

Operation

Industrial Generator Sets



Models:

30–600 kW

Controller:

Decision-Maker® 3500

⚠ WARNING: This product can expose you to chemicals, including carbon monoxide and benzene, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65warnings.ca.gov

⚠ WARNING: Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65warnings.ca.gov/diesel

Product Identification Information

Product identification numbers determine service parts. Record the product identification numbers in the spaces below immediately after unpacking the products so that the numbers are readily available for future reference. Record field-installed kit numbers after installing the kits.

Generator Set Identification Numbers

Record the product identification numbers from the generator set nameplate(s).

Model Designation _____
 Specification Number _____
 Serial Number _____

| Accessory Number | Accessory Description |
|------------------|-----------------------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer _____
 Model Designation _____
 Serial Number _____

Controller Identification

Record the controller description from the generator set operation manual, spec sheet, or sales invoice. Record the Controller Serial Number from the controller nameplate.

Controller Description Decision-Maker® 3500
 Controller Serial Number _____

Firmware/Software Version Numbers

Record the version and reference numbers as shipped from the manufacturer. Determine the Application Program Version Number as shown in Menu 20. Determine the Personality Profile Reference Number from the disk supplied with the literature packet.

Application Program Version Number _____
 Personality Profile Reference Number _____
 User Parameter File Reference Number _____

Version Number Upgrades/Updates

Record the version number upgrade/updates when installed.

Version No./Date Installed _____

Software Options

Record the software options.
 Number and Description _____

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Notes

Safety Precautions and Instructions

IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. **SAVE THESE INSTRUCTIONS.**

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

DANGER

Danger indicates the presence of a hazard that **will cause severe personal injury, death, or substantial property damage.**

WARNING

Warning indicates the presence of a hazard that **can cause severe personal injury, death, or substantial property damage.**

CAUTION

Caution indicates the presence of a hazard that **will or can cause minor personal injury or property damage.**

NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

| |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  WARNING |
|  |
| Accidental starting. Can cause severe injury or death. |
| Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. |

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

Battery

| |
|----------------------------------------------------------------------------------------------------|
|  WARNING |
|  |
| Sulfuric acid in batteries. Can cause severe injury or death. |
| Wear protective goggles and clothing. Battery acid may cause blindness and burn skin. |

| |
|-------------------------------------------------------------------------------------------------------------|
|  WARNING |
|  |
| Explosion. Can cause severe injury or death. Relays in the battery charger cause arcs or sparks. |
| Locate the battery in a well-ventilated area. Isolate the battery charger from explosive fumes. |

Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery gases. Explosion can cause severe injury or death. Incorrect use of the equalize charge state may lead to hazardous situations. Equalization is ONLY applicable for flooded lead acid (FLA) type batteries and will damage gel, absorbed glass mat (AGM), or nickel-cadmium (NiCad) type batteries. In the controller menu or SiteTech™ settings, verify that the battery topology is set correctly for the battery type used. Do not smoke or permit flames, sparks, or other sources of ignition to occur near a battery at any time.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

Engine Backfire/Flash Fire

| |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|
|  WARNING |
|  |
| <p>Risk of fire. Can cause severe injury or death.</p> <p>Do not smoke or permit flames or sparks near fuels or the fuel system.</p> |

Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or carburetor.

Servicing the air cleaner. A sudden backfire can cause severe injury or death. Do not operate the generator set with the air cleaner removed.

Combustible materials. A fire can cause severe injury or death. Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

Exhaust System

| |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  WARNING |
|  |
| <p>Carbon monoxide. Can cause severe nausea, fainting, or death.</p> <p>The exhaust system must be leakproof and routinely inspected.</p> |

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate the generator set where exhaust gas could accumulate and seep back inside a potentially occupied building.

Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

Fuel System

| |
|-----------------------------------------------------------------------------------------------------------------------------------------|
|  WARNING |
|  |
| <p>Explosive fuel vapors. Can cause severe injury or death.</p> <p>Use extreme care when handling, storing, and using fuels.</p> |

The fuel system. Explosive fuel vapors can cause severe injury or death. Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

Explosive fuel vapors can cause severe injury or death. Take additional precautions when using the following fuels:

Propane (LPG)—Adequate ventilation is mandatory. Because propane is heavier than air, install propane gas detectors low in a room. Inspect the detectors per the manufacturer's instructions.

Natural Gas—Adequate ventilation is mandatory. Because natural gas rises, install natural gas detectors high in a room. Inspect the detectors per the manufacturer's instructions.

Fuel tanks. Explosive fuel vapors can cause severe injury or death. Gasoline and other volatile fuels stored in day tanks or subbase fuel tanks can cause an explosion. Store only diesel fuel in tanks.

Draining the fuel system. Explosive fuel vapors can cause severe injury or death. Spilled fuel can cause an explosion. Use a container to catch fuel when draining the fuel system. Wipe up spilled fuel after draining the system.

Gas fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LPG vapor or natural gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to 6-8 ounces per square inch (10-14 inches water column). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

LPG liquid withdrawal fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LPG liquid withdrawal fuel system for leakage by using a soap and water solution with the fuel system test pressurized to at least 90 psi (621 kPa). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

Hazardous Noise

| |
|--------------------------------------------------------------------------------------------------------------------------------------------------|
|  CAUTION |
|  |
| <p>Hazardous noise. Can cause hearing loss.</p> <p>Never operate the generator set without a muffler or with a faulty exhaust system.</p> |

Engine noise. Hazardous noise can cause hearing loss. Generator sets not equipped with sound enclosures can produce noise levels greater than 105 dBA. Prolonged exposure to noise levels greater than 85 dBA can cause permanent hearing loss. Wear hearing protection when near an operating generator set.

Hazardous Voltage/ Moving Parts

| |
|---------------------------------------------------------------------------------------------------------------------------------------|
|  DANGER |
|  |
| <p>Hazardous voltage. Will cause severe injury or death.</p> <p>Disconnect all power sources before opening the enclosure.</p> |

| |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  DANGER |
|   |
| <p>Hazardous voltage. Moving parts. Will cause severe injury or death.</p> <p>Operate the generator set only when all guards and electrical enclosures are in place.</p> |

| |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  WARNING |
|  |
| <p>Hazardous voltage. Backfeed to the utility system can cause property damage, severe injury, or death.</p> <p>If the generator set is used for standby power, install an automatic transfer switch to prevent inadvertent interconnection of standby and normal sources of supply.</p> |

Grounding electrical equipment. Hazardous voltage will cause severe injury or death. Electrocutation is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

High voltage test. Hazardous voltage will cause severe injury or death. Follow the instructions of the test equipment manufacturer when performing high-voltage tests on the rotor or stator. An improper test procedure can damage equipment or lead to generator set failure.

Installing the battery charger. Hazardous voltage will cause severe injury or death. An ungrounded battery charger may cause electrical shock. Connect the battery charger enclosure to the ground of a permanent wiring system. As an alternative, install an equipment grounding conductor with circuit conductors and connect it to the equipment grounding terminal or the lead on the battery charger. Install the battery charger as prescribed in the equipment manual. Install the battery charger in compliance with local codes and ordinances.

Connecting the battery and the battery charger. Hazardous voltage will cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Short circuits. Hazardous voltage/current will cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Engine block heater. Hazardous voltage will cause severe injury or death. The engine block heater can cause electrical shock. Remove the engine block heater plug from the electrical outlet before working on the block heater electrical connections.

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Install a transfer switch in standby power installations to prevent the connection of standby and other sources of power. Electrical backfeed into a utility electrical system can cause severe injury or death to utility personnel working on power lines.

Testing live electrical circuits. Hazardous voltage or current will cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically. *(600 volts and under)*

Servicing the generator set when it is operating. Exposed moving parts will cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

Heavy Equipment

| |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  WARNING |
|  |
| <p>Unbalanced weight. Improper lifting can cause severe injury or death and equipment damage.</p> <p>Do not use lifting eyes. Lift the generator set using lifting bars inserted through the lifting holes on the skid.</p> |

Hot Parts

| |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  WARNING |
|  |
| <p>Hot coolant and steam. Can cause severe injury or death.</p> <p>Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.</p> |

| |
|----------------------------------------------------------------------------------------------------------------------------------------|
|  WARNING |
|  |
| <p>Hot engine and exhaust system. Can cause severe injury or death.</p> <p>Do not work on the generator set until it cools.</p> |

Servicing the alternator. Hot parts can cause severe injury or death. Avoid touching the alternator field or exciter armature. When shorted, the alternator field and exciter armature become hot enough to cause severe burns.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

Notice

| |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NOTICE |
| <p>This generator set has been rewired from its nameplate voltage to</p> <div style="border: 1px solid black; width: 150px; height: 40px; margin: 10px auto;"></div> |
| <small>246242</small> |

NOTICE

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/dealer.

NOTICE

Parallel Operation. This product includes features intended to support operation in parallel with the utility grid, but these features have not been evaluated for compliance with specific utility interconnection protection standards or requirements.

NOTICE

Canadian installations only. For standby service connect the output of the generator set to a suitably rated transfer switch in accordance with Canadian Electrical Code, Part 1.

Notes

This manual provides operation instructions for 30–600 kW generator sets equipped with the following controller:

- Decision-Maker® 3500, Software (Code) Version 1.25.0 or higher.

To determine the generator set controller software version, go to the Overview menu.

Wiring diagram manuals are available separately. Refer to the engine operation manual for generator set engine scheduled maintenance information.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with the equipment for future reference.

The equipment service requirements are very important to safe and efficient operation. Inspect the parts often and perform required service at the prescribed intervals. Maintenance work must be performed by appropriately skilled and suitably trained maintenance personnel familiar with generator set operation and service.

List of Related Materials

Separate literature contains communication and software information not provided in this manual. Figure 1 lists the available literature part numbers.

Several engine manufacturers provide engines with electronic controls. These electronic controls indicate engine fault codes in addition to the generator set controller. The engine operation and service literature provide information for identifying engine fault codes. For the latest literature part numbers, see the respective generator set parts catalog.

| Literature Description | Literature Part No. |
|-------------------------------------------------------------------------|---------------------|
| Generator Set/Controller Wiring Diagram Manual | TP-6924 |
| Modbus® Communications Protocol Operation Manual | TP-6113 |
| SiteTech™ Software Manual | TP-6701 |
| Converters, Connections, and Controller Setup for Network Communication | TT-1405 |
| Wound Field Alternator Service Manual | TP-6878 |
| Fast-Response X Alternator Service Manual | TP-6783 |
| Controller Service Manual | TP-6929 |
| Remote Serial Annunciator III (RSA III) | TT-1625 |

Figure 1 Related Literature

Abbreviations

This publication makes use of numerous abbreviations. Typically, the word(s) are spelled out along with the abbreviation in parentheses when shown for the first time in a section. Appendix A, Abbreviations, also includes many abbreviation definitions.

SiteTech™ Software

Several instances in this manual make reference to SiteTech™ software which is required for programming the Decision-Maker® 3500 controller if the factory defaults are not appropriate for the application. SiteTech™ software is also needed for updating the controller application code. Contact your local distributor/dealer for assistance.

Requires SiteTech software version 1.02 or higher to upgrade the controller firmware.

Tech Tools

Note: Tech Tools is for Kohler authorized personnel only.

Access Tech Tools to find the following topics:

- **Software** used by generator set controllers including updates and documentation references.
- **Network Communications** provides basics to terms, protocols, standards, wiring, configurations, and model.
- **Engine Electronic Control Module (ECM)** has information about electronic devices provided by the engine manufacturer to manage engine data.

Service Assistance

For professional advice on generator set power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Visit the Kohler Co. website at KOHLERPower.com.
- Look at the labels and decals on your Kohler product or review the appropriate literature or documents included with the product.
- Call toll free in the US and Canada 1-800-544-2444.
- Outside the US and Canada, call the nearest regional office.

Headquarters Europe, Middle East, Africa (EMEA)

Kohler EMEA Headquarters
Netherlands B.V.
Kristallaan 1
4761 ZC Zevenbergen
The Netherlands
Phone: (31) 168 331630
Fax: (31) 168 331631

Asia Pacific

Power Systems Asia Pacific Regional Office
Singapore, Republic of Singapore
Phone: (65) 6264-6422
Fax: (65) 6264-6455

China

North China Regional Office, Beijing
Phone: (86) 10 6518 7950
(86) 10 6518 7951
(86) 10 6518 7952
Fax: (86) 10 6518 7955

East China Regional Office, Shanghai
Phone: (86) 21 6288 0500
Fax: (86) 21 6288 0550

India, Bangladesh, Sri Lanka

India Regional Office
Bangalore, India
Phone: (91) 80 3366208
(91) 80 3366231
Fax: (91) 80 3315972

Japan, Korea

North Asia Regional Office
Tokyo, Japan
Phone: (813) 3440-4515
Fax: (813) 3440-2727

Section 1 Specifications and Features

1.1 Introduction

The spec sheets for each generator set provide model-specific generator and engine information. The controller spec sheet provides specifications for this controller. Refer to the respective spec sheet for data not supplied in this manual. Refer to the generator set service manual, installation manual, engine operation manual, and engine service manual for additional specifications.

1.2 Controller Specifications

| Decision-Maker® 3500 Controller | |
|--------------------------------------|----------------------------------------------|
| Power source with circuit protection | 12- or 24-volt DC |
| Power drain | 400 milliamps at 12V 200 milliamps at 24V |
| Humidity range | 5-95% |
| Operating temperature | -40° to 70°C (-40° to 158°F) |
| Storage temperature | -40° to 85°C (-40° to 185°F) |

Note: Have setup and adjustments of the controller performed only by an authorized Kohler distributor. The setup and adjustments are password protected.

1.3 Controller and Customer Connection Panel Features

The controller features include the annunciator lamp, graphical display and pushbutton/rotary selector dial, switches and controls, and terminal blocks. See Figure 1-1 for an illustration of the controller front panel. See Figure 1-2 and Figure 1-3 for illustrations of the electrical power panel features. The following paragraphs detail the features by general topics. The controller provides:

- The backlit LCD (liquid crystal display) for monitoring the generator set functions and output values
- Master control buttons with status lights
- Fault lamp
- Pushbutton/rotary selector dial to navigate the generator set displays
- Alarm horn and alarm silence switch/light
- Mini USB connector for PC setup using SiteTech™ software

The controller features, accessories, and menu displays depend upon the engine electronic control module (ECM) setup and features. Controller features apply to generator set models with ECM and non-ECM engines unless otherwise noted.

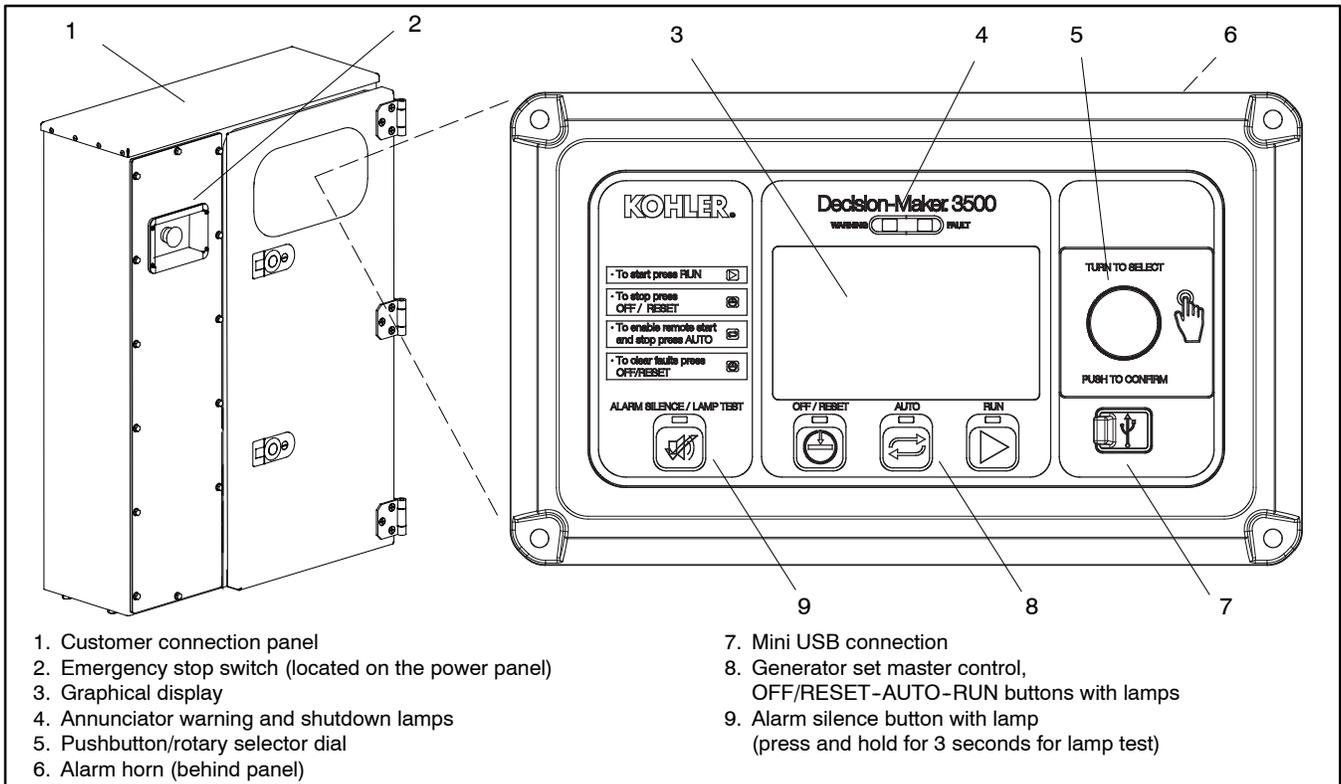


Figure 1-1 Customer Connection Panel and Decision-Maker® 3500 Controller

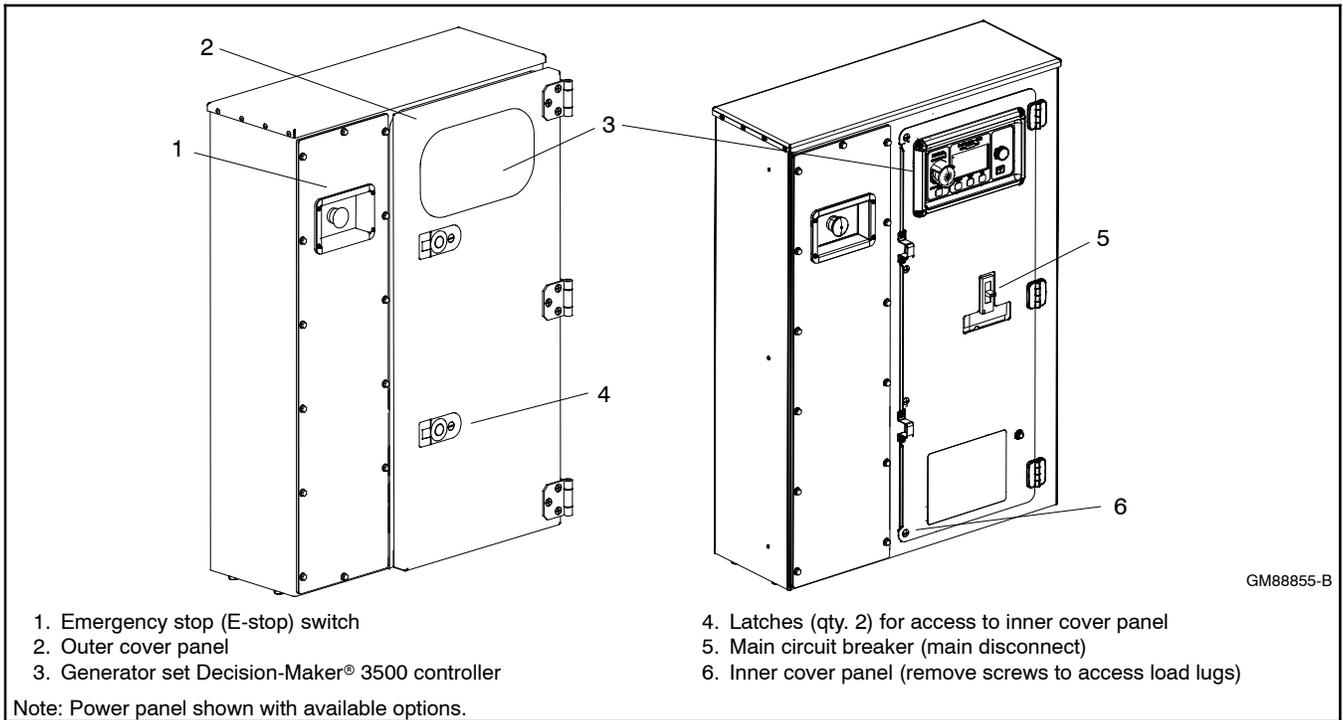


Figure 1-2 Customer Connection Panel with E-Stop Switch and Main Circuit Breaker

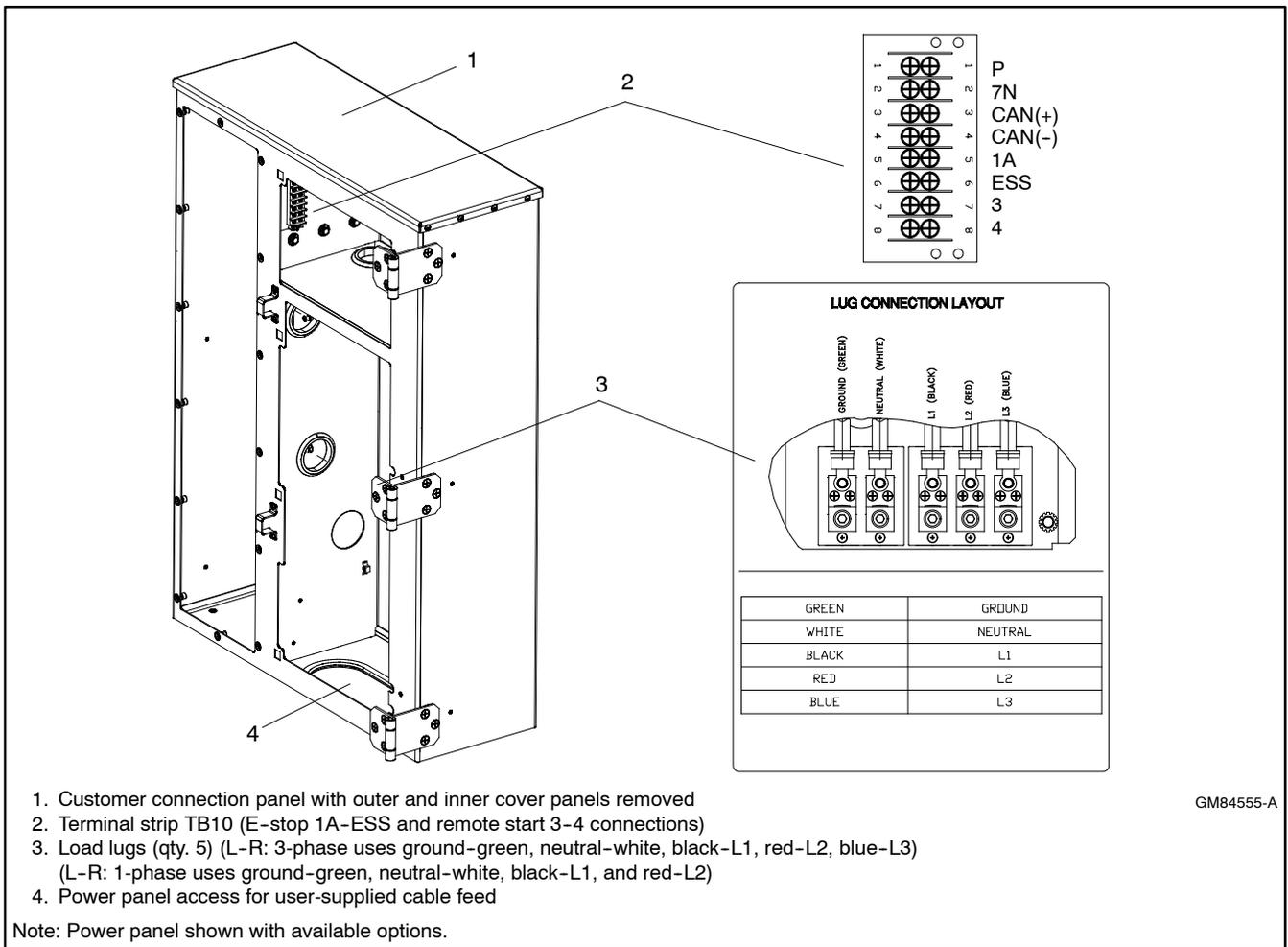


Figure 1-3 Customer Connection Panel with Main Load Lugs and TB10 Terminal Strip Connections

Note: Measurements display in metric or English units. Use the Controller Configuration menu to change the measurement display.

Note: Press the pushbutton/rotary selector dial to turn on the controller lights and display. The backlight turns off 60 minutes after the last entry when in the AUTO mode.

Note: After about 15 minutes of no user input (pushbutton/rotary selector dial or buttons), the menu is reset to the top of the main menus and auto-paging activates for the Overview submenus.

1.3.1 Switches and Controls

Note: US/Metric Display is selectable in Section 1.6, Controller Configuration Menu.

Alarm Horn. The alarm horn alerts the operator or other attendants that a shutdown condition exists.

Alarm (Horn) Silence. The alarm silence switch silences the alarm horn at the operator’s discretion. Press the master control switch AUTO button *before* pressing the alarm silence button. The alarm horn cannot be silenced unless the master control switch AUTO button is pressed.

Note: Additional alarm silencing options are shown in Section 1.6, Controller Configuration Menu.

Restore alarm horn switches at all locations including those on remote annunciator kits after correcting the fault shutdown to avoid reactivating the alarm horn. See 2.4.6 Controller Resetting for resetting the controller.

Emergency Stop (located on the power panel). The operator-activated pushbutton immediately shuts down the generator set in emergency situations. Reset the emergency stop switch after shutdown by pulling the emergency stop switch outward. *Use the emergency stop switch for emergency shutdowns only.* Use the master control switch OFF/RESET button for normal shutdowns.

Generator Set Master Control (OFF/RESET-AUTO-RUN). These buttons reset the controller fault lamps and start/stop the generator set. Additional information in shown in Section 2, Operation.

Lamp Test. Press and hold the Alarm Silence/Lamp Test button to test the controller indicator lamps, alarm horn, and digital display.

Pushbutton/Rotary Selector Dial. This control provides access to the menus for monitoring. Press the selector dial to activate the graphical display and to select choices shown on the display. Rotate the dial to navigate through the menus.

The pushbutton/rotary selector dial has several features and functions:

- Momentarily press the dial to activate the graphical display if dark.
- Rotate the dial to navigate through the main menus—turn counterclockwise to go forward (down) and clockwise to go back (up). The menus wrap to the beginning.
- Press the dial at a given main menu to access the submenus within the selected main menu.
- When in the submenu, rotate the dial to navigate through the submenu—counterclockwise to go forward (down) and clockwise to go back (up). The menus wrap to the beginning.
- Momentarily press the dial when in the submenu to make a user selection choice (if available) or to go back to the respective main menu.
- To return to the previous menu, rotate the dial (counterclockwise or clockwise) until the back arrow appears in the upper left corner and press the dial. See Figure 1-4.

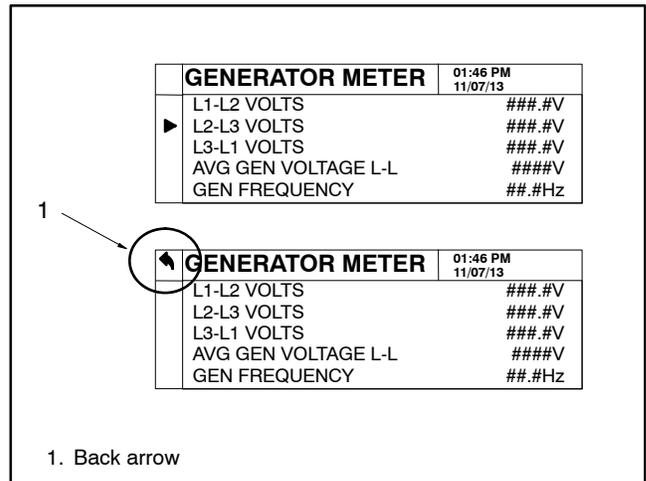


Figure 1-4 Back Arrow Location

- After about 15 minutes of no user input (pushbutton/rotary selector dial or buttons), the menu resets to the top of the main menus and auto-paging activates for the Overview submenus.

1.3.2 Annunciator Lamps

The controller has a single annunciator fault lamp providing visual generator set status. In addition, each button has a lamp. See Figure 1-5.

| Lamp/Button | Lamp Color |
|----------------------|------------------------------------|
| Alarm (Fault) Lamp | Yellow (Warning) or Red (Shutdown) |
| Off/Reset Button | Blue |
| Auto Button | Blue (System Ready) |
| Run Button | Blue |
| Alarm Silence Button | Orange |

Figure 1-5 Annunciator Lamps

System Status Lamps (Master Control Switches)

The lamp illuminates on the master control switch AUTO (automatic start) button indicating the system senses no faults and the unit is ready to start by remote command.

The lamp illuminates on the master control switch OFF/RESET button indicating the generator set is stopped.

The lamp illuminates on the master control switch RUN button indicating the generator set is cranking or running from a local command.

Only one of the three master control switch lamps will illuminate at any given time.

Alarm Silence Lamp. Orange lamp illuminates indicating the alarm horn was silenced.

Alarm Fault Lamp. Yellow lamp illuminates indicating a warning condition or red lamp illuminates indicating a shutdown condition. See 2.4.3 System Fault Warning Lamp and Digital Displays and 2.4.4 System Fault Shutdown Lamp with Digital Displays for system fault conditions.

System Warning Fault Lamp. Yellow lamp identifies an existing fault condition that does not shut down the generator set. A continuing system warning fault condition may cause a system shutdown. Correct all system warnings as soon as practical.

See Section 2.4.3, System Fault Warning Lamp with Digital Displays, for definitions of the items listed.

System Shutdown Fault Lamp. Red lamp indicates that the generator set has shut down because of a fault condition. The unit will not start without resetting the controller, see Section 2.4.6, Controller Resetting procedure.

See Section 2.4.4, System Fault Shutdown Lamp with Digital Displays, for definitions of the items listed.

1.3.3 Graphical Display

Press the pushbutton/rotary selector dial to turn on the controller lamps and display. The backlight turns off 10 minutes after the last entry when in the AUTO mode.

The generator set must be running for some displays to indicate values. If the generator set is not running some values will display zero or N/A (not available).

The 5-line, 35 character per line backlit heated display provides generator set and engine data, system status, and fault information. See Figure 1-1. The graphical display shows abbreviations in some instances.

Note: **US/Metric Unit Display** is selectable in the Controller Configuration menu.

Note: After about 5 minutes (10 minutes with firmware) of no user input (pushbutton/rotary selector dial or buttons), the menu resets to the top of the main menus and auto-paging activates for the Overview submenus.

The main menus are listed below. Within each main menu are multiple submenus with descriptions following.

- Metering (See Section 1.4)
- Generator Information (See Section 1.5)
- Controller Configuration (See Section 1.6)
- I/O Setup (See Section 1.7)
- Active Events (See Section 2.4.3, Section 2.4.4, and Section 2.4.5)

1.3.4 Main Circuit Breaker

The single 3-pole main circuit breaker (main disconnect) protects the load lugs and camlocks (if equipped). The circuit breaker works with 480-volt (high wye), 208 to 240-volt (low wye), and single-phase voltage circuits. The 600-volt model offers circuit protection using a single 3-pole circuit breaker.

Note: When changing the position of the voltage selector switch, the output current rating of the generator set changes. The new output current may require adjustment of the trip setting on the main circuit breaker. This setting is indicated by the ir dial on the circuit breaker. The ir dial has indications from 0.4 to 1.0 of the trip plug rating (typically indicated on a plate at the bottom of the breaker trip unit).

1.4 Metering Menu

1.4.1 Generator Metering Submenu

- **Volts** displays the alternator output AC voltages. The display shows all line-to-line and line-to-neutral voltage combinations for three-phase or single-phase configurations. The display also shows the average line-to-line and line-to-neutral voltages.

Note: The average line-to-neutral is not listed for the delta connection.

- **Current** displays the alternator output AC amps. The display shows each line (L1-L2-L3) of three-phase models or L1-L2 current for single-phase models. The display also shows the average current.

- **Frequency (Hz)** displays the frequency (Hz) of alternator output voltage.
- **Power kW** displays the total and the individual L1, L2, and L3 alternator output as actual output values.
- **Power Factor** displays the total and individual line power factor values.
- **% Rated kW** displays alternator output as a percentage of the entered rated value.
- **Reactive Power kVAR** displays the total and individual L1, L2, and L3 kVAR.
- **Apparent Power kVA** displays the total and individual L1, L2, and L3 kVA.
- **% Rated kVA** displays alternator kVA as a percentage of the entered rated value.
- **Phase Rotation** displays the actual generator rotation.

1.4.2 Engine Metering Submenu

Note: Not all of these engine metering submenus may apply as they are dependent upon the engine manufacturer and corresponding ECM. Refer to Appendix B, Controller Displays from the Engine ECM for more specific information.

- **Engine Speed (Tachometer)** displays the engine speed (RPM) at which the engine is presently running.
- **Oil Pressure** displays the engine oil pressure.
- **Coolant Temperature** displays the engine coolant temperature.
- **Fuel Rate** displays the calculated fuel consumption rate based on fuel injector outputs (if available from ECM).
- **Gen Battery Voltage** displays the DC voltage of the generator set starting battery(ies) as measured by the controller.
- **ECM Battery Voltage** displays the DC voltage of the engine starting battery(ies) as reported from the ECM.
- **Oil Temperature** displays the engine oil temperature.

- **Coolant Pressure** displays for the engine coolant pressure.
- **Fuel Pressure** displays the fuel line pressure at the generator set inlet for gas-powered models.
- **Fuel Temperature** displays the fuel supply temperature.
- **Fuel Used Last Run** displays the accumulated amount of fuel used since last reset (if available from ECM).
- **Crankcase Pressure** displays the engine crankcase pressure.
- **Intake Air Pressure** displays the engine intake manifold air pressure if available.
- **Intake Air Temperature** displays the engine intake manifold air temperature if available.

1.4.3 Overview Submenu

Generator Status:

- **Average Volts Line-to-Line.** For three-phase configurations the average line-to-line voltage of L1, L2, and L3 is displayed. Single-phase configurations show the L1-L2 voltage.
- **Average Current** value displays as the average for three-phase configurations or the current value for L1-L2 with single-phase configurations.
- **Frequency (Hz)** value displays for the output AC voltage.

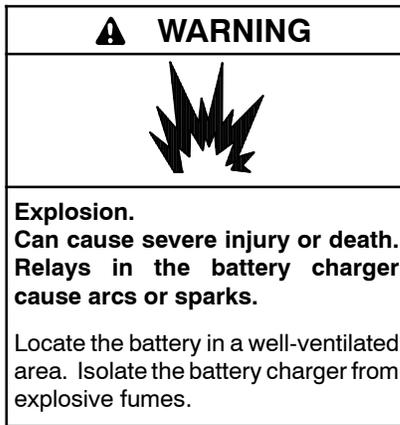
Engine Status:

- **Coolant Temperature** displays the engine coolant temperature.
- **Oil Pressure** displays the engine oil pressure.
- **Battery Voltage** displays the DC voltage of the engine starting battery(ies).

System Status:

- **Fuel Pressure** displays fuel injection pressure.
- **Total Power** displays the generator set operating power rating in kW.
- **Engine Run Time** displays the total run time hours.

Charger Status:



Battery gases. Explosion can cause severe injury or death. Incorrect use of the equalize charge state may lead to hazardous situations. Equalization is ONLY applicable for flooded lead acid (FLA) type batteries and will damage gel, absorbed glass mat (AGM), or nickel-cadmium (NiCad) type batteries. In the controller menu or SiteTech™ settings, verify that the battery topology is set correctly for the battery type used. Do not smoke or permit flames, sparks, or other sources of ignition to occur near a battery at any time.

Battery charger menus are available on Decision-Maker® 3500 Controllers with controller firmware version 1.25.0 and higher.

Battery Charger 1 and 2 menus provide battery charger information and metering. Use this menu to view the charger output metering and charger states.

Note: Incorrect charger output system voltage may cause irreversible damage to the battery and abnormal out gassing. Ensure that the battery charger parameters match the battery manufacturer's specifications before using. In the controller user interface settings, verify that the battery topology and system voltage is set correctly for the battery type that is used.

Note: The battery charger menus are designed to work with charger GM87448. Unless connected to charger GM87448 through CAN communication, the battery charger menus, although visible, have no effect on the battery charger.

1.4.4 Paralleling Metering Submenu

Note: The paralleling metering is only valid if the generator set controller is controlling a motor-operated circuit breaker.

- **Connected to Bus** displays if the generator set is connected to the paralleling bus (the output breaker or contactor is closed).

- **Avg Bus Voltage L-L** displays the average of the three-phase line-to-line voltage measured by the paralleling bus sensing.
- **Avg Gen Voltage L-L** displays the average of the three-phase line-to-line voltage of the generator set output.
- **Bus Frequency** displays the cycle frequency of the paralleling bus.
- **Gen Frequency** displays the cycle frequency of the generator set.
- **Bus Total Power** displays the real power provided by all of the generator sets in the paralleling system.
- **Bus % of Rated kW** displays the ratio between the Bus Total Power and the Bus Total Capacity (found in the Generator Management screen) expressed as a percentage.
- **Bus % of Rated kVAR** displays the ratio between the reactive load on all generator sets in the paralleling system and the bus reactive capacity (the sum of 3/4 of the rated kW of all connected generator sets) expressed as a percentage.

1.5 Generator Information Menu

1.5.1 Generator Information Submenu

- **Total Run Time** displays the total run time hours.
- **Hours Loaded** displays the total loaded hours.
- **Hours Unloaded** displays the total unloaded hours.
- **kW Hours** displays the total kW hours.
- **Operating Hours** displays the total operating hours.
- **Total Number of Starts** displays the total number of times that the engine was started via the generator set controller.
- **Last Maintenance** displays the date on the controller system clock when the last maintenance was performed.
- **Operating Hours Since Maintenance** displays the total number of hours of operation since the last maintenance date.

- **Starts Since Maintenance** displays the total number of generator set startup events since the last maintenance date.
- **Engine Hours Since Maintenance** displays the total engine hours since last maintenance.
- **Loaded Since Maintenance** displays the total loaded hour since last maintenance.
- **Unloaded Since Maintenance** displays the unloaded hours since last maintenance.
- **kW Hours Since Maintenance** displays the total kW hours since last maintenance.
- **Reset Maintenance Records:** displays a Yes/No choice for the user to select.
- **Last Start** displays the date when the generator set last operated.
- **Last Run Length** displays the length of time that the engine ran the last time it was started via the generator set controller.
- **Controller Serial No.** displays the controller serial number.
- **Software Version** displays the software version number. Use the version number to determine if an upgrade is needed and/or when troubleshooting the controller.
- **ECM Serial No.** displays the ECM serial number.
- **Genset Model No.** displays the generator set model number. Only adjustable from SiteTech™.
- **Genset Spec No.** displays the generator set specification number. Only adjustable from SiteTech™.
- **Genset Serial No.** displays the generator set serial number. Only adjustable from SiteTech™.
- **Alternator Part No.** displays the alternator part number. Only adjustable from SiteTech™.
- **Engine Part No.** displays the engine part number. Only adjustable from SiteTech™.
- **Engine Model No.** displays the engine model number. Only adjustable from SiteTech™.
- **Engine Serial No.** displays the engine serial number. Only adjustable from SiteTech™.

