

Operation

Commercial Marine Generator Sets



Models:

350/500EOZCS
300/450EFOZCS

Controller:

Decision-Maker® 3500

KOHLER®

AMP
A SAIM Group Company

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TP-7126 5/20b

⚠ 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 _____

Table of Contents

Product Identification Information	2
Safety Precautions and Instructions	5
Introduction	9
Service Assistance	10
Maintenance and Service Parts/Related Literature	11
Section 1 Specifications	13
1.1 Service Views	13
1.2 Introduction	17
1.3 Controller Specifications	17
1.4 Decision-Maker® 3500 Controller Information	17
1.5 Controller Features	18
1.5.1 Switches and Controls	19
1.5.2 Annunciator Lamps	20
1.5.3 Graphical Display	20
1.6 Metering Menu	21
1.6.1 Generator Metering Submenu	21
1.6.2 Engine Metering Submenu	21
1.6.3 Overview Submenu	22
1.6.4 Paralleling Metering Submenu	22
1.7 Generator Information Menu	22
1.7.1 Generator Information Submenu	22
1.7.2 Event History Submenu	23
1.7.3 Configuration Submenu	23
1.7.4 Voltage Regulation Submenu	25
1.7.5 Voltage Selector Switch	26
1.7.6 Paralleling Operation	26
1.7.7 Emissions Information (IMO Tier III Models Only)	34
1.8 Controller Configuration Menu	34
1.8.1 Controller Configuration Submenu	34
1.8.2 Communication Setup Submenu	35
1.8.3 Calibration Submenu	36
1.9 I/O Setup Menu	37
1.9.1 Controller Fault Diagnostics	38
1.9.2 Main Logic Circuit Board	43
1.9.3 For Units Equipped with 3rd Party Marine Option	43
Section 2 Operation	45
2.1 Prestart Checklist	45
2.2 Marine Inspection	46
2.3 Angular Operation	46
2.4 Operation in European Union Member Countries	46
2.5 Load Profile	47
2.6 Controller Operation	47
2.6.1 Emergency Stop	50
2.6.2 System Status Lamps	50
2.6.3 System Fault Warning Lamp with Digital Displays	51
2.6.4 System Fault Shutdown Lamp With Digital Displays	54
2.6.5 Status and Notice Digital Displays	57
2.6.6 Controller Resetting (Following System Shutdown or Warning)	58
2.7 Menu Displays	58
2.8 Monitoring and Programming Setup	66
2.8.1 PC Communications	66
2.8.2 Modbus® Communications	66

Table of Contents, continued

Section 3 Scheduled Maintenance	67
3.1 General Maintenance	67
3.2 Alternator Service	68
3.3 Engine Service	68
3.4 Generator Set Service Schedule	70
3.5 Cooling System	72
3.5.1 Impeller Inspection and Replacement Procedure	72
3.6 Exhaust System	73
3.7 Diesel Exhaust Fluid (DEF)	73
3.8 Storage Procedure	74
3.8.1 Lubricating System	74
3.8.2 Cooling System	74
3.8.3 Fuel System	74
3.8.4 Exterior	74
3.8.5 Battery	74
Section 4 Troubleshooting	75
4.1 Controller Display and Voltage Regulation Troubleshooting Chart	79
Section 5 Wiring Diagrams	81
Appendix A Abbreviations	97
Appendix B Operating Hour Service Log	99

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 a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

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

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

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) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Engine Backfire/Flash Fire

 WARNING

Risk of fire. Can cause severe injury or death. Do not smoke or permit flames or sparks near fuels or the fuel system.

Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the fuel injection system, 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 fuel system.

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

Combustible materials. A sudden flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the generator set. Keep the compartment and the generator set clean and free of debris to minimize the risk of fire. Catch fuels in an approved container. Wipe up spilled fuels and engine oil.

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

Carbon monoxide. Can cause severe nausea, fainting, or death. The exhaust system must be leakproof and routinely inspected.

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.

Inspecting the exhaust system. **Carbon monoxide can cause severe nausea, fainting, or death.** For the safety of the craft's occupants, install a carbon monoxide detector. Never operate the generator set without a functioning carbon monoxide detector. Inspect the detector before each generator set use.

Operating the generator set. **Carbon monoxide can cause severe nausea, fainting, or death.** Be especially careful if operating the generator set when moored or anchored under calm conditions because gases may accumulate. If operating the generator set dockside, moor the craft so that the exhaust discharges on the lee side (the side sheltered from the wind). Always be aware of others, making sure your exhaust is directed away from other boats and buildings.

Fuel System

⚠ WARNING

Explosive fuel vapors. Can cause severe injury or death. Use extreme care when handling, storing, and using fuels.

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.

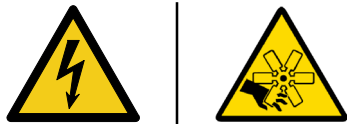
Draining the fuel system. **Explosive fuel vapors can cause severe injury or death.** Spilled fuel can cause an explosion. Use a container to catch fuel when draining the fuel system. Wipe up spilled fuel after draining the system.

Hazardous Noise

⚠ CAUTION

Hazardous noise. Can cause hearing loss. Never operate the generator set without a muffler or with a faulty exhaust system.

Hazardous Voltage/ Moving Parts

⚠ DANGER

Hazardous voltage. Moving parts. Will cause severe injury or death. Operate the generator set only when all guards and electrical enclosures are in place.

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.

Grounding electrical equipment. **Hazardous voltage will cause severe injury or death.** Electrocution 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.

Disconnecting the electrical load. Hazardous voltage will cause severe injury or death. Disconnect the generator set from the load by turning off the line circuit breaker or by disconnecting the generator set output leads from the transfer switch and heavily taping the ends of the leads. High voltage transferred to the load during testing may cause personal injury and equipment damage. Do not use the safeguard circuit breaker in place of the line circuit breaker. The safeguard circuit breaker does not disconnect the generator set from the load.

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.

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Connect the generator set to the building/marina electrical system only through an approved device and after the building/marina main switch is turned off. Backfeed connections can cause severe injury or death to utility personnel working on power lines and/or personnel near the work area. Some states and localities prohibit unauthorized connection to the utility electrical system. Install a ship-to-shore transfer switch to prevent interconnection of the generator set power and shore power.

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)*

Hot Parts

⚠ WARNING

Hot coolant and steam. Can cause severe injury or death. Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure. Fill system before starting unit.

⚠ WARNING

Hot engine and exhaust system. Can cause severe injury or death. Do not work on the generator set until it cools.

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

Fuse replacement. Replace fuses with fuses of the same ampere rating and type (for example: 3AB or 314, ceramic). Do not substitute clear glass-type fuses for ceramic fuses. Refer to the wiring diagram when the ampere rating is unknown or questionable.

NOTICE

Saltwater damage. Saltwater quickly deteriorates metals. Wipe up saltwater on and around the generator set and remove salt deposits from metal surfaces.

Notes

This manual provides operation instructions for 350/500EOZCS and 300/450EFOZCS Scania-powered marine model generator sets equipped with the following controller:

- Decision-Maker® 3500

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. Obtain service from an authorized service distributor/dealer to keep equipment in top condition.

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.

Before installing a marine generator set, obtain the most current installation manual from your local distributor/dealer. Only qualified persons should install the generator set.

Software

Kohler distributors can download the latest software from the Kohler Power Resource Center website including 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.

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Maintenance and Service Parts/Related Literature

Maintenance and Service Parts

Figure 1-1 identifies maintenance and service parts for your generator set. Obtain a complete list of maintenance and service parts from your authorized generator distributor/dealer.

Part Description	Models			
	350EOZCS/300EFOZCS		500EOZCS/450EFOZCS	
Engine	DI13		DI16	
Specification	GM105546-GA9 GM105546-GA10	GM105546-GA11 GM105546-GA12	GM105546-GA1 GM105546-GA2	GM105546-GA3 GM105546-GA4
Air Filter Element	GM106264 (qty. 1 on unit)	GM106264 (qty. 1 on unit)	GM106264 (qty. 2 on unit)	GM106264 (qty. 2 on unit)
Drive Belt	GM107935	GM107935	GM107939	GM107939
Fuel Filter, Engine	GM67251	GM67251 (qty. 2 on unit)	GM67251	GM109187 (qty. 2 on unit)
Oil Filter (Centrifugal Oil Cleaner, Paper Insert) (see * below)	GM107936	GM107936	GM107936	GM107936
Oil Filter (see * below)	GM67211 (canister)	GM67211 (qty. 2 on unit) (canister)	GM67265 (kit)	GM67211 (qty. 2 on unit) (kit)
Oil Filter Maintenance Kit * Includes both Oil Filters (above) & Seals	GM107937	GM107937 (but includes only 1 filter GM67211)	GM107940	GM107937 (but includes only 1 filter GM67211)
Seawater Pump Impeller Kit	GM106505	GM106505	GM106505	GM106505
Zinc Anode (in Heat Exchanger)	GM67215 (qty. 1 on unit)	GM67215 (qty. 1 on unit)	GM67214 (qty. 4 on unit)	GM67214 (qty. 4 on unit)
Zinc Anode (in Charge Air Cooler)	GM67215 (qty. 1 on unit)	GM67215 (qty. 1 on unit)	GM67215 (qty. 2 on unit)	GM67215 (qty. 2 on unit)

Figure 1-1 Maintenance and Service Parts

Related Literature

Figure 1-2 identifies related literature available for the generator sets covered in this manual. Only trained and qualified personnel should install or service the generator set.

Literature Type	Models	
	350EOZCS	500EOZCS
	300EFOZCS	450EFOZCS
Specification Sheet	G2-198	G2-199
Installation Manual	TP-7127	
Parts Catalog *	TP-7129	
Operation Manual—Engine	TP-7132	TP-7134
Operation and Service Manual—Alternator	TP-7140	
Modbus® Communications Protocol Operation Manual	TP-6113	
SiteTech™ Software Operation Manual	TP-6701	
Program Loader Software Installation	TT-1285	
* Includes the generator and engine information.		

Figure 1-2 Generator Set Literature

Notes

1.1 Service Views

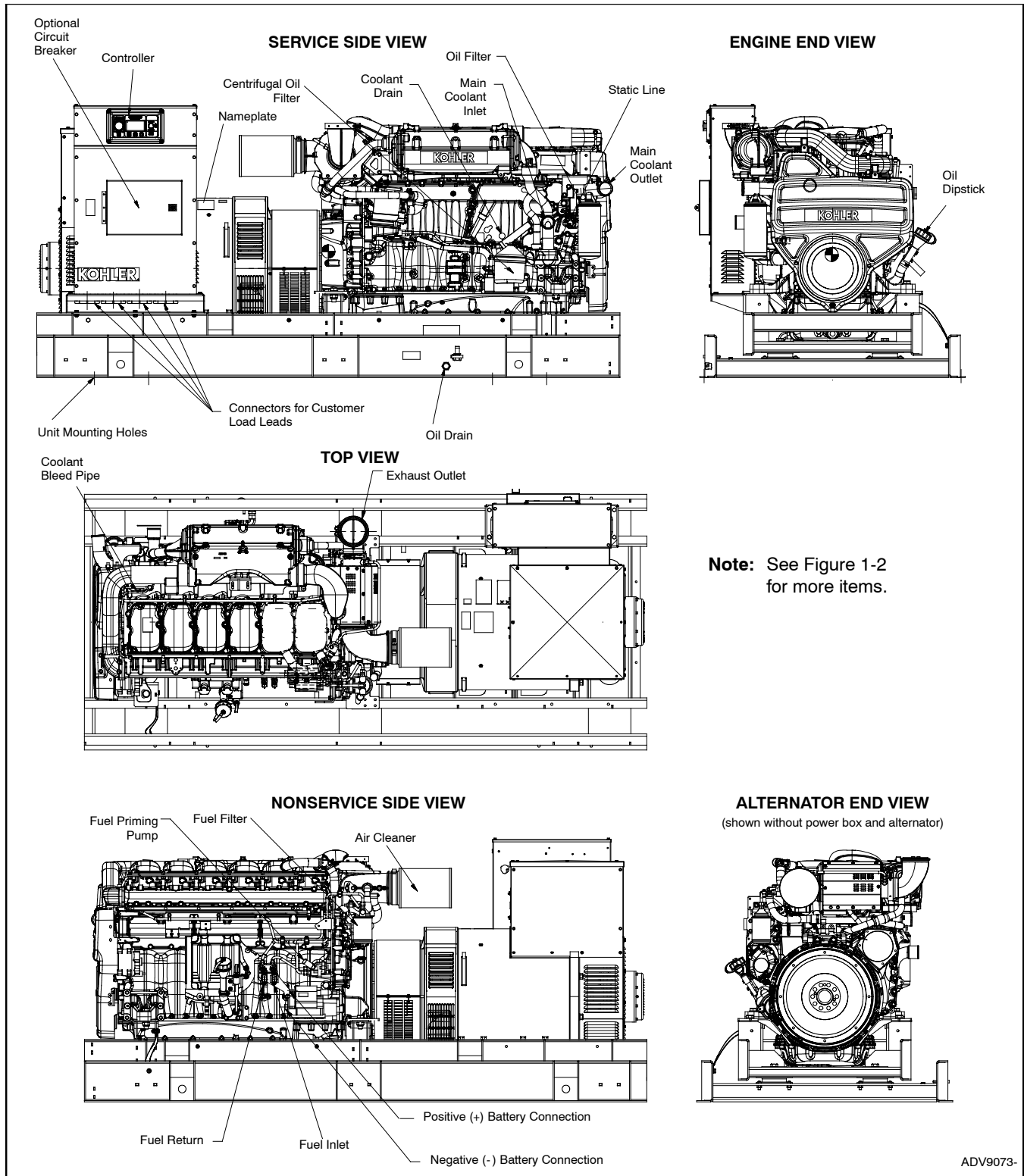
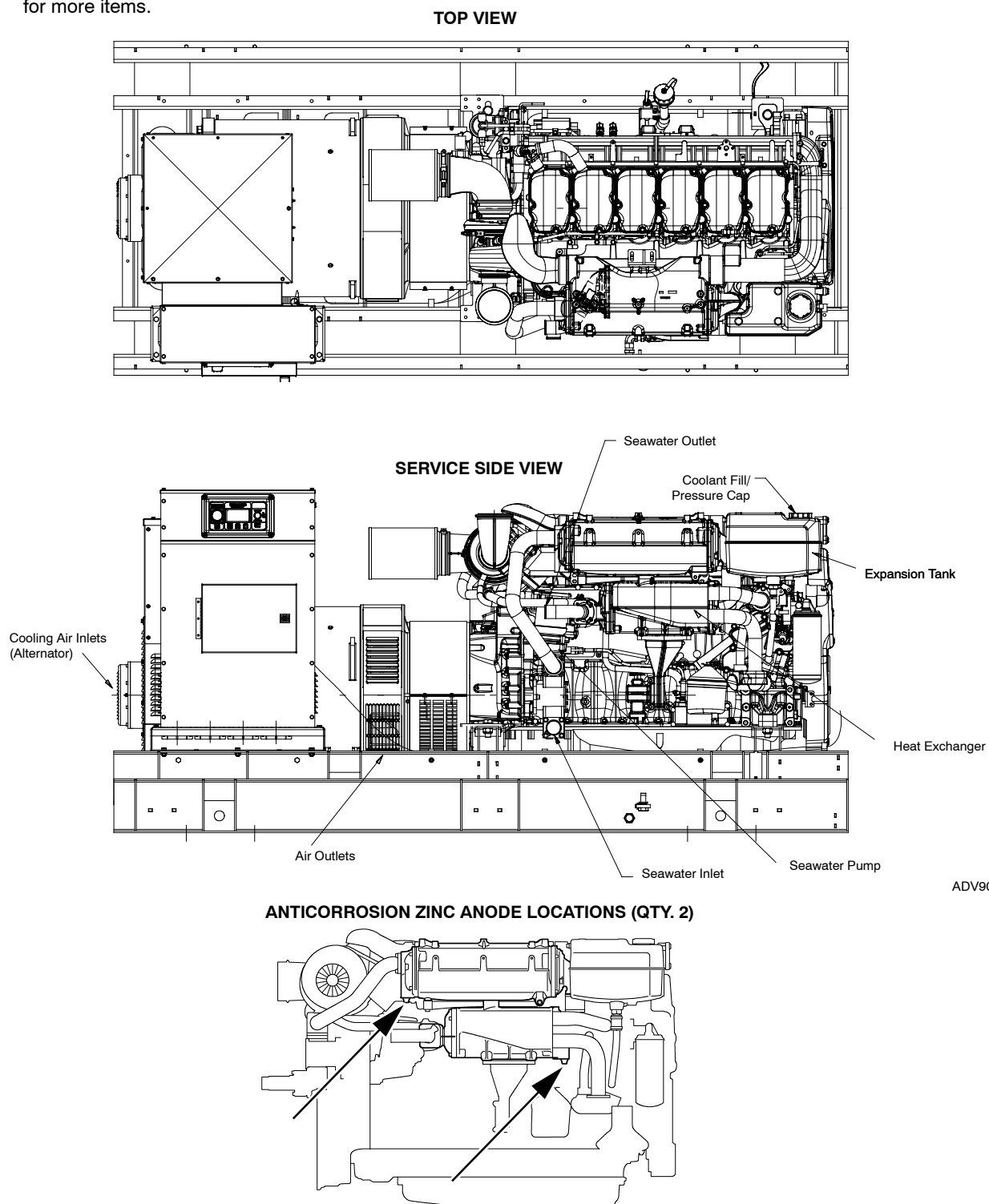


Figure 1-1 Service Views, Typical (350EOZCS/300EFOZCS Keel Cooled Model with Single Fuel/Oil Filter Shown)

Note: See Figure 1-1
for more items.



