Service Manual

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Cummins Power Generation

Controller

PowerCommand® 2100

English
Original Instructions

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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.

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 the equipment.

DANGER: Warns of a hazard that will result in severe personal injury or death.

WARNING: Warns of a hazard that may result in severe personal injury or death.

CAUTION: Warns of a hazard or an unsafe practice that can result in product or property damage.

NOTE: A short piece of text giving information that augments the current text.

1.2 General Information

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

NOTE: 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

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Allow the generator set to cool and bleed the system pressure first. To prevent severe scalding, let the engine cool down before removing the coolant pressure cap. Turn the cap slowly, and do not open it fully until the pressure has been relieved.
- Benzene and lead, found in some fuels, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline (if applicable to your product), take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.

- Keep multi-class ABC fire extinguishers handy. 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. (ref. NFPA No. 10).
- Make sure that rags are not left on or near the engine.
- Make sure generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.
- Substances in exhaust gases have been identified by some state or federal agencies as causing cancer or reproductive toxicity. Take care not to breath, ingest, or come into contact with exhaust gases.
- Do not store any flammable liquids, such as fuel, cleaners, oil, etc., near the generator set. A fire or explosion could result.
- Wear hearing protection when going near an operating generator set.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, the turbo charger, and the exhaust system.

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: Improper operation and maintenance can lead to severe personal injury or loss of life and property by fire, electrocution, mechanical breakdown, or exhaust gas asphyxiation. Read and follow all Safety Precautions, Warnings and Cautions throughout this manual and the documentation supplied with your generator set.

WARNING: Lifting and repositioning of the generator set must only be carried out using suitable lifting equipment, shackles, and spreader bars, in accordance with local guidelines and legislation, by suitably trained and experienced personnel. Incorrect lifting can result in severe personal injury, death and/or equipment damage. For more information, contact your authorized distributor.

1.3.1 Moving Parts Can Cause Severe Personal Injury Or Death

- Keep your hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect the battery charger from its AC source, then disconnect the starting batteries, 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.
- 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.
- 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 area for positioning the set should be adequate and level and the area immediately around the set must be free of any flammable material.

CAUTION: On an enclosed generator set, the canopy doors must be locked before re-positioning and they must remain locked during transportation and sitting.

1.4 Electrical Shock Can Cause Severe Personal Injury Or Death

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment. Do not wear jewelry. Jewelry can short out electrical contacts and cause shock or burning.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag and lock open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

1.4.1 AC Supply and Isolation

It is the sole responsibility of the customer to provide the AC power supply and the means to isolate the AC input to the terminal box. Refer to the wiring diagram supplied with the generator set.

NOTE: A separate disconnecting device is required by BS EN 12601:2001 and local electrical code.

NOTE: 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).

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

1.4.2 Medium Voltage Equipment (601 V to 15 kV)

- Medium voltage acts differently than low voltage. Special equipment and training is required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and experienced to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Due to the nature of medium voltage electrical equipment, induced voltage remains even after the equipment is disconnected from the power source. Plan the time for maintenance with authorized personnel so that the equipment can be de-energized and safely grounded.

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.
- Be sure all fuel supplies have a positive shutoff valve.
- Be 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 or during oil top-off or oil change must be cleaned up before starting the generator set.

1.5.2 Fluid Containment

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 line 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.

NOTE: ***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/sources.***

1.5.3 Do Not Operate in Flammable and Explosive Environments

Flammable vapor can cause an engine to overspeed 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 by fuel spill, leak, etc., 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 Power Generation 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 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.
- Be sure the unit is well ventilated.

WARNING: Engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

1.6.1 Exhaust Precautions

WARNING: Exhaust pipes and charge air pipes are very hot and they can cause severe personal injury or death from direct contact or from fire hazard.

WARNING: Hot exhaust gas can cause burns resulting in severe personal injury.

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.

WARNING: Inhalation of exhaust gases can result in serious personal injury or death. Be sure deadly exhaust gas is piped outside and away from windows, doors, or other inlets to buildings. Do not allow to accumulate in habitable areas.

WARNING: Contaminated insulation is a fire risk which can result in severe personal injury.

The exhaust pipes may have some insulating covers fitted. If these covers become contaminated by fuel or oil, 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 topping off the oil or draining the fuel filters.
- Clean the exhaust pipe thoroughly.

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2 Introduction

2.1 About This Manual

Read **Chapter 1 on page 1** and carefully observe all instructions and precautions in this manual. Keep this manual with the other generator set and/or controller manuals.

You should have a basic understanding of generator sets and power generation before you read this manual.

This is the service manual for the PCC 2100. It is not the service manual for the generator set ("genset") or any accessories.

2.2 System Overview

The PCC is a microprocessor-based control for Cummins Power Generation generator sets. All generator set control functions are contained in one circuit board (base board). The base 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 a digital display panel. It accepts menu-driven control and setup input from the push button switches on the front panel.

2.3 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 2100 Interface Kit (Used with InPower service tool)

2.4 How to Obtain Service

When the generator set requires servicing, contact your nearest Cummins Power Generation distributor. To locate your local Cummins Power Generation distributor, refer to www.cumminspower.com and select Distributor Locator. When contacting your distributor, always supply the complete Model, Specification, and Serial Number as shown on the nameplate.

2.4.1 Locating Your Distributor

In North America

Telephone 1-800-888-6626 (this is an automated service for touch-tone phones only) to contact the nearest Cummins Onan distributor in the United States or Canada. By selecting Option 1 (press 1), you will be automatically connected to the distributor nearest you.

If you are unable to contact a distributor using the automated service, consult the Yellow Pages. Typically, our distributors are listed under:

GENERATORS – ELECTRIC or

ENGINES – GASOLINE OR DIESEL

If you have difficulty arranging service or resolving an issue, please contact the Service Manager at the nearest Cummins Onan distributor for assistance.

When contacting your distributor, always supply the complete Model, Specification, and Serial Number as shown on the generator set nameplate.

Outside North America

If you are outside North America, telephone Cummins Onan at 1-763-574-5000 from 7:30 am to 4:00 pm, Central Standard Time, Monday through Friday, or fax 1-763-528-7229.

2.5 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.

AmpSentry and InPower are trademarks of Cummins Inc. PowerCommand is a registered trademark of Cummins Inc.

ACRONYM	DESCRIPTION	ACRONYM	DESCRIPTION
AC	Alternating Current	LED	Light-emitting Diode
AMP	AMP, Inc., part of Tyco Electronics	Mil Std	Military Standard
ASTM	American Society for Testing and Materials (ASTM International)	MMHG	Millimeters of Mercury
ATS	Automatic Transfer Switch	NC	Not Connected
AVR	Automatic Voltage Regulator	NC	Normally Closed
AWG	American Wire Gauge	NFPA	National Fire Protection Agency
CAN	Controlled Area Network	NO	Normally Open
CB	Circuit Breaker	NWF	Network Failure
CE	Conformité Européenne	OEM	Original Equipment Manufacturer

ACRONYM	DESCRIPTION	ACRONYM	DESCRIPTION
CFM	Cubic Feet per Minute	OOR	Out of Range
CGT	Cummins Generator Technologies	OORH / ORH	Out of Range High
CMM	Cubic Meters per Minute	OORL / ORL	Out of Range Low
CT	Current Transformer	PSI	Pounds per square inch
DC	Direct Current	PB	Push Button
ECM	Engine Control Module	PC	Personal Computer
ECS	Engine Control System	PCC	PowerCommand® Control
EMI	Electromagnetic interference	PGI	Power Generation Interface
EN	European Standard	PGN	Parameter Group Number
EPS	Engine Protection System	PI	Proportional/Integral
E-Stop	Emergency Stop	PID	Proportional/Integral/Derivative
FAE	Full Authority Electronic	PLC	Programmable Logic Controller
FMI	Failure Mode Identifier	PMG	Permanent Magnet Generator
FSO	Fuel Shutoff	PT	Potential Transformer
Genset	Generator Set	PTC	Power Transfer Control
GCP	Generator Control Panel	PWM	Pulse-width Modulation
GND	Ground	RFI	Radio Frequency Interference
HMI	Human-machine Interface	RH	Relative Humidity
IC	Integrated Circuit	RMS	Root Mean Square
INHG	Inches of Mercury	RTU	Remote Terminal Unit
ISO	International Organization for Standardization	SAE	Society of Automotive Engineers
kPA	kilo-Pascal	SPN	Suspect Parameter Number
LBNG	Lean-burn Natural Gas	SW_B+	Switched B+
LCD	Liquid Crystal Display	UL	Underwriters Laboratories
LCL	Low Coolant Level		
LCT	Low Coolant Temperature		

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3 Circuit Boards

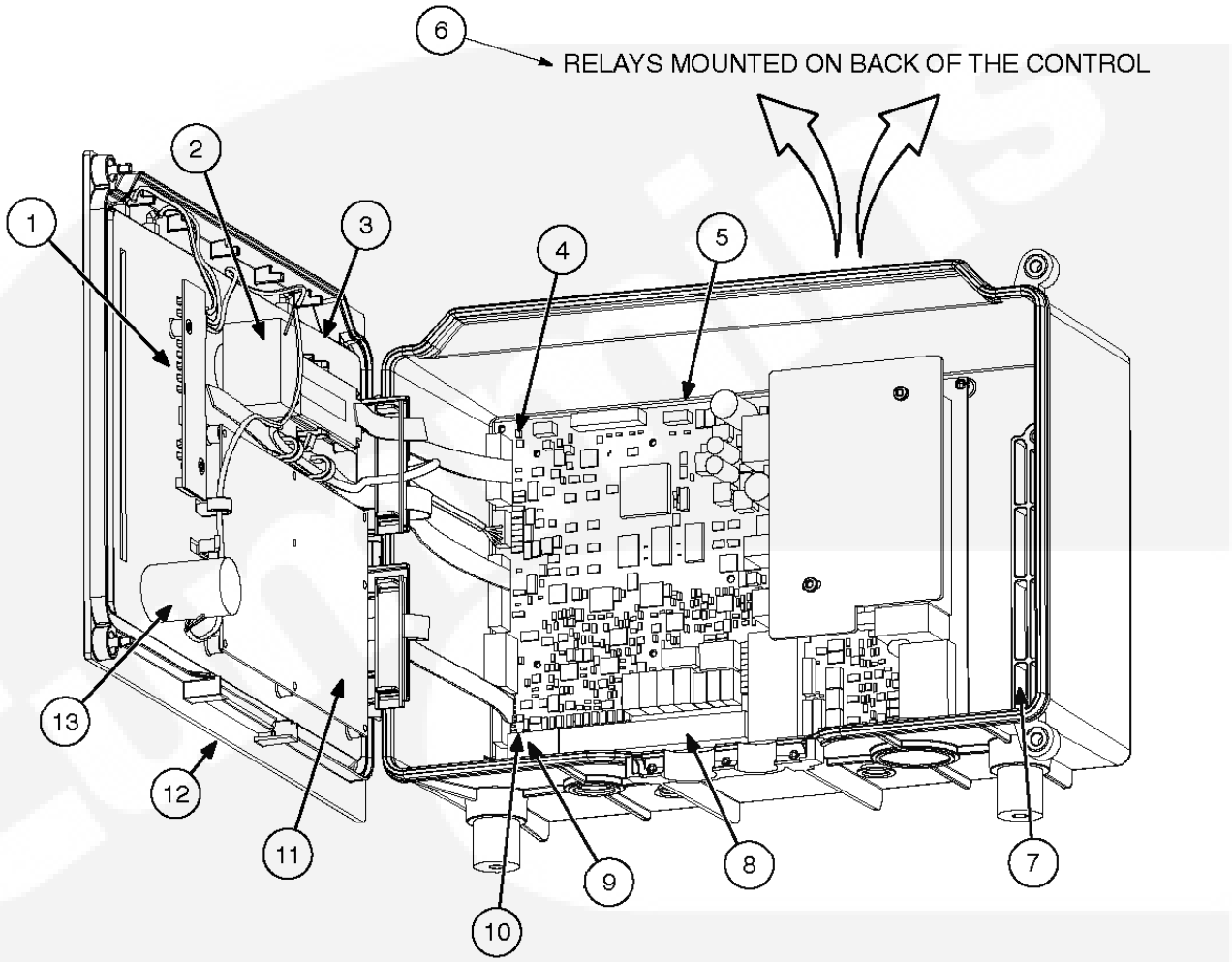
WARNING: HAZARDOUS VOLTAGE. Touching uninsulated parts inside the control panel box can result in severe personal injury or death. Measurements and adjustments must be done with care to avoid touching hazardous voltage parts.

WARNING: To avoid personal injury or harm, 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.

This section describes the function of the PowerCommand® 2100 Control (PCC) base circuit board that is contained in the control panel box.

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

3.1 Circuit Board Locations



NO	DESCRIPTION	NO	DESCRIPTION
1	Indicator Board	8	TB1 (1-22)
2	Emergency Stop Button	9	TB2 (1-6)
3	Display Board	10	Chassis Ground Screw
4	Control Alive Indicator	11	Bargraph Board (Optional)
5	Base Board	12	Front Control Panel Assembly (Membrane Buttons)
6	Relays	13	O/Manual/Auto Switch (S12)
7	AUX Relays (Optional)		

FIGURE 1. CIRCUIT BOARD LOCATIONS

3.2 Block Diagram

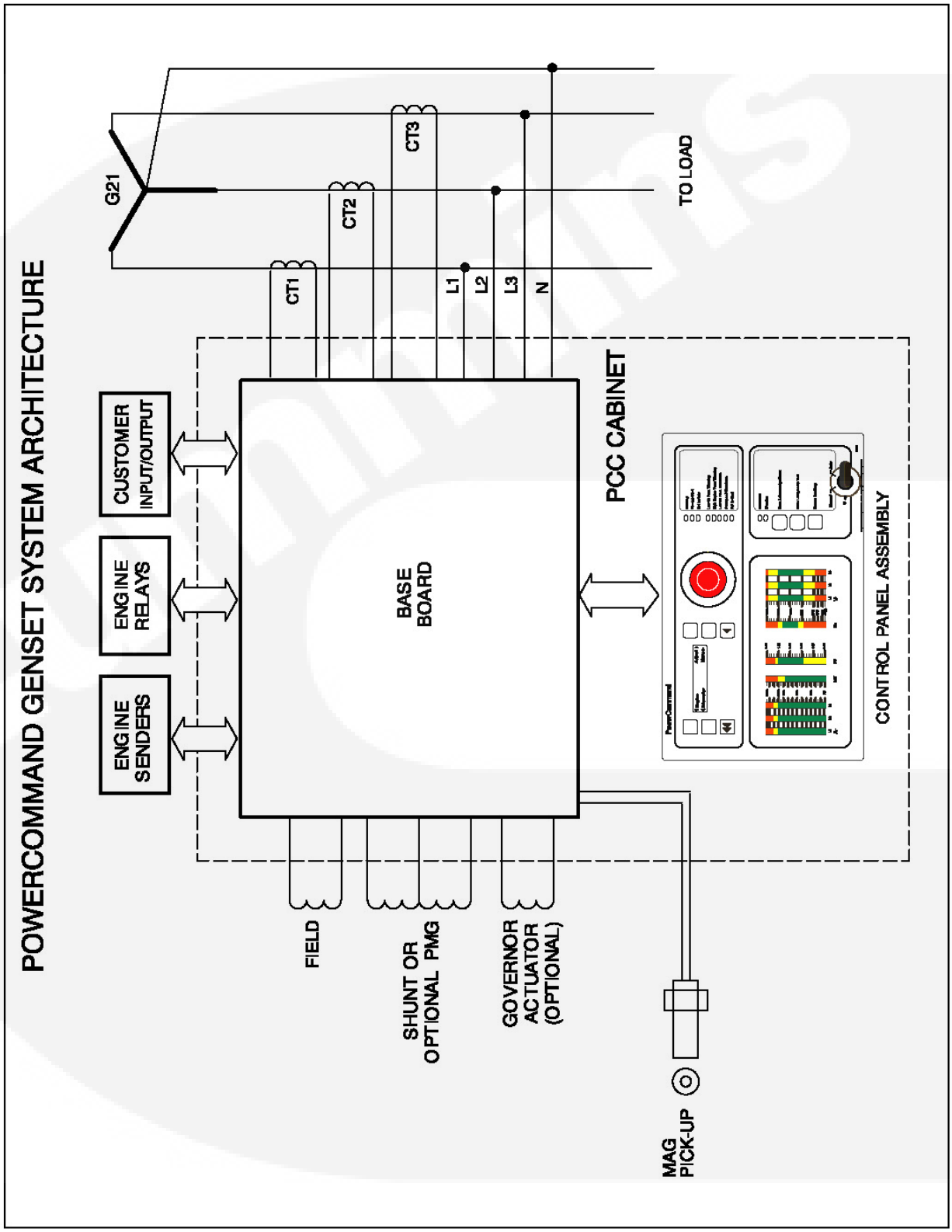


FIGURE 2. BLOCK DIAGRAM (NON-FAE)

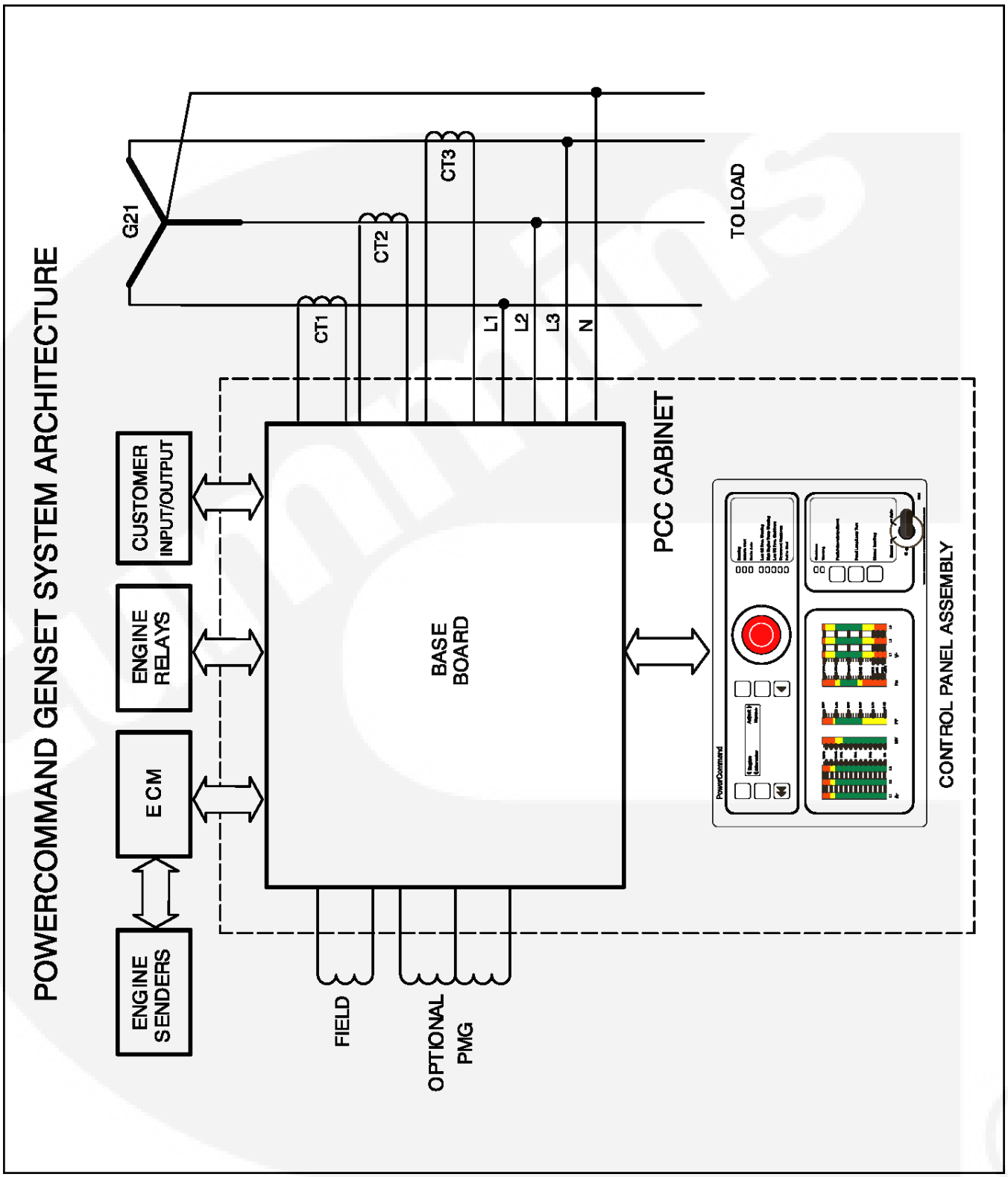


FIGURE 3. BLOCK DIAGRAM (ECM)

3.3 Base Board

The base circuit board contains all of the electronic circuitry required to operate the generator set. The Base board provides fuel control and engine speed governing, main alternator voltage output regulation, and complete generator set control and monitoring.

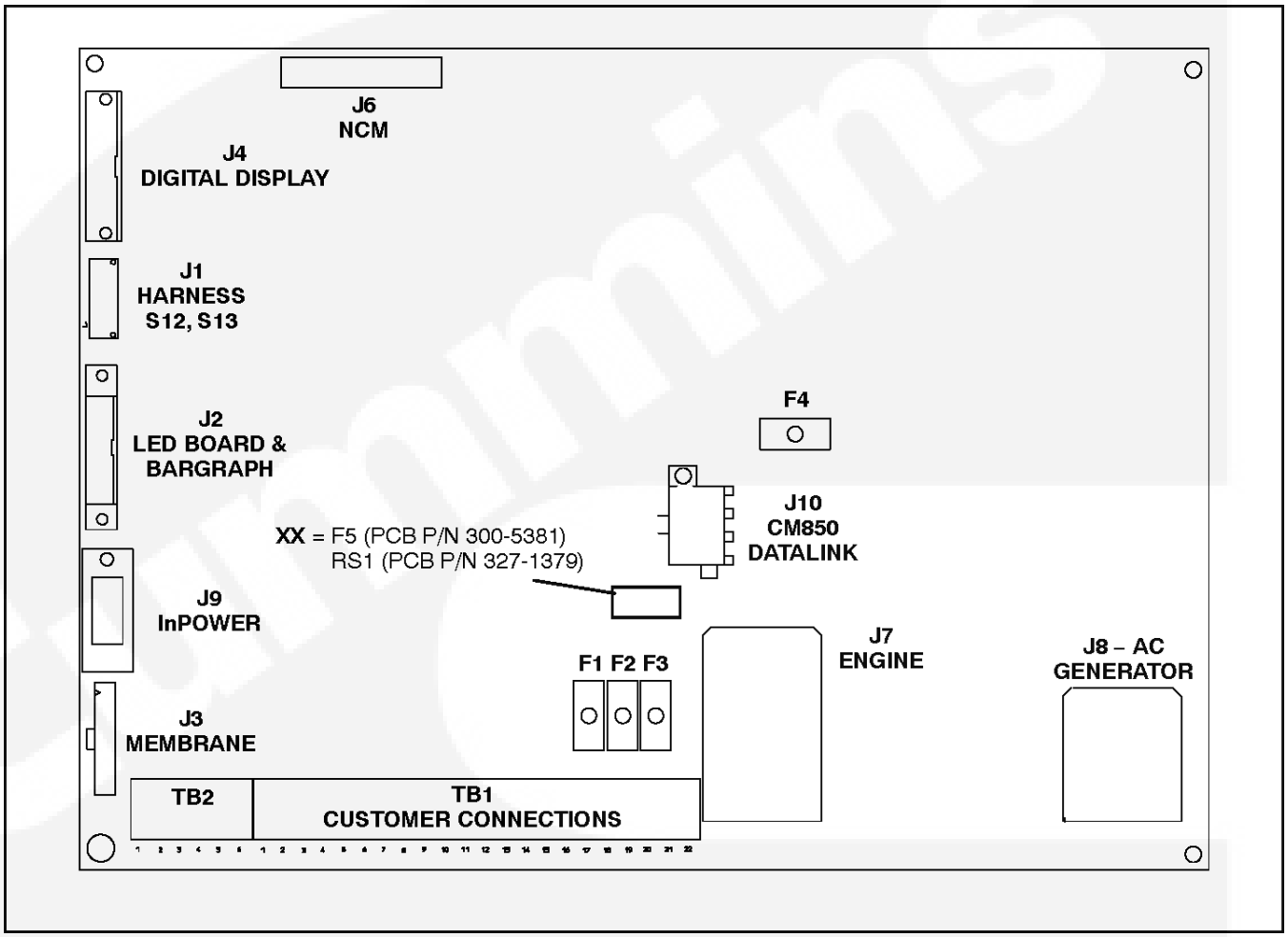


FIGURE 4. BASE BOARD

3.4 Connector J1

J1 connects to the Emergency Stop switch (S13) and the O/Manual/Auto control panel switch (S12).

