SENR5827-01
September 1999

# Systems Operation Testing and Adjusting

## Electronic Modular Control Panel II (EMCP II) For PEEC Engines

**2WJ1-Up (Engine)**

# Important Safety Information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

**Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.**

**Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.**

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

The hazards are identified by the “Safety Alert Symbol” and followed by a “Signal Word” such as “DANGER”, “WARNING” or “CAUTION”. The Safety Alert “WARNING” label is shown below.

**⚠ WARNING**

The meaning of this safety alert symbol is as follows:

**Attention! Become Alert! Your Safety is Involved.**

The message that appears under the warning explains the hazard and can be either written or pictorially presented.

Operations that may cause product damage are identified by “NOTICE” labels on the product and in this publication.

**Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. If a tool, procedure, work method or operating technique that is not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that the product will not be damaged or be made unsafe by the operation, lubrication, maintenance or repair procedures that you choose.**

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Caterpillar dealers have the most current information available. For a list of the most current publication form numbers available, see the Service Manual Contents Microfiche, REG1139F.

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**Testing and Adjusting**

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# Systems Operation Section

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## General Information

**SMCS Code:** 4490; 7451

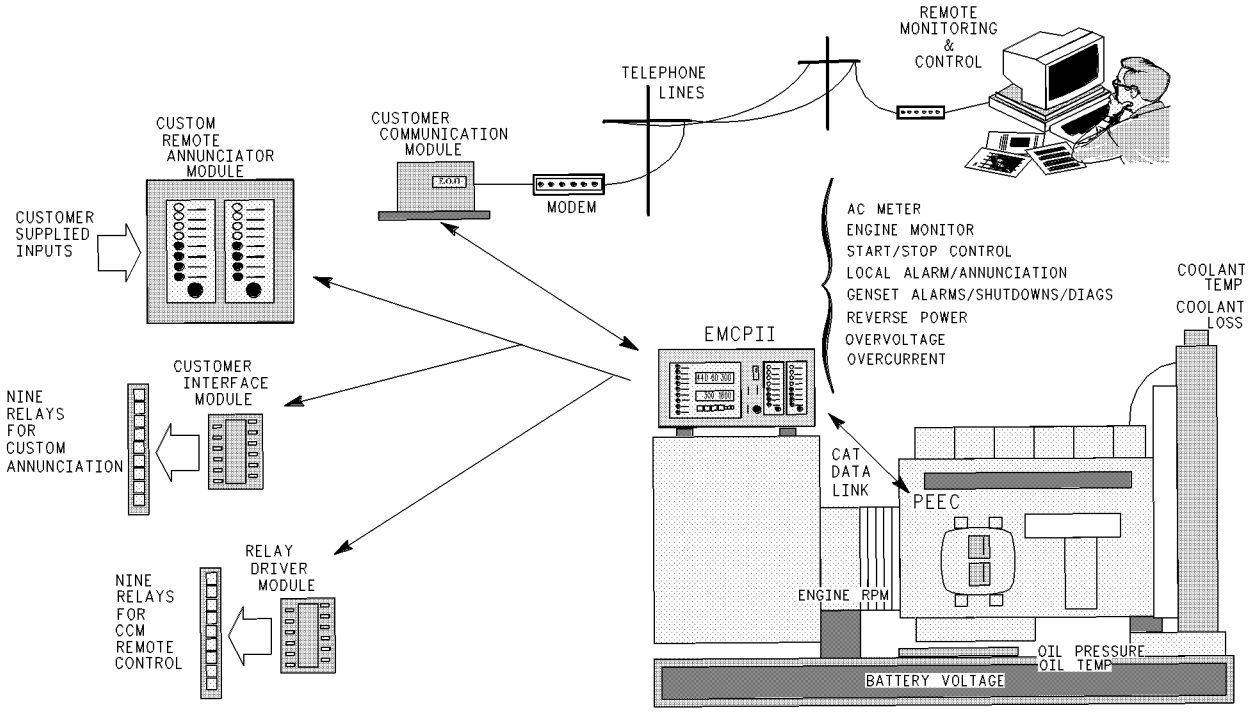


Illustration 1 g00593544

Block Diagram Of The Generator Set With EMCP II

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# Component Location

**SMCS Code:** 4490; 7451

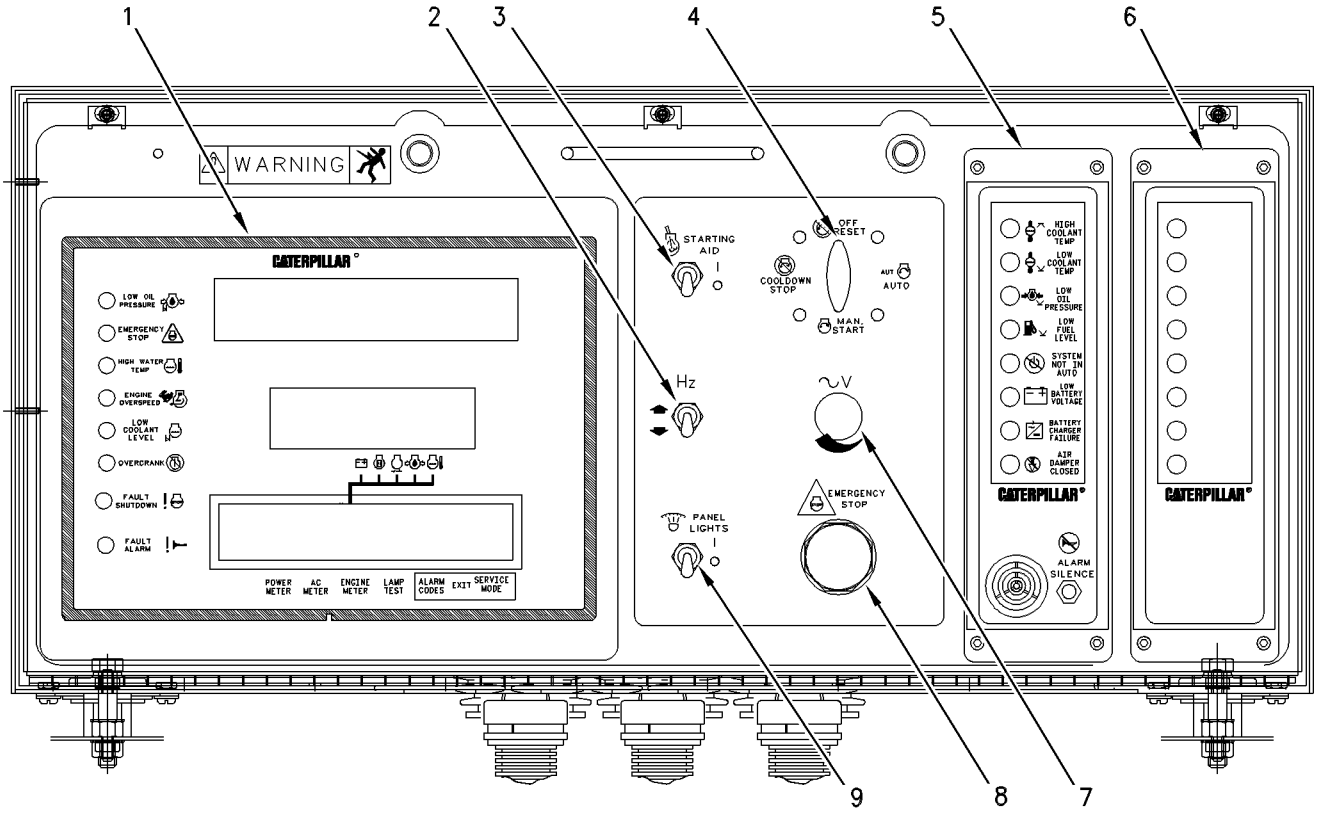


Illustration 2 g00593180

Instrument Panel

(1) Generator Set Control (GSC)
(2) Speed Potentiometer (SP)
(3) Starting Aid Switch (SAS) (optional)
(4) Engine Control Switch (ECS)
(5) Alarm Module (ALM) (optional)
(6) Custom Alarm Module (CAM) (optional)
(7) Voltage Adjust Rheostat (VAR)
(8) Emergency Stop Push Button (ESPB)
(9) Panel Light Switch (PLS) (optional)

Most of the components for the EMCP II are located on the instrument panel or the subpanel. Other components for the EMCP II that exist near the engine are the engine oil pressure sensor (EOPS), the engine coolant temperature sensor (ECTS), the magnetic speed pickup (MPU), and the engine coolant loss sensor (ECLS) (optional).

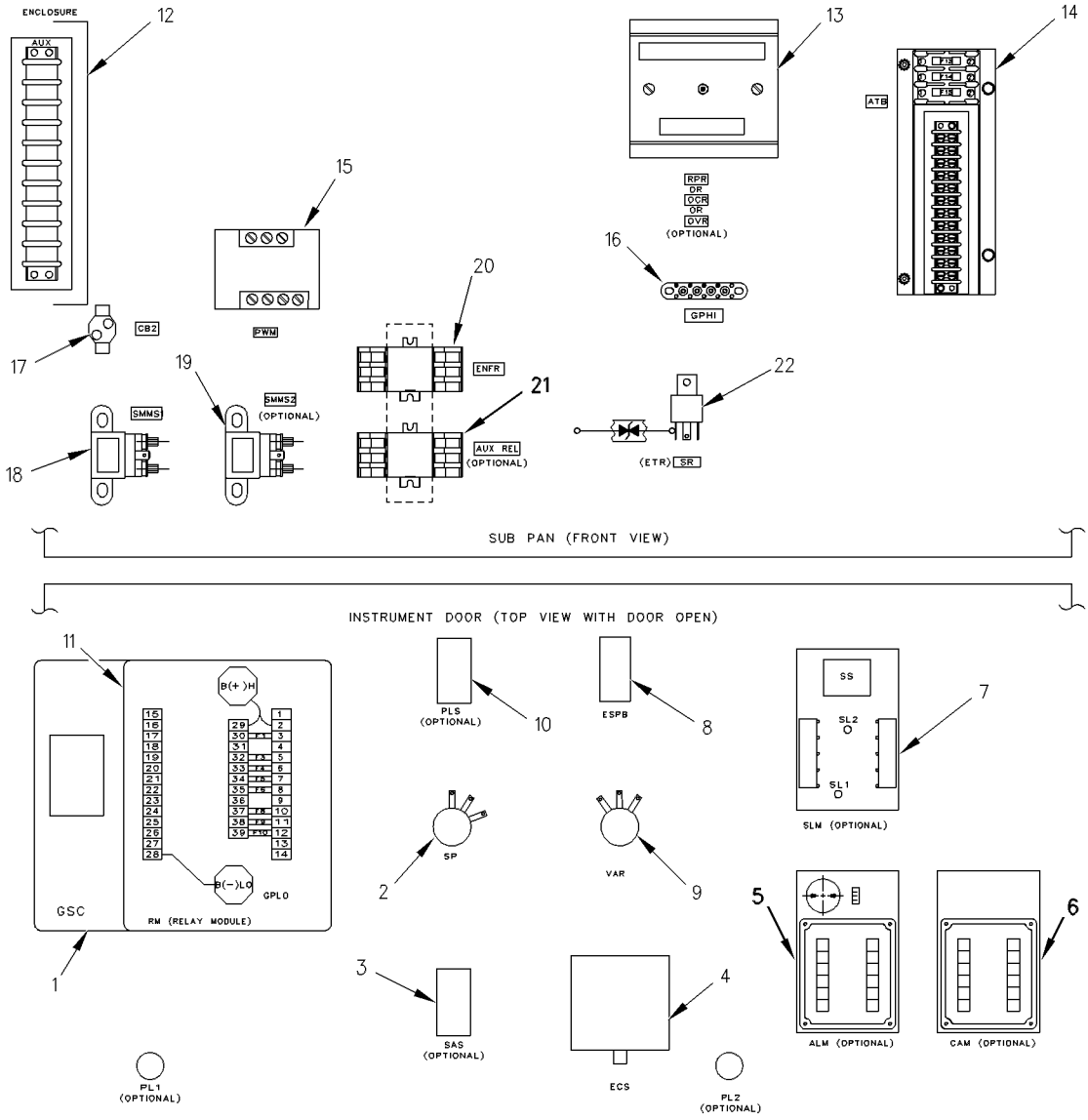


Illustration 3 g00593214

Panel Interior Of Instrument Panel and Subpanel Instrument Panel

(1) Generator Set Control (GSC)
(2) Speed Potentiometer (SP)
(3) Starting Aid Switch (SAS) (optional)
(4) Engine Control Switch (ECS)
(5) Alarm Module (ALM) (optional)
(6) Custom Alarm Module (CAM) (optional)
(7) Synchronizing Lights Module (SLM) (optional)
(8) Emergency Stop Push Button (ESPB)
(9) Voltage Adjust Rheostat (VAR)
(10) Panel Light Switch (PLS) (optional)
(11) Relay Module (RM) (part of GSC)
(12) Auxiliary Terminal Strip (AUX)
(13) Reverse Power Relay (RPR) (optional). Overcurrent Relay (OCR) (optional). Overvoltage Relay (OVR) (optional).
(14) AC Transformer Box (ATB)
(15) Electrical Converter (PWM)
(16) Ground Post (High Voltage) (GPHI)
(17) Circuit Breaker 2 (CB2)
(18) Starting Motor Magnetic Switch 1 (SMMS1)
(19) Starting Motor Magnetic Switch 2 (SMMS2) (optional)
(20) Engine Failure Relay (ENFR)
(21) Auxiliary Relay (AUXREL) (optional)
(22) Slave Relay (SR)

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# EMCP Electronic Control (Generator Set)

**SMCS Code:** 4490; 7451

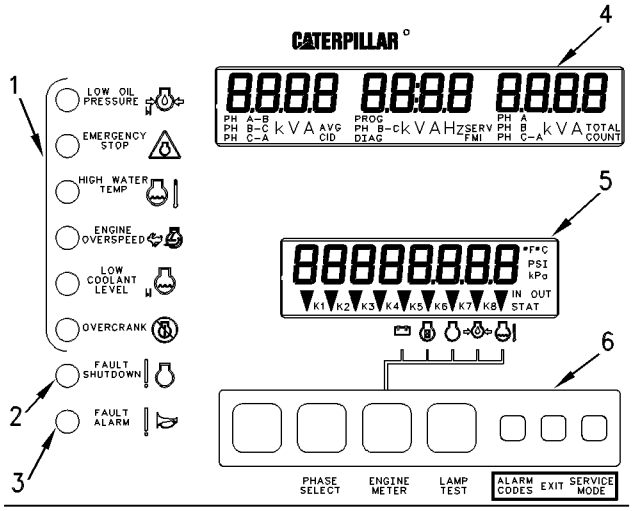


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Illustration 4

Display Area Of Generator Set Control (GSC)

(1) Dedicated shutdown indicators. (2) Fault shutdown indicator. (3) Fault alarm indicator. (4) Upper display. (5) Lower display. (6) Keypad.

The main component of the EMCP II is the generator set control (GSC). The GSC is designed to operate when the GSC is powered by a 24 DCV battery system or a 32 DCV battery system. The GSC monitors many of the functions of the generator set. The GSC has the following functions and features.

- The GSC controls the starting of the engine and the GSC also controls the stopping of the engine.
- The GSC shows engine conditions and generator output information on two displays. The displays also show diagnostic codes and GSC programming information.
- The GSC monitors the system for faults. If a fault occurs, the GSC performs a controlled fault shutdown, or the GSC provides a fault alarm annunciation. The GSC uses indicators and displays to describe the fault to the operator.
- The GSC contains programmable features for certain applications or requirements from customers.

## Fault Indicators

The eight fault indicators are used to show that a fault is present. The fault indicators describe the fault. The fault indicators are divided into three groups: fault alarm indicator (3), fault shutdown indicator (2) and dedicated shutdown indicators (1).

The yellow fault alarm indicator (3) FLASHES when the GSC detects an alarm fault. The alarm fault does not cause the engine status to change. The engine will continue to run if the the alarm fault had occurred when the engine was running. The engine will be able to start. Fault alarm indicator (3) is accompanied by a diagnostic code that is shown on upper display (4) when the alarm codes key is pressed.

The red fault shutdown indicator (2) FLASHES when the GSC detects a fault that is a shutdown fault. The engine is shut down if the engine is running. The engine is not allowed to start. Fault shutdown indicator (2) is accompanied by a diagnostic code that is immediately shown on upper display (4).

The red dedicated shutdown indicators (1) represent the following shutdown faults: low oil pressure, emergency stop, high water temperature, engine overspeed, low coolant level and engine overcrank. When the GSC detects a fault in one of these areas, the dedicated fault shutdown indicator that corresponds to the fault FLASHES. If the engine is running, the engine is shut down. The engine is not allowed to start. There are no diagnostic codes that are associated with the dedicated fault shutdown indicators because each indicator has a descriptive label.

Many of the dedicated shutdown faults depend on certain setpoints in the GSC. See Systems Operation, “Engine/Generator Programming OP5”. To restart the engine after a shutdown, see Systems Operation, “Shutdown Mode”.

The conditions that are required for each dedicated fault are in the following list. The results of each dedicated fault are in the following list.

Low Oil Pressure – The engine oil pressure drops below the setpoints for low oil pressure shutdown that are programmed into the GSC. There are two low oil pressure setpoints. One setpoint is used when the engine is at idle speed. One setpoint is used when the engine is at rated speed. When this fault occurs, the low oil pressure indicator FLASHES. The engine is shut down. The engine is not allowed to start until the fault is corrected.

Emergency Stop – The operator presses the emergency stop push button (ESPB) on the instrument panel. When this condition occurs, the indicator for emergency stop FLASHES. The engine is shut down. The engine is not allowed to start until the condition is corrected.

High Water Temperature – The engine coolant temperature rises above the setpoint for high water temperature shutdown that is programmed into the GSC. When this fault occurs, the high water temperature indicator FLASHES. The engine is shut down. The engine is not allowed to start until the fault is corrected.

Engine Overspeed – The engine speed exceeds the setpoint for engine overspeed that is programmed into the GSC. When this fault occurs, the engine overspeed indicator FLASHES. The engine is shut down. The engine is not allowed to start until the fault is corrected.

Low Coolant Level – The engine coolant level drops below the probe of the optional coolant loss sensor. When this fault occurs, the indicator for the engine coolant level FLASHES. The engine is shut down. The engine is not allowed to start until the fault is corrected.

Overcrank – The engine does not start within the setpoint for total cycle crank time that is programmed into the GSC. When this fault occurs, the overcrank indicator FLASHES. The engine is not allowed to start until the fault is corrected.

Note: The GSC can be programmed to override the shutdown for the following conditions: low oil pressure, high water temperature, and low coolant level. When the shutdown faults are overridden then the faults are treated as alarm faults. The corresponding dedicated fault shutdown indicator is ON CONTINUOUSLY instead of flashing. The engine continues to run instead of shutting down. The dedicated fault shutdown indicator that is ON CONTINUOUSLY means that the setpoint for shutdown has been exceeded. However, the GSC is programmed to override the shutdown fault and the GSC treats the fault as an alarm fault. The factory programs the GSC to treat low oil pressure, high water temperature and low coolant level as shutdowns. The operator must make a decision in order to override these shutdown faults.

## Display

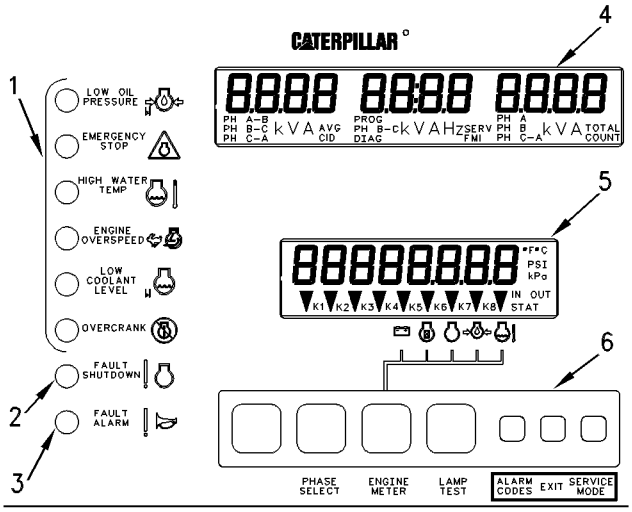


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Illustration 5

Display Area Of Generator Set Control (GSC)

(1) Dedicated shutdown indicators. (2) Fault shutdown indicator. (3) Fault alarm indicator. (4) Upper display. (5) Lower display. (6) Keypad.

The upper display (4) and lower display (5) of the GSC provide information about the generator set.

Upper display (4) shows AC voltage, current and frequency of one phase of the generator output. Each phase can be viewed one at a time by pushing the phase select key. Upper display (4) is also used to show the various diagnostic codes for system faults. See Systems Operation, “Fault Description” for more information on diagnostic codes.

Lower display (5) shows system battery voltage, engine hours, engine speed, engine oil pressure and engine coolant temperature. The value for one of these conditions is shown for two seconds. The display scrolls to the value for the next condition. A small pointer identifies the engine condition that corresponds to the value that is showing. When the engine meter key is pressed, lower display (5) stops scrolling. The lower display continuously shows one particular value. The pointer flashes above the condition with the value that is showing.

The relay status indicator is on the lower display. When a GSC relay is activated, the corresponding indicator (K1, K2, etc) is shown on lower display (5). When a relay is not activated, the corresponding indicator (K1, K2, etc) is not shown.

Both displays are used for programming functions when you are in service mode. See Systems Operation, “Service Mode” for more information.

## Keypad

Keypad (6) is used to control the information that is shown on upper display (4) and lower display (5). The seven keys have two sets of functions, normal functions and service functions. For a description of the service functions of the keys, see Systems Operation, “Service Mode”. The normal functions of the keys are in the following list.

Leftmost Key – This key only functions when the GSC is in service mode. See Systems Operation, “Service Mode”.

Phase Select Key – This key selects the phase of the generator output that is shown on the GSC. Pressing this key allows the operator to check the voltage, current and frequency of each phase one at a time.

Engine Meter Key – This key stops the scrolling of engine conditions on lower display (5). The display continuously shows the value for one particular engine condition. The pointer flashes in order to indicate that scrolling is stopped. Pressing the key again resumes the scrolling of engine conditions.

Lamp Test Key – This key performs a lamp test on the GSC and the optional alarm module. The eight fault indicators are ON CONTINUOUSLY. Every segment of upper display (4) and lower display (5) are ON. On the optional alarm module, all of the indicators are ON and the horn will sound.

Alarm Codes Key – If fault alarm indicator (3) is FLASHING, pressing this key causes upper display (4) to show the corresponding diagnostic code. Pressing this key again resumes the showing of generator output information on upper display (4). If fault alarm indicator (3) is OFF, this key has no function. See Systems Operation, “Fault Description”for more information on diagnostic codes.

Exit Key – This key only functions when the GSC is in service mode. See Systems Operation, “Service Mode” for more information.

Service Mode Key – Pressing this key causes the GSC to enter service mode. See Systems Operation, “Service Mode” for more information.

## Relays

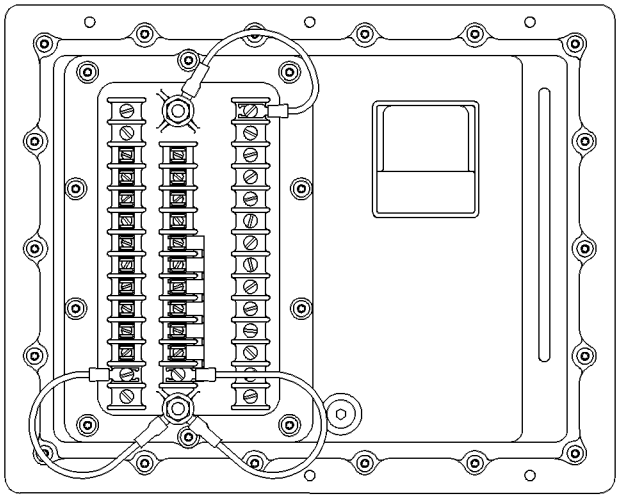

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Illustration 6

Relay Module On Rear Of GSC

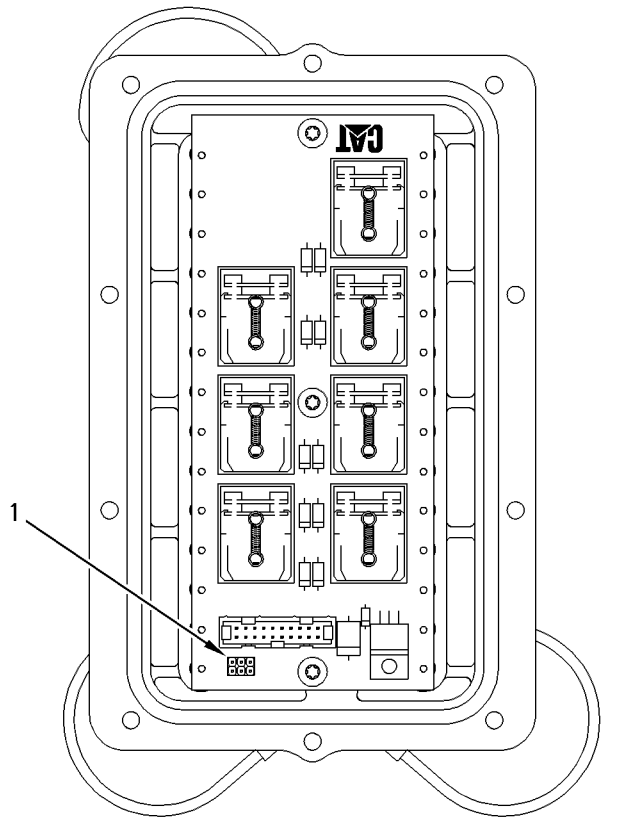


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Illustration 7

Relays In Relay Module

(1) Jumper block.

The relays are located in the relay module on the rear of the GSC. The relays are permanently attached within the relay module and the relays are not removable. The entire relay module is replaced if a relay is faulty. See Testing and Adjusting, “Schematics and Wiring Diagrams (DC Schematics)”for more information.

Some of the contacts of the relays are internally connected to the terminals of the relay module. The contacts are available for the customer to use. The voltage and current specifications for each terminal (relay) are listed in the following table.

Note: Jumper block (1) is used to select the voltage range of the GSC voltmeter. Jumper block (1) is installed for systems with 700 volts full scale AC inputs. Jumper block (1) is NOT installed for systems with 150 volts full scale AC inputs or for any unit with external potential transformers. The relay module comes from the factory with jumper block (1). See Testing and Adjusting, “AC Voltage Range Selection”.

Table 1

| Load Specifications For GSC Relay Module | | |
|---|---|---|
| Relay Module Terminal No. | Rating For Resistive Loads | Rating For Inductive Loads |
| RM13, 14 - K1-OSR N/O | 0.45A at 24 DCV | none(1) |
| RM15 - K7-FCR N/O<br>RM16 - K3-CTR N/O<br>RM17 - K3-CTR N/C<br>RM18 - K4-SMR N/O<br>RM19 - K6-ASR N/O<br>RM20 - K6-ASR N/C<br>RM22 - K2-GFR N/O<br>RM24 - K5-RR N/O | 10A at 24 DCV | 10A at 24 DCV |
| RM23, 36 - K5-RR N/C | 10A at 24 DCV | 5A at 24 DCV |

(1) Do NOT connect inductive loads to these terminals

K1 Electronic Governor Relay (EGR) – When the relay is active the normally open contacts close. This signals the PEEC electronic control module to begin injection. The relay has no normally closed contacts.

K2 Generator Fault Relay (GFR) – When the relay is active the normally open contacts close. This trips the optional circuit breaker when a shutdown fault occurs. The relay has no normally closed contacts.

K3 Crank Termination Relay (CTR) – When the relay is active the normally open contacts close. This activates the optional AUX relay (customer use). When the relay is inactive the normally closed contacts close.

K4 Starting Motor Relay (SMR) – When the relay is active the normally open contacts close. This activates the starting motor magnetic switch. This also enables the AUTOMATIC position of the optional starting aid switch. When the relay is inactive the normally closed contacts close.

K5 Run Relay (RR) – When the relay is active the normally open contacts close. This activates the MANUAL position of the optional starting aid switch. When the relay is inactive the normally closed contacts close. This provides a signal for engine shutdown to the PEEC electronic control module.

K6 Air Shutoff Relay (ASR) – This relay is not used in applications of the PEEC electronic control module. The relay is active during fault shutdowns. When the relay is active the normally open contacts close. When the relay is inactive, the normally closed contacts close.

K7 Fuel Control Relay (FCR) – This relay is not used in applications of the PEEC electronic control module. The relay is active during the starting of the engine and the relay is active while the engine is running. When the relay is active the normally open contacts close. The relay has no normally closed contacts.

## GSC Part Number

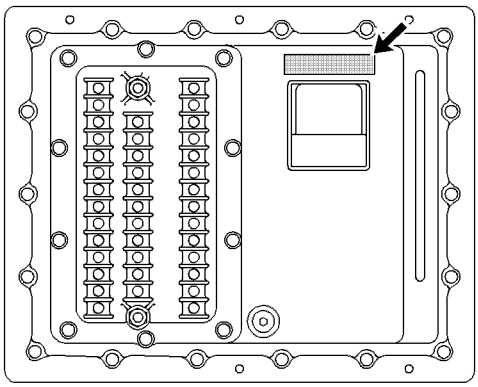

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Illustration 8

Location Of GSC Part Number

Rear View Of GSC

Table 2

| GSC History | |
|---|---|
| **GSC Part No.** | **Description Of Change** |
| 103-6177<br>113-4500 | First production of the GSC. |
| 117-6200 | CCM capability was added. |
| | Setpoint P22 was added |
| | Spare Output enabled to activate during a coolant loss (alarm or shutdown). |
| 120-6880 | Setpoint P08 is changed. |
| | Setpoints P23 and P24 are added. |
| | Diagnostic codes are changed (560-11 to 248-9, 330-7 to 566-7, 331-2 to 336-2). |
| 123-6004 | Fly back diodes are removed from RR1 outputs to enable the use of AC loads on this output terminal. |
| 136-3870 | Enhanced communication. |
| 133-6350 | Relay Driver Module capability added to the spare data output |
| | Service Mode (OP4 through OP8) can only be entered while the ECS is in OFF/RESET or STOP positions. |
| | 30.0kV added to setpoint P20. |

Every GSC has a part number that is stamped on the rear housing that is above the harness connector. There have been numerous internal changes in the operation of the GSC. The part number can be used to identify the effectivity of the different changes.

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## Instrument Panel

**SMCS Code:** 4490; 7451

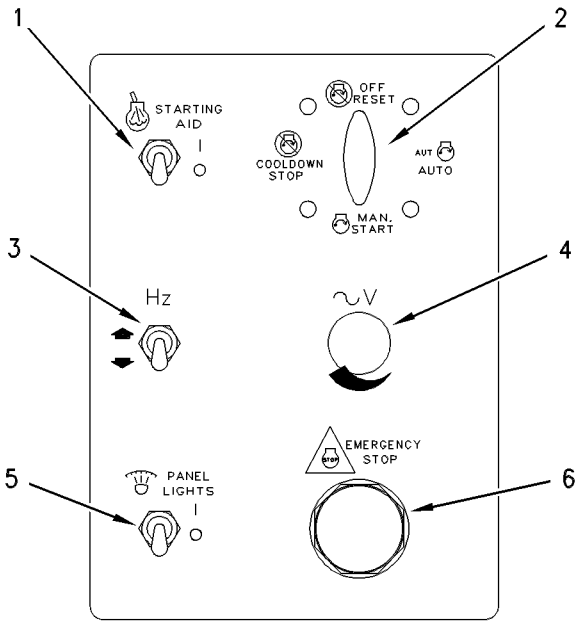


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Illustration 9

Instrument Panel Switches

(1) Starting Aid Switch (SAS) (optional). (2) Engine Control Switch (ECS). (3) Speed Potentiometer (SP). (4) Voltage Adjust Rheostat (VAR). (5) Panel Light Switch(PLS) (optional). (6) Emergency Stop Push Button (ESPB).

The engine control switch (ECS) (2) determines the status of the control panel. In the AUTO position, the GSC allows the engine to start whenever the remote initiating contact (IC) is closed. The engine also shuts down after the initiate contacts open. A cooldown period is programmable in order to give a 0 to 30 minute cooldown period before the engine shuts down. The cooldown period is factory set at five minutes. In the MANUAL START position, the engine will be able to start. In the COOLDOWN/STOP position, the fuel solenoid shuts off the engine after the cooldown period. In the OFF/RESET position, the engine shuts down immediately. Also, any fault indicators are reset except the emergency stop.

If the red emergency stop push button (ESPB) (6) is pressed, the fuel is shut off. In order to restart the engine, follow these steps. Turn the ESPB (6) clockwise until the push button releases. Turn the ECS to OFF/RESET and then turn the ECS to MANUAL START.

The voltage adjust rheostat (VAR) (4) is used to adjust the generator voltage to the desired level.

The speed adjust potentiometer (SP) (3) controls the engine speed. The speed potentiometer connects to the electrical converter. The electrical converter sends a signal to the PEEC electronic control module. Then, the PEEC electronic control module adjusts the engine speed.

The optional panel light switch (PLS) (5) turns the panel lamps ON and OFF.

The optional starting aid switch (SAS) (1) is present only on required gensets. Two types of starting aid systems exist.

Manual – This type is used for metered shot starting aid systems.

Automatic – This type is used for continuous flow starting aid systems.

On manual starting aid systems, when the SAS (1) is held in the ON position, the metered shot starting aid system is activated. A specific amount of ether is metered into a holding chamber. When SAS (1) is released, a solenoid allows ether to flow to the engine. The metered shot starting aid system deactivates when any of the following events occurs.

- The contacts of the crank termination relay (CTR) open at an engine speed of approximately 400 rpm.
- The engine coolant temperature is sufficient to open the start aid temperature switch (SATS).
- The SAS (1) is released to the OFF position.

NOTICE

Crank the engine before you activate the metered shot start aid system. Damage to the engine is possible by activating the system when the engine is not turning.

On automatic starting aid systems, the continuous flow starting aid system operates in the automatic mode or the manual mode. When SAS (1) is placed in the AUTO position, the automatic mode is activated. The system automatically injects ether during the crank cycle. When SAS (1) is placed and held in the MAN position (momentary contact), the manual mode is activated. This system allows the operator to control the amount of time that is allowed for the ether to be injected during the crank cycle. The manual mode also allows the operator to inject additional ether after the crank termination. This is usually used on cold running engines which continue to detonate. The automatic mode of the continuous flow starting aid system deactivates when any of the following events occurs.

- The contacts of the crank termination relay (CTR) open at an engine speed of approximately 400 rpm. This is only for automatic mode.
- The engine coolant temperature is sufficient to open the start aid temperature switch (SATS).
- The SAS (1) is returned to the OFF position.

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# Electrical Converter (Pulse Width Modulated)

**SMCS Code:** 4490; 7451

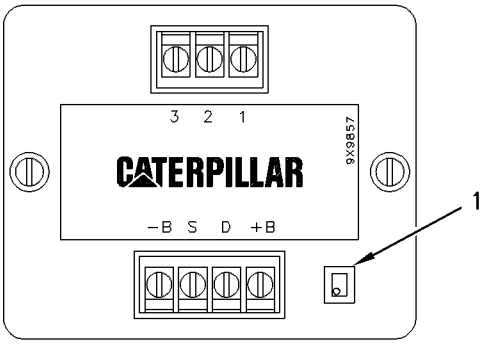


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Illustration 10

PWM: Analog to PWM Converter

(1) Droop potentiometer.

The electrical converter is used to change the analog signal of the speed potentiometer into a pulse width modulated signal. The engine electronics can now recognize the PWM signal. The electrical converter is mounted on the subpanel within the control panel.

The electrical converter continuously generates two PWM signals, speed and droop. The duty cycle of the speed cycle varies from 2 to 95% in proportion to the signal that is being received from the speed potentiometer. This is adjusted by the operator. The duty cycle of the droop signal varies from 2 to 95% in proportion to the signal that is being received from the droop potentiometer on the electrical converter. This is adjusted by the service personnel. The base frequency of the PWM signals are constant at 415 to 528 Hz.

The electrical converter is supplied the operating power at the throttle position sensor terminals “B-” and “B+”. The terminal “1” is an input and the terminal connects to terminal “3” of the speed potentiometer. The terminal “2” is an input and the terminal connects to terminal “2” (wiper) of the speed potentiometer. The terminal “3” of the electrical converter is an input and the terminal connects to terminal “1” of the speed potentiometer. The terminal “S” of the electrical converter is an output and the terminal provides a speed signal to the engine electronic control. The terminal “D” of the electrical converter is an output and the terminal provides a droop signal to the engine electronic control.

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# Relay (Overvoltage)

**SMCS Code:** 4490; 7451

The overvoltage relay (OVR) is an option. The OVR is mounted to the subpanel within the control panel and the OVR provides system protection for line to line overvoltage. The OVR is a three-phase relay. The OVR has a setpoint for an adjustable pickup. This setpoint can be set at 100 to 125% of the nominal rating. The setpoint also has an adjustable time delay from 0.5 seconds to 20 seconds.

If the system voltage exceeds the setpoint for more than the time delay setting then contacts 7 and 8 of the OVR will close. The generator set control (GSC) will record an SP1 fault and the engine is shutdown. If the generator set is equipped with an optional circuit breaker shunt trip solenoid then the generator is taken off the line. See Systems Operation, “Schematics And Wiring Diagrams”.

**⚠ WARNING**

**To avoid personal injury from electrical shock, do NOT touch the high voltage terminals while adjusting the over voltage relay.**

After the SP1 fault is corrected, the generator set control (GSC) is reset by turning the engine control switch (ECS) to the OFF/RESET position. The generator output circuit breaker must also be reset if the generator is equipped with a shunt trip. The setpoints are adjustable in the field. The setpoint for the pickup is set at the factory to the maximum value. The setpoint is 125% of nominal rating for the relay.

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# Relay (Overcurrent)

**SMCS Code:** 4490; 7451

The overcurrent relay (OCR) is an option and mounts to the subpanel that is within the control panel. The OCR provides system protection for excessive line current. The OCR is a three-phase relay. The OCR uses a solid state sensor in order to detect excessive line currents. The relay receives a signal of 0 amperes to 5 amperes from the secondary windings of the generator current transformers. Each generator is equipped with three current transformers. The transformers are sized according to the voltage rating and the kilowatt rating of the generator. The current transformer provides a 5 amp AC signal when the generator is operating at approximately 115% of the generator rating. The OCR has a setpoint for an adjustable pickup from 1 ampere to 5 amperes. The setpoint also has an adjustable time delay which allows the standard inverse time delay to be increased from 0.5 to 20 seconds. The OCR requires DC power to operate. See “DC Schematics” in Testing and Adjusting, “Schematics and Wiring Diagrams”.

If one of the three-phase currents exceeds the setpoint for more than the time delay setting then contacts 11 and 12 of the OCR will close. The generator set control (GSC) will record an SP1 fault and the engine is shutdown. If the generator set is equipped with an optional circuit breaker with shunt trip, the generator is taken off the line. See the Testing and Adjusting, “Schematics and Wiring Diagrams” for more information.

After the SP1 fault is corrected, the generator set control (GSC) is reset by turning the engine control switch (ECS) to the OFF/RESET position. If the generator is equipped with shunt trip, the generator output circuit breaker must also be reset. The setpoint for the pickup can be adjusted in the field. The time delay can also be adjusted in the field. The setpoint for the pickup is set to the maximum value at the factory. The value is 115% of the generator rating.

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# Data Link

**SMCS Code:** 4490; 7451

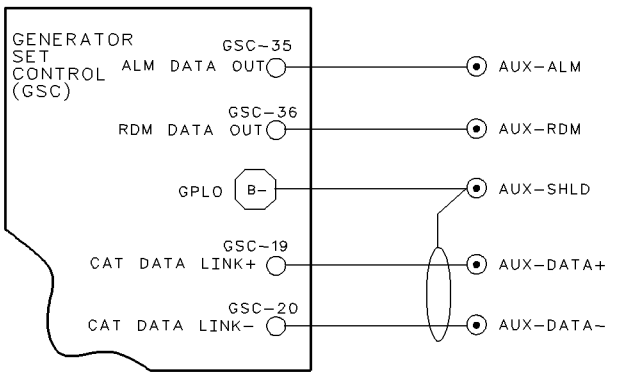


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Illustration 11

Connection Points For The Data Link

There are three serial data links. The preceding illustration shows the connection points at the GSC. The data links provide the means for the GSC in order to communicate with other devices. The data links are defined in the following list:

ALM Data Out – This serial data link is a single directional link. The GSC uses this data link for one-way communication with optional Alarm Modules (ALM) or the optional Customer Interface Module (CIM). The data link for the ALM consists of a single wire that connects the GSC (connector contact 35) to an ALM or CIM. A return connection between the GSC and the module is also required. For more information, see Systems Operation, “Alarm Modules” or Systems Operation, “Customer Interface Module”.

RDM Data Out – This serial data link is a single directional link. The GSC uses this data link for one-way communication with the optional Relay Driver Module (RDM). The RDM data link consists of a single wire that connects the GSC (connector contact 36) to the RDM. A return connection between the GSC and the module is also required. An RDM is used in conjunction with the optional Customer Communication Module (CCM). For more information, see Systems Operation, “Relay Driver Module”.

CAT Data Link – This serial data link is bidirectional. The GSC uses this data link for two-way communication with the optional CCM. The CAT data link consists of a cable that connects the GSC (connector contacts 19 and 20) to the CCM. For more information, see Systems Operation, “System Communication Module (Customer)”.

i01122858

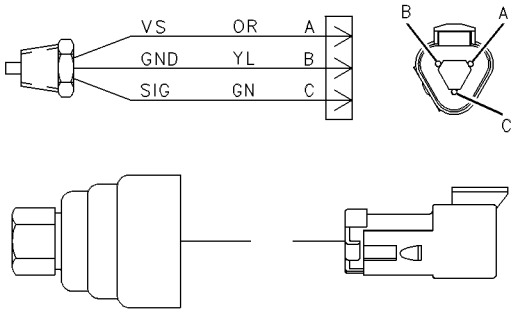
# Sensors

**SMCS Code:** 4490; 7451

The GSC monitors the following engine sensors that are listed below.

- Pressure Sensor (Engine Oil)
- Temperature Sensor (Engine Coolant)
- Optional Fluid Level Sensor (Engine Coolant)
- Speed Sensor (Engine)

## Pressure Sensor (Engine Oil)




g00593652

Illustration 12

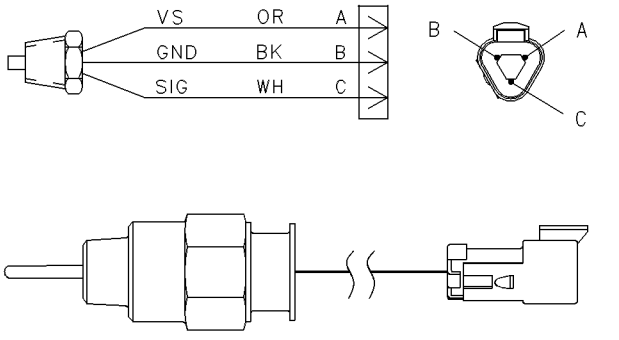
Pressure Sensor (Engine Oil)

The engine oil pressure sensor is an input of the GSC. The sensor tells the GSC the current engine oil pressure. The GSC shows the engine oil pressure on the lower display and the GSC also uses the sensor information to determine when a low engine oil pressure fault exists. The engine oil pressure sensor is mounted on the outside of one of the engine oil galleries. The engine model determines the exact location of the engine oil pressure sensor.

The engine oil pressure sensor is a pulse width modulated sensor. This sensor continuously generates a PWM signal. The duty cycle of the PWM signal varies from 10 to 90%. The duty cycle varies proportionally to the oil pressure of the engine. The GSC receives the PWM signal. The GSC measures the duty cycle in order to determine the oil pressure of the engine. The base frequency of the signal is constant at 500 ± 150 Hz. The signal wire of the oil pressure sensor connects to connector contact 8 of the GSC. The signal wire of the oil pressure sensor is found on connector contact “C”. The sensor is supplied operating power (8 DCV) at connector contact “A” from the GSC (connector contact 9).

There are five setpoints that are related to engine oil pressure. The setpoints that are programmed into the GSC are P03, P04, P12, P13 and P14. See Systems Operation, “Engine/Generator Programming OP5”.

## Temperature Sensor (Engine Coolant)




g00310269

Illustration 13

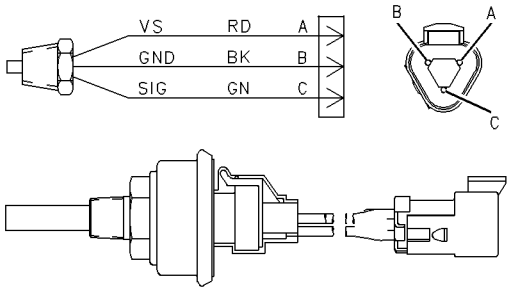
Temperature Sensor (Engine Coolant)

The engine coolant temperature sensor is an input of the GSC. The engine coolant temperature sensor tells the GSC the engine coolant temperature. The GSC shows the engine coolant temperature on the lower display. Also, the GSC uses the information from the sensor in order to determine when a high coolant temperature fault exists or a low coolant temperature fault exists. The engine coolant temperature sensor is mounted in the water jacket. The sensor is usually mounted toward the front of the engine. The exact location depends on the engine model.

The engine coolant temperature sensor is a pulse width modulated sensor (PWM). This sensor continuously generates a PWM signal. The duty cycle of the signal varies from 10 to 95% in proportion to the coolant temperature of the engine. The GSC receives the PWM signal and the GSC measures the duty cycle in order to determine the coolant temperature of the engine. The base frequency of the signal is constant at 455 Hz (370 to 550 Hz). The signal wire of the coolant temperature sensor connects to connector contact 7 of the GSC. The signal wire is found at connector contact “C” of the sensor. The sensor is supplied operating power (8 DCV) at connector contact “A” from the GSC connector contact 9.

There are four setpoints that are related to the engine coolant temperature. These setpoints are programmed into the GSC. The related setpoints are P03, P04, P15 and P16. See Systems Operation, “Engine/Generator Programming OP5”.

## Fluid Level Sensor (Engine Coolant)




g00474732

Illustration 14

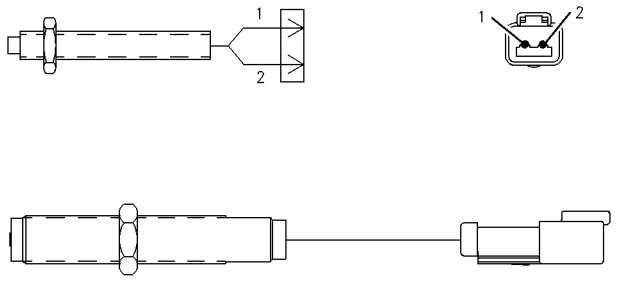
Fluid Level Sensor (Engine Coolant)

The fluid level sensor is optional and the sensor is an input of the GSC. The sensor tells the GSC when the engine has lost coolant. The GSC uses the information from the sensor in order to determine when a fault for a low coolant level exists. The sensor is usually mounted near the top of the engine radiator. The exact location depends on the engine model.

The fluid level sensor sends a ground signal to the GSC in order to indicate a normal level. The sensor sends a signal of 5 DCV in order to indicate a low level. The signal wire of the sensor connects to connector contact 13 of the GSC. The sensor is supplied with the power at connector contact “A” from the GSC (connector contact 9).

There are three setpoints that are related to the loss of engine coolant. The setpoints P04, P05 and P06 are programmed into the GSC. See Systems Operation, “Setpoint Programming OP5”.

## Speed Sensor (Engine)




g00311291

Illustration 15

Speed Sensor (Engine)

The engine speed sensor is an input of the GSC. The sensor tells the GSC the engine speed. The GSC shows the engine speed on the lower display. Also, the GSC uses the information from the sensor for tasks. The tasks are included in the following list.

- activation of an engine overspeed shutdown
- terminating engine cranking
- determining the oil step speed

The engine speed sensor is mounted on the flywheel housing of the engine.

The sensor creates a sine wave signal from passing ring gear teeth at the rate of one pulse per tooth. The sensor sends a sine wave signal to the GSC. The frequency of the signal is in proportion to the speed of the engine. The GSC receives the sine wave signal and the GSC measures the frequency in order to determine the speed of the engine. The wires of the sensor connect to connector contacts 1 and 2 of the GSC within a shielded cable. One wire is grounded near the GSC.

There are four setpoints that are related to engine speed. The setpoints P09, P10, P11, and P12 are programmed into the GSC. See Systems Operation, “Setpoint Programming OP5”.

i01123462

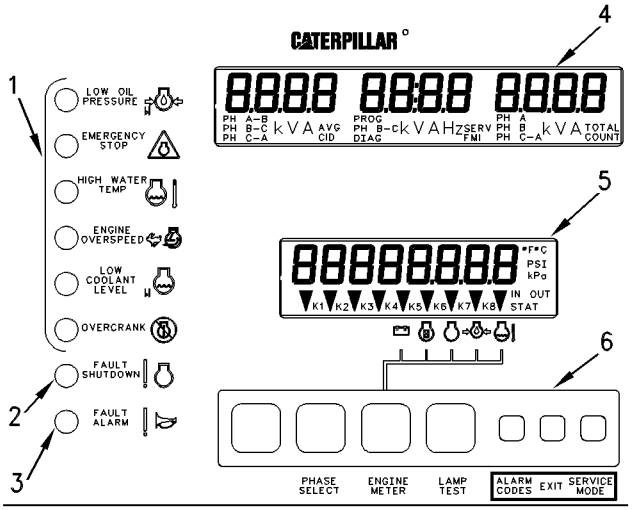
# Modes Of Operation

**SMCS Code:** 4490; 7451

Table 3

| Display Area Functions When In Normal Mode, Alarm Mode Or Shutdown Mode[1] | | | |
|---|---|---|---|
| **Item Of Display Area** | **Normal Mode** | **Alarm Mode** | **Shutdown Mode** |
| Upper Display | AC Data Shown | AC Data Shown[2] | Fault Code Shown |
| Lower Display | Engine Data And Relay Status Shown | Engine Data And Relay Status Shown | Engine Data And Relay Status Shown |
| Shutdown Indicator/s | All Off | All Off | Flashing |
| Fault Alarm Indicators | Off | Flashing[2] | Off |
| | | | |
| **Key Function** | **Normal Mode** | **Alarm Mode** | **Shutdown Mode** |
| Left Most Key[3] | No Function | No Function | No Function |
| Phase Select Key | Selects The AC Phase That Is Shown On The Upper Display | Selects The AC Phase That Is Shown On The Upper Display | No Function |
| Engine Meter Key | Stops And Starts The Scrolling Of Engine Conditions On Lower Display | Stops And Starts The Scrolling Of Engine Conditions On Lower Display | Stops And Starts The Scrolling Of Engine Conditions On Lower Display |
| Lamp Test Key | Performs A Lamp Test | Performs A Lamp Test | Performs A Lamp Test |
| Alarms Code Key | No Function | Shows The Fault Code On The Upper Display | No Function |
| Exit Key[3] | No Function | No Function | No Function |
| Service Mode Key | Enters The GSC Into Service Mode | Enters The GSC Into Service Mode | No Function |

(1) For a description of the display area functions when in service mode, see Systems Operation, “Service Mode”.
(2) When an alarm fault is present, the fault code is shown on the upper display when the alarm codes key is pressed.
(3) This key only functions when in service mode, see Systems Operation, “Service Mode”.




g00593349

Illustration 16

Display Area Of Generator Set Control (GSC)

(1) Dedicated Shutdown Indicators
(2) Fault Shutdown Indicator
(3) Fault Alarm Indicator
(4) Upper Display
(5) Lower Display
(6) Keypad

The GSC has four modes of operation. A brief description of each mode follows this paragraph. See the individual topic for more detailed information.

Normal Mode – The GSC uses normal mode for the normal operation of the generator set. The operator can identify the normal mode by observing the display area. When the GSC is in the normal mode, all dedicated shutdown indicators are OFF. The fault shutdown indicator is OFF . The fault alarm indicator is OFF and “SERV ”is NOT SHOWING on the upper display.

Alarm Mode – If there is an alarm fault, the GSC will automatically go into alarm mode in order to alert the operator. The operator can identify the alarm mode by observing the display area. When the GSC is in alarm mode, the fault alarm indicator is FLASHING. When the alarm codes key is pressed, the diagnostic code will be shown.

Shutdown Mode – If there is a shutdown fault, the GSC will automatically go into shutdown mode in order to alert the operator. The operator can identify the shutdown mode by observing the display area. When the GSC is in shutdown mode, a dedicated shutdown indicator is FLASHING, or the fault shutdown indicator is FLASHING.

Service Mode – The GSC goes into service mode when the operator presses the service mode key on the keypad. The operator can use service mode for the following purposes.

- Assist with troubleshooting diagnostic faults.
- Verify the generator set functions.
- Calibrate the generator set functions.
- Adjust the generator set functions.
- Satisfy special applications.
- Satisfy the needs of the customer.

The operator can identify service mode by observing the display area. When the generator set is in service mode, “SERV” is SHOWN on the upper display.

Note: Service mode can not be entered when the ECS is in the AUTO position.

i01123510

# Normal Mode

**SMCS Code:** 4490; 7451

The normal mode monitors the generator set and the normal mode controls the generator set. The GSC controls the engine through information that is received from panel switches, controls, and engine sensors. The GSC performs the following functions in normal mode.

- Starting the engine
- Monitoring of important conditions for the generator set
- Showing important conditions of the generator set to the operator
- Fault Detection
- Engine Stopping

The operator can identify the normal mode by observing the display area . When the GSC is in the normal mode all shutdown indicators are OFF. The fault alarm indicator is OFF and “SERV” is NOT SHOWING on the upper display. When the GSC is in normal mode, the engine is able to start.

Note: The optional Customer Communication Module (CCM) can remotely control certain generator set functions. This remote control can only occur when the ECS is in the AUTO position. See Systems Operation, “Customer Communication Module (CCM)” for more information.

**Engine Starting Sequence**

**1.** The GSC will receive an engine start signal. The signal will be one of three.

- The operator turns the ECS to the MANUAL START position.
- The ECS is in the AUTO position and the remote initiate contacts (IC) close.
- The ECS is in the AUTO position and a start command is sent by the optional Customer Communication Module (CCM).

**2.** The GSC checks the system before beginning the cranking sequence. The GSC checks that no system faults are present. The GSC checks that all previous shutdown faults have been reset. Note that shutdown faults are removed by turning the ECS to OFF/RESET. The GSC also checks that the engine is not already running.

**3.** The GSC activates the starting motor relay (SMR) and the run relay (RR). The activated run relay removes the shutdown signal from the PEEC electronic control module.

**4.** The GSC activates the fuel control relay (FCR). This is not used in applications of the PEEC electronic control module.

**5.** The GSC cycle cranks the engine until the cycle crank time reaches the setpoint (P17) for total cycle crank time or until the engine starts. The factory default of setpoint P17 is 10 seconds crank time and 10 seconds rest.

**6.** While the starting motor is cranking, the GSC shows the status of the relays on the relay status indicators of the lower display. The relays that are shown are K4 (SMR), K5 (RR), and K7 (FCR).

**7.** The GSC deactivates the starting motor relay (SMR) and the GSC activates the crank termination relay (CTR) when the engine speed reaches the setpoint P11 crank terminate speed. The factory default of setpoint P11 is 400 rpm.

**8.** The GSC activates the oil step relay (OSR) when the oil pressure reaches the setpoint P14 for low oil pressure at idle speed. The factory default of setpoint P14 is 70 kPa (10 psi). The OSR signals the PEEC electronic control module to accelerate the engine to rated speed.

Note: The optional Customer Communication Module (CCM) can remotely activate the OSR when the low oil pressure setpoint is exceeded. The optional Customer Communication Module (CCM) can remotely deactivate the OSR when the low oil pressure setpoint is exceeded.

**9.** The GSC shows AC voltage, current, and frequency for one phase at a time on the upper display. The GSC shows system battery voltage, engine hours, engine rpm, oil pressure, and coolant temperature on the lower display. The GSC shows the relay status on the relay status indicators of the lower display. The status is shown for the relays K1, K3, K5, and K7.

**Engine Stopping Sequence**

**1.** The GSC will receive an engine stop signal. The signal will be one of three.

- The operator turns the ECS to the STOP position.
- The ECS is in the AUTO position and the remote initiate contacts (IC) open.
- The ECS is in the AUTO position and a stop command is sent by the optional Customer Communication Module (CCM).

**2.** After receiving the engine stop signal, the GSC checks that no system faults are present.

**3.** The GSC begins the adjustable cooldown period (setpoint P19). The factory default of setpoint P19 is five minutes.

**4.** The GSC may now activate the spare output. This only occurs if the spare output SP07 has been programmed. The spare output can activate a slave relay during the cooldown period. The optional circuit breaker is then activated and this takes the generator off load.

**5.** After the cooldown period (setpoint P19), the GSC deactivates the run relay (RR). The normally closed contacts of the run relay now send a shutdown signal to the PEEC electronic control module. The PEEC turns off the fuel shutoff solenoid which shuts down the engine.

The OSR is deactivated after the engine oil pressure drops below the setpoint P14.

**6.** When engine speed reaches zero rpm, the GSC deactivates the crank terminate relay (CTR) and a restart is now allowed.

If the GSC receives a start signal before the engine speed reaches zero rpm. Then, the GSC turns on the fuel, and the GSC allows the engine to run. If the engine does not run, the starting motor relay (SMR) does not activate until the crank termination relay (CTR) is deactivated at 0 rpm.

7. The GSC shows the status of the relays on the relay status indicators of the lower display. All relay indicators should be OFF.

Note: The engine may be shutdown by turning the ECS to OFF/RESET. The cooldown timer is bypassed and the spare data output is deactivated.

i00932023

# Alarm Mode

**SMCS Code:** 4490; 7451

The alarm mode alerts the operator when an alarm fault is occurring. An alarm fault is not critical but an alarm fault is potentially serious. An alarm fault precedes certain dedicated shutdown faults.

When an alarm fault exists the GSC automatically activates alarm mode. The operator is alerted by the FLASHING fault alarm indicator. Press the “alarm codes” key in order to identify the alarm fault. A corresponding fault code is then shown on the upper display. This fault code can be an AL fault code, a SP fault code or a diagnostic fault code. For more information on fault codes, see Systems Operation, “Fault Description”. When the GSC is in alarm mode the engine is able to start or the engine is able to run.

The AL fault codes that are shown on the GSC indicate the current status of the generator set. The GSC does not show the AL fault codes after the fault has been corrected. However, diagnostic fault codes are logged in the GSC fault log for viewing later by service personnel.

Note: A shutdown fault can be overridden by the operator by programming the shutdown fault to be an alarm fault. The corresponding indicator of the dedicated fault will be ON CONTINUOUSLY if the fault occurs after overriding the shutdown fault. The “ON CONTINUOUSLY” state means that the normal shutdown response has been overridden by the operator. The shutdown fault is treated as an alarm fault. A fault code is not shown on the upper display for the overridden shutdown faults. The dedicated shutdown indicator remains ON CONTINUOUSLY until the fault is corrected and the engine control switch is turned to the OFF/RESET position. The dedicated shutdown faults that can be overridden are low oil pressure and high coolant temperature. See Systems Operation, “Setpoint Programming OP5 (P03)”. Also, see Systems Operation, “Shutdown Mode”.

Alarm faults do not have an immediate adverse effect on the generator set. However, the operator should investigate the cause of the alarm fault condition at the earliest opportunity. If the operation of the generator set is mandatory, then the procedure to start and stop is identical to normal mode. The GSC will respond to the operator input from the panel switches and the input from the engine sensors.

### Alarm Mode Sequence

1. An alarm fault occurs.

2. The GSC will detect the alarm fault. The GSC will FLASH the fault alarm indicator. The GSC does not change the status or the operation of the generator set.

3. Pressing the alarm codes key causes the upper display to show a corresponding fault code.

4. Correct the alarm fault. See Testing and Adjusting, “Fault Identification”.

5. After the alarm fault has been corrected, the GSC turns OFF the fault alarm indicator and the GSC removes the fault code from the upper display. The GSC now returns to normal mode.

i01123822

# Shutdown Mode

**SMCS Code:** 4490; 7451

The shutdown mode prevents damage to the generator set when a shutdown fault is occurring. A shutdown fault is critical. When a shutdown fault occurs, the GSC automatically activates shutdown mode until the shutdown fault is corrected. The GSC shuts down the engine when the GSC is in shutdown mode. The GSC prevents starting of the engine and the GSC alerts the operator.

The GSC alerts the operator and the GSC identifies the shutdown fault by FLASHING the corresponding shutdown indicator. The name of the shutdown indicator identifies the shutdown fault.

Shutdown Indicators

- Low oil pressure
- Emergency stop
- High water temperature
- Engine overspeed
- Low coolant level
- Engine overcrank
- Fault shutdown

If the fault shutdown indicator is the only indicator FLASHING, additional information is available. A diagnostic code is shown on the upper display which more precisely identifies the cause of the shutdown fault. See Systems Operation, “Fault Description” for more information.

**Shutdown Mode Sequence**

**1.** A shutdown fault occurs and the GSC detects the shutdown fault.

**2.** To shut off the fuel, the GSC deactivates the run relay (RR). The normally closed contacts of the RR send a shutdown signal to the PEEC electronic control module. The PEEC turns OFF the fuel shutoff solenoid which shuts down the engine.

**3.** In order to prevent the engine from cranking, the GSC deactivates the starting motor relay (SMR).

**4.** In order to remove the load from the generator, the GSC activates the generator fault relay (GFR). This activates the optional circuit breaker shunt trip coil.

Note: The spare output may also be programmed to activate when a shutdown occurs. This output can drive a relay in order to open the circuit breaker, or the output can open a transfer switch. See Systems Operation, “Spare Input/Output Programming OP6”.

**5.** The GSC activates the air shutoff relay (ASR) for 15 seconds during a fault for the emergency stop, the engine overspeed, or the engine speed sensor.

**6.** When engine speed reaches 0 rpm, the GSC deactivates the crank termination relay (CTR). The oil step relay (OSR) is deactivated when the engine oil pressure reaches the setpoint (P14) for low oil pressure shutdown at the idle speed 70 kPa (10 psi).

**7.** If engine speed does not decrease at least 100 rpm within five seconds, the GSC activates the air shutoff relay (ASR) for 15 seconds.

Note: The ASR would already be activated for a fault with the emergency stop, the engine overspeed, or the engine speed sensor.

**8.** The GSC FLASHES the corresponding shutdown indicator. If the fault shutdown indicator is FLASHING, a diagnostic code is shown on the upper display. See Systems Operation, “Fault Description”.

**9.** If the fault shutdown indicator is the only indicator FLASHING, additional information is available. A diagnostic code is shown on the upper display that more precisely identifies the cause of the shutdown fault. See the Systems Operation, “Fault Description”.

**10.** The lower display continues to show the engine data.

**11.** The relay status indicators show.

- K2 (GFR)
- K6 (ASR) will show for 15 seconds for a fault with the emergency stop, the engine overspeed, or the engine speed sensor. K6 (ASR) will also show if engine speed does not decrease at least 100 rpm.

**Engine Start Sequence After A Shutdown**

**1.** Correct the shutdown fault. See the Testing And Adjusting, “Fault Identification”.

**2.** Reset the GSC by turning the ECS to “OFF/RESET”. If no shutdown fault is active, the GSC returns to normal mode and the engine is able to start.

i01123921

# Service Mode

**SMCS Code:** 4490; 7451

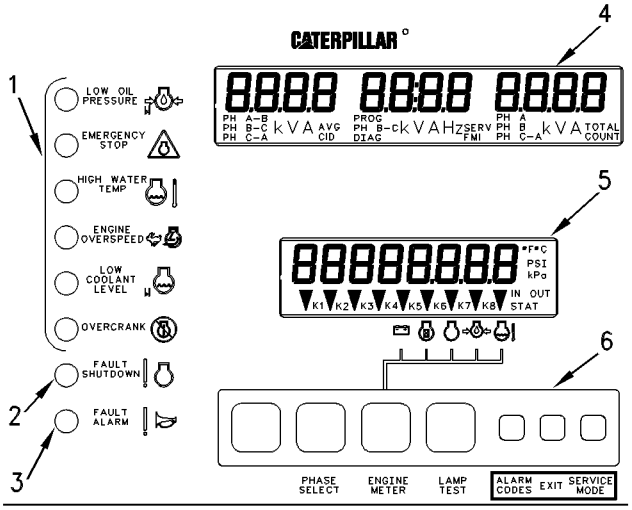



Illustration 17 g00593349

Display Area Of Generator Set Control (GSC)

(1) Dedicated Shutdown Indicators. (2) Fault Shutdown Indicators. (3) Fault Alarm Indicator. (4) Upper Display. (5) Lower Display. (6) Keypad.

Service Mode is used for the following purposes.

- Assist with the troubleshooting of diagnostic codes.
- Satisfy special applications.
- Satisfy customer needs.
- Verify generator set functions.
- Calibrate or adjust generator set functions.

Service mode has ten options that can be selected. Service personnel use the option to obtain information about the generator set, and the operator can program functions of the generator set.

Table 4

| | |
|---|---|
| OP1 | Fault log viewing |
| OP2 | Setpoint viewing |
| OP3 | Password entry |
| OP4 | Fault log clearing |
| OP5 | Setpoint programming |
| OP6 | Spare Input/Output programming |
| OP7 | Hourmeter programming |
| OP8 | Voltmeter/Ammeter programming |
| OP9 | Engine setpoint verification |
| OP10 | AC offset adjustment |

The keypad and the display of the GSC are used for activating service mode and selecting the desired option. In service mode, the keys on the keypad have different functions, and the keys on the keypad have different names. The preceding illustration shows the name of each key in service mode. Also, there is a film (label) on the vandal door of the control panel that identifies each key. The service functions of the keys are listed below.

Scroll Right Key – This key is used to view information by scrolling. When you are entering the password this key represents the number 1.

“Scroll Up” Key – This key is used to scroll up through information or this key is used to increase the value of information. When you are entering the password this key represents the number 2.

“Scroll Down” Key – This key is used to scroll down through information or this key is used to decrease the value of information. When you are entering the password this key represents the number 3.

Note: In order to rapidly scroll through a large range of information, hold down the appropriate scroll key.

“Select” Key – To view an option, use the “Select” Key. To change an option, use the “Select” Key. To start the scrolling of information, use the “Select” Key.

“Enter” Key – This key is used to enter information that has been changed into the memory of the GSC.

“Exit” Key – This key is used to exit service mode. Then, the display will go to normal mode. The “SERV” indicator on the upper display is NOT SHOWING when the GSC is NOT in service mode.

“Service Mode” Key – This key is used to enter service mode. The “SERV” indicator on the upper display FLASHES when the GSC is in service mode. The “SERV” indicator on the upper display FLASHES when the keypad performs the functions of the service mode.

**Procedure To Enter Service Mode**

Note: Any active shutdown fault must be made inactive in order to access service mode. A FLASHING shutdown indicator means that a shutdown fault exists. To temporarily change a shutdown fault from an active shutdown fault to an inactive shutdown fault, turn the ECS to the OFF/RESET position. To permanently change a shutdown fault from an active shutdown fault to an inactive shutdown fault, the fault must not be occurring. Also, the ECS must be turned to the OFF/RESET position. If the jumper from terminal 6 to terminal 9 is not installed on the ECS, then the GSC will not power up in OFF/RESET and any active shutdown fault must be corrected before entering service mode.

Note: Service mode cannot be entered when the ECS is in the AUTO position.

1. Press the “Service Mode” key on the keypad of the GSC. The “SERV” indicator on the upper display FLASHES whenever the GSC is in service mode.

2. The desired option (OP1 through OP10) can now be selected. Each option is described in the topics that follow.

3. To return to normal mode, press the “EXIT” key a few times until the “SERV” indicator is not showing.

Note: To enter OP4 through OP8, the engine must be shut down. Turn the ECS to the STOP position.

OP4 through OP10 are protected by a password in order to reduce the possibility of altering information by mistake. The password is entered in OP3. The password must be correctly entered before access is gained to OP4 through OP10. See Systems Operation, “Password Entry OP3”. Options OP1 and OP2 are for the viewing of information. These options are not password protected.

i01105678

# Fault Log Viewing OP1

**SMCS Code:** 4490; 7451

OP1 is the option for viewing of diagnostic codes that are recorded in the fault log of the GSC. The fault log contains a history of diagnostic codes that have occurred in the genset system since the last service call. Also, the total number of occurrences are shown on the upper display. The fault log assists when service personnel are troubleshooting the generator set system.

Each diagnostic code consists of the following descriptions: a component identifier (CID), a failure mode identifier (FMI), and an active/inactive status indicator (DIAG). These indicators are shown on the upper display. The CID informs the operator of faulty components. The FMI describes the type of failure that has occurred. When the diagnostic code is active, “DIAG” FLASHES.

Only inactive diagnostic codes are stored in the fault log. An active diagnostic alarm fault becomes inactive when the fault is no longer occurring. An active diagnostic shutdown fault becomes inactive when the fault is no longer occurring and the ECS is turned to OFF/RESET. Active diagnostic alarm faults and diagnostic shutdown faults are indicated when “DIAG” is FLASHING. When the faults become inactive “DIAG” is ON CONTINUOUSLY. The GSC stores a maximum of 12 inactive diagnostic codes in the fault log. If an additional diagnostic code becomes inactive, the GSC automatically clears the earliest inactive diagnostic code. Then, the GSC puts the new inactive diagnostic code in the fault log.

The GSC automatically clears any inactive diagnostic codes that have been stored in the fault log for more than 750 hours. For example, if a CID 190 FMI 3 is logged at 10 hours, then the GSC clears the diagnostic code when the hour meter is at 760 hours. If a CID 100 FMI 4 is logged at 20 hours, then the diagnostic code remains logged until the hour meter is at 770 hours. This feature keeps old diagnostic codes from clogging the fault log, if service personnel have forgotten to clear the log after correcting faults.

When an active diagnostic code changes to an inactive diagnostic code, the GSC will function in the following manner.

1. The diagnostic code is recorded in the fault log of the GSC.

2. If no other active diagnostic codes are present, then the “DIAG” indicator changes from FLASHING (active diagnostic code) to being ON CONTINUOUSLY. This signifies an inactive diagnostic code.

3. The fault alarm indicator or fault shutdown indicator changes from FLASHING to “OFF”.

## Procedure To View The Fault Log

Note: For a list of all diagnostic codes, see Testing and Adjusting, “Troubleshooting Diagnostic Codes”.

Note: Service mode cannot be entered when the ECS is in the AUTO position.

Note: Any active shutdown fault must be made inactive in order to access service mode. A FLASHING shutdown indicator means that a shutdown fault exists. To temporarily change a shutdown fault from an active shutdown fault to an inactive shutdown fault, turn the ECS to the OFF/RESET position. To permanently change a shutdown fault from an active shutdown fault to an inactive shutdown fault, the fault must not be occurring. Also, the ECS must be turned to the OFF/RESET position. If the jumper from terminal 6 to terminal 9 is not installed on the ECS, then the GSC will not power up in OFF/RESET and any active shutdown fault must be corrected before entering service mode.

1. Press “SERVICE MODE” key in order to enter service mode. “OP 1” is showing on the lower display. See Systems Operation, “Service Mode” for more information.

2. Press “SELECT” key. The diagnostic codes scroll on the upper display if more than one diagnostic code is in the log. Each diagnostic code has the number of occurrences that are showing above the “COUNT” indicator. The lower display shows the hourmeter values of the last occurrence of each fault.

3. Press “SELECT” key. The diagnostic codes stop scrolling.

4. Press “SCROLL RIGHT” key. If the diagnostic code is logged more than one time, then the first occurrence with a corresponding hourmeter value is showing on the lower display.

5. Press “SELECT” key. Diagnostic codes continue scrolling.

6. Press “EXIT” key. OP 1 is showing on lower display.

7. Press “EXIT” key. The display will return to the normal mode.

i00932296

# Engine/Generator Setpoint Viewing OP2

**SMCS Code:** 4490; 7451

OP2 is the option for viewing the setpoints of the generator set. The engine setpoints and the generator setpoints affect the operation and serviceability of the engine. The setpoints affect the accuracy of the information that is shown on the display. The setpoints that are viewed on the GSC should match the specified setpoints of the control panel. The programmable setpoints that are covered under OP2 are P01 through P24. See Systems Operation, “Setpoint Programming OP5” for a description of each of these setpoints.

## Procedure To View The Setpoints

1. Press the “SERVICE MODE” key in order to enter service mode. “OP 1” is showing on the lower display. See Systems Operation, “Service Mode”for more information.

2. Press “SCROLL UP” key. “OP 2” is showing.

3. Press “SELECT” key. “P01” is followed by the value of the setpoint that is showing.

4. Press “SCROLL UP” or “SCROLL DOWN” key. The next setpoint is showing with the corresponding value. Repeat this step until all the desired setpoints and corresponding values are viewed.

5. Press “EXIT” key. “OP 1” is showing on lower display.

6. Press “EXIT” key. The display returns to the normal mode.

i00932362

# Password Entry OP3

**SMCS Code:** 4490; 7451

OP3 is the option for entering the password that is required for accessing OP4 through OP10. Service mode options OP4 through OP10 are password protected. This reduces the possibility of information being altered by mistake. Options OP1 and OP2 are for the viewing of information. Options OP1 and OP2 are not password protected.

Password entry consists of actuating the scroll keys in the correct sequence. The password is identical for every GSC. The password cannot be changed. After the password is entered, the OP4 through OP10 options can be accessed. If a mistake is made during password entry, “FAIL” is briefly shown on the upper display. Pressing the “SELECT” key starts the password entry process again.

## Procedure To Enter The Password

Note: Service mode cannot be entered when the ECS is in the AUTO position.

