

Service Manual

Controller

PowerCommand© 1.1

PowerCommand© 1.1R

PowerCommand© 1.2

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1 Important Safety Instructions

SAVE THESE INSTRUCTIONS - This manual contains important instructions that should be followed during installation and maintenance of the generator set and batteries.

Before operating the generator set, read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the equipment is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

1.1 Warning, Caution, and Note Styles Used in This Manual

The following safety styles and symbols found throughout this manual indicate potentially hazardous conditions to the operator, service personnel, or equipment.

DANGER

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

WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates information considered important, but not hazard-related (e.g., messages relating to property damage).

1.2 General Information

This manual should form part of the documentation package supplied by Cummins with specific generator sets. In the event that this manual has been supplied in isolation, please contact your authorized distributor.

NOTICE

It is in the operator's interest to read and understand all warnings and cautions contained within the documentation relevant to the generator set, its operation and daily maintenance.

1.2.1 General Safety Precautions

WARNING

Hot Pressurized Liquid

Contact with hot liquid can cause severe burns.

Do not open the pressure cap while the engine is running. Let the engine cool down before removing the cap. Turn the cap slowly and do not open it fully until the pressure has been relieved.

WARNING

Moving Parts

Moving parts can cause severe personal injury.

Use extreme caution around moving parts. All guards must be properly fastened to prevent unintended contact.

WARNING

Toxic Hazard

Used engine oils have been identified by some state and federal agencies to cause cancer or reproductive toxicity.

Do not ingest, breathe the fumes, or contact used oil when checking or changing engine oil. Wear protective gloves and face guard.

WARNING

Electrical Generating Equipment

Incorrect operation can cause severe personal injury or death.

Do not operate equipment when fatigued, or after consuming any alcohol or drug.

WARNING

Toxic Gases

Substances in exhaust gases have been identified by some state and federal agencies to cause cancer or reproductive toxicity.

Do not breathe in or come into contact with exhaust gases.

WARNING

Combustible Liquid

Ignition of combustible liquids is a fire or explosion hazard which can cause severe burns or death.

Do not store fuel, cleaners, oil, etc., near the generator set.

WARNING

High Noise Level

Generator sets in operation emit noise, which can cause hearing damage.

Wear appropriate ear protection at all times.

⚠ WARNING**Hot Surfaces**

Contact with hot surfaces can cause severe burns.

The unit is to be installed so that the risk of hot surface contact by people is minimized. Wear appropriate PPE when working on hot equipment and avoid contact with hot surfaces.

⚠ WARNING**Electrical Generating Equipment**

Incorrect operation and maintenance can result in severe personal injury or death.

Make sure that only suitably trained and experienced service personnel perform electrical and/or mechanical service.

⚠ WARNING**Toxic Hazard**

Ethylene glycol, used as an engine coolant, is toxic to humans and animals.

Wear appropriate PPE. Clean up coolant spills and dispose of used coolant in accordance with local environmental regulations.

⚠ WARNING**Combustible Liquid**

Ignition of combustible liquids is a fire or explosion hazard which can cause severe burns or death.

Do not use combustible liquids like ether.

⚠ WARNING**Automated Machinery**

Accidental or remote starting of the generator set can cause severe personal injury or death.

Isolate all auxiliary supplies and use an insulated wrench to disconnect the starting battery cables (negative [-] first).

⚠ WARNING**Fire Hazard**

Materials drawn into the generator set are a fire hazard. Fire can cause severe burns or death.

Make sure the generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.

⚠ WARNING**Fire Hazard**

Accumulated grease and oil are a fire hazard. Fire can cause severe burns or death.

Keep the generator set and the surrounding area clean and free from obstructions. Repair oil leaks promptly.

⚠ WARNING**Fall Hazard**

Falls can result in severe personal injury or death.

Make sure that suitable equipment for performing tasks at height are used in accordance with local guidelines and legislation.

⚠ WARNING**Fire Hazard**

Materials drawn into the generator set are a fire hazard. Fire can cause severe burns or death.

Keep the generator set and the surrounding area clean and free from obstructions.

⚠ WARNING**Pressurized System**

Pressurized systems can rupture/leak which can result in severe personal injury or death.

Use appropriate lock out/tag out safety procedures to isolate from all energy sources before performing any service tasks. Use PPE.

⚠ WARNING**Confined Areas**

Confined spaces or areas with restricted access or potential to entrap can cause severe personal injury or death.

Use appropriate lock out/tag out safety procedures to isolate from all energy sources. Use PPE. Follow site specific lone worker protocols/permits to work.

⚠ CAUTION**Manual Handling Heavy Objects**

Handling heavy objects can cause severe personal injury.

Use appropriate lifting equipment and perform tasks with two people where doing so would make completion of the task safe.

⚠ CAUTION**Power Tools and Hand Tools**

Tools can cause cuts, abrasions, bruising, puncture injuries.

Only trained and experienced personnel should use power tools and hand tools. Use PPE.

⚠ CAUTION**Sharp Edges and Sharp Points**

Projecting corners/parts may cause cuts, abrasions and other personal injury.

Use PPE. Be aware of sharp edges and corners/sharp points. Cover/protect them.

NOTICE

Keep multi-type ABC fire extinguishers close by. Class A fires involve ordinary combustible materials such as wood and cloth. Class B fires involve combustible and flammable liquid fuels and gaseous fuels. Class C fires involve live electrical equipment. (Refer to NFPA No. 10 in the applicable region.)

NOTICE

Before performing maintenance and service procedures on enclosed generator sets, make sure the service access doors are secured open.

NOTICE

Stepping on the generator set can cause parts to bend or break, leading to electrical shorts, or to fuel leaks, coolant leaks, or exhaust leaks. Do not step on the generator set when entering or leaving the generator set room.

NOTICE

Remove fuel from subbase fuel tank before conducting any hot work.

1.3 Generator Set Safety Code

Before operating the generator set, read the manuals and become familiar with them and the equipment. Safe and efficient operation can be achieved only if the equipment is properly operated and maintained. Many accidents are caused by failure to follow fundamental rules and precautions.

⚠ WARNING***Electrical Generating Equipment***

Incorrect operation and maintenance can result in severe personal injury or death.

Read and follow all Safety Precautions, Warnings, and Cautions throughout this manual and the documentation supplied with the generator set.

1.3.1 Moving Parts Can Cause Severe Personal Injury or Death

- Keep hands, clothing, and jewelry away from moving parts. Do not wear loose clothing or jewelry in the vicinity of moving parts or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts.
- Before starting work on the generator set, disconnect the battery charger from its AC source, then disconnect the starting batteries using an insulated wrench, negative (–) cable first. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps; keep guards in position over fans, drive belts, etc.
- If any adjustments must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

1.3.2 Positioning of Generator Set

The generator set should be placed on level ground with adequate open space around it. The immediate area around the generator set should be free of any flammable material.

NOTICE

Access or service doors must be closed and locked before repositioning, and they must remain locked during transportation and siting.

NOTICE

The generator set is capable of operating at inclines of up to +/- 2.5 degrees.

1.4 Electrical Shocks and Arc Flashes Can Cause Severe Personal Injury or Death

⚠ WARNING***Electric Shock Hazard***

Voltages and currents present an electrical shock hazard that can cause severe burns or death. Contact with exposed energized circuits with potentials of 50 Volts AC or 75 Volts DC or higher can cause electrical shock and electrical arc flash. Refer to standard NFPA 70E or equivalent safety standards in corresponding regions for details of the dangers involved and for the safety requirements.

Guidelines to follow when working on de-energized electrical systems:

- Use proper PPE. Do not wear jewelry and make sure that any conductive items are removed from pockets as these items can fall into equipment and the resulting short circuit can cause shock or burning. Refer to standard NFPA 70E for PPE standards.
- De-energize and lockout/tagout electrical systems prior to working on them. Lockout/Tagout is intended to prevent injury due to unexpected start-up of equipment or the release of stored energy. Please refer to *Locking the Generator Set Out of Service* section for more information.
- De-energize and lockout/tagout all circuits and devices before removing any protective shields or making any measurements on electrical equipment.
- Follow all applicable regional electrical and safety codes.

Guidelines to follow when working on energized electrical systems:

NOTICE

It is the policy of Cummins Inc. to perform all electrical work in a de-energized state. However, employees or suppliers may be permitted to occasionally perform work on energized electrical equipment only when qualified and authorized to do so and when troubleshooting, or if de-energizing the equipment would create a greater risk or make the task impossible and all other alternatives have been exhausted.

NOTICE

Exposed energized electrical work is only allowed as per the relevant procedures and must be undertaken by a Cummins authorized person with any appropriate energized work permit for the work to be performed while using proper PPE, tools and equipment.

In summary:

- Do not tamper with or bypass interlocks unless you are authorized to do so.
- Understand and assess the risks - use proper PPE. Do not wear jewelry and make sure that any conductive items are removed from pockets as these items can fall into equipment and the resulting short circuit can cause shock or burning. Refer to standard NFPA 70E for PPE standards.
- Make sure that an accompanying person who can undertake a rescue is nearby.

1.4.1 AC Supply and Isolation

NOTICE

Local electrical codes and regulations (for example, *BS EN 12601:2010 Reciprocating internal combustion engine driven generating sets*) may require the installation of a disconnect means for the generator set, either on the generator set or where the generator set conductors enter a facility.

NOTICE

The AC supply must have the correct over current and earth fault protection according to local electrical codes and regulations. This equipment must be earthed (grounded).

It is the sole responsibility of the customer to provide AC power conductors for connection to load devices and the means to isolate the AC input to the terminal box; these must comply with local electrical codes and regulations. Refer to the wiring diagram supplied with the generator set.

The disconnecting device is not provided as part of the generator set, and Cummins accepts no responsibility for providing the means of isolation.

1.5 Fuel and Fumes Are Flammable

Fire, explosion, and personal injury or death can result from improper practices.

- Do not fill fuel tanks while the engine is running unless the tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- Do not permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.
- Make sure all fuel supplies have a positive shutoff valve.
- Make sure the battery area has been well-ventilated prior to servicing near it. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by arcing, sparking, smoking, etc.

1.5.1 Spillage

Any spillage that occurs during fueling, oil top-off, or oil change must be cleaned up before starting the generator set.

1.5.2 Fluid Containment

NOTICE

Where spillage containment is not part of a Cummins supply, it is the responsibility of the installer to provide the necessary containment to prevent contamination of the environment, especially water courses and sources.

If fluid containment is incorporated into the bedframe, it must be inspected at regular intervals. Any liquid present should be drained out and disposed of in accordance with local health and safety regulations. Failure to perform this action may result in spillage of liquids which could contaminate the surrounding area.

Any other fluid containment area must also be checked and emptied, as described above.

1.5.3 Do Not Operate in Flammable and Explosive Environments

Flammable vapor can cause an engine to over speed and become difficult to stop, resulting in possible fire, explosion, severe personal injury, and death. Do not operate a generator set where a flammable vapor environment can be created, unless the generator set is equipped with an automatic safety device to block the air intake and stop the engine. The owners and operators of the generator set are solely responsible for operating the generator set safely. Contact your authorized Cummins distributor for more information.

1.6 Exhaust Gases Are Deadly

- Provide an adequate exhaust system to properly expel discharged gases away from enclosed or sheltered areas, and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust system daily for leaks per the maintenance schedule. Make sure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- Make sure the unit is well ventilated.

1.6.1 Exhaust Precautions

WARNING

Hot Exhaust Gases

Contact with hot exhaust gases can cause severe burns.

Wear personal protective equipment when working on equipment.

WARNING

Hot Surfaces

Contact with hot surfaces can cause severe burns.

The unit is to be installed so that the risk of hot surface contact by people is minimized. Wear appropriate PPE when working on hot equipment and avoid contact with hot surfaces.

WARNING

Toxic Gases

Inhalation of exhaust gases can cause asphyxiation and death.

Pipe exhaust gas outside and away from windows, doors, or other inlets to buildings. Do not allow exhaust gas to accumulate in habitable areas.

WARNING

Fire Hazard

Contaminated insulation is a fire hazard. Fire can cause severe burns or death.

Remove any contaminated insulation and dispose of it in accordance with local regulations.

The exhaust outlet may be sited at the top or bottom of the generator set. Make sure that the exhaust outlet is not obstructed. Personnel using this equipment must be made aware of the exhaust position. Position the exhaust away from flammable materials - in the case of exhaust outlets at the bottom, make sure that vegetation is removed from the vicinity of the exhaust.

The exhaust pipes may have some insulating covers fitted. If these covers become contaminated they must be replaced before the generator set is run.

To minimize the risk of fire, make sure the following steps are observed:

- Make sure that the engine is allowed to cool thoroughly before performing maintenance or operation tasks.
- Clean the exhaust pipe thoroughly.

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2 Schedule of Abbreviations

This list is not exhaustive. For example, it does not identify units of measure or acronyms that appear only in parameters, event/fault names, or part/accessory names.

ABBR.	DESCRIPTION	ABBR.	DESCRIPTION
AC	Alternating Current	LED	Light-emitting Diode
AMP	AMP, Inc., part of Tyco Electronics	LTS	Long Term Storage
ANSI	American National Standards Institute	LVRT	Low Voltage Ride Through
ASOV	Automatic Shut Off Valve	MFM	Multifunction Monitor
ASTM	American Society for Testing and Materials (ASTM International)	Mil Std	Military Standard
ATS	Automatic Transfer Switch	MLD	Masterless Load Demand
AVR	Automatic Voltage Regulator	NC	Normally Closed
AWG	American Wire Gauge	NC	Not Connected
CAN	Controlled Area Network	NFPA	National Fire Protection Agency
CB	Circuit Breaker	NO	Normally Open
CE	Conformité Européenne	NWF	Network Failure
CFM	Cubic Feet per Minute	OEM	Original Equipment Manufacturer
CGT	Cummins Generator Technologies	OOR	Out of Range
CMM	Cubic Meters per Minute	OORH / ORH	Out of Range High
CT	Current Transformer	OORL / ORL	Out of Range Low
D-AVR	Digital Automatic Voltage Regulator	PB	Push Button
DC	Direct Current	PCC	PowerCommand® Control
DEF	Diesel Exhaust Fluid	PGI	Power Generation Interface
DPF	Diesel Particulate Filter	PGN	Parameter Group Number
ECM	Engine Control Module	PI	Proportional/Integral
ECS	Engine Control System	PID	Proportional / Integral / Derivative
EMI	Electromagnetic interference	PLC	Programmable Logic Controller
EN	European Standard	PMG	Permanent Magnet Generator
EPS	Engine Protection System	PPE	Personal Protective Equipment
E-Stop	Emergency Stop	PT	Potential Transformer
FAE	Full Authority Electronic	PTC	Power Transfer Control
FMI	Failure Mode Identifier	PWM	Pulse-width Modulation
FRT	Fault Ride Through	RFI	Radio Frequency Interference

ABBR.	DESCRIPTION	ABBR.	DESCRIPTION
FSO	Fuel Shutoff	RH	Relative Humidity
Genset	Generator Set	RMS	Root Mean Square
GCP	Generator Control Panel	RTU	Remote Terminal Unit
GND	Ground	SAE	Society of Automotive Engineers
LCT	Low Coolant Temperature	SCR	Selective Catalytic Reduction
HMI	Human-machine Interface	SPN	Suspect Parameter Number
IC	Integrated Circuit	SWL	Safe Working Load
ISO	International Organization for Standardization	SW_B+	Switched B+
LBNG	Lean-burn Natural Gas	UL	Underwriters Laboratories
LCD	Liquid Crystal Display	UPS	Uninterruptible Power Supply
		VPS	Valve Proving System

3 Glossary

Term	Definition
Accessory Part	A part comes standard with the product. An accessory is optional and provides additional interfaces or functionality.
Active Inactive	<p>General terms to describe the states for inputs, signals, or outputs that have only two states (like true/false or 1/0). For example, a low coolant level switch is either on (active) or off (inactive). The Ready to Load output is either on (active) or off (inactive). Usually, the expected state is inactive.</p> <p>For events/faults, this term describes the time the PCC generates the event/fault through the time the event/fault is cleared.</p>
Active-closed Active-open	Some inputs and outputs use resistance to distinguish between active and inactive. If an input or output is active-closed, the input or output is active if there is no resistance between two pins. If an input or output is active-open, the input or output is active if there is infinite resistance between two pins.
Active-high Active-low	Some inputs and outputs use voltage differential to distinguish between active and inactive. If an input or output is active-high, a high voltage differential means the input or output is active, and a low voltage differential means the input or output is inactive. If an input or output is active-low, a low voltage differential means the input or output is active, and a high voltage differential means the input or output is inactive.
Configurable analog input Configurable input	"Configurable input" refers to discrete inputs (for example, open or closed). "Configurable analog input" refers to analog inputs (for example, 0-5 VDC).
Configurable analog output Configurable output	"Configurable output" refers to discrete outputs (for example, open or closed). "Configurable analog output" refers to analog outputs (for example, 0-5 VDC).
Connection	A connection between two devices. A connection might be as simple as one pin-to-pin connection, or it might require several pins as well as additional components such as relays, fuses, etc. This term also includes some settings that refer to the physical (for example, normally-closed vs. normally-open) or electrical (for example, active-high vs. active-low) characteristics of the connection.
Connector	<p>This term has no meaning if you do not have access to the PCC control board or the back panel of the Operator Panel.</p> <p>One or more pins that are in the same housing. Many times, the pins are related by function (for example, pins that are connected to the engine) or by electrical characteristics (for example, relay outputs).</p> <p>This term also refers to the end of a wire or harness that is plugged into the housing.</p>
Event Fault	<p>Used to notify the operator or external devices whether or not certain conditions are true. Each event or fault has two sets of conditions. When the first set of conditions becomes true, the event or fault becomes active. This might turn on or turn off a light or LED, display a warning on the PCC, shut down the generator set, or so on. When the second set of conditions becomes true, the event or fault becomes inactive and can be cleared.</p> <p>The PCC generates a fault when the conditions indicate a more serious problem; the PCC generates an event only for information purposes.</p>
Low-side driver	When this output is active, it provides a path to ground. When this output is inactive, it blocks the path to ground.

Term	Definition
Mode Mode of operation	A term to describe certain states that affect the PCC's behavior. The PCC is either in a particular mode or not in a particular mode, and the PCC's behavior changes accordingly. Sometimes, the PCC is always in one mode out of a set of two or more modes. For example, the PCC is always in one of the modes of operation: Off mode, Auto mode, or Manual mode.
Mounting	The physical placement and installation of the PCC or the Operator Panel.
Normally-closed Normally-open	Some inputs and outputs use open circuits and short circuits to distinguish between active and inactive. If an input or output is normally-closed, an open circuit means the input or output is active, and a short circuit means the input or output is inactive. If an input or output is normally-open, a short circuit means the input or output is active, and an open circuit means the input or output is inactive.
Parameter	Refers to monitored values or settings in the PCC or the Operator Panel that can be looked at and, in some cases, adjusted. Some parameters are protected by passwords. In this manual, italics are used to identify a specific parameter by name.
Pin	A specific point on the PCC or the Operator Panel to which it is acceptable to connect a specific point on an external device. For example, a B+ pin might be connected to the positive terminal on the battery. It takes more than one pin to connect an external device to the PCC. For example, it takes B+ and Ground to connect the battery to the PCC. Depending on the access you have to the controller, you might see a specific pin on the PCC control board, the terminal at the end of a harness, a wire that runs between the PCC and the external device, or nothing at all.
Sensor	Refers to a device that measures something and reports one of many (or unlimited) values. For example, a coolant level sensor reports the current level of coolant.
Sequence of operation	A term used to describe the steps the PCC follows when it starts the generator set or when it stops the generator set.
Signal	A term used for convenience to talk about two or more connections as a single input. Usually, all of these connections have the same effect on the PCC's behavior, and it does not matter which connection is active. For example, the term "remote start signal" is used frequently. In Auto mode, the PCC starts the generator set when the remote start signal is active. The remote start signal may come from any of several connections: a switch connected to the remote start pin, the Operator Panel, a PLC (programmable logic controller) connected on Modbus, InPower, etc. It is not important between these connections when explaining the way the remote start signal affects the PCC's decisions to start and stop the generator set. It is only important whether or not any of them are active.
Switch	Refers to a device that measures something and reports one of two states, active or inactive, about something. For example, a low coolant level switch is active when the coolant level is too low, but the low coolant level switch does not report what the coolant level really is. In some cases, this may refer to a physical switch (similar to a light switch) instead.
Trim	Refers to the subset of parameters that can be adjusted, as opposed to parameters that can only be monitored.

4 Introduction

Read [Chapter 1](#) and carefully observe all instructions and precautions in this manual. Keep this manual with the other generator set and/or controller manuals.

4.1 About this Manual

This is the Service Manual for the PowerCommand® 1.1, 1.1R, and 1.2 Controller. It is not the Service Manual for the generator set or any accessories.

4.2 System Overview

The PowerCommand® control is a microprocessor-based control for Cummins generator sets. All generator set control functions are contained on one circuit board (control board). The control board provides fuel control, main alternator voltage output regulation and complete generator set control and monitoring.

The operating software provides control of the generator set and its performance characteristics, and displays performance information on an operator panel. It accepts menu-driven control and setup input from the push button switches on the operator panel.

4.2.1 PowerCommand 1.1 Components

The PowerCommand 1.1 System consists of the following:

- A PCC 1302 Control Board
- An optional Alarm Module
- An optional AC Metering Panel
- An HMI 211 Operator Panel.

4.2.2 PowerCommand 1.1R Components

The PowerCommand 1.1R System consists of the following:

- A PCC 1302 Control Board
- An HMI 211R Operator Panel.

4.2.3 PowerCommand 1.2 Components

The PowerCommand 1.2 System consists of the following:

- A PCC 1302 Control Board
- An optional Alarm Module
- An optional AC Metering Panel
- An HMI 220 Operator Panel.

4.3 Test Equipment

To perform the test procedures in this manual, the following test equipment must be available:

- True RMS meter for accurate measurement of small AC and DC voltages (Fluke models 87 or 8060A are good choices)
- Grounding wrist strap to prevent circuit board damage due to electrostatic discharge (ESD)
- Battery Hydrometer
- Jumper Leads
- Tachometer or Frequency Meter
- Wheatstone Bridge or Digital Ohmmeter
- Variac
- Load Test Panel
- Megger or Insulation Resistance Meter
- InPower™ Service Tool (PC based generator set service tool)
- PCC 1302 Interface Kit (Used with InPower Service Tool)

4.4 How To Obtain Service

When the control requires servicing, contact your nearest Cummins Inc. distributor. To contact your local Cummins Inc. distributor refer to the [Manufacturing Facilities section](#) contained within this document. When contacting your distributor, always supply the complete Model, Specification, and Serial Number as shown on the nameplate.

 **WARNING**

Incorrect service or replacement of parts can result in severe personal injury or death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical service. Read and follow [Important Safety Instructions](#).

5 Control System - PowerCommand 1.1

5.1 PowerCommand 1.1 Components

The PowerCommand 1.1 System consists of the following:

- A PCC 1302 Control Board
- An optional Alarm Module
- An optional AC Metering Panel
- An HMI 211 Operator Panel.

5.2 Control Description

The control is used to start and stop the generator set, and provides full generator set monitoring capability and protection in a stand-alone situation (non paralleling) from the display screen. It monitors the engine for temperature, oil pressure and speed, and provides voltage and current metering. In the event of a fault, the unit indicates the fault type and on critical faults automatically shuts down the generator set.

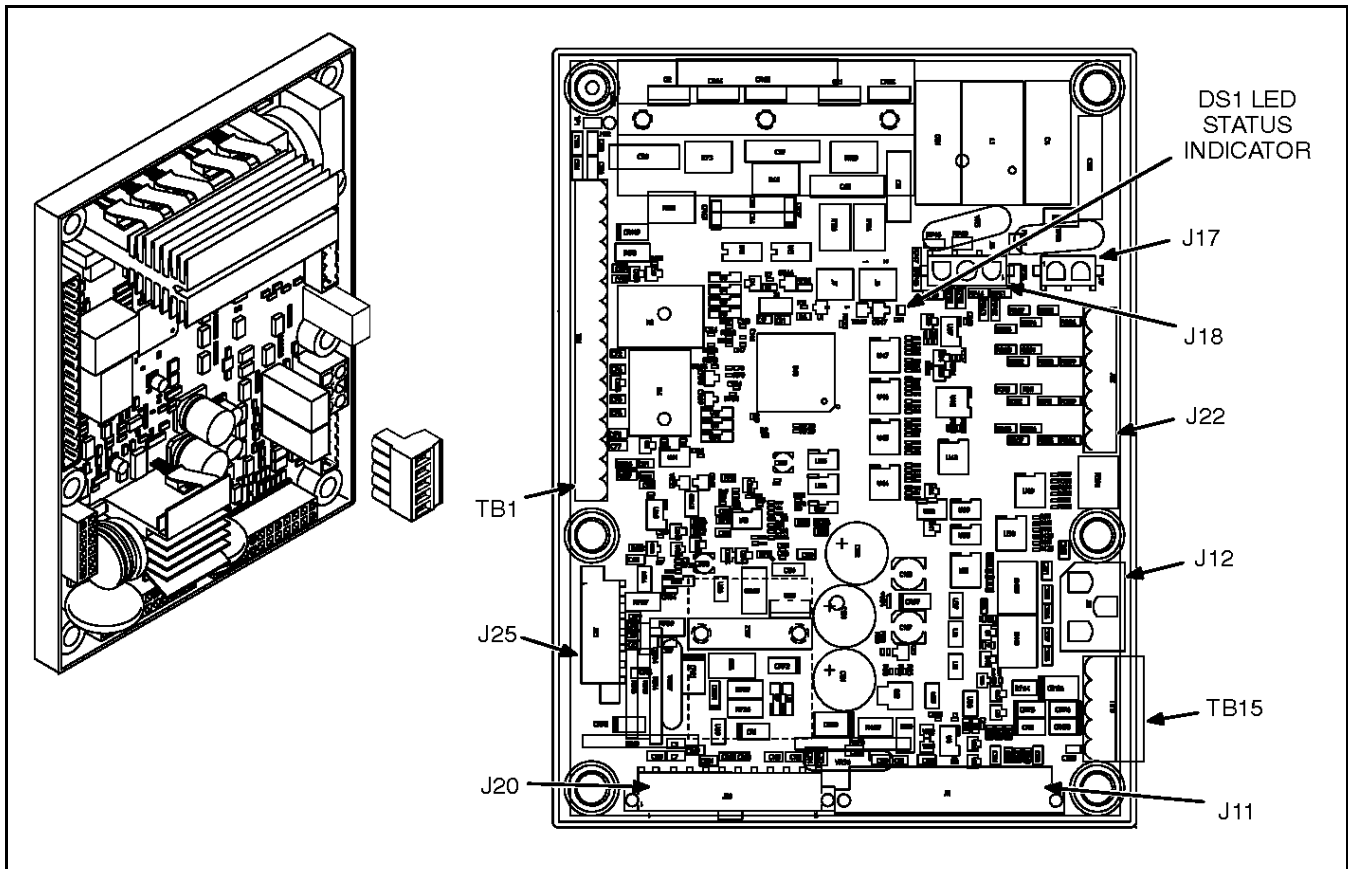
All indicators, control buttons, and the display screen are on the face of the operator panel.

There are two fault level signals generated by the control:

- Warning: signals an imminent or non-critical fault for the engine. The control provides an indication only for this condition.
- Shutdown: signals a potentially critical fault for the engine. The control immediately takes the engine off-load and automatically shuts down.

The standard control system operates on 12 or 24 VDC battery power. The auxiliary equipment operates on LV AC power. The history data is stored in non-volatile memory and is not deleted if battery power is lost.

TABLE 1. PCC 1302 CONTROL BOARD



Connector	Description
J11	Engine Harness
J12	Generator Set CTs
J17	AVR Field
J18	AVR Power
J20	Generator Set Accessories Harness
J22	Generator Set Voltage Sense
J25	Operator Panel Harness
TB1	Field Connections
TB15	RS-485 Communications

5.3 PCC 1302 Features

The PCC 1302 includes:

- Single-phase or three-phase (delta or wye) 600 volt voltage sensing and 5 amp CT current sensing
- 50 or 60 Hertz frequency
- Service Tool / ModBus communications connector (TB15)

- Start/stop functionality through either an operator panel or a Manual Run/Off/Auto switch located in the harness
- Control board status LED
- Shunt or PMG excitation methods
- CAN Datalink with PGI protocol support
- Common connector scheme support
- Programmable wake-in-auto function

A PCC 1302 installation may also include the following options.

- If a operator panel is mounted on the generator set (local display), one additional operator panel can be mounted up to 4000 feet (1219.2 meters) from the generator set (remote displays). A setup menu in the optional display panel is required to designate a display as Local or Remote.
- Local status indicator lamp driver
- Remote and local emergency stop
- Four configurable inputs
- Annunciator fault inputs 1, 2, and 3 - These outputs can be used when an annunciator is installed as part of an PCCNet interface connected to TB1-2 and TB1-3. Grounding one of these inputs on the annunciator activates the corresponding warning or shutdown sequence.
Three Customer Annunciator Text message submenus are supplied to enter the event type and description.
- ECM CAN engine interface

5.3.1 Local Status Output

A status indicator lamp can be used to flash generator set status and shutdown fault codes. The Manual Run/Off/Auto switch may include a status indicator lamp.

- Constant On = The generator set is running.
- Shutdown, warning and remote start LED indicators are available on front display.

NOTICE

Only the last shutdown fault is flashed.

5.4 Operating Modes

The PCC 1302 works with a Manual Run/Off/Auto switch, used to control generator set operating modes. This capability is located either in the harness (switch) or is integrated into the control panel.

5.4.1 Off Mode

When in Off mode, the control does not allow the generator set to start. If the generator set is already running and the control is set to Off, it initiates a normal shutdown sequence.

5.4.2 Manual Run Mode

When in Manual Run mode, the generator set starts and continues to run until the control is put into the Off mode. While in Manual Run mode, the remote start signal is ignored.

5.4.3 Auto Mode

When in Auto mode, the control allows the generator set to be started with a remote start signal only.

When in Auto mode, the generator set can start at any time. When a remote start signal is received, the genset starts after a time delay preheat (if programmed) and time delay start (if programmed) is completed.

If the generator set is running in Auto mode and the Off button is pressed, the control immediately stops the genset and the control transitions to the Off mode.

When all remote start signals are removed, the control performs a normal shutdown sequence which may include a time delay stop.

5.4.4 Emergency Stop Mode

When an optional emergency stop button is used, it immediately shuts down the generator set, bypassing any time delay stop. If an optional emergency stop is not used, the local and remote E-stop signals must be shorted to GND. The red Shutdown LED lights and one of the two emergency stop fault codes (**1433 - Local Emergency Stop** or **1434 - Remote Emergency Stop**) is either displayed (installations with an operator panel) or flashed (installations with a status indicator lamp), depending on which was activated last.

To reset the control, close (disable) the active emergency stop button(s) and perform a fault reset.

5.4.5 Sleep Mode

The PCC 1302 control enters a low power (sleep) mode of operation where the current draw is not greater than 60 milliamps (DC) at normal battery voltage levels. The control is set to enter sleep mode after five minutes in Off mode or Auto mode, if configured. (Sleep mode can be disabled if a jumper is installed connecting TB15-1 to TB15-5.)

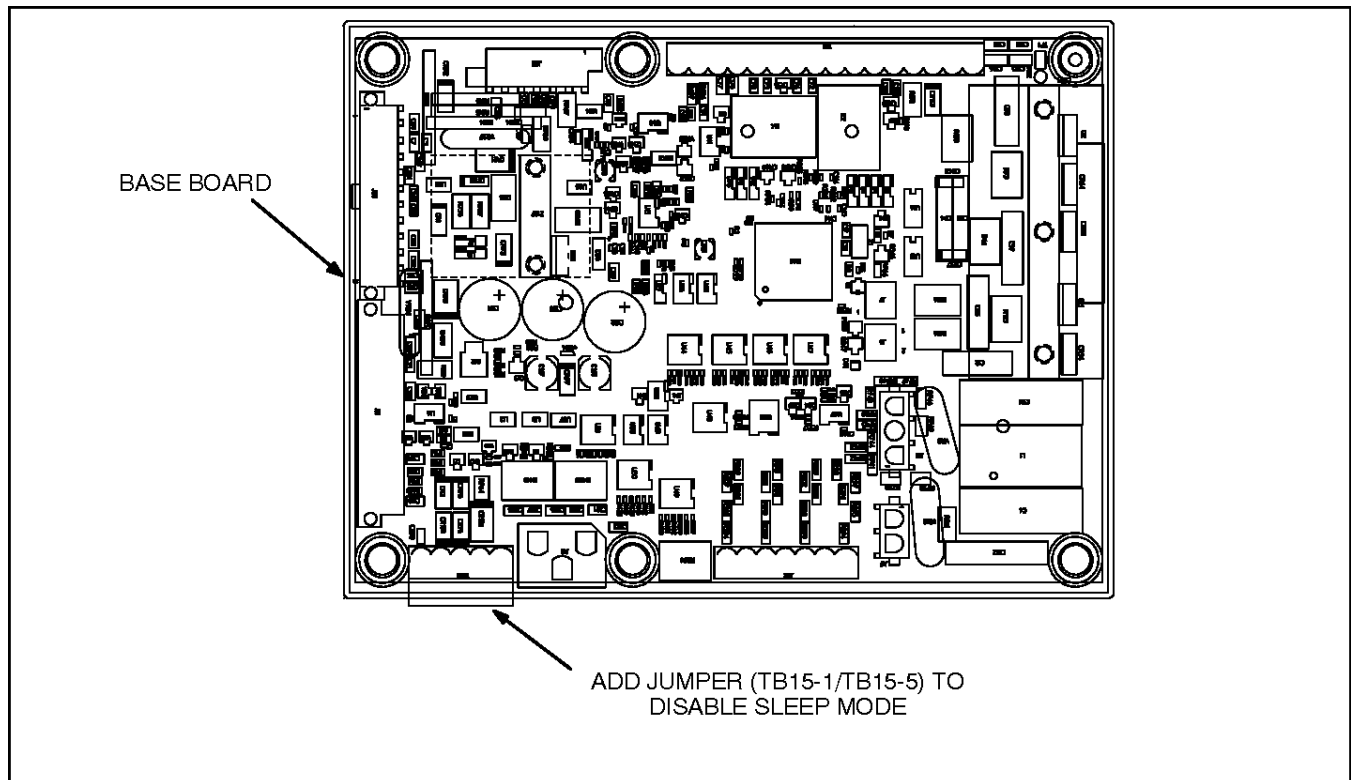


FIGURE 1. SLEEP MODE ACTIVATION SETTINGS

The control will not enter the sleep mode if there are any active, unacknowledged shutdown faults, if the control is in the Manual Run mode, or if there are any active wake-up signals. Once in sleep mode, any of the following inputs will wake the control.

- Remote Start
- Manual Start
- Configurable Input 3
- Configurable Input 4
- Local E-Stop (active when switch is open)
- Remote E-Stop (active when switch is open)
- Auto Mode (if configured)
- Bi-directional System Wake-Up

Sleep mode is automatically enabled on the operator panel. The PCC 1302 control determines that it should sleep when the display panel has had no key presses for five minutes and wake-up signals are inactive. The control system can be awakened by pressing the keypad on the operator panel or by activating any wake-up input.

5.4.5.1 Configuring Sleep In Auto Mode

1. Power the control and wake it up.
2. Use InPower to connect to the PCC 1302.
3. Use InPower to disable the Wake-In-Auto feature.
4. Save adjustments.
5. Disconnect the PCC 1302 from InPower.

5.4.5.2 Installations with a Manual Run/Off/Auto Switch

For installations that utilize an Manual Run/Off/Auto switch located in the harness, the control awakes from sleep mode if Manual Run mode is selected. The control will also wake up if Auto mode is selected and the control is configured to stay awake when in Auto mode, Wake-In-Auto = Enabled.

5.4.6 Battle Short Mode

The purpose of Battle Short is to satisfy local code requirements, where necessary. To use this feature, the necessary software must either be installed at the factory when the PCC 1302 is purchased or else installed by a customer service representative.

Battle Short mode prevents the generator set from being shutdown by all but a select few critical shutdown faults. All shutdown faults, including those overridden by Battle Short, must be acted upon immediately to ensure the safety and well being of the operator and the genset.

WARNING

Use of the Battle Short mode feature can cause a fire or electrical hazard, resulting in severe personal injury or death and/or property and equipment damage. Operation of the generator set must be supervised during Battle Short operation.

This feature must only be used during supervised, temporary operation of the generator set. The faults that are overridden when in Battle Short mode are faults that can affect generator set performance or cause permanent engine, alternator, or connected equipment damage. Operation may void the generator set warranty if damage occurs that relates to the fault condition(s).


Only trained and experienced service personnel should enable this feature. When shipped from the factory, this feature is disabled.

Battle Short can be enabled or disabled (set to Active or Inactive) using the operator panel.

The PC service tool is required to enable the Battle Short mode feature. Contact an authorized service center for assistance.

Before Battle Short can be used on installations with the display panel, the Switch Input setting on the Battle Short submenu must be set to "Operator Panel". In addition, Battle Short mode must be enabled (set to Active) in the Battle Short submenu.

When Battle Short mode is enabled, the Warning status indicator lights, and **Code 1131 - Battle Short Active** is displayed.

When Battle Short mode is enabled and an overridden shutdown fault occurs, the shutdown lamp remains lit even though the generator set continues to run. **Fault code 1416 - Fail to Shut Down** is displayed. If the ▲ or ▼, or  button is pressed to acknowledge the fault, the fault message is cleared from the display but remains in the Fault History file.

Battle Short is suspended and a shutdown occurs immediately if:

- Any of the following shutdown faults occurs.
 - Overspeed - Fault code **234**
 - Speed Signal Lost (Loss of Speed Sense) - Fault code **121**
 - Excitation Fault (Loss of Voltage Sense) - Fault code **2335**
 - Local Emergency Stop - Fault Code **1433**
 - Remote Emergency Stop - Fault code **1434**
- Battle Short mode is disabled after an overridden shutdown fault occurred while in Battle Short mode. To disable Battle Short mode, navigate to the Battle Short submenu and select "Inactive." **Fault code 1123 - Shutdown After Battle Short** is then displayed.

5.5 Control Board

WARNING

HAZARDOUS VOLTAGE. *Touching uninsulated parts in the controller can result in severe personal injury or death. Measurements and adjustments must be done with care to avoid touching hazardous voltage parts.*

WARNING

Stand on a dry wooden platform or rubber insulating mat, make sure your clothing and shoes are dry, remove jewelry and use tools with insulated handles.

CAUTION

Electrostatic discharge will damage circuit boards. Always wear a grounding wrist strap when touching or handling circuit boards.

The control board contains all of the electronic circuitry required to operate the generator set. The control board provides main alternator voltage output regulation and complete generator set control and monitoring. Refer to Block diagram in [Appendix A on page 239](#) for each terminal board connection and connector pin input/output signal.

The block diagram that follows shows the external connections of the PCC system.

After determining that a control board assembly is faulty, replace it; do not repair it. Attempts to repair a control board can lead to costly damage to the equipment.

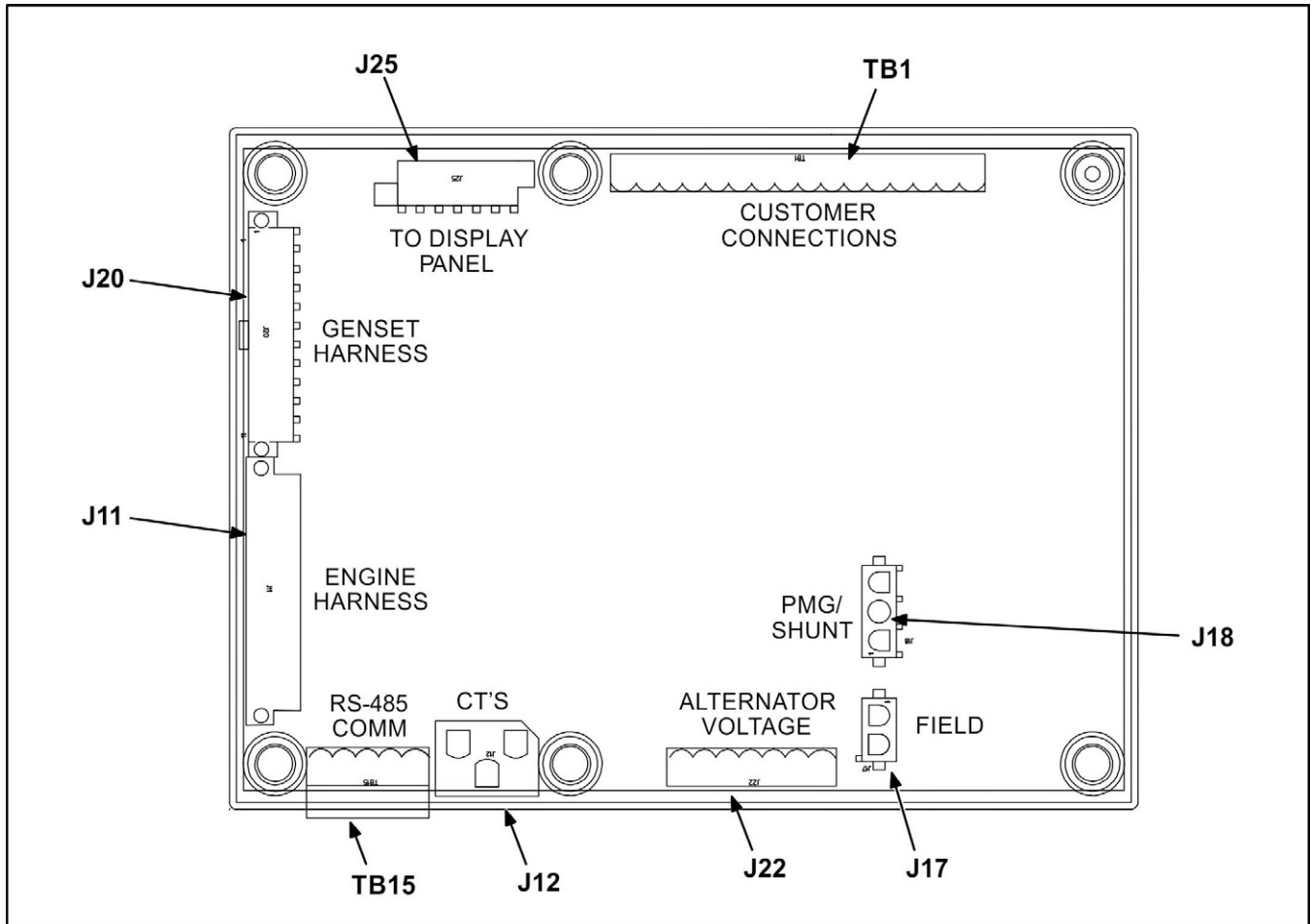


FIGURE 2. CONTROL BOARD CONNECTOR/TERMINAL PIN LOCATIONS

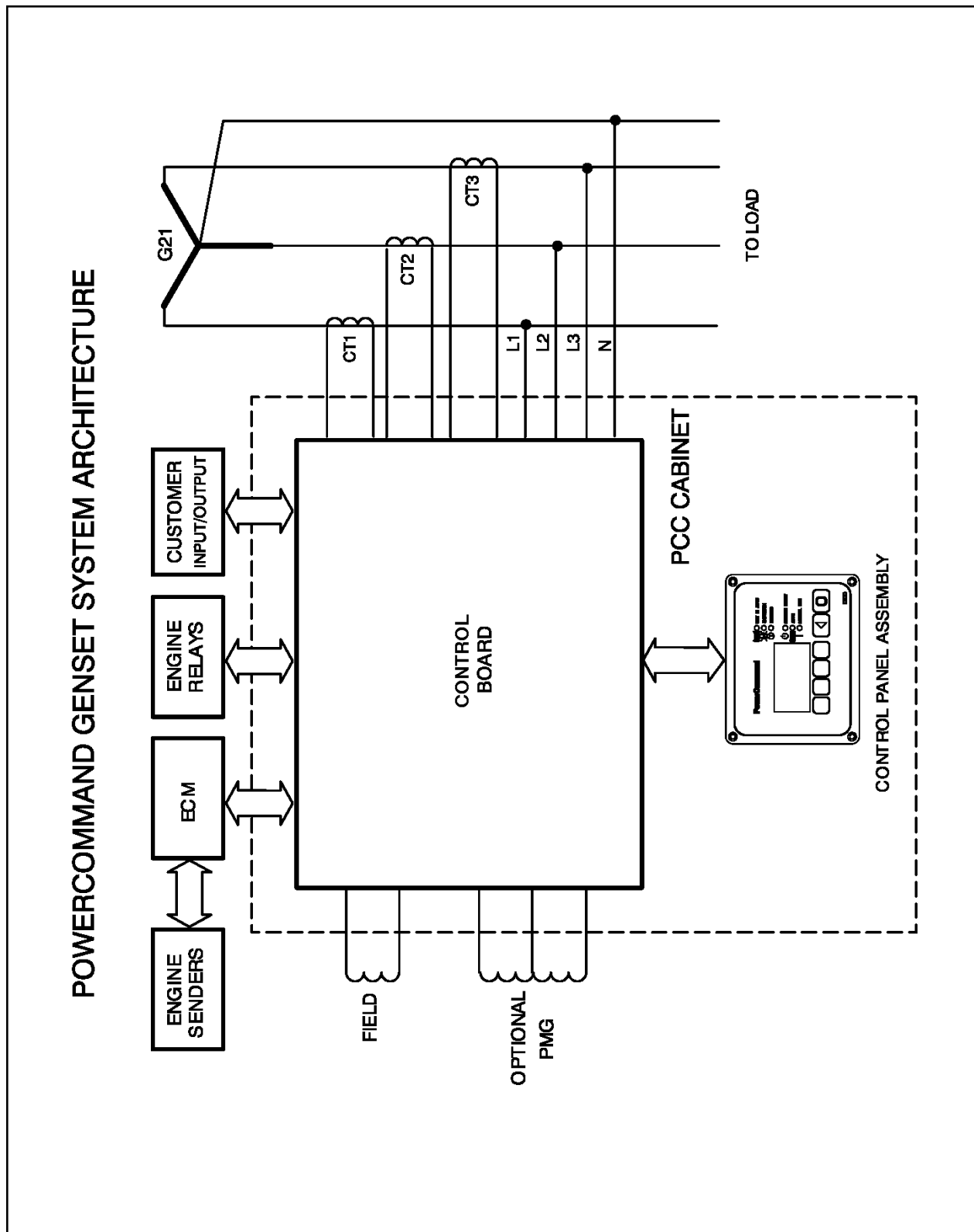
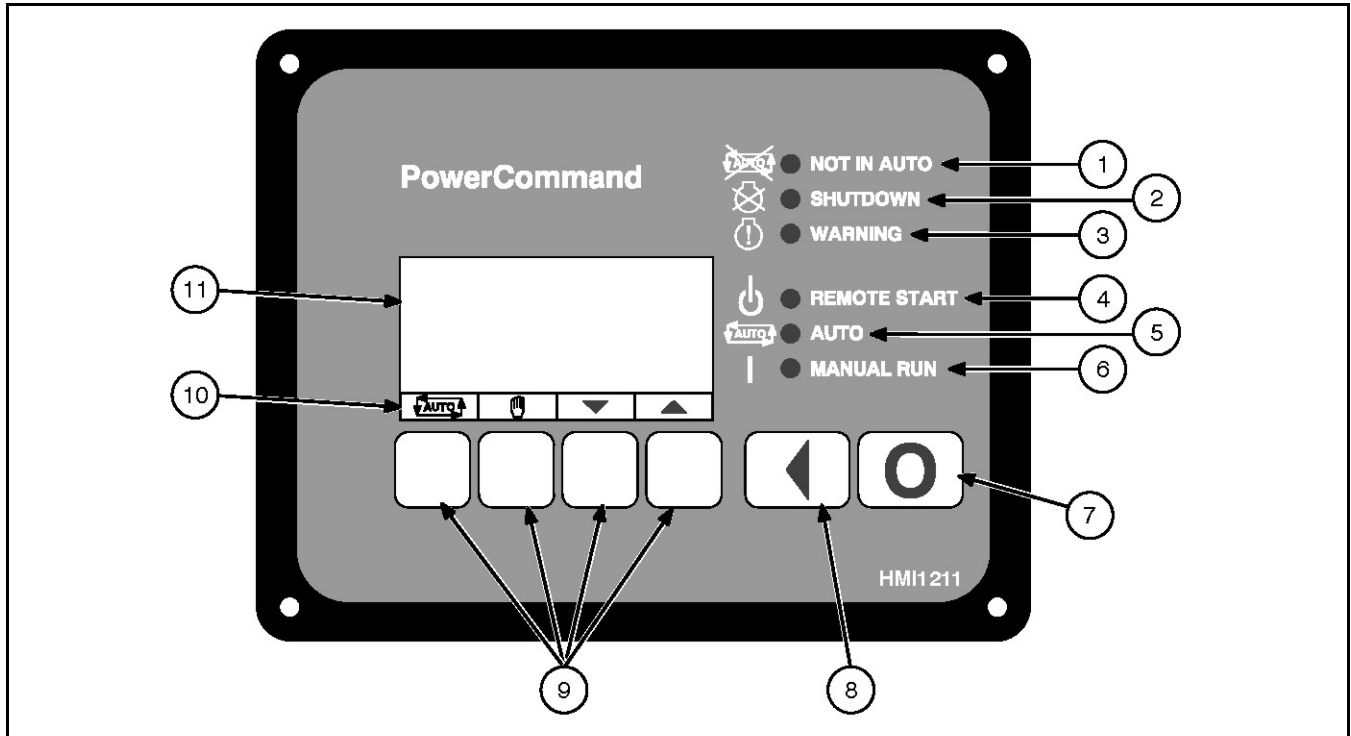


FIGURE 3. BLOCK DIAGRAM

5.6 Operator Panel

[Figure 4 on page 25](#) shows the features of the front panel. It includes six LED indicators, the graphical display, and six buttons used to navigate through the menus and adjust parameters.



No.	Description	No.	Description
1	LED Indicator – Not in Auto	7	Generator Set Off Mode Button
2	LED Indicator – Shutdown	8	Previous Screen Button
3	LED Indicator – Warning	9	Selection Buttons (four) (for use with Item 10)
4	LED Indicator – Remote Start	10	Menu Bar (provision for four symbols)
5	LED Indicator – Auto	11	Graphical LCD Display
6	LED Indicator – Manual Run		

FIGURE 4. OPERATOR PANEL

5.6.1 Graphical Display

This graphical display is used to view menus of the menu-driven operating system. The bottom of the graphical display indicates the functions that are available by pressing the four selection buttons.
















System messages (communication, event, status and fault) are also shown on the graphical display. For more information, see [System Messages on page 29](#).

5.6.2 Display Text or Symbolic Version

This graphical display can be set to show text (English only) or symbols for fault messages, some Operator menus, and the Mode Change menu. Descriptions of commonly used symbols are included in [Table 2 on page 26](#). Combinations of symbols are used to display some fault conditions. Additional specialized symbols are also used for some faults.

When shipped from the factory, the display is set to display symbols. Qualified service personnel are required to change the default setting.





TABLE 2. SYMBOLS

SYMBOL	DESCRIPTION	
	Actual text shown – English only	Translation
	Generator Warning Fault	
	Generator Shutdown Fault	
	Coolant Temperature	
	Oil Pressure	
	Voltage Alternating Current (VAC)	
	Voltage Direct Current (VDC)	
	AC Current	
Hz	Frequency	
	Battery	
	Out of Range	
	High or Pre-High	
	Low or Pre-Low	
	Annunciator	
	Over Speed	
	Crank Fail	
	Emergency Stop	



5.6.3 Display Menu Selection Buttons

Four momentary soft-key buttons are used to step through the various menus and to adjust parameters. These selection buttons are "active" when a word or symbol in the graphical display is shown above the button. Some submenus do not include any active buttons.

The function of the four selection buttons varies with each menu.




- When the  symbol is displayed, the selection button can be used to switch to Auto mode.
- When the  symbol is displayed, the selection button can be used to switch to Manual Run mode.
- When the up and down triangles ( and ) are displayed, the selection buttons are used to navigate between a series of submenus.

NOTICE


When any Operator menu ([Figure 15 on page 37](#) or [Figure 16 on page 38](#)) is displayed, a series of Service menus can be viewed by simultaneously pressing the  and  selection buttons for two seconds.

NOTICE

When a fault is displayed, it can be cleared from the front panel by pressing the  or  button.


- When a  symbol is displayed, the selection button can be used to abort the Auto or Manual Run mode and return to the Operator menu that was displayed before the Auto or Manual Run mode was selected.
- When **ADJUST** is displayed, the selection button is used to display an adjustable menu. When the **ADJUST** button is pressed, the first adjustable parameter or value in the submenu is highlighted.
- When the  symbol is displayed, the selection button is used to navigate to an editable field within a menu.
- When the **+** and **-** symbols are displayed, the selection buttons are used to increase or decrease a parameter or value shown on the screen.
When changing values, pressing the button below the **+** symbol increase the value and pressing the button below the **-** symbol decreases the value.
- When **SAVE** is displayed, the selection button is used to save changes made in a submenu. **If the Previous Menu button is pressed before pressing SAVE, the changes are not saved.**
- Some menus include a list of numbered subjects. These menus include numbers in parenthesis (for example, **(1)**) displayed above the selection buttons. The selection buttons are then used to display submenus of the subjects included in the list.
- When a black box  is displayed, the selection button has no function.

5.6.4 Previous Main Menu Button

Press the  button to view the previous main menu. (See [Figure 5 on page 28](#).)

NOTICE

In the Screen Adjust menu, settings are not saved when the  button is pressed.

The  button is also used to acknowledge warning and shutdown messages after the fault has been corrected. Pressing this button clears the fault from the front panel display and the previous menu is redisplayed.

NOTICE

Pressing the ▲ or ▼ button also clears the fault from the front panel display.

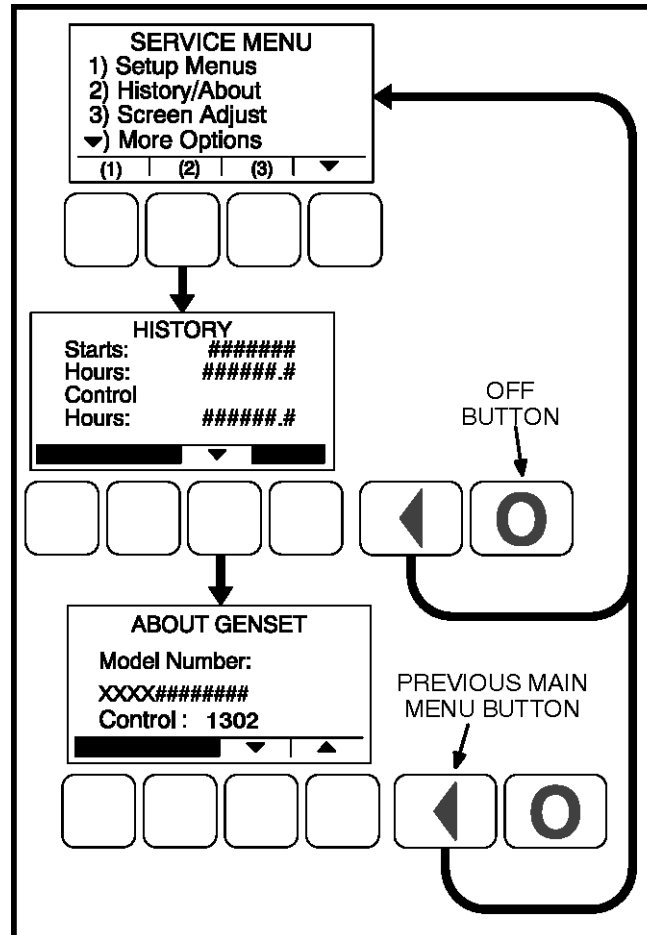





FIGURE 5. PREVIOUS MAIN MENU AND OFF BUTTONS

5.6.5 Off Button

Press the  button to switch to the Off mode. The Off mode will disable the control Auto or Manual modes. (See [Figure 5 on page 28.](#))


If the  button is pressed during generator set operation (manual or remote start), the engine will immediately shut down. If possible, hot shutdown under load should be avoided to help prolong the reliability of the generator set.

The  button is also used to acknowledge warning and shutdown messages after the fault has been corrected. Pressing this button clears the fault from the front panel and resets the control.

5.6.6 Not In Auto Indicator

This red lamp is lit when the control is not in the Auto mode.

5.6.7 Shutdown Status Indicator

This red lamp is lit when the control detects a Shutdown condition. The generator set cannot be started when this lamp is on. After the condition is corrected, the lamp can be reset by pressing the  (off) button.


5.6.8 Warning Indicator

This yellow lamp is lit whenever the control detects a warning condition. This lamp is automatically shut off when the warning condition no longer exists.


5.6.9 Remote Start Indicator

This green lamp indicates the control is receiving a remote run signal.



5.6.10 Auto Indicator

This green lamp indicates the control is in Auto mode. Auto mode can be selected by pressing the  selection button from any of the Operator menus (see [Figure 15 on page 37](#) or [Figure 16 on page 38](#)).

5.6.11 Manual Run Indicator

This green lamp indicates the control is in the Manual Run mode. Manual Run mode can be selected by pressing the  selection button from any of the Operator menus (see [Figure 15 on page 37](#) or [Figure 16 on page 38](#)).

5.7 System Messages

A system pop-up message is displayed when the event it is displaying becomes active. These pop-up messages remain displayed until pre-empted by another pop-up message or until the ▼ or the  display buttons is pressed. Once the ▼ or  the button is pressed, the previous screen is redisplayed.

5.7.1 Communication Messages

System messages are displayed for initial power-up or when there is a subsequent loss of communications. Note that the Auto and Manual Run modes can be selected when communication messages are displayed.

Upon initial power-up, the message "Establishing communication with control" is displayed (see [Figure 6 on page 30](#)). This menu also displays the screen's software number and version.

When the display detects that it is no longer communicating with the control, the Shutdown, Warning, and Remote Start LEDs are turned off.

If communications are lost, the message "Re-establishing communication with control" is displayed until communications have been re-established (see [Figure 7 on page 30](#)). The LEDs then return to the state determined by the control.

NOTICE

If either communication message remains displayed (cannot view other menus), contact an authorized service center for service. This indicates that communications between the operator panel and the control logic is lost.

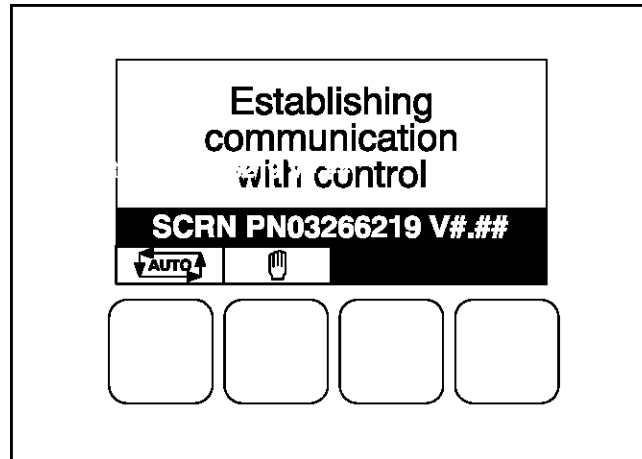


FIGURE 6. ESTABLISHING COMMUNICATION WITH CONTROL

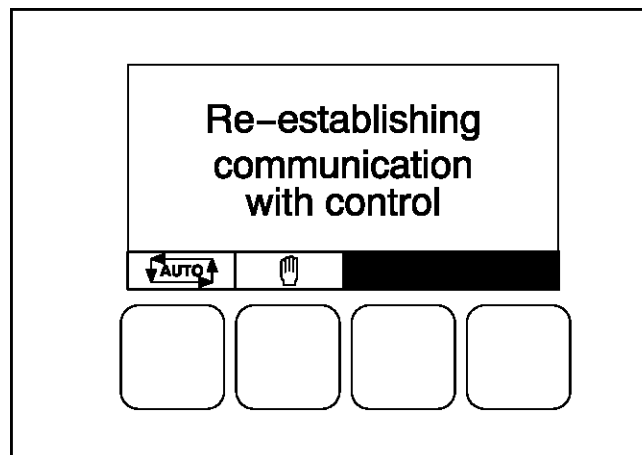


FIGURE 7. RE-ESTABLISHING COMMUNICATION WITH CONTROL

5.7.2 Event Messages

When pre-set events (time delay to start or stop) are activated, Event messages are displayed showing the time remaining until the event occurs (see [Figure 8 on page 31](#)).

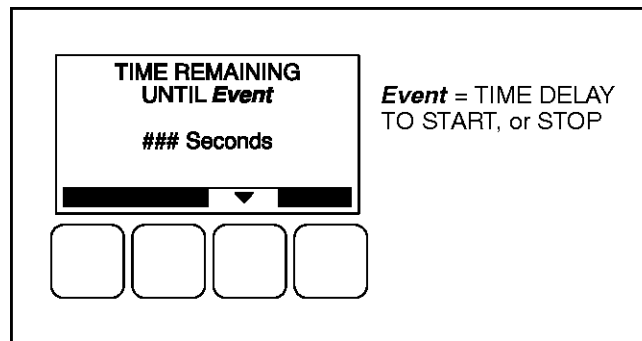


FIGURE 8. EVENT MESSAGE

5.7.3 Status Messages

Status messages for some events are displayed on the operator panel with a code number but are not announced with a lamp indicator. Text status messages include the event code, a short description, and the time the event occurred. Symbolic status messages include the event code and symbols to indicate the type of event that occurred.

On Full Authority Electronic engines, the engine controller saves data after each run. During this time, the display shows the message in [Figure 9 on page 31](#). The generator can still be started while the ECM Datasave is in progress.

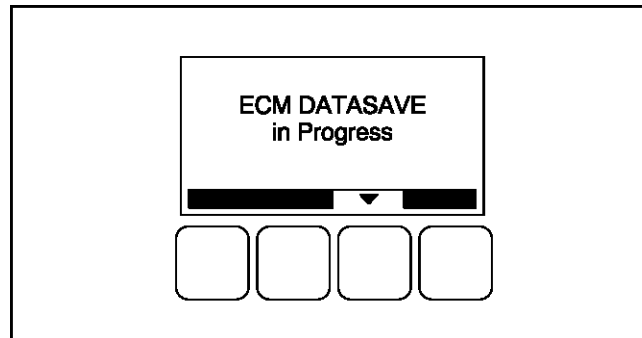




FIGURE 9. DATASAVE STATUS MESSAGE

5.7.4 Fault Messages

A Fault message is an indicator of a Warning or Shutdown condition. It includes the fault number, a short description, and when the fault occurred (see [Figure 10 on page 32](#)). Symbolic fault messages include the fault code number and symbols, indicating the type of fault (see [Figure 11 on page 32](#)). With the

symbolic versions of fault messages, the  and  symbols flash. [Chapter 9 on page 143](#) provides a list of fault codes, fault types, messages displayed, and descriptions of the faults.

Five of the most recent faults are placed in a fault history file that can be viewed using the Fault History Menu (see [Figure 21 on page 45](#)).

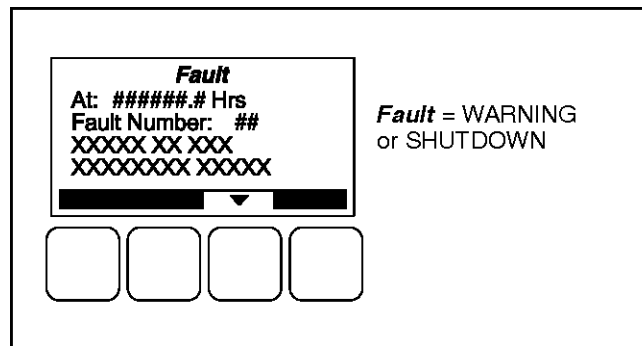


FIGURE 10. FAULT MESSAGE - TEXT VERSION

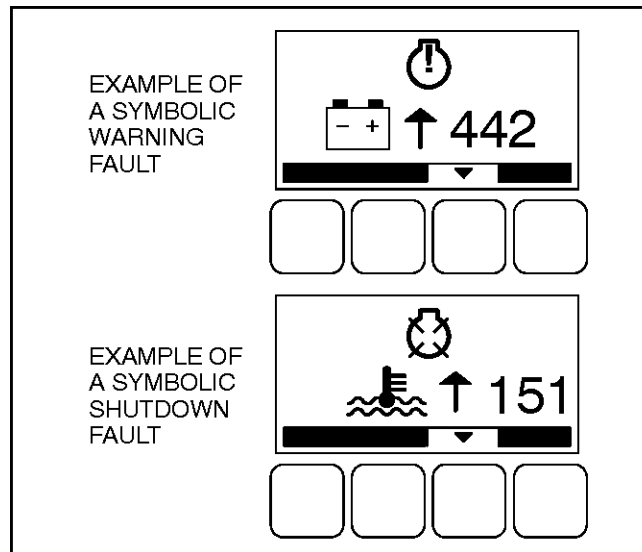



FIGURE 11. FAULT MESSAGES - SYMBOLIC VERSION

5.7.5 Fault Acknowledgement

Shutdown faults must be acknowledged after the faults have been corrected. If in Auto or Manual Run mode, the control must be set to "O" (off). Also, faults are acknowledged when in Auto and the Remote Start command is removed. Faults are cleared from the operator panel display by pressing the ▲, ▼, or  button.

Faults are re-announced if they are detected again after being acknowledged.

5.8 Selecting Auto, Manual Run, and Off Modes

Auto, Manual Run, and Off modes can be selected:

- From any of the Operator menus
- When the message "Establishing communication with control" is displayed
- When the message "Re-establishing communication with control" is displayed

Switching to Auto, Manual Run, or Off mode can be restricted to authorized personnel. If a operator panel is set up with the mode change access code feature enabled, an access code must first be entered before the mode can be changed.

NOTICE

The InPower service tool or access to the Setup menu is required to enable/disable the mode change access code feature. Contact an authorized service center for assistance.

5.8.1 Entering the Mode Change Access Code

If the mode change access code feature is enabled, an access code must be entered to switch to Auto, Manual Run, or Off mode. The text and symbolic versions of the Mode Change menu are shown in [Figure 12 on page 33](#).

To enter the mode change access code,

1. With the first character highlighted, press the button below to the + or - symbols until the value reads "1."
2. Press the arrow selection button → to move to the next numeric character.
3. Press the button below the + or - symbols until the value reads "2."
4. Press the arrow selection button → to move to the next numeric character.
5. Press the button below the + or - symbols until the value reads "1."
6. After you have completed entering the password, press the arrow selection button →.

NOTICE

If an incorrect password is entered, the Operator menu that was displayed before Auto, Manual Run, or Off mode was selected is redisplayed.

