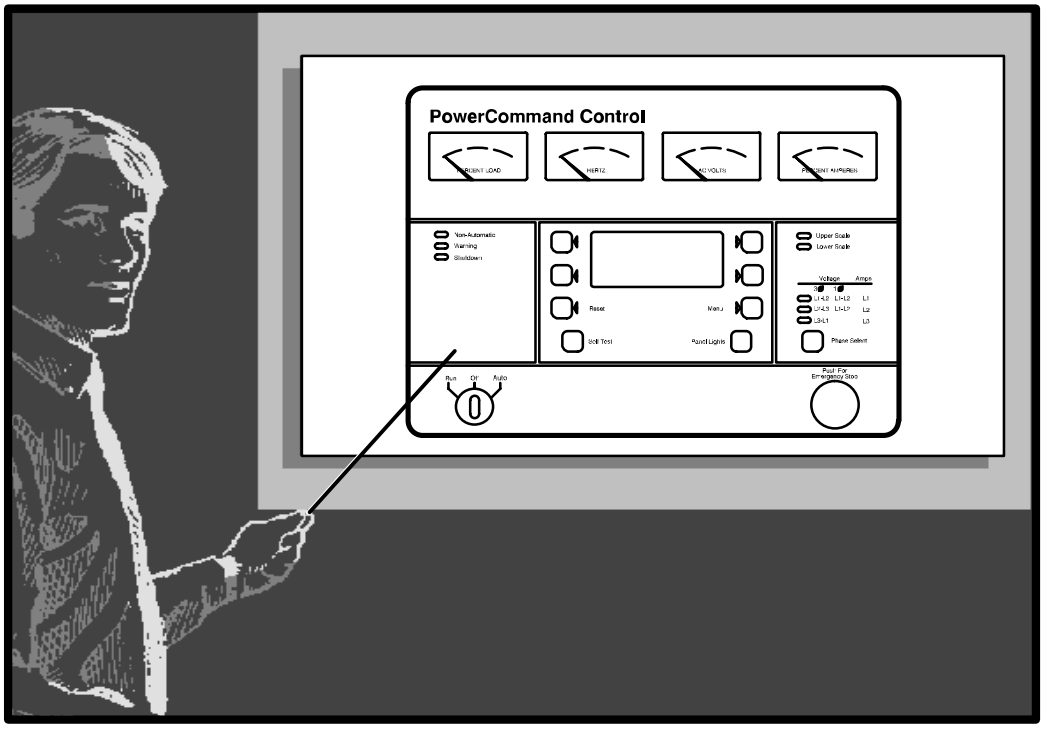
Power Generation

Technical Training

Participant's Guide

PowerCommand® Control 3100



CMT0309-EN-PG
932-0367C
02/2003

PowerCommand® Control 3100 Module

Table of Contents

This page intentionally left blank

Introduction

Welcome!

Welcome to the Participant's Guide for the PowerCommand® Control 3100 module! This guide was written by Onan's Sales and Technical Training department for your use and reference.

We suggest you read through the entire Introduction to become familiar with the guide's structure. Then, just follow along in the guide during your training session.

Module Purpose

The purpose of the PowerCommand® Control 3100 module is to help you, the Cummins/Onan distributor technician understand the use, operation, service and troubleshooting of the PowerCommand™ Control.

With this information, you will be better prepared to meet your customers' varying needs.

Module Audience

This module was written for Cummins Power Generation distributor power generation technicians who have previous experience with or knowledge of Integrated generator sets.

Module Structure

This module contains lessons on related topics. Each lesson follows a carefully designed training format, including a warm up, presentation, and activity (or exercise).

Lesson Format

Warm ups help you focus and begin thinking about the lesson topic. The *presentation* portion of the lesson is where you receive new information. The *activity* follows the presentation; it gives you the chance to practice new skills or work with new ideas.

Module Assessment

After completing all the lessons in the module, you will complete a *module assessment*. The module assessment lets us evaluate the level of knowledge you have on the topic after completing the module.

Module Comment Form

You will also complete a *module comment form*. This form gives you the chance to comment on the usefulness and effectiveness of the training module and make suggestions for improvements.

We will use the results from the module assessment and module comment form to help us determine if there is a need to modify the module.

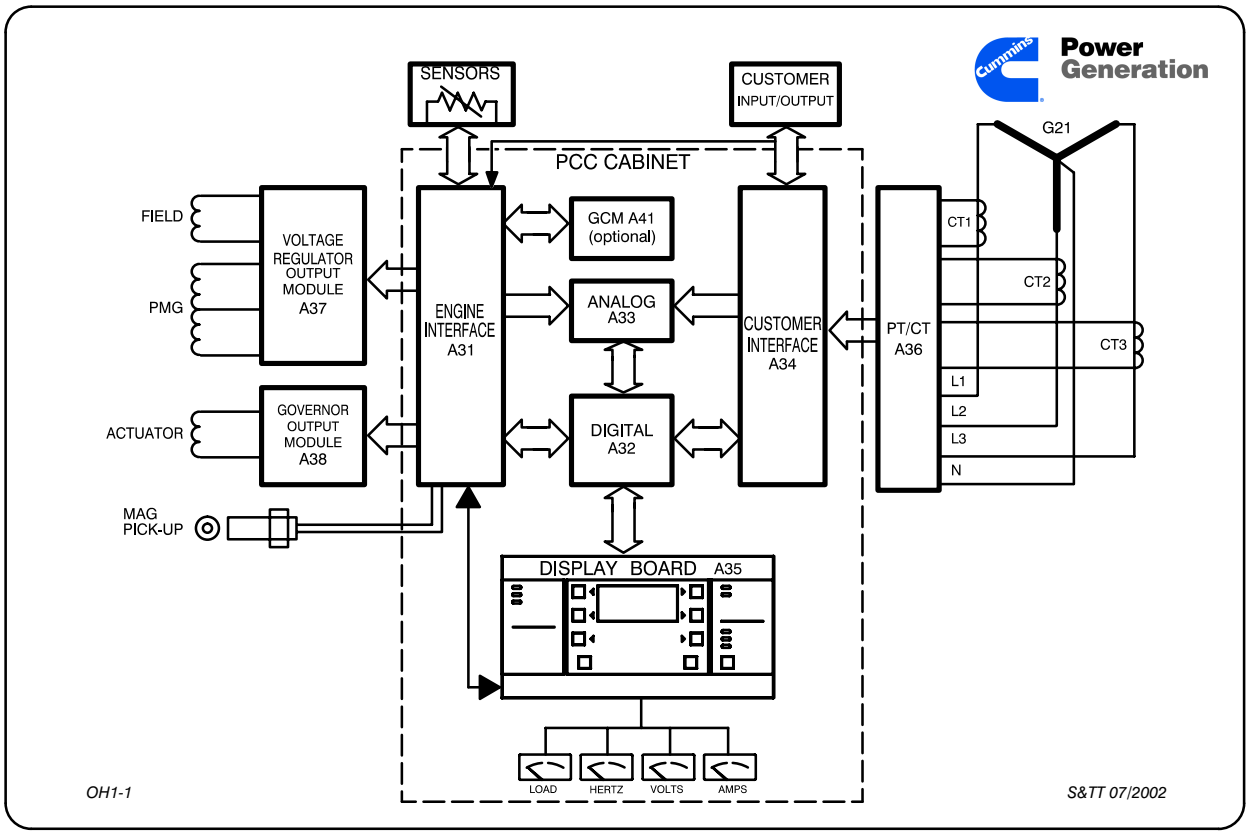
Introduction to the PowerCommand® Control 3100

This lesson presents an overview of the PowerCommand® Control 3100 components used on 200-1500 kW generator sets built after August 5, 1994.

