

A solenoid repair kit is available from your Harley-Davidson dealer. Follow the repair procedure given in the Instruction Sheet included with the repair kit.
<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SOURCE OF PROBLEM</th>
<th>PROBABLE CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Pinion does not engage with ring gear while starter is running/engine cannot be cranked.</td>
<td>2.1 Battery.</td>
<td>2.1.1 Voltage drop because of discharged battery. 2.1.2 Worn or defective battery. 2.1.3 Corroded battery terminal(s).</td>
<td>2.1.1 Charge battery. 2.1.2 Replace battery. 2.1.3 Clean and retighten.</td>
</tr>
<tr>
<td>2.2 Overrunning clutch.</td>
<td>2.2.1 Overrunning clutch malfunction (rollers or compression spring). 2.2.2 Pinion teeth worn out. 2.2.3 Pinion does not run in overrunning direction. 2.2.4 Spline teeth do not slide properly. 2.2.5 Reduction gears damaged.</td>
<td></td>
<td>2.2.1 Replace overrunning clutch. 2.2.2 Replace pinion. 2.2.3 Replace overrunning clutch. 2.2.4 Remove foreign materials, dirt, or replace overrunning clutch or pinion shaft. 2.2.5 Replace overrunning clutch and idler gear.</td>
</tr>
<tr>
<td>2.3 Jackshaft assembly.</td>
<td>2.3.1 Improper jackshaft parts assembly.</td>
<td></td>
<td>2.3.1 Disassemble and assemble parts properly.</td>
</tr>
<tr>
<td>2.4 Ring gear.</td>
<td>2.4.1 Worn out teeth.</td>
<td></td>
<td>2.4.1 Replace pinion and clutch shell.</td>
</tr>
<tr>
<td>3. Starter does not stop running.</td>
<td>3.1 Right handlebar starting switch or starter relay.</td>
<td>3.1.1 Unopened contacts. 3.1.2 Poor return caused by sticky switch or relay contacts.</td>
<td>3.1.1 Replace starting switch or starter relay. 3.1.2 Replace starting switch or starter relay.</td>
</tr>
<tr>
<td>3.2 Solenoid.</td>
<td>3.2.1 Return spring worn. 3.2.2 Coil layer shorted. 3.2.3 Contact plate melted and stuck.</td>
<td></td>
<td>3.2.1 Replace spring. 3.2.2 Replace solenoid. 3.2.3 Repair solenoid. See NOTE on opposite page.</td>
</tr>
</tbody>
</table>
RELAY/STARTER TESTS

Before removing the starter, perform one of the Starter Relay Tests which follow. If the relay is known to be good, perform the Starter Current Draw Test.

STARTER RELAY TEST #1

1. Remove harness connector from bottom of relay. See Figure A-85.
2. Substitute a new relay known to be good and verify operation. (For convenience, use the brake light relay as a temporary substitute.)

STARTER RELAY TEST #2

The starter relay can be tested using the vehicle's 12 volt battery and a continuity tester or ohmmeter (HD-35500B). Proceed as follows:

1. Remove harness connector from bottom of relay.
2. To energize the relay, connect the battery leads to terminals 86 and 85. See Figure A-86.
3. Check for continuity between terminals 30 and 87.

   If the tester lamp illuminates or there is a zero ohm reading on the ohmmeter, then continuity is present and the relay is good. Replace the relay if continuity is not present.

⚠️ CAUTION ⚠️

Relay terminal “85” must be connected to the negative battery terminal to avoid damaging the diode connected across the relay winding.

STARTER CURRENT DRAW TEST

Check the starter current draw with an inductive amp probe (HD-39617) or induction ammeter. Before proceeding, be sure that the battery is fully charged and that the engine temperature is stable and at room temperature.

1. Verify that the transmission is in neutral.
2. Disconnect the spark plug wires from the spark plug terminals.
3. Clamp induction ammeter over the positive battery cable. See Figure A-87.
4. With the ignition ON, turn the engine over by pressing start switch while taking a reading on the ammeter. Disregard initial high current reading which is normal during time the engine is first turned over. Typical starter current draw will range between 160 and 180 amperes.
5. If the starter current draw exceeds 200 amperes, the problem may be in the starter or starter drive.

Remove the starter for testing and then see the FREE RUNNING CURRENT DRAW TEST which follows.
Testing Assembled Starter

Starter Solenoid

**Warning**

Wear eye protection during this series of tests. These tests may produce flying sparks which could cause eye injury.

**Note**

Do not disassemble solenoid. Before testing, disconnect field wire from "Motor" terminal shown in Figure A-88.

**Caution**

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

**Note**

Perform the following tests in as rapid a sequence as possible.

**Solenoid Pull-In**

Connect test leads from the 12 volt battery as shown in Figure A-88. Connect the test lead to the "Relay" terminal last. The starter shaft should extend forcefully if the solenoid is working properly. If shaft does not extend, solenoid should be replaced.

**Solenoid Hold-In**

Keep test leads connected as in Pull-In Test above. Begin with the starter shaft still extended. Disconnect "Motor" terminal test lead from the battery negative terminal and connect it to the battery positive terminal as shown in Figure A-89. If shaft does not remain in the extended position, replace solenoid.

**Solenoid Return**

Keep test leads connected as they were at the completion of the Hold-In Test. Disconnect the "Relay" terminal test lead as shown in Figure A-90. If shaft retracts, the solenoid is working properly. If the shaft does not retract, the solenoid should be replaced.

**Free Running Current Draw Test**

1. Place starter in vise, using a clean shop towel to prevent scratches or other damage.

2. Connect a heavy jumper cable (6 gauge minimum) to starter mounting flange as shown in Figure A-91.

3. Connect other end to the negative (-) terminal of a fully charged battery.
4. Connect a heavy jumper cable (6 gauge minimum) to the positive (+) terminal of the battery.

5. Attach an inductive ammeter to positive cable and connect the other end of the positive cable to the "Battery" terminal of the starter solenoid.

6. Use a smaller jumper cable (14 gauge) and connect to the positive (+) terminal of the battery.

7. Connect other end of small jumper cable to the solenoid "Relay" terminal.

8. Check ammeter reading. Ammeter should show 90 amps maximum. If reading is higher, disassemble starter for inspection.

NOTE

If starter current draw on vehicle was over 200 amps and the starter FREE RUNNING CURRENT DRAW TEST was within specification, there may be a problem with engine, primary drive or starter jackshaft.

---

1. Field wire
2. Thru-bolt (2)
3. Field coil
4. End cap
5. End cap screw (2)
6. Brush spring (4)
7. Brushes
8. Brush holder
9. Armature
10. Armature bearings
11. Drive housing mounting screw (2)
12. Lockwasher (2)
13. Drive housing

---

14. Solenoid housing
15. Drive assembly/overrunning clutch
16. Idler gear
17. Idler gear bearing & cage
18. O-ring
19. Spring
20. Shaft
21. Return spring
22. Ball
23. O-ring (2)

Figure A-93. Remove Thru-Bolts

2. See Figures A-92, A-94. Remove thru-bolts (2). Remove field coil (3) and cap (4).

Figure A-94. Remove Field Coil and Cap

3. See Figures A-95 and A-96. Remove the end cap screws and cap.

Figure A-95. Remove End Capscrews and O-Rings

Figure A-96. Remove End Cap

4. See Figures A-92, A-97. Disengage brush springs (6) and pull field coil brushes (7) out of brush holders (8).

Figure A-97. Remove Brush Holder
5. Check the brush length. Brushes less than 0.433 inch (11 mm) long should be replaced.

NOTE

- Replace brushes in sets of four only.
- Field coil and brush holder brushes are attached to field coil and brush holder. To replace brushes, replace field coil and brush holder.

6. See Figure A-92. Remove armature (9).

7. Place armature in lathe or truing stand and check runout of commutator. Commutators with more than 0.015 in. (0.38 mm) of runout should be replaced or machined on a lathe. Commutators should be replaced when diameter is less than 1.141 in. (29.98 mm).

8. Check depth of mica on commutator. If undercut is less than 0.008 in. (0.20 mm), use an undercutting machine to undercut the mica to 1/32 in. (0.79 mm) deep. The slots should then be cleaned to remove any dirt or copper dust.

9. See Figure A-98. If an undercutting machine is not available, undercutting can be done satisfactorily using a thin hacksaw blade. After undercutting, lightly sand the armature with crocus cloth to remove any burrs.

**CAUTION**

Do not use sandpaper or emery cloth on commutator. The abrasive grit may remain on commutator segments and could cause excessive brush wear.

10. See Figure A-99. Check for SHORTED ARMATURE with a growler. Place armature on growler. Hold a thin steel strip (hacksaw blade) against armature core and slowly turn armature. A shorted armature will cause the steel strip to vibrate and be attracted to the core. Shorted armatures should be replaced.
11. See Figure A-100. Check for a GROUNDED ARMATURE with an ohmmeter or continuity tester. Touch one probe to any commutator segment, and the other probe to the armature core. There should be no continuity (infinite ohms). If there is any continuity the armature is grounded and should be replaced.

12. See Figure A-101. Check for OPEN ARMATURE with an ohmmeter or continuity tester. Check for continuity between all commutator segments. There should be continuity (0 ohms) at all test points. No continuity at any test point indicates armature is open and should be replaced.

13. See Figure A-102. Check for GROUNDED FIELD WINDING with an ohmmeter or continuity tester. Touch one probe to the frame, and the other probe to each of the brushes attached to the field winding. There should be no continuity (infinite ohms). If there is any continuity at either brush, the field winding(s) are grounded and the field frame should be replaced.

14. See Figure A-103. Check for OPEN FIELD WINDING with an ohmmeter or continuity tester. Touch one probe to the field wire, and the other probe to each of the brushes attached to the field coils. There should be continuity. If there is no continuity at either brush, the field winding(s) are open and the field frame should be replaced.
15. See Figure A-104. Test BRUSH HOLDER INSULATION with an ohmmeter or continuity tester. Touch one probe to holder plate and the other probe to each of the positive (insulated) brush holders. There should be no continuity (infinite ohms). If there is continuity at either brush holder, the brush holder assembly should be replaced. Touch one probe to the non-insulated brush holders and the other probe to the holder plate. If you measure any resistance, the brush holder must be replaced.

![Figure A-104. Brush Holder Insulation Test](image)

16. Check armature bearings (10) and replace if necessary. See Figure A-92.

**NOTE**

_Spring (21) and ball (22) are loose in shaft gear end. See Figure A-92._

17. See Figures A-92, A-105 and A-106. Remove the two drive housing mounting screws (11) and washers (12). Remove drive housing (13) from solenoid housing (14).

18. See Figures A-92 and A-107. Remove drive (15), idler gear (16) and idler gear bearing (17) from drive housing (13). O-ring (18) is in groove in drive housing.

19. Remove spring (19) and shaft (20).

**ASSEMBLY**

1. See Figure A-92. Replace O-rings (18, 23).
CAUTION

Do not use solvents to clean drive assembly/over-running clutch (15). It is lubricated and sealed. If you use a solvent to clean it, the lubricant will be washed out and the clutch will fail.

2. Clean, inspect and lubricate drive assembly components. Lubricate parts with high temperature grease such as LUBRIPLATE 110.

3. When installing drive assembly components, open end of idler bearing cage (17) faces toward solenoid.

4. When installing drive housing (13) to solenoid housing (14) use new O-ring (18). Be sure to install return spring (21) and ball (22).

5. Lubricate armature bearings (10) with high temperature grease such as LUBRIPLATE 110. Install armature (9) and field coil (3) to solenoid housing (14).

6. Replace brush springs (6), if necessary. Install brushes (7) and brush holder (8).

7. Install end cover (4) with screw (5).

8. Install thru-bolts (2).

9. Connect solenoid wire (1) to terminal.
OPERATION

General

Both the turn signals and 4-way flashers are controlled by an electronic self-cancelling turn signal module.

Steps 1 and 2 below explain the cancelling operation when a rider signals for a left turn; step 3 explains cancelling operation when a right turn is signalled.

1. Pressing and releasing the left turn signal switch causes a momentary 12 VDC to be applied to Pin 8. The module sends a series of 12 VDC pulses (Pin 4) to flash the left turn signal lamps (front and rear).

2. The module monitors the number of speedometer reed switch closures (vehicle speed signal on FLHR/C) at Pin 5. The switch closures indicate vehicle distance traveled. When the number of switch closures equals a quantity preset in the self-cancelling module, the left turn signal is automatically canceled.

3. Pressing and releasing the right turn signal switch causes a momentary 12 VDC to be applied to Pin 7 and an output at Pin 3 identical to that just described for a left turn signal.

NOTE

If the handlebar switch is pressed and held, the turn signal will flash indefinitely. Counting of reed switch closures begins only after the turn signal switch is released.

Manual or Rider Control

Turn signal may be cancelled by pressing the turn signal switch a second time. Pressing the left turn signal switch while the right turn signal lamps are flashing will cancel the right turn lamps and activate the left turn lamps (and vice versa).

Hazard Flasher (4-Way)

To activate the hazard flashers, simultaneously press and hold both right and left turn signal switches for 1-1/2 seconds. To cancel hazard flashers, momentarily press and release right and left turn signal switches simultaneously.

NOTE

Distance test and time test described below can also be performed using the Speedometer Tester (HD-41354) as an input device.

DISTANCE TEST

Turn signals automatically cancel after the front wheel travels a certain distance at a specific speed. The turn signal module begins measuring the distance traveled upon release of the handlebar mounted turn signal switch button.

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Wire Color</th>
<th>DESCRIPTION/FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>Module ground to motorcycle</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>12 VDC input from accessory fuse</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>Pulsed 12 VDC for flashing right turn signal lights</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>Pulsed 12 VDC for flashing left turn signal lights</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>Vehicle speed sensor input</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>Not used</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>12 VDC from right turn signal switch (when pressed)</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>12 VDC from left turn signal switch (when pressed)</td>
</tr>
</tbody>
</table>

Figure A-108. Turn Signal Module Pinout

Turn signals will remain flashing for the following distances within the speed ranges specified:

<table>
<thead>
<tr>
<th>Speed range</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 0-34 mph</td>
<td>221 ft. (0.04 mi.)</td>
</tr>
<tr>
<td>0-56 km/h</td>
<td>67 m</td>
</tr>
<tr>
<td>#2 35-44 mph</td>
<td>339 ft. (0.06 mi.)</td>
</tr>
<tr>
<td>56-71 km/h</td>
<td>103 m</td>
</tr>
<tr>
<td>#3 45-60 mph</td>
<td>680 ft. (0.14 mi.)</td>
</tr>
<tr>
<td>72-97 km/h</td>
<td>207 m</td>
</tr>
<tr>
<td>#4 61+ mph</td>
<td>1051 ft. (0.20 mi.)</td>
</tr>
<tr>
<td>99+ km/h</td>
<td>323 m</td>
</tr>
</tbody>
</table>

A-124
To check module operation, proceed as follows:

1. Operate the motorcycle at 15 mph (24 km/h), which is the midpoint of speed range #1.

2. Press and release right turn signal switch button. Closely monitor vehicle speed and odometer reading. Measure the distance traveled from the time the button is released to the time the turn signal cancels.

3. Repeat steps 1 and 2 for left turn.

**NOTE**

Since the odometer's smallest unit-of-measure for distance (0.1 mile) is larger than the distance you will be measuring for speed range #1 (0.04 mile), release the turn signal switch button when a number is completely centered on the odometer's tenths wheel and watch for the point where the tenths wheel has rotated 4/10 of the way toward the next number.

4. Repeat steps 2 and 3 for right and left turns at midpoint of speed ranges 2 through 4.

5. If the distances observed in Steps 1 through 4 are not correct, check the following:
   a. Turn signal module ground and module pin connections.
   b. Reed switch operation (vehicle speed sensor on FLHR/C), connections and grounds. See Troubleshooting.
   c. Replace module with one known to be good and repeat DISTANCE TEST.

**ALTERNATE TIME TEST**

Another way of checking the turn signal module is to measure the length of time the directional operates at a constant vehicle speed. From the instant the turn signal switch button is released, measure the number of seconds that elapse before the turn signal cancels.

The approximate elapsed times at four constant speeds should be as follows:

<table>
<thead>
<tr>
<th>CONSTANT SPEED</th>
<th>TURN SIGNAL ELAPSED TIME (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 mph (40 km/h)</td>
<td>5-7</td>
</tr>
<tr>
<td>38 mph (61 km/h)</td>
<td>5-7</td>
</tr>
<tr>
<td>52 mph (84 km/h)</td>
<td>8-10</td>
</tr>
<tr>
<td>65 mph (105 km/h)</td>
<td>10-12</td>
</tr>
</tbody>
</table>

**RIDER CONTROL**

To extend the distance/time that turn signals flash, simply press and hold the turn signal switch button. Since the module does not begin to measure distance traveled and time elapsed until the switch button is released, the flashing sequence is prolonged.

To shorten the distance/time that turn signals flash, press the turn signal switch button a second time while the turn signals are flashing. This serves to cancel the turn signal operation.

**TROUBLESHOOTING**

See the flow charts starting on page A-126 for troubleshooting procedures.

**CAUTION**

Do not apply 12 vdc to self-cancelling module without pin 1 connected to ground or module will be damaged.
Chart 1: Turn Signals Will Not Cancel.

Flash Will Not Cancel.

Check for Voltage on W/GN Wire in Connector [30B] While Connected. Meter Should Alternate Between 6-12 VDC (From Turn Signal Module) and 0-1 VDC When Rear Wheel is Rotated. Does It?

YES

Replace Turn Signal Module. 5202

NO Voltage.


YES

Repair Short to Ground on W/GN Wire. 5203

NO

Replace Turn Signal Module. 5223

No Fluctuation.

Check Continuity Between W/GN Speedometer Harness Wire on Stud at Back of Speedometer and W/GN Wire in Turn Signal Module Connector [30]. Continuity Present?

YES

Speedometer Functional? 5204

YES

Replace Speedometer. 5206

NO

Repair Open in W/GN Wire.

NO

See Chart 2 of Speedometer Troubleshooting.
Chart 2: Turn Signals Will Not Flash Right, Will Not Flash Left.

Does Turn Signal Indicator Illuminate on Side That Will Not Flash?

YES

Inspect Bulbs on Side That Will Not Flash. Bulbs Failed?

YES

Replace Bulbs as Necessary.

NO

See Chart 3.

NO

Place Jumper Wire Between Pins 2 and 3. Turn Ignition Switch to ON. The Right Turn Signal Lamps (Front and Rear) Should Illuminate. Do They?

YES

NO

Place Jumper Wire Between Pins 2 and 4. Turn Ignition Switch to ON. The Left Turn Signal Lamps (Front and Rear) Should Illuminate. Do They?

YES

NO

With Bulbs Removed, Check Continuity Between Terminal in Bulb Socket and Pin 3. Continuity Present?

YES

NO

Repair Open Ground Circuit.

NO

Repair Open in Wire.

YES

With Bulbs Removed, Check Continuity Between Terminal in Bulb Socket and Pin 4. Continuity Present?

YES

NO

Repair Open Ground Circuit.

NO

Repair Open in Wire.
Chart 3: Turn Signals Will Not Flash, 4-Way Flashers Inoperative.

- Inspect Bulbs on Side That Will Not Flash. Bulbs Failed?
  - NO
    - Check for 12 VDC With Red Meter Lead at Pin 2 and Place Black Meter Lead at Pin 1. Is 12 VDC Present?
      - NO
        - Check for 12 VDC at Pin 7 with the Right Turn Switch Button Depressed. Is 12 VDC present?
          - NO
            - Place Jumper Wire Between Pins 2 and 3. Do the Right Turn Signal Lamps (Front and Rear) Illuminate?
              - NO
                - Replace Turn Signal Module.
                - YES
                  - Repair Open Ground Circuit.
          - YES
            - Repair Open Between Connector [22] and Turn Signal Module.
    - YES
      - Check Resistance To Ground on Pin 1. Is Resistance Less than 1 Ohm?
        - NO
          - Check for 12 VDC at Both Terminals of 15 Amp Accessory Circuit Breaker. Is 12 VDC Present at Both Terminals?
            - NO
              - Repair Poor Ground.
              - YES
                - Repair Open in O/W Wire Between Accessory Circuit Breaker Terminal and Turn Signal Module.
            - YES
              - One Terminal.
                - YES
                  - Repair Open Between Ignition Switch and Circuit Breaker Block.
                - NO
                  - Neither Terminal.
                    - Replace Circuit Breaker.
      - YES
        - Repair Open Between Connector [22] and Turn Signal Module.

- Is 12 VDC Present at W/W Wire in Connector [22] With Right Turn Switch Button Depressed?
  - NO
    - Repair Open Between Connector [22] and Turn Signal Module.
  - YES
    - Check Continuity on W/W Wire to Ground. Continuity Present?
      - NO
        - Repair Short to Ground.
        - YES
          - Is 12 VDC Present at O/W Wire in Connector [22]?
            - NO
              - Replace Turn Signal Switch.
              - YES
                - Repair Open Between Connector [22] and Circuit Breaker Block.
          - YES
            - Is 12 VDC Present at W/W Wire in Connector [24] With Left Turn Switch Button Depressed?
              - NO
                - Replace Turn Signal Module.
                - YES
                  - Repair Open Ground Circuit.
          - YES
            - Repair Open Between Lamps and Turn Signal Module Connector [30].

- Place Jumper Wire Between Pins 2 and 3. Do the Right Turn Signal Lamps (Front and Rear) Illuminate?
  - NO
    - Check Continuity Between Pin 3 and Lamps. Continuity Present?
      - YES
        - Repair Open Between Connector [24] and Turn Signal Module.
      - NO
        - Repair Open Between Lamps and Turn Signal Module Connector [30].
  - YES
    - Check Continuity Between Pin 4 and Lamps. Continuity Present?
      - YES
        - Repair Open Ground Circuit.
      - NO
        - Repair Open Between Lamps and Turn Signal Module Connector [30].

A-128
**Turn Signal Troubleshooting**

**Chart 1: Turn Signals Will Not Cancel.**

---

**DIAGNOSTIC NOTES**

The reference numbers below correlate with those on the diagnostic flow chart.

1. Remove the outer fairing.
2. Remove left saddlebag and side cover.
3. Remove turn signal module.
4. Remove instrument console.

---

**FL Models**

---

[Flowchart diagram showing the troubleshooting process for turn signals not canceling.]

---

A-129
Chart 2: Turn Signals Will Not Flash Right, Will Not Flash Left.

Does Turn Signal Indicator Illuminate on Side That Will Not Flash?

YES  NO

Inspect Bulbs on Side That Will Not Flash. Bulbs Failed?

YES  NO

Replace Bulbs as Necessary.

Place Jumper Wire Between Pins 2 and 3. Turn Ignition Switch to ON. The Right Turn Signal Lamps (Front and Rear) Should Illuminate. Do They?

YES  NO

Place Jumper Wire Between Pins 2 and 4. Turn Ignition Switch to ON. The Left Turn Signal Lamps (Front and Rear) Should Illuminate. Do They?

YES  NO

Replace Turn Signal Module.

With Bulbs Removed, Check Continuity Between Terminal in Bulb Socket and Pin 4. Continuity Present?

YES  NO

Repair Open Ground Circuit.

Repair Open Ground Circuit.

With Bulbs Removed, Check Continuity Between Terminal in Bulb Socket and Pin 3. Continuity Present?

YES  NO

Repair Open Ground Circuit.

Repair Open in Wire.

Repair Open in Wire.
Turn Signal Troubleshooting

Chart 3: Turn Signals Will Not Flash, 4-Way Flashers Inoperative.

Inspect Bulbs on Side That Will Not Flash. Bulbs Failed?

YES
Replace Bulbs as Necessary. 5213

NO
Check for 12 VDC With Red Meter Lead at Pin 2 and Place Black Meter Lead at Pin 1. Is 12 VDC Present?

YES
Check for 12 VDC at Pin 7 With the Right Turn Switch Button Depressed. Is 12 VDC Present?

YES
Right Side

NO

Check for 12 VDC at Pin 8 With the Left Turn Switch Button Depressed. Is 12 VDC Present?

YES
Left Side

NO

Place Jumper Wire Between Pins 2 and 3. Do the Right Turn Signal Lamps (Front and Rear) Illuminate?

YES

NO

Place Jumper Wire Between Pins 2 and 4. Do the Left Turn Signal Lamps (Front and Rear) Illuminate?

YES

NO

Check Continuity Between Pin 3 and Lamps. Continuity Present?

YES
Repair Open Ground Circuit. 5218

NO

Check Continuity Between Pin 4 and Lamps. Continuity Present?

YES
Repair Open Ground Circuit. 5218

NO

Check Resistance To Ground on Pin 1. Is Resistance Less than 1 Ohm?

YES
Check for 12 VDC at Both Terminals of 15 Amp Accessory Fuse. Is 12 VDC Present at Both Terminals?

YES
Repair Open in O/W Wire Between Accessory Fuse Terminal and Turn Signal Module. 5219

NO
Replace Fuse. 5222

Repair Open Between Ignition Switch and Fuse Block. 5221

NO

Is 12 VDC Present at W/B/N Wire in Connector [22] With Right Turn Switch Button Depressed?

YES
Repair Open Between Connector [22] and Turn Signal Module. 5219

NO
Check Continuity on W/V Wire to Ground, Continuity Present?

YES
Repair Short to Ground. 5219

NO
Is 12 VDC Present at O/W Wire in Connector [22]?

YES
Replace Turn Signal Switch. 5220

NO
Is 12 VDC Present at O/W Wire in Connector [24]?

YES
Repair Open Between Connector [24] and Fuse Block. 5219

NO
Replace Turn Signal Switch. 5220

Repair Open Between Connector [24] and Fuse Block. 5219

Replace Turn Signal Switch. 5220
VACUUM OPERATED ELECTRIC SWITCH (V.O.E.S.)

ADJUSTMENT/TESTING

Timing Mark Method

Verify engine ignition timing. See IGNITION SYSTEM, ADJUSTMENT/TESTING, IGNITION TIMING CHECK. Adjust ignition timing, if necessary, and then perform the following checks:

1. With the engine running at idle, disconnect V.O.E.S. vacuum hose from carburetor fitting.

2. Momentarily plug the open carburetor fitting. The ignition timing should retard (front cylinder advance timing mark disappears from view in timing inspection hole) and engine RPM should decrease.

3. Connect V.O.E.S. vacuum hose to carburetor fitting. Timing mark should reappear and engine speed should increase to previous RPM.

If speed does not first decrease and then increase as described, check V.O.E.S. ground wire and wire connection to ignition module. Replace V.O.E.S. if defective.

Ohmmeter and Vacuum Pump Method

The V.O.E.S. can also be checked using an ohmmeter and VACUUM PUMP (HD-23738).

1. Disconnect wire from V.O.E.S. to ignition module.
2. Disconnect V.O.E.S. ground wire from engine.
3. Remove V.O.E.S. from vehicle.
4. Insert probes of ohmmeter in socket terminals of 2-place Deutsch connector. Ohmmeter should indicate an open circuit (≈ ohms).
5. Connect hose of vacuum pump to V.O.E.S. vacuum fitting.
6. Slowly squeeze vacuum pump handle while observing vacuum gauge and ohmmeter readings.

Ohmmeter should indicate switch closed (zero ohms) with an applied vacuum of 5.0-6.0 inches (127-152 mm) of mercury. If a vacuum reading of more than 6.0 inches (152 mm) mercury or less than 5.0 inches (127 mm) mercury is required to close the switch, then the unit must be replaced.

7. Refer to the latest Harley-Davidson Parts Catalog for the V.O.E.S. part number.

NOTE

A red paint dab on the wire side of the hose nipple can be used to identify the correct V.O.E.S.

VEHICLE ATTITUDE SENSOR

NOTE

Removal of the inner and outer timer cover is required to perform the Vehicle Attitude Sensor Test.

1. Connect test harness (fabricated for use with the Speedometer Tester) between pin and socket halves of Cam position sensor connector [14]. See Figure A-110.

2. Using black pin probes and patch cords from Harness Connector Test Kit (HD-41404), connect voltmeter between GN (+) and BK/W (-) wires on remaining 3-way socket of test harness.

3. Scribe cam position sensor plate at cam position sensor plate screws. Remove cam position sensor plate screws. Remove sensor from timer cover bore.

4. Turn the Ignition/Light Key Switch to IGNITION.

5. Voltmeter should register 5 VDC (+/- 0.5 volts) with plate in vertical position, and after a delay of approximately 2 seconds, 7-9 VDC with plate in horizontal position. Replace the cam position sensor plate if these results are not obtained.
## B. ELECTRICAL TROUBLESHOOTING - XL 1200 SPORT IGNITION

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checking for Trouble Codes - 1200 Sport Trouble Codes</td>
<td>B-3</td>
</tr>
<tr>
<td>Check Engine Lamp</td>
<td>B-3</td>
</tr>
<tr>
<td>Retrieving Trouble Codes</td>
<td>B-3</td>
</tr>
<tr>
<td>Sc analyzer</td>
<td>B-4</td>
</tr>
<tr>
<td>Check Engine Lamp Diagnostics</td>
<td>B-6</td>
</tr>
<tr>
<td>Breakout Box</td>
<td>B-7</td>
</tr>
<tr>
<td>Diagnostic Check</td>
<td>B-8</td>
</tr>
<tr>
<td>CHART A-1, Check Engine Lamp Not Illuminated at Key ON</td>
<td>B-10</td>
</tr>
<tr>
<td>CHART A-2, Check Engine Lamp On Continuously</td>
<td>B-12</td>
</tr>
<tr>
<td>CHART A-3, Engine Cranks But Will Not Start</td>
<td>B-14</td>
</tr>
<tr>
<td>CHART A-4, No Spark, No Check Engine Lamp at Key ON</td>
<td>B-18</td>
</tr>
<tr>
<td>CHART C, Misfire</td>
<td>B-20</td>
</tr>
<tr>
<td>TROUBLE CODE 12, MAP Sensor</td>
<td>B-22</td>
</tr>
<tr>
<td>TROUBLE CODE 16, Battery Voltage</td>
<td>B-24</td>
</tr>
<tr>
<td>TROUBLE CODES 24 and 25, Ignition Coil</td>
<td>B-26</td>
</tr>
<tr>
<td>TROUBLE CODE 35, Tachometer</td>
<td>B-29</td>
</tr>
<tr>
<td>TROUBLE CODE 41, Cam Sync Failure</td>
<td>B-30</td>
</tr>
<tr>
<td>TROUBLE CODE 44, Bank Angle Sensor</td>
<td>B-31</td>
</tr>
<tr>
<td>TROUBLE CODES 52, 54 and 55, Ignition Module Failure</td>
<td>B-33</td>
</tr>
</tbody>
</table>
Checking For Trouble Codes - XL 1200 Sport

Check Engine Lamp

To diagnose system problems, start by observing the behavior of the Check Engine Lamp.

When the Ignition Switch is turned ON (Key ON) after being off for 10 seconds or more, the Check Engine Lamp will illuminate for approximately four seconds and then turn off.

**NOTE**

- "Key ON" means only that the Ignition Key Switch is turned to ON and the handlebar Engine Stop Switch is in the RUN position (although the engine is NOT running).

- If the Check Engine Lamp is not illuminated at Key ON or if it fails to go OFF after the initial four second ON period, then a problem exists in the lamp circuit. See DIAGNOSTIC FLOW CHARTS in this section.

When the lamp turns off after being illuminated for the first four second period, it will remain off if there are no fault conditions or trouble codes currently detected by the ignition module.

However, if the Check Engine Lamp stays off for only 4 seconds and then comes back on for an 8 second period, then a functional error is stored (although no current trouble code exists).

If the Check Engine Lamp remains on beyond the 8 second period, then a current trouble code exists.

**NOTE**

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

If a particular problem happens to resolve itself, the active status is dropped and it becomes a "historic," rather than a "current" fault. Historic trouble codes are stored for a length of time to assist in the diagnosis of intermittent faults. The Check Engine Lamp will not indicate the existence of only historic trouble codes.

While the trouble codes are stored (whether current, historic or functional), they can be read by either the Scanalyzer or the Check Engine Lamp. All trouble codes reside in the memory of the ignition module until the code is cleared by use of the Scanalyzer or a total of 50 trips has elapsed. A "trip" consists of a start and run cycle, the run cycle lasting at least 30 seconds. After the 50 trip retention period, the trouble code is automatically erased from memory (that is, assuming no subsequent faults of the same type are detected in that period).

**IMPORTANT NOTE**

It is important to note that historic trouble codes may also be present whenever the system indicates the existence of a CURRENT fault.

Retrieving Trouble Codes

Data Link Connector

The behavior of the Check Engine Lamp as described under CHECKING FOR TROUBLE CODES indicates the existence of a fault condition. Turn the Ignition/Light Key Switch to OFF and proceed as follows:

Diagnostic Modes

The XL 1200S Ignition System provides two levels of system diagnostics.

In the more sophisticated mode, a portable Scan Tool called a "Scanalyzer" (HD-41325) plugs into the Data Link Connector and facilitates the diagnosis of system problems through a direct interface with the ignition module. Using a special programmable application cartridge, the Scanalyzer offers data displays and menu selections that allow for quick and easy retrieval of data and enables the user to perform a variety of diagnostic tests while monitoring inputs and outputs.

Figure B-1. Scanalyzer (HD-41325)

At the second level, the Check Engine Lamp is observed by the user after being placed in the diagnostic mode. The lamp blinks a code which correlates to a particular problem area.
Scanalyzer

1. Gently pull left side cover from frame downtubes (no tools required).

2. See Figure B-2. Note the Data Link connector (pin side of 4-place Deutsch) on the side cover.

3. Remove rubber protective plug from open end of Data Link connector.

4. Plug the Scanalyzer (HD-41325) into the Data Link Connector.

5. Turn the Ignition/Light Key Switch to IGNITION. Turn the handlebar mounted Engine Stop Switch to the RUN position (but do not start the engine).

6. Insert the diagnostic application cartridge HD-41325-95A, into the Scanalyzer. During the next few seconds, the Scanalyzer sequences through a series of screens that reflect a power-on self test, the system copyright, and then an attempt at communications with the ignition module. Once communications is established with the ignition module, the Diagnostic Menu appears. See Figure B-3.

7. The Diagnostic Menu, which consists of seven items, is the primary system menu (main menu) through which all other secondary menus and displays are accessed. Since the screen may not be large enough to display all line items at any given time, use the up and down arrow keys to scroll through the list.

8. From the Diagnostic Menu, press the number “2” to access the Trouble Codes Menu. At this point, the unit allows the operator to display current trouble codes (by pressing the number “1”), display historic codes (number “2”) or clear trouble codes (number “3”). Unlike the Check Engine Lamp Diagnostics, note that the Scanalyzer does allow the operator to clear trouble codes from memory as well as differentiate between current and historic codes.

9. After reading trouble codes, simply press the Mode key to return to the Trouble Codes Menu. Press the Mode key again to return to the Diagnostic Menu. In this manner, regardless of where the operator is in the program, the Mode key need only be pressed once or twice to return to the main menu.

NOTE

For more detailed instructions, refer to the literature provided with the Scanalyzer.

10. Write down all trouble codes on a piece of paper. If a current trouble code exists, place it at the top of the list.

11. If trouble codes are present, refer to the applicable flow chart. A Scanalyzer icon appears at those points in the flow chart where use of the Scanalyzer would be most convenient or desirable.

12. If trouble codes are NOT present, but starting or driveability problems are evident, see the Symptoms Chart under DIAGNOSTIC CHECK.

13. After correcting system problems, clear trouble codes using the Trouble Codes Menu of the Scanalyzer.

NOTE

Trouble codes cannot be cleared while the engine is running. Turn the engine off, but leave the Ignition/Light Key Switch in the IGNITION position and return the handlebar Engine Stop Switch to RUN.

14. Turn the Ignition/Light Key Switch to OFF. Turn the handlebar mounted Engine Stop Switch to the OFF position.

15. Unplug the Scanalyzer from the Data Link Connector. Install protective plug over pin side of Data Link Connector.

16. Place Data Link Connector in clip on left side cover.

17. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).

18. Road test the vehicle and observe the Check Engine Lamp to confirm proper operation without the reoccurrence of trouble codes.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>MAP Sensor</td>
<td>B-22</td>
</tr>
<tr>
<td>16</td>
<td>Battery Voltage</td>
<td>B-24</td>
</tr>
<tr>
<td>24</td>
<td>Front Coil</td>
<td>B-26</td>
</tr>
<tr>
<td>25</td>
<td>Rear Coil</td>
<td>B-26</td>
</tr>
<tr>
<td>35</td>
<td>Tachometer</td>
<td>B-29</td>
</tr>
<tr>
<td>41</td>
<td>Cam Sync Failure</td>
<td>B-30</td>
</tr>
<tr>
<td>44</td>
<td>Bank Angle Sensor</td>
<td>B-31</td>
</tr>
<tr>
<td>52</td>
<td>RAM/ROM Failure</td>
<td>B-33</td>
</tr>
<tr>
<td>54</td>
<td>EEPROM Failure</td>
<td>B-33</td>
</tr>
<tr>
<td>55</td>
<td>Module Failure</td>
<td>B-33</td>
</tr>
</tbody>
</table>
Figure B-3. Scanalyzer Menu Selections
Check Engine Lamp Diagnostics

NOTE

Use of the Check Engine Lamp Diagnostics assumes that the Scanalyzer (HD-41925) is not available.

1. To activate the diagnostic feature of the Check Engine Lamp, proceed as follows:
   A. Install diagnostic test wire across pins 1 and 2 on Data Link connector [91A].
   B. Turn the Ignition/Light Key Switch to IGNITION and wait approximately eight seconds for the Check Engine Lamp to start flashing.

![Figure B-4. Diagnostic Test Wire](image)

2. All trouble codes are sent out as a series of flashes.

   The transmission of a trouble code is always preceded by a series of rapid flashes (about 3 per second). This “intermission” is followed by a 2 second pause in which the lamp is off. The lamp will then flash one or more times to indicate the first digit of the trouble code. The length of time the lamp is illuminated and the length of time in which it is off are each about 1 second in duration. Simply count the number of times the lamp flashes in order to retrieve the first digit of the trouble code.