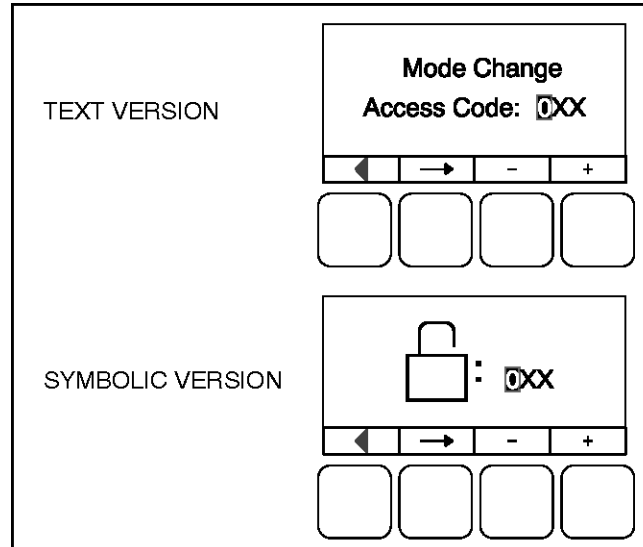

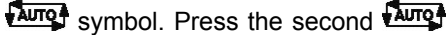




FIGURE 12. MODE CHANGE MENU

5.8.2 Selecting Auto Mode

To switch to Auto mode (see [Figure 13 on page 34](#)):

1. Press the  button on any of the Operator menus or the "Establishing/Re-establishing communication with control" menus.

- If the mode change access code feature is enabled, the Mode Change Access Code menu is displayed. Enter the mode change access code as described above.
- A menu with alternating arrows is displayed above a second  symbol. Press the second  button. The Operator menu that was displayed before Auto mode was selected is redisplayed and the Auto indicator is lit.
- To disable auto mode, press the  button.

NOTICE

If an incorrect password is entered, the Operator menu that was displayed before Auto, Manual Run, or Off mode was selected is redisplayed.

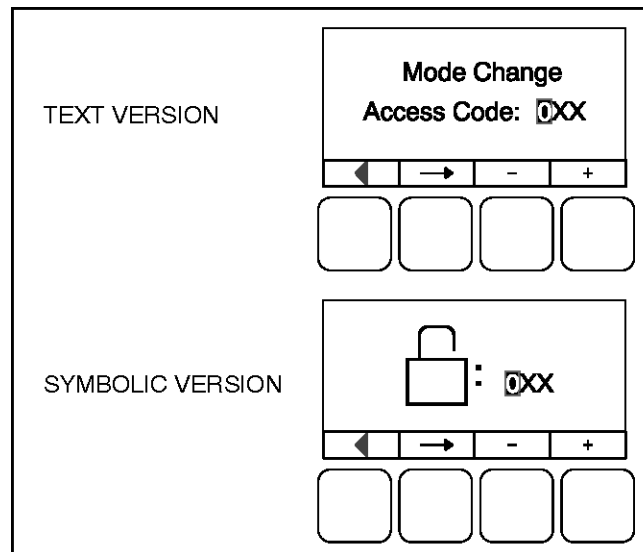





FIGURE 13. MODE CHANGE MENU

5.8.3 Selecting Manual Run Mode

To switch to Manual Run mode (see [Figure 14 on page 35](#)):

- Press the  button on any of the Operator menus or if displayed, the "Establishing/Re-establishing communication with control" menus.
- If the mode change access code feature is enabled, the Mode Change Access Code menu is displayed. Enter the mode change access code as described in [Section 5.8.1 on page 33](#).
- A menu with alternating arrows is displayed above a second  symbol. Press the second  button to start the generator set.

The Operator menu that was displayed before Manual Run mode was selected is redisplayed and the Manual Run indicator is lit.

To disable Manual Run mode, press the  button.

NOTICE

Auto mode can also be selected while in Manual Run mode. Switching to Auto mode may result in the generator set shutting down.

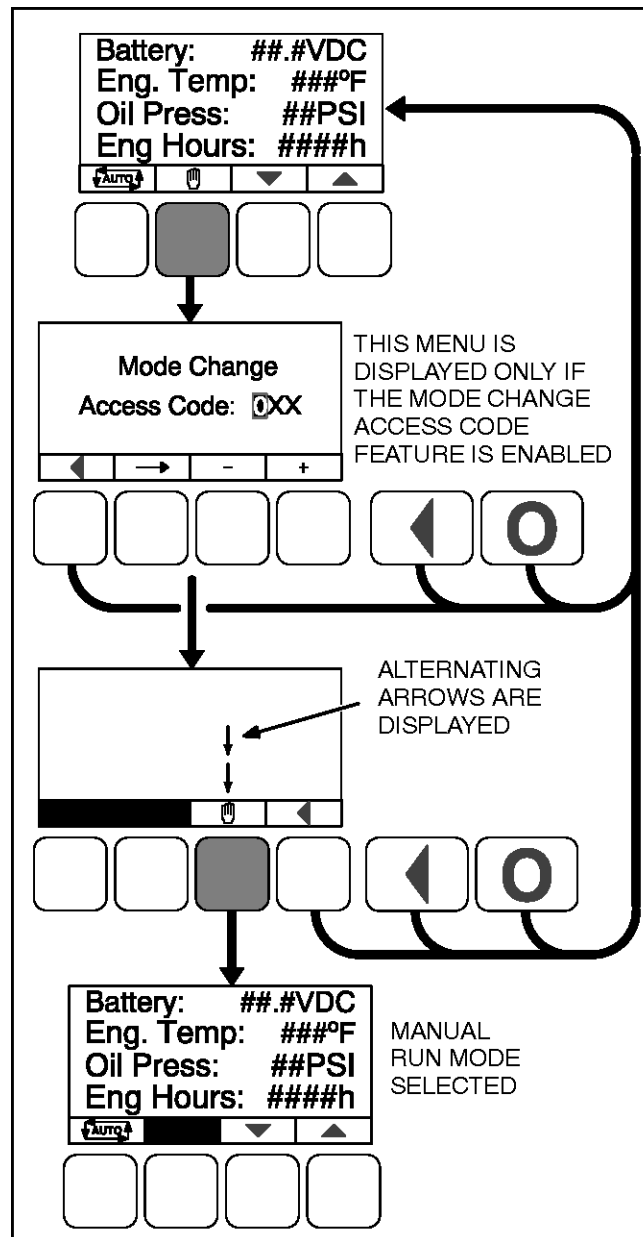









FIGURE 14. SELECTING MANUAL RUN MODE

5.8.4 Aborting the Transition to Auto or Manual Run Mode

If the Mode Change Access Code menu or the menu showing alternating arrows above the  or  buttons is displayed, the transition to Auto or Manual Run mode is aborted when:

- Either the , , or  button is pressed.
- The  or  button is not pressed within ten seconds.

If the transition to Auto or Manual Run mode is aborted, the Operator menu that was displayed before Auto or Manual Run mode was selected is redisplayed.

5.9 Operator Menus

[Figure 15 on page 37](#) and [Figure 16 on page 38](#) show block representations of the following Operator menus.

- Engine Status
- Alternator Status
- Line-to-Line Voltage
- Line-to-Neutral Voltage
- Alternator Amperage

To navigate between the Operator menus, press the buttons next to the ▲ and ▼ symbols in the graphical display.

The Operator menus can be used to select Auto or Manual Run modes.

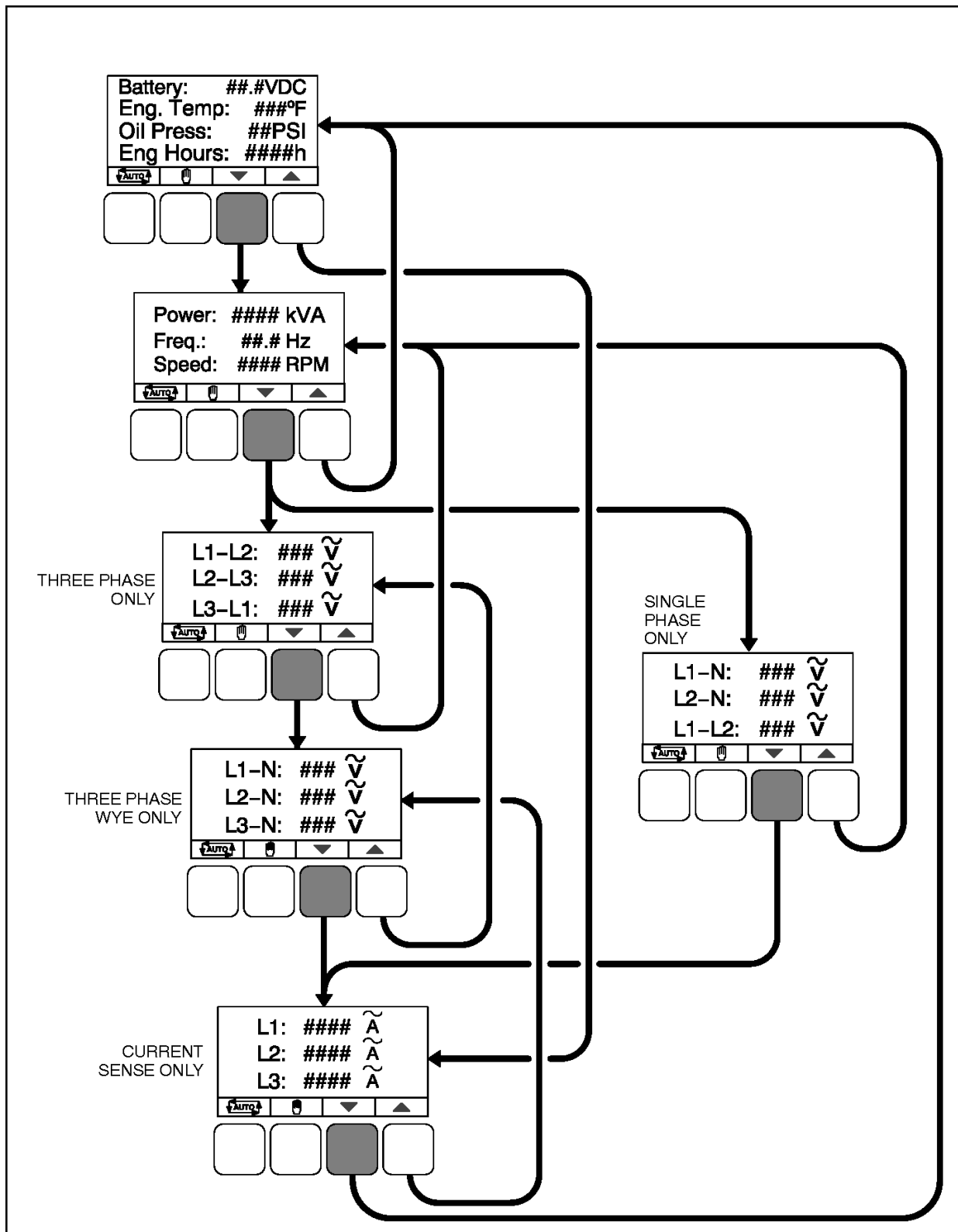


FIGURE 15. OPERATOR MENUS - TEXT VERSION

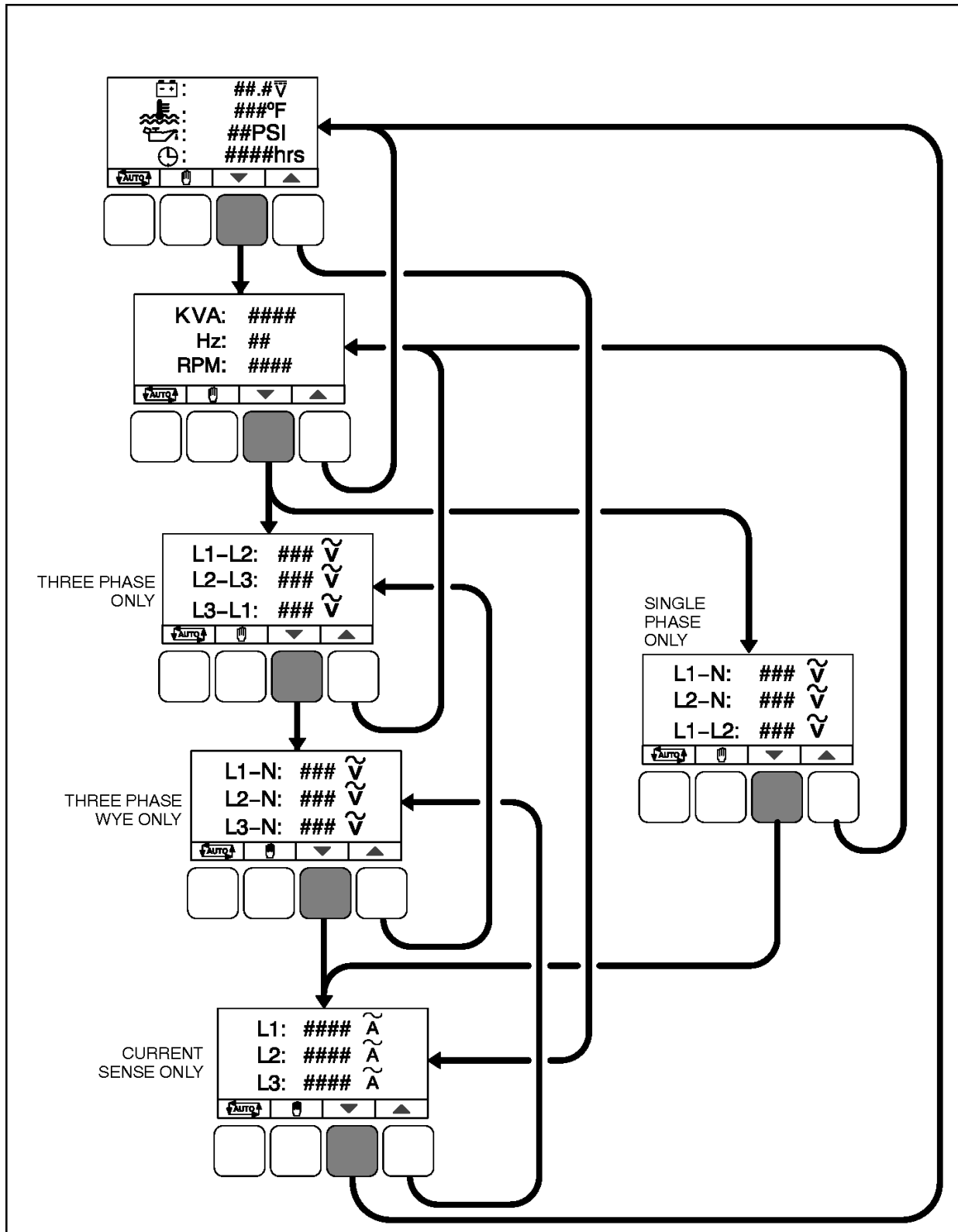


FIGURE 16. OPERATOR MENUS - SYMBOLIC VERSION

5.9.1 Engine Status Menu

This menu displays the engine starting battery voltage, engine coolant temperature, engine oil pressure, and hours of engine operation. (Oil pressure - only available on some models).

5.9.2 Alternator Status Menu

This menu displays generator set power (in kVA), frequency, and engine speed (RPM). (In applications without current transformers, the kVA is not shown.)

5.9.3 Alternator Line-to-Line Voltage Menu

This menu displays L1-L2, L2-L3, and L3-L1 line-to-line voltages for three phase applications only.

5.9.4 Alternator Line-to-Neutral Voltage Menu

This menu displays line-to-neutral voltages for L1, L2, and L3 for three phase wye configurations only. (In delta configurations, this menu is not shown.)

5.9.5 Alternator Single Phase Voltage Menu

This menu displays L1-N, L2-N, and L1-L2 voltages for single phase applications only.

5.9.6 Alternator Amperage Menu

This menu displays L1, L2, and L3 amperage. (In applications without current transformers, this menu is not shown.)

5.10 Service Menus


[Figure 17 on page 40](#) shows a block representation of the menus available from the Service Menu.

NOTICE

[Appendix A on page 239](#) provides a block diagram that illustrates the sequence of how the Service Menus are displayed.

The first Service Menu can be viewed from any of the Operator menus by simultaneously pressing the ▲ and ▼ selection buttons for two seconds. The first Service Menu provides access to the following menus:

- Setup Menu - Used by Service personnel. Adjusting the Setup menu is restricted by a password. To view the Setup menu only, press the VIEW button on the Setup password menu.
- History / About - see [Section 5.11 on page 41](#).
- Screen Adjust - see [Section 5.12 on page 43](#).

To return to the Operator menu that was displayed prior to viewing the Service Menu, press the  button.

The second Service Menu can be viewed by pressing the ▼ selection button on the first Service Menu. The second Service Menu provides access to the following menus:

- Fault History - see [Section 5.13 on page 44](#).
- Status - see [Section 5.10.1 on page 41](#).
- Lamp Test - The six LEDs on the operator panel should light as long as the button (6) is pressed.

The third Service Menu can be viewed by pressing the ▼ selection button on the second Service Menu. The third Service Menu provides access to the Network Status menus.

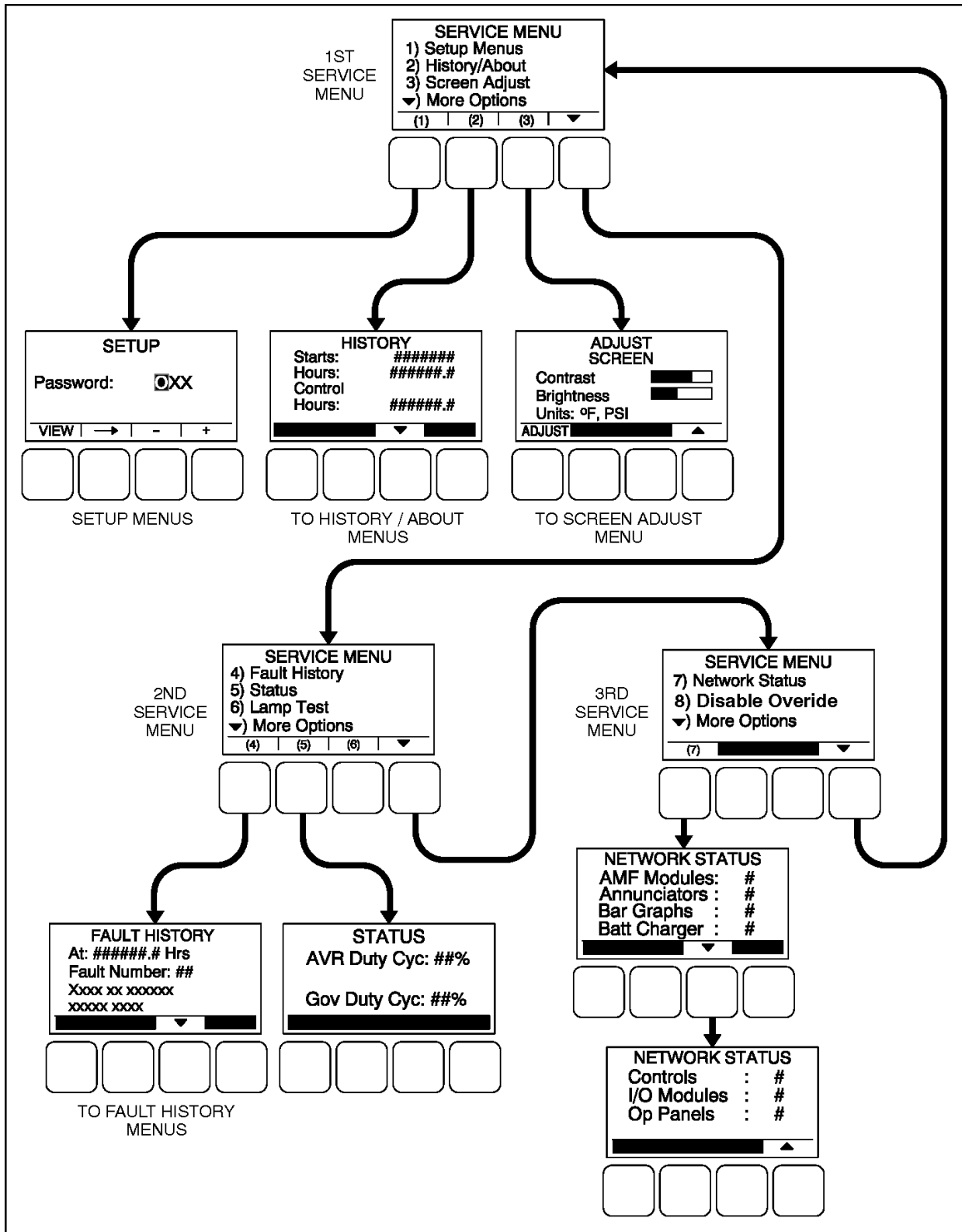


FIGURE 17. SERVICE MENUS

5.10.1 Status Menu

The Status menu is displayed when the **(5)** button is pressed on the second Service Menu. The Status menu shows the following:

- Voltage regulator (drive) level, in percentage of duty cycle
- Governor regulator (drive) level, in percentage of duty cycle. This value is only displayed if the governor is enabled.


5.10.2 Network Status Menus

The Network Status menus are displayed when the **(7)** button is pressed on the third Service Menu. Two menus are used to display the quantity of the following devices that are connected to the network.

- Auto Mains Failure (AMF) modules
- Universal Annunciators
- Bar graphs
- Battery chargers
- Controls
- I/O modules
- Operator panels (any type)

5.11 History / About Menu

[Figure 18 on page 42](#) shows a block representation of the History / About menu. The first History / About submenu is displayed when the **(2)** button is pressed on the Service Menu.

Press the buttons next to the ▲ and ▼ symbols in the graphical display to navigate between the History / About submenus. Press the  button to return to the Service Menu.

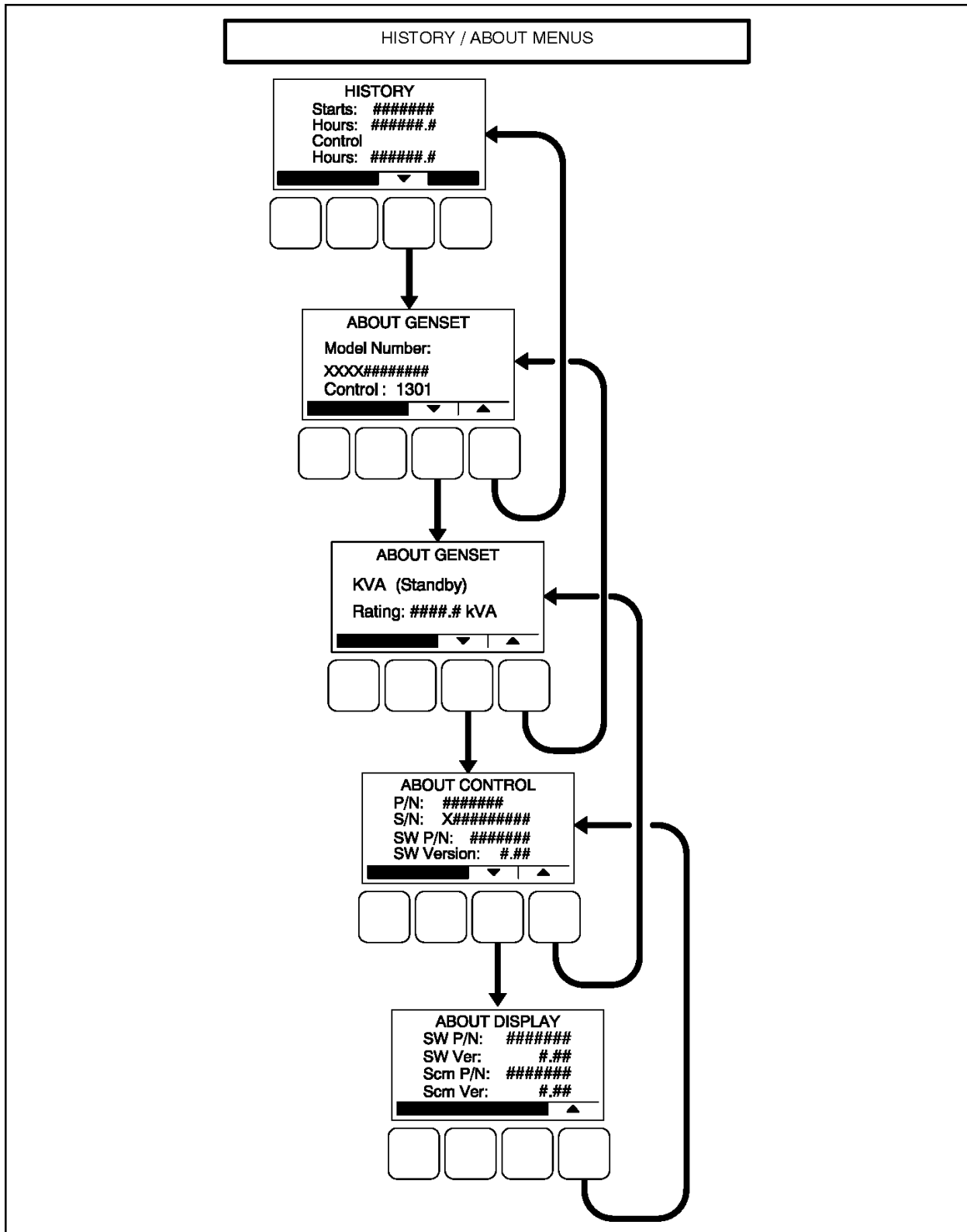


FIGURE 18. HISTORY / ABOUT MENU

5.11.1 History Submenu

This submenu displays the number of engine starts, hours of operation for the engine, and hours of operation for the control.

5.11.2 About Genset Submenu

This submenu displays the generator set model number and rating.

5.11.3 About Control Submenu

This submenu displays the control's part number, serial number (up to 11 characters), software part number, and software version.

5.11.4 About Display Submenu

This submenu displays the optional operator panel software part number, software version, screen part number, and screen version of the display.

5.12 Screen Adjust Menu

[Figure 19 on page 43](#) shows a block representation of the Screen Adjust menu. The Screen Adjust submenu is displayed when the **(3)** button is pressed in the first Service Menu.

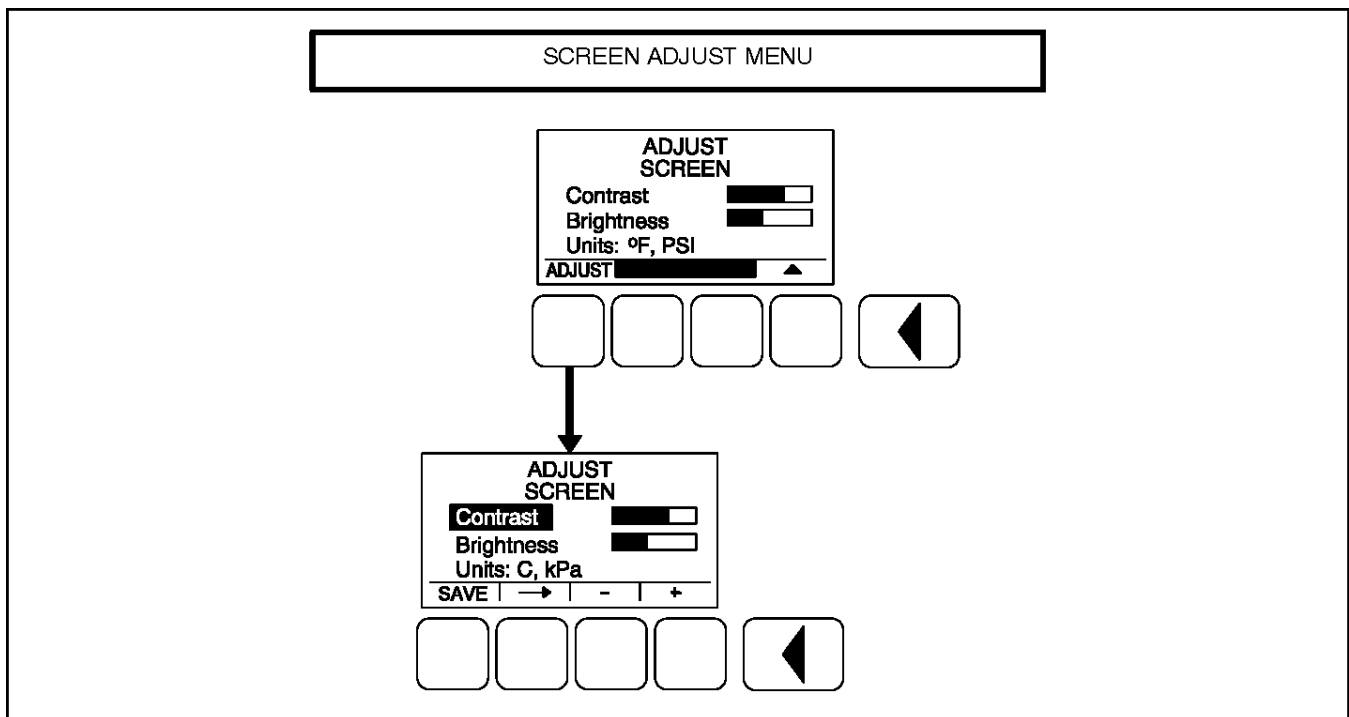


FIGURE 19. SCREEN ADJUST MENU


5.12.1 Adjusting Values/Parameters

1. Press the **ADJUST** selection button to select the first parameter or value to be changed.
2. Press the **+** or **-** selection buttons to adjust values or select parameters.

3. Press the arrow selection button → to navigate to the next or previous adjustable value or parameter.
4. After adjusting values/selecting parameters, press the SAVE button to save your settings.

NOTICE

If the Previous Menu button  is pressed before pressing the SAVE button, the changes are not saved.

5. Press the  button to return to the Service Menu.

5.12.2 Screen Adjust Menu


This menu allows for adjusting the screen's contrast and brightness and for selecting the units of measurement (SAE or SI) to be displayed.

- Contrast and Brightness: Press the + or - selection buttons to adjust the screen's contrast and brightness. Changing the brightness setting also affects the brightness of the LEDs on the operator panel.
- Units: Press the + or - selection buttons to select SAE (°F, PSI) or SI (C, kPa) units of measurement to be displayed.

5.13 Fault History Menu

[Figure 21 on page 45](#) shows a block representation of the Fault History menu. The first Fault menu is displayed when the (4) button is pressed on the second Service Menu. If there are any active fault submenus, an "Active Fault" heading is displayed for the most recent active fault. All other fault submenus display a "Fault History" heading. Five of the most recent faults can be viewed. An example of how a fault code is displayed is shown in [Figure 20 on page 44](#).

Press the buttons next to the ▲ and ▼ symbols in the graphical display to navigate between menus.

Press the  button to return to the Service Menu.

Information on faults is found in [Chapter 9 on page 143](#).

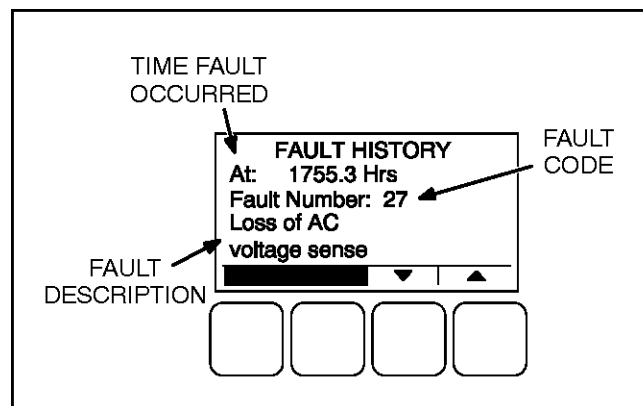


FIGURE 20. FAULT HISTORY MENU EXAMPLE

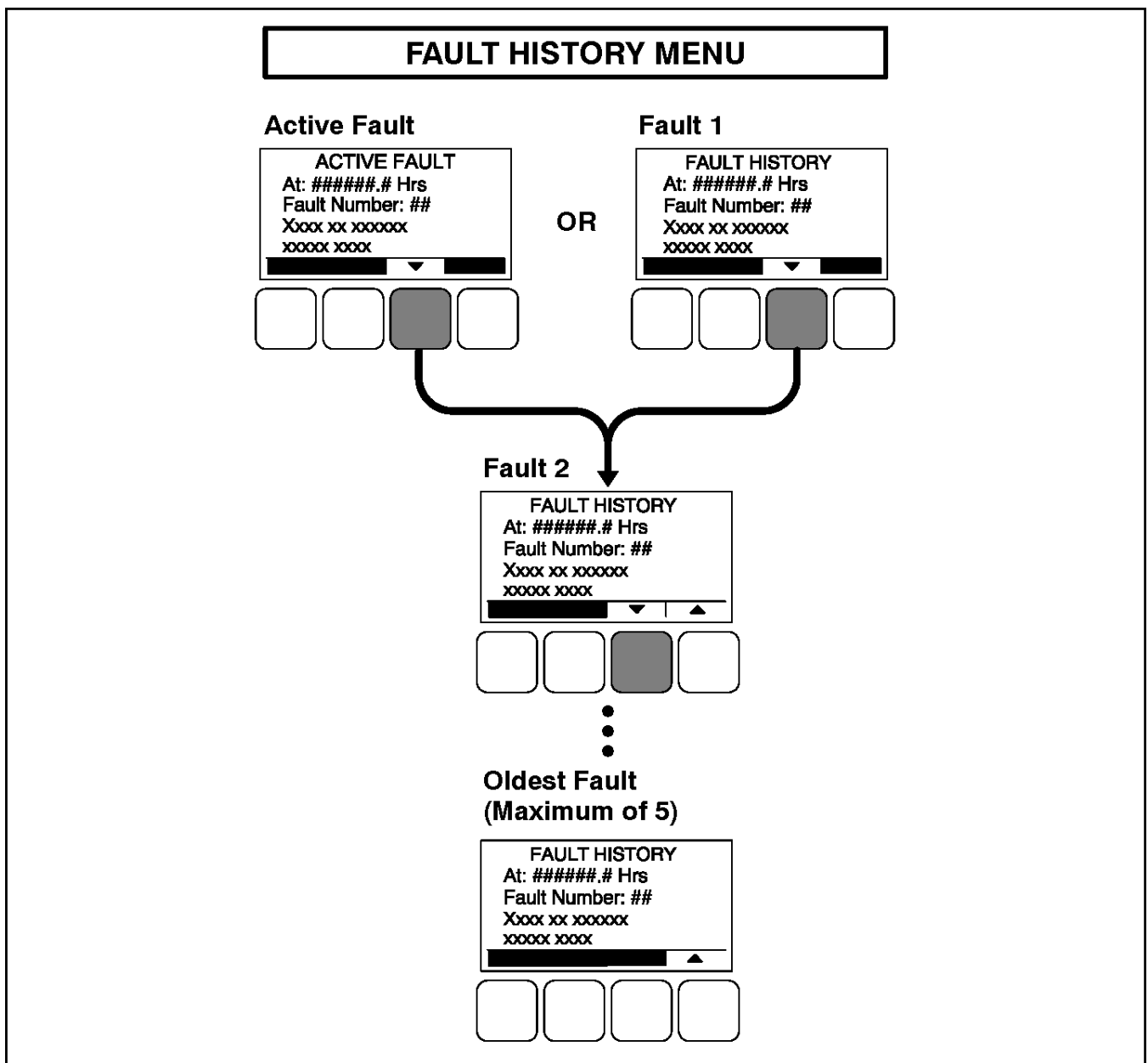


FIGURE 21. FAULT HISTORY MENU

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6 Control System - PowerCommand 1.1R

6.1 PowerCommand 1.1R Components

The PowerCommand 1.1R System consists of the following:

- A PCC 1302 Control Board
- An HMI 211R Operator Panel.

6.2 Control Description

The control is used to start and stop the generator set, and provides full generator set monitoring capability and protection in a stand-alone situation (non paralleling) from the display screen. It monitors the engine for temperature, oil pressure and speed, and provides voltage and current metering. In the event of a fault, the unit indicates the fault type and on critical faults automatically shuts down the generator set.

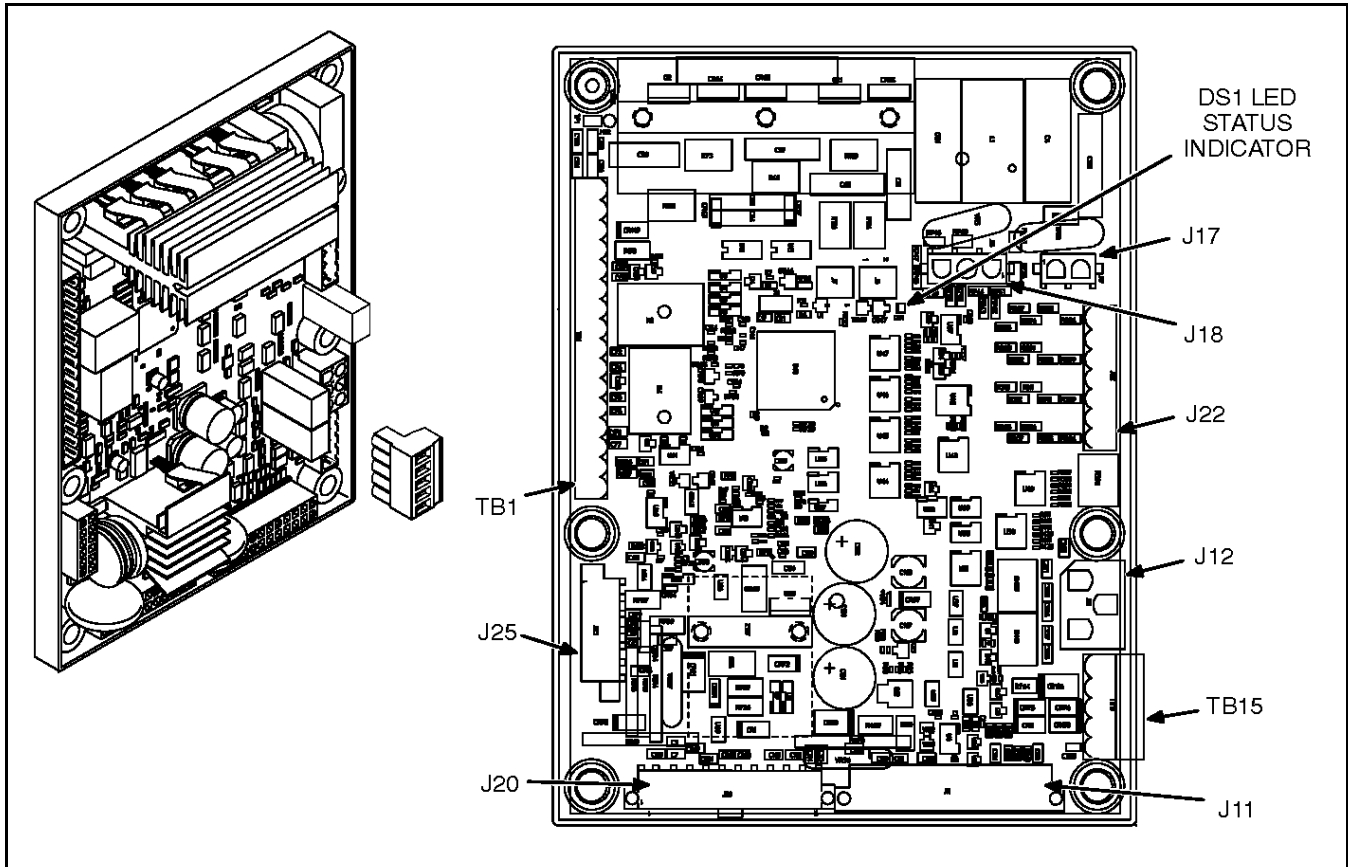
All indicators, control buttons, and the display screen are on the face of the operator panel.

There are two fault level signals generated by the control:

- Warning: signals an imminent or non-critical fault for the engine. The control provides an indication only for this condition.
- Shutdown: signals a potentially critical fault for the engine. The control immediately takes the engine off-load and automatically shuts down.

The standard control system operates on 12 or 24 VDC battery power. The auxiliary equipment operates on LV AC power. The history data is stored in non-volatile memory and is not deleted if battery power is lost.

TABLE 3. PCC 1302 CONTROL BOARD



Connector	Description
J11	Engine Harness
J12	Generator Set CTs
J17	AVR Field
J18	AVR Power
J20	Generator Set Accessories Harness
J22	Generator Set Voltage Sense
J25	Operator Panel Harness
TB1	Field Connections
TB15	RS-485 Communications

6.3 PCC 1302 Features

The PCC 1302 includes:

- Single-phase or three-phase (delta or wye) 600 volt voltage sensing and 5 amp CT current sensing
- 50 or 60 Hertz frequency
- Service Tool / ModBus communications connector (TB15)

- Start/stop functionality through either an operator panel or a Manual Run/Off/Auto switch located in the harness
- Control board status LED
- Shunt or PMG excitation methods
- CAN Datalink with PGI protocol support
- Common connector scheme support
- Programmable wake-in-auto function

A PCC 1302 installation may also include the following options.

- If a operator panel is mounted on the generator set (local display), one additional operator panel can be mounted up to 4000 feet (1219.2 meters) from the generator set (remote displays). A setup menu in the optional display panel is required to designate a display as Local or Remote.
- Local status indicator lamp driver
- Remote and local emergency stop
- Four configurable inputs
- Annunciator fault inputs 1, 2, and 3 - These outputs can be used when an annunciator is installed as part of an PCCNet interface connected to TB1-2 and TB1-3. Grounding one of these inputs on the annunciator activates the corresponding warning or shutdown sequence.
Three Customer Annunciator Text message submenus are supplied to enter the event type and description.
- ECM CAN engine interface

6.3.1 Local Status Output

A status indicator lamp can be used to flash generator set status and shutdown fault codes. The Manual Run/Off/Auto switch may include a status indicator lamp.

- Constant On = The generator set is running.
- Shutdown, warning and remote start LED indicators are available on front display.

NOTICE

Only the last shutdown fault is flashed.

6.4 Operating Modes

The PCC 1302 works with a Manual Run/Off/Auto switch, used to control generator set operating modes. This capability is located either in the harness (switch) or is integrated into the control panel.

6.4.1 Off Mode

When in Off mode, the control does not allow the generator set to start. If the generator set is already running and the control is set to Off, it initiates a normal shutdown sequence.

6.4.2 Manual Run Mode

When in Manual Run mode, the generator set starts and continues to run until the control is put into the Off mode. While in Manual Run mode, the remote start signal is ignored.

6.4.3 Auto Mode

When in Auto mode, the control allows the generator set to be started with a remote start signal only.

When in Auto mode, the generator set can start at any time. When a remote start signal is received, the genset starts after a time delay preheat (if programmed) and time delay start (if programmed) is completed.

If the generator set is running in Auto mode and the Off button is pressed, the control immediately stops the genset and the control transitions to the Off mode.

When all remote start signals are removed, the control performs a normal shutdown sequence which may include a time delay stop.

6.4.4 Emergency Stop Mode

When an optional emergency stop button is used, it immediately shuts down the generator set, bypassing any time delay stop. If an optional emergency stop is not used, the local and remote E-stop signals must be shorted to GND. The red Shutdown LED lights and one of the two emergency stop fault codes (**1433 - Local Emergency Stop** or **1434 - Remote Emergency Stop**) is either displayed (installations with an operator panel) or flashed (installations with a status indicator lamp), depending on which was activated last.

To reset the control, close (disable) the active emergency stop button(s) and perform a fault reset.

6.4.5 Sleep Mode

The PCC 1302 control enters a low power (sleep) mode of operation where the current draw is not greater than 60 milliamps (DC) at normal battery voltage levels. The control is set to enter sleep mode after five minutes in Off mode or Auto mode, if configured. (Sleep mode can be disabled if a jumper is installed connecting TB15-1 to TB15-5.)

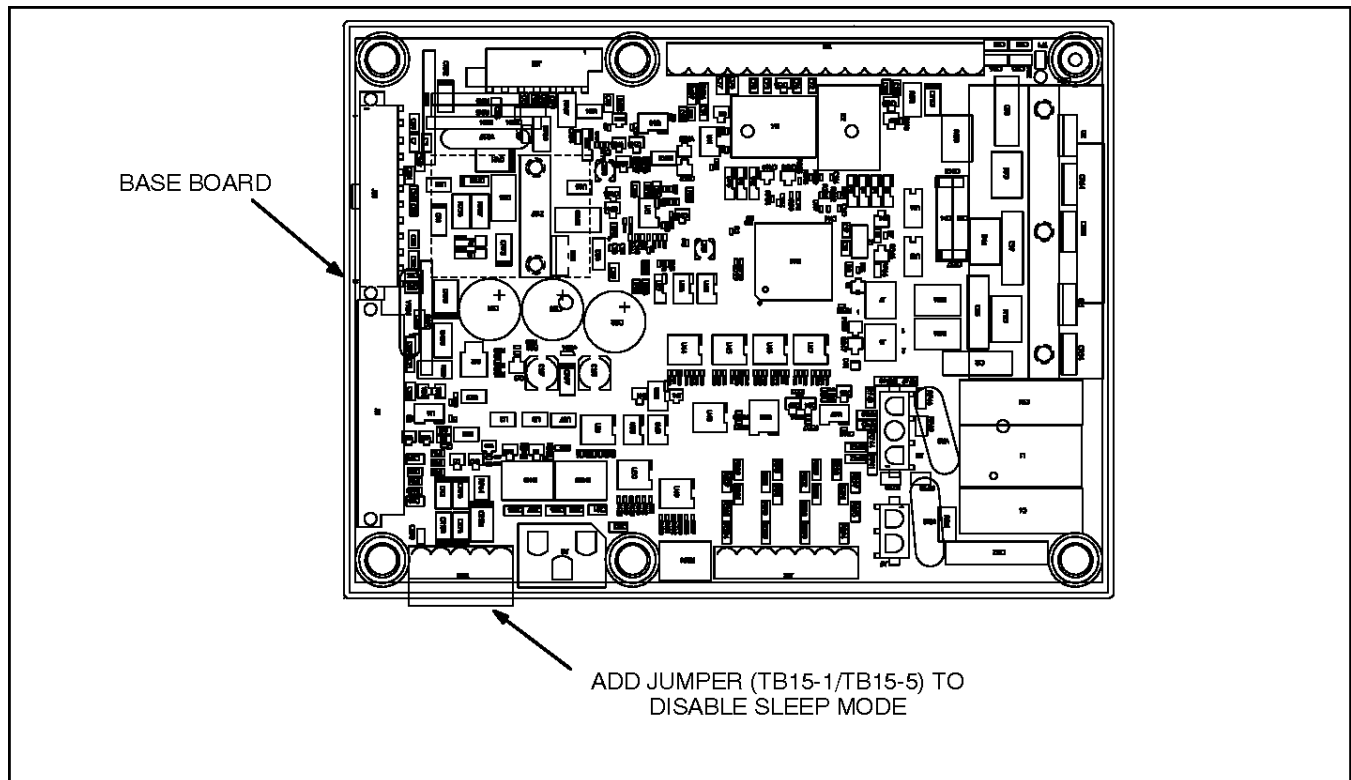


FIGURE 22. SLEEP MODE ACTIVATION SETTINGS

The control will not enter the sleep mode if there are any active, unacknowledged shutdown faults, if the control is in the Manual Run mode, or if there are any active wake-up signals. Once in sleep mode, any of the following inputs will wake the control.

- Remote Start
- Manual Start
- Configurable Input 3
- Configurable Input 4
- Local E-Stop (active when switch is open)
- Remote E-Stop (active when switch is open)
- Auto Mode (if configured)
- Bi-directional System Wake-Up

Sleep mode is automatically enabled on the operator panel. The PCC 1302 control determines that it should sleep when the display panel has had no key presses for five minutes and wake-up signals are inactive. The control system can be awakened by pressing the keypad on the operator panel or by activating any wake-up input.

6.4.5.1 Configuring Sleep In Auto Mode

1. Power the control and wake it up.
2. Use InPower to connect to the PCC 1302.
3. Use InPower to disable the Wake-In-Auto feature.
4. Save adjustments.
5. Disconnect the PCC 1302 from InPower.

6.4.5.2 Installations with a Manual Run/Off/Auto Switch

For installations that utilize an Manual Run/Off/Auto switch located in the harness, the control awakes from sleep mode if Manual Run mode is selected. The control will also wake up if Auto mode is selected and the control is configured to stay awake when in Auto mode, Wake-In-Auto = Enabled.

6.5 Control Board

WARNING

HAZARDOUS VOLTAGE. *Touching uninsulated parts in the controller can result in severe personal injury or death. Measurements and adjustments must be done with care to avoid touching hazardous voltage parts.*

WARNING

Stand on a dry wooden platform or rubber insulating mat, make sure your clothing and shoes are dry, remove jewelry and use tools with insulated handles.

CAUTION

Electrostatic discharge will damage circuit boards. Always wear a grounding wrist strap when touching or handling circuit boards.

The control board contains all of the electronic circuitry required to operate the generator set. The control board provides main alternator voltage output regulation and complete generator set control and monitoring. Refer to Block diagram in [Appendix A on page 239](#) for each terminal board connection and connector pin input/output signal.

The block diagram that follows shows the external connections of the PCC system.

After determining that a control board assembly is faulty, replace it; do not repair it. Attempts to repair a control board can lead to costly damage to the equipment.

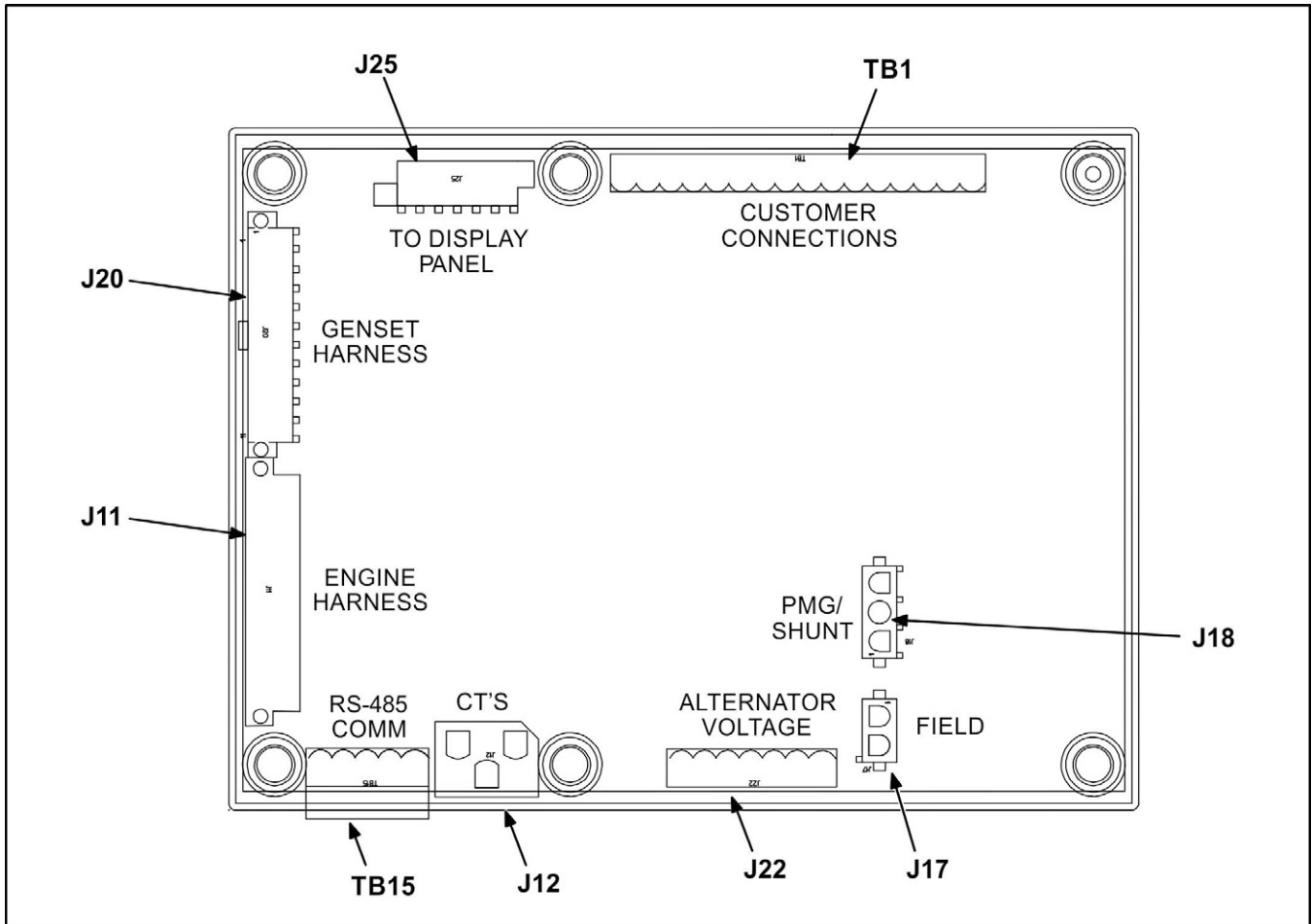


FIGURE 23. CONTROL BOARD CONNECTOR/TERMINAL PIN LOCATIONS

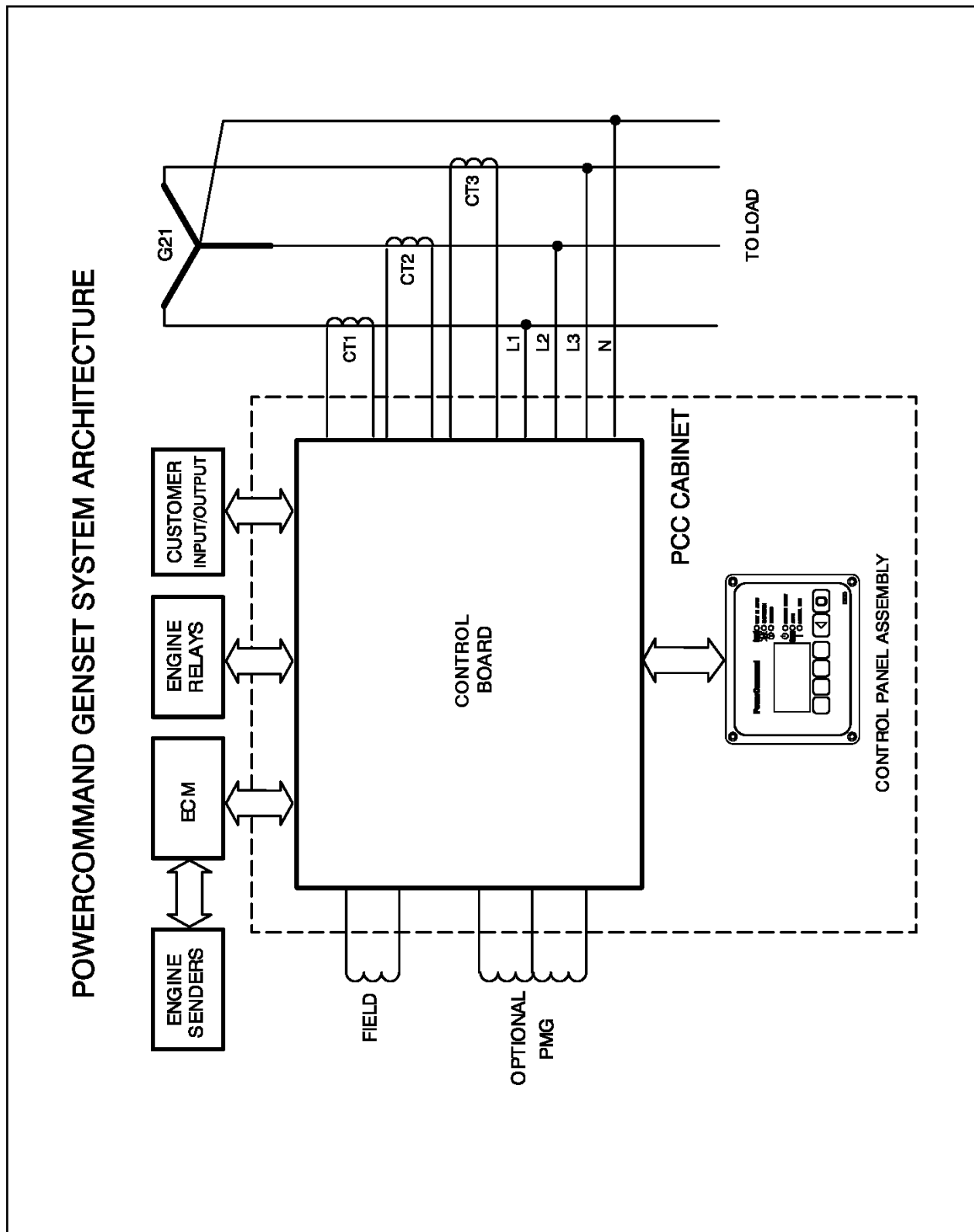


FIGURE 24. BLOCK DIAGRAM

6.6 Operator Panel

[Figure 25 on page 54](#) shows the features of the front panel. It includes six LED indicators, the display, and six buttons.

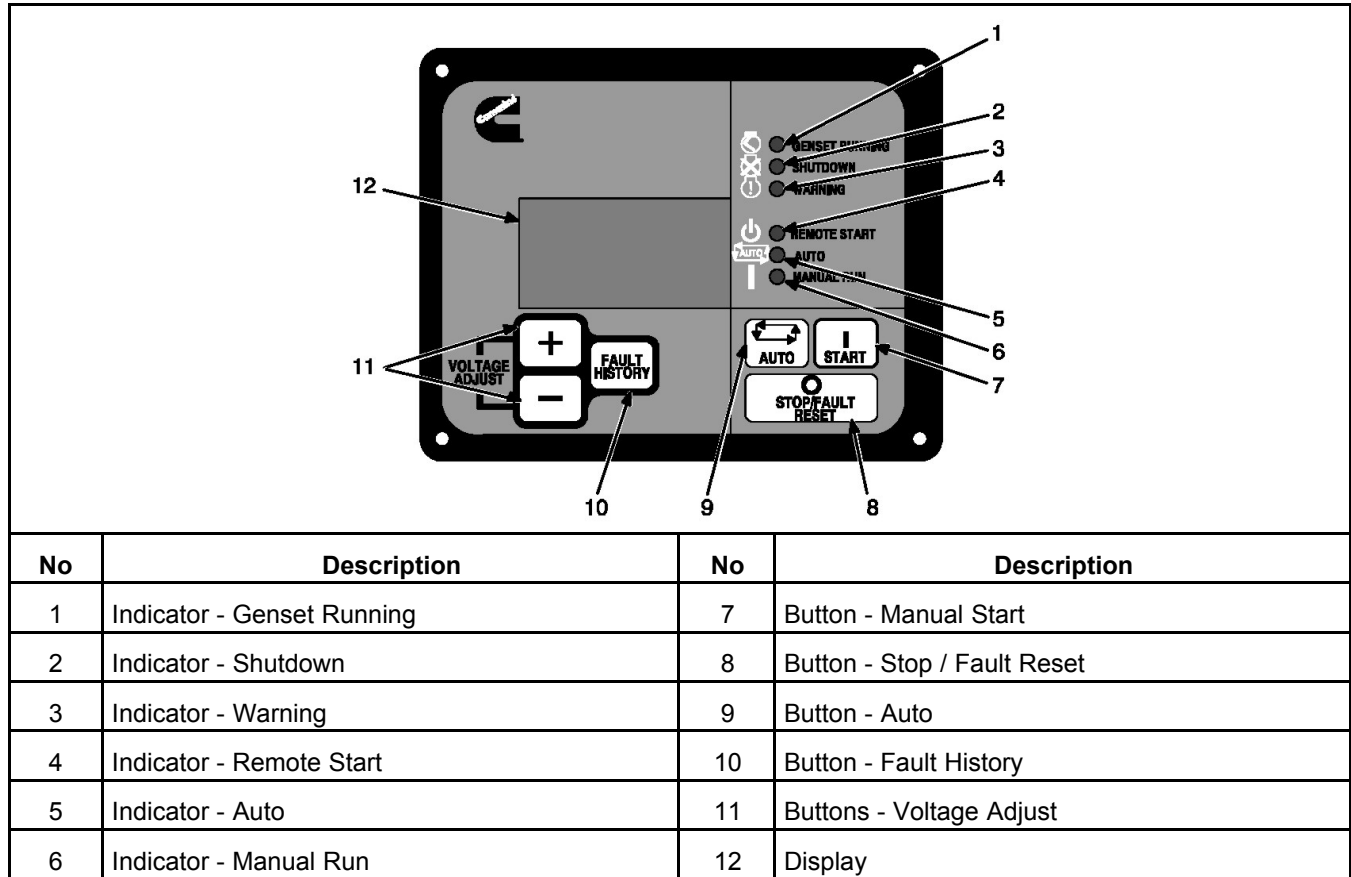


FIGURE 25. OPERATOR PANEL

6.6.1 LED Indicators

[Figure 25 on page 54](#) shows the front panel of the Operator Panel. It includes six LED indicators, the display, and six buttons used to navigate through the menus and adjust parameters.

6.6.1.1 Generator Set Running Lamp

The green lamp is lit when the generator set is running at, or near, rated speed and voltage. This is not lit while the generator set is warming up or cooling down.

6.6.1.2 Shutdown Status

This red lamp is lit when the control detects a Shutdown condition. The generator set cannot be started when this lamp is on. After the condition has been corrected, the lamp can be reset by pressing the



6.6.1.3 Warning

This amber lamp is lit whenever the control detects a Warning condition. This lamp is automatically shut off when the Warning condition no longer exists.

6.6.1.4 Remote Start


This green lamp indicates the control is receiving a **remote run** signal.

6.6.1.5 Auto

This green lamp indicates that the control is in Auto mode.

6.6.1.6 Manual Run Mode

When in Manual Run mode, the generator set starts and continues to run until the control is shutdown.

Pressing the  button initiates a normal shutdown sequence that does not include a time delay stop. While in the Manual Run mode, any remote start signal is ignored.

6.6.2 Display and Buttons

[Figure 25 on page 54](#) shows the display and the buttons.

The display is used to view system messages (communication, event, and fault). The buttons select operation modes, display fault history, and adjust generator set voltage.

System messages (communication and fault) are also shown on the display. For more information see [Operator Panel Messages on page 57](#).

6.6.2.1 Start Button



When the **Start** button is pressed, the generator set starts in manual mode.

6.6.2.2 Auto Button



Press the **Auto** button to put the generator set into the Auto mode. In this mode, the generator set is controlled by a remote switch.

6.6.2.3 Stop / Fault Reset Button



Press the **Stop/Fault Reset** button to shutdown the generator set and to reset faults. Auto or Manual mode is disabled.

NOTICE

If possible, hot shutdown under load should be avoided to help prolong the reliability of the generator set.

6.6.2.4 Fault History Button



Press the **Fault History** button to see the first fault in fault history. Press the **Fault History** button again to see the next fault in fault history. The control shows up to ten faults. Repeated pressing of this button cycles through the last ten faults ([Figure 26](#)).

If a key is not pressed for 30 seconds, the display returns to the home screens.

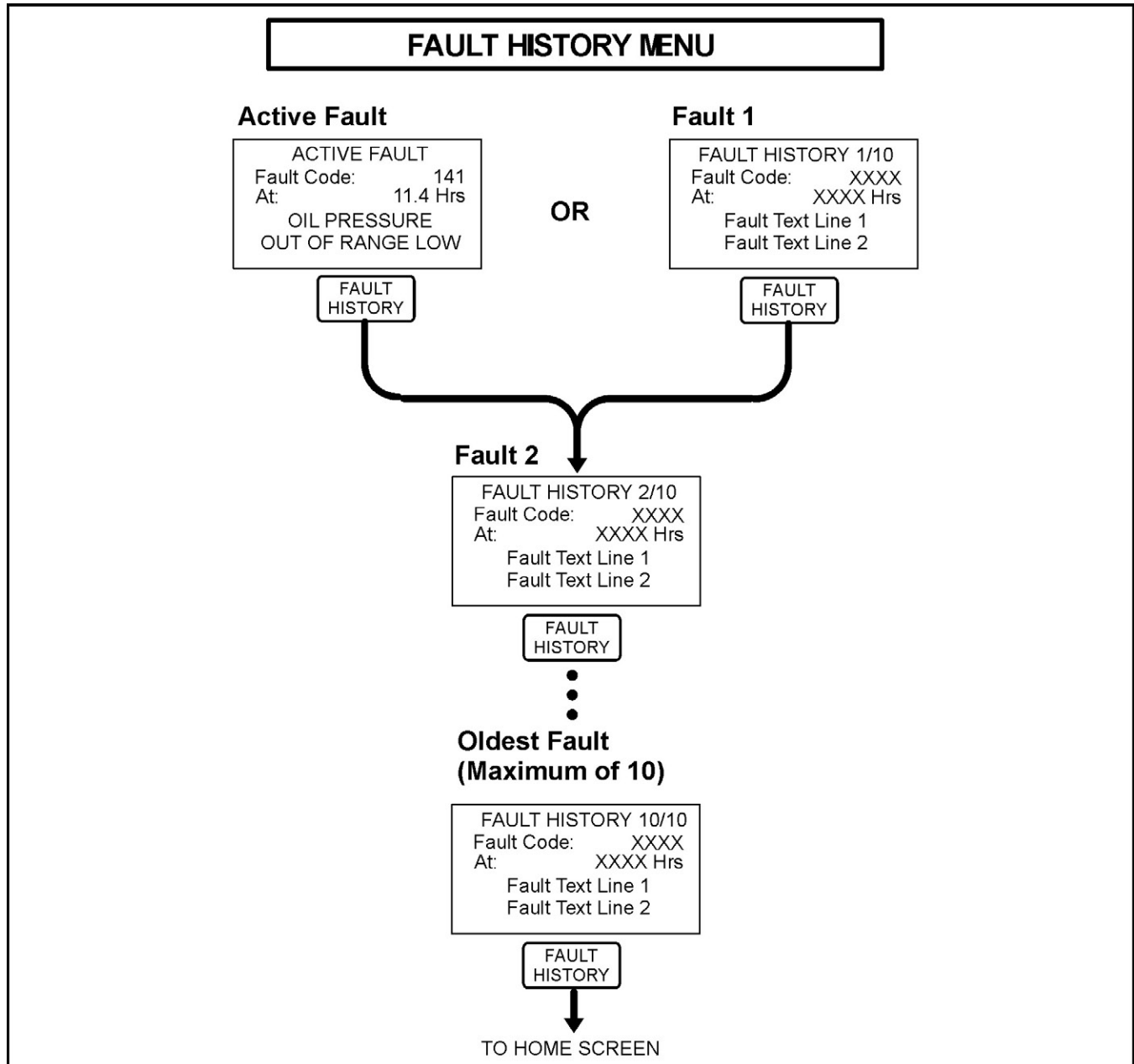
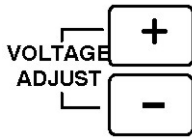


FIGURE 26. FAULT HISTORY CYCLE

6.6.2.5 Voltage Adjust Buttons



Press the + or - button to change the generator voltage. Each time the + button is pressed, the voltage increases approximately 1 V. Each time the - button is pressed, the voltage decreases approximately 1 V. Maximum voltage increase is + 5% of Nominal. Maximum voltage decrease is -15% of nominal.

NOTICE

Voltage decrease of -15% may only be achievable while generator set is running under load. Nominal voltage is considered 480V or 240V depending on the setting.

6.7 System Messages

The operator panel shows messages for six types of events.

- Generator set is running (also called home screens).
- Generator set is starting.
- Generator set is idling.
- Generator set is stopped.
- Generator set has a fault.
- Generator set is in regeneration or requires regeneration.