ADV9073-

Figure 1-2 Service Views, Typical (350EOZCS/300EFOZCS Heat Exchanger Cooled Model with Single Fuel/Oil Filter Shown)

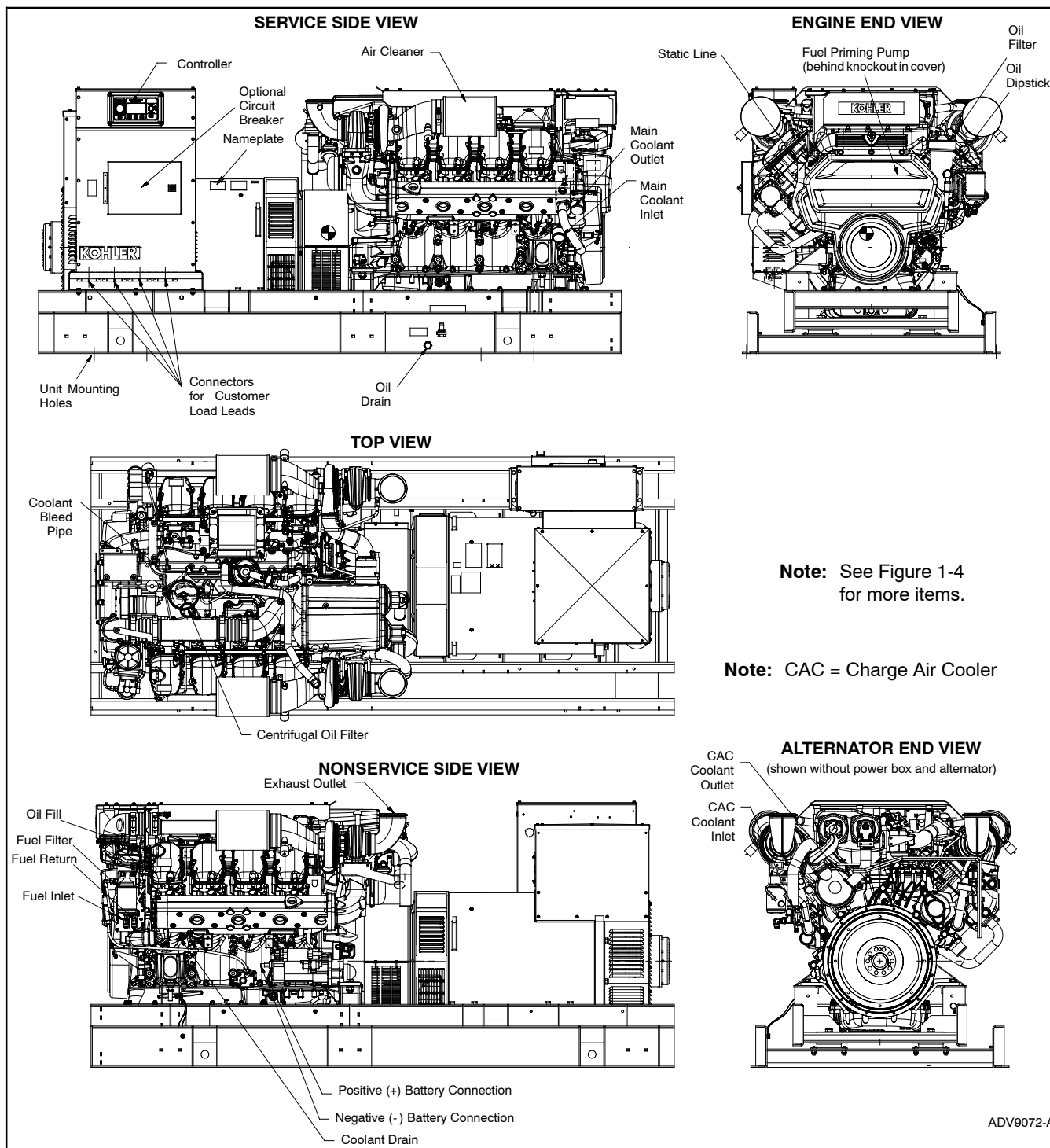


Figure 1-3 Service Views, Typical (500EOZCS/450EFOZCS Keel Cooled Model with Single Fuel/Oil Filter Shown)

Note: See Figure 1-3
for more items.

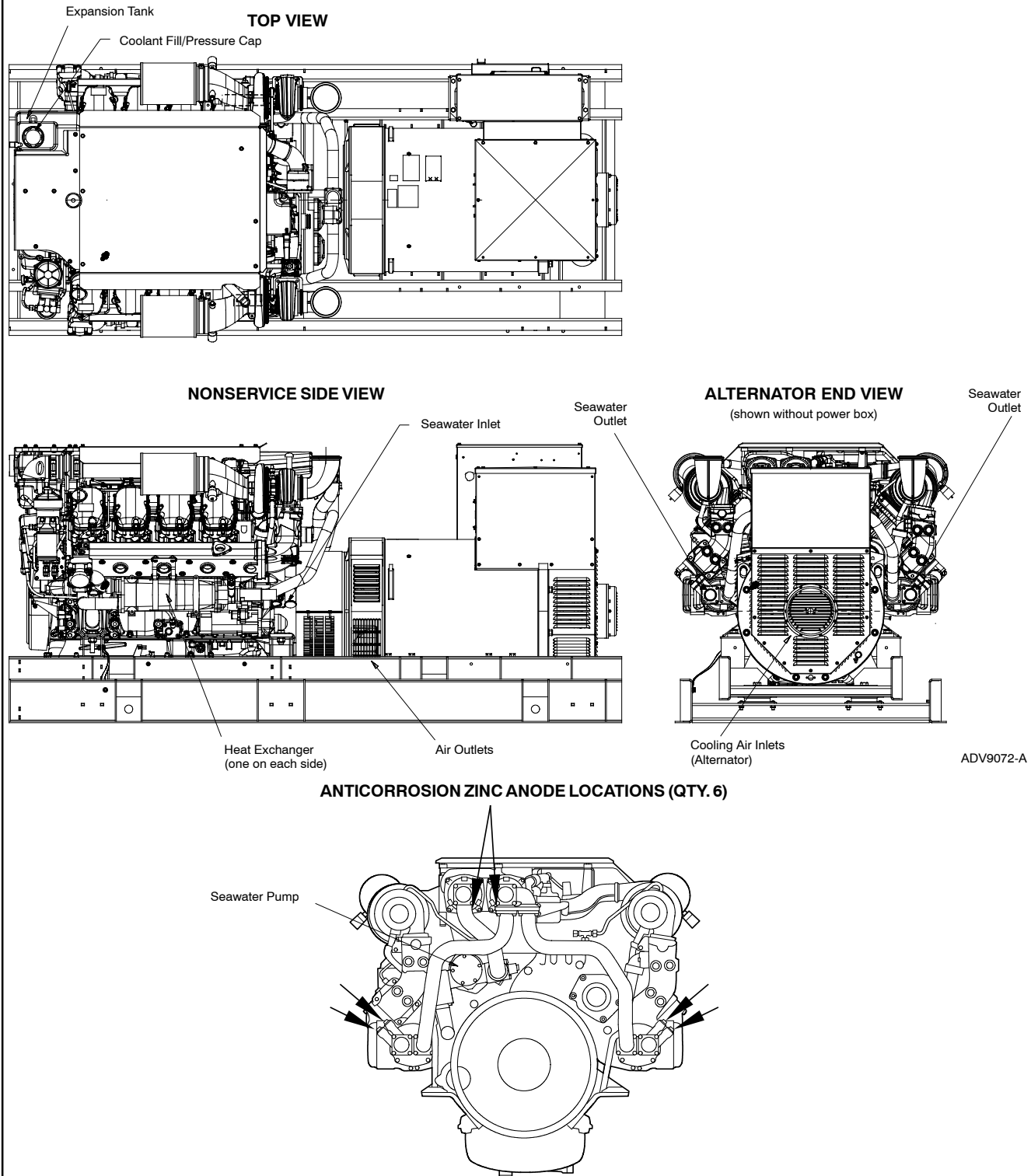


Figure 1-4 Service Views, Typical (500EOZCS/450EFOZCS Heat Exchanger Cooled Model with Single Fuel/Oil Filter Shown)

1.2 Introduction

The spec sheets for each generator set provide model-specific generator and engine information. 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.

1.3 Controller Specifications

Decision-Maker® 3500	
Power source with circuit protection	24-volt DC
Power drain	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 Decision-Maker® 3500 controller performed only by an authorized Kohler distributor/dealer. The setup and adjustments are password protected.

1.4 Decision-Maker® 3500 Controller Information

The following data must be resident for the controller to function.

- **Application program** contains the software that controls system operation. The application file was preprogrammed in the *original* controller at the factory.
- **Personality profile** is specific to the engine and alternator and was preprogrammed in the *original* controller at the factory.

A backup disk of the personality profile and application program is supplied in the junction box of the generator set. Typically, the Kohler authorized distributor/dealer passes this disk onto the owner. The owner should store this disk for possible future use such as controller replacement or other circumstances requiring a backup.

Note: If the personality disk is NOT available, request a replacement from Kohler Co. using the generator set serial number or order number.

- **User parameters** unique to an installation include timer values, setpoints, generator set data such as voltage and input/output selections. These parameters are typically set up for or by the installer at the time of installation. User parameters are typically recorded on the personality profile disk, a separate backup disk/drive, or written on a paper form.

Note: If the user parameters are included on the personality disk, the disk label should indicate Site Program—Yes.

Note: After the unit is set up on the vessel, Kohler authorized distributor/dealer saves any user parameter changes to an external medium. Kohler authorized distributor/dealer passes this information onto the owner. The owner should store this information for possible future use such as controller replacement or other circumstances requiring a backup.

Note: Controller service replacement kits do not include the three files. The service technician *must* install the three files into the replacement controller.

1.5 Controller Features

The controller features include the annunciator lamp, graphical display and pushbutton/rotary selector dial, switches, and controls. See Figure 1-5 for an illustration of the controller front panel. 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.

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

Note: After about 5 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.

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

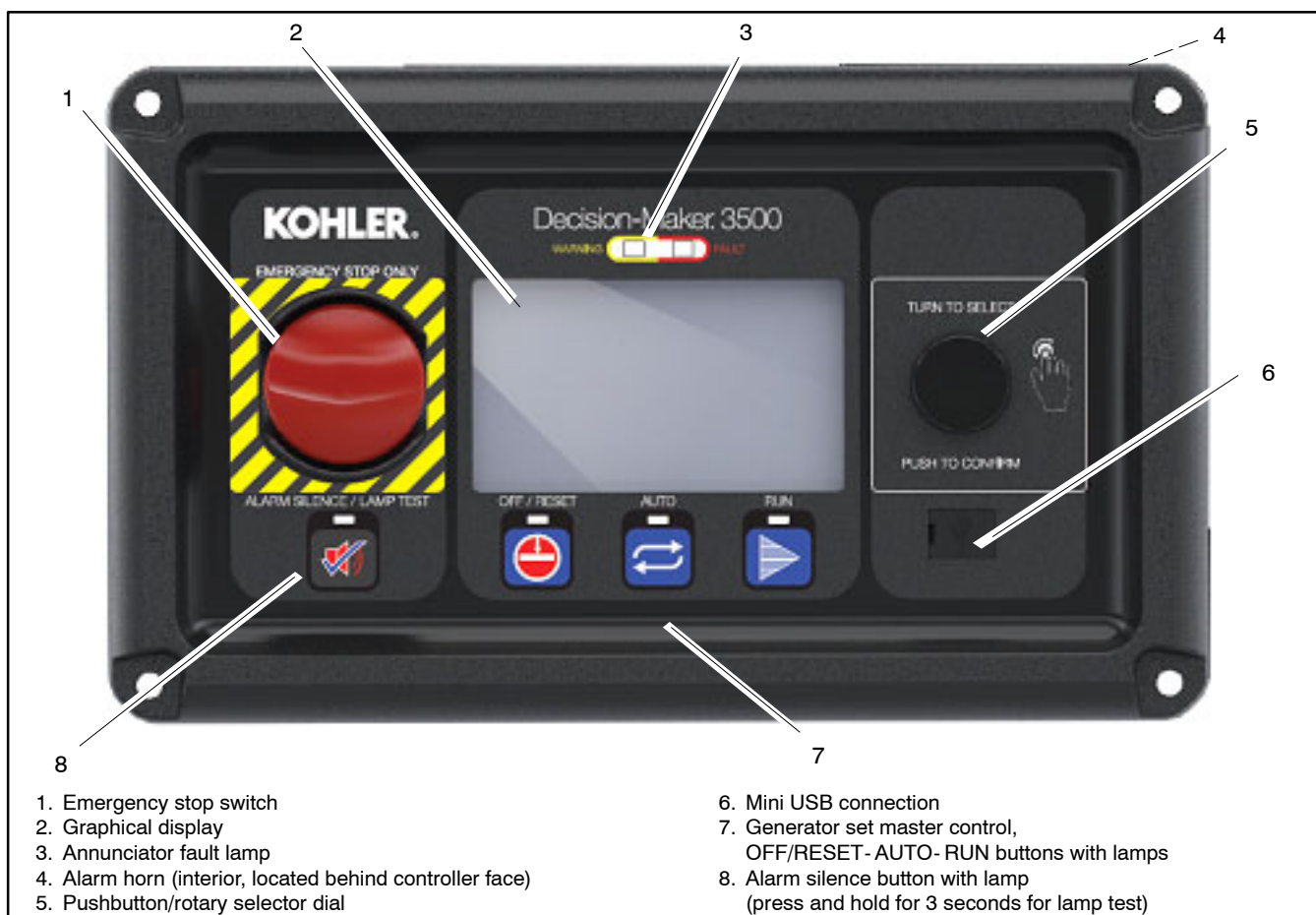


Figure 1-5 Decision-Maker® 3500 Controller with Digital Display and Pushbutton/Rotary Selector Dial

1.5.1 Switches and Controls

Note: US/Metric Display is selectable in Section 1.8—Controller Configuration Menu.

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

Alarm (Horn) Silence. The alarm silence switch silences the alarm horn at the operator's discretion.

Note: Additional alarm silencing options are shown in Section 1.8—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 Section 2—Operation, 2.6.6 Controller Resetting for resetting the controller.

Emergency Stop. 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 is 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.

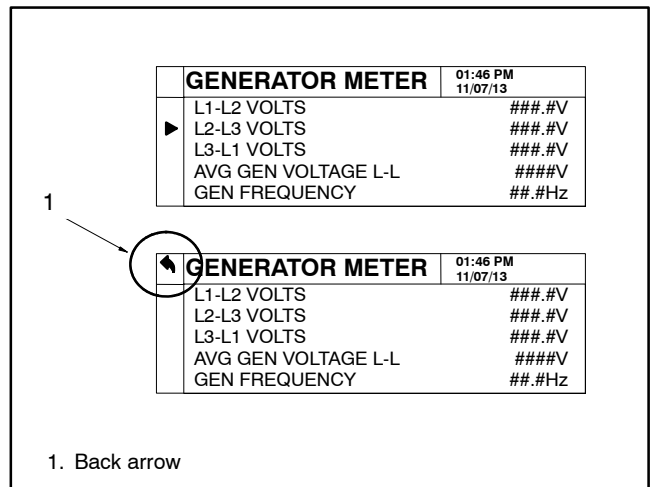


Figure 1-6 Back Arrow Location

- After about 5 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.

1.5.2 Annunciator Lamps

The controller has a single annunciator fault lamp providing visual generator set status. In addition, each button has a lamp. See Figure 1-7.

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 1-7 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 System Warning Fault Lamp and System Shutdown Fault Lamp following 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 2.6.3, 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 2.6.6, Controller Resetting procedure.

See Section 2.6.4, System Fault Shutdown Lamp with Digital Displays, for definitions of the items listed.

1.5.3 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 1-5. 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 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 1.6)
- Generator Information (See Section 1.7)
- Controller Configuration (See Section 1.8)
- I/O Setup (See Section 1.9)
- Active Events (See Section 2.6.3, Section 2.6.4, and Section 2.6.5)

1.6 Metering Menu

1.6.1 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** displays the total (in kW) and the individual L1, L2, and L3 (in watts) 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** displays the total and individual L1, L2, and L3 in VAR.
- **Apparent Power** displays the total and individual L1, L2, and L3 in VA.
- **% Rated kVA** displays alternator kVA as a percentage of the entered rated value.
- **Phase Rotation** displays the actual generator rotation.

1.6.2 Engine Metering Submenu

Note: Not all of these engine metering submenus may apply.

- **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.
- **Controller Temperature** displays the controller temperature inside of the Decision-Maker® 3500 controller.
- **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 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.

1.6.3 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 operating power rating in kW.
- **Engine Run Time** displays the total run time hours.

1.6.4 Paralleling Metering Submenu

Note: The paralleling metering is only valid if the Decision-Maker® 3500 controller is controlling a motor-operated circuit breaker.

- **Connected to Bus** displays if the generator 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 output.
- **Bus Frequency** displays the cycle frequency of the paralleling bus.
- **Gen Frequency** displays the cycle frequency of the generator.

- **Bus Total Power** displays the real power provided by all the generators 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 generators in the paralleling system and the bus reactive capacity (the sum of 3/4 of the rated kW of all connected generators) expressed as a percentage.

1.7 Generator Information Menu

1.7.1 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 hours 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.

- **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™.

1.7.2 Event History Submenu

Generator Event History:

This menu allows the user to review up to 1000 entries of generator system events including shutdown faults, warning faults, notices, and status events with date and time stamp. See 1.9.1 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.

1.7.3 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 Decision-Maker® 3500 controller performed only by an authorized Kohler distributor/dealer. 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 Doleg, 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.
- **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 Decision-Maker® 3500 controller performed only by an authorized Kohler distributor/dealer. The setup and adjustments are password protected.

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

1.7.4 Voltage Regulation Submenu

Note: Have setup and adjustments of the Decision-Maker® 3500 controller performed only by an authorized Kohler distributor/dealer. The setup and adjustments are password protected.

The Decision-Maker® 3500 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.

Avg Gen Voltage L-L. Average generator set voltage L-L and each line-to-line volts is shown.

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 Decision-Maker® 3500 controller is trying to achieve including droop and paralleling bias.

Gen Frequency. Generator set frequency in Hz is shown.

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 PC-based 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. 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 circuit board typically requires a voltage adjustment.

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

1.7.5 Voltage Selector Switch

The voltage selector switch menu does not apply to the EOZCS/EFOZCS models.

1.7.6 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 Decision-Maker® 3500 controller is a paralleling controller and provides varying degrees of paralleling functionality.

While the Decision-Maker® 3500 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 to be within the **Voltage OK Pickup** of the system voltage, the frequency window requires the operating frequency of the generator to be within the **Frequency OK Pickup** of the system frequency. This delay may need to be increased if the first generator 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 comes online.

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

kW Ramp Rate. The generator will load and unload against the other generators at this rate. The default rate (5%/sec) requires 20 sec to accept 100% load. Increasing the ramp rate will allow the generator 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 system. The ramp rate can be decreased if there is noticeable fluctuation in the voltage or frequency when a generator 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 system is operating. The trims default is enabled on all generators, but they can be disabled on some generators in the system to improve load sharing. The trims should be enabled on at least one generator in the paralleling system or the voltage and frequency may drift significantly during the operation of the system.

Load Enable. The generator will unload and trip the circuit breaker/contactors when this setting is set to OFF. This can be used to force a generator 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 is not considered for generator management when Load Enable is set to OFF. This parameter should always be returned to ON after the generator has been stopped for service, as it will keep the generator from sharing load or starting 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 on the communication lines. This may be required if all other generator 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. The Stand Alone Mode is set to OFF in order for the controller to see PGEN communication to control the motor operator breaker.

Sync Mode In Auto. This should be set to Active before leaving the vessel when commissioning or testing is complete, but can be used to keep the controller from closing the paralleling breaker/contactors to complete a test or to take a generator 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 from service manually, set the Sync Mode in Auto to OFF, wait for any additional generators to start, and set the Load Enable to OFF. When the breaker/contactors trips, stop the generator 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 from the paralleling bus, but it will not give the other generators any opportunity to negotiate an arrangement to support the load. Even if there are enough generators online to support the load, the voltage and frequency may dip when the other running generators are required to pick up the load formerly supported by this generator.

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 generators supplying the load) but will hold synchronism with the bus without closing the paralleling breaker/contactors if it is already supplied by another generator. This allows operational verification of the synchronizer, but does not allow the generator to supply the load. If the generator 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 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 have matched that of the bus and the generator and bus have been in phase for the duration of the dwell timer. This value is only updated when the controller is synchronizing (Synch Mode = Active, Passive or Check, breaker/contactors is open, generator is running).

Voltage Matched. The difference between the generator 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 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.

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 voltage to the bus voltage

Frequency Matched. The difference between the generator 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 is running).

Bus Frequency. The operating frequency of the paralleling bus.

Gen Frequency. The operating frequency of this generator.

Speed Bias. The amount that the controller is attempting to adjust the output frequency of the generator

(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 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 is running).

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

Note: This value is only accurate if the generator 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 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 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 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 unreliable and to start another generator (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. This value is only populated when the generator is actively synchronizing (Sync Mode = Active, breaker/contactors is open, generator 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 generators) to the total bus capacity (sum of all the connected generator 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 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 and bus is site-dependent. The adjustment of the parameters on this screen (during commissioning) will determine how closely the generators share load.