3. Following transmission of the first digit, there is another 2 second pause in which the lamp is off. The lamp will then flash one or more times to indicate the second digit of the trouble code. Count the number of times the lamp flashes to retrieve the second digit.

   Following transmission of the second digit, there is a third 2 second pause in which the lamp is off. After the pause comes the intermission, which is followed by transmission of the next recorded trouble code. All subsequent codes are sent in the same manner, each separated from the next by the intermission.

4. Write down the trouble codes on a piece of paper. Once all codes have been sent, the data string is repeated. When you have recorded the same trouble code twice, it is an indication that the transmission has been restarted and that all trouble codes have been retrieved.

NOTE

If the lamp flashes at a rate faster than normal, then you are observing the “intermission” only, which means that no trouble codes are present.

5. If trouble codes are present, refer to the applicable flow chart in the XLH Service Manual.

If trouble codes are NOT present, but starting or driveability problems are evident, see DIAGNOSTIC CHECK for help in diagnosing system problems.

6. Turn the Ignition/Light Key Switch to OFF. Remove diagnostic test wire from Data Link Connector.

IMPORTANT NOTE

If Diagnostic Test Wire is installed across Pins 1 and 2 on connector [91A] in lieu of Scanalyzer, the Ignition Module is placed in a Diagnostics Mode and engine will start. The test wire must be removed from the Data Link Connector and the Ignition Switch turned to OFF or the Check Engine lamp will continue to flash codes.

7. After correcting system problems, clear trouble codes. If the Scanalyzer is not available, perform 50 start and run cycles. To execute one run cycle, start the vehicle, let it run for at least 30 seconds and then turn the engine off for a minimum of 10 seconds.

8. Road test the vehicle and observe the Check Engine Lamp to confirm proper operation without the reoccurrence of trouble codes.
Breakout Box (HD-42682) Installation

General

The breakout box splices into the main harness of the Sportster. Used in conjunction with a DVOM, it allows circuit diagnosis of the wiring harness and connections without having to probe with sharp objects.

The unit connects at the ignition module and allows the vehicle to run during testing.

The Breakout Box may be connected directly to the 1200S ignition module. On all other models, connector adapters (HD-42962) must be installed to connect the Breakout Box.

![Figure B-6. Breakout Box Connections (1200S)](image)

![Figure B-7. Breakout Harness Adapters](image)

![Figure B-5. Breakout Box Connection](image)


3. On all other models separate six pin connector [10], under engine on left frame tube.

4. On all except 1200S Sport, connect Harness Adapters (HD-42962) to connector [10].

5. See Figure B-5 and B-6. On 1200S models, connect the Black male connector from the Breakout Box to Ignition module connector [10B] and connector [10A] from the harness to the black female connector on the breakout box.

6. On all other models except 1200S, connect Black connectors from breakout box to Harness Adapters installed in step 4.

7. On 1200S models, connect the gray male connector from the Breakout Box to Ignition module connector [11B] and connector [11A] from the harness to the gray female connector on the breakout box.

Circuit Diagnostics may now be performed.
GENERAL
The diagnostic check is an organized approach to identifying a problem caused by an electronic control system malfunction. If no problems are found after completion of the Diagnostic Check, a comparison of Scanalyzer parameters may be used to help locate intermittent and out-of-specification sensors. See TYPICAL SCAN VALUES table.

If the Scanalyzer is not working properly, check operation on another vehicle. If OK, check Data Link Connector for 12 volts and proper ground. If Scanalyzer reads “No Response” with the Ignition Switch turned to ON (Engine Stop Switch at RUN with the engine off), check serial data wire for an open or short to ground between Data Link terminal “1” and Ignition Module. Also check for an open diagnostic test terminal between Data Link terminal “3” and Ignition Module. With Ignition Switch turned to ON, Transmit Data and Receive Data line should have 5 volts.

NOTE
If Diagnostic Test Wire (see below) is installed across Pins 1 and 2 on connector [91A] in lieu of Scanalyzer, the Ignition Module is placed in a Diagnostics Mode and engine will start. The test wire must be removed from the Data Link Connector and the Ignition Switch turned to OFF or the Check Engine lamp will still flash codes.

---

Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>ign. Module</td>
<td>12 - Place Deutsch (Black)</td>
<td>Under Seat</td>
</tr>
<tr>
<td>[91]</td>
<td>Data Link</td>
<td>4 - Place Deutsch</td>
<td>Under Left Side Cover</td>
</tr>
</tbody>
</table>

---

**Figure B-9. Diagnostic Test Wire**

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Figure B-10. Data Link Connector [91A]

---

Figure B-8. 1200S Ignition Module
DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. See Retrieving Trouble Codes page B-3.
2. See Typical Scan Values Chart Below.

<table>
<thead>
<tr>
<th>SCAN VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
</tr>
<tr>
<td>MAP Sensor</td>
</tr>
<tr>
<td>Spark Advance (While Running)</td>
</tr>
<tr>
<td>RPM</td>
</tr>
<tr>
<td>Bank Angle Sensor</td>
</tr>
<tr>
<td>Dwell</td>
</tr>
</tbody>
</table>

3. Wiggle Test. Shake or wiggle harness with DVOM or Scanalyzer connected. Radical voltage changes on the DVOM will indicate the presence of intermittents, while the Scanalyzer (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. (If a current trouble code is present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear trouble codes and then perform wiggle test with vehicle running.)

4. See Symptoms Chart Below.

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STARTS HARD</td>
</tr>
<tr>
<td>Battery Discharged.</td>
</tr>
<tr>
<td>Ignition Coil.</td>
</tr>
<tr>
<td>Water or Dirt in Fuel System.</td>
</tr>
</tbody>
</table>

5. Use Harness Connector Test Kit (HD-41404), black socket probes and patch cord.


<table>
<thead>
<tr>
<th>SYMPTOMS (Cont’d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HESITATES, STUMBLING, SURGES, MISFIRES AND/OR SLUGGISH PERFORMANCE</td>
</tr>
<tr>
<td>Manifold Leak.</td>
</tr>
<tr>
<td>MAP Sensor or Hose Plugged or Not Operating Properly</td>
</tr>
<tr>
<td>Water or Dirt in Fuel System.</td>
</tr>
<tr>
<td>Spark Plugs.</td>
</tr>
<tr>
<td>EVAP Hose Disconnected From Carburetor (Calif. Models)</td>
</tr>
<tr>
<td>Throttle Plates Not Opening Fully</td>
</tr>
</tbody>
</table>

| ENGINE EXHAUST EMITS BLACK SMOKE OR FOULS PLUGS |
| Clogged Air Filter. | See Air Cleaner. |
| MAP Sensor or Hose Plugged or Not Operating Properly | See TROUBLE CODE 12. |

<table>
<thead>
<tr>
<th>Diagnostic Codes for XL 1200S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>16</td>
</tr>
<tr>
<td>24</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td>35</td>
</tr>
<tr>
<td>41</td>
</tr>
<tr>
<td>44</td>
</tr>
<tr>
<td>52</td>
</tr>
<tr>
<td>54</td>
</tr>
<tr>
<td>55</td>
</tr>
</tbody>
</table>
GENERAL
When the Ignition Switch is turned to ON (Engine Stop Switch at RUN with the engine off), the Check Engine Lamp should illuminate for 4 seconds. Battery voltage is supplied to the lamp bulb. The lamp bulb is grounded by the Ignition Module through the BK/Y wire. A lack of power to the Ignition Module will cause the Check Engine Lamp to be inoperative and also create a no start situation.

DIAGNOSTIC TIPS
- Check for open in BK/Y wire.
- Check for blown Accessory fuse.

DIAGNOSTIC NOTES
The reference numbers correlate with those on the diagnostic flow chart.

1. Use Harness Connector Test Kit (HD-41404), black pin probe and patch cord.
2. Inspect Connector [10] (BK) for contamination or corrosion. If connection is good, Ignition Module requires replacement, see Ignition Module, Removal/Installation, in the 1998 XLH Service Manual.
3. Use special pick (Snap-On Tool TT600-3) as described under Amp Multilock Electrical Connectors in Section 7 of this Service Manual.
4. Use Harness Connector Test Kit (HD-41404), gray socket probe and patch cord.
5. Check continuity. If continuity present, then most likely short to voltage; if no continuity, then open.
6. LED failure requires tachometer replacement.

Check Engine Lamp Circuit Diagram
Chart A-1, No Check Engine Lamp at Key On

1. Turn Ignition Switch ON. Turn Engine Stop Switch to RUN. Does the Engine Start?
   - YES
   - Turn Ignition Switch OFF.
   - Disconnect Ignition Module Connector (10B)(BK) and Connect Breakout Box.
   - Turn Ignition Switch ON.
   - Jumper Breakout Box (BK) Pin 4 to Ground.
   - Check Engine Lamp Should be ON. Is it?
   - YES
   - Replace Faulty Ignition Module.
   - NO
   - NO
   - Did No Check Engine Lamp and No Start Conditions Occur Simultaneously?
     - YES
     - No Ignition Module Power. Refer to CHART A-4.
     - NO
     - Refer to CHART A-3 for No Start Condition and then Return to CHART A-1 to Resolve No Check Engine Lamp.

2. Disconnect Connector [20]. Remove BK/Y Wire from Connector [20B] and ground it. Reconnect Connector [20B].

3. Check Engine Lamp ON?
   - YES
   - NO

4. Repair Open or Short to Voltage on BK/Y Wire Between Connector [20A] and Connector [10B].

5. Is there an Open on O/W Wire that Feeds Bulb or Open on Wire From Bulb to Connector [20B]?
   - YES
   - Repair.
   - NO
   - Replace Faulty Tachometer (Lamp not replaceable).

Figure B-12. Breakout Box (HD-42682)

Figure B-11. 1200S Ignition Module

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[20]</td>
<td>Main Harness to Instruments</td>
<td>14 - Place Multilock</td>
<td>Under Headlamp bracket</td>
</tr>
<tr>
<td>[10]</td>
<td>Ignition Module</td>
<td>12 - Place Deutsch (BK)</td>
<td>Under seat</td>
</tr>
</tbody>
</table>
The Check Engine Lamp should illuminate for 4 seconds when the Ignition Switch is turned to ON (with the Engine Stop Switch at RUN and the engine off). Following the initial period of illumination, the lamp should go off for 4 seconds. It may then come back on for an 8 second period (for a stored functional error) or remain on continuously (current error).

Battery voltage is supplied to the lamp bulb. The lamp bulb is grounded by the Ignition Module through the BK/Y wire. A steady light may indicate a short to ground on the BK/Y wire.

**DIAGNOSTIC NOTES**

The reference numbers below correlate with those on the diagnostic flow chart.

1. If the lamp goes off when Ignition Module connector is unplugged, BK/Y wire is not shorted to ground.

2. See Retrieving Trouble Codes.


4. Use special pick (Snap-On Tool TT600-3) as described under Amp Multilock Electrical Connectors in Section 7 of the 1998 XLH Service Manual.
Chart A-2, Check Engine Lamp On Continuously

**Diagram:**

1. **Ignition Switch OFF.**
   - Disconnect Ignition Module Connector [10](BK).
   - Ignition Switch ON.
   - Check Engine Lamp Should be OFF. Is it?

   **YES**
   - With Ignition Switch OFF, Reconnect Ignition Module. With Ignition Switch ON, Verify That There is NOT a 4 Second Lamp OFF Period. Is There a Lamp OFF Period?

   **YES**
   - Check Engine Lamp Function OK. Check for Trouble Codes.

   **NO**
   - Replace Ignition Module.

2. **NO**
   - Disconnect Connector [20]. Remove BK/Y Wire from Connector [20B]. Reconnect [20B].
   - Check Engine Lamp ON?

   **YES**
   - Repair Short to Ground on BK/Y Wire Between Connector [20B] and Lamp in Speedometer.

   **NO**
   - Repair Short to Ground on BK/Y Wire Between Connector [20A] and Connector [10](BK).

**Wire Harness Connectors**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[20]</td>
<td>Main Harness to Instruments</td>
<td>12 - Place Multilock</td>
<td>Under Headlamp Bracket</td>
</tr>
<tr>
<td>[10]</td>
<td>Ignition Module</td>
<td>12 - Place Deutsch</td>
<td>Under Seat</td>
</tr>
</tbody>
</table>
CHART A-3, ENGINE CRANKS BUT WILL NOT START

GENERAL

NOTE
If starter will not crank engine, the problem is not ignition related. Refer to Section 5 of this Service Manual, Electric Starter.

NOTE
Engine can be started with Diagnostics Test wire installed or if Receive Data Line is grounded. Ignition/Light Key Switch must be turned to OFF after test wire is removed or check engine lamp will continue to flash stored codes.

DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. See Retrieving Trouble Codes, page B-3.
2. Check the condition of the battery. Perform a voltage test and recharge if below 12.80. Check battery connections and perform load test. Replace the battery if necessary. See Section 7 of the 1998 XLH Service Manual for detailed information.

Ignition Circuit Diagram
Chart A-3, Engine Cranks But Will Not Start (1 of 3)

1. Check for Trouble Codes. Codes Found?
   YES
   Refer to Applicable Trouble Code Chart. Start With Lowest Code.
   NO
   Check Battery Connections. Check Voltage is Voltage Above 12.60?
     YES
     Does Battery Pass Load Test?
     NO
     Recharge Battery.
   7180
   7185
   Check Spark Plug Condition. Replace, if Fouled.
   Check Spark at Both Plugs While Cranking. Spark Present?
   YES
   NO
   Turn Ignition ON and Engine Stop Switch to RUN. Check Engine Lamp Should Illuminate for 4 seconds, Does It?
   YES
   Check Battery Voltage at Terminal B of Coil Connector [83B] using DVOM. Battery Voltage Present?
     YES
     To CHART A-3, 2 of 3.
     NO
     See Chart A-4
   NO
   Open in W/BK Wire to coil. Repair Open.
   7210


4. Use Harness Connector test Kit (HD-41404) gray pin probes and patch cords.

Figure B-14. 1200S Ignition Module
Chart A-3, Engine Cranks But Will Not Start (2 of 3)

5. Use Test lamp as shown in Figure B-16.
6. Connect Breakout Box (HD-42682) between harness and Ignition Module. See Breakout Box Installation, page B-7.
7. Use Harness Connector Test Kit (HD-41404), gray pin probe and patch cord.

### Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[14]</td>
<td>CMP Sensor</td>
<td>3 - Place Deutsch</td>
<td>Bottom Frame Cross Member (Right Side)</td>
</tr>
<tr>
<td>[10]</td>
<td>Ignition Module</td>
<td>12 - Place Deutsch (BK)</td>
<td>Under Seat</td>
</tr>
<tr>
<td>[83]</td>
<td>Ignition Coil</td>
<td>3 - Place Packard</td>
<td>Below Fuel Tank</td>
</tr>
</tbody>
</table>

Diagram:
- Disconnect Coil Connector (83B). Gently Connect Test Lamp to Connector (83B) Terminal A (front cyl.) or Terminal C (rear cyl.). Crank Engine, Does Light Flash?
- Faulty Coil Connection, Spark Plug Wires or Coil. Proceed as follows:
  - Check Coil Connections.
  - Test Spark Plug Cable Resistance. See Chart C-2, Spark Plug Cable Resistance Test.
  - Check Coil by Substituting One Known To Be Good
- OR Check Coil Resistance. See Troubleshooting.
- Connect Breakout Box. Check continuity between Ignition Coil Terminal A of Connector (83B) and Breakout Box (BK) Pin 6. Measure resistance between Ignition Coil Terminal C (83B) and Ignition Module Pin 7 (10B) on Breakout Box. Resistance Should be less than 1.0 Ohm. Is it?

Diagram:
- HDX 42682
- KENT-MOORE
- Figure B-15, Breakout Box (HD-42682)
- Figure B-16. XL1200S Ignition Coil Test
Use Harness Connector Test Kit (HD-41404), black pin probe and patch cord.

The Ignition Module turns on when power is applied to Pin 1 of [10], the black connector. The Ignition Module goes through an initialization sequence every time power is removed and re-applied to Pin 1. 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.

**DIAGNOSTIC NOTES**

The reference numbers which follow correlate with those on the diagnostic flow chart.

2. Use Harness Connector Test Kit (HD-41404), black pin probe and patch cord.

**Ignition Module Power Circuit Diagram**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>Ignition Module</td>
<td>12-Place Deutsch (BK)</td>
<td>Under Seat</td>
</tr>
<tr>
<td>[22]</td>
<td>RT Handlebar Switch</td>
<td>6-Place Deutsch (BK)</td>
<td>In Headlight</td>
</tr>
</tbody>
</table>
Chart A-4, No Spark, No Check Engine Lamp at Key On

NOTE

With one exception (noted in flow chart), always turn Key ON prior to probing terminals with test lamp.

1. Check Ignition Fuse. Is Fuse OK?
   - NO
     - Replace - Find Source of Fault.
     - 7270
   - YES

2. Disconnect Connector [10](BK) and Connect Breakout Box. With ignition ON, Multimeter Red Wire to Pin 1 terminal on [10]. Multimeter Black wire to Pin 2 on [10B]. Is Voltage 12V± 1.0V?
   - YES
     - Replace Ignition Module.
     - 7305
   - NO

3. Check continuity between Breakout Box Pin 2 connector [10](BK) and ground. Continuity present?
   - NO
     - Repair Open in BK wire (Pin 2) to ground.
     - 7310
   - YES

4. Check Continuity between Breakout Box Pin 1 (W/BK) Connector [10](BK) and Right Handlebar Connector [22B] Pin 4(W/BK). Continuity Present?
   - YES
     - Repair Open in W/BK Wire.
     - 7285
   - NO

5. Check Continuity between Pin 3 Connector [11](GY) and Pin 4 (W/BK) on Connector [22B]. Continuity Present?
   - YES
     - Repair Open in GY Wire between [22A] and Fuse Block
     - 7290
   - NO
     - Replace Engine Stop Switch.
     - 7295
## CHART C, MISFIRE

### GENERAL

Battery condition and connections may also cause misfires. See Battery in Section 7 of the 1998 XLH Service Manual for more information.

**DIAGNOSTIC NOTES**

The reference numbers below correlate with those on the diagnostic flow chart.

### WARNING

Any open spark around gasoline or other combustibles may result in fire or explosion causing personal injury and/or property damage. Thoroughly wipe up any spilt fuel and dispose of rags in a suitable manner.

1. A Spark Tester (HD-26792) must be used to verify adequate available secondary voltage at the spark plug (25,000 volts). Remove spark plug cable from spark plug. Visually check condition of plug. Attach cable to Spark Tester (HD-26792). Clip tester to cylinder head bolt. While cranking engine, look for spark. Repeat procedure on other spark plug cable.

2. **SPARK PLUG CABLE RESISTANCE TEST:** Remove spark plug cable from spark plug and ignition coil. Using an ohmmeter, touch probes to terminals on each end of plug wire. Resistance must be within values shown in Table below. Reinstall and repeat on other cable. For best results, use a needle nose pliers for removal and installation on coil. Gently grasp cable as close to terminals as possible.

3. If carbon tracking is evident, replace the ignition coil and be sure spark plug wire to that coil is clean and tight. Excessive wire resistance or faulty connections can cause coil damage. See Ignition Coil, Removal/Installation in the 1998 XLH Service Manual.

4. See Ignition Coil, Removal/Installation. This test can also be performed by substituting a known good coil for the one causing the no spark condition. The coil does not require full installation to be functional. Verify faulty coil by performing resistance test (see Troubleshooting).

5. Use Harness Connector Test Kit (HD-41404), GY pin probe and patch cord to the coil connector [83B].

6. Inspect for corrosion at battery terminals, main circuit breakers, ignition fuse terminals (GY and R/BK), right handlebar connector [22] and coil connector.

**NOTE**

Fuel system problems may also cause misfires. Refer to SYMPTOMS chart.

### Spark Plug Cables Length / Resistance

<table>
<thead>
<tr>
<th>No.</th>
<th>Position</th>
<th>Length In. (mm)</th>
<th>Resistance (ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Front Left</td>
<td>20.2 (512)</td>
<td>5039-11758</td>
</tr>
<tr>
<td>2</td>
<td>Rear Center</td>
<td>18.7 (474)</td>
<td>4665-10866</td>
</tr>
<tr>
<td>3</td>
<td>Rear Left</td>
<td>23.1 (588)</td>
<td>5787-13504</td>
</tr>
<tr>
<td>4</td>
<td>Front Center</td>
<td>19.5 (496)</td>
<td>4882-11392</td>
</tr>
</tbody>
</table>

---

Figure B-17. Spark Tester (HD-26792)
Chart C, Misfire At Idle Or Under Load (2 of 2)

From CHART C-2, 1 of 2.


   NO

6. Replace Cam Sensor with known good Cam Sensor. Static time engine and retest. Problem still exist?

   YES

   NO

   Find Source of Intermittent and Repair. 7540

   YES

   Replace Ignition Module. 7541

---

Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>Ignition Module</td>
<td>12 - Place Deutsch (BK)</td>
<td>Under Seat</td>
</tr>
<tr>
<td>[22]</td>
<td>RT Handlebar Switch</td>
<td>6 - Place Deutsch (BK)</td>
<td>In Headlight</td>
</tr>
<tr>
<td>[83]</td>
<td>Coil</td>
<td>3 - Place Packard</td>
<td>Undr Fuel Tank</td>
</tr>
</tbody>
</table>

---

*Ignition Coil Circuit Diagram*
TROUBLE CODE 12, MAP SENSOR

The Manifold Absolute Pressure Sensor (MAP Sensor) is supplied 5 volts from the Ignition Module and sends a signal back to the Ignition Module which varies in accordance with engine vacuum and atmospheric barometric pressure. Changes in barometric pressure are influenced by weather and altitude.

The Ignition Module and Scanalyzer should recognize a high voltage. MAP Sensor Output Check. Using the vacuum pump (HD-23738A), apply a vacuum to the pressure port of the MAP Sensor. The signal voltage should lower as the vacuum is applied.

DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. Connect Breakout Box (HD-42682) between wire harness and Ignition Module. See Breakout Box Installation page B-7.

   NOTE

   Engine must be running for scanalyzer to work properly.

2. Shake or wiggle harness with DVOM or Scanalyzer connected. Radical voltage changes on the DVOM will indicate the presence of intermittents, while the Scanalyzer (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. (If a current trouble code is present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear trouble codes and then perform wiggle test with vehicle running.)

DIAGNOSTIC TIPS

- Code 12 will set if the MAP Sensor signal is out of range or fluctuates faster than normal operation.
- With the MAP Sensor disconnected, the Ignition Module and Scanalyzer should recognize a low voltage. If low voltage is observed, the Ignition Module and harness are not at fault.
- Gently place a jumper wire across MAP Sensor connector [80B] terminals 1 and 2 using Harness Connector Test Kit (HD-41404), purple male probes and patch cord. With the MAP Sensor connector jumper in place,

---

**MAP Sensor Circuit Diagram**

---

Figure B-18. MAP Sensor
NOTE
The Scannerizer icon appears
at those points in the flow
chart where the Scannerizer
may be used.

3. Use Harness Connector Test Kit (HD-41404), purple pin probes and patch cords.

**Breakout Box Method**

Connect Breakout Box. With the Ignition ON, Measure the Voltage Between Pin 2 on Breakout Box and Pin 9. Is the Voltage Between 4.2 and 4.95 VDC?

**Scancerizer Method**

With the Engine Running, Observe Scancerizer MAP Voltage Values. Typical voltage at Idle should be 1.5-2.5 VDC. Is it?

2. With DVOM or Scannerizer (Wiggle Test Mode) Still Connected, Check for Intermittents by Performing "Wiggle" Test. Radical Voltage Changes or Trouble Code Set While Wiggling Harnes s Will Indicate the Presence of Intermittents. Intermittent Present?

3. To Identify the Source of Intermittents, Start at Box Marked by Bold Asterisk on Right Side of Flow Chart and Wiggle Harness While Monitoring DVOM.

4. Replace MAP Sensor. Clear Codes if Scannerizer is Available and Read Test. Did Check Engine Lamp Come On and Set CODE 12?


7. Connect Breakout Box. Measure Continuity between MAP Connector [80B] Terminal 1 and Breakout Box (GY) Pin 1, then between MAP Connector (80B) and Chassis Ground. Is Resistance Greater Than 1 Megohm?

8. Locate and Repair OPEN on W/W Wire.

9. Replace Sensor

10. Locate and Repair Grounded V/W Wire.

**Wire Harness Connectors**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[80]</td>
<td>MAP Sensor</td>
<td>3 - Place Amp</td>
<td>Under Fuel Tank</td>
</tr>
<tr>
<td>[10]</td>
<td>Ign. Module</td>
<td>12 - Place Deutsch (BK)</td>
<td>Under Seat</td>
</tr>
</tbody>
</table>

Clear Codes and Confirm Proper Operation with No Check Engine Lamp.

At some point in the flow chart you may be instructed to jump directly to the box marked by an asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.
TROUBLE CODE 16, BATTERY VOLTAGE

A Code 16 is set if the Ignition Module sees battery positive voltage less than 8 or greater than 16 volts. Low voltage generally indicates loose wire and/or corroded connections or a charging system problem. A high voltage condition may be caused by a faulty voltage regulator.

DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.


2. Connect Breakout Box (HD-42682) between wire harness and Ignition Module. See Breakout Box Installation, page B-7.

3. The Ignition Module is monitoring voltage at Ignition Module connector [10](BK) Pin1.

4. This checks for voltage drops in the Ignition Module power circuit.

5. Perform Wiggle Test. Shake or wiggle harness with DVOM or Scanalyzer connected. Radical voltage changes on the DVOM will indicate the presence of intermittents, while the Scanalyzer (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. (If a current trouble code is present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear trouble codes and then perform wiggle test with vehicle running.)


Battery Voltage Circuit Diagram
Code 16, Battery Voltage Test

Perform Charging System Tests. Charging System OK?

YES

Perform Charging System Tests. Charging System OK?

NO


YES

NO

Repair Charging System.

System OK.

With Ignition On, Measure Voltage Drop Between Battery Positive Terminal and Breakout Box connector [10(BK)] Pin 1. Is Voltage Drop Greater than 0.5 Volts?

YES

NO

With Ignition On, Measure Voltage Drop Between Battery Positive Terminal (+) and Connector [22A], Pin 4. Is Voltage Drop Greater than 0.5 Volts?

YES

Check for Voltage Drop between Battery Negative Terminal (-) and Breakout Box connector [10(BK)] Pin 2(-). Is Voltage Drop Greater than 0.5 VDC?

NO

Locate and Repair Bad Connection.

With Ignition On, Measure Voltage Drop Between Battery Positive Terminal (+) and Silver Post on Main Circuit Breaker (-). Is Voltage Drop Greater than 0.5 Volt?

YES

NO

Replace W/BK Wire or Terminals.

With Ignition On, Measure Voltage Drop Between Battery Positive Terminal (+) and Copper Post on Main Circuit Breaker (-). Is Voltage Drop Greater than 0.5 Volt?

YES

NO

Inspect [22] for Corrosion or loose wires. If not present replace Right hand Run/Start Switches.

With Ignition On, Measure Voltage Drop Between Battery Positive Terminal (+) and GY Terminal on 15 Amp Fuse (-). Is Voltage Drop Greater than 0.5 Volt?

YES

NO

Replace GY Wire or Terminals.

High Resistance Between 30 Amp Circuit Breaker and Battery. Replace Wire or Terminals.

YES

NO

Replace Circuit Breaker.

Clear Codes and Confirm Proper Operation with No Check Engine Lamp.
TROUBLE CODE 24 and 25, IGNITION COIL

Code 24 = Front Coil  
Code 25 = Rear Coil

A Code 24 or 25 will set if the ignition coil voltage is out of range. This could occur if there is an open coil or loss of power to the coil. The coil receives power from the Run/Stop Switch.

The Ignition Module is responsible for turning the coils on by providing the ground to activate the coils, which in turn powers the coils. If both codes are set, it is likely a coil power failure or a coil failure.

Ignition Coil Circuit Diagram
DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. Use Test Lamp as shown in Figure B-19.
3. Use Harness Connector Test Kit (HD-41404), gray pin probe and patch cord.
4. Connect Breakout Box (HD-42682) between wire harness and Ignition Module. See Breakout Box Installation.
5. Shake or wiggle harness with DVOM or Scaler (Engine running) connected. Radical voltage changes on the DVOM will indicate the presence of intermittents, while the Scaler (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. (If a current trouble code is present when the wiggle test is entered, the Scaler will respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear trouble codes and then perform wiggle test with vehicle running.)

SCALER NOTES

The Scaler icon appears at those points in the flow chart where the Scaler may be used. If a number is printed next to the icon, then refer to the Scaler Notes which follow.

With the engine off, Scaler (Active Diagnostic Test Mode) can be used to energize either the front or rear coil once each second for a total of 5 seconds.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[83]</td>
<td>Ignition Coil</td>
<td>3 - Place Amp</td>
<td>Below Fuel Tank</td>
</tr>
<tr>
<td>[22]</td>
<td>R/H Handlebar Switch</td>
<td>6 - Place Deutsch (BK)</td>
<td>Inside Headlamp Housing</td>
</tr>
</tbody>
</table>

Wire Harness Connectors

Using Breakout Box, measure Resistance Between Ignition Module and Coil Terminals as follows:

<table>
<thead>
<tr>
<th>Trouble Code</th>
<th>Coil Terminal</th>
<th>Breakout Box (BK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>A (BE/C)</td>
<td>Pin 6</td>
</tr>
<tr>
<td>25</td>
<td>C (Y/BE)</td>
<td>Pin 7</td>
</tr>
</tbody>
</table>

Resistance Should be Less Than 0.5 Ohms. Is It?

Figure B-19. Ignition Coil Test Lamp

Clear Codes and Confirm Proper Operation with No Check Engine Lamp.
GENERAL

The ignition coil is a pulse type transformer that transforms or steps up low battery voltage to the high voltage necessary to jump the electrode at the spark plug in the cylinder head. Internally the coil consists of primary and secondary windings with a laminated iron core and sealed in waterproof insulating compound. The ignition coil cannot be taken apart or repaired. If the ignition coil is faulty it must be replaced.

Troubleshooting

When the engine will not start or when hard starting or missing indicates a faulty ignition system, see CHART C in this section. If the condition persists, check primary and secondary resistance of ignition coil with an ohmmeter. See Wiring Diagram below.

Resistances should be within the following limits: primary resistance 0.4-0.6 ohms, secondary resistance 11.7-12.7K ohms. Check ignition coil with a coil tester.

If a coil tester is not available, temporarily substitute a new ignition coil by attaching it at any convenient point near the old coil (coil will function without being secured). Transfer terminal wires to new coil.

Attach new spark plug cables to coil and plugs. If ignition trouble is eliminated by the temporary installation of new coil, carefully inspect old coil for damaged cables and insulation. The insulation on cables may be cracked or otherwise damaged allowing high tension current to short to metal parts. This is most noticeable in wet weather or after motorcycle has been washed.

Figure B-20. Ignition Coil Wiring Diagram
TROUBLE CODE 35, TACHOMETER

Code 35 will set if the PK wire is shorted to power or ground.

DIAGNOSTIC NOTES

The reference numbers which follow correlate with those on the diagnostic flow chart.

1. See page B-7. Install Breakout Box HD-42682
2. Shake or wiggle harness with DVOM or Scanalyzer (Engine running) connected. Radical voltage changes on the DVOM will indicate the presence of intermittents, while the Scanalyzer (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. (If a current trouble code is present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear trouble codes and then perform wiggle test with vehicle running).


Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[10]</td>
<td>Ignition Module</td>
<td>12 - Place Deutsch (BK)</td>
<td>Below Fuel Tank</td>
</tr>
<tr>
<td>[20]</td>
<td>Instruments</td>
<td>14 - Place Multitock</td>
<td>Under Headlamp Bracket</td>
</tr>
</tbody>
</table>

Tachometer Circuit Diagram
TROUBLE CODE 41, CAM SYNC FAILURE

GENERAL

This code occurs only when the engine is running if the ignition module either does not receive a signal from the timing plate or receives an unexpected signal. The motorcycle may continue to run, run poorly, or stop running altogether.

1. Install Breakout Box HD-42682
2. Perform Wiggle Test (Engine Running).
3. Refer to appropriate section of Service Manual and job time code for operation.

Diagram:

- Install Breakout Box. Disconnect Connector [14].
- Ignition ON. Connect Voltmeter across Terminal A, R/W, and Terminal C B/KW wires of connector [14B]. Is voltage 5 ± 0.25 VDC?
  - YES: Reconnect the Cam Position Sensor, connector [14]. Using Breakout Box (GY) Measure voltage between Pin 3 and Pin 8 while cranking the engine. Is voltage 2-3 VDC?
  - NO: Intermittent Open in GN/W wire or short in BK/W, W/BK or R/W. Repair Intermittent.

- Check for continuity on GN/W wire between connector [14B] terminal B and [11B](GY) terminal 3. Continuity present?
  - YES: Repair Open in R/W wire or BK/W between connectors [11] and [14].
  - NO: Remove Timing Cover and CAM Position Sensor. Observe rotor cup while cranking engine. Does Rotor turn?

- Rotor attached properly?
  - NO: Repair.
  - YES: Check Rotor for Damage. Is Rotor Loose or Damaged?

- YES: Replace Rotor and Retest.
  - NO: Replace Cam Position Sensor Plate and Clear Code. Retest. Problem still exist?
    - YES: Replace Ignition Module.
    - NO: Locate and Repair R/W Short to Ground.

  - NO: Locate and Repair R/W Short to Voltage.
  - YES: Replace Ignition Module.

Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[14]</td>
<td>Cam Position Sensor</td>
<td>6 - Place Deutsch (BK)</td>
<td>Under Crankcase</td>
</tr>
</tbody>
</table>

B-30
GENERAL

This code occurs when the Bank Angle Sensor voltage is outside of the normal operating range. This may be caused by a short to ground, or voltage in the harness between the ignition module and the Bank Angle Sensor, or a failed Bank Angle Sensor. If this code occurs, the engine may stop running. The engine may still be restarted and ridden to the dealership for repair.

[Diagram of Bank Angle Sensor Circuit]

Disconnect connector [134]. Measure voltage on [134B] between Socket A, (LT GN/GY) and Socket B, (BK).

- 3.0-3.5 VDC
- 11-13 VDC
- 0 V

Repair Short to Voltage on LT GN/GY Wire.

Disconnect Connector [10] (BK) from Module and Plug into breakout box. Check Continuity Between Socket A, LT GN/GY on Connector [134B] and Breakout Box (BK) Pin 10. Is Continuity Present?

- YES
- NO

Check continuity to ground on BK wire, socket B, connector [134B]. Is continuity present?

- YES
- NO

Repair open in LT GN/GY wire.

Check continuity to ground on LT GN/GY wire, socket A, and connector [134B]. Is continuity present?

- YES
- NO

Repair open ground wire.

Repair short to ground on LT GN/GY wire.

Replace Ignition Module and Recheck for Codes

Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[14]</td>
<td>Cam Position Sensor</td>
<td>6 - Place Deutsch (BK)</td>
<td>Under Crankcase</td>
</tr>
</tbody>
</table>

1 See page B-7. Install Breakout Box HD-42682
Code 44, Bank Angle Sensor

3.0-3.5 VDC

Measure Voltage Between Socket C, GY, and Socket B, BK.
Is Voltage 11-13 VDC?

YES

Is Bank Angle Sensor Correctly Installed?

YES

Are Ferrous Metals Located Within 1/4" of Sides, Face, or Top of Bank Angle Sensor?

YES

Return to Original Configuration.

NO

NO

Replace Bank Angle Sensor.

NO

Install Properly

Repair Open in GY wire Between [134] and Harness

7972

7975
TROUBLE CODES 52, 54 and 55, IGNITION MODULE FAILURE

GENERAL

All of the following codes indicate an internal failure which requires replacement of the Ignition Module.

- Code 52 - RAM/ROM Failure
- Code 54 - EE PROM Failure
- Code 55 - Module Microprocessor Malfunction

# ELECTRICAL TROUBLESHOOTING - FUEL INJECTION

**SUBJECT** | **PAGE NO.**
---|---
INTRODUCTION | C-2
Checking for Trouble Codes | C-3
Retrieving Trouble Codes | C-5
Tools | C-9
Diagnosing System Problems | C-12
Diagnostic Check | C-16
CHART A-1, No Check Engine Lamp | C-18
CHART A-2, Check Engine Lamp On Continuously | C-21
CHART A-3, Engine Cranks But Will Not Start | C-23
CHART A-4, No ECM Power | C-27
CHART B-1, Fuel System Electrical Test | C-30
CHART B-2, Fuel Pressure Test | C-35
CHART C-1, Idle Speed Control | C-38
CHART C-2, Misfire at Idle or Under Load | C-40
TROUBLE CODE 11, Throttle Position Sensor | C-42
TROUBLE CODE 12, Barometric Pressure Sensor | C-44
TROUBLE CODE 14, Engine Temperature Sensor | C-46
TROUBLE CODE 15, Intake Air Temperature Sensor | C-48
TROUBLE CODE 16, Battery Voltage | C-50
TROUBLE CODES 23 and 32, Fuel Injector | C-52
TROUBLE CODES 24 and 25, Ignition Coil | C-55
TROUBLE CODE 33, Fuel Pump Relay | C-58
TROUBLE CODES 52, 53, 54 and 55, ECM Failure | C-60
TROUBLE CODE 56, Crank Position and Cam Position Sensor Timing | C-61
INTRODUCTION

GENERAL

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 bad starter, dead battery, etc., and assumes that all obvious checks are made - there is sufficient fuel in the tank, etc.

Poor Performance: The engine starts but there are performance problems, such as poor fuel economy, rough idle, engine misfire, engine hesitation, severe spark knock, etc.

Check Engine Lamp: The lamp indicates the existence of a fault condition. There may also be starting or performance problems.