6.7.1 Initial Power-up - Messages

When the generator set is started, the display panel establishes communication with the controller ([Figure 27](#)). The Genset Status message shows after communication is established ([Figure 28](#)).

Establishing
communication
With control

FIGURE 27. SAMPLE POWER-UP DISPLAY

Genset Status: Stopped
Voltage Setpoint: 480V
Three Phase, Wye.

FIGURE 28. SAMPLE GENSET STATUS DISPLAY

6.7.2 Generator Set Starting - Messages

When the generator set starts, the display shows three status messages, a pre-lube message, a preheat message, and a starting message ([Figure 29](#)). After the status messages display and the generator set is started, the display shows either the Genset Running messages or the Genset Idling message (Refer to [Generator Set Running - Messages on page 58](#) and [Generator Set Idling - Message on page 59](#)).

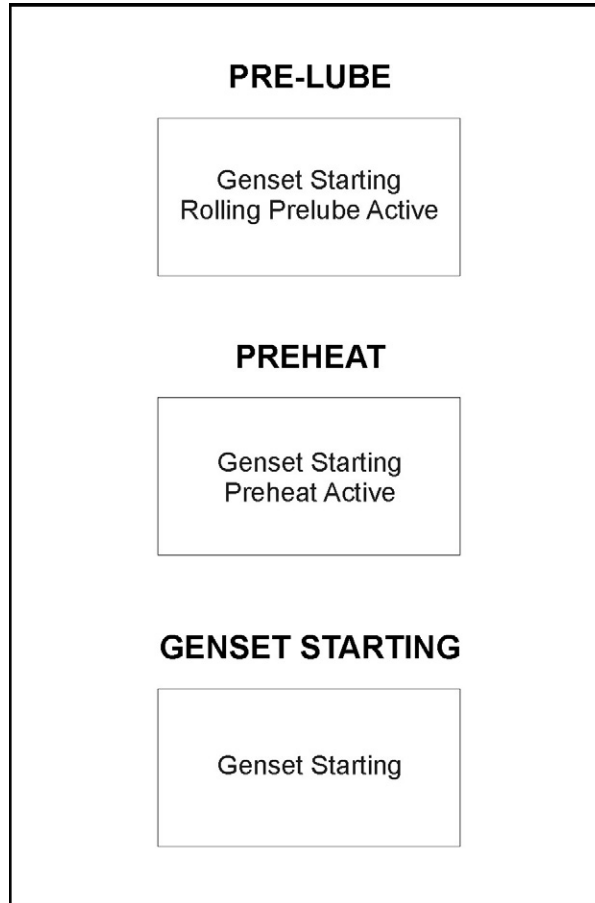


FIGURE 29. SAMPLE STARTING MESSAGES

6.7.3 Generator Set Running - Messages

The display changes between two messages when the generator set is running. One message shows engine data. One message shows generator power data. The message changes every five seconds. See [Figure 30](#).

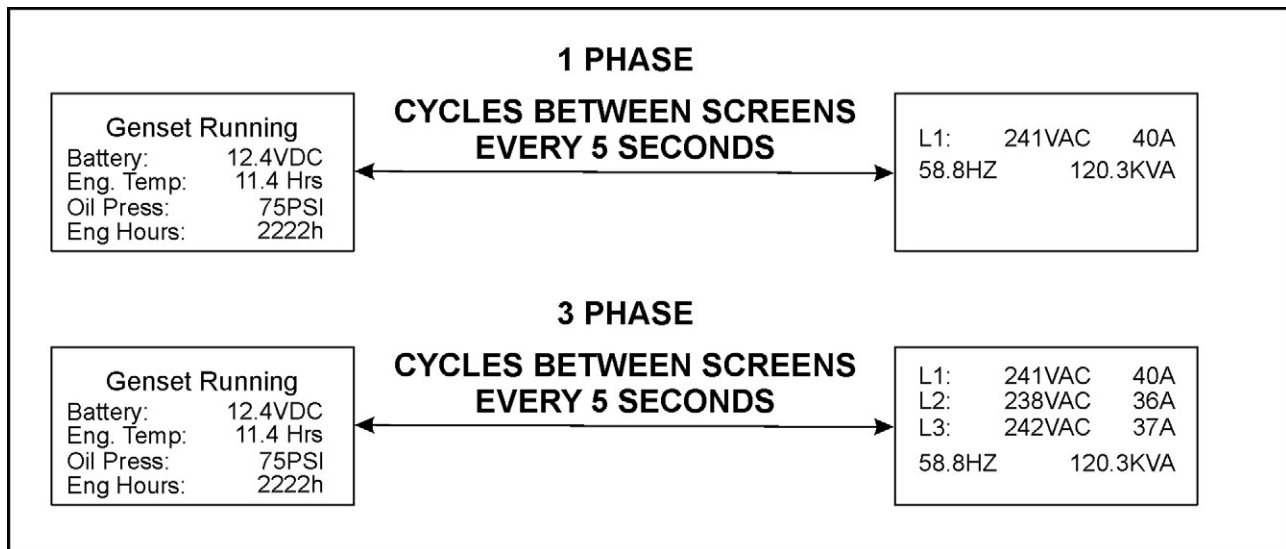


FIGURE 30. EXAMPLE GENSET RUNNING MESSAGES

6.7.4 Generator Set Idling - Message

The **RUN/IDLE** switch on the operator panel selects engine idle and engine run. When the switch is in the **IDLE** position, the display shows the Genset Idling message. See [Figure 31](#).

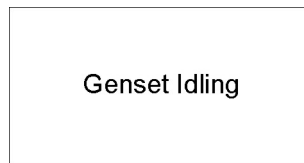


FIGURE 31. SAMPLE GENSET IDLING MESSAGE

6.7.5 Generator Set Stopped - Messages

The display changes between two messages when the generator set is stopped. One message shows engine data and battery data. One message shows generator power data or fault data. The generator power data shows if the generator set had a normal stop. The fault data shows if the generator set stopped because of a fault. See [Figure 32](#).

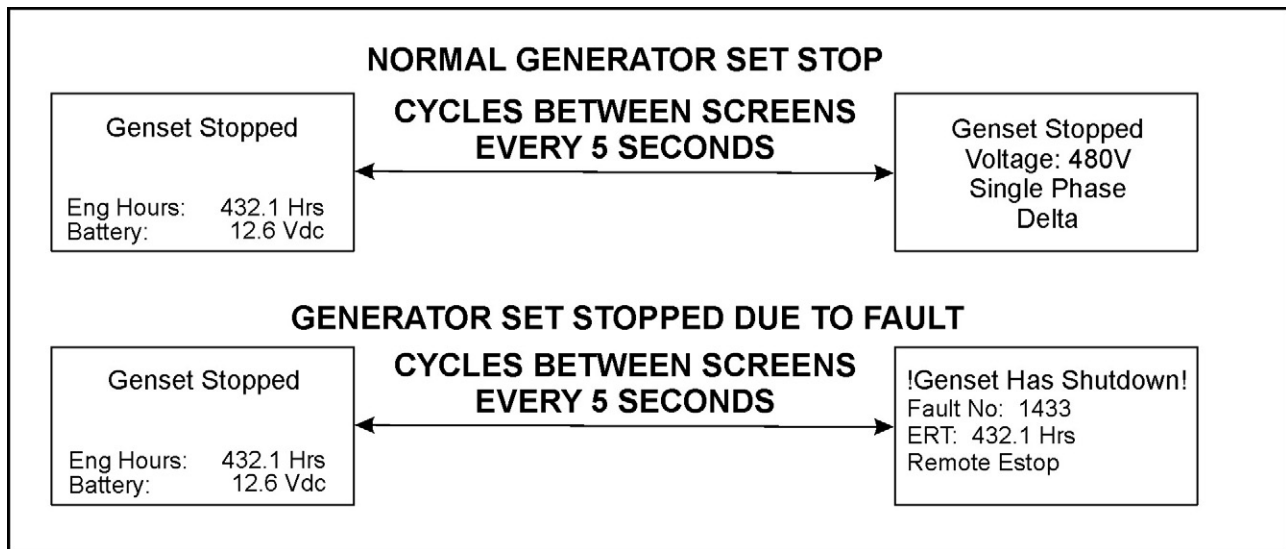


FIGURE 32. SAMPLE GENSET STOPPED MESSAGES

6.7.6 Re-establishing Communication - Message

The Re-establishing Communication message shows if the display panel loses communication with the controller ([Figure 33](#)). When communication is re-established, the display panel shows the message that was active before the loss of communication.

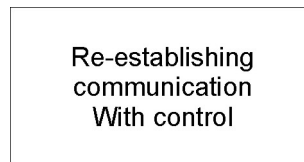


FIGURE 33. SAMPLE RE-ESTABLISHING COMMUNICATION MESSAGE

6.7.7 Generator Set Fault - Messages

The display shows two types of fault messages, active fault messages and fault history messages. The first line of the message shows the type of message. See [Figure 34](#).

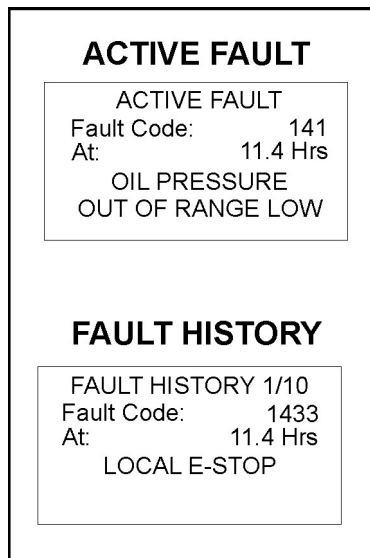



FIGURE 34. SAMPLE FAULT MESSAGES

6.7.8 Fault Acknowledgement

Shutdown faults must be acknowledged. Shutdown faults are acknowledged by pressing the  on the operator panel.

Faults are removed from the display when they are cleared.

NOTICE

Faults are re-announced if they are detected again after being acknowledged.

6.8 Selecting Auto, Manual Run, and Off Modes

Auto, Manual Run and Off modes can be selected at the following times:


- When the message 'Establishing communication with control' is displayed.
- When the message 'Re-establishing communication with control' is displayed.

6.8.1 Selecting Manual Run Mode

NOTICE

Make sure that there is no danger to personnel or equipment when the generator set is started.



1. Press the  button on the control panel.
2. Wait five minutes for the engine to warm up.
3. If the **RUN/IDLE** toggle switch is in the **IDLE** position, set the switch to **RUN**.
4. Check for proper generator set voltage. The generator set voltage is shown on the panel.


NOTICE

Auto mode can also be selected while in Manual Run mode. Switching to Auto mode may result in the generator set shutting down.

6.8.2 Selecting Auto Mode

NOTICE

When changing modes, the generator set can start or stop without warning. Make sure there is no danger to personnel or equipment, if the generator set starts or stops when changing modes.

1. Press the  button on the panel. The AUTO LED turns on.
2. The generator set starts when a connection is made between the two remote start posts.

NOTICE

The generator set starts automatically when a remote start signal is received. Make sure there is no danger to personnel or equipment if the generator set starts without warning.

NOTICE

Selecting Manual run mode starts the generator set. Make sure there is no danger to personnel or equipment if the generator set starts.


6.8.3 Selecting Off Mode

NOTICE

Never shut down the generator set while it is under load. Never shut down the generator set when the main circuit breaker is set to ON.

NOTICE

Make sure that there is no danger to personnel or equipment if the generator set is stopped.

1. Set all generator set circuit breakers to OFF.
2. Wait five minutes with the engine running. This allows the engine to cool down.
3. Press the  button on the operator panel.

7 Control System - PowerCommand 1.2

7.1 PowerCommand 1.2 Components

The PowerCommand 1.2 System consists of the following:

- A PCC 1302 Control Board
- An optional Alarm Module
- An optional AC Metering Panel
- An HMI 220 Operator Panel.

7.2 Control Description

The control is used to start and stop the generator set, and provides full generator set monitoring capability and protection in a stand-alone situation (non paralleling) from the display screen. It monitors the engine for temperature, oil pressure and speed, and provides voltage and current metering. In the event of a fault, the unit indicates the fault type and on critical faults automatically shuts down the generator set.

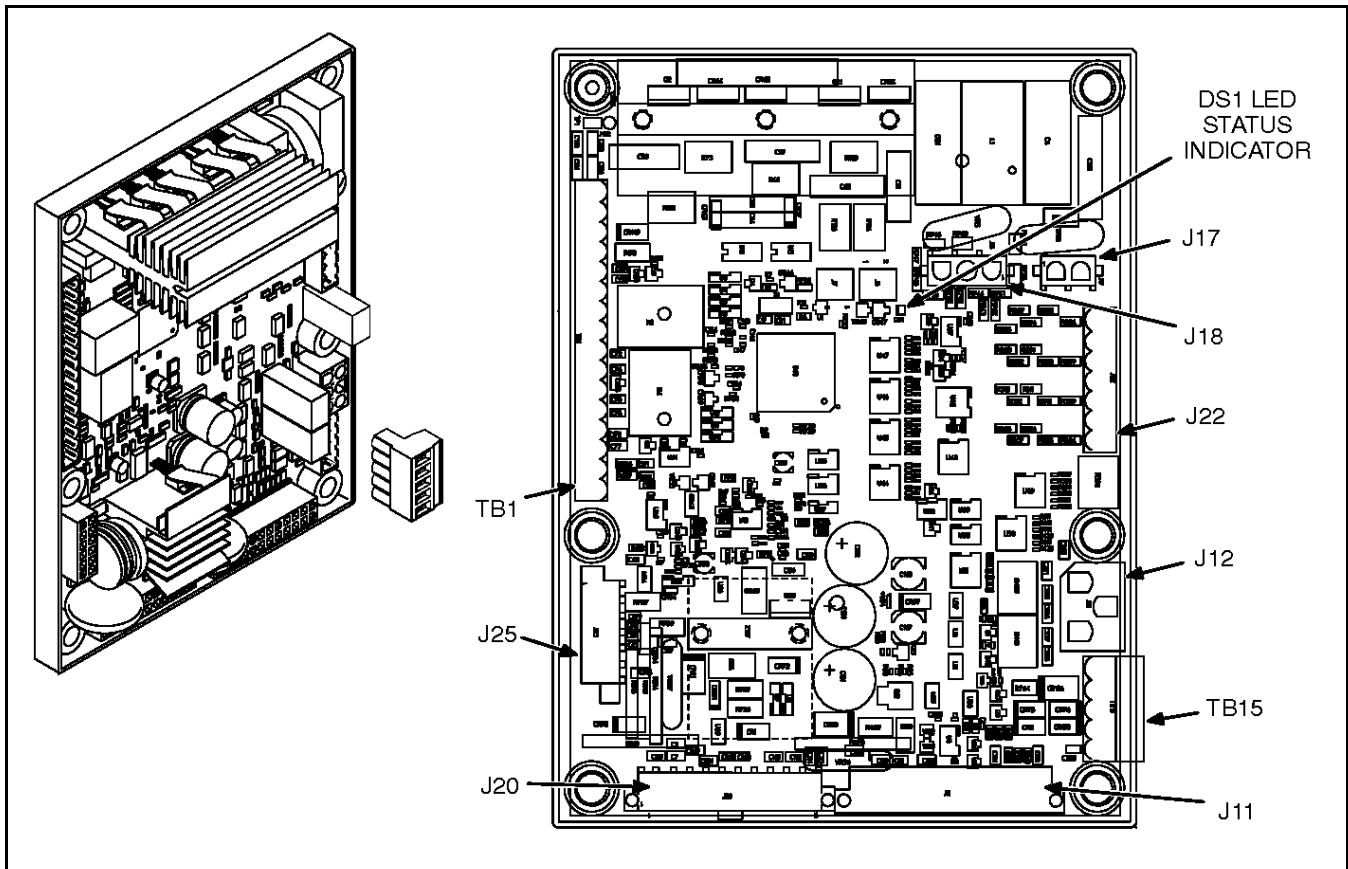
All indicators, control buttons, and the display screen are on the face of the operator panel.

There are two fault level signals generated by the control:

- Warning: signals an imminent or non-critical fault for the engine. The control provides an indication only for this condition.
- Shutdown: signals a potentially critical fault for the engine. The control immediately takes the engine off-load and automatically shuts down.

The standard control system operates on 12 or 24 VDC battery power. The auxiliary equipment operates on LV AC power. The history data is stored in non-volatile memory and is not deleted if battery power is lost.

TABLE 4. PCC 1302 CONTROL BOARD



Connector	Description
J11	Engine Harness
J12	Generator Set CTs
J17	AVR Field
J18	AVR Power
J20	Generator Set Accessories Harness
J22	Generator Set Voltage Sense
J25	Operator Panel Harness
TB1	Field Connections
TB15	RS-485 Communications

7.3 PCC 1302 Features

The PCC 1302 includes:

- Single-phase or three-phase (delta or wye) 600 volt voltage sensing and 5 amp CT current sensing
- 50 or 60 Hertz frequency
- Service Tool / ModBus communications connector (TB15)

- Start/stop functionality through either an operator panel or a Manual Run/Off/Auto switch located in the harness
- Control board status LED
- Shunt or PMG excitation methods
- CAN Datalink with PGI protocol support
- Common connector scheme support
- Programmable wake-in-auto function

A PCC 1302 installation may also include the following options.

- If a operator panel is mounted on the generator set (local display), one additional operator panel can be mounted up to 4000 feet (1219.2 meters) from the generator set (remote displays). A setup menu in the optional display panel is required to designate a display as Local or Remote.
- Local status indicator lamp driver
- Remote and local emergency stop
- Four configurable inputs
- Annunciator fault inputs 1, 2, and 3 - These outputs can be used when an annunciator is installed as part of an PCCNet interface connected to TB1-2 and TB1-3. Grounding one of these inputs on the annunciator activates the corresponding warning or shutdown sequence.
Three Customer Annunciator Text message submenus are supplied to enter the event type and description.
- ECM CAN engine interface

7.3.1 Local Status Output

A status indicator lamp can be used to flash generator set status and shutdown fault codes. The Manual Run/Off/Auto switch may include a status indicator lamp.

- Constant On = The generator set is running.
- Shutdown, warning and remote start LED indicators are available on front display.

NOTICE

Only the last shutdown fault is flashed.

7.3.2 Operating Modes

The PCC 1302 works with a Manual Run/Off/Auto switch, used to control generator set operating modes. This capability is located either in the harness (switch) or is integrated into the control panel.

7.3.2.1 Off Mode

When in Off mode, the control does not allow the generator set to start. If the generator set is already running and the control is set to Off, it initiates a normal shutdown sequence.

7.3.2.2 Manual Run Mode

When in Manual Run mode, the generator set starts and continues to run until the control is put into the Off mode. While in Manual Run mode, the remote start signal is ignored.

7.3.2.3 Auto Mode

When in Auto mode, the control allows the generator set to be started with a remote start signal only.

When in Auto mode, the generator set can start at any time. When a remote start signal is received, the genset starts after a time delay preheat (if programmed) and time delay start (if programmed) is completed.

If the generator set is running in Auto mode and the Off button is pressed, the control immediately stops the genset and the control transitions to the Off mode.

When all remote start signals are removed, the control performs a normal shutdown sequence which may include a time delay stop.

7.3.2.4 Emergency Stop Mode

When an optional emergency stop button is used, it immediately shuts down the generator set, bypassing any time delay stop. If an optional emergency stop is not used, the local and remote E-stop signals must be shorted to GND. The red Shutdown LED lights and one of the two emergency stop fault codes (**1433 - Local Emergency Stop** or **1434 - Remote Emergency Stop**) is either displayed (installations with an operator panel) or flashed (installations with a status indicator lamp), depending on which was activated last.

To reset the control, close (disable) the active emergency stop button(s) and perform a fault reset.

7.3.2.5 Sleep Mode

The PCC 1302 control enters a low power (sleep) mode of operation where the current draw is not greater than 60 milliamps (DC) at normal battery voltage levels. The control is set to enter sleep mode after five minutes in Off mode or Auto mode, if configured. (Sleep mode can be disabled if a jumper is installed connecting TB15-1 to TB15-5.)

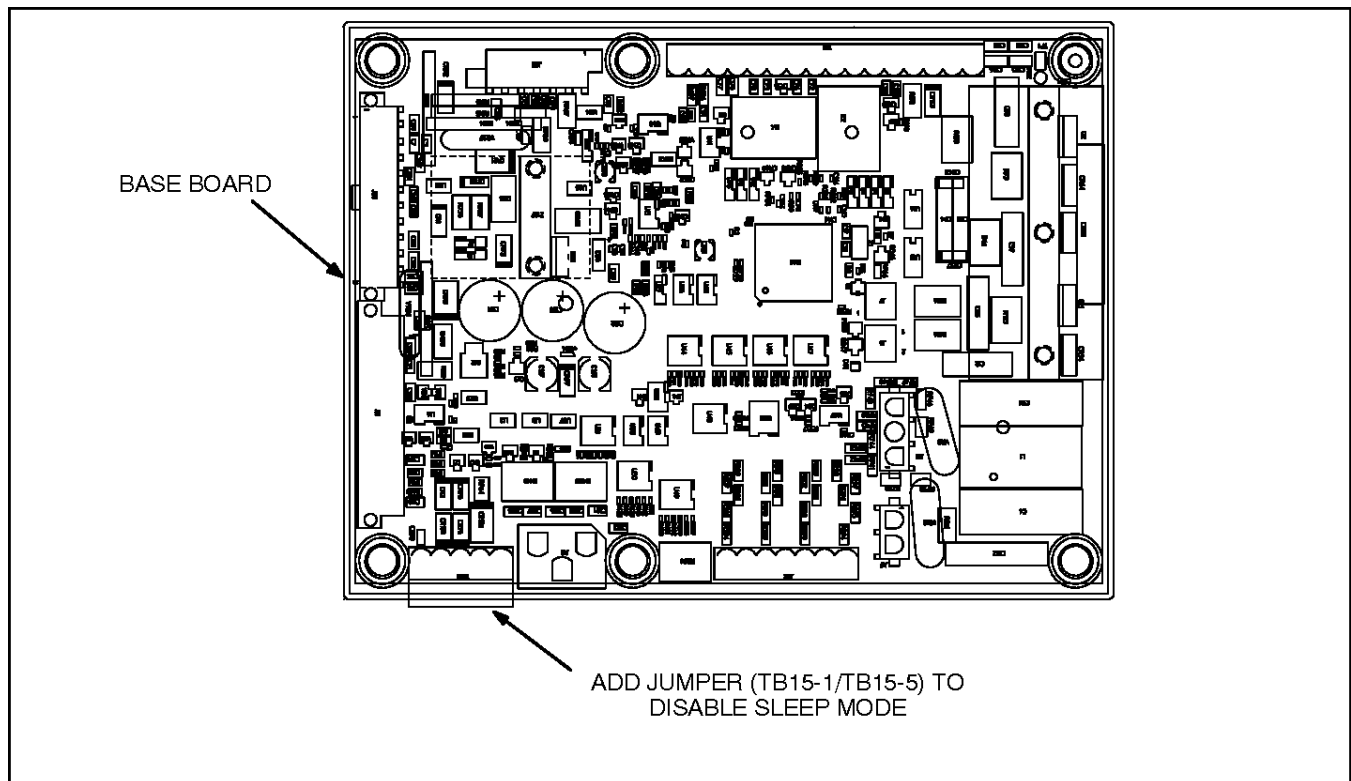


FIGURE 35. SLEEP MODE ACTIVATION SETTINGS

The control will not enter the sleep mode if there are any active, unacknowledged shutdown faults, if the control is in the Manual Run mode, or if there are any active wake-up signals. Once in sleep mode, any of the following inputs will wake the control.

- Remote Start
- Manual Start
- Configurable Input 3
- Configurable Input 4
- Local E-Stop (active when switch is open)
- Remote E-Stop (active when switch is open)
- Auto Mode (if configured)
- Bi-directional System Wake-Up

Sleep mode is automatically enabled on the operator panel. The PCC 1302 control determines that it should sleep when the display panel has had no key presses for five minutes and wake-up signals are inactive. The control system can be awakened by pressing the keypad on the operator panel or by activating any wake-up input.

7.3.2.5.1 Configuring Sleep In Auto Mode

1. Power the control and wake it up.
2. Use InPower to connect to the PCC 1302.
3. Use InPower to disable the Wake-In-Auto feature.
4. Save adjustments.
5. Disconnect the PCC 1302 from InPower.

7.3.2.5.2 Installations with a Manual Run/Off/Auto Switch

For installations that utilize an Manual Run/Off/Auto switch located in the harness, the control awakes from sleep mode if Manual Run mode is selected. The control will also wake up if Auto mode is selected and the control is configured to stay awake when in Auto mode, Wake-In-Auto = Enabled.

7.3.2.6 Battle Short Mode

The purpose of Battle Short is to satisfy local code requirements, where necessary. To use this feature, the necessary software must either be installed at the factory when the PCC 1302 is purchased or else installed by a customer service representative.

Battle Short mode prevents the generator set from being shutdown by all but a select few critical shutdown faults. All shutdown faults, including those overridden by Battle Short, must be acted upon immediately to ensure the safety and well being of the operator and the genset.

WARNING

Use of the Battle Short mode feature can cause a fire or electrical hazard, resulting in severe personal injury or death and/or property and equipment damage. Operation of the generator set must be supervised during Battle Short operation.

This feature must only be used during supervised, temporary operation of the generator set. The faults that are overridden when in Battle Short mode are faults that can affect generator set performance or cause permanent engine, alternator, or connected equipment damage. Operation may void the generator set warranty if damage occurs that relates to the fault condition(s).


Only trained and experienced service personnel should enable this feature. When shipped from the factory, this feature is disabled.

Battle Short can be enabled or disabled (set to Active or Inactive) using the operator panel.

The PC service tool is required to enable the Battle Short mode feature. Contact an authorized service center for assistance.

Before Battle Short can be used on installations with the display panel, the Switch Input setting on the Battle Short submenu must be set to "Operator Panel". In addition, Battle Short mode must be enabled (set to Active) in the Battle Short submenu.

When Battle Short mode is enabled, the Warning status indicator lights, and **Code 1131 - Battle Short Active** is displayed.

When Battle Short mode is enabled and an overridden shutdown fault occurs, the shutdown lamp remains lit even though the generator set continues to run. **Fault code 1416 - Fail to Shut Down** is displayed. If the ▲ or ▼, or  button is pressed to acknowledge the fault, the fault message is cleared from the display but remains in the Fault History file.

Battle Short is suspended and a shutdown occurs immediately if:

- Any of the following shutdown faults occurs.
 - Overspeed - Fault code **234**
 - Speed Signal Lost (Loss of Speed Sense) - Fault code **121**
 - Excitation Fault (Loss of Voltage Sense) - Fault code **2335**
 - Local Emergency Stop - Fault Code **1433**
 - Remote Emergency Stop - Fault code **1434**
- Battle Short mode is disabled after an overridden shutdown fault occurred while in Battle Short mode. To disable Battle Short mode, navigate to the Battle Short submenu and select "Inactive." **Fault code 1123 - Shutdown After Battle Short** is then displayed.

7.4 Control Board

WARNING

HAZARDOUS VOLTAGE. Touching uninsulated parts in the controller can result in severe personal injury or death. Measurements and adjustments must be done with care to avoid touching hazardous voltage parts.

WARNING

Stand on a dry wooden platform or rubber insulating mat, make sure your clothing and shoes are dry, remove jewelry and use tools with insulated handles.

CAUTION

Electrostatic discharge will damage circuit boards. Always wear a grounding wrist strap when touching or handling circuit boards.

The control board contains all of the electronic circuitry required to operate the generator set. The control board provides main alternator voltage output regulation and complete generator set control and monitoring. Refer to Block diagram in [Appendix A on page 239](#) for each terminal board connection and connector pin input/output signal.

The block diagram that follows shows the external connections of the PCC system.

After determining that a control board assembly is faulty, replace it; do not repair it. Attempts to repair a control board can lead to costly damage to the equipment.

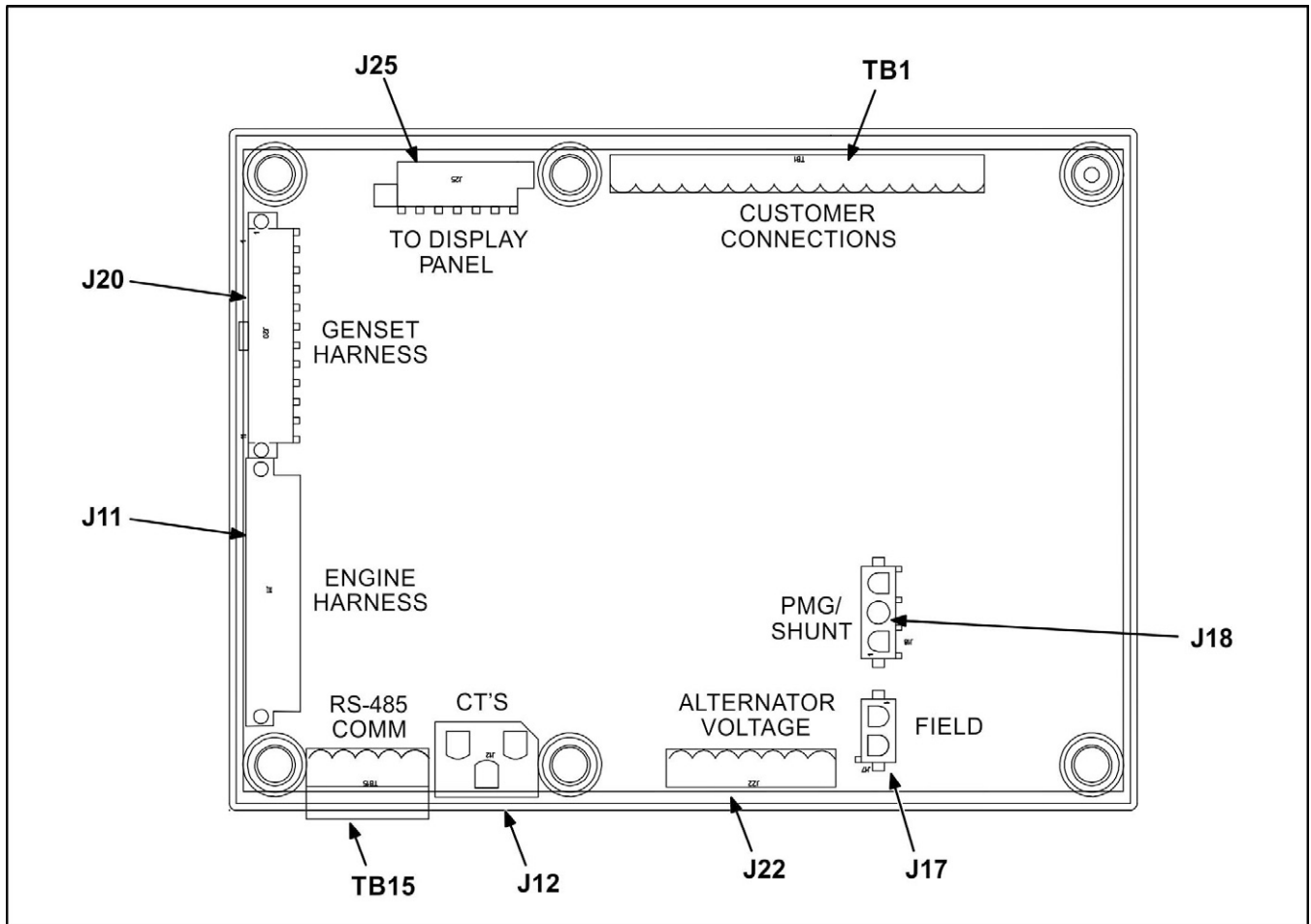


FIGURE 36. CONTROL BOARD CONNECTOR/TERMINAL PIN LOCATIONS

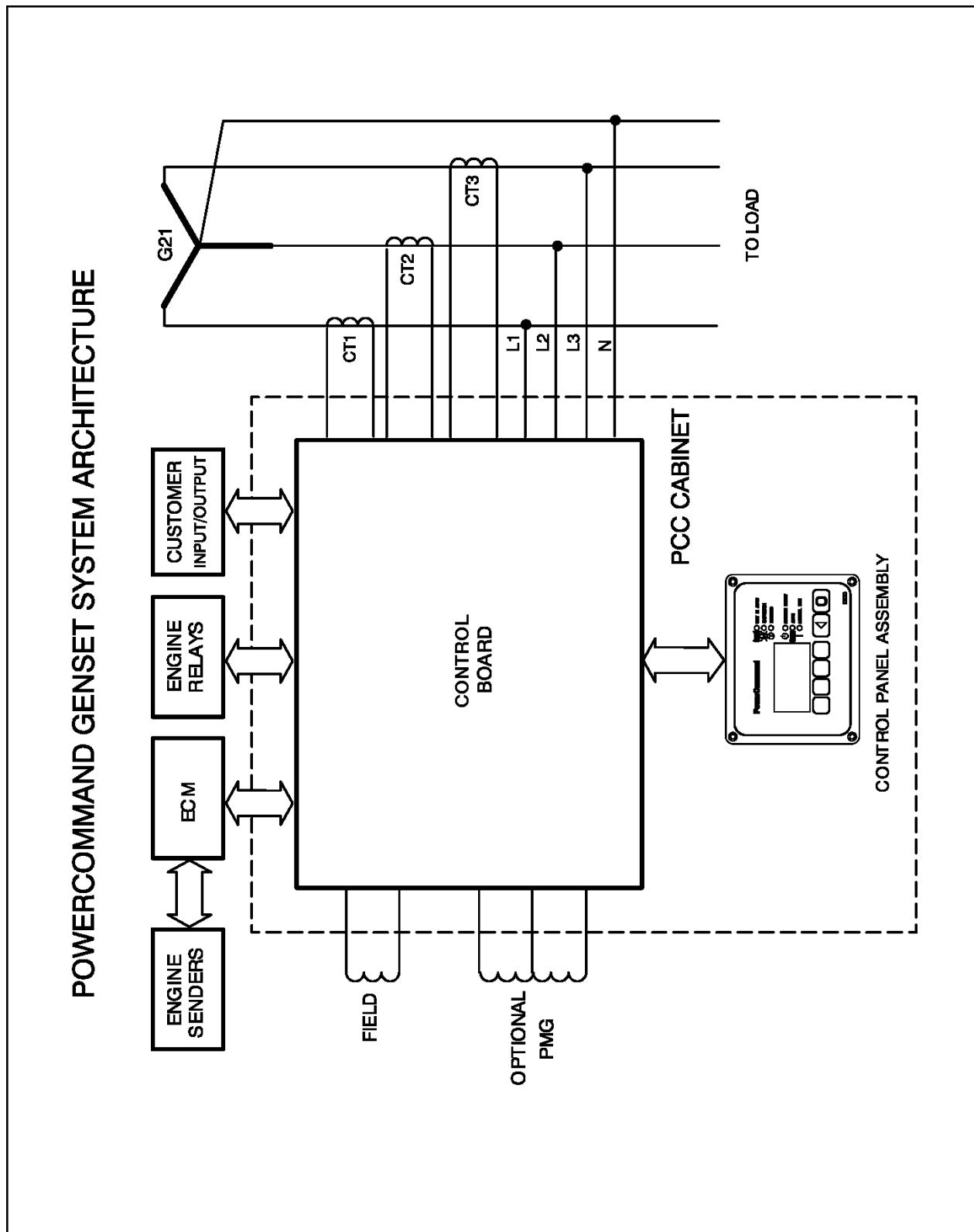


FIGURE 37. BLOCK DIAGRAM

7.5 Operator Panel

The figure below shows the features of the front panel. It includes five lamp indicators; the graphical display with two menu select and seven menu navigation buttons; and four control mode buttons. This display panel enables the operator to look at the status, adjust the settings, and start and stop the generator set

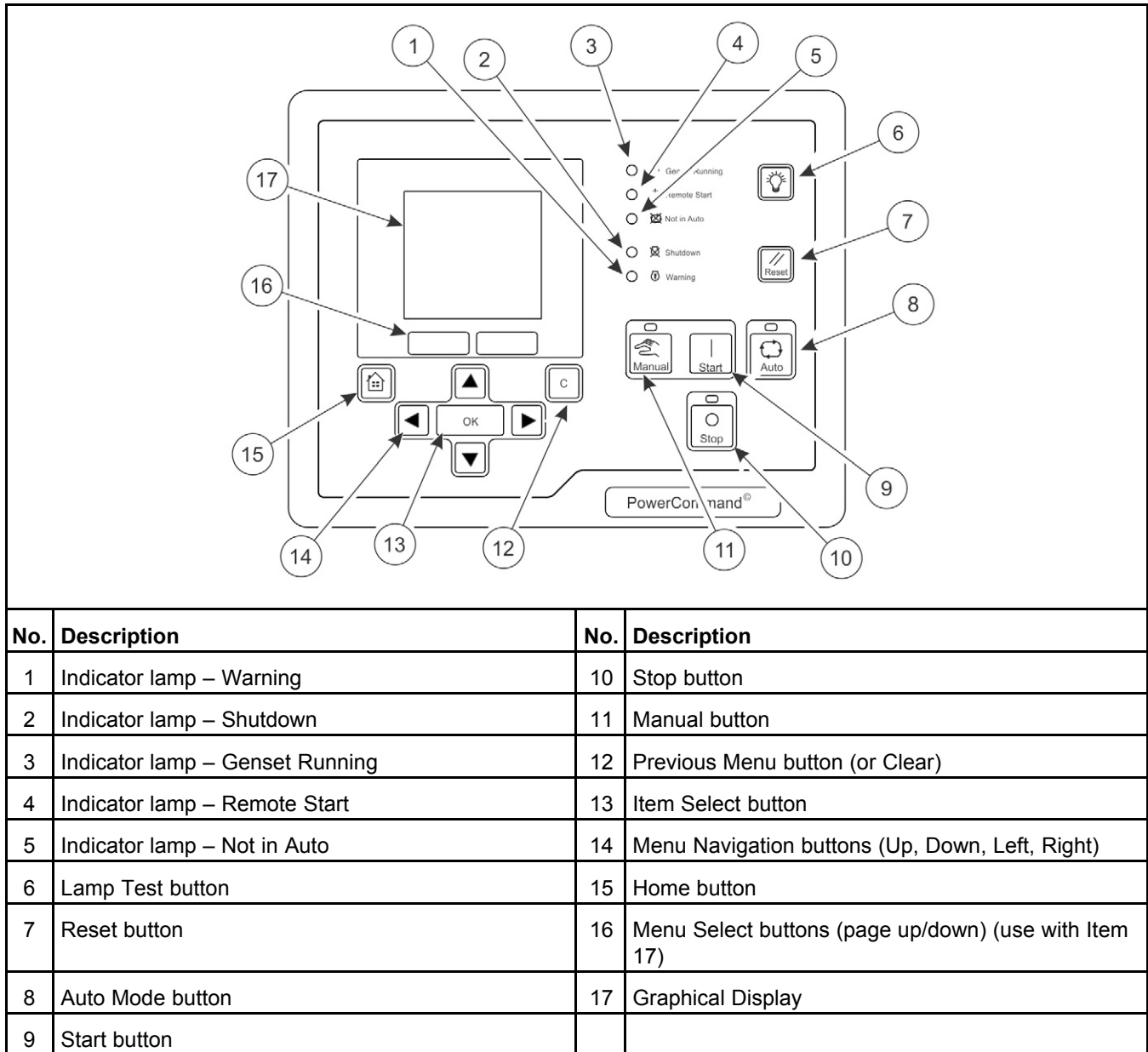


FIGURE 38. OPERATOR PANEL (HMI 220)

7.5.1 Lamp Indicators

[Figure 38 on page 71](#) shows the front panel of the Operator Panel with the five lamp indicators.

7.5.1.1 Warning

This amber lamp is lit whenever the control detects a Warning condition. This lamp is automatically shut off when the Warning condition no longer exists.

7.5.1.2 Shutdown Status

This red lamp is lit when the control detects a Shutdown condition. The generator set cannot be started when this lamp is on. After the condition has been corrected, the lamp can be reset by first pressing the **Stop** button and then the **Reset** button.

7.5.1.3 Not in Auto

This red lamp is lit when the control is not in Auto.

7.5.1.4 Remote Start

This green lamp indicates the control is receiving a Remote Run signal. The Remote Run signal has no effect unless the generator set is in Auto.

7.5.1.5 Generator Set Running Lamp

The green lamp is lit when the generator set is running at, or near, rated speed and voltage. This is not lit while the generator set is warming up or cooling down.

7.5.2 Lamp (LED) Test Button

Press this button to test the lamps (LEDs). All of the lamps should turn on for five seconds.

Press and hold this for three seconds to turn on or off (to toggle) an external panel lamp.

7.5.3 Reset Button

Press this to reset any active faults.

If the condition(s) that caused an existing shutdown fault still exists, the generator set generates the fault again.

If the condition(s) that caused an existing warning fault still exists, the generator set generates the fault again, but the operator panel stops displaying it in the graphical display.

7.5.4 Graphical Display and Buttons

[Figure 39 on page 73](#) shows the graphical display and the relevant menu selection buttons.

The graphical display is used to view menus of the menu-driven operating system. System messages (communication, event, and fault) are also shown on the display.

Two momentary soft-key buttons (item 5) are used to change pages within each screen. These selection buttons are “active” when the up and down triangles (▲ and ▼) are displayed in the graphical display. Some sub-menus do not include any active buttons.

Use the graphical display to view event/fault information, status, screens, and parameters.

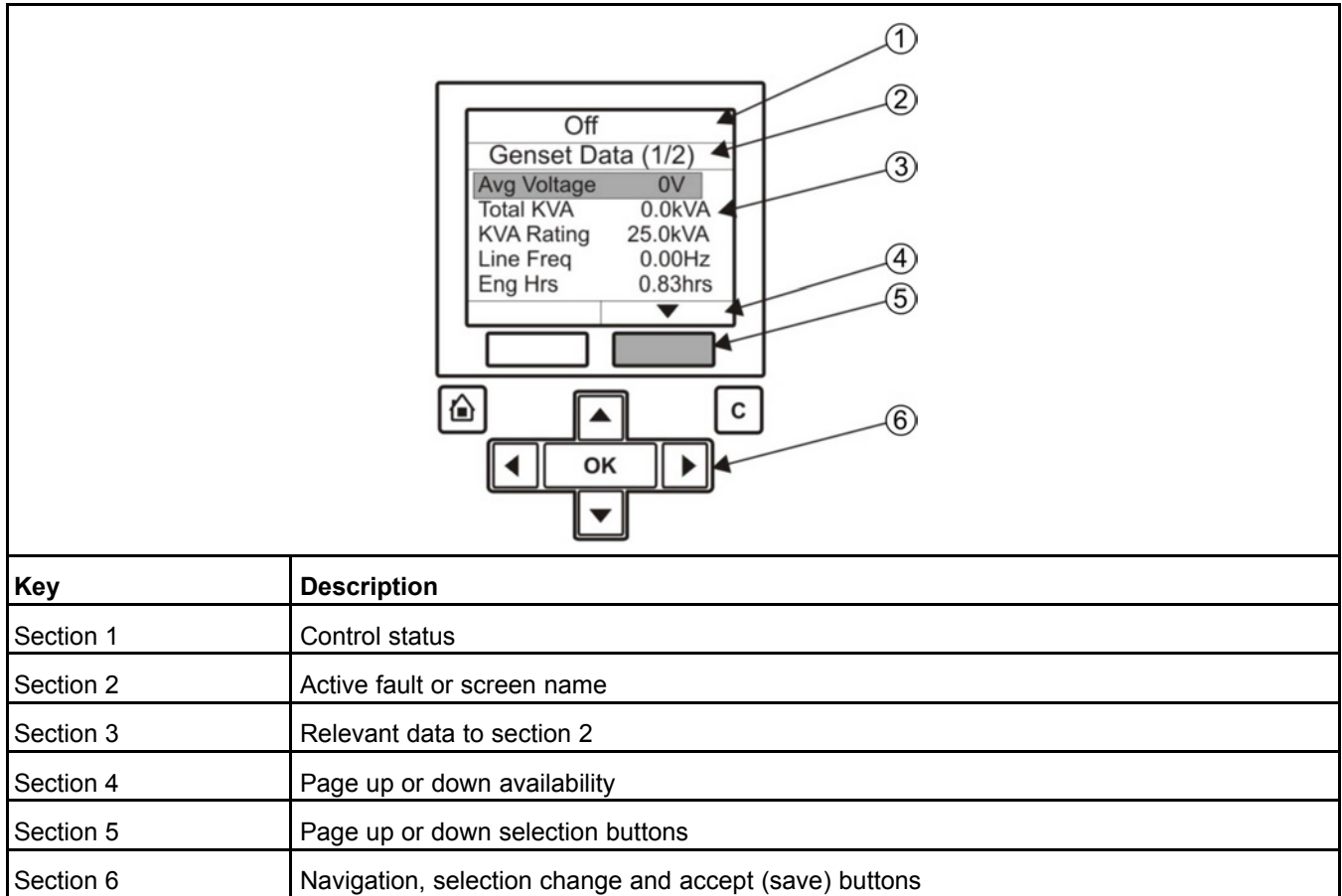


FIGURE 39. GRAPHICAL DISPLAY WITH TYPICAL SCREENSHOT

7.5.4.1 Section 1 - Control Status

Section one displays the status of the controller.

Status	Description
Ready	This is the default state. The controller is ready to start the generator set, or it has started one of the start sequences but has not started the engine yet.
Starting	The controller is starting the engine in one of the start sequences. The generator set has not reached idle speed (if applicable) or rated speed and voltage, and the controller is not raising the engine speed to idle or rated speed.
Idle Warmup	The controller is raising the engine speed to idle speed, or the engine is running at idle speed in one of the start sequences.
Rated Freq and Voltage	The controller is raising the engine speed to rated speed; the generator set is running at rated speed and voltage; or the controller has started one of the stop sequences but has not started reducing the engine speed yet.
Idle Cooldown	The controller is reducing the engine speed to idle speed, or the engine is running at idle speed in one of the stop sequences.
Stopping	The controller is stopping the engine.

Emergency Stop	There is an active shutdown fault.
Setup Mode	The controller is in Setup mode.
Wait to Powerdown	The controller is ready to enter Powerdown mode, but another device is sending a System Wakeup signal.
Demo Mode	The controller is running a demonstration. Every screen is available in the demonstration, and any changes you make in the demonstration have no effect on the controller. To end the demonstration, the Operator Panel must be turned off.

7.5.4.2 Section 2 - Active Fault or Screen Name

Section two displays information about the last active shutdown fault. If there are no active shutdown faults, it displays the last active warning fault. If there are no active faults, the Operator Panel displays the screen name.

If there is an active fault, the Operator Panel displays the following information about it:

- Fault type.
- Fault code number.
- Name of the controller that detected the fault e.g. the engine ECM unit. This is blank if the controller detected the fault.
- Fault name.

If you press the Reset button the Operator Panel stops displaying active warning faults, even if the condition(s) that caused the fault(s) has not been corrected. The Warning LED remains on, however.

The Operator Panel always displays any active shutdown faults, even if the Reset button is pressed.

Fault Type	Description
Warning	This is a warning fault. (See Chapter 9 on page 143)
Derate	This is a derate fault. (See Chapter 9 on page 143)
Shutdown	This is a shutdown fault that initiates a Shutdown Without Cooldown sequence. (See Chapter 9 on page 143)

7.5.4.3 Section 3 - Interactive Screen or Menu

Section 3 shows information relevant to Section 2. You can view the operating values for the generator set, navigate through screens and adjust parameters (if permitted).

The default screen is the Genset Data screen.

The following table explains how the operator panel displays when the value of a specific parameter is missing, unexpected, or outside the range allowed for the parameter.

TABLE 5. PARAMETER VALUES THAT ARE MISSING, UNEXPECTED, OR OUTSIDE THE RANGE ALLOWED

Operator Panel	Description
NWF	Network Failure - There is a PCCNet network failure or a CAN (ECM) failure.
OORL	Out Of Range Low - The value is less than the lowest allowed value for this parameter.
OORH	Out Of Range High - This value is greater than the highest allowed value for this parameter.
-- -- --	This value is not applicable.

7.5.4.4 Section 4 - Additional Functions Indicators

Section 4 indicates if additional information or further sub-menus are available by up or down arrows (▲ and ▼). If that particular page or menu has no additional information, then no arrow will be visible at this time.

For example if the graphical display is not big enough to display the screen at one time an up and/or down arrow (▲ and ▼) will be visible. Press the appropriate selection button beneath the graphical display to look at the previous or next page of information in that screen.

7.5.4.5 Menu Navigation Buttons



Home Button

Press this to return to the main menu at any time.

NOTICE
<p>If you have not pressed the OK button before pressing the  button, any changes made will not be saved.</p>



Previous Menu Button

Press this button to return to the previous menu.

NOTICE
<p>If you have not pressed the OK button before pressing the  button, any changes made will not be saved.</p>

7.5.5 Selection Buttons

Four momentary buttons are used to navigate and change the selection in the graphical display:

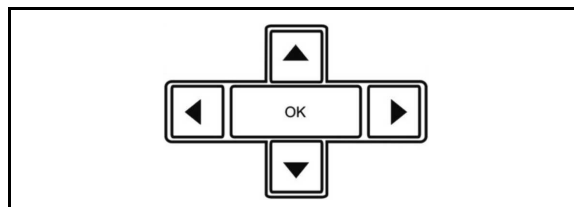


FIGURE 40. SELECTION BUTTONS

Press the **OK** button to select the item that is currently highlighted in the graphical display:

Item	Results of Pressing OK
Menu	Opens the sub-menu or screen
Parameter	Allows adjustment of the parameter (if possible) or prompts for a password
Adjusted Value	Saves the change

Item	Results of Pressing OK
Action	The graphical display runs the action or prompts for a password

7.5.6 Default Settings

The operator panel can display SAE or Metric units of measurement and should be set during the initial setup of the generator set. Only trained and experienced personnel are allowed to change the default setting. Contact your authorized distributor.

7.6 Fault Messages



FIGURE 41. FAULT MESSAGE DISPLAY

A Fault message is an indicator of a Warning or Shutdown condition. It includes the fault type (Warning or Shutdown), fault number, and a short description. It also includes where the fault occurred if the generator set control did not detect the fault and is simply reporting the fault.

Active and acknowledged faults may be viewed in the Faults menu.


7.6.1 Fault Acknowledgement

Shutdown faults must be acknowledged after the fault has been corrected. If in Auto or Manual mode, the control must be set to Stop mode (Off).

Faults are also acknowledged when in Auto mode and the remote start command is removed.

Faults are re-announced if they are detected again after being acknowledged.

7.7 Operator Panel - Initial Operator Menu

[Figure 42](#) shows the initial menu and subsequent menu shown when the Home button  is pressed.

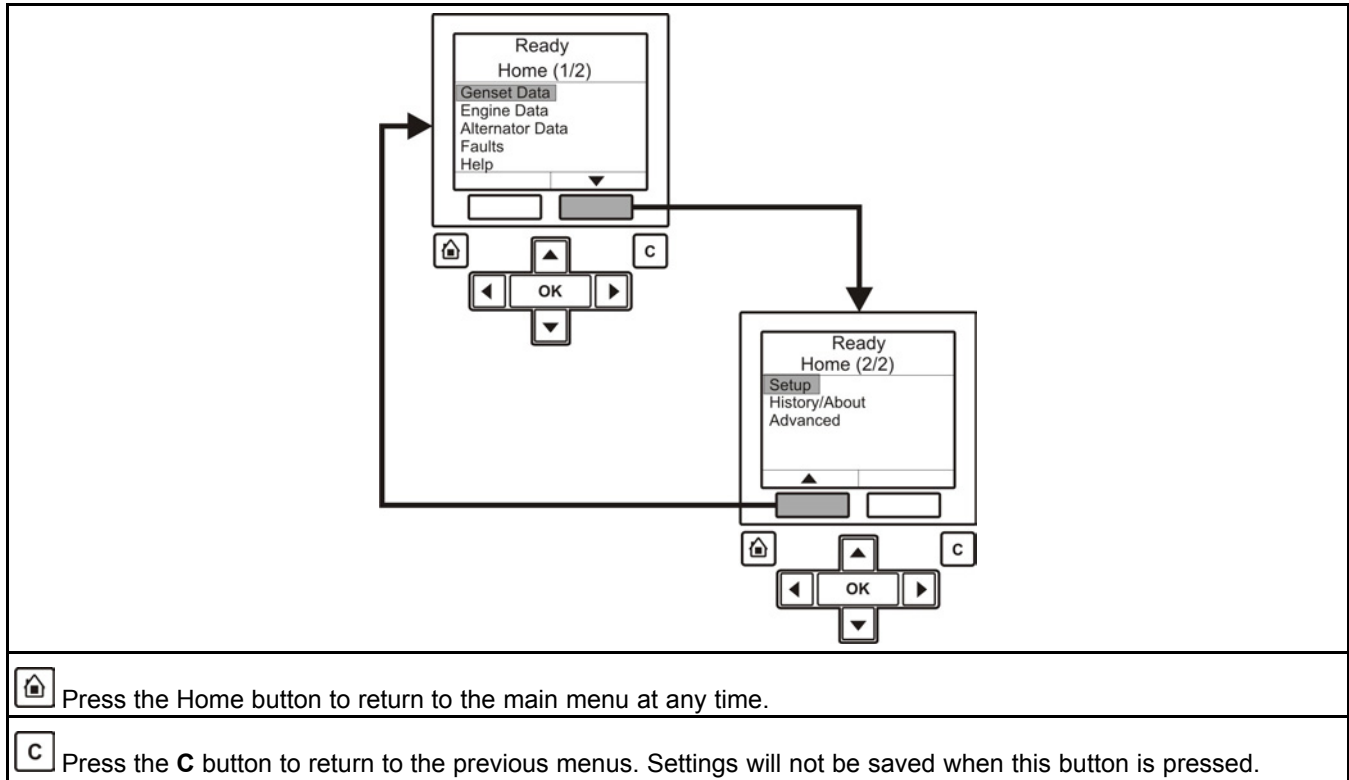
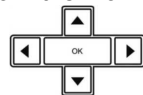


FIGURE 42. INITIAL OPERATOR MENU

7.8 Operator Panel - Generator Set Data Operator Menu

Figure 43 on page 78 shows a block representation of a typical Genset Data menu.

To navigate from the Home menu, make sure that the Genset Data line of text is highlighted, and press



the **OK** button.

The **Genset Data** menu is displayed on two pages. Use the buttons below the up and down arrows [▲ and ▼]) in the menu to toggle between the screens.

7.8.1 Generator Set Data

Use this screen to look at the status of the generator set.

Name	Description
Avg Voltage	Generator set line-to-line average voltage
Total kVA	Total kVA output. Allowed values: 0–2000 kVA
kVA Rating	kVA Rating for the specified application. Allowed values: 0–2000 kVA
Line Freq	Measured frequency of L1-L2 frequency signal
Eng Hrs	Engine running hours in tenths of hours. Allowed values: 0–6553.5 hours.
Coolant Temp	Measured sensor value

Oil Pressure	Allowed values: 0–145 psi (0–999.7 kPa)
Fuel Rate	Fuel consumption in gallons per hour
Battery Volt	Battery voltage

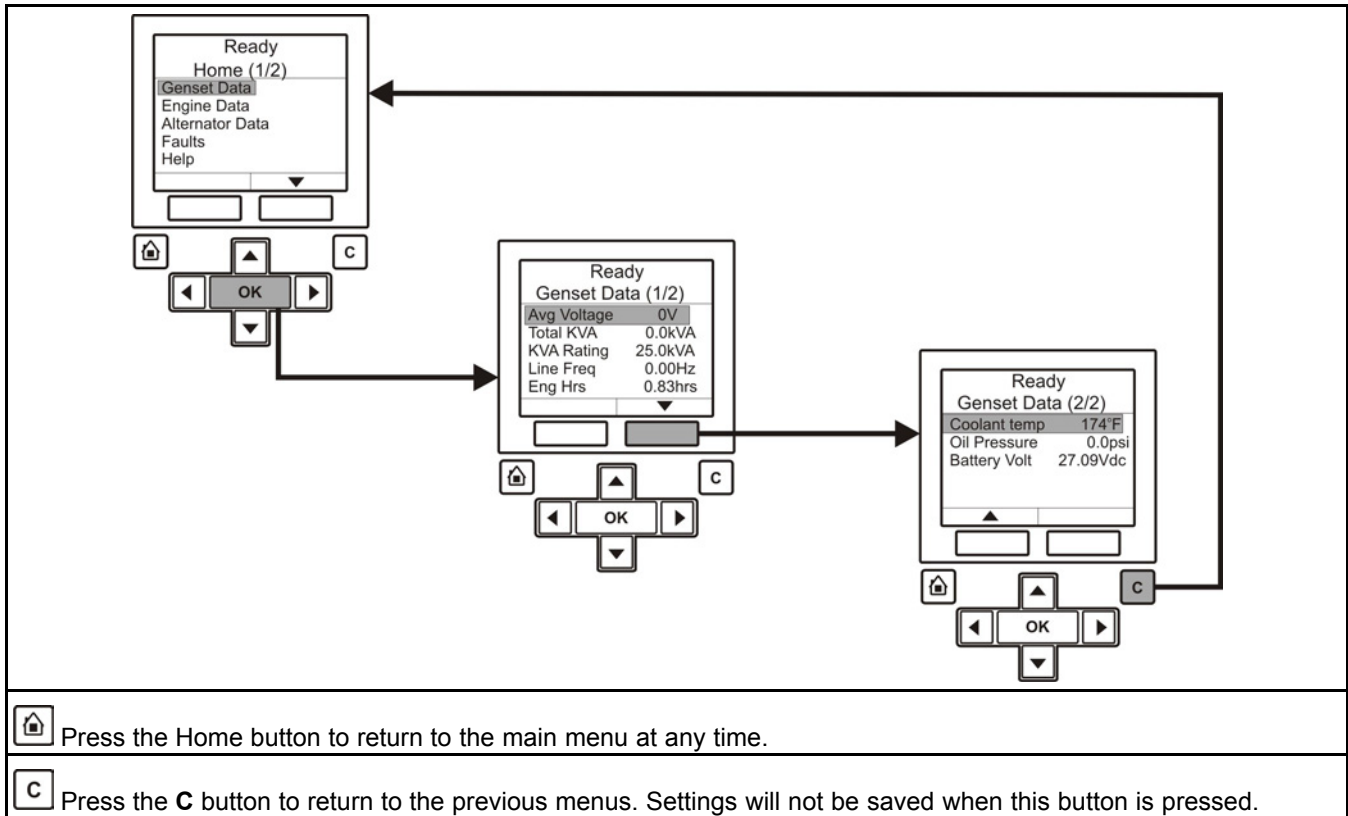
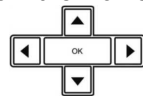


FIGURE 43. GENSET DATA MENU - TYPICAL DATA

7.9 Operator Panel - Engine Data Operator Menu

[Figure 44 on page 79](#) shows a block representation of a typical **Engine Data** menu. This menu displays the engine starting battery voltage, coolant temperature, engine oil pressure, and hours of engine operation.

To navigate from the Home menu, toggle down until the Engine Data line of text is highlighted, and press



the **OK** button.

The **Engine Data** menu is displayed on two pages. Use the buttons below the up and down arrows (▲ and ▼) in the menu to toggle between the two screens.

7.9.1 Engine Data

Use this screen to look at the status of the engine.

Name	Description
Engine Hours	Engine running hours in tenths of hours. (Password level 2) Allowed values: 0–6553.5 hours
Coolant Temp	Measured sensor value
Engine Speed	Sensed Instantaneous Engine speed after the Output Enabled process
Battery Volt	Points to the function the analog input signal feeds. Allowed values: 0–35 VDC
Oil pressure*	Allowed values: 0–145 psi (0–999.7 kPa)
Oil Temp	Allowed values: –40–63 °C (–40–145 °F)
Manf Temp	Intake Manifold Temperature
Fuel Supply Press	Allowed values: 0–145 psi (0–999.7 kPa)

* Oil pressure is not available for all models

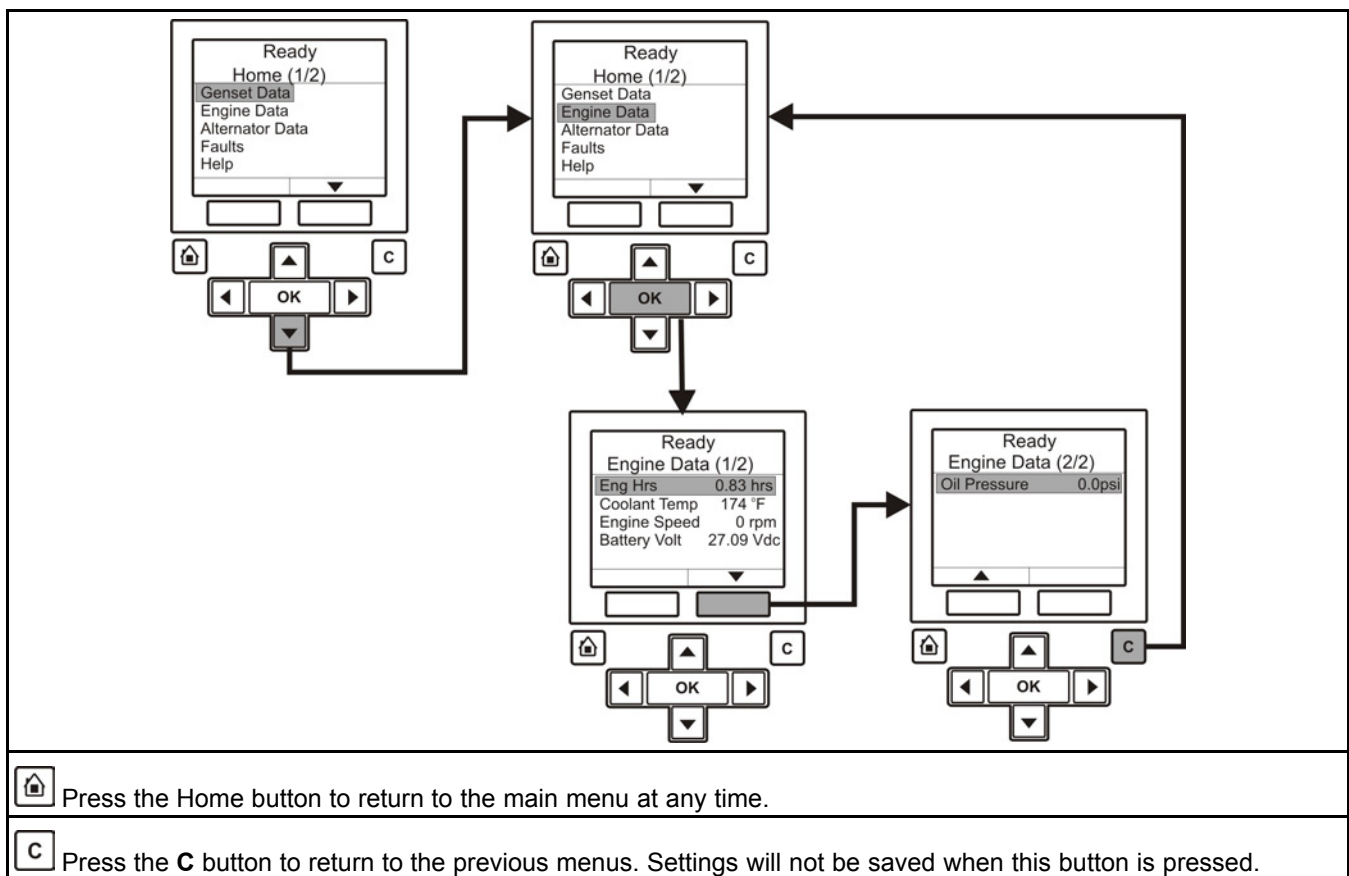
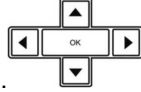


FIGURE 44. ENGINE DATA MENU - TYPICAL DATA

7.10 Operator Panel - Alternator Data Operator Menu

[Figure 45 on page 81](#) shows a block representation of a typical **Alternator Data** menu. Use this screen to look at the status of the alternator. This menu displays line-to-line voltage, line-to-neutral voltage, current, and generator set power (kVA). Some values are not available, dependent on the number of phases (one or three) and whether or not the application has current transformers.

To navigate from the Home menu, toggle down until the Alternator Data line of text is highlighted, and



press the **OK** button.

The **Alternator Data** menu is displayed on three pages. Use the buttons below the up and down arrows (▲ and ▼) in the menu to toggle between the screens.

7.10.1 Alternator Data

Use this screen to look at the status of the alternator. This menu displays line-to-line voltage, line-to-neutral voltage, current, and generator set power (in kVA). Some values are not available, dependent on the number of phases (one or three) and whether or not the application has current transformers.

Name	Description
L1 L2 L3	Alternator terminals
LL(Vac)	Measured line-to-line voltage. Allowed values: 0–750 V
LN(Vac)	Measured L1-N voltage. Measured L2-N voltage. Measured L-N voltage. Allowed values: 0–450 V
Amps	Measured line current. Allowed values: 0~1000 amps
kVA	kVA provided through phase 1. kVA provided through phase 2. kVA provided through phase 3. Allowed values: 0–700 kVA
Alt Voltage	The alternator line-to-line voltage
Total kVA	Total kVA output. Allowed values: 0–2000 kVA
AVR Reg % Out	Output command to Voltage Regulator PWM
Line Freq	Measured frequency of L1-L2 frequency signal

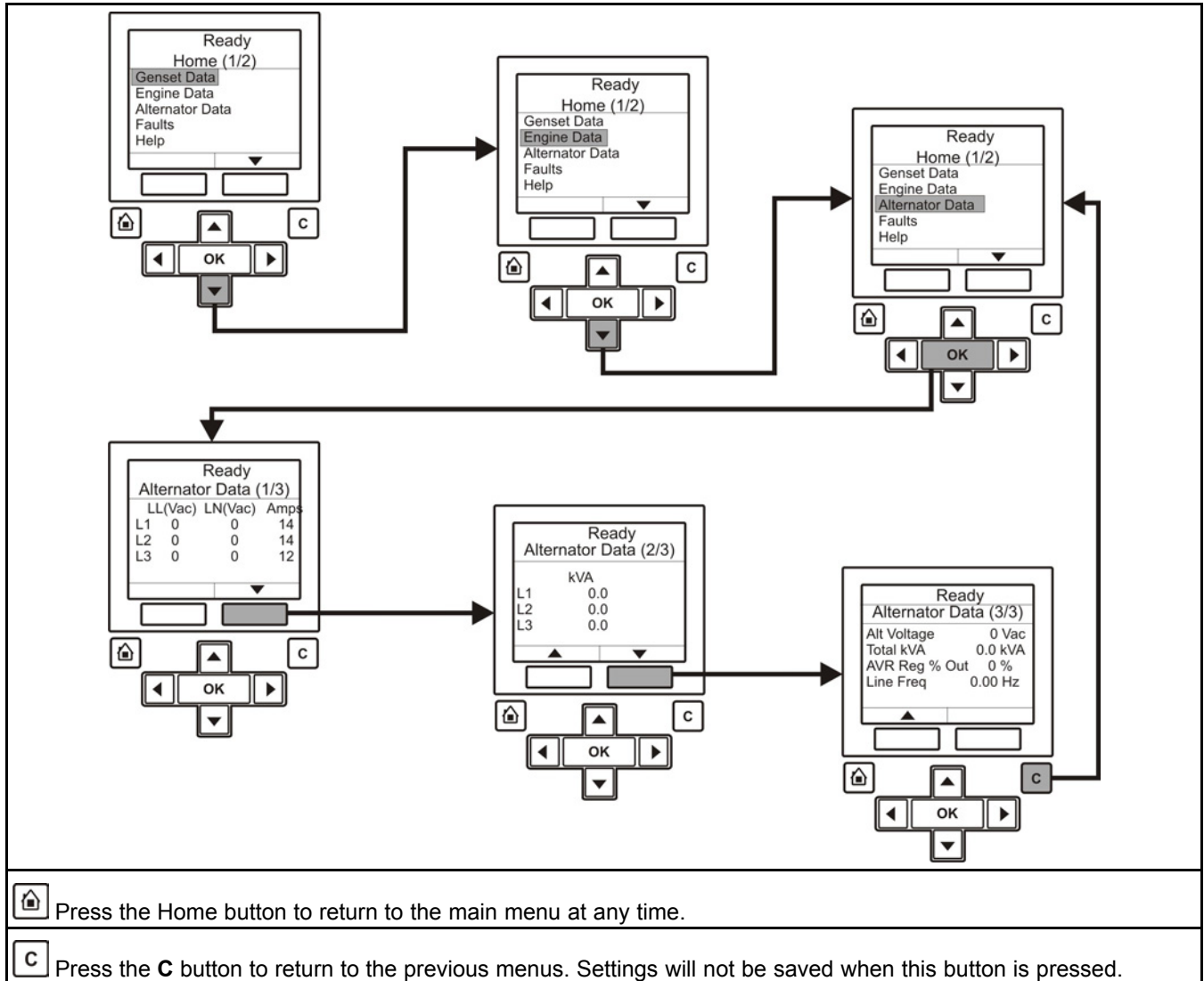
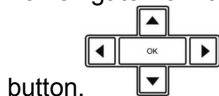


FIGURE 45. ALTERNATOR DATA MENU - TYPICAL DATA

7.11 Operator Panel - Current Fault Data Operator Menu

[Figure 46 on page 82](#) shows a block representation of a typical **Current Fault** menu.