TABLE 1. WIRE TABULATION

SIGNAL	FROM	TO
GND	S12-4	J1-8
OFF (O)	S12-1	J1-7
MANUAL	S12-3	J1-6
AUTO	S12-5	J1-5

ESTOP-NC1	S13-1	J1-2
ESTOP-NC2	S13-2	J1-1
ESTOP-NO1	S13-3	J1-3
ESTOP-NO2	S13-4	J1-4

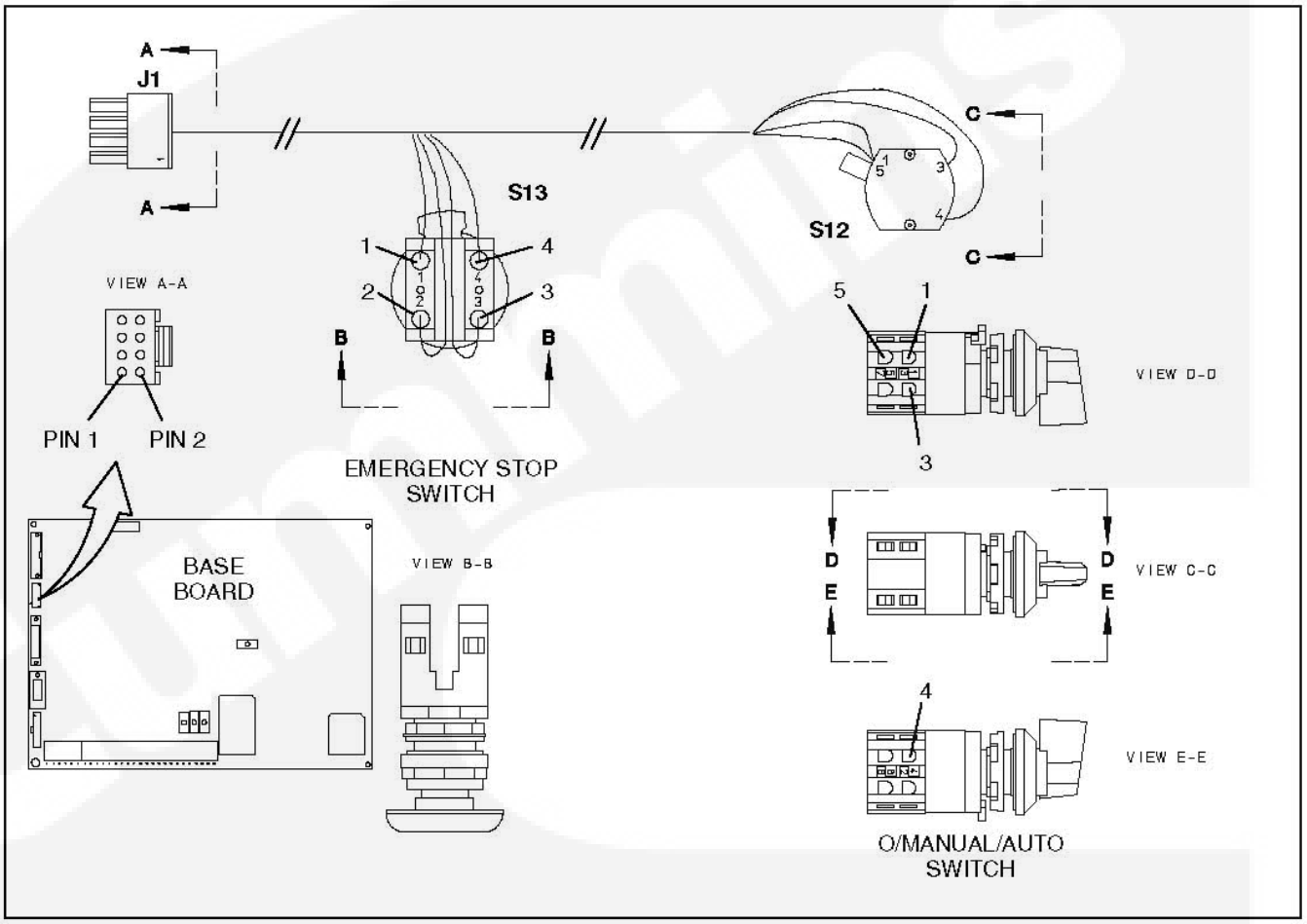


FIGURE 5. CONNECTOR J1 (CONTROL HARNESS)

3.5 Connector J2

J2 connects to LED (indicator) board and bargraph board of front control panel assembly.

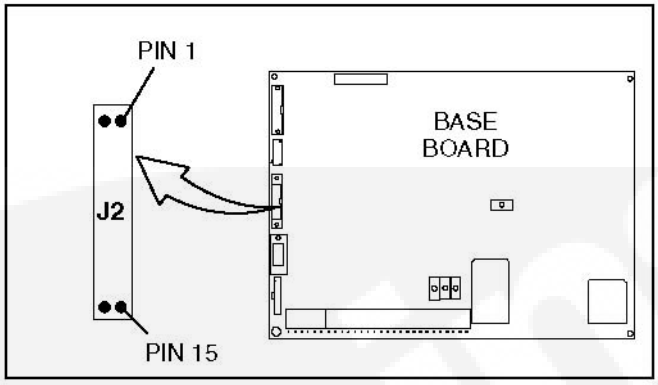


FIGURE 6. J2 LED/BARGRAPH CONNECTOR

TABLE 2. CONNECTOR J2

PIN	SIGNAL
1	MOSI
2, 4, 6, 16	GND
3	SCK
5	SEL_A
7	SEL_B
10, 14, 15	VCC
9	SEL_C
11	SEL_D
13	BAR_ENABLE

3.6 Connector J3

J3 connects to membrane buttons of front control panel assembly.

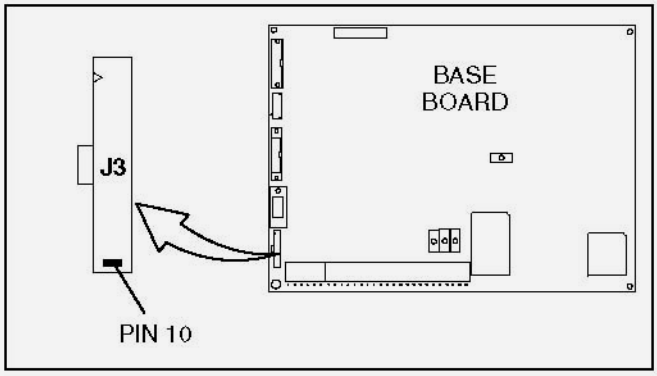


FIGURE 7. J3 MEMBRANE CONNECTOR

TABLE 3. CONNECTOR J3

PIN	SIGNAL

1	HOME MENU <<
2	PREVIOUS MENU <
3	UPPER LEFT
4	LOWER LEFT
5	UPPER RIGHT
6	LOWER RIGHT
7	FAULT ACK/RESET
8	PANEL LAMP
9	MANUAL RUN/STOP
10	COMMON (GND)

3.7 Connector J4

J4 connects to display menu of front control panel assembly.

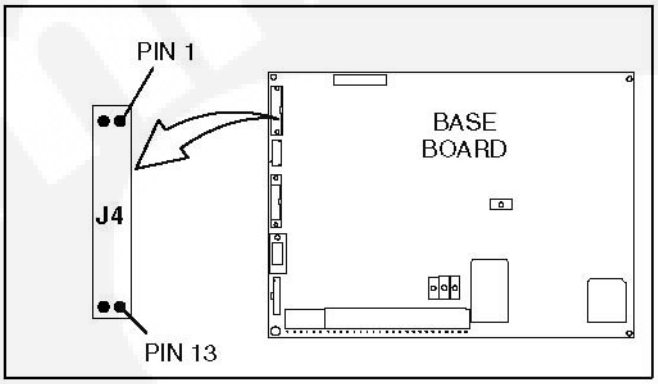


FIGURE 8. J4 DISPLAY MENU CONNECTOR

TABLE 4. CONNECTOR J4

PIN	SIGNAL
1	GND
2	VCC
3	N.U.
4	RS
5	R/W
6	ENABLE DISPLAY
7	D[0]
8	D[1]
9	D[2]
10	D[3]
11	D[4]
12	D[5]

13	D[6]
14	D[7]

3.8 Connector J7

In hydromechanical applications, J7 connects to the engine sensors, battery, starter, governor actuator and magnetic pickup. In ECM applications, J7 connects to the generator CT's, engine battery, K4 (starter) and K10 (fuel) pilot relays.

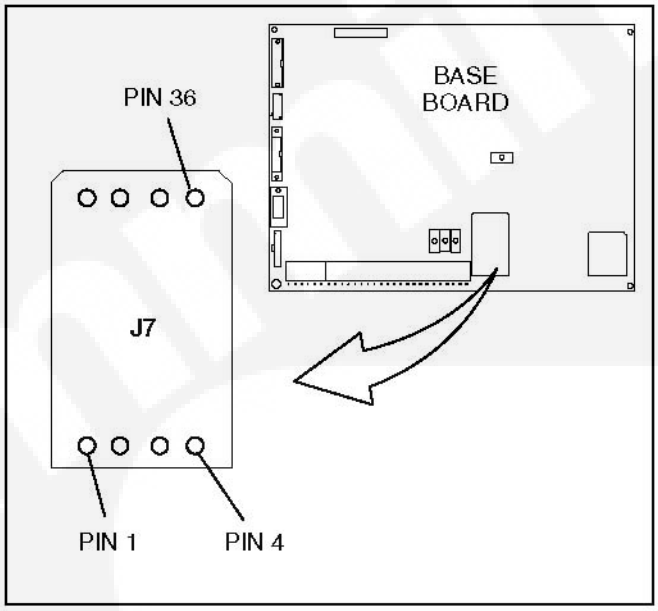


FIGURE 9. J7 ENGINE HARNESS CONNECTOR

TABLE 5. CONNECTOR J7 (NON-FAE)

PIN	SIGNAL
5, 6, 7, 8	GND
1, 2, 3, 4	B+ IN
9 10	GEN SW B+ FUEL SOL -
11 12	CT1 CT1-COM
13 17 21	OIL PRESS OUT OIL PRESS COM OIL PRESS 5V
15 16	CT2 CT2-COM
18	ALT FLASHOUT
19 20	CT3 CT3-COM

23 27	GEN SW B+ START SOL B-
24 36 14	ACTUATOR + GND ACTUATOR SIG
25 29 33	MAG PICKUP+ MAG PICKUP- GND
30 34	COOLANT SNDER COOLANT SNDER COM
31 32 35	COOL LVL B+ COOL LVL RTN COOL LVL GND

TABLE 6. CONNECTOR J7 (ECM)

PIN	SIGNAL
5, 6, 7, 8	GND
1, 2, 3, 4	B+ IN
9 10	GEN SW B+ K12 RELAY
11 12	CT1 CT1-COM
15 16	CT2 CT2-COM
18	ALT FLASHOUT
19 20	CT3 CT3-COM
23 27	GEN SW B+ START SOL B-

3.9 Connector J8

J8 connects directly to the generator to monitor and control AC output of the genset.

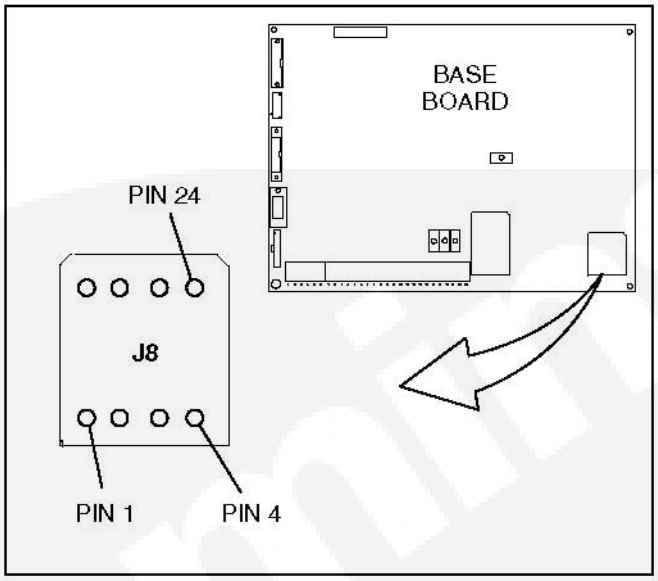


FIGURE 10. J8 AC GENERATOR CONNECTOR

TABLE 7. CONNECTOR J8

PIN	SIGNAL	COMMENTS
4 12 20 7	U1 (T1) V2 (T2) W3 (T3) N (T4)	Used for alternator voltage sensing and power factor angle sensing
13 5	FIELD + FIELD -	Excitation drive output
21 22 23	AC2 (PMG2) AC3 PMG3) AC4 (PMG4)	Used for excitation power (Shunt connection - pins 21 & 22 only)

TABLE 8. BASE BOARD FUSES

REFERENCE DESIGNATION	RATING	FUNCTION
F1	10A	Customer B+ (to TB1 customer terminal block)
F2	5A	Customer switched B+ (to TB1 customer terminal block)
F3	2A	Customer switched B+ (to T26 engine terminal block)
F4	5A	Base board power supply fuse
F5	2A	B+ supply to Power Transfer Control (PTC) module (optional) (PCB P/N 300-5381)
RS1 (Fuse/Auto Reset)	0.9A	B+ supply to Power Transfer Control (PTC) module (optional) (PCB P/N 327-1379)

3.10 Connector J10

In hydromechanical applications, J10 is not used. In ECM applications, J10 is the SAE J1939 CAN datalink connector. J10 connects to the engine control module (ECM) and the keyswitch relay.

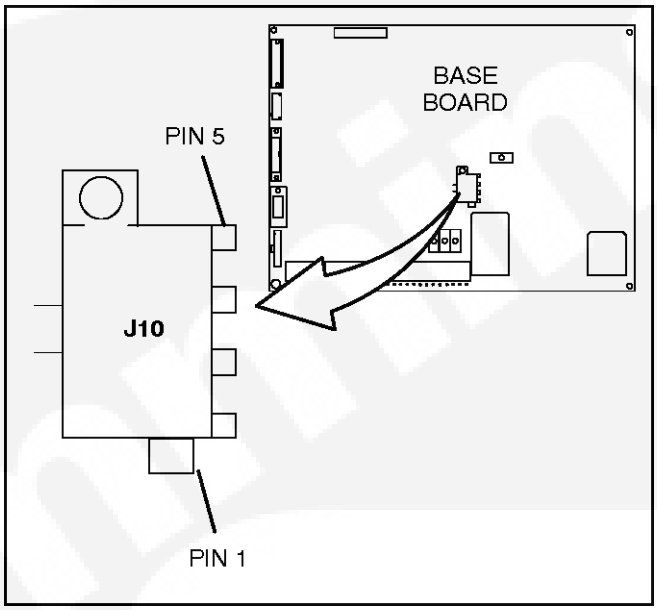


FIGURE 11. J10 ECM CONNECTOR

TABLE 9. CONNECTOR J10

PIN	SIGNAL
1 2	CAN + CAN -
3	Shield GND
4 5	Keyswitch Relay + Keyswitch Relay -

3.11 TB1 Customer Connections

Customer monitor/control connections are attached to terminal board TB1. Optional equipment such as sensing devices used to monitor genset operation, remote start/stop switches and etc. are attached to this terminal. Refer to Customer Connections diagram in *Appendix A* for TB1 connections.

4 Control System - PCC 2100

4.1 Control System Description

This manual covers the PowerCommand® Control 2100 (PCC2100) control module for single generator sets. All indicators, control switches/buttons and digital display are located on the face of the control panel as illustrated in the figure below.

The main control panel and its associated equipment are located in the Control Housing, which is mounted at the rear of the generator set. A Load Terminal Box may be mounted on either the left or right side of the housing, as required for the site.

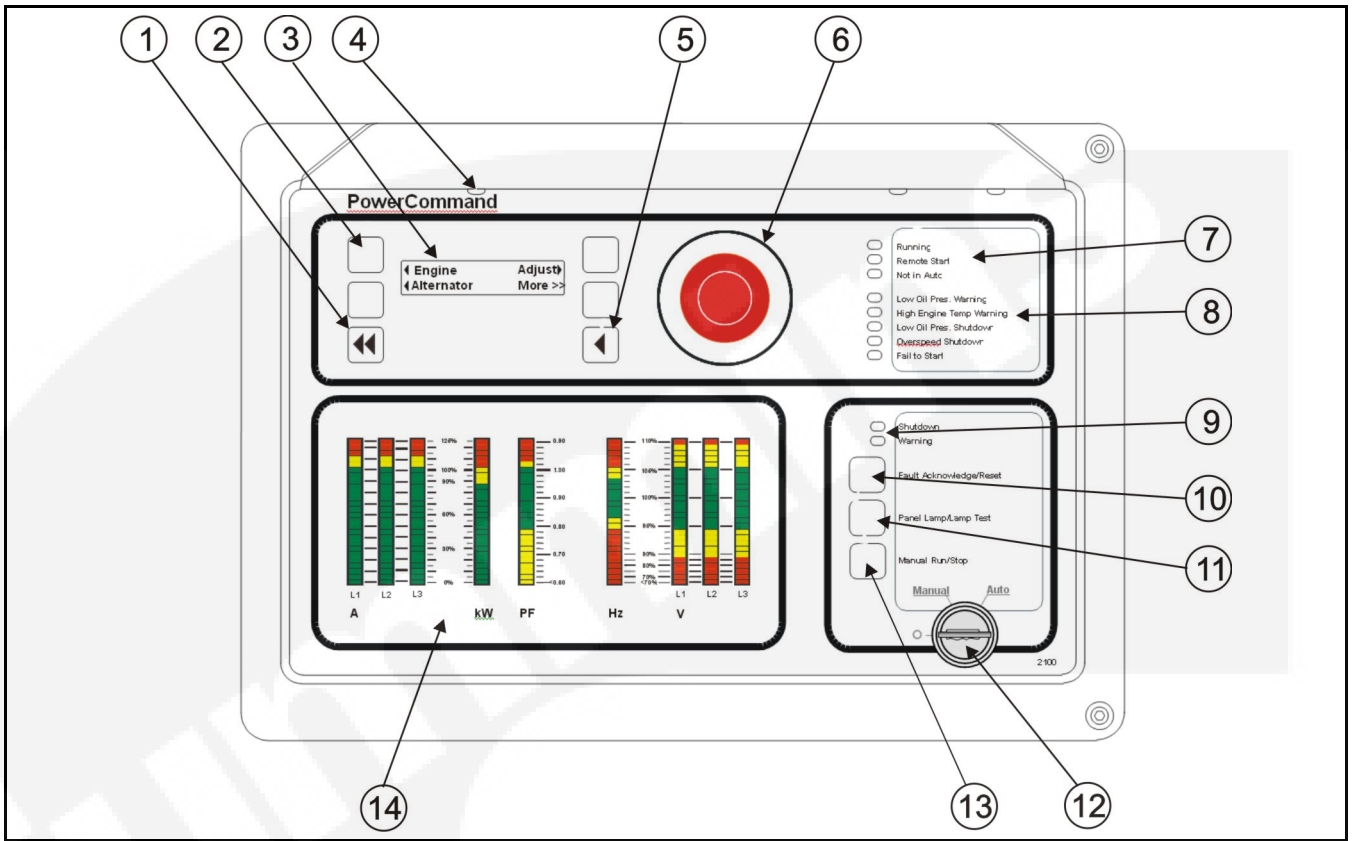
The PCC2100 is a microprocessor-based control for generator sets. It provides fuel control and engine speed governing, main alternator voltage output regulation, and complete generator set control and monitoring. The control also monitors the health of the engine, alternator, and auxiliary systems continuously, and will affect an Automatic Shutdown if a serious fault occurs.

The PCC2100 operates in conjunction with an array of sensors and senders located on the engine, alternator and auxiliary systems. Data is passed between components over a digital data link.

An important function of the control system is to continuously monitor the generator set for faults. If a fault occurs during engine running, the control will provide an indication for the operator and, if the fault is serious, affect an automatic, fully programmed, shutdown. There are two fault level signals generated by the PCC2100. These two fault levels are:

1. **Warning:** signals an imminent or non-critical engine fault. The PCC2100 provides an indication only for this condition.
2. **Shutdown:** signals a potentially critical fault for the engine. The PCC2100 will automatically take the engine off-load and shut it down immediately, without a cooldown run.

The control systems operate on 12 or 24VDC battery power. Data backup is taken care of by a small rechargeable battery installed within the PCC2100 enclosure. Auxiliary equipment operates on low voltage AC power.



NO	DESCRIPTION	NO	DESCRIPTION
1	Home Button	8	Configurable Indicators
2	Menu Selection Button (1 of 4)	9	Shutdown & Warning Status Indicators
3	Digital Display	10	Fault Acknowledgement/Reset Button
4	Panel Lamp	11	Panel Lamp & Lamp Test Button
5	Previous Main Menu Button	12	O/Manual/Auto Key Switch (Mode Switch)
6	Emergency Stop Push Button	13	Manual Run/Stop Button
7	Running/Remote Start/Not in Auto Indicators	14	Analog AC Metering Panel (Optional)

FIGURE 12. FRONT PANEL

4.2 Control Panel Power On/Off Modes

The power on/off modes of the control panel and operating software are Power On, Screen Saver, and Sleep/Awake.

4.2.1 Power On Mode

In this mode, power is continuously supplied to the control panel. The control's operating software and control panel LEDs/graphical display will remain active until the Screen Saver mode is activated.

4.2.2 Screen Saver Mode

Power to the graphical display will be removed after 10 minutes (generator set not running or running). The 10 minute timer resets and begins after each control panel action (any button or switch selection) or signal received by the operating software. The bottom LEDs of the Analog AC Metering Panel (bar graphs) may stay On during Screen Saver mode, indicating that the operating software is active (Awake mode).

When a "Warning" signal (for example, low coolant temp) is sensed by the control will display the warning message. The control will remain active until the Fault Acknowledge button is pressed to clear the warning message and start the 10 minute timer.

4.2.3 Sleep/Awake Mode

In the Sleep mode, the control's operating software is inactive and the LEDs and the digital display on the control panel are all off. Sleep mode is a feature used to reduce battery power consumption when the control is not being used and the O/Manual/Auto switch is in the O position.

When all conditions are met (i.e., no unacknowledged faults and O/Manual/Auto switch is in the O position), the Sleep mode is activated.

The operating software is initialized and the digital display and control panel LEDs are turned on in response to moving/pressing the following control panel switch/buttons:

- Off/Manual/Auto switch
- Emergency Stop button
- Fault Acknowledge/Reset button
- Panel Lamp/Lamp Test button

To activate the control and view the menu display without starting the generator set, press the Fault Acknowledge or Panel Lamp button or move the mode switch from O to Manual.

The InPower™ service tool is required to enable or disable the Sleep mode. When shipped from the factory, Sleep mode is disabled. When disabled, the operating software will always remain active (Awake mode). If network and/or power transfer control (PTC) feature is installed, the sleep mode is not available.

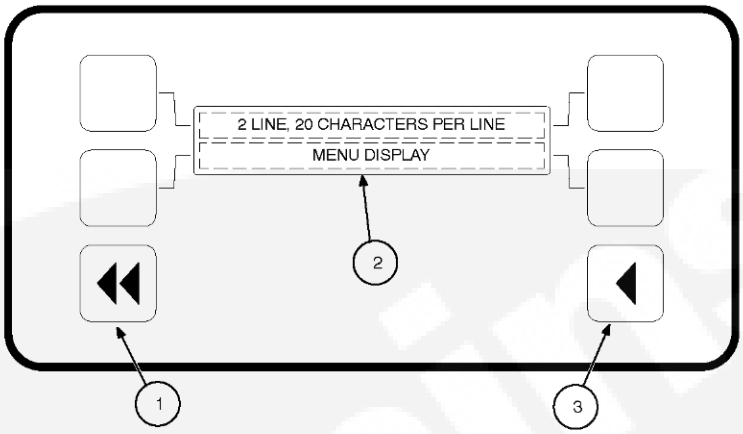
NOTE: The InPower service tool is required to select the desired mode. Contact an authorized service center for assistance.

4.3 Front Panel

The front panel contains the following components:

4.3.1 Digital Display

This two-line, 20-characters per line alphanumeric display is used to view menus of the menu-driven operating system. Refer to the menu trees later in this section. The display is also used to show warning and shutdown messages.



NO	Description
1	Home Button
2	Digital Display
3	Previous Main Menu Button

FIGURE 13. DIGITAL DISPLAY AND MENU SELECTION BUTTON

4.3.2 Display Menu Selection Button

Four momentary buttons-two on each side of the digital display window-are used to step through the various menu options and to adjust generator set parameters. A green triangle (◄ or ►), arrow (↑, ↓, ←, or →), >>, or plus/minus sign (+ or –) in the digital display adjacent to the button is shown when the button can be used (button is "active").