Speed Bias. The amount that the controller is attempting to adjust the output frequency of the generator

(100% bias = +5% on the engine speed, -100% = -5% on the engine speed).

The controller adjusts the speed bias to share load between the generators 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 generators) to the total bus reactive capacity (sum of all the connected generator 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 is fixed at 3/4 of the rated kW capacity of the generator (even in single-phase applications).

Gen % of Rated kVAR. The ratio of the total reactive load on this generator 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 and bus is site-dependent. The adjustment of the parameters on this screen (during commissioning) will determine how closely the generators share reactive load. The Reactive Power rating of the generator is fixed at 3/4 of the rated kW capacity of the generator (even in single-phase applications).

Voltage Bias. The amount that the controller is attempting to adjust the output voltage of the generator (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 generators connected to the paralleling bus.

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

Protective Relays

The protective relays serve two purposes:

1. To protect the generator from damage and
2. To protect the loads supplied by the generator 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 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 will remain running. The protective relay can be reset by pressing the AUTO button (note, if the generator is in Run, the protective relay will have to be cleared by stopping the generator). Pressing OFF/RESET or removing the remote start signal to the generator 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 to stop when it is unneeded. If generator management for a generator is disabled, the generator will start—generator management failures will result in additional generators running any time the system receives a start signal (this unit or others).

Generator management sequences the generators off in a predetermined order. The highest order generators 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 (if the load increases) varies with the degree of overload.

The time to stop a generator (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 generators to start, synchronize, and close to the bus. Generator management requires that the generators are available (not faulted) in order to be permitted to stop. If a generator is faulted or manually stopped and then placed back in Auto, Generator Management will require the generator 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 to stop.

Start Capacity. The percent of generator rated kW of the running generators that the system allows before the accumulator to start this generator begins filling. ***The Start Capacity is set during commissioning and should not be changed.***

Start Delay. The time to decide to start the generator at 10% over capacity. ***The Start Delay is set during commissioning and should not be changed.***

Stop Capacity. The percent of generator rated kW of the other running generators that the system allows before the accumulator to stop this generator begins filling. ***The Stop Capacity is set during commissioning and should not be changed.***

Stop Delay. The time to decide to stop the generator at 10% available capacity. ***The Stop Delay is set during commissioning and should not be changed.***

Gen Management Modes

The method that generator management uses to determine the starting and stopping order of the available generators. All the generators 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 the generators which are connected to the PGEN network. This parameter can be set to one of the following:

- **Manual/Fixed.** The order of the generators 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 generators will run all the time).

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

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

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

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

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

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

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

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

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

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

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

Total Bus Capacity. The total bus capacity is simply the sum of the kW rating of all generators that are connected

to the paralleling bus (running with paralleling breaker/contactors closed). Generators 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 generators which are connected to the bus and available for sharing load. Generators 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 to determine if the generator should be started, stopped, or remain as-is.

Start kW. The threshold of Bus Total Power above which the Start Accumulator for this generator 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 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 may have a problem in the future. If Generator Management has stopped the generators, it will start one of the unused generators but keep the running generator 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 is that it will be able to supply the load when the generator 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 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 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 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 may remain running and connected to the paralleling bus for a few seconds after the Stop Accumulator reaches 0%. During this time, the generator 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 generators to equalize hours (see Gen Management Order earlier in this section). All the generators in the system must have the same setting for the Run Time Threshold for the generator management to operate. If this parameter is changed on any controller, it will be updated on all the generators which are connected to the PGEN network.

Total Run Time. The actual runtime hours of this generator (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 generators to equalize fuel level. (See Gen Management Order earlier in this section). All the generators 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 the generators which are connected to the PGEN network.

Fuel Level. The level of the fuel in the tank supplying this generator. 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 is closed to the paralleling bus
- Generator Management is enabled
- The configuration of vital parameters of the system are identical between all controllers
- No generators 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 fails (shuts down with either a fault or user input)
- All generators 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 the generators 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 the generators which are connected to the PGEN network.

Minimum Gens Online. Generator Management will always try to keep this many generators online (even if they are not needed). All the generators 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 the generators which are connected to the PGEN network.

The purpose of this setting is to allow configuration to support large transient loads or potential generator 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. This is implemented so that generators aren't stopped prematurely (before all the available load has been applied to the system). All the generators 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 the generators 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.

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

Stopped By Gen Mgmt. If a stop command is issued by Gen Management, the display will indicate TRUE. This field only changes when a stop command is issued.

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 generators 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 generators 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 generators in the paralleling system. This allows Priorities 1 and 2 to be connected to one generator, while Priorities 3 and 4 can be connected to another generator.

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

Load Control Description

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

The Load Control in the Decision-Maker® 3500 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 14 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 the generators. 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 14 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 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 generators 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 or generator controlled by external switchgear) the load control logic uses the Gen % or Rated kW and the Gen Frequency.

In a paralleling application (where the Decision-Maker® 3500 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 generators 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 Generator Management. Even if the generator set is Off, it may de-activate its Load Control outputs to energize those loads. This may seem counter-intuitive, 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 is not operating in a paralleling application.

Gen % Max Cap. The load level on the generator (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 starts, synchronizes and closes its paralleling breaker/contactors, in a paralleling application).

Gen Overload Percent. The load level on the generator (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 is heavily overloaded, more slowly if the

generator 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 Decision-Maker® 3500 controller performed only by an authorized Kohler distributor/dealer.

1.7.7 Emissions Information
(IMO Tier III Models Only)

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.

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, refill the DEF tank as necessary.

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

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 IMO Tier III engines. These symbols are shown in Figure 1-8. When one of these symbols is displayed, refer to the specific engine event codes from the engine ECM and refer to the 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.

EMISSIONS			hh:hh dd:mm:yy
			
HIGH EX TEMP	SYSTEM ISSUE	LOW DEF	

Figure 1-8 ECM Emissions Symbols

1.8 Controller Configuration Menu

1.8.1 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.

1.8.2 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 1-9. 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.

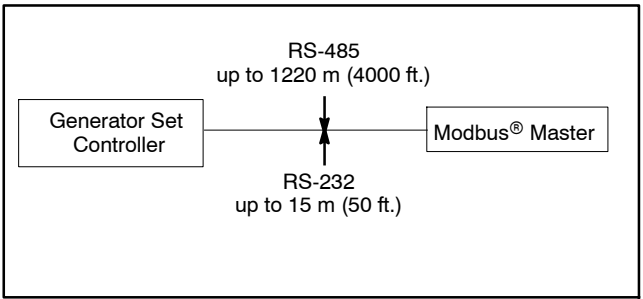


Figure 1-9 Modbus® Connections

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.

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.

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 master PC and all devices in the system.

Figure 1-10 Decision-Maker® 3500 Communication Parameters

Select the baud rate. Choose the same baud rate for the Modbus® master, modems, and connected devices. See Figure 1-10.

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 generators.

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.

1.8.3 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 Kohler distributor/dealer.

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 2.6.5 Status and Notice Digital Displays.

1.9 I/O Setup Menu

Note: Have setup and adjustments of the Decision-Maker® 3500 controller performed only by an authorized Kohler distributor/dealer. There is a lot of setup information that can be accessed on this screen, but the parameters should be adjusted only during commissioning.

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 2.7 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 2.7 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 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.

The fifteen-relay dry contact board has four digital inputs and two analog inputs. There are fourteen programmable relay outputs and one common fault relay output.

The 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

1.9.1 Controller Fault Diagnostics

Figure 1-12 provides descriptions of possible 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 indicates attention is required. **Shutdowns** show a red fault lamp, sound an audible alarm, and stop the generator set. **Statuses** 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. A triangle in the upper right corner (see Figure 1-11) indicates the presence of an event such as a warning, shutdown, status, or notice.

Note: Always identify and correct the cause of a fault shutdown before resetting the controller.

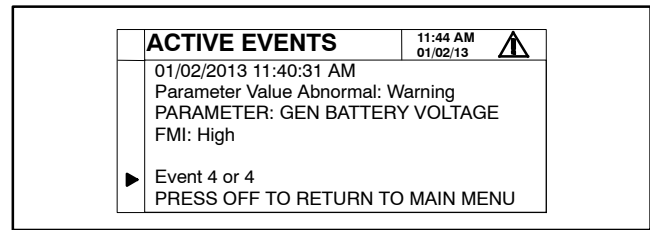


Figure 1-11 Event Screen Capture (Example)

Engine Specific Events

FMI (Failure Mode Indicator)	Event ID/Parameter at Local Display	Level	Alarm Horn	Fault Lamp	Programmed Input	Programmed Output
Protectives						
Low	After Treatment1 Def Concentration, if equipped	Warning	On			
Critically Low	Def Level, if equipped	Warning	On	Yellow		D
Low	Def Level, if equipped	Warning	On	Yellow		D
	Def Level, if equipped	Warning	On			
Critically Low	Engine Coolant Level	Shutdown	On	Red	AD	D
Low	Engine Coolant Level	Shutdown	On	Red	AD	D
Shorted High	Engine Coolant Level	Warning	On	Yellow	AD	D
Shorted Low	Engine Coolant Level	Warning	On	Yellow	AD	D
Critically High	Engine Coolant Temperature	Shutdown	On	Red	AD	D
High	Engine Coolant Temperature	Warning	On	Yellow	AD	D
Critically Low	Engine Oil Level	Warning	On	Yellow	AD	D
Critically Low	Engine Oil Pressure	Shutdown	On	Red	AD	D
Low	Engine Oil Pressure	Warning	On	Yellow	AD	D
Critically High	Engine Speed	Shutdown	On	Red		D
Critically High	Exhaust Aftertreatment System Temperature, if equipped	Warning	On			
	Exhaust Bypass Valve Not Closed, if equipped	Warning	On			
	Exhaust Bypass Valve Not Open, if equipped	Warning	On			
	In Imo Tier2 Mode, if equipped	Warning	On			
	In Imo Tier3 Mode, if equipped	Notice				
	Keep Battery On	Warning	On			
Critically High	Lube Oil Temperature	Warning	On	Yellow	AD	D
Other Alerts						
	Ecm Communication Loss	Shutdown	On	Red		
	Ecm Model Mismatch	Shutdown	On	Red		
	Ecm Red Alarm	Shutdown	On	Red		

Decision-Maker® 3500 Common Events

FMI (Failure Mode Indicator)	Event ID/Parameter at Local Display	Level	Alarm Horn	Fault Lamp	Programmed Input	Programmed Output
High	AC Frequency	Shutdown	On	Red		
Low	AC Frequency	Shutdown	On	Red		
	AC Sensing Lost	Shutdown	On	Red		D
	AC Sensing Lost	Warning	On	Yellow		D
	Alternator Protection	Shutdown	On	Red		D
	Auxiliary Input	Shutdown	On	Red	D	D
	Battery Charger Fault, if equipped	Warning	On	Yellow		
	Battery Charger Identity Conflict, if equipped	Warning	On	Yellow		
High	Breaker Close Attempts	Warning	On	Yellow		
High	Breaker Trip To Shutdown Time Delay	Shutdown	On	Red		
	Bus Voltage Average Line To Line	Warning	On	Yellow		
High	Bus Voltage Average Line To Line	Warning	On	Yellow		
Low	Bus Voltage Average Line To Line	Warning	On	Yellow		
	Cabinet Intrusion Alarm	Warning	On	Yellow	D	D
	Charger Comm Loss Events, if equipped	Warning	On	Yellow		
	Charger Parameter Mismatch, if equipped	Warning	On	Yellow		
	Common Fault	Shutdown	On	Red		
High	Coolant Pressure	Shutdown	On	Red	AD	D
High	Coolant Pressure	Warning	On	Yellow	AD	D
Low	Coolant Pressure	Shutdown	On	Red	AD	D
Low	Coolant Pressure	Warning	On	Yellow	AD	D
Open Circuit	Coolant Pressure	Shutdown	On	Red	AD	D
Open Circuit	Coolant Pressure	Warning	On	Yellow	AD	D
Shorted High	Coolant Pressure	Shutdown	On	Red	AD	D
Shorted High	Coolant Pressure	Warning	On	Yellow	AD	D
Shorted Low	Coolant Pressure	Shutdown	On	Red	AD	D
Shorted Low	Coolant Pressure	Warning	On	Yellow	AD	D
Low	Cranking Voltage	Warning	On	Yellow		D
	Ecm Diagnostic	Warning	On	Yellow		
	Ecm Model Mismatch	Shutdown	On	Red		
	Egr System Fault, if equipped	Shutdown	On	Red	D	
	Egr System Fault, if equipped	Warning	On	Yellow	D	
	Emergency Stop	Shutdown	On	Red		D
High	Engine Coolant Level	Shutdown	On	Red	AD	D
High	Engine Coolant Level	Warning	On	Yellow	AD	D
Low	Engine Coolant Level	Shutdown	On	Red	AD	D
Low	Engine Coolant Level	Warning	On	Yellow	AD	D
Open Circuit	Engine Coolant Level	Shutdown	On	Red	AD	D
Open Circuit	Engine Coolant Level	Warning	On	Yellow	AD	D
Shorted High	Engine Coolant Level	Shutdown	On	Red	AD	D
Shorted High	Engine Coolant Level	Warning	On	Yellow	AD	D
Shorted Low	Engine Coolant Level	Shutdown	On	Red	AD	D
Shorted Low	Engine Coolant Level	Warning	On	Yellow	AD	D
	Engine Fluid Leak	Warning	On	Yellow	D	D
Critically High	Engine Fuel Level	Warning	On	Yellow	AD	D
High	Engine Fuel Level	Shutdown	On	Red	AD	D
High	Engine Fuel Level	Warning	On	Yellow	AD	D
Low	Engine Fuel Level	Shutdown	On	Red	AD	D
Low	Engine Fuel Level	Warning	On	Yellow	AD	D
Open Circuit	Engine Fuel Level	Shutdown	On	Red	AD	D
Open Circuit	Engine Fuel Level	Warning	On	Yellow	AD	D
Shorted High	Engine Fuel Level	Shutdown	On	Red	AD	D
Shorted High	Engine Fuel Level	Warning	On	Yellow	AD	D

FMI (Failure Mode Indicator)	Event ID/Parameter at Local Display	Level	Alarm Horn	Fault Lamp	Programmed Input	Programmed Output
Shorted Low	Engine Fuel Level	Shutdown	On	Red	AD	D
Shorted Low	Engine Fuel Level	Warning	On	Yellow	AD	D
High	Engine Oil Level	Shutdown	On	Red	AD	D
High	Engine Oil Level	Warning	On	Yellow	AD	D
Low	Engine Oil Level	Shutdown	On	Red	AD	D
Low	Engine Oil Level	Warning	On	Yellow	AD	D
Open Circuit	Engine Oil Level	Shutdown	On	Red	AD	D
Open Circuit	Engine Oil Level	Warning	On	Yellow	AD	D
Shorted High	Engine Oil Level	Shutdown	On	Red	AD	D
Shorted High	Engine Oil Level	Warning	On	Yellow	AD	D
Shorted Low	Engine Oil Level	Shutdown	On	Red	AD	D
Shorted Low	Engine Oil Level	Warning	On	Yellow	AD	D
High	Engine Seawater Pressure, if equipped	Shutdown	On	Red	AD	D
High	Engine Seawater Pressure, if equipped	Warning	On	Yellow	AD	D
Low	Engine Seawater Pressure, if equipped	Shutdown	On	Red	AD	D
Low	Engine Seawater Pressure, if equipped	Warning	On	Yellow	AD	D
Open Circuit	Engine Seawater Pressure, if equipped	Shutdown	On	Red	AD	D
Open Circuit	Engine Seawater Pressure, if equipped	Warning	On	Yellow	AD	D
Shorted High	Engine Seawater Pressure, if equipped	Shutdown	On	Red	AD	D
Shorted High	Engine Seawater Pressure, if equipped	Warning	On	Yellow	AD	D
Shorted Low	Engine Seawater Pressure, if equipped	Shutdown	On	Red	AD	D
Shorted Low	Engine Seawater Pressure, if equipped	Warning	On	Yellow	AD	D
	Engine Speed	Shutdown	On	Red		D
	Exhaust Gas Temp High	Shutdown	On	Red	D	
High	Exhaust Temperature, if equipped	Shutdown	On	Red	AD	D
High	Exhaust Temperature, if equipped	Warning	On	Yellow	AD	D
Low	Exhaust Temperature, if equipped	Shutdown	On	Red	AD	D
Low	Exhaust Temperature, if equipped	Warning	On	Yellow	AD	D
Open Circuit	Exhaust Temperature, if equipped	Shutdown	On	Red	AD	D
Open Circuit	Exhaust Temperature, if equipped	Warning	On	Yellow	AD	D
Shorted High	Exhaust Temperature, if equipped	Shutdown	On	Red	AD	D
Shorted High	Exhaust Temperature, if equipped	Warning	On	Yellow	AD	D
Shorted Low	Exhaust Temperature, if equipped	Shutdown	On	Red	AD	D
Shorted Low	Exhaust Temperature, if equipped	Warning	On	Yellow	AD	D
	Fail To Close Delay	Warning	On	Yellow		
	Fail To Open Delay	Warning	On	Yellow		
	Failure To Synchronize	Warning	On	Yellow		
High	Fuel Pressure	Shutdown	On	Red	AD	D
High	Fuel Pressure	Warning	On	Yellow	AD	D
Low	Fuel Pressure	Shutdown	On	Red	AD	D
Low	Fuel Pressure	Warning	On	Yellow	AD	D
Open Circuit	Fuel Pressure	Shutdown	On	Red	AD	D
Open Circuit	Fuel Pressure	Warning	On	Yellow	AD	D
Shorted High	Fuel Pressure	Shutdown	On	Red	AD	D
Shorted High	Fuel Pressure	Warning	On	Yellow	AD	D
Shorted Low	Fuel Pressure	Shutdown	On	Red	AD	D
Shorted Low	Fuel Pressure	Warning	On	Yellow	AD	D
	Fuel Tank Leak	Shutdown	On	Red	D	D
High	Generator Total Real Power	Shutdown	On	Red		
High	Generator Voltage L1-L2	Shutdown	On	Red		D
High	Generator Voltage L2-L3	Shutdown	On	Red		D
High	Generator Voltage L3-L1	Shutdown	On	Red		D
Low	Generator Voltage L1-L2	Shutdown	On	Red		D
Low	Generator Voltage L2-L3	Shutdown	On	Red		D

FMI (Failure Mode Indicator)	Event ID/Parameter at Local Display	Level	Alarm Horn	Fault Lamp	Programmed Input	Programmed Output
Low	Generator Voltage L3-L1	Shutdown	On	Red		D
Erroneous Data Received	Gen Management Enabled	Warning	On	Yellow		
High	Genset System Frequency	Warning	On	Yellow		
Low	Genset System Frequency	Warning	On	Yellow		
High	Genset System Voltage	Warning	On	Yellow		
Low	Genset System Voltage	Warning	On	Yellow		
Erroneous Data Received	Genset Voltage Phase Connection	Warning	On	Yellow		
Critically High	Intake Air Temperature Higher Than Expected 2	Shutdown	On	Red		
	Locked Rotor	Shutdown	On	Red		D
	Maximum Alternator Current	Shutdown	On	Red		D
	Not In Auto	Warning	On	Yellow		D
	Option Board 2A Communication Loss	Warning	On	Yellow		
	Option Board 2B Communication Loss	Warning	On	Yellow		
	Option Board 2C Communication Loss	Warning	On	Yellow		
	Over Crank	Shutdown	On	Red		D
	PR Over Current VR Trip	Warning	On	Yellow		D
	PR Over Frequency Trip	Warning	On	Yellow		D
	PR Over Power Trip	Warning	On	Yellow		D
	PR Over Voltage Trip	Warning	On	Yellow		D
	PR Reverse Power Trip	Warning	On	Yellow		D
	PR Reverse Var Trip	Warning	On	Yellow		D
	PR Under Frequency Trip	Warning	On	Yellow		D
	PR Under Voltage Trip	Warning	On	Yellow		D
	Reserve Oil Empty	Warning	On	Yellow	D	D
	Run Relay Coil Overload	Shutdown	On	Red		
	Speed Sensor Fault	Warning	On	Yellow		D
	Starter Relay Coil Overload	Shutdown	On	Red		
Other Alerts						
	Alarm Horn Silenced	Status				
	Baseload Mode	Status			D	
	Close Breaker	Notice				D
	Cold Start Ignition Delay	System Status Change			D	
	Common Warning	Notice				
	Contactor	Notice				D
	Date And Time Not Set	Status				
	Emergency Power System Supplying Load	Notice				D
	Enable Generator Management	Notice			D	
	Enable Trims	Status			D	
	Engine Cool Down Active	Notice				D
	Engine Start Aid Active	Notice				D
	Engine Started	Status				
	Engine Stopped	Status				
	File System Error	Status				
	Firmware Upgrade Fault	Notice				
	Fuel Priming Started	Status				
	Fuel Priming Stopped	Status				
	Generator Paralleling Breaker	System Status Change			D	
	Generator Running	Notice				
	Idle Start Command Issued	Notice			D	
	Load Enable	Status			D	

FMI (Failure Mode Indicator)	Event ID/Parameter at Local Display	Level	Alarm Horn	Fault Lamp	Programmed Input	Programmed Output
	Load Priority 1 Shed	Notice				D
	Parameter Value Abnormal	Status			D	
	Remote Reset	Status			D	
	Remote Start	Status				
	Remote Start Command Issued	Notice				
	Remove Breaker Trip	Notice				D
	Run Button Acknowledged	Notice				
	Standalone Operation	Status			D	
	Stationary Regen Aborted, if equipped	Status				
	Stationary Regen Completed, if equipped	Status				
	Stationary Regen Failed, if equipped	Status				
	Stationary Regen Started, if equipped	Status				
	Stopped By Generator Management	Notice				D
	Synchronization Disabled	Notice			D	
	System Control Mode	Status			D	
	System Ready	Notice				D
	System Sync Mode	Status			D	

Note: Some events are sensor dependent.