Objectives

After completing this lesson, you should be able to:

- Identify the PowerCommand® Control 3100.
- Locate and identify the PowerCommand® Control 3100 front panel switches and components.
- Identify the PowerCommand® Control 3100 internal modules.
- Identify the PowerCommand® Control 3100 external modules.



Slide 1-1 PowerCommand System Architecture

Participant's Information

What is the PowerCommand® Control 3100 (PCC 3100)?

The PowerCommand® 3100 Control is part of a networkable PowerCommand system that can incorporate gensets, transfer switches, paralleling systems, and customers' equipment and their SCADA system.

It is used as the "Standard" control on all 200-1500 kW gensets with hydro-mechanical fuel systems since August 5, 1994. This control has a microprocessor and stored information for each generator set kW and frequency selection. This customized setup of the control is done at the time the generator set is run in the test cell.

Your Notes

Participant's Guide

What does the PowerCommand® Control 3100 do?

In addition to the many control and annunciation functions of the Detector-Series of controls, the PCC 3100 controls the automatic voltage regulator and governor functions. In the PCC 3100, the AVR and governor are related because the same microprocessor controls both of them.

Besides operating the engine, the PCC 3100 also monitors and displays the generator voltage, current, power factor, and load level. If the active or reactive load goes over 95% of the limit for the selected generator set, a warning message will be displayed on the LED display panel on the front of the PCC 3100. If the current or load goes over 100% of the limit, the PCC 3100 will shut down the generator set well before the generator is damaged.

What are the PCC 3100 remote start modes?

The PCC 3100 can wait for a remote start signal in either the standby or service mode. In the service mode, the PCC 3100 power supplies are operating, and the PCC 3100 will constantly draw current from the generator set batteries. In the standby mode the PCC 3100 draws much less current from the generator set batteries until a "wake-up" signal is received.

Your Notes

Participant's Guide

The "wake-up" signals are:

Engine Wakeups

- Low engine coolant level
- Low engine coolant temperature
- Low Fuel level, and
- Customer Faults 2 & 3

Control Wakeups

- S12 placed in the RUN position
- Remote start signal with S12 in the AUTO position
- Self Test switch, and
- Emergency Stop switch.

When the PCC 3100 is in the awake mode, it constantly measures the engine pressures, temperatures, and coolant level.

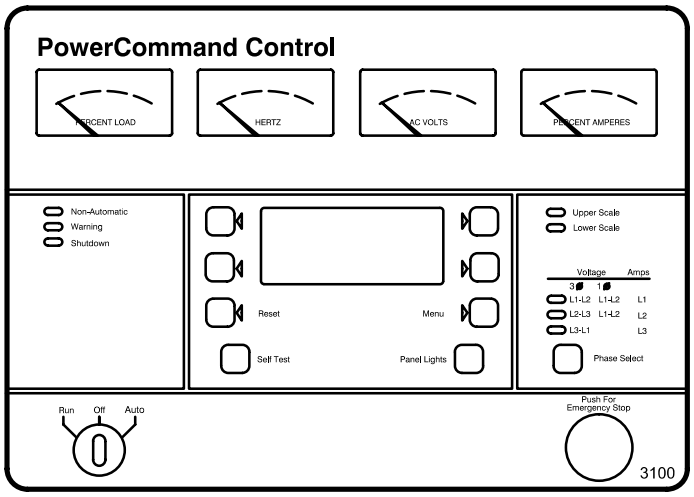
By selecting the "engine" menus, the operator can check oil pressure and temperature and coolant temperature.

There will only be an indication of coolant level on the LED display panel if the coolant level is low.

- In automatic (sleep) mode, the PCC 3100 draws 0.05 amps.
- In service (awake) mode, the PCC 3100 draws 0.46 amps.
- The panel lamps are an additional 0.50 amp. drain.

Your Notes

Standby Control Front Panel



OH1-2 S&TT 07/2002

Slide 1-2 PowerCommand® 3100 Control Front Panel

Participant's Information

Top Row

Percent of Load Meter

Shows you the percent of KW (1.0 power factor) load the generator set is carrying.

Frequency Meter

Shows you the frequency of the output voltage from the generator.

AC Voltmeter

Shows you the output voltage of the generator.

Percent of Current Meter

Shows you the percent of KVA (0.8 power factor) load current the generator is carrying.

Your Notes

Participant's Guide

Left Side Panel

The standard control has three lamps in this panel:

- Non–Automatic S12 is not in the AUTO position
- Warning There is a non-shutdown condition
- Shutdown There is a shutdown condition

Right Side Panel

The Voltmeter indicators are located in this panel.

- Upper & Lower Voltmeter scale indicator lamps
- Indicator lamps for single–phase and three–phase measurements

Center Panel

This panel has the LED Display and eight push buttons. Four of these buttons help the operator to navigate the PCC menu system, and are to the left and right of the LED Display panel.

The operator must turn the Run–Off–Auto switch (S12) to the OFF position and then press the RESET push button to re-set the PCC control.

When the PCC is in the Standby Mode, one of the signals that "Wakes Up" the PCC is the SELF TEST push button. This button also is a Lamp Test button for NFPA–110 requirements.

Your Notes

Participant's Guide

The Panel Lamps are actually bulbs, and will stay on for eight minutes after you press the PANEL LAMPS button.

The MENU button will get you back to the main menu that is displayed whenever the PCC is not in the sleep mode.

Bottom Panel

This section of the PCC front panel has the RUN–OFF–AUTO (S12) switch and the Emergency Stop (S13) switch.

