MAIN MENU

MERCURY MerCruiser

SERVICE MANUAL

Number 33

PCM 555 DIAGNOSTICS
SN 0M000000 and ABOVE

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Notice

Throughout this publication, Dangers, Warnings and Cautions (accompanied by the International HAZARD Symbol ⚠) are used to alert the mechanic to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. **OBSERVE THEM CAREFULLY!**

These Safety Alerts alone cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus common sense operation, are major accident prevention measures.

⚠ DANGER

Immediate hazards which will result in severe personal injury or death.

⚠ WARNING

Hazards or unsafe practices which could result in severe personal injury or death.

⚠ CAUTION

Hazards or unsafe practices which could result in minor personal injury or product or property damage.

Notice to Users of This Manual

This service manual has been written and published by the Service Department of Mercury Marine to aid our dealers' mechanics and company service personnel when servicing the products described herein.

It is assumed that these personnel are familiar with marine product servicing procedures. Furthermore, it is assumed that they have been trained in the recommended service procedures of Mercury MerCruiser product, including the use of mechanics' common hand tools and the special Mercury Marine or recommended tools from other suppliers.

We could not possibly know of and advise the marine trade of all conceivable procedures and of the possible hazards and/or results of each method. Therefore, anyone who uses a service procedure and/or tool, which is not recommended by the manufacturer, first must completely satisfy himself that neither his nor the products safety will be endangered.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. As required, revisions to this manual will be sent to all dealers contracted by us to sell and/or service these products.

We reserve the right to make changes to this manual without prior notification.

Refer to dealer service bulletins, operation maintenance and warranty manuals and installation manuals for other pertinent information concerning the products described in this manual.

Precautions

It should be kept in mind, while working on the product, that the electrical system and ignition system are capable of violent and damaging short circuits or severe electrical shocks. When performing any work where electrical terminals could possibly be grounded or touched by the mechanic, the battery cables should be disconnected at the battery.

Any time the intake or exhaust openings are exposed during service they should be covered to protect against accidental entrance of foreign material which could enter the cylinders and cause extensive internal damage when the engine is started.

It is important to note, during any maintenance procedure replacement fasteners must have the same measurements and strength as those removed. Numbers on the heads of the metric bolts and on the surfaces of metric nuts indicate their strength. American bolts use radial lines for this purpose, while most American nuts do not have strength markings. Mismatched or incorrect fasteners can result in damage or malfunction, or possibly personal injury. Therefore, fasteners removed should be saved for reuse in the same locations whenever possible. Where the fasteners are not satisfactory for re-use, care should be taken to select a replacement that matches the original.

Engine Mechanical Components

Many of the engine mechanical components are designed for marine applications. Unlike automotive engines, marine engines are subjected to extended periods of heavy load and wide open throttle operation and, therefore, require heavy-duty components. Special marine engine parts have design and manufacturing specifications that are required to provide long life and dependable performance. Marine engine parts also must be able to resist the corrosive action of salt or brackish water that will rust or corrode standard automotive parts within a short period of time.

Failure to use recommended Quicksilver service replacement parts can result in poor engine performance and/or durability, rapid corrosion of parts subjected to salt water and possibly complete failure of the engine.

Replacement Parts

⚠ WARNING

Electrical, ignition and fuel system components on MerCruiser Engines and Sterndrives are designed and manufactured to comply with U.S. Coast Guard Rules and Regulations to minimize risks of fire or explosion.

Use of replacement electrical, ignition or fuel system components, which do not comply with these rules and regulations, could result in a fire or explosion hazard and should be avoided.

When servicing the electrical, ignition and fuel systems, it is extremely important that all components are properly installed and tightened. If not, any electrical or ignition component opening would permit sparks to ignite fuel vapors from fuel system leaks, if they existed.

Failure to use recommended Quicksilver service replacement parts can result in poor engine performance and/or durability, rapid corrosion of parts subjected to salt water and possibly complete failure of the engine.

Use of parts other than recommended service replacement parts will void the warranty on those parts which are damaged as a result of the use of other than recommended replacement parts.

Models Covered in This Manual

Sterndrive (MCM) Model	Serial Number
496 MAG HO	0M000000 and Above
496 MAG	0M000000 and Above

Inboard (MIE) Model	Serial Number
8.1S HO	0M000000 and Above
8.1S Horizon	0M000000 and Above

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Service Manual Outline

Section 1 - General Information

Section 2 - Troubleshooting

Section 3 - Wiring Diagrams

General Information 1

Troubleshooting 2

Wiring Diagrams 3

SECTION 1A - GENERAL INFORMATION

SECTION 2A - TROUBLESHOOTING

SECTION 3A - WIRING DIAGRAMS

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SECTION 1A - GENERAL INFORMATION

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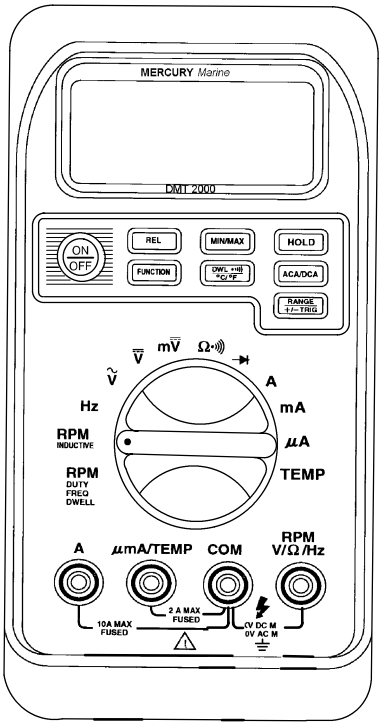
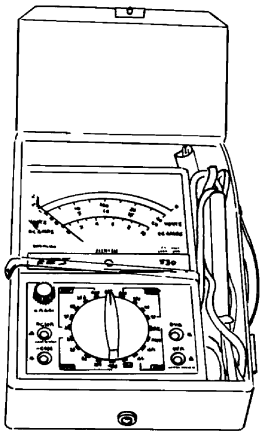
Abbreviations

amp	Amperes	IAC	Idle Air Control
BARO	Barometric Pressure	IGN	Ignition
Bat	Battery Positive Terminal, Battery or System Voltage	in. hg	Inches Of Mercury
B+	Battery Positive	INJ	Injection
Bps	Beeps	kPa	Kilopascal
CAM	Camshaft	KS	Knock Sensor System
cond	Condition	kV	Kilovolts
cont	Continuous	mA	milliamperes
Crank	Crankshaft	MPR	Main Power Relay
CAN	Control Area Network	MAP	Manifold Air Pressure
CKT	Circuit	MAT	Manifold Air Temperature
CMP	Camshaft Position Sensor	mohms	Milliohms
Conn	Connector	mSec	Millisecond
CPS	Crankshaft Position Sensor	N/C	Normally Closed
Cyl	Cylinder	N/O	Normally Open
DDT	Digital Diagnostic Terminal	PCM	Propulsion Control Module
Deg	Degrees	RAM	Random Access Memory
Diag	Diagnostic	REF HI	Reference High
DIS	Distributorless Ignition System	REF LO	Reference Low
DLC	Data Link Connector	ROM	Read Only Memory
Dtc	Diagnostic Trouble Code	SW	Switch
DMM DMT DMT DMT	Digital Multimeter	TACH	Tachometer
ECM	Engine Control Module	TERM	Terminal
ECT	Engine Coolant Temperature	TPS	Throttle Position Sensor
EFI	Electronic Fuel Injector	V	Volts
EMCT	Exhaust Manifold Coolant Temperature	VAC	Vacuum
ENG	Engine	WOT	Wide Open Throttle
GND	Ground		

Special Tools

DMT 2000A Tachometer / Multi-Meter Kit	91-854009A3
Description: Measures rpm on both 2 and 4 cycle marine engines, records the maximums and minimums simultaneously and will read accurately in high RFI environments. **Replacement components:** 91-854010-1 8 ft (2.4 m) Inductive Pick-Up 91-854011-1 Temperature Probe 91-854012 Ferrite Core 91-854013-1 Interface Module 91-854014-1 Hard Carrying Case 91-854015-1 User's Guide 91-802651 Test Leads **Optional Accessories:** 84-854016T 8 ft (2.4 m) Inductive Pick-Up Extension 91-802650 Clamp-On Current Probe 91-89045-1 Direct Voltage Adaptor	 77959

DVA / Multi-Meter Kit	91-99750A1
Description: Tests the electrical and ignition systems; consists of a VOA meter with built-in direct voltage adaptor.	 73609

Digital Diagnostic Terminal DDT

91-823686A2

Description:

Display problem codes stored in the ECM. It also allows the monitoring of various circuits and components in the fuel injection system. Must order the 91-803999 cartridge for MEFI 1, MEFI 2 and MEFI 3 ECM models 91-880118A2 cartridge for ECM 555 and PCM 555 models.

84-825003A1 Replacement 10 ft. (3 m) 25 pin Harness

91-8404805 Optional Heavy Duty Carrying case

Accessories:

An additional harness assembly may be required when using the DDT, refer to the following:

91-822560A13 Harness Assembly / Diagnostic Tester

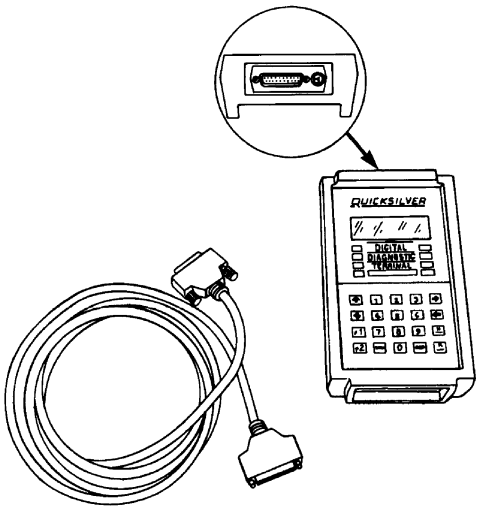
91-861540A1 Adaptor Harness

91-822560A7 Outboard Adapter Harness

91-84-822560A5 EFI Outboard Adaptor

91-822560T12 Scan Tool Harness Adaptor

91-822560A2 Harness Assembly / Diagnostic Tester



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EFI Outboard Harness Adaptor

Scan Tool Harness Adaptor

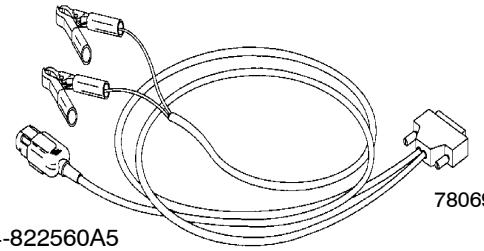
84-822560A5

84-822560T12

Description:

84-822560A5 Outboard Harness Adaptor may be used with 91-823686A32 DDT Scan Tool for PCM 555 and ECM 555 models.

Use the Harness Adaptor 84-822560T12 For PCM 555 Models to adapt the 4-pin Mercury MerCruiser connector to the 2-pin 84-822560A5 Outboard Harness.



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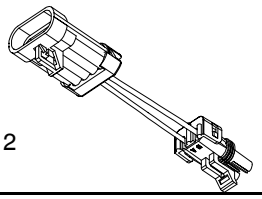
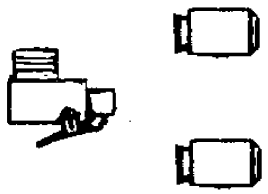
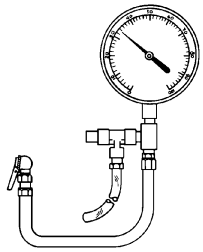
84-822560A5

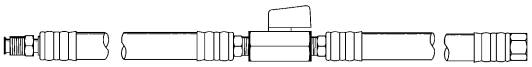


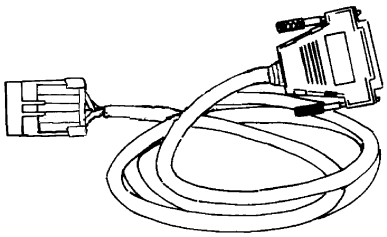
84-822560T12

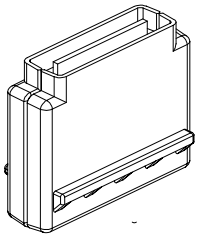
78034

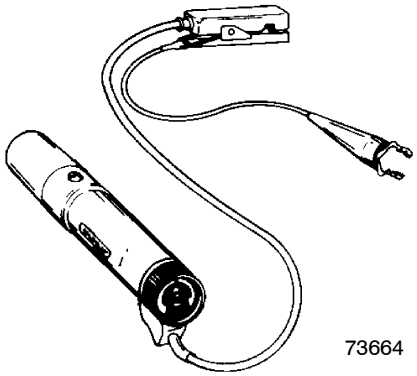
Fuel Pressure Gauge Adaptor Kit	91-803135
Description: Allows updating 91-16850A 2 and older Fuel Pressure Gauge Kits. Adapts the gauge to fit either the Mercury MerCruiser or the GM Shrader valve. This Adaptor Kit is included with the Fuel Pressure Gauge Kit 91-881833A2.	

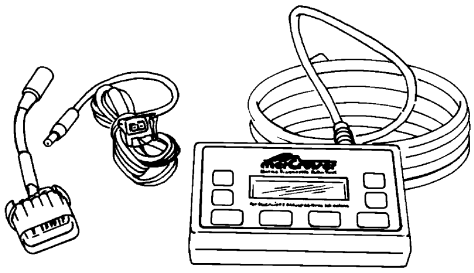
Fuel Pressure Gauge Kit	91-881833A2
Description: Use to test the fuel pump pressure, includes: 91-803135 Fuel Pressure Gauge Adaptor Kit 91-806901 Fuel Pressure Tee 91-881833A1 160 psi Gauge	 73814

Fuel Shut Off Tool	91-805918A1
Description: Use in fuel system pressure tests.	 74227

Harness Assembly / Diagnostic Tester	91-822560A13
Description: 25-pin to 4-pin Adaptor harness. For PCM 555 and ECM 555 models (4-pin connectors, no additional harness required).	 74214

Mercury MerCruiser DDT Cartridge Version 1.2	91-880118A2
Description: Use on PCM 555 and ECM 555 models.	 78036

Portable Timing Light	91-99379
Description: Checks the ignition timing, powered by two D-cell batteries.	 73664

Scan Tool Kit / Version 4.0	Note in Description
Description: Hand-held Scan Tool updated for 2001. (refer to Service Bulletin 2001-1). Use with models: MCM/MIE EFI (TBI) and MPI Gasoline MCM/MIE 496/8.1S MPI PCM 555 1997 and Newer MCM/MIE Carburetor Models with Thunderbolt Ignition System MCM/MIE D-Tronic Diesel ***NOTE:*** *Tool must be ordered from Rinda Technologies, Inc.*	 72428

Special Tools (continued)

NOTE: *[1] The High Impedance Multimeter that comes with the existing Outboard 2 Cycle EFI Tester, P/N 91-11001A2 meets the requirements listed above.*

NOTE: *[2] Quicksilver Digital Tachometer / Multi-Meter (DMT 2000) P/N 91-854009A1, meets the requirements listed above.*

NOTE: *[3] Using a test light with 100 mA or less rating may show a faint glow when test actually states no light.*

Tools may be ordered from:

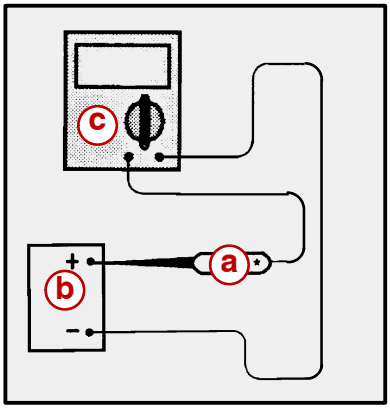
Kent-Moore Tools, Inc.	**Rinda Technologies**	**Mercury Marine**	**OTC**
29784 Little Mack	4563 N. Elston Ave.	W6250 Pioneer Road, P.O. Box1929	28635 Mound Rd.
Roseville, MI 48066	Chicago, IL 60630	Fond Du Lac, WI 54936-1939	Warren, MI 48092-3499
Phone: 800-345-2233	Phone: 773-736-6633	Phone: 920-929-5589, 800-487-MERC	Phone: 586-574-2332, 800-328-6657
	Fax: 773-736-2950	Fax: 920-457-8736	
	E-mail: Sales@rinda.com	www.MERCURYMARINE.com	www.servicesolutions.spx.com

Service Precautions

Observe the following:

- Before removing any ECM system component, disconnect both battery cables.
- Never start the engine without the battery being solidly connected.
- Never separate the battery from the on-board electrical system while the engine is operating.
- Never disconnect battery cables from the charging system while the engine is operating.
- When charging the battery, disconnect it from the boat's electrical system.
- Ensure that all cable harnesses are connected and that battery connections are clean.
- Never connect or disconnect the wiring harness at the ECM when the ignition is switch is in the on position.
- Before attempting any electric arc welding, disconnect the battery leads and the ECM connectors.
- When steam cleaning engines, do not direct the steam cleaning nozzle at ECM system components. If this happens, corrosion of the terminals or damage of components can occur.
- Use only the test equipment specified in the diagnostic charts, since other test equipment may either give incorrect results or damage good components.

- All voltage measurements using a voltmeter require a digital voltmeter with a rating of 10 megaohms input impedance.
- When a test light is specified, a low-power test light must be used. Do NOT use a high-wattage test light. While a particular brand of test light is not suggested, a simple test, as shown below, on any test light will ensure it to be safe for system circuit testing. Connect an accurate ammeter (such as the DMT) in series with the test light being tested and power the test light ammeter circuit with the battery.



a - Test Light
b - Battery
c - Ammeter

IMPORTANT: If the ammeter indicates LESS than 3/10 amp current flow (.3 A or 300 mA), the test light is SAFE to use. If the ammeter indicates MORE than 3/10 amp current flow (.3 A or 300 mA), the test light is NOT SAFE to use.

NOTE: *Using a test light with 100 mA or less rating may show a faint glow when test actually states no light.*

- When using a DMT to perform voltage measurements, switch to the OFF position when connecting the DMT to the circuitry being tested.

How To Use This Guide

This diagnostic guide is separated into 3 sections: General Information, Troubleshooting and Wiring Diagrams.

General Information covers:

- General wiring information
- General distributorless ignition system (DIS) description
- Engine Guardian description
- Warning chart

Troubleshooting covers:

- Basic scan tool information
- Symptom trouble chart
- Fault chart

Wiring diagram covers:

- Engine EFI harness
- 10-pin harness
- Single circuit diagrams

Troubleshooting gives possible electrical and mechanical causes for engine faults on the scan tool. In wiring diagrams, the single circuit diagrams cover each sensor and subset of the electrical system of the 8.1 liter/496 cid engine. These two sections will help the technician pinpoint problems occurring in the electrical system.

General Information

Electrostatic Discharge Damage

Electronic components are often designed to carry very low voltage and are susceptible to damage caused by electrostatic discharge. It is possible for less than 100 volts of static electricity to cause damage to some electronic components. By comparison, it takes 4,000 volts for a person to even feel the effect of a static discharge.

There are several ways for a person to become statically charged. The most common methods are by friction and by induction. An example of charging by friction is a person sliding across a seat, in which a charge of as much as 25,000 volts can build up. Charging by induction occurs when a person with well-insulated shoes stands near a highly charged object and momentarily grounds the circuit. Charges of the same polarity are drained off, leaving the person highly charged with the opposite polarity. Static charges of either type can cause damage electronic components. Use care when handling and testing electronic components.

Wiring Harness Service

Marine engine control circuits contain many special design features not found in standard land vehicle wiring. Environmental protection is used extensively to protect electrical contacts and proper splicing methods must be used.

IMPORTANT: Before component replacement and/or during normal troubleshooting procedures, visually inspect any questionable mating connector.

The proper operation of low amperage input/output circuits depends upon good continuity between circuit connectors. Mating surfaces should be properly formed, clean and likely to make proper contact. Some typical causes of connector problems are listed below.

1. Improperly formed contacts and/or connector housing.

- Damaged contacts or housing due to improper connection.
- Corrosion, sealer or other contaminants on the contact mating surfaces.

2. Incomplete mating of the connector halves during initial assembly or during subsequent troubleshooting procedures.
3. Tendency for connectors to come apart due to vibration and/or temperature cycling.
4. Terminals not fully seated in the connector body.
5. Inadequate terminal crimps to the wire.

Wire harnesses should be replaced with the appropriate replacement part, refer to specified part numbers. When signal wires are spliced into a harness, only use high temp insulated wire the same gauge as the existing harness.

With the low current and voltage levels found in the system, it is important to solder splices and create the best possible connection, refer to Wire Repair.

Use care when probing a connector or replacing connector terminals. It is possible to short between opposite terminals. If this happens, certain components can be damaged. Always use jumper wires with the corresponding mating terminals between connectors for circuit checking. **NEVER** probe through connector seals, wire insulation, secondary ignition wires, boots or covers. Microscopic damage or holes will result in eventual water intrusion, corrosion and/or component or circuit failure.

WIRE REPAIR

1. Locate damaged wire.
2. Remove insulation as required.

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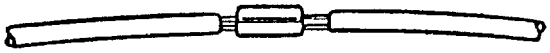
3. Splice two wires together using splice clips and rosin core solder.



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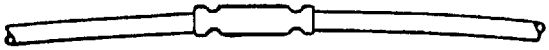
4. Cover splice with heat shrink sleeve to insulate from other wires.



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Wiring Connector Service

Most connectors in the engine compartment are protected against moisture and dirt that could create oxidation and deposits on the terminals. This protection is important because of the very low voltage and current levels found in the electronic system. The connectors have a lock that secures the male and female terminals together. A secondary lock holds the seal and terminal into the connector.

When diagnosing, open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor or in the wiring harness may locate the open circuit condition. This should always be considered when an open circuit or failed sensor is indicated. Intermittent problems may also be caused by oxidized or loose connections.

Before making a connector repair, be certain of the type of connector. Some connectors look similar but are serviced differently. Replacement connectors and terminals are listed in the *Mercury Precision Parts / Quicksilver Accessories Guide*.

Ensure that the connector seals are not deformed or crushed when mating the connectors together.

Intermittents

IMPORTANT: Intermittent problems may or may not store a fault. The fault must be present to locate the problem.

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful visual check for the following conditions:

- Poor mating of the connector halves, or a terminal not fully seated in the connector body.
- Improperly formed or damaged terminals and/or connectors.

All connector terminals in the problem circuit should be carefully checked for proper contact tension.

- Poor terminal-to-wire connection (crimping). Remove the terminal from the connector body to check.

The vessel may be driven with a Digital Multimeter connected to a suspected circuit. An abnormal voltage when malfunction occurs is a good indication that there is a fault in the circuit being monitored.

A diagnostic tool can be used to help detect intermittent conditions. The diagnostic tool allows manipulation of wiring harnesses or components with the engine not operating, while observing the scan tool readout. The diagnostic tool can also be plugged in and observed while operating the vessel.

If the problem seems to be related to certain parameters that can be checked on the scan tool, they should be checked while operating the vessel. If there does not seem to be any correlation between the problem and a specific circuit use the diagnostic tool data to see if there is any change in the readings that might indicate intermittent operation.

The diagnostic tool is also an easy way to compare the operating parameters of a poorly operating engine with those of a known good one. For example, a sensor may shift in value but not set a fault. Comparing the sensor's readings with those of the typical scan tool data readings may uncover the problem.

The diagnostic tool has the ability to save time in diagnosis and prevent the replacement of good parts. The key to using the diagnostic tool successfully lies in the technician's ability to understand the system being diagnosed and the diagnostic tool operation and limitations. The technician should read the tool manufacturer's operating manual to become familiar with the tool's operation.

To check loss of fault memory, disconnect TP sensor and idle engine. Attach diagnostic tool. The fault TPS1 CKT Lo should be stored and kept in memory when ignition is turned OFF. If not, the ECM is faulty. When this test is completed clear the fault.

An intermittent may be caused by the following:

- Ignition coil shorted to ground and arcing at ignition wires or plugs.
- Poor ECM grounds.
- An electrical system interference caused by a sharp electrical surge. Normally, the problem will occur when the faulty component is operated.
- Improper installation of electrical options such as lights, ship to shore radios and sonar.
- Knock sensor wires are routed too close to spark plug wires, ignition system components or charging system components.
- Secondary ignition components shorted to ground or an open ignition coil ground (coil mounting brackets).
- Components internally shorted to ground such as starters, alternators or relays.

Ignition System

⚠ WARNING

High voltage produced by the ignition system can cause personal injury or property damage. Disconnect both battery cables, before working on the ignition system and use caution while troubleshooting the ignition system.

The distributorless ignition system (DIS) is designed to replace the mechanical distributor system in controlling the ignition secondary voltage. It has no moving parts and does not require timing adjustments. All ignition coils are designed to operate with the secondary loaded. However, this is particularly true with DIS.

Coil design saturation time and primary current flow on distributorless systems are modified to produce more available energy. If maximum current is attained, the dwell time is shortened to reduce the wattage consumed by the system. If minimum current is not attained, dwell time is increased to allow full saturation of the ignition coil. If current limiting occurs prior to discharge, dwell is decreased for the next sequence.

A sensing device is used to determine the crankshaft and camshaft position. Hall Effect sensors are used on the 8.1 liter/496 cid engine to synchronize and fire the coils at the proper time. A Hall Effect sensor has a magnetic field introduced perpendicular to a current flowing through a solid conductor causing a measurable voltage. This is why the voltage readings on these two sensors fluctuate within a range, generating a square wave with the same pattern as on the interrupter vanes on the sensor. Full voltage will be present when there is no vane on the sensor.

