CATERPILLAR®

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January 2008

Systems Operation Troubleshooting Testing and Adjusting

Electronic Modular Control Panel II+ Paralleling (EMCP II+P)

SXC1-Up (Generator Set)

For C32 Generator Set Packaged in Griffin, GA

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.

⚠ WARNING

When replacement parts are required for this product Caterpillar recommends using Caterpillar replacement parts or parts with equivalent specifications including, but not limited to, physical dimensions, type, strength and material.

Failure to heed this warning can lead to premature failures, product damage, personal injury or death.

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General Information

SMCS Code: 4490

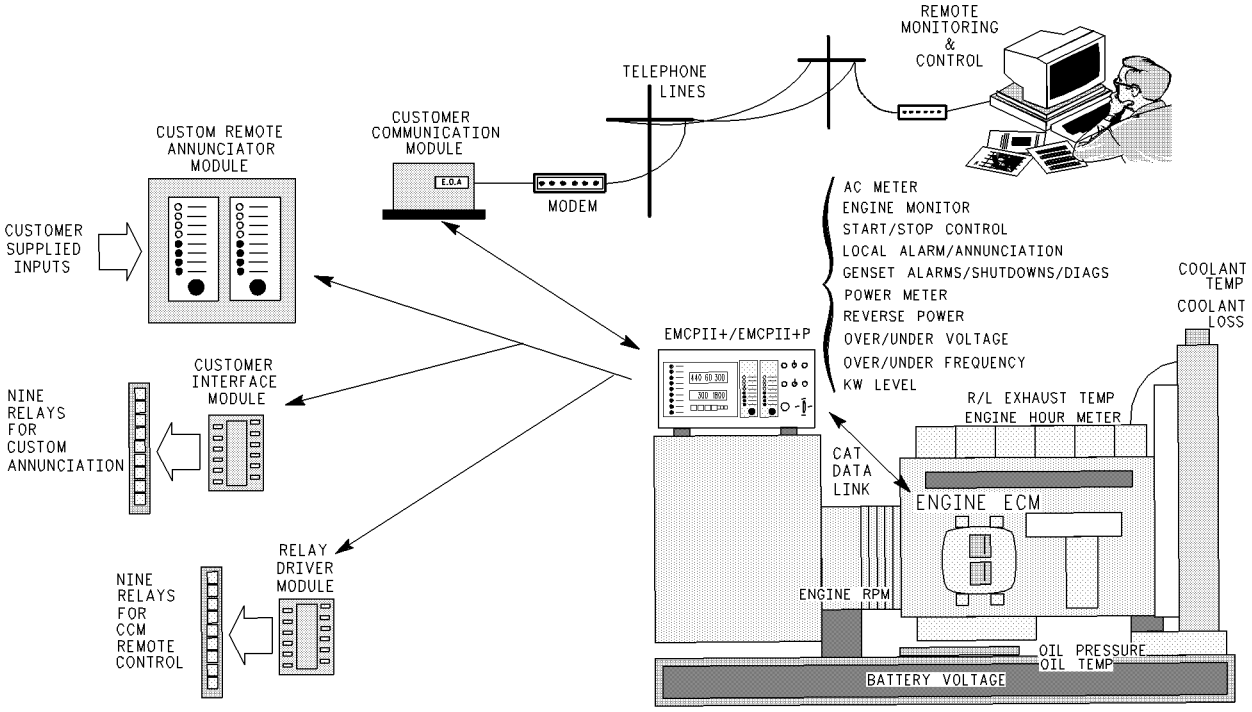

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Illustration 1

Block diagram of a generator set with EMCP II+

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Component Location

SMCS Code: 4490

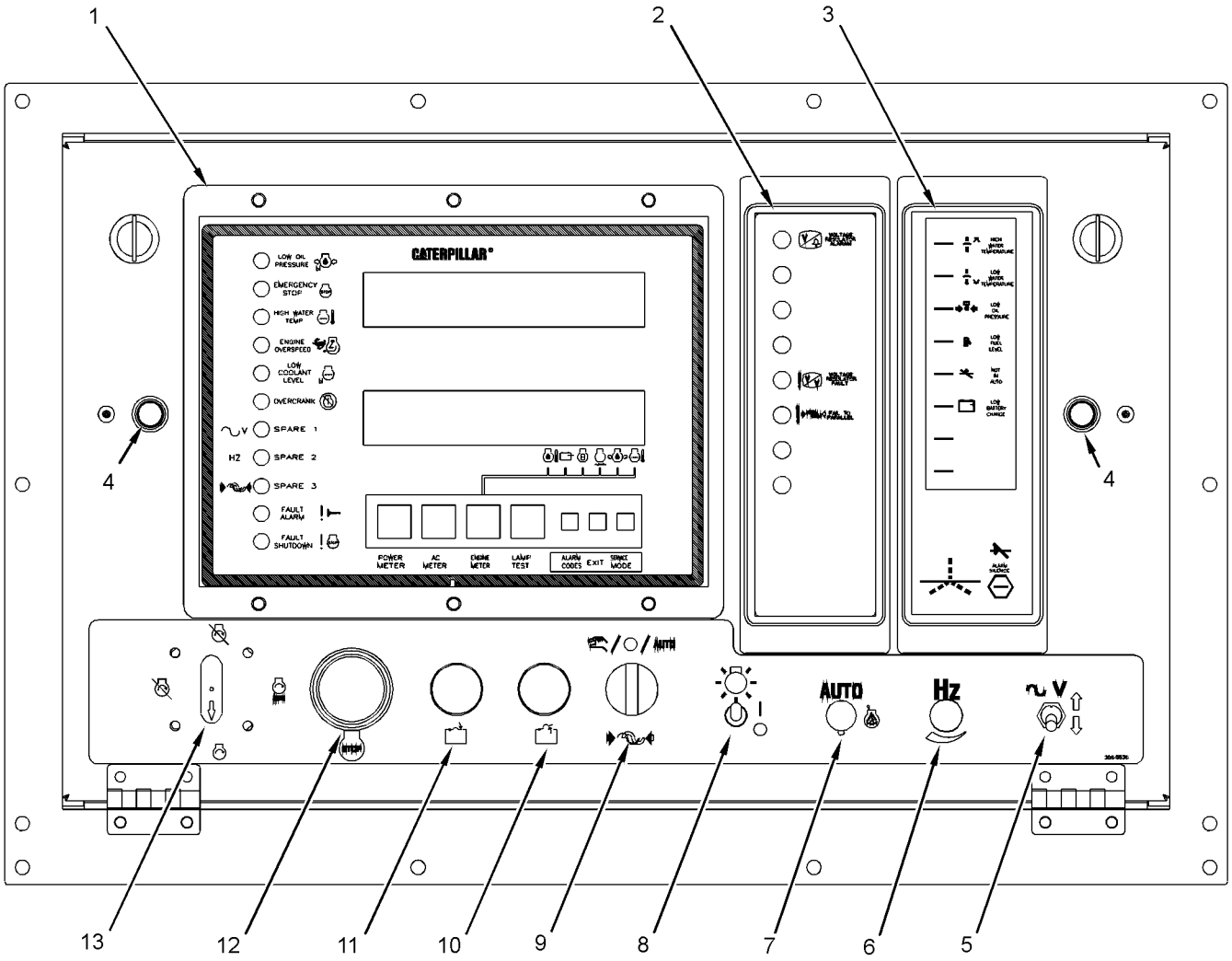

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Illustration 2

Control Panel

(1.) Generator Set Control with Paralleling (GSC+P)
(2) Custom Alarm Module (CAM)
(3) Alarm Module (ALM)
(4) Panel light
(5) Voltage Adjust Switch (VAS)
(6) Speed Adjust Potentiometer (SAP)
(7) Either Starting aid (ES)
(8) Panel Light Switch (PLS)
(9) Paralleling Control Switch (PCS)
(10) Circuit Breaker Close Push button (CBCPB) indicator light
(11) Circuit Breaker Open Push button (CBOPB) indicator light
(12) Emergency Stop Push button (ESTOP)
(13) Engine Control Switch (ECS)

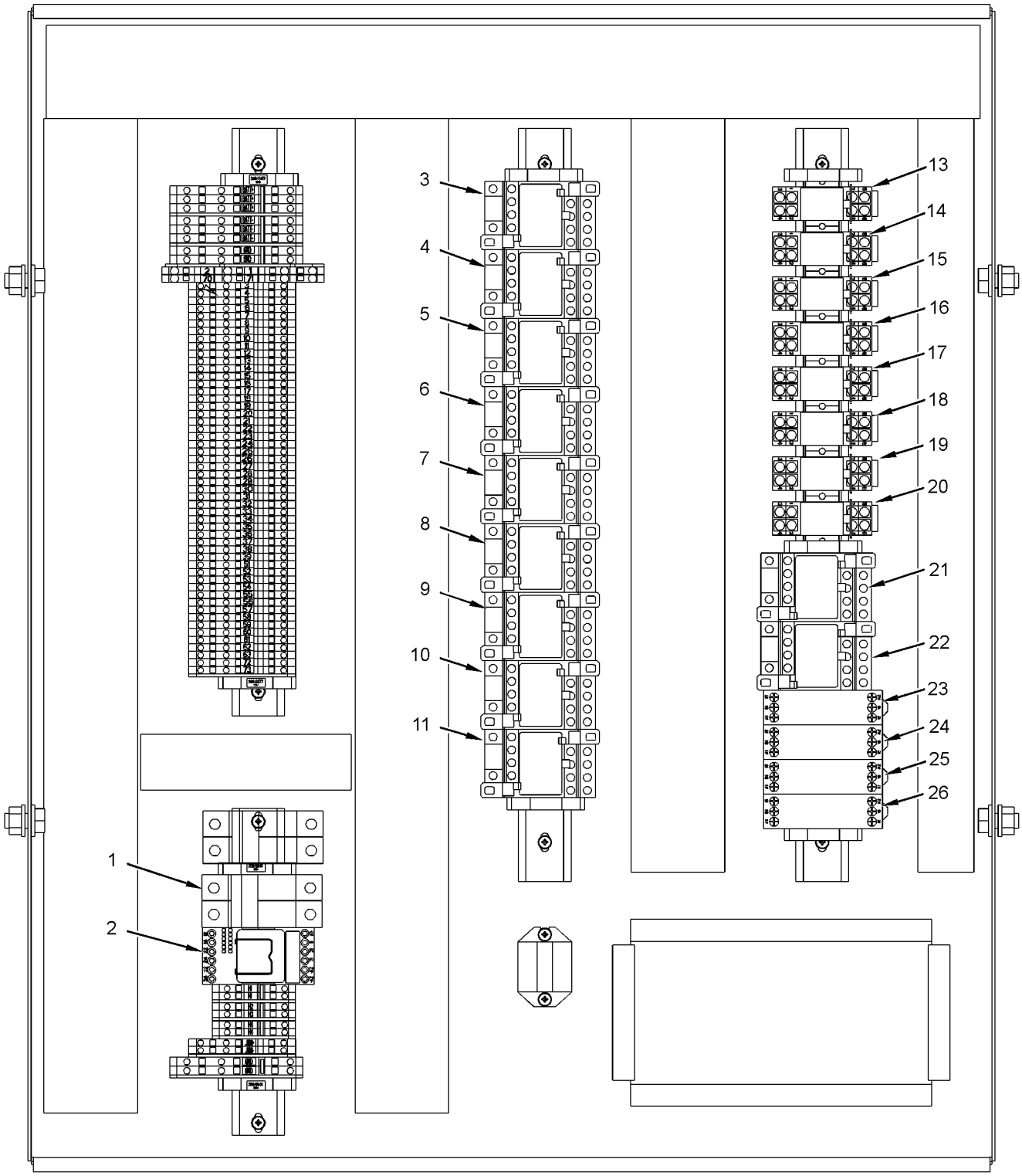

Illustration 3 g01444726
Relay panel

(1) AC Circuit Breaker (AC-CB1)
(2) AC Control Relay (AC-CR2)
(3) Off/Reset Relay (ORR)
(4) Shutdown Relay (SDR)
(5) Circuit Breaker Relay (CBR)
(6) Dead Bus Relay (DBR)
(7) Off/Reset Relay Auxiliary (ORRX)
(8) Fail to Parallel Relay (FPR)
(9) Cooldown Relay (CDR)
(10) Voltage Build up Relay (VBR)
(11) System in Auto Relay (SIAR)
(12) Diode
(13) Voltage Regulator Alarm Relay (VRAR)
(14) Voltage Regulator Failure Relay (VRFR)
(15) Generator Run Relay (GRR)
(16) Control Transformer Shorting Relay (CSR)
(17) Circuit Breaker Close Relay (CBCR)
(18) Circuit Breaker Permissive Relay (CBPR)
(19) Run Relay (RR)
(20) Dead Bus Permissive Relay (DBPR)
(21) Load Shed/add Relay (LSR)
(22) Circuit Breaker Relay Auxiliary (CBX1)
(23) Dead Bus Permissive Timer (DBPT)
(24) Dead Bus Alternate Timing Relay (DBATR)
(25) Fail to Parallel Timer (FPT)
(26) Dead Bus Timing Relay (DBTR)

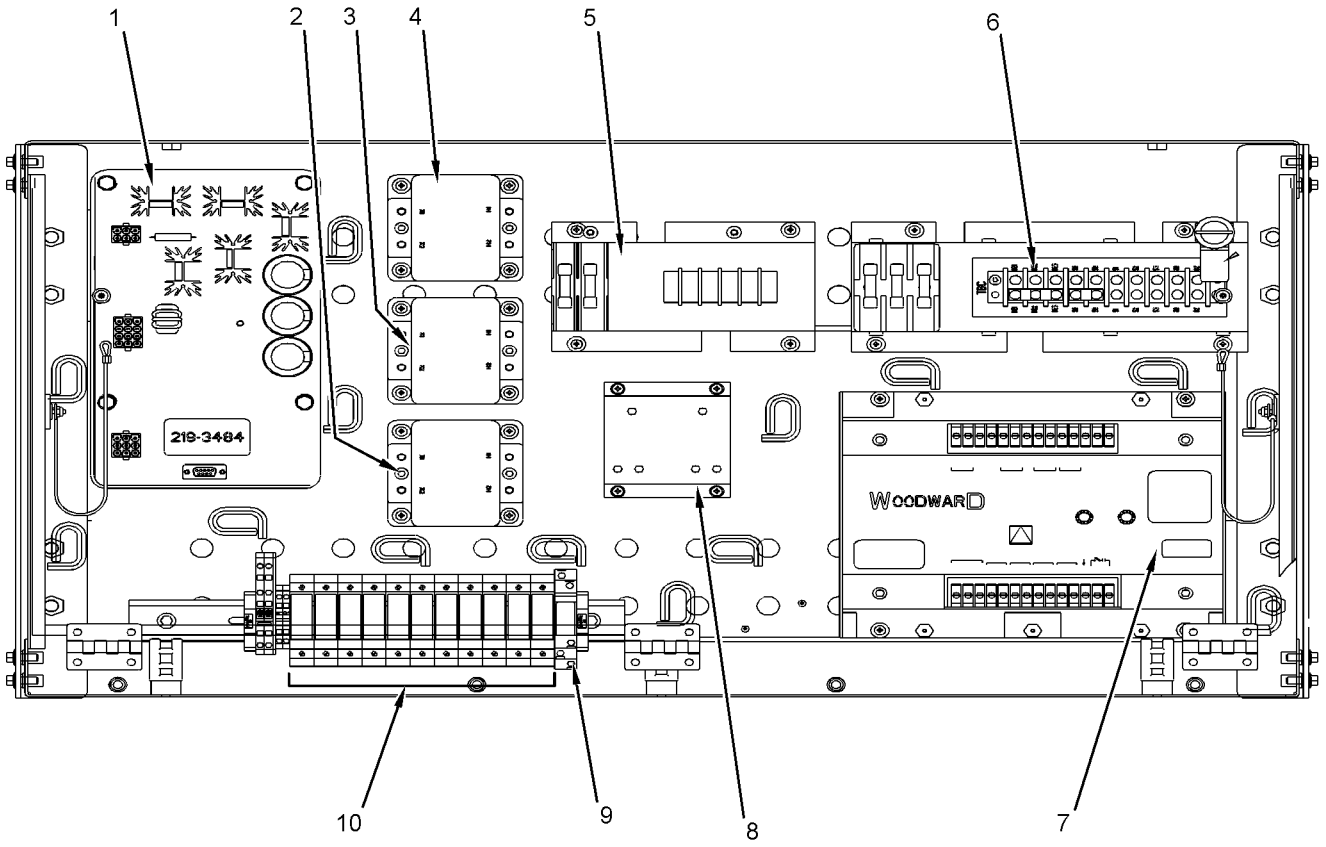

Illustration 4
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Caterpillar Digital Voltage Regulator (CDVR) panel

(1) Caterpillar Digital Voltage Regulator (CDVR)
(2) Bus Potential Transformer (PT3)
(3) Generator Potential Transformer (PT2)
(4) Generator Potential Transformer (PT1)
(5) Bus Transformer Box (BTB+)
(6) AC Transformer Box (ATB+)
(7) Load Share Module (LSM)
(8) Voltage Frequency Relay (VFR)
(9) Bus Voltage Relay (BVR)
(10) Fuses (F6-F12)

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EMCP Electronic Control (Generator Set)

SMCS Code: 4490

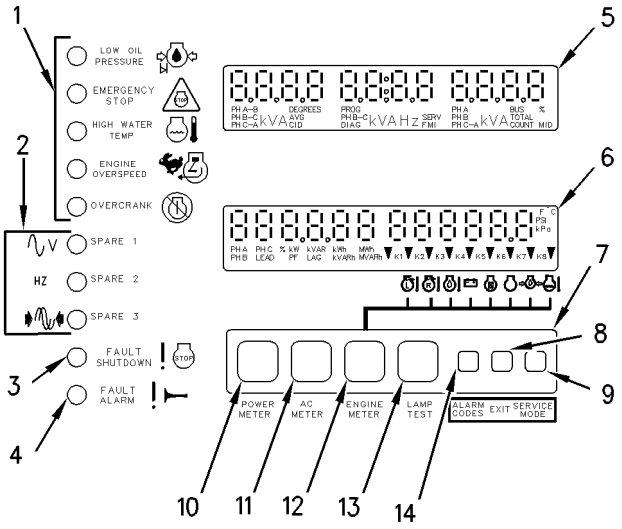

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Illustration 5

Display Area Of The Generator Set Control+P (GSC+P)

(1) Dedicated Shutdown Indicators
(2) Spare Fault Indicators (Or synchronizing lights on GSC+P)
(3) Fault Shutdown Indicator
(4) Fault Alarm Indicator
(5) Upper Display
(6) Lower Display
(7) Keypad
(8) Exit Key
(9) Service Mode Key
(10) Power Meter Key And Scroll Right Key
(11) AC Meter Key And Scroll Up Key
(12) Engine Meter Key And Scroll Down Key
(13) Lamp Test Key And Select Key
(14) Alarm Codes Key And Enter Key

Note: The pictographs shown to the left of the Spare Fault Indicators (2) are present only in paralleling applications.

The main component of the EMCP II+P system is the generator set control (GSC+P). The GSC+P is designed to operate when the GSC+P is powered by 24 DCV or 32 DCV. The GSC+P monitors and controls many of the functions of the generator set. The functions and features of the GSC+P are listed below.

- The GSC+P provides the generator AC output information. The information includes the metering of power. The GSC+P controls starting and stopping of the engine.
- The GSC+P shows engine conditions and generator output information on two displays.
- The displays show the fault codes. The displays also show the information for programming that is used by the GSC+P.
- The GSC+P monitors the system for faults. If a fault occurs, the GSC+P provides a fault alarm annunciation or the GSC+P performs a controlled fault shutdown. The GSC+P uses indicators and displays in order to describe the fault to the operator or the service technician.
- The GSC+P contains programmable features for certain applications. The programmable features are also used by the GSC+P in order to meet the requirements of the customers.

Note: Setting P023 to 0 ensures proper operation on MUI engines. Set P023 to 1 for Gas engines. Set P023 to 2 for EUI engines. Failure to set setpoint P023 can result in improper engine operation, incorrect display of engine parameters, and logging an erroneous CID 590 diagnostic code. For more information on the P023 setpoint and other GSC+P setpoints, refer to Systems Operation, “Engine-Generator Programming OP5-0”.

GSC+P Part Number

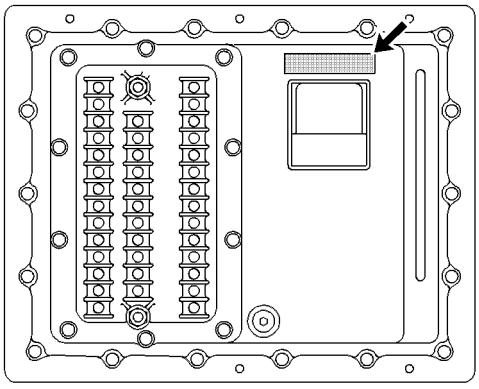

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Illustration 6

Location Of GSC+P Part Number

Rear View Of GSC+P

The part number is stamped into the rear housing of every GSC+P above the harness connector. When the GSC+P is updated internally, the part number also changes. The part number can be used to identify the effectivity of any changes.

GSC+P Serial Number

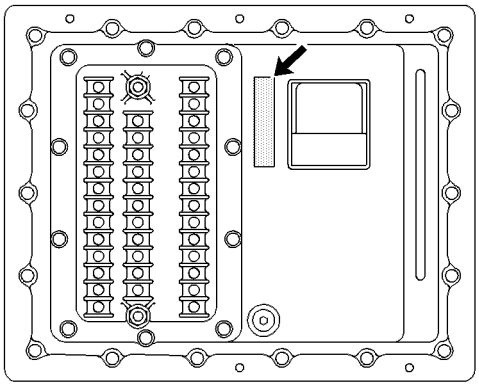

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Illustration 7

Location Of GSC+P Serial Number

Rear View Of GSC+P

The serial number of the GSC+P is a ten digit number which is unique for each GSC+P. The preceding illustration shows the location of the serial number on the back of the GSC+P. The serial number is also shown to service personnel when the GSC+P is in option OP2-2. The serial number which is shown on the display and the actual serial number will always match. Refer to Systems Operation, “AC Factory Calibration Setpoint Viewing OP2-2”.

Fault Indicators

The ten fault indicators are used in order to show a fault that is present. The ten fault indicators are also used to describe a fault that is present. The fault indicators are divided into four groups. The four groups are the fault alarm indicator (4), the spare fault indicators (2), the fault shutdown indicator (3) and the dedicated shutdown indicators (1).

The yellow fault alarm indicator (4) FLASHES when the GSC+P detects a fault that is an alarm fault. The alarm fault does not cause the engine status to change. The engine is able to start. The engine will continue operating, only if the engine is running at the time of the alarm fault. Fault alarm indicator (4) is accompanied by an alarm fault code that is shown on upper display (5) when the alarm codes key is pressed.

The red fault shutdown indicator (3) FLASHES when the GSC+P detects a fault that is a shutdown fault. The engine is shutdown if the engine is running and the engine is not allowed to start. Fault shutdown indicator (3) is accompanied by a fault code that is immediately shown on the upper display (5).

The yellow spare fault indicators (2) FLASH when the conditions that are associated with that spare fault are active. The three spare faults can be programmed to show coolant loss, oil temperature, spare fault condition or no assignment. The spare fault condition may be a customer generated switch input. Refer to Systems Operation, “SP Fault Codes” for more information. The yellow fault alarm indicator (4) or the red fault shutdown indicator (3) will accompany the spare fault indicators (2). The spare fault indicators will tell whether the spare fault input is programmed to be an alarm condition or a shutdown condition.

The “Spare Fault” indicators have alternate functions on the GSC+P during synchronization functions. Spare 1 becomes the voltage indicator. This indicator will illuminate when the difference between the bus voltage and the oncoming generator voltage are within acceptable limits. Spare 2 becomes the frequency indicator. This indicator will illuminate when the frequency difference between the bus and the oncoming generator are within acceptable limits. Spare 3 becomes the phase match indicator. This indicator illuminates when the phase difference between the bus and the oncoming generator are within acceptable limits. When the GSC+P is not performing paralleling functions, the Spare Fault indicators retain normal function as explained in Systems Operation, “Spare Input/Output Programming OP6”.

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

Many of the dedicated shutdown faults depend on certain setpoints in the GSC+P. Refer to Systems Operation, “Setpoint Programming OP5” for more information. To restart the engine after a shutdown, refer to Systems Operation, “Shutdown Mode”.

The conditions that are required to activate the dedicated fault shutdowns 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+P. There are two low oil pressure setpoints. One setpoint is used when the engine is at idle speed. The other setpoint is used when the engine is at rated speed. When a low oil pressure fault occurs, the low oil pressure indicator FLASHES, and the engine is shut down. The engine is not allowed to start until the fault is corrected.

Emergency Stop – The operator presses the Emergency Sop Push Button (ESPB) on the front panel. When an emergency stop condition occurs, the emergency stop indicator FLASHES and 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+P. When the high water temperature fault occurs, the high water temperature indicator FLASHES. The engine is shutdown and 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+P. When the engine overspeed fault occurs, the engine overspeed indicator FLASHES. The engine is shutdown and 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+P. When the overcrank fault occurs, the overcrank indicator FLASHES. The engine is not allowed to start until the fault is corrected.

Note: The GSC+P can be programmed to override the shutdown for low oil pressure and high water temperature faults. When the operator overrides the shutdown faults, the GSC+P responds to the faults as though the faults are alarm faults. The corresponding dedicated shutdown indicator is ON CONTINUOUSLY. The corresponding dedicated shutdown indicator will not be flashing. The engine continues to run and the engine continues to start instead of shutting down. When the dedicated shutdown indicator is ON CONTINUOUSLY, the setpoint for shutdown has been exceeded, but the GSC+P is programmed to override the shutdown fault. The GSC+P does not treat the shutdown fault as a shutdown fault. The GSC+P treats the shutdown fault as an alarm fault. At the factory, the GSC+P is programmed to treat a low oil pressure fault and a high water temperature fault as shutdown faults. The operator or the service technician must decide to override these shutdown faults. If desired, the operator or the service technician can program the GSC+P to treat the shutdown faults as alarm faults.

Upper Display

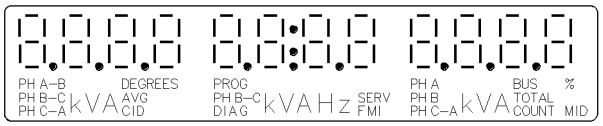

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Illustration 8

Upper Display (5) With All Segments

The primary function of the upper display (5) is showing the following information of the generator output: AC voltage, current, and frequency. Several options are available on the upper display for AC metering. These options can be viewed one at a time by pressing the AC Meter key on the keypad. The options are listed below.

- Voltage (average), generator frequency, current (total)
- Voltage (line-line), generator frequency, current (line) for any one phase
- Voltage (line-line) for all three phases at once
- Current (line) for all three phases at once

Note: When total current increases above “9999A”, the GSC+P will show current in “kA” units.

- Voltage (line-neutral) for all three phases at once

Note: Line-neutral voltages are not shown when setpoint “P032” is set to 1 (delta generator sets)

Upper display (5) is also used to show the various fault codes for system faults. For more information on fault codes, refer to Systems Operation, “Fault Description”.

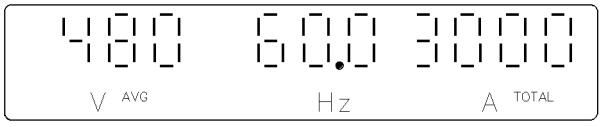

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Illustration 9

Upper Display Showing:

480 volts, average line to line voltage of all three phases

60 hertz, generator frequency

3000 amperes, total line current of all three phases

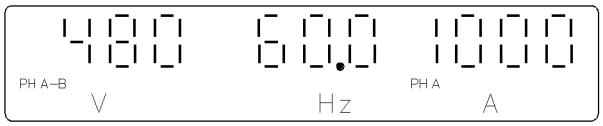

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Illustration 10

Upper Display Showing:

480 volts, line to line voltage of phase A to phase B

60 hertz, generator frequency

1000 amperes, total line current of phase A

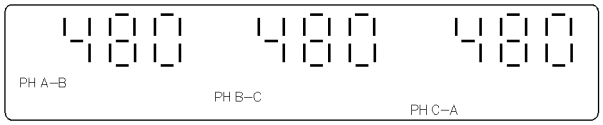

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Illustration 11

Upper Display Is Showing:

480 volts, line to line voltage of phase A-B

480 volts, line to line voltage of phase B-C

480 volts, line to line voltage of phase C-A

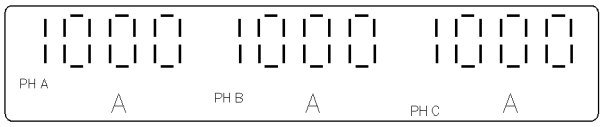

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Illustration 12

Upper Display Is Showing:

1000 Amps, line current of phase A

1000 Amps, line current of phase B

1000 Amps, line current of phase C

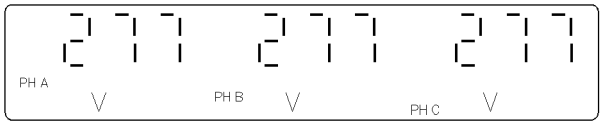

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Illustration 13

Upper Display Is Showing:

277 Volts, line to neutral voltage of phase A

277 Volts, line to neutral voltage of phase B

277 Volts, line to neutral voltage of phase C

Note: Line to neutral voltages are not shown when the setpoint P032 is set to 1 for delta generator sets.

Lower Display

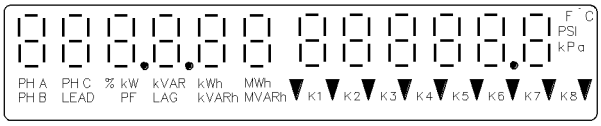

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Illustration 14

Lower Display (6) With All Segments

The lower display (6) shows values for power metering, engine parameters and the relay status. The left side of the lower display serves as a power meter for the generator set. The following functions will scroll automatically.

- Total real power (kW)
- Total reactive power (KVAR)
- Percentage of rated power (%kW)
- Power factor (average)
- Total energy output (kW/h)

The display will stop scrolling when the operator presses the power meter key for less than five seconds. The display will show a particular parameter continuously. Additional power meter functions will scroll, if the power meter key is held for more than five seconds and then released. The additional functions are shown below.

- Total real power (kW)
- Real power phase A (kW)
- Real power phase B (kW)
- Real power phase C (kW)
- Total apparent power (kVA)
- Total reactive power (KVAR)
- Percentage of rated power (%kW)
- Power factor (average)
- Power factor phase A
- Power factor phase B
- Power factor phase C
- Total energy output (kW/h)

- Total reactive energy output (kVARHr)

Note: All real power values are signed with a “+” or a “−”. A negative value indicates reverse power.

Note: Real power phase A, B, and C as well as power factor phase A, B, and C are not shown when setpoint P032 is set to 1 for delta generator sets.

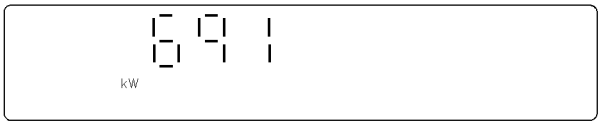

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Illustration 15

Lower Display Showing:

691 kW, total real power of generator output

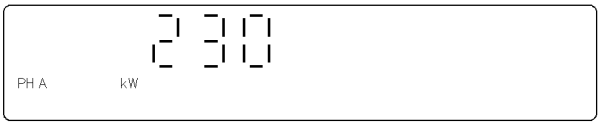

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Illustration 16

Lower Display Showing:

230 kW, real power of phase A

Note: Phase B and phase C can be viewed in a similar manner.

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Illustration 17

Lower Display Showing:

831 kVA, total apparent power.

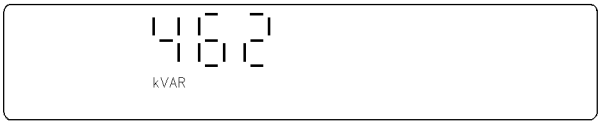

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Illustration 18

Lower Display Showing:

462 KVAR, total reactive power of generator output.

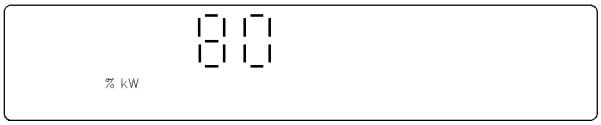

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Illustration 19

Lower Display Showing:

80 %kW, percentage of rated power of generator output

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Illustration 20

Lower Display Showing:

.83 PF, average power factor of generator output

Note: You may view the power factor for the individual phases in a similar manner.

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Illustration 21

Lower Display Showing:

1000 kW/h, total energy of generator output.

Note: Total energy output that is greater than 999,999 kW/h will be shown as MW/h in two steps in order to maintain a resolution of 1 kW/h. The first step will show MW/hm> as a whole number up to six places. The second step will show MW/hm> as a decimal to three places. For example: 1,000,001 kW/h will be shown as 1000 MW/h (first step), followed by .001 MW/h (second step).

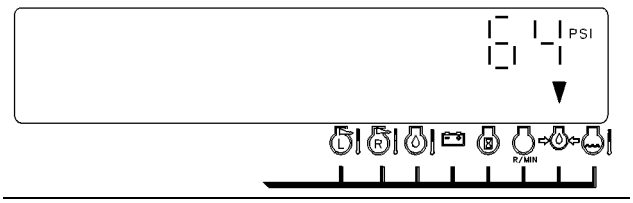

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Illustration 22

Lower Display Showing:

64 psi engine oil pressure.

The right side of lower display (6) shows the value of certain engine parameters. The parameters are listed below.

- Left side exhaust temperature (optional)
- Right side exhaust temperature (optional)
- Engine oil temperature (optional)
- System battery voltage
- Engine hours
- Engine speed
- Engine oil pressure
- Engine coolant temperature

Note: If the GSC+P displays dashes (---) for oil pressure, coolant temperature, or engine oil temperature, this indicates that the GSC+P is receiving invalid data from the sensor. The upper display will be showing a corresponding diagnostic code for the sensor. Refer to the appropriate procedure in Troubleshooting, “Troubleshooting Diagnostic Codes”.

The value for one of these conditions is shown on the display for two seconds. The display then 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, the lower display (6) stops scrolling. The lower display continuously shows one particular value. The pointer flashes above the value that is showing on the display.

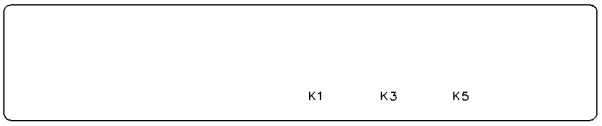

Illustration 23 g00394569

Lower Display Showing:

K1, K3 and K5 are active.

K2, K4, K6, K7 and K8 are not active.

The relay status indicators are on the bottom of the lower display. When a GSC+P relay is activated, the corresponding indicator (K1, K2, etc) is shown on lower display (6). When a relay is not activated, the corresponding indicator (K1, K2, etc) is not shown.

Keypad

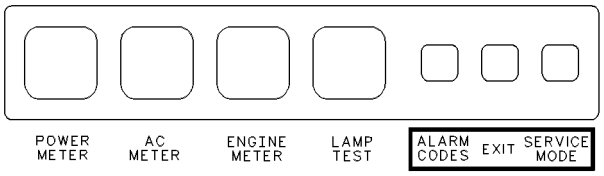

Illustration 24 g00395398

Keypad (7) for the EMCPII+P Control Panel

Keypad (7) is used to control the information that is shown on upper display (5) and lower display (6). The seven keys have two sets of functions, normal functions and service functions. Refer to the topic Systems Operation, “Service Mode” for a description of the service functions of the keys. The normal functions of the keys are described in the following paragraphs.

Power Meter Key – This key controls the viewing of power meter information. This information is shown on the lower display. Pressing the key for at least five seconds causes all the power meter data to scroll once. The default power meter data then resumes scrolling. Briefly pressing this key (for less than five seconds) will stop the scrolling of the power meter functions until the key is pressed again.

AC Meter Key – The AC meter key controls the viewing of the AC parameters on the upper display. Pressing the key causes the display to show a different set of parameters.

Engine Meter Key – This key controls the viewing of engine parameters on the lower display. Pressing the key stops the scrolling of engine conditions. The value for one particular engine condition will show continuously. The pointer flashes indicating that the scrolling is stopped. The scrolling of the engine conditions will resume when the engine meter key is pressed again.

Lamp Test Key – Pressing this key performs a lamp test on the GSC+P and the optional alarm module. On the GSC+P, the ten fault indicators are ON CONTINUOUSLY. Every segment of upper display (5) and lower display (6) are ON. On the optional alarm module, all of the indicators are ON and the horn sounds. The lamp test function automatically turns off if an operator presses the key and holds the key for longer than ten seconds.

Alarm Codes Key – If fault alarm indicator (4) is FLASHING, pressing this key causes upper display (5) to show the corresponding alarm fault code. Pressing this key again will resume the showing of generator AC output information on the upper display (5). If fault alarm indicator (4) is OFF, this key has no function. For more information on alarm fault codes, refer to Systems Operation, “Fault Description”.

Exit Key – This key only functions when the GSC+P is in Service Mode. Refer to Systems Operation, “Service Mode”.

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

Relays

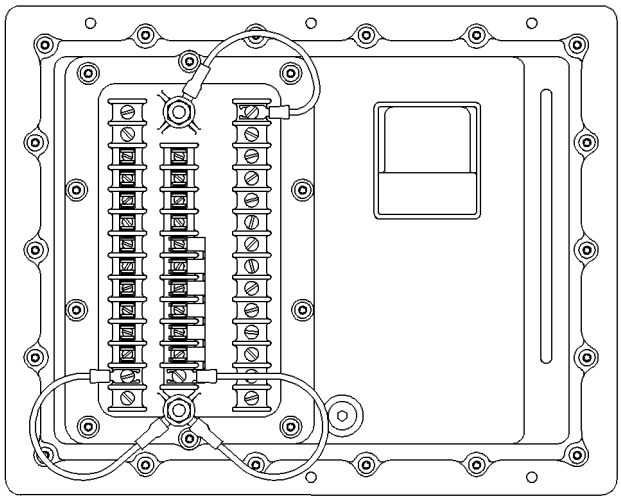

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Illustration 25

Relay Module On Rear Of GSC+P

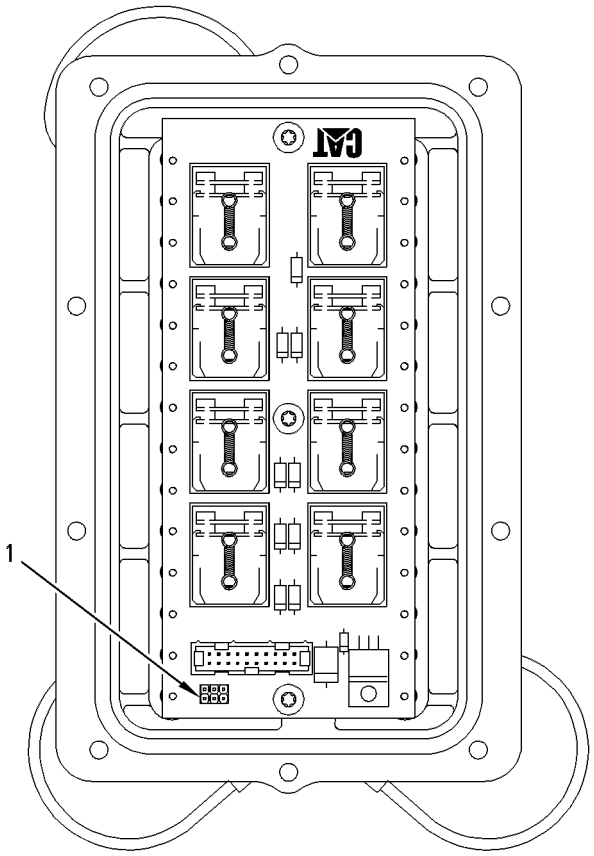

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Illustration 26

Relays In Relay Module

(1) Jumper block

The relays are located in the relay module on the rear of the GSC+P. The relays are permanently attached within the relay module. The relays are not removable. The entire relay module is replaced if a relay has failed. For more information, refer to Schematics And Wiring Diagrams, “Generator Set Wiring Diagram”.

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

Note: Jumper block (1) is used to select the voltage range of the voltmeter of the GSC+P. 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 factory equipped with the jumper block (1) installed. Refer to Testing And Adjusting, “AC Voltage Range Selection”.

Table 1

Load Specifications For GSC+P Relay Module		
Relay Module Terminal Number	**Rating For Resistive Loads**	**Rating For Inductive Loads**
RM13,14 - K1 - EGR N/O	0.45A at 24DCV	none(1)
RM15 - K7 - FCR N/O RM16 - K3 - CTR N/O RM17 - K3 - CTR N/C RM18 - K4 - SMR N/O RM21 - K4 - SMR N/C RM19 - K6 - ASR N/O RM20 - K6 - ASR N/C RM22 - K2 - GFR N/O RM24 - K5 - RR N/O	10A at 24DCV	10A at 24DCV
RM36,23 - K5 - RR N/C RM37,26 - K8 - PSR N/C RM38,25 - K8 - PSR N/O	10A at 24DCV	5A at 24DCV

(1) Do NOT connect inductive loads to these terminals.

The relays and the functions are listed below.

K1 – Electronic Governor Relay (EGR)

For the C32 package, this contact sends a run command to the ECM on the engine to begin the cranking sequence.

- When the relay is active the normally open contacts close.
- The relay has no normally closed contacts.

K2 – Generator Fault Relay (GFR)

The GSC+P uses the generator fault relay (GFR) to activate the shunt trip coil of the optional circuit breaker during a shutdown fault. The circuit breaker is located in the generator housing.

- 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)

The CTR is used to indicate that the engine is beginning to run without cranking. The GSC+P activates the CTR when the engine speed is greater than the crank terminate setpoint (400 RPM, setpoint P011) and the starting motor relay has been deactivated. The CTR deactivates when the engine RPM reaches 0.

- When the relay is active the normally open contacts close.
- 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 output is not used on the C32 package generator set.
- When the relay is inactive the normally closed contacts close.
- This relay is not used.

K5 – Run Relay (RR)

- When the relay is active the normally open contacts close. This provides power to the Run Relay (RR), AC Control Power Relay (AC-CR2). The K5 relay also sends the run command to the ADEM 3 controller on the engine.
- When the relay is inactive the normally closed contacts close. This contacts are for customer use.

K6 – Air Shutoff Relay (ASR)

- When the relay is active the normally open contacts close.
- When the relay is inactive the normally closed contacts close.
- This relay is not used.

K7 – Fuel Control Relay (FCR)

- When the relay is active the normally open contacts close.
- The relay has no normally closed contacts.
- This relay is not used.

K8 – Programmable Spare Relay (PSR)

On non-paralleling panels, this relay is for customer use. It is programmable to activate for a variety of conditions. On paralleling panels, this relay is used by the EMCP II+P and is not available for customer use. For more information, refer to Systems Operation, “Service Mode”.

- When the relay is active, the normally open contacts close.
- When the relay is inactive, the normally closed contacts close.

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Instrument Panel

SMCS Code: 4490; 7451

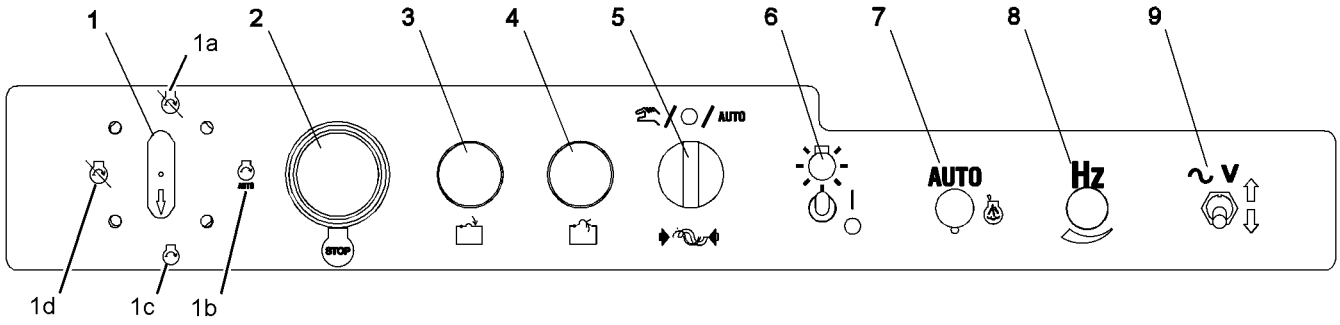

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Illustration 27

Instrument Panel Switches

(1) Engine Control Switch (ECS)
(2) Emergency Stop Push button (ESTOP)
(3) Circuit Breaker Close Push button (CBCPB)
(4) Circuit Breaker Open Push button (CBOPB)
(5) Paralleling Control Switch (PCS)
(6) Panel Light Switch (PLS)
(7) Ether Starting Aid Switch (ES)
(8) Speed Adjust Potentiometer (SAP)
(9) Voltage Adjust Switch (VAS)

The Engine Control Switch (ECS) (1) determines the status of the control panel. In the AUTO position (1b), the GSC+P allows the operator to remotely control the generator set via customer supplied contacts. Also, the GSC+P allows the operator to remotely monitor the generator set via customer supplied contacts. The GSC+P allows the engine to start whenever the remote initiating contact is closed. The engine shuts down after the remote initiating contacts open.

A cooldown period for the engine is programmable for 0 to 30 minutes. The cooldown period allows the engine to cool before the engine shuts down. The cooldown period for the engine is set for five minutes at the factory. The engine starts and the engine runs while the ECS is in the MANUAL START position (1c). In the COOLDOWN/STOP position (1d), the engine shuts down after the programmed cooldown period. In the OFF/RESET position (1a), the engine shuts down immediately. Also, any fault indicators are reset. An active Emergency Stop Push Button (ESTOP) will not be reset until the ESTOP button is pulled out.

If the red ESTOP (2) is pressed, the power is removed from the engine ECM. The operator must pull the ESTOP (2) button out in order to to restart the engine. Next the operator must turn the ECS to OFF/RESET and then turn the ECS to the MANUAL START.

The Circuit Breaker Close Push Button (CBCPB) (3) is used to manually close the circuit breaker when operating the GSC+P in the MANUAL/PARALLELING mode. The CBCPB is also an illuminated button. The CBCPB will illuminate when the circuit breaker is closed.

The Circuit Breaker Open Push button (CBOPB) (4) is used to manually open the circuit breaker. The CBOPB is also an illuminated button. The CBCPB will illuminate when the circuit breaker is open.

The Paralleling Control Switch (PCS) (5) controls the paralleling operation of the generator. Refer to Systems Operation, “Paralleling Mode” for a description of the paralleling functions.

The Panel Light Switch (PLS) (6) turns ON the panel lights and turns OFF the panel lights.

The Speed Adjust Potentiometer (SAP) (8) is used to raise the engine speed. The SAP is also used to lower the engine speed.

The Voltage Adjust Switch (VAS) (9) is used to raise the generator voltage. The VAS switch is also used to lower the generator voltage.

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Data Link

SMCS Code: 4490

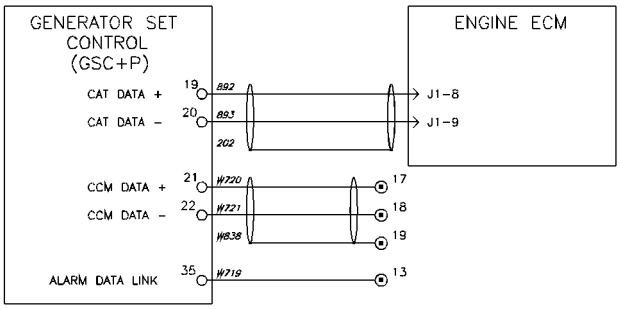

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Illustration 28

The Connection Points For The CAT Data Link.

ALM Data Output – This serial data link is a single directional link. The GSC+P uses this data link for one-way communication with optional Alarm Modules (ALM) or the optional Customer Interface Module (CIM). The ALM Data Link consists of a single wire that connects the GSC+P (connector contact 35) to an ALM or a CIM. A return connection (battery negative) is required between the GSC+P and the module. Refer to Systems Operation, “Alarm Modules” for more information about the ALM Data Link. Also, refer to Systems Operation, “Customer Interface Module”for more information on the ALM Data Link.

CAT Data Link – This serial data link is bidirectional. The data link has two functions. This data link is used for two-way communication with the engine ECM. The CAT Data Link uses a shielded twisted pair cable that connects the GSC (connector contact 19 and connector contact 20) to the CCM or to the engine ECM. For more information, refer to the Systems Operation, “Customer Communication Module”.

CCM Data Link – This serial data link is bidirectional. The GSC uses this data link for two-way communication with the optional Customer Communication Module (CCM). The Data Link uses a shielded twisted pair cable that connects the GSC (connector contact 21 and connector contact 22) to the CCM. For more information, refer to the Systems Operation, “Customer Communication Module”.

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Sensors

SMCS Code: 4490

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

- Liquid Level Sensor (Engine Coolant) for all engines
- Optional Temperature Sensor (Engine Oil) for all engines
- Speed Sensor (Engine) for all engines

Note: On C32 controlled engines, all of the listed sensors are connected directly to the GSC+P. On C32 engines the oil pressure sensor and coolant temperature sensor are connected to the engine ECM instead of the GSC+P. The engine ECM sends the data from these two sensors to the GSC+P display. Refer to Troubleshooting, RENR9348 for information on these two sensors.

Temperature Sensor (Engine Oil)

Note: This description applies to EUI,MUI and PEEC controlled engines.

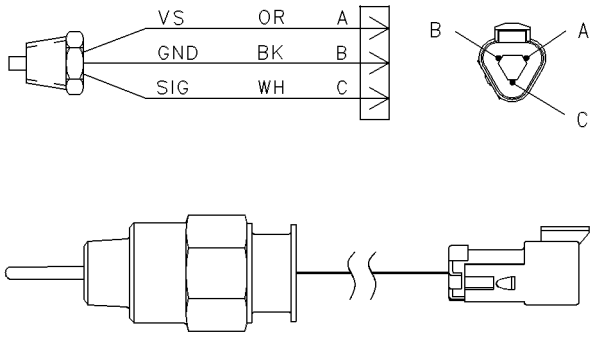

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Illustration 29

Engine Oil Temperature Sensor

The engine oil temperature sensor is optional and the sensor is an input of the GSC+P. The sensor reports the engine oil temperature to the GSC+P. The GSC+P shows the engine oil temperature on the lower display. Also, the GSC+P uses the information from the sensor in order to determine when a high oil temperature alarm exists. The engine oil temperature sensor is mounted on the outside of one of the engine oil galleries. The exact location depends on the engine model.

The engine oil temperature sensor is a pulse width modulated type of sensor. The sensor continuously generates a PWM signal. The duty cycle of the PWM signal continuously varies from 10% to 95% in proportion to the oil temperature of the engine. The GSC+P receives the PWM signal and the GSC+P measures the duty cycle in order to determine the engine oil temperature. The base frequency of the signal is constant at 455 Hz (370 to 550 Hz). The signal wire of the oil temperature sensor connects to connector contact 14 of the GSC+P. 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+P (connector contact 9).

There are five setpoints that are related to engine oil temperature. The five setpoints are programmed into the GSC+P. The related setpoints are P003, P004, P025, P026 and P027. Refer to Systems Operation, “Engine/Generator Programming OP5-0”.

Fluid Level Sensor (Engine Coolant)

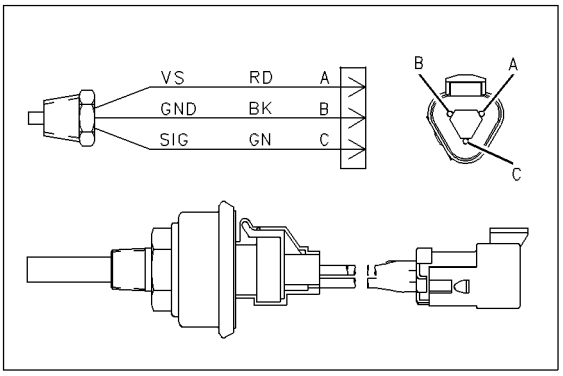

Illustration 30 g00311256

Engine Coolant Loss Sensor

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

The engine coolant loss sensor sends a negative battery signal to the GSC+P. “BATT-” for a normal level. Also, the engine coolant loss sensor sends +5 DCV to the GSC+P for a low level. The signal wire (connector contact “C”) of the coolant loss sensor connects to connector contact 13 of the GSC+P. The sensor is supplied operating power (8 DCV) at connector contact “A” from the GSC+P (connector contact 9).

There are three setpoints that are related to the loss of engine coolant. The setpoints are programmed into the GSC+P. The related setpoints are P004, P005 and P006. Refer to Systems Operation, “Engine/Generator Programming OP5-0”.

Speed Sensor (Engine)

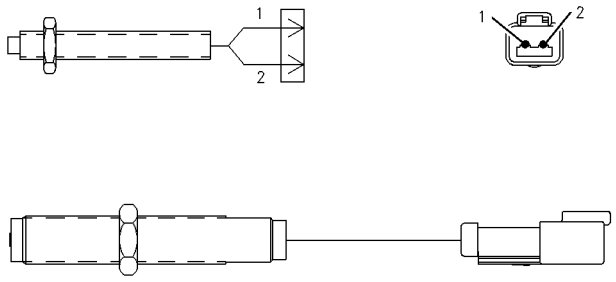

Illustration 31 g00311291

Engine Magnetic Speed Sensor

The engine magnetic speed sensor is an input of the GSC+P. The sensor tells the engine speed to the GSC+P. The GSC+P shows the engine speed on the lower display. Also, the GSC+P uses the information from the sensor for tasks such as activating an engine overspeed shutdown and terminating engine cranking and determining the oil step speed. The engine magnetic 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+P. The frequency of the signal is directly proportional to the speed of the engine. The GSC+P receives the sine wave signal and the GSC+P measures the frequency. The frequency is measured at one pulse per gear tooth in order to determine the engine speed. The wires of the sensor connect to connector contact 1 and connector contact 2 of the GSC+P within a shielded cable. The drain wire of the shielded cable is connected to the “AUX” terminal strip.

There are four setpoints that are related to the engine speed. The setpoints are programmed into the GSC+P. The related setpoints are P009, P010, P011 and P012. Refer to Systems Operation, “Engine/Generator Programming OP5-0”.

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Modes Of Operation

SMCS Code: 4490

Table 2

Display Area Functions When In Normal Mode, Alarm Mode Or Shutdown Mode(1)			
Item Of Display Area	**Normal Mode**(2)	**Alarm Mode**(2)	**Shutdown Mode**
Upper Display	AC Data Shown	AC Data Shown(3)	Fault Code Shown
Lower Display	AC Power Data, Engine Data And Relay Status Shown	AC Power Data, Engine Data And Relay Status Shown	AC Power Data, Engine Data And Relay Status Shown
Shutdown Indicator(s)	All Off	All Off	Flashing
Fault Alarm Indicator	Off	Flashing(3)	Off
Key Function	**Normal Mode**	**Alarm Mode**	**Shutdown Mode**
Power Meter Key	Starts And Stops The Scrolling Of Power Meter Data On Lower Display. Selects All Power Meter Data To Be Shown.	Starts And Stops The Scrolling Of Power Meter Data On Lower Display. Selects All Power Meter Data To Be Shown.	Starts And Stops The Scrolling Of Power Meter Data On Lower Display Selects All Power Meter Data To Be Shown.
AC Select Key	Selects The AC Data That Is Shown On The Upper Display	Selects The AC Data That Is Shown On The Upper Display	No Function
Engine Meter Key	Starts And Stops The Scrolling Of Engine Conditions On Lower Display	Starts And Stops The Scrolling Of Engine Conditions On Lower Display	Starts And Stops 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 Alarm Fault Code On The Upper Display	No Function
Exit Key(4)	No Function	No Function	No Function
Service Mode Key	Enters The GSC+P Into Service Mode(4)	Enters The GSC+P Into Service Mode(5)	No Function

(1) For a description of the display area functions when in Service Mode, refer to Systems Operation, “Service Mode”. For a description of the display area functions when in Paralleling Mode, refer to Systems Operation, “Paralleling Mode”.
(2) Synchronization Mode is enabled in Normal Mode or Alarm Mode.
(3) When an alarm fault is present, the alarm fault code is shown on the upper display when the alarm codes key is pressed.
(4) This key only functions when in service mode, refer to Systems Operation, “Service Mode”.
(4) Service Mode cannot be entered when the ECS is in the AUTOposition.

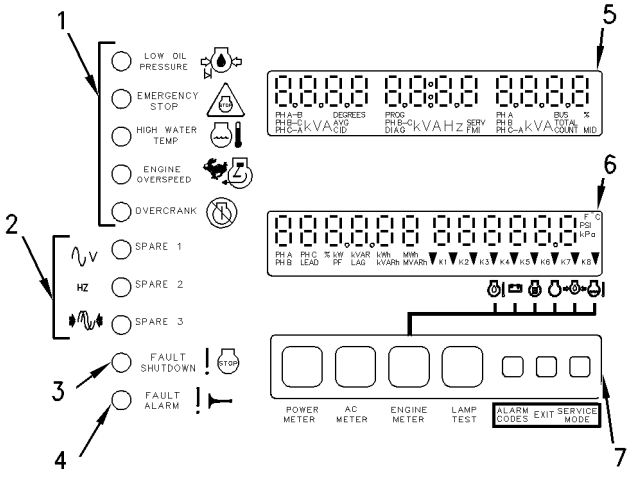

Illustration 32 g00688554

Display Area Of Generator Set Control +P (GSC+P).

(1) Dedicated shutdown indicators.
(2) Spare fault indicators (Or synchronizing lights on the GSC+P).
(3) Fault shutdown indicator.
(4) Fault alarm indicator.
(5) Upper display.
(6) Lower display.
(7) Keypad.

The GSC+P has five modes of operation. A brief description of each mode follows this paragraph. Refer to the individual topics for more detailed information.

Normal Mode – The GSC+P uses normal mode for the normal operation of the generator set. The operator can identify normal mode by observing the display area. When the GSC+P is in the normal mode, all the 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+P will automatically go into alarm mode in order to alert the operator of a non-critical fault. The operator can identify the Alarm Mode by observing the display area. When the GSC+P is in Alarm Mode, the fault alarm indicator is FLASHING. The fault code will be shown when the “Alarm Codes” Key is pressed.

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

Service Mode – The GSC+P goes into Service Mode when the operator presses the “Service Mode” key that is located on the keypad. The operator can use Service Mode for the following purposes:

- Assist with troubleshooting diagnostic faults.
- Verify, calibrate or 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 cannot be entered when the ECS is in the AUTO position.

Parallel Mode – The GSC+P uses Parallel Mode to synchronize the generator sets to other generator sets or to a utility bus. The GSC+P is in Parallel Mode whenever the Parallel Mode Switch is in AUTO, Semi-Auto, or Permissive positions. Parallel Mode is enabled in Normal Mode or Alarm Mode. Some alarm conditions may stop the process of Synchronization. For more information, refer to Systems Operation, “Paralleling Mode”.

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Normal Mode

SMCS Code: 4490

Normal mode is used in order to monitor the generator set. Normal mode is also used to control the generator set. The GSC+P controls the engine according to the information which is received from the operator and the information that is received from the engine sensors. The GSC+P performs the following functions in normal mode:

- Start Engine command
- Monitoring of the important GSC+P conditions
- Showing the important GSC+P conditions to the operator
- Fault detection
- Engine stopping

The operator can identify normal mode by observing the display area. When the GSC+P is in 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+P is in normal mode, the engine is able to start or the engine is able to run.

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

Engine Starting Sequence

1. The GSC+P receives an engine start signal. The signal will be one of two.
   - The operator turns the ECS to the Manual Start position.
   - The ECS is in the AUTO position and the customer issues a remote start command.
2. The GSC+P checks the system before beginning the starting sequence. The GSC+P checks that no system faults are present. The GSC+P checks that all previous shutdown faults have been reset. The GSC+P also checks that the engine is not already running.

Note: Shutdown faults are removed by turning the ECS to OFF/RESETposition.

3. The GSC+P begins the starting sequence.
   a. The GSC+P activates the RR and the Electronic Governor Relay (EGR). The EGR relay sends a run command to the Engine Control Module (ECM) located on the engine.
4. The engine cranks until the cycle crank time reaches the setpoint for total crank time or until the engine starts. The factory default of the setpoint is 10 seconds of crank time and 10 seconds of rest time. The GSC+P setpoints that are related to cranking (P017 and P018), do not affect on the cranking cycle. In order to adjust the cranking time, adjust the cranking parameters in the ECM.
5. While the starting motor is cranking, the GSC+P shows the status of the relays on the relay status indicators of the lower display.
   - ETR fuel systems: K4 (SMR), K5 (RR), K7 (FCR)
   - On EUI engines, K1 (EGR) is also shown.
6. The engines’ ECM deactivates the starting motor relay when the engine speed has reached the crank terminate speed. Factory default for crank terminate is 400 RPM. The GSC+P activates the Crank Termination Relay (CTR) when the engine speed reaches the setpoint P011 for crank terminate speed. The factory default of setpoint P011 is 400 rpm.

Note: The GSC+P crank terminate setpoint does not impact the actual crank terminate speed.

7. The GSC+P shows the following information.
   - Information for one or more phases on the upper display
   - Information for power meter on the lower display
   - Information for the engine system on the lower display
   - For ETR fuel system, the relay status of K1 (EGR), K3 (CTR), K5 (RR), and K7 (FCR) on the lower display
   - For ETS fuel system, the relay status of K1 (EGR), K3 (CTR), K5 (RR) on the lower display

Engine Stopping Procedure

1. The GSC+P will receive an engine stop signal. The signal will be one of two.
   - The operator turns the ECS to the STOP position.
   - The ECS is in the AUTO position and remote start contacts open
2. After receiving the stop signal, the GSC+P checks that there are no present system faults.
3. The GSC+P begins the cooldown period. The cooldown period is the setpoint P019. The factory default of setpoint P019 is five minutes.
4. The GSC+P may now activate the spare output. The spare output is activated only if the spare output SP07 has been programmed for this purpose. The spare output can activate the slave relay during the cooldown cycle. The circuit breaker is then activated , removing load from the generator set..
5. After the cooldown cycle (setpoint P019), the GSC+P deactivates the RR. The EGR is deactivated after the engine oil pressure decreases to less than the setpoint for low oil pressure shutdown at idle speed (SP14).

6. When the engine speed reaches zero rpm, the GSC+P deactivates the Crank Terminate Relay (CTR) and a restart is now allowed.

   Before the engine speed reaches 0 rpm, a restart of the engine is possible. When the GSC+P receives an engine start signal, the GSC+P turns on the fuel and the GSC+P allows the engine to run. If the engine does not run, the Starting Motor Relay (SMR) does not activate until the CTR is deactivated at 0 rpm.

7. The GSC+P shows the status of the relays on the relay status indicator of the lower display. All relay indicators should be “OFF” .

Note: The engines can be shut down immediately by turning the ECS to the OFF/RESET. The cooldown timer is bypassed and the spare data output is deactivated.

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Alarm Mode

SMCS Code: 4490

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. An alarm fault can be protective relaying functions that have been enabled as an alarm fault.

When an alarm fault exists the GSC+P 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. “Spare 1” indicator, “Spare 2” indicator or “Spare 3” indicator may be flashing. The fault alarm indicator may also be flashing. For more information on fault codes, refer to System Operation, “Fault Description”. When the GSC+P is in alarm mode, the engine is able to start and the engine is able to run.

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

Note: When the operator overrides a shutdown fault to be an alarm fault, the corresponding dedicated fault shutdown indicator is on continuously. The fault shutdown indicator stays on continuously if the particular fault occurs. When the fault shutdown indicator is ON CONTINUOUSLY, the normal shutdown response has been overridden by the operator. The shutdown fault is treated as an alarm fault. For the shutdown faults that are overridden, a fault code is not shown on the upper display. The dedicated shutdown indicator remains ON CONTINUOUSLY until the fault is corrected and the Engine Control Switch (ECS) is turned to the “OFF/RESET” position. The dedicated shutdown faults that can be overridden are low oil pressure and high coolant temperature. Refer toSystems Operation, “Setpoint Programming OP5 (P03)”. For more information, refer to System 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+P will respond to the operator input that is from the instrument panel and the engine sensors.

Alarm Mode Sequence

1. An alarm fault occurs.

2. The GSC+P detects the alarm fault and the GSC+P FLASHES the fault alarm indicator. The GSC+P does not change the status or 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. Refer to Testing And Adjusting, “Fault Identification”.

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

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Shutdown Mode

SMCS Code: 4490

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+P automatically activates shutdown mode until the shutdown fault is corrected. The GSC+P shuts down the engine when the GSC+P is in shutdown mode. The GSC+P prevents starting of the engine and the GSC+P alerts the operator.