1.5.2 Event History Submenu

Generator Event History:

This menu allows the user to review up to 1000 entries of generator set system events including shutdown faults, warning faults, notices, and status events with date and time stamp. See 1.7.1 Controller Fault Diagnostics for a list of the items that appear on the Generator Event History.

Engine Event Log:

A message is sent each time there is a change in a monitored engine condition (i.e. fault becomes active, fault is cleared). Upon broadcast of this message, the controller will request another message that contains the following information for each fault:

- **SPN (Suspect Parameter Number)** is a four-digit code that represents an engine component.
- **FMI (Failure Mode Indicator)** is a two-digit code that represents the type of fault that occurred (i.e. short circuit, out of range).
- **Occurrence Count** is a count of how many times a fault has occurred.

1.5.3 Configuration Submenu

Generator Configuration

The values in this menu are user-entered for the generator set configuration and are NOT measured values of the generator set.

Note: Have setup and adjustments of the generator set controller performed only by an authorized Kohler distributor. The setup and adjustments are password protected.

- **Operating Mode** displays the programmer-entered generator set application configuration as Standby or Prime.
- **Application Type** displays the programmer-entered generator set application type as None, Marine, Mobile, Standby or Prime.
- **System Voltage** displays the programmer-entered L1-L2-L3 output voltage for three-phase or the L1-L2 output voltage for single-phase.
- **System Frequency** displays the programmer-entered L1-L2-L3 output voltage frequency for three-phase or the L1-L2 output voltage frequency for single-phase.

- **System Phase** displays the programmer-entered configuration as Single Phase, Single Phase Dogleg, Three Phase Wye, or Three Phase Delta.
- **Rated Engine Speed** displays the programmer-entered engine speed in RPM.
- **Adjusted Engine RPM** displays the target engine speed setting.
- **kW Rating** displays the programmer-entered kW value for the generator set.
- **kVA Rating** displays the programmer-entered kVA value for the generator set.
- **Rated Current** displays the programmer-entered current value for the generator set.
- **Battery Voltage** displays the programmer-entered battery voltage.
- **Engine Start Delay** displays the time delay before the generator set starts while the master switch is in AUTO or RUN positions.
- **Starting Aid Delay** displays the engine starting aid activation time.
- **Crank On Delay** displays the time allocated for generator set crank on in seconds.
- **Crank Pause Delay** displays the time allocated for generator set crank pause in seconds.
- **Engine Warmed Up** displays the temperature when the engine is warmed up enough to be loaded.
- **Engine Cooled Down** displays the temperature below which the engine cooldown can be overridden. See Cooldown Override below.
- **Cooldown Delay** displays the time delay for engine cooldown while the master switch is in the AUTO or RUN positions and not in the idle mode.
- **Cooldown Override** allows the user to select the Cooldown Temperature Override Mode. If set to ON, the engine will stop immediately if the coolant temperature is below the engine cooled threshold, but will run for the duration of the cooldown cycle otherwise. If set to OFF, the engine will always complete the cooldown cycle.
- **Fuel Type** displays the programmer entered fuel type as NG (Natural Gas), LP (Liquefied Petroleum), Gasoline, Diesel, or Unknown.

- **Crank Cycles Limit** displays the programmer-entered crank cycle.
- **Enable NFPA Defaults** allows the user to Enable or Disable the NFPA defaults.
- **Enable Emergency Battlemode** allows the user to turn On/Off the emergency battlemode feature.
Note: Conditional for certain units.

Protection Configuration

Note: The time delays are user adjustable using SiteTech™. Have setup and adjustments of the generator set controller performed only by an authorized Kohler distributor. The setup and adjustments are password protected.

- **Overvoltage** displays the percentage of the system voltage that the generator set voltage must exceed for an overvoltage condition to be indicated.
- **Overvoltage Delay** displays the time that the generator set voltage must be in an overvoltage condition before a fault is indicated.
- **Undervoltage** displays the percentage of the system voltage that the generator set voltage must drop below for an undervoltage condition to be indicated.
- **Undervoltage Delay** displays the time that the generator set voltage must be in an undervoltage condition before a fault is indicated.
- **Overfrequency** displays the percentage of the system frequency that the generator set frequency must exceed for an overfrequency condition to be indicated.
- **Underfrequency** displays the percentage of the system frequency that the generator set frequency must drop below for an under frequency condition to be indicated.
- **Overspeed** displays the engine speed that the engine must exceed for an overspeed condition to be indicated.
- **Low Battery Voltage** displays the system battery voltage that the battery voltage must drop below for a low battery voltage condition to be indicated.
- **High Battery Voltage** displays the system battery voltage that the battery voltage must exceed for a high battery voltage condition to be indicated.

1.5.4 Voltage Regulation Submenu

Note: Have setup and adjustments of the generator set controller performed only by an authorized Kohler distributor. The setup and adjustments are password protected.

The generator set controller has a built-in voltage regulation function. This means that no external voltage regulator is necessary. The voltage regulation of the controller uses Root Mean Square (RMS) sensing for fast response to changes in indicated and regulated voltages resulting in excellent regulation accuracy.

The descriptions of the voltage regulator adjustments and features follow.

Voltage Adjust. The voltage adjust allows the user to enter the desired generator set output level. The voltage regulator controls the average of the three output phase voltages to this target in a three phase configuration, and L1-L2 voltage to this target in a single phase configuration.

Submenus display the individual line-to-line voltages and the individual phase voltages. These voltages are for reference only and are relevant in unbalanced load conditions. The voltage adjust setpoint can be changed to accommodate an important phase in an unbalanced system.

Target Voltage. The voltage that the generator set controller is trying to achieve including droop and paralleling bias.

Volts/Hz. The excitation control system includes an under-frequency unloading feature. This is sometimes referred to as Volts-per-Hertz or V/Hz. When the frequency drops below a certain value, the output voltage is reduced to decrease engine load, allowing the engine speed to recover more quickly. The output voltage reduction is based on the frequency.

Volts per Hz Settings. The amount of voltage reduction can be adjusted to achieve the desired transient response of the engine and alternator system. The V/Hz function will use the following parameter settings:

- V/Hz Setpoint (Hz)
- V/Hz Slope (%/Hz)
- V/Hz reduction limit (fixed at 50% of rated voltage)

Volts per Hz Adjustment. The V/Hz settings can be changed using the SiteTech™ setup program or at the front panel using the password. The setup program will read current settings to determine a similar function when making changes to alternator connections, system voltages, or operating frequency.

Volts/Hz Setpoint. This adjustment affects the voltage droop (volts per Hz) when load is applied and underfrequency occurs. The volts/Hz setpoint setting defines the threshold below which the underfrequency unloading is active. Any frequency below the setpoint causes the voltage to drop thus reducing the load allowing the engine speed to recover according to the volts/Hz slope setting.

Engine speed recovery depends upon characteristics such as engine make, fuel type, load types, and operating conditions. The volts/Hz setpoint setting is set at the factory to match the engine speed recovery characteristics for the application.

Volts/Hz Slope. This setting determines how much the voltage drops during an underfrequency condition. The Volts/Hz Slope setting is set at the factory. Typically, applying a large electrical load causes a dip in engine speed and frequency. The voltage regulator reduces voltage, allowing engine speed recovery. The volts-per-Hz setting determines the degree of unloading that occurs for each 1 Hz decrease in frequency.

Voltage Droop at 100% kVAR (Reactive Droop). Reactive droop compensation provides reactive current flow adjustment in the generator set when connected in paralleling applications. Reactive droop reduces excitation levels with increasing reactive power current. A reduced excitation level reduces generator set reactive power or generated VARs, improving reactive load sharing.

Enter the parameter as a percentage of system voltage when full-rated load with 0.8 power factor is applied. Any loads less than full load force the voltage to drop by the ratio of reactive volt-amps (VARs) to rated VARs.

Voltage Gain Adjust. Regulator gain refers to the gain of the control system. Generally, the higher the gain the faster the system responds to changes and the lower the gain, the more stable the system.

If the voltage is slow to recover when loads are applied or removed, increase the regulator gain. If the voltage is unstable, decrease the regulator gain.

The voltage regulator value is reviewable at all times and provides the ability to fine adjust voltage. Changing the system voltage or replacing the controller typically requires a voltage adjustment.

The user can change the individual value or can select *Reset Regulator Defaults?* - Yes to reset to the default value. The *Reset Regulator Defaults* display will only show if editing is enabled.

Start-Up Ramp Rate. Slowly ramps the voltage to its target to minimize voltage overshoot at startup.

1.5.5 Voltage Selector Switch (Menu)

The voltage selector switch menu typically applies to towable models only. This feature allows easy voltage reconnection on models equipped with a voltage selector switch mounted on the generator set junction box. This menu provides settings that may be viewed or adjusted relating to system voltage, frequency, and phase.

Present Position. The setting indicates the voltage configuration currently set in the controller. The position number corresponds to a number identifying the voltage, frequency, and phase selected by the end user. Each position is explained further in the following menu items shown as Pos. 1, Pos. 2, and Pos. 3.

System Voltage L-L.. Indicates the system line-to-line voltage as setup to correspond to the voltage selector switch.

System Frequency. Indicates the system frequency as setup to correspond to the voltage selector switch.

System Phase. Indicates the system phase as setup to correspond the the voltage selector switch.

kW Rating. Indicates the system kW rating as setup to correspond to the generator set's rating based on the voltage, frequency, and phase selection. Some voltage connections cause the kW rating to change. This setting affects the trip point of select warnings and shutdowns.

Max Positions. Indicates the number of positions of the voltage selector switch mounted on the junction box. This value is either 2 (for 277/480 V, 3 Ph. or 120/208 V, 3 Ph.) or 3 (for 277/480 V, 3 Ph.; 120/208 V, 3 Ph.; or 120/240 V, 1 Ph.).

Note: Some 4-position voltage selector switch generator sets are available as engineered specials for 277/480 V, 3 Ph.; 120/208 V, 3 Ph.; 120/240 V, 3 Ph. delta; or 120/240 V, 1 Ph.

Pos. 1 Volts. Factory set at 277/480 volts.

Pos. 1 Frequency. Factory set at 60 Hz.

Pos. 1 Phase. Factory set at Three Phase Wye.

Pos. 2 Volts. Factory set at 120/208 volts.

Pos. 2 Frequency. Factory set at 60 Hz.

Pos. 2 Phase. Factory set at Three Phase Wye.

Pos. 3 Volts. Factory set at 120/240 volts with 3-position switch only.

Pos. 3 Frequency. Factory set at 60 Hz. with 3-position switch only.

Pos. 3 Phase. Factory set Single Phase Dogleg with 3-position switch only.

1.5.6 Paralleling Operation

Note: Have paralleling setup performed by appropriately skilled and suitably trained maintenance personnel familiar with generator set parallel commissioning, operation, service, and troubleshooting..

The generator set controller is a paralleling controller and provides varying degrees of paralleling functionality.

While the generator set controller can also be used with external switchgear controlling the speed, voltage and paralleling breaker/contactors, the Parallel Operation menu is used to configure settings for parallel operation where the controller is communicating on a network with other controllers and provides integral paralleling functionality.

Paralleling Setup

The Paralleling Setup menu is intended to configure the basic settings for the parallel operation of the controller. Most of the settings in this menu are configured during commissioning and do not require user adjustment. There are a few settings that may be viewed or adjusted after commissioning is complete.

Volts-Hz OK Delay. The time that the voltage and frequency must remain within the acceptable window before the controller considers them to be stable. The voltage window requires the output voltage of the generator set to be within the **Voltage OK Pickup** of the system voltage, the frequency window requires the operating frequency of the generator set to be within the **Frequency OK Pickup** of the system frequency. This delay may need to be increased if the first generator set to close to the bus has not yet reached rated operating parameters or if the speed/voltage is in an overshoot condition when the generator set comes online.

First On Delay. The time that the system will wait before closing the first generator set to the bus. This delay should be set as low as possible, but can be extended to ensure that a different generator set will be the first to close. One generator set in the system should have the first on delay set to a low number to minimize the delay before the generator set can supply power to the load.

kW Ramp Rate. The generator set will load and unload against the other generator sets at this rate. The default rate (5%/sec) requires 20 sec to accept 100% load. Increasing the ramp rate will allow the generator set to disconnect more quickly from the bus when signal to stop by generator management, but may result in variations in the output voltage or frequency of the generator set system. The ramp rate can be decreased if there is noticeable fluctuation in the voltage or frequency when a generator set is loading or unloading.

Trims Enable. The trims are the mechanism that the paralleling system uses to keep the output voltage and frequency near the rated values when the generator set system is operating. The trims default is enabled on all generator sets, but they can be disabled on some generator sets in the system to improve load sharing. The trims should be enabled on at least one generator set in the paralleling system or the voltage and frequency may drift significantly during the operation of the system.

Load Enable. The generator set will unload and trip the circuit breaker/contactors when this setting is set to OFF. This can be used to force a generator set to soft-unload and shut down for service. To keep the breaker/contactors from reclosing, the Sync Mode in Auto can be set to OFF (see Sync Mode In Auto below). A generator set is not considered for generator management when Load Enable is set to OFF. This parameter should always be returned to ON after the generator set has been stopped for service, as it will keep the generator set from sharing load or stopping for generator management if it is set to OFF.

Stand Alone Mode. This will tell the controller that it is a paralleling controller, even if it does not see another generator set on the communication lines. This may be required if all other generator set controllers are removed from service for a period of time in which the battery power to this controller will be cycled (the controller remembers that it is in a paralleling system until power is cycled). If the controller sees another controller on the PGEN communication network, this parameter will not change the operation of the system in any way.

Sync Mode In Auto. This should be set to Active before leaving the site when commissioning or can be used to keep the controller from closing the paralleling breaker/contactors to complete a test or to take a generator set out of service. Setting the Sync Mode to OFF will disable the synchronizer, the paralleling breaker/contactors will not close with the synchronizer disabled. To remove a

generator set from service manually, set the Sync Mode in Auto to OFF, wait for any additional generator sets to start, and set the Load Enable to OFF. When the breaker/contactors trips, stop the generator set by pressing the OFF button, then set the Sync Mode back to Active and the Load Enable back to ON.

Note: Pressing the OFF button will also disconnect the generator set from the paralleling bus, but it will not give the other generator sets any opportunity to negotiate an arrangement to support the load. Even if there are enough generator sets online to support the load, the voltage and frequency may dip when the other running generator sets are required to pick up the load formerly supported by this generator set.

Sync Mode In Run. The default setting for this parameter is Check. In Check mode, the controller will close the paralleling breaker/contactors to a dead bus (no other generator sets supplying the load) but will hold synchronism with the bus without closing the paralleling breaker/contactors if it is already supplied by another generator set. This allows operational verification of the synchronizer, but does not allow the generator set to supply the load. If the generator set system is to be operated with the engine control switch in Run, the Sync Mode in Run may need to be set to Active.

Note: System Start (AUTO-RUN) is the preferred method of operating a generator set system. RUN is intended for testing or verification only.

Note: Sync Mode in Auto and Sync Mode in Run can also be found on the Synchronizing Setup screen.

Synchronizing Setup

This screen is primarily used to configure the synchronizer. There is a lot of metering information that can be accessed on this screen, but the parameters should be adjusted only during commissioning.

Volts-Hz OK. The voltage and frequency have been within the acceptable window for the Volts-Hz OK Delay.

In Sync. The frequency, voltage and phase rotation of the generator set have matched that of the bus and the generator set and bus have been in phase for the duration of the dwell timer. This value is only updated when the controller is synchronizing (Sync Mode = Active, Passive or Check, breaker/contactors is open, generator set is running).

Voltage Matched. The difference between the generator set voltage and the bus voltage is within the acceptable window. This value is only updated when the controller is synchronizing (Synch Mode = Active, Passive or Check, breaker/contactors is open, generator set is running).

AVG Bus Voltage L-L. The average voltage of the paralleling bus.

AVG Gen Voltage L-L. The average voltage of this generator set.

Voltage Bias. The amount that the controller is attempting to adjust the output voltage (100% bias = +10% on the output voltage, -100% = -10% on the output voltage).

The controller adjusts the Voltage Bias to match the generator set voltage to the bus voltage

Frequency Matched. The difference between the generator set frequency and the bus frequency is within the acceptable window. This value is only updated when the controller is synchronizing (Synch Mode = Active, Passive or Check, breaker/contactors is open, generator set is running).

Bus Frequency. The operating frequency of the paralleling bus.

Gen Frequency. The operating frequency of this generator set.

Speed Bias. The amount that the controller is attempting to adjust the output frequency of the generator set (100% bias = +5% on the engine speed, -100% = -5% on the engine speed).

The controller adjusts the Speed Bias to match frequency and phase with the paralleling bus.

Phase Matched. The phase between the generator set voltage and the bus voltage is within the acceptable window. This value is only updated when the controller is synchronizing (Synch Mode = Active, Passive or Check, breaker/contactors is open, generator set is running).

Phase Difference. The phase angle between the generator set and the bus.

Note: This value is only accurate if the generator set is running and the bus is energized. The phase angle must be established between two waveforms.

Dwell Time Remaining. The remaining time for the dwell timer in seconds. The generator set is considered to be in Sync when the dwell timer expires. If this value is resetting to the Dwell Time (directly above it), the generator set is not holding synchronism. This value is only updated when the controller is synchronizing (Synch Mode = Active, Passive or Check, breaker/contactors is open, generator set is running).

Sync Time Remaining. The remaining time before the controller issues a Failure to Synchronize warning. The Failure to Synchronize warning will cause the generator management to consider this generator set unreliable and to start another generator set (if available). If the system commissioning has been performed properly, this warning should only occur if the system is overloaded or if there is a malfunction on this generator set. This value is only populated when the generator set is actively synchronizing (Sync Mode = Active, breaker/contactors is open, generator set is running).

Note: Dwell Time Remaining and Sync Time Remaining are not supported on all firmware versions. If the controller firmware does not support the time remaining parameters, they will be populated with N/A.

Sharing Setup

Bus % of Rated kW. The ratio of the total load on the bus (sum of the loads on all connected generator sets) to the total bus capacity (sum of all of the connected generator set capacities), expressed as a percentage. This value can be monitored to determine system loading (also found on Bus Metering screen, and Generator Management screen).

Gen % of Rated kW. The ratio of the total load on this generator set to its rated capacity, expressed as a percentage. This value can be compared to the Bus % of Rated kW (directly above it) to determine if the system is sharing load properly. The acceptable difference between the generator set and bus is site-dependent. The adjustment of the parameters on this screen (during commissioning) will determine how closely the generator sets share load.

Speed Bias. The amount that the controller is attempting to adjust the output frequency of the generator set (100% bias = +5% on the engine speed, -100% = -5% on the engine speed).

The controller adjusts the speed bias to share load between the generator sets connected to the paralleling bus.

Bus % of Rated kVAR. The ratio of the total reactive load on the bus (sum of the reactive loads on all connected generator sets) to the total bus reactive capacity (sum of all of the connected generator set reactive capacities), expressed as a percentage. This value can be monitored to determine system loading (also found on Bus Metering screen). The Reactive Power rating of the generator set is fixed at 3/4 of the rated kW capacity of the generator set (even in single-phase applications).

Gen % of Rated kVAR. The ratio of the total reactive load on this generator set to its rated reactive capacity, expressed as a percentage. This value can be compared to the Bus % of Rated kVAR (directly above it) to determine if the system is sharing reactive load properly. The acceptable difference between the generator set and bus is site-dependent. The adjustment of the parameters on this screen (during commissioning) will determine how closely the generator sets share reactive load. The Reactive Power rating of the generator set is fixed at 3/4 of the rated kW capacity of the generator set (even in single-phase applications).

Voltage Bias. The amount that the controller is attempting to adjust the output voltage of the generator set (100% bias = +10% on the output voltage, -100% = -10% on the output voltage). The controller adjusts the voltage bias to share reactive load between the generator sets connected to the paralleling bus.

Note: The metering values in this screen are populated regardless of the state of the generator set system, but the system must be in a sharing mode before it will attempt to match generator set and bus loading.

Protective Relays

The protective relays serve two purposes:

1. To protect the generator set from damage and
2. To protect the loads supplied by the generator set from damage

The protective relays are configured during commissioning and should not be adjusted except by a trained commissioning agent. These settings are often taken into consideration for breaker trip curves, load control settings, and generator management settings. The adjustment without careful consideration of the implications may mask a problem in the system and cause another. Properly-configured protective relays should only trip due to a failure.

Note: All protective relay events will trip the breaker/contactors, but will not stop the generator set until the Trip to Shutdown Delay has expired. During this time, the protective relay which tripped the breaker/contactors will be listed under the Active Events, the warning LED will be active, and the generator set will remain running. The protective relay can be reset by pressing the AUTO button (note, if the generator set is in Run, the protective relay will have to be cleared by stopping the generator set). Pressing OFF/RESET or removing the remote start signal to the generator set system also clears any active protective relays.

Gen Management

Generator Management is intended to minimize wear and tear, fuel consumption, pollutant/sound emissions, and generated heat. It acts by signaling each generator set to stop when it is unneeded. If generator management for a generator set is disabled, the generator set will start—generator management failures will result in additional generator sets running any time the system receives a start signal (this unit or others).

Generator management sequences the generator sets off in a predetermined order. The highest order generator sets stop first (when load is low enough) and re-start last (when load is too high). The order can be viewed on the front panel of the controller, but can only be adjusted under certain conditions (see Gen Management Order later in this section).

The time to start a generator set (if the load increases) varies with the degree of overload.

The time to stop a generator set (if the load is low enough that the generator is no longer needed) varies with the degree of available capacity.

Note: Receipt of a start signal will cause all generator sets to start, synchronize, and close to the bus. Generator management requires that the generator sets are available (not faulted) in order to be permitted to stop. If a generator set is faulted or manually stopped and then placed back in Auto, Generator Management will require the generator set to start and connect to the bus before it is considered available (and permitted to stop) again—even if generator management had previously signaled the generator set to stop.

Start Capacity. The percent of generator set rated kW of the running generator sets that the system allows before the accumulator to start this generator set begins filling.

Start Delay. The time to decide to start the generator set at 10% over capacity.

Stop Capacity. The percent of generator set rated kW of the other running generator sets that the system allows before the accumulator to stop this generator set begins filling.

Stop Delay. The time to decide to stop the generator set at 10% available capacity.

Gen Management Modes

The method that generator management uses to determine the starting and stopping order of the available generator sets. All of the generator sets in the system must have the same setting for this parameter for the generator management to operate. If this parameter is changed, it will be updated on all of the generator sets which are connected to the PGEN network. This parameter can be set to one of the following:

- **Manual/Fixed.** The order of the generator sets is manually set. In this mode, the order is set once by the user.

Note: The controllers require that the order be valid. If two nodes share a common order or there is a gap in the order sequence, the controllers will attempt to re-sort the order until it is valid. If the order is not valid (automatic re-sorting failed) generator management will be disabled (all generator sets will run all of the time).

- **Run Time.** The generator management start/stop order is determined by the runtime hours on the generator sets. In this mode, the order is determined to ensure that the generator set with the fewest runtime hours is the last to stop. Each subsequent order is assigned to generator sets with increasing runtime hours.

If a generator set is not running, the system will add the Run Time Threshold to the runtime hours for that generator set before it considers it in the order—this allows the generator sets to avoid starting and stopping continuously. The actual runtime will have to differ by more than the threshold to force the generator set order to switch (the stopped generator set will start, synchronize to the paralleling bus, and begin sharing load—the running generator set will soft-unload, disconnect

from the bus, cool down and stop).

The generator management order is not user adjustable in runtime mode.

Note: If the load on the system requires an additional generator set to start, the generator set with the most runtime hours will always be the first one to stop if the load decreases enough to permit it (the threshold is no longer taken into consideration as soon as the generator set is connected to the paralleling bus).

- **Fuel Level.** The generator management start/stop order of the generator sets is determined by the level of the fuel in the tank which supplies each generator set. In this mode, the order is determined to ensure that the generator set with the most fuel is the last to stop. Each subsequent order is assigned to generator sets with decreasing fuel percentage.

If a generator set is running, the system will add the Fuel Level Threshold to the measured Fuel Level for that generator set before it considers it in the order. This allows the generator sets to avoid starting and stopping continuously. The actual fuel level will have to differ by more than the threshold to force the generator set order to switch (the stopped generator set will start, synchronize to the paralleling bus, and begin sharing load and the running generator set will soft-unload, disconnect from the bus, cool down, and stop).

The generator management order is not user adjustable in Fuel Level mode.

Note: Fuel Level Order Selection mode requires separate fuel tanks for the generator sets and fuel level senders connected to the controller to operate. Operation of Fuel Level mode without sensors is not defined.

Note: If the load on the system requires an additional generator set to start, the generator set with the lowest fuel level will always be the one to stop (the threshold is no longer taken into consideration as soon as the generator set is connected to the paralleling bus).

Gen Management. Allows permanent disabling of the generator management on this generator set. This parameter can be set individually for each generator set and will inhibit the Generator Management Configuration Mismatch Warning for this generator set if set to OFF.

Note: Disabling the generator management on one generator set in a paralleling system will not keep the other generator sets in the paralleling system from alarming if the generator management configuration of any of the other nodes differs from the disabled generator set.

Note: Generator sets with Generator Management disabled are not taking into consideration for generator management on the other generator sets. It is not recommended to disable any of the generator sets in a paralleling system where generator management is intended to be used, the generator management may operate too many generator sets in these cases.

Generator management defaults to OFF. It should be enabled on all generator sets in the system if it is desired.

Gen Management Order. Determines the Start/Stop Order of this generator set. Generator sets with a lower order will start before generator sets with a higher order, higher order generator sets stop before lower order generator sets.

If the Generator Management Order for a generator set changes, generator management will start any generator sets which were involved in the order changing process (including automatic re-sort). After the incoming generator sets connect to the paralleling bus, the generator sets with a high enough order to stop will start filling their accumulators to stop.

The generator set order is adjustable in Manual/Fixed Order selection mode. It is only adjustable in Runtime or Fuel level mode if the generator sets have identical runtime or fuel level.

Total Bus Capacity. The total bus capacity is simply the sum of the kW rating of all generator sets that are connected to the paralleling bus (running with paralleling breaker closed). Generator sets in Baseload, System Control, or Unload mode are not taking into consideration for this capacity.

Bus Total Power. The sum of the power output of all generator sets which are connected to the bus and available for sharing load. Generator sets in Baseload, System Control, or Unload mode are not taking into consideration for this level. The Bus Total Power is compared to the Start kW and Stop kW of the generator set to determine if the generator set should be started, stopped, or remain as-is.

Start kW. The threshold of Bus Total Power above which the Start Accumulator for this generator set will start filling.

Note: The Accumulator fill rate is higher for larger differences between Bus Total Power and Start kW.

Stop kW. The threshold of Bus Total Power below which the Stop Accumulator for this generator set will start filling.

Note: The Accumulator fill rate is higher for larger differences between Stop kW and the Bus Total Power.

Preemptive Warnings. A preemptive warning tells the system that a generator set may have a problem in the future. If Generator Management has stopped the generator sets, it will start one of the unused generator sets but keep the running generator set with the preemptive fault online. The following conditions are considered preemptive warnings:

- Low Oil Pressure Warning
- Low Fuel Pressure Warning
- High Coolant Temperature Warning
- Failure to Synchronize Warning
- Water in Fuel Warning
- Fuel Tank Leak Warning
- Loss of Fuel Warning

A preemptive warning disables Generator Management on the unit which has the warning. It will run as long as the start signal is present.

Note: Most of the preemptive warnings have a shutdown which follows shortly after the warning. The intent of starting another generator set is that it will be able to supply the load when the generator set shuts down on a fault.

Start Accumulator. The Start Accumulator fills from 0% to 100% while the Bus Total Load remains above the Start kW. This generator set will be signaled to start when this accumulator reaches 100%.

Note: The Start Accumulator will reset to 0% if the Bus Total Power drops below the Start kW for one second.

The Start Accumulator may be filling while the engine is running in cooldown. If it reaches 100% before the cooldown is complete, the generator set will synchronize and close to the bus (it will not have to go through a start sequence).

Stop Accumulator. The Stop Accumulator fills from 0% to 100% while the Bus Total Load remains below the Stop kW. This generator set will be signaled to stop when this accumulator reaches 100%.

Note: The Stop Accumulator will reset to 0% if the Bus Total Power exceeds the Stop kW for one second.

The generator set may remain running and connected to the paralleling bus for a few seconds after the Stop Accumulator reaches 0%. During this time, the generator set is unloading so that it can trip the circuit breaker/contactors connecting it to the bus with minimal wear on the contacts in the breaker/contactors and minimal disturbance to the voltage and frequency of the system.

Run Time Threshold. The maximum difference in runtime hours that generator management will accept before it re-sorts the Start/Stop Order of the generator sets to equalize hours (see Gen Management Order earlier in this section). All of the generator sets in the system must have the same setting for the Run Time Threshold for the generator management to operate. If this parameter is changed, it will be updated on all of the generator sets which are connected to the PGEN network.

Total Run Time. The actual runtime hours of this generator set (to the nearest tenth of an hour). This parameter is also available in the Generator Information screen, but is rounded to the nearest hour.

Fuel Level Threshold. The maximum difference in fuel level that generator management will accept before it re-sorts the Start/Stop Order of the generator sets to equalize fuel level. (See Gen Management Order earlier in this section). All of the generator sets in the system must have the same setting for the Fuel Level Threshold for the generator management to operate. If this parameter is changed, it will be updated on all of the generator sets which are connected to the PGEN network.

Fuel Level. The level of the fuel in the tank supplying this generator set. This is available in the engine metering section in SiteTech™, but not elsewhere on the User Interface. If no fuel level sensor is connected, this parameter will display N/A. Do not use Fuel Level as the Generator Management Mode if there is no fuel level sensor connected—the operation of the system is not defined in this case.

Stable Delay. The time between the system entering a valid generator management state and the time that generator management becomes active.

A valid generator management state requires:

- A Start Signal is present (Local start, remote start, or communications start)
- A least one generator set is closed to the paralleling bus
- Generator Management is enabled
- The configuration of vital parameters of the system are identical between all controllers
- No generator sets have recently failed
- Load control has added priorities through the Min Loads Added Threshold
- The generator management order is valid

Once active, generator management will only go inactive if:

- A generator set fails (shuts down with either a fault or user input)
- All generator sets are disconnected from the bus
- The Start Signal is removed
- Generator Management is disabled
- The configuration on any controller on the network is changed by a user
- The order becomes invalid

All of the generator sets in the system must have the same setting for the stable delay for the generator management to operate. If this parameter is changed, it will be updated on all of the generator sets which are connected to the PGEN network.

Minimum Gens Online. Generator Management will always try to keep this many generator sets online (even if they are not needed). All of the generator sets in the system must have the same setting for the Minimum Gens Online for the generator management to operate. If this parameter is changed, it will be updated on all of the generator sets which are connected to the PGEN network.

The purpose of this setting is to allow configuration to support large transient loads or potential generator set failure (N+1 redundancy).

Note: Only 1 and 2 Minimum Gens Online is supported at this time.

Min Loads Added. The Load Shed priority that must be online before generator management will consider stopping a generator set. This is implemented so that generator sets aren't stopped prematurely (before all of the available load has been applied to the system). All of the generator sets in the system must have the same setting for Min Loads Added for the generator management to operate. If this parameter is changed, it will be updated on all of the generator sets which are connected to the PGEN network.

Note: Min Loads Added should be set up to support the load control outputs which are connected to actual loads. There is no reason to wait for a load control output to add if no load will be added to the system when it does. At the same time, it is important that all load which the paralleling system will have to support be supplied by the system before generator management makes the determination to stop a generator set.

The load control outputs should be capable of shedding enough load that a single generator set can support what remains (this should be handled during commissioning, but is included for consideration as loads grow).

Load Control

Load Control drives 6 outputs (Load Priority 1 Shed through Load Priority 6 Shed) to remove loads from the paralleling bus when the attached generator sets are unable to support them. See the Load Control Description Section following for more information.

The outputs must be tied to programmable outputs in the configuration before they can be used, but they are controlled internally regardless of output configuration or external connection status.

All generator sets on the PGEN network initiate load control at the same time and use the same measured values to determine the Add and Shed timing (Bus % kW and Bus Frequency). If the load control settings are set identically, each load control priority will add at the same time on all generator sets in the paralleling system. This allows Priorities 1 and 2 to be connected to one generator set, while Priorities 3 and 4 can be connected to another generator set.

Note: Load Control in a paralleling system operates identically to the load control on a single generator set, except that it takes different metered values into consideration.

Load Control Description

The purpose of Load Control is to permit a generator set to support load which may occasionally exceed the rated capacity of the generator set. In paralleling systems, load shed permits the bus to stay at rated voltage and frequency while an additional generator set is synchronizing to it. In single-generator set applications, load control may shed unimportant but highly demanding loads when the generator set is overloaded, preventing a power outage caused by the generator set going offline.

The Load Control in the generator set controller supports 6 load control priorities. These priorities generate internal notices for the shed condition. The internal notices are generated any time a load is shed, but they will only operate a load control relay if they are configured to a digital output.

Only 4 load control priorities can be configured to the RDO outputs on the controller (2 in paralleling applications) but the optional relay dry contact kit will permit all 6 load control priorities to be accessed and configured to disconnect 6 different loads (each load priority can interrupt several devices).

In paralleling applications, the load shed priorities can be divided between all of the generator sets. For instance, Generator #1 can support Load Priorities 1 and 4, Generator #2 can support Priorities 2 and 5 and Generator #3 can support Priorities 3 and 6. This configuration does not require the optional relay dry contact kit and permits partial load shed functionality even if one controller is powered down or fails (redundancy).

Load Priority 1 is shed last and added first, the priorities are added in increasing sequence and shed in decreasing sequence.

All Load Priorities are immediately shed when load control is initiated. Load control is initiated when the system receives a start signal (a system start, a remote start, or a start by communication). In a paralleling application, the controller can receive a start signal from any generator set which is connected to the PGEN communication network. Pressing RUN on the controller will not cause the loads to shed.

All loads are added immediately when Load Control is de-activated—this occurs when the start signal is removed.

Load Control adds loads based on the capacity of the system—loads will add more quickly if the available capacity is higher.

Load Control sheds loads based on the degree of overload of the system—loads will shed more quickly as the degree of the system overload increases.

Note: The Generator Management start % should be significantly lower than the Gen Overload Percent so that additional generator sets will come online before a load is shed.

An under frequency event will also shed load—the under frequency threshold is not adjustable from the User Interface.

The load control will shed subsequent loads more quickly if shedding a load did not remove the overload or underfrequency condition.

In a standard application (single generator set or generator set controlled by external switchgear) the load control logic uses the Gen % or Rated kW and the Gen Frequency.

In a paralleling application (where the controller is responsible for first-on, synchronizing, load sharing, and Generator Management) the load control logic uses the Bus % of Rated kW and Bus Frequency. All generator sets use the same start signal, load and frequency values to determine load control timing, hence each controller will shed and add a given load priority at the same time (provided that the load control settings are identical in each controller).

In a paralleling application where Generator Management is used, some generator sets may be shut down (turned Off) by the Generator Management. Even if the generator set is Off, it may de-activate its Load Control outputs to energize those loads. This may seem contrary to intuition, but the generator sets are acting as a system. If voltage and frequency of the paralleling bus are adequate, and Load Add accumulators are met, the loads will be enabled, even if a particular generator set is shut down by the Generator Management.

Description of User Adjustable Load Control Settings

The Load Control settings are found under GENERATOR INFO -> PARALLEL OPERATION -> LOAD CONTROL. Load control is active, even if the generator set is not operating in a paralleling application.

Gen % Max Cap. The load level on the generator set (or paralleling bus, in a paralleling application) that the load

control will not intentionally exceed. If the load is within 15% of this load level, the load control will not add the next priority until the load decreases (or another generator set starts, synchronizes and closes its paralleling breaker/contactors, in a paralleling application).

Gen Overload Percent. The load level on the generator set (or paralleling bus, in a paralleling application) above which the Load Control will start to consider shedding loads. Loads will shed more quickly if the generator set is heavily overloaded, more slowly if the generator set is barely overloaded. If the load drops below the Gen Overload Percent before a load priority is shed, the accumulator for shedding load is reset.

Note: Additional load control settings are provided in SiteTech™, but they are configured during commissioning and should not require adjustment after commissioning is complete. Have setup and adjustments of the generator set controller performed only by an authorized Kohler distributor.

1.5.7 Emissions Information

Note: Have emission information setup performed by appropriately skilled and suitably trained maintenance personnel familiar with generator set operation and service.

The controller provides emissions related information on selected generator sets. This information is intended to provide the service technician data for maintaining functionality and compliance with federal and local emissions requirements.

The Emissions Info menu provides the user a means to prevent active regeneration or request stationary regeneration. Most of the settings in this menu do not require user adjustment. If PREVENT ACTIVE REGEN is set to NO, the generator set will automatically perform cleaning as needed. If PREVENT ACTIVE REGEN is set to YES, cleaning will not be allowed. The user may be prompted by the ECM to manually initiate stationary regeneration. Further information is shown under the PREVENT ACTIVE REGEN and REQUEST REGEN headings following.

The PREVENT ACTIVE REGEN and REQUEST REGEN parameters can be adjusted locally by the user at the controller. Changes to the status may be password protected. These two functions cannot be changed using the SiteTech™ software.

Note: Refer to 3.10 Stationary Regeneration of the Exhaust System for procedure options and scenarios.

Emissions

DEF LEVEL. The display provides the monitored Diesel Exhaust Fluid (DEF) level expressed as a percentage (0.0–100.0%). The DEF is injected into the exhaust where it is used in the Selective Catalyst Reduction (SCR). The DEF fluid level must be monitored and maintained by the user, refilling the DEF tank as necessary.

EXHST SYSTEM REGEN. The display shows the need for cleaning of the exhaust system as Not Needed (0), Needed Low (1), Needed Moderate (2), Needed High (3), Needed Very High (4), or Needed Service Only (5).

When the status indicates cleaning is Needed High (Level 3), steps should be taken to allow active cleaning or to initiate stationary cleaning. If action is not taken and engine operation continues, derating of the engine output will begin; eventually falling to zero. Upon further operation, the engine will be shut down. If the need for regeneration is at Needed Service Only, stationary cleaning is no longer an option and a manual cleaning procedure with brushes, blowers, etc. by a certified technician is required to resolve the fault.

SOOT LEVEL. The display provides the monitored soot level at the Diesel Particulate Filter (DPF) expressed as a percentage (0–250%). This parameter will not be shown if no DPF is included as part of the exhaust system equipment.