Note: Any active shutdown fault must be made inactive in order to access service mode. A FLASHING shutdown indicator means that a shutdown fault exists. To temporarily change a shutdown fault from an active shutdown fault to an inactive shutdown fault, turn the ECS to the OFF/RESET position. To permanently change a shutdown fault from an active shutdown fault to an inactive shutdown fault, the fault must not be occurring. Also, the ECS must be turned to the OFF/RESET position. If the jumper from terminal 6 to terminal 9 is not installed on the ECS, then the GSC will not power up in OFF/RESET and any active shutdown fault must be corrected before entering service mode.

1. Press “SERVICE MODE” key in order to enter service mode. “OP 1” is showing on the lower display. See Systems Operation, “Service Mode” for more information.
2. Press “SCROLL UP” key twice. “OP 3” is showing.
3. Press “SELECT” key. “PE _ _ _ _ _” is showing.
4. Press “SELECT” key. “PE _ _ _ _ _” is showing and the first dash is flashing.
5. Press “SCROLL RIGHT” key. “PE 1 _ _ _ _ ” is showing and the next dash is flashing.
6. Press “SCROLL DOWN” key. “PE 1 3 _ _ _ ” is showing and the next dash is flashing.
7. Press “SCROLL UP” key. “PE 1 3 2 _ _” is showing and the next dash is flashing.
8. Press “SCROLL DOWN” key. “PE 1 3 2 3 _ ” is showing and the last dash is flashing.
9. Press “SCROLL RIGHT” key. “PE 1 3 2 3 1 ” is showing.
10. Press “ENTER” key. “PE PASS” is showing.
11. Press “EXIT” key. “OP 1” is showing.

Note: After the password is entered, any option can be accessed. Options can be accessed repeatedly. The password remains in effect until service mode is exited. If the operator attempts to enter the password twice, “PE PASS” reappears on the lower display.

i01105721

# Fault Log Clearing OP4

**SMCS Code:** 4490; 7451

OP4 is the option for clearing a diagnostic code from the fault log of the GSC. Diagnostic codes should be cleared from the fault log after being investigated. This will help to avoid confusion that might otherwise occur during the maintenance in the future. After all diagnostic codes are cleared and the GSC is in normal mode, the “DIAG” indicator is not shown on the upper display. See Systems Operation, “Fault Log Viewing OP1”.

## Procedure For Clearing Diagnostic Codes

1. Turn the ECS to the STOP position in order to shut down the engine. Enter service mode and enter the password. “OP 1” is showing on lower display. See Systems Operation, “Service Mode” for more information. See Systems Operation, “Password Entry OP3” for more information.
2. Press “SCROLL UP” key three times. “OP 4” is showing on the lower display.
3. Press “SELECT” key. A diagnostic code and the number of occurrences are showing. The lower display shows the value of the hourmeter of the last occurrence.
4. Press “SELECT” key. The diagnostic code will flash. The count and the value for the hourmeter will also flash.
5. Press and hold “ENTER” key for two seconds. If there is only one diagnostic code, the CID FMI that was flashing disappears and the upper display is blank except for the flashing “SERV” indicator. “OP 1” is showing on the lower display. Go to the next step.

If there is more than one diagnostic code, the CID FMI that was flashing disappears. The upper display shows the next CID FMI with the corresponding count and the value for the hourmeter. Repeat steps 4 and 5 until all diagnostic codes are erased. The lower display then shows “OP 1”. Go to the next step.

6. Press “EXIT” key. “OP 1” is showing on lower display.

7. Press “EXIT” key. The display will return to the normal mode.

i01136578

# Engine/Generator Programming OP5

**SMCS Code:** 4490; 7451

OP5 is the option for programming the engine/generator setpoints. The engine/generator setpoints affect the proper operation and serviceability of the engine, and the accuracy of information shown on the display. The setpoints are programmed in the GSC at the factory.

The setpoints may require changing when the GSC is moved from one engine to another engine. Customer requirements and moving the GSC from one engine to another engine may require changes in the setpoints. The setpoints that are stored in the GSC must match the specified setpoints of the particular generator set. The setpoints are P01 to P24 and the setpoints are programmable. The setpoints are described in Table 5.

## Procedure For Engine/Generator Programming

Note: Service Mode cannot be entered when the ECS is in the AUTO position.

Note: Any active shutdown fault (any shutdown indicator FLASHING) must be made inactive in order to access service mode. To temporarily change a shutdown fault from an active shutdown fault to an inactive shutdown fault, the shutdown fault must be no longer occurring. The fault must be corrected and the ECS must be turned to the OFF/RESET position. If the jumper from terminal 6 to terminal 9 is not installed on the ECS, the GSC does not power up in the OFF/RESET position and any active shutdown fault must be corrected before entering service mode.

1. Turn the ECS to the STOP position in order to shut down the engine. Enter service mode and enter the password. OP 1 is showing on the lower display. See Systems Operation, “Procedure To Enter The Password” that is located within the topic Password Entry OP3 for more information.

2. Press “SCROLL UP” key again. OP5 is showing on the lower display.

3. Press “SELECT” key again. P01 is showing on the display. P01 is followed by the value of the setpoint.

4. Press the “SCROLL UP” key or the “SCROLL DOWN” key. The next setpoint is showing with the value of the setpoint. Repeat this step until the desired setpoint is showing.

5. Press the “SELECT” key. The value of the setpoint is flashing.

6. Press the “SCROLL UP” key or “SCROLL DOWN” key in order to adjust the value of the setpoint.

Note: Press and hold the appropriate “SCROLL” key in order to rapidly scroll through a large range of values.

7. Press the “ENTER” key. The value of the setpoint stops flashing. Repeat steps 4, 5, 6 and 7 until all the desired setpoints are adjusted.

8. Press “EXIT” key. “OP 1” is showing on the lower display.

9. Press “EXIT” key. The display will return to the normal mode.

Table 5

| OP5 Setpoints - Engine/Generator Programming[1] | | | | |
|---|---|---|---|---|
| **Setpoint** | **Name** | **Description** | **Range Of Value** | **Factory Default** |
| P01 | Fuel Solenoid Type | Type of fuel system solenoid used on the generator set. | 0 - ETR fuel solenoid<br>1 - ETS fuel solenoid | 0 |
| P02 | Units Shown | Type of measurement units shown on the GSC display. | 0 - English units (psi, degrees F)<br>1 - Metric units (kPa, degrees C) | 0 |
| P03 | Shutdown Override For Engine Fault | GSC responds to a low engine oil pressure or high coolant temperature fault. (Determined by application or customer.) | 0 - engine shutdown<br>1 - alarm only (shutdown override, no engine shutdown) | 0 |
| P04 | Shutdown Enable For Sensor Fault | GSC responds to a diagnostic fault with the engine oil pressure sensor, coolant temperature sensor, oil temperature sensor, sensor power supply or coolant loss sensor. (Determined by application or customer.) | 0 - alarm only (shutdown override, no engine shutdown)<br>1 - for engine shutdown | 0 |
| P05 | Coolant Loss Sensor Installed | Tells whether or not the optional engine coolant loss sensor is installed on the generator set. | 0 - generator sets without sensor<br>1 - generator sets with sensor | 0 |
| P06 | Shutdown Override For Coolant Loss Fault | GSC+ responds to an engine coolant loss fault. (Determined by application or customer.) | 0 - engine shutdown<br>1 - alarm only (shutdown override, no engine shutdown.) | 0 |
| P07 | System Voltage | System voltage (battery voltage) of the generator set. (Determined by application or customer.) | 0 - 24 DCV<br>1 - 32 DCV | 0 |
| P08 | Upper Display Enable/Disable | Informs the GSC to enable or disable the showing of AC values on the upper display. | 0 - upper display enabled<br>1 - upper display disabled | 0 |
| P08[2] | Engine Type | Informs the GSC of the type of engine that is in the genset. The engine is either a diesel or a gas engine. | 0 - diesel engine<br>1 - gas engine | 0 |
| P09 | Number Of Ring Gear Teeth | Number of teeth on the ring gear engine. Used by the GSC to determine engine speed. | 95 to 350 teeth in increments of 1 | 136 |
| P10 | Engine Overspeed | Engine speed used by the GSC to declare that an engine overspeed fault exists. The engine overspeed setpoint (for all 60 Hz applications) is 1.18 times the rated speed. | 500 to 4330 rpm in increments of 10 | 2120 rpm |
| P11 | Crank Terminate Speed | Engine speed used by the GSC to disengage the starting motor during engine cranking. | 100 to 1000 rpm in increments of 10 | 400 rpm |
| P12 | Oil Step Speed | Engine speed used by the GSC for distinguishing between rated speed and idle speed when a low oil pressure fault exists. | 400 to 1800 rpm in increments of 10 | 1350 rpm |
| P13[3] | Low Oil Pressure Shutdown At Rated Speed | Oil pressure used by the GSC to declare that a low oil pressure shutdown fault exists with engine at rated speed (the engine must have exceeded the oil step speed for at least nine seconds). | 34 to 420 kPa (5 to 61 psi) in increments of one. | 205 kPa (30 psi) |

(continued)

(Table 5, contd)

| OP5 Setpoints - Engine/Generator Programming[1] | | | | |
|---|---|---|---|---|
| **Setpoint** | **Name** | **Description** | **Range Of Value** | **Factory Default** |
| P14[3] | Low Oil Pressure Shutdown At Idle Speed | Oil pressure used by the GSC to declare that a low oil pressure shutdown fault exist with the engine at idle speed (the engine must have been running for at least nine seconds and the engine speed must be less than oil step speed). | 20 to 336 kPa (3 to 49 psi) in increments of 1 | 70 kPa (10 psi) |
| P15[4] | High Water Temperature Shutdown | Coolant temperature used by the GSC to declare a high coolant temperature shutdown fault exists (after a 10 second delay). | 94 to 123°C (201 to 253° F) in increments of 1 | 107°C (225°F) |
| P16 | Low Water Temperature Alarm | Coolant temperature used by the GSC to declare that a low temperature alarm fault exists (after a 2 second delay). (Determined by application or customer.) | 0 to 36°C (32 to 97°F) in increments of 1 | 21°C (70°F) |
| P17 | Total Cycle Crank Time | Cycle crank time used by the GSC to declare that an overcrank fault exists. ( Determined by application or customer.) | 5 to 360 seconds in increments of 1 | 90 seconds |
| P18 | Cycle Crank Time | Amount of time the GSC cranks and then rests the starting motor during a single crank cycle. Determined by application of customer.) | 5 to 300 seconds in increments of 1 | 10 seconds |
| P19 | Cooldown Time | Amount of time the GSC allows the engine to run after a normal shutdown is initiated. (Determined by application or customer.) | 0 to 30 minutes in increments of one | 5 minutes |
| P20[5] | AC Voltage | Full scale AC voltage of the generator. The GSC measures the AC voltage and shows it on the display. (Determined by application or customer.) | 700, 150, 300, 500, 600, 750, 3.0k, 4.5k, 5.25k, 9.0k, 15.0k, 18.0k, 30.0k | 700 |
| P21 | AC Current Full Scale | AC current full scale is the ratio of the current transformers (CT) based on a 5A secondary. It does not represent the maximum AC current of the generator. The GSC measures the current and shows it on the display. | 75, 100, 150, 200, 300, 400, 600, 800, 1000, 1200, 1500, 2000, 2500, 3000, 4000A | 600A |
| P22 | GSC Engine Number | Informs other devices on the CAT Data Link (for example, CCM) of the engine number for the GS (Determined by application or customer). | 01 through 08 | 01 |
| P23 | Engine Type | Identifies the engine as a mechanical unit injector (MUI) diesel, spark ignited (gas), or electronic unit injector (EUI) diesel engine. | 0 - MUI diesel<br>1 - Gas<br>2 - EUI diesel | 0 |
| P24[6] | Crank Time Delay | Amount of time the GSC delays activation of the fuel control relay (FCR) during a crank cycle. This setpoint is for gas engines only. (Determined by application or customer.) | 0 to 20 seconds in increments of 1 | 5 seconds |

(1) The setpoints that are stored or the setpoints that are being programmed must match the specified setpoints of the particular generator set.

(2) On former 103-6177, 113-4500 and 117-6200 GSC's

(3) When oil pressure drops to within 34 kPA (5 psi) of the “P13” or “P14” setpoint, a low oil pressure alarm is issued by the GSC and the optional alarm module (with the exception of the NFPA 99 RAN).

(4) When coolant temperature rises to within 6°C (11°F) of the “P15 ” setpoint, a high water temperature alarm is issued by the GSC and the optional alarm module (with the exception of the NFPA 99 RAN).

(5) The values other than the default (700V) are for switchgear applications and require the use of external potential transformers and the removal of the AC voltage range jumper located in the relay module. See the topic AC Voltage Range Selection in the Testing And Adjusting section.

(6) The P24 setpoint only functions when the P23 setpoint is set to 1 (gas engine).

i01136794

# Spare Input/Output Programming OP6

**SMCS Code:** 4490; 7451

OP6 is the option for programming of the spare inputs. OP6 is the option for programming the spare output. These spare inputs and spare outputs are provided in order to satisfy the needs of the customer.

## Spare Inputs

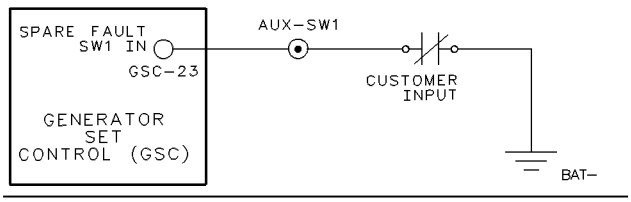
The spare inputs are referred to as SP1, SP2, and SP3. The spare inputs are accessed on the auxiliary terminal strip (AUX) within the control panel on the left wall. The terminations at the auxiliary terminal strip for the spare inputs are marked.

SP1 is marked as “SW1”.

SP2 is marked as “SW2”.

SP3 is marked as “SW3”.

The following tasks for each spare input are programmable: active input state, response taken, and time delay. The GSC responds to the active state of an input, although the response can be delayed. Setpoints SP01 through SP06 and SP08 through SP10 are used for programming the spare inputs. Each of the setpoints is described in the following topics.




g00308511

Illustration 18

Typical Active High Input Configuration For Spare Input 1 (SP1)

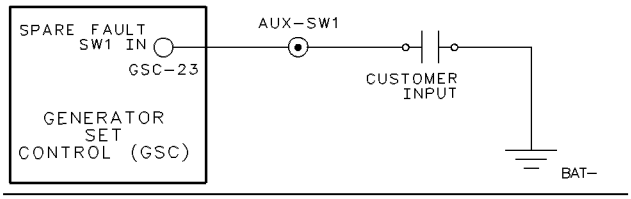



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Illustration 19

Typical Active Low Input Configuration For Spare Input 1 (SP1)

The active input state must be programmed into the GSC. A high state is 5 DCV to B+. A low state is B-. When an input is programmed for an active high state a high state at the input is a spare fault. A low state at the input is a normal condition.

When an input is programmed for an active low state, a low state at the input is a spare fault. A high state at the input is a normal condition. Setpoints SP01, SP03 and SP05 are used for the programming of the active input state of the spare inputs.

Note: If an input is left floating, then the internal circuitry of the GSC pulls the input high. The GSC will respond accordingly.

The GSC response to an active spare fault must be programmed. One response option treats the condition as a shutdown fault. The other response option treats the condition as an alarm fault. Setpoints SP02, SP04, and SP06 are used for programming the response.

Note: Spare faults that are programmed to shutdown are ignored by the GSC when engine speed is less than crank termination speed.

The GSC must be programmed for the amount of time to delay the response to a spare fault (active input). After a spare fault occurs, the GSC does not respond until the time delay has elapsed. Indicators are not activated. Codes are not shown. The operation of the engine has not changed. Setpoints SP08, SP09, and SP10 are used for programming the time delay. The time delay is selectable from 0 to 250 seconds.

SP01 Spare Input 1 Active State – The value is 0 for an active low or the value is 1 for an active high. The default setting from the factory is 0.

SP02 Spare Input 1 Response – The value is 0 for a shutdown fault or the value is 1 for an alarm fault. The default setting from the factory is 0.

SP03 Spare Input 2 Active State – The value is 0 for an active low or the value is 1 for an active high. The default setting from the factory is 0.

SP04 Spare Input 2 Response – The value is 0 for a shutdown fault or the value is 1 for an alarm fault. The default setting from the factory is 0.

SP05 Spare Input 3 Active State. – The value is 0 for an active low or the value is 1 for an active high. The default setting from the factory is 0.

SP06 Spare Input 3 Response. – The value is 0 for a shutdown fault or the value is 1 for an alarm fault. The default setting from the factory is 0.

SP08 Spare Input 1 Delay Time – The value is selectable from 0 to 250 seconds in increments of 1 second. The default setting from the factory is 0 seconds.

SP09 Spare Input 2 Delay Time – The value is selectable from 0 to 250 seconds in increments of 1 second. The default setting from the factory is 0 seconds.

SP10 Spare Input 3 Delay Time – The value is selectable from 0 to 250 seconds in increments of one second. The default setting from the factory is 0 seconds.

Alarm Mode Sequence Of Operation – When a fault occurs in a spare input and the fault is programmed as an alarm fault, the GSC will respond in the following manner:

1. The GSC waits for the programmed time delay.
2. The fault alarm indicator FLASHES.
3. When the alarm codes key is pressed, the corresponding SP fault code is shown on the upper display of the GSC.
4. The engine continues to run or the engine is able to start.

Shutdown Mode Sequence Of Operation – When a fault occurs in a spare input and the fault is programmed as a shutdown fault, the GSC will respond in the following manner:

1. The GSC waits for the programmed time delay.
2. The fault shutdown indicator FLASHES.
3. The corresponding SP fault code of SP1, SP2, or SP3 is immediately shown on the upper display of the GSC.
4. The engine is shut down or the engine is disabled from starting.

The fault shutdown indicator remains FLASHING and the SP fault code remains shown until the ECS is turned to OFF/RESET. After you turn the ECS to OFF/RESET and after you correct the cause of the spare fault, the engine is able to start and the engine is able to run.

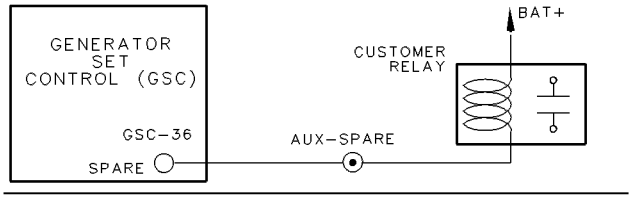
Note: SP fault codes are not logged into the GSC fault log.

Note: If the operator does not desire the use of the spare inputs, then program the spare inputs for a LOW active state and connect nothing to the spare input wiring.

## Spare Output

Note: The spare output is usually used to give a high logic signal to a device for a customer or the spare output is used to give a low logic signal to a device for a customer. However, the spare output can be programmed to be a spare data output on the latest generator set controls. As a spare data output, the necessary serial data is available for operating the optional relay driver module (RDM). Earlier generator set controls such as the **103-6177, 113-4500, 117-6200, 120-6880, 123-6004 and 136-3870** EMCP Electronic Controls do not have the serial data capability which is necessary for the RDM.

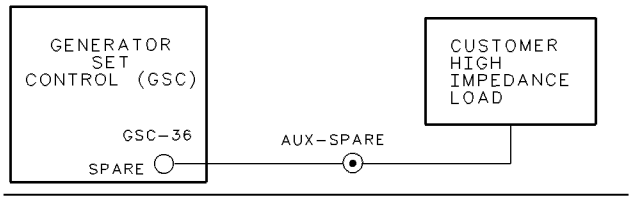
The spare output responds to a selected trigger condition. The response and the trigger condition are programmable. The spare output is accessed on the auxiliary terminal strip (AUX) within the control panel on the left wall. The spare output is marked as “SPARE” on the auxiliary terminal strip.




g00307942

Illustration 20

Typical Active Low Configuration For Spare Output




g00308023

Illustration 21

Typical Active High Configuration For Spare Output

The GSC must be programmed to make the active state of the spare output high or low. An active low state means that the output is pulled to the battery negative terminal when the output is active. The output draws approximately 100 mA when the output is in the low state. The output is floating at a high state when the GSC is programmed for an active high state. The voltage will measure approximately 5.0 DCV when no devices are connected to the spare output. When the spare output is in the high state, the spare output is floating. The spare output is also capable of driving the high impedance logic circuits only. When the spare output is in the high state, the spare output will not drive the low impedance loads such as relays. Setpoint SP07 is used for programming the active state of the spare output.

SP07 – Spare Output Active State. The default setting from the factory is 0.

0 – active low state

1 – active high state

The condition that activates the spare output must be programmed in the GSC. A large selection of trigger conditions are available to activate the spare output. Setpoint SP11 is used for programming the trigger condition.

SP11 – . The default setting from the factory is 7 (cooldown).

Table 6

| SP11 Spare Output Trigger Conditions | |
|---|---|
| 1 | For an active SP1 fault code that is an alarm fault. |
| 2 | For an active SP2 fault code that is an alarm fault. |
| 3 | For an active SP3 fault code that is an alarm fault. |
| 4 | Any active SP1, SP2 or SP3 fault code that is an alarm fault. |
| 5 | Any active AL fault code (AL1, AL2 or AL3) or diagnostic fault code (CID FMI) that is an alarm fault. |
| 6 | Any active alarm fault (SP1, SP2, SP3, AL1, AL2, AL3 or CID FMI) |
| 7 | Activate during cooldown time |
| 8 | Activate during a coolant loss alarm or shutdown condition |
| 9 | Provide serial data for relay driver module (RDM). Only available on the latest GSC's. Earlier 133-6350, 123-6004 and 136-3870 EMCP Electronic Controls do not have the serial data capability which is necessary for the RDM. |

Note: The spare output activates the shunt trip coil of the AC circuit breaker during the engine cooldown.

Note: The GSC diagnoses a fault in the spare output circuit. See Testing and Adjusting, “Diagnostic Fault Codes”.

## Procedure For Spare Input/Output Programming

Note: Service mode cannot be entered when the ECS is in the AUTO position.

Note: Any active shutdown fault must be made inactive in order to access service mode. A FLASHING shutdown indicator means that a shutdown fault exists. To temporarily change a shutdown fault from an active shutdown fault to an inactive shutdown fault, turn the ECS to the OFF/RESET position. To permanently change a shutdown fault from an active shutdown fault to an inactive shutdown fault, the fault must not be occurring. Also, the ECS must be turned to the OFF/RESET position. If the jumper from terminal 6 to terminal 9 is not installed on the ECS, then the GSC will not power up in OFF/RESET and any active shutdown fault must be corrected before entering service mode.

1. Turn the ECS to the STOP position. This shuts down the engine. Enter service mode and enter the password. “OP 1” is showing on lower display. For more information, see the Procedure To Enter The Password in the System Operation, “Password Entry OP3”.

2. Press “SCROLL UP” key five times. “OP 6” is showing on the lower display.

3. Press “SELECT” key. “SP01” is showing and “SP01” is followed with the value of the setpoint.

4. Press “SCROLL UP” or “SCROLL DOWN” key. The next setpoint with a corresponding value is showing. Repeat this step until the desired setpoint is showing.

5. Press “SELECT” key. The value of the setpoint is flashing.

6. Press the “SCROLL UP” or “SCROLL DOWN” key in order to adjust the value of the setpoint.

7. Press “ENTER” key. The value of the setpoint stops flashing. Repeat steps 4, 5, 6 and 7 until all the desired setpoints are adjusted.

8. Press “EXIT” key. “OP 1” is showing on the lower display.

9. Press “EXIT ”key. The display returns to the normal mode.

i01124649

# Hourmeter Programming OP7

**SMCS Code:** 4490; 7451

OP7 is the option for programming the hours that are shown on the hourmeter. The hours can be increased but not decreased. This allows the hours on a new GSC to exactly match the hours of a GSC that is being replaced. This improves the tracking of engine maintenance such as oil changes when the GSC is replaced. Also, if the GSC is moved from one engine to another engine, the hours can be changed in order to match the new engine. This procedure can take place when the reprogrammed hours are more than the original hours.

If the hourmeter shows all dashes, the hours can not be reprogrammed. If the hourmeter shows all dashes instead of a reasonable numeric value then see Testing and Adjusting, “Troubleshooting Diagnostic Codes”.

## Procedure For Programming The Hourmeter

This procedure uses a new GSC with 0 hours as an example. The hourmeter in the new GSC will be set to a value of 1,234 hours. The value must be higher than the original value.

Note: Service mode cannot be entered when the ECS is in the AUTO position.

Note: Any active shutdown fault must be made inactive in order to access service mode. A FLASHING shutdown indicator means that a shutdown fault exists. To temporarily change a shutdown fault from an active shutdown fault to an inactive shutdown fault, turn the ECS to the OFF/RESET position. To permanently change a shutdown fault from an active shutdown fault to an inactive shutdown fault, the fault must not be occurring. Also, the ECS must be turned to the OFF/RESET position. If the jumper from terminal 6 to terminal 9 is not installed on the ECS, then the GSC will not power up in OFF/RESET and any active shutdown fault must be corrected before entering service mode.

1. Turn the ECS to the STOP position in order to shut down the engine. Enter service mode and enter the password. “OP 1” is showing on lower display. See Systems Operation, “Service Mode” for more information. See Systems Operation, “Password Entry OP3” for more information.

2. Press “SCROLL UP” key six times. “OP 7” is showing on the lower display.

3. Press “SELECT” key. The present value for the hourmeter is showing.

4. . Press “SELECT” key. “000000” is showing and the first digit is flashing.

5. Press “SCROLL RIGHT” key two times. “000000” is showing and the third digit is flashing.

6. Press “SCROLL UP” key. “001000” is showing and the third digit is flashing.

7. Press “SCROLL RIGHT” key. “001000” is showing and the fourth digit is flashing.

8. . Press “SCROLL UP” key two times. “001200” is showing and the fourth digit is flashing.

9. Press “SCROLL RIGHT” key. “001200” is showing and the fifth digit is flashing.

10. Press “SCROLL UP” key three times. “001230” is showing and the fifth digit is flashing.

11. Press “SCROLL RIGHT” key. “001230” is showing and the sixth digit is flashing.

12. Press “SCROLL UP” key four times. “001234” is showing and the sixth digit is flashing.

13. Press “ENTER” key. “001234” flashes on the lower display and “ArE YOU SUrE” is showing on the upper display.

    - For yes, press “ENTER” key. “001234” stops flashing.

    - For no, press “SELECT” key. “000000” is showing and the first digit is flashing. Repeat this procedure to program the hourmeter again.

Note: In order to exit this procedure without saving any changes, press the exit key twice when the display shows “ArE YOU SUrE”. The GSC returns to the normal display. The original value for the hourmeter is kept in the memory of the GSC.

Note: Lower hours cannot be entered into the GSC if the GSC has a value that is stored. the upper display briefly shows “Error”. The display then shows the original hours that are stored in the GSC and the first digit is flashing.

14. Press “EXIT” key. “OP 1” is showing on lower display.

15. Press “EXIT” key. The display returns to the normal mode. The programmed value for the hourmeter should show on the lower display as the engine data scrolls.

i00933037

# Voltmeter/Ammeter Programming OP8

**SMCS Code:** 4490; 7451

OP8 is the option for programming the calibration value of the voltmeter and ammeter. When the GSC or the AC transformer box (ATB) is replaced, the calibration values, written on the ATB bar code sticker, must be programmed into the GSC in order to ensure accurate voltage values and accurate current values.

There are five transformers in the ATB that the GSC monitors for information on voltage and current. Each transformer has individual characteristics that affect the voltage and current measurements by the GSC. At the factory, these characteristics are measured, assigned a calibration value and recorded on the bar code sticker which is located on the lower left side of the ATB. When the generator set is assembled at the factory, the calibration values on the bar code sticker are programmed into the GSC. The calibration value of a transformer is from 0 to 255 in increments of 1.

The setpoints for the calibration value of the voltmeter and ammeter are in the following list.

AC01 – "A-B" Voltage Calibration. The value is selectable from 0 to 255.

AC02 – "B-C" Voltage Calibration. The value is selectable from 0 to 255.

AC03 – "C-A" Voltage Calibration. The value is selectable from 0 to 255.

AC04 – "A" Current Calibration. The value is selectable from 0 to 255.

AC05 – "B" Current Calibration. The value is selectable from 0 to 255.

AC06 – "C" Current Calibration. The value is selectable from 0 to 255.

## Procedure For Voltmeter/Ammeter Programming

Note: Service mode cannot be entered when the ECS is in the AUTO position.

Note: Any active shutdown fault must be made inactive in order to access service mode. A FLASHING shutdown indicator means that a shutdown fault exists. To temporarily change a shutdown fault from an active shutdown fault to an inactive shutdown fault, turn the ECS to the OFF/RESET position. To permanently change a shutdown fault from an active shutdown fault to an inactive shutdown fault, the fault must not be occurring. Also, the ECS must be turned to the OFF/RESET position. If the jumper from terminal 6 to terminal 9 is not installed on the ECS, then the GSC will not power up in OFF/RESET and any active shutdown fault must be corrected before entering service mode.

1. Turn the ECS to the STOP position in order to shut down the engine. Enter service mode and enter the password. "OP 1" is showing on lower display. See Systems Operation, "Service Mode" for more information. See the Systems Operation, "Password Entry OP3" for more information.

2. Press "SCROLL UP" key seven times. "OP 8" is showing on the lower display.

3. Press "SELECT" key. "AC01" is showing. The value of the setpoint is also showing. The value will range from 0 to 255.

4. Press "SELECT" key. The value of the setpoint is flashing.

5. Press "SCROLL UP" or "SCROLL DOWN" key to adjust the value of the AC01 setpoint to match the value shown on the ATB for "A-B" voltage.

6. Press "ENTER" key. The value of the setpoint stops flashing.

7. Press "SCROLL UP" key. Repeat steps 3, 4, 5 and 6 for setpoints AC02 through AC06.

8. Press "EXIT" key. "OP 1" is showing on the lower display.

9. Press "EXIT" key. The display will return to the normal mode.

i00933051

# Engine Setpoint Verification OP9

**SMCS Code:** 4490; 7451

OP9 is the option for verifying that EMCP II operates correctly when a fault occurs with low oil pressure, high coolant temperature or engine overspeed.

The GSC will shut down the engine during a engine overspeed fault. The GSC will shut down the engine or the GSC will sound the alarm during a low oil pressure fault. The programmed setpoint P03 determines the GSC response.

The GSC will shut down the engine or the GSC will sound the alarm during a high water temperature fault. Setpoint P03 determines the GSC response.

OP9 is only for verification of certain engine setpoints. OP5 is used for the actual programming of these setpoints. The setpoints that are verified by this procedure are listed below.

P03 Shutdown Override For Engine Fault – This action is the GSC response to a low engine oil pressure fault. This is also the GSC response to a high coolant temperature fault. The default setting from the factory is 0.

0 – engine shutdown

1 – alarm only (shutdown override)

P10 Engine Overspeed – P10 is the engine speed that is used by the GSC in order to declare that an engine overspeed fault exists. The setpoint for the engine overspeed for all 60 Hz applications is 1.18 times the rated speed. The range of values is from 50 to 4330 rpm. The value is set in increments of 10. The default setting from the factory is 2120 rpm.

P13 Low Oil Pressure Shutdown At Rated Speed – P13 is the selected oil pressure that is used by the GSC to declare that a low oil pressure shutdown fault exists. This setpoint is active with the engine at rated speed. Also, the engine speed must have exceeded the oil step speed for nine seconds. The range of values is from 34 to 420 kPa (5 to 61 psi). The value can be raised in increments of 1. The default setting from the factory is 205 kPa (30 psi).

Note: When oil pressure drops to 34 kPa (5 psi) of the P13 setpoint a low oil pressure alarm is issued by the GSC. If the generator is equipped, the optional alarm module issues an alarm also. The NFPA 99 remote annunciator will not issue an alarm.

P14 Low Oil Pressure Shutdown At Idle Speed – This setpoint tells the GSC when the GSC should declare that a low oil pressure shutdown fault exists with the engine at idle speed. The engine must have been running for at least nine seconds, and the engine speed must be less than the oil step speed. The fifth character of the model number specifies this setpoint. The default setting from the factory is 70 kPa (10 psi). The value is selectable from 20 to 336 kPa (3 to 50 psi) in increments of one.

Note: An oil pressure alarm is issued by the GSC when the oil pressure drops to 34 kPa (5 psi) of the P14 setpoint. When oil pressure is greater than the P14 setpoint, the GSC activates the EGR K1 relay. The GSC tells the electronic governor to go to the engine rated speed. When oil pressure is less than the P14 setpoint, the GSC deactivates the EGR K1 relay. The GSC tells the electronic governor to go to idle speed.

P15 High Water Temperature Shutdown – P15 is the coolant temperature that is used by the GSC to declare that a high coolant temperature shutdown fault exists. The fault is declared after a 10 second delay. The range of values is from 94° to 123°C (201° to 253°F). The value can be changed in increments of 1. The default setting from the factory is 107°C (225°F).

Note: When coolant temperature rises to 6°C (11°F) of the P15 setpoint, a high water temperature alarm is issued by the GSC. If the generator is so equipped the optional alarm module issues an alarm as well. The NFPA 99 remote annunciator will not issue an alarm.

The engine setpoints cannot be verified until the following conditions are met.

- The setpoints must be correct for the engine application. To view the setpoints, see Systems Operation, “Setpoint Viewing OP2”. To program the setpoints, see Systems Operation, “Setpoint Programming OP5”.
- When the operator is starting the engine, there should not be any faults. If necessary, troubleshoot and correct any fault.

## Procedure For Overspeed Verification

1. Start and run the engine at rated speed. Enter service mode. Enter the password. “OP 1” is showing on lower display. See Systems Operation, “Service Mode”for more information. See Systems Operation, “Password Entry OP3” for more information.

2. Press “SCROLL UP” key eight times. “OP 9” is showing on the lower display.

3. Press “SELECT” key. The value of overspeed setpoint P10 is showing on the upper display. “SC1” is showing on the lower display. “SC1” is followed by the present engine speed value.

4. Press “SELECT” key. The setpoint value is flashing on the upper display.

5. Decrease the value of the setpoint by pressing the “SCROLL DOWN” key. The value is flashing on the upper display. The default setting from the factory is 2120. The setpoint value decreases by 10 rpm with each press of the scroll down key. Continue pressing the key until the value of the setpoint is lower than the present engine speed value. The present engine speed value is showing on the lower display.

   When the setpoint value is less than the present engine speed value, the engine shuts down. The indicator for engine overspeed will be flashing. The GSC is not in service mode.

## Procedure For Low Oil Pressure Verification

Note: Service mode cannot be entered when the ECS is in the AUTO position.

1. Start and run the engine at rated speed. Enter service mode and enter the password. “OP 1” is showing on lower display. See Systems Operation, “Service Mode” for more information. See Systems Operation, “Password Entry OP3” for more information.

2. Press “SCROLL UP” key eight times. “OP 9” is showing on the lower display.

3. Press “SELECT” key. The value of overspeed setpoint P10 is showing on the upper display. The default setting from the factory is 2120. “SC1” is showing on the lower display. SC1 is followed with the present engine speed value.

4. Press the “SCROLL UP” key once. The value of the P13 setpoint for low oil pressure shutdown at rated speed is showing on the upper display. The default setting from the factory is 205 kPa (30 psi). “SC2” is showing on the lower display. SC2 is followed by the present oil pressure value.

5. Press “SELECT” key. The setpoint value is flashing on the upper display. The default setting from the factory is 205 kPa (30 psi).

6. Press the “SCROLL UP” key in order to increase the value of the setpoint. The setpoint value is flashing on the upper display. The setpoint value increases by five with each press of the “SCROLL UP” key. Continue pressing the key until the setpoint value increases past the present oil pressure. The present oil pressure value is showing on the lower display.

When the setpoint value is greater than the present oil pressure value, the engine shuts down. The indicator for low oil pressure will be flashing. The GSC is no longer in service mode.

## Procedure For High Water Temperature Verification

Note: Service mode cannot be entered when the ECS is in the AUTO position.

1. Start and run the engine at rated speed. Enter service mode and enter the password. “OP 1” is showing on lower display. See Systems Operation, “Service Mode” for more information. See Service Manual, “Password Entry OP3” for more information.

2. Press “SCROLL UP” key eight times. “OP 9” is showing on the lower display.

3. Press “SELECT” key. The value of overspeed setpoint P10 is showing on the upper display. The default setting from the factory is 2120. “SC1” is showing on the lower display. “SC1” is followed by the present engine speed value.

4. Press “SCROLL UP” key two times. The value of the P15 setpoint for high water temperature shutdown is showing on the upper display. The default setting from the factory is 107°C (225°F). SC3 is showing on the lower display. SC3 is followed by the present coolant temperature value.

5. Press “SELECT” key. The setpoint value is flashing on the upper display. The default setting from the factory is 107°C (225°F).

6. Decrease the setpoint by pressing the “SCROLL DOWN” key. The value is flashing on the upper display. The setpoint value decreases by five degrees with each press of the “SCROLL DOWN” key. Continue pressing the key until the setpoint value decreases past the present coolant temperature value. The present coolant temperature value is showing on the lower display.

When the setpoint value is less than the present coolant temperature value, the engine shuts down. The indicator for high water temperature will be flashing. The GSC is no longer in service mode.

i01124801

# AC Offset Adjustment OP10

**SMCS Code:** 4490; 7451

Table 7

| OP10 Setpoints[1] - AC Offset Adjustment | | | | |
|---|---|---|---|---|
| **Setpoint** | **Name** | **Description** | **Range Of Value** | **Factory Default** |
| PH A | Phase A Voltage Adjustment | Value used by the GSC in order to offset the voltmeter (for the phase A to neutral reading) from the actual voltage measurement. | –5.0% to +5.0% of measured voltage in increments of 0.04% | 0 |
| PH B | Phase B Voltage Adjustment | Value used by the GSC to offset the voltmeter (for the phase B to neutral reading) from the actual voltage measurement. | –5.0% to +5.0% of measured voltage in increments of 0.04% | 0 |
| PH C | Phase C Voltage Adjustment | Value used by the GSC to offset the voltmeter (for the phase C to neutral reading) from the actual voltage measurement. | –5.0% to +5.0% of measured voltage in increments of 0.04% | 0 |
| PH A-B | Phase A-B Voltage Adjustment | Value used by the GSC to offset the voltmeter (for the phase A to phase B reading) from the actual voltage measurement. | –5.0% to +5.0% of measured voltage in increments of 0.04% | 0 |
| PH B-C | Phase B-C Voltage Adjustment | Value used by the GSC to offset the voltmeter (for the phase B to phase C reading) from the actual voltage measurement. | –5.0% to +5.0% of measured voltage in increments of 0.04% | 0 |
| PH C-A | Phase C-A Voltage Adjustment | Value used by the GSC to offset the voltmeter (for the phase C to phase A reading) from the actual voltage measurement. | –5.0% to +5.0% of measured voltage in increments of 0.04% | 0 |

[1] The setpoints are programmed to the default value at the factory. The setpoints may be changed in order to satisfy the customer requirements or the application requirements.

OP10 is the option for adjusting the voltmeter readings of the GSC. This adjustment may be necessary when generator sets are operated in parallel. The GSC AC voltage measurements are calibrated at the factory. An accurate standard is used. However, when two generator sets are paralleled, the application may require the paralleled generator sets to have exactly the same voltage value. The AC offset of one GSC is changed to match the voltage value of another generator set.

Note: It is NOT recommended that the AC offset be altered under any other circumstances. Performing this procedure takes the GSC out of factory calibration.

## Procedure For Voltmeter Offset Adjustment

The paralleled generator sets must be running at rated speed. The generator sets can then have the voltage adjustment made.

Note: Service mode cannot be entered when the ECS is in the AUTO position.

1. Enter service mode on the GSC that is being adjusted. Enter the password. “OP 1” is showing on lower display. For more information, see the Systems Operation, “Password Entry OP3”.
2. Press “SCROLL UP” key nine times. “OP 10” is showing on the lower display.
3. Press “SELECT” key. “AC CAL” is showing on lower display. The present A-B voltage value is showing on the upper display.
4. Press “SELECT” key. The voltage value is flashing.
5. Press the “SCROLL UP” key or press the “SCROLL DOWN” key in order to adjust the voltage. Adjust the value to exactly match the other generator set(s) that are running in parallel. Voltage value continues to flash.
6. Press “ENTER” key. The value of the setpoint stops flashing.
7. Press “SCROLL UP” key. Repeat steps 3, 4, 5 and 6 for the B-C voltage and the C-A voltage.
8. Press “EXIT” key. “OP 1” is showing on the lower display.
9. Press “EXIT” key. The display returns to the normal state.

i01192575

# Fault Description

**SMCS Code:** 4490; 7451

A fault is any condition that does not conform to the GSC operating rules. A fault is an abnormal condition. An active fault is a fault that is occurring now. An inactive fault is a fault that previously occurred. Some examples of a fault are listed below.

- Coolant temperature is 123°C (254°F). This is a high water temperature fault.
- Engine speed is 4500 rpm. This is a fault for the engine overspeed.
- There is a broken wire in the engine harness. This is a diagnostic code.
- There is a failed oil pressure sensor. This is a diagnostic code.

There is a level of severity that is attached to every fault. This level also describes the GSC response to the fault. Faults are either a noncritical alarm fault or a critical shutdown fault.

An alarm fault provides an early warning of a possible future shutdown fault to the operator. During an alarm fault, the GSC will automatically activate the alarm mode. The fault alarm indicator FLASHES. See Systems Operation, “Alarm Mode” for more information.

A shutdown fault tells the GSC to shutdown the engine. This shutdown prevents damage to the generator set. For a shutdown fault, the GSC automatically activates shutdown mode. Shutdown mode shuts down the engine. The corresponding shutdown indicator flashes automatically. See Systems Operation, “Shutdown Mode” for more information.

Most faults have a code. There are three types of fault codes. The type of fault code is derived from the related GSC input. The three types of fault codes are listed below.

- AL Fault Codes are shown as “AL1” through “AL3” on the upper display. AL fault codes include specific fault conditions such as an alarm for the low engine oil pressure.
- SP fault codes are shown as “SP1” through “SP3” on the upper display.
- Diagnostic Codes are numeric values that are identified by the illumination of “CID” and “FMI” on the upper display.

Note: There are no fault codes for the shutdown faults that correspond to the dedicated shutdown indicators. Each of these shutdown faults are identified to the operator by the nomenclature that is nearest to the dedicated shutdown indicator. An example would be low oil pressure shutdown.

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# AL Fault Codes

**SMCS Code:** 4490; 7451

AL fault codes are shown as AL1 through AL3 on the upper display. The fault codes include specific engine fault conditions. For example, a specific fault would be low engine oil pressure. The fault codes also include functions for protective relaying. The underfrequency fault is an example of a protective relaying function.

AL fault codes rely upon certain setpoints. See Systems Operation, “Service Mode” for more information on setpoints. AL fault codes are not stored in the fault log of the GSC. Many of the AL fault codes are programmable as a fault alarm or as a fault shutdown. To show the severity of the fault, the AL fault codes are accompanied by the fault alarm indicator, or the fault shutdown indicator on the GSC. The AL fault codes and the related setpoints are described in the paragraphs that follow.

AL1 High Water Temperature Alarm – The GSC issues a high water temperature shutdown when the engine coolant temperature comes within 6°C (11°F) of setpoint P15. The fault alarm indicator will FLASH. The AL1 fault code is shown on the upper display after the “Alarm Fault Codes” key is pressed.

P15 is the setpoint for high water temperature shutdown. The GSC uses the temperature in order to declare that a high water temperature shutdown is present. When the setpoint is reached, the dedicated shutdown indicator for high water temperature FLASHES and the engine is shutdown.

AL2 Low Water Temperature Alarm – When the engine coolant temperature decreases to setpoint P16, the GSC issues a low water temperature alarm. The fault alarm indicator will FLASH and the AL2 fault code is shown on the upper display after the alarm codes key is pressed.

P16 is the setpoint for a low water temperature alarm. This setpoint tells the GSC when a low water temperature alarm “(AL2)” exists.

AL3 Low Oil Pressure Alarm – The GSC issues a low oil pressure alarm when the engine oil pressure drops to within 34 kPa (5 psi) of the P13 setpoint or the P14 setpoint. The fault alarm indicator will FLASH and the “AL3” fault code is shown on the upper display after the alarm codes key is pressed.

P13 is the setpoint for low oil pressure shutdown at rated speed. When the setpoint is reached, the dedicated shutdown indicator for low oil pressure flashes and the engine is shut down.

P14 is the setpoint for low oil pressure shutdown at idle speed. When the setpoint is reached, the dedicated shutdown indicator for low oil pressure FLASHES and the engine is shutdown.

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# SP Fault Codes

**SMCS Code:** 4490; 7451

SP fault codes are associated with the spare inputs. SP fault codes are either alarm faults or shutdown faults. The four spare inputs and a spare output are for meeting the needs of the customer.

- The active state can be programmed to be high or low.
- The SP fault code can be designated as an alarm fault.
- The SP fault code can be designated as a shutdown fault.
- Delay time can be programmed.

See Systems Operation, “Spare Input/Output Programming OP6”. The spare inputs consist of SP1 through SP3. Also, the corresponding SP fault codes consist of SP1through SP3.

Alarm Mode Sequence Of Operation – The following procedure happens when a fault occurs in a spare input with the fault that is programmed as an alarm fault.

- The GSC waits for the end of the time delay.
- The fault alarm indicator FLASHES.
- When the alarm codes key is pressed, the corresponding fault code SP1, SP2 or SP3 is shown on the upper display.
- The engine continues to run or the engine is able to start.

Shutdown Mode Sequence Of Operation – When a fault occurs in a spare input the spare input is active. If the spare input is programmed as a shutdown fault, then the GSC will operate in the following manner.

- The GSC waits for the end of the time delay.
- The fault shutdown indicator FLASHES.
- The corresponding fault code SP1, SP2 or SP3 is immediately shown on the upper display of the GSC.
- The engine is shut down or the engine is disabled from starting.

The fault shutdown indicator remains FLASHING. The SP fault code remains shown until the ECS is turned to “OFF/RESET”. After turning the ECS to “OFF/RESET” and correcting the cause of the spare fault, the engine is able to run.

Note: Spare faults are not logged into the GSC fault log.

Note: Spare faults that are programmed to shut down the engine are ignored by the GSC when the engine speed is less than the crank terminate speed.

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# Diagnostic Codes

**SMCS Code:** 4490; 7451

Diagnostic codes are associated with failed electrical components or circuits. These components or circuits provide information to the GSC or the components or circuits receive information from the GSC. The diagnostic codes are designated as alarm faults or shutdown faults. See Systems Operation, “Shutdown Mode”for more information. See Systems operation, “Alarm Mode”for more information.

Alarm Mode Sequence Of Operation – When an alarm fault occurs the GSC performs the following steps.

- The GSC activates the alarm mode.
- The fault alarm indicator FLASHES.
- When the alarm codes key is pressed, the corresponding diagnostic code (CID FMI) is shown on the upper display.
- The engine continues to run or the engine is able to start.

Shutdown Mode Sequence Of Operation – When a shutdown fault occurs the GSC performs the following steps.

- The GSC activates shutdown mode.
- The fault shutdown indicator FLASHES.
- The corresponding diagnostic code (CID FMI) is immediately shown on the upper display.
- The engine is shut down or the engine cannot be started.

The diagnostic code (CID FMI) closely identifies the cause of the fault. Each diagnostic code consists of two identifiers and an indicator. The identifiers are shown on the upper display. Service personnel interpret the identifiers in order to assist with troubleshooting.

The indicators are listed below.

Component Identifier (CID) – The CID is a three digit code. The code that is indicated corresponds to a faulty component. The CID is shown on the upper display. For example, a “190” is the code for the circuit for the engine magnetic pickup (MPU). See the Testing And Adjusting, “Troubleshooting Diagnostic Codes” for a list of CID codes.

Failure Mode Identifier (FMI) – The FMI is a two digit code. The FMI tells the type of failure that has occurred. The FMI is shown on the upper display at the same time as the CID. For example, FMI “3” means that the signal voltage is too high. See Testing And Adjusting, “Troubleshooting Diagnostic Codes” for a list of failure mode identifiers.

DIAG indicator – When “DIAG” is FLASHING, the diagnostic code (CID FMI) that is shown on the upper display is active. When “DIAG” is ON CONTINUOUSLY there is an inactive diagnostic fault. The diagnostic codes are recorded in the fault log. Also, see Systems Operation, “Fault Log Viewing OP1”. When “DIAG” is not showing, there are NO diagnostic codes that have been detected.

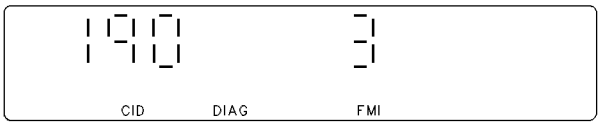



Illustration 22 g00318043

Upper Display That Is Showing A “CID 190 FMI 3” Diagnostic Code

The above example shows a diagnosed fault. Also, that fault is sending the information to the GSC for display. The GSC is receiving a signal from the engine speed sensor (CID 190). The signal is too high so the FMI is 3. The signal is being received at this time so “DIAG” is FLASHING.

Note: The GSC response (alarm or shutdown) to four diagnostic faults is programmable by service personnel. The response that is usually programmed into the GSC is for an alarm. P04 would then be “0”. When a shutdown response is programmed P04 would be “1”. See Setpoint P04 within Systems Operation, “Engine/Generator Programming OP5”. The following diagnostic codes are diagnostic faults: pressure sensor (engine oil) (CID 100), temperature sensor (engine coolant) (CID 110), fluid level sensor (engine coolant) (CID 111), and sensor power supply (CID 269).

The GSC has a fault log to help with troubleshooting of diagnostic faults. Inactive diagnostic codes (CID FMI) are recorded in the fault log for viewing at a later time. Also, the number of occurrences are totalled. The number of occurrences are shown on the upper display. The diagnostic codes are also shown on the upper display. An active diagnostic alarm fault is signified by “DIAG” FLASHING on the upper display. When a diagnostic alarm fault becomes inactive “DIAG” is ON CONTINUOUSLY. When the fault is no longer occurring the ECS must be turned to “OFF/RESET”. When a diagnostic shutdown fault becomes inactive “DIAG” is ON CONTINUOUSLY. When the fault is no longer occurring the ECS must be turned to “OFF/RESET”. The GSC stores a maximum of 12 diagnostic codes in the fault log.

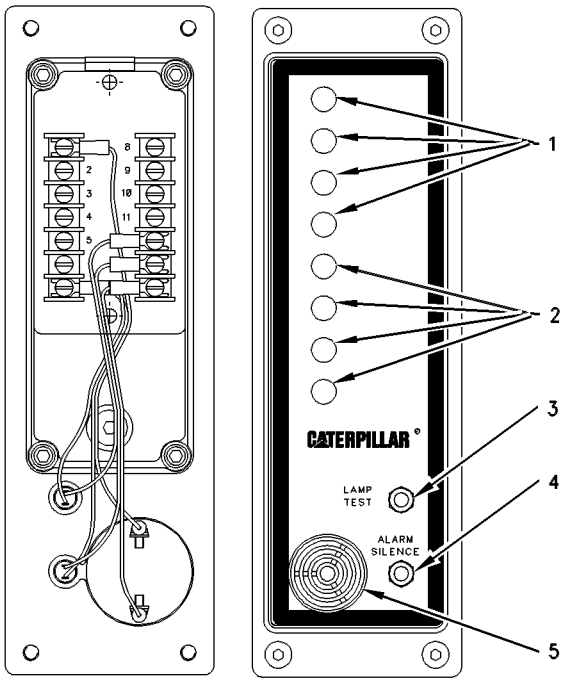
If an additional diagnostic fault becomes inactive, the GSC automatically clears the earliest diagnostic code. The GSC puts the additional diagnostic code in the fault log. Inactive diagnostic codes that are more than 750 engine hours old are cleared automatically by the GSC. Only diagnostic codes are recorded in the fault log. AL fault codes and SP fault codes are not recorded in the fault log. See Systems Operation, “Fault Log Viewing OP1”.

Clear diagnostic codes from the fault log after correcting the fault. Clearing old codes will help avoid confusion. When all diagnostic faults are cleared from the fault log and no active diagnostic faults exist the DIAG indicator is OFF. See Systems Operation, “Fault Log Clearing OP4” .

i01170083

# Alarm Modules

**SMCS Code:** 4490; 7451




g00321237

Illustration 23

Alarm Module

(1)Amber indicators. (2)Red indicators.(3)Lamp test switch.(4)Alarm silence switch.(5)Horn.

The alarm module (ALM) is an attachment. The ALM is located on the instrument panel. Red indicators (2) and amber indicators (1) are the visual indicators. The horn (5) is the audible indicator. The ALM is designed to be powered by only a 24 DCV battery system or a 32 DCV battery system.

There are six versions of the basic module. The modules are either alarm modules or a remote annunciator. The term “remote annunciator” is used but the annunciator is the same basic alarm module. The versions are listed below.

- NFPA 99 Standby alarm module.
- A NFPA 99 remote annunciator which is used with a standby NFPA 99 alarm module.
- NFPA 110 Standby alarm module which is used with NFPA 110 remote annunciator panel. See Systems Operation, “Alarm Module Control (NFPA 110)”.
- Prime power single engine alarm module .

- Prime power multiple engine alarm module.

- EMCP II remote annunciator.

The only difference between these modules is in the graphics film on the front of the panel and the jumper wires on the rear. See the Testing And Adjusting, “DC Schematic”. The NFPA 99 remote annunciator and the remote annunciator for the EMCP II have a lamp test switch.

The alarm module (ALM) gives a warning of conditions that are becoming a problem. The warning occurs before conditions are severe enough to shut down the engine.

If an alarm fault develops with the ECS in the COOLDOWN/STOP or AUTO positions, then the fault is indicated by the optional alarm module and/or the remote annunciator.

## Description of Change

Note: In the following description, the word “annunciator” may mean “alarm module” or “remote annunciator module”.

The annunciator module receives data from switch inputs, internal circuitry, and a serial data link from the GSC.

### Switch Inputs

Four inputs are available as connections for the switch inputs. Switch inputs are activated when the inputs are connected to the battery negative terminal (“B–”). See Table 8.

### Internal Circuitry

Internal circuitry is used in order to determine if the DC battery supply voltage is too low. The setpoint is set at the factory at 24 DCV.

### Data Link

The annunciator module receives data from the generator set control (GSC) by a serial data link. The items that are included in this data stream of information are listed below.

**1.** Coolant temperature has exceeded the high temperature alarm setpoint that is programmed into the GSC.

**2.** Oil pressure is below the low oil pressure alarm setpoint that is programmed into the GSC.

**3.** Coolant temperature is below the setpoint for the low temperature alarm that is programmed into the GSC.

**4.** The engine control switch (ECS) is not in the MAN/START position or the AUTO position.

**5.** Oil pressure is below the setpoint for the low oil pressure shutdown that is programmed into the GSC.

**6.** Coolant temperature has exceeded the setpoint for the high water temperature shutdown that is programmed into the GSC.

**7.** The engine has failed to start.

**8.** The engine speed exceeded the setpoint for the engine overspeed that is programmed into the GSC.

**9.** The engine is shut down due to a coolant loss fault.

**10.** The engine shut down due to a spare fault.

**11.** The engine shut down due to an emergency stop fault.

**12.** The engine shut down due to a diagnostic fault.

The first eight items control the operation of the indicators and horn. See Table 8 for more information. The last four items control the operation of the horn only.

A maximum of three modules are connected to the serial data link: alarm, CIM, and RDM. The maximum distance between a module and the GSC is 305 m (1000 ft).

The data link will malfunction under the following conditions with multiple modules:

- One of the modules is powered down. (“B+” or “B-” is disconnected.)

- The module that is powered down remains connected to the data link.

Under these conditions, the indicators that are controlled by the data link of the other modules that are powered up will flash at .5 Hz.

## Indicator And Horn Operation

Table 8

| Indicator And Horn Function | | | | | | |
|---|---|---|---|---|---|---|
| **Indicator Color** | **NFPA 99 ALM** | **NFPA 100 ALM** | **NFPA 99 RAN** | **Prime Power Single Engine** | **Prime Power Multi Engine** | **EMCP RAN** |
| 1 Amber | High Coolant Temp Alarm LI, H, LAT, TD | High Coolant Temp Alarm LI, H, LAT, TD | Gen On Load SW(3) | High Coolant Temp Alarm LI, H, LAT, TD | High Coolant Temp Alarm LI, H, LAT, TD | High Coolant Temp Alarm LI, H, LAT, TD |
| 2 Amber | Low Coolant Temp Alarm LI, H, LAT | Low Coolant Temp Alarm LI, H, LAT | Low Coolant Temp Alarm LI, H, LAT | Low Coolant Level Alarm SW(2), H | Low Coolant Level Alarm SW(2), H | Low Coolant Temp Alarm LI, H, LAT |
| 3 Amber | Low Oil Press Alarm LI, H, LAT | Low Oil Press Alarm LI, H, LAT | Charger Malfunction SW(4), TIM | Low Oil Press Alarm LI, H, LAT | Low Oil Press Alarm LI, H, LAT | Low Oil Press Alarm LI, H, LAT |
| 4 Amber | Low Fuel Level SW(1), H | Low Fuel Level SW(1), H | Low Fuel Level SW(1), H | Low Oil Level SW(1), H | Low Oil Level SW(1), H | Not In Auto LI, H |
| 5 Red | Not In Auto LI, H | Not In Auto LI, H | High Coolant Temp Shutdown(1) LI, H, TD | Low DCV INT, TIM | Not In Auto LI, H | High Coolant Temp Shutdown(1) LI, H, TD |
| 6 Red | Low DCV INT, TIM | Low DCV INT, TIM | Low Oil Press Shutdown(1) LI, H | Spare SW(3) | Low DCV INT, TIM | Low DCV INT, TIM |
| 7 Red | Spare SW(3) | Charger Malfunction SW(4), TIM | Overcrank Shutdown(1) LI, H | Not Used | Spare SW(3) | Overcrank Shutdown(1) LI, H |
| 8 Red | Spare SW(4) | Air Damper Closed(2) | Overspeed Shutdown(1) LI, H | Not Used | Spare SW(4) | Overspeed Shutdown(1) LI, H |
| | SW(2) Not Used | SW(2) Not Used | SW(2) Not Used | SW(2) Not Used | | |

(1) Latched by the GSC
(2) Air Damper Switch to be supplied by customer.

Table 9

ALM = Alarm Module

H = Horn is sounded

INT = The signal source is internal to the module

LAT = LATCHED alarm fault

LI = The data link from the GSC is the signal source

RAN = Remote Annunciator

SW = One of 4 switches is the signal source (the number in parentheses indicates which switch is the signal source

TD = A 10 second delay occurs before the fault is annunciated

TIM = A 60 second delay occurs before the fault is annunciated

When an alarm fault occurs, the corresponding indicator flashes. The indicator flashes at two hertz and the horn sounds. If the alarm fault is NOT LATCHED, the indicator turns off when the alarm fault ceases. The horn also turns off when the alarm fault ceases. If the alarm fault is LATCHED, the indicator continues to flash until the “acknowledge/silence” input is activated. See Table 8 for LATCHED alarm faults as well as the indicator and horn functions for each operating mode.

Normally switch input 3 (terminal 10) and switch input 4 (terminal 11) only operate indicators 7 and 8. However, switch inputs 3 and 4 can be made to also operate the horn. Connect terminal 10 (“sw input 3”) to terminal 3 and connect terminal 11 (“sw input 4”) to terminal 4.

## Alarm Silence

Activating the alarm silence switch (4) causes the horn to cease and the indicator to stay on continuously.

## Data Link Malfunction

If the data link malfunctions, the indicators that are controlled by the data link flash at 0.5 hertz. The switch controlled indicators function normally.

## Lamp Test

Activating the lamp test switch (3) results in sounding the horn and turning on all indicators continuously for 10 seconds or until the switch is deactivated.

## Mode Selection

Table 10

| Mode Selection And Switch Input Connections[1] | | | | | | |
|---|---|---|---|---|---|---|
| **Input** | **Mode SEL1** | **Mode SEL2** | **Switch 1** | **Switch 2** | **Switch 3** | **Switch 4** |
| **Terminal** | **5** | **6** | **8** | **9** | **10** | **11** |
| | | | | | | |
| **Mode** | | | | | | |
| NFPA 99 Alarm | (Float) | (Float) | Low Fuel Level | (Float) | Spare | Spare |
| NFPA 110 Alarm | (Float) | (B-) | Low Fuel Level | (Float) | Air Damper Closed | Charger Malfunction |
| NFPA 99 Remote Annunciator | (B-) | (Float) | Low Fuel Level | (Float) | Gen On Load | Charger Malfunction |
| Prime Power Single Engine | (Float) | (Float) | Low Oil Level | (B-) | (Spare) | Low Coolant Level |
| Prime Power Multi Engine | (B-) | (B-) | Low Oil Level | Low Coolant Level | (Spare) | (Spare) |
| EMCP RAN | (Float) | (B-) | (Float) | (B-) | (Float) | (Float) |

[1] NOTE: Connections in parentheses are required to select the mode specified

The annunciator module operates in one of the six modes described in Table 10. The modes are selected by connections made to the mode select inputs (terminals 5 and 6) and switch 2 input (terminal 9) as shown in Table 10.

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# Alarm Module Control (NFPA 110)

**SMCS Code:** 4490; 7451

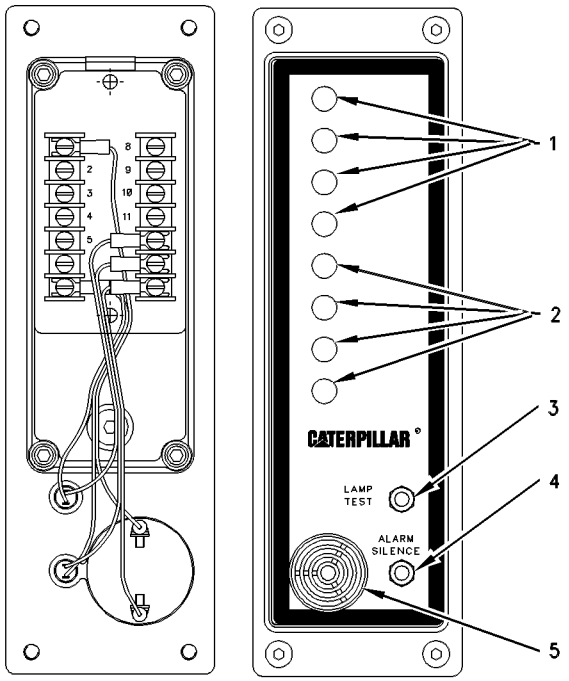


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Illustration 24

Alarm Module

(1) Amber Indicators. (2) Red Indicators. (3) Lamp Test Switch. (4) Alarm Silence Switch. (5) Horn.

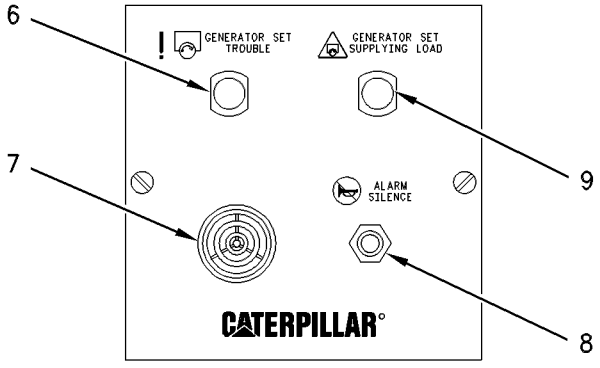


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Illustration 25

NFPA 110 Remote Annunciator Panel

(6) Trouble Indicator. (7) Horn. (8) Alarm Silence Switch. (9) Load Indicator.

This remote panel functions in conjunction with the NFPA 110 alarm module. The alarm module is mounted in the right side of the instrument panel. When an alarm occurs on the alarm module or a fault occurs on the GSC, horns (5) and (7) sound in both the alarm module and the remote annunciator. Trouble indicator (6) lights in the remote annunciator panel. The appropriate alarm indicator also lights in the alarm module or the appropriate fault indicator flashes in the GSC. The remote annunciator is designed to operate when powered by only 24 DCV or 32 DCV battery systems.

The horns stop sounding when alarm silence switch (8) is pressed on the remote panel. Also, the horns stop sounding when alarm silence switch (4) is pressed on the alarm module. Trouble indicator (6) on the remote panel also goes out. The indicator on the alarm module or the indicator in the GSC remains on. Another alarm fault will reactivate the horns and indicators.

Trouble indicator (6) also acts as a test switch on the remote panel. When indicator (6) is pressed, horn (7) and indicator (6) turn on. The alarm module is not affected by the test switch.

Load indicator (9) is triggered by a transfer switch or similar device. When the transfer switch provides a ground signal, load indicator (9) is ON.

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# Alarm Module Control (Custom)

**SMCS Code:** 4490; 7451

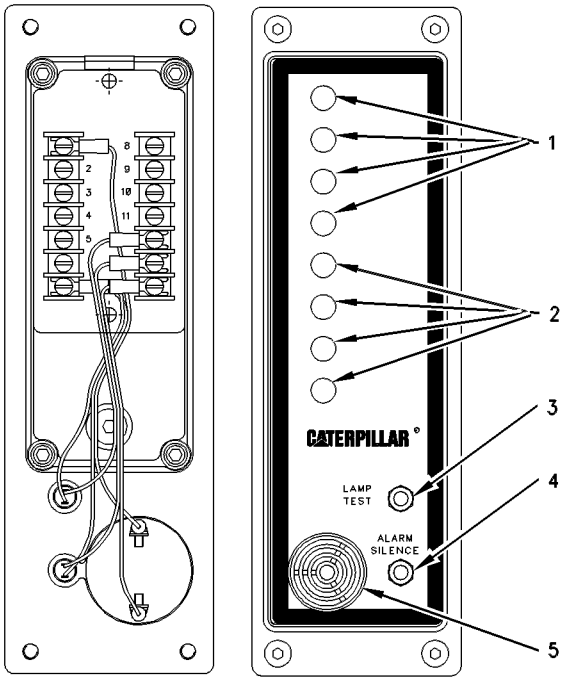


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Illustration 26

Custom Alarm Module (CAM)

(1) Amber indicators. (2) Red indicators. (3) Lamp test switch. (4) Alarm silence switch. (5) Horn.

Table 11

| Connections For Customer Alarm Module | |
|---|---|
| **Screw Terminal** | **Signal Name** |
| 1 | B+ |
| 2 | Not Used |
| 3 | Input 5 - Indicator 5 (Red) |
| 4 | Input 6 - Indicator 6 (Red) |
| 5 | Input 7 - Indicator 7 (Red) |
| 6 | Input 8 - Indicator 8 (Red) |
| 7 | B- |
| 8 | Input 1 - Indicator 1 (Amber) |
| 9 | Input 2 - Indicator 2 (Amber) |
| 10 | Input 3 - Indicator 3 (Amber) |
| 11 | Input 4 - Indicator 4 (Amber) |
| 12 | Lamp Test |
| 13 | Horn Silence |
| 14 | Horn Output |

The custom alarm module (CAM) is an attachment that can be mounted at the generator set or at a remote location. The CAM annunciates faults, alarms or other conditions. Customer supplied inputs give the CAM this information.

The CAM operates when it is powered only by 24 DCV or 32 DCV battery systems. The CAM is equipped with a horn, alarm silence switch, a lamp test switch, and 8 switched inputs for customer use.

Note: A basic version of the CAM also exists. The basic version does not have a horn, an alarm/silence switch or a lamp test switch. The basic CAM is to be used with a existing fully equipped CAM or ALM.

### Alarm Operation

A given switch input corresponds to 1 of 8 indicators on the face of the CAM. The indicators will FLASH at a rate of 2 hertz when the corresponding input is closed to battery negative. The red indicators are used to display shutdown conditions, and the amber indicators are used to display alarm conditions.

When an input corresponding to one of the red indicators is activated, the indicator will flash and the horn will sound. The input is connected to battery negative when the input is active. When the input is disconnected from battery negative, the horn will continue to sound and the red indicator will continue to flash. This annunciation continues until the alarm silence switch is pressed.

When an input corresponding to one of the amber indicators is activated, the indicator will flash. The horn does NOT sound. When the input is disconnected from battery negative, the amber indicator will turn off.

### Alarm Silence Function

The alarm silence switch is activated by connecting the corresponding input to battery negative.

When an input is connected to battery negative, activating the alarm silence switch causes the horn to cease. The indicator stops flashing and the indicator changes to being ON continuously. The alarm silence function will be overridden if the following event occurs. The status of any of the eight switched inputs changes and this change causes additional inputs to be closed to battery negative.

The alarm silence function will not be overridden if the change in status is the opening of any of the inputs from battery negative. The indicators will turn off when the corresponding input is disconnected from battery negative.

### Lamp Test Function

Activating the lamp test switch results in sounding the horn and turning on all indicators continuously for 10 seconds or until the switch is deactivated. The lamp test input can be wired to the switch of another alarm module.

### Customized Labeling

The condition that is being monitored by each indicator is determined by the customer. The 130-3326 Film provides a wide variety of labels for the customer to customize the CAM to an application.

i00934916

# Relay Driver Module

**SMCS Code:** 4490; 7451

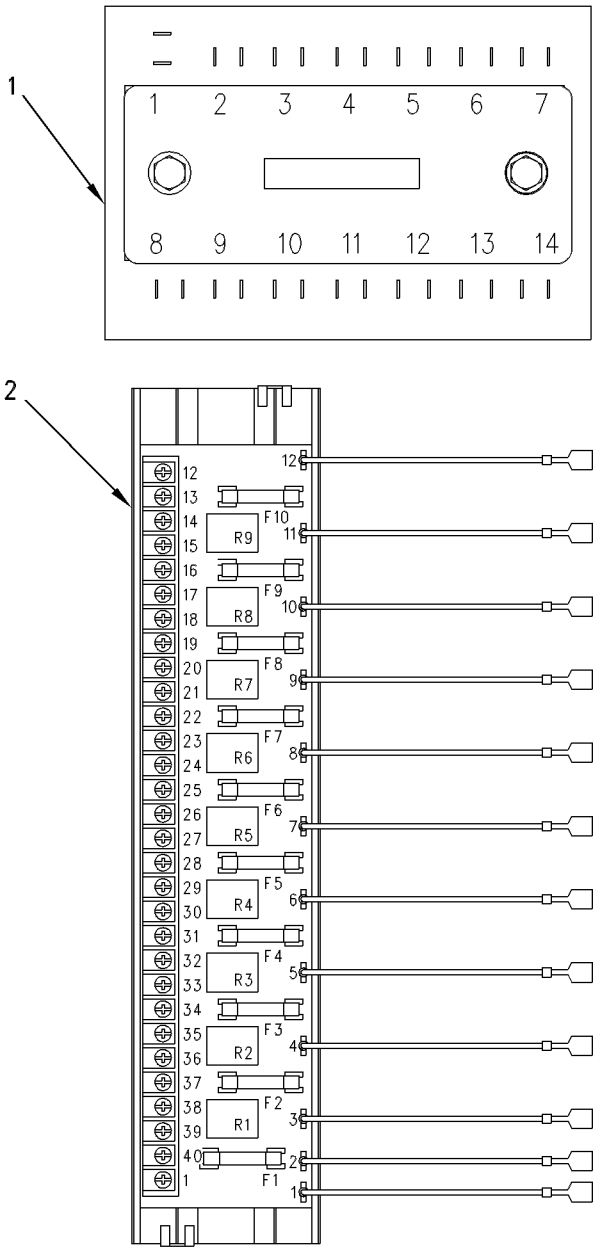


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Illustration 27

(1) Relay driver module. (2) Relay board (optional).

Note: Only the latest generator set controls (GSC) have the relay driver module (RDM) capability. Earlier 123-6004, 133-6350 and 136-3870 EMCP Electronic Controls do not have the RDM capability. On the latest GSC's, setpoint SP11 must be programmed to the value 9. This tells the GSC to provide serial data at the spare output. See Systems Operation, “Spare Input/Output Programming OP6”.

The relay driver module (RDM) is an optional module that can be used to expand the number of available outputs on the GSC. The RDM outputs are controlled by the customer communication module (CCM). For use by the customer, the RDM provides nine additional outputs. The RDM outputs are individually controlled by a serial data link from the GSC. These outputs may drive the optional relay board or these outputs can be directly connected to horns, lamps, or other devices. The relay board contains nine relays. Each relay has one set of NO and NC contacts for use by the customer. These relays are distinct from the seven relays contained within the relay module on the rear of the GSC. These relays are in addition to the seven relays contained within the relay module on the rear of the GSC.

**Output Test**

When an output test signal is received, the RDM activates all outputs for 10 seconds. The operator can deactivate the test signal early. To do an output test, connect terminal 5 of the RDM to terminal 7 of the RDM with a jumper. When the data link malfunctions, R1 output at terminal 2 of the RDM will FLASH at a rate of 0.5 Hz. Relays R2 through R9 will maintain the present state, or the relays will default to OFF. This is controlled by a jumper between terminals 6 and 7 of the RDM. The relay outputs will maintain the present state if a jumper is NOT present. If the jumper is present, R2 through R9 will default to OFF.

**Specifications:**

- The maximum distance between the RDM and the GSC is 305 m (1000 ft).
- The operating voltage range is from 15 to 45 DCV.
- The RDM is designed to operate when powered by 24 DCV or 32 DCV battery systems.
- The RDM is capable of operating with an earth ground or without an earth ground.
- The RDM must share a common ground with the GSC and the relay board.
- The terminals on the RDM are 6.4 mm (.25 in.) push on blade type connectors.
- The terminals on the relay board are 6-32 screw terminals.
- The driver outputs of the RDM are intended to drive incandescent lamps or relay loads. The driver outputs sink up to 600mA at 15 to 45 DCV. The driver outputs are protected against short circuits to B±.
- The relay outputs of the relay board are protected by 1 amp fuses. The contacts are flashed silver. The contacts are rated at 1A at 28 DCV. The relay coils draw 20mA at 24 DCV.