The GSC+P alerts the operator and the GSC+P 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
- Engine overcrank
- Fault shutdown
- Spare 1, Spare 2, Spare 3 (that are accompanied by the fault shutdown indicator)

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

Shutdown Mode Sequence

1. A shutdown fault occurs and the GSC+P detects the shutdown fault.
2. On EUI engines, in order to shut off the fuel, the GSC+P deactivates the Electronic Governor Relay (EGR).
3. In order to prevent the engine from starting, the GSC+P deactivates the Run Relay (RR), and the GSC+P deactivates the Starting Motor Relay (SMR).
4. In order to remove the generator load, the GSC+P activates the Genset 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. Refer to System Operation, “Spare Input/Output Programming OP6”.

5. When engine speed reaches 0 rpm, the GSC+P deactivates the Crank Termination Relay (CTR). The Electronic Governor Relay (EGR) is deactivated when the engine oil pressure reaches the setpoint P014 for low oil pressure shutdown at idle speed 70 kPa (10 psi).
6.
7. The GSC+P FLASHES the corresponding shutdown indicator. If the fault shutdown indicator is FLASHING, a fault code is shown on the upper display. Refer to Systems Operation, “Fault Description”.
8. If the fault shutdown indicator is the only indicator FLASHING, additional information is available. A fault code is shown on the upper display that better identifies the cause of the shutdown fault. Refer to the Systems Operation, “Fault Description”.
9. The lower display continues to show the engine data.
10. The relay status indicators show.
    - K2 (GFR)
    - K6 (ASR) will show for 15 seconds for an emergency stop fault, engine overspeed fault, or an speed sensor fault. K6 (ASR) will also show if engine speed does not decrease at least 100 rpm.
    - K7 (FCR) - (ETS fuel systems) for 70 seconds after engine speed decreases to 40 rpm and oil pressure decreases to 80 kPa (12 psi). (K7 is not shown for ETR fuel systems.)

Engine Start Sequence (After Shutdown)

1. Correct the shutdown fault. Refer to the System Operation, “Fault Identification”.
2. Turning the Engine Control Switch (ECS) to the OFF/RESET position resets the GSC+P. If no shutdown fault is active, the GSC+P returns to normal mode and the engine is able to start.

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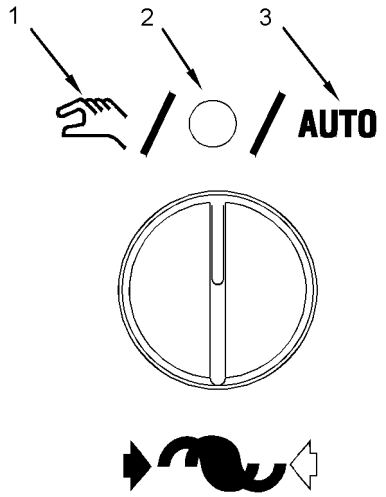
Paralleling Mode

SMCS Code: 4490



g01445132

Illustration 33

Parallel Control Switch

(1) MANUAL (Permissive) Position
(2) OFF Position
(3) AUTO Position

The GSC+P is in Parallel Mode whenever the Parallel Control Switch (PCS) is in the AUTO position, or the Permissive position. There are several paralleling functions within Parallel Mode. These functions are determined by the following items: PCS and Engine Control Switch (ECS).

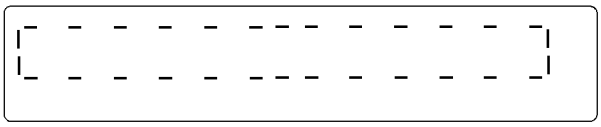


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Illustration 34

Note: The EMCP II+P is not designed for paralleling with a UTILITY in a standard installation. The EMCP II+P WILL support paralleling of multiple generators. The EMCP II+P can be reconfigured to operate in parallel with a utility, but must be modified to operate in droop mode. Additional components must be added in order to perform proper load control when paralleling with a utility. These subjects are beyond the scope of this manual. Consult your Caterpillar Dealer for more information.

Note: The GSC+P is not intended for use with DELTA WIRED GENERATORS. If setpoint P032 is set to 1 (delta generators), the synchroscope will flash as shown in illustration 34. An “AL17” diagnostic code will appear when the “Alarm Codes” key is pressed.

Table 3

EMCP +P Parallel Functions					
Parallel Function	**Bus Status**	**ECS Position**	**Parallel Control Switch Position**	**GSC+P Frequency Control**	**Close Breaker Output**
Automatic Synchronization	Live	Start or Auto(1)	Auto	Controls frequency, brings generator in SYNC with bus.	When synchronization conditions are met, activates for a programmed duration.
Dead Bus Paralleling	Dead	Start or Auto(1)	Auto	Does not control frequency.	Activates for a programmed duration.
Permissive Paralleling	Live	Start or Auto(1)	Permissive	Does not control frequency.	When synchronization conditions are met, activates continuously. Enables manual breaker closure.
Off	Live or Dead	Off/Reset, Auto, Start, Stop	Off	Does not control frequency.	Not activated.

(1) Remote initiate contacts are closed.

Glossary

Bus – The common power conducting wires or bars to which all power sources within the power system are connected through individual circuit breakers.

Dead Bus – A bus from which all of the available power sources are disconnected.

Incoming Generator – The generator that is being connected to the bus

Generator Circuit Breaker – A mechanical device that has the ability to make, carry, or interrupt the phase currents between the incoming generator and the bus.

Phase Sequence – The order that the phase voltages pass the zero crossover. The individual sine waves must appear in the same sequence for the bus and the incoming generator.

Generator Circuit Breaker Closure Time – The amount of time required for the breaker to close its contacts after its closing control circuit is energized.

Oscillate – To move back and forth with a steady, uninterrupted rhythm.

Synchroscope – The lower display of the GSC+P is performing one of the synchronizing functions. A revolving square is used to indicate the phase angle and the frequency relationship between the bus and the incoming generator.

RPM indicators – Indicates frequency relationship between the bus and the generator. If the generator frequency is greater than the bus frequency, then the RPM “UP” indicator is shown. If the generator frequency is less than the bus frequency, then the RPM “down” indicator is shown. These indicators are only used in the Permissive Mode.

Phase Angle – The relative angle between the corresponding phase voltages of the incoming generator to those of the bus.

Gain – GSC+P controlled parameter that determines the rate of change of the phase angle difference between the generator and bus during synchronization. Increasing the rate of change setpoint (P308) will increase the rate that the GSC+P matches the phase angle between the generator and the bus.

Damping – The GSC+P controlled parameter that determines the amount of overshoot and settling time of engine speed during synchronization. Increasing the damping setpoint (P309) will increase the damping effect.

Close Breaker Sensor – A set of normally open auxiliary contacts on the generator circuit breaker that indicate when the generator circuit breaker is closed. The contacts are active (closed) when the circuit breaker is closed, and the level of the GSC+P close breaker sensor input is negative. The inactive level is floating (approximately 12.0 DCV). Refer to the DC Schematic of GSC+P Synchronization.

Dead Bus Relay – The Dead Bus Relay (DBR) that indicates the state of the bus The normally closed contacts are closed when the bus is dead, and the level of the GSC+P dead bus sensor input is battery negative. A live bus is indicated by an inactive level floating at approximately 12.0 DCV. Refer to the DC Schematic Of GSC+P Synchronization.

–

Synchroscope

The lower display of the GSC+P becomes the synchroscope when the GSC+P is performing one of the synchronizing functions. A square symbol revolves around the perimeter of the display in order to indicate the phase angle and frequency relationship between the bus and the incoming generator.

Table 4

GSC+P Synchroscope - Frequency And Phase Angle Relationship	
Pointer Position	**Indication**
Rotating Clockwise	Frequency of the incoming generator is greater than the bus.
Rotating counterclockwise	Frequency of the incoming generator is less than the bus.
Stopped in any position other than top center	Frequency of the incoming generator and bus are the same. The phases are different.
Stopped at top center	Frequency of the incoming generator and bus are the same. In phase (phase angle is 0°).

The upper display toggles between the incoming generator phase C-A voltage and frequency. The right side of the upper display shows “BUS” or “GEN”. Pressing the AC meter keypad will stop the toggling and the upper display will show only the generator voltage and frequency or the voltage of the bus and the frequency of the bus. When the toggling is locked, “GEN” or “BUS” will be flashing.

Illustration 35 g00502139

The Bus Voltage and the frequency are shown on the Upper Display.

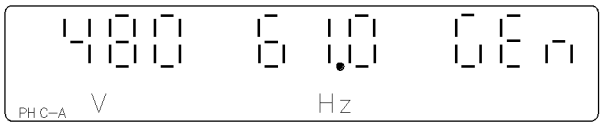

Illustration 36 g00502174

The Generator Voltage And Frequency are shown on the Upper Display.

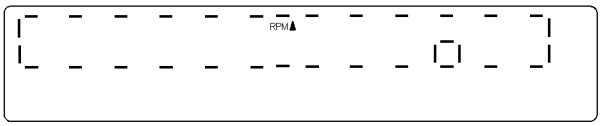

Illustration 37 g00502175

The Lower Display (synchroscope) is showing the Bus And frequency of the generator. The Phase Angle Relationship is also shown on the Lower Display.

The Generator And the Bus are not synchronized.

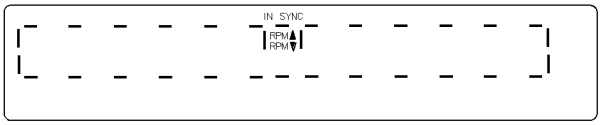

Illustration 38 g00502177

The Lower Display (synchroscope) is Showing that the Generator And the Bus are Synchronized.

Note: The “RPM” indicators are shown only in Permissive Mode.

Spare Fault Indicators

The “Spare Fault” indicators have alternate functions on the GSC+P during synchronization functions. “Spare 1” becomes the voltage indicator. This indicator will illuminate when the difference between the bus voltage and the oncoming generator voltage are within acceptable limits. “Spare 2” becomes the frequency indicator. This indicator will illuminate when the frequency difference between the bus and the oncoming generator are within acceptable limits. “Spare 3” becomes the phase match indicator. This indicator illuminates when the phase difference between the bus and the oncoming generator are within acceptable limits. When the GSC+P is not performing paralleling functions, the Spare Fault indicators retain their normal functions as explained in Systems Operation, “Spare Input/Output Programming OP6”.

Synchronizing Tuning Procedure

Due to the variance in the characteristics of the engine and the characteristics of the governor, the GSC+P is used to tune the response of the Speed Adjust 1 output. The response is tuned for optimum speed and smoothness.

.

Note: Before the operator begins the synchronization tuning procedure, the governor for the engine and the fuel system should be adjusted. The adjustment provides optimum performance. Changes to the governor settings will require retuning of the Speed Adjust 1 output. Refer to the appropriate governor service manual. DO NOT proceed with synchronization tuning or attempt to parallel the generator before completing these adjustments.

Note: For optimum performance, synchronization tuning should be performed under the same temperature conditions as the synchronization will be performed.

The GSC+P uses proportional integral derivative (PID) control to accomplish synchronization quickly and smoothly. The P, I and D parameters are independently controlled by setpoints P307, P308 and P309. Adjusting any one of these setpoints will not affect the other two settings.

The GSC+P checks the following conditions during synchronization:

- The phase sequence of the incoming generator must be the same phase sequence of the bus.
- Voltages of the incoming generator must match the voltages of the bus within the acceptable range. This requirement can be enabled or disabled with setpoint P303. Setpoint P304 determines the acceptable range.
- The frequency of the incoming voltages must match the frequency of the voltages of the bus. The voltages must be within acceptable tolerances.
- The phase angles between the incoming generator voltage and the bus voltage must be within the acceptable range. The acceptable range is determined by setpoint P305. The dwell time for the acceptable phase angle is determined by setpoint P306.

During synchronization, the GSC+P continuously monitors the frequency and the phase angle of the incoming voltage of the generator and the bus. The GSC+P uses this information to adjust the voltage of the Speed Adjust 1 output. The GSC+P raises the engine speed or the GSC+P lowers the engine speed until the frequencies and the phase angles match within the programmed acceptable ranges.

After all synchronization conditions are within the acceptable ranges, the GSC+P will activate the Close Breaker control output for either a programmed duration or continuously, depending on the synchronization function selected.

Tuning Procedure

1. Turn the PCS to the “OFF” position. DISCONNECT THE CIRCUIT BREAKER FROM THE GSC+P AND CLOSE BREAKER CONTROL OUTPUT FOR THE UNIT TO BE TUNED. This can be done by temporarily removing wire W703 from the CIRCUIT BREAKER CLOSE RELAY (CBCR) terminal 4..

2. Enter Service Mode and program the following setpoints under OP5-3:

   P301 is set to 1 to enable synchronization.

   P307 is set to 2.5%.

   P308 is set to 0%.

   P309 is set to 0%.

   Ensure that the other setpoints are programmed to the default setting that is programmed in the factory.

   Exit Service Mode.

3. Place the PCS of the unit to be tuned in the OFF position. Start both units via remote start contact, and allow the unit that will not be tuned to to close to the bus. Adjust the engine speed so that the frequency of the generator is 0.5 Hz higher than the frequency of the bus.

4. Ensure the PCS is in the OFF position. Place the Engine Control Switch (ECS) in the COOLDOWN position. Enter Service Mode and select OP11. Refer to Service Mode, “Synchronization Setpoint Tuning - OP11”.

5. Place the PCS in the AUTO position. Place the ECS in the AUTO position. The GSC+P will adjust the engine speed to the frequency of the bus. Wait for twenty seconds. Then note the position of the synchroscope pointer. If the synchroscope pointer is not oscillating at least two segments, proceed to Step 6. If the synchroscope pointer is oscillating, proceed to Step 8.

6. Turn the PCS to the OFF. Place the ECS in the COOLDOWN position. Enter the service mode and select OP11. Adjust P307 upward by a small increment.

7. Repeat the previous two steps until the synchroscope pointer is oscillating steadily at least two segments at the end of 20 seconds.

Note: With some engine/governor combinations, oscillation or instability may be minimal or may not occur. When this happens, adjust setpoint P307 to 60 and proceed to Step 9.

8. Note the setting of Setpoint P307. Calculate 60% of this value. This is done by multiplying Setpoint P307 by 0.6. Reset Setpoint P307 to the new value.

   For example, when the engine oscillates for 20 seconds, P307 is set to 80. Multiplying 80 by 0.6 equals 48. P307 is then set to 48.

9. Turn the PCS to the OFF. Enter Service Mode and select OP11. Enter SERVICE MODE and select OP11 P307 remains set to the value that was determined in Step 8. Set P308 to 2.5%.

10. Place the PCS in AUTO and the ECS in AUTO. The GSC+P will adjust the engine speed to the frequency of the bus. Then, the synchroscope pointer will lock at a phase angle of 0%. The “IN SYNCH” symbol is ON. Wait 20 seconds, if “IN SYNCH” is ON proceed to Step 11. Otherwise, proceed to Step 13.

11. Turn the PCS to the OFF position. Place the ECS in the COOLDOWN position. Enter Service Mode and select OP11. The GSC+P display should return to the OP11 function. Adjust P308 upward by a small increment.

12. Repeat the previous two Steps until the “IN SYNCH” indicator does not come ON within 20 seconds.

Note: With some engine/governor combinations, oscillation may be minimal or instability may be minimal or may not occur. When this happens, adjust setpoint P308 to 100 and proceed to Step 13. Lower settings for P308 can be tried.

13. Turn the PCS to the OFF position. Place the ECS in the COOLDOWN position. Enter Service Mode and select OP11 Setpoints P307 and P308 are left programmed to the previously determined values. Set P309 to 2.5%.

14. Place the PCS in the AUTO position. Place the ECS in the AUTO position. The GSC+P will adjust the engine speed to the frequency of the bus. If oscillation and overshoot are acceptable proceed to Step 16. Otherwise, proceed to Step 15.

15. Turn the PCS to the OFF position. Place the ECS in the COOLDOWN position. Enter Service Mode and select OP11Adjust setpoint P309 upward in small increments. Repeat this and the previous step until oscillation and overshoot are acceptable.

16. For optimum performance, further adjustment of setpoints P307, P308 and P309 may be necessary. Usually, the P307 setpoint should be somewhat lower than P308 for optimum performance. Setpoint P309 should only be adjusted high enough for maximum stability.

17. When satisfied with the performance, replace circuit breaker close close wire.

Synchronization Sequence Of Operation

Note: Before attempting to execute these functions, ensure that the Synchronization Tuning Procedure has been completed.

Automatic Synchronization Mode

Dead Bus Close

1. For automatic synchronization, the ECS and PCS must be in the AUTO position. The following sequence of operations assumes the switches are in these positions. Changing either of these switch positions will interrupt the automatic mode of operation and prevent the circuit breaker from automatically closing.

2. Upon receipt of a remote system start signal, the generator set will start and begin ramping to rated speed and voltage.

3. As the generator set reaches approximately 90% speed and voltage, the Voltage Frequency Relay (VFR) of that generator set will energize. This will energize the Voltage Build up Relay (VBR).

4. The first generator set to energize VBR will initiate the dead bus close sequence and will inhibit the other generator set from closing to the dead bus. If the first generator sets circuit breaker does not close after 2 seconds, it will pass dead bus close control to the second generator set. The second generator set will inhibit the first generator set from closing to the dead bus and attempt to close its circuit breaker to the dead bus. If the second generator sets circuit breaker does not close after 2 seconds (field adjustable), it will pass dead bus close control back to the first generator set. This process continues until one of the generator sets closes to the dead bus or the fail to parallel time delay expires. Detailed explanation follows:

   a. As the first generator set reaches 90% rated speed and voltage, the VBR relay energizes. The dead bus circuit confirms the bus is dead through a DBR contact.

   b. After a 0.25 second delay, the Dead Bus Permissive Timer (DBPT) will close its contact, energizing the Dead Bus Permissive Relay (DBPR). When DBPR energizes in the first generator set, the normally closed contact wired to the second generator set opens, preventing it from closing to the dead bus

   c. After a 0.25 second delay, the DBTR energizes. The contact from this relay is fed into the GSC+P Auto Sync logic, starting the process of an automatic dead bus closure.

   d. If the circuit breaker does not close within 2 seconds, the Dead Bus Alternate Timing Relay (DBATR) will energize, and stop the automatic dead bus close sequence for the first generator set. The second generator set will then begin the automatic dead bus close sequence, starting at step 4.babove.

5. Before the GSC+P will issue an automatic dead bus close command, the following conditions must be met.

   a. The DBTR must be energized.

   b. The bus must be dead, as indicated by the DBR.

   c. The System In Auto Relay (SIAR) must be energized. The SIAR relay is energized when the ECS and the PCS are both in auto, and the Shutdown Relay (SDR) is not energized.

   d. The generator sets circuit breaker is not closed, as indicated by the Circuit Breaker Relay (CBR).

   e. The generator set has reached 90% rated speed and voltage, as indicated by the VBR.

   f. The PCS is in AUTO.

6. Once the above conditions are met, the GSC+P will confirm the bus voltage is below the dead bus voltage setpoint (P311) and will issue a breaker close output command, activating the Circuit Breaker Permissive Relay (CBPR).

7. A CBPR contact will energize the Circuit Breaker Close Relay (CBCR).

8. A CBCR contact will energize the circuit breaker close coil, automatically closing the circuit breaker.

Live Bus Close

1. For automatic synchronization, the ECS and PCS must be in the AUTO position. The following sequence of operations assumes the switches are in these positions. Changing either of these switch positions will interrupt the automatic mode of operation and prevent the circuit breaker from automatically closing.

2. When a source is present on the load bus, the dead bus relay is energized, indicating the bus is live. TheBus Transformer Box (BTB+) also detects voltage present on the bus.

3. The GSC+P will actively adjust the generator set frequency to automatically bring the generator set voltage in phase with the bus voltage. The GSC+P checks if there are phase sequence alarms, inappropriate voltage alarms, or any other alarm present.

   a. Yes – The GSC+P will issue the appropriate alarm. Breaker closure is prevented until the fault is corrected.

   b. No – The GSC+P will verify conditions for synchronization and perform automatic synchronization.

4. When the output frequency is in phase with the bus frequency and within the phase tolerance limit (P305), the GSC+P will issue a breaker close command, activating the CBPR.

5. A CBPR contact will energize the CBCR.

6. A CBCR contact will energize the circuit breaker close coil, automatically closing the circuit breaker.

   a. If the circuit breaker is not closed within 45 seconds of receipt of remote start signal, the fail to parallel alarm will activate and initiate a generator set shutdown.

Manual Synchronization Mode

Dead Bus Close

1. For manual synchronization, the PCS must be in the MANUAL position. The following sequence of operations assumes the switch is in this position. Changing the switch position will interrupt the manual mode of operation and prevent the circuit breaker from being manually closed.
2. To initiate a manual dead bus closure, the ECS is placed in the RUN position
3. As the generator set reaches approximately 90% speed and voltage, the Voltage Frequency Relay (VFR) will energize. This will energize the VBR.
4. With the VBR relay energized, the operator presses the circuit breaker close pushbutton CBCPB, activating the CBPR.
5. A CBPR contact will energize the CBCR.
6. A CBCR contact will energize the circuit breaker close coil, closing the circuit breaker.

Live Bus Close

1. For manual synchronization, the PCS must be in the MANUAL position. The following sequence of operations assumes the switch is in this position. Changing the switch position will interrupt the manual mode of operation and prevent the circuit breaker from being manually closed.
2. To initiate a manual dead bus closure, the ECS is placed in the RUN position.
3. When a source is present on the load bus, the dead bus relay is energized, indicating the bus is live. The bus transformer box (BTB+) also detects voltage present on the bus.
4. The GSC+P checks if there are phase sequence alarms, inappropriate voltage alarms, or any other alarm present.
   a. Yes – The GSC+P will issue the appropriate alarm. Breaker closure is prevented until the fault is corrected.
   b. No – The GSC+P will verify conditions for synchronization.
5. Using the GSC+P synchroscope, the generator set frequency is manually adjusted to bring the generator set voltage in phase with the bus voltage. Refer to the SYNCHROSCOPE section for more details.
6. When the output frequency is in phase with the bus frequency and within the phase tolerance limit (P305), the GSC+P will issue a breaker close command.
7. To close the circuit breaker, the operator presses the circuit breaker close pushbutton (CBCPB). 7. With the GSC+P issuing a breaker close command and the CBCPB pressed, the CBPR is activated. A CBPR contact will energize the CBCR.
8. A CBCR contact will energize the circuit breaker close coil, closing the circuit breaker.

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Service Mode

SMCS Code: 4490

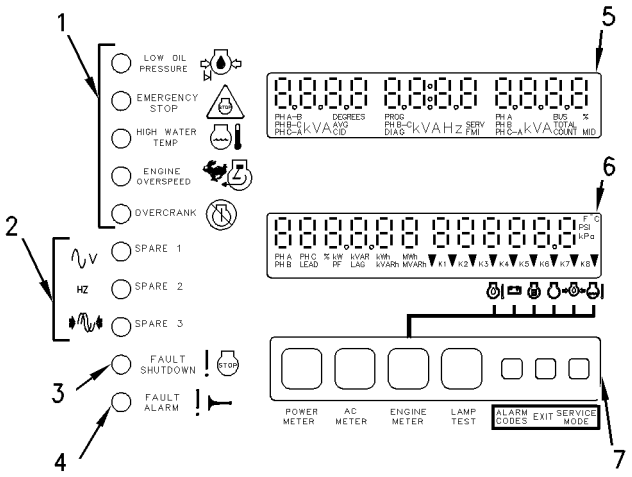

Illustration 39 g00688554

GSC+P Display Area With Service Mode Descriptions Of Keypad.

(1) Dedicated shutdown indicators
(2) Spare fault indicators (Or synchronizing lights on GSC+P).
(3) Fault shutdown indicator
(4) Fault alarm indicator
(5) Upper display
(6) Lower display
(7) Keypad

Service Mode is used for the following purposes:

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

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

Table 5

OP1, Fault log viewing
OP2-0, Engine/Generator setpoint viewing
OP2-1, Protective relaying setpoint viewing
OP2-2, AC factory calibration setpoint viewing
OP2-3, Synchronization setpoints(1)
OP3, Password entry
OP4, Fault log clearing
OP5-0, Engine/Generator programming
OP5-1, Protective relaying programming
OP5-2, For factory use, not accessible by the user.
OP5-3, Synchronization setpoint programming(1)
OP6, Spare Input/Output programming
OP7, Hour meter programming
OP8, Voltmeter/Ammeter programming
OP9, Engine setpoint verification
OP10, AC offset adjustment
OP11, Synchronization setpoint tuning(1)

(1) For use in paralleling applications only.

The keypad and the display of the GSC+P 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 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 and scroll information. When you are entering the password, this key represents the number 1.

Scroll Up Key – This key is used to scroll up 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: The appropriate “Scroll” Key should be held down in order to rapidly scroll through a large range of information.

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+P.

Exit Key – This key is used to exit Service Mode. The display now returns to Normal Mode. The “SERV” indicator on the upper display is NOT SHOWING when the GSC+P 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+P is in Service Mode. The “SERV” indicator on the upper display FLASHES when the keypad performs functions in 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 Engine Control Switch (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+P 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+P. The “SERV” indicator on the upper display FLASHES whenever the GSC+P is in Service Mode.

2. The desired option (OP1 through OP11) 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 options OP4 through OP8 of the Service Mode, the engine must be shut down. Turn the ECS to the STOP position.

Options OP4 through OP11 of the Service Mode require a password. Password entry reduces the possibility of mistakenly altering information. OP3 is the option that is used for password entry. The password must be correctly entered before access is gained to OP4 through OP11. Refer to Systems Operation, “Password Entry OP3”. Option OP1 and option OP2 are used for viewing information. Option OP1 and option OP2 are not protected with passwords.

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Fault Log Viewing OP1

SMCS Code: 4490

OP1 is the option that is used for viewing diagnostic codes. The fault log contains a history of the diagnostic codes. These diagnostic codes have occurred in the generator set system since the last service (diagnostic code clearing). 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.

The diagnostic code consists of a Component Identifier (CID) and a Failure Mode Identifier (FMI). A “DIAG” status indicator is also shown on the upper display. The CID informs the operator of the component that may have failed. The FMI describes the type of failure that has occurred. When the diagnostic code is active the DIAG status indicator FLASHES.

Only inactive diagnostic codes are stored in the fault log. An active diagnostic code that is programmed to be treated as an alarm fault becomes inactive when the problem is no longer occurring. An active diagnostic code that is programmed to be treated as a shutdown fault becomes inactive when the problem is no longer occurring AND the Engine Control Switch (ECS) is turned to the OFF/RESET position. Active diagnostic codes are indicated when “DIAG” is FLASHING. When the problem becomes inactive “DIAG” is ON CONTINUOUSLY. The GSC+P stores a maximum of 12 diagnostic codes in the fault log. If an additional diagnostic code becomes inactive, the GSC+P automatically clears the earliest inactive diagnostic code. The GSC+P then places the new inactive diagnostic code in the fault log.

The GSC+P automatically clears any inactive diagnostic codes that have been stored in the fault log longer than 750 hours. For example, if a diagnostic code is logged at 10 hours, then the GSC+P clears the diagnostic code when the hour meter is at 760 hours. If a diagnostic code is logged at 20 hours, then the code remains logged until the hour meter is at 770 hours. This feature prevents old diagnostic codes from clogging the fault log, if service personnel have forgotten to clear the fault log after correcting diagnostic codes.

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

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

2. If no other active diagnostic codes are present the DIAG indicator will stop FLASHING and the DIAG indicator remains on CONTINUOUSLY.

3. The fault alarm indicator that was FLASHING turns OFF or the shutdown fault indicator that was FLASHING turns OFF.

Procedure To View The Fault Log

Note: For a list of all diagnostic codes, refer to 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 indicates 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 fault, the fault must not be occurring. The ECS must also be turned to the OFF/RESET position. If the jumper that electrically connects terminal 6 to terminal 9 is not installed on the ECS, then the GSC+P will not power up in OFF/RESET and any active shutdown fault must be corrected before entering service mode.

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

2. Press “SELECT” key. If more than one diagnostic code is present then the codes begin scrolling on the display. The number of occurrences is shown above the “COUNT” indicator. The lower display shows the value from the hour meter at the first occurrence and the last occurrence of each diagnostic code.

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

4. Press “SCROLL RIGHT” key. If more than one count of a diagnostic code is logged then the first occurrence with a corresponding value from the hour meter 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 is now in normal mode.

i02898106

Engine/Generator Setpoint Viewing OP2-0

SMCS Code: 4490

OP2-0 is the option for viewing the engine/generator setpoints. The engine/generator setpoints affect the proper operation and serviceability of the engine. The engine/generator setpoints also affect the accuracy of the information that is shown on the display. The setpoints that are viewed or the setpoints that are stored in the GSC+P should match the specified setpoints of the particular generator set. The setpoints are from P001 through P033 and the setpoints are programmable. Refer to System Operation, “Engine/Generator Programming OP5-0”.

i02898129

Protective Relaying Setpoint Viewing OP2-1

SMCS Code: 4490

OP2-1 is the option for viewing the protective relaying setpoints. The protective relaying setpoints determine the response of the GSC+P when one or more of the protective relaying functions occur. The protective relaying functions reduce the possibility of damaging the generator or the customers’ equipment. These setpoints are from P101 through P142 and the setpoints are programmable. For a description of each of these setpoints, refer to System Operation, “Protective Relaying Programming OP5-1”.

i02898145

AC Factory Calibration Setpoint Viewing OP2-2

SMCS Code: 4490

The option for the AC factory calibration setpoint viewing is OP2-2. OP2-2 is also used for viewing other specific data. None of these items are programmable by service personnel.

The following information is shown on the display.

GSC+P Serial Number – The serial number of the GSC+P has ten digits. This number is unique for each GSC+P. The serial number is stamped on a label on the back of the GSC+P. The displayed serial number will always match the number on the label.

GSC+P Software Level Identifier – The software level identifier indicates the level of the software that is included within the GSC+P. The identifier has nine characters. “XXXXXXX-XX” is the form of the identifier.

Setpoints P201 through P222 – These setpoints are the AC factory calibration setpoints. The AC factory calibration setpoints contain information that is used during the factory calibration. These setpoints are not programmable by service personnel.

Procedure To View The Setpoints

Note: The engine may be running or the engine may be stopped while the operator is viewing the setpoints.

Note: Service mode cannot be entered when the Engine Control Switch (ECS) is in the AUTO position.

Note: An active shutdown fault 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, turn the ECS to the OFF/RESET position. The shutdown fault must be corrected, and the ECS must be turned to the OFF/RESET position in order to permanently change a shutdown fault from an active shutdown fault to an inactive shutdown fault. If the jumper from terminal 6 to terminal 9 is not installed on the ECS, the GSC+P does 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. Refer to System Operation, “Service Mode” for more information.

2. Press “SCROLL UP” key. “OP2-0” is showing.

   a. Go to Step 3 in order to view the setpoints that are within OP2-0.

   b. Press the “SCROLL UP” key once or press the “SCROLL UP” key twice in order to view OP2-1 or OP2-2. The display will show OP2-1 or OP2-2. Go to Step 3.

3. Press “SELECT” key. “P001” is showing for OP2-0 which is followed by the value of the setpoint. “P101” is showing for OP2-1 which is followed by the value of the setpoint. The ten digit serial number is showing on the display for OP2-2.

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

5. Press “EXIT” key. “OP1” is showing on the lower display.

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

i02882853

Parallel Setpoint Viewing OP2-3

SMCS Code: 4490

OP2-3 is the option for Parallel Setpoint Viewing. The Parallel setpoints define various parameters that allow precise frequency and phase matching. The setpoints from P301 to P314 are programmable. For a description of these setpoints, see Testing And Adjusting, “Parallel Setpoint Programming OP5-3”.

i02898181

Password Entry OP3

SMCS Code: 4490

OP3 is the option for entering the password that is required for accessing OP4 through OP11. Options for the service modes OP4 through OP11 are protected with passwords. The passwords reduce the possibility of mistakenly altering information. Options OP1 and OP2 are used to view information. OP1 and OP2 are not protected with passwords.

The “SCROLL” keys must be actuated in the correct sequence in order to gain access to OP4 through OP11. The password is identical for every GSC+P. The password cannot be changed. After the password is entered, the OP4 through OP10 options can be accessed. If a mistake is made during the entry of the password, “PE FAIL” is briefly shown on the upper display. The operator can restart the process of entering the password by pressing the “SELECT” key.

Procedure To Enter The Password

Note: Service mode cannot be entered when the Engine Control Switch (ECS) is in the “AUTO” position.

Note: Any active shutdown fault must be made inactive in order to access Service Mode. A shutdown fault is active if the shutdown indicator for the fault is FLASHING. 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, the GSC+P 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. “OP1” is showing on the lower display. Refer to Systems Operation, “Service Mode ” for more information.

2. Press the “SCROLL UP” key four times.“OP3” is showing.

3. Press the “SELECT” key. “P E _ _ _ _ _” is showing on the display. The first dash is flashing.

4. Press “SCROLL RIGHT” key. “P E 1 _ _ _ _” is showing on the display. The second dash is flashing.

5. Press “SCROLL DOWN”key. “P E 1 3 _ _ _” is showing on the display. The third dash is flashing.

6. Press “SCROLL UP” key. “P E 1 3 2 _ _”is showing on the display. The fourth dash is flashing.

7. Press “SCROLL DOWN” key. “P E 1 3 2 3 _” is showing on the display. The fifth dash is flashing.

8. Press “SCROLL RIGHT” key. “P E 1 3 2 3 1” is showing.

9. Press “ENTER” key. “P E PASS”is showing.

10. Press “EXIT” key. OP 4 is showing.

Note: Once the password is entered, any option can be accessed. The password remains activated until Service Mode is exited.

i02898183

Fault Log Clearing OP4

SMCS Code: 4490

Fault Log Clearing OP4

OP4 is the option for clearing an inactive fault from the fault log of the GSC+P. After a diagnostic fault is investigated and/or the fault is corrected, the fault should be cleared from the fault log. Fault log clearing helps prevent confusion during future service calls. After all diagnostic faults are cleared and the GSC+P is in normal mode, the “DIAG” indicator is not shown on the upper display. Refer to Systems Operation, “Fault Log Viewing OP1” for more information.

Procedure for Clearing Faults

Note: Service Mode cannot be entered when the Engine Control Switch (ECS) is in the AUTO position.

Note: An active shutdown indicator will be FLASHING. Active shutdown indicators must be deactivated in order to access the service mode. To temporarily change a shutdown fault from an active shutdown fault to an inactive shutdown fault, turn the ECS to the OFF/RESET position. Permanently changing a shutdown fault from an active shutdown fault requires correcting the active shutdown fault. 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+P does not power up in OFF/RESET. Any active shutdown fault must be corrected before the service mode is entered.

1. Turn the ECS to the STOP position in order to shut down the engine. Enter service mode and enter the password. “OP 4” is showing on the lower display. Refer to Systems Operation, “Password Entry OP3” for more information on entering the password.

2. Press “SELECT” key. A CID FMI fault code is showing and the number of occurrences are showing. The lower display shows the hour meter reading of the first occurrence of the fault and the last occurrence of the fault.

3. Press “SELECT” key. The CID FMI fault code, hour meter reading, and fault count will flash.

4. Press and hold the “ENTER” key for two seconds. If there is only one CID FMI fault code, the CID FMI fault that was flashing disappears and the upper display is blank except for the flashing “SERV” indicator. “OP1” is showing on the lower display. Proceed to the next step. If there is more than one CID FMI fault code, the CID FMI that was flashing disappears. The upper display shows the next CID FMI fault code, the fault count, and the hour meter reading. Repeat steps 3 and 4 until all faults are erased. The lower display then shows OP 1. Proceed to Step 5.

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

6. Press the “EXIT” key. The display is now in normal mode.

i02898192

Engine/Generator Programming OP5-0

SMCS Code: 4490

OP5-0 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+P at the factory.

The setpoints may require changing when the GSC+P is moved from one engine to another engine. The setpoints may also require changing in order to satisfy the customer’s requirements. The setpoints that are stored in the GSC+P must match the specified setpoints of the particular generator set. The setpoints are P001 to P033 and the setpoints are programmable. The setpoints are described in the OP5-0 Setpoints. Refer to Table 6.

Procedure For Engine/Generator Programming

Note: Service Mode cannot be entered when the Engine Control switch (ECS) is in the AUTO position.

Note: Any active shutdown fault must be made inactive in order to access service mode. When a shutdown fault is active, a shutdown indicator is FLASHING. 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 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+P 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. “OP4” is showing on the lower display. For more information, refer to Systems Operation, “Password Entry OP3”.

2. Press “SCROLL UP” key again. “OP5-0” is showing on the lower display.

3. Press “SELECT” key again. “P001” is showing on the display. “P001” 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 press the “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 6

OP5-0 Setpoints - Engine/Generator Programming[1]				
Setpoint	**Name**	**Description**	**Range Of Value**	**Controller Default**
P001	Fuel Solenoid Type	Type of fuel system solenoid used on the generator set. All Larne-built generators covered by this maual are ALWAYS programmed as ETR (0), even if the generator has an ETS fuel solenoid.	0 - ETR fuel solenoid 1 - ETS fuel solenoid	0
P002	Units Shown	Type of measurement units shown on the GSC+P display.	0 - English units (psi, degrees F) 1 - Metric units (kPa, degrees C)	0
P003	Shutdown Override For Engine Fault	GSC+P responds to a low engine oil pressure or high coolant temperature fault. (Determined by application or customer.)	0 - engine shutdown 1 - alarm only (shutdown override, no engine shutdown)	0
P004	Shutdown Enable For Sensor Fault	GSC+P 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) 1 - for engine shutdown	0
P005	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 1 - generator sets with sensor	0
P006	Shutdown Override For Coolant Loss Fault	GSC+P responds to an engine coolant loss fault. (Determined by application or customer.)	0 - engine shutdown 1 - alarm only (shutdown override, no engine shutdown.)	0
P007	System Voltage 24 Or 32 Volts	System voltage (battery voltage) of the generator set. (Determined by application or customer.)	24 or 32	24
P008	N/A	This setpoint is not currently being used by the GSC+P and cannot be programmed.	N/A	N/A
P009	Number Of Ring Gear Teeth	Number of teeth on the ring gear engine. Used by the GSC+P to determine engine speed.	95 to 350 teeth in increments of 1	136 teeth for MUI and PEEC engines. 183 teeth for EUI engines.
P010	Engine Overspeed	Engine speed used by the GSC+P 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
P011	Crank Terminate Speed	Engine speed used by the GSC+P to disengage the starting motor during engine cranking.	100 to 1000 rpm in increments of 10	400 rpm
P012[2]	Oil Step Speed	Engine speed used by the GSC+P 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
P013[3]	Low Oil Pressure Shutdown At Rated Speed	Oil pressure used by the GSC+P 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 1	205 kPa (30 psi)

(continued)

(Table 6, contd)

OP5-0 Setpoints - Engine/Generator Programming[1]				
Setpoint	**Name**	**Description**	**Range Of Value**	**Controller Default**
P014[3]	Low Oil Pressure Shutdown At Idle Speed	Oil pressure used by the GSC+P 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)
P015[4]	High Water Temperature Shutdown	Coolant temperature used by the GSC+P to declare a high coolant temperature shutdown fault exists (after a 10 second delay).	85 to 123°C (185 to 253°F) in increments of 1	107°C (225°F)
P016	Low Water Temperature Alarm	Coolant temperature used by the GSC+P 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)
P017	Total Cycle Crank Time	Cycle crank time used by the GSC+P to declare that an overcrank fault exists. (Determined by application or customer.)	5 to 360 seconds in increments of 1	90 seconds
P018	Cycle Crank Time	Amount of time the GSC+P 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
P019	Cooldown Time	Amount of time the GSC+P allows the engine to run after a normal shutdown is initiated. (Determined by application or customer.)	0 to 30 minutes in increments of 1	5 minutes
P020[5]	AC Voltage	Full scale AC voltage of the generator. The GSC+P 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
P021	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+P 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
P022[6]	GSC+P Engine Number	Informs other devices on the CAT Data Link (for example, CCM) of the engine number for the GSC+P (Determined by application or customer).	01 through 08	01
P023	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 1 - Gas 2 - EUI diesel	
P024[7]	Crank Time Delay	Amount of time the GSC+P 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
P025	Oil Temperature Sensor Installed	Tells whether or not the optional engine oil temperature sensor is installed on the generator set.	0 - generator sets without an oil temperature sensor 1 - generator sets with an oil temperature sensor	0
P026	High Oil Temperature Shutdown	Oil temperature used by the GSC+P to declare a high oil temperature shutdown fault exists (after a 10 second delay).	85 to 123°C (185 to 253°F) in increments of 1	107°C (225°F)

(continued)

(Table 6, contd)

OP5-0 Setpoints - Engine/Generator Programming[1]				
Setpoint	**Name**	**Description**	**Range Of Value**	**Controller Default**
P027	Shutdown Override For High Oil Temperature Fault	GSC+P responds to an engine high oil temperature fault. (Determined by application or customer.)	0 - alarm only (shutdown override, no engine shutdown) 1 - engine shutdown	0
P028	Nameplate Voltage	Rated voltage of the generator. This setpoint is used for protective relaying functions.	100V to 25kV in increments of 1	480V
P029	Nameplate Current	Rated current output of the generator.	0 to 4000A in increments of 1	600A
P030	Nameplate Power	Rated power capability of the generator.	0 through 10MW in increments of 1kW	400kW
P031	Rated Frequency	Nominal frequency rating of generator set.	50, 60 or 400Hz	60Hz
P032	Connection Configuration Of Generator	Wye or delta configuration of generator.	0 - wye 1 - delta	0
P033[8]	Number Of Generator Poles.	Number of generator poles.	0 through 254 in increments of 2	4

(1) The setpoints that are stored or the setpoints that are being programmed must match the specified setpoints of the particular generator set.
(2) The defaults shown represent the defaults in the GSC+P controller. Setpoints will be changed at the factory for specific generator set applications.
(3) When oil pressure drops to within 34 kPA (5 psi) of the “P013” or “P014”setpoint, a low oil pressure alarm is issued by the GSC+P 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 “P015 ”setpoint, a high water temperature alarm is issued by the GSC+P 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. Refer to Testing And Adjusting, “AC Voltage Range Selection”.
(6) After setpoint P022 is reprogrammed, the GSC+P must be power cycled (powered down and then powered up).
(7) The P024 setpoint only functions when the P023 setpoint is set to 1 (gas engine).
(8) When P033 is programmed to 0 poles, the AL15 fault (GSC+P Configuration Error) is disabled.

i02898415

Protective Relaying Programming OP5-1

SMCS Code: 4490

Protective Relaying Programming

OP5-1 is the option for the programming of the protective relaying setpoints. When one or more of the protective relay functions occur, the protective relaying setpoints determine the response of the GSC+P. The GSC+P provides the protective relaying function in order to reduce the possibility of damage to the generator. The protective relaying functions are used in order to reduce the possibility of damage to the customer equipment. The setpoints are programmed in the GSC+P at the factory to the default values. The setpoints may be changed in order to satisfy the requirements of the customer. The setpoints are from P101 to P142 and the setpoints are programmable. Each of the setpoints is described in Table 7.

Procedure For Protective Relaying Programming

Note: Service Mode cannot be accessed when the Engine Control Switch (ECS) is in the AUTO position.

Note: An active shutdown fault is indicated by a FLASHING shutdown indicator . An active shutdown fault 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 no longer be occurring. The fault must be corrected. The ECS must be returned to the OFF/RESET position. If the jumper from terminal 6 to terminal 9 is not installed on the ECS, the GSC+P does 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 4” is showing on the lower display. For more information, refer to System Operation, “Password Entry OP3”.

2. Press “SCROLL UP” key two times. “OP5-1” is showing on the lower display.

3. Press “SELECT” key once. “P101” is showing. “P101” 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 setpoint value. 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 the “SCROLL DOWN” key in order to adjust the value of the setpoint.

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

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 normal mode.

Table 7

OP5-1 Setpoints (1) - Protective Relaying Programming				
Setpoint	**Name**	**Description**	**Range Of Value**	**Factory Default**
P101	Overvoltage Alarm Enable	The GSC+P enables or disables the generator overvoltage alarm function.	0 - disabled 1 - enabled	1
P102	Overvoltage Alarm Threshold	Voltage the GSC+P uses to issue an overvoltage alarm.	100 to 125% of nameplate voltage in increments of 1%	105%
P103	Overvoltage Alarm Time Delay	Amount of time the GSC+P waits before issuing an overvoltage alarm.	0 to 120 seconds(2) in increments of 1	10 seconds
P104	Overvoltage Shutdown Enabled	The GSC+P enables or disables the generator overvoltage shutdown function.	0 - disabled 1 - enabled	1
P105	Overvoltage Shutdown Threshold	Voltage the GSC+P uses to issue an overvoltage shutdown.	100 to 125% of nameplate voltage in increments of 1%	110%
P106	Overvoltage Shutdown Time Delay	Amount of time the GSC+P waits before inssuing an overvoltage shutdown.	0 to 120 seconds(2) in increments of 1	10 seconds
P107	Undervoltage Alarm Enable	The GSC+P enables or disables the generator undervoltage alarm function.	0 - disabled 1 - enabled	1
P108	Undervoltage Alarm Threshold	Voltage the GSC+P uses to issue an undervoltage alarm.	60 to 100% of nameplate voltage in increments of 1%	90%

(continued)

(Table 7, contd)

OP5-1 Setpoints (1) - Protective Relaying Programming				
Setpoint	**Name**	**Description**	**Range Of Value**	**Factory Default**
P109	Undervoltage Alarm Time Delay	Amount of time the GSC+P waits before inssuing an undervoltage alarm.	0 to 120 seconds(2) in increments of 1	10 seconds
P110	Undervoltage Shutdown Enable	The GSC+P enables or disables the generator undervoltageshutdown function.	0 - disabled 1 - enabled	1
P111	Undervoltage Shutdown Threshold	Voltage the GSC+P uses to issue an undervoltage shutdown.	60 to 100% of nameplate voltage in increments of 1%	85%
P112	Undervoltage Shutdown Time Delay	Amount of time the GSC+P waits before issuing an undervoltage shutdown.	0 to 120 seconds(2) in increments of 1	15 seconds
P113	Overfrequency Alarm Enable	The GSC+P enables or disables the generator overfrequency alarm function.	0 - disabled 1 - enabled	1
P114	Overfrequency Alarm Threshold	Frequency that the GSC+P uses to issue an overfrequency alarm.	50 to 60, for 50 Hz Gen 60 to 70 , for 60 Hz Gen 400 to 480, for 400 Hz Gen	53 Hz 63 Hz 422 Hz
P115	Overfrequency Alarm Time Delay	Amount of time the GSC+P waits before issuing an overfrequency alarm.	0 to 120 seconds(2) in increments of 1	10 seconds
P116	Overfrequency Shutdown Enable	The GSC+P enables or disables the generator overfrequency shutdown function.	0 - disabled 1 - enabled	1
P117	Overfrequency Shutdown Threshold	Frequency the GSC+P uses to issue an overfrequency shutdown.	50 to 60, for 50 Hz Gen	55Hz
			PEEC and EUI Engines: 60 to 70, for 60Hz Gen	66 Hz
			MUI Engines: 60 to 70, for 60 Hz Gen	63 Hz
			PEEC and EUI Engines: 400 to 480, for 400 Hz Gen	440 Hz
			MUI Engines: 400 to 480, for 400 Hz Gen	422 Hz
P118	Overfrequency Shutdown Time Delay	Amount of time the GSC+P waits before issuing an overfrequency shutdown.	0 to 120 seconds(2) in increments of 1	10 seconds
P119	Underfrequency Alarm Enable	The GSC+P enables or disables the generator underfrequency alarm function.	0 - disabled 1 - enabled	1

(continued)

(Table 7, contd)

OP5-1 Setpoints (1) - Protective Relaying Programming				
Setpoint	**Name**	**Description**	**Range Of Value**	**Factory Default**
P120	Underfrequency Alarm Threshold	Frequency the GSC+P uses to issue an underfrequency alarm.	MUI Engines: 30 to 50, for 50 Hz Gen	45 Hz
			PEEC and EUI Engines: 30 to 50, for 50 Hz Gen	47 Hz
			MUI Engines: 36 to 60, for 60 Hz Gen	54 Hz
			PEEC and EUI Engines: 36 to 60, for 60 Hz Gen	57 Hz
			MUI Engines: 240 to 400, for 400 Hz Gen	360 Hz
			PEEC and EUI Engines: 240 to 400, for 400 Hz Gen	378 Hz
P121	Underfrequency Alarm Time Delay	Amount of time the GSC+P waits beforeissuing an underfrequency alarm.	0 to 120 seconds(2) in increments of 1	10 seconds
P122	Underfrequency Shutdown Enable	The GSC+P enables or disables the generator underfrequency shutdown function.	0 - disabled 1 - enabled	1
P123	Underfrequency Shutdown Threshold	Frequency the GSC+P uses to issue an underfrequency shutdown.	30 to 50, for 50 Hz Gen 36 to 60, for 60 Hz Gen 240 to 400, for 400 Hz Gen	45 Hz 54 Hz 360 Hz
P124	Underfrequency Shutdown Time Delay	Amount of time the GSC+P waits before issuing an underfrequency shutdown.	0 to 120 seconds(2) in increments of 1	15 seconds
P125	Reverse Power Shutdown Enable	The GSC+P enables or disables the generatorreverse power shutdown function.	0 - disabled 1 - enabled	1
P126	Reverse Power Shutdown Threshold	Level of reverse power the GSC+P uses to issue a reverse power shutdown.	0 to 20% of nameplate power in increments of 1%	15%
P127	Reverse Power Shutdown Time Delay	Amount of time the GSC+Pwaits before issuing a reverse power shutdown.	0 to 30 seconds(2) in increments of 1	10 seconds
P128	Overcurrent Alarm Enable	The GSC+P enables or disables the overcurrent alarm.	0 - disabled 1 - enabled	1
P129	Phase Overcurrent Alarm Threshold	Level of current the GSC+P uses to issue a phase overcurrent alarm.	100 to 160% of nameplate current in increments of 5%	105%
P130	Phase Overcurrent Alarm Time Delay	Amount of time the GSC+P waits before issuing a phase overcurrent alarm.	0 to 250 seconds(2) in increments of 1	20 seconds
P131	Total Overcurrent Alarm Threshold	Level of current the GSC+P uses to issue a total overcurrent alarm.	100 to 160% of three times nameplate current in increments of 5%	105%
P132	Total Overcurrent Alarm Time Delay	Amount of time the GSC+P waits before issuing a total overcurrent alarm.	0 to 250 seconds(2) in increments of 1	20 seconds
P133	Overcurrent Shutdown Ecable	The GSC+P enables or disables the overcurrent shutdown.	0 - disabled 1 - enabled	1
P134	Phase Overcurrent Shutdown Threshold	Level of current the GSC+P uses to issue a phase overcurrent shutdown.	100 to 160% of nameplate current in increments of 5%	110%

(continued)

(Table 7, contd)

OP5-1 Setpoints (1) - Protective Relaying Programming				
Setpoint	**Name**	**Description**	**Range Of Value**	**Factory Default**
P135	Phase Overcurrent Shutdown Time Delay	Amount of time the GSC+P waits before issuing a phase overcurrent shutdown.	0 to 250 seconds(2) in increments of 1	30 seconds
P136	Total Overcurrent Shutdown Threshold	Level of current the GSC+P uses to issue a total overcurrent shutdown.	100 to 160% of three times nameplate current in increments of 5%	110%
P137	Total Overcurrent Shutdown Time Delay	Amount of time the GSC+P waits before issuing a total overcurrent shutdown.	0 to 250 seconds(2) in increments of one.	30 seconds
P138	KW Level Relay Enable	The GSC+P enables or disables the kW level relay function.	0 - disabled 1 - enabled	1
P139	KW Level Relay Threshold	Level of power the GSC+P uses to activate the kW level relay function.	0 to 110% of nameplate power in increments of 1%	105%
P140	KW Level Relay Time Delay	Amount of time the GSC+P waits before activating the kW relay function.	0 to 120 seconds(2) in increments of 1	0 seconds
P141	KW Level Relay Disengage Threshold	Level of power the GSC+P uses deactivate the kW level relay function.	0 to 110% of nameplate power in increments of 1%	100%
P142	KW Level Relay Disengage Time Delay	Amount of time the GSC+P waits before deactivating the kW level relay function.	0 to 120 seconds(2) in increments of 1	10 seconds

(1) The setpoints are programmed at the factory to the default value. The setpoints may be changed in order to satisfy customer or application requirements.
(2) When programmed to 0 seconds, the actual time is from 0.5 to 1.0 seconds.

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AC Factory Calibration Setpoint Programming OP5-2

SMCS Code: 4490

The AC Factory Calibration Setpoints (OP5-2) are only used in the factory. The setpoints are read only and the setpoints are not accessible by the user.

i02896713

Parallel Setpoint Programming OP5-3

SMCS Code: 4490

The Synchronization setpoints within the GSC+P define various parameters that allow precise frequency and phase matching.

The setpoints are programmed (set) in the GSC+P at the factory to the default values that are in the following chart. The setpoints may be changed to satisfy the requirements of the customer. Also the setpoints may be changed to satisfy the requirements of the application.

Table 8

OP5-3 Setpoints - Paralleling Programming				
Setpoint	**Name**	**Description**	**Range Of Value**	**Factory Default**
P301	Synchronization Enable	Enables or disables the synchronization function, and specifies the type of Load Share control being driven.	0 - disabled 1 - Woodward	0
P302	Breaker Coil Time Limit	The maximum amount of time the breaker coil can be energized without damaging the coil.	0.2 to 5.0 seconds in increments of 0.1 second	1.0 second
P303	Voltage Limit Enable	Enables or disables the generator/bus voltage checking during automatic synchronization	0 - disabled 1 - enabled	1
P304	Voltage Limit	The maximum acceptable difference between the bus voltage and the oncoming voltage, expressed as a percentage of bus voltage.	1% to 15 % in increments of 1%	1%
P305(1)	Phase Tolerance Limit	The maximum phase angle magnitude allowed for breaker closure	1 to 25 degrees in increments of 1 degree	5 degrees
P306(1)	Dwell Time	The time during which the phase angle between the generator and the bus during synchronization.	0.1 to 1.0 seconds in increments of 0.1 second	0.5 second
P307(1)(2)	Speed Control Gain	Controls how fast the engine speed will change during synchronization.	0.0% to 100.0% in increments of 0.1%	50.0%
P308(1)(2)	Speed Control Rate	Controls the rate of change of the phase angle differencebetween the generator and the bus during synchronization.	0.0% to 100.0% in increments of 0.1%	50.0%
P309(1)(2)	Speed Control Damping	Controls the amount of overshoot and settling time of engine speed during synchronization.	0.0% to 100.0% in increments of 0.1%	0.0%
P310	Dead Bus Closure Enable	Enables or disables automatic closing to a dead bus.	1 - enabled(3) 0 - disabled	0
P311	Dead Bus Limit	The maximum acceptable voltage for the bus to be considered dead, as a percent of rated voltage.	5% to 50% in increments of 1%	20%
P312	Dead Bus On Time Delay	The amount of time the GSC+P waits before closing to a dead bus.	0 to 120 seconds in increments of 1 second	0 seconds
P313	Frequency Match Notification Time	The amount of time before notification of possible synchronization failure. Must not be greater than the Maximum Synchronization Time.	5 to 1000 seconds in increments of 1 seconds	20 seconds
P314	Maximum Synchronization Time	The maximum amount of time to spend attempting to synchronize before setting the Synchronization Time-out Alarm	5 to 1000 seconds in increments of 1 second	30 seconds

(1) P305, P306, P307, P308, and P309 can be adjusted to precisely match individual engine response and breaker closure characteristics using OP11 - Synchronization Setpoint Tuning.

(2) The GSC+P uses P-I-D (proportional-integral-derivative) control to accomplish synchronization quickly and smoothly. The P parameter, I parameter, and D parameter are independantly controlled by setpoints P307, P308, and P309 respectively. Adjusting any one of these setpoints will not affect the other two settings. For more information, see Systems Operation, “Synchronization Mode” Setpoint Tuning.

(3) Dead bus closure will only work in the automatic mode, NOT in permissive mode or semi automatic mode.

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Spare Input/Output Programming OP6

SMCS Code: 4490

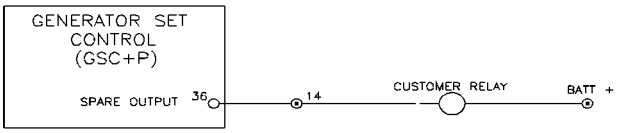
OP6 is the option for the programming of the following parameters: Spare Inputs, Spare Indicators, Spare Outputs, and Programmable Spare Relay Outputs. These spare inputs and outputs are provided in order to satisfy the needs of the customer.

On EMCP II+P panels, spare input 1, spare input 3 and spare input 4 are not available for use by the customer. Any other fault signals can be connected to spare input 2. Multiple signals can be separated using diodes provided that all signals are switched negative or all signals are switched positive. A mixture of both types of signals is incorrect.

Spare Inputs

The spare inputs are referred to as SP1, SP2, SP3 and SP4. The spare inputs are accessed through the terminal strip. The terminal strip is located within the control panel on the rear wall. The terminations for the spare inputs that are located on the terminal strip are listed below.

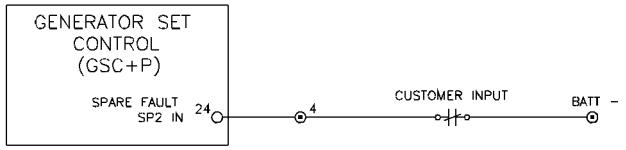
The active input state, the response that is taken and the time delay for each spare input is programmable. The GSC+P responds to the active state of an input and the response can be delayed. Setpoints SP01 through SP12 are used for the programming of the spare inputs. Table 9 describes each of the setpoints.



g01443349

Illustration 40

Typical Active Low Input Configuration For Spare Input .



g01443366

Illustration 41

Typical Active High Input Configuration For Spare Input .

The GSC+P must be programmed to accept a HIGH active input state or a LOW active input state. A HIGH active input state is +5 DCV to the voltage of the batteries. A LOW active input state is “BATT-”. When an input is programmed for a HIGH active input state, a HIGH signal at the input creates a spare fault condition. When an input is programmed for a LOW active input state, a LOW signal at the input creates a spare fault condition. When an input is programmed for a LOW active input state, a LOW signal at the input is considered as a spare fault condition. A HIGH signal at the input is considered as a normal condition. Setpoints SP01, SP04, SP07 and SP10 are used to program the active input state of the spare inputs. Table 9 describes each of the setpoints.

Note: If an input is left floating, the internal circuitry of the GSC+P pulls the input high and the GSC+P responds accordingly.

The GSC+P must be programmed for a response to an active spare fault. The GSC+P responds by treating the condition as a fault shutdown or a fault alarm. Setpoints SP02, SP05, SP08 and SP11 are used for the programming of the response. Table 9 describes the setpoints below.

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

The GSC+P 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+P does not respond. Indicators are not activated and codes are not shown until the time delay has elapsed. Also, engine operation is not changed until the time delay has elapsed. Setpoints SP03, SP06, SP09 and SP12 are used for the programming of the time delay. The time delay is selectable from 0 to 250 seconds. Table 9 describes the setpoints.

Alarm Mode Sequence Of Operation – If a fault occurs in a spare input that is programmed as an active input, the following steps occur and the fault is programmed as an alarm fault:

1. The GSC+P waits until the time delay elapses.
2. The fault alarm indicator FLASHES.
3. The corresponding code SP1, SP2, SP3 or SP4 is shown on the upper display of the GSC+P.
4. The engine continues to run and the engine is able to start.

Shutdown Mode Sequence Of Operation – The following sequence occurs when a fault occurs in a spare input and the fault is programmed as a shutdown fault. The spare input must be programmed to receive an active input.

1. The GSC+P waits until the time delay elapses.
2. The fault shutdown indicator FLASHES.
3. The corresponding code SP1, SP2, SP3 or SP4 is immediately shown on the upper display of the GSC+P.
4. The engine is shutdown or the engine is disabled from starting.

The fault shutdown indicator remains FLASHING and the spare fault code remains shown until the Engine Control Switch (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 start and the engine is able to run.

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

Note: If the customer does not prefer to use the spare inputs, program the spare inputs to receive an active low state. Do not connect any components to the spare input.

Spare Indicators

The spare indicators are located on the face of the GSC+P and the spare indicators are referred to as Spare 1, Spare 2, and Spare 3. The spare indicators are programmable. A large selection of trigger conditions is available to activate the spare indicators. Setpoints SP17, SP18 and SP19 are used for the programming of the trigger condition. Table 9 describes all of the setpoints.

Spare Output

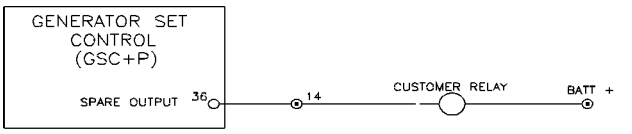


Illustration 42 g01443349

Typical Active Low Configuration For Spare Output.

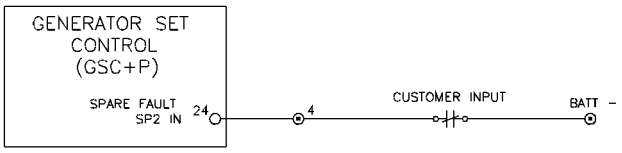


Illustration 43 g01443366

Typical Active High Configuration For Spare Output.

The spare output responds to a selected trigger condition. The trigger condition should be high or low. The response and the trigger condition are programmable. The spare output is accessed on the terminal strip in the customer connection box on the side of the control panel. The spare output is marked as “SPARE” on the auxiliary terminal strip.

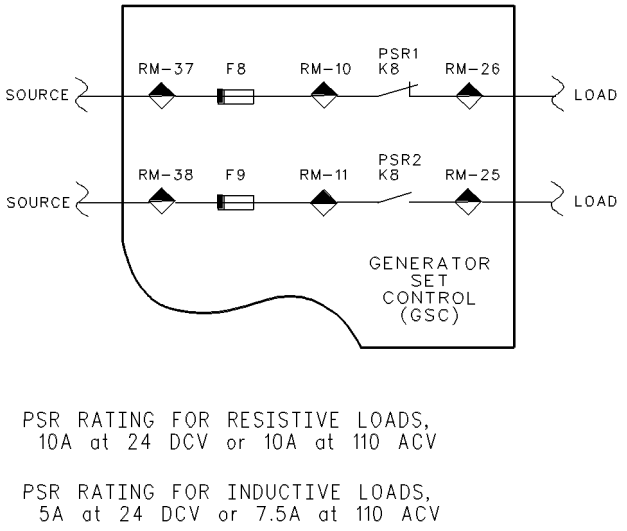
The GSC+P must be programmed to accept a high input or a low input for the active state of the spare output. An active low state means that the output is pulled to ground. The output draws approximately 100 mA when the output is in the low state. A high state allows the output to float. When there are no devices that are connected to the spare output, a high input is 5.0 DCV. When the spare output is in the high state, the spare output is floating. The spare output is only capable of driving logic circuits that have a high impedance. A high impedance is one that is greater than 36 000 ohms. When the spare output is in the high state, the spare output will not drive loads that have a low impedance. An example of a load with a low impedance is a relay. Setpoint SP13 is used for the programming of the active state of the spare output. Table 9 describes the setpoints.

The GSC+P must be programmed to accept the condition that triggers the spare output to the active state. A large selection of trigger conditions is available to activate the spare output. Setpoint SP14 is used for the programming of the trigger condition. Table 9 describes the setpoints.

Note: A common use of the spare output is activating the shunt trip coil of the AC circuit breaker during engine cooldown.

Note: The GSC+P diagnoses a fault in the spare output circuit. Refer toCID 334 in the topic Testing And Adjusting Section, “Diagnostic Fault Codes” for more information.

Programmable Spare Relay Outputs



g00409883

Illustration 44

Programmable Spare Relay (PSR)

Note: On EMCP II+P panels, the PSR is not available for use by the customer. The EMCP II+P uses this output.

The (PSR) should respond to a selected trigger condition. The response and the trigger condition are programmable. The programmable spare relay (K8) is located in the relay module on the rear of the GSC+P. RM-25 is the termination for the normally open contacts of the PSR. RM-26 is the termination for the normally closed contacts of the PSR.

When the outputs are triggered, the GSC+P must be programmed to decide whether the outputs of the PSR are active or inactive. In an active state, the normally open contacts will close and the normally closed contacts will open. Setpoint SP15 is used to program the active state of the spare relay output. The setpoint is described in 9.