The crankshaft sensor is placed near a machined wheel on the crankshaft. As the crank rotates, the camshaft sprocket also rotates at one-half engine speed. The camshaft signal is synchronized with one of the crankshaft signal pull downs. The PCM processes the voltage signal from the sensor to determine engine position and engine speed. After 1-1/2 to 2 revolutions, the PCM will sync the camshaft and crankshaft sensors and charge the secondary circuit of the coil.

PCM 555 Engine Guardian

Engine Guardian is the focal point of the self-diagnostic strategy of PCM 555. It helps protect the engine from possible damage that could result from several faulty conditions. The system monitors the sensors incorporated on the engine and if a malfunction is discovered, a fault description is stored in the PCM and available power is normally reduced. By ensuring that engine output is at a low enough level, the engine is better protected from thermally induced failures.

For example, if an open or short is found in an exhaust manifold sensor, available power will be reduced to 90% of total, the audio alarm will sound 2 beeps per minute (2 Bp/min) and the MercMonitor gauge (SC1000) will display a warning lamp. In an exhaust manifold overheat condition, the maximum rpm will vary with the temperature of the manifold and could be limited to idle in extreme cases of overheating, a constant beep will sound and the SC1000 will display a warning lamp.

IMPORTANT: Engine Guardian cannot guarantee that engine damage will not occur when adverse operating conditions are encountered. Engine Guardian is designed to warn the operator of an adverse condition and to reduce power by limiting rpm in an attempt to reduce possible engine damage. The boat operator is ultimately responsible for proper engine operation.

Warning System

The engine warning system incorporates an audio alarm and, if installed, a SC1000 System Monitor. When the key switch is turned to the ON position, the audio alarm will momentarily activate to test the warning system. The alarm should sound once if the system is operable. This table is a guick guide, showing what warning output will accompany a fault.

Fault	SC1000	Audio Alarm	Available Power	Description
Cam Sensor	Yes	2 Bp/min	90%	Open or short, engine must be cranking to set this fault code.
ECT CKT HI	Yes	2 Bp/min	90%	Open
ECT CKT LO	Yes	2 Bp/min	90%	Short
ECT Coolant Overheat	Yes	Constant	6-100 %	Engine guardian overheat condition
EST 1-8 Open	Yes	2 Bp/min	NA	Coil harness wire open
EST 1-8 Short	Yes	2 Bp/min	NA	Coil harness wire short
Fuel Injector 1-8 Open	Yes	2 Bp/min	NA	Fuel injector wire open
Fuel Injector 1-8 Short	Yes	2 Bp/min	NA	Fuel injector wire short
IAC Output	Yes	2 Bp/min	90%	Only with rpm
Knock Sensor 1	Yes	2 Bp/min	90%	Alarm sounds for 20 seconds in NEUTRAL and indefinitely in gear.
Knock Sensor 2	Yes	2 Bp/min	90%	Alarm sounds for 20 seconds in NEUTRAL and indefinitely in gear.
Low Drive Lube Strategy	Yes	Steady Bp	0-100%	Low oil in sterndrive
Low Oil Pressure Strategy	Yes	Constant	0-100%	Low oil pressure strategy
MAP Sensor 1 Input High	No	2 Bp/min	90%	Short, no visual on SC1000
MAP Sensor 1 Input Low	No	2 Bp/min	90%	Open, no visual on SC1000
MAT Sensor	Yes	2 Bp/min	90%	Open or short in MAT circuit

NOTE: *If any 5v sensor becomes shorted to ground the engine will not start. If the engine is operating when the short occurs the engine may stop operating and will not start.*

Fault	SC1000	Audio Alarm	Available Power	Description
Oil PSI CKT Hi	Yes	2 Bp/min	90%	Short, defaults to 51.7 psi
Oil PSI CKT Lo	Yes	2 Bp/min	90%	Open, zero oil pressure
Overspeed	Yes	Constant	RPM Limit	Engine over rpm limit
Port EMCT CKT Hi	Yes	2 Bp/min	90%	Open, defaults to 32 degrees F (0 degree C)
Port EMCT CKT Lo	Yes	2 Bp/min	90%	Short, defaults to 32 degrees F (0 degree C)
Port EMCT CKT Overheat	Yes	Constant	6-100%	Overheat condition, 212 degrees F (100 degrees C) limit
Sea Pump PSI Lo	Yes	Constant	6-100%	Low water pressure strategy, defaults to 43.4 psi
Sea Pump CKT Hi	Yes	2 Bp/min	90%	Open
Sea Pump CKT Lo	Yes	2 Bp/min	90%	Short
STB EMCT CKT Hi	Yes	2 Bp/min	90%	Open, defaults to 32 degrees F (0 degrees C)
STB EMCT CKT Lo	Yes	2 Bp/min	90%	Short, defaults to 32 degrees F (0 degrees C)
STB EMCT CKT Overheat	Yes	Constant	6-100%	Overheat condition, 212 degrees (100 degrees C) limit
Steer CKT Hi	Yes	No	No	Open and short
TPS1 CKT Hi	Yes	2 Bp/min	90%	Short, signal to 5v+, engine will not start. Refer to data monitor screen.
TPS1 CKT Lo	Yes	2 Bp/min	90%	Open
TPS 1 Range Hi	Yes	2 Bp/min	90%	Above 4.8v, 994 counts
TPS 1 Range Lo	Yes	2 Bp/min	90%	Below 0.5v, 35 counts
Trim CKT Hi	Yes	No	No	Short, high range, visual warning on SC1000 only.
Trim CKT Lo	Yes	No	No	Open, low range, visual warning on SC1000 only.
5 VDC PWR Low	Yes	2 Bp/min	varies	Short any 5v+ to ground

NOTE: *If any 5v sensor becomes shorted to ground the engine will not start. If the engine is operating when the short occurs the engine may stop operating and will not start.*

Reference Charts

8.1 LITER/496 CID RESISTANCE READINGS AT 70 DEGREES F (21 DEGREES C)

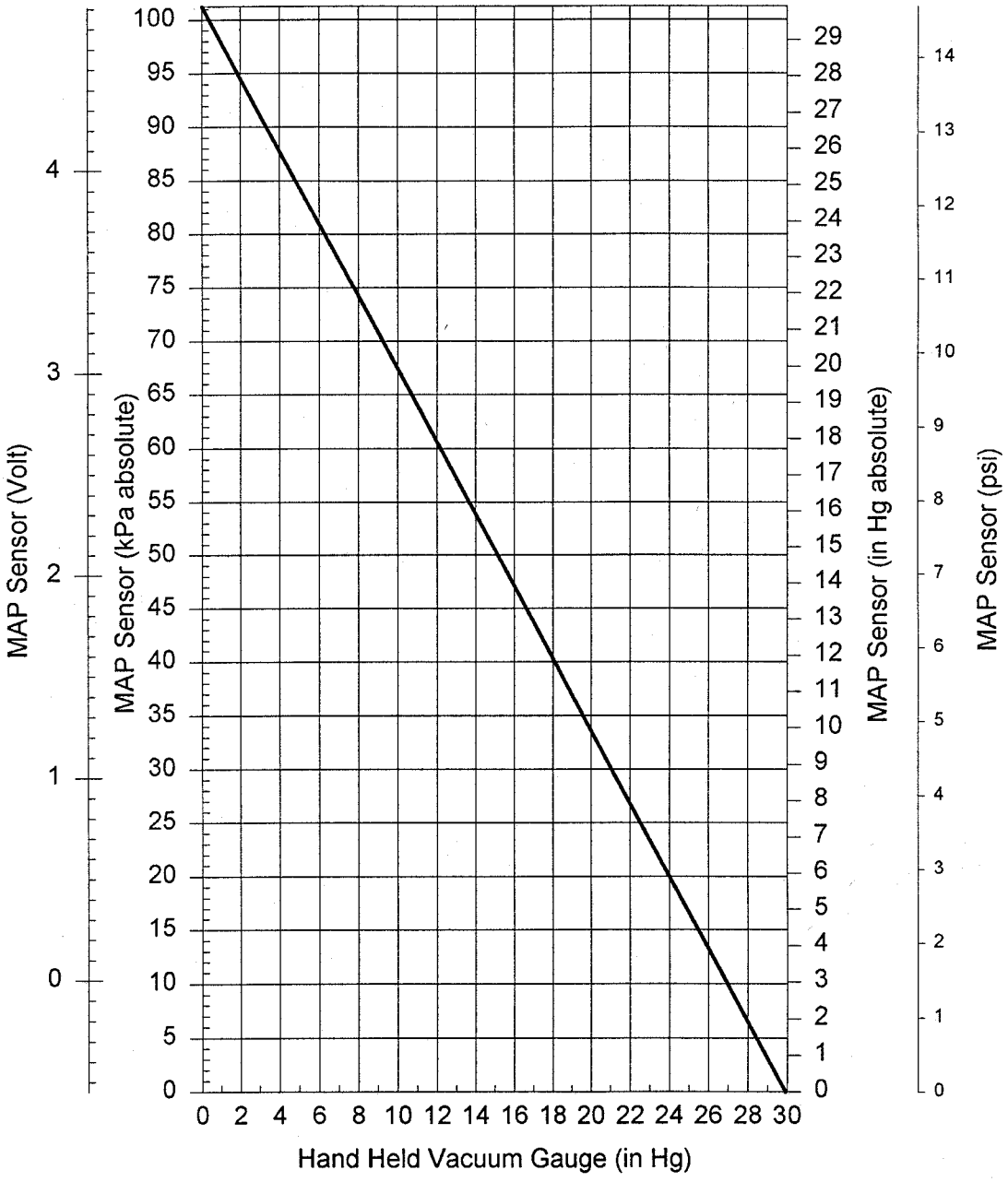
Sensor	Pinout	Value
SEA PUMP, OIL, PITOT PRESSURE	A-B	31.5 kohms
	A-C	42.9 kohms
MAT	A-B	3.14 ohms
ECT	A-B	3.12 kohms
EMCT	A-B	11.01 kohms
MAP	A-B	9.33 kohms
	A-C	3.89 ohms
	B-C	5.44 kohms
CAMSHAFT SENSOR	A-B	24.04 mohms
	B-C	24.5 mohms
CRANKSHAFT SENSOR	A-B	23.30 mohms
	B-C	23.21 mohms
IAC	1-2	10.1 ohms
FUEL INJECTOR	A-B	12 ohms
TRIM SENDER set to index mark	A-B	0.614 mohms

All values have a range of +/- 2 percent.

MANIFOLD VACUUM / PRESSURE

Manifold Vacuum	Absolute Pressure		Manifold Vacuum	Absolute Pressure	
psi	psi	kPa	psi	psi	kPa
0	14.7	101.3	7 1/4	7.45	51.4
1/4	14.45	99.6	7 1/2	7.2	49.6
1/2	14.2	97.9	7 3/4	6.95	47.9
3/4	13.95	96.2	8	6.7	46.2
1	13.7	94.4	8 1/4	6.45	44.5
1 1/4	13.45	92.7	8 1/2	6.2	42.7
1 1/2	13.2	91.0	8 3/4	5.95	41.0
1 3/4	12.95	89.3	9	5.7	39.3
2	12.7	87.5	9 1/4	5.45	37.6
2 1/4	12.45	85.8	9 1/2	5.2	35.8
2 1/2	12.2	84.1	9 3/4	4.95	34.1
2 3/4	11.95	82.4	10	4.7	32.4
3	11.7	80.6	10 1/4	4.45	30.7
3 1/4	11.45	78.9	10 1/2	4.2	29.0
3 1/2	11.2	77.2	10 3/4	3.95	27.2
3 3/4	10.95	75.5	11	3.7	25.5
4	10.7	73.8	11 1/4	3.45	23.8
4 1/4	10.45	72.0	11 1/2	3.2	22.1
4 1/2	10.2	70.3	11 3/4	2.95	20.3
4 3/4	9.95	68.6	12	2.7	18.6
5	9.7	66.9	12 1/4	2.45	16.9
5 1/4	9.45	65.1	12 1/2	2.2	15.2
5 1/2	9.2	63.4	12 3/4	1.95	13.4
5 3/4	8.95	61.7	13	1.7	11.7
6	8.7	60.0	13 1/4	1.45	10.0
6 1/4	8.45	58.2	13 1/2	1.2	8.3
6 1/2	8.2	56.5	13 3/4	0.95	6.5
6 3/4	7.95	54.8	14	0.7	4.8
7	7.7	53.1	14 1/4	0.45	3.1
			14 1/2	0.2	1.4

VACUUM GAUGE VS MAP SENSOR



This graph is correct at sea level only.

Centigrade to Fahrenheit Conversion

Centigrade	Fahrenheit	Centigrade	Fahrenheit
-55	-67	85	185
-50	-58	90	194
-45	-49	95	203
-40	-40	100	212
-35	-31	105	221
-30	-22	110	230
-25	-13	115	239
-20	-4	120	248
-15	5	125	257
-10	14	130	266
-5	23	135	275
0	32	140	284
5	41	145	293
10	50	150	302
15	59	155	311
20	68	160	320
25	77	165	329
30	86	170	338
35	95	175	347
40	104	180	356
45	113	185	365
50	122	190	374
55	131	195	383
60	140	200	392
65	149	205	401
70	158	210	410
75	167	215	419
80	176	220	428

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SECTION 2A - TROUBLESHOOTING

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2 A

Troubleshooting Without A Diagnostic Tool

Troubleshooting without a diagnostic tool is limited to checking resistance on the sensors. Typical failures usually do not involve the PCM. Loose connections or mechanical wear are likely at fault.

- Verify engine is in good mechanical condition.
- Verify ECM grounds and sensor connections are clean, tight and in their proper location.
- Check vacuum hoses for splits, kinks and proper connections. Check thoroughly for any type of leak or restriction.
- Check for air leaks at throttle body mounting area and intake manifold sealing surfaces.
- Check ignition wires for cracking, hardness and proper routing.
- Inspect wiring for proper connections, pinches and cuts.
- Check for moisture in primary or secondary ignition circuit connections.
- Check for salt corrosion on electrical connections and exposed throttle body linkages.
- Check fuel pump terminals and fuel pump pressure.
- Verify that throttle cable is adjusted properly for the TPS at 0 degrees.

Troubleshooting With A Diagnostic Tool

The Quicksilver Digital Diagnostic Terminal (DDT) and the Mercury MerCruiser Scan Tool have been developed specifically to help technicians diagnose and repair Mercury MerCruiser engines.

These diagnostic tools enable the technician to monitor sensors, ECM/PCM data values and also retrieve stored fault information. The data that can be monitored in real time includes:

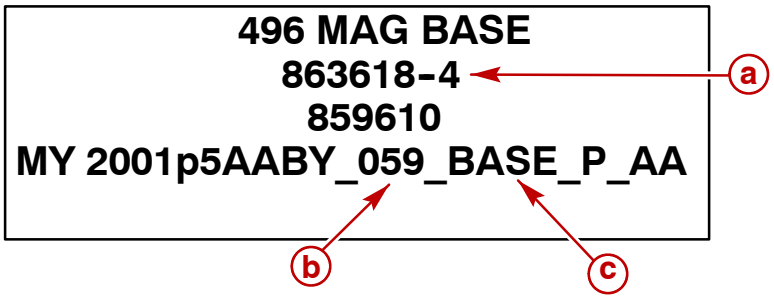
Engine rpm	Fuel Level
Battery Voltage	Manifold Air Pressure
Available Power	Trim
Lake / Sea Temperature	Idle Air Control (IAC) pwm percent
Barometric pressure	Oil pressure
Engine Coolant Temperature	Seapump pressure
Throttle Position Sensor voltage and percent	Manifold Air Temperature
Pitot	Port and Starboard Exhaust Manifold Coolant Temperatures

The diagnostic tools also have the capability of performing several diagnostic tests such as cylinder misfire, injector, IAC, fuel pump relay and main power relay output or load tests.

Refer to the appropriate reference manual for complete diagnostic tool instructions.

Troubleshooting Worksheet

PCM Calibration Label For 8.1 liter (496 cid) Engines



a - Calibration Part Number
b - Software Version Identification
c - Base Or High Output (HO) Engine Designation

The PCM Calibration Label includes all the information necessary to determine the factory calibration. The top line is the engine model designation. Both the 496 MAG BASE and 8.1S Horizon BASE labels will show 496 MAG BASE. Both the 496 MAG HO and 8.1S HO will show 496 MAG HO. The second line specifies the model year of the engine followed by critical identification codes. The first letters, following the PAA, designate power rating. The letter or letters will specify B for base engine or HO for high output engine. The next four letters specify the ECM software version. This is followed by the 7-digit calibration part number.

Prior to contacting Mercury MerCruiser Customer Service, you will need to determine the calibration part number. With the calibration part number, the Customer Service personnel will be able to identify the correct parameters for your specific engine.

Data Collection

The following chart can be filled out to help troubleshoot problems with the 8.1 liter (496 cid) engine. With this information the Mercury MerCruiser Customer Service personnel will be better able to identify the potential problem.

PCM 555/ECM 555 DDT/Rinda 8.1 liter (496 cid)/GM EFI SCAN TOOL SHEET

Dealer #		Seawater Temperature		
Engine S/N		Ambient Air Temperature		
Engine Type		Engine Run Time		
PCM Part #		Altitude		
Exhaust		Propeller Pitch		
Drive Type And Ratio		Propeller Type	Stainless Steel	Aluminum

Idle / Closed Throttle / Neutral					
Engine Conditions	**Metric**	**SAE**	**Engine Conditions**	**Metric**	**SAE**
RPM			BARO (pressure)	kpa	psi
BATTERY VOLTAGE	volts	volts	STB EMCT	C	F
PWR 1 VOLTS	volts	volts	PORT EMCT	C	F
MAP (pressure)	kpa	psi	OIL (pressure)	kpa	psi
FUEL LEVEL			ECT	C	F
AVAILABLE POWER	%	%	SEAPUMP PRESSURE	kpa	psi
TRIM			TPS 1 VOLTS	volts	volts
PITOT			TPS	%	%
PADDLE WHEEL			MAT	C	F
LAKE/SEA TEMP	C	F	FPC TOTAL	mg	oz
IAC PWM	%	%	FUEL PRESSURE	kpa	psi
SPARK ANG BTDC					
NOTES					

Idle / Closed Throttle / In Gear					
Engine Conditions	**Metric**	**SAE**	**Engine Conditions**	**Metric**	**SAE**
RPM			BARO (pressure)	kpa	psi
BATTERY VOLTAGE	volts	volts	STB EMCT	C	F
PWR 1 VOLTS	volts	volts	PORT EMCT	C	F
MAP (pressure)	kpa	psi	OIL (pressure)	kpa	psi
FUEL LEVEL			ECT	C	F
AVAILABLE POWER	%	%	SEAPUMP PRESSURE	kpa	psi
TRIM			TPS 1 VOLTS	volts	volts
PITOT			TPS	%	%
PADDLE WHEEL			MAT	C	F
LAKE/SEA TEMP	C	F	FPC TOTAL	mg	oz
IAC PWM	%	%	FUEL PRESSURE	kpa	psi
SPARK ANG BTDC					
NOTES					

In Gear 2000 rpm					
Engine Conditions	**Metric**	**SAE**	**Engine Conditions**	**Metric**	**SAE**
RPM			BARO PSI	kpa	psi
Battery Voltage	volts	volts	STB EMCT	C	F
PWR 1 Volts	volts	volts	PORT EMCT	C	F
MAP PSI	kpa	psi	OIL PSI	kpa	psi
FUEL LEVEL			ECT	C	F
AVAILABLE POWER	%	%	SEA/PUMP PRESSURE	kpa	psi
TRIM			TPS 1 VOLTS	volts	volts
PITOT			TPS %	%	%
PADDLE WHEEL			MAT	C	F
LAKE/SEA TEMP	C	F	FPC TOTAL OZ.	mg	oz
IAC PWM	%	%	FUEL PRESSURE	kpa	psi
SPARK ANG BTDC					
NOTES					

In Gear 3000 rpm					
Engine Conditions	**Metric**	**SAE**	**Engine Conditions**	**Metric**	**SAE**
RPM			BARO PSI	kpa	psi
Battery Voltage	volts	volts	STB EMCT	C	F
PWR 1 Volts	volts	volts	PORT EMCT	C	F
MAP PSI	kpa	psi	OIL PSI	kpa	psi
FUEL LEVEL			ECT	C	F
AVAILABLE POWER %	%	%	SEA/PUMP PRESSURE	kpa	psi
TRIM			TPS 1 VOLTS	volts	volts
PITOT			TPS %	%	%
PADDLE WHEEL			MAT	C	F
LAKE/SEA TEMP.	C	F	FPC TOTAL OZ.	mg	oz
IAC PWM %	%	%	FUEL PRESSURE	kpa	psi
SPARK ANG BTDC					
NOTES					

WOT/In Gear/Trim									
Engine Conditions	**Metric**	Scale	**SAE**	Scale	**Engine Conditions**	**Metric**	Scale	**SAE**	Scale
RPM					BARO PSI		kpa		psi
Battery Voltage		volts		volts	STB EMCT		C		F
PWR 1 Volts		volts		volts	PORT EMCT		C		F
MAP PSI		kpa		psi	OIL PSI		kpa		psi
FUEL LEVEL					ECT		C		F
AVAILABLE POWER %		%		%	SEA/PUMP PRESSURE		kpa		psi
TRIM					TPS 1 VOLTS		volts		volts
PITOT					TPS %		%		%
PADDLE WHEEL					MAT		C		F
LAKE/SEA TEMP.		C		F	FPC TOTAL OZ.		mg		oz
IAC PWM %		%		%	FUEL PRESSURE		kpa		psi
SPARK ANG BTDC									
NOTES									

Troubleshooting Guides

The following charts were designed to help the technician systematically troubleshoot the electrical system of the 8.1 liter (496 cid) engine. The two charts can be used separately or combined to determine the malfunction.

Symptom Chart

Symptom	Possible Cause	Action
1. Engine cranks but will not start	**1.0** Lanyard stop switch in wrong position	**1.0** Reset lanyard stop switch
	1.1 Weak battery or bad starter motor. Battery voltage drops below 8 volts while cranking.	**1.1** Replace or recharge battery. Inspect condition of starter motor. Inspect condition of battery connections.
	1.2 No fuel	**1.2** Key ON engine to verify fuel pump operates for 3 seconds. Check fuel tank for fuel. Verify fuel pressure is 43 psi. Listen for fuel pump relay to click.
	1.3 Blown fuse	**1.3** Inspect engine harness and electrical components. Replace fuse.
	1.4 Main power relay (MPR) malfunction	**1.4** Listen for MPR to click when the key switch is turned ON.
	1.5 Crankshaft or camshaft sensor defective	**1.5** Inspect for loose connection or corrosion. Check for tachometer signal while cranking engine. If no signal, faulty crankshaft sensor. Inspect continuity between sensors and PCM.
	1.6 ECM malfunction	**1.6** Listen for fuel injector ticking when cranking the engine. Check battery voltage. Check for blown fuse. Check battery voltage to the fuse from the MPR. Inspect harness connections. Replace PCM.
2. Engine overheat	**2.0** Reduced or no water flow	**2.0** Verify water inlet valve is open. Inspect seawater strainer for debris. Clogged water hose.
	2.1 Faulty seapump impeller	**2.1** Replace impeller.
	2.2 Faulty thermostat	**2.2** Replace thermostat.
	2.3 Faulty water pump	**2.3** Replace water pump.

Symptom	Fault Cause	Action
3. Engine cranks, starts and stalls	**3.0** Low fuel pressure	**3.0** Key on engine to verify fuel pump operates for 3 seconds. Check fuel tank for fuel. Check fuel pressure is 43 psi. Listen for fuel pump relay to click.
	3.1 Contaminated fuel	**3.1** Change water separating fuel filter.
	3.2 TPS sensor range	**3.2** Inspect throttle linkage for wear and binding. Verify TPS is in range.
	3.3 Engine mechanical malfunction	**3.3** Check for low compression, cylinder head gasket leaks, worn camshaft, valve train problem or restricted exhaust system.
4. Engine lacks power, sluggish	**4.0** Extremely dirty flame arrestor	**4.0** Clean or replace flame arrestor.
	4.1 Contaminated fuel	**4.1** Change water separating fuel filter.
	4.2 Improper ignition voltage	**4.2** Check ignition voltage.
	4.3 Fouled spark plugs	**4.3** Change spark plugs.
	4.4 Engine mechanical problems	**4.4** Check for low compression, cylinder head gasket leaks, worn camshaft, valve train problem or restricted exhaust system.
	4.5 Engine Guardian	**4.5** Read fault descriptions.
5. Engine idle is rough	**5.0** Fouled spark plugs	**5.0** Check ignition voltage.
	5.1 Weak spark	**5.1** Inspect coils, spark plug wires and harness connections.
	5.2 IAC faulty	**5.2** Listen for IAC motor upon key ON. Read fault descriptions.
	5.3 Faulty injectors	**5.3** Perform Injector Balance Test.
	5.4 Engine mechanical malfunction	**5.4** Check for low compression, cylinder head gasket leaks, worn camshaft, valve train problem or restricted exhaust system.
	5.5 Faulty motor mounts	**5.5** Inspect motor mounts.
	5.6 Vacuum leak	**5.6** Check vacuum lines and gaskets for leaks and wear. Replace.
	5.7 Throttle cable not adjusted properly	**5.7** Adjust throttle cable.
6. Detonation or spark knock	**6.0** Faulty knock sensor circuit	**6.0** Inspect both knock sensor circuits.
	6.1 Poor ignition system ground	**6.1** Inspect ignition system connections.
	6.2 Contaminated fuel	**6.2** Replace fuel with known high quality fuel.

Fault Chart

This chart correlates with the fault list of the diagnostic tool. After displaying the faults stored in a PCM, the fault can be referenced on this chart for possible causes and checks to fix the problem. The single circuit diagrams in SECTION 3A show most of these faults with the sensor circuit schematic to help locate wiring problems.