Note: The GSC diagnoses a fault in the relay driver module circuit. See Testing and Adjusting, “Diagnostic Fault Codes, CID 334”. The CID 334 procedure also contains schematics for relay driver module installation purposes.

i00934964

# Synchronizing Lights Module

**SMCS Code:** 4490; 7451

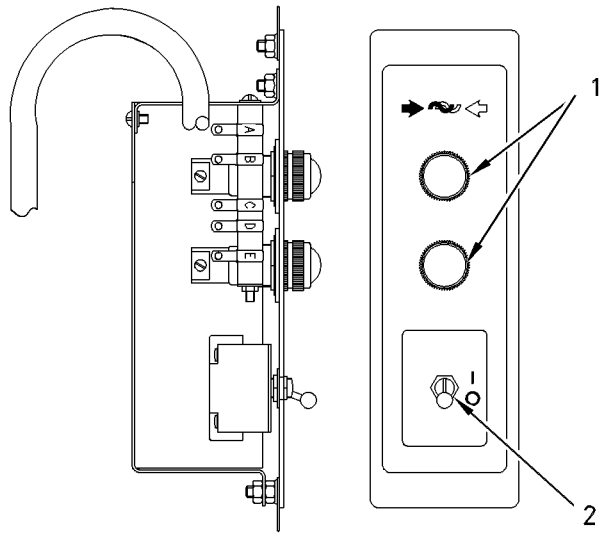


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Illustration 28

Synchronizing Lights Module

(1) Synchronizing lights. (2) Synchronizing switch.

The synchronizing lights module is optional. The synchronizing lights module is located on the instrument panel (right side).

The synchronizing lights module is not used when the panel is equipped with an electronic governor.

Synchronizing lights (SL) are used as an aid for paralleling the generators that are independent of the load. Two lights are in the module. Each light is connected to the side with the load of the generator output circuit breaker. The voltage of two phases are measured. The lights are used to indicate to the operator when the voltages are in-phase. Close the circuit breaker now. The generator is on the line with the other generators.

Note: For a complete explanation on the procedure to parallel two units, make reference to the Operation And Maintenance Manual, SEBU6918, “SR4B Generators and Control Panels”.

## Installation Of The Synchronizing Module

**⚠ WARNING**

**To avoid electrical shock and personal injury, shutdown all on-line gensets before installing or repairing the synchronizing module.**

Note: For the connection of the synchronizing light module, see the Testing And Adjusting, “Schematic and Wiring Diagrams”.

Make an orderly shutdown of all generators connected to the system. Connect the wires of the synchronizing light module to the terminals, as shown below.

1. Connect wire L1 to terminal L1 of TS1 in the generator housing.
2. Wire L3 to terminal L3 of TS1 in the generator housing.
3. Wire T11 to terminal 2 of fuse F13 on the AC transformer box (ATB).
4. Wire T13 to terminal 2 of fuse F15 on the AC transformer box (ATB).

The customer is responsible for providing the proper electrical material that is needed to connect L1 and L3. L1 and L3 connect to the side of the generator output circuit breaker with the load. See the Testing And Adjusting, “Schematics And Wiring Diagrams”.

Adjust the connection of the wires on the taps of the synchronizing resistors. Adjust the connection for the particular AC voltage for the generator to the requirements below.

208 ACV line to line ..... taps E to D (1760Ω)
240 ACV line to line ..... taps E to C (2400Ω)
300 ACV line to line ..... taps E to B (5600Ω)
380 ACV line to line ..... taps E to B (5600Ω)
400 ACV line to line ..... taps E to B (5600Ω)
416 ACV line to line ..... taps E to A (7200Ω)
480 ACV line to line ..... taps E to A (7200Ω)

Note: Remove the synchronizing module cover for access to the resistor taps.

Example – The following connection is for a generator with a line voltage of 400 volts. Connect wire T11 to tap B of SLR1. Also, connect wire T13 to tap B of SLR2. See the Testing And Adjusting, “Schematics And Wiring Diagrams”.

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## Synchronizing Lights Module With Reverse Power Relay

**SMCS Code:** 4490; 7451

Note: The synchronizing lights module with the reverse power relay option has the same operation as the module without the reverse power relay. An exception is the reverse power relay (RPR) that is mounted on the subpanel within the control panel.

For information on the synchronizing lights module, see the Systems Operation, “Synchronizing Lights Module”.

The reverse power relay (RPR) provides system protection when the generator set is in parallel with other units. If the engine loses power, then the other parallel unit attempts to motorize the engine and the generator. If the voltage is present at the generator leads connection, then the voltage regulator maintains the field excitation. The engine and the generator remain magnetically coupled. The generator then drives the engine. Power no longer flows OUT of the generator. Power flows INTO the failing generator. This reverse flow of power could possibly result in overloading of the other generators and the whole system.

The reverse power relay (RPR) is a single phase relay which is energized by power in one direction. The power flows into the generator instead of out of the generator. In a reverse power fault, the relay (RPR) closes the contact across the RPR (5 and 6) (line 19) that is located on the DC Schematic. The GSC records an SP1 fault and the engine is shutdown. If the generator output circuit breaker is equipped with a shunt trip, then the generator is taken off the line. See Testing And Adjusting, “Schematics And Wiring Diagrams”.

After the reverse power fault is corrected, the generator set control (GSC) is reset by turning the engine control switch (ECS) to the OFF/RESET position. If the generator set is equipped with a shunt trip, then reset the generator output circuit breaker.

The operation of the RPR is tested by pushing the test button on the RPR while the generator is on load. Depress the test button for 10 to 15 seconds.

**⚠ WARNING**

**To avoid personal injury from electrical shock, do NOT touch the high voltage terminal while adjusting the reverse power relay.**

The trip point of the relay is adjustable in the field. The relay trip point is normally set at the factory at approximately 15% of the generator rated kW.

i00935162

# Customer Interface Module

**SMCS Code:** 4490; 7451

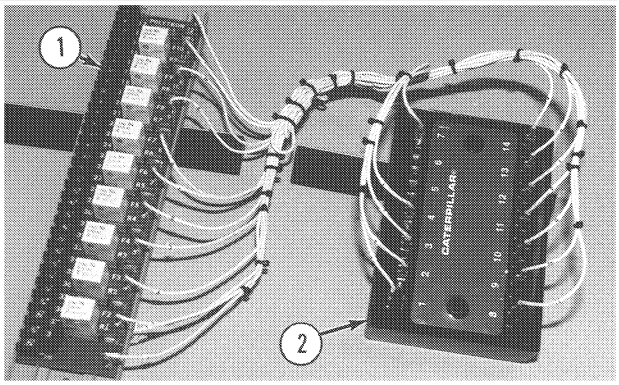


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Illustration 29

Customer Interface Module (CIM)

(1) Relay board. (2) Electronic control.

For more information, see the Testing And Adjusting, “Schematics And Wiring Diagrams”.

The CIM provides an interface (separate relay contacts) between the GSC and switch gear. The two major components of CIM are relay board (1) and electronic control (2). The electronic control (2) connects to the same serial data link as the alarm annunciator. The CIM and the alarm annunciator operate similarly. One difference is that the data link information is decoded into discrete outputs. The outputs then drive the relays that are located on relay board (1). The relay contacts can be used to sound a horn. The relay contacts can be used to flash a lamp. The relay contacts can be used to trigger some other action. Once an output is activated it remains energized until the initiating faults are cleared. If there is a malfunction in the serial data link, all electronic control outputs will flash at 0.5 Hz. This includes all relays. The CIM is designed to be powered only by a 24 DCV or 32 DCV battery system. .

The available serial data link information is listed below.

- High coolant temperature alarm.
- Low oil pressure alarm.
- Low coolant temperature alarm.
- Engine control switch (ECS) NOT in auto.
- Low oil pressure shutdown.
- High coolant temperature shutdown.
- Overcrank.
- Overspeed.
- Diagnostic fault (GSC).

## Application Guidelines

### Lamp Test

When a lamp test signal is received, the CIM activates all outputs for 10 seconds. The CIM deactivates the outputs early if the lamp test signal is deactivated. Two lamp test signals are possible. The CIM lamp test is activated when either of the following conditions are present.

- Terminal 5 is connected to terminal 7 of electronic control (2).
- The GSC lamp test signal is received over the data link.

Note: CIM ignores the GSC lamp test signal when terminal 6 is connected to terminal 7 of electronic control (2).

### Outputs

- The relays on relay board (1) are protected by fuses. The contacts are flashed silver. The contacts are rated at 1 amp 28 DCV. The relays draw 20 mA (at 24 DCV).
- The driver outputs of electronic control 2 are intended to drive incandescent lamps or relay loads. The driver outputs draw up to 600 mA (15 to 45 DCV).

### Specifications

- For CIM installation, the maximum distance between electronic control (2) and the GSC is 305 m (1000 ft).
- The operating voltage range is 15 to 45 DCV (24 DCV nominal)
- CIM is capable of operating with or without earth ground.
- The terminals on electronic control (2) are 6.4 mm (0.25 inch) push on connectors.
- Customer connections at relay board (1) are 6-32 screw terminals.

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# System Communication Module (Customer)

**SMCS Code:** 1926; 4490; 7451

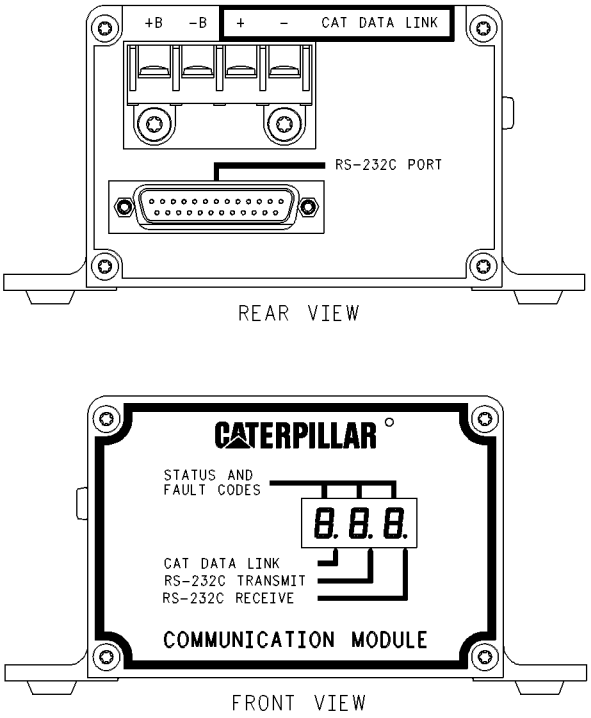


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Illustration 30

Customer Communication Module (CCM)

The customer communication module (CCM) provides a communication link between the GSC and a host computer of the customer. The CCM converts data from standard RS-232C format to CAT data link format and vice versa. The CCM allows an operator at the host computer to remotely control and monitor the generator set. The CCM can monitor the same information that is available on the GSC display.

The CCM can remotely control the following functions when the GSC is in the normal mode with the ECS in the AUTO position.

- Start the engine.
- Stop the engine, provided the remote initiate contact is not closed.
- Activate or deactivate the EGR, provided the low oil pressure shutdown setpoint has been exceeded.

- Activate or deactivate the GFR, provided the GSC has not detected a fault. (In this case, the GSC will already have activated the GFR.)

- Remotely abort the cooldown time.

- Remotely control the spare output.

- Remotely control the programmable spare relay.

Note: The CCM can only control the spare output in an active low type of configuration. For more information, see Systems Operation, “Spare Input/Output Programming OP6”.

The addition of a specified modem allows two-way communication when the generator set and host computer are separated by great distances.

See Operation & Maintenance Manual, SEBU6874, “Customer Communication Module For EMCP II”for more information regarding the CCM.

# Testing and Adjusting Section

# Testing and Adjusting

i00966698

## General Information

**SMCS Code:** 4490

**WARNING**

**Do not connect generator to a utility electrical distribution system unless it is isolated from the system. Electrical feedback into the distribution system can occur and could cause personal injury or death.**

**Open and secure main distribution system switch, or if the connection is permanent, install a double throw transfer switch to prevent electrical feedback. Some generators are specifically approved by a utility to run in parallel with the distribution system and isolation may not be required. Always check with your utility as to the applicable circumstances.**

**WARNING**

**When the engine-generator, or any source to which the engine-generator is synchronized to, is operating, voltages up to 600V are present in the control panel.**

**Do not short these terminal with line voltage to ground with any part of the body or any conductive material. Loss of life or injury could result from electrical shock or injury from molten metal.**

**WARNING**

**When servicing or repairing electric power generation equipment:**

- **Make sure the unit is either locked out or tagged DO NOT OPERATE.**
- **Remove all fuses.**
- **Make sure the generator engine is stopped.**
- **Make sure all batteries are disconnected.**
- **Make sure all capacitors are discharged.**
- **Make sure residual voltage in the rotor, stator and the generator is discharged.**

**Failure to do so could result in personal injury or death.**

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## Service Tools

**SMCS Code:** 0785; 4490

Table 12

| Tools Needed | | |
|---|---|---|
| 4C-3406 | Connector Repair Kit (Deutsch) | 1 |
| 6V-3000 | Connector Repair Kit (Sure Seal) | 1 |
| 9U-7246 | Connector Repair Kit (Deutsch DT) | 1 |
| | 4 mm Hex Wrench | 1 |
| 6V-7070 | Digital Multimeter | 1 |
| 9U-7330 | Multimeter | 1 |
| 146-4080 | Digital Multimeter (RS-232) | 1 |
| 7X-1710 | Multimeter Probe Group | 1 |

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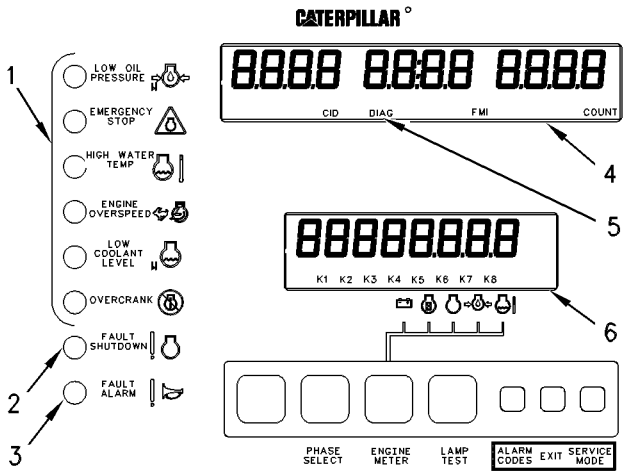
# Fault Identification

**SMCS Code:** 4490-038

Table 13

| Fault Identification | | | | |
|---|---|---|---|---|
| **Indicator** | **Fault Code** | **DIAG Indicator** | **Fault Type** | **See Topic** |
| Fault Alarm | CID FMI(1) | Flashing | Active Alarm | Troubleshooting Diagnostic Codes |
| | SP1, SP2, SP3(1) | Not Present | Active Alarm | SP Fault Code - Troubleshoot |
| | AL1, AL2, AL3(1) | Not Present | Active Alarm | AL Fault Codes - Troubleshoot |
| Dedicated Shutdown | Not Present | Not Present | Active Alarm | Troubleshooting Dedicated Shutdown Indicators |
| | Not Present | Not Present | Active Shutdown | |
| Fault Shutdown | CID FMI | Flashing | Active Shutdown | Troubleshooting Diagnostic Codes |
| | SP1, SP2, SP3 | Not Present | Active Shutdown | SP Fault Codes - Troubleshoot |
| None | CID FMI(2) | On Continuously | Inactive Alarm | Troubleshooting Diagnostic Codes |
| | CID FMI(2) | On Continuously | Inactive Shutdown | Troubleshooting Diagnostic Codes |
| | SP1, SP2, SP3 | Not Present | Inactive Shutdown | SP Fault Codes - Troubleshoot |
| | Not Present | Not Present | Undiagnosed Shutdown | Troubleshooting Undiagnosed Problems |

(1) Fault code is shown after the alarm code key is pressed.
(2) Diagnostic code is stored in the fault log of the GSC. In order to view the fault code, see Systems Operation, “Fault Log Viewing OP1”.




g00595806

Illustration 31

GSC Display Area

(1) Dedicated shutdown indicators. (2) Fault shutdown indicator. (3) Fault alarm indicator. (4) Upper display. (5) DIAG indicator. (6) Lower display.

Faults that are detected and diagnosed by the GSC are shown to service personnel in the display area of the GSC. The GSC uses dedicated shutdown indicators (1), fault shutdown indicator (2), fault alarm indicator (3), “DIAG” indicator (5), upper display (4) and lower display (6) to tell service personnel about a fault. Perform the following procedure in order to identify the fault that is detected by the GSC.

Note: “DIAG” indicator (8) functions (either FLASHING or ON CONTINUOUSLY) whenever the diagnostic information is available from the GSC.

1. Note the indicators that are functioning on the left side of the GSC.

2. View the diagnostic code on upper display (4). If the fault alarm indicator (3) is FLASHING and no diagnostic code is present on upper display (4), press the alarm codes key to view the fault code.

3. Note whether or not “DIAG” indicator (5) is FLASHING, ON CONTINUOUSLY, or NOT PRESENT.

4. Look at the first column on the table 13 and locate the fault indicator that is functioning.

5. Go to the second column in the table 13 and find the fault code that is presently shown on upper display (4).

6. Go to the third column in the table 13 which describes the status of “DIAG” indicator (5).

7. Read the last two columns in order to find the type of fault and the corresponding topic.

i01136850

# Troubleshooting Diagnostic Codes

**SMCS Code:** 4490-038; 7569

Diagnostic codes are associated with failed electrical components or circuits. These components and circuits provide information to the GSC. Also, these components and circuits receive information from the GSC. The diagnostic code closely identifies the cause of the fault. Each diagnostic code consists of the following indicators that are shown on the upper display: a component identifier (CID), a failure mode identifier (FMI), and a “DIAG” indicator. The CID describes the component in the system that is faulty. The FMI describes the nature of the fault. When the “DIAG” indicator is FLASHING, the fault is active. When the “DIAG” indicator is ON CONTINUOUSLY, the fault is inactive and the CID FMI is recorded in the fault log. To view the fault log, see Systems Operation, “Fault Log Viewing OP1”. When the “DIAG” indicator is not present, there are NO diagnostic codes that have been detected or recorded. Service personnel interpret the identifiers in order to assist with troubleshooting.

When a diagnostic code is active, the GSC FLASHES the “DIAG” indicator. The GSC determines the type of fault (alarm or shutdown). Then, the GSC FLASHES the corresponding fault alarm indicator or the fault shutdown indicator. For a shutdown fault, the CID FMI is immediately shown on the upper display. For an alarm fault, the alarm codes key must be pressed first. Then, the CID FMI is shown on the upper display.

The GSC has a fault log to help with troubleshooting of diagnostic faults. Inactive diagnostic codes (CID FMI) are recorded in the fault log for viewing at a later time. Also, the number of occurrences are totalled. The total number of occurrences is shown on the upper display. An active alarm fault becomes inactive when the fault is no longer occurring. Also, in order for shutdown faults to become inactive, the ECS must be turned to OFF/RESET. See Systems Operation, “Fault Log Viewing OP1”.

During troubleshooting, it is necessary to disconnect the harness connector (40 contact) from the GSC and faults are created. Because of internal circuitry, the GSC recognizes this condition as a FMI 3 for certain components. This fact is also used as an aid for troubleshooting. Clear these created diagnostic codes after the original diagnostic code is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded:

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

You can avoid confusion in a future service call if you clear a diagnostic fault from the fault log. Clear the diagnostic fault after you have corrected the fault. The “DIAG” indicator is NOT PRESENT when all diagnostic faults are cleared from the fault log and no active diagnostic faults exist. See Systems Operation, “Fault Log Clearing OP4”.

Table 14

| Diagnostic Codes | |
|---|---|
| **CID / FMI** | **Description** |
| **CID 100 - Pressure Sensor (Engine Oil)** | |
| FMI 2 | Data erratic, intermittent, or incorrect |
| FMI 3 | Voltage above normal or shorted high |
| FMI 4 | Voltage below normal or shorted low |
| **CID 110 - Temperature Sensor (Engine Coolant)** | |
| FMI 2 | Data erratic, intermittent, or incorrect |
| FMI 3 | Voltage above normal or shorted high |
| FMI 4 | Voltage below normal or shorted low |
| **CID 111 - Fluid Level Sensor (Engine Coolant)** | |
| FMI 3 | Voltage above normal or shorted high |
| **CID 168 - Electrical System** | |
| FMI 3 | Voltage above normal or shorted high |
| FMI 4 | Voltage below normal or shorted low |
| **CID 190 - Speed Sensor (Engine)** | |
| FMI 2 | Data erratic, intermittent, or incorrect |
| FMI 3 | Voltage above normal or shorted high |

(continued)

(Table 14, contd)

| Diagnostic Codes | |
|---|---|
| **CID / FMI** | **Description** |
| **CID 248 - CAT Data Link** | |
| FMI 9 | Abnormal update |
| **CID 268 - EMCP Electronic Control (Generator Set)** | |
| FMI 2 | Data erratic, intermittent, or incorrect |
| **CID 269 - Sensor Power Supply** | |
| FMI 3 | Voltage above normal or shorted high |
| FMI 4 | Voltage below normal or shorted low |
| **CID 330 - Unexpected Shutdown** (1) | |
| FMI 7 | Mechanical system not responding properly |
| **CID 331 - Switch (Engine Control)** (2) | |
| FMI 2 | Data erratic, intermittent, or incorrect |
| **CID 333 - Alarm Module Control** | |
| FMI 3 | Voltage above normal or shorted high |
| FMI 4 | Voltage below normal or shorted low |
| **CID 334 - Spare Output** | |
| FMI 3 | Voltage above normal or shorted high |
| FMI 4 | Voltage below normal or shorted low |
| **CID 336 - Switch (Engine Control)** | |
| FMI 2 | Data erratic, intermittent, or incorrect |
| **CID 441 - Oil Step Relay** | |
| FMI 12 | Bad device or component |
| **CID 442 - Generator Fault Relay** | |
| FMI 12 | Bad device or component |
| **CID 443 - Crank Termination Relay** | |
| FMI 12 | Bad device or component |
| **CID 444 - Starting Motor Relay** | |
| FMI 12 | Bad device or component |
| **CID 445 - Run Relay** | |
| FMI 12 | Bad device or component |
| **CID 446 - Air Shutoff Relay** | |
| FMI 12 | Bad device or component |
| **CID 447 - Fuel Control Relay** | |
| FMI 12 | Bad device or component |
| **CID 500 - EMCP II Electronic Control (Generator Set)** | |
| FMI 12 | Bad device or component |
| **CID 560 - CAT Data Link** (3) | |
| FMI 11 | Failure mode not identified |

(continued)

(Table 14, contd)

| Diagnostic Codes | |
|---|---|
| **CID / FMI** | **Description** |
| **CID 566 - Unexpected Shutdown** | |
| FMI 7 | Mechanical system not responding properly |
| **CID 590 - Engine Electronic Control Module** | |
| FMI 8 | Abnormal update |

(1) This diagnostic code is applicable to the former 103-6177, 113-4500, 117-6200 and 118-2121 Generator Set Control. This diagnostic code has been replaced by CID 566.

(2) This diagnostic code is applicable to the former 103-6177, 113-4500, 117-6200 and 118-2121 Generator Set Control. This diagnostic code has been replaced by CID 336.

(3) This diagnostic code is applicable to the former 103-6177, 113-4500, 117-6200 and 118-2121 Generator Set Control. This diagnostic code has been replaced by CID 248.


Illustration 32 g00318043

Upper Display With Diagnostic Code “CID 190 FMI 3” Showing

i01125765

# CID 100 FMI 2 Pressure Sensor (Engine Oil) Incorrect Signal - Test

**SMCS Code:** 1924-038; 4490-038-NS

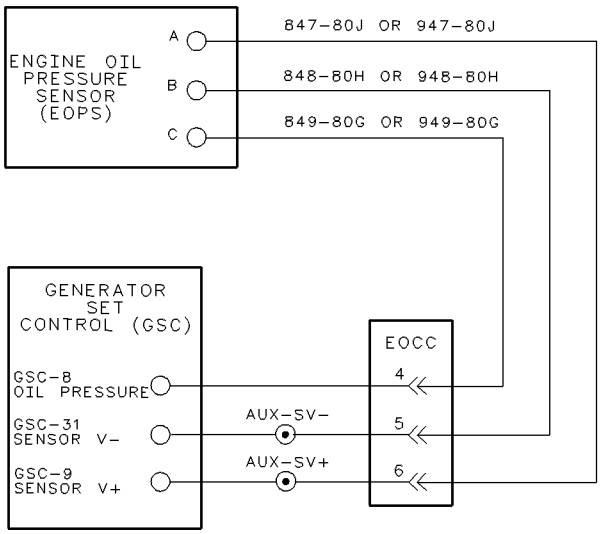



Illustration 33 g00595836

Schematic For Pressure Sensor (Engine Oil)

The EMCP II monitors the engine oil pressure in order to protect the engine in case of a problem with the oil pressure. The pressure sensor is usually mounted on an oil gallery of the engine. The exact location of the engine oil pressure sensor depends on the engine model.

The sensor is powered by an 8 volt sensor supply from the GSC. The oil pressure signal is a pulse width modulated signal. The base frequency of the signal is 500 ± 150 Hz. As pressure changes, the duty cycle of the signal varies from 10% to 95%. A pressure of 0 kPa (0 psi) is approximately 13% of the duty cycle. A pressure of 690 kPa (100 psi) is approximately 85% of the duty cycle.

Note: The GSC is usually programmed to treat a diagnostic code with the pressure sensor as an alarm fault (P04 = 0). If the GSC is programmed to treat a fault with the pressure sensor as a shutdown fault (P04 = 1), then diagnostic codes are automatically shown on the upper display.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

This diagnostic code can be caused by the following conditions:

- The base frequency of the sensor is beyond the accepted limits.
- The duty cycle of the sensor signal is beyond the accepted limits.

Begin performing these procedures only when CID 100 FMI 2 is showing and the “DIAG” indicator is FLASHING on the upper display. The GSC treats a CID 100 FMI 2 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed and the ECS is in any position except the OFF/RESET position. For an inactive fault, the problem may be intermittent. To troubleshoot an inactive fault, use the preceding system schematic and see Testing And Adjusting, “Electrical Connector - Inspect”. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: This procedure can be replaced with Testing and Adjusting, “Pulse Width Modulated (PWM) Sensor - Test” if you are using a meter with the capability of measuring frequency and duty cycle.

Note: If CID 269 is active, then correct the diagnostic code prior to proceeding with this procedure.

1. **Check the GSC and the harness.**

   **a.** Ensure that CID 100 FMI 2 is showing on the display.

   **b.** Turn the ECS to the “OFF/RESET” position.

   **c.** Disconnect the sensor from the engine harness. The sensor should remain fastened to the engine.

   **d.** Turn the ECS to the “STOP” position.

   **e.** Press the alarm codes key. This is not required for shutdown faults.

   **f.** Verify that CID 100 FMI 02 is no longer showing and verify that CID 100 FMI 03 is now showing.

   **Expected Result:** CID 100 FMI 2 is not showing. CID 100 FMI 3 is now showing.

   **Results:**

   - OK - The GSC and the harness function properly. Therefore, the sensor is faulty. Replace the sensor. STOP.
   - NOT OK - CID 100 FMI 02 is still showing. There is a fault in the GSC or the harness. Proceed to 2.

2. **Check the GSC.**

   **a.** Turn the ECS to the “OFF/RESET” position.

   **b.** Disconnect the harness connector from the GSC.

**c.** Turn the ECS to the “STOP” position.

**d.** Press the alarm codes key.

**e.** Verify that CID 100 FMI 02 is no longer showing and verify that CID 100 FMI 03 is now showing.

**Expected Result:** CID 100 FMI 2 is not showing. CID 100 FMI 3 is now showing.

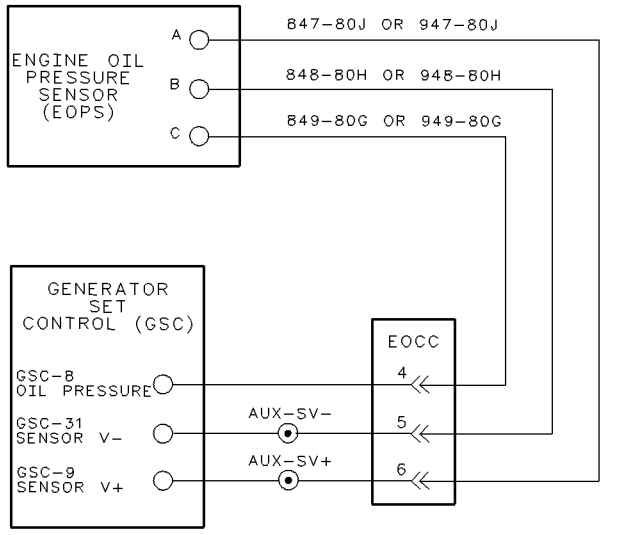
**Results:**

- OK - The GSC functions properly. Therefore, the signal wire is faulty in the harness. Troubleshoot the signal wire in the harness between the sensor connector and the GSC connector. Also check the electrical connectors and terminals. See Testing and Adjusting, “Electrical Connector - Inspect”. STOP.
- NOT OK - CID 100 FMI 2 is still showing. The GSC is faulty. Replace the GSC. See Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

i01125946

# CID 100 FMI 3 Pressure Sensor (Engine Oil) Voltage Above Normal - Test

**SMCS Code:** 1924-038; 4490-038-NS




g00595836

Illustration 34

Schematic For Pressure Sensor (Engine Oil)

The EMCP II monitors the engine oil pressure in order to protect the engine in case of a problem with the oil pressure. The pressure sensor is usually mounted on an oil gallery of the engine. The exact location of the engine oil pressure sensor depends on the engine model.

The sensor is powered by an 8 volt sensor supply from the GSC. The oil pressure signal is a pulse width modulated signal. The base frequency of the signal is 500 ± 150 Hz. As pressure changes, the duty cycle of the signal varies from 10% to 95%. A pressure of 0 kPa (0 psi) is approximately 13% of the duty cycle. A pressure of 690 kPa (100 psi) is approximately 85% of the duty cycle.

Note: The GSC is usually programmed to treat a diagnostic code with the pressure sensor as an alarm fault (P04 = 0). If the GSC is programmed to treat a fault with the pressure sensor as a shutdown fault (P04 = 1), then diagnostic codes are automatically shown on the upper display.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

This diagnostic code can be caused by the following conditions:

- There is a short to the +battery of the sensor signal.
- There is an open circuit of the sensor signal.

Begin performing these procedures only when CID 100 FMI 3 is showing and the “DIAG” indicator is FLASHING on the upper display. The GSC treats a CID 100 FMI 3 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed and the ECS is in any position except the OFF/RESET position. For an inactive fault, the problem may be intermittent. To troubleshoot an inactive fault, use the preceding system schematic and see Testing And Adjusting, “Electrical Connector - Inspect”. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: If CID 269 is active, then correct the diagnostic code prior to proceeding with this procedure.

**1. Check the circuit for the supply.**

**a.** Turn the ECS to OFF/RESET and then turn the ECS to the STOP position.

**b.** Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

**c.** At the side of the engine harness on the sensor connector, measure the voltage (DCV) between contact “A” (supply) and contact “B” (sensor ground).

**Expected Result:** The voltage should be 8.0 ± 0.5 DCV.

**Results:**

- OK - The supply circuit functions properly. Proceed to 2.
- NOT OK - The supply circuit is faulty. Check the upper display for a CID 269. If necessary, correct the fault. If a CID 269 is not showing on the upper display, then the engine harness has an open circuit. Proceed to 4.

**2. Check the signal circuit.**

The ECS remains in the STOP position and the sensor remains disconnected from the engine harness.

**a.** At the side of the engine harness on the sensor connector, measure the voltage (DCV) between contact “C” (signal) and contact “B” (sensor ground).

**Expected Result:** The voltage should be 7.0 ± 0.5 DCV.

**Results:**

- OK - The signal circuit functions properly. Verify that the diagnostic code remains present. Reconnect the sensor. Turn the ECS to OFF/RESET and then turn the ECS to STOP. If the CID 100 FMI 3 is still showing on the upper display, the sensor is faulty. Replace the sensor. STOP.
- NOT OK - Voltage is equal to battery positive (B+). The engine harness is faulty. The signal circuit within the engine harness is shorted to the battery (“B+”). Troubleshoot the engine harness and repair the engine harness. STOP.
- NOT OK - Voltage is NOT 7.0 ± 0.5 DCV and is NOT equal to battery positive (B+). The GSC or the harness is faulty. Proceed to 3.

**3. Check for a shorted harness.**

When you are performing this step, see the preceding System Schematic. The sensor remains disconnected from the engine harness.

**a.** Turn the ECS to OFF/RESET.

**b.** Disconnect the harness connector from the GSC.

**c.** At the GSC harness connector, measure the resistance from signal contact 8 to all other contacts of the connector.

**Expected Result:** For each measurement, the resistance should be greater than 5000 ohms.

**Results:**

- OK - The harness functions properly. Proceed to 4.
- NOT OK - The harness wiring with the incorrect resistance is shorted in the harness. Troubleshoot and repair the faulty harness wiring between the sensor connector and the GSC connector. STOP.

**4. Check for an open harness.**

When you are performing this step, see the preceding System Schematic. The ECS remains in the OFF/RESET position. The sensor remains disconnected from the engine harness and the GSC remains disconnected from the harness connector.

**a.** Measure the resistance of the ground circuit. Measure the resistance from contact “B” of the sensor harness connector to contact “31” of the GSC harness connector.

**b.** Measure the resistance of the signal circuit. Measure the resistance from contact “C” of the sensor harness connector to contact “8” of the GSC harness connector.

**c.** Measure the resistance of the sensor supply circuit. Measure the resistance from contact “A” of the sensor harness connector to contact “9” of the GSC harness connector.

**Expected Result:** For each measurement, the resistance should be 5 ohms or less.

**Results:**

- OK - The harness functions properly. Proceed to 5.
- NOT OK - The harness wiring with the incorrect resistance measurement is open (faulty). Troubleshoot and repair the faulty harness wiring between the sensor connector and the GSC connector. STOP.

**5. Check the electrical connectors.**

**a.** Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”.

**Expected Result:** All connectors, terminals and wiring should function properly.

**Results:**

- OK - Connect all harness connectors that were previously disconnected. Start the engine. If CID 100 FMI 3 is still showing, replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.
- NOT OK - Repair the faulty area. STOP.

i01126225

# CID 100 FMI 4 Pressure Sensor (Engine Oil) Voltage Below Normal - Test

**SMCS Code:** 1924-038; 4490-038-NS

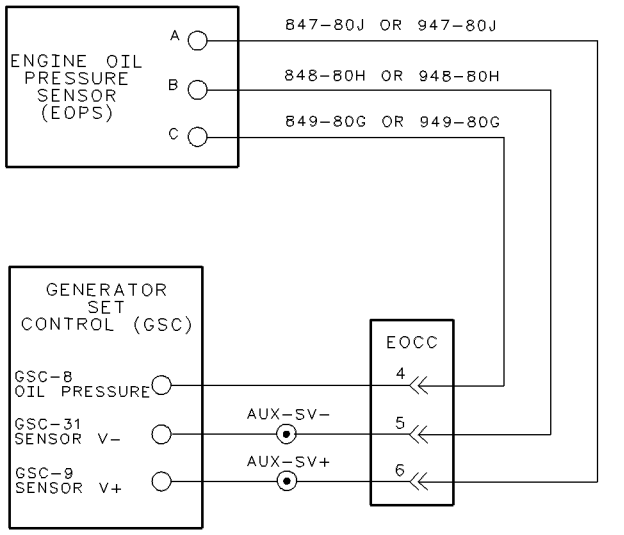



Illustration 35 g00595836

Schematic For Pressure Sensor (Engine Oil)

The EMCP II monitors the engine oil pressure in order to protect the engine in case of a problem with the oil pressure. The pressure sensor is usually mounted on an oil gallery of the engine. The exact location of the engine oil pressure sensor depends on the engine model.

The sensor is powered by an 8 volt sensor supply from the GSC. The oil pressure signal is a pulse width modulated signal. The base frequency of the signal is 500 ± 150 Hz. As pressure changes, the duty cycle of the signal varies from 10% to 95%. A pressure of 0 kPa (0 psi) is approximately 13% of the duty cycle. A pressure of 690 kPa (100 psi) is approximately 85% of the duty cycle.

Note: The GSC is usually programmed to treat a diagnostic code with the pressure sensor as an alarm fault (P04 = 0). If the GSC is programmed to treat a fault with the pressure sensor as a shutdown fault (P04 = 1), then diagnostic codes are automatically shown on the upper display.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

This diagnostic code can be caused by the following condition:

- There is a short to the –battery of the sensor signal.

Begin performing these procedures only when CID 100 FMI 4 is showing and the “DIAG” indicator is FLASHING on the upper display. The GSC treats a CID 100 FMI 4 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed and the ECS is in any position except the OFF/RESET position. For an inactive fault, the problem may be intermittent. To troubleshoot an inactive fault, use the preceding system schematic and see Testing And Adjusting, “Electrical Connector - Inspect”. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: If CID 269 is active, then correct the diagnostic code prior to proceeding with this procedure.

1. **Check the GSC and the harness.**

   **a.** Ensure that CID 100 FMI 4 is showing on the display.

   **b.** Turn the ECS to the “OFF/RESET” position.

   **c.** Disconnect the sensor from the engine harness. The sensor should remain fastened to the engine.

   **d.** Turn the ECS to the “STOP” position.

   **e.** Press the alarm codes key. This is not required for shutdown faults.

   **f.** Verify that CID 100 FMI 04 is no longer showing and verify that CID 100 FMI 03 is now showing.

   **Expected Result:** CID 100 FMI 4 is not showing. CID 100 FMI 3 is now showing.

   **Results:**

   - OK - The GSC and the harness function properly. Therefore, the sensor is faulty. Replace the sensor. STOP.
   - NOT OK - CID 100 FMI 04 is still showing. There is a fault in the GSC or the harness. Proceed to 2.

2. **Check the GSC.**

   **a.** Turn the ECS to the “OFF/RESET” position.

   **b.** Disconnect the harness connector from the GSC.

   **c.** Turn the ECS to the “STOP” position.

   **d.** Press the alarm codes key.

   **e.** Verify that CID 100 FMI 04 is no longer showing and verify that CID 100 FMI 03 is now showing.

   **Expected Result:** CID 100 FMI 4 is not showing. CID 100 FMI 3 is now showing.

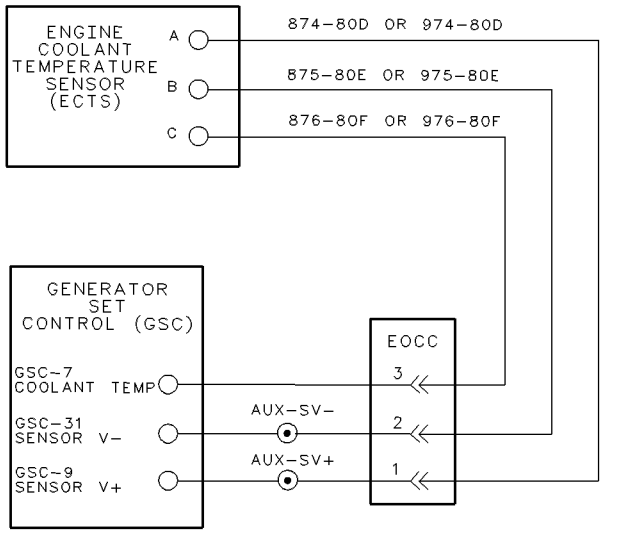
   **Results:**

   - OK - The GSC functions properly. Therefore, the signal wire is faulty in the harness. Troubleshoot the signal wire in the harness between the sensor connector and the GSC connector. Also check the electrical connectors and terminals. See Testing and Adjusting, “Electrical Connector - Inspect”. STOP.
   - NOT OK - CID 100 FMI 4 is still showing. The GSC is faulty. Replace the GSC. See Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

i01126327

# CID 110 FMI 2 Temperature Sensor (Engine Coolant) Incorrect Signal - Test

**SMCS Code:** 1906-038; 4490-038-NS




g00596060

Illustration 36

Schematic For Temperature Sensor (Engine Coolant)

The EMCP II monitors the engine coolant temperature in order to protect the engine in case of a problem with the coolant temperature. The temperature sensor is mounted in the water jacket toward the front of the engine. The exact location of the engine coolant temperature sensor depends on the engine model.

The sensor is powered by an 8 volt sensor supply from the GSC. The coolant temperature signal is a pulse width modulated signal. The base frequency of the signal is 455 ± 90 Hz. As temperature changes, the duty cycle of the signal varies from 10% to 95%. A temperature of –40 °C (–40 °F) is approximately 10% of the duty cycle. A temperature of 135 °C (275 °F) is approximately 93% of the duty cycle.

Note: The GSC is usually programmed to treat a diagnostic code with the temperature sensor as an alarm fault (P04 = 0). If the GSC is programmed to treat a fault with the temperature sensor as a shutdown fault (P04 = 1), then diagnostic codes are automatically shown on the upper display.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

This diagnostic code can be caused by the following conditions:

- The base frequency of the sensor is beyond the accepted limits.
- The duty cycle of the sensor signal is beyond the accepted limits.

Begin performing these procedures only when CID 110 FMI 2 is showing and the “DIAG” indicator is FLASHING on the upper display. The GSC treats a CID 110 FMI 2 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed and the ECS is in any position except the OFF/RESET position. For an inactive fault, the problem may be intermittent. To troubleshoot an inactive fault, use the preceding system schematic and see Testing And Adjusting, “Electrical Connector - Inspect”. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: This procedure can be replaced with Testing and Adjusting, “Pulse Width Modulated (PWM) Sensor - Test” if you are using a meter with the capability of measuring frequency and duty cycle.

Note: If CID 269 is active, then correct the diagnostic code prior to proceeding with this procedure.

1. **Check the GSC and the harness.**

   **a.** Ensure that CID 110 FMI 2 is showing on the display.

   **b.** Turn the ECS to the “OFF/RESET” position.

   **c.** Disconnect the sensor from the engine harness. The sensor should remain fastened to the engine.

**d.** Turn the ECS to the “STOP” position.

**e.** Press the alarm codes key. This is not required for shutdown faults.

**f.** Verify that CID 110 FMI 02 is no longer showing and verify that CID 110 FMI 03 is now showing.

**Expected Result:** CID 110 FMI 2 is not showing. CID 110 FMI 3 is now showing.

**Results:**

- OK - The GSC and the harness function properly. Therefore, the sensor is faulty. Replace the sensor. STOP.
- NOT OK - CID 110 FMI 02 is still showing. There is a fault in the GSC or the harness. Proceed to 2.

**2. Check the GSC.**

**a.** Turn the ECS to the “OFF/RESET” position.

**b.** Disconnect the harness connector from the GSC.

**c.** Turn the ECS to the “STOP” position.

**d.** Press the alarm codes key.

**e.** Verify that CID 110 FMI 02 is no longer showing and verify that CID 110 FMI 03 is now showing.

**Expected Result:** CID 110 FMI 2 is not showing. CID 110 FMI 3 is now showing.

**Results:**

- OK - The GSC functions properly. Therefore, the signal wire is faulty in the harness. Troubleshoot the signal wire in the harness between the sensor connector and the GSC connector. Also check the electrical connectors and terminals. See Testing and Adjusting, “Electrical Connector - Inspect”. STOP.
- NOT OK - CID 110 FMI 2 is still showing. The GSC is faulty. Replace the GSC. See Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

i01126631

# CID 110 FMI 3 Temperature Sensor (Engine Coolant) Voltage Above Normal - Test

**SMCS Code:** 1906-038; 4490-038-NS

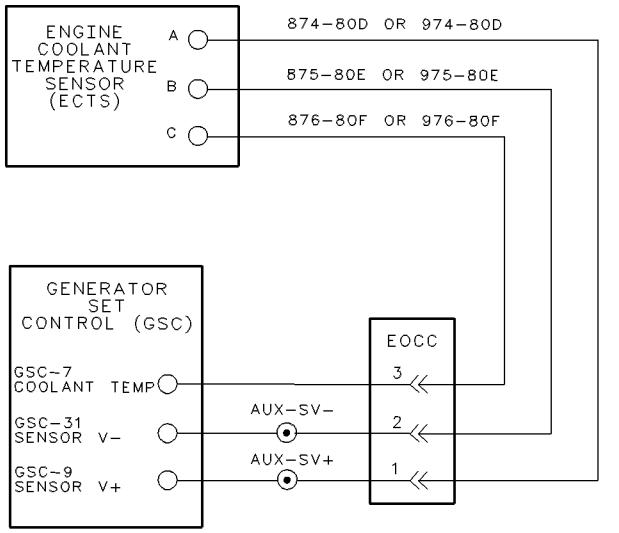



Illustration 37 g00596060

Schematic For Temperature Sensor (Engine Coolant)

The EMCP II monitors the engine coolant temperature in order to protect the engine in case of a problem with the coolant temperature. The temperature sensor is mounted in the water jacket toward the front of the engine. The exact location of the engine coolant temperature sensor depends on the engine model.

The sensor is powered by an 8 volt sensor supply from the GSC. The coolant temperature signal is a pulse width modulated signal. The base frequency of the signal is 455 ± 90 Hz. As temperature changes, the duty cycle of the signal varies from 10% to 95%. A temperature of –40 °C (–40 °F) is approximately 10% of the duty cycle. A temperature of 135 °C (275 °F) is approximately 93% of the duty cycle.

Note: The GSC is usually programmed to treat a diagnostic code with the temperature sensor as an alarm fault (P04 = 0). If the GSC is programmed to treat a fault with the temperature sensor as a shutdown fault (P04 = 1), then diagnostic codes are automatically shown on the upper display.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

This diagnostic code can be caused by the following conditions:

- There is a short to the +battery of the sensor signal.
- There is an open circuit of the sensor signal.

Begin performing these procedures only when CID 110 FMI 3 is showing and the “DIAG” indicator is FLASHING on the upper display. The GSC treats a CID 110 FMI 3 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed and the ECS is in any position except the OFF/RESET position. For an inactive fault, the problem may be intermittent. To troubleshoot an inactive fault, use the preceding system schematic and see Testing And Adjusting, “Electrical Connector - Inspect”. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: If CID 269 is active, then correct the diagnostic code prior to proceeding with this procedure.

1. **Check the circuit for the supply.**

   **a.** Turn the ECS to OFF/RESET and then turn the ECS to the STOP position.

   **b.** Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

   **c.** At the side of the engine harness on the sensor connector, measure the voltage (DCV) between contact “A” (supply) and contact “B” (sensor ground).

   **Expected Result:** The voltage should be 8.0 ± 0.5 DCV.

   **Results:**

   - OK - The supply circuit functions properly. Proceed to 2.
   - NOT OK - The supply circuit is faulty. Check the upper display for a CID 269. If necessary, correct the fault. If a CID 269 is not showing on the upper display, then the engine harness has an open circuit. Proceed to 4.

2. **Check the signal circuit.**

   The ECS remains in the STOP position and the sensor remains disconnected from the engine harness.

   **a.** At the side of the engine harness on the sensor connector, measure the voltage (DCV) between contact “C” (signal) and contact “B” (sensor ground).

   **Expected Result:** The voltage should be 7.0 ± 0.5 DCV.

   **Results:**

   - OK - The signal circuit functions properly. Verify that the diagnostic code remains present. Reconnect the sensor. Turn the ECS to OFF/RESET and then turn the ECS to STOP. If the CID 110 FMI 3 is still showing on the upper display, the sensor is faulty. Replace the sensor. STOP.
   - NOT OK - Voltage is equal to battery positive (B+). The engine harness is faulty. The signal circuit within the engine harness is shorted to the battery (“B+”). Troubleshoot the engine harness and repair the engine harness. STOP.
   - NOT OK - Voltage is NOT 7.0 ± 0.5 DCV and is NOT equal to battery positive (B+). The GSC or the harness is faulty. Proceed to 3.

3. **Check for a shorted harness.**

   When you are performing this step, see the preceding System Schematic. The sensor remains disconnected from the engine harness.

   **a.** Turn the ECS to OFF/RESET.

   **b.** Disconnect the harness connector from the GSC.

   **c.** At the GSC harness connector, measure the resistance from signal contact 7 to all other contacts of the connector.

**Expected Result:** For each measurement, the resistance should be greater than 5000 ohms.

**Results:**

- OK - The harness functions properly. Proceed to 4.
- NOT OK - The harness wiring with the incorrect resistance is shorted in the harness. Troubleshoot and repair the faulty harness wiring between the sensor connector and the GSC connector. STOP.

**4. Check for an open harness.**

When you are performing this step, see the preceding System Schematic. The ECS remains in the OFF/RESET position. The sensor remains disconnected from the engine harness and the GSC remains disconnected from the harness connector.

**a.** Measure the resistance of the ground circuit. Measure the resistance from contact “B” of the sensor harness connector to contact “31” of the GSC harness connector.

**b.** Measure the resistance of the signal circuit. Measure the resistance from contact “C” of the sensor harness connector to contact “7” of the GSC harness connector.

**c.** Measure the resistance of the sensor supply circuit. Measure the resistance from contact “A” of the sensor harness connector to contact “9” of the GSC harness connector.

**Expected Result:** For each measurement, the resistance should be 5 ohms or less.

**Results:**

- OK - The harness functions properly. Proceed to 5.
- NOT OK - The harness wiring with the incorrect resistance measurement is open (faulty). Troubleshoot and repair the faulty harness wiring between the sensor connector and the GSC connector. STOP.

**5. Check the electrical connectors.**

**a.** Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”.

**Expected Result:** All connectors, terminals and wiring should function properly.

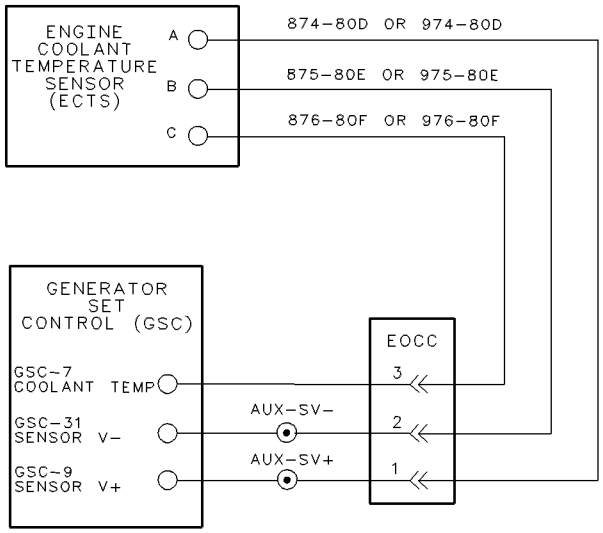
**Results:**

- OK - Connect all harness connectors that were previously disconnected. Start the engine. If CID 110 FMI 3 is still showing, replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.
- NOT OK - Repair the faulty area. STOP.

i01126950

# CID 110 FMI 4 Temperature Sensor (Engine Coolant) Voltage Below Normal - Test

**SMCS Code:** 1906-038; 4490-038-NS




g00596060

Illustration 38

Schematic For Temperature Sensor (Engine Coolant)

The EMCP II monitors the engine coolant temperature in order to protect the engine in case of a problem with the coolant temperature. The temperature sensor is mounted in the water jacket toward the front of the engine. The exact location of the engine coolant temperature sensor depends on the engine model.

The sensor is powered by an 8 volt sensor supply from the GSC. The coolant temperature signal is a pulse width modulated signal. The base frequency of the signal is 455 ± 90 Hz. As temperature changes, the duty cycle of the signal varies from 10% to 95%. A temperature of –40 °C (–40 °F) is approximately 10% of the duty cycle. A temperature of 135 °C (275 °F) is approximately 93% of the duty cycle.

Note: The GSC is usually programmed to treat a diagnostic code with the temperature sensor as an alarm fault (P04 = 0). If the GSC is programmed to treat a fault with the temperature sensor as a shutdown fault (P04 = 1), then diagnostic codes are automatically shown on the upper display.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

This diagnostic code can be caused by the following conditions:

- There is a short to –battery of the sensor signal.

Begin performing these procedures only when CID 110 FMI 4 is showing and the “DIAG” indicator is FLASHING on the upper display. The GSC treats a CID 110 FMI 4 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed and the ECS is in any position except the OFF/RESET position. For an inactive fault, the problem may be intermittent. To troubleshoot an inactive fault, use the preceding system schematic and see Testing And Adjusting, “Electrical Connector - Inspect”. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: If CID 269 is active, then correct the diagnostic code prior to proceeding with this procedure.

**1. Check the GSC and the harness.**

**a.** Ensure that CID 110 FMI 4 is showing on the display.

**b.** Turn the ECS to the “OFF/RESET” position.

**c.** Disconnect the sensor from the engine harness. The sensor should remain fastened to the engine.

**d.** Turn the ECS to the “STOP” position.

**e.** Press the alarm codes key. This is not required for shutdown faults.

**f.** Verify that CID 110 FMI 4 is no longer showing and verify that CID 110 FMI 3 is now showing.

**Expected Result:** CID 110 FMI 4 is not showing. CID 110 FMI 3 is now showing.

**Results:**

- OK - The GSC and the harness function properly. Therefore, the sensor is faulty. Replace the sensor. STOP.
- NOT OK - CID 110 FMI 4 is still showing. There is a fault in the GSC or the harness. Proceed to **2**.

**2. Check the GSC.**

**a.** Turn the ECS to the “OFF/RESET” position.

**b.** Disconnect the harness connector from the GSC.

**c.** Turn the ECS to the “STOP” position.

**d.** Press the alarm codes key.

**e.** Verify that CID 110 FMI 4 is no longer showing and verify that CID 110 FMI 3 is now showing.

**Expected Result:** CID 110 FMI 4 is not showing. CID 110 FMI 3 is now showing.

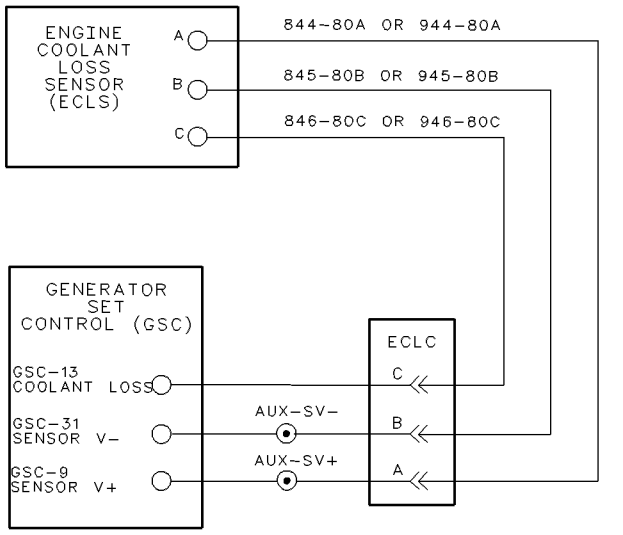
**Results:**

- OK - The GSC functions properly. Therefore, the signal wire is faulty in the harness. Troubleshoot the signal wire in the harness between the sensor connector and the GSC connector. Also check the electrical connectors and terminals. See Testing and Adjusting, “Electrical Connector - Inspect”. STOP.
- NOT OK - CID 110 FMI 4 is still showing. The GSC is faulty. Replace the GSC. See Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

i01127120

# CID 111 FMI 3 Fluid Level Sensor (Engine Coolant) Voltage Above Normal - Test

**SMCS Code:** 1395-038-NS; 4490-038-NS




g00483875

Illustration 39

Schematic For Fluid Level Sensor (Engine Coolant)

The EMCP II monitors the engine coolant for loss of coolant in order to protect the engine in case of a problem with the coolant temperature. This function is an option and the function requires the presence of the optional coolant loss sensor. The coolant loss sensor is usually mounted near the top of the radiator.

The sensor is powered by an 8 volt sensor supply from the GSC. When coolant is NOT present at the sensor, a high signal (+5 DCV) is sent to the GSC. When coolant is present at the sensor, a low signal (B–) is sent to the GSC.

Note: The GSC is usually programmed to treat a fault with the coolant loss sensor as an alarm fault (P04 = 0). The GSC is usually programmed to treat a fault with the coolant loss sensor as an shutdown fault (P04 = 1). The diagnostic codes are automatically shown on the upper display.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

This diagnostic code can be caused by the following conditions:

- There is a short to +battery of the sensor signal.
- There is an open circuit of the sensor signal.

Begin performing these procedures only when CID 111 FMI 3 is showing and the “DIAG” indicator is FLASHING on the upper display. The GSC treats a CID 111 FMI 3 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed and the ECS is in any position except the OFF/RESET position. For an inactive fault, the problem may be intermittent. To troubleshoot an inactive fault, use the preceding system schematic and see Testing And Adjusting, “Electrical Connector - Inspect”. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: If CID 269 is active, then correct the diagnostic code prior to proceeding with this procedure.

**1. Check the circuit for the supply.**

**a.** Turn the ECS to OFF/RESET and then turn the ECS to the STOP position.

**b.** Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

**c.** At the side of the engine harness on the sensor connector, measure the voltage (DCV) between contact “A” (supply) and contact “B” (sensor ground).

**Expected Result:** The voltage should be 8.0 ± 0.5 DCV.

**Results:**

- OK - The supply circuit functions properly. Proceed to 2.

- NOT OK - The supply circuit is faulty. Check the upper display for a CID 269. If necessary, correct the fault. If a CID 269 is not showing on the upper display, then the engine harness has an open circuit. Proceed to 4.

**2. Check the signal circuit.**

The ECS remains in the STOP position and the sensor remains disconnected from the engine harness.

**a.** At the side of the engine harness on the sensor connector, measure the voltage (DCV) between contact “C” (signal) and contact “B” (sensor ground).

**Expected Result:** The voltage should be 2.5 ± 0.5 DCV.

**Results:**

- OK - The signal circuit functions properly. Verify that the diagnostic code remains present. Reconnect the sensor. Turn the ECS to OFF/RESET and then turn the ECS to STOP. If the CID 111 FMI 3 is still showing on the upper display, the sensor is faulty. Replace the sensor. STOP.

- NOT OK - Voltage is equal to battery positive (B+). The engine harness is faulty. The signal circuit within the engine harness is shorted to the battery (“B+”). Troubleshoot the engine harness and repair the engine harness. STOP.

- NOT OK - Voltage is NOT 2.5 ± 0.5 DCV and is NOT equal to battery positive (B+). The GSC or the harness is faulty. Proceed to 3.

**3. Check for a shorted harness.**

When you are performing this step, see the preceding System Schematic. The sensor remains disconnected from the engine harness.

**a.** Turn the ECS to OFF/RESET.

**b.** Disconnect the harness connector from the GSC.

**c.** At the GSC harness connector, measure the resistance from signal contact 13 to all other contacts of the connector.

**Expected Result:** For each measurement, the resistance should be greater than 5000 ohms.

**Results:**

- OK - The harness functions properly. Proceed to 4.

- NOT OK - The harness wiring with the incorrect resistance is shorted in the harness. Troubleshoot and repair the faulty harness wiring between the sensor connector and the GSC connector. STOP.

**4. Check for an open harness.**

When you are performing this step, see the preceding System Schematic. The ECS remains in the OFF/RESET position. The sensor remains disconnected from the engine harness and the GSC remains disconnected from the harness connector.

**a.** Measure the resistance of the ground circuit. Measure the resistance from contact “B” of the sensor harness connector to contact “31” of the GSC harness connector.

**b.** Measure the resistance of the signal circuit. Measure the resistance from contact “C” of the sensor harness connector to contact “13” of the GSC harness connector.

**c.** Measure the resistance of the sensor supply circuit. Measure the resistance from contact “A” of the sensor harness connector to contact “9” of the GSC harness connector.

**Expected Result:** For each measurement, the resistance should be 5 ohms or less.

**Results:**

- OK - The harness functions properly. Proceed to 5.

- NOT OK - The harness wiring with the incorrect resistance measurement is open (faulty). Troubleshoot and repair the faulty harness wiring between the sensor connector and the GSC connector. STOP.

**5. Check the electrical connectors.**

**a.** Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”.

**Expected Result:** All connectors, terminals and wiring should function properly.

**Results:**

- OK - Connect all harness connectors that were previously disconnected. Start the engine. If CID 111 FMI 3 is still showing, replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.

- NOT OK - Repair the faulty area. STOP.

i01127146

# CID 168 FMI 3 Electrical System Voltage Above Normal - Test

**SMCS Code:** 1406-038; 4490-038

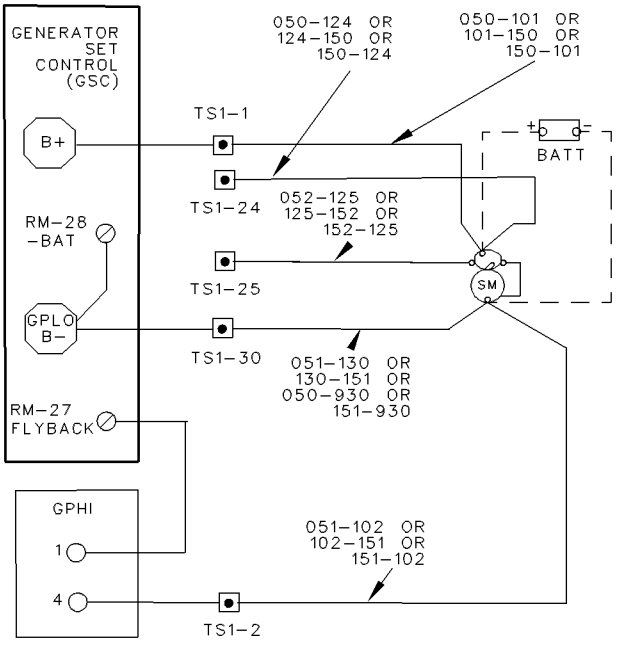



Illustration 40 g00596452

Schematic For Electrical System

The EMCP II monitors battery voltage in order to protect the EMCP II in case of a problem with the battery or battery charging. The EMCP II operates on a 24 DCV battery system or a 32 DCV battery system. The GSC receives battery voltage from RM-1 of the relay module terminal strip. The GSC measures this voltage. Voltage is received whenever the ECS is in the “START”, “AUTO”, or “STOP” position.

Note: The GSC does not receive battery power when the ECS is in the OFF/RESET position. The GSC receives power when the contacts “6” and “9” of the ECS are jumpered.

The GSC treats a CID 168 as an alarm fault.

**Procedure**

This diagnostic code can be caused by the following conditions:

- The battery voltage is greater than 32 DCV for a 24 DCV battery system.

- The battery voltage is greater than 45 DCV for a 32 DCV battery system.

The setpoint for system voltage (P07) specifies the battery voltage as “0” for 24 volts and “1” for 32 volts. Clear the diagnostic code from the fault log after troubleshooting is complete.

This procedure is used for troubleshooting an active fault or an inactive fault. Active alarm faults are shown on the upper display when the alarm codes key is pressed and the ECS is in any position except the OFF/RESET position. Inactive alarm faults are viewed in the fault log while the operator is in service mode. See Systems Operation, “Fault Log Viewing OP1”.

1. **Verify the fault.**

   **a.** View the upper display and check for active diagnostic faults for the battery voltage (CID 168 FMI 3).

   **b.** Enter service mode and check the fault log for inactive diagnostic faults for the battery voltage (CID 168 FMI 3).

   **Expected Result:** A CID 168 FMI 3 is active.

   **Results:**

   - No - Battery voltage diagnostic faults, DO NOT EXIST. STOP.

   - Yes - Battery voltage diagnostic faults, DO EXIST. Proceed to 2.

2. **Check the voltage.**

   **a.** Turn the ECS to the STOP position.

   **b.** Note the battery voltage that is showing on the lower display.

   **c.** Measure the voltage (DCV) between the terminals of the battery.

   **d.** Measure the voltage (DCV) between RM-1 (B+) and RM-28 (B-) of the terminal strip on the relay module.

**Expected Result:** The three voltages (preceding step 2.b, 2.c and 2.d) should be within 2.0 volt of each other.

**Results:**

- OK - All voltages agree (less than 2.0 DCV difference). Proceed to 4.
- NOT OK - Voltage measured at the batteries does not agree (greater than 2.0 DCV difference) with voltage measured at relay module terminal strip. Proceed to 3.
- NOT OK - Voltage that is showing on the lower display does not agree (greater than 2.0 DCV difference) with voltage measured at relay module terminal strip. Replace the GSC. See the Testing And Adjusting, "EMCP Electronic Control (Generator Set) - Replace". STOP.

3. **Check the harness.**

   **a.** Disconnect the "B+" and "B-" cables from the battery.

   **b.** Disconnect the "B+" wire from RM-1 and the "B-" wire from RM-28 of the terminal strip on the relay module.

   **c.** Measure the resistance of each wire. Measure the resistance from the end of the battery to the end of the terminal strip.

   **Expected Result:** The resistance of a single harness wire should be 5 ohms or less.

   **Results:**

   - OK - Both resistance measurements are correct. Therefore, an intermittent harness problem is likely. To further check the harness, proceed to Testing And Adjusting, "Electrical Connector - Inspect". STOP.
   - NOT OK - A resistance measurement is greater than 5 ohms. The harness wiring with the incorrect resistance measurement is faulty. Troubleshoot and repair the faulty harness wiring between the battery and the terminal strip on the relay module.

4. **Check the system voltage.**

   **a.** Ensure that the engine is off. Measure the system voltage at the battery.

   **Expected Result:** For 24 volt systems, the battery voltage should be from 24.8 to 29.5 DCV. For 32 volt systems, the battery voltage should be from 33.1 to 39.3 DCV.

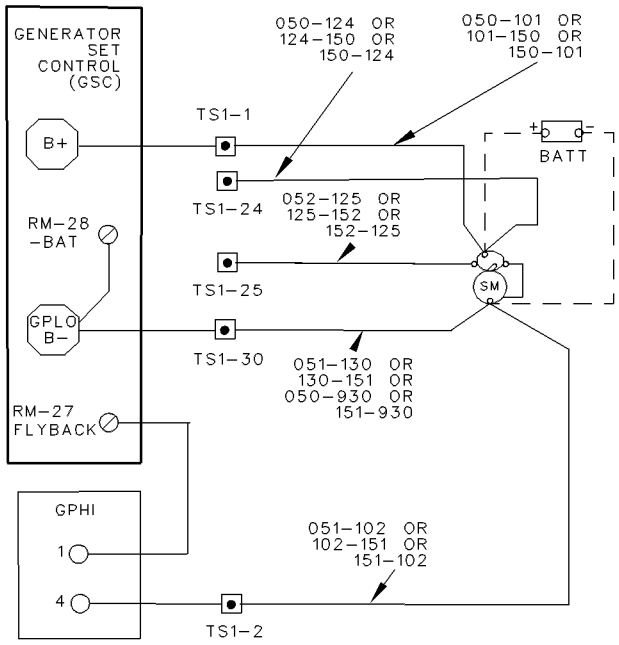
**Results:**

- OK - This procedure did not find the cause of the fault. The GSC is an unlikely cause of this diagnostic code. If the batteries or the charging system are suspect, perform "Charging System - Test". See Testing And Adjusting, "Charging System - Test". If an intermittent harness or a terminal problem is suspected, proceed to Testing And Adjusting, "Electrical Connector - Inspect". If the diagnostic code is not discovered, clear the fault log. Check for another occurrence of a CID 168. If a CID 168 persists, replace the GSC. See Testing And Adjusting, "EMCP Electronic Control (Generator Set) - Replace". STOP.
- NOT OK - The battery voltage is NOT correct. The charging system and/or the batteries are faulty. Perform the "Charging System - Test". See Testing And Adjusting, "Charging System - Test". STOP.

i01127722

# CID 168 FMI 4 Electrical System Voltage Below Normal - Test

**SMCS Code:** 1406-038; 4490-038




g00596452

Illustration 41

Schematic For Electrical System

The EMCP II monitors battery voltage in order to protect the EMCP II in case of a problem with the battery or battery charging. The EMCP II operates on a 24 DCV battery system or a 32 DCV battery system. The GSC receives battery voltage from RM-1 of the relay module terminal strip. The GSC measures this voltage. Voltage is received whenever the ECS is in the “START”, “AUTO”, or “STOP” position.

Note: The GSC does not receive battery power when the ECS is in the OFF/RESET position. The GSC receives power when the contacts “6” and “9” of the ECS are jumpered.

The GSC treats a CID 168 as an alarm fault.

**Procedure**

This diagnostic code can be caused by the following conditions:

- The battery voltage is less than 32 DCV for a 24 DCV battery system.
- The battery voltage is less than 45 DCV for a 32 DCV battery system.

The setpoint for system voltage (P07) specifies the battery voltage as “0” for 24 volts and “1” for 32 volts. Clear the diagnostic code from the fault log after troubleshooting is complete.

This procedure is used for troubleshooting an active fault or an inactive fault. Active alarm faults are shown on the upper display when the alarm codes key is pressed and the ECS is in any position except the OFF/RESET position. Inactive alarm faults are viewed in the fault log while the operator is in service mode. See Systems Operation, “Fault Log Viewing OP1”.

**1. Verify the fault.**

**a.** View the upper display and check for active diagnostic faults for the battery voltage (CID 168 FMI 4).

**b.** Enter service mode and check the fault log for inactive diagnostic faults for the battery voltage (CID 168 FMI 4).

**Expected Result:** A CID 168 FMI 4 is active.

**Results:**

- No - Battery voltage diagnostic faults, DO NOT EXIST. STOP.
- Yes - Battery voltage diagnostic faults, DO EXIST. Proceed to 2.

**2. Check the voltage.**

**a.** Turn the ECS to the STOP position.

**b.** Note the battery voltage that is showing on the lower display.

**c.** Measure the voltage (DCV) between the terminals of the battery.

**d.** Measure the voltage (DCV) between RM-1 (B+) and RM-28 (B-) of the terminal strip on the relay module.

**Expected Result:** The three voltages (preceding step 2.b, 2.c and 2.d) should be within 2.0 volt of each other.

**Results:**

- OK - All voltages agree (less than 2.0 DCV difference). Proceed to 4.
- NOT OK - Voltage measured at the batteries does not agree (greater than 2.0 DCV difference) with voltage measured at relay module terminal strip. Proceed to 3.
- NOT OK - Voltage that is showing on the lower display does not agree (greater than 2.0 DCV difference) with voltage measured at relay module terminal strip. Replace the GSC. See the Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.

**3. Check the harness.**

**a.** Disconnect the “B+” and “B-” cables from the battery.

**b.** Disconnect the “B+” wire from RM-1 and the “B-” wire from RM-28 of the terminal strip on the relay module.

**c.** Measure the resistance of each wire. Measure the resistance from the end of the battery to the end of the terminal strip.

**Expected Result:** The resistance of a single harness wire should be 5 ohms or less.

**Results:**

- OK - Both resistance measurements are correct. Therefore, an intermittent harness problem is likely. To further check the harness, proceed to Testing And Adjusting, “Electrical Connector - Inspect”. STOP.

- NOT OK - A resistance measurement is greater than 5 ohms. The harness wiring with the incorrect resistance measurement is faulty. Troubleshoot and repair the faulty harness wiring between the battery and the terminal strip on the relay module.

**4. Check the system voltage.**

**a.** Ensure that the engine is off. Measure the system voltage at the battery.

**Expected Result:** For 24 volt systems, the battery voltage should be from 24.8 to 29.5 DCV. For 32 volt systems, the battery voltage should be from 33.1 to 39.3 DCV.

**Results:**

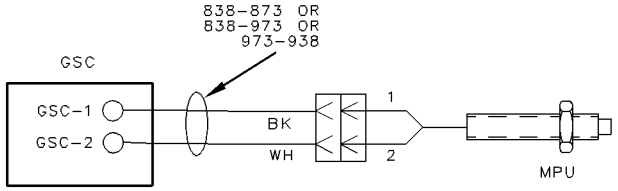
- OK - This procedure did not find the cause of the fault. The GSC is an unlikely cause of this diagnostic code. If the batteries or the charging system are suspect, perform “Charging System - Test”. See Testing And Adjusting, “Charging System - Test”. If an intermittent harness or a terminal problem is suspected, proceed to Testing And Adjusting, “Electrical Connector - Inspect”. If the diagnostic code is not discovered, clear the fault log. Check for another occurrence of a CID 168. If a CID 168 persists, replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.

- NOT OK - The battery voltage is NOT correct. The charging system and/or the batteries are faulty. Perform the “Charging System - Test”. See Testing And Adjusting, “Charging System - Test”. STOP.

i01127749

# CID 190 FMI 2 Speed Sensor (Engine) Incorrect Signal - Test

**SMCS Code:** 1907-038; 4490-038-NS




g00596481

Illustration 42

Schematic For Speed Sensor (Engine)

Note: This speed sensor is sometimes referred to as a magnetic pickup (MPU).

The EMCP II monitors engine speed in order to use the information when the information is needed for other tasks. The following list contains tasks that use the information from the speed sensor:

- Activating an engine overspeed shutdown
- Terminating engine cranking
- Determining the oil step speed
- Engaging the air shut off solenoids

The EMCP II does not control engine speed. The engine speed sensor is mounted on the flywheel housing of the engine.

The sensor creates a sine wave signal from passing ring gear teeth at the rate of one pulse per tooth. The sensor sends the GSC a sine wave signal in which the frequency is in direct proportion to the speed of the engine.

The GSC treats a CID 190 as a shutdown fault. The engine is not allowed to crank when this diagnostic code is active.

Note: Engines that are equipped with a PEEC electronic control module have a separate speed sensor. The cable of the speed sensor that is used by the GSC is marked “838-873”, “838-973”, or “973-938”.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded:

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

The following conditions could be the cause of a CID 190 FMI 2:

- The frequency of the signal is beyond accepted limits (short to “B-”).
- The air gap of the speed sensor is too large.

