2016 Harley-Davidson Dyna Models Electrical Diagnostic Manual

99496-16A

IMPORTANT NOTICE

Harley-Davidson motorcycles conform to all applicable U.S.A. Federal Motor Vehicle Safety Standards and U.S.A. Environmental Protection Agency regulations effective on the date of manufacture.

To maintain the safety, dependability, and emission and noise control performance, it is essential that the procedures, specifications and service instructions in this manual are followed.

Any substitution, alteration or adjustment of emission system and noise control components outside of factory specifications may be prohibited by law.

Harley-Davidson Motor Company

2016 Harley-Davidson Dyna Models Electrical Diagnostic Manual

99496-16A

Printed in the U.S.A.

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http://www.harley-davidson.com

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2016 Harley-Davidson Dyna Models Electrical Diagnostic Manual (99496-16A)

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NOTES

ABOUT THIS MANUAL

GENERAL

⚠WARNING

The rider's safety depends upon proper motorcycle service and maintenance. If a procedure in this manual is not within your capabilities or you do not have the correct tools, have a Harley-Davidson dealer perform the procedure. Improper service or maintenance could result in death or serious injury. (00627b)

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

HOW TO USE YOUR MANUAL

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

NO.	CHAPTER
1	Initial Diagnostics
2	Serial Data
3	Starting and Charging
4	Instruments
5	Accessories, Horn, Lighting and Security
6	Engine Management
7	ABS
A	Appendix A Wiring
B	Appendix B Connector Repair
C	Appendix C Reference

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

For example, a cross-reference shown as **2.2 SPECIFICATIONS** refers to chapter 2 CHASSIS, heading 2.2 SPECIFICATIONS.

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

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

PREPARATION FOR SERVICE

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

⚠WARNING

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

Good preparation is very important for efficient service work. Start each job with a clean work area. This will allow the repair to proceed as smoothly as possible. It will also reduce the incidence of misplaced tools and parts.

Clean a motorcycle that is excessively dirty before work starts. Cleaning will occasionally uncover sources of trouble. Gather any tools, instruments and any parts needed for the job before work begins. Interrupting a job to locate tools or parts is a distraction and causes needless delay.

NOTES

- *To avoid unnecessary disassembly, carefully read all related service information before repair work begins.*
- *In figure legends, the number which follows the name of a part indicates the quantity necessary for one complete assembly.*
- *When servicing a vehicle equipped with the Harley-Davidson Smart Security System (H-DSSS), first disarm the system. Keep the fob close to the vehicle or use DIGITAL TECHNICIAN II (Part No. HD-48650) to disable the system. Activate the system after service is completed.*

SERVICE BULLETINS

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

USE GENUINE REPLACEMENT PARTS

⚠WARNING

Harley-Davidson parts and accessories are designed for Harley-Davidson motorcycles. Using non-Harley-Davidson parts or accessories can adversely affect performance, stability or handling, which could result in death or serious injury. (00001b)

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

WARNINGS AND CAUTIONS

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

WARNING

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

CAUTION

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

NOTICE

NOTICE indicates a potentially hazardous situation which, if not avoided, may result in property damage. (00140b)

NOTE

Refers to important information. It is recommended that you take special notice of these items.

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

WARNING

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

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

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

PRODUCT REFERENCES

WARNING

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

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

Special Tools

All tools mentioned in this manual with a part number beginning with "HD", "J" or "B" must be ordered through your local Harley-Davidson dealer. Special tools may only be purchased, serviced or warrantied through a Harley-Davidson dealer.

LOCTITE Sealing and Threadlocking Products

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

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

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

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SPECIFICATIONS

Table 1-1. Fuel System Specifications

FUEL SYSTEM	TYPE
Intake	Side draft
Recommended fuel	91 Octane

Table 1-2. Idle Speed Specifications

ADJUSTMENT	RPM
Normal idle speed	950-1050 Nominal, non-adjustable

Table 1-3. Battery Specifications

BATTERY	SPECIFICATIONS
Size	12V/19 AH/315CCA
Type	Sealed, AGM

Table 1-4. Spark Plug Specifications

SPARK PLUG	SPECIFICATIONS	
Gap	0.038-0.043 in.	0.97-1.09 mm
Torque with anti-seize applied to threads	12-18 ft-lbs	16.3-24.4 Nm

Table 1-5. Spark Plug Cable Specifications

SPECIFICATION	FRONT	REAR
Length in.	21.9-22.4	7.25-7.50
Length mm	555.8-568-5	184.2-190.5
Resistance-ohms	5475-14,941	1813-5003

Table 1-6. Ignition Coil Specifications

WINDING	RESISTANCE
Ignition coil primary resistance at room temperature	0.3-1.5 ohm
Ignition coil secondary resistance at room temperature	5500-7500 ohms

Table 1-7. Starter Specifications

STARTER	SPECIFICATIONS
Cranking current	200A
Free speed	3000 rpm (min)
Free current	90A
Stall torque	8.0 ft-lbs (10.8 Nm)

Table 1-8. Fuel Pump Pressure Specifications

RANGE	VALUE
Normal	55-62 psi (380-425 kPA)

Table 1-9. Alternator Specifications

MEASUREMENT	VALUE
AC voltage output	16-23 VAC per 1000 rpm
Stator coil resistance	0.1-0.2 ohm

Table 1-10. Regulator Specifications

MEASUREMENT	VALUE
Amperes @ 3600 rpm	35-50A
Voltage @ 3600 rpm	14.3-14.7V @ 75 °F (24 °C)

Table 1-11. Fuse Specifications

ITEM	RATING (AMPERES)
Battery fuse	15
Main fuse	40
P&A fuse	15

INITIAL DIAGNOSTICS 1.2

DESCRIPTION AND OPERATION

Use initial diagnostics as a starting point to efficiently troubleshoot concerns. A basic understanding of electronics and a general knowledge of the vehicle are necessary to effectively use this manual.

NOTE

Certain diagnostic procedures require part removal. See the service manual for details.

Before diagnosing a concern, perform a general functional test of the vehicle to verify the concern. This will also identify any other issues that may affect diagnostics. Use the procedures in this chapter for initial diagnostics.

NOTE

When working through a diagnostic procedure follow the steps in the order instructed. Never jump to a test in another procedure. All "Go to test" statements refer to a test in that procedure.

INITIAL DIAGNOSTICS

1. Fuse Test

1. Verify all fuses are good.
2. Are all fuses good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace fuse. If fuse opens again, repair short to ground in that circuit.

2. Current DTC Test

1. Check for current DTCs. See 1.2 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.

NOTE

Historic DTCs are not to be diagnosed unless the condition is reoccurring and intermittent.

2. Are current DTCs present?
   a. **Yes.** Refer to Table 1-12.
   b. **No.** Go to Test 3.

3. Odometer Function Test

1. Enter odometer self-diagnostics.
2. Did odometer self-diagnostics mode function properly?
   a. **Yes.** Refer to Table 1-13.
   b. **No.** Go to Test 4.

4. Odometer Inoperative Test

1. Turn IGN ON.
2. Does the odometer display illuminate?
   a. **Yes.** Go to Test 7.
   b. **No.** Go to Test 5.

5. Battery Power Test

1. Turn IGN/engine stop switch ON.
2. Does headlamp and/or tail lamp illuminate?
   a. **Yes.** Go to Test 6.
   b. **No.** Verify battery condition and connections. If all are good, see 2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, No Vehicle Power: DTC U0140.

6. Starter Test

1. Attempt to start vehicle.
2. Does starter crank?
   a. **Yes.** See 4.1 INSTRUMENTS.
   b. **No.** See 2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274.

7. LHCM Test

1. With IGN ON, operate all left hand control functions.
2. Do any left hand controls function properly?
   a. **Yes.** All controls are operational except the trip switch. See 4.3 TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255.
   b. **No.** All left hand control functions are inoperative. See 2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, Left Hand Controls Inoperative: DTC U0141.

DIAGNOSTICS

Diagnostic Tips

- The trip odometer reset switch is located in the left hand control module. The switch signal is sent to the speedometer over the CAN bus. If there is a problem with the CAN bus, the odometer self-diagnostic mode may not function.
- For a quick check of instrument function, perform a "WOW" test by entering odometer self-diagnostics. Background lighting will illuminate, gauge needles will sweep their full range of motion and all indicator lamps controlled by the CAN circuit will illuminate.
- If the instrument fails "WOW" test, check for battery power and ground to the instrument. If any feature in the speedometer is non-functional, see 4.1 INSTRUMENTS.

Table 1-12. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
B1101	178	LHCM turn signal bulb out	5.4 DTC B1101, B1151
B1103	34	LHCM internal error	5.9 SWITCH DIAGNOSTICS
B1151	177	RHCM turn signal bulb out	5.4 DTC B1101, B1151
B1153	33	RHCM internal error	5.9 SWITCH DIAGNOSTICS
B1200	22	Internal fault	4.4 NO INSTRUMENT POWER DIAGNOSTICS
B1210	148	Fuel level sender shorted low/open	4.2 FUEL LEVEL SENDER DIAGNOSTICS
B1211	154	Fuel level sender shorted high	4.2 FUEL LEVEL SENDER DIAGNOSTICS
B2102	35	System power output shorted high	6.6 SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC 6.7 SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC
B2103	36	System power output shorted low	6.6 SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC 6.7 SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC
B2104	43	System power output over-loaded	6.6 SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC 6.7 SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC
B2106	229	L4 output open	5.10 RUNNING LAMP DIAGNOSTICS
B2107	197	L4 output shorted high	5.10 RUNNING LAMP DIAGNOSTICS
B2108	198	L4 output shorted low	5.10 RUNNING LAMP DIAGNOSTICS
B2109	199	L4 output overloaded	5.10 RUNNING LAMP DIAGNOSTICS
B2112	113	ACC output shorted high	5.1 ACC CIRCUIT DIAGNOSTICS
B2113	115	ACC output shorted low	5.1 ACC CIRCUIT DIAGNOSTICS
B2114	117	ACC output overloaded	5.1 ACC CIRCUIT DIAGNOSTICS
B2116	82	Fuel pump output open	6.8 FUEL PUMP DIAGNOSTICS
B2117	83	Fuel pump output shorted high	6.8 FUEL PUMP DIAGNOSTICS
B2118	84	Fuel pump output shorted low	6.8 FUEL PUMP DIAGNOSTICS
B2119	85	Fuel pump output overloaded	6.8 FUEL PUMP DIAGNOSTICS
B2121	47	Starter output open	3.3 STARTER OUTPUT DTCS
B2122	48	Starter output shorted high	3.3 STARTER OUTPUT DTCS
B2123	49	Starter output shorted low	3.3 STARTER OUTPUT DTCS
B2124	50	Starter output overloaded	3.3 STARTER OUTPUT DTCS
B2127	215	E4 output shorted high	5.2 HORN DIAGNOSTICS
B2128	216	E4 output shorted low	5.2 HORN DIAGNOSTICS
B2129	217	E4 output overloaded	5.2 HORN DIAGNOSTICS
B2132	206	High beam output shorted high	5.7 HEADLAMP DIAGNOSTICS
B2133	207	High beam output shorted low	5.7 HEADLAMP DIAGNOSTICS
B2134	208	High beam output overloaded	5.7 HEADLAMP DIAGNOSTICS
B2137	202	Low beam output shorted high	5.7 HEADLAMP DIAGNOSTICS
B2138	203	Low beam output shorted low	5.7 HEADLAMP DIAGNOSTICS
B2139	204	Low beam output overloaded	5.7 HEADLAMP DIAGNOSTICS
B2141	179	Left front turn signal output open	5.5 FRONT TURN SIGNAL DIAGNOSTICS
B2143	186	Left front turn signal output shorted low	5.5 FRONT TURN SIGNAL DIAGNOSTICS

Table 1-12. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
B2144	187	Left front turn signal output overloaded	5.5 FRONT TURN SIGNAL DIAGNOSTICS
B2146	188	Right front turn signal output open	5.5 FRONT TURN SIGNAL DIAGNOSTICS
B2148	189	Right front turn signal output shorted low	5.5 FRONT TURN SIGNAL DIAGNOSTICS
B2149	190	Right front turn signal output overloaded	5.5 FRONT TURN SIGNAL DIAGNOSTICS
B2151	191	Left rear turn signal output open	5.6 REAR TURN SIGNAL DIAGNOSTICS
B2153	192	Left rear turn signal output shorted low	5.6 REAR TURN SIGNAL DIAGNOSTICS
B2154	193	Left rear turn signal output overloaded	5.6 REAR TURN SIGNAL DIAGNOSTICS
B2156	194	Right rear turn signal output open	5.6 REAR TURN SIGNAL DIAGNOSTICS
B2158	195	Right rear turn signal output shorted low	5.6 REAR TURN SIGNAL DIAGNOSTICS
B2159	196	Right rear turn signal output overloaded	5.6 REAR TURN SIGNAL DIAGNOSTICS
B2161	170	Brake lamp output open	5.8 STOP LAMP DIAGNOSTICS
B2163	171	Brake lamp output shorted low	5.8 STOP LAMP DIAGNOSTICS
B2164	172	Brake lamp output overloaded	5.8 STOP LAMP DIAGNOSTICS
B2168	146	Running lights output shorted low	5.10 RUNNING LAMP DIAGNOSTICS
B2169	147	Running lights output over-loaded	5.10 RUNNING LAMP DIAGNOSTICS
B2172	209	H2 output shorted high	5.15 ALARM DIAGNOSTICS
B2173	210	H2 output shorted low	5.15 ALARM DIAGNOSTICS
B2176	211	Security antenna output open	5.16 SECURITY ANTENNA DIAGNOSTICS
B2177	212	Security antenna output shorted high	5.16 SECURITY ANTENNA DIAGNOSTICS
B2178	213	Security antenna output shorted low	5.16 SECURITY ANTENNA DIAGNOSTICS
B2183	223	G2 output shorted low	5.17 DTC B2183, B2188, B2193, B2198
B2188	226	G3 output shorted low	5.17 DTC B2183, B2188, B2193, B2198
B2193	228	H4 output shorted low	5.17 DTC B2183, B2188, B2193, B2198
B2198	231	H3 output shorted low	5.17 DTC B2183, B2188, B2193, B2198
B2201	41	IGN switch off w/VSS	3.9 IGN SWITCH DIAGNOSTICS
B2203	39	Ignition switch input shorted low	3.9 IGN SWITCH DIAGNOSTICS
B2206	40	Run/stop switch input open/shorted high	3.10 ENGINE STOP SWITCH DIAGNOSTICS
B2208	42	Run/stop switch input shorted low	3.10 ENGINE STOP SWITCH DIAGNOSTICS
B2210	44	Run/stop switch inputs both open	5.9 SWITCH DIAGNOSTICS

Table 1-12. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
B2212	45	Run/stop switch inputs both closed	5.9 SWITCH DIAGNOSTICS
B2218	112	Neutral switch shorted low	5.18 NEUTRAL SWITCH DIAGNOSTICS
B2223	169	Rear brake switch shorted low (light on)	5.8 STOP LAMP DIAGNOSTICS
B2250	111	Clutch switch stuck	5.9 SWITCH DIAGNOSTICS
B2251	214	Horn switch stuck	5.9 SWITCH DIAGNOSTICS
B2253	200	FTP switch stuck	5.9 SWITCH DIAGNOSTICS
B2254	175	Left turn switch stuck	5.9 SWITCH DIAGNOSTICS
B2255	218	Trip switch stuck	4.3 TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255
B2260	46	Start switch stuck	5.9 SWITCH DIAGNOSTICS
B2261	176	Right turn switch stuck	5.9 SWITCH DIAGNOSTICS
B2262	168	Front brake switch stuck	5.9 SWITCH DIAGNOSTICS
B2263	174	Hazard switch stuck	5.9 SWITCH DIAGNOSTICS
B2270	14	BCM internal error	5.9 SWITCH DIAGNOSTICS
B2271	13	BCM voltage low	3.11 BCM VOLTAGE DIAGNOSTICS
B2272	18	BCM voltage high	3.11 BCM VOLTAGE DIAGNOSTICS
B2274	38	Constant battery line error	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274
C0562	23	ABS voltage low	3.7 ABS VOLTAGE DIAGNOSTICS
C0563	25	ABS voltage high	3.7 ABS VOLTAGE DIAGNOSTICS
C1014	155	ABS ECU relay error	7.2 ABS INTERNAL DIAGNOSTICS
C1021	163	ABS front WSS always zero	7.3 WSS DIAGNOSTICS
C1023	164	ABS rear WSS always zero	7.3 WSS DIAGNOSTICS
C1025	166	ABS front wheel speed intermittent	7.3 WSS DIAGNOSTICS
C1027	167	ABS rear wheel speed intermittent	7.3 WSS DIAGNOSTICS
C1029	165	ABS wheel speed difference too high	7.3 WSS DIAGNOSTICS
C1032	161	ABS front wheel speed circuit open/shorted	7.3 WSS DIAGNOSTICS
C1034	162	ABS rear wheel speed circuit open/shorted	7.3 WSS DIAGNOSTICS
C1040	156	ABS pump/motor error	7.2 ABS INTERNAL DIAGNOSTICS
C1055	24	ABS ECU internal error	7.2 ABS INTERNAL DIAGNOSTICS
C1061	157	ABS front apply solenoid circuit open/high resistance	7.2 ABS INTERNAL DIAGNOSTICS
C1062	159	ABS front release solenoid circuit open/high resistance	7.2 ABS INTERNAL DIAGNOSTICS
C1065	158	ABS rear apply solenoid circuit open/high resistance	7.2 ABS INTERNAL DIAGNOSTICS
C1066	160	ABS rear release solenoid circuit open/high resistance	7.2 ABS INTERNAL DIAGNOSTICS
C1159	30	ABS invalid stored VIN	7.4 ABS VIN CALIBRATION DIAGNOSTICS

Table 1-12. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
C1178	28	ABS no VIN received from ECM	7.4 ABS VIN CALIBRATION DIAGNOSTICS
C1184	29	ABS invalid VIN from ECM	7.4 ABS VIN CALIBRATION DIAGNOSTICS
P0031	128	Front HO2S low/open	6.15 HO2S DIAGNOSTICS
P0032	131	Front HO2S shorted high	6.15 HO2S DIAGNOSTICS
P0051	129	Rear HO2S low/open	6.15 HO2S DIAGNOSTICS
P0052	130	Rear HO2S shorted high	6.15 HO2S DIAGNOSTICS
P0107	90	MAP sensor failed low/open	6.9 MAP SENSOR DIAGNOSTICS: IAC 6.11 TMAP SENSOR DIAGNOSTICS: ETC
P0108	91	MAP sensor failed high/open port	6.9 MAP SENSOR DIAGNOSTICS: IAC 6.11 TMAP SENSOR DIAGNOSTICS: ETC
P0112	106	IAT sensor shorted low	6.10 IAT DIAGNOSTICS: IAC 6.11 TMAP SENSOR DIAGNOSTICS: ETC
P0113	108	IAT sensor high/open	6.10 IAT DIAGNOSTICS: IAC 6.11 TMAP SENSOR DIAGNOSTICS: ETC
P0117	92	ET sensor shorted low	6.12 ET SENSOR DIAGNOSTICS
P0118	95	ET sensor high/open	6.12 ET SENSOR DIAGNOSTICS
P0120	63	TPS1 range error	6.14 TCA DIAGNOSTICS: ETC
P0122	64	TPS1 low/open	6.13 TPS DIAGNOSTICS: IAC 6.14 TCA DIAGNOSTICS: ETC
P0123	65	TPS1 high	6.13 TPS DIAGNOSTICS: IAC 6.14 TCA DIAGNOSTICS: ETC
P0131	132	O2 sensor low/engine lean (front)	6.15 HO2S DIAGNOSTICS
P0132	134	Engine running rich (front)	6.15 HO2S DIAGNOSTICS
P0134	136	O2 sensor high/open (front)	6.15 HO2S DIAGNOSTICS
P0151	133	O2 sensor low/engine lean (rear)	6.15 HO2S DIAGNOSTICS
P0152	135	Engine running rich (rear)	6.15 HO2S DIAGNOSTICS
P0154	137	O2 sensor high/open (rear)	6.15 HO2S DIAGNOSTICS
P0220	68	TPS2 range error	6.14 TCA DIAGNOSTICS: ETC
P0222	66	TPS2 low/open	6.14 TCA DIAGNOSTICS: ETC
P0223	67	TPS2 high	6.14 TCA DIAGNOSTICS: ETC
P0261	86	Fuel injector low/open (front)	6.16 FUEL INJECTOR DIAGNOSTICS
P0262	87	Fuel injector shorted high (front)	6.16 FUEL INJECTOR DIAGNOSTICS
P0264	88	Fuel injector low/open (rear)	6.16 FUEL INJECTOR DIAGNOSTICS
P0265	89	Fuel injector shorted high (rear)	6.16 FUEL INJECTOR DIAGNOSTICS
P0371	54	CKP sensor wrong number of pulses	6.17 CKP SENSOR DIAGNOSTICS
P0374	53	CKP sensor no pulses	6.17 CKP SENSOR DIAGNOSTICS
P0444	122	Purge solenoid low/open	6.18 PURGE SOLENOID DIAGNOSTICS
P0445	123	Purge solenoid shorted high	6.18 PURGE SOLENOID DIAGNOSTICS
P0502	118	VSS failed low	6.19 VSS DIAGNOSTICS
P0503	119	VSS failed high	6.19 VSS DIAGNOSTICS

Table 1-12. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
P0505	124	Idle speed control - unstable	6.21 IDLE SPEED CONTROL DIAGNOSTICS: ETC
P0506	107	Idle speed control - rpm too low	6.20 IDLE SPEED CONTROL DIAGNOSTICS: IAC
P0507	109	Idle speed control - rpm too high	6.20 IDLE SPEED CONTROL DIAGNOSTICS: IAC
P0572	173	Brake switch low	
P0577	141	Cruise control input error	
P0562	110	ECM voltage low	3.8 BATTERY AND SYSTEM VOLTAGE DIAGNOSTICS
P0603	16	ECM EEPROM memory error	6.22 ECM INTERNAL DIAGNOSTICS
P0605	15	ECM FLASH memory error	6.22 ECM INTERNAL DIAGNOSTICS
P0641	51	5 Volt reference out of range	6.23 DTC P0641: IAC 6.24 5V REFERENCE DIAGNOSTICS: ETC
P0651	52	5V reference 2 out of range	6.24 5V REFERENCE DIAGNOSTICS: ETC
P0661	114	Intake solenoid low/open	6.25 INTAKE SOLENOID DIAGNOSTICS
P0662	116	Intake solenoid shorted high	6.25 INTAKE SOLENOID DIAGNOSTICS
P1009	17	VTD disabled fuel due to bad password	6.26 DTC P1009
P1270	56	TGS2 A/D validation error	6.27 DTC P1270: ETC
P1353	120	No combustion detected (front)	6.28 COMBUSTION EFFICIENCY DIAGNOSTICS
P1356	121	No combustion detected (rear)	6.28 COMBUSTION EFFICIENCY DIAGNOSTICS
P1475	125	Exhaust position actuation error	6.29 EXHAUST ACTUATOR DIAGNOSTICS
P1478	127	Exhaust valve actuator shorted high	6.29 EXHAUST ACTUATOR DIAGNOSTICS
P1501	144	JSS low	6.30 JSS DIAGNOSTICS
P1502	145	JSS high/open	6.30 JSS DIAGNOSTICS
P1510	138	ETC limited performance mode	6.31 ETC MANAGEMENT DIAGNOSTICS
P1511	139	ETC power management mode	6.31 ETC MANAGEMENT DIAGNOSTICS
P1512	140	ETC forced idle mode	6.31 ETC MANAGEMENT DIAGNOSTICS
P1514	76	TCA airflow error	6.32 ETC ERROR DIAGNOSTICS
P1600	55	TCA internal error	6.32 ETC ERROR DIAGNOSTICS
P1655	142	ACR solenoid low/open	6.33 ACR DIAGNOSTICS
P1656	143	ACR solenoid shorted high	6.33 ACR DIAGNOSTICS
P2100	71	ETC driver open circuit	6.34 ETC ACTUATOR DIAGNOSTICS
P2101	72	ETC actuation error	6.34 ETC ACTUATOR DIAGNOSTICS
P2102	73	ETC driver shorted low	6.34 ETC ACTUATOR DIAGNOSTICS
P2103	74	ETC driver shorted high	6.34 ETC ACTUATOR DIAGNOSTICS
P2105	77	ETC forced shutdown mode	6.35 DTC P2105, P2107
P2107	57	ETC driver internal error	6.35 DTC P2105, P2107
P2119	70	ETC actuator return error	6.36 DTC P2119
P2122	58	TGS1 low/open	6.37 TGS DIAGNOSTICS
P2123	58	TGS1 high	6.37 TGS DIAGNOSTICS

Table 1-12. Diagnostic Trouble Codes (DTCs) and Fault Conditions Priority Table

DTC	PRIORITY ORDER	FAULT CONDITION	SOLUTION
P2127	60	TGS2 low/open	6.37 TGS DIAGNOSTICS
P2128	61	TGS2 high	6.37 TGS DIAGNOSTICS
P2135	69	TPS correlation error	6.38 CORRELATION ERROR DIAGNOSTICS
P2138	62	TGS correlation error	6.38 CORRELATION ERROR DIAGNOSTICS
P2176	75	ETC zero position learning error	6.39 DTC P2176
P2300	78	Ignition coil driver low/open (front)	6.40 IGN COIL DRIVER DIAGNOSTICS
P2301	79	Ignition coil driver shorted high (front)	6.40 IGN COIL DRIVER DIAGNOSTICS
P2303	80	Ignition coil driver low/open (rear)	6.40 IGN COIL DRIVER DIAGNOSTICS
P2304	81	Ignition coil driver shorted high (rear)	6.40 IGN COIL DRIVER DIAGNOSTICS
U0001	1	CAN BUS error	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274
U0002	12	CAN comm bus perf error	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS
U0011	2	CAN bus low shorted to CAN bus high	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274
U0100	4	Lost comm w/ECM	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS
U0121	8	Lost comm w/ABS	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS
U0140	3	Lost comm w/BCM	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS
U0141	6	Lost comm w/LHCM	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS
U0142	5	Lost comm w/RHCM	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS
U0156	7	Lost comm w/speedo	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS
U0157	10	Lost comm w/tach	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS
U0300	11	Internal control module software incompatibility	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS

RETRIEVING TROUBLE CODES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

There are two levels of diagnostics.

- The most sophisticated mode uses a computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650).
- The second mode requires using odometer self-diagnostics. Speedometer, BCM, ECM, tachometer and ABS (if equipped) DTCs can be accessed and cleared.

ODOMETER SELF-DIAGNOSTICS

Diagnostic Mode

1. To enter diagnostic mode, press and hold the trip odometer reset switch located on the left handlebar controls, while turning the IGN ON.

NOTE

The trip odometer reset switch is located in the left hand control module. The switch signal is sent to the speedometer over the CAN bus. Therefore, if there is a problem with the CAN bus, the odometer self-diagnostic mode may not function.

2. Release the trip odometer reset switch. "diag" will appear on the odometer display.
3. Press and release the trip odometer reset switch. ECM will appear on the odometer display. It will have either a "Y" or an "N" after it, depending if there are any ECM codes or not.
4. Quickly press and release the trip odometer reset switch to cycle through the modules. The modules include the BCM, SPDO, TACH and ABS.
5. Once the desired module is displayed, press and hold the trip odometer reset switch.
6. If any DTCs are stored in the module, the odometer will display the DTC. Quickly pressing and releasing the trip odometer reset switch will cycle through the stored DTCs.

7. When all the DTCs have been cycled the odometer will display "end".
8. To clear all the DTCs in that module press and hold the trip odometer reset switch, while a DTC is displayed. If DTCs are not to be cleared quickly press and release the trip odometer reset switch. The part number of the module will be displayed.
9. Press and release the trip odometer reset switch again to continue to the next module.
10. Make note of all DTCs. Clear all the DTCs and operate the vehicle to verify DTCs set and are current. Historic DTCs are not to be diagnosed unless the condition is reoccurring and intermittent.
11. Turn the IGN OFF to exit diagnostic mode. If IGN is not turned off, vehicle will exit diagnostics mode when vehicle starts moving.

CODE TYPES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

There are two types of DTCs: current and historic. The odometer self-diagnostics displays all codes and does not differentiate between current and historic DTCs. The computer-based diagnostic package called DIGITAL TECHNICIAN II (Part No. HD-48650) differentiates between current and historic DTCs.

NOTES

- *Current DTCs reside in the memory of the ECM, BCM, instruments or ABS module (if equipped) until the DTC is resolved.*
- *DTCs are designated by a P, C, B or U depending on the type of code and what module sets them. The ECM sets "P" codes to indicate issues monitored by the ECM. The ABS module sets "C" codes indicating an issue with the ABS on the vehicle. The instruments or BCM can all set "B" codes. All the modules set "U" codes when there is an issue causing the modules not to communicate properly.*

Current

Current DTCs are those which presently disrupt motorcycle operation and are set during the current ignition cycle. To determine if current DTCs are present, clear the DTCs and operate the vehicle within the parameters for setting the DTC. See the appropriate diagnostic procedures for solutions.

Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic DTC rather than a current DTC. DTCs will also lose their current status when the ignition is turned off. If the problem still exists when the ignition is turned ON, the code will show as current.

A historic DTC can be cleared by use of the odometer self-diagnostics or after a total of 20 error-free ignition cycles (start and run cycle) have elapsed.

It is important to note that historic DTCs will exist whenever the system indicates the existence of a current fault. See 1.2 INITIAL DIAGNOSTICS, Multiple Trouble Codes if multiple DTCs are found.

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

MULTIPLE TROUBLE CODES

All DTCs are assigned a priority number to determine the order in which they should be diagnosed. If there are multiple DTCs present, always diagnose the highest priority first. Refer to Table 1-12.

1. Complete the repair.
2. Restore connections.
3. Clear DTCs.
4. Start vehicle.
5. Perform odometer self-diagnostics test to verify repair and DTCs have been cleared. If any DTCs are still present, refer to Table 1-12.

CLEARING DTCS

Clear DTCs after any diagnostic or repair procedure. The odometer is capable of displaying and clearing ECM, BCM, speedometer, tachometer and ABS DTCs. Once the DTCs are cleared perform a road test to verify DTCs do not return. It is important to perform a road test and not simply start the motorcycle since some DTCs may require vehicle speed or other inputs in order to validate repair.

SECURITY LAMP

The security lamp functions in the same manner as the check engine lamp, except that it is controlled by the BCM. The security lamp will be turned on when current codes are present in the BCM.

CHECK ENGINE LAMP

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

NOTES

- *"IGN ON" means that the engine stop switch is set to RUN (although the engine is **not** running).*
- *When the IGN is turned ON, the check engine lamp will illuminate for approximately four seconds and then turn off.*
- *If the check engine lamp is not illuminated at IGN ON or if it fails to turn off after the initial four-second period, then refer to Table 1-12.*

1. See Figure 1-1. After the check engine lamp turns off following the first four second illumination period, one of two events may occur.
   a. The lamp remains off. This indicates there are no current fault conditions or stored DTCs currently detected by the ECM.
   b. If the lamp illuminates again and remains illuminated, a current DTC exists.

HOME

2. The check engine lamp may not illuminate for less than 4 seconds under the following conditions:
   a. IGN OFF/ON within 5 seconds.
   b. Trip switch activated, then IGN ON within 5 seconds.
   c. Run/stop switch cycled, then IGN ON within 5 seconds.
   d. Security armed vehicles that are moved, then IGN ON, or IGN ON and FOB response is not immediately received (interference).

   Current DTC notification is not affected by above conditions.
3. See 1.2 INITIAL DIAGNOSTICS, Code Types for a complete description of DTC formats.

NOTE

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

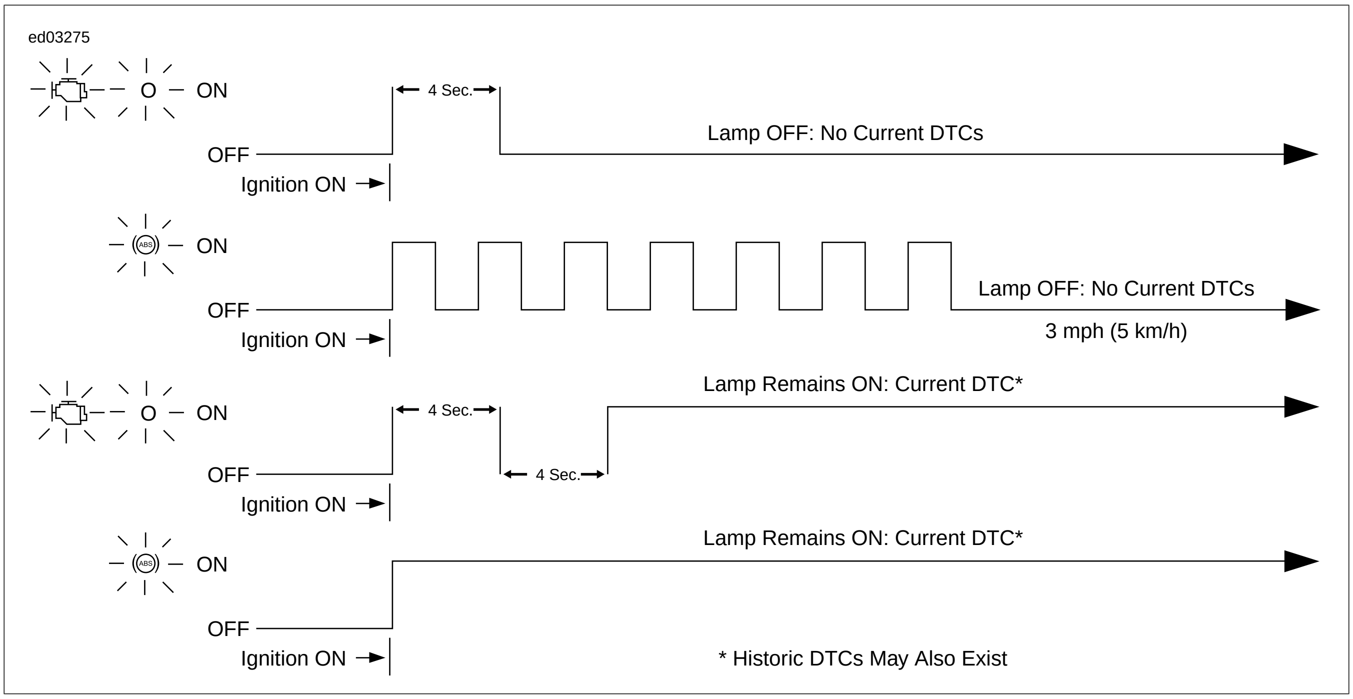


Figure 1-1. Check Engine Lamp and Security Lamp Operation

SYMPTOMS

If no DTCs are present, address any symptoms indicating a malfunction. Refer to Table 1-13.

Table 1-13. Symptom Table

CHAPTER	SYMPTOM	DIAGNOSTIC PROCEDURE
Serial Data	Left hand controls inoperative	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS
	No vehicle power	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS
	Odometer self-diagnostics inoperative	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274
	Speedometer inoperative	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS
	Tachometer inoperative	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS

Table 1-13. Symptom Table

CHAPTER	SYMPTOM	DIAGNOSTIC PROCEDURE
Starting and Charging	Battery runs down during use	3.6 CHARGING SYSTEM
	Low battery after extended IGN OFF	3.6 CHARGING SYSTEM
	Low or no charging	3.6 CHARGING SYSTEM
	Nothing clicks	3.2 STARTING SYSTEM
	Overcharging	3.6 CHARGING SYSTEM
	Starter solenoid clicks	3.2 STARTING SYSTEM
	Starter spins but does not engage	3.2 STARTING SYSTEM
	Starter stalls or spins too slowly	3.2 STARTING SYSTEM
Instruments	Fuel gauge inaccurate, no DTCs	4.6 GAUGES
	Fuel gauge inoperative	4.6 GAUGES
	High beam indicator always on	4.5 INDICATOR LAMPS
	High beam indicator inoperative	4.5 INDICATOR LAMPS
	Low fuel lamp always on	4.5 INDICATOR LAMPS
	Low fuel lamp flashes at steady rate	Fuel sender DTC set. See 1.2 INITIAL DIAGNOSTICS.
	Low fuel lamp inoperative	4.5 INDICATOR LAMPS
	Neutral lamp always on	4.5 INDICATOR LAMPS
	Neutral lamp inoperative	4.5 INDICATOR LAMPS
	No instrument power	4.4 NO INSTRUMENT POWER DIAGNOSTICS
	Odometer displays "DIAG" at IGN ON	4.3 TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255
	Oil pressure lamp always on	4.5 INDICATOR LAMPS
	Oil pressure lamp inoperative	4.5 INDICATOR LAMPS
	Trip odometer functions inoperative	4.3 TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255
	Turn signal indicator always on	4.5 INDICATOR LAMPS
	Turn signal indicator inoperative	4.5 INDICATOR LAMPS

Table 1-13. Symptom Table

CHAPTER	SYMPTOM	DIAGNOSTIC PROCEDURE
Accessories, Horn, Lighting and Security	Any hand control switch inoperative	5.9 SWITCH DIAGNOSTICS
	Front running lamps inoperative	5.10 RUNNING LAMP DIAGNOSTICS
	High beam headlamp inoperative	5.7 HEADLAMP DIAGNOSTICS
	Horn always on	5.2 HORN DIAGNOSTICS
	Horn inoperative	5.2 HORN DIAGNOSTICS
	License plate lamp inoperative	5.10 RUNNING LAMP DIAGNOSTICS
	Low beam headlamp inoperative	5.7 HEADLAMP DIAGNOSTICS
	P&A battery power inoperative	5.1 ACC CIRCUIT DIAGNOSTICS
	Rear running lamps inoperative	5.10 RUNNING LAMP DIAGNOSTICS
	Running lamps inoperative	5.10 RUNNING LAMP DIAGNOSTICS
	Security fails to disarm	5.16 SECURITY ANTENNA DIAGNOSTICS
	Stop lamp always on	5.8 STOP LAMP DIAGNOSTICS
	Will not cancel upon turn completion, no DTCs	5.3 TURN SIGNALS
Engine Management	Engine cranks but will not start	6.41 ENGINE CRANKS BUT WILL NOT START
	Erratic idle	6.45 ERRATIC IDLE
	Hesitation or loss of power	6.42 ENGINE PERFORMANCE DIAGNOSTICS
	Misfire at idle or under load	6.44 MISFIRE AT IDLE OR UNDER LOAD
	Side stand displayed on speedometer	6.30 JSS DIAGNOSTICS
	Starts hard or emits black smoke	6.42 ENGINE PERFORMANCE DIAGNOSTICS
	Starts, then stalls	6.43 STARTS, THEN STALLS
ABS	ABS indicator continuously flashing, no DTCs	7.5 ABS INDICATOR ALWAYS ON, FLASHING OR INOPERATIVE
	ABS lamp always on or inoperative	7.5 ABS INDICATOR ALWAYS ON, FLASHING OR INOPERATIVE

DIAGNOSTIC TOOLS 1.3

HOW TO USE DIAGNOSTIC TOOLS

PART NUMBER	TOOL NAME
GRX-3110HD	BATTERY DIAGNOSTIC STATION
HD-39617	FLUKE AC/DC CURRENT PROBE
HD-39978	DIGITAL MULTIMETER (FLUKE 78)
HD-41199-3	IAC TEST LIGHT
HD-41404	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	BREAKOUT BOX ADAPTERS
HD-48650	DIGITAL TECHNICIAN II
HD-50341	WHEEL SPEED SENSOR TEST LEAD
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY
HD-50390-6	ABS CABLE
HD-51724	INLINE SPARK TESTER KIT

GRX-3110 HD Battery Diagnostic Station

See Figure 1-2. Read the BATTERY DIAGNOSTIC STATION (Part No. GRX-3110HD) instruction manual to perform a battery test. The test results include a decision on the battery condition.

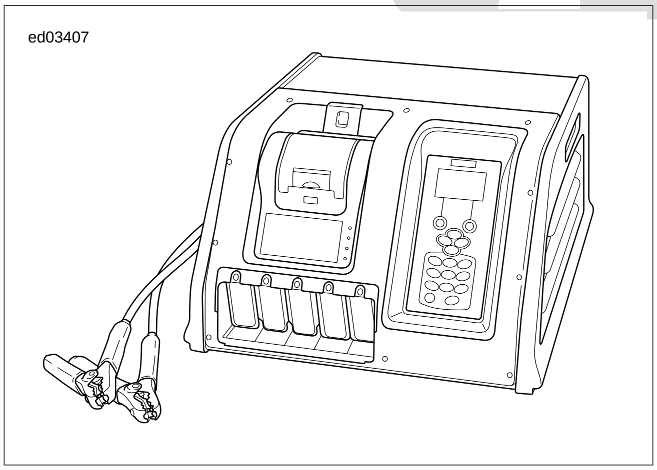


Figure 1-2. Advanced Battery Conductance and Electrical System Analyzer Kit

HD-51724 Inline Spark Tester Kit

See Figure 1-3. The INLINE SPARK TESTER KIT (Part No. HD-51724) is used to verify adequate spark at the spark plug. Install the inline spark tester between front ignition coil cable and spark plug. Start engine and inspect tester light. The light will flash on each spark event if power is transmitted to the plug. Remove inline spark tester and install cable on plug. Repeat procedure for rear cylinder.

NOTE

The coil will not produce spark voltage with both spark plugs removed. When checking for spark, use the inline spark tester with both plugs installed.

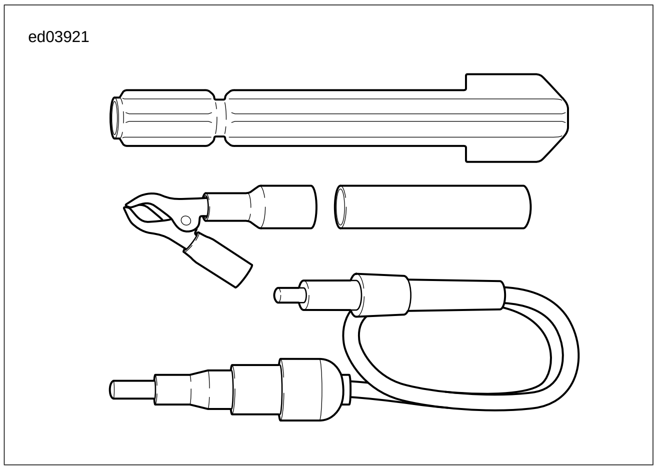


Figure 1-3. Spark Tester

HD-39978 Digital Multimeter (Fluke 78)

See Figure 1-4. The DIGITAL MULTIMETER (FLUKE 78) (Part No. HD-39978) is used for various tests throughout this manual.

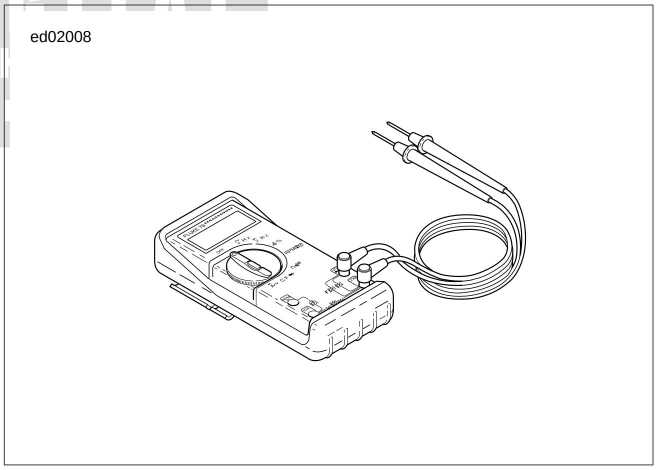


Figure 1-4. Digital Multimeter (Fluke 78)

HD-39617 Fluke AC/DC Current Probe

See Figure 1-5. The FLUKE AC/DC CURRENT PROBE (Part No. HD-39617) is used to measure current draw. Use in conjunction with DIGITAL MULTIMETER (FLUKE 78) (Part No. HD-39978).

1. Connect the current probe to positive and negative input terminals on the multimeter.
2. Position the rotary switch to mV dc (millivolt direct current).
3. Push the ON/OFF button and the ON indicator will illuminate.
4. With the inductive jaws empty, turn the zero adjust so that the multimeter reads 0.000 mV.

5. Clamp the inductive jaws around the conductor that is being tested.
6. With the circuit activated read the multimeter display, 1 mV = 1 A.

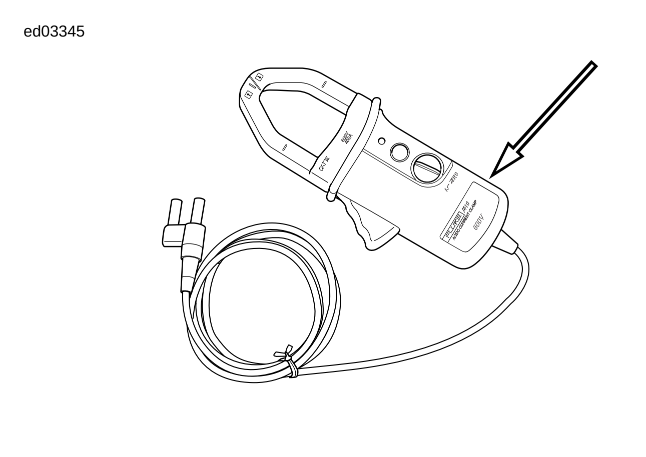


Figure 1-5. Fluke AC/DC Current Probe

HD-41199-3 IAC Test Light

The IAC TEST LIGHT (Part No. HD-41199-3) is used to verify that the electrical circuit from the ECM to the IAC is operating correctly.

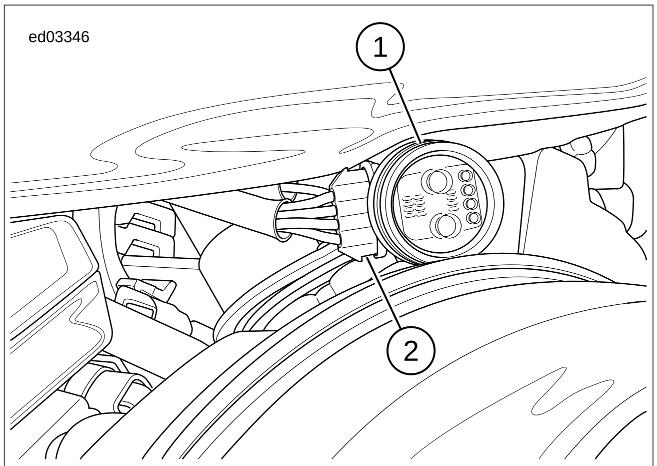
1. See Figure 1-6. Disconnect IAC [87B] and connect test light.
2. Turn IGN ON for 2 seconds, then turn IGN OFF for 10 seconds. Test light behavior may follow two patterns. The color of the lights is not relevant to IAC operation.

- **Normal behavior:** At IGN ON, test lights will alternately flash and then remain on to confirm ECM signals. At IGN OFF, lights alternately flash and go out after 10 second reset procedure.
- **Problem indicated:** One or more lights fail to illuminate during IGN ON/IGN OFF cycle.

NOTE

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

3. Disconnect test light and connect IAC [87B].



1. **IAC test light**
2. **IAC [87]**

Figure 1-6. IAC Test Light

HD-41404 Harness Connector Test Kit

The HARNESS CONNECTOR TEST KIT (Part No. HD-41404) contains pin and socket terminals and stackable banana jack patch cords used to test circuits. The pin and socket terminals are used to connect to various connectors. See the tool instruction sheet for specific terminal usage.

NOTES

- *Insert probe tip straight into the terminal cavity.*
- *Do not wiggle or move the probe tip once it is inserted into the terminal.*
- *Do not use more than one probe per terminal or cavity at one time.*

HD-50341 Wheel Speed Sensor Test Lead

See Figure 1-7. The WHEEL SPEED SENSOR TEST LEAD (Part No. HD-50341) is a stackable banana jack patch cord with a resistor to test the wheel speed sensor circuit. Used in conjunction with HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect the test lead in place of the WSS when required during diagnostics.

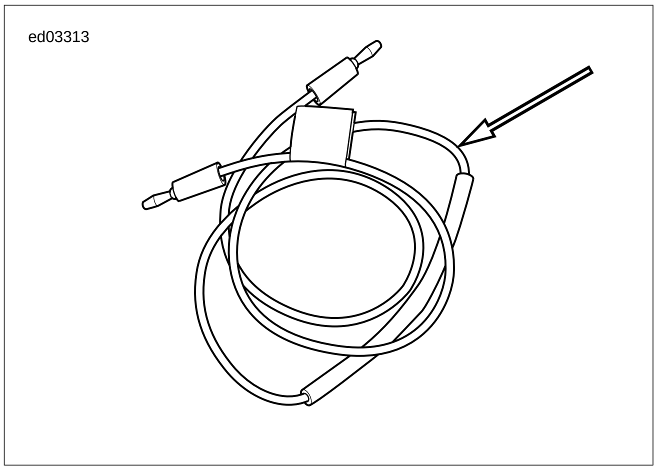
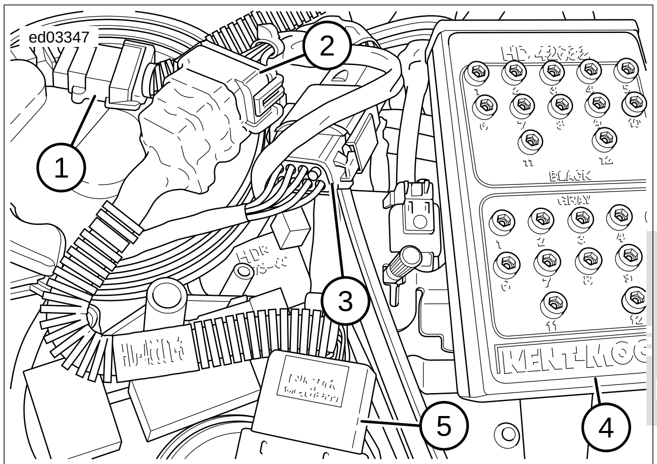


Figure 1-7. Wheel Speed Sensor Test Lead

HD-42682 Breakout Box (Instruments)

The BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) connect to the speedometer [39]. Used in conjunction with a multimeter, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects. Install BOB in series using the black connectors:

1. Access the speedometer [39].
2. See Figure 1-8. Press latch and disconnect [39B].
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39A] and [39B].
4. Attach black connectors from BREAKOUT BOX (Part No. HD-42682) to BREAKOUT BOX ADAPTERS (Part No. HD-46601). All tests will be performed using the black side of BOB.
5. Remove BOB and jumper harness and restore connections when testing is completed.



1. **Speedometer [39]**
2. **Breakout box adapter HD-46601 to speedometer [39]**
3. **Breakout box adapter to harness connector**
4. **Breakout box HD-42682**
5. **Breakout box harness connector**

Figure 1-8. Breakout Box Connection

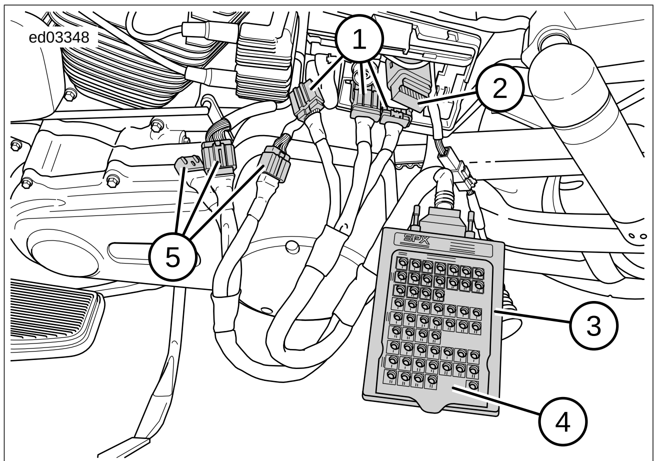
HD-50390-1 Breakout Box (ECM)

The BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) splice into the main harness. Used in conjunction with a multimeter, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects. Install BOB in series:

NOTE

See wiring diagrams for ECM terminal functions.

1. Access ECM.
2. Press latch and disconnect ECM connectors [78B-1], [78B-2] and [78B-3] (if applicable).
3. See Figure 1-9. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to connectors.
4. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
5. When testing is completed remove BOB and restore connections.



1. **ECM [78-A]**
2. **ECM**
3. **Breakout box**
4. **ECM overlay**
5. **Wiring harness [78-B]**

Figure 1-9. ECM Breakout Box Connection

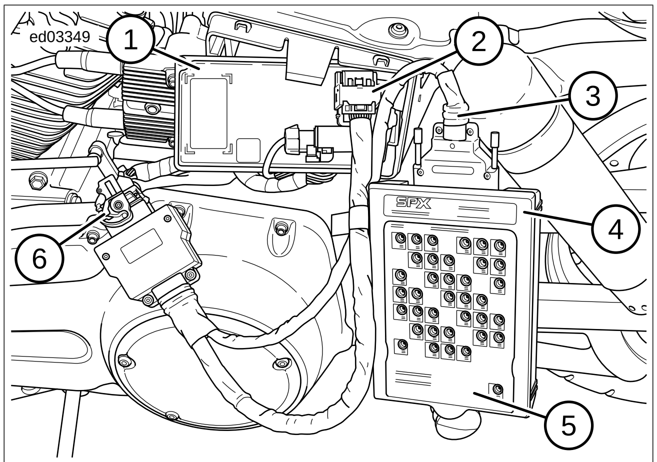
HD-50390-1 Breakout Box (BCM)

The BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) splice into the main harness. Used in conjunction with a multimeter, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects. Install BOB in series:

NOTE

See wiring diagrams for BCM terminal functions.

1. Access the BCM.
2. Press latch and disconnect BCM [242B].
3. See Figure 1-10. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to connectors.
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. When testing is completed remove BOB and restore connections.



1. **BCM**
2. **BCM [242A]**
3. **BCM cable**
4. **Breakout box**
5. **BCM overlay**
6. **Wiring harness [242B]**

Figure 1-10. BCM Breakout Box Connection

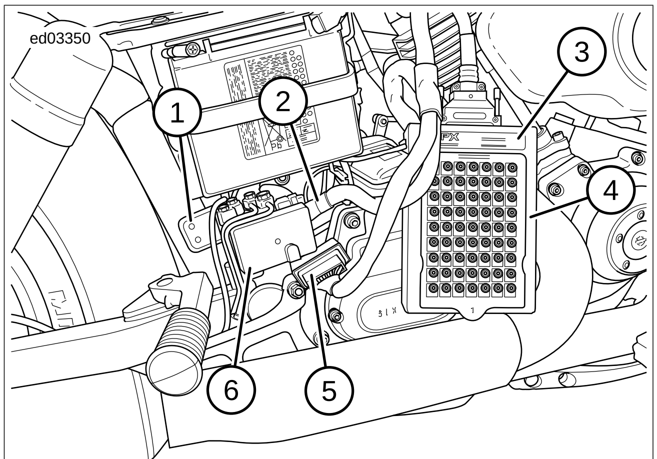
HD-50390-1 Breakout Box (ABS)

The BREAKOUT BOX (Part No. HD-50390-1) and ABS CABLE (Part No. HD-50390-6) splice to the ABS harness. Used in conjunction with a multimeter, allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects. Install BOB in series:

NOTE

See wiring diagrams for ABS module terminal functions.

1. Access the ABS module.
2. See Figure 1-11. Remove the ABS module bracket screws.
3. Press latch and disconnect ABS module [166B]. Route the connector below the ABS module.
4. Connect BREAKOUT BOX (Part No. HD-50390-1) and ABS CABLE (Part No. HD-50390-6) to [166].
5. In some cases it is necessary to leave the ABS module disconnected.
6. When testing is completed remove BOB, restore connections and install the ABS module bracket screws.



1. **ABS module bracket screws**
2. **ABS module [166A]**
3. **Breakout box**
4. **ABS overlay**
5. **Wiring harness [166B]**
6. **ABS module**

Figure 1-11. Typical Breakout Box Installation

HD-48650 Digital Technician II

DIGITAL TECHNICIAN II (Part No. HD-48650) is a computer-based diagnostic device used to communicate/diagnose and program systems and modules.

Diagnostics in this manual are developed under the assumption that DTII is not available.

VOLTAGE DROP

Voltage drop test:

- Helps locate poor connections or components with excessive voltage drops.
- Measures the difference in potential or actual voltage dropped between source and destination.
- Checks integrity of the wiring, switches, fuses, connectors and contacts between source and destination.
- Identifies poor grounds.

A voltage drop test measures the difference in voltage between two points in a circuit. The amount of voltage dropped over any part of a circuit is directly related to the amount of resistance in that part of the circuit and the current flowing through it.

Components such as wires, switches and connectors are designed to have very little resistance and very little voltage drop. A voltage drop greater than 1.0V across these components indicates a high resistance and possible fault.

The benefits of doing it this way are:

- Readings are not as sensitive to real battery voltage.
- Readings show the actual voltage dropped not just the presence of voltage.
- System is tested as it is actually being used.
- Testing is more accurate and displays hard-to-find poor connections.
- Starting circuits, lighting circuits or ignition circuits can be tested with this approach. Start from the most positive and go to the most negative destination or component.

When testing a typical power circuit, place positive (red) meter lead on most positive part of circuit or positive battery post. There is nothing more positive than the positive post of the battery.

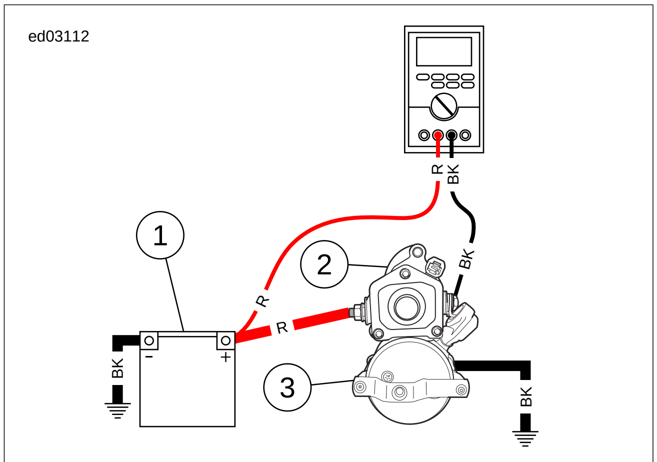
Place negative (black) meter lead at positive side of connector in question. Activate circuit. Move negative meter lead through the circuit until high voltage drop is found.

When testing a typical ground circuit, place negative lead on most negative part of circuit or negative battery post. There is nothing more negative than the negative post of the battery.

Place positive meter lead at negative side of connector in question. Activate circuit. Move positive meter lead through the circuit until high voltage drop is found.

The following steps demonstrate a typical starter circuit voltage drop test:

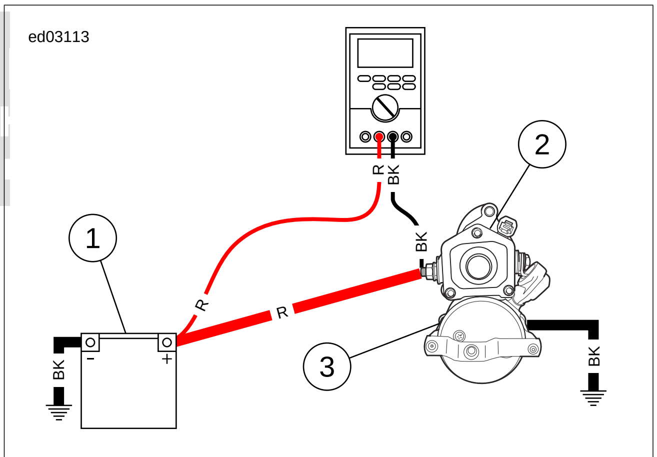
1. Disconnect CKP [79] to prevent engine from starting.
   a. See Figure 1-12. Connect red meter lead to positive battery post.
   b. Connect black meter lead to starter side post of starter solenoid. Observe meter reading.
   c. Crank starter and observe meter reading. The difference in the voltage is the voltage drop.



1. Battery
2. Starter solenoid
3. Starter motor

Figure 1-12. To Starter Solenoid Starter Terminal

2. See Figure 1-13. Move black meter lead to battery side post on starter solenoid. Crank starter. Observe voltage drop.

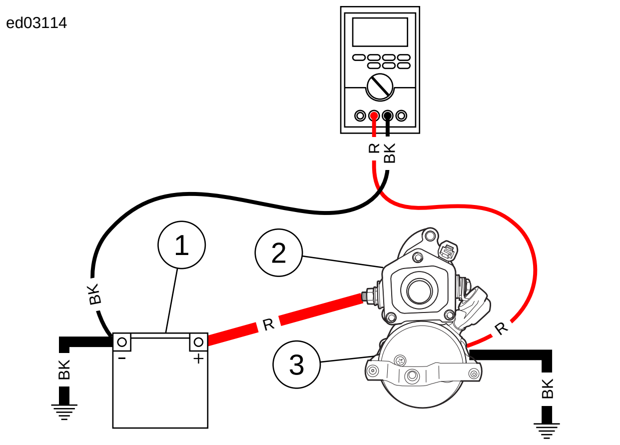


1. Battery
2. Starter solenoid
3. Starter motor

Figure 1-13. To Starter Solenoid Battery Terminal

3. See Figure 1-14. Move black meter lead to negative battery post and red meter lead to starter case. Crank starter. Observe voltage drop.

HOME



1. **Battery**
2. **Starter solenoid**
3. **Starter motor**

Figure 1-14. Starter Ground Circuit

WIGGLE TEST

PART NUMBER	TOOL NAME
HD-39978	DIGITAL MULTIMETER (FLUKE 78)
HD-48650	DIGITAL TECHNICIAN II
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Wiggle test checks for the presence of intermittents in a wiring harness. If available, use DIGITAL TECHNICIAN II (Part No. HD-48650) to perform wiggle test.

1. See Figure 1-15. Connect DIGITAL MULTIMETER (FLUKE 78) (Part No. HD-39978) to wiring harness between suspect connections. When diagnosing ECM connections, use BREAKOUT BOX (Part No. HD-50390-1), ECM CABLE (Part No. HD-50390-4) and ECM OVERLAY (Part No. HD-50390-4-P) to simplify the procedure. See 1.3 DIAGNOSTIC TOOLS.
2. Set the multimeter to read voltage changes.
3. Start motorcycle engine and run at idle.
4. Shake or wiggle harness to detect intermittents. If intermittents are present, radical voltage changes register on multimeter.

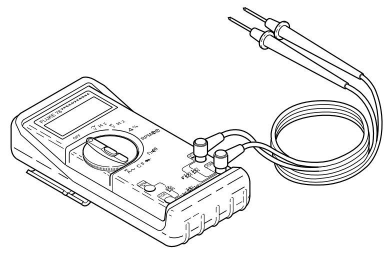


Figure 1-15. Digital Multimeter (Fluke 78)

JOB TIME CODES VALUES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Dealership technicians filing warranty claims should use job time code values printed in bold text at the end of the appropriate repair. When using DIGITAL TECHNICIAN II (Part No. HD-48650), dealership technicians filling out warranty claims should use job time code given by the computer.

TABLE OF CONTENTS

SERIAL DATA

NOTES

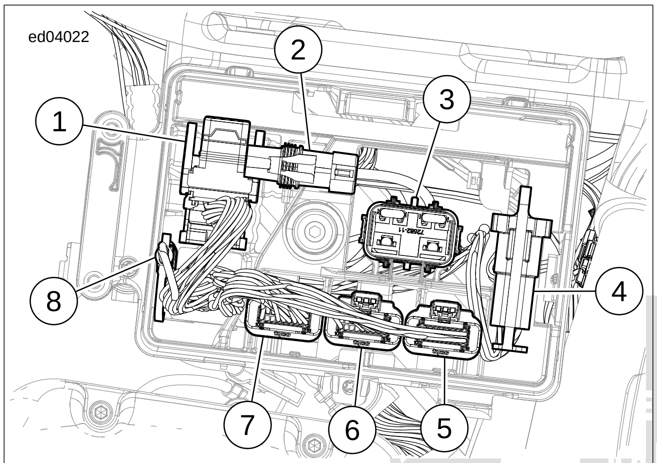
CAN DATA COMMUNICATION 2.1

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

CAN bus circuits are used by modules and diagnostic tools to share information.

The instruments, ECM, BCM, hand controls and ABS (if equipped) all communicate on the CAN bus. The CAN communication uses a (W/BK) and (W/R) wire in a twisted pair that runs to all the modules. It is used to transfer data from one module to the other. It also runs to the DLC [91] and is used to communicate with the modules using DIGITAL TECHNICIAN II (Part No. HD-48650).



1. **BCM [242]**
2. **BCM power [259]**
3. **Fuse block [64]**
4. **DLC [91]**
5. **ECM [78-3] (BN) (if applicable)**
6. **ECM [78-2] (GY)**
7. **ECM [78-1] (BK)**
8. **Battery tender [281] (if applicable)**

Figure 2-1. Under Left Side Cover

COMPONENTS

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Electronic Control Module (ECM)

See Figure 2-1. The ECM is located under the left side cover. The ECM monitors the engine sensors to enhance performance and driveability. This is done by adjusting the fuel and spark delivery based on the information provided by the sensors.

Instruments

The speedometer contains part of the indicator and warning lamps for the motorcycle. It uses the CAN communication to receive information from the other modules to know which lamps to illuminate at any given time. Vehicle speed is also sent to the speedometer over the CAN bus. The LEDs in the indicator bar are directly wired to the speedometer. The speedometer turns the indicators on and off based off commands from the BCM over the CAN bus. The tachometer uses CAN communication to receive engine speed information from the ECM.

BCM

See Figure 2-1. The BCM is located under the left side cover. The BCM supplies ignition and accessory power to most of the vehicle and controls the power mode of the electrical system. It controls the lighting along with other functions on the vehicle by using the switches as inputs, and the power circuits for the lights as outputs. The BCM is also connected to the CAN bus and shares information with the other modules on the vehicle.

ABS Module

See Figure 2-1. The ABS ECU is located below right side cover. The ECU receives input from the front and rear WSS, and controls the HCU accordingly. The ABS ECU communicates over the CAN bus to the speedometer to control the ABS indicator.

Hand Control Modules

The left and right hand control modules control all the switches and controls on the handlebars. The engine stop switch has a redundant wire directly to the BCM. In the event of a communication malfunction, this redundant circuit is used to keep the engine from shutting off until the switch is turned off.

The hand controls also control the turn signals and running lights (DOM) on vehicles where the front turn signals are wired to the hand controls.

Data Link Connector (DLC)

The DLC is located under the seat. The DLC is used to connect the DIGITAL TECHNICIAN II (Part No. HD-48650) to the motorcycle.

COMMUNICATION DTCS AND ERROR MESSAGES

There are several DTCs that may set due to an issue with the CAN bus communication. Different DTCs are set by different modules. If a module loses communication with the rest of the system it will set DTC U0001, but the DTC cannot be retrieved until the CAN lines to that module are restored. If a module goes offline due to loss of PWR or GND or a loss of communication to that module, the module will not set a code, but the other modules will set DTCs indicating they are not able to communicate with it. When the speedometer recognizes a problem on the CAN bus it may display "BUS Err" on the odometer.

"VINERR" may also be displayed in the odometer if the speedometer and ECM are not seeing the same VIN in both modules. This will usually occur after replacing one of the two modules. The two modules must have the VINs match before they can share odometer mileage.

Both the ECM and speedometer retain the odometer value. If the speedometer is replaced, it will display the odometer value stored in the ECM. The replacement speedometer will become locked to the ECM after 31.1 miles (50 km) have been accumulated. The trip B odometer will display the countdown mileage. Once the countdown reaches zero, the speedometer is locked to the ECM. If installed on another vehicle, the odometer will display "VINERR". If the speedometer is removed from the vehicle before the countdown reaches zero, it has not been locked to the ECM. This mileage countdown allows for a road test to verify that speedometer replacement was the proper repair.

Diagnostic Tips

Modules must have power and be grounded in order to communicate. Therefore, when checking any communication DTC be sure to check the power and ground connections on the suspected module. BUS Err may show on the odometer if the following are present:

- CAN wires shorted together.
- CAN wire shorted to PWR or GND.
- CAN transceiver on some module failed shorted.
- Non-compliant module connected to the CAN bus.

ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274 2.2

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

CAN communication uses a set of wires in a twisted pair. These two wires are designated as CAN low and CAN high circuits. Both circuits are connected to the ECM, BCM, instruments, both hand control modules and the ABS ECU (if equipped). The ECM and the right hand control module contain 120 ohm terminating resistors. Typical resistance between the two circuits is approximately 60 ohms.

- DTC U0001 indicates there is a fault on the CAN bus circuits. This code can be set by the ECM, BCM, instruments and ABS ECU (if equipped). This code is usually accompanied by other "U" codes, due to it causing a loss of communication between the modules on the CAN bus.
- DTC U0011 indicates the high and low CAN circuits are shorted together. This fault will be accompanied by other "U" codes and may cause the odometer display not to function.
- DTC B2274 indicates there is a fault with the battery fuse or the (R/O) wire.

NOTE

Always start from 1.2 INITIAL DIAGNOSTICS before proceeding with this test.

Table 2-1. Code Description

DTC	DESCRIPTION
U0001	CAN bus error
U0011	CAN bus low shorted to CAN bus high
B2274	Constant battery line error

Diagnostic Tips

The speedometer does not have an ignition input. Instead, it receives a message over the CAN bus, indicating the IGN is ON. Also, the trip odometer reset switch is a CAN communication to the speedometer. Therefore, CAN bus errors can cause the odometer self-diagnostics to be completely inoperative or to only partially function. The speedometer backlighting may not function along with the hand control switches and the indicators. The odometer may read "BUS Err" in this condition, prior to the odometer becoming inoperative.

NOTE

If DIGITAL TECHNICIAN II (Part No. HD-48650) is connected to the DLC [91] and communicating with the vehicle, then the odometer self-diagnostics will not function properly. Disconnect DIGITAL TECHNICIAN II (Part No. HD-48650) before entering odometer self-diagnostics.

The BCM supplies power to several systems on the vehicle. When testing for a short to voltage, perform all tests before disconnecting the BCM to keep from powering down systems on the vehicle. If the short to voltage goes away when the BCM is disconnected, test for continuity between the circuit in question and BCM [242B] terminals F4, J3, L3, L4 and M2 to verify the tested circuit is not shorted to one of these circuits. If continuity is present, repair short to circuit instead of replacing the BCM.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.1 CONNECTORS.

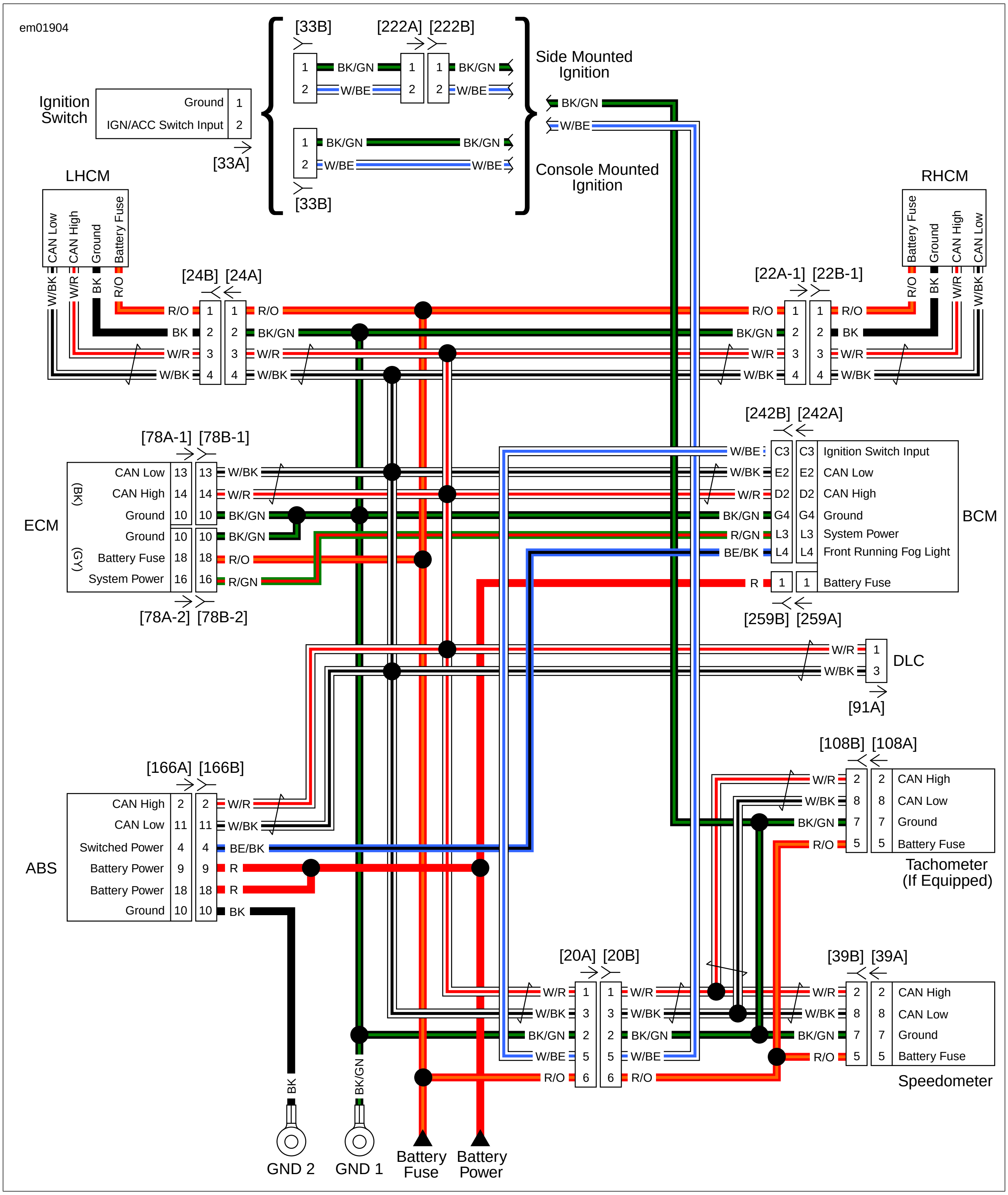


Figure 2-2. CAN Bus Circuit - IAC

HOME

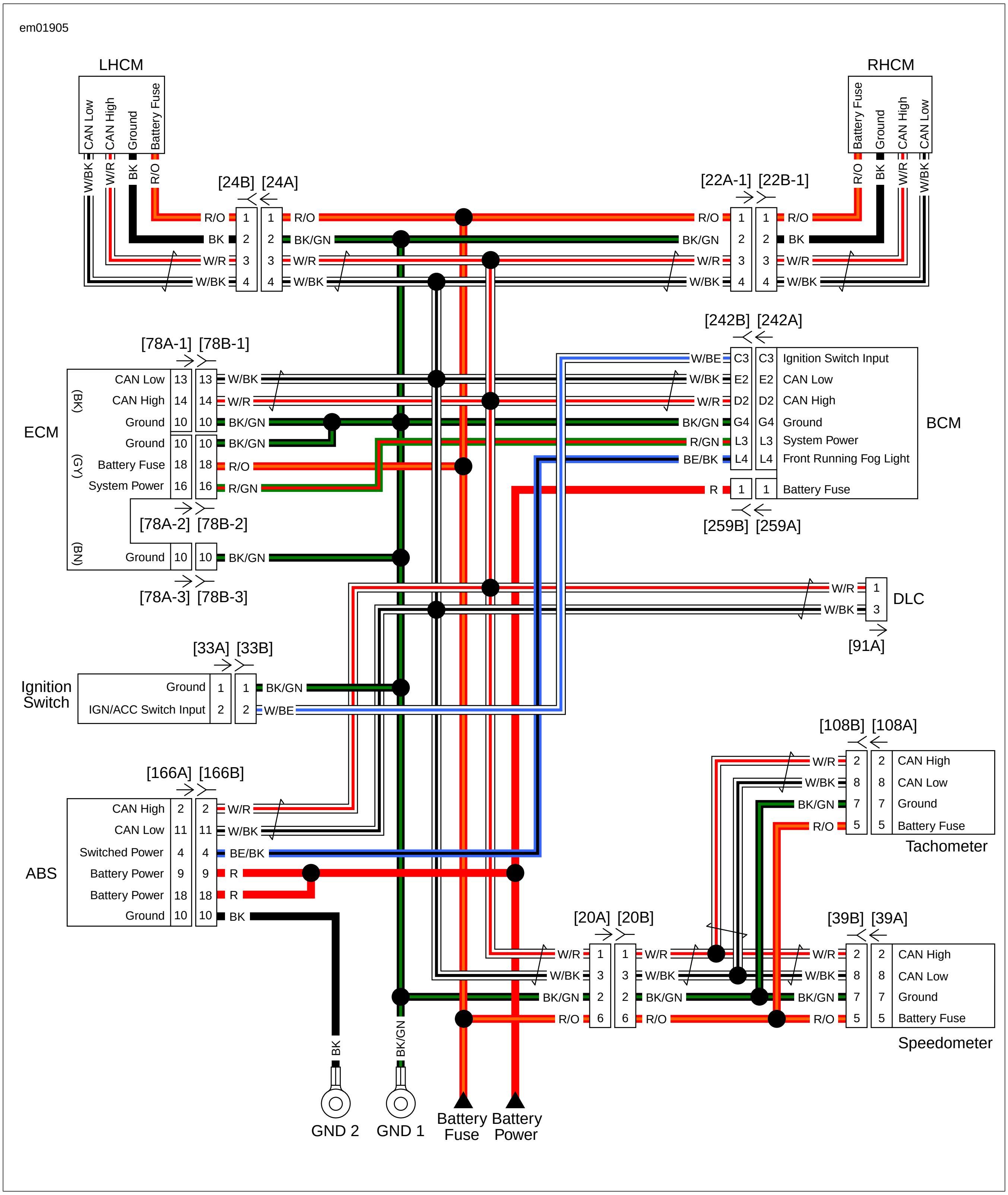


Figure 2-3. CAN Bus Circuit - ETC

ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	BREAKOUT BOX ADAPTERS
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY
HD-50390-6	ABS CABLE

Table 2-2. Odometer Self-Diagnostic Inoperative Diagnostic Faults: DTC U0001, U0011, B2274

POSSIBLE CAUSES
Short between CAN low and high circuits
Open in CAN high circuit
Open in CAN low circuit
Short to ground on CAN high circuit
Short to ground on CAN low circuit
Short to voltage on CAN high circuit
Short to voltage on CAN low circuit

1. Speedometer System Voltage Test

1. Disconnect speedometer [39].
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [39A] disconnected.
3. Turn IGN ON.
4. Test voltage between BOB terminal 5 and ground.
5. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (R/O) wire.

2. CAN Bus Test

1. Turn IGN OFF.
2. Connect [39].
3. Remove main fuse.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between DLC [91A] terminals 1 and 3.
5. Is resistance between 50-70 ohms?
   a. **Yes.** Go to Test 15.
   b. **No. Resistance less than 50 ohms.** Go to Test 3.
   c. **No. Resistance greater than 70 ohms.** Go to Test 10.

3. Speedometer Test

1. Disconnect speedometer [39].
2. Is resistance between [91A] terminals 1 and 3 between 50-70 ohms?
   a. **Yes.** Replace speedometer.
   b. **No.** Go to Test 4.

4. BCM Test

1. Disconnect BCM [242].
2. Is resistance between [91A] terminals 1 and 3 between 50-70 ohms?
   a. **Yes.** Replace BCM.
   b. **No, with ABS.** Go to Test 5.
   c. **No, without ABS.** Go to Test 6.

5. ABS Test

1. Disconnect ABS module [166].
2. Is resistance between [91A] terminals 1 and 3 between 50-70 ohms?
   a. **Yes.** Replace ABS module.
   b. **No.** Go to Test 6.

6. LHCM Test

1. Disconnect LHCM [24].
2. Is resistance between [91A] terminals 1 and 3 between 50-70 ohms?
   a. **Yes.** Replace LHCM.
   b. **No, with tachometer.** Go to Test 7.
   c. **No, without tachometer.** Go to Test 8.

7. Tachometer Test

1. Disconnect tachometer [108].
2. Is resistance between [91A] terminals 1 and 3 between 50-70 ohms?
   a. **Yes.** Replace tachometer.
   b. **No.** Go to Test 8.

8. ECM Test

1. Disconnect ECM [78B-1].
2. Is resistance between [91A] terminals 1 and 3 between 100-130 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Go to Test 9.

9. RHCM Test

1. Disconnect RHCM [22-1].
2. Is resistance between [91A] terminals 1 and 3 greater than 500 ohms?
   a. **Yes.** Replace RHCM.
   b. **No.** Repair short between (W/R) and (W/BK) wires.

10. CAN Circuit Open Test

1. Watch the resistance between DLC [91A] terminals 1 and 3, disconnect ECM [78-1].
2. Did resistance change?
   a. **Yes.** Go to Test 11.
   b. **No.** Go to Test 13.

11. CAN High Circuit Resistance to RHCM Test

1. Disconnect RHCM [22-1].
2. Test resistance between [91A] terminal 1 (W/R) wire and [22A-1] terminal 3.
3. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/R) wire.
   b. **No.** Go to Test 12.

12. CAN Low Circuit Resistance to RHCM Test

1. Test resistance between [91A] terminal 3 (W/BK) wire and [22A-1] terminal 4.
2. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/BK) wire.
   b. **No.** Replace RHCM.

13. CAN Low Circuit Resistance to ECM Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], leaving [78A-1] disconnected.
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Test resistance between [91A] terminal 3 (W/BK) wire and BOB [78-1] terminal 13.

NOTE

When measuring resistance (ohms), compensate for test lead resistance before performing the measurement. Select the ohms position and touch the test leads together. Refer to the multimeter user's manual to either zero the display or manually subtract the test lead resistance from the measured circuit's value.

4. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/BK) wire.
   b. **No.** Go to Test 14.

14. CAN High Circuit Resistance to ECM Test

1. Test resistance between [91A] terminal 1 (W/R) wire and BOB terminal 14.
2. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/R) wire.
   b. **No.** Replace ECM.

15. CAN High Circuit Short to Ground Test

1. Turn IGN OFF.
2. Test resistance between [91A] terminal 1 and ground.
3. Is resistance less than 1000 ohms?
   a. **Yes.** Go to Test 16.
   b. **No.** Go to Test 24.

16. Speedometer Test

1. Disconnect speedometer [39].
2. Is resistance between [91A] terminal 1 and ground less than 1000 ohms?
   a. **Yes.** Go to Test 17.
   b. **No.** Replace speedometer.

17. ECM Test

1. Disconnect ECM [78B-1].
2. Is resistance between [91A] terminal 1 and ground less than 1000 ohms?
   a. **Yes.** Go to Test 18.
   b. **No.** Replace ECM.

18. LHCM Test

1. Disconnect LHCM [24].
2. Is resistance between [91A] terminal 1 and ground less than 1000 ohms?
   a. **Yes, with tachometer.** Go to Test 19.
   b. **Yes, without tachometer.** Go to Test 20.
   c. **No.** Replace LHCM.

19. Tachometer Test

1. Disconnect tachometer [108].
2. Is resistance between [91A] terminals 1 and ground less than 1000 ohms?
   a. **Yes.** Go to Test 20.
   b. **No.** Replace tachometer.

20. BCM Test

1. Disconnect BCM [242].

2. Is resistance between [91A] terminal 1 and ground less than 1000 ohms?
   a. **Yes, with ABS.** Go to Test 21.
   b. **Yes, without ABS.** Go to Test 22.
   c. **No.** Replace BCM.

21. ABS Test

1. Disconnect ABS module [166].
2. Is resistance between [91A] terminal 1 and ground less than 1000 ohms?
   a. **Yes.** Go to Test 22.
   b. **No.** Replace ABS module.

22. RHCM Test

1. Disconnect RHCM [22-1].
2. Is resistance between [91A] terminal 1 and ground less than 1000 ohms?
   a. **Yes.** Repair short to ground in (W/R) wire.
   b. **No.** Go to Test 23.

23. CAN Low Circuit Short to Ground Test

1. Test resistance between [91A] terminal 3 and ground.
2. Is resistance less than 1000 ohms?
   a. **Yes.** Repair short to ground in (W/BK) wire.
   b. **No.** Replace RHCM.

24. CAN High Circuit Short to Voltage Test

1. Install main fuse.
2. Turn IGN ON.
3. Test voltage between [91A] terminal 1 and ground.
4. Is voltage greater than 4V?
   a. **Yes.** Go to Test 25.
   b. **No.** Go to Test 33.

25. Speedometer Test

1. Turn IGN OFF.
2. Disconnect speedometer [39].
3. Turn IGN ON.
4. Is voltage between [91A] terminal 1 and ground greater than 4V?
   a. **Yes.** Go to Test 26.
   b. **No.** Replace speedometer.

26. ECM Test

1. Turn IGN OFF.
2. Disconnect ECM [78B-1].
3. Turn IGN ON.
4. Is voltage between [91A] terminal 1 and ground greater than 4V?
   a. **Yes.** Go to Test 27.
   b. **No.** Replace ECM.

27. LHCM Test

1. Turn IGN OFF.
2. Disconnect LHCM [24].
3. Turn IGN ON.
4. Is voltage between [91A] terminal 1 and ground greater than 4V?
   a. **Yes, with ABS.** Go to Test 28.
   b. **Yes, without ABS.** Go to Test 29.
   c. **No.** Replace LHCM.

28. ABS Test

1. Turn IGN OFF.
2. Disconnect ABS module [166].
3. Turn IGN ON.
4. Is voltage between [91A] terminal 1 and ground greater than 4V?
   a. **Yes.** Go to Test 29.
   b. **No.** Replace ABS module.

29. BCM Test

1. Turn IGN OFF.
2. Disconnect BCM power [259].
3. Disconnect BCM [242].
4. Turn IGN ON.
5. Is voltage between [91A] terminal 1 and ground greater than 4V?
   a. **Yes, with tachometer.** Go to Test 30.
   b. **Yes, without tachometer.** Go to Test 31.
   c. **No.** Replace BCM. Refer to diagnostic tips.

30. Tachometer Test

1. Turn IGN OFF.
2. Disconnect tachometer [108].
3. Turn IGN ON.
4. Is voltage between [91A] terminals 1 and ground greater than 4V?
   a. **Yes.** Go to Test 31.
   b. **No.** Replace tachometer.

31. RHCM Test

1. Turn IGN OFF.
2. Disconnect RHCM [22-1].
3. Turn IGN ON.

4. Is voltage between [91A] terminal 1 and ground greater than 4V?
   a. **Yes.** Repair short to voltage in (W/R) wire.
   b. **No.** Go to Test 32.

32. CAN Low Circuit Short to Voltage Test

1. Test voltage between [91A] terminal 3 and ground.
2. Is voltage present?
   a. **Yes.** Repair short to voltage in (W/BK) wire.
   b. **No.** Replace RHCM.

33. CAN Low Circuit Resistance to BCM Test

1. Turn IGN OFF.
2. Remove cables and ECM BOB, connect ECM.
3. Disconnect BCM [242].
4. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wiring harness [242B], leaving [242A] disconnected.
5. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
6. Test resistance between [91A] terminal 3 (W/BK) wire and BOB terminal E2.
7. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/BK) wire between [91A] terminal 3 and [242B] terminal E2.
   b. **No.** Go to Test 34.

34. CAN High Circuit Resistance to BCM Test

1. Test resistance between [91A] terminal 1 (W/R) wire and BOB terminal D2.
2. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/R) wire between [91A] terminal 1 and [242B] terminal D2.
   b. **No, with ABS.** Go to Test 35.
   c. **No, without ABS.** Go to Test 37.

35. CAN Low Circuit Resistance to ABS Module Test

1. Remove cables and BCM BOB. Connect BCM.
2. Disconnect ABS [166].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and ABS CABLE (Part No. HD-50390-6) to wiring harness connector [166B]. Leaving [166A] disconnected, test resistance between [91A] terminal 3 (W/BK) wire and BOB terminal 11.
4. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/BK) wire between [91A] terminal 3 and [166B] terminal 11.
   b. **No.** Go to Test 36.

36. CAN High Circuit Resistance to ABS Module Test

1. Test resistance between [91A] terminal 1 (W/R) wire and BOB terminal 2.
2. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/R) wire between [91A] terminal 1 and [166B] terminal 2.
   b. **No, with tachometer** Go to Test 37.
   c. **No, without tachometer.** Go to Test 39.

37. CAN Low Circuit Resistance to Tachometer Test

1. Remove cables and ABS BOB. Connect ABS module.
2. Disconnect tachometer [108].
3. Connect BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) to wiring harness connectors [108B]. Leaving [108A] disconnected, test resistance between [91A] terminal 3 (W/BK) wire and BOB terminal 8.
4. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/BK) wire between [91A] terminal 3 and [108B] terminal 8.
   b. **No.** Go to Test 38.

38. CAN High Circuit Resistance to Tachometer Test

1. Test resistance between [91A] terminal 1 (W/R) wire and BOB terminal 2.
2. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/R) wire between [91A] terminal 1 and [108B] terminal 2.
   b. **No.** Go to Test 39.

39. CAN Low Circuit Resistance to Speedometer Test

1. Remove cables and ABS BOB, connect ABS module.
2. Remove tachometer BOB and connect tachometer.
3. Disconnect speedometer [39].
4. Connect BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) to wiring harness connectors [39B]. Leaving [39A] disconnected, test resistance between [91A] terminal 3 (W/BK) wire and BOB terminal 8.
5. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/BK) wire between [91A] terminal 3 and [39B] terminal 8.
   b. **No.** Go to Test 40.

40. CAN High Circuit Resistance to Speedometer Test

1. Test resistance between [91A] terminal 1 (W/R) wire and BOB terminal 2.
2. Is resistance greater than 0.5 ohm?
   a. **Yes.** Repair (W/R) wire between [91A] terminal 1 and [39B] terminal 2.
   b. **No.** Concern is intermittent. Perform wiggle test and verify all connectors are properly connected. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

NO VEHICLE POWER OR LOST COMMUNICATION DTCS 2.3

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The CAN bus circuit provides a means for the ECM, speedometer, BCM, hand control modules and the ABS ECU (if equipped) to communicate their current status. When all operating parameters on the CAN bus are within specifications, a state of health message is sent between the components.

The CAN bus is made up of two circuits. The (W/R) is the CAN bus high circuit and the (W/BK) is the CAN bus low circuit. Both of these circuits show approximately 2.5V when measured between each of the circuits and ground with the IGN ON. These circuits are connected to each module on the CAN bus network. A fault on either one of these circuits will cause several modules to set "U" codes and may cause a complete loss of communication between all modules.

Table 2-3. Code Description

DTC	DESCRIPTION
U0100	Lost comm w/ECM
U0121	Lost comm w/ABS
U0140	Lost comm w/BCM
U0141	Lost comm w/LHCM
U0142	Lost comm w/RHCM
U0156	Lost comm w/speedo
U0157	Lost comm w/tach
U0002	CAN comm bus perf error
U0300	Internal control module software incompatibility

Diagnostic Tips

Modules must have power in order to communicate on the CAN bus. It is important to check for good power and ground on any module that is not communicating effectively on the CAN bus network.

- At least two modules will set a DTC when one module loses the ability to communicate on the CAN bus.
- When two or more modules set the same U code it indicates a problem with the device or wiring at the device the codes are set against.
- Two or more modules setting the same U code intermittently indicates an intermittent problem with the device or wiring.

See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test to test wiring to the component.

The BCM supplies power to several systems on the vehicle.

- When testing for a short to voltage, perform all tests before disconnecting the BCM to keep from powering down systems on the vehicle.
- If the short to voltage goes away when the BCM is disconnected, test for continuity between the circuit in question and BCM [242B] terminals F4, J3, L3, L4 and M2 to verify the tested circuit is not shorted to one of these circuits.
- If continuity is present, repair shorted circuit instead of replacing the BCM.

Historic U codes may be found if battery power has been lost for any reason or if the main or battery fuses have been disconnected and reconnected. This may also happen if during diagnostics using DIGITAL TECHNICIAN II (Part No. HD-48650). The diagnostics connector has been disconnected before vehicle has been powered down. This is not an indication of a problem and does not cause any loss of functionality.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.1 CONNECTORS.

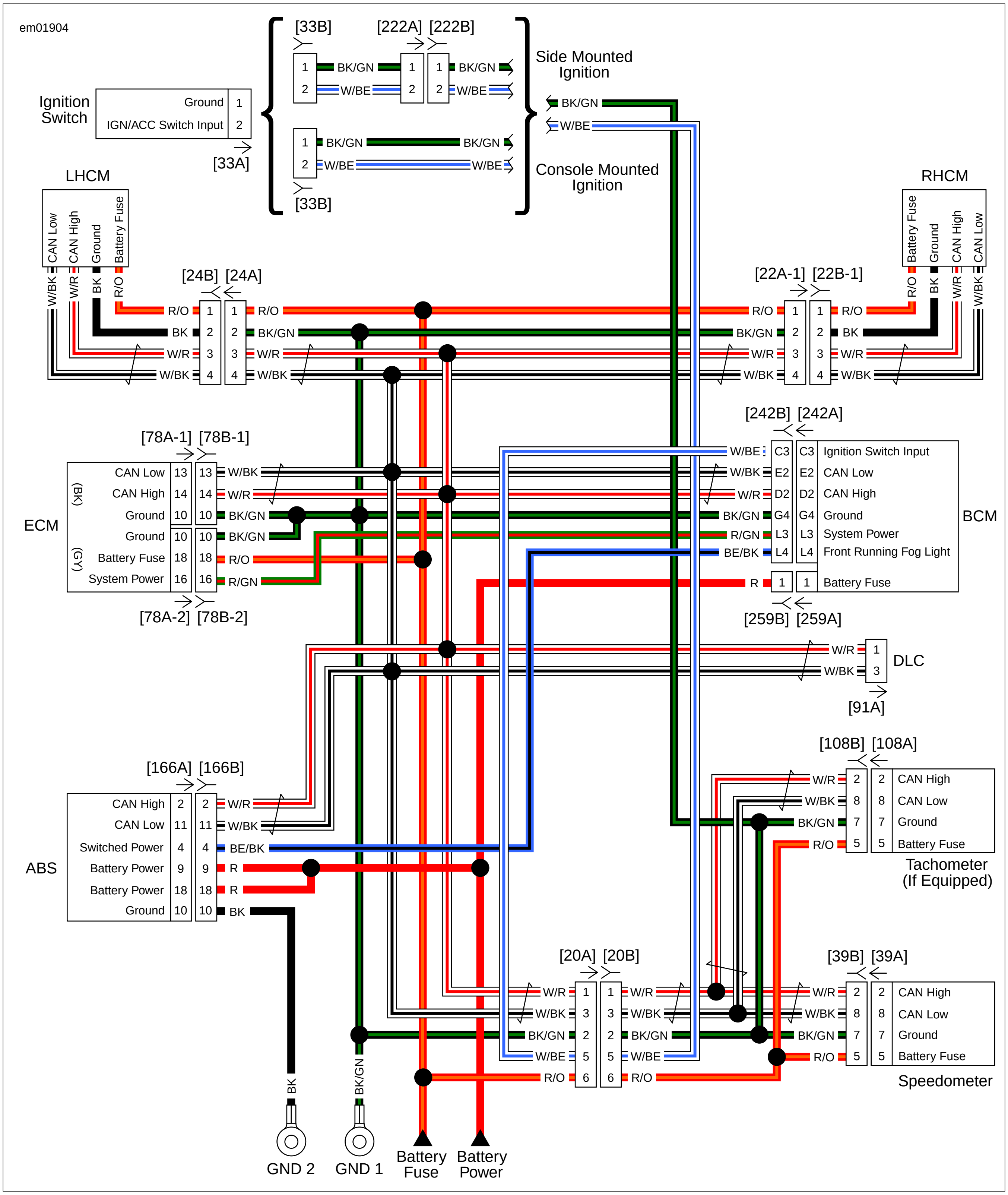


Figure 2-4. CAN Bus Circuit - IAC

HOME

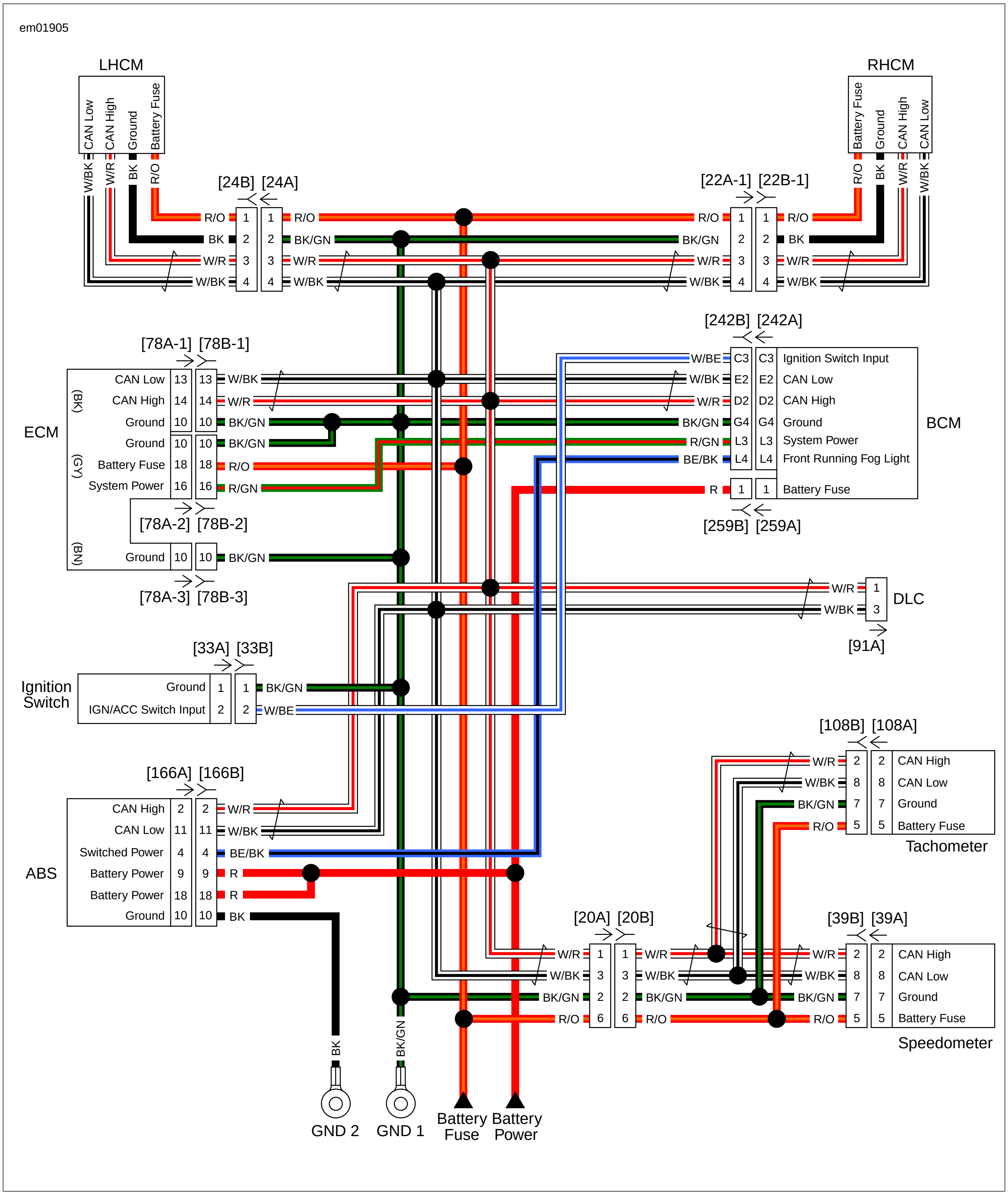


Figure 2-5. CAN Bus Circuit - ETC

DTC U0100

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 2-4. DTC U0100 Diagnostic Faults

POSSIBLE CAUSES
Open in CAN high circuit to the ECM
Open in CAN low circuit to the ECM
Open in ECM system power circuit
Open in ECM ground circuit

1. Module Test

1. View odometer.
2. Is only BCM setting DTC?
   a. **Yes.** Go to Test 10.
   b. **No, ABS module only.** Go to Test 7.
   c. **No, speedometer only.** Go to Test 8.
   d. **No, tachometer only.** Go to Test 9.
   e. **No, multiple modules.** Go to Test 2.

2. System Power Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness connectors [78B-1] and [78B-2], leaving [78A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminal 16 and ground.
6. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (R/GN) wire.

3. ECM [78-1] Ground Test

1. Turn IGN OFF.
2. Test resistance between BOB [78-1] terminal 10 and ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (BK/GN) wire.

4. ECM [78-2] Ground Test

1. Test resistance between BOB [78-2] terminal 10 and ground.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (BK/GN) wire.

5. CAN High Circuit Continuity Test

1. Test resistance between BOB [78-1] terminal 14 and DLC [91A] terminal 1.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair open in (W/R) wire.

6. CAN Low Circuit Continuity Test

1. Test resistance between BOB [78-1] terminal 13 and [91A] terminal 3.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (W/BK) wire.

7. Verify ABS Module Test

1. Turn IGN OFF.
2. Replace ABS module with a known good ABS module.
3. Turn IGN ON.
4. Attempt to start vehicle.
5. Check DTC.
6. Is DTC U0100 present?
   a. **Yes.** Check vehicle for any accessories connected to the CAN bus.
   b. **No.** Replace ECM.

8. Verify Speedometer Test

1. Turn IGN OFF.
2. Replace speedometer with a known good speedometer.
3. Turn IGN ON.
4. Attempt to start vehicle.
5. Check DTC.
6. Is DTC U0100 present?
   a. **Yes.** Check vehicle for any accessories connected to the CAN bus.
   b. **No.** Replace speedometer.

9. Verify Tachometer Test

1. Turn IGN OFF.
2. Replace tachometer with a known good tachometer.
3. Turn IGN ON.
4. Attempt to start vehicle.

5. Check DTC.
6. Is DTC U0100 present?
   a. **Yes.** Check vehicle for any accessories connected to the CAN bus.
   b. **No.** Replace tachometer.

10. Verify BCM Test

1. Replace BCM with a known good BCM.
2. Turn IGN ON.
3. Attempt to start vehicle.
4. Check DTC.
5. Is DTC U0100 present?
   a. **Yes.** Check vehicle for any accessories connected to the CAN bus.
   b. **No.** Replace BCM.

DTC U0121

PART NUMBER	TOOL NAME
HD-50390-1	BREAKOUT BOX
HD-50390-1-P1	ABS OVERLAY
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50390-6	ABS CABLE

Table 2-5. DTC U0121 Diagnostic Faults

POSSIBLE CAUSES
Open in CAN high circuit to the ABS ECU
Open in CAN low circuit to the ABS ECU
Open in ABS system power circuit
Open in ABS ground circuit

1. ABS Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ABS CABLE (Part No. HD-50390-6) to wiring harness [166B], leaving [166A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ABS OVERLAY (Part No. HD-50390-1-P1) is in position on BOB.
4. Test voltage between BOB terminal 9 and ground.
5. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (R) wire.

2. ABS Ground Test

1. Test voltage between BOB terminals 9 and 10.
2. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK) wire.

3. Switched Power Test

1. Turn IGN ON.
2. Test voltage between BOB terminal 4 and ground.
3. Is battery voltage present?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 6.

4. CAN High Circuit Continuity Test

1. Turn IGN OFF.
2. Test resistance between ABS [166B] terminal 2 and DLC [91A] terminal 1.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (W/R) wire.

5. CAN Low Circuit Continuity Test

1. Turn IGN OFF.
2. Test resistance between [166B] terminal 11 and [91A] terminal 3.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace ABS module.
   b. **No.** Repair open in (W/BK) wire.

6. Switched Power Ground Test

1. Turn IGN OFF.
2. Test continuity between BOB terminal 4 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (BE/BK) wire.
   b. **No.** Go to Test 7.

7. BCM Test

1. Remove BOB.
2. Connect [166].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Turn IGN ON.
6. Test voltage between BOB terminal L4 and ground.
7. Is battery voltage present?
   a. **Yes.** Repair open in (BE/BK) wire.
   b. **No.** Replace BCM.

NO VEHICLE POWER: DTC U0140

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL

Table 2-6. No Vehicle Power Diagnostic Faults: DTC U0140

POSSIBLE CAUSES
Open in CAN high circuit to the BCM
Open in CAN low circuit to the BCM
Open in ignition switch circuit
Short to ground in ignition switch circuit
Short to voltage in ignition switch circuit
Ignition switch malfunction
Open in BCM battery power circuit
Open in BCM ground circuit

1. Ignition Switch Ground Test

1. Turn IGN OFF.
2. Disconnect ignition switch [33].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [33B] terminal 1 and ground.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (BK/GN) ground wire.

2. Ignition Switch Test

1. Turn IGN ON.
2. Test resistance between [33A] terminals 1 and 2.
3. Is resistance between 50-500 ohms?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace ignition switch.

3. Ignition Switch Accessory Test

1. Turn IGN to ACC.
2. Test resistance between [33A] terminals 1 and 2.
3. Is resistance between 400-1900 ohms?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace ignition switch.

4. Ignition Switch Signal Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Test resistance between [33B] terminal 2 (W/BE) wire and BOB terminal C3.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (W/BE) wire.

5. Switch Signal Short to Ground Test

1. Test continuity between [33B] terminal 2 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (W/BE) wire.
   b. **No.** Go to Test 6.

6. Ignition Switch Signal Short to Voltage Test

1. Disconnect [242B].
2. Using 0.6 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50423), remove terminal C3 from [242B].
3. Connect [242B] to BOB.
4. Test voltage between [33B] terminal 2 (W/BE) wire and ground.
5. Is voltage present?
   a. **Yes.** Repair short to voltage in (W/BE) wire.
   b. **No.** Go to Test 7.

7. BCM Ground Test

1. Turn IGN OFF.
2. Connect [33].
3. Test resistance between BOB terminal G4 (BK/GN) wire and ground.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 8.
   b. **No.** Repair open in (BK/GN) wire.

8. CAN High Circuit Continuity Test

1. Test resistance between BOB terminal D2 and DLC [91A] terminal 1 (W/R) wire.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 9.
   b. **No.** Repair open in (W/R) wire.

9. CAN Low Circuit Continuity Test

1. Test resistance between BOB terminal E2 and [91A] terminal 3 (W/BK) wire.

2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 10.
   b. **No.** Repair open in (W/BK) wire.

10. BCM Voltage Test

1. Disconnect BCM power [259B].
2. Test voltage between [259B] terminal 1 and ground.
3. Is battery voltage present?
   a. **Yes.** Replace BCM.
   b. **No.** Repair open in (R) wire.

LEFT HAND CONTROLS INOPERATIVE: DTC U0141

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 2-7. Left Hand Controls Inoperative, DTC U0141 Diagnostic Faults

POSSIBLE CAUSES
Open in CAN high circuit to the LHCM
Open in CAN low circuit to the LHCM
Open in LHCM battery power circuit
Open in LHCM ground circuit

1. LHCM Voltage Test

1. Turn IGN OFF.
2. Disconnect LHCM [24A].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [24A] terminal 1 and ground.
4. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (R/O) wire.

2. LHCM Test

1. Test voltage between [24A] terminals 1 and 2.
2. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK/GN) wire.

3. CAN High Circuit Continuity Test

1. Test resistance between [24A] terminal 3 and DLC [91A] terminal 1.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (W/R) wire.

4. CAN Low Circuit Continuity Test

1. Test resistance between [24A] terminal 4 and [91A] terminal 3.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace LHCM.
   b. **No.** Repair open in (W/BK) wire.

DTC U0142

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 2-8. DTC U0142 Diagnostic Faults

POSSIBLE CAUSES
Open in CAN high circuit to the RHCM
Open in CAN low circuit to the RHCM
Open in RHCM battery power circuit
Open in RHCM ground circuit

1. RHCM Voltage Test

1. Turn IGN OFF.
2. Disconnect RHCM [22A-1].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [22A-1] terminal 1 and ground.
4. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (R/O) wire.

2. RHCM Test

1. Test voltage between [22A-1] terminals 1 and 2.
2. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK/GN) wire.

3. CAN High Circuit Continuity Test

1. Test resistance between [22A-1] terminal 3 and DLC [91A] terminal 1.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (W/R) wire.

4. CAN Low Circuit Continuity Test

1. Test resistance between [22A-1] terminal 4 and [91A] terminal 3.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace RHCM.
   b. **No.** Repair open in (W/BK) wire.

SPEEDOMETER INOPERATIVE: DTC U0156

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

Table 2-9. Speedometer Inoperative: DTC U0156 Diagnostic Faults

POSSIBLE CAUSES
Open in CAN high circuit to the speedometer
Open in CAN low circuit to the speedometer
Open in speedometer battery power circuit
Open in speedometer ground circuit

1. Speedometer Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) to the wiring harness [39B], leaving [39A] disconnected.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal 5 and ground.
4. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (R/O) wire.

2. Speedometer Ground Test

1. Test voltage between BOB terminals 5 and 7.
2. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK/GN) wire.

3. CAN High Circuit Continuity Test

1. Test resistance between BOB terminal 2 and DLC [91A] terminal 1.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (W/R) wire.

4. CAN Low Circuit Continuity Test

1. Test resistance between BOB terminal 8 and [91A] terminal 3.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace speedometer.
   b. **No.** Repair open in (W/BK) wire.

TACHOMETER INOPERATIVE: DTC U0157

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

Table 2-10. Tachometer Inoperative: DTC U0157 Diagnostic Faults

POSSIBLE CAUSES
Open in CAN high circuit to the tachometer
Open in CAN low circuit to the tachometer
Open in tachometer battery power circuit
Open in tachometer ground circuit

1. Tachometer Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) to the wiring harness [108B], leaving the [108A] disconnected.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal 5 and ground.
4. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (R/O) wire.

2. Tachometer Ground Test

1. Test voltage between BOB terminals 5 and 7.
2. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK/GN) wire.

3. CAN High Circuit Continuity Test

1. Test resistance between BOB terminal 2 and DLC [91A] terminal 1.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (W/R) wire.

4. CAN Low Circuit Continuity Test

1. Test resistance between BOB terminal 8 and [91A] terminal 3.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace the tachometer.
   b. **No.** Repair open in (W/BK) wire.

DTC U0002

Table 2-11. DTC U0002 Diagnostic Faults

POSSIBLE CAUSES
ABS ECU malfunction

1. ABS ECU DTC Test

1. Clear DTCs.
2. Turn IGN OFF.
3. Check DTCs.
4. Did DTC U0002 reset?
   a. **Yes.** Replace ABS module.
   b. **No.** ABS system working properly.

DTC U0300

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Table 2-12. DTC U0300 Diagnostic Faults

POSSIBLE CAUSES
ECM software error

1. Verify DTC

1. Clear DTC.
2. Turn IGN OFF for 30 seconds.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Go to Test 2.
   b. **No.** System working properly.

2. Reflash ECM

1. Using DIGITAL TECHNICIAN II (Part No. HD-48650) reflash ECM.
2. Clear DTCs.
3. Turn IGN OFF for 30 seconds.
4. Check DTCs.
5. Did DTC reset?
   a. **Yes.** Replace ECM.
   b. **No.** System working properly.

NOTES

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NOTES

BATTERY TESTING 3.1

GENERAL

Test battery condition by using a voltage, charging or load test.

Always fully charge battery prior to load testing.

NOTE

An automatic, constant monitoring battery charger/tender with a charging rate of 5 amps or less at less than 14.6V is recommended. The use of constant current chargers (including trickle chargers) to charge sealed AGM batteries is not recommended. Any overcharge will cause dry-out and premature battery failure.

VOLTMETER TEST

The voltmeter test provides a general indication of battery state of charge or condition. Check the voltage of the battery to verify that it is in a 100% fully charged condition. Refer to Table 3-1.

If the open circuit (disconnected) voltage reading is below 12.6V, charge battery and then check voltage after battery has set for 1-2 hours. If voltage reading is 12.7V or above, perform a load test. See 3.1 BATTERY TESTING, Load Test.

Table 3-1. Voltmeter Test For Battery Charge Conditions

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

BATTERY DIAGNOSTIC TEST

PART NUMBER	TOOL NAME
GRX-3110HD	BATTERY DIAGNOSTIC STATION

Test battery using the BATTERY DIAGNOSTIC STATION (Part No. GRX-3110HD).

WARNING

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

1. Disconnect and remove battery.
2. Read GRX instruction manual before performing a battery test.
3. Connect BATTERY DIAGNOSTIC STATION (Part No. GRX-3110HD) leads to the battery terminals.
4. Test results will include a decision on battery condition and measured state of charge. See Figure 3-1. The GRX printer will provide a printout including test results:
   a. GOOD BATTERY - Return battery to service.
   b. REPLACE BATTERY - Replace battery.

Figure 3-1. Battery Test Results Printout (Typical)

LOAD TEST

WARNING

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

1. With vehicle battery on a bench, charge battery using an automatic, constant monitoring battery charger approved for AGM batteries.

WARNING

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

NOTE

Always fully charge battery before testing or test readings will be incorrect. Load testing a discharged battery can also result in permanent battery damage.

2. See Figure 3-2. Connect tester leads to battery posts and place induction pickup over negative (black) cable.

NOTE

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

3. Load battery at 50 percent of CCA rating using load tester. Voltage reading after 15 seconds should be 9.6V or more at 70 °F (21 °C). Refer to Table 3-2.

⚠WARNING

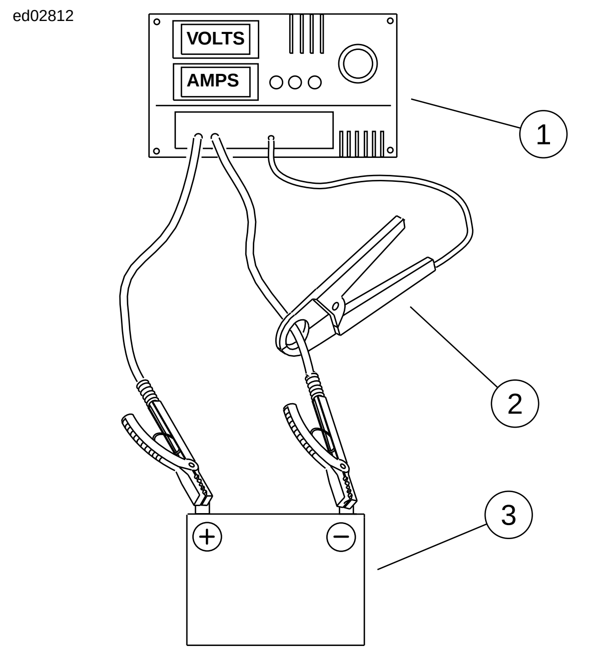
Turn battery load tester OFF before disconnecting tester cables to battery terminals. Disconnecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00253a)

⚠WARNING

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

NOTICE

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



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

Figure 3-2. Load Test Battery

Table 3-2. Battery Load Test

COLD CRANKING AMPERAGE (CCA)	100%	50%
Dyna models	315	155

STARTING SYSTEM 3.2

DESCRIPTION AND OPERATION

Battery voltage is supplied to the BCM at all times through the main fuse. The BCM provides and monitors a voltage signal to the ignition switch. This signal changes depending on the position of the IGN switch.

When the engine stop switch is in the RUN position, a CAN message is sent, signaling the BCM that the switch is in the RUN position. If CAN communication is interrupted while the engine is running, the BCM checks for the signal from the redundant engine stop switch circuit.

When the start switch is pressed, a CAN message is sent to the BCM. The BCM provides power to the starter solenoid. This energizes the solenoid and full battery power is sent to the starter. The BCM disables the starter solenoid if the start switch is pressed for more than 10 seconds.

COMPONENTS

Starter

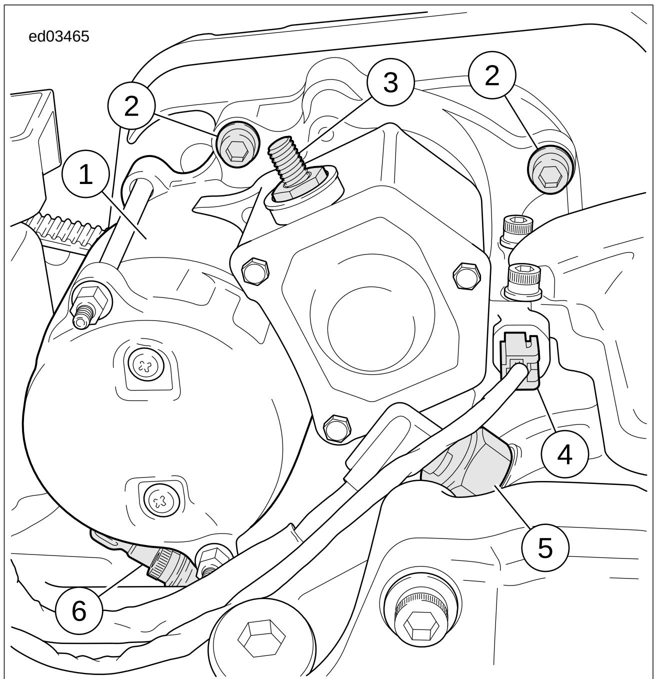
The starter receives power from the battery through the starter solenoid and is grounded through the starter case. When the starter solenoid is energized, two events happen:

- The plunger pulls inward which allows current to flow to the starter motor.
- The pinion gear engages with the ring gear on the clutch shell.

With the starter motor turning, the rotation is transferred:

- The starter armature gear transfers rotation to the idler gear.
- The idler gear transfers rotation to the starter clutch.
- The starter clutch transfers rotation through a spline gear to the starter drive shaft which also drives the pinion gear.
- The pinion gear transfers its rotation to the ring gear on the clutch shell.
- The primary chain drives the alternator rotor sprocket on the end of the crankshaft.

The starter clutch has a one-way clutch. When the engine starts, it allows the clutch shell and sprocket to spin freely without causing any damage to the starter motor. After the engine starts and the start switch is released, the plunger returns to its normal position, disengaging the pinion gear from the clutch shell and sprocket.



1. **Starter**
2. **Starter mounting fasteners**
3. **Positive battery cable post**
4. **Solenoid wire**
5. **Neutral switch**
6. **VSS**

Figure 3-3. Starter Components

Starter Solenoid

See Figure 3-3. The starter solenoid provides power to the starter. The solenoid is a means of controlling a high amperage device with a low amperage switch. The low amperage switch in this circuit is the BCM. The BCM sends voltage to the starter solenoid making a magnetic field that pulls a larger circuit closed, allowing voltage to the starter.

Engine Stop Switch

The engine stop switch is located on the right hand controls. With the engine stop switch in the RUN position, a CAN message is sent, signaling the BCM that the switch is in the RUN position. If CAN communication is interrupted while engine is running, a redundant engine stop switch circuit allows communication to the BCM.

Start Switch

The start switch is a push button switch located in the right hand controls. When the start switch is pressed, a CAN message is sent to the BCM.

BCM

The BCM supplies ignition and accessory power to most of the vehicle. It controls the lighting along with other functions by using the switches as inputs and the power circuits for the lights and other electrical loads as outputs.

Ignition Switch

The BCM provides and monitors a voltage signal to the ignition switch, which is an open circuit in the OFF position. The ignition switch routes the signal through a 200 ohm resistor to ground in the IGN position or through a 800 ohm resistor to ground in the ACC position. The difference in resistance in the ignition switch informs the BCM of the switch position.

Battery

WARNING

Batteries contain sulfuric acid, which could cause severe burns to eyes and skin. Wear a protective face shield, rubberized gloves and protective clothing when working with batteries. KEEP BATTERIES AWAY FROM CHILDREN. (00063a)

WARNING

Never remove warning label attached to top of battery. Failure to read and understand all precautions contained in warning, could result in death or serious injury. (00064a)

WARNING

Explosive hydrogen gas, which escapes during charging, could cause death or serious injury. Charge battery in a well-ventilated area. Keep open flames, electrical sparks and smoking materials away from battery at all times. KEEP BATTERIES AWAY FROM CHILDREN. (00065a)

WARNING

If battery becomes hot, gassing or spewing of electrolyte can occur, which could cause death or serious injury. Unplug or turn OFF the charger until battery cools. (00412b)

WARNING

Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the State of California to cause cancer, and birth defects or other reproductive harm. Wash hands after handling. (00019e)

NOTICE

If battery releases an excessive amount of gas during charging, decrease the charging rate. Overheating can result in plate distortion, internal shorting, drying out or damage. (00413b)

The AGM batteries are permanently sealed, maintenance-free, valve-regulated, lead/calcium and sulfuric acid batteries.

The battery is recharged by the alternator and kept from overcharging by the regulator during use.

Battery condition can be determined by a voltage test, a charging and a load test. See 3.1 BATTERY TESTING.

The battery must be fully charged to perform a conductance test or a load test.

Grinding Noise or Erratic Starting

1. Remove starter.
2. Inspect the starter mounting surface and mating area on inner primary for arcing and pitting. This condition is caused by insufficient ground and or clamp load.
3. Clean mating surfaces.
4. Inspect starter pinion gear. Replace starter clutch assemblies with cracked or missing teeth. Rounding of pinion gear teeth is considered normal. If replacing pinion gear, inspect ring gear on clutch. Replace clutch ring gear if damaged.
5. Install starter.

Job/Time Code Values

Dealership Technicians filing warranty claims should use the job/time code values printed in (bold text) beside the appropriate repair.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

HOME

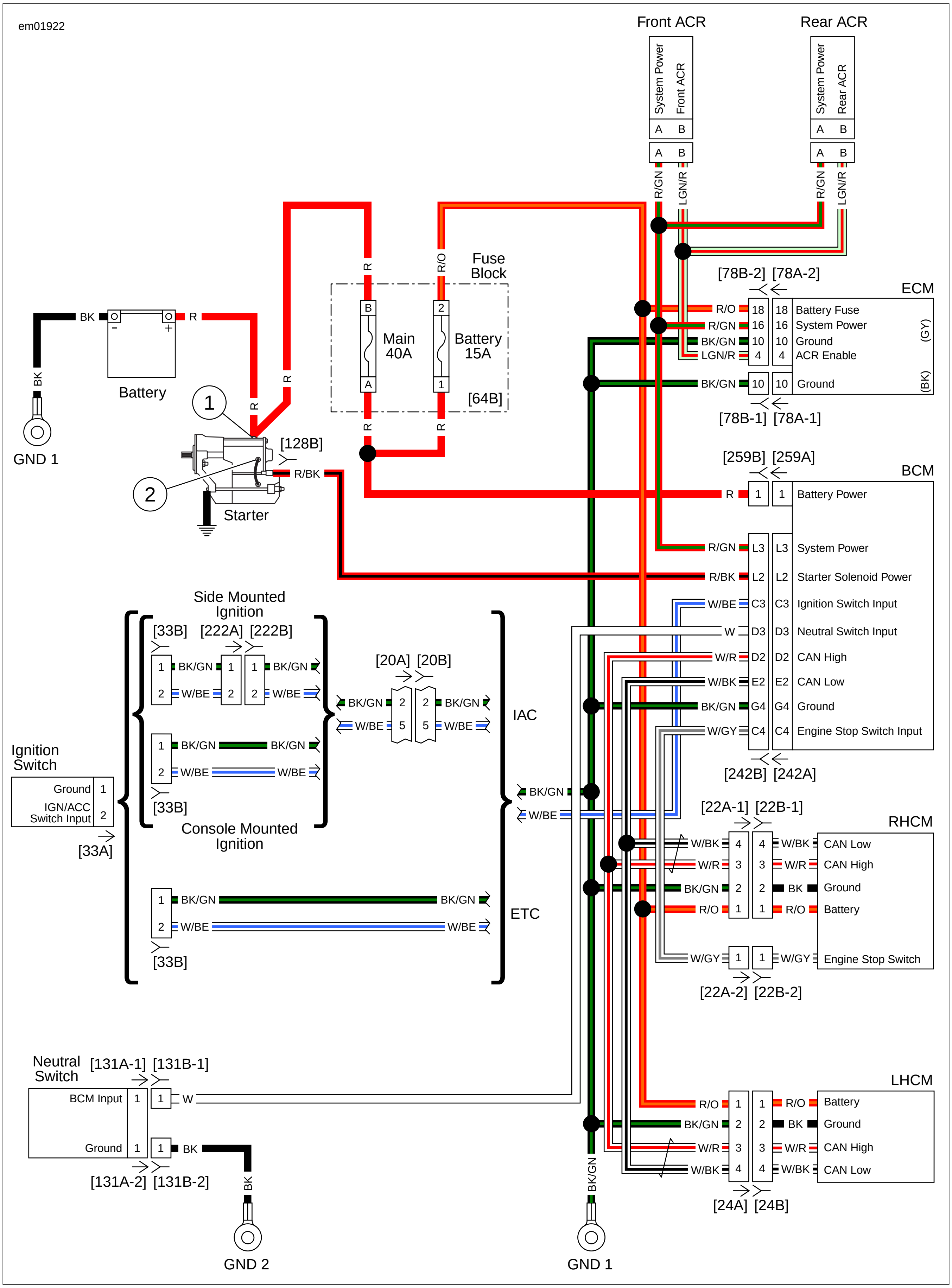


Figure 3-4. Starting Circuit

HOME

STARTER TROUBLESHOOTING

Troubleshooting tables contain detailed procedures to solve and correct problems. Follow 3.2 STARTING SYSTEM to diagnose starting system problems. The 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop procedure will help you to locate poor connections or components with excessive voltage drops.

STARTER TESTING

Table 3-3. Starter Testing Diagnostic Faults

POSSIBLE CAUSES
Short to voltage at starter solenoid
Start switch malfunction
Short to voltage on BCM supply circuit

1. Starting System Operational Test

1. Press start switch.
2. Does starter spin?
   a. **Yes, starter spins but does not engage.** See 3.2 STARTING SYSTEM, Starter Spins But Does Not Engage.
   b. **Yes, starter stalls or spins too slowly.** See 3.2 STARTING SYSTEM, Starter Stalls or Spins Too Slowly.
   c. **Yes, starter runs on.** Go to Test 3.
   d. **No.** Go to Test 2.

2. Noise Test

1. While listening for clicking noise from starter solenoid, press start switch.
2. Is there a click?
   a. **Yes, starter solenoid clicks.** See 3.2 STARTING SYSTEM, Starter Solenoid Clicks.
   b. **No.** See 3.2 STARTING SYSTEM, Nothing Clicks.

3. Starter Solenoid Test

1. Disconnect starter solenoid [128].
2. Does starter stop?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace starter solenoid assembly.

4. Checking DTCs Test

1. Check DTCs.
2. Is DTC B2122 present?
   a. **Yes.** See 3.3 STARTER OUTPUT DTCS.
   b. **No.** Replace BCM.

NOTHING CLICKS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-4. Nothing Clicks Diagnostic Faults

POSSIBLE CAUSES
Low battery
Open fuse
Neutral switch malfunction
Open neutral circuit
Ignition switch malfunction
Open ignition circuit

NOTES

- *Verify that vehicle is in neutral.*
- *Check that key fob is present and in working order (if security equipped).*
- *Verify the engine stop switch is in RUN position.*

1. Battery Test

1. Perform battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery. **(5705)**

2. Ignition Circuit Test

1. Turn IGN ON.
2. Do odometer, headlamp and tail lamps illuminate?
   a. **Yes.** Go to Test 3.
   b. **No. Odometer is inoperative, but headlamp and tail lamps illuminate.** See 2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274.
   c. **No. Odometer, headlamp and tail lamps inoperative.** See 2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, No Vehicle Power: DTC U0140.

3. Starter Solenoid Circuit Test

1. Turn IGN OFF.
2. Disconnect starter solenoid [128].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), during the first 4-5 seconds, while start button is pressed, test voltage between [128B] (R/BK) wire and ground.

5. Is battery voltage present?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 5.

4. Starter Ground Test

1. Remove starter attaching bolts.
2. Clean bolts and starter base, install starter bolts.
3. Does engine crank?
   a. **Yes. Engine cranks at normal speed.** Repair complete. **(5817)**
   b. **Yes. Engine cranks, but at a slower speed.** See 3.4 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.
   c. **No.** Replace starter solenoid. **(5845)**

5. Neutral Switch Test

1. With IGN ON and the transmission in neutral, observe the neutral lamp.
2. Is the neutral lamp illuminated?
   a. **Yes.** Go to Test 6.
   b. **No.** See 4.5 INDICATOR LAMPS, Neutral Lamp Inoperative.

6. Starter Solenoid Circuit Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and BCM [242A]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Test resistance between BOB terminal L2 and [128B].
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open in (R/BK) wire. **(5041)**

7. BCM Test

1. Turn IGN OFF.
2. Remove main fuse [5].
3. Disconnect BCM and replace with known good BCM.
4. Install main fuse.
5. Turn IGN ON.
6. Attempt to start vehicle.
7. Does engine crank?
   a. **Yes.** Replace BCM. **(5838)**
   b. **No.** Replace RHCM. **(6166)**

STARTER SOLENOID CLICKS

Table 3-5. Starter Solenoid Clicks Diagnostic Faults

POSSIBLE CAUSES
Low battery
Starter malfunction
Starter solenoid malfunction
Open battery cable
Open starter cable
Mechanical binding

1. Battery Test

1. Perform battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

2. Start Voltage Drop Test

1. Perform voltage drop tests from battery (+) to starter stud on starter (BK) wire. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 5.

3. Starter Solenoid Voltage Drop Starter Side Test

1. Perform voltage drop test from battery (+) terminal to starter solenoid terminal 2 (BK) wire.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace starter solenoid assembly.

4. Starter Solenoid Battery Side Voltage Drop Test

1. Perform voltage drop test from battery (+) terminal to starter solenoid terminal 1 (BK) wire.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Repair or replace (BK) wire from starter solenoid terminal 1 to battery (+) terminal.
   b. **No.** Replace starter solenoid assembly.

5. Starter Ground Circuit Voltage Drop Test

1. Perform voltage drop test from battery (-) terminal to ground.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Inspect (BK) wire for damage from battery (-) terminal to chassis ground, repair or replace if necessary. Go to Test 6.
   b. **No.** Go to Test 7.

6. Starter Ground Test

1. Remove starter attaching bolts.
2. Clean bolts and starter base, install starter bolts.
3. Does engine crank?
   a. **Yes, engine cranks at normal speed.** Repair complete.
   b. **Yes, engine cranks, but at a slower speed.** See 3.4 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.
   c. **No.** Replace starter.

7. Starter Draw Test

1. Perform Starter Current Draw Test on motorcycle. See 3.4 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.
2. Perform Starter Motor Free Running Current Draw Test on bench. See 3.5 TESTING STARTER ON BENCH, Free Running Current Draw Test.
3. Are test results within range?
   a. **Yes.** Go to Test 8.
   b. **No.** Replace starter.

8. Mechanical Binding Test

1. Remove spark plugs and place transmission in sixth gear.
2. Raise vehicle.
3. Rotate rear wheel.
4. Check for engine binding in the primary and/or crankshaft or starter clutch.
5. Is engine binding?
   a. **Yes.** Repair as needed.
   b. **No.** Replace starter solenoid assembly.

STARTER SPINS BUT DOES NOT ENGAGE

Table 3-6. Starter Spins But Does Not Engage Diagnostic Faults

POSSIBLE CAUSES
Clutch assembly
Clutch shell and sprocket

1. Pinion Gear and Clutch Shell Test

1. Remove primary cover.
2. Inspect for damage to starter pinion gear and clutch shell and sprocket.

NOTE

*Inspect ACR operation (if equipped) before installation of **new** starter clutch assembly.*

3. Is damage present?
   a. **Yes.** Replace clutch assembly or clutch shell and sprocket.
   b. **No.** Replace clutch assembly.

STARTER STALLS OR SPINS TOO SLOWLY

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 3-7. Starter Stalls or Spins Too Slowly Diagnostic Faults

POSSIBLE CAUSES
Low battery
Starter malfunction
Starter solenoid malfunction
Poor connections at starter ground
Open battery cable
Open starter cable

1. Battery Test

1. Perform battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

2. Starter Stud Voltage Drop Test

1. Perform voltage drop test from battery (+) terminal to starter stud on starter (BK) wire. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 3.

3. Starter Ground Circuit Voltage Drop Test

1. Perform voltage drop test between battery (-) terminal and starter attaching bolts.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Clean ground connections. **(5041)**
   b. **No.** Go to Test 4.

4. ACR Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wire harness [78B-1], [78B-2] and [78A-1], [78A-2]. See 1.3 DIAGNOSTIC TOOLS.

3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper between BOB [78-2] terminal 16 and terminal 18.
6. Jumper between BOB [78-2] terminal 4 and terminal 10.
7. Do ACRs click?
   a. **Yes.** Go to Test 5.
   b. **No.** Replace front and rear ACR solenoids.

5. Starter Draw Test

1. Perform Starter Current Draw Test on motorcycle. See 3.4 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test.
2. Perform Starter Motor Free Running Current Draw Test (on bench). See 3.5 TESTING STARTER ON BENCH, Free Running Current Draw Test.
3. Are test results within range?
   a. **Yes.** With the spark plugs removed and the transmission in 5th gear, rotate rear wheel. Check for engine, primary and/or crankshaft bind. (Use appropriate code)
   b. **No.** Replace starter. **(5817)**

6. Starter Solenoid Voltage Drop Starter Side Test

1. Perform voltage drop test between battery (+) terminal to starter solenoid terminal 2.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair connection or (BK) wire between starter solenoid and starter. **(5041)**

7. Starter Solenoid Battery Side Voltage Drop Test

1. Perform voltage drop test between battery (+) terminal and starter solenoid terminal 1 (R) wire.
2. Is voltage drop greater than 1.0V?
   a. **Yes.** Repair or replace connection between battery (+) terminal and starter solenoid terminal 1 (R) wire. **(5041)**
   b. **No.** Repair or replace starter solenoid assembly. **(5845)**

STARTER OUTPUT DTCS 3.3

DESCRIPTION AND OPERATION

The starter solenoid circuit is controlled and monitored by the BCM. The BCM receives a CAN message from the start switch in the RHCM to engage the starter. Voltage is sent from the BCM to the starter solenoid [128] (R/BK) wire. The BCM disables the starter solenoid if the start switch is pressed for more than 10 seconds.

Table 3-8. Code Description

DTC	DESCRIPTION
B2121	Starter output open
B2122	Starter output shorted high
B2123	Starter output shorted low
B2124	Starter output overloaded

Conditions for Setting

- DTC B2121 will set if the starter solenoid circuit draws less than 600 milliamps.
- DTC B2124 will set if the starter solenoid circuit draws more than 12 amps.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

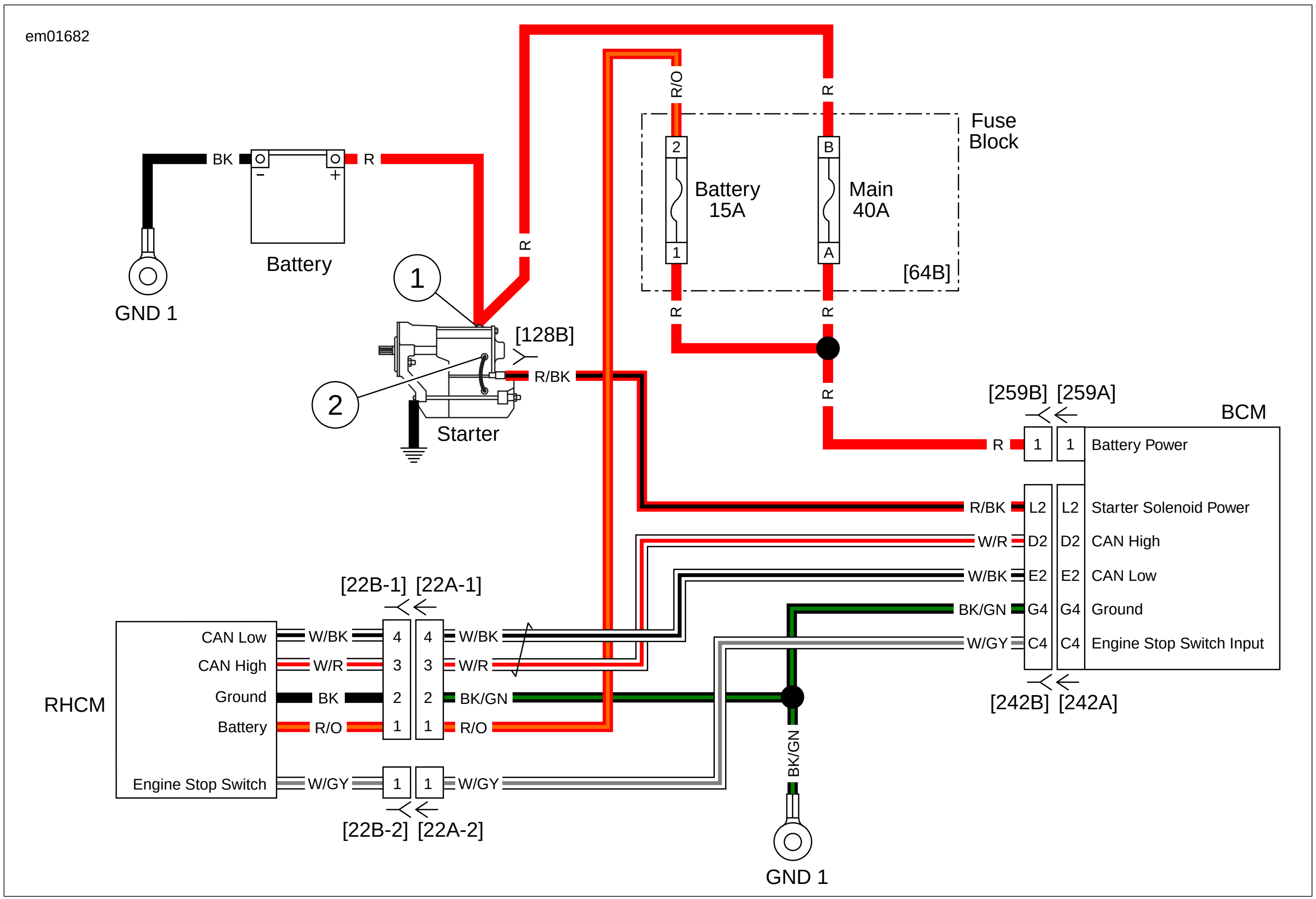


Figure 3-5. Starter

DTC B2121

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-9. DTC B2121 Diagnostic Faults

POSSIBLE CAUSES
Open in starter circuit
Open in starter solenoid

1. Starter Solenoid Circuit Test

1. Turn IGN OFF.
2. Disconnect starter solenoid [128].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), during first 4-5 seconds, while start button is pressed, test battery voltage between [128B] (R/BK) and ground.
5. Is battery voltage present?
   a. **Yes.** Replace starter solenoid assembly.
   b. **No.** Go to Test 2.