Faults	Possible Causes	Action
1. Cool TMP CKT Hi or Lo	**1.0** Open(Hi) or Short (Lo) in harness wiring, faulty connection	**1.0** Repair harness connection or cut in wire.
	1.1 Open(Hi) or Short (Lo) sensor	**1.1** Replace sensor.
	1.2 Water in the connector	**1.2** Dry connector and inspect for cracks or wear. Replace.
2. ECT Coolant Overheat	**2.0** Coolant leak	**2.0** Inspect closed cooling system.
	2.1 Restricted waterflow	**2.1** Check for blockage in inlet and outlet water hoses.
	2.2 Faulty seapump	**2.2** Inspect seapump water ports, impeller and seals for damage. Replace damaged parts.
	2.3 Faulty thermostat	**2.3** Replace thermostat.
	2.4 Faulty water pump	**2.4** Replace water pump.
	2.5 Worn or broken drive belt	**2.5** Replace drive belt.
3. EST 1-8 Open or Short	**3.0** Loose spark plug wire connection.	**3.0** Verify spark plug boot firmly connected.
	3.1 Broken spark plug	**3.1** Inspect spark plug for damage. Replace.
	3.2 Open or Short in harness wiring, bad harness connection	**3.2** Inspect coil harness. Repair or replace.
	3.3 Faulty coil	**3.3** Replace coil.
	3.4 Water in connection	**3.4** Dry connector and inspect for cracks or wear. Replace.
4. FINJ 1-8 Open or Short	**4.0** Open or short in harness wire, bad harness connection or corroded terminals	**4.0** Inspect fuel injector harness. Repair or replace.
	4.1 Faulty fuel injector	**4.1** Replace fuel injector.
	4.2 12 volt fuel injector wire shorted to ground	**4.2** Inspect fuel injector harness. Repair or replace.
	4.3 Corroded harness terminals	**4.3** Inspect fuel injector harness. Repair or replace.
5. Guardian Strategy	**5.0** Block pressure, map sensor, oil pressure, port and starboard exhaust temperature, engine coolant temperature or overspeed readings are out of normal ranges	**5.0** Other fault codes will appear on the diagnostic tool. Verify repairs associated with the other faults. Scan for faults again.

Faults	Possible Causes	Action
6. IAC Output	**6.0** Cut harness wire, bad harness connection, short in harness	**6.0** Inspect IAC wiring circuit. Repair.
	6.1 Faulty IAC, pindle stuck	**6.1** Replace IAC.
7. Knock Sensor 1-2 Hi or Lo	**7.0** Corrosion or wear on the sensor	**7.0** Replace sensor.
	7.1 Open or short in circuit	**7.1** Inspect harness. Repair or replace harness.
8. Low Drive Lube Strategy MCM engines only.	**8.0** Improper hose routing	**8.0** Route hose as shown in installation manual.
	8.1 Float in bottle stuck	**8.1** Replace bottle.
	8.2 Short in circuit	**8.2** Inspect circuit. Repair or replace harness.
	8.3 Incorrect gear lube level	**8.3** Fill drive lube monitor. Refer to appropriate service manual for filling instructions.
	8.4 System leak	**8.4** Inspect drive lube system. Repair or replace any worn parts.
9. Low Oil Pressure Strategy	**9.0** Faulty sensor readings	**9.0** Replace sensor with a known good sensor.
	9.1 Faulty oil pump	**9.1** Replace oil pump.
	9.2 Low oil level	**9.2** Check oil level, add oil.
10. Main Power Relay Output	**10.0** Short in MPR circuit	**10.0** Inspect MPR circuit. Repair or replace harness.
	10.1 Low battery voltage	**10.1** Charge battery or replace battery.
	10.2 Faulty MPR	**10.2** Replace MPR.
11. Main Power Relay Backfeed	**11.0** Driver power from some other source	**11.0** Test for voltage at 87 of the MPR with key OFF.
	11.1 Short in circuit at splice 105	**11.1** Inspect wiring harness. Repair or replace harness.
12. MAP Sensor 1 Input Hi or Low	**12.0** Loose connection, corrosion, open (Lo) or short (Hi) in circuit	**12.0** Inspect circuit. Repair or replace harness.
	12.1 Faulty sensor	**12.1** Replace sensor.
13. Oil PSI CKT Hi or Lo	**13.0** Loose connection, corrosion, open (Lo) or short (Hi) in circuit	**13.0** Inspect circuit. Repair or replace harness.
	13.1 Faulty sensor	**13.1** Replace sensor.
14. Overspeed	**14.0** Underpropped	**14.0** Change propeller.
	14.1 Over trimmed condition	**14.1** Trim drive properly.
	14.2 Rev-limit out of range	**14.2** Check rev-limit.

Faults	Possible Causes	Action
15. Pitot CKT HI or Lo	**15.0** Loose connection, open (Lo) or short (Hi) in wiring circuit	**15.0** Inspect wiring harness. Repair or replace harness.
	15.1 Corroded or faulty sensor	**15.1** Check sensor for damage. Replace seals or sensor.
	15.2 Loose hose connection	**15.2** Tighten hose connection.
16. Port and Starboard EMCT CKT Hi or Lo	**16.0** Loose connection, open (Hi) or short (Lo) in wiring circuit	**16.0** Inspect wiring harness. Repair or replace harness.
	16.1 Corroded or faulty sensor	**16.1** Replace sensor.
17. Port and Starboard EMCT Overheat	**17.0** Restricted or loss of water flow	**17.0** Inspect for blockage or leaks in the raw water section of the engine.
	17.1 Faulty seapump	**17.1** Inspect seapump for excessive wear. Repair.
	17.2 Faulty shaft log seal	**17.2** Inspect shaft log seal. Replace shaft log seal.
18. Seapump PSI Lo	**18.0** Restricted waterflow	**18.0** Check for blockage in inlet and outlet water hoses.
	18.1 Faulty seapump	**18.1** Inspect seapump water ports, impeller and seals for damage. Replace damaged parts.
	18.3 Faulty thermostat	**18.2** Replace thermostat.
	18.3 Faulty water pump	**18.3** Replace water pump.
	18.4 Worn or broken drive belt	**18.4** Replace drive belt.
19. Seapump CKT Hi or Lo	**19.0** Loose connection, corrosion, open (Hi) or short (Lo) in circuit	**19.0** Inspect circuit. Repair or replace harness.
	19.1 Faulty sensor	**19.1** Replace sensor.
20. Steer CKT Hi or Lo	**20.0** Loose connection, corrosion, open (Hi) or short (Lo) in circuit	**20.0** Inspect circuit. Repair or replace harness.
	20.1 Faulty sensor	**20.1** Replace sensor.
21. TPS1 CKT Hi or Lo	**21.0** Loose connection, corrosion, open (Lo) or short (Hi) in circuit	**21.0** Inspect circuit. Repair or replace harness.
	21.1 Faulty sensor	**21.1** Replace sensor.

Faults	Possible Causes	Checks
22. TPS1 Range Hi or Lo	**22.0** Worn or damaged sensor, count reading over 990 for Hi, under 45 for Lo	**22.0** Inspect sensor for damage. Replace TPS.
	22.1 Short in transducer ground circuit	**22.1** Inspect harness for short to ground. Repair or replace harness.
	22.2 Worn, bent or corroded throttle lever	**22.2** Inspect throttle lever. Repair any damage.
23. TPS1 No Adapt	**23.0** Wrong, worn or damaged sensor. TPS must read 10 counts to adapt	**23.0** Inspect sensor for damage. Replace TPS.
24. Transmission Overtemp	**24.0** Loose connection, corrosion, open (Lo) or short (Hi) in circuit	**24.0** Inspect circuit. Repair or replace harness.
	24.1 Faulty sensor	**24.1** Inspect circuit. Repair or replace harness.
25. Trim CKT Hi or Lo	**25.0** Loose connection, corrosion, open (Lo) or short (Hi) in circuit	**25.0** Inspect circuit, repair or replace harness.
	25.1 Faulty sensor	**25.1** Replace sensor.
26. VDC PWR Lo	**26.0** Short to ground in the 5 volt system, harness or 3-wire sensor	**26.0** Read other faults for a starting point for finding the short. Repair or replace harness or faulty sensor.

Engine Will Not Crank Over

IGNITION SYSTEM CHART

Step	Action	Yes	No
1.	Turn Key to the ON position. **Did the Main Power Relay turn on (should here a click) and does the Fuel Pump operate for 10 seconds?**	Go to Step 3.	Go to Step 2.
2.	Check the battery for 12 volts, ensure that the battery switch is in the ON position, check wire connections from the battery to the engine. **Was a problem found?**	Repair. Recheck system.	Go to Service Manual 30, SECTION 1C, Engine Will Not Crank Over.
3.	Key OFF. Attach an analog Tachometer to the GRY auxiliary Tachometer Lead located under the PCM. Key ON. **Did the tachometer show any tach signal?**	Go to Service Manual 30, SECTION 1C, Engine Cranks Over But Will Not Start.	Go to Step 4.
4.	a. Unplug Crankshaft Position Sensor. b. With key ON, use a DMT to check for 5 volts between the BLK/PNK and GRY wires. **Was 5 volts found?**	Go to Step 5.	Go to Step 6.
5.	Using the DMT, check continuity of the tan wire of the CPS (PCM Pin B14). **Was continuity present?**	Go to Step 7.	Repair or replace the engine harness
6.	Attach scan tool to the engine. Check for faults. **Were faults present?**	Repair. Recheck system.	Go to Step 7.
7.	Check continuity between PCM Pin A-23 and the 5 volt sensors (GRY wire) for all sensors in harness Splice 101. See 5 Volt Sensor Circuit Diagram in SECTION 3A. **Was continuity present?**	Go to Step 8.	Repair or replace the engine harness.
8.	Using the scan tool, perform the Auto Self Test. a. IDisconnect Fuel Pump. (Remove the Fuel Pump Fuse A-B). b. Do you wish to perform test with any spark plugs? Yes c. Continue. **Were any problems found?**	Repair. If the problem was found in the coils go to the EST chart.	The coils, spark plugs, and harness wiring from the PCM to the coils and spark plugs and related components are good. Go to Step 9.

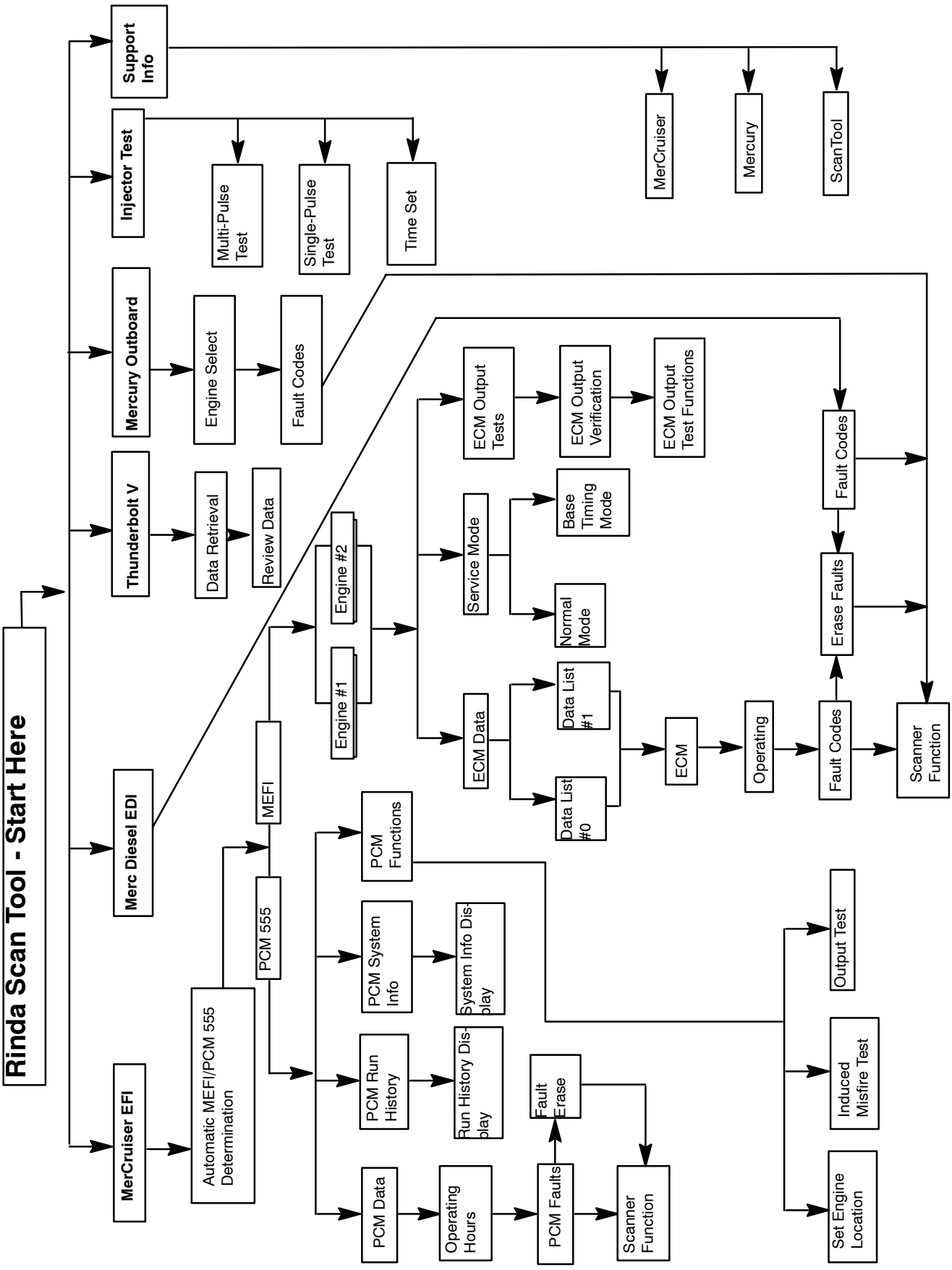
IGNITION SYSTEM CHART (CONTINUED)

Step	Action	Yes	No
9.	Remove the CPS. Using the DMT, check the resistance across the sensor. A-B is 23.30 mohms and B-C 23.21 mohms. **Does the sensor show these values?**	Go to 10.	Replace the CPS.
10.	Unplug the PCM connectors from A and C. Using the DMT check continuity between A-22-to-C-15, A-22-to-C-16 and A-22-to-C-24 on the PCM. **Was continuity present?**	Go to Step 11.	Replace the PCM.
11.	Inspect the reluctor wheels for damage. **Was the reluctor wheels damaged?**	Replace.	Go to Service Manual 30, SECTION 1-C, Engine Will Not Crank Over.

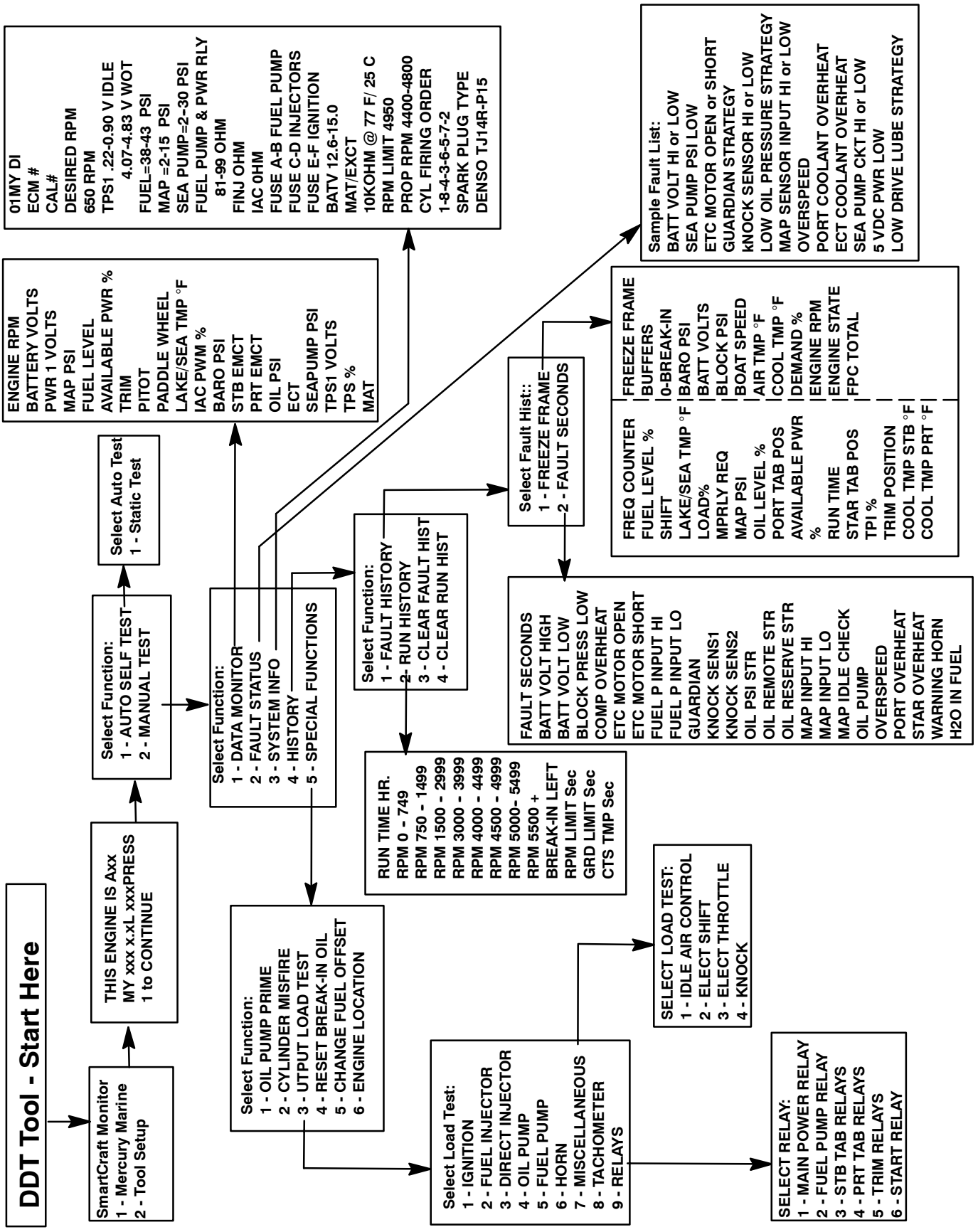
EST CHART

Step	Action	Yes	No
1.	Using the scan tool, a. Choose Manual Test, Special Functions, Output Load Test, Ignition. b. Do you wish to perform test with any spark plugs? No. c. Select the cylinder number that you are testing. d. Install Spark Gap Tester 91-63998A1 between the spark plug and the spark plug wire on the cylinder to be tested. Attach the ground on the tester to a known good ground. e. Test each cylinder by repeating these steps. f. Visually verify that spark is present in the Spark Gap Tester. **Was spark present on each cylinder and did all cylinders pass?**	All coils are good.	Go to Step 2.
2.	Check continuity between the coil and the individual coil harness. Refer to the Coil Harness Circuit in SECTION 3A. **Was a problem found?**	Repair.	Go to Step 3.
3.	Check continuity from the coil connector to the PCM. Refer to the Ignition Circuit in SECTION 3A. **Was a problem found?**	Repair.	Replace faulty coil with a known good coil and retest.

Mercury MerCruiser Scan Tool Flowchart



Digital Diagnostic Terminal Flowchart



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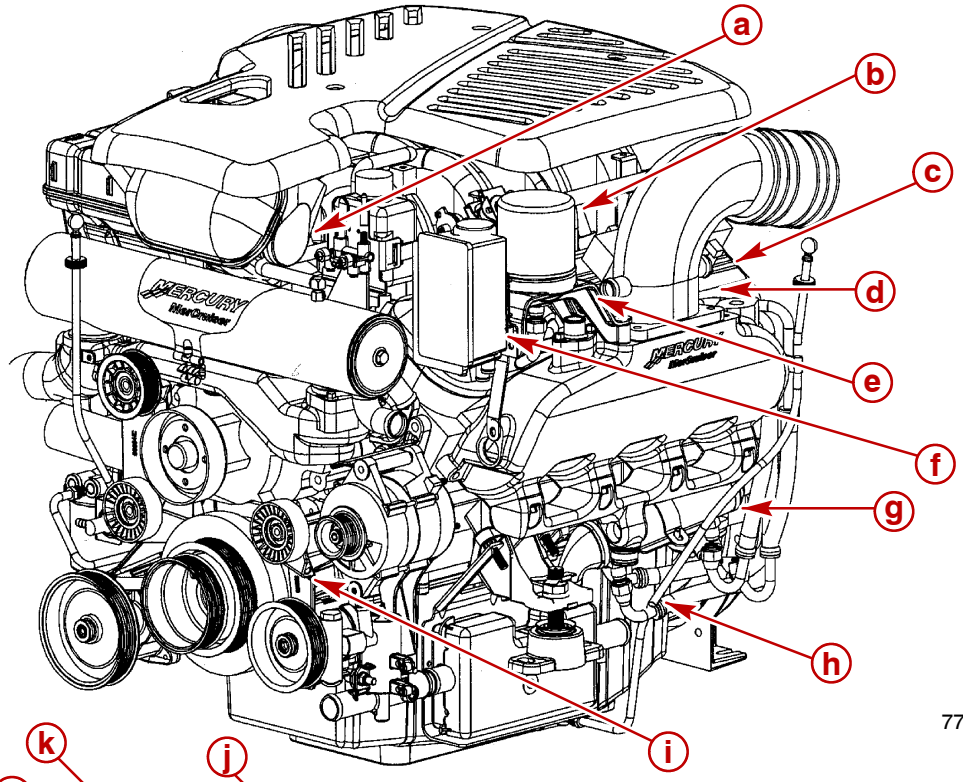
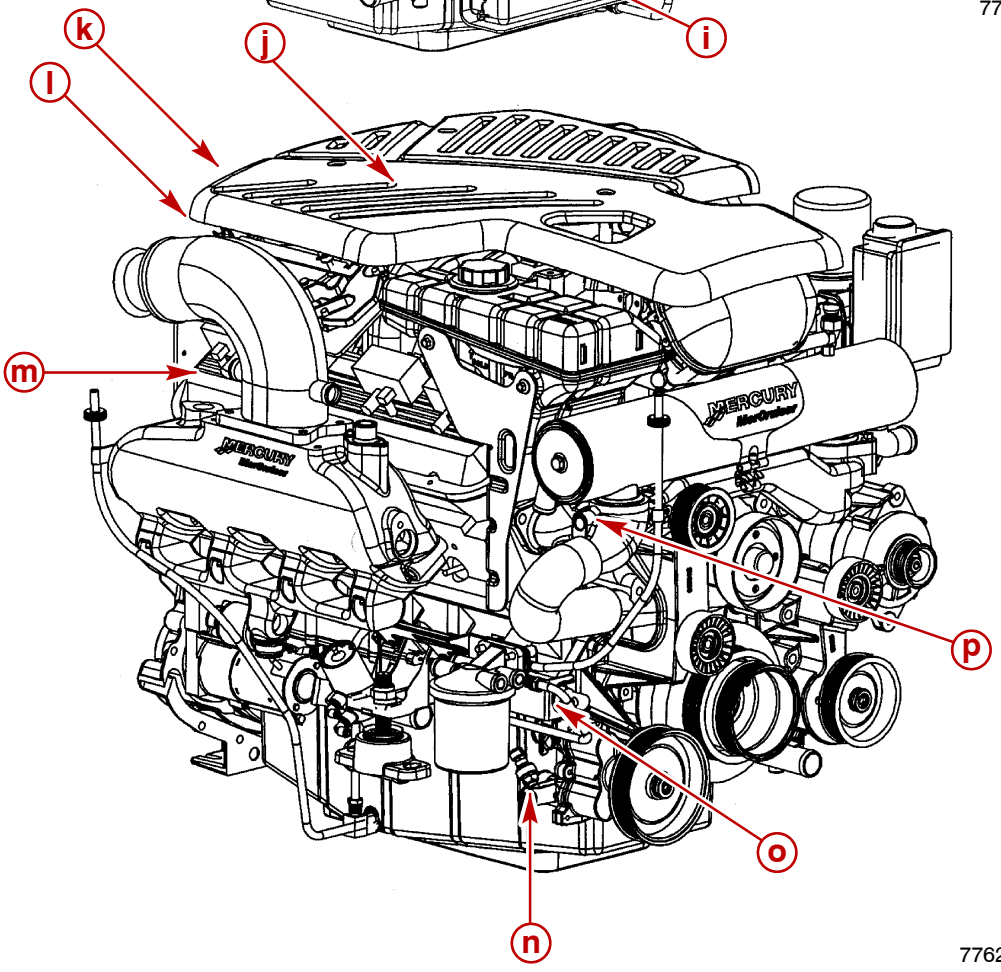
SECTION 3A - WIRING DIAGRAMS

Table of Contents

3 A

Sensor Locations On The 8.1 liter (496 cid) Engine





a - Throttle Position Sensor (TPS)
b - Electronic Control Module (PCM)
c - Crankshaft Position Sensor (CPS)
d - Port Exhaust Manifold Coolant Temperature Sensor (EMCT)
e - Data Link Connector (DLC)
f - Drive Lube Monitor
g - Oil Pressure Sensor
h - Cool Fuel Pump Connector
i - Camshaft Position Sensor (CMP)
j - Manifold Absolute Pressure Sensor (MAP)
k - Manifold Air Temperature Sensor (MAT)
l - Idle Air Control Valve (IAC)
m - Starboard Exhaust Manifold Coolant Temperature Sensor (EMCT)
n - Seapump Pressure Sensor
o - Boost Fuel Pump Connector
p - Engine Coolant Temperature Sensor (ECT)

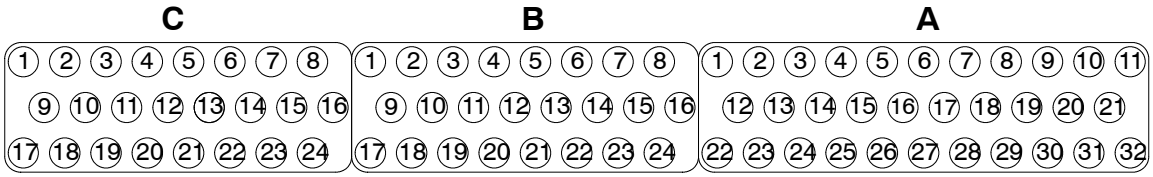
8.1 Liter (496 cid) Engine Harness Legend

Wire Splice Description

Splice Number	Description
100	5 Volt Transducer Ground
101	5 Volt Transducer Power For Sensors
102	Fused 20 AMP 12 Volt Power, Key ON Only
103	Continuous 12 Volt Battery Power
104	Battery Ground
105	Main Power Relay, Key ON Only
106	Coil Return
107	Fused 12 Volt Power to the PCM
108	Fused 12 Volt Power to the Fuel Pump Relay and the Injectors
110	Continuous 12 Volt Battery Power to the Main Power Relay
111	Fused 12 Volt Power to the Fuel Pumps

PCM 555 Pinout

This is a quick reference guide to the pins of the PCM. It can be used to verify broken pins and what they control and to help in checking wire continuity for suspect sensors.