Clear the diagnostic code from the fault log after troubleshooting is complete.

**1. Check the harness and the sensor.**

**a.** Turn the ECS to OFF/RESET.

**b.** Disconnect the harness connector from the GSC.

**c.** At the GSC harness connector, measure the resistance from contact 1 to contact 2.

**Expected Result:** The resistance should be 100 to 350 ohm.

**Results:**

- OK - The fault is most likely intermittent. Reconnect the harness connector to the GSC. Turn the ECS to OFF/RESET and then turn the ECS to STOP. Verify that a CID 190 remains active on the upper display.
- If a CID 190 is showing, continue with this procedure. Proceed to next step.
- If a CID 190 is NOT showing, this step has corrected the fault. STOP. If you are desired then continue with this procedure. Proceed to next step.
- NOT OK - The harness wiring or the speed sensor is faulty. Proceed to 2.

**2. Check the resistance of the sensor.**

**a.** Disconnect the speed sensor from the engine harness. The speed sensor remains fastened to the engine.

**b.** At the connector of the speed sensor, measure the resistance between contact “1” and contact “2”.

**Expected Result:** The resistance should be 100 to 350 ohm.

**Results:**

- OK - The resistance of the speed sensor is correct. Proceed to next step.
- NOT OK - Replace the speed sensor. Also, see Testing And Adjusting, “Speed Sensor (Engine) - Adjust”. STOP.

**3. Check the harness for an open and a short.**

The ECS remains in the OFF/RESET position. The speed sensor and the GSC remain disconnected from the harness.

**a.** Check for an open circuit. Measure the resistance from contact “2” of the speed sensor harness connector to contact “2” of the GSC harness connector. The resistance should be 5 ohms or less.

**b.** Check for an open circuit. Measure the resistance from contact “1” of the speed sensor harness connector to contact “1” of the GSC harness connector. The resistance should be 5 ohms or less.

**c.** Check for a short circuit. Measure the resistance from contact “1” to contact “2”, both of the GSC harness connector. The resistance should be greater than 5000 ohms.

**Expected Result:** The resistance for 3.a and 3.b should be 5 ohms or less. The resistance for step 3.c should be greater than 5000 ohms.

**Results:**

- OK - The harness functions properly. Proceed to next step.

- NOT OK - The harness wiring with the incorrect resistance measurement is faulty. Replace the faulty harness from the speed sensor to the GSC connector. STOP.

**4. Check the shield and the connectors.**

The ECS remains in the OFF/RESET position. The speed sensor and the GSC remain disconnected from the harness. The harness has a shield (bare wire) which protects the signal wire for the speed sensor from electrical interference. Ensure that this shield is securely fastened. Also ensure that the shield makes a good electrical connection to the inside enclosure of EMCP II.

**a.** Within the EMCP II, check that the shield is securely fastened to a GSC mounting stud.

**b.** Within the EMCP II, measure the resistance from the shield to a metal surface within the enclosure of EMCP II. A good reference point is a mounting screw for a component that directly contacts the metal enclosure. The resistance should be 5 ohms or less.

**c.** Check the connector of the speed sensor and the mating harness connector. Proceed to Testing And Adjusting, “Electrical Connector - Inspect”.

**Expected Result:** The shield should be securely fastened. The resistance in 4.b should be 5 ohms or less. Also, the connectors should be proper.

**Results:**

- OK - Proceed to next step.

- NOT OK - One of the items is NOT correct. Repair the harness or replace the harness. STOP.

**5. Inspect the sensor and adjust the sensor.**

**a.** Remove the speed sensor from the engine flywheel housing.

**b.** Inspect the speed sensor for damage. Remove any debris from the tip.

**Expected Result:** No damage should be present.

**Results:**

- OK - Reinstall and adjust the speed sensor. See Testing And Adjusting, “Speed Sensor (Engine) - Adjust”. Proceed to next step.

- Not OK - Replace the speed sensor. Also, see Testing And Adjusting, “Speed Sensor (Engine) - Adjust”. STOP.

**6. Check the status of the fault.**

**a.** Reconnect the harness connector to the GSC and the speed sensor.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to STOP.

**c.** Verify that CID 190 is showing on the upper display.

**Expected Result:** A CID 190 FMI 2 is active.

**Results:**

- No - These procedures have corrected the fault. STOP. If you are desired then continue with this procedure. Proceed to next step.

- Yes - A CID 190 is showing, the diagnostic code is still active and the engine will not start. Use the process of elimination to find the faulty component. Stop when the diagnostic code is no longer showing. First, replace the speed sensor and adjust the speed sensor. Then replace the harness. Finally, replace the GSC.

**7. Check the signal voltage.**

This is an additional check of the circuit. Make sure that all harness connectors are connected.

**a.** Set up a multimeter with 7X-1710 Multimeter Probe Group in order to measure the ACV from contact “1” to contact “2” of the GSC connector.

**b.** Start and run the engine at rated speed.

**c.** Measure the ACV of the speed sensor.

**Expected Result:** The voltage should be greater than 2 ACV.

**Results:**

- OK - The speed sensor circuit checks correctly. STOP.

- NOT OK - The most likely cause is improper air gap of the speed sensor. Repeat 5. STOP.

i01127868

# CID 190 FMI 3 Speed Sensor (Engine) Voltage Above Normal - Test

**SMCS Code:** 1907-038; 4490-038-NS

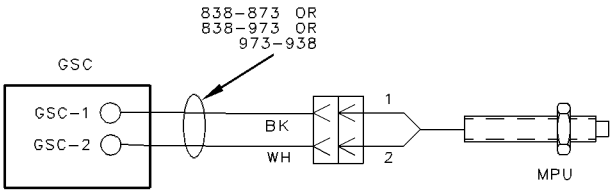



Illustration 43 g00596481

Schematic For Speed Sensor (Engine)

Note: This speed sensor is sometimes referred to as a magnetic pickup (MPU).

The EMCP II monitors engine speed in order to use the information when the information is needed for other tasks. The following list contains tasks that use the information from the speed sensor:

- Activating an engine overspeed shutdown
- Terminating engine cranking
- Determining the oil step speed
- Engaging the air shut off solenoids

The EMCP II does not control engine speed. The engine speed sensor is mounted on the flywheel housing of the engine.

The sensor creates a sine wave signal from passing ring gear teeth at the rate of one pulse per tooth. The sensor sends the GSC a sine wave signal in which the frequency is in direct proportion to the speed of the engine.

The GSC treats a CID 190 as a shutdown fault. The engine is not allowed to crank when this diagnostic code is active.

Note: Engines that are equipped with a PEEC electronic control module have a separate speed sensor. The cable of the speed sensor that is used by the GSC is marked “838-873”, “838-973”, or “973-938”.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded:

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

The following condition could be the cause of a CID 190 FMI 3:

- There is an open circuit of the signal wire.

Clear the diagnostic code from the fault log after troubleshooting is complete.

**1. Check the harness and the sensor.**

**a.** Turn the ECS to OFF/RESET.

**b.** Disconnect the harness connector from the GSC.

**c.** At the GSC harness connector, measure the resistance from contact 1 to contact 2.

**Expected Result:** The resistance should be 100 to 350 ohm.

**Results:**

- OK - The fault is most likely intermittent. Reconnect the harness connector to the GSC. Turn the ECS to OFF/RESET and then turn the ECS to STOP. Verify that a CID 190 remains active on the upper display.
- If a CID 190 is showing, continue with this procedure. Proceed to next step.
- If a CID 190 is NOT showing, this step has corrected the fault. STOP. If you are desired then continue with this procedure. Proceed to next step.

- NOT OK - The harness wiring or the speed sensor is faulty. Proceed to 2.

**2. Check the resistance of the sensor.**

**a.** Disconnect the speed sensor from the engine harness. The speed sensor remains fastened to the engine.

**b.** At the connector of the speed sensor, measure the resistance between contact “1” and contact “2”.

**Expected Result:** The resistance should be 100 to 350 ohm.

**Results:**

- OK - The resistance of the speed sensor is correct. Proceed to next step.

- NOT OK - Replace the speed sensor. Also, see Testing And Adjusting, “Speed Sensor (Engine) - Adjust”. STOP.

**3. Check the harness for an open and a short.**

The ECS remains in the OFF/RESET position. The speed sensor and the GSC remain disconnected from the harness.

**a.** Check for an open circuit. Measure the resistance from contact “2” of the speed sensor harness connector to contact “2” of the GSC harness connector. The resistance should be 5 ohms or less.

**b.** Check for an open circuit. Measure the resistance from contact “1” of the speed sensor harness connector to contact “1” of the GSC harness connector. The resistance should be 5 ohms or less.

**c.** Check for a short circuit. Measure the resistance from contact “1” to contact “2”, both of the GSC harness connector. The resistance should be greater than 5000 ohms.

**Expected Result:** The resistance for 3.a and 3.b should be 5 ohms or less. The resistance for step 3.c should be greater than 5000 ohms.

**Results:**

- OK - The harness functions properly. Proceed to next step.

- NOT OK - The harness wiring with the incorrect resistance measurement is faulty. Replace the faulty harness from the speed sensor to the GSC connector. STOP.

**4. Check the shield and the connectors.**

The ECS remains in the OFF/RESET position. The speed sensor and the GSC remain disconnected from the harness. The harness has a shield (bare wire) which protects the signal wire for the speed sensor from electrical interference. Ensure that this shield is securely fastened. Also ensure that the shield makes a good electrical connection to the inside enclosure of EMCP II.

**a.** Within the EMCP II, check that the shield is securely fastened to a GSC mounting stud.

**b.** Within the EMCP II, measure the resistance from the shield to a metal surface within the enclosure of EMCP II. A good reference point is a mounting screw for a component that directly contacts the metal enclosure. The resistance should be 5 ohms or less.

**c.** Check the connector of the speed sensor and the mating harness connector. Proceed to Testing And Adjusting, “Electrical Connector - Inspect”.

**Expected Result:** The shield should be securely fastened. The resistance in 4.b should be 5 ohms or less. Also, the connectors should be proper.

**Results:**

- OK - Proceed to next step.

- NOT OK - One of the items is NOT correct. Repair the harness or replace the harness. STOP.

**5. Inspect the sensor and adjust the sensor.**

**a.** Remove the speed sensor from the engine flywheel housing.

**b.** Inspect the speed sensor for damage. Remove any debris from the tip.

**Expected Result:** No damage should be present.

**Results:**

- OK - Reinstall and adjust the speed sensor. See Testing And Adjusting, “Speed Sensor (Engine) - Adjust”. Proceed to next step.

- Not OK - Replace the speed sensor. Also, see Testing And Adjusting, “Speed Sensor (Engine) - Adjust”. STOP.

**6. Check the status of the fault.**

**a.** Reconnect the harness connector to the GSC and the speed sensor.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to STOP.

**c.** Verify that CID 190 is showing on the upper display.

**Expected Result:** A CID 190 FMI 3 is active.

**Results:**

- No - These procedures have corrected the fault. STOP. If you are desired then continue with this procedure. Proceed to next step.
- Yes - A CID 190 is showing, the diagnostic code is still active and the engine will not start. Use the process of elimination to find the faulty component. Stop when the diagnostic code is no longer showing. First, replace the speed sensor and adjust the speed sensor. Then replace the harness. Finally, replace the GSC.

**7. Check the signal voltage.**

This is an additional check of the circuit. Make sure that all harness connectors are connected.

**a.** Set up a multimeter with 7X-1710 Multimeter Probe Group in order to measure the ACV from contact “1” to contact “2” of the GSC connector.

**b.** Start and run the engine at rated speed.

**c.** Measure the ACV of the speed sensor.

**Expected Result:** The voltage should be greater than 2 ACV.

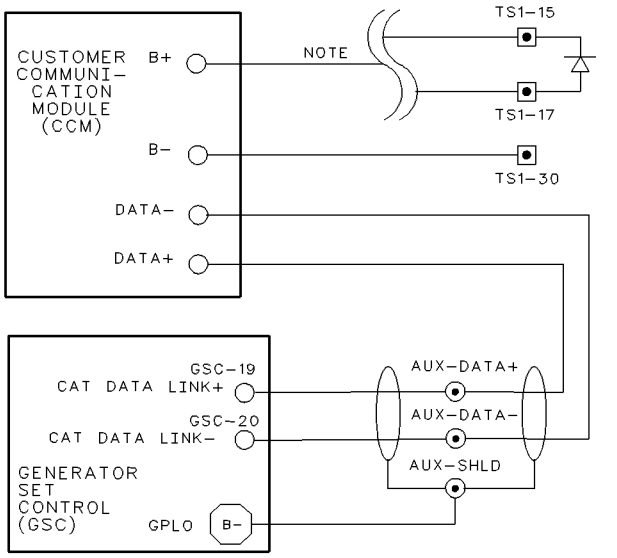
**Results:**

- OK - The speed sensor circuit checks correctly. STOP.
- NOT OK - The most likely cause is improper air gap of the speed sensor. Repeat 5. STOP.

i01128025

# CID 248 FMI 9 CAT Data Link Abnormal Update - Test

**SMCS Code:** 1408-038; 4490-038




g00596658

Illustration 44

Schematic For CAT Data Link

Note: When a CCM is connected to a single genset, “B+” is connected directly from TS1-17. When a CCM is connected to multiple gensets the diode must be connected. Also, “B+” must be wired to TS1-15.

Note: CID 248 FMI 9 replaces the former CID 560 FMI 11 for a fault with the CAT data link.

The following conditions will cause a CID 248 FMI 9:

- There is a short from the wire that connects to contact “19” of the CAT data link to the battery (“B+”).
- There is a short from the wire that connects to contact “20” of the CAT data link to the battery (“B+”).
- There is a short from the wire that connects to contact “19” of the CAT data link to ground (“B-”).
- There is a short from the wire that connects to contact “20” of the CAT data link to ground (“B-”).

The GSC cannot detect an open in the circuit of the CAT data link. Troubleshoot the wiring and repair the wiring. See Testing And Adjusting, “Schematic and Wiring Diagrams”.

The GSC treats a CID 248 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed. Also, the ECS is in any position except the OFF/RESET position. Clear the fault from the fault log after troubleshooting is complete.

i01108184

# CID 268 FMI 2 EMCP Electronic Control (Generator Set) Incorrect Signal - Test

**SMCS Code:** 4490-038

A portion of the memory within the GSC stores the setpoints of important conditions of the genset. The setpoints are found in the following service modes: “Engine/Generator Programming” (OP5), “Spare Input/Output Programming” (OP6), and “Voltmeter/Ammeter Programming” (OP8). The GSC detects a CID 268 when the data for the setpoint is invalid or out of range. After detecting a CID 268, the GSC sets the affected setpoints to the default value. For more information regarding setpoints and default values, see the following topics:

- Systems Operation, “Engine/Generator Programming OP5”
- Systems Operation, “Spare Input/Output Programming OP6”
- Systems Operation, “Voltmeter/Ammeter Programming OP8”

**Procedure**

Electrical interference is a possible cause of a CID 268 FMI 2.

This procedure is for a CID 268 that is active or inactive. Clear the diagnostic code from the fault log after troubleshooting is complete.

The GSC treats a CID 268 as an alarm fault or a shutdown fault. This will depend on the particular setpoint with the incorrect data. The setpoint for the ring gear teeth (P09) and the setpoint for the engine overspeed (P10) are treated as shutdown faults when the particular data is corrupted. All other setpoints are treated as alarm faults when the particular data is corrupted.

Note: If the fault shutdown indicator is FLASHING and the 6 to 9 jumper is NOT installed on the ECS, then the jumper must be temporarily installed. The GSC setpoints must be programmed in OFF/RESET when a fault shutdown is active. If the fault alarm indicator is FLASHING the GSC can be programmed with the ECS in any position.

1. **Check the setpoints.**

   **a.** View the setpoints that are stored in the memory of the GSC. See Systems Operation, “Engine/Generator Setpoint Viewing OP2”.

   **b.** Also check the spare input/output programming (OP6) and the voltmeter/ammeter programming (OP8).

   **c.** Compare the stored setpoints to the specified setpoints of the particular genset.

   **Expected Result:** The stored setpoints and specified setpoints should match.

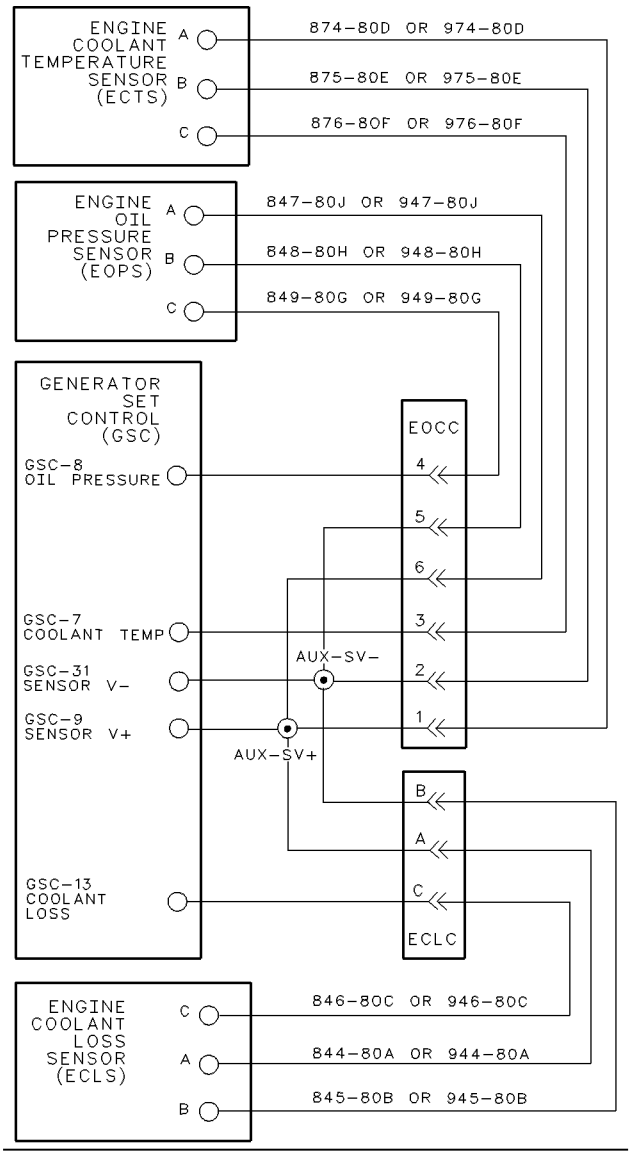
   **Results:**

   - OK - All the setpoints match. Start the engine. Verify that the CID 268 FMI 2 is active. If the fault remains active, replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. If the fault was inactive prior to performing this procedure, then these steps should have corrected the fault. STOP.
   - NOT OK - One or more of the setpoints do not match. Program the setpoints. See Systems Operation, “Engine/Generator Programming OP5”, Systems Operation, “Spare Input/Output Programming OP6”, and Systems Operation, “Voltmeter/Ammeter Programming OP8”. STOP.

i01128134

# CID 269 FMI 3 Sensor Power Supply Voltage Above Normal - Test

**SMCS Code:** 1408-038; 4490-038




g00596717

Illustration 45

System Schematic For Sensor Power Supply

The EMCP II has an 8 DCV sensor supply from the GSC that powers the optional engine coolant loss sensor. The sensor power supply functions whenever power is applied to the GSC.

Note: The GSC is usually programmed to treat a fault with the sensor power supply (CID 269) as an alarm fault (P04 = 0). If the GSC is programmed to shut down (P04 = 1) for a fault with the sensor power supply, then the alarm codes key is not needed to view the diagnostic code. The CID FMI is automatically shown on the upper display.

Note: Diagnostic codes are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created diagnostic codes after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

The following condition is a possible cause of a CID 269 FMI 3.

- The voltage of the sensor power supply is greater than 8.5 DCV.

Begin performing these procedures only when CID 269 FMI 3 is showing and the “DIAG” indicator is FLASHING on the upper display. The GSC treats a CID 269 FMI 3 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed. Also, the ECS is in any position except the OFF/RESET position. For an inactive fault, the problem may be intermittent. To troubleshoot an inactive fault, use the preceding system schematic. See Testing And Adjusting, “Electrical Connector - Inspect”. Clear the diagnostic code from the fault log after troubleshooting is complete.

**1. Check the GSC.**

**a.** Disconnect the harness connector from the GSC.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to the STOP position.

**c.** Press the alarm codes key.

**d.** Observe the upper display in order to verify that the CID 269 FMI 3 is showing.

**Expected Result:** The CID 269 FMI 3 should NOT be showing.

**Results:**

- OK - The GSC is functioning properly. Therefore, the engine harness has a short to the “B+”. Repair the engine harness. STOP.
- NOT OK - The GSC is faulty, replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.

i01128202

# CID 269 FMI 4 Sensor Power Supply Voltage Below Normal - Test

**SMCS Code:** 1408-038; 4490-038

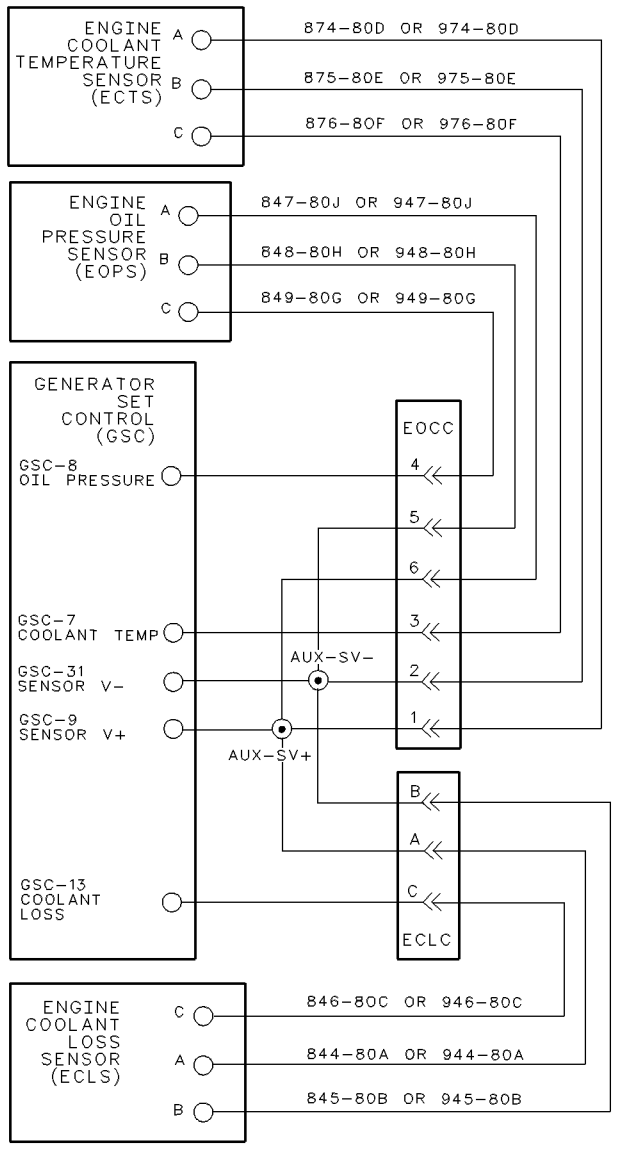



Illustration 46 g00596717

System Schematic For Sensor Power Supply

The EMCP II has an 8 DCV sensor supply from the GSC that powers three engine sensors: the fluid level sensor (engine coolant), the temperature sensor (engine coolant), and the pressure sensor (engine oil). The sensor power supply functions whenever power is applied to the GSC.

Note: The GSC is usually programmed to treat a fault with the sensor power supply (CID 269) as an alarm fault (P04 = 0). If the GSC is programmed to shut down (P04 = 1) for a fault with the sensor power supply, then the alarm codes key is not needed in order to view the CID FMI. The CID FMI is automatically shown on the upper display.

Note: Diagnostic codes are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created diagnostic codes after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

The following condition is a possible cause of a CID 269 FMI 3.

- The voltage of the sensor power supply is less than 7.5 DCV.

Begin performing these procedures only when CID 269 FMI 4 is showing and the “DIAG” indicator is FLASHING on the upper display. The GSC treats a CID 269 FMI 4 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed. Also, the ECS is in any position except the OFF/RESET position. For an inactive fault, the problem may be intermittent. To troubleshoot an inactive fault, use the preceding system schematic. See Testing And Adjusting, “Electrical Connector - Inspect”. Clear the diagnostic code from the fault log after troubleshooting is complete.

**1. Check the GSC.**

**a.** Disconnect the harness connector from the GSC.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to the STOP position.

**c.** Press the alarm codes key.

**d.** Observe the upper display in order to verify that the CID 269 FMI 4 is showing.

**Expected Result:** The CID 269 FMI 4 should NOT be showing.

**Results:**

- OK - The GSC is functioning properly. Therefore, the engine harness or a sensor is faulty. Proceed to **2**.
- NOT OK - The GSC is faulty, replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.

**2. Check the fluid level sensor (engine coolant).**

**a.** Turn the ECS to OFF/RESET.

**b.** Reconnect the harness connector to the GSC.

**c.** Disconnect the engine harness from the fluid level sensor (engine coolant).

**d.** Turn the ECS to STOP.

**e.** Press the alarm codes key.

**f.** Verify that CID 269 FMI 4 is showing.

**Expected Result:** If the sensor is the cause of this diagnostic code, then CID 269 FMI 4 should NOT be showing when the sensor is disconnected.

**Results:**

- OK - The CID 269 FMI 4 is NOT showing. The engine coolant loss sensor is faulty. Replace the sensor. STOP.
- NOT OK - The CID 269 FMI 4 is still showing. The sensor is not the cause of this diagnostic code. Proceed to **2**.

**3. Check the temperature sensor (engine coolant).**

**a.** Turn the ECS to OFF/RESET.

**b.** Reconnect the harness connector to the GSC.

**c.** Disconnect the engine harness from the temperature sensor (engine coolant).

**d.** Turn the ECS to STOP.

**e.** Press the alarm codes key.

**f.** Verify that CID 269 FMI 4 is showing.

**Expected Result:** If the sensor is the cause of this diagnostic code, then CID 269 FMI 4 should NOT be showing when the sensor is disconnected.

**Results:**

- OK - The CID 269 FMI 4 is NOT showing. The engine coolant temperature sensor is faulty. Replace the sensor. STOP.
- NOT OK - The CID 269 FMI 4 is still showing. The sensor is not the cause of this diagnostic code. Proceed to **2**.

**4. Check the pressure sensor (engine oil).**

**a.** Turn the ECS to OFF/RESET.

**b.** Reconnect the harness connector to the GSC.

**c.** Disconnect the engine harness from the pressure sensor (engine oil).

**d.** Turn the ECS to STOP.

**e.** Press the alarm codes key.

**f.** Verify that CID 269 FMI 4 is showing.

**Expected Result:** If the sensor is the cause of this diagnostic code, then CID 269 FMI 4 should NOT be showing when the sensor is disconnected.

**Results:**

- OK - The CID 269 FMI 4 is NOT showing. The engine oil pressure sensor is faulty. Replace the sensor. STOP.
- NOT OK - The CID 269 FMI 4 is still showing. The sensor is not the cause of this diagnostic code. Therefore, the engine harness has a short to ground (“B-”). Repair the engine harness. STOP.

i01128241

# CID 330 FMI 7 Unexpected Shutdown Improper Mechanical Response - Test

**SMCS Code:** 4490-038

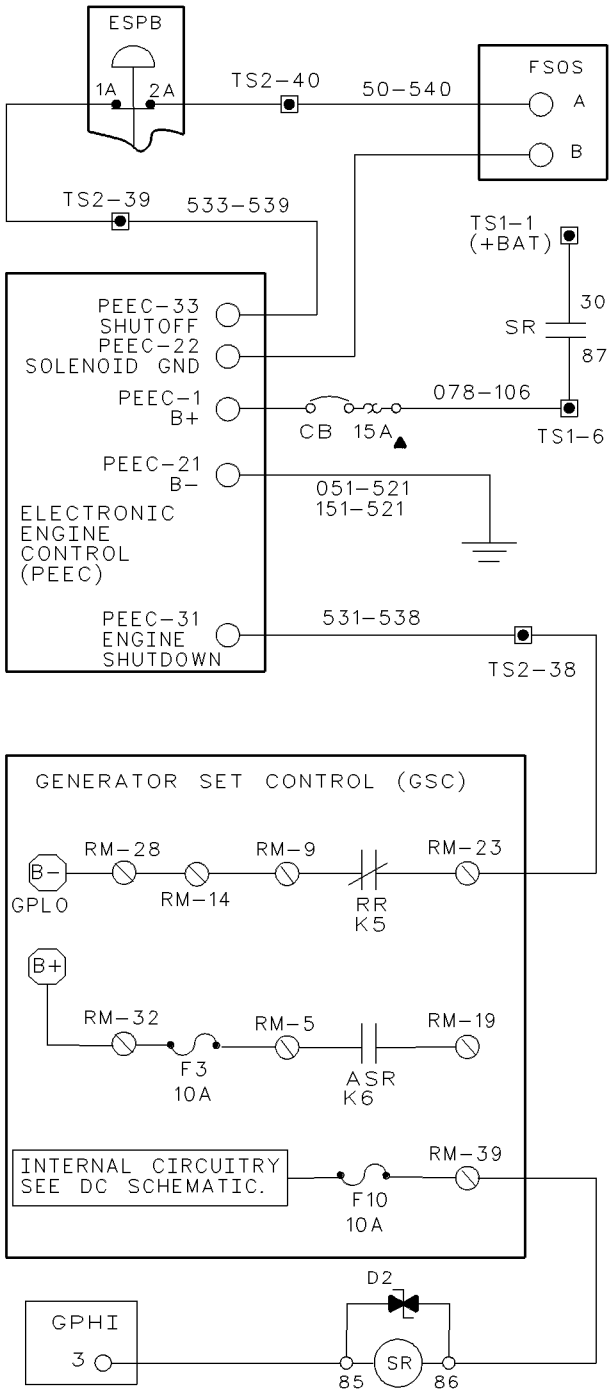



Illustration 47 g00596877

Schematic For An Unexpected Shutdown

The CID 330 alerts the operator that the GSC did not control the engine shutdown. The GSC normally controls all engine shutdowns. If an outside influence causes the engine to shut down, the GSC indicates a CID 330. There is only one failure mode for a CID 330 and the mode is FMI 7 (faulty mechanical response).

The diagnostic code causes the following sequence of events:

- On a running engine, the GSC detects that the engine speed has dropped from the rated speed to 0 rpm when the GSC has not called for a shutdown.
- The GSC determines that no fault for the engine speed sensor is present that explains the drop in the speed signal.
- The GSC indicates a CID 330 FMI 7 and the GSC disables the engine from running.

Note: An unexpected shutdown fault will initiate a signal from the shunt trip circuit breaker.

Note: Diagnostic codes are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created diagnostic codes after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

The following condition is a possible cause of a CID 330 FMI 7:

- A component that is not under the control of the GSC has caused an engine shutdown.

The GSC treats this diagnostic code as a shutdown fault. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: This procedure requires many voltage measurements during simulated engine cranking. The fuse for the starting motor “F4” on the relay module is removed in order to prevent the activation of the starting motor. Voltage measurements must be made quickly before the total cycle crank time (setpoint P17) elapses. The total cycle crank time has been defaulted to ninety seconds. See Systems Operation, “Engine/Generator Programming OP5”. If a voltage measurement takes too long (more than 90 seconds), the GSC indicates an overcrank fault. The indicator for the overcrank shutdown will FLASH. In order to continue with a voltage measurement, the overcrank fault must be reset by turning the ECS to OFF/RESET. Then turn the ECS to START.

**1. Perform an initial check.**

Before proceeding with the troubleshooting procedures, do the following steps:

**a.** Make sure that there are NO OTHER ACTIVE FAULTS. Erroneous troubleshooting and needless replacement of parts can be caused by a failure to check for other diagnostic codes. The operator will make many voltage measurements while the GSC is attempting to crank the engine. The GSC detects other diagnostic codes. If the GSC detects other diagnostic codes, the GSC will prevent the starting of the engine by sending a signal to the PEEC electronic control module. This signal will turn off the fuel shutoff solenoid and this signal will shut down the engine.

**b.** Check the fuel level and the fuel quality.

**c.** Check for a plugged fuel filter.

**d.** Check for a plugged air filter.

**e.** Refer to the Engine Service Manual if there is an obvious engine fault. Also, refer to the Engine Service Manual if there is an obvious fault with the fuel system.

**f.** Check the engine speed sensor for the PEEC electronic control module.

**g.** Check the air shutoff solenoid for activation. If the air shutoff solenoid is activated and the air shutoff solenoid cannot be deactivated, begin troubleshooting with 17. Otherwise begin troubleshooting with 2.

**2. Verify the diagnostic code.**

**a.** Observe the upper display. Check that the CID 330 FMI 7 is showing.

**Expected Result:** A CID 330 FMI 7 is showing as an active fault.

**Results:**

- No - A CID 330 FMI 7 is NOT showing. No active CID 330 FMI 7 exists. STOP.
- Yes - Only a CID 330 FMI 7 is showing. Proceed to 3. (If an inactive CID 330 FMI 7 is showing in the fault log, check the history of the genset and proceed to 3.)

3. **Check the system voltage.**

   **a.** Ensure that the engine is off. Measure the system voltage at the battery. Make a note of this measurement. The measurement for the system voltage is used for comparison in future steps of this procedure.

   **Expected Result:** For 24 volt systems, the system voltage should be from 24.8 to 29.5 DCV. For 32 volt systems, the system voltage should be from 33.1 to 39.3 DCV.

   **Results:**

   - OK - Proceed to 4.
   - NOT OK - System voltage is NOT correct. For troubleshooting, see the procedure for system voltage. STOP.

4. **Check the setpoint P01.** PEEC engines have ETR systems.

   **a.** Check the setpoint P01 for proper programming (“0” for ETR). See Systems Operation, “Setpoint Viewing OP2”.

   **Expected Result:** Setpoint P01 should be programmed to “0” for ETR.

   **Results:**

   - OK - Proceed to 5.
   - Not OK - Setpoint P01 is NOT programmed correctly. Reprogram setpoint P01. See Systems Operation, “Engine/Generator Programming OP5”.

5. **Check the fuses.**

   **a.** Turn the ECS to OFF/RESET.

   **b.** Check fuse “F10” on the relay module.

   **Expected Result:** Fuse “F10” should not be blown.

   **Results:**

   - OK - Proceed to 7.
   - NOT OK - One or more of the fuses are blown. Proceed to 6.

6. **Troubleshoot the blown fuse.**

   For reference, see the preceding System Schematics and Testing And Adjusting, “Schematics and Wiring Diagrams”.

   **a.** The ECS remains in the OFF/RESET position.

   **b.** Remove the fuse that is blown.

   - Measure the resistance from RM-39 of the relay module to ground (B-).

   **Expected Result:** The resistance of the circuit should be less than 3 ohms for the circuit with the fuse that is blown.

   **Results:**

   - OK - Resistance is greater than 3 ohms and fuse is no longer blowing. Carefully check ALL wires that are connected to the appropriate terminal of the relay module for abrasion or worn spots in the insulation that could be causing the short. Check the wires in the panel and the generator panel. Also check the wires on the engine harness. Refer to the various wiring diagrams. Repair the wiring or replace wiring, if necessary. STOP.
   - NOT OK - If a resistance is less than 3 ohms, there is a short to ground (B-). Remove one component or wire at a time that is in series with the load side of the fuse terminal. Remove a component or wire until the faulty component or wire is isolated. Repair the faulty component or wiring. If necessary, replace the faulty component or wiring. STOP.
   - NOT OK - If a resistance is greater than 3 ohms and the fuse still blows when all wires are removed from the appropriate terminal, replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.

7. **Check the condition of the low voltage.**

   This test continues troubleshooting from 5. Fuse “F4” remains removed from the relay module. For reference, see the “Generator Set Wiring Diagram” in the Testing And Adjusting, “Schematics & Wiring Diagrams”. Prepare to make voltage measurements at the relay module.

   **a.** Prepare to measure voltage at the generator housing.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**c.** At the generator housing, measure the voltage from TS2-40 to the TS1-2 terminal.

**Expected Result:** The voltage should increase to greater than 4.0 DCV. Then the voltage should stabilize to between 1.5 and 2.0 DCV.

**Results:**

- OK - Voltage is correct. The fault is with the fuel shutoff solenoid, the PEEC electronic control module, the fuel rack, or an open wire between TS2-40 and the fuel solenoid. See the Service Manual, "Engine Electronic Troubleshooting". STOP.
- NOT OK - Voltage is low. Check the wiring. Proceed to 8.

**8. Check that the diagnostic code exists.**

**a.** Make sure that no other diagnostic codes are active.

**b.** Check the upper display for any active diagnostic codes.

**Expected Result:** Only CID 330 FMI 7 is active.

**Results:**

- OK - Only CID 330 FMI 7 is active. Proceed to 9.
- NOT OK - A diagnostic code other than CID 330 FMI 7 is active. Correct the other diagnostic code. Proceed to the corresponding troubleshooting procedure. STOP.

**9. Check the system voltage.**

**a.** Prepare to measure voltage at the generator housing.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**c.** At the generator housing, measure the voltage from TS2-40 to the TS1-2 terminal.

**Expected Result:** The voltage should increase to greater than 4.0 DCV. Then the voltage should stabilize to between 1.5 and 2.0 DCV.

**Results:**

- OK - The voltage is correct. There is an open circuit between TS2-39 and TS2-40. Carefully check the resistance of the contacts for the ESPB. Check all wires for abrasion or worn spots in the insulation. Check the wires in the control panel and the generator housing. Repair the wiring. See the "Generator Set Wiring Diagram" in the Testing And Adjusting, "Schematics & Wiring Diagrams". STOP.
- NOT OK - The voltage remains low. Proceed to 10.

**10. Measure the voltage of the PEEC shutoff solenoid.**

**a.** Prepare to measure the voltage from the contact "A" of the PEEC shutoff solenoid to the -battery.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to the START.

**c.** Measure the voltage from contact "A" of the PEEC shutoff solenoid to -battery.

**Expected Results:** The voltage should increase to greater than 4.0 DCV. Then the voltage should stabilize to between 1.5 and 2.0 DCV.

- OK - The voltage is correct. There is an open circuit between PEEC shutoff solenoid and TS2-39. Carefully check the resistance of the contacts for the ESPB. Check all wires for abrasion or worn spots in the insulation. Check the wires in the control panel and the generator housing. Repair the wiring. See the "Generator Set Wiring Diagram" in the Testing And Adjusting, "Schematics & Wiring Diagrams". STOP.
- NOT OK - The voltage remains low. Proceed to 11.

**11. Check the supply voltage of the PEEC electronic control module.**

Fuse "F4" remains removed from the relay module. Prepare to make a voltage measurement at the PEEC electronic control module.

**a.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**b.** At the PEEC ECM, measure the voltage from contact 1 to the contact 21.

**Expected Result:** The voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - Voltage is correct. There is a fault in the PEEC electronic control module. There could be an open between the PEEC electronic control module and TS2-39. See the Service Manual, "Engine Electronic Troubleshooting". STOP.
- NOT OK - Voltage is low. Proceed to 12.

**12. Check the voltage at the terminal strip TS1.**

Fuse "F4" remains removed from the relay module. Prepare to make voltage measurements at the terminal strip in the generator terminal box.

**a.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**b.** Measure the voltage from terminal TS1-6 to terminal TS1-2.

**Expected Result:** the voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - Voltage is correct. There is an open between TS1-6 and the PEEC electronic control module. See the "Generator Set Wiring Diagram" in the Testing And Adjusting, "Schematics & Wiring Diagrams". STOP.
- NOT OK - Voltage is low. Proceed to 13.

**13. Check the voltage at the slave relay.**

Fuse "F4" remains removed from the relay module. Prepare to make voltage measurements at the slave relay (SR).

**a.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**b.** Measure the voltage from terminal 30 of the slave relay to terminal B- of the relay module.

**Expected Result:** the voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - Voltage is correct. Proceed to 14.
- NOT OK - Voltage is NOT correct. Check the wiring. STOP.

**14. Check the voltage at the slave relay.**

**a.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**b.** Measure the voltage from terminal 87 of the slave relay to terminal B- of the relay module.

**Expected Result:** the voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - Voltage is correct. Proceed to 15.
- NOT OK - Voltage is NOT correct. Replace the slave relay. STOP.

**15. Check that the diagnostic code exists.**

**a.** Make sure that no other diagnostic codes are active.

**b.** Check the upper display for any active diagnostic codes.

**Expected Result:** Only CID 330 FMI 7 is active.

**Results:**

- OK - Only CID 330 FMI 7 is active. Proceed to 16.
- NOT OK - A diagnostic code other than CID 330 FMI 7 is active. Correct the other diagnostic code. Proceed to the corresponding troubleshooting procedure. STOP.

**16. Check the system voltage.**

**a.** Recheck the voltage on terminal TS1-6. See 12.

**Expected Result:** The voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - The voltage is correct. There is an open circuit between TS1-6 of the terminal strip and the PEEC electronic control module. Check the wiring. See the "Generator Set Wiring Diagram" in the Testing And Adjusting, "Schematics & Wiring Diagrams". STOP.

- NOT OK - The voltage remains low. Check the wiring. See the “Generator Set Wiring Diagram” in the Testing And Adjusting, “Schematics & Wiring Diagrams”. STOP.

**17. Check the voltage at the air shutoff solenoid.**

This test continues troubleshooting from the preliminary step (initial check). Prepare to make a voltage measurement at the air shutoff solenoid. (The air shutoff solenoid may be active for 15 seconds.)

**a.** Remove fuse “F4” from the relay module.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**c.** At the air shutoff solenoid, measure the voltage across the terminals of solenoid.

**Expected Result:** The voltage should be from 0 to 2.0 DCV.

**Results:**

- OK - Voltage is correct. If the air shutoff solenoid cannot be reset then the fault is in the air shutoff solenoid. Refer to the Engine Service Manual. STOP.

- NOT OK - Voltage is high. Proceed to 18.

**18. Check the voltage at the relay module.**

Fuse “F4” remains removed from the relay module. Prepare to make a voltage measurement at the relay module.

**a.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**b.** At the relay module, measure the voltage from RM-19 to the B- terminal.

**Expected Result:** The voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - The voltage is correct. A wire or a component that is located between RM-19 of the relay module and the air shutoff solenoid is shorted to the battery (B+). Repair the circuit. See the “Generator Set Wiring Diagram” in the Testing And Adjusting, “Schematics & Wiring Diagrams”. STOP.

- NOT OK - The voltage is high. Proceed to 19.

**19. Check the ASR.**

Fuse “F4” remains removed from the relay module.

**a.** Remove fuse “F3” from the relay module.

**b.** Turn the ECS to OFF/RESET.

**c.** Make sure that “K6” is not shown on the lower GSC display. (If “K6” is showing, make sure that no other diagnostic codes are active.)

**d.** At the relay module, measure the resistance from RM-5 to RM-19. A measurement of less than 100 ohms indicates that the air shutoff relay is shorted.

**Expected Result:** The resistance should be greater than 10000 ohms.

**Results:**

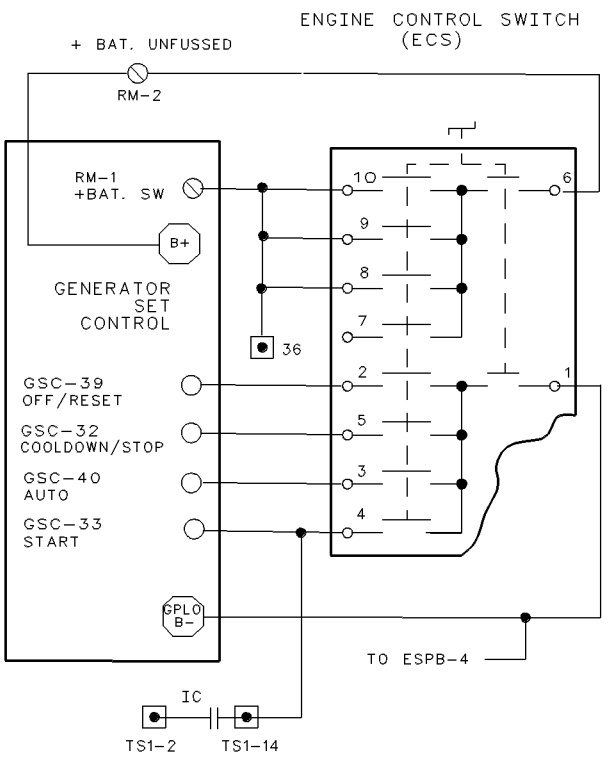
- OK - Resistance is greater than 10000 ohms. Check for a short from the battery (B+) to RM-19 of the relay module. Repair the shorted wiring. If the short is internal to the relay module, replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.

- NOT OK - Resistance is less than 100 ohms. The short is internal to the relay module. Replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.

i01130183

# CID 331 FMI 2 Switch (Engine Control) Incorrect Signal - Test

**SMCS Code:** 4490-038-ZS; 7332-038




g00481066

Illustration 48

Schematic For Engine Control Switch (ECS)

The Engine Control Switch (ECS) is used by the operator for manually controlling the engine. The ECS has four positions and each position connects to a corresponding input of the GSC. The selected position of the ECS connects the corresponding input of the GSC to ground (“B-”). At any time, only one of these four positions is connected to ground (“B-”).

Each position of the ECS places the engine in a different mode. The following information contains the four positions and the corresponding engine modes.

OFF/RESET – The engine is shut down and the GSC is reset. The upper display and the fault indicators on the left side are temporarily cleared. The GSC turns OFF unless a jumper is installed from terminal 6 of the ECS to terminal 9 of the ECS.

AUTO – The engine will start when the customer's remote start/stop contact closes the start input on the GSC to the ground (“B-”). the engine will start. The engine starts when the customer communication module (CCM) sends a remote start command. At this time, the GSC starts the engine and the engine runs normally until the remote start/stop contact opens. The engine stops when the customer communication module (CCM) sends a remote signal to stop. Then, the engine enters a time of cooldown before the engine is shut down. The GSC shows faults on the upper display and on the fault indicators as the faults occur. The GSC is ON with the ECS in this position.

MAN/START – The engine starts and runs until the operator turns the ECS to OFF/RESET, to COOLDOWN/STOP or until the GSC detects a fault shutdown. The GSC shows faults on the upper display and on the fault indicators as the faults occur. The GSC is ON with the ECS in this position.

COOLDOWN/STOP – The engine maintains rated speed for the cooldown period (programmable 0 to 30 minutes). After the cooldown period elapses, the engine is shut down. The GSC shows faults on the upper display and on the fault indicators as the faults occur. The GSC is ON with the ECS in this position.

Note: The remote start/stop contacts are connected to the GSC start input via the terminal TS1-14 in the generator housing. Before troubleshooting, disconnect the remote start contacts by removing the wire from terminal TS1-14.

Note: Diagnostic codes are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic fault codes are recorded:

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

The following conditions could be a possible cause of this diagnostic code:

- None of the GSC inputs from the ECS are connected to ground.

- More than one of the GSC inputs from the ECS is connected to ground (“B-”) at the same time.

The one exception is the start input. The start input of the GSC is also connected to the remote start/stop contact. The start input is controlled by the customer. Therefore, the GSC accepts a connection to ground (“B-”) at the start input. This connection is accepted with a combination of any other input for the ECS.

The CID 331 FMI 2 is the only fault for the ECS that is detected by the GSC. Clear the diagnostic code from the fault log after troubleshooting is complete. The GSC treats this diagnostic code as a shutdown fault. Use these procedures for an active fault or an inactive fault.

**1. Check for an open circuit.**

When you are performing this step, see the preceding System Schematic.

**a.** If equipped, disconnect the remote start/stop contacts by removing the wire from terminal TS1-14. Reconnect after troubleshooting is complete.

**b.** Disconnect the harness connector from the GSC.

**c.** For each position of the ECS, the corresponding contact of the GSC harness connector, is the only contact that is connected to ground (“B-”).

**d.** Place the ECS in the OFF/RESET position. At the GSC harness connector, measure the resistance from contact 39 to the “B-” terminal of the relay module. The resistance should be 5 ohms or less. Measure the resistance from contacts 32, 33 and 40 to the “B-” terminal. The resistance should be greater than 5000 ohms.

**e.** Place the ECS in the AUTO position. At the GSC harness connector, measure the resistance from contact 40 to the “B-” terminal of the relay module. The resistance should be 5 ohms or less. Measure the resistance from contacts 32, 33 and 39 to the “B-” terminal. The resistance should be greater than 5000 ohms.

**f.** Place the ECS in the MAN/START position. At the GSC harness connector, measure the resistance from contact 33 to the “B-” terminal of the relay module. The resistance should be 5 ohms or less. Measure the resistance from contacts 32, 39 and 40 to the “B-” terminal. The resistance should be greater than 5000 ohms.

**g.** Place the ECS in the COOLDOWN/STOP position. At the GSC harness connector, measure the resistance from contact 32 to the “B-” terminal of the relay module. The resistance should be 5 ohms or less. Measure the resistance from contacts 33, 39 and 40 to the “B-” terminal. The resistance should be greater than 5000 ohms.

**Expected Result:** For each measurement of steps 1.d, 1.e, 1.f and 1.g, the resistance should be as stated in the step.

**Results:**

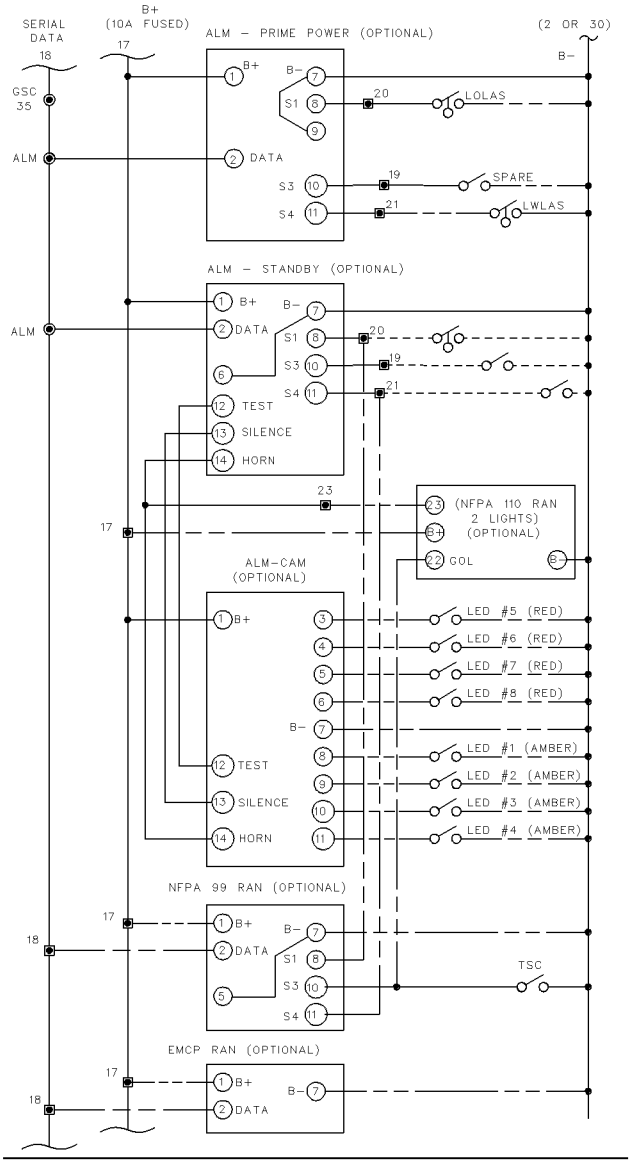
- OK - All resistance measurements are correct. The circuits in the harness are NOT open. To further check the harness, go to Testing And Adjusting, “Electrical Connector - Inspect”. STOP.

- NOT OK - One or more of the resistance measurements are NOT correct. The ECS is faulty or the harness wiring with the incorrect resistance measurement is open. Troubleshoot the ECS and/or repair the faulty harness wiring between ground (“B-”) and the GSC connector. STOP.

i01130287

# CID 333 FMI 3 Alarm Module Control Voltage Above Normal - Test

**SMCS Code:** 4490-038




g00481278

Illustration 49

Schematic For Alarm Module (ALM)

The alarm module (ALM) is available as an option. The ALM can be mounted on the instrument panel. The ALM can also be mounted at a distance as a remote annunciator. The ALM is used to satisfy requirements from customers and The National Fire Protection Association (NFPA) by annunciating the presence of a fault.

The ALM communicates with the GSC by a serial data link. When the data link malfunctions, all of the indicators on the ALM that are controlled by the data link, flash at a rate of .5 Hz.

Note: The maximum number of modules that can be connected to the serial data link is three. The maximum distance between a module and the GSC is 305 m (1000 ft). If these specifications are not met, there is a possibility for the ALM indicators to flash. Also, there is a possibility for the GSC to declare a diagnostic code of a CID 333. If the modules are not in compliance with the specifications, reduce the number of modules and/or shorten the distance to modules.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

The following condition is a possible cause of a CID 333 FMI 3.

- A short to the “B+” of the signal for the data is present.

The GSC treats this diagnostic code as an alarm fault. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: If a CID 333 FMI 3 is showing on the upper display and no alarm module is installed, check for a short. Check between the auxiliary terminal strip and the GSC.

**1. Check the fault status (Active/Inactive).**

**a.** Turn the ECS to OFF/RESET and then turn the ECS to STOP.

**b.** Press the alarm codes key.

**c.** Verify that a CID 333 FMI 3 is showing.

**d.** If the diagnostic code is not showing, enter the service mode and view the fault log (OP1). Verify that the diagnostic codes are showing.

**Expected Result:** A CID 333 FMI 3 is showing as active or inactive.

**Results:**

- No - A CID 333 FMI 3 has not occurred (is NOT active and is NOT inactive). STOP.
- Yes - A CID 333 FMI 3 is active. Proceed to 2.
- Yes - A CID 333 FMI 3 is inactive. Proceed to 4.

**2. Check the voltage of the signal for the data.**

**a.** Turn the ECS to STOP.

**b.** At the ALM, measure the DC voltage from terminal 2 (positive meter lead) to terminal 7 (negative meter lead).

**Expected Result:** The voltage that is measured should change constantly. The voltage should change within the range of 0 to 10 DCV.

**Results:**

- OK - Voltage measurement is correct. Proceed to 4.
- NOT OK - Voltage measurement is NOT correct. Proceed to 3.

**3. Check the voltage of the ALM and the GSC.**

**a.** Turn the ECS to STOP.

**b.** At the ALM, remove wire (18) from terminal 2.

**c.** Disconnect the harness connector from the GSC.

**d.** At the ALM, measure the DC voltage from terminal 2 (positive meter lead) to terminal 7 (negative meter lead). The voltage should be 11.6 ± 0.5 DCV.

**e.** At the GSC, measure the DC voltage from contact 35 of the GSC, to the ground (“B-”) terminal of the relay module. The measured voltage should change constantly. The voltage should change within the range of 0 to 5.5 DCV.

**Expected Result:** For 3.d, the voltage should be 11.6 ± 0.5 DCV. For 3.e, the voltage should be changing constantly. The voltage should change within the range of 0 to 5.5 DCV.

**Results:**

- OK - Both voltage measurements are correct. Proceed to 4.
- NOT OK - Voltage measured at the ALM is NOT correct. Replace the ALM. STOP.
- NOT OK - Voltage measured at the GSC is NOT correct. Replace the GSC. STOP.

**4. Check for a “B+” short in the harness.**

**a.** Disconnect the harness connector from the GSC.

**b.** At the ALM, remove wire (18) from terminal 2.

**c.** Measure the resistance from wire (18) at the ALM to the battery (“B+”) at the relay module.

**d.** Also, measure the resistance from wire (18) at the ALM to ground (“B-”) at the relay module.

**Expected Result:** For each measurement, the resistance should be greater than 20000 ohms.

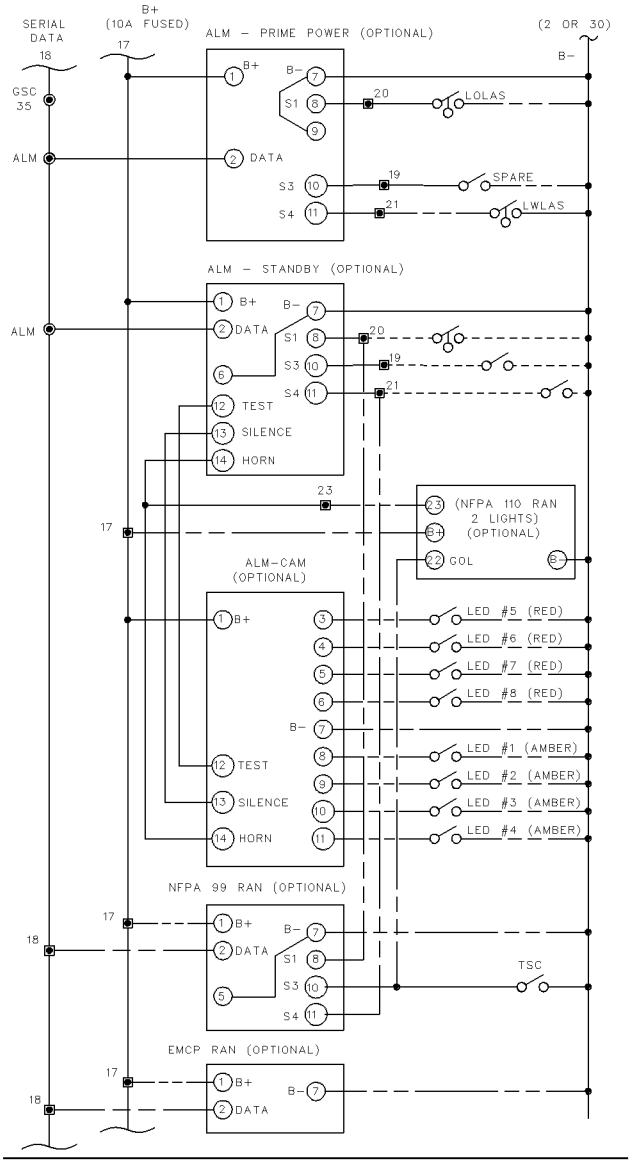
**Results:**

- OK - Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”. If the indicators on the ALM still flash after the inspection, replace the ALM. STOP.
- NOT OK - One or both of the resistance measurements are less than 20000 ohms. The harness wiring with the incorrect resistance measurement is shorted. Troubleshoot and repair the faulty harness wiring between the ALM and the GSC. See the preceding System Schematic.

i01130331

# CID 333 FMI 4 Alarm Module Control Voltage Below Normal - Test

**SMCS Code:** 4490-038




g00481278

Illustration 50

Schematic For Alarm Module (ALM)

The alarm module (ALM) is available as an option. The ALM can be mounted on the instrument panel. The ALM can also be mounted at a distance as a remote annunciator. The ALM is used to satisfy requirements from customers and The National Fire Protection Association (NFPA) by annunciating the presence of a fault.

The ALM communicates with the GSC by a serial data link. When the data link malfunctions, all of the indicators on the ALM that are controlled by the data link, flash at a rate of .5 Hz.

Note: The maximum number of modules that can be connected to the serial data link is three. The maximum distance between a module and the GSC is 305 m (1000 ft). If these specifications are not met, there is a possibility for the ALM indicators to flash. Also, there is a possibility for the GSC to declare a diagnostic code of a CID 333. If the modules are not in compliance with the specifications, reduce the number of modules and/or shorten the distance to modules.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 2 pressure sensor (engine oil)
- CID 110 FMI 2 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

The following condition is a possible cause of a CID 333 FMI 4.

- A short to the “B-” of the signal for the data is present.

The GSC treats this diagnostic code as an alarm fault. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: If a CID 333 FMI 4 is showing on the upper display and no alarm module is installed, check for a short. Check between the auxiliary terminal strip and the GSC.

1. **Check the fault status (Active/Inactive).**

   **a.** Turn the ECS to OFF/RESET and then turn the ECS to STOP.

   **b.** Press the alarm codes key.

   **c.** Verify that a CID 333 FMI 4 is showing.

**d.** If the diagnostic code is not showing, enter the service mode and view the fault log (OP1). Verify that the diagnostic codes are showing.

**Expected Result:** A CID 333 FMI 4 is showing as active or inactive.

**Results:**

- No - A CID 333 FMI 4 has not occurred (is NOT active and is NOT inactive). STOP.
- Yes - A CID 333 FMI 4 is active. Proceed to 2.
- Yes - A CID 333 FMI 4 is inactive. Proceed to 4.

**2. Check the voltage of the signal for the data.**

**a.** Turn the ECS to STOP.

**b.** At the ALM, measure the DC voltage from terminal 2 (positive meter lead) to terminal 7 (negative meter lead).

**Expected Result:** The voltage that is measured should change constantly. The voltage should change within the range of 0 to 10 DCV.

**Results:**

- OK - Voltage measurement is correct. Proceed to 4.
- NOT OK - Voltage measurement is NOT correct. Proceed to 3.

**3. Check the voltage of the ALM and the GSC.**

**a.** Turn the ECS to STOP.

**b.** At the ALM, remove wire (18) from terminal 2.

**c.** Disconnect the harness connector from the GSC.

**d.** At the ALM, measure the DC voltage from terminal 2 (positive meter lead) to terminal 7 (negative meter lead). The voltage should be 11.6 ± 0.5 DCV.

**e.** At the GSC, measure the DC voltage from contact 35 of the GSC, to the ground (“B-”) terminal of the relay module. The measured voltage should change constantly. The voltage should change within the range of 0 to 5.5 DCV.

**Expected Result:** For 3.d, the voltage should be 11.6 ± 0.5 DCV. For 3.e, the voltage should be changing constantly. The voltage should change within the range of 0 to 5.5 DCV.

**Results:**

- OK - Both voltage measurements are correct. Proceed to 4.
- NOT OK - Voltage measured at the ALM is NOT correct. Replace the ALM. STOP.
- NOT OK - Voltage measured at the GSC is NOT correct. Replace the GSC. STOP.

**4. Check for a “B+” short in the harness.**

**a.** Disconnect the harness connector from the GSC.

**b.** At the ALM, remove wire (18) from terminal 2.

**c.** Measure the resistance from wire (18) at the ALM to the battery (“B+”) at the relay module.

**d.** Also, measure the resistance from wire (18) at the ALM to ground (“B-”) at the relay module.

**Expected Result:** For each measurement, the resistance should be greater than 20000 ohms.

**Results:**

- OK - Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”. If the indicators on the ALM still flash after the inspection, replace the ALM. STOP.
- NOT OK - One or both of the resistance measurements are less than 20000 ohms. The harness wiring with the incorrect resistance measurement is shorted. Troubleshoot and repair the faulty harness wiring between the ALM and the GSC. See the preceding System Schematic.

i01158789

# CID 334 FMI 3 Spare Output Voltage Above Normal - Test

**SMCS Code:** 4490-038

The spare output of the GSC can be programmed as a high/low logic signal for customer devices. Also, the spare output can be programmed as a serial data link for operating the relay driver module (RDM).

When you are troubleshooting CID 334, it is necessary to determine the setting of the spare output. Setpoint SP11 is used to program the spare output. See Systems Operation, “Spare Input/Output Programming OP6”.

- SP11 = 1 through 8, for high/low logic.
- SP11 = 9, for serial data link.

If necessary, check the setpoint SP11 in order to determine the operation of the spare output. Perform the corresponding procedure that follows.

## High/Low Logic Circuit


g00487533

Illustration 51

System Schematic For Spare Output

When used as a high/low logic circuit.

The spare output on the GSC is strictly used for the customer. The spare output is programmed to activate under a variety of conditions. The default is set for the output to activate when the engine is in the cooldown (SP11 = 7). The GSC treats this diagnostic code as a alarm fault. For more information, see Systems Operation, “Spare Input/Output Programming OP6”. The responsibility of documenting any connections to this spare output falls on the customer and/or the dealer. Also, The responsibility of troubleshooting any connections to this spare output falls on the customer and/or the dealer.

The voltage on the spare output is approximately 3.0 DCV when the spare output is not active. The voltage is approximately 3.0 DCV when there are no connections to the spare output. When the spare output is active, the voltage on the spare output is approximately 0 volts. The spare output is capable of drawing (sinking) approximately 100 mA.

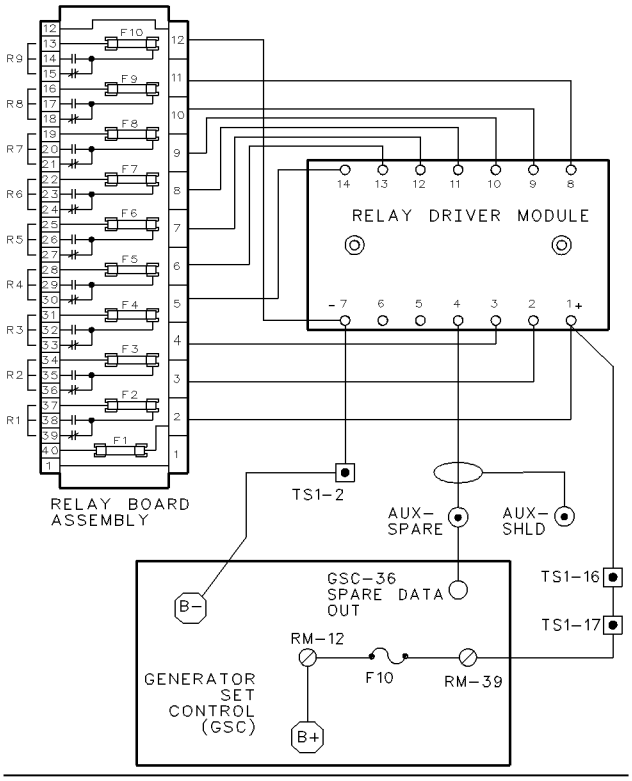
**Procedure**

The following condition could be a possible cause of a CID 334 FMI 3.

- A short to the battery (“B+”) of the signal for the spare output is present.

Troubleshooting of a spare output fault is direct. The FMI defines the diagnostic code. FMI 3 is a short to the +battery. In order to find the exact cause of the diagnostic code, use the following information: the FMI, the system schematic for the spare output, and the documentation that is provided by the dealer and/or the customer

## Serial Data Link




g00487536

Illustration 52

System Schematic For Spare Output

When used as a serial data link.

The GSC communicates with the relay driver module (RDM) by a serial data link. The serial data link is enabled when the setpoint SP11 is 9. For more information, see Systems Operation, “Spare Input/Output Programming OP6”.

Note: Earlier **103-6177, 113-4500, 117-6200, 120-6880, 123-6004 and 136-3870** EMCP Electronic Controls do not have the RDM serial data link capability.

When the data link malfunctions, R1 output (terminal 2 of the RDM) will be activated on and off at a rate of 0.5 Hz. Relays “R2” through “R9” will maintain the current states or the relays will default to off. This is controlled by a jumper between terminals 6 and 7 of the RDM. If a jumper is NOT present when the serial data link has a fault, the relay outputs (“R2” through “R9”) will maintain the current states. If the jumper is present, “R2” through “R9” will default to OFF.

Note: The maximum distance between a module and the GSC is 305 m (1000 ft). If this specification is not met, it is possible for the data link to malfunction. Also, a diagnostic code of CID 334 could occur. If the distance is not in compliance with the specification, shorten the distance between the RDM and the GSC.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created diagnostic codes after the particular diagnostic code is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded:

- CID 100 FMI 2 pressure sensor (engine oil)
- CID 110 FMI 2 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 336 FMI 2 switch (engine control)

**Procedure**

The following condition could be a possible cause of a CID 334 FMI 3.

- A short to the + battery of the signal for the data is present.

The GSC is not able to detect an open circuit condition of the data link for the relay driver module. Clear the diagnostic code from the fault log after troubleshooting is complete.

**1. Check the voltage of the signal for the data.**

**a.** At the RDM, measure the DC voltage from terminal 4 (positive meter lead) to terminal 7 (negative meter lead).

**Expected Result:** The voltage should change constantly. The voltage should change within the range of 0 to 10 DCV.

**Results:**

- OK - The voltage measurement is correct. Proceed to 3.
- NOT OK - The voltage measurement is NOT correct. Proceed to 2.

**2. Check the voltage of RDM and the GSC.**

**a.** At the RDM, disconnect all wires from terminal 4.

**b.** Disconnect the harness connector from the GSC.

**c.** At the RDM, measure the DC voltage from terminal 4 (positive meter lead) to terminal 7 (negative meter lead). Voltage should be 11.6 ± 0.5 DCV.

**d.** Measure the voltage from the contact 36 of the GSC to the ground (“B-”) terminal of the relay module. The voltage should change constantly. The voltage should change within the range of 0 to 5.5 DCV.

**Expected Result:** For 2.c, the voltage should be 11.6 ± 0.5 DCV. For 2.d, the voltage should change constantly. The voltage should change within the range of 0 to 5.5 DCV.

**Results:**

- OK - Both voltage measurements are correct. Proceed to 3.
- NOT OK - Voltage measured at the RDM is NOT correct. Replace the RDM. STOP.
- NOT OK - Voltage measured at the GSC is NOT correct. Replace the GSC. STOP.

**3. Check for the short in the harness.**

**a.** Disconnect the harness connector from the GSC.

**b.** At the RDM, remove wire 1-PK from terminal 4.

**c.** Measure the resistance from the wire at RDM terminal 4 to the positive battery (“B+”) terminal of the relay module on the rear of the GSC.

**d.** Measure the resistance from the wire at RDM terminal 4 to ground (“B-”) terminal of the relay module on the rear of the GSC.

**Expected Result:** Both measurements should be greater than 20000 ohms.

**Results:**

- OK - Both resistance measurements are correct. Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”. If the diagnostic code still exists after the inspection, replace the RDM. STOP.

- NOT OK - Either one or both of the resistance measurements are NOT correct. The harness wiring with the incorrect resistance measurement is shorted. Troubleshoot and repair the faulty harness wiring between the RDM and the GSC. See the preceding System Schematic. STOP.

i01158871

# CID 334 FMI 4 Spare Output Voltage Below Normal - Test

**SMCS Code:** 4490-038

The spare output of the GSC can be programmed as a high/low logic signal for customer devices. Also, the spare output can be programmed as a serial data link for operating the relay driver module (RDM).

When you are troubleshooting CID 334, it is necessary to determine the setting of the spare output. Setpoint SP11 is used to program the spare output. See Systems Operation, “Spare Input/Output Programming OP6”.

- SP11 = 1 through 8, for high/low logic.

- SP11 = 9, for serial data link.

If necessary, check the setpoint SP11 in order to determine the operation of the spare output. Perform the corresponding procedure that follows.

## High/Low Logic Circuit


g00487533

Illustration 53

System Schematic For Spare Output

When used as a high/low logic circuit.

The spare output on the GSC is strictly used for the customer. The spare output is programmed to activate under a variety of conditions. The default is set for the output to activate when the engine is in the cooldown (SP11 = 7). The GSC treats this diagnostic code as a alarm fault. For more information, see Systems Operation, “Spare Input/Output Programming OP6”. The responsibility of documenting any connections to this spare output falls on the customer and/or the dealer. Also, The responsibility of troubleshooting any connections to this spare output falls on the customer and/or the dealer.

The voltage on the spare output is approximately 3.0 DCV when the spare output is not active. The voltage is approximately 3.0 DCV when there are no connections to the spare output. When the spare output is active, the voltage on the spare output is approximately 0 volts. The spare output is capable of drawing (sinking) approximately 100 mA.

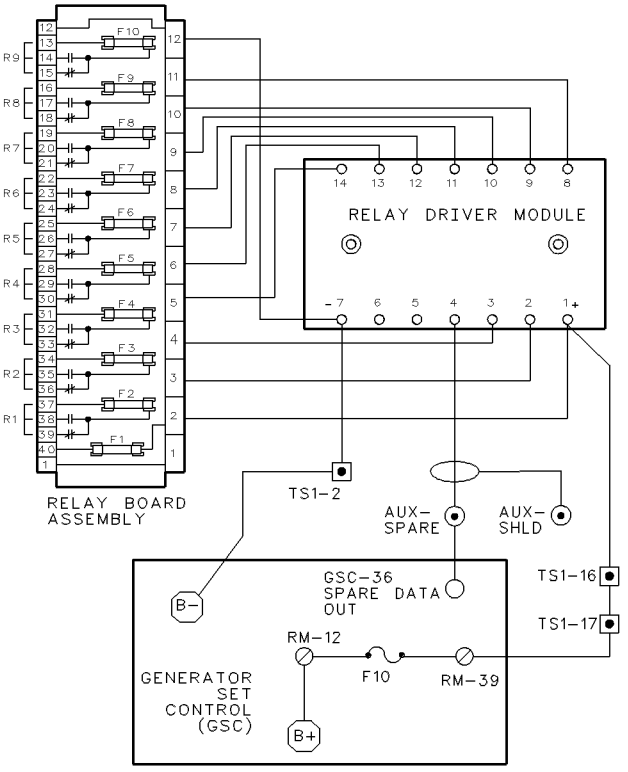
**Procedure**

The following condition could be a possible cause of a CID 334 FMI 4.

- A short to the ground (“B-”) of the signal for the spare output is present.

Troubleshooting of a spare output fault is direct. The FMI defines the diagnostic code. FMI 4 is a short to ground. In order to find the exact cause of the diagnostic code, use the following information: the FMI, the system schematic for the spare output, and the documentation that is provided by the dealer and/or the customer

## Serial Data Link




g00487536

Illustration 54

System Schematic For Spare Output

When used as a serial data link.

The GSC communicates with the relay driver module (RDM) by a serial data link. The serial data link is enabled when the setpoint SP11 is 9. For more information, see Systems Operation, “Spare Input/Output Programming OP6”.

Note: Earlier 103-6177, 113-4500, 117-6200, 120-6880, 123-6004 and 136-3870 EMCP Electronic Controls do not have the RDM serial data link capability.