2. Starter Solenoid Supply Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. During first 4-5 seconds, while start button is pressed, test voltage between BOB terminal L2 and ground.
5. Is voltage present?
   a. **Yes.** Repair open in (R/BK) wire between [242B] terminal L2 and [128B].
   b. **No.** Replace BCM.

DTC B2122

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-10. DTC B2122 Diagnostic Faults

POSSIBLE CAUSES
Short in starter circuit
Short in starter solenoid

1. Starter Solenoid Circuit Test

1. Turn IGN OFF.
2. Disconnect starter solenoid [128].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [128B] (R/BK) and ground.
5. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace starter solenoid assembly.

2. Starter Solenoid Supply Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Turn IGN ON.
5. Without pressing start button, test voltage between BOB terminal L2 and ground.
6. Is voltage present?
   a. **Yes.** Repair short to voltage in (R/BK) wire between [242B] terminal L2 and [128B].
   b. **No.** Replace BCM.

DTC B2123

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-11. DTC B2123 Diagnostic Faults

POSSIBLE CAUSES
Short in starter circuit
Short in starter solenoid

1. Starter Solenoid Supply Resistance Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal L2 and ground.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Repair short to ground in (R/BK) wire between [242B] terminal L2 and [128B].
   b. **No.** Replace BCM.

DTC B2124

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-12. DTC B2124 Diagnostic Faults

POSSIBLE CAUSES
Short in starter circuit
Starter solenoid malfunction
Corrosion at connector

1. Starter Solenoid [128] Test

1. Turn IGN OFF.
2. Disconnect starter solenoid [128].
3. Inspect [128] and (R/BK) wire for damage or corrosion.
4. Is any present?
   a. **Yes.** Repair or replace [128] and (R/BK) wire.
   b. **No.** Go to Test 2.

2. Starter Solenoid Circuit Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [128B] (R/BK) wire and ground.
2. Is continuity present?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace starter solenoid assembly.

3. Starter Solenoid Supply Continuity Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Test continuity between BOB terminal L2 and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground in (R/BK) wire between [242B] terminal L2 and [128B].
   b. **No.** Replace BCM.

TESTING STARTER ON MOTORCYCLE 3.4

STARTER CURRENT DRAW TEST

PART NUMBER	TOOL NAME
HD-39617	FLUKE AC/DC CURRENT PROBE

NOTES

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

Check starter current draw with FLUKE AC/DC CURRENT PROBE (Part No. HD-39617). See 1.3 DIAGNOSTIC TOOLS.

1. Verify that transmission is in neutral.
2. Disconnect CKP sensor [79].
3. Clamp FLUKE AC/DC CURRENT PROBE (Part No. HD-39617) around positive starter cable to starter solenoid.

NOTE

After the start button has been pressed for 10 seconds, the BCM will stop voltage to the starter solenoid automatically.

4. With IGN ON, press start button and read ammeter. Disregard initial high current reading. This is normal when engine is first turned over.
5. Did starter current draw exceed 250A?
   a. **Yes.** Perform a bench test. See 3.5 TESTING STARTER ON BENCH, Free Running Current Draw Test.
   b. **No.** Starter current is within specification.

TESTING STARTER ON BENCH 3.5

FREE RUNNING CURRENT DRAW TEST

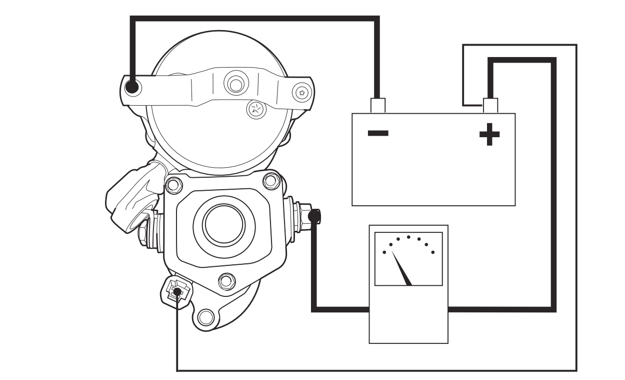
PART NUMBER	TOOL NAME
HD-39617	FLUKE AC/DC CURRENT PROBE

1. Place starter in vise. Use a clean shop towel to prevent scratches or other damage.
2. See Figure 3-6. Attach one heavy jumper cable (6 gauge minimum).
   a. Connect one end to starter mounting flange.
   b. Connect the other end to battery (-) terminal of a fully charged battery.
3. Connect a second heavy jumper cable (6 gauge minimum).
   a. Connect one end to battery (+) terminal of battery.
   b. Connect other end to battery terminal on starter. Clamp FLUKE AC/DC CURRENT PROBE (Part No. HD-39617) around cable.

CAUTION

Keep fingers and clothing away from starter gear to prevent personal injury. (00613b)

4. Connect a smaller jumper cable (14 gauge minimum).
   a. Connect one end to positive (+) terminal of battery.
   b. Connect other end to solenoid relay terminal.
5. Check ammeter reading.
   a. Ammeter should show 90A maximum.
   b. If reading is higher, replace starter.
   c. If starter current draw on vehicle was over 250A and this test was within specification, possible causes may be ACR malfunction, engine modifications, or powertrain binding.



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

Figure 3-6. Free Running Current Draw Test

STARTER SOLENOID

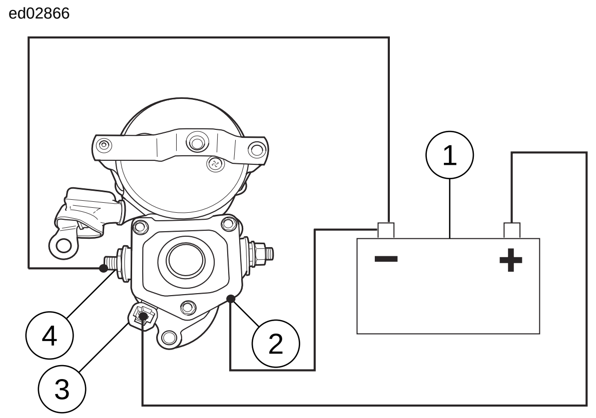
Do not disassemble solenoid. Before testing, disconnect field wire from solenoid motor terminal as shown in Figure 3-7.

Perform each test for only 3-5 seconds to prevent damage to solenoid.

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

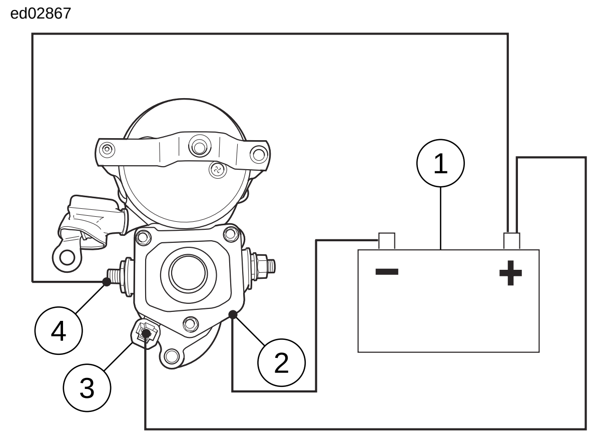
SOLENOID PULL-IN TEST

1. See Figure 3-7. Using a 12V battery, connect three separate test leads as follows:
   a. Solenoid housing to negative battery post.
   b. Solenoid motor terminal to negative battery post.
   c. Solenoid relay terminal to positive battery post.
2. Observe starter shaft.
   a. If starter shaft extends strongly, solenoid is working properly.
   b. If starter shaft does not extend strongly, replace solenoid assembly.



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

Figure 3-7. Pull-In Test



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

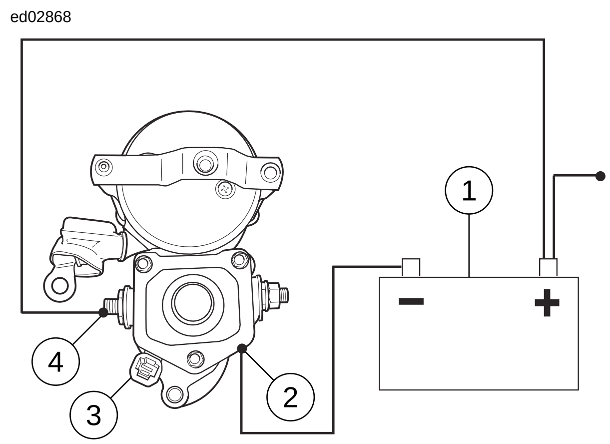
Figure 3-8. Hold-In Test

SOLENOID HOLD-IN TEST

1. See Figure 3-8. With test leads still connected in the manner specified in the previous 3.5 TESTING STARTER ON BENCH, Solenoid Pull-In Test, disconnect solenoid motor terminal negative battery test lead at negative battery post only. Connect loose end of this test lead to positive battery post instead.
2. Observe starter shaft.
   a. If starter shaft remains extended, solenoid is working properly.
   b. If starter shaft retracts, replace solenoid assembly.

SOLENOID RETURN TEST

1. See Figure 3-9. With test leads still connected in the manner specified at the end of 3.5 TESTING STARTER ON BENCH, Solenoid Hold-In Test, disconnect solenoid relay terminal positive battery post test lead at either end.
2. Observe starter pinion.
   a. If starter shaft retracts, solenoid is working properly.
   b. If starter shaft does not retract, replace solenoid assembly.



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

Figure 3-9. Return Test

CHARGING SYSTEM 3.6

DESCRIPTION AND OPERATION

The charging system is the source of electric current that supplies power to run the ignition, lights, accessories and charges the battery.

- AC voltage is generated by an alternator assembly driven by the crankshaft.
- A rotor supplied with a magnetic field spins around a stator.
- A rectifier (located in the regulator) converts the voltage from AC to DC.
- A regulator matches the output voltage to the battery voltage as engine speed varies.

Even though the alternator provides additional voltage at all engine speeds, avoid idling the engine for extended periods of time.

Alternator

The alternator consists of two main components:

- The rotor which mounts to the primary side of the crankshaft.
- The stator which is attached to the crankcase half.

Voltage Regulator

See Figure 3-10. The voltage regulator is a series regulator. The circuit combines the functions of rectifying and regulating.

TROUBLESHOOTING

Battery

Test for a weak or dead battery. Battery must be fully charged in order to perform a battery diagnostic test, load test or starting or charging tests. See 3.1 BATTERY TESTING.

Wiring

The stator connections must be clean and tight.

Check for corroded or loose connections in the charging system circuit.

Voltage Regulator Inspection

The voltage regulator must be clean and tight. Verify both AC and DC connectors are fully inserted and locked with the regulator latch.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

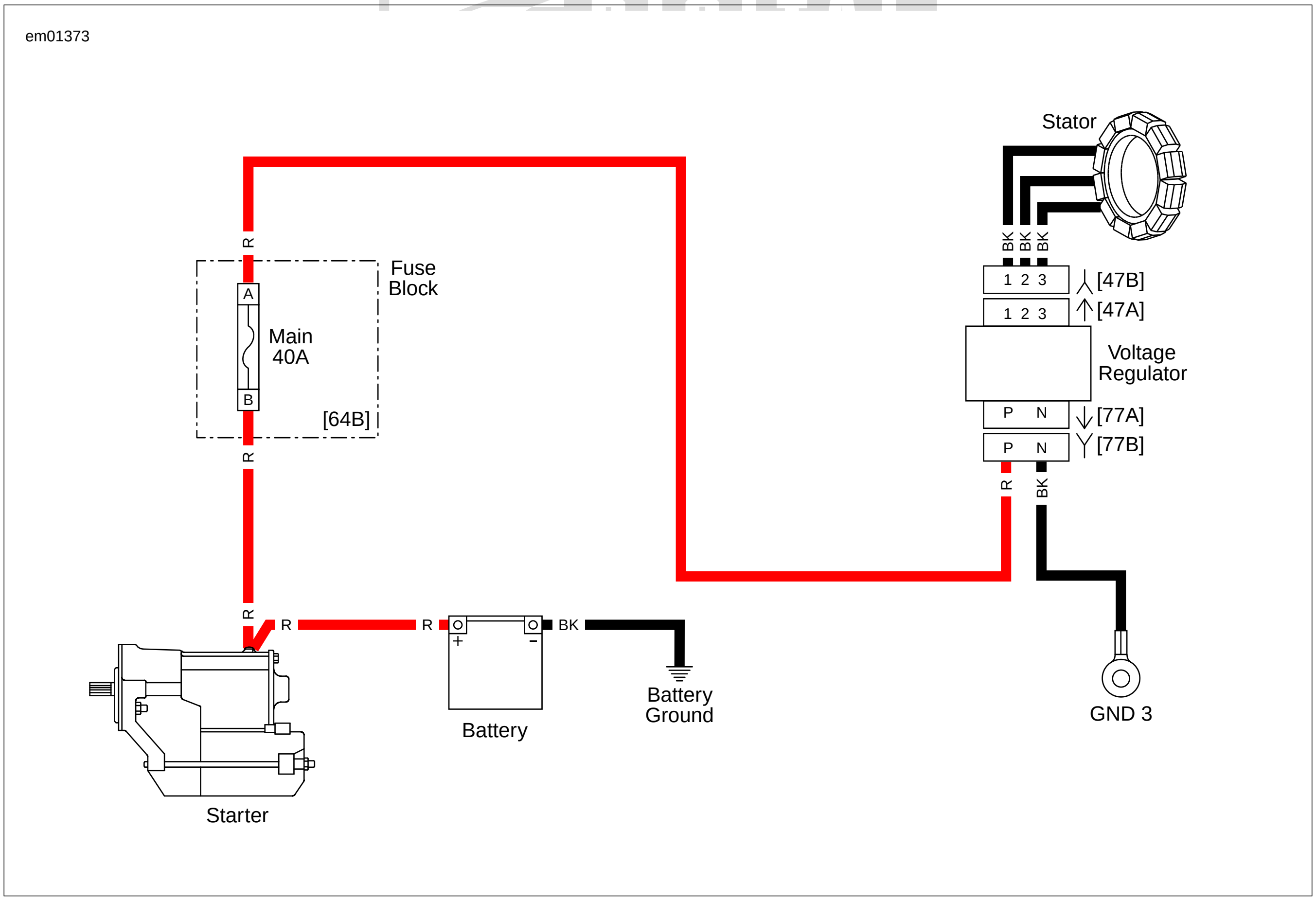


Figure 3-10. Charging System Circuit

LOW OR NO CHARGING

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 3-13. Low or No Charging Diagnostic Faults

POSSIBLE CAUSES
Low battery
Stator malfunction
Rotor malfunction
Voltage regulator malfunction
Open voltage regulator circuit
Stator shorted to ground
AC wire shorted to ground

1. Battery Test

1. Perform battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

2. Off Idle Voltage Test

1. Start engine and run at 3000 rpm for 30 seconds.
2. Test battery voltage.
3. Is voltage above 14V?
   a. **Yes.** Charging system working properly.
   b. **No.** Go to Test 3.

3. AC Output Test

1. Perform AC output test. See 3.6 CHARGING SYSTEM, Battery Charging Tests.
2. Did output test pass?
   a. **Yes.** Go to Test 6.
   b. **No.** Go to Test 4.

4. Stator Test

1. Perform stator test. See 3.6 CHARGING SYSTEM, Battery Charging Tests.
2. Is the stator good?
   a. **Yes.** Go to Test 5.
   b. **No.** Replace stator.

5. Rotor Inspection Test

1. Turn IGN OFF.
2. Inspect rotor for damage.
3. Remove center bolt and inspect for signs of center hole becoming oval.
4. Verify stator bolts have not backed out and contacted rotor.
5. Is rotor in good condition?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace rotor.

6. Voltage Regulator Power Circuit Test

1. Disconnect voltage regulator [77].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [77B] terminal (+) and battery.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open wire between voltage regulator [77B] terminal (+) and battery.

7. Voltage Regulator Ground Circuit Test

NOTE

Voltage regulator ground must have a clean, tight connection for proper grounding.

1. Test resistance between [77B] terminal (-) and ground.
2. Is resistance less than 0.5 ohms?
   a. **Yes.** Replace voltage regulator.
   b. **No.** Repair open wire between voltage regulator [77B] terminal (-) and ground (BK) wire.

OVERCHARGING

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 3-14. Overcharging Diagnostic Faults

POSSIBLE CAUSES
Voltage regulator malfunction
Open in ground circuit

1. Battery Voltage Test

1. Start engine and run at 3000 rpm, test battery voltage.
2. Is voltage above 15.5V?
   a. **Yes.** Go to Test 2.
   b. **No.** Charging system working properly.

2. Voltage Regulator Ground Circuit Test

NOTE

Voltage regulator ground must have a clean and tight connection for proper grounding.

1. Turn IGN OFF.
2. Disconnect voltage regulator [77].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [77B] terminal (-) and ground.

4. Is resistance less than 0.5 ohms?
   a. **Yes.** Replace voltage regulator.
   b. **No.** Repair open wire between [77B] terminal (-) and ground (BK) wire.

LOW BATTERY AFTER EXTENDED IGN OFF

Table 3-15. Low Battery After Extended IGN OFF Diagnostic Faults

POSSIBLE CAUSES
Battery
Accessories improperly wired to stay on at all times
Excessive draw from electrical component with IGN OFF
Battery self-discharge and/or component draw because motorcycle was not operated for a long period

1. Battery Test

1. Perform battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

2. Amp Draw Test

1. Perform milliampere draw test. See 3.6 CHARGING SYSTEM, Battery Charging Tests.
2. Did test exceed maximum draw?
   a. **Yes.** Repair excessive draw and run test again.
   b. **No.** System is working properly.

BATTERY RUNS DOWN DURING USE

Table 3-16. Battery Runs Down During Use Diagnostic Faults

POSSIBLE CAUSES
Low battery
Excessive accessory draw
Accessories on when idling or low rpm riding for extended period

1. Battery Test

1. Perform battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

2. Total Current Draw Test

1. Perform total current draw and output test. See 3.6 CHARGING SYSTEM, Battery Charging Tests.
2. Does charging system exceed current draw by 3.5A?
   a. **Yes.** System is working properly.
   b. **No.** System accessory power requirements exceed charging system capability.

BATTERY CHARGING TESTS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Milliampere Draw Test

NOTE

Be sure accessories are not wired so they stay on at all times. This condition could drain battery completely if vehicle is parked for a long time.

1. **Security system:** Enable service mode before performing test.
2. Disconnect the security siren (if equipped).
3. Remove main fuse.

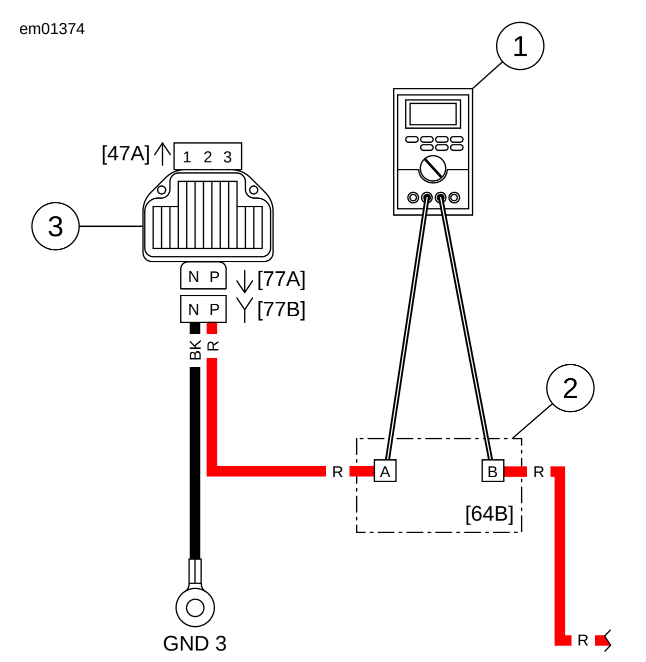
NOTE

With IGN OFF, an initial current draw will occur directly after connecting meter. This should drop to the values shown in Table 3-17 in less than 30 seconds.

4. See Figure 3-11. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect ammeter to main fuse socket terminals. With this arrangement, you will also pick up any regulator drain.
5. With IGN OFF and all lights and accessories off, observe current reading.
   a. Add voltage regulator draw to appropriate value for BCM and ECM. If observed ammeter reading is less than listed in Table 3-17.
   b. A higher reading indicates excessive current draw. Verify each accessory's current draw.

Table 3-17. Milliampere Draw Test

ITEM	MAXIMUM DRAW IN MILLI-AMPERES
LHCM	1.0
RHCM	1.0
Speedometer	1.0
Tachometer (if equipped)	1.0
Regulator	1.0
ABS (if equipped)	1.0
BCM	1.0
ECM	1.0
Security siren (if equipped)	20.0*
* Siren will draw for 2-24 hours from time motorcycle battery is connected and 0.05 mA once siren battery is charged. Disconnect siren during milliampere draw test.	



1. **Ammeter**
2. **Fuse block [64B]**
3. **Voltage regulator**

Figure 3-11. Milliampere Draw Test (Ignition Turned to OFF)

Total Current Draw and Output Test

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

NOTE

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

WARNING

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

1. See Figure 3-12. Connect load tester.
   a. Connect negative and positive leads to battery terminals.
   b. Place load tester induction pickup over battery negative cable.
2. With IGN OFF, disconnect voltage regulator [77].
3. Start engine.
4. Turn all continuously running lights and accessories ON (headlamp on high beam).
5. Run engine at 3000 rpm and make note of the current draw.
6. Turn IGN OFF.
7. Connect voltage regulator [77].
8. Remove the induction pickup from the battery negative cable.
9. Place induction pickup over positive regulator cable.
10. Start engine and run at 3000 rpm.

NOTE

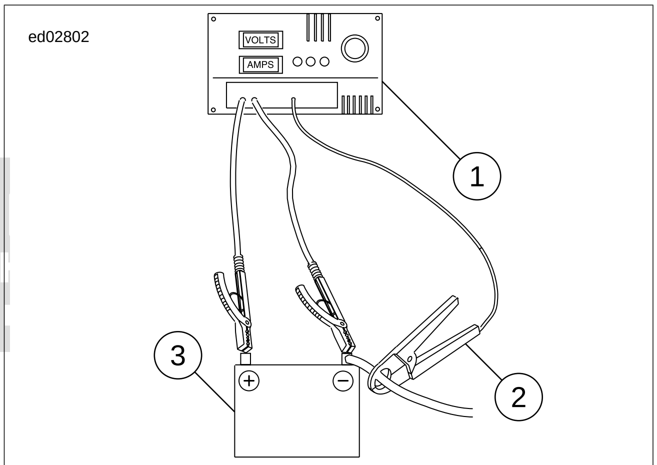
Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible.

11. Increase the load as required to obtain a constant 13.0V.
12. Current output should be 35-50A. Make note of current output.

NOTE

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

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



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

Figure 3-12. Check Current Draw (Ignition On)

Stator Test

1. Turn IGN OFF.
2. See Figure 3-13. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect an ohmmeter.
   a. Disconnect voltage regulator [47] from alternator stator wiring.
   b. Insert one ohmmeter lead into a stator connector socket.
   c. Attach the other lead to a suitable ground.
3. Test continuity.
   a. A good stator will show no continuity (open circuit) between all stator sockets and ground.
   b. Any other reading indicates a grounded stator which must be replaced.

4. See Figure 3-14. Remove ground lead. Test resistance across stator [47B] terminals 1-2, 2-3 and 3-1.
   a. Resistance across all stator terminals should be 0.1-0.3 ohm.
   b. If resistance is out of range, replace stator.

NOTE

When testing resistance (ohms), compensate for test lead resistance before performing the measurement. Select the ohms position and touch the test leads together. See the multimeter user's manual to zero display or manually subtract test lead resistance from the measured circuit's value.

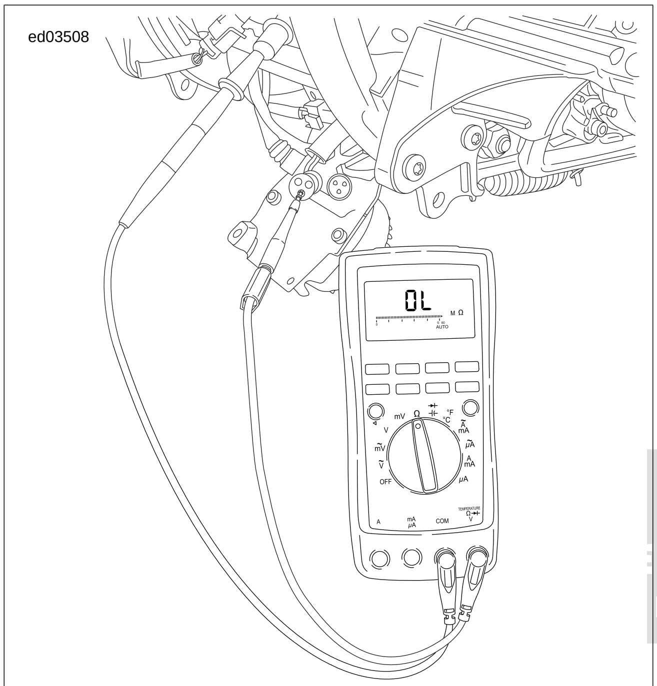


Figure 3-13. Test for Grounded Stator (Typical)

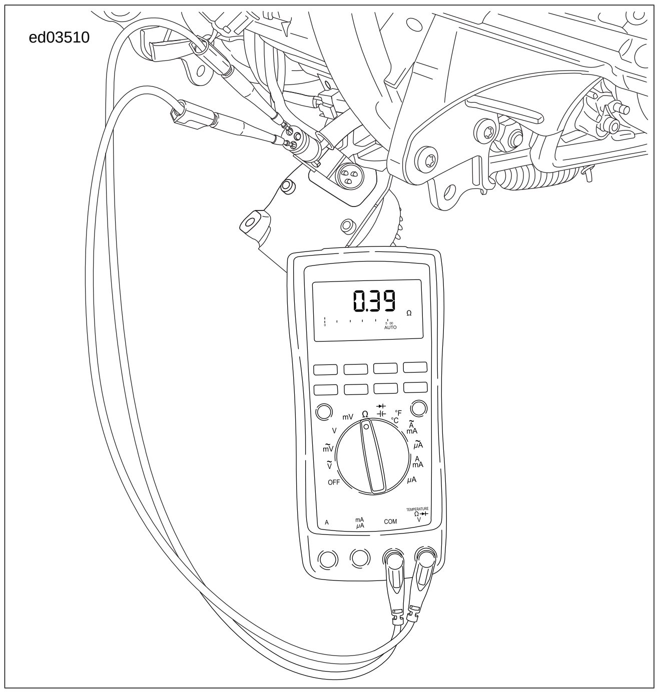


Figure 3-14. Check for Stator Resistance (Typical)

AC Output Test

1. See Figure 3-15. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test AC output.
   a. Disconnect voltage regulator [47] from alternator stator wiring.
   b. Test for VAC across stator [47B] terminals 1 to 2.
   c. Run the engine at 2000 rpm. The VAC output should be 32-46 VAC (approximately 16-22 per 1000 rpm).
   d. Repeat test using terminals 2 to 3 and 1 to 3.
2. Compare test results to specifications.
   a. If the output is below specifications, charging problem could be a faulty rotor or stator.
   b. If output is within specifications, charging problem might be faulty voltage regulator. Replace as required.
3. Check output again as previously described under Total Current Draw and Output Test.

HOME

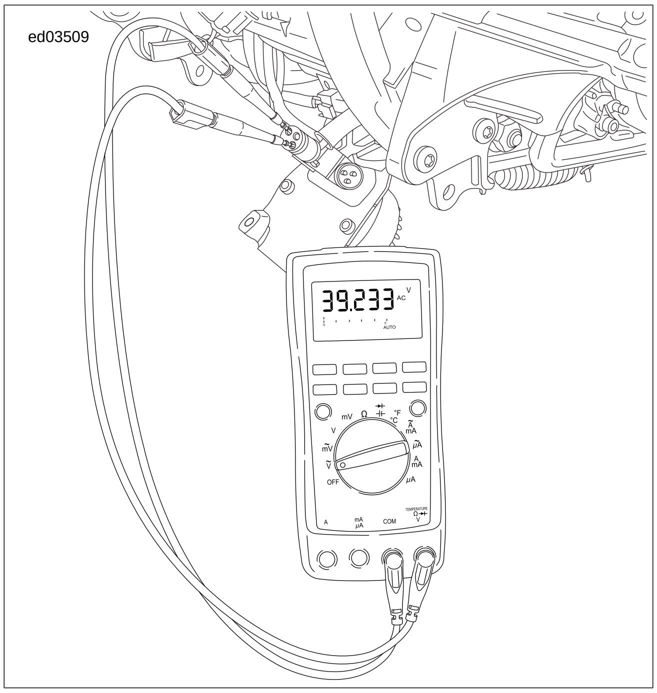


Figure 3-15. Check Stator AC Voltage Output (Typical)

ABS VOLTAGE DIAGNOSTICS 3.7

DESCRIPTION AND OPERATION

Battery voltage is monitored by the ABS module.

- If the battery voltage fails to meet normal operating parameters, the ABS indicator is illuminated.
- If the voltage remains out of normal operating parameters and the vehicle speed is above 4 mph (6 km/h), a DTC is set.

DTC C0562 and C0563

Battery voltage is monitored by the ABS module on both terminals 9 and 18.

- DTC C0562 is displayed when the ABS ECU falls below 9.4V during a non-ABS event or the ABS ECU falls below 9.2V during an ABS event.
- DTC C0563 is displayed when the ABS ECU exceeds 16.8V during a non-ABS event.

Table 3-18. Code Description

DTC	DESCRIPTION
C0562	ABS voltage low
C0563	ABS voltage high

DIAGNOSTICS

Diagnostic Tips

Any of the following conditions could cause these DTCs to set:

- The charging system is malfunctioning.
- There is excessive battery draw.
- Extended idling in heavy traffic.
- A faulty system ground is present.
- Shorted ABS actuator circuit.

Low voltage generally indicates a loose wire, corroded connections, battery or a charging system problem.

High voltage DTC may set when the vehicle is placed on an unapproved constant current battery charger for a long period of time.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

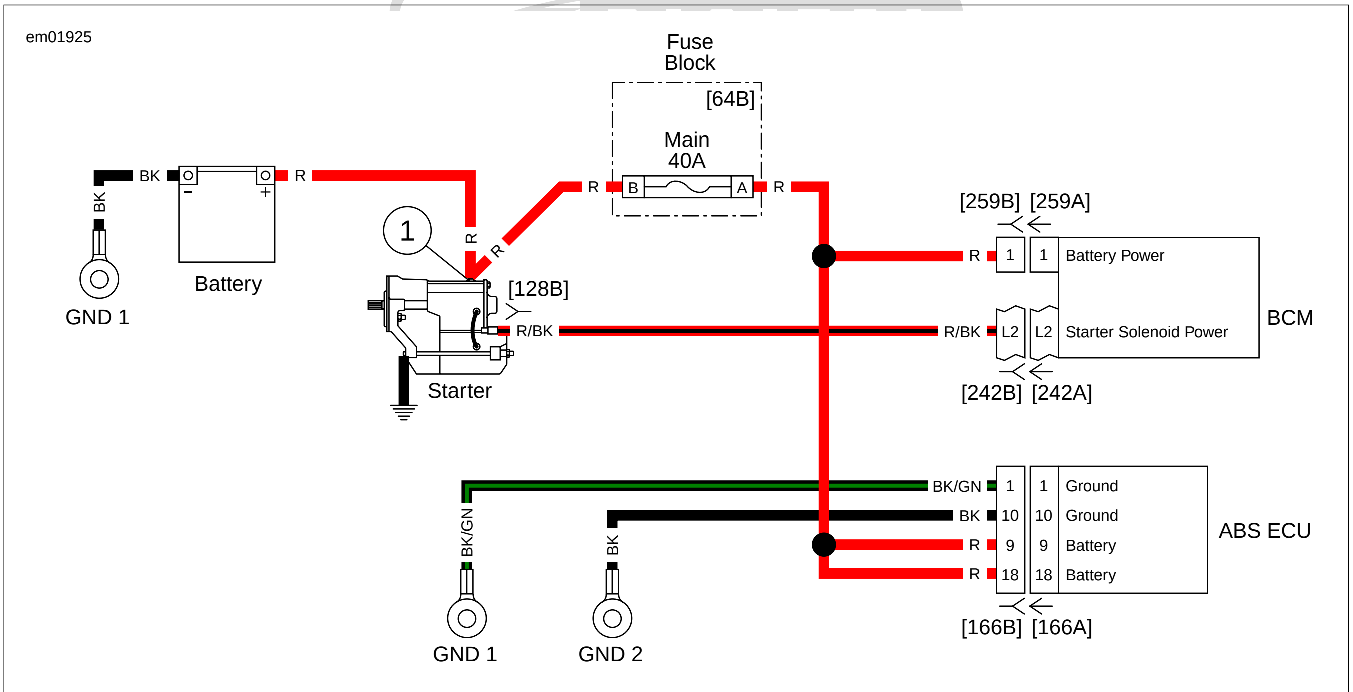


Figure 3-16. ABS Power Circuit

DTC C0562

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-1-P1	ABS OVERLAY
HD-50390-6	ABS CABLE

Table 3-19. DTC C0562 Diagnostic Faults

POSSIBLE CAUSES
Low battery
Open ABS ECU ground circuit
Open ABS ECU battery circuit

1. Battery Test

1. Perform battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

2. Charging System Test

1. Perform charging system test. See 3.6 CHARGING SYSTEM, Low or No Charging.
2. Is charging system working properly?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair charging system.

3. ABS ECU Battery Voltage Terminal 9 Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ABS CABLE (Part No. HD-50390-6) to wiring harness [166B], leaving [166A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ABS OVERLAY (Part No. HD-50390-1-P1) is in position on BOB.
4. With the engine stop switch in the RUN position and the transmission in neutral, turn the IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminals 9 and 10.
6. Is battery voltage present?
   a. **Yes.** Go to Test 10.
   b. **No.** Go to Test 4.

4. ABS ECU Battery Voltage Terminal 18 Test

1. Test voltage between BOB terminals 18 and 10.
2. Is battery voltage present?
   a. **Yes.** Go to Test 10.
   b. **No.** Go to Test 5.

5. ABS ECU Battery Voltage Drop Test

1. Perform a voltage drop test between battery (+) terminal and BOB terminal 9. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop.
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Go to Test 7.
   b. **No.** Go to Test 6.

6. ABS ECU Ground Circuit Voltage Test

1. Perform a voltage drop test between BOB terminal 1 and battery (-) terminal.
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Repair wiring between [166B] terminal 1 and battery negative.
   b. **No.** Problem may be intermittent. Locate and repair bad connection. Perform 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test. If no problem is found, then continue with tests. Go to Test 10.

7. Main Fuse Voltage Drop Test

1. Perform a voltage drop test between fuse block [64B] socket terminal A and battery (+).
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Go to Test 8.
   b. **No.** Repair or replace (R) wire between [64B] socket terminal A and BCM power [259B].

8. Fuse Block Voltage Drop Test

1. Perform a voltage drop test between [64B] socket terminal B and battery (+).
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Go to Test 9.
   b. **No.** Repair or replace [64B] socket terminals A and B.

9. Fuse Block Supply Voltage Drop Test

1. Perform a voltage drop test between starter terminal 1 and battery (+).
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Repair or replace (R) wire between starter terminal 1 and battery (+).
   b. **No.** Repair or replace (R) wire between starter terminal 1 and [64B] socket terminal B.

10. Repair Validation Test

1. Clear DTCs.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Did DTC reset?
   a. **Yes.** Replace ABS module.
   b. **No.** System working properly.

DTC C0563

Table 3-20. DTC C0563 Diagnostic Faults

POSSIBLE CAUSES
Charging system malfunction

1. Charging System Test

1. Perform charging system tests. See 3.6 CHARGING SYSTEM.
2. Is charging system good?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair charging system.

2. Repair Validation Test

1. Clear DTCs.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Did DTC reset?
   a. **Yes.** Replace ABS ECU.
   b. **No.** System working properly.

BATTERY AND SYSTEM VOLTAGE DIAGNOSTICS 3.8

DESCRIPTION AND OPERATION

Battery voltage is monitored by the ECM on the system power terminal 16 of [78-2]. The system power is supplied to the ECM from the BCM system power terminal L3.

DTC P0562 is displayed when system power is less than 12.2V at idle and voltage does not increase when engine speed is greater than 2000 rpm.

Table 3-21. Code Description

DTC	DESCRIPTION
P0562	ECM voltage low

Diagnostic Tips

Any of the following conditions could cause these DTCs to set:

- The charging system is malfunctioning.
- There is excessive battery draw and/or extended idling in heavy traffic.
- A faulty system ground is present. Low voltage generally indicates a loose wire, corroded connections, battery and/or a charging system problem.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

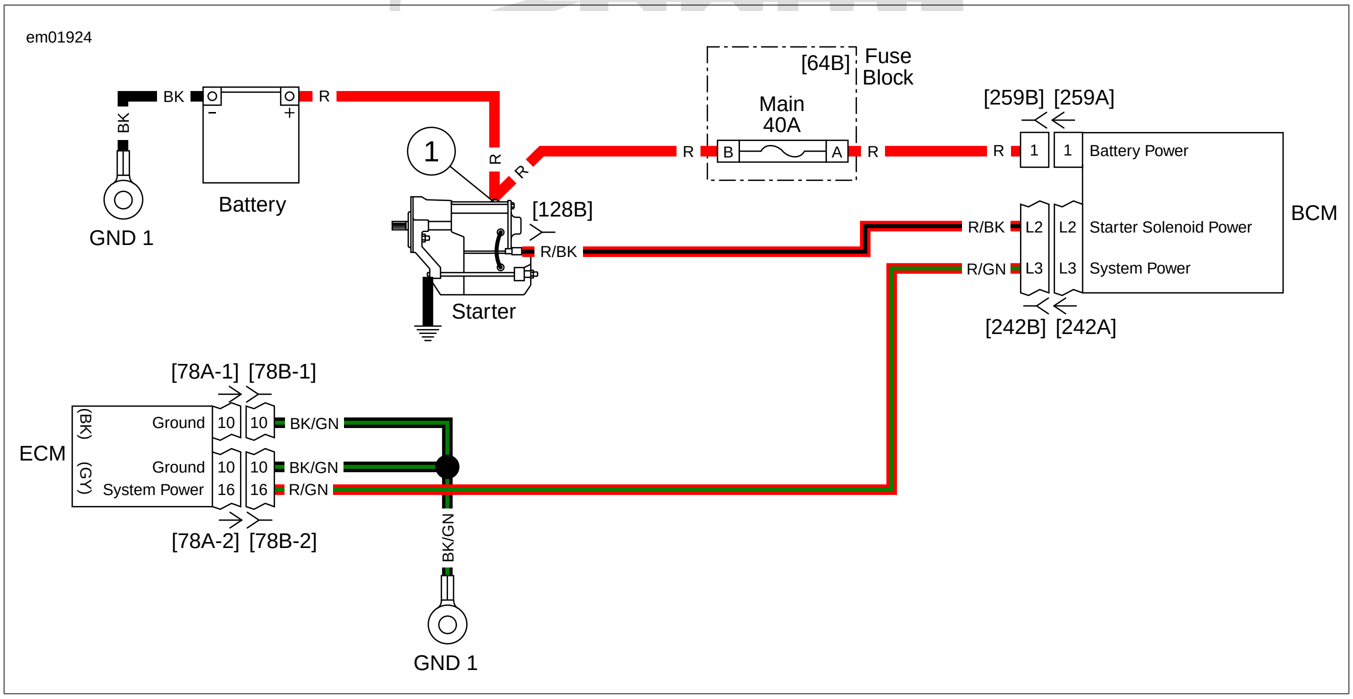


Figure 3-17. ECM System Power

DTC P0562

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 3-22. DTC P0562 Diagnostic Faults

POSSIBLE CAUSES
Low battery
Open ECM ground circuit
Open ECM system power circuit

1. Battery Test

1. Perform battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

2. Charging System Test

1. Perform charging system test. See 3.6 CHARGING SYSTEM, Low or No Charging.
2. Is charging system working properly?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair charging system.

3. ECM Switched Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness connectors [78B-1] and [78B-2]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Start vehicle.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminals 16 and 10 of [78-2].
6. Is voltage greater than 12.2V?
   a. **Yes.** System is working properly.
   b. **No.** Go to Test 4.

4. ECM System Power Test

1. Test voltage between BOB terminal 16 of [78-2] and ground.
2. Is voltage greater than 12.2V?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 7.

5. ECM Ground [78-1] Circuit Test

1. Turn IGN OFF.
2. Test resistance between BOB terminal 10 of [78-1] and ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair wiring between ECM [78B-1] terminal 10 and ground.

6. ECM Ground [78-2] Circuit Test

1. Test resistance between BOB terminal 10 of [78-2] and ground.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Problem may be intermittent. Locate and repair bad connection. Perform 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Voltage Drop. If no problem is found, then continue with tests. Go to Test 12.
   b. **No.** Repair wiring between ECM [78B-2] terminal 10 and ground.

7. BCM System Power Test

1. Turn IGN OFF.
2. Remove BOB from ECM.
3. Connect [78A] to [78B].
4. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
5. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
6. Start vehicle.
7. Test voltage between BOB terminal L3 and ground.
8. Is voltage greater than 12.2V?
   a. **Yes.** Repair (R/GN) wire between [242B] terminal L3 and [78B-2] terminal 16. **(5041)**
   b. **No.** Go to Test 8.

8. BCM Power Test

1. Turn IGN OFF.
2. Disconnect BCM power [259].
3. Test voltage at [259B].
4. Is battery voltage present?
   a. **Yes.** Replace BCM.
   b. **No.** Go to Test 9.

9. Main Fuse Voltage Test

1. Connect [259].

2. Turn IGN ON.
3. Perform a voltage drop test between fuse block [64B] socket terminal A and battery (+).
4. Is voltage drop greater than 0.5V?
   a. **Yes.** Go to Test 10.
   b. **No.** Repair or replace (R) wire between fuse block [64B] socket terminal A and [259B].

10. Fuse Block Voltage Drop Test

1. Leaving main fuse in place, perform a voltage drop test between fuse block [64B] socket terminal B and battery (+).
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Go to Test 11.
   b. **No.** Repair or replace fuse block [64B] socket terminals A and B.

11. Fuse Block Supply Voltage Drop Test

1. Perform a voltage drop test between starter terminal 1 and battery (+).
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Repair or replace (R) wire between starter terminal 1 and battery (+).
   b. **No.** Repair or replace (R) wire between starter terminal 1 and fuse block [64B] socket terminal B.

12. Repair Validation Test

1. Clear DTCs.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Does code set?
   a. **Yes.** Replace ECM.
   b. **No.** System working properly.

IGN SWITCH DIAGNOSTICS

DESCRIPTION AND OPERATION

The ignition switch turns on the BCM and the BCM then turns on all the other components. The ignition switch has three positions: OFF, IGN and ACC. However, there are only two wires coming from the ignition switch. There is a ground wire and a signal wire that runs to the BCM.

There are two resistors built into the ignition switch:

- 200 ohms for the IGN position.
- 800 ohms for the ACC position.

The BCM will see a different voltage depending on position of ignition switch.

DTC B2201 is set when the BCM detects vehicles speed and indicates an open circuit between [242B] and [33B] in the (W/BE) wire.

DTC B2203 is set when the BCM indicates a short to ground between [242B] and [33B] in the (W/BE) wire.

Table 3-23. Code Description

DTC	DESCRIPTION
B2201	IGN switch off w/VSS
B2203	Ignition switch input shorted low

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see [A.3 CONNECTOR END VIEWS](#).

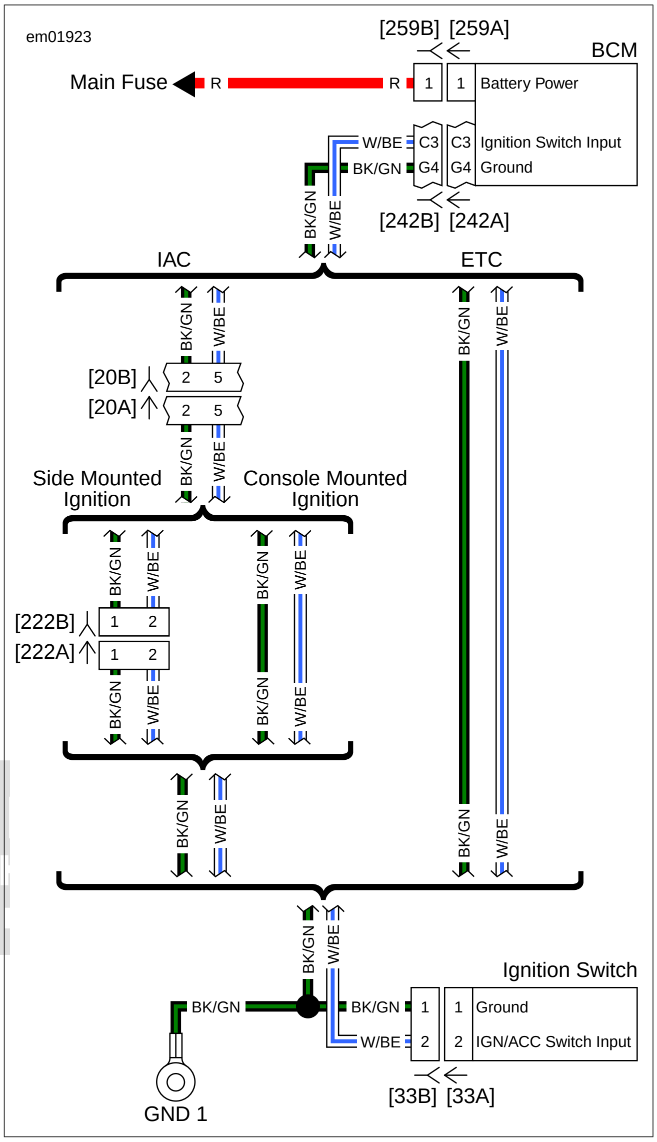


Figure 3-18. Ignition Circuit

DTC B2201

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-24. DTC B2201 Diagnostic Faults

POSSIBLE CAUSES
Ignition switch malfunction
Open in (W/BE) wire

NOTE

Verify the vehicle is in neutral, the key fob is present and in working order (if security equipped), and the engine stop switch is in RUN position.

1. Ignition Circuit Test

1. Observe headlamp.
2. Does headlamp illuminate?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 2.

2. Ignition Switch Ground Test

1. Turn IGN OFF.
2. Disconnect ignition switch [33].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [33B] terminal 1 and ground.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open between [33B] terminal 1 and ground (BK/GN) wire.

3. Ignition Switch to BCM Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B], leaving BCM [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal C3 and [33B] terminal 2.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (W/BE) wire between [242B] terminal C3 and [33B] terminals 2.

4. Ignition Switch Test

1. Perform wiggle test. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
2. Check DTCs.
3. Did DTC reset?
   a. **Yes.** Replace ignition switch.
   b. **No.** System operating properly.

DTC B2203

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-25. DTC B2203 Diagnostic Faults

POSSIBLE CAUSES
Short in ignition switch
Ignition switch malfunction

1. Ignition Continuity [242B] Test

1. Turn IGN OFF.
2. Disconnect ignition switch [33].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving BCM [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal C3 and ground.
6. Is continuity present?
   a. **Yes.** Repair short to ground in (W/BE) wire.
   b. **No.** Go to Test 2.

2. Ignition Switch Run Test

1. Turn IGN ON.
2. Test resistance between [33A] terminals 1 (BK/GN) wire and 2 (W/BE) wire.
3. Is resistance between 50-400 ohms?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace ignition switch.

3. Ignition Switch ACC Test

1. Turn IGN ACC.
2. Test resistance between [33A] terminals 1 (BK/GN) wire and 2 (W/BE) wire.
3. Is resistance between 500-1900 ohms?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace ignition switch.

4. Ignition Switch OFF Test

1. Turn IGN OFF.
2. Test continuity between [33A] terminals 1 (BK/GN) wire and 2 (W/BE) wire.

3. Is continuity present?
    a. **Yes.** Replace ignition switch.
    b. **No.** Replace BCM.

ENGINE STOP SWITCH DIAGNOSTICS 3.10

DESCRIPTION AND OPERATION

The RHCM is monitored by the BCM. Any communication failures between both modules sets a DTC.

These DTCs only refer to the redundant engine stop switch (W/GY) wire from the RHCM.

- DTC B2206 is set when the BCM indicates an open between [242B] terminal C4 and the engine stop switch.
- DTC B2208 is set when the BCM indicates a short to ground between [242B] terminal C4 and the engine stop switch.

Table 3-26. Code Description

DTC	DESCRIPTION
B2206	Run/stop switch input open/shorted high
B2208	Run/stop switch input shorted low

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

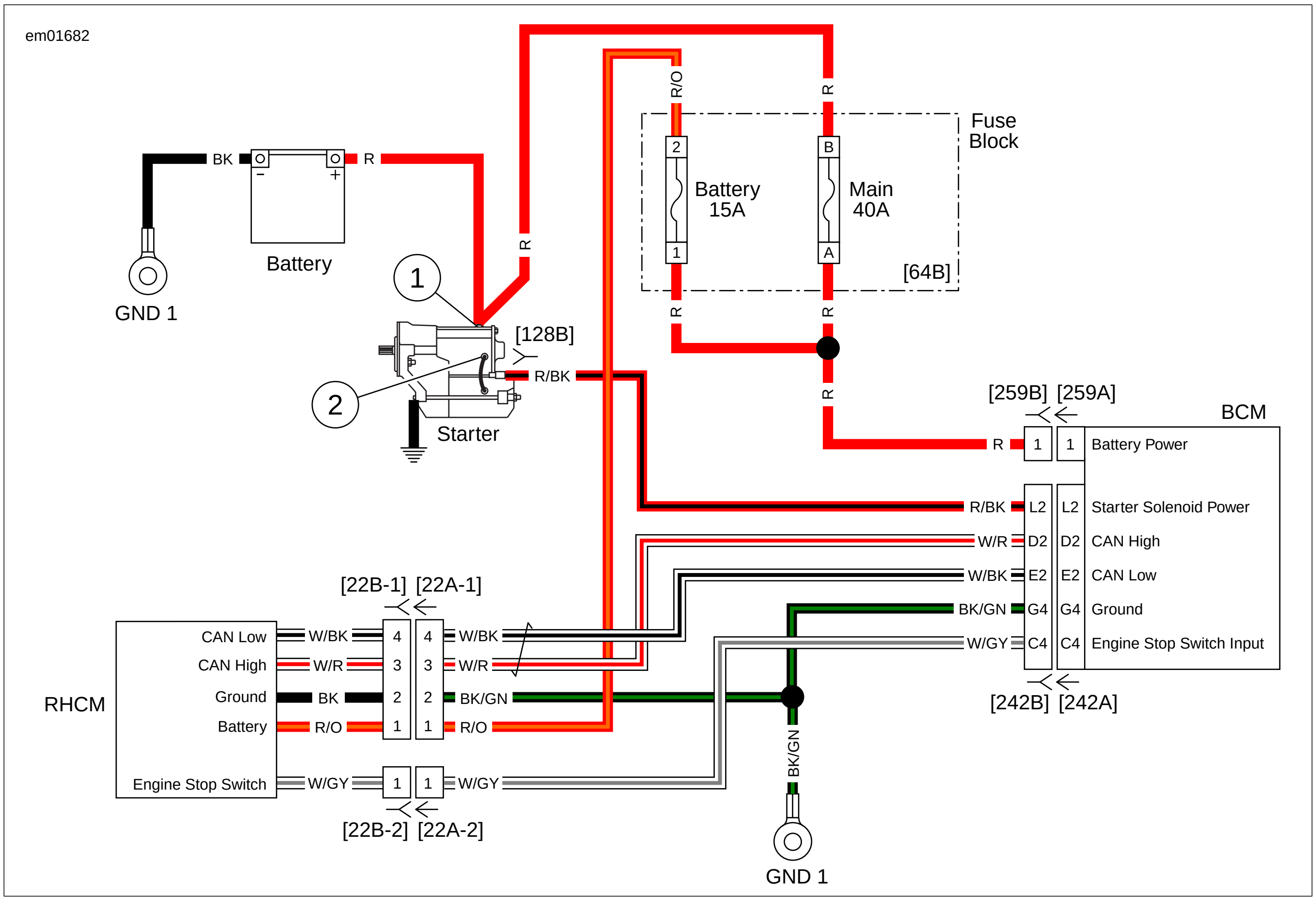


Figure 3-19. Starter

DTC B2206

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-27. DTC B2206 Diagnostic Faults

POSSIBLE CAUSES
Open in engine stop circuit

1. BCM Supply Voltage Test

1. Turn IGN OFF.
2. Disconnect RHCM [22-2].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [22A-2] terminal 1 (W/GY) wire and ground during the first 4-5 seconds after IGN ON.
4. Turn IGN ON.
5. Is voltage present?
   a. **Yes.** Replace RHCM.
   b. **No.** Go to Test 2.

2. BCM Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. During the first 4-5 seconds after IGN ON, test voltage between BOB terminal C4 and ground.
5. Is voltage present?
   a. **Yes.** Repair open in (W/GY) wire between [242B] terminal C4 and [22A-2].
   b. **No.** Replace BCM.

DTC B2208

PART NUMBER	TOOL NAME
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 3-28. DTC B2208 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in engine stop circuit

1. BCM to Ground Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Test continuity between BOB terminal C4 and ground.
5. Is continuity present?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace BCM.

2. RHCM to Ground Continuity Test

1. Disconnect RHCM [22A-2].
2. Test continuity between BOB terminal C4 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground between [242B] terminal C4 and [22A-2] (W/GY) wire.
   b. **No.** Replace RHCM.

HOME

DESCRIPTION AND OPERATION

See Figure 3-20. Battery voltage is constantly monitored by the BCM and speedometer. Any voltage readings outside of normal parameters set a DTC.

DTC B2271

The BCM monitors [259] terminal 1 for battery power.

DTC B2271 is displayed when battery voltage is less than 9.0V.

DTC B2272

The BCM monitors [259] terminal 1 and the speedometer monitors terminal 5 for battery power.

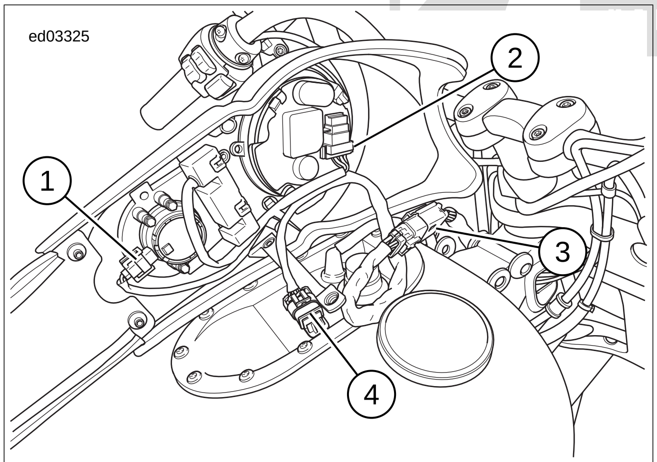
- DTC B2272 (BCM) is displayed when the BCM battery voltage is greater than 16.1V for longer than 5 seconds.
- DTC B2272 (Speedometer) is displayed when the speedometer battery voltage is greater than 16.0V for longer than 5 seconds.

NOTE

ECM and ABS may also set a battery voltage DTC.

Table 3-29. Code Description

DTC	DESCRIPTION
B2271	BCM voltage low
B2272	BCM/speedometer voltage high



1. **Ignition switch [33]**
2. **Speedometer [39]**
3. **Console gauges/instrument lamps [20]**
4. **Fuel pump [141]**

Figure 3-20. Under Console: Typical

Diagnostic Tips

High voltage DTC may set when the vehicle is placed on an unapproved constant current battery charger, on fast charge, for a long period of time.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

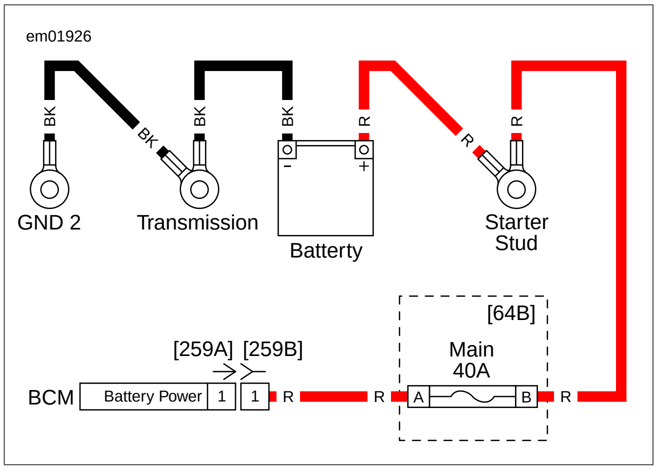


Figure 3-21. BCM Power Supply

DTC B2271

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 3-30. DTC B2271 Diagnostic Faults

POSSIBLE CAUSES
Charging system malfunction
BCM power circuit
Open in battery power circuit

1. Battery Test

1. Perform battery test. See 3.1 BATTERY TESTING.
2. Did battery pass test?
   a. **Yes.** Go to Test 2.
   b. **No.** Charge or replace battery as needed. Verify repair.

2. Charging System Test

1. Perform charging system test. See 3.6 CHARGING SYSTEM, Low or No Charging.
2. Is charging system working properly?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair charging system. Go to Test 7.

3. BCM Power Test

1. Turn IGN OFF.
2. Disconnect BCM power [259].

3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [259B] to ground.
4. Is battery voltage present?
   a. **Yes.** Go to Test 7.
   b. **No.** Go to Test 4.

4. Main Fuse Voltage Test

1. Perform a voltage drop test between fuse block [64B] socket terminal A and battery (+).
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair or replace (R) wire between fuse block [64B] socket terminal A and [259B].

5. Fuse Block Voltage Test

1. Perform a voltage drop test between fuse block [64B] socket terminal B and battery (+).
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair or replace fuse block [64B] socket terminals A and B.

6. Fuse Block Supply Voltage Test

1. Perform a voltage drop test between starter terminal 1 and battery (+).
2. Is voltage drop greater than 0.5V?
   a. **Yes.** Repair or replace (R) wire between starter terminal 1 and battery (+).
   b. **No.** Repair or replace (R) wire between starter terminal 1 and fuse block [64B] socket terminal B.

7. Repair Validation Test

1. Clear DTCs.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** System working properly.

DTC B2272

Table 3-31. DTC B2272 Diagnostic Faults

POSSIBLE CAUSES
Charging system malfunction

1. Charging System Test

1. Perform charging system tests. See 3.6 CHARGING SYSTEM.
2. Is charging system good?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair charging system.

2. Repair Validation Test

1. Clear DTCs.
2. Start vehicle.
3. Run at 3000 rpm for 5 seconds.
4. Did DTC reset?
   a. **Yes, DTC set by speedometer.** Replace speedometer.
   b. **Yes, DTC set by BCM.** Replace BCM.
   c. **No.** System working properly.

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NOTES

INSTRUMENTS 4.1

DESCRIPTION AND OPERATION

See Figure 4-1. The speedometer contains several indicators. These indicators include the check engine, security, low battery, low fuel lamps and ABS and cruise control (if equipped). The cruise control indicator may also be visible, but is not used.

Trip Odometer Reset Switch Operation

Pressing the trip odometer reset switch, located on the left hand controls, provides the following functions:

- Change the odometer display between total mileage, trip odometer A and trip B, 12/24 hour clock and tachometer with gear indication.
- Reset the trip odometer (press and hold 2-3 seconds).
- Gain access to self-diagnostic mode and clear diagnostic codes. See 1.2 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.

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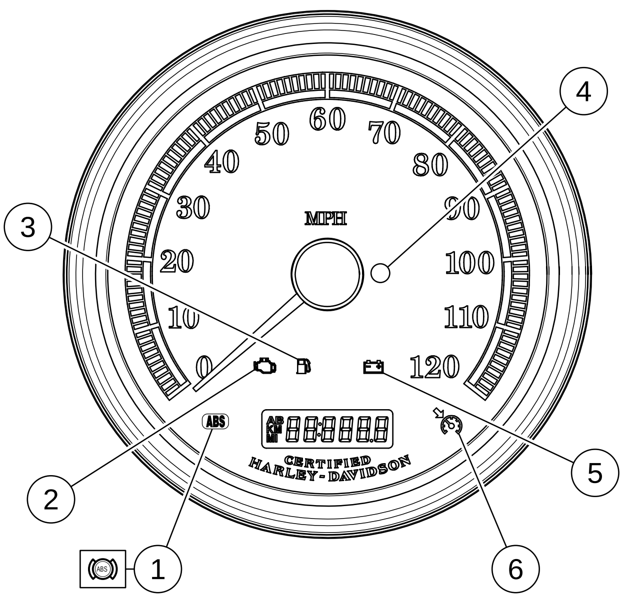


1. **ABS icon lamp (km/h ABS icon lamp also shown)**
2. **Check engine lamp**
3. **Low fuel lamp**
4. **Security lamp**
5. **Low battery**
6. **Cruise enabled lamp (not used)**

Figure 4-1. Indicator Lamps

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

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

SPEEDOMETER THEORY OF OPERATION

The speed sensor is mounted at the back of the transmission case. The sensor circuitry is a Hall-Effect sensor that is triggered by the gear teeth of fifth gear on the transmission mainshaft.

The output from the sensor is a series of pulses that are interpreted by ECM circuitry, converted into CAN bus data then sent to the speedometer. The speedometer converts the data to control the position of the speedometer needle. It also provides input to the BCM for turn signal cancellation.

TACHOMETER THEORY OF OPERATION

The CKP sensor, located on the left front of the lower crankcase half, is a variable reluctance device that generates AC voltage as the teeth on the crankshaft pass by the sensor. The signal is routed to the ECM where it is used to determine crankshaft position, engine speed (rpm) and engine phase (TDC compression). The ECM converts to engine speed to CAN data where it is sent to the tachometer.

If tachometer does not function, check for DTCs. See 1.2 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics. If there are no tachometer DTCs, then replace the tachometer.

INSTRUMENT DIAGNOSTICS

The speedometer monitors direct inputs from sensors and switches, along with receiving information from the other modules over the CAN bus lines. It sets codes when the parameters for the inputs are out of range.

Table 4-1. Code Description

DTC	DESCRIPTION
B1200	Internal fault
B1210	Fuel level sender shorted low/open
B1211	Fuel level sender shorted high
B2255	Trip switch stuck

FUEL LEVEL SENDER DIAGNOSTICS 4.2

DESCRIPTION AND OPERATION

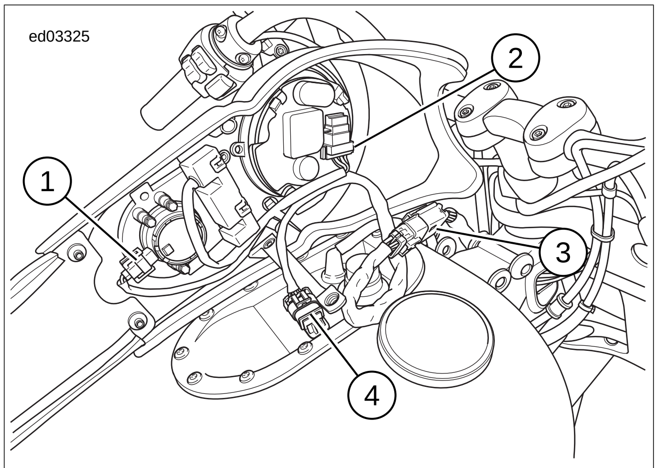
See Figure 4-2. The fuel level is monitored by the speedometer [39] at terminal 9 (W/Y) wire. The low fuel warning lamp serves two functions. It is used to indicate a low fuel condition and to communicate a circuit problem with the fuel sender circuit. The speedometer will flash the low fuel warning lamp on and off at a steady rate when a current fuel level sender DTC is set.

- If the voltage on terminal 9 exceeds the lower limit for greater than or equal to 15 seconds, a DTC B1210 will be set. The low fuel warning lamp will flash on and off at a steady rate.
- If the voltage on terminal 9 exceeds the upper limit (or is open) for greater than or equal to 15 seconds, a DTC B1211 will set. The low fuel warning lamp will flash on and off at a steady rate.

Table 4-2. Code Description

DTC	DESCRIPTION
B1210	Fuel level sender shorted low/open
B1211	Fuel level sender shorted high

Voltage is supplied to the fuel level sender on the (W/Y) wire from the fuel gauge. As the fuel level changes the resistance of the sender changes. The fuel gauge and the low fuel lamp are controlled through the (W/Y) wire based off the change in the resistance of the fuel level sender.



1. **Ignition switch [33]**
2. **Speedometer [39]**
3. **Console gauges/instrument lamps [20]**
4. **Fuel pump [141]**

Figure 4-2. Under Console: Typical

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

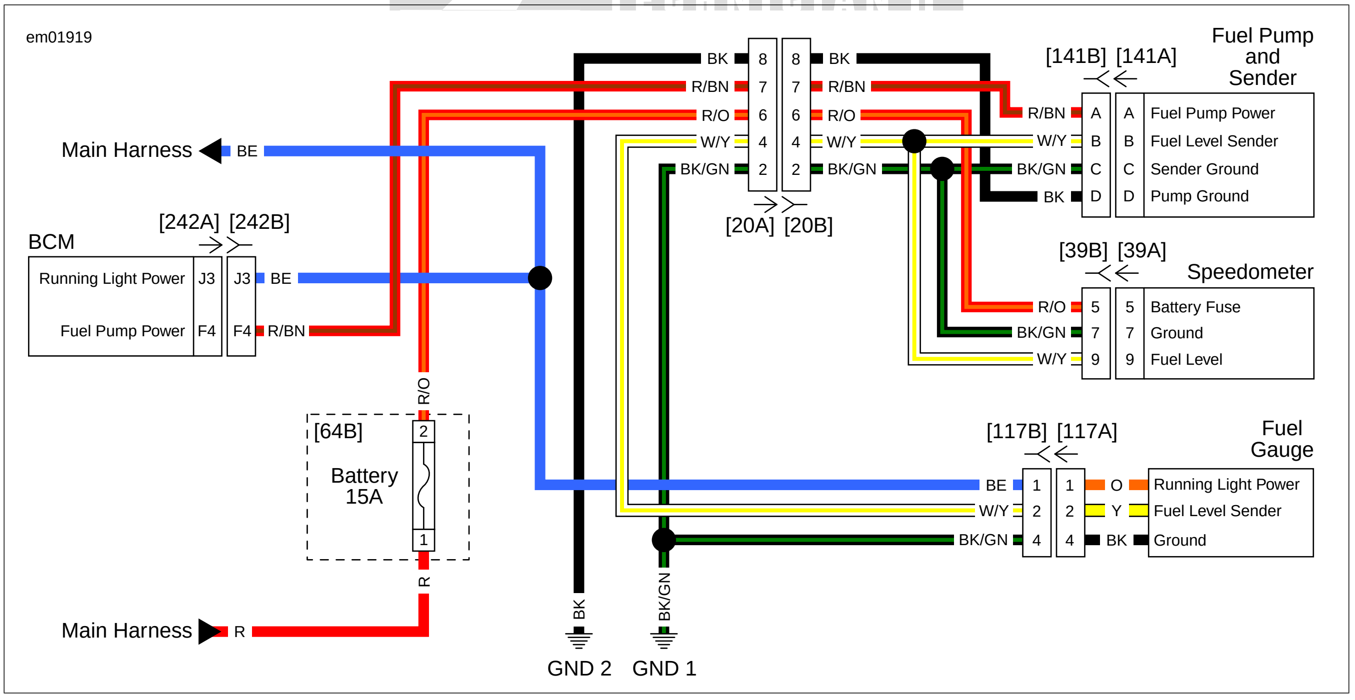


Figure 4-3. Fuel Sensor Circuit

HOME

DTC B1210

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	BREAKOUT BOX ADAPTERS
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 4-3. DTC B1210 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in fuel level sender circuit
Fuel level sender assembly malfunction
Open fuel gauge circuit
Fuel gauge malfunction

1. BCM Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Turn IGN ON.
5. Test voltage between BOB terminal J3 and ground.
6. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace BCM.

2. Fuel Gauge Power Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Test resistance between BOB terminal J3 and [117B] terminal 1 (BE) wire.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open between [117B] terminal 1 and [242] terminal J3 (BE) wire.

3. Fuel Level Sender Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] disconnected.
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal 9 and ground.
5. Is voltage greater than 2.0V?
   a. **Yes.** Replace speedometer.
   b. **No.** Go to Test 4.

4. Fuel Pump and Sender Test

1. Disconnect fuel pump and sender assembly [141].
2. Test voltage between BOB terminal 9 and ground.
3. Is voltage greater than 2.0V?
   a. **Yes.** Replace fuel pump and sender assembly.
   b. **No.** Go to Test 5.

5. Fuel Gauge Voltage Test

1. Disconnect fuel gauge [117].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [117B] terminal 1 and ground.
3. Is battery voltage present?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair open in (BE) wire between [117B] terminal 1 and BCM.

6. Fuel Gauge Circuit Test

1. Test resistance between [117B] terminal 2 and BOB terminal 9.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open in (W/Y) wire between [117B] terminal 2 and speedometer [39].

7. Fuel Gauge Circuit Short to Ground Test

1. Test continuity between [117B] terminal 2 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (W/Y) wire.
   b. **No.** Replace fuel gauge.

DTC B1211

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

Table 4-4. DTC B1211 Diagnostic Faults

POSSIBLE CAUSES
Open ground circuit
Short to voltage in fuel level sensor circuit
Fuel gauge malfunction
Fuel level sender malfunction
Open fuel level sender circuit

1. Fuel Level Sender Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] disconnected.
3. Turn IGN ON.
4. Test voltage between BOB terminal 9 and ground.
5. Is voltage greater than 8.0V?
   a. **Yes.** Go to Test 2.
   b. **No, voltage between 2-8V.** Replace the speedometer.
   c. **No, voltage below 2V.** Go to Test 8.

2. Fuel Pump and Sender Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Turn IGN ON.
4. Test voltage between BOB terminal 9 and ground.
5. Is voltage greater than 8.0V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 4.

3. Fuel Level Sender Circuit Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect fuel level sender [141].
3. Test voltage between BOB terminal 9 and ground.
4. Is voltage greater than 8.0V?
   a. **Yes.** Repair short to voltage on (W/Y) wire.
   b. **No.** Replace the fuel pump and sender assembly.

4. Fuel Level Sender Circuit Open Test

1. Turn IGN OFF.
2. Disconnect fuel level sender [141].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [117B] terminal 2 and [141B] terminal B.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (W/Y) wire between fuel gauge and fuel level sender.

5. Fuel Level Sender Ground Circuit Test

1. Test resistance between [141B] terminal C and ground.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair open in (BK/GN) wire.

6. Fuel Gauge Ground Circuit Test

1. Test resistance between [117B] terminal 4 and ground.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open between [117] terminal 4 (BK/GN) wire and ground.

7. Fuel Sender Resistance Test

1. Test resistance between [141A] terminals B and terminal C.
2. Is resistance greater than 260 ohms?
   a. **Yes.** Replace fuel level sender.
   b. **No.** Replace fuel gauge.

8. Fuel Gauge Voltage Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [117B] terminal 1 and ground.
4. Is battery voltage present?
   a. **Yes.** Go to Test 9.
   b. **No.** Repair open in (BE) wire between fuel gauge terminal 1 and BCM.

9. Fuel Gauge Test

1. Test resistance between [117B] terminal 2 and BOB terminal 9.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace fuel gauge.
   b. **No.** Repair open in (W/Y) wire between fuel gauge and speedometer.

TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255 4.3

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Trip Odometer Reset Switch Closed

DTC B2255 will be set if trip odometer reset switch is closed for more than 2 minutes. This code can be set by the speedometer or the BCM. It will normally be set by both if there is a concern with the trip odometer reset switch.

Odometer self-diagnostics will not function if the switch is stuck. It will not be possible to toggle the switch to navigate through the different diagnostic steps in the odometer.

- A stuck trip odometer reset switch disables odometer self-diagnostics.
- If DIGITAL TECHNICIAN II (Part No. HD-48650) is connected to the DLC [91] and communicating with the vehicle then the odometer self-diagnostics will not function properly.
- Disconnect DIGITAL TECHNICIAN II (Part No. HD-48650) before entering odometer self-diagnostics.

Table 4-5. Code Description

DTC	DESCRIPTION
B2255	Trip switch stuck

TRIP ODOMETER FUNCTIONS INOPERATIVE: DTC B2255

Table 4-6. Trip Odometer Functions Inoperative Diagnostic Faults: DTC B2255

POSSIBLE CAUSES
Instrument malfunction
Trip odometer reset switch malfunction

1. Trip Switch Test

1. Check trip switch for damage or obstruction.
2. Is switch moving freely?
   a. **Yes.** Go to Test 2.
   b. **No.** Remove obstruction. If switch will not move freely replace LHCM.

2. Odometer Test

1. Press and release trip odometer reset switch.
2. Does odometer cycle through different odometer counters?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 4.

3. Speedometer "WOW" Test

1. Turn IGN OFF.
2. Turn IGN ON while pressing trip odometer reset switch.
3. Does speedometer needle sweep its full range of motion?
   a. **Yes.** System functioning properly. Test for intermittent condition. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No.** Replace speedometer.

4. LHCM Test

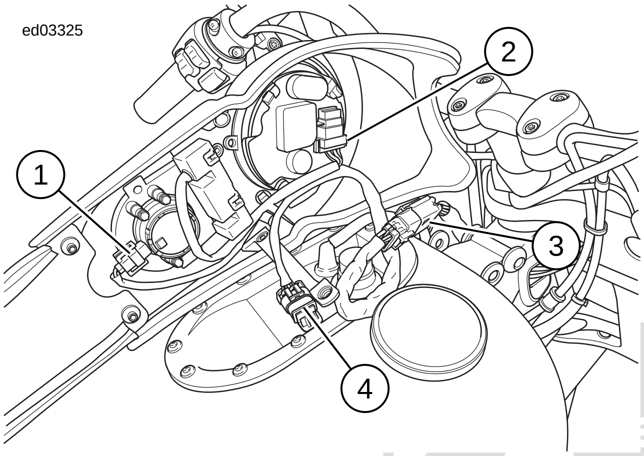
1. Operate other switches on LHCM.
2. Do any switches operate?
   a. **Yes.** Replace LHCM.
   b. **No.** See 2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, Left Hand Controls Inoperative: DTC U0141.

NO INSTRUMENT POWER DIAGNOSTICS 4.4

DESCRIPTION AND OPERATION

See Figure 4-4. The speedometer and tachometer (if equipped) receives battery power at terminal 5. This is supplied through the battery fuse located in fuse block [64]. The speedometer and tachometer (if equipped) receives a message from the BCM over the CAN bus to know if the ignition switch is in the IGN or ACC position. When the ignition switch is in the ACC position, the speedometer and tachometer (if equipped) illuminates the backlighting, the odometer and the security lamp.

When the ignition switch is in the IGN position, the speedometer illuminates the check engine, low fuel level, security and ABS lamp (if equipped). The backlighting, odometer, neutral lamp and low oil lamp also illuminate with the IGN ON.



1. **Ignition switch [33]**
2. **Speedometer [39]**
3. **Console gauges/instrument lamps [20]**
4. **Fuel pump [141]**

Figure 4-4. Under Console: Typical

The speedometer uses DTC B1200 as an internal fault code. The speedometer will set this code if it detects a malfunction inside the speedometer.

Table 4-7. Code Description

DTC	DESCRIPTION
B1200	Internal fault

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

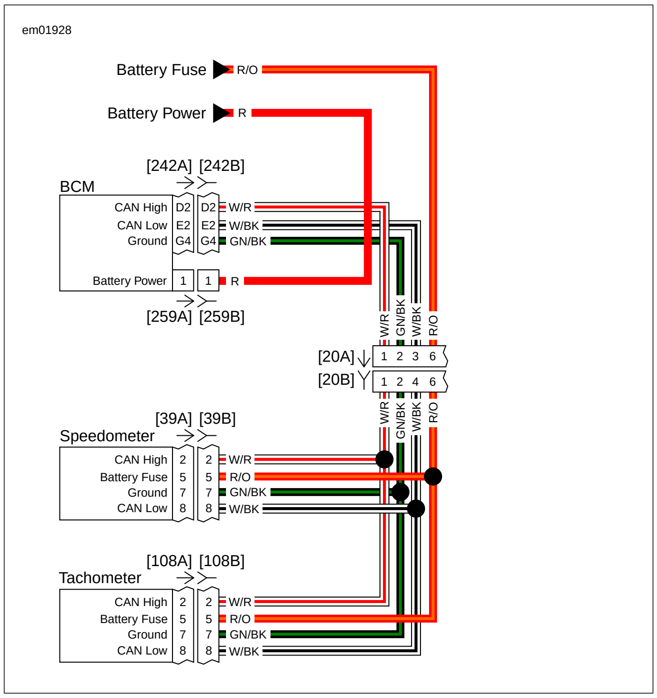


Figure 4-5. Instrument Power

NO INSTRUMENT POWER

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

Table 4-8. No Instrument Power Diagnostic Faults

POSSIBLE CAUSES
Open battery circuit
Open ground circuit

1. Battery Circuit Test

1. Turn IGN ON.
2. Does headlamp or tail lamp illuminate?
   a. **Yes.** Go to Test 2.
   b. **No.** See 2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, No Vehicle Power: DTC U0140.

2. Accessory Function Test

1. Attempt to start vehicle.
2. Does engine crank?
   a. **Yes.** Speedometer inoperative. Go to Test 3.
   b. **Yes.** Tachometer inoperative. Go to Test 5.
   c. **No.** See 2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274.

3. Battery Circuit to Speedometer Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal 5 and ground.
4. Is battery voltage present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (R/O) wire. **(5041)**

4. Speedometer Ground Circuit Test

1. Test resistance between BOB terminal 7 and ground.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace speedometer. **(6020)**
   b. **No.** Repair open in (BK/GN) wire. **(5041)**

5. Battery Circuit to Tachometer Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [108]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [108A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal 5 and ground.
4. Is battery voltage present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (R/O) wire.

6. Tachometer Ground Circuit Test

1. Test resistance between BOB terminal 7 and ground.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace tachometer. **(6020)**
   b. **No.** Repair open in (BK/GN) wire. **(5041)**

DTC B1200

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

Table 4-9. DTC B1200 Diagnostic Faults

POSSIBLE CAUSES
Open in speedometer battery power circuit
Open in speedometer ground circuit

1. Speedometer Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-42682) and BREAKOUT BOX ADAPTERS (Part No. HD-46601) to wiring harness [39B], leaving [39A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal 5 and ground.
4. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (R/O) wire.

2. Speedometer Ground Test

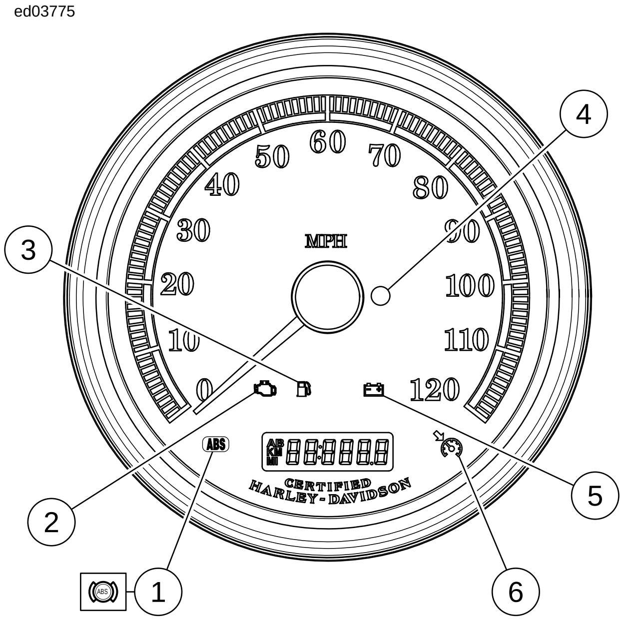
1. Test voltage between BOB terminals 5 and 7.
2. Is battery voltage present?
   a. **Yes.** Replace speedometer.
   b. **No.** Repair open in ground circuit.

INDICATOR LAMPS 4.5

DESCRIPTION AND OPERATION

See Figure 4-6. The battery, check engine, security, cruise control, ABS and low fuel indicators are located in the speedometer. The other indicators are located in the indicator bar separate from the speedometer (except FXDL).

See Figure 4-7. FXDL indicators are left and right turn signals, neutral and high beam indicators are located in the tachometer.



1. **ABS icon lamp (km/h ABS icon lamp also shown)**
2. **Check engine lamp**
3. **Low fuel lamp**
4. **Security lamp**
5. **Low battery**
6. **Cruise enabled lamp (not used)**

Figure 4-6. Indicator Lamps

ABS Indicator

The speedometer illuminates the ABS indicator when:

- The ECU detects an ABS disabling malfunction. The ECU sends a serial data message to the instrument requesting illumination.
- The speedometer performs a bulb check.
- The speedometer detects a loss of communication with the ECU.
- The ABS light may flash when the IGN is turned on. This will continue until the vehicle is driven to verify WSS operation.

The ECU sends a message to the instrument when a malfunction that disables ABS operation is detected. Depending on the fault, the ABS indicator may stay on even after the malfunction is corrected. The indicator will not go off until the vehicle is operated at speeds greater than 10 mph (16 km/h). It is important to verify that this is not the cause of an ABS indicator, which is illuminated when no DTCs are set, before attempting to diagnose other possible causes.

Security Lamp

When the IGN is turned ON, the security lamp will illuminate for approximately four seconds and then turn off. The BCM controls the security lamp by sending a CAN message to the speedometer. After the security lamp turns off following the first four second illumination period, one of two events may occur.

- The lamp remains off. This indicates there are no current fault conditions or stored DTCs currently detected by the BCM.
- If the lamp remains on beyond the four-second period, a current DTC exists.

Check Engine Lamp

When the IGN is ON, the check engine lamp will illuminate for approximately four seconds and then turn off. The ECM controls the check engine lamp by sending a CAN message to the speedometer. After the check engine lamp turns off following the first four second illumination period, one of two events may occur.

- The lamp remains off. This indicates there are no current fault conditions or stored DTCs currently detected by the ECM.
- If the lamp illuminates again and remains lit, a current DTC exists.

The check engine lamp may not illuminate for less than 4 seconds under the following conditions:

- IGN OFF/ON within 5 seconds.
- Trip switch activated, then IGN ON within 5 seconds.
- Run/stop switch cycled, then IGN ON within 5 seconds.
- Security armed vehicles that are moved, then IGN ON, or IGN ON and FOB response is not immediately received (interference).

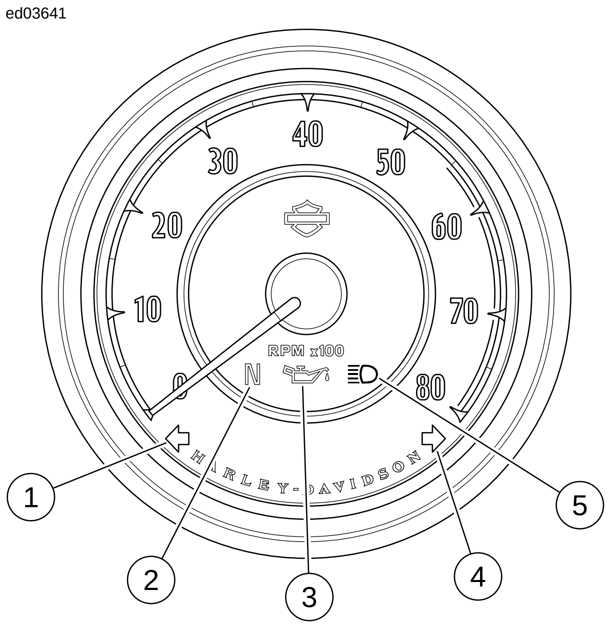
Low Battery Lamp

The BCM sends a message to the speedometer to control the low battery lamp. The speedometer will turn the lamp on if the BCM identifies a low voltage condition on [259] terminal 1.

Low Fuel Indicator

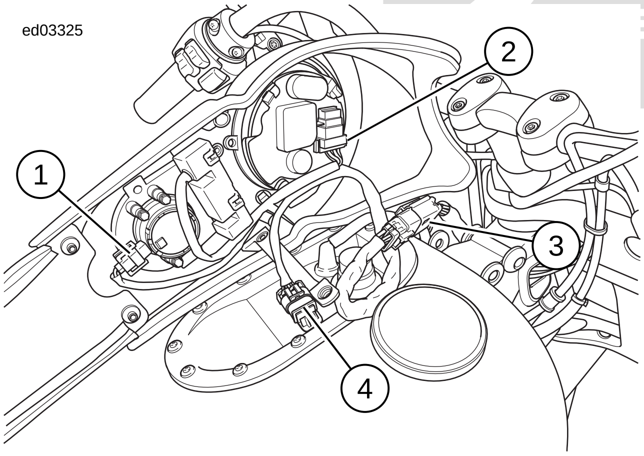
See Figure 4-8. The low fuel indicator is controlled at terminal 9 (W/Y) of the speedometer. The fuel gauge or resistor assembly sends voltage on the (W/Y) wire to the low fuel lamp and fuel level sender. When the fuel level drops below 1.0 gal (3.8 L), it signals the speedometer to activate the low fuel lamp. The low fuel lamp will also flash on and off at a steady rate if there is a problem with the circuit.

The low fuel lamp will not turn off until there is sufficient fuel in the tank, the ignition switch has been turned off and back on, and the vehicle has begun forward speed.



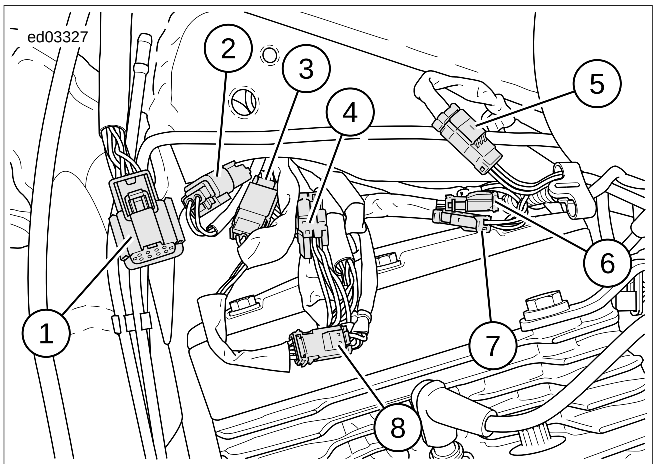
1. **Left turn signal indicator**
2. **Neutral indicator**
3. **Oil pressure indicator**
4. **Left turn signal indicator**
5. **High beam indicator**

Figure 4-7. Tachometer Indicator Lamp: FXDL



1. **Ignition switch [33]**
2. **Speedometer [39]**
3. **Console gauges/instrument lamps [20]**
4. **Fuel pump [141]**

Figure 4-8. Under Console: Typical



1. **Console gauges/instrument lamps [20]**
2. **Front WSS (ABS only) [167]**
3. **Left front turn signal [31LA]**
4. **Right front turn signal [31RA]**
5. **Fuel gauge [117]**
6. **Right hand control [22-2]**
7. **Right hand control [22-1]**
8. **Left hand control [24]**

Figure 4-9. Under Fuel Tank (IAC): Except FXDB

Neutral Indicator

See Figure 4-10. The neutral indicator is controlled through the (W) wire connected to the speedometer. When the transmission is in neutral, the neutral switch closes and supplies a ground to the BCM on terminal D3. The BCM then sends a message to the speedometer over the CAN bus indicating the transmission is in neutral. The speedometer supplies ground to the neutral indicator causing it to illuminate.

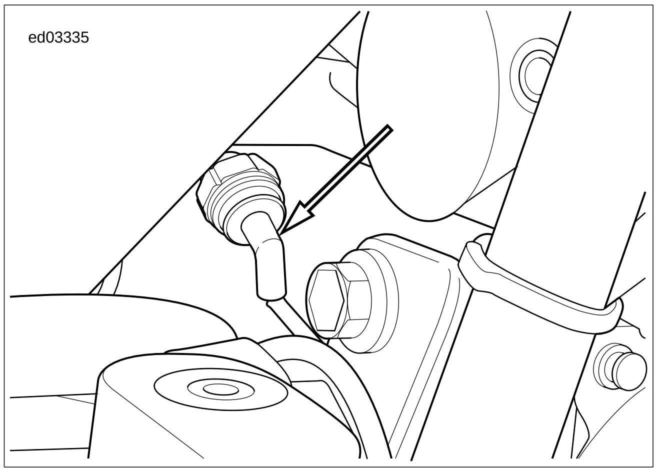


Figure 4-10. Oil Pressure Switch [120]

Oil Pressure Indicator

See Figure 4-10. The oil pressure indicator is connected to the speedometer. The switch closes when oil pressure is low and supplies ground to the BCM at terminal E3. The BCM then sends a message to the speedometer over the CAN bus indicating the oil pressure is low. The speedometer supplies ground to the oil pressure indicator. This ground causes the indicator to illuminate with the IGN ON and the engine OFF.

Turn Signal Indicators

The turn signal indicators are controlled by the speedometer. When the BCM receives a CAN bus message from the left or right turn signal switch it flashes the correct turn signals. At the same time the BCM sends a message to the speedometer over the CAN bus indicating which turn signal to operate. The speedometer supplies ground to the corresponding turn signal indicator causing it to illuminate.

High Beam Indicator

This circuit is grounded by the speedometer when the headlamp switch is placed in the high beam position. In the high beam position, a message is sent over the CAN bus to the speedometer and the BCM. The speedometer controls the indicator and the BCM controls the headlamp.

Diagnostic Tips

After replacing a component in the fuel circuit, verify the tank is full of fuel and that the main fuse is removed for 2 minutes and reinstalled to turn low fuel lamp off.

Some aftermarket fuel gauges not made by Harley-Davidson may cause the fuel circuit to report inaccurate readings.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

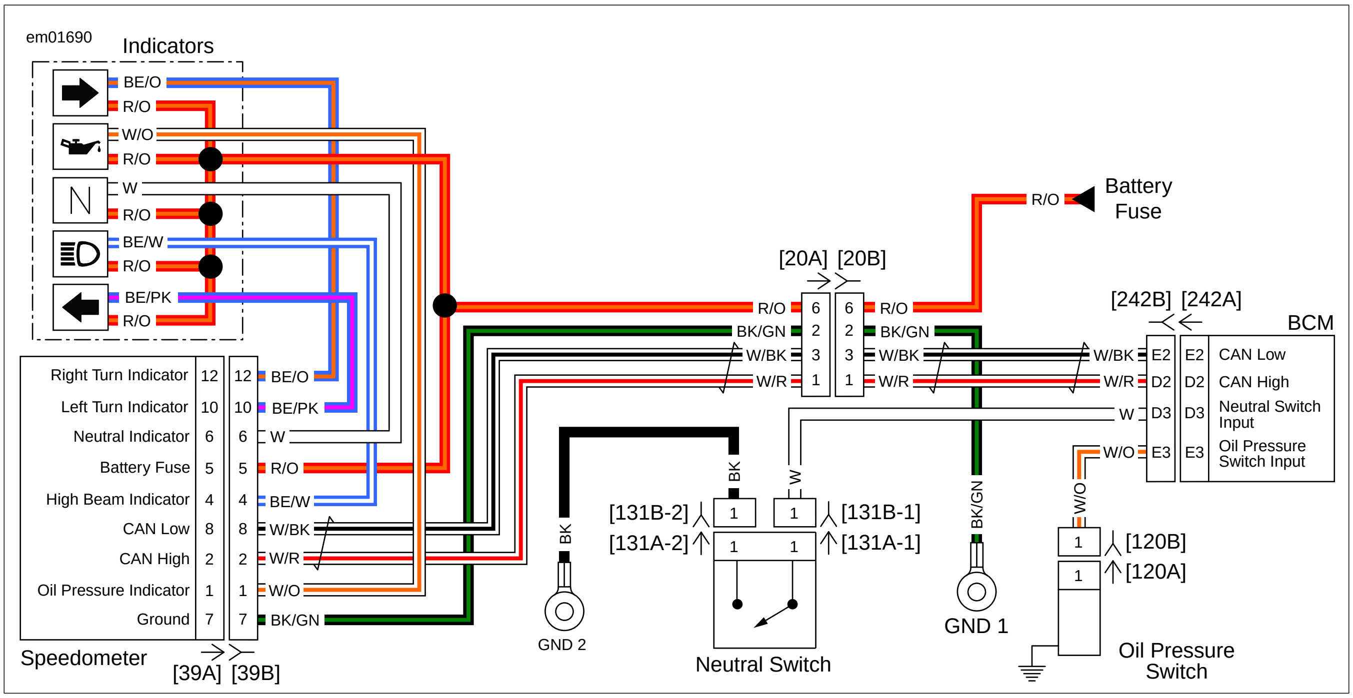


Figure 4-11. Indicator Lamps: Except FXDL

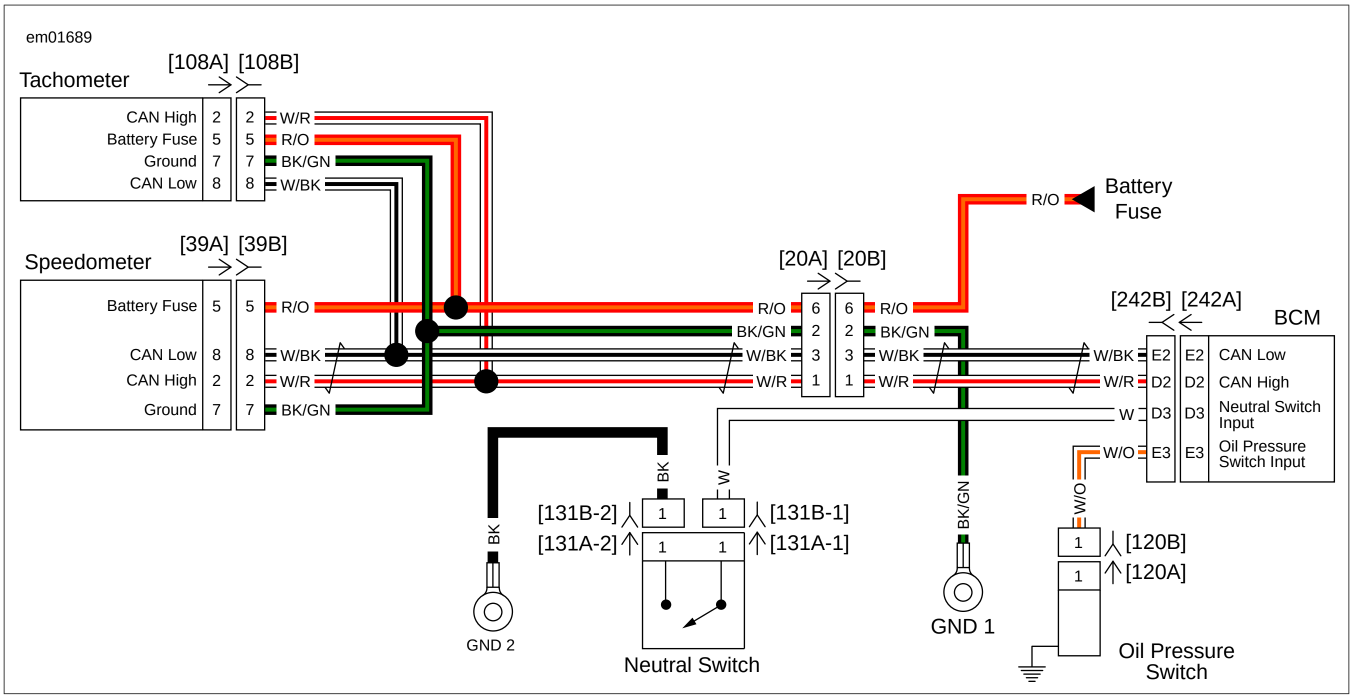


Figure 4-12. Indicator Lamps: FXDL

OIL PRESSURE LAMP ALWAYS ON

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX
HD-46601	BREAKOUT BOX ADAPTERS
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-96921-52D	OIL PRESSURE GAUGE SET

Table 4-10. Oil Pressure Lamp Always On Diagnostic Faults

POSSIBLE CAUSES
Short to ground in oil pressure circuit
Indicator malfunction
Mechanical issue
Oil pressure switch malfunction

1. Oil Pressure Lamp Function Test

1. Turn IGN ON.
2. Does oil pressure lamp illuminate?
   a. **Yes.** Go to Test 2.
   b. **No.** See 4.5 INDICATOR LAMPS, Oil Pressure Lamp Inoperative.

2. Engine Running Test

1. Start engine.
2. Does oil pressure lamp turn OFF and stay off?
   a. **Yes.** Oil pressure lamp is operating properly. Test for intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No.** Go to Test 3.

3. Oil Pressure Sensor Test

1. Disconnect oil pressure switch [120].
2. Does oil pressure lamp turn OFF when the engine is running?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 4.

4. Oil Pressure Circuit Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness BCM [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Turn IGN ON.
5. Test voltage between BOB terminal E3 and ground.
6. Is battery voltage present?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace BCM. **(5863)**

5. Mechanical Test

1. Inspect engine for any issues that impact oil pressure.
2. Using OIL PRESSURE GAUGE SET (Part No. HD-96921-52D), verify engine oil pressure.

3. Is oil pressure within specification?
   a. **Yes.** Replace oil pressure switch. **(5161)**
   b. **No.** Repair as needed.

6. Oil Pressure Switch Circuit Test

1. Turn IGN OFF.
2. Disconnect [242A].
3. Test continuity between BOB terminal E3 and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground. **(5041)**
   b. **No. Except FXDL.** Go to Test 7.
   c. **No. FXDL.** Replace tachometer.

7. Speedometer Test

1. Remove BCM BOB.
2. Connect [242].
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [39A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Test continuity between BOB terminal 1 and ground.
5. Is continuity present?
   a. **Yes.** Repair short to ground in (W/O) wire. **(5041)**
   b. **No.** Replace speedometer. **(6020)**

OIL PRESSURE LAMP INOPERATIVE

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

Table 4-11. Oil Pressure Lamp Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open oil pressure circuit
Indicator malfunction

1. Oil Pressure Lamp Function Test

1. Turn IGN ON.
2. Does oil pressure lamp illuminate?
   a. **Yes.** Test for intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No. Except FXDL.** Go to Test 2.
   c. **No. FXDL.** Replace tachometer.

2. Speedometer Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters leaving [39A] disconnected.
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jump BOB terminal 1 to ground.
5. Does oil pressure lamp turn ON?
   a. **Yes.** Replace speedometer. **(6020)**
   b. **No.** Repair or replace the console harness. **(5191)**

NEUTRAL LAMP ALWAYS ON

Table 4-12. Neutral Lamp Always On Diagnostic Faults

POSSIBLE CAUSES
Short to ground in neutral switch circuit
Short to ground in neutral indicator circuit

1. Neutral Lamp Function Test

1. With vehicle in neutral, turn IGN ON.
2. Does neutral lamp illuminate?
   a. **Yes. All except FXDL.** Go to Test 2.
   b. **Yes. FXDL.** Go to Test 3.
   c. **No.** See 4.5 INDICATOR LAMPS, Neutral Lamp Inoperative.

2. Indicator Harness Test

1. Disconnect speedometer [39].
2. Did neutral lamp turn OFF?
   a. **Yes.** Replace speedometer. **(6020)**
   b. **No.** Repair short to ground between neutral indicator and [39B] terminal 6 (W). **(5041)**

3. Tachometer Test

1. Shift transmission out of neutral.
2. Did neutral lamp turn OFF?
   a. **Yes.** Test for intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No.** Replace tachometer.

NEUTRAL LAMP INOPERATIVE

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-46601	BREAKOUT BOX ADAPTERS
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 4-13. Neutral Lamp Inoperative Diagnostic Faults

POSSIBLE CAUSES
Neutral switch malfunction
Open ground circuit
Open neutral switch circuit
Indicator malfunction

1. Neutral Lamp Function Test

1. With vehicle in neutral, turn IGN ON.
2. Does neutral lamp illuminate?
   a. **Yes.** Test for intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No.** Go to Test 2.

2. BCM Message Test

1. Verify transmission is in neutral.
2. With clutch lever released, start engine.
3. Does engine start?
   a. **Yes. All Expect FXDL.** Go to Test 6.
   b. **Yes. FXDL.** Replace tachometer.
   c. **No.** Go to Test 3.

3. Neutral Switch Test

1. Turn IGN OFF.
2. Disconnect neutral switch [131].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper between [131B-1] terminal 1 (W) and [131B-2] terminal 1 (BK).
4. Turn IGN ON.
5. Does neutral lamp turn ON?
   a. **Yes.** Replace neutral switch. **(5157)**
   b. **No.** Go to Test 4.

4. Ground Wire Test

1. Jumper between [131B-1] terminal 1 (W) and ground.
2. Does neutral lamp turn on?
   a. **Yes.** Repair open in (BK) ground wire. **(5041)**
   b. **No.** Go to Test 5.

5. Neutral Switch Power Circuit Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness BCM [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Test resistance between BOB terminal D3 and [131B-1] terminal 1 (W) wire.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace BCM. **(5863)**
   b. **No.** Repair open between [242B] terminal D3 and [131B-1] terminal 1 (W). **(5041)**

6. Speedometer Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [39A] disconnected.
3. Turn IGN ON.
4. Jumper BOB terminal 6 to ground.
5. Does neutral lamp illuminate?
   a. **Yes.** Replace speedometer. **(6020)**
   b. **No.** Repair or replace console harness. **(5191)**

HIGH BEAM INDICATOR ALWAYS ON

Table 4-14. High Beam Indicator Always On Diagnostic Faults

POSSIBLE CAUSES
Indicator malfunction
Short to ground in high beam indicator circuit

1. High Beam Indicator Function Test

1. Operate headlamp switch.
2. Do high and low beam headlamps function correctly?
   a. **Yes. All except FXDL.** Go to Test 2.
   b. **Yes. FXDL.** Replace tachometer.
   c. **No.** See 5.7 HEADLAMP DIAGNOSTICS.

2. High Beam Indicator Circuit Test

1. With IGN OFF, disconnect speedometer [39].
2. Turn IGN ON.
3. Does high beam indicator illuminate?
   a. **Yes.** Repair or replace the console harness. **(5191)**
   b. **No.** Replace speedometer. **(6020)**

HIGH BEAM INDICATOR INOPERATIVE

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

Table 4-15. High Beam Indicator Inoperative Diagnostic Faults

POSSIBLE CAUSES
Indicator malfunction
Open high beam indicator circuit

1. High Beam Indicator Function Test

1. Operate headlamp switch.
2. Do high and low beam headlamps function correctly?
   a. **Yes. All except FXDL.** Go to Test 2.
   b. **Yes. FXDL.** Replace tachometer.
   c. **No.** See 5.7 HEADLAMP DIAGNOSTICS.

2. High Beam Indicator Circuit Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [39A] disconnected.
3. Turn IGN ON.
4. Jumper BOB terminal 4 to ground.
5. Does high beam indicator illuminate?
   a. **Yes.** Replace speedometer. **(6020)**
   b. **No.** Repair or replace the console harness. **(5191)**

TURN SIGNAL INDICATOR ALWAYS ON

Table 4-16. Turn Signal Indicator Always On Diagnostic Faults

POSSIBLE CAUSES
Indicator malfunction
Short to ground turn signal circuit

1. Turn Signal Function Test

1. Operate turn signals.
2. Do turn signals operate?
   a. **Yes. All except FXDL.** Go to Test 2.
   b. **Yes. FXDL.** Replace tachometer.
   c. **No.** See 5.3 TURN SIGNALS.

2. Turn Signal Indicator Circuit Test

1. Turn IGN OFF.
2. Disconnect speedometer [39].
3. Turn IGN ON.
4. Does the turn signal indicator illuminate?
   a. **Yes.** Repair or replace console harness. **(5191)**
   b. **No.** Replace speedometer. **(6020)**

TURN SIGNAL INDICATOR INOPERATIVE

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

Table 4-17. Turn Signal Indicator Inoperative Diagnostic Faults

POSSIBLE CAUSES
Indicator malfunction
Open turn signal circuit

1. Turn Signal Function Test

1. Operate turn signals.
2. Do turn signals operate?
   a. **Yes. All except FXDL.** Go to Test 2.
   b. **Yes. FXDL.** Replace tachometer.
   c. **No.** See 5.3 TURN SIGNALS.

2. Turn Signal Indicator Circuit Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) to harness adapters, leaving [39A] disconnected.
3. Turn IGN ON.
4. Jumper BOB terminal 10 (left) or terminal 12 (right) to ground.
5. Does turn signal indicator illuminate?
   a. **Yes.** Replace speedometer. **(6020)**
   b. **No.** Repair or replace console harness. **(5191)**

LOW FUEL LAMP ALWAYS ON

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

Table 4-18. Low Fuel Lamp Always On Diagnostic Faults

POSSIBLE CAUSES
Fuel pump and sender assembly malfunction
Excessive resistance in fuel sender circuit

1. Fuel Sender Circuit Resistance Test

1. Turn IGN OFF.
2. Disconnect fuel pump [141].
3. Connect BREAKOUT BOX ADAPTERS (Part No. HD-46601) to [39]. Attach connectors from BREAKOUT BOX (Part No. HD-42682) between harness adapters [39A] and [39B].
4. Test resistance between BOB terminal 9 and [141B] terminal B (W/Y).
5. Is resistance greater than 0.5 ohms?
   a. **Yes.** Repair excessive resistance between [39B] terminal 9 and [141B] terminal B (W/Y).
   b. **No.** Go to Test 2.

2. Fuel Gauge Circuit Resistance Test

1. Disconnect fuel gauge [117].
2. Test resistance between BOB terminal 9 and [117B] terminal 2 (W/Y).
3. Is resistance greater than 0.5 ohms?
   a. **Yes.** Repair excessive resistance between [39B] terminal 9 and [117B] terminal 2 (W/Y).
   b. **No.** Go to Test 3.

3. Fuel Level Test

1. Connect [141].
2. Connect [117].
3. Verify fuel tank is at least half full.
4. Is fuel tank at least half full?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 4.

4. Fuel Sender High Test

1. Turn IGN ON.
2. Record voltage between BOB terminal 9 and ground.
3. Turn IGN OFF.
4. Fill tank with fuel.
5. Turn IGN ON.
6. Record voltage between BOB terminal 9 and ground.
7. Did voltage decrease?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace fuel sender.

5. Fuel Sender Low Test

1. Turn IGN ON.
2. Record voltage between BOB terminal 9 and ground.
3. Turn IGN OFF.
4. Drain fuel tank.
5. Turn IGN ON.
6. Record voltage between BOB terminal 9 and ground.
7. Did voltage increase?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace fuel sender.

6. Speedometer Test

1. Turn IGN OFF.
2. Fill tank with fuel if needed.
3. Remove main fuse for 1 minute and install.
4. Turn IGN ON.
5. Is indicator still illuminated?
   a. **Yes.** Replace speedometer.
   b. **No.** System working correctly.

LOW FUEL LAMP INOPERATIVE

Table 4-19. Low Fuel Lamp Inoperative Diagnostic Faults

POSSIBLE CAUSES
Fuel level sensor malfunction
Fuel gauge malfunction

1. Speedometer Test

NOTE

Test must be performed with fuel level in tank less than 1.0 gal (3.8 L).

1. Turn IGN OFF.
2. Remove main fuse for 1 minute and install main fuse.
3. Turn IGN ON.
4. View speedometer and fuel gauge.
5. Does the fuel gauge read low?
   a. **Yes.** Replace speedometer.
   b. **No.** Replace fuel level sensor.

THEORY OF OPERATION

See Figure 4-13. With IGN ON, the fuel gauge receives 12V through the running lamp circuit. 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.

Inoperative gauges occur if:

- Sender or fuel gauge not grounded.
- Malfunction in sender or fuel gauge.
- Inoperative or disconnected wire to fuel gauge.
- Corroded connections at fuel gauge.

Use the 4.6 GAUGES, Fuel Gauge Inaccurate, No DTCs to test suspected components.

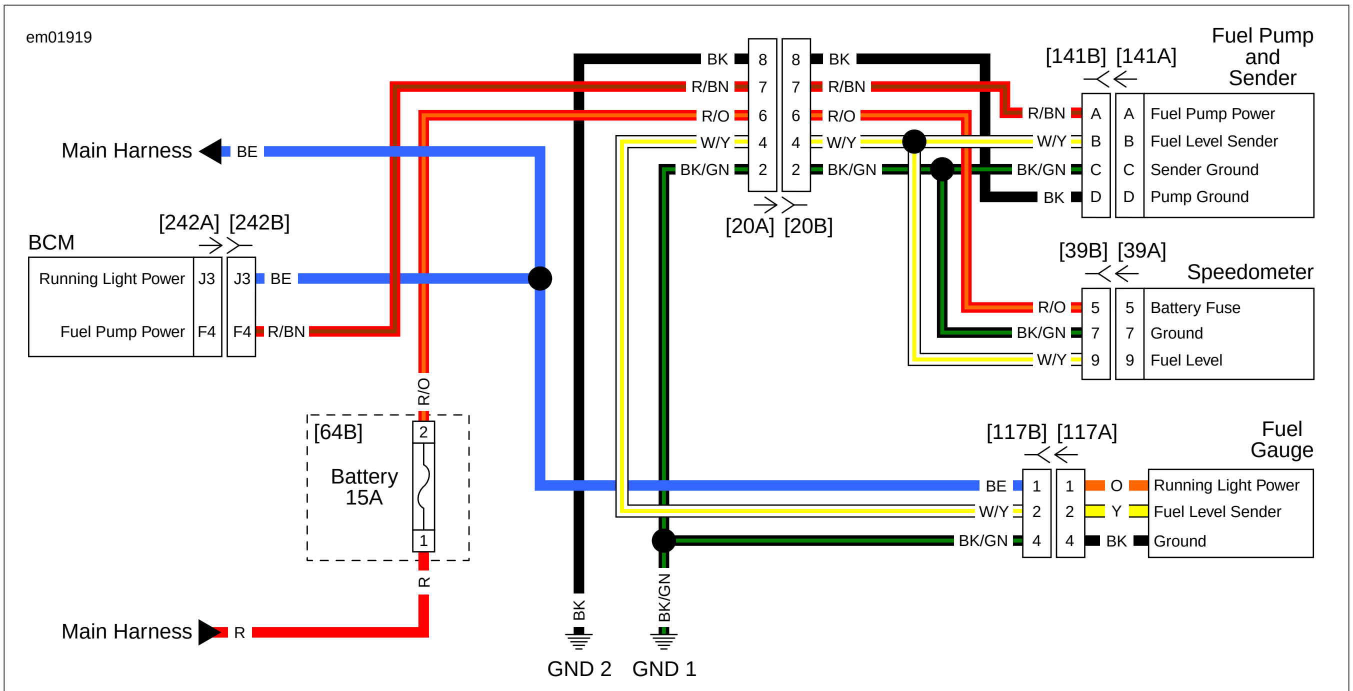


Figure 4-13. Fuel Sensor Circuit

FUEL GAUGE INACCURATE, NO DTCS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 4-20. Fuel Gauge Inaccurate, No DTCs Diagnostic Faults

POSSIBLE CAUSES
Open in fuel gauge power circuit
Open in fuel gauge ground circuit
Fuel sender malfunction
Fuel gauge malfunction

1. Fuel Gauge Test

1. Turn IGN OFF.
2. Disconnect fuel pump and sender [141].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper [141B] terminal B to ground.
4. Turn IGN ON.
5. Does fuel gauge indicate full?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 3.

2. Sending Unit Test

1. Test resistance between [141A] terminals B and C.
2. Is resistance within specified range? Refer to Table 4-21.
   a. **Yes.** System operating properly.
   b. **No.** Replace fuel sender.

Table 4-21. Fuel Sender Resistance Values

FUEL LEVEL	RESISTANCE
Full	27-40 ohms
Half-full	97-118 ohms
Empty	240-264 ohms

HOME

3. Fuel Gauge Circuit Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Turn IGN ON.
4. Test voltage between [117B] terminals 1 and 4.
5. Is battery voltage present?
   a. **Yes.** Replace fuel gauge.
   b. **No.** Repair open in (BE) or (BK/GN) wire.

FUEL GAUGE INOPERATIVE

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 4-22. Fuel Gauge Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open in power circuit
Open in ground circuit
Fuel gauge malfunction

1. Ignition Voltage Test

1. Turn IGN OFF.
2. Disconnect fuel gauge [117].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [117B] terminal 1 and ground.
5. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (BE) wire.

2. Ground Circuit Test

1. Test voltage between [117B] terminals 1 and 4.
2. Is battery voltage present?
   a. **Yes.** Replace fuel gauge.
   b. **No.** Repair open in the ground circuit.

NOTES

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NOTES

ACC CIRCUIT DIAGNOSTICS 5.1

DESCRIPTION AND OPERATION

The P&A battery circuit is connected to battery power through the P&A fuse. This circuit supplies power to additional systems on the vehicle. The P&A circuit runs from the fuse to the DLC connector terminal 6.

There is also an accessory power circuit from the BCM terminal M2 that runs to the rear lighting and DLC connectors. This circuit is energized by the BCM when the IGN is in the ACC or ON position.

Table 5-1. Code Description

DTC	DESCRIPTION
B2112	ACC output shorted high
B2113	ACC output shorted low
B2114	ACC output overloaded

Conditions for Setting

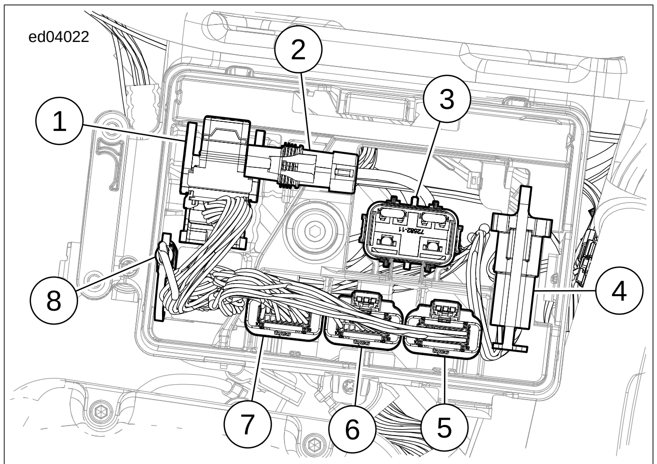
The accessory circuit normally has power when the IGN is ON or in the ACC positions. If the accessory circuit has power when the IGN is OFF, then DTC B2112 will set.

DTC B2114 will set if the accessory circuit draws more than 15 Amps.

The other accessory circuit DTCs will set if the BCM identifies them with the IGN ON or in the ACC position.

Diagnostic Tips

This circuit may be used for aftermarket accessories or systems. If a code is set and cannot be duplicated, check for aftermarket devices.



1. **BCM [242]**
2. **BCM power [259]**
3. **Fuse block [64]**
4. **DLC [91]**
5. **ECM [78-3] (BN) (if applicable)**
6. **ECM [78-2] (GY)**
7. **ECM [78-1] (BK)**
8. **Battery tender [281] (if applicable)**

Figure 5-1. Under Left Side Cover

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

[HOME](#)

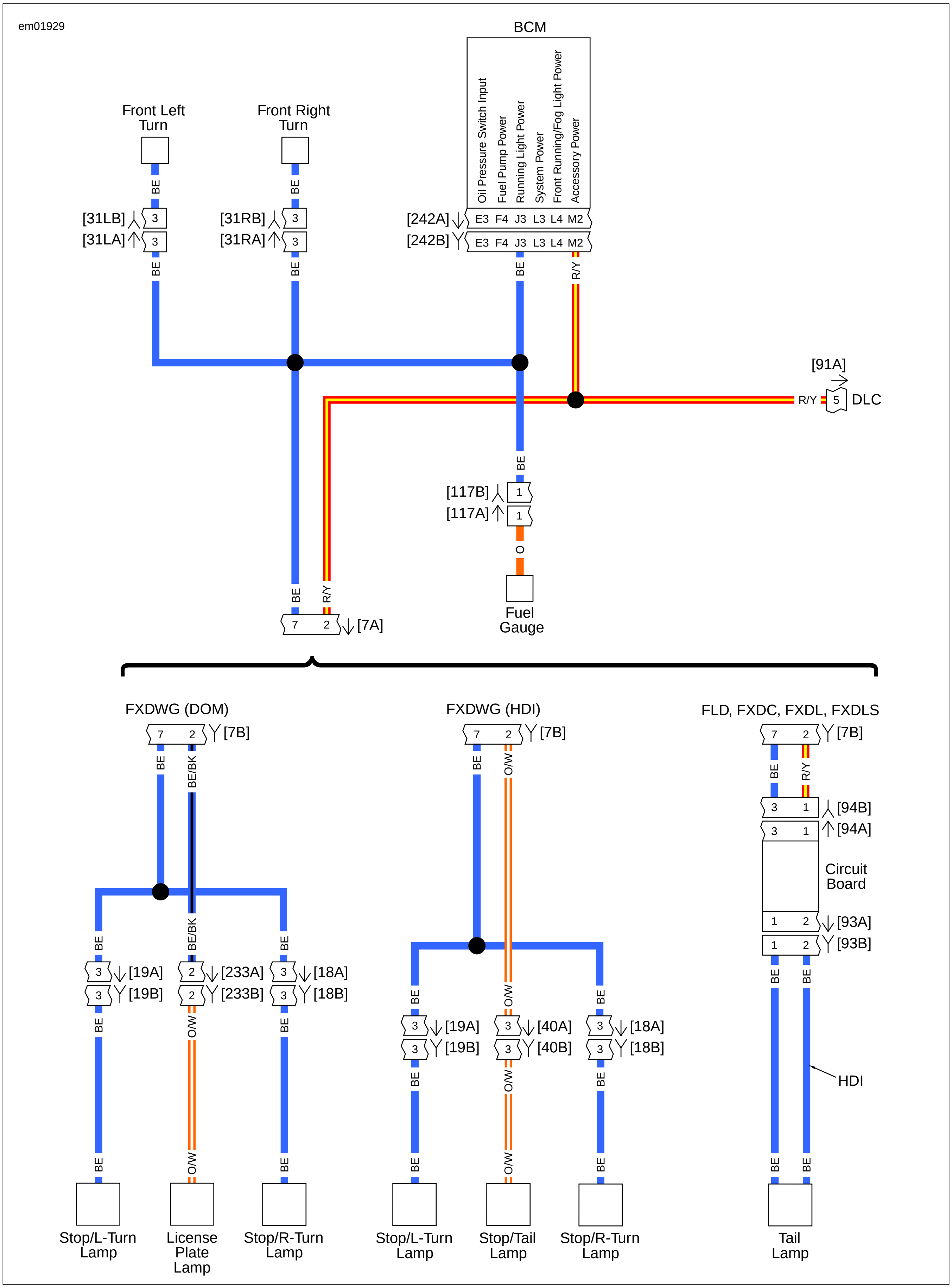


Figure 5-2. Accessory and Running Light Power: 1 of 2

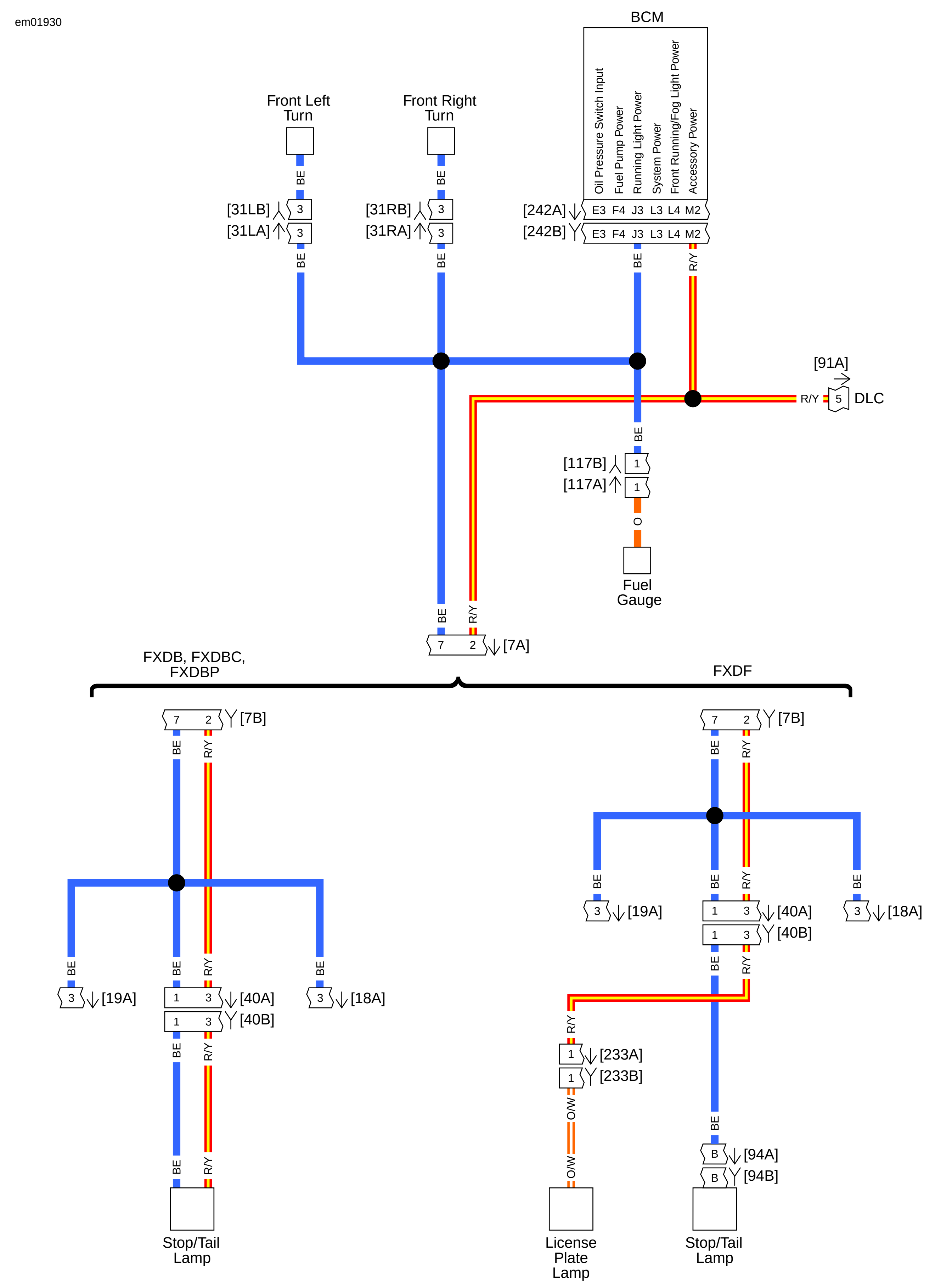


Figure 5-3. Accessory and Running Light Power: 2 of 2

DTC B2112

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-2. DTC B2112 Diagnostic Faults

POSSIBLE CAUSES
Short to battery in the accessory power circuit

1. Accessory Power Circuit Short to Voltage Test

1. Turn IGN OFF.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between DLC [91A] terminal 5 and ground.
3. Is battery voltage present?
   a. **Yes.** Repair short to voltage on (R/Y) wire.
   b. **No.** Go to Test 2.

2. BCM Test

1. Clear DTC.
2. Turn IGN ON, then OFF.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Concern is intermittent. Accessory devices may have caused DTC to set. Inspect and repair as needed.

DTC B2113, B2114

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-3. DTC B2113, B2114 Diagnostic Faults

POSSIBLE CAUSES
Excessive current draw in accessory power circuit
Short to ground in the accessory power circuit

1. Accessory Power Circuit Short to Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B] leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal M2 and ground.
5. Is resistance less than 2 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

2. Accessory Circuit Test

1. Inspect for any accessories connected to the accessory circuit.
2. Disconnect any accessories on the circuit.
3. Test resistance between BOB terminal M2 and ground.
4. Is resistance less than 2 ohms?
   a. **Yes.** Repair short to ground in (R/Y) wire.
   b. **No.** Go to Test 3.

3. BCM Test

1. Leave all aftermarket accessories disconnected.
2. Connect BCM [242A].
3. Clear DTC.
4. Turn IGN ON.
5. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Accessory devices may have caused DTC to set. Inspect and repair as needed.

HORN DIAGNOSTICS 5.2

DESCRIPTION AND OPERATION

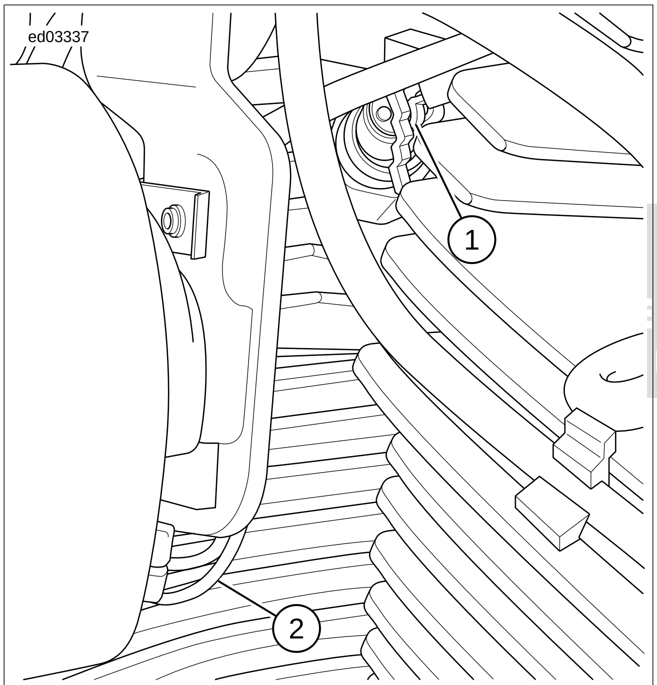
The horn is powered by the BCM from terminal E4 and grounded through GND 2. When the horn switch is pressed, a CAN signal is sent to the BCM. The BCM then supplies power to the horn over the (R/V) wire.

The LHCM sends a signal to the BCM over the CAN bus when the horn switch is pressed. The horn switch is diagnosed with the other switches in the hand controls. See 5.9 SWITCH DIAGNOSTICS.

NOTE

If the horn button is pressed for more than 10 seconds, the BCM deactivates the horn to protect it from damage. Checking horn output from the BCM has to be done within 10 seconds of pressing the horn button.

See Figure 5-4. The horn is located on the left side of the vehicle between the cylinders.



1. **ET sensor [90]**
2. **Horn [122]**

Figure 5-4. Horn and ET Sensor

Table 5-4. Code Description

DTC	DESCRIPTION
B2127	E4 output shorted high
B2128	E4 output shorted low
B2129	E4 output overloaded

Conditions for Setting

The horn switch may have to be pressed attempting to activate the horn in order to set these DTCs.

DTC B2129 will set if the horn circuit draws more than 5 Amps.

Diagnostic Tips

There will not be a code set if the horn switch is always open. If the horn will not function when the switch is pressed but the other switches on the LHCM work normally, see 5.9 SWITCH DIAGNOSTICS.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

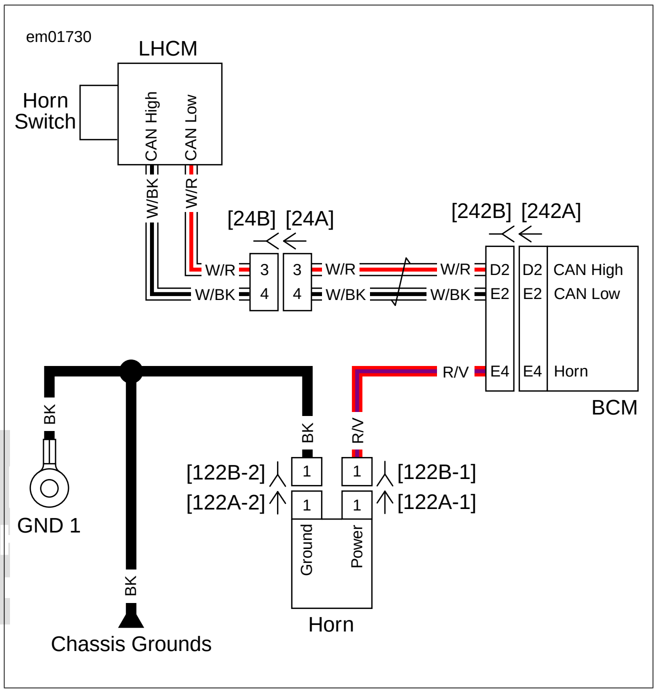


Figure 5-5. Horn

DTC B2127

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL

Table 5-5. DTC B2127 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in horn power circuit

1. Horn Power Circuit Short to Voltage Test

1. Turn IGN OFF.

2. Using 0.6 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50423), remove terminal E4 (R/V) wire from BCM harness connector [242B].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Turn IGN ON.
6. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between extracted terminal E4 and ground.
7. Is voltage present?
   a. **Yes.** Repair short to voltage in horn power circuit (R/V) wire.
   b. **No.** Go to Test 2.

2. DTC Test

1. Clear DTCs.
2. Turn IGN ON.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

DTC B2128, B2129

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-6. DTC B2128, B2129 Diagnostic Faults

POSSIBLE CAUSES
Accessory horn overloading circuit
Short to ground in horn power circuit
Horn malfunction

1. Horn Circuit Test

1. Turn IGN OFF.
2. Disconnect horn [122].
3. Disconnect BCM [242].
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [122B-1] terminal 1 and ground.
5. Is continuity present?
   a. **Yes.** Repair short to ground in (R/V) wire.
   b. **No.** Go to Test 2.

2. DTC Test

1. Connect [242].
2. Clear DTC.
3. Turn IGN ON.
4. Press horn switch.
5. Check DTCs.
6. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Replace horn.

HORN INOPERATIVE

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-7. Horn Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open in horn ground circuit
Open in horn power circuit
Horn malfunction

1. Horn Test

1. Turn IGN OFF.
2. Disconnect horn [122].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [122B-1] and [122B-2] while pressing horn switch.
5. Is battery voltage present?
   a. **Yes.** Replace horn.
   b. **No.** Go to Test 2.

2. Ground Circuit Open Test

1. While pressing horn switch, test voltage between [122B-1] terminal 1 and ground.

NOTE

If the horn button is pressed for more than 10 seconds, the BCM deactivates the horn to protect it from damage. Checking horn output from the BCM has to be done within 10 seconds of pressing the horn button.

2. Is battery voltage present?
   a. **Yes.** Repair open in (BK) ground circuit.
   b. **No.** Go to Test 3.

3. Power Circuit Open Test

1. Turn IGN OFF.

2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. While pressing horn switch, test voltage between BOB terminal E4 and ground.
5. Is battery voltage present?
   a. **Yes.** Repair open in (R/V) wire.
   b. **No.** Replace BCM.

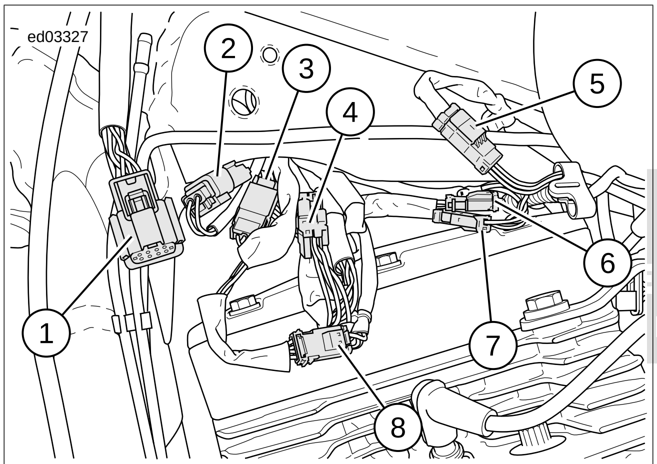
TURN SIGNALS 5.3

DESCRIPTION AND OPERATION

The BCM controls the turn signal functions, including the hazard lamps and turn signal cancellation feature. The BCM has separate controls for each of the turn signals. This allows the BCM to set DTCs for each turn signal individually.

The front turn signals are controlled two different ways depending on the wire routing of the front turn signals. If the front turn signals are wired to the LHCM and RHCM, then the power and ground for the turn signal comes from the LHCM or RHCM. The BCM only controls the rate of the flash of the turn signal by sending a message over the CAN bus to the hand control modules.

See Figure 5-6. If the front turn signals are not wired to the LHCM and RHCM, then the BCM controls the front turn signals, as well as the rear turn signals. In this configuration, the BCM sends power to the turn signals directly over the specific wire for each signal. The BCM has different turn signal DTCs depending on vehicle configuration.



1. **Console gauges/instrument lamps [20]**
2. **Front WSS (ABS only) [167]**
3. **Left front turn signal [31LA]**
4. **Right front turn signal [31RA]**
5. **Fuel gauge [117]**
6. **Right hand control [22-2]**
7. **Right hand control [22-1]**
8. **Left hand control [24]**

Figure 5-6. Under Fuel Tank (IAC): Except FXDB

In either configuration, the LHCM and RHCM send messages to the BCM over the CAN bus when either of the turn signal switches or hazard warning switch are pressed. The BCM will also set codes if it determines a switch is stuck in the pressed position for longer than two minutes. The switch DTCs are diagnosed with the other hand control module switches. See 5.9 SWITCH DIAGNOSTICS.

Manual Cancellation

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

If signaling to turn in one direction, pressing the switch for the opposite turn signal will cause the first signal to cancel and the opposite side to begin.

Automatic Cancellation

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

- When the turn signal switch is released, the system starts a 20 count. As long as the vehicle is traveling above 8 mph (13 km/h), the directional will always cancel after 20 flashes if the system does not recognize any other input.
- If the vehicle speed drops to 8 mph (13 km/h) or less, including stopped, the directionals will continue to flash. Counting will resume when vehicle speed reaches 8 mph (13 km/h) and will automatically cancel when the count total equals 20 as stated above.
- The turn signals may cancel within two seconds upon turn completion depending on vehicle lean angle during turn. An accelerometer inside the BCM cancels the signal after the vehicle has been returned to an upright position.

NOTE

The bank angle cancellation function has an automatic calibration feature. Ride the vehicle for 0.25 mile (0.4 km) at steady speeds (upright) to calibrate the system. This calibration process optimizes the performance of the bank angle function. This automatic calibration is performed automatically every time the vehicle is started and ridden.

Four-Way Flashing

Use the following method to activate the four-way flashers:

1. With the ignition switch ON or in ACC, press the hazard warning switch.

NOTE

To activate or deactivate hazards on vehicle equipped with security system, the fob must be within range of the vehicle.

2. Turn the ignition switch OFF (the security system will arm if equipped). The four-way flashers will continue for two hours.
3. To cancel four-way flashing, disarm the security system if equipped, turn the ignition switch ON or to ACC and press the hazard warning switch.

NOTE

To activate or deactivate hazards on vehicle equipped with security system, the fob must be within range of the vehicle.

This system allows a stranded vehicle to be left in the four-way flashing mode and secured until help is found.

If the security system is disarmed while the four-way flashers are active, the lights will flash as follows:

1. BCM stops four-way flashing mode. Vehicle sits for one second with turn signals off.
2. BCM performs disarming confirmation (one flash).

3. Vehicle sits for one second with turn signals off.
4. Vehicle restarts four-way flashing mode.

Tip Over Detection Operation

The BCM uses an internal accelerometer to monitor vehicle position. Under normal driving conditions, the BCM uses the accelerometer along with speed input provided from the ECM to know when to automatically cancel the turn signals after a turn. The BCM will disable turn signal lamps, accessory power and starter activation and will shut down the ignition and the fuel pump if the vehicle is tipped over. The odometer will display "TIP" when a tip-over condition is present.

Tip Over Reset

1. Return the vehicle to an upright position.
2. Cycle the IGN OFF-ON before restarting the vehicle.

WILL NOT CANCEL UPON TURN COMPLETION, NO DTCS

Table 5-8. Will Not Cancel Upon Turn Completion, No DTCs Diagnostic Faults

POSSIBLE CAUSES
Conditions to self-cancel not met
Improper configuration

1. BCM Mounting Test

1. Verify BCM is mounted correctly.
2. Is BCM mounted correctly?
   a. **Yes.** Go to Test 2.
   b. **No.** Mount correctly.

2. Correct Configuration Test

1. Check if BCM is configured correctly. See 5.14 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS.
2. Is BCM configured correctly?
   a. **Yes.** Go to Test 3.
   b. **No.** Select proper vehicle configuration.

3. Turn Signals Cancel Test

1. Operate vehicle at a speed greater than 8 mph (13 km/h) in a straight line.
2. Activate either turn signal.
3. Turn signals should cancel after 20 flashes.
4. Do turn signals cancel?
   a. **Yes.** System operating properly.
   b. **No.** Go to Test 4.