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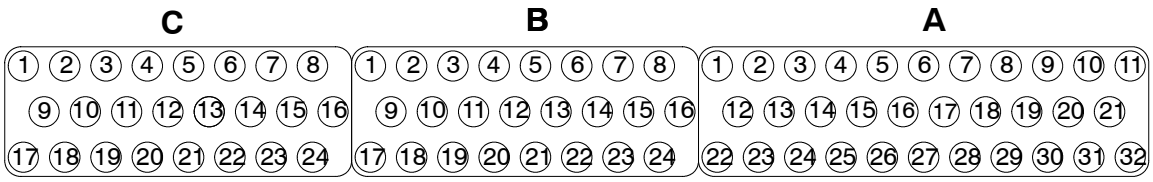
Connector A

1 - Key-on Power
2 - Empty
3 - Map Sensor Connector Pin B
4 - Oil Pressure Sensor Connector Pin C
5 - Pitot Pressure Smart Transom Connector Pin D
6 - Throttle Position Sensor Connector Pin C
7 - Empty
8 - Trim Position Smart Transom Connector Pin C
9 - Starboard Tab Position Tab Connector Pin A
10 - Port Tab Position Tab Connector Pin B
11 - CAN Line Pos (+) Connector Pin J
12 - Steering Position Smart Transom Connector Pin E
13 - Seawater Temperature Paddle Wheel Connector Pin D
14 - MAT Sensor Connector Pin B
15 - Coolant Temperature Sensor Connector Pin B
16 - Port Exhaust Water Temperature Connector Pin B
17 - Starboard Exhaust Temperature Connector Pin B
18 - Data Link Connector Pin C
19 - Port Knock Sensor Connector Pin B
20 - Starboard Knock Sensor Connector Pin B
21 - CAN Line Neg (-) Connector Pin K
22 - Splice 100
23 - Splice 101
24 - Seapump Pressure Connector Pin C
25 - Fuel Level Connector Pin C
26 - Fuel Level Connector Pin B
27 - Empty
28 - Data Link Connector Pin B
29 - Port Knock Sensor Connector Pin A
30 - Starboard Knock Connector Pin B
31 - CAN2 Line Pos (+) Connector Pin G
32 - CAN2 Line Neg (-) Connector Pin H



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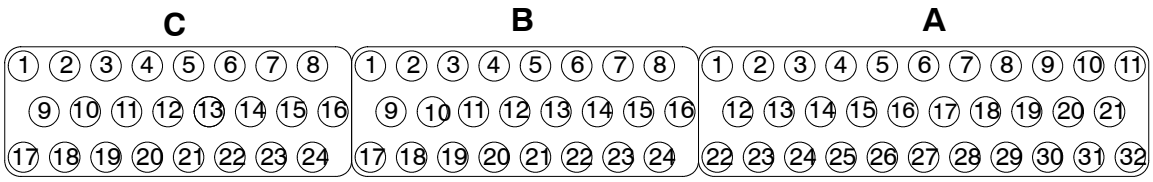
Connector B

1 - Splice 106 Coil Return
2 - Port Coil 1 Connector Pin G
3 - Paddle Wheel Connector Pin C
4 - Main Power Relay Pin 85
5 - Empty
6 - CAM Sensor Connector Pin C
7 - IAC Connector Pin 1
8 - Transmission Temperature Ground
9 - Port Coil 5 Connector Pin C
10 - Port Coil 3 Conector Pin F
11 - Fuel Pump Relay Pin 85
12 - Tachometer
13 - Empty
14 - Crankshaft Position Sensor Connector Pin C
15 - Charging Harness Connector Pin F
16 - Drive Lube Monitor Or Transmission Oil Temperature Switch
17 - Splice 107
18 - Splice 107
19 - Empty
20 - Fuel Injector 4 Connector Pin B
21 - Charging Harness Connector Pin D
22 - Fuel Injector 3 Connector Pin A
23 - CAN Line Connector Pin E
24 - Empty



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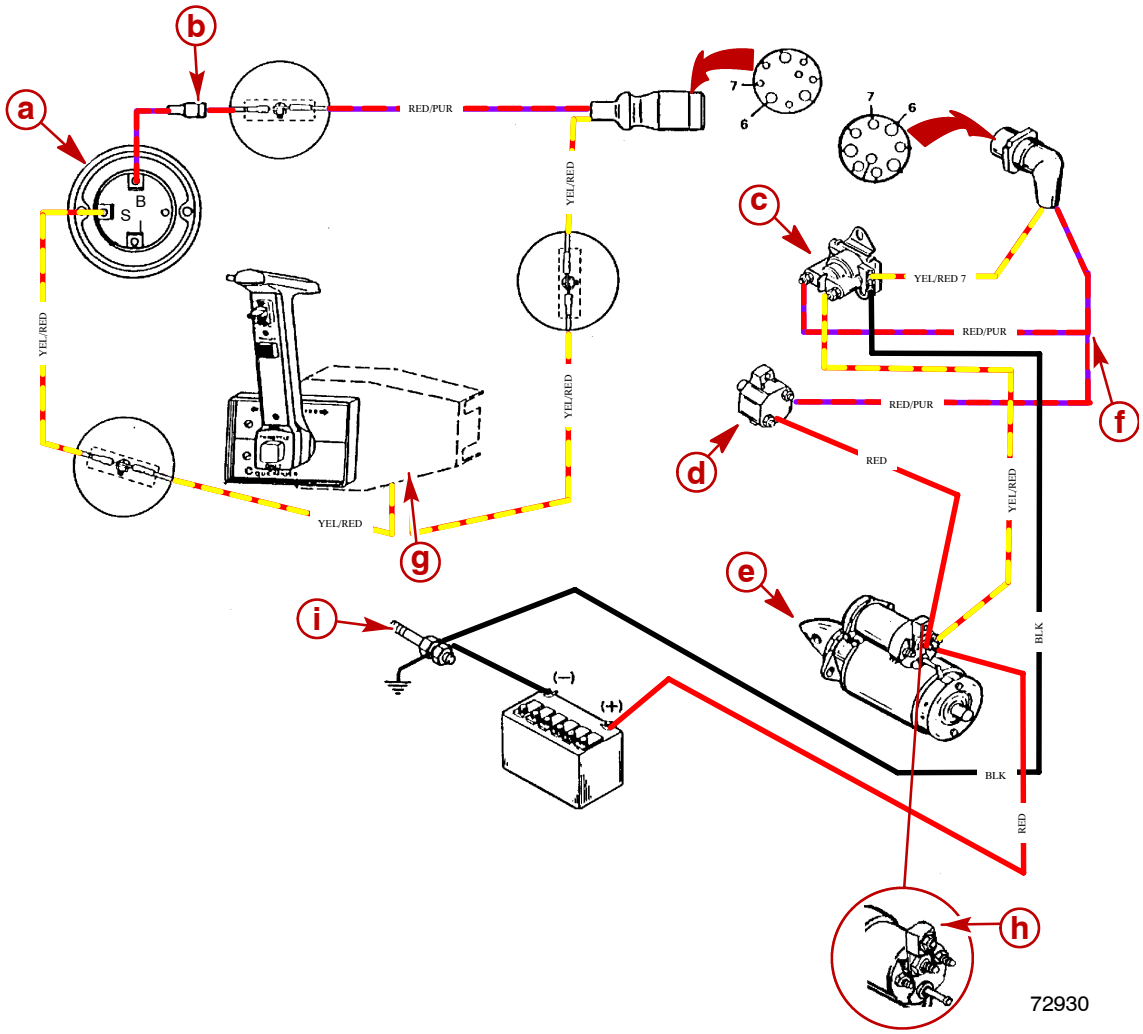
Connector C

1 - Port TAB Up Solenoid Connector Pin G
2 - Empty
3 - Fuel Injector 8 Connector Pin E
4 - Empty
5 - Fuel Injector 7 Connector Pin G
6 - Fuel Injector 1 Connector Pin H
7 - Starboard Coil 4 Connector Pin C
8 - Starboard Coil 2 Connector Pin B
9 - Starboard TAB Up Solenoid Connector Pin C
10 - Starboard TAB Down Solenoid Connector Pin D
11 - Fuel Injector 2 Connector Pin F
12 - Starboard Coil 6 Connector Pin F
13 - Port Coil 7 Connector Pin B
14 - Starboard Coil 8 Connector Pin G
15 - Splice 104
16 - Splice 104
17 - Empty
18 - Empty
19 - Port TAB Down Solenoid Connector Pin H
20 - Smart Transom Connector Pin G
21 - Fuel Injector 6 Connector Pin D
22 - Trim Up Relay Pin 85
23 - Fuel Injector 5 Connector Pin C
24 - Splice 104

8.1 liter (496 cid) Electrical Wiring Diagrams

Typical Starting System Components



a - Ignition Switch
b - 20 Amp Fuse
c - Starter Slave Solenoid
d - Circuit Breaker
e - Starter Motor
f - Wire Junction
g - Neutral Safety Switch
h - 90 Amp Fuse
i - Engine Ground (–)

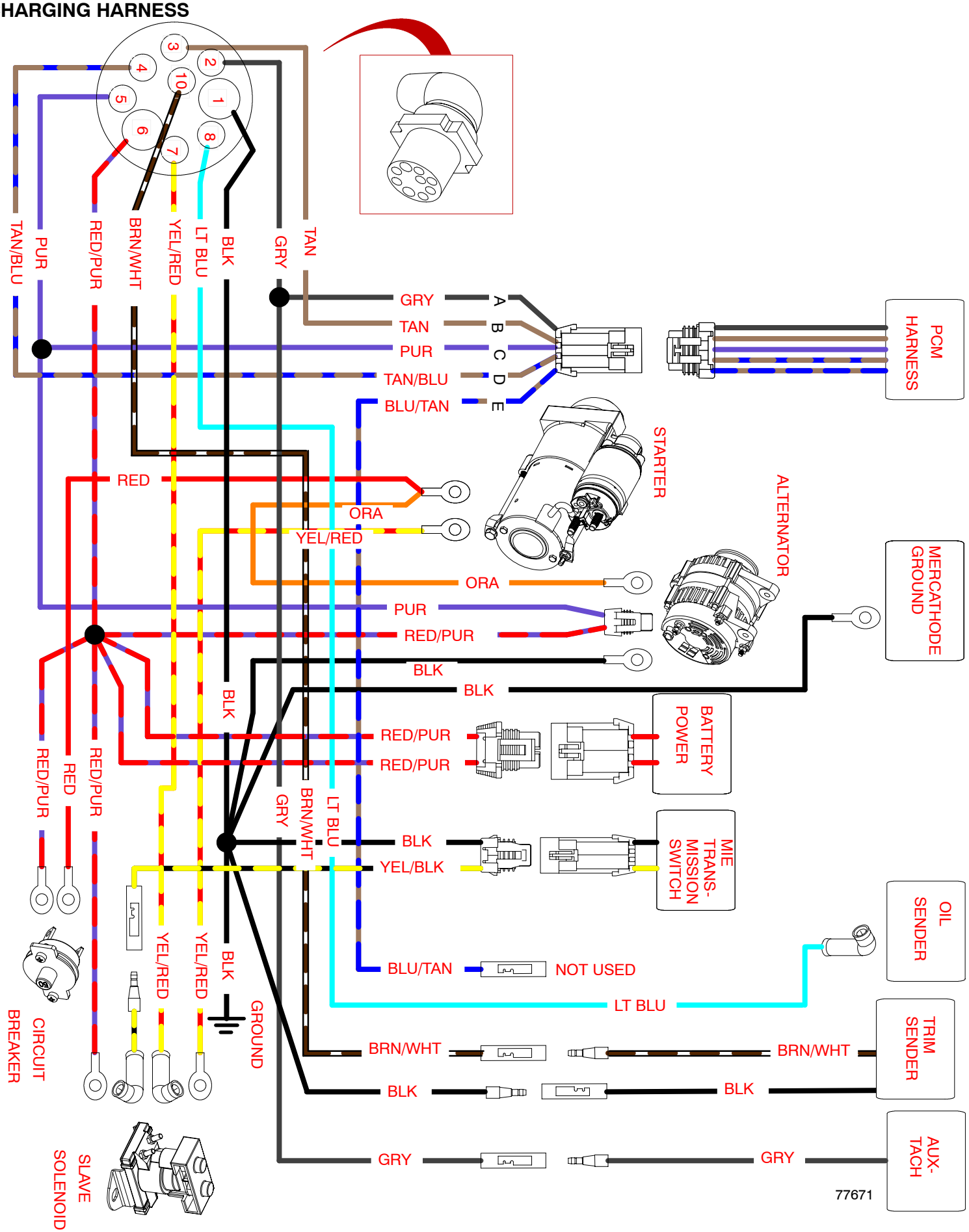
Positive Current Flow

This is a general description of the positive current flow from the battery through the system until the starter motor cranks.

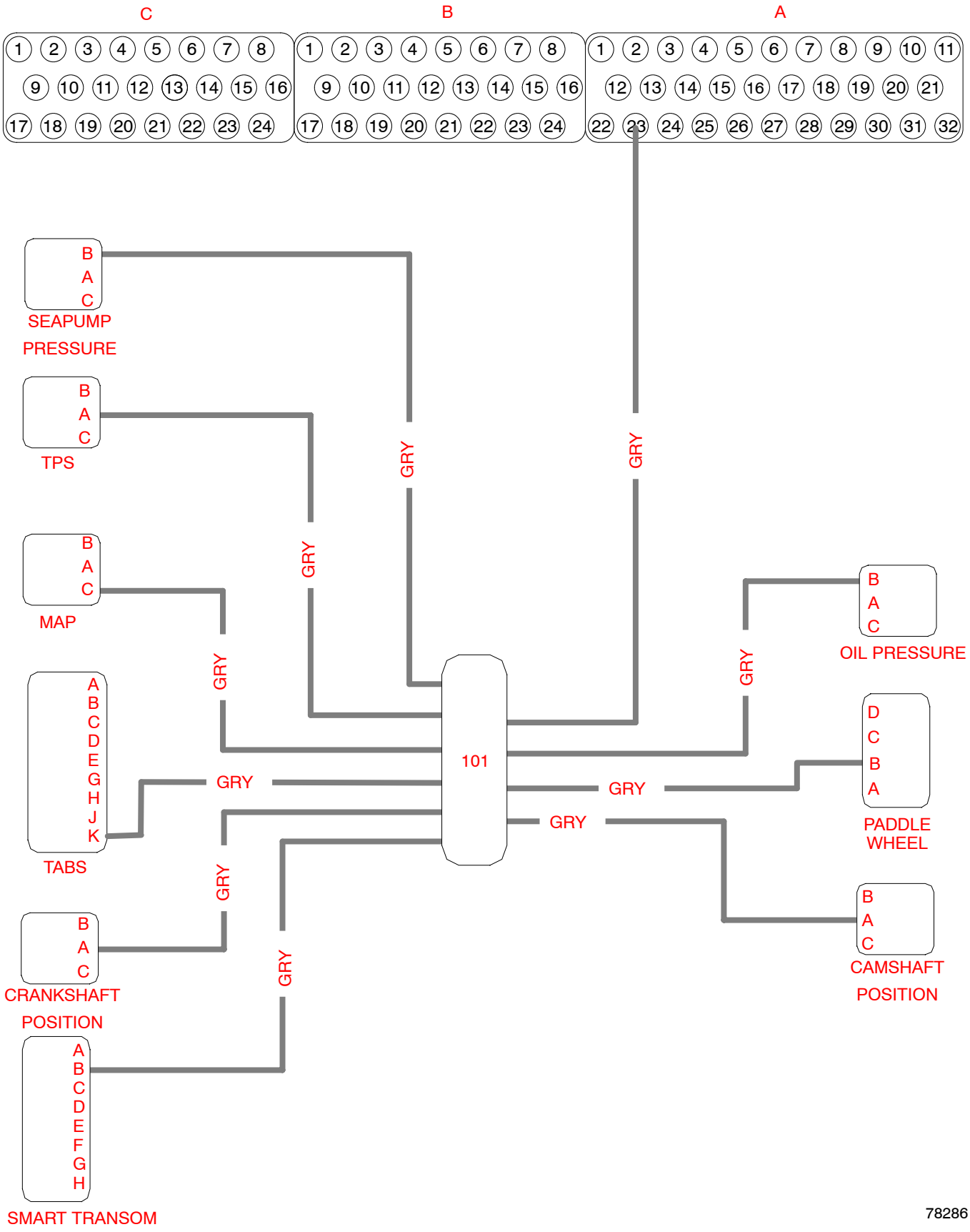
NOTE: *Ensure that all connections are tight and have the required resistance.*

- Battery to the solenoid switch on the starter (RED battery cable).
- Solenoid switch to circuit breaker (RED).
- Circuit breaker to wire junction (RED/PUR).
- Wire junction to wiring harness plug (RED/PUR) Terminal 6.
- Wiring harness plug to 20 amp fuse (RED/PUR).
- 20 amp fuse to the ignition switch Terminal B (RED/PUR). At this point ignition switch is turned to the START position.
- Ignition switch Terminal B to Terminal S.
- Ignition switch Terminal C to neutral start switch (YEL/RED). NEUTRAL START SWITCH MUST BE AT NEUTRAL POSITION.
- Neutral start switch to wiring harness plug Terminal 7 (YEL/RED).
- Wiring harness plug to starter solenoid (small terminal) (YEL/RED). Also, ensure that BLK (small terminal) wire is grounded.
- Starter solenoid is now CLOSED, completing circuit between large terminal (RED/PUR) and other large terminal (YEL/RED), causing starter motor to crank.

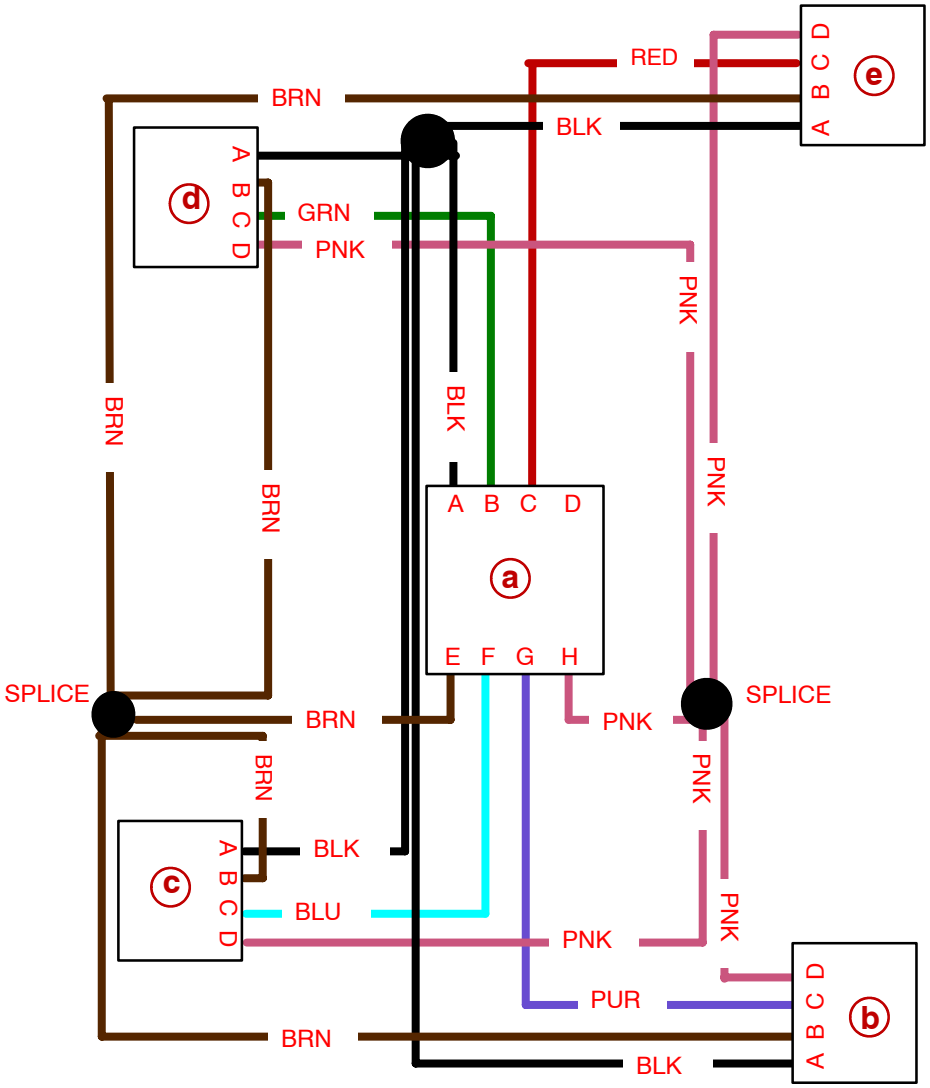
CHARGING HARNESS



5 VOLT SENSOR CIRCUIT



COIL HARNESS CIRCUIT



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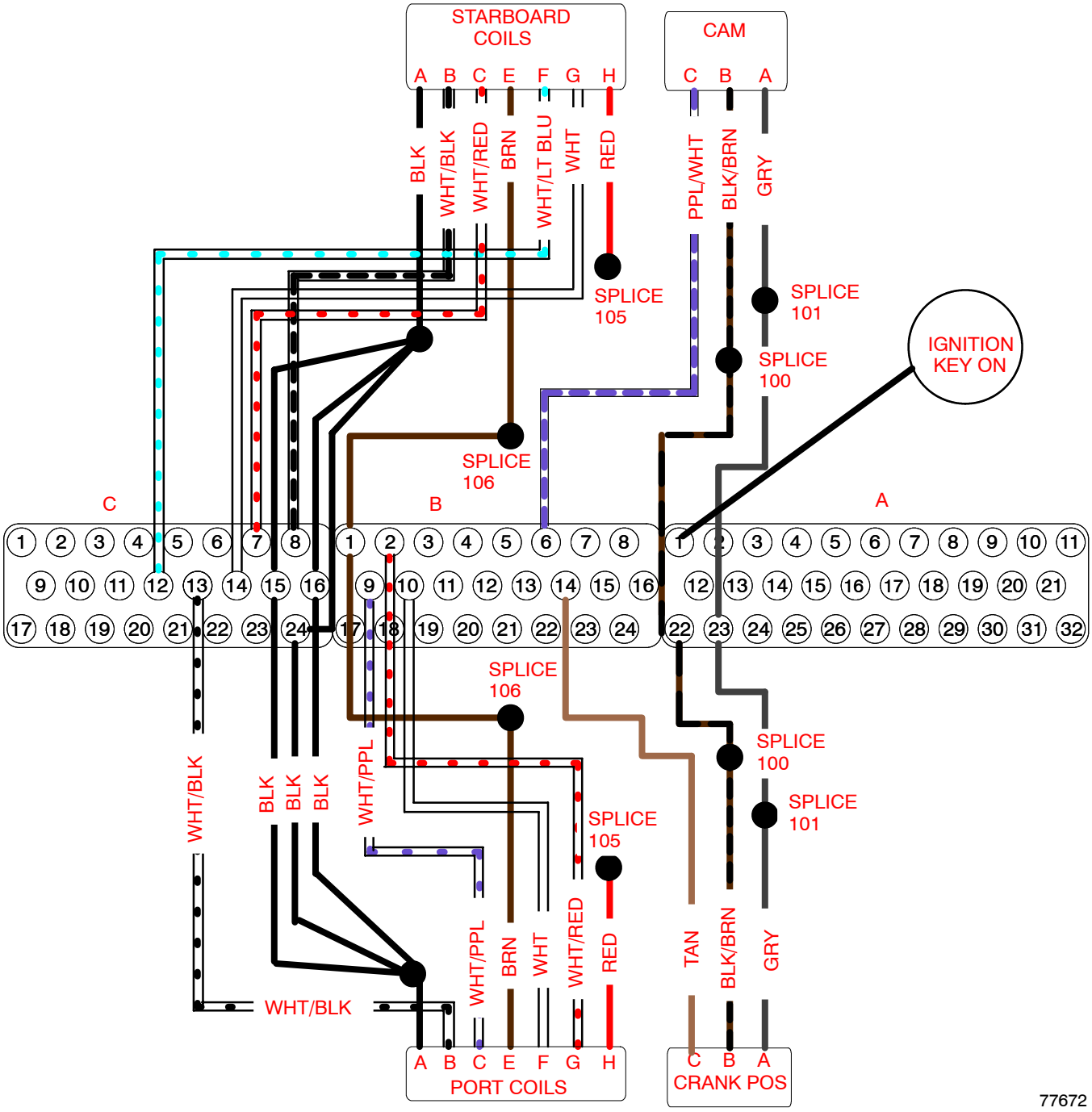
a - Coil Harness To Engine Harness Connector
b - 1 And 8 Coil Connector
c - 3 And 6 Coil Connector
d - 5 And 4 Coil Connector
e - 7 And 2 Coil Connector

There are 2 coil harnesses on the engine, one for each side of the engine. The harnesses are wired identically. The signal wire color for coils 1 and 8 is BLU, coils 3 and 6 is PUR, 5 and 4 wire is GRN, and 7 and 2 is RED The PNK wire is 12 volt power, the BRN wire is 5 volt power and the BLK wire is ground. If a possible problem is suspected in the ignition system, check for faults once with key ON and once with engine running. An EST Open will only register a fault in a key ON only state and an EST Short will only register with the engine operating.