To navigate from the Home menu, toggle down until the Faults line of text is highlighted and press the **OK**



The **Faults** menu is divided into two main subsections; Current Fault covers the latest active fault, and Faults History ([Figure 47 on page 84](#)) shows faults that have been cleared.

With the Current Fault line of text highlighted, press the **OK** button. This will display information regarding the current fault.

7.11.1 Current Fault Data

Use this screen to look at the current fault code and description.

Name	Description
Fault #	Fault code
SA	Controller that identified the fault
Gen Response	Type of fault (Shutdown or Warning)

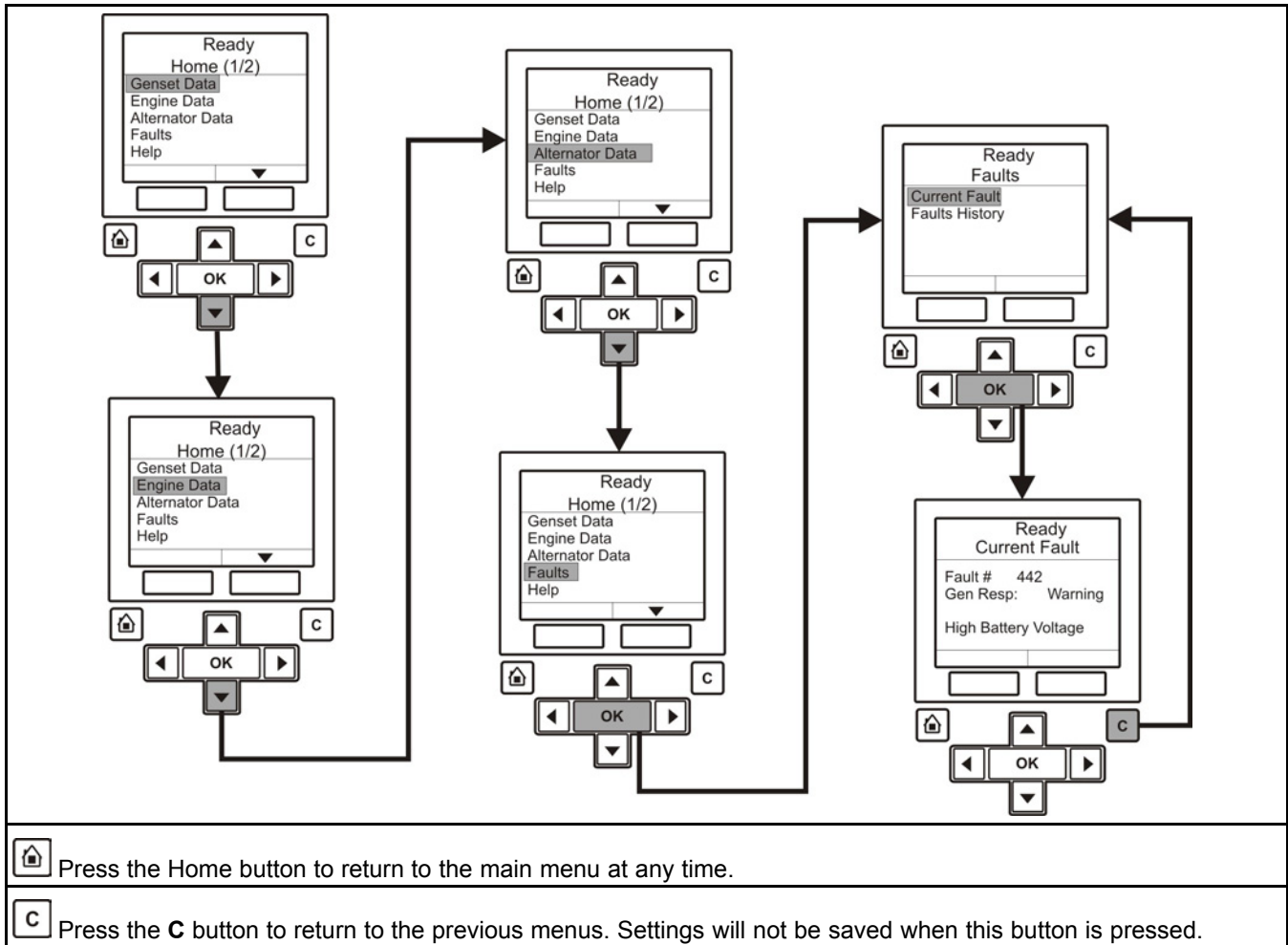
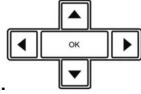


FIGURE 46. CURRENT FAULT MENU - TYPICAL DATA

7.12 Operator Panel - Faults History Data Operator Menus

[Figure 47 on page 84](#) shows a block representation of a typical **Faults History** menu.

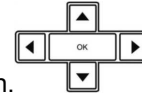
To navigate from the Home menu, toggle down until the Faults line of text is highlighted and press the **OK**



button.

The **Faults** menu is divided into two main subsections; Current Fault covers the latest active fault, and Faults History shows faults that have been cleared.

Toggle down to the **Faults History** menu using the buttons below the up and down arrows (▲ and ▼) in



the menu. With the Faults History line of text highlighted, press the **OK** button.

This will display information regarding the previous faults.

The **Faults History** menu contains up to ten screens. Use the buttons below the up and down arrows (▲ and ▼) in the menu to toggle between the screens.

7.12.1 Faults History

This screen displays up to ten faults.

Name	Description
Index #	Number of the fault in the fault history. It is not the fault code
Fault #	Fault code
SA	Controller that identified the fault. It is blank if the PowerCommand Controller identified the fault
Gen Response	Type of fault (Shutdown or Warning)
Cntl Time	Number of hours that the engine has run (not necessarily continuously) when the fault was generated

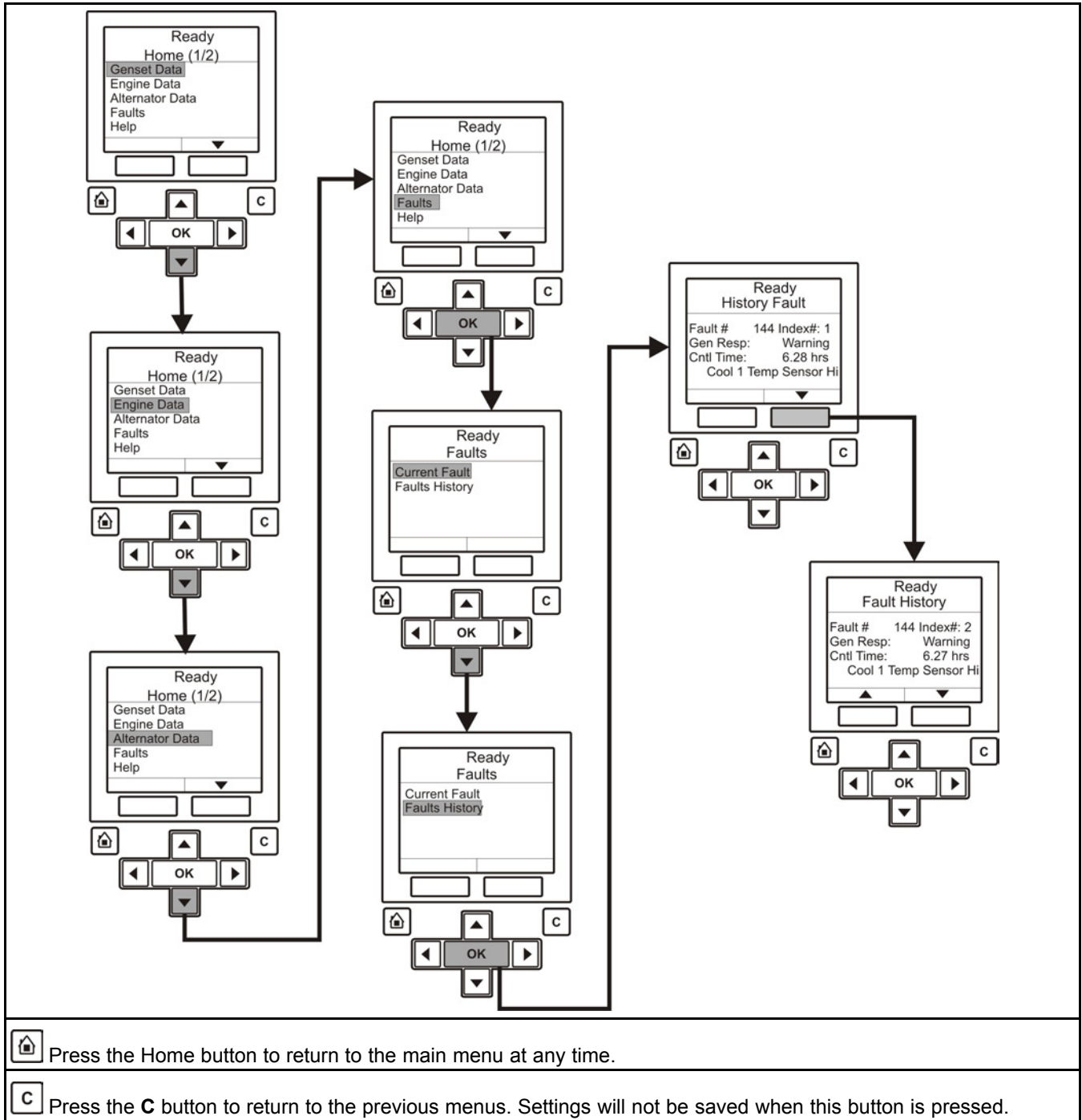
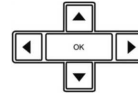


FIGURE 47. HISTORY FAULT MENU - TYPICAL DATA

7.13 Operator Panel - Generator Set Setup Data Operator Menu

[Figure 48 on page 86](#) shows a block representation of the Setup/Genset Data Menu.

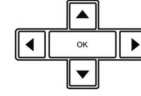
Page down to the second page of the Home menu (using the buttons below the up and down arrows [▲ and ▼]) in the menu. See [Section 7.7 on page 76](#).



With the Setup line of text highlighted, press the **OK** button.

This displays the **Setup Menu (1/2)**.

Page down to the second page of the Setup Menu (using the buttons below the up and down arrows [▲ and ▼]) in the menu.



With the Genset Setup line of text highlighted, press the **OK** button.

This displays the **Setup/Genset Data (1/5)** menu.

Page down to the fifth page of the **Setup/Genset Data** menu (using the buttons below the up and down arrows [▲ and ▼]) in the menu to review the generator set data.

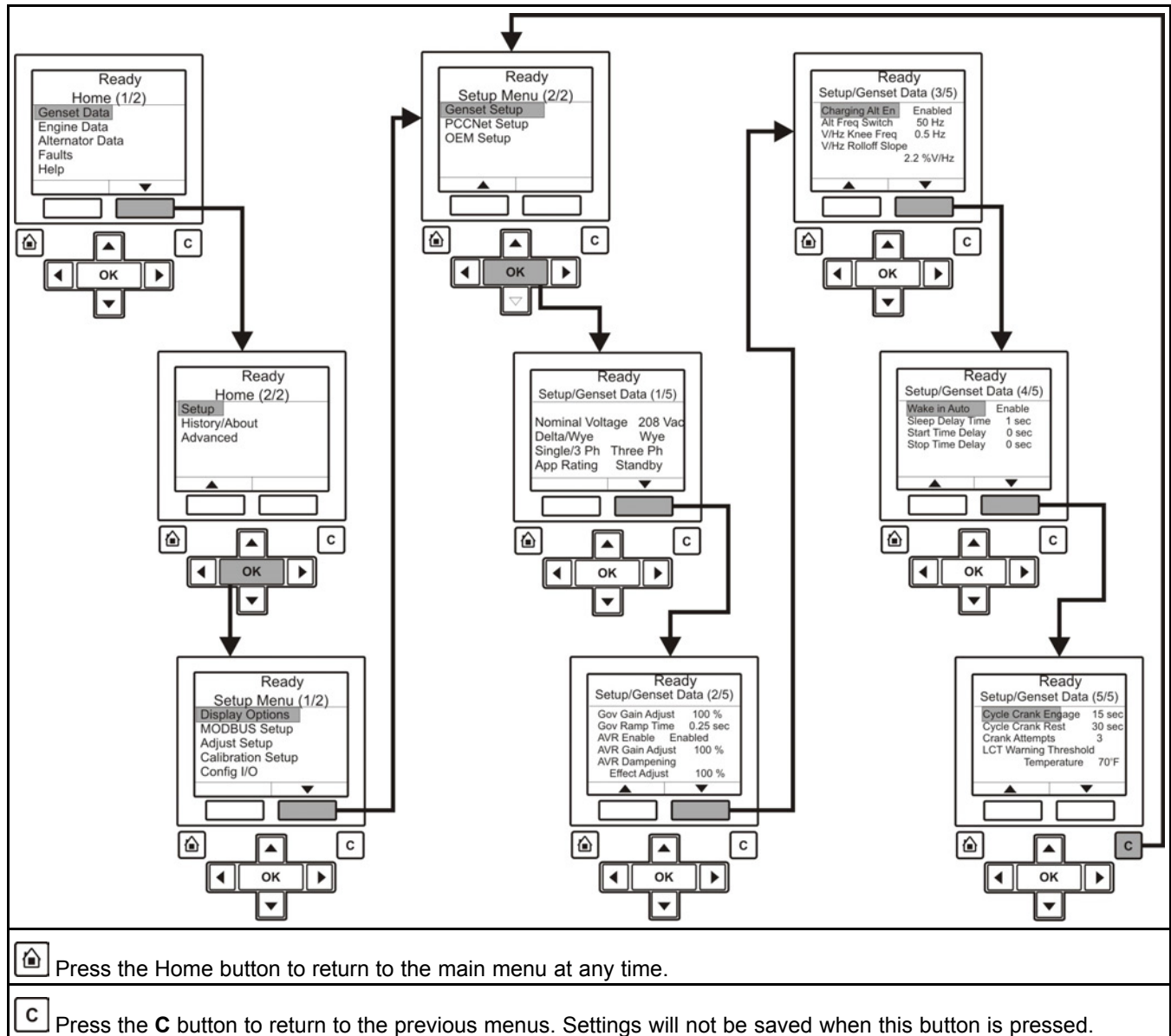


FIGURE 48. SETUP DATA MENU - TYPICAL DATA

7.14 Selecting Operating Modes

7.14.1 Passwords and Mode Change Access

7.14.1.1 Entering the Mode Change Access Code

The Mode Change submenus are intended for trained and experienced service personnel and site personnel only, and by default will require an Access password. If a password is required, the Mode Change – Access Code menu appears when the Auto, Manual Run, or Stop mode is selected.

To enter the mode access code:

1. With the first character highlighted, press the up and down arrow buttons until the required value is displayed.
2. Press the left arrow button to move to the next numeric character.
3. Repeat steps 1 and 2 until all characters of the Access Code are correct.
4. After you have completed entering the password, press the **OK** button.

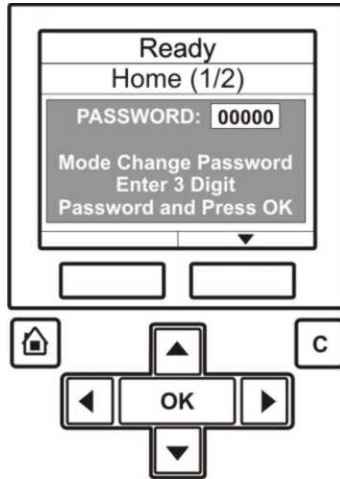


FIGURE 49. MODE CHANGE ACCESS CODE DISPLAY SCREEN

NOTICE

If an incorrect password is entered, the operator menu that was displayed before Auto, Manual Run, or Stop mode was selected is redisplayed.

7.14.1.1.1 Passwords

It is possible for the operator to view every parameter in the graphical display; however, a password may be required before adjustment of a parameter is permitted. The generator set will prompt you if a password is required and inform you of the level of password required.

TABLE 6. PASSWORDS



Level	Description	Comment
0	No password	None required
1	Operator password	Restricted
2	Service password	Restricted
3	Engineering password	Restricted

7.14.2 Selecting Manual Run Mode

⚠ WARNING

When changing modes, the generator set may start or stop without warning (For example: Auto Mode may have been selected with no mains (utility) power available). Make sure there is no danger to personnel or equipment should the generator set start or stop when changing modes.



Press the Manual button  and then (within ten seconds) the Start button . This bypasses the 'Time Delay to Start' function; activate the engine control system and the starting system.



If the engine does not start, the starter disengages after a specified period of time and the controller indicates a 'Fail to Start' shutdown.

The generator set can be configured for one to seven starting cycles with set times for crank and rest periods for all starting modes (manual/remote). The default setting is for three start cycles, composed of fifteen seconds of cranking and thirty seconds of rest.

NOTICE

The InPower service tool or access to the Setup menu is required to change the cycle number, and the crank and rest times. Contact your authorized distributor for assistance.



To clear a Fail to Start shutdown, press the Stop button  and then press the Reset button .

Before attempting to restart, wait two minutes for the starter motor to cool and then repeat the starting procedure.

7.14.3 Selecting Auto Mode


NOTICE

When changing modes, the generator set can start or stop without warning. Make sure there is no danger to personnel or equipment should the generator set start or stop.

NOTICE

Make sure that it is safe to do so before proceeding to change the mode.



Press the **Auto** button . This allows the generator set to be started from a remote switch or device (e.g. transfer switch).

In response to the **Remote Start**, the control lights the Remote Start indicator and initiates the starting sequence. This start incorporates a Time Delay to Start function.

NOTICE

The InPower service tool or access to the setup menu is required to change the cycle number, and crank and rest times. Contact your authorized distributor for assistance.

NOTICE

Should a remote start signal be received, the generator set starts automatically. Make sure there is no danger to personnel or equipment should the generator set start without warning.

The starting/stopping sequence for a remote start is as follows:

1. A Remote Start signal is received at the customer connection on the generator set. This input signal is received from a transfer switch, a remote start switch, etc.
2. The Time Delay to Start (0–300 seconds) begins.
3. When the Time Delay to Start has expired, the engine starts. Once it has reached its rated speed and voltage, the generator set is available for use.
4. When the Remote Start signal is removed, a Time Delay to Stop (0–600 seconds) begins. This time delay is used to transfer the load, if connected to another power source, and let the engine cool down.
5. When the Time Delay to Stop has expired, the engine stops.

NOTICE


If the emergency stop or control off button is pressed at any time during the starting/stopping sequence, the engine immediately stops, bypassing the cooldown sequence.

7.14.4 Selecting Off Mode

⚠ WARNING

When changing modes, the generator set can stop without warning. Make sure there is no danger to personnel or equipment should the generator set stop when changing modes.



Press the Stop button  to put the generator set into the Off mode. This disables Auto and Manual modes.

If the generator set is running, in either Manual or Auto mode, and the Stop button is pressed, the engine will shut down. This action may include a cooldown run.

⚠ CAUTION

Do not perform a hot shutdown under load; a hot shutdown will result in engine damage.

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8 Control Adjustment and Service

8.1 General

This section contains circuit board removal and replacement procedures and adjustment procedures for the generator set control.

This section also describes the function and operation of engine sensors, generator set options, and other special features of the generator set control system, such as, customer connection points, optional run relays, etc. Installation information is also provided for these items where necessary.

WARNING

Incorrect service or replacement of parts can result in severe personal injury or death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical service.

WARNING

HAZARDOUS VOLTAGE. The PCC 1302 control must be opened only by technically qualified personnel. Site power for optional equipment and generator set voltages of up to 600 VAC are present on the control board. These voltages can cause electrical shock, resulting in personal injury.

8.2 Control Board Removal/Replacement

No special tools (other than a grounding wrist strap and InPower Service tool) are required to remove a control board. The InPower Service tool is required when replacing the control board.

Before replacing the control board, make sure that a capture file of the generator set parameter values has been created using InPower. (During generator set installation, it was suggested that a capture file be made before and after changes were made to the generator set operating parameters.)

After replacing the control board, use the capture file as a template to write the previous settings to the new control board software.

Refer to InPower User's Guide for specifics.

8.2.1 Control Board Removal Safety Precautions

CAUTION

Before disconnecting battery cable(s), press the Emergency Stop button and wait at least 30 seconds. Fault Code 1117 may display and engine performance may be affected (e.g., engine dying or hard starting) if battery cable(s) is removed during the 30 second waiting period. See Fault code 1117 in Section 5 to reset ECM.

⚠ WARNING

Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

Ventilate battery area before working on or near battery-Wear goggles-Stop generator set and disconnect charger before disconnecting battery cables-Disconnect negative (-) cable first and reconnect last.

⚠ CAUTION

Disconnect battery charger from AC source before disconnecting battery cables. Otherwise, disconnecting cables can result in voltage spikes damaging to DC control circuits of the set.



⚠ WARNING

Accidental starting of the generator set can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (-) cable from the battery terminal.

⚠ CAUTION

Electrostatic discharge will damage circuit boards. Always wear a grounding wrist strap when handling circuit boards or socket-mounted ICs.

Before starting procedure, disconnect the negative (-) cable from the battery. This is to make sure the set will not start while working on it and to avoid circuit board damage, caused by voltage spikes when removing and replacing circuit board connectors.

1. Press the  or  button to switch to the **Off** mode.
2. Turn off or remove AC power from the battery charger.
3. Press the Emergency Stop button and wait at least 30 seconds before completing Step 4.
4. Remove the negative (-) battery cable from the generator set starting battery.
5. To prevent circuit board damage due to electrostatic discharge (ESD), a grounding wrist strap must be worn when handling circuit boards or socket-mounted IC's. (The wrist strap **does not** provide a direct short to ground, but is typically rated at approximately 1 megohm to ground.)
6. Attach the clip to the chassis ground screw in the mounting area of the control board and place the strap around your wrist before handling a circuit board.

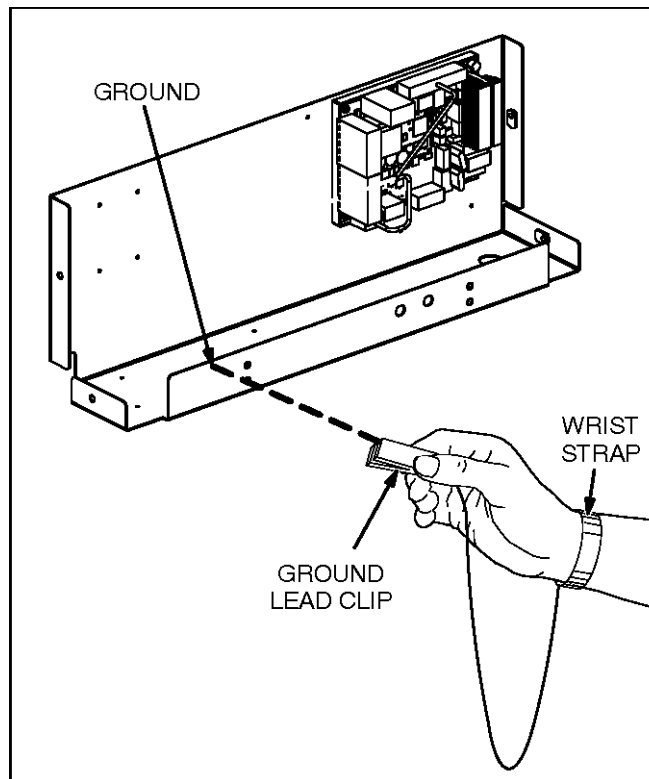


FIGURE 50. WRIST STRAP

8.3 Setup and Service Menus

The following provides setup and service menus for the PCC 1302 Controller that uses a HMI211 Operator Panel ([Figure 4 on page 25](#)). Adjustment of the setup and service parameters with the HMI220 is similar. If the PCC 1302 Controller has a HMI211R Operator Panel ([Figure 25 on page 54](#)), use the InPower Service Tool to adjust the setup and service parameters.

8.3.1 Setup Menu

The Setup Menus menu ([Figure 51 on page 94](#)) provides access to generator set menus with system parameters that can be viewed and, if a password is entered, adjusted. The Setup "Password" menu is displayed when the "1" button is pressed on the Service Menu.

Pressing the VIEW button in the Setup "Password" menu, will display the 1st generator set service menu (see [Figure 52 on page 95](#)). Note that when viewing the generator set service menus, the ADJUST button will not be displayed as shown in [Figure 52 on page 95](#).

After entering the password from the Setup "Password" menu, a second Setup menu is displayed that provides access to the following two categories of generator set adjust menus:

- Generator set service menus - see [Section 8.3.3 on page 97](#)
- Generator set setup menus - see [Section 8.3.10 on page 120](#)

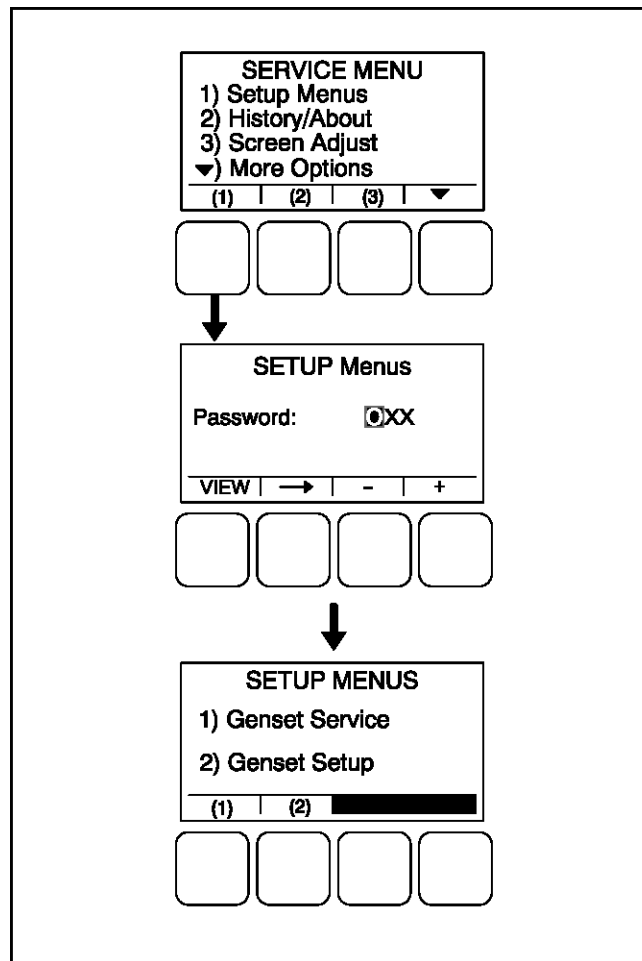


FIGURE 51. SETUP MENUS

8.3.2 Generator Set Service Menu

NOTICE

In the following menu entry descriptions, the default parameter/value is not shown because the default value is subject to change by model. Always create and refer to the initial capture file for factory default settings of system parameters/values.

The generator set service menus are available by pressing the (1) button in the Setup menu (see [Figure 52 on page 95](#)).

This section covers generator set service menus only. For information on generator set setup menus, go to [Section 8.3.10 on page 120](#).

If a password is entered, the settings in the generator set service menus can be adjusted. However, if a password is not entered, these menus can still be viewed.

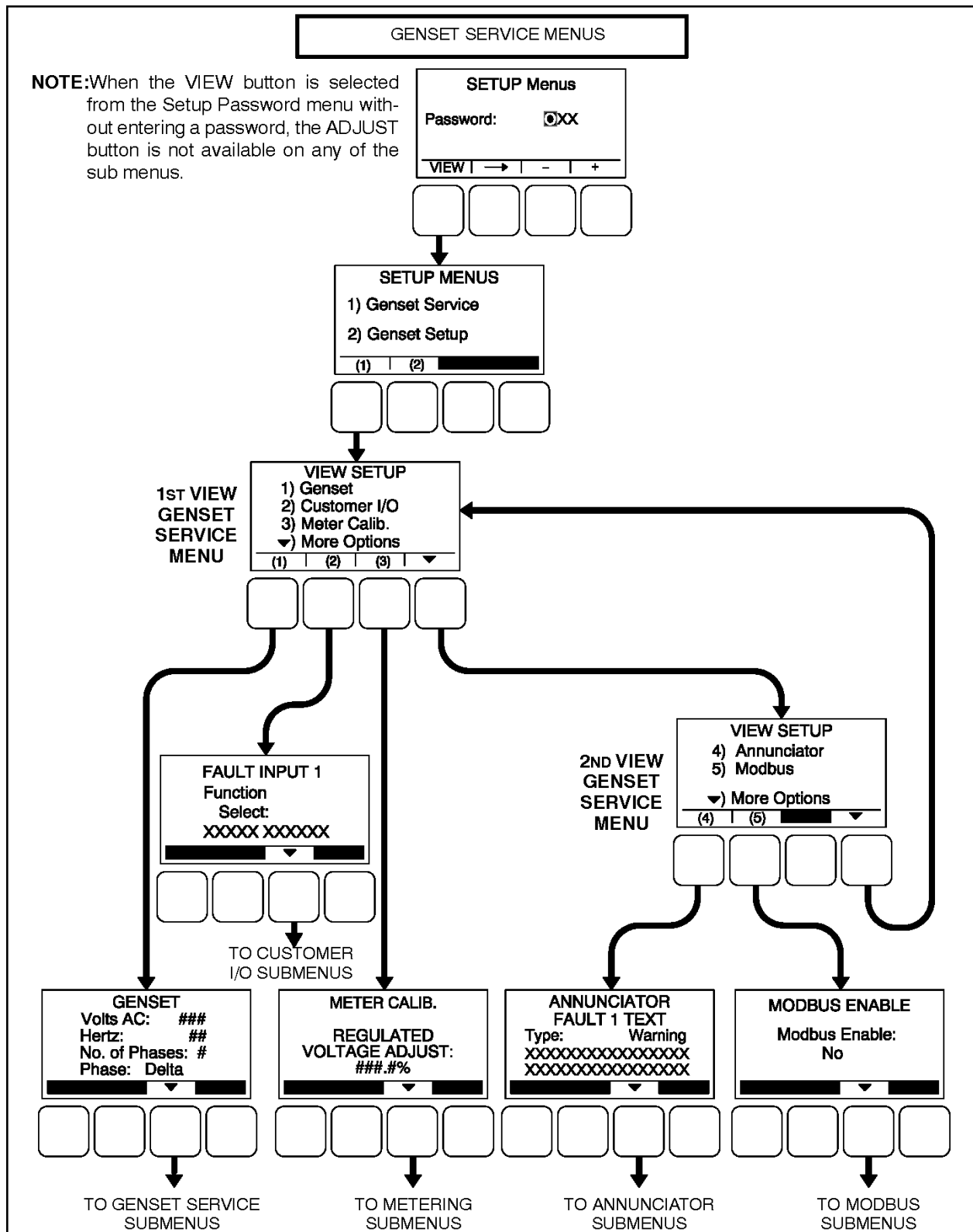


FIGURE 52. GENERATOR SET SERVICE MENU

8.3.2.1 Viewing and Adjusting

[Figure 52 on page 95](#) is a block representation of the two generator set service menus that are available from the Setup menu after the correct password has been entered. The Genset Service menus provide access to the following categories.

The first generator set service menu provides access to the following menus:

- Genset
- Customer I/O
- Meter Calibration

The second generator set service menu provides access to the following menu:

- Annunciator
- ModBus

8.3.2.2 Setup Password Menu

Adjusting the generator set service submenus is restricted to service personnel and a password must be entered to modify these menus.

When the Password menu is displayed, the first numeric character (0) is highlighted (see [Figure 52 on page 95](#)).

NOTICE

When selected (highlighted), each character initially turns to "0" and the remaining characters turn to "X".

NOTICE

Make sure that each numeric character is correct before you move to the next character. If a wrong character is entered, you will not be able to go back and correct it. If the wrong password is entered, you will be able to view the generator set service menus but you won't be able to change them.

To enter the generator set service menu password **574**:

1. With the first character highlighted, press the button below the + or - symbols until the value reads "5."
2. Press the arrow selection button → to move to the next numeric character.
3. Press the button below the + or - symbols until the value reads "7."
4. Press the arrow selection button → to move to the next numeric character.
5. Press the button below the + or - symbols until the value reads "4."
6. After you have completed entering the password, press the arrow selection button →. The first main Setup menu is displayed.


After the correct password is entered, it will be remembered until five minutes of button inactivity has elapsed. If five minutes of button inactivity has elapsed, you will have to re-enter the password to access and change the generator set service submenus.


8.3.2.3 Adjusting Values/Parameters

Once the correct password has been entered after Genset Service (1) is selected on the Setup Menu menu, the first Genset Service menu is displayed.

1. Press the buttons above the ▲ and ▼ symbols in the digital display to navigate between submenus.
2. Press the **ADJUST** selection button to select the first parameter or value to be changed.
3. Press the + or - selection buttons to adjust values or select parameters. Press the arrow selection button → to move to the next numeric character.
4. Press the arrow selection button → to navigate to the next or previous adjustable value or parameter.
5. After adjusting values/selecting parameters, press the **SAVE** button to save your settings.

NOTICE

If the  button is pressed before pressing the **SAVE** button, the changes are not saved.

6. Press the  button to return to the Service Menu.

8.3.3 Genset Service Submenus

The Genset Service submenus are available by pressing the (1) button on the first Genset Service menu (see [Figure 52 on page 95](#)).

NOTICE

[Appendix A on page 239](#) provides a block diagram that illustrates the sequence of how the Genset Service Submenus are displayed.

The Genset Service submenus consist of ten basic menus.

- Genset, Part 1 ([Figure 53 on page 98](#))
- Genset, Part 2 ([Figure 53 on page 98](#))
- Fuel System ([Figure 53 on page 98](#))
- Start/Stop Time Delays ([Figure 53 on page 98](#))
- Cycle Crank ([Figure 54 on page 99](#))
- Automatic Voltage Regulator Setup ([Figure 54 on page 99](#))
- Electronic Governor ([Figure 55 on page 100](#))

NOTICE

If enabled, the Automatic Voltage Regulator has two additional submenus and the Electronic Governor has five additional submenus.

- Genset Model and Serial Number ([Figure 55 on page 100](#))
- Display Setup ([Figure 56 on page 101](#))
- Volts and Hz Password ([Figure 56 on page 101](#))

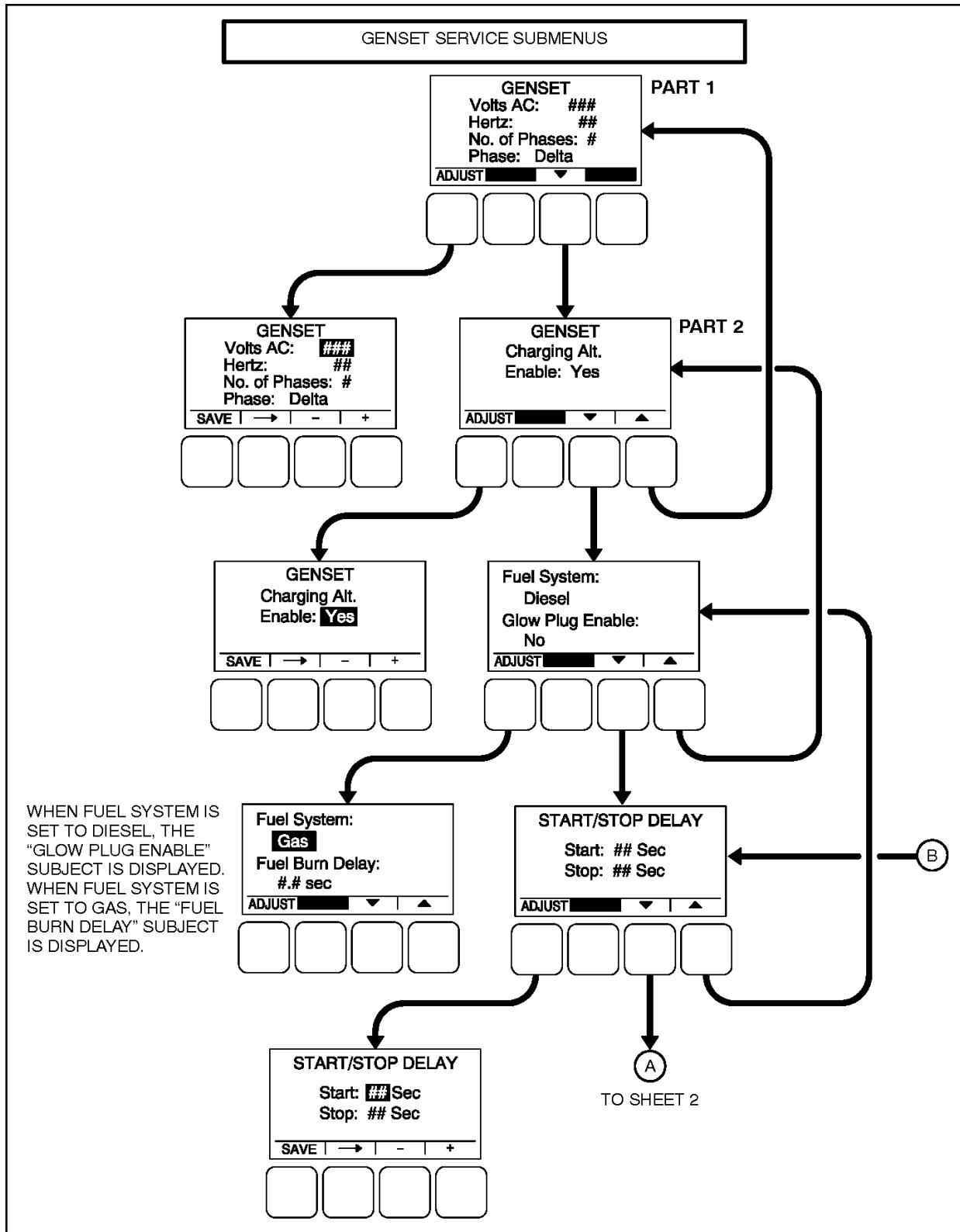


FIGURE 53. GENSET SERVICE - GENSET, FUEL SYSTEM, AND START/STOP DELAY SUBMENUS

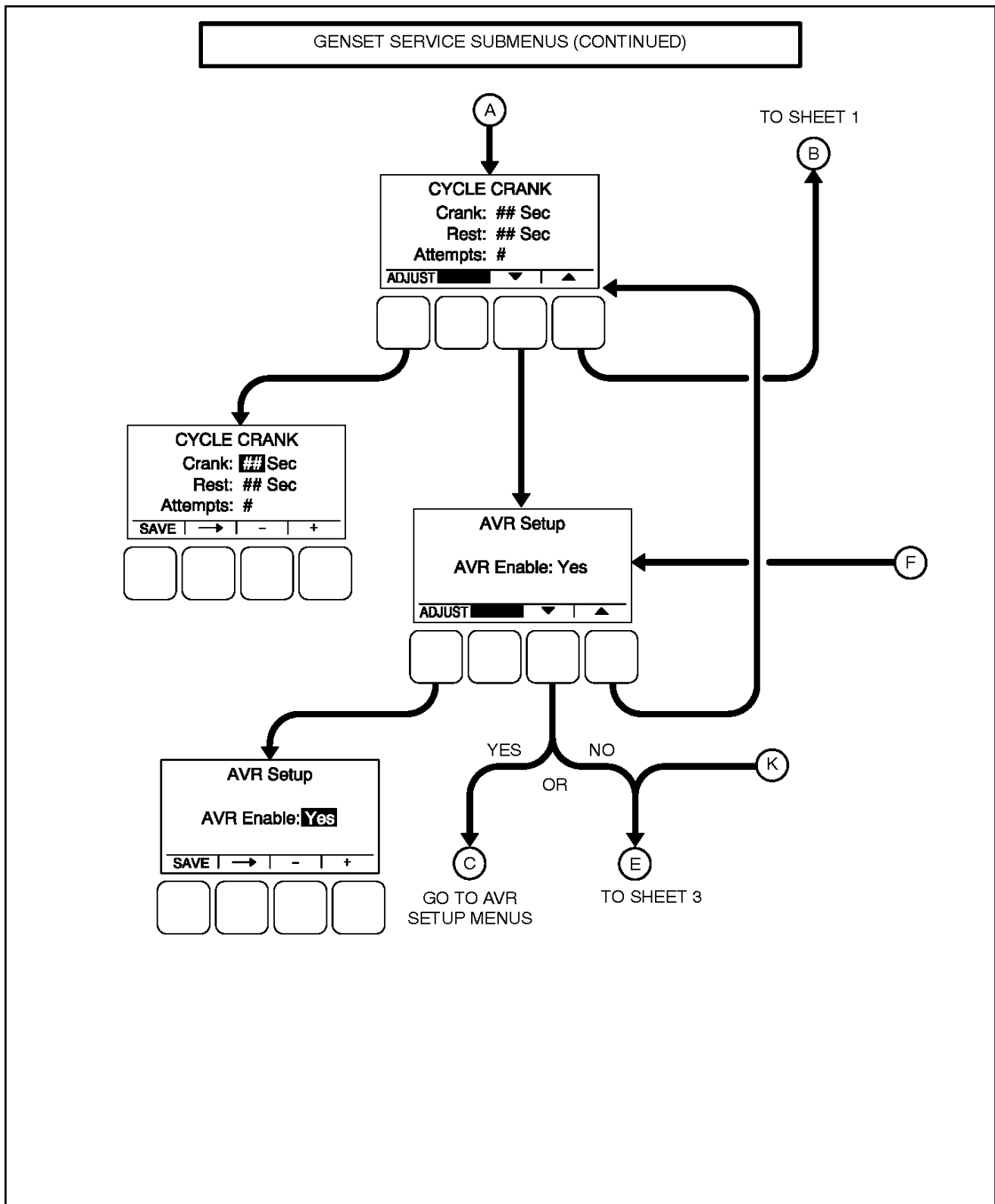


FIGURE 54. GENSET SERVICE - CYCLE CRANK AND AVR SETUP SUBMENUS

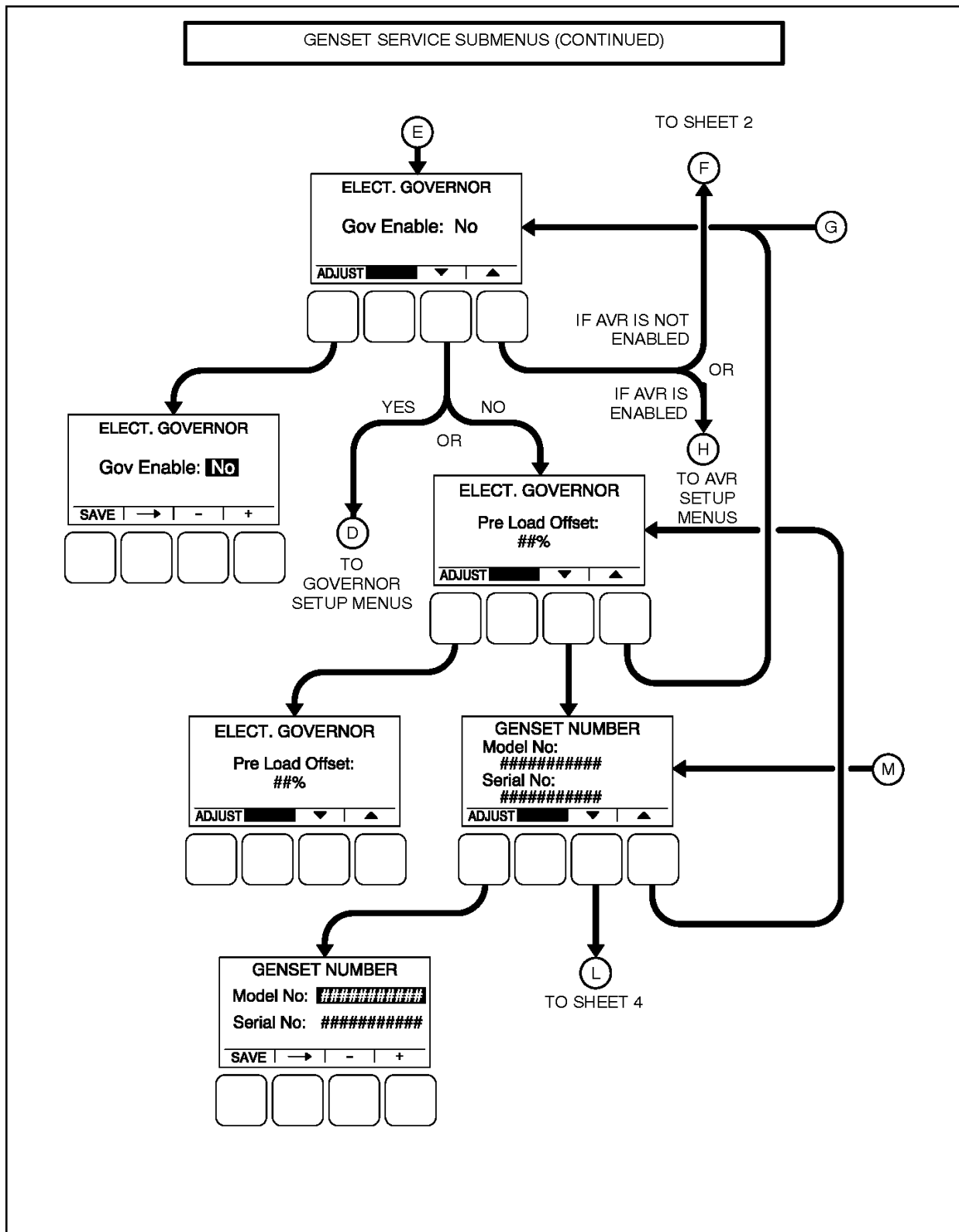


FIGURE 55. GENSET SERVICE - ELECTRONIC GOVERNOR AND GENSET NUMBER SUBMENUS

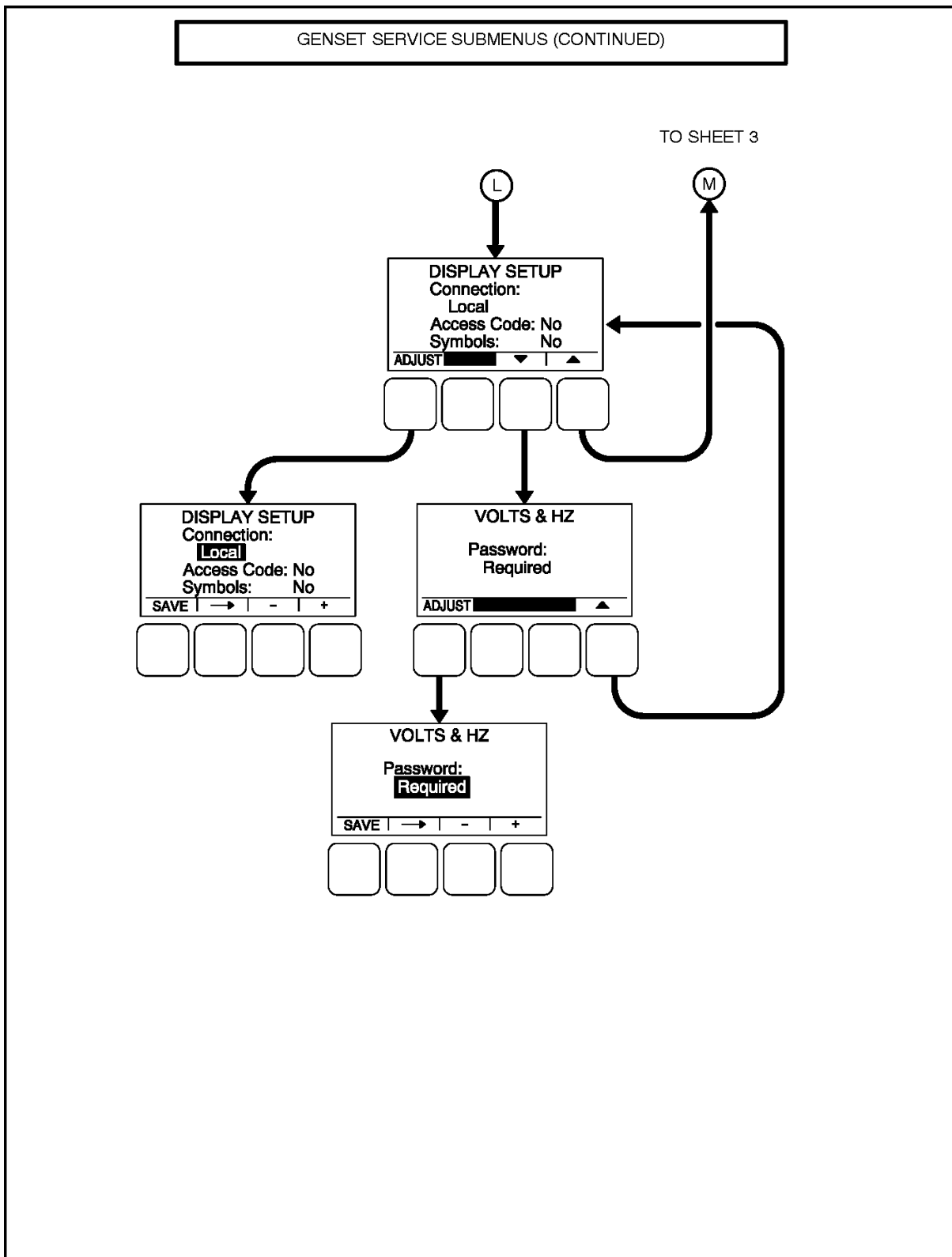


FIGURE 56. GENSET SERVICE - DISPLAY SETUP, AND VOLTS AND HERTZ SUBMENUS

8.3.3.1 Genset Menu, Part 1

The first genset menu displays the preset AC Voltage, generator set frequency, number of phases, and phase type.

- *Volts AC*: Displays the AC voltage (190, 200, 208, 220, 230, 240, 380, 400, 416, 440, 460, 480 or 600 VAC).
- *Hertz*: Displays the generator set frequency (50 or 60 Hz). The control selects limits, gains, and frequency values based upon this selection.
- *No. of Phases*: Displays the number of phases (1 or 3).
- *Phase*: Displays the phase type (Delta or Wye)

8.3.3.2 Genset Menu, Part 2

The second genset menu ([Figure 53 on page 98](#)) allows for enabling or disabling charging alternators.

- *Charging Alt. Enable*:

A starter disconnect will occur whenever any one of the following three possible signals reaches its disconnect setpoint.

- The average engine speed (if a magnetic pickup unit is installed)
- The average frequency
- The charging alternator voltage (if the Charging Alt feature is enabled)

The Charging Alt. Enable menu is used to enable or disable the Charging Alt feature. This menu provides a means to disable the control's charging alternator logic if it is not supported by the alternator. If the alternator does not support this functionality, the Charger Failure warning (Fault code **2678**) will constantly be displayed unless this setting is changed to "No". When disabled (set to "No"), the start disconnect signal is based only on the average engine speed or frequency and the Charger Failure warning is disabled.

8.3.3.3 Fuel System

The Fuel System menu ([Figure 53 on page 98](#)) allows for selecting fuel type and, depending on the type selected, enabling/disabling glow plugs or setting a fuel burn time delay.

- *Fuel System*: Allows for selecting the fuel type (Diesel or Gas).

If Fuel System is set to "Diesel"

- *Glow Plug Enable*: Allows control of Glow Plugs for a particular generator set (Yes or No).

If Fuel System is set to "Gas"

- *Fuel Burn Delay*: After the generator set receives a stop signal, this feature allows for setting a fuel time delay from 0 to 10 seconds in which the ignition remains on so that any fuel down stream of the intake manifold is burned.

8.3.3.4 Start/Stop Delay Menu

The time delay after receiving a valid start signal, until the generator set starts, can be adjusted ([Figure 53 on page 98](#)). The time delay that the generator set is allowed to run at rated speed after receiving a stop signal, until the generator set stops, can also be adjusted. These time delays do not apply to manual start/runs.

- *Start*: The generator set start time delay can be adjusted from 0 to 3600 seconds.
- *Stop*: The generator set stop time delay can be adjusted from 0 to 600 seconds.

8.3.3.5 Cycle Crank Menu

The Cycle Crank menu ([Figure 54 on page 99](#)) allows for configuring the generator for all starting modes (manual and remote), as follows:

- *Crank*: The cranking period can be set from 3 to 30 seconds. This time limit is used to determine a Fail to Start status.
- *Rest*: The minimum amount of time between crank attempts can be set from 0 to 60 seconds.
- *Attempts*: The maximum number of times the starter can be engaged when attempting to start the engine with cycle cranking can be set from 1 to 7 attempts.

8.3.3.6 AVR Setup Menu

The AVR Setup menu ([Figure 54 on page 99](#)) is used to enable or disable the automatic voltage regulator. If enabled, two additional menus are displayed that can be used to adjust the AVR settings (see [Section 8.3.4 on page 103](#)).

8.3.3.7 Electronic Governor Menu, Part 1

The engine Electronic Governor Enable menu ([Figure 55 on page 100](#)) is used to enable or disable the electronic governor on generator sets with electronic governors and magnetic pickup sensors. If enabled (set to "Yes"), four additional menus are displayed that can be used to adjust governor settings (see [Section 8.3.5 on page 105](#)).

8.3.3.8 Electronic Governor Menu, Part 2

The Pre-Load Offset menu ([Figure 55 on page 100](#)) is used to enter a percentage of governor duty cycle that is first used when exiting cranking.

8.3.3.9 Genset Number Menu

The Genset Number menu ([Figure 55 on page 100](#)) is used to enter the generator set model and serial numbers. Each allow up to 16 characters to be entered.

8.3.3.10 Display Setup Menu

The Display Setup menu ([Figure 56 on page 101](#)) is used to set the display for Local (Auto/Off/Manual Run switch functions on the operator panel are turned on) or Remote (Auto/Off/Manual Run switch functions on the operator panel are turned off).

- *Connection*: A display can be set up to be Local or Remote.
- *Access Code*: A display can be set up to require or not require entering the mode (Auto, Manual Run or Off) change access code. If enabled, an access code must be entered to change generator set mode of operation
- *Symbols*: A display can be set up to display international symbols on the Operator menus.

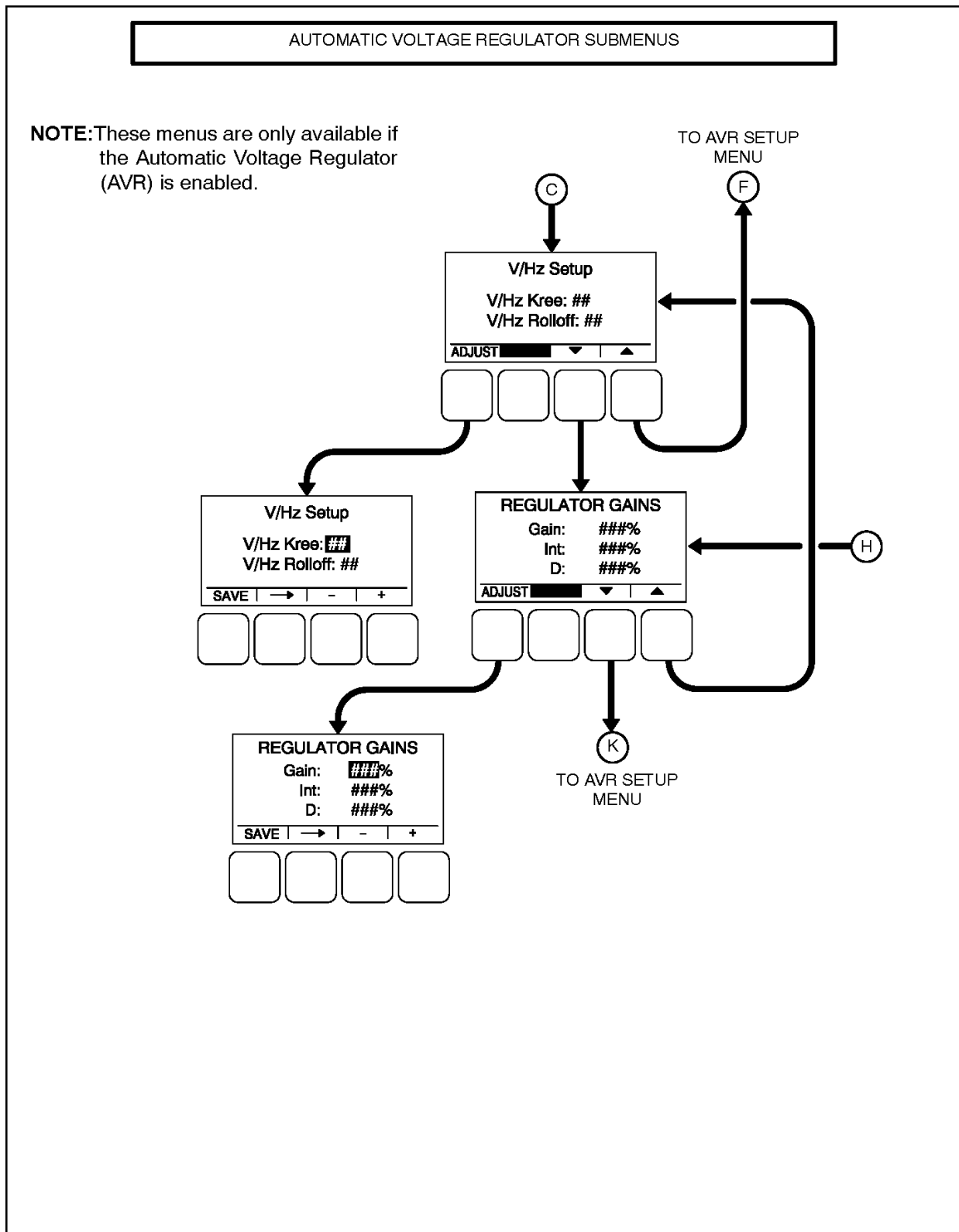
8.3.3.11 Volts and Hertz Menu

The Volts and Hertz menu ([Figure 56 on page 101](#)) is used to select whether or not a password is required in order to change voltage and hertz settings outside of the Genset Service menus.

8.3.4 Automatic Voltage Regulator Submenus

The Automatic Voltage Regulator (AVR) submenus are available only if the AVR is enabled (see [Section 8.3.3.6 on page 103](#)).

Two Automatic Voltage Regulator (AVR) submenus (see [Figure 57 on page 104](#)) can be used to adjust Volts/Hz Rolloff and Regulator Gains settings.



8.3.4.1 Volts/Hz Rolloff Menu

The Volts/Hz Rolloff function helps optimize the generator set response to added load. If the engine speed drops below nominal frequency, the control automatically drops the voltage until the engine speed starts to recover.

This menu allows for adjusting the knee frequency and voltage setpoint slope parameters ([Figure 58 on page 105](#)). The knee frequency is the value below nominal frequency at which the rolloff function begins. For example, if the knee frequency is set to 5 Hz on a 60 Hz generator set, this function begins when the frequency drops below 55 Hz.

Slope refers to how fast the voltage is rolled off below the knee frequency. The voltage is rolled off the slope percent setting for every 1 Hz below the knee. For example, on a 60 Hz generator set, if the slope is set to 5% and the knee frequency is set to 5 Hz, then if the frequency drops to 54 Hz, the voltage set point is reduced 5%. If the frequency drops to 53 Hz, the voltage set point is reduced 10%, etc.

- *V/Hz Knee*: The Knee Frequency can be adjusted from 0.0 to 10.0 Hertz in 0.1 Hz increments. When generator set speed decreases below the value of the knee frequency, the generator set voltage decreases by the %/Hz value.
- *V/Hz Rolloff*: The Rolloff setting can be adjusted from 0.0 to 5.0 percent of rated voltage, in 0.1% increments.

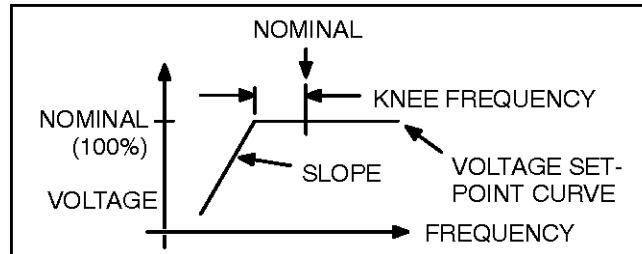


FIGURE 58. KNEE FREQUENCY AND SLOPE

8.3.4.2 Regulator Gains Menu

The Regulator menu allows for setting proportional Gain, Integral Gain, and Damping values.

- *Gain*: The proportional Gain (K1) multiplier can be set from 5 to 1000%. This allows for a scale factor of 0.05 to 10.0.
- *Int*: The Integral Gain (K2) multiplier can be set from 5 to 1000%.
- *D*: The Damping adjustment can be set from 95 to 105%.

8.3.5 Electronic Governor Submenus

The Electronic Governor submenus are available only if the governor is enabled (see [Section 8.3.3.7 on page 103](#)).

Four Electronic Governor submenus (see [Figure 59 on page 106](#)) can be used to adjust governor settings.

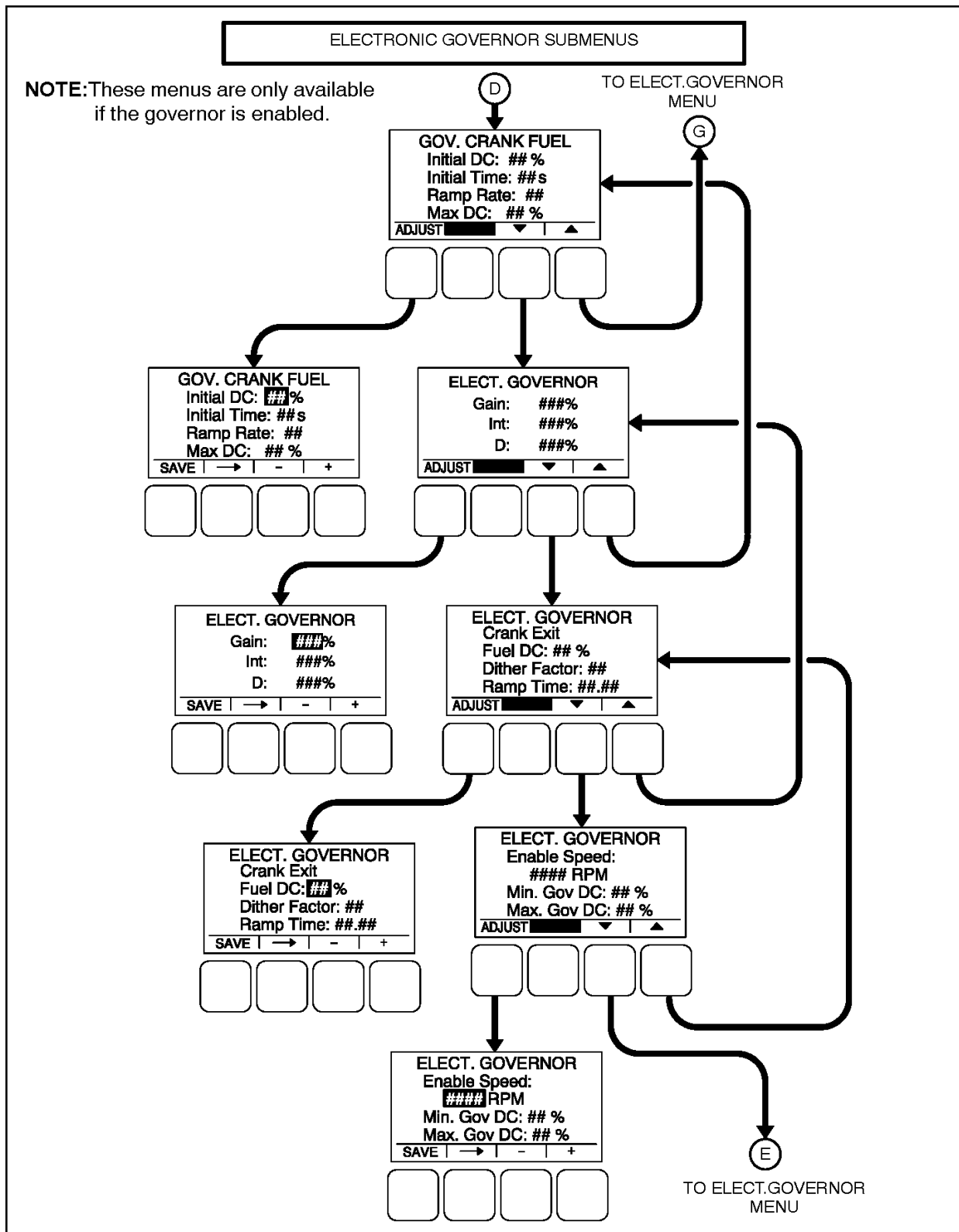


FIGURE 59. ELECTRONIC GOVERNOR SUBMENUS

8.3.5.1 Governor Crank Fuel Menu

The Governor Crank Fuel menu allows for setting the Initial Crank Fuel Duty Cycle, the Initial Crank Fueling Period, the Crank Fuel Ramp Rate, and the Maximum Crank Fuel Duty Cycle.