- In the digital display for main menus, the ◄ or ► symbols indicate that pressing the adjacent button causes the operating program to go to the selected submenu (e.g., Engine Menu).
- In the digital display, the More>> symbol indicates that pressing the adjacent button causes the operating program to go to the next main menu.
- In the digital display, the ↑ or ↓ symbols indicate that pressing the adjacent button causes the operating program to go to the next or previous submenu, as shown in the menu diagrams. Only the ↓ symbol is displayed in the first submenu. Only the ↑ is displayed in the last submenu. Both symbols are displayed in the rest of the submenus.
- In the digital display, the plus or minus symbols (+ or –) indicate that pressing the adjacent button can be used to change a parameter or value shown on the display.

  When there is a choice of two parameters, one parameter is associated with the + symbol and the other is associated with the – symbol.

  When changing values, pressing the button adjacent to the + symbol increases the value and pressing the button adjacent to the – symbol decreases the value. Only one numeric character of a field can be changed at a time.
- In the digital display, the ← or → symbol indicates that pressing the adjacent button causes the operating program to move the cursor to the next numeric character. The selected numeric character can then be changed by pressing the buttons adjacent to the + and – symbols. Only the → symbol is displayed when the cursor is on the first character of a field that can be changed. Only the ← is displayed when the cursor is on the last character. Both symbols are displayed when the cursor is on any other character.

- After adjusting values/parameters, pressing the ► symbol results in the changes being saved. **If the Home button or Previous Main Menu button is pressed before pressing the ► symbol, the changes are not saved.**

4.3.3 Home Button

Press this button (◄◄) to view the Home Menu. Refer to the menu trees that appear later in the manual.

4.3.4 Previous Main Menu Button

Press this button (◄) to view the previous Main Menu. All main menus include both types of green triangles (◄ and ►). Refer to the menu trees later in this manual.

NOTE: The up and down arrows (↑ and ↓) are used to navigate between the submenus.

4.3.5 Emergency Stop Button

Push this button in for emergency shutdown of the generator set. This will stop the generator set immediately and prevent starting of the set from any location (local and remote).

CAUTION: To avoid equipment damage, the Emergency Stop button must not be used for a normal shutdown, as this will prevent a cooling run in which the lubricating oil and engine coolant carry heat away from the engine combustion chamber and bearings in a safe manner.

If the generator set is not running, pushing the button in will prevent the starting of the engine, regardless of the Start signal source.

CAUTION: Ensure the remote start control is not active when the Emergency Stop is reset. The generator set may start after the Emergency Stop is reset upon receiving a remote start signal.

To reset:

1. Pull the button and allow it to pop out.
2. Press the Off button to acknowledge this action.
3. Press the front panel Fault Acknowledge/Reset button.
4. Select Manual or Auto, as required.

NOTE: Emergency Stop shutdown can be reset only at the operator panel.

CAUTION: Ensure that the cause of the emergency stop is fully investigated and remedied before a fault Reset and generator Start are attempted.

NOTE: On enclosed sets, an external Emergency Stop button is situated in close proximity to the control panel viewing window. For open generator sets, it is recommended that an additional Emergency Stop button be situated in close proximity to the plant room exit.

4.3.6 Running Indicator

This green lamp is lit whenever the generator (local or remote) is running.

4.3.7 Remote Start Indicator

This green lamp indicates the control is receiving a remote run signal. When flashing, it indicates a load demand stop mode.

4.3.8 Not in Auto

This red lamp flashes continuously when the O/Manual/Auto switch is not in the Auto position.

☞ **NOTE: If the switch is in the Auto position and the lamp is still flashing, service is required.**

4.3.9 Analog AC Metering Panel

This panel simultaneously displays 3-phase line to line AC volts and current, kW, power factor and frequency.

The meter panel is composed of a series of LEDs, that are configured in bar graphs for each function. The LEDs are color coded, with green indicating normal range values, amber for warning levels, and red for shutdown conditions.

Scales for each function are in % of nominal values. Resolution is 1% for values close to nominal, and increases at values further from nominal.

4.3.10 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 turning the O/Manual/Auto switch to the O position, and pressing the Fault Acknowledge button. The generator set cannot be started when this lamp is on.

Dependent upon the specific fault that occurs, the engine may or may not shut down immediately. A fault that could cause engine damage, causes an immediate engine shutdown (bypasses engine cooldown sequence). All other faults would allow the engine to run during the cooldown sequence before engine shutdown. In this case, the Shutdown Status indicator blinks during the cooldown period.

4.3.11 Warning Status Indicator

This yellow lamp is lit whenever the control detects a warning condition. After the condition is corrected, warning indicators can be reset by pressing the Fault Acknowledge button. (It is **not** necessary to stop the generator set if the fault becomes inactive during generator set operation.) In auto mode, warning indicators can also be reset by cycling the remote reset input after the condition is corrected.

Some warnings remain active after the condition is corrected and the control reset button is pressed. This will require the generator set to be shut down to reset the warning indicator.

4.3.12 Fault Acknowledgement/Reset Button

Press this button to acknowledge warning and shutdown messages after the fault has been corrected. Pressing this button clears the fault from the current fault list.

To acknowledge a Warning message, the O/Manual/Auto switch can be in any position. (It is not necessary to stop the generator set to acknowledge an inactive Warning condition.) To acknowledge a shutdown message with this button, the O/Manual/Auto switch must be in the O position.

4.3.13 Panel Lamp and Lamp (LED) Test Button

Press this button to turn the control panel lamps on or off. The lights will shut off after about ten minutes. Press and hold this button to test all front panel LEDs and meters. The meters will light one bar at a time.

4.3.14 Manual Run/Stop Button

This button starts and stops the generator set locally and will bypass the Time Delay to Start and Stop sequences. The O/Manual/Auto switch must be in the Manual position to enable this button.

4.3.15 O/Manual/Auto Switch

Manual position enables the use of the switch panel Manual Run/Stop button.

Auto position enables start/stop control of the engine from a remote location. (Disable the use of the switch panel Manual Run/Stop button.)

O (off) position prevents the starting of the set (local or remote).

CAUTION: If moved to the O position during set operation, this will cause an immediate engine shutdown (bypasses cooldown timers). Hot shutdowns should be avoided to prolong the reliability of the generator set. Hot shutdowns are logged by the system software.

NOTE: When the generator set is operating in the Remote Start Mode, removing the Remote Start Command does not shut off the engine if the load is more than 10 percent, the cooldown timer is set to zero, and the control is configured for a single unit (not in parallel). The generator set continues to operate until it runs out of fuel, the E-stop button is used, or the load is removed.

4.3.16 Configurable Indicators

The following configurable indicators (default values shown) can be changed with the InPower service tool. The configurable items are: change generator event and LED color (green, yellow or red), and enable/disable indicator.

The InPower service tool is required to select the desired settings. Contact an authorized service center for assistance.

4.3.17 Low Oil Pressure Warning Indicator

This yellow lamp indicates the oil pressure is lower than the normal range of operation.

4.3.18 High Engine Temperature Warning Indicator

This yellow lamp indicates the engine temperature is higher than the normal range of operation.

4.3.19 Low Oil Pressure Shutdown Indicator

This red lamp indicates the engine has shut down because of low oil pressure.

4.3.20 Overspeed Shutdown Indicator

This red lamp indicates the engine has shut down because of excessive speed.

4.3.21 Fail to Start Indicator

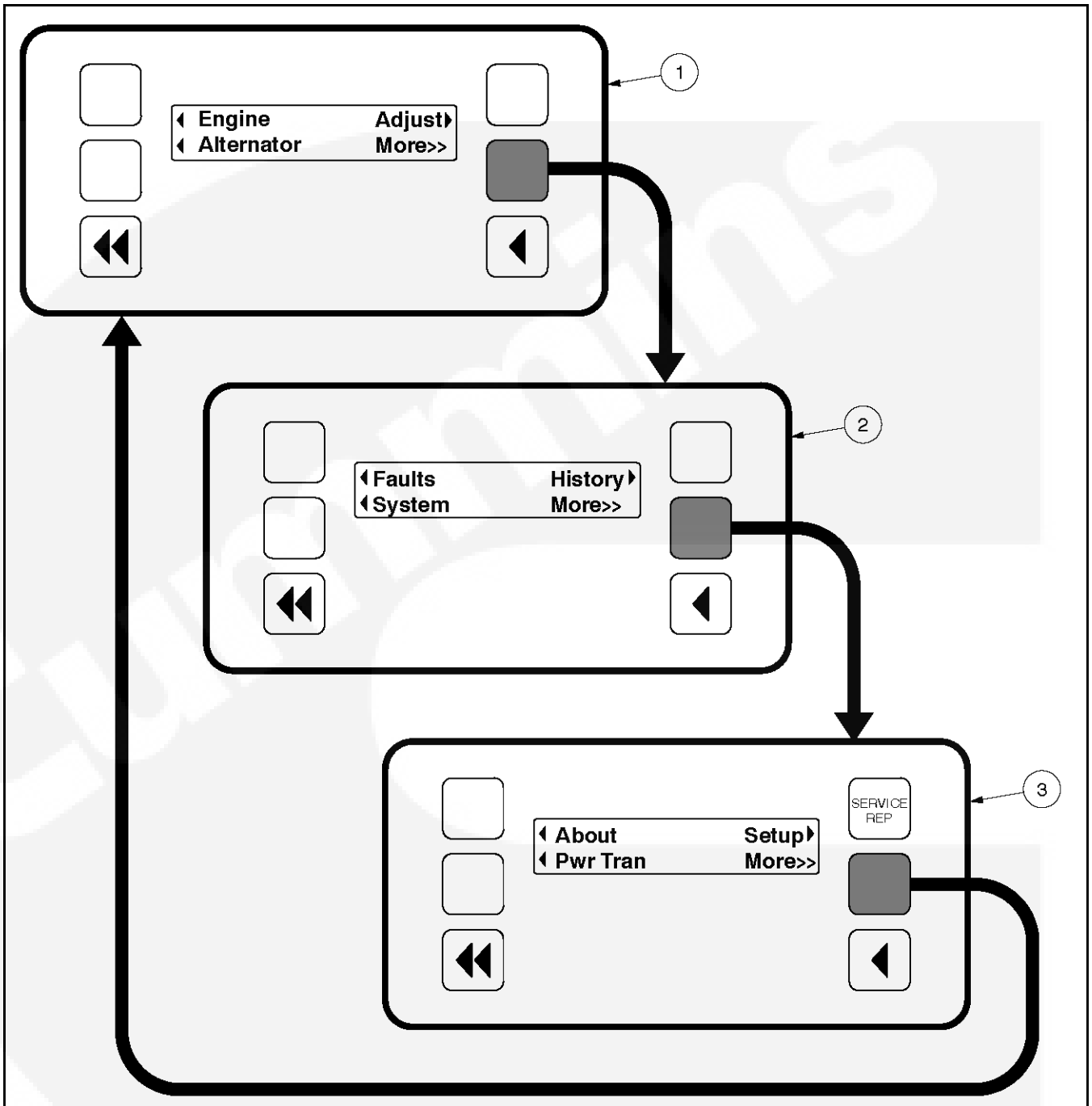
This red lamp indicates the engine failed to start.

4.4 Control Menus

4.4.1 Main Menus

The figure below shows the three major main menus available to the user. When viewing a submenu, you can press the previous main menu button at any time to view its main menu.

As shown in the illustration, each main menu can branch into one of four directions. Press the button next to "More>>" in the display to view the next Main menu. Main Menu 1 is redisplayed when you press the button next to "More>>" in the Main Menu 3 display.



NO	DESCRIPTION	NO	DESCRIPTION
1	Main Menu 1	3	Main Menu 3
2	Main Menu 2		

FIGURE 14. MAIN MENUS

4.4.1.1 Main Menu 1

Main Menu 1 is also the Home menu. When viewing any of the other main menus or any submenu, you can press the home button to view this menu.

To display engine parameters, such as coolant temperature, oil pressure, oil temperature, etc., press the button next to the word "Engine" in the display. Refer to the Engine menu diagram.

To display alternator parameters, such as line-to-line voltage, line-to-neutral voltage, amperage, frequency, etc., press the button next to the word "Alternator" in the display. Turn to the Alternator menu diagram.

To adjust generator parameters, such as idle start, voltage, frequency, start delay, and stop delay, press the button next to the word "Adjust" in the display. Turn to the Adjust menu diagram.

To view one of the other main menus, press the button next to "More>>" in the display.

4.4.1.2 Main Menu 2

To display system faults, press the button next to the word "Faults" in the display. Up to 20 of the most recent/current faults can be displayed. Refer to the Faults menu diagram.

To view network system parameters, such as on the automatic transfer switch (ATS), Master, or Genset system, press the button next to the word "System" in the display. Refer to the System menu diagram.

To display historical engine parameters such as number of starts, engine hours, control hours, kilowatt hours, and genset duty cycle, press the button next to the word "History" in the display. Refer to the History menu diagram.

To view one of the other main menus, press the button next to "More>>" in the display.

4.4.1.3 Main Menu 3

To view parameters on the generator, such as model, standby rating, and software version, press the button next to the word "About" in the display. Refer to the About menu diagram.

To view power transfer parameters, such as source power, frequency, generator, utility, and active transfer timer, press the button next to the word "Pwr Tran" in the display. Refer to the Power Transfer Menu

Main Menu 3 also includes a link to the Setup menus. These menus can be viewed but changes to these menus are restricted to service personnel with the appropriate access code.

To view one of the other main menus, press the button next to "More>>" in the display.

4.4.2 Adjusting Default Settings

The Controller Configuration Menu can be used to adjust the following default settings:

- Language - Select from available loaded languages
- Temperature Units - Fahrenheit or Centigrade
- Fluid Pressure Units - kPA or PSI

For more information on adjusting these settings, turn to the Controller Configuration menu diagram.

4.4.3 System Messages

A system message pop-up screen is displayed when the event it is displaying becomes active. These pop-up screens remain displayed until pre-empted by another pop-up screen or until any display button is pressed. Once a button is pressed, the previous menu is redisplayed. To return to an active pop-up screen from the previous menu, select the following menu:

- *Engine* to redisplay Time Delay Idle
- *Faults* to redisplay Faults

Pop-up screens are displayed for the following:

- Faults
- Power Transfer Control timer
- Time Delay - Start, Stop, and Idle

An example of a Time Delay Idle pop-up screen is shown below. A countdown, in seconds, is included in the display.

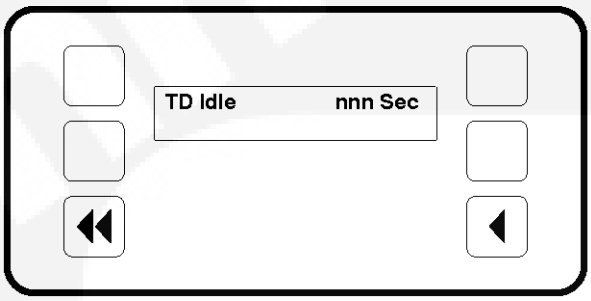


FIGURE 15. TIME DELAY IDLE POP-UP SCREEN

4.4.4 Controller Configuration Menu

Figure 16 on page 34 shows a block representation of the Controller Configuration menus. These menus are used to change the default language, temperature units, and pressure units to be displayed in menus.

To view the first Controller Configuration menu, make sure Main Menu 1 is displayed and simultaneously press the Home Menu and Previous Main Menu buttons.

As shown in the diagram, the Controller Configuration menu has three submenus.

- **Language Selected submenu:** Used to select desired language (default = English).
- **Temperature Units submenu:** Used to select Fahrenheit or Centigrade for temperature readings.
- **Fluid Pressure Units submenu:** Used to select PSI or kPA for pressure readings.

Press the buttons next to the up and down arrows in the digital display to navigate between the menus.

Press the button next to the ► symbol in the display until the + and - symbols are displayed.

Press the button next to the + or – symbol to select the desired option.

After selecting option, pressing the ► symbol results in the changes being saved. If the Home button or Previous Main Menu button is pressed before pressing the ► symbol, the changes are not saved.

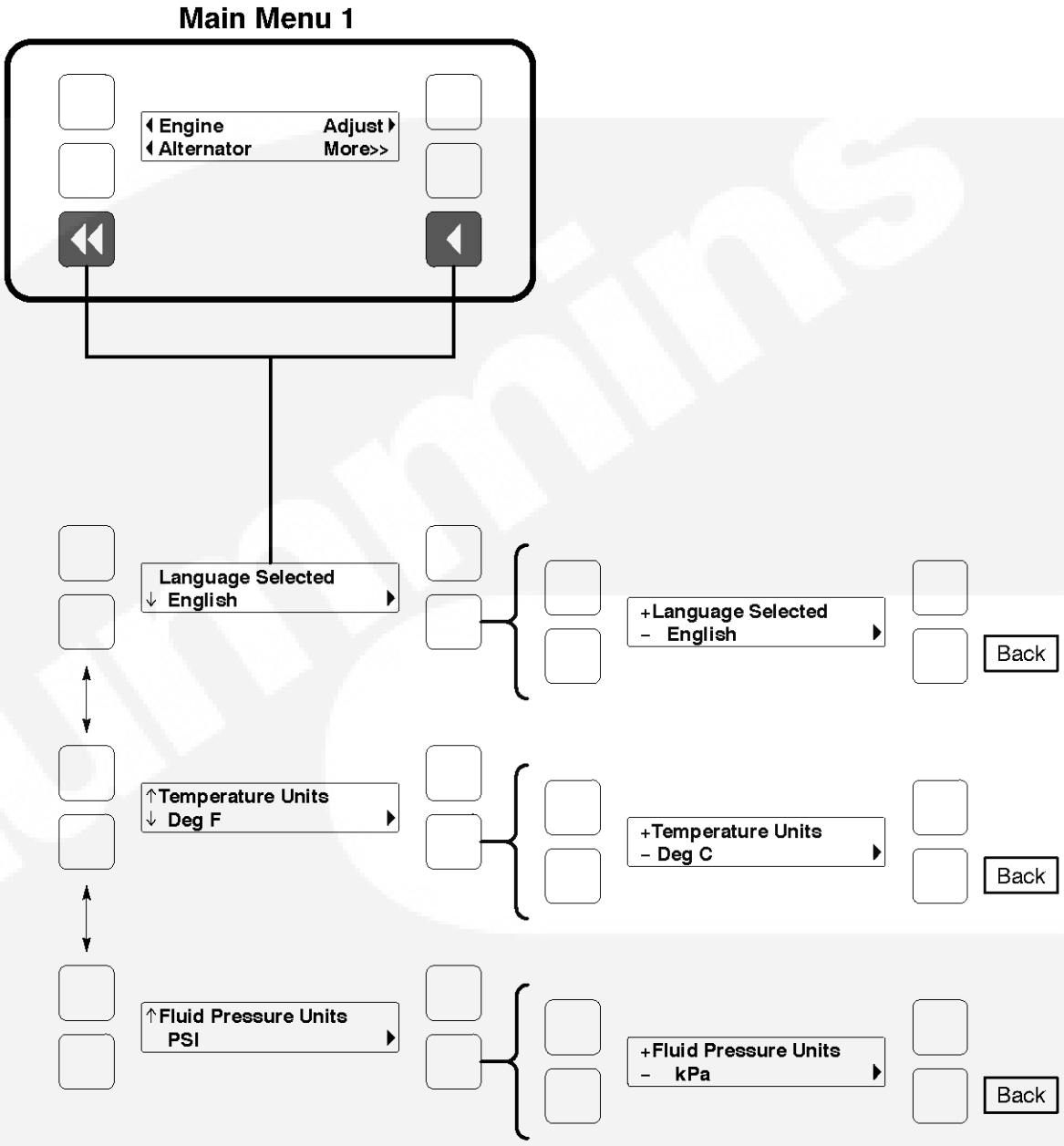


FIGURE 16. CONTROLLER CONFIGURATION MENU

4.4.5 Engine Menu

Figure 17 on page 36 shows a block representation of the Engine menu. If you press the button next to the word "Engine" in the display, the first Engine submenu is displayed.

As shown in the diagram, the Engine menu has seven submenus. The data in the submenus will vary according to the type and number of sensors provided with the engine.

- **Coolant Temperature submenu:** This submenu displays the engine coolant temperature which can be viewed in degrees Fahrenheit or Centigrade (see the **Section 4.4.4**).
- **Oil Pressure submenu:** This submenu displays the engine oil pressure which can be viewed in PSI or kPA (see **Section 4.4.4 on page 33**).
- **Oil Temperature submenu (Only available on some models):** This submenu displays the engine oil temperature which can be viewed in degrees Fahrenheit or Centigrade (see **Section 4.4.4 on page 33**).
- **Engine Speed submenu:** This submenu displays the engine RPM.
- **Battery Voltage submenu:** This submenu displays the engine battery voltage.
- **Governor Duty Cycle submenu:** This submenu displays the governor duty cycle (drive) levels in percentage of maximum.
- **Active Time Delay submenu:** This submenu displays the time delay that is currently active: warm-up, cooldown, start, or stop delays.

Press the buttons next to the ↓ and ↑ symbols in the digital display to navigate between the menus. Press the Home button or the Previous Main Menu button to return to Main Menu 1.

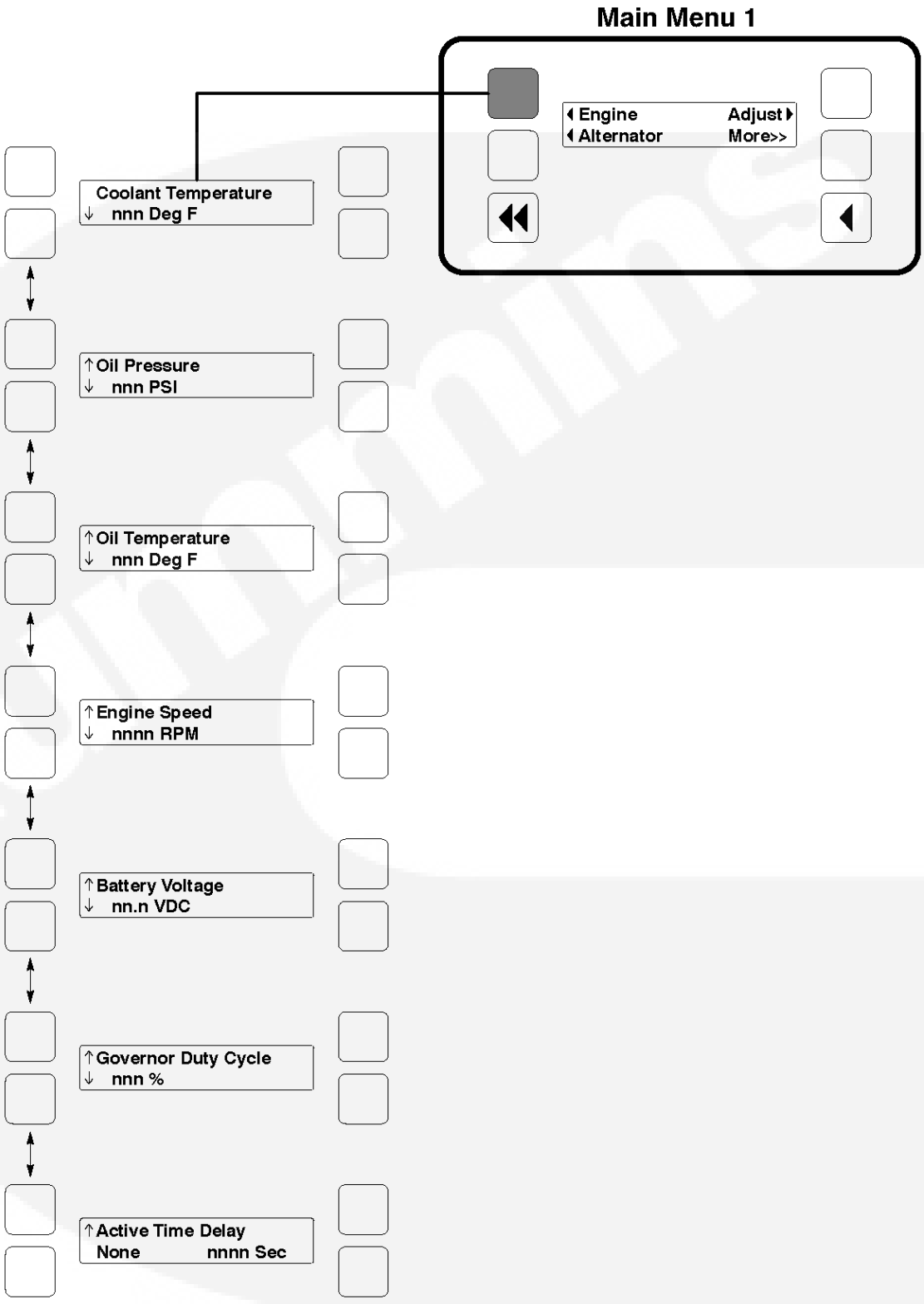


FIGURE 17. ENGINE MENU

4.4.6 Alternator Menu

Figure 18 on page 38 shows a block representation of the Alternator menu. If you press the button next to the word "Alternator" in the display, the first Alternator submenu is displayed.