Note: A = Analog; D = Digital

Figure 1-12 System Events Display Message List

ECM Diagnostic Warnings From Engine ECU (All Models)	
SPN	Reference
94	Engine Fuel Delivery Pressure
97	Water in Fuel Indicator
103	Engine Turbocharger 1 Speed
107	Engine Air Filter 1 Differential Pressure
108	Barometric Pressure
131	Engine Exhaust Back Pressure
156	Engine Injector Timing Rail 1 Pressure
167	Charging system Potential (Voltage)
168	Battery Potential/Power Input 1
171	Ambient Air Temperature
172	Engine Air Intake Temperature
174	Engine Fuel Temperature 1
188	Engine Speed At Idle, Point 1 (Engine Configuration)
234	Software Identification
636	Engine Position Sensor
641	Engine Variable Geometry Turbocharger Actuator #1
645	Engine Tachometer Signal Output
651	Engine Injector Cylinder #01
652	Engine Injector Cylinder #02
653	Engine Injector Cylinder #03
654	Engine Injector Cylinder #04
655	Engine Injector Cylinder #05
656	Engine Injector Cylinder #06
657	Engine Injector Cylinder #07
658	Engine Injector Cylinder #08
677	Engine Starter Motor Relay
2791	Engine Exhaust Gas Recirculation 1 (EGR1) Valve Control

ECM Diagnostic Warnings From Engine ECU (All Models)	
2797	Engine Injector Group 1
2798	Engine Injector Group 2
2858	Machine Data Configuration 1
2859	Machine Data Configuration 2
2860	Machine Data Configuration 3
2861	Machine Data Configuration 4
2862	Machine Data Configuration 5
3464	Engine Throttle Actuator 1 Control Command
3468	Engine Fuel Temperature 2
3563	Engine Intake Manifold #1 Absolute Pressure
3606	Engine Controlled Shutdown Request
3607	Engine Emergency (Immediate) Shutdown Indication
3673	Engine Throttle Valve 2 Position
3822	Engine Exhaust Gas Recirculation 1 Valve 2 Position
4201	Engine Speed 1
4814	Engine Coolant Pump Command
5264	Engine Exhaust Gas Recirculation 2 (EGR2) Valve Control
5265	Engine Exhaust Gas Recirculation 2 (EGR2) Valve 2 Control
5285	Engine Charge Air Cooler 1 Efficiency
5401	Engine Turbocharger Turbine Bypass Actuator
5419	Engine Throttle Actuator 1
5421	Engine Turbocharger Wastegate Actuator 1
5541	Engine Turbocharger 1 Turbine Outlet Pressure
5543	Engine Exhaust Brake Actuator Command

Note: SPN = Suspect Parameter Number

1.9.2 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.

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.

1.9.3 For Units Equipped with 3rd Party Marine Option

Additional engine sensors are provided to satisfy 3rd party approval requirements. Handling of these redundant sensors is described below. Every ECM handles their respective sensor readings and values independently and the ECM may send warnings or cause shutdowns on their own. Refer to the respective Engine ECM documentation for unique handling.

- All units will have two oil pressure sensors. If the engine is equipped with an ECM, the primary oil pressure sensor (#1) will go to the ECM and the primary oil pressure readings are derived from CAN communications. If the engine is not equipped with an ECM, the primary oil pressure sensor connects to the genset controller at one of the auxiliary analog inputs and primary oil pressure readings will be measured directly by the controller. On all units, the secondary oil pressure sensor (#2) connects to the genset controller at one of the auxiliary analog inputs and secondary oil pressure readings will be measured directly by the controller.
- All units will have a single coolant pressure sensor. This sensor connects to the genset controller at one of the auxiliary inputs and coolant pressure signal will be monitored directly by the controller. Low coolant pressure and/or loss of coolant pressure readings will cause a warning only (not a shutdown).
- All units will have a single oil temperature sensor. This sensor connects to the genset controller at one of the auxiliary inputs and oil temperature signal will be monitored directly by the controller.

- All units will have two coolant temperature sensors. If the engine is equipped with an ECM, the primary coolant temperature sensor (#1) will go to the ECM and the primary coolant temperature readings are derived from CAN communications. If the engine is not equipped with an ECM, the primary coolant temperature sensor connects to the genset controller at one of the auxiliary analog inputs and primary coolant temperature readings will be measured directly by the controller. On all units, the secondary coolant temperature sensor (#2) connects to the genset controller at one of the auxiliary inputs and the secondary coolant temperature signal will be monitored directly by the controller.
- When two sensors are installed (oil pressure and coolant temperature), separate warning messages are initiated for each sensor when a warning limit is exceeded. Should either sensor provide a reading that violates a shutdown limit, a shutdown occurs regardless of the other sensor reading. If either sensor signal is lost, a Loss of Signal (LOS) warning will be initiated. If both sensor signals are lost, a Loss of Signal (LOS) shutdown occurs.

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 the engine.

Air Inlets. Check for clean and unobstructed air inlets.

Air Shrouding. Check for securely installed and positioned air shrouding.

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 (IMO Tier III Models). Ensure that there is 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 water pump and battery charging alternator belt.

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, mixing elbow, exhaust line, hose clamps, silencer, and exhaust outlet) for cracks, leaks, and corrosion.

- Check the hoses for softness, cracks, leaks, or dents. Replace the hoses as needed.
- Check for corroded or broken metal parts and replace them as needed.
- Check for loose, corroded, or missing clamps. Tighten or replace the hose clamps 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.
- Ensure that the carbon monoxide detector(s) is (1) in the craft, (2) functional, and (3) energized whenever the generator set operates.

For your safety: Never operate the generator set without a functioning carbon monoxide detector(s) for your safety and the safety of others on your vessel.

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

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

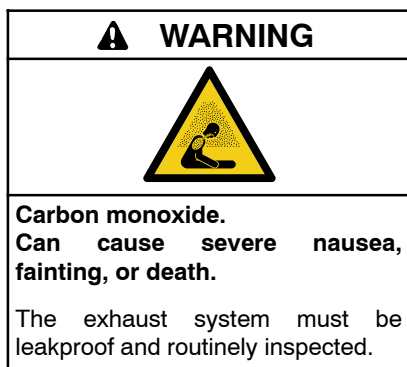
Operating Area. Check for obstructions that could block the flow of cooling air. Keep the air intake area clean. Do not leave rags, tools, or debris on or near the generator set.

Seawater Pump Priming. Prime the seawater pump before initial startup. To prime the pump: (1) close the seacock, (2) remove the hose from the water-filter outlet, (3) fill the hose and seawater pump with clean water, (4) reconnect the hose to the water filter outlet, and (5) open the seacock. Confirm seawater pump operation on startup as indicated by water discharge from the exhaust outlet.

2.2 Marine Inspection

Kohler Co. recommends that all boat owners have their vessels inspected at the start of each boating season by the US Coast Guard, the local Coast Guard Auxiliary, or local state agency.

Kohler Co. also recommends having the generator's exhaust system inspected at the start of each boating season by an authorized Kohler® distributor/dealer. Repair any problems identified before operating the generator set.



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.

Inspecting the exhaust system. Carbon monoxide can cause severe nausea, fainting, or death. For the safety of the craft's occupants, install a carbon monoxide detector. Never operate the generator set without a functioning carbon monoxide detector. Inspect the detector before each generator set use.

Operating the generator set. Carbon monoxide can cause severe nausea, fainting, or death. Be especially careful if operating the generator set when moored or anchored under calm conditions because gases may accumulate. If operating the generator set dockside, moor the craft so that the exhaust discharges on the lee side (the side sheltered from the wind). Always be aware of others, making sure your exhaust is directed away from other boats and buildings.

2.3 Angular Operation

See Figure 2-1 for angular operation limits for units covered in this manual.

Model	Angle to the Rear *	Angle to the Front *	Right Hand/Left Hand *
350EOZCS/ 300EFOZCS	25°	25°	30°
500EOZCS/ 450EFOZCS	25°	25°	30°

* Maximum permitted inclination angle for an engine in operation and with minimum oil level. The maximum permitted operating angle may only be applied for short periods. The maximum forwards or rearwards operating angles are not applicable to their full extent if the engine is inclined laterally at the same time.

Figure 2-1 Max. Operating Angle

2.4 Operation in European Union Member Countries

This generator set is specifically intended and approved for operation below the deck in the engine compartment. Operation above the deck and/or outdoors would constitute a violation of European Union Directive 2000/14/EC noise emission standard.

Sound Levels

A- weighted emission sound pressure level greater than 80 dB(A):

The A- weighted emission sound pressure level at 1 m:
Lpa = 103.7 dB(A),
associated uncertainty, Kpa = 2 dB(A).

Sound pressure levels per ANSI S1.13, ASA 118, and ISO 6798 as applicable. Reference sound pressure is 20 µPa.

The A- weighted sound power level:

Lwa = 114.8 dB(A),
associated uncertainty, Kpa = 3 dB(A).

The measurement standard selected from those referenced was ISO 3745.

Note: Sound pressure levels are specific to testing performed in a factory-controlled environment to specific standards. Actual sound pressure achieved will vary depending on each installation and on-site conditions such as existing ambient noise, instrumentation used, installation methods, objects around the generator set, and generator set variations.

2.5 Load Profile

Whenever operating the generator set, Kohler Co. recommends maintaining the minimum load profile indicated in Figure 2-2. Maintaining the load profile prevents corrosion formation on internal engine components when they're exposed to the breakdown of exhaust gases. Extended light loading may result in engine "wet stacking."

Minimum Engine HP Load Requirement	Maximum Ideal Engine HP Load Requirement
30% load	70% load

Figure 2-2 Load Profile

Unburned Fuel (Wet Stacking) occurs when water/fuel vapor condenses in the exhaust system. At normal combustion temperatures, water stays vaporized but at low combustion temperatures, it condenses back to a liquid. When running the generator set under normal loads (30% load or more) for long periods of time, diesel exhaust stays hot enough to prevent water/fuel vapor from condensing. Conversely, if the generator set is subjected to light loads (30% or less) for long periods of time, water/fuel vapors accumulate and may result in the following conditions to develop:

- Cylinder wall glazing
- Fuel on water
- Crankcase oil dilution
- Wet stacking

Note: Consult the engine manufacturer's guidelines for more details on unburned fuel and wet stacking.

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

2.6 Controller Operation

Note: Opening seacock. Before starting the generator set, open the seacock to allow cooling water passage. Failure to do so could damage the seawater pump impeller and cause serious engine overheating damage.

Note: Transfer switch. Check that the marine ship-to-shore transfer switch, if equipped, is in the ship position.

Note: If the generator set does not start after 3 crank attempts (an overcrank fault occurs):

- 1) Close the seacock.
 - 2) Completely drain the water from the exhaust system at the silencer's drain plug.
 - 3) Do not attempt generator set restart.
 - 4) Contact an authorized Kohler® distributor/dealer.
- A water-filled exhaust piping and silencer may further hinder generator starting and cause seawater entry into the engine cylinders through the exhaust valves. Water ingested into the engine may cause major engine damage that the Kohler Co. warranty does not cover.

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 2-3.

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 shutdown after a period of time.

With removal of the start signal, all generator sets will shutdown 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 affect. 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.

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 used in the vessel 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 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 used in the vessel 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 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 will enter cooldown when the start signal is removed, only if 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 will enter cooldown when the start signal is removed, only if 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.

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 Off	— Pressed	— Yellow	Not In Auto Warning (Depending on SiteTech™ parameter setting)
			On Off	— Pressed	— Yellow	
RUN (unit fails to start)	Off (or Cranking)	Yellow	On Off	— Pressed	— Yellow	Not in Auto Warning (Depending on SiteTech™ parameter setting)
	Off	Red	On Off	— Pressed	— Yellow	
RUN (unit starts)	Off (or Cranking)	Yellow	On Off	— Pressed	— Yellow	Not in Auto Warning (Depending on SiteTech™ parameter setting)
	On		On Off	— Pressed	— Yellow	
	Running and then Off	Red	On Off	— Pressed	— Yellow	Shutdown Message

* The alarm horn on/off is based on SiteTech™ parameter settings.

Figure 2-3 Button Function Summary

2.6.1 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 2.6.6, 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.
3. Press the generator set OFF/RESET button.
4. After resetting all faults using the controller reset procedure in Section 2.6.6, 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.

2.6.2 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.

2.6.3 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. See Section 2.6.6, 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.

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 encounters excessive load or a downstream fault. The output breaker trips. The available sustained fault current of the generator can be obtained from the per-unit transient reactance of the generator and the system voltage and power.

Average Generator Voltage High. The fault lamp illuminates yellow and the alarm horn sounds when the generator 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 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 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 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.

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 Exhaust Aftertreatment System Temperature (IMO Tier III Models). The fault lamp illuminates yellow and the alarm horn sounds to inform the user that the temperature of the exhaust is excessively high to a point of causing damage to the aftertreatment system.

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.

Critically Low DEF Level (IMO Tier III Models). The fault lamp illuminates yellow and the alarm horn sounds to inform the user that they need to refill the DEF tank immediately before damage to the exhaust aftertreatment occurs.

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.

Exhaust Bypass Valve Not Closed (IMO Tier III Models). The fault lamp illuminates yellow and the alarm horn sounds to inform the user that they need to close the Manual Exhaust Bypass Valve.

Exhaust Bypass Valve Not Open (IMO Tier III Models). The fault lamp illuminates yellow and the alarm horn sounds to inform the user that they need to open the Manual Exhaust Bypass Valve.

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 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 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 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 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 2-4 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
24	26.4- 32.4	30

Figure 2-4 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 in the paralleling system has a lower system frequency than this generator. 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 in the paralleling system has a lower system voltage than this generator. 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.

In IMO Tier2 Mode (IMO Tier III Models). The fault lamp illuminates yellow and the alarm horn sounds to inform the user that the engine ECM is currently running in IMO Tier2 mode.

Invalid Generator Management Enabled. The fault lamp illuminates yellow and the alarm horn sounds when the generator management has been disabled because the generator management configuration of this generator does not match the generator management configuration of another generator 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 in the paralleling system has a different phase connection than this generator. The local display shows System Phase.

Keep Battery On (IMO Tier III Models). The fault lamp illuminates yellow and the alarm horn sounds to inform the user to keep the battery power on the unit so the ECM can run the afterrun cycle.

Low Aftertreatment1 Def Concentration (IMO Tier III Models). The fault lamp illuminates yellow and the alarm horn sounds to inform the user that the DEF quality is low.

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
24	19.2- 25.2	24

Figure 2-5 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 DEF Level (IMO Tier III Models). The fault lamp illuminates yellow and the alarm horn sounds to inform the user that they need to refill the DEF tank.

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 in the paralleling system has a higher system frequency than this generator. 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 in the paralleling system has a higher system voltage than this generator. 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.

Low Seawater Pressure (Heat Exchanger Model). The fault lamp illuminates yellow and the alarm horn sounds after a loss of seawater pressure is detected.

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 has a loss of field condition due to insufficient reactive load production to support real load. The output breaker trips.

2.6.4 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 2.6.6, 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. See 2.6.5 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 D, 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.

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 Exhaust Temperature (Heat Exchanger Model). The fault lamp illuminates red, the alarm horn sounds, and the unit shuts down immediately when the engine exhaust temperature exceeds the default 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 2-6.

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

Figure 2-6 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 2-7 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 2-7 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 2-8 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 2-8 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 2-9 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 2-9 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 first the 20 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 Section 2.6 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 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.

2.6.5 Status and Notice Digital 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. Status is an event that is not an alert but is part of the event history. Notice is an alert that is not part of the event history.

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 status 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 2.6.6, 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).

Contactor. 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 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. This status indicates that the generator set start circuit is closed allowing the engine to crank and run.

Engine Stopped. 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.

In IMO Tier3 Mode (IMO Tier III Models). This notice indicates that the engine ECM is currently running in IMO Tier3 mode.

Load Priority # Shed. This status 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. This notice 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.

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

2.6.6 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 2.6.1, 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.

2.7 Menu Displays

Use the Menu Summary List and Figure 2-10 after reading and understanding the features of the pushbutton/rotary selector dial. See Section 1.5.3, Digital Display.

The Menu Summary List and Figure 2-10 provide a quick 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. Use SiteTech™ software for changing programmable information.