ASH LEVEL. The display provides the monitored ash level at the DPF expressed as a percentage (0–250%). This parameter will not be shown if no DPF is included as part of the exhaust system equipment.

EXHST OUT TEMP. The display provides the monitored exhaust outlet temperature expressed as xxxxC/F degrees.

TIME SINCE REGEN. The display provides the engine run time since the last active regeneration expressed as hhhhhh:mm:ss.

CLEANING STATUS. This display shows the status of the ability of the engine ECM and exhaust system (controls and equipment) to perform active cleaning. There are numerous conditions that can prevent active cleaning from being performed. These are observed

and monitored by the engine ECM to determine whether or not it can conduct cleaning.

If it is determined that cleaning cannot be conducted, the engine ECM will report all of the reason(s), as codes, to the generator set controller. The most common reasons for disabling cleaning are captured and displayed in a hierarchical format.

CLEANING STATUS—ENABLED. If there are no conditions that would prevent active cleaning, the display shows ENABLED. This does not imply cleaning is in process, only that there is nothing to prevent such functionality.

CLEANING STATUS—USER SWITCH. If the user has disabled cleaning by setting PREVENT ACTIVE REGEN to YES, the display shows USER SWITCH. This will be the display even if other conditions exist that would prevent cleaning.

CLEANING STATUS—LOW EX TEMP. If the user switch (PREVENT ACTIVE REGEN) is not preventing cleaning, the exhaust temperature will be considered next. If the exhaust temperature is too low, thus preventing active cleaning, the display shows LOW EX TEMP, regardless of other conditions.

CLEANING STATUS—SYSTEM FAULT. The next consideration is the cleaning system (controls and equipment). If there is a fault in the cleaning system, the display shows SYSTEM FAULT.

CLEANING STATUS—UNKNOWN. If the engine ECM is reporting that cleaning is disabled for some other reason, the display shows UNKNOWN.

PREVENT ACTIVE REGEN. The display allows the user to review or change the status of the parameter to prevent or allow active regeneration. Use the generator set controller to change the setting between YES and NO. After each engine start, the parameter will revert to the default value of No, to allow active cleaning.

The cleaning system is intended to operate autonomously. Since disabling cleaning will cause residue levels to rise in the exhaust system, setting this parameter to YES will decrease the ability of the system to be performed as intended. Setting the parameter to YES requires conscious user action with understanding of the implications. This parameter must be changed only by personnel at the generator set who will continuously monitor the system.

Since PREVENT ACTIVE REGEN and REQUEST REGEN cannot be YES at the same time, the Prevent Active Regen parameter changes to NO when the Request Regen parameter is set to YES.

REQUEST REGEN. The display allows the user to request stationary regeneration. This function is only available at the generator set controller. The exhaust system regen status must be at Level 3 or Level 4 in order to request regeneration.

If the regen status gets too high (Level 3), the controller menu will alert the need to perform a stationary regeneration. If the regeneration is not performed and the residue level continues to rise (Level 4), the engine ECM will derate engine output by as much as 50%. If residue levels reach an unacceptable level (Level 5), the engine ECM will initiate an engine shutdown where a manual cleaning process with brushes, blowers, etc. by a certified technician is required to resolve the fault.

For the cleaning process to be initiated the proper interlock conditions must be satisfied, including user acknowledgement or request, disabling alternator excitation, and opening the output circuit breaker/contact. During cleaning, steps are taken to actively elevate the exhaust temperatures by using hydrocarbon dosing, etc. During stationary regeneration, the generator set system logic will not allow connection to load since alternator excitation is disabled and output voltage will be low.

Use the controller to change the settings between YES and NO.

Stationary Regeneration Stages:

Initiation of Stationary Regeneration. Stationary regeneration or cleaning may be requested in the Run, Cooldown, or Off modes. The request may also be made when running in the special regeneration cooldown mode (stationary regen state) following the cancel or failure of a previous regeneration request.

When stationary regeneration is successfully requested, the following actions will occur:

- The process of stationary cleaning is initiated when the request is seen as active and the generator set is running (RUN mode active) or in cooldown (AUTO mode active). If the request is made while in the OFF mode, it will be necessary to press RUN to transition to running where cleaning will be initiated. If the request is made while running, cleaning will be initiated immediately.
- When stationary regeneration is successfully initiated, the generator set controller allows 5 minutes

for the engine ECM to indicate stationary regeneration has started. If this timer expires before indication stationary regeneration is in process, a failure of stationary regeneration will be shown as a status event. Refer to Failure of Stationary Cleaning following for additional information.

- Alternator excitation is disabled during stationary cleaning. This prevents any load being applied to the engine. This will further prevent paralleling routines from closing the generator set circuit breaker.

Stationary Regeneration is Active. When stationary regeneration is successfully initiated, the engine ECM controls the cleaning process. The engine ECM indicates cleaning is active through CAN communications and the high exhaust temperature symbol is displayed.

The generator set controller allows 60 minutes for the engine ECM to indicate stationary regeneration is completed. If this timer expires before indication that stationary regeneration is complete, a failure of stationary regeneration will be shown as a status event. Refer to Failure of Stationary Cleaning following for additional information.

Completion of Stationary Regeneration. Stationary cleaning will continue until the process is aborted, fails to start, fails to complete, or until completion is detected. When stationary regeneration is complete, the generator set controller will transition to the special regeneration cooldown mode if in the Run mode. When stationary regeneration is complete, the generator set controller will transition to the cooldown state if in the Auto mode.

Abort Stationary Regeneration. Stationary cleaning may be cancelled or aborted for several reasons. If any of these reasons or causes occur during the stationary cleaning process, the process will be aborted and generator set operation will proceed as described below:

- If the request parameter is changed to NO from the generator set controller during stationary cleaning, an abort event will occur.
- If the prevent active cleaning parameter is changed to YES at the generator set controller during stationary cleaning, an abort stationary regeneration occurs.
- If the OFF mode button is pressed during stationary cleaning, stationary regeneration will abort and the generator set shuts down with transitioning to the OFF mode.

- If the stationary cleaning was initiated from the RUN mode, pushing the AUTO button is acceptable. However, when the AUTO mode is active, a remote start input causes an abort stationary regeneration.
- If stationary regeneration is aborted, a status event is created.
- If stationary regeneration is aborted when in the AUTO mode, the generator set transitions back to the cooldown state where alternator excitation will resume and output voltage should be present. After the cooldown state is complete, the remote start inputs will be checked and normal operation will resume.
- If stationary regeneration is aborted in the RUN mode, the generator set transitions to a special regeneration cooldown mode (within the stationary regeneration state). This special mode is described in Stationary Cleaning Cooldown Mode following.
- If the stationary regeneration is aborted by means other than setting the request parameter to NO, the request parameter as seen on the generator set controller or SiteTech™ software is changed to NO.

Failure of Stationary Cleaning. Stationary cleaning may be determined as failed for either of two reasons. If cleaning is not seen as active within the specified time of request, the process is declared as failed. If cleaning is not seen as complete within the specified time of starting, the process is declared as failed.

Stationary regeneration may fail if the exhaust temperature does not reach satisfactory levels within the allowed time to initiate cleaning. This may occur in cases where ambient temperature is low and the generator set has not been running for an extended period of time. In this case, multiple attempts to perform regeneration may be required.

If cleaning fails to complete within the 60 minutes of time allowed, inspect and confirm that the regen needed status remains high and the Exhaust System Regeneration remains Needed High or Needed Very High. If these conditions no longer indicate cleaning is required, the regeneration was completely successful.

If the need for regeneration is at Needed Service Only, stationary cleaning is no longer an option and a manual cleaning process with brushes, blowers, etc. by a certified technician is required to resolve the fault.

If stationary cleaning fails the following actions will occur:

- If stationary cleaning fails while in the RUN mode, the generator set controller transitions to a special stationary cleaning cooldown mode (as described in Stationary Cleaning Cooldown Mode) before transitioning to the OFF mode.
- If stationary cleaning fails in the AUTO mode, the generator set controller transitions to the normal cooldown state, alternator excitation resumes, and remote start is monitored. The generator set controller changes to the cooldown state.
- If stationary cleaning fails, a status event is posted to indicate the time of failure.

Stationary Cleaning Cooldown Mode. If the RUN mode is active, stationary cleaning will eventually transition to a special regeneration cooldown mode. The following events occur during the stationary cleaning cooldown model:

- The cooldown mode may be entered by failure, abort, or completion of stationary cleaning while in the RUN mode.
- Alternator excitation remains off and output voltage will be low.
- The GensetState parameter will continue to show Regeneration.
- If the AUTO mode button is pressed during regeneration cooldown, the generator set controller transitions to the cooldown state where alternator excitation and normal operation resume.
- If the REQUEST REGEN parameter is set (YES) during the special regeneration cooldown mode, the generator set controller will re-initiate cleaning by transitioning back to the initial stage of stationary regeneration.
- The cooldown mode continues for 5 minutes. If the cooldown period continues for the full 5 minutes, the generator set controller transitions to the OFF mode.
- If the OFF mode button is pressed during the cooldown period, the generator set shuts down and the controller transitions to the OFF mode.
- The user parameter REQUEST REGEN changes to NO when the special regeneration cooldown mode begins.
- The user may re-initiate cleaning during the special cooldown mode by setting the REQUEST REGEN parameter to YES if all other appropriate conditions are satisfied.

Notifications

The controller will receive messages from the engine ECM. When important emissions related messages are received, they will be indicated on the generator set controller through the use of special symbols for Tier 4 engines. These symbols are shown in Figure 1-6. When one of these symbols is displayed, refer to the specific engine event codes from the engine ECM and refer to the respective engine operation manual.

High Exhaust Temperature. This symbol indicates the exhaust temperature is high when cleaning is in process and indicates the system is functioning properly.

System Issue. This symbol indicates something is wrong with the exhaust or emissions control system.

Low DEF. This symbol indicates the Diesel Exhaust Fluid (DEF) level is low (steady) or extremely low (flashing) and the DEF tank must be filled.

Cleaning Disabled by User. This symbol indicates cleaning/ regeneration has been disabled by the user setting the PREVENT ACTIVE REGEN parameter.

Cleaning Needed. This symbol indicates exhaust system cleaning is required. A solid symbol indicates a low level need. A flashing symbol indicates a higher level need.

| EMISSIONS | | hh:hh dd:mm:yy |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |
| HIGH EX TEMP | SYSTEM ISSUE | LOW DEF |
|  | |  |
| CLEANING DISABLED | | CLEANING NEEDED |

Figure 1-6 ECM Emissions Symbols

1.6 Controller Configuration Menu

1.6.1 Controller Configuration Submenu

- **Language** displays the user selected language. At this time, English is the only available option.
- **Units** displays the user selected unit of measure as Metric or English.

- **Time Format** displays the user selected time format as 12 hours or 24 hours.
- **Date Format** displays the user selected date format as mm/dd/yyyy or dd/mm/yyyy.
- **Contrast** displays user selected resolution values to improve digital display clarity.
- **Alarm Silence** displays the programmer selected alarm silence method Always or Auto Only using SiteTech™ software. The Always selection activates the alarm horn in any of the OFF/RESET-AUTO-RUN modes. The Auto Only selection activates the alarm horn only when in the Auto mode.

Note: Press the Alarm Silence/Lamp Test button to silence the alarm horn.

1.6.2 Communication Setup Submenu

Modbus® Communications

The controller communicates using Modbus® as a slave connection with the Modbus® master initiating the communication. The controller seeks the system and alternator parameters and diagnostic information then responds back to the Modbus® master. In addition, the controller accepts information to alter controller parameters including generator set starting and stopping. See Figure 1-7. Refer to the List of Related Materials for available Modbus® literature.

Note: Only one Modbus® master can be connected to the controller. Examples include the remote serial annunciator, monitoring software, and switchgear applications.

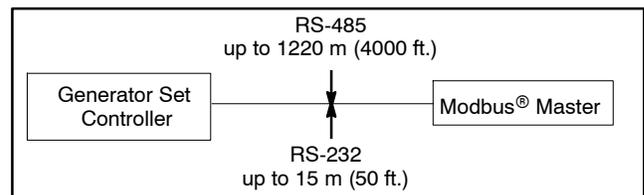


Figure 1-7 Modbus® Connections

A controller can communicate directly to a Modbus® master or participate in a network of devices. It can also be used to interface a local master to a network of devices.

Modbus® is a registered trademark of Schneider Electric.

The Modbus® master polls slave devices for data. Controller devices are slaves. Examples of master devices are a personal computer running monitoring software and the remote serial annunciator. See Figure 1-8.

| SiteTech Group | Parameter | Setting |
|----------------|-----------|-------------------------------------------------------------------------------------------------------------------|
| Modbus | Address | Use a unique network address between 1 and 247 for each unit. Use 1 for a single connection. Do not use 0 (zero). |
| | Baud rate | 9600, 19200, 38400, or 57600. Must match the PC and all devices in the system. |

Figure 1-8 Controller Communication Parameters

Select the baud rate. Choose the same baud rate for the Modbus® master, modems, and connected devices.

Each generator set controller must have a unique Modbus® address and PGEN node number (1-4).

Note: The PGEN node number is automatically determined. The number of nodes online should match the number of installed generator sets.

Note: The PGEN baud rate should not be adjusted except under direction from a factory service representative. Different baud rates between controllers on the network will result in a loss of communication on the network.

1.6.3 Calibration Submenu

The calibration values are reviewable at all times and provide the calibration of the voltage and current sensing logic. Changing the system voltage or replacing the circuit board requires a calibration adjustment.

Note: Have calibration adjustments performed by an authorized distributor.

To enable calibration, when the line is highlighted, push and hold the pushbutton/rotary selector dial to enable the calibration capability. The user is prompted with a Yes/No prompt for calibration. The display will show the following:

- Gen L1-L0 Volts
- Gen L2-L0 Volts
- Gen L3-L0 Volts
- Gen L1-L2 Volts
- Gen L2-L3 Volts
- Gen L3-L1 Volts

- Gen L1 Current
- Gen L2 Current
- Gen L3 Current
- Bus L1-L2 Volts
- Bus L2-L3 Volts
- Bus L3-L1 Volts
- Reset Gen Volt Meter: (Yes/No)
- Reset Gen Amp Meter: (Yes/No)
- Reset Bus Volt Meter: (Yes/No)
- Reset All Meters: (Yes/No)

The user can change individual values or can select the individual Reset to reset certain values. The Reset selections will only show if calibration is enabled. Refer to the requirements shown with Generator Set Calibration in 2.4.5 Status and Notice Digital Displays.

1.7 I/O Setup Menu

Note: Have setup and adjustments of the generator set controller performed only by an authorized Kohler distributor.

Analog and Digital Input Setup

There are three types of inputs setups:

1. Analog Resistive
2. Analog Differential (used in paralleling applications)
3. Digital

Note: Analog = a sender, variable-resistant device.
Digital = a switch with contacts.

The I/O Setup Menu displays the setup of digital and analog warning and shutdown inputs. These inputs provide choices for configuring customized auxiliary inputs.

The user must enable the programming mode to edit the display. See Section 2.5 Menu Displays for changeable settings in this menu.

Descriptions. Descriptions for user inputs (auxiliary analog or auxiliary digital) may be entered using the SiteTech™ software accessory where the user determines the descriptions.

Enabled. This menu indicates whether or not the input is enabled, if the input is not enabled, the controller will ignore this input signal.

Analog inputs have separate warning and shutdown enabled choices.

Inhibit Time Delay. The inhibit time delay is the time period following crank disconnect during which the generator set stabilizes and the controller does not detect the fault or status event. The controller will ignore the input until the inhibit time expires. If the inhibit time is set to zero, the input is monitored at all times, even when the generator set is not running. The inhibit time delay range is from 0 to 60 seconds.

Time Delay (shutdown or warning). The time delay follows the inhibit time delay. The time delay is the time period between when the controller first detects the fault or status event and the controller warning or shutdown lamp illuminates. The delay prevents any nuisance alarms. The time delay range is from 0 to 60 seconds.

Additional Analog Input Entries. The analog input selection typically requires entering four values—low warning, high warning, low shutdown, and high shutdown.

Digital Output and Relay Driver Output Setup

The I/O Setup Menu displays the setup of digital status and fault outputs and relay driver outputs (RDO). These RDO outputs provide choices for configuring customized auxiliary outputs. Additional individual outputs are available for monitoring, diagnostics, and control functions. See Optional Dry Contact Kit following.

The user must enable the programming mode to edit the display. See Section 2.5 Menu Displays for changeable settings in this menu.

Note: Changes to the Digital Outputs description requires the use of SiteTech™ software. The digital output can either open or close the circuit to activate.

Optional Dry Contact Kit

Dry contact kits provide an isolated interconnection between the generator set controller and optional

devices. Up to fourteen conditions can be specifically identified with this kit.

A relay coil will be energized when the corresponding engine or generator set sensing device or switch monitored by the microprocessor control board is activated.

Each relay provides one set of SPST contacts for field connection of customer supplied indicators or alarms. Contacts are rated for a maximum resistive load of 10A at 120VAC.

1.7.1 Controller Fault Diagnostics

See Figure 1-9 for an event screen example. Figure 1-10 provides descriptions of the system events and their types—warning, shutdown, status, and notice.

Warnings show a yellow warning lamp and sound an audible alarm to signal an abnormal condition. A warning does not shut down the unit but requires attention. **Shutdowns** show a red fault shutdown lamp, sound an audible alarm, and stop the generator set. **Statuses** are not indicated by lamps or text messages on the controller interface LCD and do not require user interaction but are part of the event history. **Notices** are used for controlling outputs and notifying the user of the operating status. Notices are NOT part of the event history.

The default selection time delays and digital outputs are factory set and adjustable. Some data entries require using a PC and SiteTech™ software.

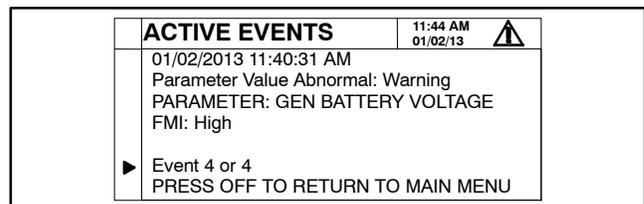


Figure 1-9 Event Screen Capture (Example)

| FMI (Failure Mode Indicator) | Event ID/Parameter at Local Display | Level | Programmed Input | Programmed Output |
|---------------------------------|------------------------------------------|----------|---------------------|----------------------|
| | Protectives | | | |
| Low | Engine Speed | Shutdown | | D |
| High | Engine Speed | Shutdown | | D |
| Shorted High | Engine Oil Pressure * | Warning | AD | D |
| Shorted High | Engine Oil Pressure * | Shutdown | AD | D |
| Shorted Low | Engine Oil Pressure * | Shutdown | | D |
| Low | Engine Oil Pressure | Warning | AD | D |
| Low | Engine Oil Pressure | Shutdown | D | D |
| Open Circuit | Engine Oil Pressure * | Shutdown | | D |
| Low | Engine Coolant Temperature * | Warning | AD | D |
| Low | Engine Coolant Temperature * | Shutdown | | D |
| High | Engine Coolant Temperature * | Warning | AD | D |
| High | Engine Coolant Temperature * | Shutdown | AD | D |
| Open Circuit | Engine Coolant Temperature * | Shutdown | | D |
| Shorted High (3) | Engine Coolant Temperature * | Shutdown | | D |
| Shorted Low (4) | Engine Coolant Temperature * | Shutdown | | D |
| High | Lube Oil Temperature * | Warning | AD | |
| High | Lube Oil Temperature * | Shutdown | D | |
| Low | Engine Coolant Level | Shutdown | D | D |
| Low | Engine Fuel Level | Warning | AD | D |
| Low | Engine Fuel Level | Shutdown | D | D |
| High | Engine Fuel Level | Warning | D | D |
| Critically High | Engine Fuel Level | Warning | D | D |
| Low | Fuel Pressure | Warning | AD | D |
| Low | Fuel Pressure | Shutdown | AD | D |
| Low | Gen Battery Voltage | Warning | | D |
| High | Gen Battery Voltage | Warning | | D |
| Low | Cranking Voltage | Warning | | D |
| Low | Engine Oil Level | Warning | AD | D |
| Low | Engine Oil Level | Shutdown | D | D |
| Low | Generator Voltage L1-L2 | Shutdown | | D |
| High | Generator Voltage L1-L2 | Shutdown | | D |
| Low | Generator Voltage L2-L3 | Shutdown | | D |
| High | Generator Voltage L2-L3 | Shutdown | | D |
| Low | Generator Voltage L3-L1 | Shutdown | | D |
| High | Generator Voltage L3-L1 | Shutdown | | D |
| Low | Avg Gen Voltage L-L | Warning | | D |
| High | Avg Gen Voltage L-L | Warning | | D |
| Low | Generator Frequency | Warning | | D |
| High | Generator Frequency | Warning | | D |
| Low | Generator Frequency | Shutdown | | D |
| High | Generator Frequency | Shutdown | | D |
| Low | Total Power (Generator Total Real Power) | Warning | | D |
| High | Total Power (Generator Total Real Power) | Warning | | D |
| High | Total Power (Generator Total Real Power) | Shutdown | | D |
| Low | Total Reactive Power | Warning | | D |
| High | Avg Current | Warning | | D |
| Low | Maximum Alternator Current | Shutdown | | D |
| High | Intake Air Temperature | Warning | | D |
| High | Intake Air Temperature | Shutdown | | D |
| High | Fuel Temperature | Warning | | D |
| High | Fuel Temperature | Shutdown | | D |
| Low | Coolant Pressure | Warning | AD | D |
| | AC Sensing Lost | Warning | | D |
| | AC Sensing Lost | Shutdown | | D |

| FMI (Failure Mode Indicator) | Event ID/Parameter at Local Display | Level | Programmed Input | Programmed Output |
|-----------------------------------------|-------------------------------------------------------------|--------------|-----------------------------|------------------------------|
| | Alternator Protection | Shutdown | | D |
| | Auxiliary Input | Warning | AD | D |
| | Auxiliary Input | Shutdown | D | D |
| | Battery Charger Fault | Warning | AD | D |
| | Battery Charger 1 Communication Loss | Warning | AD | D |
| | Battery Charger 2 Communication Loss | Warning | AD | D |
| | Battery Charger Identity Conflict | Warning | AD | D |
| | Battery Charger Parameter Mismatch | Warning | AD | D |
| | ECM Communication Loss | Shutdown | | D |
| | ECM Model Mismatch | Shutdown | | |
| | Emergency Stop | Shutdown | | D |
| | Fuel Tank Leak | Warning | AD | D |
| | Fuel Tank Leak | Shutdown | D | D |
| | Ground Fault Input | Warning | AD | D |
| | Locked Rotor | Shutdown | | D |
| | Electrical Metering Communication Loss | Shutdown | | |
| | Over Crank | Shutdown | | D |
| | Speed Sensor Fault | Warning | | D |
| | Other Alerts | | | |
| | Alarm Horn Silenced | Status | | |
| | Engine Cool Down Active | Notice | | D |
| | Engine Start Aid Active | Notice | | D |
| | Engine Started | Status | | |
| | Engine Stopped | Status | | |
| | Emergency Power System Supplying Load | Notice | | D |
| | Generator Running | Notice | | D |
| | Not In Auto | Warning | | D |
| | Option Board 2A Communication Loss | Notice | | |
| | Option Board 2B Communication Loss | Notice | | |
| | Option Board 2C Communication Loss | Notice | | |
| | Remote Start | Status | | |
| | Load Priority 1 Shed | Notice | | D |
| | Load Priority 2 Shed | Notice | | D |
| | Load Priority 3 Shed | Notice | | D |
| | Load Priority 4 Shed | Notice | | D |
| | Load Priority 5 Shed | Notice | | D |
| | Load Priority 6 Shed | Notice | | D |
| | Cabinet Intrusion Alarm | Warning | D | D |
| | Reserve Oil Empty | Warning | D | D |
| | Stopped By Generator Management | Status | | D |
| | Failure To Synchronize | Warning | | D |
| High | Fail To Open Delay | Warning | | |
| High | Fail To Close Delay | Warning | | |
| High | Max Close Attempts | Warning | | |
| Erroneous Data Received | Generator Management (Invalid Generator Management Enabled) | Warning | | |
| High | Trip To Shutdown Delay | Shutdown | | |
| | Run Relay Coil Overload | Shutdown | | |
| | Starter Relay Coil Overload | Shutdown | | |
| High | System Frequency | Warning | | |
| Low | System Frequency | Warning | | |
| High | System Voltage | Warning | | |
| Low | System Voltage | Warning | | |
| Erroneous Data Received | System Phase | Warning | | |
| | ECM Diagnostics | | | |

| FMI (Failure Mode Indicator) | Event ID/Parameter at Local Display | Level | Programmed Input | Programmed Output |
|--------------------------------------|-------------------------------------|---------|---------------------|----------------------|
| | Engine Derate Active | Warning | | |
| | Injector Wiring Fault | Warning | | |
| | Run Relay Coil Overload | Warning | | |
| | Sensor Supply Voltage | Warning | | |
| | Speed Sensor Fault | Warning | | |
| | Starter Relay Coil Overload | Warning | | |
| | Water In Fuel | Warning | | |
| Notices Excluded From Display | | | | |
| | Common Fault | Notice | | D |
| | Common Warning | Notice | | D |
| | System Ready | Notice | | D |
| | Remote Start Command Issued | Notice | | |
| | Run Button Acknowledged | Notice | | |
| | Contactor | Notice | | D |
| | Close Breaker | Notice | | D |
| | Remove Breaker Trip | Notice | | D |
| | Standalone Operation | Status | D | |
| | Load Enable | Status | D | |
| | Baseload Mode | Status | D | |
| | System Control Mode | Status | D | |
| | System Sync Mode | Status | D | |
| | Enable Trims | Status | D | |

* Sensor dependent

Note: A = Analog, D = Digital

Figure 1-10 System Events Display Message List

1.7.2 Main Logic Circuit Board

The main logic circuit board provides the connection sockets to connect the controller to the engine/generator, input/output connections, optional I/O module kit, and circuit protection fuses. See Figure 1-11 for the circuit board connectors.

Note: The main logic circuit board contains fuses that are either auto-resettable or non-replaceable.

Circuit Board Connections

P1 (35-Pin) Connector for engine/generator wiring harness.

P2 (14-Pin) Connector for sensor input connections and relay driver output connections.

P3 (8-Pin) Connector for generator set output voltage connection and paralleling bus voltage sensing connections.

P4 (Ethernet) Connector connects to a network communication line.

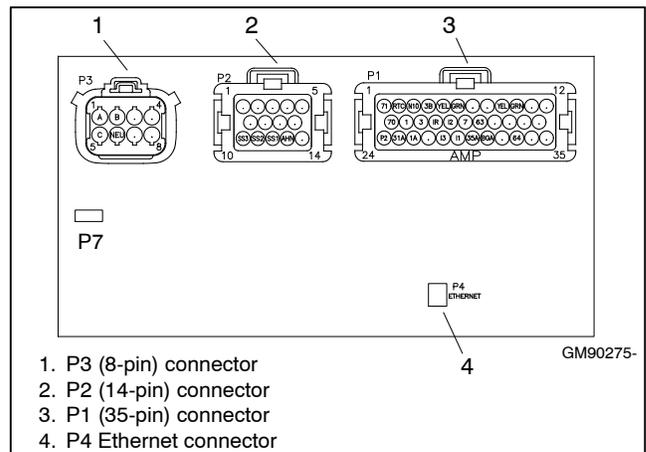
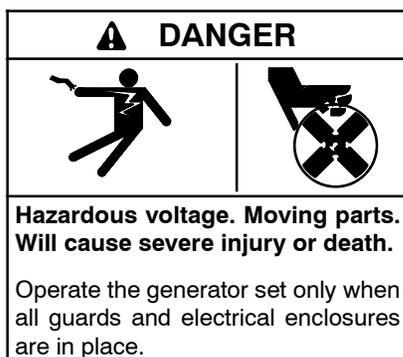


Figure 1-11 Main Circuit Board Connectors

Notes

2.1 Prestart Checklist

To ensure continued satisfactory operation, perform the following checks or inspections before or at each startup, as designated, and at the intervals specified in the service schedule. In addition, some checks require verification after the unit starts.



Air Cleaner. Check for a clean and installed air cleaner element to prevent unfiltered air from entering engine.

Air Inlets. Check for clean and unobstructed air inlets.

Battery. Check for tight battery connections. Consult the battery manufacturer's instructions regarding battery care and maintenance.

Coolant Level. Check the coolant level according to the cooling system maintenance information.

Note: Block Heater Damage. The block heater will fail if the energized heater element is not immersed in coolant. Fill the cooling system before turning on the block heater. Run the engine until it is warm, and refill the radiator to purge the air from the system before energizing the block heater.

Diesel Exhaust Fluid (DEF) Tank, if equipped. Ensure that there is an adequate DEF supply; keep the DEF tank full. When filling, watch that the DEF tank is not overfilled.

Drive Belts. Check the belt condition and tension of the radiator fan, water pump, and battery charging alternator belt(s) according to the drive belt system maintenance information.

Enclosure Doors, if equipped. Check that the service access doors are closed and secured. Leaving the doors open will create excessive noise.

Check that the enclosure door to the load connection panel is closed and secured. Some units have a microswitch safety feature that will trip (by shunt trip) the main line circuit breaker if the load connection panel is open.

Exhaust System. Check for exhaust leaks and blockages. Check the silencer and piping condition and check for tight exhaust system connections.

Inspect the exhaust system components (exhaust manifold, exhaust line, flexible exhaust, clamps, silencer, and outlet pipe) for cracks, leaks, and corrosion.

- Check for corroded or broken metal parts and replace them as needed.
- Check for loose, corroded, or missing clamps and hangers. Tighten or replace the exhaust clamps and/or hangers as needed.
- Check that the exhaust outlet is unobstructed.
- Visually inspect for exhaust leaks (*blowby*). Check for carbon or soot residue on exhaust components. Carbon and soot residue indicates an exhaust leak. Seal leaks as needed.

Fuel Level. Check the fuel level and keep the tank(s) full to ensure adequate fuel supply.

Lamp-Test. Press the lamp-test button to verify all controller lamps are operational. Refer to Section 1.3.1 Switches and Controls for details.

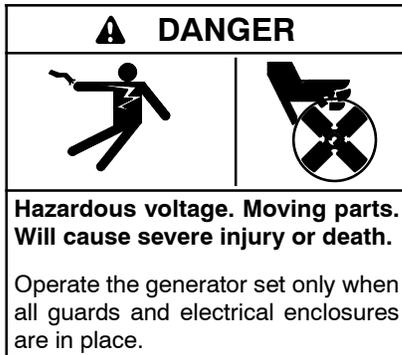
Oil Level. Maintain the oil level at or near, not over, the full mark on the dipstick.

Operating Area. Check for obstructions that could block the flow of cooling air. Keep the air intake area clean. Do not leave rags, tools, or debris on or near the generator set.

Radiator. Check that the radiator fins and air inlets/outlets are clean of leaves, insects, dirt, and other debris. Use compressed air to clear the obstructed passages as needed.

Visual Inspection. Walk around the generator set and look for leaking fluids, loose or dangling wiring, and loose or missing hardware. Repair as needed before starting the generator set. This visual inspection should be routinely done while the unit is running.

2.2 Exercising Generator Set



Operate the generator set under load once each week for one hour. Perform the exercise in the presence of an operator when the generator set does not have an automatic transfer switch with an exercise option.

During the exercise period apply a minimum of 35% load based on the nameplate standby rating, unless otherwise instructed in the engine operation manual.

The operator should perform all of the prestart checks before starting the manual exercise procedure. Start the generator set according to the starting procedure in Section 2.4, Controller Operation. While the generator set is operating, listen for a smooth-running engine and visually inspect generator set for fluid or exhaust leaks.

The generator set controller does not provide weekly scheduled exercise periods. For scheduled exercise periods, refer to the automatic transfer switch (if equipped) literature.

2.2.1 Exhaust System Regeneration Requirements (Models: 80-150REOZJ4)

The exhaust system includes a Diesel Particulate Filter (DPF). Regeneration is required based on three factors:

- Time basis of 50 hours
- Measured accumulation of residue in the exhaust system
- Calculation based on fuel usage, ambient and operating temperatures, etc.

If the exhaust system requires regeneration, the ECM may limit the power output of the engine during regeneration up to 50%. Effective cleaning of the

exhaust system will not occur until system temperatures reach acceptable levels. These levels may not be achieved during short exercise periods. As a result, the operator should evaluate the exercise time period and monitor the exhaust system parameters and performance to determine the most efficient means to perform coordinated exercises and regeneration without affecting the availability of the generator set. The regeneration status is displayed on the controller in the Generator Information menu.

2.3 Operation in Cold Weather Climates

Cold weather operation is generally considered ambient temperatures below freezing 0°C (32°F). The following items are recommended for cold weather starting and/or operation when the unit is located in an enclosure or unheated structure. Have a licensed electrician install 120 VAC, 15 amp outlets as needed if not already in the immediate area.

Refer to the engine operation manual regarding engine oil viscosity, fuel composition, and coolant mixture recommendations.

- The **engine block heater** is generally recommended for most units when operated below 0°C (32°F) and required as part of NFPA 110. Refer to the respective spec sheet for temperature recommendations in available options.
- A **battery heater** is generally recommended for most units when operated below 0°C (32°F). Refer to the respective spec sheet for model availability.
- An **alternator strip heater** is available for most generator sets providing a heat source to prevent moisture and frost buildup.
- **Heater tape** is recommended when the generator set is equipped with a closed crankcase ventilation system and operated at or below 50% of rated load. Wrap the UL/CSA compliant heater tape around the crankcase canister/breather system hose that runs from the crankcase to the air intake and use cable ties as needed to secure the heater tape. If the heater tape is within 152 mm (6 in.) of the exhaust system, use thermal insulation material to protect the heater tape.

2.4 Controller Operation

The controller operation includes several types of starting and stopping functions as detailed below. The controller buttons, lamps, and alarm horn functions are summarized in Figure 2-1.

There are three primary modes of operation, selected by pressing the respective buttons:

- **OFF**
- **RUN**
- **AUTO** (Standby Mode)

When the OFF button is pressed, the generator set is in OFF or goes to OFF and will not start. When the RUN button is pressed, the generator set starts and runs until the OFF or AUTO button is pressed or until a fault is received. When the AUTO button is pressed, the generator set enters the Standby Mode (STANDBY-RUNNING or STANDBY-OFF depending upon the start signal).

- **OFF.** If the generator set was previously running, pressing the OFF button immediately shuts off the generator set, with no engine cooldown. The generator set remains off and will not respond to a remote start signal.
- **RUN—Local Start.** A single generator set starts. No other generator sets in the system will start (or stop).
- **AUTO—Standby or System Ready.** The generator set is waiting for a start signal. The generator set will start and run when a start signal is received via a remote start, local auto-start, or communications-based start.

All generator sets in the system (connected by PGEN and in Standby Mode by pressing AUTO) will start when any one of the generator sets receives a start signal.

Any generator set in the system not in AUTO will not start.

If Generator Management is on, some generator sets may shut down after a period of time.

With removal of the start signal, all generator sets will shut down with the appropriate engine cooldown.

- **AUTO-RUN** (Press AUTO and RUN together for a system start signal). All generator sets in the system start and run, close to bus, synchronize, parallel, share load, etc. Some generator sets may shut down after a period of time (indicated by Generator Management) but they remain in Standby Mode ready to start and run if needed.
- **AUTO-OFF** (Press AUTO and OFF together to remove a system start signal, if AUTO-RUN is active). All generator sets in the system open their breakers, enter engine cooldown, shut down, and enter Standby Mode. Closing the remote start contacts has no effect. Generator sets in the system will enter Standby Mode.

Note: Pressing AUTO and OFF together only stops the generator sets if there are no other system start signals present.

| Button Mode | Generator Set Status | Fault Lamp | Alarm Horn | Alarm Silence Button | Alarm Horn Lamp | Controller Display |
|------------------------------|----------------------|------------|------------|----------------------|-----------------|---------------------------------------------------|
| AUTO | Off | — | Off | — | — | Scrolling Overview Menu Only |
| | On (or Cranking) | — | Off | — | — | |
| | Running and then Off | Red | On Off | — Pressed | — Yellow | Shutdown Message |
| OFF/RESET | Off | Yellow | On | — | — | Not In Auto Warning |
| | | | Off | Pressed | Yellow | |
| RUN (unit fails to start) | Off (or Cranking) | Yellow | On | — | — | Not in Auto Warning |
| | | | Off | Pressed | Yellow | |
| | Off | Red | On | — | — | Locked Rotor Shutdown (or other shutdown message) |
| | | | Off | Pressed | Yellow | |
| RUN (unit starts) | Off (or Cranking) | Yellow | On | — | — | Not in Auto Warning |
| | On | | Off | Pressed | Yellow | |
| | Running and then Off | Red | On | — | — | Shutdown Message |
| | | | Off | Pressed | Yellow | |

Figure 2-1 Button Function Summary

Start Signal

A start signal includes the following:

- Remote start signal via contacts 3 and 4. An ATS (used during a power outage, exercise period, etc.) or a remote panel take precedence over all other start signals.
- System Start (AUTO-START). Press AUTO and RUN simultaneously to send a start signal.
- Communications-based start message from SiteTech™ or a CAN-based remote panel.

Hardwired contacts (remote start contacts 3 and 4) have priority over all other start signals. If the remote start contacts are activated, the generator sets in the system that are in AUTO will start and run. If the generator sets were already running, they will remain running but the original source of that start signal will be ignored. The contacts now have control.

Note: The alarm horn sounds and the Not-In-Auto Warning display appears whenever the generator set is not in the AUTO mode.

Note: The transient start/stop function of the controller prevents accidental cranking of the rotating engine. The generator set stops and recranks when the OFF/RESET button is momentarily pressed and then the RUN button is pressed.

Note: The controller provides up to 30 seconds of programmable cyclic cranking and up to 60 seconds rest with up to 6 cycles. The default setting is 15 seconds cranking and 15 seconds rest for 3 cycles. Make cyclic cranking adjustments using SiteTech™ software.

Stop Signal

A stop signal includes the following:

- Removal of start signal via contacts 3 and 4. An ATS (used during a power outage, exercise period, etc.) or a remote panel take precedence over all other start signals.
- System Stop (AUTO-OFF). Press AUTO and OFF simultaneously to send a stop signal to cancel the system start.

Note: This will not do anything if the system start is not active or if the system is receiving a start signal from another source. Press AUTO and OFF on any controller in the system.

- Communications-based stop message from SiteTech™ or a CAN-based remote panel.

Engine Cooldown

Cooldown is a state where the generator set is running at no load to allow hot engine components time to cool slowly before the engine is stopped. In paralleling applications, this occurs with the circuit breaker open.

When the generator set is running in AUTO mode (AUTO-RUN), an engine cooldown cycle begins when the remote start input is deactivated. Also, if stopping due to a stop signal, a cooldown cycle begins.