When the data link malfunctions, R1 output (terminal 2 of the RDM) will be activated on and off at a rate of 0.5 Hz. Relays “R2” through “R9” will maintain the current states or the relays will default to off. This is controlled by a jumper between terminals 6 and 7 of the RDM. If a jumper is NOT present when the serial data link has a fault, the relay outputs (“R2” through “R9”) will maintain the current states. If the jumper is present, “R2” through “R9” will default to OFF.

Note: The maximum distance between a module and the GSC is 305 m (1000 ft). If this specification is not met, it is possible for the data link to malfunction. Also, a diagnostic code of CID 334 could occur. If the distance is not in compliance with the specification, shorten the distance between the RDM and the GSC.

Note: Faults are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created diagnostic codes after the particular diagnostic code is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded:

- CID 100 FMI 2 pressure sensor (engine oil)
- CID 110 FMI 2 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 336 FMI 2 switch (engine control)

**Procedure**

The following condition could be a possible cause of a CID 334 FMI 4.

- A short to the ground of the signal for the data is present.

The GSC is not able to detect an open circuit condition of the data link for the relay driver module. Clear the diagnostic code from the fault log after troubleshooting is complete.

**1. Check the voltage of the signal for the data.**

**a.** At the RDM, measure the DC voltage from terminal 4 (positive meter lead) to terminal 7 (negative meter lead).

**Expected Result:** The voltage should change constantly. The voltage should change within the range of 0 to 10 DCV.

**Results:**

- OK - The voltage measurement is correct. Proceed to 3.
- NOT OK - The voltage measurement is NOT correct. Proceed to 2.

**2. Check the voltage of RDM and the GSC.**

**a.** At the RDM, disconnect all wires from terminal 4.

**b.** Disconnect the harness connector from the GSC.

**c.** At the RDM, measure the DC voltage from terminal 4 (positive meter lead) to terminal 7 (negative meter lead). Voltage should be 11.6 ± 0.5 DCV.

**d.** Measure the voltage from the contact 36 of the GSC to the ground (“B-”) terminal of the relay module. The voltage should change constantly. The voltage should change within the range of 0 to 5.5 DCV.

**Expected Result:** For 2.c, the voltage should be 11.6 ± 0.5 DCV. For 2.d, the voltage should change constantly. The voltage should change within the range of 0 to 5.5 DCV.

**Results:**

- OK - Both voltage measurements are correct. Proceed to 3.
- NOT OK - Voltage measured at the RDM is NOT correct. Replace the RDM. STOP.
- NOT OK - Voltage measured at the GSC is NOT correct. Replace the GSC. STOP.

**3. Check for the short in the harness.**

**a.** Disconnect the harness connector from the GSC.

**b.** At the RDM, remove wire 1-PK from terminal 4.

**c.** Measure the resistance from the wire at RDM terminal 4 to the positive battery (“B+”) terminal of the relay module on the rear of the GSC.

**d.** Measure the resistance from the wire at RDM terminal 4 to ground (“B-”) terminal of the relay module on the rear of the GSC.

**Expected Result:** Both measurements should be greater than 20000 ohms.

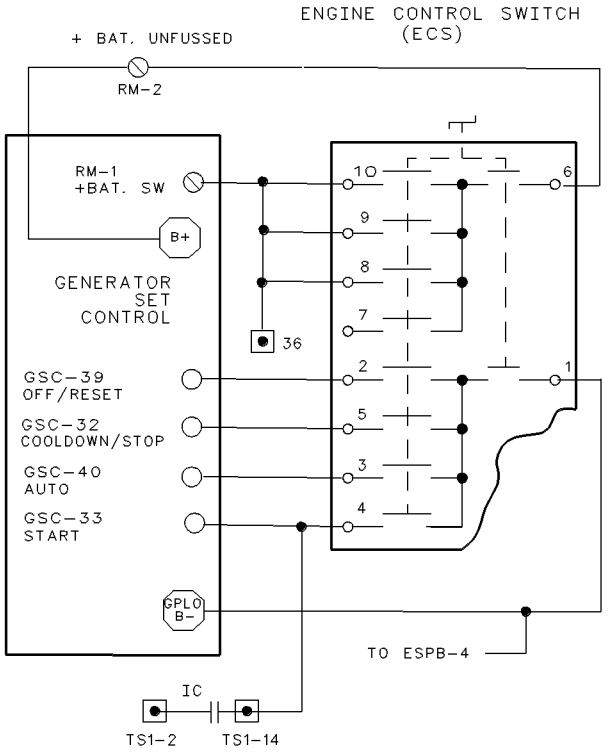
**Results:**

- OK - Both resistance measurements are correct. Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”. If the diagnostic code still exists after the inspection, replace the RDM. STOP.
- NOT OK - Either one or both of the resistance measurements are NOT correct. The harness wiring with the incorrect resistance measurement is shorted. Troubleshoot and repair the faulty harness wiring between the RDM and the GSC. See the preceding System Schematic. STOP.

i01130403

# CID 336 FMI 2 Switch (Engine Control) Incorrect Signal - Test

**SMCS Code:** 4490-038-ZS; 7332-038




g00481066

Illustration 55

Schematic For Engine Control Switch (ECS)

The Engine Control Switch (ECS) is used by the operator for manually controlling the engine. The ECS has four positions and each position connects to a corresponding input of the GSC. The selected position of the ECS connects the corresponding input of the GSC to ground (“B-”). At any time, only one of these four positions is connected to ground (“B-”).

Each position of the ECS places the engine in a different mode. The following information contains the four positions and the corresponding engine modes.

OFF/RESET – The engine is shut down and the GSC is reset. The upper display and the fault indicators on the left side are temporarily cleared. The GSC turns OFF unless a jumper is installed from terminal 6 of the ECS to terminal 9 of the ECS.

AUTO – The engine will start when the customer's remote start/stop contact closes the start input on the GSC to the ground (“B-”). the engine will start. The engine starts when the customer communication module (CCM) sends a remote start command. At this time, the GSC starts the engine and the engine runs normally until the remote start/stop contact opens. The engine stops when the customer communication module (CCM) sends a remote signal to stop. Then, the engine enters a time of cooldown before the engine is shut down. The GSC shows faults on the upper display and on the fault indicators as the faults occur. The GSC is ON with the ECS in this position.

MAN/START – The engine starts and runs until the operator turns the ECS to OFF/RESET, to COOLDOWN/STOP or until the GSC detects a fault shutdown. The GSC shows faults on the upper display and on the fault indicators as the faults occur. The GSC is ON with the ECS in this position.

COOLDOWN/STOP – The engine maintains rated speed for the cooldown period (programmable 0 to 30 minutes). After the cooldown period elapses, the engine is shut down. The GSC shows faults on the upper display and on the fault indicators as the faults occur. The GSC is ON with the ECS in this position.

Note: The remote start/stop contacts are connected to the GSC start input via the terminal TS1-14 in the generator housing. Before troubleshooting, disconnect the remote start contacts by removing the wire from terminal TS1-14.

Note: Diagnostic codes are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created faults after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic fault codes are recorded:

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

The following conditions could be a possible cause of this diagnostic code:

- None of the GSC inputs from the ECS are connected to ground.
- More than one of the GSC inputs from the ECS is connected to ground (“B-”) at the same time.

The one exception is the start input. The start input of the GSC is also connected to the remote start/stop contact. The start input is controlled by the customer. Therefore, the GSC accepts a connection to ground (“B-”) at the start input. This connection is accepted with a combination of any other input for the ECS.

The CID 336 FMI 2 is the only fault for the ECS that is detected by the GSC. Clear the diagnostic code from the fault log after troubleshooting is complete. The GSC treats this diagnostic code as a shutdown fault. Use these procedures for an active fault or an inactive fault.

**1. Check for an open circuit.**

When you are performing this step, see the preceding System Schematic.

**a.** If equipped, disconnect the remote start/stop contacts by removing the wire from terminal TS1-14. Reconnect after troubleshooting is complete.

**b.** Disconnect the harness connector from the GSC.

**c.** For each position of the ECS, the corresponding contact of the GSC harness connector, is the only contact that is connected to ground (“B-”).

**d.** Place the ECS in the OFF/RESET position. At the GSC harness connector, measure the resistance from contact 39 to the “B-” terminal of the relay module. The resistance should be 5 ohms or less. Measure the resistance from contacts 32, 33 and 40 to the “B-” terminal. The resistance should be greater than 5000 ohms.

**e.** Place the ECS in the AUTO position. At the GSC harness connector, measure the resistance from contact 40 to the “B-” terminal of the relay module. The resistance should be 5 ohms or less. Measure the resistance from contacts 32, 33 and 39 to the “B-” terminal. The resistance should be greater than 5000 ohms.

**f.** Place the ECS in the MAN/START position. At the GSC harness connector, measure the resistance from contact 33 to the “B-” terminal of the relay module. The resistance should be 5 ohms or less. Measure the resistance from contacts 32, 39 and 40 to the “B-” terminal. The resistance should be greater than 5000 ohms.

**g.** Place the ECS in the COOLDOWN/STOP position. At the GSC harness connector, measure the resistance from contact 32 to the “B-” terminal of the relay module. The resistance should be 5 ohms or less. Measure the resistance from contacts 33, 39 and 40 to the “B-” terminal. The resistance should be greater than 5000 ohms.

**Expected Result:** For each measurement of steps 1.d, 1.e, 1.f and 1.g, the resistance should be as stated in the step.

**Results:**

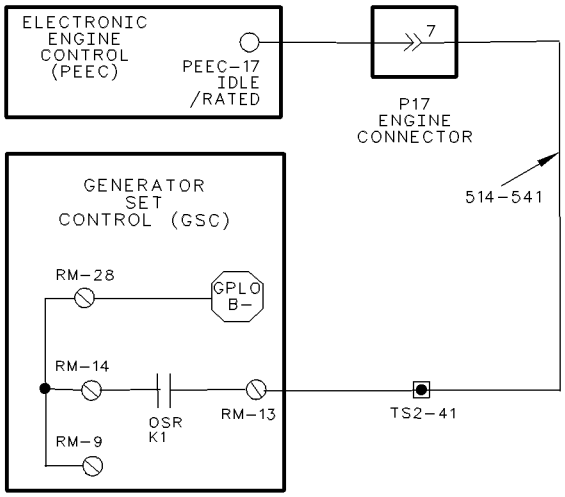
- OK - All resistance measurements are correct. The circuits in the harness are NOT open. To further check the harness, go to Testing And Adjusting, “Electrical Connector - Inspect”. STOP.

- NOT OK - One or more of the resistance measurements are NOT correct. The ECS is faulty or the harness wiring with the incorrect resistance measurement is open. Troubleshoot the ECS and/or repair the faulty harness wiring between ground (“B-”) and the GSC connector. STOP.

i01130463

# CID 441 FMI 12 Oil Step Relay Failed - Test

**SMCS Code:** 4490-038-R7




g00597815

Illustration 56

Schematic For Oil Step Relay (OSR)

The oil step relay (OSR) is used by the GSC for the activation of the close-for-rated speed contacts of the PEEC ECM. When the contacts are activated, the PEEC ECM increases the engine speed from idle speed to rated speed. The output of the oil step relay is rated at 1 ampere. The OSR is located within the relay module.

The GSC activates the OSR when the engine oil pressure is greater than the setpoint for low oil pressure shutdown at idle speed (P14). (Also, “K1” is showing on the lower display.) This closes the contacts of the OSR. Also, the PEEC electronic control module places the engine at rated speed.

The GSC does not activate the OSR when the engine oil pressure is less than the setpoint for low oil pressure shutdown at idle speed (P14). (Also, “K1” is not showing on the lower display.) This opens the contacts of the OSR. Also, the PEEC electronic control module places the engine at idle speed.

Note: Whenever the GSC activates the OSR, “K1” is shown on the lower display. “K1” is also shown on the lower display when the GSC attempts to activate the OSR. When the OSR is not activated, “K1” is not shown.

**Procedure**

The following condition is a possible cause of a CID "441" FMI "12".

- A coil is open on the OSR.
- A coil is shorted on the OSR.

The following response is the system response to this fault while the OSR is activated:

- If a CID 441 FMI 12 occurs, then the engine speed drops from rated speed to idle speed.

The following response is the system response to this fault while the OSR is not activated:

- If a CID 441 FMI 12 occurs, then the engine is able to start but the engine is unable to reach rated speed.

The GSC treats this diagnostic code as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed. Also, the active alarm faults are shown when the ECS is in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

1. **Check the status of the diagnostic code (Active/Inactive).**

   **a.** Turn the ECS to OFF/RESET and then turn the ECS to STOP.

   **b.** Press the alarm codes key.

   **c.** Observe the upper display. Check that the diagnostic code is showing.

   **d.** If the diagnostic code is not showing, enter the service mode. View the fault log (OP1). Check that the diagnostic code is showing.

   **Expected Result:** A CID 441 FMI 12 is showing as a active fault or an inactive fault.

   **Results:**

   - No - A CID 441 FMI 12 has not occurred. STOP.
   - Yes - A CID 441 FMI 12 is active or inactive. Proceed to 2.

2. **Check internal cable of relay module.**

Note: Only open the relay module in a dry environment. If the inspection takes more than twenty minutes replace the desiccant bag in the GSC housing. See Testing And Adjusting, "Relay Module - Replace".

   **a.** Turn the ECS to OFF/RESET.

   **b.** Temporarily, remove the relay module from the GSC. See Testing And Adjusting, "Relay Module - Replace".

   **c.** Check the cable that attaches the relay module to the GSC.

   **Expected Result:** The cable should be firmly seated in the connector. The clamp should be in place. The cable should not be damaged.

   **Results:**

   - OK - Reassemble the relay module to the GSC. Proceed to 3.
   - NOT OK - Replace the connector clamp if it is missing. If the cable is damaged, replace the GSC. STOP.

3. **Perform a functional check for the OSR.**

   **a.** Turn the ECS to OFF/RESET.

   **b.** Disconnect all wires from RM-13 and RM-14 of the relay module.

   **c.** At the relay module, measure the resistance from RM-13 to RM-14. Resistance should be greater than 5000 ohms.

   **d.** Start the engine. Make sure that the engine oil pressure is greater than the setpoint for low oil pressure shutdown at idle speed (P14).

   **e.** At the relay module, measure the resistance from RM-13 to RM-14. Resistance should be less than 5 ohms.

   **Expected Result:** For 3.c, the resistance should be greater than 5000 ohms. For 3.e, the resistance should be less than 5 ohms.

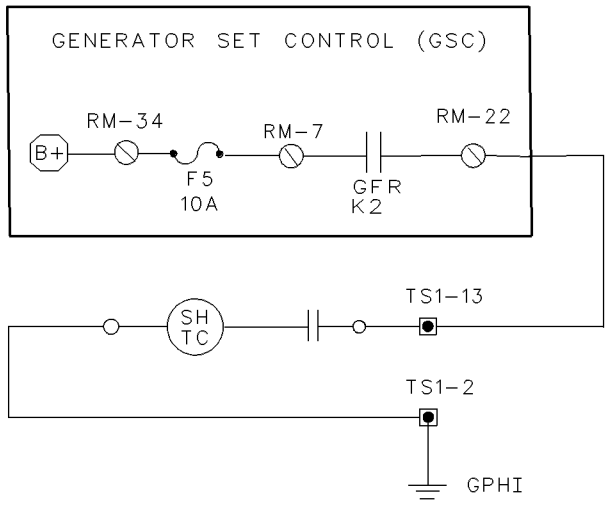
   **Results:**

   - OK - It is likely that a temporary bad electrical connection existed and this troubleshooting procedure corrected it. Check the electrical connectors, terminals and wiring. See Testing And Adjusting, "Electrical Connector - Inspect". STOP.
   - NOT OK - Either one of the resistance measurements are NOT correct. The relay module is faulty. Replace the relay module. See Testing And Adjusting, "Relay Module - Replace". STOP.

i01109432

# CID 442 FMI 12 Generator Fault Relay Failed - Test

**SMCS Code:** 4490-038-R7




g00487968

Illustration 57

System Schematic For Generator Fault Relay (GFR)

The GSC uses the generator fault relay (GFR) to activate the shunt trip coil of the optional circuit breaker during a shutdown fault. This circuit breaker takes the generator off the line during a shutdown fault. The GFR is located within the relay module. The optional circuit breaker is located in the generator housing and the shunt trip coil is located within the circuit breaker.

Note: Whenever the GSC activates the GFR, “K2” is shown on the lower display. “K2” is also shown on the lower display when the GSC attempts to activate the GFR. When the GFR is not activated, “K2” is not shown.

### Procedure

The possible cause of this diagnostic code is an open coil or a shorted coil of the GFR.

The following response is the system response to this fault while the GFR is activated:

- If a CID 442 occurs, then there is no effect on the system because the optional circuit breaker is already open. Also, the shutdown mode is functioning. The generator is already off the line.

The following response is the system response to this fault while the GFR is not activated and a shutdown fault occurs:

- If a CID 442 occurs, then the GFR cannot activate the shunt trip coil of the optional circuit breaker. The generator remains on-line.

The GSC treats a CID 442 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed. Also, the active alarm faults are shown when the ECS is in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

**1. Check the status of the diagnostic code (Active/Inactive).**

**a.** Turn the ECS to OFF/RESET and then turn the ECS to STOP.

**b.** Press the alarm codes key.

**c.** Observe the upper display. Check that the diagnostic code is showing.

**d.** If the diagnostic code is not showing, enter the service mode. View the fault log (OP1). Check that the diagnostic code is showing.

**Expected Result:** A CID 442 FMI 12 is showing as a active fault or an inactive fault.

**Results:**

- No - A CID 442 FMI 12 has not occurred (NOT active and NOT inactive). STOP.
- Yes - A CID 442 FMI 12 is active or inactive. Proceed to **2**.

**2. Check internal cable of relay module.**

Note: Only open the relay module in a dry environment. If the inspection takes more than twenty minutes replace the desiccant bag in the GSC housing. See Testing And Adjusting, “Relay Module - Replace”.

**a.** Turn the ECS to OFF/RESET.

**b.** Temporarily, remove the relay module from the GSC. See Testing And Adjusting, “Relay Module Replace”.

**c.** Check the cable that attaches the relay module to the GSC.

**Expected Result:** The cable should be firmly seated in the connector. The clamp should be in place. The cable should not be damaged.

**Results:**

- OK - Reassemble the relay module to the GSC. Proceed to **3**.

- NOT OK - Replace the connector clamp if it is missing. If the cable is damaged, replace the GSC. STOP.

**3. Perform a functional check for the GFR.**

**a.** Turn the ECS to OFF/RESET.

**b.** Disconnect all wires from RM-22 of the relay module.

**c.** At the relay module, measure the resistance from RM-22 to RM-7. Resistance should be greater than 5000 ohms.

**d.** Turn the ECS to STOP and push in the emergency stop button.

**e.** At the relay module, measure the resistance from RM-22 to RM-7. Resistance should be less than 5 ohms.

**Expected Result:** For 3.c, the resistance should be greater than 5000 ohms. For 3.e, the resistance should be less than 5 ohms.

**Results:**

- OK - It is likely that a temporary bad electrical connection existed and this troubleshooting procedure corrected it. Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”. STOP.

- NOT OK - Either one of the resistance measurements are NOT correct. The relay module is faulty. Replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.

i01109465

# CID 443 FMI 12 Crank Termination Relay Failed - Test

**SMCS Code:** 1453-038-R7; 4490-038-R7

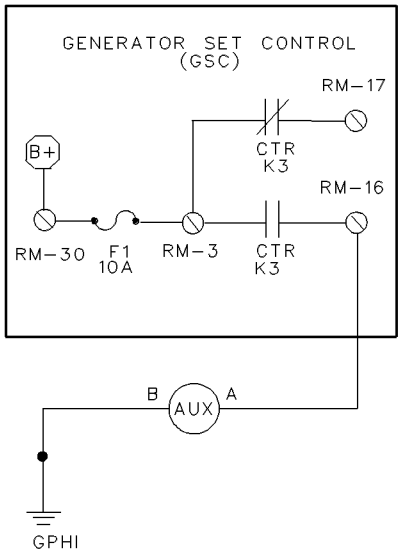



Illustration 58 g00488088

System Schematic For Crank Termination Relay (CTR)

The GSC uses the crank termination relay (CTR) to activate the optional auxiliary relay (AUXREL). The CTR is located within the relay module. The AUXREL is located on the subpanel within the control panel.

The CTR is used to indicate that the engine is beginning to run without cranking. The GSC activates the CTR when the engine speed is greater than the crank terminate setpoint. (Setpoint P11 should be 400 RPM.) Also, the GSC activates the CTR when the starting motor relay has been deactivated. The CTR deactivates when the engine RPM reaches 0.

Note: Whenever the GSC activates the CTR, “K3” is shown on the lower display. “K3” is also shown on the lower display when the GSC attempts to activate the crank terminate relay. When the CTR is not activated, “K3” is not shown.

**Procedure**

The possible cause of this diagnostic code is an open coil or a shorted coil of the CTR.

The following response is the system response to this fault while the CTR is activated:

- If a CID 443 occurs, then the engine continues to run and the AUXREL is deactivated.

The following response is the system response to this fault while the CTR is not activated:

- If a CID 443 occurs, then the engine is able to start and the engine can run. The AUXREL is not activated.

The GSC treats a CID 443 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed. Also, the active alarm faults are shown when the ECS is in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

**1. Check the status of the diagnostic code (Active/Inactive).**

**a.** Turn the ECS to OFF/RESET and then turn the ECS to STOP.

**b.** Press the alarm codes key.

**c.** Observe the upper display. Check that aCID 443 FMI 12 is showing.

**d.** If the diagnostic code is not showing, enter the service mode. View the fault log (OP1). Check that the diagnostic code is showing.

**Expected Result:** A CID 443 FMI 12 is showing as a active fault or an inactive fault.

**Results:**

- No - A CID 443 FMI 12 has not occurred. STOP.
- Yes - A CID 443 FMI 12 is active or inactive. Proceed to 2.

**2. Check internal cable of relay module.**

Note: Only open the relay module in a dry environment. If the inspection takes more than twenty minutes replace the desiccant bag in the GSC housing. See Testing And Adjusting, “Relay Module Replace”.

**a.** Turn the ECS to OFF/RESET.

**b.** Temporarily, remove the relay module from the GSC. See Testing And Adjusting, “Relay Module Replace”.

**c.** Check the cable that attaches the relay module to the GSC.

**Expected Result:** The cable should be firmly seated in the connector. The clamp should be in place. The cable should not be damaged.

**Results:**

- OK - Reassemble the relay module to the GSC. Proceed to 3.
- NOT OK - Replace the connector clamp if it is missing. If the cable is damaged, replace the GSC. STOP.

**3. Perform a functional check for the CTR.**

**a.** Turn the ECS to OFF/RESET.

**b.** Disconnect all wires from RM-16 of the relay module.

**c.** At the relay module, measure the resistance from RM-16 to RM-3. Resistance should be greater than 5000 ohms.

**d.** Start the engine. Make sure that the engine speed is greater than the setpoint for crank termination (P11).

**e.** At the relay module, measure the resistance from RM-16 to RM-3. Resistance should be less than 5 ohms.

**Expected Result:** For 3.c, the resistance should be greater than 5000 ohms. For 3.e, the resistance should be less than 5 ohms.

**Results:**

- OK - It is likely that a temporary bad electrical connection existed and this troubleshooting procedure corrected it. Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”. STOP.
- NOT OK - Either one of the resistance measurements are NOT correct. The relay module is faulty. Replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.

i01130614

# CID 444 FMI 12 Starting Motor Relay Failed - Test

**SMCS Code:** 1453-038-R7; 4490-038-R7

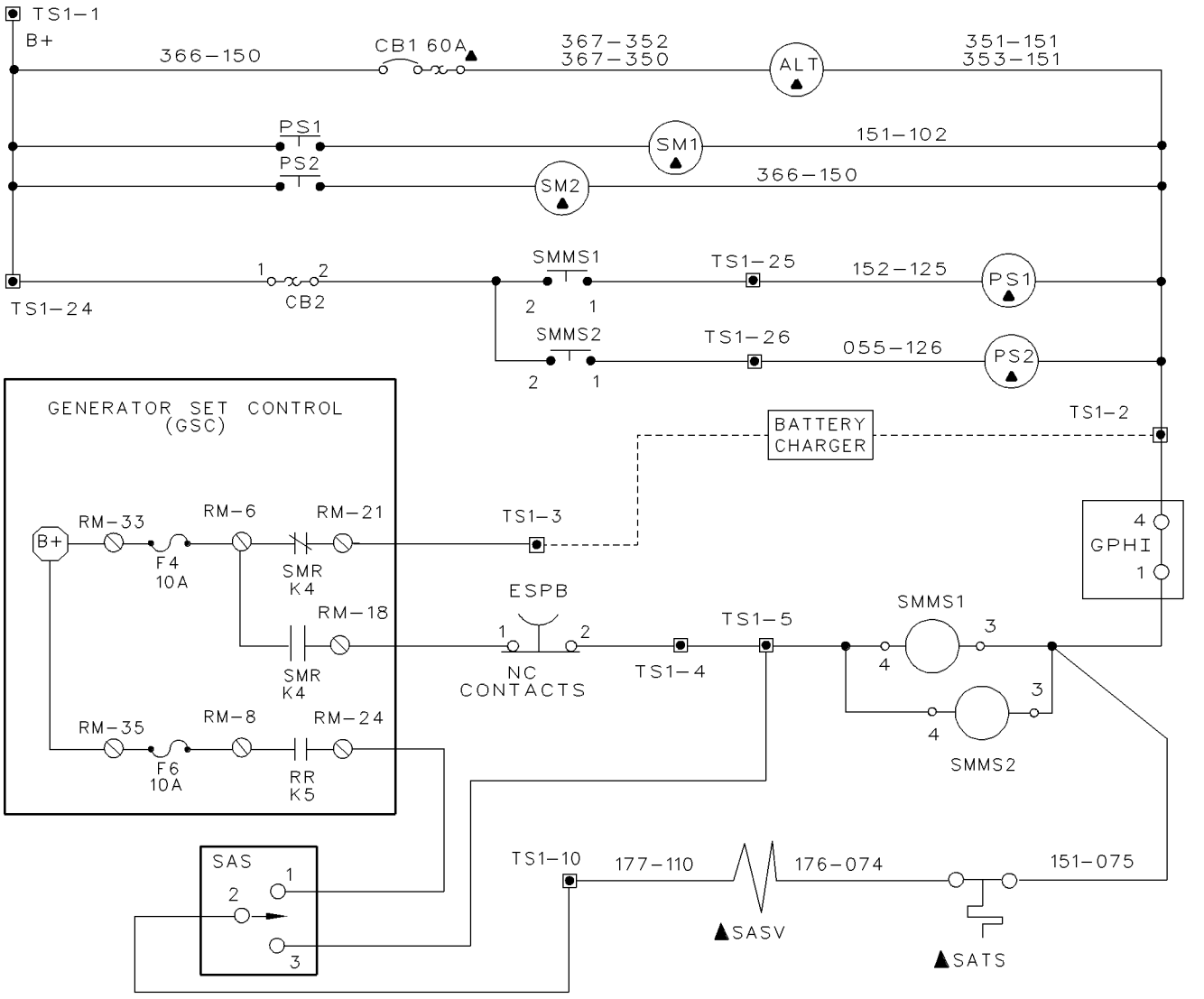



Illustration 59 g00597871

Schematic For Starting Motor Relay (SMR)

The GSC uses the starting motor relay (SMR) to activate the following components: the starting motor magnetic switches (“SMMS1” and “SMMS2”), the “AUTO” position of the starting aid switch, and the optional prelube pump. Also, the SMR deactivates the optional battery charge during engine cranking. The SMR is located within the relay module. “SMMS1” and “SMMS2” are located on the subpanel within the control panel.

**Note:** Whenever the GSC activates the SMR, “K4” is shown on the lower display. “K4” is also shown on the lower display when the GSC attempts to activate the crank terminate relay. When the SMR is not activated, “K4” is not shown.

## Procedure

The possible cause of this diagnostic code is an open coil or a shorted coil of the SMR.

The following response is the system response to this fault while the SMR is activated:

- If a CID 444 occurs, then the following events take place: the engine stops cranking, the prelube pump is disabled, and the “AUTO” position of the starting aid switch is disabled. The battery charger will continue to function.

The following response is the system response to this fault while the SMR is not activated:

- If a CID 444 occurs, then the following events take place: the engine cannot crank, the engine cannot start, the prelube pump is disabled, and the “AUTO” position of the starting aid switch is disabled. The battery charger will continue to function. If the engine is already running, then the engine continues to run.

The GSC treats a CID 444 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed. Also, the active alarm faults are shown when the ECS is in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

**1. Check the status of the diagnostic code (Active/Inactive).**

**a.** Turn the ECS to OFF/RESET and then turn the ECS to STOP.

**b.** Press the alarm codes key.

**c.** Observe the upper display. Check that a CID 444 FMI 12 is showing.

**d.** If the diagnostic code is not showing, enter the service mode. View the fault log (OP1). Check that the diagnostic code is showing.

**Expected Result:** A CID 444 FMI 12 is showing as a active fault or an inactive fault.

**Results:**

- No - A CID 444 FMI 12 has not occurred (NOT active and NOT inactive). STOP.

- Yes - A CID 444 FMI 12is active or inactive. Proceed to 2.

**2. Check internal cable of relay module.**

Note: Only open the relay module in a dry environment. If the inspection takes more than twenty minutes replace the desiccant bag in the GSC housing. See Testing And Adjusting, “Relay Module - Replace”.

**a.** Turn the ECS to OFF/RESET.

**b.** Temporarily, remove the relay module from the GSC. See Testing And Adjusting, “Relay Module - Replace”.

**c.** Check the cable that attaches the relay module to the GSC.

**Expected Result:** The cable should be firmly seated in the connector. The clamp should be in place. The cable should not be damaged.

**Results:**

- OK - Reassemble the relay module to the GSC. Proceed to 3.

- NOT OK - Replace the connector clamp if it is missing. If the cable is damaged, replace the GSC. STOP.

**3. Perform a functional check for the SMR.**

**a.** Turn the ECS to OFF/RESET.

**b.** Disconnect all wires from RM-18 of the relay module.

**c.** Remove the fuse “F4” from the relay module.

**d.** At the relay module, measure the resistance from RM-18 to RM-6. Resistance should be greater than 5000 ohms.

**e.** Prepare to measure the resistance from RM-18 to RM-6 of the relay module.

**f.** Turn the ECS to the START position. Quickly measure the resistance before the starting motor relay deactivates because of the crank time. Resistance should be less than 5 ohms.

**Expected Result:** For 3.d, the resistance should be greater than 5000 ohms. For 3.f, the resistance should be less than 5 ohms.

**Results:**

- OK - It is likely that a temporary bad electrical connection existed and this troubleshooting procedure corrected it. Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”. STOP.

- NOT OK - Either one of the resistance measurements are NOT correct. The relay module is faulty. Replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.

i01130697

# CID 445 FMI 12 Run Relay Failed - Test

**SMCS Code:** 4490-038-R7

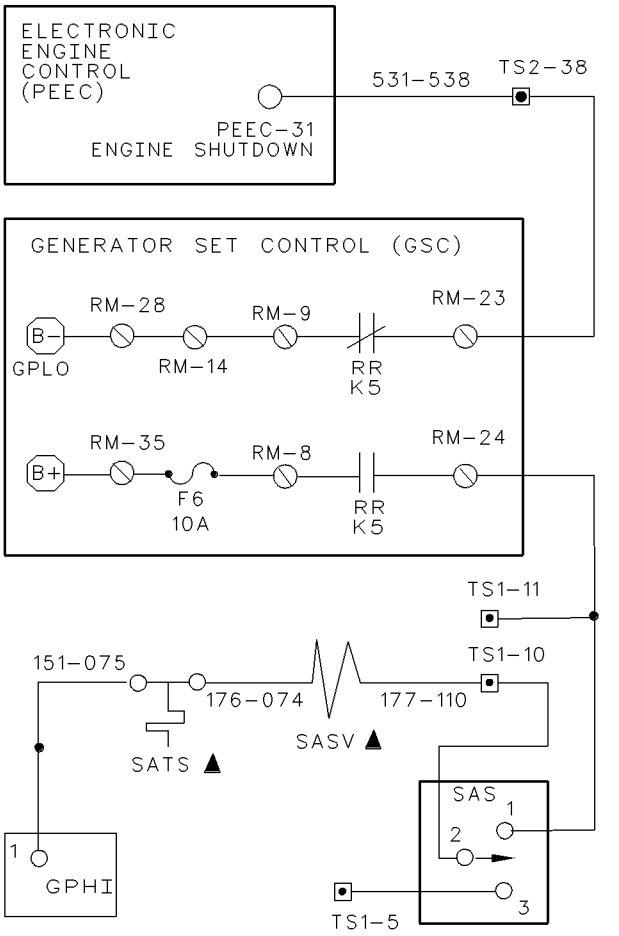



Illustration 60 g00597986

Schematic For Run Relay (RR)

The GSC uses the run relay (RR) in order to provide a signal for engine shutdown to the PEEC electronic control module. The GSC also uses the RR to activate the MAN position of the starting aid switch (SAS). The RR is located within the relay module. The SAS is mounted on the instrument panel. The GSC activates the run relay (RR) during engine cranking and running.

Note: Whenever the GSC activates the RR, “K5” is shown on the lower display. “K5” is also shown on the lower display when the GSC attempts to activate the crank terminate relay. When the RR is not activated, “K5” is not shown.

**Procedure**

The possible cause of this diagnostic code is an open coil or a shorted coil of the RR.

The following response is the system response to this fault while the RR is activated:

- If a CID 445 occurs, then the engine shuts down and the engine does not start. The “MAN” position of the starting aid switch (SAS) is disabled.

The following response is the system response to this fault while the RR is not activated:

- If a CID 445 occurs, then the engine cannot start. The “MAN” position of the starting aid switch (SAS) is disabled.

The GSC treats this diagnostic code as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed. Also, the active alarm faults are shown when the ECS is in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

**1. Check the status of the diagnostic code (Active/Inactive).**

**a.** Turn the ECS to OFF/RESET and then turn the ECS to STOP.

**b.** Press the alarm codes key.

**c.** Observe the upper display. Check that a CID 445 FMI 12 is showing.

**d.** If this diagnostic code is not showing, enter the service mode. View the fault log (OP1). Check that the diagnostic code is showing.

**Expected Result:** A CID 445 FMI 12 is showing as a active fault or an inactive fault.

**Results:**

- No - A CID 445 FMI 12 has not occurred (NOT active and NOT inactive). STOP.
- Yes - A CID 445 FMI 12 is active or inactive. Proceed to **2**.

**2. Check internal cable of relay module.**

Note: Only open the relay module in a dry environment. If the inspection takes more than twenty minutes replace the desiccant bag in the GSC housing. See Testing And Adjusting, “Relay Module Replace”.

**a.** Turn the ECS to OFF/RESET.

**b.** Temporarily, remove the relay module from the GSC. See Testing And Adjusting, “Relay Module - Replace”.

**c.** Check the cable that attaches the relay module to the GSC.

**Expected Result:** The cable should be firmly seated in the connector. The clamp should be in place. The cable should not be damaged.

**Results:**

- OK - Reassemble the relay module to the GSC. Proceed to 3.
- NOT OK - Replace the connector clamp if it is missing. If the cable is damaged, replace the GSC. STOP.

**3. Perform a functional check for the RR.**

**a.** Turn the ECS to OFF/RESET.

**b.** Disconnect all wires from RM-23 and RM-24 of the relay module.

**c.** Remove the fuse “F4” from the relay module.

**d.** At the relay module, measure the resistance from RM-24 to RM-8. Resistance should be greater than 5000 ohms.

**e.** At the relay module, measure the resistance from RM-23 to RM-9. Resistance should be less than 5 ohms.

**f.** Turn the ECS to the START position.

**g.** At the relay module, measure the resistance from RM-23 to RM-9. Resistance should be greater than 5000 ohms.

**h.** At the relay module, measure the resistance from RM-24 to RM-8. Resistance should be less than 5 ohms.

**Expected Result:** For 3.d and 3.g, the resistance should be greater than 5000 ohms. For 3.h and 3.e, the resistance should be less than 5 ohms.

**Results:**

- OK - It is likely that a temporary bad electrical connection existed and this troubleshooting procedure corrected it. Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”. STOP.
- NOT OK - Either one of the resistance measurements are NOT correct. The relay module is faulty. Replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.

i01130752

# CID 446 FMI 12 Air Shutoff Relay Failed - Test

**SMCS Code:** 1078-038-R7; 4490-038-R7

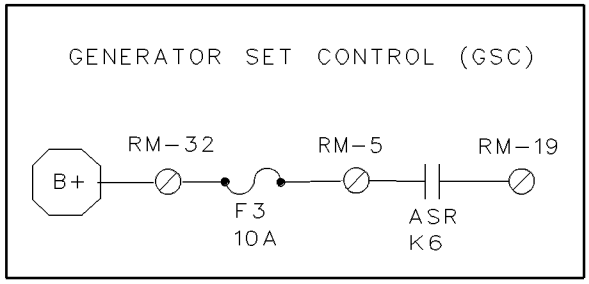



Illustration 61 g00598041

Schematic For Air Shutoff Relay (ASR)

The GSC uses the air shutoff relay (ASR) to activate the air shutoff solenoid during a shutdown fault. The ASR is located within the relay module. The air shutoff solenoid are located within the air inlet system of the engine.

The GSC activates the air shutoff relay (ASR) for some active shutdown faults.

Note: Whenever the GSC activates the ASR, “K6” is shown on the lower display. “K6” is also shown on the lower display when the GSC attempts to activate the crank terminate relay. When the ASR is not activated, “K6” is not shown.

**Procedure**

The possible cause of diagnostic code is an open coil or a shorted coil of the ASR.

The following response is the system response to this fault while the ASR is activated:

- If a CID 446 occurs, then there is no effect on the system because the air shutoff is already operating and the shutdown mode is functioning.

The following response is the system response to this fault while the ASR is not activated:

- If a CID 446 occurs, then there is no immediate effect on the system. The engine is able to start and the engine is able to run.

The following response is the system response to this diagnostic code while the ASR is not activated and a shutdown fault occurs:

- If a CID 446 occurs, then the ASR cannot energize the air shutoff solenoids.

The GSC treats this diagnostic code as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed. Also, the active alarm faults are shown when the ECS is in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

1. **Check the status of the diagnostic code (Active/Inactive).**

   **a.** Turn the ECS to OFF/RESET and then turn the ECS to STOP.

   **b.** Press the alarm codes key.

   **c.** Observe the upper display. Check that a CID 446 FMI 12 is showing.

   **d.** If the diagnostic code is not showing, enter the service mode. View the fault log (OP1). Check that the diagnostic code is showing.

   **Expected Result:** A CID 446 FMI 12 is showing as a active fault or an inactive fault.

   **Results:**

   - No - A CID 446 FMI 12 has not occurred (NOT active and NOT inactive). STOP.

   - Yes - A CID 446 FMI 12 is active or inactive. Proceed to 2.

2. **Check internal cable of relay module.**

Note: Only open the relay module in a dry environment. If the inspection takes more than twenty minutes replace the desiccant bag in the GSC housing. See Testing And Adjusting, “Relay Module - Replace”.

   **a.** Turn the ECS to OFF/RESET.

   **b.** Temporarily, remove the relay module from the GSC. See Testing And Adjusting, “Relay Module - Replace”.

   **c.** Check the cable that attaches the relay module to the GSC.

   **Expected Result:** The cable should be firmly seated in the connector. The clamp should be in place. The cable should not be damaged.

   **Results:**

   - OK - Reassemble the relay module to the GSC. Proceed to 3.

   - NOT OK - Replace the connector clamp if it is missing. If the cable is damaged, replace the GSC. STOP.

3. **Perform a functional check for the ASR.**

   **a.** Turn the ECS to OFF/RESET.

   **b.** Disconnect all wires from RM-19 of the relay module.

   **c.** At the relay module, measure the resistance from RM-19 to RM-5. Resistance should be greater than 5000 ohms.

   **d.** Turn the ECS to the STOP position and push in the emergency stop push button (ESPB).

   **e.** At the relay module, measure the resistance from RM-19 to RM-5. Resistance should be less than 5 ohms.

   **Expected Result:** For 3.c, the resistance should be greater than 5000 ohms. For 3.e, the resistance should be less than 5 ohms.

   **Results:**

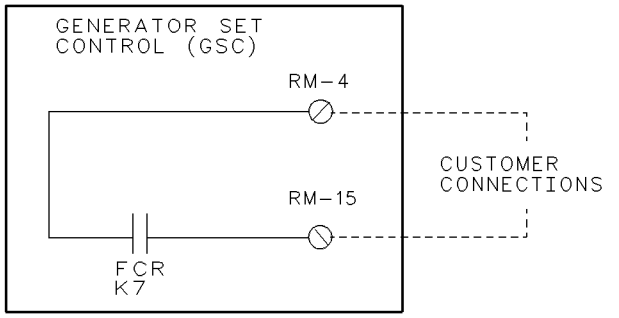
   - OK - It is likely that a temporary bad electrical connection existed and this troubleshooting procedure corrected it. Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”. STOP.

   - NOT OK - Either one of the resistance measurements are NOT correct. The relay module is faulty. Replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.

i01130861

# CID 447 FMI 12 Fuel Control Relay Failed - Test

**SMCS Code:** 4490-038-R7




g00598138

Illustration 62

Schematic For Fuel Control Relay

The status of the FCR has no effect on the PEEC engine. The contacts are not used in applications of the PEEC electronic control module. However, the GSC still activates the FCR during normal running of the engine. The contacts for the fuel control relay (FCR) are available for use by the customer. The FCR is located within the relay module.

Note: Whenever the GSC activates the FCR, “K7” is shown on the lower display. “K7” is also shown when the GSC attempts to activate the FCR. When the FCR is not activated, “K7” is not shown.

**Procedure**

The possible cause of this diagnostic code is an open coil or a shorted coil of the FCR.

The following response is the system response to this fault while the engine is running:

- If a CID 447 occurs, then any equipment that is connected to RM-4 and RM-15 is deactivated.

The following response is the system response to this fault while the engine is NOT running:

- If a CID 447 occurs, then any equipment that is connected to RM-4 and RM-15 will remain deactivated.

The GSC treats this diagnostic code as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed. Also, the active alarm faults are shown when the ECS is in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

1. **Check the status of the diagnostic code (Active/Inactive).**

   **a.** Turn the ECS to OFF/RESET and then turn the ECS to STOP.

   **b.** Press the alarm codes key.

   **c.** Observe the upper display. Check that a CID 447 FMI 12 is showing.

   **d.** If the diagnostic code is not showing, enter the service mode. View the fault log (OP1). Check that the diagnostic code is showing.

   **Expected Result:** A CID 447 FMI 12 is showing as a active fault or an inactive fault.

   **Results:**

   - No - A CID 447 FMI 12 has not occurred (NOT active and NOT inactive). STOP.
   - Yes - A CID 447 FMI 12 is active or inactive. Proceed to 2.

2. **Check internal cable of relay module.**

Note: Only open the relay module in a dry environment. If the inspection takes more than twenty minutes replace the desiccant bag in the GSC housing. See Testing And Adjusting, “Relay Module - Replace”.

   **a.** Turn the ECS to OFF/RESET.

   **b.** Temporarily, remove the relay module from the GSC. See Testing And Adjusting, “Relay Module Replace”.

   **c.** Check the cable that attaches the relay module to the GSC.

   **Expected Result:** The cable should be firmly seated in the connector. The clamp should be in place. The cable should not be damaged.

   **Results:**

   - OK - Reassemble the relay module to the GSC. Proceed to 3.
   - NOT OK - Replace the connector clamp if it is missing. If the cable is damaged, replace the GSC. STOP.

3. **Perform a functional check for the ASR.**

   **a.** Turn the ECS to OFF/RESET.

   **b.** Disconnect all wires from RM-15 of the relay module.

**c.** At the relay module, measure the resistance from RM-15 to RM-4. Resistance should be greater than 5000 ohms.

**d.** Turn the ECS to the START position. Make sure that “K7” is showing in the lower display.

**e.** At the relay module, measure the resistance from RM-15 to RM-4. Resistance should be less than 5 ohms.

**Expected Result:** For 3.c, the resistance should be greater than 5000 ohms. For 3.e, the resistance should be less than 5 ohms.

**Results:**

- OK - It is likely that a temporary bad electrical connection existed and this troubleshooting procedure corrected it. Check the electrical connectors, terminals and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”. STOP.
- NOT OK - Either one of the resistance measurements are NOT correct. The relay module is faulty. Replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.

i01109615

# CID 500 FMI 12 EMCP Electronic Control (Generator Set) Failed - Test

**SMCS Code:** 4490-038

A CID 500 FMI 12 means that the GSC is unable to accurately measure the AC voltage and the AC current. The engine remains able to run. The engine also remains able to start.

Note: On the GSC, the CID 500 FMI 12 will be shown even when the engine control switch (ECS) is in the OFF/RESET position.

**Procedure**

If a CID 500 FMI 12 occurs, replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

NOTICE

If a CID 500 FMI 12 occurs and the engine is running, the generator output may be at full voltage potential. This could occur even if the GSC display is showing 0 AC volts and 0 AC current for all three phases.

i01130988

# CID 560 FMI 11 CAT Data Link Failure Mode Not Identified - Test

**SMCS Code:** 1408-038; 4490-038

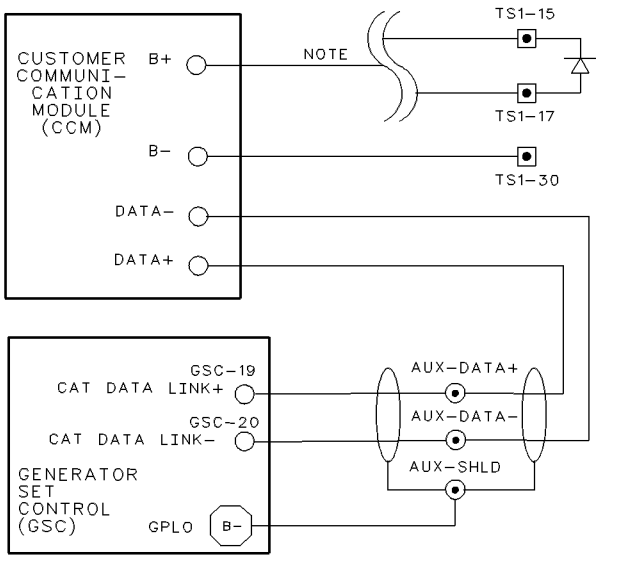



Illustration 63 g00596658

Schematic For CAT Data Link

Note: When a CCM is connected to a single genset, “B+” is connected directly from TS1-17. When a CCM is connected to multiple gensets the diode must be connected. Also, “B+” must be wired to TS1-15.

Note: CID 248 FMI 9 replaces the former CID 560 FMI 11 for a fault with the CAT data link.

The following conditions will cause a CID 560 FMI 11:

- There is a short from the wire that connects to contact “19” of the CAT data link to the battery (“B+”).
- There is a short from the wire that connects to contact “20” of the CAT data link to the battery (“B+”).
- There is a short from the wire that connects to contact “19” of the CAT data link to ground (“B-”).
- There is a short from the wire that connects to contact “20” of the CAT data link to ground (“B-”).

The GSC cannot detect an open in the circuit of the CAT data link. Troubleshoot the wiring and repair the wiring. See Testing And Adjusting, “Schematic and Wiring Diagrams”.

The GSC treats a CID 560 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed. Also, the ECS is in any position except the OFF/RESET position. Clear the fault from the fault log after troubleshooting is complete.

i01131069

# CID 566 FMI 7 Unexpected Shutdown Improper Mechanical Response - Test

**SMCS Code:** 4490-038

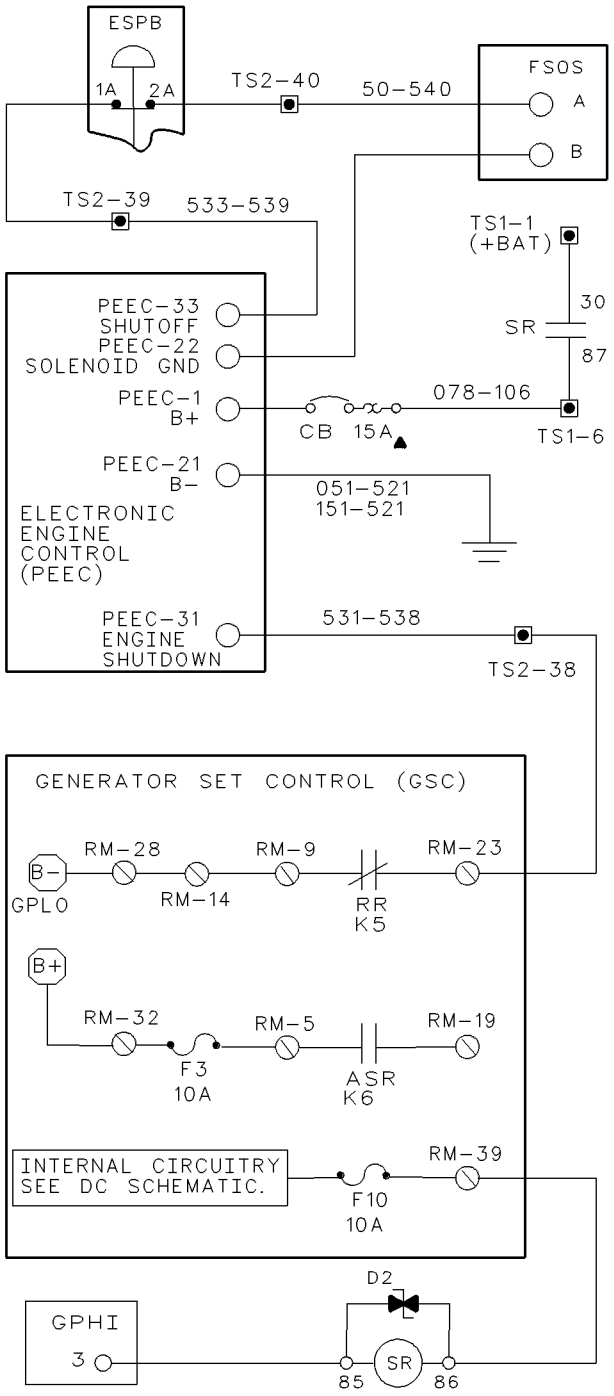



Illustration 64 g00596877

Schematic For An Unexpected Shutdown

Note: CID 566 FMI 7 replaces the former CID 330 FMI 7 for a fault with an unexpected shutdown.

The CID 566 alerts the operator that the GSC did not control the engine shutdown. The GSC normally controls all engine shutdowns. If an outside influence causes the engine to shut down, the GSC indicates a CID 566. There is only one failure mode for a CID 566 and the mode is FMI 7 (faulty mechanical response).

The diagnostic code causes the following sequence of events:

- On a running engine, the GSC detects that the engine speed has dropped from the rated speed to 0 rpm when the GSC has not called for a shutdown.
- The GSC determines that no fault for the engine speed sensor is present that explains the drop in the speed signal.
- The GSC indicates a CID 566 FMI 7 and the GSC disables the engine from running.

Note: An unexpected shutdown fault will initiate a signal from the shunt trip circuit breaker.

Note: Diagnostic codes are created when the harness connector (40 contact) is disconnected from the GSC during these troubleshooting procedures. Clear these created diagnostic codes after the particular fault is corrected. In a properly operating system, when the harness connector is removed from the GSC, the following diagnostic codes are recorded.

- CID 100 FMI 3 pressure sensor (engine oil)
- CID 110 FMI 3 temperature sensor (engine coolant)
- CID 111 FMI 3 fluid level sensor (engine coolant)
- CID 190 FMI 3 speed sensor (engine)
- CID 331 FMI 2 switch (engine control)
- CID 336 FMI 2 switch (engine control)

**Procedure**

The following condition is a possible cause of a CID 566 FMI 7:

- A component that is not under the control of the GSC has caused an engine shutdown.

The GSC treats this diagnostic code as a shutdown fault. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: This procedure requires many voltage measurements during simulated engine cranking. The fuse for the starting motor “F4” on the relay module is removed in order to prevent the activation of the starting motor. Voltage measurements must be made quickly before the total cycle crank time (setpoint P17) elapses. The total cycle crank time has been defaulted to ninety seconds. See Systems Operation, “Engine/Generator Programming OP5”. If a voltage measurement takes too long (more than 90 seconds), the GSC indicates an overcrank fault. The indicator for the overcrank shutdown will FLASH. In order to continue with a voltage measurement, the overcrank fault must be reset by turning the ECS to OFF/RESET. Then turn the ECS to START.

**1. Perform an initial check.**

Before proceeding with the troubleshooting procedures, do the following steps:

**a.** Make sure that there are NO OTHER ACTIVE FAULTS. Erroneous troubleshooting and needless replacement of parts can be caused by a failure to check for other diagnostic codes. The operator will make many voltage measurements while the GSC is attempting to crank the engine. The GSC detects other diagnostic codes. If the GSC detects other diagnostic codes, the GSC will prevent the starting of the engine by sending a signal to the PEEC electronic control module. This signal will turn off the fuel shutoff solenoid and this signal will shut down the engine.

**b.** Check the fuel level and the fuel quality.

**c.** Check for a plugged fuel filter.

**d.** Check for a plugged air filter.

**e.** Refer to the Engine Service Manual if there is an obvious engine fault. Also, refer to the Engine Service Manual if there is an obvious fault with the fuel system.

**f.** Check the engine speed sensor for the PEEC electronic control module.

**g.** Check the air shutoff solenoid for activation. If the air shutoff solenoid is activated and the air shutoff solenoid cannot be deactivated, begin troubleshooting with 17. Otherwise begin troubleshooting with 2.

**2. Verify the diagnostic code.**

**a.** Observe the upper display. Check that the CID 566 FMI 7 is showing.

**Expected Result:** A CID 566 FMI 7 is showing as an active fault.

**Results:**

- No - A CID 566 FMI 7 is NOT showing. No active CID 566 FMI 7 exists. STOP.
- Yes - Only a CID 566 FMI 7 is showing. Proceed to 3. (If an inactive CID 566 FMI 7 is showing in the fault log, check the history of the genset and proceed to 3.)

3. **Check the system voltage.**

   **a.** Ensure that the engine is off. Measure the system voltage at the battery. Make a note of this measurement. The measurement for the system voltage is used for comparison in future steps of this procedure.

   **Expected Result:** For 24 volt systems, the system voltage should be from 24.8 to 29.5 DCV. For 32 volt systems, the system voltage should be from 33.1 to 39.3 DCV.

   **Results:**

   - OK - Proceed to 4.
   - NOT OK - System voltage is NOT correct. For troubleshooting, see the procedure for system voltage. STOP.

4. **Check the setpoint P01.** PEEC engines have ETR systems.

   **a.** Check the setpoint P01 for proper programming (“0” for ETR). See Systems Operation, “Setpoint Viewing OP2”.

   **Expected Result:** Setpoint P01 should be programmed to “0” for ETR.

   **Results:**

   - OK - Proceed to 5.
   - Not OK - Setpoint P01 is NOT programmed correctly. Reprogram setpoint P01. See Systems Operation, “Engine/Generator Programming OP5”.

5. **Check the fuses.**

   **a.** Turn the ECS to OFF/RESET.

   **b.** Check fuse “F10” on the relay module.

   **Expected Result:** Fuse “F10” should not be blown.

   **Results:**

   - OK - Proceed to 7.
   - NOT OK - One or more of the fuses are blown. Proceed to 6.

6. **Troubleshoot the blown fuse.**

   For reference, see the preceding System Schematics and Testing And Adjusting, “Schematics and Wiring Diagrams”.

   **a.** The ECS remains in the OFF/RESET position.

   **b.** Remove the fuse that is blown.

   - Measure the resistance from RM-39 of the relay module to ground (B-).

   **Expected Result:** The resistance of the circuit should be less than 3 ohms for the circuit with the fuse that is blown.

   **Results:**

   - OK - Resistance is greater than 3 ohms and fuse is no longer blowing. Carefully check ALL wires that are connected to the appropriate terminal of the relay module for abrasion or worn spots in the insulation that could be causing the short. Check the wires in the panel and the generator panel. Also check the wires on the engine harness. Refer to the various wiring diagrams. Repair the wiring or replace wiring, if necessary. STOP.
   - NOT OK - If a resistance is less than 3 ohms, there is a short to ground (B-). Remove one component or wire at a time that is in series with the load side of the fuse terminal. Remove a component or wire until the faulty component or wire is isolated. Repair the faulty component or wiring. If necessary, replace the faulty component or wiring. STOP.
   - NOT OK - If a resistance is greater than 3 ohms and the fuse still blows when all wires are removed from the appropriate terminal, replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.

7. **Check the condition of the low voltage.**

   This test continues troubleshooting from 5. Fuse “F4” remains removed from the relay module. For reference, see the “Generator Set Wiring Diagram” in the Testing And Adjusting, “Schematics & Wiring Diagrams”. Prepare to make voltage measurements at the relay module.

   **a.** Prepare to measure voltage at the generator housing.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**c.** At the generator housing, measure the voltage from TS2-40 to the TS1-2 terminal.

**Expected Result:** The voltage should increase to greater than 4.0 DCV. Then the voltage should stabilize to between 1.5 and 2.0 DCV.

**Results:**

- OK - Voltage is correct. The fault is with the fuel shutoff solenoid, the PEEC electronic control module, the fuel rack, or an open wire between TS2-40 and the fuel solenoid. See the Service Manual, “Engine Electronic Troubleshooting”. STOP.
- NOT OK - Voltage is low. Check the wiring. Proceed to 8.

**8. Check that the diagnostic code exists.**

**a.** Make sure that no other diagnostic codes are active.

**b.** Check the upper display for any active diagnostic codes.

**Expected Result:** Only CID 566 FMI 7 is active.

**Results:**

- OK - Only CID 566 FMI 7 is active. Proceed to 9.
- NOT OK - A diagnostic code other than CID 566 FMI 7 is active. Correct the other diagnostic code. Proceed to the corresponding troubleshooting procedure. STOP.

**9. Check the system voltage.**

**a.** Prepare to measure voltage at the generator housing.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**c.** At the generator housing, measure the voltage from TS2-40 to the TS1-2 terminal.

**Expected Result:** The voltage should increase to greater than 4.0 DCV. Then the voltage should stabilize to between 1.5 and 2.0 DCV.

**Results:**

- OK - The voltage is correct. There is an open circuit between TS2-39 and TS2-40. Carefully check the resistance of the contacts for the ESPB. Check all wires for abrasion or worn spots in the insulation. Check the wires in the control panel and the generator housing. Repair the wiring. See the “Generator Set Wiring Diagram” in the Testing And Adjusting, “Schematics & Wiring Diagrams”. STOP.
- NOT OK - The voltage remains low. Proceed to 10.

**10. Measure the voltage of the PEEC shutoff solenoid.**

**a.** Prepare to measure the voltage from the contact “A” of the PEEC shutoff solenoid to the -battery.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to the START.

**c.** Measure the voltage from contact “A” of the PEEC shutoff solenoid to -battery.

**Expected Results:** The voltage should increase to greater than 4.0 DCV. Then the voltage should stabilize to between 1.5 and 2.0 DCV.

- OK - The voltage is correct. There is an open circuit between PEEC shutoff solenoid and TS2-39. Carefully check the resistance of the contacts for the ESPB. Check all wires for abrasion or worn spots in the insulation. Check the wires in the control panel and the generator housing. Repair the wiring. See the “Generator Set Wiring Diagram” in the Testing And Adjusting, “Schematics & Wiring Diagrams”. STOP.
- NOT OK - The voltage remains low. Proceed to 11.

**11. Check the supply voltage of the PEEC electronic control module.**

Fuse “F4” remains removed from the relay module. Prepare to make a voltage measurement at the PEEC electronic control module.

**a.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**b.** At the PEEC ECM, measure the voltage from contact 1 to the contact 21.

**Expected Result:** The voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - Voltage is correct. There is a fault in the PEEC electronic control module. There could be an open between the PEEC electronic control module and TS2-39. See the Service Manual, "Engine Electronic Troubleshooting". STOP.
- NOT OK - Voltage is low. Proceed to 12.

**12. Check the voltage at the terminal strip TS1.**

Fuse "F4" remains removed from the relay module. Prepare to make voltage measurements at the terminal strip in the generator terminal box.

**a.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**b.** Measure the voltage from terminal TS1-6 to terminal TS1-2.

**Expected Result:** the voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - Voltage is correct. There is an open between TS1-6 and the PEEC electronic control module. See the "Generator Set Wiring Diagram" in the Testing And Adjusting, "Schematics & Wiring Diagrams". STOP.
- NOT OK - Voltage is low. Proceed to 13.

**13. Check the voltage at the slave relay.**

Fuse "F4" remains removed from the relay module. Prepare to make voltage measurements at the slave relay (SR).

**a.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**b.** Measure the voltage from terminal 30 of the slave relay to terminal B- of the relay module.

**Expected Result:** the voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - Voltage is correct. Proceed to 14.
- NOT OK - Voltage is NOT correct. Check the wiring. STOP.

**14. Check the voltage at the slave relay.**

**a.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**b.** Measure the voltage from terminal 87 of the slave relay to terminal B- of the relay module.

**Expected Result:** the voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - Voltage is correct. Proceed to 15.
- NOT OK - Voltage is NOT correct. Replace the slave relay. STOP.

**15. Check that the diagnostic code exists.**

**a.** Make sure that no other diagnostic codes are active.

**b.** Check the upper display for any active diagnostic codes.

**Expected Result:** Only CID 566 FMI 7 is active.

**Results:**

- OK - Only CID 566 FMI 7 is active. Proceed to 16.
- NOT OK - A diagnostic code other than CID 566 FMI 7 is active. Correct the other diagnostic code. Proceed to the corresponding troubleshooting procedure. STOP.

**16. Check the system voltage.**

**a.** Recheck the voltage on terminal TS1-6. See 12.

**Expected Result:** The voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - The voltage is correct. There is an open circuit between TS1-6 of the terminal strip and the PEEC electronic control module. Check the wiring. See the "Generator Set Wiring Diagram" in the Testing And Adjusting, "Schematics & Wiring Diagrams". STOP.

- NOT OK - The voltage remains low. Check the wiring. See the “Generator Set Wiring Diagram” in the Testing And Adjusting, “Schematics & Wiring Diagrams”. STOP.

**17. Check the voltage at the air shutoff solenoid.**

This test continues troubleshooting from the preliminary step (initial check). Prepare to make a voltage measurement at the air shutoff solenoid. (The air shutoff solenoid may be active for 15 seconds.)

**a.** Remove fuse “F4” from the relay module.

**b.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**c.** At the air shutoff solenoid, measure the voltage across the terminals of solenoid.

**Expected Result:** The voltage should be from 0 to 2.0 DCV.

**Results:**

- OK - Voltage is correct. If the air shutoff solenoid cannot be reset then the fault is in the air shutoff solenoid. Refer to the Engine Service Manual. STOP.
- NOT OK - Voltage is high. Proceed to 18.

**18. Check the voltage at the relay module.**

Fuse “F4” remains removed from the relay module. Prepare to make a voltage measurement at the relay module.

**a.** Turn the ECS to OFF/RESET and then turn the ECS to START.

**b.** At the relay module, measure the voltage from RM-19 to the B- terminal.

**Expected Result:** The voltage should be ± 2.0 DCV of the system voltage that was previously measured in 3.

**Results:**

- OK - The voltage is correct. A wire or a component that is located between RM-19 of the relay module and the air shutoff solenoid is shorted to the battery (B+). Repair the circuit. See the “Generator Set Wiring Diagram” in the Testing And Adjusting, “Schematics & Wiring Diagrams”. STOP.
- NOT OK - The voltage is high. Proceed to 19.

**19. Check the ASR.**

Fuse “F4” remains removed from the relay module.

**a.** Remove fuse “F3” from the relay module.

**b.** Turn the ECS to OFF/RESET.

**c.** Make sure that “K6” is not shown on the lower GSC display. (If “K6” is showing, make sure that no other diagnostic codes are active.)

**d.** At the relay module, measure the resistance from RM-5 to RM-19. A measurement of less than 100 ohms indicates that the air shutoff relay is shorted.

**Expected Result:** The resistance should be greater than 10000 ohms.

**Results:**

- OK - Resistance is greater than 10000 ohms. Check for a short from the battery (B+) to RM-19 of the relay module. Repair the shorted wiring. If the short is internal to the relay module, replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.
- NOT OK - Resistance is less than 100 ohms. The short is internal to the relay module. Replace the relay module. See Testing And Adjusting, “Relay Module - Replace”. STOP.

i01191415

# CID 590 FMI 9 Engine Electronic Control Module Abnormal Update - Test

**SMCS Code:** 1901-038; 4490-038

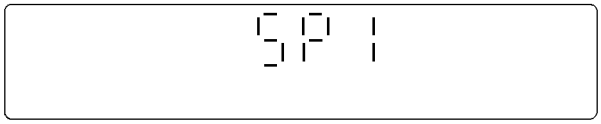
The CID 590 indicates that setpoint P23 has been incorrectly programmed to “2” for an engine with electronic unit injection.

- Verify that the engine does not have electronic unit injection.
- Program setpoint P23 to “0” for an engine with mechanical unit injection. See Systems Operation, “Engine/Generator Programming OP5”.

i01131236

# SP Fault Code - Troubleshoot

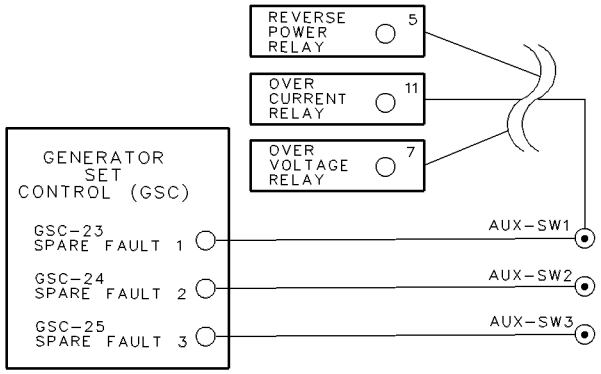
**SMCS Code:** 4490-035



g00515355

Illustration 65

Upper Display With SP Fault Code SP1 Showing




g00598329

Illustration 66

System Schematic For Spare Fault Inputs

A spare fault informs the operator of an undesirable condition (fault) that exists. The spare inputs are programmed into the GSC to meet the requirements of the customer or application. An active spare input causes an alarm fault or a shutdown fault. For programming of the spare inputs, see Systems Operation, “Spare Input/Output Programming OP6”. The programmer (customer, operator, or service personnel) is responsible for noting the actual conditions that cause a SP fault code. The GSC does not diagnose the spare inputs and spare faults are not recorded in the fault log.

The GSC treats an active input state as a fault. The active state is programmable on the GSC to be either a high or a low (factory default) voltage level. A high level is within the range of +5 DCV to the positive battery. If the input is left floating (for example an open switch), the GSC pulls the input voltage up to 10.5 DCV and the input is treated as high level. A low level on the input is B– (ground).

When a spare fault occurs (active), the GSC determines the type of fault (alarm or shutdown). The GSC also FLASHES the corresponding fault alarm indicator or fault shutdown indicator. For a shutdown type of fault, the SP fault code is immediately shown on the upper display. For an alarm type of fault, the alarm code key is pressed first. Then the SP fault code is shown on the upper display. After a spare fault is corrected or is not present, the SP fault code is no longer shown on the upper display.

Table 15

| Spare Fault Codes | | | |
|---|---|---|---|
| **Spare Fault Code** | **GSC Connector Contact** | **Terminal Strip** | **Related Setpoints**(1) |
| SP1 Spare Fault 1 | 23 | SP1 | SP01, SP02, SP08 |
| SP2 Spare Fault 2 | 24 | SP2 | SP03, SP04, SP09 |
| SP3 Spare Fault 3 | 25 | SP3 | SP05, SP06, SP10 |

(1) See Spare Input/Output Programming OP6 within the topic Service Mode in the Systems Operation section.

SP fault codes are associated with the spare inputs. The SP fault code that is shown on the upper display, identifies the spare input that caused the alarm fault or shutdown fault. The spare inputs are accessed on the terminal strip within the control panel on the rear wall.

When a SP fault code is showing on the upper display, check the programming notes in order to determine the cause.

The spare fault inputs can be used with options that are installed by the factory and/or the customer. The following list contains the factory options for the spare fault inputs:

- ground fault
- low fuel level
- high fuel level
- high generator winding temperature
- high generator bearing temperature

Each of these options will include a dedicated indicator and a label on the custom alarm module.

## Troubleshooting Procedure

To troubleshoot spare faults, use this general procedure.

1. Check for obvious causes that are related to the device that is responsible for the spare fault.

2. Verify that the programming of the spare fault (alarm or shutdown) is appropriate for the application.

3. Check the function of the responsible device. Reset the fault by turning the ECS to the OFF/RESET position. Verify that the fault is still present.

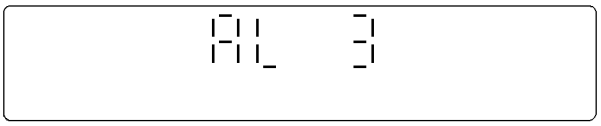
4. Disconnect the device that is responsible from the spare fault input. Verify that the fault still exists.

5. Check the wiring to the corresponding spare fault input for an unwanted short to either battery negative (B–) or battery positive (B+).

i01131280

# AL Fault Code - Troubleshoot

**SMCS Code:** 4490-035



g00515350

Illustration 67

Upper Display With AL Fault Code “AL3”

An alarm fault informs the operator of a condition that could cause a dedicated fault shutdown. An alarm fault precedes certain dedicated shutdown faults. Alarm faults are activated automatically by the GSC and the faults depend on certain setpoints. The GSC does not record alarm faults in the fault log.

When an alarm fault occurs, the GSC FLASHES the fault alarm indicator. The corresponding alarm code is shown on the upper display after the alarm codes key is pressed. When the alarm fault is no longer active, the alarm fault code is no longer shown on the upper display.

Table 16

| Troubleshooting AL Fault Codes | | |
|---|---|---|
| **AL Fault Code** | **Description** | **Troubleshooting** |
| AL1 | High Water Temperature Alarm<br>Coolant temperature increases to within 6°C (11°F)of setpoint P15 | See Testing And Adjusting, “Troubleshooting Dedicated Shutdown Indicators”. |
| AL2 | Alarm for Low Engine Coolant Temperature<br>Coolant temperature decreases to setpoint P16. | See Testing And Adjusting, “Troubleshooting Dedicated Shutdown Indicators”. |
| AL3 | Alarm for Low Engine Oil Pressure<br>Oil pressure drops to within 34 kPa (5 psi) of the P13 or P14 setpoint | See Testing And Adjusting, “Troubleshooting Dedicated Shutdown Indicators”. |

## Troubleshooting Procedure

If the operation of the AL fault codes is suspected to be incorrect, perform this procedure.

**1. Check For A Diagnostic Fault.**

**a.** Check for an active CID 110 diagnostic code or a CID 269 diagnostic code. See Testing And Adjusting, “Troubleshooting Diagnostic Codes”.

**Expected Result:** CID 110 or CID 269 should not be showing.

**Results:**

- OK - Proceed to next step.
- NOT OK - Correct the active CID 110 or CID 269 prior to proceeding with this procedure. See Testing And Adjusting, “Troubleshooting Diagnostic Codes”. STOP.

**2. Identify The AL Fault Code That Is Suspected To Be Incorrect.**

- If AL fault code AL1 or AL3 is suspected to be incorrect, then see Testing And Adjusting, “Troubleshooting Dedicated Shutdown Indicators”.
- If AL fault code AL2 is suspected to be incorrect, go to 3.

**3. Check The Function Of The Low Engine Coolant Temperature.**

**a.** Note the setpoint P16 (low water temperature alarm), see Systems Operation, “Setpoint Viewing OP2”.

**b.** Check and note the actual coolant temperature that is showing on the lower display.

**c.** Compare the two temperatures.

**Expected Results:** The actual coolant temperature that is showing on the lower display should be greater than setpoint P16. This actual temperature should not cause an AL2 fault code.

**Results:**

- OK - The actual temperature is greater than the setpoint P16 and the alarm fault indicator does not FLASH and AL2 fault code is not showing on the upper display when the alarm code key is pressed. The problem is not present now. The problem may be intermittent. Check the harness and the electrical connections of the circuit for the coolant temperature. See Testing And Adjusting, “Electrical Connector - Test”. STOP.
- OK - The temperature that is showing on the lower display is greater than setpoint P16. Therefore, the temperatures are not correct for an AL2 fault code. If the AL2 fault remains active, replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace” for more information. STOP.
- NOT OK - The temperature that is showing on the lower display is less than setpoint P16. Therefore, the temperatures are correct for an AL2 fault code. The GSC is operating properly. Make sure that the setpoint P16 is reasonable for the local climate. Adjust, if necessary. Refer to the Engine Service Manual in order to find the cause of the low engine coolant temperature. STOP.