As shown in the diagram, the Alternator menu has eleven submenus.

- **Line-to-Line Voltage submenu:** The voltages Line-to-Line (L1, L2 and L3) are measured between L1 to L2, L2 to L3 and L3 to L1, respectively. (Single phase - L1 to L2 only.)
- **Line-to-Neutral Voltage submenu:** Note that the Line-to -Neutral menu will not be displayed for a 3 phase/3 wire system. Single phase - L1 to N and L2 to N.
- **Amps submenu:** All phases. (Single phase - L1 and L2 only.)
- **Frequency submenu:** Generator set output frequency.
- **Total Real Power submenu:** This submenu displays the total amount of real power output, in kilowatts (kW).
- **Real Power submenu:** This submenu displays the amount of real power output for L1, L2, and L3, in kilowatts (kW). (Single phase - L1 and L2 only.)
- **Total Apparent Power submenu:** This submenu displays the total amount of apparent power output, in kilovolt amps (kVA).
- **Apparent Power submenu:** This submenu displays the amount of apparent power output for L1, L2, and L3, in kilovolt amps (kVA). (Single phase - L1 and L2 only.)
- **Total Power Factor submenu:** This submenu displays the power factor with leading/lagging indication.

  The PF reading will contain an asterisk if the power factor is leading (for example, Total PF 0.9).*
- **Power Factor submenu:** This submenu displays a power factor value for L1, L2, and L3. (Single phase - L1 and L2 only.)

  The PF reading will contain an asterisk if the power factor is leading (for example, PF L1 0.9).*
- **AVR Duty Cycle submenu:** This submenu displays the voltage regulator (drive) level in percentage of maximum. (Where maximum is 100% Duty Cycle, software clamps Duty Cycle maximum to 60% for PMG and 90% for shunt.)

Press the buttons next to the ↑ and ↓ arrows in the digital display to navigate between the menus. Press the Home button or the Previous Main Menu button to return to Main Menu 1.

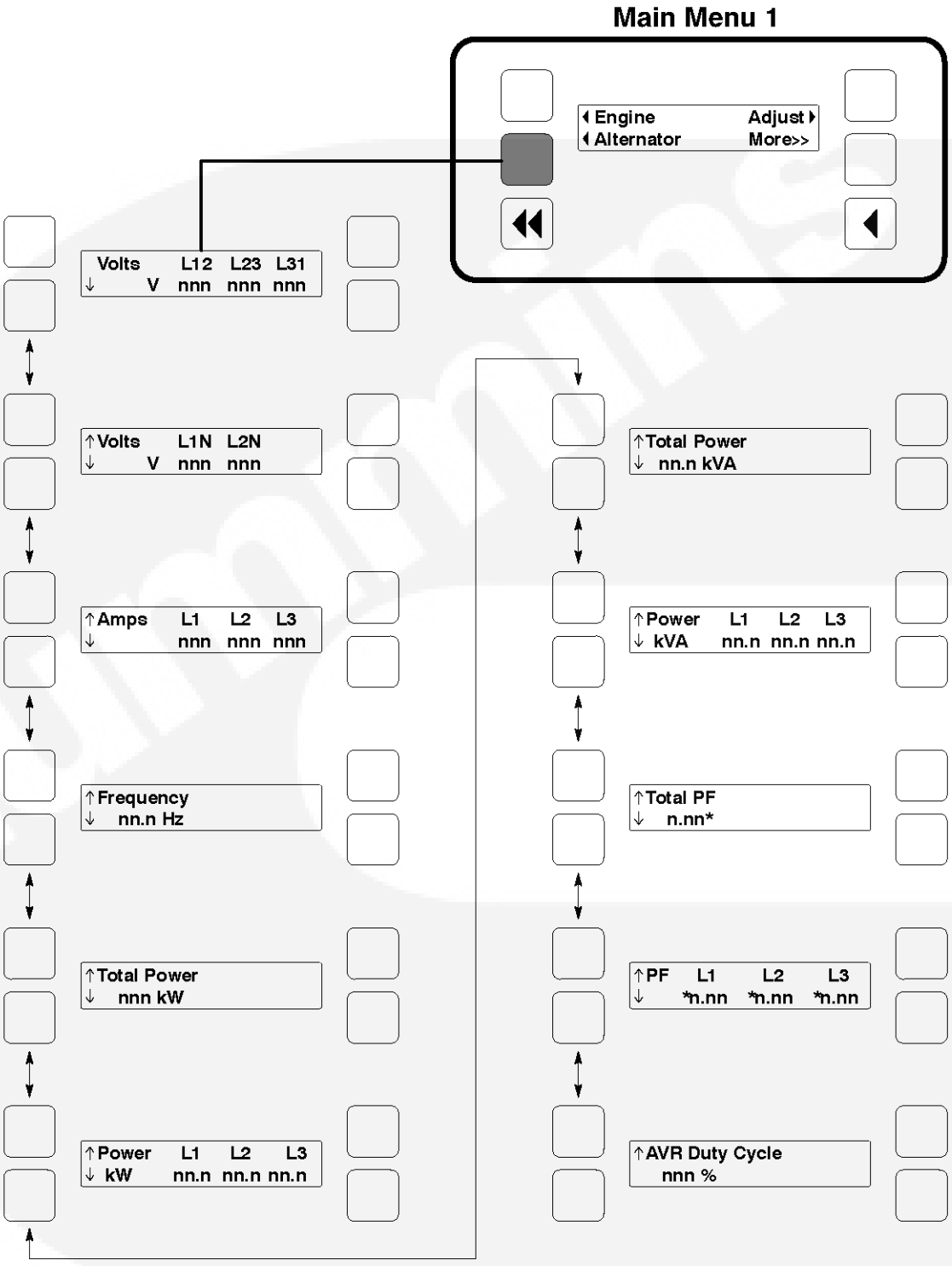


FIGURE 18. ALTERNATOR MENU

4.4.7 Adjust Menu

Figure 19 on page 40 shows a block representation of the Adjust menu. If you press the button next to the word "Adjust" in the display, the first Adjust submenu is displayed.

As shown in the diagram, the Adjust menu has six submenus. Each submenu includes a parameter or value that can be changed.

- **Voltage Adjust submenu:** Voltage can be adjusted to 5 percent of the nominal voltage. For example, if generator set output voltage is 208 volts, the voltage can be adjusted from 198 to 218 volts.

  If the displayed value is greater or less than the allowed (5%) range, the control will not except the entry and will return to the previous setting. Retry by entering a smaller change in one volt increments.

- **Frequency Adjust submenu:** Frequency can be adjusted to 5 percent of the nominal frequency. For example, if the generator set frequency is 60.0 Hz, the frequency can be adjusted from 57.0 to 63.0 Hz.
- **Start Delay submenu:** Start Delay can be set from 0 to 300 seconds (default = 0). (Enter 1 or more to enable.) This function is bypassed during a manual start/stop sequence.
- **Stop Delay submenu:** Stop Delay can be set from 0 to 600 seconds (default = 0). (Enter 1 or more to enable.) This function is bypassed during a manual start/stop sequence and engine shutdown faults.
- **Rated To Idle (Beginning Version 2.303):** Rated To Idle delay can be set from 0 to 10 seconds (default = 0). (Enter 1 or more to enable.) Entering a non-zero delay will cause the generator set to delay the transition to Cooldown At Idle.
- **Idle Start submenu (Only available on some models):** Idle Start can be enabled or disabled (default = Disable). This function is only enabled when the generator set is started in manual mode. Idle Start can also be enabled while the generator set is running in manual mode. (Auto/remote start is not affected by this setting.)

Press the buttons next to the ↑ and ↓ arrows in the digital display to navigate between the menus. Press the Home button or the Previous Main Menu button to return to Main Menu 1.

Adjusting Values/Parameters:

1. Press the button next to the ► symbol in the display until the + and - symbols are displayed.
2. If necessary, press the button next to the symbols to move to the numeric character you wish to change.
3. Press the button next to the + symbol to increase the value or select parameter; press the button next to the – symbol to decrease the value or select parameter.
4. After adjusting values/selecting parameters, pressing the ► symbol results in the changes being saved. (When adjusting values, make sure the cursor is on the last numeric character before pressing the ► symbol).

   If the Home button or Previous Main Menu button is pressed before pressing the ►

   symbol, the changes are not saved.

Enabling Idle Start will cause the genset to run in idle mode until Idle Start is disabled. A warning is displayed if genset is left in idle more than 10 minutes. Long periods of engine idling can eventually affect engine performance and may void engine warranty.

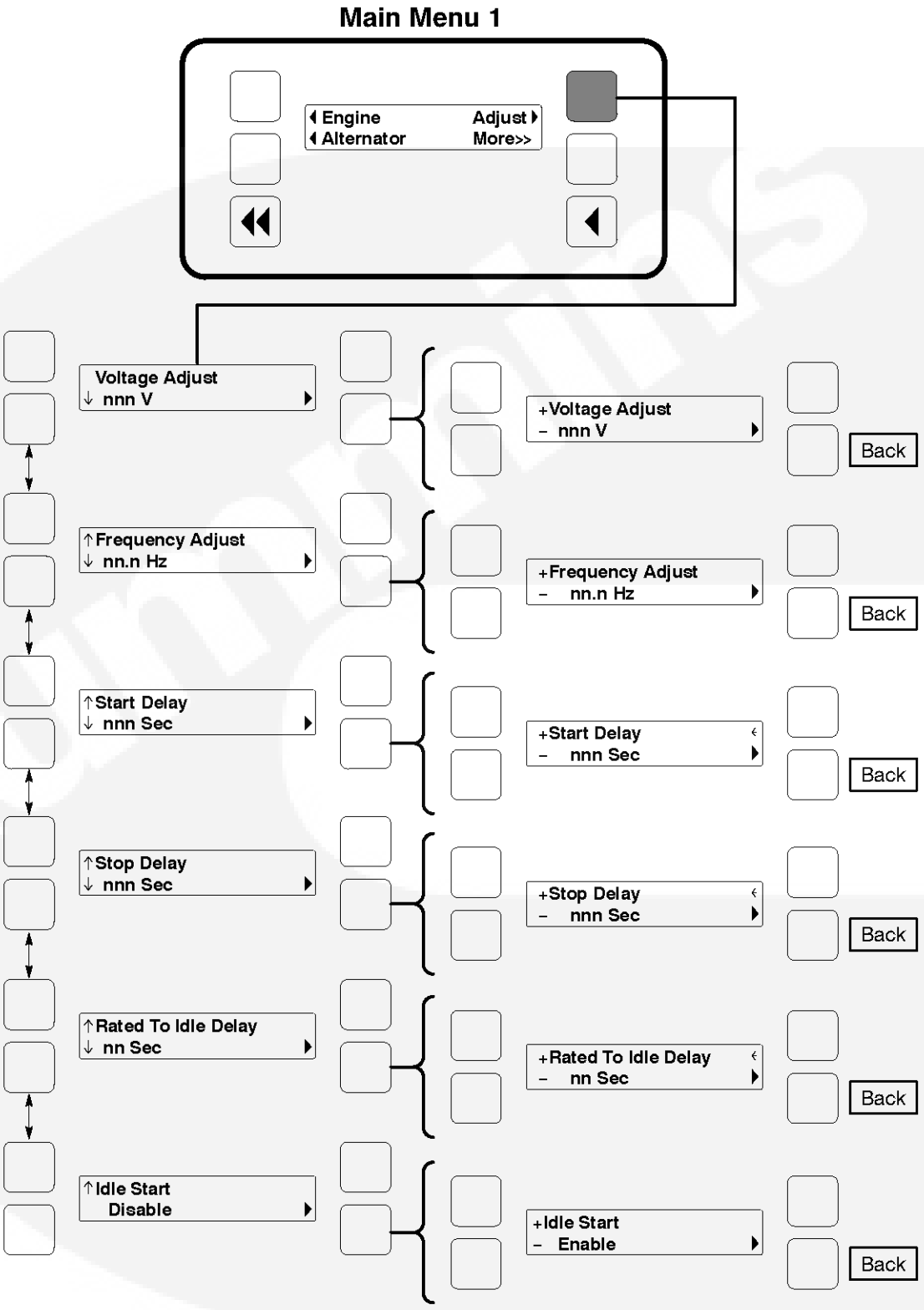


FIGURE 19. ADJUST MENU

4.4.8 Faults Menu

Figure 20 shows a block representation of the Faults menu. Up to 20 of the most recent faults can be viewed. An example of how a fault code is displayed is shown in Figure 21 on page 42.

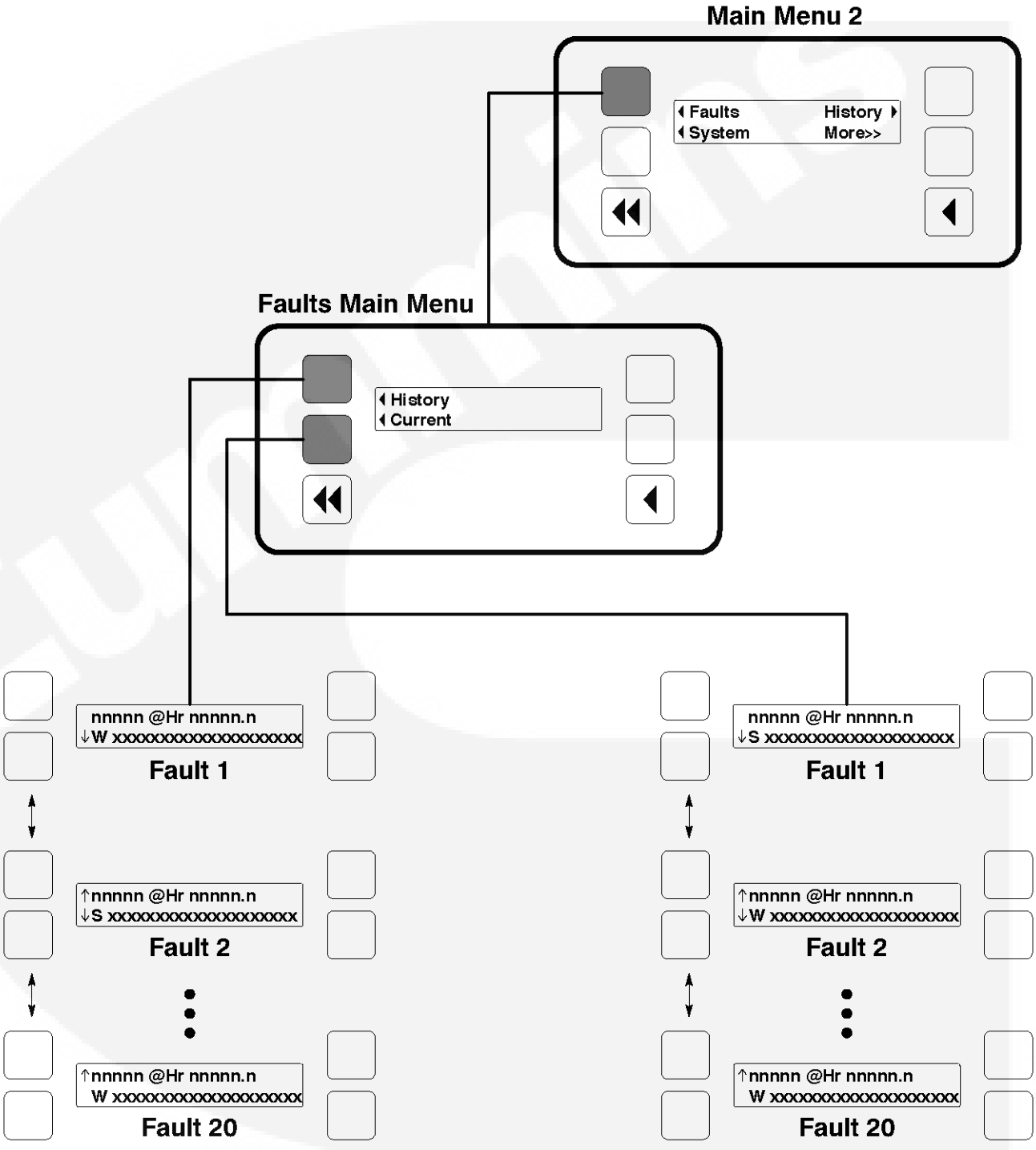


FIGURE 20. FAULTS MENU

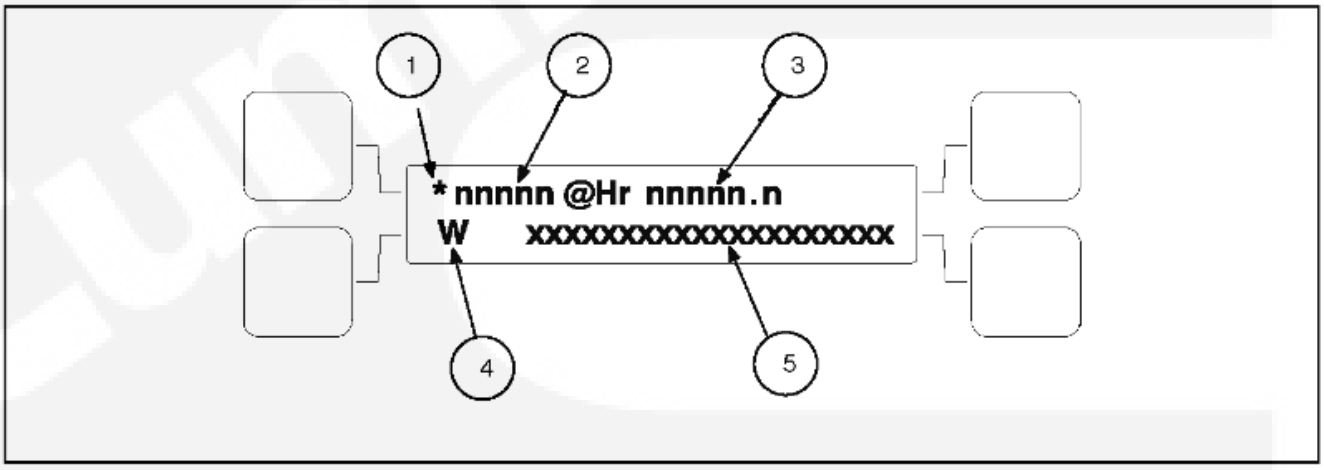
The available menus are dependent on the number of faults that have occurred.

- **History submenu:** From the Faults Main Menu, press the button next to the word "History" in the display to view up to twenty of the most recent acknowledged faults. Press the buttons next to the ↑ and ↓ symbols in the digital display to navigate between the menus. Press the Previous Main Menu button to return to the Faults Main Menu.
- **Current Fault submenu:** From the Faults Main Menu, press the button next to the word "Current" in the display to view up to twenty of the most recent unacknowledged faults. Press the Previous Main Menu button to return to the Faults Main Menu.

If there are no faults, the ◄ symbol next to the word "Faults" is not displayed and no Fault menus are available.

If more than one fault has occurred, press the button next to the word "Fault" in the screen display to view the Faults Main Menu. As shown in the diagram, the Faults Main Menu has two submenus. Press the Previous Main Menu button to return to the Faults Main Menu. Press the Previous Main Menu button a second time to return to Main Menu 2.

Press the Home button at any time to return to Main Menu 1.



NO	DESCRIPTION	NO	DESCRIPTION
1	Asterisk = Active Fault	4	W=Warning S=Shutdown
2	Fault Code	5	Fault Description
3	Hour Fault Occurred		

FIGURE 21. HISTORY/CURRENT FAULT SUBMENU

4.4.9 System Menu

Figure 22 on page 44 shows a block representation of the System menu. If you press the button next to the word "System" in the display, the System Main Menu is displayed. This menu is displayed only if the network communications module (NCM) feature is installed. The System Main Menu allows you to view the status and load of other PCC equipment connected on a common network with the PCC 2100 control.

As shown in the diagram, the System Main Menu has three submenus.

- **ATS System submenus:** From the System Main Menu, press the button next to the word "ATS" in the display to view the first of up to 16 ATS System submenus. An ATS system must be available in the network to display this submenu.

  The ATS submenu allows viewing of the transfer switch name (configured with InPower), kW load (if monitored by the ATS system), status (e.g., not in auto), and source connected and availability (ON = source connected, OK = source available, or NA = source not available).

- **Master System submenu:** From the System Main Menu, press the button next to the word "Master" in the display to view the Master System submenu. A master controller must be available in the network to display this submenu.

  The master submenu allows viewing of the master controller name (configured with InPower), kW load and operational state.

- **Genset System submenus:** From the System Main Menu, press the button next to the word "Genset" in the display to view the first of up to 16 Genset System submenus. One generator set must be available in the network to display this submenu.

  The genset submenu allows viewing of the generator set name (configured with InPower), kW load and operational state.

When viewing ATS and Genset System submenus, press the buttons next to the ↑ and ↓ symbols in the digital display to navigate between the menus. Press the Previous Main Menu button to return to the System Main Menu. Press the Previous Main Menu button a second time to return to Main Menu 2. Press the Home button to return to Main Menu 1.

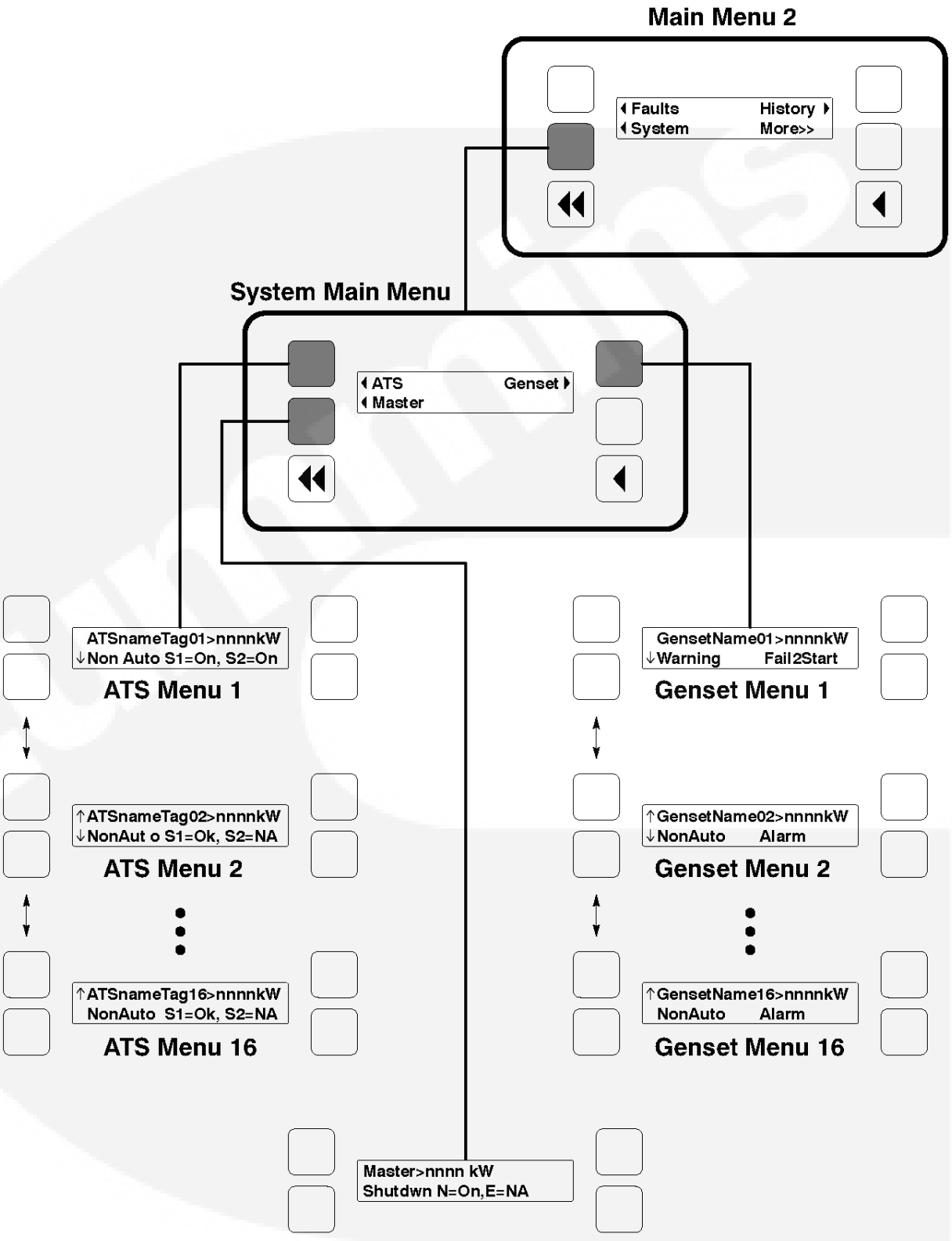


FIGURE 22. SYSTEM MENU

4.4.10 History Menu

Figure 23 on page 46 shows a block representation of the History menu. If you press the button next to the word "History" in the display, the first History submenu is displayed.