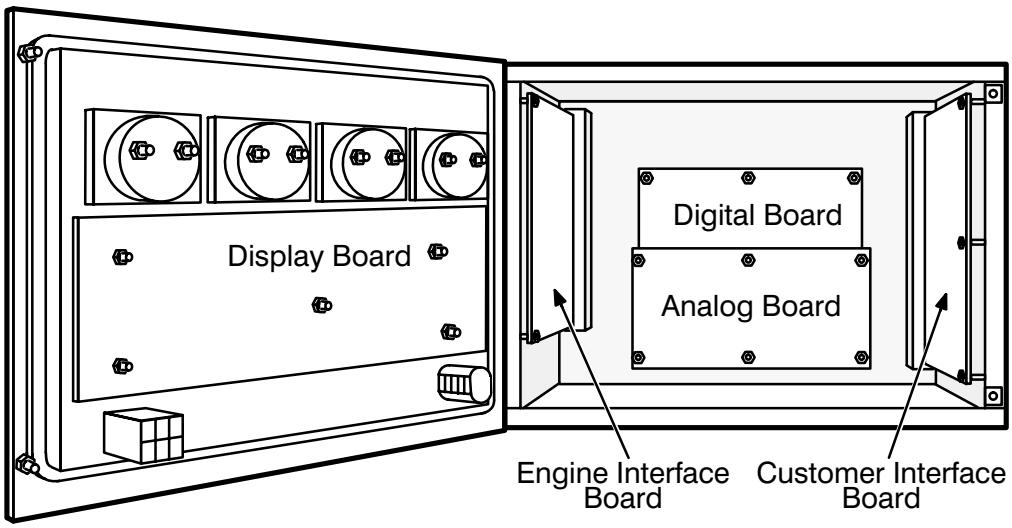
When S12 is not in the AUTO position, the Non–Automatic lamp should flash.

When the Emergency Stop switch is pushed in, the PCC should wake up (if in sleep mode) and display "EMERGENCY STOP."

NOTE: Emergency Stop must be reset at the front panel of the PCC 3100 genset control. This is also true with a remote E-Stop or network E-Stop signal.

Your Notes

Inside the Control Box



OH1-3 S&TT 07/2002

Slide 1-3 Inside the PowerCommand® 3100 Control

Participant's Information

There are five circuit boards inside the standard PCC 3100, and six inside a networked PCC 3100. From the left side around they are:

Display Board (on the door)
Contains LED Display Panel, Panel Lamps and LEDs

Engine Interface Board (at left of cabinet)

- Has two plugs to the engine harness at the back of the cabinet.
- Has four connectors for ribbon cables and the network cable.

Your Notes

Participant's Guide

- Connects all engine components to the PCC (e.g., Engine senders, Mag pick–up, Starter, Fuel system components, Governor Output Module, Belt–drive alternator)
- Connects Regulator drive signal to the Regulator Output Module.
- Connects to front panel switches though small connector on front of board.

Analog Board (in front of Digital board)
All ribbon cables that connect to this board are soldered to the board.

The Analog board:

- Sends power to all engine senders, and scales all non–digital signals to fit within a 0–5 VDC range.
- This is the only board with NO LEDs.

Digital Board (at rear of cabinet)

- Microprocessor is on this board. Receives digital (on–off) signals directly from Engine Interface Board or Customer Interface Board.
- Receives analog (varying) signals through Analog board.

Three types of memory on Digital Board hold data.

- **EPROM** Erasable Programmable Read-Only Memory hods PCC 3100 operation software.

Your Notes

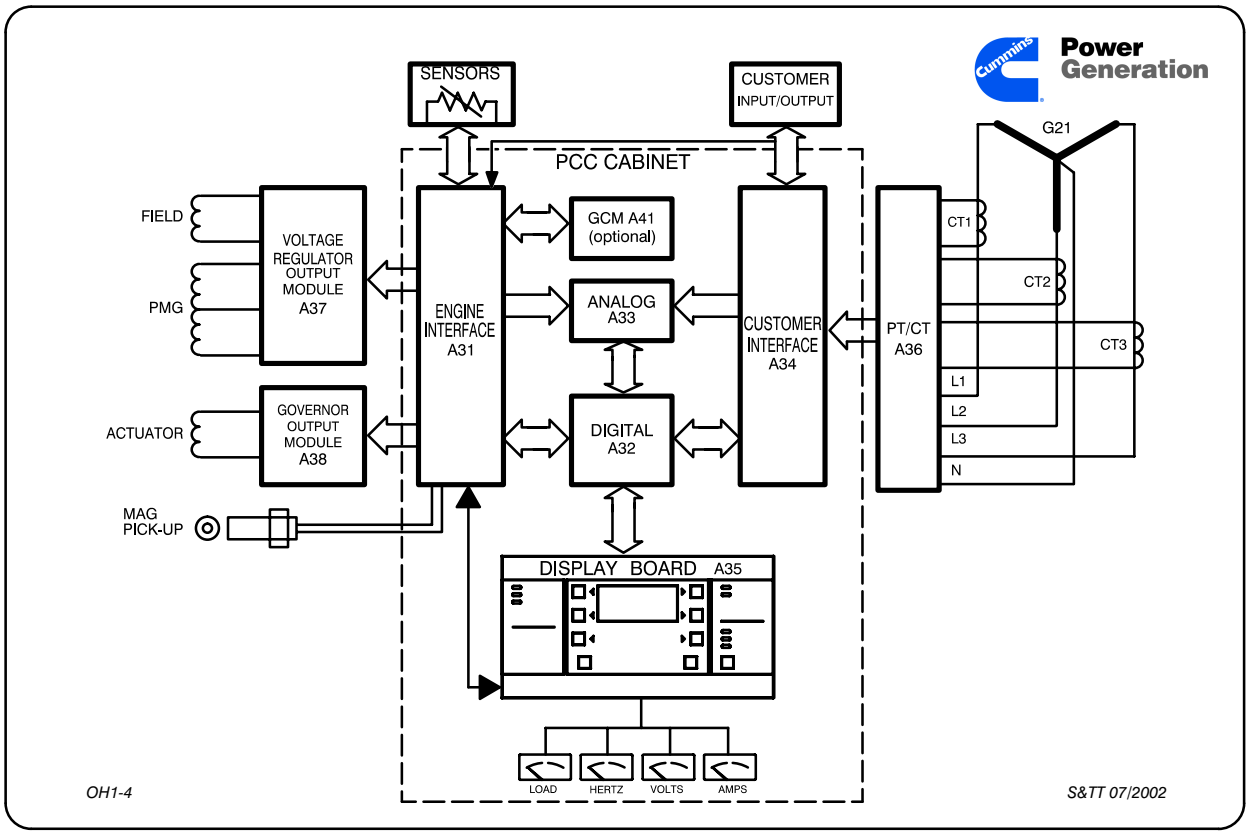
Participant's Guide

- **EEPROM** Electrically Erasable Programmable Read-Only memory holds PCC 3100 operation data. This is really read-write software, and is updated any time you save changes in the PCC menus.
- **RAM** Random Access Memory holds data when the PCC 3100 is running, and "forgets" what it held when the PCC is turned off.