4. Speedometer Test

1. Does speedometer register vehicle speed?
   a. **Yes.** Replace BCM.
   b. **No.** See 1.2 INITIAL DIAGNOSTICS.

DTC B1101, B1151 5.4

DESCRIPTION AND OPERATION

See Figure 5-7. These DTCs are specific for vehicles with the front turn signals wired to the LHCM and RHCM. If the turn signals are not wired in this configuration, a different set of codes are used to determine turn signal circuit malfunction. The LHCM and RHCM control the turn signals, but any DTCs related to the turn signals are reported by the BCM.

Before troubleshooting errors after relocating front turn signals, perform following steps:

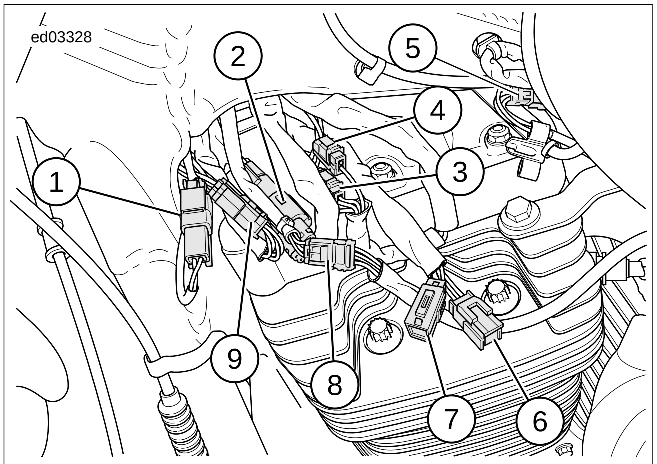
1. Turn IGN ON.
2. Activate hazard lights for 10 flashes.
3. Deactivate hazards.
4. Activate hazard lights for 10 flashes.
5. Deactivate hazards.
6. Clear DTCs.
7. Turn IGN OFF, ON, activate hazard lights.
8. Verify DTCs.

NOTE

This is necessary for the BCM to validate the proper front lighting configuration and which module is actually controlling them.

Table 5-9. Code Description

DTC	DESCRIPTION
B1101	LHCM turn signal bulb out
B1151	RHCM turn signal bulb out



1. **Ignition switch [222]**
2. **Console gauges/instrument lamps [20]**
3. **Right hand control [22-2]**
4. **Right hand control [22-1]**
5. **Fuel gauge [117]**
6. **Right directional and DOM running lamp [31RA]**
7. **Left directional and DOM running lamp [31LA]**
8. **Left hand control [24]**
9. **Headlamp [38]**

Figure 5-7. Under Fuel Tank (IAC): FXDB

Diagnostic Tips

After clearing the DTCs, activate the inoperative turn signal to check if the DTC has returned.

DTC B1101, B1151

Table 5-10. DTC B1101, B1151 Diagnostic Faults

POSSIBLE CAUSES
Bulb malfunction

1. Bulb Test

1. Inspect inoperative turn signal bulb.
2. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb.

2. Socket and Wiring Inspection Test

1. Inspect bulb socket and wiring to turn signal for damage or poor connections.
2. Were any issues found?
   a. **Yes.** Repair as needed.
   b. **No.** Replace inoperative side module (LHCM or RHCM).

FRONT TURN SIGNAL DIAGNOSTICS 5.5

DESCRIPTION AND OPERATION

See Figure 5-8. These DTCs only apply to vehicles where the turn signals are not wired directly to the hand control modules.

The turn signals are controlled by the BCM. The BCM supplies power to the turn signals and controls the flash rate of the turn signals through the turn signals individual power circuit.

When the turn signal or hazard warning lamp switch is pressed, the hand control module sends a message over the CAN bus to the BCM. The BCM then controls the power to the turn signal. The turn signals have a constant ground.

Before troubleshooting errors after relocating front turn signals, perform following steps:

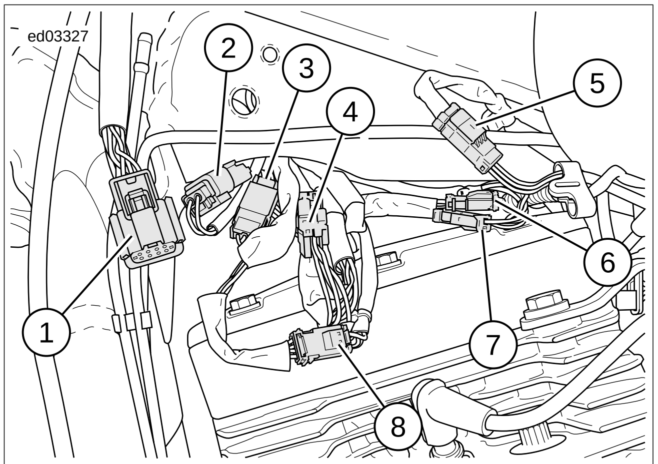
1. Turn IGN ON.
2. Activate hazard lights for 10 flashes.
3. Deactivate hazards.
4. Activate hazard lights for 10 flashes.
5. Deactivate hazards.
6. Clear DTCs.
7. Turn IGN OFF, ON, activate hazard lights.
8. Verify DTCs.

NOTE

This is necessary for the BCM to validate the proper front lighting configuration and which module is actually controlling them.

Table 5-11. Code Description

DTC	DESCRIPTION
B2141	Left front turn signal output open
B2143	Left front turn signal output shorted low
B2144	Left front turn signal output overloaded
B2146	Right front turn signal output open
B2148	Right front turn signal output shorted low
B2149	Right front turn signal output overloaded



1. **Console gauges/instrument lamps [20]**
2. **Front WSS (ABS only) [167]**
3. **Left front turn signal [31LA]**
4. **Right front turn signal [31RA]**
5. **Fuel gauge [117]**
6. **Right hand control [22-2]**
7. **Right hand control [22-1]**
8. **Left hand control [24]**

Figure 5-8. Under Fuel Tank (IAC): Except FXDB

Conditions for Setting

After clearing DTCs, test inoperative turn signal. Verify DTC does not return.

- DTC B2141 or B2146 will set if the corresponding front turn signal circuit draws less than 120 milliamps.
- DTC B2144 or B2149 will set if the corresponding front turn signal circuit draws more than 3 Amps.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

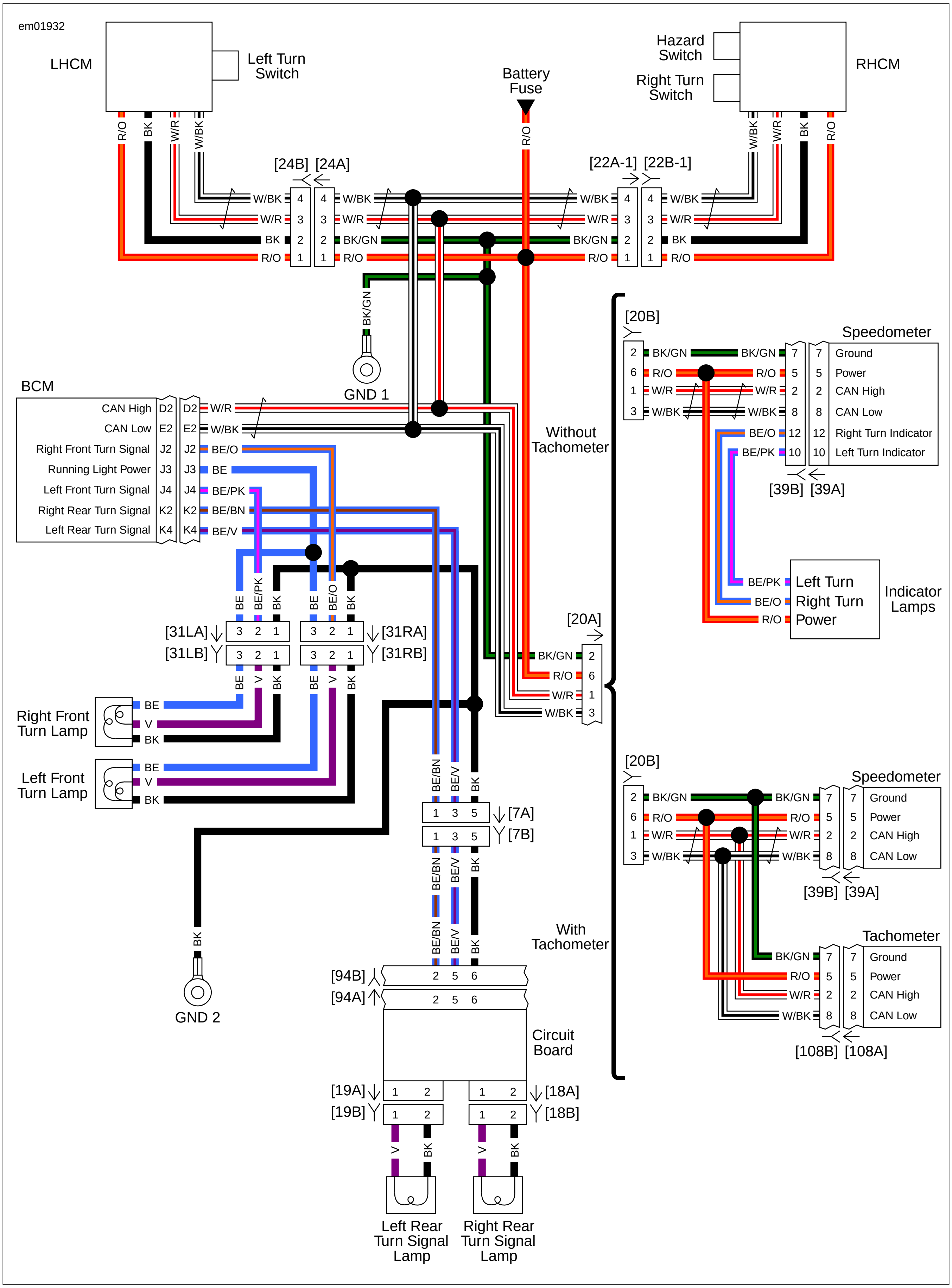


Figure 5-9. Turn Signal Circuit: FLD, FXDL, FXDLS, FXDC

HOME

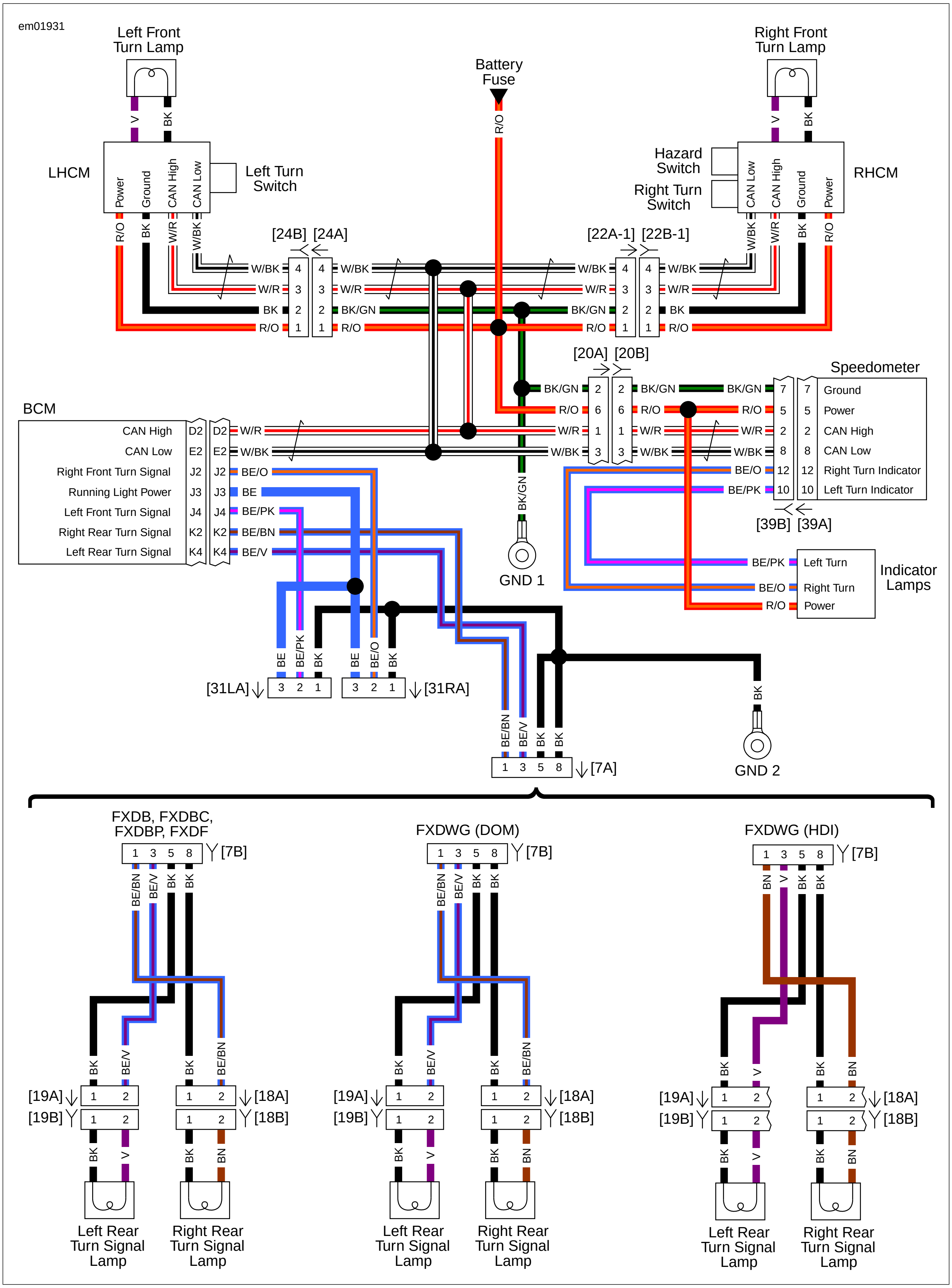


Figure 5-10. Turn Signal Circuit: FXDB, FXDBC, FXDBP, FXDF, FXDWG

DTC B2141

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-12. DTC B2141 Diagnostic Faults

POSSIBLE CAUSES
Open in left front turn signal ground circuit
Open in left front turn signal power circuit
Short to voltage in left front turn signal power circuit
Bulb malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Inspect left front turn signal bulb.
3. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between bulb socket ground and ground.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK) wire.

3. Power Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Test resistance between BOB terminal J4 and left front turn signal bulb socket terminal.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace BCM.
   b. **No.** Repair open in left front turn signal power circuit (BE/PK) or (V).

DTC B2143, B2144

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-13. DTC B2143, B2144 Diagnostic Faults

POSSIBLE CAUSES
Left front turn signal bulb current exceeds 3.0A
Accessory lighting overloading circuit
Short to ground in left front turn signal power circuit

1. Bulb Test

1. Turn IGN OFF.
2. Inspect left front turn signal bulb.
3. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb.

2. Power Circuit Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), with bulb out, test continuity between BOB terminal J4 and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground in left front turn signal power circuit (BE/PK) or (V) wire.
   b. **No.** Go to Test 3.

3. DTC Test

1. Connect [242A].
2. Clear DTC.
3. Turn IGN ON.
4. Turn on left turn signal.
5. With bulb out, check DTCs.
6. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Replace turn signal bulb.

DTC B2146

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-14. DTC B2146 Diagnostic Faults

POSSIBLE CAUSES
Open in right front turn signal ground circuit
Open in right front turn signal power circuit
Short to voltage in right front turn signal power circuit
Bulb malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Inspect right front turn signal bulb.
3. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between bulb socket ground and ground.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK) wire.

3. Power Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Test resistance between BOB terminal J2 and right front turn signal bulb socket terminal.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace BCM.
   b. **No.** Repair open in right front turn signal power circuit (BE/O) or (BN).

DTC B2148, B2149

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-15. DTC B2148, B2149 Diagnostic Faults

POSSIBLE CAUSES
Right front turn signal bulb current exceeds 3.0A
Accessory lighting overloading circuit
Short to ground in right front turn signal power circuit

1. Bulb Test

1. Turn IGN OFF.
2. Inspect right front turn signal bulb.
3. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb.

2. Power Circuit Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), with bulb out, test continuity between BOB terminal J2 and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground in right front turn signal power circuit (BE/O) or (BN) wire.
   b. **No.** Go to Test 3.

3. DTC Test

1. Connect [242A].
2. Clear DTC.
3. Turn IGN ON.
4. Turn on right turn signal.
5. With bulb removed, check DTCs.
6. Did DTC B2148 or B2149 reset?
   a. **Yes.** Replace BCM.
   b. **No.** Replace turn signal bulb.

REAR TURN SIGNAL DIAGNOSTICS 5.6

DESCRIPTION AND OPERATION

See Figure 5-11. The rear turn signals are controlled by the BCM. The BCM supplies power to the rear turn signals and controls the flash rate of the turn signals through the power circuit.

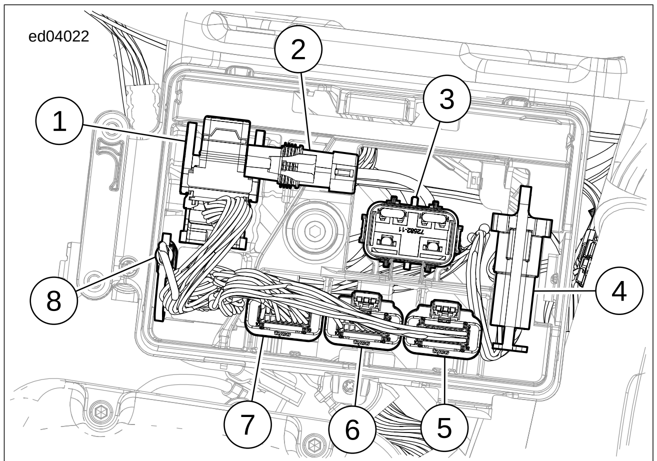
Table 5-16. Code Description

DTC	DESCRIPTION
B2151	Left rear turn signal output open
B2153	Left rear turn signal output shorted low
B2154	Left rear turn signal output overloaded
B2156	Right rear turn signal output open
B2158	Right rear turn signal output shorted low
B2159	Right rear turn signal output overloaded

Conditions for Setting

After clearing the DTCs, operate the inoperative turn signal to verify if the DTC has returned.

- DTC B2151 or B2156 will set if the corresponding rear turn signal circuit draws less than 120 milliamps.
- DTC B2154 or B2159 will set if the corresponding rear turn signal circuit draws more than 3 Amps.



1. **BCM [242]**
2. **BCM power [259]**
3. **Fuse block [64]**
4. **DLC [91]**
5. **ECM [78-3] (BN) (if applicable)**
6. **ECM [78-2] (GY)**
7. **ECM [78-1] (BK)**
8. **Battery tender [281] (if applicable)**

Figure 5-11. Under Left Side Cover

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

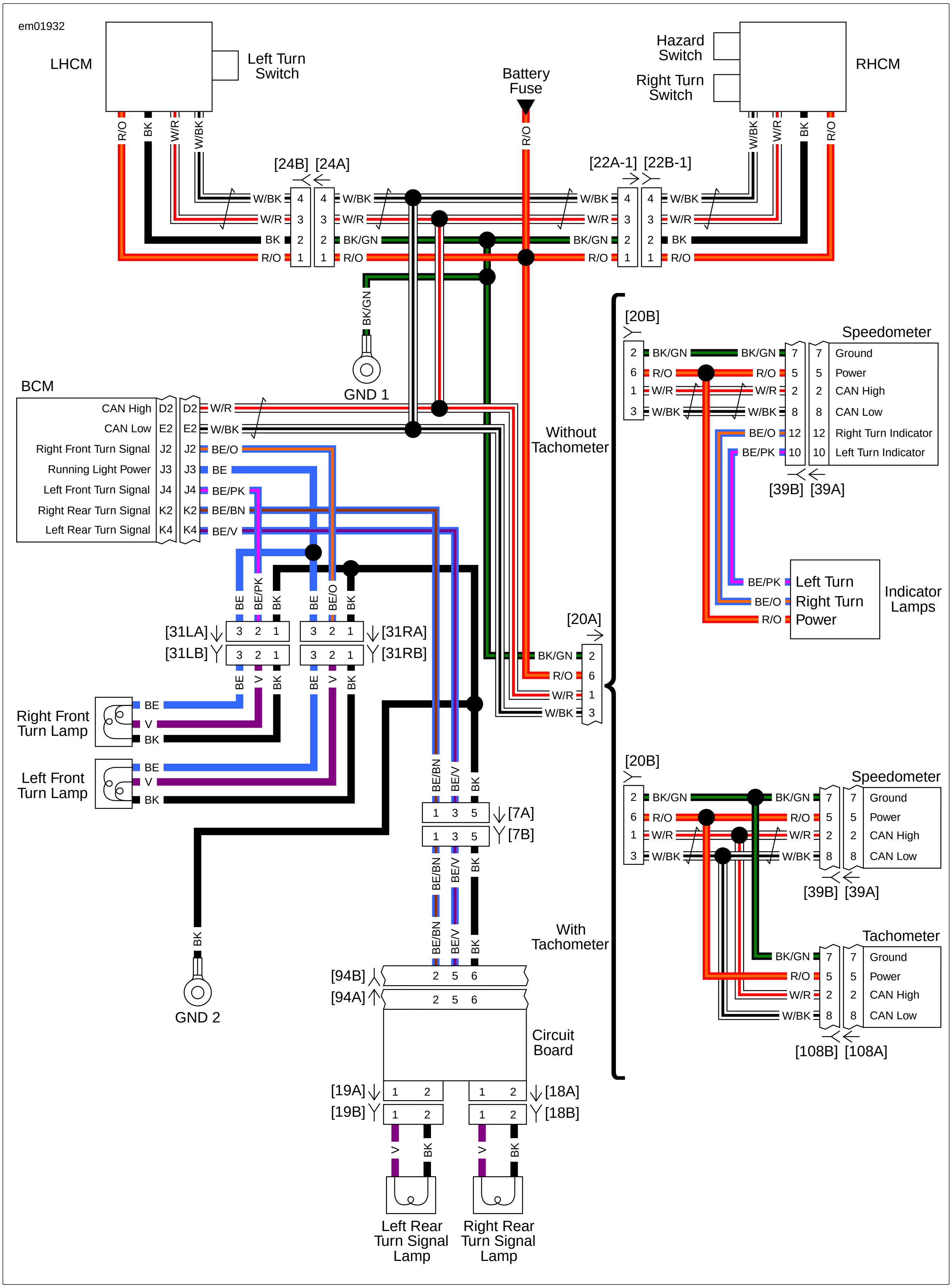


Figure 5-12. Turn Signal Circuit: FLD, FXDL, FXDLS, FXDC

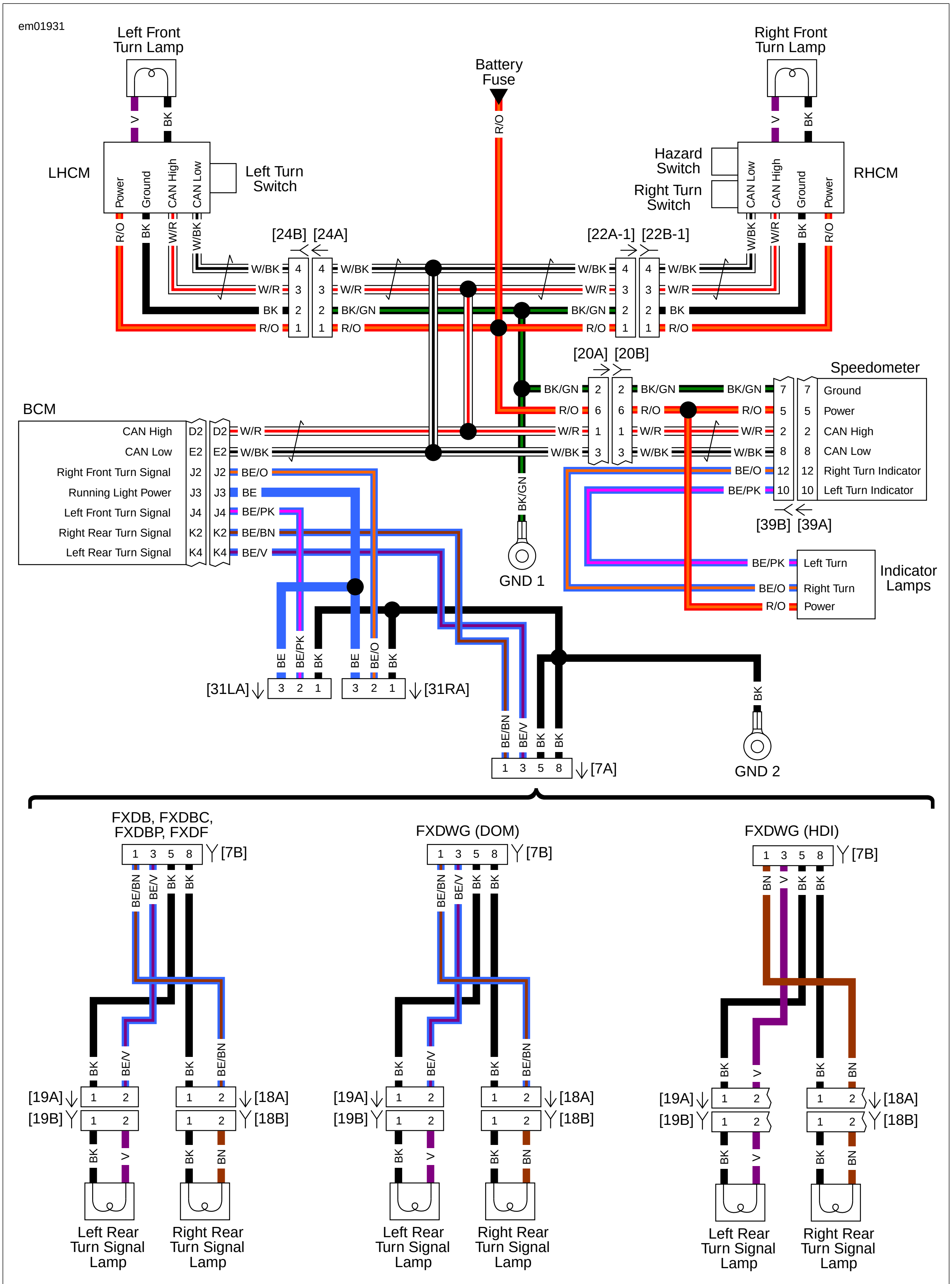


Figure 5-13. Turn Signal Circuit: FXDB, FXDBC, FXDBP, FXDF, FXDWG

DTC B2151

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-17. DTC B2151 Diagnostic Faults

POSSIBLE CAUSES
Open in left rear turn signal ground circuit
Open in left rear turn signal power circuit
Short to voltage in left rear turn signal power circuit
Bulb malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Remove left rear turn signal bulb.
3. Inspect bulb.
4. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between bulb socket ground and ground.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK) wire.

3. Power Circuit Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal K4 and left rear turn signal bulb power circuit socket terminal.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace BCM.
   b. **No.** Repair open in left rear turn signal power circuit (BE/V).

DTC B2153, B2154

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-18. DTC B2153, B2154 Diagnostic Faults

POSSIBLE CAUSES
Left rear turn signal bulb current too high
Accessory lighting overloading circuit
Short to ground in left rear turn signal power circuit

1. Bulb Test

1. Turn IGN OFF.
2. Remove left rear turn signal bulb.
3. Inspect bulb.
4. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb.

2. Power Circuit Short to Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal K4 and ground.
5. Is continuity present?
   a. **Yes.** Repair short to ground in left rear turn signal power circuit (BE/V) wire.
   b. **No.** Replace BCM.

DTC B2156

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-19. DTC B2156 Diagnostic Faults

POSSIBLE CAUSES
Open in right rear turn signal ground circuit
Open in right rear turn signal power circuit
Short to voltage in right rear turn signal power circuit
Bulb malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Remove right rear turn signal bulb.
3. Inspect bulb.
4. Is bulb good?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Turn IGN OFF.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between bulb socket ground and ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK) wire.

3. Power Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal K2 and right rear turn signal bulb power circuit socket terminal.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace BCM.
   b. **No.** Repair open in right rear turn signal power circuit (BE/BN).

DTC B2158, B2159

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-20. DTC B2158, B2159 Diagnostic Faults

POSSIBLE CAUSES
Right rear turn signal bulb current too high
Accessory lighting overloading circuit
Short to ground in right rear turn signal power circuit

1. Bulb Test

1. Turn IGN OFF.
2. Remove right rear turn signal bulb.
3. Inspect bulb.
4. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal K2 and ground.
5. Is continuity present?
   a. **Yes.** Repair short to ground in right rear turn signal power circuit (BE/BN) wire.
   b. **No.** Replace BCM.

HEADLAMP DIAGNOSTICS 5.7

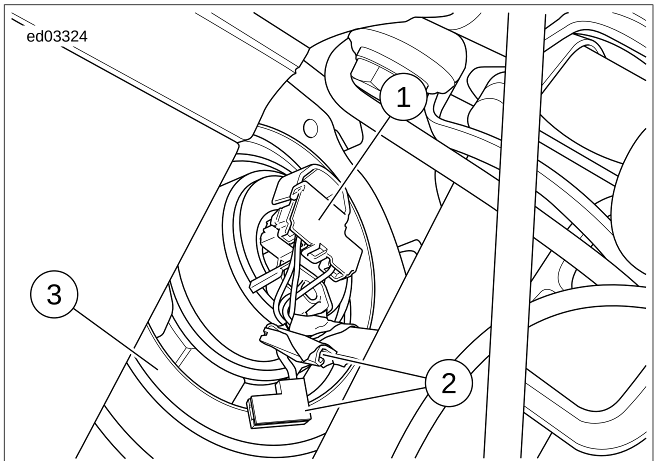
DESCRIPTION AND OPERATION

See Figure 5-14. The headlamp switch activates either the high beam or the low beam headlamps. When the ignition is turned ON, the BCM defaults to the low beam position. Pressing the upper part of the switch toggles to the high beam headlamp and the lower part of the switch toggles to the low beam headlamp.

- In the low position, the BCM supplies power to illuminate the low beam headlamp.
- Push the low position again, the BCM supplies power to the high beam headlamp to provided a flash to pass feature.
- In the high position, BCM supplies power to the high beam headlamp and sends a message to the speedometer over the CAN bus to illuminate the high beam indicator.

Table 5-21. Code Description

DTC	DESCRIPTION
B2132	High beam output shorted high
B2133	High beam output shorted low
B2134	High beam output overloaded
B2137	Low beam output shorted high
B2138	Low beam output shorted low
B2139	Low beam output overloaded



1. **Headlamp connector**
2. **Position lamp connector**
3. **Headlamp housing**

Figure 5-14. Behind Headlamp

Conditions for Setting

The headlamp DTCs may require either the high or low beam headlamp be activated in order to set the DTC. Toggle back and forth between the high and low beam headlamp positions to check DTCs on both circuits.

DTC B2134 or B2139 will set if the corresponding headlamp circuit draws more than 12 Amps.

Diagnostic Tips

If the headlamp cannot be switched from one position to the other with no codes, it could be an open switch causing the problem. See 5.9 SWITCH DIAGNOSTICS.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

HOME

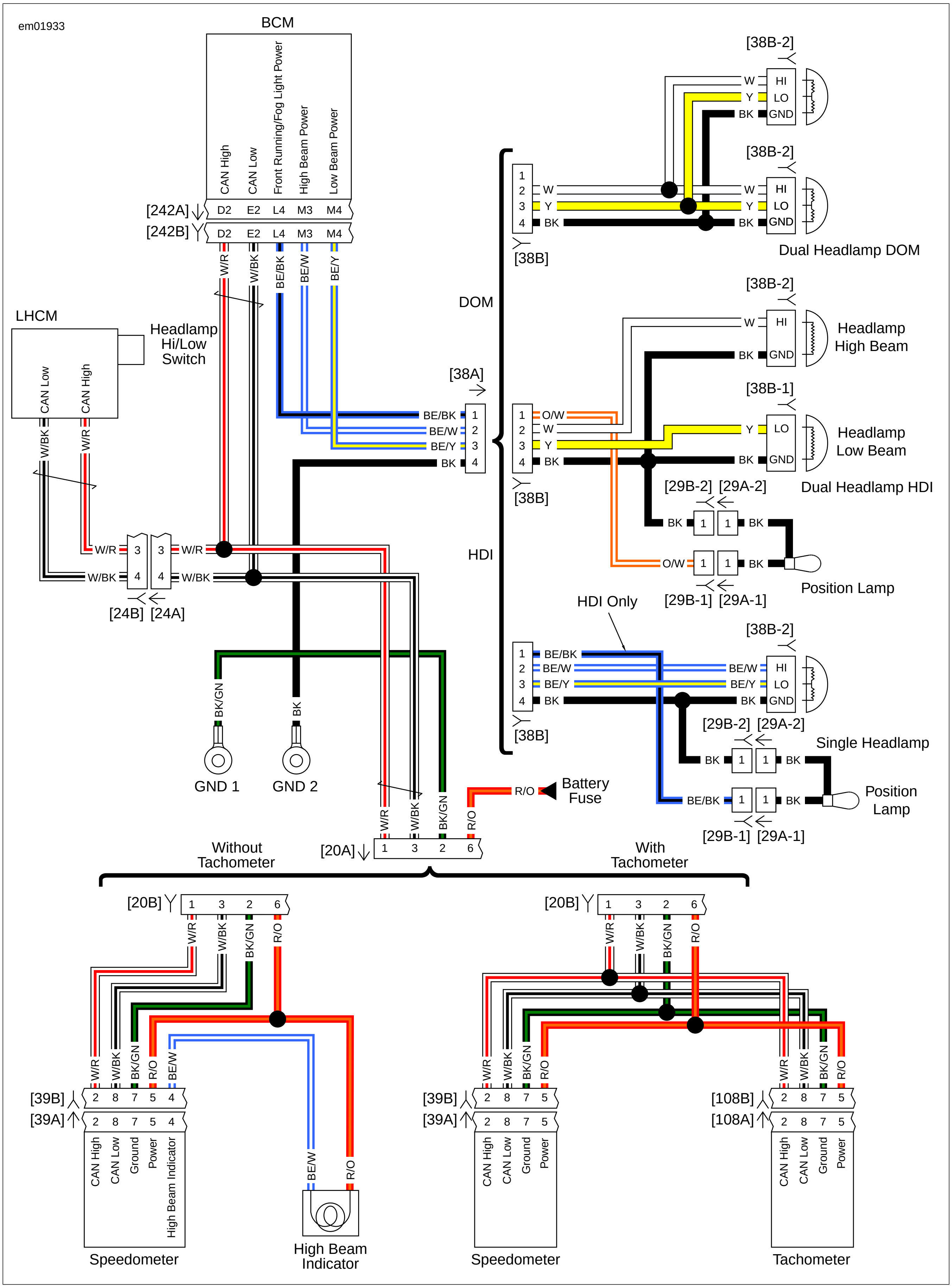


Figure 5-15. Headlamp

DTC B2132

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL

Table 5-22. DTC B2132 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in headlamp high beam circuit

1. Headlamp Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Using 1.5 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50424), remove terminal M3 from [242B].
4. Connect [242].
5. Turn IGN ON.
6. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between extracted terminal M3 and ground.
7. Is voltage present?
   a. **Yes.** Repair short to voltage in (BE/W) wire.
   b. **No.** Go to Test 2.

2. DTC Test

1. Install terminal M3 from [242B].
2. Connect [242].
3. Clear DTCs.
4. Turn IGN ON.
5. Observe headlamp in high and low beam positions.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Condition is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

DTC B2133, B2134

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-23. DTC B2133, B2134 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in high beam headlamp circuit
Accessory lighting overloading circuit
Headlamp malfunction

1. High Beam Headlamp Circuit Test

1. Turn IGN OFF.
2. Disconnect headlamp [38-2].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal M3 and ground.
6. Is continuity present?
   a. **Yes.** Repair short to ground in (W) or (BE/W) wire.
   b. **No.** Go to Test 2.

2. DTC Test

1. Connect [242].
2. Clear DTCs.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Replace headlamp.

DTC B2137

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL

Table 5-24. DTC B2137 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in headlamp low beam circuit

1. Headlamp Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Using 1.5 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50424), remove terminal (M4) from [242B].
4. Connect BCM [242].
5. Turn IGN ON.
6. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between removed terminal (M4) and ground.
7. Is voltage present?
   a. **Yes.** Repair short to voltage in (BE/Y) wire.
   b. **No.** Go to Test 2.

2. DTC Test

1. Install terminal M4 from [242B].
2. Connect [242].
3. Clear DTCs.
4. Turn IGN ON.
5. Observe headlamp in high and low beam positions.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Condition is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

DTC B2138, B2139

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-25. DTC B2138, B2139 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in low beam headlamp circuit
Accessory lighting overloading circuit
Headlamp malfunction

1. Low Beam Headlamp Circuit Test

1. Turn IGN OFF.
2. Disconnect headlamp [38-2].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal (M4) and ground.
6. Is continuity present?
   a. **Yes.** Repair short to ground in (Y) or (BE/Y) wire.
   b. **No.** Go to Test 2.

2. DTC Test

1. Connect [242].
2. Clear DTCs.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Replace headlamp.

HIGH BEAM HEADLAMP INOPERATIVE

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-26. High Beam Headlamp Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open in high beam ground circuit
Open in high beam power circuit
Headlamp malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Inspect headlamp.
3. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace headlamp.

2. Headlamp Test

1. Turn IGN ON.
2. Observe headlamp in high and low beam positions.
3. Is headlamp only inoperative in high beam position?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 3.

3. Ground Circuit Open Test

1. Disconnect headlamp [38-2].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [38B-2] terminal GND and ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace headlamp.
   b. **No.** Repair open in (BK) ground wire.

4. Power Circuit Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Disconnect headlamp [38-2].
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal M3 and [38-2] high beam terminal (W) wire.
6. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (W) or (BE/W) wire between BCM and headlamp.

5. BCM Test

1. Connect [38-2].
2. Turn IGN ON.
3. Jumper BOB terminal M2 to M3.
4. Does high beam headlamp illuminate?
   a. **Yes.** Replace BCM.
   b. **No.** Replace headlamp.

LOW BEAM HEADLAMP INOPERATIVE

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-27. Low Beam Headlamp Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open in low beam ground circuit
Open in low beam power circuit
Headlamp malfunction

1. Headlamp Test

1. Observe headlamp in high and low beam positions.
2. Is headlamp only inoperative in low beam position?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 2.

2. Ground Circuit Open Test

1. Turn IGN OFF.
2. Disconnect headlamp [38-2].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [38B-2] terminal GND and ground.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace headlamp.
   b. **No.** Repair open in (BK) ground wire.

3. Power Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.

3. Disconnect the headlamp [38-2].
4. Test resistance between BOB terminal M4 and [38-2] low beam terminal (Y) wire.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (Y) or (BE/Y) wire between BCM and headlamp.

4. BCM Test

1. Connect headlamp [38-2].
2. Turn IGN ON.
3. Jumper BOB terminal M2 to M4.
4. Does low beam headlamp illuminate?
   a. **Yes.** Replace BCM.
   b. **No.** Replace headlamp.

STOP LAMP DIAGNOSTICS 5.8

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

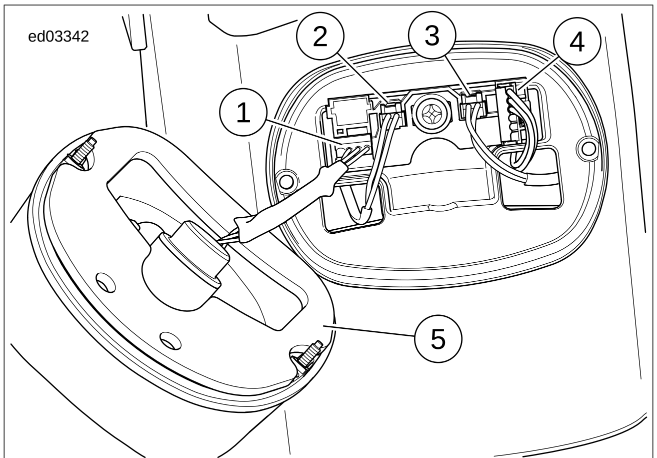
See Figure 5-16 and Figure 5-17. The BCM controls the stop lamp based off inputs from the front and rear stop lamp switches. The front stop lamp switch is a mechanical switch. When the front brake lever is applied, the lever presses a mechanical switch and closes the contacts on the switch. The front stop lamp switch is part of the RHCM. When the switch is pressed, the RHCM sends a message to the BCM over the CAN bus and the BCM supplies power to the stop lamp.

The rear stop lamp switch is a pressure switch. When the rear brake is applied, it generates pressure in the brake fluid. This pressure in the fluid closes the contacts for the rear stop lamp switch. The BCM supplies power to the rear stop lamp switch. When the rear stop lamp switch is closed, it grounds the circuit from the BCM. This signals the BCM to supply power to the stop lamp.

Some models have no center brake lamp. Instead the turn signals are used for stop, turn and tail lamp functions. If DTCs B2161, B2163, B2164 set on a model with no center brake lamp, it means the vehicle is improperly configured. Use DIGITAL TECHNICIAN II (Part No. HD-48650) to configure properly.

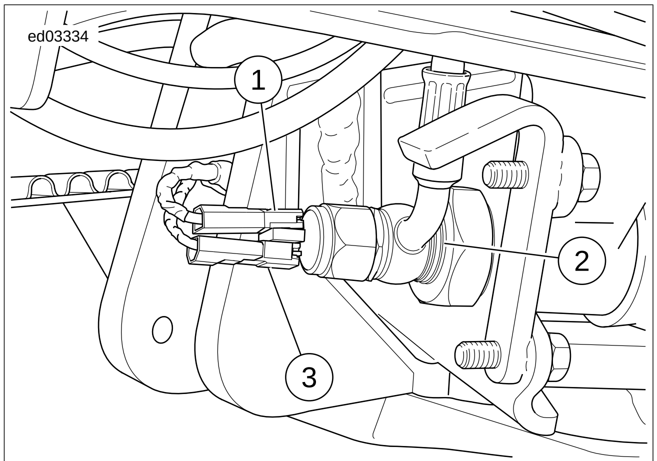
Table 5-28. Code Description

DTC	DESCRIPTION
B2161	Brake lamp output open
B2163	Brake lamp output shorted low
B2164	Brake lamp output overloaded
B2223	Rear brake switch shorted low (light on)



1. **Tail lamp [93]**
2. **Left rear turn signal [19]**
3. **Right rear turn signal [18]**
4. **Tail lamp power in [94]**
5. **Tail lamp**

Figure 5-16. Tail Lamp: With Circuit Board (Non-LED)



1. **Rear brake switch [121A]**
2. **Rear brake line**
3. **Rear brake switch [121B]**

Figure 5-17. Rear Brake Switch

Conditions for Setting

The brake lamp circuit needs to see activation to set DTCs. Apply the front and rear brakes to verify brake lamp DTCs do not return.

- DTC B2161 is set when the stop lamp circuit current draw is less than 120 milliamps.
- DTC B2164 is set when the stop lamp circuit current draw is above 4 Amps.
- DTC B2223 is set when the brake switch input circuit is grounded for 120 seconds and the vehicle speed is above 45 mph (72 km/h).

The brake switch is normally open and supplies a path to ground when closed. In order to set a shorted brake switch code, the vehicle needs to be operated over 30 mph (48 km/h) for at least two minutes. DTC B2161 will only set when all loads on the circuit are inoperable.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

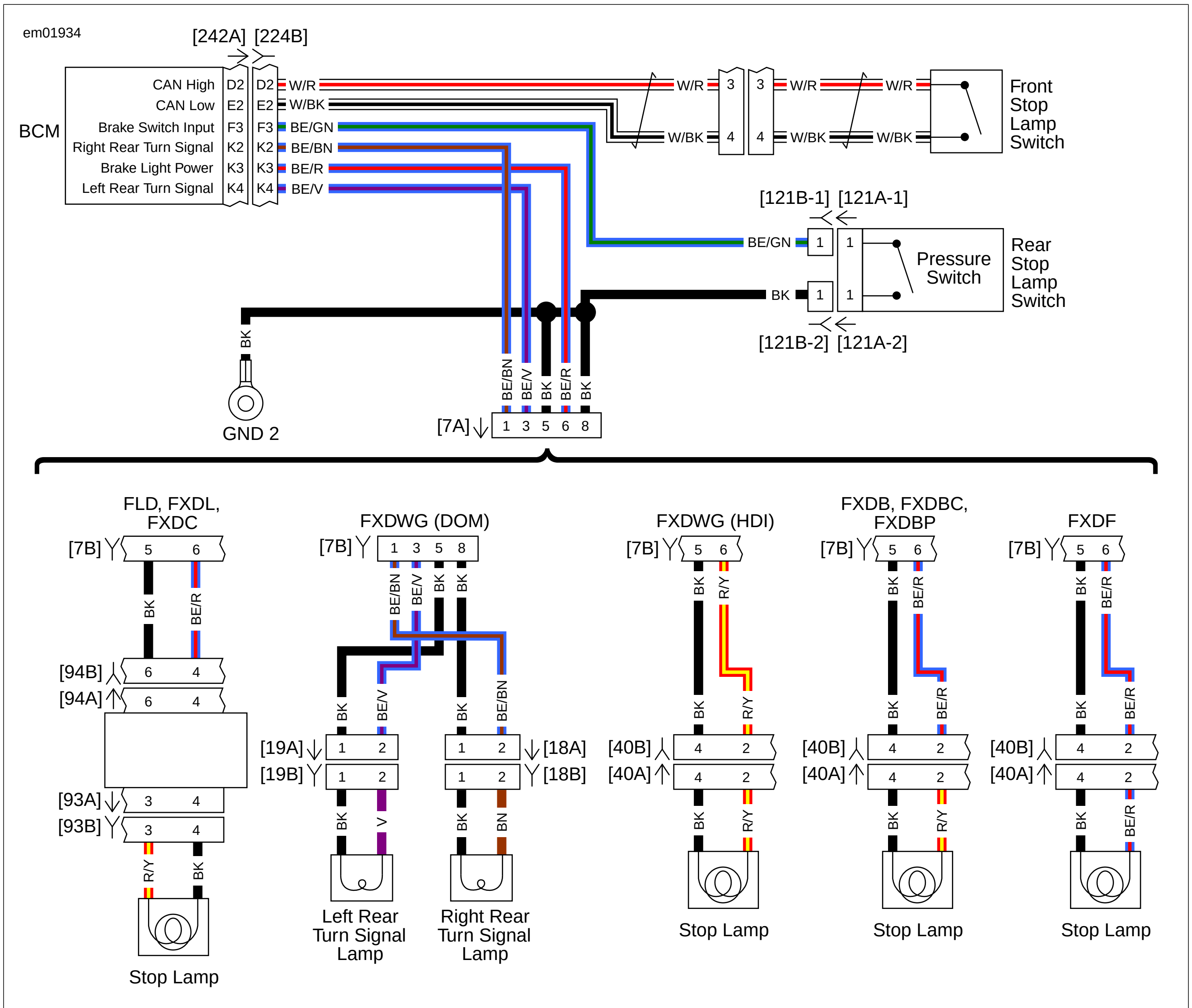


Figure 5-18. Stop/Tail Lamps

STOP LAMP ALWAYS ON: DTC B2223

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL

Table 5-29. Stop Lamp Always On, DTC B2223 Diagnostic Faults

POSSIBLE CAUSES
Brake switch malfunction
Short to voltage on stop lamp output circuit

1. Brake Switch Test

1. Turn IGN OFF.
2. Disconnect rear brake switch [121-1] (BE/GN) wire.
3. Turn IGN ON.
4. Does stop lamp go out?
   a. **Yes.** Replace rear brake switch.
   b. **No.** Go to Test 2.

2. Brake Switch Input Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.

4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal F3 and ground.
5. Is continuity present?
   a. **Yes.** Repair short to ground between [242B] and [121B-1] (BE/GN) wire.
   b. **No.** Go to Test 3.

3. Stop Lamp Power Test

1. Using 0.6 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50423), remove terminal K3 from [242B] (BE/R) wire.
2. Connect [242A].
3. Turn IGN ON.
4. Is stop lamp on?
   a. **Yes.** Repair short to voltage on stop lamp power circuit.
   b. **No.** Go to Test 4.

4. DTC Test

1. Remove BOB.
2. Insert terminal K3 into [242B] (BE/R) wire.
3. Connect [242].
4. Clear DTCs.
5. Operate system in the conditions for setting DTCs.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

DTC B2161

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-30. DTC B2161 Diagnostic Faults

POSSIBLE CAUSES
Open in brake lamp ground circuit
Open in brake lamp power circuit
Bulb malfunction

1. Stop Lamp Test

1. Turn IGN OFF.
2. Inspect stop lamp bulb.
3. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb.

2. Ground Circuit Open Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between stop lamp socket ground and ground.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK) ground circuit.

3. Power Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A].
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Install stop lamp bulb.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper BOB terminals M2 and K3.
5. Turn IGN ON.
6. Does stop lamp illuminate?
   a. **Yes.** Replace BCM.
   b. **No.** Repair open in stop lamp power circuit.

DTC B2163, B2164

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-31. DTC B2163, B2164 Diagnostic Faults

POSSIBLE CAUSES
Accessory tail lamp overloading circuit
Short to ground in stop lamp power circuit
Bulb malfunction

1. Bulb Test

1. Turn IGN OFF.
2. Inspect bulb.
3. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb.

2. Stop Lamp Power Circuit Short to Ground Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal K3 and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground in (BE/R) wire.
   b. **No.** Replace BCM.

SWITCH DIAGNOSTICS 5.9

DESCRIPTION AND OPERATION

All of these DTCs pertain to stuck switches or an internal fault in the LHCM, RHCM or BCM. If the switches are open they will not set DTCs. In most cases, there will be symptoms depending on which switch is malfunctioning.

Table 5-32. Switch Symptoms

OPEN SWITCH	SYMPTOM
High beam	Headlamp will not toggle to high beam
Low beam	Headlamp will not toggle to low beam
Left turn signal	Left turn signals will not function, PIN cannot be entered
Right turn signal	Right turn signals will not function, PIN cannot be entered
Trip	Odometer will not cycle through different settings
Front brake	Stop lamp will not function with brake lever pulled in
Clutch	Vehicle will not start unless in neutral
Horn	Horn will not sound
Hazard	Hazard lamps will not function
Start switch	Vehicle will not start (nothing clicks)
Engine stop switch	Vehicle will not start (nothing clicks)

Table 5-33. Code Description

DTC	DESCRIPTION
B1103	LHCM internal error
B1153	RHCM internal error
B2210	Engine stop switch inputs both open
B2212	Engine stop switch inputs both closed
B2250	Clutch switch stuck
B2251	Horn switch stuck
B2253	FTP switch stuck
B2254	Left turn switch stuck
B2260	Start switch stuck
B2261	Right turn switch stuck
B2262	Front brake switch stuck
B2263	Hazard switch stuck
B2270	BCM internal error

Conditions for Setting

If any of the switches are held or stuck for over 2 minutes with the IGN ON, the stuck switch code will set for that switch. The engine stop is either in the run or the stop position. If the RHCM does not see either input or both inputs at the same time, DTC B2210 or B2212 will set.

For DTC B2262 or B2250 to be set, the vehicle has to be in operation for more than 2 minutes at speed above 30 mph (48 km/h). Historic codes may indicate the rider continually applies the brake or clutch. For example, coasting downhill with the clutch lever pulled in for more than 2 minutes will set codes.

Diagnostic Tips

Clear the DTCs and operate the vehicle to verify the DTCs are current. Stuck switch codes will take over two minutes to set.

DTC B1103, B1153

Table 5-34. DTC B1103, B1153 Diagnostic Faults

POSSIBLE CAUSES
Open in hand control module ground circuit
Open in hand control module power circuit

1. Switch Test

1. Clear DTC.
2. Turn IGN ON and wait 3 minutes.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Replace LHCM or RHCM.
   b. **No.** Condition not currently present.

DTC B2210, B2212, B2250, B2251, B2253, B2254, B2260, B2261, B2262, B2263

Table 5-35. DTC B2210, B2212, B2250, B2251, B2253, B2254, B2260, B2261, B2262, B2263 Diagnostic Faults

POSSIBLE CAUSES
Damaged switch cap

1. Switch Test

1. Operate and view designated switch.
2. Does switch operate freely and have no damage?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace switch cap.

2. DTC Test

1. Clear DTC.
2. Turn IGN ON and wait 3 minutes.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Replace LHCM or RHCM.
   b. **No.** Condition not currently present.

DTC B2270

Table 5-36. DTC B2270 Diagnostic Faults

POSSIBLE CAUSES
Open in BCM battery circuit
Open in BCM ground circuit

1. DTC Test

1. Clear DTC.
2. Turn IGN ON.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Condition not currently present.

ANY HAND CONTROL SWITCH INOPERATIVE

Table 5-37. Any Hand Control Switch Inoperative Diagnostic Faults

POSSIBLE CAUSES
Clutch switch malfunction
Brake switch malfunction

1. Switch Operation Test

1. Operate inoperative switch.
2. Does switch operate correctly?
   a. **Yes.** Condition not currently present.
   b. **No.** Replace LHCM or RHCM.

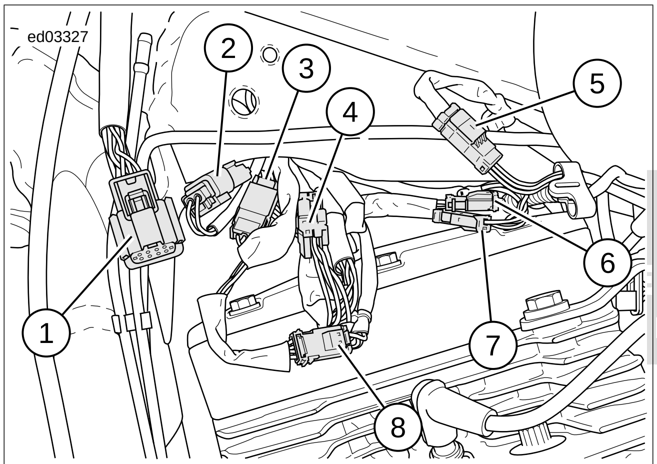
RUNNING LAMP DIAGNOSTICS 5.10

DESCRIPTION AND OPERATION

See Figure 5-19 and Figure 5-20. The running lamps consist of the front position lamp (HDI), located in the headlamp housing, the front running lamps, the license plate lamp and the tail lamp. The running lamps are powered by the BCM through terminal J3 and L4 (if equipped).

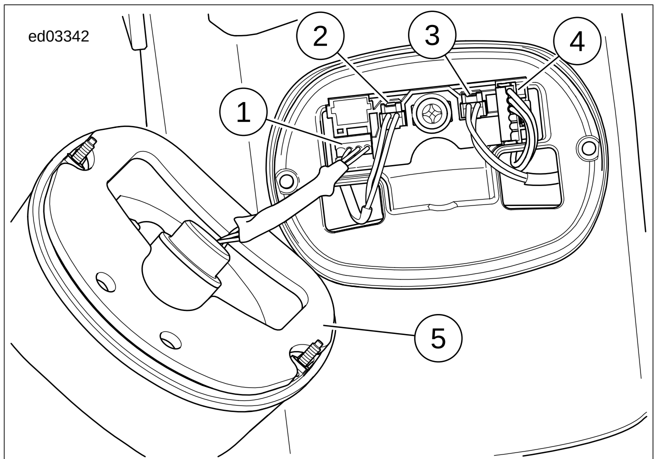
Table 5-38. Code Description

DTC	DESCRIPTION
B2106	L4 output open
B2107	L4 output shorted high
B2108	L4 output shorted low
B2109	L4 output overloaded
B2168	Running lights output shorted low
B2169	Running lights output overloaded



1. **Console gauges/instrument lamps [20]**
2. **Front WSS (ABS only) [167]**
3. **Left front turn signal [31LA]**
4. **Right front turn signal [31RA]**
5. **Fuel gauge [117]**
6. **Right hand control [22-2]**
7. **Right hand control [22-1]**
8. **Left hand control [24]**

Figure 5-19. Under Fuel Tank (IAC): Except FXDB



1. **Tail lamp [93]**
2. **Left rear turn signal [19]**
3. **Right rear turn signal [18]**
4. **Tail lamp power in [94]**
5. **Tail lamp**

Figure 5-20. Tail Lamp: With Circuit Board (Non-LED)

Conditions for Setting

The running lamps circuit powers up when the ignition is turned on. On HDI models, the running lamp circuit is also powered in the ACC position. Any running lamp related DTCs will set shortly after the ignition is turned on.

- DTC B2106 will set if the running lights circuit current is below 120 milliamps. This will happen if all lights on the circuit are open.
- DTC B2109 will set if the switched power output circuit current is above 10 Amps.
- DTC B2169 will set if the running lights circuit current is above 3 Amps.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

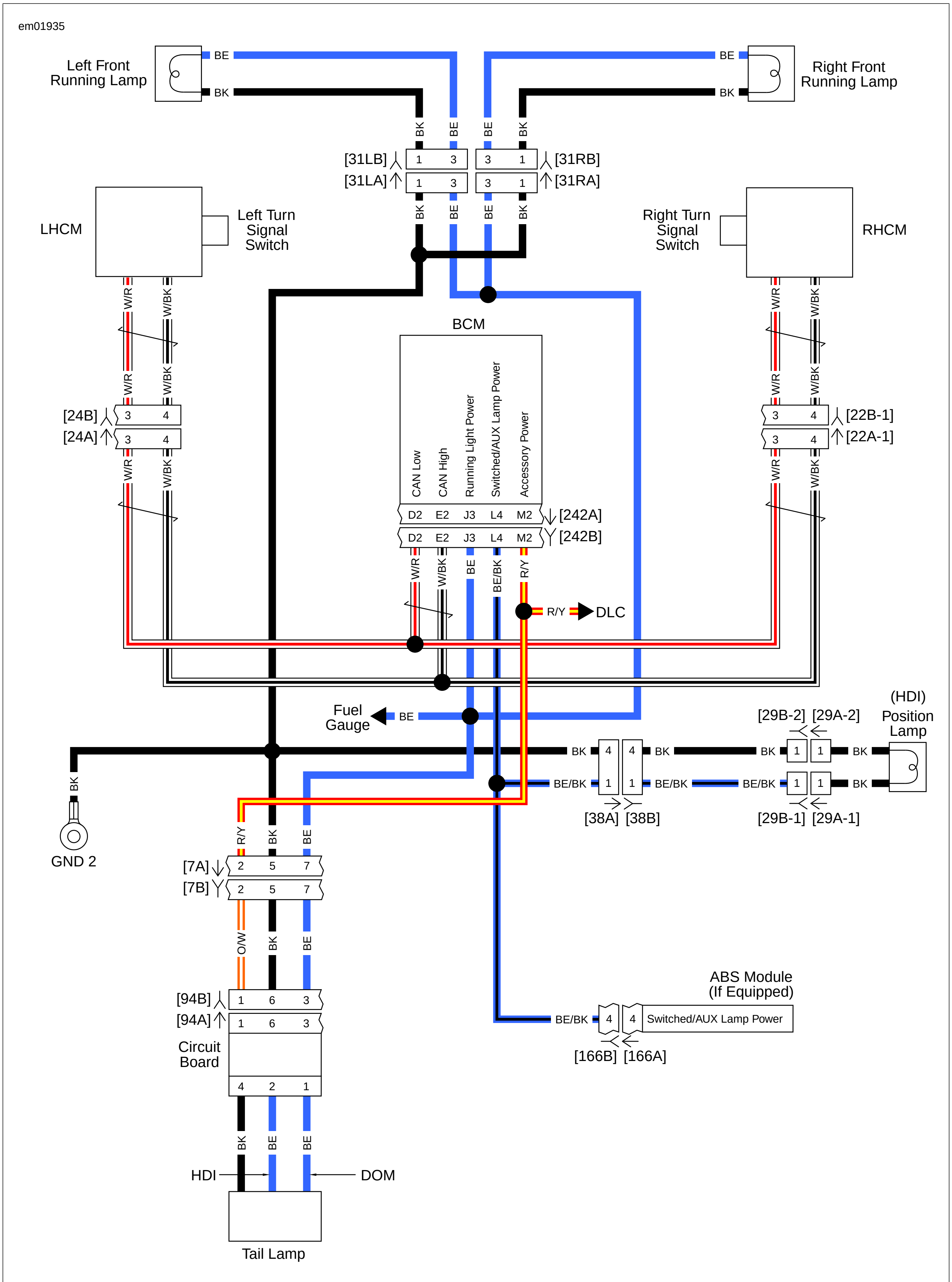


Figure 5-21. Running Lamps: FLD, FXDL, FXDC

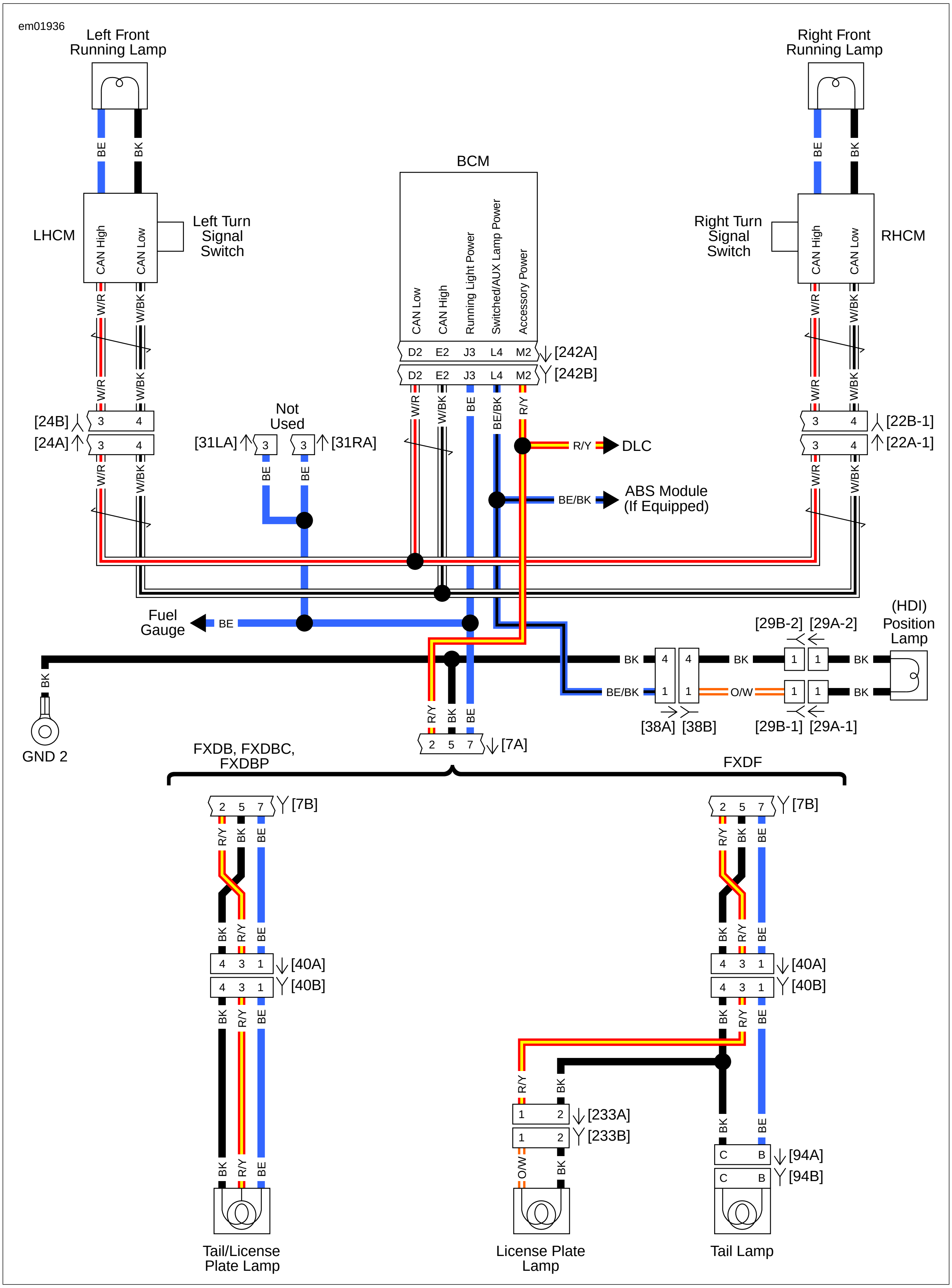


Figure 5-22. Running Lamps: FXDB, FXDBC, FXDBP, FXDF

HOME

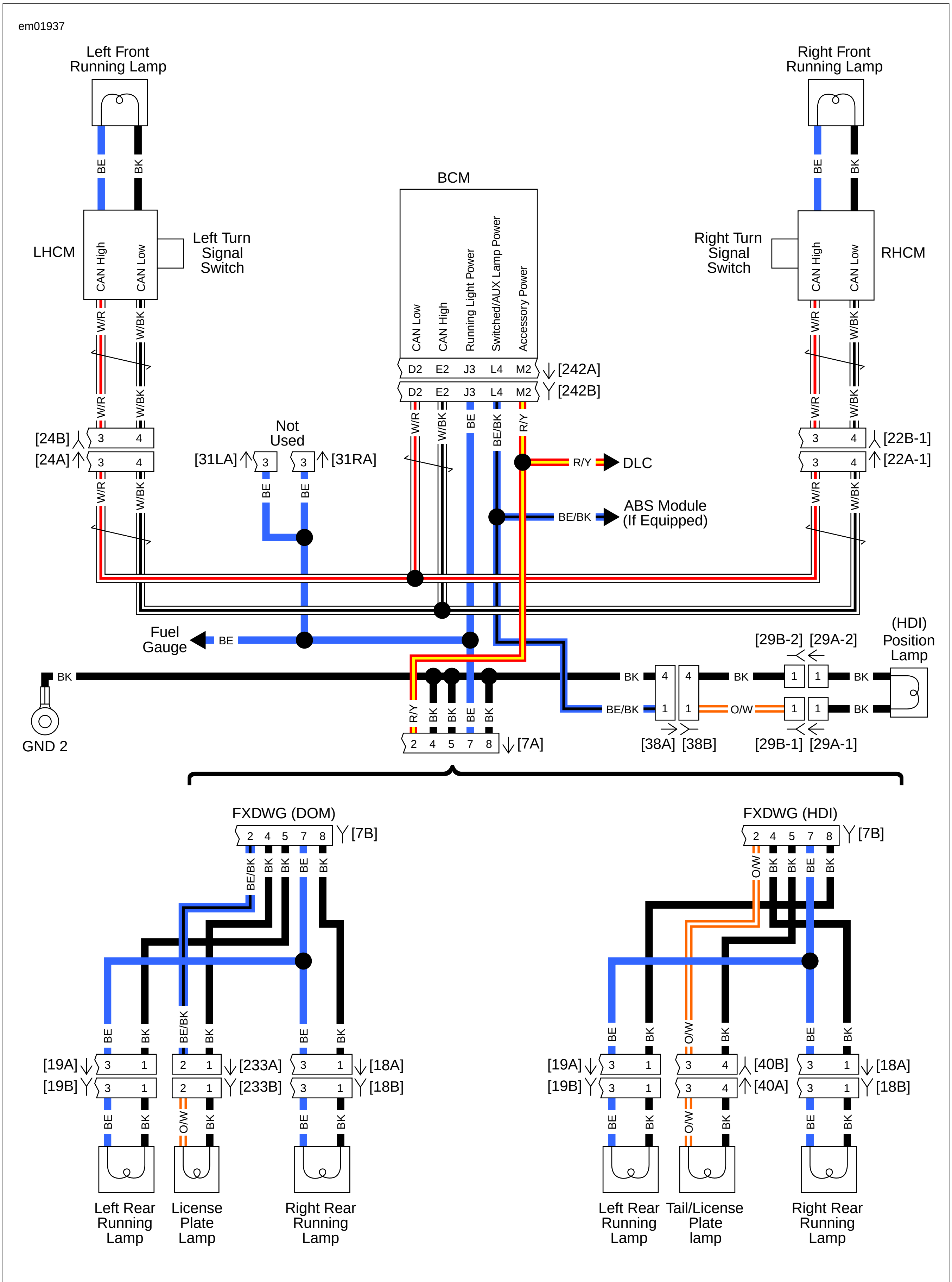


Figure 5-23. Running Lamps: FXDWG

FRONT RUNNING LAMPS INOPERATIVE

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-39. Front Running Lamps Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open running lights circuit
Lamp malfunction
Open ground circuit

NOTE

This test refers to U.S. running lamps integrated with the front turn signals.

1. Domestic Running Lamp Configuration Test

1. Inspect front running lamps.
2. Are running lamps wired directly to the LHCM and RHCM?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 3.

2. Bulb Test

1. Inspect inoperative bulb and socket.
2. Is bulb and socket good?
   a. **Yes.** Replace LHCM or RHCM for the inoperative lamp. **(6165) or (6166)**
   b. **No.** Replace bulb. **(6796)**

3. Running Lamp Test

1. Inspect inoperative bulb.
2. Is bulb good?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace bulb. **(6796)**

4. Ground Circuit Test

1. Turn IGN OFF.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between running lamp bulb socket ground and ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Repair open in running lamp power circuit (BE) wire. **(5041)**
   b. **No.** Repair open in (BK) ground circuit. **(5041)**

REAR RUNNING LAMPS INOPERATIVE

Table 5-40. Rear Running Lamps Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open running lights circuit
Lamp malfunction
Open ground circuit

1. Bulb Test

1. Inspect the inoperative bulb.
2. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb. **(6796)**

2. Ground Circuit Test

1. Turn IGN OFF.
2. Test resistance between the tail lamp bulb socket terminal ground and battery ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Repair open in running lamp power circuit. **(5041)**
   b. **No.** Repair open in ground circuit (BK) wire. **(5041)**

LICENSE PLATE LAMP INOPERATIVE: FXDWG (WITHOUT CENTER STOP LAMP)

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-41. License Plate Lamp Inoperative Diagnostic Faults: FXDWG (without Center Stop Lamp)

POSSIBLE CAUSES
Open running lights circuit
Lamp malfunction
Open ground circuit

1. Bulb Test

1. Inspect inoperative bulb.
2. Is bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace bulb. **(6796)**

2. Running Lamps Configuration Test

1. Inspect rear running lamps.
2. Do rear turn signals also function as the brake lamps?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 3.

3. Ground Circuit Test

1. Turn IGN OFF.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between the tail lamp bulb socket terminal ground and ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Repair open in running lamp power circuit. **(5041)**
   b. **No.** Repair open in ground circuit (BK) wire. **(5041)**

4. License Plate Lamps Power Test

1. Disconnect rear lighting [7].
2. Turn IGN ON.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage [7A] terminal 2 and ground.
4. Is battery voltage present?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (R/Y) wire. **(5041)**

5. License Plate Lamp Ground Circuit Test

1. Turn IGN OFF.
2. Test resistance between [7A] terminal 5 and ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace rear lighting harness. **(6823)**
   b. **No.** Repair open in (BK) ground circuit. **(5041)**

LICENSE PLATE LAMP INOPERATIVE: EXCEPT FXDWG (WITHOUT CENTER STOP LAMP)

Table 5-42. License Plate Lamp Inoperative Diagnostic Faults: Except FXDWG (without Center Stop Lamp)

POSSIBLE CAUSES
Open running lights circuit
Lamp malfunction
Open ground circuit

1. Bulb Test

1. Inspect the license plate lamp.
2. Is the bulb good?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace the bulb. **(6796)**

2. Ground Circuit Test

1. Turn IGN OFF.
2. Test resistance between the license plate lamp bulb socket terminal ground and battery ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Repair open in running lamp power circuit. **(5041)**
   b. **No.** Repair open in ground circuit (BK) wire. **(5041)**

DTC B2106, B2107

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL

Table 5-43. DTC B2106, B2107 Diagnostic Faults

POSSIBLE CAUSES
Short to power in front position/running circuit

1. Position Lamp Circuit Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Using 1.5 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50424), remove terminal L4 from [242B].
4. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
5. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
6. Turn IGN ON.
7. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between extracted terminal L4 and ground.
8. Is voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 3.

2. ABS ECU Test

1. Turn IGN OFF.
2. Disconnect ABS ECU [166].
3. Turn IGN ON.
4. Test voltage between extracted terminal L4 and ground.
5. Is voltage present?
   a. **Yes.** Repair short to voltage in the front position/running circuit.
   b. **No.** Replace ABS module.

3. DTC Test

1. Connect [242].

2. Clear DTC.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Condition not currently present.

DTC B2108, B2109

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-44. DTC B2108, B2109 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in front position/running circuit
High current in front position/running circuit
Accessory lighting overloading circuit

1. Position Lamp Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect the position lamp.
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal L4 and ground.
6. Is resistance less than 500 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 3.

2. ABS ECU Test

1. Disconnect ABS ECU [166].
2. Test resistance between BOB terminal L4 and ground.
3. Is resistance less than 500 ohms?
   a. **Yes.** Repair short to ground in (BE/BK) wire.
   b. **No.** Replace ABS ECU.

3. DTC Test

1. Connect [242].
2. Clear DTC.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Condition not currently present.

RUNNING LAMPS INOPERATIVE (DOMESTIC ONLY)

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-45. Running Lamps Inoperative Diagnostic Faults (Domestic Only)

POSSIBLE CAUSES
Open in running lights ground circuit
Open in runnings lights power circuit
Incorrect configuration (HDI only)

1. Running Lamp Operation Test

1. Verify tail lamp/license plate lamp, fuel gauge and fork mounted front running lamps are operational.
2. Are all lights on?
   a. **Yes.** Replace BCM.
   b. **No, some of the lights are on.** Go to Test 3.
   c. **No, all lights are inoperative: FXD/B/WG.** Go to Test 2.
   d. **No, all lights are inoperative: FLD/FXD/C/L/F.** Go to Test 5.

2. Running Lamps Circuit Test

1. Disconnect rear lighting harness [7].
2. Turn IGN ON.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [7A] terminal 7 and ground.
4. Is battery voltage present?
   a. **Yes.** Replace BCM.
   b. **No.** Repair open in (BE) wire.

3. Bulb Test

1. Inspect inoperative bulb.
2. Is bulb good and the correct bulb?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace bulb.

4. Running Lamp Open Circuit Test

1. Turn IGN OFF.

2. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.2 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Test resistance between BOB terminal J3 and inoperative running lamp power circuit.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace bulb and socket.
   b. **No.** Repair open in running lamp circuit between inoperative lamp and [242] terminal J3.

5. Running Lamps Circuit Test

1. Disconnect left rear stop/tail/turn harness [19].
2. Turn IGN ON.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [19A] terminal 1 and ground.
4. Is battery voltage present?
   a. **Yes.** Replace BCM.
   b. **No.** Repair open in (BE) wire.

DTC B2168, B2169

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-46. DTC B2168, B2169 Diagnostic Faults

POSSIBLE CAUSES
Running lights circuit resistance too low
Short to ground in running lights power circuit
Accessory lighting overloading circuit

1. Rear Running Lamps Circuit Test

1. Turn IGN OFF.
2. Disconnect rear running lamps [7].
3. Clear DTC.
4. Cycle IGN OFF-ON.
5. Did DTC return?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair short to ground or high current draw in rear lighting harness in the running lamp power circuits.

2. Ground Circuit Open Test

1. Turn IGN OFF.
2. Disconnect the fuel gauge [117].
3. Clear DTC.
4. Cycle IGN OFF-ON.
5. Did DTC return?
   a. **Yes, the front running lamps are wired to hand control modules.** Go to Test 4.
   b. **Yes, the front running lamps are not wired to hand control modules.** Go to Test 3.
   c. **No.** Replace fuel gauge.

3. Front Running Lamp Circuit Test

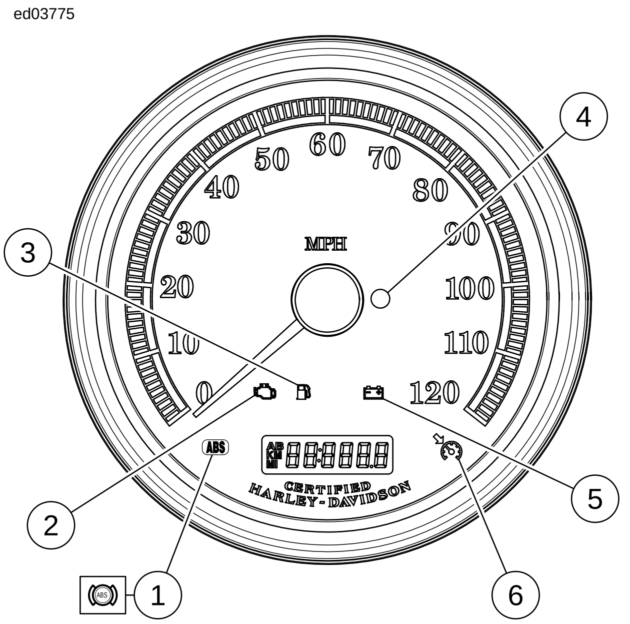
1. Turn IGN OFF.
2. Disconnect front turn signal [31L] and [31R].
3. Clear DTC.
4. Turn IGN ON.
5. Did DTC return?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair short to ground in front running lamps harness.

4. BCM Test

1. Turn IGN OFF.
2. Connect the BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test for continuity between BOB terminal (J3) and ground.
5. Is continuity present?
   a. **Yes.** Repair short to ground in (BE) wire.
   b. **No.** Replace BCM.

SECURITY LAMP

See Figure 5-24. The security lamp indicates system status. Refer to Table 5-47.



1. **ABS icon lamp (km/h ABS icon lamp also shown)**
2. **Check engine lamp**
3. **Low fuel lamp**
4. **Security lamp**
5. **Low battery**
6. **Cruise enabled lamp (not used)**

Figure 5-24. Indicator Lamps

Table 5-47. Security Lamp Status

LAMP	MODE
Does not flash.	Security system not armed.
Flashes every second.	Two minute timeout after failed PIN entry attempt or a battery reconnect has occurred while armed.
Flashes every 2.5 seconds.	Security system armed.
Flashes four times a second.	PIN entry mode.
Stays on solid with IGN OFF.	Arming is starting up. You have five seconds before system is armed.
Stays on solid with IGN ON.	If solid for more than four seconds after IGN ON, a current DTC is present.

SECURITY IMMOBILIZATION

NOTE

Always disarm the vehicle by turning the IGN ON with the fob present before removing or disconnecting the battery. This prevents the siren (if installed) from activating.

If the vehicle is equipped with the security system, the functionality is provided by a security BCM. The BCM will disable the starter and ignition system. Additional functions include the ability to alternately flash the left and right turn signals and sound a siren (if equipped) if a theft attempt is detected.

NOTE

The siren must be in the chirp mode for the siren to chirp on arming or disarming. See 5.13 SIREN, Siren Chirp Mode Confirmation.

Conditions that trigger a security event when system is armed include:

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

SECURITY SYSTEM FEATURES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The following information applies only to vehicles equipped with the security.

- **Personal code disarming:** If the fob is not available or inoperative, the BCM allows the rider to disable the security alarm and immobilization functions with a five-digit personal code.
- **Arming confirmation:** When the security system is armed, the system provides visual feedback (confirmation) to the rider by flashing the turn signals and an audible "chirp" if equipped with the optional smart siren and chirp mode is enabled.
- **Disarming confirmation:** When the security system is disarmed, the system provides an audible "chirp" (confirmation) if equipped with the optional smart siren and chirp mode is enabled.
- **Transport mode:** It is possible to arm the security system without enabling the motion detector for one ignition cycle.

This allows the vehicle to be moved in an immobilized state.

- **Starter/ignition disable:** When armed the starter and ignition system are disabled.
- **Security system alarm:** See 5.13 SIREN. The system will alternately flash the left and right turn signals and sound an optional Smart Siren if a vehicle security condition is detected while the system is armed.
- **Dealer service mode:** This mode allows the dealer to disable security system via DIGITAL TECHNICIAN II (Part No. HD-48650). Dealer service mode is exited when the IGN is turned ON with the assigned fob in range.

SECURITY SYSTEM WARNINGS

A warning consists of three alternate flashes of the turn signals and chirp from the optional smart siren. Warnings are issued from an armed security system in the following order:

1. **First warning:** A warning is issued whenever a person without a fob present or with the system armed attempts to move the vehicle or turns the ignition switch to **IGN.**
2. **Second warning:** If the motion continues or the ignition switch is not turned back to **OFF**, a second warning is issued within four seconds of the first.
3. **Alarm:** If the motion continues or the ignition switch is not turned to **OFF** past the second warning, the smart security system will go into full alarm.

ARMING

The H-DSSS automatically arms within 5 seconds when the vehicle is parked and the ignition switch is turned to **OFF** or **ACC** and motion is not detected.

On arming, the turn signals flash twice and the smart siren will chirp twice if chirp function is activated. While armed, the security lamp will flash once every 2.5 seconds. Refer to Table 5-47.

DISARMING

There are two ways to disarm the H-DSSS:

- Automatic disarming.
- Using the PIN.

Automatic Disarming

Always have the fob present when riding, loading, fueling, moving, parking or servicing the vehicle. The vehicle can be moved in an armed state with the fob present without triggering the alarm. The H-DSSS disarms automatically when the ignition switch is turned to ON.

On disarming, the smart siren will chirp once (if chirp function is activated) and the security lamp will turn ON solid for 4 seconds then go out. Refer to Table 5-47.

Disarming with a PIN

See 5.14 SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS to enter an initial PIN to enable the system.

If you make an error while disarming the security system using the PIN, the alarm will activate for 30 seconds after the last digit is entered. After a failed attempt, the security lamp will flash once every second for 2 minutes. **During this time, the vehicle will not accept any attempt to enter a PIN.** Refer to Table 5-48.

Table 5-48. Entering a PIN to Disarm Harley-Davidson Smart Security System

STEP NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	If necessary, verify the current 5-digit PIN.		Should be recorded on wallet card.
2	Turn ignition to **IGN**.	If armed, the odometer window display will read: ENTER PIN and the security lamp will be flashing at a fast rate. The headlight will not be on.	
3	Press and release the left turn signal switch.	In the odometer window, a flashing 1 will appear.	
4	Increment the digit by tapping the left turn signal until the odometer window displays the first digit of the PIN.	The first digit in the odometer will be the first digit in the PIN.	
5	Press **right** turn switch **one time.**	The first digit is stored and the next digit will flash.	Serves as enter key.
6	Increment the second digit using the left turn switch until the digit reaches the second digit of the PIN.	The second digit in the odometer will be the second digit in the PIN.	
7	Press right turn switch 1 time.	The second digit is stored and the next dash will flash.	Serves as enter key.
8	Increment the third digit using the left turn switch until it reaches the third digit of the PIN.	The third digit in the odometer will be the third digit in the PIN.	

Table 5-48. Entering a PIN to Disarm Harley-Davidson Smart Security System

STEP NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
9	Press **right** turn switch **one time**.	The third digit is stored and the next dash will flash.	Serves as enter key.
10	Increment the fourth digit using the left turn switch until it reaches the fourth digit of the PIN.	The fourth digit in the odometer will be the fourth digit in the PIN.	
11	Press **right** turn switch **one time.**	The fourth digit is stored and the next dash will flash.	Serves as enter key.
12	Increment the fifth digit using the left turn switch until it reaches the fifth digit of the PIN.	The fifth digit in the odometer will be the fifth digit in the PIN.	
13	Press **right** turn switch **one time**.	The fifth digit is stored. The security system indicator lamp stops blinking.	Smart Security System is disarmed.

ALARM

Activation

When the alarm system is activated:

- Turn signals alternately flash.
- Smart siren, if equipped, sounds.

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

NOTE

*Vehicle must be returned to original parked position with ignition **OFF**.*

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

The security system will repeat the alarm cycles 10 times for a total of 5 minutes, with a 10-second pause between alarm cycles.

During warnings and alarms, the starter motor and the ignition remain disabled.

Deactivation

Stop the alarm at any time by moving an assigned fob to the vehicle. The presence of the fob will terminate the alarm.

KEY FOB 5.12

DESCRIPTION AND OPERATION

See Figure 5-25. The fob's reception range for the signal depends on a specific receiver pattern. The typical range will be an arm's length.

See Figure 5-26. Replace the fob battery every year.

NOTES

- *Environmental and geographic conditions impact signal range.*
- *Always have the fob present whenever the vehicle is operated.*
- *Do not place fob in metal enclosure. Do not place it closer than 3.0 in. (80.0 mm) to cellular phones, the hands-free antenna, PDAs, displays and other electronic devices while operating the vehicle. That may prevent the fob from disarming the security system.*

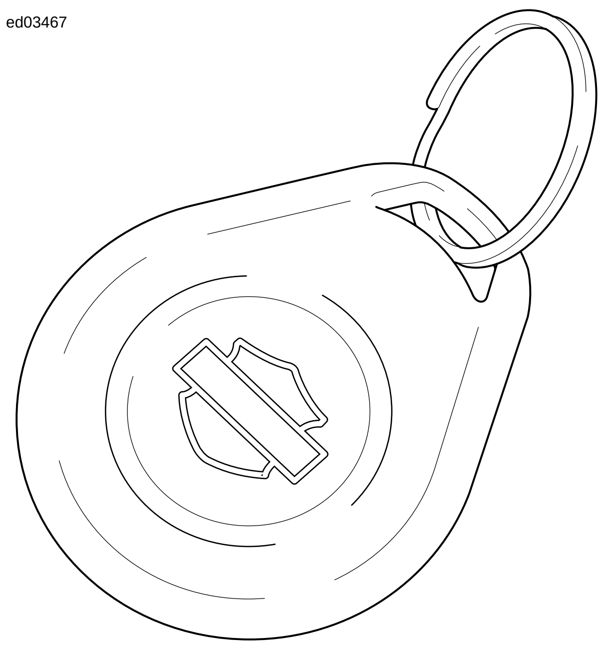
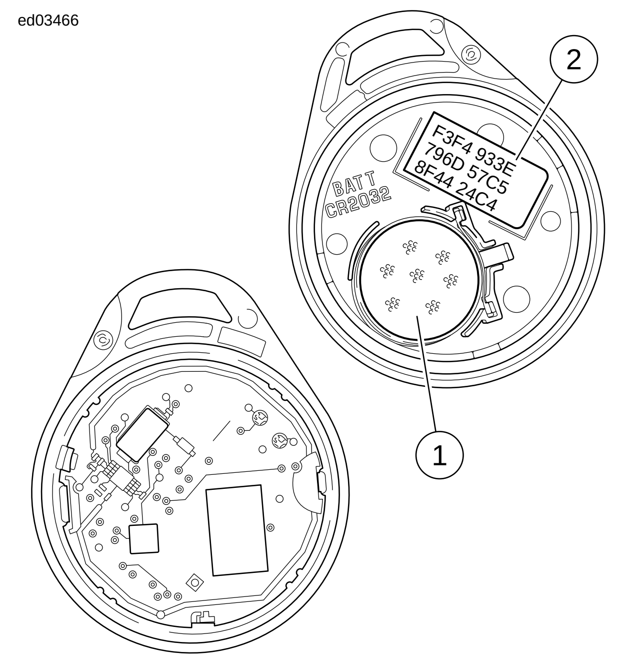


Figure 5-25. Hands-Free Fob



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

Figure 5-26. Open Fob

FOB ASSIGNMENT

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Use DIGITAL TECHNICIAN II (Part No. HD-48650) to assign both fobs to the H-DSSS. Follow the menu prompts in the DIGITAL TECHNICIAN II (Part No. HD-48650) display and scan the fob serial number with the bar code reader, or key-in the number from the keyboard.

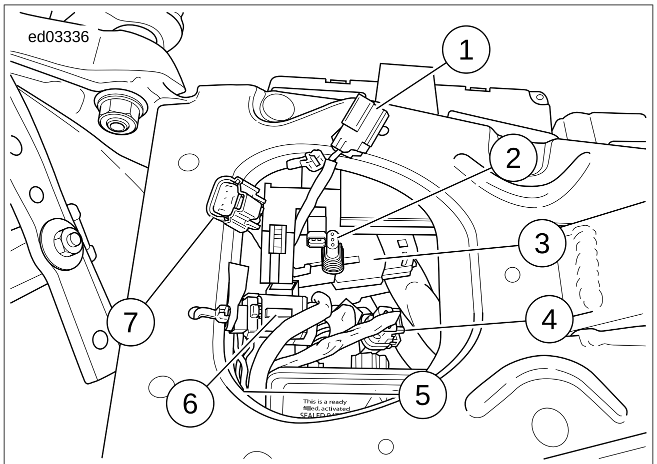
NOTE

Each fob has a unique serial number. Attach fob label to a blank NOTES page in the owner's manual for reference.

SIREN 5.13

DESCRIPTION AND OPERATION

See Figure 5-27. If equipped, the siren is attached at [142] off the BCM. Through this connector it shares the battery circuit, the ground circuit and the alarm signal circuit with the BCM. The siren adds an audible warning to the visual warnings that are a standard function of the security system.



1. **Security antenna [209]**
2. **Security siren [142]**
3. **Rear HO2S [137]**
4. **Rear WSS [168]**
5. **Grounds**
6. **Rear lighting [7]**
7. **JSS [133]**

Figure 5-27. Under the Seat

SIREN CHIRP MODE CONFIRMATION

Chirpless Mode

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

NOTE

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

Chirp Mode

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

Switching Modes

Cycling quickly through three armings and disarmings will switch chirp mode.

1. With the fob present, the IGN ON and the system disarmed, turn the IGN OFF.
2. When the security lamp turns off, immediately turn the IGN ON. If the turn signals flash twice before the IGN is turned ON, the system will drop out of the switching mode sequence and will have to be started over from the beginning.
3. Wait until the security lamp goes out, then immediately turn the IGN OFF.
4. When the security lamp turns off, immediately turn the IGN ON. If the turn signals flash twice before the IGN is turned ON, the system will drop out of the switching mode sequence and will have to be started over from the beginning.
5. Wait until the security lamp goes out, then immediately turn the IGN OFF.
6. When the security lamp turns off, immediately turn the IGN ON. If the turn signals flash twice before the IGN is turned ON, the system will drop out of the switching mode sequence and will have to be started over from the beginning.

SERVICE AND EMERGENCY FUNCTIONS AND CONFIGURATIONS 5.14

GENERAL

Setting up a vehicle's security requires a BCM that is security equipped.

ACTUATION

Actuation consists of assigning two fobs to the system and entering an initial PIN. The PIN can be changed by the owner at any time.

1. Configure vehicles by assigning **both** fobs to the vehicle.
2. Configure vehicles by entering a PIN picked by the owner. The personal code allows the owner to operate the system if the fob is lost or inoperable. Record the PIN in the owner's manual wallet card. Instruct the customer to always carry this card when riding the motorcycle.

Once the system has been activated, it will always arm within 5 seconds of turning the ignition switch to **OFF** or **ACC** and no vehicle motion.

SELECTING A PIN

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

INITIAL PIN ENTRY

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The initial PIN entry should be performed using DIGITAL TECHNICIAN II (Part No. HD-48650) in conjunction with fob assignment.

CHANGING THE PIN

To change a PIN, refer to Table 5-49.

If a PIN was previously entered, the odometer will display the equivalent digit. To increment the digits, press the left turn signal switch. The first press selects the same value and then each additional press of the left turn signal switch will increment the digit by one.

Examples:

- To advance from 5 to 6, press and release the left turn switch twice.
- To advance from 8 to 2, press and release the left turn switch four times.

Table 5-49. Changing the PIN

STEP NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Select a 5-digit (1 thru 9) PIN and record on the wallet card from owner's manual.		
2	With an assigned fob present, turn the engine stop switch to **OFF**.		
3	Turn the ignition switch to **IGN**.		
4	Cycle the OFF/RUN switch twice: **RUN - OFF - RUN - OFF - RUN**.		
5	Press **left** turn signal switch **two times**.	ENTER PIN will scroll through the odometer window.	
6	Press **right** turn signal switch **one time** and release.	Turn signals will flash three times. Current PIN will appear in odometer. The first digit will be flashing.	
7	Enter first digit of new PIN by pressing and releasing the **left** turn signal switch until the selected digit appears.		
8	Press **right** turn signal switch **one time** and release.	The new digit will replace the current in odometer window.	
9	Enter second digit of selected PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		
10	Press **right** turn signal switch **one time** and release.	The new digit will replace the current in odometer window.	

Table 5-49. Changing the PIN

STEP NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
11	Enter third digit of the selected PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		
12	Press **right** turn switch **one time** and release.	The new digit will replace the current in odometer window.	
13	Enter fourth digit of new PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		
14	Press **right** turn switch **one time** and release.	The new digit will replace the current in odometer window.	
15	Enter fifth digit of the new PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		
16	Press **right** turn switch **one time** and release.	The new digit will replace the current in odometer window.	
17	Turn the engine stop switch **OFF**, then turn the ignition switch to **OFF**.		Pushing the engine stop switch to **OFF** stores the new PIN in the module.

TRANSPORT MODE

Put the system in transport mode to transport the motorcycle. Otherwise, the alarm activated by motion detection can discharge the battery.

In the transport mode, the security system is armed without enabling the motion detector for one ignition cycle. This allows the vehicle to be picked up and moved in an armed state. Any attempt to start the engine when the fob is not within range will trigger the alarm.

To Enter Transport Mode

1. With an assigned fob within range, turn the ignition ON.
2. Before the security system lamp goes out, turn the ignition OFF.
3. Within 3 seconds, simultaneously press both the left and the right turn signal switches.
4. After the turn signals flash once, the system enters the transport mode. With the fob removed, the motorcycle can be moved without setting off the alarm.

To Exit Transport Mode

With the fob present, turn the ignition ON to disarm the system.

SERVICE MODE

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

With a fob present, the security system can be configured for service by disabling the security system with DIGITAL TECHNICIAN II (Part No. HD-48650).

Once disabled, the vehicle can be operated without an assigned fob present. To maintain the service mode, the assigned fobs must be kept out of range. If the fob appears in range, the service mode is cancelled.

FOUR-WAY FLASHER

To Arm the Security System with the Hazard Warning Flashers ON

If it is necessary to leave a vehicle parked on the side the road, the hazard warning four-way flashers can be turned ON with the smart security system armed.

1. Turn IGN ON or ACC.
2. Press the hazard warning switch. The four-way flashers will continue for two hours.
3. Turn IGN OFF to arm the smart security system.

To Disarm the Security System and Turn the Hazard Warning Flashers OFF

1. With a fob present, turn IGN to ON or ACC.
2. Press the hazard warning switch.

DESCRIPTION AND OPERATION

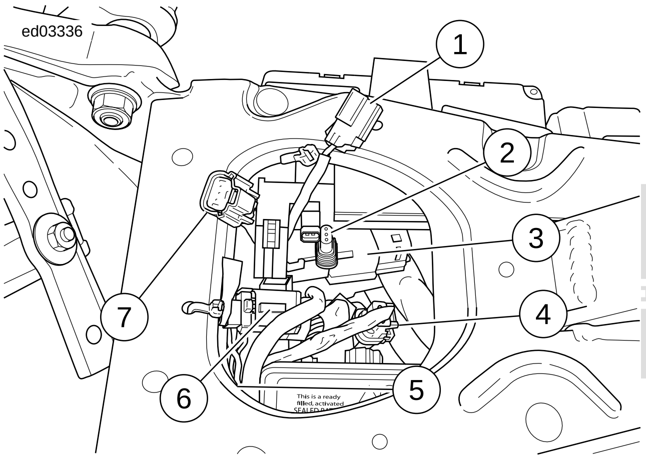
NOTE

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

See Figure 5-28. An alarm cycle is activated when the BCM is connected, the siren has been armed by the BCM and a security event occurs. See 5.11 SECURITY SYSTEM. Under normal armed operation, the siren input (terminal 2) is driven low by the BCM to trigger the audible alarm. When the siren input is driven high by the BCM the audible alarm stops.

Table 5-50. Code Description

DTC	DESCRIPTION
B2172	H2 output shorted high
B2173	H2 output shorted low



1. **Security antenna [209]**
2. **Security siren [142]**
3. **Rear HO2S [137]**
4. **Rear WSS [168]**
5. **Grounds**
6. **Rear lighting [7]**
7. **JSS [133]**

Figure 5-28. Under the Seat

Diagnostic Tips

- If the siren is armed and the internal siren battery is dead, shorted, disconnected or has been charging for a period longer than 24 hours, the siren will respond with three chirps on arming instead of two.
- The internal siren battery may not charge if the vehicle battery is less than 12.5V.
- If the siren does not chirp two or three times on a valid arming command from the BCM, the chirp function has been disabled, the siren is either not connected, not working or the siren wiring was opened or shorted while the siren was disarmed.
- If the siren enters the self-driven mode where it is powered from the siren internal 9V battery, the turn signal lamps will not alternately flash. If the BCM activates the siren, the turn signal lamps will flash. If the siren has been armed and a security event occurs, and the siren is in self-driven mode, the siren will alarm for 20-30 seconds and then turn off for 5-10 seconds. This alarm cycle will be repeated 10 times if the siren is in the self-driven mode.
- If the siren does not stop sounding after it has been armed, then either the BCM output or siren input may be shorted to ground, the siren vehicle battery connection is open or the siren vehicle ground connection is open or a security event has occurred. See 5.11 SECURITY SYSTEM for a description of alarm functions.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

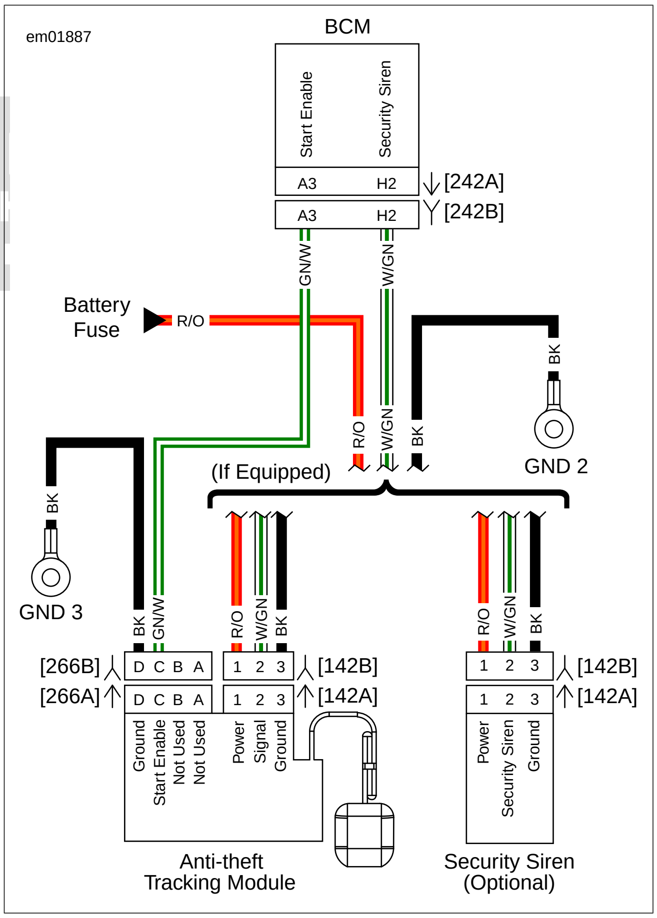


Figure 5-29. Smart Siren Circuit

DTC B2172

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-51. DTC B2172 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in alarm signal
Siren malfunction

1. Siren Circuit Short to Voltage Test

1. Disconnect siren [142] (if equipped).
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [142B] terminal 2 and ground.
3. Is battery voltage present?
   a. **Yes.** Repair short to voltage in (W/GN) wire.
   b. **No.** Go to Test 2.

2. DTC Test

1. Clear DTCs.
2. Turn IGN OFF. Verify security activates.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Replace siren.

DTC B2173

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-52. DTC B2173 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in alarm signal
Open ground circuit
Open alarm signal
Siren malfunction

1. Siren Signal Short to Ground Test

1. Disconnect security siren [142] (if equipped).
2. Turn IGN OFF.
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal H2 and ground.
6. Is continuity present?
   a. **Yes.** Repair short to ground in (W/GN) wire between [142B] and [242B].
   b. **No.** Go to Test 2.

2. DTC Test

1. Connect [242].
2. Clear DTCs.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Replace security siren.

SECURITY ANTENNA DIAGNOSTICS 5.16

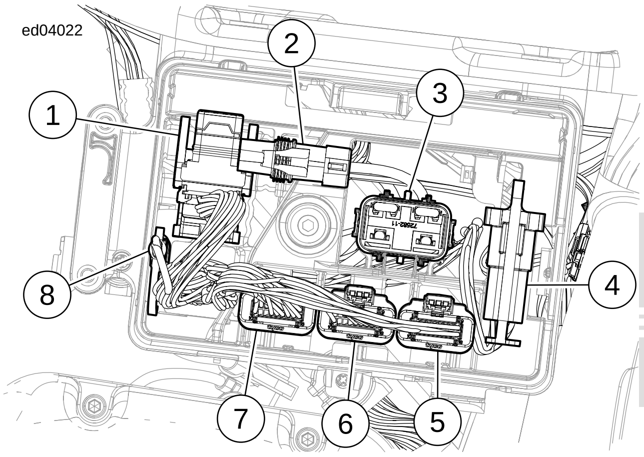
DESCRIPTION AND OPERATION

See Figure 5-30, Figure 5-31 and Figure 5-32. DTC B2176, B2177 or B2178 will set when a fault occurs to the security antenna circuit used to transmit to the fob. Refer to Table 5-53.

If the security system does not respond, responds with limited range or will not consistently disarm with fob within normal range, see 5.16 SECURITY ANTENNA DIAGNOSTICS, Fails to Disarm.

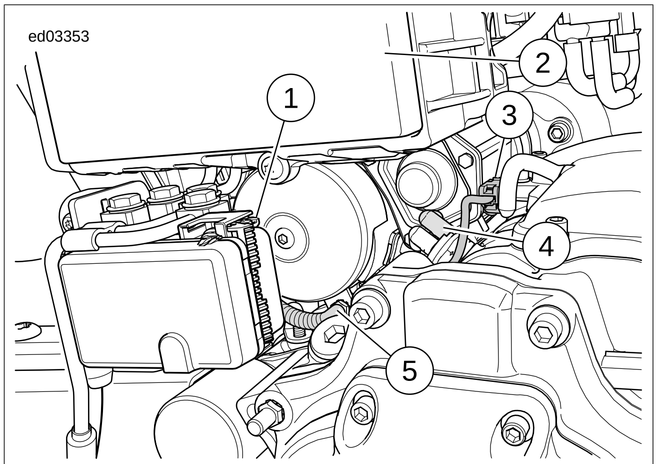
Table 5-53. Code Description

DTC	DESCRIPTION
B2176	Security antenna output open
B2177	Security antenna output shorted high
B2178	Security antenna output shorted low



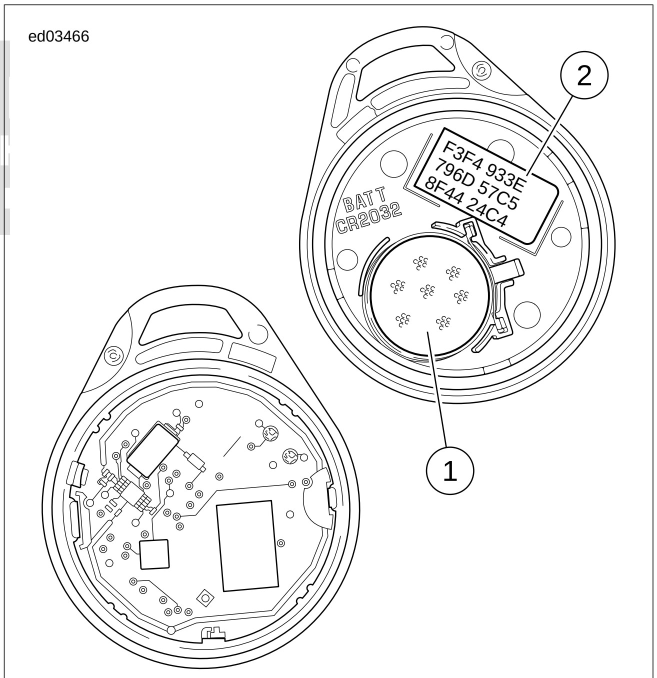
1. **BCM [242]**
2. **BCM power [259]**
3. **Fuse block [64]**
4. **DLC [91]**
5. **ECM [78-3] (BN) (if applicable)**
6. **ECM [78-2] (GY)**
7. **ECM [78-1] (BK)**
8. **Battery tender [281] (if applicable)**

Figure 5-30. Under Left Side Cover



1. **ECU [166]**
2. **Battery**
3. **Starter solenoid [128]**
4. **Neutral switch [131]**
5. **Ground**

Figure 5-31. Under Seat



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

Figure 5-32. Open Fob

Conditions for Setting

The BCM will recognize the faults with IGN ON.

Diagnostic Tips

- Verify that cell phone is not within 3.0 in (80.0 mm) of key fob.
- Interference from physical surroundings impacts RF transmission. Place fob next to vehicle or move vehicle to a new location and retest.
- Verify that antenna is in OE location. Make sure that seat has not been replaced with a metal base seat.
- Check for damage to antenna wire.
- Verify fob battery voltage is at least 2.9V.
- Fob serial number is located inside fob. Twist thin blade in thumbnail slot to open.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

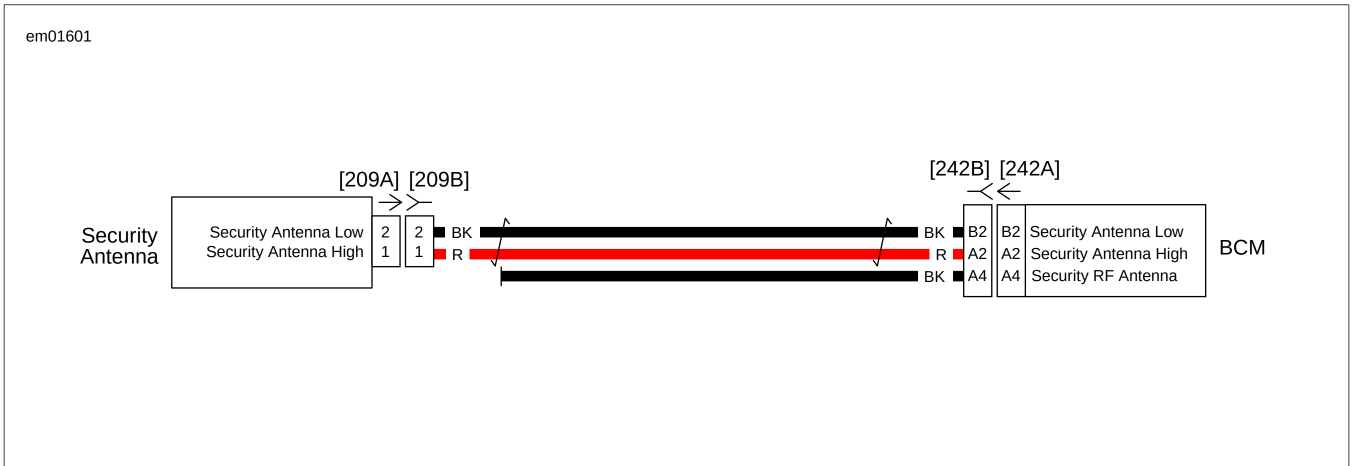


Figure 5-33. Antenna Circuit

DTC B2176

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-54. DTC B2176 Diagnostic Faults

POSSIBLE CAUSES
Security antenna malfunction
Open antenna circuit

1. Fob Test

1. Turn IGN OFF.
2. With fob present, turn IGN ON.
3. Does odometer read ENTER PIN?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 6.

2. Security Antenna Visual Test

1. Inspect security antenna for damage.
2. Is security antenna damaged?
   a. **Yes.** Repair or replace security antenna as needed.
   b. **No.** Go to Test 3.

3. Security Antenna Resistance Test

1. Turn IGN OFF.
2. Disconnect antenna [209].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [209A] terminals 1 and 2.
4. Is resistance greater than 5700 ohms?
   a. **Yes.** Replace security antenna.
   b. **No.** Go to Test 4.

4. Antenna B Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Test resistance between BOB terminal B2 and [209B] terminal 2.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (BK) wire.

5. Antenna A Circuit Open Test

1. Test resistance between BOB terminal A2 and [209B] terminal 1.

2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair open in (R) wire.

6. DTC Test

1. Connect [242] and [209] (if needed).
2. Clear DTCs.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

DTC B2177

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-55. DTC B2177 Diagnostic Faults

POSSIBLE CAUSES
Security antenna malfunction
Short to voltage in antenna circuit

1. Security Antenna Visual Test

1. Inspect security antenna for damage.
2. Is security antenna damaged?
   a. **Yes.** Repair or replace security antenna as needed.
   b. **No.** Go to Test 2.

2. Security Antenna High Circuit Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B] and [242A]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal A2 and ground.
6. Is voltage greater than 0.6V?
   a. **Yes.** Repair short to voltage in (R) wire.
   b. **No.** Go to Test 3.

3. Security Antenna Low Circuit Short to Voltage Test

1. Test voltage between BOB terminal B2 and ground.
2. Is voltage greater than 0.6V?
   a. **Yes.** Repair short to voltage on (BK) wire.
   b. **No.** Go to Test 4.

4. DTC Test

1. Clear DTCs.
2. Turn IGN ON.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

DTC B2178

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 5-56. DTC B2178 Diagnostic Faults

POSSIBLE CAUSES
Security antenna malfunction
Open antenna circuit

1. Security Antenna Visual Test

1. Inspect security antenna for damage.
2. Is security antenna damaged?
   a. **Yes.** Repair or replace security antenna as needed.
   b. **No.** Go to Test 2.

2. Security Antenna High Circuit Short to Ground Test

1. Disconnect security antenna [209].
2. Turn IGN OFF.
3. Disconnect BCM [242].
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [209B] terminal 1 and ground.
5. Is continuity present?
   a. **Yes.** Repair short to ground in (R) wire.
   b. **No.** Go to Test 3.

3. Security Antenna Low Circuit Short to Ground Test

1. Test continuity between [209B] terminal 2 and ground.

2. Is continuity present?
   a. **Yes.** Repair short to ground in (BK) wire.
   b. **No.** Go to Test 4.

4. DTC Test

1. Connect BCM [242] and [209].
2. Clear DTC.
3. Turn IGN ON.
4. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

FAILS TO DISARM

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-57. Fails to Disarm Diagnostic Faults

POSSIBLE CAUSES
Open antenna circuit
Short to ground in antenna circuit
RF interference
Antenna malfunction
Fob malfunction or dead battery

1. Non-Functional Fob Test

1. Check battery on non-functional fob.
2. Is battery voltage greater than 2.9V?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace battery.

2. Interference Test

1. Move vehicle away from any possible interference sources.
2. Place fob on seat.
3. Will security system disarm?
   a. **Yes.** Inspect for electrical accessories or an after-market seat that may be causing interference.
   b. **No.** Go to Test 3.

3. Antenna Connection Test

1. Inspect antenna location and connection.
2. Is antenna properly located and connected?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair connection.

4. Antenna Circuit Short to Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving BCM [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal A4 and ground.
5. Is continuity present?
   a. **Yes.** Repair short to ground.
   b. **No.** Go to Test 5.

5. Antenna Circuits Shorted Together Test

1. Disconnect security antenna [209].
2. Test continuity between BOB terminals A2 and B2.
3. Is continuity present?
   a. **Yes.** Repair short between antenna circuits.
   b. **No.** Go to Test 6.

6. Antenna Circuit Open Test

1. Test resistance between BOB terminal A4 and end of (BK) wire. Pull back conduit to expose unterminated end of wire.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open on (BK) wire.

7. Security System Antenna Test

1. Replace security antenna with a known good security antenna.
2. Does security system now disarm?
   a. **Yes.** Replace security antenna.
   b. **No.** Replace BCM.

DTC B2183, B2188, B2193, B2198 5.17

DESCRIPTION AND OPERATION

These outputs are intended for future applications and are not used for this model.

Table 5-58. Code Description

DTC	DESCRIPTION
B2183	G2 output shorted low
B2188	G3 output shorted low
B2193	H4 output shorted low
B2198	H3 output shorted low

Conditions for Setting

This output is shorted to ground in one of three areas:

- Wire harness.
- Device the output is connected to.
- BCM.

Diagnostic Tips

This circuit may be used for aftermarket accessories or systems. If a code is set and cannot be duplicated, check for aftermarket devices.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

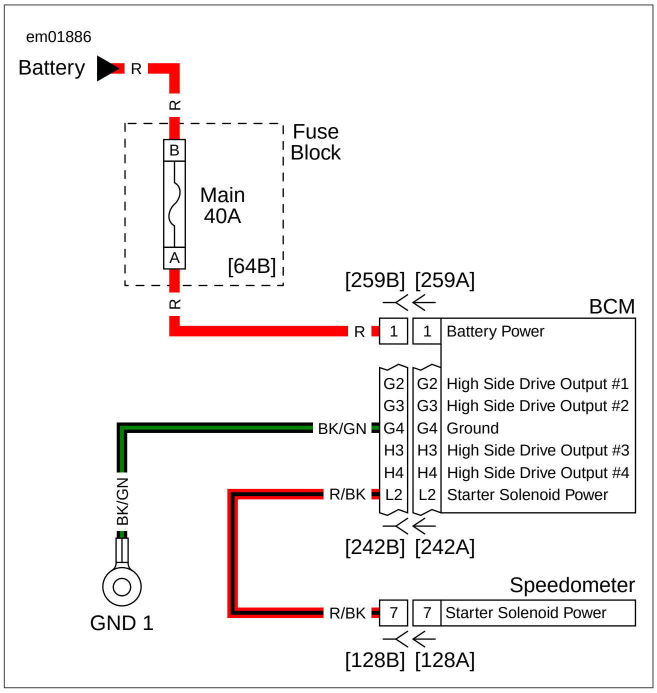


Figure 5-34. Spare Outputs

DTC B2183, B2188, B2193, B2198

Table 5-59. DTC B2183, B2188, B2193, B2198 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in spare output circuit

1. Circuit Inspection Test

1. Visually inspect BCM [242].
2. Are there wires plugged into any of the spare output terminals?
   a. **Yes.** Problem may be caused by aftermarket devices. See aftermarket manufacturer for repair.
   b. **No.** Go to Test 2.

2. DTC Test

1. Clear DTCs.
2. Turn IGN ON.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Concern is intermittent.

NEUTRAL SWITCH DIAGNOSTICS 5.18

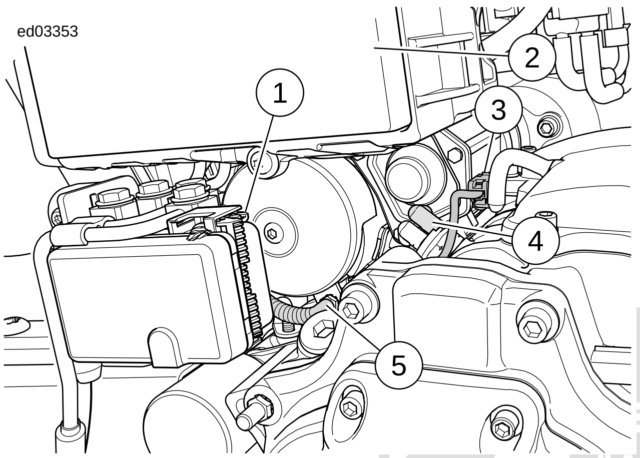
DESCRIPTION AND OPERATION

See Figure 5-35. The BCM monitors the clutch and neutral switch circuits to determine whether or not to let the vehicle start. No power will be supplied to the starter solenoid unless either:

- Clutch switch is closed (lever pulled in).
- Neutral switch is closed (shifted to neutral).

Table 5-60. Code Description

DTC	DESCRIPTION
B2218	Neutral switch shorted low



1. **ECU [166]**
2. **Battery**
3. **Starter solenoid [128]**
4. **Neutral switch [131]**
5. **Ground**

Figure 5-35. Under Seat

Conditions for Setting

DTC B2218 will set when the neutral switch circuit is shorted low at speeds greater than 5 mph (8 km/h) for more than 60 seconds.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

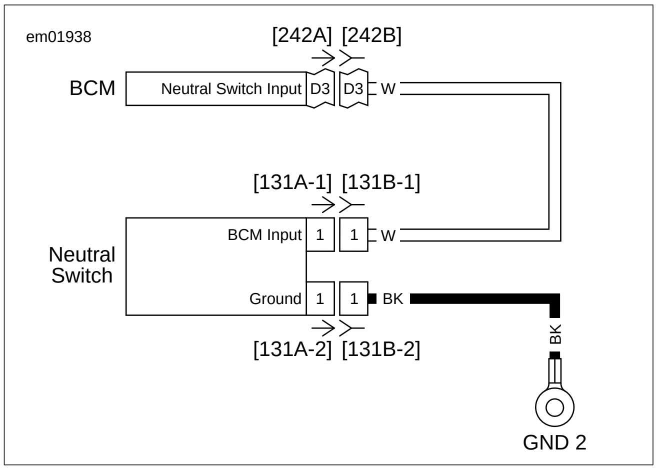


Figure 5-36. Neutral Switch Circuit

DTC B2218

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 5-61. DTC B2218 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in neutral circuit
Neutral switch malfunction

NOTE

This DTC may occur if the vehicle is ridden in neutral at speeds greater than 5 mph (8 km/h) for more than 60 seconds. For example, if coasting down a long mountain road with the transmission in neutral.

1. Neutral Circuit Short to Ground Test

1. Shift transmission into 1st or 2nd gear.
2. Turn IGN ON.
3. Is neutral indicator illuminated?
   a. **Yes.** Go to Test 2.
   b. **No.** Verify neutral switch torque.

2. Neutral Switch Test

1. Disconnect neutral switch [131-1].
2. Is neutral lamp illuminated?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace neutral switch.

3. Neutral Switch Short to Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal D3 and ground.
5. Is resistance less than 10 ohms?
   a. **Yes.** Repair short to ground on (W) wire.
   b. **No.** Go to Test 4.

4. DTC Test

1. Connect BCM [242] and neutral switch.
2. Clear DTC.
3. Turn IGN ON.
4. Operate vehicle above 5 mph (8 km/h) for at least two minutes.
5. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

TABLE OF CONTENTS

NOTES

EFI SYSTEM: IAC 6.1

GENERAL

This chapter describes the operation of the Harley-Davidson EFI system. A good working knowledge of motorcycle components are required for troubleshooting engine and EFI problems. 6.3 ELECTRONIC CONTROL MODULE and 6.4 SENSORS AND DRIVERS: IAC briefly explain the operation of the ECM and function of the various sensors and drivers. See 1.3 DIAGNOSTIC TOOLS for instructions on using the test equipment called out in the diagnostic test procedures in this chapter.

The EFI system provides microprocessor-based electronic engine management for the engine. The EFI system has the following features:

- Independently mapped spark and fuel control.
- Compensated fuel delivery through engine temperature, intake air temperature and manifold air pressure.
- Engine load measurement via throttle position sensing.
- Single point spark delivery.
- Sequential port indirect (manifold) fuel injection.
- Open/closed loop air/fuel control.
- Automatic enrichment at start-up.
- Engine speed and position determined by using a single CKP sensor.
- Engine idle speed electronically managed with an IAC system.

The ECM makes decisions for enabling ignition, starting, spark and fuel delivery. Sensors include:

- CKP sensor
- TPS
- JSS
- BCM including an integrated accelerometer
- Clutch switch
- Neutral switch
- ET sensor
- VSS
- HO2 sensor
- MAP
- IAT sensor

EFI Operation

The EFI system operates as an open or closed loop system, allowing it to adjust for all possible operating conditions.

- During open loop operation, the system uses programmed fuel and spark maps in the ECM providing easy cold starting and maximum power at Wide Open Throttle (WOT). The adaptive fuel value, learned during closed loop operation, is applied to open loop operation to adjust fuel and spark maps for optimal performance.
- During closed loop operation, the HO2 sensors provide input for an optimal air/fuel mixture resulting in reduced emissions, good fuel economy and smooth power. HO2 sensors must be at the normal operating temperature of the engine.

By using both open and closed loop systems, engine performance is tuned. This compensates for change in conditions and provides maximum performance. A simplified signal flow diagram for the EFI system is shown in Figure 6-1.

HOME

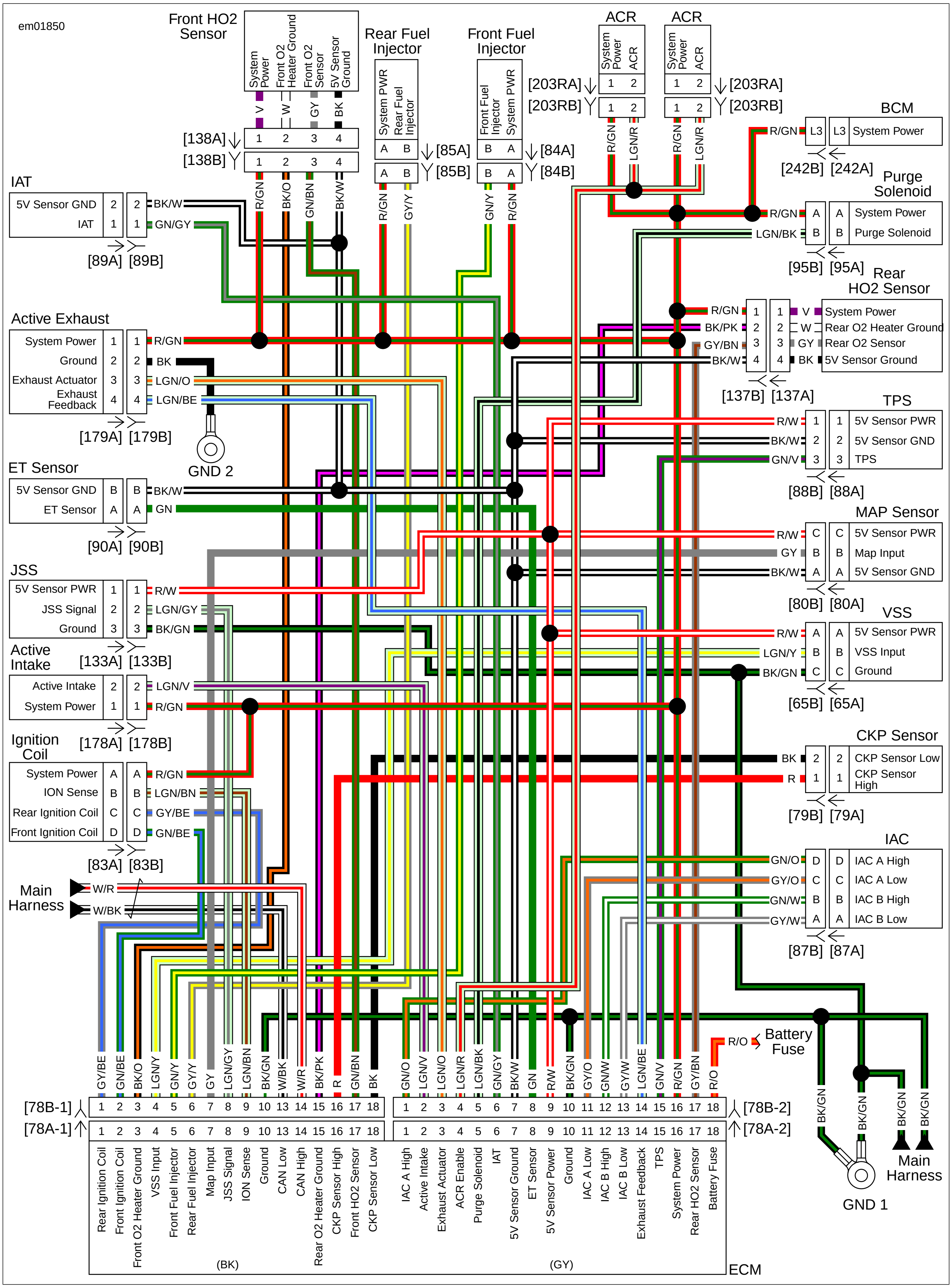


Figure 6-1. EFI Simplified Schematic - IAC

EFI SYSTEM: ETC 6.2

GENERAL

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

See Figure 6-2. The engine management system consists of the following components:

- ECM
- CKP sensor
- TMAP sensor
- ET sensor
- TGS
- TCA
- VSS
- HO2S
- Active exhaust actuator (HDI)
- Ignition coil
- Fuel pump
- Fuel injector
- Purge solenoid (if equipped)

The ECM is a solid state device mounted under the seat and sealed to prevent contamination from dust/dirt, water and oil. The ECM controls engine performance based upon input supplied to the ECM from the ET, CKP, TMAP, TGS, HO2S and the VSS sensors and other additional low-voltage circuits and components between the battery and ignition coil.

- The ECM controls the dwell time for the ignition coil, providing optimum ignition circuit performance for all engine speeds/load conditions. Optimizing the ignition system allows the ECM to control/vary engine timing (as needed) from 0-50 degrees BTDC.
- The ECM also has built-in protection against transient voltages, continuous reverse voltages and inadvertent damage resulting from jump starts. The ECM is a non-repairable item and must be replaced when it fails.

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

The TMAP sensor is a dual-purpose sensor, mounted in the top of the intake manifold. One portion is used to measure temperature and the other portion is used to measure the air pressure inside the intake manifold. The temperature part of the TMAP contains a thermistor element, used to measure the temperature of the air entering the intake manifold. The MAP portion of this sensor is used to measure the difference between atmospheric pressure and vacuum pressure, within the intake manifold. The ECM processes information from the TMAP (and other sensors) to adjust ignition timing and fuel to achieve optimum engine performance.

The ET sensor contains a thermistor element that varies the sensor's internal electrical resistance. As the engine temperature changes the resistance in the ET sensor changes. The ECM monitors this resistance to compensate for various operating conditions.

The TGS, mounted on the right hand side of the handlebar, houses two internal (opposing) Hall-effect sensors for operator control of the engine's throttle. The opposing operation of the sensors ensures that repositioning of the throttle twist grip, forward and/or back, is accurately reported to the ECM. As the throttle is operated, position changes are reported to the ECM which controls the corresponding movement of the throttle plate by the TCA.

The TCA, mounted to the intake manifold, operates the throttle plate internal to the induction module on the engine. Two corresponding TP sensors receive input from the ECM, corresponding to the position of the TGS, to adjust the position of the throttle plate, accordingly. The ECM incorporates an H-Bridge and WatchDog microprocessor, used to control inadvertent or unexpected operations/conditions of the TCA and TGS.

The VSS is mounted in the transmission, beneath the starter motor. The VSS is a Hall-effect sensor, used to monitor and report vehicle speed based upon a reference point on the 5th gear of the transmission. A 5V reference signal and common ground circuitry are provided to the VSS, from the ECM. The VSS communicates electrical pulses to the ECM, where vehicle speed is calculated and sent to the speedometer as a serial data message.

The HO2S diagnostic codes may be seen during the vehicle break-in period. The sensor diagnostic codes will not illuminate the check engine lamp for current or historic codes and will only be indicated by DIGITAL TECHNICIAN II (Part No. HD-48650) or speedometer self-diagnostics. If the diagnostic codes are reported during the break-in period, clear or ignore the code(s) until the break-in period is complete.

There are two HO2S, one mounted in each of the two exhaust pipes, to monitor the exhaust gas air/fuel mixture ratio. Each HO2S samples the exhaust oxygen content and provides specific voltage to the ECM. The ECM continuously adjusts the air/fuel mixture to maintain an optimal air/fuel mixture. When properly mixed, the HO2S voltage(s) will measure approximately 0.45V, each when measuring across the sensor.

The active exhaust system (certain International configurations) uses an actuator valve located in the rear of the exhaust pipe that is connected via a cable. The valve position automatically adjusts to enhance engine performance.

The ignition coils, mounted rearward on the chassis behind the engine, provide high voltage output to the spark plugs. Each ignition coil is made up of a primary winding where low voltage input creates a high voltage spike in the collapsible field of the secondary winding. The front and rear coils are fired independently (one cylinder at a time). The ignition coil contains an extra terminal where the ECM monitors the current of the secondary winding for knock detection and combustion diagnostics.

The fuel pump, mounted inside the fuel tank, is a submersible pump used to provide fuel to the fuel injectors. The fuel pump is powered by the BCM.

- When the ignition switch is in the IGNITION position and the engine stop switch is in the RUN position, the BCM supplies voltage to the fuel pump.
- The fuel pump continues running during cranking and normal running operation, as long as the ECM is receiving input from the CKP sensor. If no CKP pulses are received, the ECM sends a message to the BCM to turn off the fuel pump within 2 seconds after the ignition is turned on, the engine has stalled or immediately after the engine is shut off.
- The fuel pump contains a pressure regulator which maintains consistent fuel pressure to each of the fuel injectors. Excess fuel flow is bypassed into the fuel tank by the pressure regulator.

There are two fuel injectors mounted to the intake manifold. The ECM controls the injectors by actuating the injector solenoid enabling fuel to be metered through the injector and atomized into the intake manifold.

- The injectors are timed to the combustion cycle and are triggered sequentially. When the ECM determines that fuel is required, the ECM supplies a short duration ground to the fuel injector, which opens and releases fuel into the air intake manifold.
- The BCM supplies voltage to the fuel injectors. Each injector is protected and grounded by the ECM, through a common point ground within the ECM.

The purge solenoid (working with the charcoal canister only used in certain destinations) allows the vapors to escape back into the throttle body. The purge solenoid is timed to the throttle position but is disabled at startup, low engine temperature, low engine speed or low vehicle speed. The power for the purge solenoid comes from the BCM. The ECM provides the path to ground to trigger the purge solenoid.

Engine Idle Temperature Management System

To improve rider comfort, an optional heat management system (EITMS) may be enabled. After being enabled, the heat management system improves rider comfort by turning off the rear cylinder fuel injector when all of the following conditions exist:

- High engine temperature.
- Engine at idle speed.
- Low or no vehicle speed.
- Clutch lever pulled in or transmission in neutral.

There is a four minute delay after startup before EITMS will engage. As the engine maintains idle speed, the rear cylinder functions as an "air pump," helping to cool the engine. This continues until one of the above listed conditions is no longer met, then the rear cylinder fires normally again.

NOTE

When the engine is in heat management mode, a noticeable difference in idle may be accompanied by a unique exhaust odor. While these conditions are normal, a rider or technician unaware of the heat management system may incorrectly assume an idle problem is present.

Enable/Disable EITMS

1. Turn the ignition ON. Push the engine OFF/RUN switch on the right handlebar to the RUN position (the motorcycle may be running or not running).
2. Verify cruise control is OFF.
3. Push the throttle to roll-off position and hold.
4. After approximately 3 seconds, the cruise indicator will flash either amber (disabled) or green (enabled).
5. Repeat the procedure as necessary to enable or disable.

NOTE

On platforms/models equipped with a radio, the status of the EITMS can be viewed on the information display.

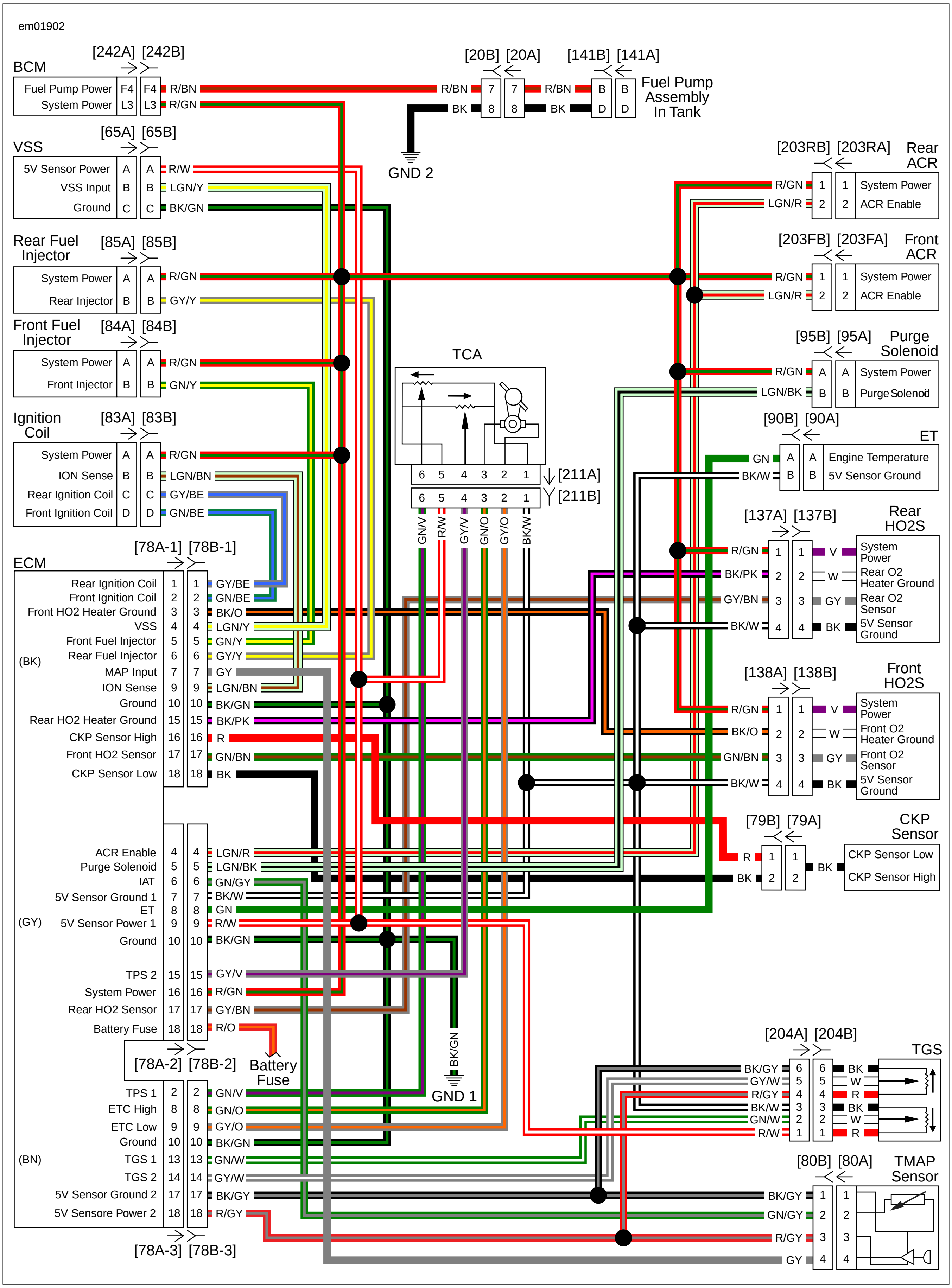


Figure 6-2. EFI Simplified Schematic - ETC

ELECTRONIC CONTROL MODULE 6.3

GENERAL

See Figure 6-3. The ECM receives and processes signals from the sensors and applies output signals to the drivers to crank, start, idle and run the engine. This section describes the configuration of the ECM.

ECM - IAC

The ECM is mounted under the seat. It computes the spark advance for proper ignition timing and fuel control based on sensor inputs (from CKP, MAP and TPS sensors). The ECM controls the low-voltage circuits for the ignition coils and injectors.

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

ECM - ETC

The ECM is mounted under the seat or on the electrical panel behind the fender extension. It computes the spark advance for proper ignition timing and fuel control based on sensor inputs (from ET, CKP, TMAP, HO2S and TGS sensors). The ECM controls the low-voltage circuits for the ignition coils and injectors.

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

32-2 Crankshaft

The crankshaft has 32 teeth evenly spaced around its circumference with two consecutive teeth missing (sync gap). In this configuration, the ECM determines engine position, engine phase and engine speed from the CKP sensor input. Phase (TDC compression) is determined by the ECM during startup and, when necessary, while running. No engine ignition events can occur until the ECM determines the relationship of piston position to crankshaft position. These continual ECM adjustments allow smooth engine operation at all speeds.

Crank Position Signal Synchronization

In the 32-2 crank configuration, crankshaft position is determined by the ECM finding the two-tooth (sync gap) in the CKP sensor signal. This is usually accomplished the first time the sync gap is encountered. The ECM monitors the CKP signal status every engine revolution. If the ECM determines synchronization is lost, it immediately terminates ignition events and synchronizes on the next occurrence of the sync gap.

Engine Phase

Phasing is accomplished by the ECM identifying a widening in the CKP signal caused by the deceleration of the crankshaft, as a piston approaches TDC on its compression stroke. Since the rear cylinder approaches TDC earlier than the front cylinder, engine phase can be readily discriminated. Phasing is normally accomplished on the first TDC cycle after engine synchronization. Once phased, the ECM can begin normal ignition events. If the ECM experiences a system reset or loss of synchronization while the engine is running it also loses phase.

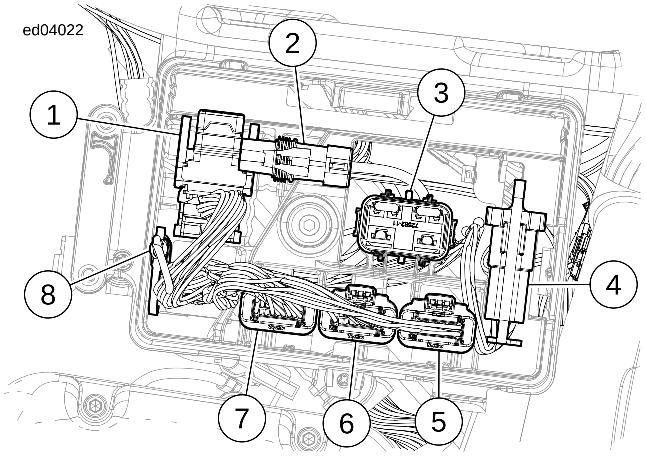
When phase is lost one of the following occurs:

- If an engine-not-running (crank mode) rpm is detected, the ECM executes the normal start-up phasing process.
- If engine run mode is detected, the ECM executes a running re-phase sequence.