If the Cooldown Override is disabled (OFF) in the Generator Configuration Menu, coolant temperature is ignored. The generator set will enter cooldown when the start signal is removed, only if the engine control switch is in AUTO. The engine will run for a period of time equal to the Cooldown Delay parameter setting, regardless of the coolant temperature.

If the Cooldown Override is enabled (ON) in the Generator Configuration Menu, coolant temperature will be considered for cooldown. The generator set will enter cooldown when the start signal is removed, only if the engine control switch is in AUTO. The engine will run until the coolant temperature is below the Engine Cooled Down parameter setting, or until the Cooldown Delay has expired.

The cooldown cycle lasts for some predetermined amount of time. The cooldown delay is an adjustable parameter. The Engine Cooled Down temperature is not adjustable.

Note: No engine cooldown cycle occurs if the OFF button is pressed or if a fault occurs. The shutdown is immediate. If possible, run the generator set without load for 5 minutes to ensure adequate engine cooldown.

2.4.1 Emergency Stop

Use the controller emergency stop switch for immediate emergency shutdown.

The emergency stop switch bypasses the time delay engine cooldown and immediately shuts down the generator set.

Note: Use the emergency stop switch(es) for emergency shutdowns only. Use the generator set OFF/RESET button for normal shutdowns.

The controller fault lamp lights and the unit shuts down when the local emergency stop switch activates.

Use the following procedure to reset the generator set after shutdown by a local or remote emergency stop switch. Refer to Section 2.4.6, Controller Resetting procedure, to restart the generator set following a fault shutdown.

1. Investigate and correct the cause of the emergency stop.
2. Reset the controller emergency stop switch by pulling the switch dial outward and/or reset the remote emergency stop switch (if equipped).
3. Press the generator set OFF/RESET button.
4. After resetting all faults using the controller reset procedure in Section 2.4.6, press the generator set RUN and/or AUTO button to restart the generator set. The generator set will not crank until the reset procedure completes.

2.4.2 System Status Lamps

The (OFF/RESET-AUTO-RUN) buttons indicate the status condition with an integrated lamp at the button.

The lamp illuminates on the AUTO (automatic start) button indicating the system senses no faults and the unit is ready to start by remote command.

The lamp illuminates on the OFF/RESET button indicating the generator set is stopped.

The lamp illuminates on the RUN button indicating the generator set is cranking or running from a local command or is commanded to run from a local command.

Only one of the three button lamps will illuminate at any given time.

2.4.3 System Fault Warning Lamp with Digital Displays

The system FAULT lamp glows yellow and the alarm horn sounds indicating a warning fault but does not shut down the generator set. The fault lamp illuminates yellow and the alarm horn sounds when the fuel tank level on diesel-fueled models approaches empty. This fault requires an optional low fuel level switch for the lamp to function. See Section 2.4.6, Controller Resetting procedure, for instructions on resetting a system warning.

When the system warning lamp is on and no message displays, rotate the dial to the Active Events menu. Press the dial to view messages. Rotate the dial to view additional messages. Press the OFF button to return to the main menu. When the system warning continues, it may lead to a fault and cause a system shutdown.

Use the Silence Alarm button to silence the alarm horn at the operator's discretion.

If the controller is setup for an NFPA 110 application, press the AUTO button before silencing the alarm horn. The alarm horn cannot be silenced unless the button is in the AUTO mode. See 2.4.5 Status and Notice Digital Displays for more information.

AC Sensing Lost (controller in RUN or AUTO and voltage was never present). The fault lamp illuminates yellow and the alarm horn sounds when the controller does not detect the nominal generator set AC output voltage after crank disconnect.

Auxiliary Input. The fault lamp illuminates yellow and the alarm horn sounds when an auxiliary digital or analog input signals the controller. The digital inputs do not function during the first 30 seconds after startup. Use SiteTech™ software to define inputs as shutdowns or warnings.

Average Current High. The fault lamp illuminates yellow and the alarm horn sounds when the generator set encounters excessive load or a downstream fault. The output breaker trips. The available sustained fault current of the generator set can be obtained from the per-unit transient reactance of the generator set and the system voltage and power.

Average Generator Voltage High. The fault lamp illuminates yellow and the alarm horn sounds when the generator set encounters an over voltage condition. This condition can be caused by a loss of sensing wire, a winding failure, voltage regulator failure, etc. The output breaker trips. The generator set may continue to produce excessive voltage until it is shut down.

Average Generator Voltage Low. The fault lamp illuminates yellow and the alarm horn sounds when the generator set encounters an under voltage condition. This condition can be caused by a loss of a diode on the rectifier bridge, sensing problem, a winding failure, voltage regulator failure, etc. The output breaker trips. The generator set may continue to produce insufficient voltage until it is shut down.

Battery Charger Fault. The fault lamp illuminates yellow and the alarm horn sounds when the battery charger malfunctions. This fault feature requires an optional battery charger with a malfunction output for the lamp to function. Local display shows *Batt Chg Flt*.

Battery Charger Communication Loss. The warning fault lamp on the controller illuminates yellow and the alarm horn sounds when CAN communication with the battery charger has been lost. Local display shows either *bat1CommLoss* or *bat2CommLoss*.

Note: *bat2CommLoss* indicates communication loss for battery charger number 2. *bat2CommLoss* is only relevant for generator sets with more than one battery charger.

Battery Charger Identity Conflict. The warning lamp on the controller illuminates yellow and the alarm horn sounds when there is a CAN address communication error. The battery charger has the same CAN address as another generator set component. To correct a CAN address error, verify the address identification in the harness and power cycle the controller. Local display shows *BatIdErr*.

Battery Charger Parameter Mismatch. The warning lamp on controller illuminates yellow and the alarm horn sounds when the battery charger metering is not in range of the specified parameters. Local display shows *ParMismatch*.

Battery Fault. The warning lamp on controller illuminates yellow and the alarm horn sounds when there is an issue with the battery such as a connection problem or a dead battery. When the temperature compensation sensor is connected, whether active or inactive, and the temperature rises above 60°C (140°F) or below -20°C (-4°F), the battery failure warning will also be displayed indicating that the battery is unable to take charge due to temperature. Absorption timeout will also cause a failure since the battery was unable to accept the expected charge in the time frame given which indicates a potential battery issue. Local display shows *Battery Flt*.

Cabinet Intrusion. The fault lamp illuminates yellow and the alarm horn sounds when the door to the unit was opened.

Common Warning. The fault lamp illuminates yellow and the alarm horn sounds when the controller is signaled by a common warning. Use SiteTech™ software to activate the common warning. The common warning comprises all of the warnings under a single alert.

Critically High Fuel Level (diesel-powered models only). The fault lamp illuminates yellow and the alarm horn sounds when the fuel tank level on diesel models approaches full. This fault requires an optional critical high fuel switch and fuel tank for the lamp to function.

DEF Reagent Concentration Low. The fault lamp illuminates yellow and the alarm horn sounds when the fluid in the DEF tank contains a low concentration of DEF reagent.

DEF Reagent Concentration Sensor Obstruction Fault. The fault lamp illuminates yellow and the alarm horn sounds when there is a malfunction in the DEF quality sensor.

DEF Reagent Concentration Invalid. The fault lamp illuminates yellow and the alarm horn sounds when an invalid DEF concentration is detected. If experiencing the fault, check the harness connections between the DEF tank and the engine, and/or replace the DEF in the tank.

Reagent Fluid Type Fault. The fault lamp illuminates yellow and the alarm horn sounds when the fluid in the DEF tank is not DEF.

DEF Reagent Concentration High. The fault lamp illuminates yellow and the alarm horn sounds when the fluid in the DEF tank has a high concentration of DEF reagent.

ECM Diagnostics (Multiple Engine Inputs). The fault lamp illuminates yellow and the alarm horn sounds when ECM diagnostics signals the controller. The specific display will be a brief message or fault code that is engine manufacturer dependant. The engine literature provides the fault code description and further information.

Failure to Synchronize. The fault lamp illuminates yellow and the alarm horn sounds when the generator set does not successfully synchronize to the live bus within the time delay as defined in the synchronizing setup menu. The controller will continue attempting to synchronize to the bus after the time delay expires and the warning occurs. Generator Management will start another generator set if this warning occurs.

Fuel Tank Leak. The fault lamp illuminates yellow and the alarm horn sounds when the fuel tank signals a leak of the inner tank. This fault requires an optional fuel tank leak switch for the lamp to function.

Generator Frequency High. The fault lamp illuminates yellow and the alarm horn sounds when the generator set has an overfrequency condition. The output breaker trips. This condition can be caused by various mechanical failures (loss of speed signal to ECU, improperly controlled or inadvertent injection of gaseous fuel etc.).

Generator Frequency Low. The fault lamp illuminates yellow and the alarm horn sounds when the generator set has an underfrequency condition. The output breaker trips.

Generator Total Real Power High. The fault lamp illuminates yellow and the alarm horn sounds when the generator set encounters excessive load or a downstream fault. The output breaker trips.

Generator Total Real Power Low. The fault lamp illuminates yellow and the alarm horn sounds when the generator set is no longer producing power (loss of fuel, bearing failure, fuel system failure, ECU problem, or speed bias connection failure on non-ECM engines). The output breaker trips.

Ground Fault Input. The fault lamp illuminates yellow and the alarm horn sounds when a user-supplied ground fault detector signals the controller.

High Battery Voltage. The fault lamp illuminates yellow and the alarm horn sounds when the battery voltage rises above the preset level for more than 10 seconds. Figure 2-2 shows high battery voltage specifications. The high battery voltage feature monitors the battery and battery charging system in the generator set operating and off modes.

| Engine Electrical System Voltage | High Battery Voltage Range | High Battery Voltage Default Setting |
|----------------------------------|----------------------------|--------------------------------------|
| 12 | 13.2-16.2 | 15 |
| 24 | 26.4-32.4 | 30 |

Figure 2-2 High Battery Voltage Specs

High Coolant Temperature. The fault lamp illuminates yellow and the alarm horn sounds when the engine coolant temperature approaches the shutdown range. The high coolant temperature warning does not function during the preset inhibit time delay period after startup.

High Fail To Close Delay. The fault lamp illuminates yellow and the alarm horn sounds when the circuit breaker did not close within the allocated breaker closure time.

High Fail To Open Delay. The fault lamp illuminates yellow and the alarm horn sounds when the circuit breaker did not open as quickly as the controller expected.

High Fuel Level (diesel-powered models only). The fault lamp illuminates yellow and the alarm horn sounds when the fuel tank level on diesel models approaches near full. This fault requires an optional high fuel switch and fuel tank for the lamp to function.

High Genset System Frequency. The fault lamp illuminates yellow and the alarm horn sounds when another generator set in the paralleling system has a lower system frequency than this generator set. The local display shows System Frequency, FMI: High.

High Genset System Voltage. The fault lamp illuminates yellow and the alarm horn sounds when another generator set in the paralleling system has a lower system voltage than this generator set. The local display shows System Voltage, FMI: High.

High Intake Air Temperature. The fault lamp illuminates yellow and the alarm horn sounds when the engine intake air temperature approaches the shutdown range.

High Lube Oil Temperature. The fault lamp illuminates yellow and the alarm horn sounds when the engine high oil temperature approaches the shutdown range.

High Max. Close Attempts The fault lamp illuminates yellow and the alarm horn sounds when the circuit breaker did not close, even after the controller attempted to close it as many times as specified by the max. close attempts.

Invalid Generator Management Enabled. The fault lamp illuminates yellow and the alarm horn sounds when the generator set management has been disabled because the generator management configuration of this generator set does not match the generator management configuration of another generator set that is connected to the same PGEN network. The local display shows Generator Management.

Invalid Genset Voltage Phase Connection. The fault lamp illuminates yellow and the alarm horn sounds when another generator set in the paralleling system has a different phase connection than this generator set. The local display shows System Phase.

Low Battery Voltage. The fault lamp illuminates yellow and the alarm horn sounds when the battery voltage drops below a preset level for more than 90 seconds.

| Engine Electrical System Voltage | Low Battery Voltage Range | Low Battery Voltage Default Setting |
|----------------------------------|---------------------------|-------------------------------------|
| 12 | 9.6-12.6 | 12 |
| 24 | 19.2-25.2 | 24 |

Figure 2-3 Low Battery Voltage Specs

The low battery voltage feature monitors the battery and battery charging system in the generator set operating and off modes. The controller logic inhibits the low battery voltage warning during the crank cycle.

Low Coolant Temperature. The fault lamp illuminates yellow and the alarm horn sounds when the engine coolant temperature is low. The low coolant temperature warning does not function during the preset inhibit time delay period after startup.

Low Cranking Voltage. The fault lamp illuminates yellow and the alarm horn sounds when the battery voltage drops below 60% of the nominal voltage (12 VDC or 24 VDC) for more than 6 seconds during the crank cycle.

Low Engine Oil Level. The fault lamp illuminates yellow and the alarm horn sounds because of low engine oil level. This fault feature requires an optional low engine oil level sensor for the lamp to function.

Low Fuel Level. The fault lamp illuminates yellow and the alarm horn sounds when the fuel tank level on diesel-fueled models approaches empty. This fault requires an optional low fuel level switch for the lamp to function.

Low Fuel Pressure. The fault lamp illuminates yellow and the alarm horn sounds when low fuel pressure occurs. This fault requires an optional low fuel pressure switch for the lamp to function.

Low Genset System Frequency. The fault lamp illuminates yellow and the alarm horn sounds when another generator set in the paralleling system has a higher system frequency than this generator set. The local display shows System Frequency, FMI: Low.

Low Genset System Voltage. The fault lamp illuminates yellow and the alarm horn sounds when another generator set in the paralleling system has a higher system voltage than this generator set. The local display shows System Voltage, FMI: Low.

Low Oil Pressure. The fault lamp illuminates yellow and the alarm horn sounds when the engine oil pressure approaches the shutdown range. The low oil pressure warning does not function during first the 30 seconds after startup.

Not in Auto (Generator Master Control Switches). The fault lamp illuminates yellow and the alarm horn sounds when the generator set button is in the RUN or OFF/RESET mode.

Option Board 2X Communication Loss. The fault lamp illuminates yellow and the alarm horn sounds when the communication with option board 2X (A, B, or C) has been lost.

Reserve Oil Empty. The fault lamp illuminates yellow and the alarm horn sounds when the oil makeup kit level has dropped below a threshold.

Speed Sensor Fault. The fault lamp illuminates yellow and the alarm horn sounds when the speed signal is absent for one second while the generator set runs.

Total Reactive Power Low. The fault lamp illuminates yellow and the alarm horn sounds when the generator set has a loss of field condition due to insufficient reactive load production to support real load. The output breaker trips.

2.4.4 System Fault Shutdown Lamp with Digital Displays

The system FAULT lamp glows red, the alarm horn sounds, and the unit shuts down to indicate a fault shutdown under the following conditions. See Section 2.4.6, Controller Resetting procedure, for information on resetting a system shutdown.

When the system shutdown lamp is on and no message displays, rotate the dial to the Active Events menu. Press the dial to view messages. Rotate the dial to view additional messages. Press the OFF button to return to the main menu.

Use the Alarm Off button to silence the alarm horn at the operator's discretion. If the controller is setup for an NFPA 110 application, press the AUTO button before silencing the alarm horn. The alarm horn cannot be silenced unless the button is in the AUTO mode. See 2.4.5 Status and Notice Digital Displays for more information.

AC Sensing Lost (controller in AUTO and voltage was previously present). The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the controller does not detect the nominal generator set AC output voltage for more than 3 seconds after crank disconnect.

Alternator Protection. The fault lamp illuminates red and the unit shuts down because of an alternator overload or short circuit. See Appendix C, Alternator Protection for more information.

Auxiliary Input (Shutdown). The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when an auxiliary digital or analog inputs signals the controller. The digital inputs do not function during the first 30 seconds after startup. Use SiteTech™ software to define inputs as shutdowns or warnings.

Common Fault. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the controller is signaled by a common fault. Use SiteTech™ software to activate the common fault shutdown. The common fault comprises of any combination of the fault shutdowns under a single alert.

Coolant Temperature Open Circuit. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the engine coolant temperature sender circuit is open.

ECM Communications Loss. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the ECM communication link is disrupted.

ECM Diagnostics (Multiple Engine Inputs). The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when ECM diagnostics signals the controller. The specific display will be a brief message or fault code that is engine manufacturer dependant. The engine literature provides the fault code description and further information.

ECM Model Mismatch. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the controller detects an error with the ECM model.

Electrical Metering Communication Loss. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the metering to the controller communication link is disrupted.

Emergency Stop. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the local or optional remote emergency stop switch activates.

Fuel Tank Leak. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the fuel tank signals a leak of the inner tank. This fault requires an optional fuel tank leak switch for the lamp to function.

Generator Total Real Power High. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the generator set supplies more than 102% of the rated standby output kW (or 112% of the rated prime power output kW) for more than 60 seconds.

High Coolant Temperature. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down because of high engine coolant temperature. The high coolant temperature shutdown does not function during the preset inhibit time delay period after startup.

Note: The high engine temperature shutdown function and the low coolant level shutdown function are independent. A low coolant level condition may not activate the high engine temperature switch.

High Engine Speed. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down immediately when the governed frequency on 50 and 60 Hz models exceeds the over speed setting.

High Intake Air Temperature. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down because of high intake air temperature. The shutdown occurs 5 seconds after the engine intake air reaches the temperature shutdown range. The engine intake air temperature shutdown does not function during the first 30 seconds after startup.

High Generator Frequency. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the frequency is above the overfrequency setting. See Figure 2-4.

| Overfrequency Setting Range | Time Delay | Overfrequency Default Setting |
|-----------------------------|------------|-------------------------------|
| 102%-140% of nominal | 10 sec. | 110% of nominal |

Figure 2-4 Overfrequency Specs

High Generator Voltage (Each Phase). The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the voltage exceeds the overvoltage setting for the preset time delay period. See Figure 2-5 for overvoltage specifications.

Note: Overvoltage can damage sensitive equipment in less than one second. Install separate overvoltage protection on online equipment requiring faster than 2-second shutdown.

| Overvoltage Setting Range | Time Delay Range | Overvoltage Default Setting |
|---------------------------|------------------|-----------------------------|
| 105%-135% of nominal | 2-10 sec. | 120% at 2 sec. |

Figure 2-5 Overvoltage Specs

High Lube Oil Temperature. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down because of high engine oil temperature. The shutdown occurs 5 seconds after the engine oil reaches the temperature shutdown range. The high engine oil temperature shutdown does not function during the first 30 seconds after startup.

Locked Rotor (failed to crank). If none of the speed sensing inputs show engine rotation within the preset time delay of initiating engine cranking, the ignition and crank circuits turn off for the preset period and the cycle repeats. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down after the second cycle of the preset period of cranking.

Low Coolant Level. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down because of low coolant level. Shutdown occurs 5 seconds after low coolant level is detected.

Low Engine Oil Level. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down because of low engine oil level. This fault feature requires an optional low engine oil level sensor for the lamp to function.

Low Engine Speed. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down immediately when the governed frequency on 50 and 60 Hz models drops below the under speed setting.

Low Fuel Level (diesel-powered models only). The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the fuel tank level on diesel-fueled models approaches empty. This fault requires an optional low fuel level switch for the lamp to function.

Low Fuel Pressure. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when low fuel pressure occurs. This fault requires an optional low fuel pressure switch for the lamp to function.

Low Generator Frequency. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the frequency drops below the underfrequency setting. See Figure 2-6 for underfrequency specifications.

| Underfreq. Setting Range | Time Delay | Underfrequency Default Setting |
|--------------------------|---------------------------------------------|--------------------------------|
| 80%-95% of nominal | 10 sec. (short term) 60 sec. (long term) | 90% of nominal |

Figure 2-6 Underfrequency Specs

Low Generator Voltage (Each Phase). The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the voltage drops below the undervoltage setting for the time delay period. See Figure 2-7 for undervoltage specifications

| Undervoltage Setting Range | Time Delay Range | Undervoltage Default Setting |
|----------------------------|------------------|------------------------------|
| 70%-95% of nominal | 5-30 sec. | 80% of nominal at 10 sec. |

Figure 2-7 Undervoltage Specs

Low Oil Pressure. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down because of low oil pressure. The shutdown occurs 5 seconds after the low pressure condition is detected. The low oil pressure shutdown does not function during the first the 30 seconds after startup.

Max. Alternator Current Low. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when Alternator Protection Configuration in the personality profile is not correct. If the settings are correct for the application, the controller may need a new or updated personality profile. Consult your local authorized distributor.

Oil Pressure Open Circuit. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the engine oil pressure sender circuit is open for more than 5 seconds.

Overcrank. The fault lamp illuminates red, the alarm horn sounds, and cranking stops when the unit does not start within the defined cranking period. See note at the end of Engine Cooldown in Section 2.4, Controller Operation for cyclic crank specifications.

Run Relay Coil Overload. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the current draw on the 70 wire from the controller has exceeded 40 amps or has exceeded 10 amps for at least 10 ms.

Starter Relay Coil Overload. The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the current draw on the 71 wire from the controller has exceeded 40 amps or has exceeded 10 amps for at least 10 ms.

Trip to Shutdown Delay The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down when the generator set is stopped if the circuit breaker has tripped for a Protective Relay function, and the trip to shutdown time delay has expired. This delay allows mitigation of problem conditions without engine shutdown. If the delay expires, it is presumed no successful action was taken in the allotted time.

2.4.5 Fault, Notice, and Status Displays

Warnings and shutdown faults appear on the digital display under the Active Events menu and become part of the event history. Beyond the warnings and shutdowns there are several events which also appear on the digital display under the Active Events menu. Notice is an alert that is not part of the event history. Status is an event that is only viewable in SiteTech™.

The controller allows a selected number of changes by the user for setting up the controller application which are covered in this section.

Alarm Horn Silence. This notice message indicates whether the alarm horn can be silenced in any button mode (OFF/RESET-AUTO-RUN) or requires the AUTO button be pressed first compliant per NFPA 110. Use SiteTech™ software to change this setting. See Section 2.4.6, Controller Resetting procedure, for information on resetting the system.

The local display shows *Alarm Silence: Always* when the alarm horn can be silenced with the master control buttons in any position (default setting).

The local display shows *Alarm Silence: Auto Only* when the alarm horn can be silenced only when in the AUTO mode. The correct reset sequence requires pressing the OFF/RESET button, then pressing the AUTO button, and then pressing the ALARM SILENCE button.

Close Breaker. This notice message indicates that the controller is attempting to close the circuit breaker (a close command is being sent to the circuit breaker). This notice only appears in paralleling applications (where the bus sensing is connected to the bus side of the paralleling breaker).

Common Fault. This notice is defined in 2.4.4, System Fault Shutdown Lamp with Digital Displays.

Common Warning. This notice is defined in 2.4.3, System Fault Warning Lamp with Digital Displays.

Contactors. This notice message indicates that the controller wants to be connected to the paralleling bus. If a contactor is used for paralleling, this output controls it. This notice only appears in paralleling applications (where the bus sensing is connected to the bus side of the paralleling breaker).

Emergency Power System (EPS) Supplying Load.

This notice message indicates when the generator set supplies more than 1% of the rated standby output current.

Engine Cooldown (Delay) Active. This notice message indicates that the delay for engine cooldown is active where the generator set will continue to run after the OFF/RESET button is pressed. The unit will continue to run until the time delay times out.

Engine Load Indication. This notice message indicates that there is a load connected to the generator set.

Engine Start Aid Active. This notice message indicates that the start aid is active and will energize an engine equipped preheat or ether system during the crank cycle. Use SiteTech™ software to set up this feature.

Engine Started (SiteTech™ only). This status indicates that the generator set start circuit is closed allowing the engine to crank and run.

Engine Stopped (SiteTech™ only). This status indicates that the generator set start circuit is open causing the engine to shut down.

Generator Running. This notice indicates that the generator set has started and is running.

Load Priority # Shed. This notice message indicates the digital output for load priority # (1, 2, 3, 4, 5, or 6) shed is active (contacts closed), indicating the 1st, 2nd, 3rd, 4th, 5th, or 6th priority load shed has been activated.

Remote Start (SiteTech™ only). This status indicates that the generator set start circuit was closed from a remote location allowing the engine to crank and run. The remote location is typically a set of contacts on a transfer switch or remote start switch.

Remove Breaker Trip. This notice message indicates that the controller considers the breaker to be safe to close. The breaker may be closed or preparing to close when this notice is displayed. This notice only appears in paralleling applications (where the bus sensing is connected to the bus side of the paralleling breaker).

Run Button Acknowledged . This notice message indicates that the RUN button on the controller has been pushed.

Stationary Regeneration Aborted (SiteTech™ only). This status indicates stationary cleaning was interrupted by one of the following: user cancelled by pressing off, user cancelled by setting cleaning request to NO, or detection of remote start.

Stationary Regeneration Completed (SiteTech™ only). This status indicates a user initiated stationary cleaning of the Tier 4 exhaust system equipment and that the cleaning was performed successfully.

Stationary Regeneration Failed (SiteTech™ only). This status indicates that the stationary cleaning of the Tier 4 exhaust system equipment was initiated but failed to start (as indicated by the ECM) within the allotted time or failed to complete within the allotted time.

Stationary Regeneration Started (SiteTech™ only). The status indicates that the stationary cleaning of the Tier 4 exhaust system equipment was initiated by a user setting the cleaning request parameter to YES.

System Ready. This notice indicates that the generator set is in the AUTO mode and available to start if the start circuit is closed.

2.4.6 Controller Resetting (Following System Shutdown or Warning)

Use the following procedure to restart the generator set after a system shutdown or to clear a warning lamp condition. This procedure includes the resetting of the optional remote annunciator.

Refer to Section 2.4.1, Emergency Stop, to reset the generator set after an emergency stop.

1. Disconnect the generator set load using the line circuit breaker or automatic transfer switch.
2. Correct the cause of the fault shutdown or warning. See the Safety Precautions and Instructions section of this manual before proceeding.
3. Reset the fault by pressing the OFF/RESET button.
4. Start the generator set by pressing the generator set OFF/RESET button and then press the RUN button.

When equipped, the remote annunciator alarm horn sounds. Press the ALARM SILENCE/LAMP TEST button to stop the alarm horn. The alarm silenced lamp turns on if the alarm is silenced.

5. Test operate the generator set to verify correction of the shutdown cause by pressing the RUN button.

6. Press the generator set OFF/RESET button to stop the generator set.
7. Press the generator set AUTO button.
8. Silence the controller alarm horn by pressing the ALARM SILENCE button.
9. Reconnect the generator set load via the line circuit breaker or automatic transfer switch.
10. When equipped, the remote annunciator alarm horn sounds. Press the ALARM SILENCE/LAMP TEST button to stop the alarm horn. The alarm silenced lamp turns on if the alarm is silenced.

2.5 Menu Displays

Use the Menu Summary List and Figure 2-8 to Figure 2-13 after reading and understanding the features of the pushbutton/rotary selector dial. See Section 1.3.3, Graphical Display.

The Menu Summary List and Figure 2-8 to Figure 2-13 provide a reference to the digital display data. Some digital display data may not be identical to your display due to generator set application differences. The closed bullet items represent main level data and the open bullet items are sub-level data. The Menu Summary List indicates items that are user selectable. Some menu selections are password protected. Use SiteTech™ software for changing other programmable information.

Menu Summary List (Legend: ● First level submenu, ○ second level submenu, ◇ third level submenu)

| Metering Menu | Metering Menu (Continued) | Generator Information Menu (Continued) |
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| <ul style="list-style-type: none"> ● Generator Metering <ul style="list-style-type: none"> ○ L1-L2 VOLTS: ###V ○ L2-L3 VOLTS: ###V ○ L3-L1 VOLTS: ###V ○ AVG GEN VOLTAGE L-L: ###V ○ GEN FREQUENCY: ##. #Hz ○ L1-L0 VOLTS: ###V ○ L2-L0 VOLTS: ###V ○ L3-L0 VOLTS: ###V ○ AVG GEN VOLTAGE L-N: ###V ○ GEN FREQUENCY: ##. #Hz ○ L1 CURRENT: ###A ○ L2 CURRENT: ###A ○ L3 CURRENT: ###A ○ AVG CURRENT: ###A ○ GEN FREQUENCY: ##. #Hz ○ L1 POWER: ####W ○ L2 POWER: ####W ○ L3 POWER: ####W ○ TOTAL POWER: ####.#kW ○ GEN % OF RATED kW: ###% ○ L1 REACTIVE POWER: ####VAR ○ L2 REACTIVE POWER: ####VAR ○ L3 REACTIVE POWER: ####VAR ○ TOTAL REACTIVE POWER: ####VAR ○ L1 APPARENT POWER: ####VA ○ L2 APPARENT POWER: ####VA ○ L3 APPARENT POWER: ####VA ○ TOTAL APPARENT PWR: ####VA ○ GEN % OF RATED kVA: ###% ○ L1 PF: #.## ○ L2 PF: #.## ○ L3 PF: #.## ○ TOTAL PF: #.## ○ GEN PHASE ROTATION: ### ● Engine Metering <ul style="list-style-type: none"> ○ ENGINE SPEED: ####RPM ○ ECM BATTERY VOLTAGE: ##.#VDC ○ GEN BATTERY VOLTAGE: ##.#VDC ○ GENSET CONTROLLER TEMP: ###°F ○ OIL PRESSURE: ###PSI ○ OIL TEMPERATURE: ###°F ○ COOLANT TEMPERATURE: ###°F ○ COOLANT PRESSURE: ###PSI ○ FUEL LEVEL: ###% ○ FUEL PRESSURE: ###PSI ○ FUEL TEMPERATURE: ###°F ○ FUEL RATE: ##.#GAL/h (shown if available from ECM) ○ FUEL USED LAST RUN: ##.#GAL (shown if available from ECM) ○ CRANKCASE PRESSURE: ###PSI ○ INTAKE AIR PRESSURE: ###PSI ○ INTAKE AIR TEMP: ###°F ● Battery X Meter <ul style="list-style-type: none"> ○ STATUS: (IDLING/STANDBY/ CHARGING/ BATT FAIL/CHRGR FAIL/ NOT AVAILABLE) ○ OUTPUT VOLTAGE: ##.#VDC ○ OUTPUT CURRENT: ##.#A ○ CHARGER STATE: IDLE/BULK/ ABSORB/FLOAT/EQUAL/REFRESH/ RECOVER/NA | <ul style="list-style-type: none"> ○ CHARGER TEMP: ###°F ○ REDUCED OUTPUT ACTIVE: YES/NO ○ TEMP COMPENSATION ACTIVE: YES/NO ○ SOFTWARE VER.: XXXXXXXXXXXXX ● Overview <ul style="list-style-type: none"> ○ GENERATOR STATUS <ul style="list-style-type: none"> ◇ AVG GEN VOLTAGE L-L: ###V ◇ AVG CURRENT: ###A ◇ GEN FREQUENCY: ##. #Hz ○ ENGINE STATUS <ul style="list-style-type: none"> ◇ COOLANT TEMPERATURE: ###°F ◇ OIL PRESSURE: ###PSI ◇ GEN BATTERY VOLTAGE: ##.#V ○ SYSTEM STATUS <ul style="list-style-type: none"> ◇ FUEL PRESSURE: ###PSI ◇ TOTAL POWER: ####kW ◇ TOTAL RUN TIME: #####.hrs ● Paralleling Metering <ul style="list-style-type: none"> ○ CONNECTED TO BUS: TRUE/FALSE ○ AVG BUS VOLTAGE L-L: ##.#V ○ AVG GEN VOLTAGE L-L: ##.#V ○ BUS FREQUENCY: ##.##Hz ○ GEN FREQUENCY: ##.##Hz ○ BUS TOTAL POWER: #####.kW ○ BUS % OF RATED kW: ###% ○ BUS % OF RATED kVAR: ###% <hr/> <p>Generator Information Menu</p> <ul style="list-style-type: none"> ● Generator Information <ul style="list-style-type: none"> ○ TOTAL RUN TIME: #####.hrs ○ HOURS LOADED: #####hrs ○ HOURS UNLOADED: #####hrs ○ kW HOURS: #####kWh ○ OPERATING HOURS: #####hrs ○ TOTAL # OF STARTS: ##### ○ LAST MAINTENANCE: ##/##/#### ○ OP HRS SINCE MAINT: #####hrs ○ STARTS SINCE MAINT: ### ○ ENG HRS SINCE MAINT: #####hrs ○ LOADED SINCE MAINT: #####hrs ○ UNLOADED SINCE MAINT: #####hrs ○ kW HRS SINCE MAINT: #####kWh ○ RESET MAINT RECORDS: YES/NO* ○ LAST START: ##/##/#### ○ LAST RUN LENGTH: #####hrs ○ CTRL SERIAL #: XXXXXXXXX ○ SOFTWARE VER.: XXXXXXXXX ○ ECM SERIAL #: XXXXXXXXX ○ GENSET MODEL #: XXXXXXXXX ○ GENSET SPEC #: XXXXXXXXX ○ GENSET SERIAL #: XXXXXXXXX ○ ALT. PART #: XXXXXXXXX ○ ENGINE PART #: XXXXXXXXX ○ ENGINE MODEL #: XXXXXXXXX ○ ENGINE SERIAL #: XXXXXXXXX ● Event History <ul style="list-style-type: none"> ○ GENERATOR EVENT HISTORY ##/##/#### (Date) ##.##.##XX (Time) DEVICE EVENT: ### STATUS/FAULT/NOTICE/WARNING EVENT X OF Y ○ ENGINE EVENT LOG SPN: ##### FMI: ## OCCURRENCE COUNT: ### EVENT X OF Y | <ul style="list-style-type: none"> ● Configuration <ul style="list-style-type: none"> ○ GENERATOR CONFIGURATION <ul style="list-style-type: none"> ◇ OPERATING MODE: (STANDBY/PRIME) ◇ APPLICATION TYPE: (NONE/MARINE/ MOBILE/STANDBY/PRIME) ◇ SYSTEM VOLTAGE L-L: ##.#V* ◇ SYSTEM FREQUENCY: ##. #Hz* ◇ SYSTEM PHASE: (SINGLE/SINGLE DOG/THREE-WYE/THREE-DELTA)* ◇ RATED ENGINE SPEED: ####RPM ◇ ENGINE SPEED ADJUSTMENT: * ◇ ADJUSTED ENGINE RUN SPEED: ####RPM ◇ kW RATING: ####kW ◇ kVA RATING: #####kVA ◇ RATED CURRENT: ###A ◇ BATTERY VOLTAGE: ##VDC* ◇ POWER ECM: ON/OFF* ◇ ENGINE START DELAY: ##s* ◇ STARTING AID DELAY: ##s* ◇ CRANK ON DELAY: ##s* ◇ CRANK PAUSE DELAY: ##s* ◇ ENGINE WARMED UP: ###°F ◇ ENGINE COOLED DOWN: ###°F ◇ COOLDOWN DELAY: ##s* ◇ COOLDOWN OVERRIDE: ON/OFF* ◇ FUEL TYPE: (NATURAL GAS/LP/ GASOLINE/DIESEL/UNKNOWN)* ◇ CRANK CYCLES LIMIT: ##* ◇ NFPA DEFAULTS: ON/OFF* ◇ EMERGENCY BATTLEMODE: ON/OFF* ○ PROTECTION CONFIGURATION <ul style="list-style-type: none"> ◇ OVERVOLTAGE: ###%* ◇ OVERVOLTAGE: ##.#V ◇ OVERVOLTAGE DELAY: ##s* ◇ UNDERVOLTAGE: ##%* ◇ UNDERVOLTAGE: ##.#V ◇ UNDERVOLTAGE DELAY: ##s* ◇ OVERFREQUENCY: ##%* ◇ OVERFREQUENCY: ##. #Hz ◇ UNDERFREQUENCY: ##%* ◇ UNDERFREQUENCY: ##. #Hz ◇ OVERSPEED: ##. #Hz* ◇ OVERSPEED: ##.#Hz ◇ OVERSPEED: ####RPM ◇ LOW BATTERY VOLTAGE: ###%* ◇ LOW BATTERY VOLTAGE: ##.#VDC ◇ HIGH BATTERY VOLTAGE: ###%* ◇ HIGH BATTERY VOLTAGE: ##.#VDC ○ BATT X BASIC CONFIG <ul style="list-style-type: none"> ◇ BATTERY TOPOLOGY: (DEFAULT/ VRLA/ AGM/GEL/NiCd*) ◇ CHARGER SYSTEM VOLTAGE: 12VDC/24VDC* ◇ AUTO EQUALIZE ENABLED: ON/OFF* ◇ TEMP COMPENSATION ENABLED: ON/OFF* ◇ ABSORPTION TERMINATION: #.##A (+/- 0.05)* ◇ BULK VOLTAGE: ##.#VDC (+/- 0.05)* ◇ ABSORPTION VOLTAGE: ##.#VDC (+/- 0.05) * ◇ FLOAT VOLTAGE: ##.#VDC (+/- 0.05)* ◇ MANUAL EQUALIZE ACTIVE: YES/NO* ◇ CUSTOM PROFILE ENABLED: ON/OFF* ◇ TEMP COMPENSATION SLOPE: ##mV/C* ◇ EQUALIZE VOLTAGE: ##.#VDC (+/- 0.05)* ◇ MAX ABSORPTION TIME: ##.#MIN* ◇ MAX BULK TIME: ##.#MIN* ◇ BULK STATE RETURN: ##.#V (+/- 0.05)* |

* User-Defined (changeable) Menu Displays. Use SiteTech™ software to change other settings including User-Defined Menu Displays.