A malfunction in the coil harness will set the fault of EST 1-8 Open or EST 1-8 Short.

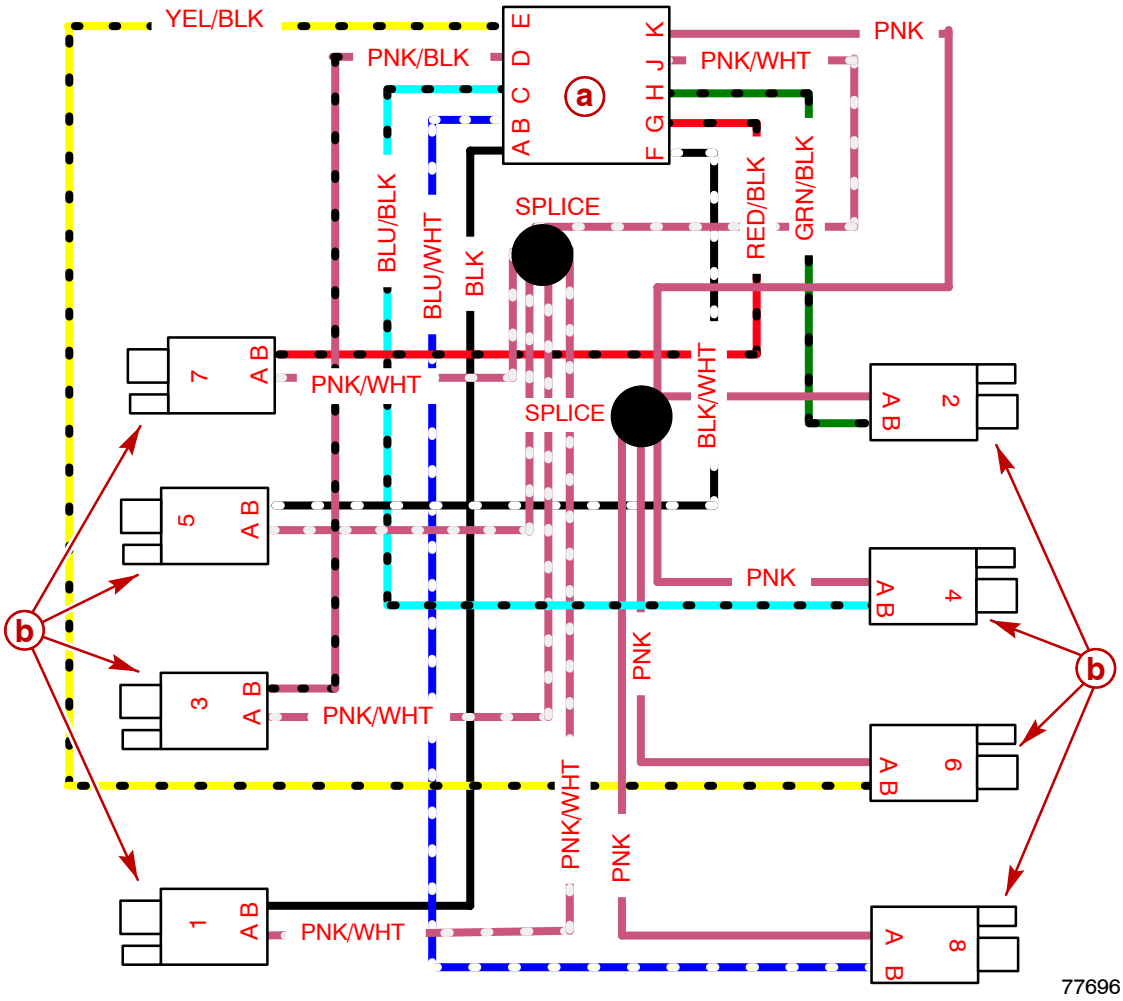
IGNITION CIRCUIT



With initial key ON, 12 volt power is sent from the battery through the purple lead in the 10-pin harness to the pink lead at Engine Harness Pin C. This is wake up power to the PCM. The PCM powers pin B4 which in turn pulls the MPR low. The MPR powers the coils through Splice 105 and powers the engine for ignition.

PCM Pinout	Cylinder	PCM Pinout	Cylinder	PCM Pinout	Cylinder
B2	1	C8	2	B9	5
C7	4	C13	7	C14	8
B10	3	C12	6		

FUEL INJECTOR HARNESS



a - Injector Harness To Engine Harness Connector
b - Individual Injector Connectors

The fuel injectors receive fused 12 volt power from Splice 108 (Pins J and K) on the injector harness. The PCM signals the injector to fire by pulling the 12 volts to ground and completing the circuit. The normal resistance at 21 degrees C (70 degrees F) is 12.5 ohms.

A malfunction in the fuel injector harness will set the fault of FINJ 1-8 Open or FINJ 1-8 Short.

When the fuel injector driver wire is shorted to ground, the scan tool will read Open Sensor, this means that the fuel injector is full Open.

When the fuel injector is shorted, the scan tool will read Short Injector.

A shorted 12 volt fuel injector power lead will blow the injector fuse E-F; the scan tool will read Bad Fuel Pump Fuse.

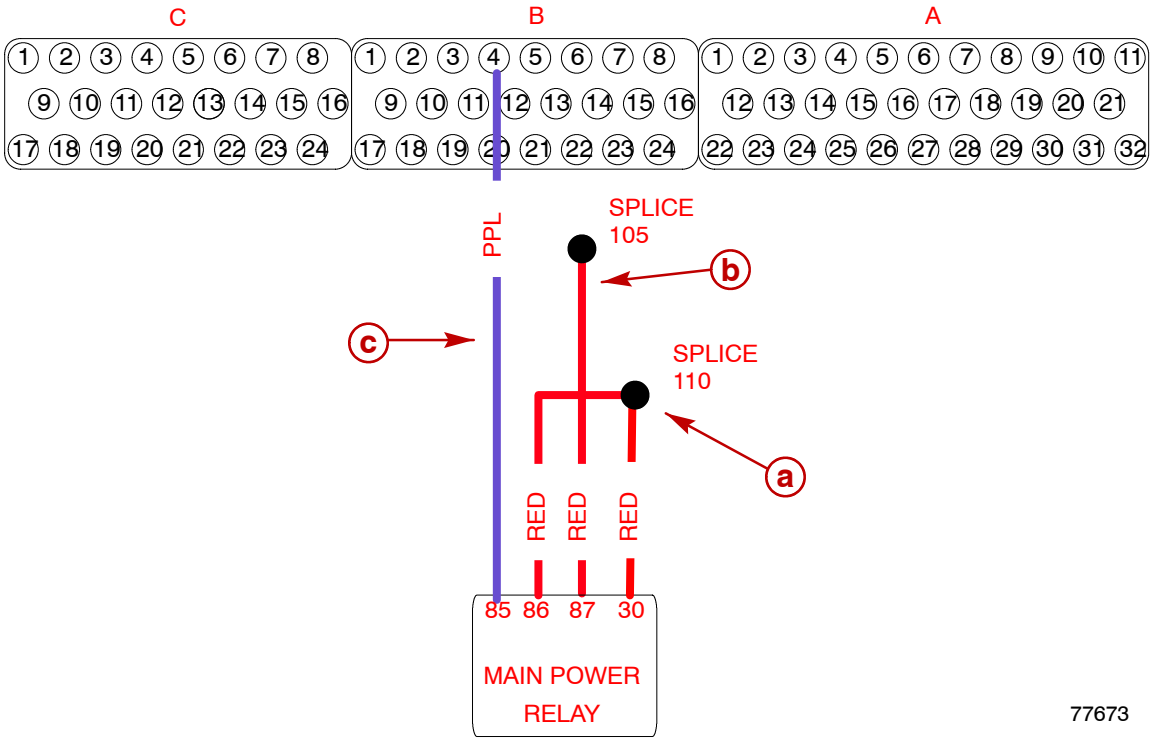
FUEL INJECTOR HARNESS (CONTINUED)

Fuel Injector Number	Wire Colors on Fuel Injector Harness	PCM Pinout
1	BLK	C-6
2	GRN/BLK	C-11
3	PNK/BLK	B-22
4	BLU/BLK	B-20
5	BLK/WHT	C-23
6	YEL/BLK	C-21
7	RED/BLK	C-5
8	BLU/WHT	C-3

Single Circuit Diagrams

This section outlines the circuitry of the 8.1 liter (496 cid) wiring harness and sensors as individual systems. This allows for a quick reference point when trying to detect a faulty connection. However, the complete system wiring diagram should be referenced if multiple electrical faults are occurring.

MAIN POWER RELAY CIRCUIT

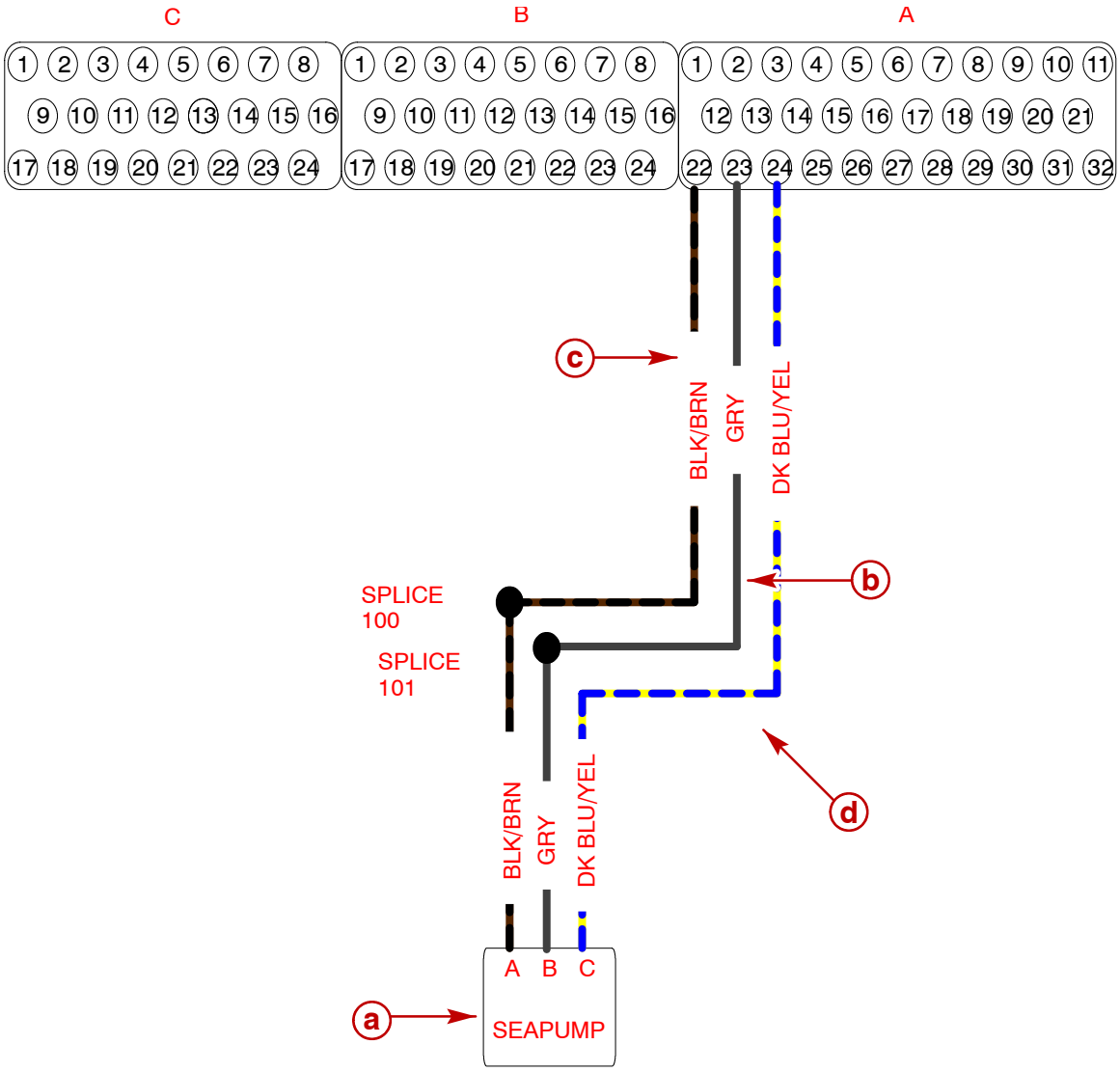


a - Battery Power
b - Output Power To Splice 105
c - Signal From PCM

The Main Power Relay (MPR) switches ON upon key ON and sends 12 volt power to Splice 105, which powers the IAC, fuel injectors and part of the PCM. It is located on the top of the engine near the PCM. Listen for a click on initial key ON and check continuity to the MPR if a problem is suspected.

A malfunction of the MPR could result in the fault MPR Output or MPR Backfeed.

SEAPUMP CIRCUIT

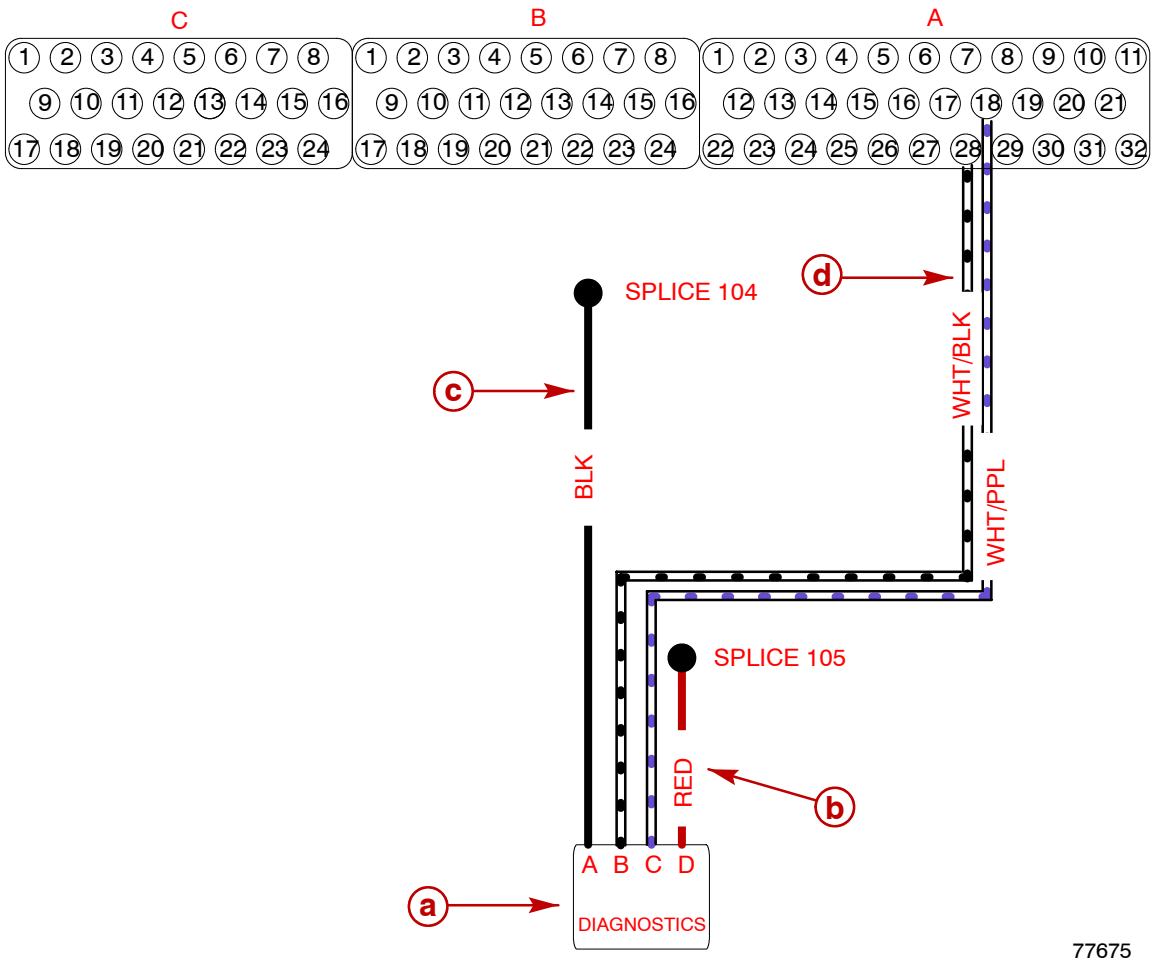


a - Seapump Sensor Connecter
b - 5 Volt Transducer Power
c - 5 Volt Transducer Ground
d - Signal To PCM

The seapump sensor measures water inlet pressure or water block pressure. It is located at the seapump inlet hose. Normal diagnostic tool ranges are 1-5 psi (7-34 kPa) at idle and 7-17 psi (48-117 kPa) at WOT. To check if sensor is within range, the diagnostic tool reading with key ON should be approximately zero. The normal resistance value for the oil pressure sensor at 70 degrees F (21 degrees C) is A to B 31.5 kohms and A to C 42.9 kohms.

A malfunction of the seapump sensor will set the fault of Seapump CKT Hi, Seapump CKT Lo or Seapump PSI Lo.

DIAGNOSTICS CIRCUIT



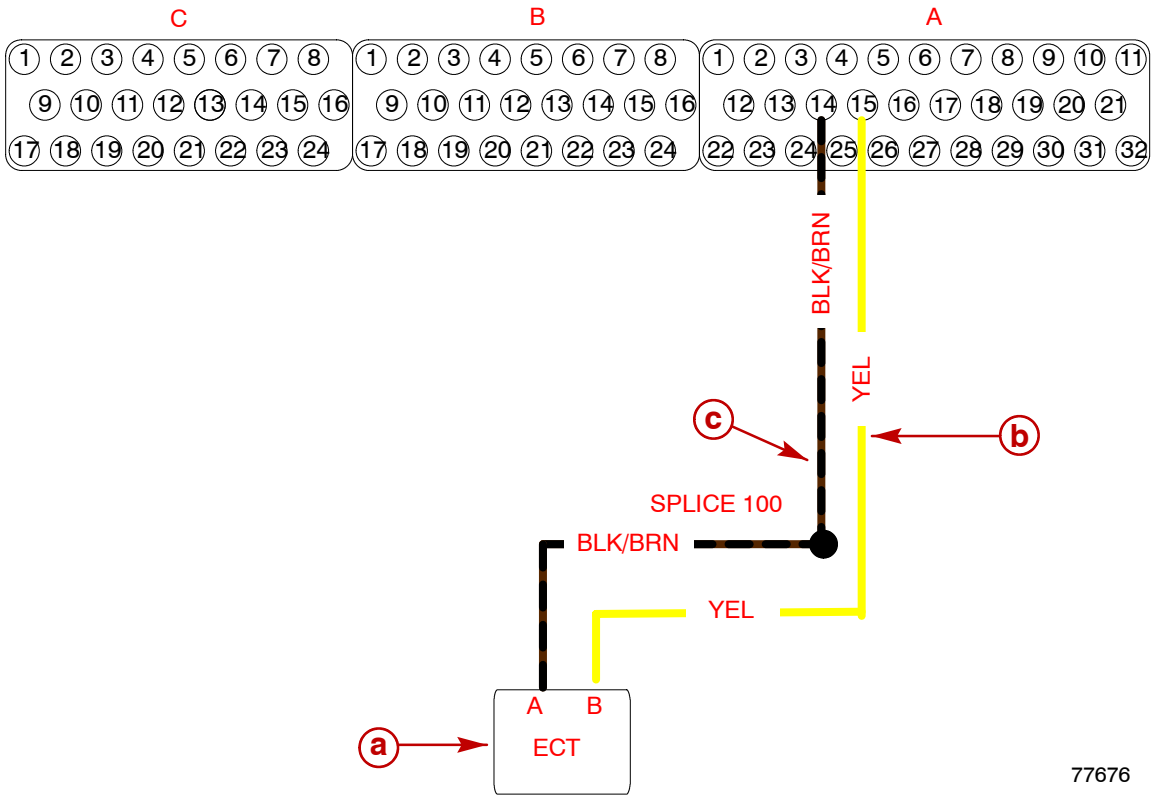
a - Data Link Connecter
b - 12 Volt Transducer Power
c - 12 Volt Transducer Ground
d - Data Leads From PCM

The data link connector (DLC) is a 4-pin circuit for attaching the diagnostic tool to the PCM. It is located on the port side of the engine next to the oil filter. Before attaching a diagnostic tool to the engine, verify that the key is OFF and the pins are clean of corrosion and debris. Pin A is the 12 volt ground connected to the engine harness at splice 104. Pins B and C are data retrieval lines from the PCM. Pin D is the 12 volt supply to the diagnostic tool.

IMPORTANT: Diagnostic tools can only receive data with key ON or engine operating. Diagnostic tools need a minimum of 8 volts. If the diagnostic tool does not respond, verify the connection, verify that the key is ON and check the battery voltage.

A malfunction of the data link connector will not set a fault.

ENGINE COOLANT TEMPERATURE CIRCUIT



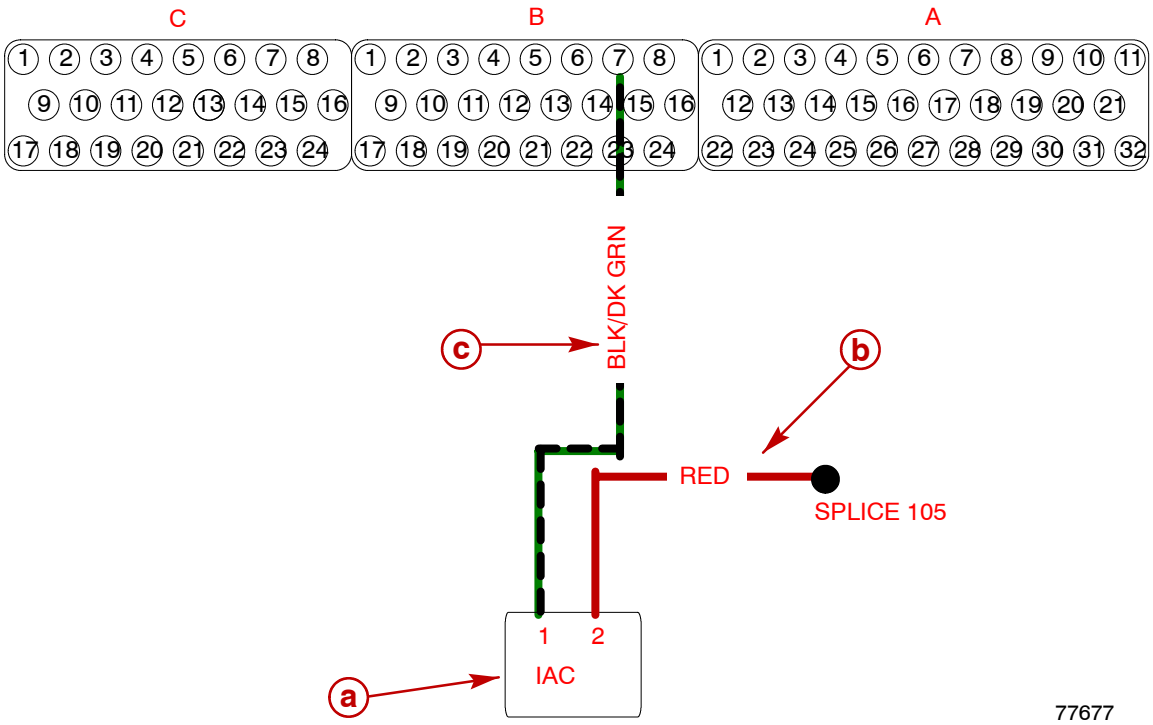
a - Engine Coolant Temperature Sensor
b - 5 Volt Transducer Power
c - 5 Volt Transducer Ground

The engine coolant temperature (ECT) sensor is a thermistor immersed in the engine coolant stream. It is located in the water crossover on the front starboard side of the engine. Low coolant temperature produces high resistance, while high temperature causes low resistance. The normal resistance value for the ECT sensor at 21 degrees C (70 degrees F) is 3.12 kohms.

A malfunction of the ECT sensor will set a fault of Cool TEMP CKT Hi, Cool TEMP CKT Lo or ECT Coolant Overheat.