The front cylinder is fired every engine revolution. The ECM monitors the power stroke after the fire event to determine if sufficient acceleration occurred to indicate the ECM fired on the compression stroke. When two valid power strokes are detected, the ECM locks phase and resumes normal ignition events.

Engine Run Mode

Many functions of the EFI system require an engine run mode determination. Engine run is determined by the level of engine rpm. Generally, the engine is considered to be running when engine rpm exceeds a minimum of 750 rpm.



1. **BCM [242]**
2. **BCM power [259]**
3. **Fuse block [64]**
4. **DLC [91]**
5. **ECM [78-3] (BN) (if applicable)**
6. **ECM [78-2] (GY)**
7. **ECM [78-1] (BK)**
8. **Battery tender [281] (if applicable)**

Figure 6-3. Under Left Side Cover

SENSORS AND DRIVERS: IAC 6.4

DESCRIPTION AND OPERATION

Sensors and drivers play an important part in the ECM's ability to provide the proper operational parameters for engine efficiency, emissions control and fuel economy. When a failure occurs, a DTC is generated by, and stored in, the ECM. These codes help the technician diagnose engine trouble to the proper sensor or driver. See 1.2 INITIAL DIAGNOSTICS.

SENSORS

A failed CKP sensor completely disables the engine. Other sensor problems may cause engine performance issues or complete engine shutdowns. The following are brief explanations of sensor types and their functions within the EFI system.

Crank Position (CKP) Sensor

The CKP sensor, located on the left front of the lower crankcase half, is a variable reluctance device that generates AC voltage as the teeth on the crankshaft pass by the sensor. The signal is routed to the ECM where it is used to determine crankshaft position, engine speed (rpm) and engine phase (TDC compression). Without the presence of the CKP signal, the ECM will not allow the ignition and fuel injection drivers to operate, and thus the engine will not run. The ECM uses crankshaft compression slow down events to determine engine phase. Therefore, the spark plugs must be installed when checking for spark.

Throttle Position Sensor (TPS)

The TPS is a variable resistor (potentiometer) having a linear resistance range. It is mounted on the throttle plate. The output of the sensor is a voltage dependent on the position of the throttle plate. The output is used by the ECM to determine ignition timing and fuel required at any given rpm and engine load.

Jiffy Stand Sensor (JSS)

The JSS uses a Hall-effect device to monitor jiffy stand position. When the jiffy stand is fully retracted, the sensor picks up the presence of a metal tab mounted to the jiffy stand. When extended, the engine only starts and runs if the ECM receives a signal from the neutral switch indicating the transmission is in neutral, or a signal from the clutch switch indicating the clutch is engaged. Otherwise, the engine stalls as the clutch is released with the transmission in gear.

Accelerometer

The accelerometer is within the BCM. The BCM will shut the engine down if the vehicle is tipped over. Once the sensor is tripped, the motorcycle must be righted, the ignition turned off and then on again before the engine can be restarted. This is communicated across the CAN communication.

Clutch Switch

The clutch switch is part of the left hand control module. Its operation is communicated to the ECM and BCM over the CAN communication circuits.

Neutral Switch

The BCM provides voltage to the neutral switch, which is open when the transmission is in gear. With the transmission in neutral, the switch is closed, allowing current flow to ground. The BCM will not allow the engine to start unless the transmission is in neutral or the clutch is pulled in.

Engine Temperature (ET) Sensor

The ET sensor is a thermistor device. At a specific temperature it has a specific resistance across its terminals. As this resistance varies, so does the voltage.

- At high temperatures, the resistance of the sensor is very low. This effectively lowers the signal voltage on ECM [78-2] terminal 8.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5V. The ECM monitors this voltage to compensate for various operating conditions. The ECM also uses the sensor input as a reference for determining Idle Air Control (IAC) pintle position.

Manifold Absolute Pressure (MAP) Sensor

The MAP sensor is supplied 5V from the ECM and sends a signal back to the ECM. This signal changes with engine vacuum, intake air temperature and atmospheric barometric pressure. The MAP sensor monitors the intake manifold pressure (vacuum) and sends the information to the ECM. The ECM then adjusts the spark and fuel timing advance curves for optimum performance. The sensor output determines if the engine is rotating when a fault with CKP sensor is present.

Intake Air Temperature (IAT) Sensor

The IAT sensor is a thermistor device. At a specific temperature it has a specific resistance across its terminals. As the temperature varies, the thermistor resistance varies and so does the voltage on ECM [78-2] terminal 6.

- At high temperatures, the resistance of the sensor is very low. This effectively lowers the signal voltage on ECM [78-2] terminal 6.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5V. The ECM monitors this voltage to compensate for various operating conditions.

Vehicle Speed Sensor (VSS)

The VSS is a Hall-effect device mounted close to the teeth of the 5th gear in the transmission. The output signal frequency varies with vehicle speed. The ECM processes the vehicle speed signal and transmits it via the CAN bus to the speedometer to indicate vehicle speed.

HO2S: Front and Rear

The HO2S detects unburned oxygen in the engine exhaust. The output of the sensor is a voltage having a range of about 0-1.0V.

- The normal output is 0.5V which represents a balance between a lean (not enough fuel) and rich (too much fuel) air/fuel mixture.
- An output less than 0.5V represents a lean mixture; greater than 0.5V represents a rich mixture.
- The change in output level signals the ECM to modify the air/fuel ratio.

The HO2S does not operate efficiently until the engine is at operating temperature. Always warm-up the vehicle prior to troubleshooting the HO2S. The heater elements on the HO2S helps bring the HO2S up to operating temperature quicker. Leaks in the exhaust system, leaky exhaust valves, misfires or any engine problem allowing unburned oxygen into the exhaust stream could create a DTC indicating a bad sensor. Look for problems related to an improper air/fuel mixture before replacing the sensor.

DRIVERS

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

Fuel Pump

The BCM provides battery voltage to the fuel pump which is inside the fuel tank.

Ignition Coils and Spark Plugs

The ignition coils create the energy to fire the spark plugs and ignite the air/fuel mixture in the cylinders. Advancing or retarding the spark is controlled by the ECM to suit load and speed conditions of the engine. See Figure 6-1. The BCM power a separate ignition coil for each cylinder.

Fuel Injectors

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

Idle Air Control (IAC)

The IAC motor is a stepper-motor used to regulate the amount of air entering the intake manifold during idle. The ECM controls engine idle speed by moving the IAC pintle to open or close a passage around the throttle plate. It does this by sending voltage pulses to the proper motor winding of the IAC. This causes the pintle to move in or out of the IAC a given distance for each pulse received.

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

Active Intake Solenoid (AIS): HDI Only

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

Active Exhaust Actuator: HDI Only

The active exhaust system utilizes an actuator valve located in the rear exhaust pipe. This valve is connected to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance.

SENSORS AND DRIVERS: ETC 6.5

DESCRIPTION AND OPERATION

Sensors and drivers play an important part in the ECM's ability to provide the proper operational parameters for engine efficiency, emissions control and fuel economy. When a failure occurs, a DTC is generated by, and stored in, the ECM. These codes help the technician diagnose engine trouble to the proper sensor or driver. See 1.2 INITIAL DIAGNOSTICS.

SENSORS

A failed CKP sensor completely disables the engine. Other sensor problems may cause engine performance issues or complete engine shutdowns. The following are brief explanations of sensor types and their functions within the EFI system.

Crank Position (CKP) Sensor

The CKP sensor, located on the left front of the lower crankcase half, is a variable reluctance device that generates AC voltage as the teeth on the crankshaft pass by the sensor. The signal is routed to the ECM where it is used to determine crankshaft position, engine speed (rpm) and engine phase (TDC compression). Without the presence of the CKP signal, the ECM will not allow the ignition and fuel injection drivers to operate, and thus the engine will not run. The ECM uses crankshaft compression slow down events to determine engine phase. Therefore, the spark plugs must be installed when checking for spark.

Twist Grip Sensor (TGS)

The TGS, mounted on the right hand side of the handlebar, houses two internal (opposing) Hall-effect sensors for operator control of the engine's throttle. The opposing operation of the sensors ensures that repositioning of the throttle twist grip, forward and/or back, is accurately reported to the ECM. As the throttle is operated, position changes are reported to the ECM that controls the corresponding movement of the throttle plate by the TCA.

Throttle Control Actuator (TCA)

The TCA, mounted to the intake manifold, operates the throttle plate internal to the induction module on the engine. Two corresponding TPS provide input to the ECM, so the ECM may verify that plate position corresponds to TGS input (rider desired position of the plate) and to adjust the position of the throttle plate, accordingly.

Jiffy Stand Sensor (JSS)

The JSS uses a Hall-effect device to monitor jiffy stand position. When the jiffy stand is fully retracted, the sensor picks up the presence of a metal tab mounted to the jiffy stand. When extended, the engine only starts and runs if the ECM receives a signal from the neutral switch indicating the transmission is in neutral, or a signal from the clutch switch indicating the clutch is engaged. Otherwise, the engine stalls as the clutch is released with the transmission in gear.

Accelerometer

The accelerometer is within the BCM. The BCM will shut the engine down if the vehicle is tipped over. Once the sensor is tripped, the motorcycle must be righted, the ignition turned off and then on again before the engine can be restarted. This is communicated across the CAN communication.

Clutch Switch

The clutch switch is part of the LHCM. There are two types of clutch switches, one type for mechanical (cable) operated clutches and one for hydraulic operated clutches. The switches function differently and are not interchangeable. The LHCM communicates the position of the clutch switch to the ECM and BCM over the CAN communication circuits.

NOTE

The clutch switches are not interchangeable. If swapped, it could cause DTCs or improper vehicle operation.

Neutral Switch

The BCM provides voltage to the neutral switch, which is open when the transmission is in gear. With the transmission in neutral, the switch is closed, allowing current flow to ground. The BCM will not allow the engine to start unless the transmission is in neutral or the clutch is pulled in.

Engine Temperature (ET) Sensor

The ET sensor is a thermistor device. At a specific temperature it has a specific resistance across its terminals. As this resistance varies, so does the voltage.

- At high temperatures, the resistance of the sensor is very low. This effectively lowers the signal voltage on ECM [78-2] terminal 8.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5V. The ECM monitors this voltage to compensate for various operating conditions. The ECM also uses the sensor input as a reference for determining Idle Air Control (IAC) pintle position.

Temperature Manifold Absolute Pressure (TMAP) Sensor

The TMAP sensor combines the MAP and IAT in a single component. The functions of each are described in the following paragraphs. During diagnostics the two parts of the TMAP are tested as separate units.

Manifold Absolute Pressure (MAP) Sensor

The MAP sensor is supplied 5V from the ECM and sends a signal back to ECM. This signal varies in accordance with engine vacuum, intake air temperature and atmospheric barometric pressure. The MAP sensor monitors the intake manifold pressure (vacuum) and sends the information to the ECM. The ECM then adjusts the spark and fuel timing advance curves for optimum performance. The output of the sensor can also be used to determine if the engine is rotating when a fault with the CKP sensor is present.

Intake Air Temperature (IAT) Sensor

The IAT sensor is a thermistor device. As such, it will have a specific resistance across its terminals at a specific temperature. As the temperature varies, the thermistor resistance varies, and so does the voltage on ECM [78-2] terminal 6.

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on ECM [78-2] terminal 6.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5V. The ECM monitors this voltage to compensate for various operating conditions.

Vehicle Speed Sensor (VSS)

The VSS is a Hall-effect device mounted close to the teeth of the 5th gear in the transmission. The output signal frequency varies with vehicle speed. The ECM processes the vehicle speed signal and transmits it via the CAN bus to the speedometer to indicate vehicle speed.

HO2S: Front and Rear

The HO2S detects unburned oxygen in the engine exhaust. The output of the sensor is a voltage having a range of about 0-1.0V.

- The normal output is 0.5V which represents a balance between a lean (not enough fuel) and rich (too much fuel) air/fuel mixture.
- An output less than 0.5V represents a lean mixture; greater than 0.5V represents a rich mixture.
- The change in output level signals the ECM to modify the air/fuel ratio.

The HO2S does not operate efficiently until the engine is at operating temperature. Always warm-up the vehicle prior to troubleshooting the HO2S. The heater elements on the HO2S helps bring the HO2S up to operating temperature quicker. Leaks in the exhaust system, leaky exhaust valves, misfires or any engine problem allowing unburned oxygen into the exhaust stream could create a DTC indicating a bad sensor. Look for problems related to an improper air/fuel mixture before replacing the sensor.

DRIVERS

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

Fuel Pump

The BCM provides battery voltage to the fuel pump which is inside the fuel tank.

Ignition Coils and Spark Plugs

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

See Figure 6-1. The BCM power a separate ignition coil for each cylinder.

Fuel Injectors

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

Active Exhaust Actuator: HDI Only

The active exhaust system utilizes an actuator valve located in the rear exhaust pipe. This valve is connected to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance.

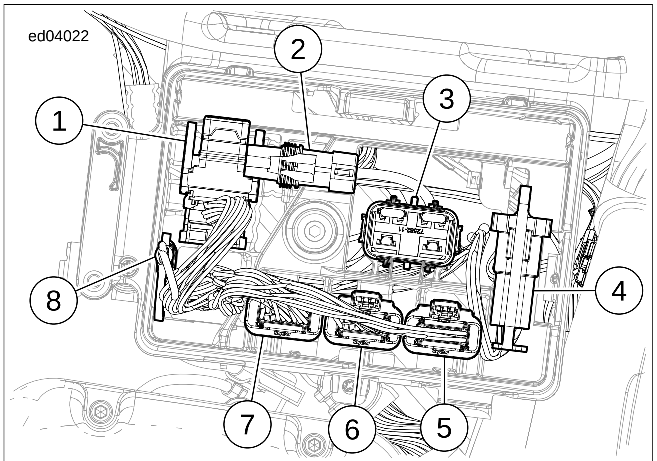
SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC 6.6

DESCRIPTION AND OPERATION

See Figure 6-4. The BCM supplies and monitors the 12V system power circuit from terminal L3 of the BCM to the following components:

- Ignition coil
- Active intake
- Active exhaust
- Front fuel injector
- Rear fuel injector
- Purge solenoid
- ECM
- Front HO2S
- Rear HO2S
- Front ACR
- Rear ACR

If the vehicle is equipped with ACRs, the power for the ACRs is also supplied by the BCM through the system power circuit. The system power circuit is energized when the ignition is turned on.



1. **BCM [242]**
2. **BCM power [259]**
3. **Fuse block [64]**
4. **DLC [91]**
5. **ECM [78-3] (BN) (if applicable)**
6. **ECM [78-2] (GY)**
7. **ECM [78-1] (BK)**
8. **Battery tender [281] (if applicable)**

Figure 6-4. Under Left Side Cover

Table 6-1. Code Description

DTC	DESCRIPTION
B2102	System power output shorted high
B2103	System power output shorted low
B2104	System power output overloaded

Conditions for Setting

DTC B2104 will set if the system power circuit draws more than 10 Amps.

Diagnostic Tips

Since the system power circuit normally has ignition voltage with IGN ON, the short to voltage will have to be present with the vehicle turned off in order to set DTC B2102.

When disconnecting connectors, always inspect connector for corrosion or backed out terminals and repair as required.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

HOME

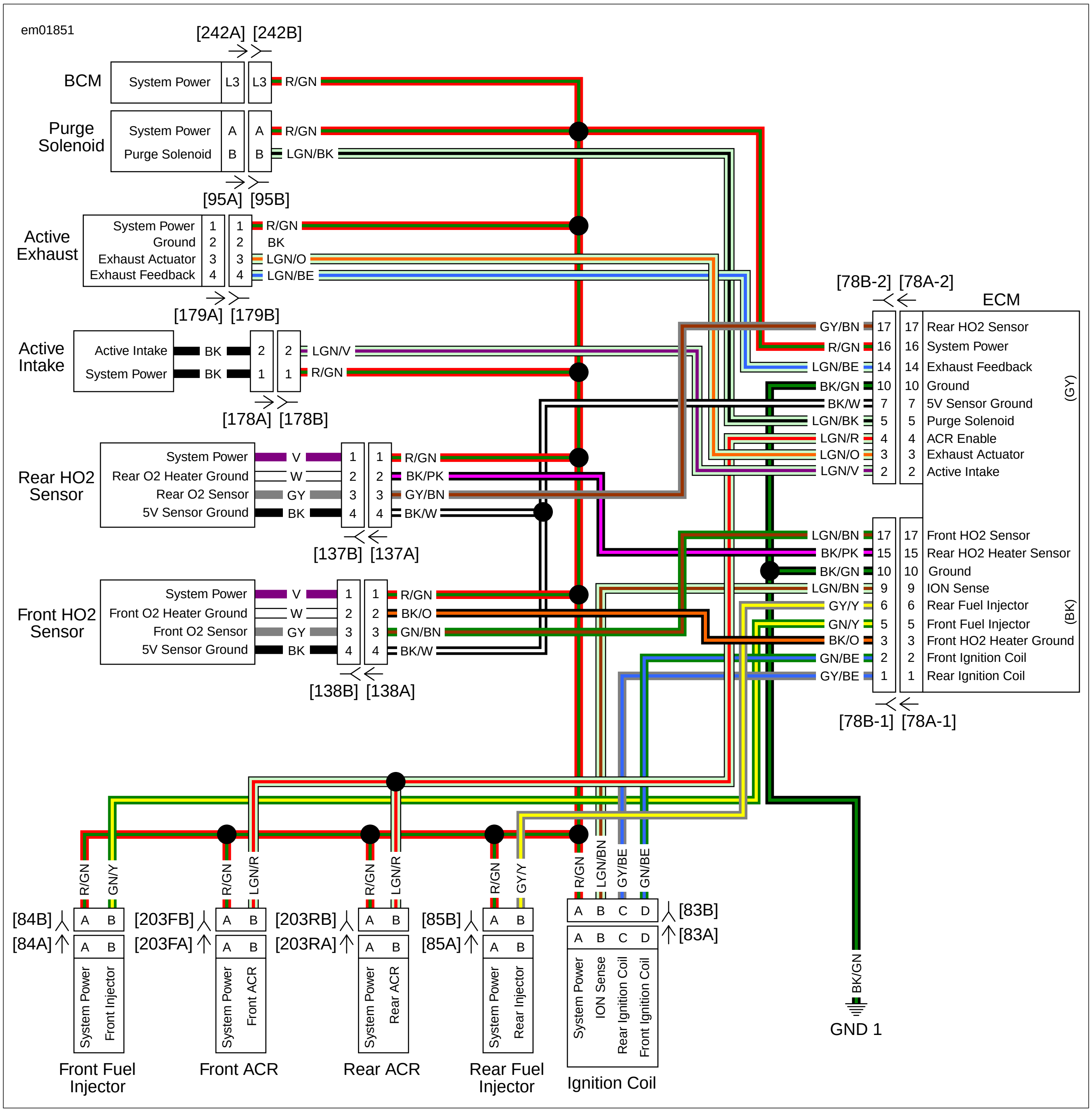


Figure 6-5. System Power Circuit - IAC

DTC B2102

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-2. DTC B2102 Diagnostic Faults

POSSIBLE CAUSES
Short to battery in the system power circuit

1. System Power Circuit Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminal 16 and ground.
5. Is battery voltage present?
   a. **Yes.** Repair short to voltage in (R/GN) wire.
   b. **No.** Replace BCM.

DTC B2103, B2104

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 6-3. DTC B2103, B2104 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in the system power circuit
Ignition coil resistance too low
Front coil shorted low
Rear coil shorted low
Active intake resistance too low
Active exhaust resistance too low
Front HO2S resistance too low
Rear HO2S resistance too low
Front fuel injector resistance too low
Rear fuel injector resistance too low
ACR resistance too low
Purge solenoid resistance too low

1. Ignition Coil Test

1. Turn IGN OFF.
2. Disconnect ignition coil [83].
3. Clear DTCs.
4. Turn IGN ON.
5. Check DTCs.
6. Did DTC reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace ignition coil.

2. Rear Coil Shorted to Ground Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [83B] terminal C and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (GY/BE) wire
   b. **No.** Go to Test 3.

3. Front Coil Shorted to Ground Test

1. Test continuity between [83B] terminal D and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (GN/BE) wire.
   b. **No.** Go to Test 4.

4. Rear Fuel Injector Test

1. Turn IGN OFF.
2. Connect [83].
3. Disconnect rear fuel injector [85].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 5.
   b. **No.** Replace rear fuel injector.

5. Front Fuel Injector Test

1. Turn IGN OFF.
2. Connect [85].
3. Disconnect front fuel injector [84].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace front fuel injector.

6. Purge Solenoid Test

1. Turn IGN OFF.
2. Connect [84].
3. Disconnect purge solenoid [95].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 7.
   b. **No.** Replace purge solenoid.

7. Exhaust Actuator Test

1. Turn IGN OFF.
2. Connect [95].
3. Disconnect exhaust actuator [179].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 8.
   b. **No.** Replace exhaust actuator.

8. AIS Test

1. Turn IGN OFF.
2. Connect [179].
3. Disconnect AIS [178].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 9.
   b. **No.** Replace AIS.

9. Front HO2S Test

1. Turn IGN OFF.
2. Connect [178].
3. Disconnect front HO2S [138].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 10.
   b. **No.** Replace front HO2S.

10. Rear HO2S Test

1. Turn IGN OFF.
2. Connect [138].
3. Disconnect rear HO2S [137].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 11.
   b. **No.** Replace rear HO2S.

11. Front ACR Test

1. Turn IGN OFF.
2. Connect [137].
3. Disconnect front ACR [203F].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 12.
   b. **No.** Replace front ACR.

12. Rear ACR Test

1. Turn IGN OFF.
2. Connect [203F].
3. Disconnect rear ACR [203R].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
    a. **Yes.** Go to Test 13.
    b. **No.** Replace rear ACR.

13. ECM Test

1. Turn IGN OFF.
2. Connect [203R].
3. Disconnect ECM [78-1] and [78-2].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
    a. **Yes.** Go to Test 14.
    b. **No.** Replace ECM.

14. BCM Test

1. Turn IGN OFF.
2. Connect [78].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B] leaving BCM [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal L3 and ground.
6. Is continuity present?
    a. **Yes.** Repair short to ground in (R/GN) wire.
    b. **No.** Replace BCM.

SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC 6.7

DESCRIPTION AND OPERATION

See Figure 6-6. The BCM supplies and monitors the 12V system power circuit from terminal L3 of the BCM to the following components:

- Ignition coil
- Active exhaust
- Front fuel injector
- Rear fuel injector
- Purge solenoid
- ECM
- Front HO2 sensor
- Rear HO2 sensor
- Front ACR
- Rear ACR

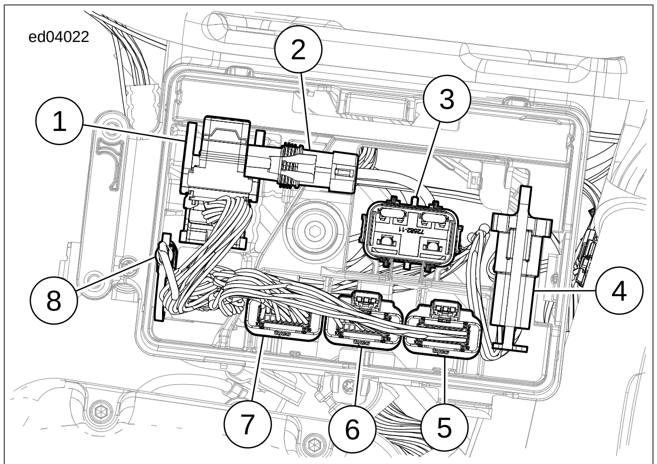
The system power circuit is energized when the ignition is turned on.

Table 6-4. Code Description

DTC	DESCRIPTION
B2102	System power output shorted high
B2103	System power output shorted low
B2104	System power output overloaded

Conditions for Setting

DTC B2104 will set if the system power circuit draws more than 10 Amps.



1. **BCM [242]**
2. **BCM power [259]**
3. **Fuse block [64]**
4. **DLC [91]**
5. **ECM [78-3] (BN) (if applicable)**
6. **ECM [78-2] (GY)**
7. **ECM [78-1] (BK)**
8. **Battery tender [281] (if applicable)**

Figure 6-6. Under Left Side Cover

Diagnostic Tips

Since the system power circuit normally has ignition voltage with IGN ON, the short to voltage will have to be present with the vehicle turned off in order to set DTC B2102.

When disconnecting connectors, always inspect connector for corrosion or backed out terminals and repair as required.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.1 CONNECTORS.

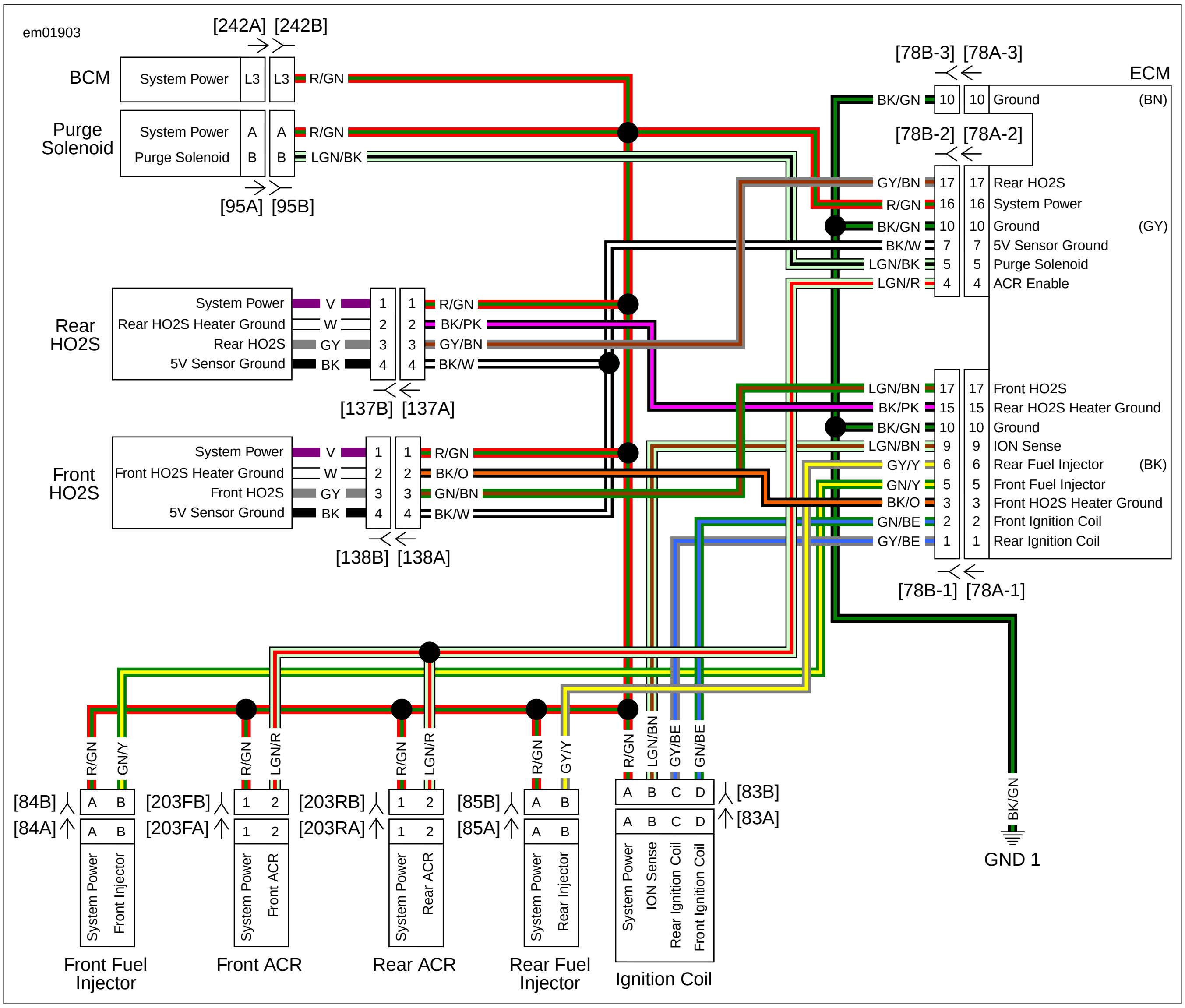


Figure 6-7. System Power Circuit - ETC

DTC B2102

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-5. DTC B2102 Diagnostic Faults

POSSIBLE CAUSES
Short to battery in the system power circuit

1. System Power Circuit Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to [78B-1], 78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminal 16 and ground.
5. Is battery voltage present?
   a. **Yes.** Repair short to voltage in (R/GN) wire.
   b. **No.** Replace BCM.

DTC B2103, B2104

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 6-6. DTC B2103, B2104 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in the system power circuit
Ignition coil resistance too low
Front coil shorted low
Rear coil shorted low
Front HO2S resistance too low
Rear HO2S resistance too low
Front fuel injector resistance too low
Rear fuel injector resistance too low
ACR resistance too low
Purge solenoid resistance too low

1. Ignition Coil Test

1. Turn IGN OFF.
2. Disconnect ignition coil [83].
3. Clear DTCs.
4. Turn IGN ON.
5. Check DTCs.
6. Did DTC reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace ignition coil.

2. Rear Coil Shorted to Ground Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [83B] terminal C and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (GY/BE) wire
   b. **No.** Go to Test 3.

3. Front Coil Shorted to Ground Test

1. Test continuity between [83B] terminal D and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (GN/BE) wire.
   b. **No.** Go to Test 4.

4. Rear Fuel Injector Test

1. Turn IGN OFF.
2. Connect [83].
3. Disconnect rear fuel injector [85].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 5.
   b. **No.** Replace rear fuel injector.

5. Front Fuel Injector Test

1. Turn IGN OFF.
2. Connect [85].
3. Disconnect front fuel injector [84].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace front fuel injector.

6. Purge Solenoid Test

1. Turn IGN OFF.
2. Connect [84].
3. Disconnect purge solenoid [95].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 7.
   b. **No.** Replace purge solenoid.

7. Front HO2S Test

1. Turn IGN OFF.
2. Connect [178].
3. Disconnect front HO2S [138].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 8.
   b. **No.** Replace front HO2S.

8. Rear HO2S Test

1. Turn IGN OFF.
2. Connect [138].
3. Disconnect rear HO2S [137].

4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 9.
   b. **No.** Replace rear HO2S.

9. Front ACR Test

1. Turn IGN OFF.
2. Connect [137].
3. Disconnect front ACR [203F].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 10.
   b. **No.** Replace front ACR.

10. Rear ACR Test

1. Turn IGN OFF.
2. Connect [203F].
3. Disconnect rear ACR [203R].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 11.
   b. **No.** Replace rear ACR.

11. ECM Test

1. Turn IGN OFF.
2. Connect [203R].
3. Disconnect ECM [78-1], [78-2] and [78-3].
4. Clear DTCs.
5. Turn IGN ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 12.
   b. **No.** Replace ECM.

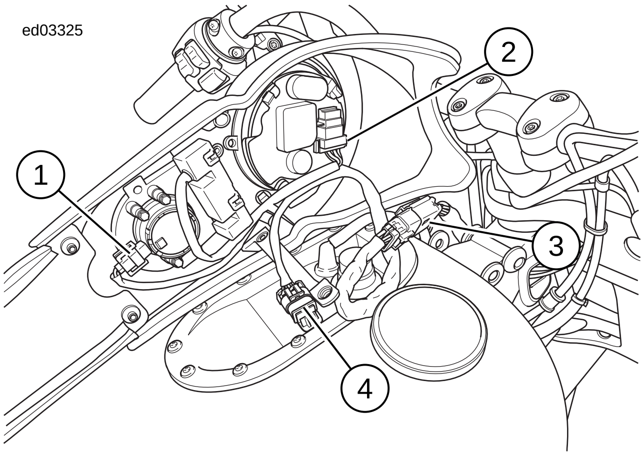
12. BCM Test

1. Turn IGN OFF.
2. Connect [78].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B] leaving BCM [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB terminal L3 and ground.
6. Is continuity present?
   a. **Yes.** Repair short to ground in (R/GN) wire.
   b. **No.** Replace BCM.

FUEL PUMP DIAGNOSTICS 6.8

DESCRIPTION AND OPERATION

See Figure 6-8. The BCM supplies and monitors the 12V fuel pump power circuit from terminal F4 of the BCM to the fuel pump. The fuel pump is constantly grounded. The BCM controls the fuel pump by turning on and off the power to the pump on the (R/BN) wire.



1. **Ignition switch [33]**
2. **Speedometer [39]**
3. **Console gauges/instrument lamps [20]**
4. **Fuel pump [141]**

Figure 6-8. Under Console: Typical

Table 6-7. Code Description

DTC	DESCRIPTION
B2116	Fuel pump output open
B2117	Fuel pump output shorted high
B2118	Fuel pump output shorted low
B2119	Fuel pump output overloaded

Conditions for Setting

DTC B2116 will set if the fuel pump circuit draws less than 600 mA.

DTC B2119 will set if the fuel pump circuit draws more than 6 amps.

Diagnostic Tips

DTC B2119 will set if the BCM sees an excessive load on the fuel pump circuit. This could be caused by a fuel pump being run dry. If the fuel pump was replaced or the vehicle was run out of gas, prime the pump and clear the code. Start the vehicle and check DTCs to see if the code returns.

Any circuit that is powered up continually with IGN ON will cause DTC B2117 or B2119 to set if shorted to the fuel pump circuit. If a short to voltage or overload condition is found, test for continuity between fuel pump circuit and the other power circuits from the BCM.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

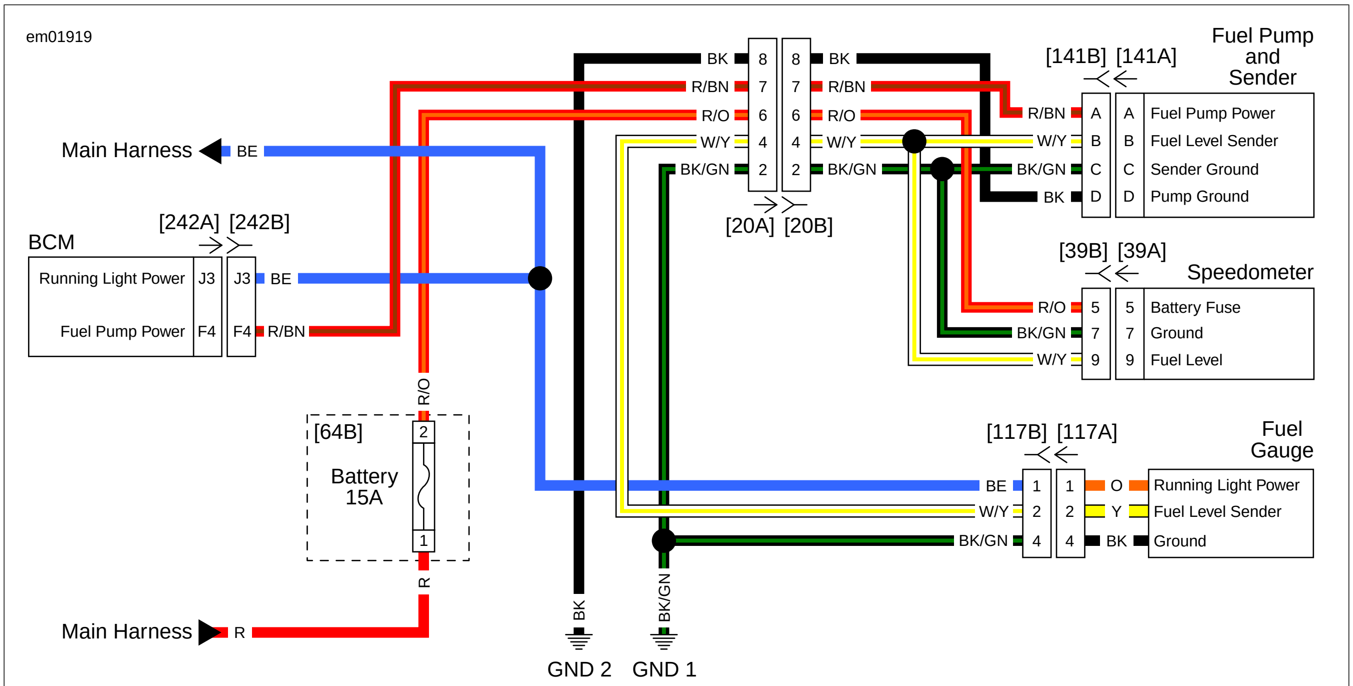


Figure 6-9. Fuel Sensor Circuit

DTC B2116

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY

Table 6-8. DTC B2116 Diagnostic Faults

POSSIBLE CAUSES
Open in the fuel pump power circuit
Fuel pump fault or malfunction

1. Fuel Pump Circuit Test

1. Turn IGN OFF.
2. Disconnect fuel pump [141].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect voltmeter between [141B] terminals A and D.
4. Turn IGN ON.
5. Was battery voltage displayed for a short time?
   a. **Yes.** Replace fuel pump.
   b. **No.** Go to Test 2.

2. Ground Circuit Open Test

1. Turn IGN OFF.
2. Test resistance between [141B] terminal D and ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK) ground wire.

3. Power Circuit Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) to wire harness [242B], leaving BCM [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
3. Test resistance between BOB terminal F4 and [141B] terminal A.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace BCM.
   b. **No.** Repair open in (R/BN) wire.

DTC B2117

Table 6-9. DTC B2117 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in the fuel pump power circuit

1. Fuel Pump Power Circuit Short to Voltage Test

1. Turn IGN ON.
2. Does fuel pump continue to run after the initial 2 second start up?
   a. **Yes.** Repair short to voltage in (R/BN) wire. See diagnostic tips. If no source of short is found, replace BCM.
   b. **No.** Go to Test 2.

2. Code Verification Test

1. Clear DTC.
2. Start engine.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Replace BCM.
   b. **No.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

DTC B2118, B2119

Table 6-10. DTC B2118, B2119 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in the fuel pump power circuit
Fuel pump malfunction

1. Fuel Test

1. Verify there is fuel in fuel tank.
2. Is fuel present in tank?
   a. **Yes.** Go to Test 2.
   b. **No.** Fill tank with fuel and clear DTCs. If the DTC returned, then continue with tests. Go to Test 2.

2. Fuel Pump Test

1. Turn IGN OFF.
2. Disconnect fuel pump [141].
3. Clear DTC.
4. Turn IGN ON.
5. Check DTCs.
6. Did DTC reset?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace fuel pump.

3. Power Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect BCM [242].
3. Test continuity between [141B] terminal B (R/BN) wire and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground on (R/BN) wire.
   b. **No.** See diagnostic tips. If problem not found, replace BCM.

MAP SENSOR DIAGNOSTICS: IAC 6.9

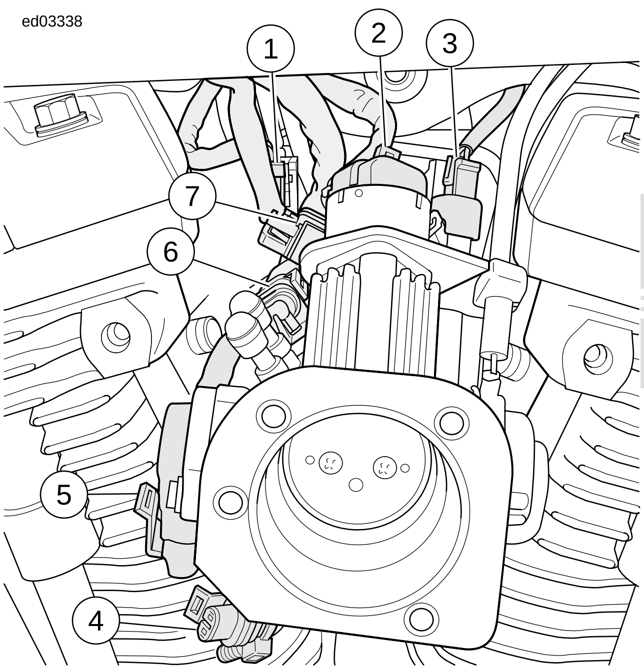
DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-23738	VACUUM PUMP

See Figure 6-10. The MAP sensor is supplied 5V from the ECM [78-2] terminal 9 and sends a signal back to the ECM [78-1] terminal 7. This signal varies in accordance with engine vacuum and atmospheric barometric pressure. Changes in barometric pressure are influenced by weather and altitude.

Table 6-11. Code Description

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



1. **Rear fuel injector [85]**
2. **IAC [87]**
3. **Front fuel injector [84]**
4. **Active intake solenoid [178]**
5. **TPS [88]**
6. **IAT sensor [89]**
7. **MAP sensor [80]**

Figure 6-10. Between Cylinders Right Side: IAC

Diagnostic Tips

Shorted IAC wiring can cause MAP sensor DTCs.

These codes will set if the MAP sensor signal is out of range. Code P0108 can only be detected with the engine running.

NOTE

Do not over-pump vacuum pump during MAP sensor output check as sensor damage may result.

- Check MAP sensor output. Using the VACUUM PUMP (Part No. HD-23738), apply a vacuum to the pressure port of the MAP sensor. The signal voltage should decrease as the vacuum is applied.
- The MAP, JSS, TPS and VSS are connected to the same 5V reference line. If the reference line shorts to ground or opens, multiple codes will be set (DTC P0107, P0108, P0122, P0123, P1501, P1502).
- A faulty sensor can negatively affect the signal voltage of the other sensors sharing the same 5V reference. If the wiring passes the following tests, disconnect one sensor at a time on the 5V reference and verify the DTC is still present. Additional DTCs will be set as each sensor is disconnected, clear DTCs after this test. Be sure to perform this test before replacing a component.
- MAP sensor codes may be set in cases of an intermittent TPS which has not yet set TPS codes.

See Figure 6-11 for common 5V sensor power and ground interconnections.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

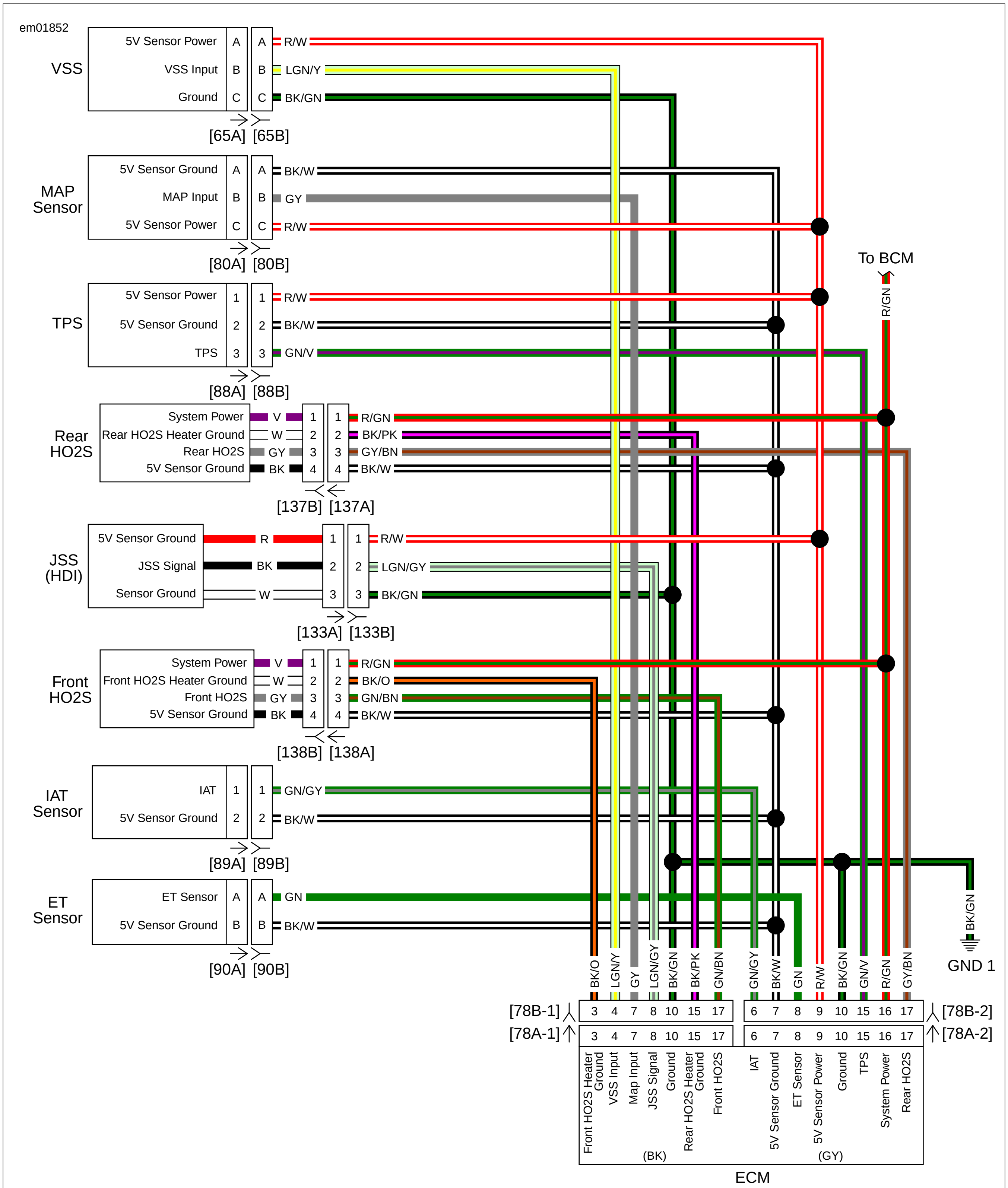


Figure 6-11. Sensor Circuit

DTC P0107

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-12. DTC P0107 Diagnostic Faults

POSSIBLE CAUSES
MAP sensor malfunction
Open or shorted to ground signal wire
Open or shorted to ground 5V reference circuit

1. MAP Sensor Test

1. Turn IGN OFF.
2. Disconnect MAP sensor [80].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect a test wire between [80B] terminals B (GY) wire and C (R/W) wire.
4. Clear DTCs.
5. Start engine.
6. Turn IGN OFF.
7. Check DTCs.
8. Did DTC reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace MAP sensor.

2. Signal Voltage Test

1. Turn IGN OFF.
2. Remove test wire.
3. Turn IGN ON.
4. Test voltage between [80B] terminal C (R/W) wire to ground.
5. Is voltage approximately 5V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 6.

3. Signal Wire Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [80B] terminal B (GY) wire and BOB [78-1] terminal 7.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (GY) wire.

4. Signal Wire Shorted to Ground Test

1. Test continuity between BOB [78-1] terminal 7 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (GY) wire.
   b. **No.** Go to Test 5.

5. Signal Wire Shorted to Sensor Ground Test

1. Test continuity between BOB [78-1] terminal 7 and [78-2] terminal 7.
2. Is continuity present?
   a. **Yes.** Repair short between (GY) and (BK/W) wires.
   b. **No.** Replace ECM.

6. 5V Reference Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [80B] terminal C (R/W) wire and BOB [78-2] terminal 9.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open in (R/W) wire.

7. 5V Reference Shorted to Signal Ground Test

1. Test continuity between BOB [78-2] terminals 9 and 7.
2. Is continuity present?
   a. **Yes.** Repair short between the (R/W) and (BK/W) wires.
   b. **No.** Go to Test 8.

NOTE

The following tests are related to IAC circuitry.

8. IAC A High Shorted to Voltage Test

1. Disconnect IAC [87].
2. Turn IGN ON.
3. Test voltage between BOB [78B-2] terminal 1 and ground.
4. Is voltage greater than 1.0V?
   a. **Yes.** Repair short to voltage on (GN/O) wire.
   b. **No.** Go to Test 9.

9. B High Shorted to Voltage Test

1. Test voltage between BOB [78B-2] terminal 12 and ground.
2. Is voltage greater than 1.0V?
   a. **Yes.** Repair short to voltage on (GN/W) wire.
   b. **No.** Go to Test 10.

10. B Low Shorted to Voltage Test

1. Test voltage between BOB [78B-2] terminal 13 and ground.
2. Is voltage greater than 1.0V?
   a. **Yes.** Repair short to voltage on (GY/W) wire.
   b. **No.** Replace ECM.

DTC P0108

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4-P	ECM OVERLAY

Table 6-13. DTC P0108 Diagnostic Faults

POSSIBLE CAUSES
MAP sensor malfunction
Short to voltage

1. MAP Sensor Test

1. Turn IGN OFF.
2. Disconnect MAP sensor [80].
3. Clear DTC.
4. Start engine.
5. Turn IGN OFF.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace MAP sensor.

2. Signal Wire Short to 5V Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) to wire harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between BOB [78-1] terminal 7 and [78-2] terminal 9.
5. Is continuity present?
   a. **Yes.** Repair short between (R/W) and (GY) wires.
   b. **No.** Go to Test 3.

3. Signal Wire Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB [78-1] terminal 7 and ground.
3. Is voltage present?
   a. **Yes.** Repair short to voltage in (GY) wire.
   b. **No.** Go to Test 4.

4. Ground Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) to wire harness [78B-1] and [78B-2], leaving EMC [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [80B] terminal A and BOB [78-2] terminal 7.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace the MAP sensor.
   b. **No.** Go to Test 5.

5. IAC B High Shorted to Voltage Test

1. Disconnect IAC [87].
2. Turn IGN ON.
3. Test voltage between BOB [78B-2] terminal 12 and ground.
4. Is voltage greater than 1.0V?
   a. **Yes.** Repair short to voltage on (GN/W) wire.
   b. **No.** Go to Test 6.

6. B Low Shorted to Voltage Test

1. Test voltage between BOB [78B-2] terminal 13 and ground.
2. Is voltage greater than 1.0V?
   a. **Yes.** Repair short to voltage on (GY/W) wire.
   b. **No.** Replace ECM.

IAT DIAGNOSTICS: IAC 6.10

DESCRIPTION AND OPERATION

See Figure 6-12. The ECM supplies and monitors a voltage signal on [78-2] terminal 6 to one side of the IAT sensor. The other side of the IAT sensor is connected to a common sensor ground, which is also connected to the ECM [78-2] terminal 7.

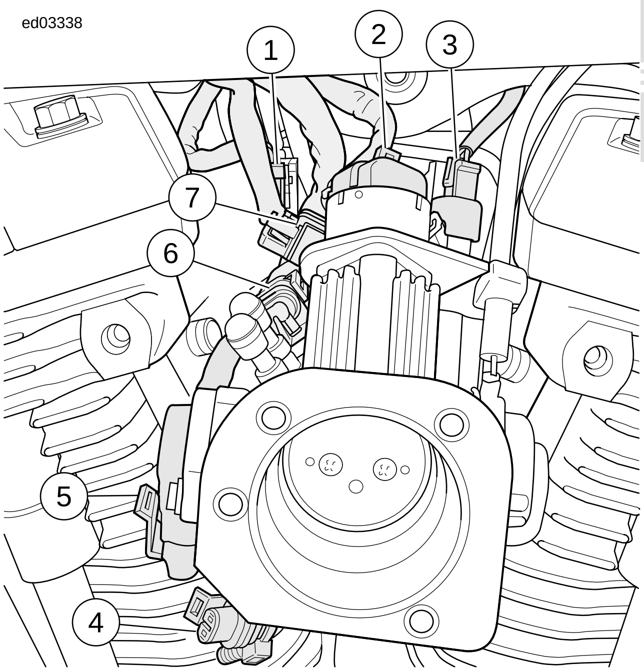
The IAT sensor is a thermistor device, meaning that at a specific temperature, it will have a specific resistance across its terminals. As this resistance varies, so does the voltage at [78-2] terminal 6.

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on [78-2] terminal 6.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5V.

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

Table 6-14. Code Description

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



1. **Rear fuel injector [85]**
2. **IAC [87]**
3. **Front fuel injector [84]**
4. **Active intake solenoid [178]**
5. **TPS [88]**
6. **IAT sensor [89]**
7. **MAP sensor [80]**

Figure 6-12. Between Cylinders Right Side: IAC

Diagnostic Tips

An intermittent may be caused by a poor connection, rubbed through wire insulation or an open wire inside the insulation.

Check the following conditions:

- **Poor connection:** Inspect ECM and harness connector [78-1] and [78-2] for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Perform** 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test **to locate intermittents:** If connections and harness check out OK, use a multimeter to check the IAT sensor voltage while moving related connectors and wiring harness. If the failure is induced, the IAT voltage will change.
- **Shifted sensor resistance value:** Compare the temperatures of the ET and IAT sensors with the engine at ambient temperature in order to evaluate the possibility of a shifted (out of calibration) sensor which may result in driveability problems. The sensor temperatures should be within 10 degrees of each other.
- A faulty sensor can negatively affect the signal voltage of the other sensors sharing the same 5V reference. If the wiring passes the following tests, disconnect one sensor at a time on the 5V reference and verify the DTC is still present. Additional DTCs will be set as each sensor is disconnected, clear DTCs after this test. Be sure to perform this test before replacing a component.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

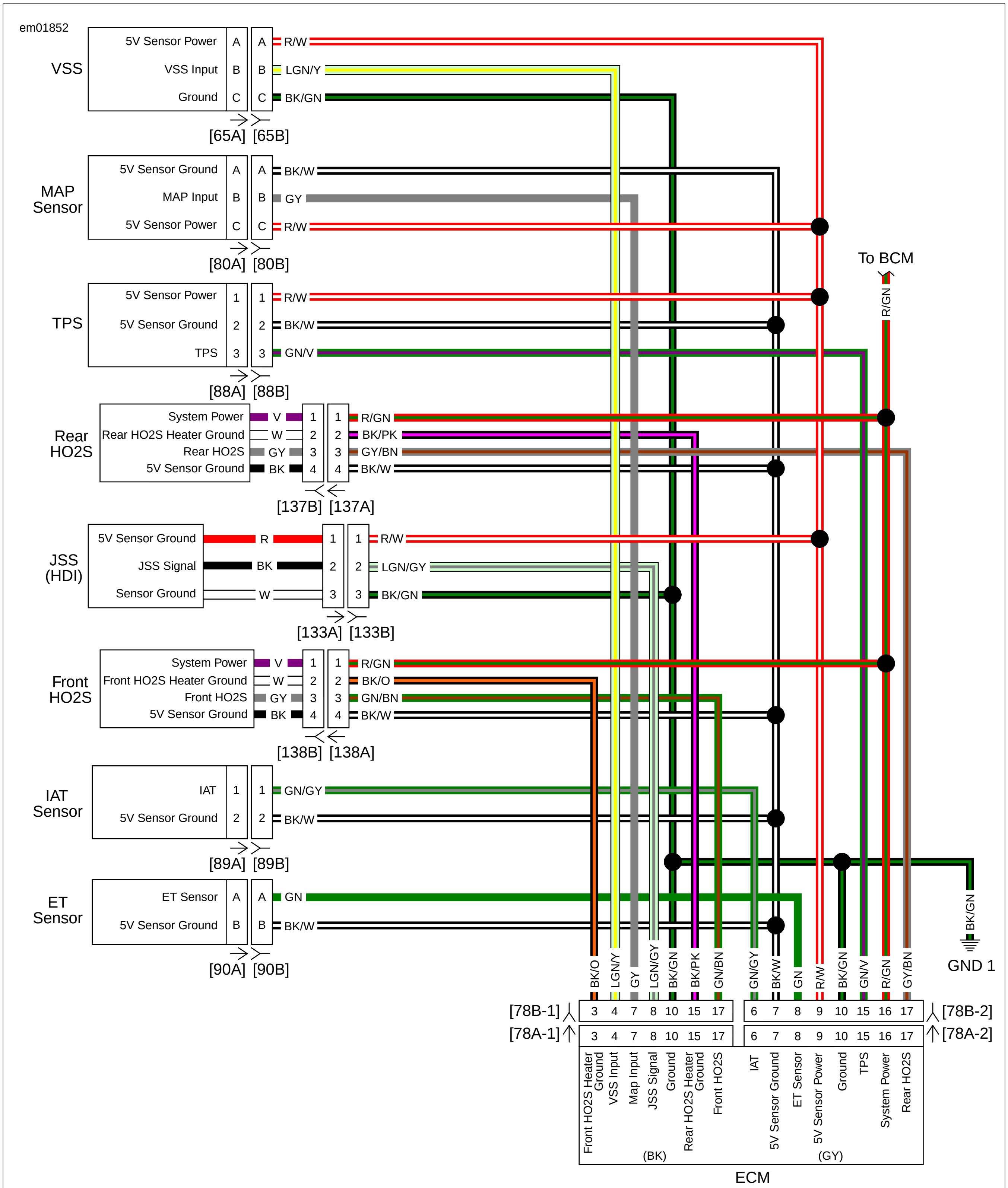


Figure 6-13. Sensor Circuit

DTC P0112

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-15. DTC P0112 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in 5V reference circuit

NOTE

Vehicle and sensor must be at ambient temperature before starting diagnostic test.

1. IAT Sensor Test

1. Turn IGN OFF.
2. Disconnect IAT sensor [89].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [89A] terminals 1 (GN/GY) wire and 2 (BK/W) wire.
4. Is resistance between 500-5000?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace IAT sensor.

2. Signal Grounded Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Test continuity between BOB [78-2] terminals 6 and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground on (GN/GY) wire.
   b. **No.** Go to Test 3.

3. Signal Wire Shorted to Sensor Ground Test

1. Test continuity between BOB [78-2] terminals 6 and 7.
2. Is continuity present?
   a. **Yes.** Repair short between [89B] terminals 1 (GN/GY) wire and 2 (BK/W) wire.
   b. **No.** Replace ECM.

DTC P0113

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-16. DTC P0113 Diagnostic Faults

POSSIBLE CAUSES
Open or short to voltage in 5V reference circuit

NOTE

Vehicle and sensor must be at ambient temperature before starting diagnostic test.

1. IAT Sensor Test

1. Turn IGN OFF.
2. Disconnect IAT sensor [89].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [89A] terminals 1 (GN/GY) wire and 2 (BK/W) wire.
4. Is resistance between 500-5000?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace IAT sensor

2. IAT Signal Voltage Test

1. Turn IGN OFF.
2. Disconnect IAT sensor [89].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [89B] terminal 1 (GN/GY) wire and ground.
4. Turn IGN ON.
5. Is voltage greater than 6V?
   a. **Yes.** Repair short to voltage on (GN/GY) wire.
   b. **No.** Go to Test 3.

3. Signal Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [89B] terminal 1 (GN/GY) and BOB [78-2] terminal 6.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open circuit.

4. Open Ground Wire Test

1. Test resistance between BOB [78-2] terminal 7 and [89B] terminal 2 (BK/W) wire.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (BK/W) wire.

5. IAT Sensor Signal Wire Shorted to Sensor Power Test

1. Test continuity between BOB [78-2] terminals 6 and 9.
2. Is continuity present?
   a. **Yes.** Repair short between (GN/GY) and (R/W) wires.
   b. **No.** Replace ECM.

TMAP SENSOR DIAGNOSTICS: ETC 6.11

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-23738	VACUUM PUMP

See Figure 6-14. The TMAP sensor provides the functions of both an IAT sensor and a MAP sensor in one unit. The TMAP sensor is supplied 5V from ECM [78-3] terminal 18. It sends MAP and IAT signals back to ECM [78-1] terminal 7 and [78-2] terminal 6, respectively. Refer to Table 6-17.

Table 6-17. Code Description

DTC	DESCRIPTION
P0107	MAP sensor open/low
P0108	MAP sensor high
P0112	IAT sensor voltage low
P0113	IAT sensor open/high

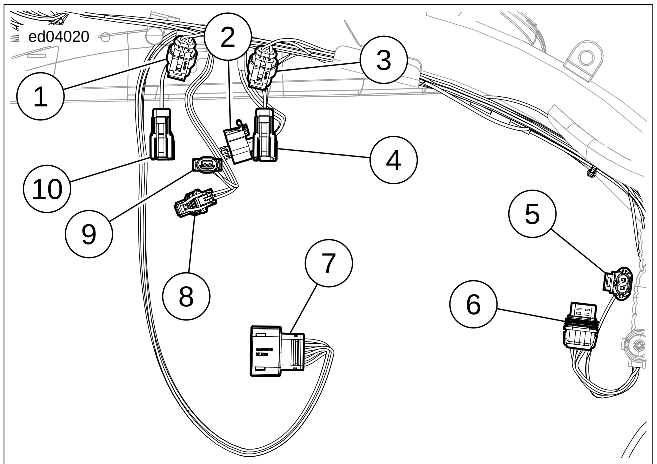
TMAP: MAP Signal

The MAP signal varies in accordance with engine vacuum and atmospheric pressure. Changes in atmospheric pressure are influenced by weather and altitude.

TMAP: IAT Signal

The IAT portion of the TMAP sensor is a thermistor device. At a specific temperature, it will have a specific resistance across its terminals. As this resistance varies, so does the voltage on [78-2] terminal 6 of the ECM.

- At high temperatures, the resistance of the IAT sensor is very low, which effectively lowers the signal voltage on [78-2] terminal 6.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5V. The ECM monitors this voltage to compensate for various operating conditions.



1. **Front ACR [230]**
2. **TMAP [80]**
3. **Rear ACR [230]**
4. **Rear fuel injector [85]**
5. **Purge solenoid [95]**
6. **Ignition coil [83]**
7. **TCA [211]**
8. **ET sensor [90]**
9. **Ignition switch [33]**
10. **Front fuel injector [84]**

Figure 6-14. Engine: ETC

Diagnostic Tips: MAP Portion of TMAP Sensor

- DTCs P0107 or P0108 will set if the MAP sensor signal is out of range. DTC P0108 can only be detected with the engine running.
- Using the VACUUM PUMP (Part No. HD-23738), apply a vacuum to the pressure port of the TMAP sensor. The MAP signal voltage should lower as the vacuum is applied.
- The TMAP and TGS are connected to the same reference line (+5V Vref). If the reference line goes to ground or open, multiple codes will be set (DTCs P0107, P0108, P0122, P0123, P1501 and P1502).

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.1 CONNECTORS.

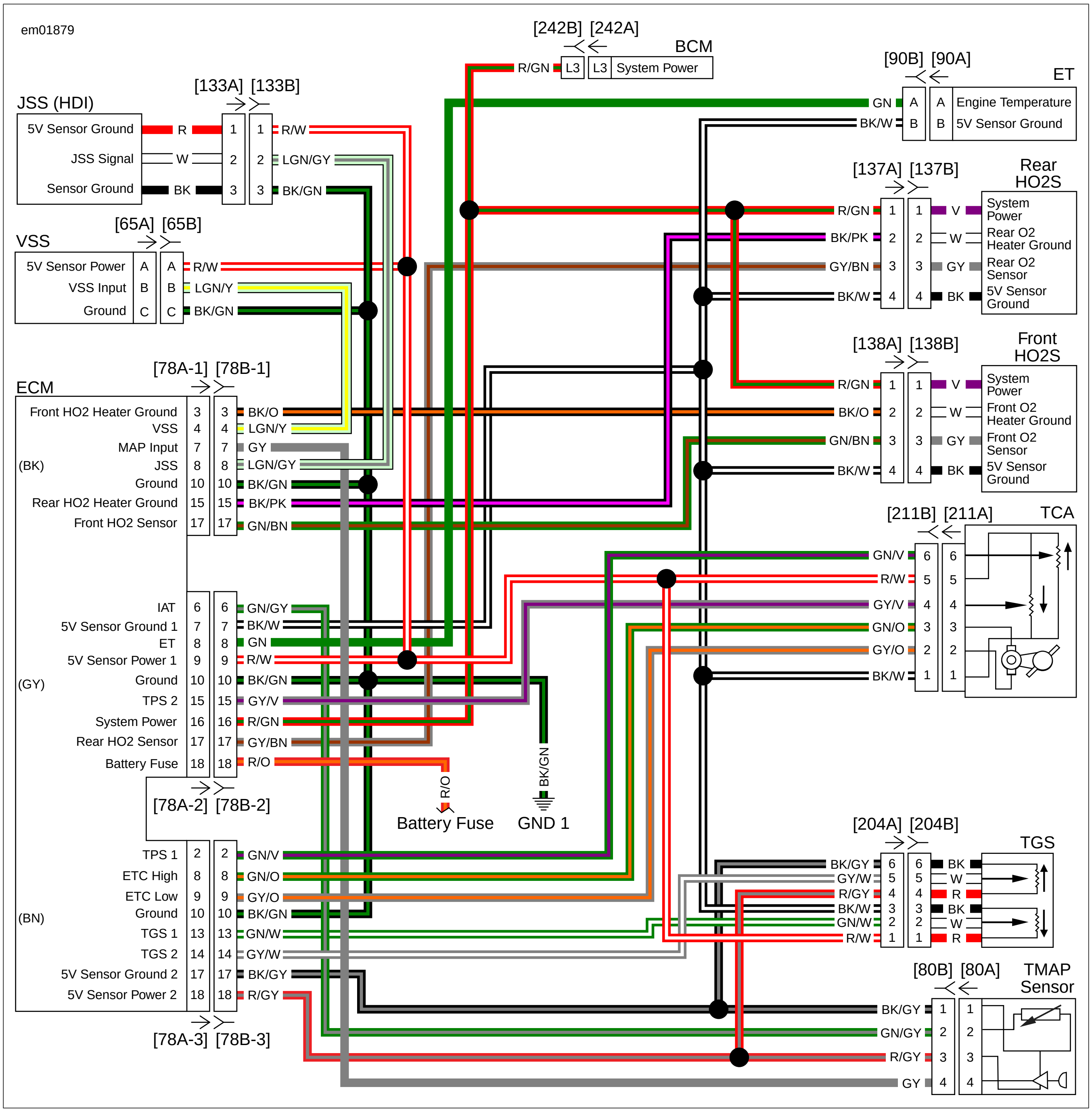


Figure 6-15. Sensor Circuit

DTC P0107

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-18. DTC P0107 Diagnostic Faults

POSSIBLE CAUSES
MAP sensor malfunction
Open or shorted to ground signal wire
Open or shorted to ground 5V reference circuit

1. MAP Sensor Test

1. Turn IGN OFF.
2. Disconnect TMAP sensor [80].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jumper between [80B] terminals 4 (GY) wire and 3 (R/GY) wire.
4. Clear DTCs.
5. Start engine.
6. Turn IGN ON.
7. Check DTCs.
8. Did DTC reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace TMAP sensor.

2. MAP Sensor Signal Voltage Test

1. Turn IGN OFF.
2. Remove jumper.
3. Turn IGN ON.
4. Test voltage between [80B] terminal 3 (R/GY) wire and ground.
5. Is voltage approximately 5V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 6.

3. MAP Sensor Signal Wire Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [80B] terminal 4 (GY) wire and BOB [78-1] terminal 7.
5. Is resistance less than 0.5 ohms?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (GY) wire.

4. MAP Sensor Signal Wire Shorted to Ground Test

1. Test continuity between BOB [78-1] terminal 7 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (GY) wire.
   b. **No.** Go to Test 5.

5. MAP Sensor Signal Wire Shorted to Sensor Ground Test

1. Test continuity between BOB [78-1] terminal 7 and [78-3] terminal 17.
2. Is continuity present?
   a. **Yes.** Repair short between (GY) and (BK/GY) wires.
   b. **No.** Replace ECM.

6. MAP Sensor 5V Reference Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [80B] terminal 3 (R/GY) wire and BOB [78-3] terminal 18.
5. Is resistance less than 0.5 ohms?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open in (R/GY) wire.

7. MAP Sensor 5V Reference Shorted to Signal Ground Test

1. Test continuity between BOB [78-3] terminals 17 and 18.
2. Is continuity present?
   a. **Yes.** Repair short between the (R/GY) and (BK/GY) wires.
   b. **No.** See diagnostic tips before replacement. Replace ECM.

DTC P0108

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-19. DTC P0108 Diagnostic Faults

POSSIBLE CAUSES
MAP sensor malfunction
Short to voltage

1. MAP Sensor Test

1. Turn IGN OFF.
2. Disconnect TMAP sensor [80].
3. Clear DTC.
4. Start engine.
5. Turn IGN OFF.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace MAP sensor.

2. MAP Sensor Signal Wire Short to 5V Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wire harness [78B-1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB [78-1] terminal 7 and [78-3] terminal 18.
5. Is continuity present?
   a. **Yes.** Repair short between (R/GY) and (GY) wires.
   b. **No.** Go to Test 3.

3. MAP Sensor Signal Wire Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB [78-1] terminal 7 and ground.
3. Is voltage present?
   a. **Yes.** Repair short to voltage in (GY) wire.
   b. **No.** Go to Test 4.

4. MAP Sensor 5V Reference Shorted to Battery Voltage Test

1. Test voltage between BOB [78-3] terminal 18 and ground.
2. Is voltage greater than 5.25V?
   a. **Yes.** Repair short to voltage in (R/GY) wire.
   b. **No.** Go to Test 5.

5. MAP Sensor Ground Wire Open Test

1. Test resistance between [80B] terminal 1 and BOB [78-3] terminal 17.
2. Is resistance less than 0.5 ohms?
   a. **Yes.** Replace TMAP sensor.
   b. **No.** Repair open in (BK/GY) wire.

DTC P0112

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-20. DTC P0112 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in 5V reference circuit

NOTE

Vehicle and sensor must be at ambient room temperature before starting diagnostic test.

1. IAT Sensor Test

1. Turn IGN OFF.
2. Disconnect TMAP sensor [80].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [80A] terminals 1 and 2.
4. Is resistance between 500-5000 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace TMAP sensor.

2. IAT Sensor Signal Wire Shorted to Ground Test

1. Test resistance between [80B] terminal 2 (GN/GY) and ground.
2. Is resistance reading less than 1 ohm?
   a. **Yes.** Repair short to ground on (GN/GY) wire.
   b. **No.** Go to Test 3.

3. IAT Sensor Signal Voltage High Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wire harness [78B-

1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See 1.3 DIAGNOSTIC TOOLS.

2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Test continuity between BOB [78-2] terminals 6 and 10.
4. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair short to ground on (GN/GY) wire.

4. IAT Sensor Signal Wire Shorted to Sensor Ground Test

1. Test continuity between BOB [78-2] terminal 6 and [78-3] terminal 17.
2. Is continuity present?
   a. **Yes.** Repair short between [80B] terminals 1 and 2 (GN/GY and BK/GY) wires.
   b. **No.** Replace ECM.

DTC P0113

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-21. DTC P0113 Diagnostic Faults

POSSIBLE CAUSES
Open or short to voltage in 5V reference circuit

NOTE

Vehicle and sensor must be at ambient temperature before starting diagnostic test.

1. IAT Sensor Test

1. Turn IGN OFF.
2. Disconnect TMAP sensor [80].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [80A] terminals 1 (BK/GY) wire and 2 (GN/GY) wire.
4. Is resistance between 500-5000 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace IAT sensor.

2. IAT Signal Voltage Test

1. Turn IGN ON.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [80B] terminal 2 (GN/GY) and ground.
3. Is voltage greater than 6V?
   a. **Yes.** Repair short to voltage on (GN/GY) wire.
   b. **No.** Go to Test 3.

3. Signal Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [80B] terminal 2 (GN/GY) and BOB [78-2] terminal 6.
5. Is resistance less than 0.5 ohms?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open circuit in (GN/GY) wire.

4. Open Ground Wire Test

1. Test resistance between BOB [78-3] terminal 17 and [80B] terminal 1 (BK/GY).
2. Is resistance less than 0.5 ohms?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (BK/GY) wire.

5. IAT Sensor Signal Wire Shorted to Sensor Power Test

1. Test continuity between BOB [78-2] terminal 6 and [78-3] terminal 18.
2. Is continuity present?
   a. **Yes.** Repair short between (GN/GY) and (R/GY) wires.
   b. **No.** Replace ECM.

ET SENSOR DIAGNOSTICS 6.12

DESCRIPTION AND OPERATION

See Figure 6-16. The ECM supplies and monitors a voltage signal from [78-2] terminal 8 to one side of the ET sensor. The other side of the ET sensor is connected to a common sensor ground. The ground is also connected to the ECM [78-2] terminal 7.

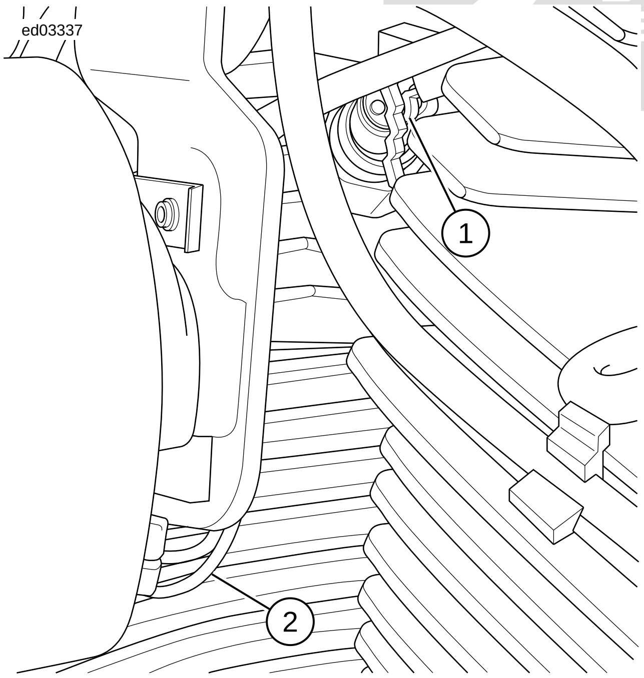
The ET sensor is a thermistor device. At a specific temperature it will have a specific resistance across its terminals. As this resistance varies, so does the voltage on ECM [78-2] terminal 8.

- At high temperatures, the resistance of the sensor is very low. This lowers the signal voltage on ECM [78-2] terminal 8.
- At low temperatures, the resistance is very high. This allows the voltage to rise close to 5V.

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

Table 6-22. Code Description

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



1. **ET sensor [90]**
2. **Horn [122]**

Figure 6-16. Horn and ET Sensor

Diagnostic Tips

Once the engine is started, the temperature should rise steadily to operating temperature.

An intermittent may be caused by a poor connection, damaged or worn wire insulation or an inoperative wire inside the insulation.

Check the following conditions:

- **Poor connection:** Inspect ECM harness connector [78-1] and [78-2] for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Perform 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test to locate intermittents:** If connections and harness check out OK, use a multimeter to check the engine temperature reading while moving related connectors and wiring harness. If the failure is induced, the engine temperature display will change.
- **Shifted sensor resistance value:** Measure ET and IAT sensor temperatures with a cool engine. The sensor temperatures should be within 10 °F (5.6 °C) of each other. If the two sensors are not within the specified range replace the inaccurate sensor.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

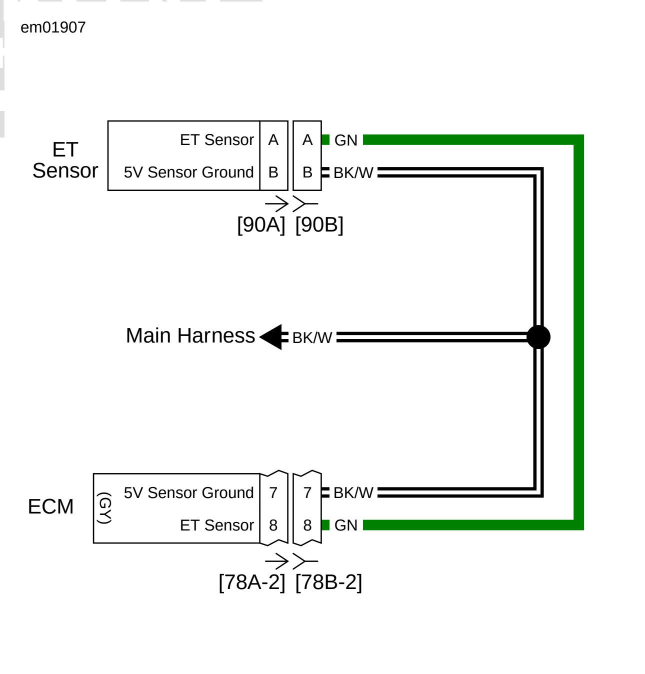


Figure 6-17. ET Circuit

DTC P0117

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-23. DTC P0117 Diagnostic Faults

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

1. ET Sensor Test

NOTE

Vehicle and sensor must be at ambient temperature before starting diagnostic test.

1. Turn IGN OFF.
2. Disconnect ET sensor [90].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test the resistance between [90A] terminals A (GN) wire and B (BK/W) wire.
4. Is the resistance reading between 900-10,000 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace ET sensor.

2. ET Sensor Signal Wire Shorted to Ground Test

1. Test resistance between [90B] terminal A (GN) wire and ground.
2. Is resistance less than 1 ohm?
   a. **Yes.** Repair short to ground in (GN) wire.
   b. **No.** Go to Test 3.

3. ET Sensor Signal Wire Shorted to Sensor Ground Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Test continuity between BOB [78-2] terminals 8 and 7.
4. Is continuity present?
   a. **Yes.** Repair short between [90B] terminals A (GN) wire and B (BK/W) wire.
   b. **No.** Replace ECM.

DTC P0118

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-24. DTC P0118 Diagnostic Faults

POSSIBLE CAUSES
ET sensor malfunction
Open or short to voltage in 5V reference circuit

1. ET Signal Voltage Test

1. Turn IGN OFF.
2. Disconnect ET sensor [90].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [90B] terminal A (GN) wire and ground.
4. Turn IGN ON.
5. Is voltage greater than 6V?
   a. **Yes.** Repair short to voltage on (GN) wire.
   b. **No.** Go to Test 2.

2. ET Sensor Signal Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [90B] terminal A (GN) wire and BOB [78-2] terminal 8.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (GN) wire.

3. ET Sensor Open Ground Wire Test

1. Test resistance between [90B] terminal B (BK/W) wire and BOB [78-2] terminal 7.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (BK/W) wire.

4. ET Sensor Signal Wire Shorted to Sensor Power Test

1. Test continuity between BOB [78-2] terminals 8 and 9.

2. Is continuity present?
   a. **Yes.** Repair short between (GN) and (R/W) wires.
   b. **No.** Go to Test 5.

5. ET Sensor Test

1. Connect [90].
2. Test continuity between BOB [78-2] terminals 8 and 7.
3. Is continuity present?
   a. **Yes.** Replace ECM.
   b. **No.** Replace ET sensor.

TPS DIAGNOSTICS: IAC 6.13

DESCRIPTION AND OPERATION

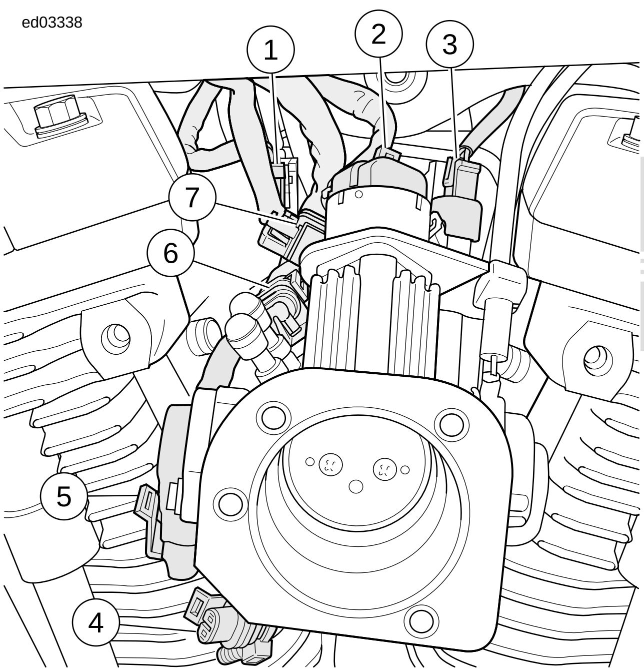
See Figure 6-18. The ECM supplies a 5V signal on [78-2] terminal 9 to terminal 1 of the TPS. The TPS sends a signal back to the ECM on [78-2] terminal 15. The returned signal varies in voltage according to throttle position.

- At idle (closed throttle), the signal is typically in the range of 0.2-0.8V.
- At wide open throttle, the signal is normally 4.0-4.9V.

DTC P0122 or P0123 will set if the TPS voltage signal does not fall within the acceptable range.

Table 6-25. Code Description

DTC	DESCRIPTION
P0122	TPS 1 low/open
P0123	TPS 1 high



1. **Rear fuel injector [85]**
2. **IAC [87]**
3. **Front fuel injector [84]**
4. **Active intake solenoid [178]**
5. **TPS [88]**
6. **IAT sensor [89]**
7. **MAP sensor [80]**

Figure 6-18. Between Cylinders Right Side: IAC

Diagnostic Tips

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

NOTE

The MAP, JSS (HDI), VSS and TPSs are connected to the same reference line (5V reference). If the line goes to ground or open, multiple trouble codes will be set (DTCs P0107, P0108 and P0122, P0123, P1501 or P1502). Start with the DTC having the lowest ranking value.

Check for the following conditions:

- **Poor connection:** Inspect ECM harness connector [78B-1] and [78B-2] for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Perform** 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test **to locate intermittents:** If connections and harness check out OK, monitor TPS voltage using a multimeter while moving related connectors and wiring harness. A TPS voltage change when a part is moved indicates an intermittent.
- **TPS scaling:** Observe the TPS voltage display while opening the throttle with engine stopped and ignition switch ON. Display should vary from closed throttle TPS voltage (when throttle is closed) to greater than 4.0V (when throttle is held wide open). As the throttle is **slowly** moved, the voltage should change gradually without spikes or low voltages being observed.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

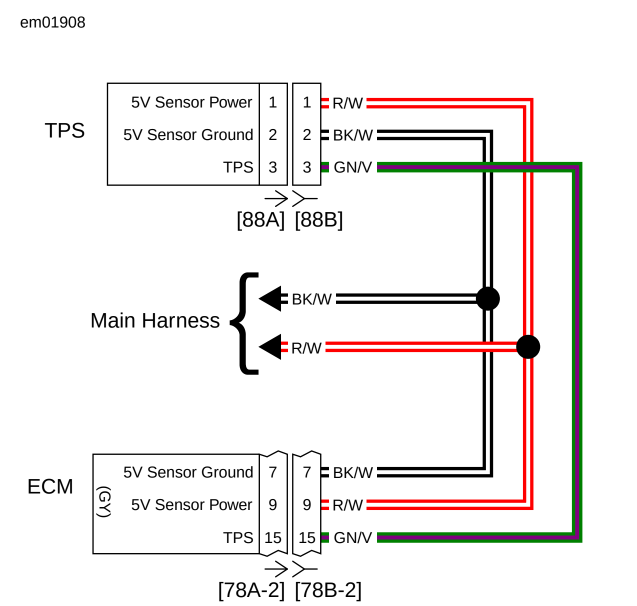


Figure 6-19. TPS Circuit

DTC P0122

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-26. DTC P0122 Diagnostic Faults

POSSIBLE CAUSES
TPS malfunction
Open or short to ground in 5V reference circuit
Short to ground in signal circuit
Open in TPS sensor wire

1. TPS Circuit Test

1. Turn IGN OFF.
2. Disconnect TPS [88].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), connect a test wire across [88B] terminals 1(R/W) wire and 3 (GN/V) wire.
4. Clear DTCs.
5. Turn IGN OFF and ON.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace TPS.

2. Signal Voltage Test

1. Turn IGN OFF.
2. Remove test wire.
3. Turn IGN ON.
4. Test voltage between [88B] terminal 1 (R/W) wire and ground.
5. Is voltage approximately 5V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 6.

3. Signal Wire Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [88B] terminal 3 (GN/V) wire and BOB [78-2] terminal 15.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (GN/V) wire.

4. Signal Wire Shorted to Ground Test

1. Test continuity between BOB [78-2] terminal 15 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (GN/V) wire.
   b. **No.** Go to Test 5.

5. Signal Wire Shorted to Sensor Ground Test

1. Test continuity between BOB [78-2] terminals 15 and 7.
2. Is continuity present?
   a. **Yes.** Repair short between (GN/V) and (BK/W) wires.
   b. **No.** Replace ECM.

6. 5V Sensor Power Open Wire Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [88B] terminal 1 (R/W) wire and BOB [78-2] terminal 9.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (R/W) wire.

DTC P0123

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-27. DTC P0123 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in 5V reference circuit
Open sensor ground

1. TPS Test

1. Turn IGN OFF.
2. Disconnect TPS [88].
3. Clear DTCs.

4. Turn IGN OFF and ON.
5. Check DTCs.
6. Did DTC reset?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 4.

2. Signal Wire Short to 5V Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [88B] terminals 1 (R/W) wire and 3 (GN/V) wire.
4. Is continuity present?
   a. **Yes.** Repair short between (R/W) and (GN/V) wires.
   b. **No.** Go to Test 3.

3. Signal Wire Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between [88B] terminal 3 (GN/V) wire and ground.
3. Is voltage present?
   a. **Yes.** Repair short to voltage in (GN/V) wire.
   b. **No.** Replace ECM.

4. 5V Shorted to Battery Voltage Test

1. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [88B] terminal 1 (R/W) wire and ground.
2. Is voltage greater than 5.25V?
   a. **Yes.** Repair short to voltage in (R/W) wire.
   b. **No.** Go to Test 5.

5. Ground Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [88B] terminal 2 (BK/W) wire and BOB [78-2] terminal 7.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace TPS.
   b. **No.** Repair open in (BK/W) wire.

TCA DIAGNOSTICS: ETC 6.14

DESCRIPTION AND OPERATION

See Figure 6-20. A dual TPS is integrated into the TCA, mounted to the induction module.

Within the TCA, a set of potentiometers are designated as TPS (TPS1 and TPS2). The ECM drives the motor in the TCA to open and close the throttle plate based on the signals from the twist grip sensor. The TPS (TPS1 and TPS2) send signals back to the ECM based on throttle plate position to verify the throttle plate movement.

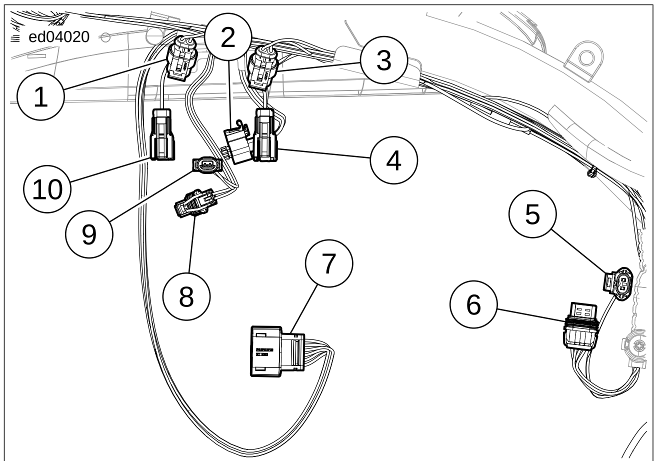
The ECM supplies a 5.0V signal from terminal [78-2] terminal 9 to TPS1 and [78-3] terminal 18 to TPS2. The signals from TPS1 and TPS2 are sent back to the ECM [78-3] terminals 13 and 14 and vary in voltage according to actual throttle plate position.

The two TP sensors work opposite each other. When one sensor reads high, the other reads low. The sum of TPS1 and TPS2 signals should measure around 5.0V.

See Figure 6-21 for TCA (TPS1 and TPS2) circuitry diagram. Refer to Table 6-28 for DTCs associated with TPS1 and TPS2 of the TCA.

Table 6-28. Code Description

DTC	DESCRIPTION
P0120	TPS1 range error
P0122	TPS1 low/open
P0123	TPS1 high
P0220	TPS2 range error
P0222	TPS2 low/open
P0223	TPS2 high



1. **Front ACR [230]**
2. **TMAP [80]**
3. **Rear ACR [230]**
4. **Rear fuel injector [85]**
5. **Purge solenoid [95]**
6. **Ignition coil [83]**
7. **TCA [211]**
8. **ET sensor [90]**
9. **Ignition switch [33]**
10. **Front fuel injector [84]**

Figure 6-20. Engine: ETC

NOTE

The TGS, JSS, TCA and VSS sensors are connected to the same reference line (5V reference). If the reference line goes to ground or open, multiple codes will be set (DTC P0122, P0123, P0502, P0503, P1501, P1502, P2101, P2102, P2103, 2122, 2123, P2127, P2128). Start with the trouble code having the highest priority DTC. Refer to Table 1-12.

Check for the following conditions:

- **Poor connection:** Inspect ECM harness connector [78B-1], [78B-2] and [78-B-3] for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Perform** 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test **to locate intermittents:** If connections and harness check out OK, monitor TPS voltage using a multimeter while moving related connectors and wiring harness. If the failure is induced, the TPS voltage will change.
- An intermittent may be caused by poor connection, rubbed through wire insulation or an inoperative wire within the wire insulation.

Diagnostic Tips

A faulty sensor can negatively affect the signal voltage of the other sensors sharing the same 5V reference. If the wiring passes the following tests, disconnect one sensor at a time on the 5V reference and verify the DTC is still present. Additional DTCs will be set as each sensor is disconnected, clear DTCs

[HOME](#)

after this test. Be sure to perform this test before replacing a component.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see [A.1 CONNECTORS](#).

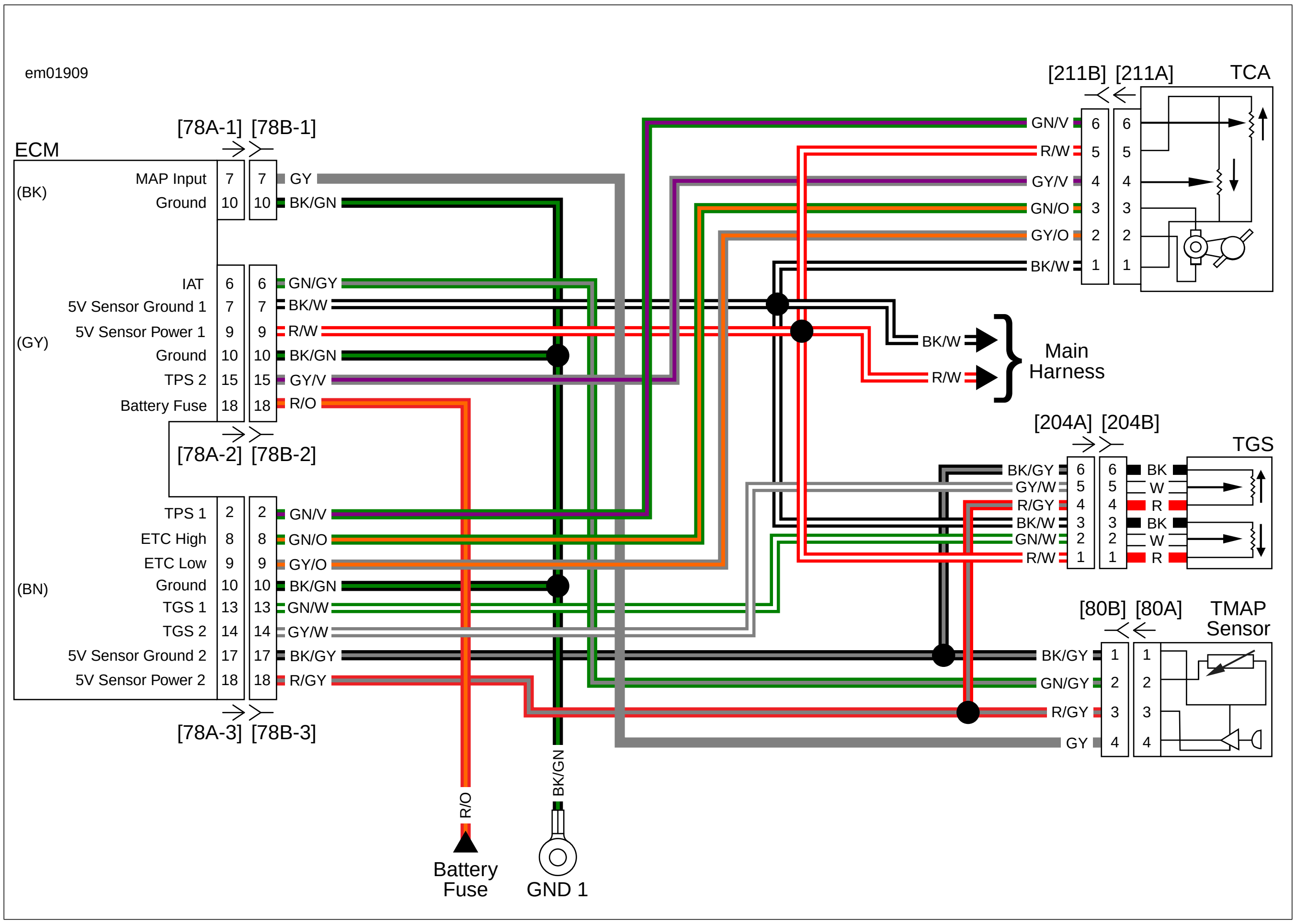


Figure 6-21. TCA, TGS, TMAP Circuits

DTC P0120

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-29. DTC P0120 Diagnostic Faults

POSSIBLE CAUSES
Open in sensor power circuit
Short to voltage in TPS-1 circuit
Open in TPS-1 circuit
Short to ground in TPS-1 circuit
Open sensor ground circuit

1. Sensor Power-1 Circuit Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See [1.3 DIAGNOSTIC TOOLS](#).
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Disconnect TCA [211].
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB [78-2] terminal 9 and [211B] terminal 5.
6. Is resistance less than 0.5 ohms?
   a. **Yes.** [Go to Test 2.](#)
   b. **No.** Repair open in (R/W) wire.

2. TPS-1 Circuit Shorted Test

1. Test continuity between BOB [78-2] terminal 9 and [78-3] terminal 2.
2. Is continuity present?
   a. **Yes.** Repair short between (GN/V) and (R/W) wires.
   b. **No.** Go to Test 3.

3. TPS-1 Circuit Continuity Test

1. Test resistance between BOB [78-3] terminal 2 and [211B] terminal 6.
2. Is resistance less than 0.5 ohms?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (GN/V) wire.

4. TPS-1 Circuit Short to Ground Test

1. Test continuity between BOB [78-3] terminal 2 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (GN/V) wire.
   b. **No.** Go to Test 5.

5. TPS-1 Circuit Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB [78-3] terminal 2 and ground.
3. Is voltage present?
   a. **Yes.** Repair short to voltage on (GN/V) wire.
   b. **No.** Go to Test 6.

6. Sensor Ground Continuity Test

1. Test resistance between BOB [78-2] terminal 7 and [211B] terminal 1.
2. Is resistance less than 0.5 ohms?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open in (BK/W) wire.

7. TCA Test

1. Turn IGN OFF.
2. Connect [78A-1], [78A-2] and [78A-3] to BOB.
3. Connect [211].
4. Turn IGN ON.
5. Test voltage between BOB [78-2] terminal 7 and [78-3] terminal 2.
6. Is voltage between 0.4-4.8V?
   a. **Yes.** Replace ECM.
   b. **No.** Replace TCA.

DTC P0122

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-30. DTC P0122 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in TPS-1 Circuit
Open in sensor power circuit

1. TCA Sensor-1 Circuit Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1], [78B-2] and [78B-3] and ECM [78A-1], [78A-2] and [78A-3]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-3] terminal 2 and [78-2] terminal 7.
6. Is voltage greater than 0.2V?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 4.

2. TCA Sensor-1 Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78A-1], [78A-2] and [78A-3] from BOB.
3. Disconnect TCA [211].
4. Test continuity between BOB [78-3] terminal 2 and ground.
5. Is continuity present?
   a. **Yes.** Repair short to ground in (GN/V) wire.
   b. **No.** Go to Test 3.

3. TCA Power-1 Circuit Open Test

1. Test resistance between BOB [78-2] terminal 9 and [211] terminal 5.
2. Is resistance less than 0.5 ohms?
   a. **Yes.** Replace TCA.
   b. **No.** Repair open in (R/W) wire.

4. TCA Sensor Test

1. Turn IGN OFF.
2. Disconnect TCA [211].

3. Test voltage between BOB [78-2] terminal 9 and ground.
4. Is voltage greater than 4V?
   a. **Yes.** Replace TCA.
   b. **No.** Go to Test 5.

5. ECM Test

1. Disconnect ECM [78A-1], [78A-2] and [78A-3] from BOB.
2. Test continuity between BOB [78-3] terminal 2 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (GN/V) wire.
   b. **No.** Replace ECM.

DTC P0123

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-31. DTC P0123 Diagnostic Faults

POSSIBLE CAUSES
Open in TPS-1 circuit
Short to voltage in TPS-1 circuit
Short to voltage in sensor power circuit
Open in sensor ground circuit

1. TPS-1 Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1], [78B-2] and [78B-3], and ECM [78A-1], [78A-2] and [78A-3]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-3] terminal 2 and [78-2] terminal 7.
6. Is voltage less than 4.8V?
   a. **Yes.** Go to Test 8.
   b. **No.** Go to Test 2.

2. TPS-1 Circuit Test

1. Turn IGN OFF.
2. Disconnect TCA [211].
3. Turn IGN ON.
4. Test voltage between [211B] terminal 6 and ground.
5. Is voltage between 4-5.25V?
   a. **Yes.** Go to Test 3.
   b. **No, less than 4V.** Repair open in (GN/V) wire.
   c. **No, greater than 5.25V.** Repair short to voltage in (GN/V) wire.

3. Sensor Power Circuit Test

1. Test voltage between [211B] terminal 5 and ground.
2. Is voltage less than 5.25V?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair short to voltage in (R/W) wire.

4. TCA Test

1. Jumper [211B] terminals 6 and 1.
2. Test voltage between BOB [78-3] terminal 2 and [78-2] terminal 7.
3. Is voltage greater than 1.0V?
   a. **Yes.** Go to Test 5.
   b. **No.** Replace TCA.

5. Sensor Ground Test

1. Turn IGN OFF.
2. Test resistance between [211B] terminal 1 and ground.
3. Is resistance less than 2 ohms?
   a. **Yes.** Go to Test 6.
   b. **No.** Go to Test 7.

6. Sensor Ground Circuit Shorted Test

1. Test continuity between [211B] terminals 5 and 6.
2. Is continuity present?
   a. **Yes.** Repair short between (GN/V) and (R/W) wires.
   b. **No.** Replace ECM.

7. Sensor Ground Circuit Test

1. Disconnect ECM [78A-1], [78A-2] and [78A-3].
2. Test resistance between [211B] terminal 1 and BOB [78-2] terminal 7.
3. Is resistance less than 0.5 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (BK/W) wire.

8. TPS-1 Circuit Function Test

1. Disconnect TCA [211].
2. Test voltage between [211B] terminal 6 and ground.
3. Is voltage between 2-5.25V?
   a. **Yes.** Go to Test 9.
   b. **No. Less than 2V.** Repair open in (GN/V) wire.
   c. **No. Greater than 5.25V.** Repair short to voltage on (GN/V) wire.

9. Sensor Power Short to Voltage Test

1. Test voltage between [211B] terminal 5 and ground.
2. Is voltage less than 5.25V?
   a. **Yes.** Go to Test 10.
   b. **No.** Repair short to voltage on (R/W) wire.

10. Ground Circuit Open Test

1. Turn IGN OFF.
2. Disconnect ECM [78A-1], [78A-2] and [78A-3].
3. Test resistance between [211B] terminal 1 and BOB [78-2] terminal 7.
4. Is resistance less than 0.5 ohms?
   a. **Yes.** Go to Test 11.
   b. **No.** Repair open in (BK/W) wire.

11. TPS-1 Continuity Test

1. Test resistance between [211B] terminal 6 and BOB [78-3] terminal 2.
2. Is resistance less than 0.5 ohms?
   a. **Yes.** Replace TCA.
   b. **No.** Repair open in (GN/V) wire.

DTC P0220

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-32. DTC P0220 Diagnostic Faults

POSSIBLE CAUSES
Open in sensor power circuit
Short to voltage in sensor power circuit
Open in TPS-2 circuit
Short to voltage in TPS-2 circuit
Short to ground in TPS-2 circuit
Open in sensor ground circuit

1. Sensor Power-1 Circuit Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Disconnect TCA [211].
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB [78-2] terminal 9 and [211] terminal 5.
6. Is resistance less than 0.5 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (R/W) wire.

2. Sensor Power-1 Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB [78-2] terminal 9 and ground.
3. Is battery voltage present?
   a. **Yes.** Repair short to voltage (R/W) wire.
   b. **No.** Go to Test 3.

3. TPS-2 Circuit Shorted Test

1. Turn IGN OFF.
2. Test continuity between BOB [78-2] terminals 9 and 15.
3. Is continuity present?
   a. **Yes.** Repair short between (R/W) and (GY/V) wires.
   b. **No.** Go to Test 4.

4. TPS-2 Circuit Resistance Test

1. Test resistance between BOB [78-2] terminal 15 and [211B] terminal 4.
2. Is resistance less than 0.5 ohms?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (GY/V) wire.

5. TPS-1 Circuit Short to Ground Test

1. Test continuity between BOB [78-2] terminal 15 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (GY/V) wire.
   b. **No.** Go to Test 6.

6. TPS-1 Circuit Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB [78-2] terminal 15 and ground.
3. Is voltage present?
   a. **Yes.** Repair short to voltage on (GY/V) wire.
   b. **No.** Go to Test 7.

7. Sensor Ground Resistance Test

1. Turn IGN OFF.
2. Test resistance between BOB [78-2] terminal 7 and [211B] terminal 1.
3. Is resistance less than 0.5 ohms?
   a. **Yes.** Go to Test 8.
   b. **No.** Repair open in (BK/W) wire.

8. TCA Test

1. Connect [78A-1], [78A-2] and [78A-3] to BOB.
2. Connect [211].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 15 and 7.
5. Is voltage between 0.4-4.8V?
   a. **Yes.** Replace ECM.
   b. **No.** Replace TCA.

DTC P0222

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-33. DTC P0222 Diagnostic Faults

POSSIBLE CAUSES
Open in sensor power circuit
Short to ground in TPS-2 circuit

1. TCA Sensor-2 Circuit Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1], [78B-2] and [78B-3], and ECM [78A-1], [78A-2] and [78A-3]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminals 15 and 7.
6. Is voltage greater than 0.2V?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 4.

2. TCA Sensor-2 Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect [78A-1], [78A-2] and [78A-3] from BOB.
3. Disconnect TCA [211].
4. Test continuity between BOB [78-2] terminal 15 and ground.
5. Is continuity present?
   a. **Yes.** Repair short to ground in (GY/V) wire.
   b. **No.** Go to Test 3.

3. TCA Power-1 Circuit Open Test

1. Test resistance between BOB [78-2] terminal 9 and [211] terminal 5.
2. Is resistance less than 0.5 ohms?
   a. **Yes.** Replace TCA.
   b. **No.** Repair open in (R/W) wire.

4. TCA 5V Reference Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect [211].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminal 9 and ground.
5. Is voltage greater than 4V?
   a. **Yes.** Replace TCA.
   b. **No.** Go to Test 5.

5. ECM Test

1. Turn IGN OFF.
2. Disconnect [78A] from BOB.
3. Test resistance between BOB [78-2] terminal 15 and ground.
4. Is resistance greater than 0.5 ohms?
   a. **Yes.** Repair short to ground in (GY/V) wire.
   b. **No.** Replace ECM.

DTC P0223

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-34. DTC P0223 Diagnostic Faults

POSSIBLE CAUSES
Open in sensor power circuit
Short to voltage in sensor power circuit
Open in TPS-2 circuit
Short to voltage in TPS-2 circuit
Short to ground in TPS-2 circuit
Open in sensor ground circuit

1. TPS-2 Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness

[78B-1], [78B-2] and [78B-3], and ECM [78A-1], [78A-2] and [78A-3]. See 1.3 DIAGNOSTIC TOOLS.

3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminals 15 and 7.
6. Is voltage less than 4.8V?
   a. **Yes.** Go to Test 7.
   b. **No.** Go to Test 2.

2. TPS-2 Circuit Test

1. Disconnect TCA [211].
2. Test voltage between [211B] terminal 4 and ground.
3. Is voltage less than 0.2V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 5.

3. Sensor Power Circuit Test

1. Test voltage between [211B] terminal 5 and ground.
2. Is voltage less than 5.25V?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair short to voltage in (R/W) wire.

4. Sensor Ground Test

1. Turn IGN OFF.
2. Test resistance between [211B] terminal 1 and ground.
3. Is resistance less than 2 ohms?
   a. **Yes.** Replace TCA.
   b. **No.** Go to Test 6.

5. Shorted 5V Circuit Test

1. Disconnect [78A-1], [78A-2] and [78A-3].
2. Test continuity between [211B] terminals 4 and 5.
3. Is continuity present?
   a. **Yes.** Repair short between (GY/V) and (R/W) wires.
   b. **No.** Replace ECM.

6. Sensor Ground Circuit Test

1. Test resistance between [211B] terminal 1 and BOB [78-2] terminal 7.
2. Is resistance less than 0.5 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (BK/W) wire.

7. TPS-2 Circuit Test

1. Disconnect [78A-1], [78A-2] and [78A-3].
2. Disconnect TCA [211].
3. Turn IGN ON.
4. Test voltage between [211B] terminal 4 and ground.
5. Is voltage less than 1.0V?
   a. **Yes.** Go to Test 8.
   b. **No.** Repair short to voltage on (GY/V) wire.

8. Sensor Short to Voltage Test

1. Test voltage between [211B] terminal 5 and ground.
2. Is voltage less than 5.25V?
   a. **Yes.** Go to Test 9.
   b. **No.** Repair short to voltage on (R/W) wire.

9. Ground Circuit Open Test

1. Turn IGN OFF.
2. Disconnect [78A-1], [78A-2] and [78A-3].
3. Test resistance between [211B] terminal 1 and BOB [78-2] terminal 7.
4. Is resistance less than 0.5 ohms?
   a. **Yes.** Replace TCA.
   b. **No.** Repair open in (BK/W) wire.

HO2S DIAGNOSTICS 6.15

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The HO2S provides a signal to the ECM which indicates whether the engine is running rich or lean.

- A P0131 (front) or P0151 (rear) is set when the ECM detects an excessively lean condition for a specified length of time. DTCs may also set if HO2S fails.
- A P0132 (front) or P0152 (rear) is set when the ECM detects an excessively rich condition for a specified length of time. This can be caused by oil contamination or fuel injector malfunctions. DTCs may also set if HO2S fails.
- A P0134 (front) or a P0154 (rear) is set when the sensor circuit is open or too cold to respond.
- When the air/fuel mixture is ideal, approximately 14.6:1 air to fuel, the voltage will be approximately 0.45V when measuring across the sensor.

The heater portion of the HO2S is powered by the BCM. The front and rear HO2S heaters have separate control circuits monitored by the ECM.

Table 6-35. Code Description

DTC	DESCRIPTION
P0031	Front HO2S low/open
P0032	Front HO2S shorted high
P0051	Rear HO2S low/open
P0052	Rear HO2S shorted high
P0131	O2 sensor low/engine lean (front)
P0132	Engine running rich (front)
P0134	O2 sensor high/open (front)
P0151	O2 sensor low/engine lean (rear)
P0152	Engine running rich (rear)
P0154	O2 sensor high/open (rear)

Diagnostic Tips

Some HO2S DTCs will not illuminate the check engine lamp for current or historic codes and will only be indicated by DIGITAL TECHNICIAN II (Part No. HD-48650) or odometer self-diagnostics. All historic HO2S DTCs are to be ignored and cleared. The multimeter displays the signal from the HO2S in Volts. This voltage will have an average value tending towards lean, rich or ideal value depending on operating temperature of the engine, engine speed and throttle position. An open/short to voltage or short to ground in the (GN/BN) wire (front) and (GY/BN) wire (rear) will cause the engine to run rich (short to ground) or lean (short to voltage) until the fault is detected. Once fault is detected, vehicle will run in open loop.

Check for the following conditions:

- **Poor connection:** Inspect the ECM [78-1] and [78-2], fuel injector [84, 85] and HO2S [137, 138] connectors for backed out terminals, improper mating, inoperative locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harnesses.
- **Dirty/stuck open injectors:** The vehicle may run lean (dirty/clogged injectors) or rich (stuck open injectors) if there are injector problems. This could also cause poor fuel economy and performance.
- **Loose HO2S:** If an HO2S is loose, engine performance may be affected. This could also show up as a slow changing HO2S voltage.
- **Loose/leaking exhaust:** This can cause a poor ground connection for the sensor or allow fresh air into the exhaust system. If fresh air enters exhaust system, the HO2S will read a lean condition, causing the system to go rich.
- **Engine misfire:** See 6.44 MISFIRE AT IDLE OR UNDER LOAD.
- **Leaking injectors:** This causes fuel imbalance and poor idle quality due to different air/fuel ratios in each cylinder.

1. To check for leaky injectors, first remove the air box and air filter.
2. With the throttle wide open, turn IGN ON for 2 seconds and then OFF for 2 seconds five consecutive times.
3. Replace the fuel injector if there is any evidence of raw fuel in the bores. See Fuel Injectors in the service manual.

- **Intake leaks:** When disconnecting any connectors, always inspect connector for corrosion or backed out terminals and repair as required. See the service manual.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

HOME

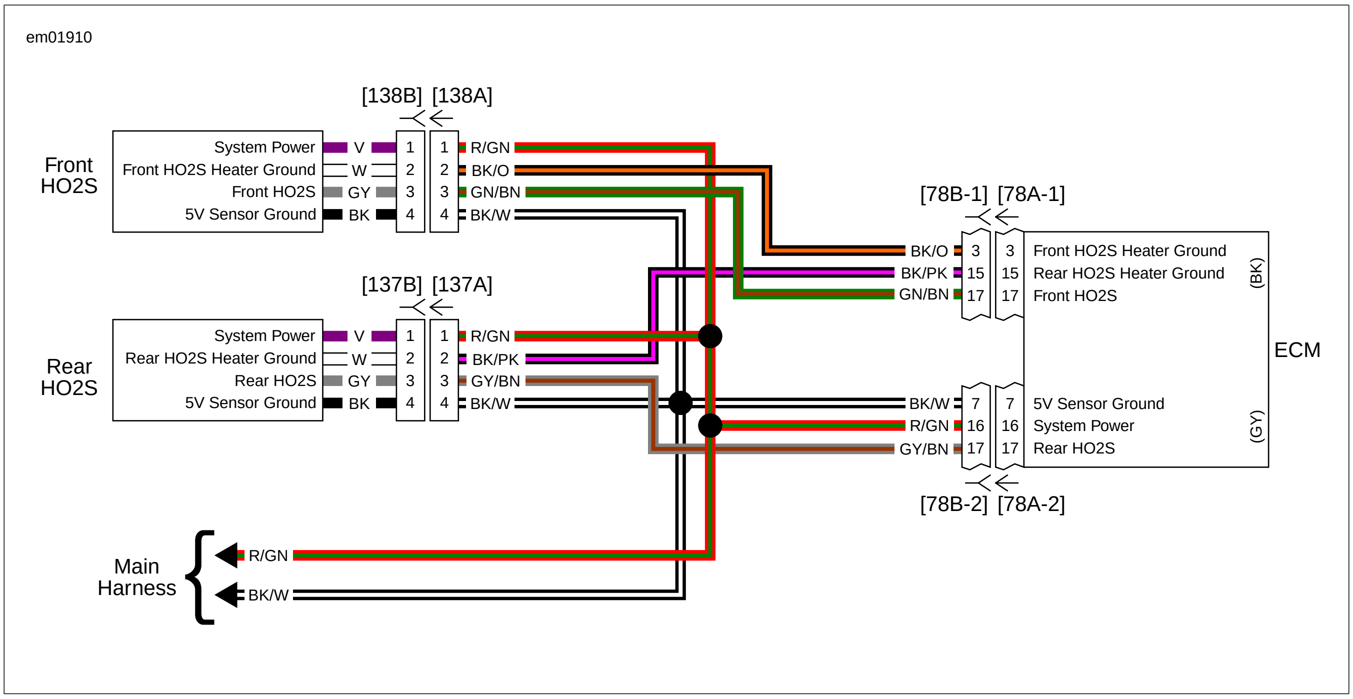


Figure 6-22. HO2S Circuit

DTC P0031

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-36. DTC P0031 Diagnostic Faults

POSSIBLE CAUSES
Open or short to ground on front HO2S circuit
Open in sensor power circuit

1. Front HO2S Voltage Test

1. Turn IGN OFF.
2. Disconnect front HO2S [138].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [138A] terminal 1 (R/GN) wire and ground.
5. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (R/GN) wire.

2. Open Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between BOB [78-1] terminal 3 and [138A] terminal 2 (BK/O) wire.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK/O) wire.

3. Short to Ground Test

1. Test continuity between BOB [78-1] terminal 3 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (BK/O) wire.
   b. **No.** Go to Test 4.

4. Resistance Test

1. Test resistance between [138B] terminals 1 (V) wire and 2 (W) wire.
2. Is resistance between 13.5-35 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace front HO2S.

DTC P0032

PART NUMBER	TOOL NAME
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-37. DTC P0032 Diagnostic Faults

POSSIBLE CAUSES
Front HO2S circuit shorted to 12V

1. Front HO2S Shorted to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test voltage between BOB [78-1] terminal 3 and ground.
5. Is voltage present?
   a. **Yes.** Repair short to voltage on (BK/O) wire.
   b. **No.** Go to Test 2.

2. Resistance Test

1. Turn IGN OFF.
2. Disconnect front HO2S [138].
3. Test resistance between [138B] terminals 1 (V) wire and 2 (W) wire.
4. Is resistance between 13.5-35 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace front HO2S.

DTC P0051

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-38. DTC P0051 Diagnostic Faults

POSSIBLE CAUSES
Open or short to ground on rear HO2S circuit
Open in sensor power circuit

1. Rear HO2S Voltage Test

1. Turn IGN OFF.
2. Disconnect rear HO2S [137].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [137A] terminal 1 (R/GN) wire and ground.
5. Is battery voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (R/GN) wire.

2. Open Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between BOB [78-1] terminal 15 and [137A] terminal 2 (BK/PK) wire.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (BK/PK) wire.

3. Short to Ground Test

1. Test continuity between BOB [78-1] terminal 15 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (BK/PK) wire.
   b. **No.** Go to Test 4.

4. Resistance Test

1. Test resistance between [137B] terminals 1 (V) wire and 2 (W) wire.
2. Is resistance between 13.5-35 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace rear HO2S.

DTC P0052

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-39. DTC P0052 Diagnostic Faults

POSSIBLE CAUSES
Rear HO2S circuit shorted to voltage

1. Rear HO2S Shorted to Voltage Test

1. Turn IGN OFF.

2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-1] terminal 15 and ground.
6. Is voltage present?
   a. **Yes.** Repair short to voltage on (BK/PK) wire.
   b. **No.** Go to Test 2.

2. Resistance Test

1. Turn IGN OFF.
2. Test resistance between [137B] terminals 1 (V) wire and 2 (W) wire.
3. Is resistance between 13.5-35 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace rear HO2S.

DTC P0131

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-40. DTC P0131 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in signal circuit
Fuel system malfunction

NOTE

Vehicle and sensor must be at ambient temperature before starting diagnostic test.

1. Front HO2S Voltage Test

1. Turn IGN OFF.
2. Disconnect front HO2S [138].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [138A] terminal 3 (GN/BN) wire, to ground.
5. Is voltage approximately 5V?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 2.

2. HO2S Test

1. Turn IGN OFF.
2. Test continuity between [138B] terminal 3 (GY) wire and ground.
3. Is continuity present?
   a. **Yes.** Replace HO2S.
   b. **No.** Go to Test 3.

3. Signal Wire Shorted to Sensor Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Test continuity between [138A] terminals 3 (GN/BN) wire and 4 (BK/W) wire.
4. Is continuity present?
   a. **Yes.** Repair short between (GN/BN) and (BK/W) wires.
   b. **No.** Go to Test 4.

4. Signal Wire Shorted to Ground Test

1. Test continuity between [138A] terminal 3 (GN/BN) wire and ground.
2. Is continuity present?
   a. **Yes.** Repair short between (GN/BN) wire and ground.
   b. **No.** Replace ECM.

5. Operation Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See 1.3 DIAGNOSTIC TOOLS.
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Connect [138].
4. Start engine and allow it to reach operating temperature.
5. With engine speed at a steady rpm, test voltage between BOB [78-1] terminal 17 and [78-2] terminal 7.
6. Is voltage approximately 0.45V?
   a. **Yes.** Replace ECM.
   b. **No.** (0.0-0.4V). Perform fuel pressure test. Look for incorrect ECM calibration, low fuel pressure, air leaks and dirty injectors. If no issues are found, replace HO2S.

DTC P0132

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-41. DTC P0132 Diagnostic Faults

POSSIBLE CAUSES
Fuel system malfunction

1. Front HO2S Operation Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Start engine and allow it to reach operating temperature.
5. With engine speed at a steady rpm, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-1] terminal 17 and [78-2] terminal 7.
6. Is voltage approximately 0.45V?
   a. **Yes.** Replace ECM.
   b. **No.** (0.6-1.0V) Perform fuel pressure test. Look for incorrect ECM calibration, high fuel pressure, stuck open or leaking injectors. If no issues are found, replace the HO2S.

DTC P0134

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-42. DTC P0134 Diagnostic Faults

POSSIBLE CAUSES
Open or short to voltage in signal circuit
Open sensor ground

1. Front HO2S Signal Wire Short Circuit Voltage Test

1. Turn IGN OFF.
2. Disconnect front HO2S [138].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [138A] terminal 3 (GN/BN) wire to ground.
5. Is voltage greater than 5V?
   a. **Yes.** Repair short to voltage on (GN/BN) wire.
   b. **No. Greater than 4V.** Go to Test 2.
   c. **No. Less than 4V.** Go to Test 3.

2. Open Sensor Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [138A] terminal 4 (BK/W) wire and BOB [78-2] terminal 7.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace front O2 sensor.
   b. **No.** Repair open on (BK/W) wire.

3. Signal Wire Open Test

1. Test resistance between [138A] terminal 3 (GN/BN) wire and BOB [78-1] terminal 17.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (GN/BN) wire.

DTC P0151

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-43. DTC P0151 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in signal circuit
Fuel system malfunction

NOTE

Vehicle and HO2S must be at ambient temperature before starting diagnostic test.

1. Rear HO2S Test

1. Turn IGN OFF.
2. Disconnect rear HO2S [137].
3. Turn IGN ON.

4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [137A] terminal 3 (GY/BN) wire to ground.
5. Is voltage approximately 5V?
   a. **Yes.** Go to Test 5.
   b. **No.** Go to Test 2.

2. HO2S Test

1. Turn IGN OFF.
2. Test continuity between [137B] terminal 3 (GY) wire and ground.
3. Is continuity present?
   a. **Yes.** Replace HO2S.
   b. **No.** Go to Test 3.

3. Signal Wire Shorted to Sensor Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Test continuity between [137A] terminals 3 (GY/BN) wire and 4 (BK/W) wire.
4. Is continuity present?
   a. **Yes.** Repair short between (GY/BN) and (BK/W) wires.
   b. **No.** Go to Test 4.

4. Signal Wire Shorted to Ground Test

1. Test continuity between [137A] terminal 3 (GY/BN) wire and ground.
2. Is continuity present?
   a. **Yes.** Repair short between (GY/BN) wire and ground.
   b. **No.** Replace ECM.

5. Operation Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See 1.3 DIAGNOSTIC TOOLS.
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Start engine and allow it to reach operating temperature.
4. With engine speed at a steady rpm, test voltage between BOB [78-2] terminal 17 and [78-2] terminal 7.
5. Is voltage approximately 0.45V?
   a. **Yes.** Replace ECM.
   b. **No.** (0.0-0.4V). Perform fuel pressure test. Look for incorrect ECM calibration, low fuel pressure, air leaks and dirty injectors. If no issues are found, replace HO2S.

DTC P0152

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-44. DTC P0152 Diagnostic Faults

POSSIBLE CAUSES
Fuel system malfunction

1. Rear HO2S Operation Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Start engine and allow it to reach operating temperature.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), with engine speed at a steady rpm, test voltage between BOB [78-2] terminal 17 and [78-2] terminal 7.
6. Is voltage approximately 0.45V?
   a. **Yes.** Replace ECM.
   b. **No.** (0.6-1.0V). Perform fuel pressure test. Look for incorrect ECM calibration, high fuel pressure, stuck open or leaking injectors. If no issues are found, replace the HO2S.

DTC P0154

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-45. DTC P0154 Diagnostic Faults

POSSIBLE CAUSES
Open or short voltage in signal circuit
Open sensor ground

1. Rear HO2S Signal Wire Short Circuit Voltage Test

1. Turn IGN OFF.
2. Disconnect rear HO2S [137].
3. Turn IGN ON.

4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [137A] terminal 3 (GY/BN) wire to ground.
5. Is voltage greater than 5V?
   a. **Yes.** Repair short to voltage on (GY/BN) wire.
   b. **No, greater than 4V.** Go to Test 2.
   c. **No, less than 4V.** Go to Test 3.

2. Open Sensor Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between [137A] terminal 4 (BK/W) wire and BOB [78-2] terminal 7.
5. Is resistance less than 0.5 ohms?
   a. **Yes.** Replace rear HO2S.
   b. **No.** Repair open on (BK/W) wire.

3. Signal Wire Open Test

1. Test resistance between [137A] terminal 3 (GY/BN) wire and BOB [78-2] terminal 17.
2. Is resistance less than 0.5 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (GY/BN) wire.

HOME

FUEL INJECTOR DIAGNOSTICS 6.16

DESCRIPTION AND OPERATION

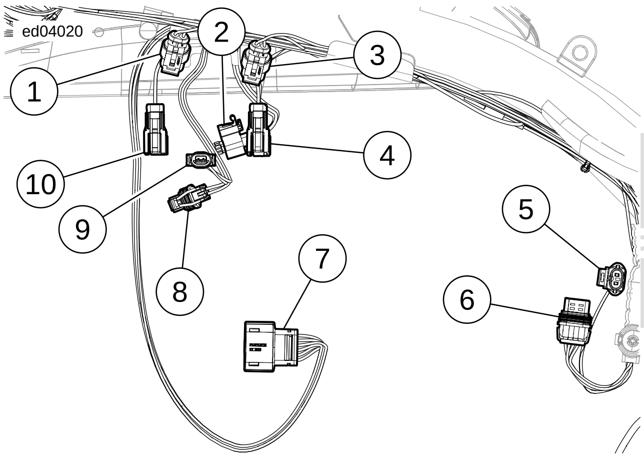
See Figure 6-23 and Figure 6-24. The fuel injectors are solenoids that allow pressurized fuel into the intake tract. The injectors are timed to the engine cycle and triggered sequentially. The power for the injectors comes from the BCM. The ECM provides the path to ground to trigger the injectors.

NOTE

System power failures or wiring harness problems will cause 12V power to be lost to both injectors and the ignition coils.

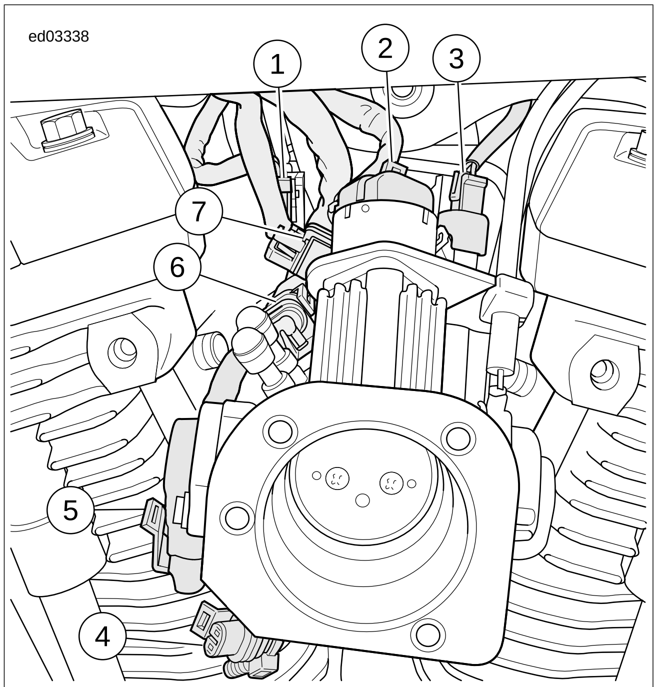
Table 6-46. Code Description

DTC	DESCRIPTION
P0261	Fuel injector low/open (front)
P0262	Fuel injector shorted high (front)
P0264	Fuel injector low/open (rear)
P0265	Fuel injector shorted high (rear)



1. **Front ACR [230]**
2. **TMAP [80]**
3. **Rear ACR [230]**
4. **Rear fuel injector [85]**
5. **Purge solenoid [95]**
6. **Ignition coil [83]**
7. **TCA [211]**
8. **ET sensor [90]**
9. **Ignition switch [33]**
10. **Front fuel injector [84]**

Figure 6-23. Engine: ETC



1. **Rear fuel injector [85]**
2. **IAC [87]**
3. **Front fuel injector [84]**
4. **Active intake solenoid [178]**
5. **TPS [88]**
6. **IAT sensor [89]**
7. **MAP sensor [80]**

Figure 6-24. Between Cylinders Right Side: IAC

Diagnostic Tips

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.1 CONNECTORS.

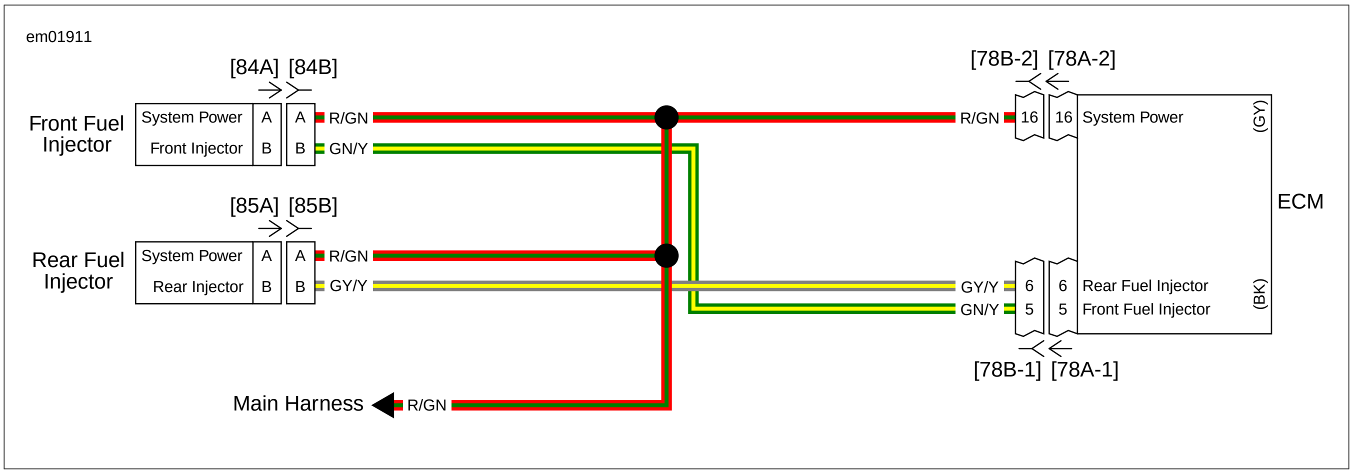


Figure 6-25. Fuel Injector Circuit

DTC P0261

PART NUMBER	TOOL NAME
HD-34730-2E	FUEL INJECTOR TEST LIGHT
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-47. DTC P0261 Diagnostic Faults

POSSIBLE CAUSES
Front fuel injector malfunction
Open signal circuit
Open power circuit

1. Front Fuel Injector Test

1. Turn IGN OFF.
2. Disconnect front fuel injector [84].
3. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) to [84B].
4. Crank engine.
5. Does light flash when engine is cranking (or running)?
   a. **Yes.** Go to Test 4.
   b. **No, lamp does not illuminate.** Go to Test 2.
   c. **No, lamp is on steady.** Go to Test 5.

2. Power Circuit Open Test

1. Turn IGN OFF.
2. Remove fuel injector test light.
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB [78-2] terminal 16 and [84B] terminal A (R/GN) wire.
6. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (R/GN) wire.

3. Control Circuit Open Test

1. Test resistance between BOB [78-1] terminal 5 and [84B] terminal B (GN/Y) wire.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (GN/Y) wire.

4. Injector Resistance Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [84A] terminals A and B.
2. Is resistance between 10-20 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace front injector.

5. Driver Short to Ground Test

1. Remove fuel injector test light.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [84B] terminal B and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground on (GN/Y) wire.
   b. **No.** Replace ECM.

DTC P0262

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-48. DTC P0262 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in signal circuit

1. Front Fuel Injector Control Circuit Shorted to Voltage Test

1. Turn IGN OFF.
2. Disconnect front injector [84].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [84B] terminal B (GN/Y) wire and ground.
5. Is voltage less than 5.0V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 2.

2. Control Circuit Shorted to System Test

1. Turn IGN OFF.
2. Test continuity between [84B] terminals A (R/GN) wire and B (GN/Y) wire.
3. Is continuity present?
   a. **Yes.** Repair short between (R/GN) and (GN/Y) wires.
   b. **No.** Repair short to voltage on (GN/Y) wire.

3. Injector Resistance Test

1. Test resistance between [84A] terminals A and B.
2. Is resistance between 10-20 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace front injector.

DTC P0264

PART NUMBER	TOOL NAME
HD-34730-2E	FUEL INJECTOR TEST LIGHT
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-49. DTC P0264 Diagnostic Faults

POSSIBLE CAUSES
Open signal circuit
Open power circuit

1. Rear Fuel Injector Test

1. Turn IGN OFF.
2. Disconnect rear fuel injector [85].
3. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E) to [85B].
4. Crank engine.
5. Does lamp flash when engine is cranking (or running)?
   a. **Yes.** Go to Test 4.
   b. **No, lamp does not illuminate.** Go to Test 2.
   c. **No, lamp is on steady.** Go to Test 5.

2. Power Circuit Open Test

1. Turn IGN OFF.
2. Remove fuel injector test light.
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB [78-2] terminal 16 and [85B] terminal A (R/GN) wire.
6. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (R/GN) wire.

3. Control Circuit Open Test

1. Test resistance between BOB [78-1] terminal 6 and [85B] terminal B (GY/Y) wire.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (GY/Y) wire.

4. Injector Resistance Test

1. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [85A] terminal A and B of injector [85A].
2. Is resistance between 10-20 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace rear injector.

5. Driver Short to Ground Test

1. Remove fuel injector test light.
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [85B] terminal B and ground.

3. Is continuity present?
    a. **Yes.** Repair short to ground on (GY/Y) wire.
    b. **No.** Replace ECM.

DTC P0265

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-50. DTC P0265 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in signal circuit

1. Rear Fuel Injector Control Circuit Shorted to Voltage Test

1. Turn IGN OFF.
2. Disconnect rear injector [85].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [85B] terminal B (GY/Y) wire and ground.
5. Is voltage less than 5.0V?
    a. **Yes.** Go to Test 2.
    b. **No.** Go to Test 3.

2. Injector Resistance Test

1. Test resistance between [85A] terminals A and B.
2. Is resistance between 10-20 ohms?
    a. **Yes.** Replace ECM.
    b. **No.** Replace rear injector.

3. Control Circuit Shorted to System Test

1. Turn IGN OFF.
2. Test continuity between [85B] terminals A (R/GN) wire and B (GY/Y) wire.
3. Is continuity present?
    a. **Yes.** Repair short between (R/GN) and (GY/Y) wires.
    b. **No.** Repair short to voltage on (GY/Y) wire.

CKP SENSOR DIAGNOSTICS 6.17

DESCRIPTION AND OPERATION

See Figure 6-26. If the CKP sensor signal is weak or absent, DTCs P0371 or P0374 will be set. DTC P0371 is usually set when several attempts to crank the engine have failed.

NOTE

If signal is not detected or cannot synchronize (DTC P0374), engine will not start.

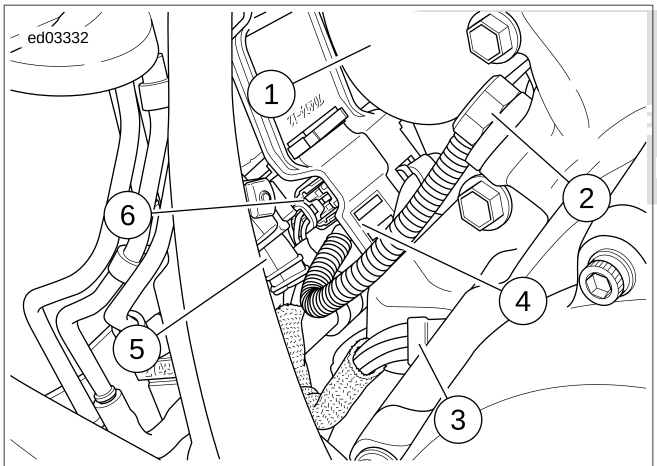
Table 6-51. Code Description

DTC	DESCRIPTION
P0371	CKP sensor wrong number of pulses
P0374	CKP sensor no pulses

Diagnostic Tips

Engine must be cranked for more than five seconds without CKP signal to set P0374 code. Intermittent MAP or IAT wiring or sensor issues may cause these codes to set prior to setting MAP or IAT codes. Verify MAP or IAT wiring and sensor prior to replacing the ECM.

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.



1. **Oil filter**
2. **CKP sensor**
3. **Stator**
4. **CKP sensor [79]**
5. **Voltage regulator [47]**
6. **Front HO2S [138]**

Figure 6-26. Voltage Regulator

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

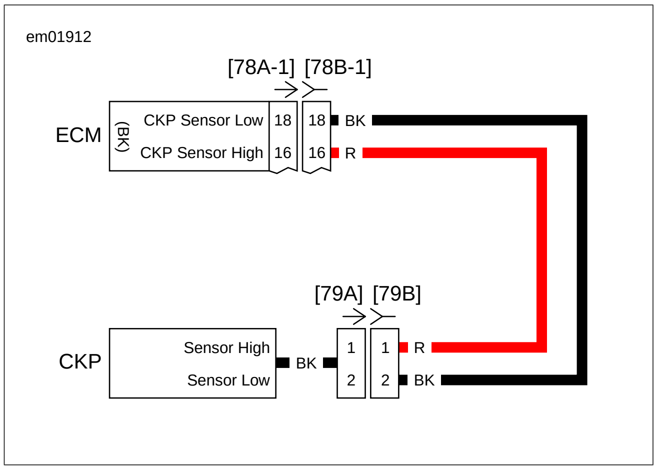


Figure 6-27. CKP Sensor Circuit

DTC P0371, P0374

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-52. DTC P0371, P0374 Diagnostic Faults

POSSIBLE CAUSES
CKP sensor malfunction
Open or short to ground in signal circuit
May be set if there are incorrect fluctuations from MAP that does not set MAP codes (examples - intermittent sensor or wiring issue)

1. CKP Sensor Connections Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Inspect connection for corrosion or backed out terminals.
4. Are terminal problems present?
   a. **Yes.** Repair terminals as required.
   b. **No.** Go to Test 2.

2. Signal Wire Continuity Test

1. Disconnect CKP sensor [79].
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.

4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB [78-1] terminal 16 to [79B] terminal 1 (R) wire.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open on (R) wire.

3. Ground Wire Continuity Test

1. Test resistance between BOB [78-1] terminal 18 to [79B] terminal 2 (BK) wire.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open on (BK) wire.

4. Signal Wire Shorted to CKP Ground Wire Test

1. Test continuity between BOB [78-1] terminals 16 and 18.
2. Is continuity present?
   a. **Yes.** Repair short between [79B] terminals 1 (R) and 2 (BK).
   b. **No.** Go to Test 5.

5. Output Test

1. Connect CKP sensor [79].
2. Test AC voltage between BOB [78-1] terminals 16 and 18.
3. Crank engine for 5 seconds while observing multimeter.
4. Is AC voltage greater than 2V?
   a. **Yes.** See diagnostic tips. If MAP and IAT sensors are good, replace the ECM.
   b. **No.** Replace CKP sensor.

HOME

PURGE SOLENOID DIAGNOSTICS 6.18

DESCRIPTION AND OPERATION

Purge Solenoid (CA and Select Foreign Market Models Only)

See Figure 6-28. The purge solenoid is mounted in front of the rear tire above the BCM. The solenoid connects to a fuel tank vent line and a vent canister.

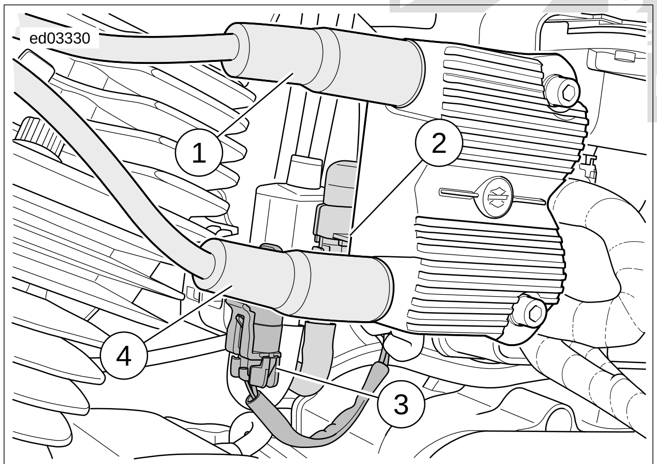
A return line from the canister reconnects to the air intake manifold allowing vented fumes to be recirculated, for emission efficiency. The purge solenoid is timed to the throttle position and is disabled during startup, low engine temperature, low engine speed or low vehicle speed.

Power for the purge solenoid is supplied by the BCM. The BCM also provides power for the VSS, fuel injectors, active exhaust, active intake, ECM and the ignition coil.

The ECM provides a path to ground to trigger the purge solenoid.