The GSC+P must be programmed for the condition that triggers the output of the programmable spare relay to the active state. A large selection of trigger conditions is available to activate the output of the spare relay. Setpoint SP16 is used for the programming of the trigger condition. The setpoint is described Table 9.

Note: The GSC+P diagnoses a fault in the output circuit of the programmable spare relay. For more information, refer to 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 shutdown fault is active when any shutdown indicator is FLASHING. 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 shutdown fault must no longer be 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+P does not power up in OFF/RESET and any active shutdown fault must be corrected before entering Service Mode.

1. Shut down the engine by turning the ECS to the STOP position. Enter Service Mode and enter the password. “OP 4” is showing on lower display. For more information, refer to Systems Operation, “Procedure To Enter The Password”.

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

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

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

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

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

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

9. Press the “EXIT” key. The display returns to Normal Mode.

Table 9

OP6-0 Setpoints(1) - Spare Input/Output Programming				
Setpoint	**Name**	**Description**	**Range Of Value**	**Factory Default**
SP01	Spare Input 1 Active State	Input state used by the GSC+P to declare that a SP01 fault exists.	0 - active low 1 - active high	0
SP02	Spare input 1 Response	GSC+P response to a SP01 fault.	0 - shutdown 1 - alarm	0
SP03	Spare Input 1 Time Delay	Amount of time the GSC+P waits before responding to a SP1 fault.	0 to 250 seconds in increments of 1	0 seconds
SP04	Spare Input 2 Active State	Input state used by the GSC+P to declare that a SP02 fault exists.	0 - active low 1 - active high	0
SP05	Spare Input 2 Response	GSC+P response to a SP02 fault	0 - shutdown 1 - alarm	0
SP06	Spare Input 2 Time Delay	Amount of time the GSC+P waits before responding to a SP02 fault.	0 to 250 seconds in increments of 1	0
SP07	Spare Input 3 Active State	Input state used by the GSC+P to declare that a SP03 fault exists.	0 - active low 1 - active high	0
SP08	Spare Input 3 Response	GSC+P response to a SP03 fault.	0 - shutdown 1 - alarm	0
SP09	Spare Input 3 Time Delay	Amount of time the GSC+P waits before responding to a SP03 fault.	0 to 250 seconds in increments of 1	0 seconds
SP10	Spare Input 4 Active State	Input state used by the GSC+P to declare that a SP04 fault exist.	0 - active low 1 - active high	0
SP11	Spare Input 4 Response	GSC+P response to a SP04 fault.	0 - shutdown 1 - alarm	0
SP12	Spare Input 4 Time Delay	Amount of time the GSC+P waits before responding to a SP04 fault.	0 to 250 seconds in increments of 1	0 seconds

(continued)

(Table 9, contd)

OP6-0 Setpoints[1] - Spare Input/Output Programming				
Setpoint	**Name**	**Description**	**Range Of Value**	**Factory Default**
SP13	Spare Output Response	GSC+P response to the spare output trigger condition.	0 - active low 1 - active high	0
SP15	Spare Relay Output Response	GSC+P response to the spare relay trigger condition.	0 - relay inactive when triggered 1 - relay active when triggered	1
SP14	Spare Output Trigger Condition	The condition used by the GSC+P to trigger the spare output trigger response.	0 - unused 1 - active SP01 fault[2] 2 - active SP02 fault[2] 3 - active SP03 fault[2] 4 - active SP04 fault[2] 5 - any combination of active SP01, SP02, SP03 or SP4 faults[2] 6 - any active shutdown fault (AL1 - AL14, SP01 - SP04, or CID FMI) 7 - any active alarm or shutdown fault (AL1 - AL15, SP01 - SP04, or CID FMI) 8 - cooldown mode 9 - coolant loss fault[2] 10 - high oil temperature fault[2] 11 - CCM control[3]	8
SP16	Spare Relay Output Trigger Condition	The condition used by the GSC+P to trigger the spare relay.		
SP17	Spare Indicator 1 Trigger Condition	The condition used by the GSC+P to trigger spare indicator 1.	0 - unused 1 - active SP01 fault[2] 2 - active SP02 fault[2] 3 - active SP03 fault[2] 4 - active SP04 fault[2] 5 - any combination of active SP01, SP02, SP03 or SP04 faults[2] 6 - coolant loss fault[2] 7 - high oil temperature fault[2] 8 - kW level relay active	0
SP18	Spare Indicator 2 Trigger Condition	The condition used by the GSC+P to trigger Spare Indicator 2.		
SP19	Spare Indicator 3 Trigger Indicator	The condition used by the GSC+P to trigger spare indicator 3.		

(1) The setpoints are programmed at the factory to the default value. The setpoints may be changed to satisfy customer requirements or application requirements.
(2) Either alarm or shutdown faults are valid trigger conditions.
(3) When SP14 is programmed to 11 (CCM control), the spare output is always active low. When SP16 is programmed to 11 (CCM control), the spare relay is always active when triggered.

i02898711

Hourmeter Programming OP7

SMCS Code: 4490

OP7 is used in order to program the hours that are on the hour meter.

Note: The value for the hour meter on the GSC+P display is determined by the engine ECM. The OP7 is not available for programming.

i02898745

Voltmeter/Ammeter Programming OP8

SMCS Code: 4490

Table 10

OP8 Setpoints[1] - Voltmeter Ammeter Programming				
Setpoint	**Name**	**Description**	**Range Of Value**	**Factory Default**
AC01	Phase A (VA) Voltage Calibration	Calibration value used by the GSC+P to compensate for the characteristics of the phase A voltage transformer within the ATB+.	0 to 255 in increments of 1	0
AC02	Phase B (VB) Voltage Calibration	Calibration value used by the GSC+P to compensate for the characteristics of the phase B voltage transformer within the ATB+.	0 to 255 in increments of 1	0
AC03	Phase C (VC) Voltage Calibration	Calibration value used by the GSC+P to compensate for the characteristics of the phase C voltage transformer within the ATB+.	0 to 255 in increments of 1	0
AC04	Phase A (IA) Current Calibration	Calibration value used by the GSC+P to compensate for the characteristics of the phase A current transformer within the ATB+.	0 to 255 in increments of 1	0
AC05	Phase B (IB) Current Calibration	Calibration value used by the GSC+P to compensate for the characteristics of the phase B current transformer within the ATB+.	0 to 255 in increments of 1	0
AC06	Phase C (IC) Current Calibration	Calibration value used by the GSC+P to compensate for the characteristics of the phase C current transformer within the ATB+.	0 to 255 in increments of 1	0
AC07[2]	Phase A (VA) Voltage Calibration of BTB+	Calibration value used by the GSC+P to compensate for the characteristics of the phase A voltage transformer within the BTB+.	0 to 255 in increments of one.	0

(1) The setpoints are programmed at the factory to the calibration value listed on the bar code sticker of the ATB+.
(2) Setpoint is available on GSC+P only.

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

The GSC+P monitors six transformers in the ATB+ for information about the voltage and current. Each transformer has individual characteristics that affect the voltage and current measurements that are taken by the GSC+P. A calibration value is measured and the value is assigned at the factory. The calibration value is recorded on the bar code sticker that is located on the lower left hand 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+P. The transformers calibration value is 0 to 255. The transformers calibration value uses increments of 1.

Procedure For Voltmeter/Ammeter Programming

Note: Service Mode cannot be entered when the Engine Control Switch (ECS) is in the AUTO position.

Note: Any active shutdown fault must be made inactive in order to access Service Mode. To temporarily change a shutdown fault from an active shutdown 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, the GSC+P does 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 4 is showing on the lower display. For more information, refer to Systems Operation, “Service Mode”for more information. Refer to the Systems Operation, “Password Entry OP3”for more information.

2. Press the “SCROLL UP” key five times. “OP 8” is showing on the lower display.

3. Press the “SELECT” key. “AC01” is showing. The value of the setpoint is also showing. The value will be between 0 to 255.

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

5. Press the “SCROLL UP” or the “SCROLL DOWN” key in order to adjust the value of the AC01 setpoint. Match the value that is shown on the ATB+ with the line voltage (A) to the line voltage (B).

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

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

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

9. Press the “EXIT” key. The display will return to the Normal Mode.

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Engine Setpoint Verification OP9

SMCS Code: 4490

OP9 is the option for verifying that the EMCP II+ operates correctly when a fault occurs with low oil pressure, high coolant temperature or engine overspeed. An overspeed fault for the engine causes the GSC+P to shut off the engine. When a low oil pressure fault or a high water temperature fault is detected the GSC+P will shut off the engine or the GSC+P will sound the alarm according to the programmed setpoint P003. Setpoint P003 is the shutdown override setpoint for an engine fault.

OP9 is only for verification of certain engine setpoints. OP5-0 is used for the actual programming of these setpoints. The setpoints that are verified by this procedure are listed below.

P003 Shutdown Override For Engine Fault – P003 is the GSC+P response to a low engine oil pressure. P003 is also the response to a high coolant temperature fault. 0 is for engine shutdown. If P003 is set to 1 then the alarm responds only. The GSC+P will override engine shutdown. The default value for P003 is 0.

P010 Engine Overspeed – The GSC+P uses setpoint P010 in order to show an overspeed fault for the engine. The engine overspeed setpoint is 1.18 times the rated speed for all 60 Hz applications. The values vary from 500 to 4330 rpm. The values are changed in increments of 10. The default value for P010 is 2120.

P013 Low Oil Pressure Shutdown At Rated Speed – The oil pressure is used by the GSC+P to declare that a low oil pressure shutdown fault exists with the engine at rated speed. The speed must have exceeded the oil step speed setting for at least nine seconds. The values vary from 34 to 420 kPa (5 to 61 psi). The increments increase with a value of 1. The default value for P013 is 205 kPa (30 psi).

Note: When the oil pressure drops to a level that is within 34 kPa (5 psi) of the P013 setpoint, a low oil pressure alarm is issued by the GSC+P and the optional alarm module.

P015 High Water Temperature Shutdown – The coolant temperature is used by the GSC+P to declare that a high coolant temperature shutdown fault exists after a 10 second delay. The values vary from 85 to 123°C (185 to 253°F). The increments increase with a value of 1. The default value for setpoint P015 is 107°C (225°F).

Note: A high water coolant temperature alarm is issued by the GSC+P when the coolant temperature rises to a level that is within 6°C (11°F) of the P015 setpoint.

The following conditions are required before the engine setpoints are verified.

- The previously listed setpoints must be correct for the engine application. Refer to System Operation, “Service Mode” in order to view a list of the setpoints. Refer to System Operation, “Setpoint Programming OP5” in order to program the setpoints.

- The engine is checked at idle and rated speed. No faults should be present at the initial starting. If necessary, troubleshoot and correct any fault.

Procedure For Overspeed Verification

Note: Service mode cannot be accessed when the Engine Control Switch (ECS) is in the AUTO position.

1. Start and run the engine at rated speed. Enter service mode and enter the password. “OP 9” is showing on the lower display. Refer to System Operation, “Password Entry OP3”.

2. Press the “SELECT” key. The value of the overspeed setpoint “P010” is showing on the upper display. The default value for P010 is 2120. “SC1” is showing on the lower display. “SC1” is followed with the present engine speed value.

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

4. Decrease the setpoint value by pressing the “SCROLL DOWN” key. The default setpoint value is 2120. The default value is flashing on the upper display. The setpoint value decreases by 10 rpm with each press of the scroll down key. Press the “SCROLL DOWN” key until the setpoint value is past the present engine speed value that is showing on the display.

When the setpoint value is less than the present engine speed value, the engine will shut down. The engine overspeed indicator will flash. The GSC+P will no longer be in the service mode.

Procedure For Oil Pressure Verification

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

1. Start the engine and run the engine at rated speed. Enter service mode and enter the password. “OP 9” is showing on the lower display. Refer to System Operation, “Password Entry OP3” for more information about entering the password.

2. Press “SELECT” key. The value of the overspeed setpoint P010 is showing on the upper display. The default value for P010 is 2120. “SC1” is showing on the lower display. The present engine speed value is then shown on the display.

3. Press the “SCROLL UP” key once. The value of the P013 setpoint for low oil pressure shutdown at rated speed is showing on the upper display. 205 kPa (30 psi) is the default value. The present oil pressure value is shown on the display.

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

5. The setpoint value that is flashing on the upper display is increased by pressing the “SCROLL UP” key. With each press of the “SCROLL UP” key, the setpoint value increases by five. Press the “SCROLL UP” key until the setpoint value is past the present value that 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 should be flashing. The GSC+P should not be in service mode.

Procedure For Verification of High Water Temperature

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

1. Start the engine and run the engine at rated speed. Enter service mode and enter the password. “OP 9” is showing on the lower display. Refer to System Operation, “Password Entry OP3”.

2. Press “SELECT” key. The value of overspeed setpoint “P010” is showing on the upper display. The default value of the overspeed setpoint is 2120. “SC1” is showing on the lower display. “SC1” is followed with the present engine speed value.

3. Press the “SCROLL UP” key two times. The value of the P015 setpoint for high water temperature shutdown is showing on the upper display. The default value for setpoint P015 is 107°C (225°F). “P015” is showing on the upper display. “SC3” is then shown on the lower display which is followed by the present coolant temperature value.

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

5. The setpoint value that is flashing on the upper display is decreased by pressing the “SCROLL DOWN” key. With each press of the “SCROLL DOWN” key, the setpoint value decreases by five degrees. Continue pressing the “SCROLL DOWN” key until the setpoint value decreases past the present coolant temperature value that is showing on the lower display.

The engine shuts down and the high water temperature indicator begins flashing when the setpoint value is less than the present coolant temperature value. The GSC+P is no longer in service mode.

i02898780

AC Offset Adjustment OP10

SMCS Code: 4490

Table 11

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+P 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+P 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+P 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+P 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+P 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+P 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 requirements of the customer or the requirements of the application.

OP10 is used in order to adjust the voltmeter readings of the GSC+P. The GSC+P AC voltages are calibrated at the factory. The measurements of AC voltage should never require adjustment.

Note: Caterpillar does NOT recommend altering the AC voltmeter. Performing this procedure reduces the accuracy of the GSC+P voltmeter.

Note: The adjusted voltages are used for the display only. The adjusted voltages will not be sent over the CAT Data Link to other modules. The customer communication module is another module that may receive information over the CAT Data Link. The adjusted voltages are not used in order to determine the fault thresholds for the protective relaying function. The GSC+P determines the values that are not adjusted in both cases. The values that are not adjusted for AC voltage are not shown in both cases. The values that are not adjusted will be used instead of the displayed values.

Procedure For AC Offset Adjustment

The adjusted voltages and the adjusted currents are shown on the left side of the upper display. The percentage of the offset is shown on the right side of the upper display. The user can adjust each voltage and current up to ±5.0% in increments of 0.04%.

Note: Service Mode cannot be entered when the Engine Control Switch (ECS) is in the AUTO position.

1. Startthe engine and run the engine at rated speed. Enter service mode and enter the password. “OP9” is showing on the lower display. Refer to System Operation, “Password Entry OP3” for more information.

2. Press the “SCROLL UP” key once. “OP 10” is showing on the lower display.

3. Press “SELECT” key. “AC CAL” is showing on the lower display. The voltage in phase “A” is showing on the left side of the upper display. The voltage in phase “A” is line to neutral voltage.

4. Press “SELECT” key. The offset percentage value is flashing on the right side of the upper display.

5. Press the “SCROLL UP” key or press the “SCROLL DOWN” key in order to adjust the voltage value to the desired value. The percentage value continues flashing.

6. Press “ENTER” key. The percentage value display will stop flashing.

7. Press “SCROLL UP” key. Repeat steps 3, 4, 5 and 6 for the other setpoints.

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

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

i02898801

Parallel Setpoint Tuning OP-11

SMCS Code: 4490

OP11 is the option for programming some of the Synchronization setpoints. For more information, refer to Systems Operation, “Synchronization Tuning Procedure”. P305, P306, P307, P308, and P309 are the setpoints that are affected by this procedure. The setpoints are described in Systems Operation, “Parallel Programming OP5-3”.

Procedure For Programming Synchronization Setpoints

The generator set must be operating at rated speed when the technician is performing this procedure. The parallel functions are available in OP11 by using the Parallel Mode Switch.

Note: If a parallel function is requested with the Parallel Mode Switch, the OP11 display will be replaced by the display of the synchroscope while the synchronization is being performed. After synchronization, the display will return to OP11.

1. Start the engine and run the engine at rated speed. Enter Service Mode and enter the password. For more information, refer to Systems Operation, “Password Entry - OP3”. “OP9” should now be showing on the lower display.

2. Press the “SCROLL UP” key twice. OP11 is showing on the lower display.

3. Press the “SELECT”. “P305” is showing on the lower display.

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

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

6. Press the “SCROLL UP” key or the “SCROLL DOWN” key in order to adjust the value of the setpoint. In order to rapidly scroll through a large range of values, press the appropriate “SCROLL” key and hold the key.

7. Press the “ENTER key”. The value of the setpoint stops flashing.

8. Repeat Steps 2, 3, 4, 5, 6, and 7 until all of the desired setpoints are adjusted.

9. Press the “EXIT” key. OP1 is showing on the lower display.

10. Press the “EXIT” key. The display returns to the Normal Mode.

i02898889

Fault Description

SMCS Code: 4490

A fault is any condition that does not conform to the rules that the GSC+P operates. A fault can be active or a fault can be inactive. An active fault is a fault that is occurring now. An inactive fault is a fault that has previously occurred. Some examples of faults are listed below.

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

An amount of severity is attached to every fault. The amount of severity also describes the GSC+P response to a fault. Faults are either alarm faults or shutdown faults. Alarm faults are not critical. Shutdown faults are critical.

An alarm fault provides the operator with an early warning to the operator of a possible future shutdown fault. For an alarm fault, the GSC+P automatically activates alarm mode and the fault alarm indicator FLASHES. Refer to System Operation, “Alarm Mode” for further information.

A shutdown fault tells the GSC+P to shutdown the engine in order to prevent engine damage. The GSC+P automatically activates shutdown mode which shuts down the engine. The GSC+P then flashes the corresponding indicator. Refer to System Operation, “Shutdown Mode” for more information.

Most faults have a code. There are three types of fault codes. The type is obtained from the GSC+P input that is involved. The three types of fault codes are listed below.

AL Fault Codes – The AL fault codes are shown as AL1 through AL18 on the upper display. The AL fault codes include specific engine conditions. An example of an AL fault code is the low engine oil pressure alarm. AL fault codes also include protective relaying functions. Another example of an AL fault code is the underfrequency fault.

SP Fault Codes – The SP fault codes are shown as SP1 through SP4 on the upper display.

Diagnostic Codes – Diagnostic codes are shown as numeric values. Diagnostic codes are identified by the illumination of “CID FMI” on the upper display.

There is an exception. There are no fault codes for the shutdown faults that correspond to the dedicated shutdown indicators. The shutdown faults are identified to the operator by the nearest dedicated fault shutdown indicator. Low oil pressure is an example of a dedicated shutdown indicator.

i02898986

AL Fault Codes

SMCS Code: 4490

AL Fault Codes are shown as AL1 through AL18 on the upper display. Fault codes AL1 through AL15 apply to all generator sets. The fault codes include specific engine fault conditions. An example of an engine fault condition is the low engine oil pressure fault. The fault codes also include protective relaying functions. The underfrequency fault is an example of the protective relaying function. The fault codes AL16 through AL18 apply to paralleling applications.

AL Fault Codes rely upon certain setpoints. Refer to Systems Operation, “Service Mode” for more information on setpoints. AL Fault Codes are not stored in the fault log of the GSC+P. Many of the AL Fault Codes are programmable as a fault alarm or as a shutdown fault. In order to show the severity of the fault, the AL Fault Codes are accompanied by a fault alarm indicator. Also, the fault shutdown indicator on the GSC+P can accompany an AL Fault Code. The AL Fault Codes and the related setpoints are described in the paragraphs that follow.

AL1 High Water Temperature Alarm – A high water temperature shutdown is issued by the GSC+P when the engine coolant temperature increases to about 6°C (11°F) from setpoint P015. The fault alarm indicator will FLASH. The AL1 fault code is shown on the upper display after the “Alarm Fault Codes” key is pressed.

P015 is the setpoint for a high water temperature shutdown. This setpoint sets the coolant level temperature. The GSC+P uses the temperature in order to declare that a shutdown fault due to high water temperature 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 P016, the GSC+P issues a low water temperature alarm. Setpoint P016 is the setpoint for the 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.

P016 is the setpoint for the low water temperature alarm. By displaying P016, the GSC+P indicates a low water temperature alarm fault.

AL3 Alarm for Low Engine Oil Pressure – When the engine oil pressure decreases to within 34 kPa (5 psi) of Setpoint P013 or P014, the GSC+P issues an alarm for the low engine oil pressure. The fault alarm indicator will FLASH and the “AL3” fault code is shown on the upper display after the “Alarm Codes” key is pressed.

P013 is the setpoint for low oil pressure shutdown at engine rated speed. If the oil pressure falls below this setpoint while the engine is at rated speed, the GSC+P will declare a low engine oil pressure fault. When the setpoint is reached, the dedicated shutdown indicator for low oil pressure flashes and the engine is shut down.

P014 is the setpoint for low oil pressure shutdown at idle speed. While the engine is at idle speed, Setpoint P014 tells the GSC+P when to declare a low oil pressure shutdown fault. When the setpoint is reached, the dedicated shutdown indicator for low oil pressure FLASHES and the engine is shutdown.

AL4 Fault Detected By The Engine ECM – The AL4 fault occurs when the Electronic Control Module (ECM) for the engine detects an alarm fault or a shutdown fault. The engine ECM tells the GSC+P whether the AL4 fault is an alarm fault or a shutdown fault. This indication includes faults that include derating of the engine. When the engine ECM is used in applications with generator sets, the engine ECM is programmed in the factory NOT to derate. The occurrence of an AL4 fault code could mean that the engine ECM is not programmed correctly. For the particular engine, refer to the Troubleshooting Service Module. The AL4 fault (P023) is disabled on MUI engines and gas engines.

When the fault is programmed as a shutdown fault, the fault shutdown indicator will FLASH and the “AL4” fault code is immediately shown on the upper display.

When the fault is programmed as an alarm fault, the fault alarm indicator will FLASH and the AL4 fault code is shown on the upper display after the alarm codes key is pressed.

AL5 Low Engine Coolant Level Fault – When the engine coolant level drops below the probe of the coolant loss sensor for ten seconds, the GSC+P issues a low coolant level warning (AL5). The GSC+P can be programmed (P006) to treat a low coolant level warning as an alarm or a shutdown. The fault can be disabled (P005). The GSC+P can be programmed to light one of the spare fault indicators when this fault occurs. The spare fault indicators are located on the front of the GSC+P.

When the fault is programmed as a shutdown fault, the fault shutdown indicator will FLASH and the AL5 fault code is immediately shown on the upper display.

When the fault is programmed as an alarm fault, the fault alarm indicator will FLASH and the “AL5” fault code is shown on the upper display after the “Alarm Codes” key is pressed.

AL6 High Engine Oil Temperature Fault – When the engine oil temperature rises to within 6 °C (11 °F) setpoint P026, the GSC+P issues a high engine oil temperature fault. The GSC+P can be programmed (P027) to treat this fault as an alarm, a shutdown, or the fault can be disabled (P025). When this fault occurs, the GSC+P can be programmed to light one of the spare fault indicators that is located on the GSC+P. The programmable setpoints are SP17, SP18 and SP19.

When the fault is programmed as a shutdown fault, the fault shutdown indicator will FLASH and the “AL6” fault code is immediately shown on the upper display.

When the fault is programmed as an alarm fault, the fault alarm indicator will FLASH and the “AL6” fault is shown on the upper display after the “Alarm Codes” key is pressed.

AL7 Generator Over Voltage Fault (protective relaying function) – When the line to line voltage between any two phases of the generator rises above the P102 setpoint or the P105 setpoint, the GSC+P issues an overvoltage fault. The GSC+P can be programmed to enable this fault or disable this fault as an alarm, a shutdown, or an alarm and a shutdown. The setpoints for the overvoltage fault are P101 and P104. The fault can be programmed with a time delay from 0 to 120 seconds. These setpoints are P103 and P106. The fault threshold can be adjusted from 100 percent to 125 percent of the nameplate voltage for the generator (P028. The setpoints for the fault threshold are P102 and P105.

When the fault is enabled as both an alarm fault and a shutdown fault, the fault thresholds and time delays can be programmed independently to allow the alarm fault to serve as an early warning for the shutdown fault.

When the fault is programmed as a shutdown fault, the fault shutdown indicator will FLASH and the AL7 fault code is immediately shown on the upper display.

When the fault is programmed as an alarm fault, the fault alarm indicator will FLASH and the AL7 fault code is shown on the upper display after the “Alarm Codes” key is pressed.

Note: If the AC offset adjustment OP10 has been performed, then the adjusted voltages are NOT used for determining the fault thresholds for protective relaying functions. The values that have not been adjusted for AC voltage are still determined by the GSC+P (but not shown), and the values will be used instead of the displayed values.

AL8 Generator Under Voltage Fault (protective relaying function) – When the line to line voltage that is between any two phases of the generator drops below Setpoint P108 or Setpoint P111, the GSC+P issues an under voltage fault. The GSC+P can be programmed to enable or disable the under voltage fault as an alarm, a shutdown, or an alarm and a shutdown. The setpoints for the under voltage fault are P107and P110. The fault can be programmed with a time delay from 0 to 120 seconds. The options with the time delay are P109 and P112. The fault threshold can be adjusted from 60 percent to 100 percent of the nameplate voltage (P028). The setpoints that are used for the fault threshold are P108 and P111.

When the fault is enabled as an alarm fault and a shutdown fault, the fault thresholds and time delays can be independently programmed. The independent programming allows the alarm fault to serve as an early warning to the shutdown fault.

When the fault is programmed as a shutdown fault, the fault shutdown indicator will FLASH and the AL8 fault code is immediately shown on the upper display.

When the fault is programmed as alarm fault, the fault alarm indicator will FLASH and the AL8 fault code is shown on the upper display after the “Alarm Codes” key is pressed.

Note: The AL8 fault is disabled when the ECS is in the STOP/COOLDOWN position.

Note: If the AC offset adjustment (OP10) has been performed, then the adjusted voltages are NOT used for determining the fault thresholds for protective relaying functions. The values that are not adjusted for the AC voltage are still determined by the GSC+P (but not shown), and will be used instead of the displayed values.

AL9 Generator Over Frequency Fault (protective relaying function) – When the generator frequency rises above the P113 or the P117setpoints, the GSC+P issues an overfrequency fault. The GSC+P can be programmed (P113 and P116) to enable or to disable this fault as an alarm, a shutdown, or both. The fault can be programmed (P115 and P118) with a time delay from 0 to 120 seconds. The fault threshold (P114 and P117) can be adjusted from 60 to 72 Hz (for 50 Hz applications, 50 to 60 Hz).

When the fault is enabled as both an alarm fault and a shutdown fault, the fault thresholds and time delays can be programmed independently to allow the alarm fault to serve as an early warning for the shutdown fault.

When the fault is programmed as a shutdown fault, the fault shutdown indicator will FLASH and the AL9 fault code is immediately shown on the upper display.

When the fault is programmed as an alarm fault, the fault shutdown indicator will FLASH and the AL9 fault code is shown on the upper display after the “Alarm Codes” key is pressed.

Note: The frequency shown on the GSC+P will FLASH when the generator frequency is greater than 70 Hz or equal to 70 Hz.

AL10 Generator Under Frequency Fault (protected relaying function) – When the generator frequency drops below the P120 or the P123 setpoints, the GSC+P issues an underfrequency fault. The GSC+P can be programmed (P119 and P122) to enable this fault or to disable this fault as an alarm, a shutdown or both. The fault can also be programmed (P121 and P124) with a time delay from 0 to 120 seconds. The fault threshold (P120and P123) can be adjusted from 36Hz to 60 Hz (for 50 Hz applications, 30 to 50 Hz).

When the fault is enabled as both an alarm fault and a shutdown fault, the fault thresholds and time delays can be programmed independently to allow the alarm fault to serve as an early warning for the shutdown fault.

When the fault is programmed as a shutdown fault, the fault shutdown indicator will FLASH and the AL10 fault code is immediately shown on the upper display.

When the fault is programmed as an alarm fault, the fault alarm indicator will FLASH and the AL10 fault code is shown on the upper display after the “Alarm Codes” key is pressed.

Note: The AL10 fault is disabled when the ECS is in the STOP/COOLDOWN position.

AL11 Generator Reverse Power Fault (protective relaying function) – When reverse power rises above the P126 setpoint, the GSC+P issues a reverse power fault. The GSC+P can be programmed (P125) to enable this fault or to disable this fault as a shutdown. In addition, the fault can be programmed (P127) with a time delay from 0 to 30 seconds. The fault threshold (P126) can be adjusted from 0 to 20 percent of the nameplate power (P030).

When the fault is programmed as a shutdown fault, the fault shutdown indicator will FLASH and the AL11 fault code is immediately shown on the upper display.

AL12 Generator Phase Over Current Fault (protective relaying function) – When any current rises above the P129 or the P134 setpoints, the GSC+P issues a phase over current fault. The GSC+P can be programmed (P128, P133) to enable or disable this fault as an alarm, a shutdown or both. The fault can also be programmed (P130 and P135) with a time delay from 0 to 250 seconds. The fault threshold (P129and P134) can be adjusted from 100 percent to 160 percent of the nameplate current (P029).

When the fault is enabled as both an alarm fault and a shutdown fault, the fault thresholds and time delays can be programmed independently to allow the alarm fault to serve as an early warning for the shutdown fault.

When the fault is programmed as a shutdown fault, the fault shutdown indicator will FLASH and the AL12 fault code is immediately shown on the upper display.

When the fault is programmed as an alarm fault, the fault alarm indicator will FLASH and the AL12 fault code is shown on the upper display after the “Alarm Codes” key is pressed.

AL13 Generator Total Over Current Fault (protective relaying function) – When generator total current (sum of three phases) rises above the P131 or P136 setpoints, the GSC+P issues a total over current fault. The GSC+P can be programmed (P128 and P133) to enable or to disable this fault as an alarm fault, a shutdown fault or both. In addition, the fault can be programmed (P132 and P137) with a time delay from 0 to 250 seconds. The fault threshold (P131 and P136) can be adjusted from 100 percent to 160 percent of three times the nameplate current rating (P029).

When the fault is enabled both as an alarm and a shutdown fault, the fault thresholds and time delays can be programmed independently to allow the alarm fault to serve as an early warning for the shutdown fault.

When the fault is programmed as a shutdown fault, the fault shutdown indicator will FLASH and the AL13 fault code is immediately shown on the upper display.

When the fault is programmed as an alarm fault, the fault alarm indicator will FLASH and the AL13 fault code is shown on the upper display after the “Alarm Codes” key is pressed.

AL14 Phase A No Voltage Input Fault (protective relaying function) – When the phase A voltage is not being received at the GSC+P input (GSC+P connector contact 10), the GSC+P issues a phase A no voltage input fault. The phase A voltage input is needed to accurately measure the generator output. The accuracy of some power metering functions and AC frequency measurement may be reduced. The GSC+P automatically treats a lost voltage input on phase A as an alarm fault. This response is not programmable.

When this fault occurs, the fault alarm indicator will FLASH and the AL14 fault code is shown on the upper display after the “Alarm Codes” key is pressed.

AL15 GSC+P Configuration Error – The GSC+P checks the relationship between the frequency of the generator output voltage and the engine speed. This relationship is shown in the formula below.

frequency (hertz) = (number of generator poles X rpm) / 120

The GSC+P automatically treats a configuration error as an alarm fault. This response is not programmable. This fault is corrected by programming the proper values into setpoints P009 (number of ring gear teeth) and P033 (number of generator poles).

When this fault occurs, the fault alarm indicator will FLASH and the AL15 fault code is shown on the upper display after the “Alarm Codes” key is pressed.

Note: If setpoint P033 (number of generator poles) is set to 0, the AL15 fault is disabled.

Paralleling Alarms

Paralleling Alarms are always treated as fault alarms and will not shut down the engine.

Synchronization may be halted, depending upon the fault. With one exception, paralleling alarms are issued only when the GSC+P is in Synchronization mode. The only paralleling alarm that will be active in Normal mode is AL16 Incorrect Phase Sequence. If this alarm is active in Normal mode, the alarm will be displayed when the “AL CODES” key is pressed, in the same manner as other fault alarms.

Paralleling alarms are detected and annunciated only if synchronization is enabled by programming the Synchronization Enabled setpoint, P301, with a non-zero value.

AL16 Incorrect Phase Sequence – This fault occurs whenever any synchronization function is in progress, and the GSC+P verifies that the generator and the bus have a phase sequence mismatch. The incorrect Phase Sequence alarm is immediately made active, and synchronization is halted. In this case, the alarm is latched until the synchronization request is removed. If the request was made locally using the SMS, then the SMS must be moved to the OFF position to CLEAR the alarm. If the phase sequence mismatch is detected immediately following closure to a dead bus, but no synchronization function is in progress, the “Incorrect Phase Sequence” alarm is made active but is not latched. In this case, if the phase sequence mismatch condition is not present, the alarm will be removed.

AL17 Improper Generator Or Bus Voltage – This fault occurs whenever the generator voltage, bus voltage, or both are incorrect for synchronization. The alarm is generated only if synchronization is enabled and synchronization request has been made. The conditions that may cause an “Improper Generator Alarm” or “Bus Voltage Alarm” are listed below.

- The Bus voltage is too low for synchronization.
- The Generator voltage is too low for synchronization.
- The Generator voltage and the Bus voltage are out of tolerance.

The specific conditions tested depend on the synchronization request and on setpoint values. Setpoint P303 enables or disables generator voltage or bus voltage checking during automatic synchronization. Setpoint P304 determines the mazimum acceptable difference in voltage between the bus voltage and the generator voltage.

This alarm will prevent frequency control and and breaker closure while the alarm is active, but will not halt synchronization. If the condition causing the alarm is removed while synchronization is in progress, then the alarm will be removed and the GSC+P will proceed with synchronization.

If the Improper Generator Alarm or the Bus Voltage Alarm is active when synchronizationis halted due to a synchronizer Time-out Alarm, the alarm is latched until the synchronization request is removed. In this case, if the request was made locally using the SMS, then the SMS must be moved to the OFF position to CLEAR the alarm. If the request was made remotely using a Customer Communication Module (CCM), then the CCM must send a Generator Synchronizer Control command (with a value of OFF) to CLEAR the alarm.

AL18 Synchronizer Time-out Alarm – This fault occurs whenever the GSC+P is unable to complete Automatic Synchronization or Dead Bus Parallel after a programmed amount of time. For the purposes of this alarm, Automatic Synchronization /Dead Bus Parallel is considered complete after breaker closure has been verified.

This alarm has two time-out thresholds, Synchronization Time Warning and Maximum Synchonization Time fault. Synchronization may be halted, depending on the time-out threshold that has been exceeded.

Timing for this alarm is started when Automatic Synchronization is requested, and the Dead Bus On-Time Delay (if the bus is dead) has completed.

Note: If the GSC+P closes the breaker, and a fault occurs that causes the breaker to open within 15 seconds, the GSC+P will lock out all synchronization functions until the SMS is turned to another position. If the breaker opens after 15 seconds, the GSC+P will reattempt the requested synchronization function.

Synchronization Time Warning

If the GSC+P is unable to complete Automatic Synchronization or Dead Bus Paralleling during the time specified in the Synchronization Time Warning setpoint, the GSC+P will activate the AL18 Synchronizer Time-out Alarm but continue synchronization. If synchronization is completed before the Maximum Synchronization Time fault setpoint has expired, the alarm will be deactivated.

Maximum Synchronization Time Fault

If the GSC+P is unable to complete Automatic Synchronization or Dead Bus Parallel during the time specified in the Maximum Synchronization Time-out Fault setpoint, the GSC+P will activate AL18 Synchronizer Time-out Alarm and halt synchronization. In this case, the alarm is latched until the synchronization request is removed. If the request was made locally using the SMS, then the SMS must be moved to the OFF position to CLEAR the alarm. If the request was made remotely by a CCM, then the CCM must send a Generator Synchonizer Control command (with a value of OFF) to CLEAR the alarm.

i02899086

SP Fault Codes

SMCS Code: 4490

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 provided in order to meet the needs of the customer. The spare inputs are programmable to active state, severity, and delay time. Refer to System Operation, “Spare Input/Output Programming OP6”. The spare inputs and the corresponding SP fault codes are referred to as SP1, SP2, SP3, and SP4.

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

1. The GSC+P waits for the time delay.
2. The fault alarm indicator FLASHES.
3. When the alarm codes key is pressed, the corresponding SP1, SP2, SP3, or SP4 is code shown on the upper display.
4. The engine continues to run or the engine is able to start.

Shutdown Mode Sequence Of Operation – The following sequence happens when a fault occurs in a spare input and the fault is programmed as a shutdown fault.

1. The GSC+P waits for the time delay.
2. The fault shutdown indicator FLASHES.
3. The corresponding code SP1, SP2, SP3, or SP4 is immediately SHOWN on the upper display of the GSC+P.
4. The engine is shut down or the engine is disabled from starting.

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

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

i02899114

Diagnostic Codes

SMCS Code: 4490

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

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

- The GSC+P activates the alarm mode.
- The fault alarm indicator FLASHES.
- When the alarm codes key is pressed, the corresponding diagnostic code 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+P performs the following steps.

- The GSC+P 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 fault code (CID FMI) closely identifies the cause of the fault. Each diagnostic fault 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 if the Engine Magnetic Pickup (MPU) is faulty then “190”would be displayed. Refer to the Testing And Adjusting, “Diagnostic Fault Codes” for a list of CID codes.

Control System Identifier – The control system identifier is a single digit. The control system that can generate a diagnostic code is the GSC+P.

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. Refer toTesting And Adjusting, “Diagnostic Fault Codes” for a list of FMI codes.

DIAG indicator – When “DIAG” is FLASHING, the diagnostic fault code (CID FMI) that is showing on the upper display is active. When “DIAG” is ON CONTINUOUSLY, there is an inactive diagnostic fault. The CID and the FMI will be recorded in the fault log. Also, refer to System Operation, “Fault Log Viewing OP1”. When the“DIAG” display is not showing then there are NO diagnostic fault codes.

Illustration 45 g00606749

Upper Display that is showing a “CID 190 FMI 3” Diagnostic Fault Code

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

The GSC+P has a fault log to help with troubleshooting of diagnostic faults. Inactive diagnostic fault codes (CID FMI) are recorded in the fault log for viewing at a later time. The total number of faults are shown on the upper display with the CID codes and the FMI codes. An active diagnostic alarm fault becomes inactive when the fault is no longer present and the ECS must be turned to OFF/RESET. The GSC+P stores a maximum of 12 diagnostic fault codes in the fault log. If an additional diagnostic fault becomes inactive, the GSC+P automatically clears the earliest diagnostic fault code. This fault code is put into the fault log by the GSC+P. Inactive diagnostic fault codes that are more than 750 hours old are cleared automatically by the GSC+P. Only diagnostic fault codes are recorded in the fault log. AL fault codes and SP fault codes are not recorded in the fault log. Refer toService Manual, “Fault Log Viewing OP1”.

Clear diagnostic fault 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. Refer to System Operation, “Fault Log Clearing OP4” .

i02899135

Programmable Spare Relay Outputs

SMCS Code: 4490

The programmable spare relay is one of the relays that is located in the relay module that is on the rear of the GSC+P. The programmable spare relay outputs respond to a selected trigger condition. The response and the trigger condition are programmable.

The GSC+P (setpoint SP15) must be programmed. The programmable spare relay outputs are active or inactive. In an active state, the normally open contacts will close and the normally closed contacts will open.

The condition that triggers the programmable spare relay outputs to the active state must be programmed in the GSC+P (setpoint SP16). The possible trigger conditions that can activate the programmable spare relay outputs are listed in System Operation, “Spare Input/Output Programming OP6”.

Refer to System Operation, “Spare Input/Output Programming OP6” for more information on programming the setpoints for this output.

Note: The GSC+P diagnoses a fault in the spare output circuit. Refer to Testing and Adjusting, “CID 448, FMI 12 Programmable Spare Relay Failed-Test” for more information.

i02899172

Programmable Spare Output

SMCS Code: 4490

The spare output responds to a selected trigger condition. The response is high or low. The response and the trigger condition are programmable.

The GSC+P spare output response must be programmed active high or active low (setpoint SP13). An active low pulls the output down to (“BATT-”) when the output is active. The output draws a maximum of 100 mA when the output is in the low state. The active high is approximately 5.0 DCV when no devices are connected to the spare output. The spare output is able to drive logic circuits with a high input impedance (36 000 ohm minimum). The spare output will not drive low impedance loads such as relays.

The setpoint SP14 must be programmed to the condition that triggers the spare output to the active state. The possible trigger conditions that can activate the spare output are listed in System Operation, “Spare Input/Output Programming OP6”.

Refer to System Operation, “Spare Input/Output Programming OP6” for more information on programming the setpoints for the output.

Note: Using the spare output to activate the shunt trip coil of the AC circuit breaker during engine cooldown is common.

Note: The GSC+P diagnoses a fault in the spare output circuit. Refer to Testing And Adjusting, “CID 334 Spare Output”.

i02899223

Programmable Kilowatt Level Output

SMCS Code: 4490

The programmable kilowatt level output is a feature that can be enabled by programming setpoint P138. The programmable kilowatt level output can be disabled by programming setpoint P138. The programmable kilowatt level output draws a maximum of 100 mA when the programmable kilowatt level output is active. When the programmable kilowatt level output is inactive, the programmable kilowatt level output is pulled high to (“BATT+”). The programmable kilowatt level output (GSC+P connector contact 34) will be activated whenever the total power output of the generator passes the programmed threshold (setpoint P139). This threshold can be programmed from 0 percent to 110 percent of the nameplate power (setpoint P030). A time delay can be programmed from 0 seconds to 120 seconds (setpoint P140).

Once the programmable kilowatt level output is activated, the programmable kilowatt level output will be deactivated when the total power output of the generator drops below a programmed threshold (setpoint P141). The programmed threshold is different from the activation threshold. The threshold can be programmed from 0 percent to 110 percent of the total power rating of the generator. A deactivation time delay can be programmed from 0 seconds to 120 seconds (setpoint P140).

Refer to System Operation, “Engine/Generator Programming OP5-0” for more information.

Note: The GSC+P diagnoses faults in the programmable kilowatt level output circuit. Refer to Testing And Adjusting, “Diagnostic Codes”.

i02899242

Alarm Modules

SMCS Code: 4490

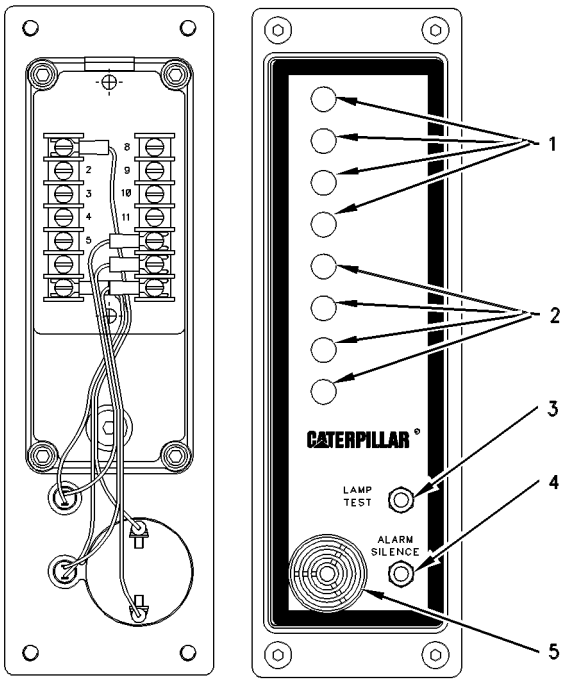

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Illustration 46

Alarm Modules

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

The 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. A 24 DCV battery system or a 32 DCV battery system powers the ALM.

The modules are either alarm modules or a remote annunciator. The versions are listed below.

- NFPA 110 Alarm Module
- EMCPII 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. The EMCP II remote annunciator has a lamp test switch. The following description of operation refers to the alarm/remote annunciator module as the annunciator module.

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.

An alarm fault develops while the generator set is running and when the Engine Control Switch (ECS) is in the COOLDOWN/STOP position or in the AUTO position . An alarm fault develops when the generator set is not running and when ECS is in the COOLDOWN/STOP position or in the AUTO position . That fault is indicated by the optional alarm module or the remote annunciator.

Description Of Operation

Note: In the following paragraphs, the annunciator can refer to the alarm module, or the annunciator can refer to the remote annunciator module.

The annunciator receives data from the following items: switch inputs, internal circuitry, and a serial data link from the GSC+PP.

Switch Inputs

Four switch inputs are available for the switch connections. Switch inputs that are connected to ground “BATT-”will be active. Refer to Table 12.

Internal Circuitry

Internal circuitry determines 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 GSC+P by a serial data link. The received data includes the following list.

1. Coolant temperature has exceeded the high temperature alarm setpoint that is programmed into the GSC+P.
2. Oil pressure is below the low oil pressure alarm setpoint that is programmed into the GSC+P.
3. Coolant temperature is below the low temperature alarm setpoint that is programmed into the GSC+P.
4. The ECS is not in the AUTO or MAN/START position.
5. Oil pressure is below the low oil pressure shutdown setpoint that is programmed into the GSC+P.

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

7. The engine has failed to start(overcrank fault).

8. The engine speed exceeded the engine overspeed setpoint that is programmed into the GSC+P.

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

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

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

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

The first eight items control the operation of the indicators and horn. Refer to Table 12 for more information. The last four items control the operation of the horn only.

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

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

- One of the modules is powered down. “BATT+” or “BATT-” could be disconnected.
- The module that is powered down remains connected to the data link.

Under these conditions the indicators controlled by the data link of the other module(s) that are powered up will flash at 0.5 hertz.

Indicator And Horn Operation

Table 12

Indicator And Horn Function		
Indicator Color	**NFPA 99 ALM**	**EMCP RAN**
1 Amber	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
3 Amber	Low Oil Press Alarm LI, H, LAT	Low Oil Press Alarm LI, H, LAT
4 Amber	Low Fuel Level SW(1), H	Not In Auto LI, H
5 Red	Not In Auto LI, H	High Coolant Temp Shutdown(1) LI, H, TD
6 Red	Low DCV INT, TIM	Low DCV INT, TIM
7 Red	Spare SW(3)	Overcrank Shutdown(1) LI, H
8 Red	Spare SW(4)	Overspeed Shutdown(1) LI, H
	SW(2) Not Used	

(1) Latched by the GSC+P

The above table lists the following abbreviations.

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+P 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 time 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. Refer to Table 12for 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 indicator (7) and indicator (8). However, switch input (3) and switch input (4) can 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. Also, activating the alarm silence switch (4) causes the indicator to light continuously.

Data Link Malfunction

If the data link malfunctions, the indicators that are controlled by the data link flash at 0.5 hertz. The indicators that are controlled by the switches 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 13

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
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 two modes described in Table 13. 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 13.

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Alarm Module Control (Custom)

SMCS Code: 4490

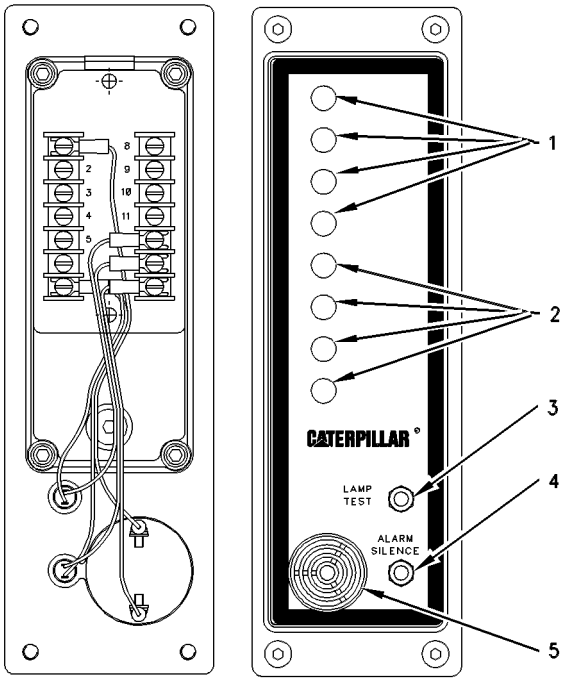

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Illustration 47

Custom Alarm Module (CAM)

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

Table 14

Connections For Customer Alarm Module	
Screw Terminal	**Signal Name**
1	“BATT+”
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	“BATT-”
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 CAM is an attachment that can be mounted at a remote location. The CAM annunciates faults, alarms or other conditions. Customer supplied inputs give the CAM this information.

The CAM operates when the CAM is powered by a 24 DCV battery system or a 32 DCV battery system. The CAM is equipped with a horn, an alarm silence switch and a lamp test switch. 8 switched inputs are also provided for the customer to 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 should be used with an existing fully equipped CAM or an ALM.

Alarm Operation

A given switch input will correspond 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 the battery negative terminal. The red indicators are used to display shutdown conditions, and the amber indicators are used to display alarm conditions.

When an input that is corresponding to one of the red indicators is activated, the indicator will flash and the horn will sound. When the input is disconnected from the battery negative terminal, the horn will continue to sound and the red indicator will continue to flash until the alarm silence switch is pressed.

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

Alarm Silence Function

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

When an input is connected to the battery negative terminal, 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 change. The change of status will cause additional inputs to be closed to the battery negative terminal.

The Alarm Silence Function will not be overridden if the change in status is the opening of any of the inputs from the battery negative terminal. The indicators will turn OFF when the corresponding input is disconnected from the battery negative terminal.

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 in order to customize the CAM to an application.

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Customer Interface Module

SMCS Code: 4490

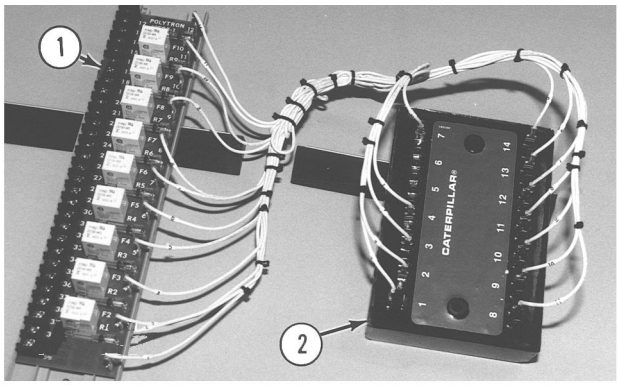

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Illustration 48

Customer Interface Module (CIM)

(1) Relay Board
(2) Electronic Control

Refer to Testing And Adjusting, “Schematics And Wiring Diagrams” for more information about the Customer Interface Module (CIM).

The CIM provides an interface between the GSC+P and the customer in the form of dry contacts. Separate relay contacts are the interface that is between the GSC+P and the switchgear. The two major components of CIM are the relay board (1) and the electronic control (2). The electronic control (2) and the alarm annunciator connect to the same serial data link. The operation of the CIM is similar to the operation of the alarm annunciator. The information on the data link is decoded into discrete outputs. The outputs then drive the relays that are located on the relay board (1). The relay contacts can be used to sound a horn. The relay contacts can be used to flash a lamp or the relay contacts can be used to trigger another procedure. Once an output is activated, the output remains energized until the faults that initiated the alarm are cleared. All electronic control outputs cycle at 0.5 Hz if a malfunction in the serial data link occurs. This includes the relays as well. The CIM is designed for operation when the CIM is powered by a battery system that supplies 24 DCV. The CIM is also designed for operation when the CIM is powered by a battery system that supplies 32 DCV.

The available serial data link information is listed below.

- High coolant temperature alarm
- Low oil pressure alarm
- Low coolant temperature alarm

- Low oil pressure shutdown
- High coolant temperature shutdown
- Overcrank
- Overspeed
- Diagnostic fault (GSC+P)
- The Engine Control Switch (ECS) is NOT in AUTO.

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. When either of the following conditions are present, the lamp test of the CIM is activated.

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

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

Outputs

- The relays that are on the relay board (1) are protected by fuses. The contacts are flashed with silver. The contacts are rated at 1 amp 28 DCV. The relays draw 20 mA at 24 DCV.
- The outputs that are from the driver of the electronic control (2) are intended to drive the incandescent lamps or the driver outputs are intended to drive the relay loads. The driver outputs will consume a maximum of 600 mA when the voltage is 15 DCV to 45 DCV.

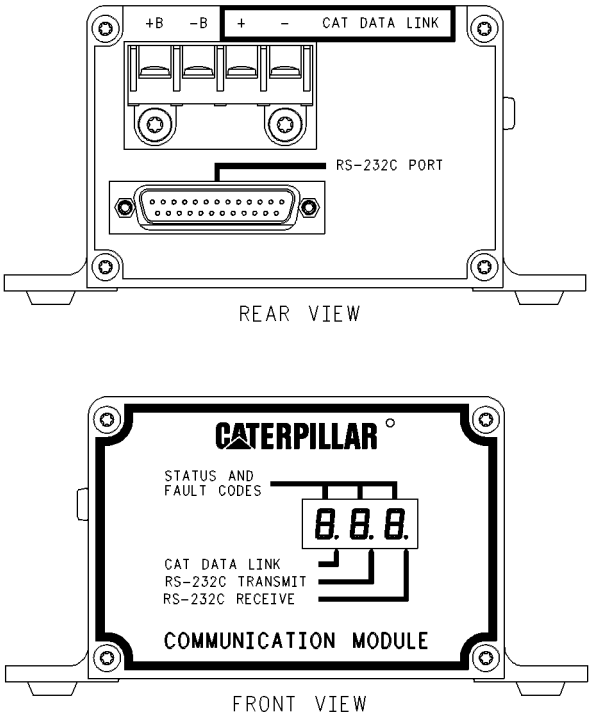
Specifications

- For installation of the CIM, the maximum distance that is between the electronic control (2) and the GSC+P is 305 m (1000 ft).
- The operating voltage range is from 15 DCV to 45 DCV. 24 DCV is the nominal voltage.
- The CIM is capable of operating with earth ground or operating without earth ground.
- The terminals that are located on the electronic control are blade type connectors (push on) 6.4 mm (0.25 inch).
- Connections that may be used by the customers at the relay board (1) are 6-32 screw terminals.

i02899537

System Communication Module (Customer)

SMCS Code: 1926



g00329183

Illustration 49

Customer Communication Module (CCM)

The Customer Communication Module (CCM) provides a communication link between the GSC+P and the host computer of the customer. The CCM converts data from the standard RS-232C format to the CAT Data Link format. The CCM can also convert data from the CAT Data Link format to the standard RS-232C format. RS-232C cable is available at most stores that sell electronics. Caterpillar's 146-8488 RS-232C Cable is a suitable cable. The CCM allows an operator to remotely control the same information that is available on the GSC+P display at the host computer.

The CCM can remotely control the following functions when the GSC+P is in the normal mode with the Engine Control Switch (ECS) in the AUTO position.

- Start the engine.
- Stop the engine if the remote start/stop contact is not closed.

- Activate or deactivate the Electronic Governor Relay (EGR), provided that the low oil pressure shutdown setpoint has been exceeded.

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

- Remotely abort the cooldown.

- 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. Refer to System Operation, “Spare Input/Output Programming OP6” for more information.

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

For more information regarding the CCM, refer to the Operations And Maintenance Manual, SEBU6874, “Customer Communication Module (CCM) for Diesel Engines”. This manual contains information for the EMCP II, EMCP II+ and EMCP II+P.

Troubleshooting Section

Introduction

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General Information

SMCS Code: 4490

WARNING

Personal injury or death can result from high voltage.

When power generation equipment must be in operation to make tests and/or adjustments, high voltage and current are present.

Improper test equipment can fail and present a high voltage shock hazard to its user.

Make sure the testing equipment is designed for and correctly operated for high voltage and current tests being made.

When servicing or repairing electric power generation equipment:

- **Make sure the unit is off-line (disconnected from utility and/or other generators power service) , and 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.**

Failure to do so could result in personal injury or death. Make sure residual voltage in the rotor, stator and the generator is discharged.

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

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.

i02897275

Service Tools

SMCS Code: 0785

Table 15

Tools Needed		
Part Number	**Description**	**Amount**
4C-3406	Connector Kit	1
	4 mm Hex Wrench for fastener on GSC+ connector	1
6V-7070	Digital Multimeter	1
9U-7330	Multimeter (Optional) for frequency and duty cycle measurements	1
146-4080	Digital Multimeter (RS-232)	1
7X-1710	Cable Probes	1

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Fault Identification

SMCS Code: 4490-035

Table 16

Fault Identification				
Indicator left side of GSC+P	**Fault Code on upper display**	**DIAG Indicator**	**Fault Type**	**Refer to Topic**
Fault Alarm	CID FMI(1)	Flashing	Active Alarm	Troubleshooting Diagnostic Codes
	SP1, SP2, SP3, SP4(1)	Absent	Active Alarm	Diagnostic System Procedures, “SP Fault Code”
	AL1 thru AL15(1)	Absent	Active Alarm	Diagnostic System Procedures, “AL Fault Code”
Fault Shutdown	CID FMI	Flashing	Active Shutdown	Troubleshooting Diagnostic Codes
	SP1, SP2, SP3, SP4	Absent	Active Shutdown	Diagnostic System Procedures, “SP Fault Code”
	AL5 thru AL15(1)	Absent	Active Alarm	Diagnostic System Procedures, “AL Fault Code”
Dedicated Shutdown:				
Flashing	Absent	Absent	Active Alarm	Troubleshooting Dedicated Shutdown Indicators
On Continuously	Absent	Absent	Active Shutdown	
None	CID FMI(2)	On Continuously	Inactive Alarm	Troubleshooting Diagnostic Codes
	CID FMI(2)	On Continuously	Inactive Shutdown	Troubleshooting Diagnostic Codes
	SP1, SP2, SP3, SP4	Absent	Inactive Shutdown	Diagnostic System Procedures, “SP Fault Code”
	AL5 through AL15(1)	Absent	Inactive Alarm	Diagnostic System Procedures, “AL Fault Code”
	Absent	Absent	Undiagnosed Shutdown	Symptom Procedures

(1) Fault code is shown after alarm codes key is pressed.
(2) Fault Code is stored in the fault log of the GSC+P. To view the fault code, see Systems Operation, “Fault Log Viewing OP1” within the topic Service Mode.

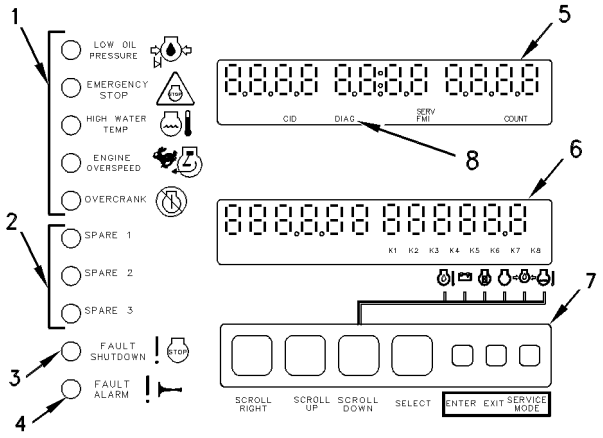


Illustration 50 g00614724

GSC+P Display Area

(1) Dedicated shutdown indicators
(2) Spare fault indicators
(3) Fault shutdown indicator
(4) Fault alarm indicator
(5) Upper display
(6) Lower display
(7) Keypad
(8) DIAG indicator

Faults that are detected and diagnosed by the GSC+P are shown to service personnel in the display area of the GSC+P. The GSC+P uses dedicated shutdown indicators (1), fault shutdown indicator (3), fault alarm indicator (4), “DIAG” indicator (8), upper display (5) 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+P.

Note: The “DIAG” indicator (8) functions when diagnostic information is available from the GSC+P.

1. Make a note of the indicators that are functioning on the left side of the “GSC+P”.

2. View the fault code on the upper display (5). If the fault alarm indicator (4) is FLASHING and no fault code is present on the upper display (5), press the alarm codes key in order to view the fault code.

3. Make a note of whether or not “DIAG” indicator (8) is FLASHING ON CONTINUOUSLY or ABSENT.

4. On the fault identification chart, look at the first column. Locate the fault indicator that is functioning.

5. Go to the second column in the chart. Find the fault code that is presently shown on the upper display (5).

6. Go to the third column in the chart which describes the status of “DIAG” indicator (8).

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

Symptom Procedures

i02895174

Engine Does Not Shutdown

SMCS Code: 4490-035

System Operation Description:

The engine does not shut down when a shutdown fault occurs.

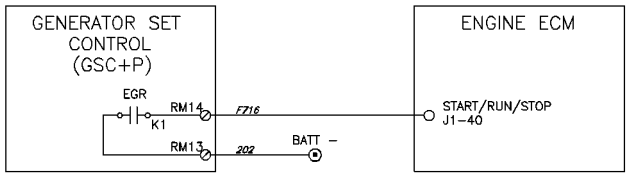


Illustration 51 g01439320

System Schematic For Electronic governor Relay

Note: It is critical that the GSC+P setpoint P023 is the correct setpoint for the engine application. Ensure that setpoint P023 is programmed correctly for the engine application before continuing with this procedure.

There are several possible causes when a shutdown fault occurs and an engine does not shut down:

- **Operator Error**: The operating conditions of the generator may not be understood by the operator. Ensure that the condition is one that should cause an engine shutdown.
- **Programming Error - Fault Is Overridden Or Disabled**: It is possible to program the GSC+P in order to override certain shutdown faults. An overridden shutdown fault will be treated as an alarm fault. The YELLOW fault alarm indicator will be FLASHING instead of the RED fault shutdown indicator. If the GSC+P is programmed in order to disable a particular fault, there will not be any fault indicators or codes shown on the GSC+P. In these cases, it is a good idea to check any setpoints related to that fault. For example, if a genset is not shutting down when an overvoltage fault occurs, make sure setpoint P104 (Overvoltage shutdown enable) is programmed correctly. It is also possible to program the engine's ECM to override or to ignore certain shutdown faults. Refer to Service Manual, RENR9968 or Service Manual, RENR9348 for more information on programming the engine's ECM.
- **Programming Error - Setpoints Incorrect For Application Or Customer Needs**: It is possible to program the GSC+P setpoints to a value that does not allow the situation to be recognized by the GSC+P as a shutdown condition. In this case, check the appropriate setpoints for correct values. For example, if the genset is not shutting down when a high coolant temperature condition occurs, make sure setpoint P015 (High Water Temperature Shutdown) is correct for the application.
- **Faulty Component**: Some examples of faulty components that could prevent the GSC+P from shutting down the engine are: engine ECM, GSC+P, and a broken harness wire or shorted harness wire. In this case, the GSC+P or the engine's ECM will be issuing a command in order to shut down the engine due to a diagnostic code, but the engine remains running.

Test Step 1. CHECK FOR DIAGNOSTIC CODES

A. Check the GSC+P for a diagnostic code on the upper display.

Expected Result:

The GSC+P should show a diagnostic code on the upper display.

Results:

- YES – The GSC+P shows a diagnostic code on the upper display.

  Repair: Refer to theTesting and Adjusting section of this book for the diagnostic code that is displayed on the GSC+P.

  STOP.

- NO – The GSC+P does NOT show a diagnostic code on the upper display. Proceed to Test Step 2.

Test Step 2. CHECK THE YELLOW FAULT ALARM INDICATOR

A. Check the display of the GSC+P for the yellow fault alarm indicator.

Expected Result:

The yellow fault alarm indicator is ON CONTINUOUSLY.

Results:

- YES – The yellow fault alarm indicator is ON CONTINUOUSLY. The GSC+P has been programmed to override the normal shutdown response. The setpoints have been modified and the GSC+P treats the condition as an alarm fault. The engine will continue to run.

  Repair: In order to view the setpoints, refer to Systems Operation, “Engine/Generator Setpoint Viewing OP2-0”. In order to reprogram the setpoints, refer to Systems Operation, “Engine/Generator Programming OP5-0”.

  STOP.

- NO – The yellow fault alarm indicator is not illuminated at all. Proceed to Test Step 3.

Test Step 3. CHECK FOR THE RED FAULT SHUTDOWN INDICATOR

A. Check the display area of the GSC+P for the red fault shutdown indicator.

Expected Result:

The red fault shutdown should be FLASHING.

Results:

- YES – The red fault shutdown indicator is FLASHING and the engine remains running. Proceed to Test Step 4.

- NO – All fault indicators are OFF. A problem that is occurring should cause the GSC+P to shut down the engine. It is possible to program the GSC+P setpoints to a value that does not allow the situation to be recognized by the GSC+P as a shutdown condition.