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

Metering Menu	Metering Menu (Continued)	Generator Information Menu (Continued)
● Generator Metering ○ 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 ○ 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 <i>Note: This menu option does not apply to marine generator sets.</i> ○ STATUS: (IDLING/STANDBY/ CHARGING/ BATT FAIL/CHRG FAIL/ NOT AVAILABLE) ○ OUTPUT VOLTAGE: ##.#VDC ○ OUTPUT CURRENT: ##.#A ○ CHARGER STATE: IDLE/BULK/ ABSORB/FLOAT/EQUAL/REFRESH/ RECOVER/NA	○ CHARGER TEMP: ###°F ○ REDUCED OUTPUT ACTIVE: YES/NO ○ TEMP COMPENSATION ACTIVE: YES/NO ○ SOFTWARE VER.: XXXXXXXXXXXX ● Overview ○ GENERATOR STATUS ◇ AVG GEN VOLTAGE L-L: ###V ◇ AVG CURRENT: ###A ◇ GEN FREQUENCY: ##.#Hz ○ ENGINE STATUS ◇ COOLANT TEMPERATURE: ###°F ◇ OIL PRESSURE: ###PSI ◇ GEN BATTERY VOLTAGE: ##.#V ○ SYSTEM STATUS ◇ FUEL PRESSURE: ###PSI ◇ TOTAL POWER: ####kW ◇ TOTAL RUN TIME: #####.hrs ● Paralleling Metering ○ 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: ###%	● Configuration ○ GENERATOR CONFIGURATION ◇ 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* ◇ POWER UP IN AUTO: ON/OFF* ◇ NOT IN AUTO WARN ENABLE: ON/OFF* ◇ AUX FAULT DELAY: ##s* ◇ AUX FAULT INHIBIT DELAY: ##s* ○ PROTECTION CONFIGURATION ◇ OVERVOLTAGE: ###%* ◇ OVERVOLTAGE: ##.#V ◇ OVERVOLTAGE DELAY: ##s* ◇ UNDERVOLTAGE: ###%* ◇ UNDERVOLTAGE: ##.#V ◇ UNDERVOLTAGE DELAY: ##s* ◇ OVERFREQUENCY: ##%* ◇ OVERFREQUENCY: ##.#Hz ◇ UNDERFREQUENCY: ##%* ◇ UNDERFREQUENCY: ##.#Hz ◇ OVERSPEED: ##.##%* ◇ OVERSPEED: ##.#Hz ◇ OVERSPEED: ####RPM ◇ LOW BATTERY VOLTAGE: ##%* ◇ LOW BATTERY VOLTAGE: ##.#VDC ◇ HIGH BATTERY VOLTAGE: ##%* ◇ HIGH BATTERY VOLTAGE: ##.#VDC ○ BATT X BASIC CONFIG <i>Note: This menu option does not apply to marine generator sets.</i> ◇ 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)*
	Generator Information Menu ● Generator Information ○ 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 ○ 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	

* 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)
● Voltage Regulation ○ 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* ● Paralleling Operation ○ PARALLELING SETUP ◇ 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 ◇ 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 ◇ 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 ◇ 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 ◇ 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 SHTDWN DELAY: #####s* ○ GENERATOR MANAGEMENT ◇ GEN MANAGEMENT MODE: (INVALID/MANUAL FIXED/RUN TIME/FUEL LEVEL)* ◇ GEN MANAGEMENT: ON/OFF* ◇ 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 ◇ GEN MAX % CAP: ##.##%* ◇ GEN OVERLOAD %: ###.##%* ● Emissions Information (IMO Tier III) ○ EMISSIONS ◇ DEF LEVEL: ###.##% ◇ EXHST OUT TEMP: #####°F/°C ○ NOTIFICATIONS ◇ HIGH EXHAUST TEMPERATURE ◇ SYSTEM ISSUE ◇ LOW DEF
Controller Configuration Menu		
● Controller Configuration ○ 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* ● Communication Setup ○ 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> ○ 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*		

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

I/O Menu	I/O Menu (Continued)	Active Events Menu
● Resistive Input - Analog Input 0:1 - Analog Input 0:2 - Analog Input 0:3 - Analog Input 0:4 - Analog Input 0:5 - Analog Input 0:6 ○ 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*	● Digital Input - Digital Input 0:1 - Digital Input 0:2 - Digital Input 0:3 - Digital Input 0:4 - Digital Input 0:5 - Digital Input 0:6 ○ 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* ● Digital Output - 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*	Rotate the dial to view Active Events: Warnings Shutdowns Statuses Notices See Section 2.6.3, Section 2.6.4, and Section 2.6.5 for descriptions. Press the OFF button to return to the main menu.

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

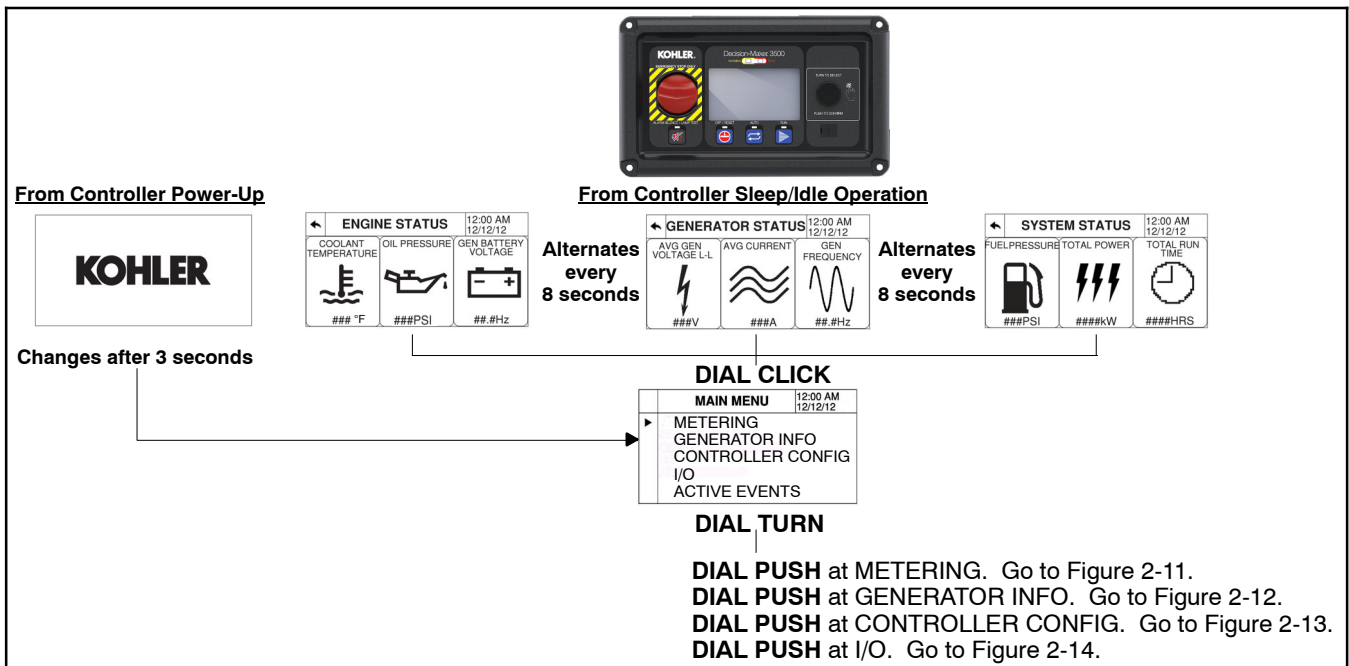


Figure 2-10 Decision-Maker 3500 Controller Information Menu Structure

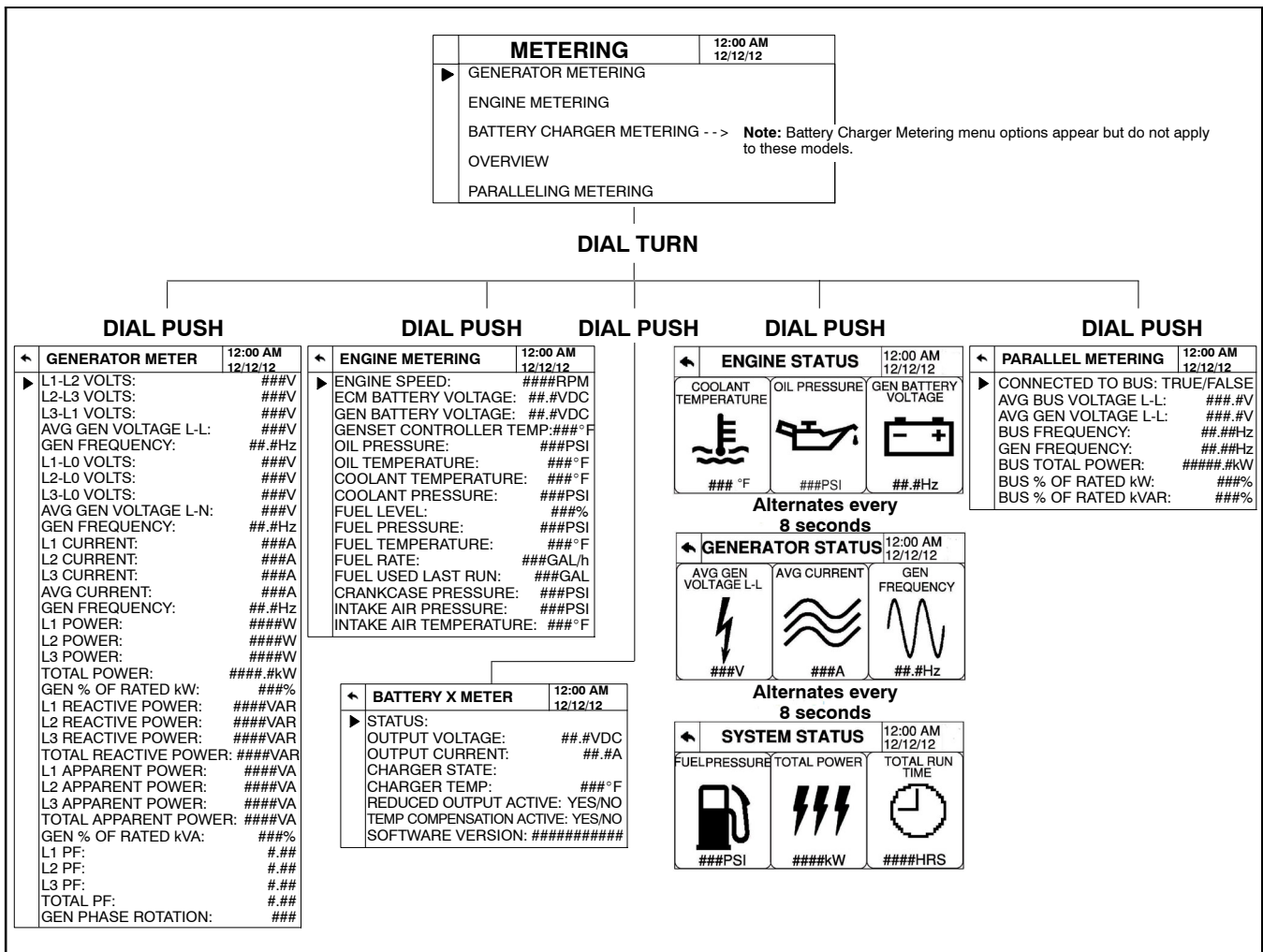


Figure 2-11 Metering Menu

Figure 2-12 Generator Information Menu

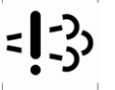
Indicator	Symbol	Description	Action
DEF Indicator On Steady	Low DEF concentration: 	DEF tank has approximately 10% or less remaining.	Fill DEF tank.
	Low DEF level: 		
DEF Indicator Flashing	Low DEF concentration: 	DEF tank has 0% measurable volume and engine performance is reduced. DEF system has lost 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.

Figure 2-15 Emission Symbols (IMO Tier III Models)

2.8 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.

2.8.1 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/dealer for assistance.

Local Single Connection

A PC connects to the USB port of the generator set controller using a mini USB connector. See Figure 2-16.

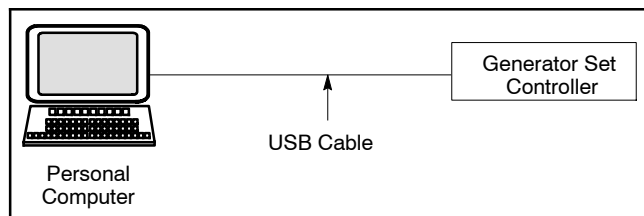


Figure 2-16 Local Single Connection

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 2-17.

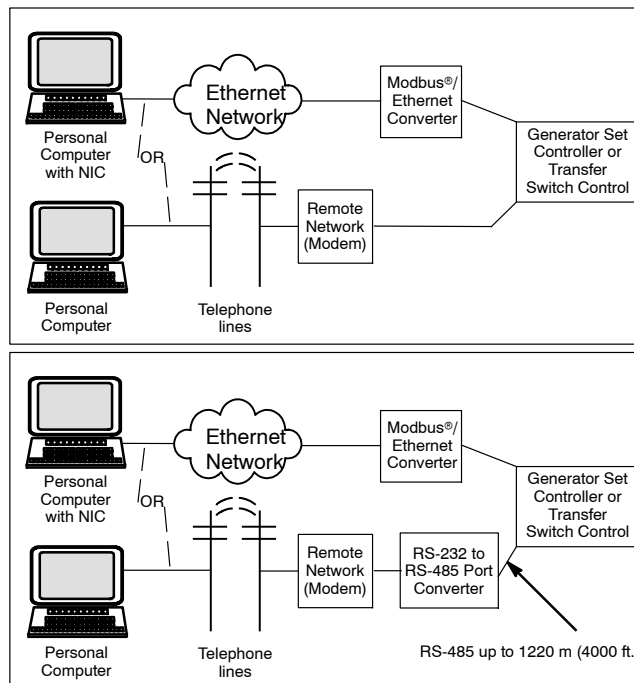


Figure 2-17 Remote Single Connections

2.8.2 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 2-18. 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.

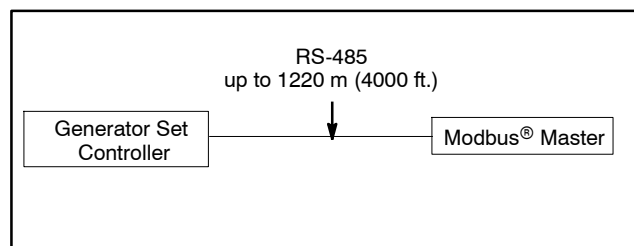
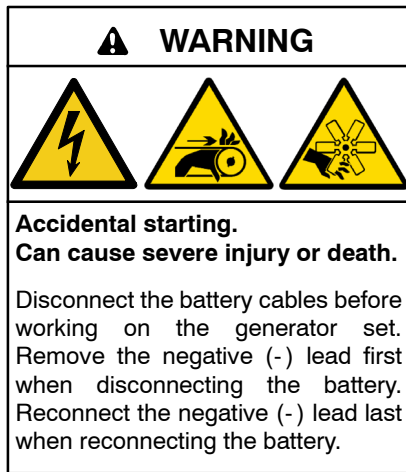


Figure 2-18 Modbus® Connections

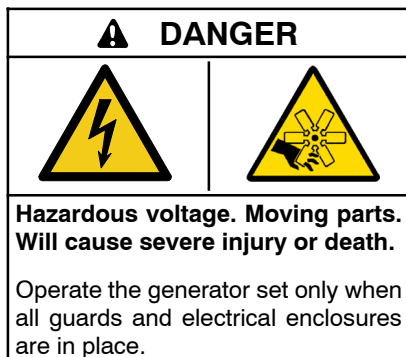
Section 3 Scheduled Maintenance

3.1 General Maintenance

Consult the prestart checklist in Section 2.1 for a list of routine checks.



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) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.



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.

NOTICE

Saltwater damage. Saltwater quickly deteriorates metals. Wipe up saltwater on and around the generator set and remove salt deposits from metal surfaces.

The engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

See the Safety Precautions and Instructions at the beginning of this manual before attempting to service, repair, or operate the generator set. Have an authorized distributor/dealer perform generator set service.

Engine Service. Perform generator set engine service at intervals specified by the engine operation manual.

Alternator Service. Perform generator set alternator service at intervals specified by the alternator operation and service manual.

Generator Set Service. Perform generator set service at the intervals specified by the generator set operation manual.

Routine Maintenance. Refer to the following generator set service schedule, the engine service schedule, and the hourmeter located on the generator set controller to determine when to schedule routine maintenance. Service more frequently generator sets that are subject to extreme weather or dusty or dirty conditions.

Service Log. Use the Operating Hour Service Log located in the back of this manual to document performed services.

Service Schedule. Perform maintenance on each item in the service schedule at the designated intervals for the life of the generator set. For example, an item requiring service every 100 hours or 3 months also requires service after 200 hours or 6 months, 300 hours or 9 months, and so on.

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.

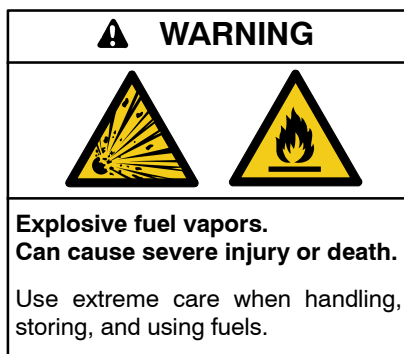
3.2 Alternator Service

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

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

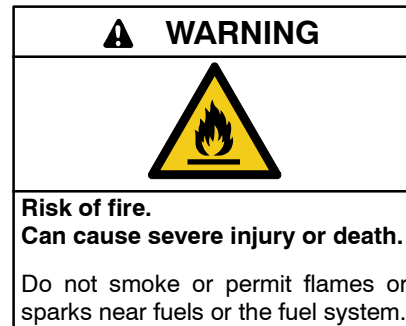
See the Safety Precautions and Instructions at the beginning of this manual before attempting to service, repair, or operate the generator set. Have an authorized distributor/dealer perform generator set service.

3.3 Engine Service



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.

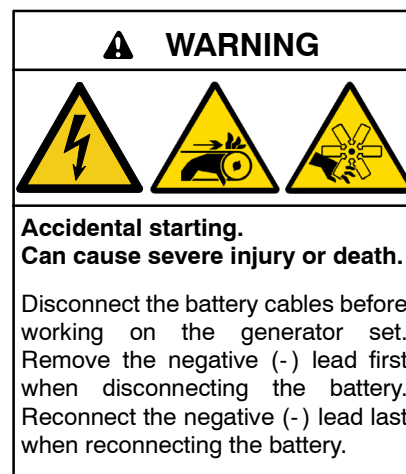
Draining the fuel system. Explosive fuel vapors can cause severe injury or death. Spilled fuel can cause an explosion. Use a container to catch fuel when draining the fuel system. Wipe up spilled fuel after draining the system.



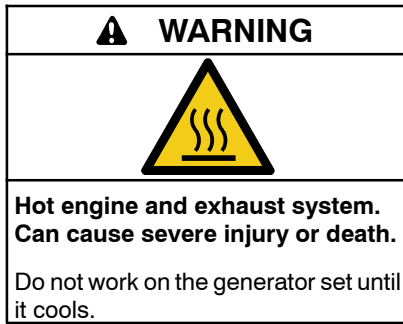
Servicing the air cleaner. A sudden backfire can cause severe injury or death. Do not operate the generator set with the air cleaner/silencer removed.

NOTICE

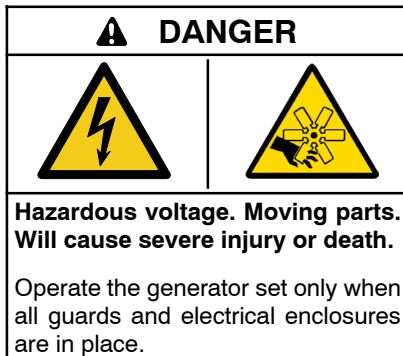
Saltwater damage. Saltwater quickly deteriorates metals. Wipe up saltwater on and around the generator set and remove salt deposits from metal surfaces.



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.

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.

Disconnecting the electrical load. Hazardous voltage will cause severe injury or death. Disconnect the generator set from the load by turning off the line circuit breaker or by disconnecting the generator set output leads from the transfer switch and heavily taping the ends of the leads. High voltage transferred to the load during testing may cause personal injury and equipment damage. Do not use the safeguard circuit breaker in place of the line circuit breaker. The safeguard circuit breaker does not disconnect the generator set from the load.