| Generator Information Menu (Continued) | Generator Information Menu (Continued) | Generator Information Menu (Continued) |
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| <ul style="list-style-type: none"> ● Voltage Regulation <ul style="list-style-type: none"> ○ AVG GEN VOLTAGE L-L: ###.#V ○ VOLTAGE ADJUST: ###.#V* ○ TARGET VOLTAGE: ###.#V ○ L1-L2 VOLTS: ###.#V ○ L2-L3 VOLTS: ###.#V ○ L3-L1 VOLTS: ###.#V ○ GEN FREQUENCY: ##.#Hz ○ V/Hz SETPOINT: ##.#Hz* ○ V/Hz SLOPE: ##%/Hz* ○ VOLT DROOP AT 100% kVAR: ##.##%* ○ VOLTAGE GAIN ADJUST: ###.* ○ START UP RAMP RATE: ###.##%/s* ○ RESET REG. DEFAULTS: YES/NO* ● Voltage Selector Switch <ul style="list-style-type: none"> ○ VOLT SELECT SWITCH <ul style="list-style-type: none"> ◇ PRESENT POSITION: # ◇ SYSTEM VOLTAGE L-L: ### V ◇ SYSTEM FREQUENCY: ##.# Hz ◇ SYSTEM PHASE: ### ◇ kW RATING: ## kW ◇ MAX POSITIONS: # ◇ POS. 1 VOLTS: ### ◇ POS. 1 FREQUENCY: ## Hz ◇ POS. 1 PHASE: ### ◇ POS. 2 VOLTS: ### ◇ POS. 2 FREQUENCY: ## Hz ◇ POS. 2 PHASE: ### ◇ POS. 3 VOLTS: ### ◇ POS. 3 FREQUENCY: ## Hz ◇ POS. 3 PHASE: ### ● Paralleling Operation <ul style="list-style-type: none"> ○ PARALLELING SETUP <ul style="list-style-type: none"> ◇ DEAD BUS LEVEL: ##.##%* ◇ VOLTAGE OK PICKUP: ##.##%* ◇ VOLTAGE OK DROPOUT: ##.##%* ◇ FREQUENCY OK PICKUP: ##.#Hz* ◇ FREQUENCY OK DROPOUT: ##.#Hz* ◇ VOLTS-Hz OK DELAY: ##.#s* ◇ FIRST ON DELAY: ##.#s* ◇ FAIL TO OPEN DELAY: ##s* ◇ FAIL TO CLOSE DELAY: ##s* ◇ RECLOSE DELAY: ##.#s* ◇ MAX CLOSE ATTEMPTS: ###* ◇ CB CRNT FAULT LIMIT: ###.##%* ◇ CB CRNT FAULT DELAY: ##.#s* ◇ CB PHASE FAULT LIMIT: ##.#°* ◇ CB PHASE FAULT DELAY: ##.#s* ◇ kW RAMP RATE: ##.##%/s* ◇ kW DISCONNECT LEVEL: ##.##%* ◇ TRIMS ENABLE: ON/OFF* ◇ LOAD ENABLE: ON/OFF* ◇ SYSTEM LOAD CONTROL: ON/OFF* ◇ SYSTEM SYNC CONTROL: ON/OFF* ◇ STAND ALONE MODE: ON/OFF* ◇ SYNC MODE IN AUTO: (INVALID/OFF/PASSIVE/CHECK/ACTIVE/DEAD FIELD)* ◇ SYNC MODE IN RUN: (INVALID/OFF/PASSIVE/CHECK/ACTIVE/DEAD FIELD)* ○ SYNCHRONIZING SETUP <ul style="list-style-type: none"> ◇ SYNC MODE IN RUN: (INVALID/OFF/PASSIVE/CHECK/ACTIVE/DEAD FIELD)* ◇ SYNC MODE IN AUTO: (INVALID/OFF/PASSIVE/CHECK/ACTIVE/DEAD FIELD)* ◇ CONNECTED TO BUS: TRUE/FALSE ◇ VOLTS-Hz OK: TRUE/FALSE ◇ IN SYNC: TRUE/FALSE ◇ VOLTAGE MATCHED: TRUE/FALSE ◇ VOLTAGE MATCH WINDOW: ##.##%* ◇ AVG BUS VOLTAGE L-L: ###.#V ◇ AVG GEN VOLTAGE L-L: ###.#V | <ul style="list-style-type: none"> ◇ VOLTAGE MATCH P GAIN: ##.##* ◇ VOLTAGE MATCH I GAIN: ##.##* ◇ VOLTAGE MATCH D GAIN: ##.##* ◇ VOLTAGE BIAS: ###.## ◇ FREQUENCY MATCHED: TRUE/FALSE ◇ FREQUENCY WINDOW: #.#Hz* ◇ BUS FREQUENCY: ##.#Hz ◇ GEN FREQUENCY: ##.#Hz ◇ FREQ MATCH P GAIN: ##.##* ◇ FREQ MATCH I GAIN: ##.##* ◇ FREQ MATCH D GAIN: ##.##* ◇ SPEED BIAS: ###.## ◇ PHASE MATCHED: TRUE/FALSE ◇ PHASE MATCH WINDOW: ##.#°* ◇ PHASE DIFFERENCE: ###.#° ◇ PHASE MATCH P GAIN: ##.##* ◇ PHASE MATCH I GAIN: ##.##* ◇ PHASE MATCH D GAIN: ##.##* ◇ SPEED BIAS: ###.## ◇ DWELL TIME: ##.#s* ◇ DWELL TIME REMAINING: ##.#s ◇ FAIL TO SYNC TIME: ###s* ◇ SYNC TIME REMAINING: ###s ◇ BUS PHASE ROTATION: DISABLED/A-B-C/C-B-A ◇ GEN PHASE ROTATION: DISABLED/A-B-C/C-B-A ○ SHARING SETUP <ul style="list-style-type: none"> ◇ BUS % OF RATED kW: ###.##% ◇ GEN % OF RATED kW: ###.##% ◇ kW SHARING P GAIN: ##.##* ◇ kW SHARING I GAIN: ##.##* ◇ kW SHARING D GAIN: ##.##* ◇ SPEED BIAS: ###.## ◇ SYSTEM FREQUENCY: ##.#Hz ◇ GEN FREQUENCY: ##.#Hz ◇ FREQ TRIM P GAIN: ##.##* ◇ FREQ TRIM I GAIN: ##.##* ◇ FREQ TRIM D GAIN: ##.##* ◇ SPEED BIAS: ###.## ◇ FREQ DROOP AT 100% kW: ##.##%* ◇ BUS % OF RATED kVAR: ###.##% ◇ GEN % OF RATED kVAR: ###.##% ◇ KVAR SHARING P GAIN: ##.##* ◇ KVAR SHARING I GAIN: ##.##* ◇ KVAR SHARING D GAIN: ##.##* ◇ VOLTAGE BIAS: ###.## ◇ SYSTEM VOLTAGE L-L: ###.#V ◇ AVG GEN VOLTAGE L-L: ###.#V ◇ VOLT TRIM P GAIN: ##.##* ◇ VOLT TRIM I GAIN: ##.##* ◇ VOLT TRIM D GAIN: ##.##* ◇ VOLTAGE BIAS: ###.## ◇ VOLT DROOP AT 100% kVAR: ##.##%* ○ PROTECTIVE RELAY SETUP <ul style="list-style-type: none"> ◇ OVER POWER TRIP: ###.##%* ◇ OVER POWER DELAY: ##.#s* ◇ REVERSE POWER TRIP: ###.##%* ◇ REVERSE POWER DELAY: ##.#s* ◇ OVER VOLTAGE TRIP: ##.##%* ◇ OVER VOLTAGE DELAY: ##.#s* ◇ UNDER VOLTAGE TRIP: ##.##%* ◇ UNDER VOLTAGE DELAY: ##.#s* ◇ OVER FREQ TRIP: ##.##%* ◇ OVER FREQ DELAY: ##.#s* ◇ UNDER FREQ TRIP: ##.##%* ◇ UNDER FREQ DELAY: ##.#s* ◇ REVERSE VAR TRIP: ##.##%* ◇ REVERSE VAR DELAY: ##.#s* ◇ OVER CURRENT TRIP: ##.##%* ◇ OVER CURRENT DELAY: ##.#s* ◇ TRIP TO SHUTDOWN DELAY: ###s* ○ GENERATOR MANAGEMENT <ul style="list-style-type: none"> ◇ GEN MANAGEMENT MODE: (INVALID/MANUAL FIXED/RUN TIME/FUEL LEVEL)* ◇ GEN MANAGEMENT: ON/OFF* | <ul style="list-style-type: none"> ◇ GEN MANAGEMENT ORDER: #* <i>will revert to previous setting in run time or fuel level mode.</i> ◇ START CAPACITY: ##.##%* ◇ START DELAY: ###s* ◇ STOP CAPACITY: ##.##%* ◇ STOP DELAY: ###s* ◇ TOTAL BUS CAPACITY: #####kW ◇ BUS TOTAL POWER: #####kW ◇ START kW: #####kW ◇ STOP kW: #####kW ◇ START ACCUMULATOR: ##### ◇ STOP ACCUMULATOR: ##### ◇ RUN TIME THRESHOLD: ###.#hrs* <i>only if in Run Time Management</i> ◇ TOTAL RUN TIME: #####.#hrs ◇ FUEL LEVEL THRESHOLD: ##.##%* <i>only if in Fuel Level Management</i> ◇ FUEL LEVEL: ##.##% ◇ STABLE DELAY: ###s* ◇ MINIMUM GENS ONLINE: ##* ◇ MIN LOADS ADDED: ##* ◇ STOPPED BY GEN MGMT: TRUE/FALSE ○ LOAD CONTROL <ul style="list-style-type: none"> ◇ GEN MAX % CAP: ##.##%* ◇ GEN OVERLOAD %: ##.##%* ● Emissions Information (selected models only) <ul style="list-style-type: none"> ○ EMISSIONS <ul style="list-style-type: none"> ◇ DEF (DIESEL EXHAUST FLUID) LEVEL: ##.##% ◇ EXHAUST SYSTEM REGENERATION: NOT NEEDED, NEEDED LOW, NEEDED MODERATE, NEEDED HIGH, NEEDED VERY HIGH, NEEDED SERVICE ONLY ◇ SOOT LEVEL: ###% ◇ ASH LEVEL: ###% ◇ EXHAUST OUTLET TEMPERATURE: ###°F/°C ◇ TIME SINCE REGENERATION: #####.### ◇ CLEANING STATUS: ENABLED, USER SWITCH, LOW EXHAUST TEMP, or SYSTEM FAULT ◇ PREVENT ACTIVE REGENERATION: YES/NO (PASSWORD PROTECTED) (DEFAULTS BACK TO NO WHEN REQUEST REGENERATION IS YES) ◇ REQUEST REGENERATION: YES/NO ○ NOTIFICATIONS <ul style="list-style-type: none"> ◇ HIGH EXHAUST TEMPERATURE ◇ SYSTEM ISSUE ◇ LOW DEF (DIESEL EXHAUST FLUID) ◇ CLEANING DISABLED BY USER ◇ CLEANING NEEDED |
| | | <h3>Controller Configuration Menu</h3> |
| | | <ul style="list-style-type: none"> ● Controller Configuration <ul style="list-style-type: none"> ○ LANGUAGE: English* ○ UNITS: Metric/English* ○ TIME FORMAT: Hr 12/Hr 24* ○ DATE FORMAT: Month Date Year/Date Month Year* ○ DATE: ##/##/####* ○ TIME: ##.## XM* ○ CONTRAST: ###* ○ ALARM SILENCE: ALWAYS/AUTO ONLY* |

* User-Defined (changeable) Menu Displays. Use SiteTech™ software to change other settings including User-Defined Menu Displays.

| Controller Configuration Menu (Continued) | I/O Menu (Continued) | Active Events Menu |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ● Communication Setup <ul style="list-style-type: none"> ○ MODBUS BAUD RATE: OFF/9600 b/s/19200 b/s/38400 b/s/57600 b/s/115200 b/s* ○ MODBUS ADDRESS: ##* ○ PGEN BAUD RATE: OFF/9600 b/s/19200 b/s/38400 b/s/57600 b/s/115200 b/s ○ PGEN NODE ID: ## ○ PGEN NODES ONLINE: ## ○ PGEN NODES OFFLINE: ## ● Calibration <i>When the line is highlighted, hold the knob down to enable the calibration capability.</i> <ul style="list-style-type: none"> ○ GEN L1-L0 VOLTS: ###.#V* ○ GEN L2-L0 VOLTS: ###.#V* ○ GEN L3-L0 VOLTS: ###.#V* ○ GEN L1-L2 VOLTS: ###.#V* ○ GEN L2-L3 VOLTS: ###.#V* ○ GEN L3-L1 VOLTS: ###.#V* ○ GEN L1 CURRENT: ###.#A* ○ GEN L2 CURRENT: ###.#A* ○ GEN L3 CURRENT: ###.#A* ○ BUS L1-L2 VOLTS: ###.#V* ○ BUS L2-L3 VOLTS: ###.#V* ○ BUS L3-L1 VOLTS: ###.#V* ○ RESET GEN VOLT METER: YES/NO* ○ RESET GEN AMP METER: YES/NO* ○ RESET BUS VOLT METER: YES/NO* ○ RESET ALL METERS: YES/NO* | <ul style="list-style-type: none"> ● Digital Input <ul style="list-style-type: none"> Digital Input 0:1 Digital Input 0:2 Digital Input 0:3 Digital Input 0:4 Digital Input 0:5 Digital Input 0:6 <ul style="list-style-type: none"> ○ DESCRIPTION: <i>(function by default unless modified via SiteTech)</i> ○ STATUS: ACTIVE/INACTIVE ○ FUNCTION: * ○ EVENT: * ○ LOGIC: ACTIVE ON/ACTIVE OFF * ○ ENABLED: ON/OFF* ○ INHIBIT TIME: ##s* ○ DELAY TIME: ##s* ○ I/O BOARD NUMBER: X ● Digital Output <ul style="list-style-type: none"> Digital Output 0:1 Digital Output 0:2 Digital Output 0:3 Digital Output 0:4 Digital Output 1:1 <i>(Note: Only displayed if the 15-Relay Dry Contact Kit is installed.)</i> ... ○ DESCRIPTION: <i>(function by default unless modified via SiteTech)</i> ○ STATUS: ACTIVE/INACTIVE ○ FUNCTION: * ○ EVENT: * ○ LOGIC: ACTIVE ON/ACTIVE OFF* ○ I/O BOARD NUMBER: X | <p>Rotate the dial to view Active Events: Warnings Shutdowns Statuses Notices</p> <p>See Section 2.4.3, Section 2.4.4, and Section 2.4.5 for descriptions.</p> <p>Press the OFF button to return to the main menu.</p> |
| <p>I/O Menu</p> | | |
| <ul style="list-style-type: none"> ● Resistive Input <ul style="list-style-type: none"> Analog Input 0:1 Analog Input 0:2 Analog Input 0:3 Analog Input 0:4 Analog Input 0:5 Analog Input 0:6 <ul style="list-style-type: none"> ○ DESCRIPTION: <i>(function by default unless modified via SiteTech)</i> ○ MEASUREMENT: ###.#Ohms ○ EVENT: * ○ INPUT ENABLED: ON/OFF* ○ SENSOR TYPE: * ○ LOW PROTECTIVE INHIBIT: ##s* ○ LOW WARNING: ON/OFF* ○ LOW WARNING LIMIT: * ○ LOW WARNING DELAY: ##s* ○ LOW SHUTDOWN: ON/OFF* ○ LOW SHUTDOWN LIMIT: * ○ LOW SHUTDOWN DELAY: ##s* ○ HIGH PROTECTIVE INHIBIT: ##s* ○ HIGH WARNING: ON/OFF* ○ HIGH WARNING LIMIT: * ○ HIGH WARNING DELAY: ##s* ○ HIGH SHUTDOWN: ON/OFF* ○ HIGH SHUTDOWN LIMIT: * ○ HIGH SHUTDOWN DELAY: ##s* ○ I/O BOARD NUMBER: X | | |

* User-Defined (changeable) Menu Displays. Use SiteTech™ software to change other settings including User-Defined Menu Displays.

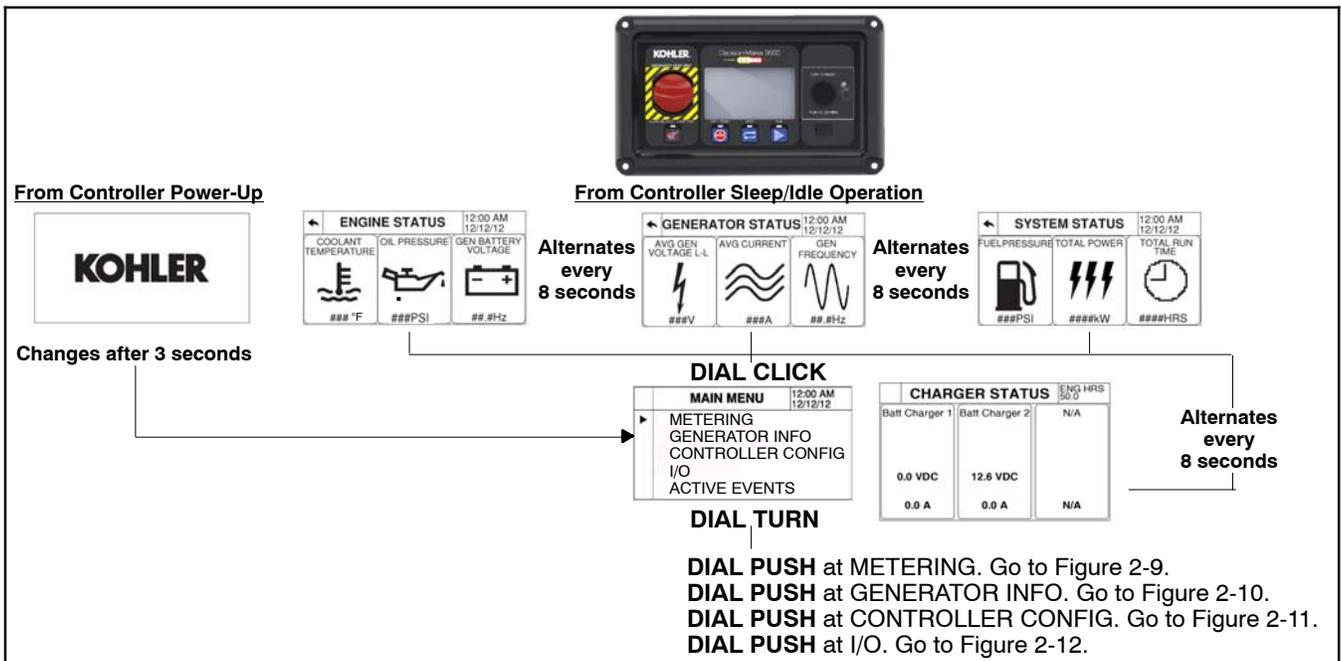


Figure 2-8 Decision-Maker 3500 Controller Information Menu Structure

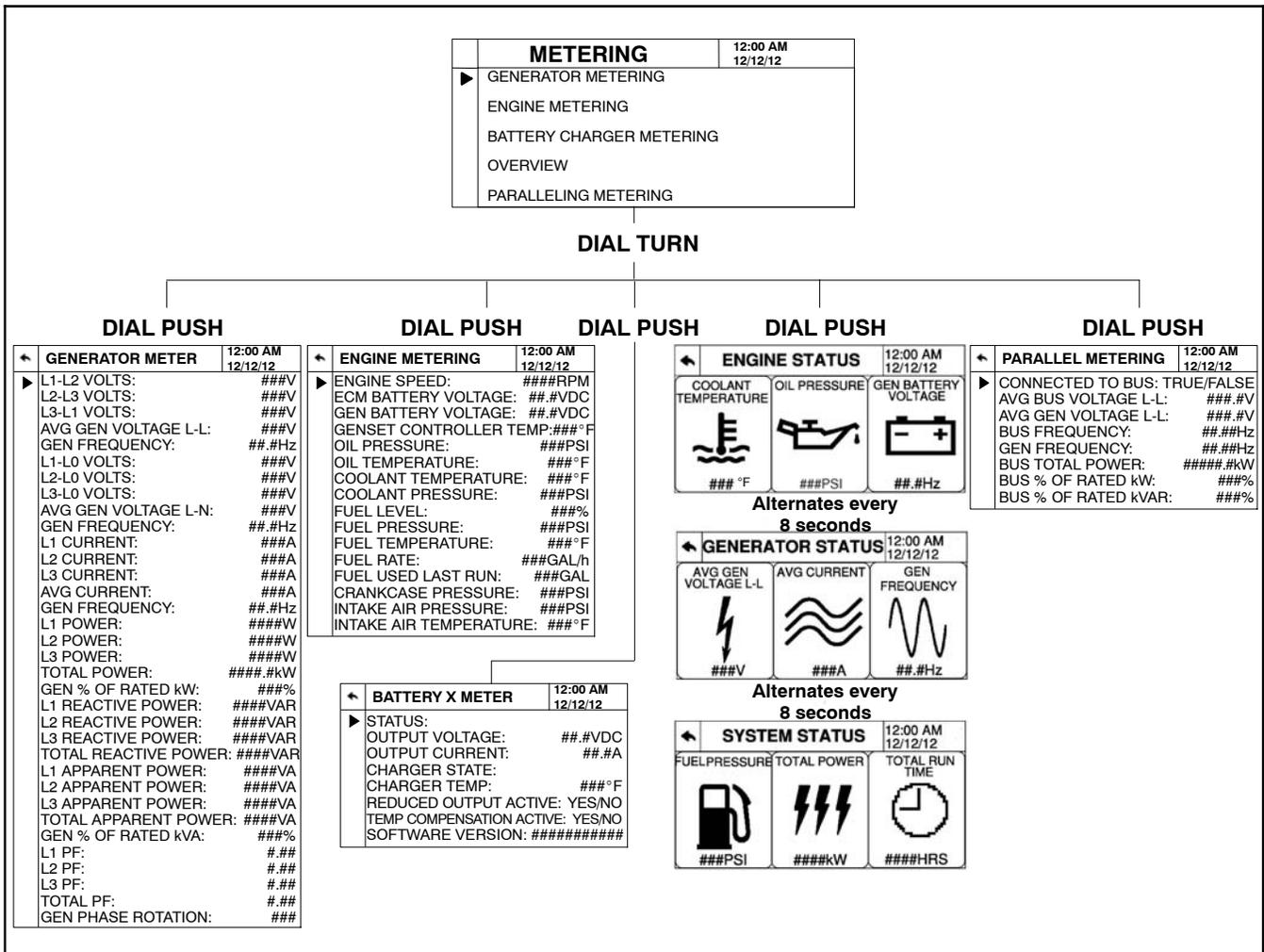


Figure 2-9 Metering Menu

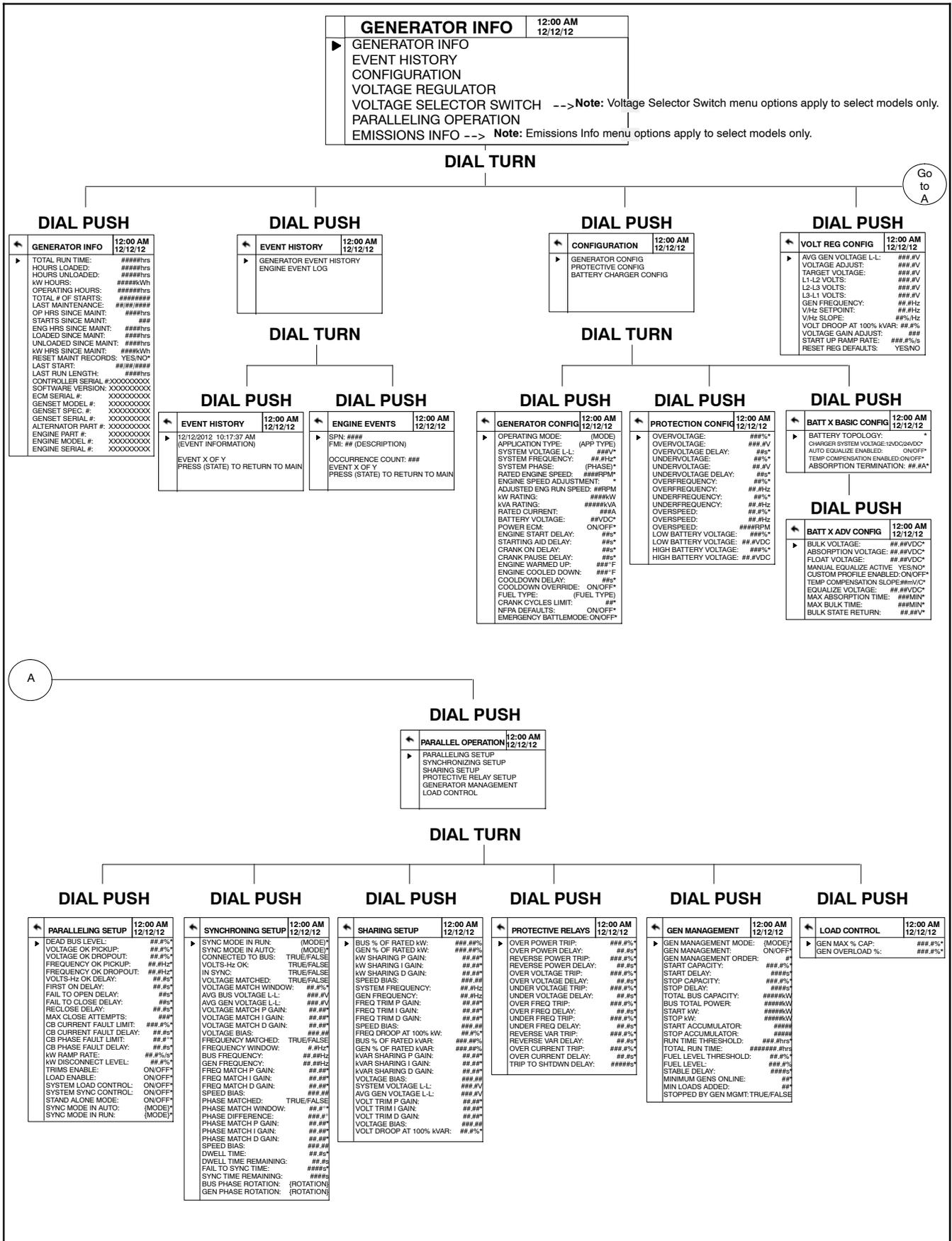


Figure 2-10 Generator Information Menu

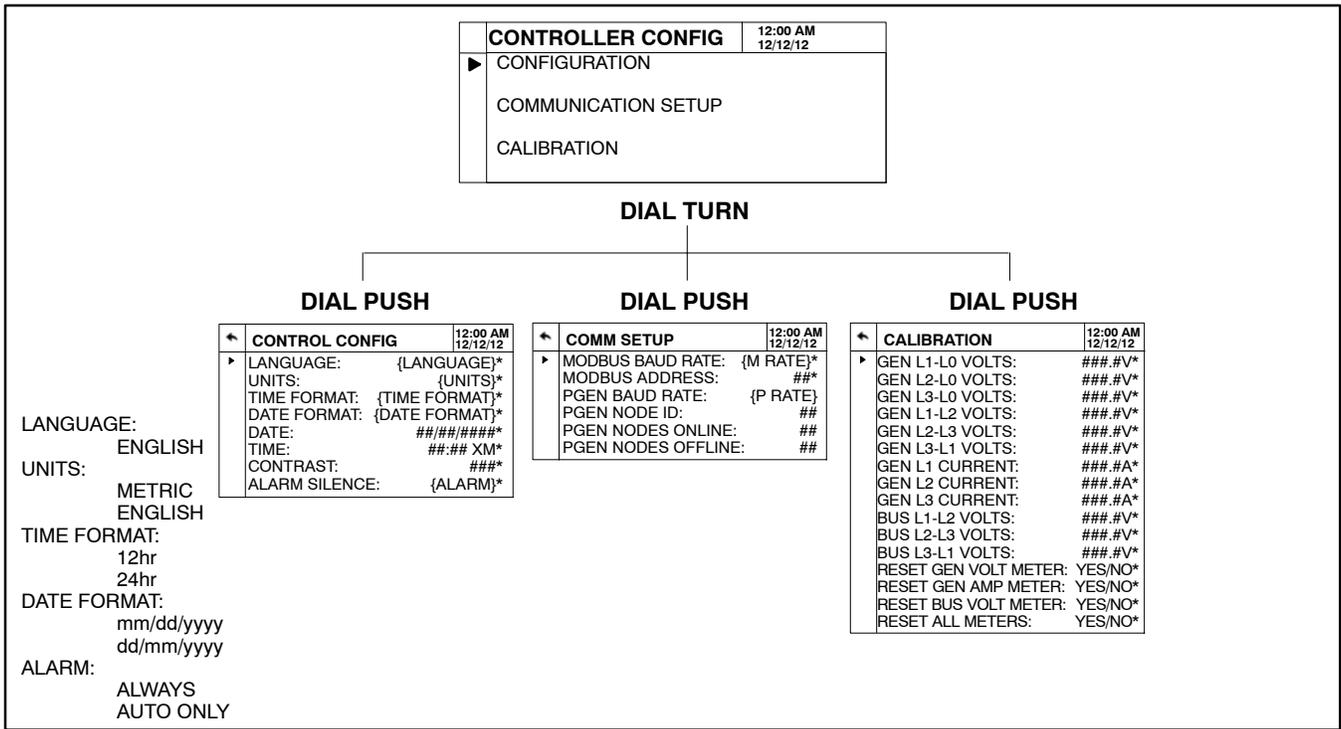


Figure 2-11 Controller Configuration Menu

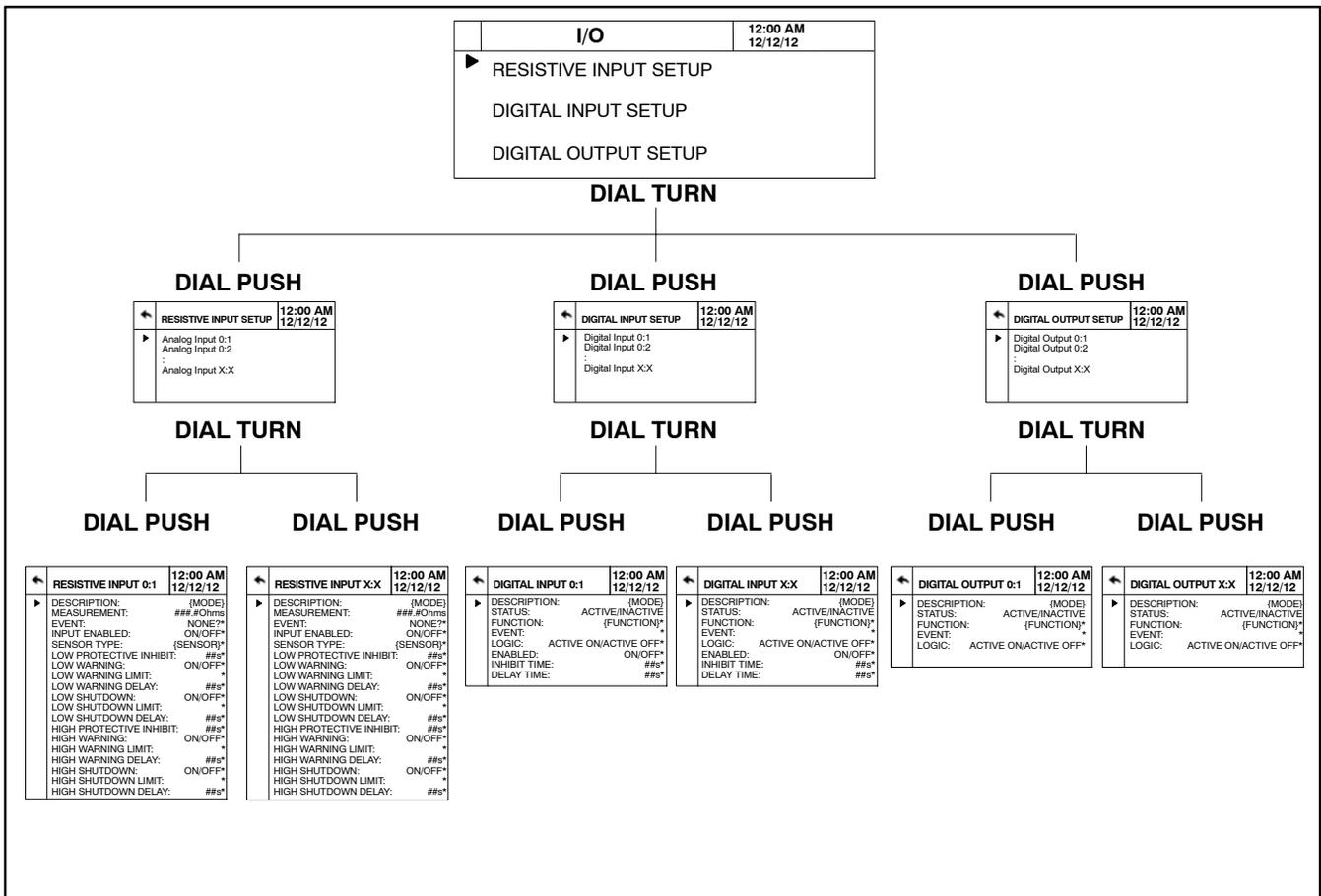


Figure 2-12 I/O Menu

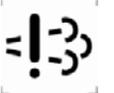
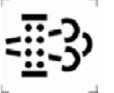
| Indicator | Symbol | Description | Action |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DEF Indicator On Steady | Low DEF concentration:  | DEF tank has approximately 10% or less remaining. | Fill DEF tank. |
| | Low DEF level:  | | |
| DEF Indicator Flashing | Low DEF concentration:  | DEF tank has 0% measurable volume and engine performance is reduced. DEF system has lost its prime and engine performance is reduced. | Fill DEF tank. |
| | Low DEF level:  | | |
| Engine Emissions System Malfunction Indicator On Steady or Flashing |  | Engine emissions outside of normal operating range. Engine emissions system fault | Contact authorized distributor. |
| Engine Emissions Temperature Indicator On Steady |  | Exhaust gas temperature is high. Exhaust cleaning is in process. | Engine can be operated as normal. If operating in an area where high exhaust temperatures may be an issue, inhibit exhaust system cleaning by using the disable feature. |
| Exhaust System Indicator On Steady or Flashing |  | Residue level in the exhaust system indicates need for an exhaust system cleaning. After treatment system fault. | Enable auto system cleaning to allow a cleaning cycle or begin stationary cleaning. If system cleaning is performed and indicator still active, contact an authorized distributor. |
| Auto Cleaning Disabled Indicator On Steady |  | Auto exhaust system cleaning has been disabled by the user setting. | If possible, enable auto cleaning. |

Figure 2-13 Emission Symbols (Models: 80–150REOZJ4)

2.6 Monitoring and Programming Setup

The user programmer can access the controller data with the controller digital display or a personal computer (PC) with optional SiteTech™ software to monitor and/or program. Access the controller system with a PC using a USB cable with a mini USB plug. Refer to the Introduction, List of Related Materials for related software literature.

While this manual focuses on data access through the controller pushbutton/rotary selector dial and display, most data entries require input using a PC for initial setup. The PC entries typically include alpha characters such as digital input descriptions.

2.6.1 PC Communications

Communicate between a PC and the generator set controller logic using USB communication protocol. The PC connections require optional SiteTech™ software. Contact your authorized distributor for assistance.

Local Single Connection

A PC connects to the USB port of the generator set controller using a mini USB connector. See Figure 2-14.

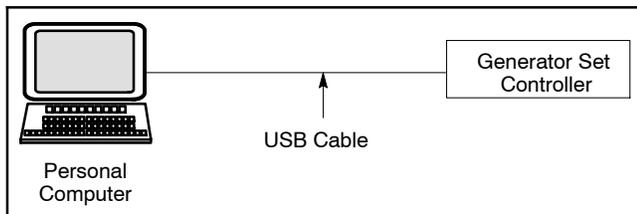


Figure 2-14 Local Single Connection

Remote Single Connection

A modem connects a PC to a single device. The PC communicates with the device via telephone line or an Ethernet network. See Figure 2-15.

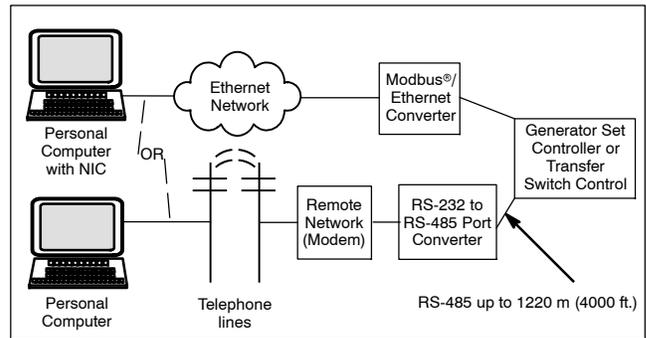
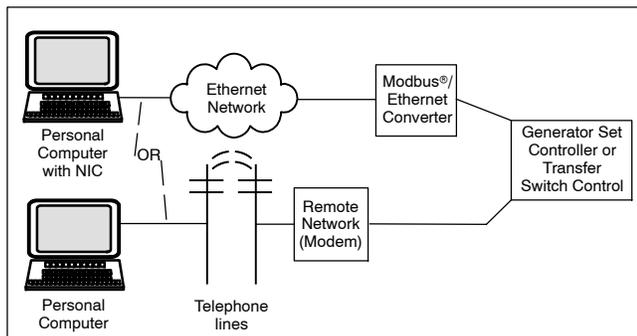


Figure 2-15 Remote Single Connections

2.6.2 Modbus® Communications

The controller communicates using Modbus® as a slave connection with the Modbus® master initiating the communication. The controller seeks the system and alternator parameters and diagnostic information then responds back to the Modbus® master. In addition, the controller accepts information to alter controller parameters including generator set starting and stopping. See Figure 2-16. Refer to the List of Related Materials for available Modbus® literature.

Note: Only one Modbus® master can be connected to the controller. Examples include the remote serial annunciator and switchgear applications.

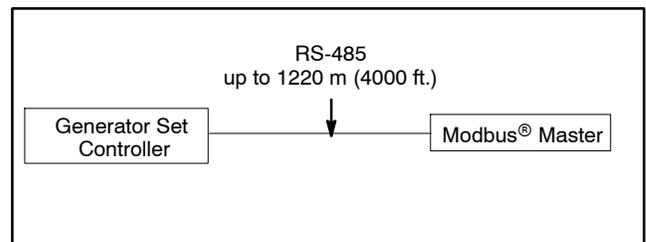


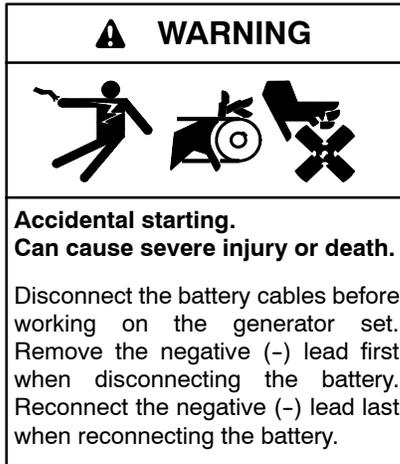
Figure 2-16 Modbus® Connections

Modbus® is a registered trademark of Schneider Electric.

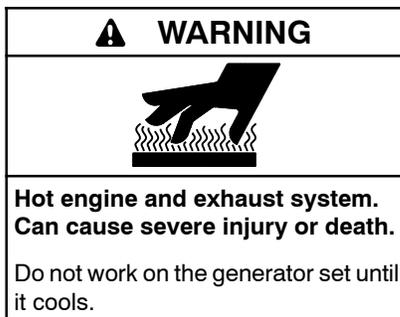
Section 3 Scheduled Maintenance

3.1 Introduction

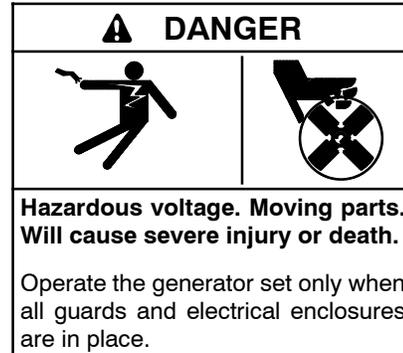
This section deals with general maintenance of the generator set and accessories. This section may refer to other literature for procedures and additional information. Refer to Appendix D, Operating Hour Service Log for a means to document maintenance.



Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.



Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.



Servicing the generator set when it is operating. Exposed moving parts will cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

3.2 Generator Set Service

The prestart checklist lists generator set main areas that require attention.