Approximate Temperature - to - Resistance Values		
Degrees F	**Degrees C**	**ohms**
210	100	185
160	70	450
100	38	1,800
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

IAC CIRCUIT

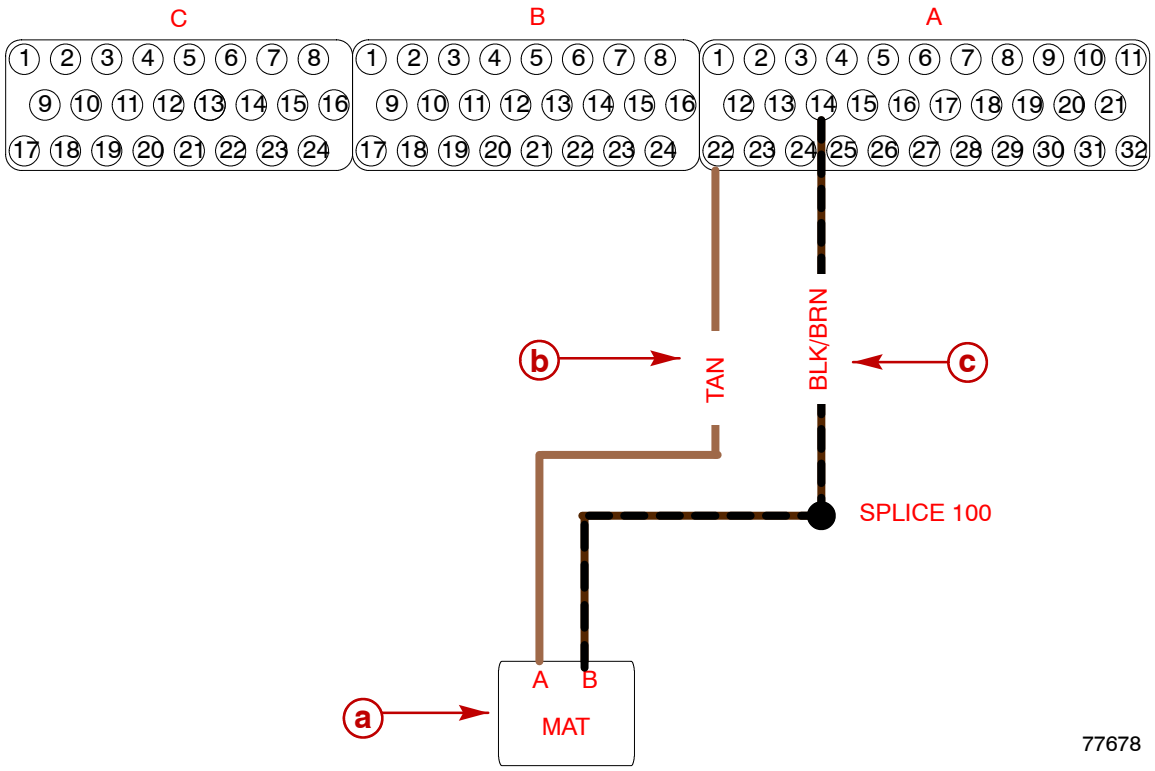


a - IAC Sensor Connector
b - 12 Volt Transducer Power From MPR
c - 12 Volt Transducer Ground

The idle air control (IAC) valve is a 12 volt circuit powered by the MPR. It is located at the top rear of the engine. The normal resistance value for the IAC at 21 degrees C (70 degrees F) is 10.1 ohms.

A malfunction of the IAC will set a fault of IAC Output.

MAT CIRCUIT

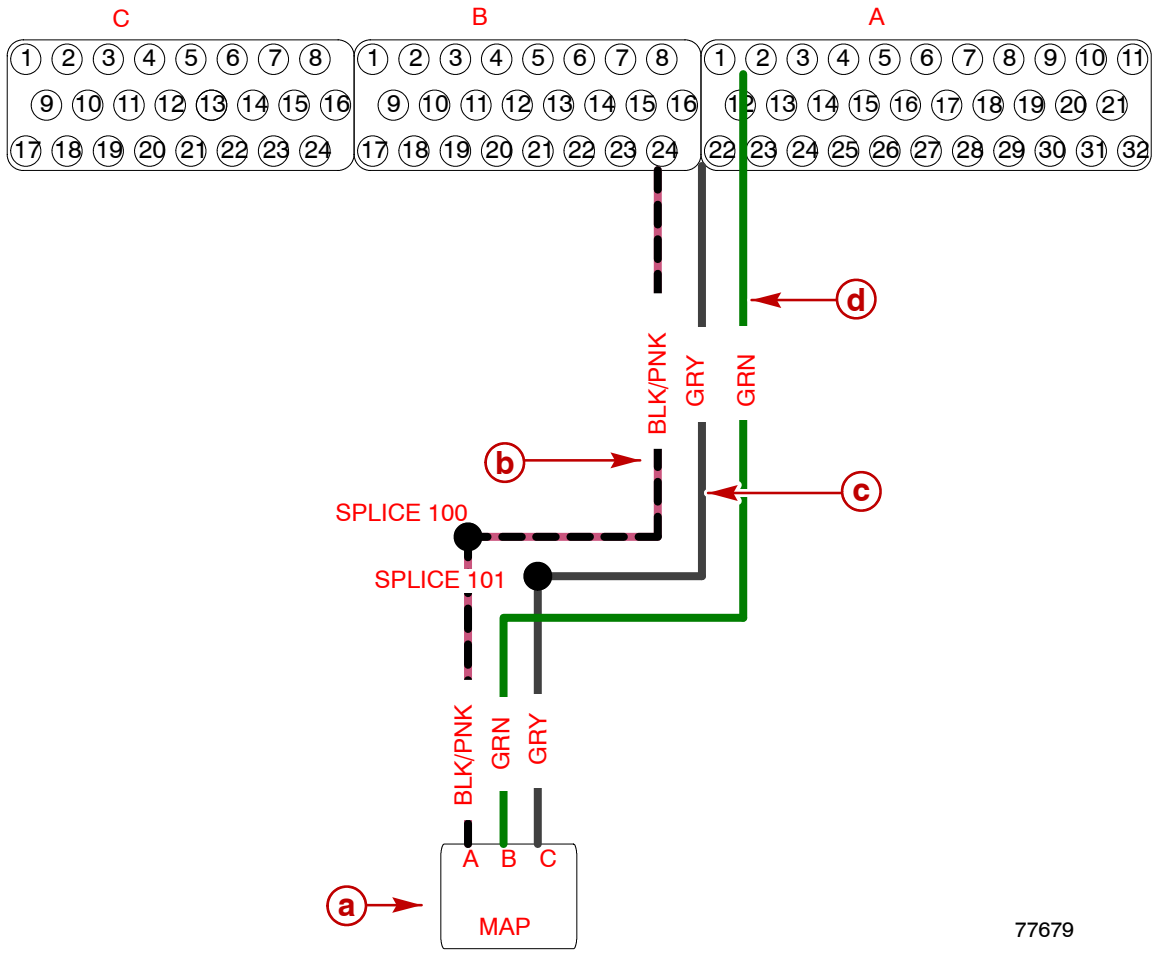


a - Manifold Air Temperature Connector
b - 5 Volt Signal
c - 5 Volt Ground

The manifold air temperature (MAT) sensor is a thermistor that controls signal voltage to the PCM. It is located at the rear of the engine in the intake manifold plenum. When intake air is cold, the sensor resistance is high. As the air temperature rises, resistance lowers. At normal engine operating temperature, 71-82 degrees C (160-180 degrees F), the voltage will measure about 1.5 to 2.0 volts. The normal resistance value for the MAT sensor at 21 degrees C (70 degrees F) is 3.14 kohms.

A malfunction in the MAT will set the fault of AIR TMP CKT Hi or AIR TMP CKT Lo.

MAP CIRCUIT



a - Manifold Absolute Pressure Connector
b - 5 Volt Ground
c - 5 Volt Power
d - Signal Wire

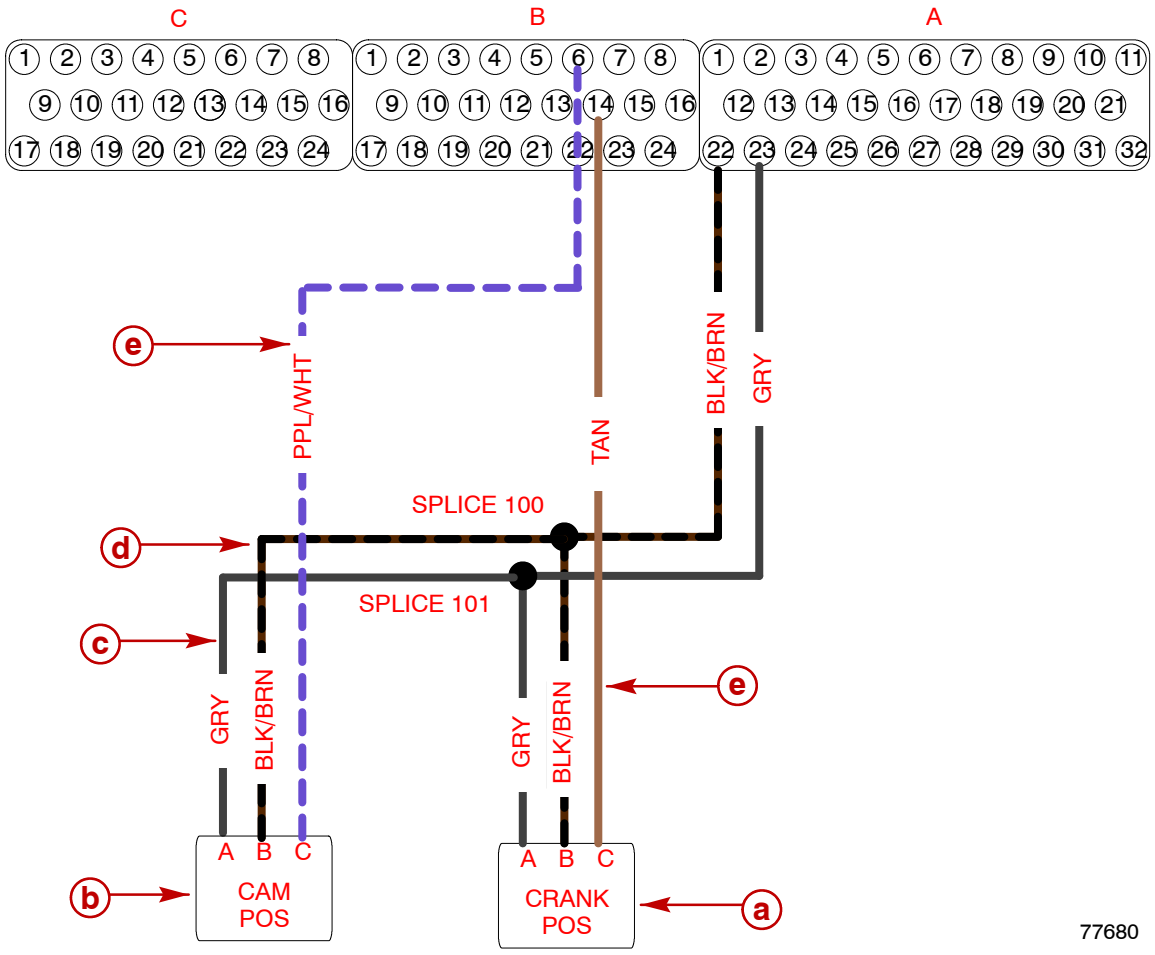
The manifold absolute pressure (MAP) sensor measures the changes in the intake manifold pressure. It is located on the intake manifold on the top of the engine. At key ON, the MAP is equal to atmospheric pressure. This information is used by the PCM as an indication of altitude and is referred to as BARO. Comparison of this BARO reading with a known good MAP sensor is a good check of a suspect sensor. The pressure changes as a result of engine load and speed change. The PCM receives this information as a signal voltage that will vary from about 1.0-2.0 volts at idle to about 4.0-5.0 volts at WOT. Typical pressure readings at idle are:

- Base Models- 50-54 kPa (7.25-7.83 psi)
- High Output Models - 58-62 kPa (8.41-8.99 psi)

The normal resistance values for the MAP sensor at 21 degrees C (70 degrees F) are A to B 9.33 kohms and A to C 3.89 kohms.

A malfunction in the MAP sensor circuit could set the fault of MAP Sensor Input HI, MAP Sensor Input Lo or MAP Sensor Idle Rationale.

CRANK POSITION AND CAMSHAFT POSITION CIRCUITS



a - Crankshaft Position Sensor
b - Camshaft Position Sensor
c - 5 Volt Power
d - 5 Volt Ground
e - Signal To The PCM

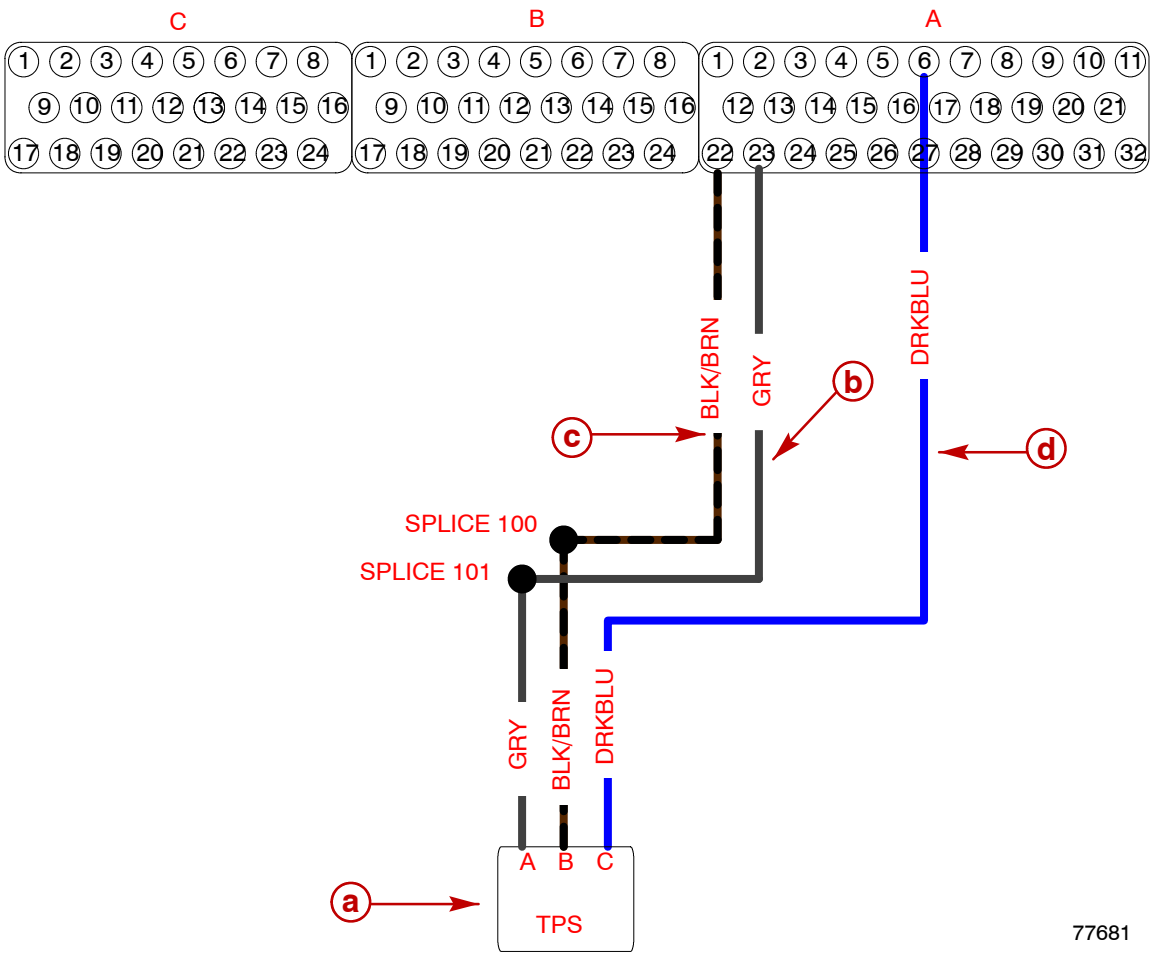
The crankshaft position sensor, located at the rear of the engine, and the camshaft position sensor, located at the front of the engine, supply the PCM with timing and rpm information. If a failure occurs in these sensor circuits, the engine will operate extremely rough or stop operating. Check for continuity between the PCM and the sensor.

The normal resistance values for these sensors at 21 degrees C (70 degrees F) are:

- Camshaft Position Sensor - A to B 24.04 mohms and B to C 24.05 mohms
- Crankshaft Position Sensor - A to B 23.2 mohms and B to C 23.21 mohms.

With software prior to level 091, a malfunction of the crankshaft position sensor or the camshaft position sensor will not set a fault. With level 091 software, if the camshaft position sensor is bad and does not send a signal to the PCM, the engine will backfire and not start. Stop cranking the engine when this occurs and then try to start the engine. Operate the engine for 20 seconds to set faults. The Audio Warning alarm will signal 2 beeps per minute. The Smartcraft system monitor will show the check engine light.

THROTTLE POSITION CIRCUIT

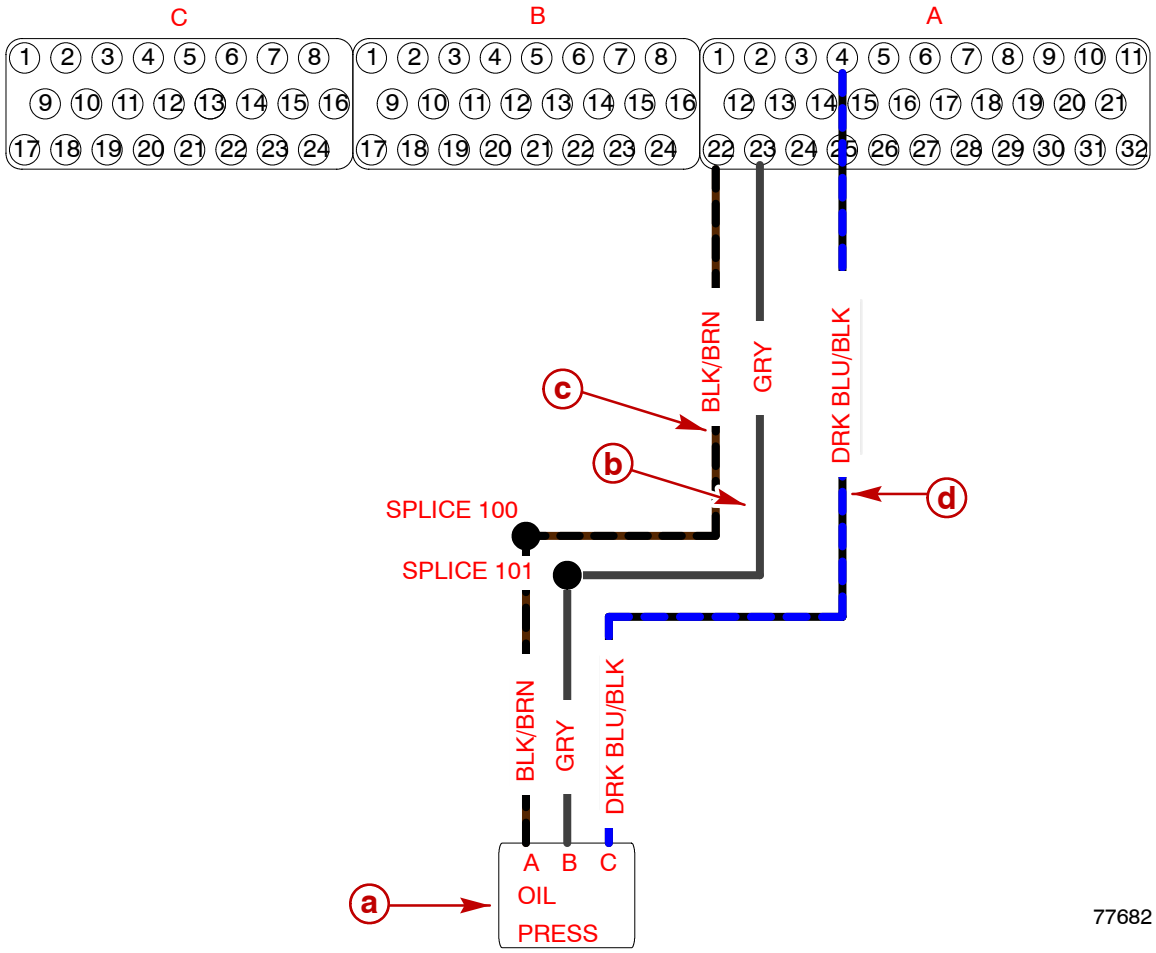


a - Throttle Position Sensor
b - 5 Volt Transducer Power
c - 5 Volt Transducer Ground
d - Signal To The PCM

The throttle position sensor (TPS) sends throttle plate angle information to the PCM. It is located on the throttle body. Signal voltage should vary from 0.5 volts at idle to 4.7 volts at WOT. If the TPS malfunctions, the ECM will reset to a default value.

A malfunction in the TPS circuit will set the fault of TPS Input Hi, TPS Input Lo, TPS Range Hi, TPS Range Lo or TPS No Adapt.

OIL PRESSURE CIRCUIT

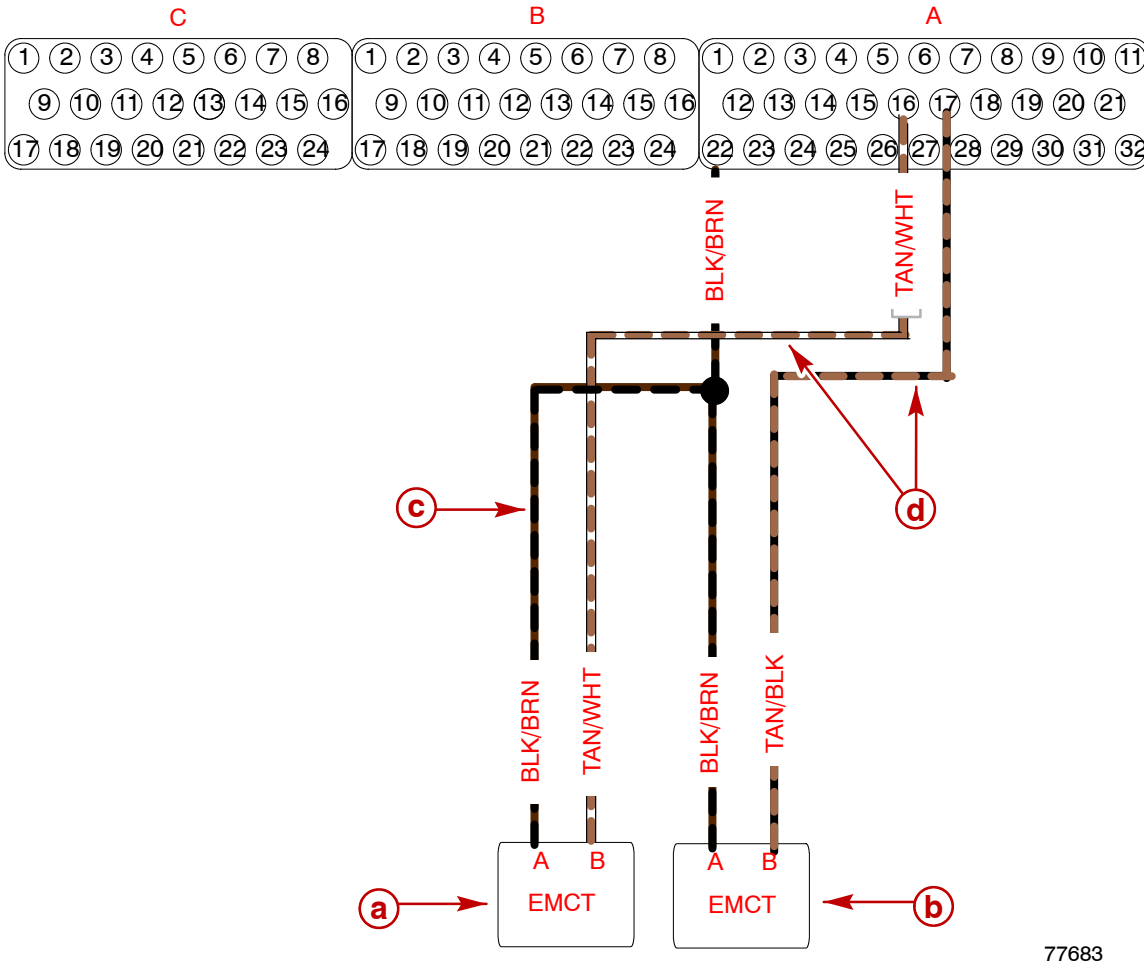


a - Oil Pressure Sensor
b - 5 Volt Power
c - 5 Volt Ground
d - Signal To The PCM

The oil pressure sensor measures oil flow through the oil galleries .It is located on the rear port side of the engine. The normal resistance value for the oil pressure sensor at 21 degrees C (70 degrees F) is A to B 31.5 kohms and A to C 42.9 kohms.

A malfunction of the oil pressure sensor will set the fault Oil PSI CKT Hi, Oil PSI CKT Lo or Oil PSI Lo.