Customer Interface Board (at right of cabinet)

- Connects voltage and current inputs from PT/CT board to PCC.
- Connects annunciator terminals in Accessory Box to PCC.
- Connects all customer inputs to the PCC 3100.

Your Notes



Slide 1-4 PowerCommand System Architecture

Participant's Information

This diagram is designed to help the technician:

- understand how the PowerCommand System components connect, and
- help determine where a problem might be in the PowerCommand System.

Notice that this diagram is laid out almost exactly like the diagram that showed the boards inside the PowerCommand Control. This is to help the technician see how the modules inside and outside the PowerCommand Control are connected.

Your Notes

Participant's Guide

Engine Interface Board (A31)

All engine sensors and switches connect through the Engine Interface Board. The Regulator Output Module and Governor Output Module connect through the Engine Interface Board also.

Customer Interface Board (A34)

The generator output voltage and current inputs connect through the Customer Interface Board. The customer remote connections and the Annunciator also connect through the Customer Interface Board.

Analog Board (A33)

All varying signals (voltage, current, pressure, temperature) are sent through the Analog Board to be 'scaled' to a 0-5 Volt range for the Digital Board. The Analog Board also sends power source signals through the Engine Interface Board to the engine sensors.

Digital Board (A32)

The Digital Board receives all non–varying signals directly from the engine harness. These include the Magnetic Pickup frequency signal. The Digital Board processor is the Voltage Regulator and Governor Controller.

Display Board (A35)

The Display Board contains outputs (LED Display Panel, LEDs, and Panel Lamps) and inputs (touch switches for LED Display Panel operation.

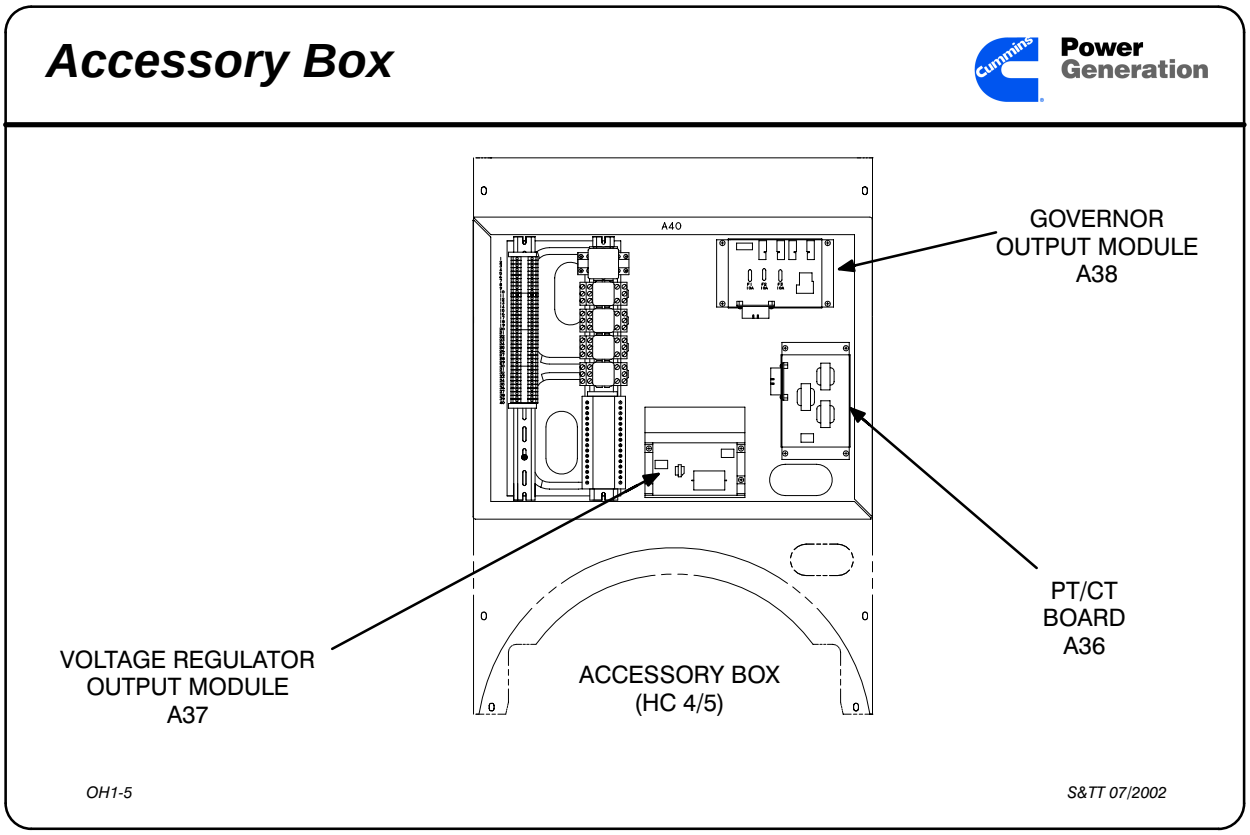
Your Notes

Participant's Guide

Genset Communications Module (A41)

The Genset Communications Module (GCM) is only used when the PCC is connected to a network. The GCM translates from PCC to Network, and from Network to PCC.

Your Notes



Slide 1-5 PowerCommand® 3100 Control–equipped generator set Accessory Box

Participant's Information

All customer control connections, and the external modules which act as interface modules between the PCC and the generator set are inside the Accessory Box.

Customer Connection Terminals

These terminals on TB1 (1–40) are used to bring in remote start signals to the PCC from a transfer switch, connect to a hard-wired annunciator or day tank control, and connect to the network twisted pair cable. All terminals will be on the left-hand rail in production gensets.

The right-hand rail will be used to install optional relays for customer inputs and outputs.

Your Notes

Participant's Guide

Governor Output (A38) Module

The governor output module acts like a power amplifier for the governor control signals. The governor control signals come from the digital board inside the PCC.

The A38 Module also has three fuses, all 10 Amps:

- F1 = Formerly used as Customer B+ fuse. Replaced by 20 Amp. fuse by starter (B1).
- F2 = Switched B+ to T26 on the engine and A40 TB1–2.
- F3 = Governor Actuator signal.