- *Initial DC*: The Initial Crank Fuel Duty Cycle is the initial value assigned to the Governor Duty Cycle parameter when cranking begins. This value can be set from 0 to 99.9 percent.
- *Initial Time*: The Initial Crank Fueling Period is the amount of time for which the value of Initial Crank Fuel Duty Cycle is assigned to the governor duty cycle after cranking begins. This value can be set from 0 to 10 seconds.
- *Ramp Rate*: The Crank Fuel Ramp Rate is the rate at which the value of the Governor Duty Cycle is ramped up by during the Crank State, after expiration of the Initial Crank Fueling Period. This value can be set from 5 to 100.
- *Max DC*: The Maximum Crank Fuel Duty Cycle is the maximum level to which the Governor Duty Cycle should be limited to during a crank state. This value can be set from 50 to 100%

8.3.5.2 Electronic Governor Regulator Menu

The Electronic Governor Regulator menu allows for setting proportional Gain, Integral Gain, and Damping values.

- *Gain*: The proportional governor gain (K1) multiplier can be set from 5 to 1000%. This allows for a scale factor of 0.05 to 10.0.
- *Int*: The integral governor gain (K2) multiplier can be set from 5 to 1000%.
- *D*: The governor Damping adjustment can be set from 95 to 105%.

8.3.5.3 Electronic Governor Menu

The Electronic Governor menu allows for setting Crank Exit Fuel DC, Dither Factor, and Damping values. This menu is displayed only if the governor has been enabled with the Engine Electronic Governor Enable menu.

- *Crank Exit Fuel DC*: The Crank Exit Fuel Duty Cycle is the value at which the governor duty cycle is held after disengaging the starter until the governor is enabled. This value can be set from 0 to 100%.
- *Dither Factor*: Dither is a signal that is superimposed on the PWM (pulse width modulation) duty cycle to prevent the actuator valve from sticking. The Dither Factor is the dither percent added to the current duty cycle. The Dither Factor can be set from 0 to 30%. The dither function is disabled when the dither factor is set to 0%.
- *Ramp Time*: This feature is used to set the minimum governor speed reference ramp rate. The governor Ramp Time can be set from 0.00 to 30.0 seconds, in 0.01 second increments.

8.3.5.4 Electronic Governor Enable Speed Menu

The Electronic Governor Enable Speed menu allows for setting the minimum and maximum governor duty cycle.

- *Min. Gov DC*: The Minimum Governor Duty Cycle can be set from 0 to 100%.
- *Max. Gov DC*: The Maximum Governor Duty Cycle (with dithered value) can be set from 0 to 100%.

8.3.6 Customer I/O Submenus

The Customer I/O menus are available by pressing the **(2)** button on the first Genset Service menu (see [Figure 52 on page 95](#)).

The Customer I/O menus (see [Figure 60 on page 109](#) thru [Figure 63 on page 112](#)) can be used to define customer input messages and output maps. The Customer I/O menus consist of four Fault Input Function Selection menus, four Customer Input Test message menus, four Fault Input Active State Selection menus, and two Customer Output Map menus.

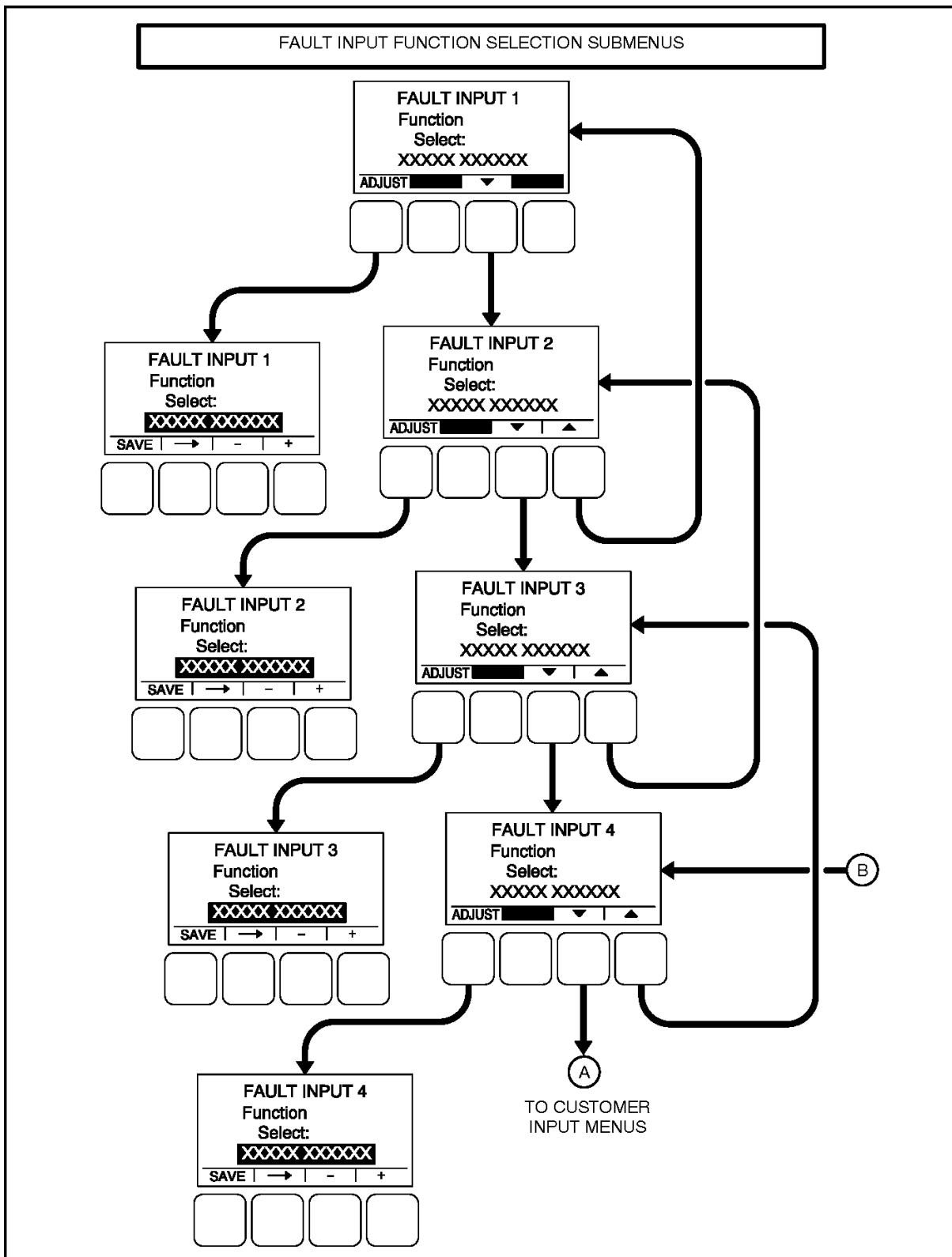


FIGURE 60. CUSTOMER I/O - FAULT INPUT FUNCTION MENUS

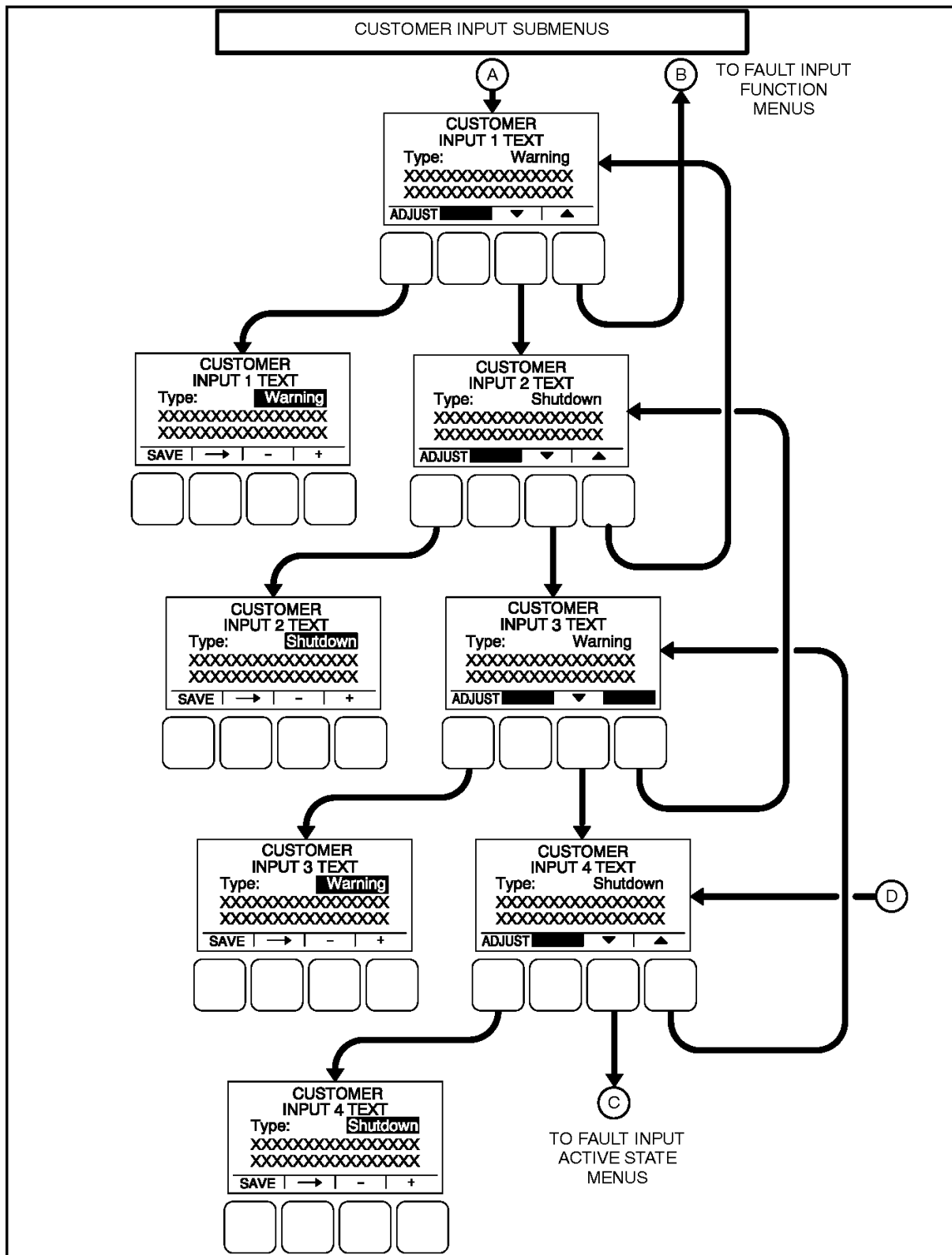


FIGURE 61. CUSTOMER I/O - CUSTOMER INPUT MENUS

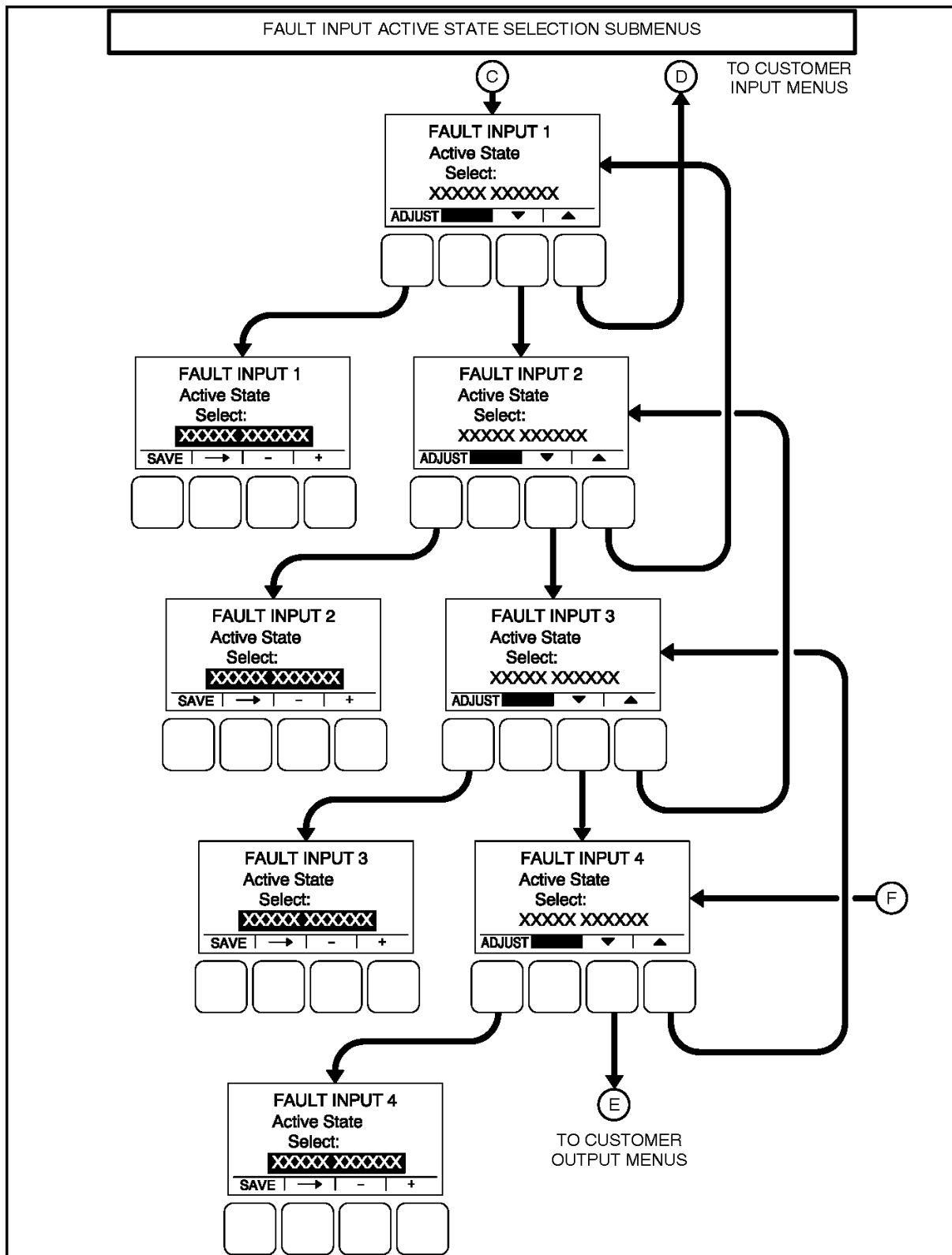


FIGURE 62. CUSTOMER I/O - FAULT INPUT ACTIVE STATE MENUS

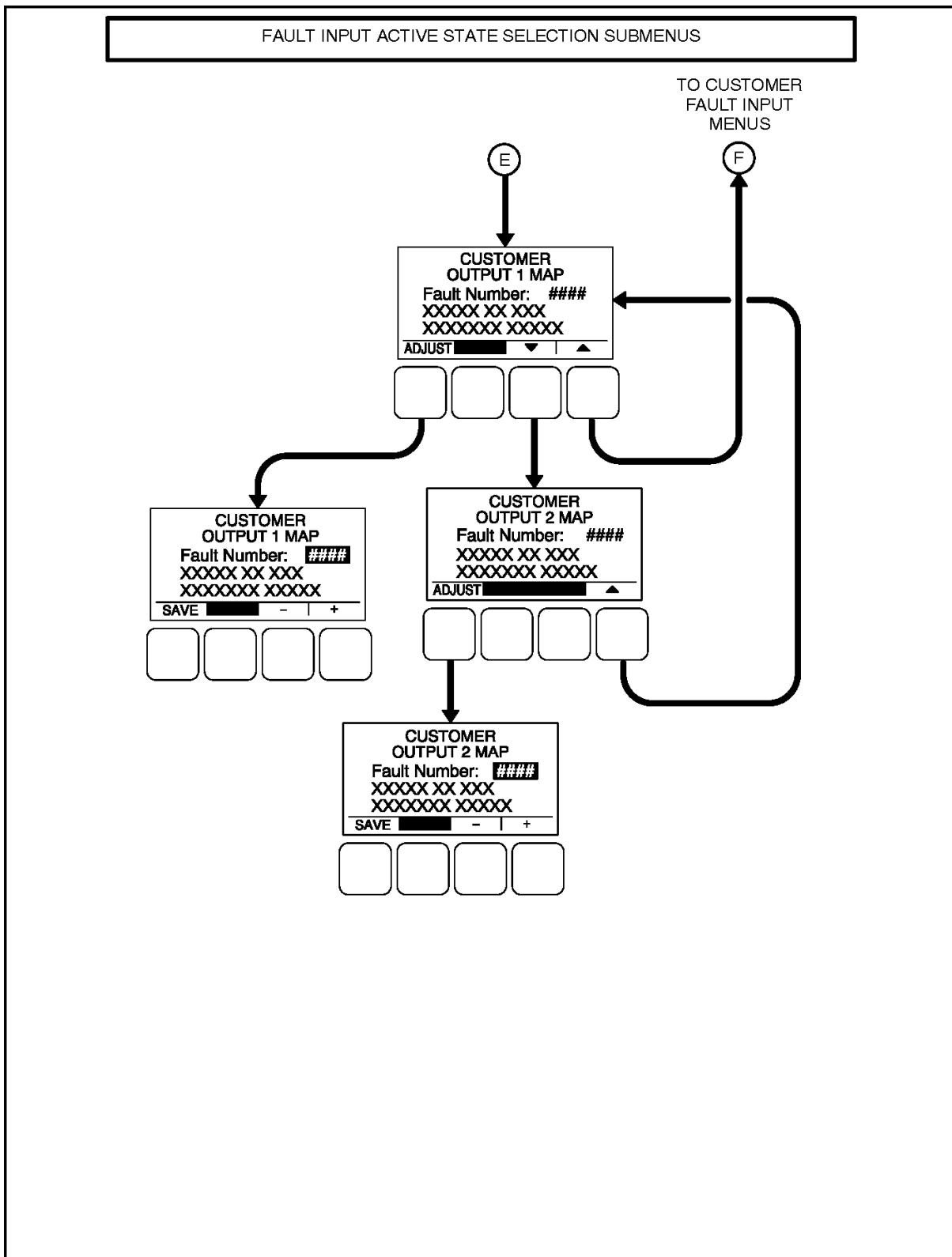


FIGURE 63. CUSTOMER I/O - FAULT OUTPUT MENUS

8.3.6.1 Fault Input Function Selection

Each of the four configurable input functions can be set to Disabled, Fault Input or Fault Reset (the default is different for each input). See [Figure 60 on page 109](#).

8.3.6.2 Customer Inputs

The Customer Input Text message menus are used to enter an event type and description for two events. See [Figure 61 on page 110](#).

- *Type*: Enter the event type (Warning, Shutdown or Event).
- Enter a brief description of the event (up to 32 characters). Example inputs: Low Coolant Level, Low Fuel Pressure, Ground Fault, etc.

8.3.6.3 Fault Input Active State Selection

Each of the four fault input active states can be set to Active Closed or Active Open, (default = Active Open). See [Figure 62 on page 111](#).

8.3.6.4 Customer Outputs

Two Customer Outputs are configurable to display common warning alarms. The two Customer Output Map menus allow for entering a fault number and fault name to be displayed for the two configurable customer outputs. (See [Figure 63 on page 112](#).)

- *Number*: Enter a code number 0 to 65535 for the event. [Section 9.8](#) lists the warning and shutdown codes. The following list shows event codes that are not shown in [Section 9.8](#).
 - Code **418** - Water In Fuel
 - Code **1463** - Not In Auto
 - Code **1468** - Ready to Load
 - Code **1483** - Common Alarm
 - Code **1540** - Common Warning
 - Code **1541** - Common Shutdown
- A brief description of the event is automatically displayed.

8.3.7 Metering Submenus

The Metering submenus are available by pressing the **(3)** button on the first Genset Service menu (see [Figure 52 on page 95](#)).

Four Metering submenus (see [Figure 64 on page 114](#)) can be used to adjust regulated voltage, frequency, line-to-neutral voltage, and line current settings.

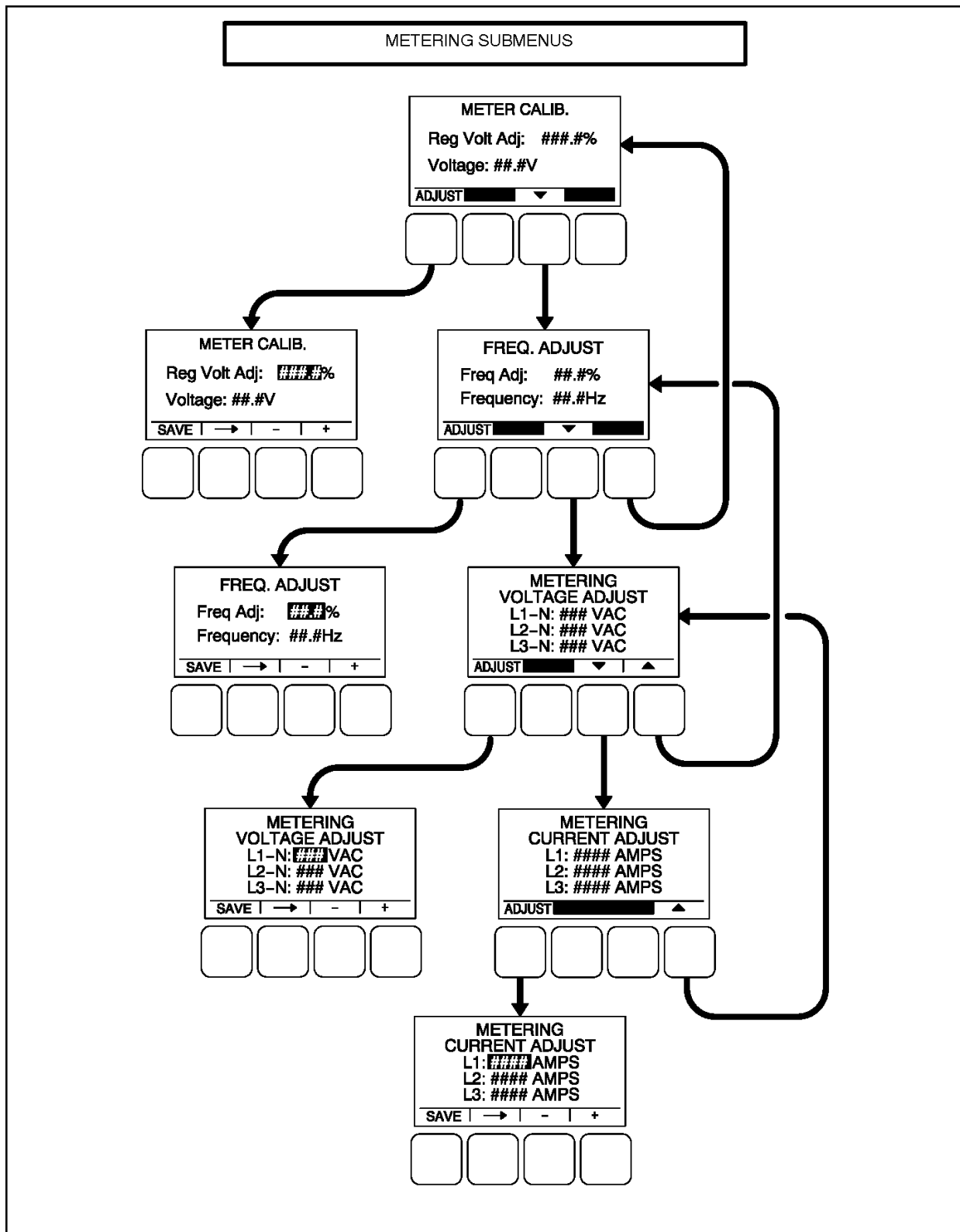


FIGURE 64. METERING SUBMENU

8.3.7.1 Meter Calib Menu

The Meter Calib menu allows for adjusting the actual output voltage of the generator set. The percentage can be set from 90 to 110%. The alternator voltage is also shown on this menu.

8.3.7.2 Freq. Adjust Menu

The Frequency Adjust menu allows for adjusting the generator set frequency. The frequency can be adjust from -6.0 to +6.0 Hz. The actual frequency is also shown on this menu.

8.3.7.3 Metering Voltage Adjust Menu

The Metering Voltage Adjust menu allows for adjusting metered generator set line voltage.

1. With the generator set OFF, attach a calibrated voltmeter to the AC output from L1 to L2. (L1 to Neutral for single phase alternators.)
2. Start the generator set and allow it to reach normal operating speed.
3. Display the *Metering Voltage Adjust* menu.
4. Calibrate voltage reading for L1 so that the reading on the display agrees with the calibrated voltmeter.
5. After adjusting, press the **SAVE** button to save the setting.
6. Shut the generator set OFF.
7. Repeat steps 1 through 6 for L2 and L3. (In step 1, attach meter to the AC output from L2 to L3 to calibrate L2, and L3 to L1 to calibrate L3.)

8.3.7.4 Metering Current Adjust Menu

The Metering Current Adjust menu allows for adjusting metered amps.

1. With the generator set OFF, attach a calibrated ammeter to L1.
2. Start the generator set and allow it to reach normal operating speed.
3. Display the *Metering Current Adjust* menu.
4. Load the generator set to maximum rated kVA at rated voltage.
5. Calibrate the reading for L1 current so that the reading on the display agrees with calibrated ammeter.
6. After adjusting, press the **SAVE** button to save the setting.
7. Shut the generator set OFF.
8. Repeat steps 1 through 7 for L2 and L3. (In step 1, attach meter to L2 to calibrate L2 current, and L3 to calibrate L3 current.)

8.3.8 Annunciator Submenus

The Annunciator submenus are available by pressing the **(4)** button on the second Genset Service menu (see [Figure 52 on page 95](#)).

Seven annunciator submenus (see [Figure 65 on page 116](#) and [Figure 66 on page 117](#)) can be used to define three Annunciator Fault Text messages and four Annunciator Output Maps.

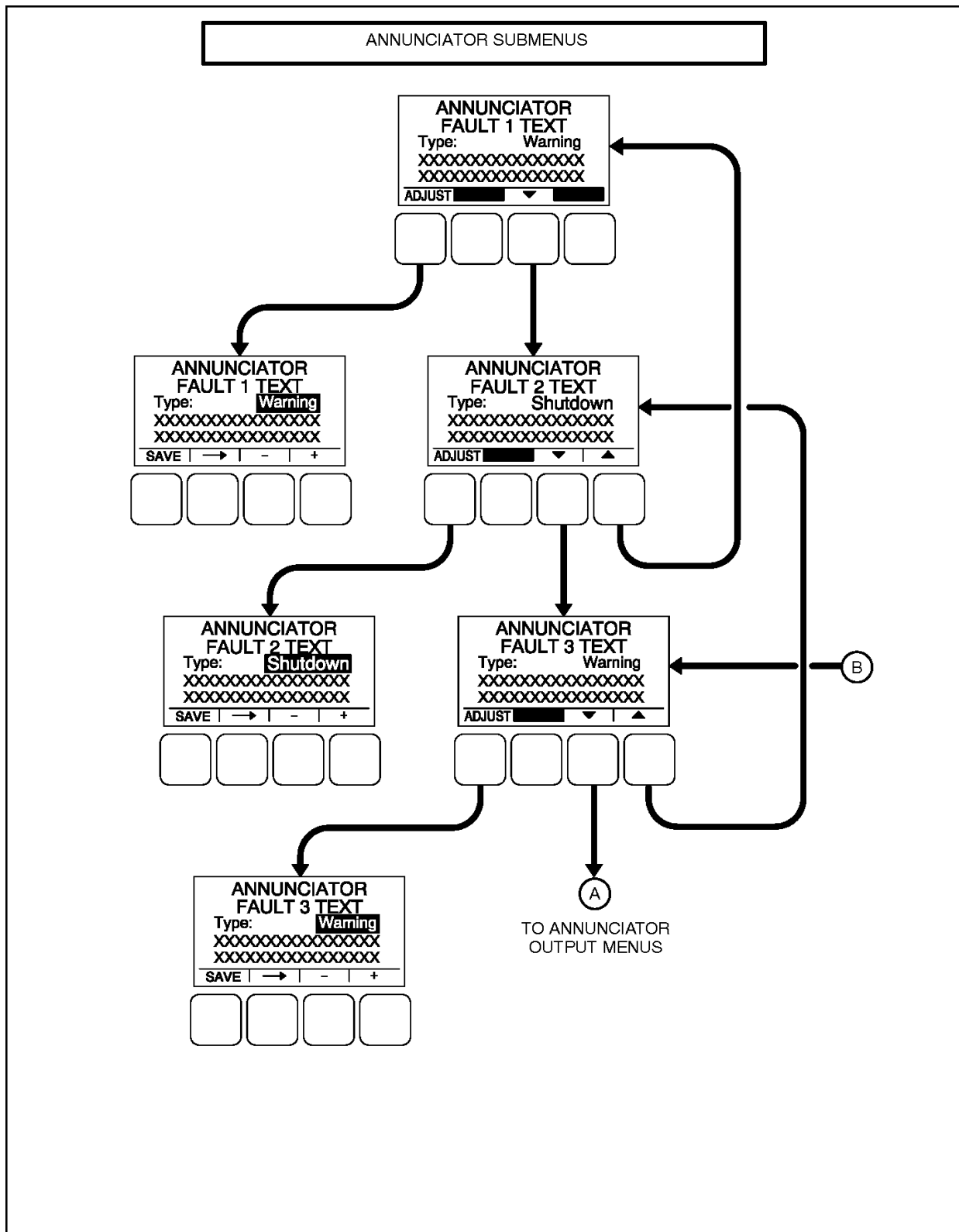


FIGURE 65. ANNUNCIATOR FAULT SUBMENU

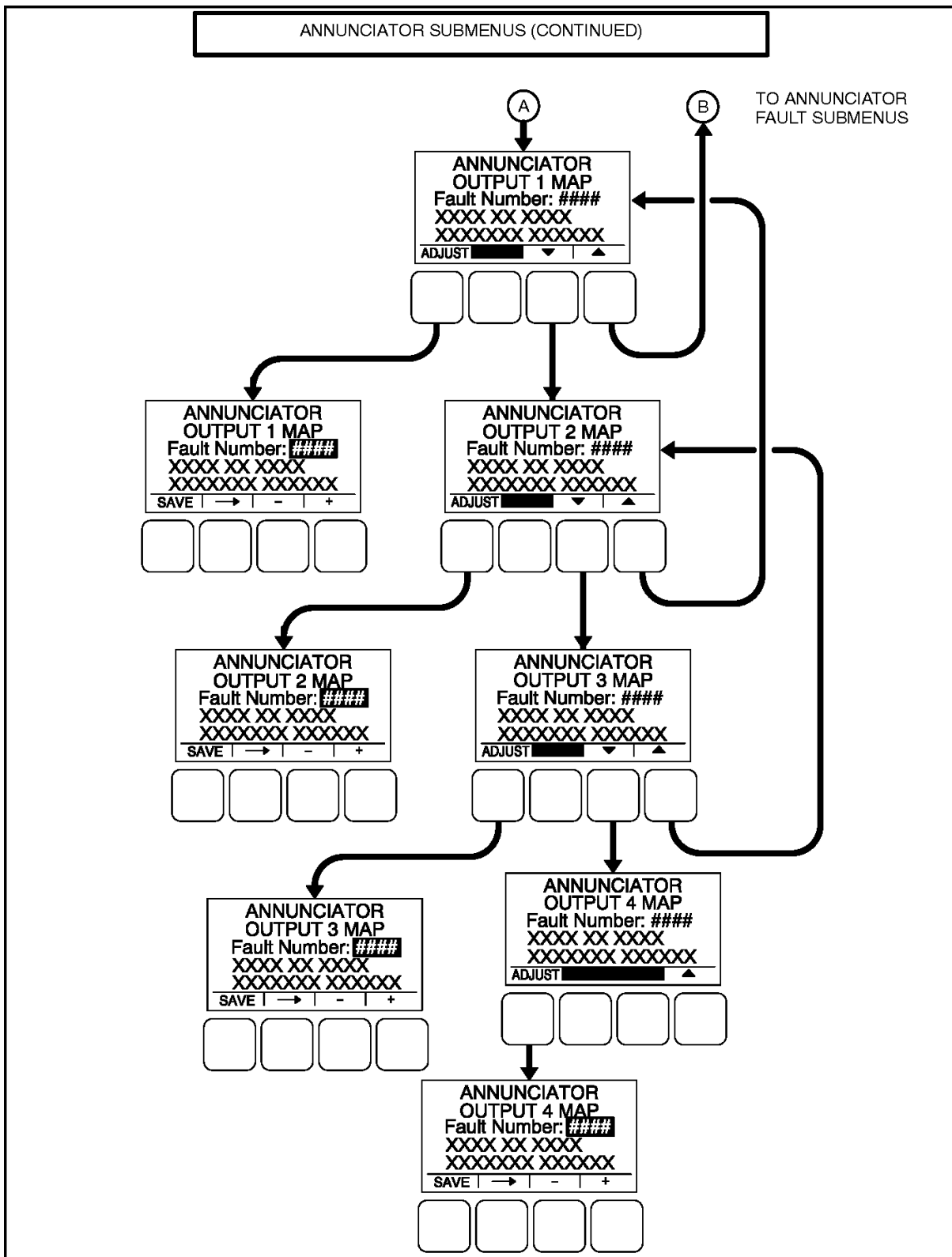


FIGURE 66. ANNUNCIATOR OUTPUT SUBMENUS

8.3.8.1 Annunciator Inputs

The annunciator has three possible customer-defined fault conditions that can be shown on the PCC 1302 display. The Annunciator Fault Text message menus are used to enter an event type and description for those three customer-defined annunciator faults.

- *Type*: Enter the event type (Warning, Shutdown or Event).
- Enter a brief description of the event (up to 32 characters).

8.3.8.2 Annunciator Outputs

An annunciator has four custom (N.O.) relays that can be controlled by the PCC 1302. When a specified event becomes active, a message can be sent by the PCC 1302 to the annunciator to turn the relay on or off. Only one event per relay is allowed.

The four annunciator outputs of the PCC 1302 are configurable to display common warning alarms. The four Annunciator Output Map menus allow for entering a fault number and fault name to be displayed for the configurable annunciator outputs.

- *Number*: Enter a code number 0 to 65535 for the event. [Section 9.8](#) lists the warning and shutdown codes. The following list contains event codes that are not shown in [Section 9.8](#).
 - Code **418** - Water In Fuel
 - Code **1463** - Not In Auto
 - Code **1468** - Ready to Load
 - Code **1483** - Common Alarm
 - Code **1540** - Common Warning
 - Code **1541** - Common Shutdown
- A brief description of the event is automatically displayed.

8.3.9 ModBus Submenus

The ModBus submenus ([Figure 67 on page 119](#)) are available by pressing the **(5)** button on the second Genset Service menu (see [Figure 52 on page 95](#)).

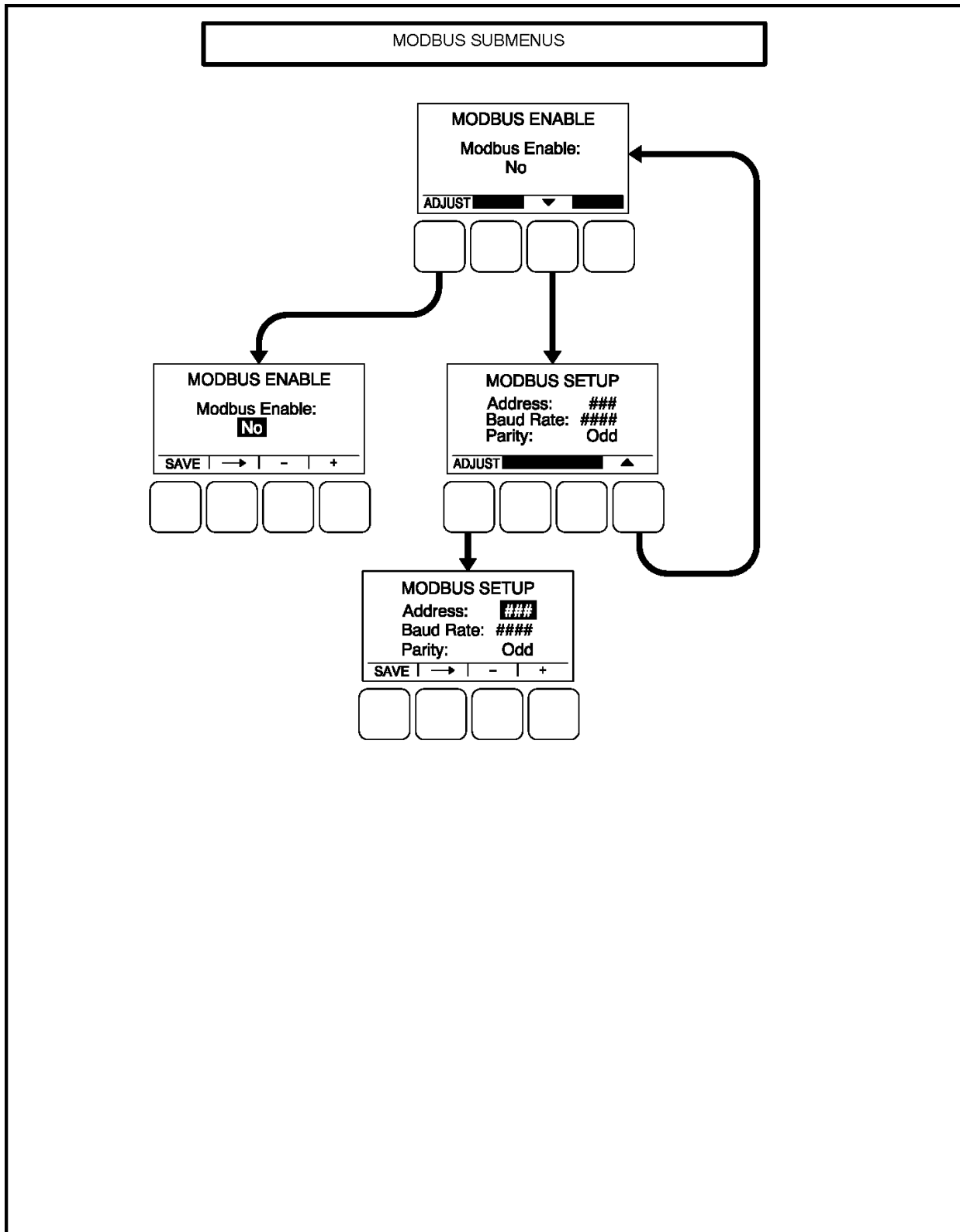


FIGURE 67. MODBUS SUBMENUS

8.3.9.1 ModBus Enable Menu

The ModBus Enable menu allows for enabling or disabling the ModBus feature.

If set to "Yes," the ModBus Setup menu is made available.

8.3.9.2 ModBus Setup Menu

The ModBus Setup menu is used to set the address, baud rate, and parity.

- *Address*: Enter the address of the control on the ModBus register.
- *Baud Rate*: Enter the appropriate baud rate - 2400, 4800, 9600, or 19200.
- *Parity*: The parity can be set to either odd or even (default = even).

8.3.10 Genset Setup Submenus

NOTICE

In the following menu entry descriptions, the default parameter/value is not shown because the default value is subject to change by model. Always create and refer to the initial capture file for factory default settings of system parameters/values.

The first Setup "Password" menu is displayed when the **(1)** button is pressed on the Service Menu. From the Setup Password menu, a Setup Menus menu is displayed that provides access to the following two categories of genset adjust menus.

- Genset Service menus - See [Section 8.3.2 on page 94](#)
- Genset Setup menus

This section covers Genset Setup menus only. To access the Genset Setup menus:

1. Enter the password into the Setup Password Menu. See [Section 8.3.2 on page 94](#).
2. Press the 2 button in the Setup Menus to display the Genset Setup Password Menu.
3. Enter the password into the Genset Setup menu ([Figure 68 on page 121](#)) - see [Section 8.3.10.2 on page 123](#) or press the View only button.

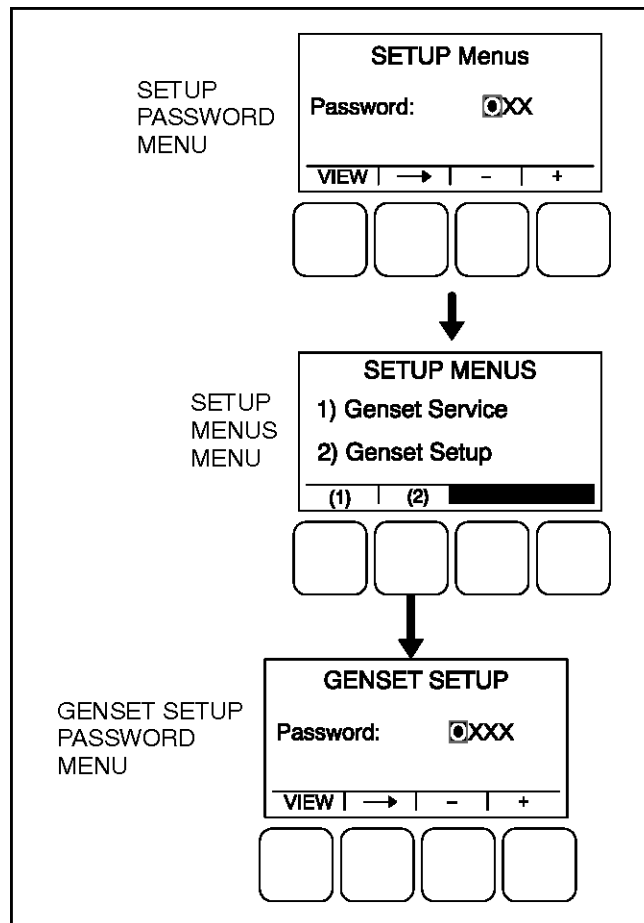


FIGURE 68. SETUP PASSWORD MENUS

8.3.10.1 Viewing and Adjusting

[Figure 69 on page 122](#) is a block representation of the two Genset Setup menus that are available after the correct password has been entered or the View button is pressed in the Genset Setup Password menu. The Genset Setup menus provide access to the following categories.

The first Genset Setup Menu provides access to the following menus:

- Genset
- Voltage Protection
- Current Protection

The second Genset Setup Menu provides access to the following menu:

- Engine Protection (ECM feature disabled)

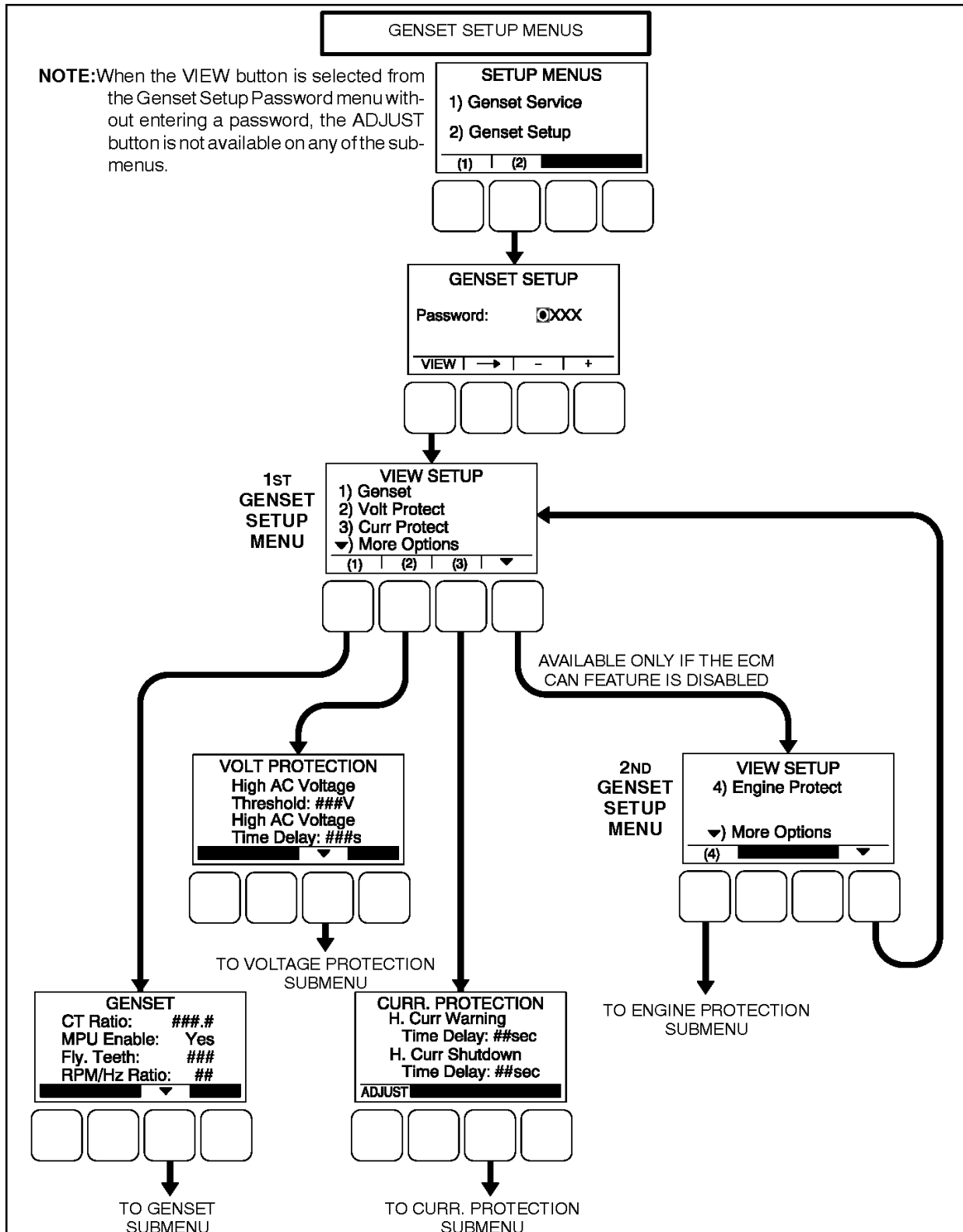


FIGURE 69. GENSET SETUP MENU

8.3.10.2 Genset Setup Password Menu

Adjusting the Genset Setup menus is restricted to service personnel and a password must be entered to modify these menus.

Once the Genset Setup button **(2)** is selected on the Setup Menus menu (see [Figure 68 on page 121](#)), the Genset Setup Password menu is displayed.

When the Genset Setup Password menu is displayed, the first numeric character (0) is highlighted (see [Figure 69 on page 122](#)).

NOTICE

When selected (highlighted), each character initially turns to "0" and the remaining characters turn to "X".

NOTICE

Make sure that each numeric character is correct before you move to the next character. If a wrong character is entered, you will not be able to go back and correct it. If the wrong password is entered, you will be able to view the Genset Setup menus but you won't be able to change them.

To enter the Genset Setup password **1209**:

1. With the first character highlighted, press the button below to the + or - symbols until the value reads "1."
2. Press the arrow selection button → to move to the next numeric character.
3. Press the button below the + or - symbols until the value reads "2."
4. Press the arrow selection button → to move to the next numeric character.
5. Press the button below the + or - symbols until the value reads "0."
6. Press the arrow selection button → to move to the next numeric character.
7. Press the button below the + or - symbols until the value reads "9."
8. After you have completed entering the password, press the arrow selection button . The first main Setup menu is displayed.


After the correct password is entered, it will be remembered until five minutes of button inactivity has elapsed. If five minutes of button inactivity has elapsed, you will have to re-enter the password to access and change Genset Setup menus.



8.3.10.3 Adjusting Values/Parameters

Once the correct password has been entered on the Genset Setup Password menu, the first Genset Setup submenu is displayed.

1. Press the buttons above the ▲ and ▼ symbols in the digital display to navigate between submenus.
2. Press the **ADJUST** selection button to select the first parameter or value to be changed.
3. Press the + or - selection buttons to adjust values or select parameters.
4. Press the arrow selection button → to navigate to the next or previous adjustable value or parameter.
5. After adjusting values/selecting parameters, press the **SAVE** button to save your settings.

NOTICE

If the  button is pressed before pressing the SAVE button, the changes are not saved.

6. Press the  button to return to the Service Menu.
7. To return to the Service Menu from the genset Setup Menus menu, press the  button.

8.3.11 Genset Submenus

The Genset submenus are available by pressing the **(1)** button on the first Genset Setup menu (see [Figure 69 on page 122](#)).

NOTICE

[Appendix A on page 239](#) provides a block diagram that illustrates the sequence of how the Genset Setup Submenus are displayed.

[Figure 70 on page 125](#), [Figure 71 on page 126](#), and [Figure 72 on page 127](#) are block representations of the Genset Submenus.

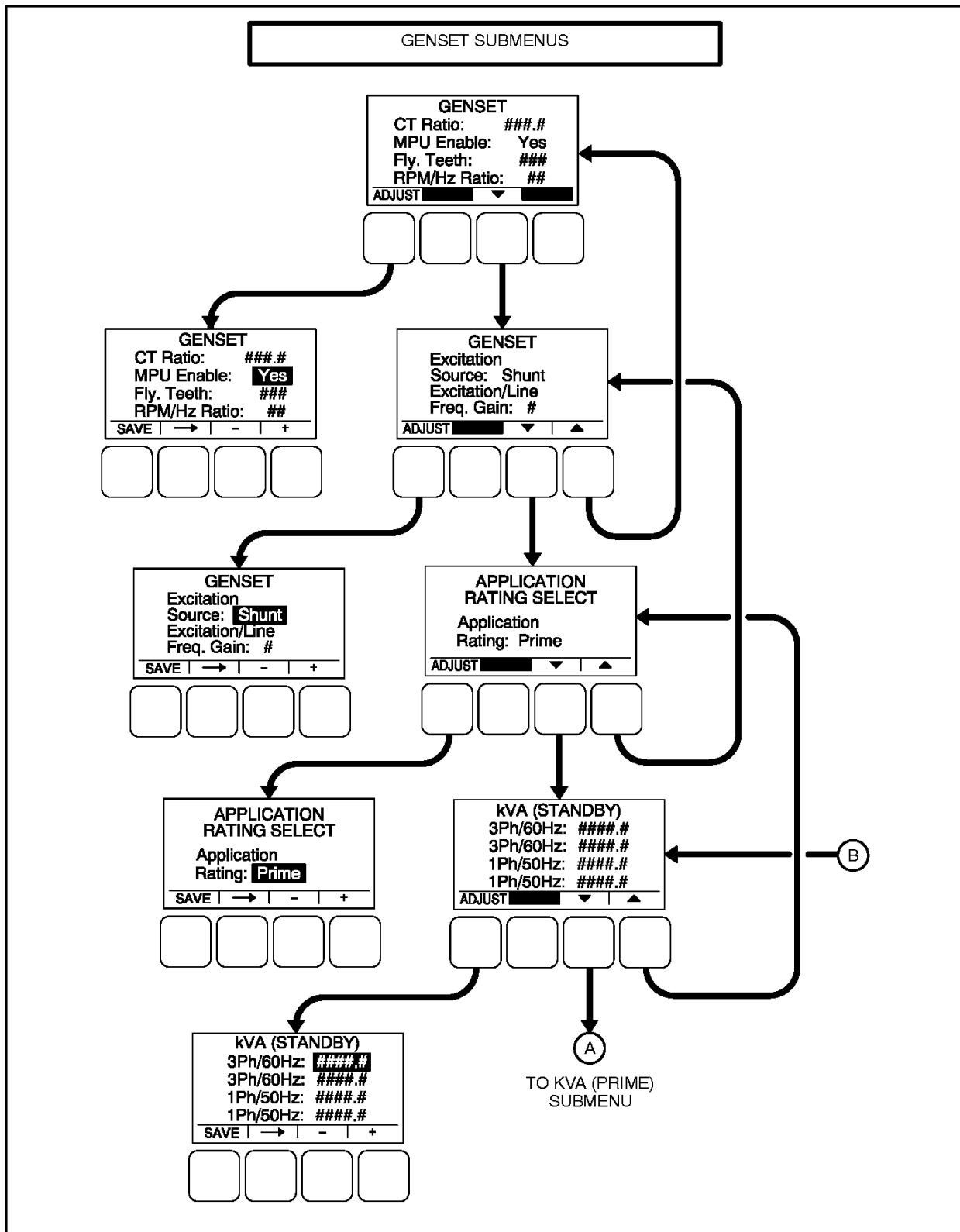


FIGURE 70. GENSET SETUP - GENSET, APPLICATION RATING SELECT, AND STANDBY KVA SUBMENUES

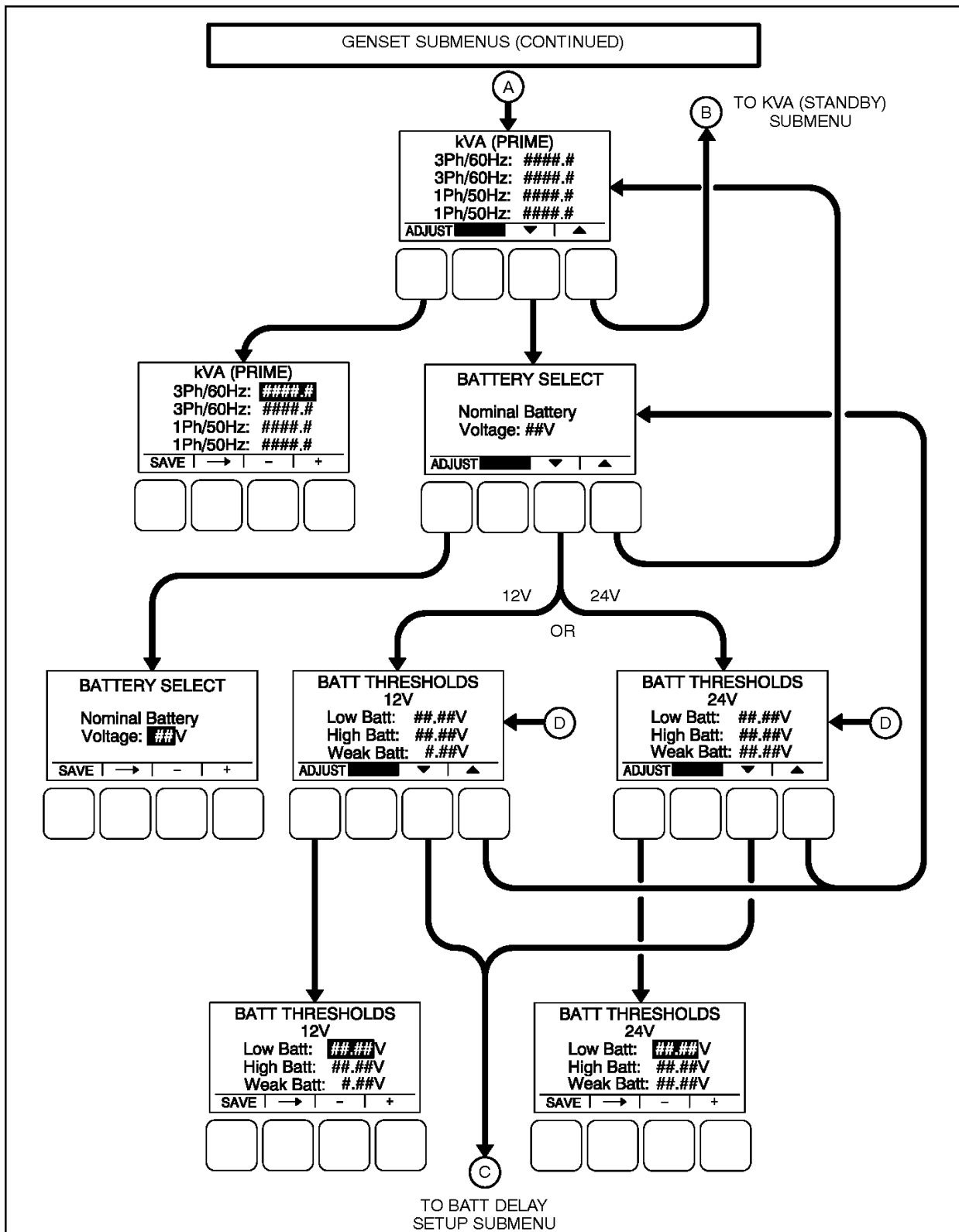


FIGURE 71. GENSET SETUP - PRIME KVA, BATTERY SELECT, AND BATTERY THRESHOLDS SUBMENUS

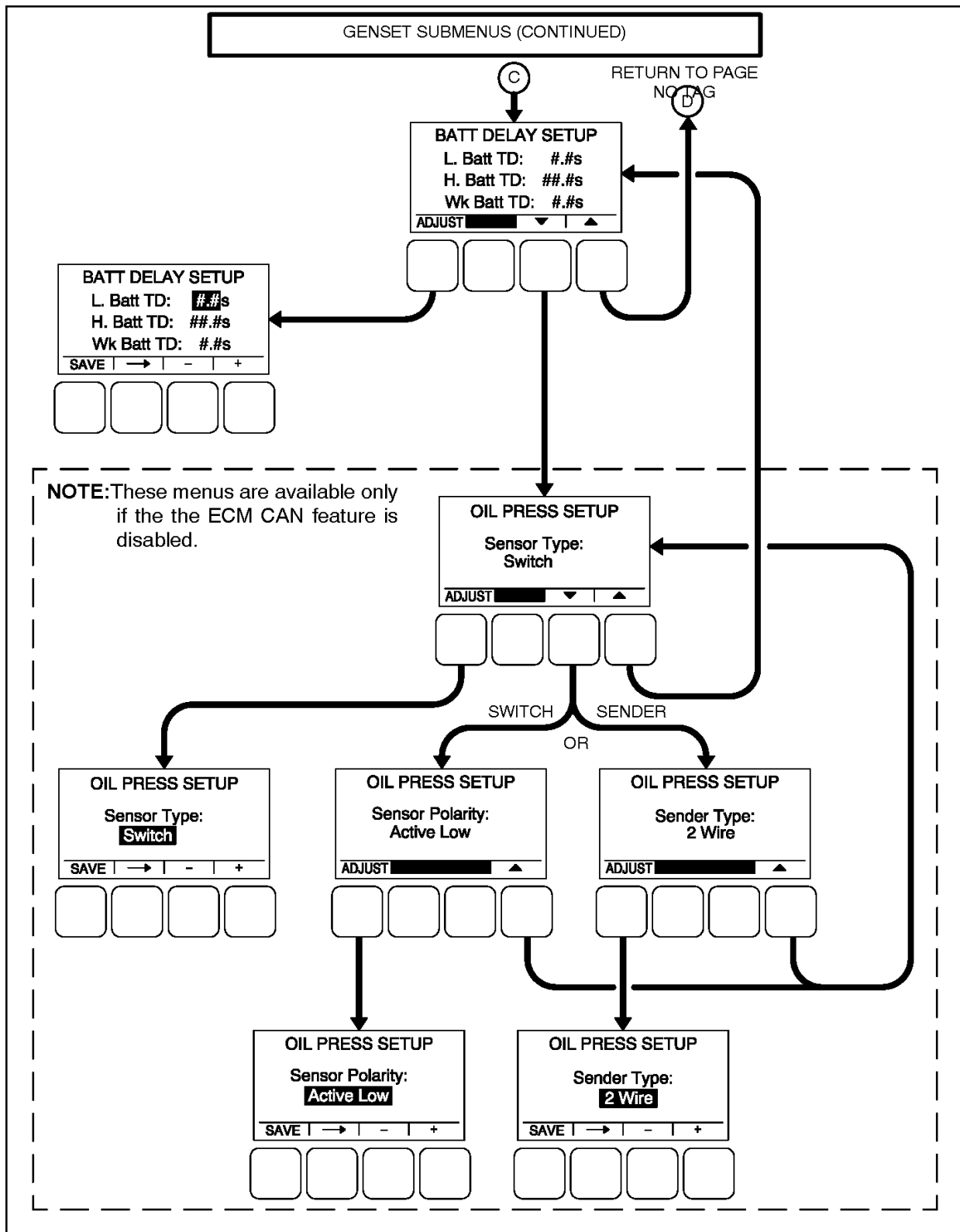


FIGURE 72. GENSET SETUP - BATTERY DELAY SETUP AND OIL PRESSURE SETUP SUBMENUS

8.3.11.1 Genset #1

The Genset menu ([Figure 70 on page 125](#)) is used to set the CT Ratio, enable the Magnetic Pickup Unit (MPU), set the number of teeth pulses per revolution on the Flywheel, and set the Speed/Frequency Ratio.

- *CT Ratio*: The CT Ratio value must be set to match the CT Ratio of the current transformers on the generator set.
- *MPU Enable*: Displays whether or not the Magnetic Pickup Unit is installed (Yes or No).
- *Fly. Teeth*: The total number of teeth pulses per revolution on the flywheel (used for electronic governed systems) can be set from 0 to 255.
- *RPM/Hz Ratio*: Allows for setting the Speed/Frequency Ratio to 20, 30, or 60 RPM/Hz.

8.3.11.2 Genset #2

The second Genset Setup menu ([Figure 70 on page 125](#)) is used to set the excitation source and the excitation/line frequency gain.

- *Excitation Source*: Select Shunt or PMG Excitation, depending upon your application.
- *Excitation/Line Freq. Gain*: If the excitation source is set to "Shunt," this value is automatically set to 1. If the excitation source is set to "PMG," the value that should be entered is the excitation frequency multiplier of the PMG system. For example, enter a "2" if the PMG output is twice the main generator frequency (120 Hz excitation frequency).

8.3.11.3 Application Rating Select Menu

The generator set application rating ([Figure 70 on page 125](#)) can be set to either Standby or Prime.

8.3.11.4 Standby kVA Rating Menu

The kVA Rating menu ([Figure 70 on page 125](#)) displays the kVA rating of single-phase or three-phase, 50 or 60 hertz standby generator set systems. These value are used by the control to determine what is 100% load. The values must match the kVA rating of the generator set application and cannot be more than 2000 kVA.

- *3Ph/50Hz*: The three phase, 50 Hertz rating can be set from 0 to 2000 kVA.
- *3Ph/60Hz*: The three phase, 60 Hertz rating can be set from 0 to 2000 kVA.
- *1Ph/50Hz*: The single phase, 50 Hertz rating can be set from 0 to 2000 kVA.
- *1Ph/60Hz*: The single phase, 60 Hertz rating can be set from 0 to 2000 kVA.

8.3.11.5 Prime kVA Rating Menu

The kVA Rating menu ([Figure 71 on page 126](#)) displays the kVA rating of single-phase or three-phase, 50 or 60 hertz prime generator set systems. These value are used by the control to determine what is 100% load. The values must match the kVA rating of the generator set application and cannot be more than 2000 kVA.

- *3Ph/50Hz*: The three phase, 50 Hertz rating can be set from 0 to 2000 kVA.
- *3Ph/60Hz*: The three phase, 60 Hertz rating can be set from 0 to 2000 kVA.
- *1Ph/50Hz*: The single phase, 50 Hertz rating can be set from 0 to 2000 kVA.
- *1Ph/60Hz*: The single phase, 60 Hertz rating can be set from 0 to 2000 kVA.

8.3.11.6 Battery Select Menu

The Battery Select menu ([Figure 71 on page 126](#)) is used to set the nominal battery voltage.

- *Nominal Battery Voltage*: Allows for setting the nominal battery voltage (12 or 24V).

8.3.11.7 Battery Thresholds Menus

The Battery Thresholds menu ([Figure 71 on page 126](#)) is used to set the low and high voltage values to determine when the battery voltage is out of the set range during normal operation. This menu is also used to determine when the battery voltage is below weak battery thresholds during cranking. The Battery Thresholds menu that is displayed is dependent upon the battery voltage entered in the Battery Select menu.

- *Low Batt*: The low battery voltage threshold can be set from 11.0 to 13.0 VDC for 12 volt batteries and from 22.0 to 28.0 VDC for 24 volt batteries, in 0.1 VDC increments.
- *High Batt*: The high battery voltage threshold can be set from 14.0 to 17.0 VDC for 12 volt batteries and from 28.0 to 34.0 VDC for 24 volt batteries, in 0.1 VDC increments.
- *Weak Batt*: The weak battery voltage threshold can be set from 6.0 to 10.0 VDC for 12 volt batteries and from 12.0 to 16.0 VDC for 24 volt batteries, in 0.1 VDC increments.

8.3.11.8 Battery Delay Setup Menu

This menu ([Figure 72 on page 127](#)) is used to determine when, after determining that the battery condition is out of the preset operating range, a warning message is announced.

- *L. Batt TD*: A time delay from 2 to 60 seconds can be set before the Low Battery warning message (Fault code **441**) is announced.
- *H. Batt TD*: A time delay from 2 to 60 seconds can be set before the High Battery warning message (Fault code **442**) is announced.
- *Wk Batt TD*: A time delay from 1 to 5 seconds can be set before the Weak Battery warning message (Fault code **1442**) is announced.

8.3.11.9 Oil Pressure Setup Menus

NOTICE

The following menus are only available if the ECM CAN feature is disabled.

A menu ([Figure 72 on page 127](#)) is available to set the sensor type. If the sensor type is Switch, then another menu is available to set the sensor polarity. If the sensor type is Sender, then another menu is available to set the sender type.

- *Sensor Type*: The sensor type can be set for either Switch or Sender.
- *Sensor Polarity*: This menu is displayed only if the sensor type is set to Switch. Sensor polarity can be set to either Active Low or Active High.
- *Sender Type*: This menu is displayed only if the sensor type is set to Sender. The sender type can be set to either 2 Wire or 3 Wire.

8.3.12 Voltage Protection Submenus

The Voltage Protection submenus are available by pressing the **(2)** button on the first Genset Setup menu (see [Figure 69 on page 122](#)).

[Figure 73 on page 130](#) is a block representation of the four Voltage Protection submenus that are available.

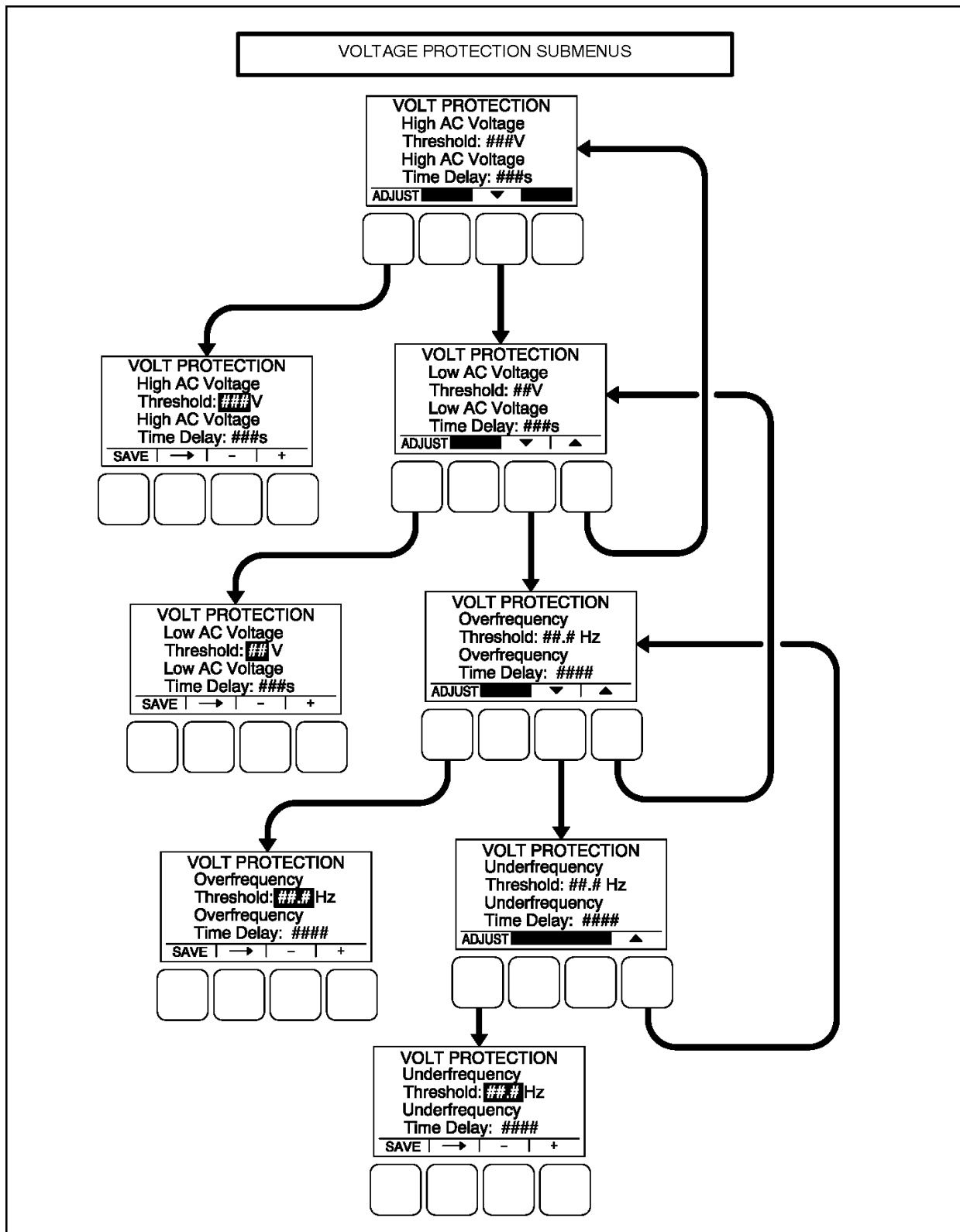


FIGURE 73. VOLTAGE PROTECTION SUBMENUS

8.3.12.1 High AC Voltage Menu

This menu is used to determine when a high AC voltage fault condition exists and for how long the fault condition should be present before the engine is shut down.