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

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

See the Safety Precautions and Instructions at the beginning of this manual before attempting to service, repair, or operate the generator set. Have an authorized distributor/dealer perform generator set service.

3.4 Generator Set Service Schedule

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

Perform Service at Intervals Indicated (X)	Reference Section	Daily	Every 200 Hrs. or 3 Months	Every 500 Hrs. or 1 Year	Every 1000 Hrs. or as shown
Lubricating Oil System					
Check the oil level	Eng. O/M	X			
Change the oil	Eng. O/M			X	
Clean the centrifugal oil cleaner	Eng. O/M			X	
Change the oil filter(s)	Eng. O/M			X	
Cooling System					
Check the coolant level	Eng. O/M	X			
Check the anticorrosion zinc anode(s)	Eng. O/M			X	
Check the seawater outlet and clean as necessary	3.6	X			
Check the function of the siphon break, if equipped			X		
Check/replace the seawater pump impeller †	Eng. O/M			X	
Check the coolant antifreeze and corrosion protection	Eng. O/M	X (At 1 st start)			X (Every 2000 hrs.) Minimum every yr.
Change the coolant and clean the cooling system	Eng. O/M				X (Every 6000 hrs.) Minimum every 5 yrs.
Fuel System					
Check the fuel level	Eng. O/M	X			
Drain the water separating prefilter	Eng. O/M			X (Every 500 hrs.)	
Change the fuel filters	Eng. O/M				X (Every 1000 hrs.) Minimum every 5 yrs.
Exhaust System					
Inspect the exhaust system components †	3.6	X (Before operation)			
Check the exhaust gas condition. If the exhaust is blue or black, contact your local distributor/dealer	3.6	X (During operation)			
Clean the exhaust/water mixing elbow †	3.6			X	
Inspect the complete exhaust system §	2.2, 3.6				X Minimum every yr.
Engine and Mounting					
Check for water, fuel, coolant, and oil leakage, rectify as necessary †‡		X			
Check the drive belt ‡	Eng. O/M	X (At 1 st start)			X Minimum every yr.
Check/adjust valve clearances and unit injectors §	Eng. O/M			X (1 st time)	X (Every 2000 hrs.)
Change the reductant filters §	Eng. O/M			X	
Check the mounting bolts/vibromounts and tighten if necessary				X	
* Consult the battery manufacturer's instructions † Consult your local distributor/dealer for service ‡ Read the WARNING found at the beginning of the manual regarding moving parts § Should be performed by your local distributor/dealer					

Perform Service at Intervals Indicated (X)	Reference Section	Daily	Every 200 Hrs. or 3 Months	Every 500 Hrs. or 1 Year	Every 1000 Hrs or as shown
Air Cleaner					
Consult the vacuum indicator	Eng. O/M	X			
Change the filter element	Eng. O/M				X (Every 2000 hrs.) Minimum every 5 yrs
Electrical System					
Keep the battery charged and in good condition *		X			
Check and tighten electrical connections		X			
Clean the battery and battery cables					X Minimum every yr.
Generator					
Test run the generator set	2.5	X (Weekly)			
Blow dust out of the generator †	3.1				X Minimum every yr.
Alternator					
Clean alternator exterior and interior	Alt. O/S/M	X (Every 15 days)			
General cleaning	Alt. O/S/M			X (Every 400 hrs.)	
Visual inspection	Alt. O/S/M				X (Every 2500 hrs.)
Verify winding state §	Alt. O/S/M				X (Every 2500 hrs.)
Verify correct alternator operation §	Alt. O/S/M				X (Every 2500 hrs.)
Check tightening torque §	Alt. O/S/M				X (Every 2500 hrs.)
Maintenance and potential replacement of bearings §	Alt. O/S/M				X (Every 4000 hrs.)
Check winding state and diode bridge fastening §	Alt. O/S/M				X (Every 8000 hrs./ 1 yr.)
Verify correct PMG fastening §	Alt. O/S/M				X (Every 8000 hrs./ 1 yr.)
Clean windings §	Alt. O/S/M				X (Every 20000 to 25000 hrs.)
* Consult the battery manufacturer's instructions † Consult your local distributor/dealer for service ‡ Read the WARNING found at the beginning of the manual regarding moving parts § Should be performed by your local distributor/dealer					

3.5 Cooling System

⚠ WARNING

Hot coolant and steam. Can cause severe injury or death. Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure. Fill system before starting unit.

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.

3.5.1 Impeller Inspection and Replacement Procedure

See Section 1.1, Service Views for the location of the seawater pump. Check and change the seawater pump impeller at the interval specified in the service schedule. Follow the instructions included with the impeller kit. If the instructions are not included with the kit, use the following procedure:

Impeller Inspection and Replacement Procedure:

Note: Always keep a spare impeller on board. The impeller can be deformed during extended periods of inactivity. Replace the impeller before starting or remove the impeller before longer periods of stoppage.

1. Close the seacock.
2. Drain the seawater circuit as described in the supplied Engine Operation Manual.
3. Remove the seawater pump cap.
4. Check that the vanes of the impeller are not heavily splintered or damaged.

Note: If the impeller requires frequent replacement, improve seawater cleaning (refer to the Engine Operation Manual).

5. Remove the impeller using a puller tool. See Figure 3-1.

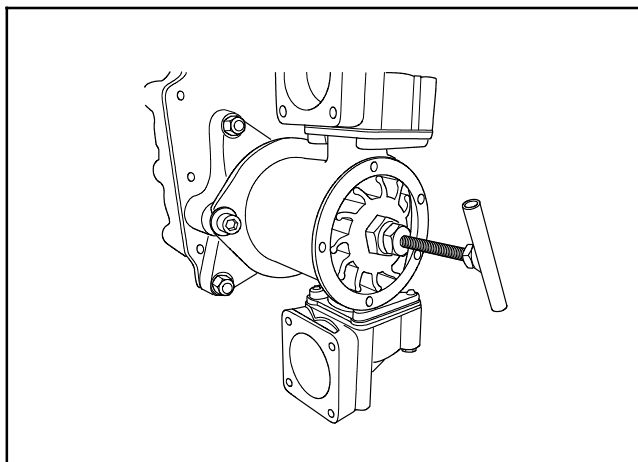


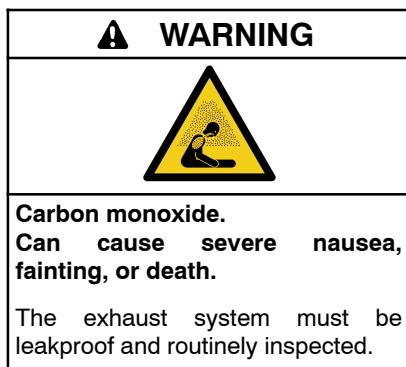
Figure 3-1 Impeller Replacement

6. When installing the new impeller, bend the vanes in the same direction as on the old one.
7. Fit a new impeller and cap. Check that the cap seal is not hard or damaged.

Note: Cover (M6 x 12) 7.5 Nm.

8. Open the seacock.
9. Start the generator set and check for leaks.
10. Stop the generator set and repair leaks or replace damaged or worn components.

3.6 Exhaust System



Inspecting the exhaust system. Carbon monoxide can cause severe nausea, fainting, or death. For the safety of the craft's occupants, install a carbon monoxide detector. Never operate the generator set without a functioning carbon monoxide detector. Inspect the detector before each generator set use.

At the interval specified in the service schedule, inspect the exhaust system components (exhaust manifold, mixing elbow, exhaust hose, hose clamps, silencer, and outlet flapper) for cracks, leaks, and corrosion.

Ensure that the carbon monoxide detector(s) is (1) in the craft, (2) functional, and (3) energized whenever the generator set operates.

For your safety: Never operate the generator set without a functioning carbon monoxide detector(s) for your safety and the safety of others on your vessel.

Exhaust System Inspection Points

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

- Check the hoses for softness, cracks, leaks, or dents. Replace the hoses as needed.
- Check for corroded or broken metal parts and replace them as needed.
- Check for loose, corroded, or missing clamps. Tighten or replace the hose clamps and/or hangers as needed.
- Check that the exhaust outlet is unobstructed.
- Visually inspect the exhaust system 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.
- Check the thermal insulation wraps and secure if needed.

3.7 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.

See the generator set spec sheet or engine operation manual for DEF solution requirements. It is recommended that surplus DEF be stored in a cool, dry, and well ventilated area with a temperature range of 10°C-30°C (50°F-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.

3.8 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.

Consult the engine operation manual for engine-specific long-term storage procedures.

3.8.1 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.

3.8.2 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.

3.8.3 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 service manual.

3.8.4 Exterior

Prepare the exterior for storage as follows:

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.

3.8.5 Battery

Perform battery storage after all other storage procedures.

1. Place the generator set master switch in the OFF/RESET position.
2. Disconnect the battery(ies), negative (-) lead first.
3. Clean the battery. Refer to the battery manufacturer's instructions 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.
6. Maintain a full charge to extend battery life.

Section 4 Troubleshooting

This section contains generator set troubleshooting, diagnostic, and repair information.

Use the following charts as a quick troubleshooting reference. The table groups generator set faults and suggests likely causes and remedies. The table also refers you to more detailed information including sections of this manual, the generator set service manual (S/M), the generator set installation manual (I/M), the alternator operation and service manual (Alt. O/S/M) and the engine service manual (Engine S/M) to correct the indicated problem.

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.

NOTICE

Fuse replacement. Replace fuses with fuses of the same ampere rating and type (for example: 3AB or 314, ceramic). Do not substitute clear glass-type fuses for ceramic fuses. Refer to the wiring diagram when the ampere rating is unknown or questionable.

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.

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															
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													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 the time delays.	Section 2, W/D, Gen. S/M
x				x									Emergency stop switch activated, if equipped.	Reset the emergency stop switch.	Section 2
										x			Controller firmware error.	Review the controller display troubleshooting chart.	Section 4.1
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.	—
			x										Wiring, terminals, or pin in the exciter field open.	Check for continuity.	Alt. O/S/M or W/D
			x										Main field (rotor) inoperative (open or grounded).	Test and/or replace the rotor.†	Alt. O/S/M
			x										Stator inoperative (open or grounded).	Test and/or replace the stator.†	Alt. O/S/M
									x				Vibration excessive.	Tighten loose components.†	—
			x	x									Voltage regulator settings incorrect.	Adjust the voltage regulator.	SiteTech O/M
* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; Alt.—Alternator; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; O/S/M—Operation/Service Manual; W/D—Wiring Diagram															
† 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				
Electrical System (DC circuits)															
x	x												Battery connections loose, corroded, or incorrect.	Verify that the battery connections are correct, clean, and tight.	—
x	x												Battery weak or dead.	Recharge or replace the battery. The spec sheet provides recommended battery CCA rating.	Eng. O/M, 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
					x								High exhaust temperature switch inoperative.	Replace the inoperative switch.	Gen. S/M or W/D
Engine															
	x	x			x			x					Air cleaner/backfire flame arrestor clogged.	Clean or replace the filter element.	Eng. O/M
	x	x				x		x	x				Compression weak.	Check the compression.†	Eng. S/M
			x		x	x		x	x				Engine overload.	Reduce the electrical load. See the generator set installation manual for wattage specifications.	I/M
									x				Exhaust system leak.	Inspect the exhaust system. Replace the inoperative exhaust system components.†	Section 3, I/M
									x				Exhaust system not securely installed.	Inspect the exhaust system. Tighten the loose exhaust system components.†	Section 3, I/M
		x	x		x			x					Governor inoperative.	Adjust the governor.†	Gen. S/M
					x				x				Valve clearance incorrect.	Adjust the valves.†	Eng. O/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
* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; Alt.—Alternator; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; O/S/M—Operation/Service Manual; W/D—Wiring Diagram															
† Have an authorized service distributor/dealer perform this service.															

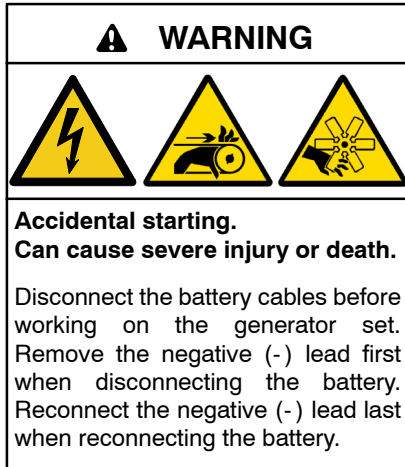
Trouble Symptoms												Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise	Displays error message/locks up	Exercise run time and/or event records inoperative			
Cooling System														
						x		x				Air openings clogged.	Clean the air openings.	—
						x						Impeller inoperative.	Replace the impeller.	Section 3
						x		x				Seawater strainer clogged or restricted.	Clean the strainer.	Section 3
				x								High temperature shutdown.	Allow the engine to cool down. Then troubleshoot the cooling system.	Eng. O/M
				x								Low coolant level shutdown, if equipped.	Restore the coolant to normal operating level.	Eng. O/M
						x						Coolant level low.	Restore the coolant to normal operating level.	Eng. O/M
						x						Cooling water pump inoperative.	Tighten or replace the belt. Replace the water pump.	Eng. O/M or Eng. S/M
						x						Thermostat inoperative.	Replace the thermostat.	Eng. S/M
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							Air in fuel system (diesel only).	Bleed the diesel fuel system.	Eng. O/M
	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	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
	x	x		x	x							Fuel filter restriction.	Clean or replace the fuel filter.†	Eng. O/M
Engine Lubrication 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; Alt.—Alternator; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; O/S/M—Operation/Service Manual; W/D—Wiring Diagram														
† Have an authorized service distributor/dealer perform this service.														

4.1 Controller Display and Voltage Regulation Troubleshooting Chart

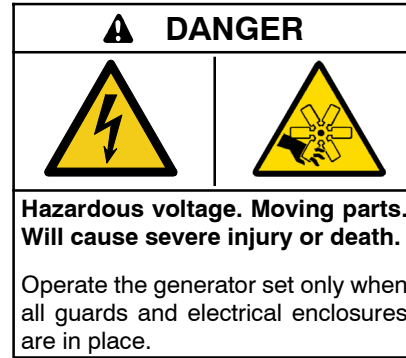
Trouble Symptoms	Probable Causes	Recommended Actions	Section or Publication Reference*
Controller Display and Voltage Regulator			
Display is black.	No/low battery charge.	Recharge/replace battery.	—
Display shows single segment.	Low battery voltage.	Recharge battery.	—
Display shows an error message.	Controller firmware fault has occurred or pushbutton/ rotary selector dial entry error.	Review the Error Message section.	—
Display locks up.	No/low battery charge.	Recharge/replace battery.	—
Output voltage ramps.	Defective 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 1.5.3 Graphical Display
* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; Alt.—Alternator; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; O/S/M—Operation/Service Manual; W/D—Wiring Diagram † Have an authorized service distributor/dealer perform this service.			

Notes

Section 5 Wiring Diagrams



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) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.



Grounding electrical equipment. Hazardous voltage will cause severe injury or death. Electrocuting 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.

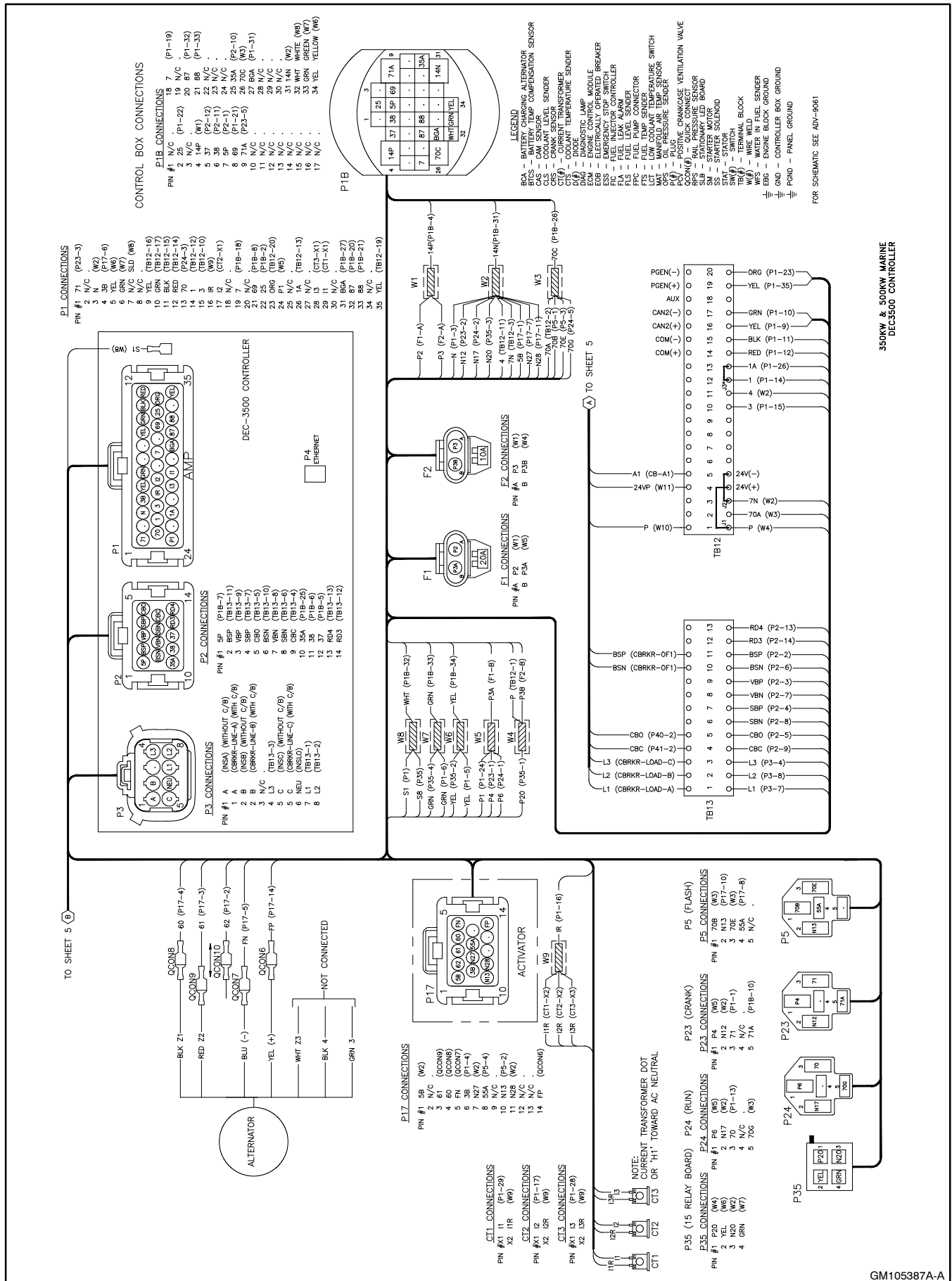
Short circuits. Hazardous voltage/current will cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

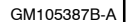
Wiring Diagram/Schematic Reference Table

Model	Wiring Diagram	Figure	Schematic	Figure
350/500EOZCS and 300/450EFOZCS	GM105387A-A	Figure 5-1	ADV-9061A-A	Figure 5-6
	GM105387B-A	Figure 5-2	ADV-9061B-A	Figure 5-7
	GM105387C-A	Figure 5-3	ADV-9061C-A	Figure 5-8
	GM105387D-A	Figure 5-4	ADV-9061D-A	Figure 5-9
	GM105387E-A	Figure 5-5	ADV-9061E-A	Figure 5-10
			ADV-9061F-A	Figure 5-11
			ADV-9061G-A	Figure 5-12

Voltage Reconnection Reference Table

Model	Voltage Reconnection	Figure
350/500EOZCS and 300/450EFOZCS	ADV-5875	Figure 5-13