NOTES

- *BCM or wiring harness problems will cause 12V power to be lost to the VSS, fuel injectors, active exhaust, active intake, ECM, ignition coil and purge solenoid.*
- *Purge solenoid is not installed on non-emission vehicles and DTCs P0444 and P0445 are not available. If these DTCs appear, the ECM should be reprogrammed.*



1. **Rear spark plug cable**
2. **Ignition coil [83]**
3. **Purge solenoid [95]**
4. **Front spark plug cable**

Figure 6-28. Ignition Coil

Table 6-53. Code Description

DTC	DESCRIPTION
P0444	Purge solenoid low/open
P0445	Purge solenoid shorted high

Diagnostic Tips

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

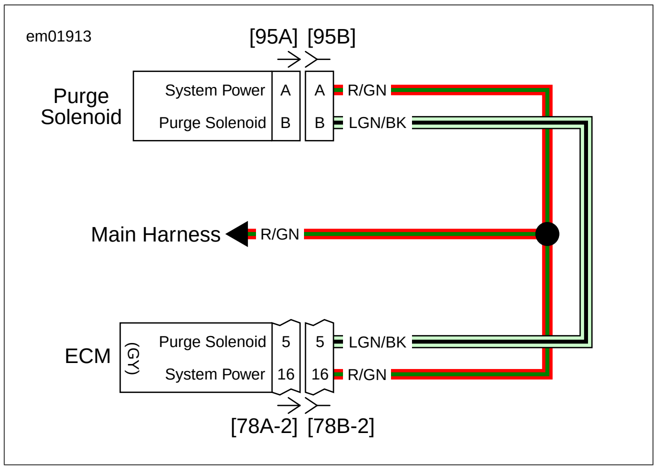


Figure 6-29. Purge Solenoid Circuit

DTC P0444

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2-P	BCM OVERLAY
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-54. DTC P0444 Diagnostic Faults

POSSIBLE CAUSES
Purge solenoid malfunction
Short to ground in signal circuit

1. Purge Solenoid Test

1. Turn IGN OFF.
2. Disconnect purge solenoid [95].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [95A] terminals A and B.
4. Is resistance between 4-21 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace purge solenoid.

2. Purge Solenoid Voltage Test

1. Test voltage between [95B] terminal A (R/GN) wire and ground.
2. Turn IGN ON.
3. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 5.

3. Control Wire Shorted to Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Test continuity between [95B] terminal B (LGN/BK) wire and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground on (LGN/BK) wire.
   b. **No.** Go to Test 4.

4. Control Wire Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Test resistance between [95B] terminal B (LGN/BK) wire and BOB [78-2] terminal 5.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (LGN/BK) wire.

5. Power Wire Open Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on breakout box.
3. Test resistance between [95B] terminal A (R/GN) wire and BOB terminal 16.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (R/GN) wire.

DTC P0445

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-55. DTC P0445 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in signal circuit

1. Purge Solenoid Test

1. Turn IGN OFF.
2. Disconnect purge solenoid [95].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [95A] terminals A and B.
4. Is resistance between 4-21 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace purge solenoid.

2. Purge Solenoid Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between [95B] terminal B (LGN/BK) wire and ground.
3. Is voltage greater than 5.0V?
   a. **Yes.** Repair short to voltage on (LGN/BK) wire.
   b. **No.** Replace ECM.

VSS DIAGNOSTICS 6.19

DESCRIPTION AND OPERATION

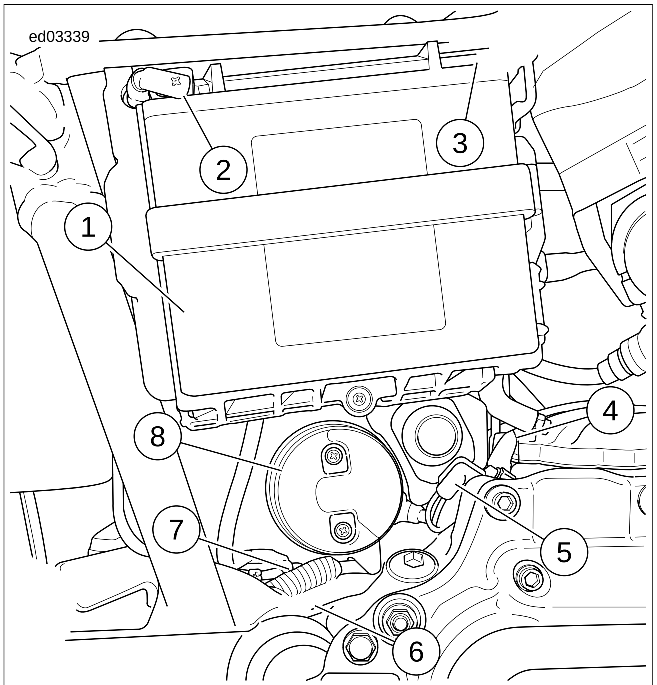
See Figure 6-30. The VSS is powered and monitored by the ECM. The ECM processes the vehicle speed signal and transmits this signal to the BCM and the speedometer through the CAN bus circuit.

NOTES

- *The ECM uses VSS input to calculate idle air control position. Therefore problems with the vehicle speed signal can lead to improper operation of the idle air control.*
- *The MAP, JSS, TPS and VSS sensors are connected to the same reference line (5V reference). If the reference line goes to ground or open, multiple codes will be set (DTC P0107, P0108, P0122, P0123, P0502, P0503, P1501, P1502). Start with the trouble code having the lowest ranking value.*
- *A faulty sensor can negatively affect the signal voltage of the other sensors sharing the same 5V reference. If the wiring passes the following tests, disconnect one sensor at a time on the 5V reference and verify the DTC is still present. Additional DTCs will be set as each sensor is disconnected, clear DTCs after this test. Be sure to perform this test before replacing a component.*

Table 6-56. Code Description

DTC	DESCRIPTION
P0502	VSS failed low
P0503	VSS failed high



1. **Battery**
2. **Battery negative**
3. **Battery positive**
4. **Starter solenoid [128]**
5. **Neutral switch [131]**
6. **Battery ground cable**
7. **VSS [65]**
8. **Starter**

Figure 6-30. Under Right Side Cover

Diagnostic Tips

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

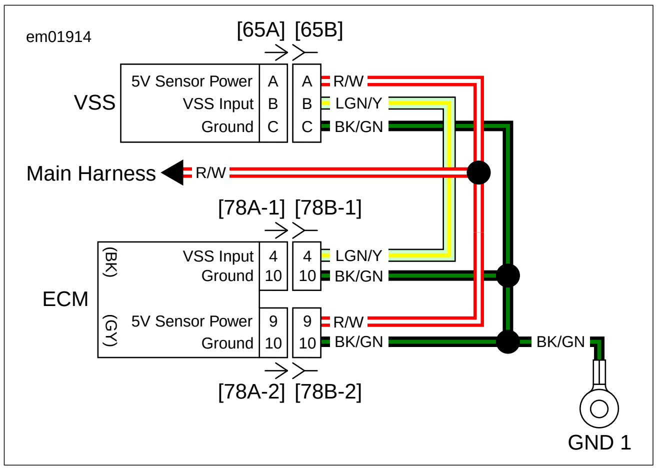


Figure 6-31. VSS Circuit

DTC P0502

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-57. DTC P0502 Diagnostic Faults

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

1. VSS Connection Test

1. Turn IGN OFF.
2. Disconnect VSS [65].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [65B] terminal A (R/W) wire and ground.
5. Is voltage approximately 5.0V?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open on (R/W) wire.

2. Signal Wire Short to Ground Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test continuity between BOB [78-1] terminals 4 and 10.
5. Is continuity present?
   a. **Yes.** Repair short to ground on (LGN/Y) wire.
   b. **No.** Go to Test 3.

3. Signal Wire Open Test

1. Test resistance between BOB [78-1] terminal 4 and [65B] terminal B (LGN/Y) wire.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open on (LGN/Y) wire.

4. Dirty or Damaged Sensor Test

1. Remove VSS.
2. Check for debris on sensor tip.
3. Is debris present?
   a. **Yes.** Clean debris from VSS and install.
   b. **No.** Replace VSS.

DTC P0503

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-58. DTC P0503 Diagnostic Faults

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

1. VSS Sensor Power Shorted to Voltage Test

1. Turn IGN OFF.
2. Disconnect VSS [65].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [65B] terminals A (R/W) wire and C (BK/GN) wire.
5. Is voltage greater than 6.0V?
   a. **Yes.** Repair short to voltage on (R/W) wire.
   b. **No.** Go to Test 2.

2. Signal Wire Short to Voltage Test

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

3. VSS Ground Wire Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between BOB [78-1] terminal 10 and [65B] terminal C (BK/GN) wire.

5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open on (BK/GN) wire.

4. Signal Wire Shorted to Sensor Power Test

1. Test continuity between BOB [78-1] terminal 4 and [78-2] terminal 9.
2. Is continuity present?
   a. **Yes.** Repair short between (LGN/Y) and (R/W) wires.
   b. **No.** Go to Test 5.

5. VSS Test

1. Connect [78A-1] and [78A-2] to breakout box.
2. Clear DTC.
3. Did DTC reset?
   a. **Yes.** Replace ECM.
   b. **No.** Replace VSS.

IDLE SPEED CONTROL DIAGNOSTICS: IAC 6.20

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

See Figure 6-32 and Figure 6-33. The ECM controls engine idle speed by moving the IAC to open or close a passage around the throttle plates. It does this by sending voltage pulses to the proper motor winding of the IAC. This causes the pintle to move in or out of the IAC a given distance for each pulse received.

- To increase idle speed, the ECM retracts the pintle, allowing more air to flow through the throttle body.
- To decrease idle speed, the ECM extends the pintle, allowing less air to flow through the throttle body. The IAC position can be measured in steps. This can only be done with DIGITAL TECHNICIAN II (Part No. HD-48650).
- A high number of steps represents a fully retracted pintle and open passage around throttle plate. This correlates with an increase in the amount of air flowing through the throttle body.
- Zero steps represents a fully extended pintle. A zero reading indicates an abnormal condition in which the pintle has been fully extended and has consequently closed the passage around throttle plate. Each time the ignition is turned OFF, the ECM resets the IAC by sending enough pulses to extend the pintle and effectively close the throttle body. The fully extended value is the ECM reference point. A given number of steps are then calculated by the ECM for use in setting the proper idle speed and IAC position for the next start event.

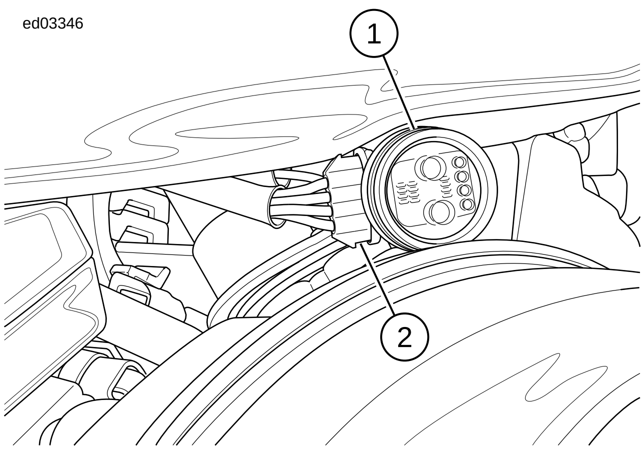
NOTE

Idle speed is controlled by the ECM and cannot be adjusted.

Loss of idle speed control will result if the idle rpm is ±200 from preset idle speed and IAC motor is at zero or maximum for greater than 5 seconds. These DTCs may occur with others for a multiple code situation. Resolve the other codes first to correct. A misfire condition or similar symptom affecting idle can cause P0506 to set. Inspect for these conditions before diagnosing DTCs.

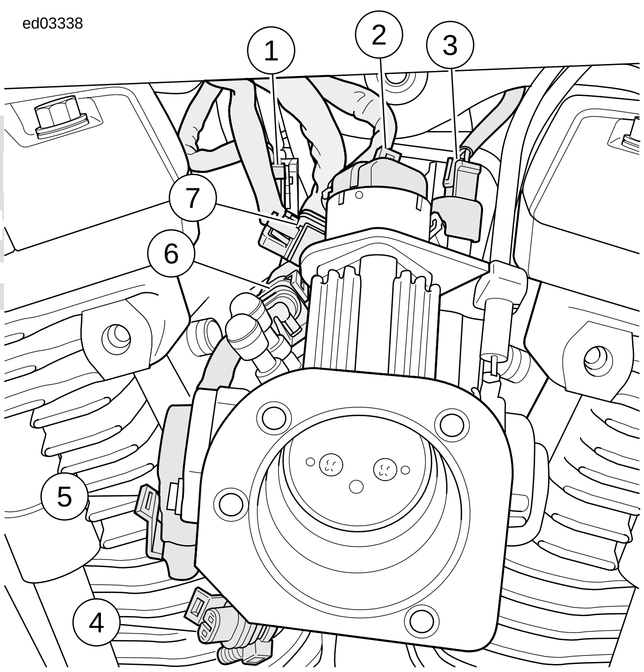
Table 6-59. Code Description

DTC	DESCRIPTION
P0506	Idle speed control - rpm too low
P0507	Idle speed control - rpm too high



1. **IAC test light**
2. **IAC [87]**

Figure 6-32. IAC Test Light



1. **Rear fuel injector [85]**
2. **IAC [87]**
3. **Front fuel injector [84]**
4. **Active intake solenoid [178]**
5. **TPS [88]**
6. **IAT sensor [89]**
7. **MAP sensor [80]**

Figure 6-33. Between Cylinders Right Side: IAC

Diagnostic Tips

The following items may impact engine idle speed:

- A loss of idle speed control does not necessarily imply the IAC actuator or wiring has failed. It can also be caused by a number of conditions such as an intake air leak, improperly adjusted throttle stop or a misfiring cylinder.

- A non-OE engine configuration can lead to idle instability and could generate a DTC.
- 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 box and air filter. Then, with the throttle wide open, turn IGN 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.
- Intake leaks.
- Contaminated fuel.
- TPS reading of greater than 1% (possible throttle cable misadjustment) or battery voltage reading of less than 9V or a VSS greater than 0 will disable idle speed control.

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

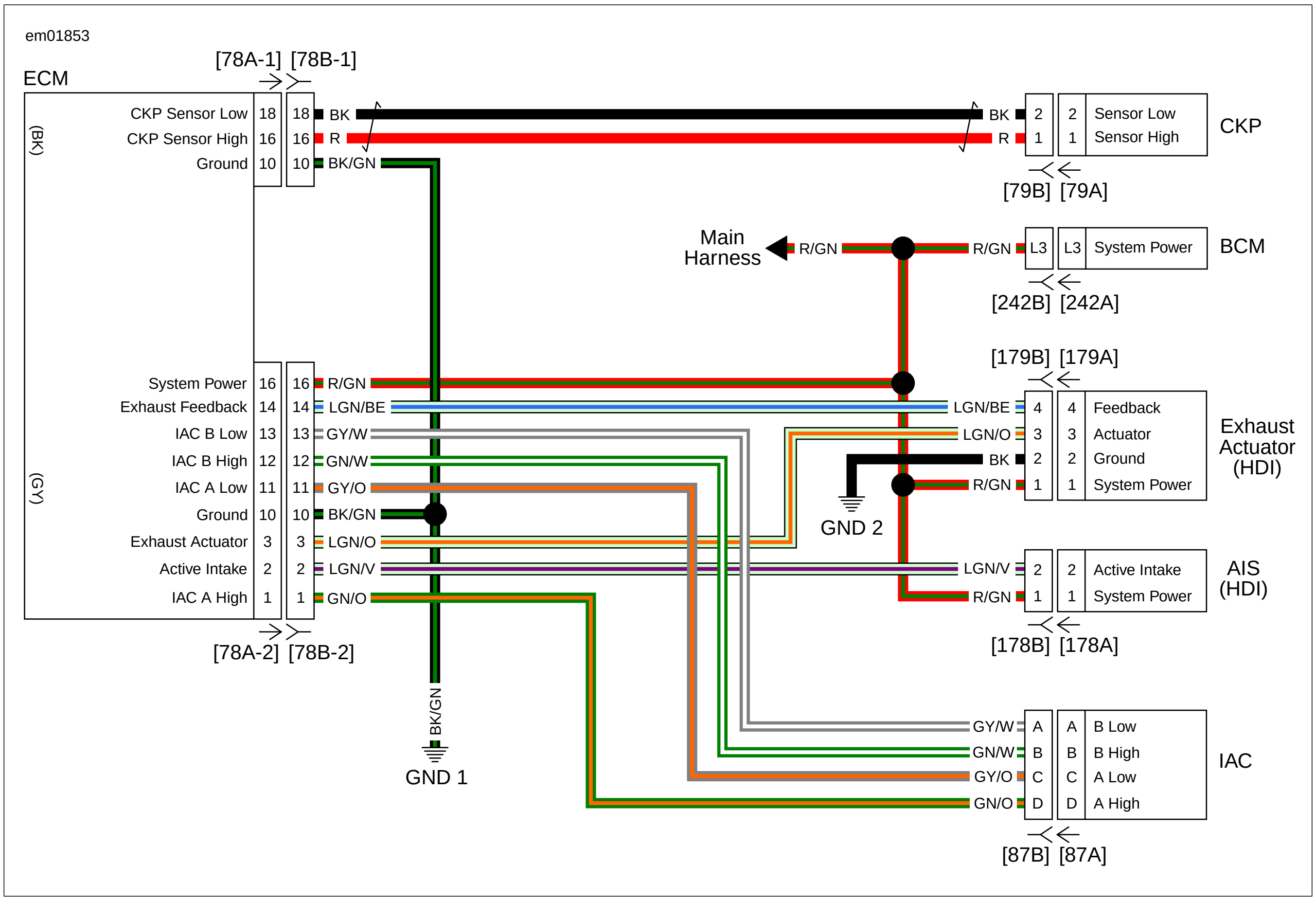


Figure 6-34. Active Exhaust Actuator and AIS Circuit

DTC P0506, P0507

PART NUMBER	TOOL NAME
HD-41199-3	IAC TEST LIGHT
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-60. DTC P0506, P0507 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in circuits
Short to ground in circuits
Open in system power circuit
Short between IAC circuits
Open circuits
Vacuum/air leaks
Fuel system problems

1. IAC Operational Test

1. While watching the IAC pintle for movement turn IGN OFF, ON, then OFF.
2. Did pintle move?
   a. **Yes.** IAC system operating properly. Check for improperly adjusted throttle stop, vacuum leaks, cylinder misfire, contaminated fuel, leaking injectors and engine mechanical failure.
   b. **No.** Go to Test 2.

2. Connector Test

1. Disconnect IAC [87].
2. Connect IAC TEST LIGHT (Part No. HD-41199-3) to [87B].
3. Turn IGN ON.
4. While observing test light, turn IGN OFF.
5. Did both IAC test lights flash alternately?
   a. **Yes.** Replace IAC.
   b. **No.** Go to Test 3.

Table 6-61. IAC, Wire Color, ECM

IAC [87B]	WIRE COLOR	ECM [78-2]
A	GY/W	13
B	GN/W	12
C	GY/O	11
D	GN/O	1

3. Circuits Open Test

1. Turn IGN OFF.
2. Remove test light.
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance on each IAC wire between BOB and [87B]. Refer to Table 6-61.
6. Is resistance less than 0.5 ohm on all circuits?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in appropriate circuit.

4. Circuits Shorted to Ground Test

1. Test continuity on each IAC wire between BOB and ground. Refer to Table 6-61.
2. Is continuity present on any circuits?
   a. **Yes.** Repair short to ground on appropriate circuit.
   b. **No.** Go to Test 5.

5. Circuits Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB and ground on each IAC wire. Refer to Table 6-61.
3. Is voltage present on any circuit?
   a. **Yes.** Repair short to voltage in appropriate circuit.
   b. **No.** Go to Test 6.

6. Short Between Circuits Test

1. Turn IGN OFF.
2. Test continuity between each IAC circuit and the other IAC circuits. Refer to Table 6-61.
3. Is continuity present between any two IAC circuits?
   a. **Yes.** Repair short between IAC circuits.
   b. **No.** Replace ECM.

IDLE SPEED CONTROL DIAGNOSTICS: ETC 6.21

LOSS OF IDLE SPEED CONTROL

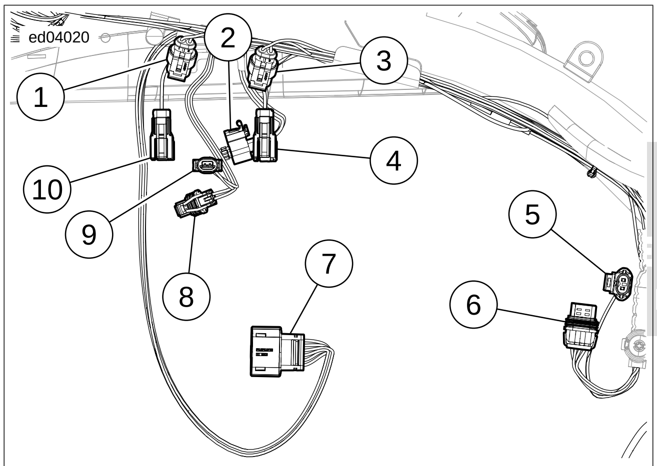
See Figure 6-35. The TCA uses a two wire DC motor to move the throttle plate from the spring loaded off-idle detent. The ECM supplies a pulse width modulated voltage signal through [78-3] terminals 8 and 9. The ECM monitors throttle position through the dual position sensors (TPS1 and TPS2). This code will set if the idle speed becomes unstable. This can be caused by a fuel or ignition related issue, throttle actuator friction or an intermittent air leak.

NOTE

Although the ECM monitors [78-3] terminals 8 and 9, faults on these terminals will not cause this DTC. Faults on these terminals will be higher priority DTCs, address them first.

Table 6-62. Code Description

DTC	DESCRIPTION
P0505	Idle speed control - unstable



1. **Front ACR [230]**
2. **TMAP [80]**
3. **Rear ACR [230]**
4. **Rear fuel injector [85]**
5. **Purge solenoid [95]**
6. **Ignition coil [83]**
7. **TCA [211]**
8. **ET sensor [90]**
9. **Ignition switch [33]**
10. **Front fuel injector [84]**

Figure 6-35. Engine: ETC

Diagnostic Tips

Before replacing the TCA, cycle the ignition four times when idle is high.

1. Start engine.
2. Increase rpm to 2500 rpm and bring engine back to idle.
3. Turn IGN OFF.
4. Repeat previous steps a total of four times.

This process will help the controller learn throttle plate position.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.1 CONNECTORS.

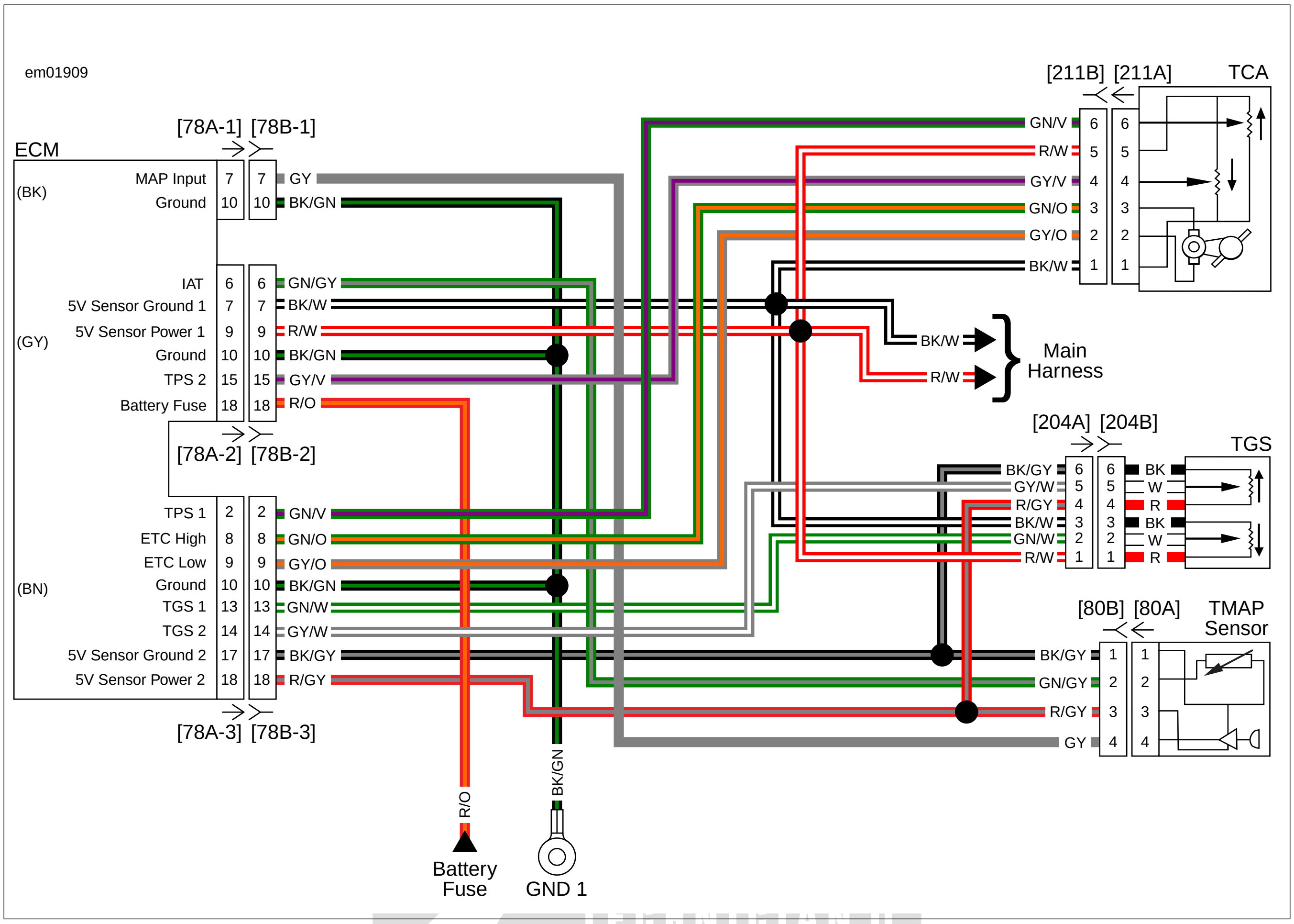


Figure 6-36. TCA, TGS, TMAP Circuits

DTC P0505

PART NUMBER	TOOL NAME
HD-26792	SPARK TESTER

Table 6-63. DTC P0505 Diagnostic Faults

POSSIBLE CAUSES
Vacuum/air leaks
Fuel system problems
Ignition system problems
Loss of engine compression

1. Preliminary Engine Tests

1. Verify battery connections are in good condition.
2. Verify fuel in the tank is fresh and not contaminated.
3. Verify spark plug wires are firmly connected to the coil and plugs.
4. Verify fuel injectors are not clogged.
5. Verify battery condition. See 3.1 BATTERY TESTING.
6. Does battery pass tests?
   a. **Yes.** Go to Test 2.
   b. **No.** Charge or replace battery.

2. Vacuum Leak Test

1. Start the motorcycle and check for vacuum leaks.
2. Were any leaks found?
   a. **Yes.** Repair the vacuum leak.
   b. **No.** Go to Test 3.

3. Spark Present Test

1. Check spark plug condition. Replace if fouled.
2. Using SPARK TESTER (Part No. HD-26792), check spark at both plugs while cranking engine.
3. Is spark present?
   a. **Yes.** Go to Test 4.
   b. **No.** The spark plugs will not spark if there is low or no compression. If spark is not present, test compression before troubleshooting ignition circuit. Once good compression is confirmed, check condition of ignition coils, coil primary wiring and spark plug boots. See 6.17 CKP SENSOR DIAGNOSTICS.

4. Compression Test

1. Perform compression test.
2. Does engine pass compression test?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair engine loss of compression.

5. Fuel System Test

1. Check fuel system and perform fuel pressure test.
2. Does fuel pressure meet specification?
   a. **Yes.** Replace TCA.
   b. **No.** Inspect fuel inlet sock and fuel filter for obstruction. Inspect internal fuel hose for leaks. If no issues are found, replace fuel pump assembly.

ECM INTERNAL DIAGNOSTICS 6.22

DESCRIPTION AND OPERATION

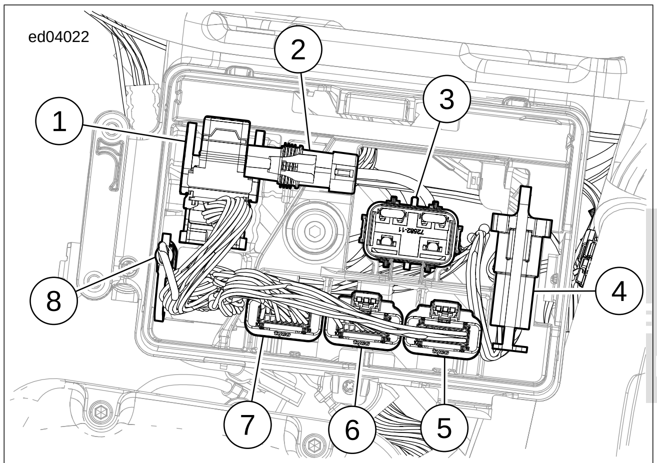
See Figure 6-37. The DTCs listed indicate a failure which requires replacement of the ECM. Refer to Table 6-64.

NOTE

After replacing ECM, perform password learning procedure and clear DTCs using odometer self-diagnostics. See 1.2 INITIAL DIAGNOSTICS, Odometer Self-Diagnostics.

Table 6-64. Code Description

DTC	DESCRIPTION
P0603	ECM EEPROM memory error
P0605	ECM flash memory error
U0300	Internal control module software incompatibility



1. **BCM [242]**
2. **BCM power [259]**
3. **Fuse block [64]**
4. **DLC [91]**
5. **ECM [78-3] (BN) (if applicable)**
6. **ECM [78-2] (GY)**
7. **ECM [78-1] (BK)**
8. **Battery tender [281] (if applicable)**

Figure 6-37. Under Left Side Cover

DTC P0603 Test

1. Clear DTCs.
2. Turn IGN ON.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Replace ECM.
   b. **No.** System operating properly.

DTC P0605 Test

1. Clear DTCs.
2. Attempt to program ECM using correct calibration.
3. Start engine.
4. Check DTCs.
5. Did DTC reset?
   a. **Yes.** Replace ECM.
   b. **No.** System operating properly.

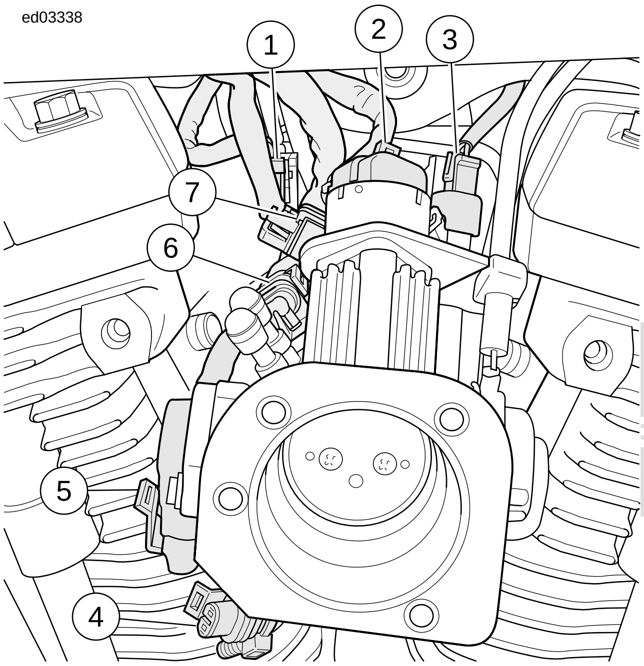
DTC P0641: IAC 6.23

DESCRIPTION AND OPERATION

See Figure 6-38, Figure 6-39 and Figure 6-40. The ECM supplies 5V to the VSS, MAP, TPS and JSS from [78-2] terminal 9. These sensors may have individual codes along with this code since they all share the 5V reference circuit. If the ECM sees a voltage of less than 4V or greater than 6V on the 5V reference circuit, P0641 will be set.

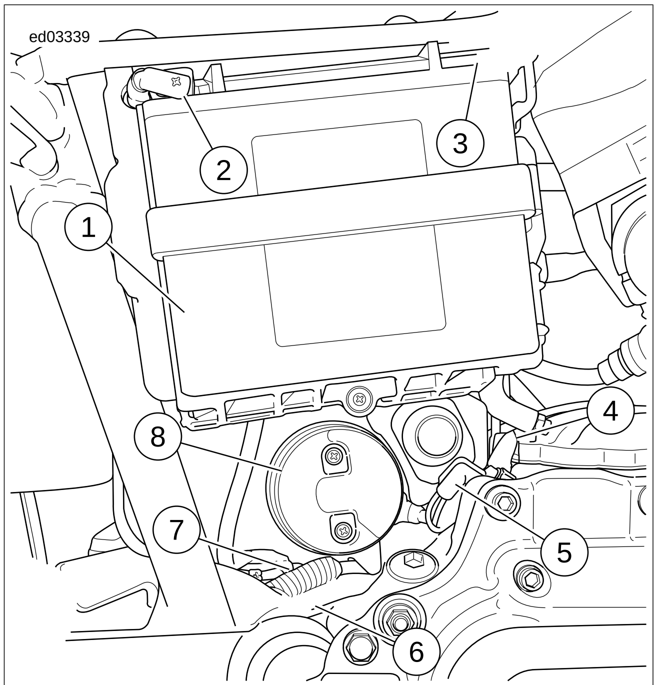
Table 6-65. Code Description

DTC	DESCRIPTION
P0641	5V Vref out of range



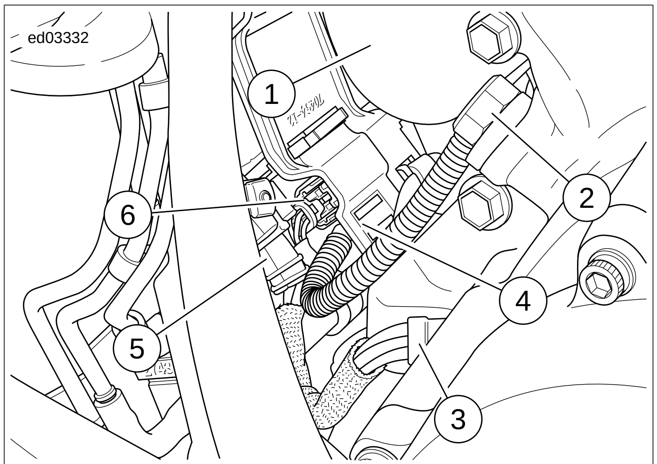
1. **Rear fuel injector [85]**
2. **IAC [87]**
3. **Front fuel injector [84]**
4. **Active intake solenoid [178]**
5. **TPS [88]**
6. **IAT sensor [89]**
7. **MAP sensor [80]**

Figure 6-38. Between Cylinders Right Side: IAC



1. **Battery**
2. **Battery negative**
3. **Battery positive**
4. **Starter solenoid [128]**
5. **Neutral switch [131]**
6. **Battery ground cable**
7. **VSS [65]**
8. **Starter**

Figure 6-39. Under Right Side Cover



1. **Oil filter**
2. **CKP sensor**
3. **Stator**
4. **CKP sensor [79]**
5. **Voltage regulator [47]**
6. **Front HO2S [138]**

Figure 6-40. Voltage Regulator

Any of these conditions will set a DTC P0641:

- Short to ground on the 5V sensor power circuit.
- Short to voltage on the 5V sensor power circuit.
- VSS fault or malfunction.
- MAP sensor fault or malfunction.
- TPS fault or malfunction.
- JSS (HDI) fault or malfunction.
- ECM fault or malfunction.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

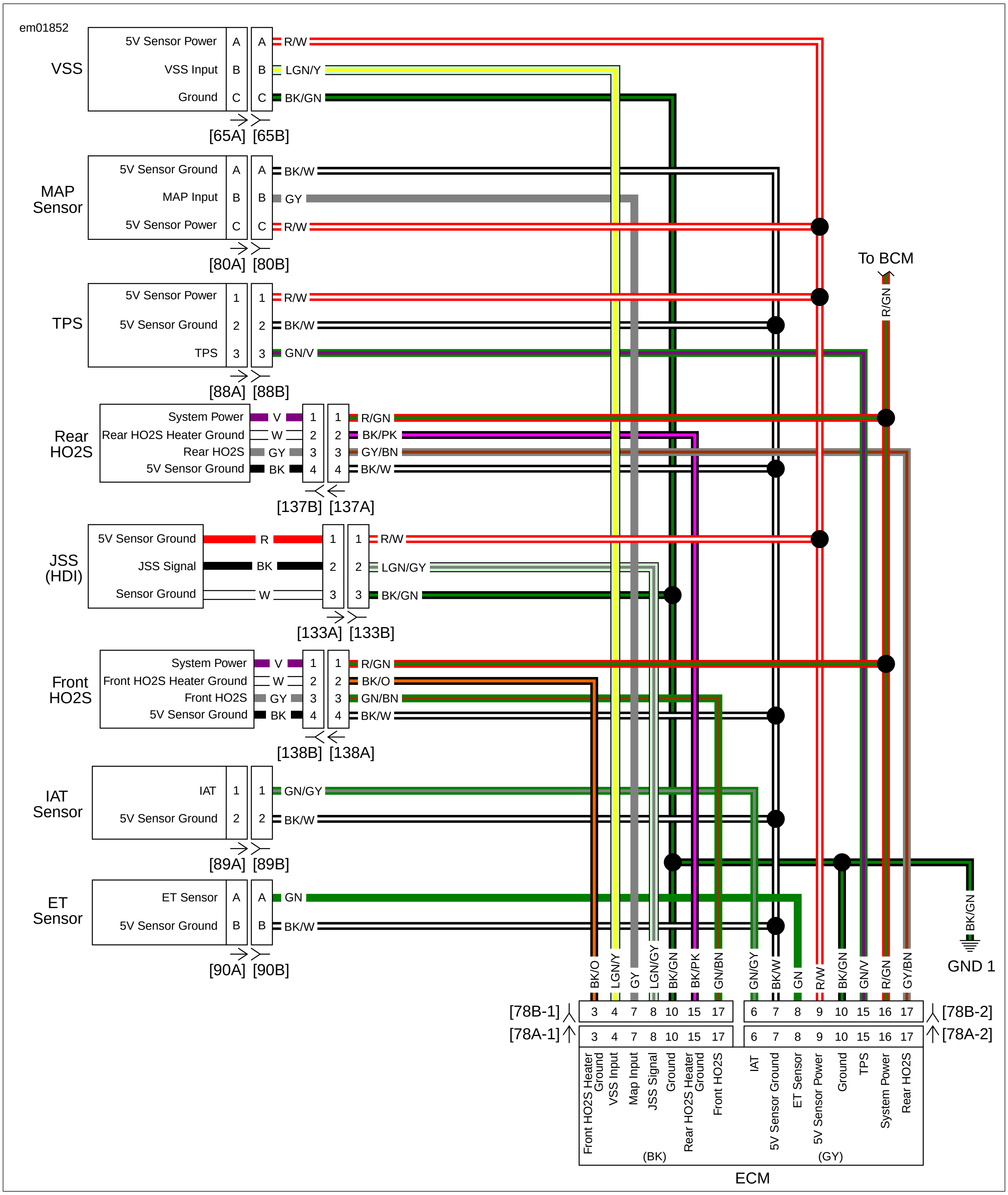


Figure 6-41. Sensor Circuit

DTC P0641

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-66. DTC P0641 Diagnostic Faults

POSSIBLE CAUSES
Short to ground on the 5V sensor power circuit
Short to voltage on the 5V sensor power circuit
VSS fault or malfunction
MAP sensor fault or malfunction
TPS fault or malfunction
JSS (HDI) fault or malfunction

1. 5V Sensor Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminal 9 and ground.
6. Is voltage between 4-6V?
   a. **Yes.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No. Greater than 6V.** Repair short to voltage on (R/W) wire.
   c. **No. Less than 4V.** Go to Test 2.

2. TPS Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect TPS [88].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 9 and 10.
5. Is voltage less than 4V?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace TPS.

3. MAP Power Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect MAP sensor [80].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 9 and 10.
5. Is voltage less than 4V?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace MAP sensor.

4. VSS Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect VSS [65].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 9 and 10.
5. Is voltage less than 4V?
   a. **Yes, with JSS.** Go to Test 5.
   b. **Yes, without JSS.** Go to Test 6.
   c. **No.** Replace VSS.

5. JSS Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect JSS [133].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 9 and 10.
5. Is voltage less than 4V?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace JSS.

6. Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect ECM from breakout box.
3. Test continuity between BOB [78-2] terminal 9 and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground in (R/W) wire.
   b. **No.** Go to Test 7.

7. Circuit Shorted to Sensor Ground Circuit Test

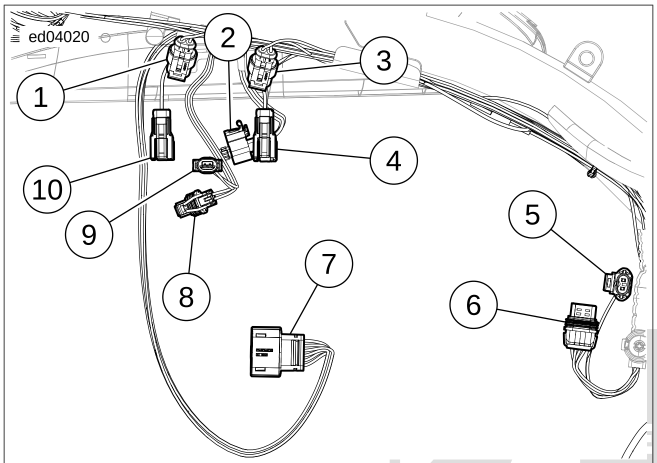
1. Test continuity between BOB [78-2] terminals 9 and 7.
2. Is continuity present?
   a. **Yes.** Repair short between (R/W) and (BK/W) wires.
   b. **No.** Replace ECM.

5V REFERENCE DIAGNOSTICS: ETC 6.24

DESCRIPTION AND OPERATION

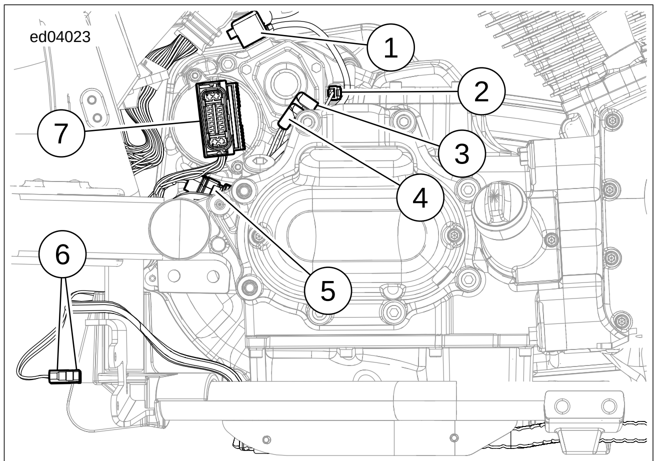
See Figure 6-42, Figure 6-42 and Figure 6-43. The ECM supplies 5V to the TGS, JSS, TCA and VSS from [78-2] terminal 9. These sensors may have individual codes along with this code since they all share the 5V reference circuit.

- DTC P0641 is displayed when sensor power-1 is out of range. The 5V sensor power-1 circuit supplies the TCA, VSS, JSS and sensor 2 of the TGS with a 5V reference signal.
- DTC P0651 is displayed when sensor power-2 is out of range. The 5V sensor power-2 circuit supplies the TMAP sensor and sensor 1 of the TGS with a 5V reference signal.



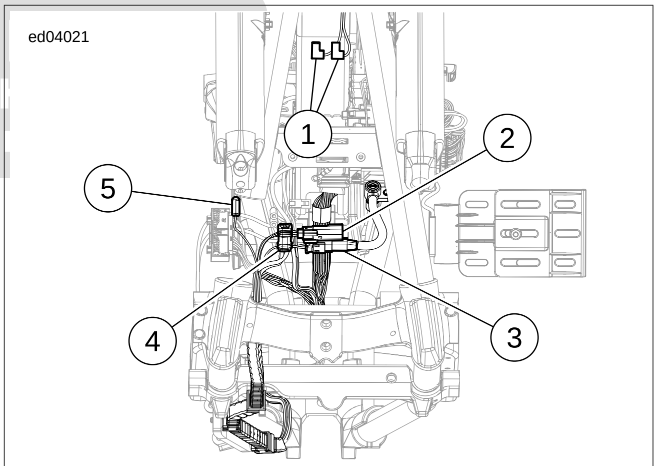
1. Front ACR [230]
2. TMAP [80]
3. Rear ACR [230]
4. Rear fuel injector [85]
5. Purge solenoid [95]
6. Ignition coil [83]
7. TCA [211]
8. ET sensor [90]
9. Ignition switch [33]
10. Front fuel injector [84]

Figure 6-42. Engine: ETC



1. Battery connection to starter
2. Starter solenoid [128]
3. Neutral switch [131-1]
4. Neutral switch [131-2]
5. VSS [65]
6. Rear brake switch [121]
7. ABS ECU [166]

Figure 6-43. Starter



1. Horn [122]
2. Front HO2S [138]
3. CKP [79]
4. Voltage regulator [78]
5. Oil pressure switch [120]

Figure 6-44. Front of Engine

Table 6-67. Code Description

DTC	DESCRIPTION
P0641	5V reference out of range
P0651	5V reference 2 out of range

Any of these conditions will set these DTCs:

- Short to ground on the 5V sensor power circuit.
- Short to voltage on the 5V sensor power circuit.
- VSS fault or malfunction.
- TMAP sensor fault or malfunction.
- TCA fault or malfunction.
- JSS (HDI) fault or malfunction.
- TGS fault or malfunction.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.1 CONNECTORS.

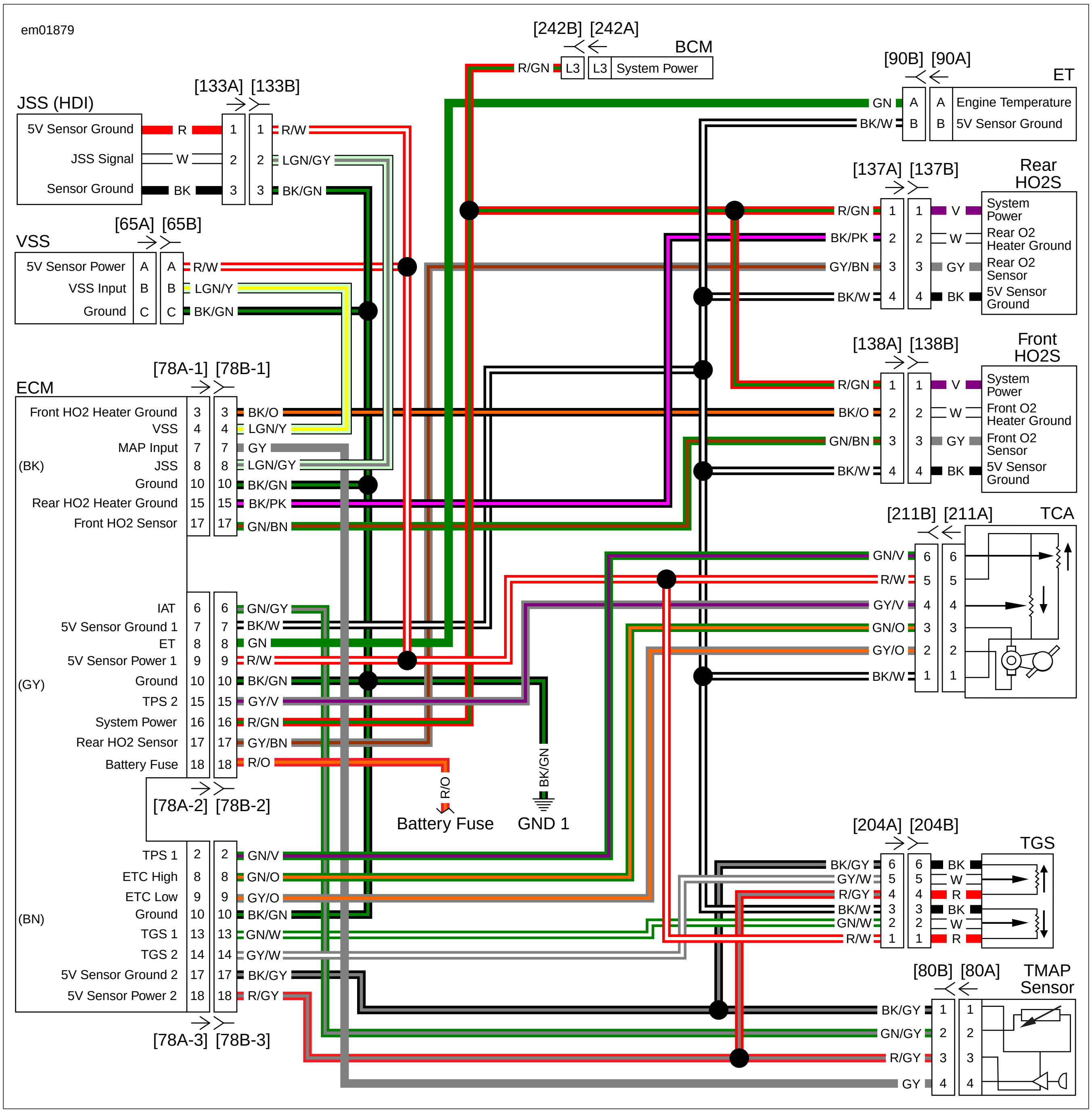


Figure 6-45. Sensor Circuit

DTC P0641

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-68. DTC P0641 Diagnostic Faults

POSSIBLE CAUSES
Short to ground on the 5V sensor power circuit
Short to voltage on the 5V sensor power circuit
VSS fault or malfunction
TGS fault or malfunction
TCA fault or malfunction
JSS (HDI) fault or malfunction

1. 5V Sensor Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1], [78B-2] and [78B-3], and ECM [78A-1], [78A-2] and [78A-3]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminal 9 and ground.
6. Is voltage between 4-6V?
   a. **Yes.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No, greater than 6V.** Repair short to voltage on (R/W) wire.
   c. **No, less than 4V.** Go to Test 2.

2. TCA Test

1. Turn IGN OFF.
2. Disconnect TCA [211].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminal 9 and terminal 7.
5. Is voltage less than 4V?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace TCA.

3. TGS Power Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect TGS [204].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 9 and 10.
5. Is voltage less than 4V?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace TGS.

4. VSS Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect VSS [65].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 9 and 10.
5. Is voltage less than 4V?
   a. **Yes, with JSS.** Go to Test 5.
   b. **Yes, without JSS.** Go to Test 6.
   c. **No.** Replace VSS.

5. JSS Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect JSS [133].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminals 9 and 10.
5. Is voltage less than 4V?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace JSS.

6. Circuit Short to Ground Test

1. Disconnect ECM from BOB.
2. Test continuity between BOB [78-2] terminal 9 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (R/W) wire.
   b. **No.** Go to Test 7.

7. Circuit Shorted to Sensor Ground Circuit Test

1. Test continuity between BOB [78-2] terminals 9 and 7.
2. Is continuity present?
   a. **Yes.** Repair short between (R/W) and (BK/W) wires.
   b. **No.** Replace ECM.

DTC P0651

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-69. DTC P0651 Diagnostic Faults

POSSIBLE CAUSES
Short to ground on the 5V sensor power circuit
Short to voltage on the 5V sensor power circuit
TMAP sensor fault or malfunction
TGS fault or malfunction

1. 5V Sensor Short to Voltage Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1], [78B-2] and [78B-3] and ECM [78A-1], [78A-2] and [78A-3]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-3] terminal 18 and ground.
6. Is voltage between 4-6V?
   a. **Yes.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.
   b. **No. Greater than 6V.** Repair short to voltage on (R/GY) wire.
   c. **No. Less than 4V.** Go to Test 2.

2. TGS Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect TGS [204].
3. Turn IGN ON.
4. Test voltage between BOB [78-3] terminals 18 and 10.
5. Is voltage less than 4V?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace TGS.

3. TMAP Power Circuit Below Range Test

1. Turn IGN OFF.
2. Disconnect TMAP sensor [80].
3. Turn IGN ON.
4. Test voltage between BOB [78-3] terminals 18 and 10.
5. Is voltage less than 4V?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace TMAP sensor.

4. Circuit Short to Ground Test

1. Disconnect ECM from BOB.
2. Test continuity between BOB [78-3] terminal 18 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (R/GY) wire.
   b. **No.** Go to Test 5.

5. Circuit Shorted to Sensor Ground Circuit Test

1. Test continuity between BOB [78-3] terminals 17 and 18.
2. Is continuity present?
   a. **Yes.** Repair short between (R/GY) and (BK/GY) wires.
   b. **No.** Replace ECM.

HOME

DESCRIPTION AND OPERATION

NOTE

Active intake solenoid (AIS) is included on HDI vehicles only.

See Figure 6-46. The AIS regulates the amount of air entering the air cleaner. Power for the AIS comes from the BCM. The ECM provides the path to ground to trigger the AIS.

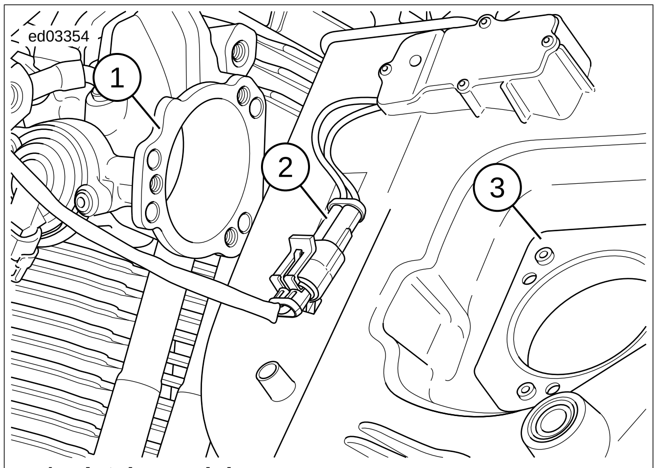
- AIS opens when vehicle speed exceeds 45 mph (70 km/h) with 50% or greater throttle opening.
- AIS closes when vehicle speed falls below 40 mph (65 km/h).

NOTE

The AIS and active exhaust actuator share the same power source and function simultaneously.

Table 6-70. Code Description

DTC	DESCRIPTION
P0661	Intake solenoid low/open
P0662	Intake solenoid shorted high



1. **Intake module**
2. **Intake solenoid connector [178]**
3. **Air cleaner backing plate**

Figure 6-46. Intake Solenoid Connector Location

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

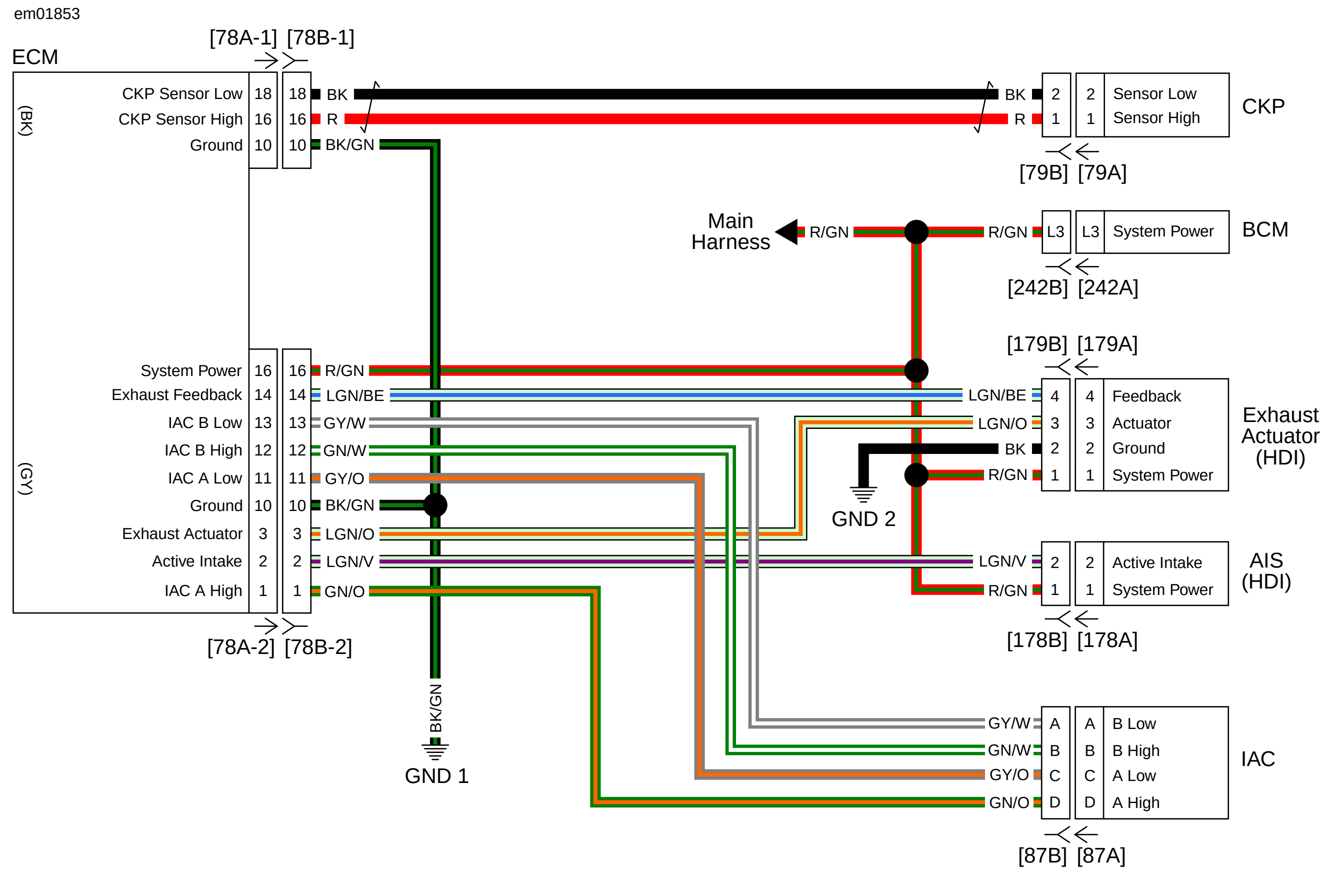


Figure 6-47. Active Exhaust Actuator and AIS Circuit

DTC P0661

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-71. DTC P0661 Diagnostic Faults

POSSIBLE CAUSES
AIS malfunction
Active intake shorted low
Open in circuit

1. AIS Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jump BOB [78-2] terminals 2 to 10.
5. Turn IGN ON.
6. Does AIS activate immediately?
   a. **Yes.** Replace ECM.
   b. **No.** Go to Test 2.

2. Resistance Test

1. Turn IGN OFF.
2. Disconnect AIS [178].
3. Test resistance between [178A] terminals 1 and 2.
4. Is resistance between 16-20 ohms?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace AIS.

3. Open Ground Wire Test

1. Test resistance between BOB [78-2] terminal 2 to AIS [178B] terminal 2 (LGN/V) wire.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (LGN/V) wire.

4. Low Short to Ground Test

1. Test continuity between BOB [78-2] terminal 2 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (LGN/V) wire.
   b. **No.** Go to Test 5.

5. Open Supply Wire Test

1. Test resistance between [78B-2] terminal 2 and [178B] terminal 1 (R/GN) wire.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (R/GN) wire.

DTC P0662

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-72. DTC P0662 Diagnostic Faults

POSSIBLE CAUSES
Active intake shorted high

1. AIS Resistance Test

1. Turn IGN OFF.
2. Disconnect AIS [178].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [178A] terminals 1 and 2.
4. Is resistance between 16-20 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace AIS.

2. Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between [178B] terminal 2 and ground.
3. Is voltage greater than 5.0V?
   a. **Yes.** Repair short to voltage on (LGN/V) wire
   b. **No.** Replace ECM.

DTC P1009 6.26

GENERAL

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Password Problem

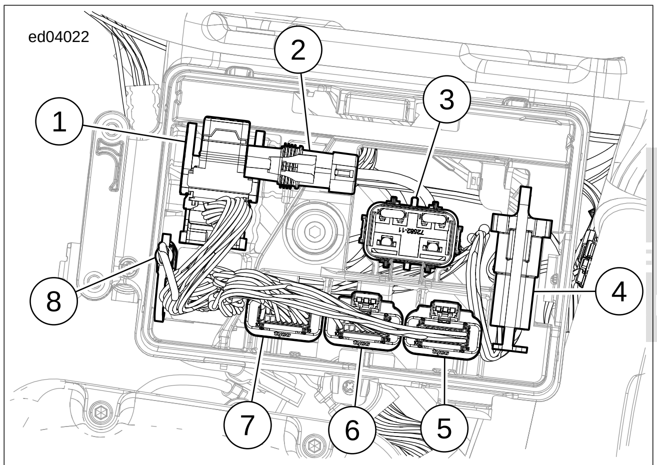
See Figure 6-48. The ECM and BCM exchange passwords during operation. An incorrect password will set a DTC. If any U-codes exist, troubleshoot the higher priority codes prior to performing the tests in this section. Refer to Table 1-12.

NOTE

Vehicle will not start if BCM is disconnected.

Table 6-73. Code Description

DTC	DESCRIPTION
P1009	VTD disabled fuel due to bad password



1. **BCM [242]**
2. **BCM power [259]**
3. **Fuse block [64]**
4. **DLC [91]**
5. **ECM [78-3] (BN) (if applicable)**
6. **ECM [78-2] (GY)**
7. **ECM [78-1] (BK)**
8. **Battery tender [281] (if applicable)**

Figure 6-48. Under Left Side Cover

Diagnostic Tips

This code will usually appear after replacing the ECM or BCM. **New** modules must be programmed using DIGITAL TECHNICIAN II (Part No. HD-48650). After parts are programmed and matched correctly for specific vehicle, clear codes.

DTC P1009

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Table 6-74. DTC P1009 Diagnostic Faults

POSSIBLE CAUSES
ECM malfunction
BCM malfunction

1. Incorrect Password Test

1. Using DIGITAL TECHNICIAN II (Part No. HD-48650), attempt to calibrate the ECM using the module replace feature found in vehicle set up.
2. Clear DTCs.
3. Turn IGN OFF.
4. Check DTCs.
5. Did DTC reset?
   a. **Yes.** Go to Test 2.
   b. **No.** System operating properly.

2. BCM Replacement Test

1. Turn IGN OFF.
2. Replace BCM.
3. Attempt to calibrate the BCM using the module replace feature found in vehicle set-up.
4. Clear DTCs.
5. Turn IGN OFF.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Install original BCM and replace ECM.
   b. **No.** System operating properly.

DTC P1270: ETC

DESCRIPTION AND OPERATION

TGS2 Validation

Within the ECM, there are two independent Analog/Digital (A/D) converter modules used to validate the input of Twist Grip Sensor 2 (TGS2). TGS2 inputs are sent into both converter modules and if the output of the two readings are not within the designated value of each other for a specified time, then DTC P1270 fault is initiated.

Unless the ECM has a poor or intermittent connection, DTC P1270 indicates the ECM is defective and requires replacement.

NOTE

After replacing the ECM, perform password learning procedure and clear codes.

Table 6-75. Code Description

DTC	DESCRIPTION
P1270	TGS 2 A/D validation error

DTC P1270

Table 6-76. DTC P1270 Diagnostic Faults

POSSIBLE CAUSES
ECM internal fault

1. DTC P1270 Test

1. Clear DTCs.
2. Turn IGN ON.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Replace ECM.
   b. **No.** System operating properly.

COMBUSTION EFFICIENCY DIAGNOSTICS 6.28

DESCRIPTION AND OPERATION

See Figure 6-49. A feedback voltage signal in the secondary ignition circuit (terminal B) detects the presence of combustion each time a cylinder fires on ECM [78-1] terminal 9. For diagnostic purposes, this signal is only analyzed at high speed and load conditions where it may be easily measured. Failure to detect combustion at high speed and load means one of following conditions is true:

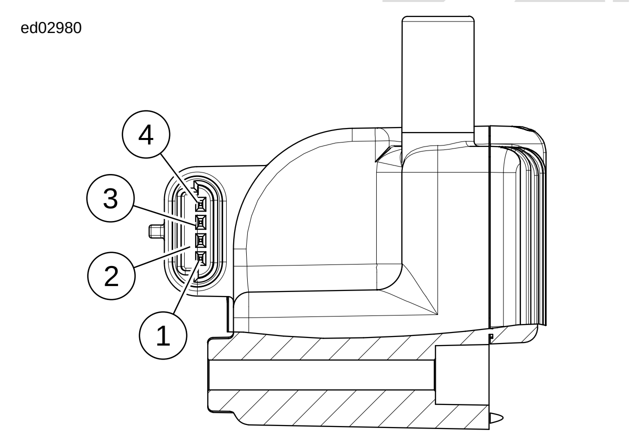
- Cylinder is truly misfiring.
- There is a lack of continuity in the ignition coil secondary circuit.

NOTES

- *Check for non-OE spark plugs and cables before testing. The incorrect resistance values of non-OE components will set these DTCs.*
- *Make sure vehicle is running properly before performing the tests in this section. Perform fuel pressure tests if required.*

Table 6-77. Code Description

DTC	DESCRIPTION
P1353	No combustion detected (front)
P1356	No combustion detected (rear)



1. **Terminal A: power**
2. **Terminal B: ion sense**
3. **Terminal C: rear coil**
4. **Terminal D: front coil**

Figure 6-49. Ignition Coil: Typical

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

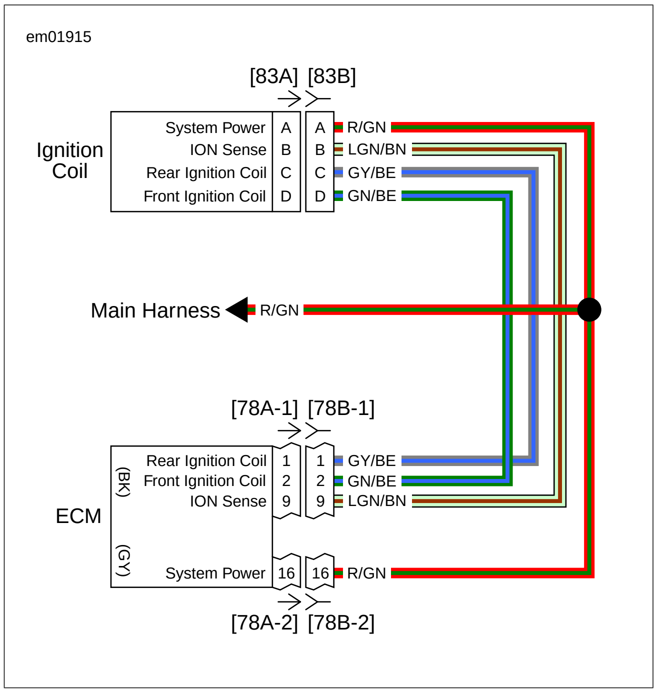


Figure 6-50. Ignition Coil Circuit

DTC P1353, P1356

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-78. DTC P1353, P1356 Diagnostic Faults

POSSIBLE CAUSES
Fuel system problems
Open or short to voltage in signal circuit
Spark plug wire connections faulty
Spark plug cables
Spark plug

1. Absence of Fuel Test

1. Verify vehicle has fuel.
2. Has vehicle run out of fuel recently?
   a. **Yes.** Clear DTCs. Fill with fresh fuel and restart. If code returns, then continue with tests. Go to Test 2.
   b. **No.** Go to Test 2.

2. Ion Sense Continuity Test

1. Turn IGN OFF.

2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Disconnect ignition coil [83].
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [83B] terminal B (LGN/BN) wire and BOB [78-1] terminal 9.
6. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (LGN/BN) wire.

3. Ion Sense Short to Voltage Test

1. Connect [78A-1] and [78A-2].
2. Turn IGN ON.
3. Test voltage between [83B] terminal B (LGN/BN) wire and BOB [78-1] terminal 10.
4. Is voltage present?
   a. **Yes.** Repair short to voltage on (LGN/BN) wire.
   b. **No.** Go to Test 4.

4. Spark Plug Cable Test

1. Disconnect spark plug cables.
2. Inspect spark plug cables for carbon tracking or loose connections.
3. Test resistance of spark plug cables.
4. Is front and rear spark plug cable resistance within specified range? Refer to Table 1-5.
   a. **Yes.** Go to Test 5.
   b. **No.** Replace out of range spark plug cable.

5. Ignition Rear Coil Primary Resistance Test

1. Test resistance between [83A] terminals A and C.
2. Is resistance 0.3-1.5 ohms?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace ignition coil.

6. Ignition Front Coil Primary Resistance Test

1. Test resistance between [83A] terminals A and D.
2. Is resistance 0.3-1.5 ohms?
   a. **Yes.** Go to Test 7.
   b. **No.** Replace ignition coil.

7. Ion Sense Coil Resistance Test

1. Test resistance between [83A] terminal B to front coil secondary output tower. Repeat test for rear output tower.
2. Is resistance 2500-3500 ohms?
   a. **Yes.** Go to Test 8.
   b. **No.** Replace ignition coil.

8. Ignition Coil Secondary Resistance Test

1. Test resistance across ignition coil front and rear secondary output towers.
2. Is resistance between 5500-7500 ohms?
   a. **Yes.** Go to Test 9.
   b. **No.** Replace ignition coil.

9. Coil Internal Short Test

1. Test continuity between [83A] terminals A and B.
2. Is continuity present?
   a. **Yes.** Replace ignition coil.
   b. **No.** Replace spark plugs and spark plug cables.

EXHAUST ACTUATOR DIAGNOSTICS 6.29

DESCRIPTION AND OPERATION

See Figure 6-51. The active exhaust actuator is included on HDI vehicles only.

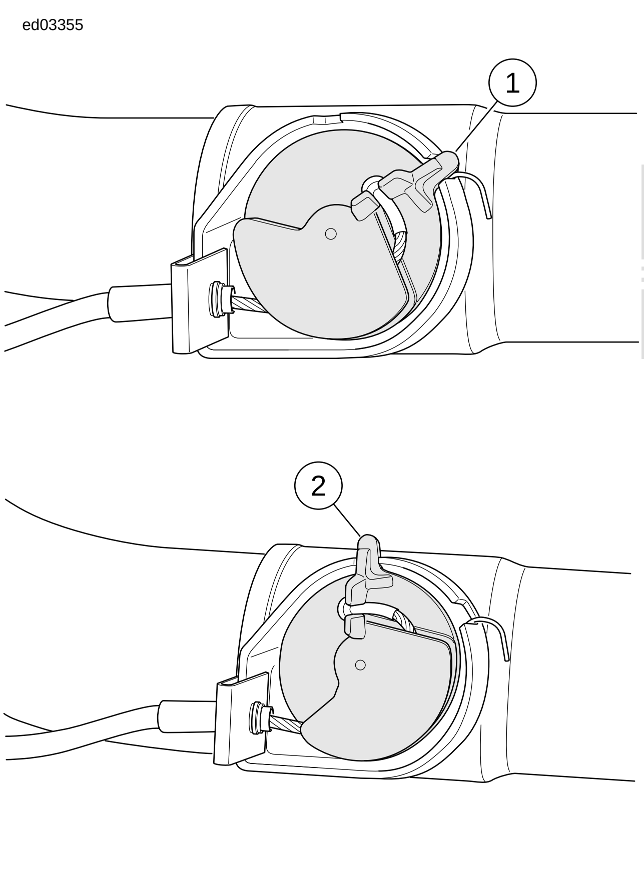
The active exhaust actuator system utilizes an actuator valve located in the rear exhaust pipe. It is connected to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance.

NOTE

The AIS and active exhaust actuator share the same power source and function simultaneously.

Table 6-79. Code Description

DTC	DESCRIPTION
P1475	Exhaust actuator position error
P1478	Exhaust actuator shorted high



1. **Open position**
2. **Closed position**

Figure 6-51. Bellcrank

Diagnostic Tips

Before replacing the exhaust actuator, check the cable and bellcrank assembly from exhaust actuator to exhaust valve for proper operation.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

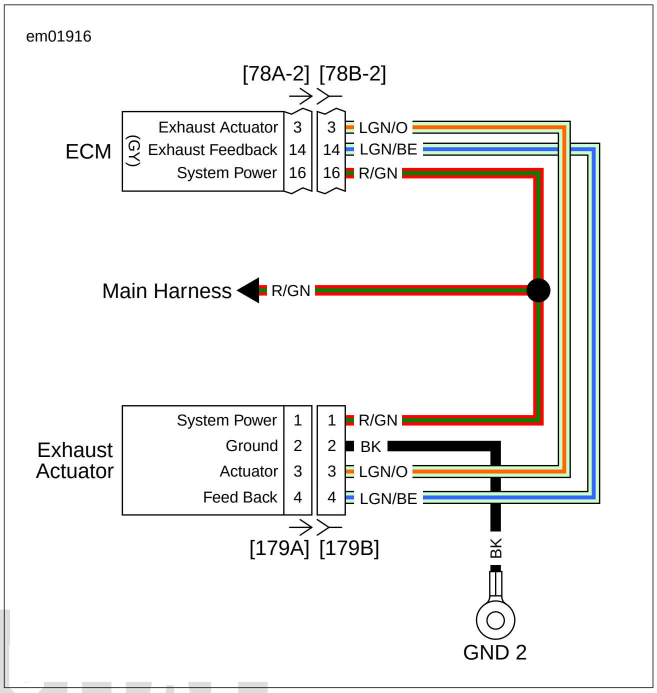


Figure 6-52. Exhaust Actuator Circuit

DTC P1475

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-80. DTC P1475 Diagnostic Faults

POSSIBLE CAUSES
Cable and bellcrank malfunction
Open in ground circuit
Open in power circuit
Open in active exhaust feedback circuit
Exhaust actuator malfunction
Short to voltage in active exhaust feedback circuit
Short to ground in active exhaust feedback circuit

1. Exhaust Actuator Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness

[78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.

3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), jump BOB [78-2] terminals 3 to 10.
5. Turn IGN ON.
6. Does actuator activate immediately?
   a. **Yes.** Replace ECM.
   b. **No.** Go to Test 2.

2. Voltage Test

1. Turn IGN OFF.
2. Turn IGN ON.
3. Disconnect exhaust actuator [179].
4. Test the voltage between [179B] terminals 1 (R/GN) wire and 2 (BK) wire.
5. Is battery voltage present?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 3.

3. Motor Ground Wire Continuity Test

1. Turn IGN OFF.
2. Test resistance between [179B] terminal 2 (BK) wire and ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Repair open in (R/GN) wire.
   b. **No.** Repair open on (BK) wire.

4. Feedback Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB [78-2] terminal 10 and 14.
3. Is voltage 4.5-5.5V?
   a. **Yes.** Go to Test 5.
   b. **No. Battery voltage.** Go to Test 8.
   c. **No. 0V.** Go to Test 9.

5. Feedback Continuity Test

1. Turn IGN OFF.
2. Test resistance between [179B] terminal 4 (LGN/BE) wire and BOB [78-2] terminal 14.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair open in (LGN/BE) wire.

6. Feedback Control Test

1. Connect [179].
2. Turn IGN ON.
3. Test voltage between BOB [78-2] terminals 10 and 14.
4. Jump between BOB [78-2] terminals 3 and 10 several times.
5. Does voltage change to less than 1.0V and exhaust actuator valve open each time?
   a. **Yes.** Go to Test 7.
   b. **No.** Replace exhaust actuator.

7. Feedback Run Test

1. Turn IGN OFF.
2. Clear codes.
3. Start engine.
4. Run engine between 1500-2500 rpm.
5. Does exhaust valve open at 1600 rpm or less and close at 1800 or more?
   a. **Yes.** System operating properly.
   b. **No.** Replace ECM.

8. Feedback Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect [78A-1] and [78A-2].
3. Test voltage between BOB [78-2] terminal 14 and ground.
4. Is voltage present?
   a. **Yes.** Repair short to voltage on (LGN/BE) wire.
   b. **No.** Replace ECM.

9. Feedback Short to Ground Test

1. Turn IGN OFF.
2. Disconnect [78A-1] and [78A-2].
3. Test continuity between [179B] terminal 4 (LGN/BE) wire and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground on (LGN/BE) wire.
   b. **No.** Replace ECM.

DTC P1478

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-81. DTC P1478 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in active exhaust circuit
Exhaust actuator malfunction

1. Exhaust Actuator Motor High Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminal 3 and ground.
6. Is voltage present?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace ECM.

2. Motor Shorted to Voltage Test

1. Turn IGN OFF.
2. Disconnect exhaust actuator [179].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminal 3 and ground.
5. Is voltage present?
   a. **Yes.** Repair short to voltage on (LGN/O) wire.
   b. **No.** Replace active exhaust control actuator.

JSS DIAGNOSTICS 6.30

DESCRIPTION AND OPERATION

See Figure 6-53. The jiffy stand sensor (JSS) uses a Hall-effect sensor to monitor jiffy stand position.

- When the jiffy stand is fully retracted the sensor picks up the presence of the metal tab mounted to the jiffy stand. The metal tab is moved away from the sensor as the jiffy stand is extended.
- When the jiffy stand is extended the engine will only start and run if the BCM determines the transmission is in neutral. This is done by monitoring the neutral switch input to the BCM and communicating that input over the CAN bus circuit to the ECM.

The JSS is powered and monitored by the ECM. The ECM supplies the 5V reference to the JSS. The JSS sends a signal back to the ECM. This signal is used by the ECM to determine when the jiffy stand is retracted or extended. The JSS is grounded through the ECM.

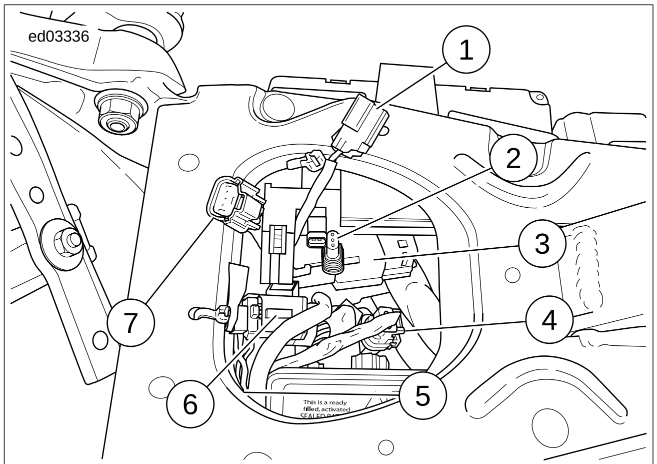
The JSS also has a Fail Enable Mode. This mode allows the engine to start and run if the system recognizes a problem with the JSS circuit. When a problem exists or if the transmission is put in gear with the jiffy stand extended the odometer will display "SIdE Stand." DTC P1501 or P1502 will set if the JSS circuits are out of range.

NOTE

The ECM supplies 5V reference voltage to the VSS, TPS and MAP sensors in addition to the JSS. Problems on the 5V reference will cause other DTCs.

Table 6-82. Code Description

DTC	DESCRIPTION
P1501	JSS low
P1502	JSS high/open



1. **Security antenna [209]**
2. **Security siren [142]**
3. **Rear HO2S [137]**
4. **Rear WSS [168]**
5. **Grounds**
6. **Rear lighting [7]**
7. **JSS [133]**

Figure 6-53. Under the Seat

Diagnostic Tips

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

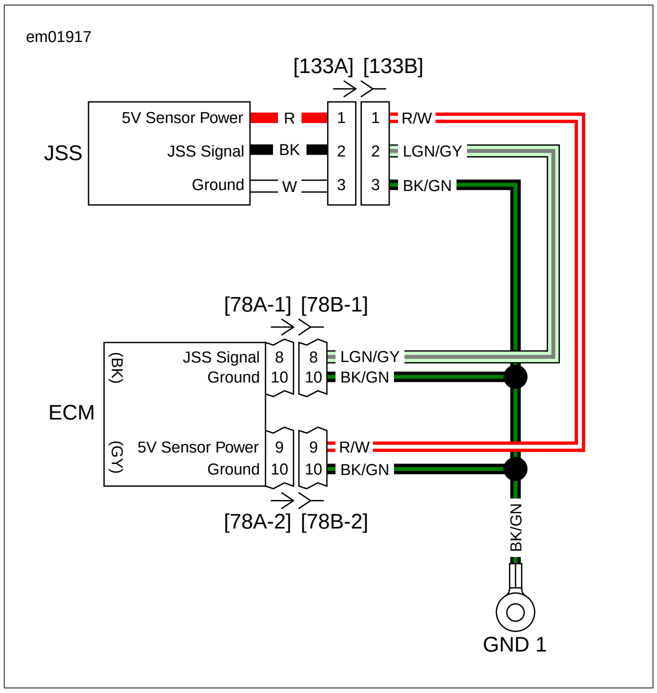


Figure 6-54. JSS Circuit

HOME

DTC P1501

Table 6-83. DTC P1501 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in signal circuit

1. Signal Wire Shorted to Ground Test

1. Turn IGN OFF.
2. Disconnect JSS [133].
3. Test continuity between [133B] terminal 2 (LGN/GY) wire and ground.
4. Is continuity present?
   a. **Yes.** Repair short to ground on (LGN/GY) wire.
   b. **No.** Replace JSS.

DTC P1502

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-84. DTC P1502 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in signal circuit
Open ground
Short between 5V reference circuit and signal circuit
Open in signal circuit

1. JSS Ground Wire Test

1. Turn IGN OFF.
2. Disconnect JSS [133].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [133B] terminal 3 and ground.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (BK/GN) wire.

2. Signal Wire Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between [133B] terminal 2 (LGN/GY) wire and ground.
3. Is voltage greater than 5V?
   a. **Yes.** Repair short to voltage in (LGN/GY) wire.
   b. **No.** Go to Test 3.

3. 5V Reference and Signal Shorted Together Test

1. Turn IGN OFF.
2. Disconnect ECM [78-1] and [78-2].
3. Test continuity between [133B] terminals 1 (R/W) wire and 2 (LGN/GY) wire.
4. Is continuity present?
   a. **Yes.** Repair short between (R/W) and (LGN/GY) wires.
   b. **No.** Go to Test 4.

4. Signal Wire Open Circuit Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Test resistance between BOB [78-1] terminal 8 and [133B] terminal 2 (LGN/GY) wire.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace JSS.
   b. **No.** Repair open on (LGN/GY) wire.

SIDE STAND DISPLAYED ON SPEEDOMETER

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-85. Side Stand Displayed on Speedometer Diagnostic Faults

POSSIBLE CAUSES
Jiffy stand is down
Jiffy stand out of adjustment
Open 5V sensor power wire

1. Starts, Then Stalls Test

1. Start engine.
2. Does engine start and stall?
   a. **Yes.** See 6.43 STARTS, THEN STALLS.
   b. **No.** Go to Test 2.

2. Neutral Test

1. Verify transmission is in neutral.

2. Is neutral indicator on?
   a. **Yes.** Go to Test 3.
   b. **No.** See 4.5 INDICATOR LAMPS.

3. JSS Clearance Test

1. Inspect JSS and jiffy stand for correct mounting and clearance to jiffy stand tab.
2. Is clearance less than 0.18 in (4.5 mm)?
   a. **Yes.** Go to Test 4.
   b. **No.** Install JSS and jiffy stand correctly.

4. 5V Reference Open Circuit Test

1. Disconnect JSS [133].
2. With IGN OFF, connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using the HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB [78-2] terminal 9 and [133B] terminal 1 (R/W) wire.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace JSS.
   b. **No.** Repair open on (R/W) wire.

ETC MANAGEMENT DIAGNOSTICS 6.31

DESCRIPTION AND OPERATION

Throttle Control Actuator Management

The ECM constantly monitors throttle actuation and throttle plate positioning. Several features are programmed into the ECM to limit performance when an error or fault in throttle actuation is detected. These DTCs always accompany another code. Refer to Table 6-86.

Table 6-86. Code Description

DTC	DESCRIPTION
P1510	ETC limited performance mode
P1511	ETC power management mode
P1512	ETC forced idle mode

Performance limitations are identified by code, as follows:

- **P1510 Limited Performance:** Enables near normal operation of the vehicle, guarding against inadvertent wide open throttle conditions. Typically this code is the result if one of the TGS or TP sensors, or one of each, has failed.
- **P1511 Power Management:** Provides more limitation on driveability, due to failure of the TCA, without a TGS, TMAP or airflow faults. The TCA is de-energized and the throttle plate returns to its idle detent position. The ECM monitors the operation of the TGS and adjusts the spark advance and cylinder shutoff/rev limiting, allowing the vehicle to reach traffic speeds (limp-home).
- **P1512 Forced Idle Mode:** Provides extreme limitation of driveability, due to a failure of both TGS, TGS validation error or failure of one TGS and the brake switch. The TCA is de-energized and the throttle plate is forced to a fast idle position providing enough torque to operate at a high idle speed.

DTC P1510, P1511, P1512

Table 6-87. DTC P1510, P1511, P1512 Diagnostic Faults

POSSIBLE CAUSES
Other DTCs set

1. DTC Verification Test

1. Clear DTCs.
2. Start and run engine for a few seconds.
3. Cycle the engine on and off, for a few seconds each time a total of three times.
4. Did DTC P1510, P1511 or P1512 set with no other DTCs?
   a. **Yes.** Replace ECM.
   b. **No, other DTCs set.** Refer to Table 1-12.
   c. **No, no DTCs set.** DTC was properly cleared.

ETC ERROR DIAGNOSTICS 6.32

DESCRIPTION AND OPERATION

Air Flow Fault

The ECM uses the TMAP sensor to monitor air flow past the throttle plate. This ensures proper throttle plate positioning when the throttle is released and allowed to return to the unpowered position. The unpowered position is typically 7% of throttle plate range.

In order to avoid inconsistent readings at low rpm (or at idle), testing air flow is only performed at engine speeds above normal idle (10% of throttle plate range or approximately 1300 rpm).

The ECM compares the intake manifold pressure value from the TMAP to the throttle plate position value from the TPS. DTC P1514 sets if the manifold pressure is higher than it should be for that given throttle plate position. If a TMAP sensor error is present, then the ECM does not check P1514 parameters and instead P2105 (forced shutdown mode) is initiated, shutting down the fuel pump and fuel injectors. See 6.35 DTC P2105, P2107. The ECM only checks for DTC P1514 if power management mode (DTC P1511) is present.

The ECM uses a main microprocessor and a monitoring microcontroller to communicate with the throttle actuation control system.

The microcontroller monitors the main microprocessor of the ECM. When a communication failure is identified, the microcontroller shuts down the TCA and fuel injectors.

An internal ignition delay timer monitors when the ignition circuit is energized. The microcontroller issues DTC P1600 if no communication is established between the main microprocessor or if a monitoring failure occurs within three consecutive ignition cycles.

Table 6-88. Code Description

DTC	DESCRIPTION
P1514	TCA airflow error
P1600	TCA internal error

DTC P1514

Table 6-89. DTC P1514 Diagnostic Faults

POSSIBLE CAUSES
Other DTCs set

1. DTC Verification Test

1. Clear DTCs.
2. Start and run the engine for a few seconds.
3. Cycle engine on and off, for a few seconds each time a total of three times.
4. Did DTC P1514 set with no other DTCs?
   a. **Yes.** Replace ECM.
   b. **No, other DTCs set.** Refer to Table 1-12.
   c. **No, no DTCs set.** DTC was properly cleared.

DTC P1600

Table 6-90. DTC P1600 Diagnostic Faults

POSSIBLE CAUSES
Other DTCs set

1. DTC Verification Test

1. Clear DTCs.
2. Start and run the engine for a few seconds.
3. Cycle engine on and off, for a few seconds each time a total of three times.
4. Did DTC P1600 set with no other DTCs?
   a. **Yes.** Replace ECM.
   b. **No, other DTCs set.** Refer to Table 1-12.
   c. **No, no DTCs set.** DTC was properly cleared.

ACR DIAGNOSTICS 6.33

DESCRIPTION AND OPERATION

See Figure 6-55. When open, compressed gases are released through the exhaust port.

See Figure 6-56. The automatic compression release (ACR) is opened and closed by the ECM to assist starting.

Table 6-91. Code Description

DTC	DESCRIPTION
P1655	ACR solenoid low/open
P1656	ACR solenoid shorted high

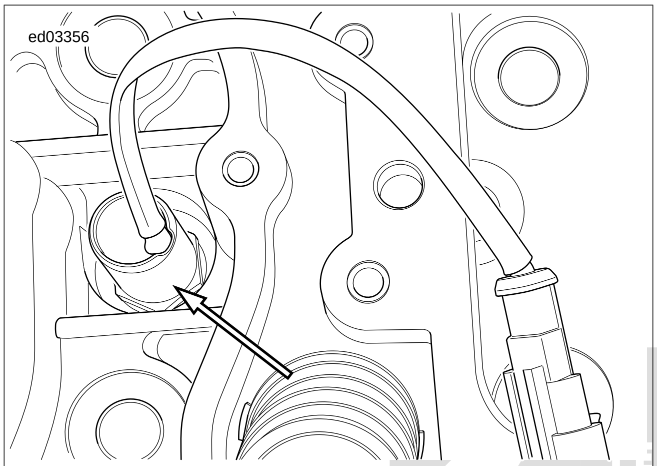
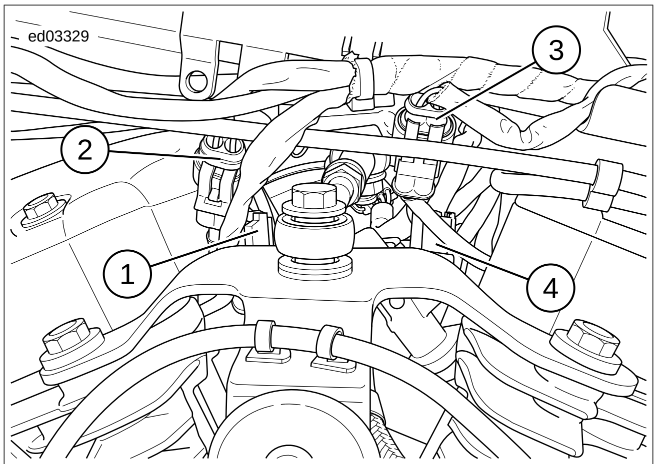


Figure 6-55. ACR in Head



1. **Front fuel injector [84]**
2. **Front ACR [203F]**
3. **Rear ACR [203R]**
4. **Rear fuel injector [85]**

Figure 6-56. Between Cylinders Left Side

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

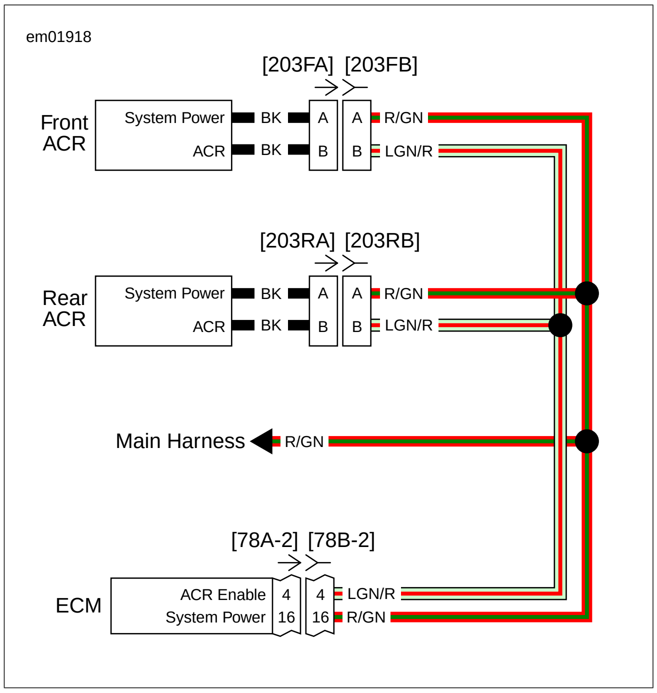


Figure 6-57. ACR Circuit

DTC P1655

PART NUMBER	TOOL NAME
HD-34730-2E	FUEL INJECTOR TEST LIGHT
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-92. DTC P1655 Diagnostic Faults

POSSIBLE CAUSES
ACR solenoid malfunction
Open in ACR control circuit
Open in system power circuit
Short to ground in ACR control circuit

1. Front ACR Test

1. Turn IGN OFF.
2. Disconnect front ACR [203F].
3. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E).
4. Crank engine for 5 seconds.

5. Does the test light flash on and off?
   a. **Yes.** Go to Test 2.
   b. **No, test light stays on steady.** Go to Test 4.
   c. **No, did not stay on steady.** Go to Test 6.

2. Rear ACR Test

1. Turn IGN OFF.
2. Disconnect rear ACR [203R].
3. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E).
4. Crank engine for 5 seconds.
5. Does the test light flash on and off?
   a. **Yes.** Replace front and rear ACR solenoids.
   b. **No.** Go to Test 3.

3. Rear ACR Control Circuit Test

1. Turn IGN OFF.
2. Disconnect test light.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [203FB] terminal 1 (R/GN) wire and [203RB] terminal 1 (R/GN) wire.
4. Is resistance less than 0.5 ohm?
   a. **Yes.** Repair open in (LGN/R) wire.
   b. **No.** Repair open in (R/GN) wire.

4. Front ACR Control Circuit Short to Ground Test

1. Turn IGN OFF.
2. Disconnect ECM [78-2].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between [203FB] terminal 2 (LGN/R) wire and ground.
4. Is continuity present?
   a. **Yes.** Go to Test 5.
   b. **No.** Replace ECM.

5. Rear ACR Control Circuit Short to Ground Test

1. Disconnect rear ACR [203R].
2. Test continuity between [203FB] terminal 2 (LGN/R) wire and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (LGN/R) wire.
   b. **No.** Replace front and rear ACR.

6. Shorted ACR Test

1. Turn IGN OFF.
2. Disconnect rear ACR [203R].
3. Crank engine for 5 seconds.
4. Does the test light flash on and off?
   a. **Yes.** Replace front and rear ACR.
   b. **No.** Go to Test 7.

7. ACR Control Circuit Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 6.43 STARTS, THEN STALLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB [78-2] terminal 4 and [203FB] terminal 2 (LGN/R) wire.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 8.
   b. **No.** Repair open in (LGN/R) wire.

8. Power Circuit Continuity Test

1. Test resistance between BOB [78-2] terminal 16 and [203B] terminal 1 (R/GN) wire.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (R/GN) wire.

DTC P1656

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

Table 6-93. DTC P1656 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in ACR control circuit
ACR solenoid malfunction

1. Front ACR Test

1. Turn IGN OFF.
2. Disconnect front ACR [203F].
3. Connect FUEL INJECTOR TEST LIGHT (Part No. HD-34730-2E).
4. Crank engine for 5 seconds.
5. Does test light flash on and off?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 4.

2. Rear ACR Test

1. Turn IGN OFF.

2. Disconnect rear ACR [203R].
3. Disconnect test light from [203F].
4. Connect test light to [203R].
5. Crank engine for 5 seconds.
6. Does test light flash on and off?
   a. **Yes.** Replace front and rear ACR.
   b. **No.** Go to Test 3.

3. Rear ACR Control Circuit Test

1. Disconnect test light.
2. While cranking engine, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [203RB] terminal 2 (LGN/R) wire and ground.
3. Is voltage greater than 5.0V?
   a. **Yes.** Repair short to voltage on (LGN/R) wire.
   b. **No.** Replace ECM.

4. Front ACR Control Circuit Test

1. Disconnect rear ACR [203R].
2. While cranking engine, using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [203FB] terminal 2 (LGN/R) wire and ground.
3. Is voltage greater than 5.0V?
   a. **Yes.** Repair short to voltage on (LGN/R) wire.
   b. **No.** Replace front and rear ACR.

ETC ACTUATOR DIAGNOSTICS 6.34

DESCRIPTION AND OPERATION

The TCA contains two potentiometers (designated as TPS1 and TPS2) and an electric DC motor for controlling the actuation of the throttle. TPS1 and TPS2 are mounted in the TCA. They are connected to the keyed shaft for the throttle plate and used to communicate the position of the throttle plate.

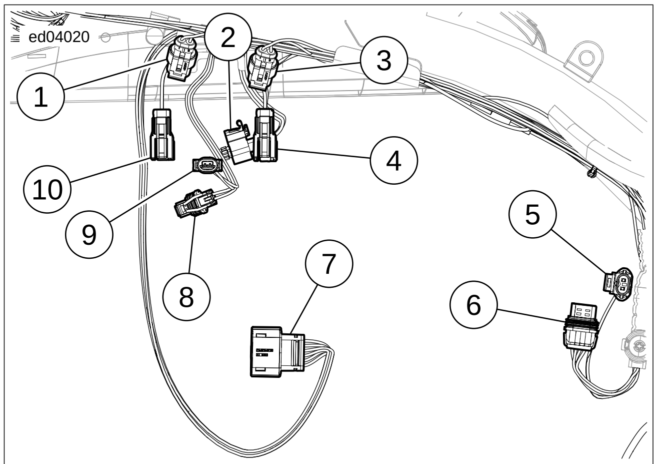
Each TPS supplies input to the ECM in response to the positioning of the throttle plate. The ECM activates the motor in the TCA to move the throttle plate, based on signals from the TGS.

See Figure 6-59. The TCA motor receives input (position data) from the ECM connector [78-3] terminal 8 for electronic throttle control - HI and terminal 9 for electronic throttle control - LOW. The TCA motor drives a series of gears to rotate the position of the throttle plate. Refer to Table 6-94 for DTCs associated with TCA drive motor.

Table 6-94. Code Description

DTC	DESCRIPTION
P2100	ETC driver open circuit
P2101	ETC actuation error
P2102	ETC driver shorted low
P2103	ETC driver shorted high

- **P2100 TCA Motor Circuit Open:** Indicates the ECM identified an open load fault for the TCA motor driver.
- **P2101 TCA Motor Circuit Range/Performance:** Indicates the actual position of the throttle plate is out of range from the commanded throttle plate position.
- **P2102 TCA Motor Control Circuit Shorted Low:** Indicates the ECM identified that the drive motor is shorted to ground within the TCA drive motor circuit.
- **P2103 TCA Motor Control Circuit Shorted High:** Indicates the drive motor is shorted high within the TCA drive motor circuit.



1. **Front ACR [230]**
2. **TMAP [80]**
3. **Rear ACR [230]**
4. **Rear fuel injector [85]**
5. **Purge solenoid [95]**
6. **Ignition coil [83]**
7. **TCA [211]**
8. **ET sensor [90]**
9. **Ignition switch [33]**
10. **Front fuel injector [84]**

Figure 6-58. Engine: ETC

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.1 CONNECTORS.

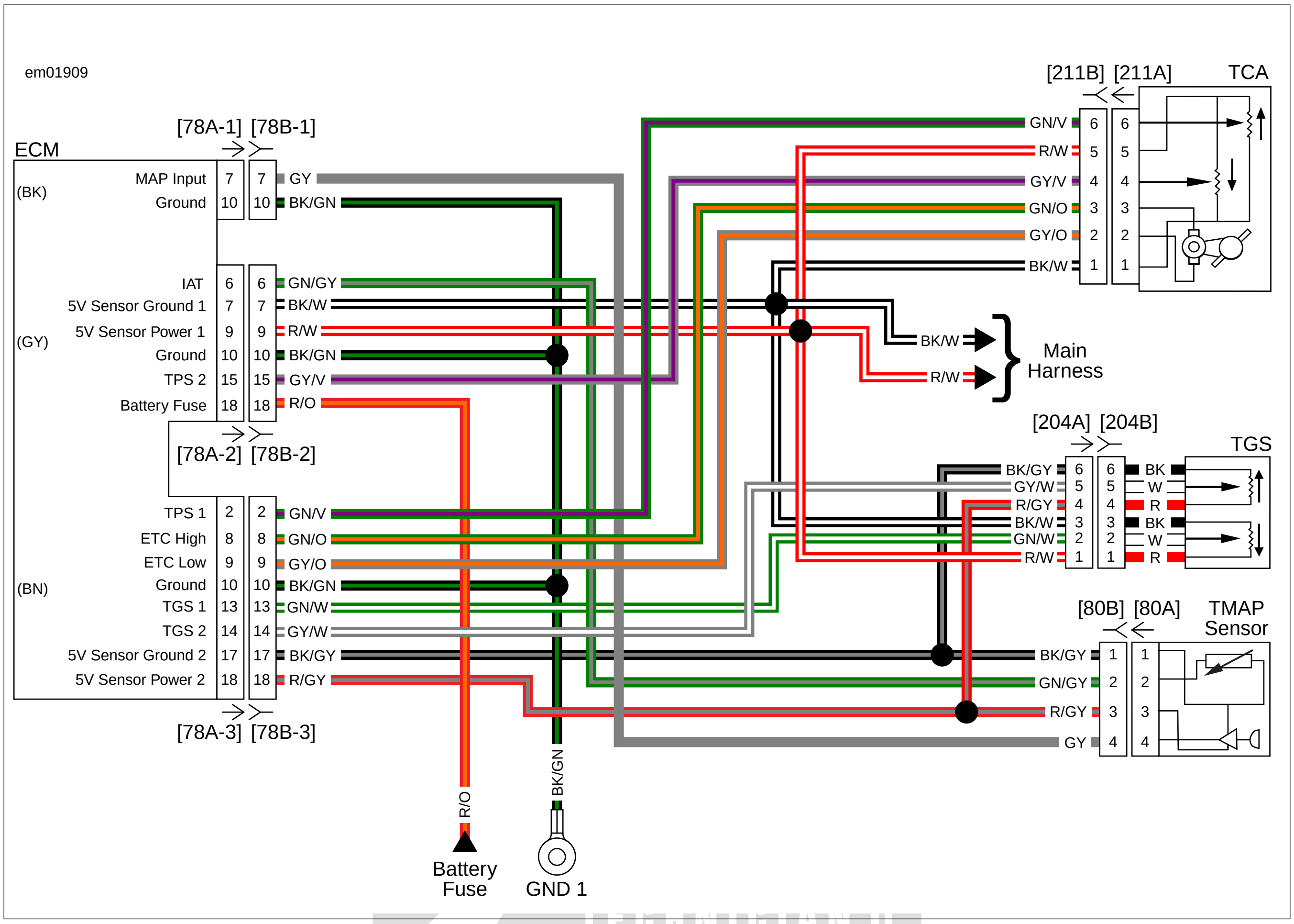


Figure 6-59. TCA, TGS, TMAP Circuits

DTC P2100

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-95. DTC P2100 Diagnostic Faults

POSSIBLE CAUSES
Open in throttle actuator control circuit high
Open in throttle actuator control circuit low

1. TCA Test

1. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See 1.3 DIAGNOSTIC TOOLS.
2. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB [78-3] terminals 8 and 9.
4. Is resistance greater than 10 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Perform wiggle test. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test. If resistance is below 10 ohms, replace ECM.

2. TCA High Circuit Test

1. Disconnect TCA [211].
2. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB [78-3] terminal 8 and TCA [211B] terminal 3.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (GN/O) wire.

3. TCA Low Circuit Test

1. Test resistance between BOB [78-3] terminal 9 and TCA [211B] terminal 2.

2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace TCA.
   b. **No.** Repair open in (GY/O) wire.

DTC P2101

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-96. DTC P2101 Diagnostic Faults

POSSIBLE CAUSES
Short between throttle actuator control circuits
Open in throttle actuator control circuit high
Open in throttle actuator control circuit low

1. TCA Circuit Resistance Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB [78-3] terminals 8 and 9.
5. Is resistance less than 2 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 3.

2. TCA Test

1. Disconnect TCA [211].
2. Test resistance between BOB [78-3] terminal 8 and terminal 9.
3. Is resistance less than 2 ohms?
   a. **Yes.** Repair short between the (GN/O) and (GY/O) wires.
   b. **No.** Replace TCA.

3. TCA High Circuit Test

1. Test resistance between BOB [78-3] terminal 8 and [211B] terminal 3.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (GN/O) wire.

4. TCA Low Circuit Test

1. Test resistance between BOB [78-3] terminal 9 and [211B] terminal 2.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace ECM.
   b. **No.** Repair open in (GY/O) wire.

DTC P2102

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-97. DTC P2102 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in throttle actuator control circuit low
Short to ground in throttle actuator control circuit high

1. TCA High Circuit Test

1. Turn IGN OFF.
2. Disconnect TCA [211].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [211B] terminal 3 and ground.
4. Is resistance greater than 1000 ohms?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair short to ground in (GN/O) wire.

2. TCA Test

1. Test resistance between [211B] terminal 2 and ground.
2. Is resistance less than 2 ohms?
   a. **Yes.** Repair short to ground in (GY/O) wire.
   b. **No.** Replace TCA.

DTC P2103

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-98. DTC P2103 Diagnostic Faults

POSSIBLE CAUSES
Short to ground in throttle actuator control circuit low
Short to ground in throttle actuator control circuit high

1. TCA High Circuit Test

1. Turn IGN OFF.

2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Disconnect TCA [211].
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB [78-2] terminal 16 and [78-3] terminal 8.
6. Is continuity present?
   a. **Yes.** Repair short between (GN/O) and (R/GN) wires.
   b. **No.** Go to Test 2.

2. TCA Low Circuit Test

1. Test continuity between BOB [78-2] terminal 16 and [78-3] terminal 9.
2. Is continuity present?
   a. **Yes.** Repair short between (GY/O) and (R/GN) wires.
   b. **No.** Replace ECM.

DTC P2105, P2107 6.35

DESCRIPTION AND OPERATION

The ECM sets DTC P2105 and provides a forced shut down of the engine when the performance of the TCA cannot be verified.

Initially, the ECM commands the fuel pump and fuel injectors to be disabled until the actual fault is cleared.

The ECM sets DTC P2107 to identify an internal over-temperature shutdown or a power supply failure. Refer to Table 6-99.

Table 6-99. Code Description

DTC	DESCRIPTION
P2105	ETC forced shutdown mode
P2107	ETC driver internal error

DTC P2105, P2107

Table 6-100. DTC P2105, P2107 Diagnostic Faults

POSSIBLE CAUSES
Internal ECM fault

1. DTC Verification Test

1. Clear DTCs.
2. Start and run the engine for 30 seconds.
3. Check DTCs.
4. Did DTC P2105 set with no other DTCs?
   a. **Yes.** Replace ECM.
   b. **No, other DTCs set.** Refer to Table 1-12.
   c. **No, no DTCs set.** DTC was properly cleared.

HOME

DTC P2119 6.36

DESCRIPTION AND OPERATION

The ECM sets DTC P2119 when it determines the throttle plate does not return to the correct de-energized position. This error primarily indicates there may be non-electrical conditions which affect the throttle body range/performance. Refer to Table 6-101.

Table 6-101. Code Description

DTC	DESCRIPTION
P2119	ETC actuator return error

This DTC may have the following conditions:

- Something may be physically interfering with the throttle plate operation such as foreign material, debris, physical obstruction or loosely/improperly mounted throttle plate.
- Damaged or inoperative throttle plate return spring.
- Defective mechanical component(s) internal to the TCA.

DTC P2119

Table 6-102. DTC P2119 Diagnostic Faults

POSSIBLE CAUSES
Mechanical interference

1. Air Inlet Interference Test

1. Inspect air inlet. Check for foreign debris and/or mechanical interference to the throttle plate.
2. Were any issues found?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace induction module.

2. Validation Test

1. Clear inlet. Check throttle plate movement.
2. Clear DTCs.
3. Start the engine and operate the throttle.
4. Check DTCs.
5. Did DTC P2119 set?
   a. **Yes.** Replace induction module.
   b. **No.** Repair complete.

TGS DIAGNOSTICS 6.37

DESCRIPTION AND OPERATION

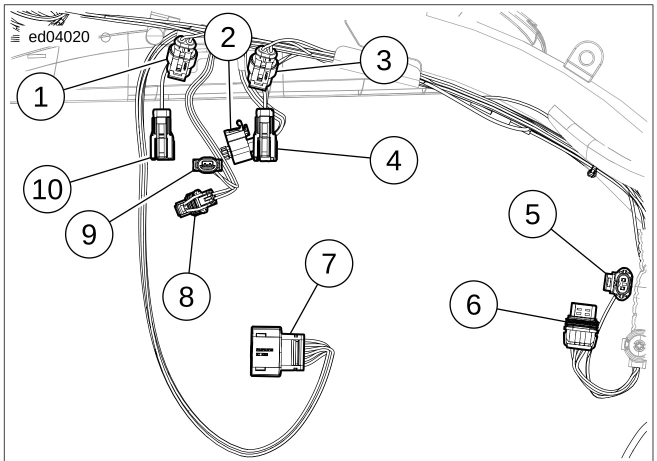
The TGS is an electronic assembly that replaces the conventional cable operated throttle. Two opposing Hall-effect sensors transmit signals to the ECM. The ECM uses these signals to determine the desired throttle plate position. The ECM controls the motor in the TCA to move the throttle plate to the desired position.

The TGS receives a 5V reference signal from the ECM. As the throttle plate is opened the TGS1 signal voltage increases and TGS2 signal voltage decreases. By design, the sum of the voltages when measured for both TGS1 and TGS2 should equal approximately 5.0V. If the sum of these voltages is not 5.0V, then DTCs are set for TGS1 and/or TGS2.

The ECM monitors and controls the TCA system and generates DTCs when errors are reported by the ECM. Refer to Table 6-103.

Table 6-103. Code Description

DTC	DESCRIPTION
P2122	TGS1 low/open
P2123	TGS1 high
P2127	TGS2 low/open
P2128	TGS2 high



1. **Front ACR [230]**
2. **TMAP [80]**
3. **Rear ACR [230]**
4. **Rear fuel injector [85]**
5. **Purge solenoid [95]**
6. **Ignition coil [83]**
7. **TCA [211]**
8. **ET sensor [90]**
9. **Ignition switch [33]**
10. **Front fuel injector [84]**

Figure 6-60. Engine: ETC

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.1 CONNECTORS.

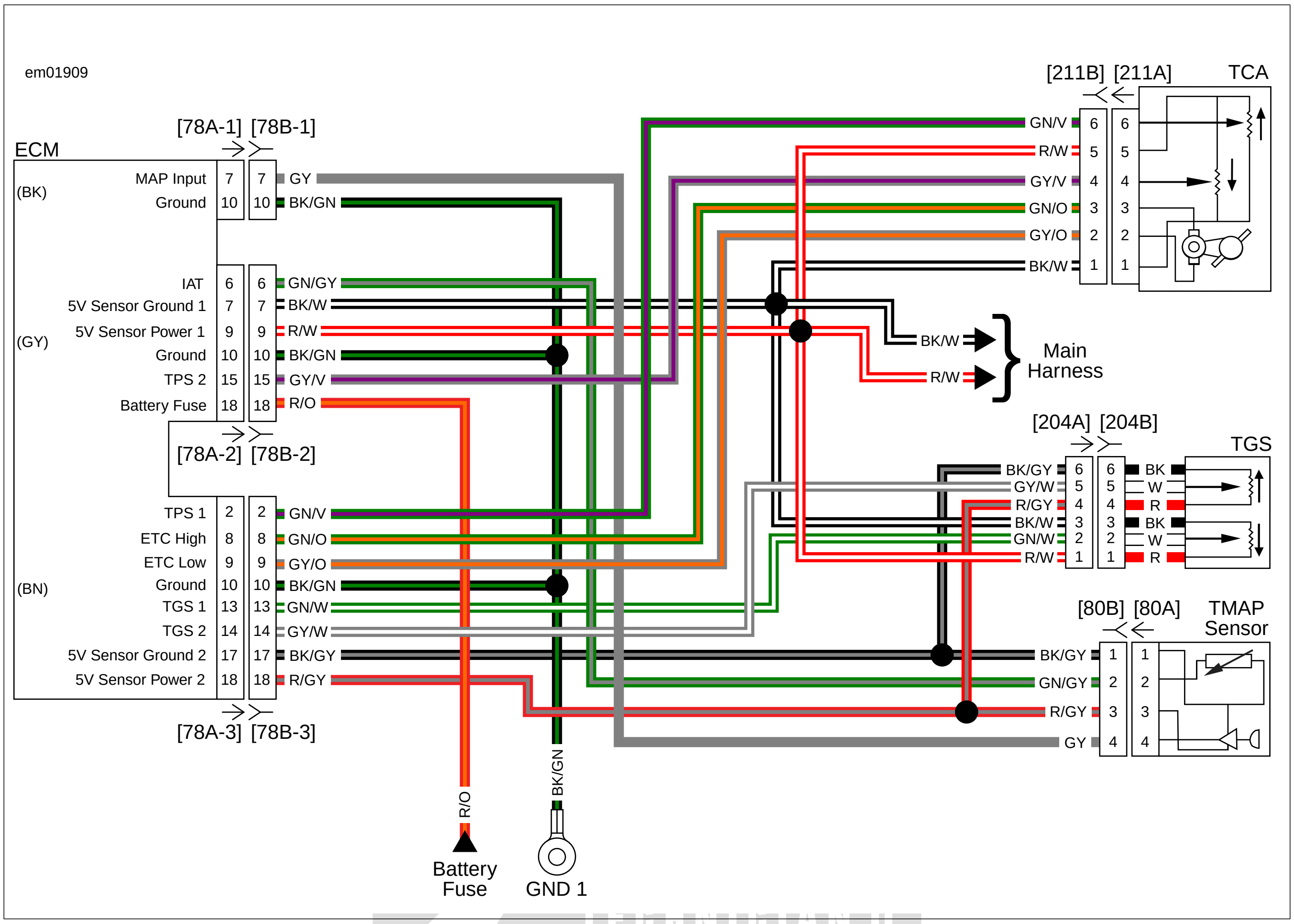


Figure 6-61. TCA, TGS, TMAP Circuits

DTC P2122

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR TOOL
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-104. DTC P2122 Diagnostic Faults

POSSIBLE CAUSES
Open in TGS-1 circuit
Short to ground in TGS-1 circuit

1. TGS1 Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], and ECM [78A-1], [78A-2] and [78A-3].
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-3] terminal 13 and [78-2] terminal 7.
6. Slowly turn throttle to wide open position and observe voltage.
7. Does voltage steadily increase to greater than 4.6V?
   a. **Yes.** Go to Test 16.
   b. **No.** Go to Test 2.

2. Power Short to Ground Test

1. Turn IGN OFF.
2. Test continuity between BOB [78-2] terminal 9 and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 11.
   b. **No.** Go to Test 3.

3. Signal Short to Ground Test

1. Test continuity between BOB [78-3] terminal 13 and ground.

2. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 6.

4. ECM Signal Short to Ground Test

1. Disconnect [78A-1], [78A-2] and [78A-3].
2. Test continuity between BOB [78-3] terminal 13 and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 5.
   b. **No.** Replace ECM.

5. TGS1 Signal Short to Ground Test

1. Disconnect TGS [204].
2. Test continuity between BOB [78-3] terminal 13 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (GN/W).
   b. **No.** Replace TGS.

6. Ground Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB [78-2] terminal 7 and ground.
3. Is voltage greater than 1.0V?
   a. **Yes.** Go to Test 7.
   b. **No.** Go to Test 9.

7. ECM Ground Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect [78B-2].
3. Using TERMINAL EXTRACTOR TOOL (Part No. B-50085), remove terminal 7 (BK/W) wire from ECM harness connector [78B-2].
4. Connect [78B-2].
5. Turn IGN ON.
6. Test voltage between extracted terminal 7 and ground.
7. Is voltage greater than 1.0V?
   a. **Yes.** Go to Test 8.
   b. **No.** Replace ECM.

8. TGS1 Ground Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect TGS [204].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminal 7 and ground.
5. Is voltage greater than 1.0V?
   a. **Yes.** Repair short to voltage on (BK/W).
   b. **No.** Replace TGS.

9. Power Open Test

1. Disconnect TGS [204].
2. Test resistance between BOB [78-2] terminal 9 and [204A] terminal 1 (R/W).
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 10.
   b. **No.** Repair open in (R/W).

10. Signal Open Test

1. Test resistance between BOB [78-3] terminal 13 and [204A] terminal 2 (GN/W).
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace TGS.
   b. **No.** Repair open in (GN/W).

11. Sensor Short to Ground Test

1. Disconnect TGS [204].
2. Test continuity between BOB [78-2] terminal 9 and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 12.
   b. **No.** Replace TGS.

12. TCA Short to Ground Test

1. Disconnect TCA [211].
2. Test continuity between BOB [78-2] terminal 9 and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 13.
   b. **No.** Replace TCA.

13. JSS Short to Ground Test

1. Disconnect JSS [131].
2. Test continuity between BOB [78-2] terminal 9 and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 14.
   b. **No.** Replace JSS.

14. VSS Short to Ground Test

1. Disconnect VSS [65].
2. Test continuity between BOB [78-2] terminal 9 and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 15.
   b. **No.** Replace VSS.

15. ECM Short to Ground Test

1. Disconnect [78A-1], [78A-2] and [78A-3].
2. Test continuity between BOB [78-2] terminal 9 and ground.

3. Is continuity present?
   a. **Yes.** Repair short to ground in (R/W) wire.
   b. **No.** Replace ECM.

16. DTC Test

1. Clear DTCs.
2. Start vehicle and operate throttle.
3. Check DTCs.
4. Did DTC return?
   a. **Yes.** Replace ECM.
   b. **No.** Issue could be intermittent. Perform wiggle test.

DTC P2123

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR TOOL
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-105. DTC P2123 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in sensor signal
Short to voltage in sensor power

1. TGS1 Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], and ECM [78A-1], [78A-2] and [78A-3].
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), voltage between BOB [78-3] terminal 13 and [78-2] terminal 7.
6. Slowly turn throttle to wide open position and observe voltage.
7. Does voltage steadily increase to greater than 4.6V?
   a. **Yes.** Go to Test 8.
   b. **No.** Go to Test 2.

2. Power Short to Voltage Test

1. Test voltage between BOB [78-2] terminal 9 and ground.
2. Is voltage greater than 6.0V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 5.

3. ECM Power Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect [78B-2].
3. Using TERMINAL EXTRACTOR TOOL (Part No. B-50085), remove terminal 9 (R/W) wire from ECM harness connector [78B-2].
4. Connect [78B-2].
5. Turn IGN ON.
6. Test voltage between extracted terminal 9 and ground.
7. Is voltage greater than 5.0V?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace ECM.

4. TGS1 Power Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect TGS [204].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminal 9 and ground.
5. Is voltage greater than 6.0V?
   a. **Yes.** Repair short to voltage in (R/W).
   b. **No.** Replace TGS.

5. Signal Short to Voltage Test

1. Test voltage between BOB [78-3] terminal 13 and ground.
2. Is voltage greater than 6.0V?
   a. **Yes.** Go to Test 6.
   b. **No.** Issue could be intermittent. Perform wiggle test.

6. ECM Signal Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect [78B-3].
3. Using TERMINAL EXTRACTOR TOOL (Part No. B-50085), remove terminal 13 (GN/W) wire from ECM harness connector [78B-3].
4. Connect [78B-2].
5. Turn IGN ON.
6. Test voltage between extracted terminal 13 and ground.
7. Is voltage greater than 6.0V?
   a. **Yes.** Go to Test 7.
   b. **No.** Replace ECM.

7. TGS1 Signal Short to Voltage Test Test

1. Turn IGN OFF.
2. Disconnect TGS [204].
3. Turn IGN ON.
4. Test voltage between BOB [78-3] terminal 13 and ground.

5. Is voltage greater than 6.0V?
   a. **Yes.** Repair short to voltage in (GN/W).
   b. **No.** Replace TGS.

8. DTC Test

1. Clear DTCs.
2. Start vehicle and operate throttle.
3. Check DTCs.
4. Did DTC return?
   a. **Yes.** Replace ECM.
   b. **No.** Issue could be intermittent. Perform wiggle test.

DTC P2127

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR TOOL
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-106. DTC P2127 Diagnostic Faults

POSSIBLE CAUSES
Open in TGS-2 circuit
Short to ground in TGS-2 circuit

1. TGS2 Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], and ECM [78A-1], [78A-2] and [78A-3].
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-3] terminals 14 and 17.
6. Slowly turn throttle to wide open position and observe voltage.
7. Does voltage steadily decrease?
   a. **Yes.** Go to Test 14.
   b. **No.** Go to Test 2.

2. Power Short to Ground Test

1. Turn IGN OFF.
2. Test continuity between BOB [78-3] terminal 18 and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 11.
   b. **No.** Go to Test 3.

3. Signal Short to Ground Test

1. Test continuity between BOB [78-3] terminal 14 and ground.
2. Is continuity present?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 6.

4. ECM Signal Short to Ground Test

1. Disconnect [78A-1], [78A-2] and [78A-3].
2. Test continuity between BOB [78-3] terminal 14 and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 5.
   b. **No.** Relace ECM.

5. TGS2 Signal Short to Ground Test

1. Disconnect TGS [204].
2. Test continuity between BOB [78-3] terminal 14 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (GY/W).
   b. **No.** Replace TGS.

6. Ground Short to Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB [78-3] terminal 17 and ground.
3. Is voltage greater than 1.0V?
   a. **Yes.** Go to Test 7.
   b. **No.** Go to Test 9.

7. ECM Ground Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect [78B-3].
3. Using TERMINAL EXTRACTOR TOOL (Part No. B-50085), remove terminal 17 (BK/GY) wire from ECM harness connector [78B-3].
4. Connect [78B-3].
5. Turn IGN ON.
6. Test voltage between extracted terminal 7 and ground.
7. Is voltage greater than 1.0V?
   a. **Yes.** Go to Test 8.
   b. **No.** Replace ECM.

8. TGS2 Ground Short to Voltage Test

1. Turn IGN OFF.

2. Disconnect TGS [204].
3. Turn IGN ON.
4. Test voltage between BOB [78-2] terminal 7 and ground.
5. Is voltage greater than 1.0V?
   a. **Yes.** Repair short to voltage on (BK/GY).
   b. **No.** Replace TGS.

9. Power Open Test

1. Disconnect TGS [204].
2. Test resistance between BOB [78-3] terminal 18 and [204A] terminal 4 (R/GY).
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 10.
   b. **No.** Repair open in (R/GY).

10. Signal Open Test

1. Test resistance between BOB [78-3] terminal 14 and [204A] terminal 5 (GY/W).
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Replace TGS.
   b. **No.** Repair open in (GY/W).

11. Sensor Short to Ground Test

1. Disconnect TGS [204].
2. Test continuity between BOB [78-3] terminal 18 and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 12.
   b. **No.** Replace TGS.

12. TMAP Short to Ground Test

1. Disconnect TMAP [80].
2. Test continuity between BOB [78-3] terminal 18 and ground.
3. Is continuity present?
   a. **Yes.** Go to Test 13.
   b. **No.** Replace TMAP.

13. ECM Short to Ground Test

1. Disconnect [78A-1], [78A-2] and [78A-3].
2. Test continuity between BOB [78-3] terminal 18 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (R/GY) wire.
   b. **No.** Replace ECM.

14. DTC Test

1. Clear DTCs.
2. Start vehicle and operate throttle.
3. Check DTCs.
4. Did DTC return?
   a. **Yes.** Replace ECM.
   b. **No.** Issue could be intermittent. Perform wiggle test.

DTC P2128

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR TOOL
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-107. DTC P2128 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in sensor signal
Short to voltage in sensor power

1. TGS2 Test

1. Turn engine stop switch OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], and ECM [78A-1], [78A-2] and [78A-3].
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-3] terminals 14 and 17.
6. Slowly turn throttle to wide open position and observe voltage.
7. Does voltage steadily decrease?
   a. **Yes.** Go to Test 8.
   b. **No.** Go to Test 2.

2. Power Short to Voltage Test

1. Test voltage between BOB [78-3] terminal 18 and ground.
2. Is voltage greater than 6.0V?
   a. **Yes.** Go to Test 3.
   b. **No.** Go to Test 5.

3. ECM Power Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect [78B-3].
3. Using TERMINAL EXTRACTOR TOOL (Part No. B-50085), remove terminal 18 (R/GY) wire from ECM harness connector [78B-3].

4. Connect [78B-3].
5. Turn IGN ON.
6. Test voltage between extracted terminal 18 and ground.
7. Is voltage greater than 5.0V?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace ECM.

4. TGS2 Power Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect TGS [204].
3. Turn IGN ON.
4. Test voltage between BOB [78-3] terminal 18 and ground.
5. Is voltage greater than 6.0V?
   a. **Yes.** Repair short to voltage in (R/GY).
   b. **No.** Replace TGS.

5. Signal Short to Voltage Test

1. Test voltage between BOB [78-3] terminal 14 and ground.
2. Is voltage greater than 6.0V?
   a. **Yes.** Go to Test 6.
   b. **No.** Issue could be intermittent. Perform wiggle test.

6. ECM Signal Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect [78B-3].
3. Using TERMINAL EXTRACTOR TOOL (Part No. B-50085), remove terminal 14 (GY/W) wire from ECM harness connector [78B-3].
4. Connect [78B-3].
5. Turn IGN ON.
6. Test voltage between extracted terminal 14 and ground.
7. Is voltage greater than 5.0V?
   a. **Yes.** Go to Test 7.
   b. **No.** Replace ECM.

7. TGS2 Signal Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect TGS [204].
3. Turn IGN ON.
4. Test voltage between BOB [78-3] terminal 14 and ground.
5. Is voltage greater than 6.0V?
   a. **Yes.** Repair short to voltage in (GY/W).
   b. **No.** Replace TGS.

8. DTC Test

1. Clear DTCs.
2. Start vehicle and operate throttle.
3. Check DTCs.
4. Did DTC return?
   a. **Yes.** Replace ECM.
   b. **No.** Issue could be intermittent. Perform wiggle test.

CORRELATION ERROR DIAGNOSTICS 6.38

DESCRIPTION AND OPERATION

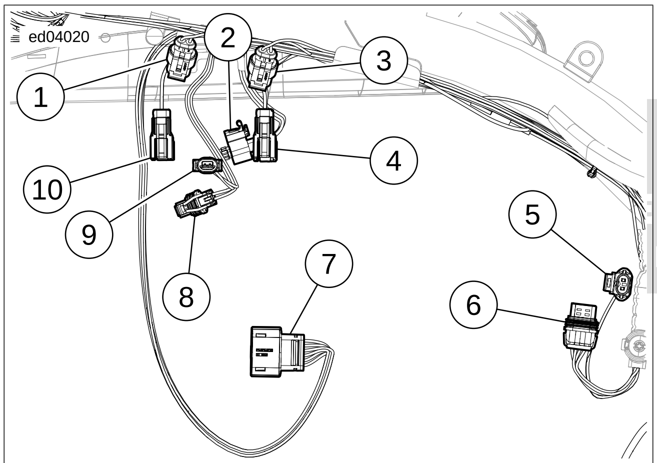
The ECM sets DTCs when it determines that a correlation error exists for either the TP sensor or the TGS.

The two TP sensors work opposite of each other. As the throttle plate opens, TPS1 voltage ranges from 0.0-5.0V, while TPS2 voltage ranges from 5.0-0.0V. The sum of the two TPS voltages should always measure approximately 5.0V.

The two TGSs work the same way. As the TGS is opened, TGS1 voltage increases and TGS2 voltage decreases. The sum of these two voltages should always measure approximately 5.0V. If either component fails to correlate the proper voltage or has out-of-range voltage conditions, the ECM will set a DTC. Refer to Table 6-108.

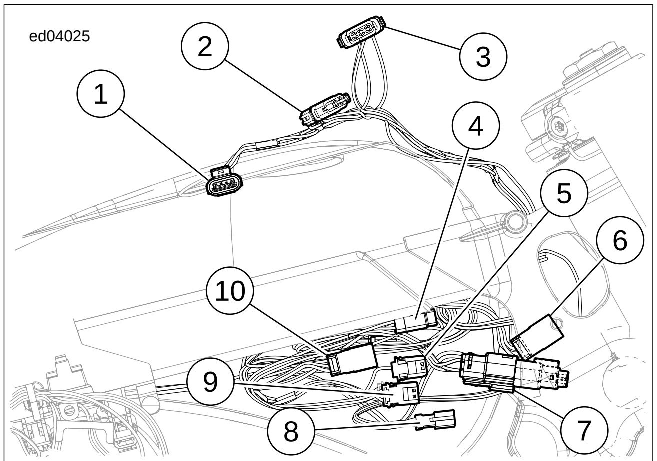
Table 6-108. Code Description

DTC	DESCRIPTION
P2135	TPS correlation error
P2138	TGS correlation error



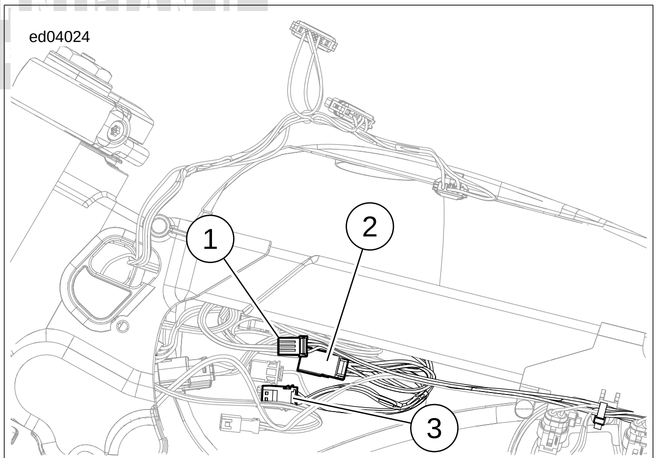
1. **Front ACR [230]**
2. **TMAP [80]**
3. **Rear ACR [230]**
4. **Rear fuel injector [85]**
5. **Purge solenoid [95]**
6. **Ignition coil [83]**
7. **TCA [211]**
8. **ET sensor [90]**
9. **Ignition switch [33]**
10. **Front fuel injector [84]**

Figure 6-62. Engine: ETC



1. **Fuel pump [141]**
2. **Tachometer [108]**
3. **Speedometer [39]**
4. **Front WSS [167]**
5. **RHCM [22-2]**
6. **Headlamp [38]**
7. **Console [20]**
8. **TGS [204]**
9. **RHCM [22-1]**
10. **Right turn [31R]**

Figure 6-63. Under Fuel Tank Right Side: ETC



1. **Fuel gauge [117]**
2. **Left turn [31L]**
3. **LHCM [24]**

Figure 6-64. Under Fuel Tank Left Side: ETC

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.1 CONNECTORS.

HOME

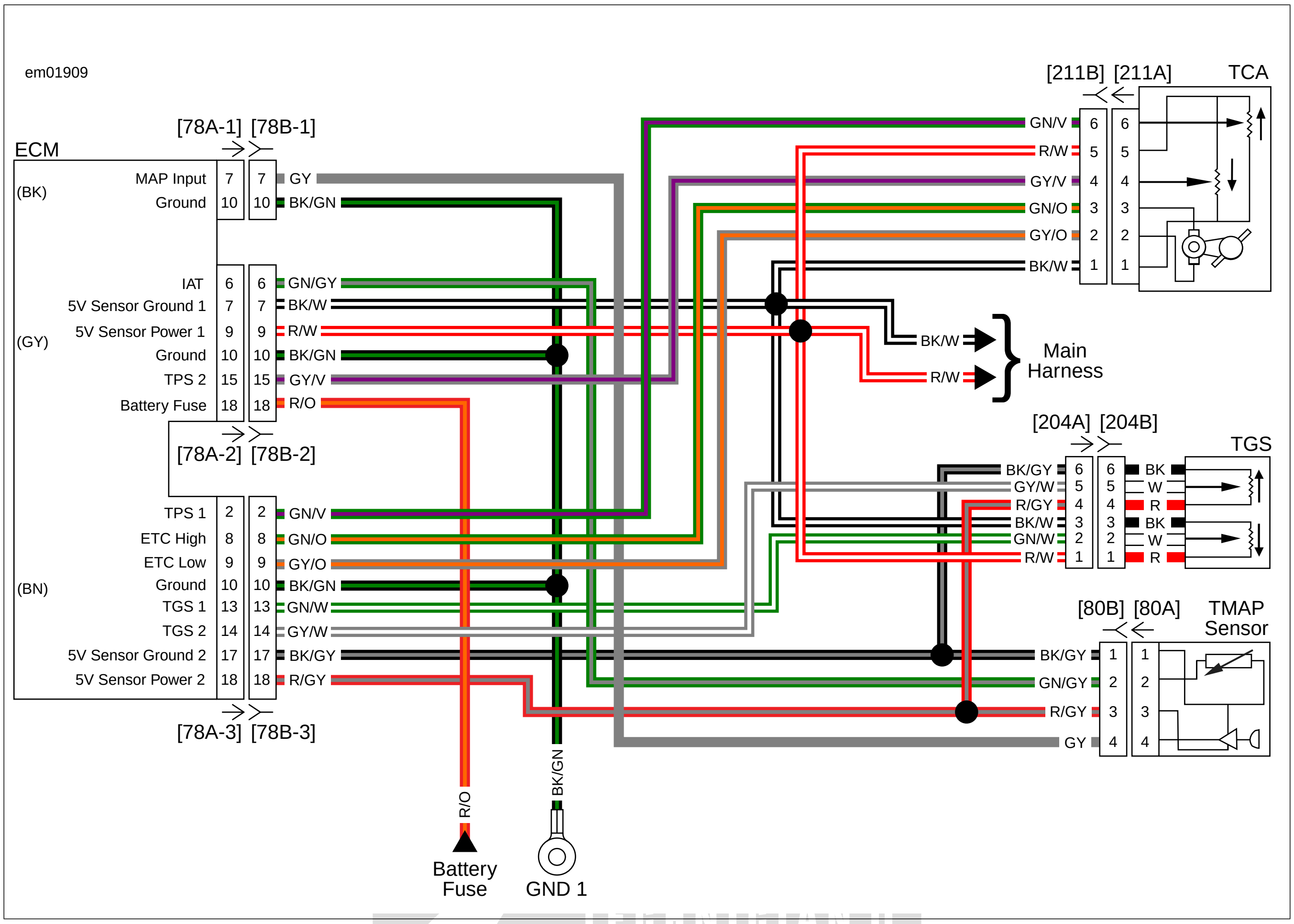


Figure 6-65. TCA, TGS, TMAP Circuits

DTC P2135

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-109. DTC P2135 Diagnostic Faults

POSSIBLE CAUSES
Open in TPS-1 circuit
Short to ground in TPS-1 circuit
Short to voltage in TPS-1 circuit
Open in TPS-2 circuit
Short to ground in TPS-2 circuit
Short to voltage in TPS-2 circuit
Short to voltage in sensor power circuit

1. TPS-1 Resistance Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Disconnect TCA [211].
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB [78-3] terminal 2 and [211B] terminal 6.
6. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open in (GN/V) wire.

2. TPS-1 Short to Ground Test

1. Test continuity between BOB [78-3] terminal 2 and [78-2] terminal 7.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (GN/V) wire.
   b. **No.** Go to Test 3.

3. TPS-1 Short to Voltage Test

1. Test continuity between BOB [78-3] terminal 2 and [78-2] terminal 9.
2. Is continuity present?
   a. **Yes.** Repair short between (GN/V) and (R/W) wires.
   b. **No.** Go to Test 4.

4. TPS-2 Continuity Test

1. Test resistance between BOB [78-2] terminal 15 and [211B] terminal 4.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (GY/V) wire.

5. TPS-2 Short to Ground Test

1. Test continuity between BOB [78-2] terminals 15 and 7.
2. Is continuity present?
   a. **Yes.** Repair short to ground in (GY/V) wire.
   b. **No.** Go to Test 6.

6. TPS-2 Short to Voltage Test

1. Test continuity between BOB [78-2] terminals 15 and 9.
2. Is continuity present?
   a. **Yes.** Repair short between (GY/V) and (R/W) wires.
   b. **No.** Go to Test 7.

7. TPS-2 Circuit Test

1. Connect [78A-1], [78A-2] and [78A-3].
2. Turn IGN ON.
3. Test voltage between BOB [78-2] terminals 15 and 7.
4. Is voltage greater than 5.25V?
   a. **Yes.** Repair short to voltage on (GY/V) wire.
   b. **No.** Go to Test 8.

8. TPS-1 Circuit Test

1. Test voltage between BOB [78-3] terminals 2 and [78-2] terminal 7.
2. Is voltage greater than 5.25V?
   a. **Yes.** Repair short to voltage on (R/W) wire.
   b. **No.** Go to Test 9.

9. Ground Circuit Open Test

1. Connect [211].
2. Clear DTCs.
3. Start vehicle. Operate throttle.
4. Did DTC return?
   a. **Yes.** Replace TCA.
   b. **No.** Operation normal.

DTC P2138

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-110. DTC P2138 Diagnostic Faults

POSSIBLE CAUSES
Open in TGS-1 ground circuit
Open in TGS-2 ground circuit

1. TGS1 Test

1. Turn stop switch OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1], [78B-2] and [78B-3], leaving ECM [78A-1], [78A-2] and [78A-3] disconnected.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-3] terminal 13 and [78-2] terminal 7.
6. Slowly turn throttle to wide open position and observe voltage.
7. Does voltage steadily increase to greater than 4.6V?
   a. **Yes.** Go to Test 4.
   b. **No.** Go to Test 2.

2. ECM Ground 1 Open Test

1. Turn IGN OFF.
2. Test resistance between BOB [78-2] terminal 7 and ground.
3. Is resistance less than 1 ohm?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace ECM.

3. TGS1 Ground Open Test

1. Disconnect TGS [204].
2. Test resistance between BOB [78-2] terminal 7 and [204A] terminal 3 (BK/W).
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open in (BK/W).

4. TGS2 Test

1. Test voltage between BOB [78-3] terminals 13 and 14.

2. Slowly turn throttle to wide open position and observe voltage.
3. Does voltage steadily decrease?
   a. **Yes.** Go to Test 8.
   b. **No.** Go to Test 5.

5. ECM Ground 2 Open Test

1. Turn IGN OFF.
2. Test resistance between BOB [78-3] terminal 14 and ground.
3. Is resistance less than 1 ohm?
   a. **Yes.** Go to Test 6.
   b. **No.** Replace ECM.

6. TGS2 Ground Open Test

1. Disconnect TGS [204].
2. Test resistance between BOB [78-3] terminal 4 and [204A] terminal 6 (BK/GY).
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open in (BK/GY).