EXHAUST MANIFOLD COOLANT TEMPERATURE CIRCUITS

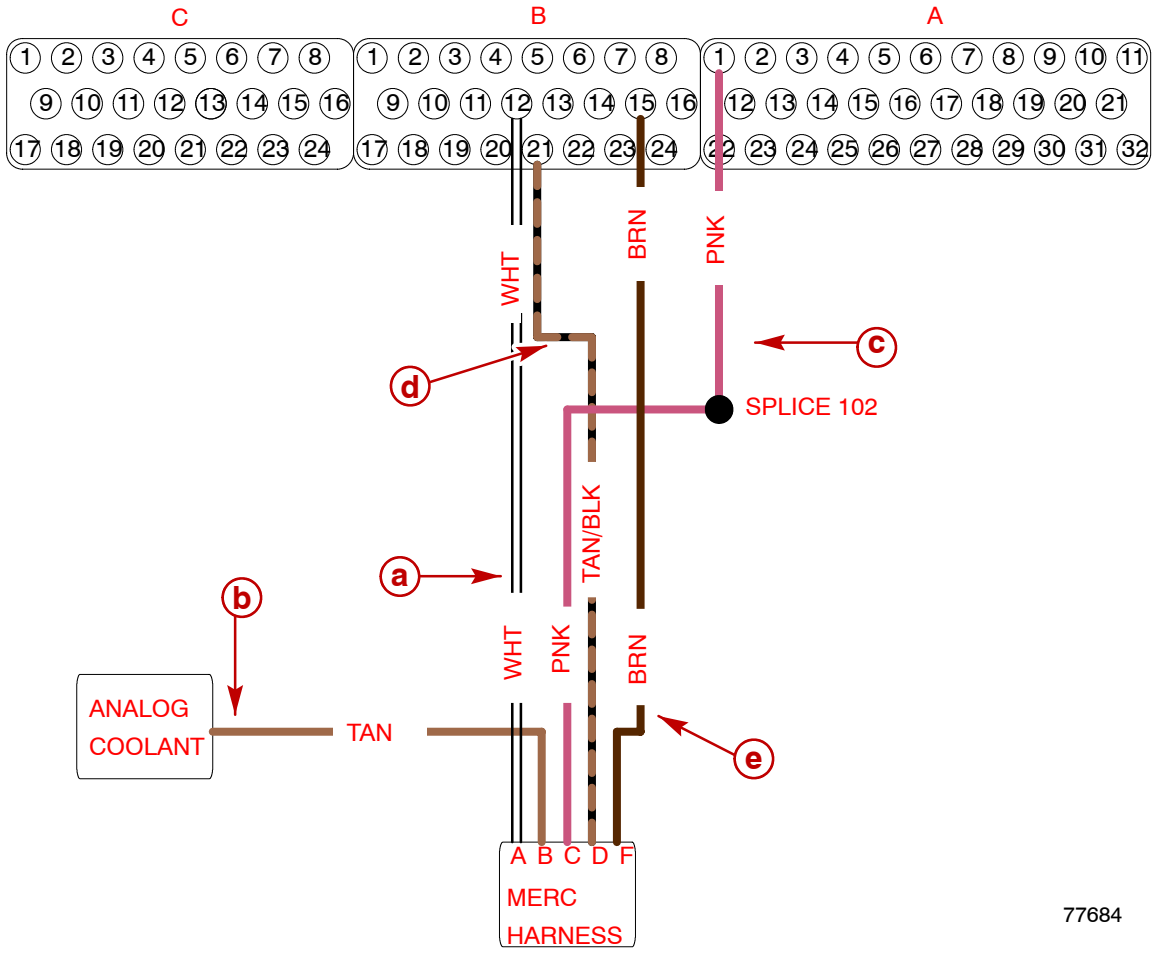


a - Port Exhaust Manifold Coolant Temperature Sensor
b - Starboard Exhaust Manifold Coolant Temperature Sensor
c - 5 Volt Transducer Power
d - 5 Volt Transducer Ground

The exhaust manifold coolant temperature (EMCT) sensors are located on the top of each exhaust manifold. The EMCT sensors are thermistors immersed in the engine exhaust stream. Low temperatures produce high resistance, while high temperatures cause low resistance. The normal resistance values for the EMCT sensors at 21 degrees C (70 degrees F) is 11.01 kohms.

A malfunction of the EMCT will set a fault of Port EMCT CKT Hi, Port EMCT CKT Lo, Port EMCT CKT Overheat, STB EMCT CKT Lo, STB EMCT CKT Hi or STB EMCT CKT Overheat.

10 PIN HARNESS CIRCUIT

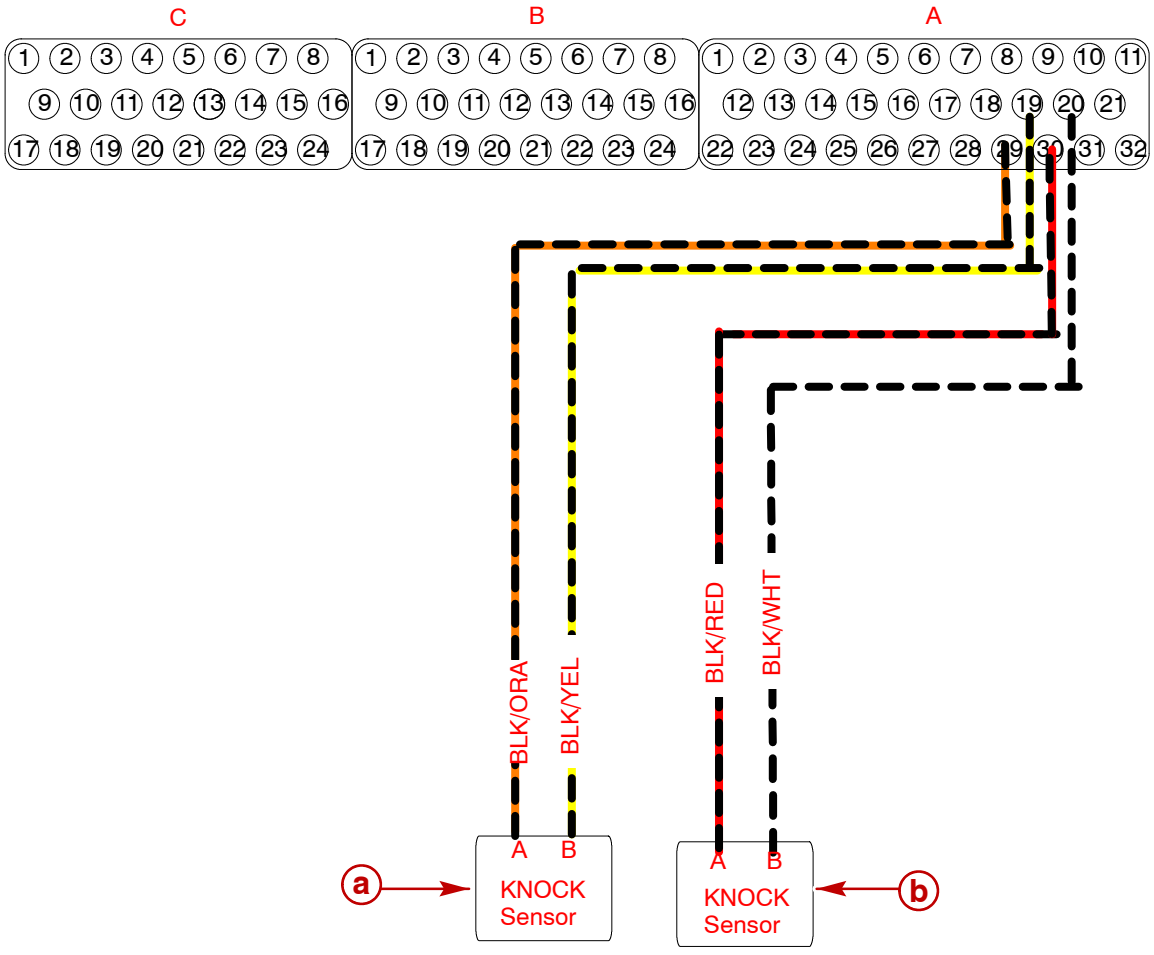


a - Tachometer Signal
b - Analog Coolant
c - 12 Volt Power
d - Audio Warning Alarm
e - Neutral Start Switch

The 10 pin harness (MERC harness) is the connecting point between the Mercury MerCruiser electronic EFI harness and the 10 pin engine harness. It supplies the PCM with the analog coolant, tachometer, audio warning alarm and neutral safety signals.

A malfunction of the 10 pin harness connection will not set a fault.

PORT AND STARBOARD KNOCK SENSOR CIRCUITS



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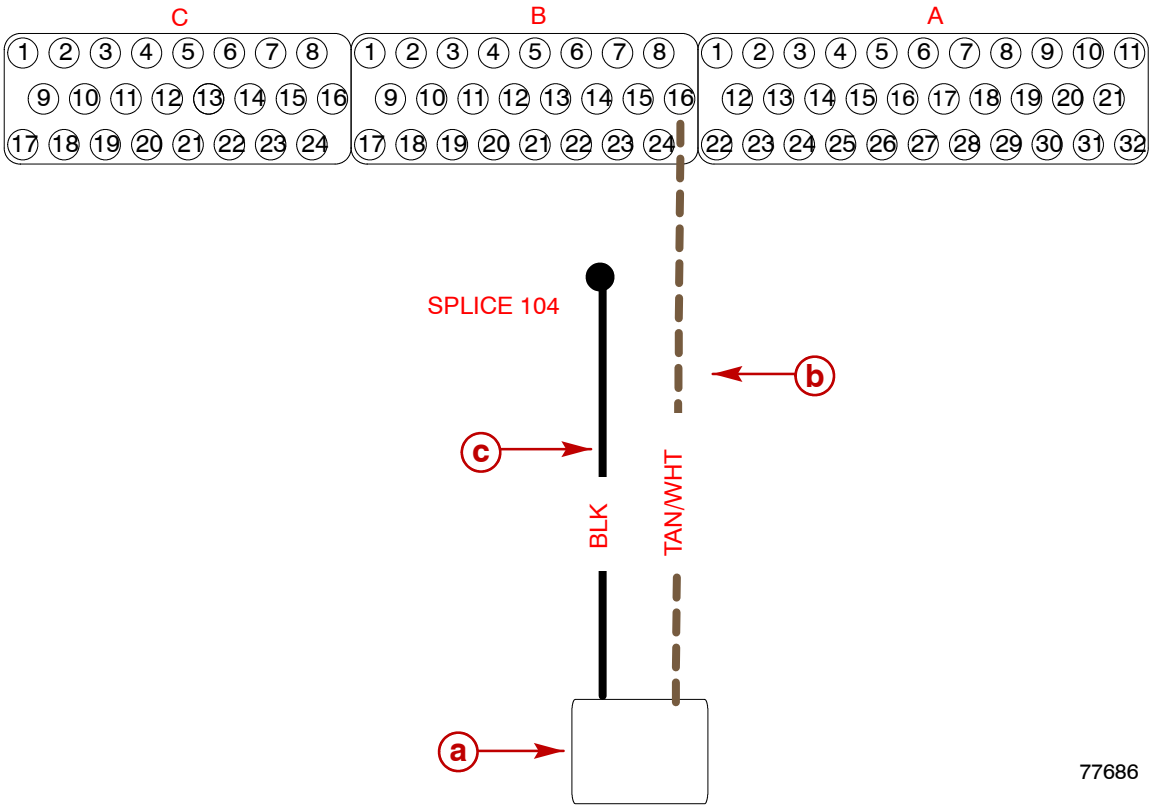
a - Port Knock Sensors
b - Starboard Knock Sensors

The knock sensors detect engine detonation or spark knock and send a voltage signal to the PCM. They are located on the lower half of the engine on both the port and starboard sides. As the sensor detects knock, the voltage output level increases and signals the PCM of the problem.

An unacceptable knock sensor reading will set a fault of Knock Sensor HI or Knock Sensor LO. A normal reading is 83,000 - 104,000 at idle. Readings indicating an open will fall in the 7,900 - 12,000 range and readings indicating a short will range from 3,800 - 5,100.

GEAR LUBE MONITOR OR TRANSMISSION OVERTEMP CIRCUIT

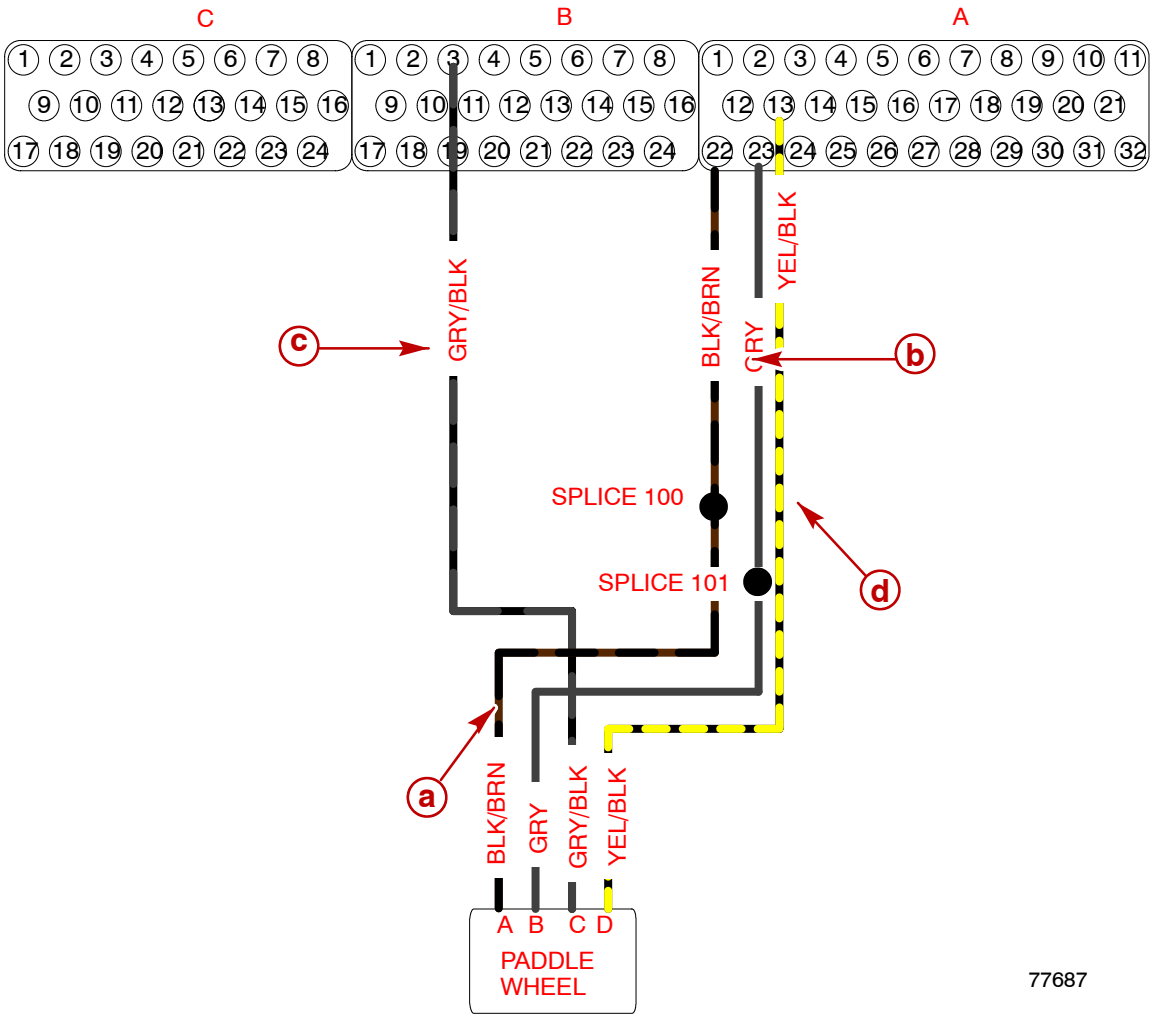


a - Drive Lube Monitor Or Transmission Temperature Sensure
b - 5 Volt Reference
c - 5 Volt Ground

The gear lube monitor circuit is an open-continuity circuit. It is located on the top port side of the engine. The circuit will show continuity if the level of fluid in the monitor is low. If a problem is suspected, check continuity. There should be continuity with an empty monitor and no continuity with a full monitor.

A low level of fluid in the gear lube monitor will set a fault of Low Drive Lube Strategy.

HARNESS TO PADDLE WHEEL CONNECTOR CIRCUIT

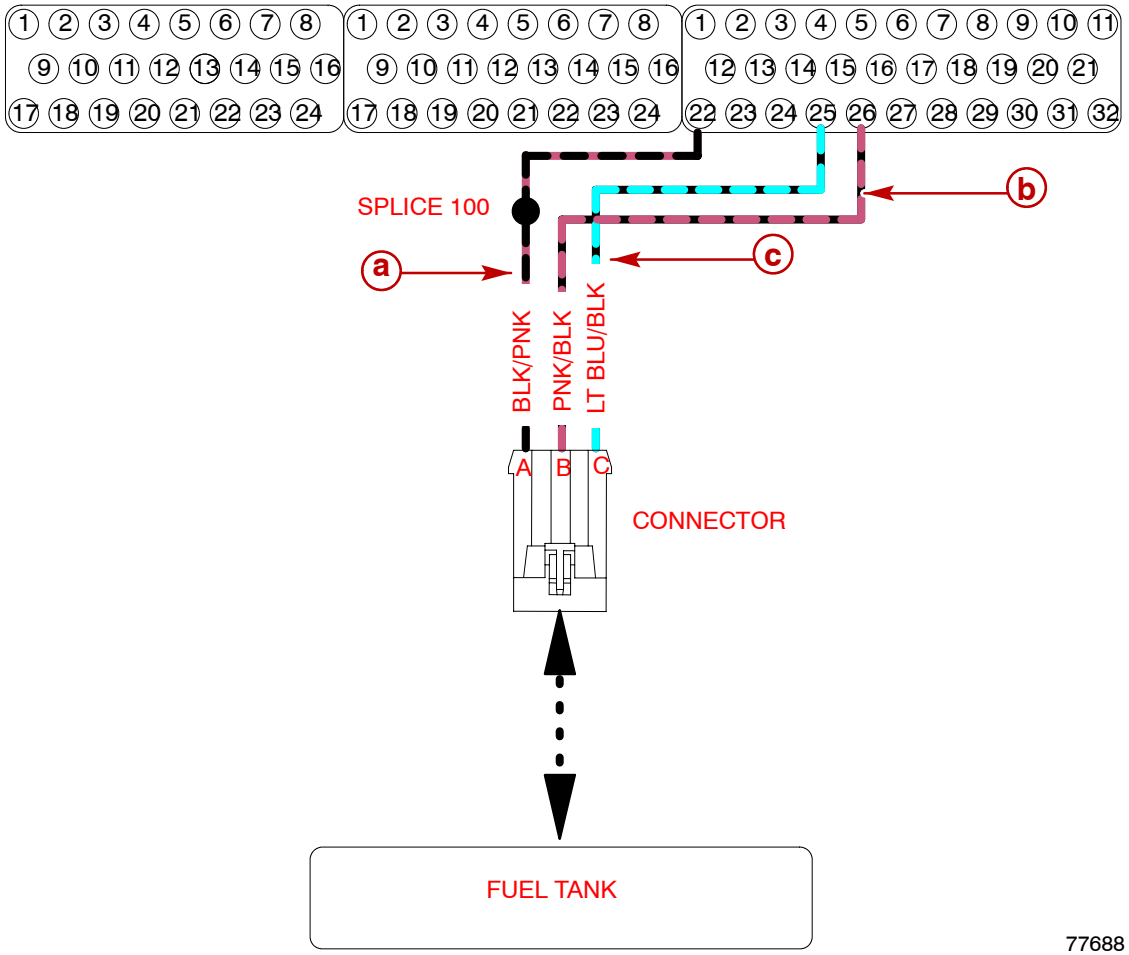


a - 5 Volt Transducer Ground
b - 5 Volt Transducer Power
c - Paddle Wheel Signal
d - Seawater Lake Temperature Signal

The paddle wheel circuit supplies the PCM with boat speed and lake water temperature readings, it is much more precise than the pitot circuit at lower speeds. It is located on the rear of the engine.

A malfunction in the paddle wheel circuit will not set a fault.

FUEL LEVEL SENSOR CIRCUIT

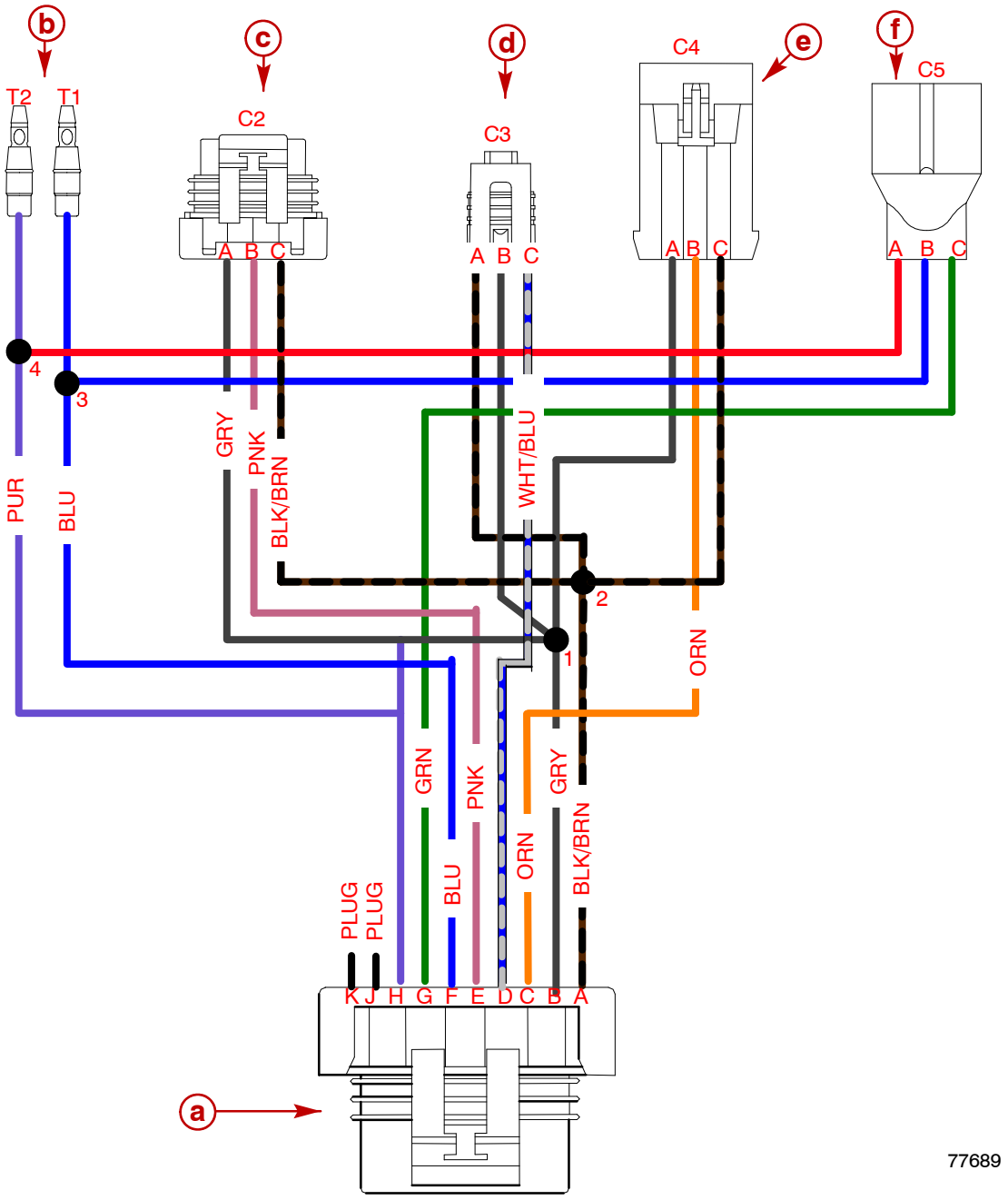


a - 5 Volt Transducer Ground
b - Fuel Level 1
c - Fuel Level 2

The fuel level sensor circuit supplies the PCM with the fuel level. It is located on the port rear of the engine.

A malfunction in the fuel level circuit will not set a fault.

TRANSOM HARNESS

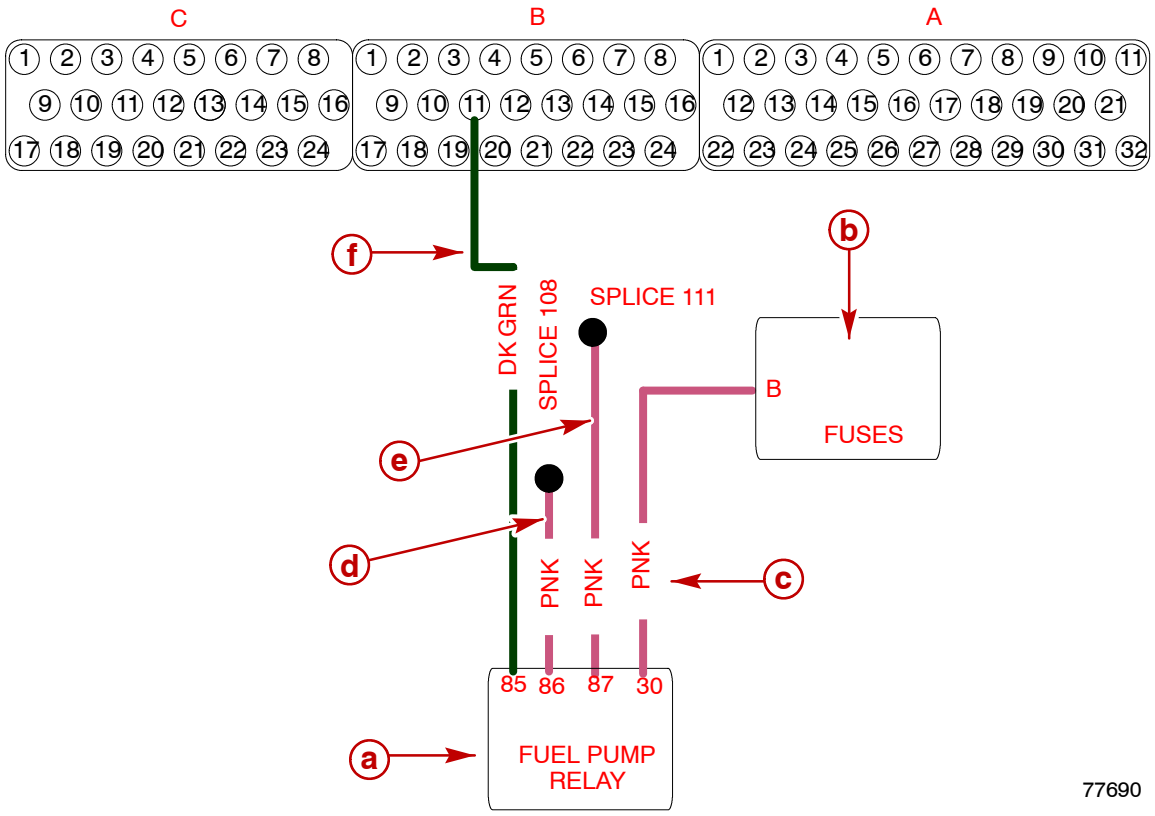


a - Transom Harness To Engine Harness Connector
b - Trim Limit Connectors On Mechanical Throttle and Shift
c - Steering Sensor Connector
d - Speedometer Sensor
e - Trim Sensor
f - Trim Limit Connector For Electronic Throttle And Shift

The transom harness has multiple leads that connect to sensors in the transom assembly. It is located on the rear of the engine between the EFI harness and the inner transom. Do NOT connect both of the trim limit connectors, "**b**" and "**f**", simultaneously as this will cause a failure in the trim limit circuit.