Note: If desired, check the accuracy of the temperature that is shown on the lower display of the GSC. Install an accurate engine coolant temperature gauge with the sensing element in an area of high coolant flow. Also, install the gauge as close as possible to the coolant temperature sensor for the EMCP II.

i01131318

# Troubleshooting Dedicated Shutdown Indicators

**SMCS Code:** 4490-035-IND

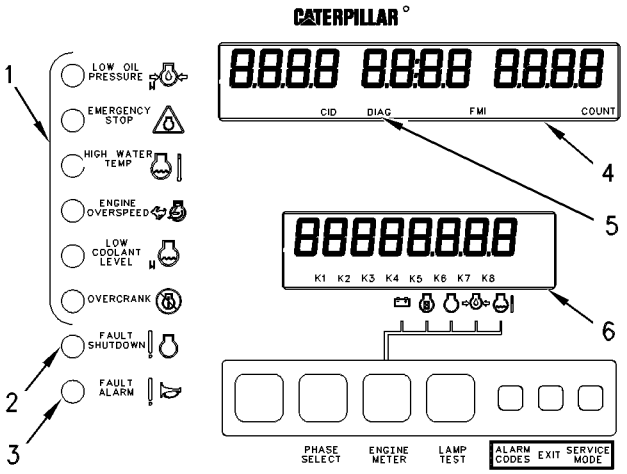



Illustration 68 g00595806

Display Area Of Generator Set Control (GSC)

(1) Dedicated shutdown indicators
(2) Fault shutdown indicator
(3) Fault alarm indicator
(4) Upper display
(5) “DIAG” indicator
(6) Lower display

The dedicated shutdown indicators inform the operator of the system that is responsible for an engine shutdown. The symbol and the nomenclature that is nearest to the indicator identifies the responsible system. Dedicated shutdown faults are activated automatically by the GSC and the faults depend on certain setpoints. When the GSC decides that operating conditions are critical, the GSC FLASHES the corresponding shutdown indicator. Also, the GSC will shut down the engine. The GSC does not record dedicated shutdown faults in the fault log.

The dedicated shutdown indicators (faults) are listed below.

- Low Oil Pressure
- Emergency Stop
- High Water Temperature
- Engine Overspeed
- Low Coolant Level
- Overcrank

To find the cause of a dedicated shutdown fault, perform the correct procedure.

i01131347

# Indicator for Low Oil Pressure - Troubleshoot

**SMCS Code:** 4490-035-IND

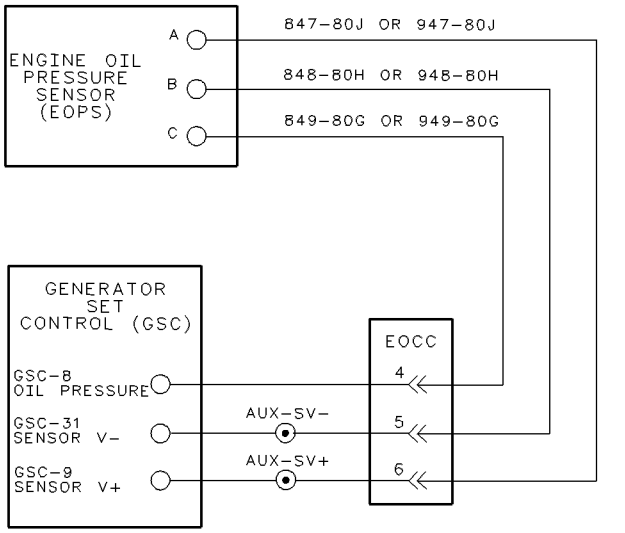



Illustration 69 g00595836

Schematic For Pressure Sensor (Engine Oil)

To find the cause of a low oil pressure shutdown, perform this procedure.

**1. Check for a diagnostic fault.**

**a.** Check for a CID 100 (oil pressure sensor) or a CID 269 (sensor power supply) that is active. See Testing And Adjusting, “Troubleshooting Diagnostic Codes”.

**Expected Result:** CID 100 or CID 269 should not be showing.

**Results:**

- OK - Proceed to 2.
- Not OK - Correct the active CID 100 or CID 269 prior to proceeding with this procedure. See Testing And Adjusting, “Troubleshooting Diagnostic Codes”. STOP.

**2. Check obvious causes.**

**a.** Check for low oil pressure.

**b.** Check oil level.

**c.** Check for oil leaks.

**d.** Check for other obvious causes of low oil pressure.

**Expected Result:** No obvious cause should exist.

**Results:**

- OK - Proceed to 3.
- Not OK - An obvious cause does exist. Correct the fault. Refer to the Engine Service Manual. STOP.

**3. Check setpoints.**

This step checks the setpoints P12 (oil step speed), P13 (low oil pressure at rated speed) and P14 (low oil pressure at idle speed).

**a.** View the setpoints and note the setpoints P12, P13, and P14. See Systems Operation, "Engine/Generator Setpoint Viewing OP2".

**b.** Compare the setpoints that are viewed with the specified setpoints of the particular generator set.

**Expected Result:** The setpoint value that is viewed and the setpoint value that is specified should agree.

**Results:**

- OK - Proceed to 4.
- Not OK - The setpoints do not agree. Reprogram setpoints P12, P13 and P14. See Systems Operation, "Engine/Generator Programming OP5". STOP.

**4. Check the function of low oil pressure.**

**a.** Turn the ECS to the OFF/RESET position and then turn the ECS to the START position.

**b.** Allow oil pressure to stabilize.

**c.** When the engine is at idle speed, compare the actual pressure that is showing on the lower display with setpoint P14. The actual pressure that is showing should be greater than setpoint P14.

**d.** When the engine is at rated speed, compare the actual pressure that is showing on the lower display with setpoint P13. The actual pressure that is showing should be greater than setpoint P13.

**Expected Result:** The actual pressure at idle speed and at rated speed should be greater than the setpoint value. These actual pressures should not cause a low oil pressure shutdown.

**Results:**

- OK - Both actual pressures are greater than the corresponding setpoint value and the low oil pressure indicator does not FLASH. The problem is not present now. The problem may be intermittent. Check the harness and all the electrical connections of the oil pressure circuit. See Testing And Adjusting, "Electrical Connector - Inspect". STOP.
- OK - Both actual pressures are greater than the corresponding setpoint value and the low oil pressure indicator remains FLASHING. Therefore, the GSC is faulty. Replace the GSC. See Testing And Adjusting, "EMCP Electronic Control (Generator Set) - Replace". STOP.
- Not OK - Actual pressure showing is less than the setpoint for rated speed or idle speed. The pressures are correct for a low oil pressure shutdown. Therefore, the engine should shut down and the low oil pressure indicator should FLASH. The GSC is operating properly. Refer to the Engine Service Manual in order to find the cause of low oil pressure. STOP.

Note: Check the accuracy of the pressure that is shown on the lower display of the GSC. Install an accurate engine oil pressure gauge as close as possible to the engine oil pressure sensor for the EMCP II.

i01131379

# Indicator for Emergency Stop - Troubleshoot

**SMCS Code:** 4490-035-IND

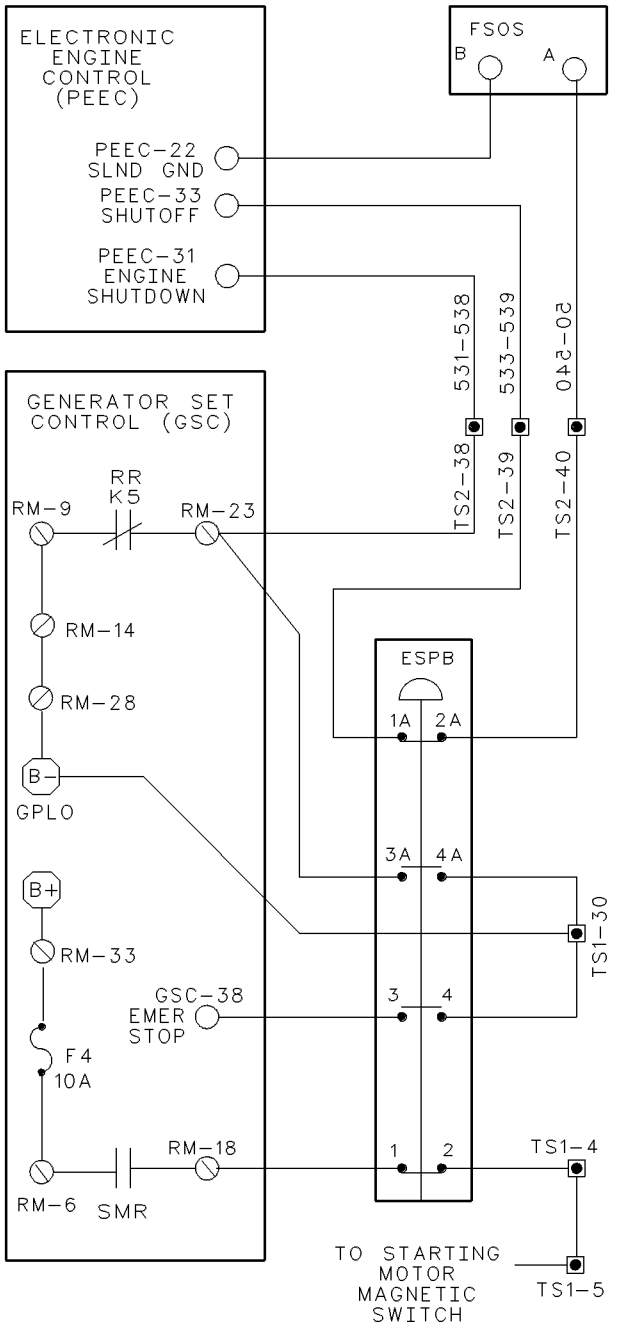



Illustration 70 g00598412

Schematic For Emergency Stop Circuit

In order to find the cause of an emergency stop shutdown, perform this procedure.

**1. Check the ESPB.**

**a.** Deactivate the ESPB by pulling the button. Some versions of ESPB must be turned clockwise before popping out.

**b.** Turn the ECS to the OFF/RESET position and then turn the ECS to the STOP position.

**Expected Result:** The ESPB should pop out. The indicator for emergency stop should be OFF.

**Results:**

- OK - The system is operating correctly. The problem may be intermittent. Check the harness and all the electrical connections of the circuit for the ESPB. See Testing And Adjusting, “Electrical Connector - Inspect”. STOP.
- Not OK - The ESPB does not pop out, then replace the ESPB. STOP.
- Not OK - The ESPB pops out and the emergency stop indicator is FLASHING. Proceed to **2**.

**2. Check the indicator for the emergency stop.**

Note: This step creates diagnostic codes. Clear these created diagnostic codes after troubleshooting is complete.

**a.** The ECS remains in the STOP position.

**b.** Disconnect the harness connector from the GSC.

**c.** Temporarily install a jumper from contact 39 of the GSC to ground. This simulates the OFF/RESET position of the ECS.

**d.** Check the operation of the indicator for the emergency stop.

**Expected Result:** The indicator for the emergency stop should be OFF.

**Results:**

- OK - Therefore, the fault is with the ESPB or the related wiring. Troubleshoot the circuit. See the Generator Set Wiring Diagram in Testing And Adjusting, “Schematics and Wiring Diagrams”. Repair faulty components or replace faulty components. Repair the wiring or replace the wiring, if necessary. STOP.

- Not OK - The emergency stop indicator is FLASHING. Replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

i01131411

# Indicator for High Water Temperature - Troubleshoot

**SMCS Code:** 4490-035-IND

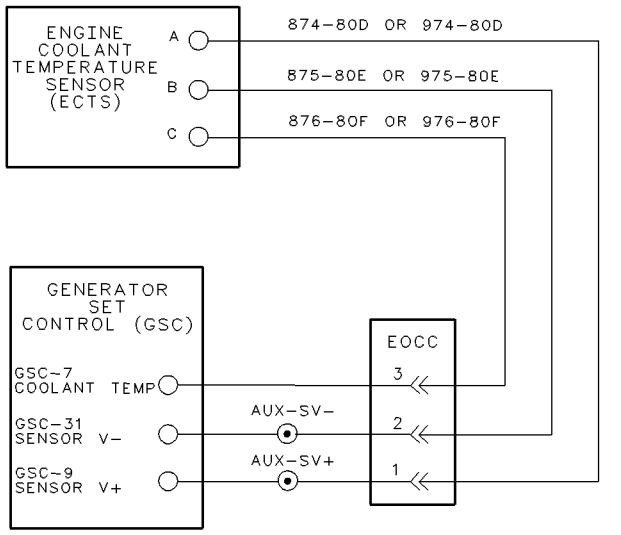



Illustration 71 g00596060

Schematic For Temperature Sensor (Engine Coolant)

In order to find the cause of a shutdown due to a high water temperature, perform this procedure.

1. **Check for a diagnostic fault.**

   **a.** Check for an active CID 110 or CID 269 diagnostic code. See Testing And Adjusting, “Troubleshooting Diagnostic Codes”.

   **Expected Result:** CID 110 or CID 269 should not be showing.

   **Results:**

   - OK - Proceed to 2.
   - Not OK - Correct the active CID 110 or CID 269 prior to proceeding with this procedure. See Testing And Adjusting, “Troubleshooting Diagnostic Codes”. STOP.

2. **Check obvious causes.**

   **a.** Check water level.

   **b.** Check fan drive belts.

   **c.** Check for other obvious causes of high water temperature.

   **Expected Result:** No obvious cause should exist.

   **Result:**

   - OK - Proceed to 3.
   - Not OK - Correct the active CID 110 or CID 269 prior to proceeding with this procedure. See Testing And Adjusting, “Troubleshooting Diagnostic Codes”. STOP.

3. **Check Setpoint P15 (high water temperature).**

   **a.** View the setpoint P15. See Systems Operation, “Engine/Generator Setpoint Viewing OP2”.

   **b.** Compare the setpoints that are viewed with the specified setpoints of the particular generator set.

   **Expected Result:** The setpoint value that is viewed and the setpoint value that is specified should agree.

   **Results:**

   -
   - OK - Proceed to 4.
   - Not OK - The setpoints do not agree. Reprogram setpoint P15. See Systems Operation, “Engine/Generator Programming OP5”. STOP.

4. **Check the function of the high water temperature.**

   **a.** Turn the ECS to the OFF/RESET position and then turn the ECS to the START position.

   **b.** Allow water temperature to stabilize.

   **c.** Check the actual water temperature that is showing on the lower display.

   **d.** Compare the actual temperature that is showing on the lower display with setpoint P15.

   **Expected Result:** The actual temperature that is showing on the lower display should be less than setpoint P15. This actual temperature should not cause a shutdown due to a high water temperature.

   **Results:**

- OK - The actual temperature is less than the setpoint P15 and the high water temperature indicator does not FLASH. The problem is not present now. The problem may be intermittent. Check the harness and all the electrical connections of the circuit for the water temperature. See Testing And Adjusting, “Electrical Connector - Inspect”. STOP.

- OK - The actual temperature is less than the setpoint P15 and the high water temperature indicator remains FLASHING. Therefore, the GSC is faulty. Replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.

- Not OK - Actual temperature that is showing is greater than the setpoint P15. The temperature is correct for shutdown due to a high water temperature. Therefore, the engine should shut down and the indicator for high water temperature should FLASH. The GSC is operating properly. Refer to the Engine Service Manual in order to find the cause of high water temperature. STOP.

Note: The following procedure checks the accuracy of the temperature that is shown on the lower display of the GSC. Install an accurate engine coolant temperature gauge with the sensing element in an area of high coolant flow. Also, install the gauge as close as possible to the coolant temperature sensor of the EMCP II.

i01131437

# Indicator for Engine Overspeed - Troubleshoot

**SMCS Code:** 4490-035-IND

In order to find the cause of an engine overspeed shutdown, perform this procedure.

**1. Check setpoints.**

This step checks setpoints P09 (ring gear teeth) and P10 (engine overspeed).

**a.** View the setpoints and note the setpoints P09 and P10. See Systems Operation , “Engine/Generator Setpoint Viewing OP2”.

**b.** Compare the setpoints that are viewed with the specified setpoints of the particular generator set.

**Expected Result:** The setpoint value that is viewed and the setpoint value that is specified should agree.

**Results:**

- OK - Proceed to 2.

- Not OK - The setpoints do not agree. Reprogram setpoints P09, P10 and P14. See Systems Operation, “Engine/Generator Programming OP5”. STOP.

**2. Check for possible causes.**

**a.** Check for the possible causes of the engine overspeed condition. Refer to the Engine Service Manual and/or the Governor Service Manuals.

**Expected Result:** No cause should be found.

**Results:**

- OK - Proceed to 3.

- Not OK - The cause is found. Repair engine components or replace engine components. If necessary, repair governor components or replace governor components. STOP.

**3. Check the engine overspeed function.**

Note: Take precautions in order to stop the engine manually when you are performing this step.

**a.** When possible, disable the engine from reaching rated speed.

**b.** Turn the ECS to the OFF/RESET position and then turn the ECS to the START position.

**c.** Slowly increase the RPM to rated speed.

**Expected Result:** The engine should not overspeed. The GSC should not shut down the engine. The GSC should not issue an overspeed fault.

**Results:**

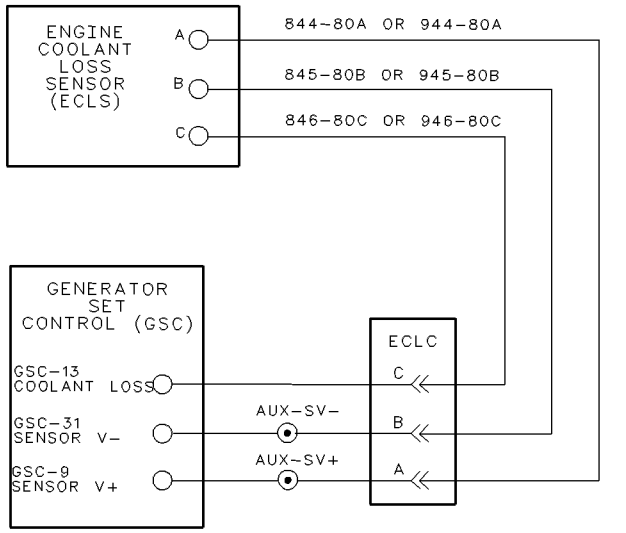
- OK - The engine reaches rated speed, the GSC does not issue an overspeed fault and the GSC does not shut down the engine. The GSC and the system are functioning properly. Perform a verification of an overspeed. See Systems Operation, “Engine Setpoint Verification OP9”. STOP.

- Not OK - The engine overspeeds and the GSC issues an overspeed fault. Refer to the Engine Service Manual and/or the Governor Service Manual in order to find the cause of the problem. STOP.

i01131452

# Indicator for Low Coolant Level - Troubleshoot

**SMCS Code:** 4490-035-IND




g00483875

Illustration 72

Schematic For Fluid Level Sensor (Engine Coolant)

In order to find the cause of a low level shutdown, perform this procedure.

**1. Check the coolant level.**

**a.** Check the level of the engine coolant. See the Operation And Maintenance Manual for the engine.

**Expected Result:** The coolant level should be at the proper level. The coolant level should be above the probe of the fluid level sensor.

**Result:**

- OK - Proceed to 2.
- NOT OK - Coolant level is not correct. Find the cause and correct the cause. Refer to the Engine Service Manual. STOP.

**2. Check for a diagnostic fault.**

**a.** Turn the ECS to the OFF/RESET position and then turn the ECS to the STOP position.

**b.** Wait for ten seconds.

**c.** Check for an active CID 111. See Testing And Adjusting, “Troubleshooting Diagnostic Codes”.

**Expected Result:** CID 111 should not be showing. The indicator for the low coolant level should not be FLASHING.

**Results:**

- OK - No CID 111 diagnostic codes are active. The indicator for the low coolant level is OFF. Therefore, the fault may be intermittent. Check the harness and all the electrical connections of the circuit for the low coolant level. See Testing And Adjusting, “Electrical Connections - Inspect”. STOP.
- NOT OK - CID 111 is active. Correct the active CID 111. See Testing And Adjusting, “Troubleshooting Diagnostic Codes”. STOP.
- NOT OK - No CID 111 is active. The indicator for the low coolant level is FLASHING. Therefore, the sensor is faulty. Replace the fluid level sensor. STOP.

i01131457

# Indicator for Overcrank - Troubleshoot

**SMCS Code:** 4490-035-IND

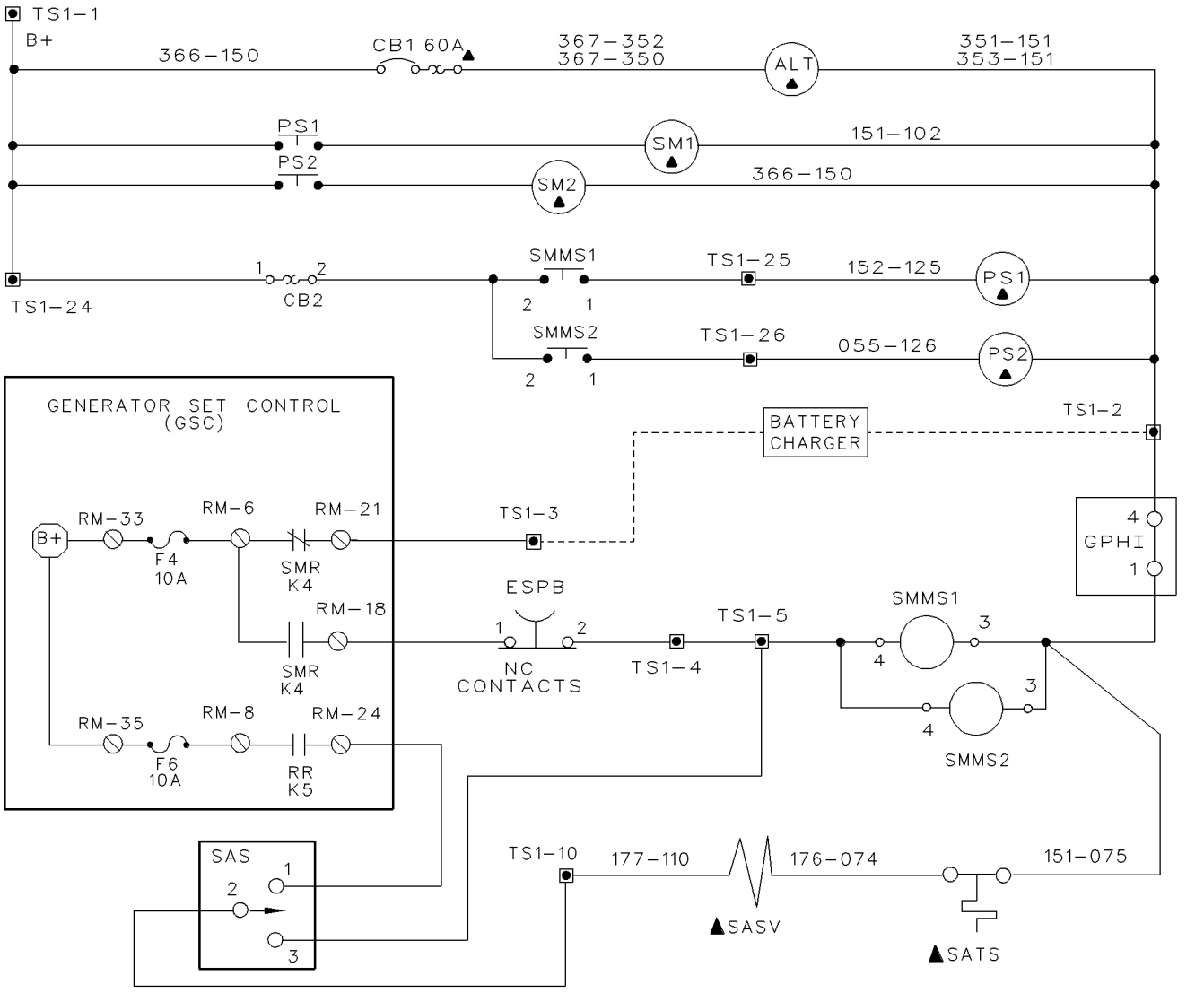



Illustration 73 g00597871

System Schematic For Starting Motor Relay (SMR)

To find the cause of an overcrank shutdown, perform this procedure.

**1. Preliminary Step. Initial Check.**

Before you proceed with the troubleshooting procedures, do the following preliminary checks.

**a.** Check for active diagnostic codes with the exception of the CID 566 FMI 7. Also check for other flashing indicators on the GSC. If the fault is present, then correct the fault first. Go to the appropriate procedure for that fault.

**b.** Check the fuel level and quality. Refer to the Engine Service Manual.

**c.** Check for a plugged fuel filter. Refer to the Engine Service Manual.

**d.** Check for a plugged air filter. Refer to the Engine Service Manual.

**e.** Check the air shutoff solenoid (if equipped) for activation. The solenoid must be deactivated in order for the engine to start. See Testing And Adjusting, "Troubleshooting Diagnostic Codes".

**f.** Check the optional prelube system for proper operation. See "DC - Schematic Prelube Pump Option" in Testing And Adjusting, "Schematics And Wiring Diagrams".

**g.** Check fuse "F4" on the relay module. If either fuse is blown, proceed to 10.

**h.** Check the engine starting system and the fuel system. (To check the fuel control solenoid, see Testing And Adjusting, "Troubleshooting Diagnostic Codes".) If there is a fault, refer to the Engine Service Manual. If there is no engine fault or fuel system fault, proceed to 2.

**2. Check setpoints.**

This step checks setpoints P17 (total cycle crank time) and P18 (cycle crank time).

**a.** View the setpoints and note the setpoints P17 and P18. See Systems Operation, "Engine/Generator Setpoint Viewing OP2".

**b.** Compare the setpoints that are viewed with the setpoints that are specified for the particular generator set. The factory default values are 90 seconds for P17 and 10 seconds for P18.

Note: Engines that are equipped with prelube pumps may require cycle crank times of thirty seconds or more.

**Expected Result:** The setpoint value that is viewed and the setpoint value that is specified should agree.

**Results:**

- OK - Proceed to 3.
- Not OK - The setpoints do not agree. Reprogram setpoints P17 and P18. See Systems Operation, "Engine/Generator Programming OP5". STOP.

**3. Check the battery voltage.**

**a.** Make sure that the engine is off. Measure the system voltage at the batteries.

**Expected Result:**

For 24 volt systems, the voltage should be from 24.8 to 29.5 DCV.

For 32 volt systems, the voltage should be from 33.1 to 39.3 DCV.

**Results:**

- OK - Proceed to 4.
- NOT OK - Further checking of the battery system is necessary. See Testing And Adjusting, "Troubleshooting Diagnostic Codes". STOP.

**4. Check the procedure for starting the engine.**

Steps 4 through 9 require voltage measurements to be made during simulated engine cranking. The starting motor is disabled.

Note: The GSC is attempting to crank whenever the K4 indicator is being displayed on the lower display. Be aware of the 10 second crank cycle that is factory set. Ensure that the K4 indicator is ON while you are making the following measurements. If necessary, a helper could observe the GSC display. More than one start may be required to complete this test.

**a.** Disconnect the wire for B+ on the pinion solenoid of the starting motor. The wire remains disconnected for all of the remaining steps of this procedure.

**b.** Prepare to measure the DC voltage from the disconnected "B+" pinion solenoid wire to "B–" (ground).

**c.** Turn the ECS to the OFF/RESET position and then turn the ECS to the START position.

**d.** Measure the voltage.

**Expected Result:** The voltage should be the system voltage that was noted in 3, ± 2.0 DCV.

**Results:**

- OK - Therefore, the starting motor is faulty. Repair the starting motor or replace the starting motor. Refer to the Engine Service Manualor the Service Manual, "Starting Motor". STOP.
- NOT OK - Proceed to 5.

**5. Check the procedure for starting the engine.**

The conditions of 4 remain. "B+" wire is disconnected from the pinion solenoid.

**a.** In the junction box, prepare to measure the DC voltage from “B–” (ground) to the terminal TS1-25.

**b.** Turn the ECS to the OFF/RESET position and then turn the ECS to the START position.

**c.** Measure the voltage.

**Expected Result:** The voltage should be the same as the system voltage that is noted in 3, ±2.0 DCV.

**Results:**

- OK - Therefore, the engine wire harness is faulty. Repair the engine wire harness or replace the engine wire harness. See the Testing And Adjusting, “Schematics And Wiring Diagram”. STOP.
- Not OK - Proceed to 6.

**6. Check the procedure for starting the engine.**

The conditions of 4 remain . “B+” wire is disconnected from the pinion solenoid.

**a.** Prepare to measure the voltage from terminal TS1-5 in the generator housing to “B–” (ground).

**b.** Turn the ECS to the OFF/RESET position and then turn the ECS to the START position.

**c.** Measure the voltage.

**Expected Result:** The voltage should be the same as the system voltage noted in 3, ±2.0 DCV.

**Results:**

- OK - Therefore, the starting motor magnetic switch (SMMS) is faulty. Also, the wiring could be faulty. Troubleshoot the SMMS and the wiring. See the Testing And Adjusting, “Schematics And Wiring Diagram”. STOP.
- Not OK - Proceed to 7.

**7. Check the procedure for starting the engine.**

The conditions of 4 remain. “B+” wire is disconnected from the pinion solenoid.

**a.** Prepare to make a voltage measurement from RM-18 of the relay module to “B–” (ground).

**b.** Turn the ECS to the OFF/RESET position and then turn the ECS to the START position.

**c.** Measure the voltage.

**Expected Result:** The voltage should be the same as the system voltage noted in 3, ±2.0 DCV.

**Results:**

- OK - Therefore the emergency stop push button (ESPB) or the related wiring is faulty. Troubleshoot the ESPB and the related wiring. See the Testing And Adjusting, “Schematics And Wiring Diagram”. STOP.
- NOT OK - Proceed to 8.

**8. Check the procedure for starting the engine.**

The conditions of 4 remain. “B+” wire is disconnected from the pinion solenoid.

**a.** Prepare to measure the DC voltage from RM-6 of the relay module to “B–” (ground).

**b.** Turn the ECS to the OFF/RESET position and then turn the ECS to the START position.

**c.** Measure the voltage.

**Expected Result:** The voltage should be the same as the system voltage noted in 3, ±2.0 DCV.

**Results:**

- OK - Therefore, the relay module is faulty. Replace the relay module. First, make sure that the “K4” indicator is ON. See Testing And Adjusting, “Relay Module - Replace”. STOP.
- Not OK - Proceed to 9.

**9. Check the procedure for starting the engine.**

The conditions of 4 remain. “B+” wire is disconnected from the pinion solenoid.

**a.** Prepare to measure the DC voltage from RM-33 of the relay module to “B–” (ground).

**b.** Turn the ECS to the OFF/RESET position and then turn the ECS to the START position.

**c.** Measure the voltage.

**Expected Result:** The voltage should be the same as the system voltage noted in 3, ±2.0 DCV.

**Results:**

- OK - Therefore, fuse “F4” is blown. Proceed to 10.

- Not OK - Therefore the B+ terminal or the wiring to RM-33 is faulty. Repair the wiring or replace the wiring. See the Testing And Adjusting, “Schematics And Wiring Diagram”. STOP.

**10. Troubleshoot a blown fuse.**

**a.** Remove fuse “F4” from the relay module.

**b.** At the relay module, measure the resistance from RM-18 to “B–” (ground).

**Expected Result:** A short to “B–” (ground) will measure 5 ohms or less.

**Results:**

- OK - Resistance is greater than 5 ohms and fuse is no longer blowing. Carefully check ALL the wires that are connected to the appropriate terminal of the relay module for abrasion or worn spots in the insulation. These wires could cause a short. Check the wires in the panel, the generator panel, and the engine harness. Refer to the various wiring diagrams. If necessary, repair the wiring or replace the wiring. STOP.

- Not OK - Resistance is 5 ohms or less. There is a short to ground. See the Testing And Adjusting, “Schematics And Wiring Diagram”. Remove one component or wire at a time that is in series with RM-18 until the faulty component or wire is isolated. Repair the faulty component or replace the faulty component. Repair wiring or replace wiring. STOP.

i00941663

# Troubleshooting Undiagnosed Problems

**SMCS Code:** 4490-038

Undiagnosed problems are NOT accompanied by any type of fault indicator or fault code on the GSC. To troubleshoot an undiagnosed problem, find the description that best fits the problem in the Undiagnosed Problem List and proceed to the corresponding procedure.

Note: If any fault indicator or fault code is showing on the GSC, then proceed to the appropriate procedure for that fault.

## Undiagnosed Problem List

- The starting motor remains engaged or the starting motor continues to run after the engine has started.

- There is no engine shutdown when a shutdown fault occurs.

- All the fault indicators of the remote annunciator flash and/or all the fault indicators of the control panel alarm module flash. The indicators flash once per two seconds (0.5 Hz).

- Fault shutdown indicator on the GSC flashes four to five times per second (4 to 5 Hz).

- The display of the GSC is showing 0 volts or 0 amperes for one or more AC phases with the genset that is running and the load that is connected.

- The AC voltage and/or current values are inaccurate.

i01132256

# Engaged Starting Motor - Troubleshoot

**SMCS Code:** 1453-035; 4490-035

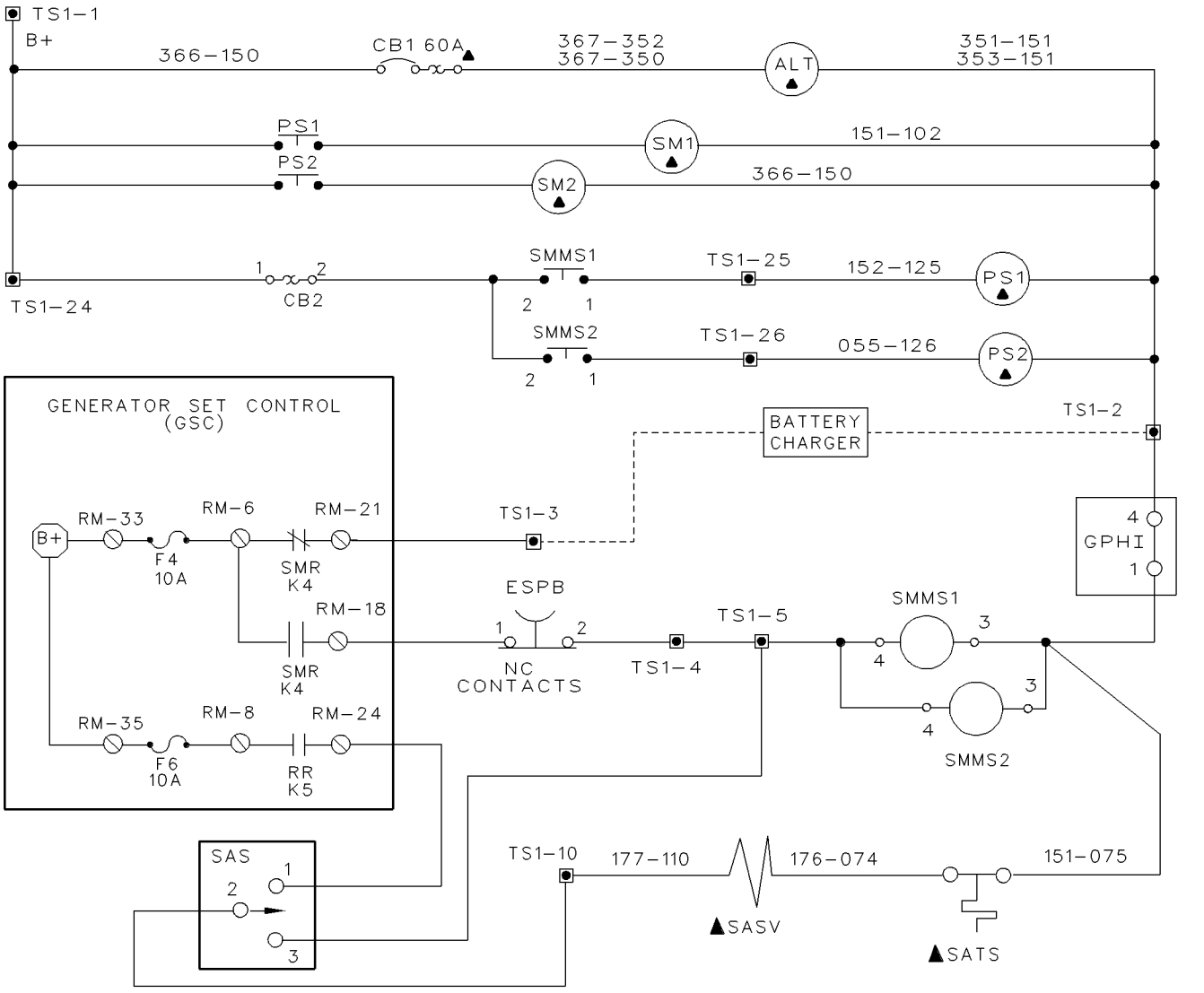



Illustration 74 g00597871

System Schematic For Starting Motor Relay (SMR)

The starting motor remains engaged or the starting motor continues to run after the engine has started.

**1. Check setpoints.**

This step checks setpoints P11 (crank terminate speed), P17 (total cycle crank time) and P18 (cycle crank time).

**a.** View the setpoints and make a note of the setpoints P11, P17 and P18. See Systems Operation, “Engine/Generator Setpoint Viewing OP2”.

**b.** Compare the setpoints that are viewed with the setpoints that are specified for the particular generator set. The factory default value for P11 is 400 rpm. The factory default value for P17 is 90 seconds. The factory default value for P18 is 10 seconds.

Note: Engines that are equipped with prelube pumps may require cycle crank times of 30 seconds or more.

**Expected Result:** The setpoint value that is viewed and the setpoint value that is specified should agree.

**Results:**

- OK - Proceed to 2.
- Not OK - The viewed setpoint does not agree with the specified setpoint. Reprogram setpoints P11, P17 and P18. See Systems Operation, "Engine/Generator Programming OP5". Proceed to 2.

**2. Check the procedure for starting the engine.**

The remaining steps of this procedure require checks to be made during a simulated engine starting. The fuel delivery system is disabled.

**a.** Disable the fuel shutoff solenoid or the PEEC electronic control module in order to prevent the engine from starting but not from cranking.

**b.** Prepare to manually stop the engine from cranking. If necessary, turn the battery disconnect switch to the OFF position.

**c.** Turn the ECS to START and allow the engine to crank.

**d.** Turn the ECS to OFF/RESET.

**Expected Result:** The engine should stop cranking.

**Results:**

- OK - Proceed to 6.
- Not OK - Engine continues to crank. Proceed to 3.

**3. Check the procedure for starting the engine.**

The conditions of 2 remain. The fuel delivery is disabled and the engine is cranking.

**a.** While the engine is still cranking from the preceding step, push the emergency stop push button.

**Expected Result:** The engine should stop cranking.

**Results:**

- OK - Check the wire on RM-18 of the relay module for a short to "B+". If a short is not found, replace the relay module. See Testing And Adjusting, "Relay Module - Replace". STOP.
- Not OK - Engine continues to crank. Proceed to 4.

**4. Check the procedure for starting the engine.**

The conditions of 3 remain. The fuel delivery is disabled and the engine is cranking.

**a.** Stop the engine. Turn the battery disconnect switch to the OFF position.

**b.** Remove all wires from terminals TS1-25 in the generator housing. For dual starting motors, remove all the wires from terminal TS1-26.

**c.** Turn the ECS to the START position and attempt to crank the engine.

**Expected Result:** The engine should not crank.

**Results:**

- OK - The engine does not crank. Therefore, the starting motor magnetic switch (SMMS) or related wiring is faulty. Troubleshoot the SMMS and the related wiring. See Testing And Adjusting, "Schematics & Wiring Diagram". STOP.
- Not OK - Engine continues to crank. Proceed to 5.

**5. Check the procedure for starting the engine.**

The conditions of 4 remain. The fuel delivery is disabled and the engine is cranking.

**a.** Stop the engine. Turn the battery disconnect switch to the OFF position.

**b.** Disconnect the B+ wire on the pinion solenoid of the starting motor.

**c.** Turn the ECS to START and attempt to crank the engine.

**Expected Result:** The engine should not crank.

**Results:**

- OK - The engine does not crank. Therefore, a wire in the engine harness is shorted to the +battery. Troubleshoot the wiring. See the “Generator Set Wiring Diagram” in Testing And Adjusting, “Schematics And Wiring Diagrams”. STOP.

- Not OK - Engine continues to crank. Therefore, the starting motor is faulty. Troubleshoot the starting motor. Refer to the Service Manual, “Starting Motor” and/or the Engine Service Manuals. STOP.

**6. Check the cycling for the starting motor.**

This step continues troubleshooting from 2. The conditions of 2 remain. The fuel delivery is disabled.

Turn the ECS to the START position.

**a. Expected Result:** The starting motor should cycle on and off according to setpoint P18 (cycle crank time).

**Results:**

- OK - If the starting motor cycles correctly, the problem is not present. STOP.

- Not OK - If the starting motor remains ON and does not stop, the starting motor is faulty. Troubleshoot the starting motor. Refer to the Starting Motor and/or Engine Service Manuals. STOP.

i01132348

# No Engine Shutdown - Troubleshoot

**SMCS Code:** 4490-035

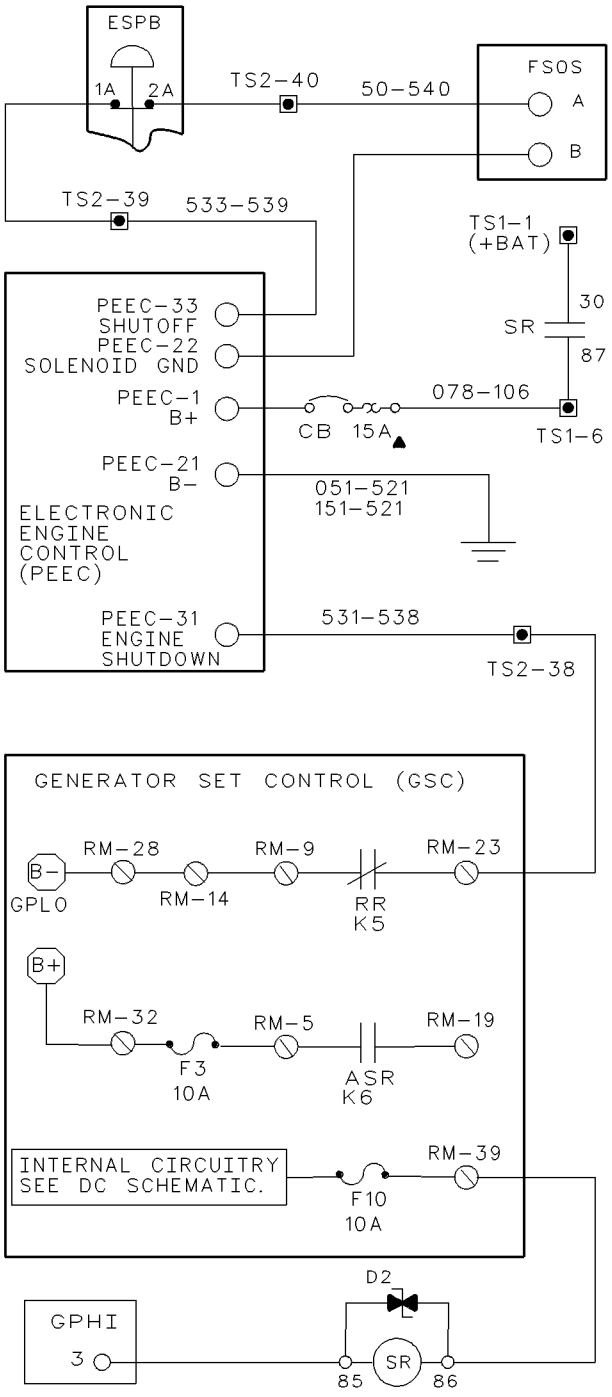



Illustration 75 g00596877

System Schematic For An Unexpected Shutdown

The engine does not shut down when a shutdown fault occurs.

**1. Check for any diagnosed faults.**

**a.** Check the display area of the GSC for a fault indicator that is FLASHING. Check for a fault code on the upper display.

Note: If the fault alarm indicator is ON CONTINUOUSLY, then the GSC is programmed to override the normal shutdown response and the GSC is programmed to treat the condition as an alarm fault. The engine continues to run and the engine is able to start. This is not a problem. To view the setpoints, see Systems Operation, "Engine/Generator Setpoint Viewing OP2". To reprogram the setpoints, see Systems Operation, "Engine/Generator Programming OP5".

**Expected Result:** The engine does not shut down when a shutdown fault occurs.

**Results:**

- Not OK - If all fault indicators are OFF and a fault exists that should cause the GSC to shutdown the engine, then proceed to 6.
- Not OK - If the fault shutdown indicator is FLASHING and the engine remains running, then proceed to 2.

**2. System check.**

The engine remains running and the fault shutdown indicator is FLASHING.

**a.** Turn the ECS to OFF/RESET.

**Expected Result:** The engine should shut down.

**Results:**

- OK - The engine shuts down. The system is functioning properly. Start the engine again. If the fault shutdown indicator is FLASHING and the engine does not shut down, replace the GSC. See Testing And Adjusting, "EMCP Electronic Control (Generator Set) - Replace". STOP.
- Not OK - The engine does NOT shut down. Proceed to 3.

**3. System check.**

The engine remains running and the fault shutdown indicator is FLASHING.

**a.** Push the emergency stop push button (ESPB).

**Expected Result:** The engine should shut down.

**Results:**

- OK - The engine shuts down. Therefore, an unwanted voltage is present at TS2-39 of the generator terminal strip. Check the related wiring for this unwanted short. If no short to ground (B–) is found in the related wiring, then replace the relay module. See Testing And Adjusting, "Relay Module - Replace". STOP.
- Not OK - The engine does NOT shut down. Proceed to 5.

**4. System check.**

The engine remains running and the fault shutdown indicator is FLASHING.

**a.** Remove all the wires from the terminal TS2-40 in the generator housing.

**Expected Result:** The engine should shut down.

**Results:**

- OK - The engine shuts down. Check the wiring. There is a short to +battery between TS2-40 and TS2-39. Troubleshoot the ESPB and all related wiring. See Testing And Adjusting, "Schematics And Wiring Diagrams". STOP.
- Not OK - If the engine does not shut down, then proceed to 5.

**5. System check.**

The engine remains running and the fault shutdown indicator is FLASHING.

**a.** Disconnect the fuel shutoff solenoid from the engine harness. Disconnect the contacts "A" and "B" of the solenoid.

**Expected Result:** The engine should shut down.

**Results:**

- OK - The engine shuts down. There is a short to the +battery in the engine harness. Troubleshoot the wiring. See Testing And Adjusting, "Schematics And Wiring Diagrams". STOP.
- Not OK - The engine does not shut down. The fuel shutoff solenoid is stuck. Refer to the Engine Service Manual in order to troubleshoot.

**6. Determine the fault.**

This step continues troubleshooting from step 1.

Note: For a fault with the coolant loss sensor that does not shut down the engine, see Testing And Adjusting, “Troubleshooting Diagnostic Codes”.

**a.** For the following faults, make a note of all the engine information that is showing on the lower display of the GSC.

- engine overspeed
- low oil pressure
- high water temperature fault that does not shut down the engine

**b.** View the related setpoints. See Systems Operation, “Engine/Generator Setpoint Viewing OP2”.

**c.** Compare the engine information that is showing on the lower display with the related setpoints.

**Expected Result:** The information on the lower display and the related setpoint values should agree.

**Results:**

- OK - The information that is showing on the lower display is within the related setpoint. The GSC is not causing the shutdown. STOP.
- Not OK - The information that is showing on the lower display is beyond the related setpoint. Then, the GSC is faulty. Replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.

i01189061

# Alarm Module or Remote Annunciator - Troubleshoot

**SMCS Code:** 4490-035

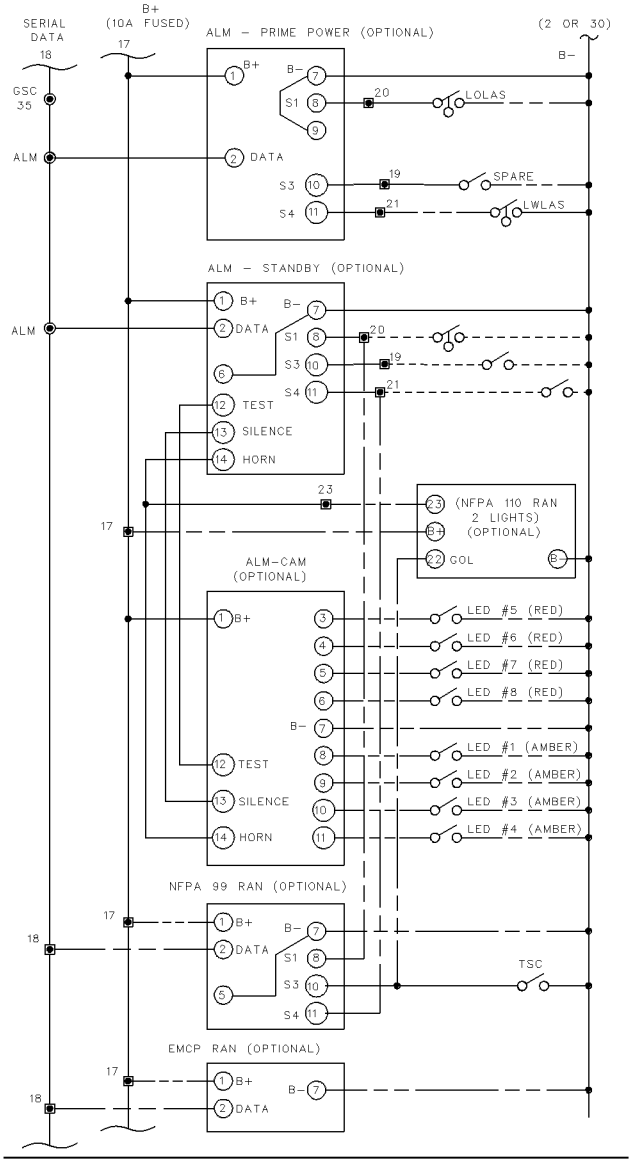



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Illustration 76

System Schematic For Alarm Module (ALM)

All the fault indicators of the remote annunciator flash and/or all the fault indicators of the control panel alarm module flash. The indicators flash once per two seconds (0.5 Hz).

Note: The maximum number of modules (Alarm, Remote Annunciator, or Customer Interface Module), that can be connected to the GSC is three. (There is no limit on the number of Custom Alarm Modules that can be used in an application.) The maximum distance between a module and the GSC is 305 m (1000 ft). If these specifications are not met, the information on the data link can be erratic. Also, the indicators on the alarm module could flash. If the conditions are not in compliance with the specifications, reduce the number of modules and/or shorten the distance to the GSC.

The data link will malfunction under the following conditions with multiple modules:

- One of the modules is powered down. (“B+” or “B-” is disconnected.)
- The module that is powered down remains connected to the data link.

Under these conditions, the indicators that are controlled by the data link of the other modules that are powered up will flash at .5 Hz.

1. **Check the data wire.**

   **a.** Turn the ECS to OFF/RESET.

   **b.** Disconnect the harness connector from the GSC.

   **c.** Check for an open. Measure the resistance from terminal 2 of the alarm module to contact 35 of the GSC harness connector. The resistance should be 5 ohms or less.

   **d.** Check for a short. Measure the resistance from contact 35 of the GSC harness connector to the battery (B+) and ground (B–) at the relay module. The resistance should be greater than 5000 ohms.

   **Expected Result:** For 1.c, the resistance should be 5 ohms or less. For 1.d, the resistance should be greater than 5000 ohms.

   **Results:**

   - OK - All resistance measurements are correct. Proceed to next step.
   - Not OK - One or more of the resistance measurements are NOT correct. Therefore, the harness wiring with the incorrect resistance is faulty. Troubleshoot the faulty wiring and repair the faulty harness wiring. STOP.

2. **Measure the voltage at the alarm module.**

   The ECS remains in the OFF/RESET position.

   **a.** Reconnect the harness connector to the GSC.

   **b.** At the alarm module, measure the DC voltage from terminal 2 to terminal 7. The voltage will be changing. The voltage should be between 1 and 10 DCV.

Note: If you are troubleshooting a remote annunciator, measure the DC voltage from contact 35 to contact 31 of the GSC harness connector. Make the measurement by using the 7X-1710 Multimeter Probe Group. Do not disconnect the harness from the GSC. This voltage measurement should agree with the preceding measurement of 2.b. If the voltages do not agree, the wire is faulty. The wire is faulty from terminal 2 of the remote annunciator to the terminal in the internal panel.

   **c.** Disconnect all wires from terminal 2 of the alarm module. Again measure the DC voltage from terminal 2 to terminal 7 at the alarm module. The voltage should be 10.5 ± 1.0 DCV.

   **Expected Result:** For 2.b, the voltage should be between 1 and 10 DCV. For 2.c, the voltage should be 10.5 ± 1.0 DCV.

   **Results:**

   - OK - Both voltage measurements are correct. Therefore, replace the alarm module. STOP.
   - Not OK - Both voltage measurements are low. Therefore, replace the alarm module.
   - Not OK - The first measurement is low and the second measurement is high. Therefore, replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.

i01132461

# Erratic GSC Operation - Troubleshoot

**SMCS Code:** 4490-035

The fault indicator on the GSC flashes four to five times per second (4 to 5 Hz). The displays of the GSC may be unclear. The GSC does not respond to any position of the engine control switch (ECS).

This is an internal fault of the GSC that can be temporary or permanent. The fault is caused by a component failure in the GSC. The fault could also be caused by extremely severe electromagnetic interference or radio frequency interference. The relays in the relay module are automatically turned off when this fault occurs. This fault will shut down the engine.

**1. Reset the GSC.**

**a.** Turn the ECS to OFF/RESET. If the GSC does not power down, remove the jumper that connects terminals 6 and 9 on the ECS.

**b.** Turn the ECS to STOP.

**Expected Result:** The GSC should power up with an identifiable display. The GSC should respond to the ECS.

**Results:**

- OK - The GSC operates correctly. Therefore, the fault is gone. STOP.
- NOT OK - The GSC does NOT operate correctly and the fault shutdown indicator still flashes at a rate of four to five times a second (4 to 5 Hz). Therefore, the GSC is faulty. Replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.

i01111047

# Zero Display of Voltage or Current - Troubleshoot

**SMCS Code:** 4490-035

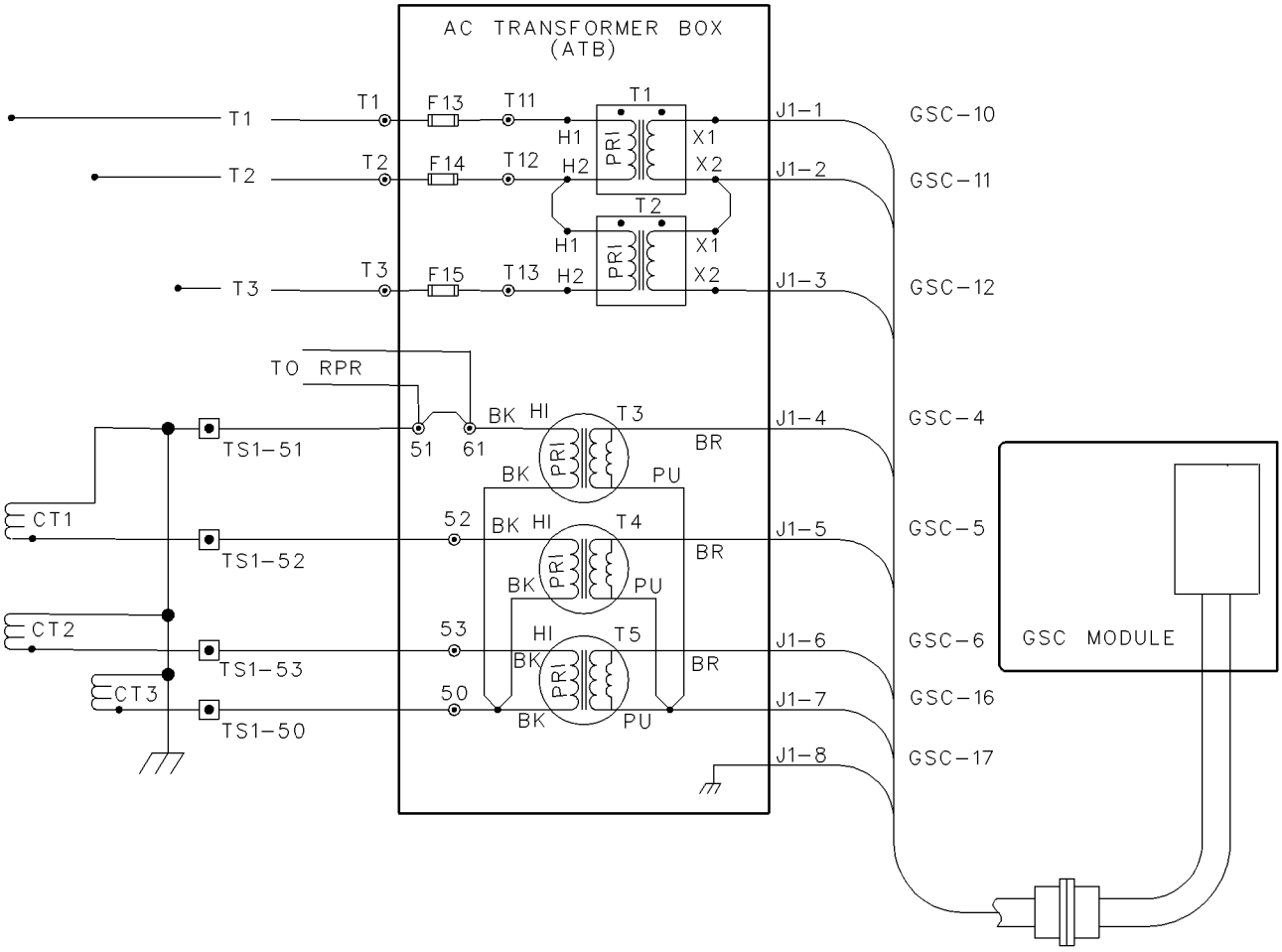



Illustration 77 g00481667

System Schematic For AC Transformer Box (ATB)

**⚠ WARNING**

**When the engine-generator, or any source to which the engine-generator is synchronized to, is operating, voltages up to 600V are present in the control panel.**

**Do not short these terminal with line voltage to ground with any part of the body or any conductive material. Loss of life or injury could result from electrical shock or injury from molten metal.**

The display of the GSC is showing 0 volts or 0 amperes for one or more AC phases with the genset that is running and the load that is connected.

For AC voltage problems, begin troubleshooting at step 1.

For AC current problems, begin troubleshooting at step 4.

**1. Check the fuses.**

**a.** Check the three fuses on the AC transformer box (ATB).

The fuses should not be blown.

**Expected Result:** The fuses should not be blown.

**Results:**

- OK - Fuses are OK. Proceed to next step.
- NOT OK - One or more of the fuses are blown. Check for a shorted component or wiring error. Troubleshoot the fault and repair the fault. See the “Generator Set Wiring Diagram” in Testing And Adjusting, “Schematics and Wiring Diagram”. STOP.

**2. Check the generator output.**

**a.** With the engine running and the circuit breaker open or the load removed, measure the voltage between all three fuses on the ATB.

**Expected Result:** The line to line voltage should measure correctly for all three phases.

**Results:**

- OK - The voltages are correct and the problem remains. Proceed to next step.
- NOT OK - One or more of the voltages are NOT correct, the wiring or connections are faulty. Check for wiring errors between the ATB and the generator buss, see the “Generator Set Wiring Diagram” in Testing And Adjusting, “Schematics And Wiring Diagram”. Also check the electrical connections at the ATB terminal. See Testing And Adjusting, “Electrical Connector Inspection”. STOP.

**3. Check the connections.**

**a.** Stop the engine.

**b.** Check the harness connector and crimp terminals of the ATB.

**c.** Check the GSC harness connector. See Testing And Adjusting, “Electrical Connector - Inspect”.

**d.** Check for one or more broken wires between the ATB and the GSC. See “Generator Set Wiring Diagram” in Testing And Adjusting, “Schematics And Wiring Diagrams”.

**Expected Result:** All connectors are OK and the problem is no longer present.

**Results:**

- OK - All connectors are OK and the problem is no longer present. This procedure has fixed the fault. STOP.
- NOT OK - Problem remains and concerns AC voltage. It is unlikely that the GSC is faulty. Replace the ATB. If the problem persists, then replace the GSC. STOP.
- NOT OK - Problem remains and concerns AC current. Proceed to next step.

**4. Check the current transformers.**

**a.** Stop the engine.

**b.** At terminals 51, 52 and 53 of the ATB, disconnect only the wires that lead away from the ATB. These disconnected wires go to the current transformers (CT1, CT2, and CT3).

**c.** Measure the resistance from terminal 50 to each of the disconnected wires.

**Expected Result:** The resistance should be less than 5 ohms.

**Results:**

- OK - The resistance is correct. Therefore, the current transformers are good. Proceed to next step.
- NOT OK - One or more of the resistance measurements are NOT correct. A current transformer or related wire is open. Check for an open CT or wiring. See “Generator Set Wiring Diagram” in Testing And Adjusting, “Schematics And Wiring Diagrams”. STOP.

**5. Check the ATB.**

**a.** Stop the engine.

**b.** Remove the harness connector from the GSC.

**c.** At the GSC harness connector, measure the resistance: from contact 4 to contact 16, from contact 5 to contact 16, and from contact 6 to contact 16. Allow each measurement to stabilize.

**Expected Result:** Each of the three resistances should be 120 ± 20 ohms.

**Results:**

- OK - Proceed to next step.

- NOT OK - One or more of the resistance measurements at the GSC harness connector is NOT correct. Therefore, the ATB or the related wiring is faulty. Check for an open or short in the wiring from the GSC harness connector to the ATB harness connector. See “Generator Set Wiring Diagram” in Testing And Adjusting, “Schematics And Wiring Diagram”. Check the electrical connections at the GSC and ATB harness connectors and at the ATB terminal strip. See Testing And Adjusting, “Electrical Connector - Inspect”. If necessary, repair the wiring or replace the wiring. If the fault is not found, replace the GSC. STOP.

**6. Check the ATB.**

The wires that were disconnected in step 4 remain disconnected. The only wires that are connected to these terminals should lead into the ATB.

**a.** At the terminal strip of the ATB, measure the resistance: from terminal 51 to 50, from terminal 52 to 50, and from terminal 53 to 50 .

**Expected Result:** All resistances should be less than 1 ohm.

**Results:**

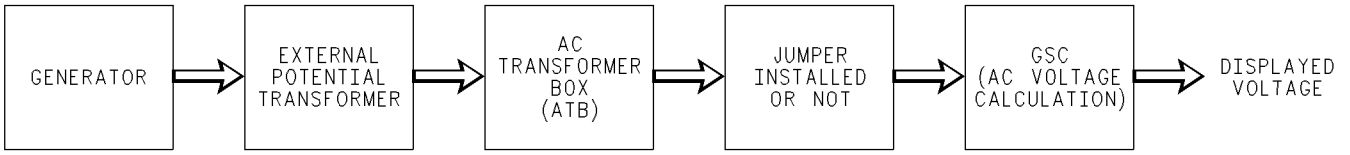
- OK - All resistances are correct, then the ATB checks good. The fault is in the GSC or the GSC harness connector. Check the GSC harness connector. See “Generator Set Wiring Diagram” in Testing And Adjusting, “Schematics and Wiring Diagram”. If the connector is good and the fault remains, then replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.

- NOT OK - One or more of the resistance measurements are NOT correct. The ATB is faulty. Replace the ATB. STOP.

i01188876

# Inaccurate Display of Voltage or Current - Troubleshoot

**SMCS Code:** 4490-035




g00481725

Illustration 78

Functional Block Diagram Of AC Voltage Display in EMCP II

Table 17

| AC Voltage Range Selection | | | | |
|---|---|---|---|---|
| **GSC P20 Setpoint** | **External Potential Transformer** | **Input Voltage Range For AC Transformer Box (ATB)** | **GSC Internal Multiplier** | **Jumper** |
| 700 | None | 0 - 700 | 5 | Required |
| 150 | None | 0 - 150 | 1 | None |
| 300 | 2:1 | 0 - 150 | 2 | None |
| 500 | 3.33:1 | 0 - 150 | 3.33 | None |
| 600 | 4:1 | 0 - 150 | 4 | None |
| 750 | 5:1 | 0 - 150 | 5 | None |
| 3000 | 20:1 | 0 - 150 | 20 | None |
| 4500 | 30:1 | 0 - 150 | 30 | None |
| 5250 | 35:1 | 0 - 150 | 35 | None |
| 9000 | 60:1 | 0 - 150 | 60 | None |
| 15000 | 100:1 | 0 - 150 | 100 | None |
| 18000 | 120:1 | 0 - 150 | 120 | None |
| 30000 | 200:1 | 0 - 150 | 200 | None |

The AC voltage and/or current values are inaccurate.

Note: For related information, see Testing And Adjusting, “AC Voltage Range - Adjust”.

The P20 setpoint determines the proper AC voltage range and the internal multiplier that are used by the GSC for calculating AC voltage. The GSC uses the internal multiplier in order to compensate for the turns ratio of the external potential transformers. The turns ratio of the external potential transformer must match the internal multiplier in order to ensure an accurate AC voltage calculation by the GSC.

The jumper block is located in the relay module. The jumper block connects a “divide-by-five circuit” to the ACV input of the GSC. The “divide-by-five circuit” reduces the ACV input to a controllable level for the GSC when P20 is 700. When setpoint P20 is 700, a multiplier of five is needed to compensate for the presence of the “divide-by-five circuit”. This is done even though no external potential transformer is present.

Note: In order to prevent an inaccurate calculation of the voltage by the GSC, the jumper block should NOT be installed when P20 is programmed to a value that is different from 700. The other values (150 through 30 000) are used with an external potential transformer. The values result in input voltages from 0 to 150 ACV at the AC Transformer Box (ATB). No further reduction of the input voltage is required.

Do the following procedure to determine the cause of inaccurate AC voltage and/or current values on the GSC.

1. Check setpoints P20 (full scale voltage) and P21 (full scale current). In order for the GSC to operate correctly, the current transformers (CT) must have 5 amp secondaries. See Testing And Adjusting, “Engine/Generator Setpoint Viewing OP2” and Testing And Adjusting, “Engine/Generator Programming OP5”. Typical factory setpoints are as follows: 700 V for P20 and 600 A for P21. The setpoints should be correct for the generator set application.

2. Refer to table 17 and illustration 78 in order to help determine the proper setpoints and any necessary external potential transformers.

3. If only the voltage is inaccurate, check the jumper for the AC voltage range for correct installation. The jumper should be installed for systems with a full scale AC voltage input of 700 volts (P20 = 700). The jumper should NOT be installed for systems with 150 volt full scale AC inputs. Also, the jumper should NOT be installed for any unit with external potential transformers. For information regarding the installation of the jumper, see Testing And Adjusting, “AC Voltage Range - Adjust”.

4. Check Systems Operation, “Voltmeter/Ammeter Programming OP8”. OP8 is the option for programming the calibration value of the voltmeter and the ammeter. The calibration values, written on the ATB bar code sticker, must be programmed into the GSC to ensure accurate voltage and current values.

i00944933

# Electrical Connector - Inspect

**SMCS Code:** 1408-040-CY; 7553-040

Many of the troubleshooting procedures in this Testing And Adjusting section require the inspection of electrical connectors and crimp terminals. Perform the following steps in order to test an electrical connector or crimp terminal. These steps can be helpful when you are troubleshooting an intermittent problem. If a faulty connection is found, repair the connection. Then return to the original troubleshooting procedures. Check if the original fault is solved. Continue with the original troubleshooting procedure.

Note: Avoid unnecessary disconnecting and connecting of connector halves in order to troubleshoot system faults. This practice can cause the connector contacts within the connector to wear out prematurely.

1. **Check the hex screw for the connector.** Make sure that the 40-pin harness connector on the rear of the GSC is aligned and seated properly and that the hex screw is tight. Any unused locations in the 40-pin harness connector should be plugged to keep out dirt, water and other contaminates.

2. **Pull test each wire.** Each connector contact and wire in the various harness connectors should easily withstand 10 pounds of pull and the wires should remain in the connector body. This test checks whether the wire in each connector contact was crimped properly. This test also checks that the connector contact was inserted into the connector body completely. Repair the connectors or repair the crimped wires as the repair is needed. When you are replacing connector contacts, use only the 1U-5804 Crimp Tool. Make sure that the connector contact and the tool are matched to the american wire gauge. Connector contacts should always be crimped onto the wire. Connector contacts should never be soldered.

   Also do the pull test for the pre-insulated crimp terminals on the terminal strips. Repair the terminals, as needed. When you are replacing crimp terminals, use the proper crimping tool and use the techniques for the type and brand of crimp terminal. Use an adequately sized terminal for the american wire gauge. If desired, crimp-on spade terminals and ring terminals may be soldered to the wire for an improved electrical connection.

3. **Visually inspect the wiring.** Look for worn out wires. Check for pinched harnesses or damaged harnesses.

4. **Visually inspect connectors and crimp terminals.** Verify that connector contacts within the connectors are not corroded or damaged. Verify proper alignment of connectors and location of connector contacts within the connector. Verify that the two halves of the connector are seated and locked together.

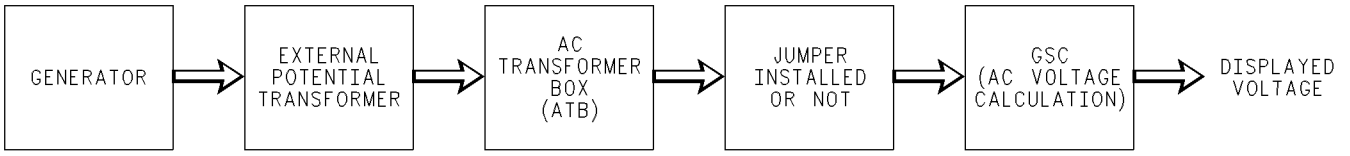
   Check all crimp terminals for corrosion and damage. When you are wiggling each wire on a crimp terminal, the ends of the bare wires on the open end of the terminal barrel should be tight and not move. Also, check tightness of the screws on the terminal strip. Repair the wires, as needed.

5. **Check individual connector contacts.** This is especially important for intermittent problems. Using a new connector contact, insert it into each of the mating connector contacts. Check for a snug fit between the mating connector contacts. Repeat this procedure for the other half of the connector. Use a new connector contact of the correct type.

i00945067

# AC Voltage Range - Adjust

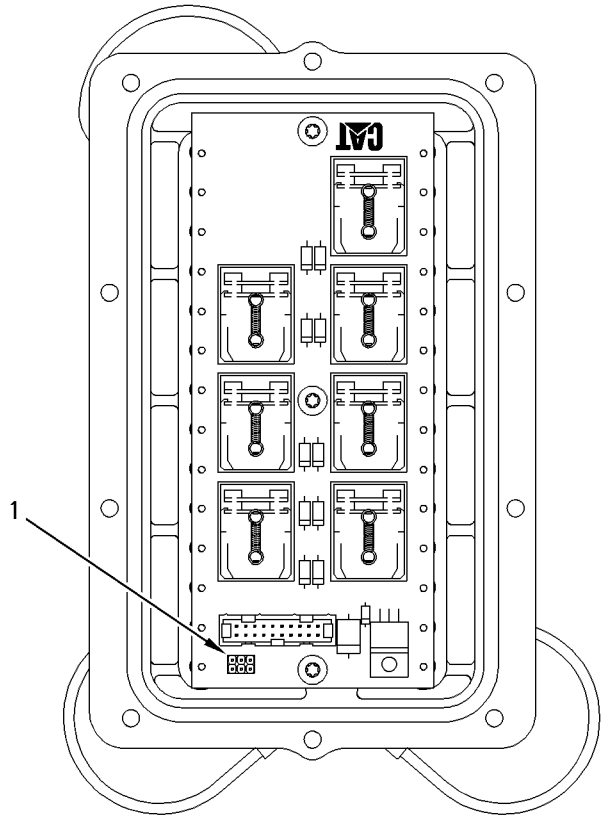
**SMCS Code:** 4490-025




g00481725

Illustration 79

Functional Block Diagram Of AC Voltage Display in EMCP II




g00311253

Illustration 80

Relays In Relay Module

(1) Jumper block.

Table 18

| AC Voltage Range Selection | | | | |
|---|---|---|---|---|
| **GSC P20 Setpoint** | **External Potential Transformer** | **AC Transformer Box (ATB) Input Voltage Range** | **GSC Internal Multiplier** | **Jumper** |
| 700 | None | 0 - 700 | 5 | Required |
| 150 | None | 0 - 150 | 1 | None |
| 300 | 2:1 | 0 - 150 | 2 | None |
| 500 | 3.33:1 | 0 - 150 | 3.33 | None |
| 600 | 4:1 | 0 - 150 | 4 | None |
| 750 | 5:1 | 0 - 150 | 5 | None |
| 3000 | 20:1 | 0 - 150 | 20 | None |
| 4500 | 30:1 | 0 - 150 | 30 | None |
| 5250 | 35:1 | 0 - 150 | 35 | None |
| 9000 | 60:1 | 0 - 150 | 60 | None |
| 15000 | 100:1 | 0 - 150 | 100 | None |
| 18000 | 120:1 | 0 - 150 | 120 | None |
| 30000 | 200:1 | 0 - 150 | 200 | None |

Jumper block (1) is used to select the voltage range of the voltmeter of the GSC. Jumper block (1) is installed for systems with 700 volts full scale AC inputs. Jumper block (1) is NOT installed for systems with 150 volts full scale AC inputs. Also, the jumper block (1) is NOT installed on any unit with external potential transformers. The relay module comes factory equipped with jumper block (1) that is installed.

Jumper block (1) is easily removed by grasping and pulling. It is easily installed by aligning and then pushing the jumper block in. If a jumper block is required but is not available, three separate jumpers can be substituted. Each of the three manufactured jumpers connect a pair of pins. A pair of pins must not touch another pair of pins.

The relay module must be removed from the GSC in order to gain access to the circuit board and jumper block (1). See Testing And Adjusting, “Relay Module - Replace”.

The P20 setpoint determines the proper AC voltage range and the internal multiplier that are used by the GSC for calculating AC voltage. The GSC uses the internal multiplier to compensate for the turns ratio of the external potential transformers (if present). The turns ratio of the external potential transformer must match the internal multiplier in order to ensure an accurate AC voltage calculation by the GSC.

