Service Manual

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Power Generation

Generator Set
with PowerCommand® 1301 Controller

DGGD (Spec B–E)
DGHD (Spec B–E)
DGHE (Spec B–E)

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Table of Contents

SECTION	TITLE	PAGE
	IMPORTANT SAFETY INSTRUCTIONS	iii
1	**INTRODUCTION**	
	About this Manual	1-1
	Generator Set	1-1
	System Overview	1-1
	Test Equipment	1-1
	How to Obtain Service	1-1
2	**CONTROL OPERATION**	
	General	2-1
	Control Panel Power On/Off Modes	2-1
	Control Panel	2-2
	System Messages	2-5
	Selecting Auto, Manual Run and OFF Modes	2-7
	Operator Menus	2-10
	Service Menus	2-14
	History/About Menu	2-16
	Screen Adjust Menu	2-18
	Fault History Menu	2-20
3	**CIRCUIT BOARD**	
	General	3-1
	Base Board	3-3
4	**TROUBLESHOOTING**	
	General	4-1
	InPower Service Tool	4-1
	Network Applications and Customer Inputs	4-1
	Safety Consideration	4-2
	Reading Fault Codes	4-2
	Troubleshooting Procedure	4-3

SECTION	TITLE	PAGE
5	**CONTROL ADJUSTMENT AND SERVICE**	
	General	5-1
	Circuit Board Removal/Replacement	5-2
	Setup Menu	5-3
	Genset Service Menus	5-4
	Genset Service Submenus	5-6
	Automatic Voltage Regulator Submenus	5-12
	Electronic Governor Submenus	5-14
	Customer I/O Submenus	5-16
	Metering Submenus	5-18
	Annunciator Submenus	5-20
	Genset Setup Submenus	5-27
	Genset Submenus	5-30
	Voltage Protection Submenus	5-36
	Current Protection Submenus	5-38
	Engine Protection Submenus	5-40
	TB1 Base Board Customer Connections	5-46
	Engine Sensors	5-47
	Magnetic Speed Pickup Unit (MPU) Installation	5-48
	Current Transformer (CT) Installation	5-49
6	**SERVICING THE GENERATOR**	
	General	6-1
	Generator/Base Board Isolation Procedure	6-2
	Generator Disassembly	6-10
	Generator Reassembly	6-12
7	**GOVERNOR**	
	Electric Governor Throttle Lever/Linkage Adjustment	7-1
	Mechanical Governor Throttle Lever/Linkage Adjustment	7-2
8	**WIRING DIAGRAMS**	
	General	8-1
A	**MENU SEQUENCE DIAGRAMS**	
	General	A-1

IMPORTANT SAFETY INSTRUCTIONS

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

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

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER ***This symbol warns of immediate hazards which will result in severe personal injury or death.***

⚠ WARNING ***This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.***

⚠ CAUTION ***This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.***

FUEL AND FUMES ARE FLAMMABLE

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

- DO NOT fill fuel tanks while engine is running, unless 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 zinc coated or copper fuel lines with diesel fuel.
- Be sure all fuel supplies have a positive shutoff valve.
- Be sure 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.

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

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 battery charger from its AC source, then disconnect 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 adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

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 genset where a flammable vapor environment can be created by fuel spill, leak, etc., unless the genset is equipped with an automatic safety device to block the air intake and stop the engine. The owners and operators of the genset are solely responsible for operating the genset safely. Contact your authorized Cummins Power Generation distributor for more information.

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.

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. To prevent severe scalding, let engine cool down before removing coolant pressure cap. Turn cap slowly, and do not open it fully until the pressure has been relieved.
- 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, combustible and flammable liquid fuels and gaseous fuels; Class C fires, live electrical equipment. (ref. NFPA No. 10).
- Make sure that rags are not left on or near the generator set.
- Make sure generator set is mounted in a manner to prevent combustible materials from accumulating under or near 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 or 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 radiator system, turbo charger system and exhaust system.

KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE

1. Introduction

ABOUT THIS MANUAL

This manual provides troubleshooting and repair information regarding the PowerCommand® 1301 Control (PCC) and generators for the generator sets (gensets) listed on the front cover. Engine service instructions are in the applicable engine service manual. Operating and maintenance instructions are in the applicable Operator's Manual.

This manual does not have instructions for servicing printed circuit board assemblies. After determining that a printed circuit board assembly is faulty, replace it, do not repair it. Attempts to repair a printed circuit board can lead to costly damage to the equipment.

This manual contains basic (generic) wiring diagrams and schematics that are included to help in troubleshooting. Service personnel must use the actual wiring diagram and schematic shipped with each unit. The wiring diagrams and schematics that are maintained with the unit should be updated when modifications are made to the unit.

Read ***Important Safety Instructions*** and carefully observe all instructions and precautions in this manual.

SYSTEM OVERVIEW

The PCC is a microprocessor-based control for Cummins Power Generation generator sets. All generator set control functions are contained on 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 set-up input from the push button switches on the front panel.

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 genset service tool).
- PCC1301 Interface Kit (Used with InPower Service Tool)

HOW TO OBTAIN SERVICE

Always give the complete Model, Specification and Serial number of the generator set as shown on the nameplate when seeking additional service information or replacement parts. The nameplate is located on the back of the control box.

⚠WARNING ***Incorrect service or replacement of parts can result in severe personal injury or death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical service. Read and follow Important Safety Instructions on pages iii and iv.***

2. Control Operation

GENERAL

The following describes the function and operation of the PowerCommand® 1301 Control. All indicators, control buttons and graphical display are located on the face of the control panel as illustrated in Figure 2-2.

CONTROL PANEL POWER ON/OFF MODES

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

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 Sleep mode is activated.

Sleep Mode: In the Sleep mode, the control's operating software is inactive and the LEDs and the graphical 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 is in either the Off or Auto mode.

When all conditions are met (i.e., no unacknowledged faults and the control is in the Off or Auto mode) the Sleep mode is activated after five minutes of keypad inactivity.

To activate the control and view the menu display without starting the generator set, press any control button.

When shipped from the factory, Sleep mode is enabled for both modes (Off and Auto mode). Internal adjustment of the control also allows the Sleep mode to be active only during the Off mode (Base board switch **S1**) or disabled for both modes (installation of jumper). When disabled, the operating software will always remain active (Power On mode).

S1 switch setting:
OFF = Sleep mode is enabled for Auto and Off modes.
ON = Sleep mode is enabled for Off mode only.

J1/**J2** jumper installation: Install jumper between J1-4 and J1-5 to disable sleep mode. (J1 and J2 are identical, either one can be used for jumper.)