7. DTC Test

1. Connect [204].
2. Clear DTCs.
3. Start vehicle and operate throttle.
4. Check DTCs.
5. Did DTC return?
   a. **Yes.** Replace TGS.
   b. **No.** Operation normal.

8. DTC Test

1. Clear DTCs.
2. Start vehicle and operate throttle.
3. Check DTCs.
4. Did DTC return?
   a. **Yes.** Replace ECM.
   b. **No.** Issue could be intermittent. Perform wiggle test.

DTC P2176 6.39

DESCRIPTION AND OPERATION

The ECM sets DTC P2176 when it determines the zero position of the throttle plate has not been successfully learned.

At power up, the ECM adjusts the throttle plate to the limp-home position, then begins to move the throttle plate closed. The ECM monitors and verifies the amount of movement that occurred. The throttle plate minimum position is held briefly then verified against the expected minimum and maximum range of throttle. If the zero position is found within range, then the position is stored.

If the ECM is not able to learn the minimum position or if the learning fails four consecutive ignition cycles, the ECM sets DTC P2176. Refer to Table 6-111.

Table 6-111. Code Description

DTC	DESCRIPTION
P2176	ETC zero position learning error

DTC P2176

Table 6-112. DTC P2176 Diagnostic Faults

POSSIBLE CAUSES
Induction module malfunction
Mechanical interference

1. Air Inlet Interference Test

1. Inspect air inlet. Check for foreign debris and/or mechanical interference to throttle plate.
2. Were any issues found?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace induction module.

2. Validation Test

1. Clear inlet. Check throttle plate movement.
2. Clear DTCs.
3. Start engine and operate throttle.
4. Check DTCs.
5. Did DTC P2176 set?
   a. **Yes.** Replace induction module.
   b. **No.** Repair complete.

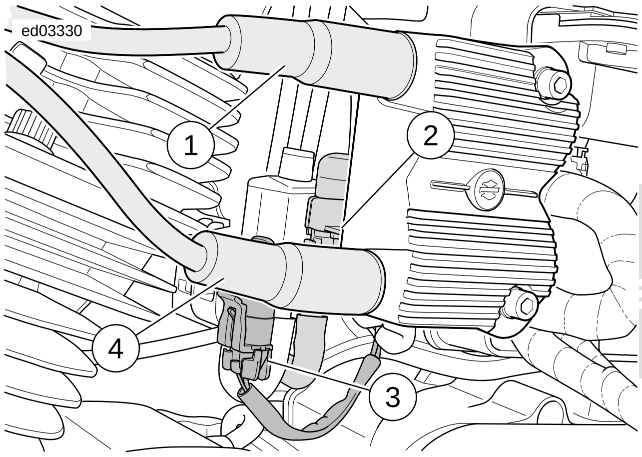
IGN COIL DRIVER DIAGNOSTICS 6.40

DESCRIPTION AND OPERATION

See Figure 6-66 and Figure 6-67. Ignition coil DTCs sets if the ignition coil primary voltage is out of range. This could occur if there is an open coil or loss of power to the coil. If front and rear DTCs are set simultaneously, it is likely a coil power failure or a coil failure. The coil receives power from the BCM at the same time the purge solenoid, active exhaust actuator, active intake solenoid, ECM and injectors are activated.

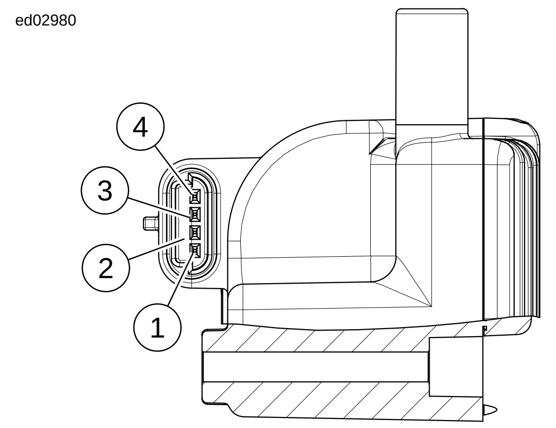
Table 6-113. Code Description

DTC	DESCRIPTION
P2300	Ignition coil driver low/open (front)
P2301	Ignition coil driver shorted high (front)
P2303	Ignition coil driver low/open (rear)
P2304	Ignition coil driver shorted high (rear)



1. **Rear spark plug cable**
2. **Ignition coil [83]**
3. **Purge solenoid [95]**
4. **Front spark plug cable**

Figure 6-66. Ignition Coil



1. **Terminal A: power**
2. **Terminal B: ion sense**
3. **Terminal C: rear coil**
4. **Terminal D: front coil**

Figure 6-67. Ignition Coil: Typical

Diagnostic Tips

When disconnecting any connectors always inspect connector for corrosion or backed out terminals and repair as required.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

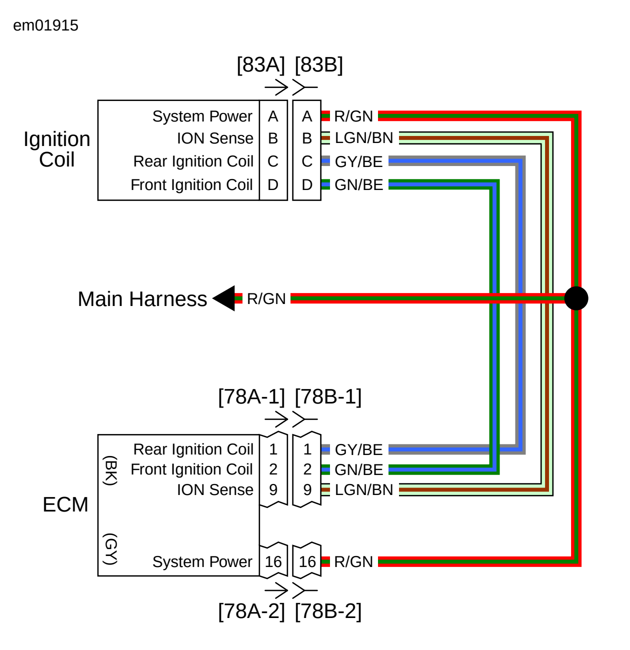


Figure 6-68. Ignition Coil Circuit

DTC P2300

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-114. DTC P2300 Diagnostic Faults

POSSIBLE CAUSES
Ignition coil malfunction
Open or short to ground in signal circuit
Open power circuit

1. Ignition Coil Test

1. Turn IGN OFF.
2. Disconnect ignition coil [83].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [83A] terminals A and D.
4. Is resistance greater than 2 ohms?
   a. **Yes.** Replace ignition coil.
   b. **No.** Go to Test 2.

2. Input Voltage Test

1. Turn IGN ON.
2. Test voltage between [83B] terminal A (R/GN) wire and ground.
3. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open on (R/GN) wire.

3. Control Wire Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and ECM [78A-1] and [78A-2]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between BOB [78-1] terminal 2 and [83B] terminal D (GN/BE) wire.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (GN/BE) wire.

4. Control Wire Shorted to Ground Test

1. Disconnect [78A-1] and [78A-2].
2. Test continuity between BOB [78-1] terminal 2 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (GN/BE) wire.
   b. **No.** Replace ECM.

DTC P2301

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-115. DTC P2301 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in signal circuit

1. Ignition Coil Shorted to Voltage Test

1. Turn IGN OFF.
2. Disconnect ignition coil [83].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [83B] terminal D (GN/BE) wire and ground.
5. Is voltage greater than 5.0V?
   a. **Yes.** Repair short to voltage in (GN/BE) wire.
   b. **No.** Go to Test 2.

2. Open Test

1. Test resistance between [83A] terminals A and D.
2. Is resistance greater than 0.4 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace ignition coil.

DTC P2303

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-116. DTC P2303 Diagnostic Faults

POSSIBLE CAUSES
Open or short to ground in signal circuit
Open power circuit

1. Ignition Coil Test

1. Turn IGN OFF.
2. Disconnect ignition coil [83].
3. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between [83A] terminals A and C.

4. Is resistance greater than 2 ohms?
   a. **Yes.** Replace ignition coil.
   b. **No.** Go to Test 2.

2. Input Voltage Test

1. Turn IGN ON.
2. Test voltage between [83B] terminal A (R/GN) wire and ground.
3. Is battery voltage present?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair open in (R/GN) wire.

3. Control Wire Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1] and [78B-2] and to ECM [78A-1] and [78A-2]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Test resistance between BOB [78-1] terminal 1 and [83B] terminal C (GY/BE) wire.
5. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (GY/BE) wire.

4. Control Wire Shorted to Ground Test

1. Disconnect [78A-1] and [78A-2].
2. Test continuity between BOB [78-1] terminal 1 and ground.
3. Is continuity present?
   a. **Yes.** Repair short to ground in (GY/BE) wire.
   b. **No.** Replace ECM.

DTC P2304

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT

Table 6-117. DTC P2304 Diagnostic Faults

POSSIBLE CAUSES
Short to voltage in signal circuit

1. Ignition Coil Shorted to Voltage Test

1. Turn IGN OFF.
2. Disconnect ignition coil [83].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [83B] terminal C (GY/BE) wire and ground.
5. Is voltage more than 5.0V?
   a. **Yes.** Repair short to voltage in (GY/BE) wire.
   b. **No.** Go to Test 2.

2. Open Test

1. Test resistance between [83A] terminals A and C.
2. Is resistance greater than 0.4 ohms?
   a. **Yes.** Replace ECM.
   b. **No.** Replace ignition coil.

HOME

DESCRIPTION AND OPERATION

If the starter will not crank the engine, the problem is not EFI related. See 3.2 STARTING SYSTEM or 5.11 SECURITY SYSTEM.

There may be DTCs associated with this problem. Check for DTCs and clear them before proceeding with this test.

NOTE

To set a CKP DTC, a start attempt must last at least 5 seconds.

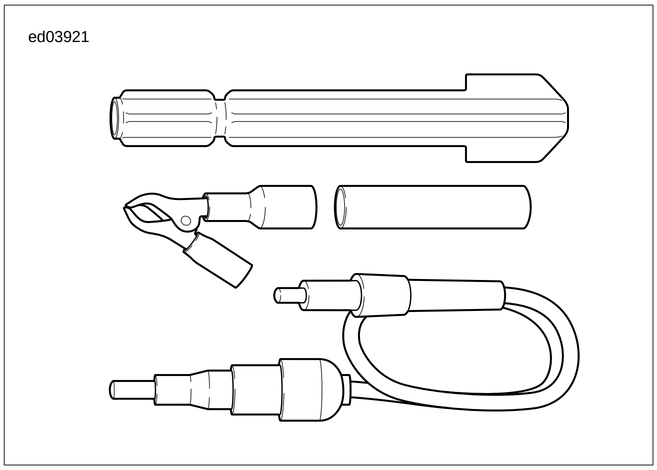


Figure 6-69. Inline Spark Tester Kit

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

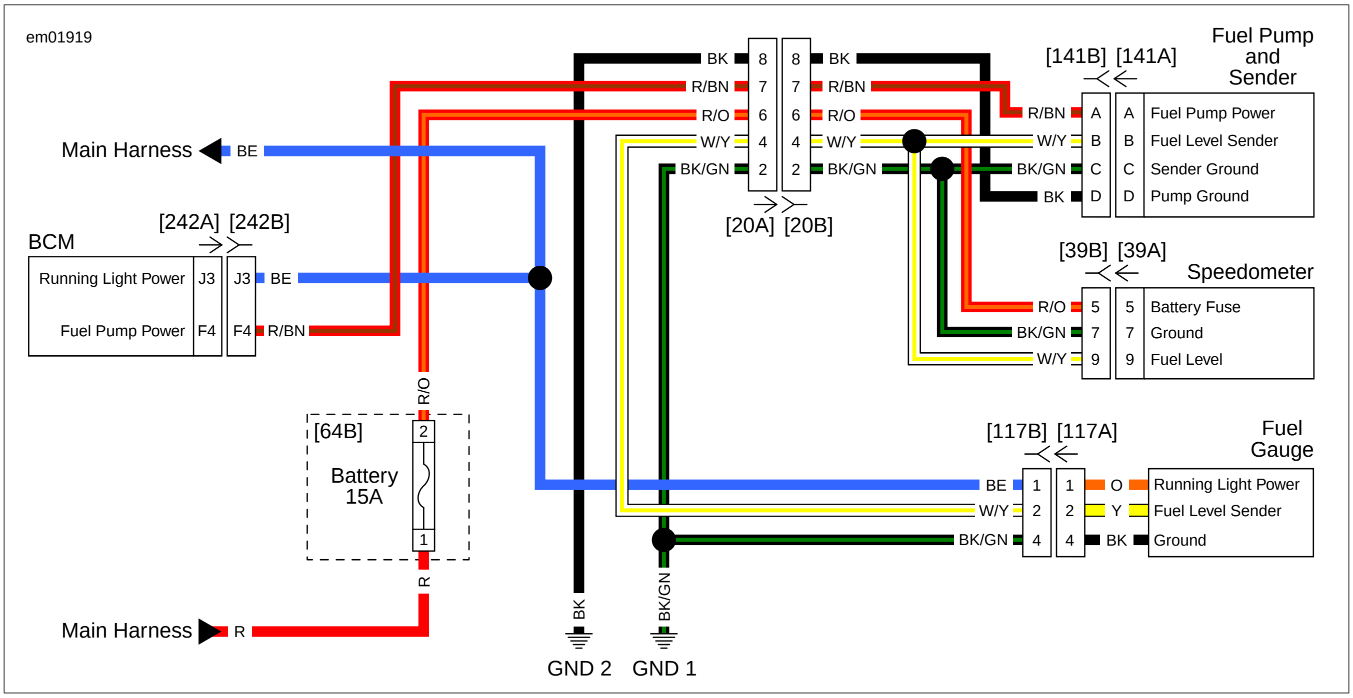


Figure 6-70. Fuel Sensor Circuit

ENGINE CRANKS BUT WILL NOT START

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-2	BCM CABLE
HD-50390-2-P	BCM OVERLAY
HD-51724	INLINE SPARK TESTER KIT

Table 6-118. Engine Cranks but Will Not Start Diagnostic Faults

POSSIBLE CAUSES
Battery voltage too low
Ignition system issues
Fuel system issues
Electrical system issues
No or low compression
Open ground circuit

1. Preliminary Engine Tests

1. Verify battery connections are in good condition.
2. Verify fuel in the tank is fresh and not contaminated.
3. Verify spark plug wires are firmly connected to the coil and plugs.
4. Verify fuel injectors are not clogged.
5. Verify battery condition. See 3.1 BATTERY TESTING.
6. Does battery pass tests?
   a. **Yes.** Go to Test 2.
   b. **No.** Charge or replace battery.

2. Check Engine Lamp Test

1. Turn IGN OFF.
2. Wait 30 seconds, then turn IGN ON.
3. Does check engine lamp illuminate for 4 seconds immediately after IGN ON?
   a. **Yes.** Go to Test 3.
   b. **No.** Verify all fuses are good. See 1.2 INITIAL DIAGNOSTICS, Initial Diagnostics.

3. Spark Present Test

1. Check spark plug condition. Replace if fouled.
2. Using INLINE SPARK TESTER KIT (Part No. HD-51724), check spark at both plugs while cranking engine.
3. Is spark present?
   a. **Yes.** Go to Test 4.
   b. **No.** The spark plugs will not spark if there is low or no compression. If spark is not present, test compression before troubleshooting ignition circuit. Once good compression is confirmed, check condition of ignition coils, coil primary wiring and spark plug boots. See 6.17 CKP SENSOR DIAGNOSTICS or 6.28 COMBUSTION EFFICIENCY DIAGNOSTICS.

4. Compression Test

1. Perform compression test.
2. Does engine pass compression test?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair engine loss of compression.

5. Fuel Pump Voltage Test

1. Turn IGN OFF.
2. Disconnect fuel pump [141].
3. Turn IGN ON.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between [141B] terminals A and D during the first 2-3 seconds after IGN ON.
5. Is battery voltage present?
   a. **Yes.** Go to Test 6.
   b. **No.** Go to Test 7.

6. Fuel System Test

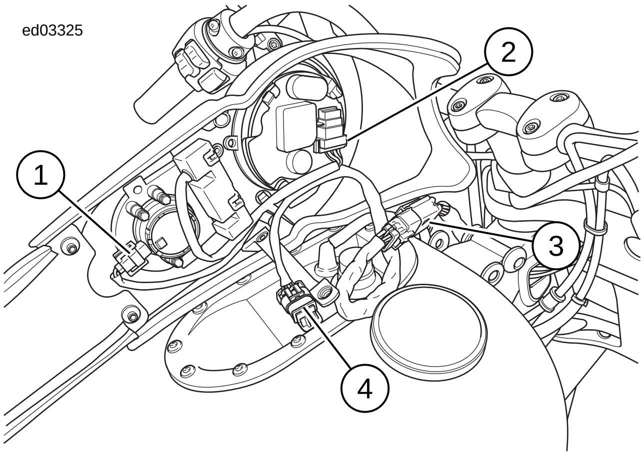
1. Check fuel system and perform fuel pressure test.
2. Does fuel pressure meet specification?
   a. **Yes.** Inspect and clean throttle body and repair as needed.
   b. **No.** Inspect fuel inlet sock and fuel filter for obstruction. Inspect internal fuel hose for leaks. If no issues are found, replace fuel pump assembly.

7. Fuel Pump Open Circuit Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and BCM CABLE (Part No. HD-50390-2) between wire harness [242B], leaving [242A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify BCM OVERLAY (Part No. HD-50390-2-P) is in position on BOB.
4. Test resistance between [141B] terminal A and BOB terminal F4.
5. Is resistance less than 0.5 ohms?
   a. **Yes.** Repair open on (BK) wire to ground.
   b. **No.** Repair open (R/BN) wire.

DESCRIPTION AND OPERATION

See Figure 6-71. Improper fuel system pressure may contribute to hesitation or loss of power.



1. **Ignition switch [33]**
2. **Speedometer [39]**
3. **Console gauges/instrument lamps [20]**
4. **Fuel pump [141]**

Figure 6-71. Under Console: Typical

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

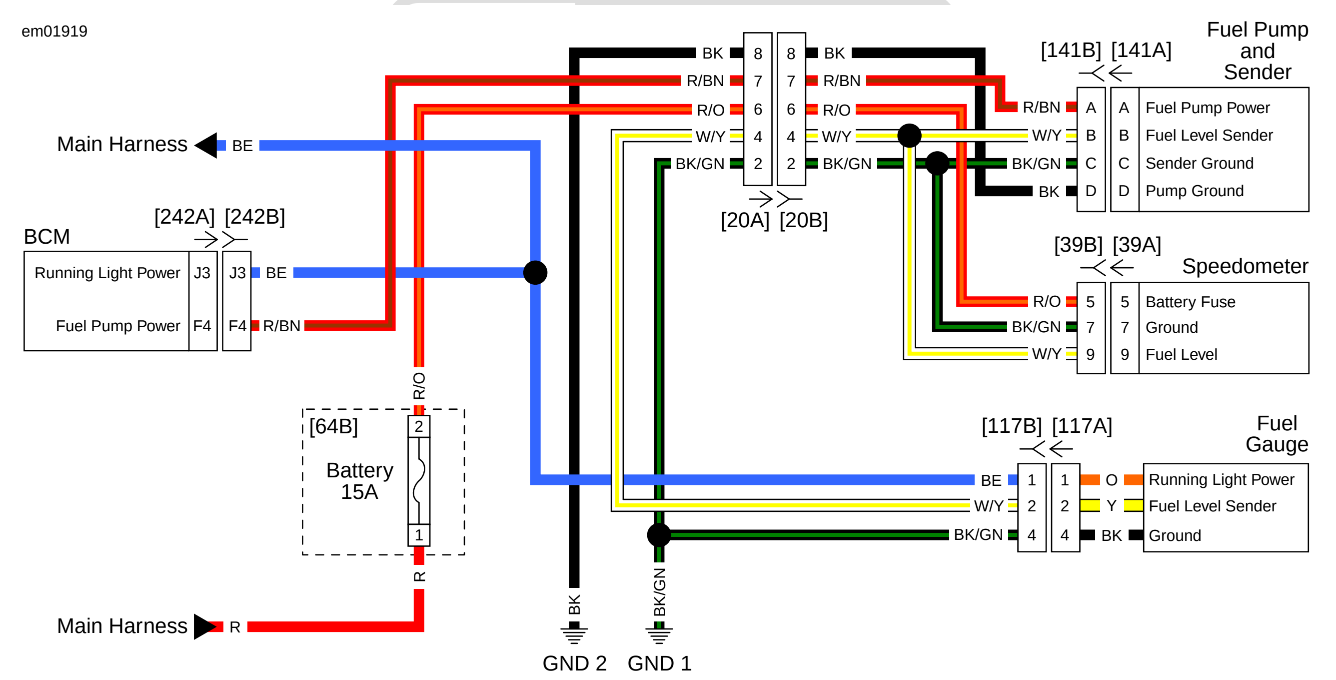


Figure 6-72. Fuel Sensor Circuit

HESITATION OR LOSS OF POWER TEST

PART NUMBER	TOOL NAME
HD-51724	INLINE SPARK TESTER KIT

Table 6-119. Hesitation or Loss of Power Test Diagnostic Faults

POSSIBLE CAUSES
Loss of engine compression
Fuel system issues
Battery condition and connections
Spark plug condition
Air filter condition
Poor chassis ground connections
Performance modifications
Electrical modifications
Throttle valve malfunction

1. Preliminary Engine Tests

1. Verify battery connections are in good condition.
2. Verify fuel in the tank is fresh and not contaminated.
3. Verify spark plug wires are firmly connected the coil and plugs.
4. Verify fuel injectors are not clogged.
5. Verify battery condition. See 3.1 BATTERY TESTING.
6. Does battery pass tests?
   a. **Yes.** Go to Test 2.
   b. **No.** Charge or replace battery.

2. Vacuum Leak Test

1. Start engine. Check for vacuum leaks.
2. Were any leaks found?
   a. **Yes.** Repair vacuum leak.
   b. **No.** Go to Test 3.

3. Spark Present Test

1. Check spark plug condition and replace if fouled.
2. Using INLINE SPARK TESTER KIT (Part No. HD-51724), check spark at both plugs while cranking engine.
3. Is spark present?
   a. **Yes.** Go to Test 4.
   b. **No.** The spark plugs will not spark if there is low or no compression. If spark is not present, test compression before troubleshooting ignition circuit. Once good compression is confirmed, check condition of ignition coils, coil primary wiring and spark plug boots. See 6.17 CKP SENSOR DIAGNOSTICS or 6.28 COMBUSTION EFFICIENCY DIAGNOSTICS.

4. Compression Test

1. Perform compression test.
2. Does engine pass compression test?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair engine loss of compression.

5. Fuel System Test

1. Perform fuel pressure test.
2. Does fuel pressure meet specification?
   a. **Yes.** Inspect and clean throttle body and repair as needed.
   b. **No.** Inspect fuel inlet sock and fuel filter for obstruction. Inspect internal fuel hose for leaks. If no issues are found, replace fuel pump assembly.

STARTS HARD OR EMITS BLACK SMOKE

Table 6-120. Starts Hard or Emits Black Smoke Diagnostic Faults

POSSIBLE CAUSES
Clogged air filter
Poor compression
Leaking injectors
Manifold leak

1. Air Filter Inspection

1. Inspect air filter.
2. Is air filter clean and in good condition?
   a. **Yes.** Go to Test 2.
   b. **No.** Replace air filter.

2. Compression Test

1. Perform compression test.
2. Is compression within normal specifications?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair as needed.

3. Intake Leak Test

1. Perform intake leak test.
2. Did leak test pass?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair as needed.

4. Fuel Injector Test

1. Inspect fuel injectors for mechanical failure.
2. Were any issues found?
   a. **Yes.** Repair as needed.
   b. **No.** Go to Test 5.

5. Throttle Cable Adjustment

1. Inspect throttle cable for correct adjustment.
2. Is throttle cable properly adjusted?
   a. **Yes. California models.** Go to Test 6.
   b. **Yes. Except California models.** Perform misfire diagnostics.
   c. **No.** Repair as needed.

6. EVAP Test

1. Inspect EVAP hose for leak.
2. Is EVAP hose in good condition?
   a. **Yes.** Perform misfire diagnostics.
   b. **No.** Repair as needed.

STARTS, THEN STALLS 6.43

DESCRIPTION AND OPERATION

The starts, then stalls condition may be created by the fuel system, the idle air control system or an ECM failure.

There may be DTCs set causing this condition. Solve the problems with the DTCs before performing the tests in this section. The DTCs that may be involved with starts, then stalls are:

- **Fuel injectors:** DTCs P0261, P0262 and P0264
- **Password problem:** DTC P1009
- **TPS1:** DTCs P0122 and P0123
- **ECM errors:** DTCs P0603 and P0605
- **IAC errors:** DTCs P0506 and P0507

Diagnostic Tips

- The vehicle will stall if the jiffy stand is extended when the transmission is in gear.
- If this condition is fuel related, perform fuel pressure test.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

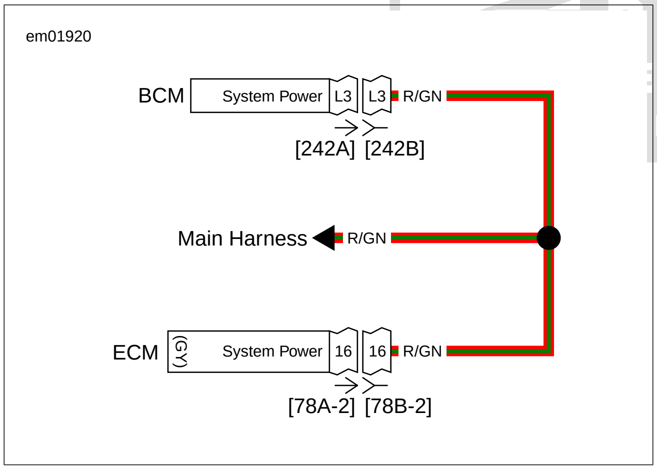


Figure 6-73. ECM System Power

STARTS, THEN STALLS

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY

Table 6-121. Starts, Then Stalls Diagnostic Faults

POSSIBLE CAUSES
Fuel system malfunction
Idle air control system malfunction

1. Throttle Test

1. Will engine start with the throttle partially opened and then stall when closed?
   a. **Yes.** See 6.20 IDLE SPEED CONTROL DIAGNOSTICS: IAC and perform IAC diagnostic procedure.
   b. **No.** Go to Test 2.

2. Fuel System Test

1. Perform fuel pressure test.
2. Is fuel pressure normal?
   a. **Yes.** If fuel injectors are okay, then continue with tests. Go to Test 3.
   b. **No.** Repair fuel pressure problem.

3. System Power Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) to wiring harness [78B-1] and [78B-2], leaving ECM [78A-1] and [78A-2] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Turn IGN ON.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB [78-2] terminal 16 and ground.
6. Is voltage present?
   a. **Yes.** Inspect connections at ECM. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test. If connections are good and wiggle test does not find intermittent, replace the ECM.
   b. **No.** Repair open in (R/GN) wire.

MISFIRE AT IDLE OR UNDER LOAD 6.44

DESCRIPTION AND OPERATION

Misfire conditions may be caused by:

- Battery condition and connections.
- Fuel system problems. See 6.42 ENGINE PERFORMANCE DIAGNOSTICS.
- Ignition system faults.

Diagnostic Tips

⚠WARNING

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

- When performing the steps in the diagnostic tests, use a known good part to verify whether a suspected part is faulty.
- The ignition coil does not require full installation to be functional.
- Verify faulty ignition coil by performing resistance test. See 6.28 COMBUSTION EFFICIENCY DIAGNOSTICS.

INLINE SPARK TESTER

PART NUMBER	TOOL NAME
HD-51724	INLINE SPARK TESTER KIT

See Figure 6-74. Using a INLINE SPARK TESTER KIT (Part No. HD-51724) or equivalent can help determine whether a problem exists in the ignition or fuel systems.

- If the test light flashes without interruption on both cylinders during the misfire event, verify spark plug condition and gap and inspect the fuel system for proper operation.
- If the test light does not flash or the flash is interrupted during the misfire event, the problem is ignition related.

1. Turn IGN OFF.
2. Remove front spark plug wire.
3. Install inline spark tester between spark plug wire and spark plug.
4. Start engine and inspect tester light. The light will flash on each spark event if power is transmitted to the plug.
5. Install and repeat procedure on rear cylinder.

NOTE

Use an inline spark tester and a load applying dynamometer to diagnose misfire under load.

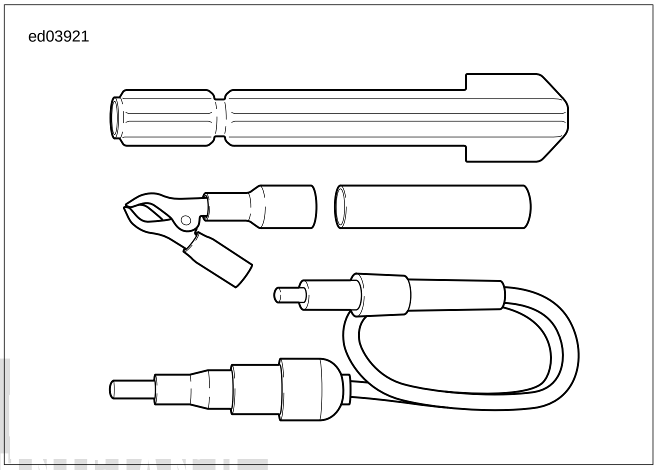


Figure 6-74. Inline Spark Tester Kit

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

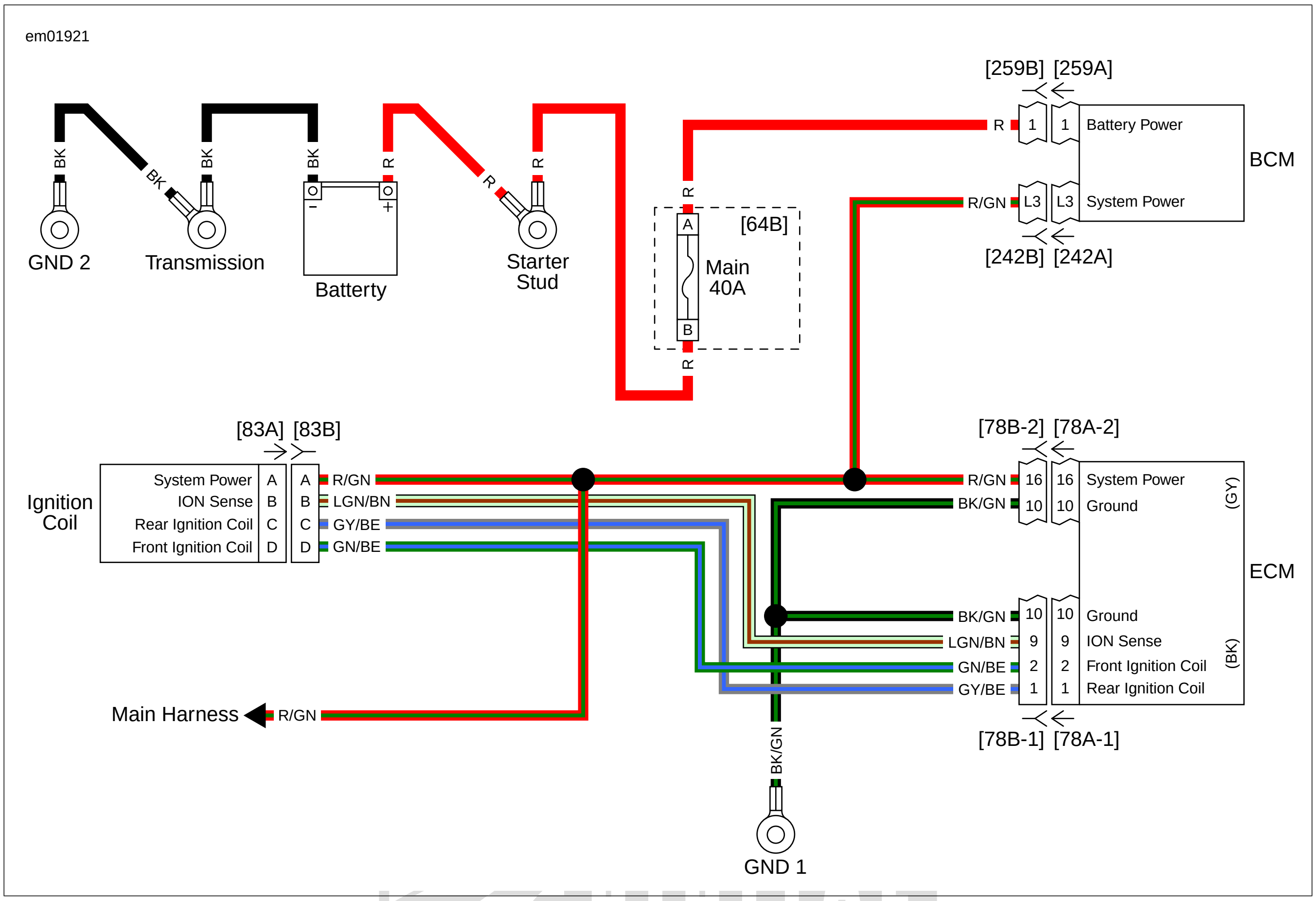


Figure 6-75. Coil and System Power

MISFIRE AT IDLE OR UNDER LOAD

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-4	ECM CABLE
HD-50390-4-P	ECM OVERLAY
HD-51724	INLINE SPARK TESTER KIT

Table 6-122. Misfire at Idle or Under Load Diagnostic Faults

POSSIBLE CAUSES
Loss of engine compression
Fuel system issues
Battery condition and connections
Spark plug condition
Air filter condition
Poor chassis ground connections
Performance modifications
Electrical modifications
Throttle valve malfunction

1. Power Ground Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ECM CABLE (Part No. HD-50390-4) between wiring harness [78B-1], [78B-2] and to ECM [78A-1] and [78A-2]. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ECM OVERLAY (Part No. HD-50390-4-P) is in position on BOB.
4. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test continuity between BOB [78-1] terminal 10 and then [78-2] terminal 10 to ground.
5. Is continuity present?
   a. **Yes.** Go to Test 2.
   b. **No.** Repair open on (BK/GN) wire.

2. Spark Test

1. Connect INLINE SPARK TESTER KIT (Part No. HD-51724) between front spark plug cable and ground. See 1.3 DIAGNOSTIC TOOLS.
2. Crank engine for a few seconds.
3. Remove tester from front spark plug cable. Connect rear spark plug cable and ground.

4. Did spark jump gap on both cables?
   a. **Yes.** Check for faulty, worn or cracked spark plugs, plug fouling due to mechanical problems or faulty connection at plug or coils. Repair as required.
   b. **No.** Go to Test 3.

3. Spark Plug Wire Test

1. Turn IGN OFF.
2. Disconnect spark plug cables.
3. Test resistance of both spark plug cables.
4. Is resistance within specifications? Refer to Table 1-5.
   a. **Yes.** Go to Test 4.
   b. **No.** Replace out of range spark plug cable.

4. Carbon Tracking Inspection Test

1. Inspect top of ignition coils for carbon tracking.
2. Is carbon tracking present?
   a. **Yes.** Replace ignition coil.
   b. **No.** Switch ignition coil with known good unit and perform previous test. If spark jumps gap, replace ignition coil. If not, then continue with tests. Go to Test 5.

5. Ignition Coil Primary Wire Continuity Test

1. Disconnect ignition coil [83].
2. Disconnect BCM [242].
3. Test resistance between [242B] terminal L3 and [83B] terminal A (R/GN) wire. Wiggle connectors while measuring.
4. Is resistance continuously less than 0.5 ohms?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair intermittent on (R/GN) wire.

6. Battery to Main Fuse Block Voltage Drop Test

1. Start engine.
2. Measure voltage drop between battery (+) and main fuse [64B] terminal B (R) wire.
3. Is voltage drop more than 1.0V?
   a. **Yes.** Repair (R) wire between terminal B of [64B] and connection at battery including connections at starter.
   b. **No.** Check for corrosion or damage at BCM [259].

HOME

ERRATIC IDLE 6.45

DESCRIPTION AND OPERATION

Erratic idle conditions may be caused by:

- Fouled spark plugs.
- Damaged spark plug cables.
- Fuel system problems.
- Ignition system faults.

Diagnostic Tips

WARNING

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

When performing the steps in the diagnostic tests, use a known good part to verify whether a suspected part is faulty.

ERRATIC IDLE

PART NUMBER	TOOL NAME
HD-51724	INLINE SPARK TESTER

Table 6-123. Erratic Idle Diagnostic Faults

POSSIBLE CAUSES
Bad fuel
Faulty spark plug cables
Malfunctioning fuel system
Fouled spark plugs

1. Preliminary Engine Tests

1. Verify battery connections are in good condition.
2. Verify fuel in the tank is fresh and not contaminated.
3. Verify spark plug wires are firmly connected to the coil and plugs.
4. Verify heat management system is not operating.
5. Verify fuel injectors are not clogged.
6. Verify battery condition. See 3.1 BATTERY TESTING.
7. Does battery pass tests?
   a. **Yes.** Go to Test 2.
   b. **No.** Charge or replace battery.

2. Spark Test

1. Connect INLINE SPARK TESTER (Part No. HD-51724), or equivalent, between front spark plug cable and ground. See 1.3 DIAGNOSTIC TOOLS.
2. Crank engine for a few seconds.
3. Remove tester from front spark plug cable. Connect rear spark plug cable and ground.
4. Did spark jump gap on both cables?
   a. **Yes.** Check for faulty, worn or cracked spark plugs, plug fouling due to mechanical problems or faulty connection at plug or coils. Repair as required.
   b. **No.** Go to Test 3.

3. Spark Plug Wire Test

1. Turn IGN OFF.
2. Disconnect spark plug cables.
3. Test resistance of both spark plug cables.
4. Is resistance within specifications? Refer to Table 1-5.
   a. **Yes.** Go to Test 4.
   b. **No.** Replace out of range spark plug cable.

4. Fuel System Test

1. Perform fuel pressure test.
2. Is fuel pressure normal?
   a. **Yes.** If fuel injectors are okay, replace the fuel.
   b. **No.** Repair fuel pressure problem.

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NOTES

ANTI-LOCK BRAKE SYSTEM (ABS) GENERAL INFORMATION 7.1

DESCRIPTION AND OPERATION

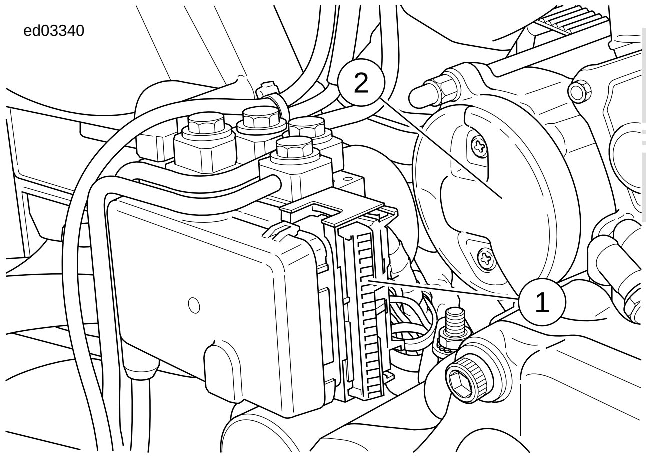
PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The ABS module consists of an electro-hydraulic control unit (EHCU) which controls brake application under extreme stopping conditions. The ABS only activates when wheel slip is detected.

The ABS includes the:

- See Figure 7-1. The EHCU.
- See Figure 7-2. Front WSS.
- See Figure 7-3. Rear WSS.

The EHCU responds to WSS inputs. When the EHCU is activated, the solenoid valves decrease, hold or increase hydraulic fluid pressure to control the individual calipers of each wheel to prevent wheel slipping. However, the EHCU cannot increase hydraulic pressure beyond the pressure or force being applied to the brake pedal or lever by the rider.



1. **ABS EHCU [166] (if equipped)**
2. **Starter**

Figure 7-1. Under Right Side Cover: ABS

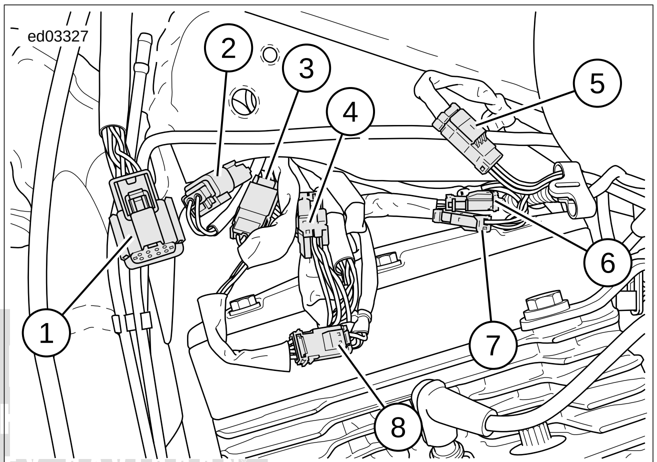
ABS CAN Communication Functionality

The RHCM has a front brake switch that supplies a signal on the CAN bus. This CAN communication signal is sent to the EHCU to indicate that the front brake is applied. The rear brake switch supplies a ground input to the BCM. The BCM sends a rear brake applied CAN communication signal to the EHCU.

During normal ABS operation:

- A series of rapid solenoid valve pulsations may be felt in either the front brake lever or rear brake pedal but only during initialization and anti-lock braking.
- A ticking or popping noise may be heard as the solenoid valves cycle rapidly.
- During anti-lock braking on dry pavement, intermittent chirping noises may be heard as the tires approach slipping.

When the EHCU is replaced, use DIGITAL TECHNICIAN II (Part No. HD-48650) to program and bleed the EHCU.

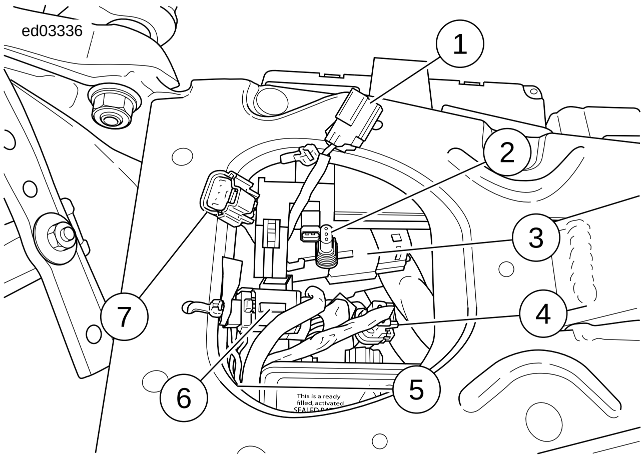


1. **Console gauges/instrument lamps [20]**
2. **Front WSS (ABS only) [167]**
3. **Left front turn signal [31LA]**
4. **Right front turn signal [31RA]**
5. **Fuel gauge [117]**
6. **Right hand control [22-2]**
7. **Right hand control [22-1]**
8. **Left hand control [24]**

Figure 7-2. Under Fuel Tank (IAC): Except FXDB

Pressure Hold

The EHCU controls the release and apply valves. This holds the same constant pressure on the appropriate caliper. The EHCU will release the pressure hold in the event of wheel slip.



1. **Security antenna [209]**
2. **Security siren [142]**
3. **Rear HO2S [137]**
4. **Rear WSS [168]**
5. **Grounds**
6. **Rear lighting [7]**
7. **JSS [133]**

Figure 7-3. Under the Seat

Pressure Decrease

Sometimes the pressure being applied to the caliper is high enough for the EHCU to detect wheel slip. To control the wheel slip, the EHCU closes the apply valve and opens the release valve. This releases pressure on the appropriate caliper until wheel slip is no longer detected. The excess fluid is stored in the accumulator until the pump can return the fluid to the master cylinder or fluid reservoir.

Pressure Increase

After the wheel slip is corrected during an ABS event, a pressure increase occurs. The EHCU closes the release valve and opens the apply valve. This increases the pressure applied to the caliper during deceleration in order to reduce the speed of the wheel. The increased pressure will not exceed the pressure being applied to the master cylinder by the rider.

Initialization Self-Test

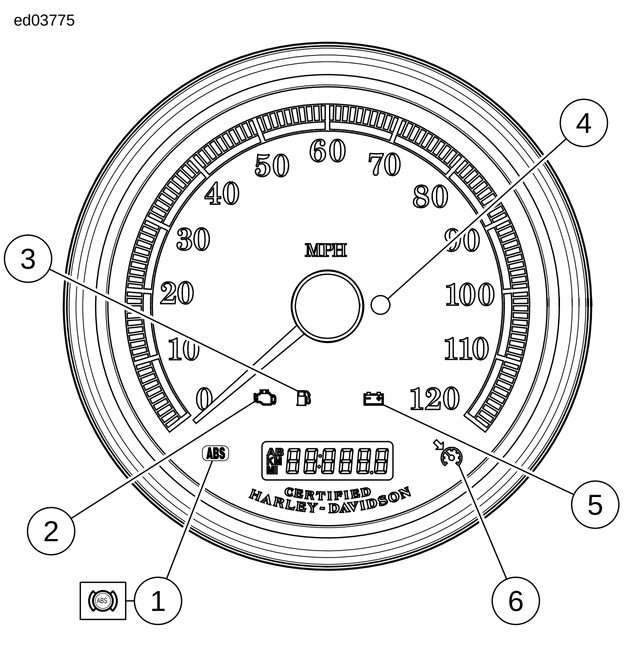
The ABS module performs one initialization test each ignition cycle. As part of the initialization self-test, the ABS module energizes the actuators and commands the motor and solenoids on and off. The ABS ECU will run this test the first time the vehicle speed exceeds 3 mph (5 km/h) in an ignition cycle.

ABS Indicator

See Figure 7-4. The speedometer illuminates the ABS indicator if:

- The EHCU detects an ABS disabling malfunction. The EHCU sends a message to the speedometer requesting illumination.
- The speedometer performs a lamp check.
- The speedometer detects a loss of communication with the EHCU.
- The ABS indicator may flash when the IGN is turned on. This will continue until the vehicle is driven to verify WSS operation.

The EHCU sends a message to the instrument when a malfunction that disables ABS operation is detected. Depending on the fault, the ABS indicator may stay on even after the malfunction is corrected. The indicator will not go off until the vehicle is operated at speeds greater than 3 mph (5 km/h). It is important to verify that this is not the cause of an ABS indicator illumination when no DTCs are set, before attempting to diagnose other possible causes.



1. **ABS icon lamp (km/h ABS icon lamp also shown)**
2. **Check engine lamp**
3. **Low fuel lamp**
4. **Security lamp**
5. **Low battery**
6. **Cruise enabled lamp (not used)**

Figure 7-4. Indicator Lamps

ABS INTERNAL DIAGNOSTICS 7.2

DESCRIPTION AND OPERATION

See Figure 7-5. The EHCU is replaced as a unit. It contains the pump, valves and solenoids along with all the controlling circuitry.

The ABS module monitors the voltage level available for system operation. A low voltage condition prevents the system from operating properly. The ABS module also performs several self-tests for internal problems.

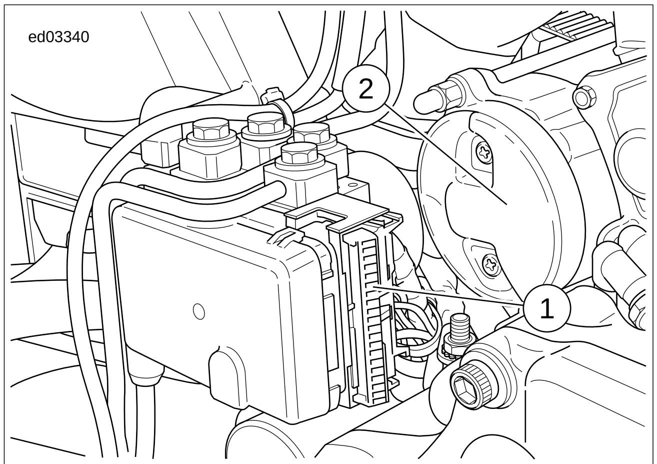
Table 7-1. Code Description

DTC	DESCRIPTION
C1014	ABS ECU relay error
C1040	ABS pump/motor error
C1055	ABS ECU internal error
C1061	ABS front apply solenoid circuit open/high resistance
C1062	ABS front release solenoid circuit open/high resistance
C1065	ABS rear apply solenoid circuit open/high resistance
C1066	ABS rear release solenoid circuit open/high resistance

Conditions for Setting the DTC

These DTCs will set if one of the following conditions exists in the EHCU:

- Low battery voltage.
- High resistance in the ABS power or ground circuits.
- EHCU malfunction.



1. **ABS EHCU [166] (if equipped)**
2. **Starter**

Figure 7-5. Under Right Side Cover: ABS

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

If improper voltage is supplied to the EHCU, these codes may set. Using an improper or high voltage charger may cause these codes to inadvertently set when there is nothing wrong with the ABS system.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

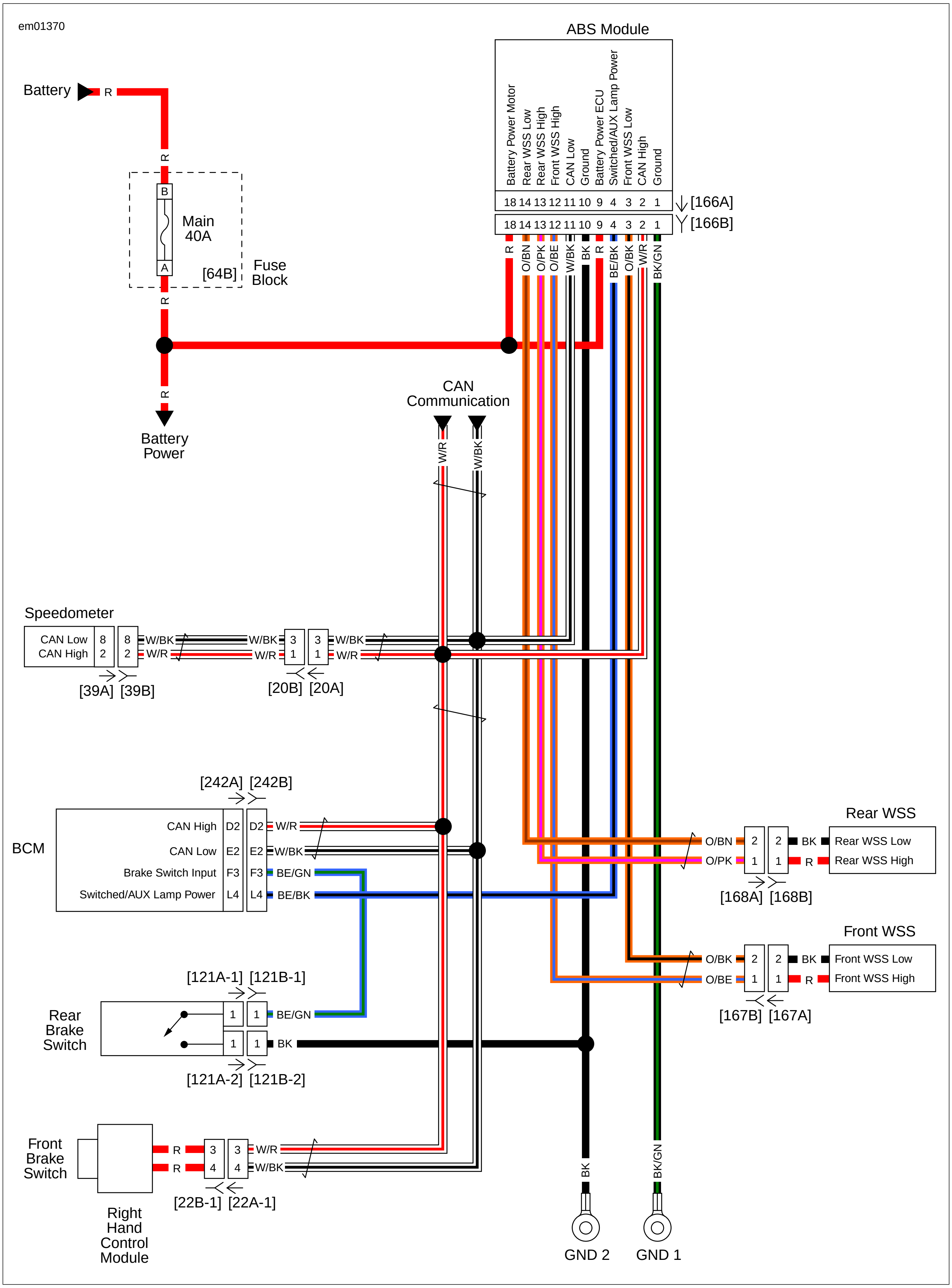


Figure 7-6. ABS Schematic

DTC C1014, C1040, C1055, C1061, C1062, C1065, C1066

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-1-P1	ABS OVERLAY
HD-50390-6	ABS CABLE

Table 7-2. DTC C1014, C1040, C1055, C1061, C1062, C1065, C1066 Diagnostic Faults

POSSIBLE CAUSES
High resistance in the ABS power or ground circuits
Low battery voltage

1. Battery Voltage Test

1. Turn IGN OFF.
2. Verify battery terminals are properly connected, tightened and clean.
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and ABS CABLE (Part No. HD-50390-6) to wiring harness [166B], leaving EHCU [166A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify ABS OVERLAY (Part No. HD-50390-1-P1) is in position on BOB.
5. Turn IGN ON.
6. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal 9 and ground.
7. Test voltage between BOB terminal 18 and ground.
8. Is voltage between 10.5-16.0V on both circuits?
   a. **Yes.** Go to Test 2.
   b. **No.** Go to Test 4.

2. Ground Circuit Resistance Test

1. Turn IGN OFF.
2. Test resistance between BOB terminal 1 and ground.
3. Test resistance between BOB terminal 10 and ground.
4. Is resistance less than 0.5 ohms on both circuits?
   a. **Yes.** Go to Test 3.
   b. **No.** Repair high resistance or open condition on ground circuit.

3. ABS ECU DTC Test

1. Clear DTCs.
2. Turn IGN ON.
3. Check DTCs.
4. Do any of the following DTCs reset: C1014, C1040, C1055, C1061, C1062, C1065, C1066?
   a. **Yes.** Replace EHCU.
   b. **No.** System working properly.

4. Battery Power Open Test

1. Turn IGN OFF.
2. Remove main fuse [64B].
3. Test resistance between BOB terminal 9 and [64B] socket terminal A (R) wire.
4. Test resistance between BOB terminal 18 and [64B] socket terminal A (R) wire.
5. Is resistance less than 0.5 ohms on both circuits?
   a. **Yes.** Inspect battery and charging system. See 3.6 CHARGING SYSTEM.
   b. **No.** Repair open in (R) wire.

WSS DIAGNOSTICS 7.3

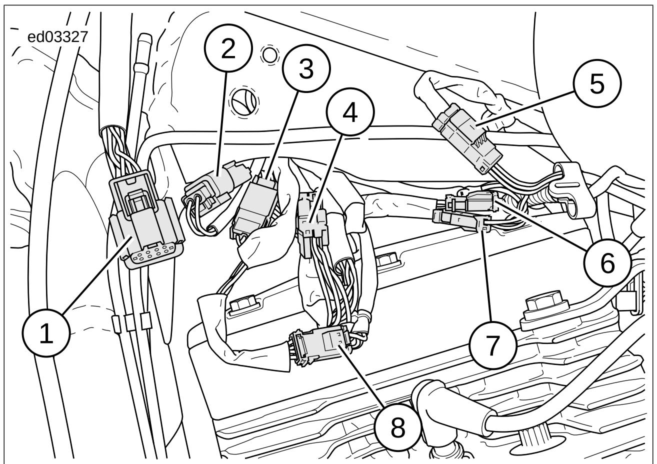
DESCRIPTION AND OPERATION

See Figure 7-7, Figure 7-8 and Figure 7-9. The active WSS is supplied system voltage from the EHCU. The sensor then returns a 7 mA or 14 mA signal back to the EHCU.

- Front WSS high circuit: The EHCU monitors ignition voltage from terminal 12 of the EHCU through terminal 1 of the front WSS.
- Front WSS low circuit: The EHCU monitors the signal from terminal 2 of the front WSS through terminal 3 of the ABS ECU.
- Rear WSS high circuit: The EHCU monitors ignition voltage from terminal 13 of the EHCU through terminal 1 of the rear WSS.
- Rear WSS low circuit: The EHCU monitors the frequency signal from terminal 2 of the rear WSS through terminal 14 of the EHCU.

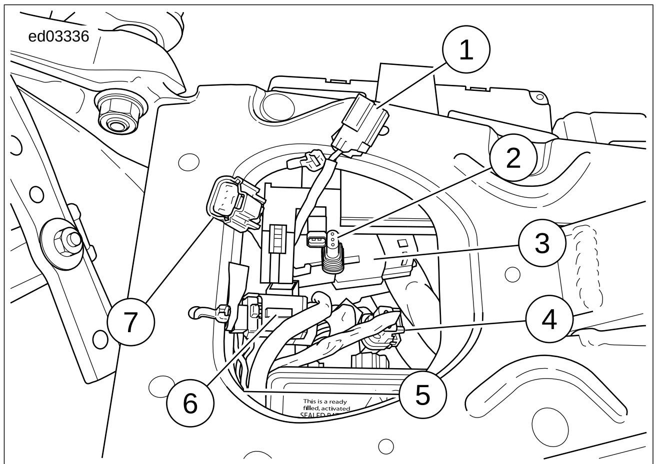
Table 7-3. Code Description

DTC	DESCRIPTION
C1021	ABS front WSS always zero
C1023	ABS rear WSS always zero
C1025	ABS front wheel speed intermittent
C1027	ABS rear wheel speed intermittent
C1029	ABS wheel speed difference too high
C1032	ABS front wheel speed circuit open/shorted
C1034	ABS rear wheel speed circuit open/shorted



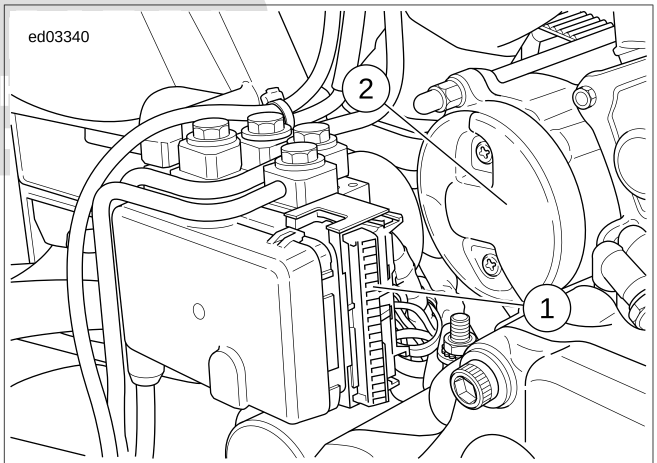
1. **Console gauges/instrument lamps [20]**
2. **Front WSS (ABS only) [167]**
3. **Left front turn signal [31LA]**
4. **Right front turn signal [31RA]**
5. **Fuel gauge [117]**
6. **Right hand control [22-2]**
7. **Right hand control [22-1]**
8. **Left hand control [24]**

Figure 7-7. Under Fuel Tank (IAC): Except FXDB



1. **Security antenna [209]**
2. **Security siren [142]**
3. **Rear HO2S [137]**
4. **Rear WSS [168]**
5. **Grounds**
6. **Rear lighting [7]**
7. **JSS [133]**

Figure 7-8. Under the Seat



1. **ABS EHCU [166] (if equipped)**
2. **Starter**

Figure 7-9. Under Right Side Cover: ABS

Conditions for Setting the DTC

DTC C1021, C1023, C1025, C1027 or C1029 can set if the following conditions exist in the WSS circuit:

- Interference on the WSS circuit.
- Dynamometer testing.
- WSS malfunction.
- ABS ECU malfunction.
- Incorrect or worn bearing assembly.
- Mismatched or improperly sized tires.
- Worn suspension components.
- Riding over rough terrain.
- External or internal wheel speed circuit intermittent open.
- Electrical noise on the WSS wires.

DTC C1032 can set if one of the following conditions exist in the front high or low WSS circuit:

- Short to ground, short to battery, open or high resistance in the front high or low WSS circuits.
- WSS malfunction.
- ABS ECU malfunction.

DTC C1034 can set if one of the following conditions exist in the rear high or low WSS circuit:

- Short to ground, short to battery, open or high resistance in the rear high or low WSS circuits.
- WSS malfunction.
- ABS ECU malfunction.

Action Taken When the DTC Sets

- The ABS module disables the ABS.
- The ABS indicator is illuminated.

Diagnostic Tips

- A correctly installed ABS wheel bearing will have a tan seal facing outward.
- If the red seal is showing, the bearing is installed backward.
- If the seal is black, it is a non-ABS bearing and should be replaced with the correct bearing.

DTC C1032 and C1034 are related to terminals 1 and 2 of the WSS, either internally in the EHCU or WSS, or externally in the wire or connectors. If a DTC is intermittent, it may be a connection problem from terminal 1 or 2 of the WSS to the harness wiring. Check for these issues prior to part replacement:

- Open in WSS circuit.
- WSS circuit short to voltage.
- Short to ground in WSS circuit.
- Short between WSS circuits.
- External or internal wheel speed circuit intermittent open.
- ABS module malfunction.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

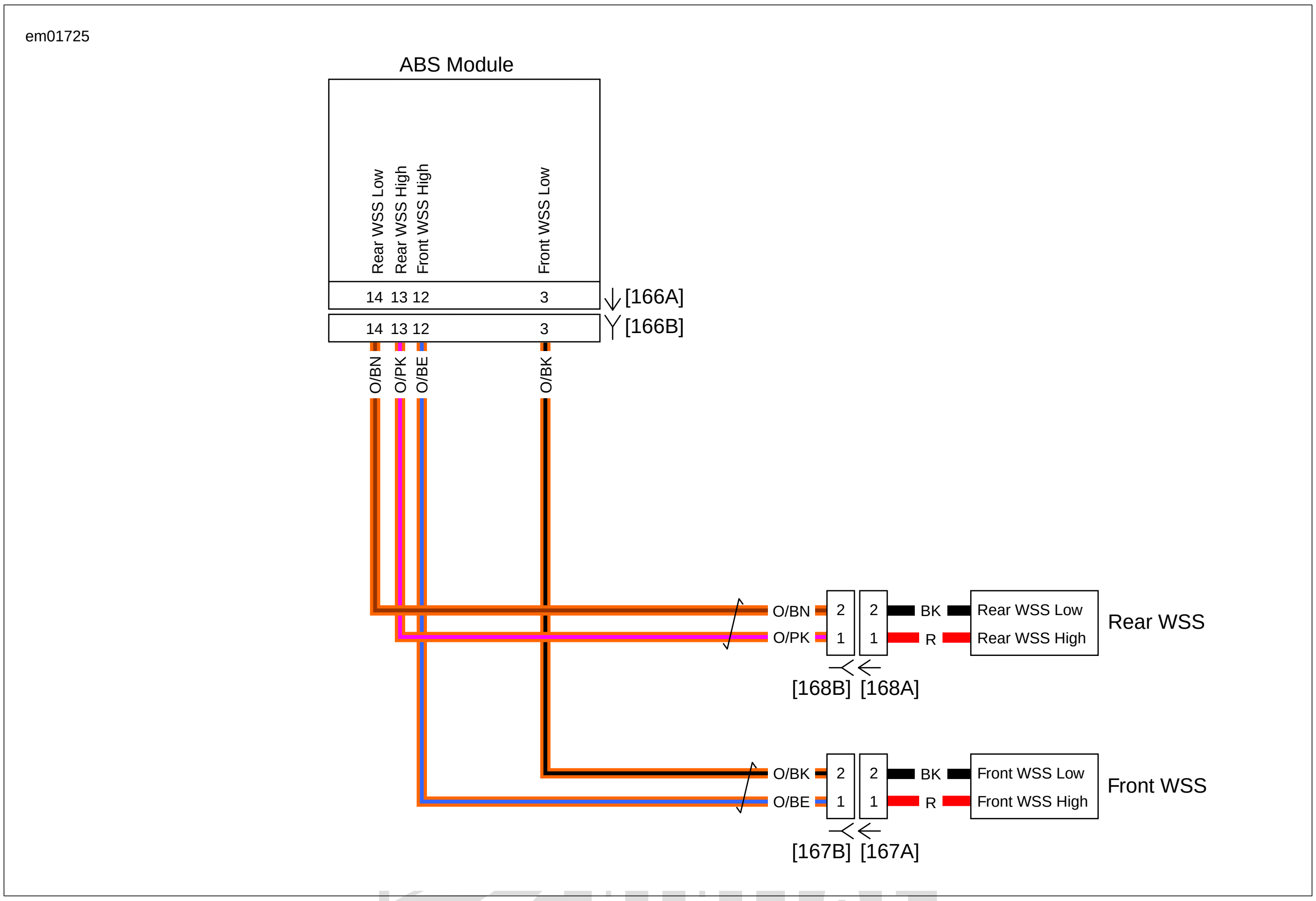


Figure 7-10. Wheel Speed Sensor Circuits

DTC C1021, C1023, C1025, C1027, C1029

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50390-1	BREAKOUT BOX
HD-50390-1-P1	ABS OVERLAY
HD-50390-6	ABS CABLE

Table 7-4. DTC C1021, C1023, C1025, C1027, C1029 Diagnostic Faults

POSSIBLE CAUSES
Electrical interference
Poor connections
WSS malfunction
Worn bearing assembly

1. Electrical Interference Test

1. Inspect vehicle for accessories that may cause electrical interference with the wheel speed sensors.
2. Electrical interference present?
   a. **Yes.** Remove or relocate interference.
   b. **No.** Go to Test 2.

2. Validation of Current DTC Test

1. Clear DTC.
2. Operate vehicle above 3 mph (5 km/h) for at least 90 seconds.
3. Check DTCs.
4. Did DTC reset?
   a. **Yes.** Go to Test 3.
   b. **No.** See diagnostic tips.

3. Worn or Damaged Components Test

1. Inspect for worn, damaged or incorrect bearing assembly.

NOTE

A correctly installed ABS wheel bearing will have a tan seal facing outward.

- *If the seal is red, the bearing is installed backward.*
- *If the seal is black, it is a non-ABS bearing and should be replaced with the correct bearing.*

2. Were worn, damaged or incorrect components found?
   a. **Yes.** Repair as needed.
   b. **No.** Go to Test 4.

4. Front Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect front WSS [167].
3. Connect BREAKOUT BOX (Part No. HD-50390-1) and ABS CABLE (Part No. HD-50390-6) to wiring harness [166B], leaving EHCU [166A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
4. Verify ABS OVERLAY (Part No. HD-50390-1-P1) is in position on BOB.
5. Turn IGN ON.
6. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test voltage between BOB terminal 12 and ground.
7. Is voltage greater than 1.0V?
   a. **Yes.** Repair short to voltage on (O/BE) wire.
   b. **No.** Go to Test 5.

5. Rear Short to Voltage Test

1. Turn IGN OFF.
2. Disconnect rear WSS [168].
3. Turn IGN ON.
4. Test voltage between BOB terminal 13 and ground.
5. Is voltage greater than 1.0V?
   a. **Yes.** Repair short to voltage on (O/PK) wire.
   b. **No.** Go to Test 6.

6. Circuit Test

1. Inspect WSS connector for proper fit and damage.
2. Is WSS connector secure and in good condition?
   a. **Yes.** Replace with appropriate bearing assembly and WSS and retest. If code comes back during retest replace ABS module.
   b. **No.** Repair or replace WSS connector.

DTC C1032

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50341	WHEEL SPEED SENSOR TEST LEAD
HD-50390-1	BREAKOUT BOX
HD-50390-1-P1	ABS OVERLAY
HD-50390-6	ABS CABLE

Table 7-5. DTC C1032 Diagnostic Faults

POSSIBLE CAUSES
WSS malfunction
Intermittent open in the front high or low WSS circuits
Short to ground, short to battery, open or high resistance in the front WSS circuits

1. Electrical Interference Test

1. Inspect vehicle for accessories that may cause electrical interference with the WSS.
2. Inspect front wheel bearing.
3. Is electrical interference or wheel bearing malfunction present?
   a. **Yes.** Remove or relocate interference or correct wheel bearing issues.
   b. **No.** Go to Test 2.

2. Loose or Damaged Connections Test

1. Turn IGN OFF.
2. Inspect for loose or damaged connections on front WSS circuits.
3. Were poor connections found?
   a. **Yes.** Repair connections and circuits.
   b. **No.** Go to Test 3.

3. Front WSS Test

1. Turn IGN OFF.
2. Disconnect front WSS [167].
3. Connect WHEEL SPEED SENSOR TEST LEAD (Part No. HD-50341) between [167B] terminals 1 and 2. See 1.3 DIAGNOSTIC TOOLS.
4. Clear DTCs.
5. Cycle IGN OFF, ON, wait 10 seconds for ABS to complete initialization test.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace front WSS.

4. (O/BK) Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ABS CABLE (Part No. HD-50390-6) between wire harness [166B], leaving ABS module [166A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ABS OVERLAY (Part No. HD-50390-1-P1) is in position on BOB.
4. Remove sensor test lead.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal 3 and [167B] terminal 2 (O/BK) wire.
6. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (O/BK) wire.

5. (O/BE) Open Test

1. Test resistance between BOB terminal 12 and [167B] terminal 1 (O/BE) wire.
2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair open in (O/BE) wire.

6. Shorted Wires Test

1. Test continuity between BOB terminals 3 and 12.
2. Is continuity present?
   a. **Yes.** Repair short between (O/BE) and (O/BK) wires.
   b. **No.** Go to Test 7.

7. (O/BK) Ground Test

1. Test continuity between BOB terminal 3 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (O/BK) wire.
   b. **No.** Go to Test 8.

8. (O/BE) Ground Test

1. Test continuity between BOB terminal 12 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (O/BE) wire.
   b. **No.** Go to Test 9.

9. (O/BK) Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB terminal 3 and ground.
3. Is voltage present?
   a. **Yes.** Repair short to voltage on (O/BK) wire.
   b. **No.** Replace ABS module.

DTC C1034

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-50341	WHEEL SPEED SENSOR TEST LEAD
HD-50390-1	BREAKOUT BOX
HD-50390-1-P1	ABS OVERLAY
HD-50390-6	ABS CABLE

Table 7-6. DTC C1034 Diagnostic Faults

POSSIBLE CAUSES
WSS malfunction
Intermittent open in the rear high or low WSS circuits
Short to ground, short to battery, open or high resistance in the rear WSS circuits

1. Electrical Interference Test

1. Inspect vehicle for accessories that may cause electrical interference with the WSS.
2. Inspect the rear wheel bearing.
3. Is electrical interference or wheel bearing malfunction present?
   a. **Yes.** Remove or relocate interference or correct wheel bearing issues.
   b. **No.** Go to Test 2.

2. Loose or Damaged Connections Test

1. Inspect for loose or damaged connections on rear WSS circuits.
2. Were poor connections found?
   a. **Yes.** Repair connections and circuits.
   b. **No.** Go to Test 3.

3. Rear WSS Test

1. Turn IGN OFF.
2. Disconnect rear WSS [168].
3. Connect WHEEL SPEED SENSOR TEST LEAD (Part No. HD-50341) between [168A] terminals 1 and 2. See 1.3 DIAGNOSTIC TOOLS.
4. Clear DTCs.
5. Cycle IGN OFF, ON, wait 10 seconds for ABS to complete initialization test.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Go to Test 4.
   b. **No.** Replace rear WSS.

4. (O/BN) Open Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ABS CABLE (Part No. HD-50390-6) between wire harness [166B], leaving ABS module [166A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ABS OVERLAY (Part No. HD-50390-1-P1) is in position on BOB.
4. Remove sensor test lead.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between BOB terminal 14 and [168A] terminal 2 (O/BN) wire.
6. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (O/BN) wire.

5. (O/PK) Open Test

1. Test resistance between BOB terminal 13 and [168A] terminal 1 (O/PK) wire.

2. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair open in (O/PK) wire.

6. Shorted Wires Test

1. Test continuity between BOB terminals 14 and 13.
2. Is continuity present?
   a. **Yes.** Repair short between (O/BN) and (O/PK) wires.
   b. **No.** Go to Test 7.

7. (O/BN) Ground Test

1. Test continuity between BOB terminal 14 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (O/BN) wire.
   b. **No.** Go to Test 8.

8. (O/PK) Ground Test

1. Test continuity between BOB terminal 13 and ground.
2. Is continuity present?
   a. **Yes.** Repair short to ground on (O/PK) wire.
   b. **No.** Go to Test 9.

9. (O/BN) Voltage Test

1. Turn IGN ON.
2. Test voltage between BOB terminal 14 and ground.
3. Is voltage present?
   a. **Yes.** Repair short to voltage on (O/BN) wire.
   b. **No.** Replace ABS module.

ABS VIN CALIBRATION DIAGNOSTICS 7.4

DESCRIPTION AND OPERATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The EHCU is calibrated to maximize ABS performance. If the correct calibration is not in the module the ABS may not perform correctly. The ECM and ABS modules also compare VINs to verify the correct ABS module is installed. These VINs must match before the ABS will operate properly.

Table 7-7. Code Description

DTC	DESCRIPTION
C1159	ABS invalid stored VIN
C1178	ABS no VIN received from ECM
C1184	ABS invalid VIN from ECM

Conditions for Setting the DTC

The ABS module determines final calibration is not completed or that the VIN does not match calibration.

Action Taken When the DTC Sets

- ABS is disabled.
- The ABS indicator is illuminated.

Diagnostic Tips

These codes will usually appear after replacing the ECM or the EHCU. The **new** modules must be programmed using DIGITAL TECHNICIAN II (Part No. HD-48650). After the parts are programmed and matched correctly for the specific vehicle, clear the codes.

DTC C1159, C1178, C1184

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Table 7-8. DTC C1159, C1178, C1184 Diagnostic Faults

POSSIBLE CAUSES
An EHCU that is not calibrated correctly or has an internal fault
ECM VIN does not match ABS

1. Validation of Current DTC Test

1. Clear DTC.
2. Start engine, wait 10 seconds for ABS to complete initialization test.
3. Turn engine off.

NOTE

If more than one DTC resets, make sure to diagnose the DTC with the higher priority first. Refer to Table 1-12.

4. Check DTCs.
5. Did DTC reset?
   a. **Yes.** Go to Test 2.
   b. **No.** See diagnostic tips.

2. Successful Calibration Test

1. Using DIGITAL TECHNICIAN II (Part No. HD-48650), attempt to calibrate the EHCU using the ABS service feature found in Vehicle Set Up.
2. Clear DTCs.
3. Turn IGN ON.
4. Check DTCs.
5. Did DTC reset?
   a. **Yes.** Go to Test 3.
   b. **No.** Calibration complete.

3. Speedometer Test

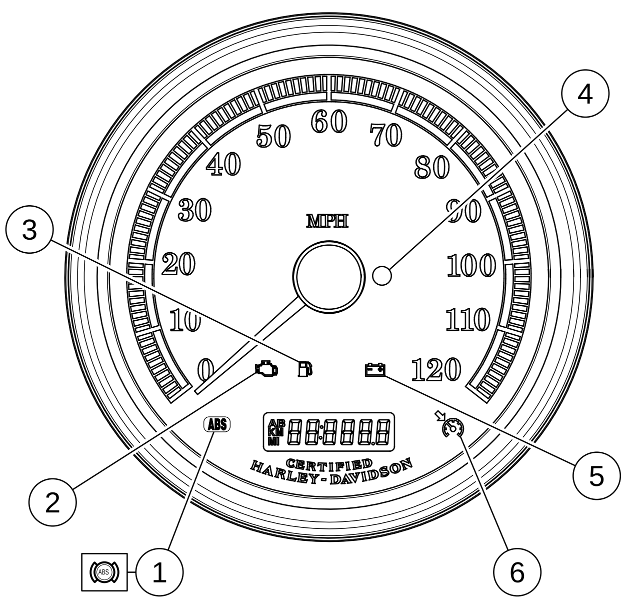
1. Cycle IGN OFF and ON.
2. Does speedometer display "VINERR"?
   a. **Yes.** Replace ECM.
   b. **No.** Replace EHCU.

ABS INDICATOR ALWAYS ON, FLASHING OR INOPERATIVE 7.5

DESCRIPTION AND OPERATION

See Figure 7-11. The speedometer illuminates the ABS indicator by supplying ground to the lamp. The ABS module sends a message on the CAN bus to the speedometer in order to command the indicator ON or OFF.

The ABS indicator will normally come on and then begin to flash when the vehicle is turned ON. It will continue to flash until the EHCU sees at least 3 mph (5 km/h) from both WSS to verify proper operation.



1. ABS icon lamp (km/h ABS icon lamp also shown)
2. Check engine lamp
3. Low fuel lamp
4. Security lamp
5. Low battery
6. Cruise enabled lamp (not used)

Figure 7-11. Indicator Lamps

Diagnostic Tips

The malfunction must be present during diagnosis in order to prevent unnecessary parts replacement.

Connector Information

For additional information about the connectors in the following diagram(s) and diagnostic procedure(s), see A.3 CONNECTOR END VIEWS.

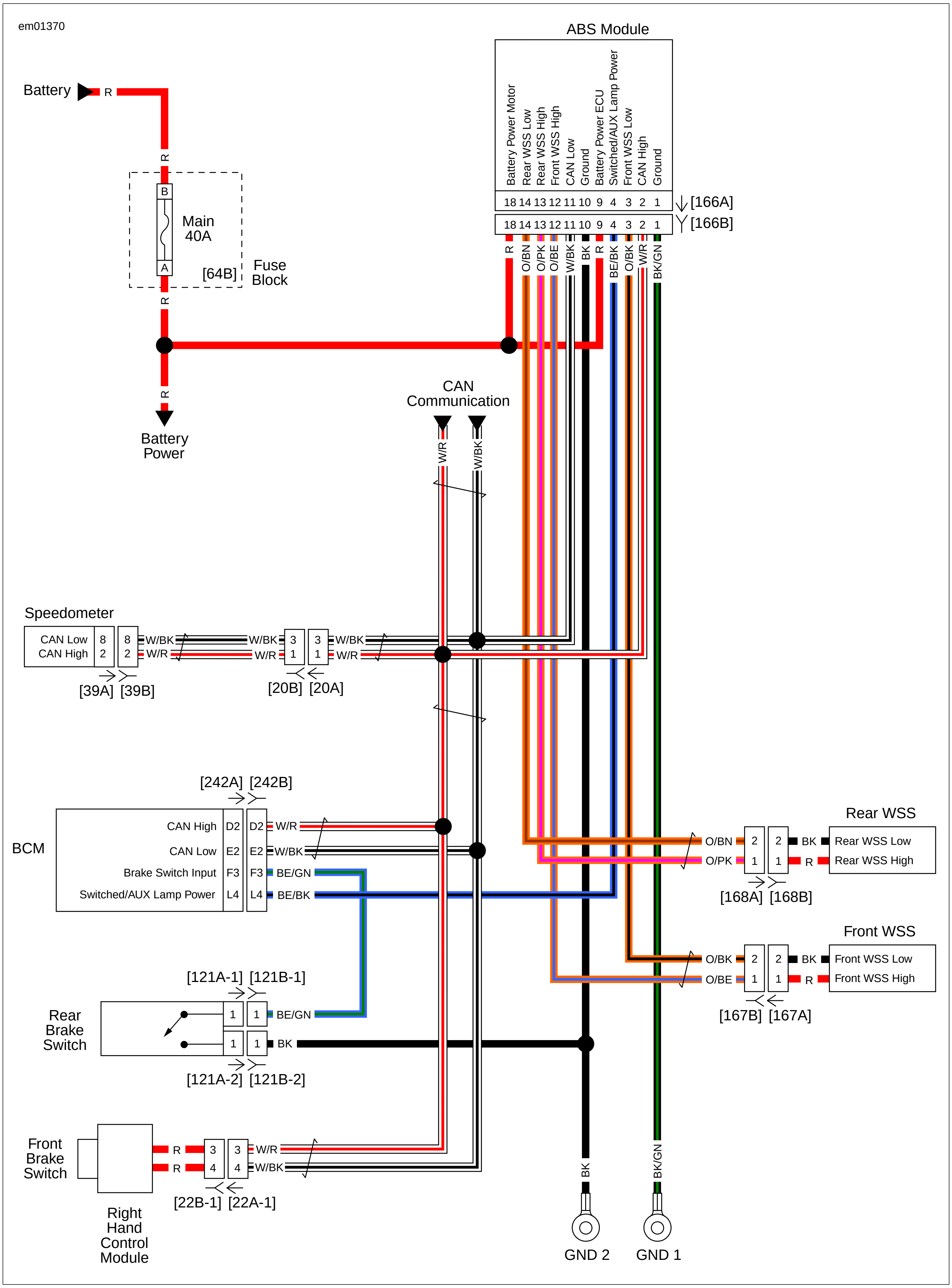


Figure 7-12. ABS Schematic

HOME

ABS INDICATOR CONTINUOUSLY FLASHING, NO DTCS

Table 7-9. ABS Indicator Continuously Flashing, No DTCs Diagnostic Faults

POSSIBLE CAUSES
Incorrect wheel bearing
Bearing not properly installed
Damaged wheel bearing

1. DTC Test

1. Verify vehicle is equipped with ABS and has appropriate speedometer.
2. Clear DTCs.
3. Turn IGN OFF.
4. Check DTCs.
5. Did DTCs set?
   a. **Yes.** See appropriate diagnostic procedure.
   b. **No.** Go to Test 2.

2. Wheel Bearing Inspection Test

1. Inspect for worn, damaged or incorrect bearing assembly on the front wheel.

NOTE

A correctly installed ABS wheel bearing will have a tan seal facing outward.

- *If the seal is red, the bearing is installed backward.*
- *If the seal is black, it is a non-ABS bearing and should be replaced with the correct bearing.*

2. Inspect for worn, damaged or incorrect bearing assembly on both wheels.
3. Were worn, damaged or incorrect components found on either wheel?
   a. **Yes.** Repair wheel bearing as needed.
   b. **No.** System working properly.

ABS INDICATOR ALWAYS ON OR INOPERATIVE

PART NUMBER	TOOL NAME
HD-41404	HARNESS CONNECTOR TEST KIT
HD-42682	BREAKOUT BOX
HD-45325	JUMPER HARNESS
HD-50390-1	BREAKOUT BOX
HD-50390-1-P1	ABS OVERLAY
HD-50390-6	ABS CABLE

Table 7-10. ABS Indicator Always On or Inoperative Diagnostic Faults

POSSIBLE CAUSES
Open battery circuit
Open ground circuit
Short to ground in battery circuit

1. DTC Test

1. Verify vehicle is equipped with ABS and has appropriate speedometer.
2. Clear DTCs.
3. Turn IGN OFF.
4. Check DTCs.
5. Did DTCs set?
   a. **Yes.** See appropriate diagnostic procedure.
   b. **No.** Go to Test 2.

2. ABS Lamp Function Test

1. Perform a "WOW" test. See 1.2 INITIAL DIAGNOSTICS.
2. Does ABS lamp function properly during the "WOW" test?
   a. **Yes.** Go to Test 3.
   b. **No.** Replace speedometer. **(6006)**

3. CAN High Circuit Continuity Test

1. Turn IGN OFF.
2. Connect BREAKOUT BOX (Part No. HD-50390-1) and ABS CABLE (Part No. HD-50390-6) to wiring harness [166B], leaving ABS module [166A] disconnected. See 1.3 DIAGNOSTIC TOOLS.
3. Verify ABS OVERLAY (Part No. HD-50390-1-P1) is in position on BOB.
4. Connect BREAKOUT BOX (Part No. HD-42682) and JUMPER HARNESS (Part No. HD-45325) between wire harness [39B] and speedometer [39A]. See 1.3 DIAGNOSTIC TOOLS.
5. Using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), test resistance between ABS BOB terminal 2 and speedometer BOB terminal 2.

6. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 4.
   b. **No.** Repair open in (W/R) wire.

4. CAN Low Circuit Continuity Test

1. Turn IGN OFF.
2. Test resistance between ABS BOB terminal 11 and speedometer BOB terminal 8.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 5.
   b. **No.** Repair open in (W/BK) wire.

5. ABS Power Circuit Test

1. Turn IGN ON.
2. Test voltage between ABS BOB terminal 9 and ground.
3. Test voltage between ABS BOB terminal 18 and ground.
4. Is battery voltage present on both circuits?
   a. **Yes.** Go to Test 6.
   b. **No.** Repair open in ABS module battery circuit. **(5041)**

6. ABS Ground Circuit Test

1. Turn IGN OFF.
2. Test resistance between ABS BOB terminal 1 and ground.
3. Is resistance less than 0.5 ohm?
   a. **Yes.** Go to Test 7.
   b. **No.** Repair open in (BK/GN) wire. **(5041)**

7. ABS Switched Power Circuit Test

1. Turn IGN ON.
2. Test voltage between ABS BOB terminal 4 to ground.
3. Is battery voltage present?
   a. **Yes.** Go to Test 8.
   b. **No.** Repair open in (BE/BK) wire. **(5041)**

8. ABS ECU Test

1. Remove ABS BOB and connect [166].
2. Remove speedometer BOB and connect [39].
3. Clear DTCs.
4. Start vehicle. Operate in the parameters for initialization self-test.
5. Turn IGN OFF.
6. Check DTCs.
7. Did DTC reset?
   a. **Yes.** Replace EHCU.
   b. **No.** Concern is intermittent. See 1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test.

TABLE OF CONTENTS

NOTES

CONNECTORS A.1

CONNECTOR LOCATIONS

Function/Location

All vehicle connectors are identified by their function and location. Refer to Table A-1.

Place and Color

The place (number of wire cavities of a connector housing) and color of the connector can also aid identification.

Connector Number

On wiring diagrams and in service instructions, connectors are identified by a number in brackets.

Repair Instructions

The repair instructions in Appendix B of the electrical diagnostic manual (EDM) are by connector type. Refer to Table A-1.

Table A-1. Dyna Connector Locations

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COLOR	LOCATION
[7]	Tail lamp harness to main harness	8-place Tyco 070 Multilock Unsealed (BK)	Gray	Under seat
[18]	Right rear turn signal	4-place Tyco 070 Multilock Unsealed (BK) (except FLD, FXD/C/L) 2-place Tyco 070 Multilock Unsealed (BK) (FLD, FXD/C/L)	Gray	Inside tail lamp lens
[19]	Left rear turn signal	4-place Tyco 070 Multilock Unsealed (BK) (except FLD, FXD/C/L) 2-place Tyco 070 Multilock Unsealed (BK) (FLD, FXD/C/L)	Gray	Inside tail lamp lens
[20]	Console gauges/instrument lamps	8-place Molex MX 150 Sealed (BK)	Gray	Under console (except FXDB) Inside top frame tube (FXDB)
[22-1]	Right hand controls	4-place JAE MX19 Sealed (BK)	Yellow	Inside top frame tube
[22-2]	Right hand controls	2-place JAE MX19 Sealed (BK)	Yellow	Inside top frame tube
[24]	Left hand controls	4-place JAE MX19 Sealed (BK)	Yellow	Inside top frame tube
[29]	Position lamp (HDI)	Spade terminals	Red	Behind headlamp
[31L]	Left directional and DOM running lamps	3-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside top frame tube
[31R]	Right directional and DOM running lamps	3-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside top frame tube
[33]	Ignition switch	2-place Delphi GT 150 Sealed (GY)	Gray	Under fuel tank console (except FXDB) Inside top frame tube (FXDB)
[38]	Headlamp	4-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside top frame tube (FXDB) Behind headlamp (except FXDB)
[39]	Speedometer	12-place Delphi Micro 64 Sealed (GY)	Breakout Box	Back of speedometer
[40]	LP, stop, and tail lamp	4-place Deutsch DT Sealed (FXDWG) (GY) 4-place Tyco 040 Multilock unsealed (BK) FXDF, FXDB/P	Brown Gray	Inside tail lamp lens Next to LP Lamp
[47]	Voltage regulator to stator	3-place Dekko (BK)	Green	Back of voltage regulator
[64]	Fuse block	Delphi 280 Metri-pack Sealed Delphi 800 Metri-pack Sealed (main fuse)	Purple/Red	Under left side cover
[65]	VSS	3-place Delphi GT 150 3.5 Sealed (BK)	Gray	Top of transmission case

Table A-1. Dyna Connector Locations

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COLOR	LOCATION
[77]	Voltage regulator	2-place Dekko (BK)	Green	Back of voltage regulator
[78-1]	ECM	18-place Tyco GET 64 (BK)	Breakout Box	Under left side cover
[78-2]	ECM	18-place Tyco GET 64 (GY)	Breakout Box	Under left side cover
[78-3]	ECM	18-place Tyco GET 64 (BN)	Breakout Box	Under left side cover
[79]	CKP sensor	2-place Deutsch DTM Sealed (BK)	Brown	Back of voltage regulator bracket
[80]	MAP sensor - IAC	3-place Delphi 150 Metri-Pack Sealed (GY)	Gray	Top of induction module
[80]	TMAP - ETC	4-place Bosch Compact 1.1M Sealed (BK)	Gray	Top of induction module
[83]	Ignition coil	4-place Delphi GT 150 Sealed (BK)	Gray	Back of coil
[84]	Front fuel injector	2-place Delphi GT 150 3.5 Sealed (GY)	Gray	Beneath fuel tank
[85]	Rear fuel injector	2-place Delphi GT 150 3.5 Sealed (GY)	Gray	Beneath fuel tank
[87]	IAC	4-place Delphi GT 150 3.5 Sealed (BK)	Gray	Top of induction module
[88]	TPS	3-place Delphi GT 150 Sealed (BK)	Gray	Behind air cleaner backing plate
[89]	IAT sensor	2-place Delphi GT 150 3.5 Sealed (GY)	Gray	Behind air cleaner backing plate
[90]	ET sensor	2-place Delphi GT 150 Sealed (BK)	Gray	Back of front cylinder, left side
[91]	DLC	6-place Deutsch DT Sealed (GY)	Black	Under left side cover
[93]	Tail lamp	4-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside tail lamp lens (except FXDB)
[94]	Rear fender lights harness in circuit board	6-place Tyco 070 Multilock Unsealed (BK) (FLD, FXD/C/L) 3-place Delphi 150 Metri-Pack (BK) (FXDF)	Gray	Circuit board under tail lamp assembly (FLD, FXD/C/L) Tail Lamp (FXDF)
[95]	Purge solenoid	2-place Delphi 150 Metri-Pack Sealed (BK)	Purple	Behind coil left side
[108]	Tachometer	12-place Delphi Micro 64 (GY)	Breakout Box	Back of tachometer
[117]	Fuel gauge	4-place Tyco 040 Unsealed (BK)	Gray	Under fuel tank
[120]	Oil pressure switch	Right angle push on molded terminal (BK)		Front of right crankcase
[121]	Rear stop lamp switch	Tyco Insulated Spade terminal (BK)	Red	Right side of transmission
[122]	Horn	Spade terminals (BK)	Red	Between cylinders, left side
[128]	Starter solenoid	Spade terminal (W)	Red	Top of starter
[131]	Neutral switch	Right angle push on molded terminal (BK)		Top of transmission
[133]	JSS	3-place Molex MX 150 Sealed (BK)	Gray	Under seat

Table A-1. Dyna Connector Locations

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COLOR	LOCATION
[137]	Rear HO2S	4-place Molex MX 150 Sealed (BK)	Gray	Under seat
[138]	Front HO2S	4-place Molex MX 150 Sealed (BK)	Gray	Behind voltage regulator
[141]	Fuel pump and sender	4-place Delphi GT 150 Sealed (BK)	Gray	Top of fuel tank
[142]	Security siren (optional)	3-place Delphi GT 150 Sealed (BK)	Gray	Under seat
[166]	ABS ECU	18-place Tyco (BK)	Breakout Box	Under battery
[167]	Front WSS	2-place Deutsch DTM Sealed (BK)	Brown	Inside top frame tube
[168]	Rear WSS	2-place Deutsch DTM Sealed (BK)	Brown	Under seat
[178]	Active intake solenoid	2-place Tyco Superseal 1.5 Sealed (BK)	Gray	Air cleaner backing plate
[179]	Active exhaust	5-place Tyco Superseal 1.5 Sealed (BK)	Gray	Above starter
[203F]	ACR (front)	2-place Tyco Superseal 1.5 Sealed	Gray	Bracket attached to the throttle body
[203R]	ACR (rear)	2-place Tyco Superseal 1.5 Sealed	Gray	Bracket attached to the throttle body
[204]	TGS harness	6-place JST FWPF Sealed	Gray	
[209]	Security antenna	2-place Molex MX 64 Unsealed (BK)	Light Blue	Under seat
[211]	TCA	6-place Moles MX 150 Sealed (BK)	Gray	Right side of engine (induction module)
[222]	Ignition switch harness	2-place Deutsch DTM Sealed Gray (GY)	Brown	Inside top frame tube (FXDB)
[233]	License plate lamp	2-place Tyco 040 Multilock unsealed (BK)	Gray	Inside tail lamp housing
[242]	BCM	48-place Molex CMC Sealed (BK)	Breakout Box	Under left side cover
[259]	BCM battery power	1-place Delphi 800 Metri-Pack Sealed (BK)		Under left side cover
[281]	Battery tender	2-place overmold (BK)		Under left side cover
[GND1] [GND2]	Harness grounds	Ring terminals		Under seat

WIRING DIAGRAMS A.2

WIRING DIAGRAM INFORMATION

Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table A-2.

For Solid Color Wires: See Figure A-1. The alpha code identifies wire color.

For Striped Wires: The code is written with a slash (/) between the solid color code and the stripe code. For example, a trace labeled GN/Y is a green wire with a yellow stripe.

Wiring Diagram Symbols

See Figure A-1. On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets [ ]. The letter inside the brackets identifies whether the housing is a socket or pin housing.

A=Pin: The letter A and the pin symbol after a connector number identifies the pin side of the terminal connectors.

B=Socket: The letter B and the socket symbol after a connector number identifies the socket side of the terminal connectors. Other symbols found on the wiring diagrams include the following:

Diode: The diode allows current flow in one direction only in a circuit.

Wire break: The wire breaks are used to show option variances or page breaks.

No Connection: Two wires crossing over each other in a wiring diagram that are shown with no splice indicating they are not connected together.

Circuit to/from: This symbol indicates a more complete circuit diagram on another page. The symbol is also identifying the direction of current flow.

Splice: Splices are where two or more wires are connected together along a wiring diagram. The indication of a splice only indicates that wires are spliced to that circuit. It is not the true location of the splice in the wiring harness.

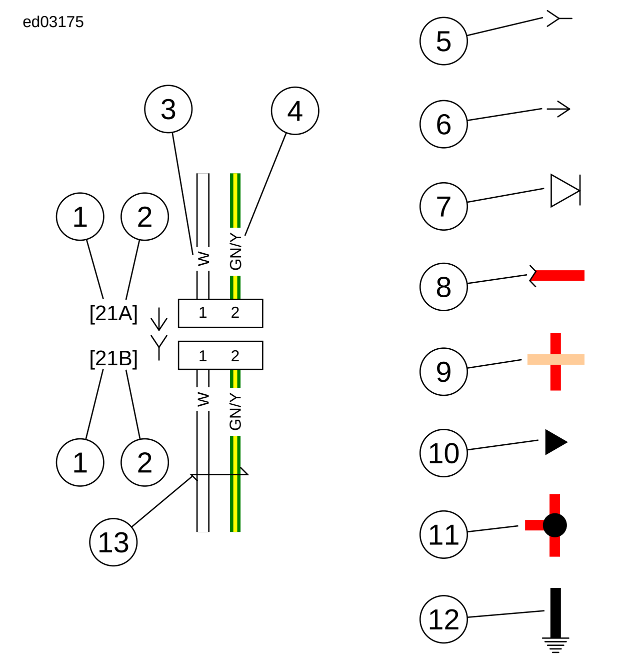
Ground: Grounds can be classified as either clean or dirty grounds. Clean grounds are identified by a (BK/GN) wire and are normally used for sensors or modules.

NOTE

Clean grounds usually do not have electric motors, coils or anything that may cause electrical interference on the ground circuit.

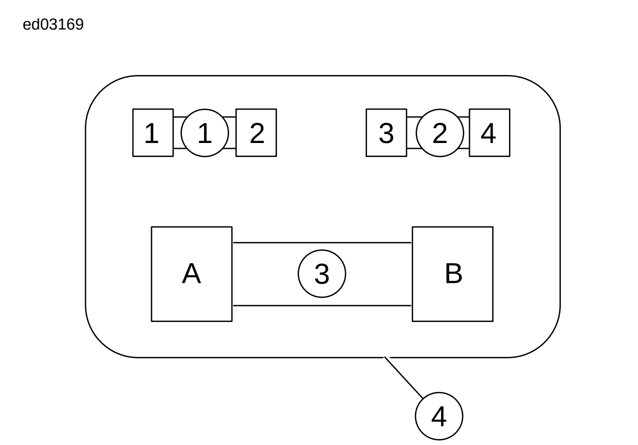
Dirty grounds are identified by a (BK) wire and are used for components that are not as sensitive to electrical interference.

Twisted pair: This symbol indicates the two wires are twisted together in the harness. This minimizes the circuit's electromagnetic interference from external sources. If repairs are necessary to these wires they should remain as twisted wires.



1. **Connector number**
2. **Terminal code (A=pin, B=socket)**
3. **Solid wire color**
4. **Striped wire color**
5. **Socket symbol**
6. **Pin symbol**
7. **Diode**
8. **Wire break**
9. **No connection**
10. **Circuit to/from**
11. **Splice**
12. **Ground**
13. **Twisted pair**

Figure A-1. Connector/Wiring Diagram Symbols



1. **Battery**
2. **P&A**
3. **Main**
4. **Fuse block [64]**

Figure A-2. Fuse Block and Socket Terminals

Table A-2. Wire Color Codes

ALPHA CODE	WIRE COLOR
BE	Blue
BK	Black
BN	Brown
GN	Green
GY	Gray
LBE	Light Blue
LGN	Light Green
O	Orange
PK	Pink
R	Red
TN	Tan
V	Violet
W	White
Y	Yellow

2016 DYNA WIRING DIAGRAMS

Refer to the table below for wiring diagram information.

Wiring Diagram List

DIAGRAM	LOCATION
Battery Power Distribution	Figure A-3
Ignition and Accessory Power Distribution: 1 of 3	Figure A-4
Ignition and Accessory Power Distribution: 2 of 3	Figure A-5
Ignition and Accessory Power Distribution: 3 of 3	Figure A-6
Grounds: 2016 Dyna	Figure A-7
Front Lighting and Hand Controls: 2016 Dyna	Figure A-8
Main Harness 1 of 3 (except FXDL, FXDLS): 2016 Dyna	Figure A-9
Main Harness 2 of 3 (FXDL, except FXDLS): 2016 Dyna	Figure A-10
Main Harness 3 of 3 (except FXDLS): 2016 Dyna	Figure A-11
Main Harness 1 of 2 (FXDLS): 2016 Dyna	Figure A-12
Main Harness 2 of 2 (FXDLS): 2016 Dyna	Figure A-13
Rear Lighting: 2016 Dyna	Figure A-14

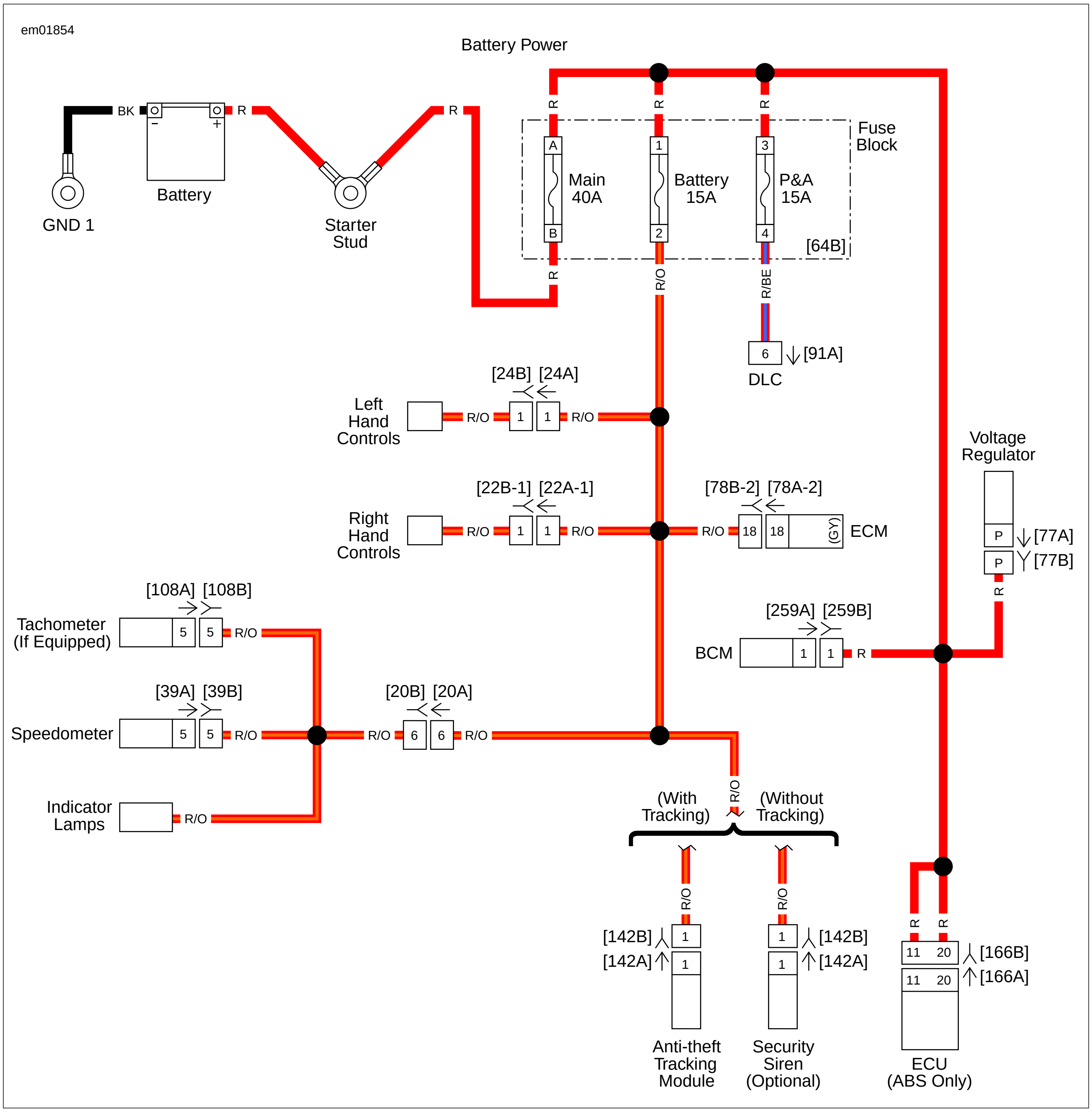


Figure A-3. Battery Power Distribution

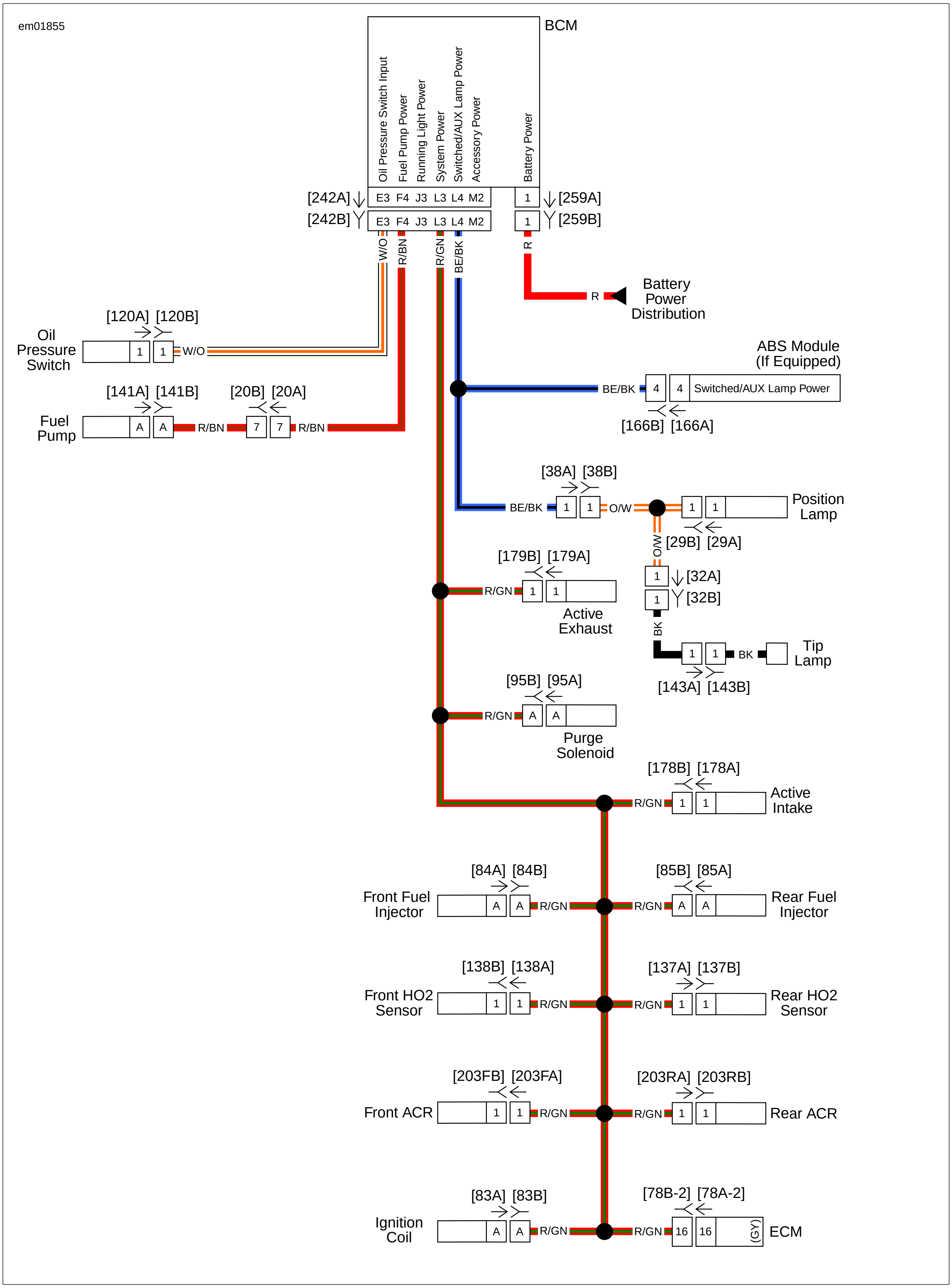


Figure A-4. Ignition and Accessory Power Distribution: 1 of 3

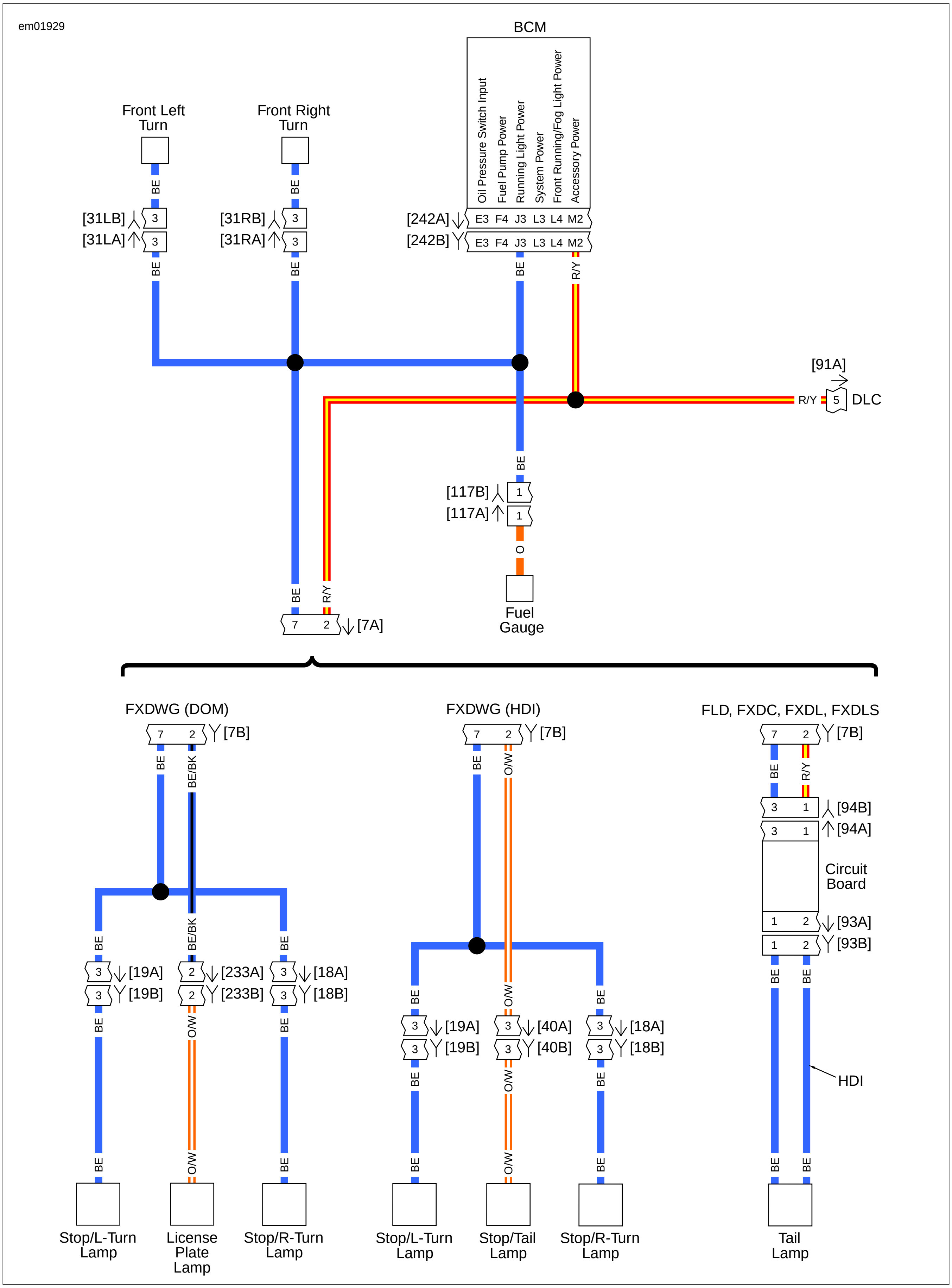


Figure A-5. Ignition and Accessory Power Distribution: 2 of 3

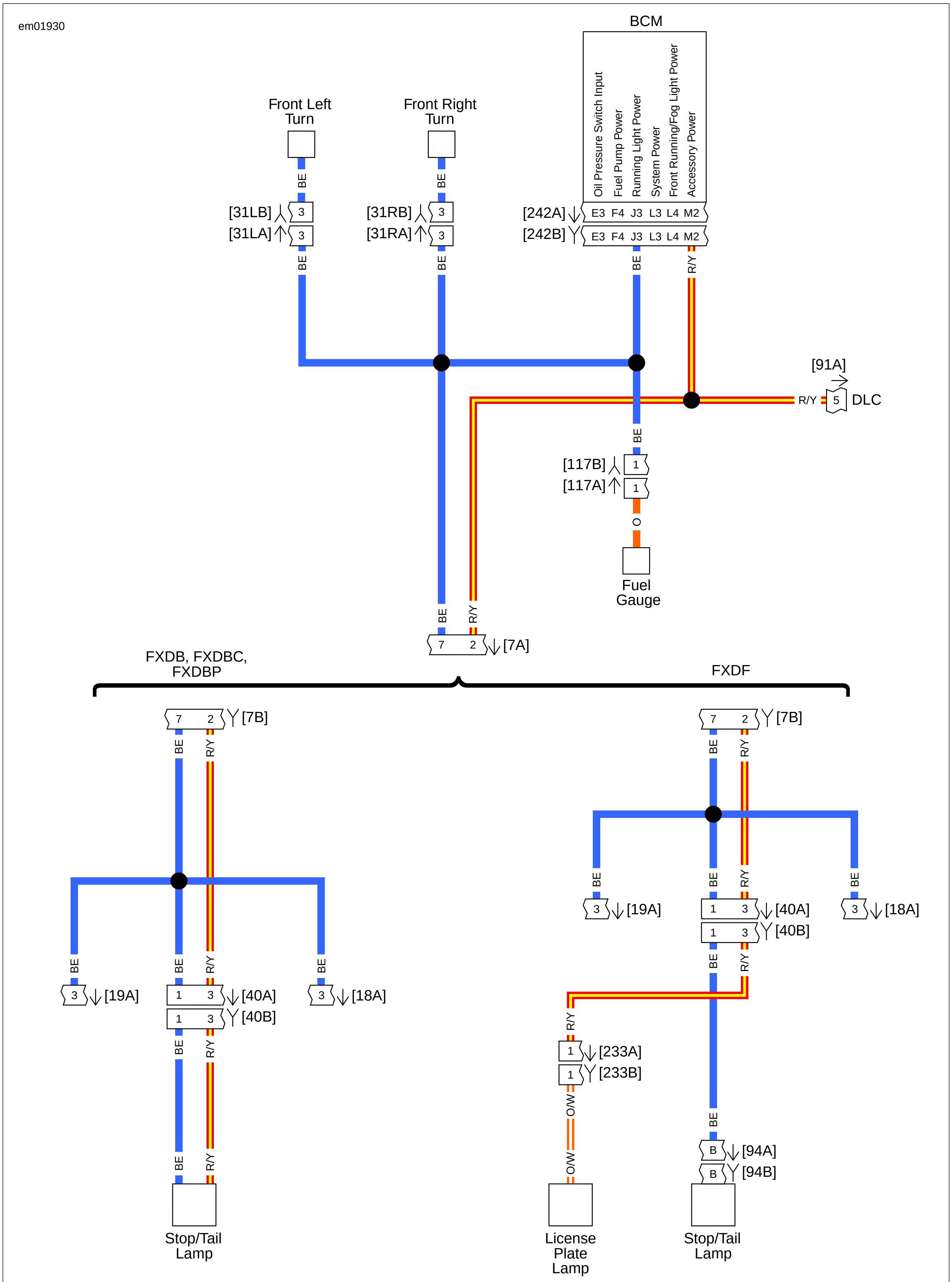


Figure A-6. Ignition and Accessory Power Distribution: 3 of 3

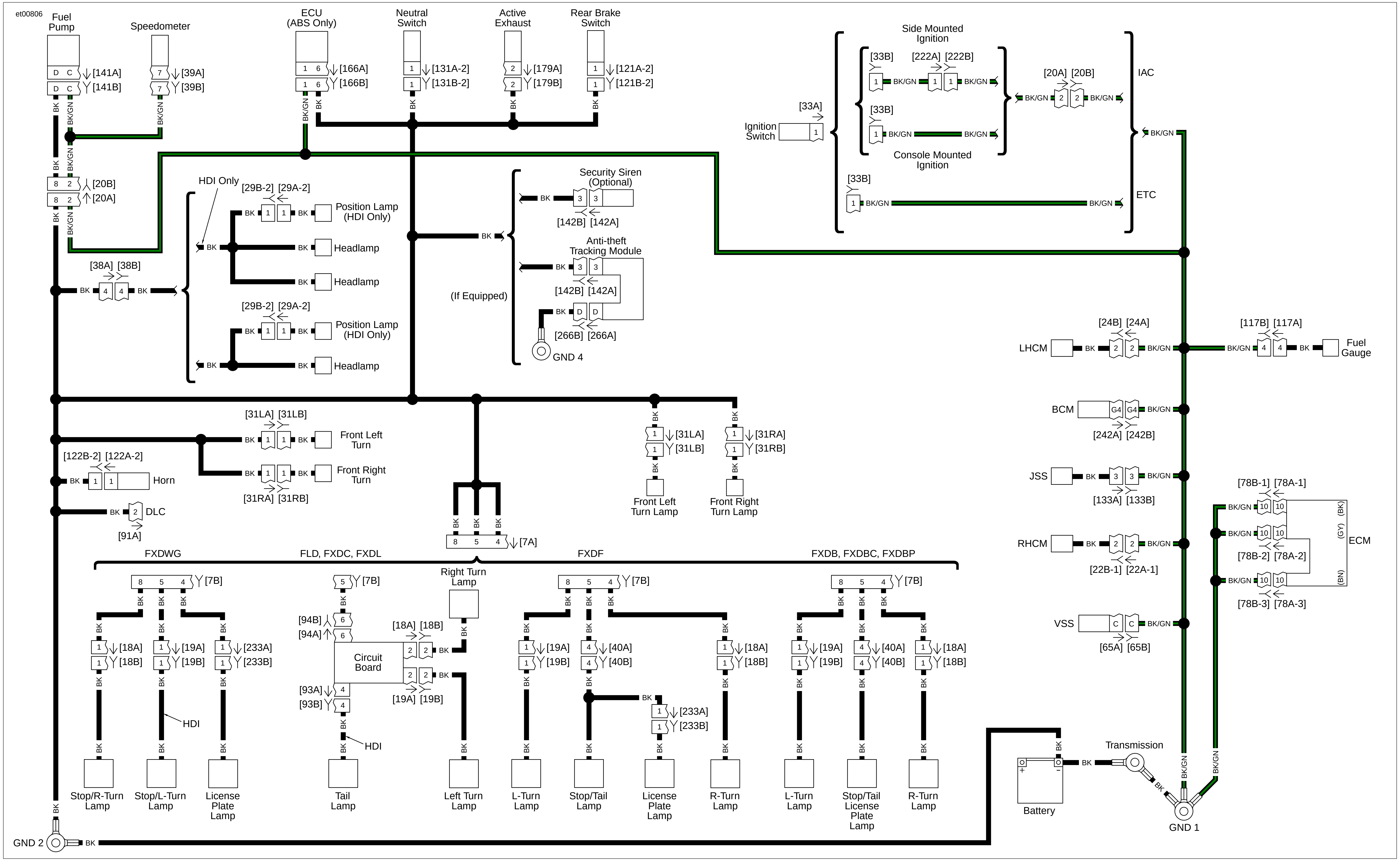


Figure A-7. Grounds: 2016 Dyna

Figure A-7.
Grounds: 2016 Dyna

Figure A-7.
Grounds: 2016 Dyna

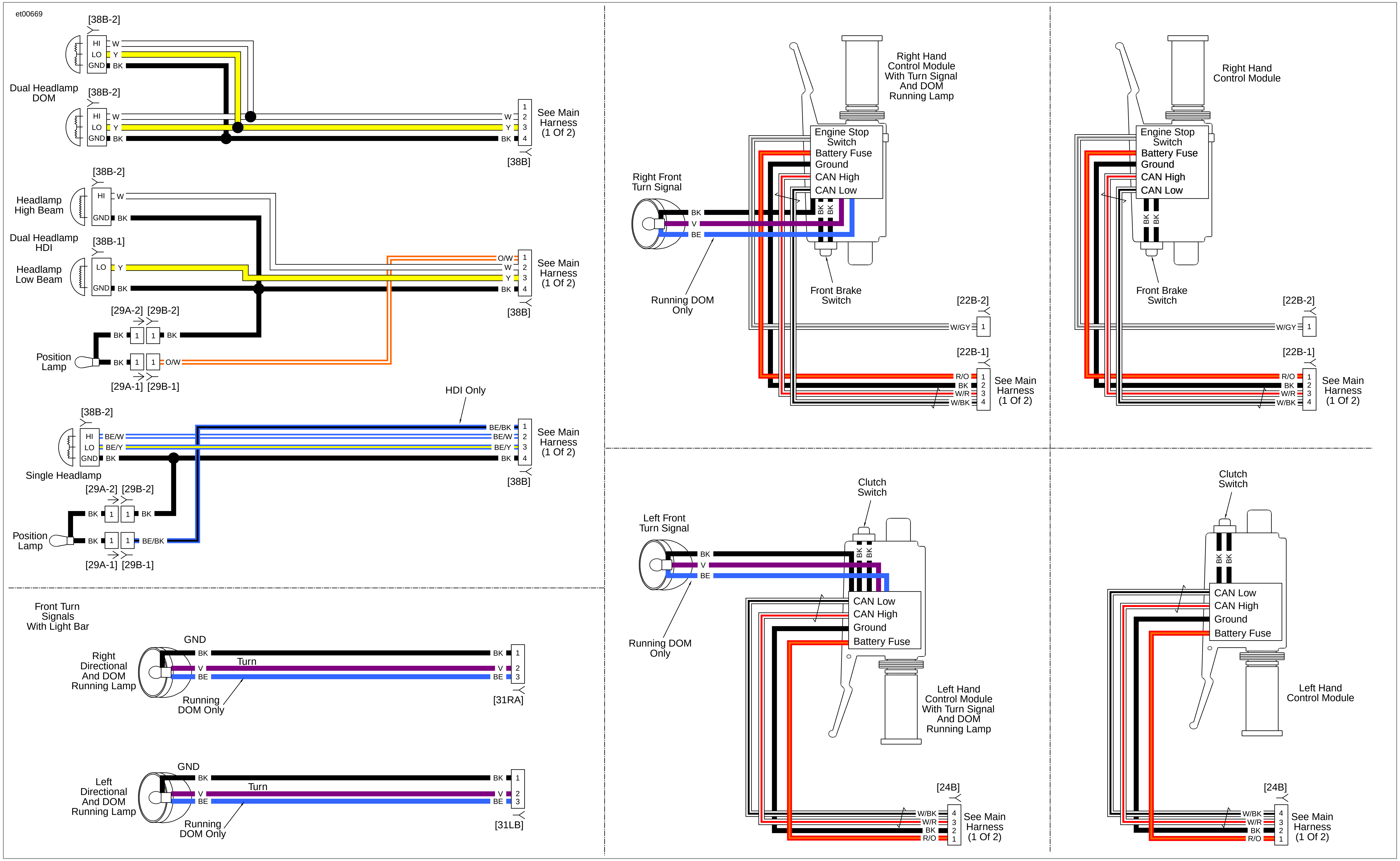


Figure A-8. Front Lighting and Hand Controls: 2016 Dyna

Figure A-8.
Front Lighting and Hand Controls: 2016 Dyna

Figure A-8.
Front Lighting and Hand Controls: 2016 Dyna

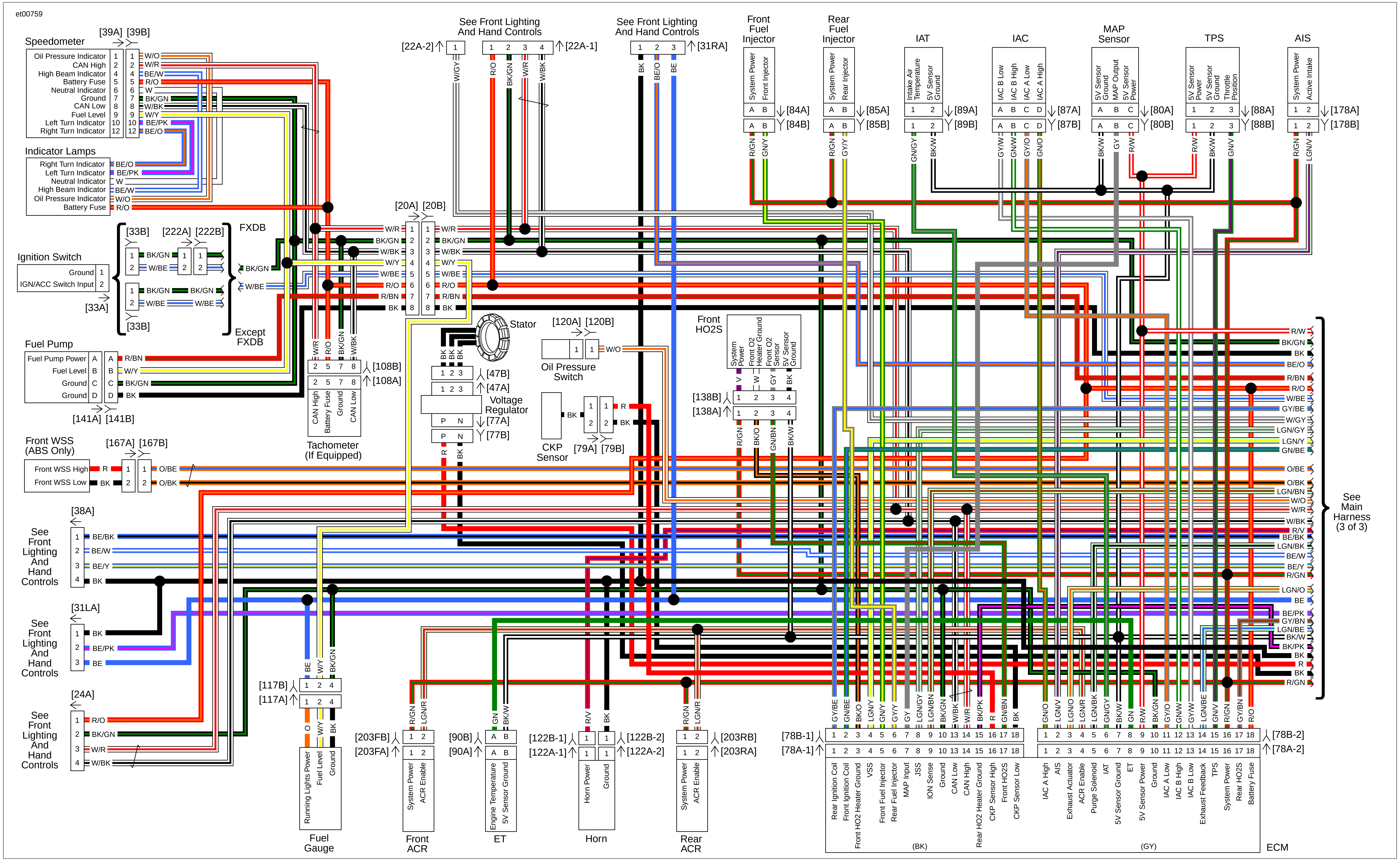


Figure A-9. Main Harness 1 of 3 (except FXDL, FXDLS): 2016 Dyna

Figure A-9.
Main Harness 1 of 3 (except FXDL, FXDLS): 2016 Dyna

Figure A-9.
Main Harness 1 of 3 (except FXDL, FXDLS): 2016 Dyna

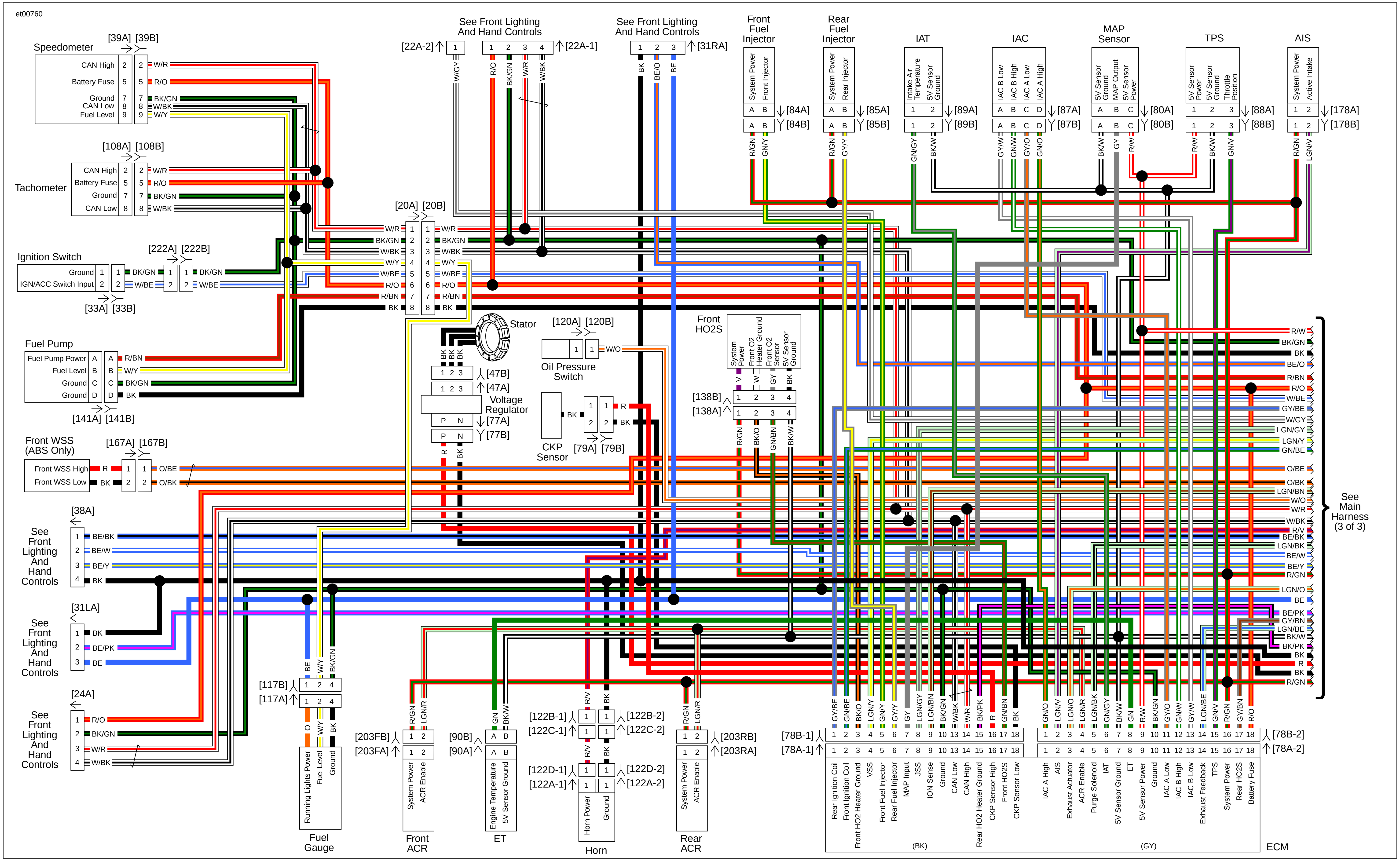


Figure A-10. Main Harness 2 of 3 (FXDL, except FXDLS): 2016 Dyna

Figure A-10.
Main Harness 2 of 3 (FXDL, except FXDLS): 2016 Dyna

Figure A-10.
Main Harness 2 of 3 (FXDL, except FXDLS): 2016 Dyna

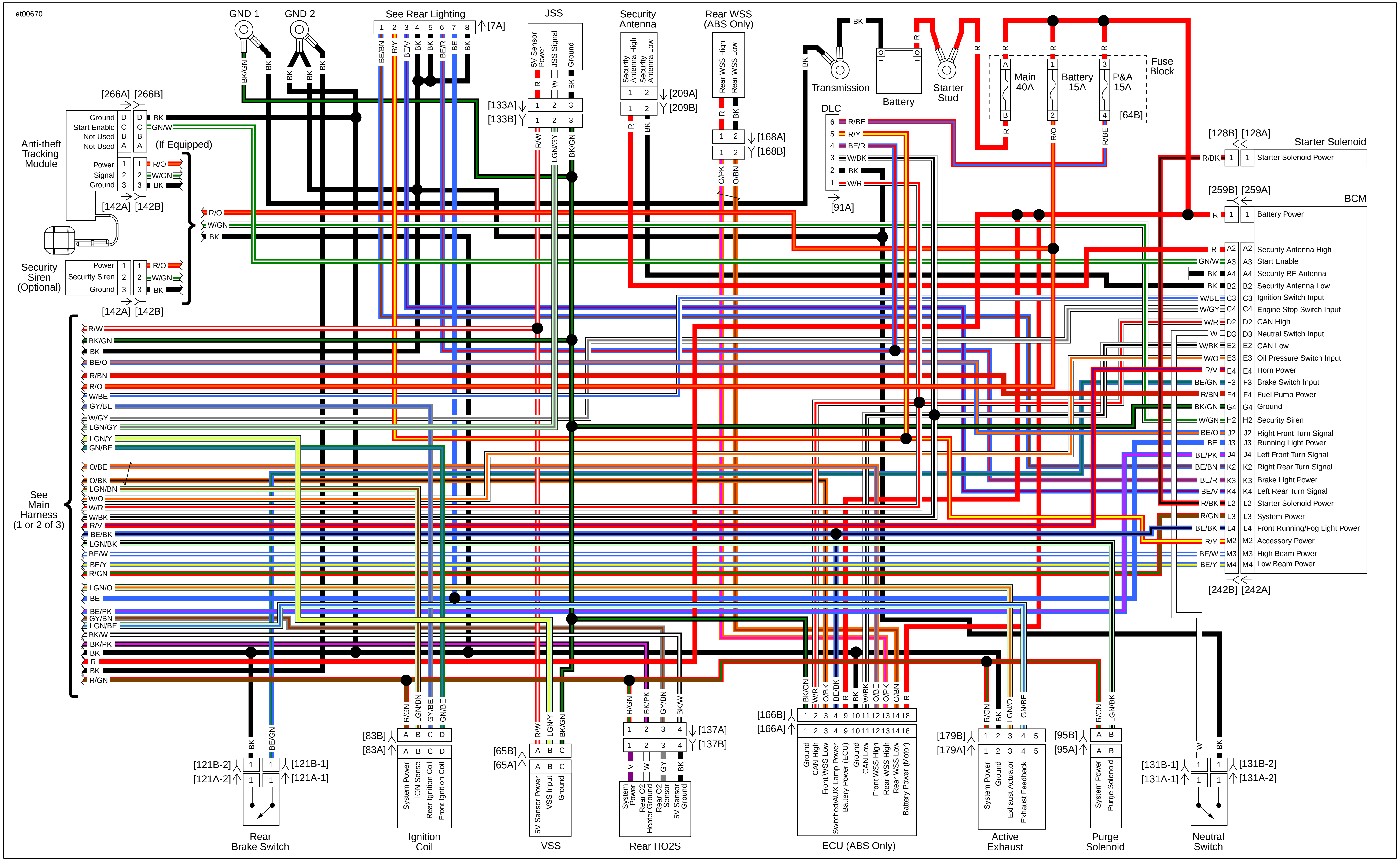


Figure A-11. Main Harness 3 of 3 (except FXDLS): 2016 Dyna

Figure A-11.
Main Harness 3 of 3 (except FXDLS): 2016 Dyna

Figure A-11.
Main Harness 3 of 3 (except FXDLS): 2016 Dyna

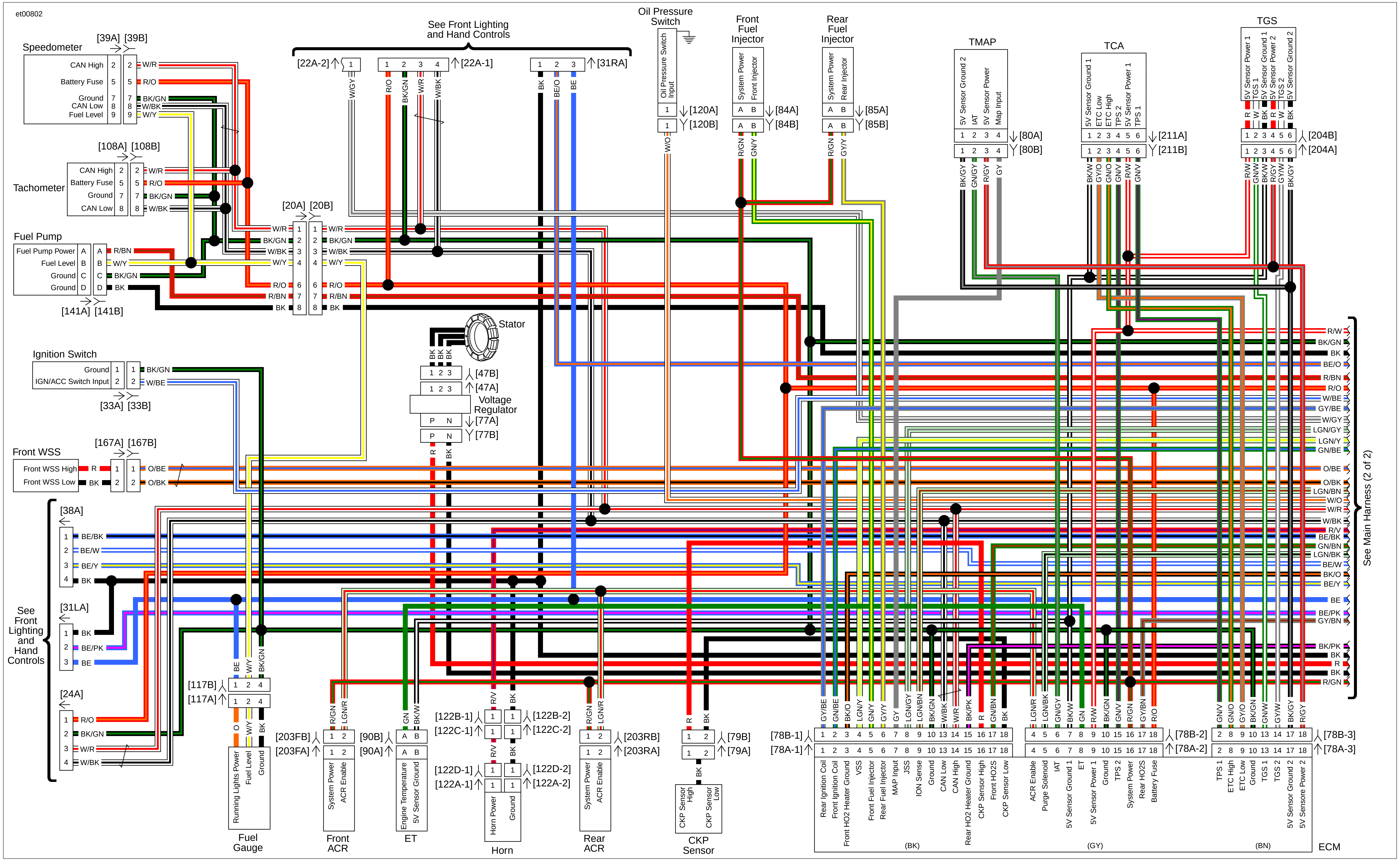


Figure A-12. Main Harness 1 of 2 (FXDLS): 2016 Dyna

Figure A-12.
Main Harness 1 of 2 (FXDLS): 2016 Dyna

Figure A-12.
Main Harness 1 of 2 (FXDLS): 2016 Dyna

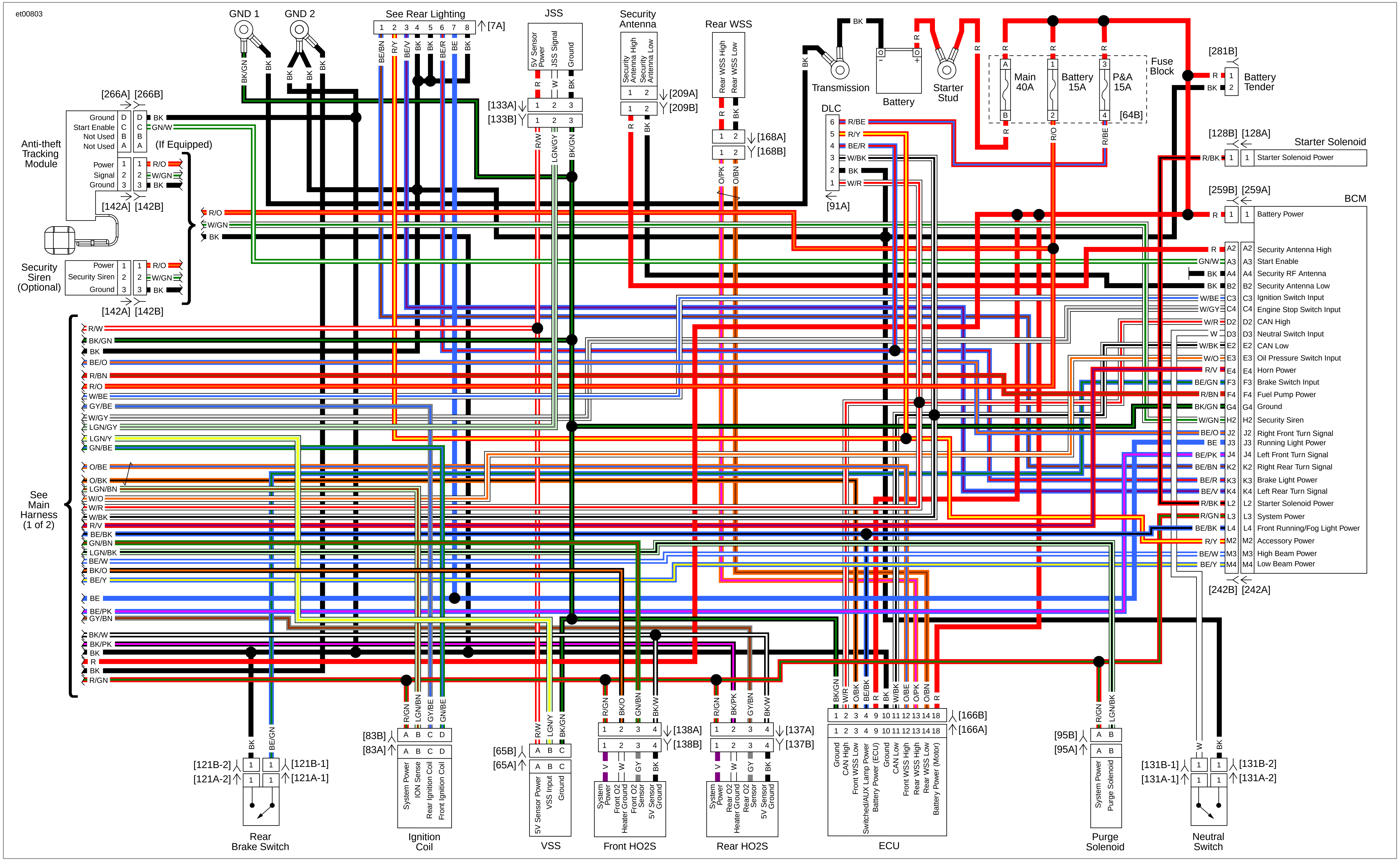


Figure A-13. Main Harness 2 of 2 (FXDLS): 2016 Dyna

Figure A-13.
Main Harness 2 of 2 (FXDLS): 2016 Dyna

Figure A-13.
Main Harness 2 of 2 (FXDLS): 2016 Dyna

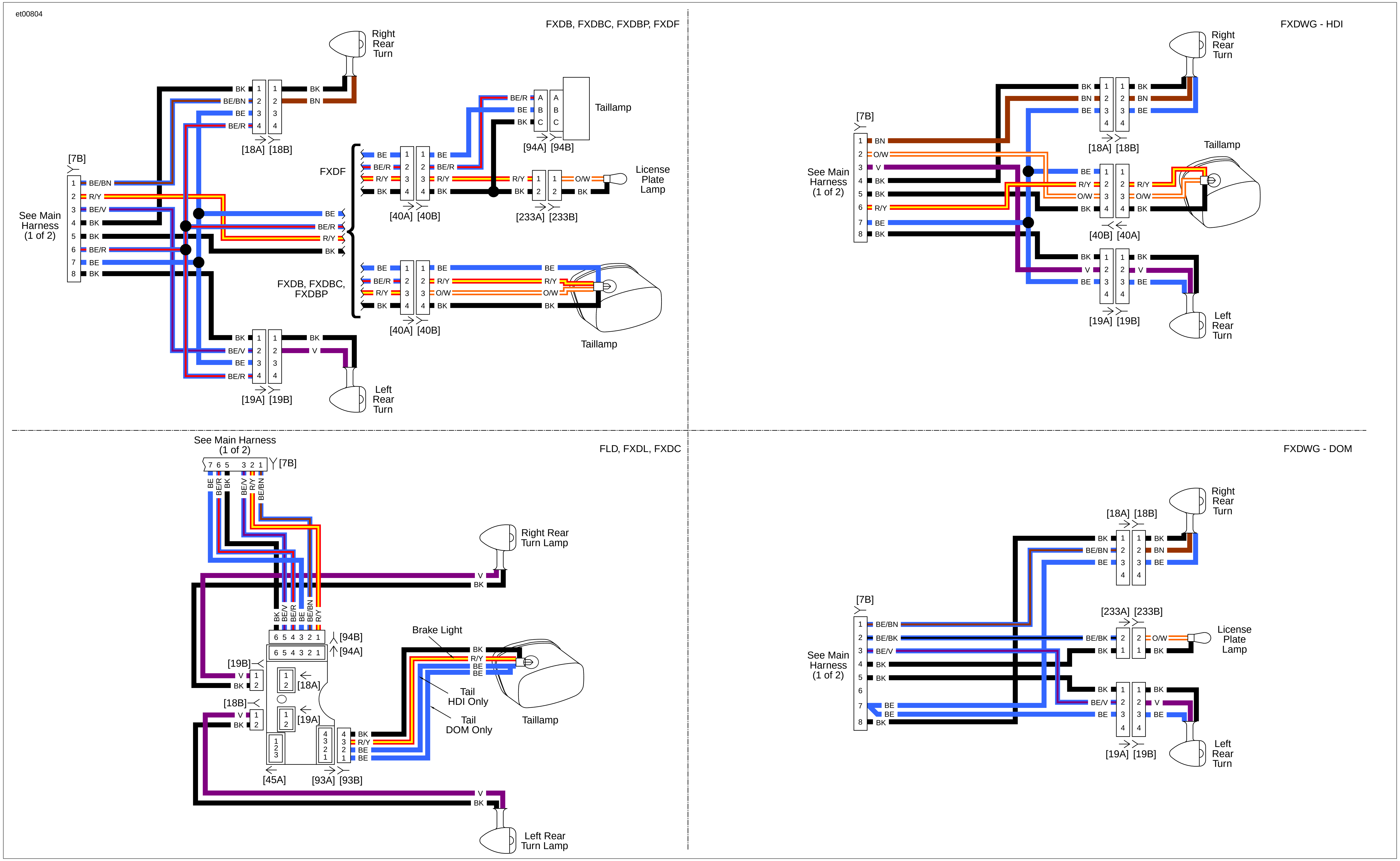


Figure A-14. Rear Lighting: 2016 Dyna

Figure A-14.
Rear Lighting: 2016 Dyna

Figure A-14.
Rear Lighting: 2016 Dyna

HOME

CONNECTOR END VIEWS

Table A-3. Rear Lighting [7A]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE/BN	Right rear turn signal
2	R/Y	Accessory power
3	BE/V	Left rear turn signal
4	BK	Ground
5	BK	Ground
6	BE/R	Brake lamp power
7	BE	Running lights power
8	BK	Ground