Note: Have maintenance work, including battery service, performed by appropriately skilled and suitably trained maintenance personnel familiar with generator set operation and service.

Some procedures may also require using the generator set service manual or engine service manual.

3.2.1 Alternator Service

Under normal operating conditions, the generator set's alternator requires no routine service.

When operating the generator set under dusty or dirty conditions, use dry compressed air to blow dust out of the alternator while the generator set is running. Direct the stream of air through openings in the generator set end bracket.

3.2.2 Engine Service

Perform engine service at the intervals specified in the engine manufacturer's service literature. Contact an authorized service distributor/dealer to obtain service literature.

3.3 Service Schedule

| System—Component | Action | | | | | Interval |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------|--------|-------|------|---------------------------------------|
| | Visually Inspect | Check | Change | Clean | Test | |
| Fuel System | | | | | | |
| Day tank level | X | X | | | | Weekly |
| Flexible lines and connections | X | | R | | | Weekly |
| Fuel level switch | X | | | | X | Weekly |
| Main tank supply level | | X | | | | Weekly |
| Water in system, remove | | • | | • | | Weekly |
| Filter(s) | | | • | | | Quarterly |
| Fuel piping | X | | | | | Yearly |
| Tank vents and return lines for obstructions | | X | | | | Yearly |
| Lubrication System | | | | | | |
| Oil level | • | • | | | | Weekly |
| Crankcase breather | • | | • | | | Quarterly |
| Change oil | | | • | | | First 50 Hrs., Then Every 250 Hrs. |
| Replace filter(s)* | | | • | | | |
| Cooling System | | | | | | |
| Air cleaner to room/enclosure | | X | | | | Weekly |
| Block heater operation | | X | | | | Weekly |
| Coolant level | • | • | | | | Weekly |
| Flexible hoses and connectors | X | X | | | | Weekly |
| Water pump(s) | • | | | | | Weekly |
| Fan and alternator belts | • | • | R | | | Monthly |
| Coolant temperature protection level | | | | | • | Six Months |
| Air ducts, louvers | | X | | X | | Yearly |
| Coolant | | | • | | | Yearly |
| Louver motors and controls | X | | | X | X | Yearly |
| Radiator exterior | | | | X | | Yearly |
| Exhaust System | | | | | | |
| Drain condensate trap | | X | | | | Weekly |
| Leakage | X | X | | | | Weekly |
| Diesel exhaust fluid (DEF) filter | | | • | | | 4500 Hours |
| Insulation, fire hazards | X | | | | | Quarterly |
| Flexible connector(s) | X | | | | | Six Months |
| Excessive back pressure | | | | | X | Yearly |
| Hangers and supports | X | | | | | Yearly |
| DC Electrical System | | | | | | |
| Battery charger operation, charge rate | X | | | | | Monthly |
| Battery electrolyte level | | X | | | | Monthly |
| Battery specific gravity, charge state | | | | | X | Monthly |
| Recharge after engine start | | X | | | | Monthly |
| Remove corrosion, clean and dry battery and rack | X | | | X | | Monthly |
| Clean and tighten battery terminals | X | X | | | | Quarterly |
| Tighten DC electrical connections | | X | | | | Six Months |
| <ul style="list-style-type: none"> • Follow procedures and frequencies indicated in the engine manufacturer's maintenance manual. If not indicated, follow this service schedule. Some items may not apply to all generator sets. R Replace as necessary. X Action * Service more frequently if operated in dusty areas. | | | | | | |

Service Schedule, continued

| System—Component | Action | | | | | Interval |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------|--------|-------|------|------------------------|
| | Visually Inspect | Check | Change | Clean | Test | |
| AC Electrical System | | | | | | |
| Controller lamp test | X | | | | R | Weekly |
| General Inspection | X | | | | | Weekly |
| Circuit breakers, fuses† | X | X | R | X | X | Monthly |
| Wire abrasions where subject to motion | X | X | | | | Quarterly |
| Safety and alarm operation | | X | | | X | Six Months |
| Tighten control and power wiring connections | | X | | | | Yearly |
| Transfer switch main contacts† | X | | | X | | Yearly |
| Wire-cable insulation breakdown | X | | | | X | 3 Years or 500 Hrs. |
| Engine and Mounting | | | | | | |
| General inspection | • | | | | | Weekly |
| Governor operation, lubricate moving parts | • | • | | | | Monthly |
| Air cleaner service | | • | • | | | Six Months |
| Injector pump and injector flow rate, pressure, spray pattern | | • | | | • | Yearly |
| Valve clearance | | • | | | | 3 Years or 500 Hrs. |
| Bolt torque | | • | | | • | 3 Years or 500 Hrs. |
| Remote Control System, etc. | | | | | | |
| Compartment condition | X | | | X | | Weekly |
| Remote control | | | | | X | Monthly |
| Run generator set | | | | | X | Monthly |
| Alternator | | | | | | |
| General inspection | X | | | | | Weekly |
| Rotor and stator | X | | | X | | Yearly |
| Bearing condition | X | X | R | | | Yearly |
| Exciter | X | X | | X | | Yearly |
| Voltage regulator | X | X | | X | | Yearly |
| Measure and record resistance readings of windings with insulation tester (Megger®, with SCR assembly or rectifier disconnected) | | | | | X | Yearly |
| Blow dust out of alternator* | X | | | • | | 2 Years or 300 Hrs. |
| General Condition of Equipment | | | | | | |
| Any condition of vibration, leakage, noise, temperature, or deterioration | X | X | | X | | Weekly |
| Ensure that system is set for automatic operation | X | | | | | Weekly |
| Interior of equipment room or outdoor weather housing | X | | | X | | Weekly |
| <ul style="list-style-type: none"> • Follow procedures and frequencies indicated in the engine manufacturer's maintenance manual. If not indicated, follow this service schedule. Some items may not apply to all generator sets. R Replace as necessary. X Action. * Service more frequently if operated in dusty areas. † Do not break manufacturer's seals or internally inspect these devices. | | | | | | |

Megger® is a registered trademark of Biddle Instruments.

3.4 Alternator Bearing Service

Have an authorized service distributor/dealer perform service.

3.4.1 20–300 kW Models

Replace the end bracket bearing every 10,000 hours of operation in prime power applications. Service the bearing more frequently if the annual inspection indicates excessive rotor end play or bearing damage. The sealed end bracket bearing requires no additional lubrication.

3.4.2 Above 300 kW Models with 4M/5M/7M Single-Bearing Alternator

The alternator bearing requires lubrication at intervals specified in the generator set technical manual. Use Chevron SRI or equivalent antifriction, high-quality grease with a lubrication temperature range of -30°C to 175°C (-22°F to 350°F).

3.5 Diesel Fuel Systems

3.5.1 Bleeding Air from Fuel System

Bleed air from the fuel system after fuel system maintenance, such as replacing the fuel filter(s). Use the information provided in the engine operation manual.

3.5.2 Two-Way Fuel Valve

Fuel valve allows the switching of the diesel fuel supply between the subbase fuel tank and an external user-supplied fuel tank. See Figure 3-1.

Place the fuel valve handle in the UP position to connect to the subbase fuel tank. Place the fuel valve handle in the DOWN position to connect to the user-supplied external fuel tank.

The generator set has pipe plugs installed in the external fuel tank fittings from the factory to prevent contaminants from entering the fuel supply. Remove the pipe plugs prior to installing the external fuel tank connections. Save these pipe plugs for future installation in the external fuel tank fittings on the skid after the external fuel tank is disconnected.

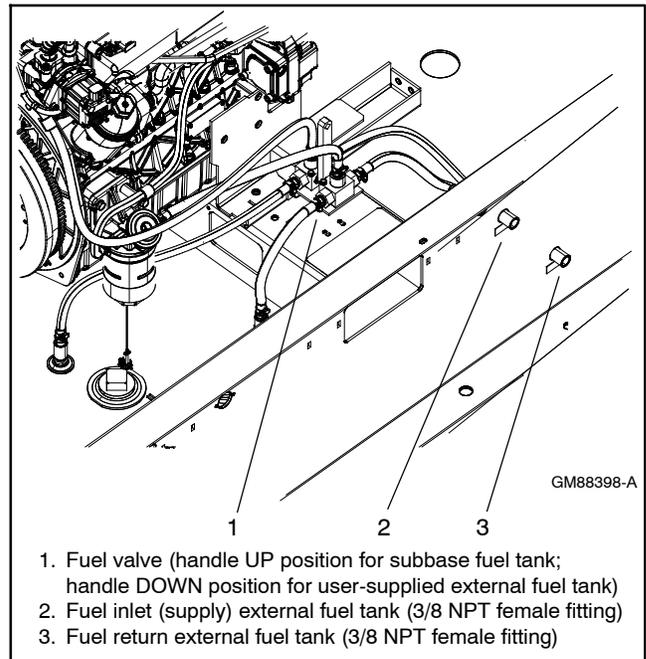


Figure 3-1 Diesel Fuel Valve

3.6 Air Cleaner Restrictor Indicator (if equipped)

The air cleaner restriction gauge mounted on the air cleaner(s) helps determine the air cleaner change interval.

The air cleaner restriction gauge monitors air flow and continuously displays restriction readings indicated as vacuum (see Figure 3-2). Increased restriction indicates a clogged air cleaner element.

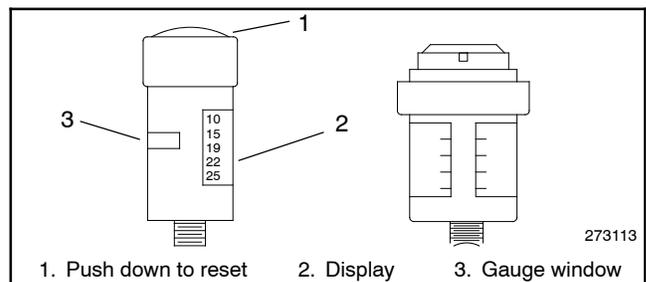
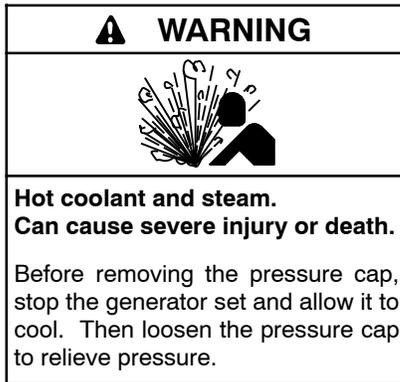


Figure 3-2 Restriction Indicators (styles vary)

As maximum allowable restriction is reached, the gauge window turns red indicating the air cleaner element needs replacement. To reset the gauge, push the gauge top down and release.

3.7 Cooling System

The cooling system maintenance information applies to radiator-cooled models which have a radiator with a pressure cap and coolant recovery tank.



Allow the engine to cool. Release pressure from the cooling system before removing the pressure cap. To release pressure, cover the pressure cap with a thick cloth and then slowly turn the cap counterclockwise to the first stop. Remove the cap after pressure has been completely released and the engine has cooled. Check the coolant level at the tank if the generator set has a coolant recovery tank.

Note: Engine damage. Bleed the air from the cooling system to prevent overheating and subsequent engine damage.

Note: Block heater damage. The block heater will fail if the energized heater element is not immersed in coolant. Fill the cooling system before turning on the block heater. Run the engine until it is warm, and refill the radiator to purge the air from the system before energizing the block heater.

3.7.1 Coolant Level Check

Check the coolant level in the coolant recovery tank (if equipped). Maintain the coolant level between the high and low marks. Check the coolant level at the radiator fill on models without a coolant recovery tank.

Note: Periodically check the coolant level by removing the pressure cap. Do not rely solely on the level in the coolant recovery tank (if equipped). Add fresh coolant until the level is just below the overflow tube opening of the filler neck.

3.7.2 Cooling System Component Inspection

To prevent generator set shutdown or damage caused by overheating:

- Keep the cooling air inlets clean and unobstructed.

- Inspect the radiator's exterior for obstructions. Remove dirt and foreign material using a soft brush or cloth to avoid damaging the radiator fins.
- Check the hoses and connections for leaks. Replace any cracked, frayed, or spongy hoses.
- Check the condition and tension of the radiator fan and water pump belt(s). Follow the belt tension procedure in this manual and/or the engine operation manual.
- Check the pressure cap seal and replace a cracked or deteriorated cap. Remove dirt and other debris from the pressure cap and filler neck. The pressure cap raises the boiling point of the coolant, enabling higher operating temperatures. Replace a leaking pressure cap with one rated for the same pressure. The pressure cap rating usually appears on the pressure cap.

3.7.3 Procedure to Drain Cooling System

For optimum protection, drain, flush, and refill the cooling system at the intervals listed in the service schedule.

Note: Dispose of all waste materials (oil, fuel, coolant, filters, and gaskets) in an environmentally safe manner.

1. Deenergize the block heater, if equipped.
2. Remove the pressure cap to allow the entire system to drain and prevent air pockets from restricting coolant flow through the engine block.
3. Open the radiator and/or engine block coolant drain valve(s) and allow the system to drain.
4. If the inside of the radiator has mineral deposits or the used coolant contains dirt or grease, refer to Section 3.7.4, Procedure to Flush and Clean the Cooling System. If the cooling system does not have mineral deposits, go to Section 3.7.5, Procedure to Refill the Cooling System.

3.7.4 Procedure to Flush and Clean Cooling System

Use the instructions in the engine operation manual when available to flush and clean the cooling system. Otherwise, use the following procedure and the cooling system cleaner manufacturer's instructions.

1. Flush the cooling system with clean water.

2. If the inside of the radiator still has mineral deposits, use a radiator cleaner to remove the remaining deposits following the manufacturer's instructions.
3. Drain, clean, and flush the coolant recovery tank.

3.7.5 Procedure to Refill Cooling System

See the generator set spec sheet for coolant capacity.

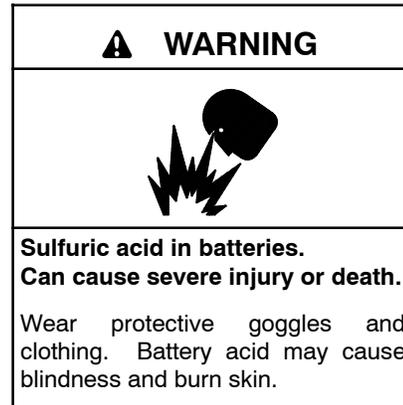
Note: Do not add coolant to a hot engine. Adding coolant to a hot engine can cause the cylinder block or cylinder head to crack. Wait until the engine has cooled.

1. Remove the pressure cap.
2. Close the radiator and/or engine block coolant drain valve(s) and tighten the cooling system hose clamps.
3. Open the air-bleed petcocks, if equipped. Close the air-bleed petcocks when coolant begins to flow from them.
4. Add coolant additives or water pump lubricants according to the engine manufacturer's recommendations in the engine operation manual.
5. Fill the cooling system with the recommended coolant/antifreeze mixture based on the engine manufacturer's recommendation.
6. Replace the pressure cap.
7. Fill the coolant recovery tank (if equipped) to the low mark.
8. Operate generator set until the thermostat opens when the upper cooling system hose warms.
9. Stop the engine and allow it to cool.
10. Check and repair any coolant leaks.
11. Remove the pressure cap.
12. Add coolant to bring the coolant level to just below the overflow tube opening of the filler neck.
13. Replace the pressure cap.
14. Maintain the coolant level in the coolant recovery tank (if equipped) between the high and low marks. Check the coolant level at the radiator fill on models without a coolant recovery tank.

Air pockets often form in the engine water jacket when the coolant system is refilled. Check the coolant level in the coolant recovery tank (if equipped) after each generator set operation and add coolant as necessary until the coolant level stabilizes. Then check the coolant at the interval specified in the service schedule.

15. Reenergize the block heater, if equipped.

3.8 Battery



Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

Refer to this section for general battery information and maintenance. All generator set models use a negative ground with a 12-volt or 24-volt engine electrical system. Consult the generator set nameplate for the engine electrical system voltage. Consult the generator set spec sheet for battery capacity recommendations for replacement purposes. The wiring diagrams provide battery connection information. See Figure 3-3 and Figure 3-4 for typical battery connections, including multiple battery configurations.

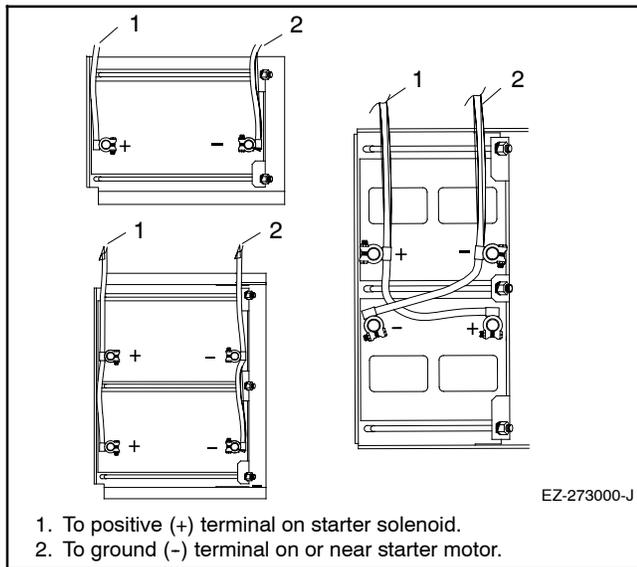


Figure 3-3 12-Volt Engine Electrical System Single Starter Motor Typical Battery Connection

3.8.1 Clean Battery

Clean the battery and cables and tighten the battery terminals according to the service schedule recommendations. Clean the battery by wiping it with a damp cloth. Keep the electrical connections dry and tight.

If corrosion exists, disconnect the cables from the battery and remove the corrosion with a wire brush. Clean the battery and cables with a solution of baking soda and water. Do not allow the cleaning solution to enter battery cells. Flush the battery and cables with clean water and wipe the battery with a dry cloth.

After reconnecting the battery cables, coat the terminals with petroleum jelly, silicon grease, or other nonconductive grease.

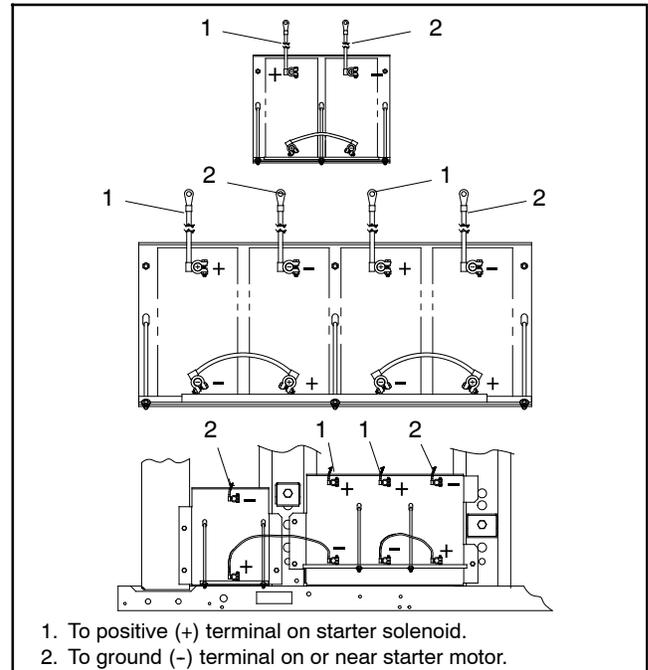


Figure 3-4 24-Volt Engine Electrical System Single Starter Motor Typical Battery Connection

3.8.2 Electrolyte Level Inspection

Check the electrolyte level and specific gravity of batteries that have filler caps. Maintenance-free batteries do not require electrolyte level checking or specific gravity testing.

Check the electrolyte level at the specified interval. Remove the filler caps and verify that the electrolyte level reaches the bottom of each filler hole. See Figure 3-5. Refill as necessary with distilled water or clean tap water. Do not add fresh electrolyte. Tighten the filler caps. After adding water during freezing temperatures, run the generator set 20-30 minutes to mix the electrolyte and the water to prevent battery damage from freezing.

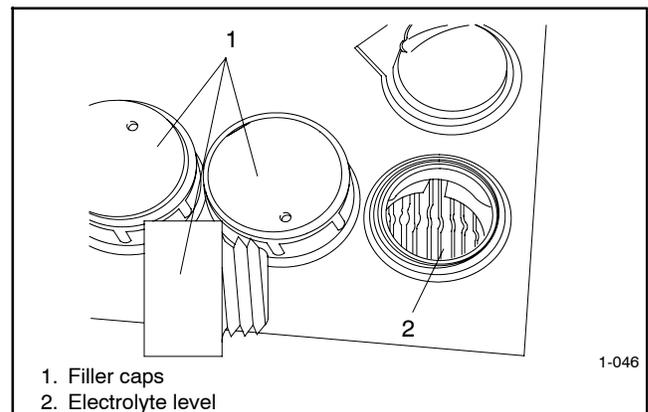


Figure 3-5 Battery Electrolyte Level Inspection

3.8.3 Specific Gravity Check

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell of batteries with filler caps. Holding the hydrometer vertically, read the number on the glass bulb at the top of the electrolyte level or the number adjacent to the pointer. If the hydrometer used does not have a correction table, consult Figure 3-6.

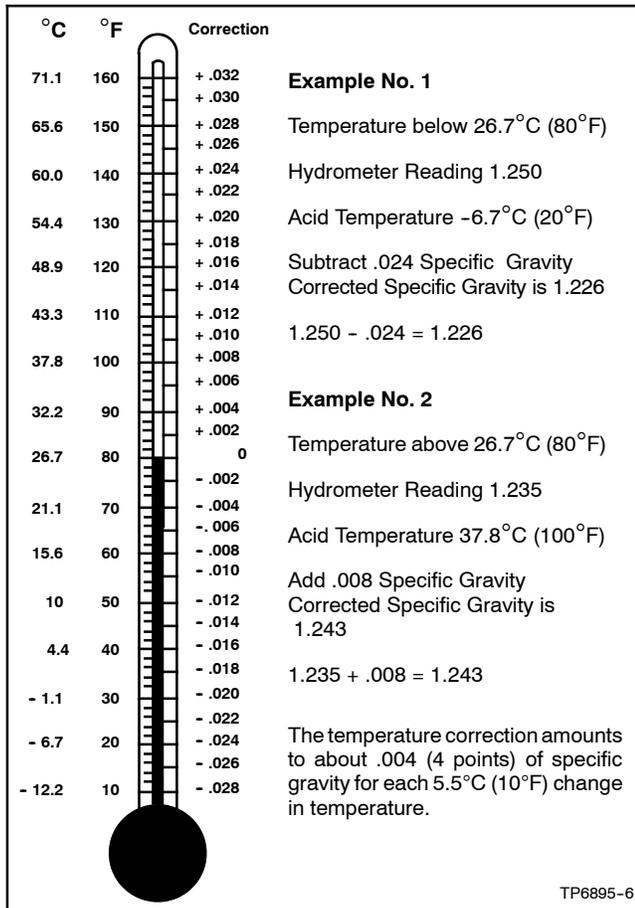


Figure 3-6 Specific Gravity Temperature Correction

Determine the specific gravity and electrolyte temperature of the battery cells. Locate the temperature in Figure 3-6 and correct the specific gravity by the amount shown. The battery is fully charged if the specific gravity is 1.260 at an electrolyte temperature of 26.7°C (80°F). Maintain the specific gravities between cells within ± 0.01 of each other. Charge the battery if the specific gravity is below 1.215 at an electrolyte temperature of 26.7°C (80°F).

Note: Some battery testers have four or five beads in a test tube. Draw electrolyte into the tube as with the battery hydrometer described in this section or use the manufacturer's instructions. Use Figure 3-7 to interpret typical test results.

| Number of Floating Beads | Battery Condition |
|--------------------------|-------------------|
| 5 | Overcharged |
| 4 | Fully charged |
| 3 | A good charge |
| 1 or 2 | A low charge |
| 0 | A dead battery |

Figure 3-7 Bead-Type Test Interpretation

3.8.4 Charge Battery

Use a battery charger to maintain a fully charged battery when the generator set is used in a standby application. The engine battery-charging alternator charges the battery while the generator set is running.

Note: If the generator set is in a temporary prime power application in which the generator set has periods of inactivity, the controller circuitry may drain the battery. If there is no power source for a battery charger, place the controller in the prime power mode, if equipped, or disconnect the battery from the generator set.

3.9 Diesel Exhaust Fluid (DEF)

Some models are equipped with a DEF tank. DEF is used as a consumable in selective catalytic reduction (SCR) systems in order to lower the NO_x concentration in the diesel exhaust emissions.

Diesel exhaust fluid from a separate DEF tank is injected into the exhaust system where the urea/ionized water solution vaporizes and forms ammonia and carbon dioxide. Within the SCR catalyst, the NO_x concentration is reduced by the ammonia into water and nitrogen and is expelled out of the exhaust system into the atmosphere.

SCR systems are sensitive to potential impurities in the urea solution so keep open containers sealed. The urea solution is clear and non-toxic but it can corrode some metals including but not limited to aluminum, copper, iron, magnesium, nickel, steel, and zinc.

The DEF solution should meet the requirements for AUS 32 according to ISO 22241-1. It is recommended that surplus DEF be stored in a cool, dry, and well ventilated area with a temperature range of 10°C to 30°C (50°F to 86°F) and kept out of direct sunlight to ensure a one-year shelf life. It should be stored and transported per the manufacturer's recommendations in the original purchased container; otherwise, containers made of polyethylene, polypropylene, or stainless steel are acceptable.

If the generator set contains a DEF tank, check and fill the DEF tank as needed during the prestart check and during regular diesel fuel refill intervals. The DEF level is reported and displayed on the generator set controller. When the level falls below 10% a warning symbol is displayed.

3.10 Stationary Regeneration of the Exhaust System

The John Deere engines contain equipment and controls that comprise the emissions control system to meet Tier 4 Final Emissions requirements. This is a fully automated control system embedded within the engine ECM. The engine ECM communicates with the generator set controller, via CAN, to provide messages for status and diagnostics regarding the emissions control system. When permitted to operate automatically, the system will monitor and control the equipment to maintain optimum performance.

Part of this control system includes injecting Diesel Exhaust Fluid (DEF). See 3.9 Diesel Exhaust Fluid (DEF) for more information.

The engine ECM controls exhaust temperatures to burn any residue accumulated in the exhaust system. However, short run durations, light loads, and cool ambient temperatures may negatively impact the ability for the engine ECM to adequately elevate the exhaust temperature to a point where residue may be incinerated. Also, since elevated exhaust temperatures may be undesirable in some applications, the user is provided a means to disable this cleaning action until it is more acceptable. The status parameter and dedicated symbol are shown on the generator set controller display.

In all these cases, residue levels may rise and decrease the performance of the exhaust system. When the engine ECM determines that residue has reached a serious level, a warning symbol is shown on the generator set controller display. In addition, the Emissions menu indicates a need for cleaning.

When the need for cleaning reaches the NEEDED HIGH level, the user should take action to enable or request cleaning. This may be as simple as clearing the PREVENT ACTIVE REGEN parameter by setting it to NO. This may include removing the generator set from service by disconnecting any loads and initiating the special cleaning process referred to as Stationary Regeneration.

This special cleaning process may be initiated in numerous ways and with several scenarios mentioned in the following paragraphs. Situations or scenarios include:

- Generator Set in OFF Mode
- Single Generator Set in RUN Mode
- Generator Set in Standby (AUTO Mode, Not Running)
- Single Generator Set in AUTO Mode with ATS
- Multiple Generator Sets in AUTO-RUN Mode
- Multiple Generator Sets in AUTO Mode with ATS
- Multiple Generator Sets in AUTO Mode with External Paralleling Switchgear

Also see the Stationary Regeneration Stages in 1.5.7 Emissions Information for more details.

3.10.1 Generator Set in OFF Mode

In this scenario there is a single generator set, not a paralleling application, and there is no motor operated circuit breaker. There may or may not be a manually operated circuit breaker. The generator set is shut down after pressing the OFF button.

Loads may be removed by turning them off, disconnecting their power cords, or by tripping the manual circuit breaker.

Stationary regeneration may be initiated by setting the REQUEST REGEN parameter to YES. The RUN button must be pressed to proceed. After pressing RUN, the cleaning process should begin.

When complete, the user may press the OFF button to shut down the unit. If OFF is not pressed, the controller logic will automatically shut down after another 5 minutes.

The user must re-apply the loads by reversing the process that was used to disconnect them. Normal operation can resume. To run the generator set, press the RUN button. To put the generator set into standby, press the AUTO button.

The following is a summary of the steps required:

1. Generator set in OFF mode
2. Disconnect loads
3. Set REQUEST REGEN to YES
4. Press the RUN button to start the generator set
5. Stationary Regen in process
6. Stationary Regen complete
7. Press the OFF button or wait for shutdown
8. Generator set in OFF mode
9. Reconnect loads

3.10.2 Single Generator Set in RUN Mode

In this scenario there is a single generator set, not a paralleling application, and there is no motor operated circuit breaker. There may or may not be a manually operated circuit breaker. The generator set is running after pressing the RUN button.

Loads may be removed by turning them off, disconnecting their power cords, or by tripping the manual circuit breaker.

Stationary regeneration may be initiated by setting the REQUEST REGEN parameter to YES. If the PREVENT ACTIVE REGEN parameter is set to YES, it will automatically change to NO. The cleaning process should begin immediately.

When complete, the user may press the OFF button to shut down the unit. If OFF is not pressed, the controller logic will automatically shut down after another 5 minutes.

The user must re-apply the loads by reversing the process that was used to disconnect them. Normal operation can resume. To run the generator set, press the RUN button. To put the generator set into standby, press the AUTO button.

The following is a summary of the steps required:

1. Generator set in RUN mode
2. Disconnect loads
3. Set REQUEST REGEN to YES
4. Stationary Regen in process
5. Stationary Regen complete
6. Press the OFF button or wait for shutdown
7. Generator set in OFF mode
8. Reconnect loads
9. Press the RUN button to resume operation

3.10.3 Generator Set in STANDBY (AUTO Mode, Not Running)

In this scenario the generator set is in the AUTO mode, but there is no signal (remote start) to indicate the generator set should be running. The generator set may be single or may be included in a paralleling application.

The generator set should be moved to the OFF mode by pressing the OFF button.

Loads may be removed by turning them off, disconnecting their power cords, or by tripping the manual circuit breaker.

Stationary regeneration may be initiated by setting the REQUEST REGEN parameter to YES. The RUN button must be pressed to proceed. After pressing RUN, the cleaning process should begin.

When the cleaning process is complete, the user may press the OFF button to shut down the unit. If OFF is not pressed, the controller logic will automatically shut down after another 5 minutes.

The user must re-apply the loads by reversing the process that was used to disconnect them. Normal operation can resume. To put the generator set into standby, press the AUTO button.

The following is a summary of the steps required:

1. Generator set in STANDBY mode
2. Press the OFF button
3. Disconnect loads
4. Set REQUEST REGEN to YES
5. Press the RUN button to start the generator set
6. Stationary Regen in process
7. Stationary Regen complete
8. Press the OFF button or wait for shutdown
9. Generator set in OFF mode
10. Reconnect loads
11. Press the AUTO button to resume STANDBY mode

3.10.4 Single Generator Set in AUTO Mode with ATS

In this scenario there is a single generator set, not a paralleling application, and there is no motor operated circuit breaker. There may or may not be a manually operated circuit breaker. The generator set is operated by pressing the AUTO mode button and started remotely by an ATS using the remote start contacts.

Loads may be removed by turning them off, disconnecting their power cords, or by tripping the manual circuit breaker. More automatically, some ATS's may be used to disconnect loads by transitioning to the OFF position (see ATS documentation).

Since the ATS is presumed to be operating correctly, the generator set would be running from loss of utility power. Tripping the manual circuit breaker may remove power from the ATS causing it to turn off, unless supplied by an optional power supply. The remote start contacts will likely remain closed.

Press the RUN button to start the generator set. This causes the generator set controller to ignore the remote start contacts.

The cleaning process can be initiated by setting the REQUEST REGEN parameter to YES. When the cleaning process is complete, the generator set may be placed back into operation by pressing the AUTO button.

The user must re-apply the loads by reversing the process that was used to disconnect them.

Alternatively, the stationary cleaning process may be initiated during the cooldown state; after the remote start signal is removed. In this case, simply set the REQUEST REGEN parameter to YES during cooldown. After completion of the regeneration, the cooldown will resume and normal generator set operation will occur. The generator set will shut down after the cooldown delay if no remote start signal is present and the generator set will go into the STANDBY mode.

If stationary cleaning is initiated during cooldown, without pressing the RUN button, monitoring of the remote start contacts will continue. If a remote start signal is detected during stationary regeneration, the process will abort and normal generator set operation will resume. High soot levels may remain if the process is aborted before completion.

If the generator set is in the AUTO mode but not running, for lack of a remote start signal, refer to 3.10.3 Generator Set in STANDBY (AUTO Mode, Not Running).

The following is a summary of the steps required when in AUTO mode (running):

1. Generator set in AUTO mode (running)
2. Press the RUN button to start the generator set and ignore remote start
3. Disconnect loads
4. Set REQUEST REGEN to YES
5. Stationary Regen in process
6. Stationary Regen complete
7. Press the OFF button or wait for shutdown
8. Generator set in OFF mode

9. Reconnect loads

10. Press the AUTO button to resume STANDBY mode

The following is a summary of the steps required when in AUTO mode (cooldown):

1. Generator set in AUTO mode (cooldown)
2. Loads disconnected by ATS
3. Set REQUEST REGEN to YES
4. Stationary Regen in process
5. Stationary Regen complete
6. Resume cooldown
7. Loads reconnected by ATS

3.10.5 Multiple Generator Sets in AUTO-RUN Mode

In this scenario there are multiple generator sets running in a paralleling application with PGEN communications. All generator sets utilize a motor operated circuit breaker or contactor for connecting to the paralleling bus. There may or may not be a manually operated circuit breaker.

The generator sets are operated by pressing the AUTO mode button (on all units) and started by simultaneously pressing AUTO and RUN (only one unit). Generator management may be enabled to automatically add or remove generator sets from operation.

Press the OFF button to remove the generator set from the paralleling system. The motorized circuit breaker should trip removing the load from the generator set. All other controllers should remain in the AUTO mode to allow them to operate in parallel.

The cleaning process can be conducted as described in 3.10.1 Generator Set in OFF Mode.

Loads may be removed by turning them off, disconnecting their power cords, or by tripping the manual circuit breaker.

Stationary regeneration may be initiated by setting the REQUEST REGEN parameter to YES. The RUN button must be pressed to proceed. After pressing RUN, the cleaning process should begin.

When the cleaning process is complete, the user may press the OFF button to shut down the unit. If OFF is not pressed, the controller logic will automatically shut down after another 5 minutes.

To resume parallel operation, press the AUTO button. The generator set may remain in the OFF-standby mode or generator management may automatically start the generator set and bring it back online. Loads will be re-applied automatically.

The stationary cleaning process may be initiated during the cooldown state, when generator management has removed the generator set from the bus. Set the REQUEST REGEN parameter to YES during cooldown. After completion of the regeneration, the cooldown will resume and normal generator set operation will occur. The generator set will shut down after the cooldown delay and the generator set will go into the STANDBY mode.

If the generator set is not running because of shut down by generator management, refer to 3.10.3 Generator Set in STANDBY (AUTO Mode, Not Running).

The following is a summary of the steps required when in AUTO-RUN (running):

1. Generator set in AUTO-RUN (running)
2. Press the OFF button to remove the generator set from parallel operation
3. Loads disconnected by paralleling breaker
4. Set REQUEST REGEN to YES
5. Press the RUN button to start the generator set and ignore remote start
6. Stationary Regen in process
7. Stationary Regen complete
8. Press the OFF button or wait for shutdown
9. Generator set in OFF mode
10. Press the AUTO button to resume paralleling operation
11. Loads reconnected by paralleling breaker

The following is a summary of the steps required when in AUTO-RUN (cooldown by generator management):

1. Generator set in AUTO-RUN (cooldown by generator management)
2. Loads disconnected by paralleling breaker
3. Set REQUEST REGEN to YES
4. Stationary Regen in process
5. Stationary Regen complete

6. Resume cooldown
7. Press the AUTO button to resume STANDBY mode
8. Loads reconnected by paralleling breaker

3.10.6 Multiple Generator Sets in AUTO Mode with ATS

In this scenario there are multiple generator sets running in a paralleling application with PGEN communications. All generator sets utilize a motor operated circuit breaker for connecting the paralleling bus. There may or may not be a manually operated circuit breaker.

The generator sets are operated by pressing the AUTO mode button (on all units) and started by closing the remote start contacts (any one controller is acceptable or by all controllers). Generator management may be enabled to automatically add or remove generator sets from operation.

Press the OFF button to remove the generator set from the paralleling system. The motorized circuit breaker should trip removing the load from the generator set. All other controllers should remain in the AUTO mode to allow them to operate in parallel.

The cleaning process can be initiated by setting the REQUEST REGEN parameter to YES. Press the RUN button to start the generator set.

When the cleaning process is complete, the user may press the OFF button to shut down the unit. If OFF is not pressed, the controller logic will automatically shut down after another 5 minutes.

To resume parallel operation, press the AUTO button. The generator set may remain in the OFF-standby mode or generator management may automatically start the generator set and bring it back online. Loads will be re-applied automatically.

The stationary cleaning process may be initiated during the cooldown state, when generator management has removed the generator set from the bus. Set the REQUEST REGEN parameter to YES during cooldown. After completion of the regeneration, the cooldown will resume and normal generator set operation will occur. The generator set will shut down after the cooldown delay if no remote start signal is present and the generator set will go into the STANDBY mode.

The following is a summary of the steps required when in AUTO mode (running):

1. Generator set in AUTO mode (running)
2. Press the OFF button to remove the generator set from parallel operation
3. Loads disconnected by paralleling breaker
4. Set REQUEST REGEN to YES
5. Press the RUN button to start the generator set and ignore remote start
6. Stationary Regen in process
7. Stationary Regen complete
8. Press the OFF button or wait for shutdown
9. Generator set in OFF mode
10. Press the AUTO button to resume paralleling operation
11. Loads reconnected by paralleling breaker

The following is a summary of the steps required when in AUTO-RUN (cooldown by generator management):

1. Generator set in AUTO-RUN (cooldown by generator management)
2. Loads disconnected by paralleling breaker
3. Set REQUEST REGEN to YES
4. Stationary Regen in process
5. Stationary Regen complete
6. Resume cooldown
7. Press the AUTO button to resume STANDBY mode
8. Loads reconnected by paralleling breaker

3.10.7 Multiple Generator Sets in AUTO Mode with External Paralleling Switchgear

In this scenario there are multiple generator sets running in a paralleling application. The generator sets

are connected to the paralleling bus by circuit breakers or contactors controlled by external switchgear. There may or may not be a manually operated circuit breaker.

The generator sets are operated by pressing the AUTO mode button (on all units) and started by the remote start contacts (independently to each unit). The PGEN communications are not utilized for automated parallel operation. Generator management may or may not be included in the switchgear.

The generator set should be removed from operation by use of the switchgear (consult the appropriate documentation). This should force the generator set to change to the cooldown state. The action should further disconnect all loads from the generator set.