- *High AC Voltage Threshold:* This threshold is used to set the percentage of desired voltage necessary to activate a High AC Voltage fault condition. This value can be set from 105 to 125%.
- *High AC Voltage Time Delay:* A time delay of 1 to 10 seconds must expire before the engine shuts down because of a high AC voltage fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the High AC Voltage shutdown message (Fault code **1446**) is announced.

8.3.12.2 Low AC Voltage Menu

This menu is used to determine when a low AC voltage fault condition exists and for how long the fault condition should be present before the engine is shut down.

- *Low AC Voltage Threshold:* This threshold is used to set the percentage of desired voltage necessary to activate a Low AC Voltage fault condition. This value can be set from 50 to 95%.
- *Low AC Voltage Time Delay:* A time delay of 2 to 20 seconds must expire before the engine shuts down because of a low AC voltage fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the Low AC Voltage shutdown message (Fault code **1447**) is announced.

8.3.12.3 Overfrequency Menu

This menu is used to determine when an overfrequency fault condition exists and for how long the fault condition should be present before the engine is shut down.

- *Overfrequency Threshold:* This threshold is used to set the amount of Hertz that the alternator line frequency can be over nominal to activate an Overfrequency fault condition. This value can be set from 2 to 10 Hz.
- *Overfrequency Delay:* A time delay of 100 to 2000 half cycles for 50 Hz generator sets or 120 to 2400 half cycles for 60 Hz generator set must expire before the engine shuts down because of an overfrequency fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the Overfrequency shutdown message (Fault code **1449**) is announced.

8.3.12.4 Underfrequency Menu

This menu is used to determine when an underfrequency fault condition exists and for how long the fault condition should be present before the engine is shut down.

- *Underfrequency Threshold:* This threshold is used to set the Hertz number that the alternator line frequency can be under nominal to activate an Underfrequency fault condition. This value can be set from 2 to 10 Hz.
- *Underfrequency Time Delay:* A time delay of 500 and 2000 half cycles for 50 Hz generator sets or 600 to 2400 half cycles for 60 Hz generator sets must expire before the engine shuts down because of an underfrequency fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the Underfrequency shutdown message (Fault code **1448**) is announced.

8.3.13 Current Protection Submenus

The Current Protection submenus are available by pressing the **(3)** button on the first Genset Setup menu (see [Figure 69 on page 122](#)).

[Figure 74 on page 132](#) is a block representation of the Current Protection submenus.

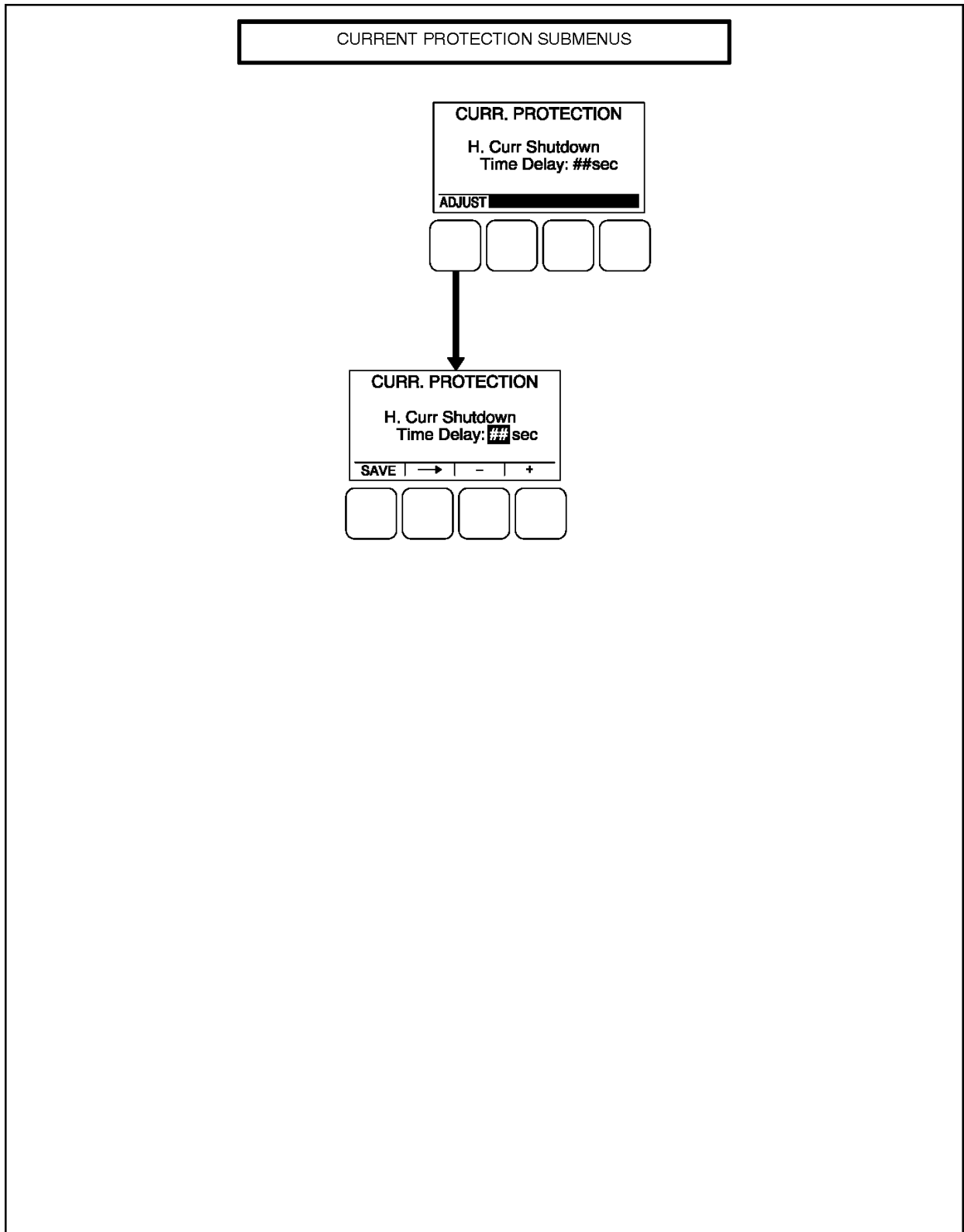


FIGURE 74. CURRENT PROTECTION SUBMENUS

8.3.13.1 Current Protection Menu

This menu is used to determine how long the fault condition should be present before the warning message is displayed and, if necessary, the shutdown message is displayed and the engine is shut down.

NOTICE
If both the High Current Warning and High Current Shutdown faults are active at the same time, the High Current Shutdown fault is displayed.

- *H. Curr Shutdown Time Delay*: The High Current Shutdown Time Delay sets how long before the fault is greater than the instantaneous threshold. If the fault condition is active for the duration of this time delay (2 to 60 seconds), the engine shuts down and the High AC Current shutdown message (Fault code **1472**) is announced.

8.3.14 Engine Protection Submenus

The Engine Protection submenus are available by pressing the **(4)** button on the second Genset Setup menu (see [Figure 69 on page 122](#)).

The Engine Protection submenus (see [Figure 75 on page 134](#), [Figure 76 on page 135](#), and [Figure 77 on page 136](#)) are used to set thresholds to determine when engine fault conditions exist and time delays to determine how long a fault condition is present before the fault message is announced and, if necessary, shut down the engine.

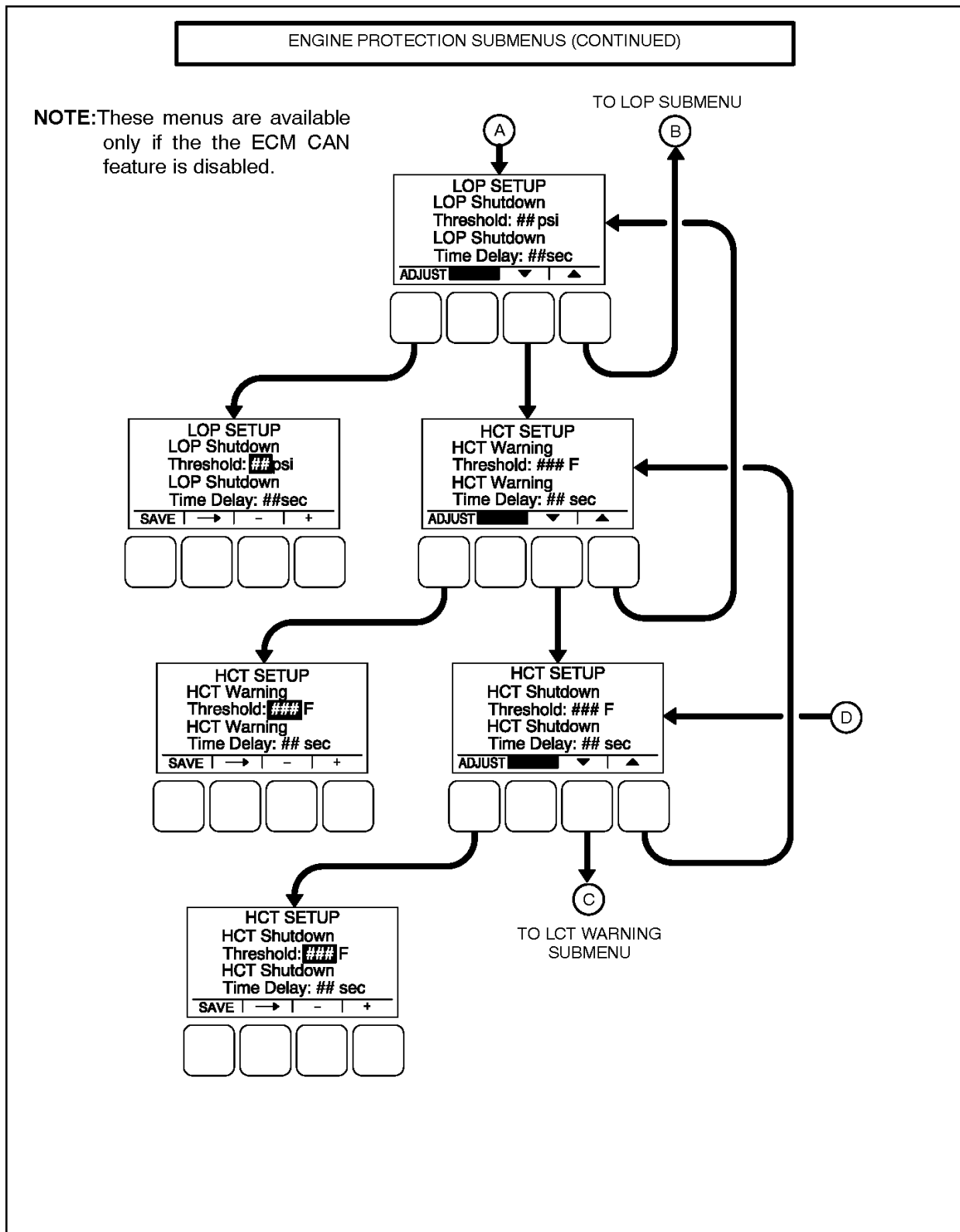


FIGURE 76. ENGINE PROTECTION - LOP SHUTDOWN AND HCT SUBMENUS

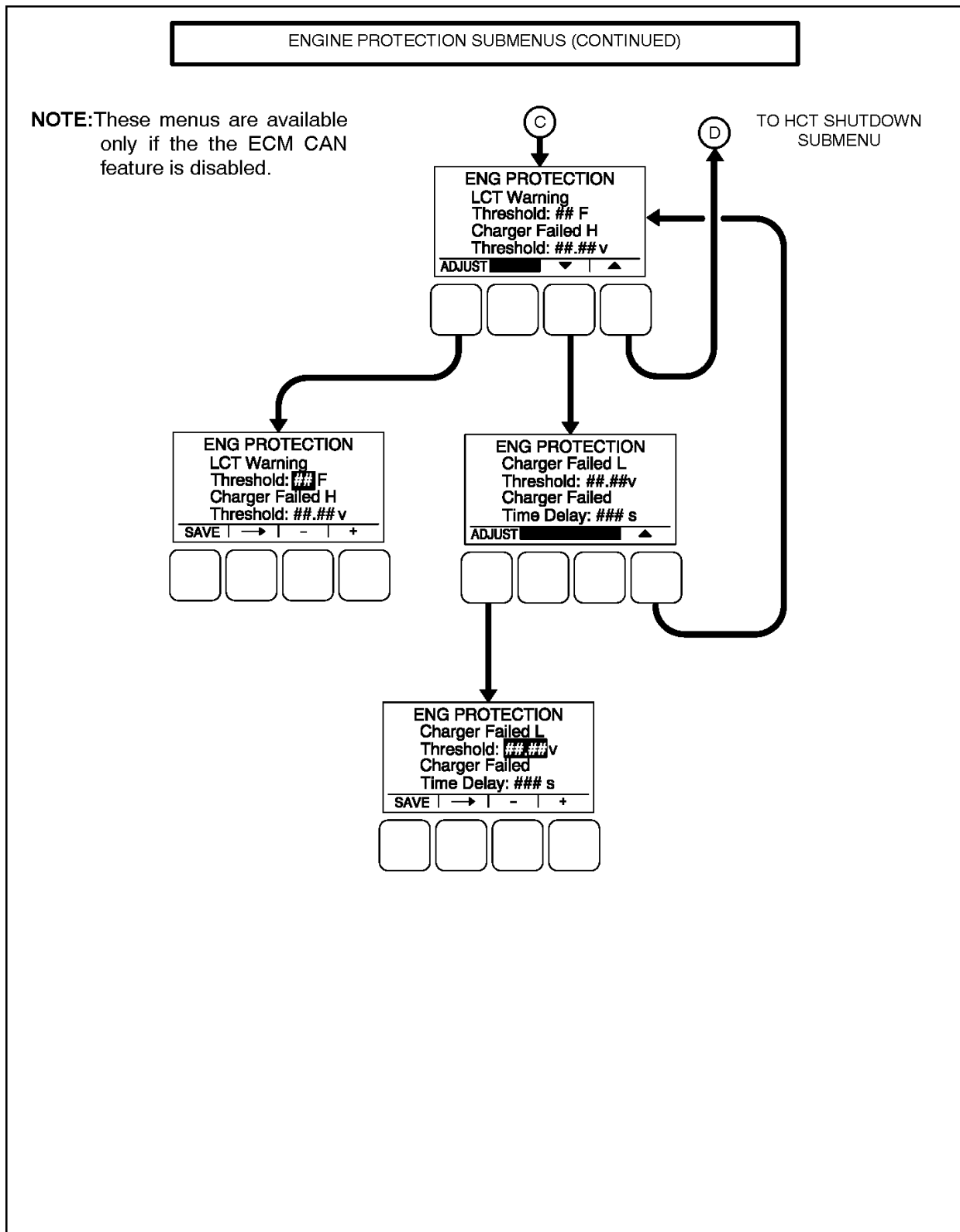


FIGURE 77. ENGINE PROTECTION - LCT AND CHARGER SUBMENUS

8.3.14.1 Engine Protection Overspeed Menu

This menu ([Figure 75 on page 134](#)) is used to set the value necessary to shut down the generator set and activate an Overspeed shutdown message (Fault code **1992**) on 50 and 60 Hz generator sets, indicating that the engine has exceeded normal operating speed.

NOTICE

Fault code 1992 does not apply to hydro-mechanical or non-PGI generator sets.

These parameters need to be set based on the number of revolutions per minute required to produce the nominal frequency of the generator (20, 30, or 60 RPM/Hz).

Overspeed Threshold (50Hz): These thresholds are used to set the overspeed values necessary to activate an Overspeed shutdown fault code on 50 Hz generator sets. The values can be set as follows:

- 20 RPM/Hz: 0 – 1250 RPM in 25 RPM increments
- 30 RPM/Hz: 0 – 1875 RPM in 25 RPM increments
- 60 RPM/Hz: 0 – 3750 RPM in 25 RPM increments

Overspeed Threshold (60Hz): These thresholds are used to set the overspeed values necessary to activate an Overspeed shutdown fault code on 60 Hz generator sets. The values can be set as follows:

- 20 RPM/Hz: 0 – 1500 RPM in 25 RPM increments
- 30 RPM/Hz: 0 – 2250 RPM in 25 RPM increments
- 60 RPM/Hz: 0 – 4500 RPM in 25 RPM increments

8.3.14.2 Engine Protection Speed/Frequency Menu

This menu ([Figure 75 on page 134](#)) is used to determine when a speed/frequency conflict shutdown fault condition exists and for how long the fault condition should be present before the engine is shut down.

- *Speed/Freq Fault Threshold*: This threshold is used to set the value necessary to activate the speed/frequency conflict shutdown fault condition. This value can be set from 0.1 to 20.0 Hz.
- *Speed/Freq Fault Time Delay*: A time delay of 0.2 to 10.0 seconds must expire before the warning message is announced because of a speed/frequency conflict shutdown fault condition. If the fault condition is active for the duration of this time delay, the genset is shut down and the Speed Hz Match shutdown message (Fault code **1469**) is announced.

8.3.14.3 Low Oil Pressure Warning Menu

This menu ([Figure 75 on page 134](#)) is used to determine when a low oil pressure warning fault condition exists and for how long the fault condition must be present before the warning message is announced.

- *LOP Warning Threshold*: This threshold is used to set the oil pressure value necessary to activate a Pre-Low Oil Pressure warning fault condition. This value can be set from 11 to 100 psi (75.8 to 689.5 kPa).
- *LOP Warning Time Delay*: A time delay of 2 to 15 seconds must expire before the warning message is announced because of a low oil pressure warning fault condition. If the fault condition is active for the duration of this time delay, the Pre-Low Oil Pressure warning message (Fault code **143**) is announced.

8.3.14.4 Low Oil Pressure Shutdown Menu

This menu ([Figure 76 on page 135](#)) is used to determine when a low oil pressure shutdown fault condition exists and for how long the fault condition should be present before the engine is shut down.

- *LOP Shutdown Threshold:* This threshold is used to set the oil pressure value necessary to activate a Low Oil Pressure Shutdown fault condition. This value can be set from 9 to 100 psi (62.0 to 689.5 kPa).
- *LOP Shutdown Time Delay:* A time delay of 2 to 10 seconds must expire before the engine shuts down because of a low oil pressure fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the Low Oil Pressure shutdown message (Fault code **415**) is announced.

8.3.14.5 High Coolant Temperature Warning Menu

This menu ([Figure 76 on page 135](#)) is used to determine when a high coolant temperature warning fault condition exists and for how long the fault condition should be present before the warning message is announced.

- *HCT Warning Threshold:* This threshold is used to set the temperature value necessary to activate a High Coolant Temperature Warning fault condition. This value can be set from 150 to 290 °F (65.5 to 143.3 °C).
- *HCT Warning Time Delay:* A time delay of 2 to 10 seconds must expire before the warning message is announced. If the fault condition is active for the duration of this time delay, the High Coolant Temperature warning message (Fault code **146**) is announced.

8.3.14.6 High Coolant Temperature Shutdown Menu

This menu ([Figure 76 on page 135](#)) is used to determine when a high coolant temperature shutdown fault condition exists and for how long the fault condition should be present before the engine is shut down.

- *HCT Shutdown Threshold:* This threshold is used to set the temperature value necessary to activate a High Coolant Temperature Shutdown fault condition. This value can be set from 150 to 290 °F (65.5 to 143.3 °C).
- *HCT Shutdown Time Delay:* A time delay of 2 to 10 seconds must expire before the engine shuts down because of a high coolant temperature fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the High Coolant Temperature shutdown message (Fault code **151**) is announced.

8.3.14.7 Engine Protection Low Coolant Temperature and Battery Charger Menus

The low coolant temperature menu ([Figure 77 on page 136](#)) is used to determine when the coolant temperature is too low and a Low Coolant Temperature warning message (Fault Code **1435**) is announced. This warning message is not announced unless the coolant temperature has been determined to be low for one minute.

- *LCT Warning Threshold:* This threshold is used to set the temperature value necessary to activate a Low Coolant Temperature Warning fault condition. This value can be set from 0 to 100 °F (-17.8 to 37.8 °C).

The battery charger menu ([Figure 77 on page 136](#)) is used to determine when the alternator charger failure condition exists and when the warning message should be announced. The fault condition exists when either the low or high threshold is reached.

- *Charger Failed H Threshold:* This threshold is used to set the high charging alternator voltage value. This value can be set from 13.0 to 20.0 VDC for 12V units and from 25.0 to 40.0 VDC for 24V units.
- *Charger Failed L Threshold:* This threshold is used to set the low charging alternator voltage value. This value can be set from 2.0 to 13.0 VDC for 12V units and from 2.0 to 25.0 VDC for 24V units.

- *Charger Failed Time Delay:* A time delay of 2 to 300 seconds must expire before the warning message is announced. If the fault condition is active for the duration of this time delay, the Charger Failure warning message (Fault code **2678**) is announced.

8.4 TB1 Control Board Customer Connections

The control board ([Figure 78 on page 139](#)) provides connection points (TB1) for remote control and monitor options.

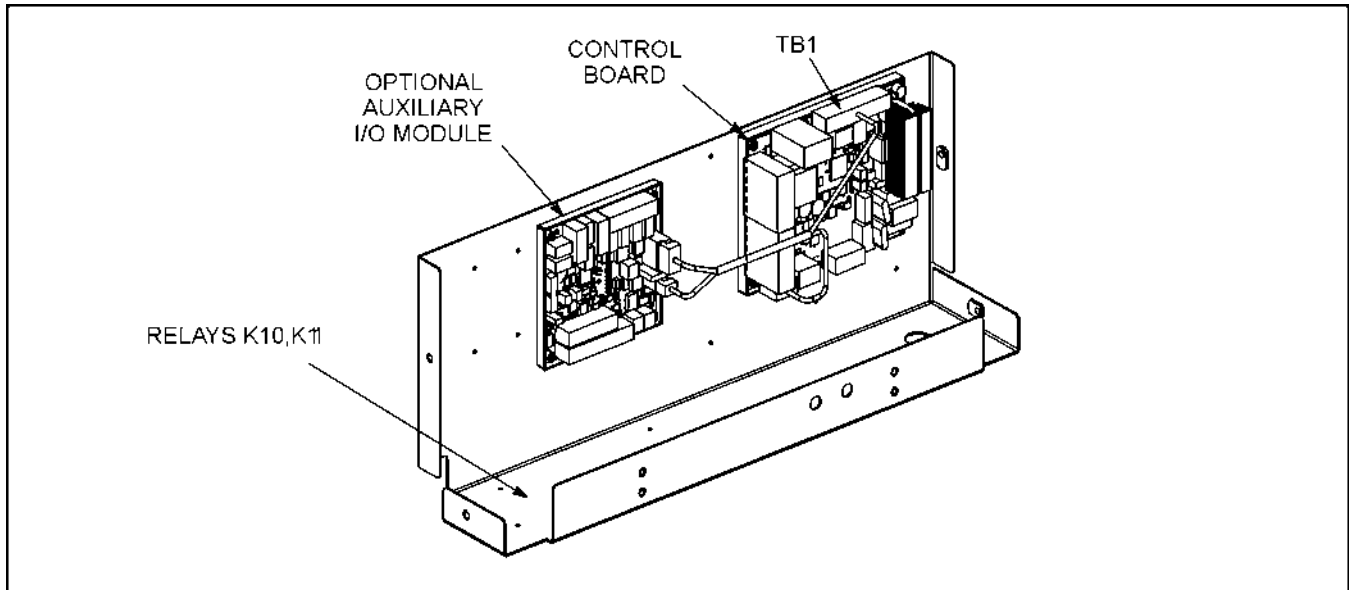


FIGURE 78. TB1 CONNECTIONS

8.4.1 TB1 Customer Inputs

Refer to Customer Connections diagram in [Appendix A on page 239](#) for typical connections to TB1.

Remote Start: When the control is in Auto/Remote mode, grounding this input initiates the engine cranking and start sequence when "Remote Start Active State Selection" = Active Closed. This circuit must be opened to permit resetting a shutdown condition with the Reset input. (The remote stop is actually the removal of the remote start signal to the control.)

Similarly, ungrounding this input initiates the engine cranking and start sequence when "Remote Start Active State Selection" = Active Open. In this case, the control will never go into Sleep mode.

Start Signal Integrity Switch: This is an input signal, a functionality enlisted in "Config Input Function Pointer," that helps to detect the health of the Remote Start Input signal. If the Remote Start Input signal or Start Signal Integrity signal is compromised (e.g., the wire falls off or breaks), then the generator set will be started with an alarm (refer to fault code 7892). This functionality makes sure that the emergency application does not have to suffer from a power cut in case of wiring failure or disconnect. The below table illustrates the Start Signal Integrity functionality:

TABLE 7. START SIGNAL INTEGRITY FUNCTIONALITY

Input		Output	
Remote Start Status	Start Signal Integrity Switch Status	Genset State	Fault
Active	Inactive	Running	No fault
Active	Active	Running	Signal Integrity Fail warning fault (FC7892)
Inactive	Active	Stop	No fault
Inactive	Inactive	Running	Signal Integrity Fail warning fault (FC7892)

Remote Emergency Stop: Opening this input causes an immediate shutdown. Emergency stop must be reset at the front panel.

Customer Fault Inputs 1 and 2: Grounding any one of these inputs activates the corresponding warning or shutdown sequence.

External sensing equipment must be connected to the designated digital input.

The nature of the fault is an optional customer selection. Example inputs: Low Coolant Level, Low Fuel Pressure, Ground Fault, etc.

The faults have an active open or active closed option.

Each of the two fault functions can be programmed as follows:

- Status, Warning or Shutdown. Default = Warning.
- Enter a brief description of the event (up to 32 characters).

NOTICE

The InPower service tool or access to the Setup Submenus is required to modify the customer fault inputs.

8.4.2 TB1 Customer Outputs

Refer to Customer Connections diagram in [Appendix A on page 239](#) for typical connections to TB1.

Customer Outputs 1 and 2: One set of normally open (NO) contacts, rated for 2 amps at 30 VDC for each of the two output signals. The relays can be used to control small devices and indicator lamps.

The nature of the customer output signal (contacts closed) is an optional customer selection. Example outputs: Genset running (event), common warning or common shutdown, etc. (Refer to Customer I/O Submenus in this section to customize these outputs.)

NOTICE

The InPower service tool or access to the Setup Submenus is required to modify the customer outputs.

Ready To Load: Operates when the generator set has reached 90% of rated speed and voltage and latches until generator set is switched to off mode (B+ signal output).

8.5 Auxiliary I/O Module (Optional)

The optional I/O module(s) ([Figure 78 on page 139](#)) provides additional customer inputs and outputs for control and monitoring of the power system. Up to sixteen relay outputs and twelve discrete analog inputs are available when the control contains both the Base I/O Module (AUX101) and the Expansion I/O Module (AUX102).

Refer to owner manual A030K737 for I/O module configuration/wiring information.

8.6 Optional Relays (K10, K11)

The optional relays are mounted near to the controlboard ([Figure 79 on page 141](#)). The relays are used to control auxiliary equipment such as fans, pumps and motorized air dampers.

The contacts are rated at 10 amps at 600 VAC.

Refer to Customer Connections diagram in [Appendix A on page 239](#).

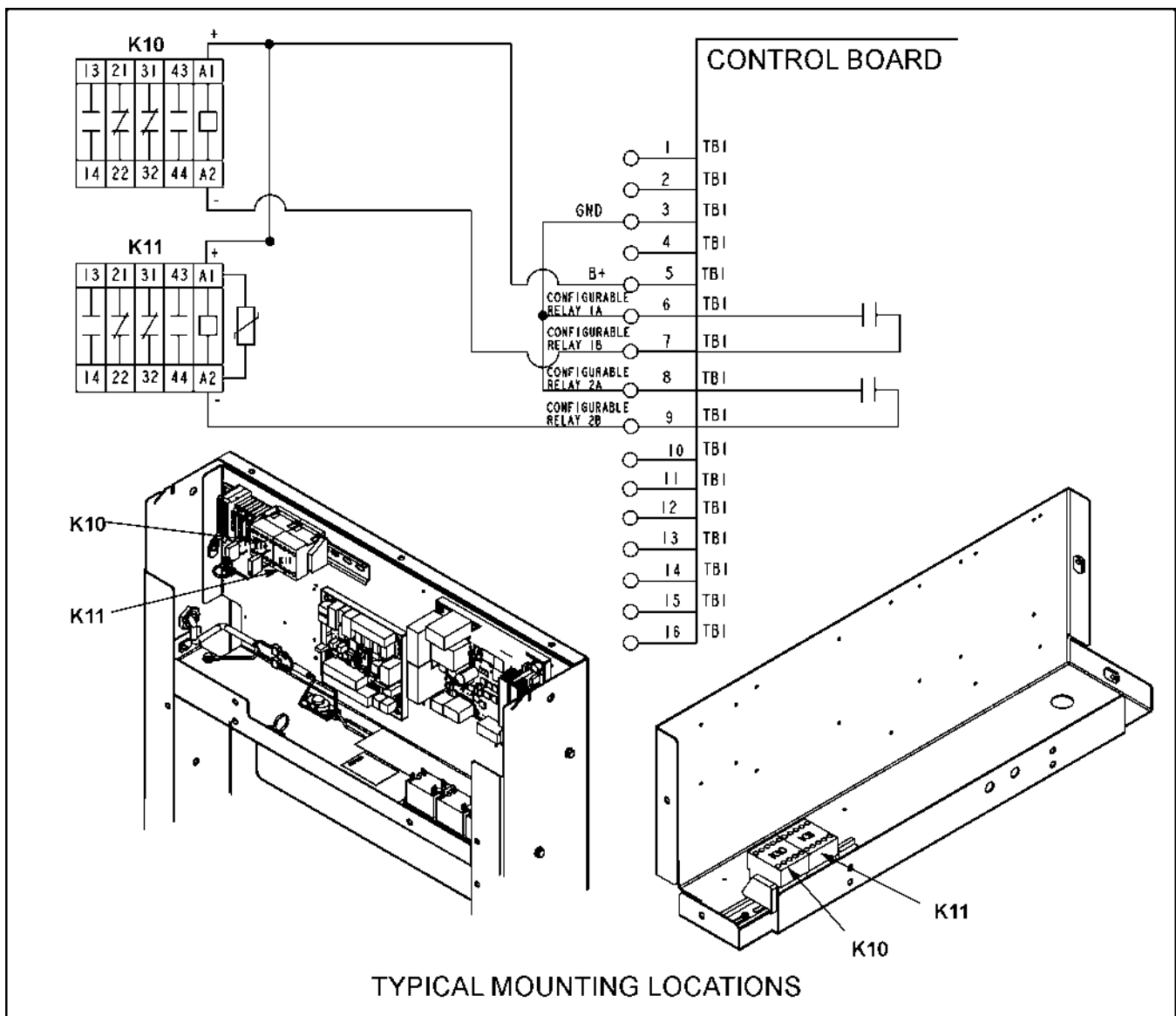


FIGURE 79. OPTIONAL RELAYS (K10, K11)

8.7 Current Transformer (CT) Installation

The current transformers (CT's) are used to display generator set load in kVA and alternator amperage. The CT's must be installed as noted in the following CT Installation Requirements.

Refer to [Appendix A on page 239](#) to identify the generator output leads/phase that must be routed through each CT, and also appropriate transformer post selection for control sensing leads. The transformers are labeled CT1, CT2 and CT3 on the reconnection wiring diagram. (The Reconnection Diagram is located on the hardware on which the CT is installed.)

CT Installation Requirements:

1. The CT has a dot on one side. This dot must be facing toward the generator reconnection terminal block. A dot is also used to indicate pin 1 of the CT.
2. Route the load lead (U, V, or W; or A, B, or C) through the appropriate CT (refer to [Appendix A on page 239](#)).
3. The CT's have dual secondaries (3 pins marked X1, X2 & X3). (Refer to [Appendix A on page 239](#).)
X1 & X2 for above 300 volts L-L
X1 & X3 for below 300 volts L-L

9 Troubleshooting

9.1 General

The PowerCommand) 1302 Control (PCC) continuously monitors the generator set for abnormal conditions, such as high or low frequency, voltage, current and also engine faults via the engine control module. If any of these conditions occur, the PCC will light a yellow Warning lamp or a red Shutdown lamp and display a message on the digital display panel.

9.2 InPower Service Tool

The InPower service tool with PCC 1302 Interface Kit can be used in troubleshooting to perform tests, verify control inputs and outputs, and test protective functions. Refer to the InPower User's Guide, provided with the InPower software for test procedures.

InPower, when used improperly, can cause symptoms like warnings and shutdowns that appear to be a defective control board. When these problems occur, always verify that a self-test or fault simulation (override) have not been left enabled with InPower. If you do not have InPower, or the enabled fault simulation(s) cannot be found using InPower, disconnect battery power to disable the test or override condition.

Make sure that parameter adjustments and time delays, related to the fault condition, have been appropriately set for the application. It may be necessary to write the initial capture file to the device or update the calibration file.

Updating a calibration file requires the InPower Pro version. Confirm that the installed calibration part number matches the serial plate information.

CAUTION

Using the wrong calibration file can result in equipment damage. Do not swap control boards from another generator set model and only use the calibration file shown on the nameplate.

Some features are not available until the hardware for that feature is installed and InPower Pro is used to update (enable) that feature. Confirm that the feature is installed and enabled prior to troubleshooting the control board for symptoms related to a feature.

9.3 Network Applications and Customer Inputs

In applications with networks and remote customer inputs, the generator set may start unexpectedly or fail to crank as a result of these inputs. These symptoms may appear to be caused by the base board. Verify that the remote input is not causing the symptom or isolate the control from these inputs before troubleshooting the control.

9.4 Safety Consideration

WARNING

Contacting high voltage components can cause electrocution, resulting in severe personal injury or death. Keep the output box covers in place during troubleshooting.

High voltages are present when the generator set is running. Do not open the generator output box while the generator set is running.

⚠ CAUTION

Before disconnecting battery cable(s), press the Emergency Stop button and wait at least 30 seconds. Fault code 1117 may display and engine performance may be affected (e.g., engine dying or hard starting) if battery cable(s) is removed during the 30 second waiting period. See Fault code 1117 in this section to reset ECM.

⚠ WARNING

Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.
Ventilate battery area before working on or near battery-Wear goggles-Stop generator set and disconnect charger before disconnecting battery cables-Disconnect negative (-) cable first and reconnect last.



⚠ CAUTION

Disconnect battery charger from AC source before disconnecting battery cables. Otherwise, disconnecting cables can result in voltage spikes damaging to DC control circuits of the generator set .

⚠ WARNING

Accidental starting of the generator set can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (-) cable from the battery terminal.

When troubleshooting a generator set that is shut down, make certain the generator set cannot be accidentally restarted as follows:

1. Press the  or  button to switch to the **Off** mode.
2. Turn off or remove AC power from the battery charger.
3. Press the Emergency Stop button and wait at least 30 seconds before completing Step 4.
4. Remove the negative (-) battery cable from the generator set starting battery.

9.5 Reading Fault Codes

When a fault occurs, the graphical display will display the fault code/message.

After the fault is acknowledged and corrected, the recorded fault will be deleted from the control panel memory, but will remain in a data log to maintain a fault code history. The InPower service tool is required to view this data log.

Refer to [Chapter 5 on page 17](#), [Chapter 6 on page 47](#), or [Section 7.12 on page 82](#) which describes how to view fault codes.

9.6 Troubleshooting Procedure

NOTICE

Each fault code "warning" can be changed to "shutdown" using InPower. Default settings are used in this manual. It is recommended that all changes to settings be recorded at each site to aid in the troubleshooting of the generator set.

[Figure 80 on page 146](#) shows the typical locations of the components within the operator panel that are referenced in the following troubleshooting procedures. Connector locations for each circuit board are provided in [Chapter 5 on page 17](#) or [Chapter 6 on page 47](#), or [Section 7.12 on page 82](#). The control wiring and circuit board connections are shown in [Appendix A on page 239](#).

⚠ CAUTION

Always make sure that the PCC is in the OFF mode before disconnecting or connecting harness connectors. Otherwise, disconnecting the harness connectors can result in voltage spikes high enough to damage the DC control circuits of the set.

⚠ CAUTION

Electrostatic discharge will damage circuit boards. Always wear a wrist strap when handling circuit boards or when disconnecting or connecting harness connectors. See Circuit Board Removal/Replacement in [Chapter 8 on page 91](#).

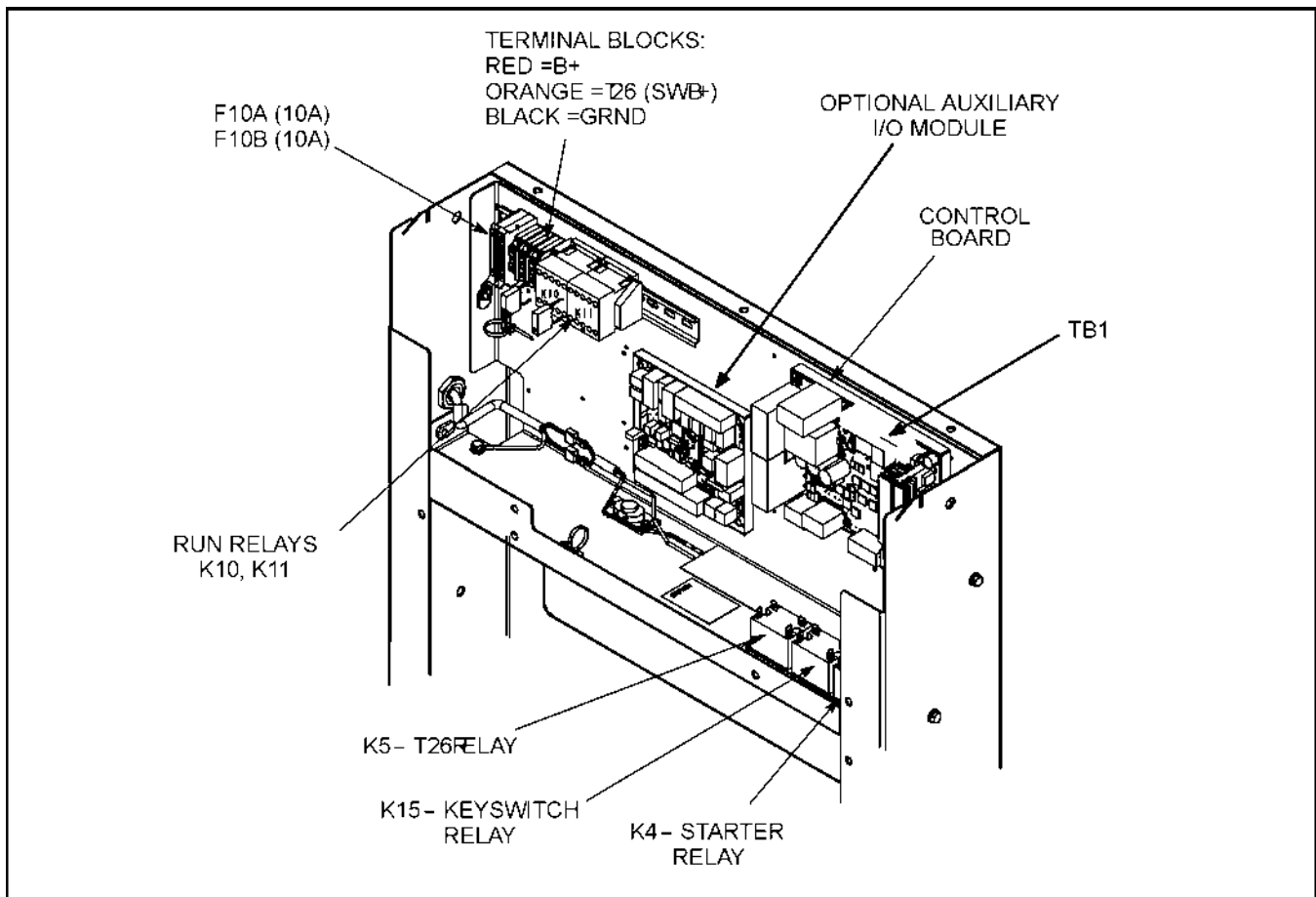


FIGURE 80. TYPICAL CONTROL COMPONENTS

9.6.1 Voltage/Continuity Testing

For voltage and continuity tests described in the troubleshooting section, it may be necessary to remove a plug to complete the test.

The following corrective actions will mention when it is necessary to remove a plug for testing. In other cases, the plug must not be removed for testing. When plug removal is not mentioned, testing must be performed by inserting a narrow meter probe into the back of the plug.

9.6.2 HMI Troubleshooting/Reprogramming

Required Items:

- PCC 1302 control
- HMI 211 Display
- Power to PCC 1302 control
- Harness to power HMI 211 Display
- DC Power Supply (12–24 VDC)

1. Inspect the HMI for any damage on the outside of the control.
2. Remove the back cover of the HMI 211 display and note the condition of the PCB and LCD. Check for dirt, corrosion, burnt or broken components, or any other damage.

3. Make sure the PCC 1302 control is powered up.
4. Check the harness connections on the PCC 1302 control and HMI 211 display.
5. Push any button on the HMI 211 display to wake it up. Observe the software version and make sure LEDs are all illuminated and that the backlight is working. Check the brightness and contrast of the display.

NOTICE

If the HMI 211 display is on and displaying control unit information and buttons are working, no further troubleshooting is needed.

6. If the HMI 211 display buttons are not working, power down the PCC 1302 control and HMI 211 display. Repower the PCC 1302 control and HMI 211 display.
7. If the screen is blank or a CRC failure message is displayed, reprogram the PCC 1302 control and HMI 211 display.
 - a. Disconnect the harness between the HMI 211 display and 1302 board.

NOTICE

The units cannot be connected when reprogramming.

- b. To reprogram the PCC 1302 control, power up the PCC 1302 and use InPower or engineering tool connected to TB15.
- c. To reprogram the HMI 211 display,
 - i. Connect a harness to back of the display to power up the HMI 211 display.

NOTICE

Harness with 8-pin mini-mate connector with 1 wire for B+ (pin 3) and 1 wire for ground (pin 5).

- ii. Use InPower or engineering tool connected to the back of the HMI 211 display to reprogram.

9.7 PCC Control Components

See [Figure 80 on page 146](#).

9.7.1 Relay K4

The starter relay is used by the control board to energize the starter solenoid. K4 is part of the engine harness assembly.

9.7.2 Relay K5

The T26 relay, which is energized by the control board, controls the T26 (switched B+) output. K5 is part of the engine harness assembly.

9.7.3 Relay K15

The keyswitch pilot relay, which is energized by the control board, controls the keyswitch input to the ECM. K15 is part of the engine harness assembly.

9.7.4 Fuse F10A and F10B (Voltage Reference Signal)

The generator set will shut down and may display Fault code **1447** or **2335** if either fuse opens. The fuses protect the PCC control circuitry from damage due to an alternator field overload condition.

9.7.5 Dinrail Terminal Blocks

The six terminal blocks mounted to the dinrail ([Figure 50 on page 93](#)) are used for customer connections to T26 (switched B+), TB B+ (battery B+) and TB B- (battery ground). Refer to Relay Connections for wire recommendations. The terminal blocks are color coded as follows:

ORANGE - T26 (20 amps, fused switched B+) RED - TB B+ (30 amps max, non-fused battery B+)
BLACK - TB- (30 amps max, battery ground)

9.8 Fault Codes

The fault codes have been divided into five categories to help you determine what corrective action to take for safe operation of the generator set. Gaps in the code numbers are for codes that do not apply to this genset model. Also, some of the codes listed are feature dependent, and will not be displayed by this genset control.

9.8.1 Code 118 – Fuel Pressure OOR High (Warning)

Logic:

Fuel pressure sensor signal is out of range – shorted high.

Possible Causes:

1. Faulty fuel pressure sensor connections
2. Faulty fuel pressure sensor
3. Faulty engine harness
4. Faulty extension harness
5. Verify the calibrations in the ECM and the PowerCommand controls

Diagnosis and Repair:

1. Faulty fuel pressure sensor connections
 - a. Inspect the fuel pressure sensor and the engine harness connector pins.
 - i. Disconnect the engine harness connector from the fuel pressure sensor.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.

2. Faulty fuel pressure sensor
 - a. Active Sensor.
 - i. Check the fuel pressure sensor supply voltage.
 - A. Disconnect the engine harness connector from the fuel pressure sensor.
 - B. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - C. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
 - ii. Check the fuel pressure sensor signal (sense) voltage.
 - A. Disconnect the engine harness connector from the fuel pressure sensor
 - B. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - C. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, sensor is faulty.
3. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pin.
 - b. Check for a short circuit from pin to pin.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Disconnect the engine harness connector from the fuel pressure sensor.
 - iii. Disconnect the engine harness from all sensors that have a shared supply or return with the fuel pressure sensor.
 - iv. Measure the resistance from the fuel pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - v. Measure the resistance from the fuel pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - vi. Measure the resistance from the fuel pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - vii. If all measurements are greater than 100k ohms, then the resistance is correct.
 - c. Check for an open circuit.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Disconnect the engine harness connector from the fuel pressure sensor.
 - iii. Measure the resistance from the fuel pressure return pin on the engine harness inline connector to the fuel pressure return pin on the engine harness sensor connector.
 - iv. If the measurement is less than 10 ohms, then the resistance is correct.

-
4. Faulty extension harness
 - a. Inspect the extension harness and the control connector pins.
 - i. Disconnect the extension harness connector from the control.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
 - b. Check for an open circuit.
 - i. Disconnect the extension harness connector from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the fuel pressure return pin on the extension harness connector to the fuel pressure return pin on the extension harness inline connection.
 - iv. If the measurement is less than 10 ohms, then the resistance is correct.
 - c. Check for a short circuit from pin to pin.
 - i. Disconnect the extension harness connector from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the fuel pressure 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.
 - iv. Measure the resistance from the fuel pressure return pin on the extension harness connector to all other pins in the extension harness connector.
 - v. Measure the resistance from the fuel pressure signal pin on the extension harness connector to all other pins in the extension harness connector.
 - vi. If all measurements are greater than 100k ohms, then the resistance is correct.
 5. Verify the calibrations in the ECM and the PowerCommand controls
 - a. Using the display or the InPower Service tool, verify the calibration in the PCC.
 - i. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
 - b. Using the InSite Service tool, verify the calibration in the ECM.
 - i. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

9.8.2 Code 119 - Fuel Pressure Sensor OOR Low (Warning)

Logic:

Fuel pressure sensor signal is out of range – shorted high.

Possible Causes:

1. Faulty fuel pressure sensor connections
2. Faulty fuel pressure sensor
3. Faulty engine harness
4. Faulty extension harness
5. Verify the calibrations in the ECM and the PowerCommand controls

Diagnosis and Repair:

1. Faulty fuel pressure sensor connections
 - a. Inspect the fuel pressure sensor and the engine harness connector pins.
 - i. Disconnect the engine harness connector from the fuel pressure sensor.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
2. Faulty fuel pressure sensor
 - a. Active Sensor.
 - i. Check the fuel pressure sensor supply voltage.
 - A. Disconnect the engine harness connector from the fuel pressure sensor.
 - B. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - C. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
 - ii. Check the fuel pressure sensor signal (sense) voltage.
 - A. Disconnect the engine harness connector from the fuel pressure sensor
 - B. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - C. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, sensor is faulty.
3. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pin.
 - b. Check for a short circuit from pin to pin.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Disconnect the engine harness connector from the fuel pressure sensor.
 - iii. Disconnect the engine harness from all sensors that have a shared supply or return with the fuel pressure sensor.
 - iv. Measure the resistance from the fuel pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - v. Measure the resistance from the fuel pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector.

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- vi. Measure the resistance from the fuel pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - vii. If all measurements are greater than 100k ohms, then the resistance is correct.
 - c. Check for a short circuit to engine block ground.
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the fuel pressure signal pin on the extension harness connector to the engine block ground.
 - iv. Measure the resistance from the fuel pressure 5 VDC pin on the extension harness connector to the engine block ground.
 - v. If the measurement is more than 100k ohms, then the resistance is correct.
 - d. Check for an open circuit.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Disconnect the engine harness connector from the fuel pressure sensor.
 - iii. Measure the resistance from the fuel pressure return pin on the engine harness inline connector to the fuel pressure return pin on the engine harness sensor connector.
 - iv. If the measurement is less than 10 ohms, then the resistance is correct.
4. Faulty extension harness
- a. Inspect the extension harness and the control connector pins.
 - i. Disconnect the extension harness connector from the control.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
 - b. Check for a short circuit from pin to pin.
 - i. Disconnect the extension harness connector from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the fuel pressure 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.
 - iv. Measure the resistance from the fuel pressure return pin on the extension harness connector to all other pins in the extension harness connector.
 - v. Measure the resistance from the fuel pressure signal pin on the extension harness connector to all other pins in the extension harness connector.
 - vi. If all measurements are greater than 100k ohms, then the resistance is correct.
 - c. Check for a short circuit to engine block ground
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the fuel pressure signal pin on the extension harness connector to the engine block ground.
 - iv. Measure the resistance from the fuel pressure 5 VDC pin on the extension harness connector to the engine block ground.
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- v. If the measurement is more than 100K ohms, then the resistance is correct.
- d. Check for an open circuit.
 - i. Disconnect the extension harness connector from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the fuel pressure return pin on the extension harness connector to the fuel pressure return pin on the extension harness inline connection.
 - iv. If the measurement is less than 10 ohms, then the resistance is correct.
- 5. Verify the calibrations in the ECM and the PowerCommand controls
 - a. Using the display or the InPower Service tool, verify the calibration in the PCC.
 - i. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
 - b. Using the InSite Service tool, verify the calibration in the ECM.
 - i. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

9.8.3 Code 121 – Loss of Speed Sense (Shutdown)

Logic:

No engine speed signal detected from one of two signals: engine crankshaft speed or engine camshaft position.

Possible Causes:

1. Faulty crankshaft speed sensor connections
2. Faulty crankshaft speed sensor
3. Faulty camshaft position sensor connections
4. Faulty camshaft position sensor
5. Faulty engine harness
6. Faulty extension harness
7. Damaged crankshaft target wheel
8. Verify the calibrations in the ECM and the PowerCommand controls

Diagnosis and Repair:

1. Faulty crankshaft speed sensor connections
 - a. Inspect the crankshaft speed sensor and the engine harness connector pins.
 - i. Disconnect the engine harness connector from the crankshaft speed sensor.
 - ii. Inspect for corroded, bent broken, pushed back, expanded, or loose pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
2. Faulty crankshaft speed sensor
 - a. Check the crankshaft speed sensor supply voltage.
 - i. Disconnect the engine harness connector from the crankshaft speed sensor.

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- ii. Install the speed sensor breakout cable between the sensor and the sensor harness connector.
 - iii. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
 - b. Check the crankshaft speed sensor signal (sense) voltage.
 - i. Disconnect the engine harness connector from the camshaft position sensor.
 - ii. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - iii. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 VDC, then the signal voltage is correct. If not, sensor is faulty.
 - 3. Faulty camshaft position sensor connections
 - a. Inspect the camshaft position sensor and the engine harness connector pins
 - i. Disconnect the engine harness connector from the camshaft position sensor.
 - ii. Inspect for corroded, bent broken, pushed back, expanded, or loose pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
 - 4. Faulty camshaft position sensor
 - a. Check the camshaft position sensor supply voltage.
 - i. Disconnect the engine harness connector from the camshaft position sensor.
 - ii. Install the speed sensor breakout cable between the sensor and the sensor harness connector.
 - iii. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
 - b. Check the camshaft position sensor signal (sense) voltage.
 - i. Disconnect the engine harness connector from the camshaft position sensor.
 - ii. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - iii. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 VDC, then the signal voltage is correct. If not, sensor is faulty.
 - 5. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seal.
 - v. Inspect for dirt or debris in or on the connector pin.

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- b. Check for a short circuit from pin to pin on the crankshaft speed sensor conductors.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Disconnect the engine harness connector from the crankshaft speed sensor.
 - iii. Disconnect the engine harness from all sensors that have a shared supply or return with the crankshaft speed sensor.
 - iv. Measure the resistance from the crankshaft speed 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - v. Measure the resistance from the crankshaft speed return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - vi. Measure the resistance from the crank shaft speed signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - vii. If all measurements are greater than 100k ohms, then the resistance is correct.
 - c. Check for a short circuit to engine block ground on the crankshaft speed sensor conductors.
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the crankshaft speed signal pin on the extension harness connector to the engine block ground.
 - iv. Measure the resistance from the crankshaft speed 5 VDC pin on the extension harness connector to the engine block ground.
 - v. If the measurement is more than 100k ohms, then the resistance is correct.
 - d. Check for an open circuit on the crankshaft speed sensor conductors.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Disconnect the engine harness from the crankshaft speed sensor.
 - iii. Measure the resistance from the crankshaft speed return pin on the engine harness inline connector to the crankshaft speed return pin on the engine harness sensor connector.
 - iv. If the measurement is less than 10 ohms, then the resistance is correct.
 - e. Check for a short circuit from pin to pin on the camshaft position sensor conductors.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Disconnect the engine harness connector from the camshaft position sensor.
 - iii. Disconnect the engine harness from all sensors that have a shared supply or return with the camshaft position sensor.
 - iv. Measure the resistance from the camshaft position 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - v. Measure the resistance from the camshaft position return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - vi. Measure the resistance from the camshaft position signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - vii. If all measurements are greater than 100k ohms, then the resistance is correct.
 - f. Check for a short circuit to engine block ground on the camshaft position sensor conductors.
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.
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- iii. Measure the resistance from the camshaft position signal pin on the extension harness connector to the engine block ground.
 - iv. Measure the resistance from the camshaft position 5 VDC pin on the extension harness connector to the engine block ground.
 - v. If the measurement is more than 100k ohms, then the resistance is correct.
- g. Check for an open circuit on the camshaft position sensor conductors.
- i. Disconnect the engine harness connector from the extension harness.
 - ii. Disconnect the engine harness from the camshaft position sensor.
 - iii. Measure the resistance from the camshaft position return pin on the engine harness inline connector to the camshaft position return pin on the engine harness sensor connector.
 - iv. If the measurement is less than 10 ohms, then the resistance is correct.
6. Faulty extension harness
- a. Inspect the extension harness and control pins.
 - i. Disconnect the extension harness connector from the control.
 - ii. Inspect for corroded, bent broken, pushed back, expanded, or loose pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
 - b. Check for a short circuit from pin to pin on the crankshaft speed sensor conductors.
 - i. Disconnect the extension harness connector from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the crankshaft speed sensor 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.
 - iv. Measure the resistance from the crankshaft speed return pin on the extension harness connector to all other pins in the extension harness connector.
 - v. Measure the resistance from the crankshaft speed signal pin on the extension harness connector to all other pins in the extension harness connector.
 - vi. If all measurements are greater than 100k ohms, then the resistance is correct.
 - c. Check for a short circuit to engine block ground on the crankshaft speed sensor conductors.
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the crankshaft speed signal pin on the extension harness connector to the engine block ground.
 - iv. Measure the resistance from the crankshaft speed 5 VDC pin on the extension harness connector to the engine block ground.
 - v. If the measurement is more than 100k ohms, then the resistance is correct.
 - d. Check for an open circuit on the crankshaft speed sensor conductors.
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.

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- iii. Measure the resistance from the crankshaft speed return pin on the engine harness inline connector to the crankshaft speed return pin on the engine harness sensor connector.
 - iv. If the measurement is less than 10 ohms, then the resistance is correct.
 - e. Check for a short circuit from pin to pin on the camshaft position sensor conductors.
 - i. Disconnect the extension harness connector from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the camshaft position sensor 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.
 - iv. Measure the resistance from the camshaft position return pin on the extension harness connector to all other pins in the extension harness connector.
 - v. Measure the resistance from the camshaft position signal pin on the extension harness connector to all other pins in the extension harness connector.
 - vi. If all measurements are greater than 100k ohms, then the resistance is correct.
 - f. Check for a short circuit to engine block ground on the camshaft position sensor conductors.
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the camshaft position signal pin on the extension harness connector to the engine block ground.
 - iv. Measure the resistance from the camshaft position 5 VDC pin on the extension harness connector to the engine block ground.
 - v. If the measurement is more than 100k ohms, then the resistance is correct.
 - g. Check for an open circuit on the camshaft position sensor conductors.
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the camshaft position return pin on the engine harness inline connector to the camshaft position return pin on the engine harness sensor connector.
 - iv. If the measurement is less than 10 ohms, then the resistance is correct.
 - 7. Damaged crankshaft target wheel
 - a. Visually inspect the crankshaft target wheel.
 - i. Inspect for damaged, malformed, missing or broken target wheel teeth.
 - ii. Inspect for evidence of corrosion or other materials on or around the target wheel teeth.
 - iii. Inspect for dirt or debris on the target wheel teeth.
 - 8. Verify the calibrations in the ECM and the PowerCommand controls.
 - a. Using the display or the InPower Service tool, verify the calibration in the PCC.
 - i. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
 - b. Using the InSite Service tool, verify the calibration in the ECM.
 - i. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

9.8.4 Code 135 - Oil Pressure Sensor OOR - High (Warning)

Logic: Engine oil pressure sensor is out of range – shorted high. An “OIL PRESSURE SENSOR OOR” warning is displayed after the fault condition is sensed for 10 seconds.

Possible Causes:

1. Failed oil pressure sensor connections
2. Failed oil pressure sensor
3. Failed engine harness
4. Failed extension harness
5. Incorrect ECM and/or the PowerCommand control calibrations

Diagnosis and Repair:

1. Failed oil pressure sensor connections
 - a. Visually inspect the oil pressure sensor and harness connector pins.
 - i. Disconnect the engine harness connector from the crankshaft speed sensor.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, expanded, or loose pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins
2. Failed oil pressure sensor
 - a. Check the oil pressure sensor supply voltage.
 - i. Disconnect the engine harness connector from the oil pressure sensor.
 - ii. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - iii. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
 - b. Check the oil pressure sensor signal (sense) voltage.
 - i. Disconnect the engine harness connector from the oil pressure sensor.
 - ii. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - iii. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, sensor is faulty.
3. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals

- Dirt or debris in or on the connector pin
- b. Check for a short circuit from pin to pin.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Disconnect the engine harness connector from the oil pressure sensor.
 - iii. Disconnect the engine harness from all sensors that have a shared supply or return with the oil pressure sensor.
 - iv. Measure the resistance from:
 - A. The oil pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector
 - B. The oil pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector
 - C. The oil pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connector

If all measurements are greater than 100k Ohms, then the resistance is correct.
 - c. Check for an open circuit.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Disconnect the engine harness connector from oil pressure sensor.
 - iii. Measure the resistance from the oil pressure return pin on the engine harness inline connector to the oil pressure return pin on the engine harness sensor connector.

If the measurement is less than 10 Ohms the resistance is correct.
4. Faulty extension harness
 - a. Inspect the extension harness and the generator set control connector pins.
 - i. Disconnect the extension harness connector from the control.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, expanded, or loose pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins
 - b. Check for an open circuit on the crankshaft speed sensor conductors.
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the crankshaft speed return pin on the engine harness inline connector to the crankshaft speed return pin on the engine harness sensor connector.

If the measurement is less than 10 Ohms, then the resistance is correct.
 - c. Check for a short circuit from pin to pin.
 - i. Disconnect the extension harness connector from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from:
 - A. The crankshaft speed sensor 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector

- B. The crankshaft speed return pin on the extension harness connector to all other pins in the extension harness connector
- C. The crankshaft speed signal pin on the extension harness connector to all other pins in the extension harness connector.

If all measurements are greater than 100k Ohms, then the resistance is correct.

5. Incorrect ECM and/or the PowerCommand control calibrations
 - a. Using the display or the InPower Service tool, verify the calibration in the PCC.
 - i. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
 - b. Using the Global Control Platform (GCP) Display or 4G service tool (latest version), verify the calibration in the ECM.
 - i. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

9.8.5 Code 141 - Oil Pressure Sensor OOR - Low (Warning)

Logic: Engine oil pressure sensor is out of range – shorted low. An “OIL PRESSURE SENSOR OOR” warning is displayed after the fault condition is sensed for 10 seconds.

Possible Causes:

1. Failed oil pressure sensor connections
2. Failed oil pressure sensor
3. Failed engine harness
4. Failed extension harness
5. Incorrect calibrations in the ECM and/or the PowerCommand controls

Diagnosis and Repair:

1. Failed oil pressure sensor connections
 - a. Visually inspect the oil pressure sensor and harness connector pins.
 - i. Disconnect the engine harness connector from the crankshaft speed sensor.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, expanded, or loose pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins
2. Failed oil pressure sensor
 - a. Check the oil pressure sensor supply voltage.
 - i. Disconnect the engine harness connector from the oil pressure sensor.
 - ii. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - iii. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.

- b. Check the oil pressure sensor signal (sense) voltage.
 - i. Disconnect the engine harness connector from the oil pressure sensor.
 - ii. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - iii. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, sensor is faulty.
3. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pin
 - b. Check for a short circuit from pin to pin.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Disconnect the engine harness connector from the oil pressure sensor.
 - iii. Disconnect the engine harness from all sensors that have a shared supply or return with the oil pressure sensor.
 - iv. Measure the resistance from:
 - A. The oil pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector
 - B. The oil pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector
 - C. The oil pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connectorIf all measurements are greater than 100k Ohms, then the resistance is correct.
 - c. Check for a short circuit to engine block ground.
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from:
 - A. The oil pressure signal pin on the extension harness connector to the engine block ground
 - B. The oil pressure 5 VDC pin on the extension harness connector to the engine block groundIf the measurement is more than 100k Ohms, then the resistance is correct.
4. Faulty extension harness
 - a. Inspect the extension harness and the generator set control connector pins.
 - i. Disconnect the extension harness connector from the control.

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- ii. Inspect for:
 - Corroded, bent, broken, pushed back, expanded, or loose pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins
 - b. Check for a short circuit from pin to pin.
 - i. Disconnect the extension harness connector from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from:
 - A. The crankshaft speed sensor 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector
 - B. The crankshaft speed return pin on the extension harness connector to all other pins in the extension harness connector
 - C. The crankshaft speed signal pin on the extension harness connector to all other pins in the extension harness connector

If all measurements are greater than 100k Ohms, then the resistance is correct.
 - c. Check for a short circuit to engine block ground.
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from:
 - A. The oil pressure signal pin on the extension harness connector to the engine block ground
 - B. The oil pressure 5 VDC pin on the extension harness connector to the engine block ground

If the measurement is more than 100k Ohms, then the resistance is correct.
 - d. Check for an open circuit.
 - i. Disconnect the extension harness from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from:
 - A. The engine oil temperature return pin on the extension harness connector to the engine oil temperature return pin at the extension harness inline connector
 - B. The engine oil temperature signal pin on the extension harness connector to the engine oil temperature signal pin at the extension harness inline connector

If the measurement is less than 10 Ohms, then the resistance is correct.
5. Incorrect calibrations in the ECM and the PowerCommand controls
- a. Using the display or the InPower Service tool, verify the calibration in the PCC.
 - i. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.

- b. Using the Global Control Platform (GCP) Display or 4G service tool (latest version), verify the calibration in the ECM.
 - i. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

9.8.6 Code 143 - Engine Oil Pressure Low (Warning)

Logic: Engine oil pressure is below the low oil pressure warning threshold.

Possible Causes:

1. Low lubricating oil level
2. External leak
3. Lubricating oil does not meet specifications
4. Lubricating oil contaminated with coolant or fuel
5. Engine angularity during operation exceeds specification
6. Coolant temperature above specification
7. Lubricating oil filter plumbing not routed correctly
8. Faulty main oil pressure regulator
9. Loose or broken lubricating oil suction or transfer tube
10. Faulty lubricating oil pump
11. Incorrect lubricating oil cooler installed
12. Plugged lubricating oil cooler
13. Lubricating oil temperature above specification
14. Damaged or incorrectly installed piston cooling nozzles
15. Inaccurate or blocked oil pressure sensor
16. Fault simulation enabled or the threshold set too high


Diagnosis and Repair:

1. Low lubricating oil level
 - Check the oil level. Add or drain oil, if necessary.
2. External leak
 - a. Inspect the engine and surrounding area for external oil leaks.
 - b. Tighten the cap screws, pipe plugs, and fittings.
 - c. Replace gaskets, if necessary.
3. Lubricating oil does not meet specifications
 - a. Verify the lubricating oil meets the specifications as required per the engine manual.
 - b. Verify the alternative oil and additives were not added during the oil life.
 - c. Verify the age of the lubricating oil.
 - d. If necessary, take an oil sample. Refer to oil analysis technique bulletins for instructions on how to take an oil sample.
4. Lubricating oil contaminated with coolant or fuel
 - a. Refer to the Lubricating Oil Contaminated symptom tree for proper troubleshooting.