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

- Checking for Trouble Codes (through observation of the Check Engine Lamp). See CHECKING FOR TROUBLE CODES, page C-3.
- Retrieving Trouble Codes (with the Scanalyzer or the Check Engine Lamp Diagnostics). See RETRIEVING TROUBLE CODES, page C-5.
- Diagnosing System Problems (with the use of the Diagnostic Flow Charts, Scanalyzer and other special tools). See TOOLS and DIAGNOSING SYSTEM PROBLEMS, pages C-9 and C-12, respectively.
- Correcting Problems through replacement and/or repair (see SECTION 9C, REMOVAL/REPLACEMENT in the 1998 FLT Service Manual).
- Validating Repairs (clearing trouble codes and confirming proper vehicle operation without recurrence of the fault condition, as indicated by the behavior of the Check Engine Lamp).
CHECKING FOR TROUBLE CODES

CHECK ENGINE LAMP

To diagnose system problems, start by observing the behavior of the Check Engine Lamp. See Figure C-1.

When the Ignition Switch is turned ON (Key ON) after being off for 10 seconds or more, the Check Engine Lamp will illuminate for approximately four seconds and then turn off.

NOTE

"Key ON" or Ignition Switch ON means that the Ignition/Light Key Switch is turned to IGNITION and the handlebar Engine Stop Switch is in the RUN position (although the engine is NOT running).

NOTE

If the Check Engine Lamp is not illuminated at Key ON or if it fails to go OFF after the initial four second ON period, then a problem exists in the lamp circuit. See CHARTS A-1 or A-2 under DIAGNOSING SYSTEM PROBLEMS.

When the lamp turns off after being illuminated for the first four second period, it will remain off if there are no fault conditions or trouble codes currently detected by the ECM. See A in Figure C-2.

If the Check Engine Lamp stays off for only 4 seconds and then comes back on for an 8 second period, then a functional error is stored (although no current trouble code exists). See B in Figure C-2. A functional error indicates an internal problem with the ECM (trouble codes 52 through 55) or with the crankshaft or camshaft sensors/timing (trouble code 56).

If the Check Engine Lamp remains on beyond the 8 second period, then a current trouble code exists. See C in Figure C-2.

NOTE

Trouble codes relating to the fuel injectors or the ignition coil can only be fully diagnosed during actuation. For example, a problem with an 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 a vehicle start sequence. In this manner, there may sometimes be a false indication of a current trouble code.

If a particular problem happens to resolve itself, the active status is dropped and it becomes a "historic," rather than a "current" fault. Historic trouble codes are stored for a length of time to assist in the diagnosis of intermittent faults. The Check Engine Lamp will not indicate the existence of only historic trouble codes.

While the trouble codes are stored (whether current, historic or functional), they can be read using either the Scanalyzer or the Check Engine Lamp Diagnostics. All trouble codes reside in the memory of the ECM until the code is cleared by use of the Scanalyzer or a total of 50 trips has elapsed. A "trip" consists of a start and run cycle, the run cycle lasting at least 30 seconds. After the 50 trip retention period, the trouble code is automatically erased from memory (that is, assuming no subsequent faults of the same type are detected in that period).

IMPORTANT NOTE

It is important to note that historic trouble codes may also be present whenever the system indicates the existence of a CURRENT fault. Always refer to your authorized Harley-Davidson dealer if multiple trouble codes are found.
Figure C-2. Check Engine Lamp Timing Diagram

Lamp OFF: No Current Trouble Code *

Lamp ON 8 Seconds: Functional Error **

Lamp Remains ON: Current Trouble Code *

* Historic Trouble Codes May Exist

** Trouble Codes 52-55, ECM Failure & 56, Crankshaft/Camshaft Timing
DATA LINK CONNECTOR

The behavior of the Check Engine Lamp as described under CHECKING FOR TROUBLE CODES indicates the existence of a fault condition. Turn the Ignition/Light Key Switch to OFF (FLHTC/U-I, FLTR-I) or LOCK (FLHRC-I) and proceed as follows:

DIAGNOSTIC MODES

The Electronic Fuel Injection (EFI) System provides two levels of system diagnostics.

In the more sophisticated mode, a portable Scan Tool called a "Scanalyzer" (HD-41325) plugs into the Data Link Connector and facilitates the diagnosis of system problems through a direct interface with the ECM. Using a special programmable application cartridge, the Scanalyzer offers data displays and menu selections that allow for quick and easy retrieval of data and enables the user to perform a variety of diagnostic tests while monitoring inputs and outputs. See Figure C-3.

At the second level, the Check Engine Lamp is observed by the user after being placed in the diagnostic mode. The lamp blinks a code which correlates to a particular problem area.

SCANALYZER

NOTE

All vehicles feature quick-release fasteners to facilitate saddlebag removal and installation.

1. Raise lid of right side saddlebag. To free saddlebag from mounting brackets on saddlebag support and frame, grasp ball wire inside saddlebag and rotate each stud a full 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. Remove saddlebag.

2. Gently pull side cover from frame downtubes (no tools required).

3. Note the Data Link connector (pin side of 4-place Deutsch) on the electrical bracket. See Figure C-4. Push connector up to disengage small end of slot on attachment clip from T-stud on bracket. Lift connector off T-stud.

4. Remove rubber protective plug from open end of Data Link connector.

5. Plug the Scanalyzer (HD-41325) into the Data Link Connector.

6. Turn the Ignition/Light Key Switch to IGNITION. Turn the handlebar mounted Engine Stop Switch to the RUN position (but do not start the engine).

7. Insert the diagnostic application cartridge into the Scanalyzer. During the next few seconds, the Scanalyzer sequences through a series of screens that reflect a power-on self test, the system copyright, and then an attempt at communications with the ECM. Once communications is established with the ECM, the Diagnostic Menu appears. See Figure C-5.

8. The Diagnostic Menu, which consists of seven items, is the primary system menu (main menu) through which all other secondary menus and displays are accessed. Since the screen may not be large enough to display all line items at any given time, use the up and down arrow keys to scroll through the list.

9. From the Diagnostic Menu, press the number “2” to access the Trouble Codes Menu. At this point, the unit allows the operator to display current trouble codes (by pressing the number “1”), display historic codes (number “2”) or clear trouble codes (number “3”). Unlike the Check Engine Lamp Diagnostics, note that the Scanalyzer does allow the operator to clear trouble codes from memory as well as differentiate between current and historic codes.

10. After reading trouble codes, simply press the Mode key to return to the Trouble Codes Menu. Press the Mode key again to return to the Diagnostic Menu. In this manner, regardless of where the operator is in the program, the Mode key need only be pressed once or twice to return to the main menu.
NOTE
For more detailed instructions, refer to the literature provided with the Scanalyzer.

11. Write down all trouble codes on a piece of paper. If a current trouble code exists, place it at the top of the list.

12. If trouble codes are present, reference the table shown in Figure C-8 to identify the source of the fault condition and then see the applicable flow chart under DIAGNOSING SYSTEM PROBLEMS. A Scanalyzer icon appears at those points in the flow chart where use of the Scanalyzer would be most convenient or desirable. If necessary, turn to Section 9C of the 1998 FLT Service Manual for removal and replacement procedures, as well as information on the location of all components.

13. If trouble codes are NOT present, but starting or drivability problems are evident, see the Symptoms Chart under DIAGNOSTIC CHECK, page C-17, and then refer to CHARTS A-1 thru C-2 for help in diagnosing system problems.

Figure C-5. Scanalyzer Menu Selections
14. After correcting system problems, clear trouble codes using the Trouble Codes Menu of the Scanalyzer.

    NOTE

    Trouble codes cannot be cleared while the engine is running. Turn the engine off, but leave the Ignition/Light Key Switch in the IGNITION position and return the handlebar Engine Stop Switch to RUN.

15. Turn the Ignition/Light Key Switch to OFF or LOCK. Turn the handlebar mounted Engine Stop Switch to the OFF position.

16. Unplug the Scanalyzer from the Data Link Connector. Install protective plug over pin side of Data Link Connector.

17. Place large end of slot on attachment clip over T-stud on electrical bracket. Push connector toward wire end to engage small end of slot.

18. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).

19. Position right side saddlebag on vehicle. Verify that molded rubber insert at bottom of saddlebag fits snugly on lower saddlebag support rail.

20. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.

21. Road test the vehicle and observe the Check Engine Lamp to confirm proper operation without the recurrence of trouble codes. See CHECKING FOR TROUBLE CODES, page C-3.

CHECK ENGINE LAMP DIAGNOSTICS

    NOTE

Use of the Check Engine Lamp Diagnostics assumes that the Scanalyzer (HD-41325) is not available.

1. To activate the diagnostic feature of the Check Engine Lamp, proceed as follows:

   a. Turn the Ignition/Light Key Switch to IGNITION for three seconds (one second pause after the fuel pump stops running), and then turn switch back to the OFF (FLHTCU-I, FLTR-I) or LOCK (FLHRC-I) position for three seconds.

   b. Repeat the instructions under step 1a. above.

   c. Turn the Ignition/Light Key Switch to IGNITION and wait approximately eight seconds for the Check Engine Lamp to start flashing. See Figure C-6.

2. All trouble codes are sent out as a series of flashes. See Figure C-7.

   The transmission of a trouble code is always preceded by a series of rapid flashes (about 3 per second). This "intermission" is followed by a 2 second pause in which the lamp is off. The lamp will then flash one or more times to indicate the first digit of the trouble code. The length of time the lamp is illuminated and the length of time in which it is off are each about 1 second in duration. Simply count the number of times the lamp flashes in order to retrieve the first digit of the trouble code.

3. Following transmission of the first digit, there is another 2 second pause in which the lamp is off. The lamp will then flash one or more times to indicate the second digit of the trouble code. Count the number of times the lamp flashes to retrieve the second digit.

Following transmission of the second digit, there is a third 2 second pause in which the lamp is off. After the pause comes the intermission, which is followed by transmission of the next recorded trouble code. All subsequent codes are sent in the same manner, each separated from the next by the intermission.
4. Write down the trouble codes on a piece of paper. Once all codes have been sent, the data string is repeated. When you have recorded the same trouble code twice, it is an indication that the transmission has been restarted and that all trouble codes have been retrieved.

**NOTE**

If the lamp flashes at a rate faster than normal, then you are observing the “Intermission” only, which means that no trouble codes are present.

5. If trouble codes are present, reference the table shown in Figure C-8 to identify the source of the fault condition and then see the applicable flow chart under DIAGNOSING SYSTEM PROBLEMS. If necessary, turn to Section 9C of the 1998 FLT Service Manual for removal and replacement procedures, as well as information on the location of all components.

If trouble codes are NOT present, but starting or driveability problems are evident, see the Symptoms Chart under DIAGNOSTIC CHECK, page C-17, and then refer to CHARTS A-1 thru C-2 for help in diagnosing system problems.

6. Turn the Ignition/Light Key Switch to OFF (FLHTC/U-I, FLTR-I) or LOCK (FLHRC-I). Wait 10 seconds for the ECM relay to click. Vehicle can now be started normally.

**IMPORTANT NOTE**

Engine operation is disabled when trouble codes are retrieved using the Check Engine Lamp Diagnostics. The Ignition/Light Key Switch must be turned to the OFF (FLHTC/U-I, FLTR-I) or LOCK (FLHRC-I) position for a minimum of 10 seconds before the engine can be started normally.

7. After correcting system problems, clear trouble codes. If the Scanalyzer is not available, perform 50 start and run cycles. To execute one run cycle, start the vehicle, let it run for at least 30 seconds and then turn the engine off for a minimum of 10 seconds.

8. Road test the vehicle and observe the Check Engine Lamp to confirm proper operation without the reoccurrence of trouble codes. See CHECKING FOR TROUBLE CODES, page C-3.

**MULTIPLE TROUBLE CODES**

The BARO, TP and CKP/CMP sensors are all connected to the same reference line (+5V Vref). If the line goes to ground or open, multiple trouble codes will be set, that is, trouble codes 11, 12 and 56.

Also, the fuel pump, fuel injectors and ignition coil all receive +12 volts from the fuel pump relay. If this line should go to ground or open, some or all trouble codes may be set, that is, codes 23, 24, 25, 32 and 33. Different combinations of these codes suggest a loss of power from the fuel pump relay to the respective device.

Start with the trouble code having the lowest numerical value and refer to the corresponding flow chart.
TOOLS

Part No. HD-23738A Mity-Vac Vacuum Gauge

Part No. HD-41182 Fuel Pressure Gauge

Part No. HD-26792 Spark Tester

Part No. HD-41182-1 Fuel Pressure Gauge Adapter

Part No. HD-34730-2C Fuel Injector Test Lamp

Part No. HD-41198 Breakout Box
Use with HD-39978.

Part No. HD-39978 Fluke 78 Multimeter (DVOM)
Use with HD-41198.

Part No. HD-41199-3 Idle Speed Control Actuator
Test Lamp
Part No. HD-41298 Fuel Tank Plugs

Part No. HD-41402 Ignition Coil Test Lamp

Part No. HD-41320 Fuel Injector Remover

Part No. HD-41404 EFI Harness Connector Test Kit

Part No. HD-41325 Scanalyzer

Part No. HD-41538 Check Valve Remover/Installer

Part No. HD-41325-95A Scanalyzer Diagnostic Application Cartridge Upgrade

Part No. HD-41771 Rotor Remover/Installer
TOOLS

Mity-Vac Vacuum Gauge (HD-23738A). A self-lubricating, maintenance-free, sealed, non-corrosive unit with a pumping rate of one cubic inch per stroke that easily attains a vacuum of 25 inches of mercury in just a few seconds. Used for testing the fuel pressure regulator and Barometric Pressure Sensor.

Spark Tester (HD-26792). Used to verify acceptable secondary voltage (25,000 volts) without removing the spark plug from the engine.

Fuel Injector Test Lamp (HD-34730-2C). Plugged directly into the harness connector, the test lamp flashes to confirm that voltage is being supplied to the fuel injector.

Fluke 78 Multimeter (HD-39978). Used with the Breakout Box to perform circuit diagnosis. Referred to as a “DVOM” throughout this document.

Fuel Pressure Gauge (HD-41182). Used with a special adapter, the gauge (0-100 PSI) allows for fuel injector and fuel system pressure diagnosis.

Fuel Pressure Gauge Adapter (HD-41182-1). The adapter allows the fuel pressure gauge to be attached to the external fuel supply line for fuel injector and fuel system pressure diagnosis.

Breakout Box (HD-41198). The unit plugs directly into the 35-place ECM connector to allow for circuit diagnosis of the wiring harness and connections without having to probe with sharp objects. Hooks in line so that the vehicle can be run during testing. Used with a DVOM, which is not included.

Idle Speed Control Actuator Test Lamp (HD-41199-3). Plugged directly into the harness connector, the test lamp flashes to confirm that proper voltage is being supplied to the ISC actuator.

Fuel Tank Plugs (HD-41298). Threaded plugs with nylon washers ensure that no leakage occurs when the fuel tank is removed for service.

Fuel Injector Remover (HD-41320). Enables the user to remove the fuel injectors from the induction module without damage to the plastic construction.

Scanalyzer (HD-41325). A portable unit that plugs directly into the Data Link Connector and facilitates the diagnosis of system problems through a direct interface with the ECM. Using a special programmable application cartridge, the Scanalyzer offers data displays and menu selections that allow for quick and easy retrieval of data and enables the user to perform a variety of diagnostic tests while monitoring inputs and outputs.

Scanalyzer Diagnostic Application Cartridge Upgrade (HD-41325-95A). Plugged into the Scanalyzer, the application cartridge is updated for use on 1998 and all earlier models.

Ignition Coil Test Lamp (HD-41402). Plugged directly into the harness connector, the test lamp flashes to confirm that voltage is being supplied to the ignition coil.

EFI Harness Connector Test Kit (HD-41404). Includes jumper wires and probe connectors for use with a DVOM (not included) to test connector and wiring harness integrity.

Check Valve Remover/Installer (HD-41538). Used to remove and install the supply and/or return check valves in the in-tank fuel fittings.

Rotor Remover/Installer (HD-41771). Since the laminated high-output rotor used on fuel injected vehicles (FLHRC-I excepted) contains magnets that are considerably more powerful than those found in the rotors of most carbureted models, the tool is required to prevent parts damage and possible personal injury during rotor removal and installation.

Flywheel Protective Cover (HD-42122). Install the cover on the left side flywheel cheek to prevent damage to the teeth during removal, installation and truing.
DIAGNOSING SYSTEM PROBLEMS

GENERAL

To locate faulty circuits or other system problems, follow the diagnostic flow charts in this section. For a systematic approach, always begin with the DIAGNOSTIC CHECK on page C-16. Read the General Information and then work your way through the chart box by box.

If a numbered circle appears adjacent to a 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.

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer may be used. If a number is printed next to the icon, then refer to the Scanalyzer Notes, which are similar to the Diagnostic Notes, but are restricted to information on the use of the Scanalyzer.

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 opposite each flow chart identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a Breakout Box (HD-41198) and a DVOM (HD-39978) are required. To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

As an introduction to these topics, see Breakout Box Installation below and then refer to the following table in conjunction with Figure C-10.

Breakout Box Installation

1. Raise lid of right side saddle bag. Grasp wire inside saddlebag and rotate each stud a full 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. Remove saddlebag.

2. Gently pull side cover from frame downtubes (no tools required).

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Models</th>
<th>Type</th>
<th>Location</th>
<th>Probe</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>Main Harness to Interconnect</td>
<td>FLHTCUU-I</td>
<td>12 - Place Deutsch</td>
<td>Inner Fairing (Front of Right Fairing Bracket)</td>
<td>Black</td>
</tr>
<tr>
<td>[6]</td>
<td>Main Harness to ECM Harness</td>
<td>All</td>
<td>8 - Place Deutsch</td>
<td>Inner Fairing (Below Radio)</td>
<td>Black</td>
</tr>
<tr>
<td>[14]</td>
<td>CMP Sensor</td>
<td>All</td>
<td>3 - Place Deutsch</td>
<td>Bottom Frame Cross Member (Right Side)</td>
<td>Black</td>
</tr>
<tr>
<td>[20]</td>
<td>Main Harness to Console</td>
<td>FLHRC-I</td>
<td>12 - Place Multilock</td>
<td>Under Left Side Cover</td>
<td>Gray Socket Probe Only</td>
</tr>
<tr>
<td>[22]</td>
<td>Interconnect to Right Handlebar</td>
<td>FLHRC-I</td>
<td>6 - Place Deutsch</td>
<td>Inside Headlamp Nacelle</td>
<td>Black</td>
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<tr>
<td>[78]</td>
<td>ECM</td>
<td>All</td>
<td>35 - Place Amp</td>
<td>Under Right Side Cover</td>
<td>Purple</td>
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<tr>
<td>[79]</td>
<td>CKP Sensor</td>
<td>All</td>
<td>3 - Place Connal</td>
<td>Under Right Side Cover Below Electrical Bracket</td>
<td>Brown</td>
</tr>
<tr>
<td>[80]</td>
<td>BARO Sensor</td>
<td>All</td>
<td>3 - Place Amp</td>
<td>Under Right Side Cover</td>
<td>Purple</td>
</tr>
<tr>
<td>[83]</td>
<td>Ignition Coil</td>
<td>All</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>Purple</td>
</tr>
<tr>
<td>[84]</td>
<td>Front Injector</td>
<td>All</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>Purple</td>
</tr>
<tr>
<td>[85]</td>
<td>Rear Injector</td>
<td>All</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>Purple</td>
</tr>
<tr>
<td>[86]</td>
<td>Fuel Pump</td>
<td>All</td>
<td>1 - Place Amp</td>
<td>Under Seat</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>[87]</td>
<td>ISC Actuator</td>
<td>All</td>
<td>4 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>Gray</td>
</tr>
<tr>
<td>[88]</td>
<td>TP Sensor</td>
<td>All</td>
<td>3 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>Gray</td>
</tr>
<tr>
<td>[89]</td>
<td>IAT Sensor</td>
<td>All</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>Gray</td>
</tr>
<tr>
<td>[90]</td>
<td>ET Sensor</td>
<td>All</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>Gray</td>
</tr>
<tr>
<td>[91]</td>
<td>Data Link</td>
<td>All</td>
<td>4 - Place Deutsch</td>
<td>Under Right Side Cover</td>
<td>Black</td>
</tr>
<tr>
<td>[108]</td>
<td>Interconnect to Tachometer</td>
<td>FLHTCUU-I</td>
<td>6 - Place Multilock</td>
<td>Inner Fairing (Above Radio)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>[108C, 108B]</td>
<td>Jumper Harness to interconnect</td>
<td></td>
<td>6 - Place Multilock</td>
<td>Inner Fairing (Below Radio)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>-</td>
<td>Electrical Relays</td>
<td>All</td>
<td>-</td>
<td>Under Seat</td>
<td>Red</td>
</tr>
<tr>
<td>-</td>
<td>Breakout Box</td>
<td>-</td>
<td>-</td>
<td></td>
<td>Purple</td>
</tr>
</tbody>
</table>
Figure C-9. Breakout Box Installation
Figure C-10. EFI Wire Harness Connectors
CAUTION
Always remove electrical bracket before disconnecting 35-place ECM connector. Removing connector with bracket installed may result in pin damage.

3. Remove two nuts to detach electrical bracket and ECM from studs on right side of battery box. Place assembly on rear footboard.

4. Pull back boot to reveal 35-place harness connector. Gently pull back spring lock on ECM to disengage locking tab on connector housing. Work that side of connector free. Disengage hook on opposite side of connector housing from hinge on ECM.

5. Remove mounting tabs on ECM from four boots anchored to electrical bracket. Reinstall electrical bracket on studs and start nuts.

6. Connect Breakout Box between EFI wire harness and ECM. See Figure C-9.

CAUTION
Do not disassemble the ECM connector or back probe wire leads to locate faulty circuits. Opening the sealed connector and/or piercing the wires will lead to corrosion and premature failure. Use a Breakout Box (HD-41198) with a DVOM (HD-39978) where necessary.

7. Wherever applicable, use the special probe tips and jumper wires provided with the EFI Harness Connector Test Kit (HD-41404). The probe tips, which are color coded for ease of identification, will prevent damage to the wire connector and Breakout Box terminals.

CAUTION
To prevent damage to the connector terminals and/or probe tips, proceed as follows:

- Use the proper color probe as shown in the table on page C-12.
- Insert the probe tip straight into the cavity and keep the probe stable during testing.
- Do not wiggle or move the probe tip once it has been inserted into the terminal.
- Do not insert more than one probe tip into any single terminal.
DIAGNOSTIC CHECK

GENERAL
The diagnostic check is an organized approach to identifying a problem caused by an electronic control system malfunction. If no problems are found after completion of the Diagnostic Check, a comparison of Scanalyzer parameters may be used to help locate intermittents and out-of-specification sensors. See TYPICAL SCAN VALUES table on page C-17.

If the Scanalyzer is not working properly, check operation on another vehicle. If OK, check Data Link Connector for 12 volts and proper ground. If Scanalyzer reads "No Response" with the Ignition Switch turned to ON (Engine Stop Switch at RUN with the engine off), check serial data wire for an open or short to ground between Data Link terminal "1" and ECM. Also check for an open diagnostic test terminal between Data Link terminal "3" and ECM. With Ignition Switch turned to ON, Transmit Data line should have between 11-12 volts and Receive Data line between 5-6 volts.

NOTE
If the Check Engine Lamp Diagnostics are used in lieu of the Scanalyzer, the ECM is placed in a Diagnostics Mode where the engine will not start. The Ignition/Light Key Switch must be turned to OFF (FLHTC/U-I, FLTR-I) or LOCK (FLHRC-I) for a minimum of 10 seconds before the engine can be started normally.

---

Figure C-12. Data Link Connector [91A]

Figure C-11. Electrical Bracket Assembly
DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. See Retrieving Trouble Codes, page C-5.
2. See Typical Scan Values Chart Below.

<table>
<thead>
<tr>
<th>TYPICAL SCAN VALUES</th>
<th>95-98 DOM</th>
<th>95-98 HDI</th>
<th>97-98 HDI</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPM 1000</td>
<td>1000</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISC 0 Steps</td>
<td>0 Steps</td>
<td>0 Steps</td>
<td>0 - 240 Steps</td>
<td></td>
</tr>
<tr>
<td>ET &gt; 284° F.</td>
<td>&gt; 140° C.</td>
<td>&gt; 140° C.</td>
<td>Ambient to 284° F.</td>
<td></td>
</tr>
<tr>
<td>ET 0.1 Volt</td>
<td>0.1 Volt</td>
<td>0.1 Volt</td>
<td>2.97 - 0.1 Volt</td>
<td></td>
</tr>
<tr>
<td>IAT Approx. 40° Above Ambient</td>
<td>Approx. 4° C. Above Ambient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IAT Approx. 1 Volt</td>
<td>Approx. 1 Volt</td>
<td>Approx. 1 Volt</td>
<td>Ambient to 158° F.</td>
<td></td>
</tr>
<tr>
<td>TP 3.1&quot; - 3.3&quot;</td>
<td>3.1&quot; - 3.3&quot;</td>
<td>3.1&quot; - 3.3&quot;</td>
<td>Idle - 88°</td>
<td></td>
</tr>
<tr>
<td>TP 0.35 - 0.41 Volt</td>
<td>0.35 - 0.41 Volt</td>
<td>0.35 - 0.41 Volt</td>
<td>0.275 - 0.47 Volt</td>
<td></td>
</tr>
<tr>
<td>INJ PW 3.5 - 4.1 mS</td>
<td>3.5 - 4.1 mS</td>
<td>3.0 - 3.5 mS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADVANCE 14&quot; - 16&quot;</td>
<td>14&quot; - 16&quot;</td>
<td>6&quot;</td>
<td>8&quot; - 44&quot;</td>
<td></td>
</tr>
<tr>
<td>BARO Ambient</td>
<td>Ambient</td>
<td>Ambient</td>
<td>3.0 - 4.8 Volts</td>
<td></td>
</tr>
<tr>
<td>BARO 29.8 in.Hg = 4.46 Volts</td>
<td>75.7 cm Hg = 4.46 Volts</td>
<td>75.7 cm Hg = 4.46 Volts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B+ 14 Volts</td>
<td>14 Volts</td>
<td>14 Volts</td>
<td>6.2 - 15.5 Volts</td>
<td></td>
</tr>
<tr>
<td>ENG RUN YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>IDLE/WOT YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>IDLE TRIM 128</td>
<td>128</td>
<td>128</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. See Symptoms Chart Below.

SYMPTOMS

- HESITATES, STUMBLING, SURGES, MISFIRES AND/OR SLUGGISH PERFORMANCE
  - Spark Plugs and/or Plug Wires. See CHART C-2, page C-40.
  - Improper Fuel Pressure. See CHART B-2, Fuel Pressure Test, page C-35.
  - Improper TPS Adjustment. See TROUBLE CODE 12, page C-44.
  - Manifold Leak. See TROUBLE CODE 12, page C-44.
  - Throttle Plates Not Opening Fully. See TROUBLE CODE 12, page C-44.
  - BARO Sensor Plugged or Not Operating Properly. See TROUBLE CODE 12, page C-44.
  - Water or Dirt in Fuel System. Drain and Refill With Fresh Fuel.

- ENGINE EXHAUST EMITS BLACK SMOKE OR FOULS PLUGS
  - Improper TPS Adjustment. See TROUBLE CODE 12, page C-44.
  - Leaky Injector(s). Remove air cleaner. With throttle wide open, turn Key ON for 2 seconds and then OFF for 2 seconds five consecutive times. Replace the fuel injector if there is any evidence of raw fuel in the bores. See the FLT Service Manual.
  - BARO Sensor Plugged or Not Operating Properly. See TROUBLE CODE 12, page C-44.
  - Improper Fuel Pressure. See CHART B-2, Fuel Pressure Test, page C-35.

4. Use Harness Connector Test Kit (HD-41404), black socket probe and patch cord.
5. Connect Breakout Box (HD-41198) to EFI wire harness only (leave ECM disconnected). See Breakout Box Installation, page C-12.
6. Touch meter probe to contact at top of fuse. See Figure C-13. If no power through the fuse, then fuse is blown. Probe the contact on the outboard side - if no power to the fuse, then look for a broken or damaged wire.

---

**WARNING:**

Never replace the fuel injectors alone - always replace the fuel injectors only if you find them to be the problem after following the troubleshooting procedures. Use the correct part numbers when replacing fuel injectors.

---

**Figure C-13. Probe 15 Amp Fuse**
GENERAL
When the Ignition Switch is turned to ON (Engine Stop Switch at RUN with the engine off), the Check Engine Lamp should illuminate for 4 seconds. Battery voltage is supplied to the lamp bulb. The lamp bulb is grounded by the ECM through the BK/Y wire. A lack of power to the ECM will cause the Check Engine Lamp to be inoperative and also create a no start situation.

DIAGNOSTIC TIPS
- Check for faulty lamp bulb.
- Check for open in BK/Y wire.

DIAGNOSTIC NOTES
The reference numbers below correlate with those on the diagnostic flow chart.

1. Connect Breakout Box (HD-41198) between EFI wire harness and ECM. See Breakout Box Installation, page C-12.
2. Use Harness Connector Test Kit (HD-41404), purple pin probe and patch cord. Look for slot in socket terminal of Breakout Box to insert pin blade.

4. Use Harness Connector Test Kit (HD-41404), black socket probe and patch cord.
5. Check continuity. If continuity present, then most likely short to voltage; if no continuity, then open.
7. Use Harness Connector Test Kit (HD-41404), black pin probe and patch cord.
8. Use Harness Connector Test Kit (HD-41404), gray socket probe and patch cord.
9. Use special pick (Snap-On Tool TT600-3) as described under Amp Multilock Electrical Connectors in Section D of this book.

Check Engine Lamp Circuit Diagram
Chart A-1, No Check Engine Lamp (2 of 2)

From CHART A-1, 1 of 2.

NO

FLHTCU-I and FLTR-I

5. Remove Outer Fairing. Disconnect Connector [1].
4. Ground BK/Y Wire on Connector [1A].
3. Check Engine Lamp ON?

YES

6. Repair Open or Short to Voltage on BK/Y Wire Between Connector [1] and Connector [8].

7140

NO

Disconnected Connector [108A]. Remove BK/Y Wire on Connector [108A]. Reconnect and Ground BK/Y Wire. Check Engine Lamp ON?

7140

YES

5. Repair Open or Short to Voltage on BK/Y Wire Between Connector [20A] and Connector [8].

7145

NO

7. Check for Faulty Bulb. Open on O/W Wire that Feeds Bulb or Open on Wire From Bulb to Connector [108A].

7145
The Check Engine Lamp should illuminate for 4 seconds when the Ignition Switch is turned to ON (with the Engine Stop Switch at RUN and the engine off). Following the initial period of illumination, the lamp should go off for 4 seconds. It may then come back on for an 8 second period (for a stored functional error) or remain on continuously (current error).

Battery voltage is supplied to the lamp bulb. The lamp bulb is grounded by the ECM through the BK/Y wire. A steady light may indicate a short to ground on the BK/Y wire.

**DIAGNOSTIC NOTES**

The reference numbers below correlate with those on the diagnostic flow chart.

2. If the lamp goes off when ECM connector is unplugged, BK/Y wire is not shorted to ground.
3. See Retrieving Trouble Codes, page C-5.
6. Use special pick (Snap-On Tool TT600-3) as described under Amp Multilock Electrical Connectors in Section D of this book.
Chart A-2, Check Engine Lamp On Continuously

1. Turn Ignition Switch OFF. Disconnect ECM Connector. Turn Ignition Switch ON. Check Engine Lamp Should be OFF. Is it?
   - YES: With Ignition Switch OFF, Reconnect ECM. With Ignition Switch ON, Verify That There is NOT a 4 Second Lamp OFF Period. Is There a Lamp OFF Period?
     - YES: Check Engine Lamp Function OK. Check for Trouble Codes.
     - NO: Replace ECM.

2. FLHTCU-I and FLTR-I
   - FLHTCU-I
     - Remove Outer Fairing, Disconnect Connector [1]. Check Engine Lamp ON?
       - YES: FLHRC-I
       - NO: Disconnect Connector [108]. Remove BK/Y Wire from Connector [108A]. Reconnect. Check Engine Lamp ON?
         - YES: Repair Short to Ground on BK/Y Wire Between Connector [1] and Connector [8].
         - NO: Repair Short to Ground on BK/Y Wire Between Connector [108A] and Connector [1].
   - FLTR-I
     - Repair Short to Ground on BK/Y Wire Between Connector [1] and Connector [8].

3. Repair Short to Ground on BK/Y Wire Between Connector [20B] and Lamp in Speedometer.

4. Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Models</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>Main Harness to Interconnect</td>
<td>FLHTCU-I</td>
<td>12 - Place Deutsch</td>
<td>Inner Fairing (Front of Right Fairing Bracket)</td>
</tr>
<tr>
<td>[8]</td>
<td>Main Harness to ECM Harness</td>
<td>FLTR-I</td>
<td>12 - Place Deutsch</td>
<td>Inner Fairing (Below Radio)</td>
</tr>
<tr>
<td>[20]</td>
<td>Main Harness to Console</td>
<td>FLHRC-I</td>
<td>12 - Place Multilock</td>
<td>Under Left Side Cover</td>
</tr>
<tr>
<td>[78]</td>
<td>ECM</td>
<td>All</td>
<td>35 - Place Amp</td>
<td>Under Right Side Cover</td>
</tr>
<tr>
<td>[108]</td>
<td>Interconnect to Tachometer</td>
<td>FLHTCU-I</td>
<td>6 - Place Multilock</td>
<td>Inner Fairing (Above Radio)</td>
</tr>
<tr>
<td>[108C, 108B]</td>
<td>Jumper Harness to Interconnect</td>
<td></td>
<td>6 - Place Multilock</td>
<td>Inner Fairing (Below Radio)</td>
</tr>
</tbody>
</table>
CHART A-3, ENGINE CRANKS BUT WILL NOT START

GENERAL

NOTE

If starter will not crank engine, the problem is not EFI related. Refer to Section 5 of the Service Manual, Electric Starter.

NOTE

Engine will not start if Diagnostics Test Lamp is installed or if Receive Data Line is grounded. Ignition/Light Key Switch must be turned to OFF for 10 seconds after test lamp is removed.

DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. See Retrieving Trouble Codes, page C-5.
3. Check the condition of the battery. Perform a hydrometer test and recharge if any cell is below 1.240. Check battery connections and perform load test. Replace the bat-
Chart A-3, Engine Cranks But Will Not Start (1 of 3)

1. Is Fresh Gasoline in Tank?
   - YES
   - NO

   2. Check for Trouble Codes. Codes Found?
      - YES
      - NO

      - YES
      - NO

   4. Check Battery Connections. Check Specific Gravity of Battery. Is Each Cell Above 1.260?
      - YES
      - NO

   5. Does Battery Pass Load Test?
      - YES
      - NO

      6. Recharge Battery.

   7. Turn Ignition Switch to ON and Engine Stop Switch to RUN. Did Fuel Pump Run for 2 Seconds and Check Engine Lamp Illuminate for 4 Seconds?
      - NO Pump/Light OK
        - See CHART B-1.
      - NO Light/Pump OK
        - See CHART A-1.

      - YES
      - NO

   9. Check Spark Plug Condition. Replace, If Fouled. Check Spark at Both Plugs While Cranking. Spark Present?
      - YES
      - NO

10. Disconnect Fuel Injector Connector and Attach Fuel Injector Test Lamp (HD-34730-2C). See Figure C-16. Crank Engine. Does Lamp Flash?
    - YES
    - NO

    - YES
    - NO

12. Check for Battery Voltage at Terminal 3 of Coil Connector (BEE) using DVM. Power Present During First 2 Seconds After Key ON?
    - YES
    - NO

From CHART A-3, 1 of 3.

**YES**

**NO**

Faulty Coil Connection, Spark Plug Wires or Coil.
Proceed as follows:
- Check Coil Connections.
- Test Spark Plug Cable Resistance. See Chart C-2, Spark Plug Cable Resistance Test, page C-40.
- Check Coil by Substituting One Known To Be Good

**OR**
Check Coil Resistance. See Troubleshooting, page C-57.

7220

At some point in the flow chart you may be instructed to jump directly to the box marked by an asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

**Figure C-18. Electrical Bracket Assembly**

**Figure C-19. CKP Sensor Connector [79A]**

**Figure C-20. Ignition Coil Connector [83B]**

* **Figure C-17. Ignition Coil Test Lamp (HD-41402)**

**Chart A-3, Engine Cranks But Will Not Start (2 of 3)**

**Fuse Holder**

**ECM Connector [78]** (Under Boot)

**CKP Sensor Connector [79]**

**ECM** (Under Electrical Bracket)

7225

7230

7235

**Wire Harness Connectors**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[14]</td>
<td>CMP Sensor</td>
<td>3 - Place Deutsch</td>
<td>Bottom Frame Cross Member (Right Side)</td>
</tr>
<tr>
<td>[78]</td>
<td>ECM</td>
<td>36 - Place Amp</td>
<td>Under Right Side Cover</td>
</tr>
<tr>
<td>[79]</td>
<td>CKP Sensor</td>
<td>3 - Place Conval</td>
<td>Under Right Side Cover Below Electrical Bracket</td>
</tr>
<tr>
<td>[83]</td>
<td>Ignition Coil</td>
<td>3 - Place Amp</td>
<td>Below Fuel Tank</td>
</tr>
</tbody>
</table>

C-25
Chart A-3, Engine Cranks But Will Not Start (3 of 3)

3. Use Harness Connector Test Kit (HD-41404), black pin probes and patch cords.
4. In a no spark situation, the Camshaft Position Sensor (CMP Sensor) may be at fault. The CMP Sensor incorporates a Vehicle Attitude Sensor, which opens the CMP circuit if the vehicle is tipped sideways at an angle greater than 80°. Uprighting the vehicle will reset the CMP Sensor.

From CHART A-3, 2 of 3.