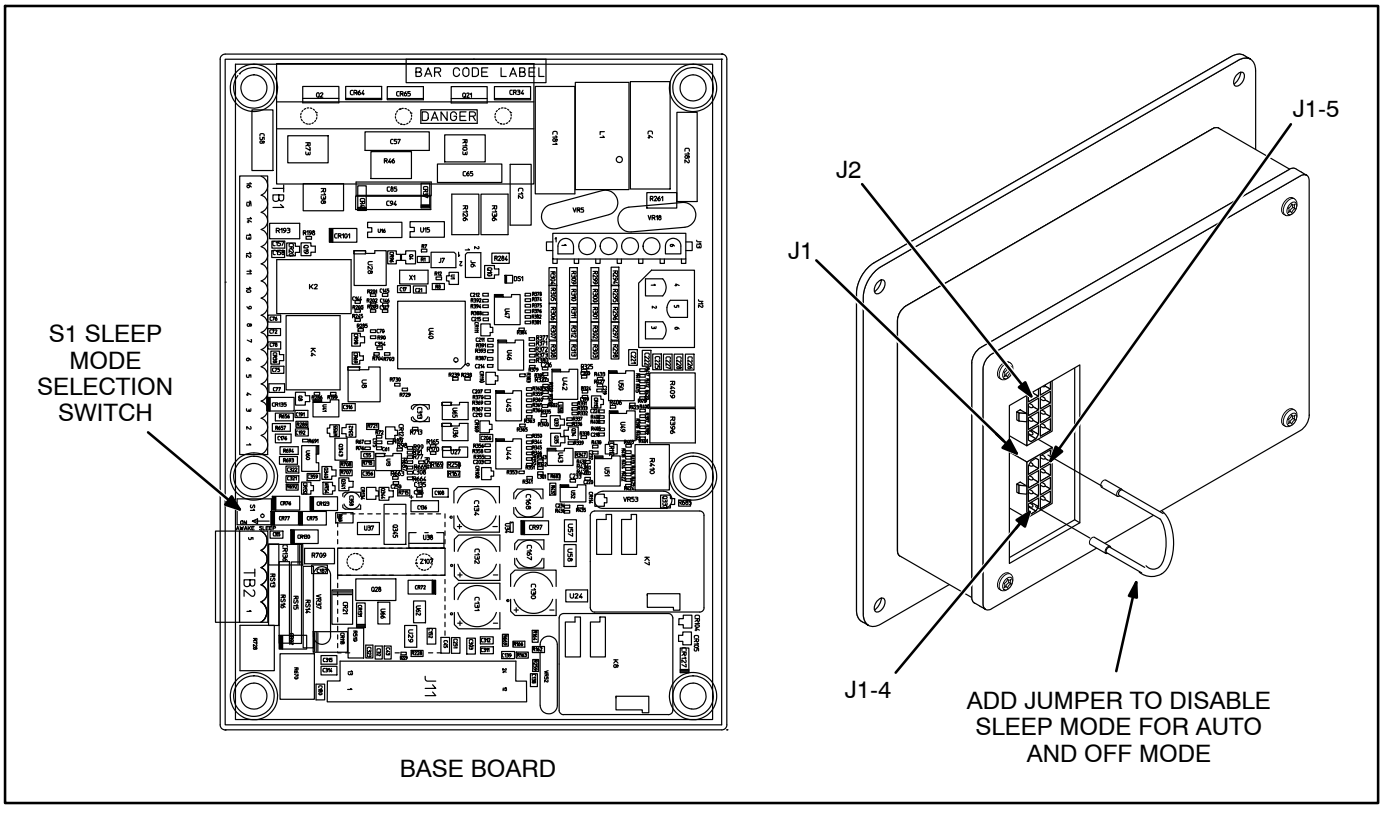

FIGURE 2-1. SLEEP MODE ACTIVATION SETTINGS

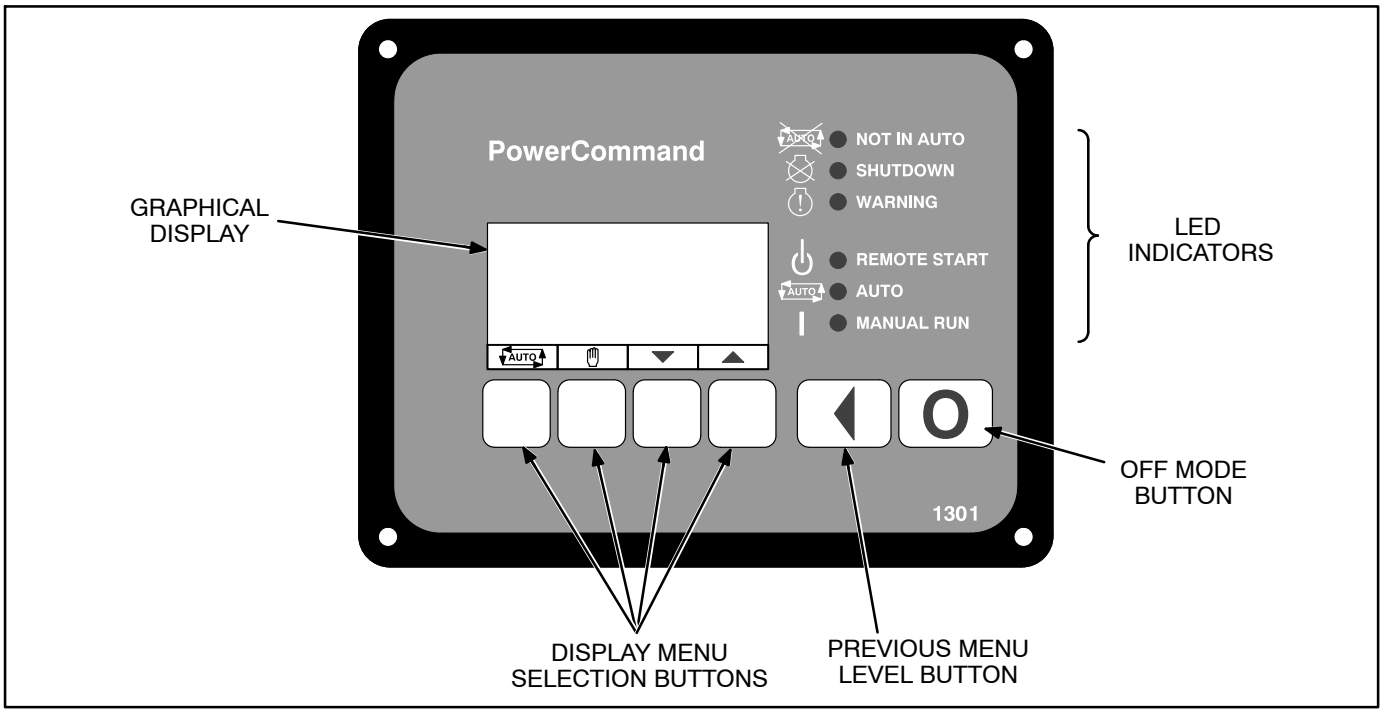

FIGURE 2-2. FRONT PANEL (WITH DISPLAY)

CONTROL PANEL

Figure 2-2 shows the features of the front panel. It includes six LED indicators, the graphical display, and six buttons used to navigate through the menus and adjust parameters.

Graphical Display

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

System messages (communication, event, and fault) are also shown on the graphical display. For more information, see *System Messages* later this section.

Display Text / Symbolic Versions

This graphical display can be set up to show either text or symbolic versions for fault messages, some Operator menus, and the Mode Change menu. A description of commonly used symbols used are included in Table 2-1. Combinations of symbols are used to display some fault conditions. Additional specialized symbols are also used for some faults (see *Section 4*).

When shipped from the factory, symbolic display is selected. (Refer to Setup menu in *Section 5* to change to text or symbolic display.)

TABLE 2-1. SYMBOLS

SYMBOL	DESCRIPTION
	Generator Warning Fault
	Generator Shutdown Fault
	Coolant Temperature
	Oil Pressure
V	Voltage Alternating Current (VAC)
V	Voltage Direct Current (VDC)
A	AC Current
Hz	Frequency
− +	Battery
	Out of Range
	High or Pre-High
	Low or Pre-Low
	Annunciator

Display Menu Selection Buttons

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

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

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

  NOTE: When any Operator menu (Figure 2-12 is displayed, a series of Service menus can be viewed by simultaneously pressing the ▲ and ▼ selection buttons for two seconds.

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

- When a ◀ symbol is displayed, the selection button can be used to abort the Auto or Manual Run mode and return to the Operator menu that was displayed before the Auto or Manual Run mode was selected.
- When **ADJUST** is displayed, the selection button is used to display an adjustable menu. When the **ADJUST** button is pressed, the first adjustable parameter or value in the submenu is highlighted.
- When the → symbol is displayed, the selection button is used to navigate to an editable field within a menu.
- When the + and – symbols are displayed, the selection buttons are used to increase or decrease a parameter or value shown on the screen.

  When changing values, pressing the button below the + symbol increase the value and pressing the button below the – symbol decreases the value.
- When **SAVE** is displayed, the selection button is used to save changes made in a submenu. **If the Previous Menu button is pressed before pressing SAVE, the changes are not saved.**
- Some menus include a list of numbered subjects. These menus include numbers in parenthesis (for example, **(1)**) displayed above the selection buttons. The selection buttons are then used to display submenus of the subjects included in the list.
- When a black box ■ is displayed, the selection button has no function.