Regulator Output (A37) Module

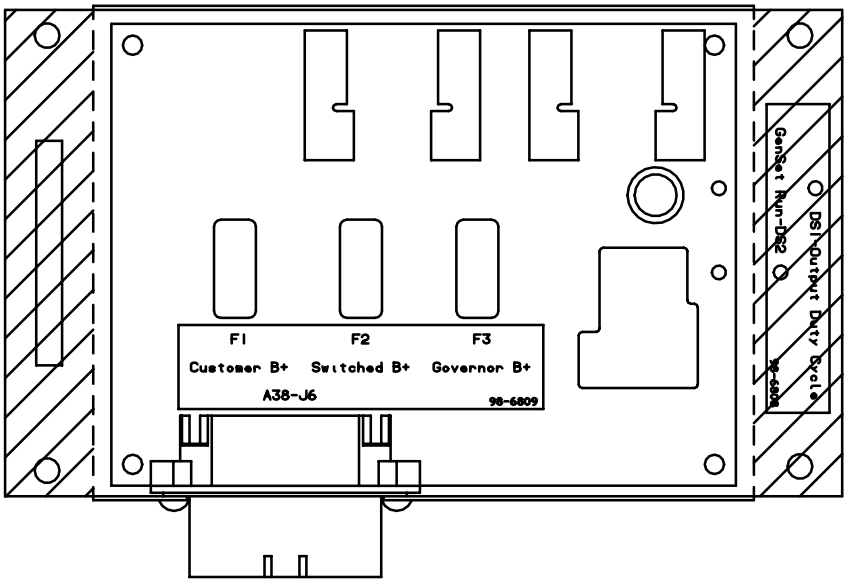
The Regulator output module acts like a power amplifier for the generator control signals. The generator control signals come from the digital board inside the PCC.

PT/CT (A36) Module

The (Potential Transformer / Current Transformer) PT/CT module isolates the PCC from the load and reduces the voltage from generator output voltage to 18 VAC. This module also has a burden resistor for each current transformer.

Your Notes

Governor Output Module



OH1-6 S&TT 07/2002

Slide 1-6 Governor Output Module

Participant's Information

Governor Output Module Inputs

Low-level governor drive signal DS1's (orange) brightness will be relative to the duty cycle of the drive signal from the Engine Interface Board (0–90%).

Fused B+ is protected by a 20 ampere fuse mounted by the starter motor (B1).

Switched B+ signal (T26 and A40 TB1-2) is protected by F2.

"RUN" signal lights DS2 (green). This signal is sent through the Governor output module to the Regulator output module, fuel solenoid, and the belt-drive alternator.

Your Notes

Participant's Guide

Governor Drive signal is protected by F3.

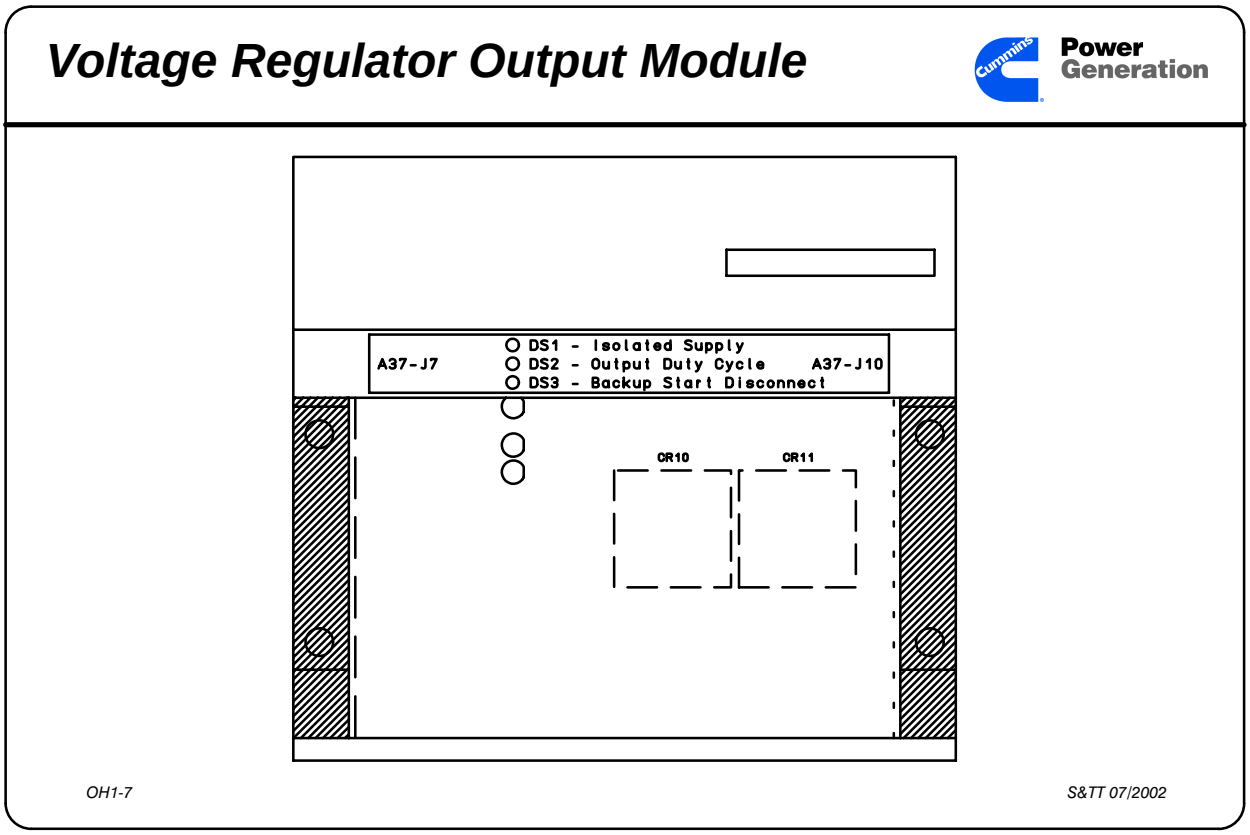
Governor Output Module Outputs

The "**RUN**" signal coming from the PCC 3100 is sent to the Regulator output module, belt-drive alternator and fuel solenoid.

The **governor drive** signal is sent to the governor actuator to maintain proper engine frequency.

The **starter pilot** signal is sent to the starter solenoid to crank the engine.

Your Notes



Slide 1-7 Regulator Output Module

Participant's Information

Regulator Output Module Inputs

"RUN" signal from the governor output module lights DS1 (green).

PMG three-phase AC input which is rectified inside the Regulator output module to power the exciter stator. When PMG output reaches 105 VAC, DS3 lights.

Low-level AVR drive signal. When this signal is received, DS2's (orange) brightness will be relative to the duty cycle of the drive signal (0–60%).