-
5. Engine angularity during operation exceeds specification
 - a. Verify rental container is level or near level. See engine specification to determine suitable amount of angularity.
 6. Coolant temperature above specification
 - a. On the display or using the InPower service tool, read the engine coolant temperature.
 - b. Compare the coolant temperature against the expected coolant temperature for that engine model. This data can be found in the engine manual.
 - c. If the coolant temperature is outside of the expected range, refer to FC 146 (Engine Coolant Temperature Above Normal [Warning]).
 7. Lubricating oil filter plumbing not routed correctly
 - Inspect the lubricating oil filter plumbing. If the routing is an issue, refer to the lubricating filter plumbing procedure in the engine manual.
 8. Faulty main oil pressure regulator
 - a. Inspect the plunger and plunger bore for nicks or scratches.
 - b. Verify the plunger moves freely in the bore.
 - c. Measure the pressure regulator spring at the following heights:
 - At 41.25 mm (1.624 in) the pressure should be at least 127 N (29 lb).
 - At 44.50 mm (1.752 in) the pressure should be at least 109 N (25 lb).
 - d. If the regulator meets the above specifications, the regulator is not faulty.
 9. Loose or broken lubricating oil suction or transfer tube
 - a. Inspect:
 - The lubricating oil suction tube or transfer tube for leaks, cracks, kinks, or tears
 - The cap screws for signs of leaks
 - The gaskets and o-rings for signs of damage, excessive wear or pinching
 10. Faulty lubricating oil pump
 - a. Check the oil pump for backlash.
 - b. If the backlash is not within 0.170 mm (0.007 in) min and 0.300 mm (0.012 in) max, then the pump needs to be replaced.
 - c. Inspect:
 - The lubricating oil pump gears for chips, cracks, or excessive wear
 - If debris is suspected of having gone through the pump, the rear cover plate may be removed to inspect for internal damage
 - The rear cover plate for scoring and grooves
 - The pump housing and generator set drive for damage and excessive wear
 11. Incorrect lubricating oil cooler installed
 - Check if the correct lubricating oil cooler part number is installed using the appropriate parts manual.
 12. Plugged lubricating oil cooler
 - Inspect the oil cooler for cleanliness. Refer to engine manual for instructions on how to clean the oil cooler housing.
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13. Lubricating oil temperature above specification
 - a. On the display or using the InPower service tool, read the engine oil temperature.
 - b. Compare the oil temperature against the expected oil temperature.
 - Refer to the engine manual for operating oil temperatures.
 - Refer to the coolant or block heater specification for a non-running engine.
 - c. If the oil temperature is outside of the expected range, refer to FC 421 (Engine Oil Temperature High [Warning]).
14. Damaged or incorrectly installed piston cooling nozzles
 - a. Inspect the capscrew and piston cooling nozzle for damage.
 - b. Check for leaks and improper seating.
15. Inaccurate or blocked oil pressure sensor
 - a. Connect a mechanical oil pressure gauge to the engine at one of the plugs on top of the oil filter head.
 - b. Connect InPower.
 - c. While the engine is stopped, compare the oil pressure reading on the service tool to the reading on the mechanical oil pressure gauge.
 - d. Start the generator set if engine troubleshooting has been completed. Do not attempt to start the engine if there is doubt about oil pressure.
 - e. Compare the oil pressure reading on the service tool to the reading on the mechanical oil pressure gauge.
 - f. Refer to the troubleshooting and repair manual for the specific engine platform for oil pressure ranges.
16. Fault simulation enabled or the threshold set too high
 - a. Connect to the control with InPower and ensure that the fault simulation for LOP is not enabled.
 - b. Using the electronic service tool, verify that the fault threshold is NOT within the normal operating range for the oil pressure sensor. Refer to the appropriate base engine manual for the normal operating range.

9.8.7 Fault Code 144 - Coolant Sensor OOR Low (Warning)

Warning Faults		
Coolant Temperature OOR Low Warning	144	

Warning and Shutdown Codes		
Fault Code	Corrective Actions	
Engine Platform	FAE (Full Authority Engine)	HM (Hydro-Mechanical)

Warning and Shutdown Codes		
144, 145 Cool Sensor OOR Low/High Lamp: Warning	Indicates that the engine controller has sensed the engine coolant temperature sensor output is out of range (high or low). Consult Engine Service Manual, check sender/connectors/wires.	Indicates that the control has sensed the engine coolant temperature sensor output is out of range (high/low). Check sender/connectors/wires.

9.8.7.1 Fault Diagnostics

Code 144/145- Coolant Sensor OOR (High/ Low) Warning

Reason: This indicates that the coolant temperature sensor signal, is out of range - shorted high or low.

Effect: No engine protection for coolant temperature during genset operation. Possible white smoke.

Possible Cause	Corrective Action	
Engine Platform	Full Authority Engine (FAE)	Hydro-Mechanical (HM)
The Sensor connections could be bad.	Consult Engine Service Manual.	Inspect the sensor and engine harness connector pins. Repair or replace as necessary.
The Sensor could be bad.		Disconnect the sensor and plug in a resistive sensor simulator to isolate the fault. If the control responds to the simulator, replace the sensor. If control does not respond, go to next step.
The Harness or Base board could be bad		<ol style="list-style-type: none"> Remove connector P11 from Base board and disconnect sensor. Check pins P11-11 (H20) and P11-12 (H20 COM) for short circuit as follows: <ul style="list-style-type: none"> Check for a short circuit to the engine block ground (more than 200k ohms OK). Check for a short circuit from pin to pin (more than 200k ohms OK). Repair or replace as necessary. Measure the resistance of the coolant sensor and reconnect the harness to the sensor. Remove connector P11 from the Base board and check resistance between the pins P11-11 (H20) and P11-12 (H20 COM). <ul style="list-style-type: none"> If resistance is not the same, harness is bad. If resistance is the same, Base board is bad.

9.8.8 Code 145 - Engine Coolant Temperature OOR High (Warning)

Logic: Engine coolant temperature signal voltage is out of range – shorted high.

Possible Causes:

1. Enabled fault simulation feature
2. Faulty coolant temperature sensor connections
3. Faulty coolant temperature sensor
4. Faulty engine harness

5. Faulty extension harness
6. Incorrect controller calibrations

Diagnosis and Repair:

1. Enabled fault simulation feature
 - a. Connect InPower.
 - b. Verify that the fault simulation is not enabled for the intake manifold temperature sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
2. Faulty coolant temperature sensor connections
 - a. Inspect the coolant temperature sensor and the harness connector pins.
 - i. Disconnect the engine harness connector from the coolant temperature sensor.
 - ii. Inspect for:
 - A. Corroded, bent, broken, pushed back, or expanded pins
 - B. Evidence of moisture in or on the connector
 - C. Missing or damaged connector seals
 - D. Dirt or debris in or on the connector pins
3. Faulty coolant temperature sensor
 - a. Check the resistance of the sensor.
 - i. Disconnect the engine harness connector from the coolant temperature sensor.
 - ii. Measure the resistance between the coolant temperature signal pin and the coolant temperature return pin.
 - iii. Refer to the troubleshooting and repair manual for the specific engine platform for coolant temperature ranges.
4. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pin
 - b. Check for a short circuit from pin to pin.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Disconnect the engine harness from the coolant temperature sensor.
 - iii. Disconnect the engine harness from all sensors that have a shared return with the coolant temperature sensor.
 - iv. Measure the resistance from:
 - A. The coolant temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector
 - B. The coolant temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector

If all measurements are greater than 100k Ohms, then the resistance is correct.

- c. Check for a short circuit to engine block ground.
 - i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from the coolant temperature signal pin on the extension harness connector to the engine block ground.

If the measurement is more than 100k Ohms, then the resistance is correct.

- d. Check for an open circuit.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Disconnect the engine harness from the coolant temperature sensor.
 - iii. Measure the resistance from:
 - A. The coolant temperature return pin on the engine harness inline connector to the coolant temperature return pin at the engine harness sensor connector
 - B. The coolant temperature signal pin on the engine harness inline connector to the coolant temperature signal pin at then engine harness sensor connector

If the measurement is less than 10 Ohms, then the resistance is correct.

5. Faulty extension harness

- a. Inspect the extension harness connector pins for:
 - Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins
- b. Check for an open circuit.
 - i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from:
 - A. The coolant temperature return pin on the extension harness connector to the coolant temperature return pin at the extension harness inline connector
 - B. The coolant temperature signal pin on the extension harness to the coolant temperature signal pin at the extension harness inline connector

If all measurements are greater than 10 Ohms, then the resistance is correct.

- c. Check for a short circuit from pin to pin.
 - i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from:
 - A. The coolant temperature return pin on the extension harness connector to all other pins in the extension harness connector
 - B. The coolant temperature signal pin on the extension harness connector to all other pins in the extension harness connector

If all measurements are greater than 100k Ohms, then the resistance is correct.

6. Incorrect controller calibrations
 - a. Using the display or the InPower Service tool, verify the calibration in the PCC.
 - i. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
 - b. Using the Global Control Platform (GCP) Display or 4G service tool (latest version), verify the calibration in the ECM.
 - i. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

9.8.9 Code 146 - Engine Coolant Temperature Above Normal (Warning)

Logic:

Engine coolant temperature has exceeded 107.2° C (225° F) for greater than 5 seconds.

Possible Cause:

1. High ambient temperature
2. Radiator blocked
3. Louvers are closed or damaged
4. Charge air cooler fins or radiator fins are damaged or obstructed
5. Coolant level is below specification
6. Antifreeze and water mixture is not correct
7. Fan shroud is damaged or air recirculation baffles are damaged
8. Fan belt is broken or loose
9. Fan drive or fan controls are malfunctioning
10. Radiator cap is not faulty
11. Thermostat is faulty
12. Cooling system hose is collapsed, restricted or leaking
13. Intake manifold air temperature is above specification
14. Cooling system is contaminated with dirt, scale, or sludge
15. Water pump is malfunctioning
16. Air or combustion gases are entering the cooling system
17. Inaccurate coolant temperature sensor
18. Fault simulation feature is enabled
19. Incorrect threshold setting

Diagnosis and Repair:

1. High ambient temperature
 - a. Using thermocouple verify air temperature entering intake louver of generator.
 - b. Reduce loads or recirculation of discharge air to generator in elevated ambient.
2. Radiator blocked
 - a. Inspect for dirt, debris or obstructions.

- b. Remove blockage or winterfront as applicable.
- 3. Louvers are closed or damaged
 - a. Inspect louvers for proper operation.
 - b. Repair or replace if damaged.
 - c. Check louver motor for proper operation.
 - d. If louver motor is operational, verify louver shutterstat is operational.
- 4. Charge air cooler fins or radiator fins are damaged or obstructed
 - a. Inspect for dirt, debris or obstructions.
 - b. Clean if necessary.
- 5. Coolant level is below specification
 - a. Inspect the engine, cooling system, and surrounding area for external coolant leaks.
 - b. Repair as required.
 - c. Inspect the coolant level is correct via the sight glass.
 - d. Add coolant as necessary.
- 6. Antifreeze and water mixture is not correct
 - a. Verify the concentration of antifreeze in the coolant. Add coolant as necessary.
- 7. Fan shroud is damaged or air recirculation baffles are damaged
 - a. Inspect shroud and baffles for damage and clearance.
 - b. Repair or replace if damaged.
- 8. Fan belt is broken or loose
 - a. Inspect belt(s) for damage, wear, and proper tension
 - b. Repair or replace if damaged or worn.
- 9. Fan drive or fan controls are malfunctioning
 - a. Inspect pulleys and belt tensioner for damage or wear.
 - b. Repair or replace if damaged or worn.
- 10. Radiator cap is not faulty
 - a. Inspect radiator cap and gasket for damage and proper pressure operation.
 - b. Replace if damaged or worn.
- 11. Thermostat is faulty
 - a. Remove thermostat and inspect/test for proper operation.
 - b. Replace if damaged or malfunctioning.
- 12. Cooling system hose is collapsed, restricted or leaking
 - a. Inspect upper and lower radiator hoses for collapse, distortion, or fluid leaks.
 - b. Replace if damaged or worn.
- 13. Intake manifold air temperature is above specification
 - a. Use a thermocouple to verify manifold air temperature.
 - b. Repair or replace faulty after cooler components.

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14. Cooling system is contaminated with dirt, scale, or sludge
 - a. Inspect cooling system components for external contaminants and clean as required.
 - b. Open radiator cap and inspect for contaminated coolant and scale.
 - c. Flush cooling system per engine service manual.
 15. Water pump is malfunctioning
 - a. Inspect water pump for proper operation.
 - b. Replace if damaged or worn.
 16. Air or combustion gases are entering the cooling system
 - a. Inspect engine for head gasket leak.
 - b. Repair or replace faulty components.
 17. Inaccurate coolant temperature sensor
 - a. Using a thermocouple or similar device, measure coolant temperature near sender and compare to coolant temperature displayed.
 - b. Verify the temperature sender resistance and compare to specifications called out in the engine manual.
 - c. Verify continuity from temperature sender wire pin to engine ECM pin. Harness resistance should be less than 5 Ohms.
 - d. Repair or replace faulty components or wiring
 18. Fault simulation feature is enabled
 - a. Use the service tool to connect to the engine ECM and verify fault override toggle is disabled.
 - b. Reconfigure generator and disable fault overrides.
 19. Incorrect threshold setting
 - a. Use the service tool to connect to the engine ECM and verify fault threshold settings and compare to the specifications called out in the engine manual.
 - b. Verify ECM and PCC calibration number and revision is correct.
 - c. Recalibrate the engine ECM to reset the threshold settings.

9.8.10 Code 151 – Engine Coolant Temperature High (Shutdown)

Logic:

Engine coolant temperature has exceeded the alarm (shutdown) threshold for high coolant temperature.

Possible Causes:

1. High ambient temperature
2. Radiator blocked
3. Louvers are closed or damaged
4. Charge air cooler fins or radiator fins are damaged or obstructed
5. Coolant level is below specification
6. Antifreeze and water mixture is not correct
7. Fan shroud is damaged or air recirculation baffles are damaged
8. Fan belt is broken or loose

9. Fan drive or fan controls are malfunctioning
10. Radiator cap is faulty
11. Thermostat is faulty
12. Cooling system hose is collapsed, restricted or leaking
13. Intake manifold air temperature is above specification
14. Cooling system is contaminated with dirt, scale, or sludge
15. Water pump is malfunctioning
16. Air or combustion gases are entering the cooling system
17. Inaccurate coolant temperature sensor
18. Fault simulation feature is enabled
19. Incorrect threshold setting

Diagnosis and Repair:

1. High ambient temperature
 - a. Using thermocouple verify air temperature entering intake louver of generator.
 - b. Reduce loads or recirculation of discharge air to generator in elevated ambient.
 2. Radiator blocked
 - a. Inspect for dirt, debris or obstructions.
 - b. Remove blockage or winterfront as applicable.
 3. Louvers are closed or damaged
 - a. Inspect louvers for proper operation.
 - b. Repair or replace if damaged.
 - c. Check louver motor for proper operation.
 - d. If louver motor is operational, verify louver shutterstat is operational.
 4. Charge air cooler fins or radiator fins are damaged or obstructed
 - a. Inspect for dirt, debris or obstructions.
 - b. Clean if necessary.
 5. Coolant level is below specification
 - a. Inspect the engine, cooling system, and surrounding area for external coolant leaks.
 - b. Repair as required.
 - c. Inspect the coolant level is correct via the sight glass.
 - d. Add coolant as necessary.
 6. Antifreeze and water mixture is not correct
 - a. Verify the concentration of antifreeze in the coolant. Add coolant as necessary.
 7. Fan shroud is damaged or air recirculation baffles are damaged
 - a. Inspect shroud and baffles for damage and clearance.
 - b. Repair or replace if damaged.
 8. Fan belt is broken or loose
 - a. Inspect belt(s) for damage, wear, and proper tension
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- b. Repair or replace if damaged or worn.
 9. Fan drive or fan controls are malfunctioning
 - a. Inspect pulleys and belt tensioner for damage or wear.
 - b. Repair or replace if damaged or worn.
 10. Radiator cap is faulty
 - a. Inspect radiator cap and gasket for damage and proper pressure operation.
 - b. Replace if damaged or worn.
 11. Thermostat is faulty
 - a. Remove thermostat and inspect/test for proper operation.
 - b. Replace if damaged or malfunctioning.
 12. Cooling system hose is collapsed, restricted or leaking
 - a. Inspect upper and lower radiator hoses for collapse, distortion, or fluid leaks.
 - b. Replace if damaged or worn.
 13. Intake manifold air temperature is above specification
 - a. Use a thermocouple to verify manifold air temperature.
 - b. Repair or replace faulty after cooler components.
 14. Cooling system is contaminated with dirt, scale, or sludge
 - a. Inspect cooling system components for external contaminants and clean as required.
 - b. Open radiator cap and inspect for contaminated coolant and scale.
 - c. Flush cooling system per engine service manual.
 15. Water pump is malfunctioning
 - a. Inspect water pump for proper operation.
 - b. Replace if damaged or worn.
 16. Air or combustion gases are entering the cooling system
 - a. Inspect engine for head gasket leak.
 - b. Repair or replace faulty components.
 17. Inaccurate coolant temperature sensor
 - a. Using a thermocouple or similar device, measure coolant temperature near sender and compare to coolant temperature displayed.
 - b. Verify the temperature sender resistance and compare to specifications called out in the engine manual.
 - c. Verify continuity from temperature sender wire pin to engine ECM pin. Harness resistance should be less than 5 Ohms.
 - d. Repair or replace faulty components or wiring
 18. Fault simulation feature is enabled
 - a. Use the service tool to connect to the engine ECM and verify fault override toggle is disabled.
 - b. Reconfigure generator and disable fault overrides.
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19. Incorrect threshold setting
 - a. Use the service tool to connect to the engine ECM and verify fault threshold settings and compare to the specifications called out in the engine manual.
 - b. Verify ECM and PCC calibration number and revision is correct.
 - c. Recalibrate the engine ECM to reset the threshold settings.

9.8.11 Code 153 - Intake Manifold Temperature OOR High (Warning)

Logic: Engine intake manifold temperature sensor signal is out of range – shorted high.

Possible Causes:

1. Faulty intake manifold temperature sensor connections
2. Faulty intake manifold temperature sensor
3. Faulty engine harness
4. Faulty extension harness

NOTICE

<p>Part Number 3822758 - Male Deutsch/AMP/Metri-Pack test lead</p>

<p>Part Number 3822917 - Female Deutsch/AMP/Metri-Pack test lead</p>

Diagnosis and Repair:

1. Faulty intake manifold temperature sensor connections
 - a. Inspect the intake manifold temperature sensor and the harness connector pins.
 - i. Disconnect the engine harness connector from the intake manifold temperature sensor.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins
2. Faulty intake manifold temperature sensor
 - a. Check the resistance of the sensor
 - i. Disconnect the engine harness connector from the intake manifold temperature sensor.
 - ii. Measure the resistance between the intake manifold temperature signal pin and the intake manifold temperature return pin.
 - iii. Refer to the troubleshooting and repair manual for the specific engine platform for intake manifold temperature ranges.
3. Faulty engine harness
 - a. Inspect the engine harness and the extension harness connector pins.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, or expanded pins

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- Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins
- b. Check for a short circuit from pin to pin.
- i. Disconnect the engine harness connector from the extension harness.
 - ii. Disconnect the engine harness from the intake manifold temperature sensor.
 - iii. Disconnect the engine harness from all sensors that have a shared return with the intake manifold temperature sensor.
 - iv. Measure resistance from:
 - A. The intake manifold temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector
 - B. The resistance from the intake manifold temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connectorIf all measurements are greater than 100k Ohms, then the resistance is correct.
- c. Check for an open circuit.
- i. Disconnect the engine harness connector from the extension harness.
 - ii. Disconnect the engine harness from the intake manifold
 - iii. Measure the resistance from:
 - A. The intake manifold temperature return pin on the engine harness inline connector to the intake manifold temperature return pin at the engine harness sensor connector
 - B. The intake manifold temperature signal pin on the engine harness inline connector to the intake manifold temperature signal pin at then engine harness sensor connectorIf the measurement is less than 10 Ohms, then the resistance is correct.
4. Faulty extension harness
- a. Inspect the extension harness for:
- Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins
- b. Check for an open circuit.
- i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from:
 - A. The intake manifold temperature return pin on the extension harness connector to the intake manifold temperature return pin at the extension harness inline connector
 - B. The intake manifold temperature signal pin on the extension harness connector to the intake manifold temperature signal pin at then engine harness inline connectorIf the measurement is less than 10 Ohms, then the resistance is correct.
- c. Check for a short circuit from pin to pin.
- i. Disconnect the extension harness from the engine harness.
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- ii. Measure the resistance from:
 - A. The intake manifold temperature return pin on the extension harness connector to all other pins in the extension harness connector
 - B. The intake manifold temperature signal pin on the extension harness connector to all other pins in the extension harness connector

If all measurements are greater than 100k Ohms, then the resistance is correct.

9.8.12 Code 154 - Intake Manifold Temperature OOR Low (Warning)

Logic: Engine intake manifold temperature sensor signal is out of range – shorted low.

Possible Causes:

1. Faulty intake manifold temperature sensor connections
2. Faulty intake manifold temperature sensor
3. Faulty engine harness
4. Faulty extension harness

NOTICE

<p>Part Number 3822758 - Male Deutsch/AMP/Metri-Pack test lead Part Number 3822917 - Female Deutsch/AMP/Metri-Pack test lead</p>

Diagnosis and Repair:

1. Faulty intake manifold temperature sensor connections
 - a. Inspect the intake manifold temperature sensor and the harness connector pins.
 - i. Disconnect the engine harness connector from the intake manifold temperature sensor.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins
2. Faulty intake manifold temperature sensor
 - a. Check the resistance of the sensor
 - i. Disconnect the engine harness connector from the intake manifold temperature sensor.
 - ii. Measure the resistance between the intake manifold temperature signal pin and the intake manifold temperature return pin.
 - iii. Refer to the troubleshooting and repair manual for the specific engine platform for intake manifold temperature ranges.
 - b. Check for a short circuit to engine block ground.
 - i. Disconnect the engine harness connector from the intake manifold temperature sensor.
 - ii. Measure the resistance from one of the pins of the intake manifold temperature sensor connector to engine block ground. If the resistance is more than 100k Ohms, the sensor is operating correctly.

3. Faulty engine harness

- a. Inspect the engine harness and the extension harness connector pins.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins
- b. Check for a short circuit from pin to pin.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Disconnect the engine harness from the intake manifold temperature sensor.
 - iii. Disconnect the engine harness from all sensors that have a shared return with the intake manifold temperature sensor.
 - iv. Measure the resistance from:
 - A. The intake manifold temperature return pin on the engine harness inline connector to all other pins in the engine harness inline connector
 - B. The intake manifold temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector
 - v. If all measurements are greater than 100k Ohms, then the resistance is correct.
- c. Check for a short circuit to engine block ground.
 - i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from the intake manifold temperature signal pin on the extension harness connector to the engine block ground.
 - iii. If the measurement is more than 100k Ohms, then the resistance is correct.
- d. Check for an open circuit.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Disconnect the engine harness from the intake manifold
 - iii. Measure the resistance from:
 - A. The intake manifold temperature return pin on the engine harness inline connector to the intake manifold temperature return pin at the engine harness sensor connector
 - B. The intake manifold temperature signal pin on the engine harness inline connector to the intake manifold temperature signal pin at then engine harness sensor connector

If the measurement is less than 10 Ohms, then the resistance is correct.

4. Faulty extension harness

- a. Inspect the extension harness for:
 - Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals

- Dirt or debris in or on the connector pins
- b. Check for a short circuit to engine block ground.
 - i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from:
 - A. The intake manifold temperature signal pin on the extension harness connector to engine block ground
 - B. The intake manifold temperature return pin on the extension harness connector to engine block ground

If all measurements are greater than 100k Ohms, then the resistance is correct.
- c. Check for a short circuit from pin to pin AUX 105.
 - i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from:
 - A. The intake manifold temperature return pin on the extension harness connector to all other pins in the extension harness connector
 - B. The intake manifold temperature signal pin on the extension harness connector to all other pins in the extension harness connector

If all measurements are greater than 100k Ohms, then the resistance is correct.
- d. Check for an open circuit.
 - i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from:
 - A. The engine oil temperature return pin on the extension harness connector to the engine oil temperature return pin at the extension harness inline connector
 - B. The engine oil temperature signal pin on the extension harness connector to the engine oil temperature signal pin at the extension harness inline connector

If the measurement is less than 10 Ohms, then the resistance is correct.

9.8.13 Code 155 - Intake Manifold Temperature High (Shutdown)

Logic: The engine intake manifold temperature has exceeded 95 °C (203 °F) for greater than 10 seconds.

Possible Causes:

1. High ambient temperature
2. Radiator blocked
3. Closed or damaged louvers
4. Damaged or obstructed charge air cooler fins or radiator fins
5. Broken or loose fan belt
6. Malfunctioning fan drive or fan controls
7. Inaccurate coolant temperature sensor
8. Fault simulation feature enabled
9. Incorrect threshold setting

Diagnosis and Repair:

1. High ambient temperature
 - a. Use a thermocouple to verify the air temperature entering the intake louver of the generator set.
 - b. Reduce loads or recirculation of discharge air to the generator set in an elevated ambient temperature.
2. Radiator blocked
 - Inspect the radiator for debris or blockages. Remove blockage or winterfront if necessary.
3. Closed or damaged louvers
 - a. Inspect the louvers for proper operation. Repair or replace them if damaged.
 - b. Check the louver motor for proper operation. If the louver motor is operational, verify the louver shutter thermostat is operational.
4. Damaged or obstructed charge air cooler fins or radiator fins
 - Inspect for dirt, debris or obstructions. Clean and/or remove obstructions if necessary.
5. Broken or loose fan belt
 - Inspect for dirt, debris or obstructions. Clean and/or remove obstructions if necessary.
6. Malfunctioning fan drive or fan controls
 - Inspect for dirt, debris or obstructions. Clean and/or remove obstructions if necessary.
7. Inaccurate coolant temperature sensor
 - a. Use a thermocouple or similar device to measure the coolant temperature near the sender. Compare that to the coolant temperature displayed.
 - b. Measure the temperature sender resistance. Compare that to the specifications called out in the engine manual.
 - c. Verify continuity from the temperature sender wire to the engine ECM. The harness resistance should be less than 5 Ohms.
 - d. Repair or replace any faulty components or wiring.
8. Fault simulation feature enabled
 - a. Use the service tool to connect to the engine ECM. Verify the fault override toggle is disabled.
 - b. Reconfigure the generator set and disable fault overrides.
9. Incorrect threshold setting
 - a. Use the service tool to connect to the engine ECM and verify fault threshold settings. Compare to the specifications in the engine manual.
 - b. Verify ECM and PCC calibration number and revision is correct.
 - c. Recalibrate the engine ECM to reset the threshold settings.

9.8.14 Code 195 - Coolant Level Sensor OOR High (Warning)

Logic: Coolant level sensor signal is out of range – shorted high.

Possible Causes:

1. Faulty coolant level sensor connections
2. Faulty coolant level sensor

3. Faulty control board

Diagnosis and Repair:

1. Faulty coolant level sensor connections

- a. Inspect the coolant level sensor and the main harness connector pins.
 - i. Disconnect the main harness connector from the coolant level sensor.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins

2. Faulty coolant level sensor

- a. Check the resistance of the sensor.
 - i. Disconnect the main harness connector from the coolant level sensor.
 - ii. Measure the resistance between the coolant level sensor signal pin and the coolant level sensor return pin.
 - iii. Measure the voltage between the coolant level sensor signal pin and the coolant level sensor return pin. The voltage should be lower than 2.00 VDC.
 - iv. If the voltage is higher than the specification above, replace the sensor.

3. Faulty control board

- a. Check the coolant level sensor output voltage at the control board.
 - i. If the sensor output is OK, check for coolant level sensor voltage at J20-17 to J20-5.
 - ii. If OK, replace the base board. If not OK, use continuity checks to isolate connectors and/or harness.

9.8.15 Code 196 - Coolant Level Sensor OOR Low (Warning)

Logic: Coolant level sensor signal is out of range – shorted low.

Possible Causes:

1. Faulty coolant level sensor connections and wiring
2. Faulty coolant level sensor
3. Faulty control board

Diagnosis and Repair:

1. Faulty coolant level sensor connections and wiring

- a. Inspect the coolant level sensor and the main harness connector pins.
 - i. Disconnect the main harness connector from the coolant level sensor.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins

- Damaged or shorting wiring
2. Faulty coolant level sensor
 - a. Check the resistance of the sensor.
 - i. Disconnect the main harness connector from the coolant level sensor.
 - ii. Measure the resistance between the coolant level sensor signal pin and the coolant level sensor return pin.
 - iii. Measure the voltage between the coolant level sensor signal pin and the coolant level sensor return pin. The voltage should be lower than 2.00 VDC.
 - iv. If the voltage is higher than the specification above, replace the sensor.
 3. Faulty control board
 - a. Check the coolant level sensor output voltage at the control board.
 - i. If the sensor output is OK, check for coolant level sensor voltage at J20-17 to J20-5.
 - ii. If OK, replace the base board. If not OK, use continuity checks to isolate connectors/harness.

9.8.16 Code 197 - Coolant Level Low (Warning)

Logic: The coolant level sensor signal shows a low coolant level for greater than 10 seconds.

Possible Causes:

1. Low coolant
2. Faulty coolant level sensor

Diagnosis and Repair:

1. Low coolant
 - a. Verify that the engine coolant is at the appropriate level.
 - b. Remove the radiator cap and check that the coolant is up to the required level.
 - c. If the coolant is below 2.54 cm (1 in) from the top of the radiator, add the manufacturer's prescribed coolant.
2. Faulty coolant level sensor
 - a. Disconnect the engine harness connector from the sensor.
 - b. Reconnect the sensor and measure the voltage between the coolant level sensor signal pin and the coolant level sensor return pin. Voltage should be lower than 2 VDC.
 - c. If voltage is higher than above specification, replace the sensor.

9.8.17 Code 234 – Engine Speed High (Shutdown)

Logic:

Engine speed signals indicate an engine speed greater than shutdown threshold.

Possible Causes:

1. Fault simulation feature is enabled
2. Incorrect threshold setting
3. Incorrect fuel type setting
4. Faulty engine speed sensor connections

5. Faulty engine harness
6. Faulty extension harness
7. Faulty engine speed/position sensor

Diagnosis and Repair:

1. Fault simulation feature is enabled
 - a. Connect InPower
 - b. Verify that the fault simulation is not enabled for the engine speed sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
 2. Incorrect threshold setting
 - a. Connect InPower
 - b. Verify that fault threshold is within the normal operating range for the engine overspeed sensor. Refer to the engine manual for correct threshold values and make the appropriate changes using InPower.
 3. Incorrect fuel type setting
 - a. Connect InPower
 - b. Verify the fuel source set with InPower is the same fuel used by the generator.
 4. Faulty engine speed sensor connections
 - a. Inspect the engine speed sensor and the harness connector pins.
 - b. Disconnect the engine harness connector from the engine speed sensor.
 - c. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - d. Inspect for evidence of moisture in or on the connector.
 - e. Inspect for missing or damaged connector seals.
 - f. Inspect for dirt or debris in or on the connector pins.
 5. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - b. Disconnect the engine harness connector from the extension harness.
 - c. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - d. Inspect for evidence of moisture in or on the connector.
 - e. Inspect for missing or damaged connector seals.
 - f. Inspect for dirt or debris in or on the connector pin.
 - g. Disconnect harness from ECM and sensor.
 - h. Measure the resistance in each pin from ECM to sensor. Resistance should be 5 ohms or less.
 - i. Repair or replace harness as necessary.
 6. Faulty engine speed/position sensor
 - a. Inspect the engine speed sensor.
 - b. Disconnect the engine speed/position sensor from the engine and engine harness.
 - c. Inspect sensor for bent, corroded or loose pins.
 - d. Inspect the sensor for structural deficiencies.
 - e. Check the crankshaft speed sensor supply voltage.
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- f. Disconnect the engine harness connector from the crankshaft speed sensor.
- g. Install the speed sensor breakout cable between the sensor and the sensor harness connector.
- h. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
- i. Check the crankshaft speed sensor signal (sense) voltage.
- j. Disconnect the engine harness connector from the camshaft position sensor.
- k. Install the speed/position sensor breakout cable between the sensor and the sensor harness connector.
- l. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 VDC, then the signal voltage is correct. If not, sensor is faulty.

9.8.18 Code 359 – Fail to Start (Shutdown)

Logic:

Engine has failed to start after the last crank cycle.

Possible Causes:

1. Faulty glow relay or glow plug settings
2. Faulty ignition relay
3. Incorrect flywheel teeth setting
4. Incorrect starter disconnect speed
5. Faulty engine harness

Diagnosis and Repair:

1. Glow plugs
 - a. Check the glow plug relay at J11-6 and J11-7. When active, J11-6 should have B+, and J11-7 should be ground.
 - b. Connect to the control via InPower.
 - Make sure *Glow Plug Enable* is enabled.
 - Make sure *Max Preheat Temperature* and *Min Preheat Temperature* are set appropriately. *Min Preheat Temperature* should be less than *Max Preheat Temperature*.
 - Make sure *Max Glow Time* is set appropriately.
2. Ignition relay
 - a. Check the ignition relay at J11-6 and J11-7. When normal operation, J11-6 should have B+, and J11-7 should be ground.
3. Flywheel teeth
 - a. Connect to the control via InPower. Make sure *Teeth Pulses per Revolution* matches the actual number of flywheel teeth.
4. Starter disconnect
 - a. Connect to the control via InPower. Make sure *Starter Disconnect Speed* is set to a reasonable value. Check the engine manual.

5. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - i. Disconnect the engine harness connector.
 - ii. Inspect for corroded pins, bent or broken pins, and pushed-back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
 - b. Check for a short circuit from pin to pin.
 - i. Disconnect the engine harness connector from the oil pressure sensor.
 - ii. Disconnect the engine harness connector from all sensors that have a shared supply or return with the oil pressure sensor.
 - iii. Measure the resistance from oil pressure 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - iv. Measure the resistance from oil pressure return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - v. Measure the resistance from oil pressure signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - vi. If all the measurements are greater than 100k ohms, then the resistance is correct
 - c. Check for an open circuit.
 - i. Disconnect the engine harness connector from the oil pressure sensor.
 - ii. Measure the resistance from oil pressure return pin on the engine harness inline connector to the oil pressure return pin on the engine harness sensor connector.
 - iii. If the measurement is less than 10 ohms, then the resistance is correct.

9.8.19 Code 415 - Engine Oil Pressure Low (Shutdown)

Logic:

Engine oil pressure is below the low oil pressure shutdown threshold.

Possible Causes:

1. Lubricating oil level is low
2. External leak
3. Lubricating oil cooler is plugged
4. Oil pressure sensor is inaccurate or blocked
5. Fault simulation is enabled or the threshold is set too high
6. Incorrect calibrations in PowerCommand controls
7. Main oil pressure regulator is faulty
8. Lubricating oil pump is faulty

Diagnosis and Repair:

1. Lubricating oil level is low
 - a. Check the oil level. Add or drain oil, if necessary. (Refer to the procedure in the Service manual).

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2. External leak
 - a. Inspect the engine and surrounding area for external oil leaks.
 - b. Tighten the cap screws, pipe plugs, and fittings.
 - c. Replace gaskets, if necessary.
 3. Lubricating oil cooler is plugged
 - a. Visually inspect the oil cooler for cleanliness.
 - b. Refer to the engine manual for instructions on how to clean the oil cooler housing.
 4. Oil pressure sensor is inaccurate or blocked
 - a. Connect a mechanical oil pressure gauge of known quality and calibration to the engine at one of the plugs on top of the oil filter head.
 - b. Connect InPower.
 - c. While the engine is stopped, compare the oil pressure reading on the service tool to the reading on the mechanical oil pressure gauge.
 - d. Only proceed if engine troubleshooting has been completed. Do not attempt to start the engine if there is doubt about oil pressure.
 - e. Start the generator set.
 - f. Compare the oil pressure reading on the service tool to the reading on the mechanical oil pressure gauge.
 - g. Refer to the engine specification in the service manual for the specific engine platform for oil pressure ranges.
 5. Fault simulation is enabled or the threshold is set too high
 - a. Connect to the control with InPower and ensure that the fault simulation for LOP is not enabled.
 - b. Using the electronic service tool, verify that the fault threshold is **not** within the normal operating range for the oil pressure sensor. Refer to the service manual for normal operating range.
 6. Incorrect calibrations in PowerCommand controls
 - a. Using the display or the InPower Service tool, verify the calibration in the PCC.
 - i. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
 - ii. Verify that the feature is defined properly for sensor/sender/switch with 2 wires or 3 wires in calibration.
 7. Main oil pressure regulator is faulty
 - a. For further information, refer to the engine service manual.
 8. Lubricating oil pump is faulty
 - a. For further information, refer to the engine service manual.

9.8.20 Code 421 - Engine Oil Temperature High (Warning)

Logic: The control has detected the engine oil temperature has exceeded the warning threshold.

Possible Causes:

1. High ambient temperature

2. Blocked radiator
3. Closed or damaged louvers
4. Damaged or obstructed charge air cooler fins or radiator fins
5. Coolant level below specification
6. Damaged fan shroud or air recirculation baffles
7. Broken or loose fan belt
8. Malfunctioning fan drive or fan controls
9. Faulty thermostat
10. Collapsed, restricted or leaking cooling system hose
11. Intake manifold air temperature above specification
12. Malfunctioning water pump
13. Inaccurate or faulty oil temperature sensor
14. Enabled fault simulation
15. Threshold set too high

Diagnosis and Repair:

1. High ambient temperature
 - a. Use a thermocouple to verify the air temperature entering the intake louver of the generator set.
 - b. Reduce loads or recirculation of discharge air to the generator set in an elevated ambient temperature.
2. Blocked radiator
 - a. Inspect the radiator for debris or blockages.
 - b. Remove blockage or winter front if necessary.
3. Closed or damaged louvers
 - a. Inspect the louvers for proper operation.
 - b. Repair or replace the louvers if damaged.
 - c. Check the louver motor for proper operation.
 - d. If the louver motor is operational, verify that the louver shutter thermostat is operational.
4. Damaged or obstructed charge air cooler fins or radiator fins
 - a. Inspect for dirt, debris or obstructions.
 - b. Clean if necessary.
5. Coolant level below specification
 - a. Inspect the engine, cooling system, and surrounding area for external coolant leaks.
 - b. Repair as required.
 - c. Inspect the coolant level is correct via the sight glass.
 - d. Add coolant if necessary.
6. Damaged fan shroud or air recirculation baffles
 - a. Inspect shroud and baffles for damage and clearance.

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- b. Repair or replace if damaged.
 7. Broken or loose fan belt
 - a. Inspect belt(s) for damage, wear, and proper tension.
 - b. Repair or replace if damaged or worn.
 8. Malfunctioning fan drive or fan controls
 - a. Inspect pulleys and belt tensioner for damage or wear.
 - b. Repair or replace if damaged or worn.
 9. Faulty thermostat
 - a. Remove thermostat and inspect/test for proper operation.
 - b. Replace if damaged or malfunctioning.
 10. Collapsed, restricted or leaking cooling system hose
 - a. Inspect upper and lower radiator hoses for collapse, distortion, or fluid leaks.
 - b. Replace any hoses that are damaged or worn.
 11. Intake manifold air temperature above specification
 - a. Use the thermocouple to verify the manifold air temperature.
 - b. Repair or replace faulty aftercooler components.
 12. Malfunctioning water pump
 - a. Inspect the water pump for proper operation.
 - b. Replace the water pump if damaged or worn.
 13. Inaccurate or faulty oil temperature sensor
 - a. Use a thermocouple or similar device to measure oil temperature near sender and compare to oil temperature displayed.
 - b. Measure the temperature sender resistance. Compare that to the specifications in the engine manual.
 - c. Verify continuity from the temperature sender wire pin to the engine ECM pin. The harness resistance should be less than 5 Ohms.
 - d. Repair and/or replace faulty components or wiring.
 14. Enabled fault simulation
 - a. Use the service tool to connect to the engine ECM and verify fault override toggle is disabled.
 - b. Reconfigure the generator set and disable fault overrides.
 15. Threshold set too high
 - a. Use the service tool to connect to the engine ECM and verify fault threshold settings. Compare that to the specifications in the engine manual.
 - b. Verify the ECM and PCC calibration number and revision are correct.
 - c. Recalibrate the engine ECM to reset the threshold settings.

9.8.21 Code 426 - J1939 Data Link Cannot Transmit

Logic: Communication between the ECM and another device on the SAE J1939 data link has been lost.

Possible Causes:

1. Communication error
2. Faulty engine harness

Diagnosis and Repair:

1. Communication error
 - a. Check for ECM communication with the Global Control Platform (GCP) Display or 4G service tool (latest version).
 - i. Connect the INLINE data link adapter to SAE J1939 data link diagnostic connector.
 - ii. Attempt to communicate with the ECM using the Global Control Platform (GCP) Display or 4G service tool (latest version).
2. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Inspect for:
 - Corroded pins, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pin

9.8.22 Code 427 - CAN Data Link Degraded

Logic:

Communication between the engine control (ECM) and the generator set control is severed.

Possible Causes:

1. The Engine ECM has lost power or failed
2. The CAN datalink has failed

Diagnosis and Repair:

1. The Engine ECM has lost power or failed
 - a. Emergency (E-Stop) button is a closed relay when it is pulled out (not active), and open relay when depressed (active). The E-Stop button on the Operator Panel disables power to the engine ECM when it is depressed (active); CAN-LINK communication will cease when power to the ECM is lost. Ensure that the E-Stop is not active on the control. Follow the procedure below:

Reset the Local/Remote Emergency Stop

 - i. Pull-out (not active) the Local/Remote Emergency Stop button.
 - ii. Press the Off button on the Operator Panel.
 - iii. Press the Reset button.
 - iv. Select Manual or Auto as required.
 - b. Ensure that the emergency stop button is functioning correctly, measure the outputs of the E-Stop (Normally Open and Normally Closed contacts) and ensure that the outputs switch state correctly when engaged and disengaged, replace the switch if faulty.
 - c. Check the wiring from the base board.

- d. Keyswitch control relay is a normally open relay. Ensure that B+ is available at the relay input, then measure the voltage output. If there is a B+ at both the input and output of the Keyswitch control relay, the relay is not faulty. If B+ is noted at the input but not at the output of the Keyswitch control relay, replace the relay.
 - e. Connect to the engine ECM with InPower and/or Insite, to verify that the ECM is functioning properly and is communicating with the CAN-LINK network. Refer to the engine service manual for ECM troubleshooting procedures, if the ECM is faulty, then replace.
2. The CAN datalink has failed
 - a. There is a defective datalink harness connection, or open circuit; inspect the Datalink harness and connector pins from J11-20 to J1939+ and from J11-19 to J1039-; also check the shield ground connection at J11-17.
 - b. Check the terminating resistors. With connector J11 disconnected from the base board and the engine datalink connection disconnected from the ECM control, measure resistance between pins J11-19 and J11-20 (60 ohms is satisfactory). If the resistance is not 60 ohms, check the terminating resistors. Each of the two terminating resistors should be 120 ohms, replace if not 120 ohms.

9.8.23 Code 436 – AUX 101 Intake Manifold Temperature ORR (Warning)

Logic:

Intake manifold temperature sensor voltage is out of range.

Possible Causes:

1. Faulty intake manifold temperature sensor connections
2. Faulty intake manifold temperature sensor
3. Faulty engine harness
4. Faulty extension harness
5. Verify controller calibrations

Diagnosis and Repair:

1. Faulty intake manifold temperature sensor connections
 - a. Inspect the intake manifold temperature sensor and the engine harness connector pins.
 - i. Disconnect the engine harness connector from the intake manifold temperature sensor.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
2. Faulty intake manifold temperature sensor
 - a. Check the resistance of the sensor.
 - i. Disconnect the engine harness connector from the intake manifold temperature sensor.
 - ii. Measure the resistance between the intake manifold temperature sensor signal pin and the intake manifold temperature sensor return pin.

3. Faulty engine harness

- a. Inspect the engine harness and the connector pins.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pin.
- b. Check for a short circuit from pin to pin.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Disconnect the engine harness from the intake manifold temperature sensor.
 - iii. Disconnect the engine harness from all sensors that have a shared return with the intake manifold temperature sensor.
 - iv. Measure the resistance from the intake manifold temperature sensor return pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - v. Measure the resistance from the intake manifold temperature sensor signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - vi. If all measurements are greater than 100k Ohms, then the resistance is correct.
- c. Check for a short circuit to engine block ground.
 - i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from the intake manifold temperature sensor signal pin on the extension harness connector to the engine block ground.
 - iii. If the measurement is more than 100k ohms, then the resistance is correct.
- d. Check for an open circuit.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Disconnect the engine harness from the intake manifold temperature sensor.
 - iii. Measure the resistance from the intake manifold temperature sensor return pin on the engine harness inline connector to the intake manifold temperature sensor return pin at the engine harness sensor connector.
 - iv. Measure the resistance from the intake manifold temperature sensor signal pin on the engine harness inline connector to the intake manifold temperature sensor signal pin at the engine harness sensor connector.
 - v. If the measurement is less than 10 ohms, then the resistance is correct.

4. Faulty extension harness

- a. Inspect the extension harness connector pins.
 - i. Disconnect the extension harness connector.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.

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- b. Check for a short circuit to engine block ground.
 - i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from the intake manifold temperature sensor signal pin on the extension harness connector to engine block ground.
 - iii. Measure the resistance from the intake manifold temperature sensor return pin on the engine harness connector to engine block ground.
 - iv. If all measurements are greater than 100k ohms, then the resistance is correct.
 - c. Check for a short circuit from pin to pin.
 - i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from the intake manifold temperature sensor return pin on the extension harness connector to all other pins in the extension harness connector.
 - iii. Measure the resistance from the intake manifold temperature sensor signal pin on the extension harness connector to all other pins in the extension harness connector.
 - iv. If all measurements are greater than 100k ohms, then the resistance is correct.
 - d. Check for an open circuit.
 - i. Disconnect the extension harness from the engine harness.
 - ii. Measure the resistance from the intake manifold temperature sensor return pin on the extension harness connector to the intake manifold temperature sensor return pin at the extension harness inline connector.
 - iii. Measure the resistance from the intake manifold temperature sensor signal pin on the extension harness connector to the intake manifold temperature sensor signal pin at the extension harness inline connector.
 - iv. If the measurement is less than 10 ohms, then the resistance is correct.
5. Verify controller calibrations
- a. Using the display or the InPower Service tool, verify the calibration in the PCC.
 - i. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
 - b. Using the InSite Service tool, verify the calibration in the ECM.
 - i. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

9.8.24 Code 441 - Battery Voltage Low (Warning)

Logic:

Battery voltage low.

Possible Causes:

1. Damaged battery cable connections
2. Low battery voltage
3. Bad battery ground connection
4. Damaged accessory wiring at B+
5. Damaged OEM battery harness
6. Damaged engine harness

7. Discharged or defective battery
8. Alternator not functioning properly
9. Incorrect battery setting

NOTICE
Part Number 3822758 - Male Deutsch/AMP/Metri-Pack test lead Part Number 3822917 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Damaged battery cable connections
 - a. Inspect the battery cable connections.
 - i. Inspect connections for corrosion.
 - ii. Inspect connections for loose connections.
2. Low battery voltage
 - a. Measure the battery voltage.
 - i. Measure the battery voltage from the positive (+) terminal to the negative (-) terminal. If the voltage is between 11.0 to 14.2 V on a 12 VDC system and 17.3 and 34.7 V on a 24 VDC system, then the voltage is within normal range.
3. Bad battery ground connection
 - a. Inspect the battery ground connection.
 - i. Disconnect the engine harness.
 - ii. Measure the resistance from the negative (-) battery terminal to the engine block ground. If the resistance is less than 10 ohms, then there exists proper grounding. If the resistance is greater than 10 ohms, then the battery ground connection is in need of repair.
4. Damaged accessory wiring at B+
 - a. Check for add-on or accessory wiring at the positive (+) terminal of the battery.
 - i. Starting at the positive (+) terminal, follow any add-on or accessory wiring and examine the wire(s) for damaged insulation or installation error that can cause supply wire to be shorted to the engine block.
5. Damaged OEM battery harness
 - a. Inspect the OEM battery harness and the Inline E connector pins.
 - i. Disconnect the OEM battery harness from the Inline E connector.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt and debris in or on the connector pins.
 - b. Check for an open circuit.
 - i. Disconnect the OEM battery harness from the engine.
 - ii. Disconnect the positive (+) battery terminal.

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- iii. Measure the resistance from all pins being supplied by unswitched battery on the OEM battery harness at the Inline E connector to the positive (+) battery terminal connector. If the resistance is less than 10 ohms, then there is not an open circuit. If the resistance is greater than 10 ohms, then there is an open circuit that is in need of repair.
 - c. Check for a short circuit from pin to pin.
 - i. Disconnect the engine harness.
 - ii. Disconnect the positive (+) battery terminal.
 - iii. Measure the resistance from all unswitched battery pins on the Inline E connector to all other pins on the Inline E connector. If the resistance is more than 100k ohms, then there is not a short circuit. If the resistance is less than 100k ohms, then there is a short circuit that is in need of repair.
6. Damaged engine harness
- a. Inspect the engine harness fuse connection. Inspect for correct installation.
 - b. Check the engine harness fuse.
 - i. Disconnect the 20 amp fuse from the OEM harness.
 - ii. Inspect that the 20 amp to verify the fuse is not blown.
 - c. Inspect the engine harness and the extension harness inline connector pins.
 - i. Disconnect the engine harness.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt and debris in or on the connector pins.
 - d. Check for an open circuit.
 - i. Disconnect the OEM battery harness from the engine connector.
 - ii. Disconnect the positive (+) battery terminal.
 - iii. Measure the resistance from all pins being supplied by unswitched battery on the OEM battery harness at the Inline E connector to the positive (+) battery terminal connector. If the resistance is less than 10 ohms, then there is not an open circuit. If the resistance is greater than 10 ohms, then there is an open circuit that is in need of repair.
 - e. Check for a short circuit from pin to pin.
 - i. Disconnect the engine harness.
 - ii. Disconnect the positive (+) battery terminal.
 - iii. Measure the resistance from all unswitched battery pins on the Inline E connector to all other pins on the Inline E connector. If the resistance is more than 100k ohms, then there is not a short circuit. If the resistance is less than 100k ohms, then there is a short circuit that is in need of repair.
7. Discharged or defective battery
- a. Measure the voltage of the battery with a voltmeter. Battery voltage should be 12 VDC or greater in a 12 V system and 24 VDC or greater in a 24 V system. If the battery voltage is low, check the electrolyte level. Replenish the electrolyte level if low and recharge the battery; the specific gravity of a fully charged lead acid battery is approximately 1.260 at 80 °F (27 °C).
 - b. If the battery cannot hold adequate voltage, then replace the battery.

8. Alternator not functioning properly
 - a. Check the engine DC alternator. If charging voltage is not 12-14 VDC for a 12 V system, or 24-26 VDC in a 24 V system, replace the alternator.
9. Incorrect battery setting
 - a. Verify that the battery voltage (12V or 24V) matches calibration.

9.8.25 Code 442 - Battery Voltage High (Warning)

Logic:

Battery voltage high.

Possible Causes:

1. Incorrect battery voltage setup
2. The voltage of the battery is above the high battery voltage threshold
3. Battery charger is overcharging the battery
4. Faulty engine DC alternator

NOTICE

Part Number 3822758 - Male Deutsch/AMP/Metri-Pack test lead

Part Number 3822917 - Female Deutsch/AMP/Metri-Pack test lead

Diagnosis and Repair:

1. Incorrect battery voltage setup
 - a. Measure the voltage of the battery with a voltmeter. Battery voltage of lead acid batteries should be between 12-14 VDC in a 12 VDC system or 24-28 VDC in a 24 VDC system. Verify that the battery voltage matches the voltage that the control is calibrated for. If the generator set has a 24 V battery, but the control is calibrated to 12 V, the high battery voltage alarm will activate. In these cases, change the voltage on the control to 24 V using InPower.
2. The voltage of the battery is above the high battery voltage threshold
 - a. Voltage of the battery is above the “High Battery” threshold for the time set in the “High Battery Time Set” parameter. Using InPower, change the battery voltage setup of the control accordingly.
3. Battery charger is overcharging the battery
 - a. Ensure that the battery charger is charging the battery at an acceptable rate and not overcharging the battery. Adjust the charge rate of the battery if the charge rate is above the recommendation of the manufacturer.
 - b. Refer to the battery charger OEM manual.
4. Faulty engine DC alternator
 - a. Check the engine DC alternator for overcharging conditions. If charging voltage is not 12-14 VDC in a 12 VDC systems or 24-28 VDC in a 24 VDC system, replace the DC alternator.

9.8.26 Code 488 - Intake Manifold Temperature High (Warning)

Logic: Engine intake manifold temperature has exceeded 85 °C (185 °F) for more than 90 seconds.

Possible Causes:

1. High ambient temperature

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2. Blocked radiator
 3. Closed or damaged louvers
 4. Damaged or obstructed charge air cooler fins or radiator fins
 5. Broken or loose fan belt
 6. Malfunctioning fan drive or fan controls
 7. Inaccurate coolant temperature sensor
 8. Fault simulation feature enabled
 9. Incorrect threshold setting

Diagnosis and Repair:

1. High ambient temperature
 - a. Use a thermocouple to verify air temperature entering the intake louver of the generator set.
 - b. Reduce loads or recirculation of discharge air to the generator set in elevated ambient temperatures.
2. Blocked radiator
 - a. Inspect the radiator for debris or blockages.
 - b. Remove the blockage or winterfront if necessary.
3. Closed or damaged louvers
 - a. Inspect the louvers for proper operation.
 - b. Repair and/or replace any that are damaged.
 - c. Check the louver motor for proper operation.
 - d. If the louver motor is operational, verify the louver shutter thermostat is operational.
4. Damaged or obstructed charge air cooler fins or radiator fins
 - a. Inspect for dirt, debris or obstructions.
 - b. Clean and/or remove if necessary.
5. Broken or loose fan belt
 - a. Inspect belt(s) for damage, wear, and proper tension.
 - b. Repair and/or replace belts if necessary.
6. Malfunctioning fan drive or fan controls
 - a. Inspect the pulleys and belt tensioner for damage or wear.
 - b. Repair and/or replace faulty components if necessary.
7. Inaccurate coolant temperature sensor
 - a. Use a thermocouple or similar device to measure the coolant temperature near the sender. Compare that temperature to the coolant temperature displayed.
 - b. Measure the temperature sender resistance. Compare that to the specifications in the engine manual.
 - c. Verify continuity from the temperature sender wire to the engine ECM. Harness resistance should be less than 5 Ohms.
 - d. Repair and/or replace faulty components or wiring if necessary.

8. Fault simulation feature enabled
 - a. Use the service tool to connect to the engine ECM. Verify the fault override toggle is disabled.
 - b. Reconfigure the generator set and disable fault overrides if necessary.
9. Incorrect threshold setting
 - a. Use the service tool to connect to the engine ECM and verify fault threshold settings. Compare those to the specifications in the engine manual.
 - b. Verify the ECM and PCC calibration number and revision are correct.
 - c. Recalibrate the engine ECM to reset the threshold settings.

9.8.27 Code 781 - ECM CAN Datalink Has Failed

Logic:

Communication between the engine control module (ECM) and the generator set control is severed.

Possible Causes:

1. The Engine ECM has lost power or failed
2. The CAN datalink has failed

Diagnosis and Repair:

1. The Engine ECM has lost power or failed
 - a. Check the wiring from the base board.
 - b. Keyswitch control relay is a normally open relay. Ensure that B+ is available at the relay input, then measure the voltage output. If there is a B+ at both the input and output of the Keyswitch control relay, the relay is not faulty. If B+ is noted at the input but not at the output of the Keyswitch control relay, replace the relay.
 - c. Connect to the engine ECM with InPower and/or Insite, to verify that the ECM is functioning properly and is communicating with the CAN-LINK network. Refer to the engine service manual for ECM troubleshooting procedures, if the ECM is faulty, replace.
2. The CAN datalink has failed
 - a. There is a defective datalink harness connection, or open circuit; inspect the datalink harness and connector pins. Also check the shield ground connection.
 - b. Check the terminating resistors. With connector disconnected from the base board and the engine datalink connection disconnected from the ECM control, measure resistance between pins (60 ohms is satisfactory). If the resistance is not 60 ohms, check the terminating resistors. Each of the two terminating resistors should be 120 ohms, replace if not 120 ohms.

9.8.28 Code 1117 - ECM Power Lost (Warning)

Logic: Indicates that "Keyswitch" to the ECM was **not** removed for 30 seconds before removing battery power to the ECM (removing connectors or battery cable).

Diagnosis and Repair:

1. To reset:
 - a. Press the Off button.
 - b. Press E-Stop.
 - c. Wait 30 seconds; then remove E-Stop.
 - d. Select the desired operating mode (manual or remote).

9.8.29 Code 1244 – Engine Normal Shutdown

Logic:

A normal shutdown request has been received by the engine and no active shutdown with cooldown fault exists on the PCC (LBNG).

Possible Causes:

The generator set is going through a normal shutdown.

Diagnosis and Repair:

1. The generator set is going through a normal shutdown.
 - a. The generator set is going through a normal shutdown and there are no active shutdown fault(s) in the ECM for at least 2 seconds.

9.8.30 Code 1245 – Engine Shutdown Fault

Logic:

Engine shutdown fault has occurred in the engine ECM, and no other active shutdown faults exist on the PCC.

Possible Cause:

1. Engine shutdown fault

Diagnosis and Repair:

1. Engine shutdown fault
 - a. Event/fault code 1245 is activated by another active shutdown fault in the ECM. Connect to the Engine ECM with InPower or Insite to determine the actual shutdown fault that is generating event/ fault code 1245; then troubleshoot the shutdown fault(s) (Reference the Engine Service Manual).

9.8.31 Code 1248 – Engine Warning

Logic:

An engine warning fault has occurred in the engine ECM, and there are no active warning faults on the PCC.

Possible Cause:

1. An engine warning fault is active.

Diagnosis and Repair:

1. An engine warning fault is active.
 - a. Event/fault code 1248 is activated by another active warning fault in the ECM. Connect to the Engine ECM with InPower or Insite to determine the actual warning fault that is generating event/fault code 1248; then troubleshoot the warning fault(s) (Reference the Engine Service Manual).

9.8.32 Code 1311 - Ruptured Basin (Warning or Shutdown)

Logic: This fault is used when an optional ruptured basin switch is installed. The nature of the fault is an optional customer selection. The fault function can be programmed (using the InPower service tool) as follows:

- Enable/disable input (Default: enable)

- Status, Warning, or Shutdown (Default: #1-None, #2 and #3-Warning)
- Active closed or open (Default: closed [ground])
- Change the display name using up to 19 characters (Default: #1- Customer Fault 1, #2-Ground Fault, #3-Low Fuel)

Possible Causes:

1. A fault
2. External wiring problem

Diagnosis and Repair:

1. A fault
 - a. Correct the fault.
2. External wiring problem
 - a. Disconnect the signal lead from TB1 and reset the control (CONFIG INPUT 1 - TB1-12).
 - b. If the message goes away, the external wiring has a short circuit. Grounding of either input activates the fault.

9.8.33 Codes 1311 and 1312 – Customer Input #1 and #2 (Warning or Shutdown)

Logic:

The nature of the fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, Low Starting Hydraulic Pressure, Low Starting Air Pressure, etc.

Each of the fault functions can be programmed (using the InPower service tool), as follows:

- Enable/disable input (Default: enable)
- Status, Warning, or Shutdown (Default: #1-None, #2 and #3-Warning)
- Active closed or open (Default: closed [ground])
- Change the display name using up to 19 characters (Default: #1- Customer Fault 1, #2-Ground Fault, #3-Low Fuel)

Possible Cause:

If there is no actual fault, the problem may be an external wiring problem.

Diagnosis and Repair:

1. Disconnect the signal lead from TB1 and reset the control.
 - a. CONFIG INPUT 1 - TB1-12
 - b. CONFIG INPUT 2 - TB1-14
2. If the message goes away, the external wiring has a short circuit. Grounding of either input activates fault.

9.8.34 Code 1317 - Low Coolant Level (Warning or Shutdown)

Logic:

This fault is used when an optional coolant level sensor is installed. The nature of the fault is an optional customer selection.

The fault function can be programmed (using the InPower service tool), as follows:

- Enable/disable input (Default: enable)
- Status, Warning, or Shutdown (Default: #1-None, #2 and #3-Warning)
- Active closed or open (Default: closed [ground])
- Change the display name using up to 19 characters (Default: #1- Customer Fault 1, #2-Ground Fault, #3-Low Fuel)

Possible Cause:

1. Low coolant
2. No actual fault, external wiring problem

Diagnosis and Repair:

1. Low coolant
 - a. If the generator set is powering critical loads and cannot be shut down, wait until next shutdown period, then do the steps that follow.
 - i. Allow engine to cool completely.
 - ii. Check coolant level and replenish if low.
2. No actual fault, external wiring problem
 - a. Disconnect the signal lead from TB1 and reset the control.
 - CONFIG INPUT 1 - TB1-13
 - b. If the message goes away, the external wiring has a short circuit. Grounding of either input activates fault.

9.8.35 Code 1318 - Low Fuel (Warning or Shutdown)

Logic:

This fault is used when an optional low fuel level sensor is installed. The nature of the fault is an optional customer selection.

The fault function can be programmed using the InPower service tool, as follows:

- Enable/disable input (default: enable)
- Status, Warning, or Shutdown (default: #1-None, #2-Warning and #3-Warning)
- Active closed or open (default: closed [ground])

Change the display name using up to 19 characters (default: #1- Customer Fault 1, #2-Ground Fault, #3-Low Fuel)

Possible Cause:

1. Low fuel level
2. No actual fault, external wiring problem

Diagnosis and Repair:

1. Low fuel level.
 - a. Add manufacturer's prescribed fuel.
2. No actual fault, external wiring problem.
 - a. Disconnect the signal lead from TB1 and reset the control.
 - b. Configure input 1 - TB1-14.

- c. If the message goes away, the external wiring has a short circuit. Grounding of either input activates the fault.

9.8.36 Code 1417 - Power Down Failure

Logic:

The PCC has failed to go to sleep.

Possible Cause:

1. Incorrect calibrations in PowerCommand controls
2. Faulty baseboard

Diagnosis and Repair:

1. Incorrect calibrations in PowerCommand controls
 - a. Using the display or the InPower Service tool, verify the calibration in the PCC.
 - i. If the calibration in the PCC matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
2. Faulty baseboard
 - a. Remove power (B+) from the PCC for 5 to 10 seconds and reconnect B+ to the PCC.
 - i. If the PCC fails to go to sleep after power is cycled from the PCC and the PCC shows event/fault code 1417 again, replace the baseboard.

9.8.37 Code 1433 - Local E-Stop

Logic:

The Local Emergency Stop has been activated.

Possible Causes:

1. The Local Emergency Stop button has been activated
2. Faulty connection or faulty Emergency Stop switch

Diagnosis and Repair:

1. The Local Emergency Stop button has been activated
 - a. Reset the Local Emergency Stop:
 - i. Pull the Local Emergency Stop button out.
 - ii. Press the Off button.
 - iii. Press the Reset button.
 - iv. Select Manual or Auto as required.
2. Faulty connection or faulty Emergency Stop switch
 - a. Check the Emergency Stop button, and verify that it is working properly. The Emergency Stop button is a closed relay when it is pulled out (not active), and open relay when depressed (active).
 - b. Verify that the connection/wiring from the Local Emergency Stop switch to the PCC for an open circuit condition. A ground connection to the Local E-Stop control input (J25-2 Input; J25-6 Ground) disables the emergency stop alarm. An open circuit should activate the Emergency stop alarm.

9.8.38 Code 1434 - Remote E-Stop

Logic:

The state of the Remote Emergency Stop has been changed.

Possible Causes:

1. The Remote Emergency Stop button has been activated
2. Wiring error
3. Faulty connection or faulty Emergency Stop switch

Diagnosis and Repair:

1. The Remote Emergency Stop button has been activated
 - a. Reset the Remote Emergency Stop.
 - i. Pull the Remote Emergency Stop button out.
 - ii. Press the Off button.
 - iii. Press the Reset button.
 - iv. Select Manual or Auto as required.
2. Wiring error
 - a. Install the missing jumper between TB1-16 and TB1-15.
 - i. Install a jumper between TB1-16 Input and TB1-15 Ground.
 - ii. Reset the Remote Emergency Stop.
 - A. Pull the Remote Emergency Stop button out.
 - B. Press the Off button.
 - C. Press the Reset button.
 - D. Select Manual or Auto as required.
3. Faulty connection or faulty Emergency Stop switch
 - a. Check the Emergency Stop button, and verify that it is working properly. The Emergency Stop button is a closed relay when it is pulled out (not active), and an open relay when pressed (active).
 - i. Verify the connection and/or wiring from the Remote Emergency Stop switch to the PCC for an open circuit condition. A ground connection to the Remote E-Stop control input (TB1-16 Input; TB1-15 Ground) disables the Emergency Stop alarm. An open circuit should activate the Emergency Stop alarm.

9.8.39 Code 1435 - Low Coolant Temperature (Warning)

Logic:

The engine coolant temperature is below the low coolant temperature warning threshold (70 °F [21 °C] for 4BT3.3 engines).

Possible Causes:

1. Threshold is set too high
2. Coolant heater(s) is/are not operating properly
3. Low ambient temperature

NOTICE

In applications where the ambient temperature falls below 40 °F (4 °C), the Low Coolant Temp may be indicated even though the coolant heaters are operating.

Diagnosis and Repair:

1. Threshold is set too high
 - a. Verify that the LCT Warning Threshold is set to 70 °F (21 °C).
2. Coolant heater(s) is/are not operating properly
 - a. Make sure that the coolant heater(s) is/are connected properly to a power supply.
 - i. Make sure that the power supply is on and has power at the connection.
 - ii. Check for open circuits in the wiring.
 - iii. If the coolant temperature is greater than the heater thermostat setting, the coolant heater will not be active and will show an open circuit.
 - b. Measure the temperature of the coolant. If the coolant temperature is close to the ambient temperature when the ambient air temperature is below the coolant heater thermostat setting, replace the coolant heater(s).
 - c. If the ambient temperature is very low, do not replace the coolant heater. Check that the coolant heater thermostat is operating properly.
3. Low ambient temperature
 - a. If the coolant heater(s) is/are working properly and the radiator has enough coolant, but the ambient temperature around the generator set is very cold (less than 40 °F [4 °C]), the coolant heaters might not have the capability to keep the coolant temperature above the low coolant temperature warning threshold. This could be an application issue and will need to be further investigated.

9.8.40 Code 1438 - Fail to Crank (Shutdown)**Logic:**

The engine failed to crank after the generator control received a start signal.

Possible Cause:

1. Dead or weak battery
2. Blown 20 Amp supply fuse
3. Failed starter
4. Failed starter solenoid
5. Failed starter relay
6. Faulty Magnetic Pick-up
7. Engine or rotor is locked or binding
8. Failed Emergency Stop switch or wiring

Diagnosis and Repair:

1. Dead or weak battery
 - a. Verify battery voltage is at least 12 VDC (24 VDC where applicable).
 - b. Charge or replace the battery as necessary.