With Ignition Switch ON and Engine Stop Switch at RUN, Is 4.8 - 5.2 Volts Present Between Terminal A (R/W, Positive) and Terminal C (BK/W, Negative) of Connector [14B]?

YES

YES

Rercheck Coil. Do Coil Test Lights Flash While Cranking?

YES

YES

Identify Intermittent and Repair Connection.

7226

NO

Reconnect CMP Sensor Connector [14]. While Cranking, Check for 5 Volts on ECM Pin 27 (Positive) and ECM Pin 34 (Negative) on Breakout Box. Voltage Should Alternate Between 0 and 6-10 VDC While Cranking. Does It?

7240

NO

Measure Resistance at Connector [14B] Terminal A (R/W Wire) to ECM Pin 14 on Breakout Box, and Also Between Connector [14B] Terminal C (BK/W Wire) and ECM Pin 16 on Breakout Box. Is Resistance Greater than 0.5 Ohm?

YES

Replace ECM.

7250

NO

Disconnect Connector [14]. Measure Resistance of GN/W Wire Between Connectors [14B] Terminal B and ECM Pin 27 on Breakout Box. Is Resistance Greater than 0.5 Ohm?

YES

Repair Open Connection.

7245

NO

With Engine Running, Wiggle CMP Sensor and CKP Sensor Wires to Identify Any Loose Connections (Engine Misfires or Stalls). Any Found?

YES

Crankshaft and Camshaft May Be Out of Phase. Check for Proper Cam Timing, Pinion Gear Key Failure, Loose Rotor Cup or Other Mechanical Failure.

7255

NO

With Ignition Switch ON and Engine Stop Switch at RUN, Is 4.8 - 5.2 Volts Present Between Terminal A (R/W, Positive) and Terminal C (BK/W, Negative) of Connector [14B]?

NO

Problem May Be Intermittent. Verify that Connectors [78] and [79] are Reconnected, Remove Breakout Box and Try to Start Vehicle. Will Vehicle Start?

YES

Repair.

7260

NO

Replace CMP Sensor.

7266

NO

Remove Cam Timer Cover Using 3/8 Inch Drill Bit Crank Starter. Does Rotor Cup Rotate?

YES

Mechanical Failure. Inspect for Loose Rotor Cup and Sheared Pinion Gear Key.

7255

NO
The ECM relay is turned on by grounding terminal 4 inside the ECM. This is done when the ECM sees power at terminal 26. When the Ignition Switch is turned OFF, the ECM keeps the relay latched on for approximately 10 seconds so that the ECM can reset the ISC actuator for the next start sequence. Also, to provide power for ECM RAM, the ECM relay continuously provides a small amount of current to the ECM whenever the Ignition Switch is turned OFF.

**DIAGNOSTIC NOTES**

The reference numbers which follow correlate with those on the diagnostic flow chart.

2. Connect Breakout Box (HD-41198) between EFI wire harness and ECM. See Breakout Box Installation, page C-12.
NOTE

With one exception (noted in flow chart), always turn Key ON with Engine Stop Switch at RUN prior to probing terminals with test lamp.

Chart A-4, No ECM Power (1 of 2)

1. Is the ECM Fuse OK?
   - YES
   - NO

   Ignition Switch ON. Probe ECM Terminal 26 on Breakout Box with Circuit Test Lamp Connected to Ground. Test Lamp Should be ON. Is it?
   - YES
   - NO

   Probe ECM Terminal 35 on Breakout Box with Test Lamp Connected to Ground. Test Lamp ON?
   - YES
   - NO

   - YES
   - NO

   Replace ECM.
   7305

2. Locate and Correct Short to Ground. Replace 5 Amp Fuse.

3. Replace ECM.
   7305

4. Repair Open Between ECM Relay Connector and ECM Connector [76].

5. Probe ECM Relay Terminal 30 (PK/BE Wire) with Test Lamp Connected to Ground. Test Lamp ON?
   - YES
   - NO

   Repair Open Between Connector [8] and Ground Post in Front of Battery (Right Side).
   7310

6. Probe ECM Relay Terminal 85 (GN/O Wire) with Test Lamp Connected to +12v (Battery Positive Terminal). Test Lamp ON?
   - YES
   - NO

   Replace ECM Relay.
   7323

7. Probe ECM Terminal 4 on Breakout Box with Test Lamp Connected to +12v (Battery Positive Terminal). Test Lamp ON?
   - YES
   - NO

   Repair Open in BE/GY Wire Between Fuse Holder and ECM Relay.
   7320

8. Probe Red Wire Terminal in 5 Amp Fuse Holder with Test Lamp Connected to Ground. Test Lamp ON?
   - YES
   - NO

   Repair Open in Red Wire Between 50 Amp Main Circuit Breaker and 5 Amp Fuse Holder.
   7320


Figure C-21. Fuse Holder

Figure C-22. Electrical Relays (Under Seat)
With the Ignition Switch ON (and the Engine Stop Switch at RUN), the ECM will energize the fuel pump 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. If there are no reference pulses, the ECM will de-energize the fuel pump relay within 2 seconds after ignition is on, or immediately after the engine is stopped.

The fuel pump delivers fuel to the induction module and injectors and then to the pressure regulator, where the system pressure is controlled. Excess fuel flow is bypassed back to the fuel tank. When the engine is stopped, the pump can be turned on by applying battery voltage to the fuel pump connector [86A] or by using the Scanalyzer (see Scanalyzer Notes). The fuel pump connector is located under the seat at the rear of the fuel tank. See Figure C-24. 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.

**DIAGNOSTIC NOTES**

The reference numbers below correlate with those on the diagnostic flow chart.

1. See Fuses, Removal, page 9-76 of the 1998 FLT Service Manual. If a fuse is blown, a short to ground is present between the fuse and fuel pump relay, between the fuel pump relay and fuel pump, coil or injectors, or the fuel pump itself may be the cause.

2. Locate fuel pump connector and separate pin and socket halves. See Figure C-24. Perform test to determine if the fuel pump circuit is being controlled by the ECM. ECM should energize fuel pump relay. Since engine is not cranking or running, ECM should de-energize relay within 2 seconds after ignition is turned on.

3. Turns on fuel pump if wiring is OK. If pump runs, problem is in basic fuel delivery.


5. This test will determine if short to ground on fuel pump relay circuit caused the fuse to blow. To prevent misdiagnosis, ensure that fuel pump is disconnected before proceeding with test.


**SCANALYZER NOTES**

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer may be used. If a number is printed next to the icon, then refer to the Scanalyzer Notes which follow.

With the engine off, Scanalyzer (Active Diagnostic Test Mode) can be used to turn fuel pump on for periods up to 30 seconds.
Chart B-1, Fuel System Electrical Test (1 of 3)

Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[13]</td>
<td>Fuel Gauge Sending Unit</td>
<td>2 - Place Multilock</td>
<td>Under Seat</td>
</tr>
<tr>
<td>[86]</td>
<td>Fuel Pump</td>
<td>1 - Place Amp</td>
<td>Under Seat</td>
</tr>
</tbody>
</table>

1. Inspect Fuel Pump Fuse. See Figure C-25. Is Fuse OK?
   - NO
     - Check for 12v at Fuel Pump Connector [86B]. During First 2-3 Seconds After Key ON. Is 12v Present?
   - NO
     - Go to CHART B-1, 3 of 3.
   - YES
     - Apply Battery Voltage to Pump Connector [96A]. See Figure C-24.
     - Listen at Fuel Tank for Pump Running.
     - Is Pump Running?
   - NO
     - Disconnect Fuel Pump Connector [86]. See Figure C-24.
     - Measure Resistance Between Connector [96A] and Ground. Resistance Should be Greater than 0.8 Ohms. Is It?
   - YES
     - Probe Fuel Pump Relay Connector Terminal 30 with Test Light to 12 Volts. Is Test Light ON?
     - NO
     - Pump in Tank or Wiring in Tank Is Shorted to Ground.
     - YES
     - Probe Fuel Pump Relay Connector Terminal 87 With Test Light to 12 Volts. Is Test Light ON?
     - NO
     - R/O Wire Shorted to Ground.
     - YES
     - Reconnect Fuel Pump Connector [86] and Install New Fuse. Turn Ignition ON, then Recheck Fuse. Is Fuse OK?
     - NO
     - Go to CHART B-1, 2 of 3.

2. Check for 12v at Fuel Pump Connector [86B]. During First 2-3 Seconds After Key ON. Is 12v Present?
   - NO
     - Check for Corroded Connections or Loose Connectors Between Fuel Pump and Pump Connector [86A]. Poor Connections?
     - YES
     - Replace In-Tank Fuel Pump.
     - 7335
     - NO
     - With Key OFF, Check for Open Pump Circuit. Connect Ohmmeter Between [86A] (Y/GN Wire) and [13A] (G wire) or Chassis Ground on FLHRC-1. Meter Should Read Continuity. Does It?
     - YES
     - Repair Short to Ground on Y/GN Wire.
     - 7355
     - NO
     - Reconnect Connectors One at a Time and Repeat Test With Test Light to Identify Defective Coil or Injector.
     - 7365

3. Apply Battery Voltage to Pump Connector [96A]. See Figure C-24.
   - YES
     - Probe Fuel Pump Relay Connector Terminal 30 with Test Light to 12 Volts. Is Test Light ON?
     - NO
     - Connectors One at a Time and Repeat Test With Test Light to Identify Defective Coil or Injector.
     - YES
     - Reconnect Fuel Pump Connector [86] and Install New Fuse. Turn Ignition ON, then Recheck Fuse. Is Fuse OK?
     - NO
     - Go to CHART B-1, 2 of 3.

4. Repair as Necessary.
   - 7335
   - Replace In-Tank Fuel Pump.
   - 7336

5. Remove Fuel Pump. Check for Continuity Across Fuel Pump Terminals. Meter Should Read Continuity. Does It?
   - YES
     - Check for Opens in Wiring.
     - 7340
     - NO
     - Replace Fuel Pump.
     - 7336

   - With Fuel System Intact and Battery Fully Charged, Disconnect Y/GN Wire from Canopy.
   - Connect DVM from Battery Positive to Pump Spade on Canopy. With the Pump Running, Check Current and Proper System Pressure. Is Current Draw Between 2.5-6.0 Amps? Is System Pressure Between (40-47 PSI)?
   - YES
     - Go to CHART B-1, 2 of 3.
   - NO
     - Current Too High.
     - Go to CHART B-1, 2 of 3.
     - NO
     - Current Too Low.
     - Check for Supply Line Leak (at Hoses and Filter Connections in Tank) or Poor Electrical Connection (Ground).
     - 7370
     - Incorrect Pressure. Current Draw in Range.
     - See CHART B-2.

NOTE
Since the position of the relays may be reversed, check the wire tags for positive identification.

Figure C-26. Electrical Relays (Under Seat)

ECM Power Relay
Fuel Pump Relay
DIAGNOSTIC NOTES (CONT’D)

The reference numbers below correlate with those on the diagnostic flow chart.

When the Ignition Switch is turned ON, the ECM will energize the fuel pump relay, which completes 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 crank position sensor and cam position sensor inputs. If there are no input signals, the ECM will de-energize the fuel pump relay within 2 seconds after ignition is ON, or the engine is stopped.

**WARNING**

To reduce the risk of vehicle fire and/or personal injury, always relieve fuel system pressure before servicing any fuel system components.

The reference numbers below correlate with those on the diagnostic flow chart.

12. Shake or wiggle harness between fuel pump relay and fuel pump connector [86B] while measuring resistance to detect intermittents.

13. Connect Breakout Box (HD-41198) between EFI wire harness and ECM. See Breakout Box Installation, page C-12.


**SCANALYZER NOTES**

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer may be used. If a number is printed next to the icon, then refer to the Scanalyzer Notes which follow.

With the engine off, Scanalyzer (Active Diagnostic Test Mode) can be used to turn fuel pump on for periods up to 30 seconds.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[86]</td>
<td>Fuel Pump</td>
<td>1 - Place Amp</td>
<td>Under Seat</td>
</tr>
</tbody>
</table>
CHART B-2, FUEL PRESSURE TEST

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 back to the fuel tank through the return line. The fuel pump wire harness connector [86] is located under the seat behind the fuel tank. See Figure C-27. The fuel pump can be turned on with the Scalyzer or by applying battery voltage to the connector [86].

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.

Fuel Pressure Test

The fuel pressure gauge (0-100 PSI) allows for fuel injector and fuel system pressure diagnosis. A special adapter allows the gauge to be attached to the external fuel supply line. Check the fuel system pressure as follows:

1. Remove the seat. See SEAT, REMOVAL in Section 2 of the Service Manual.

**WARNING**

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (43.5 psi). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before removing the plug in the supply line fitting. Inadequate safety precautions may result in personal injury and/or property damage.

2. Purge the fuel supply line of high pressure gas as follows:

![Figure C-27. Fuel Pump Connector (FLHTC/U-I Model Shown)](image)

![Figure C-28. Fuel Pressure Gauge (HD-41182) with Adapter (HD-41182-1)](image)

3. Wrap a shop towel around the fuel supply line fitting (left side of vehicle).

**WARNING**

A small amount of gasoline will drain from the fitting when the plug is removed. Thoroughly wipe up any split fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions may result in personal injury and/or property damage.

4. Position a beaker below the fitting. Holding the hex on the fitting with an open end wrench, use a 5/32 inch allen wrench to remove the plug.

5. Thread the Fuel Pressure Gauge Adapter (HD-41182-1) into the fitting. See Figure C-28. Hold the hex on the fuel tank fitting while tightening the adapter.

6. Verify that the fuel valve and air bleed petcock on the Fuel Pressure Gauge (HD-41182) are closed.
**WARNING**

A small amount of gasoline will drain from the adapter when the gauge is installed. Thoroughly wipe up any spilt fuel immediately. Dispose of rags in a suitable manner. Inadequate safety precautions may result in personal injury and/or property damage.

7. Remove the protective cap from the free end of the adapter. Thread the Fuel Pressure Gauge (HD-41182) onto the adapter.

8. Locate the one-place electrical connector [86] in front of the battery. Press the pin and socket halves together to connect the fuel pump to the main wiring harness.

9. Start and idle engine to pressurize the fuel system. Open the fuel valve to allow the flow of fuel down the hose of the pressure gauge. See Figure C-28.

10. Position the clear tube in the beaker and open and close the air bleed petcock to purge the gauge and hose of air. Repeat this step several times until only solid fuel (without bubbles) flows from the air bleed tube. Close the petcock.

11. Open throttle and rev engine. Note the reading of the pressure gauge. Fuel pressure should remain steady at 40-47 psi (280-325 kPa).

12. Turn the engine off. Open the air bleed petcock to relieve the fuel system pressure and purge the pressure gauge of gasoline.

13. Remove the pressure gauge from the adapter.

**WARNING**

A small amount of gasoline will drain from the fitting when the adapter is removed. Thoroughly wipe up any spilt fuel immediately. Dispose of rags in a suitable manner. Inadequate safety precautions may result in personal injury and/or property damage.

14. Holding the hex on the fuel tank fitting with an open end wrench, remove the adapter.

15. Apply a small amount of Hylomar or Liquid Teflon Pipe Sealant on the threads of the allen plug and install.


---

**DIAGNOSTIC NOTES**

The reference numbers below correlate with those on the diagnostic flow chart.

1. See Fuel Pressure Test on page C-35.

2. The application of 12-14 inches Hg vacuum to the pressure regulator should result in reduced fuel pressure. To facilitate installation of the Vacuum Pump (HD-23738A), first install a 6 inch length of thin-wall vacuum line onto the atmospheric pressure port. See Figure C-29.


4. If fuel system has pressure, but it is less than specification, condition may be caused by one of the following.
   - The amount of fuel to the injectors is OK, but pressure is too low. Also, hard starting cold and overall poor performance condition may exist.
   - Restricted fuel flow causing pressure drop. Normally, a vehicle with fuel pressure of less than 24 psi (170 kPa) at idle will not be driveable. However, if pressure drop occurs only while driving, engine may surge and lose power as pressure begins to drop rapidly.


7. This condition may be identified when the fuel level is low and the fuel pump is turned on for the first two seconds after Key On. A metallic ringing sound can be heard as the high pressure fuel is sprayed against the inside wall of the fuel tank.


Chart B-2, Fuel Pressure Test

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer may be used. If a number is printed next to the icon, then refer to the Scanalyzer Notes which follow.

With the engine off, Scanalyzer (Active Diagnostic Test Mode) can be used to turn fuel pump on for periods up to 30 seconds.

Figure C-29. Induction Module (Bottom View)
CHART C-1, IDLE SPEED CONTROL

NOTE
Warm idle speed is controlled by a screw. See Warm-Slow Idle Speed Adjustment procedure under Section 9C-4, Air Cleaner Assembly.

The ECM will control cold engine idle speed by moving the idle speed control lever to open or close the throttle plate. It does this by sending voltage pulses to the proper motor winding of the ISC actuator. This will cause the actuator shaft to move in or out of the actuator a given distance for each pulse received. The ISC position is measured in counts. This can be monitored on the Data Monitor Display of the Scanalyzer. A high number of counts is a fully extended pintel (high air flow), zero counts is a fully retracted pintel (minimal airflow). To increase idle speed, the ECM will send a signal to extend the throttle lever and allow more air to flow through the manifold. This will increase the ISC counts. To decrease idle speed the ECM will send a signal to retract the throttle lever to reduce airflow through the manifold. This will reduce the ISC counts to zero once the vehicle warms up.

Each time the ignition is turned on and then the ignition is turned off, the ECM will reset the ISC actuator. This is done by sending enough pulses to retract the throttle lever to the warm-idle position (zero counts). The fully retracted value is the ECM reference zero. A given number of counts are then calculated by the ECM. This is how the ECM knows what the actuator position is for a given temperature to obtain a proper idle speed.

DIAGNOSTIC NOTES
The reference numbers below correlate with those on the diagnostic chart.

2. When the engine is stopped, the ISC actuator retracts and then extends to a fixed "Park" position for increased airflow and idle speed during the next engine start sequence. This Key OFF reset procedure takes 8-10 seconds to perform.
4. At Key On, test lights will alternately flash and then remain steady on to confirm ECM signals. At Key Off, lights alternately flash and go out.
5. Connect Breakout Box (HD-41198) to EFI wire harness only (leave ECM disconnected). See Breakout Box Installation, page C-12.
6. Use Harness Connector Test Kit (HD-41404), gray pin probe and patch cord.
7. Turn the ignition ON and then OFF while placing a finger on the relay. An audible click will be heard or a sensation felt when the relay shuts off.
9. 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 on. Probe terminals to check for this condition.

DIAGNOSTIC TIPS
Engine idle speed can be adversely affected by the following:
- 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, Removal, page 9-105 of the 1998 FLT Service Manual. Then, with the throttle wide open, turn Key ON for 2 seconds and then 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, Removal/Installation, page 9-113 of the 1998 FLT Service Manual.)
- Vacuum leaks can affect idle. (To check for vacuum leaks, spray water around the Induction Module seals while idling the engine. If RPM changes, replace seals.)
- Contaminated fuel can adversely affect idle.
Chart C-1, Idle Speed Control

1. Remove Air Cleaner and Backplate Assembly.
2. Engine idling at Normal Operating Temperature.
3. Monitor ISC Actuator and Throttle Lever for 10 Seconds after you turn ignition OFF. Does Actuator retract and then extend during 8-10 Second Key OFF Reset Procedure?

YES

NO

Connect Scanalyzer and Monitor Engine Temperature While Performing Wiggle Test. Intermittent Found?

YES

NO

Repair Poor Connection.

Perform Warm/Slow and Cold Idle Speed Adjustment.

NOTE
The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer may be used.

Disconnect ISC Actuator and Connect Test Lamp (HD-41199-3) to ISC Connector [87B], See Figure C-31.

Turn Ignition Switch ON for 2 Seconds, then turn ignition Switch OFF.

One Or More Lights Out.

Lights Alternately Flash then Remain Steady after Key ON or Go Out during 8-10 Second Key OFF Reset Procedure (Normal).

Repair Faulty ISC Connection or ISC Actuator.

Remove Test Lamp (HD-41199-3).

Connect Breakout Box (HD-41198) to Connector [78B] leaving ECM Disconnected.

Using DVOM, measure resistance between connector [87B] and Breakout Box:

<table>
<thead>
<tr>
<th>ISC Connector</th>
<th>Wire Color</th>
<th>ECM Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>(BE/GN)</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>(BN/FL)</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>(BK/PK)</td>
<td>2T</td>
</tr>
<tr>
<td>D</td>
<td>(BK/O)</td>
<td>2</td>
</tr>
</tbody>
</table>

Each Wire Should be Less Than 0.5 Ohms. Is it?

YES

NO

Turn Ignition ON, With ECM Still Disconnected, Check for Voltage on all Terminals at Connector [87B]. Is Voltage Present?

YES

NO

Repair Poor Connection at Connectors [87B] or [78B], or Repair Open Wire in Harness.

Repair Short to Voltage.

Turn Ignition OFF. Measure resistance between each Terminal on Connector [87B] and Ground. Resistance Should Be Greater than 1 Megohm. Is it?

YES

NO

Remove Breakout Box and Connect ECM to EFI Harness, Check ECM Relay, Should Be ON for 10 Seconds after Key OFF. Is it?

YES

NO

Repair Short to Ground.

Inspect ECM Connections, Connections OK?

YES

NO

Refer to CHART A-4, ECM Relay.

Replace ECM.

Repair ECM Connections.

Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[78]</td>
<td>ECM</td>
<td>35 - Place Amp</td>
<td>Under Right Side Cover</td>
</tr>
<tr>
<td>[87]</td>
<td>ISC Actuator</td>
<td>4 - Place Packard</td>
<td>Below Fuel Tank</td>
</tr>
</tbody>
</table>
GENERAL
Battery condition and connections may also cause misfires. See Battery in Section 8 of the Service Manual for more information.

DIAGNOSTIC NOTES
The reference numbers below correlate with those on the diagnostic flow chart.

WARNING
Any open spark around gasoline or other combustibles may result in fire or explosion causing personal injury and/or property damage. Thoroughly wipe up any spilled fuel and dispose of rags in a suitable manner.

A Spark Tester (HD-26792) must be used to verify adequate available secondary voltage at the spark plug (25,000 volts). Remove spark plug cable from spark plug. Visually check condition of plug. Attach cable to Spark Tester (HD-26792). Clip tester to cylinder head bolt. While cranking engine, look for spark. Repeat procedure on other spark plug cable.

1. Turn Ignition Switch to OFF.
2. Disconnect One Spark Plug Lead at a Time and Install Spark Tester (HD-26792). See Figure C-33.
3. Crank Engine to Induce Spark. Observe Spark Tester During Test.
4. Spark Should Jump Tester Gap on Both Leads During Test. Did It?

Check For:
• Faulty, Worn or Cracked Spark Plug(s).
• Plug Fouling Due to Engine Mechanical Fault.
• Faulty or Poor Connection at Plug.

NOTE
Fuel system problems may also cause misfires. Refer to CHART B-2. If fuel pressure is within range, see SYMPTOMS chart on page C-17.

752A

Figure C-33. Spark Tester (HD-26792)
Chart C-2, Misfire At Idle Or Under Load (2 of 2)

Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[83]</td>
<td>Ignition Coil</td>
<td>3 - Place Amp</td>
<td>Below Fuel Tank</td>
</tr>
</tbody>
</table>

   - **NO**
   - Repeat Voltage Drop Test After Moving Negative Lead to Terminal 87. With Engine Running, Voltage Drop Should Be Less Than 1 Volt. Is It?
     - **NO**
     - Repeat Voltage Drop Test After Moving Negative Lead to 15 Amp Fuse (R/O Wire). With Engine Running, Voltage Drop Should Be Less Than 1 Volt. Is It?
       - **NO**
       - Replace 15 Amp Fuse
         - **YES**
         - Check Terminal or Replace Circuit Breaker
           - **YES**
           - Repeat Voltage Drop Test After Moving Negative Lead to Wire Between Main Circuit Breaker and Starter Motor. With Engine Running, Voltage Drop Should Be Less Than 1 Volt. Is It?
             - **YES**
             - Repair Wire Between Main Circuit Breaker and Starter Motor.
               - **NO**
               - Repair or Replace Battery Cable.
                 - **YES**
   - **YES**
   - Find Source of Intermittent and Repair.

Reassemble Coil and Fuel Tank. Measure Voltage Drop Between Battery (Positive Lead) and Terminal 30 (Negative Lead) on Fuel Pump Relay With Engine Running. Voltage Drop Should Be Less Than 1 Volt. Is It?
- **NO**
- Problem Fuel Related. Refer to Diagnostic Symptoms on page C-17.
- **YES**

**Figure C-34. Ignition Coil Connector [83B]**

**Figure C-35. Fuse Holder**
TROUBLE CODE 11, THROTTLE POSITION SENSOR

GENERAL

The Throttle Position Sensor (TP Sensor) is supplied 5 volts from the ECM (5v REF) and sends a signal back to the ECM (TP Sensor Signal) which varies according to throttle position. The output signal from the TP Sensor varies from 0.2-0.4 volts at idle (closed throttle) to 4.6-4.9 volts at wide open throttle. A Code 11 will set if the TP Sensor signal voltage does not fall within the acceptable range.

DIAGNOSTIC TIPS

The Scanalyzer or DVOM reads throttle position in volts (the Scanalyzer can also read throttle position as a percentage of throttle opening). Voltage should increase at a steady rate as throttle is moved from idle to wide open throttle. An open or short to ground in R/W or GY/V wires will also result in a Code 11. A short to ground on R/W wire (5v REF) will set multiple codes.

Check for the following conditions:

- Poor Connection - Inspect ECM 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 Wiggle Test to Locate Intermittents - If connections and harness check out OK, monitor TP Sensor voltage using a Scanalyzer or DVOM while moving related connectors and wiring harness. If the failure is induced, the TP Sensor display will change.

- TP Sensor Scaling - Observe the TP Sensor voltage display while opening the throttle with engine stopped and Ignition Switch ON. Display should vary from closed throttle TP Sensor voltage (when throttle is closed) to greater than 4.5 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.

DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. Connect Breakout Box (HD-41198) between EFI wire harness and ECM. See Breakout Box Installation, page C-12.


3. Shake or wiggle harness with DVOM or Scanalyzer connected. Radical voltage changes on the DVOM will indicate the presence of intermittents, while the Scanalyzer (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. If a current trouble code is present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear trouble codes and then perform wiggle test with vehicle running.

---

Throttle Position Sensor Circuit Diagram
Code 11, Throttle Position Sensor

1. With Ignition Switch ON, Gradually Open Throttle While Observing Voltage (Using DVOM) Across Pin 30 (+) and Pin 16 (-) on Breakout Box or observe Scannalyzer Voltage Values (Data Monitor Mode). Does Voltage Steadily Increase with No Spikes or Low Voltages Observed, from 0.2 - 0.4 Volts at Idle (Closed Throttle) to 4.6 - 4.95 Volts at Wide Open Throttle?

   YES

   CHECK ENGINE LAMP ON Continuously and CODE 11 Only One Set?

   YES

   2. Replace ECM. 7555

   NO

   With DVOM or Scannalyzer (Wiggler Test Mode) Still Connected, Check for Intermittents by Performing "Wiggler" Test. Radical Voltage Changes or Trouble Code Set While Wiggling Harness Will Indicate the Presence of Intermittents. Intermittent Present?

   YES

   Measure Resistance Between ECV Pin 30 on Breakout Box and TP Sensor Connector [88B] Terminal C. Is Resistance Less Than 0.5 Ohm?

   YES

   Replace TP Sensor. Clear Codes if Scannalyzer is Available and Road Test. Did Check Engine Lamp Come On and Set CODE 11?

   YES

   Install Original TP Sensor, Replace ECM and Road Test Again to Verify.

   NO

   System Now OK. 7560

   NO

   Replacement TP Sensor, Clear Codes if Scannalyzer is Available and Road Test. Did Check Engine Lamp Come On and Set CODE 11?

   YES

   NO


   YES

   Repair Open GYV Signal Wire. 7580

   NO

   Measure Resistance from TP Sensor Connector [88B] Terminal C to GYV Signal Wire. Is Resistance Less Than 1 Megohm?

   YES

   Replace TP Sensor. 7590

   NO

   Repair Short Between R/W and GYV Signal Wire. 7585

   NO

   Measure Resistance from TP Sensor Connector [88B] Terminal B to ECM Pin 14 on Breakout Box. Is Resistance Less Than 1 Ohm?

   YES

   Repair Open in R/W Wire. 7610

   NO

   Repair Open in R/W Wire. 7615

   NO

   At some point in the flow chart you may be instructed to jump directly to the box marked by an asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

Wire Harness Connectors

<table>
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<td>[78]</td>
<td>ECM</td>
<td>35 - Place Amp</td>
<td>Under Right Side Cover</td>
</tr>
<tr>
<td>[88]</td>
<td>TP Sensor</td>
<td>3 - Place Packard</td>
<td>Below Fuel Tank</td>
</tr>
</tbody>
</table>

NOTE

The Scannalyzer icon appears at those points in the flow chart where the Scannalyzer may be used.

Figure C-36.TP Sensor Connector [88B]

Clear Codes and Confirm Proper Operation with No Check Engine Lamp.
TROUBLE CODE 12, BAROMETRIC PRESSURE SENSOR

The Barometric Pressure Sensor (BARO Sensor) is supplied 5 volts from the ECM and sends a signal back to the ECM which varies in accordance with atmospheric barometric pressure. Changes in barometric pressure are influenced by weather and altitude. For example, the output signal from the BARO Sensor will vary from about 3 volts at an altitude of 13,000 ft. (low pressure) to about 4-4.8 volts at sea level (high pressure).

**DIAGNOSTIC TIPS**

- Code 12 will set if the BARO Sensor signal is out of range.
- With the BARO Sensor disconnected, the ECM and Scanalyzer should recognize a low voltage. If low voltage is observed, the ECM and harness are not at fault.
- Gently place a jumper wire across BARO Sensor connector [80B] terminals 1 and 3 using Harness Connector Test Kit (HD-41404), purple male probes and patch cord. With the BARO Sensor connector jumper in place, the ECM and Scanalyzer should recognize a high voltage. If high voltage is observed and connector terminal 2 has a resistance of less than 1 ohm to ground, the ECM and harness are not at fault.
- BARO Sensor Output Check. Using the vacuum pump (HD-23738A), apply a vacuum to the atmospheric pressure port of the BARO Sensor (see Figure C-37). The signal voltage/pressure should lower as the vacuum is applied.

**DIAGNOSTIC NOTES**

The reference numbers below correlate with those on the diagnostic flow chart.

1. Connect Breakout Box (HD-41198) between EFI wire harness and ECM. See Breakout Box Installation, page C-12.

2. Shake or wiggle harness with DVOM or Scanalyzer connected. Radical voltage changes on the DVOM will indicate the presence of intermittents, while the Scanalyzer (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. (If a current trouble code is present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear trouble codes and then perform wiggle test with vehicle running.)

### NOTE

All voltage values are approximate and influenced by barometric pressure.

<table>
<thead>
<tr>
<th>Barometric Pressure Sensor Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude (M)</td>
</tr>
<tr>
<td>Below 305</td>
</tr>
<tr>
<td>305-610</td>
</tr>
<tr>
<td>610-914</td>
</tr>
<tr>
<td>914-1219</td>
</tr>
<tr>
<td>1219-1524</td>
</tr>
<tr>
<td>1524-1829</td>
</tr>
<tr>
<td>1829-2134</td>
</tr>
<tr>
<td>2134-2438</td>
</tr>
<tr>
<td>2438-2743</td>
</tr>
<tr>
<td>2743-3048</td>
</tr>
<tr>
<td>3048-3353</td>
</tr>
<tr>
<td>3353-3658</td>
</tr>
<tr>
<td>3658-3962</td>
</tr>
</tbody>
</table>

Low Altitude = High Pressure = High Voltage

---

Barometric Pressure Sensor Circuit Diagram

---

C-44
Code 12, Barometric Pressure Sensor

1. With the Ignition Switch ON (or the Engine Running), Measure the Voltage Between ECM Pin 32 (+) and ECM Pin 16 (-) on Breakout Box or Observe Scanalyzer Voltage Values (Data Monitor Mode). Is the Voltage Between 2.7 and 4.96 Volts?

2. With DVOM or Scanalyzer (Wiggle Test Mode) Still Connected, Check for Intermittents by Performing "Wiggle" Test. Radical Voltage Changes or Trouble Code Set While Wiggling Harness Will Indicate the Presence of Intermittents. Intermittent Present?

3. Replace BARO Sensor. Clear Codes if Scanalyzer is Available and Road Test. Did Check Engine Lamp Come On and Set CODE 12?

4. System Now OK

* At some point in the flow chart you may be instructed to jump directly to the box marked by an asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

5. Check the 5v Reference Supply at the BARO Sensor Connector [80B]. Using the DVOM, Measure the Voltage Between Pin 3 (VREF) and Pin 2 (Sensor Ground) with the Ignition ON. Is the Voltage Approximately 5v?

6. Check BARO Signal Line for Open or Short. Disconnect ECM from Breakout Box. OPEN CHECK: Measure Resistance Between BARO Connector [80B] Terminal 1 and ECM Pin 32 on Breakout Box. Is Resistance Less Than 1 Ohm?

7. Locate Short to 12 Volts on R/W Wire in Wire Harness. Repair as Necessary.


9. SHORT (to Ground) CHECK: Measure Resistance Between BARO Connector Terminal 3 and Chassis Ground. Is Resistance Greater Than 1 Megohm?

10. Replace Sensor.

Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[80]</td>
<td>BARO Sensor</td>
<td>3 - Place Amp</td>
<td>Under Right Side Cover</td>
</tr>
</tbody>
</table>

Figure C-37. BARO Sensor

Figure C-38. BARO Sensor Connector [80B]

Clear Codes and Confirm Proper Operation with No Check Engine Lamp.
TROUBLE CODE 14, ENGINE TEMPERATURE SENSOR

The ECM supplies and monitors a 5 volt signal (Pin 13) to one side of the Engine Temperature Sensor (ET Sensor). The other side of the ET Sensor is connected to a common sensor ground, which is also connected to the ECM (Pin 16).

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 supplied voltage (Pin 13). At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on Pin 13. Conversely, at low temperatures, the resistance is very high, allowing the voltage to rise close to the supplied voltage of 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 ISC actuator position.

DIAGNOSTIC TIPS

The Scanalyzer displays engine temperature in degrees. Once the engine is started, the temperature should rise steadily.

An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation.

Check the following conditions:

- Poor Connection - Inspect ECM harness connector [78] for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.

- Shifted Sensor - The Temperature-to-Resistance Values 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.

DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. Connect Breakout Box (HD-41198) to EFI wire harness only (leave ECM disconnected). See Breakout Box Installation, page C-12.

NOTE

All voltage and resistance values are approximate (+/- 20%).

<table>
<thead>
<tr>
<th>Engine Temperature Sensor Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp. °C</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>-10</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>90</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>110</td>
</tr>
</tbody>
</table>

Engine Temperature Sensor is Measured Between Terminal 13 and System Ground (Terminal 16)

2. Shake or wiggle harness with DVOM or Scanalyzer connected. Radical voltage changes on the DVOM will indicate the presence of intermittents, while the Scanalyzer (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. (If a current trouble code is present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear trouble codes and then perform wiggle test with vehicle running.)

Code 14, Engine Temperature Sensor


Use Harness Connector Test Kit (HD-41404), gray pin probes and patch cord.

Use Harness Connector Test Kit (HD-41404), gray socket probes and patch cord.

* At some point in the flow chart you may be instructed to jump directly to the boxes marked by an asterisk. Disregard the asterisks (but not the instruction boxes) if your normal progression through the chart brings you to this location.

Figure C-39. ET Sensor Connector [90B]

Connect Breakout Box (HD-41196) to Connector [78B] Leaving ECM Disconnected. With Engine at Room Temperature (60° - 90° F), Use a DVM to Measure the Resistance Across Pins 13 and 16 on Breakout Box. Is the Resistance Between 1.4k Ohms and 6.9k Ohms?

NOTE
If Engine has Not Been Operated for a Minimum of 4 Hours, the Measured Resistance Should be Very Close to the Measured Resistance Across the IAT Sensor, which is Pins 31 and 16 on Breakout Box. Scantalyzer Values (Data Monitor Mode) Will be Approximately the Same if Code is Historic. Current Code Will Read Default Value.

YES

NO

Disconnect ET Sensor Connector [90B] and Examine for Damage. Connector OK?

YES

NO

Repair Connector. 7695

Using a DVM, Measure the Resistance Between ET Sensor Connector [90B] Terminal A and ECM Pin 13 on Breakout Box. Is it Less Than 1.0 Ohm?

YES

NO

Examine PK/Y Wire in Harness for Open Circuit and Repair. 7695

Using a DVM, Measure the Resistance Between ET Sensor Connector [90B] Terminal B and ECM Pin 16 on Breakout Box. Is it Less Than 1.0 Ohm?

YES

NO

Examine PK/Y Wire in Harness for Open Circuit and Repair. 7695

Using a DVM, Measure the Resistance Between ECM Pins 13 and 16 on Breakout Box. Is it Greater Than 1.0 Megohm?

YES

NO

Examine BK/W Wire in Harness for Open Circuit and Repair. 7695

Using a DVM, Measure the Resistance Between ECM Pins 13 and 34 on Breakout Box. Is Resistance Less Than 1 Megohm?

YES

NO

Examine ET Signal Wire (PK/Y) for Short to Voltage and Repair. 7695

With ET Sensor Disconnected. Disconnect ECM Connector [78B]. Measure Resistance Between ECM Pins 13 and 34 on Breakout Box. Is the Voltage 0 Volts?

YES

NO

Replace ECM. 7680

Replace ECM. 7685

NO Greater Than 5.5 Volts.

Figure C-40. ET Sensor

Clear Codes and Confirm Proper Operation with No Check Engine Lamp.
TROUBLE CODE 15, INTAKE AIR TEMPERATURE SENSOR

The ECM supplies and monitors a 5 volt signal (Pin 31) to one side of the Intake Air Temperature Sensor (IAT Sensor). The other side of the IAT Sensor is connected to a common sensor ground, which is also connected to the ECM (Pin 16).