TP-7126 5/20

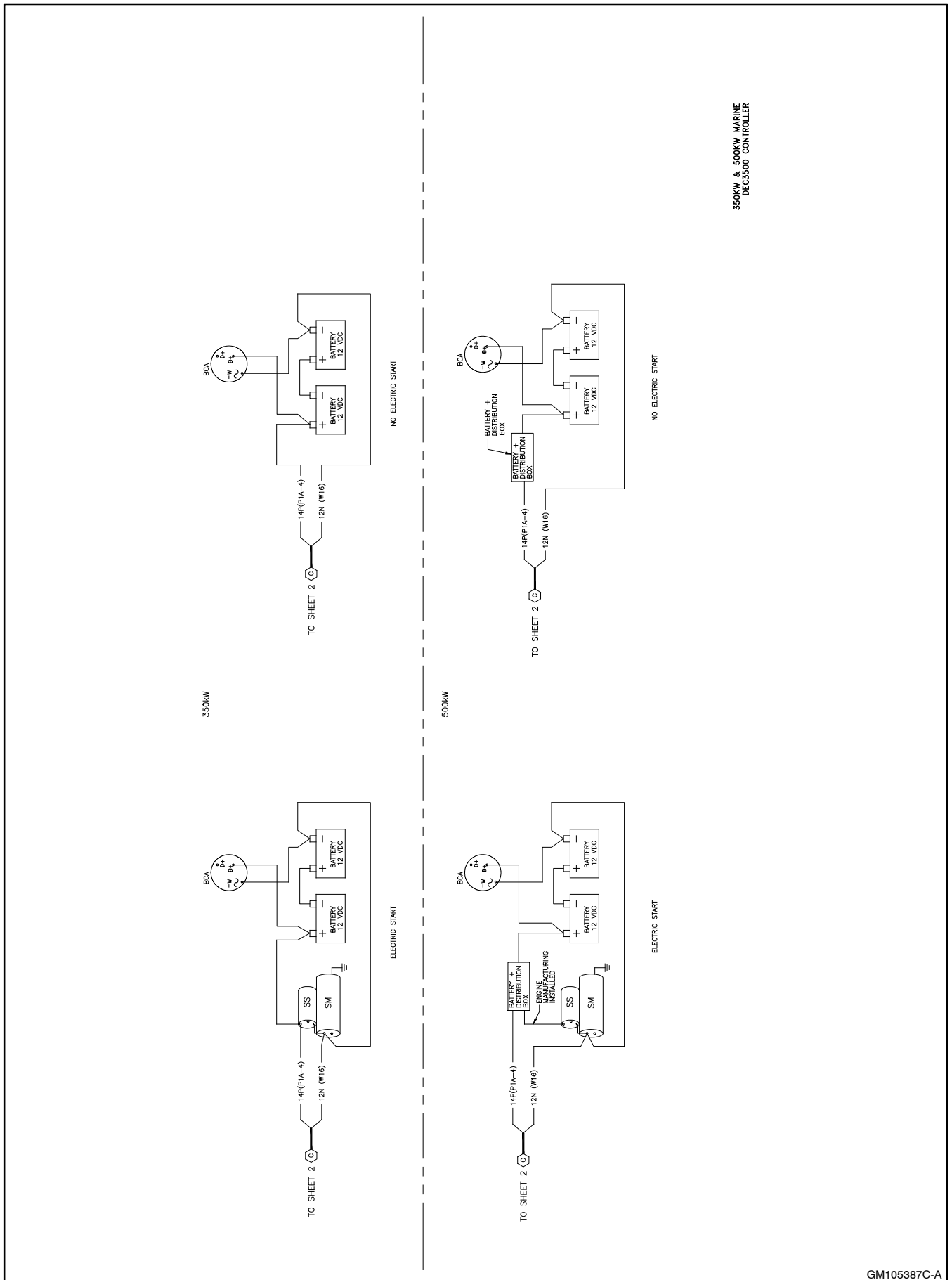
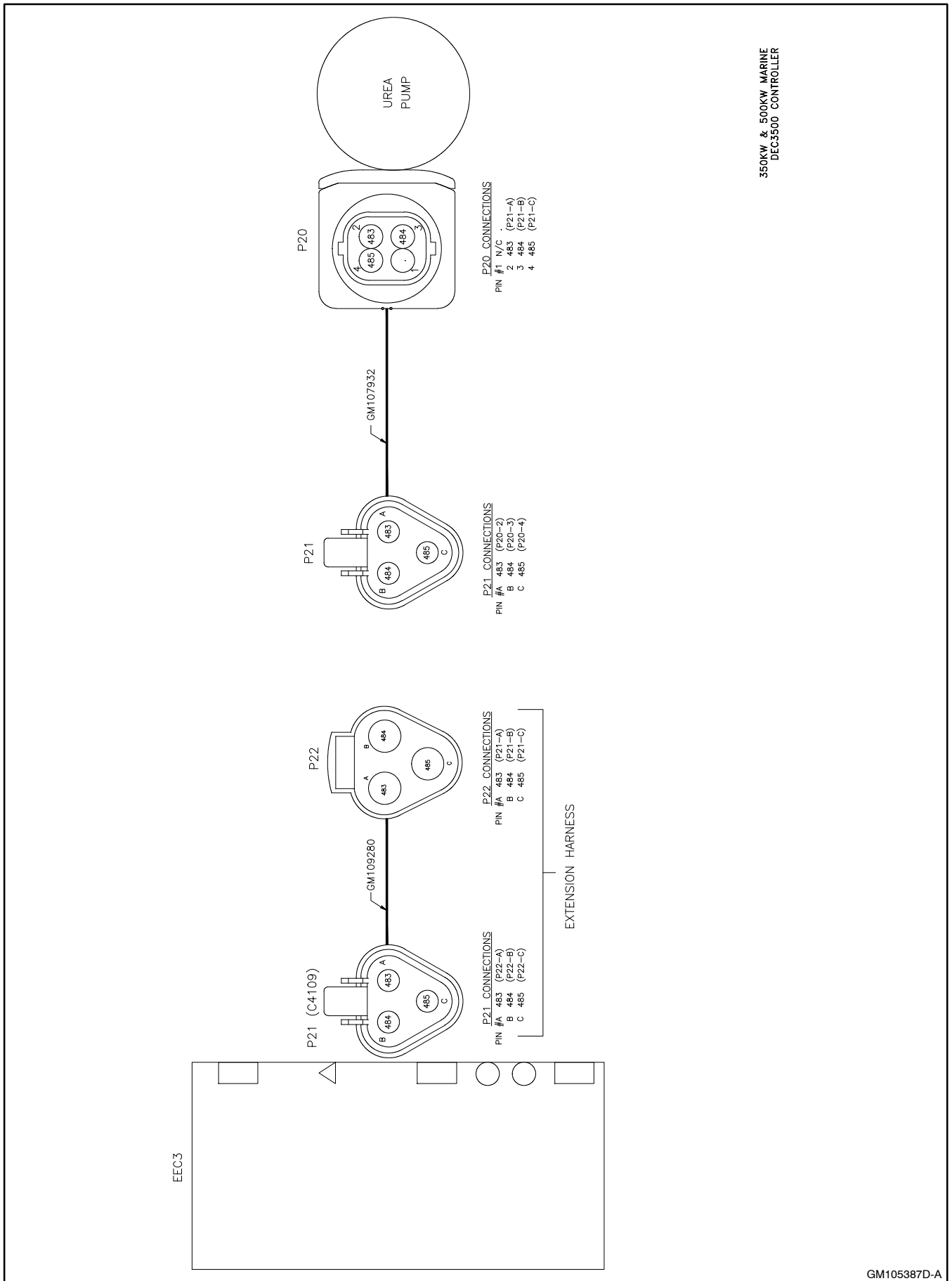


Figure 5-3 Wiring Diagram, Sheet 3 of 5, GM105387C



350KW & 500KW MARINE
DEC3500 CONTROLLER

Figure 5-4 Wiring Diagram, Sheet 4 of 5, GM105387D

GM105387D-A

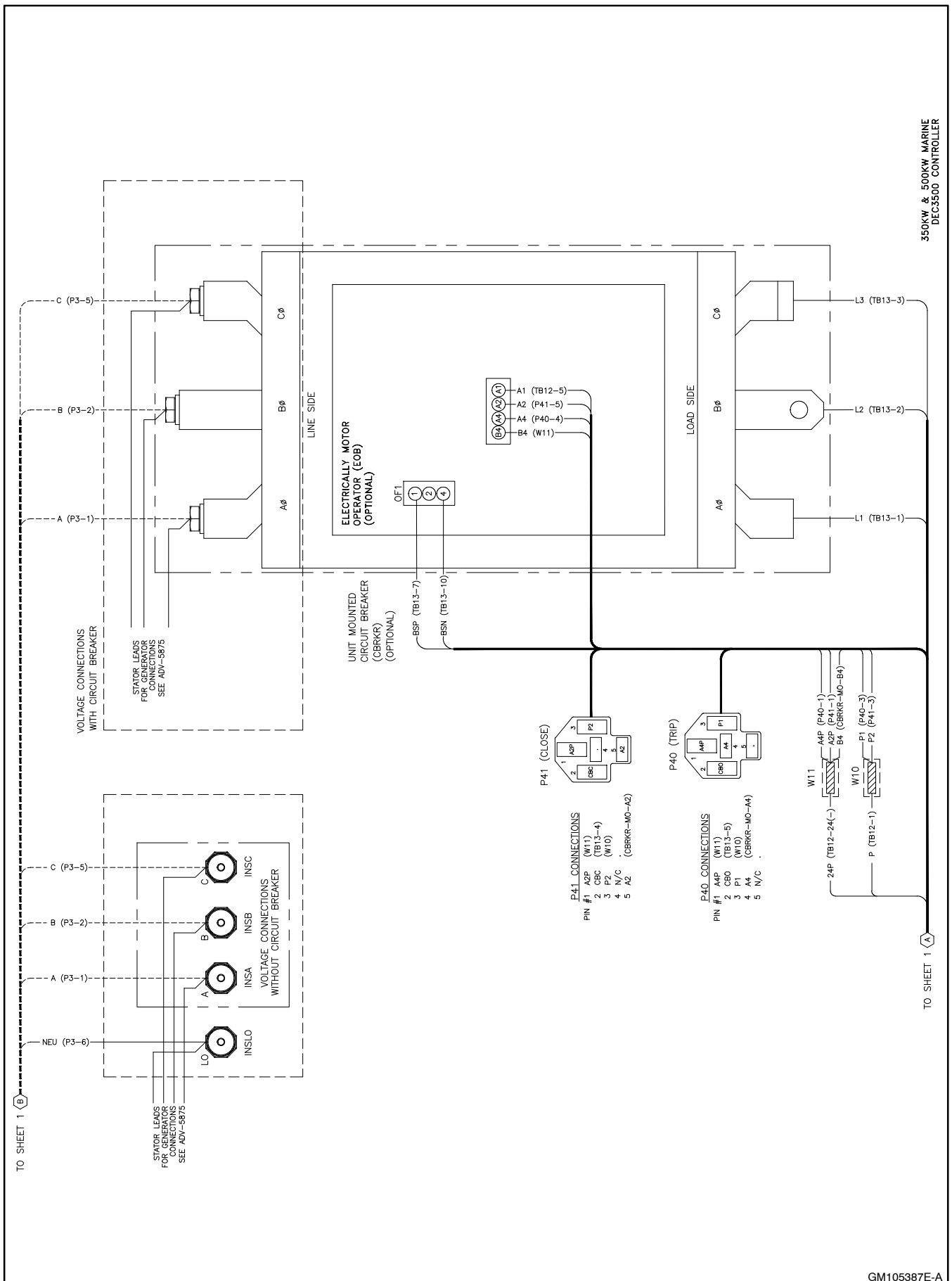
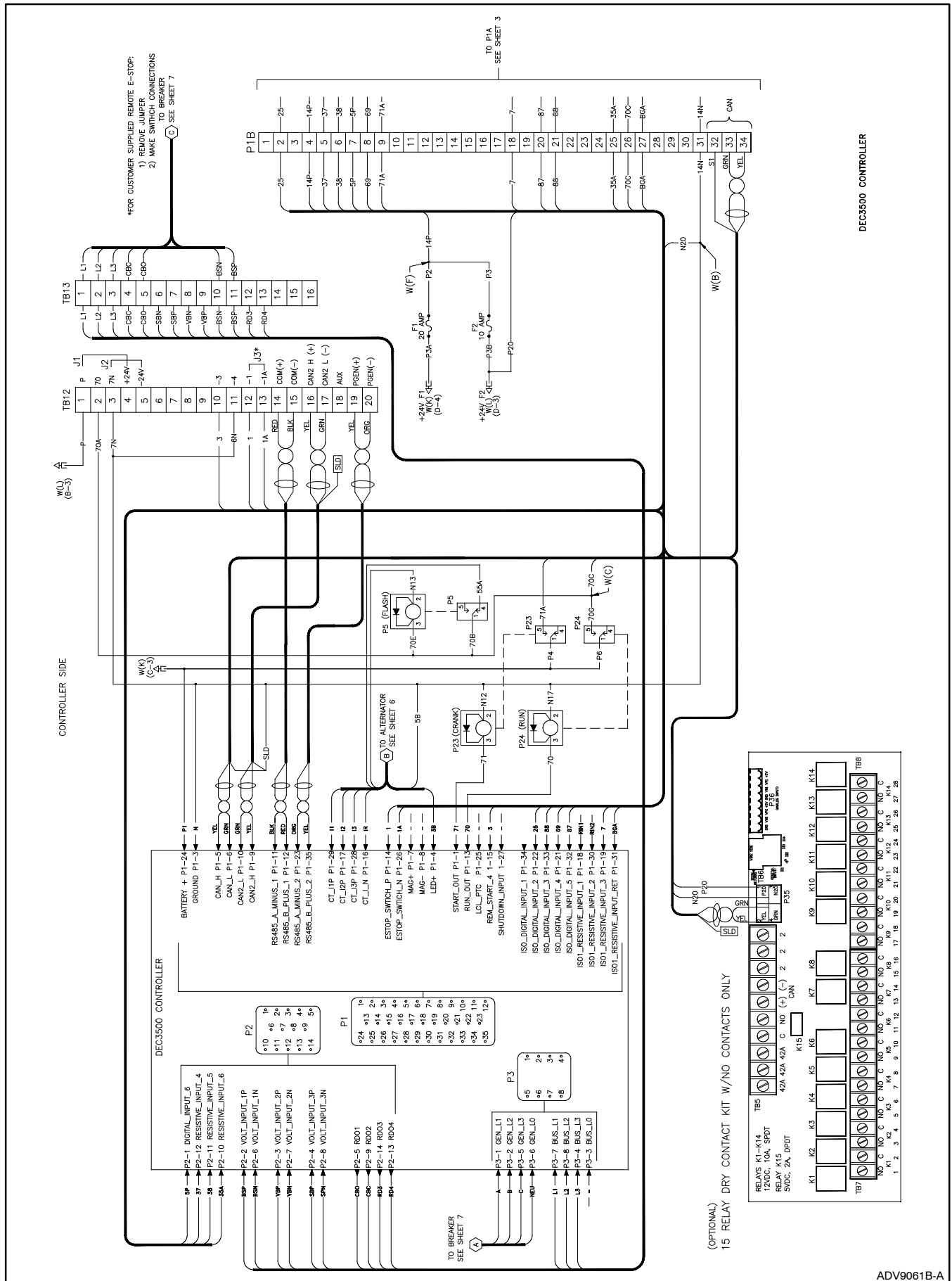
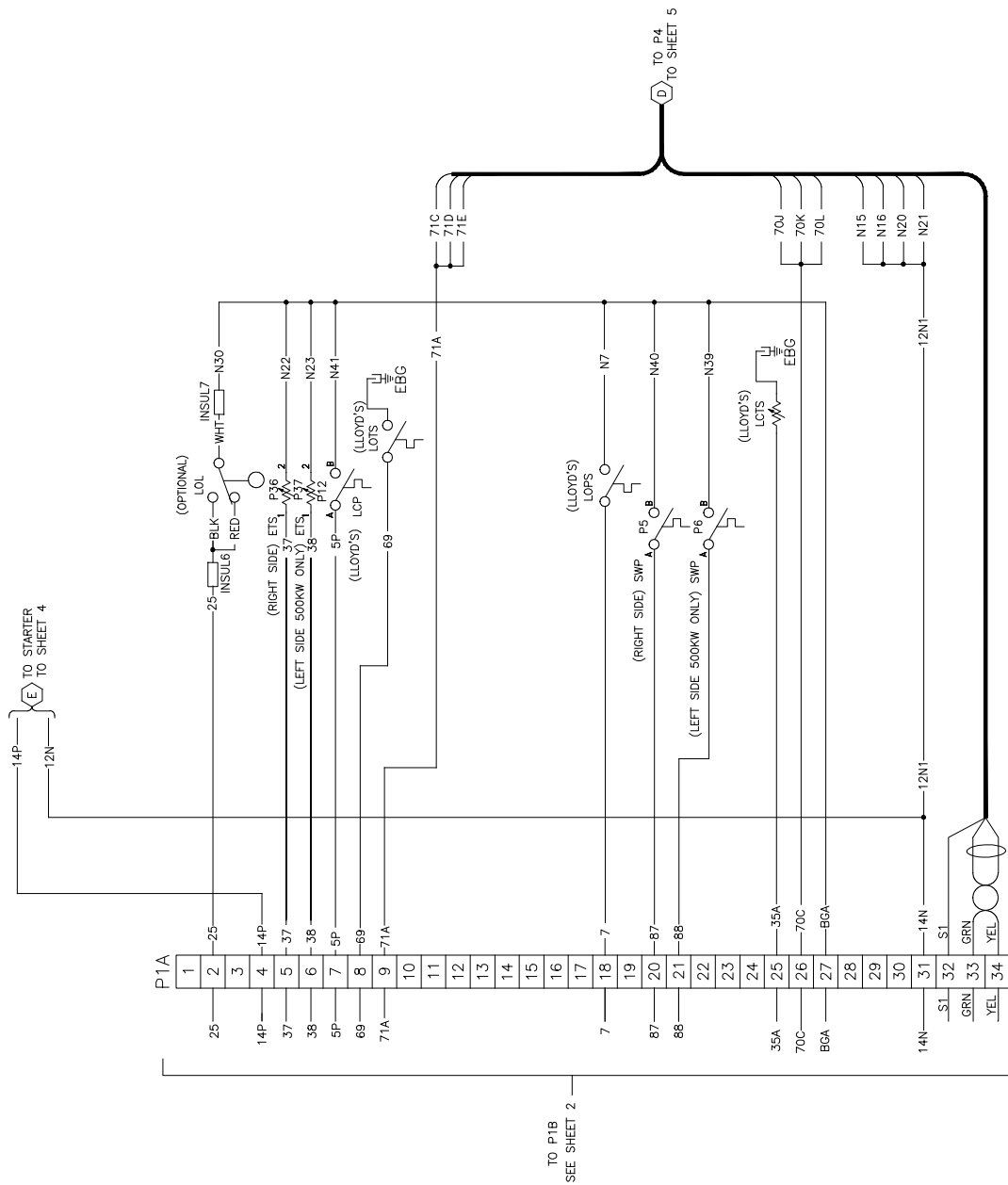