Your Notes

Participant's Guide

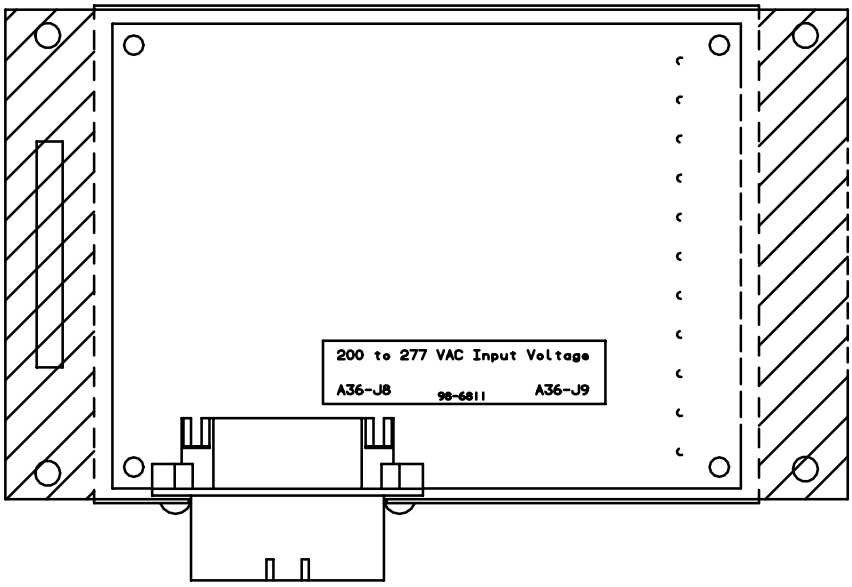
Regulator Output Module Outputs

The Regulator output module sends the **excitation** signal to the exciter stator to provide the proper output voltage from the main stator.

The PMG input signal energizes a **secondary starter disconnect** relay in the regulator output module when the PMG output reaches 105 VAC, approximately 850 rpm.

Your Notes

PT/CT Module



OH1-8 S&TT 07/2002

Slide 1-8 PT/CT Module

Participant's Information

PT/CT Module Voltage Sensing

Each phase of output voltage is sensed and the output of the generator is stepped down on the PT/CT module to 18 VAC to represent the output voltage to the PCC.

The neutral leg of the generator is connected to the PT/CT module when the generator output is a Wye connection.

PT/CT Module Current Sensing

Each phase of output current goes into the PT/CT module through a 0.55 Amp. current transformer which is connected to a burden resistor on the PT/CT Module. The burden resistor develops a maximum voltage of 1.65 VAC at full current.

Your Notes

GCM for the PCC 3100

OH1-9 S&TT 07/2002

Slide 1-9 GCM – Network Module for the PCC 3100

Participant's Information

PowerCommand Network module

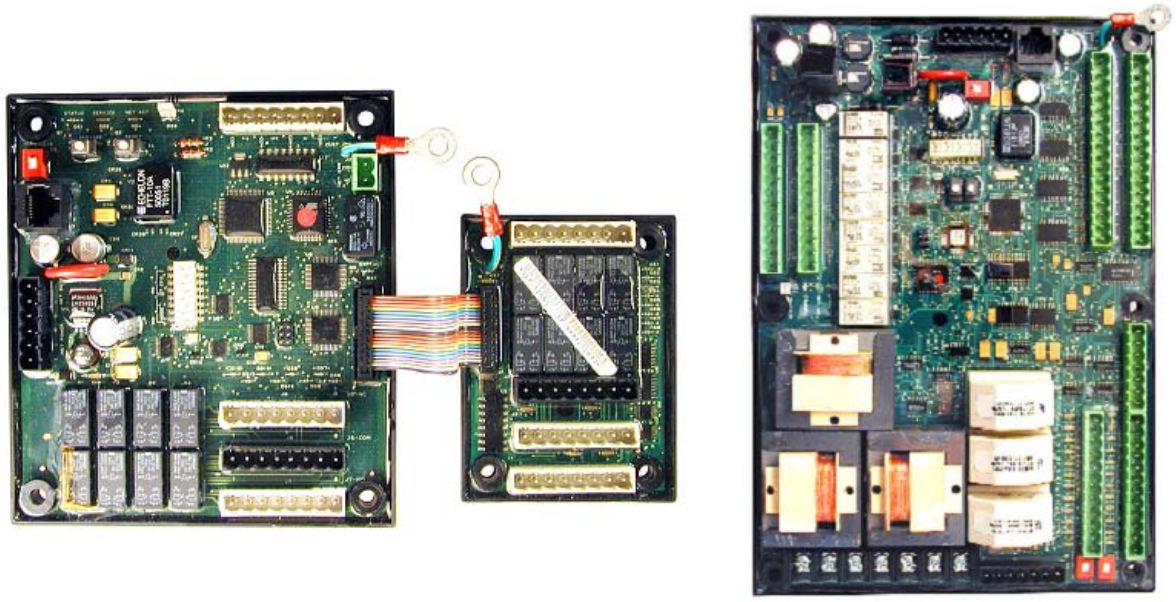
The **Genset Communications Module** acts as a bi-directional signal translator between the PCC and the rest of the network.

It allows the PCC 3100 to act as a node on the network.

It also allows the PCC 3100 to be monitored and controlled with local or remote software.

Your Notes

DIM and CCM



OH1-10 S&TT 07/2002

Slide 1-10 Other Network Modules

Participant's Information

When the network is operating, the **Digital I/O Module** can perform remote operations that are dependent on output signals from the PCC.

The **Controls Communications Module – GenSet** can start and stop a non-PowerCommand generator set, and open and close an electrically operated breaker. The **CCM-GenSet** also monitors the genset analog signals.

The **Controls Communications Module – ATS** would be used to monitor utility voltage and tell the generator sets attached to the transfer switch when to start and stop. This module also tells the ATS position.

Your Notes

Activity 1-1: Introduction to the PCC Quiz

Match the functions and components / switches; use the demonstrator or Participants' Guide.

_____ 1.	Fuse by B1 Starter Motor	A.	Starts the genset.
_____ 2.	A37 DS3	B.	Stops genset if pushed in.
_____ 3.	Shutdown LED	C.	Receives engine temperatures.
_____ 4.	Warning LED	D.	Gets signals from PT/CT module.
_____ 5.	S12 in RUN	E.	Contains microprocessor.
_____ 6.	Customer Interface Board	F.	Contains PCC program.
_____ 7.	PT/CT Module (A36)	G.	Stores PCC data changes.
_____ 8.	A38 F2	H.	Scales input from 18 VAC to 5 VAC.
_____ 9.	A38 DS2, A37 DS1	I.	Senses current from .55 Amp CTs.
_____ 10.	Non-Automatic LED	J.	Is the new standard control.
_____ 11.	A38 F3	K.	Lights on low oil pressure.
_____ 12.	Self Test button	L.	Lights when ESTOP switch is in.
_____ 13.	Menu button	M.	Lights when S12 is in RUN.
_____ 14.	Emergency Stop switch	N.	Lights when RUN signal present.
_____ 15.	Engine Interface Board	O.	Protects T26 Sw. B+ circuit.
_____ 16.	Digital Board	P.	Protects Gov. Actuator circuit.
_____ 17.	EPROM	Q.	Lights when PMG reaches 105 VAC.
_____ 18.	EEPROM	R.	Protects Fused B+ circuit.
_____ 19.	Analog Board	S.	PCC Lamp Test switch.
_____ 20.	PowerCommand® Control 3100	T.	Gets you back to the main menu.