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 supplied voltage (Pin 31). At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on Pin 31. Conversely, at low temperatures, the resistance is very high, allowing the voltage to rise close to the supplied voltage of 5 volts.

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

DIAGNOSTIC TIPS

The Scanalyzer displays intake air temperature in degrees.

An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation.

Check the following conditions:

- Poor Connection - Inspect ECM 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 Wiggle Test to Locate Intermittents - If connections and harness check out OK, use the Scanalyzer to check the intake air temperature reading while moving related connectors and wiring harness. If the failure is induced, the intake air temperature display will change.

- Shifted Sensor - The Temperature-to-Resistance Values table may be used to test the intake air 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.

DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

### Intake Air Temperature Sensor Table

<table>
<thead>
<tr>
<th>Temp. °C</th>
<th>Resistance</th>
<th>Voltage</th>
<th>Temp. °F</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40</td>
<td>10950</td>
<td>4.9</td>
<td>-40</td>
</tr>
<tr>
<td>-30</td>
<td>53100</td>
<td>4.8</td>
<td>-22</td>
</tr>
<tr>
<td>-20</td>
<td>29121</td>
<td>4.7</td>
<td>-4</td>
</tr>
<tr>
<td>-10</td>
<td>16599</td>
<td>4.5</td>
<td>14</td>
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<td>0</td>
<td>9750</td>
<td>4.2</td>
<td>32</td>
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<tr>
<td>10</td>
<td>5970</td>
<td>3.8</td>
<td>50</td>
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<tr>
<td>20</td>
<td>3747</td>
<td>3.3</td>
<td>68</td>
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<td>25</td>
<td>3000</td>
<td>3.0</td>
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<td>2417</td>
<td>2.7</td>
<td>86</td>
</tr>
<tr>
<td>40</td>
<td>1598</td>
<td>2.2</td>
<td>104</td>
</tr>
<tr>
<td>50</td>
<td>1080</td>
<td>1.8</td>
<td>122</td>
</tr>
<tr>
<td>60</td>
<td>746</td>
<td>1.4</td>
<td>140</td>
</tr>
<tr>
<td>70</td>
<td>526</td>
<td>1.0</td>
<td>158</td>
</tr>
</tbody>
</table>

**NOTE**

All voltage and resistance values are approximate (+/- 20%).

---

1. Connect Breakout Box (HD-41198) to EFI wire harness only (leave ECM disconnected). See Breakout Box Installation, page C-12.

2. Shake or wiggle harness with DVOM or Scanalyzer connected. Radical voltage changes on the DVOM will indicate the presence of intermittents, while the Scanalyzer (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. (If a current trouble code is present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear...
Code 15, Intake Air Temperature Sensor

1. Check Breakout Box (HD-41198) to Connector [78B]. Leaking ECM Disconnect. With Engine at Room Temperature (80° - 90° F), use a DVM to Measure the Resistance Across Pins 31 and 16 on Breakout Box. Is the Resistance Between 1.4k Ohms and 6.9k Ohms?

NOTE
If Engine has Not Been Operated for a Minimum of 4 Hours, the Measured Resistance Should Be Very Close to the Measured Resistance Across the ET Sensor, which is Pins 13 and 16 on Breakout Box. Scancalyzer Values (Data Monitor Mode) Will Be Approximately the Same If Code Is Historic. Current Code Will Read Default Value.

2. Connect ECM to Breakout Box. With DVOM or Scancalyzer (Wiggle Test Mode) Still Connected, Check for Intermittents by Performing "Wiggle" Test. Radical Voltage Changes or Trouble Code Set While Wiggling Harness Indicate the Presence of Intermittents. Intermittent Present?


4. Disconnect IAT Sensor Connector [89B]. Turn Ignition Switch ON. Using a DVOM, Measure the Voltage Between ECM Pins 31 (Positive) and 16 (Negative) on Breakout Box. Is the Voltage Approximately 5 Volts?

5. With IAT Sensor Disconnected. Disconnect ECM Connector [78B], Measure Resistance Between ECM Pins 31 and 34 on Breakout Box. Is Resistance Less Than 1 Megohm?

6. Unplug ECM Leaving Breakout Box Connected at Vehicle Harness. Measure Voltage Between ECM Pins 31 and 34 on Breakout Box. Is the Voltage 0 Volts?

7. Install Original IAT Sensor, Replace ECM and Road Test.

At some point in the flow chart you may be instructed to jump directly to the boxes marked by an asterisk. Disregard the asterisks (but not the instruction boxes) if your normal progression through the chart brings you to this location.

Clear Codes and Confirm Proper Operation with No Check Engine Lamp.

Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[78]</td>
<td>ECM</td>
<td>35 - Place Amp</td>
<td>Under Right Side Cover</td>
</tr>
<tr>
<td>[89]</td>
<td>IAT Sensor</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
</tr>
</tbody>
</table>

C-49
TROUBLE CODE 16, BATTERY VOLTAGE

A Code 16 is set if the ECM sees battery positive voltage less than 6.2 or greater than 15.5 volts. A low voltage condition typically occurs during activation of the starter or generally indicates loose wire connections. A high voltage condition is usually caused by a faulty voltage regulator.

**DIAGNOSTIC NOTES**

The reference numbers below correlate with those on the diagnostic flow chart.

2. Connect Breakout Box (HD-41198) between EFI wire harness and ECM. See Breakout Box Installation, page C-12.
3. The ECM is monitoring voltage at ECM connector terminal 35.
4. This checks for voltage drops in the ECM power circuit. If a significant voltage drop is not present, condition may be caused by excessive starter current draw.

---

Battery Voltage Circuit Diagram

---

Code 16, Battery Voltage Test

Was Battery Allowed to Discharge? Was Battery Drawn Down by Starting Problem?

- NO
  - Charge Battery and Diagnose Problem.

1. Perform Charging System Tests. Charging System OK?
   - NO
     - Repair Charging System.
   - YES
     - Remove Spark Plug Cables From Spark Plugs. Measure Voltage at ECM Pin 35 (Positive) and Pin 34 (Negative) on Breakout Box While Cranking Engine. Disregard Reading During First 2 Seconds of Cranking. Is Voltage Above 5.2 Volts?

2. With Key ON, Measure Voltage Drop Between Battery Positive Terminal and ECM Pin 35 on Breakout Box. Is Voltage Drop Greater than 0.5 Volt?
   - NO
     - With Key ON, Measure Voltage Drop Between Battery Negative Terminal and Main Ground. Is Voltage Drop Greater than 0.5 Volt?
   - YES
     - Measure Voltage Drop Between Battery Positive Terminal (+) and Terminal 87 (-) on ECM Power Relay With Key ON. Is Voltage Drop Greater than 0.5 Volt?

3. With Key ON, Measure Voltage Drop Between Battery Positive Terminal (+) and Silver Post on Main Circuit Breaker (-) With Key ON. Is Voltage Drop Greater than 0.5 Volt?
   - NO
     - Check for Charred Regulator Wire, Poor Connections or Faulty Main Breaker. Conditions Found?
       - NO
         - Check for Intermittent/Poor Connection or Excessive Starter Current Draw. Repair as Necessary.
       - YES
         - Replace ECM Relay.

4. With Engine Hot, Check for Overcharge Condition. Condition Found?
   - NO
     - Repair Charging System.
   - YES
     - Measure Voltage Drop Between Battery Positive Terminal (+) and BE/GY Terminal (-) on 5 Amp ECM Fuse With Key ON. Is Voltage Drop Greater than 0.5 Volt?

5. Replace FUSE or FUSE Terminals.

ECM Fuse (5 Amp)

Figure C-44. Fuse Holder

NOTE
Since the position of the relays may be reversed, check the wire tags for positive identification.

ECM Power Relay

Fuel Pump Relay

Figure C-43. Electrical Relays (Under Seat)

Clear Codes and Confirm Proper Operation with No Check Engine Lamp.
TROUBLE CODES 23 AND 32, FUEL INJECTOR

Code 23 = Front Injector  
Code 32 = Rear Injector

The fuel injectors are solenoids that allow pressurized fuel into the intake tract. The injectors are timed to the engine cycle and are triggered sequentially. The power for the injectors comes from the fuel pump relay. The fuel pump relay also provides power for the fuel pump and the ignition coil. The ECM provides the path to ground to trigger the injectors.

NOTE

System 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.
DIAGNOSTIC NOTES

The reference numbers below correlate with those on the diagnostic flow chart.

1. To access fuel injector connectors, remove bolt on back tab of fuel tank, loosen fuel tank front mounting bolt, cut cable straps and elevate tank slightly with wooden blocks.
3. Use Harness Connector Test Kit (HD-41404), purple pin probe and patch cord.

Codes 23 and 32, Fuel Injector (1 of 2)

4. Connect Breakout Box (HD-41198) between EFI wire harness and ECM. See Breakout Box Installation, page C-12.
5. Use Harness Connector Test Kit (HD-41404), purple pin probes and patch cord to Breakout Box and gray socket probes and patch cord to Fuel Injector Test Lamp (HD-34730-2C).
6. Shake or wiggle harness with DVOM or Scanalyzer connected. Radical voltage changes on the DVOM will indicate the presence of intermittents, while the Scanalyzer (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble

Figure C-45. Fuel Injector Test Lamp (HD-34730-2C)

Clear Codes and Confirm Proper Operation with No Check Engine Lamp.
code is detected. (If a current trouble code is already present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear trouble codes and then perform wiggle test with vehicle running.)


Codes 23 and 32, Fuel Injector (2 of 2)

SCANALYZER NOTES

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer may be used. If a number is printed next to the icon, then refer to the Scanalyzer Notes which follow.

With the engine off, Scanalyzer (Active Diagnostic Test Mode) can be used to energize either the front or rear injector once each second for a total of 5 seconds.

With the engine off, Scanalyzer (Active Diagnostic Test Mode) can be used to turn fuel pump on for periods up to 30 seconds. Power to the pump also includes power to the fuel injectors and ignition coil.

Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>84</td>
<td>Front Injector</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
</tr>
<tr>
<td>85</td>
<td>Rear Injector</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
</tr>
</tbody>
</table>

NOTE
Since the position of the relays may be reversed, check the wire tags for positive identification.

Figure C-47. Electrical Relays (Under Seat)
TROUBLE CODES 24 AND 25, IGNITION COIL

Code 24 = Front Coil  
Code 25 = Rear Coil

A Code 24 or 25 will set if the ignition coil charge time is out of range. This could occur if there is an open coil or loss of power to the coil. The coil receives power from the fuel pump relay at the same time that the fuel pump and injectors are activated. The fuel pump relay is active for the first two seconds after the Ignition Switch is turned to ON, and then shuts off until RPM is detected from the crank and cam position sensors, at which time it is reactivated. The ECM is responsible for turning the fuel pump relay on by providing the ground to activate the relay, which in turn powers the coils. If both codes are set, it is likely a coil power failure or a coil failure.

Ignition Coil Circuit Diagram

C-55
Codes 24 and 25, Ignition Coil Test


2. Use Harness Connector Test Kit (HD-41404), purple pin probe and patch cord.

3. Connect Breakout Box (HD-41198) between EFI wire harness and ECM. See Breakout Box Installation, page C-12.

4. Shake or wiggle harness with DVOM or Scanalyzer connected. Radical voltage changes on the DVOM will indicate the presence of intermittents, while the Scanalyzer (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. (If a current trouble code is present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear trouble codes and then perform wiggle test with vehicle running.)

Disconnect Coil Connector [83B]. Connect Coil Test Lamp (HD-41402) to Connector [83B]. See Figure C-48, Crank Engine, Do Lights Flash when Cranked.

1. Perform Wiggle Test. Intermittents Found?
   - YES
   - NO

   Repair as Necessary. 7855
   Replace Coil. 7856

2. Measure Voltage on Terminal 3 of Coil. Should be Equivalent to Battery Voltage During First Two Seconds after Key is Turned ON. Is it?
   - YES
   - NO

   Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>83</td>
<td>Ignition Coil</td>
<td>3 - Place Amp</td>
<td>Below Fuel Tank</td>
</tr>
</tbody>
</table>

NOTE
Cranking the engine with the Ignition Coil Test Lamp in place of the ignition coil can sometimes cause a Code 24 and/or Code 25. This condition is normal and does not by itself indicate a malfunction.

3. Using Breakout Box, measure Resistance Between ECM and Coil Terminals as follows:

<table>
<thead>
<tr>
<th>Trouble Code</th>
<th>ECM Terminal</th>
<th>Coil Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>1 (B/E)</td>
<td>2</td>
</tr>
<tr>
<td>25</td>
<td>1 (Y/B/E)</td>
<td>19</td>
</tr>
</tbody>
</table>

Resistance Should be Less than 0.5 Ohms. Is it?

4. Perform Wiggle Test. Intermittents Found?
   - YES
   - NO

   Repair as Necessary. 7865
   Replace ECM. 7870

5. Measure Voltage at Fuel Pump Relay Terminal 30 During First Two Seconds after Key is Turned ON. Should be Equivalent to Battery Voltage. Is it?
   - YES
   - NO

   Repair Open Wire or Connection on Y/GN Wire. 7875
   Check for Multiple Codes. Refer to Multiple Trouble Codes on page C-8.

Clear Codes and Confirm Proper Operation with No Check Engine Lamp.

Figure C-48. Ignition Coil Test Lamp (HD-41402)

Figure C-49. Ignition Coil Connector [83B]
GENERAL

The ignition coil is a pulse type transformer that transforms or steps up low battery voltage to the high voltage necessary to jump the electrode at the spark plug in the cylinder head. Internally the coil consists of primary and secondary windings with a laminated iron core and sealed in waterproof insulating compound. The ignition coil cannot be taken apart or repaired. If the ignition coil is faulty it must be replaced.

Troubleshooting

When the engine will not start or when hard starting or missing indicates a faulty ignition system, see CHART C-2 in this section or follow the procedure listed under TROUBLE-SHOOTING in Section 5 of the Service Manual. If the condition persists, check primary and secondary resistance of ignition coil with an ohmmeter. See Wiring Diagram in Figure C-50.

 Resistances should be within the following limits: primary resistance 0.4-0.6 ohms, secondary resistance 5,000-6,000 ohms. Check ignition coil with a coil tester.

If a coil tester is not available, temporarily substitute a new ignition coil by attaching it at any convenient point near the old coil (coil will function without being secured). Transfer terminal wires to new coil. See Wiring Diagram in Figure C-50.

Attach new spark plug cables to coil and plugs. If ignition trouble is eliminated by the temporary installation of new coil, carefully inspect old coil for damaged cables and insulation. The insulation on cables may be cracked or otherwise damaged allowing high tension current to short to metal parts. This is most noticeable in wet weather or after motorcycle has been washed.

Figure C-50. Ignition Coil Wiring Diagram
ECM Pin 23 provides the ground to the fuel pump relay. Code 33 will set if the BN/Y wire is shorted to 12 volts.

**DIAGNOSTIC NOTES**

The reference numbers which follow correlate with those on the diagnostic flow chart.

1. Shake or wiggle harness with DVOM or Scanalyzer connected. Radical voltage changes on the DVOM will indicate the presence of intermittent, while the Scanalyzer (in Wiggle Test Mode) will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. (If a current trouble code is present when the wiggle test is entered, the Scanalyzer will...
respond as described immediately upon entering the wiggle test mode. With Key On and engine off, clear trouble codes and then perform wiggle test with vehicle running.)


4. Use Harness Connector Test Kit (HD-41404), red pin probe and patch cord.

NOTE
The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer may be used.

**Code 33, Fuel Pump Relay**

- With DVOM, Measure Voltage Between Fuel Pump Relay Terminal 85 and Ground During First 2-3 Seconds After Ignition Switch Is Turned ON. Meter Should Read Less Than 2 Volts. Does It?
  - YES
  - 1. With DVOM Still Connected, Check for Intermittents by Performing “Wiggle” Test While Repeating First Test of This Flow Chart. Radical Voltage Changes or Trouble Code Set While Wiggling Harness Indicate the Presence of Intermittent Short to 12 Volts. Intermittent Present?
    - YES
      - 2. Replace Fuel Pump Relay. 7995
    - NO
      - 2. Replace Fuel Pump Relay. 7995

- NO
  - 2. Disconnect Fuel Pump Relay. Measure Voltage Between Fuel Pump Relay Terminal 85 and Ground During First 2 Seconds After Ignition Switch Is Turned ON. Meter Should Read 0 Volts. Does It?
    - YES
      - 3. Replace Fuel Pump Relay. 7905
    - NO
      - 4. Repair Short to 12V on BN/Y Wire. 7910

Clear Codes and Confirm Proper Operation with No Check Engine Lamp.
TROUBLE CODES 52, 53, 54 AND 55, ECM FAILURE

GENERAL
All of the following codes indicate a failure which requires replacement of the ECM.

- Code 52 - RAM Failure
- Code 53 - ROM Failure
- Code 54 - EE PROM Failure
- Code 55 - Microprocessor Failure

TROUBLE CODE 56, CRANK POSITION SENSOR AND CAM POSITION SENSOR TIMING

A Code 56 will set if the Crankshaft Position Sensor (CKP Sensor) and Camshaft Position Sensor (CMP Sensor) are not timed properly or if the CKP Sensor signal is weak or absent.

**DIAGNOSTIC NOTES**

*The reference numbers below correlate with those on the diagnostic flow chart.*

1. Connect Breakout Box (HD-41198) to EFI wire harness only (leave ECM disconnected). See Breakout Box Installation, page C-12.
2. Use Harness Connector Test Kit (HD-41404), brown pin probes and patch cords.
3. One megohm is very high resistance. Some meters will read ∞, OL, etc.
5. Use Harness Connector Test Kit (HD-41404), black pin probes and patch cords.
9. Use Harness Connector Test Kit (HD-41404), brown socket probes and patch cords.
**Wire Harness Connectors**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[14]</td>
<td>CMP Sensor</td>
<td>3 - Place Deutsch</td>
<td>Bottom Frame Cross Member (Right Side)</td>
</tr>
<tr>
<td>[78]</td>
<td>ECM</td>
<td>35 - Place Amp</td>
<td>Under Right Side Cover</td>
</tr>
<tr>
<td>[79]</td>
<td>CKP Sensor</td>
<td>3 - Place Conexall</td>
<td>Under Right Side Cover Below Electrical Bracket</td>
</tr>
</tbody>
</table>

**Code 56, Crank Position Sensor and Cam Position Sensor Timing**

1. Connect Breakout Box (HD-41198) to Connector [78B] Leaving ECM Disconnected. Measure Resistance Between Pins 11 and 34 and Between Pins 28 and 34 on Breakout Box. Resistance Should Be Greater Than 1 Megohm. Is it?

   - **YES**
     - Connect ECM to Breakout Box. Disconnect Fuel Pump Relay. Connect DVOM to Terminals 11 and 28 on Breakout Box and Set it to AC Volts. Crank Engine. Meter Should Read 1 Vac Minimum While Cranking. Does it?
     - **YES**
       - Replace Crank Position Harness Connector (Connector Kit No. 72351-95).
       - **YES**
         - Replace Crank Position Sensor.
       - **NO**
         - Repeat Test at Connector [79A] Terminals 1 and 2. Meter Should Read 1 Vac Minimum While Cranking. Does it?
         - **YES**
           - Replace Crank Position Harness Connector (Connector Kit No. 72351-95).
         - **NO**
           - Replace Crank Position Sensor.
   - **NO**
     - ECM Connector [78] (Under Boot)
     - Replace ECM Bracket (Under Electrical Bracket)

2. **CKP Sensor Connector [79]**

   - **YES**
     - Check for Intermittent Connections, Pinched or Damaged Wires, and Loose Crank Position Sensor Fasteners. Conditions Found?
     - **YES**
       - Repair as Necessary.
     - **NO**
       - YES
         - Connect ECM to Breakout Box. Disconnect Fuel Pump Relay. Connect DVOM to Terminals 11 and 28 on Breakout Box and Set it to AC Volts. Crank Engine. Meter Should Read 1 Vac Minimum While Cranking. Does it?
         - **YES**
           - Replace Crank Position Harness Connector (Connector Kit No. 72351-95).
           - Replace Crank Position Sensor.
         - **NO**
           - Repeat Test at Connector [79A] Terminals 1 and 2. Meter Should Read 1 Vac Minimum While Cranking. Does it?
           - **YES**
             - Replace Crank Position Harness Connector (Connector Kit No. 72351-95).
           - **NO**
             - Replace Crank Position Sensor.
         - With DVOM or Scanalyzer (Wiggle Test Mode) Still Connected, Check for Intermittents by Performing “Wiggle” Test. Radicals Voltage Changes or Trouble Code Set While Wigging Harness Will Indicate the Presence of Intermittents. Intermittent Present?
           - **YES**
             - Replace Cam Position Sensor.
           - **NO**
             - Repair Short to Ground on GA/N/W Wire in Main Wiring Harness.
     - **NO**
       - YES
         - Reconnect CMP Sensor Connector [14] and Check Voltage on Connector [14B] Terminal A (Pos.), Terminal C (Neg.). Does 5v Exist?
         - **YES**
           - **YES**
             - **YES**
               - Repair Open.
             - **NO**
               - Repeat Test and Wiggle Harness with DVOM Still Connected to Identify Intermittent Opens.
         - **NO**
           - YES
             - Crankshaft and Camshaft are Out of Phase. Check for Improper Cam Timing, Pinion Gear Key Failure, Loose Rotor Cup or Other Mechanical Failure.
             - **YES**
               - Repair.
             - **NO**
               - Replace Cam Position Sensor.
         - **NO**
           - YES
             - Repair as Necessary.
           - **NO**
             - Repair Short to Ground on GA/N/W Wire in Main Wiring Harness.

**Clear Codes and Confirm Proper Operation with No Check Engine Lamp.**
# Electrical Connectors - Service and Repair

## Subject

<table>
<thead>
<tr>
<th>Description</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Connector Service and Repair</td>
<td></td>
</tr>
<tr>
<td>Deutsch Electrical Connectors</td>
<td>D-3</td>
</tr>
<tr>
<td>Amp Multilock Electrical Connectors</td>
<td>D-9</td>
</tr>
<tr>
<td>Packard Electrical Connectors</td>
<td>D-14</td>
</tr>
<tr>
<td>Sealed Butt Splice Connectors</td>
<td>D-19</td>
</tr>
<tr>
<td>Amp Electrical Connectors</td>
<td>D-20</td>
</tr>
<tr>
<td>Crimp Tables</td>
<td></td>
</tr>
<tr>
<td>XLH Models</td>
<td>D-22</td>
</tr>
<tr>
<td>Table 1. 1998 XLH Components</td>
<td>D-23</td>
</tr>
<tr>
<td>Table 2. 1998 XL Custom Main Wiring Harness, Part No. 70153-98</td>
<td>D-23</td>
</tr>
<tr>
<td>Table 3. 1998 XL Main Wiring Harness, Part No. 70135-98</td>
<td>D-24</td>
</tr>
<tr>
<td>Table 4. 1998 XL Sport Main Wiring Harness, Part No. 70139-98</td>
<td>D-25</td>
</tr>
<tr>
<td>FX Models</td>
<td></td>
</tr>
<tr>
<td>Table 1. 1998 Components</td>
<td>D-25</td>
</tr>
<tr>
<td>Table 2. 1998 Main Harness, Part No. 70216-98</td>
<td>D-26</td>
</tr>
<tr>
<td>Table 3. 1998 Starter to 30 A Circuit Breaker, Part No. 70044-96</td>
<td>D-26</td>
</tr>
<tr>
<td>Table 4. 1998 Passing Lamp Harness, Part No. 67615-96, 67915-97</td>
<td>D-26</td>
</tr>
<tr>
<td>Table 5. 1998 Rear Lighting Harness, Part No.'s 68653-96 and 68655-96</td>
<td>D-26</td>
</tr>
<tr>
<td>FXD Models</td>
<td></td>
</tr>
<tr>
<td>Table 1. 1998 Components</td>
<td>D-27</td>
</tr>
<tr>
<td>Table 2. 1998 Switch Harness, Part No. 70250-95A</td>
<td>D-27</td>
</tr>
<tr>
<td>Table 3. 1998 Main Harness, Part. No. 69558-98</td>
<td>D-27</td>
</tr>
<tr>
<td>FLT Models</td>
<td></td>
</tr>
<tr>
<td>Table 1. 1998 FLT Main Harness, Part. No. 70985-98</td>
<td>D-28</td>
</tr>
<tr>
<td>Table 2. Horn Ground Wire, Part. No. 70084-96</td>
<td>D-28</td>
</tr>
<tr>
<td>Table 3. HDI Horn Jumper, Part. No. 70440-97</td>
<td>D-28</td>
</tr>
<tr>
<td>Table 4. 1998 FLHT/FLTR Components</td>
<td>D-29</td>
</tr>
<tr>
<td>Table 5. Jumper (Instrument) Harness, Part. No. 71625-98</td>
<td>D-29</td>
</tr>
<tr>
<td>Table 6. Ignition Harness, Part. No. 32435-97</td>
<td>D-29</td>
</tr>
<tr>
<td>Table 7. Ultra Overlay Harness, Part. No. 70160-98</td>
<td>D-29</td>
</tr>
<tr>
<td>Table 8. Rear Speaker Harnesses</td>
<td>D-29</td>
</tr>
<tr>
<td>Table 9. FLHTC/U Interconnect, Part. No. 70232-98</td>
<td>D-30</td>
</tr>
<tr>
<td>Table 10. Rear Lighting Harness, Part No. 68680-97, 68682-97</td>
<td>D-30</td>
</tr>
<tr>
<td>Table 11. Starter to 50 A Circuit Breaker Harness, Part No. 70045-94A</td>
<td>D-30</td>
</tr>
<tr>
<td>Table 12. Tour Pak Harness, Part Nos. 70846-97 (CLASSIC), 70648-97 (ULTRA)</td>
<td>D-30</td>
</tr>
<tr>
<td>Table 13. EFI Fuel Tank Harness, Part No. 70369-97</td>
<td>D-30</td>
</tr>
<tr>
<td>Table 14. FLTR Radio Ground Jumper Wire, Part No. 70420-98</td>
<td>D-31</td>
</tr>
<tr>
<td>Table 15. Steering Ground Wire, Part No. 70101-94</td>
<td>D-31</td>
</tr>
<tr>
<td>Table 16. ECM Harness, Part No. 70233-97</td>
<td>D-31</td>
</tr>
<tr>
<td>Table 17. FLHR/C Components</td>
<td>D-31</td>
</tr>
<tr>
<td>Table 18. FLHR/C Fuel Gauge Harness, Part. No. 75120-96</td>
<td>D-31</td>
</tr>
<tr>
<td>Table 19. FLHR/C Main Harness, Part No. 70245-98</td>
<td>D-32</td>
</tr>
</tbody>
</table>

**Continued...**
<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLHP/FLHTP Models</td>
<td></td>
</tr>
<tr>
<td>Table 1. 1998 FLHP, FLHP-I Main Harness, Part No. 70260-98</td>
<td>D-33</td>
</tr>
<tr>
<td>Table 2. Siren Harness, Part No. 70177-97</td>
<td>D-33</td>
</tr>
<tr>
<td>Table 3. 1998 Components</td>
<td>D-34</td>
</tr>
<tr>
<td>Table 4. 1998 FLHTP-I Fairing Interconnect Harness, Part No. 69552-97</td>
<td>D-34</td>
</tr>
<tr>
<td>Electrical Connector Locations</td>
<td></td>
</tr>
<tr>
<td>XLH Models</td>
<td>D-35</td>
</tr>
<tr>
<td>FX Models</td>
<td>D-35</td>
</tr>
<tr>
<td>FXD Models</td>
<td>D-36</td>
</tr>
<tr>
<td>FLHT/C/U-I Models</td>
<td>D-37</td>
</tr>
<tr>
<td>FLHR, FLHC-I Models</td>
<td>D-43</td>
</tr>
<tr>
<td>FLTR, FLTR-I Models</td>
<td>D-45</td>
</tr>
<tr>
<td>FLHP, FLHP-I Models</td>
<td>D-48</td>
</tr>
<tr>
<td>FLHTP-I Models</td>
<td>D-50</td>
</tr>
<tr>
<td>1998 Wiring Diagrams (Domestic and International Models)</td>
<td>D-53</td>
</tr>
</tbody>
</table>
DEUTSCH ELECTRICAL CONNECTORS

General

All FL models utilize Deutsch DT Series Electrical Connectors. The Deutsch Connector features a superior seal to protect electrical contacts from dirt and moisture in harsh environments. The connector also provides better pin retention than previous connectors.

A 12-place connector is illustrated in Figure D-3 to show the various parts of the Deutsch connector. The following instructions may be followed for all 2-place through 12-place Deutsch connectors.

Socket housing: alignment tabs and/or external latch, secondary locking wedge, internal seal, wire seal, seal pin.

NOTE

Seal pins or plugs are installed in the wire seals of unused pin and socket locations. If removed, seal pins must be replaced to maintain the integrity of the environmental seal.

Pin housing: alignment grooves and/or external latch cover, attachment clip, secondary locking wedge, wire seal, seal pin.

REMOVING/DISASSEMBLING

Attachment clips are attached to the pin housings of most connectors. The clips are then attached to T-studs on the motorcycle frame. T-studs give positive location to electrical connectors and wire harnesses. Consistent location reduces electrical problems and improves serviceability.

1. Push the connector to disengage small end of slot on attachment clip from T-stud. Lift connector off T-stud.
2. Depress the external latch(es) on the socket housing side and use a rocking motion to separate the pin and socket halves. Two-, three-, four- and six-place Deutsch connectors have one external latch, while eight- and twelve-place connectors have two, both of which must be pressed simultaneously to separate the connector halves.

NOTE

With few exceptions, the socket housing can always be found on the accessory side, while the pin side of the connector is plumbed to the wiring harness.

REMOVING/INSTALLING SOCKETS

1. See Figure D-1. Remove the secondary locking wedge. Insert the blade of a small screwdriver between the socket housing and locking wedge inline with the groove (inline with the pin holes if the groove is absent). Turn the screwdriver 90 degrees to pop the wedge up.
2. Gently depress terminal latches inside socket housing and back out sockets through holes in rear wire seal. See Figure D-2.

NOTE

An Electrical Terminal Crimp Tool (Part No. HD-39965) is used to install Deutsch pin and socket terminals on wires. If new terminals must be installed, follow the instructions included with the crimping tool or see Crimping Instructions in this section.

3. Fit rear wire seal into back of socket housing, if removed. Grasp socket approximately 1 inch (25.4 mm) behind the contact barrel. Gently push sockets through holes in wire seal into their respective chambers. Feed
1. Insert socket into chamber until it "clicks" in place. Verify that socket will not back out of chamber; a slight tug on the wire will confirm that it is properly locked in place.

2. Install internal seal on lip of socket housing, if removed. Insert tapered end of secondary locking wedge 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.

**NOTE**
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 pointing toward the external latch. See Figure D-4.

**NOTE**
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 D-5. 2-Place, 3-Place and 4-Place Deutsch Connectors

Socket Side
1. Socket Terminal
2. Wire Seal
3. Socket Housing
4. External Latch
5. Internal Seal
6. Locking Wedge

Pin Side
7. Locking Wedge
8. Latch Cover
9. Pin Housing
10. Wire Seal
11. Pin Terminal
REMOVING/INSTALLING PINS

1. Remove the secondary locking wedge. Use the hooked end of a stiff piece of mechanics wire, a needle nose pliers or a suitable pick tool (HD-41475-100). See Figure D-6.

2. Gently depress terminal latches inside pin housing and back out pins through holes in wire seal.

NOTE

An Electrical Terminal Crimp Tool (Part No. HD-39965) is used to install Deutsch pin and socket terminals on wires. If new terminals must be installed, see Crimping Instructions in this section.

3. Fit wire seal into back of pin housing. Grasp cramped pin approximately 1 inch (25.4 mm) behind the contact barrel. Gently push pins through holes in wire seal into their respective numbered locations. Feed pin into chamber until it “clicks” in place. Verify that pin will not back out of chamber; a slight tug on the wire will confirm that it is properly locked in place.

4. Insert tapered end of secondary locking wedge into pin housing and press down until it snaps in place. The wedge fits in the center groove within the pin housing and holds the terminal latches tightly closed.

NOTE

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 pointing toward the external latch. See Figure D-4.

NOTE

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.

ASSEMBLING/INSTALLING

1. Insert socket housing into pin housing until it snaps in place. 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.

For those connectors with two external latches (8-place and 12-place), a different system is used to prevent improper assembly. Align the tabs on the socket housing with the grooves on the pin housing. Push the connector halves together until the latches “click.” 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.

NOTE

Deutsch connectors are color 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. If it should become necessary to replace a plug or receptacle, 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. If replacing both the socket and pin halves, then the black may be substituted for the gray, and vice versa. The socket and pin halves 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.

2. Fit the attachment clip to the pin housing, if removed. Place large end of slot on attachment clip over T-stub on frame. Push assembly forward to engage small end of slot.

CRIMPING INSTRUCTIONS
(Figure D-7)

NOTE

A Deutsch Connector Service Kit (HD-41475) has been made available. The kit 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 pick tool (HD-41475-100) used for the removal of all types of locking wedges.

1. Squeeze the handles to cycle the crimp tool to the fully open position.

2. Raise the locking bar by pushing up on bottom flange. With the crimp tails facing upward, insert contact (socket/pin) through hole of locking bar, so that the rounded side of the contact barrel rests on the nest (concave split level area) of the crimp tool. Use the middle hole in the locking bar for 16-18 gauge wire, the front hole for 20 gauge wire.

3. Release locking bar to lock position of contact. If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the contact so that the tails face straight upward. When correctly positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.

Figure D-6. Deutsch Connector Pick Tool (Part No. HD-41475-100)
1. Strip lead removing 5/32 inch (3.96 mm) of insulation. Insert wires 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 insulation material.

2. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete. Raise up locking bar and remove contact.

3. Inspect the quality of the core and insulation crimps. Distortion should be minimal.

---

1. Insert contact through hole of locking bar so that barrel rests on nest of crimp tool.

2. Insert stripped lead until it contacts locking bar.

3. Close and squeeze crimp tool.

4. Raise locking bar and remove contact.

5. Inspect quality of core and insulation crimps

---

Figure D-7. Deutsch Crimping Procedure
Deutsch Solid Barrel Contact Crimping Instructions

For Size 20, 16 and 12 Contacts
Wire Range 26-12 AWG

NOTE

Mini-Deutsch connectors make use of a solid barrel contact without crimp tails. As a result, a special Terminal Crimp Tool (Part No. HD-42879) is needed to install pin and socket terminals on wires. See Crimping Instructions below for details.

1. Squeeze the handles to cycle the crimp tool to the fully open position.
2. Remove locking pin from selector knob. See Figure D-8.
3. Raise selector knob and rotate until selected wire size stamped on wheel is aligned with "SEL. NO." arrow. See upper frame of Figure D-9.
4. Loosen knurled locknut and turn adjusting screw clockwise (in) until it stops.
5. Turn tool over and drop contact into indentor cover hole with the wire end out.
6. Turn adjusting screw counterclockwise (out) until contact is flush with bottom of depression in indentor cover. Tighten knurled locknut.
7. Slowly squeeze handles of crimp tool until contact is centered between indentor points. See middle frame of Figure D-9.
8. Strip wire lead removing 1/4 inch (6.3mm) of insulation.
9. Insert bare wire strands into contact barrel. See lower frame of Figure D-9.
10. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
11. Remove crimped contact from indentor.
12. Inspect the quality of the crimp. Verify that all wire strands are in crimp barrel.

NOTE

Tool must be readjusted when changing contact size/type.

13. Install pin to lock position of selector knob.

Figure D-8. Deutsch Solid Barrel Contact Crimp Tool (Part No. HD-42879)

Figure D-9. Deutsch Solid Barrel Contact Crimping Procedure
AMP MULTILOCK ELECTRICAL CONNECTORS

REMOVING SOCKET/PIN TERMINALS

1. Remove connector from the retaining device, either attachment or rosebud clip.

2. Depress the button on the socket terminal side of the connector (plug) and pull apart the pin and socket halves. See Figure D-10.

3. Bend back the latch slightly and free one side of secondary lock, then repeat the step to release the other side. Rotate the secondary lock outward on hinge to access terminals in chambers of connector housing.

4. Looking in the terminal side of the connector (opposite the secondary lock), take note of the cavity next to each terminal.

5. See Figure D-11. With the flat edge against the terminal, insert the pick (Snap-On TT600-3) into the cavity until it stops. Pivot the end of the pick away from the terminal and gently tug on wire to pull terminal from chamber. Do not tug on the wire until the tang is released or the terminal will be difficult to remove. A "click" is heard if the tang is engaged but then inadvertently released. Repeat the step without releasing the tang.

NOTE
An Electrical Terminal Crimp Tool (Part No. HD-41609) is used to install Amp Multilock pin and socket terminals on wires. If new terminals must be installed, see Crimping Instructions on page D-12.

INSTALLING SOCKET/PIN TERMINALS

NOTE
For wire location purposes, numbers are stamped into the secondary locks of both the socket and pin housings. See Figure D-13.

1. From the secondary lock side of the connector, insert the terminal into its respective numbered chamber until it snaps in place. For proper fit, the slot in the terminal must face the tang in the chamber.

NOTE
The tang in the chamber engages the slot to lock the terminal in position. On the pin side of the connector, tangs are positioned at the bottom of each chamber, 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 chamber, so the socket terminal slot (on the same side as the crimp tails) must face upward. Up and down can be

Figure D-10. 10-Place Amp Multilock Connector (Exploded View)

See Figure D-14 for exploded views of 3-place and 6-place Amp Multilock connectors.
1. Open Secondary Lock.
2. Insert Pick into Cavity on Mating End of Connector.
4. Gently Tug on Wire to Remove Terminal from Housing.