The cleaning process can be initiated by setting the REQUEST REGEN parameter to YES. When the cleaning process is complete, the generator set should return to the cooldown state. The switchgear can be utilized to bring the generator set back into service.

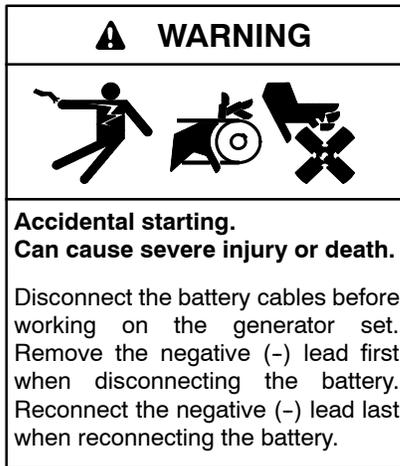
If the generator set is in the AUTO mode but not running, for lack of a remote start signal, refer to 3.10.3 Generator Set in STANDBY (AUTO Mode, Not Running).

The following is a summary of the steps required when in AUTO mode (running by external switchgear):

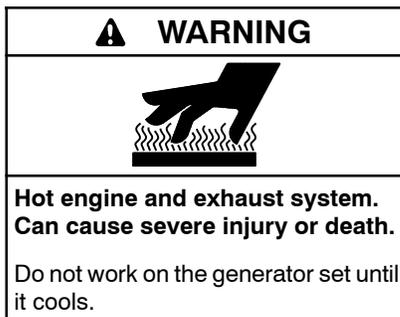
1. Generator set in AUTO mode (running by external switchgear)
2. Use switchgear to remove generator set from paralleling operation
3. Loads disconnected by switchgear
4. Generator set running in cooldown mode
5. Set REQUEST REGEN to YES
6. Stationary Regen in process
7. Stationary Regen complete
8. Generator set running in cooldown mode
9. Use switchgear to return generator set to paralleling operation
10. Loads reconnected by switchgear

3.11 Storage Procedure

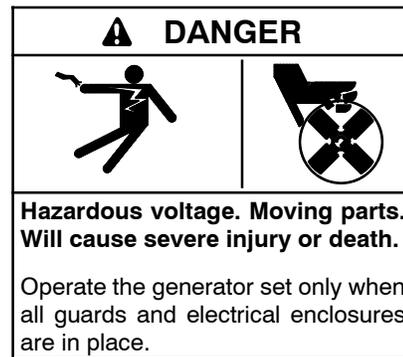
Perform the following storage procedure before taking a generator set out of service for three months or longer. Follow the engine manufacturer's recommendations, if available, for fuel system and internal engine component storage.



Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.



Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.



Servicing the generator set when it is operating. Exposed moving parts will cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

3.11.1 Lubricating System

Prepare the engine lubricating system for storage as follows:

1. Run the generator set for a minimum of 30 minutes to bring it to normal operating temperature.
2. Stop the generator set.
3. With the engine still warm, drain the oil from the crankcase.
4. Remove and replace the oil filter.
5. Refill the crankcase with oil suited to the climate.
6. Run the generator set for two minutes to distribute the clean oil.
7. Stop the generator set.
8. Check the oil level and adjust, if needed.

3.11.2 Cooling System

Prepare the cooling system for storage as follows:

1. Check the coolant freeze protection using a coolant tester.
2. Add or replace coolant as necessary to ensure adequate freezing protection. Use the guidelines included in the engine operation manual.
3. Run the generator set for 30 minutes to redistribute added coolant.

3.11.3 Fuel System

Prepare the fuel system for storage as follows:

Diesel-Fueled Engines

1. Fill the fuel tank with #2 diesel fuel.
2. Condition the fuel system with compatible additives to control microbial growth.
3. Change the fuel filter/separator and bleed the fuel system. See the engine owner's manual.

3.11.4 Exterior

1. Clean the exterior surface of the generator set.
2. Seal all engine openings except for the air intake with nonabsorbent adhesive tape.
3. To prevent impurities from entering the air intake and to allow moisture to escape from the engine, secure a cloth over the air intake.
4. Mask electrical connections.
5. Spread a light film of oil over unpainted metallic surfaces to inhibit rust and corrosion.

3.11.5 Battery

Perform battery storage after all other storage procedures.

1. Confirm that the generator set is stopped.
2. Disconnect the battery(ies), negative (-) lead first.
3. Clean the battery. Refer to Section 3.8.1 for the battery cleaning procedure.
4. Place the battery in a cool, dry location.
5. Connect the battery to a float/equalize battery charger or charge it monthly with a trickle battery charger. Refer to the battery charger manufacturer's recommendations.

Maintain a full charge to extend battery life.

Notes

Section 4 Troubleshooting

4.1 Introduction

This section contains generator set, controller, general engine, trailer, and customer connection panel troubleshooting, diagnostic, and repair information. This section may refer to other literature for procedures and additional information. See the list of related materials in the Introduction on page 9 of this manual for literature part numbers. The information in this section is a guideline for generator set operating technicians and/or maintenance personnel.

Corrective action and testing often require knowledge of electrical and electronic circuits. To avoid additional problems caused by incorrect repairs, have an authorized service distributor/dealer perform service.

Use the following charts to diagnose and correct common problems. First check for simple causes such as a dead engine starting battery or an open circuit breaker. The charts include a list of common problems, possible causes of the problem, recommended corrective actions, and references to detailed information or repair procedures.

Maintain a record of repairs and adjustments performed on the equipment. If the procedures in this manual do not explain how to correct the problem, contact an authorized distributor/dealer. Use the record to help describe the problem and repairs or adjustments made to the equipment.

4.2 Generator Set and Controller

Refer to the following charts for generator set and controller troubleshooting. Some of the corrective actions may reference the alternator and/or controller service manual for additional troubleshooting information.

4.3 Engine

Refer to the following charts for general engine troubleshooting. Refer to the engine operation manual and/or engine service manual for all specific engine troubleshooting.

4.4 Customer Connection Panel

Some electrical problems may relate to the customer connection panel and not the generator set. Refer to the Customer Connection Panel Troubleshooting Chart.

All electrical connections and troubleshooting information in this section is for licensed electricians and/or qualified technicians. All electrical wiring and connections must comply with state and local codes based on National Electrical Code (NEC) guidelines.

4.5 Transfer Switch

Some applications may use an automatic transfer switch. Some of the following charts may reference transfer switch components and/or literature. Refer to the respective transfer switch manuals as needed.

4.6 General Troubleshooting Chart

| Trouble Symptoms | | | | | | | | | | Probable Causes | Recommended Actions | Section or Publication Reference* | | |
|---------------------------------------------|---------------------------|-------------|--------------------------|----------------|-------------|-----------|------------------|-----------------------|-----------------------------|-----------------|---------------------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Does not crank | Cranks but does not start | Starts hard | No or low output voltage | Stops suddenly | Lacks power | Overheats | Low oil pressure | High fuel consumption | Excessive or abnormal noise | | | | Displays error message/locks up | Exercise run time and/or event records inoperative |
| Controller and Emergency Stop Switch | | | | | | | | | | | | | | |
| X | X | | | | | | | | | | | Controller circuit board(s) inoperative | Replace the controller. | Gen. S/M |
| X | X | | | | | | | | | | | Controller circuit board(s) wiring fault | Check the wiring. | W/D |
| | | | | X | | | | | | | | Controller fault | Troubleshoot the controller.† | Gen. S/M |
| X | X | | | X | | | | | | | | Controller internal fuse blown | Check for power battery power to the circuit board. If fuse does not auto-reset troubleshoot the controller wiring.† | W/D, Controller S/M |
| X | | | | | | | | | | | | Controller master control buttons inoperative | Replace the controller master control button circuit board. | — |
| X | | | | | | | | | | | | Controller master control button in the OFF/RESET mode | Press the controller master control RUN or AUTO button. | Section 2 |
| X | | | | | | | | | | | | Engine start circuit open | Press the controller master control RUN button to test the generator set. Troubleshoot the auto start circuit and time delays. | Section 2, W/D, Gen. I/M, S/M, ATS O/M, S/M |
| X | | | | X | | | | | | | | Emergency stop switch activated, if equipped | Reset the emergency stop switch. | Section 2 |
| | | | X | X | | | | | | | | Voltage regulation inoperative | Replace the junction box sensing fuses. If the fuse blows again, troubleshoot the controller. | W/D, Gen. S/M |
| | | | | | | | | | X | | | Controller firmware error | Review the controller display troubleshooting chart. | Section 4.7 |
| | | | | X | | | | | X | | | Controller communication error | Verify that RS-485 cable "shield" wire is connected on only one end. | W/D |

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram Manual

† Have an authorized service distributor/dealer perform this service.

| Trouble Symptoms | | | | | | | | | | Probable Causes | Recommended Actions | Section or Publication Reference* | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------|--------------------------|----------------|-------------|-----------|------------------|-----------------------|-----------------------------|-----------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------|
| Does not crank | Cranks but does not start | Starts hard | No or low output voltage | Stops suddenly | Lacks power | Overheats | Low oil pressure | High fuel consumption | Excessive or abnormal noise | | | | Displays error message/locks up |
| Alternator | | | | | | | | | | | | | |
| | | | x | | | | | | | | AC output circuit breaker open | Reset the breaker and check for AC voltage at the generator set side of the circuit breaker. | — |
| x | | | | | | | | | | | Transfer switch test switch in the OFF position | Move the transfer switch test switch to the AUTO position. | ATS O/M |
| | | | x | | | | | | | | Transfer switch fails to transfer load | Move the ATS test switch to the AUTO position. Troubleshoot the transfer circuit and time delays. | ATS O/M, S/M |
| | | | x | | | | | | | | Wiring, terminals, or pin in the exciter field open | Check for continuity. | Gen. S/M, W/D |
| | | | x | | | | | | | | Main field (rotor) inoperative (open or grounded) | Test and/or replace the rotor. † | Gen. S/M |
| | | | x | | | | | | | | Stator inoperative (open or grounded) | Test and/or replace the stator. † | Gen. S/M |
| | | | | | | | | | x | | Vibration excessive | Tighten loose components. † | — |
| | | | x | x | | | | | | | Voltage regulator settings incorrect | Adjust the voltage regulator. | SiteTech O/M |
| Electrical System (DC Circuits) | | | | | | | | | | | | | |
| x | x | | | | | | | | | | Battery connections loose, corroded, or incorrect | Verify that the battery connections are correct, clean, and tight. | Section 3 |
| x | x | | | | | | | | | | Battery weak or dead | Recharge or replace the battery. The spec sheet provides recommended battery CCA rating. | Section 3, S/S |
| x | x | | | | | | | | | | Starter/starter solenoid inoperative | Replace the starter or starter solenoid. | Eng. S/M |
| x | | | | x | | | | | | | Engine harness connector(s) not locked tight | Disconnect the engine harness connector(s) then reconnect it to the controller. | W/D |
| | | | | x | | | | | | | Fault shutdown | Reset the fault switches and troubleshoot the controller. | Section 2 |
| * Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram Manual | | | | | | | | | | | | | |
| † Have an authorized service distributor/dealer perform this service. | | | | | | | | | | | | | |

| Trouble Symptoms | | | | | | | | | | Probable Causes | Recommended Actions | Section or Publication Reference* | | |
|-----------------------|---------------------------|-------------|--------------------------|----------------|-------------|-----------|------------------|-----------------------|-----------------------------|-----------------|---------------------|-----------------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------|
| Does not crank | Cranks but does not start | Starts hard | No or low output voltage | Stops suddenly | Lacks power | Overheats | Low oil pressure | High fuel consumption | Excessive or abnormal noise | | | | Displays error message/locks up | Exercise run time and/or event records inoperative |
| Engine | | | | | | | | | | | | | | |
| X | X | X | | X | X | | | X | X | | | Air cleaner clogged | Clean or replace the filter element. | Eng. O/M |
| X | X | X | | X | X | X | | X | X | | | Compression weak | Check the compression. † | Eng. S/M |
| | | | X | X | X | X | | X | X | | | Engine overload | Reduce the electrical load. See the generator set spec sheet for wattage specifications. | S/S |
| | | | | | | | | | X | | | Exhaust system leak | Inspect the exhaust system. Replace the inoperative exhaust system components. † | I/M |
| | | | | | | | | | X | | | Exhaust system not securely installed | Inspect the exhaust system. Tighten the loose exhaust system components. † | I/M |
| | | X | X | X | X | | | X | | | | Governor inoperative | Adjust the governor. † | Eng. S/M |
| | | | | X | X | | | | X | | | Valve clearance incorrect | Adjust the valves. † | Eng. S/M |
| | | | | | | | | | X | | | Vibration excessive | Tighten all loose hardware. | — |
| X | X | | | X | | | | | | X | X | Engine ECM and/or sensors | Troubleshoot the engine ECM and/or sensors. | Eng. O/M, Eng. S/M |
| Cooling System | | | | | | | | | | | | | | |
| | | | | | X | X | | X | | | | Air openings clogged | Clean the air openings. | — |
| | | | | | X | X | | | | | | Coolant level low | Restore the coolant to normal operating level. | Section 3 |
| | | | | | X | | | | | | | Cooling water pump inoperative | Tighten or replace the belt. Replace the water pump. | Eng. O/M or S/M |
| | | | | X | | | | | | | | High temperature shutdown | Allow the engine to cool down. Then troubleshoot the cooling system. | Sec. 3, Eng. O/M |
| | | | | X | | | | | | | | Low coolant level shutdown, if equipped | Restore the coolant to normal operating level. | Section 3 |
| | | | | | | X | | | | | | Thermostat inoperative | Replace the thermostat. | Eng. S/M |

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram Manual

† Have an authorized service distributor/dealer perform this service.

| Trouble Symptoms | | | | | | | | | | Probable Causes | Recommended Actions | Section or Publication Reference* | |
|--------------------|---------------------------|-------------|--------------------------|----------------|-------------|-----------|------------------|-----------------------|-----------------------------|-----------------|-------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------|
| Does not crank | Cranks but does not start | Starts hard | No or low output voltage | Stops suddenly | Lacks power | Overheats | Low oil pressure | High fuel consumption | Excessive or abnormal noise | | | | Displays error message/locks up |
| Fuel System | | | | | | | | | | | | | |
| | x | | | x | | | | | | | Fuel tank empty or fuel valve shut off | Add fuel and move the fuel valve to the ON position. | — |
| | x | x | | x | x | | | | | | Air in fuel system (diesel only) | Bleed the diesel fuel system. | Eng. O/M |
| | x | x | | x | x | | | | | | Fuel filter restriction | Clean or replace the fuel filter. | Eng. O/M |
| | x | x | | x | x | | | | | | Fuel or fuel injectors dirty or faulty (diesel only) | Clean, test, and/or replace the inoperative fuel injector.† | Eng. S/M |
| | x | | | | | | | | | | Fuel solenoid inoperative | Troubleshoot the fuel solenoid.† | Eng. S/M |
| | x | x | | | x | | | x | | | Fuel injection timing out of adjustment (diesel only) | Adjust the fuel injection timing.† | Eng. S/M |
| | x | | | | x | | | x | | | Fuel feed or injection pump inoperative (diesel only) | Rebuild or replace the injection pump.† | Eng. S/M |
| Lube System | | | | | | | | | | | | | |
| | | | | | | x | x | | x | | Oil level low | Restore the oil level. Inspect the generator set for oil leaks. | Eng. O/M |
| | | | | x | | | | | | | Low oil pressure shutdown | Check the oil level. | Eng. O/M |
| | x | x | | | | | x | | x | | Crankcase oil type incorrect for ambient temperature | Change the oil. Use oil with a viscosity suitable for the operating climate. | Eng. O/M |

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram Manual

† Have an authorized service distributor/dealer perform this service.

4.7 Controller Display and Voltage Regulation Troubleshooting Chart

| Trouble Symptoms | Probable Causes | Recommended Actions | Section or Publication Reference* |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------|
| Controller Display and Voltage Regulator | | | |
| Display is black | No/low battery charge | Recharge/replace battery | Section 3, Battery |
| Display shows single segment | Low battery voltage | Recharge battery | Section 3, Battery |
| Display shows an error message | Controller firmware fault has occurred or pushbutton/ rotary selector dial entry error | Review the System Fault Shutdown Lamp With Digital Displays section | Section 2 |
| Display locks up | No/low battery charge | Recharge/replace battery | Section 3, Battery |
| Output voltage ramps | Faulty or damaged exciter winding. Voltage ramp on startup is normal, but ramping past the target without recovering may indicate additional failures in the alternator or excitation circuit. | Troubleshoot alternator components † | Generator Service Manual |
| Output voltage unstable | Voltage regulation calibration incorrect | Readjust voltage regulation † | SiteTech O/M |
| Unable to change voltage and current calibrations | Calibration not enabled | Enable calibration in Generator Metering section | Section 1.6.3 Calibration Submenu |
| Unable to find volt select menu | Volt select not enabled | Enable volt select in SiteTech | SiteTech O/M |

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine, Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram Manual

† Have an authorized service distributor/dealer perform this service.

Section 5 Voltage Reconnection

5.1 Introduction

Use the following voltage reconnection procedure to change the voltage of 12-lead generator sets.

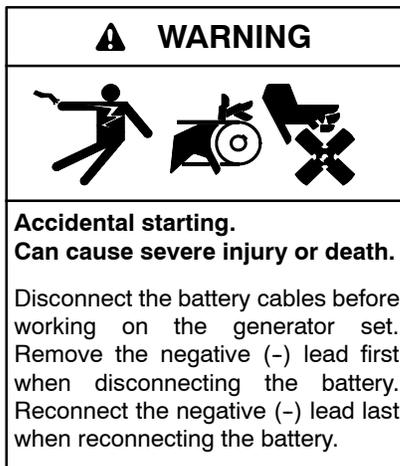
Refer to the following procedure and the connection schematics. Follow the safety precautions at the front of this manual and in the procedure text and observe National Electrical Code (NEC) guidelines.

The factory-supplied circuit breaker is sized for maximum generator set output. Have an electrician install secondary circuit protection for other current limit requirements.

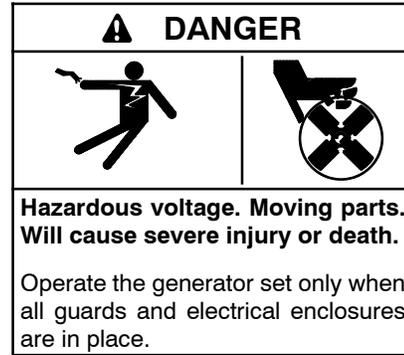
NOTICE

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/dealer.

Note: Equipment damage. Verify that the voltage ratings of the transfer switch, line circuit breakers, and other accessories match the selected line voltage.



Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.



Grounding electrical equipment. Hazardous voltage will cause severe injury or death. Electrocutation is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Short circuits. Hazardous voltage/current will cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

5.2 Voltage Reconnection Procedure

Use the following voltage reconnection procedure to change the voltage of 12-lead generator sets.

1. Press the generator set master control OFF/RESET button.
2. Open the main line circuit breaker.
3. Go to the Main Menu and turn the selector dial clockwise or counterclockwise to the Generator Info menu. Press the selector dial.
4. Turn the selector dial clockwise or counterclockwise to the Configuration menu. Press the selector dial.

Refer to 1.5.3 Configuration Submenu, Generator Configuration submenu and 2.5 Menu Displays for more information as needed.

- Turn the selector dial clockwise or counterclockwise to the Generator Config menu. Press the selector dial. See Figure 5-1.

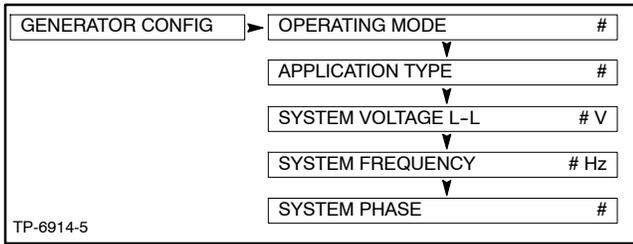


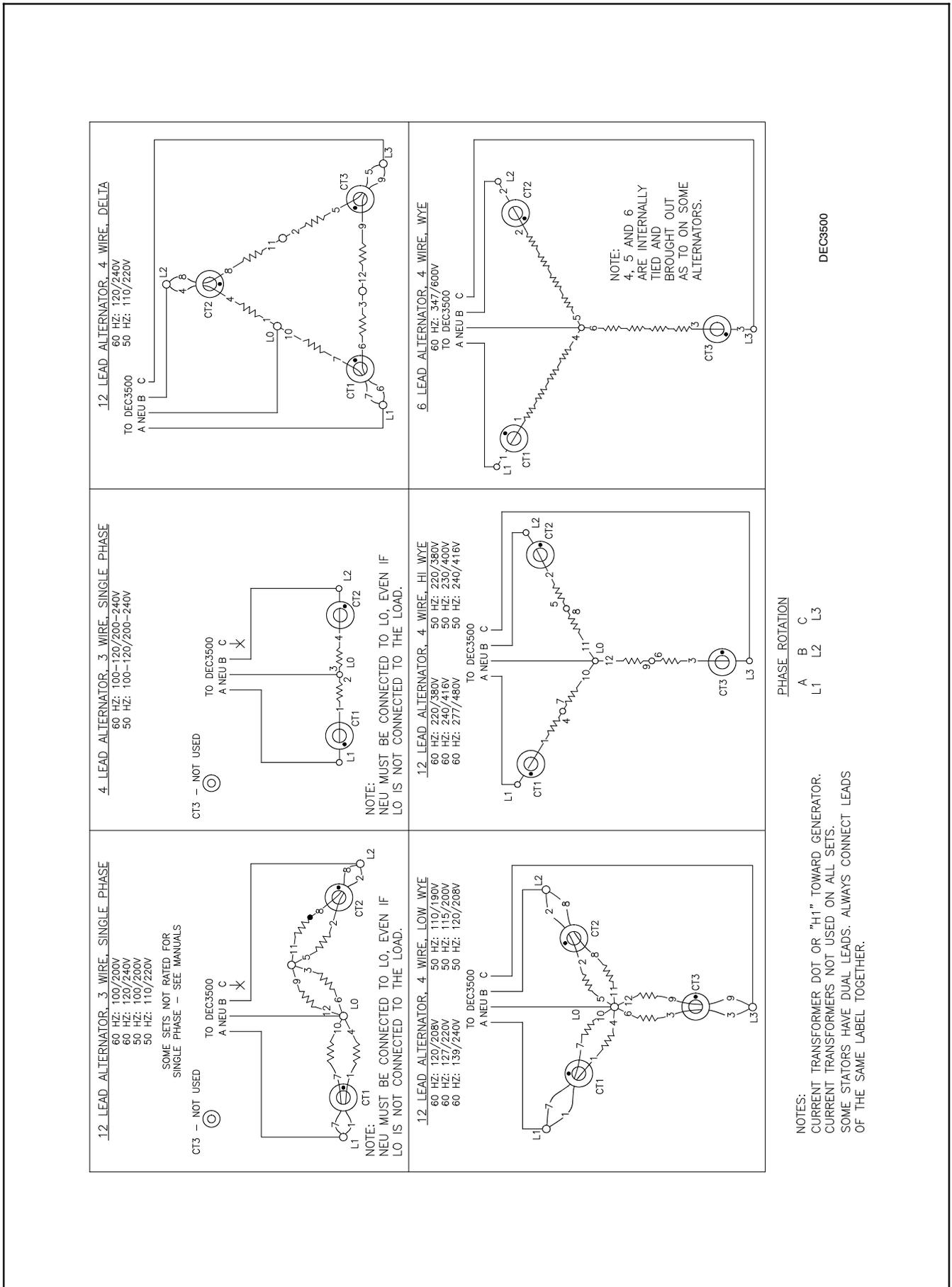
Figure 5-1 Generator Configuration

- Turn the selector dial clockwise or counterclockwise to the System Voltage L-L menu and press the selector dial for 10 seconds to enter the edit mode. Use the selector dial to enter the password, then select the System Voltage L-L, and press the selector dial. The entry will be highlighted.
- Turn the selector dial clockwise or counterclockwise to the desired voltage as needed.
 - 208 V
 - 240 V
 - 480 V
- Press the selector dial and the entry will no longer be highlighted and the new System Voltage L-L will appear with the desired voltage selection.
- Turn the selector dial clockwise or counterclockwise to the System Phase menu and press the selector dial. The entry will be highlighted.
- Turn the selector dial clockwise or counterclockwise to the desired phase as needed.
 - Three Phase
 - Single Phase (4-lead alternator)
 - Single Phase Dog-Leg (12-lead alternator)
- Press the selector dial and the entry will no longer be highlighted and the new System Frequency will appear with the desired phase selection. System frequency can be adjusted similarly, but is not typically adjustable in the engine ECM due to EPA regulations.
- Verify that the settings match the desired voltage/frequency/phase.
- Disconnect the generator set engine starting battery, negative (-) lead first. Disconnect power to the battery charger (if equipped).

- Use Figure 5-2 to determine the generator set voltage configuration. Note the original voltage and reconnect as needed. Route leads through current transformers (CTs) and connect them according to the diagram for the desired phase and voltage.

Note: Position current transformers CT1, CT2, and CT3 with the dot or HI side CT marking toward the generator set.

- Make lead connections between the load devices and the load lugs. See 1.3 Controller and Customer Connection Panel Features. The user must supply all wiring between the customer connection panel load lugs and load devices. Use wiring of size and type specified in NEC guidelines. Tighten the load lugs using a user-supplied load lug wrench to the torque shown at the load lugs. Protect all wiring and connections from inclement weather and public access.
- Make a ground connection between the generator set and earth ground according to state and local codes using NEC guidelines.
- Replace all electrical guards, barriers, covers, and other protective devices on all electrical wiring and connections.
- Reconnect the battery, negative lead last. Reconnect power to the battery charger (if equipped).
- Press the generator set master control RUN button to start the generator set. Check the digital display for correct voltages. Refer to 1.4.1 Generator Metering Submenu and Menu Displays for more information as needed.
- Press the generator set master control OFF/RESET button to stop the generator set after completing the voltage adjustments.
- Adjust the overcurrent trip setting on the main circuit breaker of the generator set to match the rated output current as a percentage of the breaker current plug rating. Refer to 1.3.4, Main Circuit Breaker for more information.
- Close the main line circuit breaker.
- Close any downstream circuit breakers, as needed.



PHASE ROTATION

A B C
L1 L2 L3

NOTES:
CURRENT TRANSFORMER DOT OR "H1" TOWARD GENERATOR.
CURRENT TRANSFORMERS NOT USED ON ALL SETS.
SOME STATORS HAVE DUAL LEADS. ALWAYS CONNECT LEADS OF THE SAME LABEL TOGETHER.

DEC3500

Figure 5-2 Reconnection Diagram 20-300 kW ADV-5875U-6

Notes

6.1 Accessories and Connections

Several accessories help finalize installation, add convenience to operation and service, and establish state and local code compliance.

Accessories vary with each generator set model and controller. Select factory-installed and/or shipped-loose accessories. See Figure 6-1 for a list of available kits. Obtain the most current accessory information from your local authorized service distributor/dealer.

| Kit Description |
|---------------------------|
| Fifteen-Relay Dry Contact |
| Fuel Valve, Two-Way |
| Remote Emergency Stop |
| Remote Serial Annunciator |

Figure 6-1 Optional Accessories

This section illustrates several accessories available at print time of this publication. Accessory kits generally include installation instructions. See wiring diagrams manual for electrical connections not shown in this section. See the installation instructions and drawings supplied with kit for information on kit mounting location.

The instructions provided with the accessory kit supersede these instructions where there are differences. In general, run AC and DC wiring in separate conduit. Use shielded cable for all analog inputs. Observe all applicable national, state, and local electrical codes during accessory installation.

See Section 6.2, Accessory Connections, for terminal identification.

6.1.1 Fifteen-Relay Dry Contact

Introduction

The optional fifteen-relay dry contact kit (Figure 6-2) provides normally open contacts to activate warning devices and other user-provided accessories allowing remote monitoring of the generator set. Connect any controller fault output to the dry contact kit. Typically, lamps, audible alarms, or other devices signal the fault conditions.

The fifteen-relay dry contact board has four digital inputs and two analog inputs. There are fourteen programmable relay outputs (K1–K14) and one common fault relay output (K15).

When a generator fault condition occurs, the contact kit relay energizes. The relay contact closure corresponds to the controller output being activated.

Check the electrical requirements of the user-supplied accessories prior to installation of the relay dry contact kit. User-supplied accessories require their own electrical source and must not exceed the relay contact ratings.

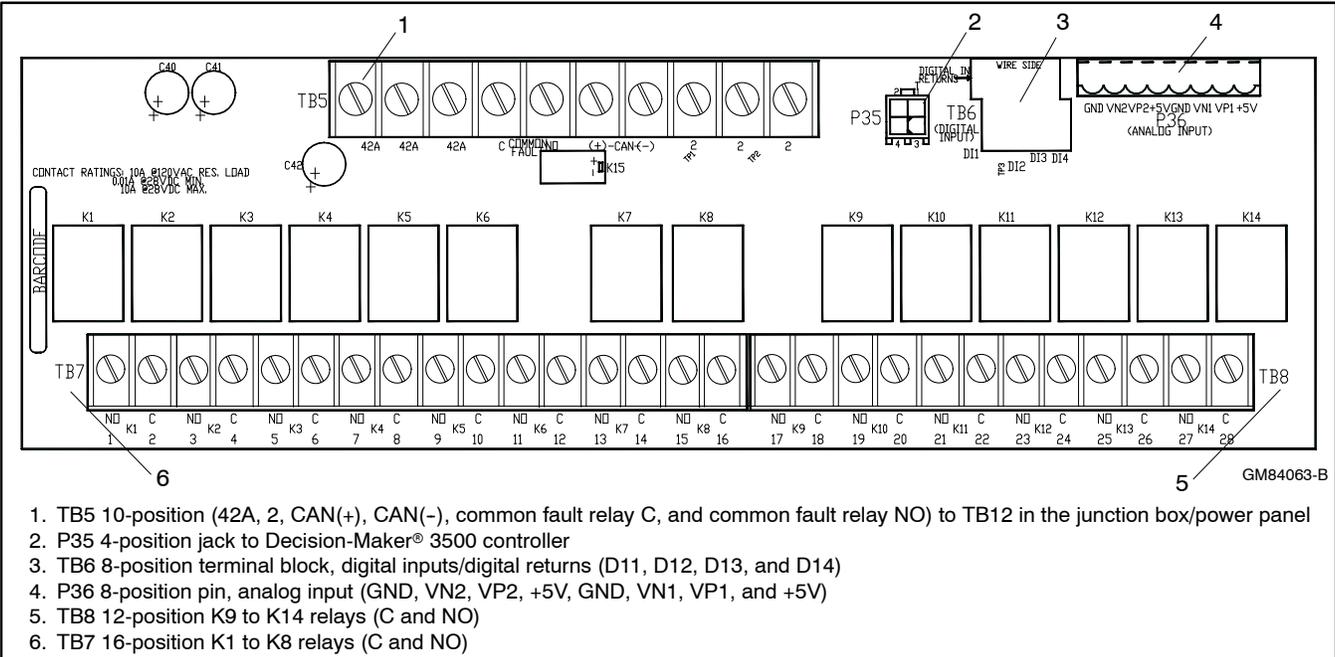


Figure 6-2 Fifteen-Relay Dry Contact Kit

The normally open (NO) relay contacts (K1 to K14) are rated:

- 10 amp @ 120 VAC
- 10 amp @ 28 VDC (max.)
- 0.01 amp @ 28 VDC (min.)

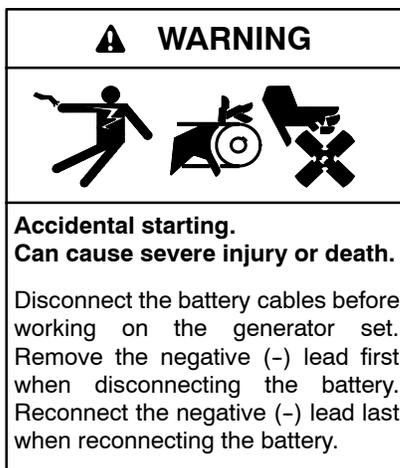
The common fault relay contact (K15) is rated:

- 500 mA @ 125 VAC
- 2 amp @ 30 VDC

Read the entire installation procedure and perform the steps in the order shown.

Observe applicable local and national electrical codes when installing the wiring system.

Observe the following safety precautions while making connections to the kit.



Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

Leads 42A and 2 provide power to the relays. Do not use terminals 42A (+) or 2 (GND) on the controller connection kit terminal strip to supply voltage to

user-supplied accessories. User-supplied DC accessories require separate leads connected directly to the battery for the voltage supply. Attach user-supplied 12/24-volt DC accessories to the battery positive (+) connection at the starter solenoid and to the battery negative (-) connection at the engine ground. The 120 VAC accessories require a user-supplied voltage source.

Note: A maximum of three inputs may be connected to a single relay driver output. Inputs include dry contacts, remote annunciator, common failure alarm, A/V alarm, and shunt trip line circuit breaker.

Note: A total of one 15-relay dry contact kit may be connected to the controller.

Electrical Connection Procedure

1. Press the generator set master control OFF/RESET button.
2. Disconnect the power to the battery charger, if equipped.
3. Disconnect the generator set engine starting battery(ies), negative (-) lead first.
4. Remove the controller by removing four screws. See Figure 6-3 for location of the relay board.
5. See Figure 6-4 for connections of analog inputs.
6. Select the normally open (NO) contacts of the relay, form A dry contact, depending upon the application. Use a two-wire harness for the NO connections.
7. Supply two lengths of stranded wire to make leads long enough to connect the user-supplied device to the dry contact terminals and power supply. Use color-coded wire for easy identification. Make leads long enough to allow for walls, ductwork, and other obstructions. Use separate conduit for the dry contact wiring.
8. **12/24-Volt DC Devices.** Attach the user-supplied 12/24-volt DC accessories to the starting battery positive (+) connection at the starter solenoid and to the battery negative (-) connection at the engine ground. Otherwise, use a separate 12/24-volt DC supply. Do not use terminals 42A and 2 on the controller connection kit terminal strip to supply the voltage to the relay contacts. Supply separate leads connected directly to the battery for the supply voltage. The circuit must include fuse or circuit breaker protection.

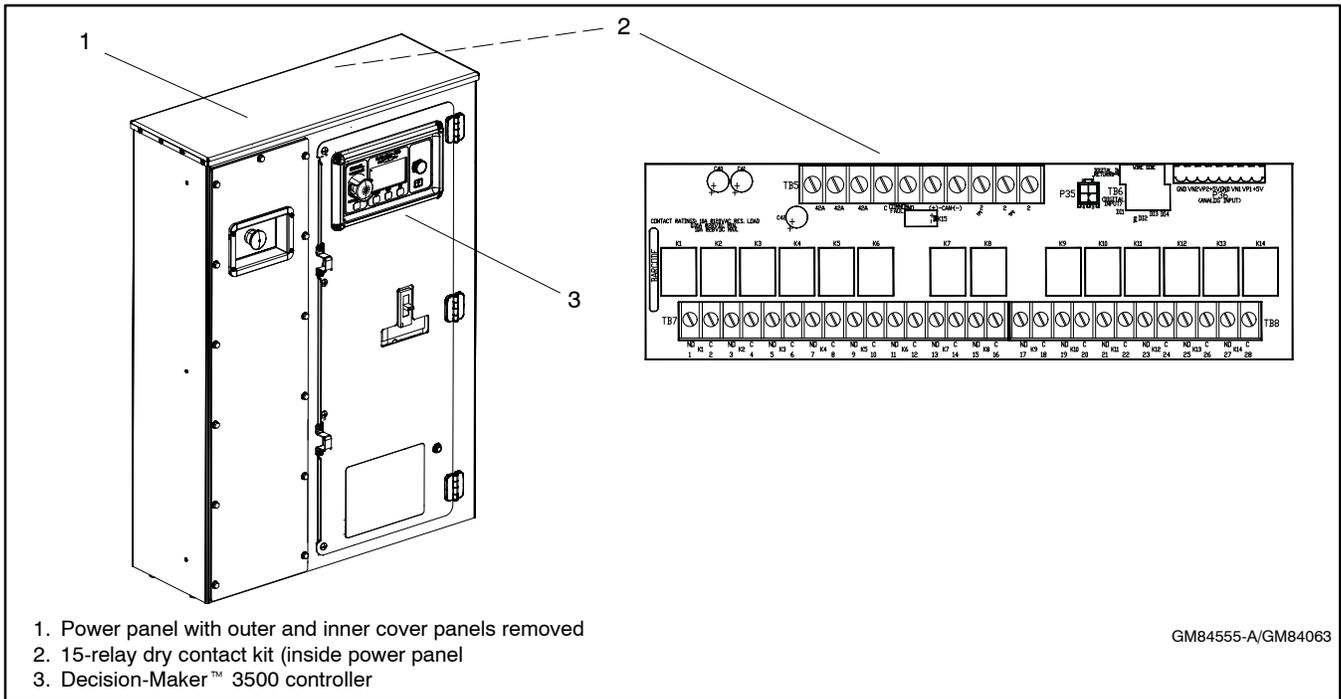


Figure 6-3 Power Panel with Optional 15-Relay Dry Contact Kit

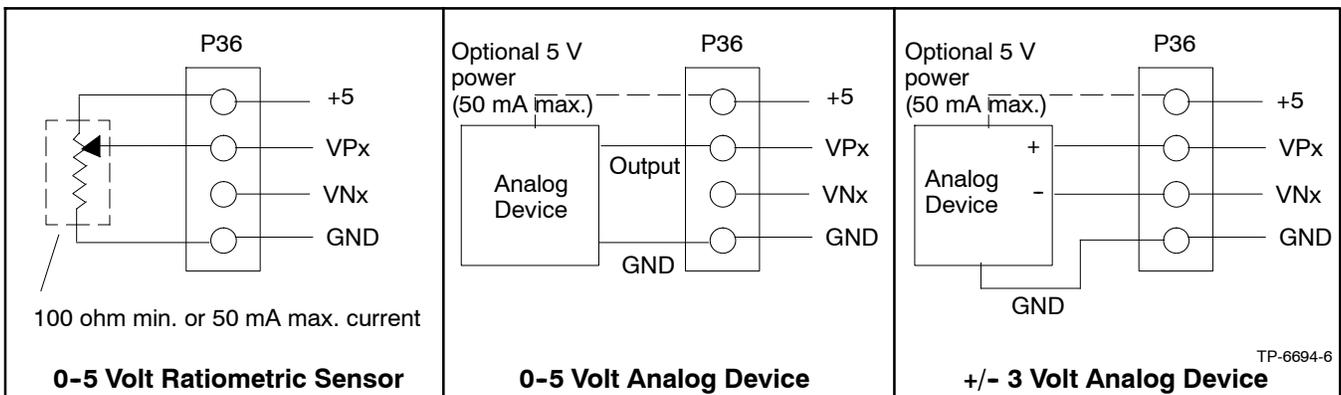


Figure 6-4 Analog Input Connections P36

9. **120-Volt AC Devices.** Connect the user-supplied accessories to a separate 120-volt AC power supply. The circuit must include fuse or circuit breaker protection.
10. Connect the user-supplied device per the Instructions and/or schematic supplied with the device to a power source and to the dry contact terminals. Cut the user-supplied leads to length, strip lead ends, crimp on spade terminals (not supplied), and connect the leads to the relay contact screw terminals. Route the wiring for the relay dry contacts away from the generator set output leads.
11. Repeat Step 6 for the remaining dry contact relays.
12. Re-attach the Decision-Maker™ 3500 controller by replacing four screws.
13. Check that the generator set is in the OFF mode.
14. Reconnect the generator set engine starting battery, negative (-) lead last.
15. Reconnect power to the battery charger, if equipped.