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2. Blown 20 Amp supply fuse
 - a. Verify the switched B+ supply fuse is in place and functional.
 - b. Replace fuse as necessary.
 3. Failed starter
 - a. Press the Reset/Fault Acknowledge button on the display.
 - b. Attempt to start the generator and test for B+ at the starter supply lug.
 - c. If B+ is present at the starter supply lug, the starter could be defective.
 4. Failed starter solenoid
 - a. Press the Reset/Fault Acknowledge button on the display.
 - b. Check wiring for continuity between terminal 87 on the starter relay and start solenoid SW terminal. Resistance should be less than 5 Ohms.
 - c. Attempt to start the generator and test for B+ at SW terminal of the starter solenoid.
 - d. Check wiring for continuity between the solenoid COM terminal and B+ lug of the battery. Resistance should be less than 5 Ohms.
 - e. Attempt to start the generator and test for B+ at the solenoid output lug.
 - f. If B+ is not present, the starter solenoid is defective.
 5. Failed starter relay
 - a. Check wiring for continuity between terminal 86 on the starter relay and J20-13 control board terminal. Resistance should be less than 5 Ohms.
 - b. Check wiring for continuity between terminal 85 on the starter relay and J20-15 control board terminal. Resistance should be less than 5 Ohms.
 - c. Check for B+ at terminal 30 on the starter relay. If voltage is not present, verify the 20 Amp fuse is in place and functional.
 - d. Attempt to start the generator and test for B+ at terminal 86 of the starter relay.
 - e. Check wiring for continuity between terminal 85 of the starter relay and ground. Resistance should be less than 5 Ohms.
 - f. Attempt to start the generator and test for B+ at terminal 87 of the starter relay.
 - g. If B+ is not present, the starter relay is defective.
 6. Faulty Magnetic Pick-up
 - a. If this generator set has an ECM, go to step number 4. For a Hydro-mechanical application, inspect the MPU wires/connector pins for shorts and open circuits. Remove the MPU connectors and check for 3.5 to 15 VAC at the MPU while cranking. If the MPU tests satisfactorily, then check the voltage output of the board at J11-9 (MPU +) and J11-10 (MPU -).
 7. Engine or rotor is locked or binding
 - a. Verify that the generator can rotate freely by barring the engine over by hand. If generator cannot be turned over, identify the source of bind, and repair as necessary.
 8. Failed Emergency Stop switch or wiring
 - a. Push Emergency Stop button in, remove the configurable leads from TB1-15 and TB1-16, and check for continuity between these two leads.
 - b. If the circuit is open, isolate to the Emergency Stop switch and wiring.
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- c. Push the Emergency Stop button in and remove P25 from the base board. Check for continuity between J25-2 and J25-6.
- d. Repair or replace the Emergency Stop switch or the wiring as necessary.

9.8.41 Code 1446 - High AC Voltage

Logic:

One or more of the phase voltages has exceeded the High AC Voltage Threshold (110% of nominal voltage, 10 seconds).

Possible Causes:

1. High AC Voltage Threshold is set too low
2. Faulty PCC control board (AVR circuit)
3. Improper connections at generator output terminals
4. Faulty PMG (if used)
5. Engine speed/frequency surge
6. Faulty EBS (Excitation Boost System) or EBS installed incorrectly (if used)

Diagnosis and Repair:

1. High AC Voltage threshold is set too low
 - a. Verify parameter settings.
2. Faulty PCC control board (AVR circuit)
 - a. Measure the output at J17-1 and J17-2 on the PCC board. The output should be at 3 - 30 VDC when the generator set is operating at "No Load".
 - i. If the voltage output of J17-1 and J17-2 is constantly above 30 VDC at no load, then the AVR portion of the baseboard is faulty. Replace the baseboard.
3. Improper connections at generator output terminals
 - a. Compare connections in the generator to the wiring schematic.
 - b. Correct according to the appropriate schematic if necessary.
4. Faulty PMG (if used)
 - a. Start the generator set and run at rated speed. Measure the voltages at the terminals P2 (J18-1) and P3 (J18-2). These should be balanced and within the range of 60 Hz generators 190 to 220 V.
5. Engine speed/frequency surge
 - a. Refer to fault codes 234 and 1449 for diagnosis.
6. Faulty EBS (Excitation Boost System) or EBS installed incorrectly (if used)
 - a. Connect with the InPower service tool and change the Local Status Output Function to Default.
 - b. Disconnect the EBS field jack from the alternator field plug.
 - c. Disconnect the EBS plug from the field jack (connected to P17-1, P17-2).
 - d. Reconnect the alternator field plug to the field jack.
 - e. The set is now connected in a Shunt configuration. Start the generator set and determine if the issue still exists.
 - f. If the problem does not exist, the EBS is faulty; replace it.

9.8.42 Code 1447 – Low AC Voltage (Shutdown)

Logic:

One or more of the phase voltages has dropped to 85% of nominal for more than 10 seconds.

Possible Causes:

1. Fault simulation feature is enabled
2. Incorrect threshold setting or AVR settings
3. Overload
4. Improper connections at generator output terminals
5. The voltage sense or setup wiring connection could be incorrect
6. Damaged voltage regulator
7. The rotating rectifier assembly (diodes CR1 through CR6) is faulty

Diagnosis and Repair:

1. Fault simulation feature is enabled
 - a. Connect InPower.
 - b. Verify that the fault simulation is NOT enabled for the engine speed sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
2. Incorrect threshold setting or AVR settings
 - a. Check threshold settings.
 - b. Connect InPower.
 - c. Verify that fault threshold is within the normal operating range for low AC voltage.
 - d. Verify AVR settings. Compare gains, settings, and calibration factors against default calibrations.
 - e. Adjust or recalibrate as necessary
3. Overload
 - a. Check for overload.
 - b. Check that load is within proper operating range.
 - c. Check inrush current.
 - d. Check for current spikes.
 - e. Check for motor starts.
 - f. Check operation by disconnecting the load and restarting the unit.
 - g. Correct any overload.
4. Improper connections at generator output terminals
 - a. Check connections.
 - b. Compare connections in generator to wiring schematic.
 - c. Correct according to the appropriate schematic as needed.
5. The voltage sense or setup wiring connection could be incorrect
 - a. Verify that the voltage sensing inputs J22-1, J22-2, J22-3, and J22-4 are connected to L1, L2, L3, and L4 respectively.

- b. Verify that excitation inputs J18–1 and J18–2 are connected to the correct generator PMG terminals.
6. Damaged voltage regulator
 - a. Bring the generator to idle.
 - b. Connect InPower.
 - c. Using InPower, verify that the AC voltage output is greater than residual.
 - d. If the AC voltage output is residual, than the regulator is operating correctly.
 - e. Inspect the voltage regulator and the generator control harness connector pins.
 - f. Turn off the generator.
 - g. Disconnect the generator control harness from the voltage regulator.
 - h. Visually inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
7. The rotating rectifier assembly (diodes CR1 through CR6) is faulty
 - a. Check each diode. See the alternator service manual.

9.8.43 Code 1471 - High AC Current (Warning)

Logic:

The generator output current has exceeded at least 110% of rated current for greater than 60 seconds.

Possible Causes:

1. Short or overload
2. Incorrect CTs, CT connections, or CT setup
3. CT harness connections
4. Incorrect rating setup

Diagnosis and Repair:

1. Short or overload
 - a. Inspect the load cables and the AC harness connections.
 - b. Disconnect the AC harness from the load cables.
 - c. Inspect the AC harness and board connector pins.
 - d. Visually inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - e. Check for a short circuit to engine block ground.
2. Incorrect CTs, CT connections, or CT setup
 - a. Check CTs.
 - i. Check that correct CT's have been installed.
 - ii. Check that CT connections are secure by zip ties to corresponding wires.
 - iii. Check that CTs are installed in the correct order.
 - iv. Connect InPower.
 - v. Verify the correct CT ratio has been entered in the generator setup.
 - vi. Adjust the setting(s) as necessary.

3. CT harness connections
 - a. Measure the resistance of the CT harness on each pin.
 - b. Disconnect connector P12 from the control board and CTs.
 - c. Verify the resistance from board connector to CT connections. Resistance should be 5 ohms or less.
 - d. Measure the resistance of each pin on the CT harness connector to engine block ground. Resistance should be open or infinite.
 - e. Verify the CT connections are correct from P12 to the CT terminals.
P12-1 (CT1) to P12-4 (CT1-COM)
P12-2 (CT2) to P12-5 (CT2-COM)
P12-3 (CT3) to P12-6 (CT3-COM)
 - f. Re-terminate connections as necessary.
4. Incorrect rating setup
 - a. Connect InPower.
 - b. Verify the generator rating in the control is set correctly.
 - c. Verify CT ratings in the control are set correctly.
 - d. Adjust settings as necessary.

9.8.44 Code 1472 - High AC Current (Shutdown)

Logic:

The generator output current has exceeded at least 150% of rated current.

Possible Causes:

1. Short or overload
2. Incorrect CTs, CT connections, or CT setup
3. CT harness connections
4. Incorrect rating setup

Diagnosis and Repair:

1. Short or overload
 - a. Inspect the load cables and the AC harness connections.
 - b. Disconnect the AC harness from the load cables.
 - c. Inspect the AC harness and board connector pins.
 - d. Visually inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - e. Check for a short circuit to engine block ground.
2. Incorrect CTs, CT connections, or CT setup
 - a. Check CTs.
 - i. Check that correct CT's have been installed.
 - ii. Check that CT connections are secure by zip ties to corresponding wires.
 - iii. Check that CTs are installed in the correct order.
 - iv. Connect InPower.

- v. Verify the correct CT ratio has been entered in the generator setup.
 - vi. Adjust the setting(s) as necessary.
3. CT harness connections
- a. Measure the resistance of the CT harness on each pin.
 - b. Disconnect connector P12 from the control board and CTs.
 - c. Verify the resistance from board connector to CT connections. Resistance should be 5 ohms or less.
 - d. Measure the resistance of each pin on the CT harness connector to engine block ground. Resistance should be open or infinite.
 - e. Verify the CT connections are correct from P12 to the CT terminals.
 - P12-1 (CT1) to P12-4 (CT1-COM)
 - P12-2 (CT2) to P12-5 (CT2-COM)
 - P12-3 (CT3) to P12-6 (CT3-COM)
 - f. Re-terminate connections as necessary.
4. Incorrect rating setup
- a. Connect InPower.
 - b. Verify the generator rating in the control is set correctly.
 - c. Verify CT ratings in the control are set correctly.
 - d. Adjust settings as necessary.

9.8.45 Code 1667 – AUX 101 Exhaust Temperature OOR (Warning)

Logic:

Exhaust gas temperature sensor signal is out of range – shorted high.

Possible Causes:

1. Faulty exhaust gas temperature sensor connections
2. Faulty exhaust gas temperature sensor
3. Faulty engine harness
4. Faulty extension harness
5. Verify the calibrations in the ECM and the PCC control

Diagnosis and Repair:

1. Faulty exhaust gas temperature sensor connections
 - a. Inspect the exhaust gas temperature sensor and the engine harness connector pins.
 - i. Disconnect the engine harness connector from the exhaust gas temperature sensor.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.

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2. Faulty exhaust gas temperature sensor
 - a. Active Sensor.
 - i. Check the exhaust gas temperature sensor supply voltage.
 - A. Disconnect the engine harness connector from the exhaust gas temperature sensor.
 - B. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - C. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
 - ii. Check exhaust gas temperature sensor signal (sense) voltage.
 - A. Disconnect the engine harness connector from the exhaust gas temperature sensor.
 - B. Install the pressure sensor breakout cable between the sensor and the sensor harness connector.
 - C. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 V, then the signal voltage is correct. If not, sensor is faulty.
 3. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - i. Disconnect the engine harness connector from the extension harness.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pin.
 - b. Check for a short circuit from pin to pin.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Disconnect the engine harness connector from the exhaust gas temperature sensor.
 - iii. Disconnect the engine harness from all sensors that have a shared supply or return with the fuel pressure sensor.
 - iv. Measure the resistance from the exhaust gas temperature 5 VDC supply pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - v. Measure the resistance from the exhaust gas temperature sensor pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - vi. Measure the resistance from the exhaust gas temperature signal pin on the engine harness inline connector to all other pins in the engine harness inline connector.
 - vii. If all measurements are greater than 100k ohms, then the resistance is correct.
 - c. Check for an open circuit.
 - i. Disconnect the engine harness from the extension harness.
 - ii. Disconnect the engine harness connector from the exhaust gas temperature sensor.

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- iii. Measure the resistance from the exhaust gas temperature return pin on the engine harness inline connector to the exhaust gas temperature return pin on the engine harness sensor connector.
 - iv. If the measurement is less than 10 ohms, then the resistance is correct.
 - 4. Faulty extension harness
 - a. Inspect the extension harness and the control connector pins.
 - i. Disconnect the extension harness connector from the control.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
 - b. Check for an open circuit.
 - i. Disconnect the extension harness connector from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the exhaust gas temperature return pin on the extension harness connector to the exhaust gas temperature return pin on the extension harness inline connection.
 - iv. If the measurement is less than 10 ohms, then the resistance is correct.
 - c. Check for a short circuit from pin to pin.
 - i. Disconnect the extension harness connector from the control.
 - ii. Disconnect the extension harness from the engine harness.
 - iii. Measure the resistance from the exhaust gas temperature 5 VDC supply pin on the extension harness connector to all other pins in the extension harness connector.
 - iv. Measure the resistance from the exhaust gas temperature return pin on the extension harness connector to all other pins in the extension harness connector.
 - v. Measure the resistance from the exhaust gas temperature signal pin on the extension harness connector to all other pins in the extension harness connector.
 - vi. If all measurements are greater than 100k ohms, then the resistance is correct.
 - 5. Verify the calibrations in the ECM and the PCC control
 - a. Using the display or the InPower Service tool, verify the calibration in the PCC control.
 - i. If the calibration in the PCC control matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
 - b. Using the InSite Service tool, verify the calibration in the ECM.
 - i. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

9.8.46 Code 1847 – Engine Coolant Temperature High (Shutdown with Cooldown)

Logic:

Exhaust gas temperature sensor signal is out of range – shorted high.

Possible Causes:

1. Inaccurate engine temperature sensor
2. Fault simulation feature is enabled
3. Threshold setting too low

Diagnosis and Repair:

1. Inaccurate engine temperature sensor
 - a. Verify the sensor accuracy with a thermocouple or similar temperature probe.
 - i. Connect the temperature probe to the engine near the coolant temperature sensor.
 - ii. Connect InPower.
 - iii. Compare the coolant temperature reading on the service tool monitor screen to the reading from the temperature probe. If the two readings are reasonably close, then the sensor is reading correctly.
2. Fault simulation feature is enabled
 - a. Verify that the fault simulation feature for the sensor is not enabled.
 - i. Connect InPower.
 - ii. Verify that the fault simulation is not enabled for the coolant temperature sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
3. Threshold setting too low
 - a. Check threshold settings.
 - i. Connect InPower.
 - ii. Verify that fault threshold is within the normal operating range for the coolant temperature sensor. Refer to the engine manual for correct threshold values and make the appropriate changes using InPower.

9.8.47 Code 1853 - Annunciator Fault 1

Logic:

Customer annunciator fault #1.

Possible Cause:

1. Condition for which "Annunciator Input #1" is configured for is active
2. Incorrectly configured or wiring issue
3. Faulty annunciator

Diagnosis and Repair:

1. Condition for which "Annunciator Input #1" is configured for is active
 - a. Check the condition for which "Annunciator Input #1" has been configured for; ex. if "Annunciator Input #1" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to the next step.
2. Incorrectly configured or wiring issue
 - a. With InPower, verify that the annunciator fault #1 is configured correctly.

- b. Check the wiring at TB1-1 and ensure that customer input 1 is not wired incorrectly. Depending on the configuration of the annunciator, ensure that there is not a short or open circuit at the TB1-2 connection.
 - c. Check the sender, relay, or device that is activating Input 1 on the Universal Annunciator, replace if faulty.
3. Faulty Annunciator
 - a. If the wiring and configuration is satisfactory, replace the Universal Annunciator.

9.8.48 Code 1854 - Annunciator Fault 2

Logic:

Customer annunciator fault #2.

Possible Cause:

1. Condition for which "Annunciator Input #2" is configured for is active
2. Incorrectly configured or wiring issue
3. Faulty annunciator

Diagnosis and Repair:

1. Condition for which "Annunciator Input #2" is configured for is active
 - a. Check the condition for which "Annunciator Input #2" has been configured for; ex. if "Annunciator Input #2" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to the next step.
2. Incorrectly configured or wiring issue
 - a. With InPower, verify that the annunciator fault #2 is configured correctly.
 - b. Check the wiring at TB1-2 and ensure that customer input 2 is not wired incorrectly. Depending on the configuration of the annunciator, ensure that there is not a short or open circuit at the TB1-2 connection.
 - c. Check the sender, relay, or device that is activating Input 2 on the Universal Annunciator, replace if faulty.
3. Faulty Annunciator
 - a. If the wiring and configuration is satisfactory, replace the Universal Annunciator.

9.8.49 Code 1855 - Annunciator Fault 3

Logic:

Customer annunciator fault #3.

Possible Cause:

1. Condition for which "Annunciator Input #3" is configured for is active
2. Incorrectly configured or wiring issue
3. Faulty annunciator

Diagnosis and Repair:

1. Condition for which "Annunciator Input #3" is configured for is active
 - a. Check the condition for which "Annunciator Input #3" has been configured for; ex. if "Annunciator Input #3" was configured to become active when the fuel level is low, check the fuel level and add fuel if needed. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to the next step.
2. Incorrectly configured or wiring issue
 - a. With InPower, verify that the annunciator fault #3 is configured correctly.
 - b. Check the wiring at TB1-3 and ensure that customer input 3 is not wired incorrectly. Depending on the configuration of the annunciator, ensure that there is not a short or open circuit at the TB1-3 connection.
 - c. Check the sender, relay, or device that is activating Input 3 on the Universal Annunciator, replace if faulty.
3. Faulty Annunciator
 - a. If the wiring and configuration is satisfactory, replace the Universal Annunciator.

9.8.50 Code 1992 - Engine Crankshaft Speed Above Rated Speed (Warning)

Logic:

Engine speed signals indicate an engine speed 15% greater than rated.

Possible Cause:

1. Fault simulation feature is enabled
2. Incorrect threshold setting
3. Incorrect fuel type setting
4. Faulty engine speed sensor connections
5. Faulty engine harness
6. Faulty engine speed/position sensor

Diagnosis and Repair:

1. Fault simulation feature is enabled
 - a. Verify that the fault simulation feature for the sensor is not enabled.
 - i. Connect InPower.
 - ii. Verify that the fault simulation is not enabled for the engine speed sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
2. Incorrect threshold setting
 - a. Connect InPower.
 - b. Verify that fault threshold is within the normal operating range for the engine overspeed sensor. Refer to the engine manual for correct threshold values and make the appropriate changes using InPower.
3. Incorrect fuel type setting
 - a. Connect InPower.
 - b. Verify the fuel source set with InPower is the same fuel used by the generator set.

4. Faulty engine speed sensor connections
 - a. Inspect the engine speed sensor and the harness connector pins.
 - i. Disconnect the engine harness connector from the engine speed sensor.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
5. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - b. Disconnect the engine harness connector from the extension harness.
 - c. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - d. Inspect for evidence of moisture in or on the connector.
 - e. Inspect for missing or damaged connector seals.
 - f. Inspect for dirt or debris in or on the connector pin.
 - g. Disconnect harness from ECM and sensor.
 - h. Measure the resistance in each pin from ECM to sensor. Resistance should be 5 ohms or less.
 - i. Repair or replace harness as necessary.
6. Faulty engine speed/position sensor
 - a. Inspect the engine speed sensor.
 - b. Disconnect the engine speed/position sensor from the engine and engine harness.
 - c. Inspect sensor for bent, corroded or loose pins.
 - d. Inspect the sensor for structural deficiencies.
 - e. Check the crankshaft speed sensor supply voltage.
 - f. Disconnect the engine harness connector from the crankshaft speed sensor.
 - g. Install the speed sensor breakout cable between the sensor and the sensor harness connector.
 - h. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
 - i. Check the crankshaft speed sensor signal (sense) voltage.
 - j. Disconnect the engine harness connector from the camshaft position sensor.
 - k. Install the speed/position sensor breakout cable between the sensor and the sensor harness connector.
 - l. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 VDC, then the signal voltage is correct. If not, sensor is faulty.

9.8.51 Code 1994 - Annunciator Output Configuration Error (Warning)

Logic:

Annunciator output relay(s) are being activated by more than one source.

Possible Cause:

1. Annunciator output relay(s) activated by more than one source at the same time
2. Faulty annunciator

Diagnosis and Repair:

1. Annunciator output relay(s) activated by more than one source at the same time
 - a. Ensure that the annunciator(s) are only connected to one genset control.
2. Faulty annunciator
 - a. Replace the annunciator.

9.8.52 Code 2112 – AUX 101 Coolant Inlet Temperature ORR (Warning)

Logic:

Coolant temperature sensor voltage is out of range.

Possible Causes:

1. Faulty coolant temperature sensor connections
2. Faulty coolant temperature sensor
3. Improper wiring
4. Verify controller calibrations

Diagnosis and Repair:

1. Faulty coolant temperature sensor connections
 - a. Inspect the coolant temperature sensor and the engine harness connector pins.
 - i. Disconnect the engine harness connector from the coolant temperature sensor.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
2. Faulty coolant temperature sensor
 - a. Check the resistance of the sensor
 - i. Disconnect the engine harness connector from the coolant temperature sensor.
 - ii. Measure the resistance between the coolant temperature sensor signal pin and the coolant temperature sensor return pin.
3. Improper wiring
 - a. Check wiring. Ensure wiring from the coolant temperature sensor is connected to the correct Aux 101 input.
 - b. Check wires for breaks or abrasions.
 - c. Check wires for moisture and debris at connection points.

4. Verify controller calibrations
 - a. Using the display or the InPower Service tool, verify the calibration in the PCC control.
 - i. If the calibration in the PCC control matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
 - b. Using the InSite Service tool, verify the calibration in the ECM.
 - i. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

9.8.53 Code 2224 - Aux 101 Fuel Level OOR (Warning)

Fuel level sensor voltage is out of range.

9.8.54 Code 2398 - Aux 101 Ambient Temperature OOR (Warning)

Logic: Ambient temperature sensor voltage is out of range.

Possible Causes:

1. Faulty ambient temperature sensor connections
2. Faulty ambient temperature sensor
3. Improper wiring
4. Incorrect controller calibrations

Diagnosis and Repair:

1. Faulty ambient temperature sensor connections
 - a. Inspect the ambient temperature sensor and the engine harness connector pins.
 - i. Disconnect the engine harness connector from the ambient temperature sensor.
 - ii. Inspect for:
 - Corroded, bent, broken, pushed back, or expanded pins
 - Evidence of moisture in or on the connector
 - Missing or damaged connector seals
 - Dirt or debris in or on the connector pins
2. Faulty ambient temperature sensor
 - a. Check the resistance of the sensor.
 - i. Disconnect the engine harness connector from the ambient temperature sensor.
 - ii. Measure the resistance between the ambient temperature sensor signal pin and the ambient temperature sensor return pin.
3. Improper wiring
 - a. Make sure the wiring from the coolant temperature sensor is connected to the correct Aux 101 input.
 - b. Check wires for breaks or abrasions.
 - c. Check wires for moisture and debris at connection points.

4. Incorrect controller calibrations
 - a. Using the display or the InPower Service tool, verify the calibration in the PCC control.
 - i. If the calibration in the PCC control matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the calibration to the latest.
 - b. Using the Global Control Platform (GCP) Display or 4G service tool (latest version), verify the calibration in the ECM.
 - i. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

9.8.55 Code 2542 - Aux 101 Voltage Bias OOR (Warning)

Logic: Fuel level sensor voltage is out of range.

Possible Causes:

1. Faulty fuel level sensor connections
2. Faulty fuel level sensor
3. Improper wiring
4. Incorrect controller calibrations

Diagnosis and Repair:

1. Faulty fuel level sensor connections
 - a. Inspect the fuel level sensor and the engine harness connector pins.
 - i. Disconnect the engine harness connector from the fuel level sensor.
 - ii. Inspect for:
 - A. Corroded, bent, broken, pushed back, or expanded pins
 - B. Evidence of moisture in or on the connector
 - C. Missing or damaged connector seals
 - D. Dirt or debris in or on the connector pins
2. Faulty fuel level sensor
 - a. Check the resistance of the sensor.
 - i. Disconnect the engine harness connector from the fuel level sensor.
 - ii. Measure the resistance between the fuel level sensor signal pin and the fuel level sensor return pin.
3. Improper wiring
 - a. Make sure the wiring from the coolant temperature sensor is connected to the correct Aux 101 input.
 - b. Check wires for breaks or abrasions.
 - c. Check wires for moisture and debris at connection points.
4. Incorrect controller calibrations
 - a. Using the display or the InPower Service tool, verify the calibration in the PCC control.
 - i. If the calibration in the PCC control matches the latest calibration on the InCal website, then the calibration is correct. If it does not, update the PCC to the latest calibration.

- b. Using the Global Control Platform (GCP) Display or 4G service tool (latest version), verify the calibration in the ECM.
 - i. If the calibration in the ECM matches the latest calibration on QSOL, then the calibration is correct. If it does not, update the ECM to the latest calibration.

9.8.56 Code 2545 – Keyswitch Reset Required (Warning)

Logic:

CAN datalink communication has been lost between the generator set control and ECM, therefore event/fault code 2545 becomes active if event/fault code 781 "CAN Data Link Failure" is also active at the ECM.

Possible Causes:

1. CAN datalink failure
2. Faulty ECM

Diagnosis and Repair:

1. CAN datalink failure
 - a. Reset the Keyswitch manually.
 - i. Put the generator set control in the OFF position and press the Reset button on the operator panel. This action will clear any shutdown faults and resets the Keyswitch.
 - ii. Enable the Keyswitch through the operator panel. Go to **Test > Output > Engine > Keyswitch Driver Override Enable**, set to Enable.
 - b. Reset the ECM and PCC controls.
 - i. Push the Emergency Stop button in.
 - ii. Wait 30 seconds.
 - iii. Disconnect the battery terminals from the battery.
 - iv. Wait 10-15 seconds.
 - v. Reconnect the battery cables to the battery terminals correctly.
 - vi. Pull the Emergency Stop button out.
 - vii. Press the Fault Reset button.
 - c. Check the relay that is proving power to the Keyswitch. This relay is normally open, and if faulty, replace.
 - d. Check the terminating resistors. With connectors J11 and J26 removed, measure resistance between pins J11-19 and J11-20 (60 ohms, is satisfactory).
 - e. Reference the troubleshooting procedure for event/fault code 781 in the engine service manual.
2. Faulty ECM
 - a. After ensuring that the ECM has an adequate B+ supply, connect to the ECM with InPower or Insite in order to determine if it is functioning correctly and can communicate with the PCC controller. Replace the controller if communication to it with InPower is not possible.

9.8.57 Code 2619 – AUX 101 Input #1 Fault

NOTICE

FC 2619 is no longer supported and has been replaced with FC 5182 for PCC1302 calibrations of V3.130 and higher.

Logic:

Analog input #1 fault is active.

Possible Causes:

1. Condition for which "Analog Input #1" is configured is active
2. "Analog Input #1 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #1" is configured is active
 - a. Check the condition for which "Analog Input #1" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #1 Active State Selection" parameter is configured incorrectly
 - a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #1. Ensure that the switch input setting is correctly set. If "Analog Input #1 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
 - a. Check the wiring at J11-1 (reference input 1) and J11-2 (switch input) for an open circuit, short circuit, or a miswired condition.

9.8.58 Code 2621 – AUX 101 Input #2 Fault

Logic:

Analog input #2 fault is active.

Possible Causes:

1. Condition for which "Analog Input #2" is configured is active
2. "Analog Input #2 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #2" is configured is active
 - a. Check the condition for which "Analog Input #2" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #2 Active State Selection" parameter is configured incorrectly
 - a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #2. Ensure that the switch input setting is correctly set. If "Analog Input #2 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.

3. Incorrectly wired; or open circuit or short circuit in the wiring
 - a. Check the wiring at J11-3 (reference input 1) and J11-4 (switch input) for an open circuit, short circuit, or a miswired condition.

9.8.59 Code 2622 – AUX 101 Input #3 Fault

Logic:

Analog input #3 fault is active.

Possible Causes:

1. Condition for which "Analog Input #3" is configured is active
2. "Analog Input #3 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #3" is configured is active
 - a. Check the condition for which "Analog Input #3" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #3 Active State Selection" parameter is configured incorrectly
 - a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #3. Ensure that the switch input setting is correctly set. If "Analog Input #3 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
 - a. Check the wiring at J11-5 (reference input 1) and J11-6 (switch input) for an open circuit, short circuit, or a miswired condition.

9.8.60 Fault Code 2623 - AUX 101 Input #4 Fault

Analog input #4 fault is active.

9.8.61 Code 2624 – AUX 101 Input #5 Fault

Logic:

Analog input #5 fault is active.

Possible Causes:

1. Condition for which "Analog Input #5" is configured is active
2. "Analog Input #5 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #5" is configured is active
 - a. Check the condition for which "Analog Input #5" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.

2. "Analog Input #5 Active State Selection" parameter is configured incorrectly
 - a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #5. Ensure that the switch input setting is correctly set. If "Analog Input #5 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
 - a. Check the wiring at J11-9 (reference input 1) and J11-10 (switch input) for an open circuit, short circuit, or a miswired condition.

9.8.62 Code 2625 – AUX 101 Input #6 Fault

Logic:

Analog input #6 fault is active.

Possible Causes:

1. Condition for which "Analog Input #6" is configured is active
2. "Analog Input #6 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #6" is configured is active
 - a. Check the condition for which "Analog Input #6" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #6 Active State Selection" parameter is configured incorrectly
 - a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #6. Ensure that the switch input setting is correctly set. If "Analog Input #6 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
 - a. Check the wiring at J11-11 (reference input 1) and J11-12 (switch input) for an open circuit, short circuit, or a miswired condition.

9.8.63 Code 2626 – AUX 101 Input #7 Fault

Logic:

Analog input #7 fault is active.

Possible Causes:

1. Condition for which "Analog Input #7" is configured is active
2. "Analog Input #7 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #7" is configured is active
 - a. Check the condition for which "Analog Input #7" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.

2. "Analog Input #7 Active State Selection" parameter is configured incorrectly
 - a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #7. Ensure that the switch input setting is correctly set. If "Analog Input #7 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
 - a. Check the wiring at J11-13 (reference input 1) and J11-14 (switch input) for an open circuit, short circuit, or a miswired condition.

9.8.64 Code 2627 – AUX 101 Input #8 Fault

Logic:

Analog input #8 fault is active.

Possible Causes:

1. Condition for which "Analog Input #8" is configured is active
2. "Analog Input #8 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #8" is configured is active
 - a. Check the condition for which "Analog Input #8" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #8 Active State Selection" parameter is configured incorrectly
 - a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #8. Ensure that the switch input setting is correctly set. If "Analog Input #8 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
 - a. Check the wiring at J11-15 (reference input 1) and J11-16 (switch input) for an open circuit, short circuit, or a miswired condition.

9.8.65 Incorrectly Wired; Or Open Circuit Or Short Circuit In The Wiring

1. Check the wiring at J4-1 (switch input 1) and J4-2 (reference input) for an open circuit, short circuit, or a miswired condition.

9.8.66 Code 2629 – AUX 102 Input #10 Fault

Discrete input #10 fault is active.

Possible Causes:

1. Condition for which "Discrete Input #10" is configured is active
2. "Discrete Input #10 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

9.8.67 Code 2631 – AUX 102 Input #11 Fault

Logic:

Discrete input #11 fault is active.

Possible Causes:

1. Condition for which "Discrete Input #11" is configured is active
2. "Discrete Input #11 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Discrete Input #11" is configured is active
 - a. Check the condition for which "Discrete Input #11" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Discrete Input #11 Active State Selection" parameter is configured incorrectly
 - a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Discrete Input #11. Ensure that the switch input setting is correctly set. If "Discrete Input #11 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
 - a. Check the wiring at J4-5 (switch input 1) and J4-6 (reference input) for an open circuit, short circuit, or a miswired condition.

9.8.68 Code 2632 – AUX 102 Input #12 Fault

Logic:

Discrete input #12 fault is active.

Possible Causes:

1. Condition for which "Discrete Input #12" is configured is active
2. "Discrete Input #12 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Discrete Input #12" is configured is active
 - a. Check the condition for which "Discrete Input #12" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Discrete Input #12 Active State Selection" parameter is configured incorrectly
 - a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Discrete Input #12. Ensure that the switch input setting is correctly set. If "Discrete Input #12 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
 - a. Check the wiring at J4-7 (switch input 1) and J4-8 (reference input) for an open circuit, short circuit, or a miswired condition.

9.8.69 Code 2676 - Alternator Frequency Conflict (Shutdown)

Logic:

Indicates the measured alternator line frequency and measured alternator excitation frequency do not match.

Possible Causes:

1. Frequency mismatch between alternator and excitation frequency.
2. Wrong configuration of Excitation/Line Frequency gain.
3. Defective wire connections and/or control board.

Diagnosis and Repair:

1. Check the alternator frequency gain trim using the operator panel or InPower.
2. Measure the alternator line frequency (J22-1 to J22-4). Measure the alternator excitation frequency (J18-1 to J18-2). The (Alternator Line Frequency) * (Alternator Frequency Gain) should equal the excitation frequency. The alternator line frequency and alternator excitation frequency are also viewable with InPower.
3. Check voltage sense leads and excitor power lead for open or shorts.

9.8.70 Code 2693 - Speed Bias OOR (Warning)

Logic: Indicates the speed bias circuit output is out of range (OOR), high or low.

Possible Cause:

1. Sensor/wiring is defective

Diagnosis and Repair:

1. Sensor/wiring is defective
 - a. Check wiring. Ensure speed bias OOR wiring is connected to the correct Aux 101 input.
 - b. Check wires for breaks or abrasions.
 - c. Check wires for moisture and debris at connection points.

9.8.71 Code 2694 - Alternator RTD OOR (Warning)

Logic: Indicates the RTD circuit output is out of range (OOR), high or low.

Possible Cause:

1. Sensor/wiring is defective

Diagnosis and Repair:

1. Sensor/wiring is defective
 - a. Check wiring. Ensure alternator RDT OOR wiring is connected to the correct Aux 101 input.
 - b. Check wires for breaks or abrasions.
 - c. Check wires for moisture and debris at connection points.

9.8.72 Code 2696 - Alternator RTD Temperature High (Warning)

Logic: Indicates that the alternator temperature is above normal and has reached the shutdown trip point.

Possible Cause:

1. Sensor/wiring is defective

Diagnosis and Repair:

1. Sensor/wiring is defective
 - a. Check wiring. Ensure alternator RDT temperature wiring is connected to the correct Aux 101 input.
 - b. Check wires for breaks or abrasions.
 - c. Check wires for moisture and debris at connection points.

9.8.73 Code 2729 - IO Module Lost (Warning)

Logic: There is an intermittent data link between the I/O module and the PCC control (Aux 101 I/O Module option) and no input fault levels were set to Shutdown.

Possible Causes:

1. Incorrect wiring
2. I/O settings misconfigured

Diagnosis and Repair:

1. Incorrect wiring
 - a. The connection between AUX 101 and PCC 1302 is incorrect. Make sure there is proper wiring.
 - PCC 1302 TB1-1 – PCC Net A (+) to AUX 101 J1-3
 - PCC 1302 TB1-2 – PCC Net B (-) to AUX 101 J1-4
 - PCC 1302 TB1-3 – B+ Return to AUX 101 J14-2
 - PCC 1302 TB1-5 – Customer Fused B+ to AUX 101 J14-1
 - PCC 1302 TB15-5 – System Wake-up to AUX 101 J1-5
2. I/O settings misconfigured
 - a. If no AUX 101 is connected to PCC 1302, connect to the InPower service tool.
 - Go to **Adjustments > System I/O Adjustment > Output Relays**. Make sure System IO Board Enable is disabled.
 - Go to **Adjustments > System I/O Adjustment**. Make sure no inputs or outputs are configured as enabled.

9.8.74 Code 2731 - IO Module Lost (Shutdown)

Logic: Indicates an intermittent data link between the I/O module and the PCC control (Aux 101 I/O Module option) and at least one input fault level was set to Shutdown.

Possible Causes:

1. Incorrect wiring
2. I/O settings misconfigured

Diagnosis and Repair:

1. Incorrect wiring
 - a. The connection between AUX 101 and PCC 1302 is incorrect. Make sure there is proper wiring.
 - PCC 1302 TB1-1 – PCC Net A (+) to AUX 101 J1-3
 - PCC 1302 TB1-2 – PCC Net B (-) to AUX 101 J1-4

- PCC 1302 TB1-3 – B+ Return to AUX 101 J14-2
 - PCC 1302 TB1-5 – Customer Fused B+ to AUX 101 J14-1
 - PCC 1302 TB15-5 – System Wake-up to AUX 101 J1-5
2. I/O settings misconfigured
 - a. If no AUX 101 is connected to PCC 1302, connect to InPower.
 - i. Go to **Adjustments > System I/O Adjustment > Output Relays**. Make sure System IO Board Enable is disabled.
 - ii. Go to **Adjustments > System I/O Adjustment**. Make sure no inputs or outputs are configured as enabled.

9.8.75 Code 2897 - Factory Memory Block Corrupt

Logic: The control has detected a corrupted memory block.

Possible Cause:

1. Defective memory block

Diagnosis and Repair:

1. Defective memory block
 - a. Connect to device using InPower version 10.0 or greater.
 - b. In InPower, right click on the device, and select Initial Calibration (Recover Device) from the menu that appears.
 - c. If the capture file for the device is available, select "overlay capture file". If not, select feature codes.
 - Feature codes can be found on the nameplate of the device, located on the alternator housing.
 - d. If the problem persists, contact the factory for support.

9.8.76 Code 2898 - Periodic or Fault Memory Block Corrupt

Logic: The control has detected a corrupted memory block.

Possible Cause:

1. Defective memory block

Diagnosis and Repair:

1. Defective memory block
 - a. Connect to the device using InPower version 10.0 or greater.
 - b. In InPower, right click on the device, and select Initial Calibration (Recover Device) from the menu that appears.
 - c. If the capture file for the device is available, select "overlay capture file". If not, select feature codes.
 - Feature codes can be found on the nameplate of the device, located on the alternator housing.
 - d. If the problem persists, contact the factory for support.

9.8.77 Code 2899 - User Memory Block Corrupt

Logic: The control has detected a corrupted memory block.

Possible Cause:

1. Defective memory block

Diagnosis and Repair:

1. Defective memory block
 - a. Connect to the device using InPower version 10.0 or greater.
 - b. In InPower, right click on the device, and select Initial Calibration (Recover Device) from the menu that appears.
 - c. If the capture file for the device is available, select "overlay capture file". If not, select feature codes.
 - Feature codes can be found on the nameplate of the device, located on the alternator housing.
 - d. If the problem persists, contact the factory for support.

9.8.78 Code 2911 - Trim Memory Block Corrupt

Logic: The control has detected a corrupted memory block.

Possible Cause:

1. Defective memory block

Diagnosis and Repair:

1. Defective memory block
 - a. Connect to the device using InPower version 10.0 or greater.
 - b. In InPower, right click on the device, and select Initial Calibration (Recover Device) from the menu that appears.
 - c. If the capture file for the device is available, select "overlay capture file". If not, select feature codes.
 - Feature codes can be found on the nameplate of the device, located on the alternator housing.
 - d. If the problem persists, contact the factory for support.

9.8.79 Code 2912 - Voltage Reconnection Switch Status Change (Shutdown)

Logic:

Generator has witnessed a voltage configuration change while generator was in operation.

Possible Causes:

1. Voltage selection switch was moved during generator operation
2. Open circuit in the voltage position switch harness or connectors
3. Damaged or failed voltage position switch

Diagnosis and Repair:

1. Voltage selection switch was moved during generator operation
 - a. Restart generator and verify operation with switch in fixed position.
 - b. Do not operate voltage selection switch while generator is in operation.
2. Open circuit in the voltage position switch harness or connectors
 - a. Inspect the engine harness and the connector pins.
 - b. Disconnect the engine harness connector from the extension harness.
 - c. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - d. Inspect for evidence of moisture in or on the connector.
 - e. Inspect for missing or damaged connector seals.
 - f. Inspect for dirt or debris in or on the connector pin.
 - g. Disconnect J20 harness connector from control and voltage selection switch.
 - h. Measure the resistance in each pin from J20 harness connector to the corresponding voltage selection switch terminal. Resistance should be 5 ohms or less.
 - i. Measure the resistance in each pin from J20 harness connector to ground. Resistance should be open or infinite.
 - j. Repair or replace harness as necessary.
3. Damaged or failed voltage position switch
 - a. Verify switch operation by moving the switch through its range of motion.
 - b. Visually inspect the selection switch for broken or loose contacts, damage to switch mechanism, rattles or noise when subjected to vibration, and areas that show signs or high heat.
 - c. Replace switch as necessary.

9.8.80 Code 2972 - Field Overload**Logic:**

If the time that the Field AVR Duty Cycle is operating at maximum output is longer than the time in the "Max Field Time" parameter, event/fault code 2972 will become active.

Possible Causes:**⚠ CAUTION**

Excessive voltage is possible during testing. Make sure your meter can handle alternator full voltage.

1. Max Field Time Delay is set too low
2. Voltage sensing into the base board is too low, or there is an open/short circuit
3. Application issue

Diagnosis and Repair:

1. Max Field Time Delay is set too low
 - a. Through the operator panel, check the "Max Field Time" parameter setting. Verify that the "Max Field Time" is not set to zero. The "Max Field Time" parameter may require adjustment to a value more appropriate for the application. To access the Max Field Time configuration menu on the operator panel go to Setup > OEM Setup > OEM Alt Setup > Max Field Time and set the "Max Field Time" parameter appropriately for the application. Refer to the parameter list to see the default value for "Max Field Time".
2. Voltage sensing into the base board is too low, or there is an open/short circuit
 - a. Measure the voltage going into the base board at L1 = J22-1, L2 = J22-2, L3 = J22-3, and LN = J22-4 (for single phase applications use L1, L2 and LN). If the generator set control is not sensing voltage, it will try to overcompensate by maxing out the AVR output. If the voltage going into the control board is zero, or less than the voltage that the control was calibrated for (Nominal Voltage), then check the wiring from the alternator to the base board for an open circuit or short circuit.
 - b. If the generator set is over 600 VAC, check connections from the alternator to the PT, and from the PT to the base board. If there is voltage going into the PT, but not coming out of the PT, replace the PT.
 - c. Measure the output of the AVR at J17 -1 and J17-2 while turning the generator set on. The output should be at least 30 VDC when the generator set is starting, but the voltage should decrease significantly when the generator set builds up voltage. If the output of J17-1 and J17-2 is constantly high or is locked in, then the AVR portion of the PCC is faulty. Replace the base board if the AVR is faulty.
3. Application issue
 - a. If the generator set runs adequately with no load or some load but as soon as additional load is applied, the generator set shuts down on "Field Overload"; then this might be an application issue (load issue, generator set undersized, etc.).

9.8.81 Code 3131 - Engine Crankshaft Speed Above Rated Speed (Warning)

Logic:

Engine speed signals indicate an engine speed 15% greater than rated.

Possible Cause:

1. Fault simulation feature is enabled
2. Incorrect threshold setting
3. Incorrect fuel type setting
4. Faulty engine speed sensor connections
5. Faulty engine harness
6. Faulty engine speed/position sensor
7. Mag Pickup Unit not adjusted properly

Diagnosis and Repair:

1. Fault simulation feature is enabled
 - a. Verify that the fault simulation feature for the sensor is not enabled.
 - i. Connect InPower.

-
- ii. Verify that the fault simulation is not enabled for the engine speed sensor by connecting to the PCC via InPower. If the fault simulation is disabled, there is no problem.
 2. Incorrect threshold setting
 - a. Connect InPower.
 - b. Verify that fault threshold is within the normal operating range for the engine overspeed sensor. Refer to the engine manual for correct threshold values and make the appropriate changes using InPower.
 3. Incorrect fuel type setting
 - a. Connect InPower.
 - b. Verify the fuel source set with InPower is the same fuel used by the generator set.
 4. Faulty engine speed sensor connections
 - a. Inspect the engine speed sensor and the harness connector pins.
 - i. Disconnect the engine harness connector from the engine speed sensor.
 - ii. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - iii. Inspect for evidence of moisture in or on the connector.
 - iv. Inspect for missing or damaged connector seals.
 - v. Inspect for dirt or debris in or on the connector pins.
 5. Faulty engine harness
 - a. Inspect the engine harness and the connector pins.
 - b. Disconnect the engine harness connector from the extension harness.
 - c. Inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - d. Inspect for evidence of moisture in or on the connector.
 - e. Inspect for missing or damaged connector seals.
 - f. Inspect for dirt or debris in or on the connector pin.
 - g. Disconnect harness from ECM and sensor.
 - h. Measure the resistance in each pin from ECM to sensor. Resistance should be 5 ohms or less.
 - i. Repair or replace harness as necessary.
 6. Faulty engine speed/position sensor
 - a. Inspect the engine speed sensor.
 - b. Disconnect the engine speed/position sensor from the engine and engine harness.
 - c. Inspect sensor for bent, corroded or loose pins.
 - d. Inspect the sensor for structural deficiencies.
 - e. Check the crankshaft speed sensor supply voltage.
 - f. Disconnect the engine harness connector from the crankshaft speed sensor.
 - g. Install the speed sensor breakout cable between the sensor and the sensor harness connector.
 - h. Measure the supply voltage by connecting the breakout cable's supply and return connectors to the multimeter. If the reading is between 4.75 and 5.25 VDC, then the supply voltage is correct.
 - i. Check the crankshaft speed sensor signal (sense) voltage.
 - j. Disconnect the engine harness connector from the camshaft position sensor.
-

- k. Install the speed/position sensor breakout cable between the sensor and the sensor harness connector.
 - l. Measure the signal voltage by connecting the breakout cable's signal and return connectors to the multimeter. If the reading is between 0.46 and 4.56 VDC, then the signal voltage is correct. If not, sensor is faulty.
7. Mag Pick is wound in too closely to flywheel
- a. Using a multimeter, verify that the voltage to the PCC is between 2.5V and 35V during the start up and running of the generator.
 - b. Using a multimeter, adjust the position of the mag pickup to ensure the voltage does not exceed 35V while the generator is running.

9.8.82 Code 4358 – Set Up Mode Shutdown

Logic:

While setting up "Remote Start" or "Start Signal Integrity" functionality in the PCC in Auto mode, if a start command gets issued within 1 second, then the "Set Up Mode Shutdown" fault will occur

Possible Causes:

1. User assigns "Start Signal Integrity Switch" to any configurable input in Auto mode without its proper feedback
2. User changes "Start Signal Integrity Switch Active State Selection" or "Remote Start Switch Active State Selection" in Auto mode

Diagnosis and Repair:

1. User assigns "Start Signal Integrity Switch" to any configurable input in Auto mode without its proper feedback
 - a. Check if "Start Signal Integrity Switch" is configured in Auto mode. It should be configured only in Stop mode with proper signal feedback.
2. User changes "Start Signal Integrity Switch Active State Selection" or "Remote Start Switch Active State Selection" in Auto mode
 - a. Check if "Active State Selection" of "Start Signal Integrity" and "Remote Start" is changed in Auto mode. It should be configured only in Stop mode with proper signal wiring.

9.8.83 Code 5134 – Unknown Shutdown at Idle Fault

Logic:

During generator set starting when PCC is in "Disengage Starter," "Pre-Ramp," "Ramp," or "Idle" states, the generator set starting has completed (i.e. generator set has reached idle speed) and engine RPM is sensed as 0 (continuously for 4 seconds), then Unknown Shutdown at Idle fault becomes active.

Possible Causes:

1. The engine runs out of fuel or the engine stalls with no fault being declared by the ECM
2. On receiving a start command, the PCC senses "Charging Alternator Voltage" above "Charging Alternator Starter Disconnect Voltage Threshold" and disengages the starter before cranking

Diagnosis and Repair:

1. The engine runs out of fuel or the engine stalls with no fault being declared by the ECM
 - a. Check the fuel system of the engine.
 - b. Check the fuel levels.

- c. Check the ECM calibration or refer to the engine manual.
2. On receiving a start command, the PCC senses "Charging Alternator Voltage" above "Charging Alternator Starter Disconnect Voltage Threshold" and disengages the starter before cranking
 - a. Check "Charging Alternator Starter Disengage Voltage Threshold."
 - If it is found as 9V, increase it to 10-11V for a 12V battery system.
 - If it is found as 18V, increase it to 20-21V for a 24V battery system.

9.8.84 Code 5182 – AUX 101 Input #1 Fault

Logic:

Analog input #1 fault is active.

Possible Causes:

1. Condition for which "Analog Input #1" is configured is active
2. "Analog Input #1 Active State Selection" parameter is configured incorrectly
3. Incorrectly wired; or open circuit or short circuit in the wiring

Diagnosis and Repair:

1. Condition for which "Analog Input #1" is configured is active
 - a. Check the condition for which "Analog Input #1" has been configured for. After the issue is resolved, press the Reset button on the Operator Panel in order to clear the fault, if the fault does not clear go to next step.
2. "Analog Input #1 Active State Selection" parameter is configured incorrectly
 - a. With InPower or through the Operator Panel check the switch input setting (active closed or active open) for Analog Input #1. Ensure that the switch input setting is correctly set. If "Analog Input #1 Sensor Type" parameter is set to active low, an active high will invert the logic, causing this fault code to go active.
3. Incorrectly wired; or open circuit or short circuit in the wiring
 - a. Check the wiring at J11-1 (reference input 1) and J11-2 (switch input) for an open circuit, short circuit, or a miswired condition.

9.8.85 Code 5637 – Engine Shutdown at Startup (Shutdown)

Logic:

During generator set starting when the PCC is in "Disengage Starter," "Pre-Ramp," or "Ramp" states, but the generator set starting has not completed (i.e. generator set has not reached rated speed) and engine RPM is sensed as 0 (continuously for cycle crank rest time), and the number of crank attempts becomes zero, then Unknown Shutdown at Startup fault becomes active.

Possible Causes:

1. The engine runs out of fuel or the engine stalls with no fault being declared by the ECM
2. On receiving a start command, the PCC senses "Charging Alternator Voltage" above "Charging Alternator Starter Disconnect Voltage Threshold" and disengages the starter before cranking

Diagnosis and Repair:

1. The engine runs out of fuel or the engine stalls with no fault being declared by the ECM
 - a. Check the fuel system or fuel levels of the engine.
 - b. Check the ECM calibration and refer to the engine manual.

2. On receiving a start command, the PCC senses "Charging Alternator Voltage" above "Charging Alternator Starter Disconnect Voltage Threshold" and disengages the starter before cranking
 - a. Check "Charging Alternator Starter Disengage Voltage Threshold."
 - If it is found as 9V, increase it to 10-11V for a 12V battery system.
 - If it is found as 18V, increase it to 20-21V for a 24V battery system.

9.8.86 Code 6227 – Current Imbalance Fault (Warning)

Logic:

If the generator set output current is unbalanced between 3 lines having the max line current greater than Current Imbalance %Load Current Floor Threshold and imbalanced more than Current Imbalance Fault Threshold continuously for Current Imbalance Fault Set Time, FC 6227 will get activated. FC 6227 severity can be decided from the trim "Current Imbalance Fault Severity."

Possible Causes:

1. Overload on one phase out of three phase or overload on one phase out of two phases
2. Incorrect CTs, CT connections, CT setup, or CT open circuit
3. CT harness connection

Diagnosis and Repair:

1. Overload on one phase out of three phase or overload on one phase out of two phases
 - a. Inspect the load cables and the AC harness connections.
 - b. Disconnect the AC harness from the load cables.
 - c. Inspect the AC harness and board connector pins.
 - d. Visually inspect for corroded pins, bent or broken pins, pushed back or expanded pins.
 - e. Check for a short circuit to engine block ground.
 - f. Make sure load applied is balanced upon all three phases.
2. Incorrect CTs, CT connections, CT setup, or CT open circuit
 - a. Check CTs.
 - i. Check that correct CTs have been installed.
 - ii. Check that CT connections are secure by zip ties to corresponding wires.
 - iii. Check that CTs are installed in the correct order.
 - iv. Connect InPower.
 - v. Verify the correct CT ratio has been entered in the generator setup.
 - vi. Adjust the setting(s) as necessary.
3. CT harness connection
 - a. Measure the resistance of the CT harness on each pin.
 - b. Disconnect connector P12 from the control board and CTs.
 - c. Verify the resistance from the board connect to CT connections. Resistance should be 5 ohms or less.
 - d. Measure the resistance of each pin on the CT connector to engine block ground. Resistance should be open or infinite.
 - e. Verify the CT connections are correct from P12 to the CT terminals.

- f. Re-terminate connections as necessary.

9.8.87 Code 7243 - Failed Normal Start Attempt (Warning)

Logic:

During generator set starting when the PCC is in 'Disengage Starter,' 'Pre-Ramp,' or 'Ramp' states, but the generator set starting has not completed (i.e. generator set has not reached rated speed) and engine RPM is sensed as 0 (continuously for cycle crank rest time after 1st crank attempt), then Failed Normal Start Attempt warning fault becomes active.

Possible Causes:

1. The engine runs out of fuel or the engine stalls with no fault being declared by the ECM
2. On receiving a start command, the PCC senses 'Charging Alternator Voltage' above 'Charging Alternator Starter Disconnect Voltage Threshold' and disengages the starter before cranking

Diagnosis and Repair:

1. The engine runs out of fuel or the engine stalls with no fault being declared by the ECM
 - a. Wait for the next start attempt to start the generator set.
 - b. Check the fuel system or fuel levels of the engine.
 - c. Check the ECM calibration and refer to the engine manual.
2. On receiving a start command, the PCC senses 'Charging Alternator Voltage' above 'Charging Alternator Starter Disconnect Voltage Threshold' and disengages the starter before cranking
 - a. Check 'Charging Alternator Starter Disengage Voltage Threshold.'
 - If it is found as 9V, increase it to 10–11V for a 12V battery system.
 - If it is found as 18V, increase it to 20–21V for a 24V battery system.

9.8.88 Code 7892 – Start Signal Integrity Fail

Logic:

If "Remote Start Signal" or "Start Signal Integrity Signal" is compromised because of a wire falls off or breaks, the generator set will start immediately with fault code 7892 active. Refer to [Section 8.4.1](#).

Possible Causes:

1. Open or short circuit in "Remote Start" and/or "Start Signal Integrity" signal wiring

Diagnosis and Repair:

1. Open or short circuit in "Remote Start" and/or "Start Signal Integrity" signal wiring
 - a. Check for a short or open circuit of "Remote Start" and "Start Signal Integrity" signal wiring and correct if found faulty.
 - b. Inspect external interfaces (e.g. relay etc.) through which the signals are routed to the PCC and correct if found faulty.

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10 Manufacturing Facilities

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10.1 How to Obtain Service

When a product requires servicing, contact the nearest Cummins service provider. To locate the distributor, go to www.cummins.com/support and select Find a Sales or Service Location. When contacting the service provider, always supply the complete model, specification, and serial number as shown on the nameplate.

10.1.1 Locating a Distributor

In the U.S. and Canada

To easily locate the nearest certified distributor/dealer for Cummins generator sets in your area, or for more information, contact us at 1-800-CUMMINS™ (1-800-286-6467) or visit www.cummins.com/support.

If unable to contact a distributor using the automated service, consult the Internet.

If unable to arrange a service or resolve an issue, contact the Service Manager at the nearest Cummins distributor for assistance.

When contacting the distributor, always supply the complete Model, Specification, and Serial Number as shown on the product nameplate.

Appendix A. Wiring Diagrams

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Note: This section contains basic (generic) wiring diagrams and schematics to help in troubleshooting. Service personnel must use the wiring diagrams and schematics shipped with the unit. These wiring diagrams and schematics should be updated when modifications are made to the unit. The following diagrams are from drawing 0630-3440.

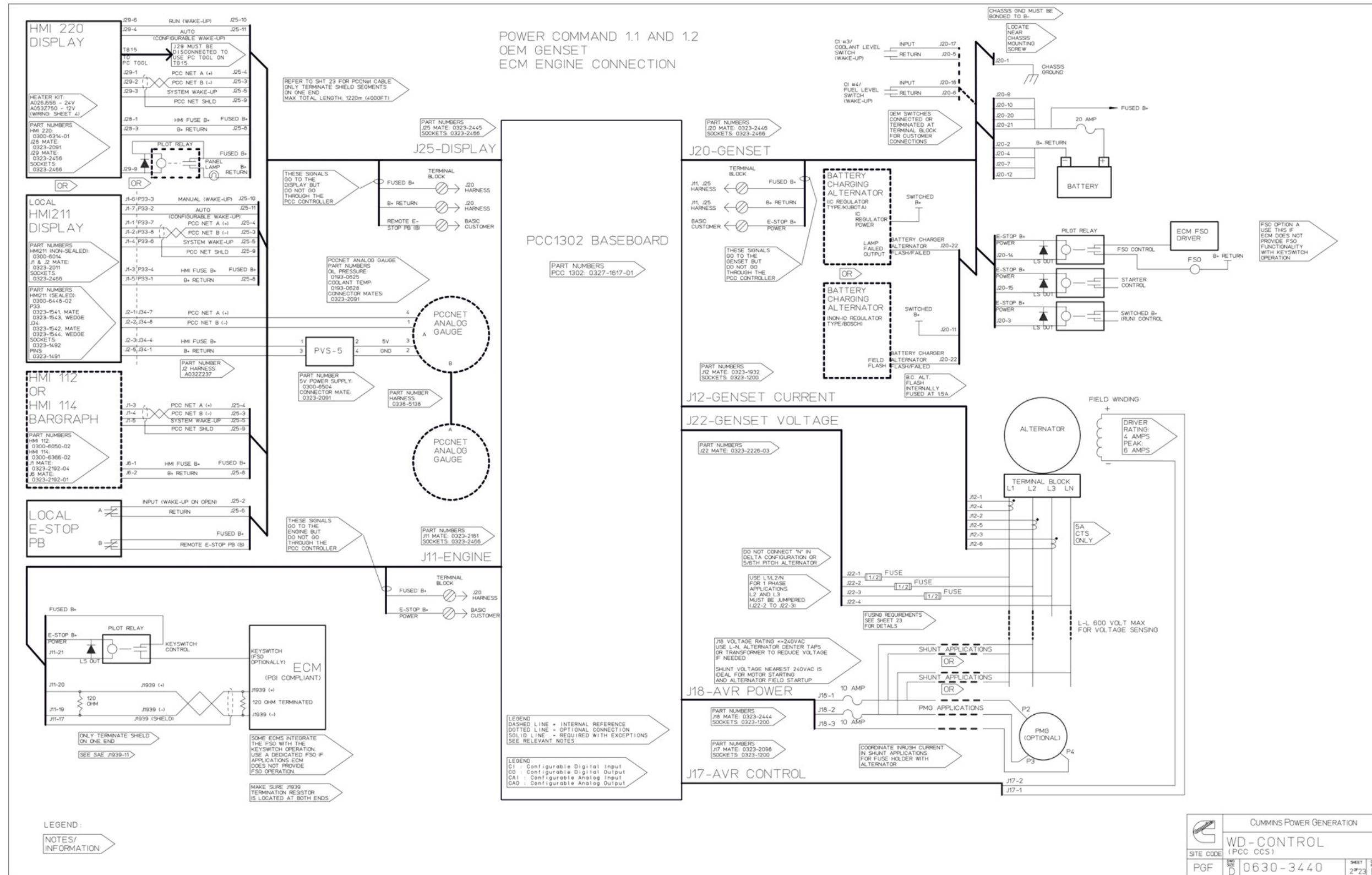


FIGURE 81. WIRING DIAGRAM (SHEET 1 OF 4)

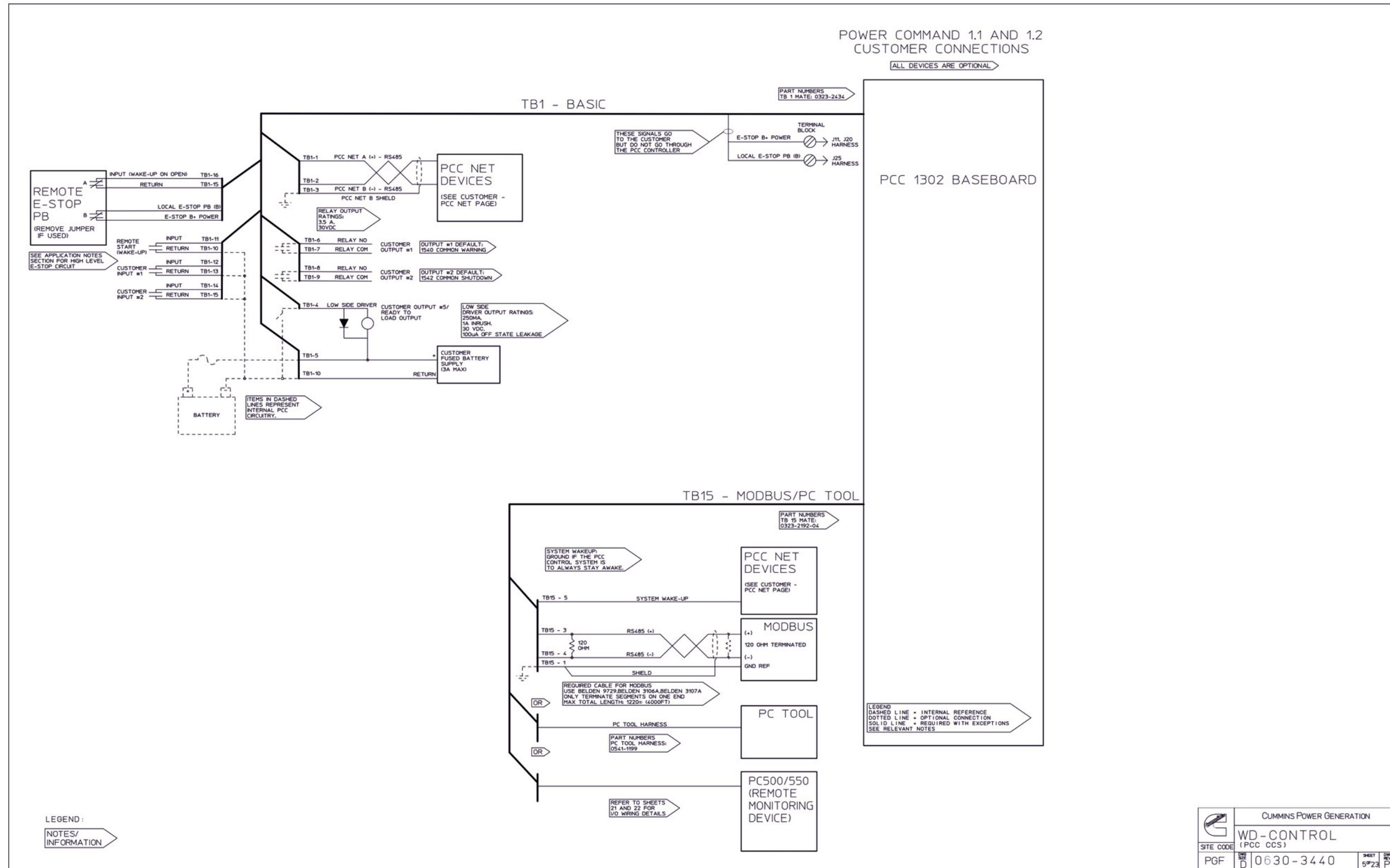


FIGURE 84. WIRING DIAGRAM (SHEET 4 OF 4)

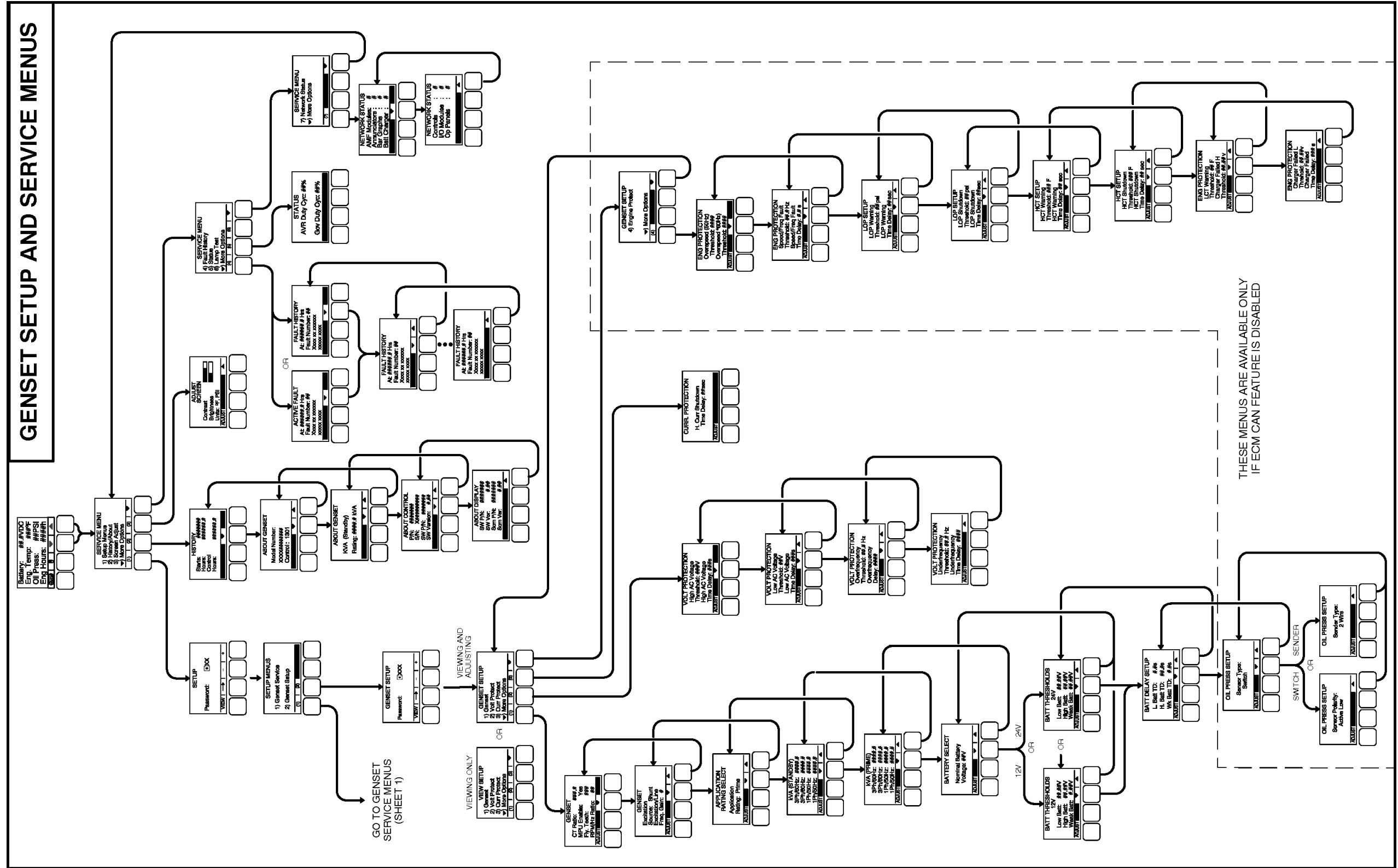


FIGURE 86. GENSET SETUP AND SERVICE MENUS (SHEET 2 OF 2)

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