Figure D-11. Release Tang and Back Out Terminals

determined by the position of the release button (used to separate the pin and socket halves), the button always being the top of the connector. See Figure D-12.

2. Gently tug on wire end to verify that the terminal is locked in place and will not back out of chamber.
3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.
4. Insert the socket housing (plug) into the pin housing (receptacle) until it snaps in place.
5. Install connector on retaining device, either attachment or rosebud clip.

Figure D-12. Tang Location (Cross Sectional View)
Secondary Locks Open

3-Place Connector

6-Place Connector

10-Place Connector

Figure D-13. Numbers Stamped on Secondary Locks for Wire Color Locations (Socket Housings Shown)

3-Place Connector

6-Place Connector

Socket Side
1. Socket Terminal
2. Secondary Lock (Open)
3. Latch
4. Socket Housing
5. Button

Pin Side
6. Pin housing
7. Latch
8. Secondary Lock (Open)
9. Pin Terminal

Figure D-14. 3-Place and 6-Place Amp Multilock Connectors
CRIMPING INSTRUCTIONS

1. Squeeze the handles to cycle the crimp tool (Part No. HD-41609) to the fully open position.

2. Raise locking bar by pushing up on bottom flange. With the crimp tails facing upward, insert contact (socket/pin) through locking bar, so that the closed side of the contact rests on the nest (concave split level area) of the crimp tool. Use the front nest for 20 gauge wire, the middle for 16 gauge and the rear for 18 gauge. See Figure D-15.

3. 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.

---

1. Raise locking bar and seat contact on nest of crimp tool. Release locking bar.

2. Insert stripped lead until it contacts locking bar.

3. Close and squeeze crimp tool.

4. Raise locking bar and remove contact.

Figure D-15. Amp Multilock Crimping Procedure
4. Strip lead removing 5/32 inch (4 mm) of insulation. Insert wires 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 insulation material.

5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete. Raise up locking bar and remove contact.

6. Inspect the quality of the core and insulation crimps. Distortion should be minimal.
PACKARD ELECTRICAL CONNECTORS

GENERAL

From a servicing standpoint, there are two basic types of Packard electrical connectors, those with pull-to-seat terminals and those with push-to-seat terminals.

Look into the mating end of the connector. If it appears that the terminal can be extracted from this side, then it is probably the pull-to-seat type.

At least one Packard pull-to-seat terminal can be easily recognized by the presence of a locking ear. The ear engages a slot in the connector housing and prevents the terminal from being removed from the wire end side of the connector. The ear also acts as a strain relief in the event that the wires are pulled and further inhibits movement of the terminal inside the chamber. For an example of this type of connector, note the IAT Sensor connector [89B].

PULL-TO-SEAT TERMINALS

Unlike most connectors, where the terminals are pulled out the wire end of the connector, to remove the terminals from the pull-to-seat connectors, the terminal is pushed out the mating end of the connector. Once a new terminal is crimped onto the end of the wire, the wire is pulled to draw the terminal back inside the chamber of the connector housing.

The Packard pull-to-seat terminal connectors found on FL model vehicles are listed below.

- IAT Sensor [89B]
- ET Sensor [90B]
- TP Sensor [88B]
- ISC Actuator [87B]
- Fuel Injector [84B and 85B]

Two types of Packard pull-to-seat electrical connectors are used. One type has an external latch to lock the pin and socket halves together, while the other makes use of a wireform. See Figure D-16. The manner in which the terminals are picked differs between these two types of connectors, as further described below.

Removing Pull-to-seat Terminals

External Latch Type

To remove a pull-to-seat terminal from connectors with external latches, proceed as follows:

1. Remove the connector from the retaining device, if present.
2. Bend back the external latch(es) slightly and separate the pin and socket halves of the connector.
3. To free a pull-to-seat terminal from the connector housing, first look into the mating end of the connector to find the locking tang. See A in Figure D-17. The tangs are always positioned in the middle of the chamber and are on the same side as the external latch. On those connectors with locking ears, the tang is on the side opposite the ear.

Figure D-16. Packard Pull-to-Seat Terminal Connectors (Socket Sides)
4. At a slight angle, gently insert the point of a one inch safety pin down the middle of the chamber (about 1/8 inch) and pivot the end of the pin toward the terminal body. When a click is heard, remove the pin and repeat the procedure. See B in Figure D-17. The click is the sound of the tang returning to the locked position as it slips from the point of the pin. Pick at the tang in this manner until the clicking stops and the pin seems to slide in at a slightly greater depth than it had previously. This is an indication that the tang has been depressed.

**NOTE**

On those terminals that have been extracted on a previous occasion, no clicking sound may be heard when the pin is pivoted to depress the tang, but proceed as if the clicking is audible and then push on the wire end of the lead to check if the terminal is free.

**NOTE**

When picking multiple terminals, the end of the pin may become malleable. For best results, continue the procedure with a new safety pin.

5. Remove the pin and push on the wire end of the lead to extract the terminal from the mating end of the connector. See C in Figure D-17. If necessary, pull back the conduit and remove the wire seal at the back of the connector to introduce some slack in the wires.

**NOTE**

A series of Packard Electrical Terminal Crimp Tools are available to install Packard pin and socket terminals on wires. If new terminals must be installed, see Crimping Instructions on page D-17.

**Installing Pull-to-seat Terminals**

**External Latch Type**

**NOTE**

For wire location purposes, alpha characters are stamped into the socket housings.

1. To install a terminal back into the chamber of the connector housing, use a thin flat blade, like that on an X-Acto knife, and carefully bend the tang outward away from the terminal body. See D in Figure D-17.

2. Gently pull on the lead at the wire end of the connector to draw the terminal back into the chamber. A click is heard when the terminal is properly seated.

3. Push on the lead to verify that the terminal is locked in place.

4. Push the pin and socket halves of the connector together until the latches "click."
Removing Pull-to-seat Terminals
Wireform Type

To remove a pull-to-seat terminal from a wireform type connector, proceed as follows:

1. Depress the wire form and use a rocking motion to detach the electrical connector.

2. Hold the connector so that the wire form is facing down.

3. Looking at the center of the connector, note the plastic rib that separates the wire terminals. On each side of the rib, you can glimpse the edge of the terminal body at the front, while the edge of the tang can be seen at the rear. See A in Figure D-18.

4. Using the tip of an X-Acto knife, depress the tang. Even if the tang is difficult to see, simply tilt the blade at an angle and place the tip at the inboard edge of the terminal body. Push down lightly and you will feel the spring tension of the tang. A click will also be heard if the tang is depressed and released. Repeat the procedure. When the clicking stops and no spring tension is felt, it is an indication that the tang is depressed.

NOTE

As with the other pull-to-seat terminals, if the terminal has been extracted on a previous occasion, there may be little or no indication that the tang is depressed, but proceed as if the clicking is audible and then push on the wire end of the lead to check if the terminal is free.

5. Push on the wire end of the lead to extract the terminal from the mating end of the connector. See B in Figure D-18.

Installing Pull-to-seat Terminals
Wireform Type

NOTE

For wire location purposes, alpha characters are stamped into the socket housings.

1. To install a terminal back into the chamber of the connector housing, use a thin flat blade, like that on an X-Acto knife, and carefully bend the tang outward away from the terminal body. See C in Figure D-18.

2. Gently pull on the lead at the wire end of the connector to draw the terminal back into the chamber. A click is heard when the terminal is properly seated.

3. Push on the lead to verify that the terminal is locked in place.

4. Push the pin and socket halves of the connector together until the latches "click." The grooves in the female spade connector (harness) must be aligned with the tabs on the male spade side.

Figure D-18. Depress Tang and Extract Terminal From Mating End of Connector
PUSH-TO-SEAT TERMINALS

The Packard push-to-seat terminal connectors found on FL model vehicles are listed below.

- Ignition Light/Key Switch [33]
- Main Power [3]

Removing Push-to-seat Terminals

Like most connectors, Packard push-to-seat terminals are pulled out the wire end of the connector. To remove a push-to-seat terminal, proceed as follows:

1. Remove the connector from the retaining device, if present.
2. Bend back the external latch(es) slightly and separate the pin and socket halves of the connector.

NOTE

Both the Ignition Light/Key Switch and the Main Power connectors are provided with secondary locks. The secondary lock, which may be molded onto the connector or exist as a separate piece, aids in terminal retention. Secondary locks must be opened (or removed) before the terminals can be extracted from the connector housing.

3. Open or remove the secondary lock. Proceed as follows:
   Ignition Light/Key Switch: Bend back the latch slightly and free one side of the secondary lock, then repeat the step to release the other side. Rotate the secondary lock outward on hinge to access the terminals in the chambers of the connector housing.
   Main Power Connector: Depress the ribs on each side of the housing to remove the secondary lock on the wire end of the connector. Exercise caution to avoid breaking barbs off the rib ends.

4. Looking in the mating end or terminal side of the connector (opposite the secondary lock), take note of the larger cavity next to each terminal.
5. Insert the pick (Snap-On TT600-3) into the cavity until it stops. Pivot the end of the pick toward the terminal to depress the locking tang. Remove the pick and gently tug on the wire to pull the terminal from the wire end of the connector. Repeat the step if the terminal is still locked in place.

NOTE

A series of Packard Electrical Terminal Crimp Tools are available to install Packard pin and socket terminals on wires. If new terminals must be installed, see Crimping Instructions on this page.

Installing Push-to-seat Terminals

NOTE

For wire location purposes, alpha characters are stamped onto the secondary locks or onto the wire end of the connector housing.

---

1. To install a terminal back into the chamber of the connector housing, use a thin flat blade, like that on an X-Acto knife, and carefully bend the tang outward away from the terminal body.
2. 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. Close or install the secondary lock. Proceed as follows:
   Ignition Light/Key Switch: Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.
   Main Power Connector: Install secondary lock on wire end of connector so that slots fully engage barbs on rib ends.
5. Push the pin and socket halves of the connector together until the latches "click."
6. Install connector on retaining device, if present.

CRIMPING INSTRUCTIONS

1. Strip wire lead removing 5/32 inch (4 mm) of insulation.
2. Compress handles until ratchet automatically opens.

NOTE

Always perform core crimp before insulation/seal crimp.

---

Packard Terminal Crimp Dyes (Nests)

<table>
<thead>
<tr>
<th>Packard 270 (HD-38125-6)</th>
<th>Packard 271 (HD-38125-7)</th>
<th>Packard 115 (HD-38125-8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sealed Terminals</td>
<td>Non-Sealed Terminals</td>
<td>Non-Sealed Terminals</td>
</tr>
<tr>
<td>1-5</td>
<td>A-E</td>
<td>F-G</td>
</tr>
<tr>
<td>Butt Splices*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Figure D-19. Packard Terminal Crimp Tools
3. See Figure D-19. Determine the correct dye or nest for the core crimp based on the information presented in the Crimp Tables beginning on page D-23.

**NOTE**
When the word “TIP” appears in the Crimp Table, use the tip of the tool specified to perform the core crimp procedure. See Figure D-20.

4. Lay the back of the core crimp tails on the appropriate nest. Be sure the core crimp tails are pointing towards the forming jaws.

5. Gently apply pressure to handles of tool until crimpers slightly secure the core crimp tails.

6. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over insulation or seal material.

7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

8. See Figure D-19. Determine the correct dye or nest for the insulation/seal crimp based on the information presented in the Crimp Tables beginning on page D-23.

9. Lay the back of the insulation/seal crimp tails on the appropriate nest. Be sure the insulation/seal crimp tails are pointing towards the forming jaws.

10. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

11. Inspect the quality of the core and insulation/seal crimps. Distortion should be minimal. See Figure D-21.

---

**Figure D-20. Tool Tips Used on Selected Core Crimps**

**Figure D-21. Inspect Core and Insulation/Seal Crimps**
SEAL ED BUTT SPLICE CONNECTORS

Butt splicing may be a necessary procedure for the replacement of some components. Proceed as follows:

1. Strip 3/8 inch of insulation off the ends of the wires.

2. Compress the handles of the Packard Crimp Tool (HD-38125-8) until the ratchet automatically opens.

3. Since the size of the connectors vary with the gauge of the wire, reference the following table to ensure properly sealed splices are used.

<table>
<thead>
<tr>
<th>Gauge Wire</th>
<th>Connector Color</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-20</td>
<td>Red</td>
<td>P/N 70585-93</td>
</tr>
<tr>
<td>14-16</td>
<td>Blue</td>
<td>P/N 70586-93</td>
</tr>
<tr>
<td>10-12</td>
<td>Yellow</td>
<td>P/N 70587-93</td>
</tr>
</tbody>
</table>

4. Determine the correct dye or nest for the crimping operation. Match the color or gauge wire marked on the butt splice connector with the corresponding crimp cavity on the crimp tool. See Figure D-22.

5. Gently apply pressure to the handles until the crimper lightly secures one side of the metal insert inside the butt splice connector. The connector must be crimped in two stages, one side and then the other.

6. See Figure D-23. Feed the wire into the butt splice connector until the stripped end contacts the wire stop inside the metal insert.

7. Squeeze the handles of the crimp tool until tightly closed. The tool automatically opens when the crimping sequence is complete.

8. Repeat steps 5, 6 and 7 on the other side of the butt splice connector.

**NOTE**

If adjacent wires are being spliced, stagger the splices so that the butt splice connectors are spaced at different positions along the length of the wires.

9. Using the UltraTorch UT-100 (HD-39969), Robair Heat Gun (HD-25070) with heat shrink attachment (HD-41183) or other suitable radiant heating device, heat the crimped splice to encapsulate the butt splice connection. Apply heat from the center of the crimp out to each end until the meltable sealant exudes out both ends of the connector. See Figure D-23.

**WARNING**

Use extreme caution when operating the UltraTorch UT-100 or any other radiant heating device. Read the manufacturers instructions carefully before use. Improper handling can result in personal injury and/or vehicle damage. Always keep hands away from tool tip area and heat shrink attachment. Avoid directing the heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion. Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed. Be sure to turn the “ON/OFF” switch to the “OFF” position after use.

**NOTE**

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

10. Heat the center of the splice until the crimp indentations disappear and the tubing assumes a smooth cylindrical appearance.
AMP ELECTRICAL CONNECTORS

Wireform Type Connector
See Figure D-24. The Amp wireform connectors found on FL model vehicles are listed below.

- BARO Sensor [80B]
- Ignition Coil [83B]

SOCKET TERMINAL REMOVAL
1. Depress the wire form and use a rocking motion to detach the electrical connector.
2. Push back the rubber boot at the back of the connector to expose the wire leads.
3. Grasp the wire and push the terminal forward toward the mating end of the connector until it stops.
4. Holding the terminal in the forward position, insert the pick (Snap-On TT600-2) into the channel on the mating end of the connector until it bottoms in the chamber. See Figure D-25.

NOTE
A click should be heard when the pick bottoms in the chamber. If no click is heard, then the wire terminal was not pushed forward far enough before insertion of the pick. If the wire terminal is not first moved forward its full length of travel, the pick will not release the terminal from the connector housing.

5. Holding the pick in position, pull the terminal out the wire end of the connector.

SOCKET TERMINAL INSTALLATION

NOTE
For wire location purposes, numbers are stamped onto the lip at the back of the socket housing (under boot).

1. Push the lead into the chamber at the wire end of the connector. A click is heard when the terminal is properly seated.

Figure D-25. Insert Pick Into Channel on Mating End of Connector

Figure D-24. Amp Wireform Electrical Connector (Socket Side)

2. Gently tug on the lead to verify that the terminal is locked in place.
3. Install the rubber boot onto the lip at the back of the connector.
4. Install the electrical connector. The grooves in the female spade connector (harness) must be aligned with the tabs on the male spade side. Push the connector halves together until the latches “click.”

1-Place Connector
The Amp 1-place connectors found on FL model vehicles are listed below.

- Fuel Pump [86]
- Passing Lamp Switch [109]

SOCKET TERMINAL
Removal
1. Bend back the ears on the pin housing slightly and separate the pin and socket halves of the connector.
2. Grasp the lead on the wire end of the socket 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.

3. Fit the barrel of the Amp Socket Terminal Remover (HD-39621-27) over the socket, and while rotating the tool slightly, push until it bottoms in the housing. Allow the plunger to “back out” of the handle. See Figure D-26.

4. Holding the socket 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 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.*

**Installation**

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.

4. Push the pin and socket halves of the connector together until the latches “click.”

**PIN TERMINAL**

**Removal**

1. Bend back the ears on the pin housing slightly and separate the pin and socket halves of the connector.

2. 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.

3. Fit the barrel of the Amp Pin Terminal Remover (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. See Figure D-27.

4. 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.*

**Installation**

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.

3. Push the pin and socket halves of the connector together until the latches “click.”
CRIMP TABLES

Crimp tables are provided to assist the user in the repair and replacement of wire terminals.

Each crimp table contains the following information:

A. The connector number as identified in the wiring diagrams, such as [14A]. The letter "A" denotes the pin side of the connector, "B" denotes the socket side.

B. The terminal Part Number.

C. Crimping tool identification. Both tool manufacturer and Kent Moore numbers are listed.

D. Wire gauge.

E. Crimp type and crimper die position.

F. There may be instances where two different crimping tools fit the same terminal. The listing will be repeated immediately for the other tool.

NOTE

Part numbers are given in the Crimp Tables for reference purposes only. Always refer to the applicable Parts Catalog when ordering parts.

G. Footnotes are used in the Crimp Tables to indicate that additional information is offered. Footnotes can be identified by a lower case alpha character in parentheses, such as that seen in the following example:

9930 (a)

When a footnote is encountered, just match the alpha character with those that follow below.

(a) This terminal requires soldering after crimping.
(b) These 9937 and 9866 terminals require the use of a 72249-94 heat shrink tube.
(c) These 72190-94 and 72191-94 terminals require soldering after crimping.
(d) These 9937 terminals require the use of 72249-94 heat shrink tube.
(e) These 9930 terminals require the use of a 71774-77 housing.
(f) The 72223-94 terminal uses a 72227-94 cable seal.
(g) The 72224-94 terminal uses a 72283-94 cable seal.
(h) Double lug crimp.
(i) The 72242-94 and 72255-94 terminals also require the use of a 72249-94 heat shrink tube.
(j) Heat sealed butt splice connector.
(k) The 72225-94 terminal uses a 72227-94 cable seal.
(l) The 72226-94 terminal uses a 72283-94 cable seal.
(m) The 72235-94 terminal uses a 72284-94 cable seal.
(n) The 72236-94 terminal uses a 72284-94 cable seal.
(o) Uses a unique 3-pin Deutsch connector housing (72163-94BK).
(p) Uses a unique 3-socket Deutsch connector housing (72113-94BK).
(q) Requires the use of a 72249-94 heat shrink tube.
(z) Use with a 7629 nut.

Fuse Block Cavity Numbers

See Figure D-28 for the cavity numbers or positions in the single and double fuse blocks. These numbers are used to identify fuse block locations in the crimp tables which follow.

Figure D-28. Fuse Blocks (As Viewed From Wire Side)
### Table 1. 1998 XLH Components

<table>
<thead>
<tr>
<th>CONNECTOR</th>
<th>POSITION</th>
<th>TERMINAL PART NUMBER</th>
<th>CRIMPER</th>
<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
<th>INSULATION CRIMP</th>
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<tbody>
<tr>
<td>IGNITION MODULE (14A)</td>
<td>ALL</td>
<td>72190-94</td>
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<td>CAM POSITION SENSOR (14A)</td>
<td>ALL</td>
<td>72190-94</td>
<td>DTT-16-00</td>
<td>18</td>
<td>CENTER POSITION</td>
<td>CENTER POSITION</td>
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<td>TRAP DOOR SOLENOID (15A)</td>
<td>ALL</td>
<td>72309-71A</td>
<td>PACKARD 270</td>
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<td>REAR LIGHTING (79)</td>
<td>ALL</td>
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<td>HD-41609</td>
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<td>REAR DIRECTIONALS (18B, 198)</td>
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<td>VO.E.S. (118)</td>
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<td>LEFT HANDLEBAR CONTROL (24B)</td>
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<td>72191-94</td>
<td>DTT-16-00</td>
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<td>CENTER POSITION</td>
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<td>RIGHT HANDLEBAR CONTROL (22B)</td>
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<td>DTT-16-00</td>
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<td>SPEEDOMETER TERMINALS</td>
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<td>PACKARD 271</td>
<td>18</td>
<td>C</td>
<td>A</td>
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### Table 2. 1998 XL Custom Main Wiring Harness, Part No. 70153-98

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<th>CONNECTOR</th>
<th>POSITION</th>
<th>TERMINAL PART NUMBER</th>
<th>CRIMPER</th>
<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
<th>INSULATION CRIMP</th>
</tr>
</thead>
<tbody>
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<td>STARTER TERMINAL</td>
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<td>9842 (a)</td>
<td>PACKARD 270,271</td>
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<td>B</td>
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<td>CIRCUIT BREAKER TERMINAL (BK)</td>
<td>ALL</td>
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<td>PACKARD 270,271</td>
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<td>B</td>
<td>3</td>
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<td>CIRCUIT BREAKER TERMINAL (2-R)</td>
<td>ALL</td>
<td>9862 (a)</td>
<td>PACKARD 115</td>
<td>12,14</td>
<td>16-14 QA. (h)</td>
<td>16-14 GA. (h)</td>
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### Table 3. 1998 Starter to 30 A Circuit Breaker, Part No. 70044-96

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### Table 1. 1998 FLT Main Harness, Part No. 70985-98

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### Table 2. Horn Ground Wire, Part No. 70084-96

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### Table 3. HDI Horn Jumper, Part No. 70440-97

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### Table 4. 1998 FLHT/FLTR Components

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### Table 5. Jumper (Instrument) Harness, Part. No. 71625-98

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### Table 6. Ignition Harness, Part. No. 32435-97

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<td>18</td>
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### Table 7. Ultra Overlay Harness, Part. No. 70160-98

<table>
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<tr>
<th>CONNECTOR</th>
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<th>CRIMPER</th>
<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
<th>INSULATION CRIMP</th>
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<tbody>
<tr>
<td>TO MAIN HARNESS [69]</td>
<td>EXCEPT 3, 4</td>
<td>72191-94</td>
<td>DTT-16-00</td>
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<tr>
<td>TO MAIN HARNESS [68]</td>
<td>3, 4</td>
<td>72193-98</td>
<td>HD-42879</td>
<td>20</td>
<td>20</td>
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<tr>
<td>TO MAIN HARNESS [68]</td>
<td>3, 4</td>
<td>72191-94 (6)</td>
<td>DTT-16-00</td>
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<td>TO CRUISE MODULE [175]</td>
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<td>PACKARD 271</td>
<td>18</td>
<td>C</td>
<td>A</td>
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<tr>
<td>TO RADIO [288]</td>
<td>ALL</td>
<td>72294-94</td>
<td>PACKARD 271, 270</td>
<td>18</td>
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<td>TO GROUND</td>
<td>72294-94</td>
<td>PACKARD 270</td>
<td>18</td>
<td>4 (a)</td>
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<td>TO REAR SPEAKERS [41A], [42A]</td>
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<td>TO POD [53A]</td>
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### Table 8. Rear Speaker Harnesses

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<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
<th>INSULATION CRIMP</th>
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<tr>
<td>SPEAKER TERMINALS</td>
<td>LI GNBIN. WIEN</td>
<td>9937</td>
<td>PACKARD 271</td>
<td>18</td>
<td>C</td>
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<tr>
<td>SPEAKER TERMINALS</td>
<td>GN, BN</td>
<td>9930</td>
<td>PACKARD 271</td>
<td>18</td>
<td>C</td>
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<tr>
<td>TO ULTRA OVERLAY HARNESS [41B], [42B]</td>
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<td>HD-42879</td>
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Table 9. FLHTC/U Interconnect, Part No. 70232-98

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<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
<th>INSULATION CRIMP</th>
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<tr>
<td>SPEAKER TERMINALS</td>
<td>L1 GNAW, L1 GNBK</td>
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<td>PACKARD 271</td>
<td>18</td>
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<td>D</td>
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<tr>
<td>SPEAKER TERMINALS</td>
<td>GYR, W/O</td>
<td>9930</td>
<td>PACKARD 271</td>
<td>18</td>
<td>C</td>
<td>A</td>
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<td>CIGAR LIGHTER</td>
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<td>D</td>
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<tr>
<td>HEADLAMP CONN. KIT 88705-93A</td>
<td>ALL</td>
<td>70580-93 (J)</td>
<td>PACKARD 115</td>
<td>16</td>
<td>(J)</td>
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<tr>
<td>SPEEDOMETER [20B]</td>
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<td>HD-41069</td>
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<td>INDICATOR LAMPS [21A]</td>
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<td>HD-41069</td>
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<td>REAR</td>
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<td>TO MAIN HARNESS [1A]</td>
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<td>TO MAIN HARNESS [1A]</td>
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<td>TO MAIN HARNESS [15B]</td>
<td>AB, C</td>
<td>72208-94</td>
<td>PACKARD 271</td>
<td>14</td>
<td>A</td>
<td>D</td>
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<tr>
<td>TO MAIN HARNESS [15B]</td>
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<td>72208-94</td>
<td>PACKARD 271</td>
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<td>TO RIGHT HAND CONTROLS [22A]</td>
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<td>TO LEFT HAND CONTROLS [24A]</td>
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<td>DTT-16-00</td>
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<td>TO RADIO (27A)</td>
<td>EXCEPT 10, 20</td>
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<tr>
<td>TO ULTRA OVERLAY HARNESS [5A]</td>
<td>EXCEPT 2, 5</td>
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<td>DTT-16-00</td>
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<td>TO FRONT DIRECTIONAL [31A]</td>
<td>ALL</td>
<td>73191-96</td>
<td>HD-41069</td>
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<td>REAR</td>
<td>REAR</td>
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<tr>
<td>TO FRONT FENDER TIP LAMP [25A]</td>
<td>ALL</td>
<td>73190-96</td>
<td>HD-41069</td>
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<tr>
<td>TO PASSING LAMPS [72A]</td>
<td>ALL</td>
<td>73190-96</td>
<td>HD-41069</td>
<td>18</td>
<td>REAR</td>
<td>REAR</td>
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<tr>
<td>HDI HORN [103B]</td>
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<td>E</td>
<td>A</td>
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<tr>
<td>FAIRING SWITCHES [105A]</td>
<td>ALL EXCEPT 5</td>
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<td>LOW FUEL MODULE [106B]</td>
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<td>TACHOMETER [108B]</td>
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<td>HD-41069</td>
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<td>REAR</td>
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<td>AUSTRALIAN SPOTLAMP [109A,109C]</td>
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<td>VOLTMETER [110B,111B]</td>
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<td>OIL PRESSURE GAUGE [1128,1138]</td>
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<td>72202-94</td>
<td>PACKARD 271</td>
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<td>AIR TEMPERATURE GAUGE [1148,115B]</td>
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<td>PACKARD 271</td>
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<td>C</td>
<td>D</td>
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<td>FUEL GAUGE [116B,117B]</td>
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<td>PACKARD 271</td>
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<td>C</td>
<td>D</td>
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<tr>
<td>HDI POSITION LAMP [86K]</td>
<td>ALL</td>
<td>9938</td>
<td>PACKARD 115</td>
<td>18</td>
<td>TIP</td>
<td>X</td>
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<td>HDI POSITION LAMP [8W]</td>
<td>ALL</td>
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<td>PACKARD 271</td>
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Table 10. Rear Lighting Harness, Part No. 68680-97, 68682-97

<table>
<thead>
<tr>
<th>CONNECTOR</th>
<th>POSITION</th>
<th>TERMINAL P.N.</th>
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<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
<th>INSULATION CRIMP</th>
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<tbody>
<tr>
<td>REAR LIGHTING [78]</td>
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<td>HD-41069</td>
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<td>REAR</td>
<td>REAR</td>
</tr>
<tr>
<td>REAR DIRECTIONAL [19A, 19A]</td>
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<td>73190-96</td>
<td>HD-41069</td>
<td>18</td>
<td>REAR</td>
<td>REAR</td>
</tr>
<tr>
<td>FENDER TIP LAMP [45A] (DOM)</td>
<td>ALL</td>
<td>73190-96</td>
<td>HD-41069</td>
<td>18</td>
<td>REAR</td>
<td>REAR</td>
</tr>
<tr>
<td>LICENSE PLATE LAMP (HDI)</td>
<td>ALL</td>
<td>73190-96</td>
<td>HD-41069</td>
<td>18</td>
<td>REAR</td>
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Table 11. Starter to 50 A Circuit Breaker Harness, Part No. 70045-94A

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<th>TERMINAL P.N.</th>
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<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
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<tr>
<td>STARTER TERMINAL</td>
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<td>CIRCUIT BREAKER TERMINAL</td>
<td>ALL</td>
<td>9943</td>
<td>PACKARD 270,271</td>
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Table 12. Tour Pak Harness, Part Nos. 70646-97 (CLASSIC), 70648-97 (ULTRA)

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<th>POSITION</th>
<th>TERMINAL P.N.</th>
<th>CRIMPER</th>
<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
<th>INSULATION CRIMP</th>
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<tbody>
<tr>
<td>TO SIDE LIGHTS</td>
<td>ALL</td>
<td>9855</td>
<td>PACKARD 115</td>
<td>18</td>
<td>20-16 GA.</td>
<td>20-18 GA.</td>
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<td>TO SIDE LIGHTS</td>
<td>ALL</td>
<td>9871 (h)</td>
<td>PACKARD 115</td>
<td>18</td>
<td>20-16 GA.</td>
<td>20-18 GA.</td>
</tr>
<tr>
<td>TO MAIN HARNESS [12B]</td>
<td>ALL</td>
<td>73190-96</td>
<td>HD-41069</td>
<td>18</td>
<td>REAR</td>
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Table 13. EFI Fuel Tank Harness, Part No. 70369-97

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<th>TERMINAL P.N.</th>
<th>CRIMPER</th>
<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
<th>INSULATION CRIMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUEL PUMP (YGN)</td>
<td>ALL</td>
<td>9937 (d)</td>
<td>PACKARD 271</td>
<td>18</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>FUEL GAUGE (Y/W)</td>
<td>ALL</td>
<td>9937 (d)</td>
<td>PACKARD 271</td>
<td>18</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>FUEL GAUGE (8K)</td>
<td>ALL</td>
<td>9930 (d)</td>
<td>PACKARD 271</td>
<td>18</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>MAIN HARNESS [13A]</td>
<td>ALL</td>
<td>73191-96</td>
<td>HD-41069</td>
<td>18</td>
<td>REAR</td>
<td>REAR</td>
</tr>
<tr>
<td>EFI SENSOR HARNESS [86A]</td>
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<td>72039-71A</td>
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<td>A</td>
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### Table 14. FLTR Radio Ground Jumper Wire, Part No. 70420-98

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<th>POSITION</th>
<th>TERMINAL P.N.</th>
<th>CRIPPER</th>
<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
<th>INSULATION CRIMP</th>
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<tr>
<td>TO INTERCONNECT HARNESS</td>
<td>9653</td>
<td>PACKARD 115</td>
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<td>20-18 GA.</td>
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<tr>
<td>TO UPPER FORK BRACKET</td>
<td>72241-84A</td>
<td>PACKARD 271</td>
<td>18</td>
<td>C</td>
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### Table 15. Steering Ground Wire, Part No. 70101-94

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<th>TERMINAL P.N.</th>
<th>CRIPPER</th>
<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
<th>INSULATION CRIMP</th>
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<tr>
<td>TO STEERING HEAD AND FRAME GROUND</td>
<td>9606</td>
<td>PACKARD 115</td>
<td>12</td>
<td>12-10 GA.</td>
<td>12-10 GA.</td>
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### Table 16. ECM Harness, Part No. 70233-97

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<th>CRIPPER</th>
<th>WIRE GAUGE</th>
<th>CORE CRIMP</th>
<th>INSULATION CRIMP</th>
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<tbody>
<tr>
<td>FUSE (BE/GY/RO)</td>
<td>C.E.</td>
<td>72356-95</td>
<td>PACKARD 270</td>
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<td>2</td>
<td>35°</td>
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<td>FUSE (F)</td>
<td>D.F.</td>
<td>72355-95</td>
<td>PACKARD 270</td>
<td>12</td>
<td>A</td>
<td>35°</td>
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<td>ECM (788)</td>
<td>72352-85 (a)</td>
<td>PACKARD 271</td>
<td>20</td>
<td>E</td>
<td>A</td>
<td></td>
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<td>ECM (780)</td>
<td>72326-95</td>
<td>PACKARD 271</td>
<td>18</td>
<td>E</td>
<td>A</td>
<td></td>
</tr>
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<td>CKP SENSOR (780)</td>
<td>ALL</td>
<td>70585-93</td>
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<td>20-18 GA.</td>
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<td>72326-95</td>
<td>PACKARD 271</td>
<td>18</td>
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<td>A</td>
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<tr>
<td>FUEL PUMP RELAY</td>
<td>ALL</td>
<td>9293</td>
<td>PACKARD 271</td>
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<td>ALL</td>
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<td>PACKARD 271</td>
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<td>72130-94</td>
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<td>CENTER</td>
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<td>DTT-16-00</td>
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<tr>
<td>MAIN HARNESS (98)</td>
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<td>72191-94</td>
<td>DTT-16-00</td>
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<td>CENTER</td>
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<td>72191-94</td>
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### Table 17. FLHR/C Components

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### Table 18. FLHR/C Fuel Gauge Harness, Part No. 75120-96

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### Table 1. 1998 FLHP, FLHP-I Main Harness, Part No. 70260-98

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### Table 2. Siren Harness, Part No. 70177-97

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**D-33**
### Table 3. 1998 Components

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### Table 4. 1998 FLHTP-I Fairing Interconnect Harness, Part. No. 69552-97

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<td>TACHOMETER [108B]</td>
<td>1</td>
<td>73191-98</td>
<td>HD-41609</td>
<td>16</td>
<td>REAR</td>
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<tr>
<td>VOLTMETER [1108,111B]</td>
<td>ALL</td>
<td>72038-94</td>
<td>PACKARD 271</td>
<td>18</td>
<td>C</td>
<td>D</td>
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<tr>
<td>FUEL GAUGE [1108,117B]</td>
<td>ALL</td>
<td>72038-94</td>
<td>PACKARD 271</td>
<td>18</td>
<td>C</td>
<td>D</td>
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<tr>
<td>TO SIREN AMPLIFIER HARNESS [70A]</td>
<td>EXCEPT 1</td>
<td>72190-94</td>
<td>DTT-16-00</td>
<td>16</td>
<td>CENTER POSITION</td>
<td>CENTER POSITION</td>
</tr>
<tr>
<td>TO SIREN AMPLIFIER HARNESS [70A]</td>
<td>1</td>
<td>72190-94</td>
<td>DTT-16-00</td>
<td>16</td>
<td>CENTER POSITION</td>
<td>CENTER POSITION</td>
</tr>
<tr>
<td>TO PURSUIT INDICATOR [71A]</td>
<td>ALL</td>
<td>72190-96</td>
<td>HD-41609</td>
<td>18</td>
<td>REAR</td>
<td>REAR</td>
</tr>
<tr>
<td>TO PURSUIT LAMPS [735]</td>
<td>ALL</td>
<td>72190-96</td>
<td>HD-41609</td>
<td>18</td>
<td>REAR</td>
<td>REAR</td>
</tr>
<tr>
<td>TO LOW FUEL MODULE [106B]</td>
<td>ALL</td>
<td>73191-96</td>
<td>HD-41609</td>
<td>18</td>
<td>REAR</td>
<td>REAR</td>
</tr>
</tbody>
</table>
# ELECTRICAL CONNECTOR LOCATIONS

## 1997 XLH WIRE HARNESS CONNECTORS

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>[7]</td>
<td>Tail Light/Stop</td>
<td>4 - Place Multilock</td>
<td>Under Seat</td>
</tr>
<tr>
<td>[9]</td>
<td>California Trap Door</td>
<td>3 - Place Multilock; 4 - Place Amp at Air Cleaner</td>
<td>Under Frame Backbone and Behind Air Cleaner</td>
</tr>
<tr>
<td>[10]</td>
<td>Ignition Module</td>
<td>8 - Place Deutsch</td>
<td>Under Left Side Cover; Rear Side Plate of Battery Tray</td>
</tr>
<tr>
<td>[14]</td>
<td>Camshaft Position Sensor</td>
<td>3 - Place Deutsch</td>
<td>Left Frame Tube Under Motor</td>
</tr>
<tr>
<td>[18]</td>
<td>Right Rear Turn Signal</td>
<td>2 - Place Multilock</td>
<td>Under Seat</td>
</tr>
<tr>
<td>[19]</td>
<td>Left Rear Turn Signal</td>
<td>2 - Place Multilock</td>
<td>Under Seat</td>
</tr>
<tr>
<td>[20]</td>
<td>Instrument Lights</td>
<td>12 - Place Deutsch; 12 - Place Multilock on XL1200C</td>
<td>Under Headlight Bracket (Inside Riser Cover on XL1200C)</td>
</tr>
<tr>
<td>[22]</td>
<td>Right Handlebar Controls</td>
<td>6 - Place Deutsch</td>
<td>Headlight Housing (Inside Riser Cover on XL1200C)</td>
</tr>
<tr>
<td>[24]</td>
<td>Left Handlebar Controls</td>
<td>6 - Place Deutsch</td>
<td>Headlight Housing (Inside Riser Cover on XL1200C)</td>
</tr>
<tr>
<td>[30]</td>
<td>Turn Signal Module</td>
<td>8 - Place Deutsch</td>
<td>Electrical Bracket Under Seat</td>
</tr>
<tr>
<td>[31]</td>
<td>Front Turn Signals</td>
<td>6 - Place Multilock</td>
<td>Under Fuel Tank</td>
</tr>
<tr>
<td>[38]</td>
<td>Headlamp (XL1200C)</td>
<td>4 - Place Multilock</td>
<td>Under Fuel Tank</td>
</tr>
<tr>
<td>[46]</td>
<td>Voltage Regulator to Stator</td>
<td>Special</td>
<td>Near Right Bottom Motor Mount</td>
</tr>
<tr>
<td>[65]</td>
<td>Speedometer Sensor</td>
<td>3 - Place Deutsch</td>
<td>Under Seat at Left Frame Rail</td>
</tr>
<tr>
<td>[77]</td>
<td>Regulator to Main Circuit Breaker</td>
<td>1 - Place Deutsch</td>
<td>Near Right Bottom Motor Mount</td>
</tr>
<tr>
<td></td>
<td>Ignition Coil</td>
<td>Ring Terminals</td>
<td>At Ignition Coil</td>
</tr>
<tr>
<td></td>
<td>Oil Pressure Sending Unit</td>
<td>Ring Terminals</td>
<td>Front of Engine Crankcase</td>
</tr>
<tr>
<td></td>
<td>Rear Stoplight Switch</td>
<td>Spade Terminals</td>
<td>Below Battery</td>
</tr>
<tr>
<td></td>
<td>Horn</td>
<td>Spade Terminals</td>
<td>Between Cylinders (1200cc); Between Front Downtakes (883cc)</td>
</tr>
<tr>
<td></td>
<td>Starter Relay</td>
<td>Spade Terminals</td>
<td>Electrical Bracket Under Seat</td>
</tr>
<tr>
<td></td>
<td>Fuse Block</td>
<td>Spade Terminals</td>
<td>Electrical Bracket Under Seat</td>
</tr>
<tr>
<td></td>
<td>Main Circuit Breaker</td>
<td>Ring Terminals</td>
<td>Electrical Bracket Under Seat</td>
</tr>
<tr>
<td></td>
<td>Starter Solenoid</td>
<td>Spade Terminals</td>
<td>Bottom of Starter</td>
</tr>
<tr>
<td></td>
<td>Neutral Switch</td>
<td>Post Terminal</td>
<td>Under Front Sprocket Cover</td>
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## 1998 FX WIRE HARNESS CONNECTORS