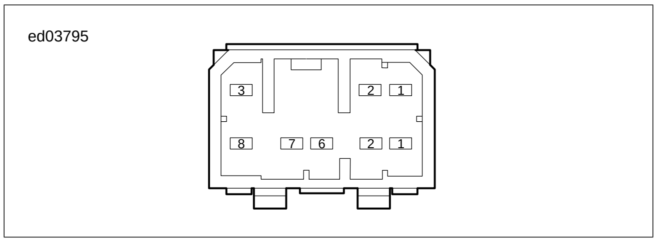


Figure A-15. Rear Lighting [7A]

Table A-4. Rear Lighting [7B] (FXDB/B/P, FXDF)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE/BN	Right rear turn signal
2	R/Y	Accessory power
3	BE/V	Left rear turn signal
4	BK	Ground
5	BK	Ground
6	BE/R	Brake lamp power
7	BE	Running lights power
8	BK	Ground

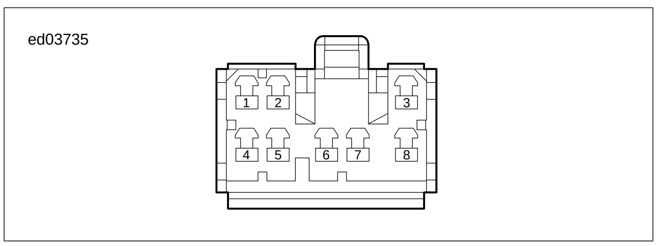


Figure A-16. Rear Lighting [7B] (FXDB/B/P, FXDF)

Table A-5. Rear Lighting [7B] (FXD/C/L)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BN	Right rear turn signal
2	O/W	Accessory power
3	V	Left rear turn signal
4	-	N/C
5	BK	Ground
6	R/Y	Brake lamp power
7	BE	Running lights power
8	-	N/C

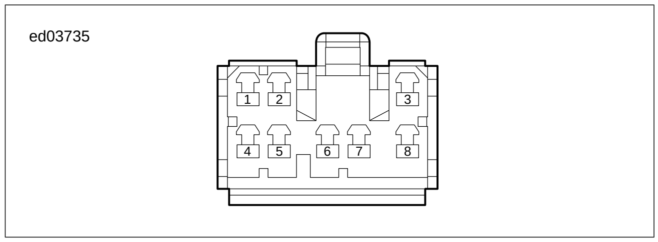


Figure A-17. Rear Lighting [7B] (FXD/C/L)

Table A-6. Rear Lighting [7B] (FXDWG - DOM)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE/BN	Right rear turn signal
2	BE/BK	Running/position light power
3	BE/V	Left rear turn signal
4	BK	Ground
5	BK	Ground
6	-	N/C
7	BE	Running/position light power
	BE	Running/position light power
8	BK	Ground

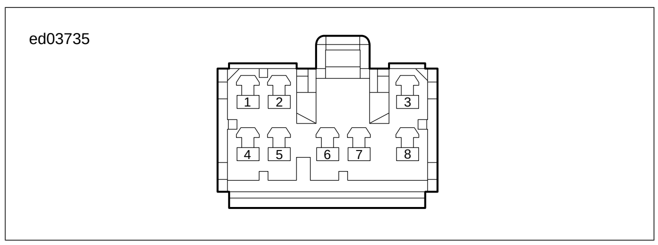


Figure A-18. Rear Lighting [7B] (FXDWG - DOM)

Table A-7. Rear Lighting [7B] (FXDB/B, FXDWG - HDI)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BN	Right rear turn signal
2	O/W	Running/position light power
3	V	Left rear turn signal
4	BK	Ground
5	BK	Ground
6	R/Y	Brake lamp power
7	BE	Running/position light power
8	BK	Ground

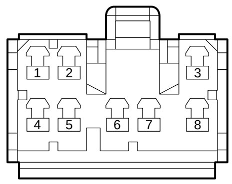


Figure A-19. Rear Lighting [7B] (FXDB/B, FXDWG - HDI)

Table A-8. Right Rear Turn Signal [18] (FLD, FXDL)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	V	Right rear turn signal
2	BK	Ground

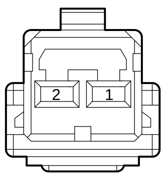


Figure A-20. Right Rear Turn Signal [18] (FLD, FXDL)

Table A-9. Right Rear Turn Signal [18] (FXDL, FXDB/B/P)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Ground
2	BE/BN	Right rear turn signal
3	BE	Running lights power
4	BE/R	Brake lamp power

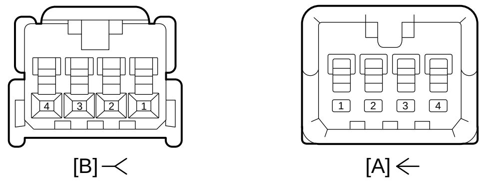


Figure A-21. Right Rear Turn Signal [18] (FXDL, FXDB/B/P)

Table A-10. Right Rear Turn Signal [18] (FXDWG - DOM)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Ground
2	BE/BN	Right rear turn signal
3	BE	Running lights power
4	-	N/C

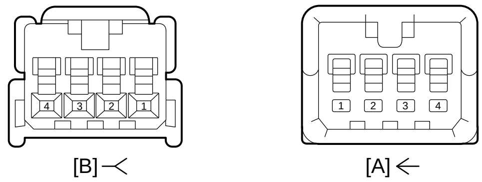


Figure A-22. Right Rear Turn Signal [18] (FXDWG - DOM)

Table A-11. Right Rear Turn Signal [18] (FXDB/B, FXDWG - HDI)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Ground
2	BN	Right rear turn signal
3	BE	Running lights power
4	-	N/C

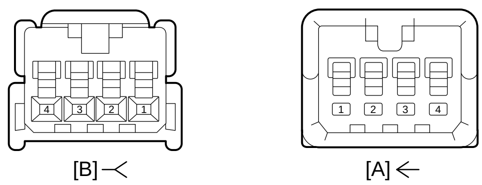


Figure A-23. Right Rear Turn Signal [18] (FXDB/B, FXDWG - HDI)

Table A-12. Left Rear Turn Signal [19] (FLD, FXDL)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	V	Left rear turn signal
2	BK	Ground

HOME

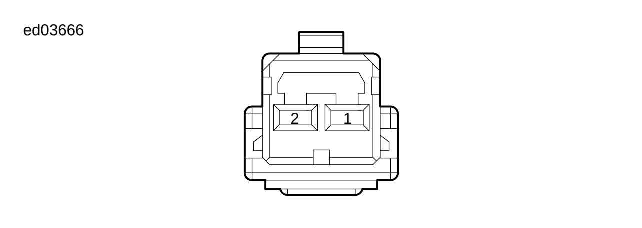


Figure A-24. Left Rear Turn Signal [19] (FLD, FXDL)

Table A-13. Left Rear Turn Signal [19] (FXDL, FXDB/B/P)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Ground
2	BE/V	Left rear turn signal
3	BE	Running lights power
4	BE/R	Brake lamp power

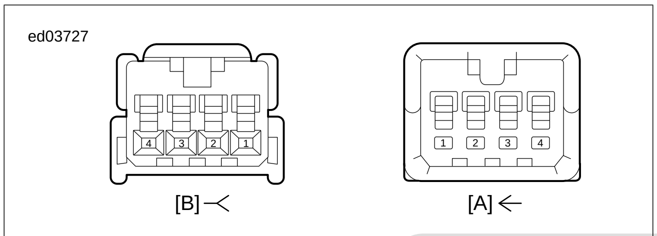


Figure A-25. Left Rear Turn Signal [19] (FXDL, FXDB/B/P)

Table A-14. Left Rear Turn Signal [19] (FXDWG - DOM)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Ground
2	BE/V	Left rear turn signal
3	BE	Running lights power
4	-	N/C

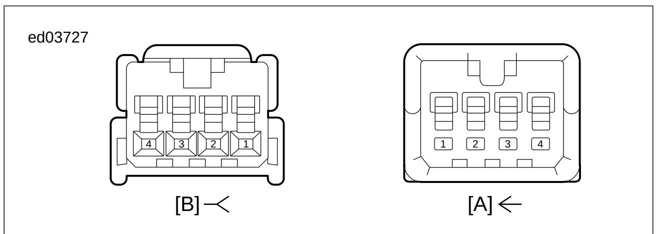


Figure A-26. Left Rear Turn Signal [19] (FXDWG - DOM)

Table A-15. Left Rear Turn Signal [19] (FXDB/B, FXDWG - HDI)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Ground
2	V	Left rear turn signal
3	BE	Running lights power
4	-	N/C

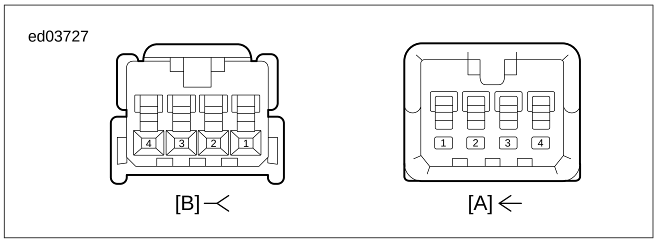


Figure A-27. Left Rear Turn Signal [19] (FXDB/B, FXDWG - HDI)

Table A-16. Console Harness [20]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	W/R	CAN high
2	BK/GN	Ground
3	W/BK	CAN low
4	W/Y	Fuel level
5	W/BE	Ignition switch
6	R/O	Battery fuse
7	R/BN	Fuel pump power
8	BK	Ground

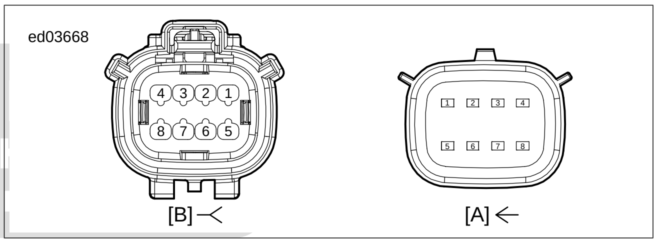


Figure A-28. Console Harness [20]

Table A-17. RHCM [22-1]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/O	Battery fuse
2	BK	Ground
3	W/R	CAN high
4	W/BK	CAN low

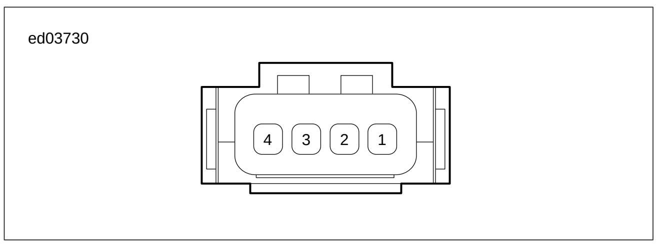


Figure A-29. RHCM [22-1]

Table A-18. RHCM [22-2]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	W/GY	Engine stop switch
2	-	N/C

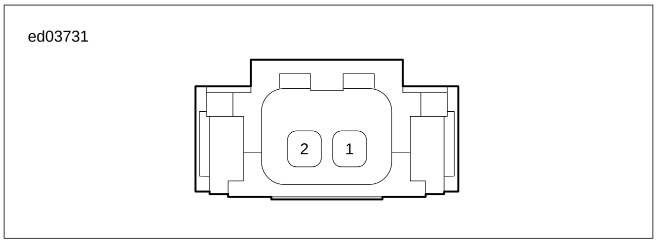


Figure A-30. RHCM [22-2]

Table A-19. LHCM [24]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/O	Battery fuse
2	BK	Ground
3	W/R	CAN high
4	W/BK	CAN low

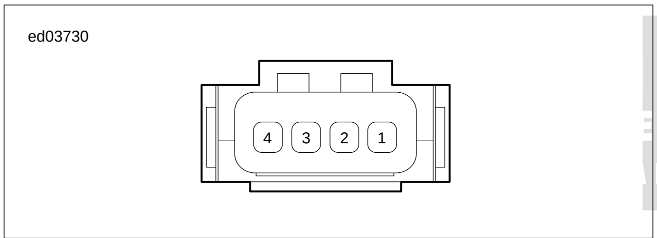


Figure A-31. LHCM [24]

Table A-20. HDI Position Lamp [29]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	O/W	Front running/fog light PWR
1	BK	Ground

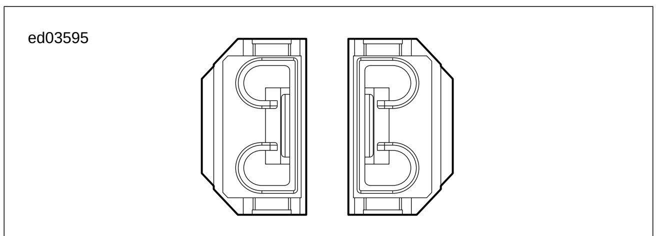


Figure A-32. HDI Position Lamp [29]

Table A-21. Left Front Turn Signal [31LA]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Ground
2	BE/PK	Left front turn signal
3	BE	Running lights

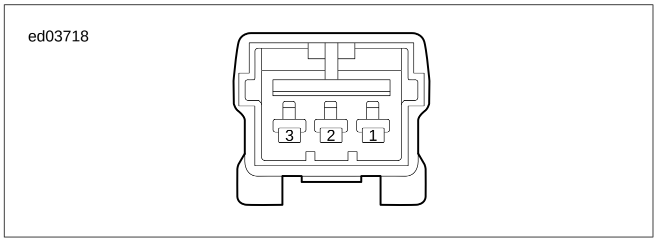


Figure A-33. Left Front Turn Signal [31LA]

Table A-22. Right Front Turn Signal [31RA]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Ground
2	BN/O	Right front turn signal
3	BE	Running lights

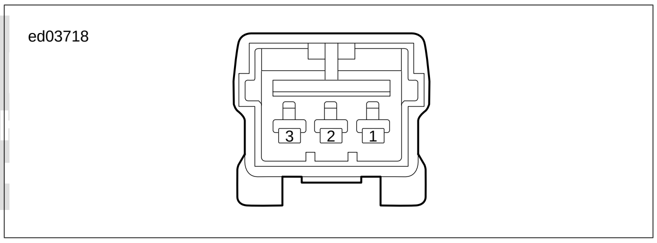


Figure A-34. Right Front Turn Signal [31RA]

Table A-23. Front Turn Signal [31L/RB]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Ground
2	V	Front turn signal
3	BE	Running lights

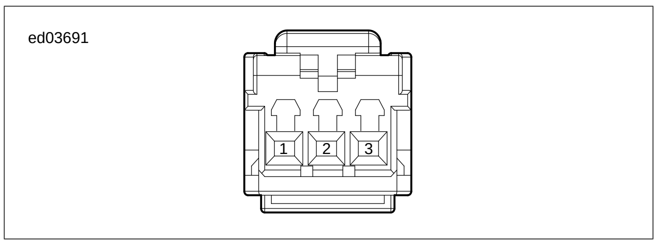


Figure A-35. Front Turn Signal [31L/RB]

Table A-24. Ignition Switch [33]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK/GN	Ground
2	W/BE	Ignition switch

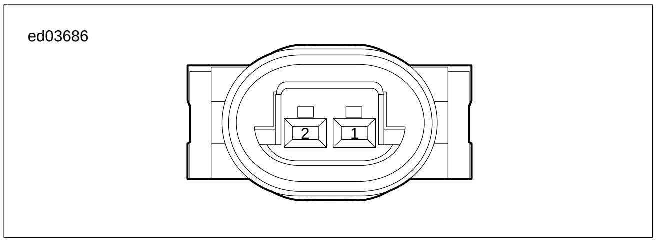


Figure A-36. Ignition Switch [33]

Table A-25. Headlamp [38A]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE/BK	Front running/fog light PWR
2	BE/W	High beam power
3	BE/Y	Low beam power
4	BK	Ground

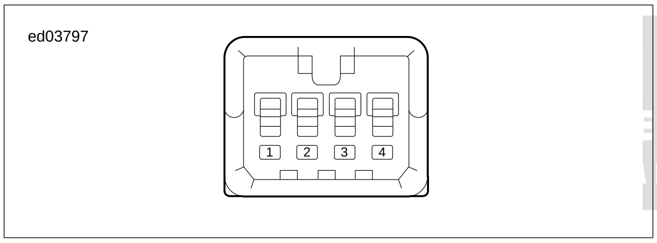


Figure A-37. Headlamp [38A]

Table A-26. Single Headlamp [38B]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE/BK	Front running/fog light PWR
2	BE/W	High beam power
3	BE/Y	Low beam power
4	BK	Ground

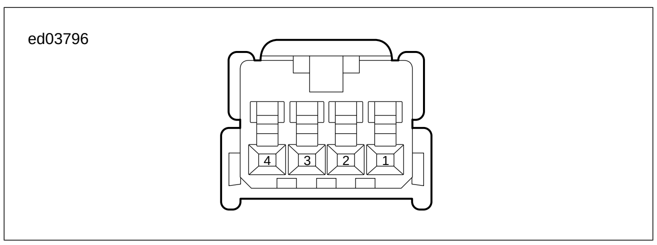


Figure A-38. Single Headlamp [38B]

Table A-27. Dual Headlamp [38B]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	O/W	Position lamp power - HDI only
2	W	High beam power
3	Y	Low beam power
4	BK	Ground

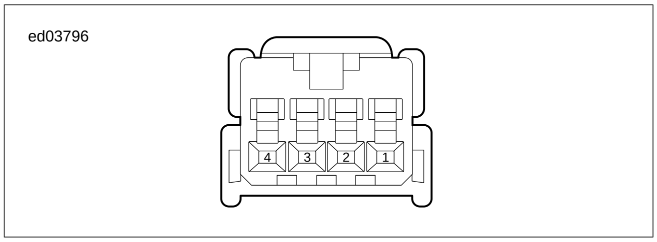


Figure A-39. Dual Headlamp [38B]

Table A-28. Single Headlamp [38B-2]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE/W	High beam power
2	BE/Y	Low beam power
3	BK	Ground

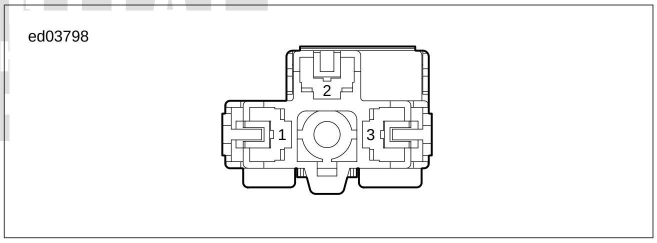


Figure A-40. Single Headlamp [38B-2]

Table A-29. Dual Headlamp - HDI [38B-1]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	Y	Low beam power
2	BK	Ground

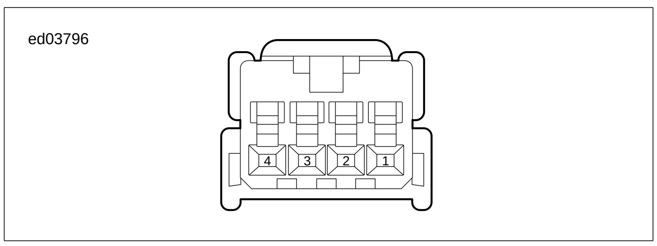


Figure A-41. Dual Headlamp - HDI [38B-1]

Table A-30. Dual Headlamp - HDI [38B-2]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	W	High beam power
2	BK	Ground

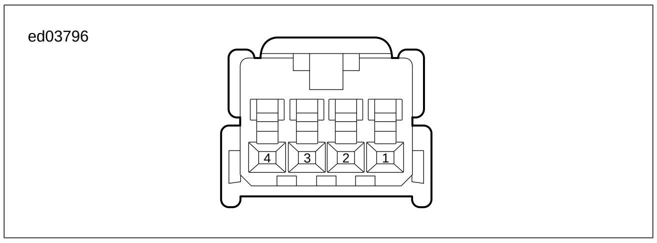


Figure A-42. Dual Headlamp - HDI [38B-2]

Table A-31. Dual Headlamp - DOM [38B-2]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	W	High beam power
2	Y	Low beam power
3	BK	Ground

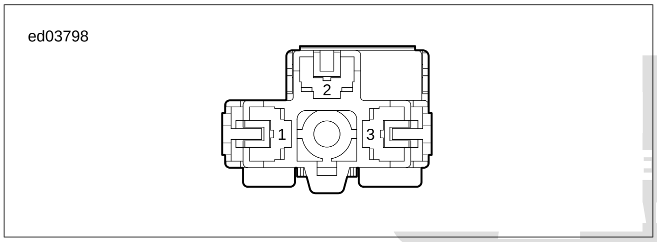


Figure A-43. Dual Headlamp - DOM [38B-2]

Table A-32. Speedometer [39] (Except FXDL)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	W/O	Oil pressure indicator
2	W/R	CAN high
3	-	N/C
4	BE/W	High beam indicator
5	R/O	Battery fuse
6	W	Neutral indicator
7	BK/GN	Ground
8	W/BK	CAN low
9	W/Y	Fuel level
10	BE/PK	Left turn indicator
11	-	N/C
12	BE/O	Right turn indicator

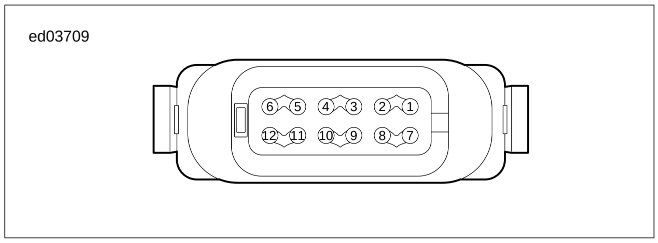


Figure A-44. Speedometer [39] (Except FXDL)

Table A-33. Speedometer [39] (FXDL)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	-	N/C
2	W/R	CAN high
3	-	N/C
4	-	N/C
5	R/O	Battery fuse
6	-	N/C
7	BK/GN	Ground
8	W/BK	CAN low
9	W/Y	Fuel level
10	-	N/C
11	-	N/C
12	-	N/C

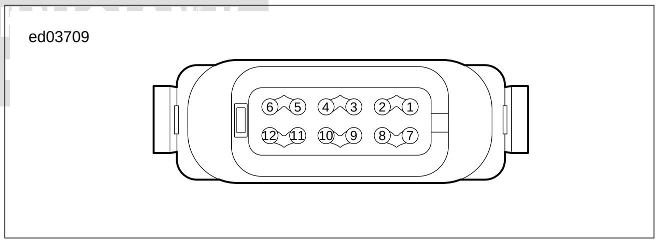


Figure A-45. Speedometer [39] (FXDL)

Table A-34. LP Lamp [40] (FXDB/B, FXDWG)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	-	N/C
2	R/Y	Brake lamp power
3	O/W	Accessory power
4	BK	Ground

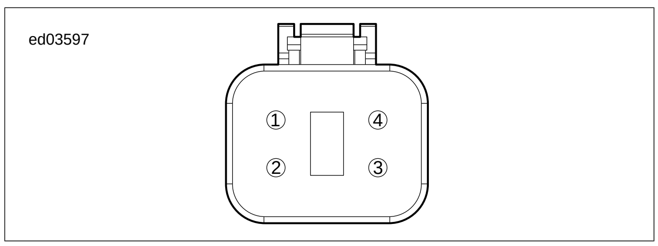


Figure A-46. LP Lamp [40] (FXDB/B, FXDWG)

Table A-35. LP Lamp [40] (FXDF, FXDB/B/P)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE	Running lamp power
2	BE/R	Brake lamp power
3	R/Y	Accessory power
4	BK	Ground

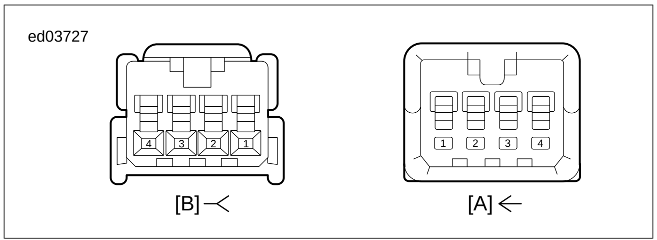


Figure A-47. LP Lamp [40] (FXDF, FXDB/B/P)

Table A-36. Stator [47]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Stator
2	BK	Stator
3	BK	Stator

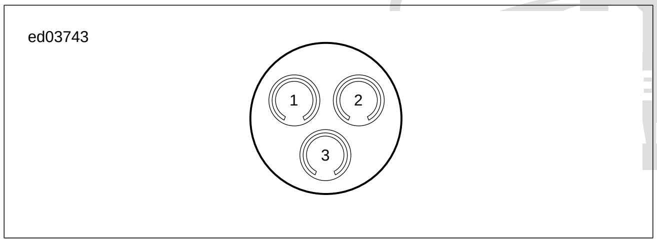


Figure A-48. Stator [47]

Table A-37. Fuse Block [64]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R	Battery
2	R/O	Battery fuse
3	R	Battery
4	R/BE	P&A fuse
A	R	Main fuse
B	R	Battery

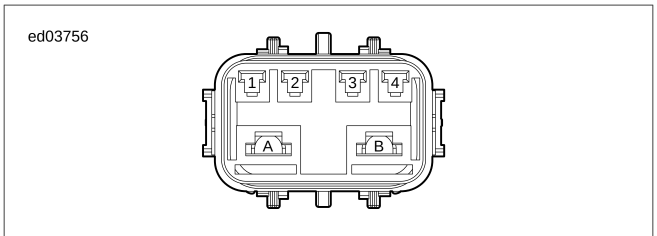


Figure A-49. Fuse Block [64]

Table A-38. VSS [65]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	R/W	5 Volt sensor power
B	LGN/Y	VSS input
C	BK/GN	Ground

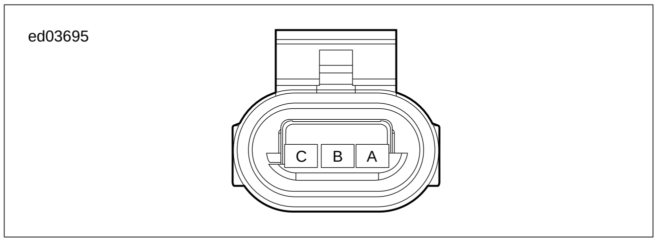


Figure A-50. VSS [65]

Table A-39. Voltage Regulator [77]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
P	R	Battery
N	BK	Ground

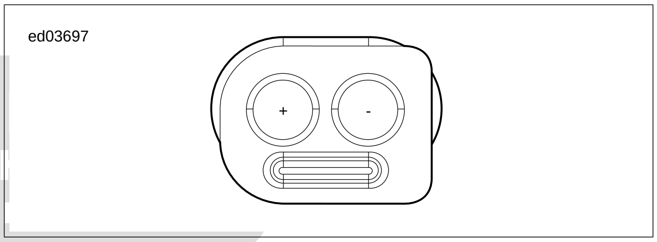


Figure A-51. Voltage Regulator [77]

Table A-40. ECM [78-1] (BK)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	GY/BE	Rear ignition coil
2	GN/BE	Front ignition coil
3	BK/O	Front HO2S heater ground
4	LGN/Y	VSS input
5	GN/Y	Front fuel injector
6	GY/Y	Rear fuel injector
7	GY	MAP input
8	LGN/GY	JSS signal
9	LGN/BN	Ion sense
10	BK/GN	Ground
11	-	N/C
12	-	N/C
13	W/BK	CAN low
14	W/R	CAN high
15	BK/PK	Rear HO2 heater ground
16	R	CKP sensor high
17	GN/BN	Front HO2S
18	BK	CKP sensor low

Table A-41. ECM [78-2] (GY)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	GN/O	IAC high
2	LGN/V	AIS
3	LGN/O	Exhause actuator
4	LGN/R	ACR enable
5	LGN/BK	Purge solenoid
6	GN/GY	IAT
7	BK/W	5 Volt sensor ground
8	GN	ET sensor
9	R/W	5 Volt sensor power
10	BK/GN	Ground
11	GY/O	IAC A low
12	GN/W	IAC B high
13	GY/W	IAC B low
14	LGN/BE	Exhause feedback
15	GN/V	TPS
16	R/GN	System power
17	GY/BN	Rear HO2S
18	R/O	Battery fuse

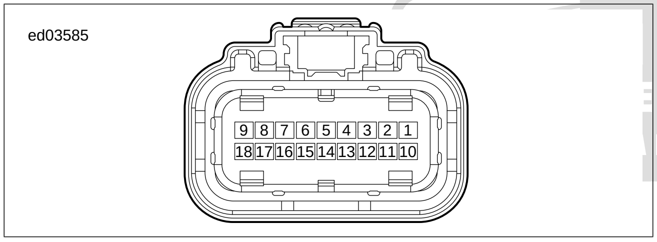


Figure A-52. ECM [78-1]

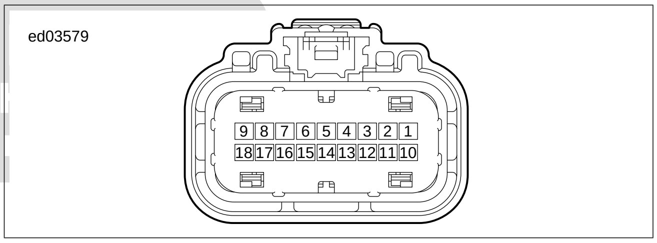


Figure A-53. ECM [78-2]

Table A-42. ECM [78-3] (BN)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	-	N/C
2	GN/V	TPS1
3	-	N/C
4	-	N/C
5	-	N/C
6	-	N/C
7	-	N/C
8	GN/O	TCA high
9	GY/O	TCA low
10	BK/GN	Ground
11	-	N/C
12	-	N/C
13	GN/W	Twist grip sensor 1
14	GY/W	Twist grip sensor 2
15	-	N/C
16	-	N/C
17	BK/GY	5V sensor ground 2
18	R/GY	5V sensor power 2

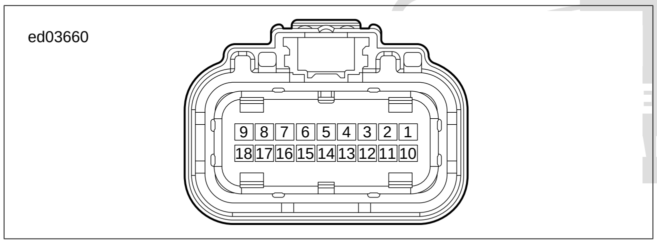


Figure A-54. ECM [78-3]

Table A-43. CKP Sensor [79]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R	CKP sensor high
2	BK	CKP sensor low

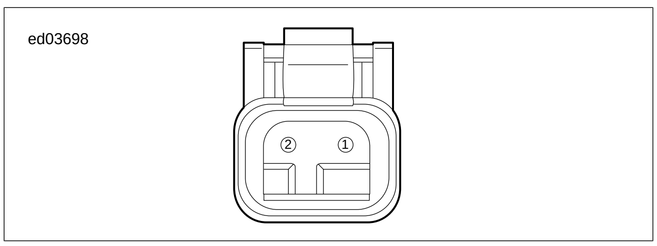


Figure A-55. CKP Sensor [79]

Table A-44. MAP [80]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	BK/W	5 Volt sensor ground
B	GY	Map output
C	R/W	5 Volt sensor power

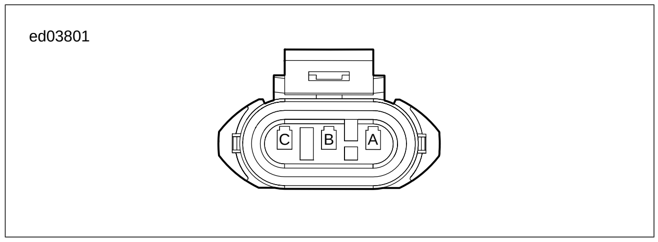


Figure A-56. MAP [80]

Table A-45. TMAP [80]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK/GY	5V sensor ground 2
2	GN/GY	IAT
3	R/GY	5V sensor power 2
4	GY	MAP input

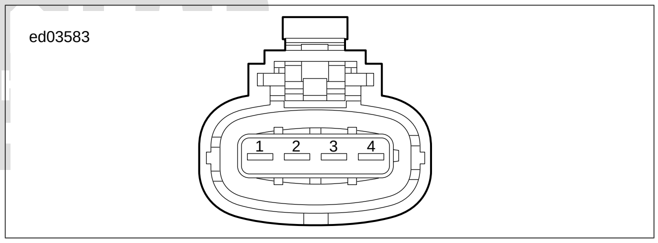


Figure A-57. TMAP [80]

Table A-46. Ignition Coil [83]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	R/GN	System power
B	LGN/BN	Ion sense
C	GY/BE	Rear ignition coil
D	GN/BE	Front ignition coil

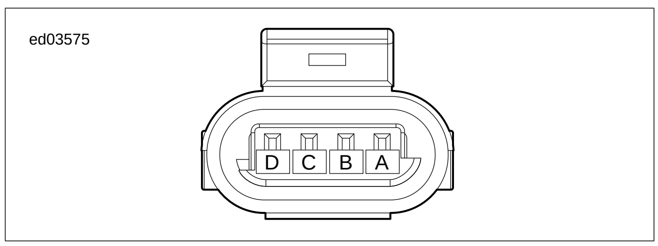


Figure A-58. Ignition Coil [83]

Table A-47. Front Fuel Injector [84]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	R/GN	System power
B	GN/Y	Rear fuel injector

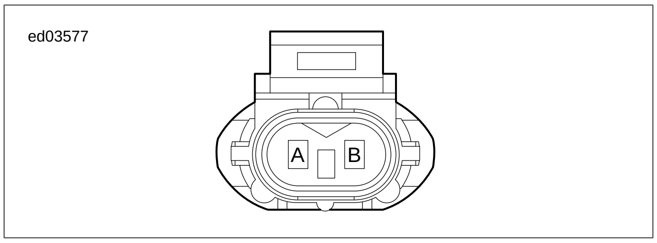


Figure A-59. Front Fuel Injector [84]

Table A-48. Rear Fuel Injector [85]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	R/GN	System power
B	GY/Y	Front fuel injector

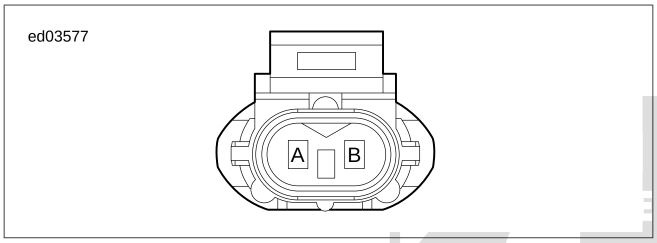


Figure A-60. Rear Fuel Injector [85]

Table A-49. IAC [87]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	GY/W	IAC B low
B	GN/W	IAC B high
C	GY/O	IAC A low
D	GN/O	IAC A high

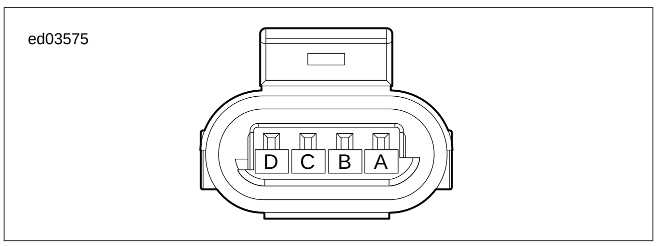


Figure A-61. IAC [87]

Table A-50. TPS [88]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/W	5 Volt sensor power
2	BK/W	5 Volt sensor ground
3	GN/V	TPS

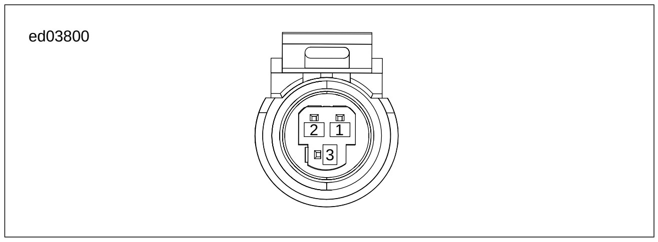


Figure A-62. TPS [88]

Table A-51. IAT Sensor [89]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	GN/GY	IAT
2	BK/W	5 Volt sensor ground

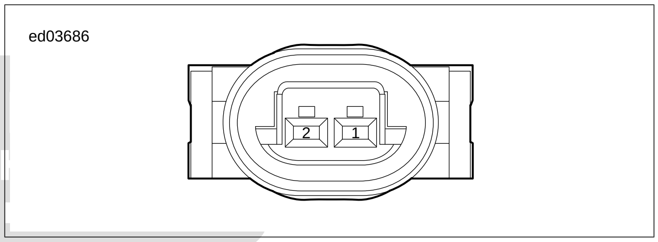


Figure A-63. IAT Sensor [89]

Table A-52. ET Sensor [90]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	GN	ET sensor
B	BK/W	5 Volt sensor ground

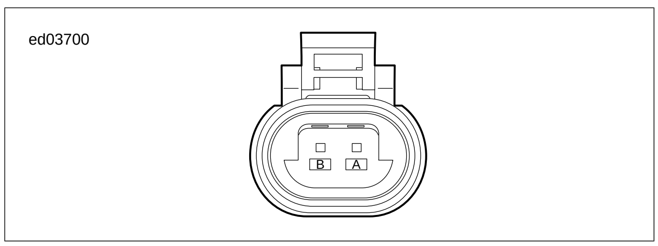


Figure A-64. ET Sensor [90]

Table A-53. DLC [91]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	W/R	CAN high
2	BK	Ground
3	W/BK	CAN low
4	BE/R	Brake lamp power
5	R/Y	Accessory power
6	R/BE	P&A power

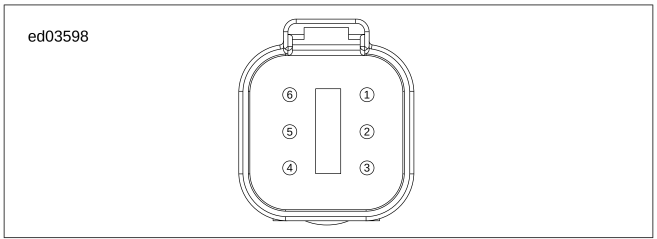


Figure A-65. DLC [91]

Table A-54. Tail Lamp [93]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE	Running light power
2	BE	Accessory power
3	R/Y	Brake lamp power
4	BK	Ground

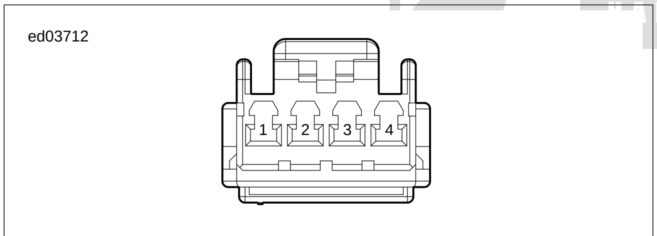


Figure A-66. Tail Lamp [93]

Table A-55. Stop Tail Lamp [94] (FLD, FXDL)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/Y	Accessory power
2	BE/BN	Right rear turn signal
3	BE	Running lights power
4	BE/R	Brake lamp power
5	BE/V	Left rear turn signal
6	BK	Ground

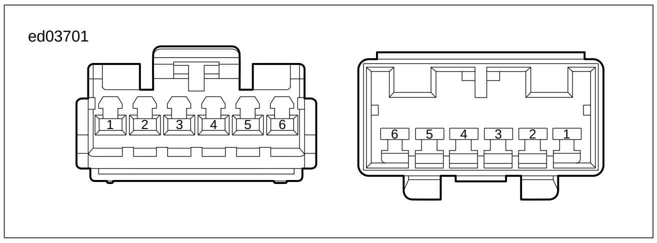


Figure A-67. Stop Tail Lamp [94] (FLD, FXDL)

Table A-56. Stop Tail Lamp [94] (FXDF)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	BE/R	Brake lamp power
B	BE	Running lights power
C	BK	Ground

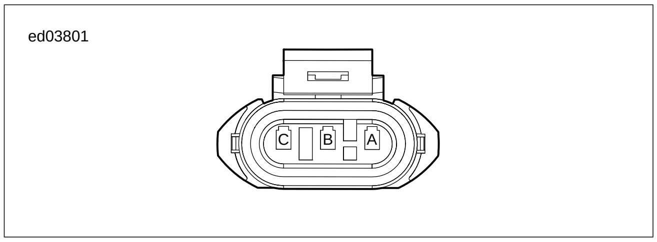


Figure A-68. Stop Tail Lamp [94] (FXDF)

Table A-57. Purge Solenoid [95]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	R/GN	System power
B	LGN/BK	Purge solenoid

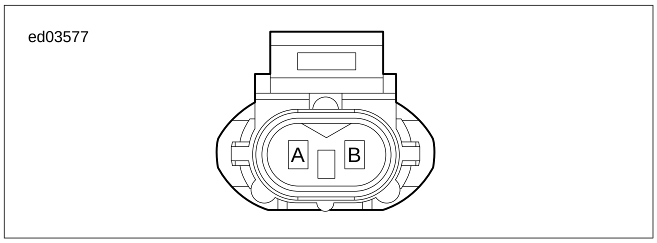


Figure A-69. Purge Solenoid [95]

Table A-58. Tachometer [108]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	-	N/C
2	W/R	CAN high
3	-	N/C
4	-	N/C
5	R/O	Battery fuse
6	-	N/C
7	BK/GN	Ground
8	W/BK	CAN low
9	-	N/C
10	-	N/C
11	-	N/C
12	-	N/C

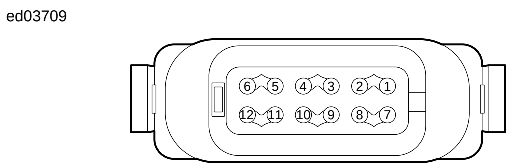


Figure A-70. Tachometer [108]

Table A-59. Fuel Gauge [117]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE	Running light power
2	W/Y	Fuel level
3	-	N/C
4	BK/GN	Ground

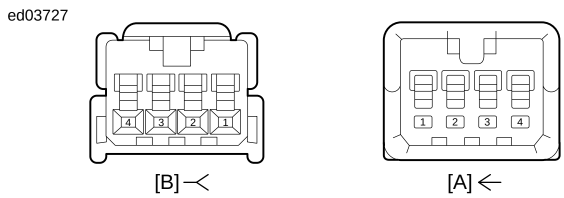


Figure A-71. Fuel Gauge [117]

Table A-60. Oil Pressure Switch [120]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	W/O	Oil pressure switch

Figure A-72. Oil Pressure Switch [120]

Table A-61. Rear Brake Switch [121B]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE/GN	Rear brake switch
1	BK	Ground

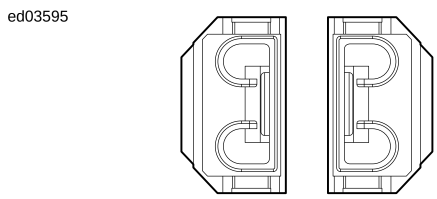


Figure A-73. Rear Brake Switch [121B]

Table A-62. Horn [122B]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/V	Horn power
1	BK	Ground

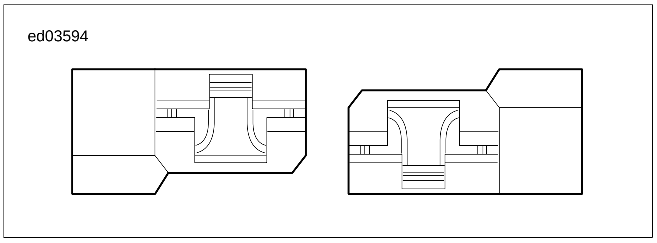


Figure A-74. Horn [122B]

Table A-63. Starter Solenoid [128]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/BK	Starter solenoid power

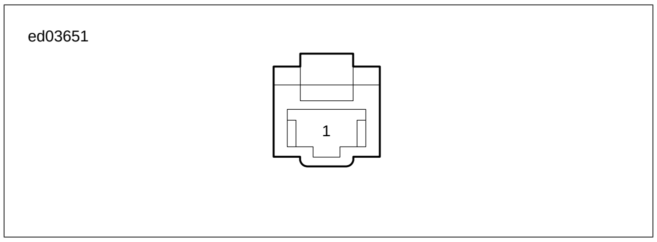


Figure A-75. Starter Solenoid [128]

Table A-64. Neutral Switch [131B]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	W	Neutral switch input
1	BK	Ground

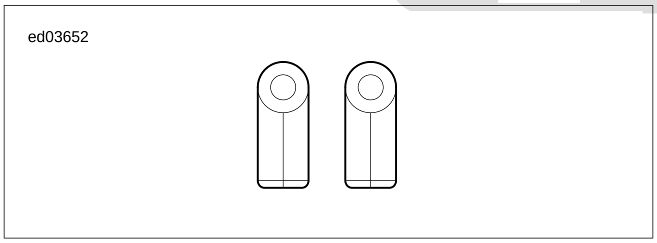


Figure A-76. Neutral Switch [131B]

Table A-65. JSS [133]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/W	5 Volt sensor power
2	LGN/GY	JSS signal
3	BK/GN	Ground

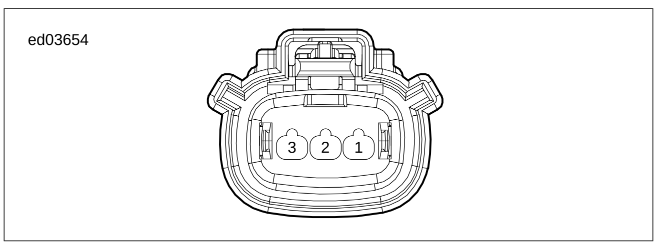


Figure A-77. JSS [133]

Table A-66. HO2S Rear [137]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/GN	System power
2	BK/PK	Rear HO2S heater ground
3	GY/BN	Rear HO2S
4	BK/W	5 Volt sensor ground

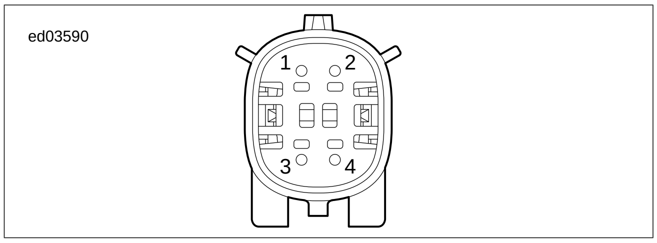


Figure A-78. HO2S Rear [137]

Table A-67. HO2S Front [138]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/GN	System power
2	BK/O	Front HO2S heater ground
3	GN/BN	Front HO2S
4	BK/W	5 Volt sensor ground

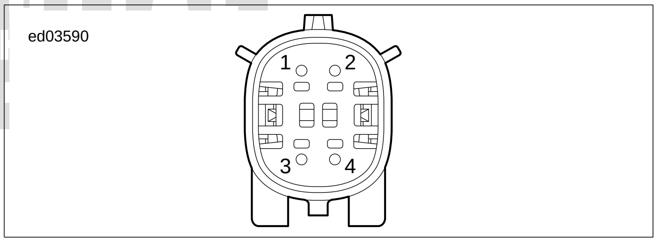


Figure A-79. HO2S Front [138]

Table A-68. Fuel Pump [141]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	R/BN	Fuel pump power
B	W/Y	Fuel level sender
C	W/BN	Sender ground
D	BK	Pump ground

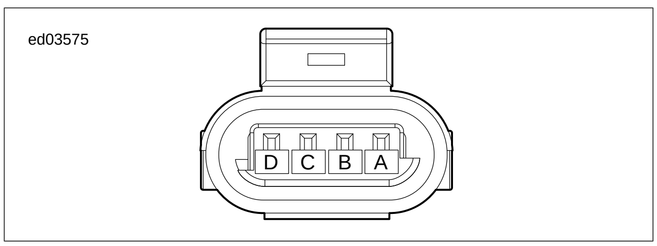


Figure A-80. Fuel Pump [141]

HOME

Table A-69. Security Siren [142]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/O	Power
2	W/GN	Security siren
3	BK	Ground

ed03657

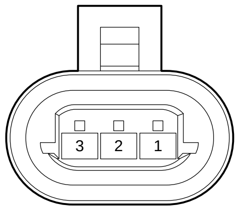


Figure A-81. Security Siren [142]

Table A-70. ABS [166]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK/GN	Ground
2	W/R	CAN high
3	O/BK	Front WSS low
4	BE/BK	Switched aux lamp PWR
5	-	N/C
6	-	N/C
7	-	N/C
8	-	N/C
9	R	Battery power
10	BK	Ground
11	W/BK	CAN low
12	O/BE	Front WSS high
13	O/PK	Rear WSS high
14	O/BN	Rear WSS low
15	-	N/C
16	-	N/C
17	-	N/C
18	R	Battery power

ed03728

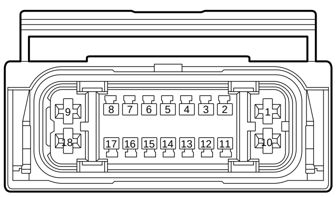


Figure A-82. ABS [166]

Table A-71. Front WSS [167]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	O/BE	Front WSS high
2	O/BK	Front WSS low

ed03698

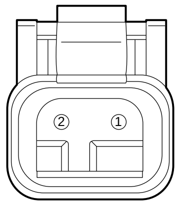


Figure A-83. Front WSS [167]

Table A-72. Rear WSS [168]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	O/PK	Rear WSS high
2	O/BN	Rear WSS low

ed03698

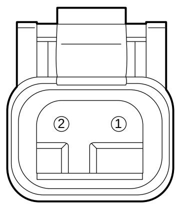


Figure A-84. Rear WSS [168]

Table A-73. AIS [178]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/GN	System power
2	LGN/V	Active intake

ed03669

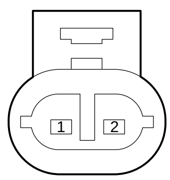


Figure A-85. AIS [178]

Table A-74. Active Exhaust [179]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/GN	System power
2	BK	Ground
3	LGN/O	Exhaust actuator
4	LGN/BE	Exhaust feedback
5	-	N/C

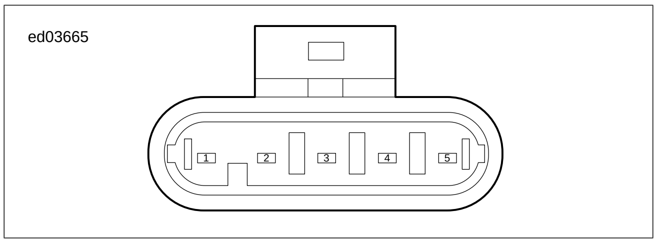


Figure A-86. Active Exhaust [179]

Table A-75. ACR [203]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/GN	System power
2	LGN/R	ACR enable

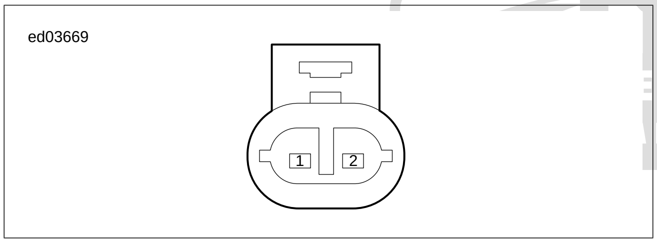


Figure A-87. ACR [203]

Table A-76. TGS [204A]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/W	5V sensor power 1
2	GN/W	TGS 1
3	BK/W	5V sensor ground 1
4	R/GY	5V sensor power 2
5	GY/W	TGS 2
6	BK/GY	5V sensor ground 2

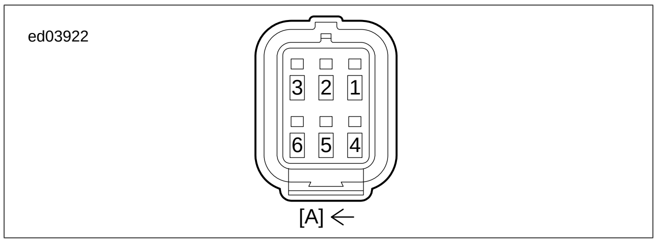


Figure A-88. TGS [204A]

Table A-77. TGS [204B]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R	5V sensor power 1
2	W	TGS 1
3	BK	5V sensor ground 1
4	R	5V sensor power 2
5	W	TGS 2
6	BK	5V sensor ground 2

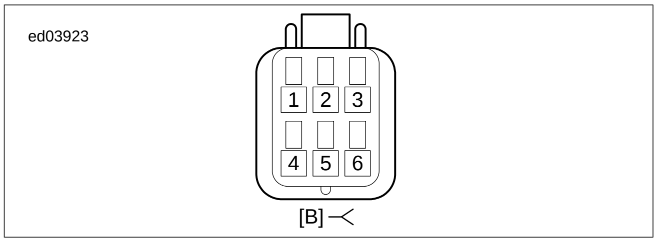


Figure A-89. TGS [204B]

Table A-78. Security Antenna [209]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R	Security antenna high
2	BK	Security antenna low

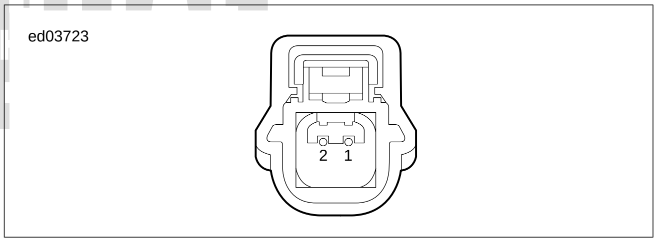


Figure A-90. Security Antenna [209]

Table A-79. TCA [211]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK/W	5V sensor ground 1
2	GY/O	TCA low
3	GN/O	TCA high
4	GY/V	TPS 2
5	R/W	5V sensor power 1
6	GN/V	TPS 1

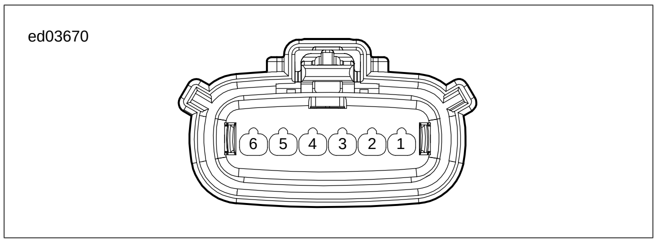


Figure A-91. TCA [211]

Table A-80. Ignition Switch Harness [222]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK/GN	Ground
2	W/BE	IGN/ACC switch input

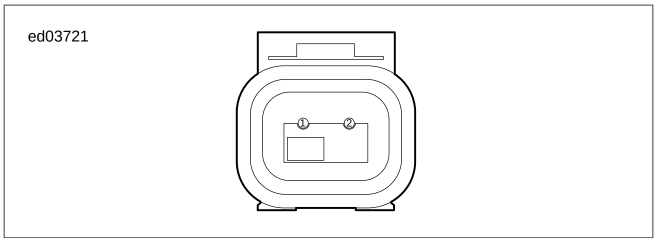


Figure A-92. Ignition Switch Harness [222]

Table A-81. LP Lamp [233] (Except FXDWG - DOM)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/Y	Accessory power
2	BK	Ground

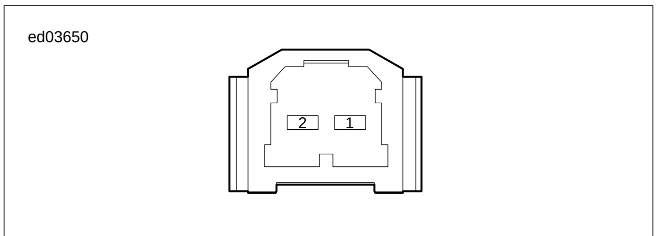


Figure A-93. LP Lamp [233] (Except FXDWG - DOM)

Table A-82. LP Lamp [233] (FXDWG - DOM)

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Ground
2	BE/BK	Accessory power

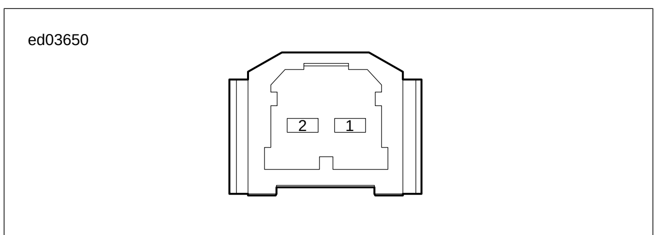


Figure A-94. LP Lamp [233] (FXDWG - DOM)

Table A-83. BCM [242]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A1	-	N/C
A2	R	Security antenna high
A3	GN/W	Start enable
A4	BK	Security RF antenna
B1	-	N/C
B2	BK	Security antenna low
B3	-	N/C
B4	-	N/C
C1	-	N/C
C2	-	N/C
C3	W/BE	Ignition switch input
C4	W/GY	Engine stop switch input
D1	-	N/C
D2	W/R	CAN high
D3	W	Neutral switch input
D4	-	N/C
E1	-	N/C
E2	W/BK	CAN low
E3	W/O	Oil pressure switch input
E4	R/V	Horn power
F1	-	N/C
F2	-	N/C
F3	BE/GN	Brake switch input
F4	R/BN	Fuel pump power
G1	-	N/C
G2	-	N/C
G3	-	N/C
G4	BK/GN	Ground
H1	-	N/C
H2	W/GN	Security siren
H3	-	N/C
H4	-	N/C
J1	-	N/C
J2	BE/O	Right front turn signal
J3	BE	Running lights
J4	BE/PK	Left front turn signal
K1	-	N/C
K2	BE/BN	Right rear turn signal
K3	BE/R	Brake lamp power
K4	BE/V	Left rear turn signal
L1	-	N/C
L2	R/BK	Starter solenoid power
L3	R/GN	System power
L4	BE/BK	Front running/fog light power
M1	-	N/C
M2	R/Y	Accessory power
M3	BE/W	High beam power
M4	BE/Y	Low beam power

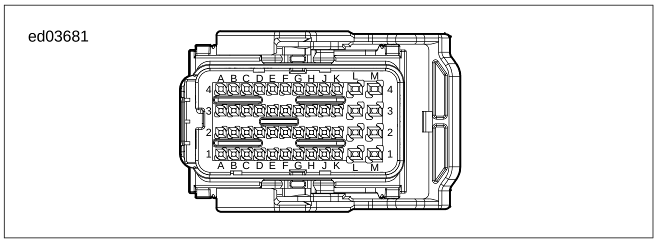


Figure A-95. BCM [242]

Table A-84. BCM Power [259]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R	Battery power

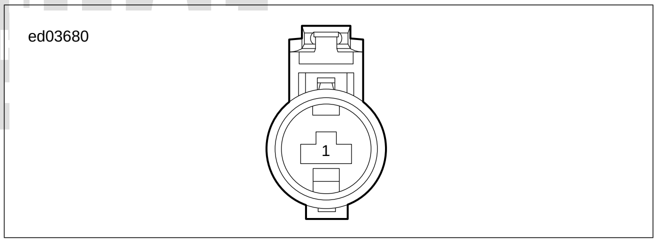


Figure A-96. BCM Power [259]

Table A-85. Battery Tender [281]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R	Battery power
2	BK	Ground

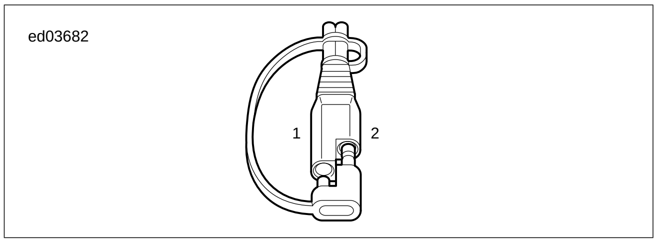
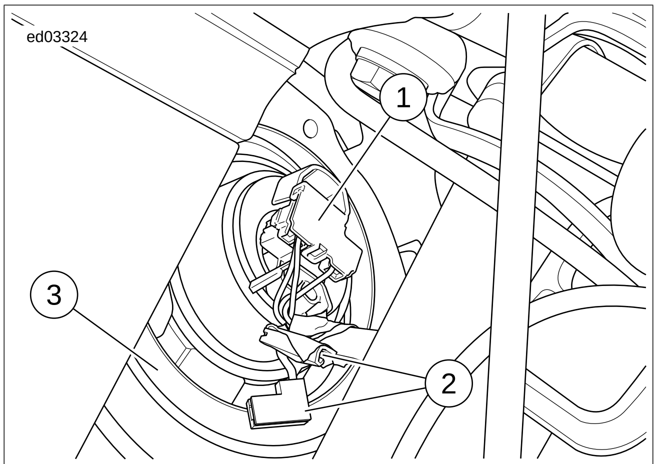


Figure A-97. Battery Tender [281]

COMPONENT LOCATION VIEWS A.4

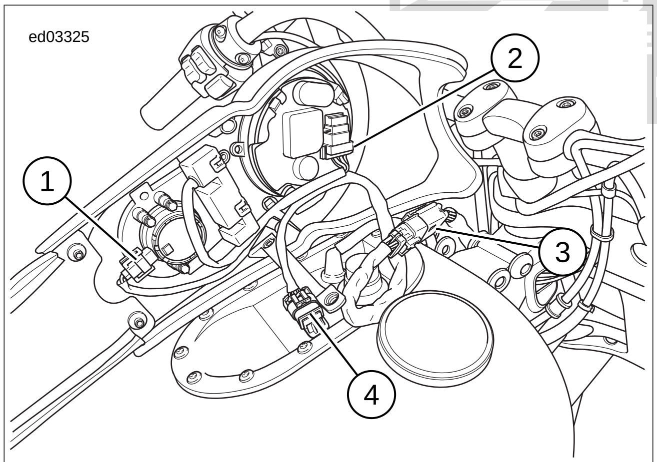
COMPONENT LOCATIONS

Some components and connectors are not easily located. The following figures show locations for these components and connectors. The figures are generally ordered from front to back around the motorcycle.



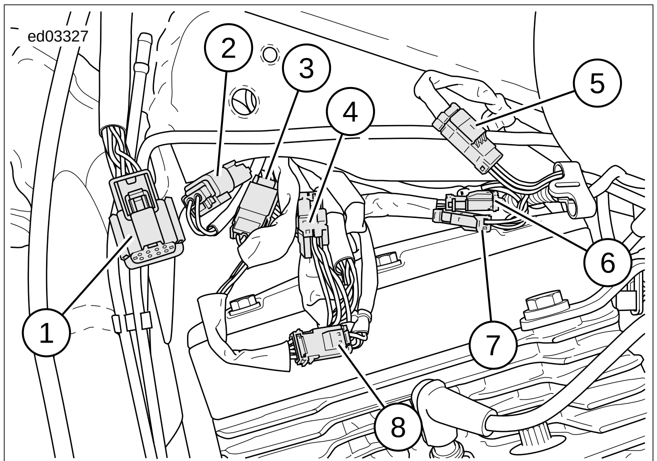
1. **Headlamp connector**
2. **Position lamp connector**
3. **Headlamp housing**

Figure A-98. Behind Headlamp



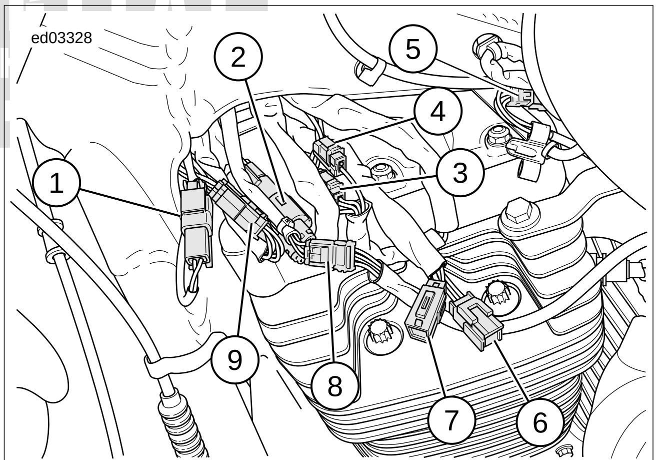
1. **Ignition switch [33]**
2. **Speedometer [39]**
3. **Console gauges/instrument lamps [20]**
4. **Fuel pump [141]**

Figure A-99. Under Console: Typical



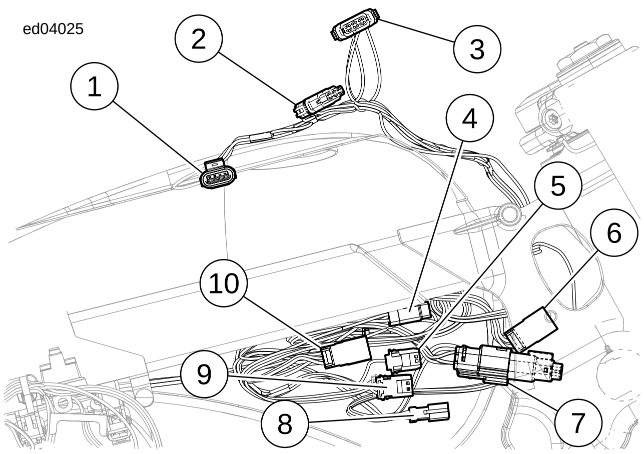
1. **Console gauges/instrument lamps [20]**
2. **Front WSS (ABS only) [167]**
3. **Left front turn signal [31LA]**
4. **Right front turn signal [31RA]**
5. **Fuel gauge [117]**
6. **Right hand control [22-2]**
7. **Right hand control [22-1]**
8. **Left hand control [24]**

Figure A-100. Under Fuel Tank (IAC): Except FXDB



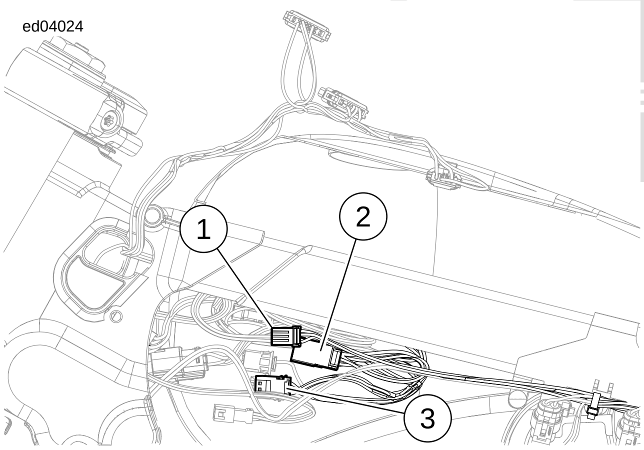
1. **Ignition switch [222]**
2. **Console gauges/instrument lamps [20]**
3. **Right hand control [22-2]**
4. **Right hand control [22-1]**
5. **Fuel gauge [117]**
6. **Right directional and DOM running lamp [31RA]**
7. **Left directional and DOM running lamp [31LA]**
8. **Left hand control [24]**
9. **Headlamp [38]**

Figure A-101. Under Fuel Tank (IAC): FXDB



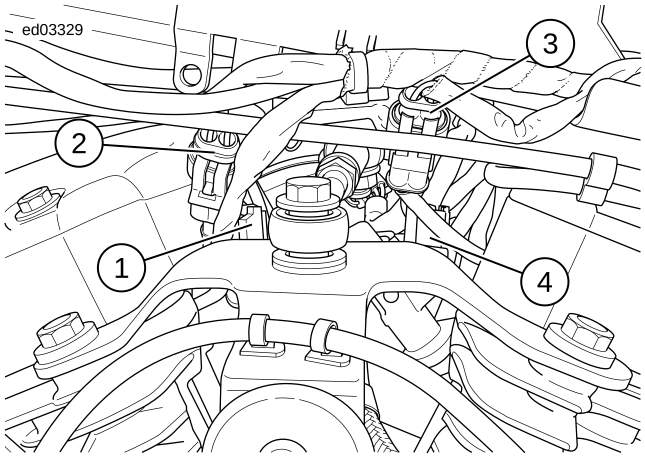
1. Fuel pump [141]
2. Tachometer [108]
3. Speedometer [39]
4. Front WSS [167]
5. RHCM [22-2]
6. Headlamp [38]
7. Console [20]
8. TGS [204]
9. RHCM [22-1]
10. Right turn [31R]

Figure A-102. Under Fuel Tank Right Side: ETC



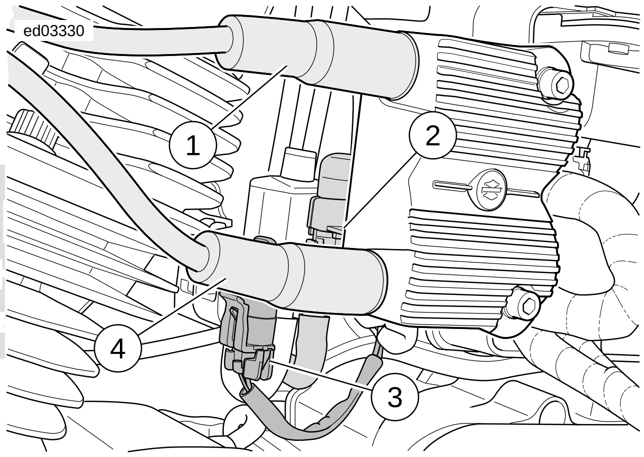
1. Fuel gauge [117]
2. Left turn [31L]
3. LHCM [24]

Figure A-103. Under Fuel Tank Left Side: ETC



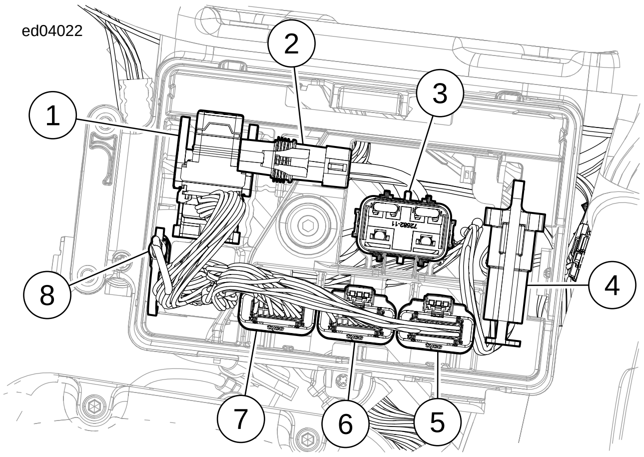
1. Front fuel injector [84]
2. Front ACR [203F]
3. Rear ACR [203R]
4. Rear fuel injector [85]

Figure A-104. Between Cylinders Left Side



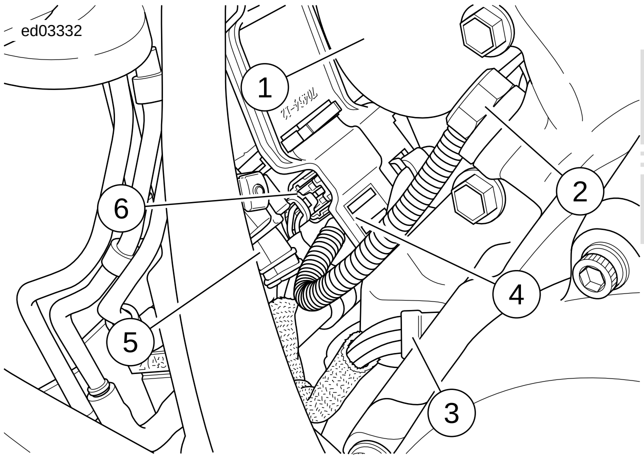
1. Rear spark plug cable
2. Ignition coil [83]
3. Purge solenoid [95]
4. Front spark plug cable

Figure A-105. Ignition Coil



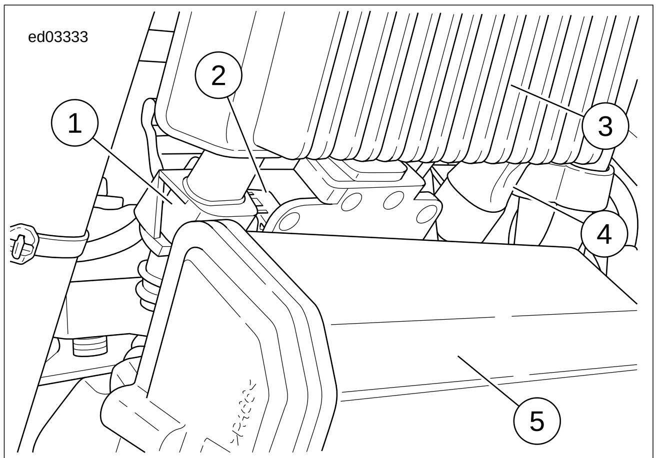
1. BCM [242]
2. BCM power [259]
3. Fuse block [64]
4. DLC [91]
5. ECM [78-3] (BN) (if applicable)
6. ECM [78-2] (GY)
7. ECM [78-1] (BK)
8. Battery tender [281] (if applicable)

Figure A-106. Under Left Side Cover



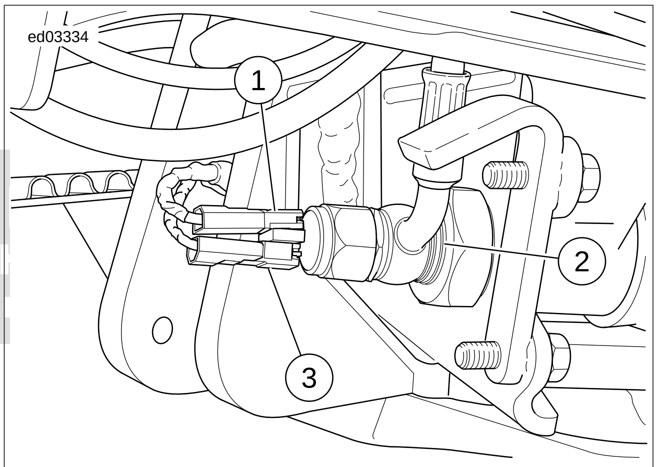
1. Oil filter
2. CKP sensor
3. Stator
4. CKP sensor [79]
5. Voltage regulator [47]
6. Front HO2S [138]

Figure A-107. Voltage Regulator



1. Voltage regulator [77]
2. Front HO2S [138]
3. Voltage regulator
4. Voltage regulator [47]
5. Purge canister (if equipped)

Figure A-108. Purge Canister



1. Rear brake switch [121A]
2. Rear brake line
3. Rear brake switch [121B]

Figure A-109. Rear Brake Switch

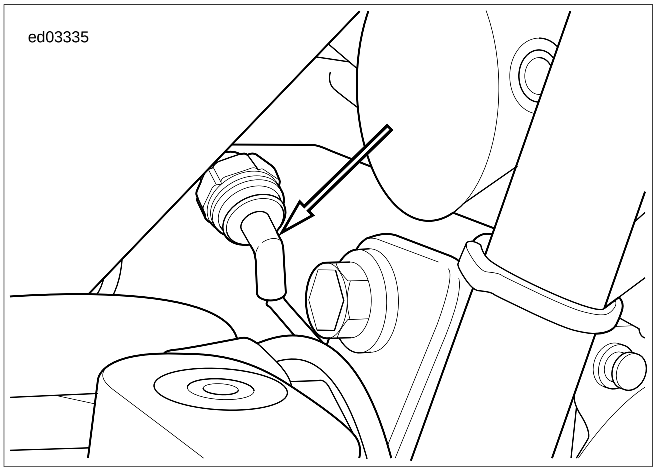
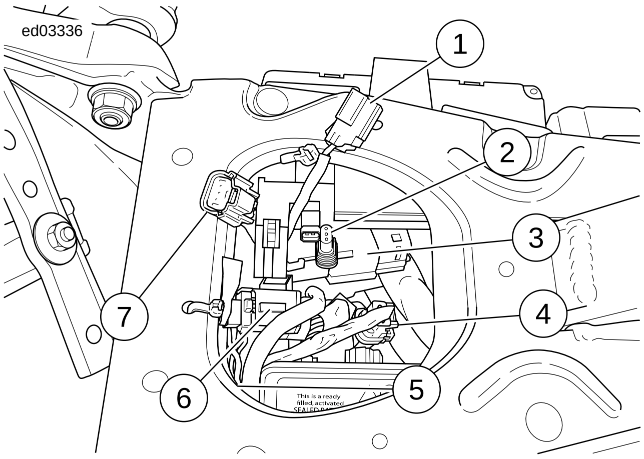
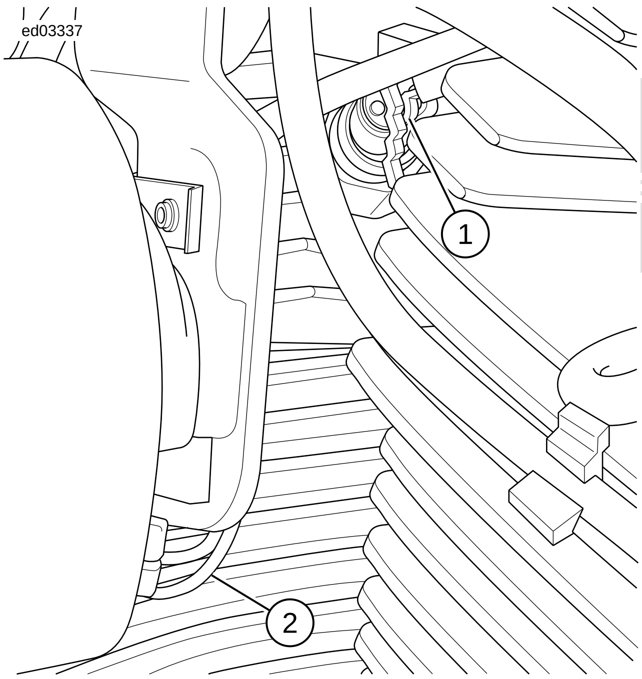


Figure A-110. Oil Pressure Switch [120]



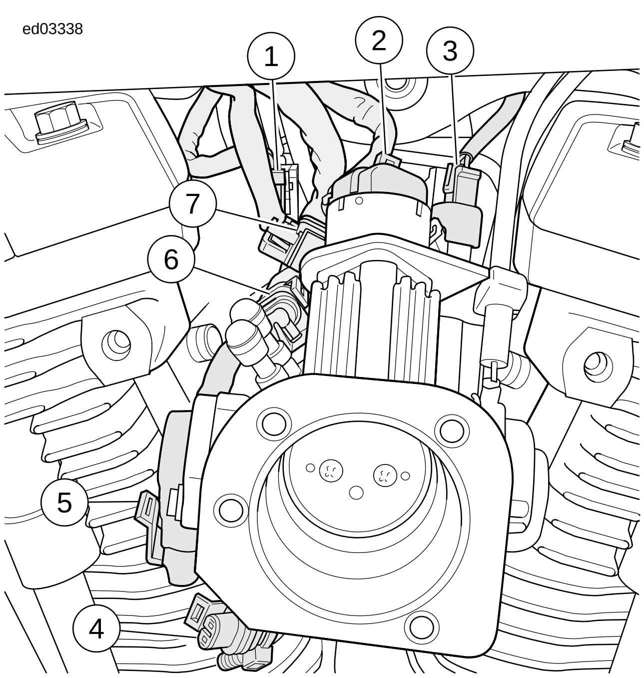
1. Security antenna [209]
2. Security siren [142]
3. Rear HO2S [137]
4. Rear WSS [168]
5. Grounds
6. Rear lighting [7]
7. JSS [133]

Figure A-111. Under the Seat



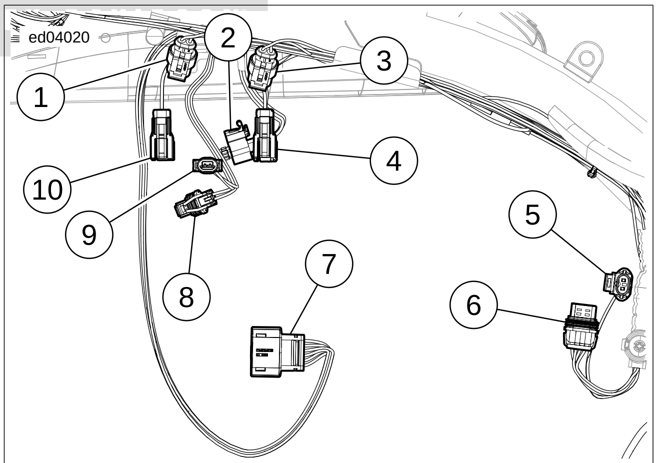
1. ET sensor [90]
2. Horn [122]

Figure A-112. Horn and ET Sensor



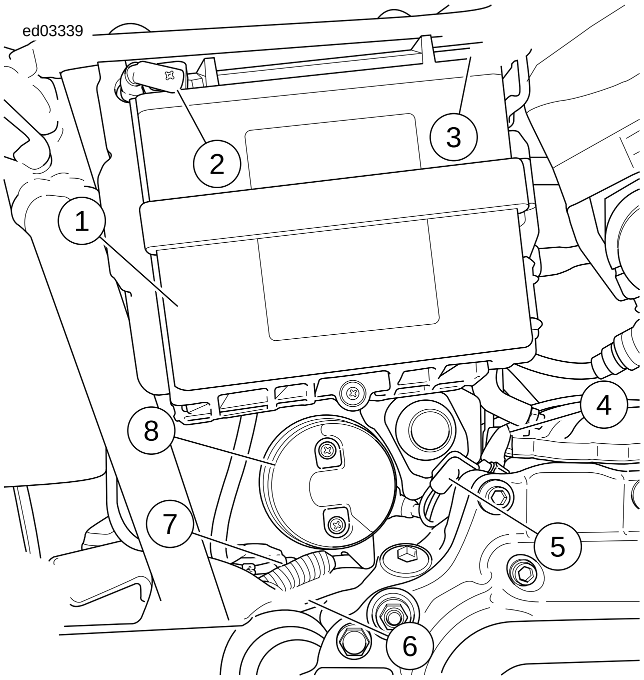
1. Rear fuel injector [85]
2. IAC [87]
3. Front fuel injector [84]
4. Active intake solenoid [178]
5. TPS [88]
6. IAT sensor [89]
7. MAP sensor [80]

Figure A-113. Between Cylinders Right Side: IAC



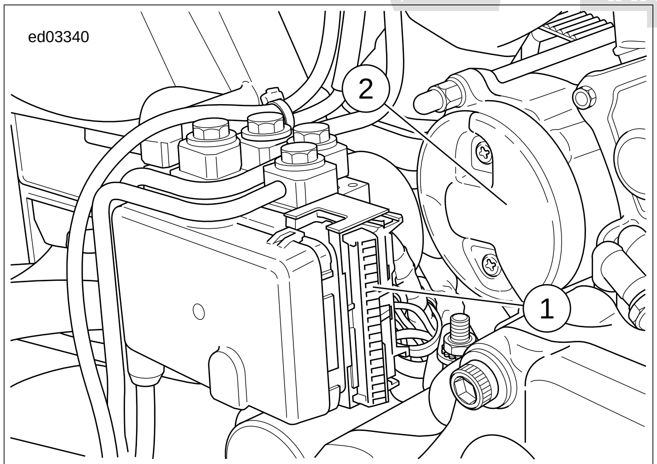
1. Front ACR [230]
2. TMAP [80]
3. Rear ACR [230]
4. Rear fuel injector [85]
5. Purge solenoid [95]
6. Ignition coil [83]
7. TCA [211]
8. ET sensor [90]
9. Ignition switch [33]
10. Front fuel injector [84]

Figure A-114. Engine: ETC



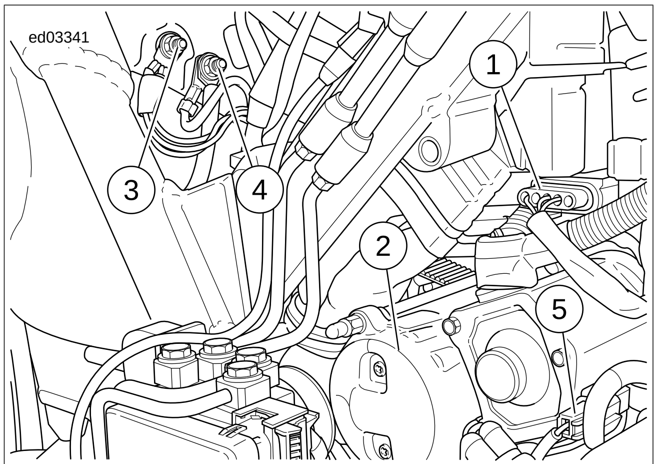
1. **Battery**
2. **Battery negative**
3. **Battery positive**
4. **Starter solenoid [128]**
5. **Neutral switch [131]**
6. **Battery ground cable**
7. **VSS [65]**
8. **Starter**

Figure A-115. Under Right Side Cover



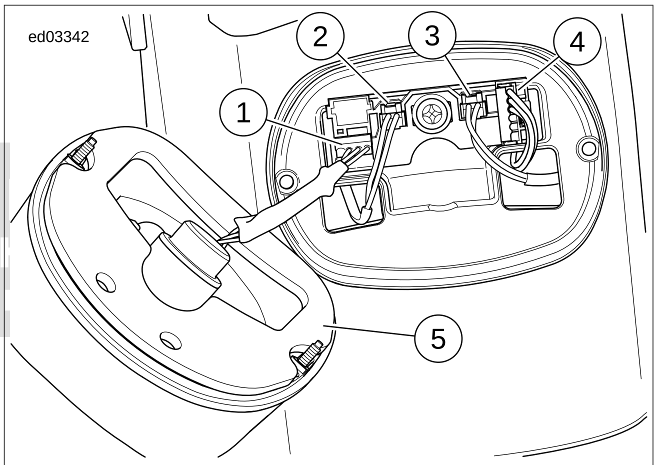
1. **ABS EHCU [166] (if equipped)**
2. **Starter**

Figure A-116. Under Right Side Cover: ABS



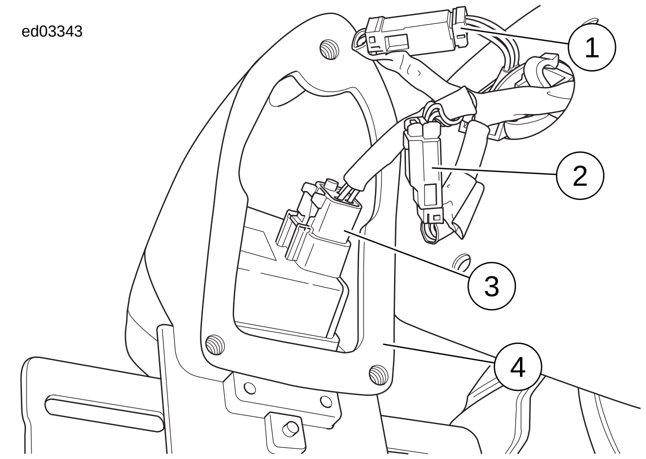
1. **Active exhaust [179]**
2. **Starter**
3. **GND 1**
4. **GND 2**
5. **Starter solenoid [128]**

Figure A-117. Active Exhaust



1. **Tail lamp [93]**
2. **Left rear turn signal [19]**
3. **Right rear turn signal [18]**
4. **Tail lamp power in [94]**
5. **Tail lamp**

Figure A-118. Tail Lamp: With Circuit Board (Non-LED)



1. Left rear turn signal [19]
2. Right rear turn signal [18]
3. Lamp module [40]
4. Tail lamp assembly

Figure A-119. Tail Lamp: FXDB/P

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NOTES

BOSCH COMPACT 1.1M SEALED CONNECTORS B.1

BOSCH COMPACT 1.1M CONNECTOR

PART NUMBER	TOOL NAME
GA500A	SNAP-ON TERMINAL PICK

See Figure B-1. The Bosch Compact 1.1M connector is found on MAP and TMAP sensors.

Separating Connector

See Figure B-1. Snap back the secondary lock. Press on the latch while pulling the connector from the sensor.

Mating Connector

1. Align the connector housings.
2. Press the housings together until the locking tab snaps into place.

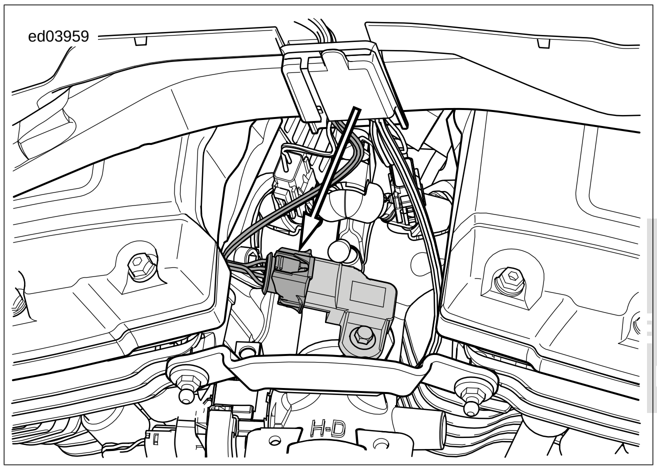


Figure B-1. Bosch Compact 1.1M Connector

Terminal Removal

1. See Figure B-2. Slide the locking bar off the terminal housing.
2. Insert the smallest pins of the SNAP-ON TERMINAL PICK (Part No. GA500A) into the gaps on each side of the terminal to compress the tangs on each side of the terminal.
3. Gently pull on the wire to remove the terminal.

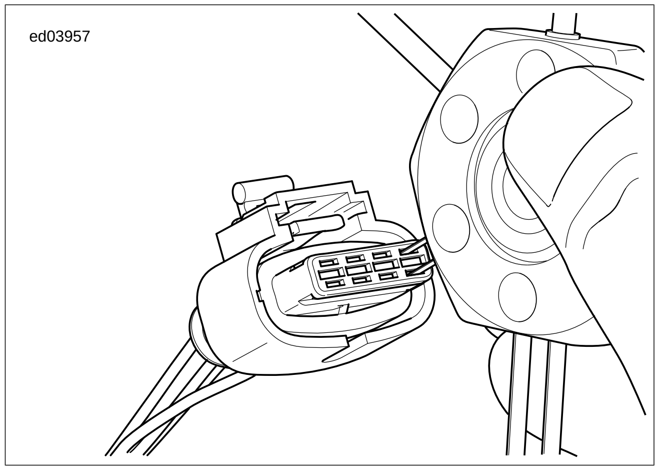


Figure B-2. Terminal Removal: Bosch Compact 1.1M Connector

Installing Terminal

1. See Figure B-3. Use a hobby knife to bend the tangs on each side of the terminal outward.
2. Align terminal to connector. Press terminal into connector until it snaps.

NOTE

The teeth on the locking bar face down.

3. Slide the locking bar onto the connector.

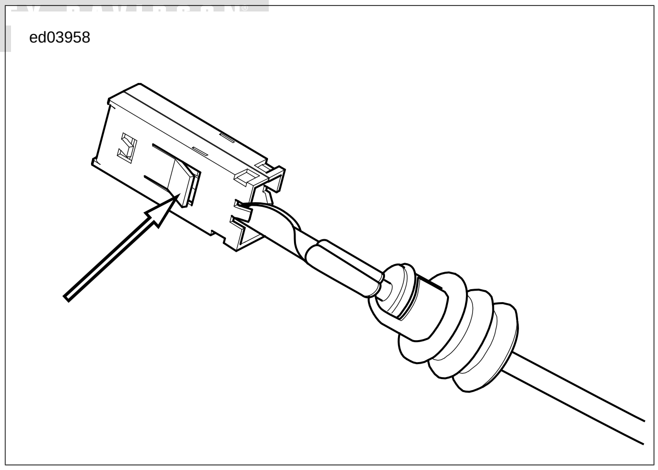


Figure B-3. Tangs: Bosch Compact 1.1M Terminal

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. DO NOT re-use a terminal by removing the wire.

DELPHI GT SEALED CONNECTORS B.2

DELPHI GT SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR
HD-38125-6	DELPHI SEALED CRIMPER

Delphi GT 150 connectors are typically used on fuel gauge, ignition coil and VSS. The GT 280 sealed connectors are used to connect to the fuel pump and sender.

See Figure B-4. The plug assembly consists of housing with connector cavities, terminals, secondary lock, wire seals, safety lock, mating seal and primary lock.

NOTE

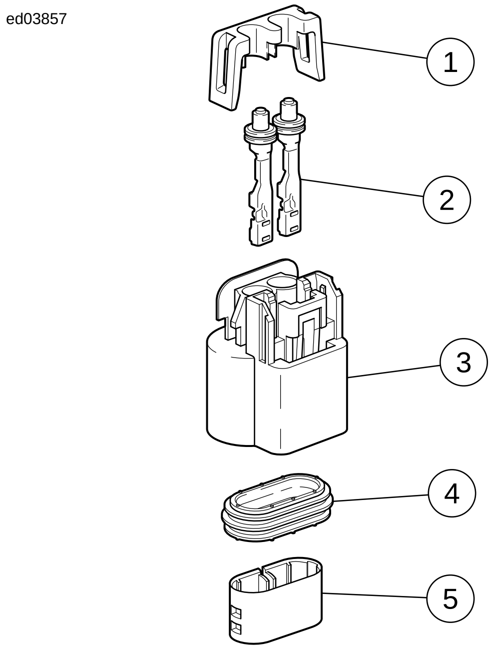
Use DELPHI SEALED CRIMPER (Part No. HD-38125-6) for Delphi GT sealed terminal crimping. Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

See Figure B-5. Press connector release (A), separate the two halves (B).

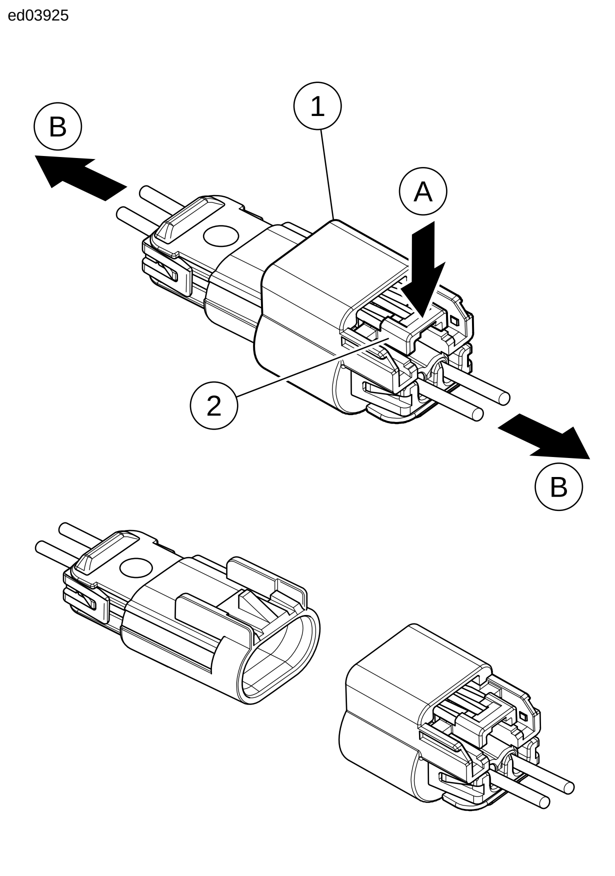
Mating Connector

Push the halves of connector together until external latch(es) engage.



1. **Secondary lock**
2. **GT 280 female terminals**
3. **Connector housing 2-way**
4. **Seal**
5. **Primary lock**

Figure B-4. Exploded View

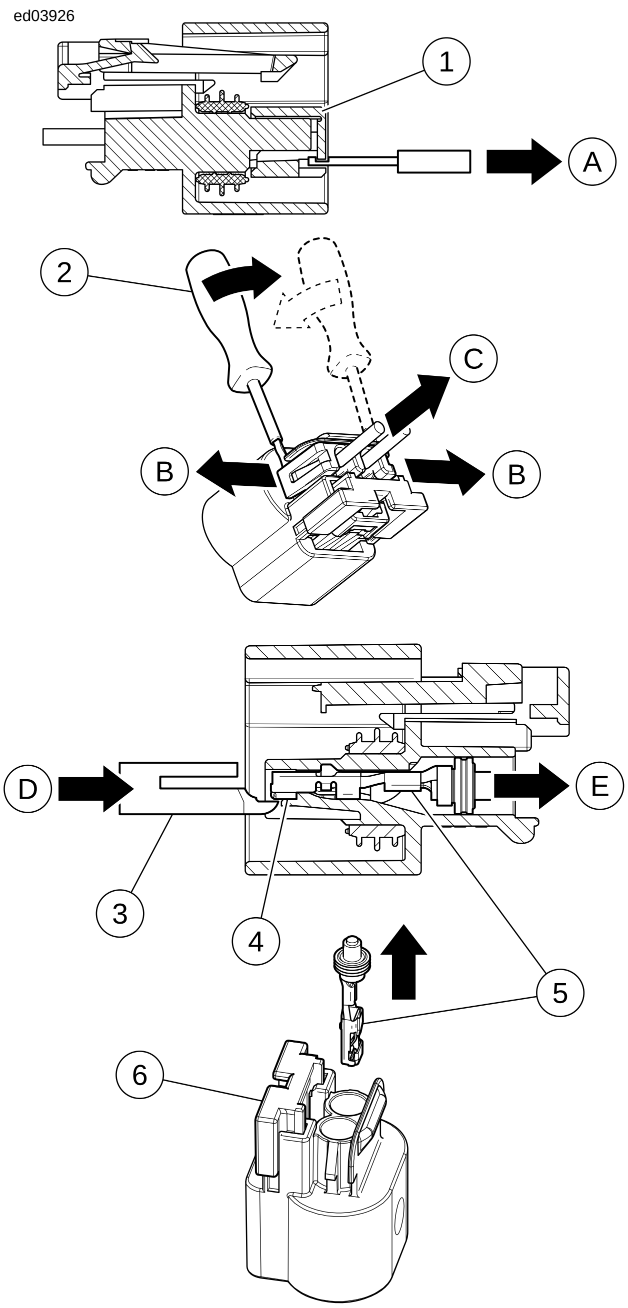


1. **Connector housing**
2. **Connector release**

Figure B-5. Disconnect

Terminal Removal

1. See Figure B-6. Using TERMINAL EXTRACTOR (Part No. B-50085), completely remove the primary lock.
2. Release the two locks and remove the secondary lock.
3. From the front of the cavity, locate the terminal lock. Insert the removal tool straight into the cavity, deflect the terminal lock and release the terminal. Gently pull on the wire to remove terminal from the connector.



1. **Primary lock**
2. **Removing secondary lock**
3. **Removal tool**
4. **Terminal lock**
5. **Terminal**
6. **Connector housing**

Figure B-6. Terminal Removal

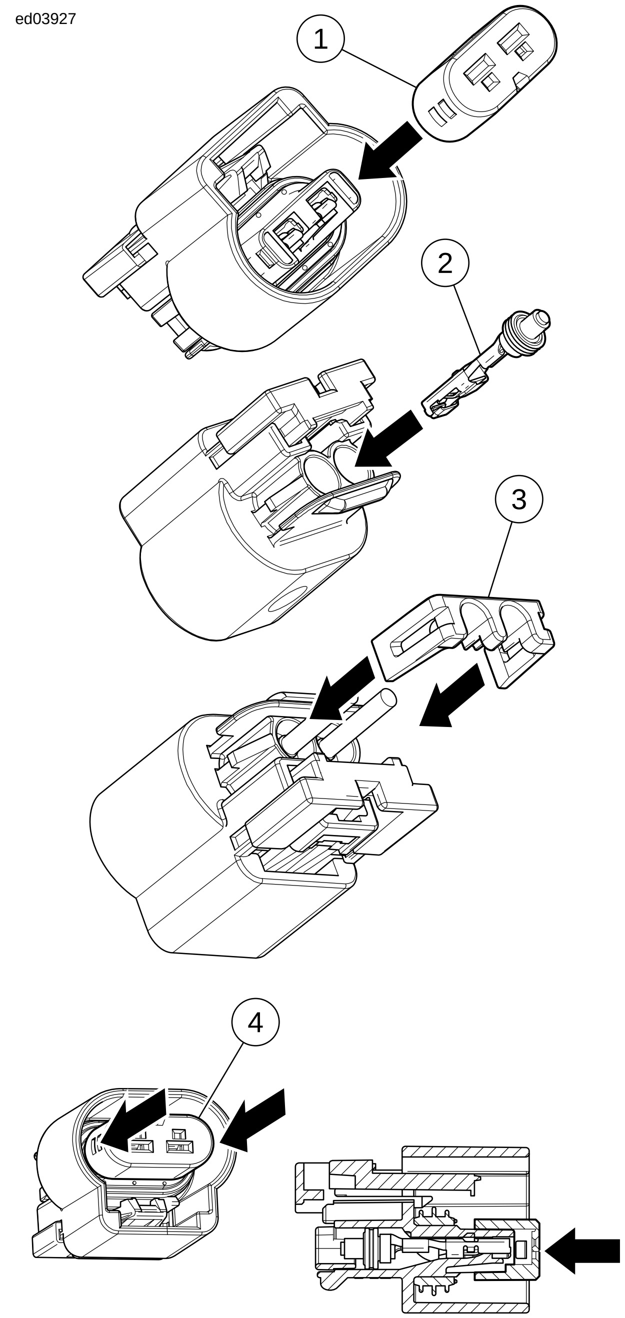
Installing Terminals

1. See Figure B-7. Insert the primary lock into the outer most position on the connector.

NOTE

Proper orientation of terminal required.

2. Insert terminals into connector housing.
3. Insert secondary lock onto cavity until locked.
4. Install primary lock until it is locked in position.



1. **Primary lock**
2. **Terminal**
3. **Secondary lock**
4. **Primary lock**

Figure B-7. Terminal Installation

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. DO NOT re-use a terminal by removing the wire.

DELPHI METRI-PACK SEALED CONNECTORS B.3

DELPHI METRI-PACK SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-38125-6	DELPHI SEALED CRIMPER
HD-38125-7	DELPHI UNSEALED CRIMPER

There are two types of connectors in this series:

- Pull-to-Seat
- Push-to-Seat

NOTES

- *Use DELPHI SEALED CRIMPER (Part No. HD-38125-6) for push-to-seat Delphi Metri-Pack terminal crimping.*
- *Use DELPHI UNSEALED CRIMPER (Part No. HD-38125-7) for pull-to-seat Delphi Metri-Pack terminal crimping.*

Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

Pry up on the external latch slightly and separate the connector.

Mating Connector

Push the halves of the connector together.

Terminal Removal Push-to-Seat

NOTES

- *The same process is followed for both the male and female ends of the push to seat connectors.*
- *For best results, free one side of the secondary lock first and then release the other side.*

1. See Figure B-8. Remove secondary lock from wire end of connector.
2. Find the locking tang in the mating end of the connector.

NOTES

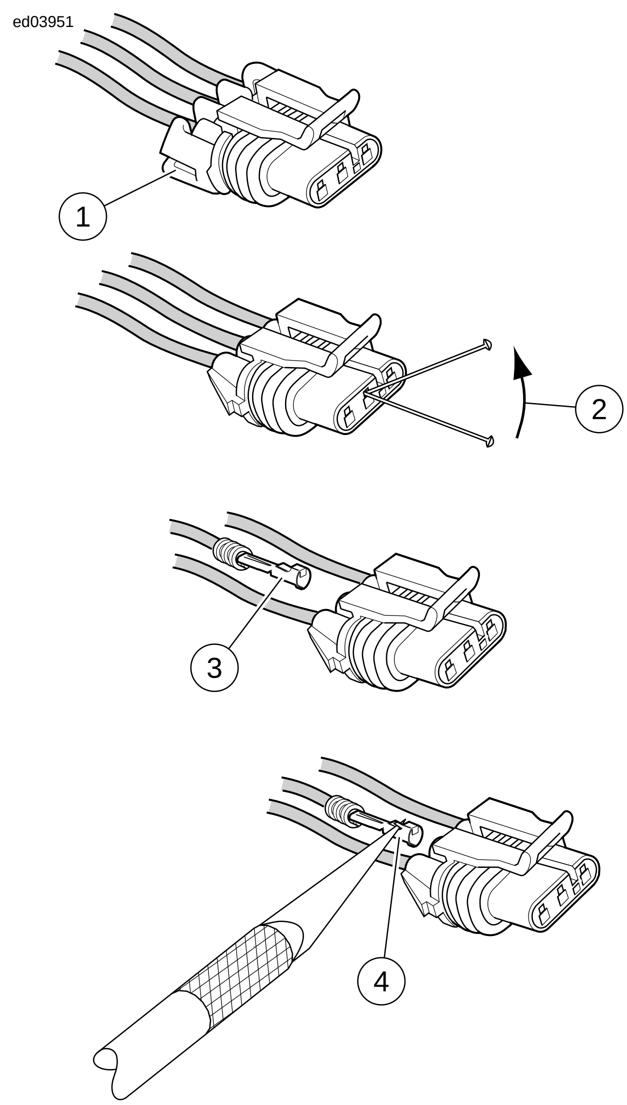
- *The tangs are always positioned in the middle of the cavity on the same side as the external latch.*
- *There is a small opening for the pin.*

3. Gently insert a small diameter straight pin into the cavity about 1/8 in (3.2 mm).

NOTE

The click is the sound of the tang returning to the locked position as it slips from the point of the pin.

4. Pick at the tang until the clicking stops and the pin seems to slide in deeper. This indicates the tang is pressed in.
5. Pull on the lead to draw the terminal out the wire end.



1. **Remove wire lock**
2. **Pivot pin to release tang**
3. **Pull to remove**
4. **Raise tang to install**

Figure B-8. Removing Delphi Metri-Pack Sealed Connector: Push-to-Seat

Terminal Removal Pull-to-Seat

NOTE

The tangs are always positioned in the middle of the cavity. The tangs are on the same side as the external latch.

1. See Figure B-9. Find the locking tang in the mating end of the connector.

NOTE

Stay between the terminal and the cavity wall and pivot the end of the pin toward the terminal body.

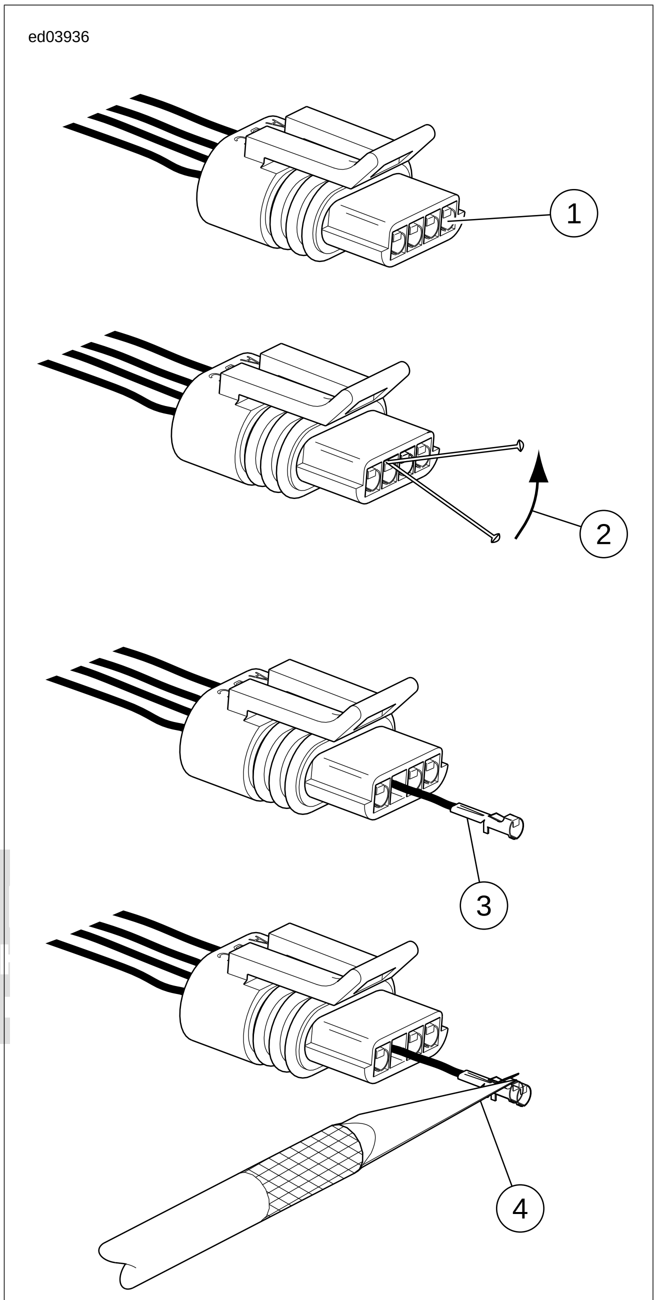
2. Gently insert a small diameter straight pin into the cavity about 1/8 in (3.2 mm).

NOTE
The click is the sound of the tang returning to the locked position as it slips from the point of the pin.

3. When a click is heard, remove the pin and repeat the procedure.

NOTE
After repeated terminal extractions, the click may not be heard, but pivot the pin as if the click was heard at least three times.

4. Pick at the tang until the clicking stops and the pin seems to slide in deeper. This indicates the tang is pressed in.
5. Push on the lead to extract the terminal from the mating end of the connector.

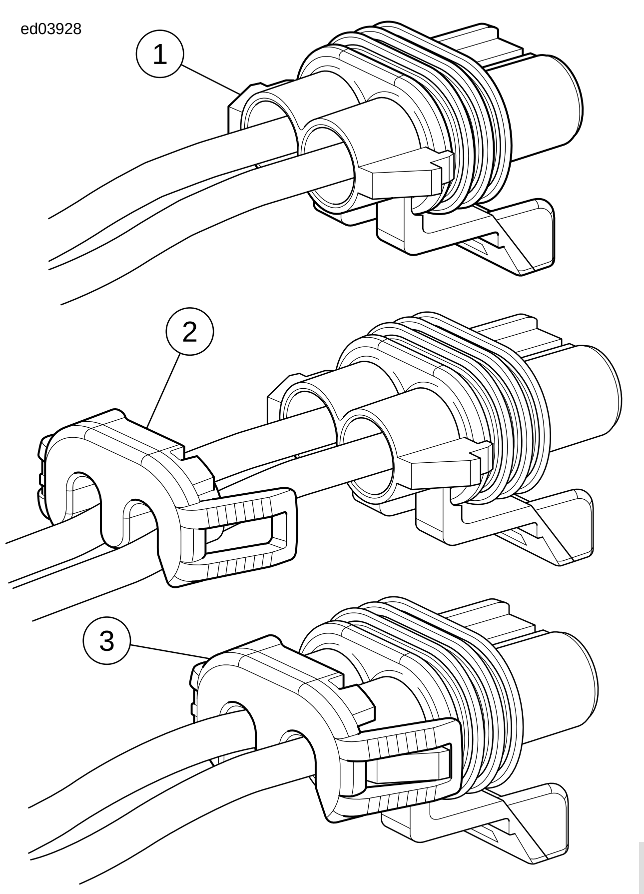


1. **Locate tang in cavity**
2. **Pivot pin to release tang**
3. **Push to remove**
4. **Raise tang to install**

Figure B-9. Delphi 150.2 Metri-Pack Sealed Connector: Pull-to-Seat

Installing Terminal Push-to-Seat

1. See Figure B-10. Plug terminals into connector assembly.
2. After all leads are plugged, install secondary lock to connector.
   a. Hold connector as shown and install secondary lock.
   b. Position secondary locks with corresponding grooves and verify one lead per cavity. Apply pressure with fingers until secondary lock snaps into place.



1. **Insert terminals into connector**
2. **Install secondary lock**
3. **Locked**

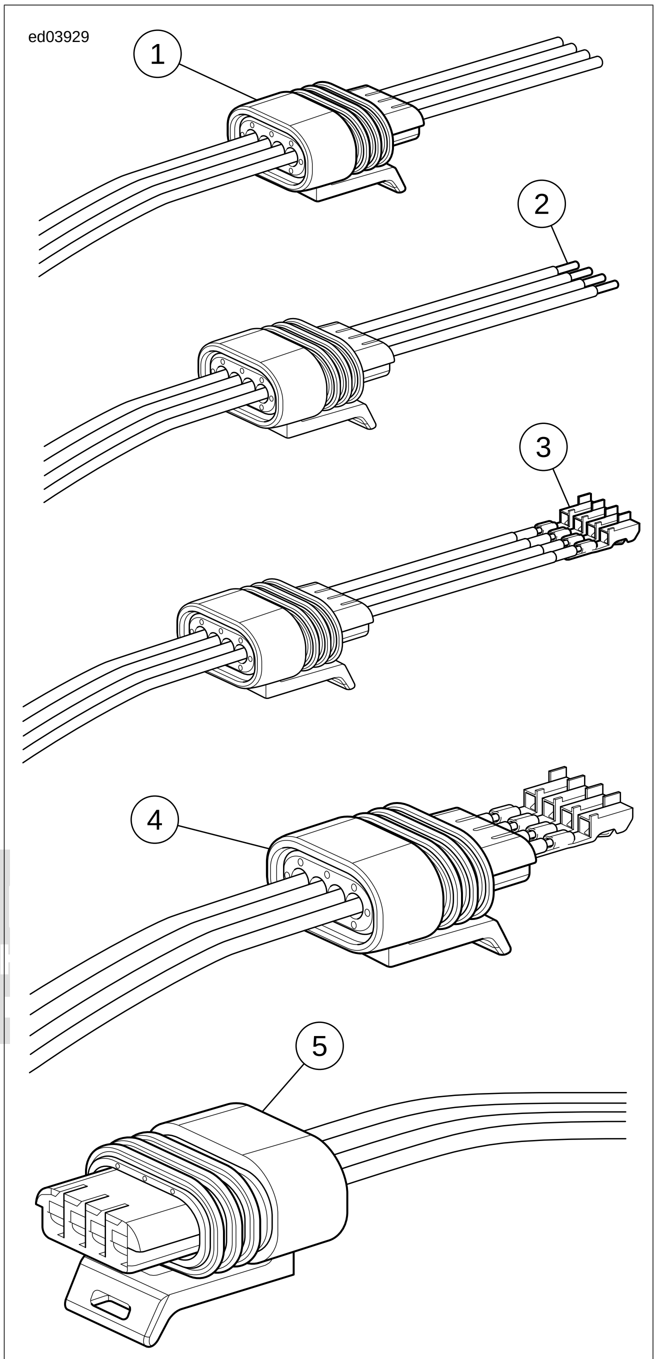
Figure B-10. Insert Terminals Push-to-Seat

Installing Terminal Pull-to-Seat

NOTE

Leads must be blunt cut for this operation.

1. See Figure B-11. Push wire leads through cable seal at least 8 in. (203 mm).
2. Strip each wire lead to the required length for the terminal being applied.
3. Crimp terminals on wire ends
4. Align the terminals with the locating tabs in the cavity and pull wires back through connector to install the terminal.
5. Verify terminal is fully seated in the terminal cavity.



1. **Push wire leads through cable seal**
2. **Strip each wire lead**
3. **Crimp terminals on wire ends**
4. **Pull wires back through connector**
5. **Verify terminal is fully seated**

Figure B-11. Inserting Terminal Pull-to-Seat

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

DELPHI MICRO 64 SEALED CONNECTORS B.4

DELPHI MICRO 64 SEALED CONNECTOR REPAIR

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

Delphi Micro 64 Sealed connectors are frequently found on speedometers and tachometers.

NOTE

Use TERMINAL CRIMPER (Part No. HD-45929) for Delphi Micro 64 terminal crimping. Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

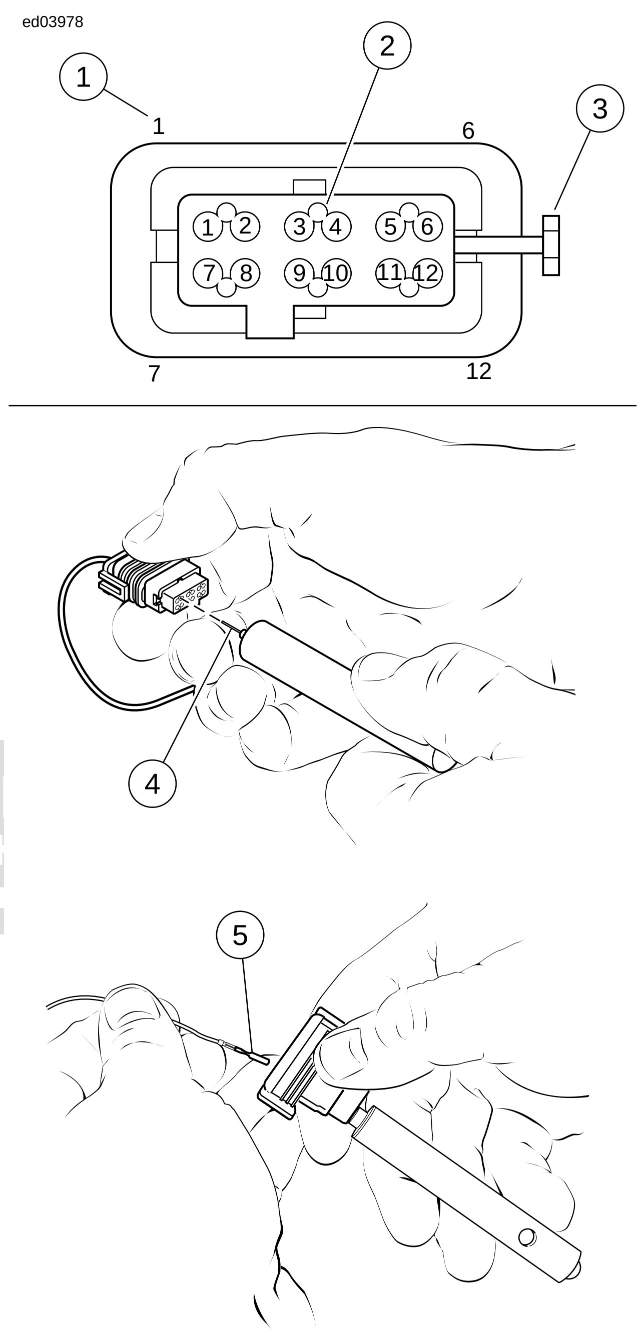
Bend back the external latches slightly and separate the connector.

Mating Connector

Align the terminals and press the connector together until the latch snaps.

Terminal Removal

1. See Figure B-12. Locate the head of the secondary lock on one side of the connector housing.
2. Insert the blade of a small screwdriver between the center ear of the lock and the connector housing and gently pry out lock. When partially removed, pull lock from connector housing.
3. Locate pin hole between terminals on mating end of connector.



1. **Stamped number**
2. **Pin hole**
3. **Secondary lock**
4. **Insert terminal remover**
5. **Remove terminal**

Figure B-12. Terminal Removal

4. Obtain the TERMINAL REMOVER (Part No. HD-45928).
5. Push the adjacent terminals all the way into the connector housing and then insert tool into hole until it bottoms.

6. Leaving the tool installed, gently tug on wires to pull either one or both terminals from wire end of connector. Remove tool.

Installing Terminal

1. Insert terminal into its respective numbered cavity on wire end of connector. No special orientation of the terminal is necessary.

NOTE

For wire location purposes, the corners of the connector are stamped with the numbers 1, 6, 7 and 12, representing terminals 1-6 on one side, and 7-12 on the other.

2. Bottom the terminal in the cavity and then gently tug on the wire to verify that it is locked in place.

NOTE

Once removed, the terminal may not lock in place when first installed. Until the lock engages, move the terminal back and forth slightly while wiggling the lead.

3. Since the terminal remover tool releases two terminals simultaneously, repeat step 2 on the adjacent terminal even if it was not pulled from the connector housing.
4. With the center ear on the head of the secondary lock facing the mating end of the connector, push secondary lock in until head is flush with the connector housing.

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

DEUTSCH DT SEALED CONNECTORS B.5

DEUTSCH DT AND DTM SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-39965-A	DEUTSCH CRIMPER
HD-41475	DEUTSCH TERMINAL REPAIR KIT
HD-41475-100	FLAT BLADE L-HOOK
HD-42879	DEUTSCH CRIMPER

A DEUTSCH TERMINAL REPAIR KIT (Part No. HD-41475) contains a selection of seals and seal plugs, locking wedges, attachment clips and terminals. Also included is a FLAT BLADE L-HOOK (Part No. HD-41475-100) used to remove locking wedges, compartmented storage box and carrying case.

NOTES

- *Use the DEUTSCH CRIMPER (Part No. HD-39965-a) for non-solid barrel terminal crimping.*
- *Use the DEUTSCH CRIMPER (Part No. HD-42879) for solid barrel terminal crimping.*

Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

See Figure B-13. To separate the connector halves, Press the external latch(es) on the connector while rocking the connector halves, and pull.

NOTES

- *Six-place and smaller Deutsch connectors have one latch on the connector.*
- *Eight- and twelve-place connectors have a latch on each side. Simultaneously press both latches to separate the connector.*

Mating Connector

1. Align the connectors to match the wire lead colors.
   a. **For One External Latch:** To join the halves, align the latch on the socket side with the latch cover on the pin side.
   b. **For Two External Latches:** Align the tabs on the connector halves.

NOTE

For Two External Latches: *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.*

2. Insert the two halves together until it locks into place.

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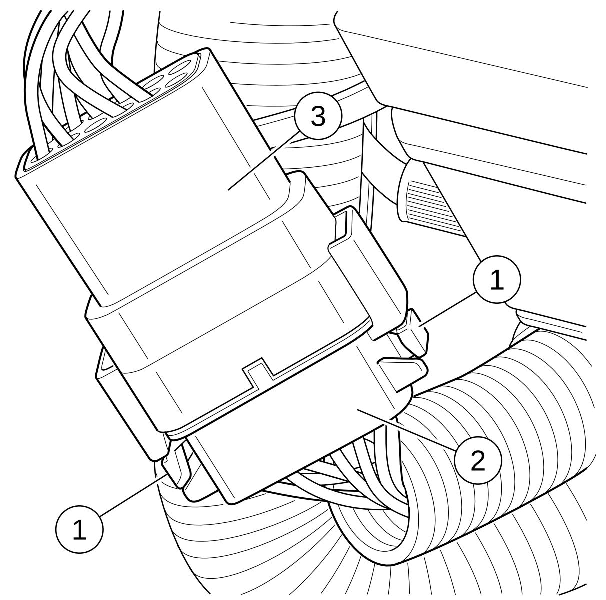
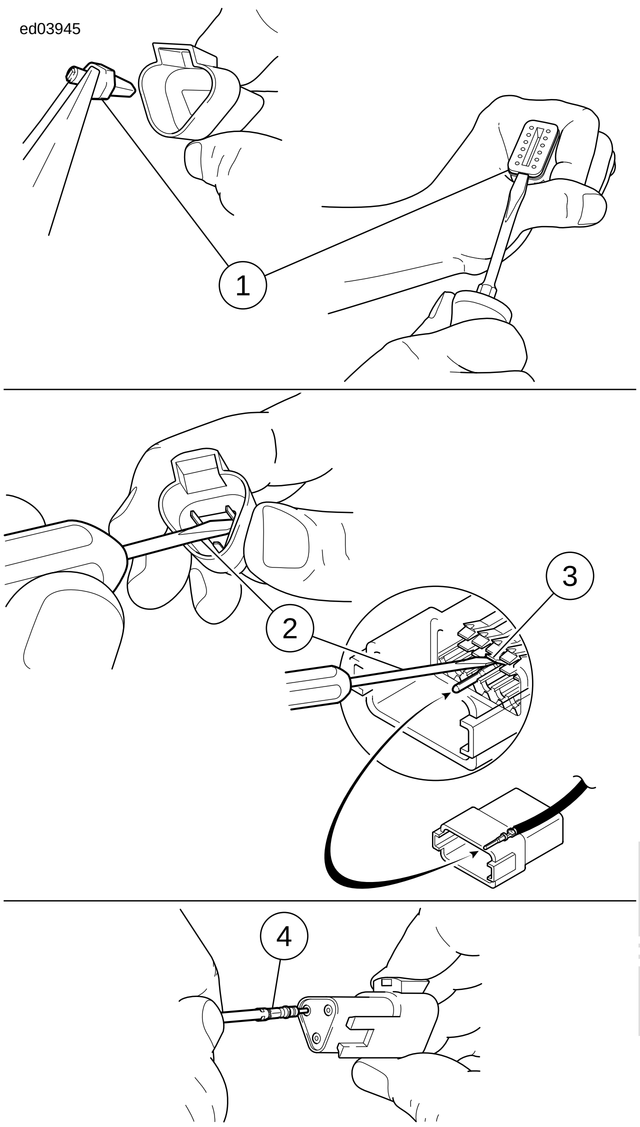


1. **External latch**
2. **Socket housing**
3. **Pin housing**

Figure B-13. Deutsch DT Sealed Connector

Terminal Removal

1. See Figure B-14. Remove wedgelock using needlenose pliers or removal tool.
2. To remove the terminals, gently pull wire backwards, while at the same time releasing the locking finger by moving it away from the terminal with a screwdriver.
3. Hold the rear seal in place when pulling terminal/wire out, as removing the terminal may displace the seal.



1. **Remove wedgelock**
2. **Releasing locking finger**
3. **Locking finger**
4. **Remove terminal**

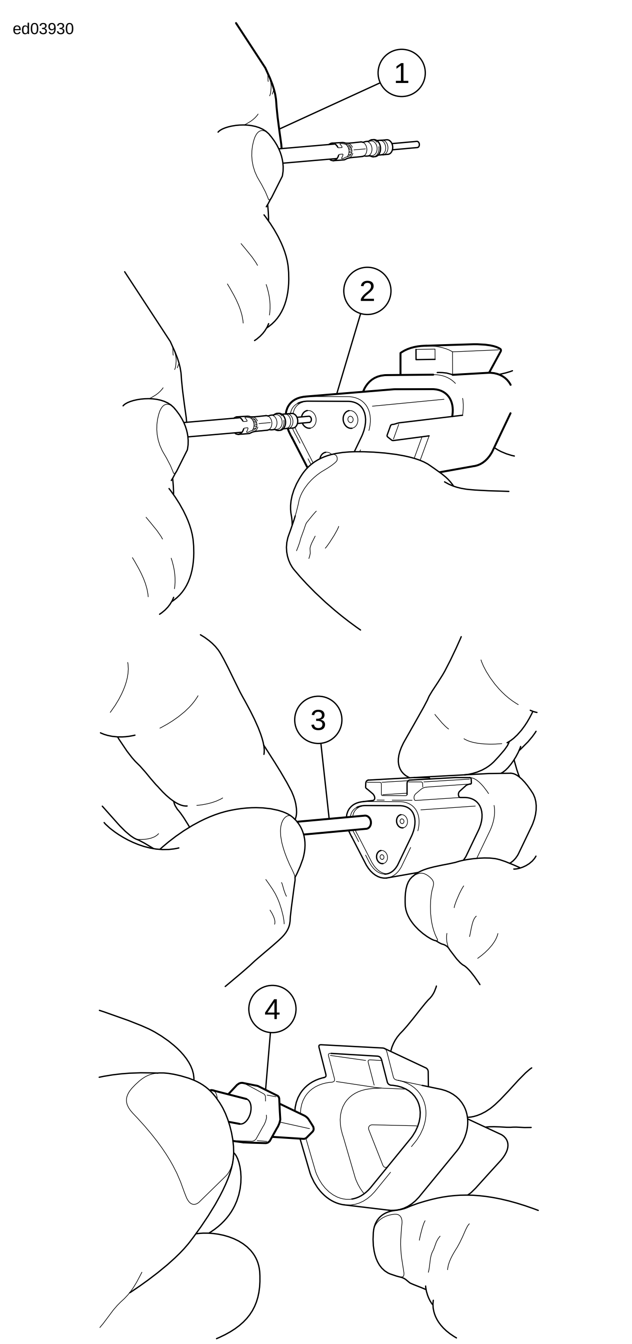
Figure B-14. Terminal Removal

Installing Terminal

NOTE

The receptacle is shown. Use the same procedure for plug.

1. See Figure B-15. Grasp terminal approximately 1.0 in. (25.4 mm) behind the terminal barrel.
2. Push terminal straight into connector grommet until a click is felt.
3. Gently pull on the wire to confirm that it is properly locked in place.
4. Once all terminals are in place, insert wedgelock. The wedgelock will snap into place.



1. **Grasp terminal**
2. **Hold connector**
3. **Insert terminal**
4. **Insert wedgelock**

Figure B-15. Inserting Terminals

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. DO NOT re-use a terminal by removing the wire.

JAE MX19 SEALED CONNECTORS B.6

JAE MX19 SEALED CONNECTORS

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR
HD-50120-2	HAND CRIMP FRAME
HD-50120-6	DIE SET

The plug assembly consists of a wire seal (part of housing), housing and two terminals.

NOTE

Use HAND CRIMP FRAME (Part No. HD-50120-2) with DIE SET (Part No. HD-50120-6) for JAE MX19 series terminal crimping. Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

See Figure B-16. Press the latch while pulling the connector halves apart.