Figure 5-5 Wiring Diagram, Sheet 5 of 5, GM105387E



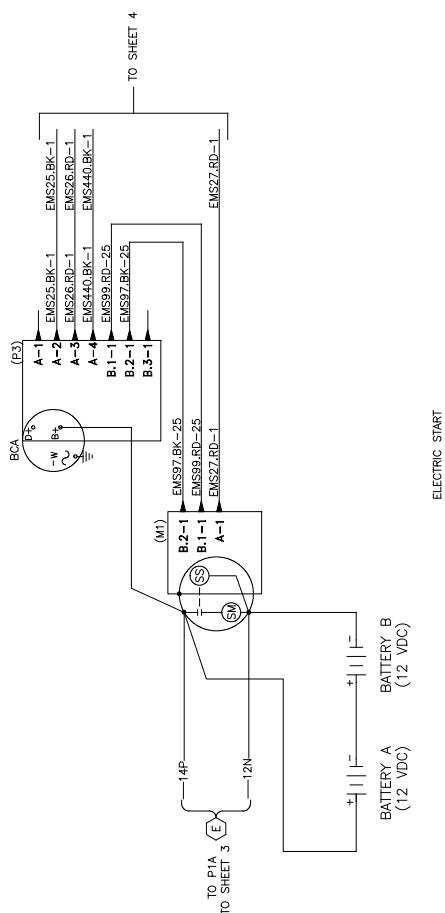
TP-7126 5/20



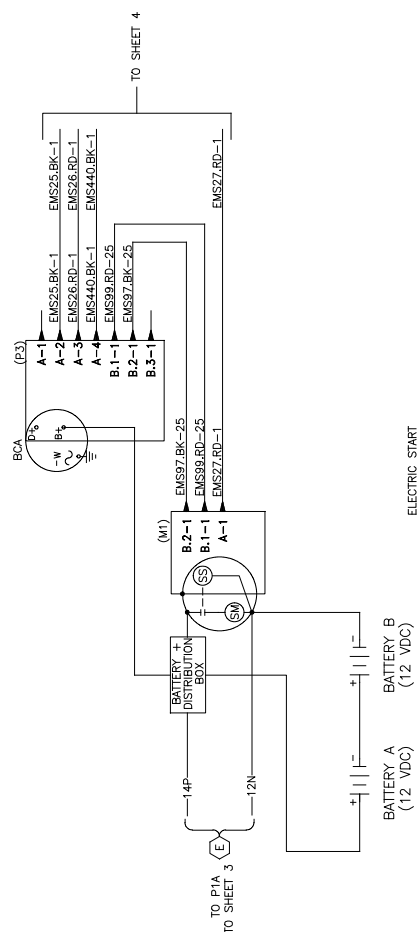


TP-7126 5/20

350kW

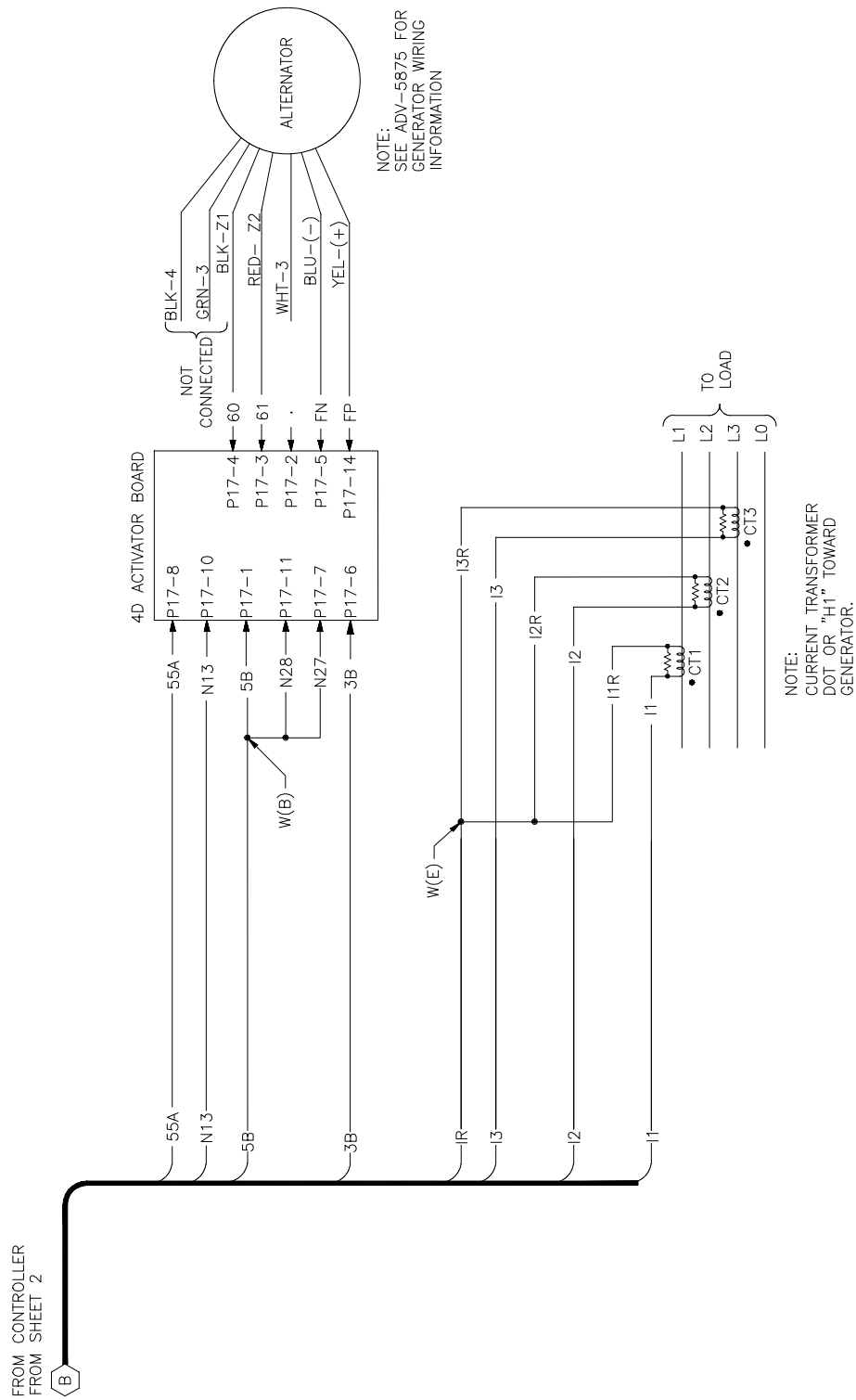


500kW



ADV9061D-A

Figure 5-9 Schematic, Sheet 4 of 7, ADV9061D



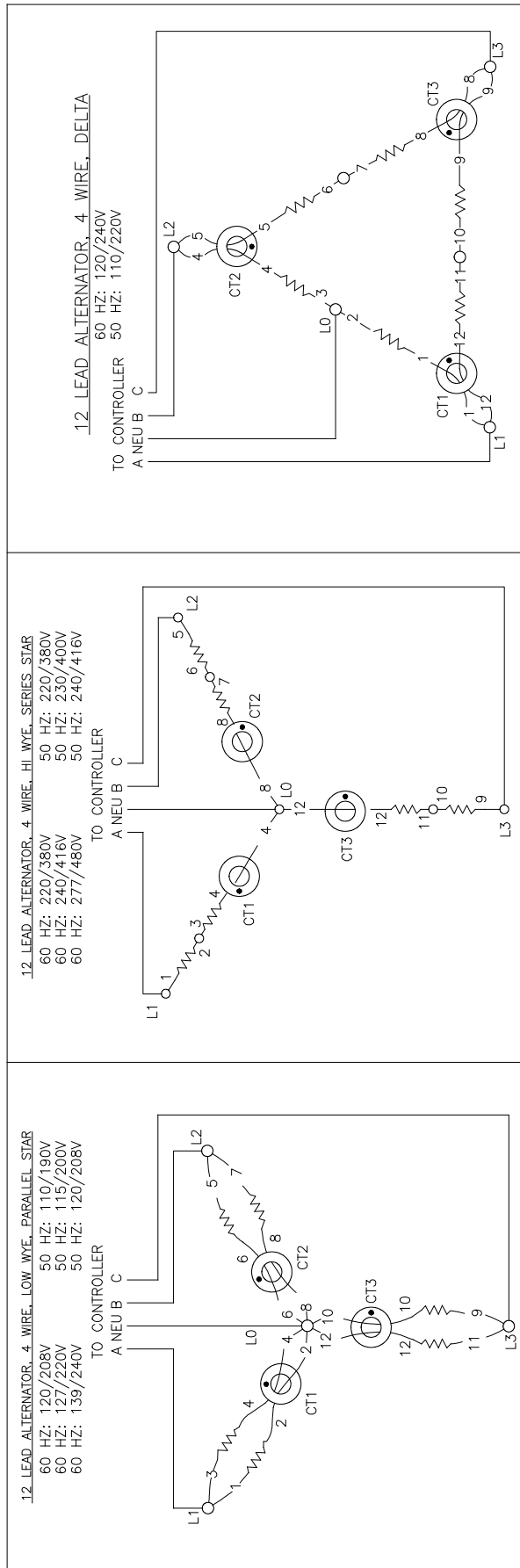
SCANIA S6 CONTROLLER

ADV9061F-A

Figure 5-11 Schematic, Sheet 6 of 7, ADV9061F



SCANIA S6 CONTROLLER



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 CONTROLLER
 MECC ALTE ALTERNATOR

ADV5875-AB

Figure 5-13 Reconnection Diagram, ADV-5875

Notes

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere	CG	center of gravity	F	Fahrenheit, female
ABDC	after bottom dead center	CID	cubic inch displacement	fglass.	fiberglass
AC	alternating current	CL	centerline	FHM	flat head machine (screw)
A/D	analog to digital	cm	centimeter	fl. oz.	fluid ounce
ADC	analog to digital converter	CMOS	complementary metal oxide substrate (semiconductor)	flex.	flexible
adj.	adjust, adjustment	cogen.	cogeneration	freq.	frequency
ADV	advertising dimensional drawing	com	communications (port)	FS	full scale
AHWT	anticipatory high water temperature	coml	commercial	ft.	foot, feet
AISI	American Iron and Steel Institute	Coml/Rec	Commercial/Recreational	ft. lb.	foot pounds (torque)
ALOP	anticipatory low oil pressure	conn.	connection	ft./min.	feet per minute
alt.	alternator	cont.	continued	g	gram
Al	aluminum	CPVC	chlorinated polyvinyl chloride	ga.	gauge (meters, wire size)
ANSI	American National Standards Institute (formerly American Standards Association, ASA)	crit.	critical	gal.	gallon
AO	anticipatory only	CRT	cathode ray tube	gen.	generator
API	American Petroleum Institute	CSA	Canadian Standards Association	genset	generator set
approx.	approximate, approximately	CT	current transformer	GFI	ground fault interrupter
AR	as required, as requested	Cu	copper	GND, ⊕	ground
AS	as supplied, as stated, as suggested	cu. in.	cubic inch	gov.	governor
ASE	American Society of Engineers	cw.	clockwise	gph	gallons per hour
ASME	American Society of Mechanical Engineers	CWC	city water-cooled	gpm	gallons per minute
assy.	assembly	cyl.	cylinder	gr.	grade, gross
ASTM	American Society for Testing Materials	D/A	digital to analog	GRD	equipment ground
ATDC	after top dead center	DAC	digital to analog converter	gr. wt.	gross weight
ATS	automatic transfer switch	dB	decibel	H x W x D	height by width by depth
auto.	automatic	dBA	decibel (A weighted)	HC	hex cap
aux.	auxiliary	DC	direct current	HCHT	high cylinder head temperature
avg.	average	DCR	direct current resistance	HD	heavy duty
AVR	automatic voltage regulator	deg., °	degree	HET	high exhaust temperature, high engine temperature
AWG	American Wire Gauge	dept.	department	hex	hexagon
AWM	appliance wiring material	dia.	diameter	Hg	mercury (element)
bat.	battery	DI/EO	dual inlet/end outlet	HH	hex head
BBDC	before bottom dead center	DIN	Deutsches Institut für Normung e. V. (also Deutsche Industrie Normenausschuss)	HHC	hex head cap
BC	battery charger, battery charging	DIP	dual inline package	HP	horsepower
BCA	battery charging alternator	DPDT	double-pole, double-throw	hr.	hour
BCI	Battery Council International	DPST	double-pole, single-throw	HS	heat shrink
BDC	before dead center	DS	disconnect switch	hsg.	housing
BHP	brake horsepower	DVR	digital voltage regulator	HVAC	heating, ventilation, and air conditioning
blk.	black (paint color), block (engine)	E, emer.	emergency (power source)	HWT	high water temperature
blk. htr.	block heater	EDI	electronic data interchange	Hz	hertz (cycles per second)
BMEP	brake mean effective pressure	EFR	emergency frequency relay	IC	integrated circuit
bps	bits per second	e.g.	for example (<i>exempli gratia</i>)	ID	inside diameter, identification
br.	brass	EG	electronic governor	IEC	International Electrotechnical Commission
BTDC	before top dead center	EGSA	Electrical Generating Systems Association	IEEE	Institute of Electrical and Electronics Engineers
Btu	British thermal unit	EIA	Electronic Industries Association	IMS	improved motor starting
Btu/min.	British thermal units per minute	EI/EO	end inlet/end outlet	in.	inch
C	Celsius, centigrade	EMI	electromagnetic interference	in. H ₂ O	inches of water
cal.	calorie	emiss.	emission	in. Hg	inches of mercury
CARB	California Air Resources Board	eng.	engine	in. lb.	inch pounds
CB	circuit breaker	EPA	Environmental Protection Agency	Inc.	incorporated
cc	cubic centimeter	EPS	emergency power system	ind.	industrial
CCA	cold cranking amps	ER	emergency relay	int.	internal
ccw.	counterclockwise	ES	engineering special, engineered special	int./ext.	internal/external
CEC	Canadian Electrical Code	ESD	electrostatic discharge	I/O	input/output
cert.	certificate, certification, certified	est.	estimated	IP	iron pipe
cfh	cubic feet per hour	E-Stop	emergency stop	ISO	International Organization for Standardization
cfm	cubic feet per minute	etc.	et cetera (and so forth)	J	joule
		exh.	exhaust	JIS	Japanese Industry Standard
		ext.	external	k	kilo (1000)
				K	kelvin
				kA	kiloampere

KB	kilobyte (2 ¹⁰ bytes)	mtg.	mounting	rly.	relay
kg	kilogram	MW	megawatt	rms	root mean square
kg/cm ²	kilograms per square centimeter	mW	milliwatt	rnd.	round
kgm	kilogram-meter	μF	microfarad	ROM	read only memory
kg/m ³	kilograms per cubic meter	N, norm.	normal (power source)	rot.	rotate, rotating
kHz	kilohertz	NA	not available, not applicable	rpm	revolutions per minute
kJ	kilojoule	nat. gas	natural gas	RS	right side
km	kilometer	NBS	National Bureau of Standards	RTV	room temperature vulcanization
kOhm, kΩ	kilo-ohm	NC	normally closed	SAE	Society of Automotive Engineers
kPa	kilopascal	NEC	National Electrical Code	scfm	standard cubic feet per minute
kph	kilometers per hour	NEMA	National Electrical Manufacturers Association	SCR	silicon controlled rectifier
kV	kilovolt	NFPA	National Fire Protection Association	s, sec.	second
kVA	kilovolt ampere	Nm	newton meter	SI	<i>Système international d'unités</i> , International System of Units
kVAR	kilovolt ampere reactive	NO	normally open	SI/EO	side in/end out
kW	kilowatt	no., nos.	number, numbers	sil.	silencer
kWh	kilowatt-hour	NPS	National Pipe, Straight	SN	serial number
kWm	kilowatt mechanical	NPSC	National Pipe, Straight-coupling	SPDT	single-pole, double-throw
L	liter	NPT	National Standard taper pipe thread per general use	SPST	single-pole, single-throw
LAN	local area network	NPTF	National Pipe, Taper-Fine	spec, specs	specification(s)
L x W x H	length by width by height	NR	not required, normal relay	sq.	square
lb.	pound, pounds	ns	nanosecond	sq. cm	square centimeter
lbm/ft ³	pounds mass per cubic feet	OC	overcrank	sq. in.	square inch
LCB	line circuit breaker	OD	outside diameter	SS	stainless steel
LCD	liquid crystal display	OEM	original equipment manufacturer	std.	standard
ld. shd.	load shed	OF	overfrequency	stl.	steel
LED	light emitting diode	opt.	option, optional	tach.	tachometer
Lph	liters per hour	OS	oversize, overspeed	TD	time delay
Lpm	liters per minute	OSHA	Occupational Safety and Health Administration	TDC	top dead center
LOP	low oil pressure	OV	overvoltage	TDEC	time delay engine cooldown
LP	liquefied petroleum	oz.	ounce	TDEN	time delay emergency to normal
LPG	liquefied petroleum gas	p., pp.	page, pages	TDES	time delay engine start
LS	left side	PC	personal computer	TDNE	time delay normal to emergency
L _{wa}	sound power level, A weighted	PCB	printed circuit board	TDOE	time delay off to emergency
LWL	low water level	pF	picofarad	TDON	time delay off to normal
LWT	low water temperature	PF	power factor	temp.	temperature
m	meter, milli (1/1000)	ph., ∅	phase	term.	terminal
M	mega (10 ⁶ when used with SI units), male	PHC	Phillips head crimp (screw)	TIF	telephone influence factor
m ³	cubic meter	PHH	Phillips hex head (screw)	TIR	total indicator reading
m ³ /min.	cubic meters per minute	PHM	pan head machine (screw)	tol.	tolerance
mA	milliampere	PLC	programmable logic control	turbo.	turbocharger
man.	manual	PMG	permanent-magnet generator	typ.	typical (same in multiple locations)
max.	maximum	pot	potentiometer, potential	UF	underfrequency
MB	megabyte (2 ²⁰ bytes)	ppm	parts per million	UHF	ultrahigh frequency
MCM	one thousand circular mils	PROM	programmable read-only memory	UL	Underwriter's Laboratories, Inc.
MCCB	molded-case circuit breaker	psi	pounds per square inch	UNC	unified coarse thread (was NC)
meggar	megohmmeter	pt.	pint	UNF	unified fine thread (was NF)
MHz	megahertz	PTC	positive temperature coefficient	univ.	universal
mi.	mile	PTO	power takeoff	US	undersize, underspeed
mil	one one-thousandth of an inch	PVC	polyvinyl chloride	UV	ultraviolet, undervoltage
min.	minimum, minute	qt.	quart, quarts	V	volt
misc.	miscellaneous	qty.	quantity	VAC	volts alternating current
MJ	megajoule	R	replacement (emergency) power source	VAR	voltampere reactive
mJ	millijoule	rad.	radiator, radius	VDC	volts direct current
mm	millimeter	RAM	random access memory	VFD	vacuum fluorescent display
mOhm, mΩ	milliohm	RDO	relay driver output	VGA	video graphics adapter
MOhm, MΩ	megohm	ref.	reference	VHF	very high frequency
MOV	metal oxide varistor	rem.	remote	W	watt
MPa	megapascal	Res/Coml	Residential/Commercial	WCR	withstand and closing rating
mpg	miles per gallon	RFI	radio frequency interference	w/	with
mph	miles per hour	RH	round head	w/o	without
MS	military standard	RHM	round head machine (screw)	wt.	weight
m/sec.	meters per second			xfrm	transformer
MTBF	mean time between failure				
MTBO	mean time between overhauls				

Appendix B Operating Hour Service Log

Use the log below to keep a cumulative record of operating hours on your generator set and the dates required services were performed. Enter hours to the nearest quarter hour.

[illegible]

Notes

TP-7126 5/20b

Original Instructions (English)

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