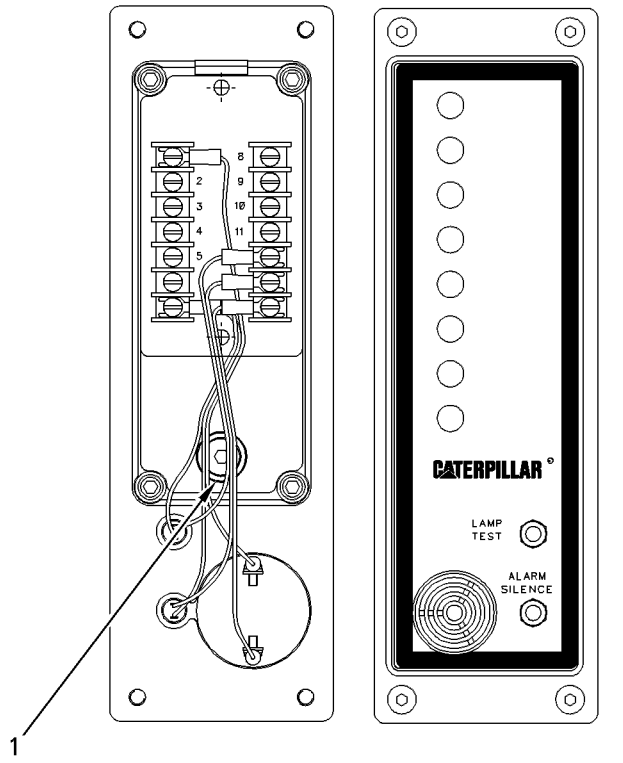
The jumper block is located in the relay module. The jumper block connects a “divide-by-five circuit” to the AC voltage input of the GSC. The “divide-by-five circuit” reduces the AC voltage input to a controllable level for the GSC when P20 is 700. When setpoint P20 is 700, a multiplier of five is needed to compensate for the presence of the “divide-by-five circuit”. This is done even though no external potential transformer is present.

Note: In order to prevent an inaccurate voltage calculation by the GSC, the jumper block should NOT be installed when P20 is programmed to a value that is different from 700. The other values (150 through 30 000) are used with an external potential transformer. The values result in input voltages from 0 to 150 ACV at the AC Transformer Box (ATB). No further reduction of the input voltage is required.

i00945261

# Alarm Module Control - Adjust

**SMCS Code:** 4490-025




g00482185

Illustration 81

Alarm Module

(1) Plug.

For all alarm applications, the low DC volts alarm setpoint is adjusted by a potentiometer that is located under access plug (1) on the rear of the module. The adjustment range is from 8 to 38 volts. The alarm setpoint is factory set at 24 DCV.

## Adjustment Procedure

1. Gain access to the rear of the ALM. It is not necessary to remove the ALM unless necessary for access. All wiring remains connected to the terminals of the ALM unless otherwise noted.

2. Remove plug (1) in order to gain access to the adjustment potentiometer. Moisture may enter the ALM when plug (1) is removed. Remove plug (1) in a dry environment. Remove the plug in an air conditioned area if the relative humidity exceeds 60%.

3. Disconnect the wires on terminals 1 and 7. Secure these wires so that the wires do not contact each other, ground or other electrical connections.

4. Connect a variable DC power supply to the alarm module (positive to terminal 1, negative to terminal 7). Set the power supply voltage to the desired low DCV alarm setpoint (between 8 and 38 volts).

5. Turn the adjustment potentiometer fully clockwise.

6. After one minute, the indicator on the ALM for low battery voltage FLASHES. Press the alarm silence switch. The low battery voltage indicator should change from FLASHING to ON CONTINUOUSLY.

7. Slowly turn the adjustment potentiometer counterclockwise until the low battery voltage indicator turns OFF.

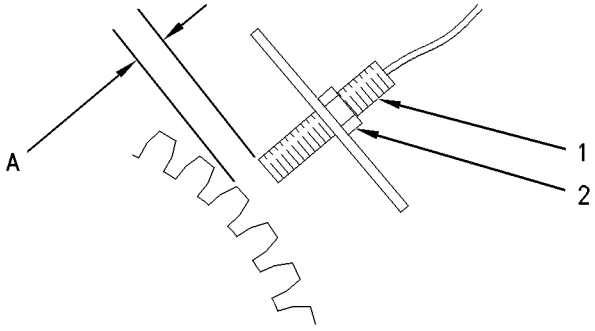
8. Replace the plug.

9. Disconnect the variable DC power supply and reconnect the wires to terminals 1 and 7.

i00945358

# Speed Sensor (Engine) - Adjust

**SMCS Code:** 1907-025; 4490-025




g00289497

Illustration 82

Speed Sensor

(1) Speed sensor
(2) Locknut
(A) Air gap

This adjustment procedure is for the engine speed sensor.

1. Remove the speed sensor (1) from the flywheel housing. Remove all debris from the tip of the speed sensor. Align a ring gear tooth directly in the center of the threaded sensor opening.

2. By hand, screw the speed sensor (1) into the hole until the end of the sensor contacts the gear tooth.

3. Turn the sensor (1) in the counterclockwise direction through 270 degrees (three-fourths turn).

4. Tighten locknut (2) to 25 ± 5 N·m (18 ± 4 lb ft).

Note: Do not allow speed sensor (1) to turn as locknut (2) is tightened.

i01160528

# Charging System - Test

**SMCS Code:** 1406-081; 4490-081

Often when problems with the charging system are being investigated, the alternator is not the problem. If a low battery condition is present test the batteries first. See Special Instruction, SEHS7633, “Battery Test Procedure” for more information. If the engine cranks slowly, then test the starting system. See Service Magazine, SEPD0020, “Testing The Starter On The Engine” for more information. If a warning indicator for the charging system is ON, see Service Magazine, SEBD1751, “Difference Between Alternator Indicator In Electronic Monitoring System (EMS) And Low Voltage Indicator In Operating Monitoring System (OMS)”. When a problem with the charging system is suspected, then complete the testing that is outlined in this Special Instruction. See “Initial Troubleshooting Procedure” in order to begin troubleshooting. The procedures in this Special Instruction are designed to guide you to the problem with as little testing as possible. In most cases, you will only use a few of the tests to diagnose a problem. The tests are labelled as T1 - T8 for easy reference. A descriptive title for each test is included as well.

## Initial Troubleshooting Procedure

1. **CHECK THE RESISTANCE IN THE EXCITATION CIRCUIT.** This step is only for alternators with external excitation when the terminal for excitation is labelled: “1”, “REG”, and “D+”. See “Alternator Specifications” if the method of excitation is unknown. Go to 3 if your alternator is self-excited. Go to 2 for alternators that have an “IG” excitation terminal.

   **a.** If the generator set is equipped with a disconnect switch then turn the disconnect switch to the ON position.

   **b.** Verify voltage at the excitation terminal. Connect the red lead from a multimeter to the excitation terminal. Connect the black lead to a ground source (alternator case ground).

   **c.** Read the voltage that is shown on the multimeter.

   **Expected Result**: The voltage reads at least .2 volts.

   **Results**:

   - YES - The voltage reads .2 volts or more. The excitation circuit is correct. Proceed to 3.

   - NO - The voltage is less than .2 volts. There is a fault in the wiring harness to the alternator or there is a poor electrical connection. Correct the problem. Watch for a recurrence of the problem.

2. **CHECK THE RESISTANCE IN THE EXCITATION CIRCUIT.** This step is only for alternators with external excitation when the terminal for excitation is labelled: “IG”. See “Alternator Specifications” if the method of excitation is unknown. Go to 3 if your alternator is self-excited.

   **a.** Turn the disconnect switch to the ON position.

   **b.** Verify voltage at the excitation terminal. Connect the red lead from a multimeter to the excitation terminal. Connect the black lead to a ground source . This is often the case of the alternator.

   **c.** Read the voltage that is shown on the multimeter.

   **Expected Result**: The voltage is within .5 volts of battery voltage.

   **Results**:

   - YES - The voltage reads battery voltage. The excitation circuit is correct. Proceed to 3.

   - NO - The voltage is more than .5 volts less than battery voltage. There is a fault in the wiring harness to the alternator or there is a poor electrical connection. Correct the problem. Watch for a recurrence of the problem.

3. **CHECK THE SYSTEM VOLTAGE.**

   **a.** Before you start the generator set, connect a voltmeter between the “B+” terminal and the case of the alternator. Disconnect all loads from the battery. Disconnect the battery voltage to the EMCP II.

**b.** Turn the disconnect switch to the ON position but do not start the engine.

**Expected Result**: This voltage should be system voltage.

**Results**:

- YES - The voltage is system voltage. Go to 4
- NO - The voltage is less than system voltage. Verify that the batteries are good and verify that battery connections are good. Go to “T4 Alternator Drive System - Check” if the batteries are good.

**4. CHECK OF THE INITIAL OPERATION OF THE ALTERNATOR.**

**a.** The voltmeter remains connected in the configuration from 3.

**b.** Start the engine. Set the throttle to at least 75%. Read the voltage on the voltmeter.

**Expected Result**: The voltage is higher than the voltage recorded in the previous Step 3.

**Results**:

- YES - The voltage is higher than the voltage observed in the previous Step 3. The voltage is also lower than the maximum voltage that is listed in the specifications for the alternator. The alternator is partially charging. See the following diagnostic flow chart for reference in continued testing. Proceed to “T1 Alternator Output - Test”.
- YES - The voltage is higher than the voltage observed in the previous Step 3. The voltage is also higher than the maximum voltage that is listed in the specifications for the alternator. The alternator is over charging. Proceed to “T8 Alternator Overcharging - Test”.
- NO - The voltage is not higher than the voltage observed in 3. Proceed to “T4 Alternator Drive System - Check”.

Note: Severely discharged batteries can cause low system voltage. This can occur even while the engine is running above idle, and the alternator is working properly. Proper low engine idle is also important. Most of the alternators in Caterpillar applications are self-excited. These alternators must exceed a turn-on speed before the charging will begin. Alternator output can be very low at idle.

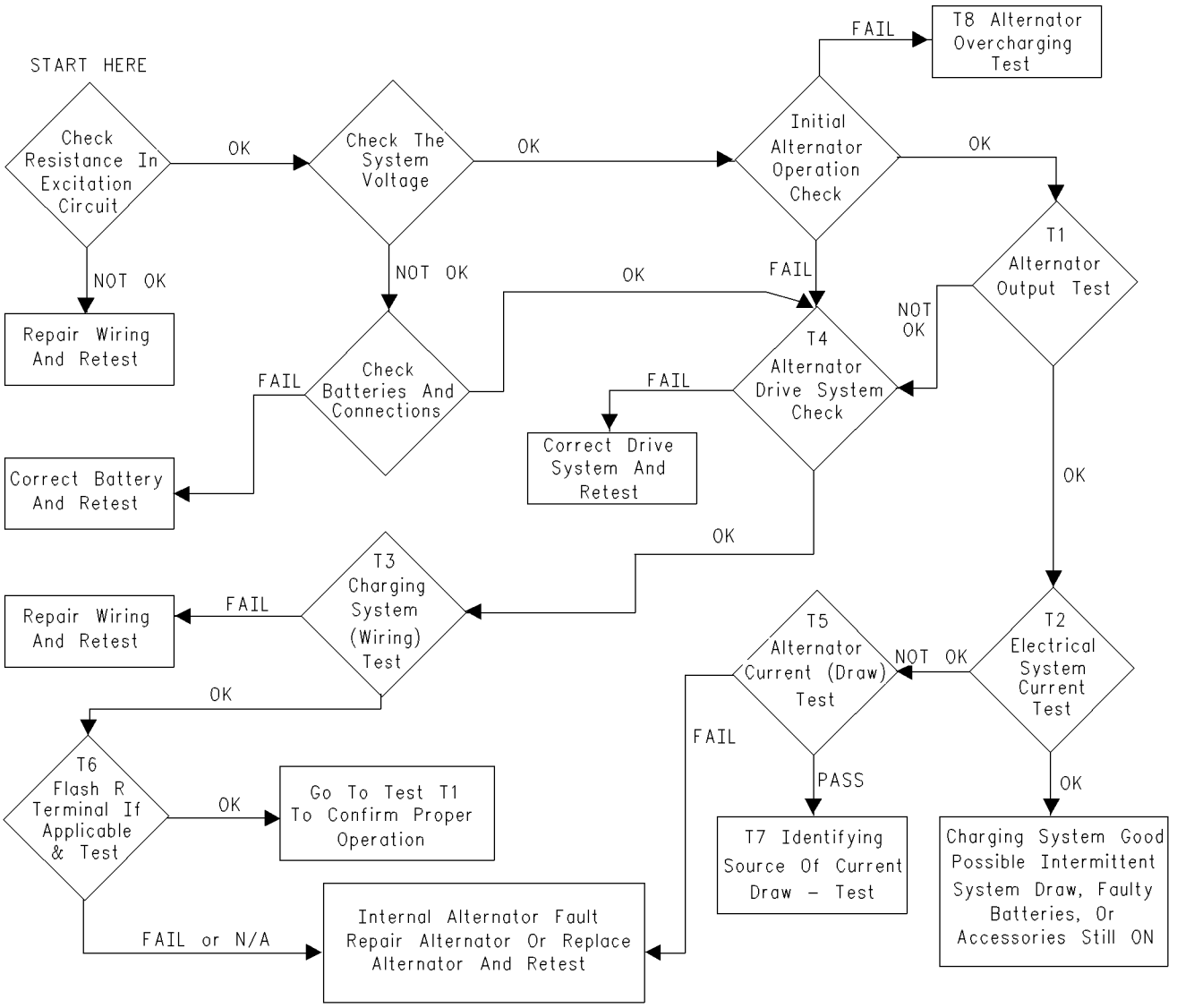



Illustration 83 g00508188

## T1 Alternator Output - Test

**1.** Ensure that the batteries are NOT fully charged.

**a.** Fully charged batteries have open circuit voltage of 25 volts on 24 volt systems.

**b.** If the batteries are fully charged then crank the engine for 30 seconds. This action reduces the battery voltage. Operate the lights for 10 minutes while the engine is off as an alternative.

**2.** Connect the 9U-5795 Current Probe or 8T-0900 Ammeter to a DMM (digital multimeter). The multimeter must have a peak hold feature. Clamp the probe around alternator output wire (“B+”). Before you clamp the probe around the wire, ensure that the probe is “zeroed” .

**3.** Set the digital multimeter to “peak hold” or “max mode” on the “mV” scale.

**4.** Start the engine, and immediately set the throttle to at least 75%. The peak current will appear on the voltmeter in “peak hold” or “max” mode.

**Expected Result**: This current reading should be at least 90% of the specified peak output.

**Results**:

- OK - The current is at least 90% of the specified peak output. See “Alternator Specifications” for exact numbers. Go to “T2a Undesired Electrical System Current - Test (For Generator Set Equipped With A Main Disconnect Switch)” or “T2b Undesired Electrical System Current - Test (For Any Generator Set)”.

- NOT OK - The current is less than 90% of the specified peak output. Go to “T4 Alternator Drive System - Check”.

## T2a - Undesired Electrical System Current - Test (For Generator Set Equipped With A Main Disconnect Switch)

1. Turn off all of the accessories. Disconnect the voltage supply to the EMCP II.

2. Clamp a 9U-5795 Current Probe or 8T-0900 Ammeter around the main ground cable. Clamp the tool with the positive side away from the battery. Reset the probe (zero) before you clamp the probe around the wire. Read the current.

   **Expected Result**: The current is below 2 amperes.

   **Results**:

   - YES - The current is below 2 amperes. Continue to 3.

   - NO - The current is above 2 amperes. There is a current draw in the system. Go to “T5 Alternator Current - Test”.

3. Turn the disconnect switch to the ON position. Connect an ammeter across the disconnect switch terminals. Connect the red lead to the terminal on the frame side. Connect the black lead to the terminal on the battery side. If a multimeter is being utilized for this test, use the 10A connections in order to avoid damage.

4. Turn off the disconnect switch and read the current.

   **Expected Result**: The current is below .050 amperes (50 milliamperes).

Note: The standard acceptable current draw is 50 milliamperes. A current draw above 50 milliamperes usually indicates a problem. Contact a Caterpillar dealer for more information.

**Results**:

- YES - The current is below 0.050 amperes. The charging system is currently good. The fault is possibly an intermittent draw in the system. The batteries may be faulty. Check that NO accessories were ON during the test.

- NO - The current is above 0.050 amperes. There is a draw in the system. Go to “T5 Alternator Current - Test”.

## T2b - Undesired Electrical System Current - Test (For Any Generator Set)

1. Turn off all accessories. Disconnect the voltage supply to the EMCP II.

2. Clamp a 9U-5795 Current Probe or 8T-0900 Ammeter around the main ground cable. Clamp the tool with the positive side away from the battery. Reset the probe (zero) before you clamp around the wire. Read the current.

   **Expected Result**: The current is below 2 amperes.

   **Results**:

   - YES - The current is below 2 amperes. Continue to 3.

   - NO - The current is above 2 amperes. There is a current draw in the system. Go to “T5 Alternator Current - Test”.

3. Remove the ground cable from the battery terminal. For systems with 4 batteries, disconnect the ground cables from both negative batteries.

4. Connect an ammeter between the disconnected battery ground cable and one of the negative battery terminals. Connect the red positive lead of the ammeter to the cable. The negative lead should be connected to the battery terminal. If a multimeter is being utilized for this test, use the 10 ampere connections in order to avoid damage.

   **Expected Result**: The current is below .050 amperes (50 milliamperes).

Note: The standard acceptable current draw is 50 milliamperes. A current draw above 50 milliamperes usually indicates a problem.

**Results**:

- YES - The current is below 0.050 amperes. The charging system is currently good. The fault is possibly an intermittent draw in the system. The batteries may be faulty. Check that NO accessories were ON during the test.

- NO - The current is above 0.050 amperes. There is a draw in the system. Go to “T5 Alternator Current - Test”.

Note: The following alternators have a connector for a regulator: 6T-1196 and 9G-6081. Disconnect the regulator connector from the alternator. Recheck the current that was found in the previous Step. If the current is below 0.050 amperes (50 milliamperes) the regulator is faulty.

## T3 Charging System - Test

1. Verify that the alternator B+ terminal nut is tight and verify that the wire has a good connection to the B+ terminal.

2. Start the engine and set the throttle to at least 75 percent. Allow the engine to run for at least 3 minutes before you continue to 3. The following table will assist in making calculations during this test.

Table 19

| Test Step | Voltage Reading | The Voltage should be less than this column for a 24 volt system. |
|---|---|---|
| 3 | | |
| 4 | | |
| 3 minus 4 = | | 2.0 volts |
| 5 | | |
| 6 | | |
| 5 minus 6 = | | 1.0 volt |
| 7 | | 1.0 volt |

3. Measure the voltage between the alternator B+ terminal and the alternator case ground.

4. Measure the voltage across the battery. Put the red lead on the + battery terminal, and put the black lead on the negative battery terminal. 4 should be completed as quickly as possible after 3.

   **Expected Result**: On 24 volt systems, the voltage is within 2 volts.

   **Results**:

   - YES - If the voltage in 3 is not more than 2 volts for 24 volt systems higher than the voltage in 4, this test is complete and the related wiring is correct at this time. Replace the alternator or disassemble the alternator and repair.

   - NO - If the voltage in 3 is more than 2 volts for 24 volt systems higher than the voltage in 4, there is high circuit resistance: corrosion, loose connections, and damaged wiring. Continue to 5.

5. Check the voltage between the frame and the alternator B+ terminal. Record the voltage.

6. Check the voltage between the frame and the + battery post. Step 6 should be completed as quickly as possible after 5.

   **Expected Result**: The voltage difference between 5 and 6 does not exceed 1 volt on 24 volt systems.

   **Results**:

   - YES - The voltage difference does not exceed the tolerance. The charging circuit is good. Go to 7.

   - NO - The voltage difference exceeds the tolerance. There is high resistance in the charging circuit: loose cables, corroded cables, damaged cables, and faulty circuit breaker. Correct the problem and retest the system.

7. Check the voltage between the negative battery post and the alternator case ground.

   **Expected Result**: The voltage does not exceed 1 volt on 24 volt systems.

   **Results**:

   - YES - The voltage difference does not exceed the tolerance. The ground circuit is good. There is an internal problem with the alternator. Go to “T6 Residual Magnetism Restoration”.

   - NO - The voltage difference exceeds the tolerance. There is high resistance in the ground circuit: loose cables, corroded cables, loose alternator mounting, and poor engine ground. Correct the problem and retest the system.

## T4 Alternator Drive System - Check

1. Check the condition of the alternator drive belt. If the drive belt is oily, clean the pulleys. Replace the drive belt, and retest the system. If the drive belt is wet, dry the belt and retest the system. If the drive belt is worn, replace the belt and retest the system.

2. Check the tension of the alternator drive belt. If the tension is off, adjust the tension.

3. Check the nut on the alternator pulley. If the nut is loose, tighten the nut and retest the system.

4. If all of the previous steps find no problems go to “T3 Charging System - Test”.

## T5 Alternator Current - Test

1. Disconnect all the loads from the battery. Disconnect the voltage supply to the EMCP II.

2. Connect the 9U-5795 Current Probe or 8T-0900 Ammeter to a DMM (digital multimeter). Clamp the probe around the alternator output wire (“B+”). Before you clamp the probe around the wire, ensure that the probe is “zeroed”.

3. Read the current.

   **Expected Result**: The current is under 2 amperes.

   **Results**:

   - YES - The current is under 2 amperes. Continue to 4.

   - NO - The current is over 2 amperes. There is an internal problem with the alternator. Proceed to “T6 Residual Magnetism Restoration”.

4. Disconnect the B+ terminal wire from the alternator. Connect the red lead of the multimeter to the wire that was just disconnected. Connect the black lead of the multimeter to the B+ terminal of the alternator. Set the multimeter on the 10 amp scale. Read the current.

   **Expected Result**: The current is under 0.015 amperes.

   **Results**:

   - YES - The current is under 0.015 amperes. The alternator is operating correctly. There is a current draw on the generator set. Go to “T7 Identifying Source Of Current Draw - Test”.

   - NO - The current is over 0.015 amperes. There is an internal problem with the alternator. Go to “T6 Residual Magnetism Restoration”.

## T6 Residual Magnetism Restoration

This test is only for self-excited alternators. See Service Magazine, SEBD1672, July 1986, “Brushless Alternators May Not Charge In Certain Conditions” for additional information.

1. Start the engine and set the throttle to at least 75%.

2. Connect a voltmeter between the “B+” terminal and the alternator case ground.

3. If a wire is connected, disconnect the wire from the “R” terminal.

   **Expected Result**: The voltage stays the same.

   **Results**:

   - YES - The voltage stays the same. Continue to 4.

   - NO - The voltage rises and the alternator begins charging. The wire to the “R” terminal is shorted. Repair the wiring or replace the wiring. Go to “Initial Troubleshooting Procedure” and retest the system.

4. Connect one end of a jumper wire to the “B+” terminal of the alternator.

5. Connect the other end of the jumper wire to the “R” terminal (“D+” terminal for Bosch alternators) of the alternator for two seconds.

   **Expected Result**: The voltage output rises on the “B+” terminal.

   **Results**:

   - OK - The voltage output rises. The alternator is now charging. Go to “Initial Troubleshooting Procedure” and retest the system.

   - NOT OK - The voltage output does not rise. There is an internal malfunction in the alternator. See the appropriate service manual or the alternator in order to test the internal components and connections.

6. Remove the wire that is connected to the “I” terminal. Check for a rise in voltage on the “B+” terminal.

   **Expected Result**: The voltage rises.

   **Results**:

   - YES - The voltage rises. There is a short in the wiring to the terminal. Repair the wiring or replace the wiring. Go to “Initial Troubleshooting Procedure” and retest the system.

   - NO - The voltage output does not rise. There is an internal malfunction in the alternator. See the appropriate service manual or the alternator in order to test the internal components and connections.

## T7 Identifying Source Of Current Draw - Test

1. Disconnect all the loads from the battery. Disconnect the system voltage from the EMCP II.

2. Clamp a 9U-5795 Current Probe or 8T-0900 Ammeter around the main ground cable. Clamp the tool with the positive side away from the battery. Reset the probe (zero) before you clamp the probe around the wire. Use the current probe if the draw is above approximately 2 amperes. Use the Ammeter if the draw is below approximately 2 amperes.

3. Monitor the current and remove the following fuses one at a time: “F1”, “F4”, “F7”, and “F8”. Check the current after each fuse is removed. After you remove a fuse, observe the current and reinstall the fuse. Start with the main fuses first, and proceed to smaller circuits.

4. If a removal of a fuse causes the current to drop, then the problem is in that circuit.

   **a.** Check if any components on the circuit are ON.

   **b.** If everything is OFF, disconnect electrical components on that circuit one at a time and monitor current.

   **c.** After all of the components in that circuit have been disconnected, check the current. If the problem still exists then check the wiring for corrosion or shorts to ground.

Note: The standard acceptable current draw is 50 milliamperes. A current draw above 50 milliamperes usually indicates a problem.

## T8a - Alternator Overcharging - Test

This test is for alternators that have an “IG” terminal , an “S” terminal, or another sense terminal.

1. Clean the connection and tighten the connection to the wiring terminal on the alternator.

2. Verify that the alternator B+ terminal nut is tight and verify that the wire has a good connection to the “B+” terminal.

3. Start the engine and set the throttle to at least 75 percent. Turn ON all electrical accessories for all test steps below. Allow the engine to run for at least 3 minutes before you continue to 4. The following table will assist in making calculations during this test.

Table 20

| Test Step | Voltage Reading | Voltage should be less than this column for a 24 volt system. |
|---|---|---|
| 4 | | |
| 5 | | |
| 4 minus 5 = | | 2.0 volts |
| 6 | | |
| 7 | | |
| 6 minus 7 = | | 1.0 volt |

4. Measure the voltage between the alternator's “B+” terminal and the case for the alternator.

5. Measure the voltage across the battery. Put the red lead on the + battery terminal, and put the black lead on the negative battery terminal. Step 5 should be completed as quickly as possible after 4.

   **Expected Result**: On 24 volt systems, the voltage is within 2 volts.

   **Results**:

   - YES - If the voltage in 4 is not more than 2 volts for 24 volt systems higher than the voltage in 5, this step is complete and the related wiring is correct at this time. Go to 8.

   - NO - If the voltage in 4 is more than 2 volts for 24 volt systems higher than the voltage in 5, there is high circuit resistance: corrosion, loose connections, and damaged wiring. Go to 6.

6. Check the voltage between the frame and the alternator B+ terminal. Record the voltage.

7. Check the voltage between the frame and the + battery post. Step 7 should be completed as quickly as possible after 6.

   **Expected Result**: The voltage difference between 6 and 7 does not exceed 1 volt on 24 volt systems.

   **Results**:

   - YES - The voltage difference does not exceed the tolerance. The charging circuit is good. Go to 8.

- NO - The voltage difference exceeds the tolerance. There is high resistance in the charging circuit: loose cables, corroded cables, damaged cables, faulty circuit breaker, and faulty main relay. Correct the problem. Go to “Initial Troubleshooting Procedure” and retest the system.

**8.** Start the engine and set the throttle to at least 75 percent.

**9.** Measure the voltage between the sense terminal and the case of the alternator.

**Expected Result**: The voltage at the sense terminal is above the specification.

**Results**:

- YES - The voltage is over specification. There is an internal malfunction in the alternator. See the appropriate service manual for the alternator in order to test the internal components and connections.

- NO - The voltage is below that found in the initial tests (B+ to alternator case). The sense circuit in the generator set has high resistance. Correct the problem and retest the system . Go to “Initial Troubleshooting Procedure” at the beginning of this test.

## T8b - Alternator Overcharging - Test (Continued)

This test is for alternators that do not have an “IG” terminal, “S” terminal, or other sense terminal.

**1.** Clean the connection and tighten the connection to the wiring terminal on the alternator.

**2.** Verify that the alternator's “B+” terminal nut is tight. Verify that the wire has a good connection to the “B+” terminal.

**3.** Run the engine at 75 percent. Allow the engine to run for at least 3 minutes before you continue to 4. The following table shows the measurements taken during this test will be used.

Table 21

| Test Step | Voltage Reading | Voltage should be below this for 24 volt system |
|---|---|---|
| 4 | | |
| 5 | | |
| 4 minus 5 = | | 2.0 volts |
| 6 | | |
| 7 | | |
| 6 minus 7= | | 1.0 volt |

**4.** Measure the voltage between the alternator B+ terminal and the alternator case ground.

**5.** Measure the voltage across the battery. Put the red lead on the positive battery terminal, and put the black lead on the negative battery terminal. Step 5 should be completed as quickly as possible after 4.

**Expected Result:** On 24 volt systems, the voltage is within 2 volts.

**Results:**

- YES - If the voltage in 4 is not more than 2 volts for 24 volt systems higher than the voltage in 5, this step is complete and the related wiring is correct at this time. There is an internal malfunction in the alternator. See the appropriate service manual for the alternator in order to test the internal components and connections.

- NO - If the voltage in 4 is more than 2 volts for 24 volt systems higher than the voltage in 5, there is high circuit resistance: corrosion, loose connections, and damaged wiring. Go to 6.

**6.** Check the voltage between the frame and the alternator B+ terminal. Record the voltage.

**7.** Check the voltage between the frame and the positive battery post. 7 should be completed as quickly as possible after 6.

**Expected Result:** The voltage difference between 6 and 7 does not exceed 1 volt on 24 volt systems.

**Results:**

- YES - The voltage difference does not exceed the tolerance. The charging circuit is good. There is an internal malfunction in the alternator. See the appropriate service manual for the alternator in order to test the internal components and connections.

- NO - The voltage difference exceeds the tolerance. There is high resistance in the charging circuit: loose cables, corroded cables, damaged cables, faulty circuit breaker, and faulty main relay. Correct the problem. Go to “Initial Troubleshooting Procedure” and retest the system.

## Alternator Specifications

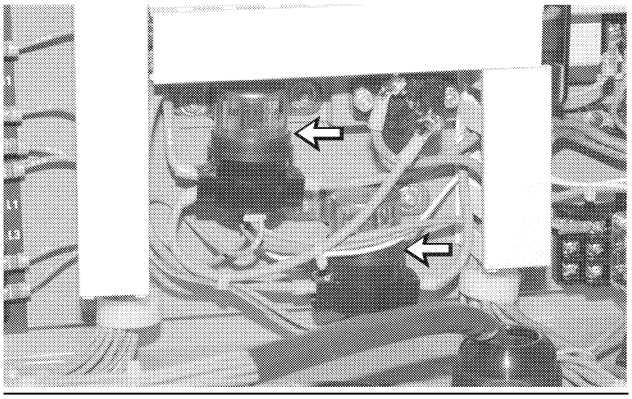
Table 22

| Alternator Specifications | | |
|---|---|---|
| | **Peak Current Rating (Amps)** | **Minimum Peak Current (Amps)** |
| **24 Volt Alternators** | | |
| 2P-1204, 3Y-8200 | 19 | 17 |
| 2Y-8310 | 21 | 19 |
| 6T-1395, 7T-2095, OR-3653 | 33 | 30 |
| 6N-9294, OR-5217, OR-3482 | 35 | 32 |
| 5N-5692, OR-2698 | 45 | 41 |
| 5S-9088, 100-5047, 112-5041, OR-5206, OR-3667, OR-3668 | 50 | 45 |
| 109-2362, 9W-3043 , OR-3652(D+), 112-8032 | 55 | 50 |
| 3E-7772(IG), OR-9437(IG), 105-3132(IG), 4N-3986, OR-5203 | 60 | 54 |
| 155-7434, 132-2156(I), 107-7977(I), OR-8279(I) | 70 | 63 |
| 107-7976, 114-2401, OR-8997, 3E-7577, OR-3615 | 75 | 68 |
| 9X-7803, OR-3749, 122-6657 | 100 | 90 |
| **Parts-Service Only Discontinued 24 Volt Alternators** | | |
| 9G-6081, 6T-1196 | 40 | 36 |
| **D+** - Diode trio output. Alternator requires external excitation. | | |
| **REG** - Regulator Terminal. Alternator requires external excitation. | | |
| **I** - Ignition Terminal. Alternator can be externally excited through this terminal. | | |
| **IG** - Ignition Terminal. System voltage must be supplied to this terminal to turn on the alternator. Some of these alternators use the IG terminal as a sense terminal. | | |

i00945718

# Starting Motor Magnetic Switch - Test

**SMCS Code:** 1426-081; 4490-081



g00482547

Illustration 84

Magnetic Switches On Subpanel

(Two Switches That Are Shown Are For The System With Two Starting Motors.)

The starting motor magnetic switch (SMMS) for the 24 DCV systems is mounted on the subpanel within the control panel. Two switches are used in a system with two starting motors. One switch is used for each starting motor.

### Test Procedure

1. Disconnect the jumper wire between terminals TS1-4 and TS1-5 in the generator housing. Measure the resistance between terminals TS1-5 and TS1-2.

   - The resistance should measure 26 to 33 ohms for the systems with one starting motor.
   - The resistance should measure 13 to 17 ohms for the systems with two starting motors.

   If resistance is NOT correct, replace the defective magnetic switch. If the resistance is correct, proceed to step 2.

2. Disconnect the cable that is going from the pinion solenoid to the starting motor. Do this procedure on both starting motors of a system with two starting motors.

3. Connect a DC voltmeter. Connect the positive cable to terminal TS1-24 and the negative cable to terminal TS1-25 in the generator housing. (If the second magnetic switch is tested in a system with two starting motors, then connect the negative cable to terminal TS1-26.)

Note: The jumper wire of step 4 can remain connected for only ten seconds.

4. Connect a jumper wire from terminal TS1-1 to terminal TS1-5 in the generator housing. Disconnect this wire immediately after the voltage is measured. Do not leave the wire on more than 10 seconds. The correct measurement changes from approximately 24 DCV to approximately 2 DCV.

   If voltage is greater than 2.0 DCV, then replace the magnetic switch. If the switch passes the requirements of step 1 and 4, the switch is functioning correctly. Reconnect the wires and cables that were removed in this procedure.

i01134686

# Pulse Width Modulated (PWM) Sensor - Test

**SMCS Code:** 1408-081; 4490-081

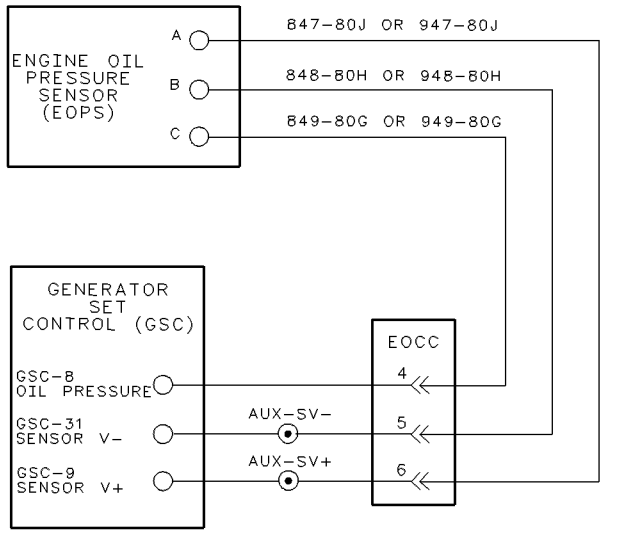



Illustration 85 g00595836

Schematic For Pressure Sensor (Engine Oil)

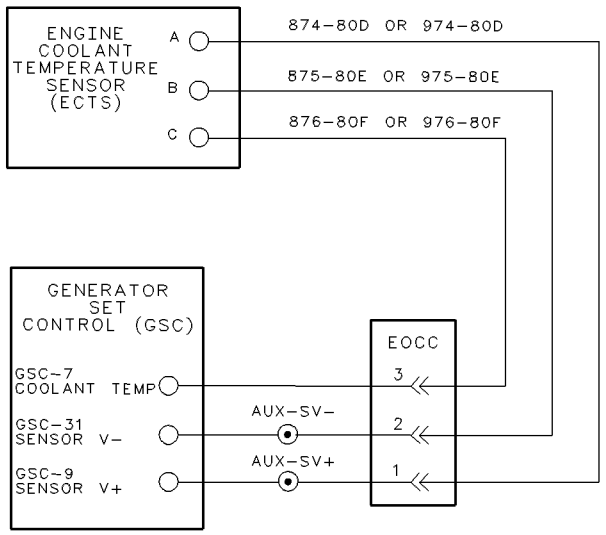



Illustration 86 g00596060

Schematic For Temperature Sensor (Engine Coolant)

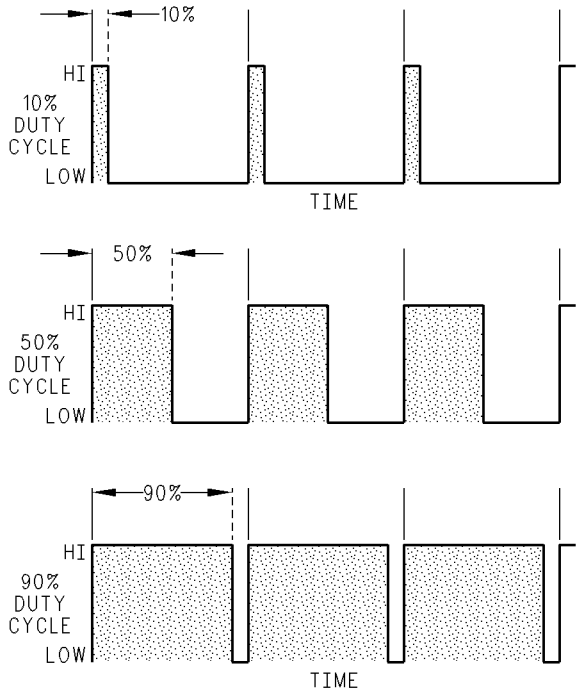



Illustration 87 g00288430

Pulse Width Modulated Signal

This test is provided in addition to the CID 100 and CID 110 troubleshooting procedures. See Testing And Adjusting, “Troubleshooting Diagnostic Codes”. The pulse width modulated sensors are listed below.

- oil pressure sensor
- coolant temperature sensor

These PWM sensors produce a digital signal. In a digital signal, the duty cycle varies as the condition changes. The frequency remains constant.

Table 23

| Sensor Specifications | | |
|---|---|---|
| **Engine Oil Pressure Sensor (EOPS)(1)** | | |
| **Pressure kPa (psi)** | **Signal Voltage(2) DCV** | **Signal Duty Cycle(2) %** |
| 0 to 69 (0 to 10) | 0.92 to 1.44 | 12.8 to 20.8 |
| 69 to 138 (10 to 20) | 1.44 to 1.92 | 20.8 to 28.1 |
| 138 to 207 (20 to 30) | 1.92 to 2.40 | 28.1 to 35.4 |
| 207 to 276 (30 to 40) | 2.40 to 2.89 | 35.4 to 42.6 |
| 276 to 345 (40 to 50) | 2.89 to 3.34 | 42.6 to 49.6 |
| 345 to 414 (50 to 60) | 3.34 to 3.89 | 49.6 to 56.6 |
| 414 to 483 (60 to 70) | 3.89 to 4.29 | 56.6 to 64.0 |
| 483 to 552 (70 to 80) | 4.29 to 4.74 | 64.0 to 70.5 |
| 552 to 621 (80 to 90) | 4.74 to 5.25 | 70.5 to 78.1 |
| 621 to 690 (90 to 100) | 5.25 to 5.74 | 78.1 to 85.0 |

(1) The base frequency is 350 to 650 Hz.
(2) The voltages and currents are guidelines for troubleshooting and are not considered exact. Tolerance is ±10%.

Table 24

| Sensor Specifications | | |
|---|---|---|
| **Engine Coolant Temperature Sensor (ECTS)(1)** | | |
| **Temperature °C (°F)** | **Signal Voltage(2) DCV** | **Signal Duty Cycle(2) %** |
| –40 to –29 (–40 to –20) | 1.18 to 1.23 | 10.0 to 10.6 |
| –29 to –18 (–20 to 0) | 1.23 to 1.30 | 10.6 to 11.6 |
| –18 to –7 (0 to 20) | 1.30 to 142 | 11.6 to 13.3 |
| –7 to 4 (20 to 40) | 1.42 to 1.63 | 13.3 to 16.2 |
| 4 to 16 (40 to 60) | 1.63 to 1.97 | 16.2 to 21.1 |
| 16 to 27 (60 to 80) | 1.97 to 2.43 | 21.1 to 27.5 |
| 27 to 38 (80 to 100) | 2.43 to 3.00 | 27.5 to 35.6 |
| 38 to 49 (100 to 120) | 3.00 to 3.67 | 35.6 to 45.0 |
| 49 to 60 (120 to 140) | 3.67 to 4.35 | 45.0 to 54.7 |
| 60 to 71 (140 to 160) | 4.35 to 5.00 | 54.7 to 63.9 |
| 71 to 82 (160 to 180) | 5.00 to 5.58 | 63.9 to 72.0 |
| 82 to 93 (180 to 200) | 5.58 to 6.05 | 72.0 to 78.6 |
| 93 to 104 (200 to 220) | 6.05 to 6.42 | 78.6 to 83.8 |
| 104 to 116 (220 to 240) | 6.42 to 6.72 | 83.8 to 88.1 |
| 116 to 125 (240 to 257) | 6.72 to 6.90 | 88.1 to 90.6 |
| 125 to 135 (257 to 275) | 6.90 to 7.05 | 90.6 to 92.7 |

(1) The Base frequency is 370 to 550 Hz.
(2) The voltages and currents are guidelines for troubleshooting and are not considered exact. Tolerance is ±10%.

# Test Procedure

Table 25

| Tools Needed | | |
|---|---|---|
| 9U-7330 | Multimeter<br>Multimeter is optional for frequency and duty cycle measurements. | 1 |
| 7X-1710 | Multimeter Probe Group | 1 |

This procedure requires the measurement of the frequency and duty cycle of the sensor signal. Use the **9U-7330** Digital Multimeter in order to measure the frequency and the duty cycle. In order to measure frequency, turn the rotary switch to AC volts. Then, press the “HZ” button once. In order to measure the duty cycle, turn the rotary switch to AC volts and press the “HZ” button twice.

Note: The 6V-7070 Digital Multimeter does not measure the frequency or the duty cycle. However, the DC voltages are listed in the Sensor Specifications chart as an alternative to measuring the frequency and the duty cycle. The 6V-7070 Digital Multimeter can be used for measurements of the DC voltage.

1. **Perform Initial Preparations.**

   **a.** Locate the suspect sensor.

   **b.** Identify the sensor wires and connector contacts. See the preceding System Schematics.

   **c.** DO NOT DISCONNECT ANY HARNESS CONNECTORS AT THIS TIME.

   **d.** Use the 7X-1710 Multimeter Probe in order to make future measurements by probing through the back of the harness connectors.

2. **Check Sensor Supply Voltage.**

   **a.** Turn the engine control switch (ECS) to OFF/RESET. Then, turn the ECS to STOP.

   **b.** Measure the sensor supply voltage at the sensor connector. Perform the measurement from contact “A” to contact “B” on the sensor connector.

   **Expected Result**: The voltage should be from 7.5 to 8.5 DCV.

   **Results**:

   - OK - The voltage is from 7.5 to 8.5 DCV. Proceed to 4.
   - NOT OK - The voltage is equal to battery positive. The sensor supply is shorted to battery positive in the engine harness. Troubleshoot and repair the engine harness. STOP.
   - NOT OK - The voltage is not from 7.5 to 8.5 DCV and the voltage is not equal to battery positive. Proceed to 3.

3. **Check The Status Of The Fault.**

   Observe the GSC display.

   **Expected Result**: A CID 269 is active.

   **Results**:

   - OK - A CID 269 is active. Go to the procedure in Testing And Adjusting, “Troubleshooting Diagnostic Codes”. STOP.
   - NOT OK - A CID 269 is NOT active. The harness is faulty. Troubleshoot and repair the harness. STOP.

4. **Check The Sensor Signal.**

   The ECS remains in the STOP position.

   **a.** Measure the frequency and the duty cycle of the signal at the sensor connector. Conduct the measurements from contact “C” to contact “B” of the sensor connector.

   **b.** Make a note of the measurements.

   **Expected Result**: The measured frequency and duty cycle should agree with the values that are listed in the Sensor Specifications chart.

   **Results**:

   - OK - The measurements agree. The sensor is functioning correctly. Proceed to 5.
   - NOT OK - The measurements DO NOT agree. Proceed to 7.

5. **Check The Signal At The GSC Harness Connector.**

   **a.** Measure the frequency and the duty cycle of the signal at the GSC harness connector.

   - For the oil pressure signal, measure the resistance from contact 8 to contact 31.
   - For the coolant temperature signal, measure the resistance from contact 7 to contact 31.
   - For the oil temperature signal, measure the resistance from contact 14 to contact 31.

   **Expected Result**: The measured frequency and duty cycle should agree with the values that were measured in Step 4.

   **Results**:

   - OK: The measurements agree. The sensor is functioning correctly. Proceed to 7.
   - NOT OK - The measurements DO NOT agree. The harness is defective. Troubleshoot and repair the engine harness. STOP.

6. **Check The Status Of The Fault.**

   **a.** Check if sensor fault codes are still active.

   **Expected Result**: Sensor fault codes are still active.

**Results**:

- OK - The GSC is faulty. Replace the GSC. See Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”. STOP.
- NOT OK - If sensor fault codes are NOT active, check the connectors and wiring. See Testing And Adjusting, “Electrical Connector - Inspect”. STOP.

**7. Check The Engine Harness.**

**a.** Disconnect the engine harness from the sensor.

**b.** Disconnect the GSC+ from the harness.

**c.** Check the harness for an open circuit. A correct circuit will be approximately 5 ohms or less.

**d.** Check the signal wire for a short to battery positive, battery negative and sensor supply. A correct circuit will be greater than 5000 ohms.

**Expected Result**: For Step 7.c, the resistance should be 5 ohms or less. For Step 7.d, the resistance should be greater than 5000 ohms.

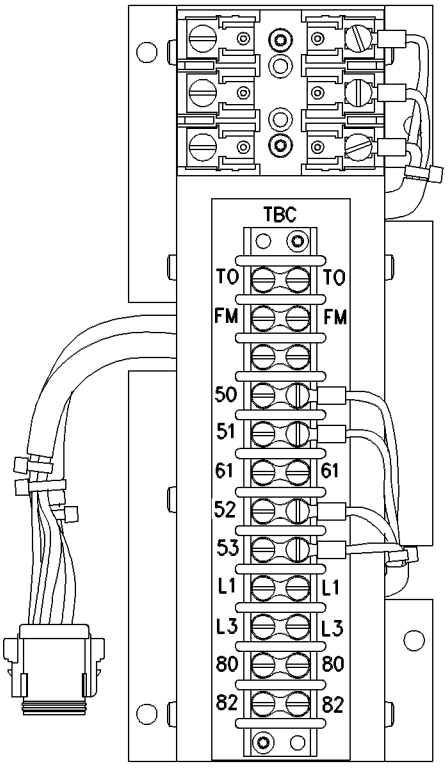
**Results**:

- OK - All resistance measurements are correct. Therefore, replace the sensor. STOP.
- NOT OK - One or more resistance measurements are NOT correct. Troubleshoot and repair the engine harness. STOP.

i00946745

# EMCP Electronic Control (AC Transformer Box) - Replace

**SMCS Code:** 1409-510; 4490-510




g00483140

Illustration 88

AC Transformer Box (ATB)

The ATB is located on the subpanel within the control panel.

**Replacement Procedure**

**1.** Shut down the engine. Remove the positive lead wire from the battery.

**2.** Make sure that all wires at the terminal strip of the ATB are marked with the respective termination point. During reassembly, these wires must be reattached to the correct terminal. Remove all external wires from the terminal strip.

**3.** Disconnect the ATB connector from the harness connector.

**4.** Remove all mounting nuts and mounting screws that fasten the ATB to the subpanel. Remove the ATB.

5. Place the new ATB in the subpanel. Install the mounting nuts and mounting screws. Tighten the mounting nuts and mounting screws.

6. Reconnect the harness connector to the ATB. Reconnect all the wires to the terminal strip that were removed. Reconnect the positive lead wire to the battery. If necessary, see the “Generator Set Wiring Diagram” in Testing And Adjusting, “Schematics and Wiring Diagrams”.

7. Program the bar code (calibration value) for the voltmeter/ammeter into the GSC. See Systems Operation, “Voltmeter/Ammeter Programming OP8”.

8. If the genset is operating in parallel with another genset and the voltmeter values match, then reprogram the AC offset. See Systems Operation, “AC Offset Adjustment OP10”.

i00946899

# EMCP Electronic Control (Generator Set) - Replace

**SMCS Code:** 4490-510

### Replacement Procedure

1. The new GSC must be reprogrammed after the GSC has been installed. If the GSC that is being replaced is functional, then make a note of the value for the hourmeter, all engine setpoints, any spare inputs, and any spare outputs that are programmed. See Systems Operation, “Engine/Generator Setpoint Viewing OP2”.

2. Shut down the engine. Remove the positive lead wire from the battery.

3. Remove the harness connector from the GSC. A 4 mm hex wrench is required to turn the fastening screw.

4. Make sure that all of the wires at the terminal strips are marked with the respective termination point. During reassembly, these wires must be reattached to the correct terminal. Remove all of the wires from the terminals and the wires from the posts of the relay module.

5. Remove the six nuts that fasten the GSC to the front panel. Remove the GSC.

6. Place the new GSC in the front panel. Install the six nuts and tighten the six nuts.

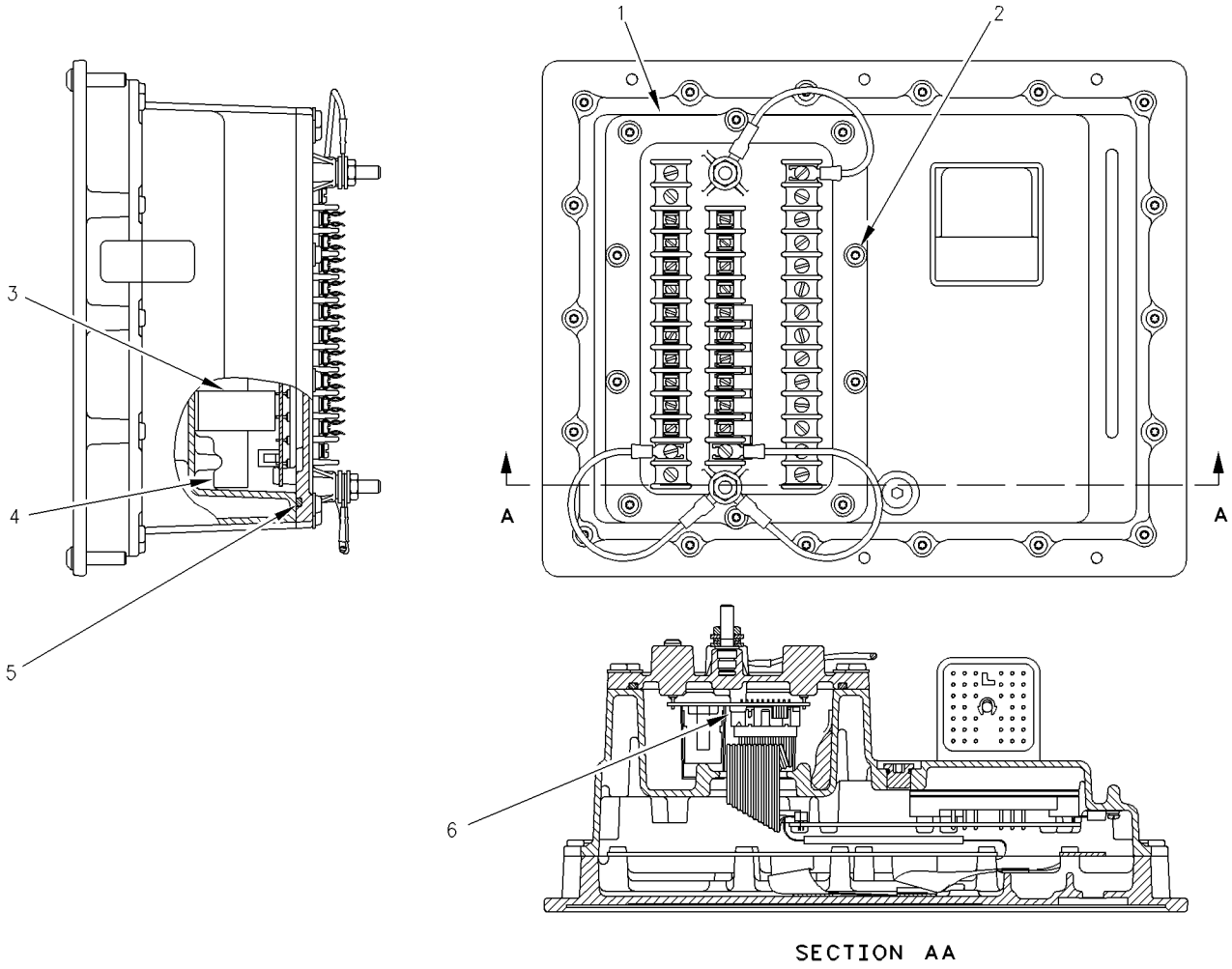
7. Reconnect the harness connector to the GSC. Reconnect all the wires to the terminals of the relay module that were removed. Reconnect the positive lead wire to the battery. If necessary, see the “Generator Set Wiring Diagram” in Testing And Adjusting, “Schematics and Wiring Diagrams ”.

8. Reprogram the setpoints, the spare inputs, the spare outputs, the hourmeter, the voltmeter, the ammeter and the AC offset adjustment. See the related topics in the Systems Operation. Use the values from the original GSC. See step 1.

i00947086

# Relay Module - Replace

**SMCS Code:** 4490-510




g00483398

Illustration 89

Relay Module At The Rear of The GSC

(1) Relay Module. (2) Screws. (3) Tape. (4) Desiccant package. (5) O-ring seal. (6) Connector of the cable.

Relay module (1) contains the relays, fuses and terminals that are used in order to operate the external devices of the EMCP II. Relay module (1) is a component of the GSC.

Reference: Special Instruction, SEHS9710, “Relay Module - Replace”.

### Replacement Procedure

1. Remove the positive lead wire from the battery.
2. Make sure that all of the wires at the terminal strips are marked with the respective termination point. During reassembly, these wires must be reattached to the correct terminal. Remove all of the wires from the terminals and the wires from the posts of the relay module (1).
3. Remove ten screws (2) that fasten relay module (1) to the GSC.

4. Be aware that O-ring seal (5) exists. Partially separate relay module (1) from the GSC. Carefully disconnect the cable clamp and the cable connector (6) from relay module (1).

   Verify the small jumper block on the PC board. The small jumper block is near the cable for the ribbon cartridge. The jumper block of the original relay module should match the jumper block on the new relay module. See Testing And Adjusting, “AC Voltage Range - Adjust”.

5. Replace the desiccant package (4) with the new desiccant package. Replace the tape that is included with the new relay module. Attach the new desiccant package in the same manner as the one that is removed.

Note: Do not remove the new desiccant package from the protective container until the relay module is installed into the GSC. The length of time that is required to install the new relay module is twenty minutes. Longer periods of time will cause the desiccant package to become saturated with moisture.

6. Install new O-ring seal (5) in the groove of relay module (1). Make sure that the O-ring seal (5) is seated properly. Align the connector of the cable and reconnect the connector of the cable (6) to the relay module (1). Install the cable clamp.

7. Place relay module (1) on the GSC. Check that O-ring (5) remains seated. Align the screw holes of relay module (1) and the GSC. Install ten screws (2) and tighten ten screws (2).

8. Reconnect all the wires to the terminals of the relay module that were removed. Reconnect the positive lead wire to the battery. If necessary, see the “Generator Set Wiring Diagram” in Testing And Adjusting, “Schematics and Wiring Diagrams”.

i01134789

# Typical Generator Abbreviations

**SMCS Code:** 4490

A – Ammeter

ACT – Actuator

ADS – Engine Combustion Air Damper Position Switch

AFCR – Auxiliary Fuel Control Valve

ALM – Alarm Module

ALS – Alarm Silence Push Button

ALT – Alternator

AR – Arming Relay

ASOS – Air Shutoff Solenoid

ASR – Air Shutoff Relay

ASSV – Air Start Solenoid Valve

ATB – AC Transformer Box

AUX – Auxiliary Terminal Strip

AUXREL – Auxiliary Relay (Crank Termination)

AWG – American Wire Gauge

BATT – Battery

BCF – Battery Charger Failure Switch

C – Common

CAM – Custom Alarm Module

CAR – Custom Alarm Relay

CB – Circuit Breaker

CCM – Customer Communication Module

CDM – Engine Cooldown Timer Module

CIM – Customer Interface Module

CT – Current Transformer

CTR – Crank Termination Relay

D – Diode

DCV – DC Voltmeter

DS – Disconnect Switch

ECLC – Engine Coolant Loss Sensor Connector

ECLS – Engine Coolant Loss Sensor

ECS – Engine Control Switch

ECTS – Engine Coolant Temperature Sensor

EFCR – Emergency Fuel Control Relay

EFL – Emergency Fuel Light

EG – Electronic Governor (Speed Sensing)

EGA – Electronic Governor Actuator

EGR – Electronic Governor Relay

EHC – Ether Hold-In Coil

EHS – Ether Hold-In Switch

ENFR – Engine Failure Relay

EOTC – Engine Oil Temperature Sensor Connector

EOTS – Engine Oil Temperature Sensor

EOPS – Engine Oil Pressure Sensor

EPC – Ether Pull-In Coil

EPS – Ether Pull-In Switch

ES – Ether Solenoid

ESPB – Emergency Stop Push Button

ESL – Emergency Stop Light

F – Fuse

FCR – Fuel Control Relay

FCTM – Fuel Control Timer Module

FRB – Fuel Rupture Basin

FS – Fuel Solenoid

FSOS – Fuel Shutoff Solenoid

GFR – Generator Fault Relay

GOL – Generator On Load

GOV – Governor

GPHI – Ground Post (High Voltage)

GPLO – Ground Post (Low Voltage)

GS – Governor Switch

GSC – Generator Set Control

GSM – Governor Synchronizing Motor

GSOV – Gas Shutoff Valve

HZ – Frequency Meter

KWR – Kilowatt Level Relay

IC – Remote Start/Stop Initiate Contact

L – Load Leads

LFL – Low Fuel Level Light

LFLAS – Low Fuel Level Alarm Switch

LFS – Latching Fuel Control Solenoid

LOLAS – Low Oil Level Alarm Switch

LWLAS – Low Water Level Alarm Switch

LWTL – Low Water Temperature Light

MAN – Manual

MPU – Magnetic Speed Pickup

NC – Normally Closed

NO – Normally Open

OCL – Overcrank Light

OCR – Overcurrent Relay

OCT – Overcrank Timer

OP – Oil Pressure

OPG – Oil Pressure Gauge

OPL – Oil Pressure Light

OSL – Overspeed Light

OSR – Oil Step Relay

OVR – Overvoltage Relay

PEEC – Programmable Electronic Engine Control

PL – Panel Illumination Light

PLS – Panel Light Switch

POS – Positive

POT – Potentiometer

PP – Prelube Pump

PPMS – Prelube Pump Magnetic Switch

PPPS – Prelube Pump Oil Pressure Switch

PR – Preregulator

PS – Pinion Solenoid

PWM – Electrical Converter (Pulse Width Modulated)

RAN – Remote Annunciator

RDM – Relay Driver Module

RPL – Reverse Power Light

RPR – Reverse Power Relay

RPSR – Reverse Power Slave Relay

RR – Run Relay

SASV – Start Aid Solenoid Valve

SATS – Start Aid Temperature Switch

SAS – Starting Aid Switch

SEC – Second

SHTC – Circuit Breaker Shunt Trip Coil

SIG – Signal

SL – Synchronizing Light

SLM – Synchronizing Light Module

SLR – Synchronizing Light Resistor

SM – Starting Motor

SMMS – Starting Motor Magnetic Switch

SMR – Starting Motor Relay

SP – Speed Adjust Potentiometer

SPM – Synchronizing Parallel Module

SR – Slave Relay

SS – Synchronizing Switch

T – Generator Line Leads

TD – Time Delay Relay

TSC – Transfer Switch Position Indicating Contact

V – AC Voltmeter

VAR – Voltage Adjust Rheostat

VR – Voltage Regulator

WT – Water Temperature

WTG – Water Temperature Gauge

WTL – Water Temperature Light

XDUCER – Transducer

Z – Zener Diode

i01134939

# Symbols

**SMCS Code:** 4490

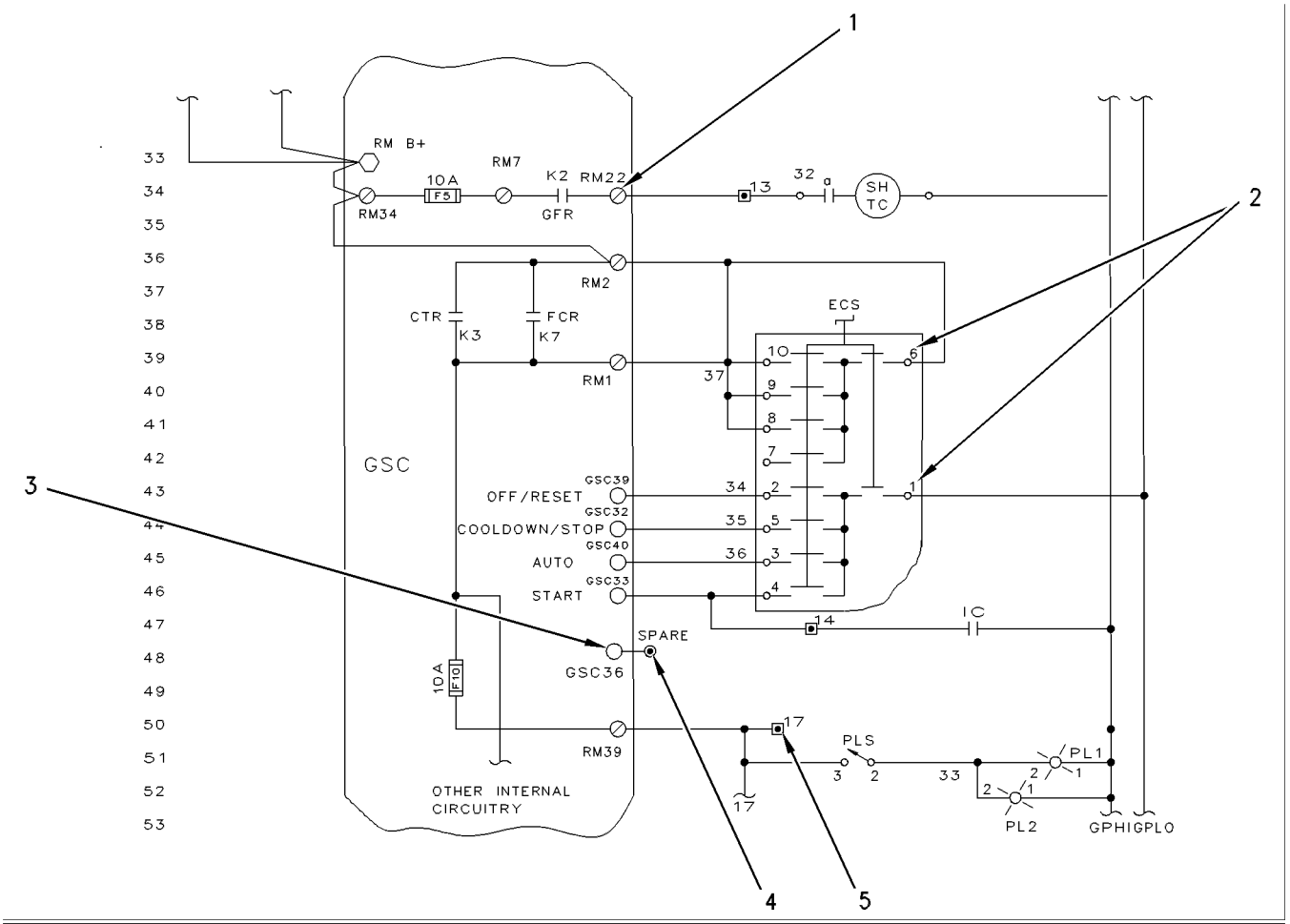

Illustration 90

g00600966

i00961141

# Reading DC Schematics

**SMCS Code:** 4490; 7566




g00489928

Illustration 91

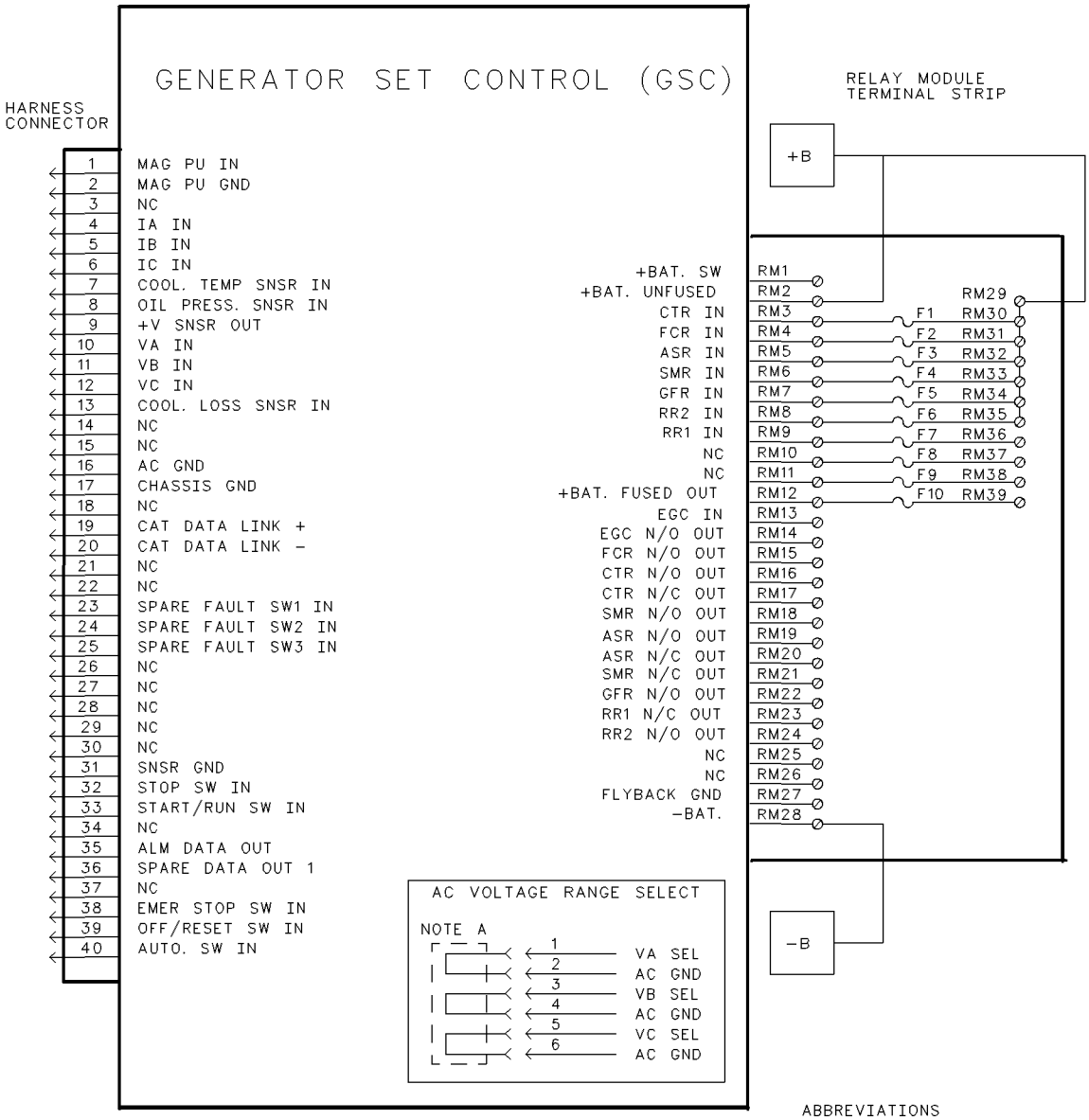
Typical DC Schematic

(1) Symbol for terminal on relay module.
(2) Pin identification on engine control switch.
(3) Symbol for contact of GSC connector.
(4) Symbol for terminal on terminal strip within control panel.
(5) Symbol for terminal on terminal strip within generator.

i00961244

# Block Diagram of Generator Set Control

**SMCS Code:** 4490; 7566




NOTE A: THE RANGE SELECT JUMPER IS INSTALLED IN ALL CONTROLS TO SELECT THE DEFAULT 0−700V INPUT RANGE. REMOVAL OF THE JUMPER SELECTS 0−150V INPUT RANGE.