A malfunction in the transom harness will set the fault of Trim CKT HI, Trim CKT LO, Steering Angle Input HI or Steering Angle Input LO.

FUEL PUMP RELAY CIRCUIT

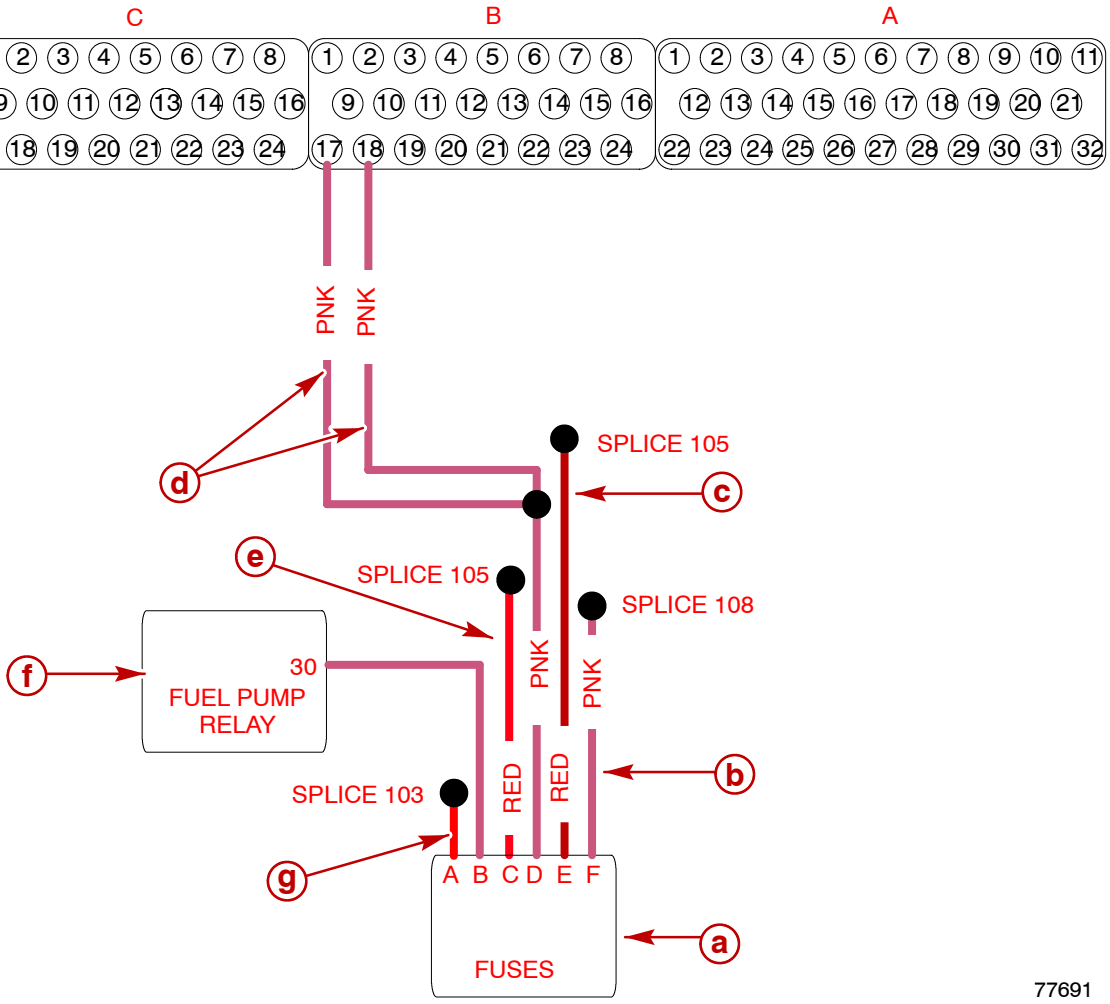


a - Fuel Pump Relay
b - Fuses
c - 12 Volt Power From The Fuses
d - 12 Volt Power To The Injectors
e - 12 Volt Power To Both Fuel Pumps
f - Signal To PCM

Upon Key ON, the fuel pump relay receives 12v battery power through the fuses at Terminal 30. The relay powers both fuel pumps and signals the PCM that the engine is ready to start. Listen at key ON for both fuel pumps to run.

A malfunction in the fuel pump relay circuit will not set a fault.

FUSE CIRCUIT

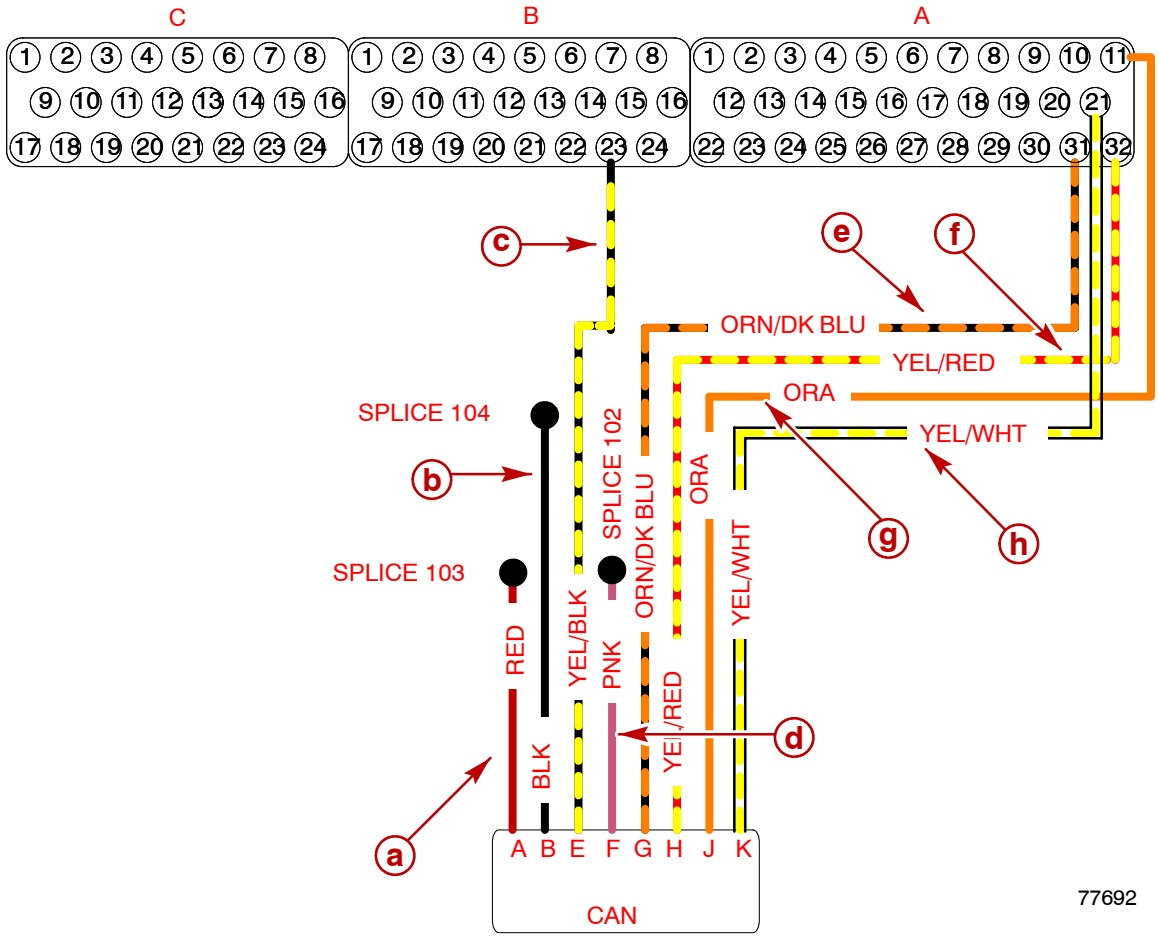


a - Transducer Ground
b - 12 Volt Power To Fuel Injectors
c - Battery Power
d - 12 Volt Power To PCM
e - Battery Power
f - 12 Power To Fuel Pump Relay
g - Battery Power

The fuse circuit receives 12v battery power through Splices 103 and 105. It is located on the upper port side of the engine. The protected power is then sent to the PCM, fuel injectors and the fuel pump relay.

A malfunction in the fuse circuit will not set a fault.

CONTROL AREA NETWORK (CAN) CIRCUIT

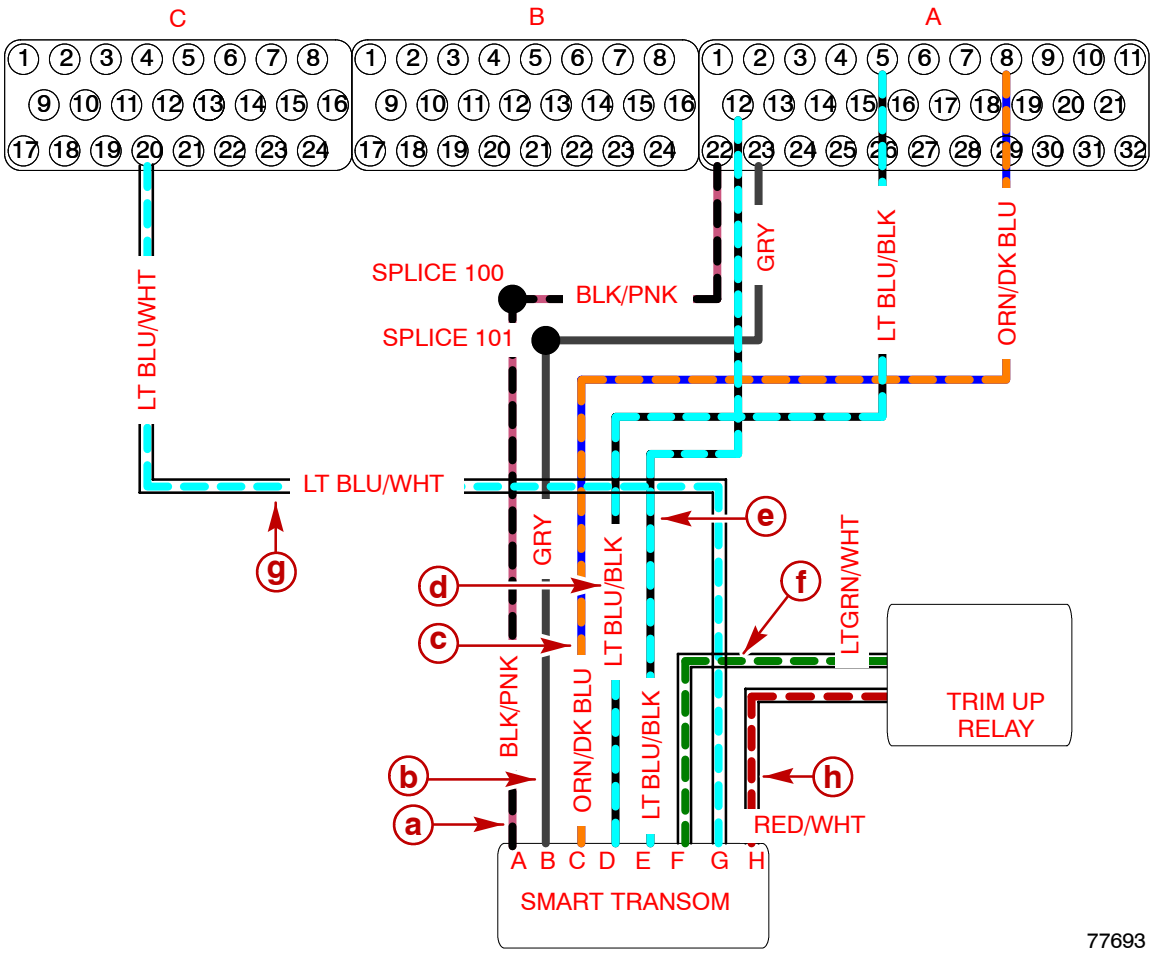


a - Bus 12 Volt Power
b - Bus Ground
c - Emergency Stop
d - Wake Up Line
e - Can 2 Power
f - Can 2 Ground
g - Can 1 Power
h - Can 1 Ground

The CAN circuit powers the Smartcraft gauges (SC1000) on mechanical throttle and shift engines. It is located on the rear of the engine on the upper port side. The gauges receive power through the BUS power and ground. Gauge information (RPM, TEMP, TRIM) is sent through the CAN leads. Emergency Stop and Wake Up is not used on the mechanical models.

A malfunction in the CAN circuit will not set a fault.

SMART TRANSOM CIRCUIT

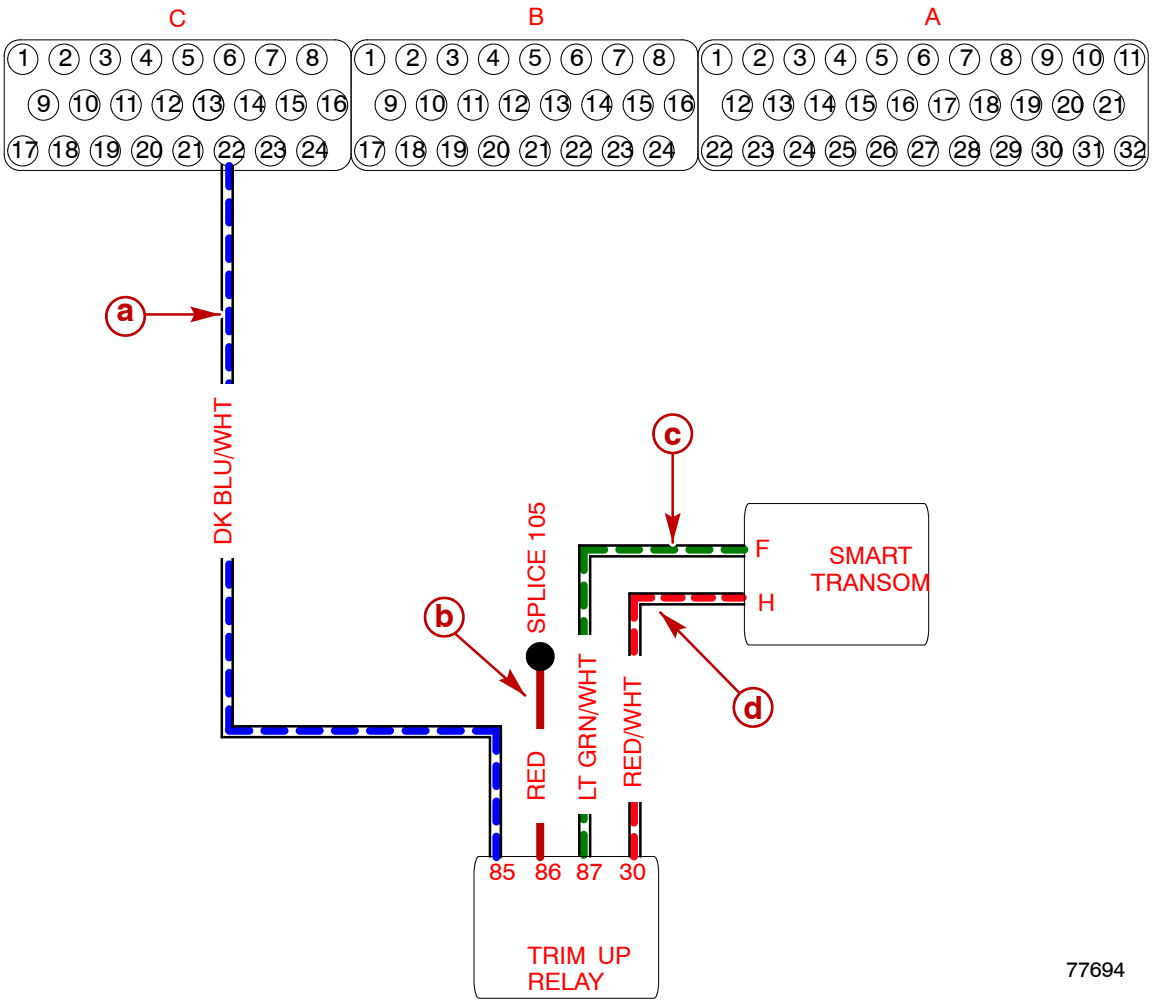


a - Transducer Ground
b - 5 Volt Transducer Power
c - Trim Position Signal
d - Pitot Signal
e - Steering Signal
f - Trim Up Relay
g - Trim Down Signal
h - 12 Volt Power From Trim Up Relay

The smart transom harness connection is located at the rear of the engine on the upper port side. It controls communication between the transom sensors and the PCM. 5 volt power is supplied to the trim position sensor, pitot and steering through Pin B.

A malfunction in the smart transom circuit will set a fault of Pitot CKT Hi, Pitot CKT Lo, Steer CKT Hi, Steer CKT Lo, Trim CKT Hi or Trim CKT Lo.

TRIM UP RELAY CIRCUIT



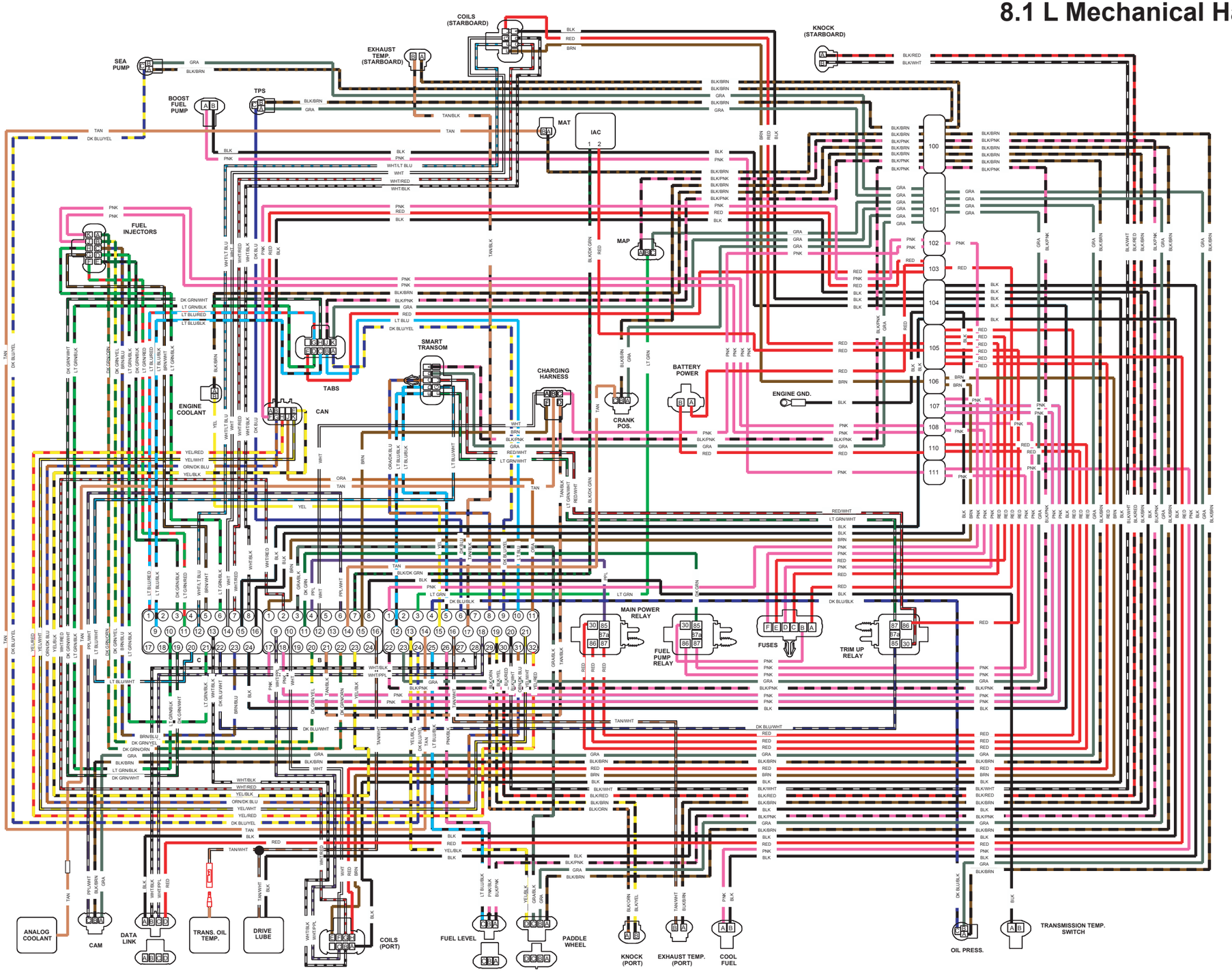
a - Reference
b - 12 Volt Power To Trim Up Relay
c - Trim Up Signal
d - 12 Volt Power To Smart Transom

The trim up relay circuit receives power through Splice 105 and signals through the smart transom to trim the sterndrive unit. It is located on the upper port side of the engine.

A malfunction in the trim up relay circuit will set the fault Trim CKT Hi or Trim CKT Lo.

Wiring Diagrams

8.1 L Mechanical Harness



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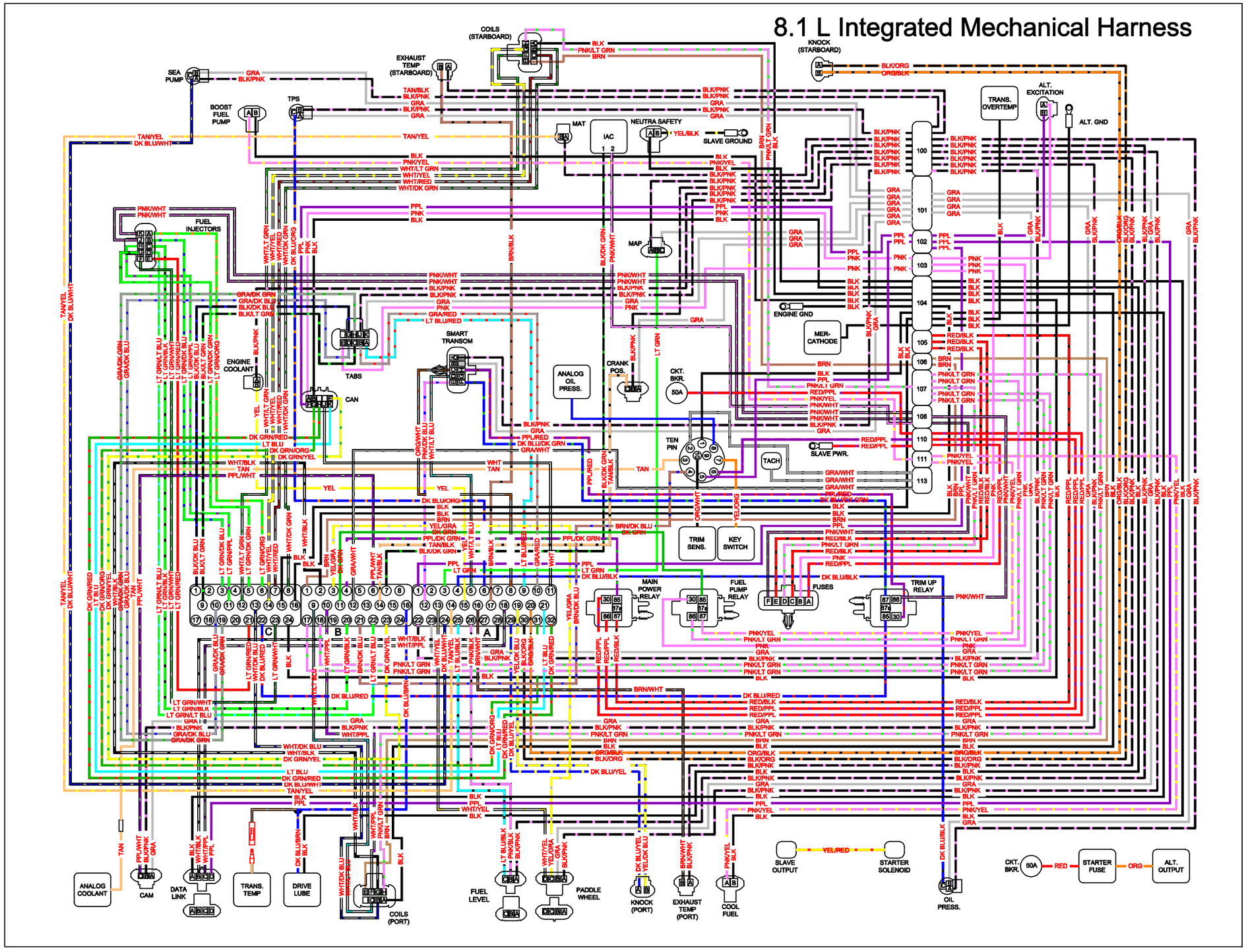
8.1 L Integrated Mechanical Harness



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