As shown in the diagram, the History menu has five submenus. This information is stored in non-volatile memory and will not be deleted due to loss of battery power.

- **Number of Starts submenu:** This submenu shows the number of engine starts.
- **Engine Hours submenu:** This submenu shows the number of operating hours for the engine.
- **Control Hours submenu:** This submenu shows the number of operating hours for the control.
- **Kilowatt Hours submenu:** This submenu shows the number of kilowatt (kW) or megawatt (MW) hours.
- **Genset Duty Cycle submenu:** This submenu shows the percent of genset operating hours that are less than 30 percent of rated load and percent of hours that are greater than 90 percent.

Press the buttons next to the ↑ and ↓ symbols in the digital display to navigate between the menus. Press the the Previous Main Menu button to return to Main Menu 2. Press the Home button to return to Main Menu 1.

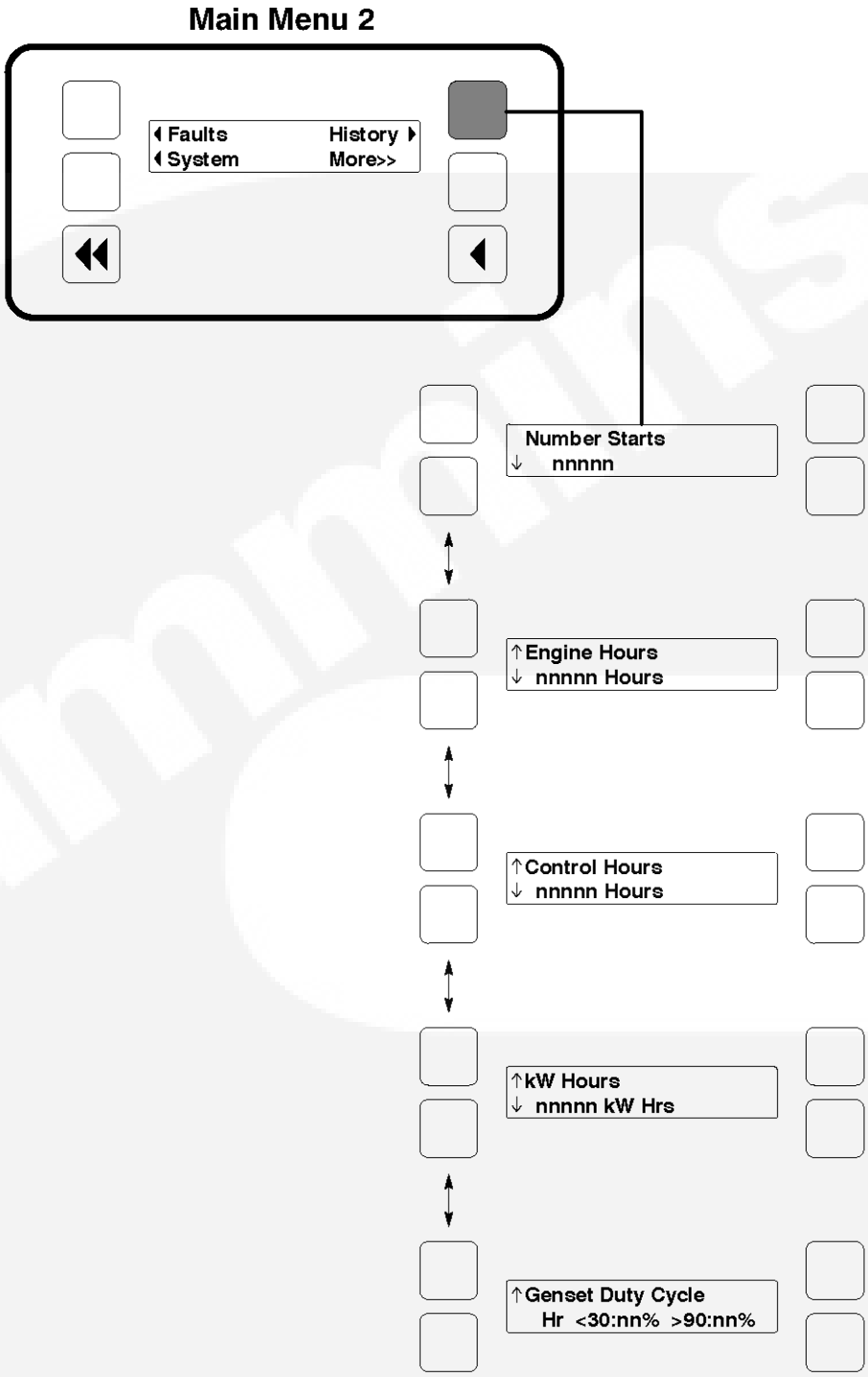


FIGURE 23. HISTORY MENU

4.4.11 About Menu

Figure 24 on page 48 shows a block representation of the About menu. If you press the button next to the word "About" in the display, the first About submenu is displayed.

As shown in the diagram, the About menu has three submenus.

- **Model submenu:** This submenu shows the generator set model.

- **Rating submenu:** This submenu shows the rating (Standby or Prime and number of kilowatts (kW)).
- **Software Version submenu:** This submenu shows the software version level. This information is required to service the generator set.

Press the buttons next to the ↑ and ↓ symbols in the digital display to navigate between the menus. Press the Previous Main Menu button to return to Main Menu 3. Press the Home button to return to Main Menu 1.

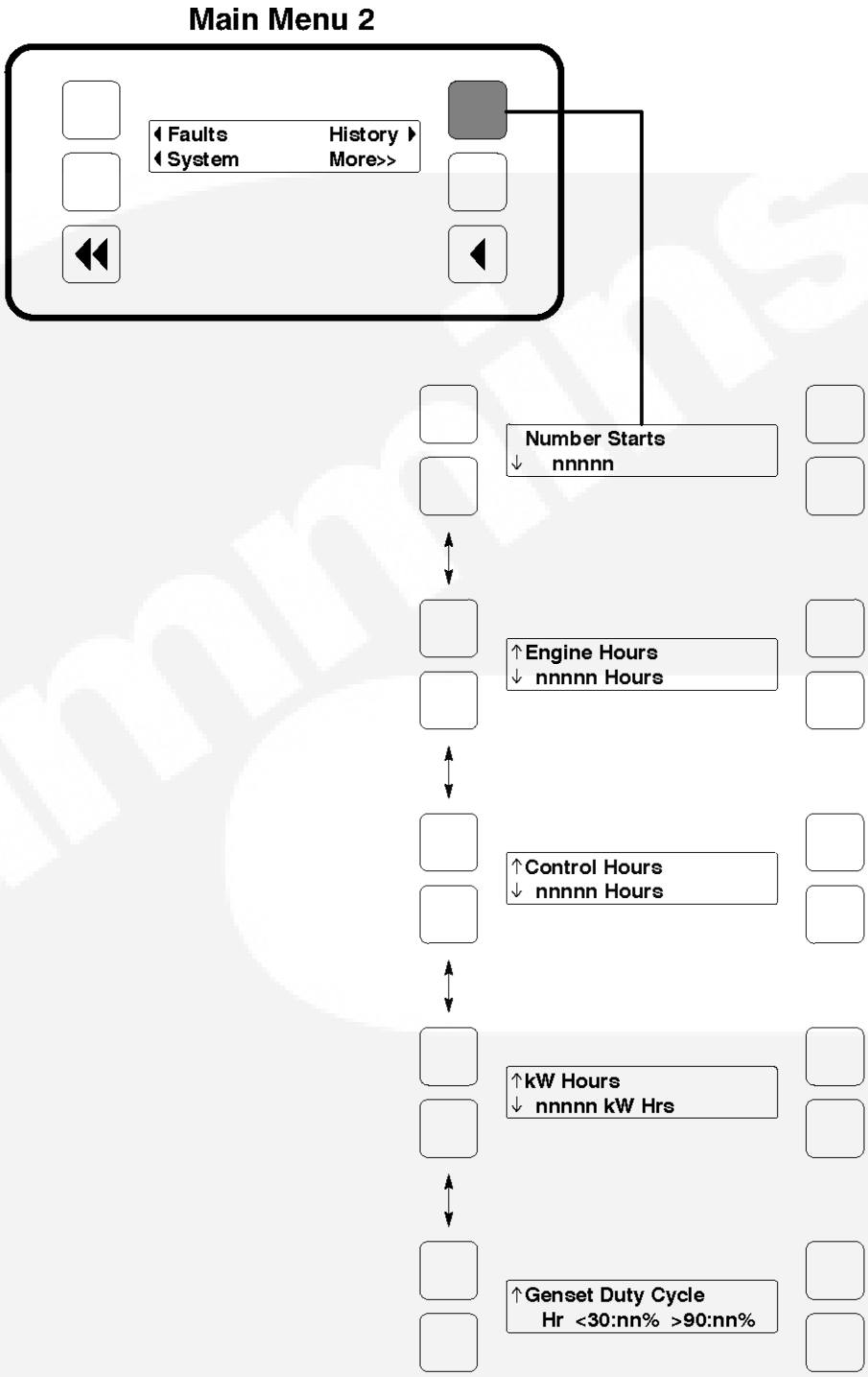


FIGURE 24. ABOUT MENU

5 Control Adjustment and Service

5.1 General

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

This section also describes the function and operation of engine sensors, genset options, and other special features of the genset 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 PCC2100 control box must be opened only by technically qualified personnel. Voltages of up to 600 VAC are present in the PCC box. These voltages can cause electrical shock, resulting in personal injury.

5.2 Circuit Board Removal/Replacement

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

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

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

Refer to INPOWER User's Guide for specifics.

5.2.1 Circuit Board Removal Safety Precautions

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.)

Attach the clip to the chassis ground screw in the control box and place the strap around your wrist before handling a circuit board.

CAUTION: Electrostatic discharge will damage circuit boards. Always wear a grounding wrist strap when handling circuit boards or socket-mounted IC's.

Turn off or remove AC power from the battery charger and then remove the negative (**-**) battery cable from the set starting battery. This is to make sure that 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.

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 genset 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.

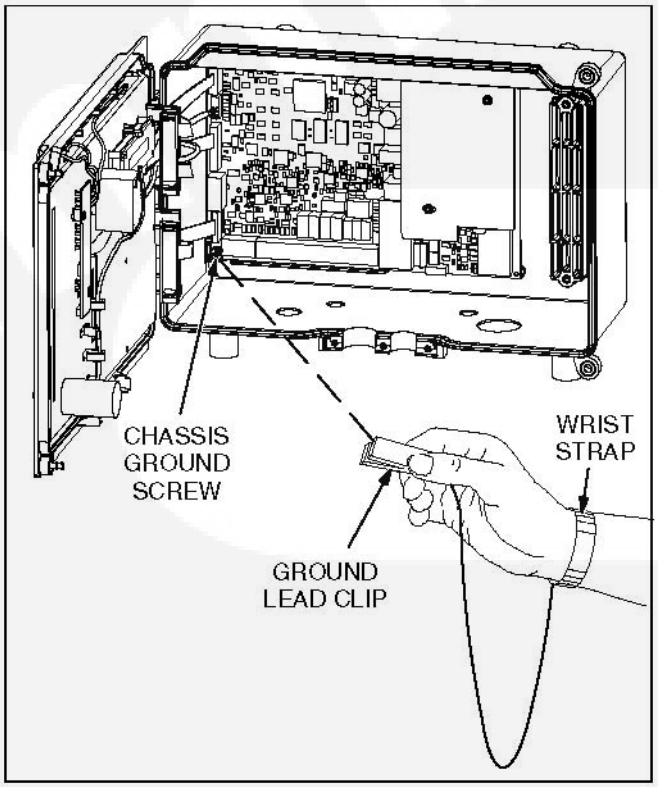


FIGURE 25. WRIST STRAP

5.3 Modifying Setup Submenus

The Setup submenus allow you to adjust system parameters.

There are three setup menus that are selectable from the Setup Main Menu:

- Crank/Idle Setup Menu
- Governor/Regulator Setup Menu (not available on all models)
- Power Transfer Setup Menu

These three menus are intended for qualified service personnel only. For this reason, a three-digit access code (password) must be entered before you can proceed to those menus.

⚠ *CAUTION: Improper adjustment of the control can cause equipment malfunction or damage. Adjustment must be performed by technically qualified personnel only.*

5.4 Password Submenu

Figure 26 on page 52 shows a block representation of the Setup Main menu. If you press the button next to the word “Setup" in the display, the Setup Password submenu is displayed. Use of Setup menus is restricted to service personnel.

Press the Previous Main Menu button to return to Main Menu 3. Press the Home button to return to Main Menu 1.

Password submenu: If you enter the correct password, the Setup Main Menu is displayed. When the Password submenu is displayed, the first numeric character (0) is flashing. The access code for your PCC is: **574**. To enter the password:

1. Press the button next to the + symbol until the value reads “5."
2. Press the button next to the → symbol to move to the next numeric character.
3. Press the button next to the + symbol until the value reads “7."
4. Press the button next to the → symbol to move to the next numeric character.
5. Press the button next to the + symbol until the value reads “4."
6. After you have completed entering the password, press the button next to the symbol. The Setup Main Menu is displayed.

If a wrong number is entered into any of the numeric character fields, use the buttons next to the ↓ and ↑ symbols until the correct value is entered.

If the wrong character field is selected, use the buttons next to the ← and → symbols to move to the character field you wish to change.

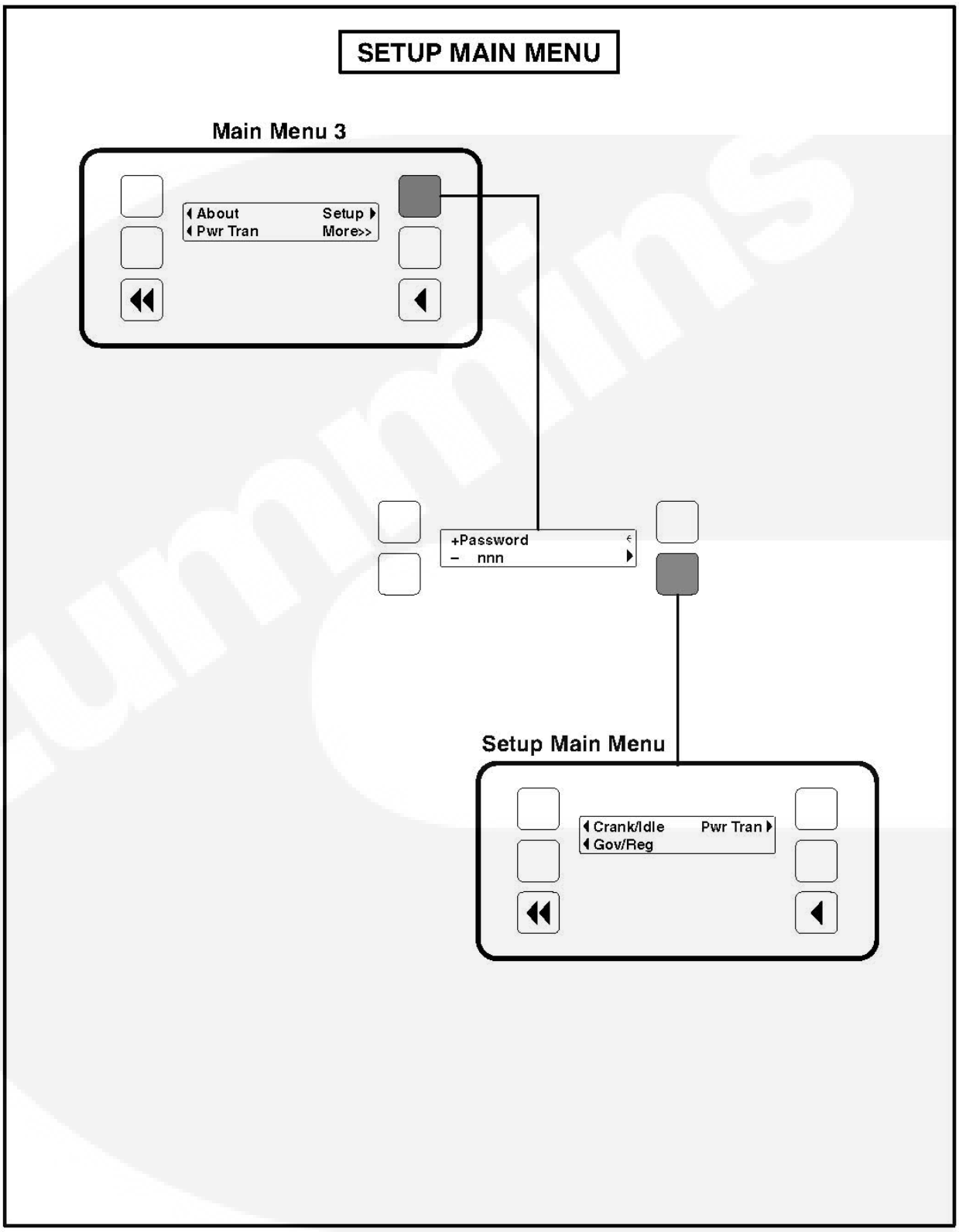


FIGURE 26. SETUP MAIN MENU

5.5 Crank/Idle Setup Menu

Figure 27 on page 54 shows a block representation of the Crank/Idle Setup menu. If you press the button next to the word “Crank/Idle" in the display, the first Crank/Idle Setup submenu is displayed.

As shown in the diagram, the Crank/Idle menu has five submenus. Each submenu includes a parameter or value that can be changed.

Press the buttons next to the ↓ and ↑ symbols in the graphical display to navigate between the menus. Press the Previous Main Menu button to return to the Setup Main Menu. Press the Previous Main Menu button again to return to Main Menu 3. Press the Home button to return to Main Menu 1.

Adjusting Values/Parameters:

1. Press the button next to the ► symbol in the display until the + and - symbols are displayed.
2. If necessary, press the button next to the ← or → symbols to move to the numeric character you wish to change.
3. Press the button next to the + symbol to increase the value or select parameter; press the button next to the - symbol to decrease the value or select parameter.
4. After adjusting values/selecting parameters, pressing the ► symbol results in the changes being saved. (When adjusting values, make sure the cursor is on the last numeric character before pressing the ► symbol).
5. If the Home button or Previous Main Menu button is pressed before pressing the ► symbol, the changes are not saved.

Cycle Crank submenu: Cycle Crank can be enabled or disabled (default = Disable).

Number of Crank Attempts submenu: This value can be adjusted from 2 to 7 attempts (default = 3 attempts).

Crank Time submenu: This value can be adjusted from 2 to 20 seconds (default = 15 seconds).

Rest Time submenu: This value can be adjusted from 7 to 40 seconds (default = 15 seconds).

Idle Speed Adjust submenu: This value can be adjusted from 700 to 1100 RPM (default = 800 RPM).

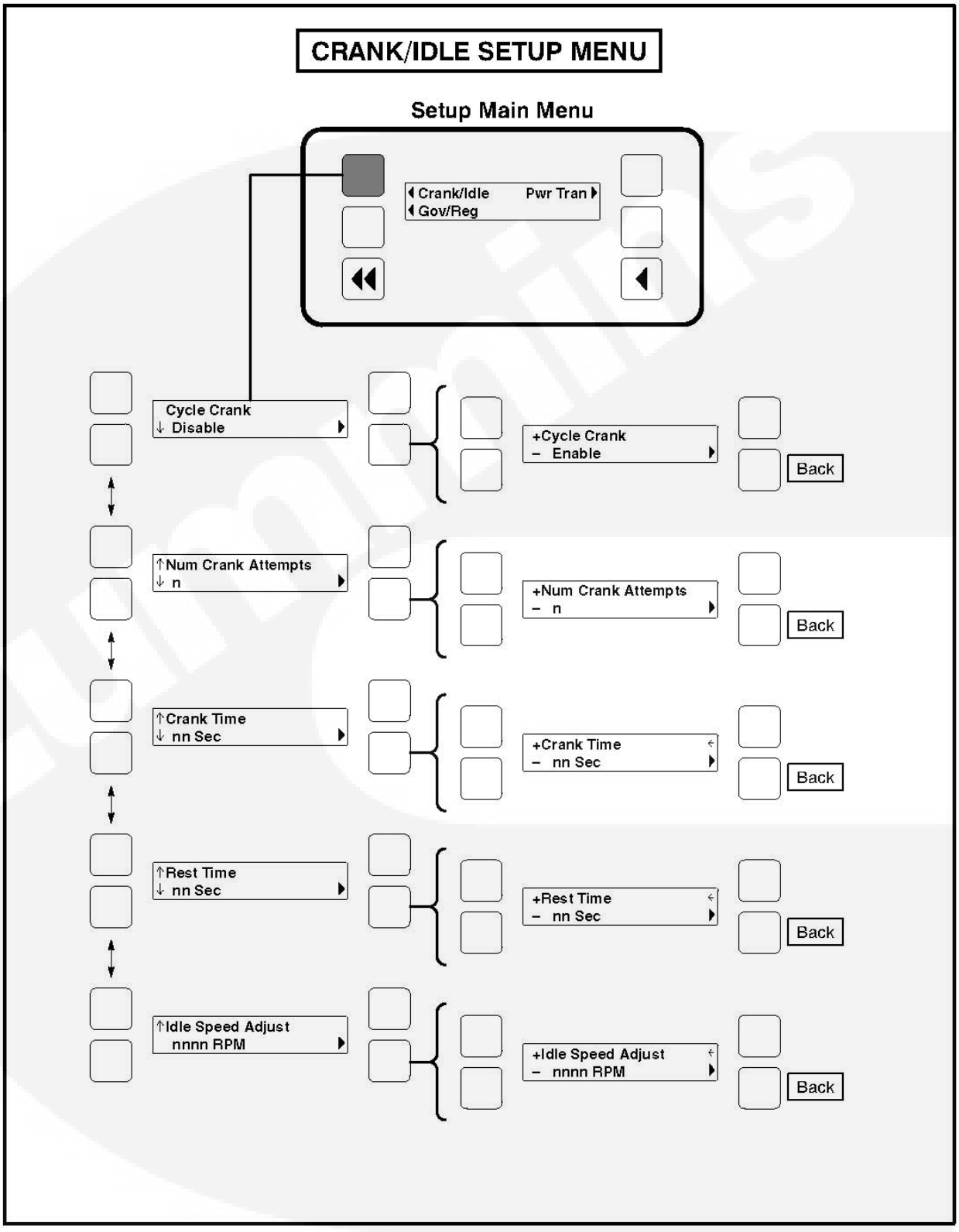


FIGURE 27. CRANK/IDLE SETUP MENU

5.6 Governor/Regulator Setup Menu

NOTE: This menu is not available on all models.

The following figure shows a block representation of the Governor/Regulator Setup menu. If you press the button next to the word “Gov/Reg" in the display, the first Governor/Regulator Setup submenu is displayed.

The GOV/REG menu values will display “100%". The expression “100%" represents the factory setting (default value) for the selected set. When increasing or decreasing the value, you are increasing or decreasing from the factory default value. (For example, entering “200%" will double the value; “50%" will decrease the value by one half.)

Default values are preset by the factory. Due to site variables, the default values may need to be adjusted to attain peak performance.