  Repair: Check the appropriate setpoints for correct values. In order to view the setpoints, refer to System Operation, “Engine/Generator Setpoint Viewing OP2-0”. In order to reprogram the setpoints, refer to System Operation, “Engine/Generator Programming OP5-0”.

  STOP.

Test Step 4. CHECK K1 INDICATOR ON GSC+P DISPLAY

A. The red fault shutdown indicator is FLASHING and the engine remains running.

B. Check the upper display of the GSC+P.

Expected Result:

The K1 symbol is showing on the GSC+P upper display.

Results:

- YES – The K1 symbol is showing on the GSC+P upper display. The red fault shutdown indicator is FLASHING and the engine remains running. The GSC+P may have failed.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set)-Replace”

  STOP.

- NO – The K1 symbol is not showing at all on the GSC+P upper display. Proceed to Test Step 5.

Test Step 5. CHECK THE GSC+P RELAY MODULE.

The engine remains running and the red fault shutdown indicator is FLASHING.

A. In the generator housing, remove BOTH of the wires from RM-13 on the GSC+P.

Expected Result:

The engine should shut down.

Results:

- OK – The engine shuts down.

Repair: The GSC+P Relay Module may have failed. It is unlikely that the GSC+P Relay Module has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P Relay Module. Refer to Testing And Adjusting, “EMCP Electronic Control (Relay Module) - Replace”.

STOP.

- NOT OK – The engine runs and the engine will start. Proceed to Test Step 6.

Test Step 6. CHECK THE SYSTEM BY USING THE ESPB.

The engine remains running and the red fault shutdown indicator is FLASHING.

A. Push the Emergency Stop Push Button (ESPB).

Expected Result:

The engine should shut down.

Results:

- OK – The engine does shutdown. Proceed to Test Step 7.
- NOT OK – The engine does NOT shut down.

  Repair: The engine’s ECM may have failed. Refer to Service Manual, RENR9968 or Service Manual, RENR9348.

  STOP.

Test Step 7. CHECK THE WIRING BETWEEN THE ENGINE’S ECM AND THE GSC+P.

The engine remains running and the red fault shutdown indicator is FLASHING.

A. Check the wiring between RM-14 of the GSC+P and J1-40 on the engine’s ECM. Check for shorts, open connections, or damaged wires.

Expected Result:

The wiring has a shorted connection, an open connection, or the wiring is damaged.

Results:

- OK – The wiring is damaged.

  Repair: Troubleshoot and repair the wiring. Refer to Generator Set Wiring Diagram in Testing And Adjusting, “Schematics And Wiring Diagrams”. Verify that the repair corrects the problem.

  STOP.

- NOT OK – The wiring is not damaged at all. The engine’s ECM may have failed.

  Repair: The engine’s ECM may have failed. Refer to Service Manual, RENR9968 or Service Manual, RENR9348.

  STOP.

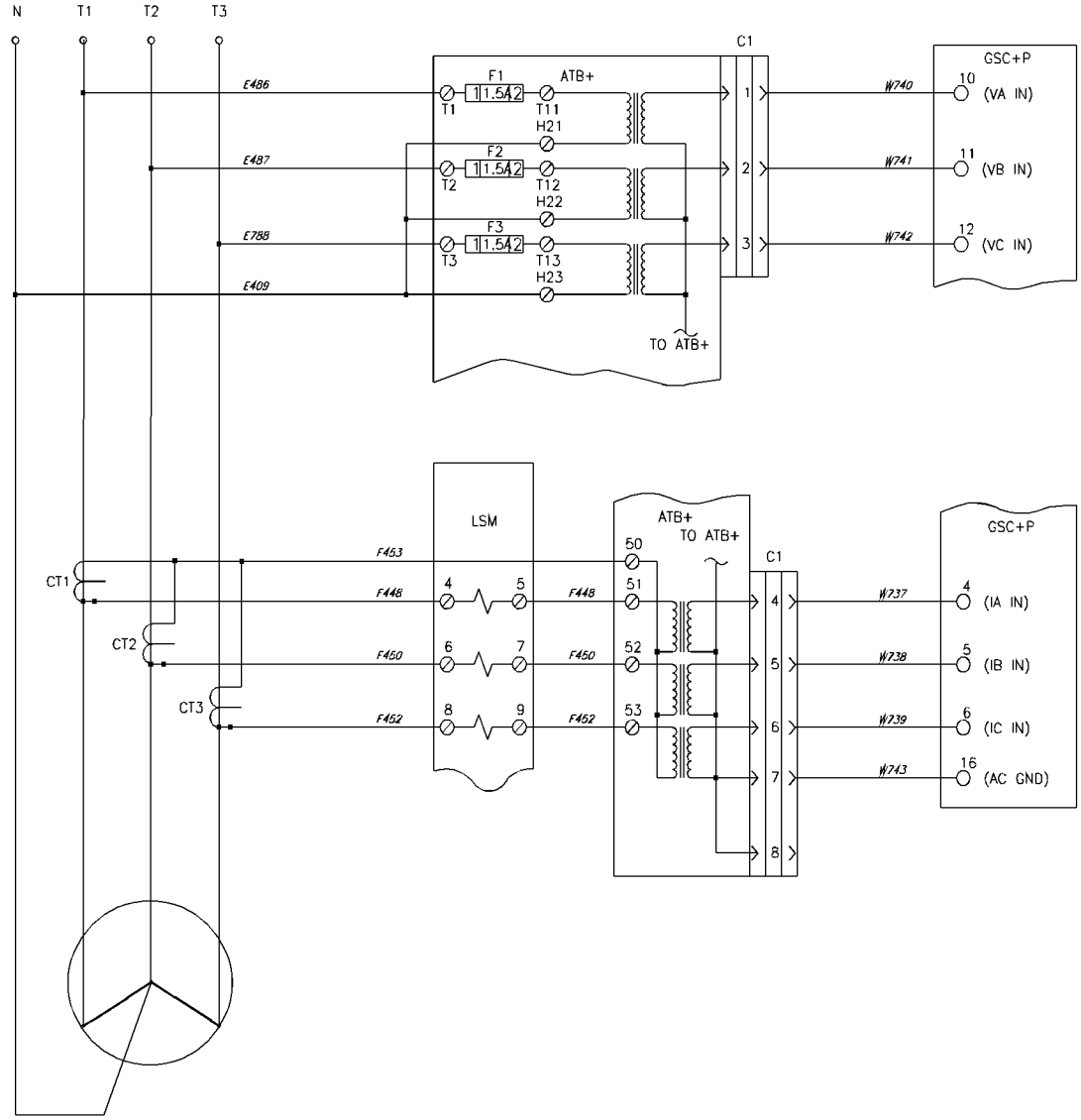
i02902638

Display of Voltage or Current Is Zero

SMCS Code: 4490-035

System Operation Description:

Zero volts or zero amperes are showing on the display of the GSC+P for one or more AC phases. This is showing while the genset is running and the load is connected.



g01436567

Illustration 52

System Schematic For An AC Transformer Box (ATB+)

A Wye Connection Is Shown For The Generator.

⚠ 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.

Test Step 1. THE PROBLEM IS WITH AC VOLTAGE OR THE PROBLEM IS WITH AC CURRENT.

A. Determine if the problem is with AC voltage or with AC current. Check the display of the GSC+P while the genset is running and the load is connected.

Results:

- AC VOLTAGE – Zero volts are showing on the display of the GSC+P for one or more AC phases. Proceed to Test Step 2.
- AC CURRENT – Zero amperes are showing on the display of the GSC+P for one or more AC phases. Proceed to Test Step 7.

Test Step 2. CHECK THE FUSES.

A. Check the three fuses on the AC Transformer Box + (ATB+).

Expected Result:

The fuses should not be open.

Results:

- OK – The fuses are not open. Proceed to Test Step 3.
- NOT OK – One or more of the fuses are open.

  Repair: One or more of the fuses are open. Check for a shorted component or damaged wiring. Troubleshoot and repair the problem. Refer to the Generator Set Wiring Diagram in Testing And Adjusting, “Schematics And Wiring Diagrams”. After the problem has been repaired, replace the fuses.

  STOP.

Test Step 3. CHECK THE GENERATOR OUTPUT.

A. Open the circuit breaker or remove the load.

B. Start the engine and run the genset.

C. Measure the voltage between all three fuses on the ATB+.

Expected Result:

The line to line voltage should measure the rated voltage of the genset.

Results:

- OK – The voltages are correct and the problem remains. Proceed to Test Step 4.
- NOT OK – One or more of the voltages are NOT correct.

  Repair: The wiring or the connections are damaged. Check for damaged wiring between the ATB+ and the bus. Refer to the Generator Set Wiring Diagram in Testing And Adjusting, “Schematics And Wiring Diagrams”. Also, check the electrical connections at the terminal of the ATB+ . Refer to Testing And Adjusting, “Electrical Connector - Inspect”.

  STOP.

Test Step 4. CHECK THE CONNECTIONS

A. Shut down the engine.

B. Check the harness connector and the terminals of the ATB+.

C. Check the GSC+P harness connector. Refer to Testing And Adjusting, “Electrical Connector - Inspect”.

D. Check for one or more damaged wires between the ATB+ and the GSC+P. Refer to the Generator Set Wiring Diagram in Testing And Adjusting, “Schematics And Wiring Diagrams”.

Expected Result:

The wiring and the connectors should have been good.

Results:

- OK – NO problem was found with the connectors or with the wiring. Proceed to Test Step 5.
- NOT OK – The problem was with the connectors or with the wiring.

  Repair: Repair the connectors or replace the wiring harness.

  STOP.

Test Step 5. CHECK THE OUTPUTS OF THE ATB+

A. Remove the GSC+P harness connector from the ATB+.

B. At the terminal of the ATB+ , measure the resistance between the following terminals: terminal J1-7 to terminal J1-1, terminal J1-7 to terminal J1-2, and terminal J1-7 to terminal J1-3

Expected Result:

Each of the resistance measurements should be 7.0 ± 1.0 Ohms.

Results:

- OK – Each of the resistance measurements is 7.0 ± 1.0 Ohms. Proceed to Test Step 6.
- NOT OK – One or more of the resistance measurements is NOT 7.0 ± 1.0 Ohms.

Repair: The ATB+ has failed. Replace the ATB+. Refer to Testing and Adjusting Section, “EMCP Electronic Control (AC Transformer Box) - Replace”.

STOP.

Test Step 6. CHECK THE INPUTS OF THE ATB+

A. Remove the three fuses on the ATB+: F11, F12, and F13

B. At the terminal of the ATB+, measure the resistance between the following terminals: terminal T11 to terminal H21, terminal T12 to terminal H21, and terminal T13 to terminal H21

Expected Result:

Each of the resistance measurements should be 1,050 ± 100 Ohms.

Results:

- OK – Each of the resistance measurements is 1,050 ± 100 Ohms.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NOT OK – One or more of the resistance measurements was NOT 1,050 ± 100 Ohms.

  Repair: The ATB+ has failed. Replace the ATB+. Refer to Testing and Adjusting Section, “EMCP Electronic Control (AC Transformer Box) - Replace”.

  STOP.

Test Step 7. CHECK THE CURRENT TRANSFORMERS

A. Shut down 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. These current transformers are CT1, CT2, and CT3.

C. Measure the resistance from terminal 50 to each of the disconnected wires.

Expected Result:

The resistance should be approximately 5 Ohms.

Results:

- OK – The resistances are approximately 5 Ohms. Therefore, the current transformers are good. Proceed to Test Step 8.

- NOT OK – One or more of the resistance measurements are NOT correct. A related current transformer or related wire is open.

  Repair: Replace the open current transformer or repair the wiring. Refer to the Generator Set Wiring Diagram in Testing And Adjusting, “Schematics And Wiring Diagrams”.

  STOP.

Test Step 8. CHECK THE OUTPUTS OF THE ATB+

A. Shut down the engine.

B. Remove the harness connector from the GSC+P.

C. At the harness connector of the GSC+P, measure the resistance between the following contacts: contact 4 to contact 16, contact 5 to contact 16, and contact 6 to contact 16. Be sure to allow each measurement to stabilize.

Expected Result:

Each of the three resistances should be 120 ± 20 Ohms.

Results:

- OK – Each of the three resistances is 120 ± 20 Ohms. Proceed to Test Step 10.

- NOT OK – One or more of the resistance measurements are NOT correct. Proceed to Test Step 9.

Test Step 9. CHECK THE GSC+P HARNESS CONNECTOR

A. Remove the GSC+P harness from the ATB+.

B. Check the resistance of the wires in the GSC+P harness for an open wire. Refer to the Generator Set Wiring Diagram in Testing And Adjusting, “Schematics And Wiring Diagrams”.

Expected Result:

The wires in the GSC+P harness should measure less than 5 Ohms.

Results:

- OK – The wires in the harness for the GSC+P measure less than 5 Ohms.

  Repair: The ATB+ has failed. Replace the ATB+. Refer to the Testing and Adjusting Section, “EMPC Electronic Control (AC Transformer Box) - Replace”.

  STOP.

- NOT OK – The wires in the harness for the GSC+P do NOT measure less than 5 Ohms.

  Repair: Repair the wiring or replace the harness for the GSC+P. Verify that the repairs fixed the problem.

  STOP.

Test Step 10. CHECK THE INPUTS OF THE ATB+

A. The wires that were previously disconnected from terminals 51, 52, and 53 will remain disconnected. The only wires which are connected to these terminals should lead into the ATB+.

B. At the terminal strip of the ATB+, measure the resistance between the following terminals: terminal 51 to terminal 50, terminal 52 to terminal 50, and terminal 53 to terminal 50.

Expected Result:

All the resistance measurements should read less than 1 Ohm.

Results:

- OK – All the resistance measurements do read less than 1 Ohm.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NOT OK – One or more of the resistance measurements are NOT correct.

  Repair: The ATB+ has failed. Replace the ATB+. Refer to the Testing and Adjusting Section, “EMPC Electronic Control (AC Transformer Box) - Replace”.

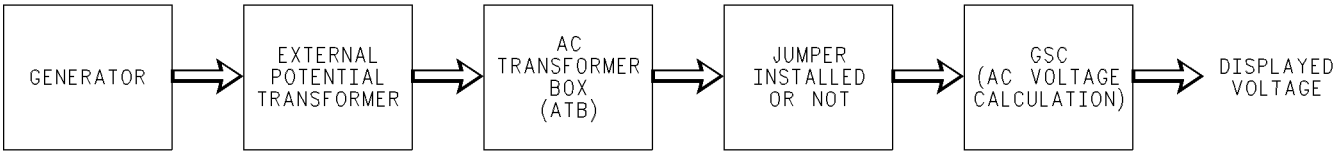
  STOP.

i02884572

Display of Voltage or Current or Power Is Inaccurate

SMCS Code: 4490-035

System Operation Description:



g00481725

Illustration 53

Block diagram of AC voltage display in the EMCP II +P

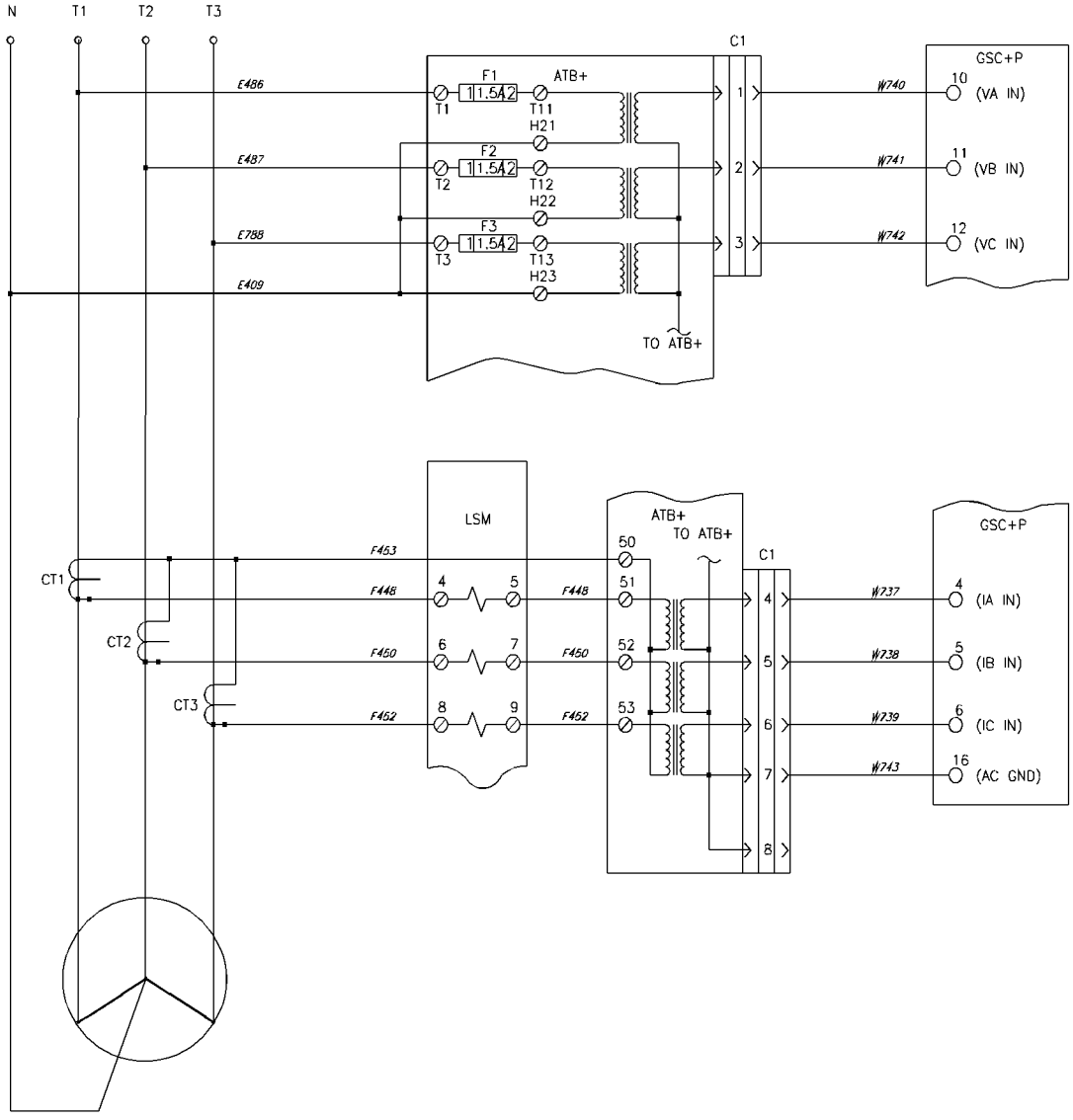


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Illustration 54

System schematic for AC Transformer Box + (ATB+) showing a wye connected generator

Table 17

Selection of AC Voltage Range				
GSC+P P020 Setpoint	External Potential Trans-former	Input Voltages for AC Trans-former Box (ATB+)	GSC+P Internal Multiplier	Jumper
700	None	0 - 700	5	Yes
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

Note: For related information, Testing And Adjusting, “AC Voltage Range - Adjust”.

The P020 setpoint determines the proper AC voltage range and the internal multipliers that are used by the GSC+P for calculating AC voltage. If the external potential transformers are present, the GSC+P uses the internal multipliers to compensate for the ratio of turns of the external potential transformers. This must take place in order to ensure accurate calculations by the GSC+P for AC voltage .

A jumper block is located in the relay module. The jumper block connects a circuit which will divide the AC voltage by five. The circuit reduces the AC voltage to an acceptable level for the GSC+P when P020 is 700. When setpoint P020 is 700, a multiplier of five is needed to compensate for the presence of the circuit even though no external potential transformer is present.

Note: The jumper block should NOT be installed when P020 is NOT programmed to a value of 700. This will prevent voltage readings that are calculated incorrectly by the GSC+P. The other values (150 through 30000) are used with an external potential transformer. These 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.

⚠ 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.

Test Step 1. CHECK THE DISPLAY OF THE GSC+P FOR VOLTAGE READINGS

A. Start the genset.

B. Check the voltage readings on the display of the GSC+P.

Expected Result:

The voltage readings on the GSC+P should be accurate.

Results:

- OK – The voltage readings on the GSC+P are accurate. Proceed to Test Step 2.
- NOT OK – The voltage readings on the GSC+P are inaccurate. Proceed to Test Step 4.

Test Step 2. CHECK THE DISPLAY OF THE GSC+P FOR CURRENT READINGS

A. Check the current readings on the display of the GSC+P.

Expected Result:

The current readings on the GSC+P should be accurate.

Results:

- OK – The current readings on the GSC+P are accurate. Proceed to Test Step 3.
- NOT OK – The current readings on the GSC+P are inaccurate. Proceed to Test Step 8.

Test Step 3. CHECK THE DISPLAY OF THE GSC+P FOR POWER CONSUMPTION

A. Check the power consumption on the display of the GSC+P.

Expected Result:

The power consumption that is displayed on the GSC+P should be accurate.

Results:

- OK – The power consumption that is displayed on the GSC+P is accurate.

  Repair: There is no problem at this time. Keep monitoring the system for inaccurate readings.

  STOP.

- NOT OK – The power consumption that is displayed on the GSC+P is NOT accurate. Proceed to Test Step 10.

Test Step 4. CHECK SETPOINT P020

A. Check the setpoint P020. Refer to Testing and Adjusting, “Engine/Generator Setpoint Viewing OP2-0”.

Expected Result:

P020 should be set to match the system’s application. To find the correct setpoint, refer to Table 17 .

Results:

- OK – Setpoint P020 is set for the application. Proceed to Test Step 5.

- NOT OK – Setpoint P020 is NOT set for the application.

  Repair: Program P020 to match the system’s application. Refer to Testing and Adjusting, “Engine/Generator Setpoint Programming OP5-0”.

  STOP.

Test Step 5. CHECK THE JUMPER FOR CORRECT INSTALLATION

A. Check the setpoint P020. Refer to Testing and Adjusting, “Engine/Generator Setpoint Viewing OP2-0”.

B. Check the jumper on the relay module for correct AC voltage range. Refer to System Operation, “AC Voltage Range - Adjust”.

Expected Result:

The jumper should be installed correctly in order to match the value in setpoint P020.

Results:

- YES – The jumper is installed correctly in order to match the value in setpoint P020. Proceed to Test Step 6.

- NO – The jumper is NOT installed correctly in order to match the value in setpoint P020.

  Repair: Install the jumper in accordance to the procedure in System Operation, “AC Voltage Range - Adjust”.

  STOP.

Test Step 6. CHECK THE VALUES IN OP8

A. Turn the ECS to the STOP position in order to shut down the engine. Enter service mode and enter the password.OP4 is showing on the lower display of the GSC+P. For more information, refer to Systems Operation, “Service Mode”for more information. Refer to the Systems Operation, “Password Entry OP3”for more information.

B. Press the “SCROLL UP” key five times. “OP 8” is showing on the lower display.

C. Press the “SCROLL UP” key five times. “OP 8” is showing on the lower display.

D. Press the “SELECT” key. “AC01” is showing. The value of the setpoint is also showing. The value will be between 0 to 255. Record the value.

E. Press the “SCROLL UP” key in order to retrieve the values for the setpoints AC02 through AC06. Record each value.

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

G. Press the “EXIT” key. The display will return to the Normal Mode.

H. Compare the recorded values with the values that are written on the bar code sticker of the ATB+.

Expected Result:

The recorded values should match the values that are written on the bar code sticker of the ATB+.

Results:

- Yes – The values match. Proceed to Test Step 7.

- NO – The values do NOT match.

Repair: Program the setpoints in OP8 to match the values on the ATB+. Refer to System Operation, “Voltmeter/Ammeter Programming OP8”.

STOP.

Test Step 7. CHECK THE AC OFFSET ADJUSTMENT

A. Check the AC offset adjustment. Refer to System Operation, “AC Offset Adjustment OP10”.

Expected Result:

The offset values should be set to zero.

Results:

- YES – The offset values are set to zero.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NO – The offset values are not set to zero.

  Repair: Reset the offset values to zero. Refer to System Operation, “AC Offset Adjustment OP10”. Verify that the voltage readings are accurate.

  STOP.

Test Step 8. CHECK SETPOINT P021

A. Check the setpoint P021. Refer to Testing and Adjusting, “Engine/Generator Setpoint Viewing OP2-0”.

Expected Result:

P021 should be set to the same ratio as the current transformers.

Results:

- OK – P021 setpoint is set to the same ratio as the current transformers. Proceed to Test Step 9.

- NOT OK – P021 setpoint is NOT set to the same ratio as the current transformers.

  Repair: Program P021 tothe same ratio as the current transformers. Refer to Testing and Adjusting, “Engine/Generator Setpoint Programming OP5-0”.

  STOP.

Test Step 9. CHECK THE VALUES IN OP8

A. Turn the ECS to the STOP position in order to shut down the engine. Enter service mode and enter the password. OP4 is showing on the lower display. For more information, refer to Systems Operation, “Service Mode”for more information. Refer to the Systems Operation, “Password Entry OP3”for more information.

B. Press the “SCROLL UP” key five times. “OP 8” is showing on the lower display.

C. Press the “SCROLL UP” key five times. “OP 8” is showing on the lower display.

D. Press the “SELECT” key. “AC01” is showing. The value of the setpoint is also showing. The value will be between 0 to 255. Record the value.

E. Press the “SCROLL UP” key in order to retrieve the values for setpoints AC02 through AC06. Record each value.

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

G. Press the “EXIT” key. The display will return to the Normal Mode.

H. Compare the recorded values with the values that are written on the bar code sticker of the ATB+.

Expected Result:

The recorded values should match the values that are written on the bar code sticker of the ATB+.

Results:

- YES – The values match.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NO – The values do NOT match.

Repair: Program the setpoints in OP8 to match the values on the ATB+. Refer to System Operation, “Voltmeter/Ammeter Programming OP8”.

STOP.

Test Step 10. INACCURATE POWER CONSUMPTION IS DISPLAYED ON THE GSC+P.

A. Start the genset.

B. Check for inaccurate power factors for each individual phase by depressing the “Power Key” for more than 5 seconds.

Expected Result:

The power factors for each phase should be accurate.

Results:

- OK – The power factors for each phase are accurate.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NOT OK – The power factors for each phase are inaccurate. Proceed to Test Step 11.

Test Step 11. CHECK THE POLARITY OF THE CURRENT TRANSFORMERS

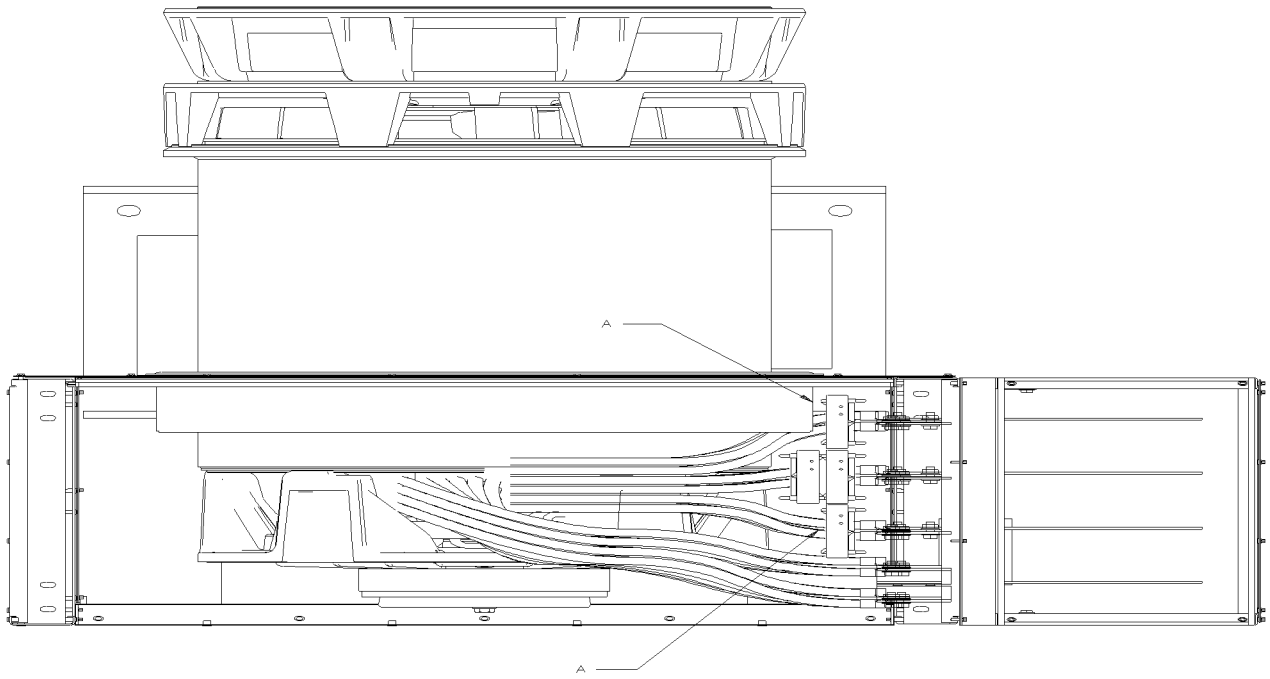


Illustration 55 g01438390

A. Turn the ECS to the STOP position in order to shut down the engine.

B. Check the polarity of the current transformers. Refer to Illustration 55.

Expected Result:

The polarity of the current transformers should be correct.

Results:

- OK – The polarity of the current transformers are correct.

  Repair: The ATB+ has failed. Replace the ATB+. Refer to Testing and Adjusting, “EMCP Electronic Control (AC Transformer Box) - Replace”.

  STOP.

- NOT OK – The polarity of the current transformers are NOT correct.

  Repair: Install the current transformers to the correct polarity.

  STOP.

i02885949

Indicators of Alarm Module or Remote Annunciator Are Constantly Flashing

SMCS Code: 4490-035

System Operation Description:

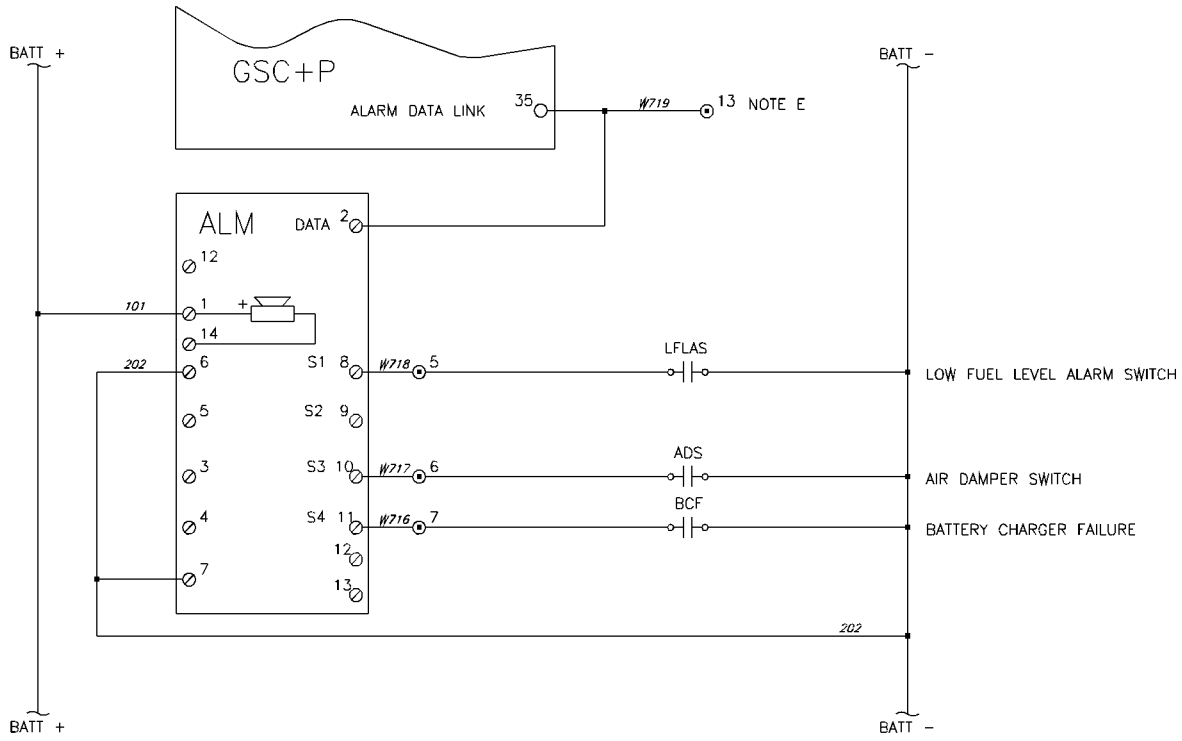


Illustration 56 g01438113

System schematic for Alarm Module (ALM)

The fault indicators of the remote annunciator or the control panel alarm module that are controlled by the data link will flash at a rate of 0.5 Hz (every two seconds).

There are several possible causes when the indicators of the alarm module are flashing. Before performing the test procedure, review the following requirements for the alarm module .

- **Check The Generator Set control + Paralleling (GSC+P) For Diagnostic Codes.** If a CID 333 FMI 03 or CID 333 FMI 04 diagnostic code is active or if the codes are contained in the fault log, perform those procedures first.
- **Verify The Number Of Modules.** A maximum of three modules can be connected to the GSC+P data link for the alarms.
- **Verify That All Remote Modules Are Powered.** If multiple modules are connected to a GSC+P, ALL of the modules must be powered up. If a module is not powered and the positive battery wire “BATT+” is disconnected or if the ground wire is disconnected, the wire on terminal 2 must be disconnected as well.
- **Verify The Length Of The Wire.** The maximum length of the wires between the GSC+P and a remote annunciator is 304 m (1000 ft). Note: The actual length of the wire can be considerably longer than the physical distance between the two modules.

- **Check The Type Of Wire Or Cable On The Remote Modules.** Three separate wires for the following connections are recommended for remote installations: The positive battery wire (“BATT+”), the negative battery wire (“BATT-”), and the data for the alarm. Other wires for the switched inputs on a remote annunciator may also be required by the application. The wires should be size 16 AWG. Verify that the wire is NOT a shielded type. Verify that the wire does not have twisted conductors. This type of cable is not appropriate for this purpose. These types of cables usually have more capacitance than separate wires and the data from the GSC+P can be corrupted.

- **Verify The Methods Of Wiring.** Each remote annunciator must have a separate set of three wires between it and the GSC+P.. Do NOT connect any wires directly between remote annunciators. The wires should NOT be in the same conduit as wires for AC voltage or other high voltage signals.

Test Step 1. CHECK THE DATA CIRCUIT WIRE FOR AN OPEN

A. Clear the GSC+P Fault Log. Refer to Systems Operation, “Fault Log Clearing OP4”.

B. Turn the Engine Control Switch (ECS) to OFF/RESET.

C. Temporarily connect terminal 1 to terminal 2 of the alarm module for a few seconds.

D. Temporarily connect terminal 7 to terminal 2 of the alarm module for a few seconds.

Expected Result:

The CID 333 FMI 03 and CID 333 FMI 04 diagnostic codes should be temporarily active while the faults are occurring. The CID 333 FMI 03 and CID 333 FMI 04 diagnostic codes should be contained in the GSC+P fault log.

Results:

- OK – The diagnostic codes occur and the codes are contained in the GSC+P fault log. The GSC+P and the wire for the alarm (data) have not failed. Proceed to Test Step 2.

- NOT OK – The diagnostic codes do NOT occur and the codes are not in the GSC+P fault log. The wire from contact 35 of the GSC+P to terminal 2 of the alarm module is open or the wire has failed. Also, the GSC+P may have failed. Proceed to Test Step 3.

Test Step 2. CHECK THE ALARM MODULE FOR FAULTS.

A. The indicators on the alarm module remain flashing.

B. Disconnect the wire on terminal 2 of the alarm module.

C. Measure the DC voltage from terminal 2 to terminal 7 of the alarm module.

Expected Result:

The voltage should be 10.5 ± 1.0 DCV.

Results:

- OK – The voltage is 10.5 ± 1.0 DCV. The requirements for the alarm module that were listed at the beginning of this procedure may not be met.

  Repair: Review the list of requirements at the beginning of this procedure. If all requirements are being met, replace the alarm module. If the problem is not solved, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NOT OK – The voltage is NOT 10.5 ± 1.0 DCV. The alarm module has failed.

  Repair: Replace the alarm module.

  STOP.

Test Step 3. CHECK THE GSC+P FOR DIAGNOSTIC CODES.

A. Install a cable probe on pin 35 of the GSC+P 40-pin connector. Ensure that the cable probe is fully seated.

B. Turn the ECS to the STOP position.

C. Temporarily connect pin 35 of the GSC+P to “BATT+” for a few seconds.

D. Temporarily connect pin 35 of the GSC+P to the negative battery terminal “(BATT-)” for a few seconds.

Expected Result:

The CID 333 FMI 03 and CID 333 FMI 04 diagnostic codes will temporarily be active on the GSC+P display while the diagnostic codes are occurring.

Results:

- OK – The diagnostic codes occur. The GSC+P has not failed. The wire from GSC+P contact 35 to terminal 2 of the alarm module is open or the wire has failed.

  Repair: Repair the wire or replace the wire.

  STOP.

- NOT OK – The diagnostic codes do not occur. The GSC+P may have failed.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. During the procedure, ensure that all cable probes are fully seated and ensure that the probes are making contact with the GSC+P pins. If the result is repeated, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Diagnostic Code Procedures

i02884424

Troubleshooting Diagnostic Codes

SMCS Code: 4490-035; 7569

Diagnostic codes are associated with failed electrical components or circuits, that provide information to the Generator Set Control + Paralleling (GSC+P). Diagnostic codes are also associated with failed electrical components or circuits, that receive information from the GSC+P. The diagnostic code closely identifies the cause of the problem.

Each diagnostic code consists of the following items: a Component Identifier (CID), a Failure Mode Identifier (FMI), and “DIAG” indicator. These items are shown on the upper display. The diagnostic code indicator can be active or inactive. The CID identifies the component that has a problem. The FMI describes the nature of the diagnostic code. When the “DIAG” indicator is FLASHING, the diagnostic code is active. This means that the diagnostic code is present. When the “DIAG” indicator is ON CONTINUOUSLY, the diagnostic code is inactive and the CID FMI is recorded in the fault log. Refer to Systems Operation, “Fault Log Viewing OP1” in order to view the fault log. When the “DIAG” indicator is not showing, there are NO diagnostic codes that are detected or recorded. Service personnel interpret the identifiers in order to assist with troubleshooting.

When a diagnostic code occurs, the GSC+P FLASHES the “DIAG” indicator. The GSC+P determines the type of problem the code represents. There are two types of problems: an alarm fault and a shutdown fault. Then, the GSC+P FLASHES the corresponding fault alarm indicator or fault shutdown indicator. The CID FMI is immediately shown on the upper display when there is a shutdown fault. When there is an alarm fault, press the alarm codes key first. Then, the CID FMI is shown on the upper display.

The GSC+P has a fault log to help with troubleshooting of diagnostic codes. Inactive diagnostic codes (CID FMI) are recorded in the fault log for viewing at a later time. Also, the number of occurrences are totalled and the number of occurrences is shown on the upper display together with the CID and FMI. An active alarm fault becomes inactive when the problem is no longer occurring. Also, the engine control switch (ECS) should be turned to the OFF/RESET position for shutdown faults. The “DIAG” indicator is FLASHING when the problem is currently occurring. The “DIAG” indicator is ON CONTINUOUSLY when the problem occurred previously, but is inactive at the present time. Refer to Testing And Adjusting, “Fault Log Viewing OP1”.

During troubleshooting, it is sometimes necessary to disconnect the harness connector from the GSC+P and diagnostic codes are created. Because of internal circuitry, the GSC+P recognizes this condition as a FMI 03 for FMI 02 for certain components. An FMI 03 or FMI 02 describes the voltage that is above normal. This fact is also used as an aid in the troubleshooting process. Clear these created diagnostic codes after the particular diagnostic code is corrected and the diagnostic code is cleared. The following diagnostic codes are recorded in a properly operating system when the harness connector is removed from the GSC+P.

CID 0100 FMI 02 – Pressure Sensor (Engine Oil)

CID 0110 FMI 02 – Temperature Sensor (Engine Coolant)

CID 0111 FMI 03 – Fluid Level Sensor (Engine Coolant)

CID 0175 FMI 03 – Temperature Sensor (Engine Oil)

CID 0190 FMI 03 – Speed Sensor (Engine)

CID 0336 FMI 02 – Switch (Engine Control)

An FMI 02 describes an incorrect signal.

Note: A CID 0111 FMI 03 and a CID 0175 FMI 03 will only be recorded if the machine is equipped with the proper sensors.

Clear diagnostic codes after the problem is investigated or the problem is corrected. This will avoid a confusion during a future service call. The “DIAG” indicator is OFF when all diagnostic codes are cleared from the fault log and no active diagnostic codes exist. Refer to Testing And Adjusting, “Fault Log Clearing OP4”.

Diagnostic Codes

Table 18

Diagnostic Codes[1]	
CID No. / FMI No.	**Description**
CID 100 - Pressure Sensor (Engine Oil):	
FMI 2	Incorrect signal
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 110 - Temperature Sensor (Engine Coolant):	
FMI 2	Incorrect signal
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 111 - Fluid Level Sensor (Engine Coolant):	
FMI 3	Voltage above normal
CID 168 - Electrical System Voltage:	
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 175 - Temperature Sensor (Engine Oil):	
FMI 2	Incorrect signal
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 190 - Speed Sensor (Engine):	
FMI 2	Incorrect signal
FMI 3	Voltage above normal
CID 248 - CAT Data Link:	
FMI 9	Abnormal update
CID 268 - EMCP Electronic Control (Generator Set):	
FMI 2	Incorrect signal
CID 269 - Sensor Power Supply:	
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 333 - Alarm Module Control:	
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 334 - Spare Output:	
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 336 - Switch (Engine Control):	
FMI 2	Undefined state
CID 441 - Electronic Governor Relay:	

(continued)

(Table 18, contd)

Diagnostic Codes[1]	
CID No. / FMI No.	**Description**
FMI 12	Failed component
CID 442 - Generator Fault Relay:	
FMI 12	Failed component
CID 443 - Crank Termination Relay:	
FMI 12	Failed component
CID 444 - Starting Motor Relay:	
FMI 12	Failed component
CID 445 - Run Relay:	
FMI 12	Failed component
CID 446 - Air Shutoff Relay:	
FMI 12	Failed component
CID 447 - Fuel Control Relay:	
FMI 12	Failed component
CID 448 - Programmable Spare Relay:	
FMI 12	Failed component
CID 475 - Relay Driver Module:	
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 500 - EMCP Electronic Control (Generator Set):	
FMI 12	Failed component
CID 566 - Unexpected Shutdown:	
FMI 7	Improper mechanical response
CID 590 - Engine Electronic Control Module:	
FMI 9	Abnormal update
CID 770 - Customer Communication Module Data Link:	
FMI 9	Abnormal update
CID 858 - Generator Close Breaker:[2]	
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 859 - Kilowatt Level Output:	
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 1038 - Governor Adjust Analog Output:	
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 1167 - EPG Circuit Breaker:	
FMI 4	Voltage below normal

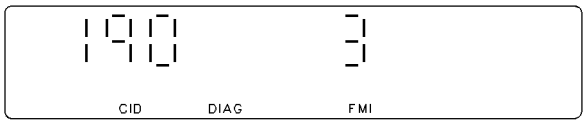
(continued)

(Table 18, contd)

Diagnostic Codes[1]	
CID No. / FMI No.	**Description**
CID 1168 - Dead Bus Sensor:	
FMI 3	Voltage above normal
FMI 4	Voltage below normal
CID 1169 - AC Transformer Box Sensor:	
FMI 2	Incorrect signal
CID 1170 - Bus Transformer Box Sensor:	
FMI 2	Incorrect siganl
FMI 4	Voltage below normal
FMI 8	Abnormal signal
CID 1178 - Pressure Sensor For Machine Overload Warning:	
FMI 3	Voltage above normal

(1) For troubleshooting, refer to the procedure with the same CID And FMI No.
(2) Parallelling Applications Only

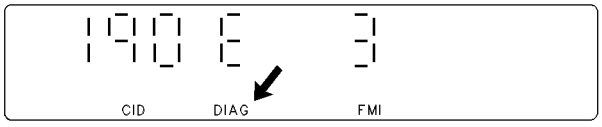
Example



g00615969

Illustration 57

Upper Display Showing A CID 190 FMI 3 Diagnostic Code



g00608337

Illustration 58

Upper Display Showing A CID 190 E FMI 3 Diagnostic Code

The “E” in the example shown in illustration 58 indicates that on EUI engines, the engine ECM has generated the diagnostic code. The EMCP II+P will display all diagnostic codes from the engine ECM. This assists the operator in diagnosing problems with the EUI engine. Refer to Troubleshooting, RENR9348 or Troubleshooting, RENR9968 for more information.

i02897294

GSC CID 0100 - FMI 02

SMCS Code: 1924-035

Conditions Which Generate This Code:

This diagnostic code is for the pressure sensor (engine oil).

The engine ECM monitors the engine oil pressure in order to protect the engine in case of a problem with the oil pressure. The oil pressure sensor is mounted on an oil gallery on the engine. The exact location of the engine oil pressure sensor varies depending on the engine model. The GSC+P monitors the oil pressure that is read by the engine ECM.

The possible causes of this diagnostic code are listed below:

- There is an open in the circuit for the CAT data link. The open is between the engine ECM and the GSC+P.
- There is a short or a failure in the oil pressure sensor that is connected to the engine ECM.

The GSC+P issues a CID 0100 FMI 02 in order to show that the GSC+P is unable to receive any valid data about the oil pressure from the engine ECM.

The sensor is connected to the engine ECM. The engine ECM sends data about the oil pressure to the GSC+P via the CAT data link. Refer to Troubleshooting, RENR9348 or System Operation Testing and Adjusting, RENR9968 for more information on the oil pressure sensor for the engine ECM.

System Response:

Note: The GSC+P is usually programmed to treat a problem with the oil pressure sensor as an alarm fault. Setpoint P04 is 0. If the GSC+P is programmed to treat a problem with the oil pressure sensor as a shutdown fault, setpoint P04 is 1. If setpoint P04 is programmed to 1, the diagnostic codes are automatically shown on the upper display.

VERIFY THE DIAGNOSTIC CODE.

View the diagnostic code that is displayed on the upper display panel of the EMCP II+P. Determine if the diagnostic code is originating from the Engine ECM.

Expected Result:

There is a letter “E” after the number of the CID that is on the upper display panel of the EMCP II+P.

Results:

- YES – There is a letter “E” after the number of the CID that is on the upper display panel of the EMCP II+P .

  Repair: Troubleshoot the diagnostic code for the Engine ECM. Refer to Troubleshooting, RENR9348 or System Operation Testing and Adjusting, RENR9968 for information on troubleshooting the diagnostic code.

  STOP.

- NO – There is not a letter “E” after the number of the CID that is on the upper display panel of the EMCP II+P .

  Repair: There may be a problem with the CAT Data Link. Determine if CID 0248 FMI 09 is present. Refer to Diagnostic Code Procedures, “GSC CID 0248 - FMI 09”.

  STOP.

i02897409

GSC CID 0110 - FMI 02

SMCS Code: 1906-035

Conditions Which Generate This Code:

The engine ECM monitors engine coolant temperature in order to protect the engine from a problem with the coolant temperature. The coolant temperature sensor is mounted in the water jacket, close to the front of the engine. The exact location of the engine coolant temperature sensor varies depending on the engine model.

The GSC+P monitors the coolant temperature that is read by the engine ECM. The engine ECM sends the information to the GSC+P by the CAT data link.

The possible causes of a CID 0110 FMI 02 are listed below:

- There is an open circuit on the CAT data link between the engine ECM and the GSC+P.
- There is a problem with the temperature sensor that is connected to the engine ECM.

If a CID 0248 FMI 09 for the CAT data link is active, correct the diagnostic code prior to proceeding with this procedure.

System Response:

Note: The GSC+P is usually programmed to treat a problem with the coolant temperature sensor as an alarm fault. Setpoint P004 is 0. If the GSC+P is programmed to treat a problem with the oil pressure sensor as a shutdown fault, setpoint P04 is 1. If setpoint P04 is programmed to 1, the diagnostic code is automatically shown in the upper display.

Note: Diagnostic codes are created when the harness connector is disconnected from the GSC+P during the troubleshooting procedures. Clear these created diagnostic codes after the particular problem is corrected. In a properly operating system, when the harness connector is removed from the GSC+P, the following diagnostic codes are recorded.

Test Step 1. VERIFY THE DIAGNOSTIC CODE.

View the diagnostic code that is displayed on the upper display panel of the EMCP II+P. Determine if the diagnostic code is originating from the Engine ECM.

Expected Result:

There is a letter “E” after the number of the CID that is on the upper display panel of the EMCP II+P.

Results:

- YES – There is a letter “E” after the number of the CID that is on the upper display panel of the EMCP II+P.

  Repair: Troubleshoot the diagnostic code for the Engine ECM. Refer to Troubleshooting, RENR9348 or System Operation Testing and Adjusting, RENR9968.

  STOP.

- NO – There is not a letter “E” after the number of the CID that is on the upper display panel of the EMCP II+P. Proceed to Test Step 2.

Test Step 2. CHECK FOR AN OPEN CIRCUIT ON THE CAT DATA LINK.

A. Turn the ECS to the OFF/RESET position.

B. Disconnect the harness connector from the GSC+P. Disconnect the harness connector from the engine ECM.

C. At the harness connector for the engine ECM, connect a jumper wire between pin J1-9 and pin J1-3.

D. At the harness connector for the GSC+P, measure the resistance between pin 19 and pin 20.

Expected Result:

The resistance that was measured between pin 19 and pin 20 is less than 5 ohms.

Results:

- OK – The resistance from pin 19 to pin 20 is less than 5 ohms. The CAT data link is correct.

  Repair: There is a problem with the temperature sensor. On EUI engines, the temperature sensor is connected to the engine ECM. Reconnect the harness connectors for the engine ECM and the GSC+P. Refer to Troubleshooting, SENR1003, “3500B EPG Engines” or Troubleshooting, RENR2227, “3406E EPG Engines” for information on troubleshooting the temperature sensor.

  STOP.

- NOT OK – The resistance from pin 19 to pin 20 is greater than 5 ohms.

  Repair: There is an open circuit in the CAT data link between the GSC+P and the engine ECM. Repair the wiring harness or replace the wiring harness.

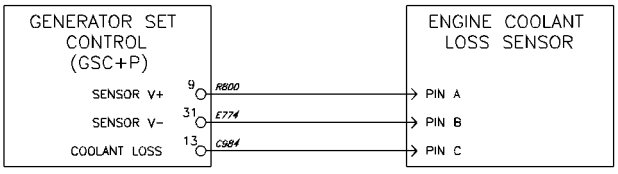
  STOP.

i02886469

GSC CID 0111 - FMI 03

SMCS Code: 1395-035

Conditions Which Generate This Code:



g01436869

Illustration 59

Simplified System Schematic For Engine Coolant Loss Sensor (ECLS)

The EMCPII+P system monitors engine coolant in order to protect the engine in case of a coolant temperature problem. The engine coolant loss function is an option that 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+P. When coolant is NOT present at the sensor, a high signal is sent to the GSC+P. A high signal is approximately +5 DCV. When coolant is present at the sensor, a low signal (approximately 0 DCV) is sent to the GSC+P.

Note: The GSC+P is usually programmed to treat coolant loss sensor problems as an alarm fault. P004 is equal to 0. If the GSC+P is programmed to shutdown, P004 is equal to 1. The operator is not required to press the “Alarm Codes” key in order to view the CID 111 FMI 3. The CID 111 FMI 3 is automatically shown on the upper display.

The possible causes of a CID 111 FMI 3 are listed below.

- A short from “BATT+” to the sensor signal
- 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 flashing indicator means that the diagnostic code is active. The GSC+P treats a CID 111 FMI 3 as an alarm fault. Active alarm faults are shown on the display when the alarm code key is pressed and the Engine Control Switch (ECS) is in any position except the OFF/RESET position. For an inactive fault, the problem may be intermittent. Refer toTesting And Adjusting, “Electrical Connector - Inspect” in order to troubleshoot an inactive fault. Also use the preceding system schematic. Clear the fault from the fault log after troubleshooting is complete.

Note: If a CID 269 FMI 3 or a CID 269 FMI 4 is active, correct the diagnostic code prior to proceeding with this procedure.

Test Step 1. CHECK THE SENSOR VOLTAGE SUPPLY CIRCUIT.

A. Turn the ECS to OFF/RESET. 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 engine harness side of the sensor connector, measure the voltage (DCV) that is between pin “A” and pin “B”. Pin “A” is the supply for the sensor. Pin “B” is the sensor ground.

Expected Result:

The voltage should be 8.0 DCV (± 0.5 DCV).

Results:

- OK – The voltage is 8.0 DCV (± 0.5 DCV). Proceed to Test Step 2.
- NOT OK – The sensor voltage supply circuit has failed. Proceed to Test Step 5.

Test Step 2. CHECK THE SIGNAL CIRCUIT.

A. Turn the ECS to OFF/RESET. 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 engine harness side of the sensor connector, measure the voltage (DCV) between pin “C” and pin “B”. Pin “C” is the signal. Pin “B” is the sensor ground.

Expected Result:

The voltage should be 2.5 DCV (± 0.5 DCV).

Results:

- OK – The voltage is 2.5 DCV (± 0.5 DCV). The signal circuit functions properly. Proceed to Test Step 3.
- NOT OK – The voltage is equal to the positive battery terminal (“BATT+”). The engine harness has failed.

  Repair: The signal circuit that is within the engine harness is shorted to the “BATT+”. Troubleshoot and repair the engine harness.

  STOP.

- The voltage is NOT 2.5 DCV (± 0.5 DCV) and the voltage is NOT equal to BATT+. – The GSC+P or the harness has failed. Proceed to Test Step 4.

Test Step 3. CHECK THE SENSOR.

A. Turn the ECS to OFF/RESET.

B. Turn the ECS to the STOP position.

C. Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

D. Turn the ECS to OFF/RESET.

E. Turn the ECS to STOP.

Expected Result:

CID 111 FMI 3 should no longer appear on the upper display.

Results:

- OK – CID 111 FMI 3 no longer appears on the upper display. STOP.
- NOT OK – CID 111 FMI 3 is still showing on the upper display. The sensor has failed. Replace the sensor. STOP.

Test Step 4. CHECK FOR A SHORTED HARNESS.

A. Turn the ECS to OFF/RESET.

B. Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

C. Disconnect the harness connector from the GSC+P.

D. At the GSC+P harness connector, measure the resistance from signal pin “13” to all other pins of the connector.

Expected Result:

For each measurement, the resistance should be greater than 5000 ohms.

Results:

- OK – For each measurement, the resistance is greater than 5000 ohms. The harness functions properly. Proceed to Test Step 5.
- NOT OK – At one or more of the measurements, the resistance is less than 5000 ohms.

  Repair: The harness wiring with the incorrect resistance is shorted in the harness. Troubleshoot and repair the failed harness wiring. The fault is between the sensor connector and the GSC+P harness connector.

  STOP.

Test Step 5. CHECK FOR AN OPEN HARNESS.

A. Turn the ECS to OFF/RESET.

B. Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

C. Disconnect the harness connector from the GSC+P.

D. Measure the resistance of the ground circuit. The ground circuit is from pin “B” of the sensor harness connector to pin “31” of the GSC+P harness connector.

E. Measure the resistance of the signal circuit. The signal circuit is from pin “C” of the sensor harness connector to pin “13” of the GSC+P harness connector.

F. Measure the resistance of the sensor voltage supply circuit. The sensor voltage supply circuit is from pin “A” of the sensor harness connector to pin “9” of the GSC+P harness connector.

Expected Result:

For each measurement, the resistance should be 5 ohms or less.

Results:

- OK – For each measurement, the resistance is 5 ohms or less. The harness functions properly. Proceed to Step 6.
- NOT OK – The harness wiring with the incorrect resistance measurement is open.

  Repair: The harness wiring has failed. Troubleshoot and repair the failed harness wiring between the sensor connector and the GSC+P harness connector.

  STOP.

Test Step 6. CHECK THE ELECTRICAL CONNECTORS.

A. Check the electrical connectors, terminals and wiring. Refer to 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. STOP.
- NOT OK – Repair the area with the problem.

  Repair: Start the engine. If the CID 111 FMI 3 is still showing, the GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

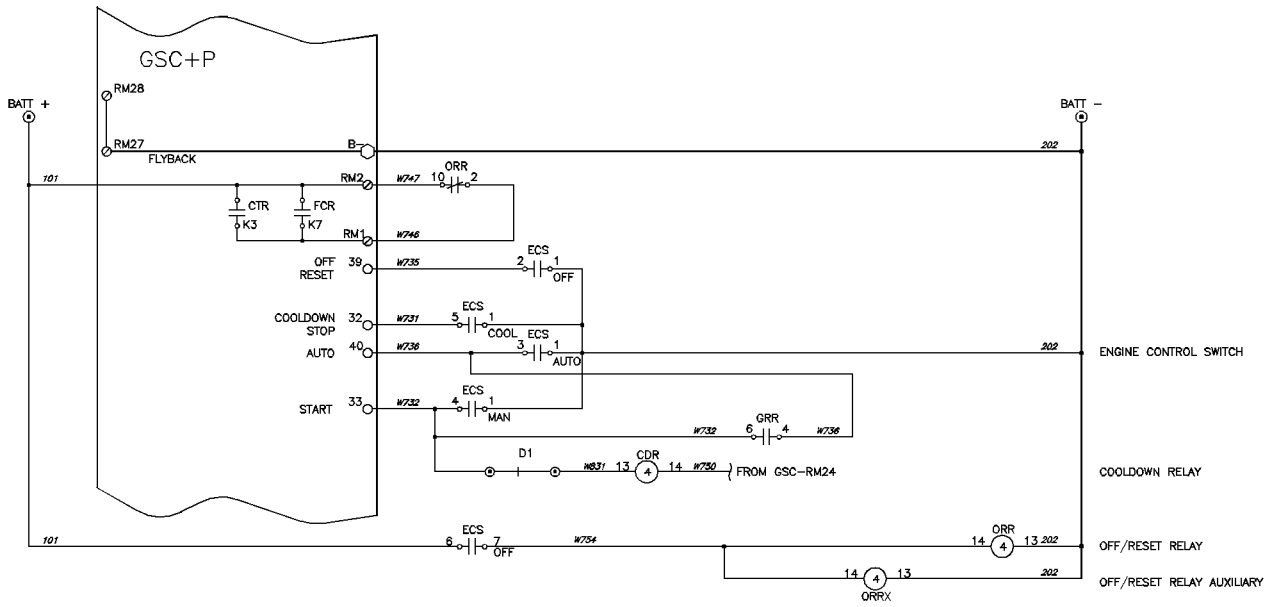
i02916977

GSC CID 0168 - FMI 03

SMCS Code: 1406-035

Conditions Which Generate This Code:

This diagnostic code is associated with an electrical system voltage that is above normal. The FMI 03 means that the engine Electronic Control Module (ECM) has determined that the electrical system voltage is above normal.



►

Illustration 60 g01447141

The EMCP II+P monitors the battery voltage in order to protect the EMCP II+P from a battery problem or from a charging problem. The battery voltage is received from the engine ECM by the CAT data link. If you receive a CID 168 E fault, refer to Troubleshooting , RENR9348 or Systems Operation Testing and adjusting, RENR9968 for C32 Generator Set Engines . The GSC+P treats a CID 168 fault as an alarm fault. The threshold for a CID 168 FMI 03 fault for battery voltage is greater than 32 DCV for 24 volt system. The threshold for a CID 168 FMI 03 fault for battery voltage is greater than 45 DCV for a 32 volt system.

Table 19

POSSIBLE CAUSES FOR CID 168 DIAGNOSTIC CODES			
The Location that the Diagnostic Code is Displayed On	**Diagnostic Code**	**Battery Voltage Thresholds (24 Volt System)**	**Battery Voltage Thresholds (32 Volt System)**
Engine ECM	CID 168 E 00	The engine is running and the battery voltage is greater than 32 DCV more than two seconds.	
Engine ECM	CID 168 E 01	The engine is not running and the battery voltage is less than 9 DCV for more than two seconds.	
Engine ECM	CID 168 E 02	The engine is not running. The battery voltage is less than 9 DCV for a period of .07 seconds. The battery voltage then returns to 9 DCV (or greater). The other possible diagnostic code cause is that the battery voltage goes below 9 DCV three times in seven seconds.	
GSC+P	CID 168 FMI 03		Regardless of engine status, the battery voltage is greater than the P007 limit.
GSC+P	CID 168 FMI 04		Regardless of the engine status, the battery voltage is less than 18 DCV.

The setpoint for the system voltage (P007) specifies the battery voltage.

24 – 24 Volt System

32 – 32 Volt System

Before beginning this procedure, ensure that the following steps have been performed:

- VERIFY THE DIAGNOSTIC CODE.
- Make sure that the CID 168 FMI 03 is shown on the display.
- Enter service mode.
- Turn the ECS to the STOP position.
- Program setpoint P023 to 0. This programs the GSC+P for an MUI engine. This eliminates the engine ECM as a possibility of the fault. For more information, refer to System Operation, “Protective Relaying Programming OP5-1”.
- Temporarily remove the Off Reset Relay (ORR) from the relay panel.
- Temporarily remove jumper wire on GSC+P relay module between terminal 1 and 2.
- Begin the Test procedure.

Test Step 1. CHECK THE SYSTEM’S VOLTAGE.

A. Turn the ECS to the STOP position.

B. Measure the voltage across the battery terminals.

Expected Result:

For a 24 volt system, the voltage should be between 24.8 DCV and 29.5 DCV. For a 32 volt system, the voltage should be between 33.1 DCV and 39.3 DCV.

Results:

- OK – For a 24 volt system, the voltage is 24.8 DCV to 29.5 DCV. For a 32 volt system, the voltage is 33.1 DCV to 39.3 DCV. Proceed to Test Step 2.
- NOT OK – For 24 volt systems, the voltage is not between 24.8 DCV to 29.5 DCV. For a 32 volt system, the voltage is not between 33.1 DCV to 39.3 DCV. The problem is in the charging system.

Repair: Proceed to Testing and Adjusting, “Charging System - Test”.

STOP.

Test Step 2. COMPARE THE VOLTAGE BETWEEN DC CONNECTOR TERMINALS AND THE BATTERY VOLTAGE.

A. Turn the ECS to the STOP position.

B. Measure the battery voltage across the battery terminals. Take note of the battery voltage.

C. Measure the voltage between BATT+ and BATT-. Take note of the voltage.

D. Compare the voltage measured at the battery with the voltage measured between the DC connector terminals.

Expected Result:

The voltage measured at the battery and the voltage measured between the DC connector terminals should be within 2.0 DCV.

Results:

- OK – The voltage measured at the battery and the voltage measured between the DC connector terminals are within 2.0 DCV of each other. Proceed to Test Step 3.
- NOT OK – The voltage measured at the battery and the voltage measured between the DC connector terminals are NOT within 2.0 DCV of each other. The wiring harness is not correct.

  Repair: Repair the wiring harness or replace the wiring harness.

  Proceed to Test Step 7.

Test Step 3. COMPARE THE VOLTAGE BETWEEN DC CONNECTOR TERMINALS AND THE ECS.

A. Turn the ECS to the STOP position.

B. Measure the voltage between “BATT+” and “BATT-”. Take note of the voltage.

C. Measure the voltage between GSC-RM2 and “BATT-”. Take note of the voltage.

D. Compare the voltage that was measured between the “BATT+” and “BATT-” terminals with the voltage that was measured between the GSC-RM2 and “BATT-” terminals.

Expected Result:

The voltage that was measured between the “BATT+” and “BATT-” terminals and the voltage that was measured measured between the GSC-RM2 and “BATT-” terminals are within 2.0 DCV of each other.

Results:

- OK – The voltage that was measured between the “BATT+” and “BATT-” terminals and the voltage that was measured measured between the GSC-RM2 and “BATT-” terminals are within 2.0 DCV of each other. Proceed to Test Step 4.
- NOT OK – The voltage that was measured between the “BATT+” and “BATT-” terminals and the voltage that was measured measured between the GSC-RM2 and “BATT-” terminals are not within 2.0 DCV of each other. The wiring harness is not correct.

  Repair: Repair the wiring harness or replace the wiring harness.

  Proceed to Test Step 7.

Test Step 4. CHECK THE CONTINUITY OF THE ECS.

Table 20

Engine Control Switch (ECS)[1][2]				
Terminal	**OFF/ RESET**	**AUTO**	**MANUAL**	**STOP**
7	X	O	O	O
8	O	X	O	O
9	O	O	X	O
10	O	O	O	X

(1) X = Less than 5 Ohms resistance from this terminal to terminal 6 (ECS).
(2) O = Greater than 5000 Ohms resistance from this terminal to terminal 6 (ECS).