This page intentionally left blank

Shop Introduction to the PowerCommand® Control 3100

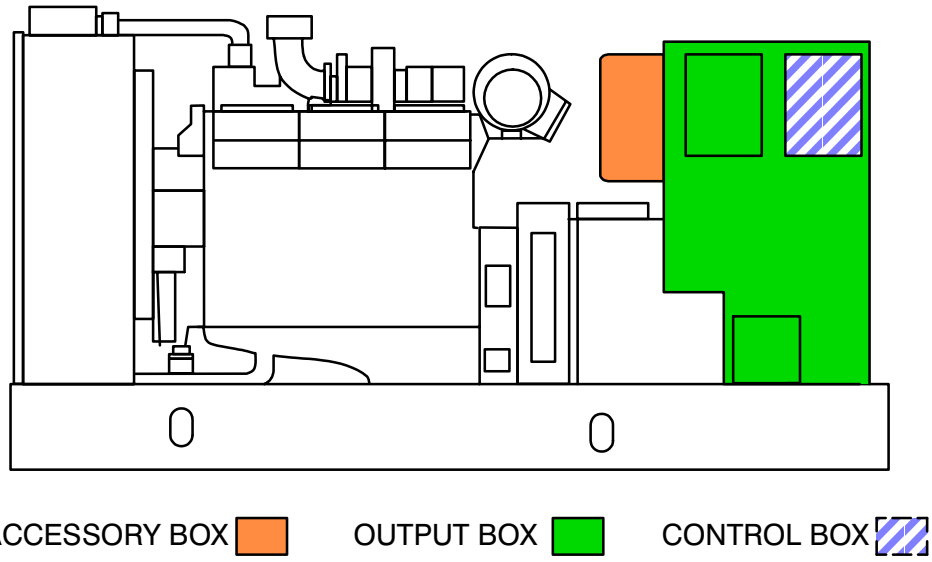
This lesson presents an introduction to the PowerCommand Control components used on 200-1500 kW generator sets built after August 5, 1994.

Objectives

After completing this lesson, you should be able to:

- Identify the PowerCommand™ Control on a generator set from the factory.
- Locate the Accessory Box on a generator set which has a PowerCommand™ Control.
- Identify the external components used with a PowerCommand™ Control.
- Locate the modules used with the PowerCommand™ Control on 200-1500 kW generator sets.
- Identify the modules used with the PowerCommand™ Control on 200-1500 kW generator sets.
- Identify the LEDs on the modules used with the PowerCommand™ Control on 200-1500 kW generator sets.
- Start a PowerCommand Control equipped generator set in the “local” mode of operation.
- Locate the customer terminal blocks used with the PowerCommand™ Control on 200-1500 kW generator sets.
- Using the prints in the Service Manual, identify the terminals used for remote start of a generator set with a PowerCommand™ Control.
- Using the prints in the Service Manual, identify the terminal used for idle mode operation of a generator set with a PowerCommand™ Control.

Control Location



OH2-1 S&TT 07/2002

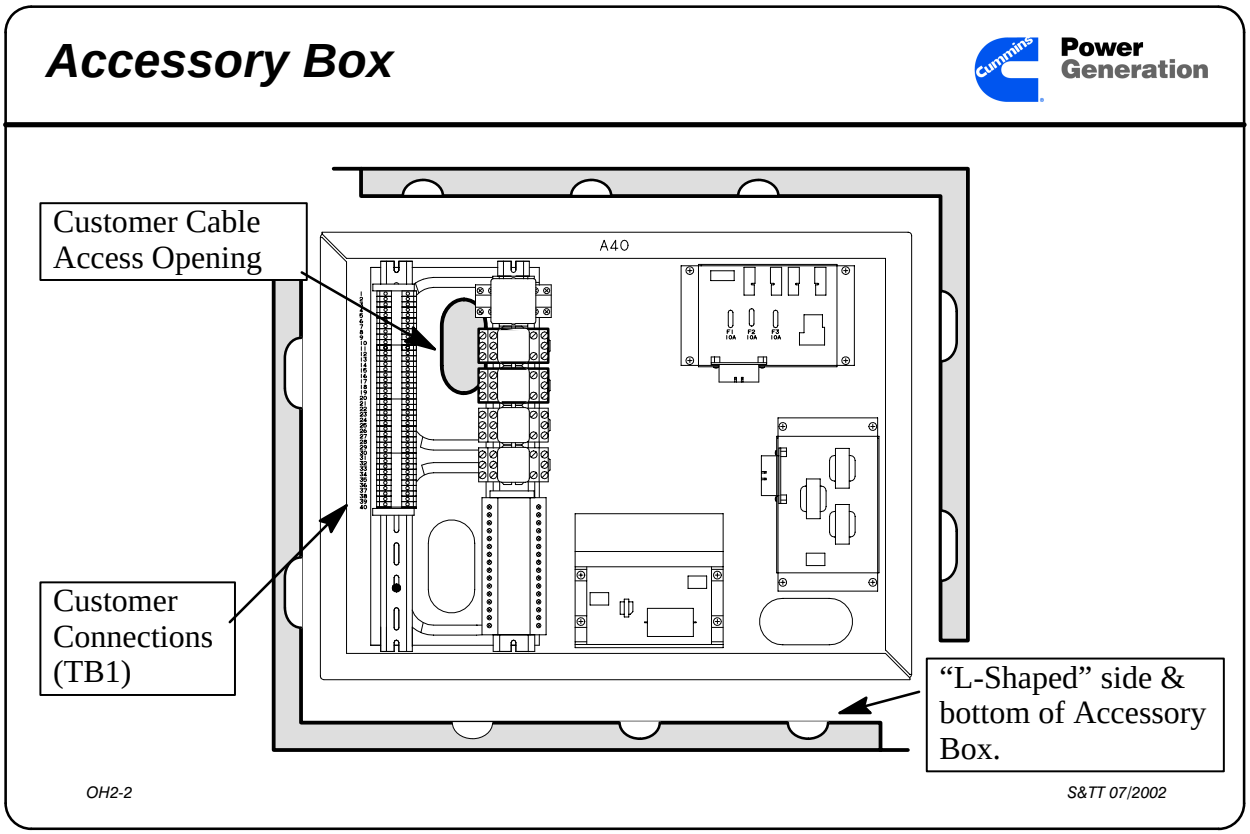
Slide 2-1 Components on a generator set with a PowerCommand Control 3100

Participant's Information

The PowerCommand™ Control is a new control that will be used by Onan Corporation as the standard control on all 200 kW and larger generator sets after August 5, 1994. This control has a microprocessor and stored information for each generator set kW and frequency selection. This customized setup of the control is done at the time the generator set is run in the test cell.