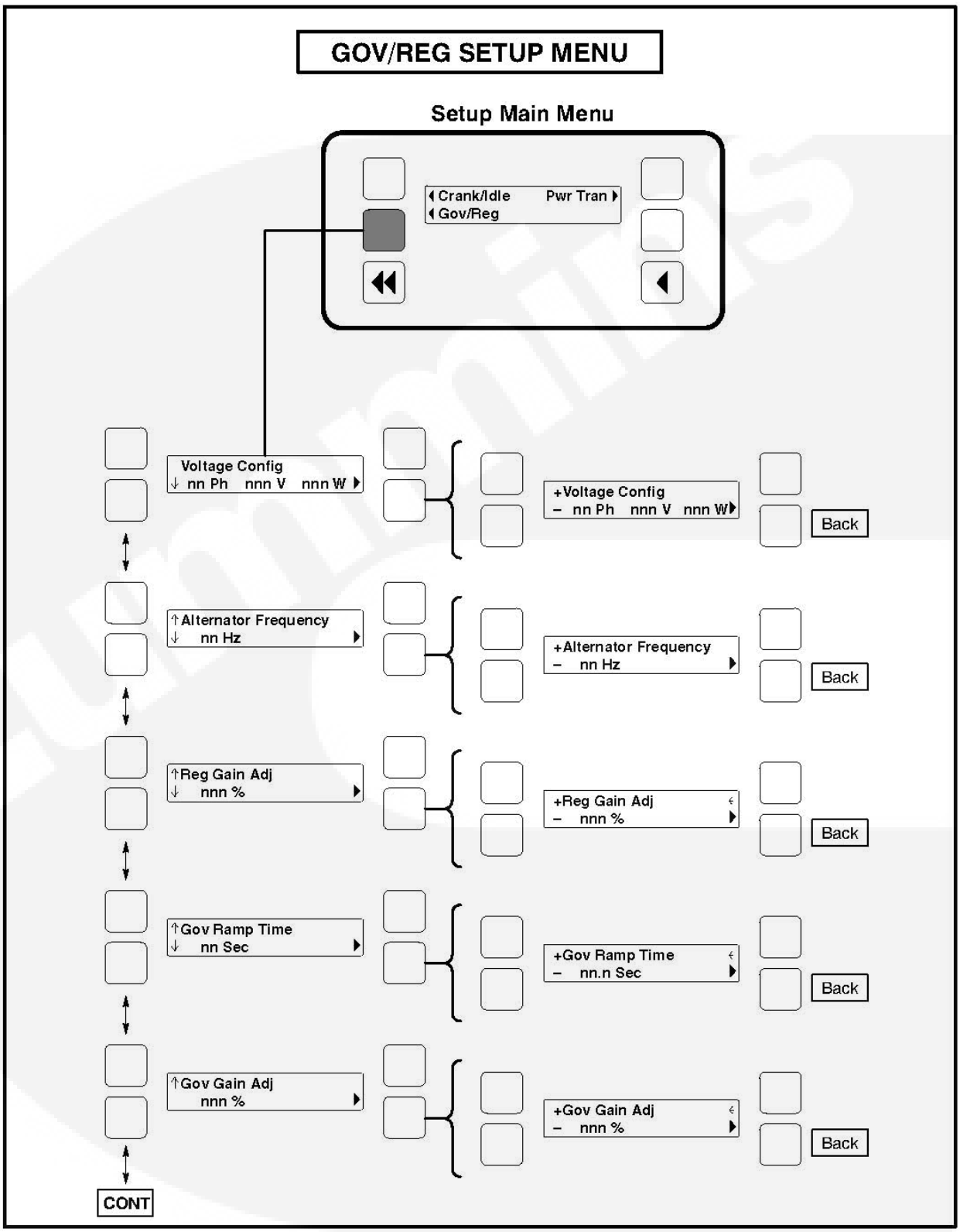


FIGURE 28. GOVERNOR/REGULATOR SETUP MENU (1 OF 2)

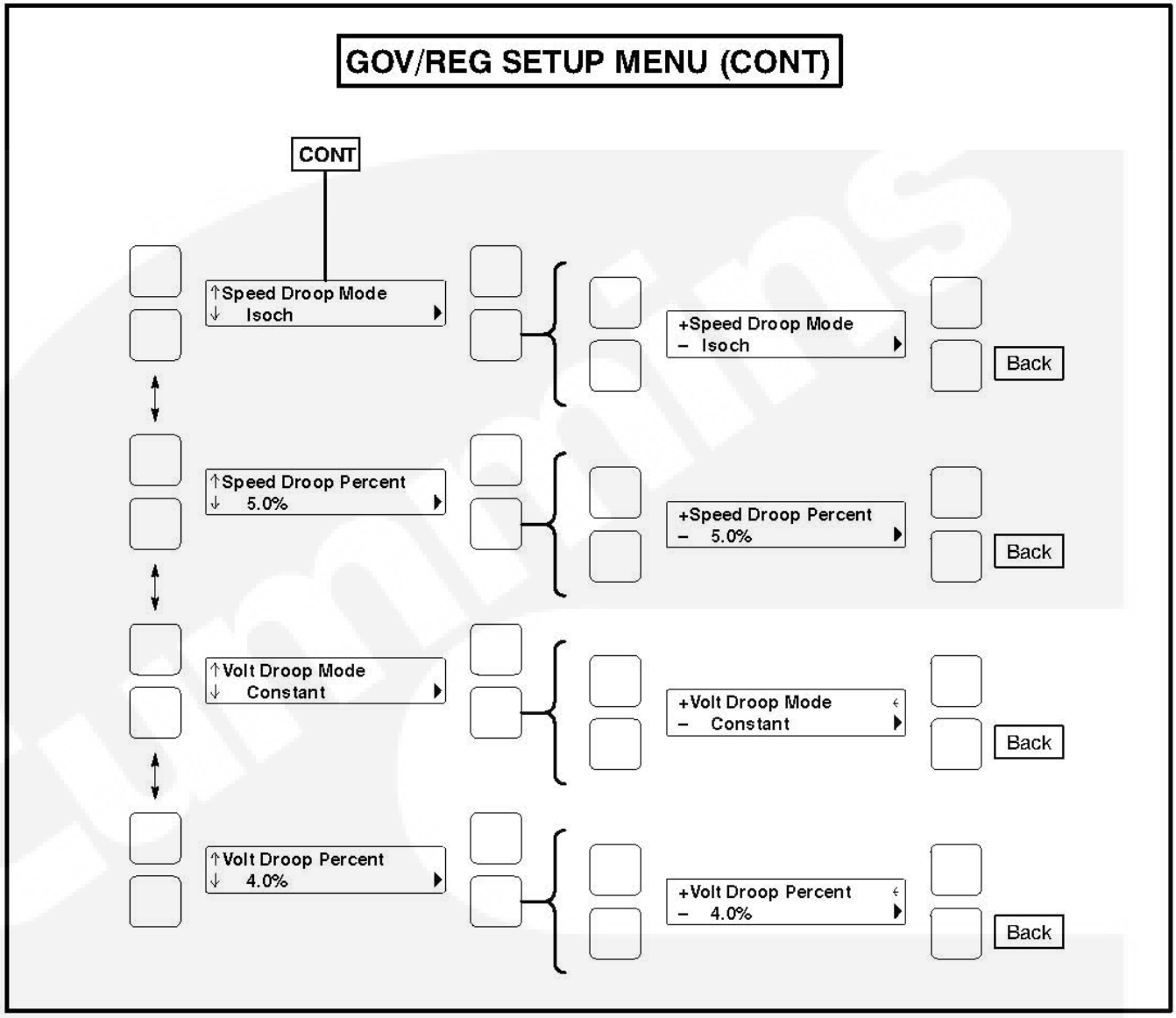


FIGURE 29. GOVERNOR/REGULATOR SETUP MENU (2 OF 2)

As shown in the diagram, the Gov/Reg menu has five submenus. Each submenu includes a parameter or value that can be changed.

⚠ *CAUTION: Improper adjustment of the PowerCommand control can cause equipment malfunction or damage. Adjustment must be performed by technically qualified personnel only.*

Press the buttons next to the ↓ and ↑ symbols in the graphical display to navigate between the menus. Press the Previous Main Menu button to return to the Setup Main Menu. Press the Previous Main Menu button again to return to Main Menu 3. Press the Home button to return to Main Menu 1.

Adjusting Values/Parameters:

1. Press the button next to the ► symbol in the display until the + and - symbols are displayed.

2. If necessary, press the button next to the ← or → symbols to move to the numeric character you wish to change.
3. Press the button next to the + symbol to increase the value or select parameter; press the button next to the - symbol to decrease the value or select parameter.
4. After adjusting values/selecting parameters, pressing the ► symbol results in the changes being saved. (When adjusting values, make sure the cursor is on the last numeric character before pressing the ► symbol).
5. If the Home button or Previous Main Menu button is pressed before pressing the ► symbol, the changes are not saved.

Voltage Configuration submenu: The phase, voltage, and wire fields can simultaneously be adjusted. If phase = 1, the line-to-line voltage can be 200, 220, 230, or 240 volts with 3 wires. If phase = 3, the line-to-line voltage can be 190, 200, 208, 220, 230, 240, 380, 416, 440, 460, or 600 volts with either 3 or 4 wires. The default = 3Ph 208V 4W.

Alternator Frequency submenu: This value can either be 50 or 60 Hz (default = 60 Hz).

Regulator Gain Adjustment submenu: This value can be adjusted from 5 to 1000 percent (default = 100 percent).

If the gain adjustment is set too high, output voltage will be unstable. If gain is set too low, the output voltage will respond sluggishly to changes in load - overshoot may result.

Governor Ramp Time submenu: This value can be adjusted from 0 to 30 seconds (default = 0 seconds).

This adjustment sets the time for the engine to ramp to full operating speed. This adjustment applies only to set start up and does not affect the transient response.

Governor Gain Adjustment submenu: This value can be adjusted from 5 to 1000 percent (default = 100 percent).

If the gain adjustment is set too high, engine speed will “hunt" or oscillate. If gain is set too low, the engine will respond too slowly to changes in load - overspeed may result.

Speed Droop Mode submenu: Selects between Isochronous and Droop kW Sharing droop modes (default = Isochronous).

Speed Droop Percent submenu): This value can be adjusted from 0 to 10 percent (default = 5%). This adjustment sets the amount of speed droop for a full standby/prime rated kW load.

Voltage Droop Mode submenu: Select between Constant and Droop kVAR Sharing Droop modes (default = Constant).

Voltage Droop Percent submenu: This value can be adjusted from 0 to 10 percent (default = 4%). This adjustment sets the amount of voltage droop for a 0.8 pf full standby rated load.

5.7 PCC Control Panel Box Components (Standard/Optional)

The PCC control panel box contains components that provide connection points for remote control and monitor options. The control panel box can be equipped with one or more of the following components.

5.7.1 Network Communications Module (Optional)

The Network Communications Module (NCM) provides an interface for data from the genset to other modules on the network. It communicates with the PCC 2100 baseboard providing complete monitoring and control of the genset. Refer to the *PowerCommand Network Installation and Operator's Manual (900-0529)* for instructions on network wiring and network software information.

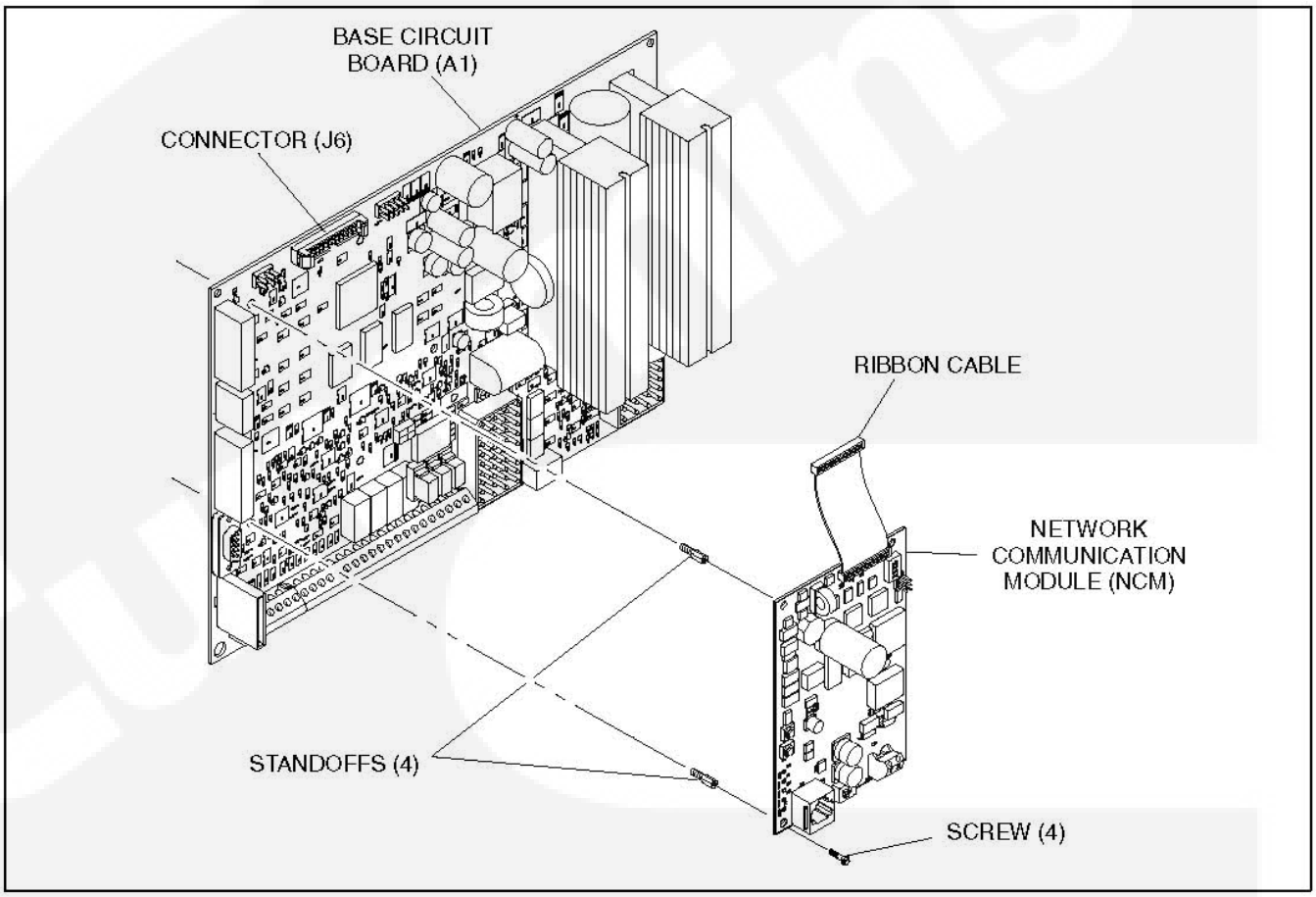


FIGURE 30. NETWORK COMMUNICATION MODULE

5.7.2 TB1 Customer Inputs

Refer to wiring diagrams for typical connections to TB1.

Remote Start: When the O/Manual/ Auto switch is in the Auto position, grounding this input initiates the engine cranking and start sequence. This circuit must be opened to permit resetting a shutdown condition with the Reset input.

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

Remote Reset: When the O/Manual/ Auto switch is in the Auto position and the remote start switch is open, grounding this input resets any warning and shutdown fault (except Emergency Stop, which must be reset at the genset front panel.)

Customer Fault Inputs 1 through 3: 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 Fuel Day Tank, Water In Fuel, Ground Fault, Low Starting Hydraulic Pressure, Low Starting Air Pressure, etc.

Each of the four fault functions can be programmed (using InPower), as follows:

- Enable/disable input. Default setting:

  Enable **1** through **3**

- Status, Warning or Shutdown. Default setting:

  1 - None

  2 thru **3** - Warning

- Active closed or open. Default setting:

  Closed [ground] **1** through **3**

- Change display name using up to 19 characters. Default setting:

  1 - Customer Fault 1

  2 - Ground Fault

  3 - Low Fuel

5.7.3 TB1 Customer Outputs

Refer to Page 9-11 for typical connections to TB1.

Customer Outputs 1 through 4: One set of normally open (NO) contacts, rated for 2 amps at 30 VDC for each of the four 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, common warning, common fault, load shed, ready to load, etc.

Each relay can be independently programmed (using InPower) to energize as follows.

- Enable/disable output. Default setting:

  Enable **1** through **4**

- Status, Warning or Shutdown. Default setting:

  1 - Common warning

  2 - Common shutdown

  3 - Not in Auto

  4 - Ready to Load

The customer outputs can also be connected to three control relays (optional) to operate larger equipment, such as, fans, pumps and motorized air dampers. Refer to *Control Relays* in this section for additional information.

B+: This is a fused 10 amp, 12/24 volt output. (Fuse F1 is located on Base board.) Two terminals (TB1-16 and -17) are connected to this 10 amp circuit.

B+ Switched: This is a fused 5 amp, 12/24 volt switched output. This output is activated when the control receives a run command. (Fuse F2 is located on Base board.)

5.7.4 Control Relays (K10, K11, K12) (Optional)

*CAUTION: Damage to the Base board can occur if the voltage suppressors (**Figure 31**) are not installed across relay coils (A1/A2) before connecting genset battery cables.*

The three optional control relays are rail mounted inside the control panel box. Each relay is a 4-pole relay with 2 poles normally open and two poles normally closed.

These relays (**Figure 31**) are used to control auxiliary equipment, such as fans, pumps and motorized air dampers. Energizing of the relays is user definable (refer to *TB1 Customer Outputs* in this section for customizing information.)

The contacts are rated at 10 amps at 600 VAC.

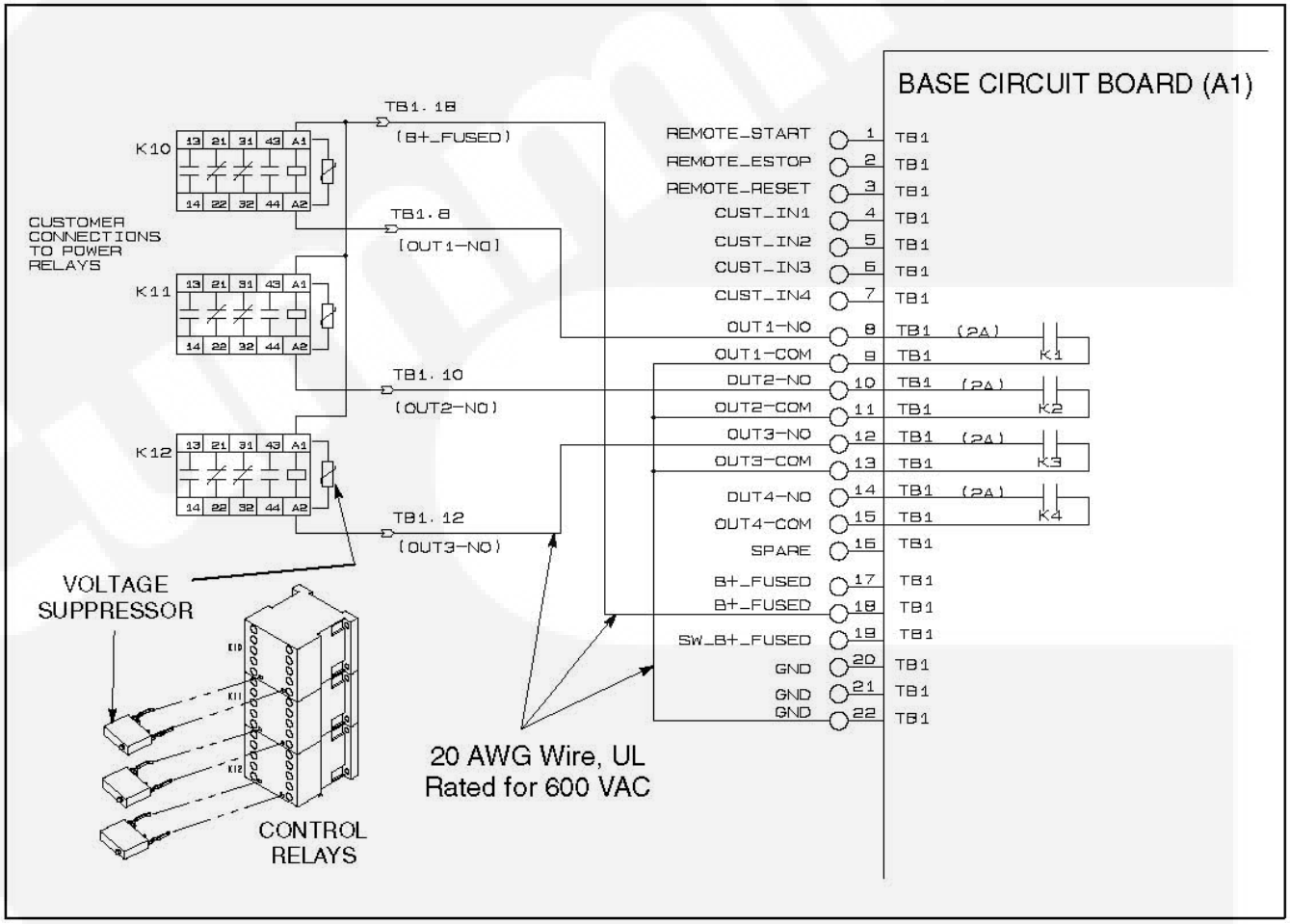


FIGURE 31. OPTIONAL CONTROL RELAYS (K10, K11, K12)

5.8 Magnetic Speed Pickup Unit (MPU) Installation

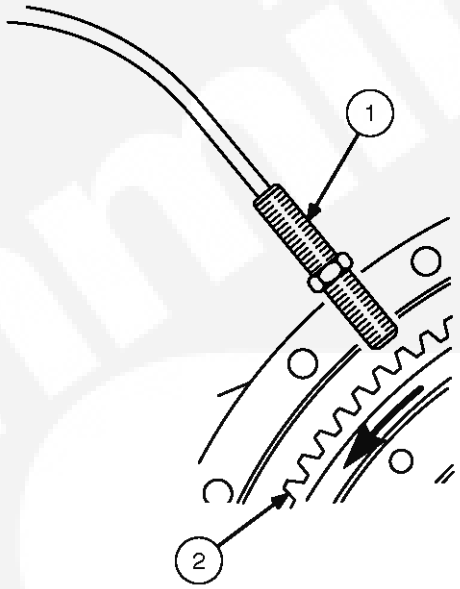
NOTE: This is not required on all models.

Measure the resistance of the magnetic speed pickup (MPU). Replace the MPU if the resistance is not between 1,000 ohms and 1,050 ohms.

With the MPU removed from the generator set, bar the engine until a gear tooth on the flywheel lines up in the center of the mounting hole. Thread the sensor in gently by hand until it just touches the gear tooth. Back it out 1/4 turn and set the locknut.

⚠ *CAUTION: Do not use fan blade to bar over the engine. That can damage blades and cause property damage and personal injury.*

After adjustment, make sure output voltage of the MPU is correct. Replace the MPU if output voltage at cranking speed is less than 1.5 VAC.



No.	Description	No.	Description
1	MPU Sensor	2	Engine Flywheel Ring Gear

FIGURE 32. MPU SENSOR

5.9 Current Transformer (CT) Installation

Current transformers (CTs) are required on gensets that contain AC meters. The CTs must be installed as noted in the following *CT Installation Requirements*. Improper installation of CTs will cause a “1459 Reverse Power" shutdown error.

Refer to the Reconnection Diagram to identify the output leads/phase that must be routed through each CT, and also appropriate transformer post selection for meter sensing leads. The transformers are labeled CT1, CT2 and CT3 on the reconnection wiring diagram. (The Reconnection Diagram is located on the upper side cover of the control housing.)

5.10 CT Installation Requirements

A. The CT has a dot on one side. This dot must be facing toward the generator (conventional current flowing into the dot). A dot is also used to indicate pin 1 of the CT.

B. CT1 - U load leads (A phase)

CT2 - V load leads (B phase)

CT3 - W load leads (C phase)

C. Route the appropriate leads through each CT.

- 6 lead generator sets - generator output leads are routed through the CT's.
- 12 lead generator sets - load wires are routed through the CTs.

D. Reconnectable gensets (12 leads) have dual secondary CTs (3 pins). The CT secondary wire marked 1 is connected to pin 1 of the CT. CT secondary wire marked 2/3 is connected to pin 2 for high voltage gensets or to pin 3 for low voltage gensets. (Refer to Reconnection Diagram.)

Non-reconnectable gensets (6 leads) have single secondary CTs (2 pins).

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6 Troubleshooting

6.1 Safety Considerations

WARNING: Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review the safety precautions in Chapter 1 on page 1.

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.

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 a trouble light ON or OFF near the battery. Discharge static electricity from your body before touching the batteries by first touching a grounded metal surface.

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

CAUTION: Disconnect the battery charger from the AC source before disconnecting the 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. Move the O/Manual/Auto switch on the control panel to the O position.
2. Turn off or remove AC power from the battery charger.
3. Remove the negative (−) battery cable from the generator set starting battery.

6.2 InPower Service Tool

The InPower™ service tool 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 base 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 base 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 base board for symptoms related to a feature.

6.3 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.

6.4 Troubleshooting Procedures

The following list of troubleshooting procedures are a guide to help you evaluate problems with the generator set. You can save time if you read through the manual ahead of time and understand the system.

Try to think through the problem. Go over what was done during the last service call. The problem could be as simple as a loose wire, an opened fuse, or a tripped circuit breaker.

NOTE: Each fault code “warning" can be changed to a “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.

This section contains the following information:

- How to troubleshoot a local/remote failure to crank problem when the control panel does not indicate any fault condition.
- How to troubleshoot engine problems that are not within the detectable range of the PC control.
- How to troubleshoot a Check Engine lamp fault for generator sets that contain the low emissions option.
- Descriptions of each status, warning, and shutdown code; warning and shutdown limits where applicable; and basic corrective actions, such as checking fluid levels, control reset functions, battery connections, etc.
- Detailed troubleshooting procedures. In the following list of troubleshooting procedures, the fault codes are arranged in numeric order.

CAUTION: Always set the O/Manual/Auto switch to the O position 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 the Circuit Board Removal/Replacement procedure in the controller Service Manual.

6.5 Relay K1

Switched B+ relay K1 supplies switched B+ power to splice SP8. SP8 supplies switched B+ to the fuel solenoids, air fuel controller, and the oxygen sensor. K1 is part of the engine harness assembly.

6.6 Relay K4

Relay K4 is the Starter Pilot relay that is used to energize the starter solenoid. K4 is part of the genset harness assembly.