A. If applicable, disconnect the jumper from terminal 6 to terminal 9 on the ECS.

B. Place the ECS in the “OFF/RESET” position.

C. Place the one lead on terminal 6 of the ECS.

D. Measure the resistance from terminal 6 to each of the terminals (7, 8, 9, and 10).

E. Use the same procedure for each switch position.

F. Compare the measured resistances with Table 20.

Expected Result:

The measured resistances match Table 20.

Results:

- OK – The measured resistances match the Table. Proceed to Test Step 5.
- NOT OK – The measured resistances match the Table. The ECS has failed. Proceed to Test Step 7.

Test Step 5. Compare the voltage between RM-1 and the ECS.

A. Turn the ECS to the STOP position.

B. Check the voltage between RM- 1 and RM-28. Take note of the voltage.

C. Check the voltage at contact 10 of the ECS . Take note of the voltage.

D. Compare the voltage measured between RM-1 and RM-28 with the voltage measured at contact 10.

Expected Result:

The voltages are within 2.0 DCV of each other.

Results:

- OK – The voltages are within 2.0 DCV of each other. Proceed to Test Step 6.
- NOT OK – The voltages are not within two volts of each other.

  Repair: The wiring harness is faulty. Repair the harness or replace the harness.

  Proceed to Test Step 7.

Test Step 6. Compare the voltage between RM-1 and the lower display.

A. Turn the ECS to the STOP position.

B. Check the voltage between RM- 1 and RM-28. Take note of the voltage.

C. Check the voltage that is shown on the lower display. Take note of the voltage.

D. Compare the two voltages.

Expected Result:

The voltages are within 2.0 VDC of each other.

Results:

- OK – The voltages are within 2.0 VDC of each other. The fault is probably an intermittent fault which is caused by a faulty connector. Inspect the electrical connectors.

  Repair: Refer to Testing and Adjusting, “Electrical Connector - Inspect”. If the faulty connector can not be found, repeat this test procedure. If the fault still remains, replace the GSC+P.

  STOP.
- NOT OK – The voltages are not within 2.0 VDC of each other.

  Repair: Replace the GSC+P.

  STOP.

Test Step 7. Reprogram the GSC+P.

A. Turn the ECS to the STOP position.

B. Program the setpoint P023 to 2 (EUI). Refer to System Operation, “Engine Generator Programming OP5-0”.

C. Turn the ECS to the OFF/RESET position. If applicable, disconnect the jumper wire on the ECS that is between terminal 6 and terminal 9. Not all generators will have a jumper wire between terminal 6 and terminal 9.

D. Verify that the diagnostic code is no longer present.

E. Replace the OFF RESET RELAY (ORR). Replace the jumper wire on the GSC+P relay module between terminal 1 and 2.

Expected Result:

Setpoint P023 should be programmed to the correct setting. The diagnostic code should no longer be present.

Results:

- OK – Setpoint P023 is programmed to the correct setting. The diagnostic code is no longer present. STOP.
- NOT OK – Setpoint P023 is not programmed to the correct setting. The diagnostic code is still present.

Repair: Reprogram the GSC+P. Refer to System Operation, “Engine Generator Programming OP5-0”.

STOP.

i02886514

GSC CID 0190 - FMI 02

SMCS Code: 1907-035

Conditions Which Generate This Code:

This diagnostic code is associated with the engine speed sensor. The FMI 2 means that the Electronic Control Module (ECM) has determined that an incorrect signal from the engine speed sensor has occurred.

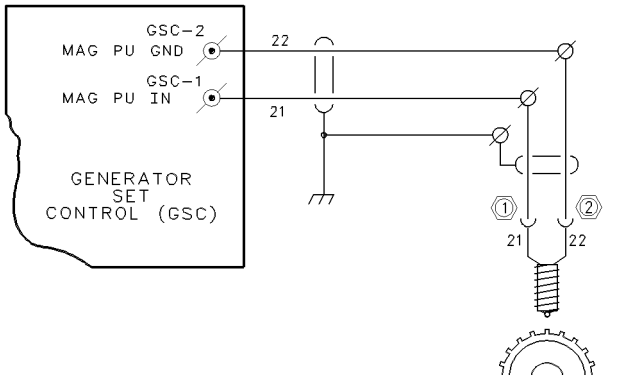


Illustration 61 g00530097

System Schematic For The Engine Speed Sensor

The EMCP II+P system monitors the speed of the engine. The EMCP II+P system uses engine speed in order to accomplish many tasks. These tasks are included in the following list.

- Activating a shutdown for engine overspeed
- Terminating engine cranking
- Determining the oil step speed
- Causing the air shutoff solenoid to engage during some fault shutdowns

The EMCP II+P 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. The signal is created from passing ring gear teeth. The rate of the signal is one pulse per tooth. The sensor sends the sine wave signal to the GSC+P. The frequency of the signal is directly proportional to the speed of the engine.

The GSC+P treats a CID 190 FMI 2 as a shutdown fault. The engine is not allowed to crank or the engine is not allowed to run when a CID 190 FMI 2 diagnostic code is active.

Note: The Engine Speed Sensor is commonly referred to as magnetic pickup.

Note: Engines that are equipped with an electronic governor have a separate speed sensor. The cable of the speed sensor that is used by the GSC+P is marked with one of the following numbers: 838-873, 838-973, and 973-938

This troubleshooting procedure is for a CID 190 FMI 2 that is active or inactive.

The possible causes of a CID 190 FMI 2 are listed below.

- The frequency of the signal is beyond accepted limits. There is a short to the battery negative terminal (“BATT-”).
- The air gap of the speed sensor is too large.

Clear the diagnostic code from the fault log after troubleshooting is complete.

Test Step 1. CHECK THE HARNESS AND THE SPEED SENSOR.

A. Turn the Engine Control Switch (ECS) to OFF/RESET.

B. Disconnect the harness connector from the GSC+P.

C. At the GSC+P harness connector, measure the resistance from pin “1” to pin “2”.

Expected Result:

The resistance should be from 100 to 350 ohms.

Results:

- OK – There is probably an intermittent problem. Proceed to Test Step 2.
- NOT OK – The harness wiring or the speed sensor has failed. Proceed to Test Step 3.

Test Step 2. CHECK FOR AN INTERMITTENT FAULT.

A. Turn the ECS to OFF/RESET.

B. Turn the ECS to STOP.

C. Check the upper display for a CID 190 FMI 2.

Expected Result:

CID 190 FMI 2 should not appear on the upper display.

Results:

- OK – CID 190 does not appear on the upper display. This step has corrected the problem. STOP.
- NOT OK – CID 190 FMI 2 appears on the upper display. Proceed to Test Step 3.

Test Step 3. CHECK THE RESISTANCE OF THE ENGINE SPEED SENSOR.

A. Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

B. At the connector of the sensor, measure the resistance between pin “1” and pin “2”.

Expected Result:

The resistance should be between 100 to 350 ohms.

Results:

- OK – The resistance of the sensor is correct. Proceed to Test Step 4.
- NOT OK – Replace the sensor.

  Repair: Refer to Testing And Adjusting, “Speed Sensor (Engine) - Adjust”.

  STOP.

Test Step 4. CHECK THE HARNESS FOR AN OPEN OR A SHORT.

A. Turn the ECS to OFF/RESET.

B. Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

C. Disconnect the harness connector from the GSC+P.

D. Check for an open circuit. Check the resistance from pin “2” of the sensor harness connector to pin “2” of the GSC+P harness connector. The resistance should be 5 ohms or less.

E. Check for an open circuit. Check the resistance from pin “1” of the sensor harness connector to pin “1” of the GSC+P harness connector. The resistance should be 5 ohms or less.

F. Check for a short circuit. Check the resistance from pin “1” to pin “2” of the GSC+P harness connector. The resistance should be greater than 5000 ohms.

Expected Result:

When the resistance is measured between pin “2” of the sensor harness connector and pin “2” of the GSC+P harness connector, there should be 5 ohms or less.

The resistance from pin “1” of the sensor harness connector to pin “1” of the GSC+P harness connector should be 5 ohms or less.

The resistance from pin “1” to pin “2” of the GSC+P harness connector should be greater than 5000 ohms.

Results:

- OK – The harness functions properly. Proceed to Test Step 5.
- NOT OK – The harness wiring with the incorrect resistance measurement has failed. Replace the failed harness from the sensor to the GSC+P connector or repair the failed harness from the sensor to the GSC+P connector. STOP.

Test Step 5. CHECK THE SHIELD AND THE CONNECTORS.

A. Turn the ECS to OFF/RESET.

B. Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

C. Disconnect the harness connector from the GSC+P.

D. The harness has a shield (bare wire) which protects the sensor signal wire from electrical interference. This shield must be securely fastened and the shield must make a good electrical connection to the battery negative post of the GSC+P.

E. Within the EMCP II+P, check that the shield is securely fastened.

F. Check the connection between the sensor and the mating harness connector. Refer to Testing and Adjusting, “Electrical Connector - Inspect”.

Expected Result:

The shield should be securely fastened. The connection between the sensor and the mating harness connector should be secure.

Results:

- OK – The shield is securely fastened. The connection between the sensor and the mating harness connector is secure. Proceed to Test Step 6.
- NOT OK – One of the items is not correct. Repair the harness or replace the harness. STOP.

Test Step 6. INSPECT THE SENSOR AND ADJUST THE SENSOR.

A. Remove the sensor from the engine flywheel housing.

B. Inspect the sensor for damage and remove any debris from the tip.

Expected Result:

No damage should be present.

Results:

- OK – No damage is present. Reinstall the engine speed sensor. Adjust the sensor.

  Repair: For more information, refer to Testing And Adjusting, “Speed Sensor (Engine) - Adjust”.

  Proceed to Test Step 7.

- NOT OK – Damage is present. Replace the engine speed sensor.

  Repair: Refer to Testing And Adjusting, “Speed Sensor (Engine) - Adjust”.

  STOP.

Test Step 7. CHECK THE STATUS OF THE FAULT.

A. Reconnect the harness connector to the GSC+P and the sensor.

B. Turn the ECS to OFF/RESET and then turn the ECS to STOP.

C. Check the upper display for a CID 190 FMI 2.

Expected Result:

A CID 190 FMI 2 diagnostic code should still be active.

Results:

- OK – A CID 190 FMI 2 is showing on the upper display. The diagnostic code is still active and the engine will not start.

  Repair: It is unlikely that the GSC+P has failed. Exit this procedure and perform this procedure again. If the diagnostic code is still present, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NOT OK – A CID 190 FMI 2 is not showing on the upper display. These procedures have corrected the problem. The operator may continue with this procedure. Proceed to Test Step 8.

Test Step 8. CHECK THE SIGNAL VOLTAGE.

A. This is an additional check of the circuit. Make sure that all of the harness connectors are connected.

B. Use a multimeter and 7x-1710 Multimeter Probes in order to measure the AC signal voltage. Measure the AC signal voltage between pin “1” and pin “2” of the GSC+P connector.

C. Start the engine and run the engine at rated speed.

D. Measure the AC signal voltage of the engine speed sensor.

Expected Result:

The voltage should be equal to 2 ACV or greater.

Results:

- OK – The voltage is equal to 2 ACV or greater. The speed sensor circuit is correct. STOP.
- NOT OK – The voltage is not equal to 2 ACV or greater. The most likely cause is improper air gap of the pickup.

  Repair: For more information, refer to Testing And Adjusting, “Speed Sensor (Engine) - Adjust”.

  STOP.

i02886705

GSC CID 0190 - FMI 03

SMCS Code: 1907-035

Conditions Which Generate This Code:

This diagnostic code is associated with the engine speed sensor. The FMI 3 means that the ECM has determined that an above normal voltage signal from the engine speed sensor has occurred.

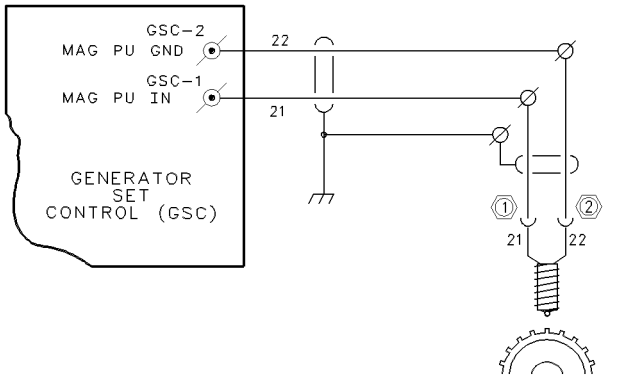


Illustration 62 g00530097

System Schematic For The Engine Speed Sensor

The EMCP II+P system monitors engine speed. The EMCP II+P system uses engine speed in order to accomplish many tasks. These tasks are included in the following list.

- Activating a shutdown for engine overspeed
- Terminating engine cranking
- Determining the oil step speed
- Causing the air shutoff solenoid to engage during some fault shutdowns

The EMCP II+P 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. The signal is created from passing ring gear teeth. The rate of the signal is one pulse per tooth. The sensor sends the sine wave signal to the GSC+P. The frequency of the signal is directly proportional to the speed of the engine.

The GSC+P treats a CID 190 FMI 3 as a shutdown fault. The engine is not allowed to crank or the engine is not allowed to run when a CID 190 FMI 3 diagnostic code is active.

Note: The Engine Speed Sensor is commonly referred to as magnetic pickup.

Note: Engines that are equipped with an electronic governor have a separate speed sensor. The cable of the speed sensor that is used by the GSC+P is marked with one of the following numbers: 838-873, 838-973, and 973-938

This troubleshooting procedure is for a CID 190 FMI 3 that is active or inactive.

The possible causes of a CID 190 FMI 3 are listed below.

- There is an open in the signal circuit.

Clear the diagnostic code from the fault log after troubleshooting is complete.

Test Step 1. CHECK THE HARNESS AND THE SPEED SENSOR.

A. Turn the Engine Control Switch (ECS) to OFF/RESET.

B. Disconnect the harness connector from the GSC+P.

C. At the GSC+P harness connector, measure the resistance from pin “1” to pin “2”.

Expected Result:

The resistance should be from 100 to 350 ohms.

Results:

- OK – There is probably an intermittent problem. Proceed to Test Step 2.
- NOT OK – The harness wiring or the speed sensor has failed. Proceed to Test Step 2.

Test Step 2. CHECK FOR AN INTERMITTENT FAULT.

A. Turn the ECS to OFF/RESET.

B. Turn the ECS to STOP.

C. Check the upper display for a CID 190 FMI 3.

Expected Result:

CID 190 FMI 3 should not appear on the upper display.

Results:

- OK – CID 190 FMI 3 does not appear on the upper display. This step has corrected the problem. STOP.
- NOT OK – CID 190 FMI 3 appears on the upper display. Proceed to Test Step 3.

Test Step 3. CHECK THE RESISTANCE OF THE ENGINE SPEED SENSOR.

A. Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

B. At the connector of the sensor, measure the resistance between pin “1” and pin “2”.

Expected Result:

The resistance should be between 100 to 350 ohms.

Results:

- OK – The resistance of the sensor is correct. Proceed to Test Step 4.
- NOT OK – Replace the sensor.

  Repair: Refer to Testing And Adjusting, “Speed Sensor (Engine) - Adjust”.

  STOP.

Test Step 4. CHECK THE HARNESS FOR AN OPEN OR A SHORT.

A. Turn the ECS to OFF/RESET.

B. Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

C. Disconnect the harness connector from the GSC+P.

D. Check for an open circuit. Check the resistance from pin “2” of the sensor harness connector to pin “2” of the GSC+P harness connector. The resistance should be 5 ohms or less.

E. Check for an open circuit. Check the resistance from pin “1” of the sensor harness connector to pin “1” of the GSC+P harness connector. The resistance should be 5 ohms or less.

F. Check for a short circuit. Check the resistance from pin “1” to pin “2” of the GSC+P harness connector. The resistance should be greater than 5000 ohms.

Expected Result:

When the resistance is measured between pin “2” of the sensor harness connector and pin “2” of the GSC+P harness connector, there should be 5 ohms or less.

The resistance from pin “1” of the sensor harness connector to pin “1” of the GSC+P harness connector should be 5 ohms or less.

The resistance from pin “1” to pin “2” of the GSC+P harness connector should be greater than 5000 ohms.

Results:

- OK – The harness functions properly. Proceed to Test Step 5.
- NOT OK – The harness wiring with the incorrect resistance measurement has failed. Replace the failed harness from the sensor to the GSC+P connector or repair the failed harness from the sensor to the GSC+P connector. STOP.

Test Step 5. CHECK THE SHIELD AND THE CONNECTORS.

A. Turn the ECS to OFF/RESET.

B. Disconnect the sensor from the engine harness. The sensor remains fastened to the engine.

C. Disconnect the harness connector from the GSC+P.

D. The harness has a shield (bare wire) which protects the sensor signal wire from electrical interference. This shield must be securely fastened and the shield must make a good electrical connection to the battery negative post of the GSC+P.

E. Within the EMCP II+P, check that the shield is securely fastened.

F. Check the connection between the sensor and the mating harness connector. Refer to Testing and Adjusting, “Electrical Connector - Inspect”.

Expected Result:

The shield should be securely fastened. The connection between the sensor and the mating harness connector should be secure.

Results:

- OK – The shield is securely fastened. The connection between the sensor and the mating harness connector is secure. Proceed to Test Step 6.
- NOT OK – One of the items is not correct. Repair the harness or replace the harness. STOP.

Test Step 6. INSPECT THE SENSOR AND ADJUST THE SENSOR.

A. Remove the sensor from the engine flywheel housing.

B. Inspect the sensor for damage and remove any debris from the tip.

Expected Result:

No damage should be present.

Results:

- OK – No damage is present. Reinstall the engine speed sensor. Adjust the sensor.

  Repair: For more information, refer to Testing And Adjusting, “Speed Sensor (Engine) - Adjust”.

  Proceed to Test Step 7.

- NOT OK – Damage is present. Replace the engine speed sensor.

  Repair: Refer to Testing And Adjusting, “Speed Sensor (Engine) - Adjust”.

  STOP.

Test Step 7. CHECK THE STATUS OF THE FAULT.

A. Reconnect the harness connector to the GSC+P and the sensor.

B. Turn the ECS to OFF/RESET and then turn the ECS to STOP.

C. Check the upper display for a CID 190 FMI 3.

Expected Result:

A CID 190 FMI 3 diagnostic code should still be active.

Results:

- OK – A CID 190 FMI 3 is showing on the upper display. The diagnostic code is still active and the engine will not start.

  Repair: It is unlikely that the GSC+P has failed. Exit this procedure and perform this procedure again. If the diagnostic code is still present, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NOT OK – A CID 190 FMI 3 is not showing on the upper display. These procedures have corrected the problem. The operator may continue with this procedure. Proceed to Test Step 8.

Test Step 8. CHECK THE SIGNAL VOLTAGE.

A. This is an additional check of the circuit. Make sure that all of the harness connectors are connected.

B. Use a multimeter and 7x-1710 Multimeter Probes in order to measure the AC signal voltage. Measure the AC signal voltage between pin “1” and pin “2” of the GSC+P connector.

C. Start the engine and run the engine at rated speed.

D. Measure the AC signal voltage of the engine speed sensor.

Expected Result:

The voltage should be equal to 2 ACV or greater.

Results:

- OK – The voltage is equal to 2 ACV or greater. The speed sensor circuit is correct. STOP.

- NOT OK – The voltage is not equal to 2 ACV or greater. The most likely cause is improper air gap of the pickup.

  Repair: For more information, refer to Testing And Adjusting, “Speed Sensor (Engine) - Adjust”.

  STOP.

i02897460

GSC CID 0248 - FMI 09

SMCS Code: 4490-035

Conditions Which Generate This Code:

This diagnostic code is associated with the CAT Data Link. The FMI 9 means that the ECM has determined that an abnormal update has occurred.

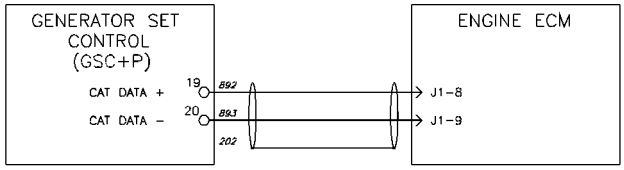


Illustration 63 g01442749

System Schematic For CAT Data Link

On C32 packages, the GSC+P uses the CAT Data Link in order to communicate with the engine ECM. The CAT Data Link consists of two wires that connect the GSC+P to the engine ECM.

The possible causes of a CID 248 FMI 9 are listed below.

- A short to the positive battery terminal (“BATT+”) of either of the two CAT Data Link wires
- A short to the negative battery terminal (“BATT-”) of either of the two CAT Data Link wires

The GSC+P cannot detect an open in the circuit of the CAT Data Link. The GSC+P treats a CID 248 FMI 9 as an alarm fault. Active alarm faults are shown on the display when the “Alarm Codes” key is pressed. The Engine Control Switch (ECS) is in any position except the OFF/RESET position. Troubleshoot and repair the wiring. Refer to Testing And Adjusting, “Schematics And Wiring Diagrams”. Clear the fault from the fault log after troubleshooting is complete.

Test Step 1. CHECK THE POSITIVE BATTERY TERMINAL

A. Ensure that there are not shorts between “BATT+” and either of the CAT Data Link wires.

B. Turn the ECS to OFF/RESET.

C. Disconnect both cables from the battery.

D. Measure the resistance between the positive battery cable and both CAT Data Link wires.

Expected Result:

The resistance between the positive battery cable and both of the CAT Data Link wires should be greater than 5000 ohms.

Results:

- OK – The resistance between the disconnected positive battery cable and either of the CAT Data Link wires is greater than 5000 ohms. Proceed to Test Step 2.
- NOT OK – The resistance between the disconnected positive battery cable and either of the CAT Data Link wires is less than 5000 ohms.

  Repair: Troubleshoot and repair the wiring. Repair any shorts between “BATT+” and the CAT Data Link wires. Refer to Testing And Adjusting, “Schematics And Wiring Diagrams”.

  STOP.

Test Step 2. CHECK THE BATTERY NEGATIVE TERMINALS

A. Ensure that there are no shorts between the battery negative terminal and either of the CAT Data Link wires.

B. Turn the ECS to OFF/RESET.

C. Disconnect both cables from the battery.

D. Measure the resistance between the negative battery cable and both CAT Data Link wires.

Expected Result:

The resistance between the negative battery cable and both of the CAT Data Link wires should be greater than 5000 ohms.

Results:

- OK – The resistance between the disconnected negative battery cable and either of the CAT Data Link wires is greater than 5000 ohms. STOP.
- NOT OK – The resistance between the disconnected negative battery cable and either of the CAT Data Link wires is less than 5000 ohms.

  Repair: Troubleshoot and repair the wiring. Repair any shorts between the disconnected negative battery cable and the CAT Data Link wires. Refer to Testing And Adjusting, “Schematics And Wiring Diagrams”.

  STOP.

i02887665

GSC CID 0268 - FMI 02

SMCS Code: 4490-035

Conditions Which Generate This Code:

A portion of memory within the GSC+P stores the setpoints of important generator set conditions. The setpoints are listed below.

- engine/generator setpoint programming OP5-0
- protective relaying setpoints OP5-1
- spare input/output programming OP6
- voltmeter/ammeter setpoint programming OP8

The GSC+P detects a CID 0268 FMI 02 when the setpoint data is invalid or the setpoint data is out of range. After detecting a CID 0268 FMI 02, the GSC+P sets the affected setpoints to the default value. For more information regarding setpoints and default values, refer to the topics that are listed below.

- Systems Operation, “Engine/Generator Programming OP5-0”
- Systems Operation, “Protective Relaying Programming OP5-1”
- Systems Operation, “Spare Input/Output Programming OP6”
- Systems Operation, “Voltmeter/Ammeter Programming OP8”

The possible cause of a CID 0268 FMI 02 is electrical interference.

This procedure is designed to correct an active CID 0268 FMI 02 or the procedure is designed to correct an inactive CID 0268 FMI 02. Clear the diagnostic code from the fault log after troubleshooting is complete.

The GSC+P treats a CID 0268 FMI 02 as an alarm fault or the GSC+P treats a CID 0268 FMI 02 as a shutdown fault. The treatment depends on the particular setpoint with bad data. The ring gear teeth P009 setpoint and the engine overspeed P010 setpoints 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: The GSC+P setpoints must be programmed in the OFF/RESET position when a shutdown fault is active. If the alarm for the fault indicator is FLASHING the GSC+P can be programmed with the ECS in the OFF/RESET position or the COOLDOWN/STOP position.

CHECK THE SETPOINTS.

A. View the setpoints that are stored in the memory of the GSC+P. Refer to Systems Operation, “Engine/Generator Setpoint Viewing OP2-0”.

B. Also check Systems Operation, “Spare Input/Output Programming (OP6)” and Systems Operation, “Voltmeter/Ammeter Programming (OP8)”.

C. Compare the stored setpoints to the specified setpoints of the particular generator set.

Expected Result:

The stored setpoints and the specified setpoints should match.

Results:

- OK – All the setpoints match. Start the engine. Check the upper display for a CID 0268 FMI 02. If the diagnostic code was inactive prior to performing this procedure, then these steps should have corrected the problem.

  Repair: If the diagnostic code remains active, The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer toTesting And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NOT OK – One or more of the setpoints do not match.

  Repair: Program the setpoints. Refer to the following sections.

  - Systems Operation, “Engine/Generator Programming OP5-0”
  - Systems Operation, “Protective Relaying Programming OP5-1”
  - Systems Operation, “Spare Input/Output Programming OP6”

- Systems Operation, “Voltmeter/Ammeter Programming OP8”

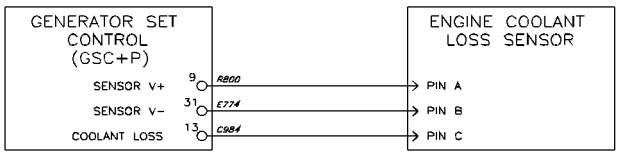
STOP.

i02896489

GSC CID 0269 - FMI 03

SMCS Code: 4490-035-NS

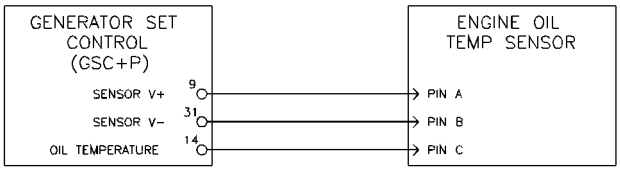
Conditions Which Generate This Code:



g01442559

Illustration 64

Schematic for the coolant loss sensor



g01442566

Illustration 65

Schematic for the oil temperature sensor

The EMCP II+P has a sensor supply voltage of 8 DCV from the GSC+P that powers the engine sensors. The sensors may vary according to the engine. Refer to table 21 in order to determine the sensors that are on your engine.

Table 21

Sensor	MUI Engines	EUI Engines	PEEC Engines
Coolant Temperature	Yes	No	Yes
Oil Pressure	Yes	No	Yes
Coolant Loss	Yes	Yes	Yes
Oil Temperature	No	Yes	Yes

The engine oil temperature sensor is optional. The engine coolant fluid level sensor is optional.

The sensor power supply functions whenever power is applied to the GSC+P.

The GSC+P is usually programmed in the factory. The GSC+P deals with a problem with the sensor power supply CID 0269 FMI 03 as an alarm fault. P004 = 0. If the GSC+P is programmed to shutdown, P004 is equal to 1 for a problem with the sensor power supply. It is not necessary to press the “Alarm Codes” key in order to view the CID 0269 FMI 03. The CID 0269 FMI 03 is automatically shown on the upper display.

Diagnostic codes are created when the harness connector is disconnected from the GSC+P during these troubleshooting procedures. Clear these created diagnostic codes after the particular problem is corrected and the particular diagnostic code is cleared.

The possible cause of a CID 0269 FMI 03 happens when the voltage of the sensor power supply is greater than 8.5 DCV.

Begin performing these procedures only when CID 0269 FMI 03 is showing and the “DIAG” indicator is FLASHING on the upper display. The GSC+P treats a CID 0269 FMI 03 as an alarm fault. Active alarm faults are shown on the upper display when the “Alarm Codes” key is pressed and the Engine Control Switch (ECS) is in any position except the OFF/RESET position. For an inactive diagnostic code, the problem may be intermittent. To troubleshoot an inactive diagnostic code, use the preceding system schematic and Refer to Testing And Adjusting, “Electrical Connector - Inspect”. Clear the diagnostic code from the fault log after the troubleshooting procedure is completed.

CHECK THE GSC+P.

A. Disconnect the harness from the GSC+P.

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 for the CID 0269 FMI 03.

Expected Result:

The CID 0269 FMI 03 should not be showing. The diagnostic code should be inactive.

Results:

- OK – The CID 0269 FMI 03 is not showing. The GSC+P is functioning properly. Therefore, the engine harness has a short to “BATT+”.

  Repair: Repair the engine harness or replace the engine harness.

  STOP.

- NOT OK – The CID 0269 FMI 03 is showing.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

i02887926

GSC CID 0269 - FMI 04

SMCS Code: 4490-035-NS

Conditions Which Generate This Code:

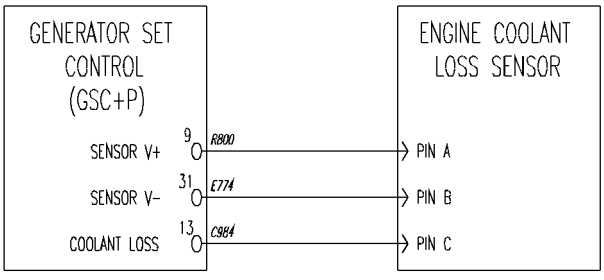


Illustration 66 g01437367

Schematic for engine coolant loss sensor

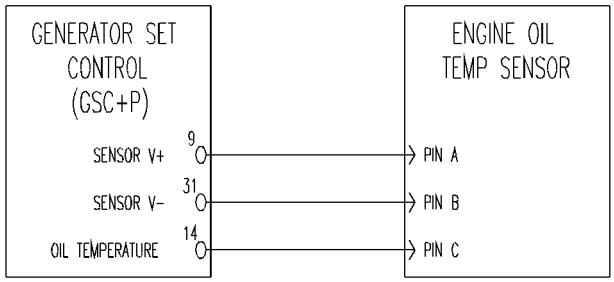


Illustration 67 g01437522

Schematic for engine oil temperature sensor

The EMCP II+P has a sensor supply voltage of 8 DCV from the GSC+P that powers the engine sensors. The sensors may vary according to the engine. Refer to Table 22 in order to determine the sensors on your engine.

Table 22

Sensor	MUI Engines	EUI Engines	PEEC Engines
Coolant Temperature	Yes	No	Yes
Oil Pressure	Yes	No	Yes
Coolant Loss	Yes	Yes	Yes
Oil Temperature	No	Yes	Yes

The engine oil temperature sensor is optional. The engine coolant fluid level sensor is optional.

The sensor power supply functions whenever power is applied to the GSC+P.

The GSC+P is usually programmed in the factory. The GSC+P handles a diagnostic code that is associated with the sensor power supply as an alarm fault. P004 = 0. If the GSC+P is programmed to shutdown, P004 is equal to 1 for a problem with the sensor power supply. It is not necessary to press the “Alarm Codes” key in order to view the CID 0269 FMI 04. The CID 0269 FMI 04 is automatically shown on the upper display.

Diagnostic codes are created when the harness connector is disconnected from the GSC+P during these troubleshooting procedures. Clear these created diagnostic codes after the particular problem is corrected and the particular diagnostic code is cleared.

The possible cause of a CID 0269 FMI 04 occurs when the voltage of the sensor supply is less than 7.5 DCV.

Begin performing these procedures only when CID 0269 FMI 04 is active and the “DIAG” indicator is FLASHING on the upper display. The GSC+P treats a CID 0269 FMI 04 as an alarm fault. Active alarm faults are shown on the upper display when the “Alarm Codes” key is pressed and the Engine Control Switch (ECS) is in any position except the OFF/RESET position. For an inactive diagnostic code, the problem may be intermittent. To troubleshoot an inactive diagnostic code, use the preceding system schematic and refer to Testing And Adjusting, “Electrical Connector - Inspect”. Clear the diagnostic code from the fault log after the troubleshooting procedure is completed.

Test Step 1. CHECK THE GSC+P.

A. Turn the ECS to OFF/RESET.

B. Disconnect the harness from the GSC+P.

C. Turn the ECS to STOP.

D. Press the “Alarm Codes” key.

E. Observe the upper display for the CID 0269 FMI 04. If the diagnostic code is displayed then the problem is active.

Expected Result:

The CID 0269 FMI 04 should NOT be showing on the upper display.

Results:

- OK – The GSC+P is functioning properly. Therefore, the engine harness or a sensor has failed. Proceed to Test Step 2.
- NOT OK – The GSC+P has failed.

  Repair: Replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 2. CHECK THE OIL TEMPERATURE SENSOR

A. Turn the ECS to OFF/RESET.

B. Reconnect the harness connector to the GSC+P.

C. Disconnect the engine harness from the oil temperature sensor.

D. Turn the ECS to STOP.

E. Press the “Alarm Codes” key.

F. Observe the upper display for the CID 0269 FMI 04.

Expected Result:

If the sensor is the cause of the CID 0269 FMI 04, then CID 0269 FMI 04 should NOT be showing when the sensor is disconnected.

Results:

- OK – The CID 0269 FMI 04 is NOT active. The oil temperature sensor has failed.

  Repair: Replace the oil temperature sensor and verify that the new sensor has corrected the problem.

  STOP.

- NOT OK – The CID 0269 FMI 04 is still active. The oil temperature sensor is not the cause of the CID 0269 FMI 04. Proceed to Test Step 3.

Test Step 3. CHECK THE COOLANT LOSS SENSOR

A. Turn the ECS to OFF/RESET.

B. Reconnect the harness connector to the GSC+P.

C. Disconnect the engine harness from the coolant loss sensor.

D. Turn the ECS to STOP.

E. Press the “Alarm Codes” key.

F. Observe the upper display for the CID 0269 FMI 04.

Expected Result:

If the sensor is the cause of the CID 0269 FMI 04, then CID 0269 FMI 04 should NOT be showing when the sensor is disconnected.

Results:

- OK – The CID 0269 FMI 04 is NOT active. The coolant loss sensor has failed.

  Repair: Replace the coolant loss sensor and verify that the new sensor has corrected the problem.

  STOP.

- NOT OK – The CID 0269 FMI 04 is still active. The coolant loss sensor is not the cause of the CID 0269 FMI 04. Therefore, the engine harness has a short to the battery negative terminal “BATT-”.

Repair: Repair the engine harness or replace the engine harness.

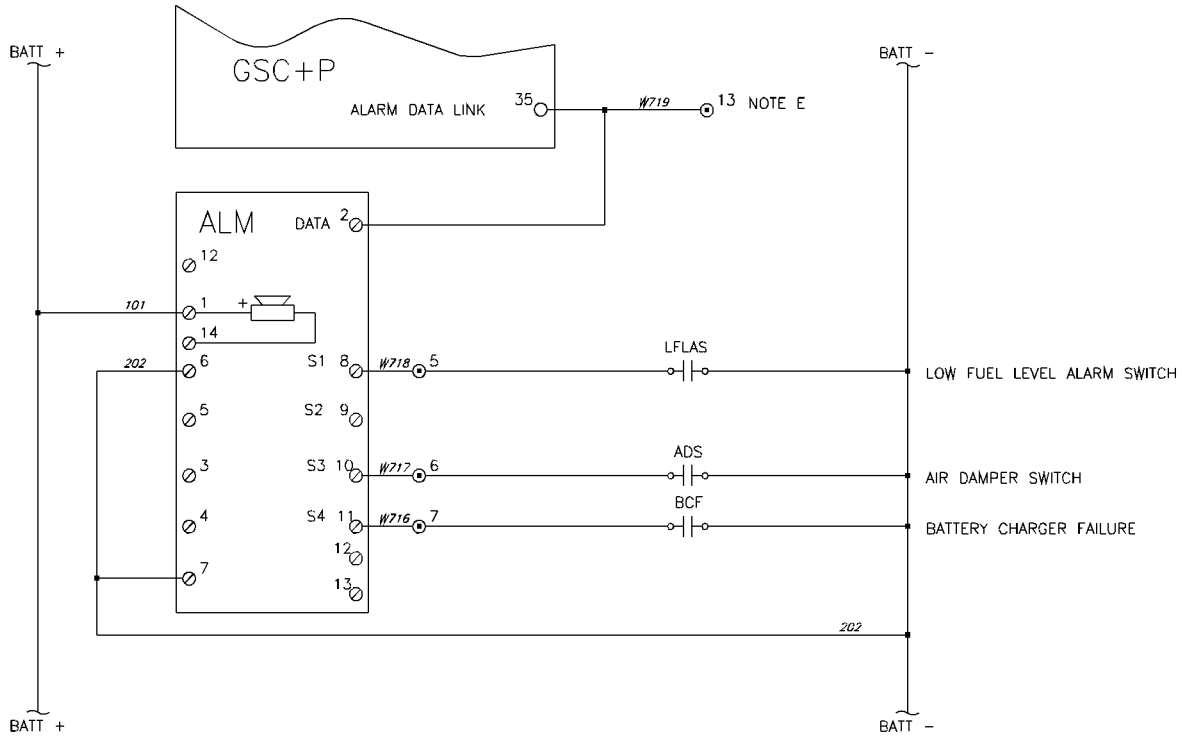
STOP.

i02887983

GSC CID 0333 - FMI 03

SMCS Code: 4490-035

Conditions Which Generate This Code:



g01438113

Illustration 68

System Schematic For Alarm Module (ALM)

The Alarm Module (ALM) is available as an option. The alarm module may be mounted on the front panel. Also, the alarm module may be placed at a distance from the control panel as a remote annunciator. The ALM is used in order to satisfy the requirements of the customer. The alarm module may be used in order to satisfy National Fire Protection Association (NFPA) requirements by annunciating the presence of a diagnostic code.

The ALM communicates with the GSC+P 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 the ALM or the Customer Interface Modules (CIM) that may be connected to the serial data link is equal to three. The maximum distance between a module and the GSC+P is 305 m (1000 ft). If these specifications are not met, the ALM indicators may begin to flash. Also, the GSC+P may show a CID 0333 FMI 03. If the setup is not in compliance with the specifications, reduce the number of modules and/or shorten the distance to the modules.

Note: Diagnostic codes are created when the harness connector is disconnected from the GSC+P during these troubleshooting procedures. Clear these created diagnostic codes after the particular problem is corrected and the diagnostic code is cleared.

One possible cause of a CID 0333 FMI 03 diagnostic code is a short to the positive battery terminal (“BATT+”).

The GSC+P treats a CID 0333 FMI 03 as an alarm fault. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: If a CID 0333 FMI 03 is active on the upper display and no alarm module is installed, then check the terminal strips on the subpanel for a short. Perform the check from the signal wire to the “BATT+”. Also, check the customers’ connection box for a short from the alarm data signal wire to “BATT+”.

Test Step 1. CHECK IF THE DIAGNOSTIC CODE IS ACTIVE

A. Turn the Engine Control Switch (ECS) to the OFF/RESET position and then turn the ECS to the STOP position.

B. Press the “Alarm Codes” key.

C. Observe the upper display for a CID 0333 FMI 03. The diagnostic code is active if the upper display shows a CID 0333 FMI 03.

D. If the diagnostic code is not showing, enter the service mode and view the fault log. Check the upper display if the diagnostic code is active.

Expected Result:

A CID 0333 FMI 03 is active.

Results:

- OK – A CID 0333 FMI 03 is active. Proceed to Test Step 2.
- NOT OK – A CID 0333 FMI 03 has not occurred. The diagnostic code is NOT active. STOP.

Test Step 2. CHECK FOR SHORTED DATA LINK WIRE

A. Disconnect the cable from the negative battery terminal “(BATT-)” or open the optional battery disconnect switch.

B. Disconnect both ends of the data link wire. The following contacts are the ends of the data link wire: pin 35 of the GSC+P and terminal 2 of the alarm module.

C. Measure the resistance between the data link wire and “BATT+” terminal of the GSC+P.

Expected Result:

The resistance should be greater than 5000 ohms.

Results:

- OK – The resistance is correct. Proceed to Test Step 3.
- NOT OK – The resistance is NOT greater than 5000 ohms. The data link wire is faulty.

  Repair: Refer to the system schematic in order to troubleshoot the harness wiring and repair the harness wiring that has failed between the ALM and the GSC+P. Refer to Testing and Adjusting, “Schematics and Wiring Diagrams” for further information.

  STOP.

Test Step 3. CHECK THE ALARM MODULE

A. The cable on the “BATT-” terminal will remain disconnected or the optional battery disconnect switch is open.

B. Measure the resistance from terminal 2 of the alarm module to “BATT+”.

Expected Result:

The resistance should be greater than 5000 ohms.

Results:

- OK – The resistance is greater than 5000 ohms. Proceed to Test Step 4.
- NOT OK – The resistance is NOT greater than 5000 ohms. The alarm module has failed.

  Repair: Replace the alarm module.

  STOP.

Test Step 4. CHECK THE GSC+P.

A. The data link wire remains disconnected.

B. Connect the cable on the “BATT-” terminal of the battery or close the optional battery disconnect switch.

C. Turn the engine control switch to the STOP position.

D. Check for an active CID 0333 FMI 03 diagnostic code on the GSC+P.

Expected Result:

The diagnostic code is NO longer active.

Results:

- YES – The diagnostic code is NOT active. The diagnostic code does not exist at this time.

  Repair: The initial diagnostic code was probably caused by a poor electrical connection or a short at one of the harness connectors that was disconnected and reconnected. Check the wiring for problems and resume normal operation. Watch for a recurrence of the problem.

  STOP.

- NO – The diagnostic code has not been corrected. The GSC+P may have failed.

  Repair: Exit this procedure and perform this procedure again. Also, recheck if the diagnostic code is active. If the cause of the diagnostic code is not found, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace” for more information.

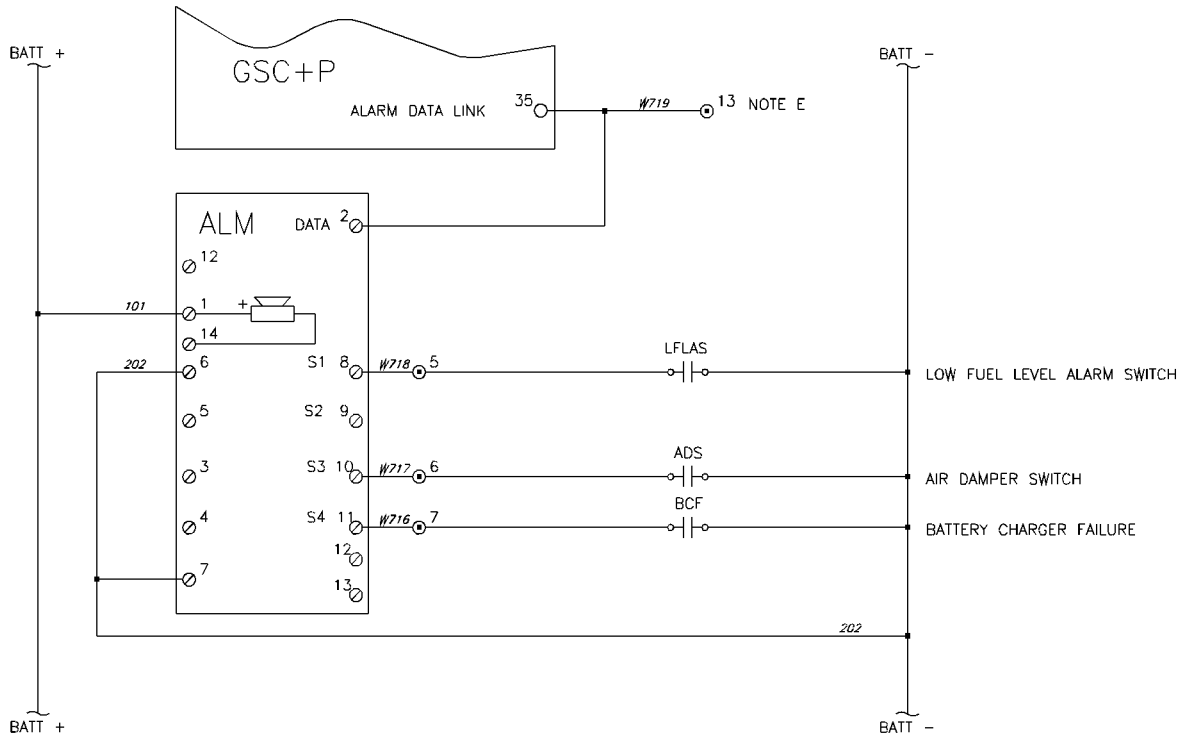
  STOP.

i02888018

GSC CID 0333 - FMI 04

SMCS Code: 4490-035

Conditions Which Generate This Code:



g01438113

Illustration 69

System Schematic For Alarm Module (ALM)

The Alarm Module (ALM) is available as an option. The ALM may be mounted on the front panel. Also, the ALM may be placed at a distance from the control panel as a remote annunciator. The ALM is used in order to satisfy the requirements of the customer. The ALM may be used in order to satisfy National Fire Protection Association (NFPA) requirements by annunciating the presence of a diagnostic code.

The ALM communicates with the GSC+P 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 the ALM or the Customer Interface Module (CIM) that may be connected to the serial data link is equal to three. The maximum distance between a module and the GSC+P is 305 m (1000 ft). If these specifications are not met, the ALM indicators may begin to flash. Also, the GSC+P may show a CID 0333 FMI 04. If the setup is not in compliance with the specifications, reduce the number of modules and/or shorten the distance to the modules.

Note: Diagnostic codes are created when the harness connector is disconnected from the GSC+P during these troubleshooting procedures. Clear these created diagnostic codes after the particular problem is corrected and the particular diagnostic code is cleared.

The possible cause of a CID 0333 FMI 04 is a short from the negative battery terminal “(BATT-)” to the data signal.

The GSC+P treats a CID 0333 FMI 04 as an alarm fault. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: If a CID 0333 FMI 04 is active on the upper display and no alarm module is installed, then check the terminal strips on the subpanel for a short. Perform the check from the signal wire to “BATT-”. Also, check the customers’ connection box for a short from the alarm data signal wire to “BATT-”.

Test Step 1. CHECK IF THE DIAGNOSTIC CODE IS ACTIVE

A. Turn the Engine Control Switch (ECS) to the OFF/RESET position and then turn the ECS to the STOP position.

B. Press the “Alarm Codes” key.

C. Observe the upper display for a CID 0333 FMI 04. The diagnostic code is active if the upper display shows a CID 0333 FMI 04.

D. If the diagnostic code is not showing, enter the service mode and view the fault log. Check the upper display if the diagnostic code is active.

Expected Result:

A CID 0333 FMI 04 is active.

Results:

- OK – A CID 0333 FMI 04 is active. Proceed to Test Step 2.
- NOT OK – A CID 0333 FMI 04 has not occurred. The diagnostic code is NOT active. STOP.

Test Step 2. CHECK THE GSC+P.

A. Disconnect the cable on the “BATT-” terminal of the battery or open the optional battery disconnect switch.

B. Disconnect the data link wire from pin 35 of the GSC+P.

C. Reconnect the cable on the “BATT-” terminal of the battery or close the optional battery disconnect switch.

D. Turn the ECS to the STOP position.

Expected Result:

The CID 0333 FMI 04 is inactive.

Results:

- OK – The CID 0333 FMI 04 is inactive. Proceed to Test Step 3.
- NOT OK – The CID 0333 FMI 04 remains active. The GSC+P may have failed.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this procedure again. Replace the GSC+P if the CID 0333 FMI 04 remains active. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”

  STOP.

Test Step 3. CHECK THE ALM AND DATA LINK WIRE

A. The data link wire remains disconnected from the GSC+P.

B. Disconnect the cable on the “BATT-” terminal of the battery or open the optional battery disconnect switch.

C. Disconnect the data link wire from terminal 2 of the Alarm module.

D. Measure the resistance from the data link wire to the negative battery terminal on the GSC+P.

Expected Result:

The resistance should be greater than 5000 ohms.

Results:

- OK – The resistance is greater than 5000 ohms. Proceed to Test Step 4.
- NOT OK – The resistance is NOT greater than 5000 ohms. The data link wiring is faulty.

  Repair: Use the system schematic in order to troubleshoot and repair the harness wiring that has failed between the ALM and the GSC+P. Refer toTesting And Adjusting, “Schematics and Wiring Diagrams”.

  STOP.

Test Step 4. CHECK THE ALARM MODULE.

A. The cable on the “BATT-” battery terminal remains disconnected or the optional battery disconnect switch is open.

B. The data link wire remains disconnected.

C. Measure the resistance from terminal 2 of the ALM to “BATT-”.

Expected Result:

The resistance should be greater than 5000 ohms.

Results:

- OK – The resistance is greater than 5000 ohms. The problem may be intermittent.

  Repair: Use the System Schematic and examine the wiring between the GSC+P and the ALM for nicks, abrasion, or other damage. Refer to Testing And Adjusting, “Schematics and Wiring Diagrams”.

  STOP.

- NOT OK – The resistance is NOT greater than 5000 ohms. The ALM has failed.

  Repair: Replace the ALM.

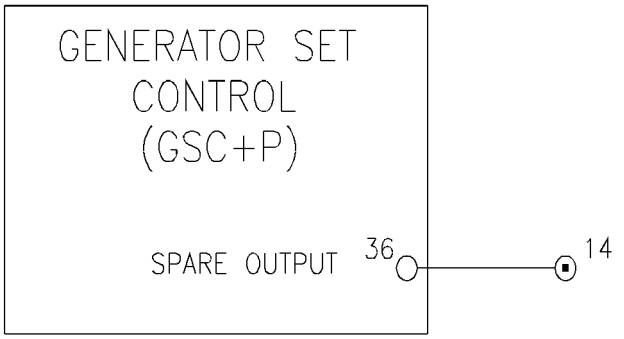
  STOP.

i02888202

GSC CID 0334 - FMI 03

SMCS Code: 4490-035

Conditions Which Generate This Code:



g01437849

Illustration 70

System schematic for the spare output

The spare output on the GSC+P is strictly for the use of customers. The spare output is programmable in order to activate under a variety of conditions. The default parameter programming causes the GSC+P to activate the output when the engine is in cooldown mode. The GSC+P treats a CID 0334 FMI 03 as an alarm fault. For more information, refer to Systems Operation, “Spare Input/Output Programming OP6”. The customer and/or the dealer are responsible for documenting and troubleshooting any connections to this output.

The voltage on the spare output is approximately 5.0 DCV when there are no connections and when the spare output is not active. 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.

The possible cause of a CID 0334 FMI 03 is a short from the positive terminal of the battery (“BATT+”) to the spare output signal.

Troubleshooting of a spare output fault is direct. The FMI defines the fault. FMI 03 occurs when the spare output is shorted to “BATT+”. In order to find the exact cause of the fault, use the following information.

- FMI information
- system schematic of spare output
- documentation of the customer
- documentation of the dealer

Test Step 1. CHECK THE GENERATOR SET CONTROL

A. Verify that the CID 0334 FMI 03 diagnostic code is active.

B. Disconnect the wire from pin 36 of the GSC+P.

C. Measure the voltage between pin 36 of the GSC+P and frame ground.

Expected Result:

The voltage is approximately 5 ± 1.0 DCV.

Results:

- OK – The voltage is approximately 5 ± 1.0 DCV. The voltage is correct. Proceed to test step 2.
- NOT OK – The voltage is NOT approximately 5 ± 1.0 DCV. The voltage is NOT correct. The GSC+P has failed.

  Repair: It is unlikely that the GSC+P has failed. Exit this diagnostic code procedure and repeat the CID 0334 FMI 03 diagnostic code procedure again. If the cause of the failure is still unknown, then replace the GSC+P.

  STOP.

Test Step 2. CHECK FOR A SHORT TO “BATT+” IN THE WIRING OF THE SPARE OUTPUT

A. Disconnect the negative battery terminal “(BATT-)”.

B. Disconnect the wire from pin 36 of the GSC+P.

C. Disconnect the other end of the wire at the customer device.

D. Measure the resistance from the wire that was disconnected from pin 36 of the GSC+P to “BATT+” of the GSC+P.

Expected Result:

The resistance is greater than 5000 ohms.

Results:

- OK – The resistance is greater than 5000 ohms. The circuit is correct. 3

- NOT OK – The resistance is less than 5000 ohms. The circuit is not correct. The spare output is shorted to “BATT+”.

  Repair: Repair the wiring of the spare output relay.

  STOP.

Test Step 3. RECONNECT TO CUSTOMERS’ DEVICE

A. Reconnect the wire to the customers’ device.

B. Reconnect the wire that was disconnected from pin 36 to the GSC+P.

C. Turn the Engine Control Switch (ECS) to STOP and check if the diagnostic code is still active.

Expected Result:

The diagnostic code is not active.

Results:

- OK – The diagnostic code is not active. It is likely that the problem was in the wiring harness or the problem is intermittent.

  Repair: Check the wiring between the GSC+P and the customer device for problems. Repair the wiring or replace the wiring if a problem is found. Watch for a recurrence of the diagnostic code.

  STOP.

- NOT OK – The diagnostic code is still active. There may be a problem with the customer device.

  Repair: Ensure that the customer device does not draw more than 100 mA. Also, the customer device may have failed. Refer to the customers’ documentation and the dealers’ documentation for the device.

  STOP.

i02888284

GSC CID 0334 - FMI 04

SMCS Code: 4490-035

Conditions Which Generate This Code:

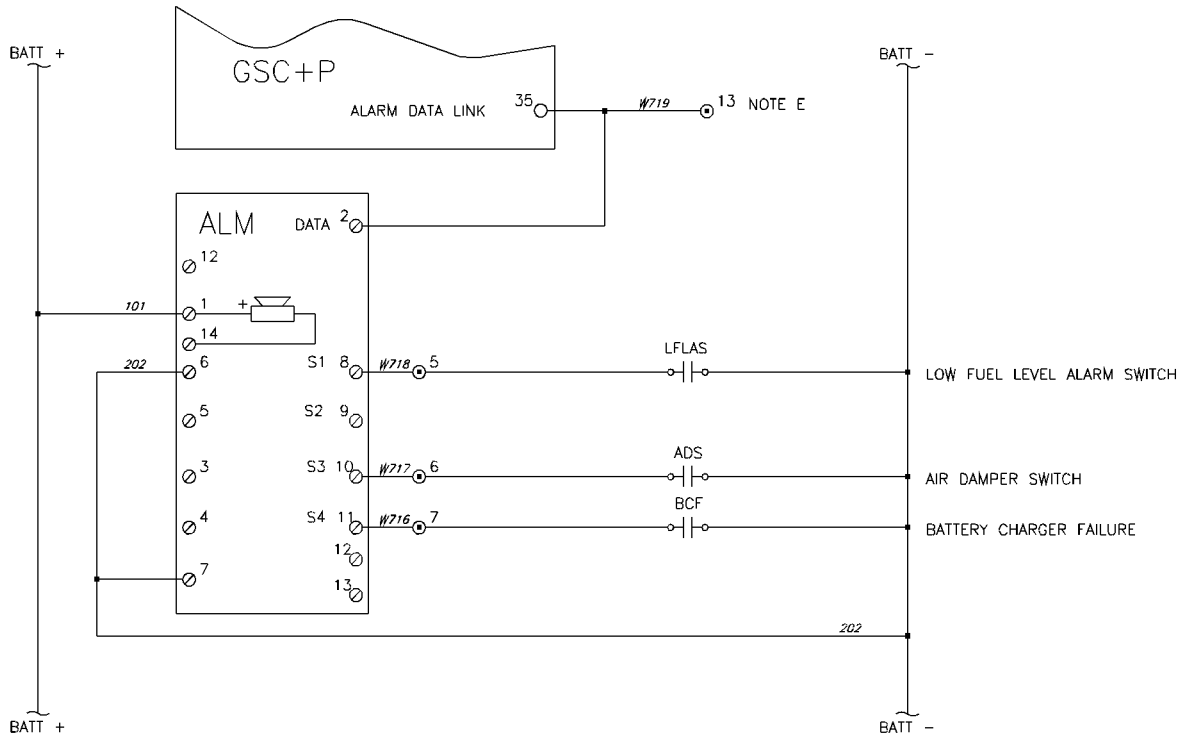


Illustration 71 g01438113

System schematic for the spare output

The spare output on the GSC+P is strictly for the use of customers. The spare output is programmable in order to activate under a variety of conditions. The default parameter programming causes the GSC+P to activate the output when the engine is in cooldown mode. The GSC+P treats a CID 0334 FMI 04 as an alarm fault. For more information, refer to Systems Operation, “Spare Input/Output Programming OP6”. The customer and/or the dealer are responsible for documenting and troubleshooting any connections to this output.

The voltage on the spare output is approximately 5.0 DCV when there are no connections and when the spare output is not active. 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.

The possible cause of a CID 0334 FMI 04 is a short from the negative battery terminal (“ BATT-”) to the spare output signal.

Troubleshooting of a spare output fault is direct. The FMI defines the fault. FMI 04 occurs when the spare output is shorted to “BATT-”. In order to find the exact cause of the fault, use the following information.

- FMI information
- system schematic of spare output
- documentation of the customer
- documentation of the dealer

Test Step 1. CHECK THE GENERATOR SET CONTROL

A. Verify that the CID 0334 FMI 04 diagnostic code is active.

B. Disconnect the wire from pin 36 of the GSC+P.

C. Measure the voltage between pin 36 of the GSC+P and frame ground.

Expected Result:

The voltage is approximately 5 ± 1.0 DCV.

Results:

- OK – The voltage is approximately 5 ± 1.0 DCV. The voltage is correct. Proceed to Test Step 2.
- NOT OK – The voltage is NOT approximately 5 ± 1.0 DCV. The voltage is NOT correct. The GSC+P has failed.

  Repair: It is unlikely that the GSC+P has failed. Exit this diagnostic code procedure and repeat the CID 0334 FMI 04 diagnostic code procedure again. If the cause of the failure is still unknown, then replace the GSC+P.

  STOP.

Test Step 2. CHECK FOR A SHORT TO "BATT-" IN THE WIRING OF THE SPARE OUTPUT

A. Disconnect the "BATT-" terminal from the battery.

B. Disconnect the wire from pin 36 of the GSC+P.

C. Disconnect the other end of the wire at the customers' device.

D. Measure the resistance between the wire that was disconnected from pin 36 of the GSC+P and the "BATT-" contact of the GSC+P.

Expected Result:

The resistance is greater than 5000 ohms.

Results:

- OK – The resistance is greater than 5000 ohms. The circuit is correct. Proceed to Test Step 3.
- NOT OK – The resistance is less than 5000 ohms. The circuit is not correct. The spare output is shorted to "BATT- ".

  Repair: Repair the wiring of the spare output.

  STOP.

Test Step 3. RECONNECT TO CUSTOMERS' DEVICE

A. Reconnect the wire to the customers' device.

B. Reconnect the wire that was disconnected from contact 36 to the GSC+P.

C. Turn the ECS to STOP and check if the diagnostic code is still active.

Expected Result:

The diagnostic code is not active.

Results:

- OK – The diagnostic code is not active. It is likely that the problem was in the wiring harness or the problem is intermittent.

  Repair: Check the wiring between the GSC+P and the customer device for problems. Repair the wiring or replace the wiring if a problem is found. Watch for a recurrence of the diagnostic code.

  STOP.

- NOT OK – The diagnostic code is still active. There may be a problem with the customer device.

  Repair: The customer device may have failed. Refer to the customers' documentation and the dealers' documentation for the device.

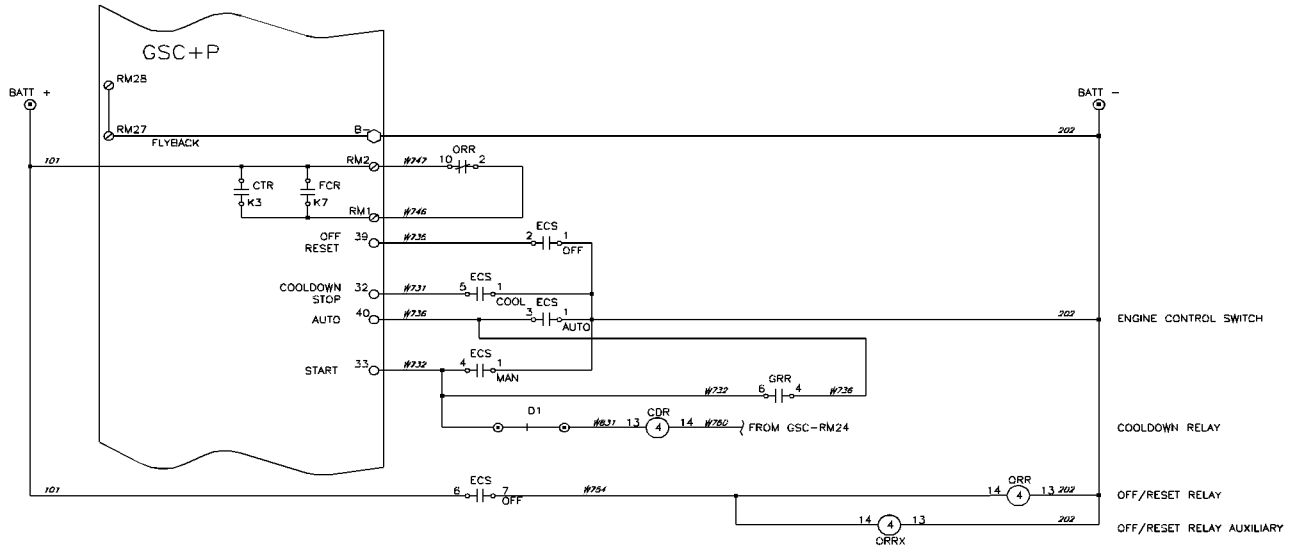
  STOP.

i02888312

GSC CID 0336 - FMI 02

SMCS Code: 7332-035

Conditions Which Generate This Code:



►

Illustration 72 g01437916

Simplified schematic for The 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+P. The selected position of the ECS connects the corresponding input of the GSC+P to the negative battery terminal “BATT-”. At any time, only one of these four positions (inputs) is connected to the “BATT-”.

Each position of the ECS places the engine in a different mode. The four positions and the corresponding modes are described in the following paragraphs.

“OFF/RESET” – The engine is shut down and the GSC+P is reset. The upper display and fault indicators on the left side are temporarily cleared.

“AUTO” – The engine starts and the engine runs when the remote start/stop initiate contact closes the start input that is located on the GSC+P. The GSC+P closes the remote start/stop initiate contact to “BATT-”. Also, the engine starts and the engine runs when the Customer Communication Module (CCM) sends a remote start command. At this time, the GSC+P starts the engine. The engine runs normally until the remote start/stop initiate contact opens. Also, the engine runs normally until the CCM sends a remote stop command. The engine enters a cooldown period. After the cooldown period, the engine is shut down. The GSC+P shows diagnostic codes on the upper display and on the fault indicators as the diagnostic code occurs. The GSC+P is ON with the ECS in this position.

“MAN/START” – The engine starts and the engine runs until the operator turns the ECS to the OFF/RESET position or the COOLDOWN/STOP position. The engine starts and the engine runs until the GSC+P detects a shutdown fault. The GSC+P shows diagnostic codes on the upper display and on the fault indicators as the diagnostic code occurs. The GSC+P is ON with the ECS in this position.

"COOLDOWN/STOP" – The engine maintains rated speed for the cooldown period. The cooldown period is programmable from 0 to 30 minutes. After the cooldown period elapses, the engine is shut down. The GSC+P shows diagnostic codes on the upper display and on the fault indicators as the diagnostic code occurs. The GSC+P is ON with the ECS in this position.

Note: The remote start/stop contact is connected to the GSC+P start input via a terminal strip. Before troubleshooting, disconnect the remote start/stop initiate contacts from the terminal strip.

Note: Diagnostic codes are created when the harness connector is disconnected from the GSC+P during these troubleshooting procedures. Clear these created diagnostic codes after the particular problem is corrected and the particular diagnostic code is cleared.

The possible causes of a CID 0336 FMI 02 are listed below.

- None of the GSC+P inputs from the ECS are connected to ground.
- More than one of the GSC+P inputs from the ECS is connected to "BATT-"at the same time. The one exception is the start input. The start input of the GSC+P is also connected to the remote start/stop initiate contact. The contact is controlled by the customer. The GSC+P will then accept a connection from the battery negative at the start input. Other inputs from the ECS are also received.

The CID 0336 FMI 02 is the only ECS diagnostic code that is detected by the GSC+P. Clear the diagnostic code from the fault log after troubleshooting is complete. The GSC+P treats a CID 0336 FMI 02 as a shutdown fault. Use these procedures for an active diagnostic code or an inactive diagnostic code.