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>[7]</td>
<td>Tail Light and Rear Turn Signals</td>
<td>8-place Multilock</td>
<td>Under Seat on Right Side of Ignition Module</td>
</tr>
<tr>
<td>[9]</td>
<td>California Trap Door</td>
<td>3 - Place Multilock</td>
<td>Behind Air Cleaner (California Models)</td>
</tr>
<tr>
<td>[10]</td>
<td>Ignition Module</td>
<td>6 - Place Deutsch</td>
<td>Under Seat on Left Side of Ignition Module</td>
</tr>
<tr>
<td>[11]</td>
<td>VOES</td>
<td>2 - Place Deutsch</td>
<td>Electrical Bracket Between Fuel Tanks (Right Side)</td>
</tr>
<tr>
<td>[14]</td>
<td>Camshaft Position Sensor</td>
<td>3 - Place Deutsch</td>
<td>Below Transmission on Right Side Support Bracket</td>
</tr>
<tr>
<td>[20]</td>
<td>Console</td>
<td>12-place Multilock</td>
<td>Electrical Bracket Between Fuel Tanks</td>
</tr>
<tr>
<td>[22]</td>
<td>Right Handlebar Controls</td>
<td>6-place Deutsch</td>
<td>Electrical Bracket Between Fuel Tanks (Right Side)</td>
</tr>
<tr>
<td>[24]</td>
<td>Left Handlebar Controls</td>
<td>6-place Deutsch</td>
<td>Electrical Bracket Between Fuel Tanks (Left Side)</td>
</tr>
<tr>
<td>[30]</td>
<td>Turn Signal Module</td>
<td>8 - Place Deutsch</td>
<td>Electrical Bracket Between Fuel Tanks (Front)</td>
</tr>
<tr>
<td>[31]</td>
<td>Front Turn Signals</td>
<td>6 - Place Multilock</td>
<td>Electrical Bracket Between Fuel Tanks (Left Side)</td>
</tr>
<tr>
<td>[32]</td>
<td>Front Fender Tip Lamp (FLSTG, FLSTS)</td>
<td>2 - Place Multilock</td>
<td>Behind Left Fuel Tank</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition/Light Key Switch</td>
<td>Spade Terminals</td>
<td>Under Console</td>
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Continued on the Next Page...
### 1998 FX WIRE HARNESS CONNECTORS (Continued)

<table>
<thead>
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<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
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<tbody>
<tr>
<td>[38]</td>
<td>Headlamp</td>
<td>4 - Place Multilock</td>
<td>Electrical Bracket Between Fuel Tanks (Left Side)</td>
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<tr>
<td>[45]</td>
<td>Rear Fender Tip Lamp (FLSTC)</td>
<td>2 - Place Multilock</td>
<td>Under Fenderlip</td>
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<td>[46]</td>
<td>Voltage Regulator to Stator</td>
<td>Special</td>
<td>Front of Engine Crankcase</td>
</tr>
<tr>
<td>[65]</td>
<td>Speedometer Sensor</td>
<td>3 - Place Deutsch</td>
<td>Electrical Bracket Between Fuel Tanks (Right Side)</td>
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<tr>
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<td>Passing Lamps</td>
<td>2 - Place Multilock</td>
<td>Behind Left Fork Panel</td>
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<tr>
<td></td>
<td>Ignition Coil</td>
<td>Ring Terminals</td>
<td>At Ignition Coil</td>
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<tr>
<td></td>
<td>Oil Pressure Sending Unit</td>
<td>Ring Terminals</td>
<td>Engine Crankcase</td>
</tr>
<tr>
<td></td>
<td>Rear Stoplight Switch</td>
<td>Spade Terminals</td>
<td>Behind Transmission</td>
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<td></td>
<td>Horn</td>
<td>Spade Terminals</td>
<td>Between Cylinders (Front Fork on FLSTS)</td>
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<td>Starter Relay</td>
<td>Spade Terminals</td>
<td>Electrical Box Under Seat</td>
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<td>Fuse Block</td>
<td>Spade Terminals</td>
<td>Electrical Box Under Seat</td>
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<tr>
<td></td>
<td>Main Circuit Breaker</td>
<td>Ring Terminals</td>
<td>On Rear Fender Debris Deflector/Splash Guard</td>
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<td>Starter Solenoid</td>
<td>Spade Terminals</td>
<td>Top of Starter</td>
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<tr>
<td></td>
<td>Neutral Switch</td>
<td>Post Terminals</td>
<td>Top of Transmission</td>
</tr>
<tr>
<td></td>
<td>Harness Grounds (2)</td>
<td>Ring Terminals</td>
<td>Under Seat</td>
</tr>
<tr>
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<td>Frame Grounds</td>
<td>Ring Terminals</td>
<td>Under Seat</td>
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<tr>
<td></td>
<td>Passing Lamps Switch</td>
<td>Spade Terminals</td>
<td>Behind Left Fork Panel</td>
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### 1998 FXD WIRE HARNESS CONNECTORS

<table>
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<td>Rear Fender Lights</td>
<td>8-Place Multilock</td>
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<td>[9]</td>
<td>California Trap Door</td>
<td>3 - Place Multilock</td>
<td>Behind Air Cleaner (California Models)</td>
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<tr>
<td>[10]</td>
<td>Ignition Module</td>
<td>8-Place Deutsch</td>
<td>Under Seat, Back of Electrical Box</td>
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<td>[14]</td>
<td>Camshaft Position Sensor</td>
<td>3 - Place Deutsch</td>
<td>Above Transmission, Back of Electrical Box</td>
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<td>[20]</td>
<td>Console Gauges</td>
<td>14-Place Multilock</td>
<td>FXD, FXDS-CONV, Under Headlight Bracket FXOL, FXDWG, Under Console</td>
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<td>Console Gauges</td>
<td>10-Place Multilock</td>
<td>FXDL, Under Console</td>
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<tr>
<td>[22]</td>
<td>Right Handlebar Controls</td>
<td>6-Place Deutsch</td>
<td>Frame Backbone</td>
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<td>[24]</td>
<td>Left Handlebar Controls</td>
<td>6-Place Deutsch</td>
<td>Frame Backbone</td>
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<tr>
<td>[30]</td>
<td>Turn Signal Module</td>
<td>8-Place Deutsch</td>
<td>Electrical Box</td>
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<tr>
<td>[31]</td>
<td>Front Turn Signals</td>
<td>6-Place Multilock</td>
<td>Frame Backbone</td>
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<td>Ignition/Light Key Switch</td>
<td>Spade Terminals</td>
<td>FXDWG: Under Console; All Others: Under Seat</td>
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<td>Frame Backbone</td>
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<td>Voltage Regulator to Stator</td>
<td>Special</td>
<td>Front of Engine Crankcase</td>
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<tr>
<td>[65]</td>
<td>Speedometer Sensor</td>
<td>3 - Place Deutsch</td>
<td>Under Seat</td>
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<td>Ignition Coil</td>
<td>Ring Terminals</td>
<td>At Ignition Coll</td>
</tr>
<tr>
<td></td>
<td>Oil Pressure Sending Unit</td>
<td>Ring Terminals</td>
<td>Engine Crankcase</td>
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<td>Rear Stoplight Switch</td>
<td>Spade Terminals</td>
<td>Behind Rear Master Cylinder</td>
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<td>Horn</td>
<td>Spade Terminals</td>
<td>Between Cylinders</td>
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<td>Starter Relay</td>
<td>Spade Terminals</td>
<td>Electrical Box</td>
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<td>Fuse Block</td>
<td>Spade Terminals</td>
<td>Electrical Box</td>
</tr>
<tr>
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<td>Main Circuit Breaker</td>
<td>Ring Terminals</td>
<td>Electrical Box</td>
</tr>
<tr>
<td></td>
<td>Starter Solenoid</td>
<td>Spade Terminals</td>
<td>Top of Starter</td>
</tr>
<tr>
<td></td>
<td>Neutral Switch</td>
<td>Post Terminals</td>
<td>Top of Transmission</td>
</tr>
<tr>
<td></td>
<td>Harness Grounds (2)</td>
<td>Ring Terminals</td>
<td>Under Seat</td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Type</td>
<td>Location</td>
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<tr>
<td>[1]</td>
<td>Main to Interconnect Harness</td>
<td>12 - Place Deutsch (Black)</td>
<td>Inner Fairing - Right Fairing Bracket</td>
</tr>
<tr>
<td>[2]</td>
<td>Main to Interconnect Harness</td>
<td>12 - Place Deutsch (Gray)</td>
<td>Inner Fairing - Right Radio Support Bracket</td>
</tr>
<tr>
<td>[4]</td>
<td>Accessory</td>
<td>4 - Place Deutsch</td>
<td>Upper Frame Cross Member (Under Seat)</td>
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<tr>
<td>[6]</td>
<td>Ultras Overlay to Interconnect Harness</td>
<td>12 - Place Deutsch (Black)</td>
<td>Inner Fairing - Left Fairing Support Bracket</td>
</tr>
<tr>
<td>[7]</td>
<td>Rear Fender Lights</td>
<td>6 - Place Multilock</td>
<td>Top of Rear Fender (Under Seat)</td>
</tr>
<tr>
<td>[8]</td>
<td>Ignition Harness (EFI: Main Harness to ECM Harness)</td>
<td>8 - Place Deutsch (Gray)</td>
<td>Under Right Side Cover</td>
</tr>
<tr>
<td>[9]</td>
<td>California Trap Door (Carbureted)</td>
<td>3 - Place Multilock</td>
<td>Behind Air Cleaner</td>
</tr>
<tr>
<td>[10]</td>
<td>Ignition Module (Carbureted)</td>
<td>8 - Place Deutsch</td>
<td>Under Right Side Cover</td>
</tr>
<tr>
<td>[11]</td>
<td>VOES (Carbureted)</td>
<td>2 - Place Deutsch</td>
<td>Below Fuel Tank (Right Side)</td>
</tr>
<tr>
<td>[12]</td>
<td>Tour-Pax Lights</td>
<td>3 - Place Multilock</td>
<td>Inside Tour-Pak</td>
</tr>
<tr>
<td>[13]</td>
<td>Fuel Gauge Sending Unit</td>
<td>2 - Place Multilock</td>
<td>Behind Fuel Tank (Under Seat)</td>
</tr>
<tr>
<td>[14]</td>
<td>Camshaft Position Sensor (CMP Sensor)</td>
<td>3 - Place Deutsch</td>
<td>Bottom Fairing Cross Member (Right Side)</td>
</tr>
<tr>
<td>[15]</td>
<td>Main Power</td>
<td>4 - Place Packard</td>
<td>Inner Fairing - Anchored to Top Fork (Below Radio)</td>
</tr>
<tr>
<td>[17]</td>
<td>Cruise Control Module **</td>
<td>10 - Place Packard</td>
<td>Under Left Side Cover</td>
</tr>
<tr>
<td>[19]</td>
<td>Left Rear Turn Signal</td>
<td>2 - Place Multilock</td>
<td>Behind Directional Support Bracket</td>
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<tr>
<td>[20]</td>
<td>Speedometer</td>
<td>3 - Place Multilock</td>
<td>Inner Fairing (Above Radio)</td>
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<tr>
<td>[21]</td>
<td>Indicator Lamps</td>
<td>16 - Place Multilock</td>
<td>Inner Fairing (Above Radio)</td>
</tr>
<tr>
<td>[22]</td>
<td>Interconnect to Right Handlebar Switch Controls</td>
<td>12 - Place Deutsch (Black)</td>
<td>Inner Fairing - Right Fairing Support Bracket</td>
</tr>
<tr>
<td>[24]</td>
<td>Interconnect to Left Handlebar Switch Controls</td>
<td>12 - Place Deutsch (Gray)</td>
<td>Inner Fairing - Left Fairing Support Bracket</td>
</tr>
<tr>
<td>[27]</td>
<td>Radio *</td>
<td>23 - Place Amp (Black)</td>
<td>Inner Fairing - Back of Radio (Right Side)</td>
</tr>
<tr>
<td>[28]</td>
<td>Radio **</td>
<td>23 - Place Amp (Gray)</td>
<td>Inner Fairing - Back of Radio (Left Side)</td>
</tr>
<tr>
<td>[30]</td>
<td>Turn Signal Module</td>
<td>8 - Place Deutsch</td>
<td>Inner Fairing - Top Fork Bracket (Below Radio)</td>
</tr>
<tr>
<td>[31]</td>
<td>Front Turn Signals</td>
<td>6 - Place Multilock</td>
<td>Inner Fairing - Inboard of Left Fairing Bracket</td>
</tr>
<tr>
<td>[32]</td>
<td>Front Fender Tip Lamp (DCM)</td>
<td>2 - Place Multilock</td>
<td>Inner Fairing - Inboard of Left Fairing Bracket</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition/Light Key Switch</td>
<td>4 - Place Packard</td>
<td>Inner Fairing - Front of Top Fork Bracket (Below Radio)</td>
</tr>
<tr>
<td>[38]</td>
<td>Headlamp</td>
<td>Headlamp Connector</td>
<td>Inner Fairing</td>
</tr>
<tr>
<td>[41]</td>
<td>Rear Right Speaker/Passenger Controls **</td>
<td>6 - Place Mini-Deutsch</td>
<td>Inside Rear Right Speaker Box</td>
</tr>
<tr>
<td>[42]</td>
<td>Rear Left Speaker/Passenger Controls **</td>
<td>6 - Place Mini-Deutsch</td>
<td>Inside Rear Left Speaker Box</td>
</tr>
<tr>
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<td>Rear Fender Tip Lamp (DCM)</td>
<td>2 - Place Multilock</td>
<td>Under Rear Fender Tip</td>
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<td>[46]</td>
<td>Stator/Voltage Regulator</td>
<td>2 - Place 4acon</td>
<td>Behind Rear Brake Master Cylinder Reservoir (Under Cover)</td>
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<tr>
<td>[50]</td>
<td>CB Antenna Cable **</td>
<td>-</td>
<td>Inner Fairing - Back of Radio (Right Side)</td>
</tr>
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<td>Radio Antenna Cable *</td>
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<td>Inner Fairing - Back of Radio (Left Side)</td>
</tr>
<tr>
<td>[53]</td>
<td>Ultra Overlay Harness to Console Pod **</td>
<td>12 - Place Mini-Deutsch</td>
<td>Rear of Battery Box (Under Seat)</td>
</tr>
<tr>
<td>[64]</td>
<td>Rear Fuse Block</td>
<td>Fuse Terminals</td>
<td>Under Left Side Cover</td>
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<tr>
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<td>Rear Fuse Block</td>
<td>Fuse Terminals</td>
<td>Under Left Side Cover</td>
</tr>
<tr>
<td>[73]</td>
<td>Passing Lamps</td>
<td>2 - Place Multilock</td>
<td>Inner Fairing - Next to Top Fork Bracket</td>
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<td>[76]</td>
<td>Passenger Headset</td>
<td>7 - Place DIN</td>
<td>Below Rear Left Speaker Box</td>
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<td>Electronic Control Module (ECM) ***</td>
<td>35 - Place Amp</td>
<td>Under Right Side Cover</td>
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<tr>
<td>[79]</td>
<td>Crankshaft Position Sensor (CRP Sensor) ***</td>
<td>3 - Place Conwal</td>
<td>Under Right Side Cover Below Electrical Bracket</td>
</tr>
<tr>
<td>[80]</td>
<td>Barometric Pressure Sensor (BARO Sensor) ***</td>
<td>3 - Place Amp</td>
<td>Under Right Side Cover</td>
</tr>
<tr>
<td>[83]</td>
<td>Ignition Coil ***</td>
<td>3 - Place Amp</td>
<td>Below Fuel Tank</td>
</tr>
<tr>
<td>[84]</td>
<td>Front Injector ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
</tr>
<tr>
<td>[85]</td>
<td>Rear Injector ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
</tr>
<tr>
<td>[86]</td>
<td>Fuel Pump ***</td>
<td>1 - Place Amp</td>
<td>Under Seat (at Rear of Fuel Tank)</td>
</tr>
<tr>
<td>[87]</td>
<td>Idle Speed Control Actuator (ISC Actuator) ***</td>
<td>4 - Place Packard</td>
<td>Below Fuel Tank</td>
</tr>
<tr>
<td>[88]</td>
<td>Throttle Position Sensor (TP Sensor) ***</td>
<td>3 - Place Packard</td>
<td>Below Fuel Tank</td>
</tr>
<tr>
<td>[89]</td>
<td>Intake Air Temperature Sensor (IAT Sensor) ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
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* Classic and Ultra  ** Ultra Only  *** Fuel Injected Models
Figure D-29. Inner Fairing Connectors (FLHT/C/U)
<table>
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<tr>
<th>No.</th>
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<th>Fig.</th>
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<tr>
<td>[90]</td>
<td>Engine Temperature Sensor (ET Sensor) ***</td>
<td>2 - Place Poodcard</td>
<td>Below Fuel Tank (Front Cylinder Head Rocker Box Opening)</td>
<td></td>
</tr>
<tr>
<td>[91]</td>
<td>Data Link ***</td>
<td>4 - Place Deutsch</td>
<td>Under Right Side Cover</td>
<td>33</td>
</tr>
<tr>
<td>[105]</td>
<td>Fairing Cap Switches</td>
<td>12 - Place Multilock</td>
<td>Inner Fairing - Beneath Radio (Right Side)</td>
<td>29</td>
</tr>
<tr>
<td>[106]</td>
<td>Low Fuel Module ***</td>
<td>6 - Place Multilock</td>
<td>Inner Fairing - Left Fairing Support Brace</td>
<td>29</td>
</tr>
<tr>
<td>[107]</td>
<td>Ambient Air Temperature Sensor *</td>
<td>3 - Place Multilock</td>
<td>Inner Fairing - Left Fairing Bracket</td>
<td>29</td>
</tr>
<tr>
<td>[108]</td>
<td>Tachometer</td>
<td>5 - Place Multilock</td>
<td>Inner Fairing - Above Radio</td>
<td>29</td>
</tr>
<tr>
<td>[109]</td>
<td>Australian Passing Lamp Switch</td>
<td>1 - Place Amp</td>
<td>Inner Fairing - Inboard of Left Fairing Bracket</td>
<td>29</td>
</tr>
<tr>
<td>[110]</td>
<td>Voltmeter Lamp</td>
<td>Spade Connector</td>
<td>Inner Fairing</td>
<td>-</td>
</tr>
<tr>
<td>[111]</td>
<td>Voltmeter</td>
<td>Spade Connector</td>
<td>Inner Fairing</td>
<td>-</td>
</tr>
<tr>
<td>[112]</td>
<td>Oil Pressure Gauge Lamp</td>
<td>Spade Connector</td>
<td>Inner Fairing</td>
<td>-</td>
</tr>
<tr>
<td>[113]</td>
<td>Oil Pressure Gauge</td>
<td>Spade Connector</td>
<td>Inner Fairing</td>
<td>-</td>
</tr>
<tr>
<td>[114]</td>
<td>Air Temperature Gauge Lamp</td>
<td>Spade Connector</td>
<td>Inner Fairing</td>
<td>-</td>
</tr>
<tr>
<td>[115]</td>
<td>Air Temperature Gauge</td>
<td>Spade Connector</td>
<td>Inner Fairing</td>
<td>-</td>
</tr>
<tr>
<td>[116]</td>
<td>Fuel Gauge Lamp</td>
<td>Spade Connector</td>
<td>Inner Fairing</td>
<td>-</td>
</tr>
<tr>
<td>[117]</td>
<td>Fuel Gauge</td>
<td>Spade Connector</td>
<td>Inner Fairing</td>
<td>-</td>
</tr>
<tr>
<td>[118]</td>
<td>Fuel Pump Relay ***</td>
<td>Relay Connector</td>
<td>Rear of Battery Box (Under Seat) - Right Side</td>
<td>34</td>
</tr>
<tr>
<td>[119]</td>
<td>EPI Fuses ***</td>
<td>Fuse Terminals</td>
<td>Under Right Side Cover</td>
<td>33</td>
</tr>
<tr>
<td>[120]</td>
<td>Oil Pressure Sending Unit</td>
<td>Ring Terminals</td>
<td>Engine Crankcase</td>
<td>-</td>
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<tr>
<td>[121]</td>
<td>Rear Brake Light Switch</td>
<td>Spade Terminals</td>
<td>Beneath Transmission (Right Side)</td>
<td>-</td>
</tr>
<tr>
<td>[122]</td>
<td>Horn</td>
<td>Spade Terminals</td>
<td>Between Cylinders (Left Side)</td>
<td>-</td>
</tr>
<tr>
<td>[123]</td>
<td>Starter Relay</td>
<td>Relay Connector</td>
<td>Rear of Battery Box (Under Seat) - Left Side</td>
<td>34</td>
</tr>
<tr>
<td>[124]</td>
<td>Brake Light Relay</td>
<td>Relay Connector</td>
<td>Rear of Battery Box (Under Seat) - Left Side</td>
<td>34</td>
</tr>
<tr>
<td>[126]</td>
<td>Front Speakers *</td>
<td>Spade Terminals</td>
<td>Inner Fairing</td>
<td>-</td>
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<tr>
<td>[128]</td>
<td>Starter Solenoid</td>
<td>Spade Terminals</td>
<td>Top of Starter</td>
<td>-</td>
</tr>
<tr>
<td>[129]</td>
<td>Harness Grounds</td>
<td>Ring Terminals</td>
<td>Upper Frame Cross Member (Under Seat)</td>
<td>36</td>
</tr>
<tr>
<td>[130]</td>
<td>Ignition Coil</td>
<td>Ring Terminals</td>
<td>At Coil</td>
<td>-</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral Switch</td>
<td>Post Terminals</td>
<td>Transmission Top Cover</td>
<td>-</td>
</tr>
<tr>
<td>[132]</td>
<td>Cigarette Lighter *</td>
<td>Spade Terminals</td>
<td>Inner Fairing</td>
<td>-</td>
</tr>
<tr>
<td>[135]</td>
<td>ECM Power Relay ***</td>
<td>Relay Connector</td>
<td>Rear of Battery Box (Under Seat) - Right Side</td>
<td>34</td>
</tr>
</tbody>
</table>

* Classic and Ultra  ** Ultra Only  *** Fuel Injected Models

Figure D-30. Tour-Pak Connectors
Figure D-31. Cruise Control Module (Under Left Side Cover)

Figure D-32. Fuse Blocks (Under Left Side Cover)

Figure D-33. Electrical Bracket - Fuel Injected Models (Under Right Side Cover)
Figure D-34. Electrical Relays (Under Seat)

Figure D-35. Ignition Module - Carbureted Models (Under Right Side Cover)

Figure D-36. Electrical Connections - Upper Frame Cross Member (Under Seat)
# 1998 FLHR, FLHRC-I Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
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<th>Type</th>
<th>Location</th>
<th>Fig.</th>
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<td>[4]</td>
<td>Accessory</td>
<td>4 - Place Deutsch</td>
<td>Upper Frame Cross Member (Under Seat)</td>
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<tr>
<td>[7]</td>
<td>Rear Fender Lights</td>
<td>8 - Place Multilock</td>
<td>Top of Rear Fender (Under Seat)</td>
<td>37</td>
</tr>
<tr>
<td>[8]</td>
<td>Ignition Harness (EFI: Main Harness to ECM Harness)</td>
<td>8 - Place Deutsch (Gray)</td>
<td>Under Right Side Cover</td>
<td>33,35</td>
</tr>
<tr>
<td>[9]</td>
<td>California Trap Door (Carbureted)</td>
<td>3 - Place Multilock</td>
<td>Behind Air Cleaner</td>
<td>-</td>
</tr>
<tr>
<td>[10]</td>
<td>Ignition Module (Carbureted)</td>
<td>8 - Place Deutsch</td>
<td>Under Right Side Cover</td>
<td>35</td>
</tr>
<tr>
<td>[11]</td>
<td>VDES (Carbureted)</td>
<td>2 - Place Deutsch</td>
<td>Below Fuel Tank (Right Side)</td>
<td>-</td>
</tr>
<tr>
<td>[13]</td>
<td>Fuel Gauge Sending Unit</td>
<td>2 - Place Multilock</td>
<td>Below Fuel Tank (Left Side)</td>
<td>-</td>
</tr>
<tr>
<td>[14]</td>
<td>Camshaft Position Sensor (CMP Sensor)</td>
<td>3 - Place Deutsch</td>
<td>Bottom Frame Cross Member (Right Side)</td>
<td>-</td>
</tr>
<tr>
<td>[18]</td>
<td>Rear Turn Signals</td>
<td>2 - Place Multilock</td>
<td>Behind Directional Support Bracket</td>
<td>-</td>
</tr>
<tr>
<td>[20]</td>
<td>Main Harness to Console</td>
<td>14 - Place Multilock</td>
<td>Under Left Side Cover</td>
<td>38</td>
</tr>
<tr>
<td>[22]</td>
<td>Interconnect to Right Handlebar Controls</td>
<td>6 - Place Deutsch</td>
<td>Inside Headlamp Nacelle</td>
<td>41</td>
</tr>
<tr>
<td>[24]</td>
<td>Interconnect to Left Handlebar Controls</td>
<td>6 - Place Deutsch</td>
<td>Inside Headlamp Nacelle</td>
<td>41</td>
</tr>
<tr>
<td>[30]</td>
<td>Turn Signal Module</td>
<td>8 - Place Deutsch</td>
<td>Inside Headlamp Nacelle</td>
<td>41</td>
</tr>
<tr>
<td>[31]</td>
<td>Front Turn Signals</td>
<td>6 - Place Multilock</td>
<td>Inside Headlamp Nacelle</td>
<td>41</td>
</tr>
<tr>
<td>[32]</td>
<td>Front Fender Tip Lamp (DOM)</td>
<td>2 - Place Multilock</td>
<td>Inside Headlamp Nacelle</td>
<td>41</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition/Light Key Switch</td>
<td>3 - Place Pushon</td>
<td>Under Left Side Cover</td>
<td>-</td>
</tr>
<tr>
<td>[38]</td>
<td>Headlamp</td>
<td>Headlamp Connector</td>
<td>Inside Headlamp Nacelle</td>
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<tr>
<td>[45]</td>
<td>Rear Fender Tip Lamp (DOM)</td>
<td>1 - Place Amp</td>
<td>Under Rear Fender Tip</td>
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<tr>
<td>[46]</td>
<td>Voltage Regulator</td>
<td>2 - Place FCI</td>
<td>Behind Rear Brake Master Cylinder Reservoir (Under Cover)</td>
<td>39</td>
</tr>
<tr>
<td>[65]</td>
<td>Speedometer Sensor</td>
<td>3 - Place Deutsch</td>
<td>Upper Frame Cross Member (Under Seat)</td>
<td>-</td>
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*** Fuel Injected Models

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**Figure D-41. Headlamp Nacelle Connectors (FLHR, FLHRC-I)**
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
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<th>Location</th>
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<tbody>
<tr>
<td>[66]</td>
<td>Passing Lamp Switch</td>
<td>4 - Place AMP</td>
<td>Inside Headlamp Nacelle</td>
<td>41</td>
</tr>
<tr>
<td>[67]</td>
<td>Passing Lamps</td>
<td>2 - Place Multilock</td>
<td>Inside Headlamp Nacelle</td>
<td>41</td>
</tr>
<tr>
<td>[68]</td>
<td>Accessory Switch</td>
<td>4 - Place AMP</td>
<td>Inside Headlamp Nacelle</td>
<td>41</td>
</tr>
<tr>
<td>[78]</td>
<td>Electronic Control Module (ECM) ***</td>
<td>35 - Place AMP</td>
<td>Under Right Side Cover</td>
<td>33</td>
</tr>
<tr>
<td>[79]</td>
<td>Crankshaft Position Sensor (CKP Sensor) ***</td>
<td>3 - Place Connal</td>
<td>Under Right Side Cover Below Electrical Bracket</td>
<td>33</td>
</tr>
<tr>
<td>[80]</td>
<td>Barometric Pressure Sensor (BARO Sensor) ***</td>
<td>3 - Place AMP</td>
<td>Under Right Side Cover</td>
<td>33</td>
</tr>
<tr>
<td>[83]</td>
<td>Ignition Coil ***</td>
<td>3 - Place AMP</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[84]</td>
<td>Front Injector ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[85]</td>
<td>Rear Injector ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[86]</td>
<td>Fuel Pump ***</td>
<td>1 - Place AMP</td>
<td>Under Seat (at Rear of Fuel Tank)</td>
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<td>Idle Speed Control Actuator (ISC Actuator) ***</td>
<td>4 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[88]</td>
<td>Throttle Position Sensor (TP Sensor) ***</td>
<td>3 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[89]</td>
<td>Intake Air Temperature Sensor (IAT Sensor) ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[90]</td>
<td>Engine Temperature Sensor (ET Sensor) ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank (Front Cylinder Head Rocket Box Opening)</td>
<td>-</td>
</tr>
<tr>
<td>[91]</td>
<td>Data Link ***</td>
<td>4 - Place Deutsch</td>
<td>Under Right Side Cover</td>
<td>33</td>
</tr>
<tr>
<td>[109]</td>
<td>Australian Passing Lamp Switch</td>
<td>1 - Place AMP</td>
<td>Inside Headlamp Nacelle</td>
<td>41</td>
</tr>
<tr>
<td>[117]</td>
<td>Fuel Gauge</td>
<td>Ring Terminals</td>
<td>Bottom of Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[118]</td>
<td>Fuel Pump Relay ***</td>
<td>Relay Connector</td>
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</tr>
<tr>
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<td>EFI Fuses ***</td>
<td>Fuse Terminals</td>
<td>Engine Crankcase</td>
<td>-</td>
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<tr>
<td>[120]</td>
<td>Oil Pressure Sending Unit</td>
<td>Ring Terminals</td>
<td>Beneath Transmission</td>
<td>-</td>
</tr>
<tr>
<td>[121]</td>
<td>Rear Brake Light Switch</td>
<td>Spade Terminals</td>
<td>Beneath Transmission</td>
<td>-</td>
</tr>
<tr>
<td>[122]</td>
<td>Horn</td>
<td>Spade Terminals</td>
<td>Between Cylinders (Left Side)</td>
<td>-</td>
</tr>
<tr>
<td>[123]</td>
<td>Starter Relay</td>
<td>Relay Connector</td>
<td>Under Seat (Left Side)</td>
<td>34</td>
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<tr>
<td>[124]</td>
<td>Brake Light Relay</td>
<td>Relay Connector</td>
<td>Under Seat (Left Side)</td>
<td>34</td>
</tr>
<tr>
<td>[125]</td>
<td>Fuse Blocks</td>
<td>Fuse Terminals</td>
<td>Under Left Side Cover</td>
<td>31,32</td>
</tr>
<tr>
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<td>Upper Frame Cross Member (Under Seat)</td>
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<tr>
<td>[128]</td>
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<td>Space Terminals</td>
<td>Top of Starter</td>
<td>-</td>
</tr>
<tr>
<td>[129]</td>
<td>Harness Grounds</td>
<td>Ring Terminals</td>
<td>Upper Frame Cross Member (Under Seat)</td>
<td>36</td>
</tr>
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<td>[130]</td>
<td>Ignition Coil</td>
<td>Ring Terminals</td>
<td>At Coll</td>
<td>-</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral Switch</td>
<td>Post Terminals</td>
<td>Top of Transmission</td>
<td>-</td>
</tr>
<tr>
<td>[135]</td>
<td>ECM Power Relay ***</td>
<td>Relay Connector</td>
<td>Under Seat (Right Side)</td>
<td>34</td>
</tr>
<tr>
<td>-</td>
<td>Position Lamp (HDI)</td>
<td>Spade Terminals</td>
<td>Inside Headlamp Nacelle</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
<td>Fuel Pump ***</td>
<td>Spade Terminals</td>
<td>Inside Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
<td>Fuel Level Sender</td>
<td>Ring Terminals</td>
<td>Fuel Tank</td>
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*** Fuel Injected Models
### 1998 FLTR, FLTR-I WIRE HARNESS CONNECTORS

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<th>Location</th>
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<tbody>
<tr>
<td>[1]</td>
<td>Main to Interconnect Harness</td>
<td>12 - Place Deutsch (Black)</td>
<td>Inner Fairing - Below Radio (Right Side)</td>
<td>43</td>
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<tr>
<td>[2]</td>
<td>Main to Interconnect Harness</td>
<td>12 - Place Deutsch (Gray)</td>
<td>Inner Fairing - Front of Radio Bracket (Right Side)</td>
<td>43</td>
</tr>
<tr>
<td>[4]</td>
<td>Accessory</td>
<td>4 - Place Deutsch</td>
<td>Upper Frame Cross Member (Under Seat)</td>
<td>36</td>
</tr>
<tr>
<td>[6]</td>
<td>Ultra Overlay to Interconnect Harness</td>
<td>12 - Place Deutsch (Black)</td>
<td>Inner Fairing - Left Side of Radio Bracket</td>
<td>43</td>
</tr>
<tr>
<td>[7]</td>
<td>Rear Fender Lights</td>
<td>8 - Place Multilock</td>
<td>Top of Rear Fender (Under Seat)</td>
<td>37</td>
</tr>
<tr>
<td>[8]</td>
<td>Ignition Harness (EFI Main Harness to ECM Harness)</td>
<td>6 - Place Deutsch (Gray)</td>
<td>Under Right Side Cover</td>
<td>33,35</td>
</tr>
<tr>
<td>[9]</td>
<td>California Trap Door (Carbureted)</td>
<td>3 - Place Multilock</td>
<td>Behind Air Cleaner</td>
<td>-</td>
</tr>
<tr>
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<td>Ignition Module (Carbureted)</td>
<td>6 - Place Deutsch</td>
<td>Under Right Side Cover</td>
<td>35</td>
</tr>
<tr>
<td>[11]</td>
<td>VCES (Carbureted)</td>
<td>2 - Place Deutsch</td>
<td>Below Fuel Tank (Right Side)</td>
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<tr>
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<td>Fuel Gauge Sending Unit</td>
<td>2 - Place Multilock</td>
<td>Behind Fuel Tank (Under Seat)</td>
<td>40</td>
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<tr>
<td>[14]</td>
<td>Camshaft Position Sensor (CMP Sensor)</td>
<td>3 - Place Deutsch</td>
<td>Bottom Frame Cross Member (Right Side)</td>
<td>-</td>
</tr>
<tr>
<td>[15]</td>
<td>Main Power</td>
<td>4 - Place Packard</td>
<td>Inner Fairing - Below Radiator</td>
<td>43</td>
</tr>
<tr>
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<td>Right Rear Turn Signal</td>
<td>2 - Place Multilock</td>
<td>Behind Directional Support Bracket</td>
<td>-</td>
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<td>[17]</td>
<td>Left Rear Turn Signal</td>
<td>2 - Place Multilock</td>
<td>Behind Directional Support Bracket</td>
<td>-</td>
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<td>[20]</td>
<td>Speedometer</td>
<td>Speedometer to Jumper Harness</td>
<td>3 - Place Multilock</td>
<td>Inside Instrument Nacelle (Under Bezel)</td>
</tr>
<tr>
<td></td>
<td>[20A, 20D]</td>
<td>Jumper Harness to Interconnect</td>
<td>3 - Place Multilock</td>
<td>Inner Fairing - Below Radio</td>
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<tr>
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<td>Indicator Lamps</td>
<td>Indicator Lamps to Jumper Harness</td>
<td>10 - Place Multilock</td>
<td>Inside Instrument Nacelle (Under Bezel)</td>
</tr>
<tr>
<td></td>
<td>[21C, 21A]</td>
<td>Jumper Harness to Interconnect</td>
<td>10 - Place Multilock</td>
<td>Inner Fairing - Below Radio</td>
</tr>
<tr>
<td>[22]</td>
<td>Interconnect to Right Handlebar Switch Controls</td>
<td>12 - Place Deutsch (Black)</td>
<td>Inner Fairing - Right Side of Radio Bracket</td>
<td>43</td>
</tr>
<tr>
<td>[24]</td>
<td>Interconnect to Left Handlebar Switch Controls</td>
<td>12 - Place Deutsch (Gray)</td>
<td>Inner Fairing - Left Side of Radio Bracket</td>
<td>43</td>
</tr>
<tr>
<td>[27]</td>
<td>Radio</td>
<td>23 - Place Amp (Black)</td>
<td>Inner Fairing - Back of Radio (Right Side)</td>
<td>43</td>
</tr>
<tr>
<td>[30]</td>
<td>Turn Signal Module</td>
<td>8 - Place Deutsch (Gray)</td>
<td>Inner Fairing - Below Radio (Right Side)</td>
<td>43</td>
</tr>
<tr>
<td>[31]</td>
<td>Front Turn Signals</td>
<td>6 - Place Multilock</td>
<td>Inner Fairing - Below Radio</td>
<td>43</td>
</tr>
<tr>
<td>[32]</td>
<td>Ignition/Light Key Switch</td>
<td>4 - Place Packard</td>
<td>Inner Fairing - Inside Fairing Bracket Tunnel (Left Side)</td>
<td>43</td>
</tr>
<tr>
<td>[36]</td>
<td>Headlamp</td>
<td>Headlamp Connector</td>
<td>Inner Fairing</td>
<td>-</td>
</tr>
</tbody>
</table>