6.7 Relay K6

NOTE: This relay is not available in all models.

Relay K6 is the fuel burn-off relay that is used to energize the ignition coil. K6 is part of the genset harness.

6.8 Fault Code 121 - Speed Signal Lost

Lamp: Shut down

Corrective Action: This indicates that the PCC is not sensing the speed sensor signal.

- Restart and check RPM on the digital display.

1. **Possible Cause:** Loose or damaged magnetic pickup (MPU) wires/connector pins.

   Corrective Action: Inspect the wires/connector pins, and repair or replace as necessary.

2. **Possible Cause:** The magnetic pickup or harness could be bad.

Corrective Action: To isolate the problem, reset the control and attempt to start the set in Idle mode (select Idle Mode − Enable menu).

- If **1438** (Fail To Crank) is displayed, or if the engine starts, but then shuts down on **121** (Speed Signal Lost), the MPU sender could be bad. Remove the MPU connectors and check for 1.5 VAC (minimum) at the MPU while cranking.
  - If no output or less than 1.5 VAC, check for damage or debris. Also check for improper adjustment of the MPU. (Refer to *Section 6*.) If there is still no output, replace the MPU sender.
  - If the MPU output is OK, check for MPU voltage at P7−25 (MAG PICK+) to P7-29 (MAG PICK−) while cranking. If not OK, use continuity checks to isolate connectors/harness.
- If the engine starts and idles, and does not display a fault, then there could be a frequency mismatch problem. Measure generator output frequency with a digital multimeter and compare to the frequency on the PCC display.
  - If they do match, multiply the frequency by 30 and compare this number to the RPM on the PCC display. If these are not the same, the MPU sender may be bad. Replace the MPU sender.
  - If the multimeter and PCC frequencies do not match, there may be a frequency sensing problem within the Base board.

6.9 Fault Code 135 - Oil Pressure Sensor High

Lamp: Warning

Corrective Action: Indicates that the control has sensed that the engine oil pressure sender signal is shorted high. Check sender/connectors/wires.

Effect: No engine protection for oil pressure during genset operation.

1. **Possible Cause:** Fault simulation was enabled with In-Power.

   Corrective Action: With InPower, verify that the fault simulation is not enabled for the oil pressure sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** The sensor connections could be bad.

   Corrective Action: Inspect the sensor and engine harness connector pins. Repair or replace as necessary.

3. **Possible Cause:** The sensor could be bad.

   Corrective Action: Disconnect the oil pressure sensor leads, and connect an oil pressure sensor simulator to the harness. **"OIL PRESSURE SENSOR H" warning is displayed after the fault condition is sensed for 10 seconds.** If the control responds to the simulator, replace the sensor. If control does not respond, go to next step.

4. **Possible Cause:** The harness could be bad.

   Corrective Action: Remove connector P7 from Base board and connector from sensor. Check P7-13, 17 & 21 as follows:

   - Check for a short circuit from pin to pin (more than 200k ohms OK).
   - Check for an open circuit (10 ohms or less OK). Repair or replace as necessary.

5. **Possible Cause:** The pressure signal could be out of range.

   Corrective Action: With all connectors attached, check pressure signal (.5 to 4.5 VDC) at P7-13 (OP OUT) and P7-17 (OP COM).

6.10 Fault Code 141 - Oil Pressure Sensor Low

Lamp: Warning

Corrective Action: Indicates that the control has sensed that the engine oil pressure sender signal is shorted low. Check sender/connectors/wires.

Effect: No engine protection for oil pressure during generator set operation.

1. **Possible Cause:** Fault simulation was enabled with InPower.

   Corrective Action: With InPower, verify that the fault simulation is not enabled for the oil pressure sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** The sensor connections could be bad.

   Corrective Action: Inspect the sensor and engine harness connector pins. Repair or replace as necessary.

3. **Possible Cause:** The sensor could be bad.

   Corrective Action: Disconnect the oil pressure sensor leads and connect an oil pressure sensor simulator to the harness. **"OIL PRESSURE SENSOR L" warning is displayed after the fault condition is sensed for 10 seconds.** If the control responds to the simulator, replace the sensor. If control does not respond, go to the next step.

4. **Possible Cause:** The harness could be defective.

   Corrective Action: Remove connector P7 from base board and the connector from the sensor. Check P7-13, 17, and 21 as follows:

   - Check for an open circuit (10 ohms or less is OK).
   - Check for a short circuit to the engine block ground (more than 200k ohms is OK).
   - Check for a short circuit from pin to pin (more than 200k ohms is OK). Repair or replace as necessary.

5. **Possible Cause:** The pressure signal could be out of range.

   Corrective Action: With all connectors attached, check pressure signal (.5 to 4.5 VDC) at P7-13 (OP OUT) and P7-17 (OP COM).

6.11 Fault Code 143 - Pre-Low Oil Pressure Sensor

Lamp: Warning

Corrective Action: Indicates engine oil pressure has dropped to an unacceptable level. If the generator is powering critical loads and cannot be shut down, wait until the next shutdown period and then follow code **415** procedure.

Effect: Calibration-dependent. No action is taken by the PCC for code **143**. Engine will shut down for code **415**.

1. **Possible Cause:** Fault simulation was enabled with InPower.

Corrective Action: With InPower, verify that the fault simulation is not enabled for the oil pressure sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** Sensor could be bad, or the generator set may be shutting down on another fault.

   Corrective Action: Disconnect the oil pressure sensor leads, and connect an oil pressure sensor simulator to the harness. If the control responds to the simulator, reconnect the sensor, disconnect the ACT− signal wire at the fuel pump actuator, and crank the engine. Check the oil pressure reading on the digital display.

   - If the display shows an acceptable oil pressure, the problem may not be in the oil or oil sensing system. The generator set may be shutting down on another fault (out of fuel, intermittent connector). Restart the generator set and monitor the PCC display panel for other faults.
   - If the display does not show an acceptable oil pressure, replace the sensor. If the control does not respond to the simulator, go to the next step.

3. **Possible Cause:** Harness could be bad.

   Corrective Action: If the control does not respond to the simulator, the harness is defective. Check for +5 VDC at the sensor (lead marked E1-A). If there is no 5 VDC at the sensor:

   - Check for 5 VDC at P7-21.
   - If yes, the harness is defective and must be replaced. If there is 5 VDC at the sensor, use the sensor simulator to generate a signal to P7-13 (OP OUT) and P7-17 (OP COMM). If the pressure signal (.5 to 4.5 VDC) does not get to P7, isolate to the harness.

6.12 Fault Code 144 - Coolant Temperature Sensor High

Lamp: Warning

Corrective Action: Indicates that the control has sensed that the engine coolant temperature signal is shorted high. Check sender/connectors/wires.

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

1. **Possible Cause:** Fault simulation was enabled with InPower.

   Corrective Action: With InPower, verify that the fault simulation is not enabled for the coolant sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides

2. **Possible Cause:** The sensor connections could be defective.

   Corrective Action: Inspect the sensor and engine harness connector pins. Repair or replace as necessary.

3. **Possible Cause:** The sensor could be defective.

   Corrective Action: 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 the control does not respond, go to the next step.

4. **Possible Cause:** The harness could be defective.

   Corrective Action: Measure the resistance of the coolant sensor and reconnect the harness to the sensor. Remove connector P7 from the base board and check resistance between pins P7-30 (IH20) and P7-34 (IH20 COM).

   - If resistance is not the same, the harness is defective and must be replaced.

6.13 Fault Code 145 - Coolant Temperature Sensor Low

Lamp: Warning

Corrective Action: Indicates that the control has sensed that the engine coolant temperature signal is shorted low. Check sender/connectors/wires.

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

1. **Possible Cause:** Fault simulation was enabled with InPower.

   Corrective Action: With InPower, verify that the fault simulation is not enabled for the coolant sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** The sensor connections could be defective.

   Corrective Action: Inspect the sensor and engine harness connector pins. Repair or replace as necessary.

3. **Possible Cause:** The sensor could be defective.

   Corrective Action: 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 the control does not respond, go to the next step.

4. **Possible Cause:** The harness could be defective.

   Corrective Action: Follow these steps.

   a. Remove connector P7 from the base board and disconnect the sensor. Check pins P7-30 (IH20) and P7-34 (IH20 COM) for short circuit as follows:

      - Check for a short circuit to the engine block ground (more than 200k ohms is OK).
      - Check for a short circuit from pin to pin (more than 200k ohms is OK). Repair or replace as necessary.

   b. Measure the resistance of the coolant sensor and reconnect the harness to the sensor. Remove connector P7 from the base board and check resistance between pins P7-30 (IH20) and P7-34 (IH20 COM).

      - If resistance is not the same, the harness is defective and must be replaced.

6.14 Fault Code 146 - Pre-High Cool Temp

Lamp: Warning

Corrective Action: Coolant temperature has risen to an unacceptable level. If the generator is powering critical loads and cannot be shut down, wait until the next shutdown period and then follow the fault code 151 procedure.

Effect: Calibration-dependent. No action is taken by the PCC for fault code **146**. Engine will shut down for fault code **151**.

1. **Possible Cause:** Fault simulation was enabled with InPower.

   Corrective Action: With InPower, verify that the fault simulation is not enabled for the coolant sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** Engine or sensor circuitry problem.

   Corrective Action: Isolate to the engine or sensor circuitry. Check the sensor accuracy with a thermocouple or similar temperature probe.

   - If the PCC ambient coolant temperature reading is accurate, the engine may be overheating. Refer to the engine service manual.
   - If the PCC ambient coolant temperature reading is not accurate, go to the next step.

3. **Possible Cause:** The sensor could be defective.

   Corrective Action: Disconnect the sensor and connect a coolant temperature sensor simulator to the harness. If the control responds to the simulator, replace the sensor. If control does not respond, go to next the step.

4. **Possible Cause:** The harness could be defective.

   Corrective Action: Measure the resistance of the coolant sensor and reconnect the harness to the sensor. Remove connector P7 from the base board and check resistance between pins P7-30 (IH20) and P7-34 (IH20 COM).

   - If resistance is not the same, the harness is defective and must be replaced.

6.15 Fault Code 151 - High Coolant Temp

Lamp: Shutdown

Corrective Action: Coolant temperature has risen above the shutdown trip point.

Allow the engine to cool down completely before proceeding with the following checks:

- Check coolant level and replenish if low. Look for possible coolant leakage points and repair if necessary.
- Check for obstructions to cooling airflow and correct as necessary.
- Check the fan belt and repair or tighten if necessary.
- Check the blower fan and circulation pumps on remote radiator installations.
- Reset the control and restart after locating and correcting the problem.

Effect: Calibration-dependent. No action is taken by the PCC for fault code **146**. Engine will shut down for fault code **151**.

1. **Possible Cause:** Fault simulation was enabled with InPower.

Corrective Action: With InPower, verify that the fault simulation is not enabled for the coolant sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** Engine or sensor circuitry problem.

   Corrective Action: Isolate to the engine or sensor circuitry. Check the sensor accuracy with a thermocouple or similar temperature probe.

   - If the PCC ambient coolant temperature reading is accurate, the engine may be overheating. Refer to the engine service manual.
   - If the PCC ambient coolant temperature reading is not accurate, go to the next step.

3. **Possible Cause:** The sensor could be defective.

   Corrective Action: Disconnect the sensor and connect a coolant temperature sensor simulator to the harness. If the control responds to the simulator, replace the sensor. If control does not respond, go to the next step.

4. **Possible Cause:** The harness could be defective.

   Corrective Action: Measure the resistance of the coolant sensor and reconnect the harness to the sensor. Remove connector P7 from the base board and check resistance between pins P7-30 (IH20) and P7-34 (IH20 COM).

   - If resistance is not the same, the harness is defective and must be replaced.

6.16 Fault Code 197 - Low Coolant Level

Lamp: Warning (Optional)

Corrective Action: Indicates engine coolant level has fallen below the warning trip point.

WARNING: Contact with a hot engine or hot coolant can result in serious burns. To avoid personal injury, allow the engine to cool down completely before proceeding.

Effect: No action is taken by the PCC for code **197**. Engine will shut down for code **235**.

1. The sensor or harness could be defective.

   If the coolant level is normal, isolate the source of the low coolant signal. (This is a ground signal.) Disconnect the signal lead at the sender and reset the control.

   a. If the **197/235** message drops out and does not reappear, replace the sender.

   b. If the **197/235** message reappears and remains after the control is reset, remove connector P7 from the base board and check continuity from P7-32 to ground. If there is continuity, replace the harness.

6.17 Fault Code 234 - Overspeed

Lamp: Shutdown

Corrective Action: Indicates that the engine speed has exceeded normal operating speed inside the generator set controller.

Effect: Engine will shut down.

1. **Possible Cause:** Fault simulation was enabled with InPower.

Corrective Action: With InPower, verify that the fault simulation is not enabled for the speed sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** Fault threshold is not set correctly with InPower.

   Corrective Action: Reset the threshold to the highest allowable setting. Determine the required operating range before adjusting the threshold.

3. **Possible Cause:** Monitor the engine RPM using InPower.

   Corrective Action: If the RPM is not correct, refer to fault code **121** for corrective action.

6.18 Fault Code 235 - Low Coolant Level

Lamp: Shutdown

Corrective Action: Indicates engine coolant level has fallen below the shutdown trip point.

CAUTION: Allow engine to cool down completely before proceeding to avoid personal injury or harm.

Effect: No action is taken by the PCC for code **197**. Engine will shut down for code **235**.

1. The sensor or harness could be bad.

   If the coolant level is normal, isolate the source of the low coolant signal. (This is a ground signal.) Disconnect the signal lead at the sender and reset the control.

   a. If the **197/235** message drops out and does not reappear, replace the sender.

   b. If the **197/235** message reappears and remains after control reset, remove connector P7 from Base board and check continuity from P7-32 to ground. If there is continuity, replace the harness.

6.19 Fault Code 359 - Fail to Start

Lamp: Shutdown

Corrective Action: Indicates the controller did not sense the engine start.

Effect: Engine will not start.

1. **Possible Cause:** Switched B+ is not present at T26 terminal block due to:

   a. Fuse F10 of the engine harness assembly may be open.

   b. Switched B+ relay K1 is defective.

   Corrective Action: Isolate to harness, F10, or K1.

   a. Remove F10 (engine harness) and check continuity. If open, replace the fuse with one of the same type and amp rating (20 Amps). If fuse reopens, check wiring continuity of the circuit.

   b. Install a harness tool between the base board and the P7 connector. Attempt to start and check for B+ at P7-9 (GEN SW B+) and P7-10 (FUEL SOL−). (These are leads to K1 SW B+ relay). If B+ is present, relay K1 or the harness is defective. Go to next step.

c. Attempt to start and check for B+ IN (K1-1) and B+ OUT (K1-4).
   - If there is no B+ IN, check for an open circuit.
   - If there is B+ IN and not OUT, K1 is defective or the circuit to the K1 coil is open.

2. **Possible Cause:** Actuator is inoperable because the harness is defective.

   Corrective Action: Isolate to the harness.

   a. Display “Governor Duty Cycle” menu. Attempt to start and check for duty cycle (approximately 20% to 40% from zero to full load). If the percentage of duty cycle is displayed before the shutdown, the harness may be defective; go to step b. (Duty cycle displayed indicates the processor is functioning.)

   b. Remove connector P7 from the base board and check wiring continuity of the actuator circuit. P7-24 (ACT +), P7-14 (ACT SIG) and P7-36 (GND) to the appropriate terminals of the governor actuator. Repair as necessary.

6.20 Fault Code 415 - Low Oil Pressure

Lamp: Shutdown

Corrective Action: Oil pressure has dropped below the shutdown trip point.

Effect: Calibration-dependent. No action is taken by the PCC for code **143**. Engine will shut down for code **415**.

1. **Possible Cause:** Fault simulation was enabled with InPower.

   Corrective Action: With InPower, verify that the fault simulation is not enabled for the oil pressure sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** Sensor could be defective. Or the generator set may be shutting down on another fault.

   Corrective Action: Disconnect the oil pressure sensor leads, and connect an oil pressure sensor simulator to the harness. If the control responds to the simulator, reconnect the sensor, disconnect the ACT− signal wire at the fuel pump actuator, and crank the engine. Check the oil pressure reading on the digital display.
   - If the display shows an acceptable oil pressure, the problem may not be in the oil or the oil sensing system. The generator set may be shutting down on another fault (out of fuel, intermittent connector). Restart the generator set and monitor the PCC display panel for other faults.
   - If the display does not show an acceptable oil pressure, replace the sensor.

3. **Possible Cause:** The harness could be defective.

   Corrective Action: If the control does not respond to the simulator, the harness is defective. Check for +5 VDC at the sensor (lead marked E1-A). If there is no 5 VDC at the sensor:
   - Check for 5 VDC at P7-21.
   - If yes, the harness is defective. If there is 5 VDC at the sensor, use the sensor simulator to generate a signal to P7-13 (OP OUT) and P7-17 (OP COMM). If the pressure signal (.5 to 4.5 VDC) does not get to P7, isolate to the harness.

6.21 Fault Code 441 - Low Battery Voltage

Lamp: Warning

Corrective Action: Indicates battery voltage supply to the control is approaching a low level at which unpredictable operation will occur.

1. Discharged or defective battery. Check the battery charger fuse. Recharge or replace the battery.
2. Poor battery cable connections. Clean the battery cable terminals and tighten all connections.
3. Check battery wiring/calibration.
4. Check engine DC alternator. Replace the engine DC alternator if normal battery charging voltage is not obtained.
5. Check the battery charge voltage float level, if applicable (raise float level).

Effect: PCC voltage supply approaching level at which unpredictable operation may occur.

1. **Possible Cause:** Weak or discharged battery.

   Corrective Action: Recharge or replace the battery. The specific gravity for a fully charged battery is approximately 1.260 at 80° F (27° C).
2. **Possible Cause:** Low electrolyte level in the battery.

   Corrective Action: Replenish electrolyte and recharge the battery.
3. **Possible Cause:** Battery connections loose or dirty.

   Corrective Action: Clean and tighten or replace the battery cable connectors and cables at the battery and at the generator set.
4. **Possible Cause:** Wrong battery voltage.

   Corrective Action: Verify that battery voltage 12 or 24 matches calibration.
5. **Possible Cause:** Insufficient battery charging voltage.

   Corrective Action: Adjust the charge rate of the battery charging circuit, according to manufacture's instructions.
6. **Possible Cause:** Engine DC alternator could be defective.

   Corrective Action: Replace the engine DC alternator if normal battery charging voltage (12 to 14 or 24 to 26 VDC) is not obtained.
7. **Possible Cause:** If the batteries are OK, the problem may be the harness.

   Corrective Action: Remove connector P7 from the base board and check battery voltage at P7−3 (B+) to P7-7 (GND) and P7-4 (B+) to P7-8 (GND).

   - If the voltage at P7 is not the same as the battery voltage, the harness is defective and must be replaced.

6.22 Fault Code 442 - High Battery Voltage

Lamp: Warning

Corrective Action: Indicates the battery voltage supply to the control is approaching a high level at which damage to the control can occur. Check the float level on the battery charger, if applicable (lower float level). Check battery wiring/calibration.

Effect: PCC damage will occur.

1. **Possible Cause:** Excessive battery charging voltage.

   Corrective Action: Adjust the charge rate of the battery charging circuit according to manufacturer's instructions.

2. **Possible Cause:** Engine DC alternator could be defective.

   Corrective Action: Replace the engine DC alternator if normal battery charging voltage (12 to 14 VDC) is not obtained.

3. **Possible Cause:** Wrong battery voltage.

   Corrective Action: Verify that the battery voltage (12 VDC) matches the calibration.

6.23 Fault Code 1123 - Shutdown After Battle Short

Lamp: Warning

Corrective Action: A shutdown fault occurred while Battle Short was enabled and Battle Short transitioned from enabled to disabled. Review the Fault History and perform corrective action.

6.24 Fault Code 1124 - Delayed Shutdown

Lamp: Warning

Corrective Action: A shutdown fault became active while the Delayed Shutdown feature was enabled. The shutdown will be delayed by the delayed shutdown time entered. Review the Fault History and perform corrective action.

6.25 Fault Code 1131 - Battle Short Active

Lamp: Warning

Corrective Action: Indicates that the control is in Battle Short mode - used to bypass several critical fault shutdowns for generator set operation during emergencies.

6.26 Fault Codes 1311, 1312, 1317, and 1318 - Customer Inputs #1-4

Lamp: Warning, Shutdown, or none for status message.

Corrective Action: 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 service tool), as follows:

- Enable/disable input (Default: enable)
- Status, Warning or Shutdown (Default: #1-None, #2 thru #4-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, #4-Rupture Basin)

Effect: Status, warning or shutdown

1. If there is no actual fault, the problem may be an external wiring problem, active input (closed or open) selection is incorrect.

   Disconnect the signal lead from TB1 and reset the control.

   - CUST_IN1 − TB1-4
   - CUST_IN2 − TB1-5
   - CUST_IN3 − TB1-6
   - CUST_IN4 − TB1-7

   If the message drops out, the external wiring has a short or open circuit, or the active input selection (closed/open) is not correct for customer input (use the service tool to check the selection).

6.27 Fault Code 1334 - Crit Scaler OR

Lamp: Shutdown

Corrective Action: An incorrect feature or calibration was entered into the control.

6.28 Fault Code 1335 - Non-Crit Scaler OR

Lamp: Warning

Corrective Action: An incorrect feature or calibration was entered into the control.

6.29 Fault Code 1416 - Fail to Shutdown

Lamp: Warning

Corrective Action: The generator set continues to run after receiving a shutdown command from the controller. The Battle Short feature is enabled - used to bypass several critical fault shutdowns for generator set operation during emergencies.

6.30 Fault Code 1417 - Power Down Error

Lamp: Warning

Corrective Action: This warning indicates that the controller cannot power down because of some unknown condition. Check to see if there is a possible drain on the battery.

6.31 Fault Code 1433 - Emergency Stop

Lamp: Shutdown

Corrective Action: Indicates a local Emergency Stop. To reset the local/remote Emergency Stop button:

1. Pull the Emergency stop button out.
2. Move the O/Manual/Auto switch to O.
3. Press the front panel Fault Acknowledge/Reset button.
4. Select Manual or Auto, as required.

6.32 Fault Code 1434 - Remote Emergency Stop

Lamp: Shutdown

Corrective Action: Indicates a remote Emergency Stop. See code 1433 to reset the Emergency Stop button.

6.33 Fault Code 1435 - Low Coolant Temperature

Lamp: Warning

Corrective Action: Coolant temperature must be below 70° F (default setting) for one minute to activate this warning and be above 70° F for five minutes before the warning can be cleared.

Effect: No action is taken by the PCC. The engine may not start due to slow cranking speed.

1. **Possible Cause:** Fault simulation was enabled with InPower.

   Corrective Action: With InPower, verify that the fault simulation is not enabled for the coolant sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** Fault threshold is not set correctly with InPower.

   Corrective Action: Reset the threshold to the lowest allowable setting. Determine the required operating range before adjusting the threshold.

3. **Possible Cause:** The sensor connections could be defective.

   Corrective Action: Inspect the sensor and engine harness connector pins. Repair or replace as necessary.

4. **Possible Cause:** The sensor could be defective.

   Corrective Action: 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 the control does not respond, the harness or base board is defective and must be replaced.

5. **Possible Cause:** The harness could be defective.

   Corrective Action: Measure the resistance of the coolant temperature sensor and reconnect the harness to the sensor. Remove connector P7 from the base board and check resistance between pins P7-30 (IH20) and P7-34 (IH20 COM).

   - If resistance is not the same, the harness is defective and must be replaced.

6.34 Fault Code 1438 - Fail to Crank

Lamp: Shutdown

Corrective Action: Indicates a possible fault with the speed sensing. This indicates that the engine failed to crank after the PCC received a start signal.

Effect: Engine will not start.

1. **Possible Cause:** Fuse F3 on the base board may be open.

   Corrective Action: Remove F3 and check continuity. If open, replace the fuse with one of the same type and amp rating (2 Amps).

   If F3 is OK, install a harness tool between the base board and the P7 connector. Attempt to start and check for B+ at P7-23 (GEN SW B+) and P7-27 (START SOL−). (These are leads to the K4 coil.)

   - If there is a B+ signal, the Start Pilot Relay K4 or starter circuitry is defective. Go to the next step.

2. **Possible Cause:** Start Pilot Relay K4 or starter circuitry could be defective.

   Corrective Action: Check for B+ IN at K4-1 (directly connected to battery B+). If not present, check for an open circuit. If there is B+ IN, attempt to start and test for B+ OUT at K4-4.

   - If there is no B+ OUT at K4-4, K4 is defective and must be replaced.
   - If there is B+ OUT at K4-4, check for an open circuit between K4-4 and the starter.

3. **Possible Cause:** The Emergency Stop switch or wiring is defective.