Test Step 1. CHECK FOR AN OPEN CIRCUIT IN THE "OFF/RESET" POSITION

A. If equipped, disconnect the remote start/stop initiate contacts from the terminal strip in the customers' connection box.

B. Disconnect the harness connector from the GSC+P.

C. Check whether the corresponding contact of the GSC+P harness connector is the only contact that is connected to "BATT-".

D. At the GSC+P harness connector, measure the resistance from pin "39" to "BATT-" of the relay module. Measure the resistance from pins "32", "33" and "40" to the "BATT-" terminal. Make a note of the resistances that are measured.

Expected Result:

The resistance that is measured from pin "39" to the "BATT-" terminal of the relay module should be 5 ohms or less. The resistance that is measured from pins "32", "33" and "40" to the "BATT-" terminal should be greater than 5000 ohms.

Results:

- OK – All resistance measurements are correct. Proceed to Test Step 2.
- NOT OK – The resistance measurements are NOT correct. The harness wiring with the incorrect resistance measurement is open or the harness wiring has failed.

  Repair: Repair the harness wiring or replace the harness wiring. Repair the wiring or replace the wiring between "BATT-", the ECS, and the GSC+P connector. Reconnect the remote start/stop initiate contacts after troubleshooting is complete.

  STOP.

Test Step 2. CHECK FOR AN OPEN CIRCUIT IN THE "AUTO" POSITION

A. If equipped, the remote start/stop initiate contacts will remain disconnected from the terminal strip in the customers' connection box.

B. The harness connector remains disconnected from the GSC+P.

C. Check whether the corresponding contact of the GSC+P harness connector is the only contact that is connected to "BATT-".

D. Place the ECS in the AUTO position. Measure the resistance from pin "40" of the GSC+P harness connector to the "BATT-" terminal of the relay module. Measure the resistance from pins "32", "33" and "39" to the "BATT-" terminal. Make a note of the resistances that are measured.

Expected Result:

The resistance that is measured from pin "40" to the "B−" terminal of the relay module should be 5 ohms or less. The resistance that is measured from pins "32", "33" and "39" to the "B−" terminal should be greater than 5000 ohms.

Results:

- OK – The resistance measurements are correct. Proceed to Test Step 3.
- NOT OK – The resistance measurements are NOT correct. The harness wiring with the incorrect resistance measurement is open or the harness wiring has failed.

  Repair: Repair the harness wiring or replace the harness wiring. Repair the wiring or replace the wiring between the “BATT-”, the ECS, and the GSC+P connector. Reconnect the remote start/stop initiate contacts after the troubleshooting is completed.

  STOP.

Test Step 3. CHECK FOR AN OPEN CIRCUIT IN THE “MAN/START” POSITION

A. If equipped, the remote start/stop initiate contacts will remain disconnected from the terminal strip in the customers’ connection box.

B. The harness connector remains disconnected from the GSC+P.

C. Check whether the corresponding contact of the GSC+P harness connector is the only contact that is connected to the battery negative.

D. Place the ECS in the MAN/START position. Measure the resistance from pin “33” of the GSC+P harness connector to the “BATT-” terminal of the relay module. Measure the resistance from pins “32”, “39” and “40” to the “BATT-” terminal. Make a note of the resistances that are measured.

Expected Result:

The resistance that is measured from pin “33” to the “B−” terminal of the relay module should be 5 ohms or less. The resistance that is measured from pins “32”, “39” and “40” to the “B−” terminal should be greater than 5000 ohms.

Results:

- OK – The resistance measurements are correct. Proceed to Test Step 4.
- NOT OK – The resistance measurements are NOT correct. The harness wiring with the incorrect resistance measurement is open or the harness wiring has failed.

  Repair: Repair the harness wiring or replace the harness wiring. Repair the wiring or replace the wiring between the “BATT-”, the ECS, and the GSC+P connector. Reconnect the remote start/stop initiate contacts after the troubleshooting is completed.

  STOP.

Test Step 4. CHECK FOR AN OPEN CIRCUIT IN THE “COOLDOWN/STOP” POSITION

A. If equipped, the remote start/stop initiate contacts will remain disconnected from the terminal strip in the customers’ connection box.

B. The harness connector remains disconnected from the GSC+P.

C. Check whether the corresponding contact of the GSC+P harness connector is the only contact that is connected to the “BATT-”.

D. Place the ECS in the COOLDOWN/STOP position. Measure the resistance from pin “32” of the GSC+P harness connector to the “BATT-” terminal of the relay module. Measure the resistance from pins “33”, “39” and “40” to the “BATT-” terminal. Make a note of the resistances that are measured.

Expected Result:

The resistance that is measured from pin “32” to the “BATT-” terminal of the relay module should be 5 ohms or less. The resistance that is measured from pins “33”, “39” and “40” to the “BATT-” terminal should be greater than 5000 ohms.

Results:

- OK – The resistance measurements are correct. STOP.
- NOT OK – The resistance measurements are NOT correct. The harness wiring with the incorrect resistance measurement is open or the harness wiring has failed.

  Repair: Repair the harness wiring or replace the harness wiring. Repair the wiring or replace the wiring between the “BATT-”, the ECS, and the GSC+P connector. Reconnect the remote start/stop initiate contacts after the troubleshooting is completed.

  STOP.

Test Step 5. CHECK IF THE DIAGNOSTIC CODE IS STILL ACTIVE

A. Clean the contacts of the harness connectors. Refer to Testing and Adjusting, “Electrical Connector - Inspect”.

B. Reconnect all of the harness connectors.

C. Clear all diagnostic codes from the fault log.

D. Operate the engine.

E. Determine if the diagnostic code is active.

Expected Result:

The diagnostic code is NOT active.

Results:

- OK – The diagnostic code is NOT active. The problem does not exist at this time. The initial problem was probably caused by a poor electrical connection or a short at one of the harness connectors that was disconnected and reconnected. Resume normal operation and watch for a recurrence. STOP.
- NOT OK – The diagnostic code is active.

  Repair: The problem has not been corrected. It is unlikely that the ECS has failed. Exit this procedure and perform this procedure again. If the cause of the diagnostic code is not found, replace the ECS.

  STOP.

i02890206

GSC CID 0441 - FMI 12

SMCS Code: 4490-035-R7

Conditions Which Generate This Code:

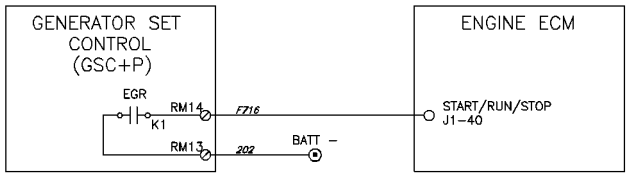


Illustration 73 g01439320

System Schematic For Electronic Governor Relay (EGR)

The GSC+P uses the Electronic Governor Relay (EGR) to signal the Engine Control Module (ECM) to begin injection. The GSC+P activates the EGR when the engine oil pressure is greater than the setpoint for low oil pressure shutdown at idle speed (“P014”). Also, “K1” will be present on the lower display. This closes the relay contacts of the EGR. The output for the EGR is rated at 1 amp. The EGR is located within the relay module.

Note: Whenever the GSC+P activates or the GSC+P attempts to activate the EGR, “K1” is shown on the lower display. When the EGR is not activated, “K1” is not shown.

The possible causes of this diagnostic code are listed:

- The EGR has an open coil or a shorted coil.

The results to this diagnostic code are listed:

- If CID 0441 FMI 12 occurs during the activation of the EGR, the ECM will stop the fuel injection and the engine will shut down immediately.
- If CID 0441 FMI 12 occurs and the EGR is not activated, the engine will be unable to start.

Note: Clear the diagnostic code from the fault log after troubleshooting is complete. The GSC+P treats a CID 0441 FMI 12 as an alarm fault. Press the “Alarm Codes” key in order to display active alarm faults. The active alarm faults will be displayed when the Engine Control Switch (ECS) is placed in any position except the OFF/RESETposition.

This troubleshooting procedure is for an active CID 0441 FMI 12 code. Also, this procedure is for an inactive CID 0441 FMI 12 code.

Test Step 1. CHECK THE STATUS OF THE DIAGNOSTIC CODE.

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

B. Press the “Alarm Codes” key.

C. Observe the upper display. Check that the CID 0441 FMI 12 is active.

D. If the diagnostic code is not active, enter the Service Mode. View the fault log for a OP1. Check that the diagnostic code is inactive.

Expected Result:

A CID 0441 FMI 12 is displayed as an active diagnostic code or CID 0441 FMI 12 is displayed as an inactive diagnostic code.

Results:

- OK – The CID 0441 FMI 12 is active or the CID 0441 FMI 12 is inactive. Proceed to Test Step 2.
- NOT OK – The CID 0441 FMI 12 has not occurred. The diagnostic code is not active and the diagnostic code is not inactive. STOP.

Test Step 2. CHECK THE INTERNAL CABLE OF THE RELAY MODULE.

Note: Only open the relay module in a dry environment. If the inspection and repair takes more than approximately twenty minutes replace the desiccant bag in the GSC+P housing. Refer toTesting And Adjusting, “Relay Module - Replace”.

A. Turn the ECS to the OFF/RESET position.

B. Disconnect the negative battery cable.

C. Temporarily, remove the relay module from the GSC+P. Refer toTesting And Adjusting, “Relay Module - Replace”.

D. Check the cable that attaches the relay module to the GSC+P.

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 – The cable is firmly seated in the connector. The clamp is in place. The cable is not damaged. Reassemble the relay module to the GSC+P. Proceed to Test Step 3.
- NOT OK – One or more of the components are damaged or the components are missing.

  Repair: Replace the clamp if the clamp is missing. If the cable is damaged, replace the GSC+P. Refer toTesting and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 3. PERFORM A FUNCTIONAL CHECK ON THE EGR.

A. Turn the ECS to the OFF/RESET position.

B. Reconnect the negative battery cable.

C. Disconnect all wires from RM-13 and RM-14 of the relay module.

D. At the relay module, measure the resistance from RM-13 to RM-14. Make a note of the resistance measurement.

E. Start the engine and run the engine. Make sure that the engine oil pressure is greater than the setpoint for low oil pressure shutdown at idle speed (P014).

F. At the relay module, measure the resistance from RM-13 to RM-14. Make a note of the resistance measurement.

Expected Result:

The initial resistance measurement after removing the wires from the relay module should be 5000 ohms. The resistance measurement should be 5 ohms after exceeding the setpoint for low oil pressure shutdown at idle speed.

Results:

- OK – The resistance measurements are correct. The problem does not exist at this time. The initial problem was probably caused by a poor electrical connection or a short at one of the harness connectors that was disconnected and reconnected. Resume normal operation and watch for a recurrence. STOP.
- NOT OK – Either one of the resistance measurements are NOT correct. The relay module has failed.

Repair: Replace the relay module. Refer toTesting And Adjusting, “Relay Module - Replace”.

STOP.

i02888433

GSC CID 0442 - FMI 12

SMCS Code: 4490-035-R7

Conditions Which Generate This Code:

The GSC+P uses the Generator Fault Relay (GFR) in order to activate the circuit breaker for the shunt trip coil during a shutdown fault. The GFR is located within the relay module. The circuit breaker is located in the generator housing.

Note: Whenever the GSC+P activates or the GSC+P attempts to activate the GFR, “K2” is shown on the lower display. When the GFR is not activated, “K2” is not shown.

The possible cause of a CID 0442 FMI 12 is an open coil or a shorted coil of the GFR.

The system response to this diagnostic code is listed below.

- When a CID 0442 FMI 12 occurs and the GFR is activated, the diagnostic code will not have an effect on the system. The system is not affected because the circuit breaker is already open and shutdown mode is functioning. The generator is already off-line.
- If a CID 0442 FMI 12 occurs and the GFR is not activated, the GFR cannot activate the shunt trip coil of the circuit breaker when a shutdown fault occurs.

The GSC+P treats a CID 0442 FMI 12 as an alarm fault. Active alarm faults are shown on the display when the “Alarm Codes” key is pressed. The ECS must be in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

This troubleshooting procedure is for an active CID 0442 FMI 12 or the troubleshooting procedure is for an inactive CID 0442 FMI 12.

Test Step 1. CHECK THE STATUS OF THE DIAGNOSTIC CODE.

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

B. Press the “Alarm Codes” key.

C. Observe the upper display. Check that the CID 0442 FMI 12 is active.

D. If the diagnostic code is not active, enter the Service Mode. View the fault log for a OP1. Check that the diagnostic code is inactive.

Expected Result:

A CID 0442 FMI 12 is displayed as an active diagnostic code or CID 0442 FMI 12 is displayed as an inactive diagnostic code.

Results:

- OK – The CID 0442 FMI 12 is active or the CID 0442 FMI 12 is inactive. Proceed to Test Step 2.
- NOT OK – The CID 0442 FMI 12 has not occurred. The diagnostic code is not active and the diagnostic code is not inactive. STOP.

Test Step 2. CHECK THE INTERNAL CABLE OF THE RELAY MODULE.

Note: Only open the relay module in a dry environment. If the inspection and repair takes more than approximately twenty minutes replace the desiccant bag in the GSC+P housing. Refer to Testing And Adjusting, “Relay Module - Replace”.

A. Turn the ECS to the OFF/RESET position.

B. Disconnect the negative battery cable.

C. Temporarily, remove the relay module from the GSC+P. Refer to Testing And Adjusting, “Relay Module - Replace”.

D. Check the cable that attaches the relay module to the GSC+P.

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 – The cable is firmly seated in the connector. The clamp is in place. The cable is not damaged. Reassemble the relay module to the GSC+P. Proceed to Test Step 3.
- NOT OK – One or more of the components are damaged or the components are missing.

Repair: Replace the clamp if the clamp is missing. If the cable is damaged, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

STOP.

Test Step 3. PERFORM A FUNCTIONAL CHECK ON THE GFR.

A. Turn the ECS to the OFF/RESET position.

B. Reconnect the negative battery cable.

C. Disconnect all wires from RM-22 of the relay module.

D. Remove fuse “F5” from the relay module.

E. At the relay module, measure the resistance from RM-22 to RM-7. Make a note of the resistance measurement.

F. Turn the ECS to the STOP position and push in the emergency stop push button.

G. At the relay module, measure the resistance from RM-22 to RM-7. Make a note of the resistance measurement.

Expected Result:

The initial resistance measurement after removing the wires from the relay module should be 5000 ohms. The resistance measurement should be less than 5 ohms when the ECS is placed in the STOP position.

Results:

- OK – The resistance measurements are correct. The problem does not exist at this time. The initial problem was probably caused by a poor electrical connection or a short at one of the harness connectors that was disconnected and reconnected. Resume normal operation and watch for a recurrence. STOP.
- NOT OK – Either one of the resistance measurements are NOT correct. The relay module has failed.

  Repair: Replace the relay module. refer to Testing And Adjusting, “Relay Module - Replace”.

  STOP.

i02888449

GSC CID 0443 - FMI 12

SMCS Code: 4490-035-R7

Conditions Which Generate This Code:

The GSC+P uses the Crank Terminate Relay (CTR) as part of the logic to activate the Voltage Build up Relay (VBR). The CTR is located within the relay module. The governor control switch is located on the front panel.

The CTR is used to indicate when the engine is finished cranking. The GSC+P activates the CTR when engine speed is greater than the crank terminate setpoint. (Setpoint P011 should be 400 RPM.) Also, the starting motor relay has been deactivated. The CTR deactivates when the engine RPM reaches 0.

Note: Whenever the GSC+P activates the CTR, “K3” is shown on the lower display. When the CTR is not activated, “K3” is not shown.

The possible cause of a CID 0443 FMI 12 is an open coil or a shorted coil of the CTR.

The system responses to this diagnostic code are listed below.

- If a CID 0443 FMI 12 occurs and the CTR is activated, the engine will continue to run, but the Generator Running Relay (GRR) and the governor control switch are deactivated. On PEEC engines, the AUX is deactivated.
- If a CID 0443 FMI 12 occurs and the CTR is not activated, then the engine is able to start and the engine is able to run. The GRR is not activated and the Governor control switch is not activated. On PEEC engines, the AUX is not activated.

The GSC+P treats a CID 0443 FMI 12 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 Engine Control Switch (ECS) is in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

This troubleshooting procedure is used to correct an active CID 0443 FMI 12 or the troubleshooting procedure is for an inactive CID 0443 FMI 12.

Test Step 1. CHECK THE STATUS OF THE DIAGNOSTIC CODE.

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

B. Press the “Alarm Codes” key.

C. Observe the upper display. Check that the CID 0443 FMI 12 is active.

D. If the diagnostic code is not active, enter the Service Mode. View the fault log for a OP1. Check that the diagnostic code is inactive.

Expected Result:

A CID 0443 FMI 12 is displayed as an active diagnostic code or CID 0443 FMI 12 is displayed as an inactive diagnostic code.

Results:

- OK – The CID 0443 FMI 12 is active or the CID 0443 FMI 12 is inactive. Proceed to Test Step 2.
- NOT OK – The CID 0443 FMI 12 has not occurred. The diagnostic code is not active and the diagnostic code is not inactive. STOP.

Test Step 2. CHECK THE INTERNAL CABLE OF THE RELAY MODULE.

Note: Only open the relay module in a dry environment. If the inspection and repair takes more than approximately twenty minutes replace the desiccant bag in the GSC+P housing. Refer to Testing And Adjusting, “Relay Module - Replace”.

A. Turn the ECS to the OFF/RESET position.

B. Disconnect the battery negative cable.

C. Temporarily, remove the relay module from the GSC+P. Refer to Testing And Adjusting, “Relay Module - Replace”.

D. Check the cable that attaches the relay module to the GSC+P.

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 – The cable is firmly seated in the connector. The clamp is in place. The cable is not damaged. Reassemble the relay module to the GSC+P. Proceed to Test Step 3.
- NOT OK – One or more of the components are damaged or the components are missing.

  Repair: Replace the clamp if the clamp is missing. If the cable is damaged, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 3. PERFORM A FUNCTIONAL CHECK ON THE CTR.

A. Turn the ECS to the OFF/RESET position.

B. Reconnect the battery negative cable.

C. Disconnect all wires from RM-16 of the relay module.

D. Remove fuse “F1” from the relay module.

E. At the relay module, measure the resistance from RM-16 to RM-3. Make a note of the resistance measurement.

F. Start and run the engine. Make sure that the engine speed is greater than crank terminate setpoint (P011).

G. At the relay module, measure the resistance from RM-22 to RM-7. Make a note of the resistance measurement.

Expected Result:

The initial resistance measurement after removing the wires from the relay module should be greater than 5000 ohms. The resistance measurement should be less than 5 ohms after exceeding the crank terminate setpoint.

Results:

- OK – The resistance measurements are correct. The problem does not exist at this time. The initial problem was probably caused by a poor electrical connection or a short at one of the harness connectors that was disconnected and reconnected. Resume normal operation and watch for a recurrence. STOP.
- NOT OK – Either one of the resistance measurements are NOT correct. The relay module has failed.

  Repair: Replace the relay module. Refer to Testing And Adjusting, “Relay Module - Replace”.

  STOP.

i02890172

GSC CID 0445 - FMI 12

SMCS Code: 4490-035-R7

Conditions Which Generate This Code:

The Run Relay (RR) is located within the relay module. The GSC+P activates the RR during engine cranking and running.

Note: Whenever the GSC+P activates or the GSC+P attempts to activate the RR, “K5” is shown on the lower display. When the RR is not activated, “K5” is not shown.

The possible cause of a CID 0445 FMI 12 is an open coil or a shorted coil of the RR.

The system responses to this fault are listed below.

- If a CID 0445 FMI 12 occurs and the RR is activated, any customer’s equipment on RM-24 of the relay module will be disabled. The customer’s equipment that is connected to RM-23 will be activated.
- If a CID 0445 FMI 12 occurs and the RR is not activated, any customer’s equipment on RM-24 of the relay module will not be activated. The customer’s equipment that is connected to RM-23 will remain activated.

Note: The GSC+P treats a CID 0445 FMI 12 as an alarm fault. Active alarm faults are shown on the display when the “Alarm Codes” key is pressed. Also, the Engine Control Switch (ECS) must be in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

This troubleshooting procedure is for an active CID 0445 FMI 12 or the troubleshooting procedure is for an inactive CID 0445 FMI 12.

Test Step 1. CHECK THE STATUS OF THE DIAGNOSTIC CODE.

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

B. Press the “Alarm Codes” key.

C. Observe the upper display. Check that the CID 0445 FMI 12 is active.

D. If the diagnostic code is not active, enter the Service Mode. View the fault log for a OP1. Check that the diagnostic code is inactive.

Expected Result:

A CID 0445 FMI 12 is displayed as an active diagnostic code or CID 0445 FMI 12 is displayed as an inactive diagnostic code.

Results:

- OK – The CID 0445 FMI 12 is active or the CID 0445 FMI 12 is inactive. Proceed to Test Step 2.
- NOT OK – The CID 0445 FMI 12 has not occurred. The diagnostic code is not active and the diagnostic code is not inactive. STOP.

Test Step 2. CHECK THE INTERNAL CABLE OF THE RELAY MODULE.

Note: Only open the relay module in a dry environment. If the inspection and repair takes more than approximately twenty minutes replace the desiccant bag in the GSC+P housing. Refer to Testing And Adjusting, “Relay Module - Replace”.

A. Turn the ECS to the OFF/RESET position.

B. Disconnect the negative battery cable.

C. Temporarily, remove the relay module from the GSC+P. Refer to Testing And Adjusting, “Relay Module - Replace”.

D. Check the cable that attaches the relay module to the GSC+P.

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 – The cable is firmly seated in the connector. The clamp is in place. The cable is not damaged. Reassemble the relay module to the GSC+P. Proceed to Test Step 3.
- NOT OK – One or more of the components are damaged or the components are missing.

  Repair: Replace the clamp if the clamp is missing. If the cable is damaged, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 3. FUNCTIONAL CHECK OF THE RUN RELAY IN THE OFF/RESET POSITION

A. Turn the ECS to the OFF/RESET position.

B. Reconnect the negative battery cable.

C. Disconnect all wires from RM-23 and RM-24 of the relay module.

D. Remove fuse “F6” from the relay module.

E. At the relay module, measure the resistance from RM-24 to RM-8. Make a note of the resistance measurement.

F. At the relay module, measure the resistance from RM-23 to RM-9. Make a note of the resistance measurement.

Expected Result:

The resistance measurement from RM-24 to RM-8 should be greater than 5000 ohms. The resistance measurement should be less than 5 ohms at RM-23 to RM-9.

Results:

- OK – The resistance measurements are correct. The problem does not exist at this time. The initial problem was probably caused by a poor electrical connection or a short at one of the harness connectors that was disconnected and reconnected. Resume normal operation and watch for a recurrence. STOP.
- NOT OK – Either one of the resistance measurements are NOT correct. The relay module has failed.

  Repair: Replace the relay module. Refer to Testing And Adjusting, “Relay Module - Replace”.

  STOP.

Test Step 4. FUNCTIONAL CHECK OF THE RUN RELAY IN THE START POSITION

A. Turn the ECS to the START position.

B. The wires from RM-23 and RM-24 remain disconnected.

C. At the relay module, measure the resistance from RM-23 to RM-9. Make a note of the resistance measurement.

D. Measure the resistance from RM-24 to RM-8. Make a note of the resistance measurement.

Expected Result:

The resistance measurement from RM-23 to RM-9 should be greater than 5000 ohms. The resistance measurement should be less than 5 ohms at RM-24 to RM-8.

Results:

- OK – The resistance measurements are correct. The problem does not exist at this time. The initial problem was probably caused by a poor electrical connection or a short at one of the harness connectors that was disconnected and reconnected. Resume normal operation and watch for a recurrence. STOP.
- NOT OK – Either one of the resistance measurements are NOT correct. The relay module has failed.

  Repair: Replace the relay module. Refer to Testing And Adjusting, “Relay Module - Replace”.

  STOP.

i02888508

GSC CID 0446 - FMI 12

SMCS Code: 4490-035-R7

Conditions Which Generate This Code:

The Air Shutoff Relay (ASR) is not used on the C32 EMCP II+P. Air shutoff is controlled by the engine’s Electronic Control Module (ECM). The ASR is located within the relay module. The air shutoff solenoid is located within the air inlet system of the engine.

The GSC+P activates the ASR for some active shutdown faults.

Note: Whenever the GSC+P activates or the GSC+P attempts to activate the ASR, “K6” is shown on the lower display. When the ASR is not activated, “K6” is not shown.

The possible cause of a CID 0446 FMI 12 is an open coil or a shorted coil of the ASR.

The system responses to this diagnostic code are listed below.

- If a CID 0446 FMI 12 occurs and the ASR is activated, then the system is not affected. The system is not affected because the air shutoff is already operating and shutdown mode is functioning.

- If a CID 0446 FMI 12 occurs and the ASR is not activated, then there is no immediate effect on the system. The engine is able to start and the engine is able to run.
- If a CID 0446 FMI 12 occurs and the ASR is not activated, then the ASR cannot energize the air shutoff solenoid when a shutdown fault occurs.

This troubleshooting procedure is for an active CID 0446 FMI 12 or the troubleshooting procedure is for an inactive CID 0446 FMI 12.

Test Step 1. CHECK THE STATUS OF THE DIAGNOSTIC CODE.

A. Turn the Engine Control Switch (ECS) to the OFF/RESET position and then turn the ECS to the STOP position.

B. Press the “Alarm Codes” key.

C. Observe the upper display. Check that the CID 0446 FMI 12 is active.

D. If the diagnostic code is not active, enter the Service Mode. View the fault log for a OP1. Check that the diagnostic code is inactive.

Expected Result:

A CID 0446 FMI 12 is displayed as an active diagnostic code or CID 0446 FMI 12 is displayed as an inactive diagnostic code.

Results:

- OK – The CID 0446 FMI 12 is active or the CID 0446 FMI 12 is inactive. Proceed to Test Step 2.
- NOT OK – The CID 0446 FMI 12 has not occurred. The diagnostic code is not active and the diagnostic code is not inactive. STOP.

Test Step 2. CHECK THE INTERNAL CABLE OF THE RELAY MODULE.

Note: Only open the relay module in a dry environment. If the inspection and repair takes more than approximately twenty minutes replace the desiccant bag in the GSC+P housing. See Testing And Adjusting, “Relay Module - Replace”.

A. Turn the ECS to the OFF/RESET position.

B. Disconnect the negative battery cable.

C. Temporarily, remove the relay module from the GSC+P. Refer to Testing And Adjusting, “Relay Module - Replace”.

D. Check the cable that attaches the relay module to the GSC+P.

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 – The cable is firmly seated in the connector. The clamp is in place. The cable is not damaged. Reassemble the relay module to the GSC+P. Proceed to Test Step 3.
- NOT OK – One or more of the components are damaged or the components are missing.

  Repair: Replace the clamp if the clamp is missing. If the cable is damaged, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 3. PERFORM A FUNCTIONAL CHECK ON THE ASR.

A. Turn the ECS to the OFF/RESET position.

B. Reconnect the negative battery cable.

C. Disconnect all wires from RM-19 and RM-5 of the relay module.

D. Remove fuse “F3” from the relay module.

E. At the relay module, measure the resistance from RM-19 to RM-5. Make a note of the resistance measurement.

F. Turn the ECS to the STOP position and push in the Emergency Stop Push Button (ESPB). Measure the resistance from RM-19 to RM-5. Make a note of the resistance measurement.

Expected Result:

The initial resistance measurement after removing the wires and the fuse from the relay module should be greater than 5000 ohms. The resistance measurement should be less than 5 ohms when the ECS is placed in the STOP position.

Results:

- OK – The resistance measurements are correct. The problem does not exist at this time. The initial problem was probably caused by a poor electrical connection or a short at one of the harness connectors that was disconnected and reconnected. Resume normal operation and watch for a recurrence. STOP.

- NOT OK – Either one of the resistance measurements are NOT correct. The relay module has failed.

  Repair: Replace the relay module. Refer to Testing And Adjusting, “Relay Module - Replace”.

  STOP.

i02890370

GSC CID 0447 - FMI 12

SMCS Code: 4490-035-R7

Conditions Which Generate This Code:

The Fuel Control Relay (FCR) is not used on the C32 EMCP II+P system. The FCR is located within the relay module. The fuel control solenoid is located in the fuel system of the engine. The Electronic Governor (EG) is located on the subpanel.

Note: Whenever the GSC+P activates the FCR or attempts to activate the FCR, “K7” is shown on the lower display. When the FCR is not activated, “K7” is not shown. Also, setpoint P001 selects the type of the fuel control solenoid. 0 = ETR. 1 = ETS.

The possible cause of a CID 0447 FMI 12 is an open coil or a shorted coil of the FCR.

The system responses to these diagnostic codes are listed below.

- If a CID 0447 FMI 12 occurs and the engine is running, a CID 0566 FMI 07 will become active. A CID 0566 FMI 07 describes an unexpected shutdown. The shutdown mode is functioning. The engine stops.

- If a CID 0447 FMI 12 occurs and the engine is NOT running, then the engine can not start and the engine can not run.

The GSC+P treats a CID 0447 FMI 12 as an alarm fault. Active alarm faults are shown on the display when the “Alarm Codes” key is pressed. Also, the ECS must be in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

Note: This troubleshooting procedure is for an active CID 0447 FMI 12 or the troubleshooting procedure is for an inactive CID 0447 FMI 12.

Test Step 1. CHECK THE STATUS OF THE DIAGNOSTIC CODE.

A. Turn the Engine Control Switch (ECS) to the OFF/RESET position and then turn the ECS to the STOP position.

B. Press the “Alarm Codes” key.

C. Observe the upper display. Check that the CID 0447 FMI 12 is active.

D. If the diagnostic code is not active, enter the Service Mode. View the fault log for a OP1. Check that the diagnostic code is inactive.

Expected Result:

A CID 0447 FMI 12 is displayed as an active diagnostic code or CID 0447 FMI 12 is displayed as an inactive diagnostic code.

Results:

- OK – The CID 0447 FMI 12 is active or the CID 0447 FMI 12 is inactive. Proceed to Test Step 2.

- NOT OK – The CID 0447 FMI 12 has not occurred. The diagnostic code is not active and the diagnostic code is not inactive. STOP.

Test Step 2. CHECK THE INTERNAL CABLE OF THE RELAY MODULE.

Note: Only open the relay module in a dry environment. If the inspection and repair takes more than approximately twenty minutes replace the desiccant bag in the GSC+P housing. Refer to Testing And Adjusting, “Relay Module - Replace”.

A. Turn the ECS to the OFF/RESET position.

B. Disconnect the battery negative cable.

C. Temporarily, remove the relay module from the GSC+P. Refer to Testing And Adjusting, “Relay Module - Replace”.

D. Check the cable that attaches the relay module to the GSC+P.

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 – The cable is firmly seated in the connector. The clamp is in place. The cable is not damaged. Reassemble the relay module to the GSC+P. Proceed to Test Step 3.
- NOT OK – One or more of the components are damaged or the components are missing.

  Repair: Replace the clamp if the clamp is missing. If the cable is damaged, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 3. FUNCTIONAL CHECK OF THE FCR

A. Turn the ECS to the OFF/RESET position.

B. Reconnect the battery negative cable.

C. Disconnect all wires from RM-15 and RM-4 of the relay module.

D. Remove fuse “F3” from the relay module.

E. At the relay module, measure the resistance from RM-15 to RM-4. Make a note of the resistance measurement.

F. Turn the ECS to the START position and push in the Emergency Stop Push Button (ESPB). Measure the resistance from RM-15 to RM-4. Make a note of the resistance measurement.

Expected Result:

The initial resistance measurement after removing the wires and the fuse from the relay module should be greater than 5000 ohms. The resistance measurement should be less than 5 ohms when the ECS is placed in the START position.

Results:

- OK – The resistance measurements are correct. The problem does not exist at this time. The initial problem was probably caused by a poor electrical connection or a short at one of the harness connectors that was disconnected and reconnected. Resume normal operation and watch for a recurrence. STOP.
- NOT OK – Either one of the resistance measurements are NOT correct. The relay module has failed.

  Repair: Replace the relay module. Refer to Testing And Adjusting, “Relay Module - Replace”.

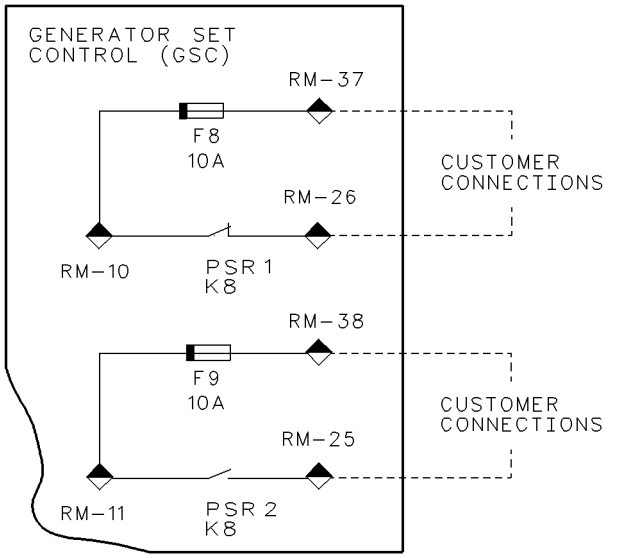
  STOP.

i02889590

GSC CID 0448 - FMI 12

SMCS Code: 4490-035-R7

Conditions Which Generate This Code:



g00721914

Illustration 74

System schematic for the programmable spare relays (“PSR1” and “PSR2”)

The GSC+P uses the Programmable Spare Relay (PSR) in order to activate the customers’ equipment. Refer to Systems Operation, “Spare Input/Output Programming OP6”.

Note: Whenever the GSC+P activates or the GSC+P attempts to activate the PSR, K8 is shown on the lower display. When the PSR is not activated, K8 is not shown.

The possible cause of a CID 0448 FMI 12 is an open coil or a shorted coil of the PSR.

The system responses to these diagnostic codes are listed below.

- If a CID 0448 FMI 12 occurs and the PSR is active, any customer’s equipment that is wired to RM-25 will be deactivated and any customer’s equipment that is wired to RM-26 will remain activated.

- If a CID 0448 FMI 12 occurs and the PSR is inactive, any customer's equipment that is wired to RM-25 will remain deactivated and any customer's equipment that is wired to RM-26 will remain activated.

The GSC+P treats a CID 0448 FMI 12 as an alarm fault. Active alarm faults are shown on the display when the "Alarm Codes" key is pressed and the Engine Control Switch (ECS) is in any position except the OFF/RESET position. Clear the diagnostic code from the fault log after troubleshooting is complete.

This troubleshooting procedure is for an active CID 0448 or the troubleshooting procedure is for an inactive CID 448 FMI 12.

Test Step 1. CHECK THE STATUS OF THE DIAGNOSTIC CODE.

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

B. Press the "Alarm Codes" key.

C. Observe the upper display. Check that the CID 0448 FMI 12 is active.

D. If the diagnostic code is not active, enter the Service Mode. View the fault log for a OP1. Check that the diagnostic code is inactive.

Expected Result:

A CID 0448 FMI 12 is displayed as an active diagnostic code or CID 0448 FMI 12 is displayed as an inactive diagnostic code.

Results:

- OK – The CID 0448 FMI 12 is active or the CID 0448 FMI 12 is inactive. Proceed to Test Step 2.
- NOT OK – The CID 0448 FMI 12 has not occurred. The diagnostic code is not active and the diagnostic code is not inactive. STOP.

Test Step 2. CHECK THE INTERNAL CABLE OF THE RELAY MODULE.

Note: Only open the relay module in a dry environment. If the inspection and repair takes more than approximately twenty minutes replace the desiccant bag in the GSC+P housing. Refer to Testing And Adjusting, "Relay Module - Replace".

A. Turn the ECS to the OFF/RESET position.

B. Disconnect the negative battery cable.

C. Temporarily, remove the relay module from the GSC+P. Refer to Testing And Adjusting, "Relay Module - Replace".

D. Check the cable that attaches the relay module to the GSC+P.

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 – The cable is firmly seated in the connector. The clamp is in place. The cable is not damaged. Reassemble the relay module to the GSC+P. Proceed to Test Step 3.
- NOT OK – One or more of the components are damaged or the components are missing.

  Repair: Replace the clamp if the clamp is missing. If the cable is damaged, replace the GSC+P. Refer to Testing and Adjusting, "EMCP Electronic Control (Generator Set) - Replace".

  STOP.

Test Step 3. FUNCTIONAL CHECK OF THE PSR

A. Turn the ECS to the OFF/RESET position.

B. Reconnect the negative battery cable.

C. Disconnect all wires from RM-25 of the relay module.

D. Remove fuse "F9" from the relay module.

E. At the relay module, measure the resistance from RM-25 to RM-11. Make a note of the resistance measurement.

F. Turn the ECS to the START position. Measure the resistance from RM-25 to RM-11. Make a note of the resistance measurement.

Expected Result:

The initial resistance measurement after removing the wires and the fuse from the relay module should be greater than 5000 ohms. The resistance measurement should be less than 5 ohms when the ECS is placed in the START position.

Results:

- OK – The resistance measurements are correct. The problem does not exist at this time. The initial problem was probably caused by a poor electrical connection or a short at one of the harness connectors that was disconnected and reconnected. Resume normal operation and watch for a recurrence. STOP.
- NOT OK – Either one of the resistance measurements are NOT correct. The relay module has failed.

  Repair: Replace the relay module. Refer to Testing And Adjusting, “Relay Module - Replace”.

  STOP.

i02889728

GSC CID 0500 - FMI 12

SMCS Code: 4490-035

Conditions Which Generate This Code:

A CID 500 FMI 12 means that the GSC+P 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+P, the CID 500 FMI 12 diagnostic code will be shown even when the Engine Control Switch (ECS) is in the OFF/RESET position.

VERIFY THAT THE DIAGNOSTIC CODE IS ACTIVE.

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.

A. The CID 500 FMI 12 is active.

Expected Result:

The CID 500 FMI 12 is active.

Results:

- YES – The CID 500 FMI 12 is active.

  Repair: Replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NO – The CID 500 FMI 12 is NOT active.

  Repair: The GSC+P is operating normally.

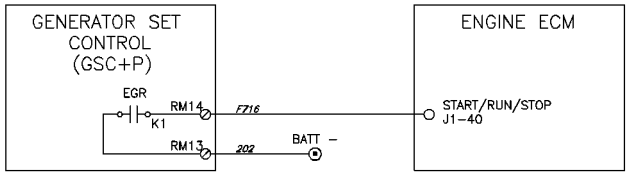
  STOP.

i02890397

GSC CID 0566 - FMI 07

SMCS Code: 4490-035

Conditions Which Generate This Code:



g01439320

Illustration 75

System Schematic For The Engine Control Module

The purpose of the CID 0566 is to alert the operator that the GSC+P did not control the engine shutdown. A shutdown fault initiated solely by the Engine Control Module (ECM) will result in a CID 566 diagnostic code appearing on the GSC+P. The GSC+P normally controls the engine shutdown for both normal operation and fault shutdowns. If an outside influence causes an engine shutdown, the GSC+P shows a CID 0566. There is only one failure mode for a CID 0566. This failure mode is FMI 07. FMI 07 is an improper mechanical response.

The diagnostic code causes the following sequence of events:

- On an engine that is running, the GSC+P will detect if the engine’s Revolutions Per Minute (RPM) drops to 0 rpm without the GSC+P initiating an engine shutdown.
- The GSC+P determines that no engine speed sensor fault is present that explains the drop in speed signal.
- The GSC+P declares a CID 0566 FMI 07 and disables the engine from running or starting.

The possible cause of a CID 0566 FMI 07 is listed below.

- A component that is not under the control of the GSC+P has caused an engine shutdown.

The GSC+P treats a CID 0566 FMI 07 as a shutdown fault. Clear the fault from the fault log after troubleshooting is complete.

Note: This procedure requires many voltage measurements during simulated engine cranking. F4 is the fuse for starting the engine. F4 is located on the Relay Module (RM). F4 is removed in order to prevent cranking the engine and starting the engine. Voltage measurements must be made quickly before the total cycle crank time (setpoint P017) elapses. The total cycle crank time is ninety seconds. Refer to Systems Operation, “Engine/Generator Programming OP5-0”. If the voltage measurement takes more than ninety seconds, the GSC+P will generate an overcrank fault. The overcrank shutdown indicator will FLASH. In order to continue with a voltage measurement, the overcrank fault must be reset by turning the Engine Control Switch (ECS) to OFF/RESET. Then, turn the ECS to START.

Test Step 1. PERFORM AN INITIAL CHECK.

A. Make sure that there are NO OTHER ACTIVE FAULTS. This means that there are no diagnostic codes which are showing on the upper display. This means that no shutdown or alarm indicators are flashing. Failure to do so may result in erroneous troubleshooting and needless replacement of parts. The operator will make many voltage measurements while the GSC+P is attempting to crank the engine. If the GSC+P detects other faults, it will prevent starting by shutting off the fuel and air to the engine. The resulting voltage measurements would then be the exact opposite of the voltage which is expected in the procedures.

B. Check the fuel level and quality.

C. Check for a plugged fuel filter.

D. Check for a plugged air filter.

E. Refer to the Service Manual for the engine if there is an obvious fault with the engine or the fuel system.

F. Check the operation of the air shutoff solenoid (if present).

Expected Result:

The air shutoff solenoid activates and the air shutoff solenoid deactivates.

Note: If there is no air shutoff solenoid present, proceed with the “YES” statement.

Results:

- YES – The air shutoff solenoid can be activated and the air shutoff solenoid can be deactivated. Proceed to Test Step 2.
- NO – The air shutoff solenoid can NOT be activated and the air shutoff solenoid can NOT be deactivated. STOP.

Test Step 2. VERIFY THE DIAGNOSTIC CODE.

A. Check if the CID 0566 FMI 07 is showing. This means that the CID 0566 FMI 07 is active.

Expected Result:

The CID 0566 FMI 07 is showing as an active fault.

Results:

- OK – Only a CID 0566 FMI 07 is showing. STOP.
- NOT OK – A CID 0566 FMI 07 is NOT showing. No active CID 0566 FMI 07 exists. STOP.

Test Step 3. CHECK THE SYSTEM VOLTAGE.

A. With the engine off, measure the system voltage at the battery. Make a note of this measurement. This measurement of the system voltage is used for comparison in future steps of this procedure.

Expected Result:

For a 24 volt system, the system voltage should be from 24.8 to 29.5 DCV. For a 32 volt system, the system voltage should be from 33.1 to 39.3 DCV.

Results:

- OK – The system voltage is correct. STOP.
- NOT OK – System voltage is NOT correct.

  Repair: For troubleshooting, refer to Testing And Adjusting, “CID 168 Electrical System”.

  STOP.

i02889768

GSC CID 0590 - FMI 09

SMCS Code: 1901-035

Conditions Which Generate This Code:

The CID 0590 failure means that the engines' Electronic Control Module (ECM) has stopped responding to the periodic requests for information from the GSC+P.

CHECK THE CAT DATA LINK

A. Turn the Engine Control Switch (ECS) to OFF/RESET position.

B. Disconnect the pins 19 and 20 of the CAT data link from the GSC+P.

C. Disconnect the pins 13 and 14 of the CAT data link from the ECM.

D. Measure the resistance between pin 19 of the GSC+P and pin 14 of the ECM.

E. Measure the resistance between pin 20 of the GSC+P and pin 13 of the ECM.

Expected Result:

The resistance for both measurements is less than 5 ohms.

Results:

- OK – The resistance for both measurements is less than 5 ohms. The circuit is correct. The ECM has failed.

  Repair: It is unlikely that the ECM has failed.

  Clear the diagnostic code from the fault log after troubleshooting is complete. The GSC+P is usually programmed to treat a CID 590 diagnostic code as an "alarm fault". Setpoint P04 is 0. If the GSC+P is programmed to treat this code as a shutdown fault, setpoint P04 is 1. Then, it is not necessary to press the "alarm codes" key in order to see the diagnostic code. The diagnostic code is automatically shown on the upper display.

  STOP.

- NOT OK – The resistance for both measurements is greater than 5 ohms. The circuit is not correct.

  Repair: Repair the wiring of the CAT data link or replace the wiring of the CAT data link.

  Clear the diagnostic code from the fault log after troubleshooting is complete. The GSC+P is usually programmed to treat a CID 590 diagnostic code as an "alarm fault". Setpoint P04 is 0. If the GSC is programmed to treat this code as a shutdown fault, setpoint P04 is 1. Then, it is not necessary to press the "alarm codes" key in order to see the diagnostic code. The diagnostic code is automatically shown on the upper display.

  STOP.

i02890100

GSC CID 0770 - FMI 09

SMCS Code: 1926-035

Conditions Which Generate This Code:

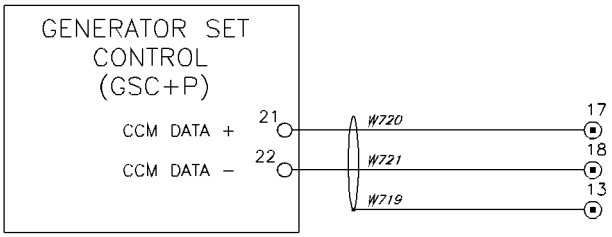


Illustration 76 g01439077

System schematic for CCM data link

Note: When a Customer Communication Module (CCM) is connected to a single genset, the positive battery terminal "BATT+" is connected directly to TS-BATT+ . When a CCM is connected to multiple gensets, connect the CCM to TS-73, and ensure that a wire is added between TS-73 on all generator sets.

On gensets that are equipped with a CCM, the GSC+P uses the "CCM data link" to communicate with the CCM.

The CCM data link consists of two wires that connect the GSC+P to the CCM.

The possible causes of a CID 0770 FMI 09 are listed below.

- A short to "BATT+" from either one of the two connector pins, 21 or 22
- A short from the negative battery terminal ("BATT-") to either of the two connector pins, 21 or 22

Note: The GSC+P cannot detect an open in the circuit of the CCM data link. The GSC+P treats a CID 0770 as an alarm fault. Active alarm faults are shown on the display when the “Alarm Codes” key is pressed and the Engine Control Switch (ECS) is in any position except the OFF/RESET position. Troubleshoot and repair the wiring. Refer to Testing and Adjusting, “Schematics and Wiring Diagrams”. Clear the fault from the fault log after troubleshooting is complete.

Test Step 1. CHECK THE CCM FOR A SHORT TO “BATT+”

A. Turn the ECS to the OFF/RESET position.

B. Disconnect the “BATT+” and “BATT-” battery leads from the battery.

C. Measure the resistance between pin 21 and “BATT+”.

D. Measure the resistance between pin 22 and “BATT+”.

Expected Result:

The resistance is greater than 5000 ohms for both cases.

Results:

- OK – The resistance is greater than 5000 ohms for both cases. The circuit is correct. Proceed to Test Step 2.
- NOT OK – The resistance is less than 5000 ohms. The circuit is not correct.

  Repair: The “CCM data link” is shorted to “BATT+”. Repair the wiring or replace the wiring.

  The GSC+P treats a CID 770 as an alarm fault. Active alarm faults are shown on the display when the alarm codes key is pressed and the ECS is not in the OFF/RESET position. Clear the fault from the fault log after the troubleshooting is complete.

  STOP.

Test Step 2. CHECK THE CCM FOR A SHORT TO “BATT-”

A. Turn the ECS to the OFF/RESET position.

B. Disconnect the “BATT+” and “BATT-” battery leads from the battery.

C. Measure the resistance between pin 21 and “BATT-”.

D. Measure the resistance between pin 21 and “BATT-”.

Expected Result:

The resistance is greater than 5000 ohms for both cases.

Results:

- OK – The resistance is greater than 5000 ohms for both cases. The circuit is correct.

  Repair: The failure is intermittent. The probable cause is a poor electrical connection. Check the wiring and repair the wiring, as needed.

  The GSC+P treats a CID 770 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. Clear the diagnostic code from the fault log after the troubleshooting is complete.

  STOP.

- NOT OK – The resistance is less than 5000 ohms. The circuit is not correct.

  Repair: The CCM data link is shorted to “BATT-”. Repair the wiring or replace the wiring.

  The GSC+P treats a CID 770 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. Clear the diagnostic code from the fault log after the troubleshooting is complete.

  STOP.

i02890528

GSC CID 0858 - FMI 03

SMCS Code: 1420-035

Conditions Which Generate This Code:

The close breaker control output drives the Circuit Breaker Permissive Relay (CBPR). The generator circuit breaker connects the generator to the bus. The inactive level of this output is floating. The voltage range may be from 5.2 DCV to the voltage of the positive battery terminal “(BATT+)”. The active voltage level is at the voltage of the negative battery terminal (“BATT-”).

For Automatic Synchronization, the output of the close breaker control is pulsed active for a programmed period of time. The period of time is set according to setpoint P302. While the conditions for synchronization are satisfied, the close breaker control output is repeatedly activated at one second intervals. When the breaker sensor input indicates that the generator circuit breaker is closed, the activation of the close breaker control output is discontinued. Also, the activation of the close breaker control input is discontinued when setpoint P314 (Maximum Synchronization Time) is exceeded.

A possible cause of a CID 0858 FMI 03 is a short from “BATT+” to the signal for the close breaker control output. A CID 0858 FMI 03 is only detected when the GSC+P is attempting to activate the output of the close breaker control. The GSC+P treats a CID 0858 FMI 03 as an alarm fault. CID 0858 FMI 03 will cause the GSC+P to stop the synchronization process until the FMI 03 is cleared and the diagnostic code is corrected.

Test Step 1. CHECK THE INACTIVE VOLTAGE LEVEL OF THE CLOSE BREAKER CONTROL OUTPUT.

A. Turn the Engine Control Switch (ECS) to STOP.

B. Locate the wire that connects pin 37 on the GSC+P to terminal SIAR-10 on the System in Auto Relay.

C. Remove the wire from terminal SIAR-10 only. The GSC+P remains connected to the wire.

D. Measure the voltage at pin 37 on the GSC+P.

Expected Result:

The voltage should measure 5.2 ± 1.0 DCV.

Results:

- OK – The voltage measures 5.2 ± 1.0 DCV. The voltage is correct. Proceed to Test Step 2.
- NOT OK – The voltage is less than 4.2 DCV or the voltage greater than 6.2 DCV.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 2. CHECK THE ACTIVE VOLTAGE LEVEL OF THE CLOSE BREAKER OUTPUT.

A. The wire from terminal SIAR-10 on the parallel mode switch remains disconnected.

B. Start the engine and run the engine.

C. Perform the Manual Paralleling function. If necessary, refer to Systems Operation, “Synchronization Sequence Of Operation”.

D. Manually bring the engine into synchronization with the bus. The synchroscope pointer will be at the top center position. This position indicates a phase angle of zero degrees.

Expected Result:

When the “IN SYNC” symbol is turned ON, the voltage level of the close breaker control output should read 0.0 ± 1.0 DCV.

Results:

- OK – The voltage level is 0.0 ± 1.0 DCV. The voltage level is correct. The GSC+P is operating correctly. The problem is in the wiring or a component that is connected to the close breaker control output.

  Repair: Use the information about the FMI and the system schematic for the close breaker control output to find the exact cause of the diagnostic code.

  STOP.

- NOT OK – The voltage level is not 0.0 ± 1.0 DCV. The voltage level is NOT correct.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

i02901402

GSC CID 0858 - FMI 04

SMCS Code: 1420-035

Conditions Which Generate This Code:

The close breaker output drives the Circuit Breaker Permissive Relay (CBPR). The CBPR activates the Circuit Breaker Close Relay (CBCR) which energizes the circuit breaker close coil on the circuit breaker, closing the breaker connecting the generator to the bus. The inactive level of this output is floating (may range from approximately 5.2 DCV to battery positive), and the active level is at battery negative ("BATT-").

For Automatic Synchronization, the close breaker output is pulsed active for a programmed period of time according to setpoint P302. As long as synchronization conditions are met, the close breaker output will be activated repeatedly at one second intervals until the breaker sensor input indicates the generator circuit breaker is closed or setpoint P314, Maximum Synchronization Time is exceeded.

For Permissive synchronization, the Close Breaker Output will be held active as long as synchronization conditions are met.

A possible cause of a CID 0858 FMI 04 is a short to ("BATT-") of the Close Breaker Output signal. A CID 0858 FMI 04 is only detected when the GSC+P is NOT activating the Close Breaker Output. The GSC+P treats a CID 0858 FMI 04 as an alarm fault. CID 0858 FMI 04 will cause the GSC+P to stop the synchronization process until the diagnostic code is cleared and corrected.

Test Step 1. CHECK THE INACTIVE VOLTAGE LEVEL OF THE CLOSE BREAKER OUTPUT.

A. Turn the "ECS" switch to STOP.

B. Locate the wire that connects pin 37 on the GSC+P and terminal SIAR-10 on the System in Auto Relay.

C. Remove the wire from terminal SIAR-10 on the System in Auto Relay only. GSC+P remains connected to the wire.

D. Use a cable probe to measure the voltage at pin 37 on the GSC+P to BATT-.

Expected Result:

The voltage should measure 5.2 ± 1.0 DCV.

Results:

- OK – The voltage measures 5.2 ± 1.0 DCV. The voltage is correct. Proceed to test step 2.
- NOT OK – The voltage is below 5.2 ± 1.0 DCV.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, "EMCP Electronic Control (Generator Set) - Replace".

  STOP.

Test Step 2. CHECK THE ACTIVE VOLTAGE LEVEL OF THE CLOSE BREAKER OUTPUT.

A. The wire from terminal SIAR-10 on the System in Auto Relay remains disconnected. GSC+P remains connected to the wire.

B. Start the engine and run the engine.

C. Perform the Manual Paralleling function. If necessary, refer to Systems Operation, "Synchronization Sequence Of Operation".

D. Manually bring the engine into SYNC with the bus. The synchroscope pointer will be at the top center position indicating 0° phase angle.

Expected Result:

When the "IN SYNC" symbol is turned ON, the close breaker output voltage level should read 0.0 ± 1.0 DCV.

Results:

- OK – The voltage level is 0.0 ± 1.0 DCV. The voltage level is correct. The GSC+P is operating correctly.

  Repair: The problem is in the wiring or a component connected to the close breaker output. Use the FMI information and the close breaker output system schematic to find the exact cause of the diagnostic code.

  STOP.

- NOT OK – The voltage level is not 0.0 ± 1.0 DCV. The voltage level is NOT correct.

Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

STOP.

i02901157

GSC CID 0859 - FMI 03

SMCS Code: 4490-035

Conditions Which Generate This Code:

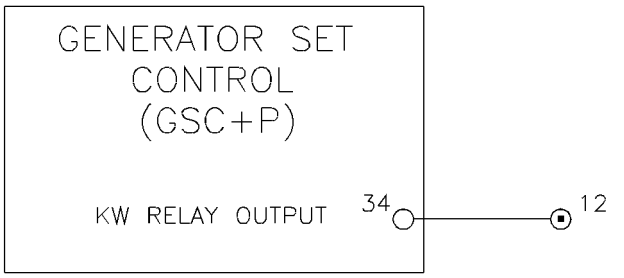


Illustration 77 g01444276

System Schematic For kW Level Output

The kW level output will be activated whenever the total power output of the generator exceeds the setpoint P139. The kW level output is the connector pin 34 of the GSC+P. This setpoint can be programmed from 0 to 110 percent of the rated power on the nameplate (setpoint P030). This setpoint can be programmed with a time delay from 0 to 120 seconds (setpoint P140). Refer to System Operation, “Engine/Generator Programming OP5-0”. Also, refer to System Operation, “Service Mode”. Once the output is activated, the kW level output will be deactivated when the total power output of the generator drops below the programmed setpoint (setpoint P141). This setpoint is different from the activation setpoint. This setpoint can be programmed from 0 to 110 percent of the power rating on the nameplate of the generator. This setpoint can be programmed with a time delay from 0 to 120 seconds.

When kW relay is disconnected from the GSC+P, the voltage on the kW level output is approximately 5.0 DCV. When kW relay is connected to the GSC+P, the voltage on the kW level output is approximately 0 volts. The kW level output is capable of drawing (sinking) approximately 100 mA. Documenting and troubleshooting any connections to this output is the responsibility of the customers and the dealers.

The possible cause of a CID 0859 FMI 3 is a short from the positive battery terminal circuit (“BATT+”) to the kW level output.

The GSC+P treats a CID 859 FMI 03 as an alarm fault.

Troubleshooting of this failure is straight forward. The FMI 03 defines the problem as a short to “BATT+”. Use the following information in order to find the exact cause of the diagnostic code.

- FMI information
- system schematic of the kW level output
- customer’s documentation
- dealer’s documentation

Test Step 1. CHECK THE GENERATOR SET CONTROL

A. Verify that the CID 0859 FMI 03 diagnostic code is active.

B. Disconnect the wire from pin 34 of the GSC+P.

C. Measure the voltage between pin 34 of the GSC+P and “BATT-”.

Expected Result:

The voltage is approximately 5 ± 1.0 DCV.

Results:

- OK – The voltage is approximately 5 ± 1.0 DCV. The voltage is correct. Proceed to Test Step 2.
- NOT OK – The voltage is NOT approximately 5 ± 1.0 DCV. The voltage is NOT correct. The GSC+P has failed.

  Repair: It is unlikely that the GSC+P has failed. Exit this diagnostic code procedure and repeat the CID 0859 FMI 03 diagnostic code procedure again. If the cause of the failure is still unknown, then replace the GSC+P.

  STOP.

Test Step 2. CHECK FOR A SHORT IN THE WIRING OF THE kW LEVEL OUTPUT

A. Shut down the genset.

B. Disconnect the cable on the negative battery terminal “BATT-” terminal of the battery, or open the optional battery disconnect switch.

C. The wire remains disconnected from pin 34 of the GSC+P.

D. Measure the resistance between the wire that was disconnected from pin 34 of the GSC+P and pin 10 of the kW relay.

Expected Result:

The resistance is 480 ohms ±48 ohms.

Results:

- OK – The resistance is between 430 and 530 ohms. It is unlikely that the GSC+P has failed.

  Repair: It is unlikely that the GSC+P has failed. The system may need to be reset. Reset the system by turning the Engine Control Switch (ECS) to the OFF/RESET position. Exit this diagnostic code procedure and repeat the CID 0859 FMI 03 diagnostic code procedure again. If the cause of the failure is still unknown, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”

  STOP.

- NOT OK – The resistance is less than 430 ohms or the resistance is greater than 530 ohms. The resistance is NOT correct.

  Repair: The kW relay is faulty or there is a short between the wire disconnected from pin 34 of the GSC+P and “BATT+”. Replace the kW relay or repair the wiring.

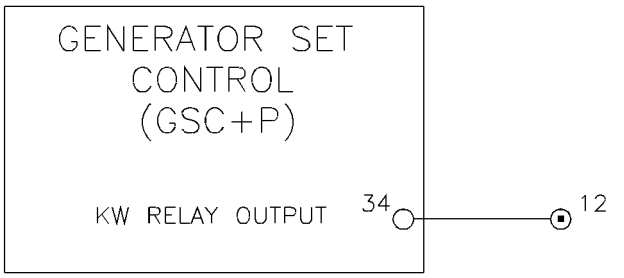
  STOP.

i02901055

GSC CID 0859 - FMI 04

SMCS Code: 4490-035

Conditions Which Generate This Code:



g01444276

Illustration 78
System Schematic For kW Level Output

The kW level output will be activated whenever the total power output of the generator exceed the setpoint P139. The kW level output is the pin 34 of the GSC+P connector. This setpoint can be programmed from 0 to 110 percent of the rated power on the nameplate (setpoint P030). This setpoint can be programmed with a time delay from 0 to 120 seconds (setpoint P140). Refer to System Operation, “Engine/Generator Programming OP5-0”. Also, refer to System Operation, “Service Mode”. Once the output is activated, the kW level output will be deactivated when the total power output of the generator drops below the programmed setpoint (setpoint P141). This setpoint is different from the activation setpoint. This setpoint can be programmed from 0 to 110 percent of the power rating on the nameplate of the generator. This setpoint can be programmed with a time delay from 0 to 120 seconds.

When kW relay is disconnected from the GSC+P, the voltage on the kW level output is approximately 5.0 DCV. When kW relay is connected to the GSC+P, the voltage on the kW level output is approximately 0 volts. The kW level output is capable of drawing (sinking) approximately 100 mA. Documenting and troubleshooting any connections to this output is the responsibility of the customers and the dealers.

The possible cause of a CID 0859 FMI 04 is a short to the “BATT-” circuit of the kW level output.

The GSC+P treats a CID 0859 FMI 04 as an alarm fault.

Troubleshooting of this failure is straight forward. The FMI 04 defines the diagnostic code as a short to “BATT-”. Use the following information in order to find the exact cause of the diagnostic code.

- FMI information
- The system schematic of the kW level output
- customer’s documentation
- dealer’s documentation

Test Step 1. CHECK THE GENERATOR SET CONTROL

A. Verify that the CID 0859 FMI 04 diagnostic code is active.

B. Disconnect the wire from pin 34 of the GSC+P.

Expected Result:

The diagnostic code becomes inactive.

Results:

- OK – The diagnostic code changes to inactive. Proceed to Test Step 2.
- NOT OK – The diagnostic code remains active. The GSC+P may have failed.

  Repair: It is unlikely that the GSC+P has failed. Exit this diagnostic code procedure and repeat the CID 0859 FMI 03 diagnostic code procedure again. If the cause of the failure is still unknown, then replace the GSC+P.

  STOP.

Test Step 2. CHECK FOR A SHORT TO "BATT-" IN THE WIRING OF THE kW LEVEL OUTPUT

A. Shut down the genset.

B. Disconnect the "BATT-" terminal from the battery.

C. The wire remains disconnected from pin 34 of the GSC+P.

D. Measure the resistance between the wire that was disconnected from pin 34 of the GSC+P and the "BATT-" terminal.

Expected Result:

The resistance is greater than 5000 ohms.

Results:

- OK – The resistance is greater than 5000 ohms. The resistance is correct.

  Repair: The failure is intermittent. The probable cause is a poor electrical connection. Check the wiring for damage and clean all connections. Exit this procedure and perform the CID 0859 FMI 04 procedure again. If no failure is found and the diagnostic code is still active, replace the GSC+P.

  STOP.

- NOT OK – The resistance is less than 5000 ohms. The resistance is NOT correct. The circuit is shorted.

  Repair: Repair the wiring between pin 34 of the "BATT-" terminal.

  STOP.

i02890649

GSC CID 1038 - FMI 03

SMCS Code: 1264-035

Conditions Which Generate This Code:

The output of the "Speed Adjust 1" provides an analog signal that is being used to vary the engine speed in order to match the phase of the generator to the phase of the bus. The full output voltage is approximately −5.0 to +5.0 DCV. If the synchronization is disabled, the output will be 0.0 ± 0.5 DCV.

Note: Setpoint P308 must be set to a value that is greater than zero in order for this procedure to be completed. This setpoint can be a value from 0 to 100. The factory default is 50. Refer to Systems Operation, "Parallel Setpoint Programming" for more information.

The possible cause of a CID 1038 FMI 03 is a short from the output signal of the "Speed Adjust 1" to the positive terminal of the battery ("B+").

A CID 1038 FMI 03 is detected when the GSC+P is NOT activating the output of the "Speed Adjust 1". The GSC+P treats a CID 1038 FMI 03 as an alarm fault. The synchronization process will be stopped until the diagnostic code is cleared and the diagnostic code is corrected.

Test Step 1. CHECK THE INACTIVE VOLTAGE LEVEL OF THE OUTPUT OF THE "SPEED ADJUST 1".

A. Turn the Engine Control Switch (ECS) to STOP.

B. Locate the wire that is connecting pin 27 of the GSC+P to terminal 24 of the Load Share Module (LSM). Pin 27 of the GSC+P will remain connected to the wire.

C. Use a cable probe to measure the voltage on pin 27 of GSC+P.

Expected Result:

The voltage should measure 0.0 ± 1.0 DCV.

Results:

- OK – The voltage level is 0.0 ± 1.0 DCV. Proceed to Test Step 2.
- NOT OK – The voltage level is below the correct range or the voltage level is above the correct range.

Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

STOP.

Test Step 2. CHECK THE ACTIVE VOLTAGE LEVELS OF THE OUTPUT OF THE “SPEED ADJUST 1”.

A. The wire that is connecting pin 27 of the GSC+P and the terminal 24 of the LSM remains disconnected.

B. Start the engine. Adjust the engine speed so the frequency is 1.0 Hz higher than the frequency of the bus .

C. Perform the Automatic paralleling function. If necessary, refer to Systems Operation, “Synchronization Tuning Procedure”.

D. Allow the voltage to stabilize. Use a cable probe to measure the voltage on pin 27 of GSC+P.

Expected Result:

The voltage should measure −5.0 ± 1.0 DCV.