*** Fuel Injected Models

---

**Figure D-42. Instrument Nacelle Connectors (FLTR, FLTR-I)**

---

**Tachometer Gauge [108D]**

**6-Place Multilock**

---

**Speedometer Gauge [20D]**

**3-Place Multilock**

---

**Speaker Switch [105CD]**

**4-Place Multilock**

---

**Speedometer Drive**

---

**Indicator Lamps [21C]**

**10-Place Multilock**

---

**f1561x8x**

---

D-45
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
<th>Fig.</th>
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<tr>
<td>[45]</td>
<td>Rear Fender Tip Lamp (DOM)</td>
<td>2 - Place Multilock</td>
<td>Under Rear Fender Tip</td>
<td>-</td>
</tr>
<tr>
<td>[46]</td>
<td>Stator/Voltage Regulator</td>
<td>2 - Place Facon</td>
<td>Behind Rear Brake Master Cylinder Reservoir (Under Cover)</td>
<td>39</td>
</tr>
<tr>
<td>[51]</td>
<td>Radio Antenna Cable</td>
<td>-</td>
<td>Inner Fairing - Back of Radio (Left Side)</td>
<td>43</td>
</tr>
<tr>
<td>[64]</td>
<td>Rear Fuse Block</td>
<td>Fuse Terminals</td>
<td>Under Left Side Cover</td>
<td>31,32</td>
</tr>
<tr>
<td>[65]</td>
<td>Front Fuse Block</td>
<td>Fuse Terminals</td>
<td>Under Left Side Cover</td>
<td>31,32</td>
</tr>
<tr>
<td>[78]</td>
<td>Electronic Control Module (ECM) ***</td>
<td>35 - Place Amp</td>
<td>Under Right Side Cover</td>
<td>33</td>
</tr>
<tr>
<td>[79]</td>
<td>Crankshaft Position Sensor (CKP Sensor) ***</td>
<td>3 - Place Connal</td>
<td>Under Right Side Cover Below Electrical Bracket</td>
<td>33</td>
</tr>
<tr>
<td>[80]</td>
<td>Barometric Pressure Sensor (BARO Sensor) ***</td>
<td>3 - Place Amp</td>
<td>Under Right Side Cover</td>
<td>33</td>
</tr>
<tr>
<td>[83]</td>
<td>Ignition Coil ***</td>
<td>3 - Place Amp</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[84]</td>
<td>Front Injector ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[85]</td>
<td>Rear Injector ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
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</table>

*** Fuel Injected Models

---

**Figure D-43. Inner Fairing Connectors (FLTR, FLTR-I)**
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
<th>Fig.</th>
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</thead>
<tbody>
<tr>
<td>[86]</td>
<td>Fuel Pump ***</td>
<td>1 - Place Amp</td>
<td>Under Seat (at Rear of Fuel Tank)</td>
<td>40</td>
</tr>
<tr>
<td>[87]</td>
<td>Idle Speed Control Actuator (ISC Actuator) ***</td>
<td>4 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[88]</td>
<td>Throttle Position Sensor (TP Sensor) ***</td>
<td>3 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[89]</td>
<td>Intake Air Temperature Sensor (IAT Sensor) ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[90]</td>
<td>Engine Temperature Sensor (ET Sensor) ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank (Front Cylinder Head Rocker Box Opening)</td>
<td>-</td>
</tr>
<tr>
<td>[91]</td>
<td>Data Link ***</td>
<td>4 - Place Deutsch</td>
<td>Under Right Side Cover</td>
<td>33</td>
</tr>
</tbody>
</table>

Instrument Nacelle Switches

| [105] | Speaker Switch to Jumper Harness | 4 - Place Multilock | Inside Instrument Nacelle (Under Bezel) | 42 |
| [105B, 105A] | Jumper Harness to Interconnect | 12 - Place Multilock | Inner Fairing - Below Radio | 43 |

Low Fuel Module ***

| [106] | 6 - Place Multilock | Inner Fairing - Left Side of Radio Bracket | 43 |

Ambient Air Temperature Sensor *

| [107] | 3 - Place Multilock | Inner Fairing - Below Radio (Left Side) | 43 |

Tachometer

| [108A, 108D] | Tachometer to Jumper Harness | 6 - Place Multilock | Inside Instrument Nacelle (Under Bezel) | 42 |
| [108C, 108B] | Jumper Harness to Interconnect | 6 - Place Multilock | Inner Fairing - Below Radio | 43 |

| [109] | Australian Passing Lamp Switch | 1 - Place Amp | Inner Fairing - Below Radio | - |
| [110] | Voltmeter | Spade Connector | Inner Fairing | - |
| [111] | | Spade Connector | Inner Fairing | - |
| [112] | Oil Pressure Gauge Lamp | Spade Connector | Inner Fairing | - |
| [113] | Oil Pressure Gauge | Spade Connector | Inner Fairing | - |
| [114] | Air Temperature Gauge Lamp | Spade Connector | Inner Fairing | - |
| [115] | Air Temperature Gauge | Spade Connector | Inner Fairing | - |
| [116] | Fuel Gauge Lamp | Spade Connector | Inner Fairing | - |
| [117] | Fuel Gauge | Spade Connector | Inner Fairing | - |

| [118] | Fuel Pump Relay *** | Relay Connector | Rear of Battery Box (Under Seat) - Right Side | 34 |
| [119] | EFI Fuses *** | Fuse Terminals | Under Right Side Cover | 33 |
| [120] | Oil Pressure Sending Unit | Ring Terminals | Engine Crankcase | - |
| [121] | Rear Brake Light Switch | Spade Terminals | Beneath Transmission (Right Side) | - |
| [122] | Horn | Spade Terminals | Between Cylinders (Left Side) | - |
| [123] | Starter Relay | Relay Connector | Rear of Battery Box (Under Seat) - Left Side | 34 |
| [124] | Brake Light Relay | Relay Connector | Rear of Battery Box (Under Seat) - Left Side | 34 |
| [125] | Front Speakers | Spade Terminals | Inner Fairing | - |
| [126] | Starter Solenoid | Spade Terminals | Top of Starter | - |
| [127] | Harness Grounds | Ring Terminals | Upper Frame Cross Member (Under Seat) | 36 |
| [130] | Ignition Coil | Ring Terminals | At Coil | - |
| [131] | Neutral Switch | Post Terminals | Transmission Top Cover | - |
| [132] | Cigarette Lighter | Spade Terminals | Inner Fairing | - |
| [135] | ECM Power Relay *** | Relay Connector | Rear of Battery Box (Under Seat) - Right Side | 34 |

*** Fuel Injected Models
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
<th>Fig.</th>
</tr>
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<tbody>
<tr>
<td>[4]</td>
<td>P&amp;A Accessory</td>
<td>4 - Place Deutsch</td>
<td>In Front of Upper Frame Cross Member (Under Seat)</td>
<td>36</td>
</tr>
<tr>
<td>[7]</td>
<td>Rear Fender Lights</td>
<td>6 - Multilock</td>
<td>Top of Rear Fender (Under Seat)</td>
<td>37</td>
</tr>
<tr>
<td>[8]</td>
<td>Ignition Harness (EFI: Main Harness to ECM Harness)</td>
<td>8 - Place Deutsch (Gray)</td>
<td>Under Right Side Cover</td>
<td>33,35</td>
</tr>
<tr>
<td>[10]</td>
<td>Ignition Module (Carbureted)</td>
<td>8 - Place Deutsch</td>
<td>Under Right Side Cover</td>
<td>35</td>
</tr>
<tr>
<td>[11]</td>
<td>VOES (Carbureted)</td>
<td>2 - Place Deutsch</td>
<td>Below Fuel Tank (Right Side)</td>
<td>-</td>
</tr>
<tr>
<td>[13]</td>
<td>Fuel Gauge Sending Unit</td>
<td>2 - Place Multilock</td>
<td>Below Fuel Tank (Left Side)</td>
<td>-</td>
</tr>
<tr>
<td>[14]</td>
<td>Camshaft Position Sensor (CMP Sensor)</td>
<td>3 - Place Deutsch</td>
<td>Bottom Frame Cross Member (Right Side)</td>
<td>-</td>
</tr>
<tr>
<td>[18]</td>
<td>Rear Turn Signals</td>
<td>2 - Place Multilock</td>
<td>Behind Directional Support Bracket</td>
<td>-</td>
</tr>
<tr>
<td>[20]</td>
<td>Main Harness to Console</td>
<td>14 - Place Multilock</td>
<td>Under Left Side Cover</td>
<td>38</td>
</tr>
<tr>
<td>[22]</td>
<td>Interconnect to Right Handlebar Controls</td>
<td>12 - Place Deutsch</td>
<td>Inside Headlamp Nacelle</td>
<td>44</td>
</tr>
<tr>
<td>[24]</td>
<td>Interconnect to Left Handlebar Controls</td>
<td>12 - Place Deutsch</td>
<td>Inside Headlamp Nacelle</td>
<td>44</td>
</tr>
<tr>
<td>[30]</td>
<td>Turn Signal Module</td>
<td>8 - Place Deutsch</td>
<td>Inside Headlamp Nacelle</td>
<td>44</td>
</tr>
<tr>
<td>[31]</td>
<td>Front Turn Signals</td>
<td>6 - Place Multilock</td>
<td>Inside Headlamp Nacelle</td>
<td>44</td>
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<tr>
<td>[32]</td>
<td>Front Fender Tip Lamp (DOM)</td>
<td>2 - Place Multilock</td>
<td>Inside Headlamp Nacelle</td>
<td>44</td>
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<tr>
<td>[33]</td>
<td>Ignition/Light Key Switch</td>
<td>3 - Place Packard</td>
<td>Under Left Side Cover</td>
<td>-</td>
</tr>
<tr>
<td>[38]</td>
<td>Headlamp</td>
<td>Headlamp Connector</td>
<td>Inside Headlamp Nacelle</td>
<td>-</td>
</tr>
<tr>
<td>[45]</td>
<td>Rear Fender Tip Lamp (DOM)</td>
<td>2 - Place Multilock</td>
<td>Under Rear Fender Tip</td>
<td>-</td>
</tr>
<tr>
<td>[46]</td>
<td>Voltage Regulator</td>
<td>2 - Place FCI</td>
<td>Behind Rear Master Cylinder Reservoir (Under Cover)</td>
<td>39</td>
</tr>
<tr>
<td>[57]</td>
<td>Siren Speaker</td>
<td>2 - Place Deutsch</td>
<td>Front of Fuel Tank (Right Side)</td>
<td>-</td>
</tr>
<tr>
<td>[58]</td>
<td>Siren P/A Amplifier</td>
<td>18 - Place Packard</td>
<td>Under Left Side Cover or Left Rear Engine Guard</td>
<td>-</td>
</tr>
<tr>
<td>[59]</td>
<td>Rear Pole Lamp</td>
<td>2 - Place Deutsch</td>
<td>Under Radio Carrier (Left Side)</td>
<td>-</td>
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<tr>
<td>[65]</td>
<td>Speedometer Sensor</td>
<td>3 - Place Deutsch</td>
<td>Upper Frame Cross Member (Under Seat)</td>
<td>-</td>
</tr>
<tr>
<td>[67]</td>
<td>Accessory Switch</td>
<td>4 - Place Amp</td>
<td>Inside Headlamp Nacelle</td>
<td>44</td>
</tr>
<tr>
<td>[69]</td>
<td>Pursuit Flasher</td>
<td>Relay Connector</td>
<td>Under Left Side Cover</td>
<td>-</td>
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<tr>
<td>[72]</td>
<td>Siren Amplifier</td>
<td>18 - Place Packard</td>
<td>Left Side Cover</td>
<td>-</td>
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<tr>
<td>[73]</td>
<td>Pursuit Lamps</td>
<td>2 - Place Multilock</td>
<td>Inside Headlamp Nacelle</td>
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<tr>
<td>[78]</td>
<td>Electronic Control Module (ECM) ***</td>
<td>35 - Place Amp</td>
<td>Under Right Side Cover</td>
<td>33</td>
</tr>
<tr>
<td>[79]</td>
<td>Crankshaft Position Sensor (CKP Sensor) ***</td>
<td>3 - Place Connex</td>
<td>Under Right Side Cover Below Electrical Bracket</td>
<td>33</td>
</tr>
<tr>
<td>[80]</td>
<td>Barometric Pressure Sensor (BARO Sensor) ***</td>
<td>3 - Place Amp</td>
<td>Under Right Side Cover Below Electrical Bracket</td>
<td>33</td>
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<tr>
<td>[83]</td>
<td>Ignition Coil ***</td>
<td>3 - Place Amp</td>
<td>Below Fuel Tank</td>
<td>-</td>
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<td>[84]</td>
<td>Front Injector ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[85]</td>
<td>Rear Injector ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[86]</td>
<td>Fuel Pump ***</td>
<td>1 - Place Amp</td>
<td>Under Seat (at Rear of Fuel Tank)</td>
<td>40</td>
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<tr>
<td>[87]</td>
<td>Idle Speed Control Actuator (ISC Actuator) ***</td>
<td>4 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[88]</td>
<td>Throttle Position Sensor (TP Sensor) ***</td>
<td>3 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[89]</td>
<td>Intake Air Temperature Sensor (IAT Sensor) ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
</tr>
<tr>
<td>[90]</td>
<td>Engine Temperature Sensor (ET Sensor) ***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank (Front Cylinder Head, Rocker Box Opening)</td>
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*** Fuel Injected Models

Continued on the Next Page...
<table>
<thead>
<tr>
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<th>Location</th>
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<td>Data Link ***</td>
<td>4-Place Deutsch</td>
<td>Under Right Side Cover</td>
<td>33</td>
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<tr>
<td>[108]</td>
<td>Tachometer</td>
<td>3-Place Deutsch</td>
<td>Inside Headlamp Nacelle</td>
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<td>[117]</td>
<td>Fuel Gauge</td>
<td>Ring Terminals</td>
<td>Fuel Tank (Bottom of Fuel Gauge)</td>
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<tr>
<td>[118]</td>
<td>Fuel Pump Relay ***</td>
<td>Relay Connector</td>
<td>Under Seat (Right Side)</td>
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<td>EFI Fuses ***</td>
<td>Fuse Terminals</td>
<td>Fuse Holder - Under Right Side Cover</td>
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<td>Oil Pressure Sending Unit</td>
<td>Ring Terminals</td>
<td>Engine Crankcase</td>
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<td>[121]</td>
<td>Rear Brake Light Switch</td>
<td>Space Terminals</td>
<td>Beneath Transmission</td>
<td>-</td>
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<td>[122]</td>
<td>Horn</td>
<td>Space Terminals</td>
<td>Between Cylinders (Left Side)</td>
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<td>[123]</td>
<td>Starter Relay</td>
<td>Relay Connector</td>
<td>Under Seat</td>
<td>34</td>
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<tr>
<td>[124]</td>
<td>Brake Light Relay</td>
<td>Relay Connector</td>
<td>Under Seat</td>
<td>34</td>
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<tr>
<td>[125]</td>
<td>Fuse Block</td>
<td>Space Terminals</td>
<td>Under Left Side Cover</td>
<td>31,32</td>
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<tr>
<td>[127]</td>
<td>Main Circuit Breaker</td>
<td>Ring Terminals</td>
<td>Upper Frame Cross Member (Under Seat)</td>
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<tr>
<td>[128]</td>
<td>Starter Solenoid</td>
<td>Space Terminals</td>
<td>Top of Starter</td>
<td>-</td>
</tr>
<tr>
<td>[129]</td>
<td>Harness Grounds</td>
<td>Ring Terminals</td>
<td>Upper Frame Cross Member (Under Seat)</td>
<td>-</td>
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<td>[130]</td>
<td>Ignition Coil</td>
<td>Ring Terminals</td>
<td>At Coil</td>
<td>-</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral Switch</td>
<td>Post Terminals</td>
<td>Top of Transmission</td>
<td>-</td>
</tr>
<tr>
<td>[135]</td>
<td>ECM Power Relay ***</td>
<td>Relay Connector</td>
<td>Under Seat (Right Side)</td>
<td>34</td>
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</tbody>
</table>

*** Fuel Injected Models

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**Figure D-44. Headlamp Nacelle Connectors (FLHP, FLHP-I)**

---

1998 FLHP, FLHP-I WIRE HARNESS CONNECTORS (Continued)
### 1998 FLHTP-I Wire Harness Connectors

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Type</th>
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<th>Fig.</th>
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<tbody>
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<td>[1]</td>
<td>Main Harness to Interconnect</td>
<td>12 - Place Deutsch</td>
<td>Inner Fairing - Right Fairing Bracket</td>
<td>45</td>
</tr>
<tr>
<td>[2]</td>
<td>Main Harness to Interconnect</td>
<td>12 - Place Deutsch</td>
<td>Inner Fairing - Right Storage Box Bracket</td>
<td>45</td>
</tr>
<tr>
<td>[4]</td>
<td>Accessory</td>
<td>4 - Place Deutsch</td>
<td>Upper Frame Cross Member (Under Seat)</td>
<td>35</td>
</tr>
<tr>
<td>[7]</td>
<td>Rear Fender Lights</td>
<td>8 - Place Multilok</td>
<td>Top of Rear Fender (Under Seat)</td>
<td>37</td>
</tr>
<tr>
<td>[8]</td>
<td>Ignition Harness (EFI: Main Harness to ECM Harness)</td>
<td>8 - Place Deutsch</td>
<td>Under Right Side Cover</td>
<td>33,35</td>
</tr>
<tr>
<td>[13]</td>
<td>Fuel Gauge Sending Unit</td>
<td>2 - Place Multilok</td>
<td>Behind Fuel Tank (Under Seat)</td>
<td>-</td>
</tr>
<tr>
<td>[14]</td>
<td>Camshaft Position Sensor (CMP Sensor)</td>
<td>3 - Place Deutsch</td>
<td>Bottom Frame Cross Member (Right Side)</td>
<td>-</td>
</tr>
<tr>
<td>[15]</td>
<td>Main Harness to Interconnect</td>
<td>4 - Place Packard</td>
<td>Inner Fairing - Front of Storage Box Bracket</td>
<td>45</td>
</tr>
<tr>
<td>[18]</td>
<td>Rear Turn Signals</td>
<td>2 - Place Multilok</td>
<td>Behind Directional Support Bracket</td>
<td>-</td>
</tr>
<tr>
<td>[20]</td>
<td>Speedometer</td>
<td>3 - Place Multilok</td>
<td>Inner Fairing - Above Storage Box</td>
<td>45</td>
</tr>
<tr>
<td>[21]</td>
<td>Indicator Lamps</td>
<td>10 - Place Multilok</td>
<td>Inner Fairing - Above Storage Box</td>
<td>45</td>
</tr>
<tr>
<td>[22]</td>
<td>Interconnect to Right Handlebar Switch Controls</td>
<td>12 - Place Deutsch</td>
<td>Inner Fairing - Right Fairing Support Brace</td>
<td>45</td>
</tr>
<tr>
<td>[23]</td>
<td>Interconnect to Left Handlebar Switch Controls</td>
<td>12 - Place Deutsch</td>
<td>Inner Fairing - Left Fairing Support Brace</td>
<td>45</td>
</tr>
<tr>
<td>[30]</td>
<td>Turn Signal Module</td>
<td>8 - Place Deutsch</td>
<td>Inner Fairing - Below Storage Box</td>
<td>45</td>
</tr>
<tr>
<td>[31]</td>
<td>Front Turn Signals</td>
<td>6 - Place Multilok</td>
<td>Inner Fairing (Inboard of Left Fairing Bracket)</td>
<td>45</td>
</tr>
<tr>
<td>[32]</td>
<td>Front Fender Tip Lamp</td>
<td>2 - Place Multilok</td>
<td>Inner Fairing - Left Fairing Bracket</td>
<td>45</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition/Light Key Switch</td>
<td>4 - Place Packard</td>
<td>Inner Fairing - Below Storage Box</td>
<td>45</td>
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<tr>
<td>[38]</td>
<td>Headlamp</td>
<td>Headlamp Connector</td>
<td>Inner Fairing</td>
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<td>Rear Fender Tip Lamp</td>
<td>2 - Place Multilok</td>
<td>Under Rear Fender Tip</td>
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<td>[46]</td>
<td>Stator/Voltage Regulator</td>
<td>2 - Place Facon</td>
<td>Behind Rear Master Cylinder Reservoir (Under Cover)</td>
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<tr>
<td>[57]</td>
<td>Siren/PA Speaker</td>
<td>2 - Place Deutsch</td>
<td>Front of Fuel Tank (Right Side)</td>
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<tr>
<td>[59]</td>
<td>Rear Pole Lamp</td>
<td>2 - Place Deutsch</td>
<td>Under Radio Carrier (Left Side)</td>
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<tr>
<td>[64]</td>
<td>Rear Fuse Block</td>
<td>Fuse Terminals</td>
<td>Under Left Side Cover</td>
<td>31,32</td>
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<tr>
<td>[65]</td>
<td>Front Fuse Block</td>
<td>Fuse Terminals</td>
<td>Under Left Side Cover</td>
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<td>Pursuit Flasher</td>
<td>Relay Connector</td>
<td>Under Left Side Cover</td>
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<tr>
<td>[70]</td>
<td>Siren Amplifier Harness</td>
<td>12 - Place Deutsch</td>
<td>Inner Fairing - Left Fairing Support Brace</td>
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<td>[71]</td>
<td>Pursuit Indicator Lamp</td>
<td>2 - Place Multilok</td>
<td>Inner Fairing - Below Storage Box Bracket</td>
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<tr>
<td>[72]</td>
<td>Siren Amplifier</td>
<td>18 - Place Packard</td>
<td>Under Left Side Cover or Left Rear Engine Guard</td>
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<tr>
<td>[73]</td>
<td>Pursuit Lamps</td>
<td>2 - Place Multilok</td>
<td>Inner Fairing - Next to Top Fork Bracket</td>
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<td>[78]</td>
<td>Electronic Control Module (ECM)***</td>
<td>35 - Place Amp</td>
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<tr>
<td>[79]</td>
<td>Crankshaft Position Sensor (CKP Sensor)***</td>
<td>3 - Place Connal</td>
<td>Under Right Side Cover or Below Electrical Bracket</td>
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<td>[80]</td>
<td>Barometric Pressure Sensor (BARO Sensor)***</td>
<td>3 - Place Amp</td>
<td>Under Right Side Cover</td>
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<tr>
<td>[83]</td>
<td>Ignition Coil***</td>
<td>3 - Place Amp</td>
<td>Below Fuel Tank</td>
<td>-</td>
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<tr>
<td>[84]</td>
<td>Front Injector***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
<td>-</td>
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<tr>
<td>[86]</td>
<td>Rear Injector***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
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<tr>
<td>[87]</td>
<td>Idle Speed Control Actuator (ISC Actuator)***</td>
<td>4 - Place Packard</td>
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<td>[88]</td>
<td>Throttle Position Sensor (TP Sensor)***</td>
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<tr>
<td>[89]</td>
<td>Intake Air Temperature Sensor (IAT Sensor)***</td>
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<td>Below Fuel Tank</td>
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<td>[90]</td>
<td>Engine Temperature Sensor (ET Sensor)***</td>
<td>2 - Place Packard</td>
<td>Below Fuel Tank</td>
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<tr>
<td>[91]</td>
<td>Data Link***</td>
<td>4 - Place Deutsch</td>
<td>Under Right Side Cover</td>
<td>33</td>
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<td>[106]</td>
<td>Low Fuel Module***</td>
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<td>Inner Fairing - Left Fairing Support Brace</td>
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<tr>
<td>[108]</td>
<td>Tachometer</td>
<td>6 - Place Multilok</td>
<td>Inner Fairing - Above Storage Box</td>
<td>45</td>
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<tr>
<td>[110]</td>
<td>Voltmeter Lamp</td>
<td>Spade Connector</td>
<td>Inner Fairing</td>
<td>45</td>
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<td>[111]</td>
<td>Voltmeter</td>
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<td>45</td>
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<td>[116]</td>
<td>Fuel Gauge Lamp</td>
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<td>Inner Fairing</td>
<td>45</td>
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<tr>
<td>[117]</td>
<td>Fuel Gauge</td>
<td>Spade Connector</td>
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<td>[118]</td>
<td>Fuel Pump Relay***</td>
<td>Relay Connector</td>
<td>Rear of Battery Box (Under Seat) - Right Side</td>
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<tr>
<td>[119]</td>
<td>EFI Fuses***</td>
<td>Fuse Terminal</td>
<td>Under Right Side Cover</td>
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Continued on the Next Page...
### 1998 FLHTP-I WIRE HARNESS CONNECTORS (Continued)

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<th>Description</th>
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<th>Location</th>
<th>Fig.</th>
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<tr>
<td>120</td>
<td>Oil Pressure Sending Unit</td>
<td>Ring Terminals</td>
<td>Engine Crankcase</td>
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<tr>
<td>121</td>
<td>Rear Brake Light Switch</td>
<td>Spade Terminals</td>
<td>Beneath Transmission (Right Side)</td>
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<tr>
<td>122</td>
<td>Horn</td>
<td>Spade Terminals</td>
<td>Between Cylinders (Left Side)</td>
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<tr>
<td>123</td>
<td>Starter Relay</td>
<td>Relay Connector</td>
<td>Rear of Battery Box (Under Seat) - Left Side</td>
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<tr>
<td>124</td>
<td>Brake Light Relay</td>
<td>Relay Connector</td>
<td>Rear of Battery Box (Under Seat) - Left Side</td>
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<tr>
<td>128</td>
<td>Starter Solenoid</td>
<td>Spade Terminals</td>
<td>Top of Starter</td>
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<td>129</td>
<td>Harness Grounds</td>
<td>Ring Terminals</td>
<td>Upper Frame Cross Member (Under Seat)</td>
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<td>130</td>
<td>Ignition Coil</td>
<td>Ring Terminals</td>
<td>At Coil</td>
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<td>131</td>
<td>Neutral Switch</td>
<td>Post Terminals</td>
<td>Top of Transmission</td>
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<td>132</td>
<td>Cigarette Lighter</td>
<td>Spade Terminals</td>
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<tr>
<td>135</td>
<td>ECM Power Relay***</td>
<td>Relay Connector</td>
<td>Under Seat (Right Side)</td>
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**Figure D-45. Inner Fairing Connectors (FLHTP-I)**
<table>
<thead>
<tr>
<th>Subject</th>
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<tbody>
<tr>
<td>XLH 883, XLH 883 Hugger, XLH 1200, XL 1200 Custom</td>
<td>D-55</td>
</tr>
<tr>
<td>Main Harness</td>
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<tr>
<td>Ignition Circuit</td>
<td>D-56</td>
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<tr>
<td>Horn and Instruments</td>
<td>D-57</td>
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<td>Headlamp, Tail Lamp, Directional Lamps and Handlebar Controls</td>
<td>D-58</td>
</tr>
<tr>
<td>XL 1200 Sport</td>
<td>D-59</td>
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<tr>
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<td>Ignition Circuit</td>
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<td>Horn and Instruments</td>
<td>D-61</td>
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<td>Headlamp, Tail Lamp, Directional Lamps and Handlebar Controls</td>
<td>D-62</td>
</tr>
<tr>
<td>FLSTS, FLSTC, FLSTF, FXSTC, FXSTS</td>
<td>D-63</td>
</tr>
<tr>
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<td>D-63</td>
</tr>
<tr>
<td>Horn and Instruments</td>
<td>D-64</td>
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<td>Headlamp, Tail Lamp, Directional Lamps and Handlebar Controls</td>
<td>D-65</td>
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<td>FXDS-CONV, FXDWT, FXD, FXDL</td>
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<td>Engine Management Circuit</td>
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<td>Ignition Switch</td>
<td>D-72</td>
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<td>Tail Lamp, Passing Lamps, Directional Lamps and Fender Tip Lamps</td>
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<tr>
<td>Tour-Pak Lights</td>
<td>D-72</td>
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<td>Handlebar Controls, Speedometer, Tachometer and Indicator Lamps</td>
<td>D-73</td>
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<td>Radio</td>
<td>D-74</td>
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<tr>
<td>Horn and Instruments</td>
<td>D-75</td>
</tr>
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<td>FLHTC Ultra-L, FLTR, FLTR-I</td>
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</tr>
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<td>D-70</td>
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<td>Engine Management Circuit</td>
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<td>Ignition Switch</td>
<td>D-72</td>
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<td>Tail Lamp, Passing Lamps, Directional Lamps and Tour-Pak Lights</td>
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<td>Handlebar Controls, Speedometer, Tachometer and Indicator Lamps</td>
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<td>Radio, CB/Intercom and Rear Speakers</td>
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<td>Cruise</td>
<td>D-74</td>
</tr>
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<td>Horn and Instruments</td>
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<tr>
<td>Main Harness</td>
<td>D-69</td>
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<td>D-71</td>
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<td>Ignition Switch</td>
<td>D-72</td>
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<td>Tail Lamp, Pursuit Lamps, Directional Lamps and Fender Tip Lamps</td>
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<td>Speedometer, Tachometer and Indicator Lamps</td>
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<td>Interconnect Harness</td>
<td>D-76</td>
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<tr>
<td>Siren Amplifier Harness, Strobe Harness and Handlebar Controls</td>
<td>D-77</td>
</tr>
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<td>FLHR, FLHRC-I</td>
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<td>D-78</td>
</tr>
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<td>D-79</td>
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<td>D-80</td>
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<td>D-80</td>
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<td>D-81</td>
</tr>
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<td>D-83</td>
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<td>Chassis</td>
<td>D-84</td>
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<td>Audio Harness</td>
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**NOTE**

Harness Part No.'s may be included on some wiring diagrams. Use these numbers for reference only. ALWAYS REFER TO THE PARTS CATALOG WHEN ORDERING WIRING HARNESSES.

D-54
1998 XLH 883, XLH 883 HUGGER, XLH 1200 and XL 1200 Custom, DOMESTIC and INTERNATIONAL
Main Harness

SPORTSTER MAIN HARNESS
P/N 70135-98 XLH 883/1200
P/N 70153-98 XLH 1200C
1998 XLH 883, XLH 883 HUGGER, 
XLH 1200 and XL 1200 Custom, 
DOMESTIC and INTERNATIONAL Models, 
Main Harness
1998 XLH 883, XLH 883 HUGGER, XLH 1200 and XL 1200 Custom, DOMESTIC and INTERNATIONAL Ignition Circuit
1998 XLH 883, XLH 883 HUGGER,
XLH 1200 and XL 1200 Custom,
DOMESTIC and INTERNATIONAL Models,
Ignition Circuit
1998 XLH 883, XLH 883 HUGGER, 
XLH 1200 and XL 1200 Custom, 
DOMESTIC and INTERNATIONAL Models, 
Horn and Instruments
1998 XLH 883, XLH 883 HUGGER, 
XLH 1200 and XL 1200 Custom, 
DOMESTIC and INTERNATIONAL Models, 
Headlamp, Tail Lamp, Directional Lamps 
and Handlebar Controls
1998 XL 1200 Sport,
DOMESTIC and INTERNATIONAL Models,
Main Harness
1998 XL 1200 Sport, DOMESTIC and INTERNATIONAL Models, Ignition Circuit
1998 XL 1200 Sport,
DOMESTIC and INTERNATIONAL Models,
Ignition Circuit
1998 XL 1200 Sport, DOMESTIC and INTERNATIONAL Models, Horn and Instruments
1998 XL 1200 Sport,
DOMESTIC and INTERNATIONAL Models,
Horn and Instruments
1998 XL 1200 Sport, DOMESTIC and INTERNATIONAL Models, Headlamp, Tail Lamp, Directional Lamps and Handlebar Controls
1998 XL 1200 Sport, DOMESTIC and INTERNATIONAL Models, Headlamp, Tail Lamp, Directional Lamps and Handlebar Controls
1998 FLSTS, FLSTC, FLSTF, FXSTC and FXSTS, DOMESTIC and INTERNATIONAL Main Harness
1998 FLSTS, FLSTC, FLSTF, FXSTC and FXSTS, DOMESTIC and INTERNATIONAL Models, Main Harness
1998 FLSTS, FLSTC, FLSTF, FXSTC and FXSTS, DOMESTIC and INTERNATIONAL Models, Horn and Instruments
1998 FLSTS, FLSTC, FLSTF, FXSTC and FXSTS, DOMESTIC and INTERNATIONAL Models, Headlamp, Tail Lamp, Directional Lamps and Handlebar Controls
1998 FXDS-CONV, FXDWG, FXD and FXDL, DOMESTIC and INTERNATIONAL Models
Main Harness
1998 FXDS-CONV, FXDWG, FXD and FXDL, DOMESTIC and INTERNATIONAL Models, Main Harness
1998 FXDS-CONV, FXDWG, FXD and FXDL, DOMESTIC and INTERNATIONAL Models, Horn and Instruments
1998 FXDS-_CONV, FXDWG, FXD and FXDL, DOMESTIC and INTERNATIONAL Models
Headlamp, Tail Lamp, Directional Lamps and Handlebar Controls
1998 FXDS-CONV, FXDWG, FXD and FXDL, DOMESTIC and INTERNATIONAL Models, Headlamp, Tail Lamp, Directional Lamps and Handlebar Controls
1998 FLHT, FLHTC, FLHTC-I, FLHTC Ultra-I, FLTR, FLTR-I and FLHTP-I, DOMESTIC and INTERNATIONAL
Main Harness
1998 FLHT, FLHTC, FLHTC-I, FLHTC Ultra-I, FLTR, FLTR-I and FLHTP-I, DOMESTIC and INTERNATIONAL Models, Main Harness
1998 FLHT, FLHTC, FLHTC-I, FLHTC Ultra-I, FLTR and FLTR-I
DOMESTIC and INTERNATIONAL Models,
Interconnect Harness
1998 FLHT, FLHTC, FLHTC-I, FLHTC Ultra-I,
FLTR, FLTR-I and FLHTP-I,
DOMESTIC and INTERNATIONAL Models,
Ignition Harness and Engine Management Circuitry
1998 FLHT, FLHTC, FLHTC-I, FLHTC Ultra-I, FLTR, FLTR-I and FLHTP-I, DOMESTIC and INTERNATIONAL
Handlebar Controls, Speedometer, Tachometer and Indicator Lamps
1998 FLHT, FLHTC, FLHTC-I, FLHTC Ultra-I, FLTR, FLTR-I and FLHTP-I, DOMESTIC and INTERNATIONAL Models, Handlebar Controls, Speedometer, Tachometer and Indicator Lamps
1998 FLHTC, FLHTC-I, FLHTC Ultra-I, FLTR and FLTR-I, DOMESTIC and INTERNATIONAL, Radio, CB/Intercom, Rear Speakers and Cruise
1998 FLHTC, FLHTC-I, FLHTC Ultra-I, FLTR and FLTR-I
DOMESTIC and INTERNATIONAL Models, Radio, CB/Intercom, Rear Speakers and Cruise
1998 FLHT, FLHTC, FLHTC-I, FLHTC Ultra-I, FLTR and FLTR-I
DOMESTIC and INTERNATIONAL Models,
Horn and Instruments

D-75
1998 FLHTP-I,
DOMESTIC and INTERNATIONAL Models,
Interconnect Harness
1998 FLHTP-I, DOMESTIC and INTERNATIONAL Models,
Siren Amplifier Harness, Strobe Harness and Handlebar Controls
1998 FLHTP-I,
DOMESTIC and INTERNATIONAL Models,
Siren Amplifier Harness, Strobe Harness
and Handlebar Controls
1998 FLHR and FLHRC-I, DOMESTIC and INTERNATIONAL Models, Main Harness
1998 FLHR and FLHRC-I, DOMESTIC and INTERNATIONAL Models, Ignition Harness and Engine Management Circuitry
1998 FLHR and FLHRC-I, DOMESTIC and INTERNATIONAL Models, Ignition Harness and Engine Management Circuitry
1998 FLHR and FLHRC-I, DOMESTIC and INTERNATIONAL Models, Handlebar Controls, Speedometer, Indicator Lamps, Tail Lamp, Passing Lamps and Directional Indicator Lamps
1998 FLHR and FLHRC-I,
DOMESTIC and INTERNATIONAL Models,
Handlebar Controls, Speedometer, Indicator Lamps,
Tail Lamp, Passing Lamps and Directional Lamps
1998 FLHP and FLHP-I, DOMESTIC and INTERNATIONAL Models, Main Harness
1998 FLHP and FLHP-I,
DOMESTIC and INTERNATIONAL Models,
Main Harness
1998 FLHP and FLHP-I, DOMESTIC and INTERNATIONAL Models, Ignition Harness and Engine Management Circuitry
1998 FLHP and FLHP-I, DOMESTIC and INTERNATIONAL Models, Ignition Harness and Engine Management Circuitry
1998 FLHP and FLHP-I,
DOMESTIC and INTERNATIONAL Models,
Headlamp, Tail Lamp, Directional Lamps, Indicator Lamps,
Handlebar Controls and Instruments
1998 TLE, TLE-U SIDECARS, DOMESTIC and INTERNATIONAL Models, Chassis and Audio Harness