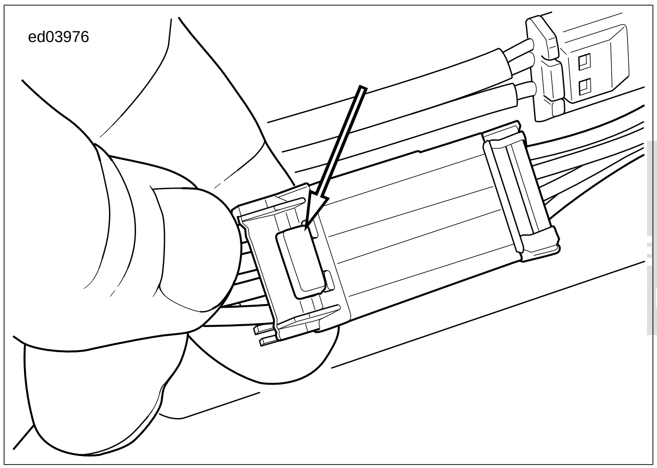


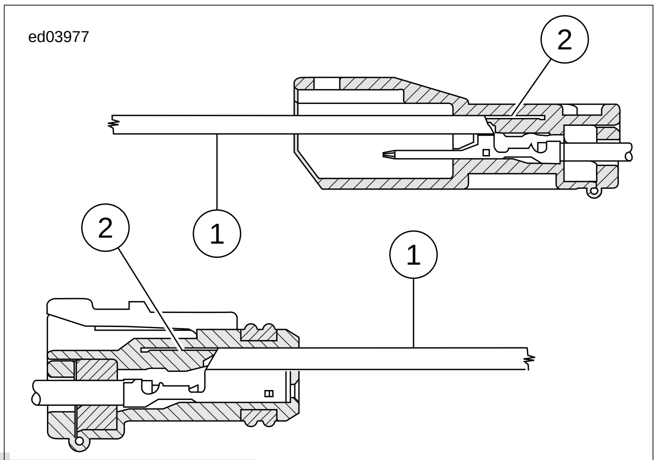
Figure B-16. Release Button

Mating Connector

Align the terminals and press the connectors together until the latch snaps.

Terminal Removal

1. Modify a TERMINAL EXTRACTOR (Part No. B-50085) by filing the front edge to 45 degrees.
2. See Figure B-17. Insert the extractor into the opening above the terminal and press the plastic molding up and out of the way.
3. Pull the wire lead and terminal out of the back of the connector.



1. **Terminal extractor**
2. **Connector**

Figure B-17. Terminal Removal

Installing Terminal

1. Inspect the connector housing and replace if necessary.
2. Orient the terminal to the housing. Push terminal into housing until it clicks into place.

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

JST JWPF SEALED CONNECTORS B.7

JST JWPF SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR
HD-50120-11	DIE SET
HD-50120-2	HAND CRIMP FRAME

The plug assembly consists of a wire seal (part of housing), housing, yellow secondary, two terminals, and one red mating seal. The mating seal provides a tight closure for mated connectors.

NOTE

Use HAND CRIMP FRAME (Part No. HD-50120-2) with DIE SET (Part No. HD-50120-11) for JST JWPF series terminal crimping. Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

See Figure B-18. Press the release buttons while pulling the connector halves apart.

Mating Connector

1. Align the connectors so the latches line up.
2. Press together until locked.

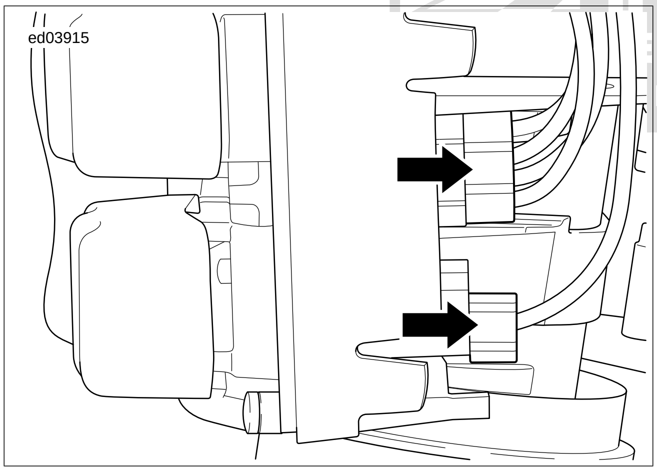
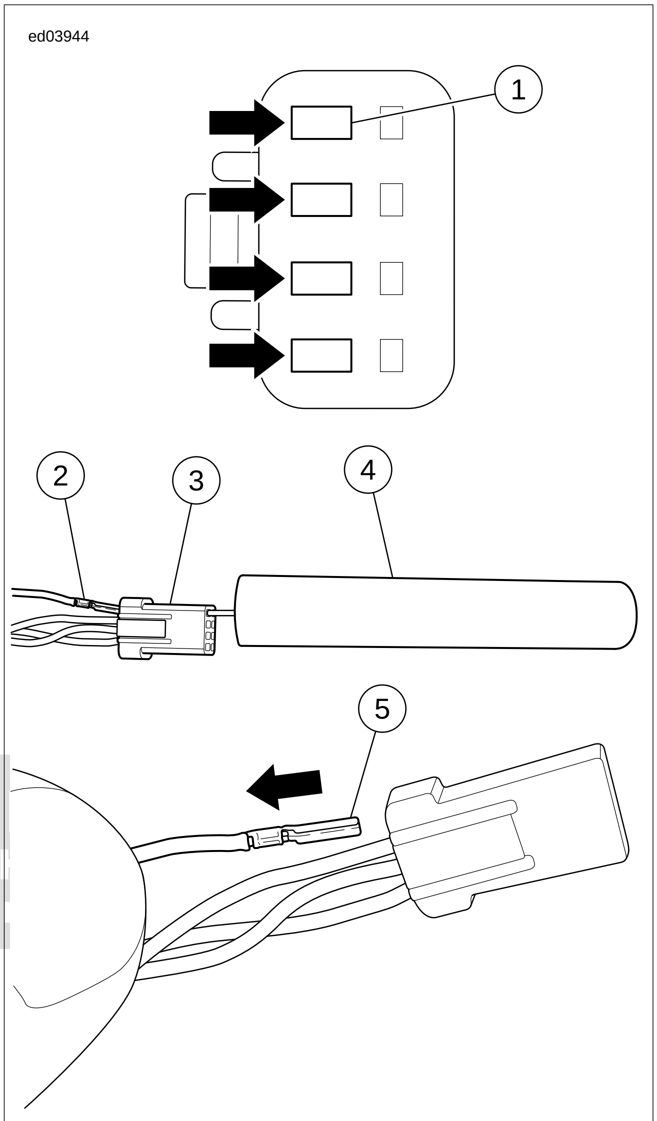


Figure B-18. Release Buttons: JST JWPF Sealed Connector



1. **Openings for removal tool**
2. **Terminal**
3. **Connector housing**
4. **Terminal extractor**
5. **Removing terminal**

Figure B-19. Terminal Removal

Terminal Removal

1. See Figure B-19. Locate large openings on the front of the connector housing.
2. Insert TERMINAL EXTRACTOR (Part No. B-50085) into large openings and release retention finger that locks terminal in place.
3. Remove terminal.

Installing Terminal

1. Inspect connector housing and replace if necessary.
2. Orient the terminal to the housing. Push terminal into housing until it clicks into place.

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

MOLEX BPT SEALED CONNECTORS B.8

MOLEX BPT SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-50120-11	DIE SET
HD-50120-2	HAND CRIMP FRAME

See Figure B-20. The plug assembly consists of a wire seal (part of housing), housing, yellow secondary, two terminals, and one red mating seal. The mating seal provides a tight closure for mated connectors.

Molex BPT sealed connectors are used to connect to the front and rear fuel injectors.

NOTE

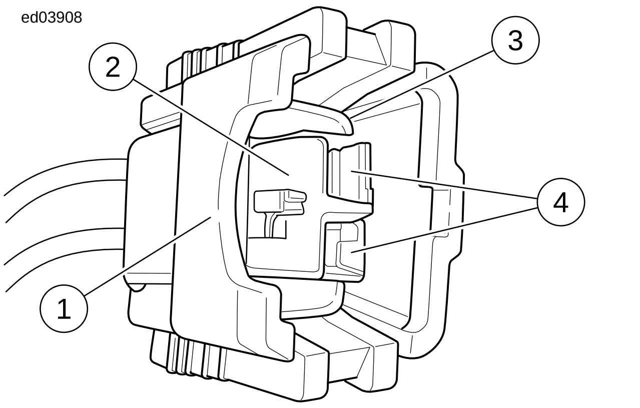
Use HAND CRIMP FRAME (Part No. HD-50120-2) with DIE SET (Part No. HD-50120-11) for Molex BPT series terminal crimping. Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

Pinch the two external latches together and separate the connector from the fuel injector.

Mating Connector

Align the connector to the fuel injector. Push the two halves of the connector together.

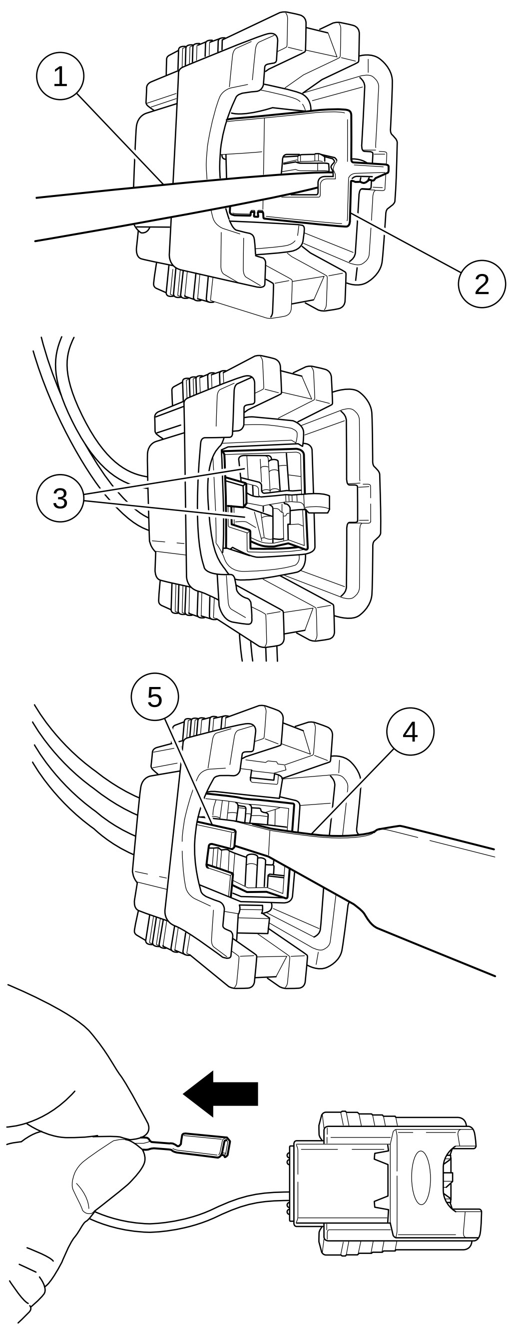


1. **Housing**
2. **Yellow secondary lock**
3. **Red mating seal**
4. **Terminals**

Figure B-20. Molex BTP Connector Assembly

Terminal Removal

1. See Figure B-21. Insert the tip of a small screwdriver into the secondary lock and gently pry the secondary lock completely out of the housing.
2. Locate the opening next to the terminals where the removing tool will be inserted.
3. Insert removal tool and release retention finger that locks terminal in place
4. Remove terminal.



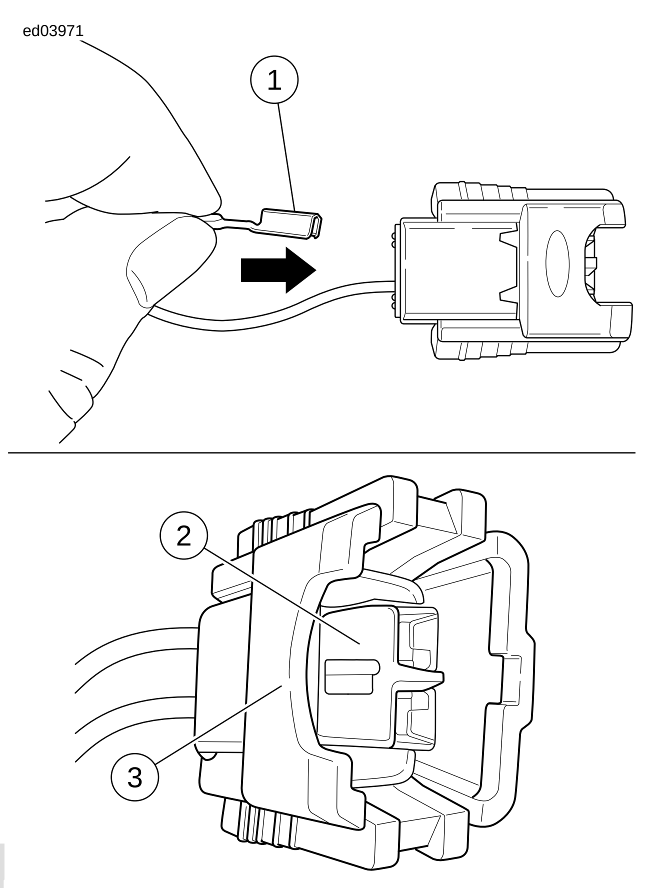
1. **Secondary lock**
2. **Insert tip of screwdriver here**
3. **Removal tool opening locations**
4. **Removal tool**
5. **Retention fingers**

Figure B-21. Terminal Removal

Installing Terminal

1. See Figure B-22. Verify that the terminals are properly crimped.

2. From the wire side of the housing, align the terminal with the applicable terminal cavity, then insert the terminal through the wire seal into the housing until there is an audible or tactile click. DO NOT force the terminal. If the terminal is difficult to insert, check to make sure they are aligned properly.
3. Pull wire slightly to verify that the terminal has engaged the retention fingers of the terminal cavity.
4. Insert secondary lock.



1. **Insert terminal**
2. **Secondary lock**
3. **Connector housing**

Figure B-22. Installing Terminal

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

MOLEX CMC SEALED CONNECTORS

PART NUMBER	TOOL NAME
HD-50120-2	HAND CRIMP FRAME
HD-50120-3	DIE SET
HD-50120-4	DIE SET
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL

NOTE

Use HAND CRIMP FRAME (Part No. HD-50120-2) with DIE SET (Part No. HD-50120-3) for 18-16 gauge or DIE SET (Part No. HD-50120-4) for 20-18 gauge Molex CMC series terminal crimping. Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

See Figure B-23. Press the catch and rotate the lever arm down.

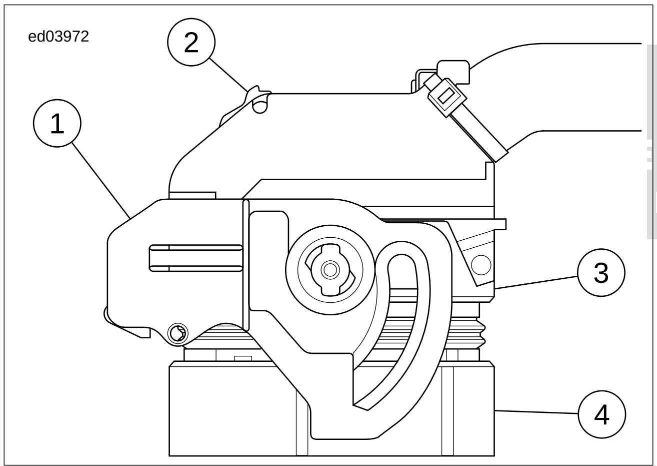


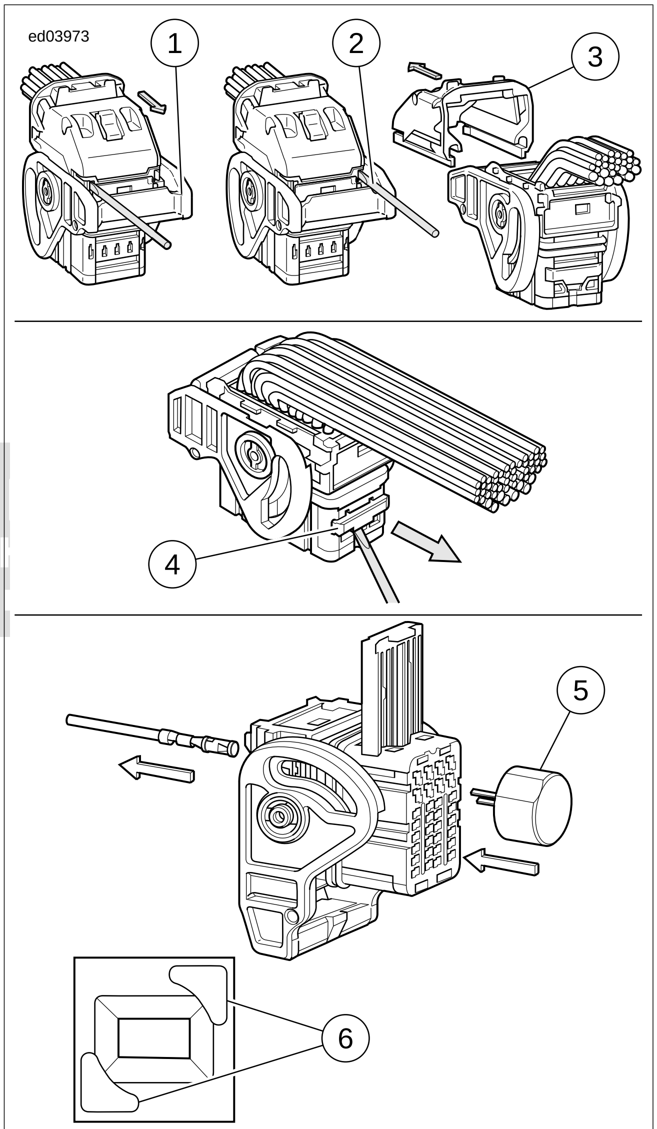
Figure B-23. Release

Mating Connector

1. Align the connector.
2. Rotate the lever arm up until the catch clicks in place.

Terminal Removal

1. With the lever arm open, cut the cable strap around the wire bundle.
2. See Figure B-24. Open a wire cap latch with a small screwdriver.
3. Maintain pressure on the cap and open the opposite latch with the screwdriver.
4. Slide the cap off.
5. Use the screwdriver to open the secondary lock. Pull the locking bar all the way out.
6. Locate the wire lead cavity by the alpha-numeric coordinates.
7. Identify the size of the terminal and select either the CMC extractor 0.6 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50423) or the 1.5 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50424).
8. Insert the pins of the CMC extractor tool into the access slots of the terminal cavity and retract the lead and terminal.



1. **Press latch**
2. **Press cap and latch**
3. **Remove wire lead cap**
4. **Remove secondary lock**
5. **Extractor tool**
6. **Access slots**

Figure B-24. Terminal Removal

Installing Terminal

1. Orient the terminal to the housing cavity. Snap the terminal in place.
2. Slide the cap over the lead bundle. Snap the cap in place.
3. Install a cable strap through the guide and around the lead bundle.

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

CRIMPING TERMINALS

PART NUMBER	TOOL NAME
HD-50120	UNIVERSAL CRIMPER SET
HD-50120-2	HAND CRIMP FRAME
HD-50120-3	DIE SET
HD-50120-4	DIE SET

1. Select the crimper die according to the terminal part number from the UNIVERSAL CRIMPER SET (Part No. HD-50120).
2. Strip the wire insulation to specification. Refer to Table B-1 or Table B-2.
3. Install the DIE SET (Part No. HD-50120-3) or DIE SET (Part No. HD-50120-4) in the handle of the HAND CRIMP FRAME (Part No. HD-50120-2).
4. Place the **new** terminal in the specified nest.
5. Insert the wire to the wire stop. Crimp the terminal.
6. Inspect the crimped terminal.

Table B-1. Molex CMC Sealed Crimper Die (Part No. HD-50120-3)

PART NO.	TERMINAL: WIRE GAUGE	STRIP LENGTH		NEST
		in	mm	
72226-11	Socket: 16 AWG	0.177	4.5	B
72227-11	Socket: 18 AWG	0.177	4.5	A

Table B-2. Molex CMC Sealed Crimper Die (Part No. HD-50120-4)

PART NO.	TERMINAL: WIRE GAUGE	STRIP LENGTH		NEST
		in	mm	
72222-11	Socket: 18 AWG	0.138	3.5	B
72222-11	Socket: 20 AWG	0.138	3.5	A

MOLEX MX SERIES SEALED CONNECTORS B.10

MOLEX MX 64 AND 150 SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-48114	1.50 MM REMOVAL TOOL
HD-48119	ELECTRICAL CRIMPER
HD-50120-11	DIE SET
HD-50120-2	HAND CRIMP FRAME

NOTES

- *Use ELECTRICAL CRIMPER (Part No. HD-48119) for Molex MX150 terminal crimping.*
- *Use HAND CRIMP FRAME (Part No. HD-50120-2) with DIE SET (Part No. HD-50120-11) for Molex MX64 series terminal crimping.*

Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

See Figure B-25. Press the latch while pulling the connector halves apart.

Mating Connector

1. Align the connectors so the latches line up.
2. Press together until locked.

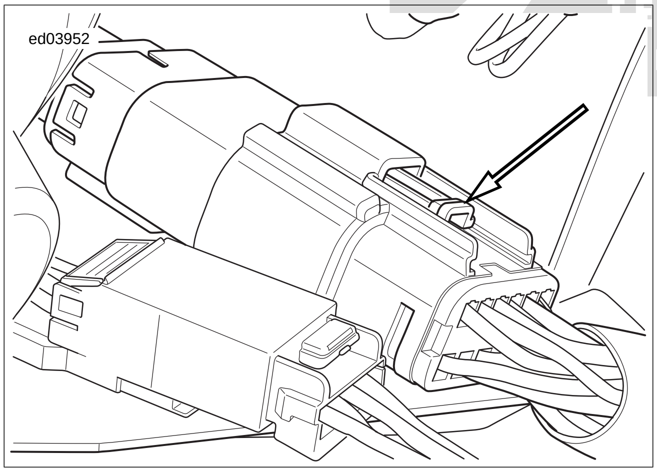


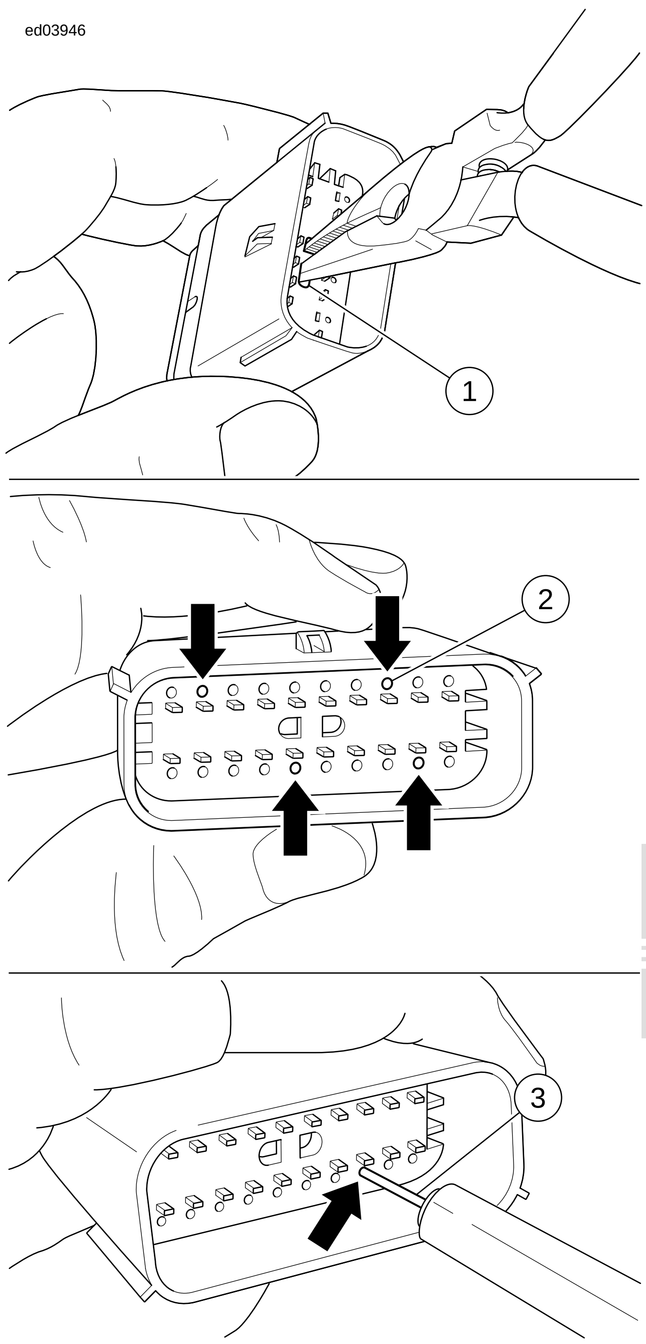
Figure B-25. Molex MX 150 Sealed Connector Latch

Terminal Removal (Male Terminals)

NOTES

- *The secondary lock should never be fully removed from the connector. Excessive force may damage the secondary lock.*
- *Do not apply any lateral force; this may damage the tool or the locking finger.*
- *Excessive force can damage the lock finger.*
- *Do not insert the service tool at an angle; this may cause damage to the terminal.*
- *Do not insert the removal tool into the terminal opening.*

1. See Figure B-26. Insert a small pair of needle nose pliers in the removal holes.
2. Pull back gently 5/16 in. (5.0 mm) until the secondary lock is unlocked.
3. Using the 1.50 MM REMOVAL TOOL (Part No. HD-48114), insert the tip into the terminal service ports adjacent to the terminal cavity to be removed.
4. Apply downward pressure to release the lock and remove the wire. If the terminal resists, the removal tool may not be fully engaged. Verify that it has fully disengaged the lock.



1. **Pull up secondary lock**
2. **Service ports**
3. **Insert removal tool**

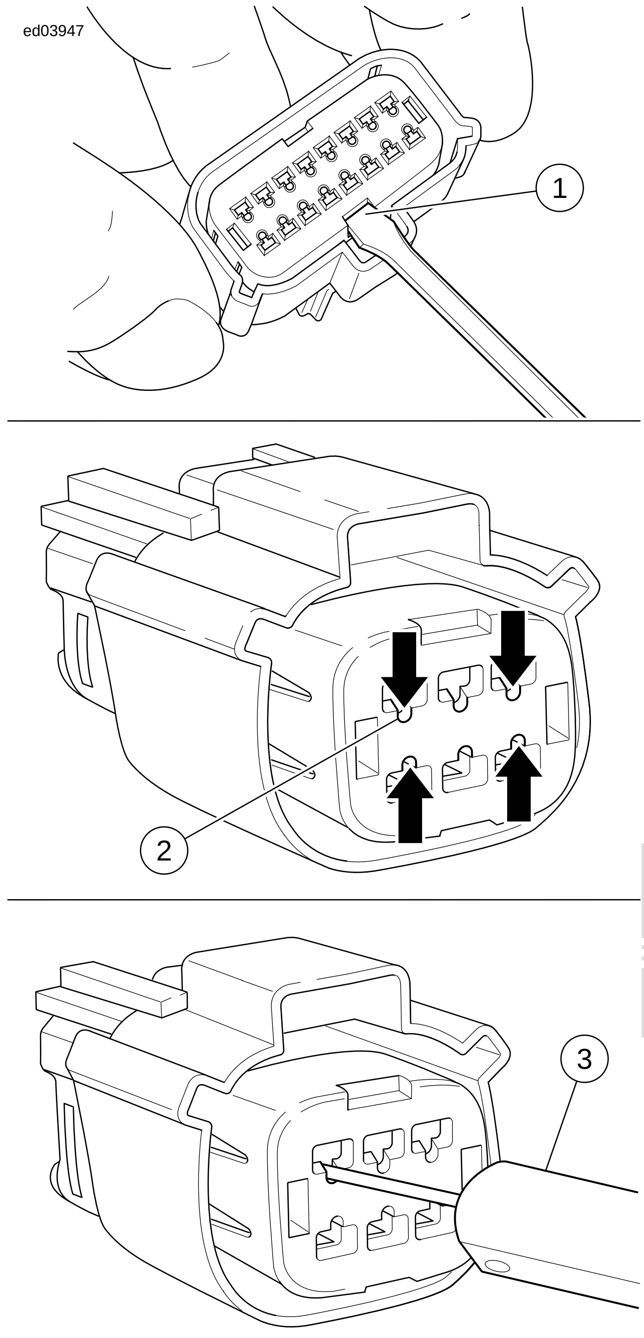
Figure B-26. Terminal Removal: Male

Terminal Removal (Female Terminals) MX150 Series

NOTES

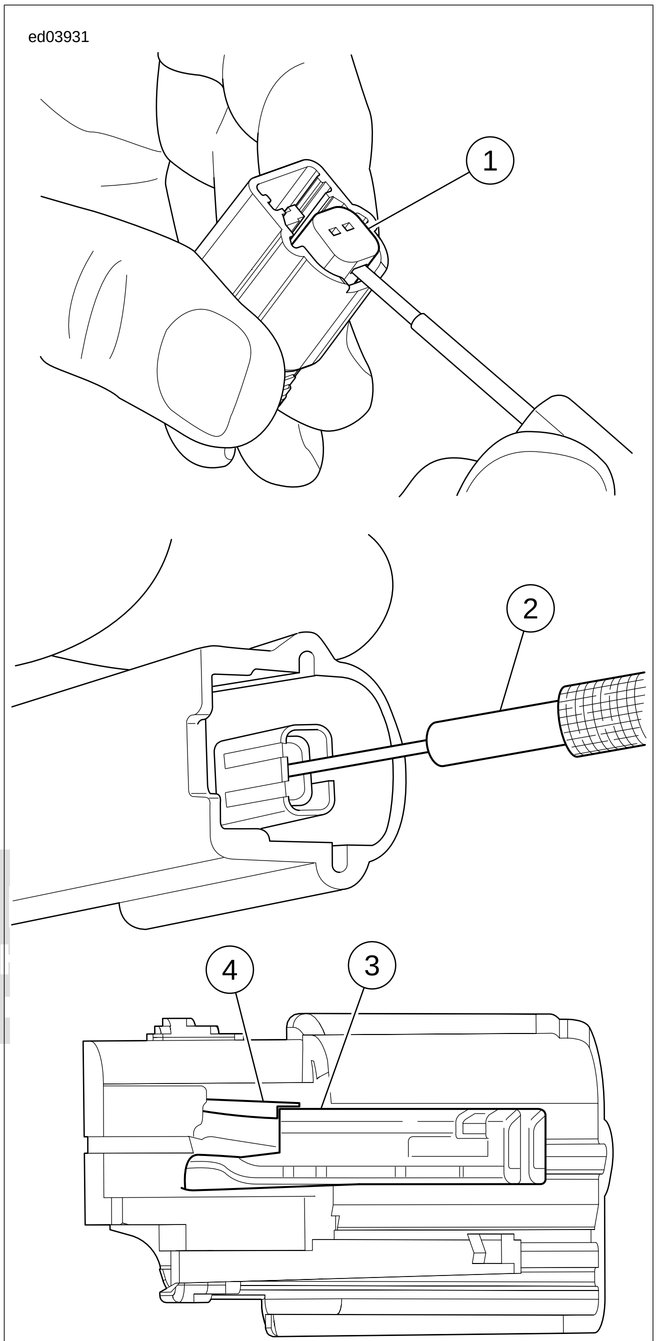
- *The secondary lock should never be fully removed from the connector housing. Excessive force may damage the secondary lock.*
- *Do not apply any lateral force; this may damage the tool or the locking finger.*
- *Excessive force can damage the lock finger.*
- *Do not insert the service tool at an angle; this may cause damage to the terminal.*
- *Do not insert the removal tool into the terminal opening.*

1. See Figure B-27. Insert a small screwdriver into the secondary lock release.
2. Using the housing as a pivot point gently pry out on the secondary lock to unlock.
3. Using the 1.50 MM REMOVAL TOOL (Part No. HD-48114), insert the tip into the terminal service ports adjacent to the terminal cavity to be removed.
4. Apply downward pressure to release the lock and remove the wire. If the terminal resists, the removal tool may not be fully engaged. Verify that it has fully disengaged the lock.



1. **Pry up secondary lock**
2. **Service ports**
3. **Insert removal tool**

Figure B-27. Terminal Removal: Female



1. **Remove secondary lock**
2. **1 mm pry tool**
3. **Pry point for terminal lock**
4. **Primary lock**

Figure B-28. Removing Terminals in MX64 Series Connector

Terminal Removal (Female Terminals) MX64 Series

1. See Figure B-28. Using a small blade screwdriver pry up on the secondary lock and remove.

NOTE

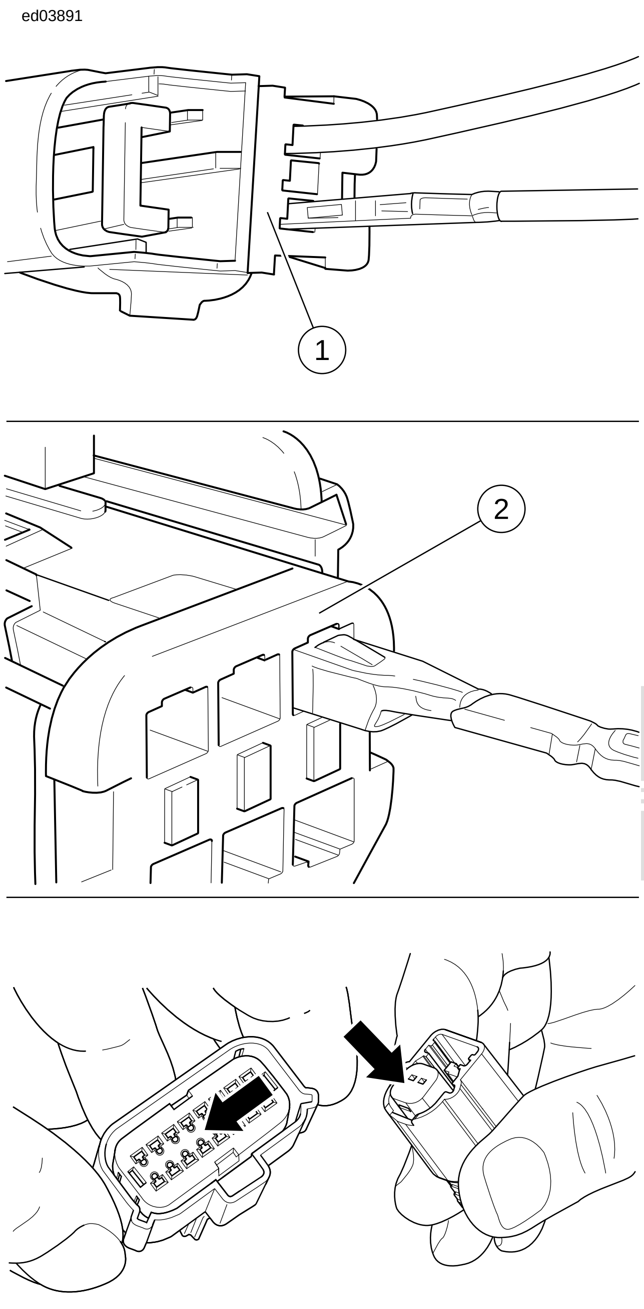
Do not use excessive force. Excessive force can damage the lock finger.

2. Using a small blade screwdriver, release the terminal lock. Gently pull on the wire to remove the terminal.

Installing Terminal

1. See Figure B-29. With secondary lock unlocked, align the terminal to rear of connector.
2. Insert the terminal until it stops and locks on the lock finger with an audible click.

3. See Figure B-29.
   a. On the MX64, install and lock the secondary lock.
   b. On the MX150, push to lock the secondary lock.



1. **MX 64 series**
2. **MX 150 series**

Figure B-29. Terminal Installation

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

SEALED SPLICE CONNECTORS B.11

SEALED SPLICE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-38125-8	PACKARD TERMINAL CRIMPER
HD-39969	ULTRA TORCH
HD-41183	HEAT SHIELD ATTACHMENT

NOTE

Refer to Bosch tool instruction sheet for crimping instructions.

Splice connectors and several OEM ring terminal connectors use heat shrink covering to seal the connection.

Preparing Wire Leads

NOTE

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

1. Using a shop gauge, identify the gauge of the wire.
2. Match the wire gauge to a sealed splice connector by color and part number. Refer to Table B-3.
3. Strip insulation off the wire lead. Refer to Table B-3.

Table B-3. Sealed Splice Connectors

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

NOTE

If any copper wire strands are cut off of the wire core, trim the end and strip the wire again in a larger gauge stripper.

Splicing Wire Leads

NOTE

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

1. See Figure B-30. Open the PACKARD TERMINAL CRIMPER (Part No. HD-38125-8) ratchet by squeezing the handles closed.
2. Match the connector color to the wire gauge crimp die in the jaws. Insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure B-31. Feed the stripped end of a wire into the connector until the wire stops inside the metal insert.
5. Squeeze the handles tightly closed to crimp the lead in the insert. The tool automatically opens when the crimping is complete.
6. Slide the connector to the other half of the metal insert. Insert the stripped wire lead until it stops. Crimp the lead in the insert.

WARNING

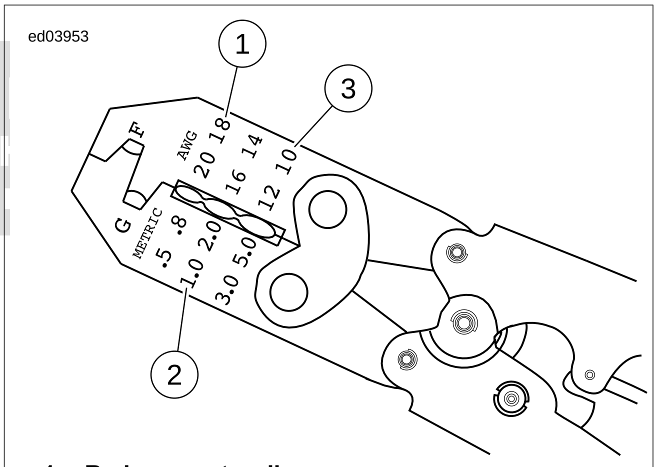
Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)

- Avoid directing heat toward any electrical system component that is not being serviced.
- Always keep hands away from tool tip area and heat shrink attachment.

NOTE

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

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

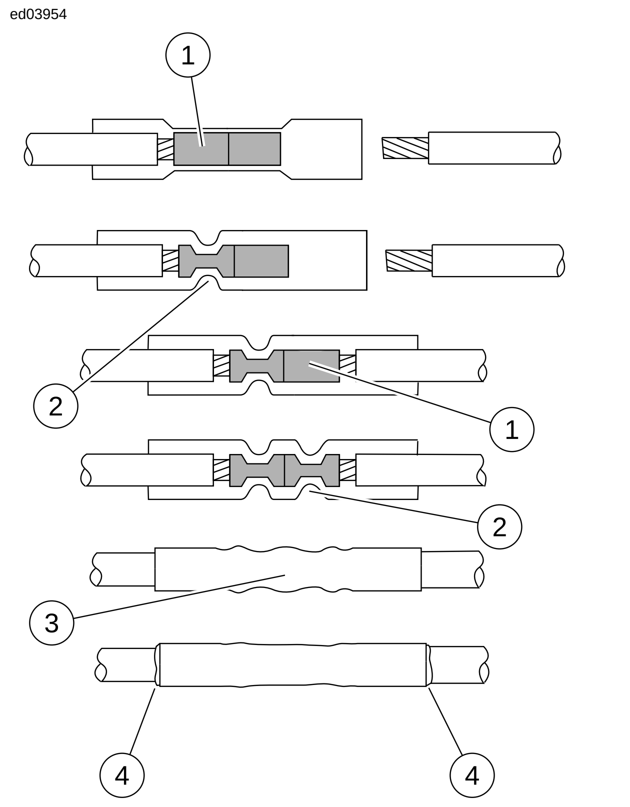


1. **Red connector die**
2. **Blue connector die**
3. **Yellow connector die**

Figure B-30. Packard Crimping Tool (HD-38125-8)

Inspecting Seals

See Figure B-31. Allow the splice to cool and inspect the seal. The insulation should appear smooth and cylindrical. Melted sealant will have extruded out the ends of the insulation.



1. Wire lead in metal insert
2. Crimp metal insert
3. Center of crimp
4. Melted SEALANT

Figure B-31. Sealed Splice Connector

TYCO GET 64 SEALED CONNECTORS B.12

TYCO GET 64 SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR
HD-50120-2	HAND CRIMP FRAME
HD-50120-7	DIE SET

NOTE

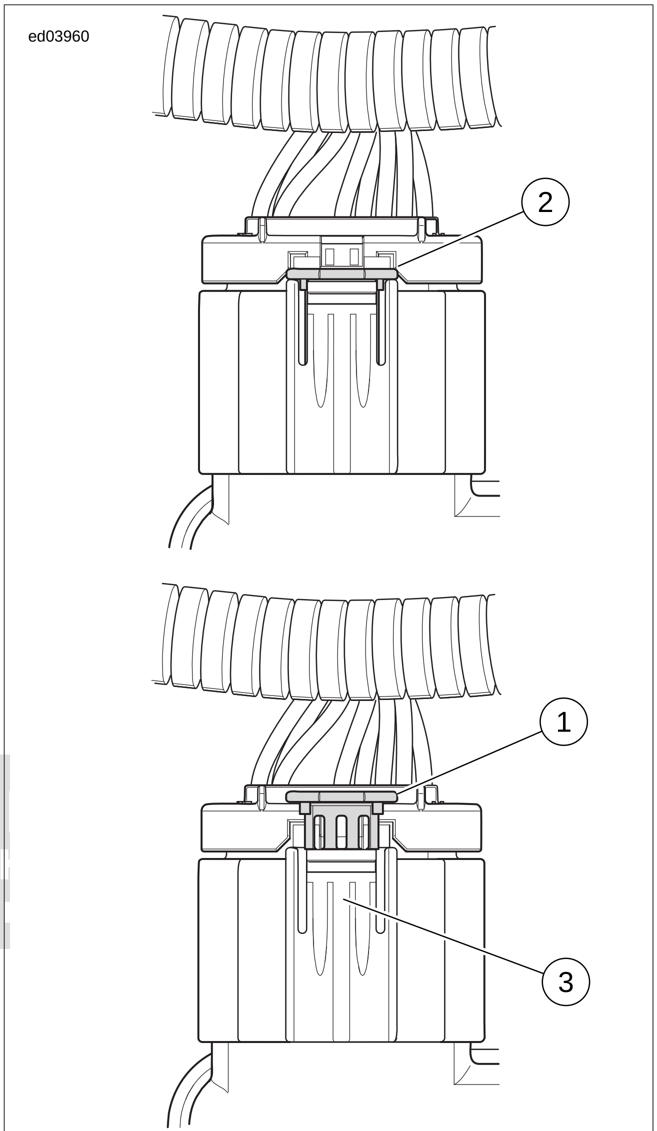
Use HAND CRIMP FRAME (Part No. HD-50120-2) with DIE SET (Part No. HD-50120-7) for Tyco GET 64 series terminal crimping. Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

1. See Figure B-32. Pull the latch lock open.
2. While pressing the connector latch, pull the connector apart.

Mating Connector

1. Align the connector housings.
2. Press the housings together.
3. Push the latch lock closed.

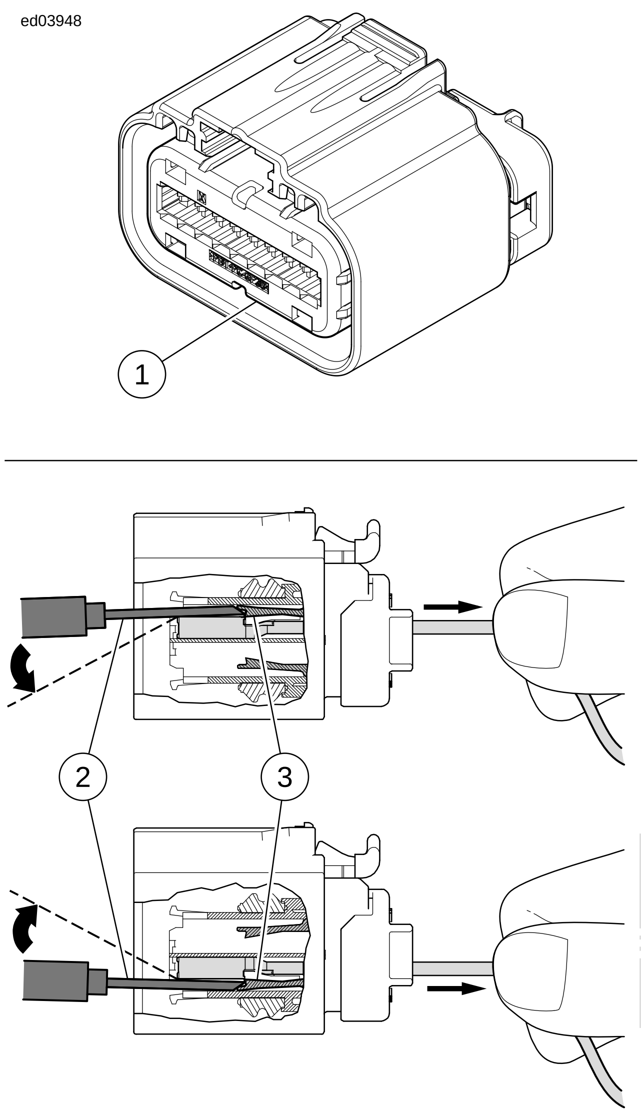


1. **Latch lock (open)**
2. **Latch lock (closed)**
3. **Connector latch**

Figure B-32. Tyco GET 64 Sealed Connector Latch and Lock

Terminal Removal

1. See Figure B-33. Remove secondary lock from the connector.
2. Insert TERMINAL EXTRACTOR (Part No. B-50085) into the cavity next to the terminal.
3. Pry and hold the tang away from the terminal.
4. Pull on the wire lead to remove the terminal.



1. **Secondary lock**
2. **Terminal extractor**
3. **Retention beam**

Figure B-33. Terminal Removal

Installing Terminal

1. See Figure B-34. Align the open side of the crimp to the tang side of the connector cavity.
2. Install the terminal into the connector. Terminal will snap into place.
3. Install secondary lock into the connector.

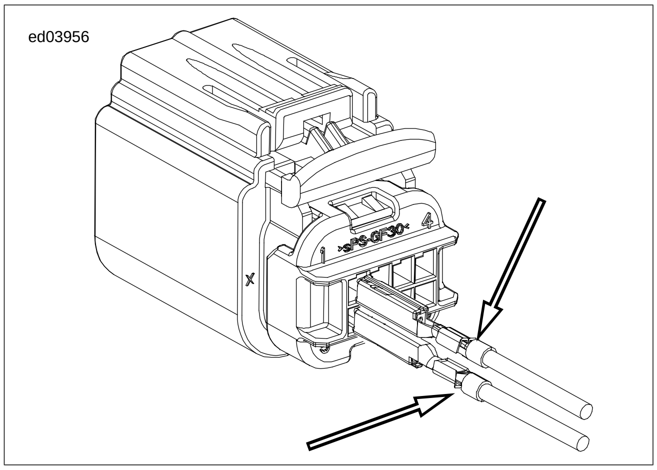


Figure B-34. Socket Terminal Orientation: Crimp Open Side

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

TYCO JUNIOR POWER TIMER UNSEALED CONNECTORS B.13

TYCO JUNIOR POWER TIMER UNSEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
GA500A	SNAPON TERMINAL PICK

Separating Connector

Remove fuses to access the terminals, as necessary.

Mating Connector

Install fuses back to their original location.

Terminal Removal

1. See Figure B-35. Insert smallest pair of pins on the SNAPON TERMINAL PICK (Part No. GA500A) into cavity on either side of terminal to press tangs on each side of terminal simultaneously.
2. Gently pull on wire to remove terminal from housing.

Installing Terminal

1. Bend tang on each side of terminal away from terminal body.
2. Install terminal into connector.
   a. Align terminal to the connector. The open side of the terminal should face the wire lead connected to the other side of the fuse.
   b. Install the terminal into connector until the terminal snaps into place.

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

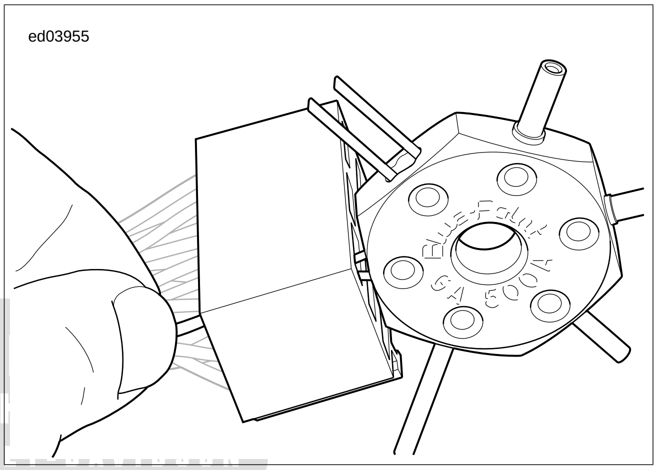


Figure B-35. Removing Autofuse Unsealed Terminal from Fuse Block

TYCO MCP SEALED CONNECTORS B.14

TYCO MCP SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR
GA500A	SNAP-ON TERMINAL PICK
HD-50120-2	HAND CRIMP FRAME
HD-50120-8	DIE SET

The Tyco MCP sealed connector is used on certain ABS modules.

NOTE

Use HAND CRIMP FRAME (Part No. HD-50120-2) with DIE SET (Part No. HD-50120-8) for Tyco MCP series terminal crimping. Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

See Figure B-36. Press and hold the lock tab. Pulling on both ends of the lever, open the lever.

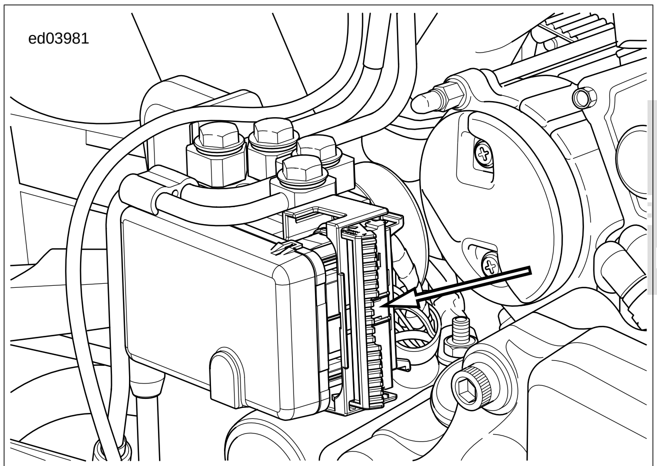


Figure B-36. Tyco MCP Connector Release Bar

Mating Connector

Gently mate the pins to the socket. Press and hold the lock tab. Pressing on both ends of the lever, close the lever.

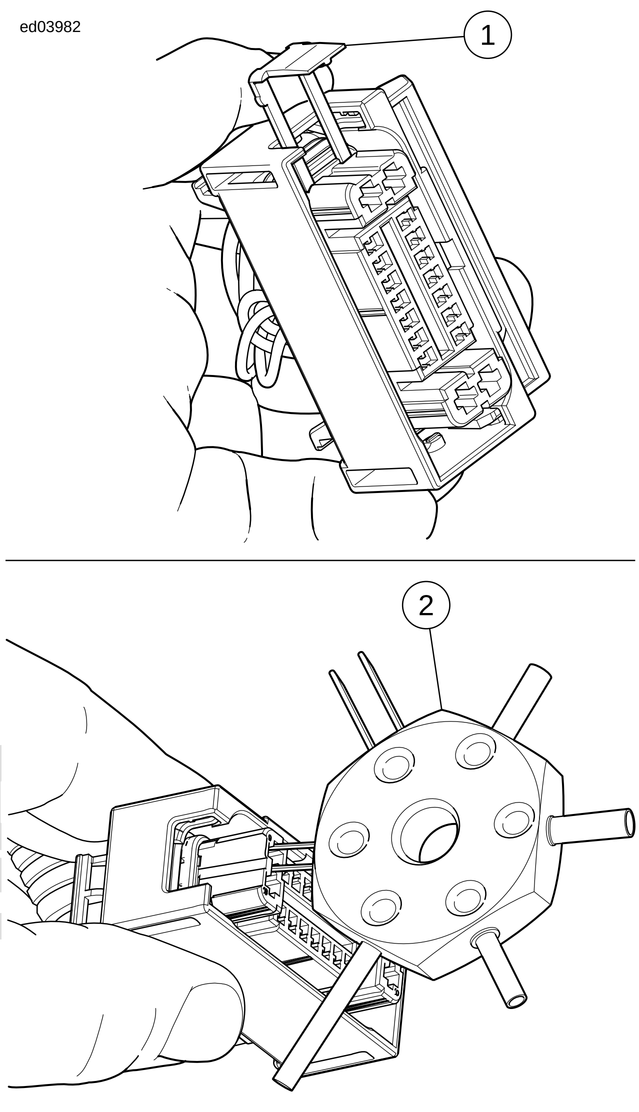
Terminal Removal (Large Terminals)

1. Snap the wire harness cover off of the back of the connector

NOTE

Insert a thin flat bladed screwdriver all the way to the bottom behind the tab of the secondary lock.

2. See Figure B-37. Gently slide the secondary lock out of the connector with a screwdriver.
3. Insert the smallest pins of the SNAP-ON TERMINAL PICK (Part No. GA500A) into the gaps on each side of the terminal to compress the tangs on each side of the terminal.
4. Gently pull on the wire to remove the terminal.



1. **Secondary lock**
2. **Terminal pick**

Figure B-37. Removing Small Socket Terminals

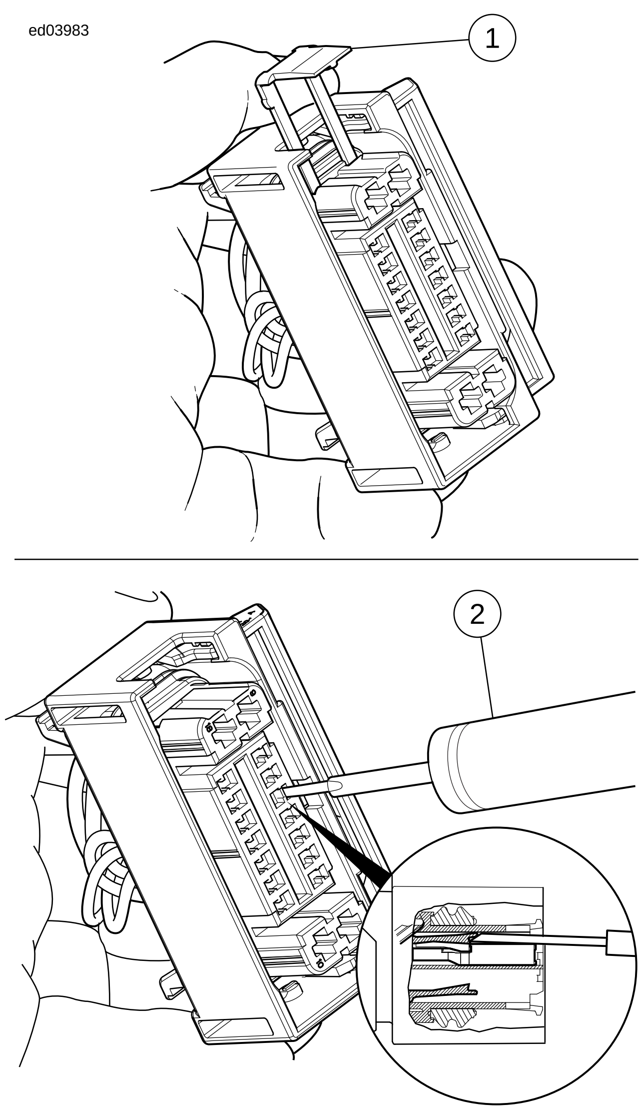
Terminal Removal (Small Terminals)

1. Snap the wire harness cover off of the back of the connector

NOTE

Insert a thin flat bladed screwdriver all the way to the bottom behind the tab of the secondary lock.

2. Gently slide the secondary lock out of the connector with a screwdriver.
3. See Figure B-38. Insert the TERMINAL EXTRACTOR (Part No. B-50085) into the cavity on the outside of the terminal.
4. Tilt extractor to lift the latch and release the terminal.
5. Gently pull on the wire to remove the terminal.



1. **Secondary lock**
2. **Terminal extractor**

Figure B-38. Removing Small Socket Terminals

Installing Terminals

1. Locate the wire lead cavity by number.
2. Use a hobby knife to bend the tangs on each side of the terminal outward.
3. Align the terminal.
4. Push the terminal in until it clicks.
5. Press the secondary lock back into the connector.
6. Snap the wire cover in place.

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

TYCO MULTILOCK UNSEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR
HD-41609	MULTI-LOCK CRIMPER
HD-44695-A	MULTI-LOCK CRIMPER

Tyco Multilock Unsealed connectors are found between wire harnesses and component wiring. They are either floating or anchored to the frame with attachment clips. To maintain serviceability, always return connectors to OEM locations after service.

Obtain the necessary tools to repair the connector and terminals.

NOTES

- *Use the MULTI-LOCK CRIMPER (Part No. HD-41609) for 070 Multilock terminal crimping.*
- *Use the MULTI-LOCK CRIMPER (Part No. HD-44695-A) for 040 Multilock terminal crimping.*

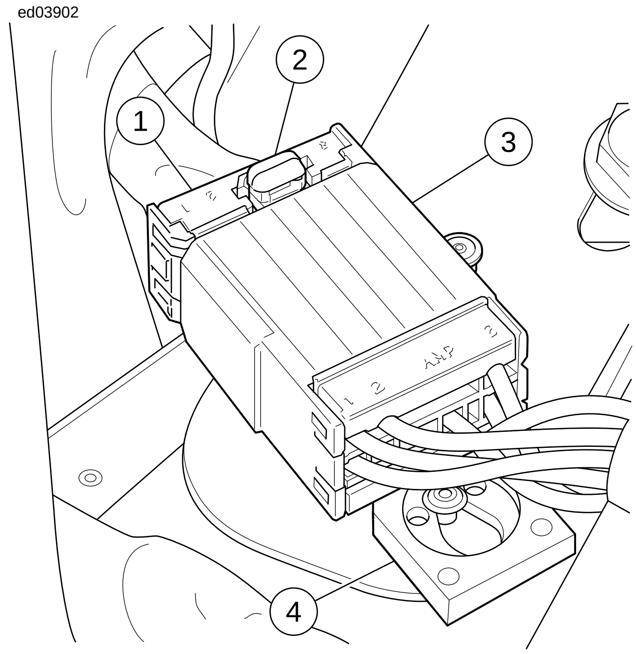
Refer to Bosch tool instruction sheet for crimping instructions.

Separating Connector

1. If necessary, slide connector attachment clip so T-stud is in the large end of the clip opening. Remove connector from T-stud.
2. See Figure B-39. Press the release button and pull the connector halves apart.

Mating Connector

1. Hold the connectors to match wire color to wire color.
2. Align the terminals and press the connectors together until they click in place.
3. If OEM location is a T-stud, fit large opening end of attachment clip over T-stud. Slide connector to engage T-stud to small end of opening in clip.



1. **Socket housing**
2. **Release button**
3. **Pin housing**
4. **Attachment clip**

Figure B-39. Tyco Multilock Unsealed Connector

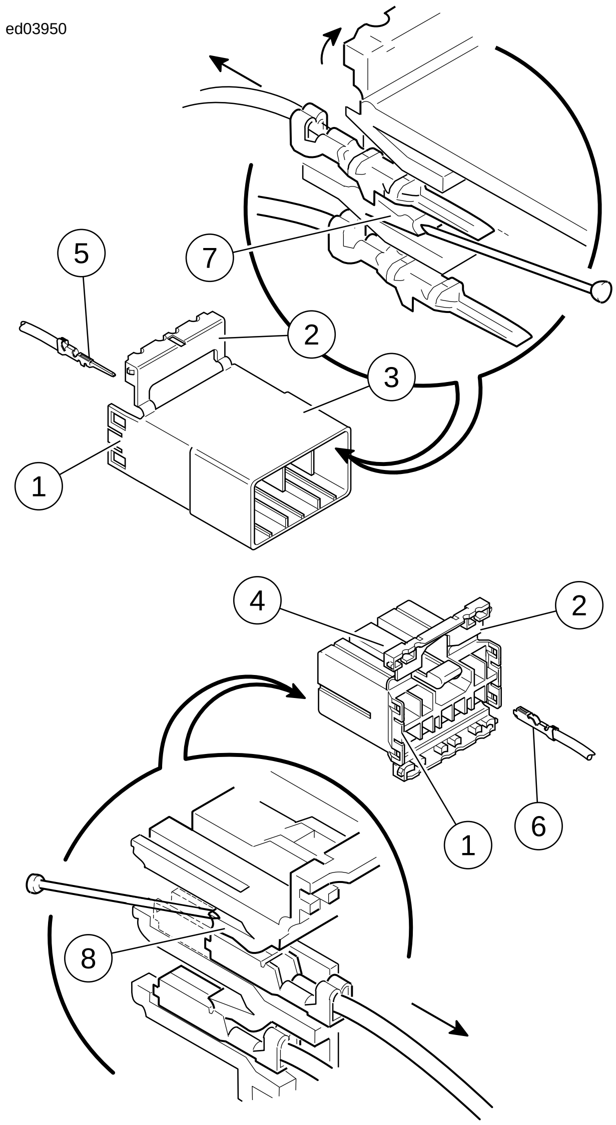
Terminal Removal

1. See Figure B-40. Bend back the latch to free one end of secondary lock then repeat on the opposite end. Hinge the secondary lock outward.
2. Look in the terminal side of the connector (opposite the secondary lock) and note the cavity next to each terminal.
3. Using TERMINAL EXTRACTOR (Part No. B-50085), press the tang in the housing to release the terminal.
   a. **Socket:** Lift the socket tang up.
   b. **Pin:** Press the pin tang down.

NOTE

If the tang is released, a click is heard.

4. Gently pull on wire to remove terminal from cavity.



1. **Latch**
2. **Secondary lock open**
3. **Pin housing**
4. **Socket housing**
5. **Pin terminal**
6. **Socket terminal**
7. **Tang (pin)**
8. **Tang (socket)**

Figure B-40. Tyco 070 Multilock Unsealed Connector: Socket and Pin Housings

Installing Terminals

NOTES

- *Match the wire color to the cavity number found on the wiring diagram.*
- *The release button is always on the top of the connector.*
- *On the pin side of the connector, tangs are positioned at the bottom of each cavity. Therefore, the slot in the pin terminal (on the side opposite the crimp tails) must face downward.*
- *On the socket side, tangs are at the top of each cavity. Therefore, the socket terminal slot (on the same side as the crimp tails) must face upward.*

1. Hold the terminal so the catch faces the tang in the cavity. Insert the terminal into its numbered cavity until it snaps in place.
2. Gently tug on wire ends to verify that all terminals are locked.
3. Rotate the hinged secondary lock inward until tabs are fully engaged on both sides of connector.

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

TYCO SUPERSEAL 1.5 SEALED CONNECTORS B.16

TYCO SUPERSEAL 1.5 SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR

Separating Connector

1. Lift locking tab.
2. Pull the connector apart.

Mating Connector

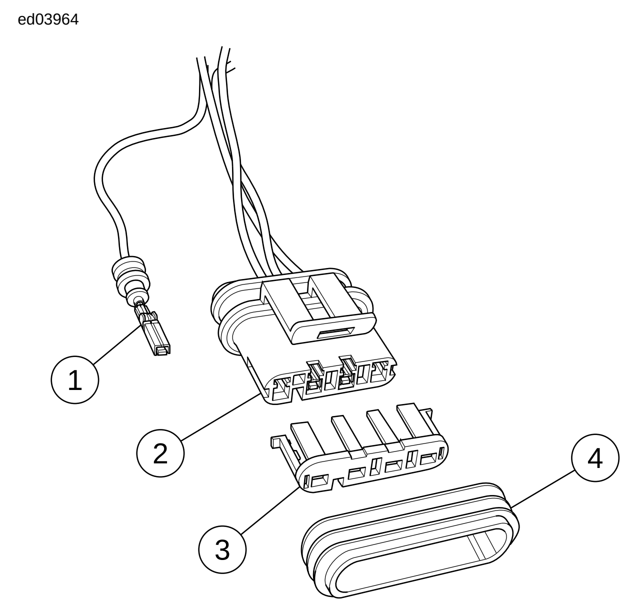
1. Align the connector housings.
2. Press the housings together until the locking tab snaps into place.

Terminal Removal

1. File the edge of a TERMINAL EXTRACTOR (Part No. B-50085) to a 45 degree angle.
2. See Figure B-41. Remove seal from connector.
3. Lift locking tab on either side of connector and remove secondary lock.
4. Insert the extractor into the cavity next to the terminal. Press the retainer away from the terminal.
5. Gently pull the wire to remove the terminal from the connector.

Installing Terminal

1. Align terminal to the connector.
2. Install the terminal into the connector until it snaps into place.
3. Gently pull wire to verify terminal is locked.
4. See Figure B-41. Install secondary lock into connector.
5. Install seal.



1. **Terminal**
2. **Connector**
3. **Secondary lock**
4. **Seal**

Figure B-41. Tyco SuperSeal 1.5 Sealed Connector

Replacement and Repair

The terminals and connector assemblies are not repairable. Discard and replace any defective or damaged terminals or connector assemblies. Do not re-use a terminal by removing the wire.

TABLE OF CONTENTS

NOTES

GLOSSARY C.1

ACRONYMS AND ABBREVIATIONS

Table C-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
A	Amperes
AAT	Ambient air temperature
ABS	Anti-lock braking system
AC	Alternating current
ACC	Accessory position on ignition switch
ACR	Automatic compression release
AGM	Absorbed glass mat (battery)
Ah	Ampere-hour
AIS	Active intake solenoid
AWG	American wire gauge
B+	Battery voltage
bar	Bar
BAS	Bank angle sensor
BCM	Body control module
BOB	Breakout box
BTDC	Before top dead center
°C	Celsius (Centigrade)
CA	California
CAL	Calibration
CAN	Controller area network
CB Tx	CB send transmission
CB Rx	CB receive transmission
cc	Cubic centimeters
CCA	Cold cranking amps
CCW	Counterclockwise
CKP	Crankshaft position
cm	Centimeters
cm^3	Cubic centimeters
CW	Clockwise
DC	Direct current
DLC	Data link connector
DOM	Domestic
DOT	Department of Transportation
DTC	Diagnostic trouble code
DVOM	Digital volt ohm meter
ECM	Electronic control module
ECT	Engine coolant temperature
ECU	Electronic control unit
EEPROM	Electrically erasable programmable read only memory
EFI	Electronic fuel injection

Table C-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
EHCU	Electro hydraulic control unit
ET	Engine temperature
ETC	Electronic throttle control
EVAP	Evaporative emissions control system
°F	Fahrenheit
fl oz	Fluid ounce
FPS	Fuel pressure sensor
ft	Feet
ft-lbs	Foot pounds
FTP	Flash to pass
g	Gram
gal	Gallon
GAWR	Gross axle weight rating
GND	Ground (electrical)
GPS	Global positioning system
GVWR	Gross vehicle weight rating
HCU	Hydraulic control unit
HDI	Harley-Davidson International
HD-Link	Networking system
H-DSSS	Harley-Davidson smart security system
HFM	Hands-free mode
HFSM	Hands-free security module
Hg	Mercury
H02S	Heated oxygen sensor
hp	Horsepower
hr	Hour
IAC	Idle air control
IAT	Intake air temperature
IC	Instrument cluster
ID	Inside diameter
IGN	Ignition light/key switch position
IM	Instrument module
in	inch
in^3	Cubic inch
INJ PW	Injector pulse width
INTCM	Intercom
in-lbs	Inch pounds
JSS	Jiffy stand sensor
kg	Kilogram
km	Kilometer
km/h	Kilometers per hour
kPa	Kilopascal
kW	Kilowatt

Table C-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
L	Liter
lb	Pounds
LCD	Liquid crystal display
LED	Light emitting diode
LH	Left hand
LHCM	Left hand control module
LP	License plate
LT	Left
mA	Milliampere
MAP	Manifold absolute pressure
max	Maximum
mi	Mile
min	Minimum
mL	Milliliter
mm	Millimeter
mph	Miles per hour
ms	Millisecond
Nm	Newton-meter
NIM	Navigation interface module
NiMH	Nickel metal hydride
N/A	Not applicable
O2	Oxygen
OD	Outside diameter
OEM	Original equipment manufacturer
oz	Ounce
P&A	Parts and Accessories
Part No.	Part number
PIN	Personal identification number
PND	Personal navigation device
psi	Pounds per square inch
PWM signal	Pulse width modulated signal
qt	Quart
RAD	Radio
RCM	Reverse control module
RDS	Radio data system
RES	Reserve mark on fuel supply valve
RH	Right hand
RHCM	Right hand control module
rpm	Revolutions per minute
RT	Right
s	Seconds
SCFH	Cubic feet per hour at standard conditions
SDARS	Satellite digital audio radio service

Table C-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
SPDO	Speedometer
SPKR	Speaker
STT	Stop/tail/turn
TA	Traffic announcement
TCA	Throttle control actuator
TDC	Top dead center
TGS	Twist grip sensor
TPMS	Tire pressure monitoring system
TPS	Throttle position sensor
TSM	Turn signal module
TSSM	Turn signal/security module
TT	Telltale
USB	Universal serial bus
V	Volt
VAC	Volts of alternating current
VDC	Volts of direct current
VIN	Vehicle identification number
VR	Voice recognition
VSS	Vehicle speed sensor
W	Watt
WA	Weather alert
WSS	Wheel speed sensor

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
B-50085	TERMINAL EXTRACTOR TOOL	6.37 TGS DIAGNOSTICS, DTC P2122
B-50085	TERMINAL EXTRACTOR TOOL	6.37 TGS DIAGNOSTICS, DTC P2123
B-50085	TERMINAL EXTRACTOR TOOL	6.37 TGS DIAGNOSTICS, DTC P2127
B-50085	TERMINAL EXTRACTOR TOOL	6.37 TGS DIAGNOSTICS, DTC P2128
B-50085	TERMINAL EXTRACTOR	B.2 DELPHI GT SEALED CONNECTORS, Delphi GT Sealed Connector Repair
B-50085	TERMINAL EXTRACTOR	B.6 JAE MX19 SEALED CONNECTORS, JAE MX19 Sealed Connectors
B-50085	TERMINAL EXTRACTOR	B.7 JST JWPF SEALED CONNECTORS, JST JWPF Sealed Connector Repair
B-50085	TERMINAL EXTRACTOR	B.12 TYCO GET 64 SEALED CONNECTORS, Tyco GET 64 Sealed Connector Repair
B-50085	TERMINAL EXTRACTOR	B.14 TYCO MCP SEALED CONNECTORS, Tyco MCP Sealed Connector Repair
B-50085	TERMINAL EXTRACTOR	B.15 TYCO MULTILOCK UNSEALED CONNECTORS, Tyco Multilock Unsealed Connector Repair
GA500A	SNAP-ON TERMINAL PICK	B.1 BOSCH COMPACT 1.1M SEALED CONNECTORS, Bosch Compact 1.1M Connector
GA500A	SNAPON TERMINAL PICK	B.13 TYCO JUNIOR POWER TIMER UNSEALED CONNECTORS, Tyco Junior Power Timer Unsealed Connector Repair
GA500A	SNAP-ON TERMINAL PICK	B.14 TYCO MCP SEALED CONNECTORS, Tyco MCP Sealed Connector Repair
GRX-3110HD	BATTERY DIAGNOSTIC STATION	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
GRX-3110HD	BATTERY DIAGNOSTIC STATION	3.1 BATTERY TESTING, Battery Diagnostic Test
HD-23738	VACUUM PUMP	6.9 MAP SENSOR DIAGNOSTICS: IAC, Description and Operation
HD-23738	VACUUM PUMP	6.11 TMAP SENSOR DIAGNOSTICS: ETC, Description and Operation
HD-25070	ROBINAIR HEAT GUN	B.11 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-26792	SPARK TESTER	6.21 IDLE SPEED CONTROL DIAGNOSTICS: ETC, DTC P0505
HD-34730-2E	FUEL INJECTOR TEST LIGHT	6.16 FUEL INJECTOR DIAGNOSTICS, DTC P0261
HD-34730-2E	FUEL INJECTOR TEST LIGHT	6.16 FUEL INJECTOR DIAGNOSTICS, DTC P0264
HD-34730-2E	FUEL INJECTOR TEST LIGHT	6.33 ACR DIAGNOSTICS, DTC P1655
HD-34730-2E	FUEL INJECTOR TEST LIGHT	6.33 ACR DIAGNOSTICS, DTC P1656
HD-38125-6	DELPHI SEALED CRIMPER	B.2 DELPHI GT SEALED CONNECTORS, Delphi GT Sealed Connector Repair
HD-38125-6	DELPHI SEALED CRIMPER	B.3 DELPHI METRI-PACK SEALED CONNECTORS, Delphi Metri-Pack Sealed Connector Repair
HD-38125-7	DELPHI UNSEALED CRIMPER	B.3 DELPHI METRI-PACK SEALED CONNECTORS, Delphi Metri-Pack Sealed Connector Repair
HD-38125-8	PACKARD TERMINAL CRIMPER	B.11 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-39617	FLUKE AC/DC CURRENT PROBE	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-39617	FLUKE AC/DC CURRENT PROBE	3.4 TESTING STARTER ON MOTORCYCLE, Starter Current Draw Test
HD-39965-A	DEUTSCH CRIMPER	B.5 DEUTSCH DT SEALED CONNECTORS, Deutsch DT and DTM Sealed Connector Repair

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-39969	ULTRA TORCH	B.11 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-39978	DIGITAL MULTIMETER (FLUKE 78)	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-39978	DIGITAL MULTIMETER (FLUKE 78)	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-39978	DIGITAL MULTIMETER (FLUKE 78)	1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test
HD-41183	HEAT SHIELD ATTACHMENT	B.11 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41199-3	IAC TEST LIGHT	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-41199-3	IAC TEST LIGHT	6.20 IDLE SPEED CONTROL DIAGNOSTICS: IAC, DTC P0506, P0507
HD-41404	HARNESS CONNECTOR TEST KIT	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-41404	HARNESS CONNECTOR TEST KIT	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-41404	HARNESS CONNECTOR TEST KIT	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-41404	HARNESS CONNECTOR TEST KIT	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, DTC U0100
HD-41404	HARNESS CONNECTOR TEST KIT	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, No Vehicle Power: DTC U0140
HD-41404	HARNESS CONNECTOR TEST KIT	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, Left Hand Controls Inoperative: DTC U0141
HD-41404	HARNESS CONNECTOR TEST KIT	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, Speedometer Inoperative: DTC U0156
HD-41404	HARNESS CONNECTOR TEST KIT	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, Tachometer Inoperative: DTC U0157
HD-41404	HARNESS CONNECTOR TEST KIT	3.2 STARTING SYSTEM, Nothing Clicks
HD-41404	HARNESS CONNECTOR TEST KIT	3.2 STARTING SYSTEM, Starter Stalls or Spins Too Slowly
HD-41404	HARNESS CONNECTOR TEST KIT	3.3 STARTER OUTPUT DTCS, DTC B2122
HD-41404	HARNESS CONNECTOR TEST KIT	3.3 STARTER OUTPUT DTCS, DTC B2123
HD-41404	HARNESS CONNECTOR TEST KIT	3.6 CHARGING SYSTEM, Low or No Charging
HD-41404	HARNESS CONNECTOR TEST KIT	3.7 ABS VOLTAGE DIAGNOSTICS, DTC C0562
HD-41404	HARNESS CONNECTOR TEST KIT	3.8 BATTERY AND SYSTEM VOLTAGE DIAGNOSTICS, DTC P0562
HD-41404	HARNESS CONNECTOR TEST KIT	3.9 IGN SWITCH DIAGNOSTICS, DTC B2201
HD-41404	HARNESS CONNECTOR TEST KIT	3.9 IGN SWITCH DIAGNOSTICS, DTC B2201
HD-41404	HARNESS CONNECTOR TEST KIT	3.9 IGN SWITCH DIAGNOSTICS, DTC B2203
HD-41404	HARNESS CONNECTOR TEST KIT	3.11 BCM VOLTAGE DIAGNOSTICS, DTC B2271
HD-41404	HARNESS CONNECTOR TEST KIT	4.2 FUEL LEVEL SENDER DIAGNOSTICS, DTC B1210
HD-41404	HARNESS CONNECTOR TEST KIT	4.2 FUEL LEVEL SENDER DIAGNOSTICS, DTC B1211
HD-41404	HARNESS CONNECTOR TEST KIT	4.4 NO INSTRUMENT POWER DIAGNOSTICS, No Instrument Power
HD-41404	HARNESS CONNECTOR TEST KIT	4.4 NO INSTRUMENT POWER DIAGNOSTICS, No Instrument Power
HD-41404	HARNESS CONNECTOR TEST KIT	4.4 NO INSTRUMENT POWER DIAGNOSTICS, DTC B1200

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41404	HARNESS CONNECTOR TEST KIT	4.5 INDICATOR LAMPS, Oil Pressure Lamp Inoperative
HD-41404	HARNESS CONNECTOR TEST KIT	4.6 GAUGES, Fuel Gauge Inaccurate, No DTCs
HD-41404	HARNESS CONNECTOR TEST KIT	5.1 ACC CIRCUIT DIAGNOSTICS, DTC B2113, B2114
HD-41404	HARNESS CONNECTOR TEST KIT	5.2 HORN DIAGNOSTICS, DTC B2127
HD-41404	HARNESS CONNECTOR TEST KIT	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2141
HD-41404	HARNESS CONNECTOR TEST KIT	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2143, B2144
HD-41404	HARNESS CONNECTOR TEST KIT	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2148, B2149
HD-41404	HARNESS CONNECTOR TEST KIT	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2151
HD-41404	HARNESS CONNECTOR TEST KIT	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2153, B2154
HD-41404	HARNESS CONNECTOR TEST KIT	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2156
HD-41404	HARNESS CONNECTOR TEST KIT	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2158, B2159
HD-41404	HARNESS CONNECTOR TEST KIT	5.7 HEADLAMP DIAGNOSTICS, DTC B2132
HD-41404	HARNESS CONNECTOR TEST KIT	5.7 HEADLAMP DIAGNOSTICS, DTC B2133, B2134
HD-41404	HARNESS CONNECTOR TEST KIT	5.7 HEADLAMP DIAGNOSTICS, DTC B2137
HD-41404	HARNESS CONNECTOR TEST KIT	5.7 HEADLAMP DIAGNOSTICS, DTC B2138, B2139
HD-41404	HARNESS CONNECTOR TEST KIT	5.7 HEADLAMP DIAGNOSTICS, High Beam Headlamp Inoperative
HD-41404	HARNESS CONNECTOR TEST KIT	5.8 STOP LAMP DIAGNOSTICS, Stop Lamp Always On: DTC B2223
HD-41404	HARNESS CONNECTOR TEST KIT	5.8 STOP LAMP DIAGNOSTICS, DTC B2161
HD-41404	HARNESS CONNECTOR TEST KIT	5.8 STOP LAMP DIAGNOSTICS, DTC B2161
HD-41404	HARNESS CONNECTOR TEST KIT	5.8 STOP LAMP DIAGNOSTICS, DTC B2163, B2164
HD-41404	HARNESS CONNECTOR TEST KIT	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2106, B2107
HD-41404	HARNESS CONNECTOR TEST KIT	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2108, B2109
HD-41404	HARNESS CONNECTOR TEST KIT	5.10 RUNNING LAMP DIAGNOSTICS, Running Lamps Inoperative (Domestic Only)
HD-41404	HARNESS CONNECTOR TEST KIT	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2168, B2169
HD-41404	HARNESS CONNECTOR TEST KIT	5.15 ALARM DIAGNOSTICS, DTC B2172
HD-41404	HARNESS CONNECTOR TEST KIT	5.15 ALARM DIAGNOSTICS, DTC B2173
HD-41404	HARNESS CONNECTOR TEST KIT	5.16 SECURITY ANTENNA DIAGNOSTICS, DTC B2177
HD-41404	HARNESS CONNECTOR TEST KIT	5.16 SECURITY ANTENNA DIAGNOSTICS, Fails to Disarm
HD-41404	HARNESS CONNECTOR TEST KIT	5.18 NEUTRAL SWITCH DIAGNOSTICS, DTC B2218
HD-41404	HARNESS CONNECTOR TEST KIT	6.6 SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC, DTC B2102
HD-41404	HARNESS CONNECTOR TEST KIT	6.6 SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC, DTC B2103, B2104
HD-41404	HARNESS CONNECTOR TEST KIT	6.7 SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC, DTC B2102

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41404	HARNESS CONNECTOR TEST KIT	6.7 SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC, DTC B2103, B2104
HD-41404	HARNESS CONNECTOR TEST KIT	6.9 MAP SENSOR DIAGNOSTICS: IAC, DTC P0107
HD-41404	HARNESS CONNECTOR TEST KIT	6.9 MAP SENSOR DIAGNOSTICS: IAC, DTC P0108
HD-41404	HARNESS CONNECTOR TEST KIT	6.10 IAT DIAGNOSTICS: IAC, DTC P0113
HD-41404	HARNESS CONNECTOR TEST KIT	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0107
HD-41404	HARNESS CONNECTOR TEST KIT	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0108
HD-41404	HARNESS CONNECTOR TEST KIT	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0113
HD-41404	HARNESS CONNECTOR TEST KIT	6.12 ET SENSOR DIAGNOSTICS, DTC P0117
HD-41404	HARNESS CONNECTOR TEST KIT	6.12 ET SENSOR DIAGNOSTICS, DTC P0118
HD-41404	HARNESS CONNECTOR TEST KIT	6.13 TPS DIAGNOSTICS: IAC, DTC P0122
HD-41404	HARNESS CONNECTOR TEST KIT	6.13 TPS DIAGNOSTICS: IAC, DTC P0123
HD-41404	HARNESS CONNECTOR TEST KIT	6.14 TCA DIAGNOSTICS: ETC, DTC P0120
HD-41404	HARNESS CONNECTOR TEST KIT	6.14 TCA DIAGNOSTICS: ETC, DTC P0122
HD-41404	HARNESS CONNECTOR TEST KIT	6.14 TCA DIAGNOSTICS: ETC, DTC P0123
HD-41404	HARNESS CONNECTOR TEST KIT	6.14 TCA DIAGNOSTICS: ETC, DTC P0220
HD-41404	HARNESS CONNECTOR TEST KIT	6.14 TCA DIAGNOSTICS: ETC, DTC P0222
HD-41404	HARNESS CONNECTOR TEST KIT	6.14 TCA DIAGNOSTICS: ETC, DTC P0223
HD-41404	HARNESS CONNECTOR TEST KIT	6.15 HO2S DIAGNOSTICS, DTC P0031
HD-41404	HARNESS CONNECTOR TEST KIT	6.15 HO2S DIAGNOSTICS, DTC P0051
HD-41404	HARNESS CONNECTOR TEST KIT	6.15 HO2S DIAGNOSTICS, DTC P0052
HD-41404	HARNESS CONNECTOR TEST KIT	6.15 HO2S DIAGNOSTICS, DTC P0132
HD-41404	HARNESS CONNECTOR TEST KIT	6.15 HO2S DIAGNOSTICS, DTC P0151
HD-41404	HARNESS CONNECTOR TEST KIT	6.15 HO2S DIAGNOSTICS, DTC P0152
HD-41404	HARNESS CONNECTOR TEST KIT	6.16 FUEL INJECTOR DIAGNOSTICS, DTC P0261
HD-41404	HARNESS CONNECTOR TEST KIT	6.16 FUEL INJECTOR DIAGNOSTICS, DTC P0264
HD-41404	HARNESS CONNECTOR TEST KIT	6.17 CKP SENSOR DIAGNOSTICS, DTC P0371, P0374
HD-41404	HARNESS CONNECTOR TEST KIT	6.18 PURGE SOLENOID DIAGNOSTICS, DTC P0445
HD-41404	HARNESS CONNECTOR TEST KIT	6.19 VSS DIAGNOSTICS, DTC P0503
HD-41404	HARNESS CONNECTOR TEST KIT	6.20 IDLE SPEED CONTROL DIAGNOSTICS: IAC, DTC P0506, P0507
HD-41404	HARNESS CONNECTOR TEST KIT	6.23 DTC P0641: IAC, DTC P0641
HD-41404	HARNESS CONNECTOR TEST KIT	6.24 5V REFERENCE DIAGNOSTICS: ETC, DTC P0641
HD-41404	HARNESS CONNECTOR TEST KIT	6.24 5V REFERENCE DIAGNOSTICS: ETC, DTC P0651
HD-41404	HARNESS CONNECTOR TEST KIT	6.25 INTAKE SOLENOID DIAGNOSTICS, DTC P0661
HD-41404	HARNESS CONNECTOR TEST KIT	6.28 COMBUSTION EFFICIENCY DIAGNOSTICS, DTC P1353, P1356
HD-41404	HARNESS CONNECTOR TEST KIT	6.29 EXHAUST ACTUATOR DIAGNOSTICS, DTC P1475
HD-41404	HARNESS CONNECTOR TEST KIT	6.29 EXHAUST ACTUATOR DIAGNOSTICS, DTC P1478
HD-41404	HARNESS CONNECTOR TEST KIT	6.30 JSS DIAGNOSTICS, Side Stand Displayed on Speedometer
HD-41404	HARNESS CONNECTOR TEST KIT	6.33 ACR DIAGNOSTICS, DTC P1655
HD-41404	HARNESS CONNECTOR TEST KIT	6.33 ACR DIAGNOSTICS, DTC P1655

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41404	HARNESS CONNECTOR TEST KIT	6.33 ACR DIAGNOSTICS, DTC P1656
HD-41404	HARNESS CONNECTOR TEST KIT	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2100
HD-41404	HARNESS CONNECTOR TEST KIT	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2101
HD-41404	HARNESS CONNECTOR TEST KIT	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2103
HD-41404	HARNESS CONNECTOR TEST KIT	6.37 TGS DIAGNOSTICS, DTC P2122
HD-41404	HARNESS CONNECTOR TEST KIT	6.37 TGS DIAGNOSTICS, DTC P2123
HD-41404	HARNESS CONNECTOR TEST KIT	6.37 TGS DIAGNOSTICS, DTC P2127
HD-41404	HARNESS CONNECTOR TEST KIT	6.37 TGS DIAGNOSTICS, DTC P2128
HD-41404	HARNESS CONNECTOR TEST KIT	6.38 CORRELATION ERROR DIAGNOSTICS, DTC P2135
HD-41404	HARNESS CONNECTOR TEST KIT	6.38 CORRELATION ERROR DIAGNOSTICS, DTC P2138
HD-41404	HARNESS CONNECTOR TEST KIT	6.40 IGN COIL DRIVER DIAGNOSTICS, DTC P2301
HD-41404	HARNESS CONNECTOR TEST KIT	6.40 IGN COIL DRIVER DIAGNOSTICS, DTC P2304
HD-41404	HARNESS CONNECTOR TEST KIT	6.41 ENGINE CRANKS BUT WILL NOT START, Engine Cranks but Will Not Start
HD-41404	HARNESS CONNECTOR TEST KIT	6.43 STARTS, THEN STALLS, Starts, Then Stalls
HD-41404	HARNESS CONNECTOR TEST KIT	6.44 MISFIRE AT IDLE OR UNDER LOAD, Misfire at Idle or Under Load
HD-41404	HARNESS CONNECTOR TEST KIT	7.2 ABS INTERNAL DIAGNOSTICS, DTC C1014, C1040, C1055, C1061, C1062, C1065, C1066
HD-41404	HARNESS CONNECTOR TEST KIT	7.3 WSS DIAGNOSTICS, DTC C1021, C1023, C1025, C1027, C1029
HD-41404	HARNESS CONNECTOR TEST KIT	7.3 WSS DIAGNOSTICS, DTC C1032
HD-41404	HARNESS CONNECTOR TEST KIT	7.3 WSS DIAGNOSTICS, DTC C1034
HD-41404	HARNESS CONNECTOR TEST KIT	7.5 ABS INDICATOR ALWAYS ON, FLASHING OR INOPERATIVE, ABS Indicator Always On or Inoperative
HD-41475	DEUTSCH TERMINAL REPAIR KIT	B.5 DEUTSCH DT SEALED CONNECTORS, Deutsch DT and DTM Sealed Connector Repair
HD-41475-100	FLAT BLADE L-HOOK	B.5 DEUTSCH DT SEALED CONNECTORS, Deutsch DT and DTM Sealed Connector Repair
HD-41609	MULTI-LOCK CRIMPER	B.15 TYCO MULTILOCK UNSEALED CON-NECTORS, Tyco Multilock Unsealed Connector Repair
HD-42682	BREAKOUT BOX	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-42682	BREAKOUT BOX	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-42682	BREAKOUT BOX	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-42682	BREAKOUT BOX	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-42682	BREAKOUT BOX	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-42682	BREAKOUT BOX	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, Speedometer Inoperative: DTC U0156

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-42682	BREAKOUT BOX	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, Tachometer Inoperative: DTC U0157
HD-42682	BREAKOUT BOX	4.2 FUEL LEVEL SENDER DIAGNOSTICS, DTC B1210
HD-42682	BREAKOUT BOX	4.2 FUEL LEVEL SENDER DIAGNOSTICS, DTC B1211
HD-42682	BREAKOUT BOX	4.4 NO INSTRUMENT POWER DIAGNOSTICS, No Instrument Power
HD-42682	BREAKOUT BOX	4.4 NO INSTRUMENT POWER DIAGNOSTICS, No Instrument Power
HD-42682	BREAKOUT BOX	4.4 NO INSTRUMENT POWER DIAGNOSTICS, DTC B1200
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, Oil Pressure Lamp Inoperative
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, Neutral Lamp Inoperative
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, High Beam Indicator Inoperative
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, Turn Signal Indicator Inoperative
HD-42682	BREAKOUT BOX	4.5 INDICATOR LAMPS, Low Fuel Lamp Always On
HD-42682	BREAKOUT BOX	7.5 ABS INDICATOR ALWAYS ON, FLASHING OR INOPERATIVE, ABS Indicator Always On or Inoperative
HD-42879	DEUTSCH CRIMPER	B.5 DEUTSCH DT SEALED CONNECTORS, Deutsch DT and DTM Sealed Connector Repair
HD-44695-A	MULTI-LOCK CRIMPER	B.15 TYCO MULTILOCK UNSEALED CONNECTORS, Tyco Multilock Unsealed Connector Repair
HD-45325	JUMPER HARNESS	7.5 ABS INDICATOR ALWAYS ON, FLASHING OR INOPERATIVE, ABS Indicator Always On or Inoperative
HD-45928	TERMINAL REMOVER	B.4 DELPHI MICRO 64 SEALED CONNECTORS, Delphi Micro 64 Sealed Connector Repair
HD-45929	TERMINAL CRIMPER	B.4 DELPHI MICRO 64 SEALED CONNECTORS, Delphi Micro 64 Sealed Connector Repair
HD-46601	BREAKOUT BOX ADAPTERS	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-46601	BREAKOUT BOX ADAPTERS	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-46601	BREAKOUT BOX ADAPTERS	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-46601	BREAKOUT BOX ADAPTERS	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-46601	BREAKOUT BOX ADAPTERS	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-46601	BREAKOUT BOX ADAPTERS	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, Speedometer Inoperative: DTC U0156
HD-46601	BREAKOUT BOX ADAPTERS	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, Tachometer Inoperative: DTC U0157
HD-46601	BREAKOUT BOX ADAPTERS	4.2 FUEL LEVEL SENDER DIAGNOSTICS, DTC B1210
HD-46601	BREAKOUT BOX ADAPTERS	4.2 FUEL LEVEL SENDER DIAGNOSTICS, DTC B1211
HD-46601	BREAKOUT BOX ADAPTERS	4.4 NO INSTRUMENT POWER DIAGNOSTICS, No Instrument Power

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-46601	BREAKOUT BOX ADAPTERS	4.4 NO INSTRUMENT POWER DIAGNOSTICS, No Instrument Power
HD-46601	BREAKOUT BOX ADAPTERS	4.4 NO INSTRUMENT POWER DIAGNOSTICS, DTC B1200
HD-46601	BREAKOUT BOX ADAPTERS	4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On
HD-46601	BREAKOUT BOX ADAPTERS	4.5 INDICATOR LAMPS, Oil Pressure Lamp Inoperative
HD-46601	BREAKOUT BOX ADAPTERS	4.5 INDICATOR LAMPS, Neutral Lamp Inoperative
HD-46601	BREAKOUT BOX ADAPTERS	4.5 INDICATOR LAMPS, High Beam Indicator Inoperative
HD-46601	BREAKOUT BOX ADAPTERS	4.5 INDICATOR LAMPS, Turn Signal Indicator Inoperative
HD-46601	BREAKOUT BOX ADAPTERS	4.5 INDICATOR LAMPS, Low Fuel Lamp Always On
HD-48114	1.50 MM REMOVAL TOOL	B.10 MOLEX MX SERIES SEALED CONNECTORS, Molex MX 64 and 150 Sealed Connector Repair
HD-48119	ELECTRICAL CRIMPER	B.10 MOLEX MX SERIES SEALED CONNECTORS, Molex MX 64 and 150 Sealed Connector Repair
HD-48650	DIGITAL TECHNICIAN II	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-48650	DIGITAL TECHNICIAN II	1.4 DIAGNOSTICS AND TROUBLESHOOTING, Job Time Codes Values
HD-48650	DIGITAL TECHNICIAN II	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, DTC U0300
HD-48650	DIGITAL TECHNICIAN II	4.3 TRIP ODOMETER FUNCTIONS INOPERATIVE, DTC B2255, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	5.8 STOP LAMP DIAGNOSTICS, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	5.11 SECURITY SYSTEM, Security System Features
HD-48650	DIGITAL TECHNICIAN II	6.2 EFI SYSTEM: ETC, General
HD-48650	DIGITAL TECHNICIAN II	6.15 HO2S DIAGNOSTICS, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	6.20 IDLE SPEED CONTROL DIAGNOSTICS: IAC, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	6.26 DTC P1009, General
HD-48650	DIGITAL TECHNICIAN II	7.1 ANTI-LOCK BRAKE SYSTEM (ABS) GENERAL INFORMATION, Description and Operation
HD-48650	DIGITAL TECHNICIAN II	7.4 ABS VIN CALIBRATION DIAGNOSTICS, Description and Operation
HD-50120	UNIVERSAL CRIMPER SET	B.9 MOLEX CMC SEALED CONNECTORS, Crimping Terminals
HD-50120-11	DIE SET	B.7 JST JWPF SEALED CONNECTORS, JST JWPF Sealed Connector Repair
HD-50120-11	DIE SET	B.8 MOLEX BPT SEALED CONNECTORS, Molex BPT Sealed Connector Repair
HD-50120-11	DIE SET	B.10 MOLEX MX SERIES SEALED CONNECTORS, Molex MX 64 and 150 Sealed Connector Repair

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50120-2	HAND CRIMP FRAME	B.6 JAE MX19 SEALED CONNECTORS, JAE MX19 Sealed Connectors
HD-50120-2	HAND CRIMP FRAME	B.7 JST JWPF SEALED CONNECTORS, JST JWPF Sealed Connector Repair
HD-50120-2	HAND CRIMP FRAME	B.8 MOLEX BPT SEALED CONNECTORS, Molex BPT Sealed Connector Repair
HD-50120-2	HAND CRIMP FRAME	B.9 MOLEX CMC SEALED CONNECTORS, Molex CMC Sealed Connectors
HD-50120-2	HAND CRIMP FRAME	B.9 MOLEX CMC SEALED CONNECTORS, Crimping Terminals
HD-50120-2	HAND CRIMP FRAME	B.10 MOLEX MX SERIES SEALED CON-NECTORS, Molex MX 64 and 150 Sealed Connector Repair
HD-50120-2	HAND CRIMP FRAME	B.12 TYCO GET 64 SEALED CONNECTORS, Tyco GET 64 Sealed Connector Repair
HD-50120-2	HAND CRIMP FRAME	B.14 TYCO MCP SEALED CONNECTORS, Tyco MCP Sealed Connector Repair
HD-50120-3	DIE SET	B.9 MOLEX CMC SEALED CONNECTORS, Molex CMC Sealed Connectors
HD-50120-3	DIE SET	B.9 MOLEX CMC SEALED CONNECTORS, Crimping Terminals
HD-50120-4	DIE SET	B.9 MOLEX CMC SEALED CONNECTORS, Molex CMC Sealed Connectors
HD-50120-4	DIE SET	B.9 MOLEX CMC SEALED CONNECTORS, Crimping Terminals
HD-50120-6	DIE SET	B.6 JAE MX19 SEALED CONNECTORS, JAE MX19 Sealed Connectors
HD-50120-7	DIE SET	B.12 TYCO GET 64 SEALED CONNECTORS, Tyco GET 64 Sealed Connector Repair
HD-50120-8	DIE SET	B.14 TYCO MCP SEALED CONNECTORS, Tyco MCP Sealed Connector Repair
HD-50341	WHEEL SPEED SENSOR TEST LEAD	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50341	WHEEL SPEED SENSOR TEST LEAD	7.3 WSS DIAGNOSTICS, DTC C1032
HD-50341	WHEEL SPEED SENSOR TEST LEAD	7.3 WSS DIAGNOSTICS, DTC C1034
HD-50390-1	BREAKOUT BOX	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-1	BREAKOUT BOX	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-1	BREAKOUT BOX	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-1	BREAKOUT BOX	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-1	BREAKOUT BOX	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-1	BREAKOUT BOX	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-1	BREAKOUT BOX	1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test
HD-50390-1	BREAKOUT BOX	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-50390-1	BREAKOUT BOX	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-1	BREAKOUT BOX	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-50390-1	BREAKOUT BOX	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, DTC U0100
HD-50390-1	BREAKOUT BOX	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, DTC U0121
HD-50390-1	BREAKOUT BOX	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, DTC U0121
HD-50390-1	BREAKOUT BOX	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, No Vehicle Power: DTC U0140
HD-50390-1	BREAKOUT BOX	3.2 STARTING SYSTEM, Nothing Clicks
HD-50390-1	BREAKOUT BOX	3.2 STARTING SYSTEM, Starter Stalls or Spins Too Slowly
HD-50390-1	BREAKOUT BOX	3.3 STARTER OUTPUT DTCS, DTC B2121
HD-50390-1	BREAKOUT BOX	3.3 STARTER OUTPUT DTCS, DTC B2122
HD-50390-1	BREAKOUT BOX	3.3 STARTER OUTPUT DTCS, DTC B2123
HD-50390-1	BREAKOUT BOX	3.3 STARTER OUTPUT DTCS, DTC B2124
HD-50390-1	BREAKOUT BOX	3.7 ABS VOLTAGE DIAGNOSTICS, DTC C0562
HD-50390-1	BREAKOUT BOX	3.8 BATTERY AND SYSTEM VOLTAGE DIAGNOSTICS, DTC P0562
HD-50390-1	BREAKOUT BOX	3.8 BATTERY AND SYSTEM VOLTAGE DIAGNOSTICS, DTC P0562
HD-50390-1	BREAKOUT BOX	3.9 IGN SWITCH DIAGNOSTICS, DTC B2201
HD-50390-1	BREAKOUT BOX	3.9 IGN SWITCH DIAGNOSTICS, DTC B2203
HD-50390-1	BREAKOUT BOX	3.10 ENGINE STOP SWITCH DIAGNOSTICS, DTC B2206
HD-50390-1	BREAKOUT BOX	3.10 ENGINE STOP SWITCH DIAGNOSTICS, DTC B2208
HD-50390-1	BREAKOUT BOX	4.2 FUEL LEVEL SENDER DIAGNOSTICS, DTC B1210
HD-50390-1	BREAKOUT BOX	4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On
HD-50390-1	BREAKOUT BOX	4.5 INDICATOR LAMPS, Neutral Lamp Inoperative
HD-50390-1	BREAKOUT BOX	5.1 ACC CIRCUIT DIAGNOSTICS, DTC B2113, B2114
HD-50390-1	BREAKOUT BOX	5.2 HORN DIAGNOSTICS, DTC B2127
HD-50390-1	BREAKOUT BOX	5.2 HORN DIAGNOSTICS, Horn Inoperative
HD-50390-1	BREAKOUT BOX	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2141
HD-50390-1	BREAKOUT BOX	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2143, B2144
HD-50390-1	BREAKOUT BOX	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2146
HD-50390-1	BREAKOUT BOX	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2148, B2149
HD-50390-1	BREAKOUT BOX	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2151
HD-50390-1	BREAKOUT BOX	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2153, B2154
HD-50390-1	BREAKOUT BOX	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2156

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PART NUMBER	TOOL NAME	NOTES
HD-50390-1	BREAKOUT BOX	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2158, B2159
HD-50390-1	BREAKOUT BOX	5.7 HEADLAMP DIAGNOSTICS, DTC B2133, B2134
HD-50390-1	BREAKOUT BOX	5.7 HEADLAMP DIAGNOSTICS, DTC B2138, B2139
HD-50390-1	BREAKOUT BOX	5.7 HEADLAMP DIAGNOSTICS, High Beam Headlamp Inoperative
HD-50390-1	BREAKOUT BOX	5.7 HEADLAMP DIAGNOSTICS, Low Beam Headlamp Inoperative
HD-50390-1	BREAKOUT BOX	5.8 STOP LAMP DIAGNOSTICS, Stop Lamp Always On: DTC B2223
HD-50390-1	BREAKOUT BOX	5.8 STOP LAMP DIAGNOSTICS, DTC B2161
HD-50390-1	BREAKOUT BOX	5.8 STOP LAMP DIAGNOSTICS, DTC B2163, B2164
HD-50390-1	BREAKOUT BOX	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2106, B2107
HD-50390-1	BREAKOUT BOX	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2108, B2109
HD-50390-1	BREAKOUT BOX	5.10 RUNNING LAMP DIAGNOSTICS, Running Lamps Inoperative (Domestic Only)
HD-50390-1	BREAKOUT BOX	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2168, B2169
HD-50390-1	BREAKOUT BOX	5.15 ALARM DIAGNOSTICS, DTC B2173
HD-50390-1	BREAKOUT BOX	5.16 SECURITY ANTENNA DIAGNOSTICS, DTC B2176
HD-50390-1	BREAKOUT BOX	5.16 SECURITY ANTENNA DIAGNOSTICS, DTC B2177
HD-50390-1	BREAKOUT BOX	5.16 SECURITY ANTENNA DIAGNOSTICS, Fails to Disarm
HD-50390-1	BREAKOUT BOX	5.18 NEUTRAL SWITCH DIAGNOSTICS, DTC B2218
HD-50390-1	BREAKOUT BOX	6.6 SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC, DTC B2102
HD-50390-1	BREAKOUT BOX	6.6 SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC, DTC B2103, B2104
HD-50390-1	BREAKOUT BOX	6.7 SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC, DTC B2102
HD-50390-1	BREAKOUT BOX	6.7 SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC, DTC B2103, B2104
HD-50390-1	BREAKOUT BOX	6.8 FUEL PUMP DIAGNOSTICS, DTC B2116
HD-50390-1	BREAKOUT BOX	6.9 MAP SENSOR DIAGNOSTICS: IAC, DTC P0107
HD-50390-1	BREAKOUT BOX	6.9 MAP SENSOR DIAGNOSTICS: IAC, DTC P0107
HD-50390-1	BREAKOUT BOX	6.9 MAP SENSOR DIAGNOSTICS: IAC, DTC P0108
HD-50390-1	BREAKOUT BOX	6.9 MAP SENSOR DIAGNOSTICS: IAC, DTC P0108
HD-50390-1	BREAKOUT BOX	6.10 IAT DIAGNOSTICS: IAC, DTC P0112
HD-50390-1	BREAKOUT BOX	6.10 IAT DIAGNOSTICS: IAC, DTC P0113
HD-50390-1	BREAKOUT BOX	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0107
HD-50390-1	BREAKOUT BOX	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0107
HD-50390-1	BREAKOUT BOX	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0108
HD-50390-1	BREAKOUT BOX	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0112
HD-50390-1	BREAKOUT BOX	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0113

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PART NUMBER	TOOL NAME	NOTES
HD-50390-1	BREAKOUT BOX	6.12 ET SENSOR DIAGNOSTICS, DTC P0117
HD-50390-1	BREAKOUT BOX	6.12 ET SENSOR DIAGNOSTICS, DTC P0118
HD-50390-1	BREAKOUT BOX	6.13 TPS DIAGNOSTICS: IAC, DTC P0122
HD-50390-1	BREAKOUT BOX	6.13 TPS DIAGNOSTICS: IAC, DTC P0122
HD-50390-1	BREAKOUT BOX	6.13 TPS DIAGNOSTICS: IAC, DTC P0123
HD-50390-1	BREAKOUT BOX	6.14 TCA DIAGNOSTICS: ETC, DTC P0120
HD-50390-1	BREAKOUT BOX	6.14 TCA DIAGNOSTICS: ETC, DTC P0122
HD-50390-1	BREAKOUT BOX	6.14 TCA DIAGNOSTICS: ETC, DTC P0123
HD-50390-1	BREAKOUT BOX	6.14 TCA DIAGNOSTICS: ETC, DTC P0220
HD-50390-1	BREAKOUT BOX	6.14 TCA DIAGNOSTICS: ETC, DTC P0222
HD-50390-1	BREAKOUT BOX	6.14 TCA DIAGNOSTICS: ETC, DTC P0223
HD-50390-1	BREAKOUT BOX	6.15 HO2S DIAGNOSTICS, DTC P0031
HD-50390-1	BREAKOUT BOX	6.15 HO2S DIAGNOSTICS, DTC P0032
HD-50390-1	BREAKOUT BOX	6.15 HO2S DIAGNOSTICS, DTC P0051
HD-50390-1	BREAKOUT BOX	6.15 HO2S DIAGNOSTICS, DTC P0052
HD-50390-1	BREAKOUT BOX	6.15 HO2S DIAGNOSTICS, DTC P0131
HD-50390-1	BREAKOUT BOX	6.15 HO2S DIAGNOSTICS, DTC P0132
HD-50390-1	BREAKOUT BOX	6.15 HO2S DIAGNOSTICS, DTC P0134
HD-50390-1	BREAKOUT BOX	6.15 HO2S DIAGNOSTICS, DTC P0151
HD-50390-1	BREAKOUT BOX	6.15 HO2S DIAGNOSTICS, DTC P0152
HD-50390-1	BREAKOUT BOX	6.15 HO2S DIAGNOSTICS, DTC P0154
HD-50390-1	BREAKOUT BOX	6.16 FUEL INJECTOR DIAGNOSTICS, DTC P0261
HD-50390-1	BREAKOUT BOX	6.16 FUEL INJECTOR DIAGNOSTICS, DTC P0264
HD-50390-1	BREAKOUT BOX	6.17 CKP SENSOR DIAGNOSTICS, DTC P0371, P0374
HD-50390-1	BREAKOUT BOX	6.18 PURGE SOLENOID DIAGNOSTICS, DTC P0444
HD-50390-1	BREAKOUT BOX	6.18 PURGE SOLENOID DIAGNOSTICS, DTC P0444
HD-50390-1	BREAKOUT BOX	6.19 VSS DIAGNOSTICS, DTC P0502
HD-50390-1	BREAKOUT BOX	6.19 VSS DIAGNOSTICS, DTC P0503
HD-50390-1	BREAKOUT BOX	6.20 IDLE SPEED CONTROL DIAGNOSTICS: IAC, DTC P0506, P0507
HD-50390-1	BREAKOUT BOX	6.23 DTC P0641: IAC, DTC P0641
HD-50390-1	BREAKOUT BOX	6.24 5V REFERENCE DIAGNOSTICS: ETC, DTC P0641
HD-50390-1	BREAKOUT BOX	6.24 5V REFERENCE DIAGNOSTICS: ETC, DTC P0651
HD-50390-1	BREAKOUT BOX	6.25 INTAKE SOLENOID DIAGNOSTICS, DTC P0661
HD-50390-1	BREAKOUT BOX	6.28 COMBUSTION EFFICIENCY DIAGNOSTICS, DTC P1353, P1356
HD-50390-1	BREAKOUT BOX	6.29 EXHAUST ACTUATOR DIAGNOSTICS, DTC P1475
HD-50390-1	BREAKOUT BOX	6.29 EXHAUST ACTUATOR DIAGNOSTICS, DTC P1478
HD-50390-1	BREAKOUT BOX	6.30 JSS DIAGNOSTICS, DTC P1502
HD-50390-1	BREAKOUT BOX	6.30 JSS DIAGNOSTICS, Side Stand Displayed on Speedometer
HD-50390-1	BREAKOUT BOX	6.33 ACR DIAGNOSTICS, DTC P1655
HD-50390-1	BREAKOUT BOX	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2100

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PART NUMBER	TOOL NAME	NOTES
HD-50390-1	BREAKOUT BOX	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2101
HD-50390-1	BREAKOUT BOX	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2103
HD-50390-1	BREAKOUT BOX	6.37 TGS DIAGNOSTICS, DTC P2122
HD-50390-1	BREAKOUT BOX	6.37 TGS DIAGNOSTICS, DTC P2123
HD-50390-1	BREAKOUT BOX	6.37 TGS DIAGNOSTICS, DTC P2127
HD-50390-1	BREAKOUT BOX	6.37 TGS DIAGNOSTICS, DTC P2128
HD-50390-1	BREAKOUT BOX	6.38 CORRELATION ERROR DIAGNOSTICS, DTC P2135
HD-50390-1	BREAKOUT BOX	6.38 CORRELATION ERROR DIAGNOSTICS, DTC P2138
HD-50390-1	BREAKOUT BOX	6.40 IGN COIL DRIVER DIAGNOSTICS, DTC P2300
HD-50390-1	BREAKOUT BOX	6.40 IGN COIL DRIVER DIAGNOSTICS, DTC P2303
HD-50390-1	BREAKOUT BOX	6.41 ENGINE CRANKS BUT WILL NOT START, Engine Cranks but Will Not Start
HD-50390-1	BREAKOUT BOX	6.43 STARTS, THEN STALLS, Starts, Then Stalls
HD-50390-1	BREAKOUT BOX	6.44 MISFIRE AT IDLE OR UNDER LOAD, Misfire at Idle or Under Load
HD-50390-1	BREAKOUT BOX	7.2 ABS INTERNAL DIAGNOSTICS, DTC C1014, C1040, C1055, C1061, C1062, C1065, C1066
HD-50390-1	BREAKOUT BOX	7.3 WSS DIAGNOSTICS, DTC C1021, C1023, C1025, C1027, C1029
HD-50390-1	BREAKOUT BOX	7.3 WSS DIAGNOSTICS, DTC C1032
HD-50390-1	BREAKOUT BOX	7.3 WSS DIAGNOSTICS, DTC C1034
HD-50390-1	BREAKOUT BOX	7.5 ABS INDICATOR ALWAYS ON, FLASHING OR INOPERATIVE, ABS Indicator Always On or Inoperative
HD-50390-1-P1	ABS OVERLAY	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, DTC U0121
HD-50390-1-P1	ABS OVERLAY	3.7 ABS VOLTAGE DIAGNOSTICS, DTC C0562
HD-50390-1-P1	ABS OVERLAY	7.2 ABS INTERNAL DIAGNOSTICS, DTC C1014, C1040, C1055, C1061, C1062, C1065, C1066
HD-50390-1-P1	ABS OVERLAY	7.3 WSS DIAGNOSTICS, DTC C1021, C1023, C1025, C1027, C1029
HD-50390-1-P1	ABS OVERLAY	7.3 WSS DIAGNOSTICS, DTC C1032
HD-50390-1-P1	ABS OVERLAY	7.3 WSS DIAGNOSTICS, DTC C1034
HD-50390-1-P1	ABS OVERLAY	7.5 ABS INDICATOR ALWAYS ON, FLASHING OR INOPERATIVE, ABS Indicator Always On or Inoperative
HD-50390-2	BCM CABLE	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-2	BCM CABLE	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-2	BCM CABLE	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-50390-2	BCM CABLE	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, DTC U0121
HD-50390-2	BCM CABLE	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, No Vehicle Power: DTC U0140
HD-50390-2	BCM CABLE	3.2 STARTING SYSTEM, Nothing Clicks

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PART NUMBER	TOOL NAME	NOTES
HD-50390-2	BCM CABLE	3.3 STARTER OUTPUT DTCS, DTC B2121
HD-50390-2	BCM CABLE	3.3 STARTER OUTPUT DTCS, DTC B2122
HD-50390-2	BCM CABLE	3.3 STARTER OUTPUT DTCS, DTC B2123
HD-50390-2	BCM CABLE	3.3 STARTER OUTPUT DTCS, DTC B2124
HD-50390-2	BCM CABLE	3.8 BATTERY AND SYSTEM VOLTAGE DIAGNOSTICS, DTC P0562
HD-50390-2	BCM CABLE	3.9 IGN SWITCH DIAGNOSTICS, DTC B2201
HD-50390-2	BCM CABLE	3.9 IGN SWITCH DIAGNOSTICS, DTC B2203
HD-50390-2	BCM CABLE	3.10 ENGINE STOP SWITCH DIAGNOSTICS, DTC B2206
HD-50390-2	BCM CABLE	3.10 ENGINE STOP SWITCH DIAGNOSTICS, DTC B2208
HD-50390-2	BCM CABLE	4.2 FUEL LEVEL SENDER DIAGNOSTICS, DTC B1210
HD-50390-2	BCM CABLE	4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On
HD-50390-2	BCM CABLE	4.5 INDICATOR LAMPS, Neutral Lamp Inoperative
HD-50390-2	BCM CABLE	5.1 ACC CIRCUIT DIAGNOSTICS, DTC B2113, B2114
HD-50390-2	BCM CABLE	5.2 HORN DIAGNOSTICS, DTC B2127
HD-50390-2	BCM CABLE	5.2 HORN DIAGNOSTICS, Horn Inoperative
HD-50390-2	BCM CABLE	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2141
HD-50390-2	BCM CABLE	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2143, B2144
HD-50390-2	BCM CABLE	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2146
HD-50390-2	BCM CABLE	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2148, B2149
HD-50390-2	BCM CABLE	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2151
HD-50390-2	BCM CABLE	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2153, B2154
HD-50390-2	BCM CABLE	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2156
HD-50390-2	BCM CABLE	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2158, B2159
HD-50390-2	BCM CABLE	5.7 HEADLAMP DIAGNOSTICS, DTC B2133, B2134
HD-50390-2	BCM CABLE	5.7 HEADLAMP DIAGNOSTICS, DTC B2138, B2139
HD-50390-2	BCM CABLE	5.7 HEADLAMP DIAGNOSTICS, High Beam Headlamp Inoperative
HD-50390-2	BCM CABLE	5.7 HEADLAMP DIAGNOSTICS, Low Beam Headlamp Inoperative
HD-50390-2	BCM CABLE	5.8 STOP LAMP DIAGNOSTICS, Stop Lamp Always On: DTC B2223
HD-50390-2	BCM CABLE	5.8 STOP LAMP DIAGNOSTICS, DTC B2161
HD-50390-2	BCM CABLE	5.8 STOP LAMP DIAGNOSTICS, DTC B2163, B2164
HD-50390-2	BCM CABLE	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2106, B2107
HD-50390-2	BCM CABLE	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2108, B2109
HD-50390-2	BCM CABLE	5.10 RUNNING LAMP DIAGNOSTICS, Running Lamps Inoperative (Domestic Only)

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-2	BCM CABLE	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2168, B2169
HD-50390-2	BCM CABLE	5.15 ALARM DIAGNOSTICS, DTC B2173
HD-50390-2	BCM CABLE	5.16 SECURITY ANTENNA DIAGNOSTICS, DTC B2176
HD-50390-2	BCM CABLE	5.16 SECURITY ANTENNA DIAGNOSTICS, DTC B2177
HD-50390-2	BCM CABLE	5.16 SECURITY ANTENNA DIAGNOSTICS, Fails to Disarm
HD-50390-2	BCM CABLE	5.18 NEUTRAL SWITCH DIAGNOSTICS, DTC B2218
HD-50390-2	BCM CABLE	6.6 SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC, DTC B2103, B2104
HD-50390-2	BCM CABLE	6.7 SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC, DTC B2103, B2104
HD-50390-2	BCM CABLE	6.8 FUEL PUMP DIAGNOSTICS, DTC B2116
HD-50390-2	BCM CABLE	6.41 ENGINE CRANKS BUT WILL NOT START, Engine Cranks but Will Not Start
HD-50390-2-P	BCM OVERLAY	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-2-P	BCM OVERLAY	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-50390-2-P	BCM OVERLAY	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, DTC U0121
HD-50390-2-P	BCM OVERLAY	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, No Vehicle Power: DTC U0140
HD-50390-2-P	BCM OVERLAY	3.2 STARTING SYSTEM, Nothing Clicks
HD-50390-2-P	BCM OVERLAY	3.3 STARTER OUTPUT DTCS, DTC B2121
HD-50390-2-P	BCM OVERLAY	3.3 STARTER OUTPUT DTCS, DTC B2122
HD-50390-2-P	BCM OVERLAY	3.3 STARTER OUTPUT DTCS, DTC B2123
HD-50390-2-P	BCM OVERLAY	3.3 STARTER OUTPUT DTCS, DTC B2124
HD-50390-2-P	BCM OVERLAY	3.8 BATTERY AND SYSTEM VOLTAGE DIAGNOSTICS, DTC P0562
HD-50390-2-P	BCM OVERLAY	3.9 IGN SWITCH DIAGNOSTICS, DTC B2201
HD-50390-2-P	BCM OVERLAY	3.9 IGN SWITCH DIAGNOSTICS, DTC B2203
HD-50390-2-P	BCM OVERLAY	3.10 ENGINE STOP SWITCH DIAGNOSTICS, DTC B2206
HD-50390-2-P	BCM OVERLAY	3.10 ENGINE STOP SWITCH DIAGNOSTICS, DTC B2208
HD-50390-2-P	BCM OVERLAY	4.2 FUEL LEVEL SENDER DIAGNOSTICS, DTC B1210
HD-50390-2-P	BCM OVERLAY	4.5 INDICATOR LAMPS, Oil Pressure Lamp Always On
HD-50390-2-P	BCM OVERLAY	4.5 INDICATOR LAMPS, Neutral Lamp Inoperative
HD-50390-2-P	BCM OVERLAY	5.1 ACC CIRCUIT DIAGNOSTICS, DTC B2113, B2114
HD-50390-2-P	BCM OVERLAY	5.2 HORN DIAGNOSTICS, DTC B2127
HD-50390-2-P	BCM OVERLAY	5.2 HORN DIAGNOSTICS, Horn Inoperative
HD-50390-2-P	BCM OVERLAY	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2141
HD-50390-2-P	BCM OVERLAY	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2143, B2144
HD-50390-2-P	BCM OVERLAY	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2146

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-2-P	BCM OVERLAY	5.5 FRONT TURN SIGNAL DIAGNOSTICS, DTC B2148, B2149
HD-50390-2-P	BCM OVERLAY	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2151
HD-50390-2-P	BCM OVERLAY	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2153, B2154
HD-50390-2-P	BCM OVERLAY	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2156
HD-50390-2-P	BCM OVERLAY	5.6 REAR TURN SIGNAL DIAGNOSTICS, DTC B2158, B2159
HD-50390-2-P	BCM OVERLAY	5.7 HEADLAMP DIAGNOSTICS, DTC B2133, B2134
HD-50390-2-P	BCM OVERLAY	5.7 HEADLAMP DIAGNOSTICS, DTC B2138, B2139
HD-50390-2-P	BCM OVERLAY	5.7 HEADLAMP DIAGNOSTICS, High Beam Headlamp Inoperative
HD-50390-2-P	BCM OVERLAY	5.7 HEADLAMP DIAGNOSTICS, Low Beam Headlamp Inoperative
HD-50390-2-P	BCM OVERLAY	5.8 STOP LAMP DIAGNOSTICS, Stop Lamp Always On: DTC B2223
HD-50390-2-P	BCM OVERLAY	5.8 STOP LAMP DIAGNOSTICS, DTC B2161
HD-50390-2-P	BCM OVERLAY	5.8 STOP LAMP DIAGNOSTICS, DTC B2163, B2164
HD-50390-2-P	BCM OVERLAY	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2106, B2107
HD-50390-2-P	BCM OVERLAY	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2108, B2109
HD-50390-2-P	BCM OVERLAY	5.10 RUNNING LAMP DIAGNOSTICS, Running Lamps Inoperative (Domestic Only)
HD-50390-2-P	BCM OVERLAY	5.10 RUNNING LAMP DIAGNOSTICS, DTC B2168, B2169
HD-50390-2-P	BCM OVERLAY	5.15 ALARM DIAGNOSTICS, DTC B2173
HD-50390-2-P	BCM OVERLAY	5.16 SECURITY ANTENNA DIAGNOSTICS, DTC B2176
HD-50390-2-P	BCM OVERLAY	5.16 SECURITY ANTENNA DIAGNOSTICS, DTC B2177
HD-50390-2-P	BCM OVERLAY	5.16 SECURITY ANTENNA DIAGNOSTICS, Fails to Disarm
HD-50390-2-P	BCM OVERLAY	5.18 NEUTRAL SWITCH DIAGNOSTICS, DTC B2218
HD-50390-2-P	BCM OVERLAY	6.6 SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC, DTC B2103, B2104
HD-50390-2-P	BCM OVERLAY	6.7 SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC, DTC B2103, B2104
HD-50390-2-P	BCM OVERLAY	6.8 FUEL PUMP DIAGNOSTICS, DTC B2116
HD-50390-2-P	BCM OVERLAY	6.18 PURGE SOLENOID DIAGNOSTICS, DTC P0444
HD-50390-2-P	BCM OVERLAY	6.41 ENGINE CRANKS BUT WILL NOT START, Engine Cranks but Will Not Start
HD-50390-4	ECM CABLE	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-4	ECM CABLE	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-4	ECM CABLE	1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test
HD-50390-4	ECM CABLE	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-4	ECM CABLE	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, DTC U0100
HD-50390-4	ECM CABLE	3.2 STARTING SYSTEM, Starter Stalls or Spins Too Slowly
HD-50390-4	ECM CABLE	3.8 BATTERY AND SYSTEM VOLTAGE DIAGNOSTICS, DTC P0562
HD-50390-4	ECM CABLE	6.6 SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC, DTC B2102
HD-50390-4	ECM CABLE	6.7 SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC, DTC B2102
HD-50390-4	ECM CABLE	6.9 MAP SENSOR DIAGNOSTICS: IAC, DTC P0107
HD-50390-4	ECM CABLE	6.9 MAP SENSOR DIAGNOSTICS: IAC, DTC P0107
HD-50390-4	ECM CABLE	6.10 IAT DIAGNOSTICS: IAC, DTC P0112
HD-50390-4	ECM CABLE	6.10 IAT DIAGNOSTICS: IAC, DTC P0113
HD-50390-4	ECM CABLE	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0107
HD-50390-4	ECM CABLE	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0107
HD-50390-4	ECM CABLE	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0108
HD-50390-4	ECM CABLE	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0112
HD-50390-4	ECM CABLE	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0113
HD-50390-4	ECM CABLE	6.12 ET SENSOR DIAGNOSTICS, DTC P0117
HD-50390-4	ECM CABLE	6.12 ET SENSOR DIAGNOSTICS, DTC P0118
HD-50390-4	ECM CABLE	6.13 TPS DIAGNOSTICS: IAC, DTC P0122
HD-50390-4	ECM CABLE	6.13 TPS DIAGNOSTICS: IAC, DTC P0122
HD-50390-4	ECM CABLE	6.13 TPS DIAGNOSTICS: IAC, DTC P0123
HD-50390-4	ECM CABLE	6.14 TCA DIAGNOSTICS: ETC, DTC P0120
HD-50390-4	ECM CABLE	6.14 TCA DIAGNOSTICS: ETC, DTC P0122
HD-50390-4	ECM CABLE	6.14 TCA DIAGNOSTICS: ETC, DTC P0123
HD-50390-4	ECM CABLE	6.14 TCA DIAGNOSTICS: ETC, DTC P0220
HD-50390-4	ECM CABLE	6.14 TCA DIAGNOSTICS: ETC, DTC P0222
HD-50390-4	ECM CABLE	6.14 TCA DIAGNOSTICS: ETC, DTC P0223
HD-50390-4	ECM CABLE	6.15 HO2S DIAGNOSTICS, DTC P0031
HD-50390-4	ECM CABLE	6.15 HO2S DIAGNOSTICS, DTC P0032
HD-50390-4	ECM CABLE	6.15 HO2S DIAGNOSTICS, DTC P0051
HD-50390-4	ECM CABLE	6.15 HO2S DIAGNOSTICS, DTC P0052
HD-50390-4	ECM CABLE	6.15 HO2S DIAGNOSTICS, DTC P0131
HD-50390-4	ECM CABLE	6.15 HO2S DIAGNOSTICS, DTC P0132
HD-50390-4	ECM CABLE	6.15 HO2S DIAGNOSTICS, DTC P0134
HD-50390-4	ECM CABLE	6.15 HO2S DIAGNOSTICS, DTC P0151
HD-50390-4	ECM CABLE	6.15 HO2S DIAGNOSTICS, DTC P0152
HD-50390-4	ECM CABLE	6.15 HO2S DIAGNOSTICS, DTC P0154
HD-50390-4	ECM CABLE	6.16 FUEL INJECTOR DIAGNOSTICS, DTC P0261
HD-50390-4	ECM CABLE	6.16 FUEL INJECTOR DIAGNOSTICS, DTC P0264
HD-50390-4	ECM CABLE	6.17 CKP SENSOR DIAGNOSTICS, DTC P0371, P0374

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-4	ECM CABLE	6.18 PURGE SOLENOID DIAGNOSTICS, DTC P0444
HD-50390-4	ECM CABLE	6.18 PURGE SOLENOID DIAGNOSTICS, DTC P0444
HD-50390-4	ECM CABLE	6.19 VSS DIAGNOSTICS, DTC P0502
HD-50390-4	ECM CABLE	6.19 VSS DIAGNOSTICS, DTC P0503
HD-50390-4	ECM CABLE	6.20 IDLE SPEED CONTROL DIAGNOSTICS: IAC, DTC P0506, P0507
HD-50390-4	ECM CABLE	6.23 DTC P0641: IAC, DTC P0641
HD-50390-4	ECM CABLE	6.24 5V REFERENCE DIAGNOSTICS: ETC, DTC P0641
HD-50390-4	ECM CABLE	6.24 5V REFERENCE DIAGNOSTICS: ETC, DTC P0651
HD-50390-4	ECM CABLE	6.25 INTAKE SOLENOID DIAGNOSTICS, DTC P0661
HD-50390-4	ECM CABLE	6.28 COMBUSTION EFFICIENCY DIAGNOSTICS, DTC P1353, P1356
HD-50390-4	ECM CABLE	6.29 EXHAUST ACTUATOR DIAGNOSTICS, DTC P1475
HD-50390-4	ECM CABLE	6.29 EXHAUST ACTUATOR DIAGNOSTICS, DTC P1478
HD-50390-4	ECM CABLE	6.30 JSS DIAGNOSTICS, DTC P1502
HD-50390-4	ECM CABLE	6.30 JSS DIAGNOSTICS, Side Stand Displayed on Speedometer
HD-50390-4	ECM CABLE	6.33 ACR DIAGNOSTICS, DTC P1655
HD-50390-4	ECM CABLE	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2100
HD-50390-4	ECM CABLE	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2101
HD-50390-4	ECM CABLE	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2103
HD-50390-4	ECM CABLE	6.37 TGS DIAGNOSTICS, DTC P2122
HD-50390-4	ECM CABLE	6.37 TGS DIAGNOSTICS, DTC P2123
HD-50390-4	ECM CABLE	6.37 TGS DIAGNOSTICS, DTC P2127
HD-50390-4	ECM CABLE	6.37 TGS DIAGNOSTICS, DTC P2128
HD-50390-4	ECM CABLE	6.38 CORRELATION ERROR DIAGNOSTICS, DTC P2135
HD-50390-4	ECM CABLE	6.38 CORRELATION ERROR DIAGNOSTICS, DTC P2138
HD-50390-4	ECM CABLE	6.40 IGN COIL DRIVER DIAGNOSTICS, DTC P2300
HD-50390-4	ECM CABLE	6.40 IGN COIL DRIVER DIAGNOSTICS, DTC P2303
HD-50390-4	ECM CABLE	6.43 STARTS, THEN STALLS, Starts, Then Stalls
HD-50390-4	ECM CABLE	6.44 MISFIRE AT IDLE OR UNDER LOAD, Misfire at Idle or Under Load
HD-50390-4-P	ECM OVERLAY	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-4-P	ECM OVERLAY	1.4 DIAGNOSTICS AND TROUBLESHOOTING, Wiggle Test
HD-50390-4-P	ECM OVERLAY	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-50390-4-P	ECM OVERLAY	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, DTC U0100
HD-50390-4-P	ECM OVERLAY	3.2 STARTING SYSTEM, Starter Stalls or Spins Too Slowly

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-4-P	ECM OVERLAY	3.8 BATTERY AND SYSTEM VOLTAGE DIAGNOSTICS, DTC P0562
HD-50390-4-P	ECM OVERLAY	6.6 SYSTEM POWER CIRCUIT DIAGNOSTICS: IAC, DTC B2102
HD-50390-4-P	ECM OVERLAY	6.7 SYSTEM POWER CIRCUIT DIAGNOSTICS: ETC, DTC B2102
HD-50390-4-P	ECM OVERLAY	6.9 MAP SENSOR DIAGNOSTICS: IAC, DTC P0107
HD-50390-4-P	ECM OVERLAY	6.9 MAP SENSOR DIAGNOSTICS: IAC, DTC P0107
HD-50390-4-P	ECM OVERLAY	6.9 MAP SENSOR DIAGNOSTICS: IAC, DTC P0108
HD-50390-4-P	ECM OVERLAY	6.10 IAT DIAGNOSTICS: IAC, DTC P0112
HD-50390-4-P	ECM OVERLAY	6.10 IAT DIAGNOSTICS: IAC, DTC P0113
HD-50390-4-P	ECM OVERLAY	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0107
HD-50390-4-P	ECM OVERLAY	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0107
HD-50390-4-P	ECM OVERLAY	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0108
HD-50390-4-P	ECM OVERLAY	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0112
HD-50390-4-P	ECM OVERLAY	6.11 TMAP SENSOR DIAGNOSTICS: ETC, DTC P0113
HD-50390-4-P	ECM OVERLAY	6.12 ET SENSOR DIAGNOSTICS, DTC P0117
HD-50390-4-P	ECM OVERLAY	6.12 ET SENSOR DIAGNOSTICS, DTC P0118
HD-50390-4-P	ECM OVERLAY	6.13 TPS DIAGNOSTICS: IAC, DTC P0122
HD-50390-4-P	ECM OVERLAY	6.13 TPS DIAGNOSTICS: IAC, DTC P0122
HD-50390-4-P	ECM OVERLAY	6.13 TPS DIAGNOSTICS: IAC, DTC P0123
HD-50390-4-P	ECM OVERLAY	6.14 TCA DIAGNOSTICS: ETC, DTC P0120
HD-50390-4-P	ECM OVERLAY	6.14 TCA DIAGNOSTICS: ETC, DTC P0122
HD-50390-4-P	ECM OVERLAY	6.14 TCA DIAGNOSTICS: ETC, DTC P0123
HD-50390-4-P	ECM OVERLAY	6.14 TCA DIAGNOSTICS: ETC, DTC P0220
HD-50390-4-P	ECM OVERLAY	6.14 TCA DIAGNOSTICS: ETC, DTC P0222
HD-50390-4-P	ECM OVERLAY	6.14 TCA DIAGNOSTICS: ETC, DTC P0223
HD-50390-4-P	ECM OVERLAY	6.15 HO2S DIAGNOSTICS, DTC P0031
HD-50390-4-P	ECM OVERLAY	6.15 HO2S DIAGNOSTICS, DTC P0032
HD-50390-4-P	ECM OVERLAY	6.15 HO2S DIAGNOSTICS, DTC P0051
HD-50390-4-P	ECM OVERLAY	6.15 HO2S DIAGNOSTICS, DTC P0052
HD-50390-4-P	ECM OVERLAY	6.15 HO2S DIAGNOSTICS, DTC P0131
HD-50390-4-P	ECM OVERLAY	6.15 HO2S DIAGNOSTICS, DTC P0132
HD-50390-4-P	ECM OVERLAY	6.15 HO2S DIAGNOSTICS, DTC P0134
HD-50390-4-P	ECM OVERLAY	6.15 HO2S DIAGNOSTICS, DTC P0151
HD-50390-4-P	ECM OVERLAY	6.15 HO2S DIAGNOSTICS, DTC P0152
HD-50390-4-P	ECM OVERLAY	6.15 HO2S DIAGNOSTICS, DTC P0154
HD-50390-4-P	ECM OVERLAY	6.16 FUEL INJECTOR DIAGNOSTICS, DTC P0261
HD-50390-4-P	ECM OVERLAY	6.16 FUEL INJECTOR DIAGNOSTICS, DTC P0264
HD-50390-4-P	ECM OVERLAY	6.17 CKP SENSOR DIAGNOSTICS, DTC P0371, P0374
HD-50390-4-P	ECM OVERLAY	6.18 PURGE SOLENOID DIAGNOSTICS, DTC P0444
HD-50390-4-P	ECM OVERLAY	6.19 VSS DIAGNOSTICS, DTC P0502
HD-50390-4-P	ECM OVERLAY	6.19 VSS DIAGNOSTICS, DTC P0503

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-4-P	ECM OVERLAY	6.20 IDLE SPEED CONTROL DIAGNOSTICS: IAC, DTC P0506, P0507
HD-50390-4-P	ECM OVERLAY	6.23 DTC P0641: IAC, DTC P0641
HD-50390-4-P	ECM OVERLAY	6.24 5V REFERENCE DIAGNOSTICS: ETC, DTC P0641
HD-50390-4-P	ECM OVERLAY	6.24 5V REFERENCE DIAGNOSTICS: ETC, DTC P0651
HD-50390-4-P	ECM OVERLAY	6.25 INTAKE SOLENOID DIAGNOSTICS, DTC P0661
HD-50390-4-P	ECM OVERLAY	6.28 COMBUSTION EFFICIENCY DIAGNOSTICS, DTC P1353, P1356
HD-50390-4-P	ECM OVERLAY	6.29 EXHAUST ACTUATOR DIAGNOSTICS, DTC P1475
HD-50390-4-P	ECM OVERLAY	6.29 EXHAUST ACTUATOR DIAGNOSTICS, DTC P1478
HD-50390-4-P	ECM OVERLAY	6.30 JSS DIAGNOSTICS, DTC P1502
HD-50390-4-P	ECM OVERLAY	6.30 JSS DIAGNOSTICS, Side Stand Displayed on Speedometer
HD-50390-4-P	ECM OVERLAY	6.33 ACR DIAGNOSTICS, DTC P1655
HD-50390-4-P	ECM OVERLAY	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2100
HD-50390-4-P	ECM OVERLAY	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2101
HD-50390-4-P	ECM OVERLAY	6.34 ETC ACTUATOR DIAGNOSTICS, DTC P2103
HD-50390-4-P	ECM OVERLAY	6.37 TGS DIAGNOSTICS, DTC P2122
HD-50390-4-P	ECM OVERLAY	6.37 TGS DIAGNOSTICS, DTC P2123
HD-50390-4-P	ECM OVERLAY	6.37 TGS DIAGNOSTICS, DTC P2127
HD-50390-4-P	ECM OVERLAY	6.37 TGS DIAGNOSTICS, DTC P2128
HD-50390-4-P	ECM OVERLAY	6.38 CORRELATION ERROR DIAGNOSTICS, DTC P2135
HD-50390-4-P	ECM OVERLAY	6.38 CORRELATION ERROR DIAGNOSTICS, DTC P2138
HD-50390-4-P	ECM OVERLAY	6.40 IGN COIL DRIVER DIAGNOSTICS, DTC P2300
HD-50390-4-P	ECM OVERLAY	6.40 IGN COIL DRIVER DIAGNOSTICS, DTC P2303
HD-50390-4-P	ECM OVERLAY	6.43 STARTS, THEN STALLS, Starts, Then Stalls
HD-50390-4-P	ECM OVERLAY	6.44 MISFIRE AT IDLE OR UNDER LOAD, Misfire at Idle or Under Load
HD-50390-6	ABS CABLE	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-6	ABS CABLE	1.3 DIAGNOSTIC TOOLS, How To Use Diagnostic Tools
HD-50390-6	ABS CABLE	2.2 ODOMETER SELF-DIAGNOSTIC INOPERATIVE: DTC U0001, U0011, B2274, Odometer Self-Diagnostic Inoperative: DTC U0001, U0011, B2274
HD-50390-6	ABS CABLE	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, DTC U0121
HD-50390-6	ABS CABLE	3.7 ABS VOLTAGE DIAGNOSTICS, DTC C0562
HD-50390-6	ABS CABLE	7.2 ABS INTERNAL DIAGNOSTICS, DTC C1014, C1040, C1055, C1061, C1062, C1065, C1066
HD-50390-6	ABS CABLE	7.3 WSS DIAGNOSTICS, DTC C1021, C1023, C1025, C1027, C1029
HD-50390-6	ABS CABLE	7.3 WSS DIAGNOSTICS, DTC C1032
HD-50390-6	ABS CABLE	7.3 WSS DIAGNOSTICS, DTC C1034

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-50390-6	ABS CABLE	7.5 ABS INDICATOR ALWAYS ON, FLASHING OR INOPERATIVE, ABS Indicator Always On or Inoperative
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL	2.3 NO VEHICLE POWER OR LOST COMMUNICATION DTCS, No Vehicle Power: DTC U0140
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL	5.2 HORN DIAGNOSTICS, DTC B2127
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL	5.8 STOP LAMP DIAGNOSTICS, Stop Lamp Always On: DTC B2223
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL	B.9 MOLEX CMC SEALED CONNECTORS, Molex CMC Sealed Connectors
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL	5.7 HEADLAMP DIAGNOSTICS, DTC B2132
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL	5.7 HEADLAMP DIAGNOSTICS, DTC B2137
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FASTENER	TORQUE VALUE	NOTES
No torque values were found in this manual.		

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