Results:

- OK – The voltage level is −5.0 ± 1.0 DCV. Proceed to Test Step 3.
- NOT OK – The voltage is above or the voltage is below the correct voltage.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 3. CHECK THE ACTIVE VOLTAGE LEVELS OF THE OUTPUT OF THE “SPEED ADJUST 1”.

A. The wire that is connecting pin 27 of the GSC+P and terminal 24 of the LSM remains disconnected.

B. Start the engine. Adjust the engine speed so that the frequency is 1.0 Hz lower than the frequency of the frequency of the bus .

C. Perform the Automatic paralleling function. If necessary, refer to Systems Operation, “Synchronization Tuning Procedure”.

D. Allow the voltage to stabilize. Use a cable probe to measure the voltage on pin 27 of GSC+P.

Expected Result:

The voltage should measure +5.0 ± 1.0 DCV.

Results:

- OK – The voltage level is +5.0 ± 1.0 DCV.

  Repair: The GSC+P is operating correctly, and the problem is in the wiring or the component that is connected to the output of the “Speed Adjust 1”. Use the FMI information and use the System Schematic of the “Speed Adjust 1” to find the exact cause of the fault.

  STOP.

- NOT OK – The voltage is above or the voltage is below the correct voltage.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

i02890866

GSC CID 1038 - FMI 04

SMCS Code: 1264-035

Conditions Which Generate This Code:

The output of the “Speed Adjust 1” provides an analog signal that is being used to vary the engine speed in order to match the phase of the generator to the phase of the bus. The full output voltage is approximately −5.0 to +5.0 DCV. If the synchronization is disabled, the output will be 0.0 ± 0.5 DCV.

Note: Setpoint P308 must be set to a value that is greater than zero in order for this procedure to be completed. This setpoint can be a value from 0 to 100. The factory default is 50. Refer to Systems Operation, “Parallel Setpoint Programming” for more information.

The possible cause of a CID 1038 FMI 04 is a short from the output signal of the “Speed Adjust 1” to the negative battery terminal.

A CID 1038 FMI 04 is detected when the GSC+P is NOT activating the output of the “Speed Adjust 1”. The GSC+P treats a CID 1038 FMI 04 as an alarm fault. The synchronization process will be stopped until the diagnostic code is cleared and the diagnostic code is corrected.

Test Step 1. CHECK THE INACTIVE VOLTAGE LEVEL OF THE OUTPUT OF THE “SPEED ADJUST 1”.

A. Turn the Engine Control Switch (ECS) to STOP.

B. Locate the wire that is connecting pin 27 of the GSC+P to terminal 24 of the Load Share Module (LSM) only. Remove this wire at terminal 24 of the LSM only. Pin 27 of the GSC+P will remain connected to the wire.

C. Use a cable probe to measure the voltage on pin 27 of GSC+P.

Expected Result:

The voltage should measure 0.0 ± 1.0 DCV.

Results:

- OK – The voltage level is 0.0 ± 1.0 DCV. Proceed to Test Step 2.
- NOT OK – The voltage level is below the correct range or the voltage level is above the correct range.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 2. CHECK THE ACTIVE VOLTAGE LEVELS OF THE OUTPUT OF THE “SPEED ADJUST 1”.

A. The wire that is connecting pin “27” of the GSC+P and terminal 24 of the LSM remains disconnected.

B. Start the engine. Adjust the engine speed so the frequency is 1.0 Hz higher than the frequency of the bus .

C. Perform the Automatic paralleling function. If necessary, refer to Systems Operation, “Synchronization Tuning Procedur”.

D. Allow the voltage to stabilize. Use a cable probe to measure the voltage on pin 27 of GSC+P.

Expected Result:

The voltage should measure −5.0 ± 1.0 DCV.

Results:

- OK – The voltage level is −5.0 ± 1.0 DCV. Proceed to Test Step 3.
- NOT OK – The voltage is above or the voltage is below the correct voltage.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 3. CHECK THE ACTIVE VOLTAGE LEVELS OF THE OUTPUT OF THE “SPEED ADJUST 1”.

A. The wire that is connecting pin 27 of the GSC+P and terminal 24 of the LSM remains disconnected.

B. Start the engine. Adjust the engine speed so that the frequency is 1.0 Hz lower than the frequency of the frequency of the bus .

C. Perform the Automatic paralleling function. If necessary, refer to Systems Operation, “Synchronization Tuning Procedure”.

D. Allow the voltage to stabilize. Use a cable probe to measure the voltage on pin 27 of GSC+P.

Expected Result:

The voltage should measure +5.0 ± 1.0 DCV.

Results:

- OK – The voltage level is +5.0 ± 1.0 DCV.

  Repair: The GSC+P is operating correctly, and the problem is in the wiring or the component that is connected to the output of the “Speed Adjust 1”. Use the FMI information and use the System Schematic of the “Speed Adjust 1” to find the exact cause of the fault.

  STOP.

- NOT OK – The voltage is above or the voltage is below the correct voltage.

Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

STOP.

i02890905

GSC CID 1167 - FMI 04

SMCS Code: 1420-035

Conditions Which Generate This Code:

The circuit breaker sensor is used by the GSC+P to determine if the generator circuit is opened or closed. When the circuit breaker sensor input is inactive the input will float to approximately 10.5 DCV. An inactive state will indicate that the circuit breaker is open. When the circuit breaker sensor input is active, the voltage level will be at the level of the negative battery terminal “BATT-”. An active state indicates that the breaker is closed.

The possible cause of a CID 1167 FMI 4 is a short from the input signal of the circuit breaker sensor to “BATT-”.

A CID 1167 FMI 04 is detected when the input of the circuit breaker sensor is active. The CID 1167 FMI 04 indicates a closed breaker and one or both of the following items are true.

- The difference of frequency between the generator and the bus is greater than 0.2 Hz.
- The difference of phase between the generator and the bus is greater than 10°.

When the above conditions are present for two seconds, the GSC+P will issue a CID 1167 FMI 4 as an alarm fault. The GSC+P will then stop the synchronization process until the diagnostic code is cleared and the diagnostic code is corrected.

Test Step 1. CHECK THE INACTIVE VOLTAGE LEVEL OF THE CIRCUIT BREAKER SENSOR.

A. Turn the Engine Control Switch (ECS) to STOP.

B. Locate the wire that is connecting pin 25 of the GSC+P to the terminal CBR-9 of the Circuit Breaker relay (CBR). Remove this wire at terminal CBR-9 of the Circuit Breaker Relay (CBR) only. Pin 25 of GSC+P will remain connected to the wire.

C. Use a cable probe to measure the voltage at pin 25 of the GSC+P.

Expected Result:

The voltage should measure 10.5 ± 1 DCV.

Results:

- OK – The voltage is 10.5 ± 1 DCV. Proceed to Test Step 2.
- NOT OK – The voltage is not within the correct range.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 2. CHECK THE FUNCTION OF THE INPUT OF THE CIRCUIT BREAKER SENSOR.

A. The wire that is connecting pin 25 of the GSC+P and terminal CBR-9 of the Circuit Breaker relay (CBR) remains disconnected.

B. Start the engine. Adjust the engine speed so the generator frequency is more than 0.2 Hz of the frequency of the bus.

C. Perform the Manual paralleling function. Refer to Systems Operation, “Synchronization Sequence Of Operation”.

D. Ensure that the synchroscope is present on the lower display of the GSC+P.

E. Touch the loose end of the wire of pin 25 of the GSC+P to “BATT-”.

Expected Result:

After two seconds, the CID 1167 FMI 4 should be active.

Results:

- OK – The GSC+P issues the diagnostic.

Repair: The GSC+P is operating correctly, and the problem is in the wiring or the component that is connected to the input of the circuit breaker sensor. Use the FMI information and use the Close Breaker Input System Schematic to find the exact cause of the diagnostic code.

STOP.

- NOT OK – The GSC+P does not issue the diagnostic.

  Repair: The GSC+P has failed. Replace the GSC+P. Refer to Testing and Adjusting, “EMPC Electronic Control (Generator Set) - Replace”.

  STOP.

i02890927

GSC CID 1168 - FMI 03

SMCS Code: 445B-035

Conditions Which Generate This Code:

This dead bus sensor provides an additional indication of the state of the bus. The bus can be live or dead. The input of the dead bus sensor is compared to the reading of the bus voltage, and the diagnostics are produced if the measurements differ.

When the input of the dead bus sensor is inactive, the input will float to approximately 10.5 DCV. An inactive state indicates that the bus is live. When the input of the dead bus sensor is active, the bus will be dead.

The possible cause of a CID 1168 FMI 03 is a short from the input signal of the dead bus sensor to the positive terminal of the battery (“BATT+”).

A CID 1168 FMI 03 is detected under the following condition.

- The voltage of the Phase A of the bus is less than 20% of the rated voltage and the input of the dead bus sensor is floating. The voltage of the Phase A is determined by the “BTB+” input to the GSC+P.

The GSC+P treats a CID 1168 FMI 03 as an alarm fault. The dead bus paralleling function will be stopped when this diagnostic code is detected. No other synchronization processes will be affected.

Test Step 1. CHECK THE INACTIVE VOLTAGE LEVEL OF THE INPUT OF THE DEAD BUS SENSOR .

A. Turn the Engine Control Switch (ECS) to STOP.

B. Locate the wire that is connecting pin 29 of the GSC+P to terminal “DBR-9” of the Dead Bus Relay (DBR). Remove this wire at terminal “DBR-9” of the DBR only. Pin 29 of GSC+P will remain connected to the wire.

C. Use a cable probe to measure the voltage at pin 29 of the GSC+P.

Expected Result:

The voltage should measure 10.5 ± 1.0 DCV.

Results:

- OK – The voltage level is 10.5± 1.0 DCV. Proceed to Test Step 2.

- NOT OK – The voltage level is not within the correct range.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 2. CHECK THE FUNCTION OF THE BUS RELAY.

A. Reconnect the wire that is connecting pin 29 of the GSC+P to the terminal “DBR-9” of the DBR.

B. Use a cable probe to monitor the voltage on pin 29 of the GSC+P.

C. Ensure that the bus is dead, or carefully disconnect power from the relay coil of the DBR.

Expected Result:

The voltage of pin 29 of the GSC+P should measure 0.0 ± 0.5 DCV.

Results:

- OK – The voltage is 0.0 ± 0.5 DCV. Proceed to Test Step 3.

- NOT OK – The voltage is incorrect.

  Repair: The GSC+P has failed. Replace the GSC+P. Refer to Testing and Adjusting, “EMPC Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 3. CHECK THE FUNCTION OF THE BUS RELAY.

A. Carefully reconnect any power wires of the DBR that may have previously been removed.

B. Ensure that the bus is live.

C. Use a cable probe to measure the voltage at pin 29 of the GSC+P.

Expected Result:

The voltage should measure 10.5 ± 1.0 DCV.

Results:

- OK – The voltage is 10.5 ± 1.0 DCV.

  Repair: The GSC+P is functioning properly. The problem is in the wiring or the component that is connected to the input of the dead bus sensor of the GSC+P. Use the FMI information and the Dead Bus Sensor input System Schematic to find the exact cause of the diagnostic code.

  STOP.

- NOT OK – The voltage is incorrect.

  Repair: The GSC+P has failed. Replace the GSC+P. Refer to Testing and Adjusting, “EMPC Electronic Control (Generator Set) - Replace”.

  STOP.

i02891044

GSC CID 1168 - FMI 04

SMCS Code: 445B-035

Conditions Which Generate This Code:

This dead bus sensor provides an additional indication of the state of the bus. The bus can be live or dead. The input of the dead bus sensor is compared to the reading of the bus voltage, and the diagnostics are produced if the measurements differ.

When the input of the dead bus sensor is inactive, the input will float to approximately 10.5 DCV. An inactive state indicates that the bus is live. When the input of the dead bus sensor is active, the bus will be dead.

The possible cause of a CID 1168 FMI 04 is a short from the input signal of the dead bus sensor to negative battery terminal (“BATT-”).

A CID 1168 FMI 04 is detected under the following condition.

- The voltage of the Phase A of the bus is greater than 50% of the rated voltage and the input of the dead bus sensor is floating. The voltage of the Phase A is determined by the “BTB+” input to the GSC+P.

The GSC+P treats a CID 1168 FMI 04 as an alarm fault. The dead bus paralleling function will be stopped when this diagnostic code is detected. No other synchronization processes will be affected.

Test Step 1. CHECK THE INACTIVE VOLTAGE LEVEL OF THE INPUT OF THE DEAD BUS SENSOR .

A. Turn the Engine Control Switch (ECS) to STOP.

B. Locate the wire that is connecting pin 29 of the GSC+P to terminal “DBR-9” of the Dead Bus Relay (DBR). Remove this wire at terminal “DBR-9” of the DBR only. Pin 29 of GSC+P will remain connected to the wire.

C. Use a cable probe to measure the voltage at pin 29 of the GSC+P.

Expected Result:

The voltage should measure 10.5 ± 1.0 DCV.

Results:

- OK – The voltage level is 10.5± 1.0 DCV. Proceed to Test Step 2.

- NOT OK – The voltage level is not within the correct range.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 2. CHECK THE FUNCTION OF THE BUS RELAY.

A. Reconnect the wire that is connecting pin 29 of the GSC+P to terminal “DBR-9” of the DBR.

B. Use a cable probe to monitor the voltage on pin 29 of the GSC+P.

C. Ensure that the bus is dead, or carefully disconnect power from the relay coil of the DBR.

Expected Result:

The voltage of pin 29 of the GSC+P should measure 0.0 ± 0.5 DCV.

Results:

- OK – The voltage is 0.0 ± 0.5 DCV. Proceed to Test Step 3.
- NOT OK – The voltage is incorrect.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

Test Step 3. CHECK THE FUNCTION OF THE BUS RELAY.

A. Carefully reconnect any power wires of the DBR that may have previously been removed.

B. Ensure that the bus is live.

C. Use a cable probe to measure the voltage at pin 29 of the GSC+P.

Expected Result:

The voltage should measure 10.5 ± 1.0 DCV.

Results:

- OK – The voltage is 10.5 ± 1.0 DCV.

  Repair: The GSC+P is functioning properly. The problem is in the wiring or the component that is connected to the input of the dead bus sensor of the GSC+P. Use the FMI information and the Dead Bus Sensor input System Schematic to find the exact cause of the diagnostic code.

  STOP.

- NOT OK – The voltage is incorrect.

  Repair: The GSC+P has failed. Replace the GSC+P. Refer to Testing and Adjusting, “EMPC Electronic Control (Generator Set) - Replace”.

  STOP.

i02891171

GSC CID 1169 - FMI 02

SMCS Code: 1409-035

Conditions Which Generate This Code:

The “ATB+” reduces the AC voltages to neutral voltages and phase currents from the generator to usable signal levels for the GSC+P. The GSC+P uses these reduced signals for the following reasons: metering AC power, calculating the phase angle with the bus, and detecting the phase sequence of the generator. The phase sequence of the generator is the following order: Phase A, Phase B, and Phase C.

The possible cause of a CID 1169 FMI 02 is a short between two or three phases of the output of the ATB+ . The phase angle between any two phases is 120°. The short will make the phase angle between any two phases unequal to 120°.

The GSC+P treats a CID 1169 FMI 02 as an alarm fault. The GSC+P will stop the “Speed Adjust 1” and Close Breaker functions by the GSC+P. The CID 1169 FMI 02 will not affect any other synchronization processes.

CHECK THE LINE-TO-LINE VOLTAGES.

A. Start the engine.

B. Record the line to line voltage on the upper display of the GSC+P.

Expected Result:

The line-to-line voltages should be equal within ±5%. The voltages should also be within a reasonable value of the rated voltage of the genset.

Results:

- OK – The line-to-line voltages are equal within ±5% and the voltages are within a reasonable value of the rated voltage of the genset.

  Repair: The ATB+ has failed. Replace the ATB+. See Testing and Adjusting, “EMPC Electronic Control (AC Transformer Box) - Replace”.

  STOP.

- NOT OK – The voltages are not correct.

Repair: Use the ATB+ System Schematic and the AC Schematic in the Schematics And Wiring Diagrams section to troubleshoot the wiring and find the exact cause of the problem. A short on the output of the phases of the ATB+ will not normally cause permanent damage to the ATB+. Remove the problem and check for proper operation before replacing any components.

STOP.

i02891187

GSC CID 1170 - FMI 02

SMCS Code: 1409-035

Conditions Which Generate This Code:

The Bus Transformer Box (BTB +) reduces the AC line to neutral voltages of phase A and phase C from the bus to usable signal levels for the GSC+P. The GSC+P uses these reduced signals for detecting the phase angle with the generator. The GSC+P also uses these reduced signals for detecting the phase sequence of the bus. The GSC+P will utilize the signal of phase A in order to measure the amplitude of the voltage on the bus. The GSC+P will utilize the signal of phase C in order to measure the frequency of the voltage on the bus.

The possible cause of a CID 1170 FMI 02 is a short between the input of phase A and the input of phase B of the BTB+. This would cause a phase angle of approximately 0°.

Test Step 1. CHECK THE PHASE ANGLE OF THE INPUTS TO THE BUS TRANSFORMER BOX (BTB +)

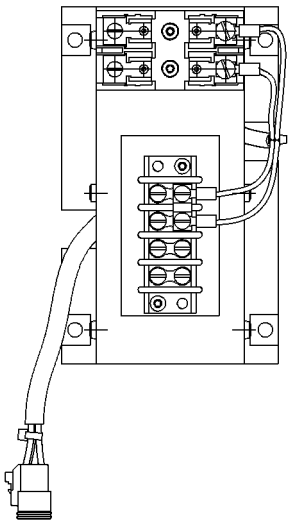


Illustration 79 g00603288
Bus transformer box

A. Stop the engine. Turn the Engine Control Switch (ECS) to “STOP”.

B. Remove the two fuses from the BTB +.

C. Measure the resistance of the fuses with a digital multimeter.

Expected Result:

The resistance should be less than 1.0 ohms.

Results:

- OK – The resistance is less than 1.0 ohms. The fuses have not failed. Install the fuses. Proceed to Test Step 2.
- NOT OK – The fuses are blown. Replace the fuses. Proceed to Test Step 2.

Test Step 2. CHECK THE VOLTAGE ON THE INPUT OF THE BTB+

A. Start the engine and run the engine at rated speed.

B. The Bus must be live. Close the breaker of the generator.

C. Use a digital multimeter and measure the voltage between “B1” and “B2” on the BTB+.

Expected Result:

The voltage between “B1” and “B2” of the generator is the same as the line to line voltage.

Note: If external potential transformers for medium and high voltage generators are present, the voltage will be the same as the secondary of the potential transformer.

Results:

- OK – The voltage is correct. Proceed to Test Step 4.
- NOT OK – The voltage is not correct. Proceed to Test Step 3.

Test Step 3. CHECK THE BTB+ INPUT CIRCUIT

A. Stop the engine. Turn the ECS to “STOP”. Ensure that no other source is connected to the bus.

B. Disconnect the wires labelled “E486” and “E488” from the BTB+ terminals.

C. Measure the resistance between “E486” and “E488” and on the BTB+.

Expected Result:

The resistance should be 2140 ohms ±400 ohms.

Results:

- OK – The resistance is correct. There is a failure in the wiring between the BTB+ and the generator.

  Repair: Use the System Schematic for the BTB+ and the AC schematic in order to troubleshoot the wiring and find the exact cause of the diagnostic code. Refer to Testing And Adjusting, “Schematics And Wiring Diagrams”.

  STOP.

- NOT OK – The resistance is not correct. BTB+ has failed.

  Repair: The BTB+ has failed. Replace the BTB+. Refer to Testing And Adjusting, “EMCP Electronic Control (Bus Transformer Box) - Replace”.

  STOP.

Test Step 4. CHECK VOLTAGE ON GSC+P INPUT

A. Stop the engine.

B. Install cable probes on the GSC+P pins 17 and 18 of the 40-pin connector.

C. Start the engine. The engine is running at rated speed.

D. Measure the voltage between pin 17 and pin 18 of the GSC+P connector.

Expected Result:

The voltage should be equal to the voltage measured in Test Step 2 divided by 15 ± 2% (14.7 to 15.3).

Results:

- OK – The voltage is correct. CID 1170 FMI 2 is still active. The GSC+P may have failed.

  Repair: It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the result is the same, replace the GSC+P. Refer to Testing and Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NOT OK – The voltage is not correct. Proceed to Test Step 5.

Test Step 5. CHECK VOLTAGE ON BTB+ OUTPUT

A. Stop the engine.

B. Install cable probes between pin A and pin B of three terminal connector “J1” on the BTB+.

C. Start the engine and run the engine at rated speed.

D. Measure the voltage between pin A and pin B of “J1”.

Expected Result:

The voltage should be equal to the voltage measured in Test Step 2 divided by 15 ± 2% (14.7 to 15.3).

Results:

- OK – The voltage is correct. There is a wiring failure between the GSC+P and the BTB+.

  Repair: Use the System Schematic for the BTB+ and the AC schematic in order to troubleshoot the wiring and find the exact cause of the diagnostic code. Testing And Adjusting, “Schematics And Wiring Diagrams”.

  STOP.

- NOT OK – The voltage is not correct. Proceed to Test Step 6.

Test Step 6. CHECK THE BTB+ OUTPUT CIRCUIT

A. Stop the engine.

B. Disconnect three terminal connector J1 on the BTB+.

C. Measure the resistance from pin A to pin B of J1.

Expected Result:

The resistance should be 14.6 ohms ± 3.0 ohms.

Results:

- OK – The resistance is correct. There may be an intermittent problem.

  Repair: The system may need to be reset. Shut down the system by turning the ECS to the OFF/RESET position. Then, restart the genset and verify that the genset is operating properly. Watch the genset for any recurrence of the problem.

  STOP.

- NOT OK – The resistance is not correct. The BTB+ is faulty.

  Repair: The BTB+ has failed. Replace the BTB+. Refer to Testing and Adjusting, “EMCP Electronic Control (Bus Transformer Box) - Replace”

  STOP.

i02891659

GSC CID 1170 - FMI 04

SMCS Code: 1409-035

Conditions Which Generate This Code:

The Bus Transformer Box (BTB +) reduces the AC line to neutral voltages of phase A and phase C from the bus to usable signal levels for the GSC+P. The GSC+P uses these reduced signals for detecting the phase sequence of the bus. The GSC+P will utilize the signal of phase A in order to measure the amplitude of the voltage on the bus. The GSC+P will utilize the signal of phase C in order to measure the frequency of the voltage on the bus.

The possible cause of CID 1170 FMI 04 diagnostic code is an open neutral connection to the input of the BTB +. An open neutral will cause a phase angle of approximately 180°.

Test Step 1. CHECK THE VOLTAGE OF THE INPUTS TO THE BUS TRANSFORMER BOX (BTB +)

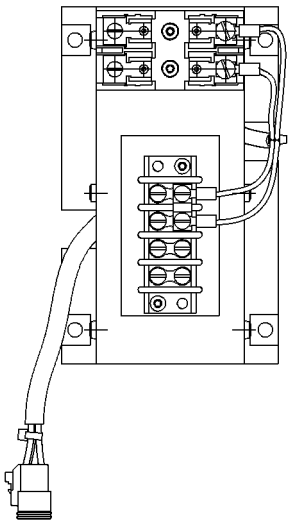


Illustration 80 g00603288
Bus transformer box

A. Turn the Engine Control Switch (ECS) to “STOP”.

B. Locate the input wires of the BTB +.

C. Start the engine and run the engine at rated speed.

D. Close the breaker in order to energize the bus.

E. Measure the voltage from phase A to the neutral lead. Also, measure the voltage from phase C to the neutral lead. Record the voltage readings.

F. Measure the voltage from Phase A to Phase B.

G. Compare the voltages measured in the previous two steps.

Expected Result:

The voltage measured from Phase A and Phase C to the neutral lead should be greater than 55% to 60% of the voltage measured from Phase A to Phase B.

Results:

- OK – The voltage measured from Phase A and Phase C to the neutral lead is greater than 55% to 60% of the voltage measured from Phase A to Phase B. Proceed to Test Step 2.

- NOT OK – The voltage measured from Phase A and Phase C to the neutral lead is NOT greater than 55% to 60% of the voltage measured from Phase A to Phase B.

  Repair: The neutral wire is open. Use the System Schematic for the BTB + and the AC schematic in Testing And Adjusting, “Schematics And Wiring Diagrams” section to troubleshoot the wiring and find the exact cause of the diagnostic code.

  STOP.

Test Step 2. CHECK VOLTAGE ON GSC+P INPUT.

A. Stop the engine. Turn the ECS to “STOP”.

B. Install cable probes on the GSC+P 40-pin connector pins 17 and 18.

C. Start the engine and run the engine at rated speed.

D. Close the breaker in order to energize the bus.

E. On the GSC+P, measure the voltage from connector pin 17 to the negative battery terminal, and from connector pin 18 to the negative battery terminal. Record the voltage measurements.

F. Measure the voltage between the GSC+P connector pin 17 and the GSC+P connector pin 18. Record the voltage measurements.

G. Compare the voltages measurements with the voltage measurements recorded from the previous two steps.

Expected Result:

The voltage measured from pin 17 and 18 to the negative battery terminal should be greater than 55% to 60% of the voltage measured between pin 17 and pin 18.

Results:

- OK – The voltage measured from pin 17 and pin 18 to battery negative is greater than 55% to 60% of the voltage measured between pin 17 and pin 18. The GSC+P may have failed.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the cause of the problem is the same, replace the GSC+P. Refer toTesting and Adjusting, “EMPC Electronic Control (Generator Set) - Replace”.

  STOP.

- NOT OK – The voltage measured from pin 17 and 18 to the negative battery terminal is NOT greater than 55% to 60% of the voltage measured between pin 17 and pin 18.

  Repair: The AC ground wire is open between the BTB+ and the GSC+P, or the jumper between terminals “B21” and “B22” on the BTB+ is broken or damaged. Repair the wire or replace the wire. Use the System Schematic for the BTB + and the AC schematic in to troubleshoot the wiring and find the exact cause of the diagnostic code. Refer to Testing And Adjusting, “Schematics And Wiring Diagrams”. If none of these repairs corrects the problem, replace the BTB +. Refer to Testing and Adjusting, “EMPC Electronic Control (Bus Transformer Box) - Replace”.

  STOP.

i02892004

GSC CID 1170 - FMI 08

SMCS Code: 1409-035

Conditions Which Generate This Code:

The Bus Transformer Box (BTB +) reduces the AC line to neutral voltages of phase A and phase C from the bus to usable signal levels for the GSC+P. The GSC+P uses these reduced signals for detecting the phase angle with the generator. The GSC+P also uses these reduced signals for detecting the phase sequence of the bus. The GSC+P will utilize the signal of phase A in order to measure the amplitude of the voltage on the bus. The GSC+P will utilize the signal of phase C in order to measure the frequency of the voltage on the bus.

The possible cause of a CID 1170 FMI 08 diagnostic code is an open connection from phase C to the input of the BTB +.

Test Step 1. CHECK THE BTB+ FUSES.

A. Stop the engine by turning the Engine Control Switch (ECS) to STOP.

B. Remove the two fuses from the BTB+.

C. Measure the resistance of the fuses with a digital multimeter.

Expected Result:

The resistance should be less than 1.0 ohms.

Results:

- OK – The resistance is less than 1.0 ohms. The fuses have not failed. Install the fuses. Proceed to Test Step 2.

- NOT OK – The fuses are blown.

  Repair: Replace the fuses.

  STOP.

Test Step 2. CHECK THE VOLTAGE OF THE INPUTS TO THE BUS TRANSFORMER BOX (BTB +)

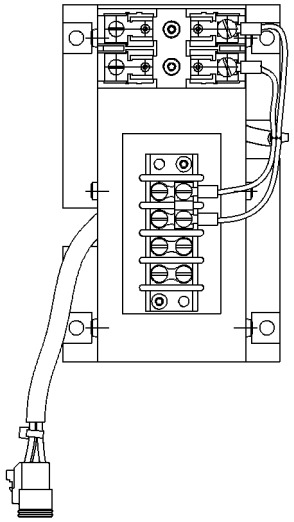


Illustration 81 g00603288
Bus transformer box

A. Turn the ECS to “STOP”.

B. Locate the input wires of the BTB +.

C. Start the engine and run the engine at rated speed.

D. Close the breaker in order to energize the bus.

E. Measure the voltage from phase A to phase C.

Expected Result:

The voltage should be the normal operating voltage.

Results:

- OK – The voltage is the normal operating voltage. Proceed to Test Step 3.
- NOT OK – The voltage is NOT the normal operating voltage.

  Repair: There is no voltage on phase C. Use the System Schematic for the BTB + and the AC schematic in Testing And Adjusting, “Schematics And Wiring Diagrams” section to troubleshoot the wiring and find the exact cause of the diagnostic.

  STOP.

Test Step 3. CHECK THE VOLTAGE ON THE OUTPUT OF THE BTB+.

A. Stop the engine. Turn the ECS to “STOP”.

B. Install cable probes on connector pins A and B of three terminal connector “J1” on the BTB+.

C. Start the engine and run the engine at rated speed.

D. Close the breaker in order to energize the bus.

E. Measure the voltage between connector pins A and B of “J1”.

Expected Result:

The voltage should be equal to the voltage measured in Test Step 2 divided by 15 ± 2% (14.7 to 15.3).

Results:

- OK – The voltage is correct. Proceed to Test Step 4.
- NOT OK – The voltage is NOT correct. The BTB+ has failed.

  Repair: The BTB + has failed. Replace the BTB +. Refer to Testing and Adjusting, “EMPC Electronic Control (Bus Transformer Box) - Replace”.

  STOP.

Test Step 4. CHECK THE INPUT WIRES OF THE GSC+P FROM THE BTB +.

A. Stop the engine. Turn the ECS to “STOP”.

B. Locate the input wires on pin 17, and pin 18 of the GSC+P from the BTB +. Install cable probes on these pins.

C. Start the engine and run the engine at rated speed.

D. Close the breaker in order to energize the bus.

E. Measure the voltage between the GSC+P connector pin 17 and pin 18.

Expected Result:

The voltage should be equal to the voltage measured in Test Step 2 divided by 15 ± 2% (14.7 to 15.3).

Results:

- OK – The voltage is correct. CID 1170 FMI 2 is still active.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

- NOT OK – The voltage is not correct. The wiring harness has failed between the BTB + and the generator.

  Repair: The wiring harness has failed between the BTB + and the generator. Repair the wiring harness or replace the wiring harness. Use the System Schematic for the BTB + and the AC schematic in the Testing And Adjusting, “Schematics And Wiring Diagrams” section.

  STOP.

Diagnostic System Procedures

i02892285

AL Fault Code

SMCS Code: 4490-035

Table 23

AL Fault Code Troubleshooting		
AL Fault Code	**Description**	**Troubleshooting**
AL1	High Water Temperature Alarm Coolant temperature increases to within 6°C (11°F) of setpoint P015.	Refer to the Troubleshooting, “Troubleshooting Dedicated Shutdown Indicators”.
AL2	Low Engine Coolant Temperature Alarm Coolant temperature decreases to setpoint P016.	Refer to the Troubleshooting, “Troubleshooting Dedicated Shutdown Indicators”.
AL3	Low Engine Oil Pressure Alarm Oil pressure drops to within 34 kPa (5 psi) of the P013 or P014 setpoint.	Refer to the Troubleshooting, “Troubleshooting Dedicated Shutdown Indicators”.
AL4	Fault Detected By Engine ECM The engine ECM detects an alarm fault or a shutdown fault.	Refer to the appropriate engine troubleshooting service manual.
AL5	Low Engine Coolant Level Fault Coolant level drops below the probe of the coolant loss sensor.	Check level of engine coolant. The level of engine coolant must be above the probe of the sensor. Check for CID 111 faults. Perform the electrical connector inspection test. Refer to the Testing and Adjusting, “Electrical Connector - Inspect”.
AL6	High Engine Oil Temp Fault Oil temperature increases to within 6°C (11°F) of setpoint P026.	Check level of engine coolant. The level of engine coolant must be above the probe of sensor. Check fan belt, etc. Check P026 setpoint.
AL7	Generator Overvoltage Fault Line to line voltages rises above the P102 or P105 setpoints.	Refer to the service manual for the voltage regulator that is being used. Check P101 through P106 setpoints.
AL8	Generator Undervoltage Fault Line to line voltage drops below the P108 or the P111 setpoints.	Refer to the service manual for the voltage regulator that is being used. Check P107 through P112 setpoints. Refer to the engine service manual for the cause of low engine speed. If engine speed is reduced and the engine control switch (ECS) is NOT in STOP, the GSC+P will issue this fault.
AL9	Generator Overfrequency Fault Frequency rises above the P114 or P117 setpoints.	Refer to the Troubleshooting, “Indicator For Engine Overspeed”. Check setpoints P113 through P118.
AL10	Generator Underfrequency Fault Frequency drops below the P120 or P123 setpoints.	Refer to the engine service manual for a cause of low engine speed. If engine speed is reduced and the ECS is NOT in STOP, the GSC+P will issue this fault. Check setpoints P119 through P124.
AL11	Generator Reverse Power Fault Reverse power rises above the P126 setpoint.	Refer to the engine service manual for a cause of lost engine power. Check setpoints P125 through P127.
AL12	Generator Phase Overcurrent Fault Phase current rises above the P129 or P134 setpoints.	Check for a cause of the overcurrent. Check setpoint P029 and setpoints P128 through P135.

(continued)

(Table 23, contd)

AL Fault Code Troubleshooting		
AL Fault Code	**Description**	**Troubleshooting**
AL13	Generator Total Overcurrent Fault Total current rises above the P131 or P136 setpoints.	Check for a cause of the overcurrent. Check setpoint P029 and setpoints P128 through P137.
AL14	Phase A No Voltage Input Fault Phase A voltage not being received at GSC+P input.	Check for an open circuit on the wire that is connected to the GSC+P connector pin 10. Check for a short on the wire that is connected to the GSC+P connector pin 10. Refer to the Testing And Adjusting, “Schematics and Wiring Diagrams”.
AL15	GSC+P Configuration Error Frequency of generator output voltage does not match engine speed.	Check setpoints P009 and P033. Setpoint P009 represents the number of ring gear teeth. Setpoint P033 represents the number of generator poles. Correct the setpoint value, if necessary.
Additional AL Fault Codes (for GSC+P)		
AL16	Incorrect Phase Sequence The generator and the bus have a phase mismatch.	Check for the cause of the phase sequence mismatch. Check wiring to the bus transformer box (BTB +) and the AC transformer box (ATB +).
AL17	Improper generator or bus voltage The generator voltage or the bus voltage are either too low or the voltages do not match.	1. The generator voltage and the bus voltage must be above 10% of the nameplate voltage in P028 when setpoint P020 is set to 700. Generator voltage and bus voltage must be above 50% of the nameplate voltage in P028 when setpoint P020 is set to any other value than 700. 2. Check Setpoints P303 and P304 in order to determine whether the generator voltage and the bus voltage match within the tolerance that is specified.
AL18	Synchronizer Time-Out [CTE_CURSOR]The GSC+P is unable to complete automatic synchronization or dead bus paralleling within the time allowed in P314.	Check for cause of synchronization time-out. Ensure that the engine is responding properly to the GSC+P Speed Adjust 1 Output signal. Check for wiring errors. Check setpoints P313 and P314 for proper values. Increase the values, if necessary.

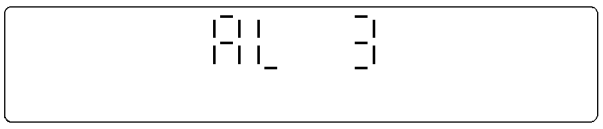


Illustration 82 g00442245

Upper Display With AL Fault Code AL3 Showing

AL Fault Codes are shown as “AL1” through “AL15” on the upper display. The fault codes include specific engine fault conditions. An example of a specific engine fault condition is the low engine oil pressure alarm. An example of a protective relaying function is the underfrequency fault.

AL fault codes depend on certain setpoints. For more information on setpoints, refer to the Systems Operation, “Service Mode”. AL fault codes are not diagnosed by the GSC+P. These codes are not stored in the fault log. Many of the AL fault codes are programmable as a fault alarm or as a fault shutdown. The AL fault codes are accompanied by either the fault alarm indicator or the fault shutdown indicator on the GSC+P in order to show the severity of the fault.

i02892435

SP Fault Code

SMCS Code: 4490-035

Illustration 83 g00578242

Upper Display With SP Fault Code SP1 Showing

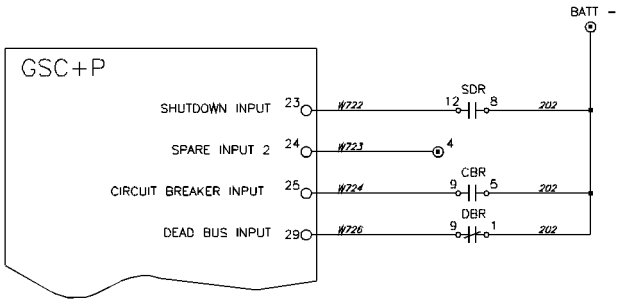


Illustration 84 g01440226

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+P 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, refer to System Operation, “Spare Input/Output Programming OP6”. The programmer (customer, operator or service personnel) should make a note of the actual conditions that cause an SP fault code to be shown on the upper display. The GSC+P does not diagnose the spare inputs. Spare faults are not recorded in the fault log.

The GSC+P treats an active input state as a fault. The active state can be programmed on the GSC+P as an active high or as an active low. The factory default is active low. An active high is within the range of +5 DCV to + battery. If the input remains floating, the GSC+P pulls up the input voltage to 10.5 DCV. In this case, the input is treated as an active high. An example of a floating input would be an open switch. An active low voltage on the input would measure the same as (“BATT-”).

When a spare fault occurs, the GSC+P determines the type of fault. There are two types of faults: alarm and shutdown. Then, the GSC+P FLASHES the corresponding fault alarm indicator or fault shutdown indicator. The SP fault code is immediately shown on the upper display for a shutdown fault. For an alarm fault, the alarm codes key is pressed first. Then, the SP fault code is shown on the upper display. After a spare fault is corrected or a spare fault is not present, the SP fault code is no longer shown on the upper display.

Table 24

Spare Fault Codes			
Spare Fault Code	**GSC+P Connector Pin**	**Terminal Strip**	**Related Setpoints**(1)
SP1 Spare Fault 1	23	N/A	SP01, SP02, SP03
SP2 Spare Fault 2	24	N/A	SP04, SP05, SP06
SP3 Spare Fault 3	25	N/A	SP07, SP08, SP09
SP4 Spare Fault 4	29	N/A	SP10, SP11, SP12

(1) Refer to Systems Operation, “Spare Input/Output Programming OP6”.

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 the shutdown fault. The spare inputs are accessed on the terminal strip within the control panel on an inside wall.

When an SP fault code is showing on the upper display, check the notes which were made by the service personnel in order to determine the cause.

The spare fault inputs can be used with the factory installed options and the customer installed options. The following items are the factory options for the spare fault input: ground fault, low fuel level, high fuel level, high generator winding temperature, and high generator bearing temperature. Each of these options will include a dedicated indicator and a label on the custom alarm module.

Troubleshooting Procedure

In order to troubleshoot spare faults, use the following general procedure.

1. Check for obvious causes which 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 Engine Control Switch (ECS) to the OFF/RESET position. Verify that the fault is still present.

4. Disconnect the responsible device from the spare fault input and verify if the fault still exists.

5. Check the wiring to the corresponding spare fault input for an unwanted short. The short can be to the negative battery terminal (“BATT-”). Also, The short can be to the positive battery terminal (“BATT+”).

i02893378

Troubleshooting Dedicated Shutdown Indicators

SMCS Code: 4490-035-IND

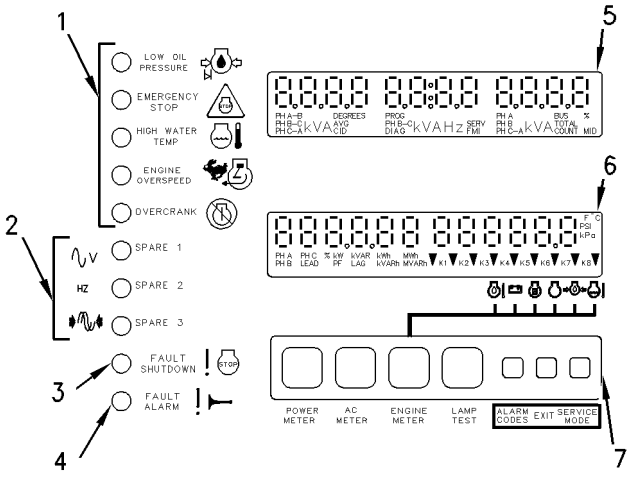


Illustration 85 g00688554

Display Area Of Generator Set Control + (GSC+P)

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

The dedicated shutdown indicators show the system that is responsible for an engine shutdown. The symbol and nomenclature that is located next to the indicator identifies the responsible system. Dedicated shutdown faults are activated automatically by the GSC+P. Dedicated shutdown faults depend on certain setpoints. When the GSC+P decides that operating conditions are critical, the GSC+P FLASHES the corresponding shutdown indicator. Then, the GSC+P shuts down the engine. The GSC+P 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
- Overcrank

To find the cause of a dedicated shutdown fault, perform the correct procedure.

i02893424

Indicator for Emergency Stop

SMCS Code: 4490-035-IND

System Operation Description:

In order to find the cause of an emergency stop shutdown, perform the following procedure.

Test Step 1. CHECK THE EMERGENCY STOP PUSH BUTTON (ESPB).

A. Pull out the ESPB in order to deactivate the push button. Some versions of ESPB must be turned clockwise before you pull out the ESPB.

B. Turn the Engine Control Switch (ECS) to the OFF/RESET position and then turn the ECS to the COOLDOWN/STOP position.

Expected Result:

The ESPB should pop out. The emergency stop indicator should be OFF.

Results:

- OK – The system is operating correctly. The problem may be intermittent.

  Repair: Check the harness and all electrical connections of the ESPB circuit. Refer to Testing and Adjusting, “Electrical Connector - Inspect”.

  STOP.

- ESPB NOT POPPED OUT – The ESPB does not pop out.

  Repair: Replace the ESPB.

  STOP.

- ESPB OUT, INDICATOR FLASHING – The ESPB pops out and the emergency stop indicator is FLASHING. Go to 2.

Test Step 2. CHECK THE EMERGENCY STOP INDICATOR.

Note: The following procedure will create 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+P.

C. Temporarily install a jumper from pin “39” of the GSC+P to “BATT-”. This simulates the OFF/RESET position of the ECS.

D. Check the operation of the emergency stop indicator.

Expected Result:

The emergency stop indicator should be OFF.

Results:

- OK – The problem is with the ESPB or the related wiring.

  Repair: Troubleshoot the circuit. Refer to the Generator Set Wiring Diagram. Refer to Testing And Adjusting, “Schematics and Wiring Diagrams”. Repair failed components or replace failed components, if necessary. Repair the wiring or replace the wiring, if necessary.

  STOP.

- NOT OK – The emergency stop indicator is FLASHING.

  Repair: The GSC+P may have failed. It is unlikely that the GSC+P has failed. Exit this procedure and perform this entire procedure again. If the problem remains, replace the GSC+P. Refer to Testing And Adjusting, “EMCP Electronic Control (Generator Set) - Replace”.

  STOP.

i02893433

Indicator for High Water Temperature

SMCS Code: 4490-035-IND

Reference: The engine Electronic Control Module (ECM) monitors the coolant temperature on C32 engines. The Electronic Control System (ECS) for the engine sends the information to the GSC+P. For troubleshooting, refer to System Operation Testing and Adjusting, RENR9968 or Troubleshooting, RENR9348.

Results:

- – STOP.

i02897098

Indicator for Low Coolant Level

SMCS Code: 4490-035-IND

System Operation Description:

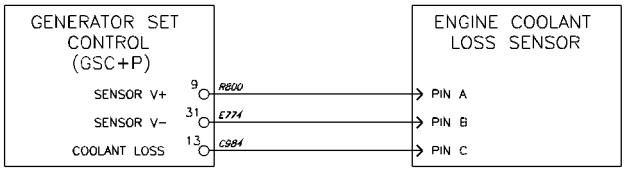


Illustration 86 g01442536

System Schematic For Engine Coolant Loss Sensor (ECLS)

In order to find the cause of a low level shutdown, perform this procedure.

Test Step 1. CHECK THE COOLANT LEVEL.

A. Check the level of the engine coolant. Refer to 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 coolant loss sensor.

Results:

- OK – The coolant level is at the proper level. Proceed to Test Step 2.
- NOT OK – Coolant level is not correct.

  Repair: Find the cause and correct the cause. Refer to the Engine Service Manual.

  STOP.

Test Step 2. CHECK FOR A DIAGNOSTIC FAULT.

A. Turn the Engine Control Switch (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 diagnostic code. CID 111 describes the coolant loss sensor. Refer to 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.

  Repair: The fault may be intermittent. Check the harness and all the electrical connections of the circuit for the low coolant level. Refer to Testing And Adjusting, “Electrical Connector - Inspect”.

  STOP.
- NOT OK – CID 111 is active.

  Repair: Correct the active CID 111. Refer to Testing And Adjusting, “Troubleshooting Diagnostic Codes”.

  STOP.
- NOT OK – CID 111 is NOT active. The indicator for the low coolant level is FLASHING.

  Repair: Therefore, the sensor has failed. Replace the coolant loss sensor.

  STOP.

i02895157

Indicator for Low Oil Pressure

SMCS Code: 4490-035-IND

Reference: The engine Electronic Control Module (ECM) monitors the oil pressure on C32 engines. The Electronic Control System (ECS) for the engine sends the information to the GSC+P. For troubleshooting, refer to System Operation Testing and Adjusting, RENR9968 or Troubleshooting, RENR9348.

Results:

- – STOP.

i02901013

Indicator for Overcrank

SMCS Code: 4490-035-IND

Reference: On C32 package generator sets, cranking is controlled by the engine Electronic Control Module (ECM). For troubleshooting, refer to System Operation Testing and Adjusting, RENR9968 or Troubleshooting, RENR9348.

Results:

- – STOP.

Testing and Adjusting Section

Testing and Adjusting

i02918685

Electrical Connector - Inspect

SMCS Code: 7553-040

Reference: Special Instruction, SEHS9615, “Servicing DT Connectors”.

Reference: Special Instruction, REHS0148, “Listing Of Deutsch Connector Components”

Reference: Special Instruction, SEHS9065, “Use Of CE Connector Tools”.

Reference: Service Magazine, SEPD0342, 27 January 97, “Field Repair Of Single Wire Breaks In Harnesses (Sealed Splice)”.

Reference: Service Magazine, SEPD0371, 28 July 97, “Protection Of Unsealed Electrical Terminations For Machines In Corrosive Applications”.

Reference: Service Magazine, SEPD0473, 24 May 99, “New DT Connector Plugs With Improved Seal Retention”.

Reference: Service Magazine, SEPD0545, 09 October 00, “Dielectric Grease Should Not Be Used In Electrical Connectors”.

Reference: Pocket Guide, SEBD0402, “Guidelines For Routing And Installing Wire Harness Assemblies”.

Use this procedure under the following situation:

Use the following steps to help determine if the connector is the cause of the problem. If a problem is found in the electrical connector, repair the connector and verify that the problem has been corrected.

The following background information is related to this procedure:

Many of the operational procedures and the diagnostic code procedures in this troubleshooting guide will instruct you to check a specific electrical connector.

Intermittent electrical problems are often caused by poor connections. Always check for an active diagnostic code before breaking any connections. Also, always check for an active diagnostic code after the connector is reconnected in order to verify that the problem disappears.

Simply disconnecting the connectors and then reconnecting the connectors can temporarily solve a problem at times. If this occurs, likely causes are loose terminals, bent terminals, improperly crimped terminals, corrosion, or harness routing that is improper.

The original source of the problem must then be identified in order to ensure that the problem does not reoccur.

Follow this procedure to thoroughly inspect the connectors in order to determine if the connectors are the cause of the problem.

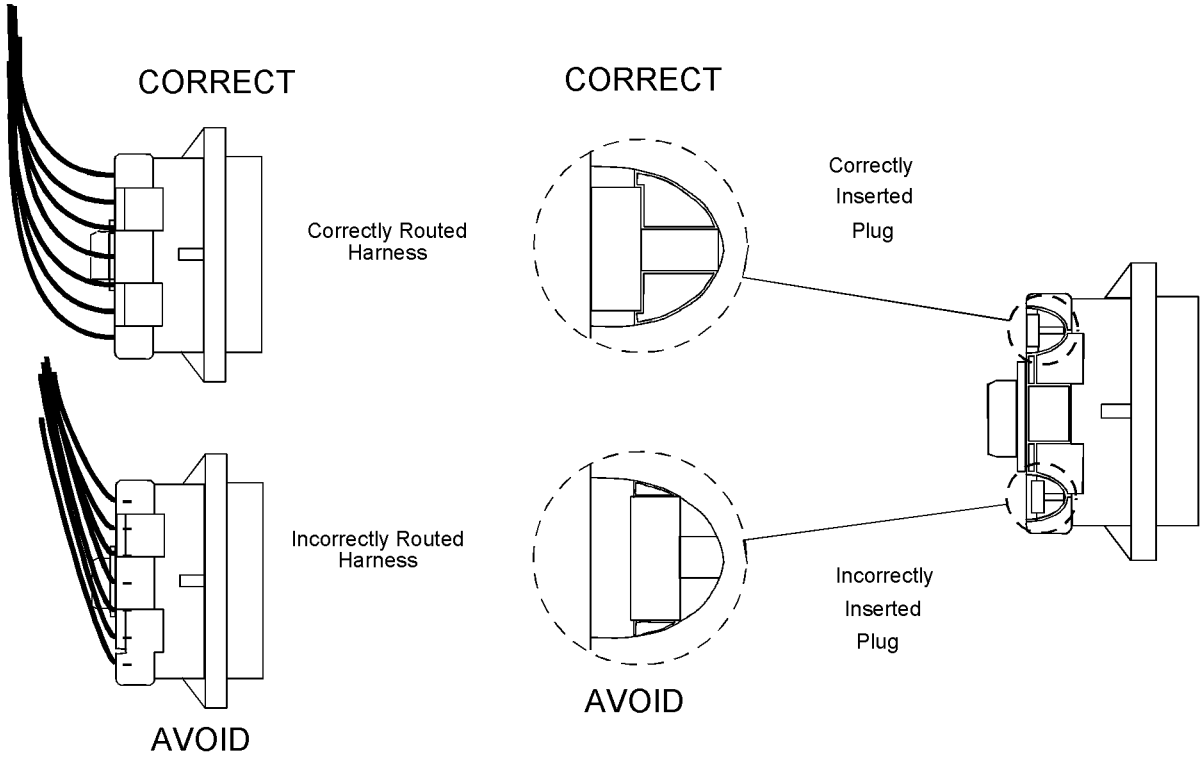


Illustration 87 g01135980

Correct way to route a harness and insert a plug

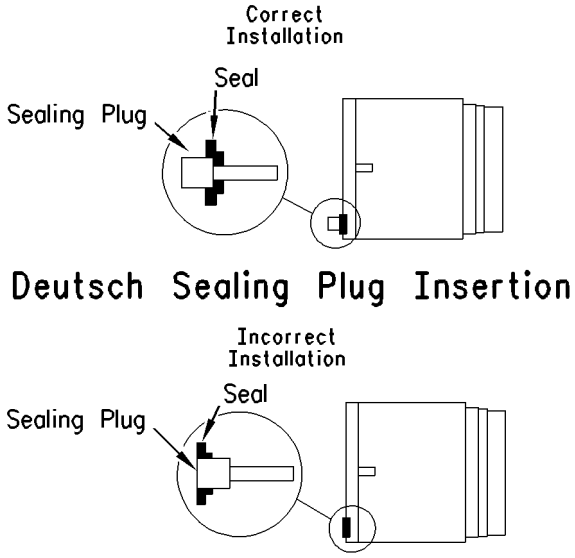


Illustration 88 g00690571

Proper Installation of Plug

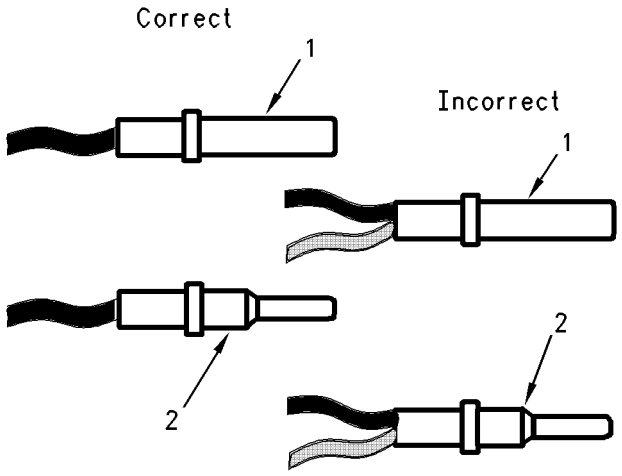


Illustration 89 g00828600

DT Type sealing plug

The 8T-8729 Connector Pin (2) and the 8T-8730 Connector Socket (1) is designed to accept only one 16/18 AWG wire. Do not insert multiple wires of a smaller wire size. An incorrect method would be using two 24 AWG wires. The 9W-0852 Connector Pin and the 9W-0844 Connector Socket is designed to accept only one 14 AWG wire. Do not insert multiple wires of a smaller wire size. An example of an incorrect method is the use of two 20 AWG wires.

1. CHECK THE CONNECTORS.

a. Ensure that the connector is properly locked. Also, ensure that the two halves of the connector can not be pulled apart.

b. Verify that the latch tab of the connector is properly latched. Verify that the latch tab of the connector is fully latched.

Expected Result: The connector will securely lock. The connector and the locking mechanism are without cracks or breaks.

Results:

OK – The connector will securely lock. The connector and the locking mechanism are without cracks or breaks. Proceed to test step 2.

NOT OK – A problem exists with the connector.

Repair: Repair the connector or replace the connector, as required.

STOP.

2. CHECK THE ALLEN HEAD SCREW ON THE HARNESS CONNECTOR OF THE ECM.

a. Ensure that the connector bolt is properly tightened. Be careful not to tighten the bolt too much. The bolt may break.

b. Do not exceed 6.0 N·m (53.0 lb in) of torque on the connector bolt of the harness when the connector is being installed on the ECM.

Expected Result: The harness connector is secure and the connector bolt of the ECM is properly torqued.

Results:

OK – The harness connector is secure and the connector is properly torqued. Proceed to test step 3.

NOT OK – A problem exists with the connector.

Repair: Secure the harness connector of the ECM. Ensure that the connector bolt is properly torqued.

STOP.

3. PERFORM A PULL TEST ON EACH CONNECTOR CONTACT.

a. Each connector contact should withstand 45 N (10 lb) of pull. Each wire should remain in the connector body. This test checks whether the wire was properly crimped in the contact and whether the contact was properly inserted into the connector.

b. The DT connectors use an orange wedge to lock the terminals in place.

c. Check in order to ensure that the orange wedge is not missing and that the orange wedge is installed properly on the DT connectors.

Note: A Crimp Tool should ALWAYS be used in order to crimp wires on connector contacts. Do not solder the terminals. Use the proper Crimp Tool.

Expected Result: Each connector contact should withstand 45 N (10 lb) of pull. Each wire remains in the connector body.

Results:

OK – Each connector contact withstands 45 N (10 lb) of pull. Each wire remains in the connector body. Proceed to test step 4.

NOT OK – A problem exists with the connector.

Repair: Repair the wiring or replace the connector contact.

STOP.

4. CHECK THE WIRES FOR NICKS OR ABRASIONS IN THE INSULATION.

a. Carefully inspect each wire for signs of abrasion, nicks, or cuts.

The following areas are locations that should be checked:

- Exposed insulation
- Points of rubbing wire

b. Check all of the hold down clamps for the harness in order to verify that the harness is properly clamped. Also check all of the hold down clamps for the harness in order to verify that the harness is not compressed by the clamp. Pull back the harness sleeves in order to check for a flattened portion of wire. The flattened portion of wire is caused by the clamp that holds the harness.

Expected Result: The wires are free of abrasion, nicks, or cuts and the harness is properly clamped.

Results:

OK – The wires are free of abrasion, nicks, or cuts and the harness is properly clamped. Proceed to test step 5.

NOT OK – A problem exists with the wiring.

Repair: Repair the wires or replace the wires, as required.

STOP.

5. CHECK THE CONNECTORS FOR MOISTURE OR CORROSION.

a. Ensure that the connector seals and the white sealing plugs are in place. If any of the seals or plugs are missing, replace the seal or plug. If necessary, replace the connector.

b. Check all of the wiring harnesses in order to verify that the harness does not make a sharp bend out of a connector. This will deform the connector seal and this will create a path for the entrance of moisture. See Illustration 87.

Note: It is normal to see some minor seal abrasion on the ECM connector seals. Minor seal abrasion will not allow the entry of moisture.

c. Thoroughly inspect ECM connectors for evidence of moisture entry. If moisture or corrosion is evident in the connector, the source of the moisture entry must be found and the source of the moisture entry must be repaired. If the source of the moisture entry is not repaired, the problem will reoccur. Simply drying the connector will not fix the problem. Likely paths for the entrance of moisture are from missing seals, improperly installed seals, nicks in exposed insulation, and improperly mated connectors.

Note: Moisture can also travel from one connector through the inside of a wire to the ECM Connector. If moisture is found in the ECM connector, thoroughly check all connectors and wires on the harness that connect to the ECM. The ECM is not the source of the moisture. Do not replace an ECM if moisture is found in either ECM connector.

Note: If corrosion is evident on the contacts or the connector, use only denatured alcohol to remove the corrosion. Use a cotton swab or a soft brush to remove the corrosion. Do not use cleaners that contain trichloro-ethylene because trichloro-ethylene may damage the connector.

Expected Result: All of the connectors should be completely coupled and all of the seals should be completely inserted. The harness and the wiring should be free of corrosion, moisture, abrasion or pinch points.

Results:

OK – All of the connectors are completely coupled and all of the seals are completely inserted. The harness and the wiring are free of corrosion, moisture, abrasions or pinch points. Proceed to test step 6.

NOT OK – A problem exists with the connector, the wiring or the wiring harness. Moisture is present.

Repair: Repair the connectors or wiring and/or replace the connectors or wiring. Ensure that all of the seals are properly in place and ensure that the connectors are completely coupled. Verify that the repair eliminates the problem by operating the machine for several minutes and by checking again for moisture.

STOP.

6. INSPECT THE CONNECTOR CONTACTS.

a. Verify that the contacts are not damaged. Verify that the contacts are properly aligned in the connector and verify that the contacts are properly located in the connector.

Expected Result: The contacts are properly aligned and the contacts appear undamaged.

Results:

OK – The contacts are properly aligned and the contacts appear undamaged. Proceed to test step 7.

NOT OK – A problem exists with the connector contacts.

Repair: Repair the contacts and wiring and/or replace the contacts and wiring.

STOP.

7. CHECK THE FIT OF THE CONTACTS.

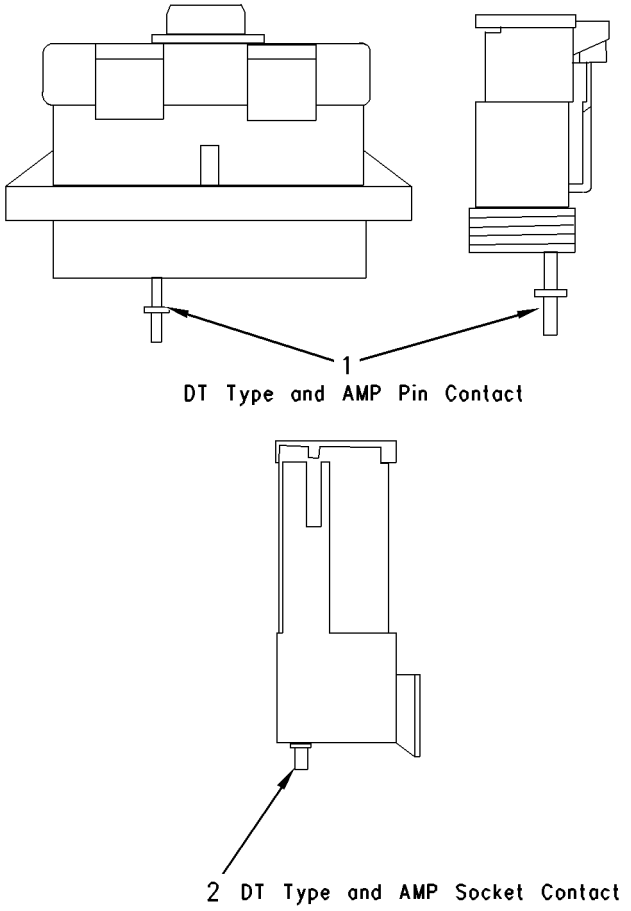


Illustration 90 g00838765

Retention of the Connector

(1) Pin Contact
(2) Socket Contact

Note: This is especially important for intermittent problems.

a. Use a new pin contact. Insert the pin contact into each socket contact one at a time in order to check for a good grip on the pin contact by the socket contact.

b. Use a new socket contact. Insert the pin contact into each socket contact one at a time in order to check for a good grip on the pin contact by the socket contact. The pin contact are located on the mating side of the connector.

c. The connector contact should stay connected when the connector is held in the position shown in Illustration 90. The connector contact is the pin contact or the socket contact.

Expected Result: The pin contacts and the socket contacts appear to be OK.

Results:

OK – The pin contacts and the socket contacts appear to be OK. **STOP.**

NOT OK – A problem exists with the connector terminal.

Repair: Replace the connector contact.

STOP.

i02916819

Alarm Module Control - Adjust

SMCS Code: 4490-025

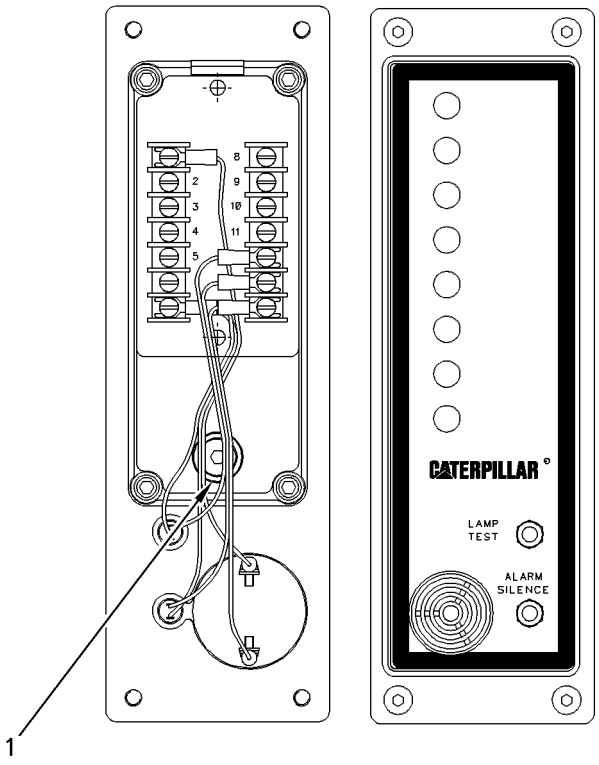


Illustration 91 g00482185

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 factory setting of the alarm setpoint is 24 DCV.

Adjustment Procedure

1. Gain access to the rear of the ALM. Removal of the ALM is not necessary unless removing the ALM is needed for access. All wiring remains connected to the terminals of the ALM unless the step notes otherwise.

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. The positive lead connects to terminal 1. The negative lead connects to terminal 7. Set the power supply voltage to the desired low DCV alarm setpoint. The setpoint must be between 8 and 38 volts.

5. Turn the adjustment potentiometer clockwise until the potentiometer stops.

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.

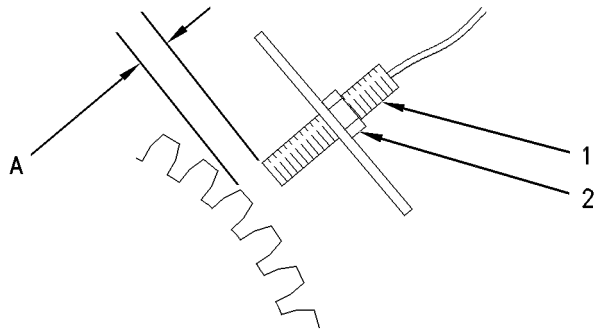
8. Replace the plug.

9. Disconnect the variable DC power supply and reconnect the wires to terminals 1 and 7.

i02916844

Speed Sensor (Engine) - Adjust

SMCS Code: 1907-025



g00289497

Illustration 92

Speed Sensor

(1) Speed sensor
(2) Locknut
(A) Air gap

Note: The engine speed sensor is also referred to as a magnetic pickup sensor.