Program the inputs and outputs using SiteTech™

Use SiteTech™ to assign functions to digital and analog inputs and outputs. Each input and output corresponds to a controller connection. Verify that the settings are appropriate for the connected sensor, switch, or equipment. Do not change factory-set inputs and outputs without verifying the input and output connections.

Refer to Introduction—List of Related Materials for the SiteTech™ Software Operation Manual part no.

SiteTech™ input and output parameters labeled 119–138 are designated for use on the optional 15-relay dry contact board. See Figure 6-5.

Note: Inputs and outputs labeled 119–138 will only appear after the initial connection of the optional 15-relay dry contact board.

Note: See Figure 6-2 for P36, TB6, TB7, and TB8 locations.

| SiteTech I/O Name | Optional Dry Contact Board Connection |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Programmable Analog Voltage Input 119 | P36 Analog Input VN1/VP1 |
| Programmable Analog Voltage Input 120 | P36 Analog Input VN2/VP2 |
| Digital Input 121 Digital Input 122 Digital Input 123 Digital Input 124 | TB6 |
| Digital Output 125 Digital Output 126 Digital Output 127 Digital Output 128 Digital Output 129 Digital Output 130 Digital Output 131 Digital Output 132 Digital Output 133 Digital Output 134 Digital Output 135 Digital Output 136 Digital Output 137 Digital Output 138 | TB7 and TB8 |

Figure 6-5 Optional Inputs and Outputs with Dry Contact Kit

Test Dry Contact Relays

Verify the dry contact relay function by using the following procedure when troubleshooting.

1. Remove the user-supplied device wiring from the relay dry contact terminals.
2. Test the relay operation by connecting an ohmmeter across the NO and C terminals on the relay terminal strip.
3. Use a jumper wire to ground the selected fault terminal on the controller connection terminal strip. The relay contacts should close and the ohmmeter should display a low resistance reading (continuity).

4. Install the user-supplied device wiring on the relay dry contact output terminals.

6.1.2 Fuel Valve, Two-Way

Fuel valve allows the switching of the diesel fuel supply between the subbase fuel tank and an external user-supplied fuel tank. See Figure 6-6. Refer to 3.5 Diesel Fuel Systems for more information.

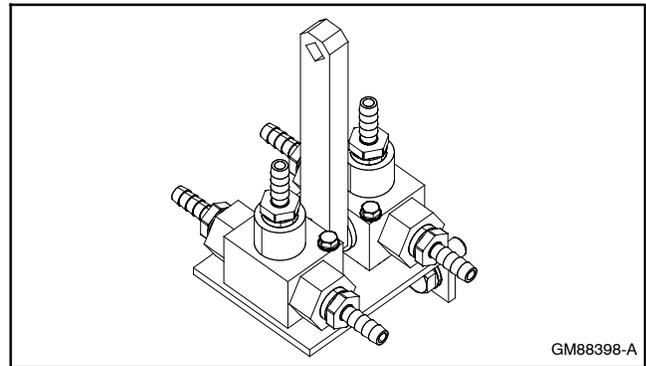


Figure 6-6 Two-Way Fuel Valve

6.1.3 Remote Emergency Stop Kit

The emergency stop (E-stop) kit allows immediate shutdown of the generator set from a remote location. See Figure 6-7. If the emergency stop switch activates, the EMERGENCY STOP lamp lights and the unit shuts down. Before attempting to restart the generator set, reset the emergency stop switch (by replacing the glass piece) and reset the generator set by pressing the master control switch OFF/RESET button.

Use the single glass piece located inside the switch for replacement and order additional glass pieces as service parts. See Section 2.4.1, Emergency Stop Switch Resetting.

See Section 6.2, Accessory Connections, for terminal identifications.

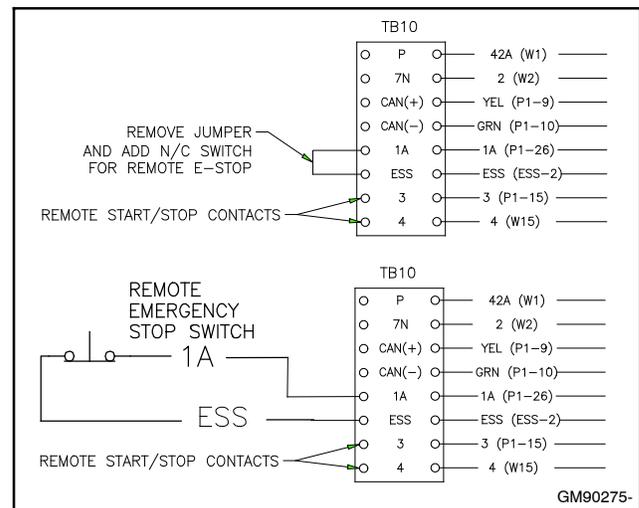


Figure 6-7 Remote E-Stop Kit Connections

6.1.4 Remote Serial Annunciator

RSA III is an annunciator panel offered in several kit configurations to support Kohler power equipment. The RSA III is a remote serial annunciator (Figure 6-8, Figure 6-9, and Figure 6-10) that monitors the condition of the generator set and/or ATS from a remote location. The RSA III alerts the operator through visual and audible signals using LED indication and a horn. An alarm silence and lamp test switch are included. An alarm silence and lamp test switch are included.

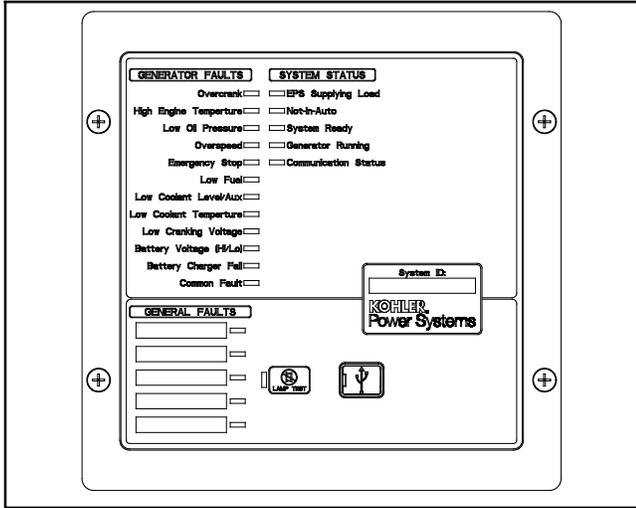


Figure 6-8 Remote Serial Annunciator (RSA III)

The RSA III meets NFPA 110, Level 1 (2005) applications that require remote controls and alarms be powered by a storage battery such as the engine starting battery. AC adaptor kit GM62466-KP1 is available when NFPA is not required.

The front panel decals include areas that can be used to identify user-selected fault inputs and identify associated power system equipment.

An RSA III annunciator can be used for a single generator set or with a combination of a generator set and automatic transfer switch. In systems using more than a single RSA III, one must be designated as the master device to broadcast to additional RSA III annunciators, designated as slave devices. Up to five RSA III slave devices can be used with an RSA III master device. All RSA III annunciators are factory set as the master device, but can be changed to a slave device using a PC and SiteTech™ software that connects to the RSA III front panel via a universal serial bus (USB) connection.

The RSA II and RSA 1000 can be connected with the RSA III provided that the master remote annunciator is an RSA III.

Refer to TT-1625 Remote Serial Annunciator (RSA III) Kits for operation and installation instructions. See Section 6.2, Accessory Connections, for terminal identifications.

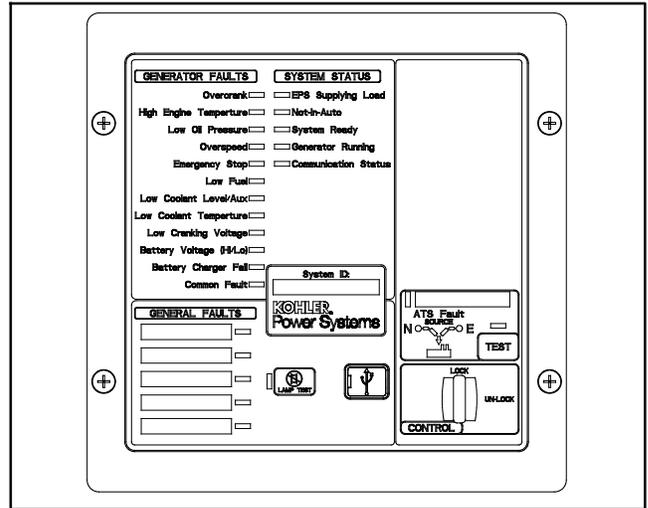


Figure 6-9 RSA III with Single ATS Control

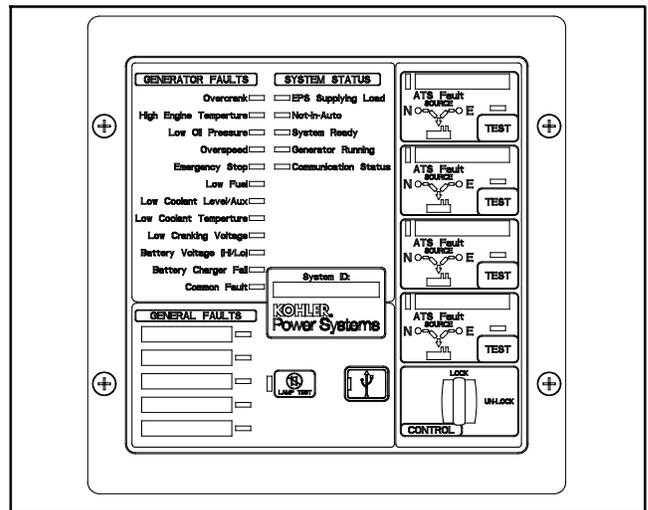


Figure 6-10 RSA III with Four ATS Controls

A PC with SiteTech™ software is required to make the RSA III functional. Use your SecurID to access KOHLERnet, click on the TechTools button, and follow the instructions to download the files. See SiteTech™ Software Settings and refer to TP-6701 SiteTech™ Software Operation Manual for more information.

The RSA III kits include components for surface mounting or flush mounting.

Figure 6-11 shows the status of the system ready LED, generator set running LED, communication status LED, common fault LED, common fault output, and horn for each fault or status condition.

If a fault occurs, the RSA III horn activates and the corresponding LED illuminates. The following paragraphs describe specific features of the RSA III.

If the RSA III is used with an Ethernet communication network, order Modbus® Ethernet converter GM41143-KP2 and refer to TT-1405 Converters, Connections, and Controller Setup for Network Communication for system installation.

| Fault and Status Condition | Fault LED | System Monitoring LEDs and Functions | | | | | |
|---------------------------------------------------------|-----------|--------------------------------------|-----------------------|---------------------------|------------------|---------------------|------|
| | | System Ready LED | Generator Running LED | Communications Status LED | Common Fault LED | Common Fault Output | Horn |
| Overcrank (Shutdown) | Red SF | Red SF | Off | Green | Red SF | On | On |
| High Engine Temperature (Warning) | Yellow SF | Red SF | Green | Green | Red SF | On | On |
| High Engine Temperature (Shutdown) | Red SF | Red SF | Off | Green | Red SF | On | On |
| Low Oil Pressure (Warning) | Yellow SF | Red SF | Green | Green | Red SF | On | On |
| Low Oil Pressure (Shutdown) | Red SF | Red SF | Off | Green | Red SF | On | On |
| Overspeed (Shutdown) | Red SF | Red SF | Off | Green | Red SF | On | On |
| Emergency Stop | Red SF | Red SF | Off | Green | Off | On | On |
| Low Coolant Level/Aux (Shutdown) | Red SF | Red SF | Off | Green | Red SF | On | On |
| Low Coolant Temperature | Yellow SF | Red SF | Green or Off | Green | Red SF | On | On |
| Low Fuel | Yellow SF | Red SF | Green or Off | Green | Red SF | On | On |
| Low Cranking Voltage | Yellow SF | Red SF | Off | Green | Red SF | On | On |
| Battery Charger Fail | Yellow SF | Green | Green or Off | Green | Off | On | On |
| Battery Voltage (Hi) | Yellow SF | Green | Green or Off | Green | Off | On | On |
| Battery Voltage (Lo) | Yellow SF | Green | Green or Off | Green | Off | Off | Off |
| Common Fault (Warning) | Yellow SF | Green | Green or Off | Green | Red SF | On | Off |
| Common Fault (Shutdown) | Red SF | Green | Green or Off | Green | Red SF | On | On |
| User Input #1 (Warning) | Yellow SF | Green | Green or Off | Green | Off | Off | Off |
| User Input #1 (Shutdown) | Red FF | Green | Green or Off | Green | Off | On | On |
| User Input #2 (Warning) | Yellow SF | Green | Green or Off | Green | Off | Off | Off |
| User Input #2 (Shutdown) | Red FF | Green | Green or Off | Green | Off | On | On |
| User Input #3 (Warning) | Yellow SF | Green | Green or Off | Green | Off | Off | Off |
| User Input #3 (Shutdown) | Red FF | Green | Green or Off | Green | Off | On | On |
| User Input #4 (Warning) | Yellow SF | Green | Green or Off | Green | Off | Off | Off |
| User Input #4 (Shutdown) | Red FF | Green | Green or Off | Green | Off | On | On |
| User Input #5 (Warning) | Yellow SF | Green | Green or Off | Green | Off | Off | Off |
| User Input #5 (Shutdown) | Red FF | Green | Green or Off | Green | Off | On | On |
| ATS Position N (RSA III with ATS only) | Green | Green | Green or Off | Green | Off | Off | Off |
| ATS Position E (RSA III with ATS only) | Red | Red SF | Green or Off | Green | Off | Off | Off |
| ATS Available N (RSA III with ATS only) | Green | Green | Green or Off | Green | Off | Off | Off |
| ATS Available E (RSA III with ATS only) | Red | Red SF | Green or Off | Green | Off | Off | Off |
| ATS Test (RSA III with ATS only, Test initiated at ATS) | Yellow | Green | Green or Off | Green | Off | Off | On |
| ATS Test (RSA III with ATS only, Test initiated at RSA) | Green | Green | Green or Off | Green | Off | Off | On |
| ATS Fault (RSA III with ATS only, No fault) | Green | Green | Green or Off | Green | Off | Off | On |
| ATS Fault (RSA III with ATS only, With fault) | Red FF | Red SF | Green or Off | Green | Off | Off | On |
| EPS Supplying Load | Green | Green | Green or Off | Green | Off | Off | Off |
| Not-In-Auto | Red FF | Red SF | Off | Green | Red SF | On | On |
| Communication Status (Loss - Master) | Red FF | Off | Off | Red FF | Off | On | On |
| Communication Status (Loss - Slave) | Red SF | Off | Off | Red SF | Off | On | On |

Note: SF = Slow Flash (once per second), FF = Fast Flash (five times per second)

Figure 6-11 System Monitoring LEDs and Functions

6.2 Accessory Connections

The controller contains a circuit board equipped with connectors for use in connecting external optional accessories including alarms, battery chargers, and remote switches. The optional fifteen relay dry contact board provides an additional four digital inputs and two analog inputs.

For specific information on accessory connections, refer to the accessory wiring diagrams in the wiring diagram manual and the instruction sheet accompanying the kit. See Figure 6-15 for controller circuit board connections.

Circuit Board Connections (see Figure 6-12)

P1 (35-Pin) Connector for engine/generator wiring harness.

P2 (14-Pin) Connector for sensor input connections and relay driver output connections.

P3 (8-Pin) Connector for generator set output voltage connection and paralleling bus voltage sensing connections.

P4 (Ethernet) RG 45 Connector connects to a network communication line.

P7 (10-Pin) Connector for factory use only.

DEC 3500 Controller Front Panel (see Figure 6-13)

Mini USB Connector for connection of a PC with SiteTech™ software programming or for firmware updates.

Panel Power Connections (see Figure 6-14)

TB10 Terminal Strip for CAN, remote emergency stop, and remote start connections.

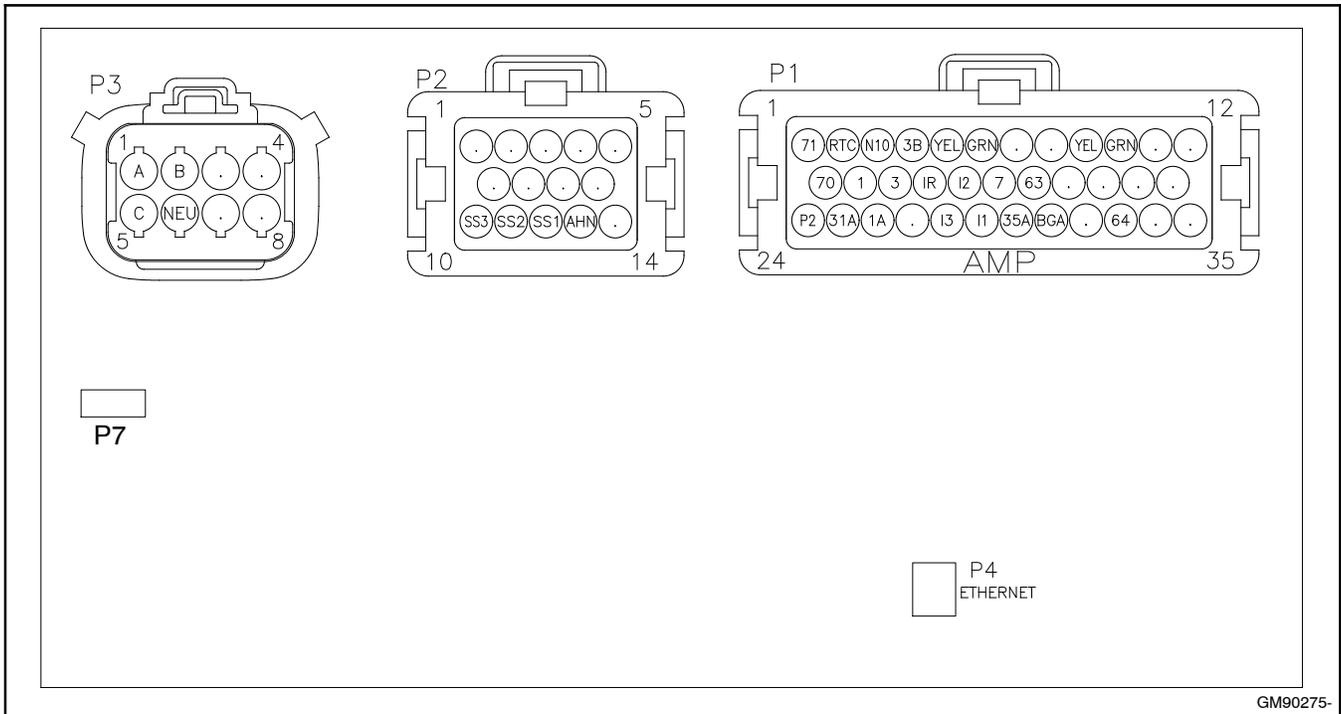


Figure 6-12 Main Circuit Board Connectors (Back of DEC 3500 Controller)

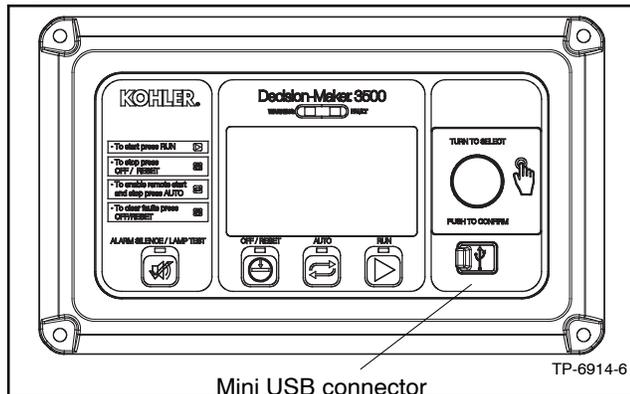


Figure 6-13 DEC 3500 Controller Front Panel

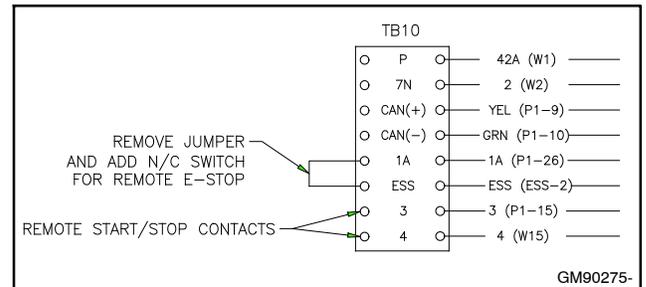


Figure 6-14 TB10 Terminal Strip (located inside the Power Panel)

| P1 35-Pin Connector | | |
|----------------------------------------|--------------------|----------------------|
| Engine/Generator Wiring Harness | | |
| Terminal | Description | Connection |
| P1-1 | 71 | P31-3 (71) |
| P1-2 | RTC | P48-23 (RTC) |
| P1-3 | N10 | P48-31 (14N1) |
| P1-4 | 3B | P7-8 (3B) |
| P1-5 | YEL | P48-34 (YEL) |
| P1-6 | GRN | P48-33 (GRN) |
| P1-7 | Open | - |
| P1-8 | Open | - |
| P1-9 | YEL | TB10-CAN(+) |
| P1-10 | GRN | TB10-CAN(-) |
| P1-11 | Open | - |
| P1-12 | Open | - |
| P1-13 | 70 | P30-3 (70) |
| P1-14 | 1 | ESS-1 (local E-stop) |
| P1-15 | 3 | TB10-3 |
| P1-16 | IR | P7-4 (IR) |
| P1-17 | 12 | P7-2 (I2) |
| P1-18 | 7 | P48-22 (7) |
| P1-19 | 63 | P48-21 (63) |
| P1-20 | Open | - |
| P1-21 | Open | - |
| P1-22 | Open | - |
| P1-23 | Open | - |
| P1-24 | P2 | P4B-9 (P1) |
| P1-25 | 31A | P48-15 (31A) |
| P1-26 | 1A | TB10-1A |
| P1-27 | Open | - |
| P1-28 | 13 | P7-3 (I3) |
| P1-29 | 11 | P7-1 (I1) |
| P1-30 | 35A | P48-14 (35A) |
| P1-31 | BGA | P48-31 (14N1) |
| P1-32 | Open | - |
| P1-33 | 64 | P7-11 (64) |
| P1-34 | Open | - |
| P1-35 | Open | - |

| P4 Connector | |
|----------------------|------------------------|
| RJ45 Ethernet | |
| Terminal | Description |
| Open | Network communications |

| P2 14-Pin Connector | | |
|-----------------------------------------------------------------|--------------------|-------------------|
| Analog/Digital Input and Relay Driver Output Connections | | |
| Terminal | Description | Connection |
| P2-1 | Open | - |
| P2-2 | Open | - |
| P2-3 | Open | - |
| P2-4 | Open | - |
| P2-5 | Open | - |
| P2-6 | Open | - |
| P2-7 | Open | - |
| P2-8 | Open | - |
| P2-9 | Open | - |
| P2-10 | SS3 | P7-7 |
| P2-11 | SS2 | P7-6 |
| P2-12 | SS1 | P7-5 |
| P2-13 | AHN | P4B-1 |
| P2-14 | Open | - |

| P3 8-Pin Connector | | |
|-----------------------------------------------------------------------|--------------------|-------------------|
| Output Voltage and Paralleling Bus Voltage Sensing Connections | | |
| Terminal | Description | Connection |
| P3-1 | A | IS15 |
| P3-2 | B | IS16 |
| P3-3 | Open | - |
| P3-4 | Open | - |
| P3-5 | C | IS17 |
| P3-6 | NEU | IS18 |
| P3-7 | Open | - |
| P3-8 | Open | - |

| TB10 8-Position Terminal Strip | | |
|---------------------------------------------------------|--------------------|--------------------|
| CAN, Remote E-Stop, and Remote Start Connections | | |
| Terminal | Description | Connection |
| TB10-1 | P | 42A Battery (+) |
| TB10-2 | 7N | 2 Battery (-) |
| TB10-3 | CAN(+) | P1-9 |
| TB10-4 | CAN(-) | P1-10 |
| TB10-5 | 1A | Remote E-stop |
| TB10-6 | ESS | Remote E-stop |
| TB10-7 | 3 | Remote start (ATS) |
| TB10-8 | 4 | Remote start (ATS) |

Figure 6-15 Controller Connections

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

| | | | | | |
|-----------|--------------------------------------------------------------------------------------------|-----------------------------|--------------------------------------------------------------------------------------|----------------------|------------------------------------------------------|
| A, amp | ampere | cfm | cubic feet per minute | etc. | et cetera (and so forth) |
| ABDC | after bottom dead center | CG | center of gravity | exh. | exhaust |
| AC | alternating current | CID | cubic inch displacement | ext. | external |
| A/D | analog to digital | CL | centerline | F | Fahrenheit, female |
| ADC | advanced digital control; analog to digital converter | cm | centimeter | FHM | flat head machine (screw) |
| adj. | adjust, adjustment | CMOS | complementary metal oxide substrate (semiconductor) | fl. oz. | fluid ounce |
| ADV | advertising dimensional drawing | com | communications (port) | flex. | flexible |
| Ah | amp-hour | coml | commercial | freq. | frequency |
| AHWT | anticipatory high water temperature | Coml/Rec | Commercial/Recreational conn. | FS | full scale |
| AISI | American Iron and Steel Institute | cont. | continued | ft. | foot, feet |
| ALOP | anticipatory low oil pressure | CPVC | chlorinated polyvinyl chloride | ft. lb. | foot pounds (torque) |
| alt. | alternator | crit. | critical | ft./min. | feet per minute |
| Al | aluminum | CSA | Canadian Standards Association | ftp | file transfer protocol |
| ANSI | American National Standards Institute (formerly American Standards Association, ASA) | cUL | Canadian Underwriter's Laboratories | g | gram |
| AO | anticipatory only | CUL | Canadian Underwriter's Laboratories | ga. | gauge (meters, wire size) |
| APDC | Air Pollution Control District | cu. in. | cubic inch | gal. | gallon |
| API | American Petroleum Institute | cw. | clockwise | gen. | generator |
| approx. | approximate, approximately | CWC | city water-cooled | genset | generator set |
| APU | Auxiliary Power Unit | cyl. | cylinder | GFI | ground fault interrupter |
| AQMD | Air Quality Management District | D/A | digital to analog | GND, ⊕ | ground |
| AR | as required, as requested | DAC | digital to analog converter | gov. | governor |
| AS | as supplied, as stated, as suggested | dB | decibel | gph | gallons per hour |
| ASE | American Society of Engineers | dB(A) | decibel (A weighted) | gpm | gallons per minute |
| ASME | American Society of Mechanical Engineers | DC | direct current | gr. | grade, gross |
| assy. | assembly | DCR | direct current resistance | GRD | equipment ground |
| ASTM | American Society for Testing Materials | DEF | diesel exhaust fluid | gr. wt. | gross weight |
| ATDC | after top dead center | deg., ° | degree | H x W x D | height by width by depth |
| ATS | automatic transfer switch | dept. | department | HC | hex cap |
| auto. | automatic | dia. | diameter | HCHT | high cylinder head temperature |
| aux. | auxiliary | DI/EO | dual inlet/end outlet | HD | heavy duty |
| avg. | average | DIN | Deutsches Institut für Normung e. V. (also Deutsche Industrie Normenausschuss) | HET | high exhaust temp., high engine temp. |
| AVR | automatic voltage regulator | DIP | dual inline package | hex | hexagon |
| AWG | American Wire Gauge | DPDT | double-pole, double-throw | Hg | mercury (element) |
| AWM | appliance wiring material | DPST | double-pole, single-throw | HH | hex head |
| bat. | battery | DS | disconnect switch | HHC | hex head cap |
| BBDC | before bottom dead center | DVR | digital voltage regulator | HP | horsepower |
| BC | battery charger, battery charging | E ² PROM, EEPROM | electrically-erasable programmable read-only memory | hr. | hour |
| BCA | battery charging alternator | E, emer. | emergency (power source) | HS | heat shrink |
| BCI | Battery Council International | ECM | electronic control module, engine control module | hsg. | housing |
| BDC | before dead center | EDI | electronic data interchange | HVAC | heating, ventilation, and air conditioning |
| BHP | brake horsepower | EFR | emergency frequency relay | HWT | high water temperature |
| blk. | black (paint color), block (engine) | e.g. | for example (<i>exempli gratia</i>) | Hz | hertz (cycles per second) |
| blk. htr. | block heater | EG | electronic governor | IBC | International Building Code |
| BMEP | brake mean effective pressure | EGSA | Electrical Generating Systems Association | IC | integrated circuit |
| bps | bits per second | EIA | Electronic Industries Association | ID | inside diameter, identification |
| br. | brass | EI/EO | end inlet/end outlet | IEC | International Electrotechnical Commission |
| BTDC | before top dead center | EMI | electromagnetic interference | IEEE | Institute of Electrical and Electronics Engineers |
| Btu | British thermal unit | emiss. | emission | IMS | improved motor starting |
| Btu/min. | British thermal units per minute | eng. | engine | in. | inch |
| C | Celsius, centigrade | EPA | Environmental Protection Agency | in. H ₂ O | inches of water |
| cal. | calorie | EPS | emergency power system | in. Hg | inches of mercury |
| CAN | controller area network | ER | emergency relay | in. lb. | inch pounds |
| CARB | California Air Resources Board | ES | engineering special, engineered special | Inc. | incorporated |
| CAT5 | Category 5 (network cable) | ESD | electrostatic discharge | ind. | industrial |
| CB | circuit breaker | est. | estimated | int. | internal |
| CC | crank cycle | E-Stop | emergency stop | int./ext. | internal/external |
| cc | cubic centimeter | | | I/O | input/output |
| CCA | cold cranking amps | | | IP | internet protocol |
| ccw. | counterclockwise | | | ISO | International Organization for Standardization |
| CEC | Canadian Electrical Code | | | J | joule |
| cert. | certificate, certification, certified | | | JIS | Japanese Industry Standard |
| cfh | cubic feet per hour | | | k | kilo (1000) |
| | | | | K | kelvin |
| | | | | kA | kiloampere |
| | | | | KB | kilobyte (2 ¹⁰ bytes) |
| | | | | KBus | Kohler communication protocol |

| | | | | | |
|----------------------|------------------------------------------------------|-----------|-----------------------------------------------------|---------|-----------------------------------------------------------------------|
| kg | kilogram | NBS | National Bureau of Standards | RTV | room temperature vulcanization |
| kg/cm ² | kilograms per square centimeter | NC | normally closed | RW | read/write |
| kgm | kilogram-meter | NEC | National Electrical Code | SAE | Society of Automotive Engineers |
| kg/m ³ | kilograms per cubic meter | NEMA | National Electrical Manufacturers Association | scfm | standard cubic feet per minute |
| kHz | kilohertz | NFPA | National Fire Protection Association | SCR | silicon controlled rectifier, selective catalytic reduction |
| kJ | kilojoule | Nm | newton meter | s, sec. | second |
| km | kilometer | NO | normally open | SI | <i>Système international d'unités</i> , International System of Units |
| kOhm, kΩ | kilo-ohm | no., nos. | number, numbers | SI/EO | side in/end out |
| kPa | kilopascal | NPS | National Pipe, Straight | sil. | silencer |
| kph | kilometers per hour | NPSC | National Pipe, Straight-coupling | SMTP | simple mail transfer protocol |
| kV | kilovolt | NPT | National Standard taper pipe thread per general use | SN | serial number |
| kVA | kilovolt ampere | NPTF | National Pipe, Taper-Fine | SNMP | simple network management protocol |
| kVAR | kilovolt ampere reactive | NR | not required, normal relay | SPDT | single-pole, double-throw |
| kW | kilowatt | ns | nanosecond | SPST | single-pole, single-throw |
| kWh | kilowatt-hour | OC | overcrank | spec | specification |
| kWm | kilowatt mechanical | OD | outside diameter | specs | specification(s) |
| kWth | kilowatt-thermal | OEM | original equipment manufacturer | sq. | square |
| L | liter | OF | overfrequency | sq. cm | square centimeter |
| LAN | local area network | opt. | option, optional | sq. in. | square inch |
| L x W x H | length by width by height | OS | oversize, overspeed | SMS | short message service |
| lb. | pound, pounds | OSHA | Occupational Safety and Health Administration | SS | stainless steel |
| lbm/ft ³ | pounds mass per cubic feet | OV | overvoltage | std. | standard |
| LCB | line circuit breaker | oz. | ounce | stl. | steel |
| LCD | liquid crystal display | p., pp. | page, pages | tach. | tachometer |
| LED | light emitting diode | PC | personal computer | TB | terminal block |
| Lph | liters per hour | PCB | printed circuit board | TCP | transmission control protocol |
| Lpm | liters per minute | pF | picofarad | TD | time delay |
| LOP | low oil pressure | PF | power factor | TDC | top dead center |
| LP | liquefied petroleum | ph., ∅ | phase | TDEC | time delay engine cooldown |
| LPG | liquefied petroleum gas | PHC | Phillips® head Crimptite® (screw) | TDEN | time delay emergency to normal |
| LS | left side | PHH | Phillips® hex head (screw) | TDES | time delay engine start |
| L _{wa} | sound power level, A weighted | PHM | pan head machine (screw) | TDNE | time delay normal to emergency |
| LWL | low water level | PLC | programmable logic control | TDOE | time delay off to emergency |
| LWT | low water temperature | PMG | permanent magnet generator | TDON | time delay off to normal |
| m | meter, milli (1/1000) | pot | potentiometer, potential | temp. | temperature |
| M | mega (10 ⁶ when used with SI units), male | ppm | parts per million | term. | terminal |
| m ³ | cubic meter | PROM | programmable read-only memory | THD | total harmonic distortion |
| m ³ /hr. | cubic meters per hour | psi | pounds per square inch | TIF | telephone influence factor |
| m ³ /min. | cubic meters per minute | psig | pounds per square inch gauge | tol. | tolerance |
| mA | milliampere | pt. | pint | turbo. | turbocharger |
| man. | manual | PTC | positive temperature coefficient | typ. | typical (same in multiple locations) |
| max. | maximum | PTO | power takeoff | UF | underfrequency |
| MB | megabyte (2 ²⁰ bytes) | PVC | polyvinyl chloride | UHF | ultrahigh frequency |
| MCCB | molded-case circuit breaker | qt. | quart, quarts | UIF | user interface |
| MCM | one thousand circular mils | qty. | quantity | UL | Underwriter's Laboratories, Inc. |
| meggar | megohmmeter | R | replacement (emergency) | UNC | unified coarse thread (was NC) |
| MHz | megahertz | rad. | power source | UNF | unified fine thread (was NF) |
| mi. | mile | RAM | radiator, radius | univ. | universal |
| mil | one one-thousandth of an inch | RDO | random access memory | URL | uniform resource locator (web address) |
| min. | minimum, minute | ref. | relay driver output | US | undersize, underspeed |
| misc. | miscellaneous | rem. | reference | UV | ultraviolet, undervoltage |
| MJ | megajoule | Res/Coml | remote | V | volt |
| mJ | millijoule | RFI | Residential/Commercial radio frequency interference | VAC | volts alternating current |
| mm | millimeter | RH | round head | VAR | voltampere reactive |
| mOhm, mΩ | milliohm | RHM | round head machine (screw) | VDC | volts direct current |
| MOhm, MΩ | megohm | rly. | relay | VFD | vacuum fluorescent display |
| MOV | metal oxide varistor | rms | root mean square | VGA | video graphics adapter |
| MPa | megapascal | rnd. | round | VHF | very high frequency |
| mpg | miles per gallon | RO | read only | W | watt |
| mph | miles per hour | ROM | read only memory | WCR | withstand and closing rating |
| MS | military standard | rot. | rotate, rotating | w/ | with |
| ms | millisecond | rpm | revolutions per minute | WO | write only |
| m/sec. | meters per second | RS | right side | w/o | without |
| mtg. | mounting | RTDs | Resistance Temperature Detectors | wt. | weight |
| MTU | Motoren-und Turbinen-Union | RTU | remote terminal unit | xfrm | transformer |
| MW | megawatt | | | | |
| mW | milliwatt | | | | |
| μF | microfarad | | | | |
| N, norm. | normal (power source) | | | | |
| NA | not available, not applicable | | | | |
| nat. gas | natural gas | | | | |

Appendix B Controller Displays from the Engine ECM

The controller display showing engine information is dependent upon the engine manufacturer and the corresponding Engine Control Module (ECM). The following list indicates what engine displays are available by the engine manufacturer. This information is subject to change by the engine manufacturer.

Some engines do not have an ECM and in some cases the ECM information is not available as a controller display. In these situations, critical information like oil pressure and coolant temperature are displayed by the controller using independent engine sensors not used by the ECM.

| Controller Displays as Provided by the Engine ECM (availability subject to change by the engine manufacturer) | | |
|--------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------------|
| Display | Kohler KDI | John Deere (JDEC) |
| Ambient temperature | | |
| Charge air pressure | X | |
| Charge air temperature | X | X |
| Coolant level | | |
| Coolant pressure | | |
| Coolant temperature | | X |
| Crankcase pressure | | |
| ECM battery voltage | | |
| ECM fault codes | | X |
| ECM serial number | | |
| Engine model number | | X |
| Engine serial number | | X |
| Engine speed | X | X |
| Fuel pressure | | |
| Fuel rate | X | X |
| Fuel temperature | X | X |
| Oil level | | |
| Oil pressure | | X |
| Oil temperature | | |
| Trip fuel | | |

Notes

Appendix C Alternator Protection

The controller has built-in thermal protection for the alternator. This feature functions similarly to a thermal circuit breaker. When the output current exceeds the nominal rating for a short period of time the condition causes the fault shutdown. The amount of time at which current is over the rating is inversely related to the amount of current above the nominal rating. In other words, the higher the current, the shorter the acceptable time.

The current and time limits are defined by actual test data and are maintained in the personality parameter file. Although the equation for detecting a fault is proprietary, some of the important limits are shown below for informational purposes.

| Rated Current | Time Delay |
|---------------|------------|
| 200% | 40 seconds |
| 300% | 10 seconds |
| 425% | 5 seconds |
| 950% | 1 second |

Notes

Notes

Notes

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KOHLER CO., Kohler, Wisconsin 53044
Phone 920-457-4441, Fax 920-459-1646
For the nearest sales/service outlet in the
US and Canada, phone 1-800-544-2444
KOHLERPower.com