   Corrective Action: With the Emergency Stop push button not activated, remove connector P1 and check for continuity between P1-1 (ESTOP-NC1) and P1-2 (ESTOP-NC2). (If the circuit is open, the control will detect a local E-Stop condition but will not display the E-Stop condition.) If circuit is open, isolate to the Emergency Stop switch and wiring. If there is continuity, go to the next step.

4. **Possible Cause:** MPU/circuit is bad.

   Corrective Action: Refer to Fault Code **121** instructions.

6.35 Fault Code 1442 - Weak Battery

Lamp: Warning

Corrective Action: Indicates that during cranking, the battery voltage is at or below the weak battery warning trip point for a time greater than or equal to the weak battery set time. See code **441** for corrective action.

Effect: No action is taken by the PCC.

1. **Possible Cause:** Weak or discharged battery

   Corrective Action: Recharge or replace the battery. Specific gravity for a fully charged battery is approximately 1.260 at 80° F (27° C).

2. **Possible Cause:** Low electrolyte level in battery.

   Corrective Action: Replenish electrolyte and recharge battery.

3. **Possible Cause:** Battery connections loose or dirty.

   Corrective Action: Clean and tighten or replace the battery cable connectors and cables at the battery and the set.

4. **Possible Cause:** Insufficient battery charging voltage.

   Corrective Action: Adjust charge rate of battery charging circuit, according to manufacturers instructions.

5. **Possible Cause:** If the batteries are OK, the problem may be the harness.

   Corrective Action: Remove connector P7 from Base board. Check battery voltage at: P7-3 (CNTL) to P7-7 (GND) and P7-4 (CNTL) to P7-8 (GND) If voltage is not OK, repair defective harness.

6.36 Fault Code 1443 - Battery Failed

Lamp: Shutdown

Corrective Action: Dead battery - engine will not start. See code **441** for corrective action.

Effect: Engine will not start.

1. **Possible Cause:** Refer to code **1438**.

   Corrective Action: Refer to code **1438** instructions.

6.37 Fault Code 1444 - kW Overload

Lamp: Warning

Corrective Action: Indicates that generator output power exceeded 105% of genset rating. Check load and load lead connections.

Effect: No action taken by the PCC.

1. **Possible Cause:** Fault threshold is not set correctly with InPower.

   Corrective Action: Reset the threshold to the highest allowable setting. Determine the required operating range before adjusting the threshold.

2. **Possible Cause:** Short or overload.

   Corrective Action: Check the load and load cables. Repair if necessary. Check operation by disconnecting load and restarting generator set.

3. **Possible Cause:** Incorrect CTs or CT connections.

   Corrective Action: Check CTs and CT connections. Correct if necessary. Refer to *Current Transformer Installation*

4. **Possible Cause:** The problem may be the harness connections.

   Corrective Action: Remove connector P7 from Base board. Check continuity from P7 to CTs. P7-11 (CT1) to P7-12 (CT1-COM) P7-15 (CT2) to P7-16 (CT2-COM) P7-19 (CT3) to P7-20 (CT3-COM) Repair connections.

6.38 Fault Code 1445 - Short Circuit

Lamp: Shutdown

Corrective Action: Indicates that generator output current has exceeded 175% of rated. Check load and load lead connections. (Fault may not reset for several minutes.)

Effect: Engine will shut down.

1. **Possible Cause:** Refer to code **1444**.

   Corrective Action: Refer to code **1444**.

6.39 Fault Code 1446 - High AC Voltage

Lamp: Shutdown

Corrective Action: Indicates one or more of the phase voltages has exceeded 130% of nominal, or has exceeded 110% of nominal for 10 seconds.

Effect: Engine will shut down.

1. **Possible Cause:** Fault simulation was enabled with In-Power.

   Corrective Action: With InPower, verify that the related fault simulation is not enabled. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** Single step large block load removal.

   Corrective Action: Clear fault and restart genset.

3. **Possible Cause:** Fault threshold is not set correctly with InPower

   Corrective Action: Reset the threshold to the highest allowable setting. Determine the required operating range before adjusting the threshold.

6.40 Fault Code 1447 - Low AC Voltage

Lamp: Shutdown

Corrective Action: Indicates that one or more of the phase voltages has dropped below 85% of nominal for 10 seconds.

Effect: Engine will shut down.

1. **Possible Cause:** Fault simulation was enabled with In-Power.

   Corrective Action: With InPower, verify that the related fault simulation is not enabled. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** Fault threshold is not set correctly with InPower.

   Corrective Action: Reset the threshold to the lowest allowable setting. Determine the required operating range before adjusting the threshold.

3. **Possible Cause:** Improper connections have been made at the generator output terminals.

   Corrective Action: Reconnect according to the appropriate reconnection diagram.

4. **Possible Cause:** PMG or field wiring could be bad.

   Corrective Action: Check and repair the PMG or field wiring

5. **Possible Cause:** Shunt wiring connection could be incorrect.

Corrective Action: Check that excitation inputs P8-21 and P8-22 are connected to the correct voltage. If misconnected to a high voltage, the AVR fault will shut down excitation and cause Low AC Voltage condition.

6. **Possible Cause:** Loose connector.

   Corrective Action: Repair connections (P8).

6.41 Fault Code 1448 - Under Frequency

Lamp: Shutdown

Corrective Action: Indicates that engine speed has dropped below 90% of nominal for 10 seconds.

Effect: Generator set will shut down.

1. **Possible Cause:** Fault simulation was enabled with In-Power.

   Corrective Action: With InPower, verify that the related fault simulation is not enabled. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** Fault threshold is not set correctly with InPower.

   Corrective Action: Reset the threshold to the lowest allowable setting. Determine the required operating range before adjusting the threshold.

3. **Possible Cause:** Overload.

   Corrective Action: Check the load and correct any overload. Check operation by disconnecting load and restarting generator set.

4. **Possible Cause:** Loose connector.

   Corrective Action: Repair connections (P8).

6.42 Fault Code 1449 - Over Frequency

Lamp: Warning

Corrective Action: Indicates frequency is 10% above base frequency for 20 seconds. Generator AC output frequency is high.

Effect: No action taken by the PCC.

1. **Possible Cause:** Fault simulation was enabled with In-Power.

   Corrective Action: With InPower, verify that the related fault simulation is not enabled. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.

2. **Possible Cause:** Fault threshold is not set correctly with InPower.

   Corrective Action: Reset the threshold to the highest allowable setting. Determine the required operating range before adjusting the threshold.

3. **Possible Cause:** Loose connector.

   Corrective Action: Repair connections (P7/P8).

6.43 Fault Code 1461 - Loss of Field

Lamp: Shutdown

Corrective Action: Indicates loss of field (electric) due to reverse kVAR.

6.44 Fault Code 1466 - Modem Failure

Lamp: Warning

Corrective Action: Indicates that the control can not communicate with the modem. Check for an open short circuit to ground and loose connections to the modem.

6.45 Fault Code 1468 - Network Error

Lamp: Warning

Corrective Action: Indicates a momentary loss of communication from the LonWorks network. Refer to the LonWorks network publications for more specific troubleshooting methods.

6.46 Fault Code 1469 - Speed/Hz Match

Lamp: Shutdown

Corrective Action: Indicates that measured speed and measured AC output frequency do not agree. Check the calibration file.

6.47 Fault Code 1471 - Over Current

Lamp: Warning

Corrective Action: Indicates that generator output current has exceeded 110% of rated for 60 seconds. Check load and load lead connections.

Effect: No action is taken by the PCC for code **1471**. Engine will shut down for code **1472**.

1. **Possible Cause:** Refer to code **1444**.

   Corrective Action: Refer to code **1444.**

6.48 Fault Code 1472 - Over Current

Lamp: Shutdown

Corrective Action: Indicates that generator output current has exceeded 110% of rated, and that a control time/current calculation has initiated an overcurrent shutdown. Check the load and load lead connections. (The fault may not reset for several minutes.)

6.49 Fault Codes 2323–2326 - Network Faults 5 through 8

Lamp: Shutdown, Warning, or none for status message

Corrective Action: Indicates network inputs (#5−#8) are in an active state. See Fault Codes 1313−1316 for corrective action.

6.50 Fault Code 2335 - Excitation Fault

Lamp: Shutdown

Corrective Action: Indicates a loss of all three voltage sense leads or a failure in the excitation circuit. Check field wiring (X1 and X2) for shorts or opens.

6.51 Fault Code 2336 - Memory Error

Lamp: Shutdown

Corrective Action: Indicates a control memory error, resulting in data corruption of critical operating parameters. Try reloading the calibration file.

6.52 Fault Code 2341 - High Control Temperature

Lamp: Warning

Corrective Action: The control temperature is above normal (158° F [70° C]) for a time greater than the control temperature set time. Check the generator set room air flow.

6.53 Fault Code 2342 - Too Long in Idle

Lamp: Warning

Corrective Action: Indicates the generator set has been in idle mode too long. Exit idle mode.

6.54 Fault Code 2967 - Governor Fault

Lamp: Warning

Corrective Action: Governor hardware drive circuitry contains a fault condition.

6.55 Fault Code 2968 - AVR Fault

Lamp: Warning

Corrective Action: Indicates AVR hardware contains a fault condition.

6.56 Fault Code 2969 - LON Failure

Lamp: Warning

Corrective Action: Indicates no communications with the LonWorks board.

6.57 Fault Code 2972 - Field Overload

Lamp: Shutdown

Corrective Action: The AVR Field has been at Max Field for a time greater than the allowed Max Field Time.

7 Manufacturing Facilities

NORTH AMERICA	EMEA, CIS	ASIA PACIFIC
Cummins Power Generation Limited 1400 73rd Ave. NE Minneapolis, MN 55432 USA	Cummins Power Generation Limited Columbus Avenue Manston Park Manston, Ramsgate Kent CT12 5BF United Kingdom	Cummins Power Generation Limited 10 Toh Guan Road #07-01 TT International Tradepark Singapore 608838
Phone 1 763 574 5000 Toll Free 1 800 888 6626 Fax 1 763 574 5298	Phone 44 1843 255000 Fax 44 1843 255902	Phone 65 6417 2388 Fax 65 6417 2399
BRAZIL	**CHINA**	**INDIA**
Rua Jati, 310, Cumbica Guarulhos, SP 07180-900 Brazil	Cummins Power Generation 2 Rongchang East Street, Beijing Economic – Technological Development Area Beijing 100176, P.R.China	35A/1/2, Erandawana Pune 411 038 India
Phone 55 11 2186 4195 Fax 55 11 2186 4729	Phone 86 10 5902 3000 Fax 86 10 5902 3199	Phone 91 020 6602 7525 Fax 91 020 6602 8090
LATIN AMERICA	**MEXICO**	
3350 Southwest 148th Ave. Suite 205 Miramar, FL 33027 USA	Eje 122 No. 200 Zona Industrial San Luis Potosi, S.L.P. 78395 Mexico	
Phone 1 954 431 551 Fax 1 954 433 5797	Phone 52 444 870 6700 Fax 52 444 824 0082	

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Appendix A. Wiring Diagrams

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Figure 35. 0620-0247 93

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0612-6764, PCC 2100 (Non-FAE)

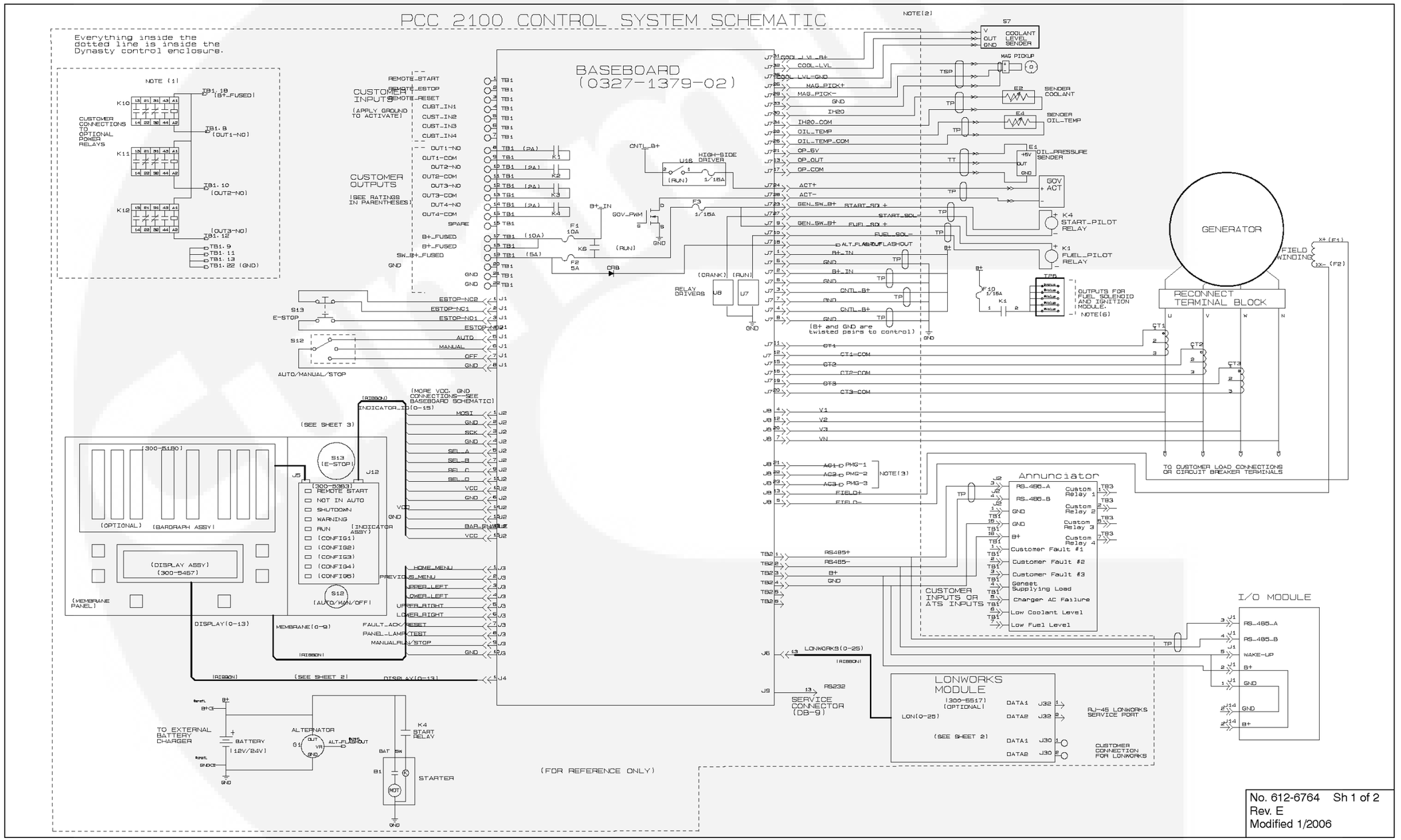


FIGURE 33. 0612-6764, SHEET 1 OF 2

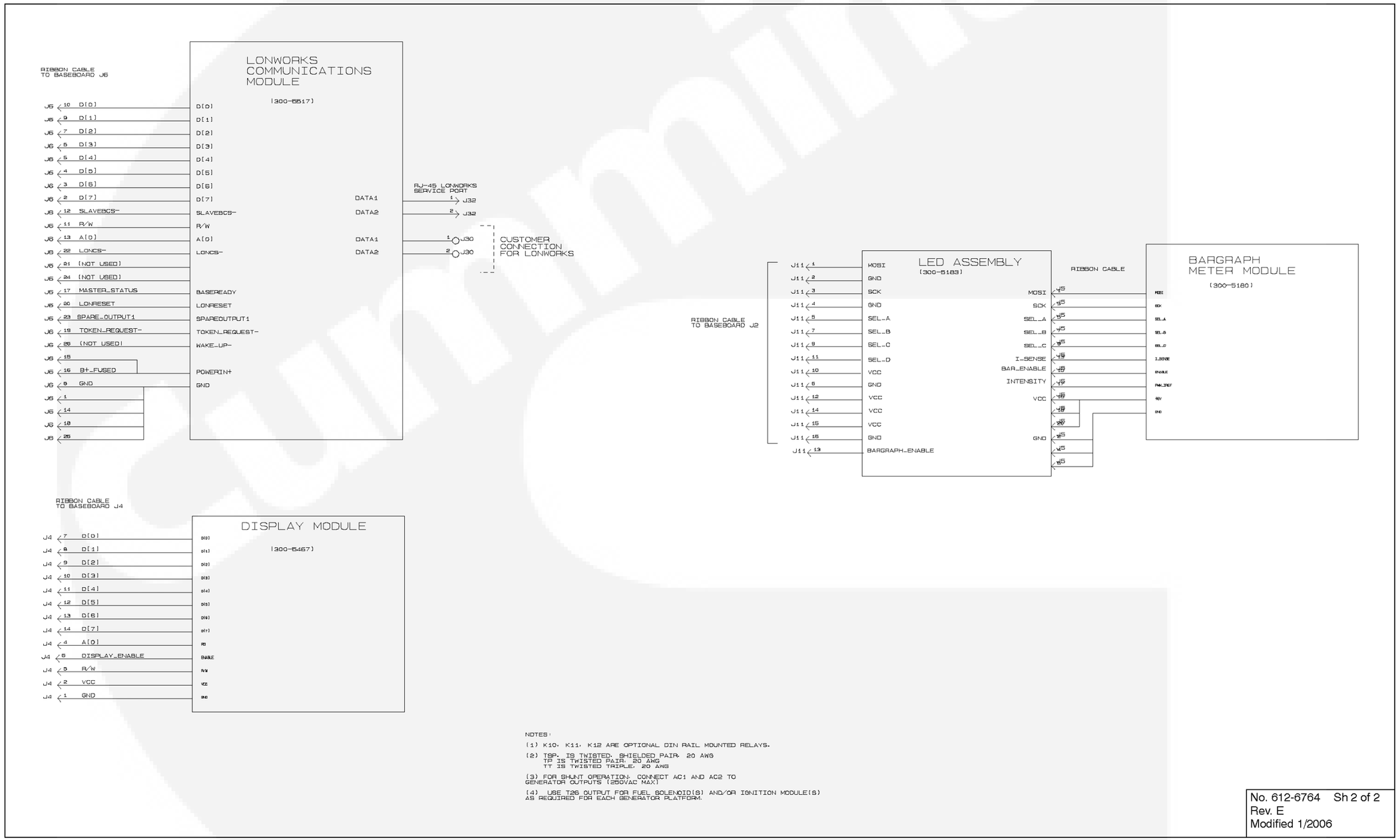
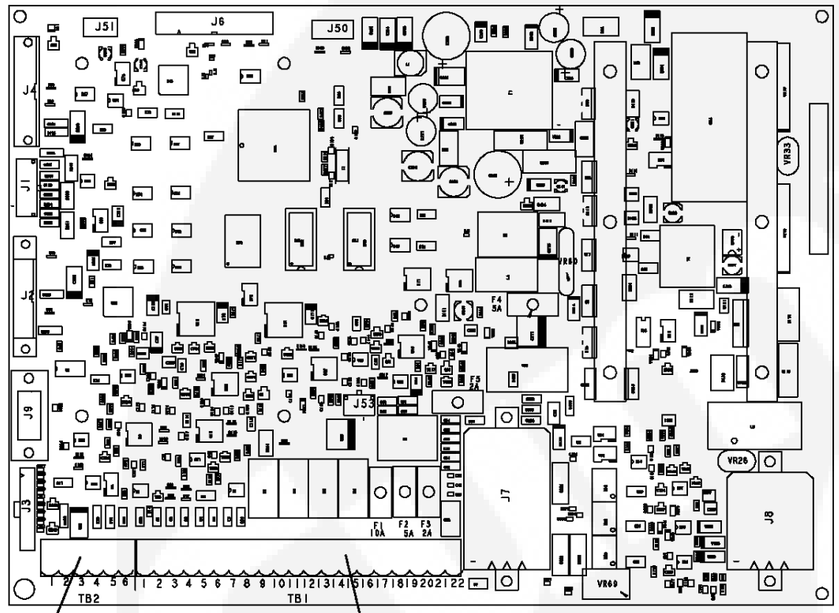


FIGURE 34. 0612-6764, SHEET 2 OF 2

0620-0247, PCC 2100 Customer Connections



TB2

1	RS485+
2	RS485-
3	PTC B+
4	PTC GND
5	PTC STATUS
6	COM

TO REMOTE UTILITY VOLTAGE SENSING MODULE. SEE OPERATOR'S MANUAL FOR CABLE TYPE.

TB1

1	REMOTE START	APPLY GROUND TO ACTIVATE
2	REMOTE E-STOP	
3	REMOTE RESET	
4	CUSTOMER FAULT 1	
5	CUSTOMER FAULT 2	
6	CUSTOMER FAULT 3	
7	CUSTOMER FAULT 4	
8	CUSTOMER RELAY 1	RATED 2A @ 30VDC (MAX)
9	COM	
10	CUSTOMER RELAY 2	
11	COM	
12	CUSTOMER RELAY 3	
13	COM	
14	CUSTOMER RELAY 4	
15	COM	
16	(NOT USED)	
17	B+ FUSED OUT	10A FUSED
18	B+ FUSED OUT	
19	SWITCHED B+	5A FUSED
20	GND	
21	GND	
22	GND	

DEFAULT SETTING

TB1-CUSTOMER FAULTS:
1 CUSTOMER FAULT 1
2 GROUND FAULT
3 LOW FUEL

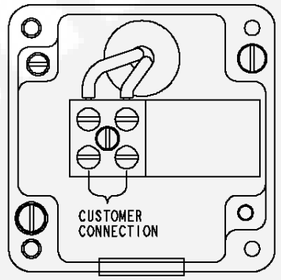
TB-1CUSTOMER RELAYS:
1 COMMON WARNING
2 COMMON SHUTDOWN
3 NOT IN AUTO
4 READY TO LOAD

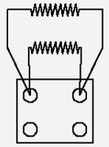
TERMINAL/WIRE SPECIFICATION

1) TORQUE TERMINALS TO 4.4 IN/LBS (0.5 Nm)
2) WIRE SIZE, 30-12 AWG (0.14-2.5MM) (TB1)
3) WIRE TYPE, USE 60°C RATED MINIMUM, COPPRER WIRE (TB1)
4) TERMINAL SCREWS ARE SLOTTED (0.6MM)
5. USE FLAT-BLADED SCREWDRIVER WITH 2.5MM BLADE
6) STRIP WIRE LENGTH TO 6.0MM

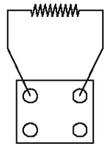
VOLTAGE SUPPRESSORS MUST BE INSTALLED BEFORE POWER IS APPLIED TO THE CONTROL OR GENSET TO PREVENT DAMAGE TO BASE BOARD

ALTERNATOR HEATER





DUAL HEATER



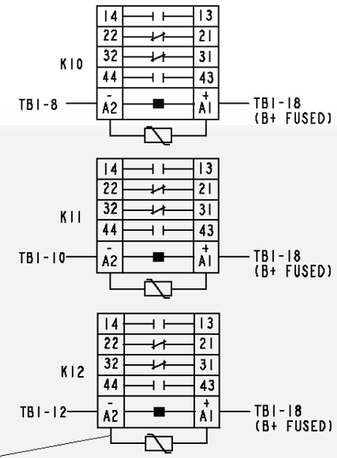
SINGLE HEATER

TERMINAL/WIRE SPECIFICATIONS

1. USE 60°C RATED MINIMUM COPPER WIRE.
2. WIRE SIZE: #12 - 18 AWG .
3. TORQUE TO 7.7 IN-Lb (0.9 Nm)
4. STRIP WIRE TO 0.32 INCHES (8.0 mm).
5. USE SLOTTED SCREWDRIVER WITH 3.0 mm BLADE
6. TERMINALS RATED AT 150V/20A AND 300V/10A.

HEATER RATING	
100 WATT	110 -125VAC 220 -260VAC
150 WATT	110 -125VAC 220 -260VAC
300 WATT	110 -125VAC 220 -260VAC

CUSTOMER RELAYS



TERMINAL/WIRE SPECIFICATIONS

1) NORNALLY OPEN (NO) TERMINALS: 13,14 43,44
NORNALLY CLOSED (NC) TERMINALS: 21,22 31,32
2) TORQUE TERMINALS TO 7 INCH LBS (0.8Nm)
3) WIRE SIZE 1-18 AWG MIN (0.75MM²)
2-14 AWG MAX (2.5MM²)
1-12 AWG MAX (4.0MM²)
4) USE 60°C RATED MINUMUM, COPPER WIRE, 600VAC
5) TERMINAL SCREWS ARE PHIL SLOT
6) USE SLOTTED SCREWDRIVER WITH 5.0 MM BLADE OR NO. 2 PHILIPS
7) CONTACT RATINGS: 600VAC, 10 AMPS MAX
8) STRIP WIRE LENGTH TO 7.0 MM

THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS SHIPPED WITH THE GENERATOR SET.

No. 620-0247, Revision C
Sheet 1 of 1, Dated June 2004

FIGURE 35. 0620-0247

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