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).

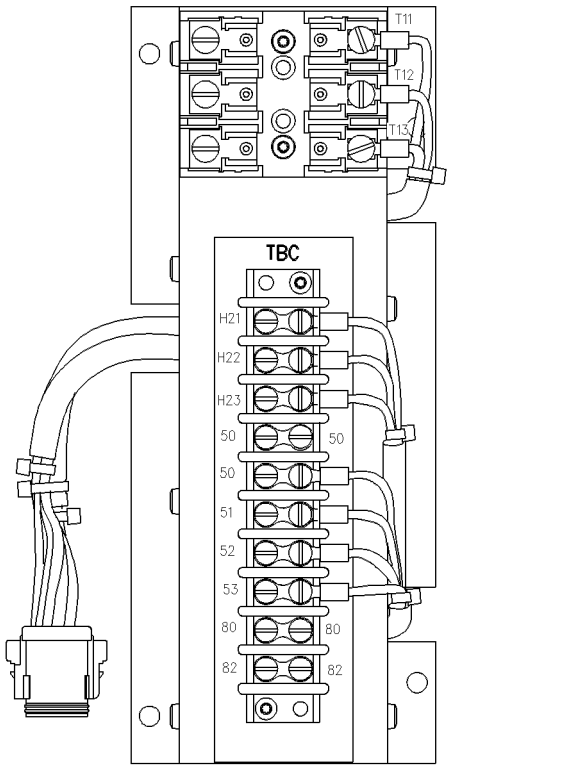
4. Tighten locknut (2) to 25 ± 5 N·m (18 ± 4 lb ft).

Note: Do not allow speed sensor (1) to turn as locknut (2) is tightened.

i02900007

EMCP Electronic Control (AC Transformer Box) - Replace

SMCS Code: 1409-510



g00436522

Illustration 93

AC Transformer Box + (ATB+)

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 ATB+ 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, refer to the Generator Set Wiring Diagram in Testing And Adjusting, “Schematics and Wiring Diagrams”.

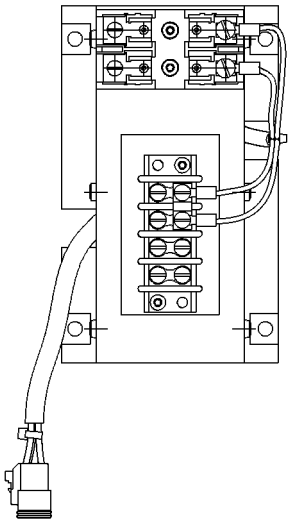
7. Program the bar code (calibration value) for the voltmeter/ammeter into the GSC+. Refer to System Operation, “Voltmeter/Ammeter Programming OP8”.

8. If the generator set is operating in parallel with another generator set and the voltmeter values must match, then reprogram the AC offset. Refer to System Operation, “AC Offset Adjustment OP10”.

i02900009

EMCP Electronic Control (Bus Transformer Box) - Replace

SMCS Code: 1409-510



g00603288

Illustration 94

Bus Transformer Box + (BTB+)

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 BTB+ 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 BTB+ connector from the harness connector.

4. Remove all mounting nuts and mounting screws that fasten the BTB+ to the subpanel. Remove the BTB+.

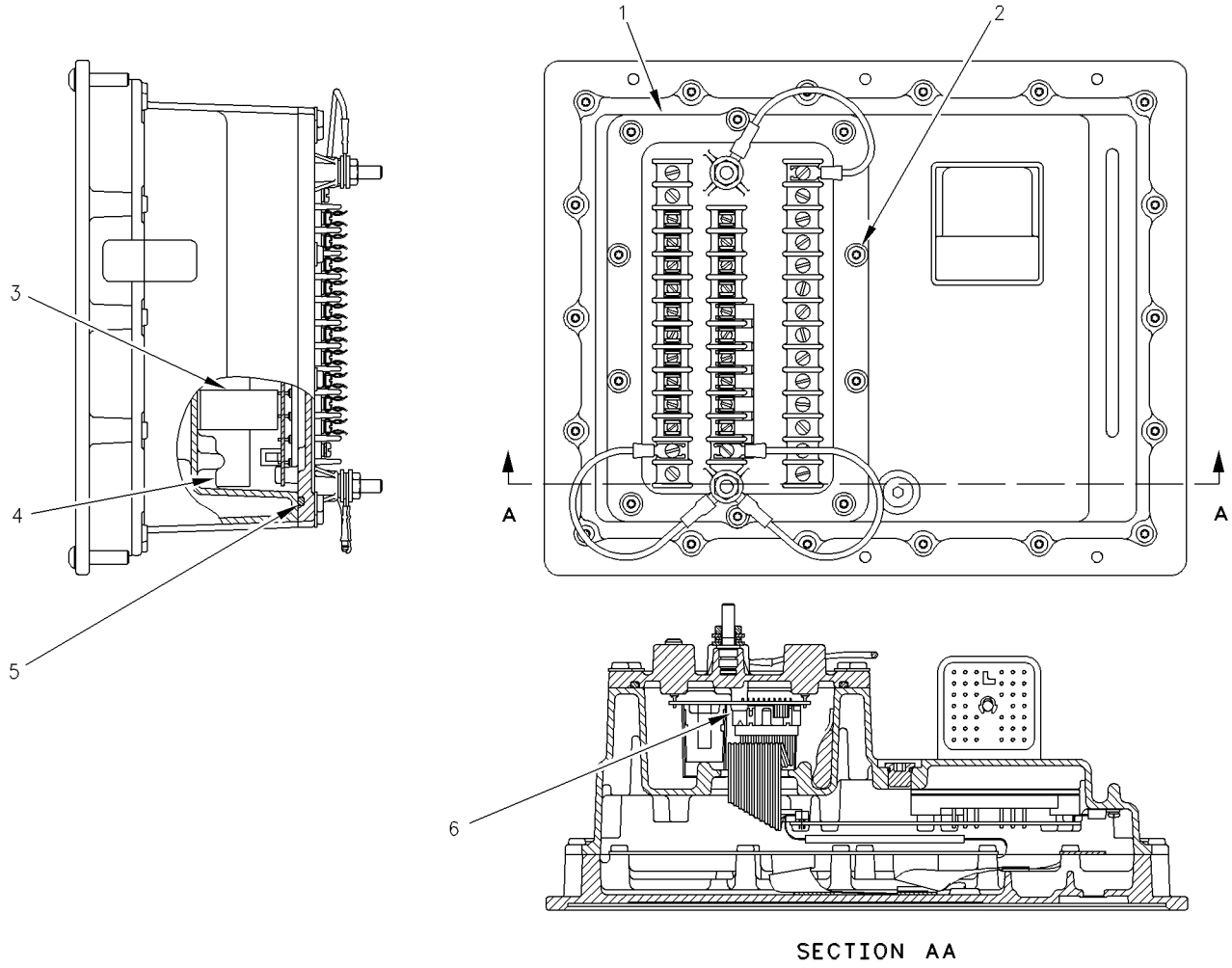
5. Place the new BTB+ in the subpanel. Install the mounting nuts and mounting screws. Tighten the mounting nuts and mounting screws.

6. Reconnect the harness connector to the BTB+. Reconnect all the wires to the terminal strip that were removed. Reconnect the positive lead wire to the battery. If necessary, refer to the “Generator Set Wiring Diagram” in Testing And Adjusting, “Schematics and Wiring Diagrams”.

i02900022

Relay Module - Replace

SMCS Code: 4490-510



g00583564

Illustration 95

Replacement Of The Relay Module

The Rear View of the GSC+P

(1) Relay Module
(2) Screws
(3) Tape
(4) Desiccant Package
(5) O-Ring Seal
(6) Cable connector

Relay module (1) contains the: relays, fuses, and terminals that are used to operate external devices of the EMCP II+P system. Relay module (1) is a component of the GSC+P.

Reference: Special Instruction, SEHS9710, “Relay Module Replacement”.

Replacement Procedure

1. Remove the positive lead wire from the battery.

2. Make sure that all wires at the terminal strips of the relay module (1) are marked with the respective termination point. During reassembly these wires must be reattached to the correct terminal. Remove all wires from the terminals and posts of relay module (1).

3. Remove ten screws (2) that fasten relay module (1) to the GSC+P.

4. Be aware that O-ring seal (5) exists. Partially separate relay module (1) from the GSC+P. Carefully disconnect cable clamp and cable connector (6) from relay module (1).

   On the PC board of the original relay module and the replacement relay module, check that the small jumper block (near the ribbon cable) is the same. Refer to Testing And Adjusting, “AC Voltage Range - Adjust”.

5. Replace desiccant package (4) with the new desiccant package and tape that is included with the replacement relay module. Attach the new desiccant package in the same manner as the one removed.

Note: Do not remove the new desiccant package from the protective container until immediately before it is installed into the GSC+P. Installing the replacement relay module should take approximately 20 minutes. Longer periods of time will cause the desiccant package to become saturated with moisture particularly if in a humid environment.

6. Install new O-ring seal (5) in the groove of relay module (1). Make sure that O-ring seal (5) is seated properly. Align and reconnect cable connector (6) to the relay module (1). Install the cable clamp.

7. Place relay module (1) on the GSC+P. Check that O-ring (5) remains seated. Align the screw holes of relay module (1) and the GSC+P. Install and tighten ten screws (2) to 1.70 ± 0.25 N·m (15 ± 2 lb in).

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, Refer to the Generator Set Wiring Diagram in Testing And Adjusting, “Schematics And Wiring Diagrams”.

i02900024

EMCP Electronic Control (Generator Set) - Replace

SMCS Code: 4490-510

Replacement Procedure

1. The new GSC+P must be reprogrammed after the new GSC+P is installed. If the GSC+P that is being replaced is functional, then make a note of the following items: value of the hour meter, all engine setpoints, and any spare inputs/outputs. Refer to System Operation, “Engine/Generator Setpoint Viewing OP2-0” and System Operation, “Protective Relaying Setpoint Viewing OP2-1”.

2. Shut down the engine. Remove the positive lead wire from the battery.

3. Remove the harness connector from the GSC+P. A 4 mm hex wrench is required to turn the fastening screw.

4. Make sure that all wires at the terminal strips are marked with the respective terminal location for reassembly. Remove all wires from the terminals and from the posts of the relay module.

5. Remove the six nuts that fasten the GSC+P to the front panel. Remove the GSC+P.

6. Place the new GSC+P in the front panel. Install the six nuts. Tighten the nuts.

7. Reconnect the harness connector to the GSC+P. Reconnect all the wires to the terminals of the relay module that were removed. Reconnect the positive lead wire to the battery. If necessary, refer to the Generator Set Wiring Diagram Testing And Adjusting, “Schematics And Wiring Diagrams”.

8. Reprogram the setpoints, the spare inputs/outputs, the hour meter, the voltmeter/ammeter and the AC offset adjustment. Refer to System Operation, “Service Mode”. Use the values from the original GSC+P. Refer to Step 1.

i02900030

EMCP Electronic Control (Generator Set) - Flash Program

SMCS Code: 4490-591

Connection Procedure

This procedure is used to update the software for generator sets that have an Electronic Modular Control Panel II+P (EMCP II+P) with Generator Set Control +P (GSC+P). There is a procedure for connecting the service tools to the GSC+P and there is a procedure for flashing the software.

Table 25

Tools Needed
152-7143 GSC Data Cable
171-4400 Communication Adapter II Group (includes ALL of the following items)
171-4401 Communication Adapter II (includes CD-ROM and User Manual)(1)
160-0133 Data Link Cable 60.96 cm (24 in)(1)
160-0141 Serial PC Cable762 cm (25 ft)(1)
177-4595 Block/Foam (for carrying case)(1)
6V-3072 Carrying Case(1)
NEHS0758 Communication Adapter II CD-ROM and User Manual(1)

(1) Included in 171-4400, but may be ordered as a separate item

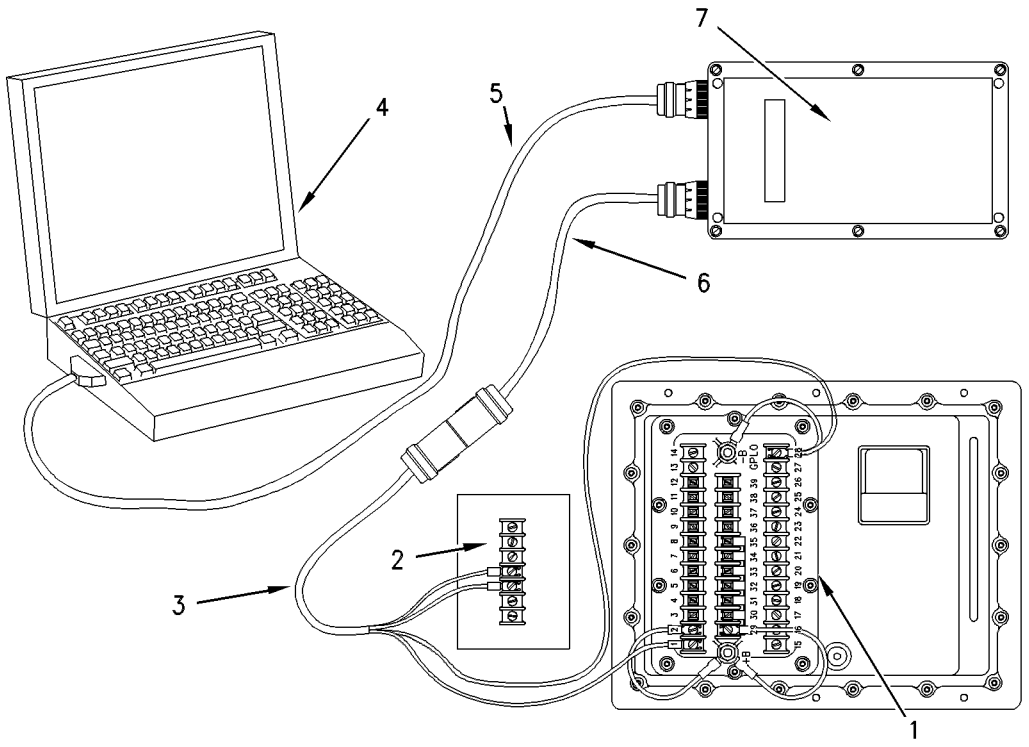


Illustration 96

g00615494

(1) Relay Module on the GSC+P Control
(2) AUX terminal strip
(3) 152-7143 GSC Data Cable
(4) Personal Computer
(5) 160-0140 PC/COMM Adapter Cable (formerly 7X-7425)
(6) 160-0133 Data Link Cable (formerly 139-4166
(7) 171-4401 Communication Adapter (formerly 7X-1701)

Note: This procedure is for Generator Set Control +P that is mounted in a EMCP II+P Panel. 24DCV must be available from the panel.

1. Verify that the generator set is not running. Turn OFF the power to the EMCP II+P panel by disconnecting the negative terminal of the battery.

2. Connect the communication adapter to the PC by using the 160-0141 PC/COMM Adapter Cable.

3. Connect the 160-0133 Data Link Cable to the “Data Link” port on the communication adapter.

4. Connect 152-7143 GSC Data Cable to the opposite end of the 160-0133 Data Link Cable.

5. Connect the “Data+” and “Data-” spade terminals of the cable to the appropriate terminals in the AUX terminal strip. The AUX terminal strip is located inside the EMCP II+P Panel. Connect the “Power+” spade terminal to “RM1” of the relay module on the GSC+P. Connect the “Power-” spade terminal to “RM28” of the relay module on the GSC+P.

6. Set the Engine Control Switch (ECS) to OFF/RESET. Connect the battery to the electrical system again. Then, turn the ECS to the COOL/STOP position.

7. Verify that the GSC+P and the communication adapter are receiving power.

8. Turn on the PC. The operating system on the computer must finish loading.

Flash Update Procedure

Note: Before starting this procedure, record setpoints P015, P016, and P026.

1. Obtain a copy of the flash file on a floppy disk or a CD-ROM. Refer to Special Instruction, “Accessing Flash Software For Machines”.

2. Find the CaterpillarElectronic Technician (ET) program by using the “File Manager”. Open Cat ET.

3. Start “WinFlash” by double clicking on the “WinFlash” icon with the pointer of the mouse. “WinFlash” is a part of the Cat ET software package.

4. After the start-up is complete, Cat ET will automatically try to connect to the GSC+P through the communication adapter.

5. The “WinFlash” program will display the serial numbers of any modules that are found on the data link.

6. Select the serial number of the unit that needs the software update. Click “OK”. The serial number of the GSC+P that is desired can be obtained by looking at the first value under OP2-2 in Service Mode. In order to obtain the value, press the “Service Mode” key on the GSC+P once. Then, press the “SCROLL UP” key once. The “SCROLL UP” key is also the “LAMP TEST” key. All GSC+P units have a serial number suffix of “HA”. This can be used for verification.

7. Insert the floppy disk or the CD-ROM that contains the flash file. Click on the “Select File” button and open the contents of the appropriate drive. Select the appropriate “.fls” file. If the flash file is already on the hard drive, select the file from the appropriate drive.

8. If the generator set has an energized-to-run solenoid, proceed to 9. If the generator has an energize-to-shutoff solenoid, wait for at least 70 seconds before proceeding to 9.

9. Click on the “Begin” button. The flash process should begin. A bar that shows the progress of the update will be displayed on the screen.

Note: If power loss to the GSC+P occurs, the Flash Update procedure must be restarted from the first step.

10. The display of the GSC+P will be blank and the “Fault Shutdown” indicator will be blinking while the software update is in progress.

11. Do not disturb the process until the process is finished. Once the process is finished, the GSC+P will automatically start working again. Exit the “WinFlash” software.

12. The GSC+P should now have the new software. In order to verify the version of the software, go to the display at OP2-2. Scroll up one time. Read the part number that is displayed. Check setpoints P015, P016, and P026. Reprogram if necessary.

13. Turn the ECS back to the “OFF/RESET” position and disconnect the negative terminal of the battery from the electrical system again. Disconnect the cables for the service tool. Remove the jumper wire from terminals 2 and 39 on the 40 contact connector if necessary. Close the panel.

14. Reconnect the battery to the electrical system and return the set back to service.

i02900031

Typical Generator Abbreviations

SMCS Code: 4490

52-AX – Circuit Breaker Auxiliary Contact

52-CC – Circuit Breaker Close Coil

52 – Generator Circuit Breaker

52-SDE – Circuit Breaker Trip Contact

52-SCM – Circuit Breaker Spring Charging Motor

52-ST – Circuit Breaker Shunt Trip

52-TR – Circuit Breaker Trip Unit (Power)

52-UVR – Circuit Breaker Under Voltage Release

A – Ampere

AC – Alternating Current

AC-CB# – AC circuit Breaker

AC-CR2 – AC Control Relay #2

ACT – Actuator

ADS – Engine Combustion Air Damper Position Switch

ALM – Alarm Module

ALS – Alarm Silence Push Button

ALT – Alternator

ASOS – Air Shutoff Solenoid

ASR – Air Shutoff Relay

ASSV – Air Start Solenoid Valve

ATB+ – AC Transformer Box

AUTO – Automatic Mode

AWG – American Wire Gauge

B- – Battery Negative Terminal On CCM

B+ – Battery Positive Terminal On CCM

“Batt-” – Battery Negative Terminal

“Batt+” – Battery Positive Terminal

BCF – Battery Charger Failure Switch

BTB – Bus Transformer Box

BVR – Bus Voltage Relay

C – Common

CAM – Custom Alarm Module

CAN – Controller Area Network

CAR – Custom Alarm Relay

CB – Circuit Breaker

CBCL – Circuit Breaker Close Light

CBCPB – Circuit Breaker Close Push Button

CBCR – Circuit Breaker Close Relay

CBOL – Circuit Breaker Open Light

CBOPB – Circuit Breaker Open Push Button

CBPR – Circuit Breaker Close Permissive Relay

CBR – Circuit Breaker Relay

CBRX – Circuit Breaker Relay Auxiliary

CCM – Customer Communication Module

CDR – Cooldown Relay

CDVR – Caterpillar Digital Voltage Regulator

CIM – Customer Interface Module

COOL – Cooldown Mode

CR1 – Control Relay

CSR – CT Shorting Relay

CT# – Current Transformer

CTR – Crank Termination Relay

D# – Diode

DBATR – Dead Bus Alternative Timing Relay

DBPR – Dead Bus Permissive Relay

DBPT – Dead Bus Permissive Timer

DBR – Dead Bus Relay

DBTR – Dead Bus Timing Relay

DC – Direct Current

DCT – Droop Current Transformer

DCV – DC Voltmeter

DS – Disconnect Switch

ECLC – Engine Coolant Loss Sensor Connector

ECLS – Engine Coolant Loss Sensor

ECM – Electronic Control Module

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

EOTC – Engine Oil Temperature Sensor Connector

EOTS – Engine Oil Temperature Sensor

EOPS – Engine Oil Pressure Sensor

ESL – Emergency Stop Light

ESPB – Emergency Stop Push Button

ESTOP – Emergency Stop

F# – Fuse

FCR – Fuel Control Relay

FPR – Fail To Parallel Relay

FPT – Fail To Parallel Timer

FRB – Fuel Rupture Basin

FS – Fuel Solenoid

FSOS – Fuel Shutoff Solenoid

GFR – Generator Fault Relay

GOL – Generator On Load

GOV – Governor

GRD – Ground

GRR – Generator Run Relay

GSC+P – Generator Set Control With Paralleling

HZ – Frequency Meter

JWH – Jacket Water Heater

K – Kilowatt

KWR – Kilowatt Level Relay

L1/L2/L3 – Phase A/B/C, Load Side Of Generator Circuit Breaker

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

LSM – Load Share Module

LSR – Load Sequence Relay

LWLAS – Low Water Level Alarm Switch

LWTL – Low Water Temperature Light

mA – Milliamp

MAN – Manual Mode

mm2 – Square Millimeter

MPU – Magnetic Speed Pickup

mSEC – Millisecond

NC – Normally Closed

NO – Normally Open

OCL – Overcrank Light

OP – Oil Pressure

OPL – Oil Pressure Light

OPT – Optional

ORR – Off/Reset Relay

ORRX – Off/Reset Relay Auxiliary

OSL – Overspeed Light

P – Pump

PB – Push Button

PCS – Paralleling Control Switch

PF – Power Factor

PL# – Panel Illumination Light

PLS – Panel Light Switch

PM – Permanent Magnet

PMG – Permanent Magnet Generator

POS – Positive

POT – Potentiometer

PP – Prelube Pump

PPMS – Prelube Pump Magnetic Switch

PPPS – Prelube Pump Oil Pressure Switch

PS – Pinion Solenoid

PSR# – programmable Spare Relay

POT – Potentiometer

PT# – Potential Transformer

PWM – Electrical Converter (Pulse Width Modulated)

R – Resistor

RAM – Remote Annunciator Module

RR – Run Relay

SAP – Speed Adjustment Potentiometer

SDR – Shutdown Relay

SEC – Second

SIAR – System In Auto Relay

SIG – Signal

SL – Synchronizing Light

SM – Starting Motor

SMMS – Starting Motor Magnetic Switch

SMR – Starting Motor Relay

SP# – Spare Input

SYNC – Synchronization

T1/T2/T3 – Phase A/B/C, Generator Side Of Generator Circuit Breaker

TB – Terminal Block

TSC – Transfer Switch Position Indicating Contact

V – AC Voltmeter

VAC – AC Voltage

VAS – Voltage Adjust Switch

VAR – Voltage Adjust Rheostat

VBR – Voltage Buildup Relay

VDC – DC Voltage

VFR – Voltage-Frequency Relay

VRAR – Voltage Regulator Alarm Relay

VRFR – Voltage Regulator Failure Relay

WT – Water Temperature

XDUCER – Transducer

i02900028

Symbols

SMCS Code: 4490

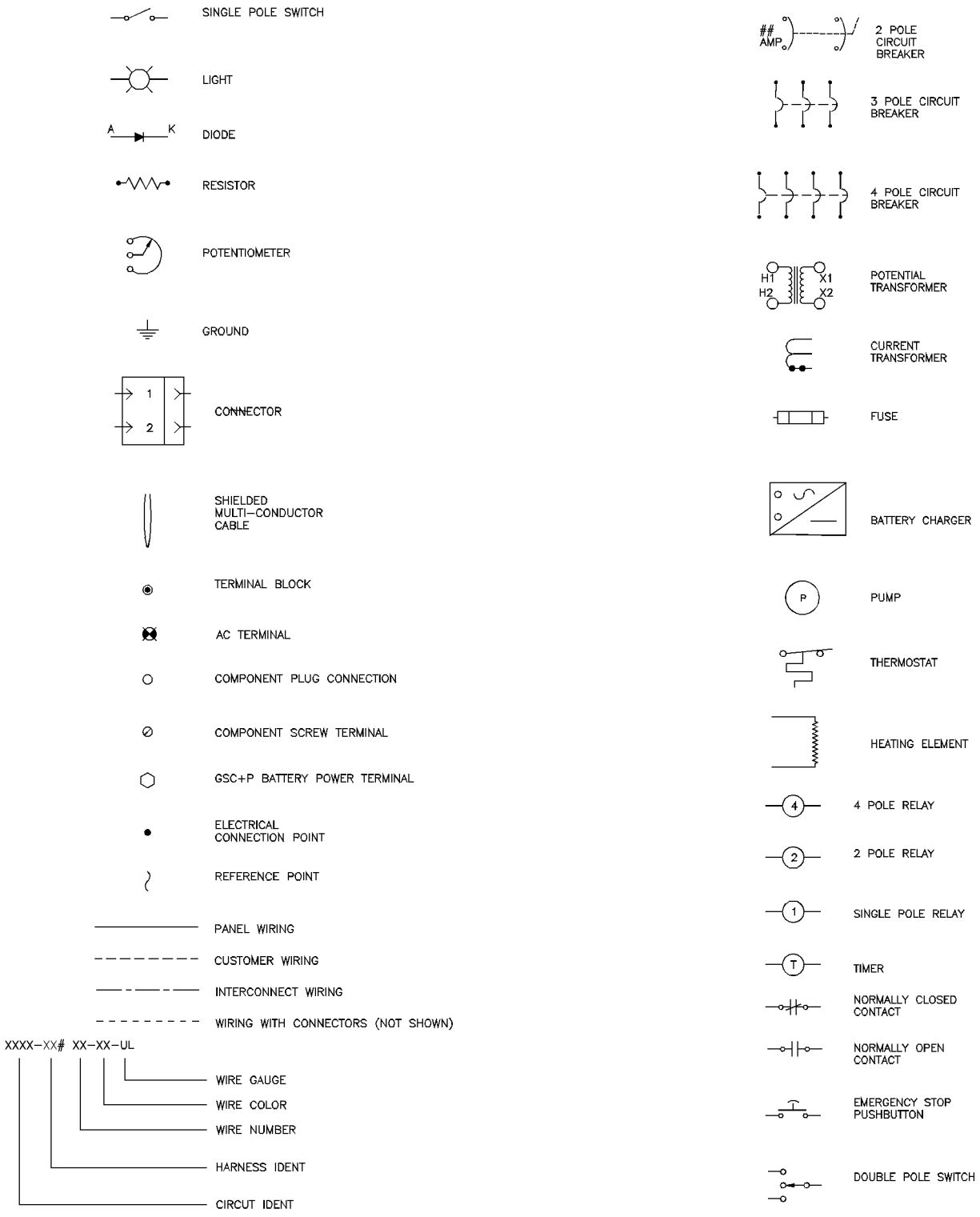


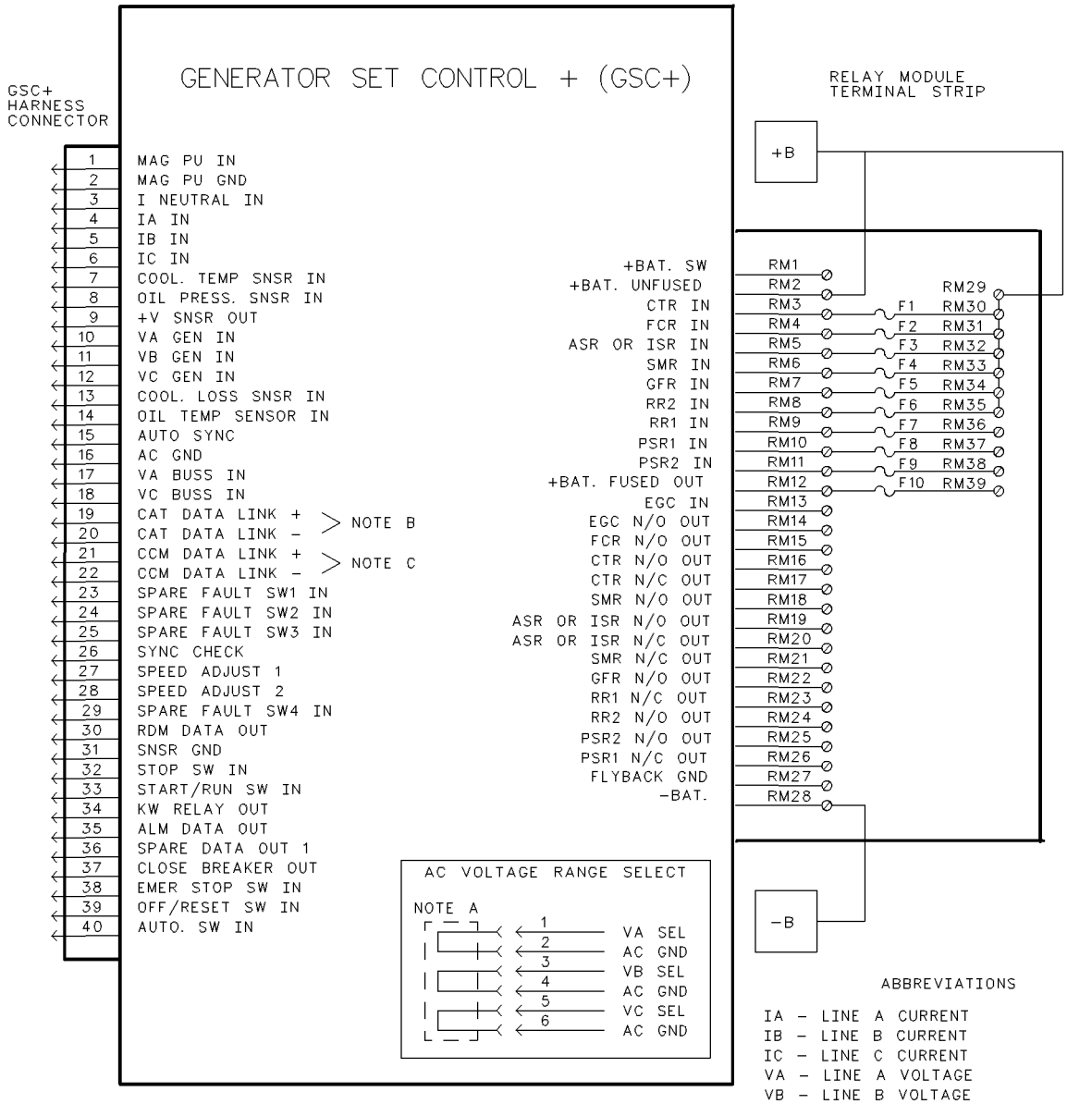
Illustration 97

g01443949

i02916911

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.

NOTE B: FOR MUI APPLICATIONS, CONNECTS TO CCM. FOR EUI APPLICATIONS, CONNECTS TO ENGINE ECM.

NOTE C: FOR MUI APPLICATIONS, NOT USED. FOR EUI APPLICATIONS, CONNECTS TO CCM.

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
ISR – IGNITION SHUT–OFF RELAY
PP – PRE–LUBE PUMP
ASR – AIR SHUT–OFF RELAY
CTR – CRANK TERMINATE RELAY
FCR – FUEL CONTROL RELAY
GFR – GENSET FAULT RELAY
PSR – PROGRAMMABLE SPARE RELAY
RR – RUN RELAY
SMR – STARTING MOTOR RELAY
GEN – GENERATOR
I – CURRENT

Illustration 98
g00508636

i02916935

Connector Contact Identification of Generator Set Control

SMCS Code: 4490; 7553

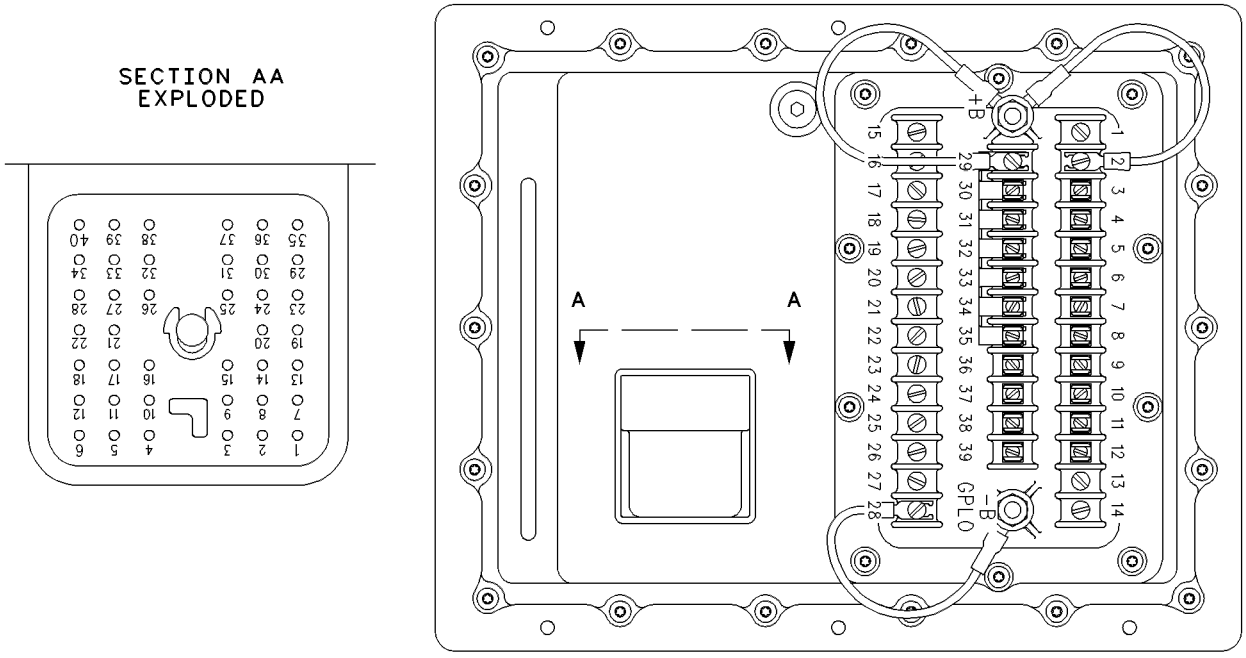


Illustration 99

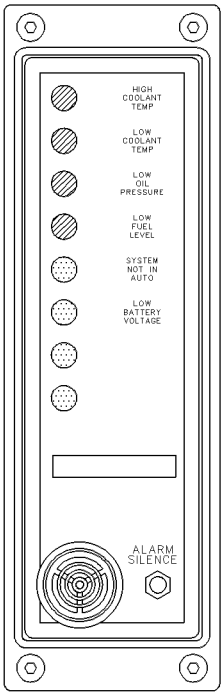
g00438305

i02900025

Schematics and Wiring Diagrams

SMCS Code: 7566

NFPA 99 Alarm Module For All Engines



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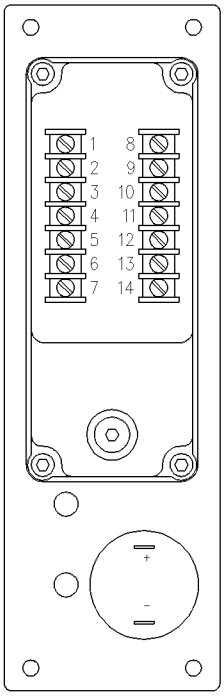

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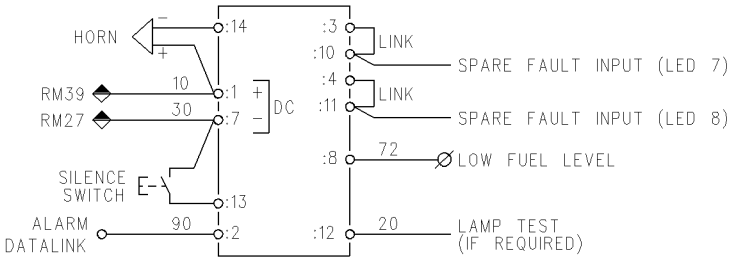
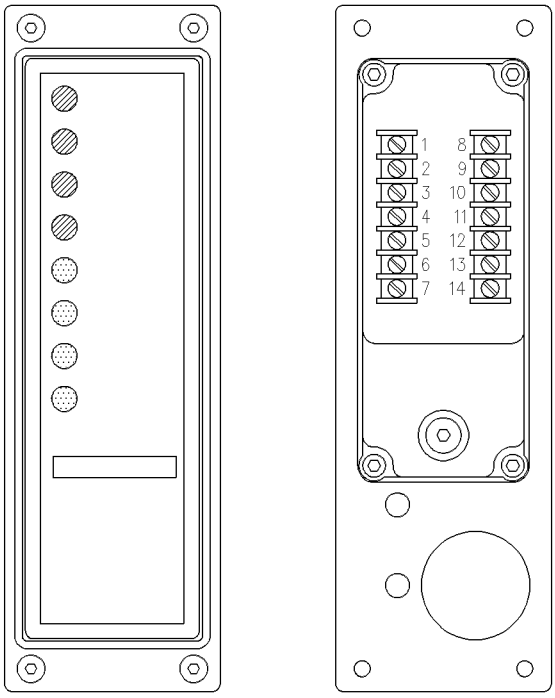


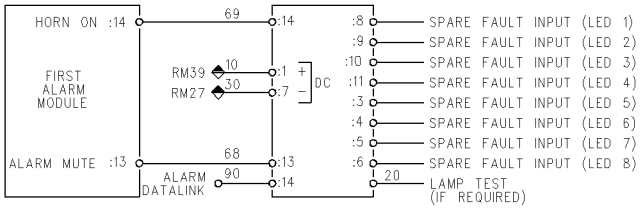
TERM. No.	CONNECTION DESCRIPTION
1	WIRE No. 10 (GSC RM39) & HORN B+
2	WIRE No. 90 (GSC 40 WAY No. 35) ALARM DATALINK
3	JUMPER TO 10
4	JUMPER TO 11
5	NOT CONNECTED
6	NOT CONNECTED
7	WIRE No. 30 (GSC RM27) & SILENCE SWITCH
8	LOW FUEL LEVEL SWITCHED B- INPUT
9	NOT CONNECTED
10	LED 7 (SPARE)
11	LED 8 (SPARE)
12	LAMP TEST B- INPUT (IF REQUIRED)
13	SILENCE SWITCH
14	HORN B-

Illustration 100

g00546229

Custom Alarm Module For All Engines

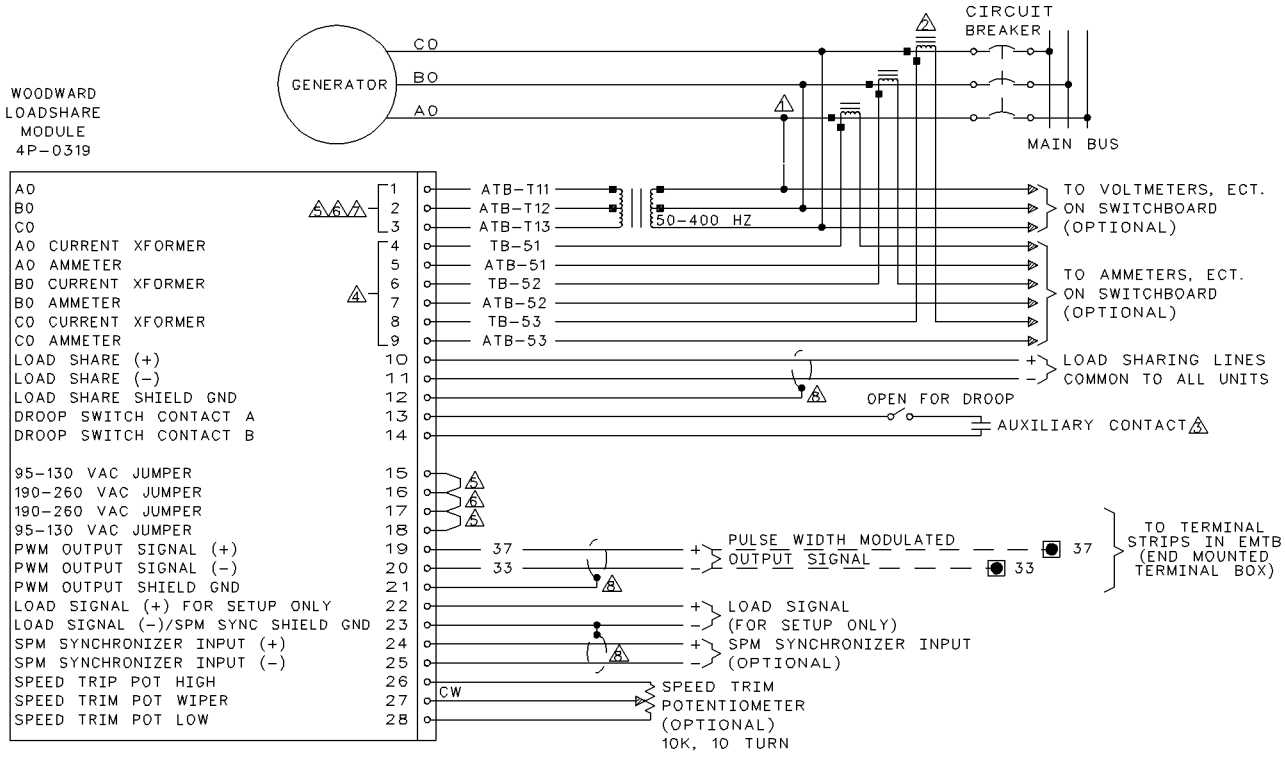




TERM. No.	CONNECTION DESCRIPTION
1	WIRE No. 10 (GSC RM39)
2	NOT CONNECTED
3	LED 5 SWITCHED B– INPUT
4	LED 6 SWITCHED B– INPUT
5	LED 7 SWITCHED B– INPUT
6	LED 8 SWITCHED B– INPUT
7	WIRE No. 30 (GSC RM27)
8	LED 1 SWITCHED B– INPUT
9	LED 2 SWITCHED B– INPUT
10	LED 3 SWITCHED B– INPUT
11	LED 4 SWITCHED B– INPUT
12	LAMP TEST B– INPUT (IF REQUIRED)
13	TERMINAL No. 13 ON 1st ALARM MODULE (ALM SILENCE)
14	TERMINAL No. 14 ON 1st ALARM MODULE (HORN ON)

Illustration 101
g00546230

Load Sharing Module



NOTES:

1. WITH A BALANCED THREE PHASE LOAD AND UTILITY POWER FACTOR, THE CURRENT TRANSFORMERS SHOULD BE WIRED IN THE CORRECT POTENTIAL LEG AND MUST BE PHASED AT THE CONTROL AS FOLLOWS:

   PHASE A: POTENTIAL TERMINAL 1, WITH RESPECT TO NEUTRAL, IN PHASE WITH CT TERMINALS 4 TO 5.
   PHASE B: POTENTIAL TERMINAL 2, WITH RESPECT TO NEUTRAL, IN PHASE WITH CT TERMINALS 6 TO 7.
   PHASE C: POTENTIAL TERMINAL 3, WITH RESPECT TO NEUTRAL, IN PHASE WITH CT TERMINALS 8 TO 9.

2. POWER SOURCE CURRENT TRANSFORMERS SHOULD BE SIZED TO PRODUCE 5A SECONDARY CURRENT WITH MAXIMUM GENERATOR CURRENT. CT BURDEN IS ESSENTIALLY 0 VA.

3. CONTACTS TO CLOSE WHEN BREAKER CLOSES.

4. THIS CONTROL CONTAINS INTERNAL BURDEN RESISTORS. THESE BURDEN RESISTORS MUST BE CONNECTED ACROSS POWER SOURCE CURRENT TRANSFORMERS WHENEVER UNIT IS RUNNING TO PREVENT LETHAL HIGH VOLTAGE FROM DEVELOPING ON LEADS TO THESE TERMINALS.

5. JUMPER 15 TO 16 AND 17 TO 18 WHEN POTENTIAL INPUT AT TERMINALS 1 THRU 3 IS 95 TO 130VAC PHASE TO PHASE (50-400HZ).

6. JUMPER 16 TO 17 WHEN POTENTIAL INPUT AT TERMINALS 1 THRU 3 IS 190 TO 260VAC PHASE TO PHASE (50-400HZ).

7. POTENTIAL TRANSFORMER BURDEN IS 5VA PER PHASE WITH 230VAC INPUT AND 2.5VA PER PHASE WITH 115VAC INPUT.

8. CONTROL SIGNAL LINES SHOULD BE TWISTED PAIRS. SHIELD IS TO BE TIED TO GROUND AT MODULE END ONLY.

Illustration 102
g00688478

i02906092

Service Record

SMCS Code: 4490

Table 26

Service Table - Record Of Setpoint Values					
Generator Description: Site, Serial No., EMCP II+ Part Number., etc..					
Engine /Generator Programming OP5-0					
Setpoint	**Specified Value**	**Actual Value**(1)	**Setpoint Description**	**Possible Values**	**Default Value**
P001			Fuel Solenoid Type	0 = ETR, 1 = ETS	0
P002			Units Shown	0 = Eng, 1 = metric	0
P003			Shutdown Override For Engine Fault	0 = shutdown, 1 = alarm	0
P004			Shutdown Enable For Sensor Fault	0 = alarm, 1 = shutdown	0
P005			Coolant Loss Sensor Installed	0 = w/o sensor, 1 = w/sensor	0
P006			Shutdown Override For Coolant Loss Fault	0 = shutdown, 1 = alarm	0
P007			System Voltage	24 volts or 32 volts	24
P008			This Setpoint Is Not Used.	NA	NA
P009			Number Of Ring Gear Teeth	95 to 350 teeth	136 teeth for MUI and PEEC engines. 183 teeth for EUI engines.
P010			Engine Overspeed	500 to 4330 rpm	2120 rpm
P011			Crank Terminate Speed	100 to 1000 rpm	400 rpm
P012			Oil Step Speed	400 to 1800 rpm	1350 rpm
P013			Low Oil Pressure Shutdown At Rated Speed	34 to 420 kPa (5 to 61 psi)	205 kPa (30 psi)
P014			Low Oil Pressure Shutdown At Idle Speed	20 to 336 kPa (3 to 49 psi)	70 kPa (10 psi)
P015			High Water Temperature Shutdown	85 to 123°C (185 to 253°F)	107°C (225°F)
P016			Low Water Temperature Alarm	0 to 36°C (32 to 97°F)	21°C (70°F)
P017			Total Cycle Crank Time	5 to 360 seconds	90 seconds
P018			Cycle Crank Time	5 to 300 seconds	10 seconds
P019			Cooldown Time	0 to 30 minutes	5 minutes
P020			AC Voltage	150V to 30.0 kV	700V
P021			AC Current Full Scale	75A to 4000A	600A
P022			GSC+ Engine Number	01 to 08	01
P023			Engine Type	0 = MUI 1 = GAS 2 = EUI	

(continued)

(Table 26, contd)

Service Table - Record Of Setpoint Values					
Generator Description: Site, Serial No., EMCP II+ Part Number., etc..					
Engine /Generator Programming OP5-0					
Setpoint	**Specified Value**	**Actual Value(1)**	**Setpoint Description**	**Possible Values**	**Default Value**
P024			Crank Time Delay	0 to 20 seconds	5 seconds
P025			Oil Temperature Sensor Installed	0 = w/o sensor, 1 = w/sensor	0
P026			High Oil Temperature Shutdown	85 to 123°C (185 to 253°F)	107°C (225°F)
P027			Shutdown Override For High Oil Temperature	0 = alarm, 1 = shutdown	0
P028			Nameplate Voltage	100 to 25kV	480V
P029			Nameplate Current	0 to 4000A	600A
P030			Nameplate Power	0 to 10MW	400kW
P031			Rated Frequency	50, 60 or 400 Hz	60
P032			Connection Configuration Of Generator	0 = wye, 1 = delta	0
P033			Number Of Generator Poles	0 to 254	4

(1) The actual value space is provided for recording and comparing values during future servicing or troubleshooting of the particular generator set.

Note: This table provides a record of setpoint values for a singular generator set. The table is intended to be an easy reference for future servicing or troubleshooting of a particular generator set.

Table 27

Service Table - Record Of Setpoint Values					
Generator Description: Site, Serial No., EMCP II+ Part Number., etc..					
Engine /Generator Programming OP5-0					
Setpoint	**Specified Value**	**Actual Value(1)**	**Setpoint Description**	**Possible Values**	**Default Value**
P001			Fuel Solenoid Type	0 = ETR, 1 = ETS	0
P002			Units Shown	0 = Eng, 1 = metric	0
P003			Shutdown Override For Engine Fault	0 = shutdown, 1 = alarm	0
P004			Shutdown Enable For Sensor Fault	0 = alarm, 1 = shutdown	0
P005			Coolant Loss Sensor Installed	0 = w/o sensor, 1 = w/sensor	0
P006			Shutdown Override For Coolant Loss Fault	0 = shutdown, 1 = alarm	0
P007			System Voltage	24 volts or 32 volts	24
P008			This Setpoint Is Not Used.	NA	NA

(continued)

(Table 27, contd)

Service Table - Record Of Setpoint Values					
Generator Description: Site, Serial No., EMCP II+ Part Number., etc..					
Engine /Generator Programming OP5-0					
Setpoint	**Specified Value**	**Actual Value**(1)	**Setpoint Description**	**Possible Values**	**Default Value**
P009			Number Of Ring Gear Teeth	95 to 350 teeth	136 teeth for MUI and PEEC engines. 183 teeth for EUI engines.
P010			Engine Overspeed	500 to 4330 rpm	2120 rpm
P011			Crank Terminate Speed	100 to 1000 rpm	400 rpm
P012			Oil Step Speed	400 to 1800 rpm	1350 rpm
P013			Low Oil Pressure Shutdown At Rated Speed	34 to 420 kPa (5 to 61 psi)	205 kPa (30 psi)
P014			Low Oil Pressure Shutdown At Idle Speed	20 to 336 kPa (3 to 49 psi)	70 kPa (10 psi)
P015			High Water Temperature Shutdown	85 to 123°C (185 to 253°F)	107°C (225°F)
P016			Low Water Temperature Alarm	0 to 36°C (32 to 97°F)	21°C (70°F)
P017			Total Cycle Crank Time	5 to 360 seconds	90 seconds
P018			Cycle Crank Time	5 to 300 seconds	10 seconds
P019			Cooldown Time	0 to 30 minutes	5 minutes
P020			AC Voltage	150V to 30.0 kV	700V
P021			AC Current Full Scale	75A to 4000A	600A
P022			GSC+ Engine Number	01 to 08	01
P023			Engine Type	0 = MUI 1 = GAS 2 = EUI	
P024			Crank Time Delay	0 to 20 seconds	5 seconds
P025			Oil Temperature Sensor Installed	0 = w/o sensor, 1 = w/sensor	0
P026			High Oil Temperature Shutdown	85 to 123°C (185 to 253°F)	107°C (225°F)
P027			Shutdown Override For High Oil Temperature	0 = alarm, 1 = shutdown	0
P028			Nameplate Voltage	100 to 25kV	480V
P029			Nameplate Current	0 to 4000A	600A
P030			Nameplate Power	0 to 10MW	400kW
P031			Rated Frequency	50, 60 or 400 Hz	60
P032			Connection Configuration Of Generator	0 = wye, 1 = delta	0
P033			Number Of Generator Poles	0 to 254	4

(1) The actual value space is provided for recording and comparing values during future servicing or troubleshooting of the particular generator set.

Table 28

Service Table - Record Of Setpoint Values					
Generator Description : Site, Serial No., EMCP II+ Part No., etc..					
OP5-1 Setpoints (1) - Protective Relaying Programming					
Setpoint	**Specified Value**	**Actual Value(1)**	**Name**	**Range Of Value**	**Factory Default**
P101			Overvoltage Alarm Enable	0 - disabled 1 - enabled	1
P102			Overvoltage Alarm Threshold	100 to 125% of nameplate voltage in increments of 1%	105%
P103			Overvoltage Alarm Time Delay	0 to 120 seconds(2) in increments of 1	10 seconds
P104			Overvoltage Shutdown Enabled	0 - disabled 1 - enabled	1
P105			Overvoltage Shutdown Threshold	100 to 125% of nameplate voltage in increments of 1%	110%
P106			Overvoltage Shutdown Time Delay	0 to 120 seconds(2) in increments of 1	10 seconds
P107			Undervoltage Alarm Enable	0 - disabled 1 - enabled	1
P108			Undervoltage Alarm Threshold	60 to 100% of nameplate voltage in increments of 1%	90%
P109			Undervoltage Alarm Time Delay	0 to 120 seconds(2) in increments of 1	10 seconds
P110			Undervoltage Shutdown Enable	0 - disabled 1 - enabled	1
P111			Undervoltage Shutdown Threshold	60 to 100% of nameplate voltage in increments of 1%	85%
P112			Undervoltage Shutdown Time Delay	0 to 120 seconds(2) in increments of 1	15 seconds
P113			Overfrequency Alarm Enable	0 - disabled 1 - enabled	1
P114			Overfrequency Alarm Threshold	50 to 60, for 50 Hz Gen 60 to 70 , for 60 Hz Gen 400 to 480, for 400 Hz Gen	53 Hz 63 Hz 422 Hz
P115			Overfrequency Alarm Time Delay	0 to 120 seconds(2) in increments of 1	10 seconds
P116			Overfrequency Shutdown Enable	0 - disabled 1 - enabled	1
P117			Overfrequency Shutdown Threshold	50 to 60, for 50 Hz Gen	55Hz
				PEEC and EUI Engines: 60 to 70, for 60Hz Gen	66 Hz
				MUI Engines: 60 to 70, for 60 Hz Gen	63 Hz
				PEEC and EUI Engines: 400 to 480, for 400 Hz Gen	440 Hz
				MUI Engines: 400 to 480, for 400 Hz Gen	422 Hz

(continued)

(Table 28, contd)

Service Table - Record Of Setpoint Values					
Generator Description : Site, Serial No., EMCP II+ Part No., etc..					
OP5-1 Setpoints (1) - Protective Relaying Programming					
Setpoint	**Specified Value**	**Actual Value(1)**	**Name**	**Range Of Value**	**Factory Default**
P118			Overfrequency Shutdown Time Delay	0 to 120 seconds(2) in increments of 1	10 seconds
P119			Underfrequency Alarm Enable	0 - disabled 1 - enabled	1
P120			Underfrequency Alarm Threshold	MUI Engines: 30 to 50, for 50 Hz Gen	45 Hz
				PEEC and EUI Engines: 30 to 50, for 50 Hz Gen	47 Hz
				MUI Engines: 36 to 60, for 60 Hz Gen	54 Hz
				PEEC and EUI Engines: 36 to 60, for 60 Hz Gen	57 Hz
				MUI Engines: 240 to 400, for 400 Hz Gen	360 Hz
				PEEC and EUI Engines: 240 to 400, for 400 Hz Gen	378 Hz
P121			Underfrequency Alarm Time Delay	0 to 120 seconds(2) in increments of 1	10 seconds
P122			Underfrequency Shutdown Enable	0 - disabled 1 - enabled	1
P123			Underfrequency Shutdown Threshold	30 to 50, for 50 Hz Gen 36 to 60, for 60 Hz Gen 240 to 400, for 400 Hz Gen	45 Hz 54 Hz 360 Hz
P124			Underfrequency Shutdown Time Delay	0 to 120 seconds(2) in increments of 1	15 seconds
P125			Reverse Power Shutdown Enable	0 - disabled 1 - enabled	1
P126			Reverse Power Shutdown Threshold	0 to 20% of nameplate power in increments of 1%	15%
P127			Reverse Power Shutdown Time Delay	0 to 30 seconds(2) in increments of 1	10 seconds
P128			Overcurrent Alarm Enable	0 - disabled 1 - enabled	1
P129			Phase Overcurrent Alarm Threshold	100 to 160% of nameplate current in increments of 5%	105%
P130			Phase Overcurrent Alarm Time Delay	0 to 250 seconds(2) in increments of 1	MUI Engines: 20 seconds
					PEEC and EUI Engines: 0 seconds

(continued)

(Table 28, contd)

Service Table - Record Of Setpoint Values					
Generator Description : Site, Serial No., EMCP II+ Part No., etc..					
OP5-1 Setpoints (1) - Protective Relaying Programming					
Setpoint	**Specified Value**	**Actual Value(1)**	**Name**	**Range Of Value**	**Factory Default**
P131			Total Overcurrent Alarm Threshold	100 to 160% of three times nameplate current in increments of 5%	105%
P132			Total Overcurrent Alarm Time Delay	0 to 250 seconds(2) in increments of 1	MUI Engines: 20 seconds
					PEEC and EUI Engines: 0 seconds
P133			Overcurrent Shutdown Ecable	0 - disabled 1 - enabled	1
P134			Phase Overcurrent Shutdown Threshold	100 to 160% in increments of 5%	110%
P135			Phase Overcurrent Shutdown Time Delay	0 to 250 seconds(2) in increments of 1	MUI Engines: 30 seconds
					PEEC and EUI Engines: 0 seconds
P136			Total Overcurrent Shutdown Threshold	100 to 160% of three times nameplate current in increments of 5%	110%
P137			Total Overcurrent Shutdown Time Delay	0 to 250 seconds(2) in increments of one.	MUI Engines: 30 seconds
					PEEC and EUI Engines: 0 seconds
P138			KW Level Relay Enable	0 - disabled 1 - enabled	1
P139			KW Level Relay Threshold	0 to 110% of nameplate power in increments of 1%	105%
P140			KW Level Relay Time Delay	0 to 120 seconds(2) in increments of 1	0 seconds

(continued)

(Table 28, contd)

Service Table - Record Of Setpoint Values					
Generator Description : Site, Serial No., EMCP II+ Part No., etc..					
OP5-1 Setpoints (1) - Protective Relaying Programming					
Setpoint	**Specified Value**	**Actual Value(1)**	**Name**	**Range Of Value**	**Factory Default**
P141			KW Level Relay Disengage Threshold	0 to 110% of nameplate power in increments of 1%	100%
P142			KW Level Relay Disengage Time Delay	0 to 120 seconds(2) in increments of 1	10 seconds

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

(1) The actual value space is provided for recording and comparing values during future servicing or troubleshooting of the particular generator set.

(2) When programmed to 0 seconds, the actual time is from 0.5 to 1.0 seconds.

Note: This table provides a record of setpoint values for a singular generator set. The table is intended to be an easy reference for future servicing or troubleshooting of a particular generator set.

Table 29

Service Table - Record Of Setpoint Values					
OP5-3 Setpoints - Paralleling Programming					
Generator Description : Site, Serial No., EMCP II+ Part No., etc..					
Setpoint	**Specied Value**	**Actual Value**	**Setpoint Description**	**Possible Values**	**Default Value**
P301			Synchronization Enable	0 - disabled 1 - Woodward	0
P302			Breaker Coil Time Limit	0.2 to 5.0 seconds in increments of 0.1 second	1.0 second
P303			Voltage Limit Enable	0 - disabled 1 - enabled	1
P304			Voltage Limit	1% to 15 % in increments of 1%	1%
P305(1)			Phase Tolerance Limit	1 to 25 degrees in increments of 1 degree	5 degrees
P306(1)			Dwell Time	0.1 to 1.0 seconds in increments of 0.1 second	0.5 second
P307(1)(2)			Speed Control Gain	0.0% to 100.0% in increments of 0.1%	50.0%
P308(1)(2)			Speed Control Rate	0.0% to 100.0% in increments of 0.1%	50.0%
P309(1)(2)			Speed Control Damping	0.0% to 100.0% in increments of 0.1%	0.0%
P310			Dead Bus Closure Enable	1 - enabled(3) 0 - disabled	0
P311			Dead Bus Limit	5% to 50% in increments of 1%	20%
P312			Dead Bus On Time Delay	0 to 120 seconds in increments of 1 second	0 seconds
P313			Frequency Match Notification Time	5 to 1000 seconds in increments of 1 seconds	20 seconds
P314			Maximum Synchronization Time	5 to 1000 seconds in increments of 1 second	30 seconds

(1) P305, P306, P307, P308, and P309 can be adjusted to precisely match individual engine response and breaker closure characteristics using OP11 - Synchronization Setpoint Tuning.

(2) The GSC+P uses P-I-D (proportional-integral-derivative) control to accomplish synchronization quickly and smoothly. The P parameter, I parameter, and D parameter are independantly controlled by setpoints P307, P308, and P309 respectively. Adjusting any one of these setpoints will not affect the other two settings. For more information, see Systems Operation, “Synchronization Mode” Setpoint Tuning.

(3) Dead bus closure will only work in the automatic mode, NOT in permissive mode or semi automatic mode.

Table 30

Service Table - Record Of Setpoint Values					
Generator Description: Site, Serial No., EMCP II+ Part No., etc..					
Setpoint	**Specified Value**	**Actual Value(1)**	**Setpoint Description**	**Possible Values**	**Default Value**
Spare Input/Output Programming OP6					
SP01			Spare Input 1 Active State	0 = active low, 1 = active high	0
SP02			Spare Input 1 Response	0 = shutdown, 1 = alarm	0
SP03			Spare Input 1 Time Delay	0 to 250 seconds	0 seconds
SP04			Spare Input 2 Active State	0 = active low, 1 = active high	0
SP05			Spare Input 2 Response	0 = shutdown, 1 = alarm	0
SP06			Spare Input 2 Time Delay	0 to 250 seconds	0 seconds
SP07			Spare Input 3 Active State	0 = active low, 1 = active high	0
SP08			Spare Input 3 Response	0 = shutdown, 1 = alarm	0
SP09			Spare Input 3 Time Delay	0 to 250 seconds	0 seconds
SP10			Spare Input 4 Active State	0 = active low, 1 = active high	0
SP11			Spare Input 4 Response	0 = shutdown, 1 = alarm	0
SP12			Spare Input 4 Time Delay	0 to 250 seconds	0 seconds
SP13			Spare Output Response	0 = shutdown, 1 = alarm	0
SP14			Spare Output Trigger Condition	Numerous(2) 8 = cooldown mode	8
SP15			Spare Relay Output Response	0 = inactive, 1 = active	1
SP16			Spare Relay Output Trigger Condition	Numerous(2) 8 = cooldown mode	8
SP17			Spare Indicator 1 Trigger Condition	Numerous(2) 0 = unused	0
SP18			Spare Indicator 2 Trigger Condition	Numerous(2) 0 = unused	0
SP19			Spare Indicator 3 Trigger Condition	Numerous(2) 0 = unused	0
Voltmeter/Ammeter Programming OP8					
AC01			Phase A Voltage Calibration	0 to 255	bar code value(3)
AC02			Phase B Voltage Calibration	0 to 255	bar code value(3)
AC03			Phase C Voltage Calibration	0 to 255	bar code value(3)
AC04			Phase A Current Calibration	0 to 255	bar code value(3)

(continued)

(Table 30, contd)

Service Table - Record Of Setpoint Values					
Generator Description: Site, Serial No., EMCP II+ Part No., etc..					
Setpoint	**Specified Value**	**Actual Value**(1)	**Setpoint Description**	**Possible Values**	**Default Value**
Spare Input/Output Programming OP6					
AC05			Phase B Current Calibration	0 to 255	bar code value(3)
AC06			Phase C Current Calibration	0 to 255	bar code value(3)
AC Offset Adjustment OP10					
PH A			Phase A Voltage Adjustment	−5.0 to +5.0 % of measured voltage	0
PH B			Phase B Voltage Adjustment	−5.0 to +5.0 % of measured voltage	0
PH C			Phase C Voltage Adjustment	−5.0 to +5.0 % of measured voltage	0
PH A-B			Phase A-B Voltage Adjustment	−5.0 to +5.0 % of measured voltage	0
PH B-C			Phase B-C Voltage Adjustment	−5.0 to +5.0 % of measured voltage	0
PH C-A			Phase C-A Voltage Adjustment	−5.0 to +5.0 % of measured voltage	0

(1) The actual value space is provided for recording and comparing values during future servicing or troubleshooting of the particular generator set.
(2) Numerous possible values exist. See System Operation, “Spare Input/Output Programming OP6”.
(3) The setpoints are programmed at the factory to the calibration value which is listed on the bar code sticker of the ATB+.

Note: This table provides a record of setpoint values for a singular generator set. The table is intended to be an easy reference for future servicing or troubleshooting of a particular generator set.

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