ABBREVIATIONS

| | | |
|---|---|---|
| IA | − | LINE A CURRENT |
| IB | − | LINE B CURRENT |
| IC | − | LINE C CURRENT |
| VA | − | LINE A VOLTAGE |
| VB | − | LINE B VOLTAGE |
| VC | − | LINE C VOLTAGE |
| EGC | − | ELECTRONIC GOVERNOR CONTROL |
| ASR | − | AIR SHUT−OFF RELAY |
| CTR | − | CRANK TERMINATE RELAY |
| FCR | − | FUEL CONTROL RELAY |
| GFR | − | GENSET FAULT RELAY |
| RR | − | RUN RELAY |
| SMR | − | STARTING MOTOR RELAY |

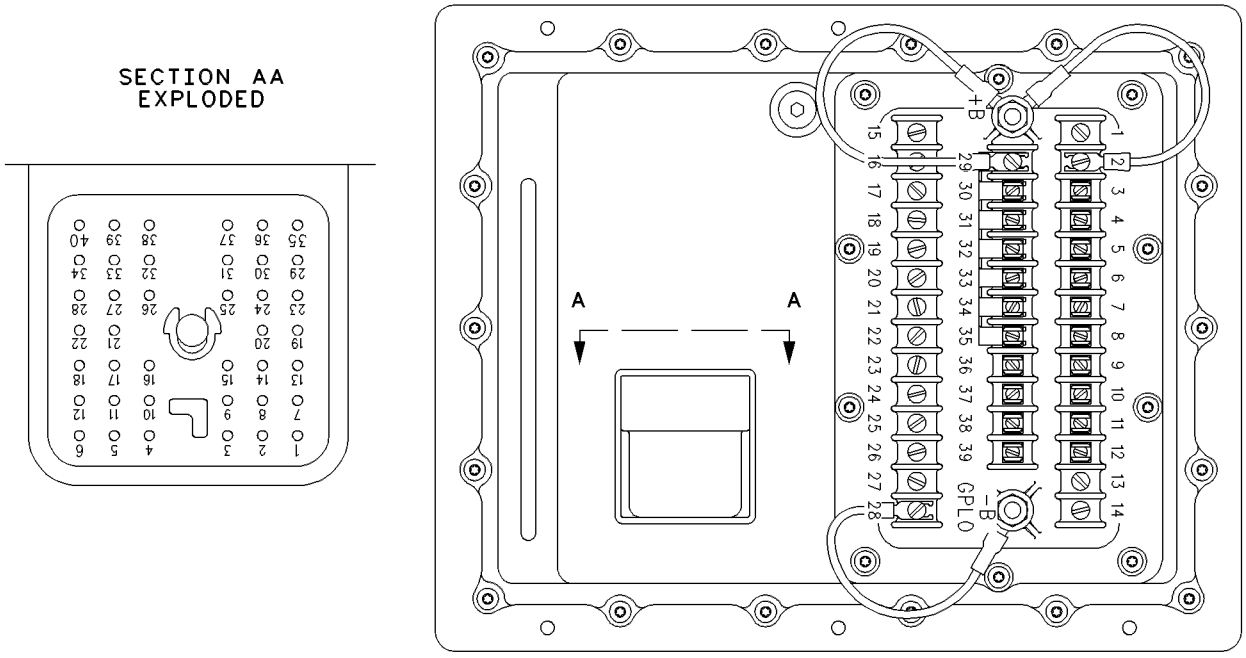
Illustration 92

g00489936

i00967906

# Connector Contact Identification of Generator Set Control

**SMCS Code:** 4490; 7553




g00493031

Illustration 93

Back Of GSC

Top View Of GSC

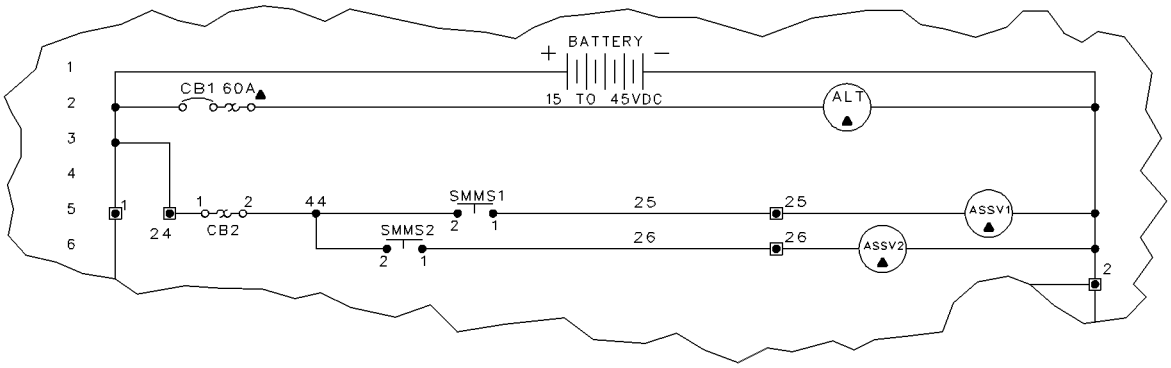
The Instrument Door Is Open.

i01134997

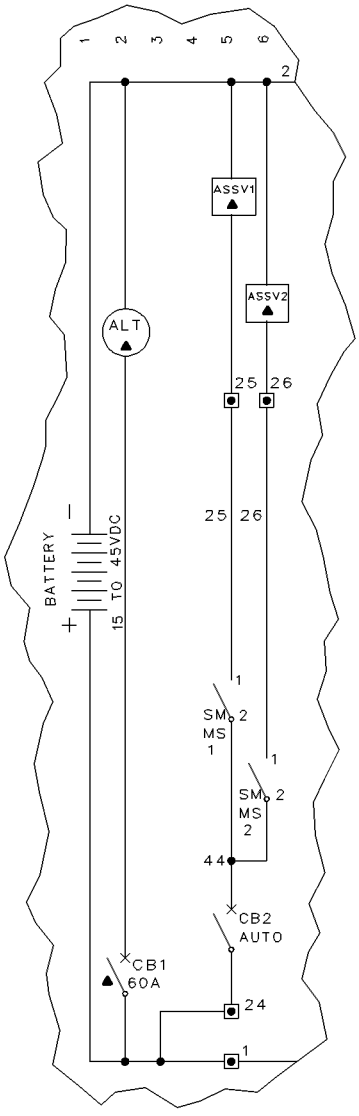
# Schematics and Wiring Diagrams

**SMCS Code:** 4490; 7566

# DC Schematic - Air Start




PARTIAL SCHEMATIC
(JIC SYMBOLS)
NOTE A




PARTIAL SCHEMATIC
(IEC SYMBOLS)
NOTE A

NOTE A. FOR COMPLETE SCHEMATICS
REFERENCE DC SCHEMATIC (JIC)
AND DC SCHEMATIC (IEC)

Illustration 94

g00601039

# DC Schematic - Prelube Pump

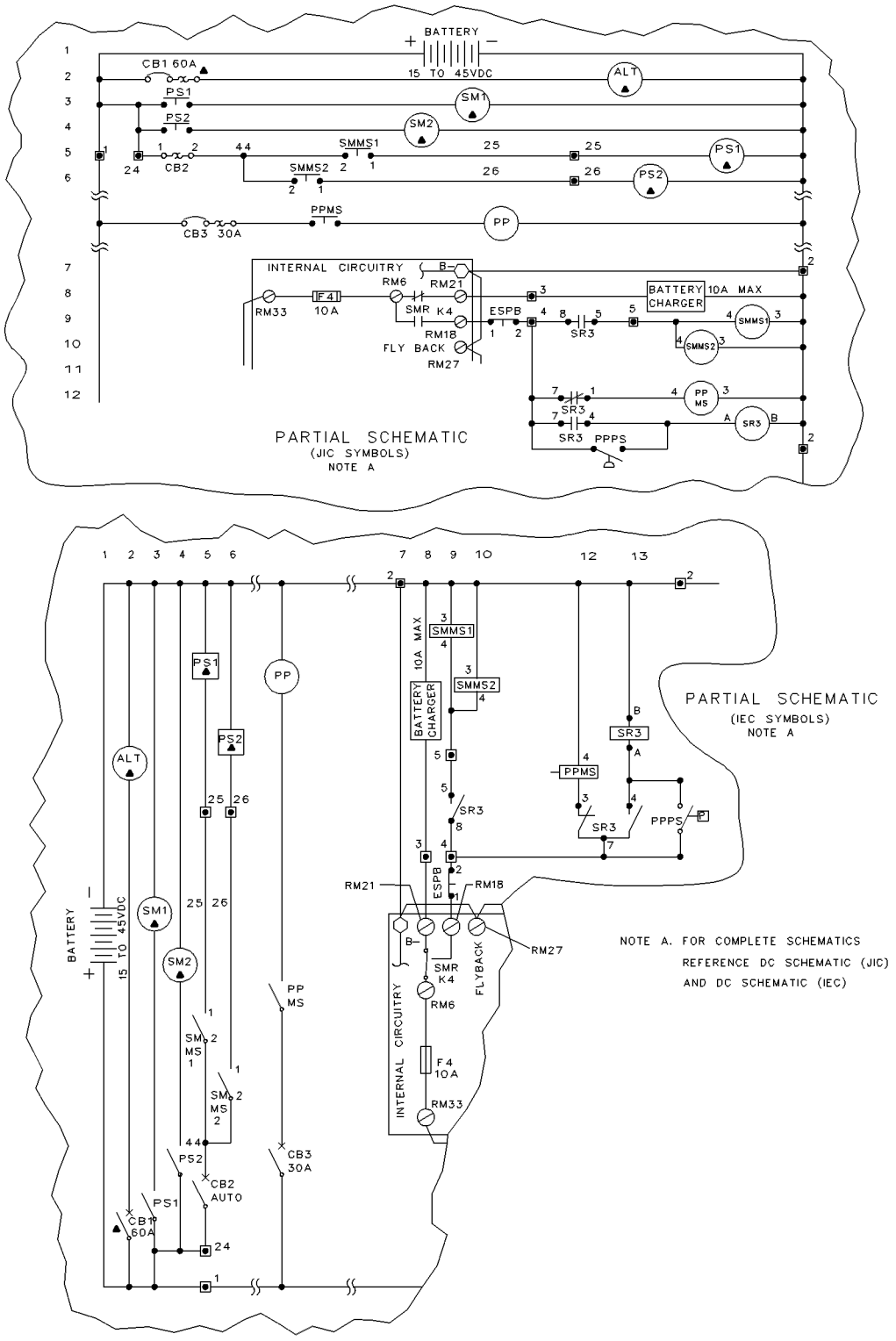



Illustration 95

g00601043

# DC Schematic - IEC ( 1 of 2)

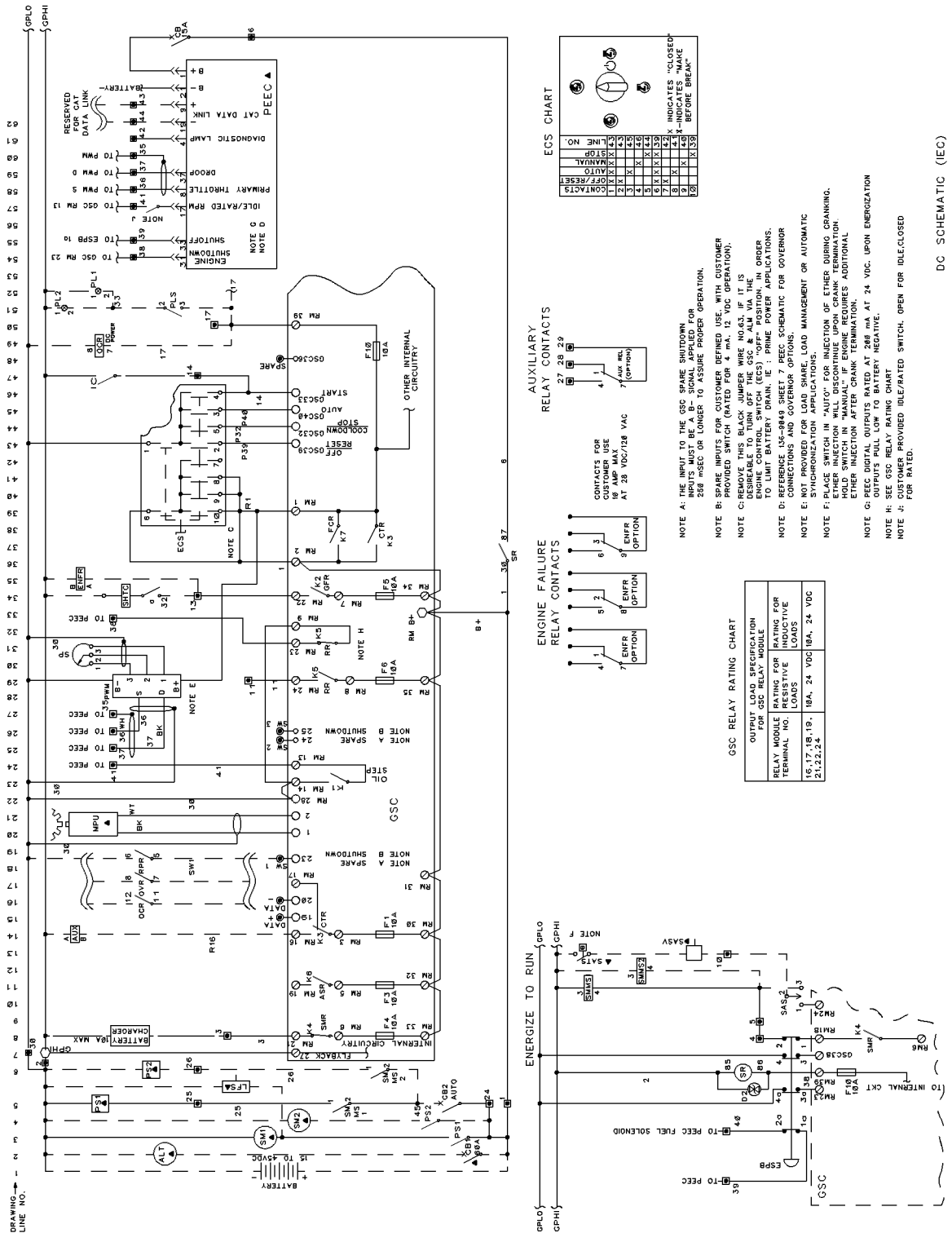



Illustration 96 g00601358

# DC Schematic - IEC ( 2 of 2)

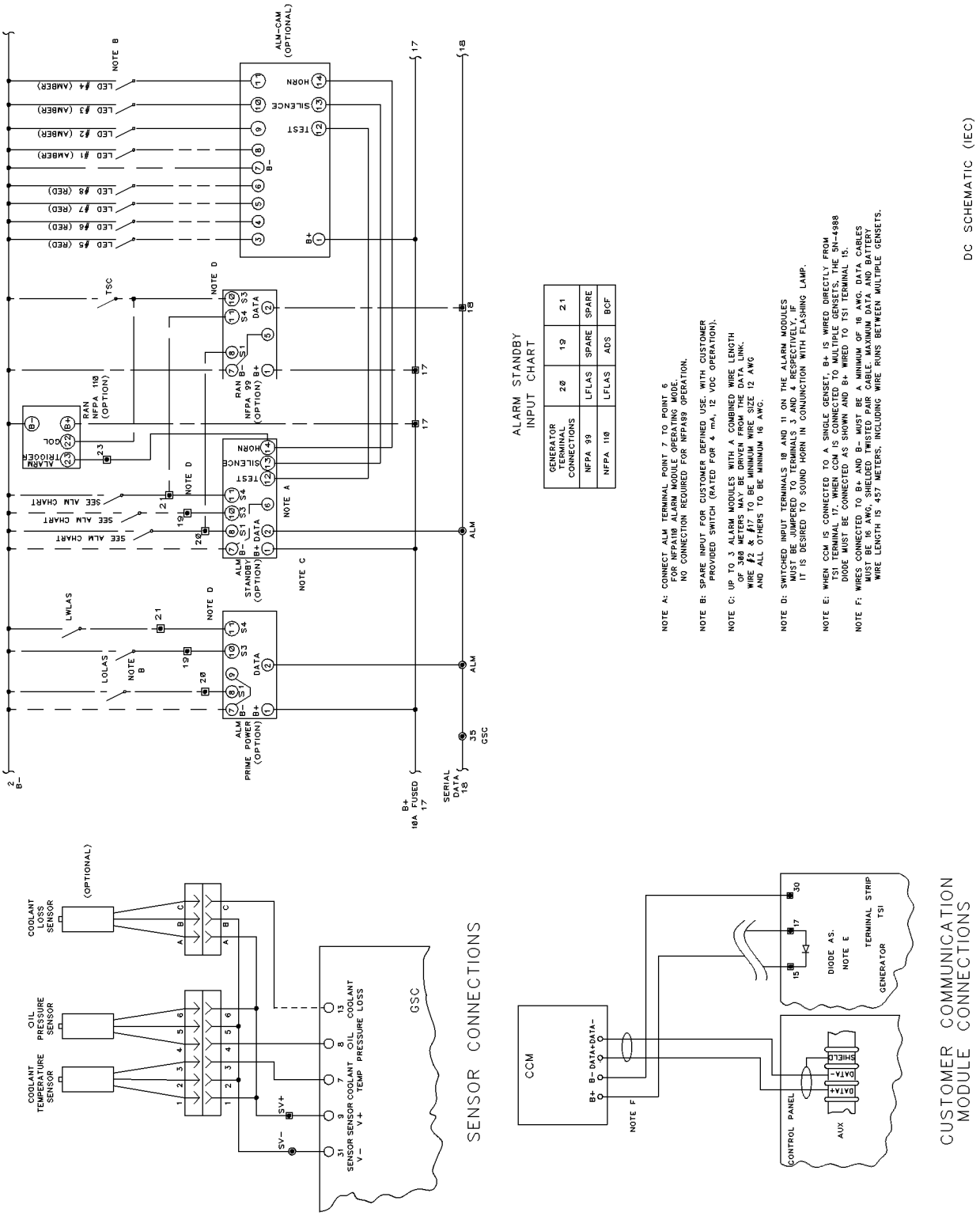



Illustration 97

g00601376

# DC Schematic - JIC ( 1 of 2)

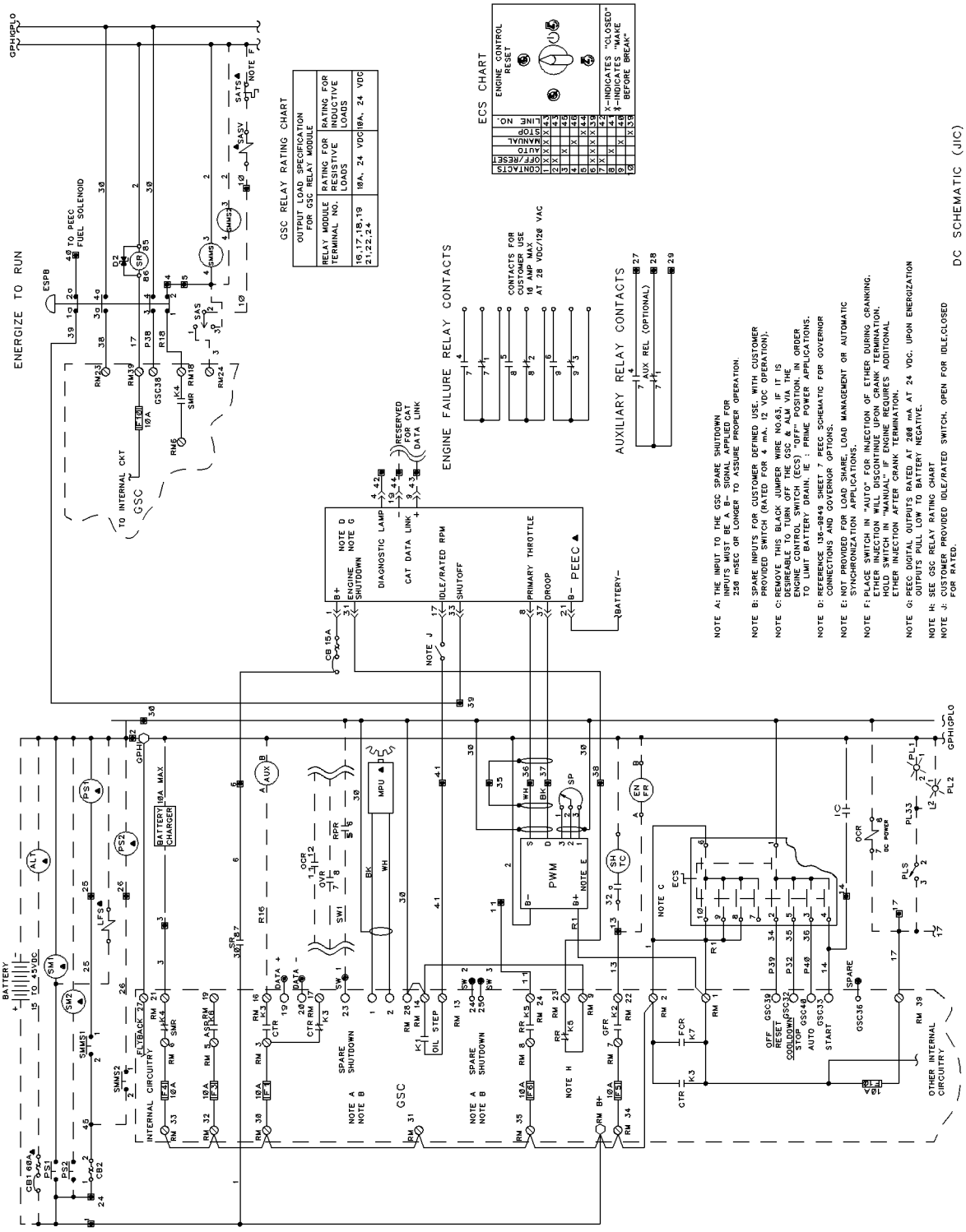
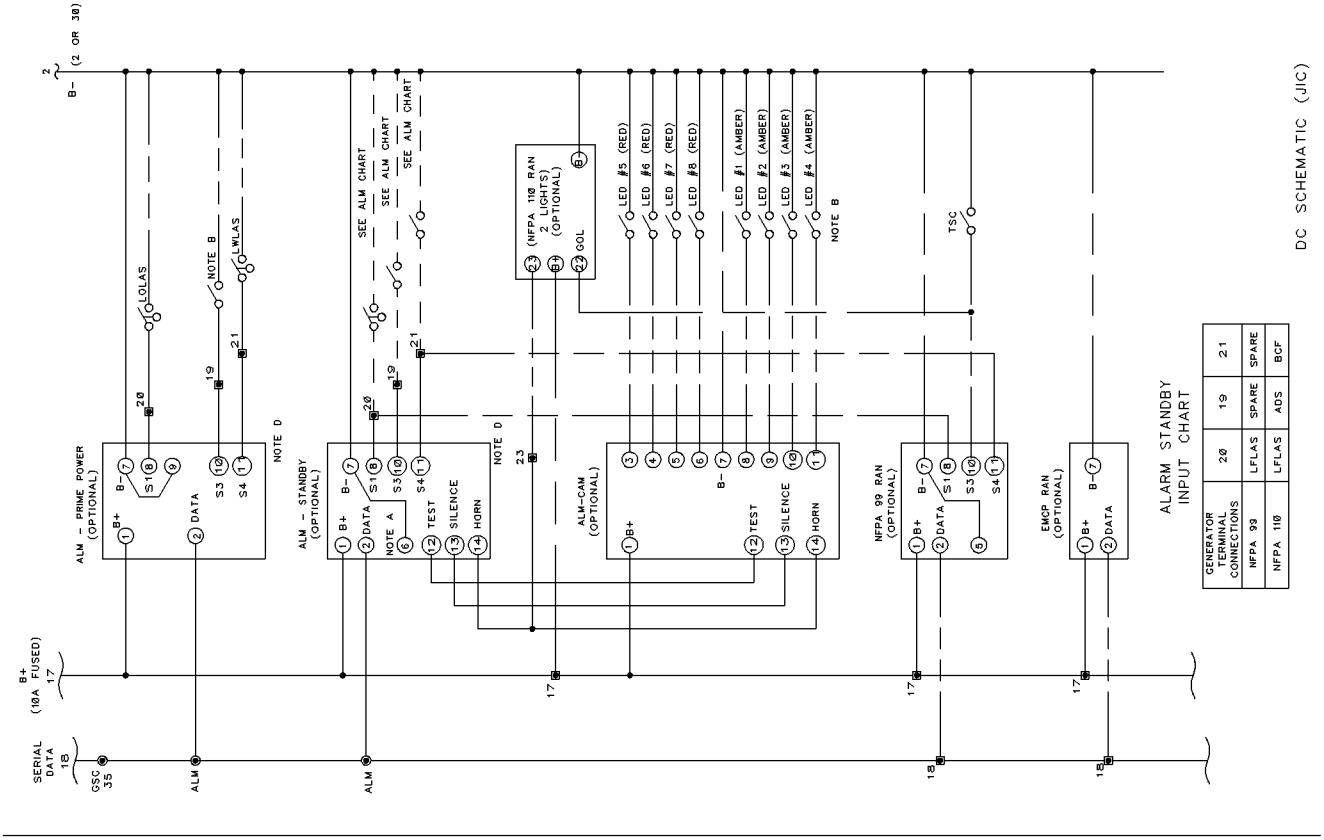



Illustration 98

g00601401

# DC Schematic - JIC ( 2 of 2)



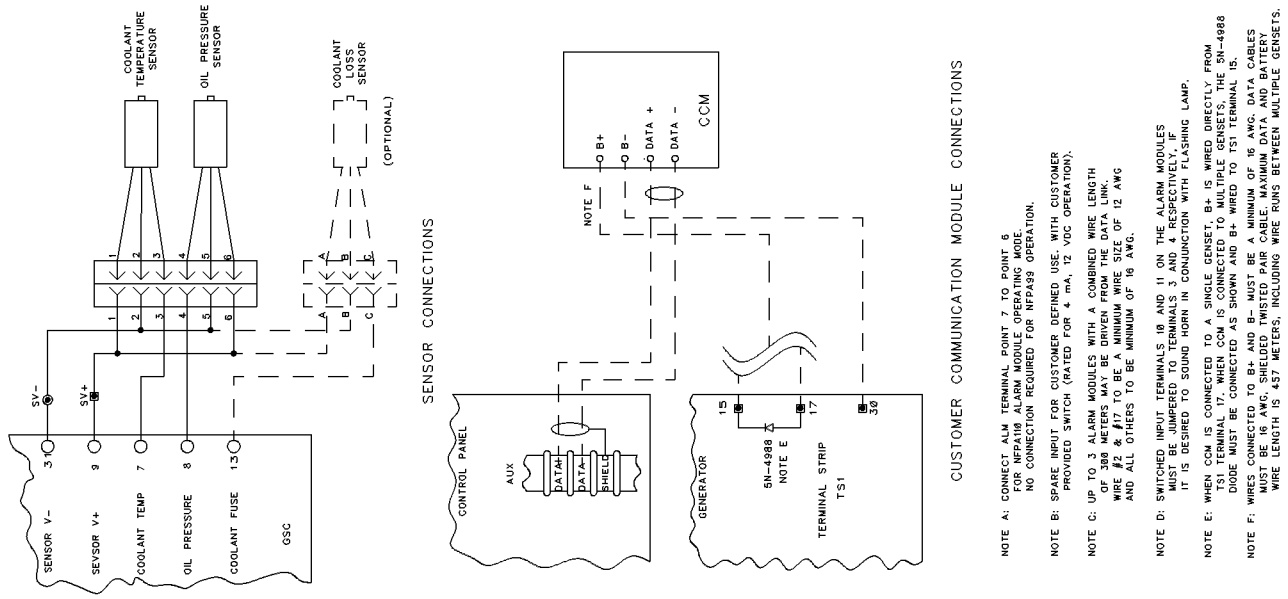




Illustration 99 g00601412

# AC Schematic - IEC

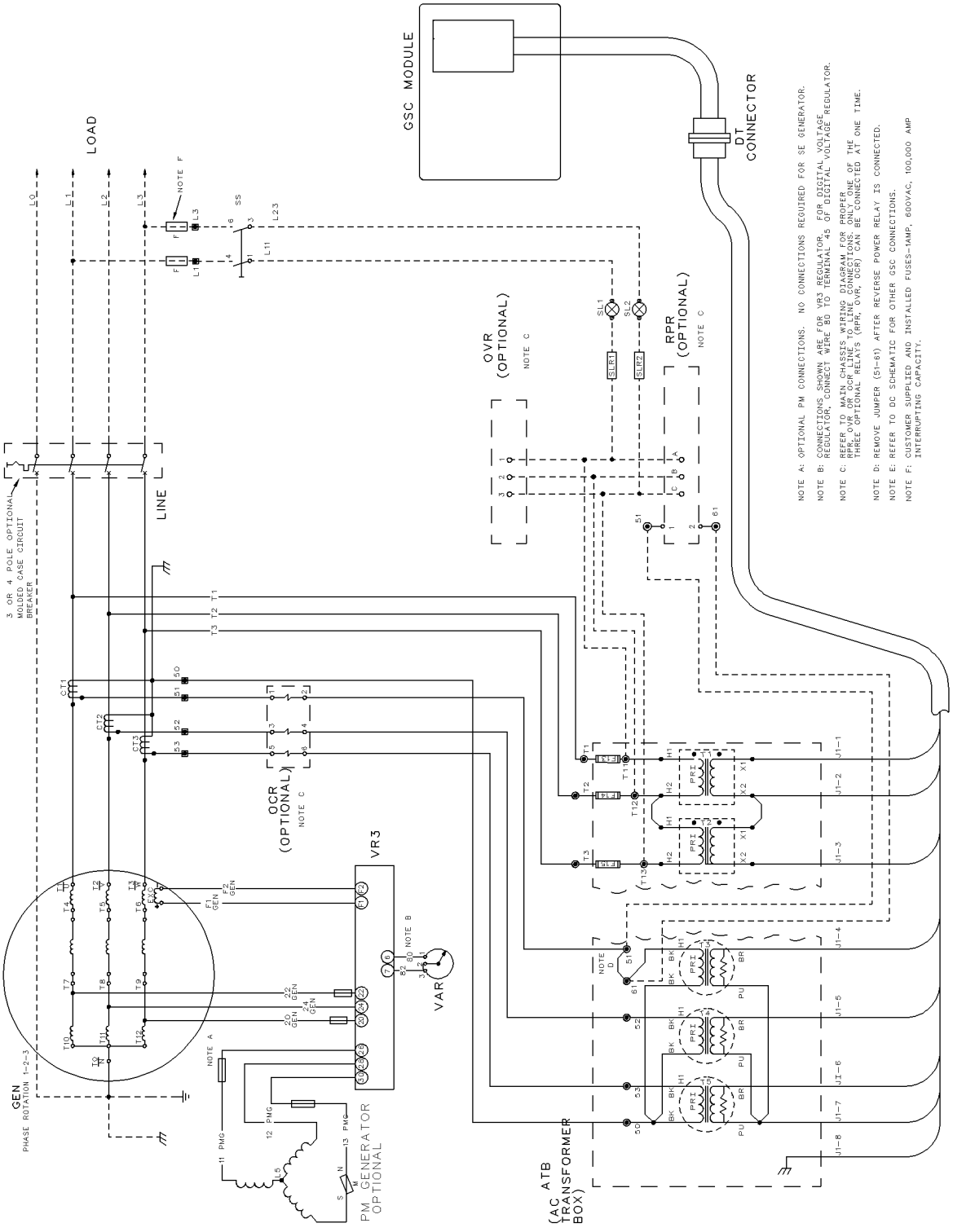



Illustration 100 g00601124

# AC Schematic - JIC

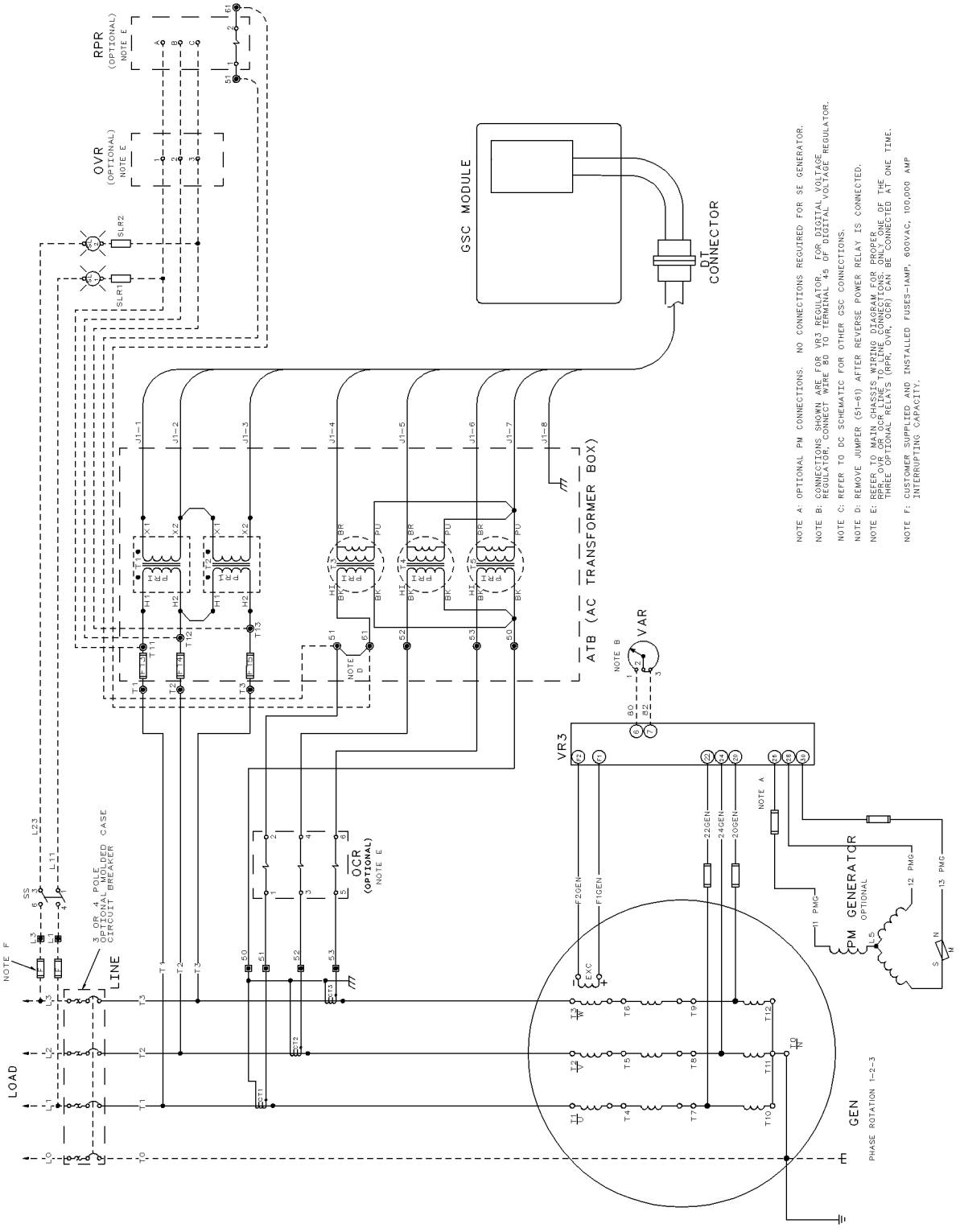



Illustration 101

g00601111

# Wiring Diagram - Relay Driver Module

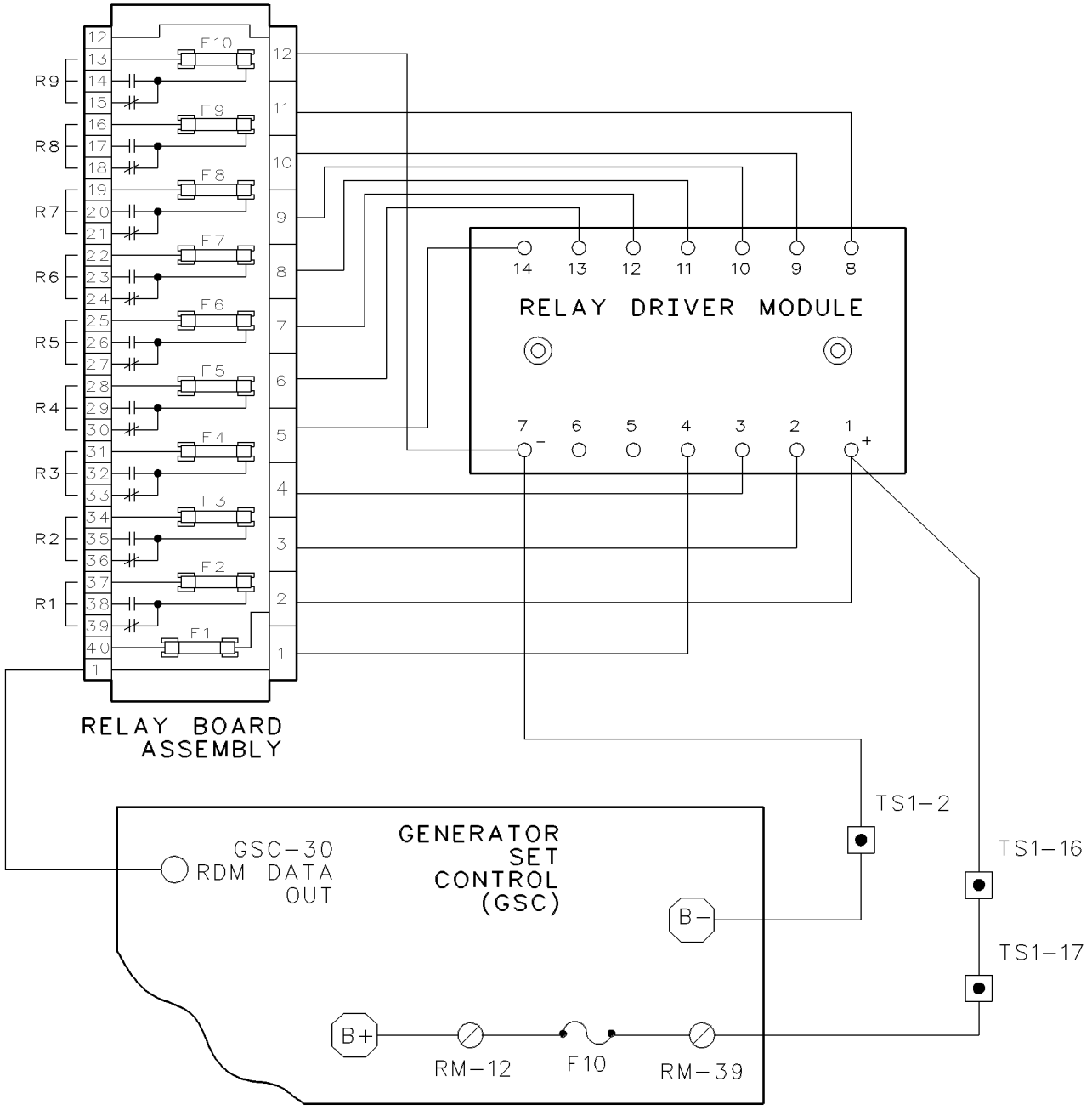



Illustration 102

g00491208

# Wiring Diagram - Customer/ Contractor

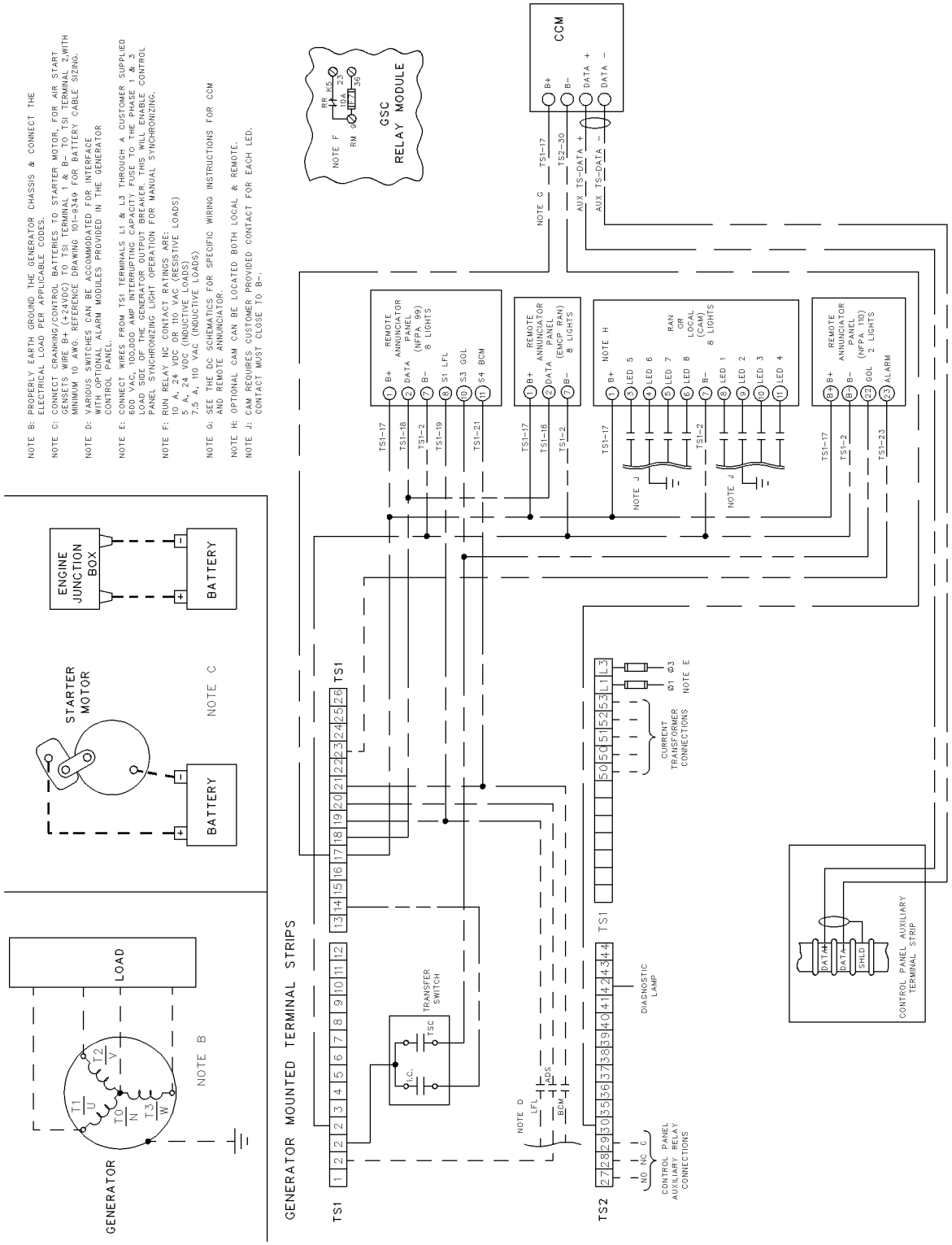
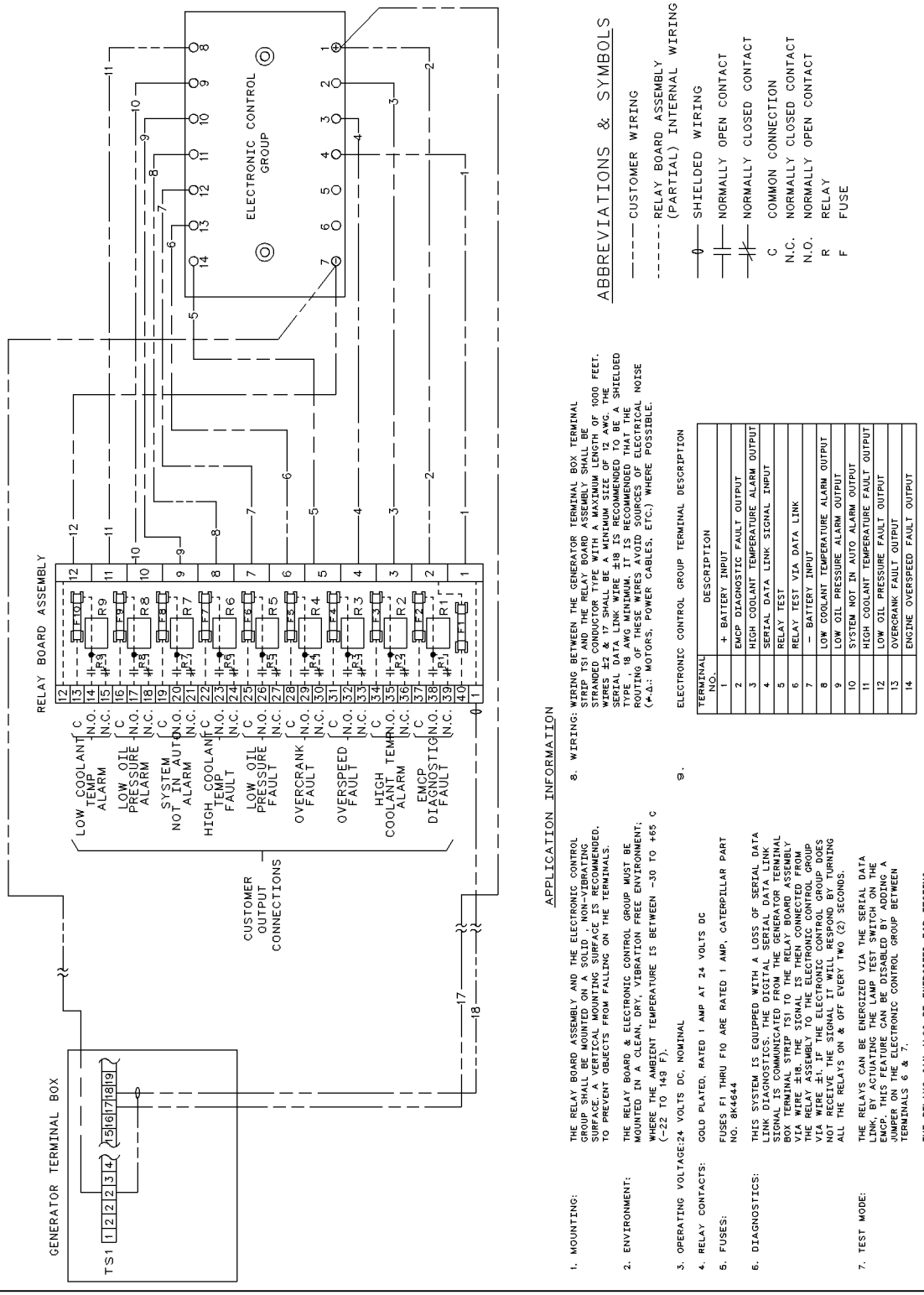



Illustration 103

g00601185

# Wiring Diagram - Customer Interface Module (CIM)




## APPLICATION INFORMATION

1. MOUNTING: THE RELAY BOARD ASSEMBLY AND THE ELECTRONIC CONTROL GROUP SHALL BE MOUNTED ON A SOLID , NON-VIBRATING SURFACE. A VERTICAL MOUNTING SURFACE IS RECOMMENDED. TO PREVENT OBJECTS FROM FALLING ON THE TERMINALS.

2. ENVIRONMENT: THE RELAY BOARD & ELECTRONIC CONTROL GROUP MUST BE MOUNTED IN A CLEAN, DRY, VIBRATION FREE ENVIRONMENT; WHERE THE AMBIENT TEMPERATURE IS BETWEEN -30 TO +65 C (-22 TO 149 F).

3. OPERATING VOLTAGE:24 VOLTS DC, NOMINAL

4. RELAY CONTACTS: GOLD PLATED, RATED 1 AMP AT 24 VOLTS DC

5. FUSES: FUSES F1 THRU F10 ARE RATED 1 AMP, CATERPILLAR PART NO. 8K4644

6. DIAGNOSTICS: THIS SYSTEM IS EQUIPPED WITH A LOSS OF SERIAL DATA LINK DIAGNOSTICS. THE DIGITAL SERIAL DATA LINK SIGNAL IS COMMUNICATED FROM THE GENERATOR TERMINAL BOX TERMINAL STRIP TS1 TO THE RELAY BOARD ASSEMBLY VIA WIRE ±18. THE SIGNAL IS THEN CONNECTED FROM THE RELAY ASSEMBLY TO THE ELECTRONIC CONTROL GROUP VIA WIRE ±1. IF THE ELECTRONIC CONTROL GROUP DOES NOT RECEIVE THE SIGNAL IT WILL RESPOND BY TURNING ALL THE RELAYS ON & OFF EVERY TWO (2) SECONDS.

7. TEST MODE: THE RELAYS CAN BE ENERGIZED VIA THE SERIAL DATA LINK, BY ACTUATING THE LAMP TEST SWITCH ON THE EMCP. THIS FEATURE CAN BE DISABLED BY ADDING A JUMPER ON THE ELECTRONIC CONTROL GROUP BETWEEN TERMINALS 6 & 7.

   THE RELAYS CAN ALSO BE ENERGIZED FOR TESTING, BY TEMPORARILY PLACING A JUMPER BETWEEN TERMINALS 5 & 7 ON THE ELECTRONIC CONTROL.

8. WIRING: WIRING BETWEEN THE GENERATOR TERMINAL BOX TERMINAL STRIP TS1 AND THE RELAY BOARD ASSEMBLY SHALL BE STRANDED CONDUCTOR TYPE WITH A MAXIMUM LENGTH OF 1000 FEET. WIRES ±2 & 17 SHALL BE A MINIMUM SIZE OF 12 AWG. THE SERIAL DATA LINK WIRE ±18 IS RECOMMENDED TO BE A SHIELDED TYPE , 18 AWG MINIMUM. IT IS RECOMMENDED THAT THE ROUTING OF THESE WIRES AVOID SOURCES OF ELECTRICAL NOISE (⇗⇩: MOTORS, POWER CABLES, ETC.) WHERE POSSIBLE.

9. ELECTRONIC CONTROL GROUP TERMINAL DESCRIPTION

| TERMINAL NO. | DESCRIPTION |
|---|---|
| 1 | + BATTERY INPUT |
| 2 | EMCP DIAGNOSTIC FAULT OUTPUT |
| 3 | HIGH COOLANT TEMPERATURE ALARM OUTPUT |
| 4 | SERIAL DATA LINK SIGNAL INPUT |
| 5 | RELAY TEST |
| 6 | RELAY TEST VIA DATA LINK |
| 7 | - BATTERY INPUT |
| 8 | LOW COOLANT TEMPERATURE ALARM OUTPUT |
| 9 | LOW OIL PRESSURE ALARM OUTPUT |
| 10 | SYSTEM NOT IN AUTO ALARM OUTPUT |
| 11 | HIGH COOLANT TEMPERATURE FAULT OUTPUT |
| 12 | LOW OIL PRESSURE FAULT OUTPUT |
| 13 | OVERCRANK FAULT OUTPUT |
| 14 | ENGINE OVERSPEED FAULT OUTPUT |

## ABBREVIATIONS & SYMBOLS

- CUSTOMER WIRING
- RELAY BOARD ASSEMBLY (PARTIAL) INTERNAL WIRING
- SHIELDED WIRING
- NORMALLY OPEN CONTACT
- NORMALLY CLOSED CONTACT
- C COMMON CONNECTION
- N.C. NORMALLY CLOSED CONTACT
- N.O. NORMALLY OPEN CONTACT
- R RELAY
- F FUSE

Illustration 104 g00601653

# Wiring Diagram - Harness

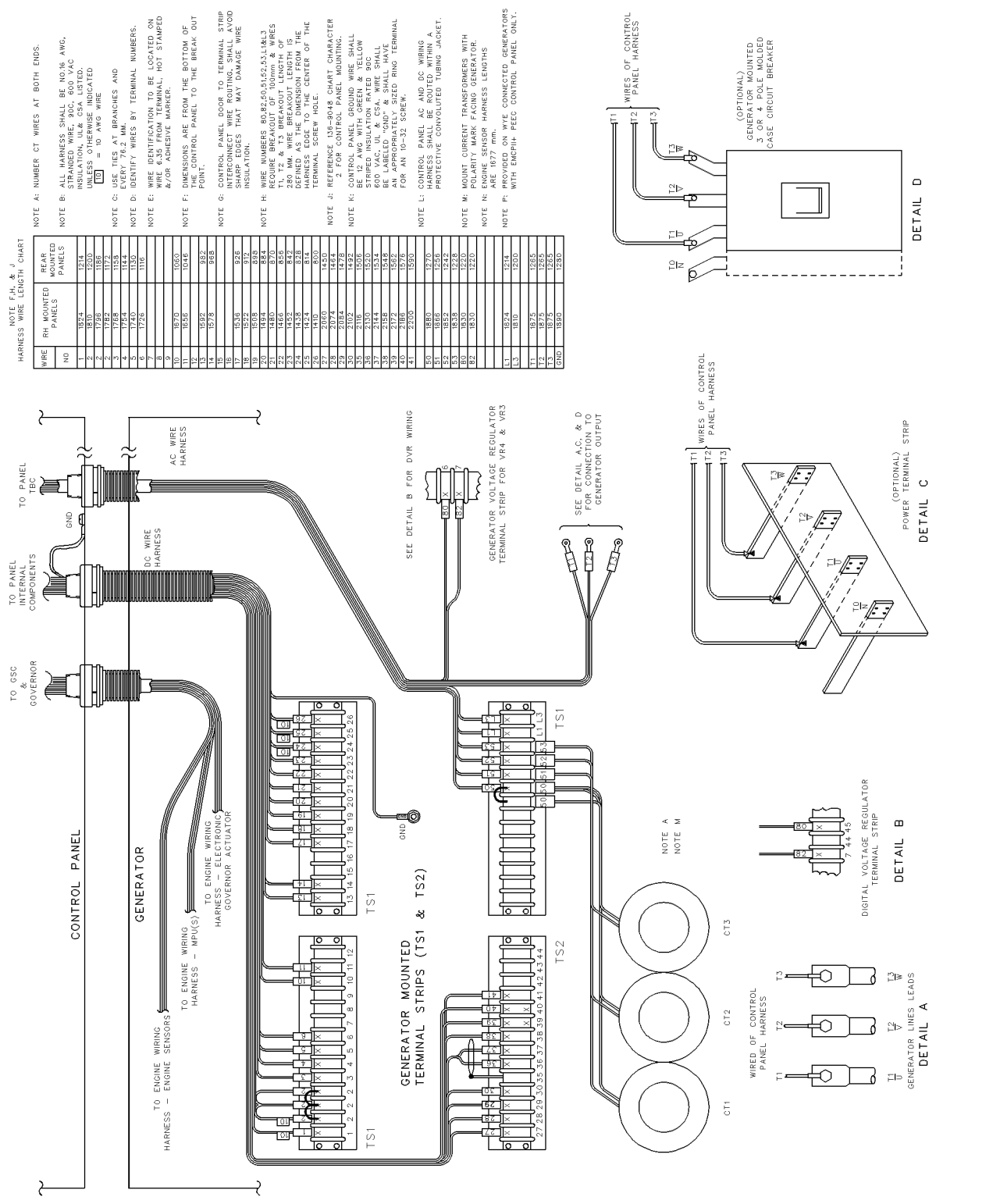



Illustration 105

g00601230

# Wiring Diagram - Main Chassis (1 of 2)

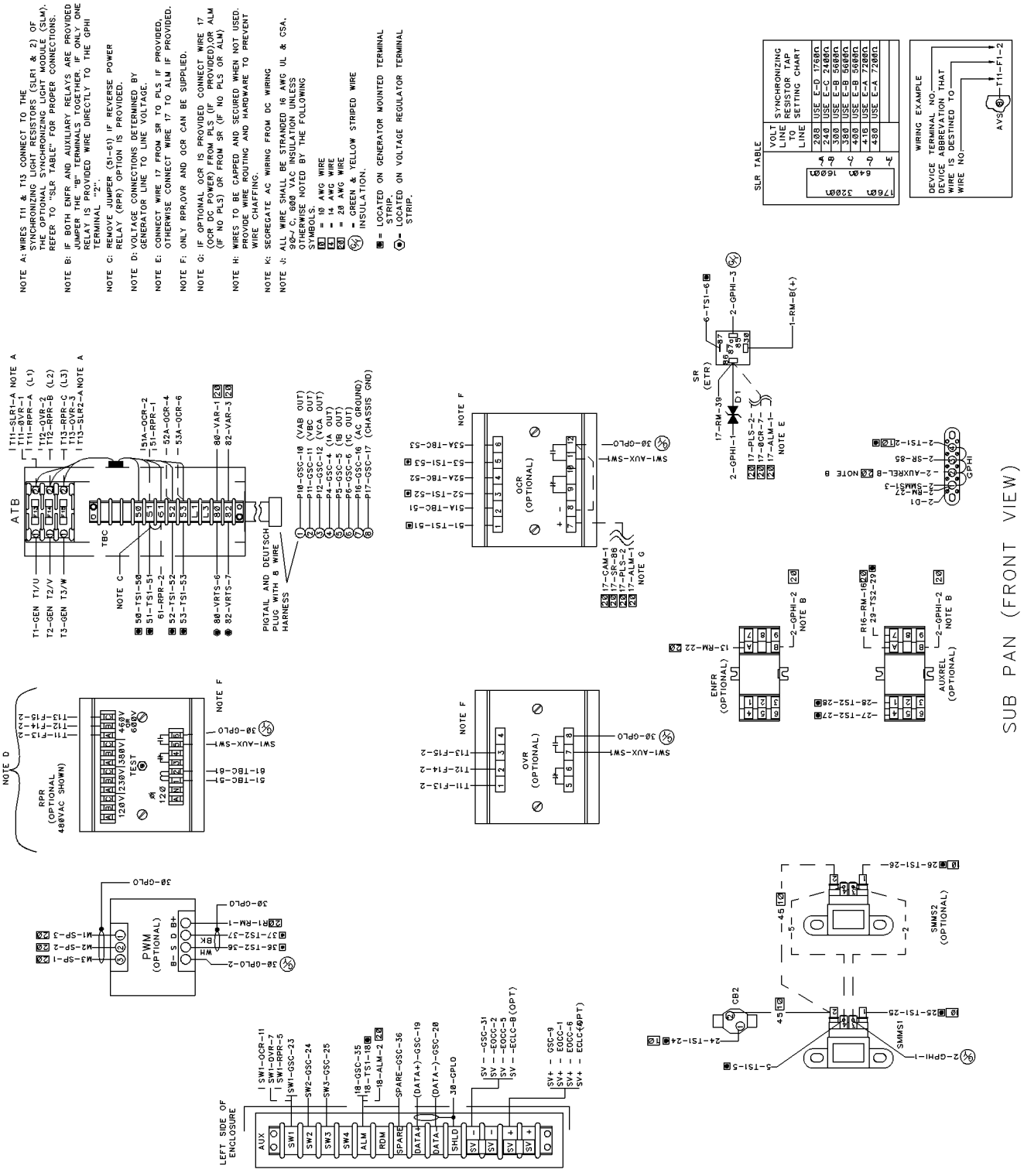



Illustration 106

g00601341

# Wiring Diagram - Main Chassis (2 of 2)

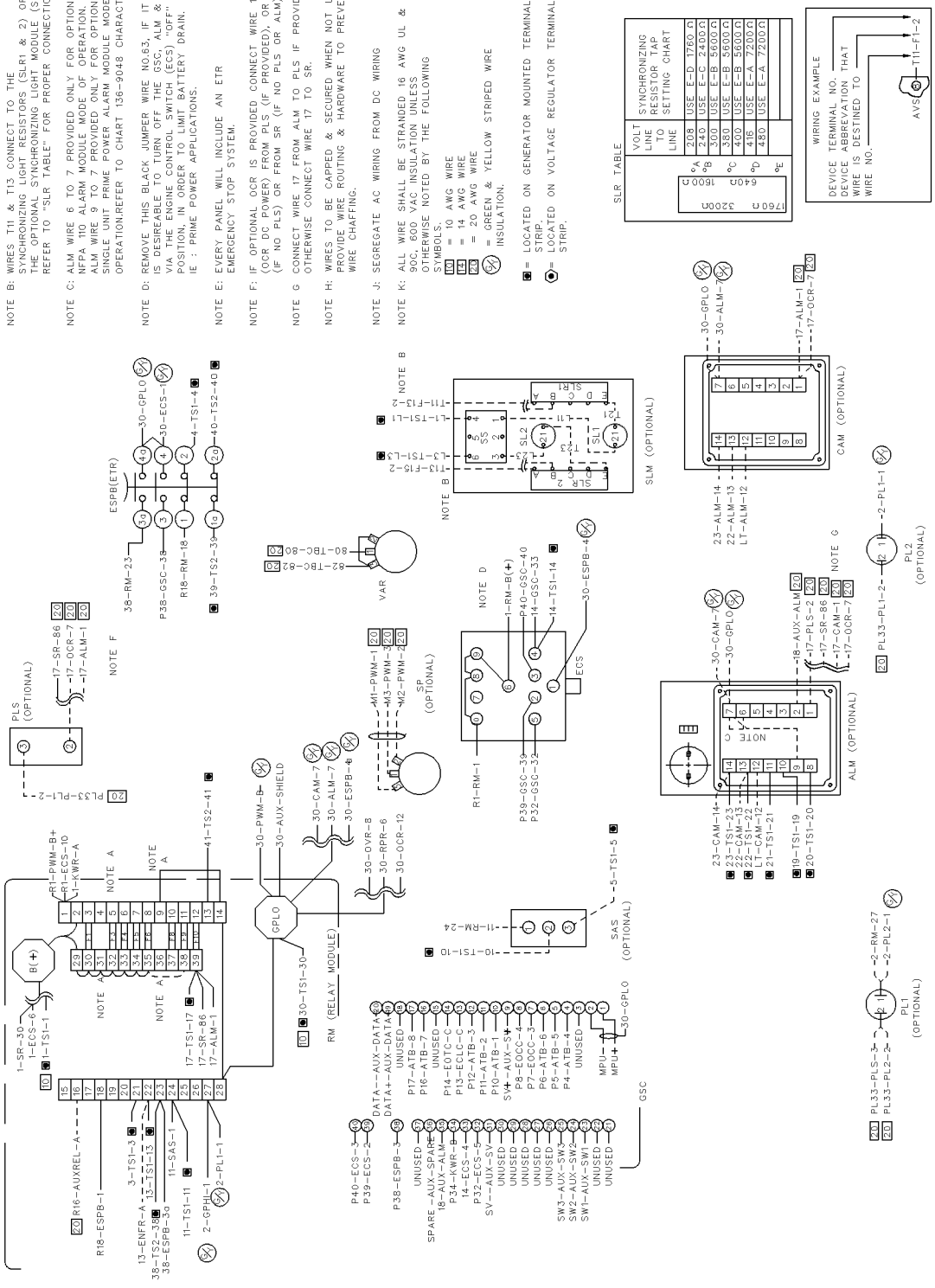



Illustration 107

g00601278

## PEEC Schematic

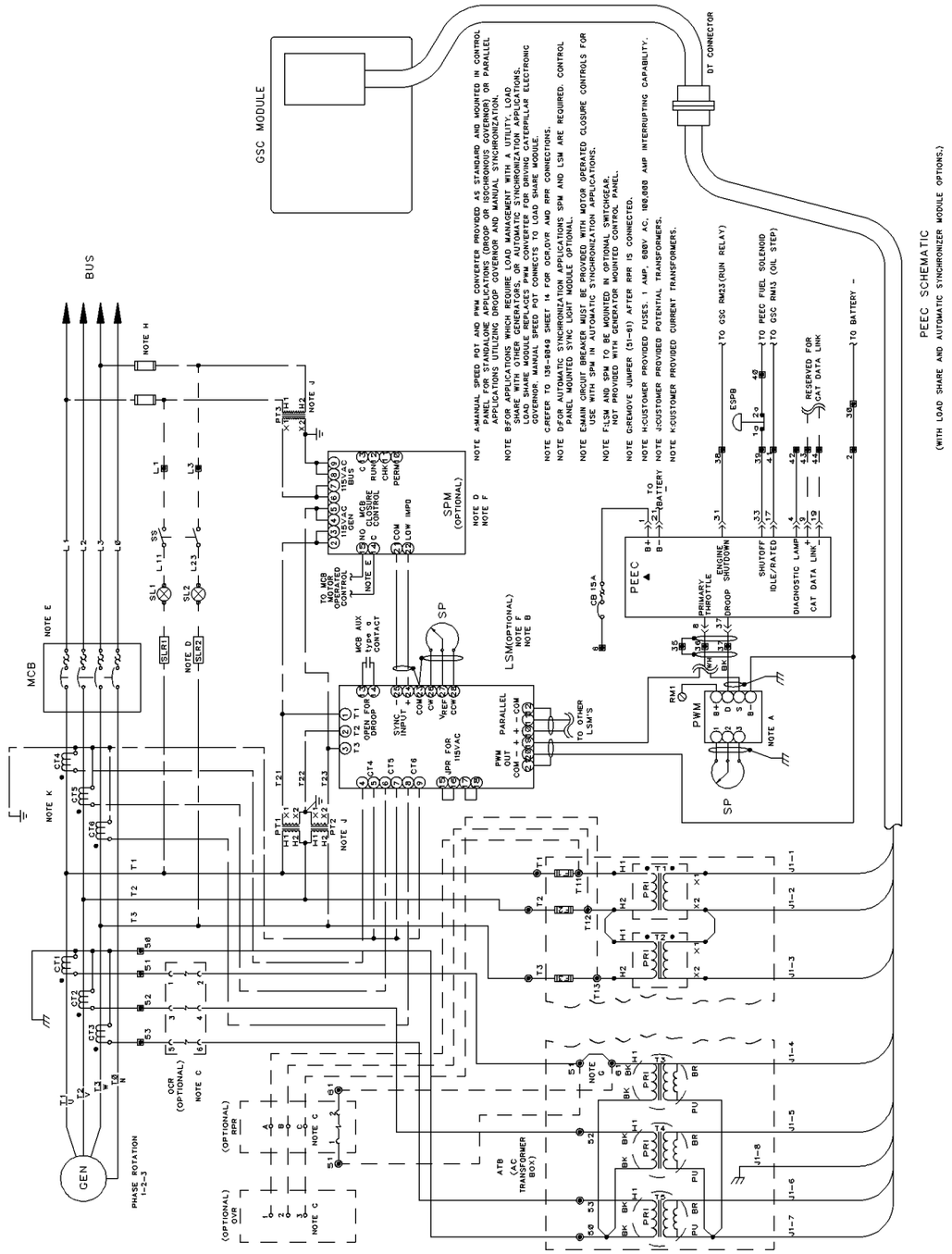
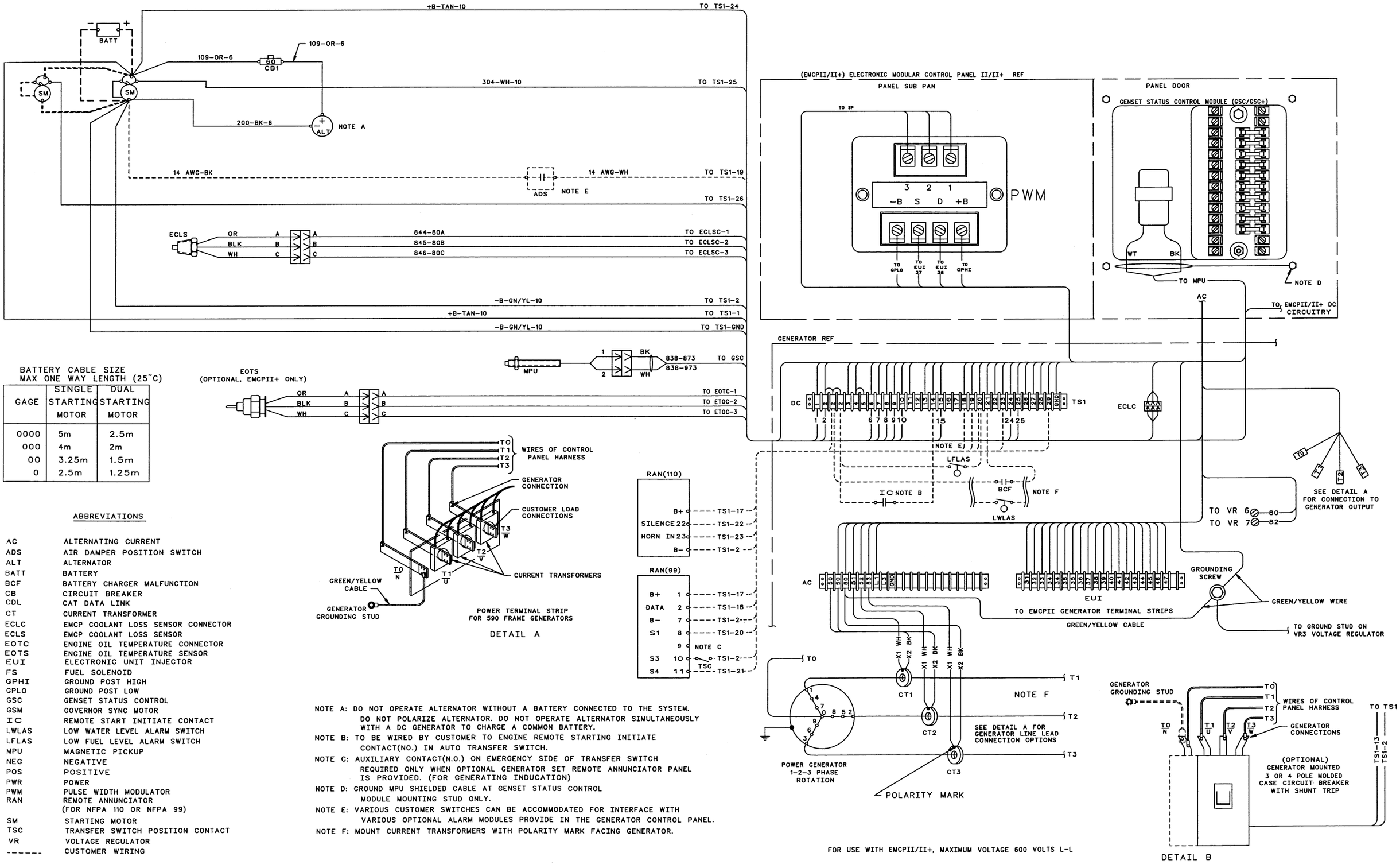



Illustration 108 g00601420

## Wiring Diagram - Generator Set




BATTERY CABLE SIZE
MAX ONE WAY LENGTH (25°C)

| GAGE | SINGLE STARTING MOTOR | DUAL STARTING MOTOR |
|---|---|---|
| 0000 | 5m | 2.5m |
| 000 | 4m | 2m |
| 00 | 3.25m | 1.5m |
| 0 | 2.5m | 1.25m |

ABBREVIATIONS

| | |
|---|---|
| AC | ALTERNATING CURRENT |
| ADS | AIR DAMPER POSITION SWITCH |
| ALT | ALTERNATOR |
| BATT | BATTERY |
| BCF | BATTERY CHARGER MALFUNCTION |
| CB | CIRCUIT BREAKER |
| CDL | CAT DATA LINK |
| CT | CURRENT TRANSFORMER |
| ECLC | EMCP COOLANT LOSS SENSOR CONNECTOR |
| ECLS | EMCP COOLANT LOSS SENSOR |
| EOTC | ENGINE OIL TEMPERATURE CONNECTOR |
| EOTS | ENGINE OIL TEMPERATURE SENSOR |
| EUI | ELECTRONIC UNIT INJECTOR |
| FS | FUEL SOLENOID |
| GPHI | GROUND POST HIGH |
| GPLO | GROUND POST LOW |
| GSC | GENSET STATUS CONTROL |
| GSM | GOVERNOR SYNC MOTOR |
| IC | REMOTE START INITIATE CONTACT |
| LWLAS | LOW WATER LEVEL ALARM SWITCH |
| LFLAS | LOW FUEL LEVEL ALARM SWITCH |
| MPU | MAGNETIC PICKUP |
| NEG | NEGATIVE |
| POS | POSITIVE |
| PWR | POWER |
| PWM | PULSE WIDTH MODULATOR |
| RAN | REMOTE ANNUNCIATOR (FOR NFPA 110 OR NFPA 99) |
| SM | STARTING MOTOR |
| TSC | TRANSFER SWITCH POSITION CONTACT |
| VR | VOLTAGE REGULATOR |
| ------ | CUSTOMER WIRING |

NOTE A: DO NOT OPERATE ALTERNATOR WITHOUT A BATTERY CONNECTED TO THE SYSTEM. DO NOT POLARIZE ALTERNATOR. DO NOT OPERATE ALTERNATOR SIMULTANEOUSLY WITH A DC GENERATOR TO CHARGE A COMMON BATTERY.

NOTE B: TO BE WIRED BY CUSTOMER TO ENGINE REMOTE STARTING INITIATE CONTACT(NO.) IN AUTO TRANSFER SWITCH.

NOTE C: AUXILIARY CONTACT(N.O.) ON EMERGENCY SIDE OF TRANSFER SWITCH REQUIRED ONLY WHEN OPTIONAL GENERATOR SET REMOTE ANNUNCIATOR PANEL IS PROVIDED. (FOR GENERATING INDUCATION)

NOTE D: GROUND MPU SHIELDED CABLE AT GENSET STATUS CONTROL MODULE MOUNTING STUD ONLY.

NOTE E: VARIOUS CUSTOMER SWITCHES CAN BE ACCOMMODATED FOR INTERFACE WITH VARIOUS OPTIONAL ALARM MODULES PROVIDE IN THE GENERATOR CONTROL PANEL.

NOTE F: MOUNT CURRENT TRANSFORMERS WITH POLARITY MARK FACING GENERATOR.

FOR USE WITH EMCPII/II+, MAXIMUM VOLTAGE 600 VOLTS L-L

Illustration 109

g00601444

i01136288

# Service Record

**SMCS Code:** 4490

Table 26

| SERVICE TABLE - RECORD OF SETPOINT VALUES | | | | | |
|---|---|---|---|---|---|
| **Generator Description: Site, Serial No., EMCP II Model No., etc.** | | | | | |
| **Setpoint** | **Specified Value** | **Actual Value(1)** | **Setpoint Description** | **Possible Values** | **Default Value** |
| **Setpoint Programming - OP5** | | | | | |
| P01 | | | Fuel Solenoid Type | 0 = ETR, 1 = ETS | 0 |
| P02 | | | Units Shown | 0 = Eng, 1 = metric | 0 |
| P03 | | | Shutdown Override For Engine Fault | 0 = shutdown, 1 = alarm | 0 |
| P04 | | | Shutdown Enable For Sensor Fault | 0 = alarm, 1 = shutdown | 0 |
| P05 | | | Coolant Loss Sensor | 0 = w/o sensor, 1 = w/sensor | |
| P06 | | | Shutdown Override For Coolant Loss Fault | 0 = shutdown, 1 = alarm | 0 |
| P07 | | | System Voltage | 0 = 24 volts, 1 = 32 volts | 0 |
| P08(2) | | | Upper Display | 0 = enable, 1 = disable | 0 |
| P09 | | | Ring Gear Teeth | 95 to 350 teeth | 136 teeth |
| P10 | | | Engine Overspeed | 500 to 4330 rpm | 2120 rpm |
| P11 | | | Crank Terminate Speed | 100 to 1000 rpm | 400 rpm |
| P12 | | | Oil Step Speed | 400 to 1800 rpm | 1350 rpm |
| P13 | | | Low Oil Pressure Shutdown At Rated Speed | 34 to 420 kPa (5 to 60 psi) | 205 kPa (30 psi) |
| P14 | | | Low Oil Pressure Shutdown At Idle Speed | 20 to 336 kPa (3 to 50 psi) | 70 kPa (10 psi) |
| P15 | | | High Water Temperature Shutdown | 85 to 123°C (185 to 253°F) | 107°C (225°F) |
| P16 | | | Low Water Temperature Alarm | 0 to 36°C (32 to 97°F) | 21°C (70°F) |
| P17 | | | Total Cycle Crank Time | 5 to 120 seconds | 90 seconds |
| P18 | | | Cycle Crank Time | 5 to 60 seconds | 10 seconds |
| P19 | | | Cooldown Time | 0 to 30 minutes | 5 minutes |
| P20 | | | AC Voltage Full Scale | 150 V to 18000 V | 700 V |
| P21 | | | AC Current Full Scale | 75 A to 40000 A | 600 A |
| P22(3) | | | GSC Engine Number | 01 to 08 | 01 |
| P23 | | | Engine Type | 0 = MUI diesel, 1 = spark ignited, 2 = EUI diesel | 0 |
| P24 | | | Crank Time Delay | 0 to 20 seconds | 5 seconds |
| **Spare Input/Output Programming - OP6** | | | | | |
| SP01 | | | Spare Fault 1 Active State | 0 = Low, 1 = High | 0 |
| SP02 | | | Spare Fault 1 Response | 0 = Shutdown, 1 = Alarm | 0 |

(continued)

(Table 26, contd)

| SERVICE TABLE - RECORD OF SETPOINT VALUES | | | | | |
|---|---|---|---|---|---|
| **Generator Description: Site, Serial No., EMCP II Model No., etc.** | | | | | |
| **Setpoint** | **Specified Value** | **Actual Value**[1] | **Setpoint Description** | **Possible Values** | **Default Value** |
| SP03 | | | Spare Fault 2 Active State | 0 = Low, 1 = High | 0 |
| SP04 | | | Spare Fault | 0 = Shutdown, 1 = Alarm | 0 |
| SP05 | | | Spare Fault | 0 = Low, 1 = High | 0 |
| SP06 | | | Spare Fault | 0 = Shutdown, 1 = Alarm | 0 |
| SP07 | | | Spare Output Active State | 0 = Low, 1 = High | 0 |
| SP08 | | | Spare Fault 1 Delay Time | 0 to 250 seconds | 0 seconds |
| SP09 | | | Spare Fault 2 Delay Time | 0 to 250 seconds | 0 seconds |
| SP10 | | | Spare Fault 3 Delay Time | 0 to 250 seconds | 0 seconds |
| SP11 | | | Spare Output Response | See Service Manual | 7 = cooldown |
| **Voltmeter/Ammeter Programming - OP8** | | | | | |
| AC01 | | | A-B Voltage Calibration | 0 to 255 | NA[4] |
| AC02 | | | B-C Voltage Calibration | 0 to 255 | [4] |
| AC03 | | | C-A Voltage Calibration | 0 to 255 | [4] |
| AC04 | | | A Current Calibration | 0 to 255 | [4] |
| AC05 | | | B Current Calibration | 0 to 255 | [4] |
| AC06 | | | C Current Calibration | 0 to 255 | [4] |

[1] The actual value space is provided for recording and comparing values during future servicing or troubleshooting of the particular genset.
[2] P08 is engine type (0 = diesel, 1 = gas) on former 103-6177, 113-4500 and 117-6200 GSC's.
[3] Not present on former 103-6177, 113-4500 and 117-6200 GSC's.
[4] The default value is not applicable (NA). A random value is assigned to the setpoint when a GSC internal memory fault (CID 268 0 occurs.

This table provides a record of setpoint values for a singular genset. The table is intended to be an easy reference for future servicing or troubleshooting of a particular genset.

# Index

**T**



**V**



**Z**

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