All of the associated hardware used with the PowerCommand Control is located inside the Accessory Box which is mounted on the front side of the generator set output box.

Your Notes



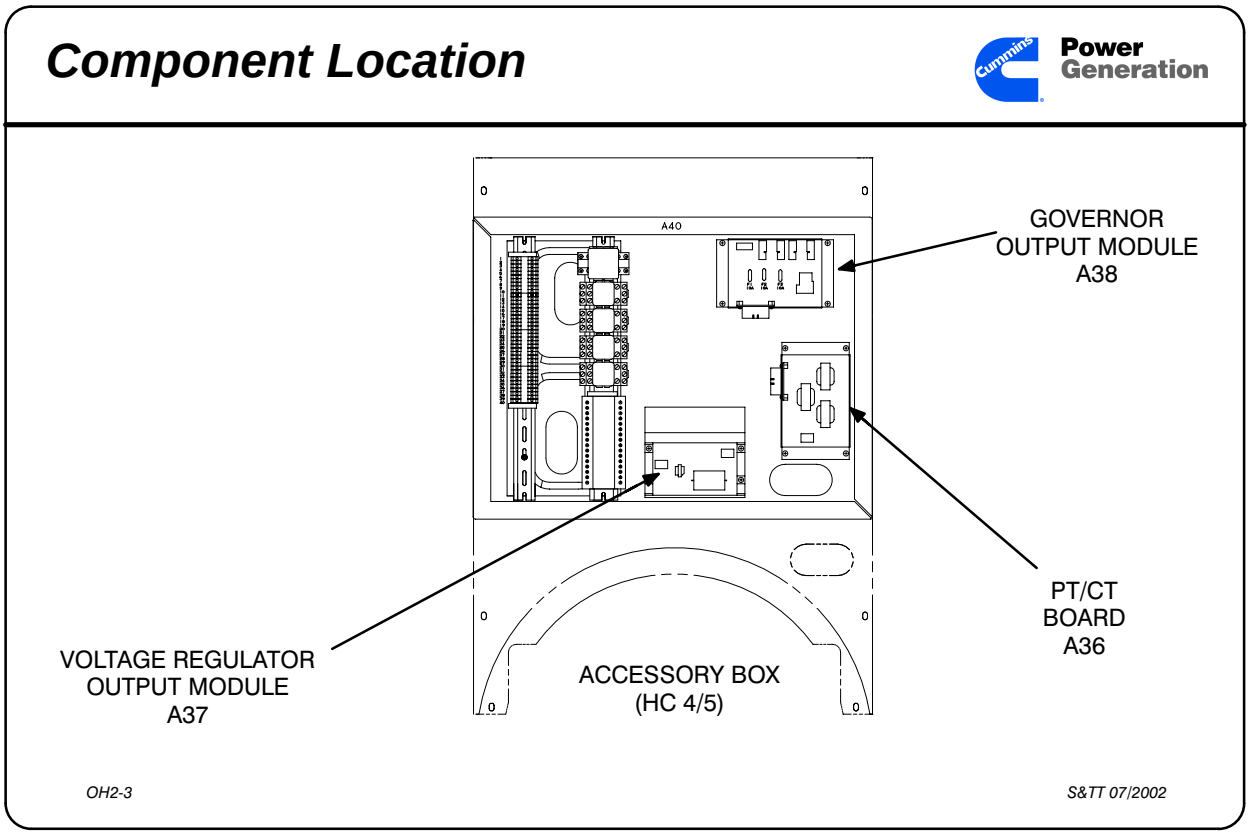
Slide 2-2 Components inside the Accessory Box

Participant's Information

After removing the Accessory Box cover, the technician will find that the box consists of two "L-shaped" pieces that are held onto the front of the generator output box, and to each other, with 10mm bolts.

The electrician should plumb the AC and DC conduits into the reconnection box and bring the control wiring into the accessory box through the upper oval (shown shaded). The lower oval is used by Onan to connect the PCC to the modules in the accessory box, the customer connection terminals, and optional relays.

Your Notes



Slide 2-3 PCC 3100 Modules

Participant's Information

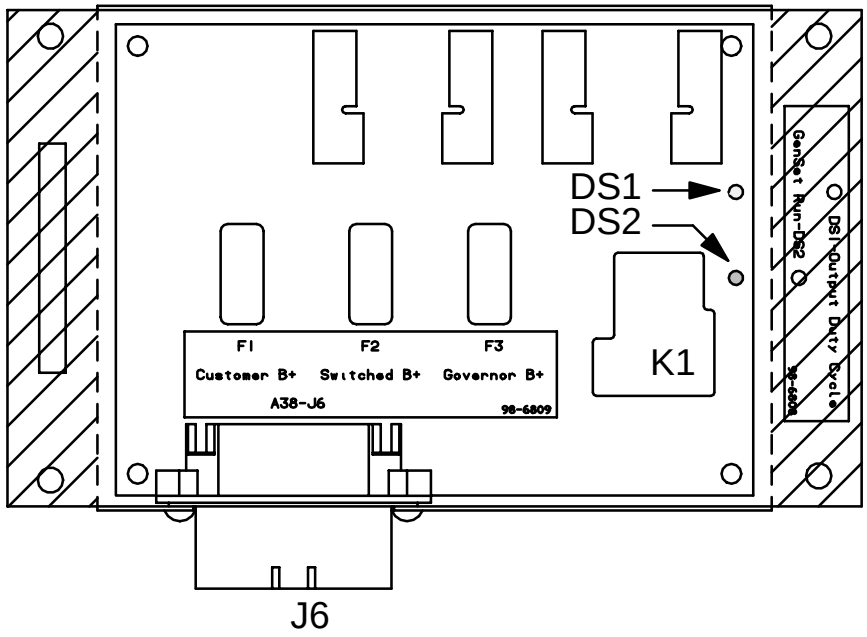
A36 The PT/CT Module brings generator output voltage and current signals into the PCC.

A37 The Regulator Output Module amplifies the low-level PCC regulator duty cycle signal and sends it to the exciter stator, and also uses the PMG voltage as a secondary start disconnect signal.

A38 The Governor Output Module amplifies the low-level PCC governor duty cycle signal and sends it to the governor actuator, and connects fused B+ and Switched B+ to the engine and customer accessories.

Your Notes

Governor Output Module Parts



OH2-4 S&TT 07/2002

Slide 2-4 A38 Governor Output Module

Participant's Information

When the PCC sends a cranking signal to the starter solenoid, the "Switched B+" RUN signal does not appear at the Governor Output Module until the PCC knows that the engine is turning.

The PCC knows the engine is turning because of the Magnetic Pickup signal.

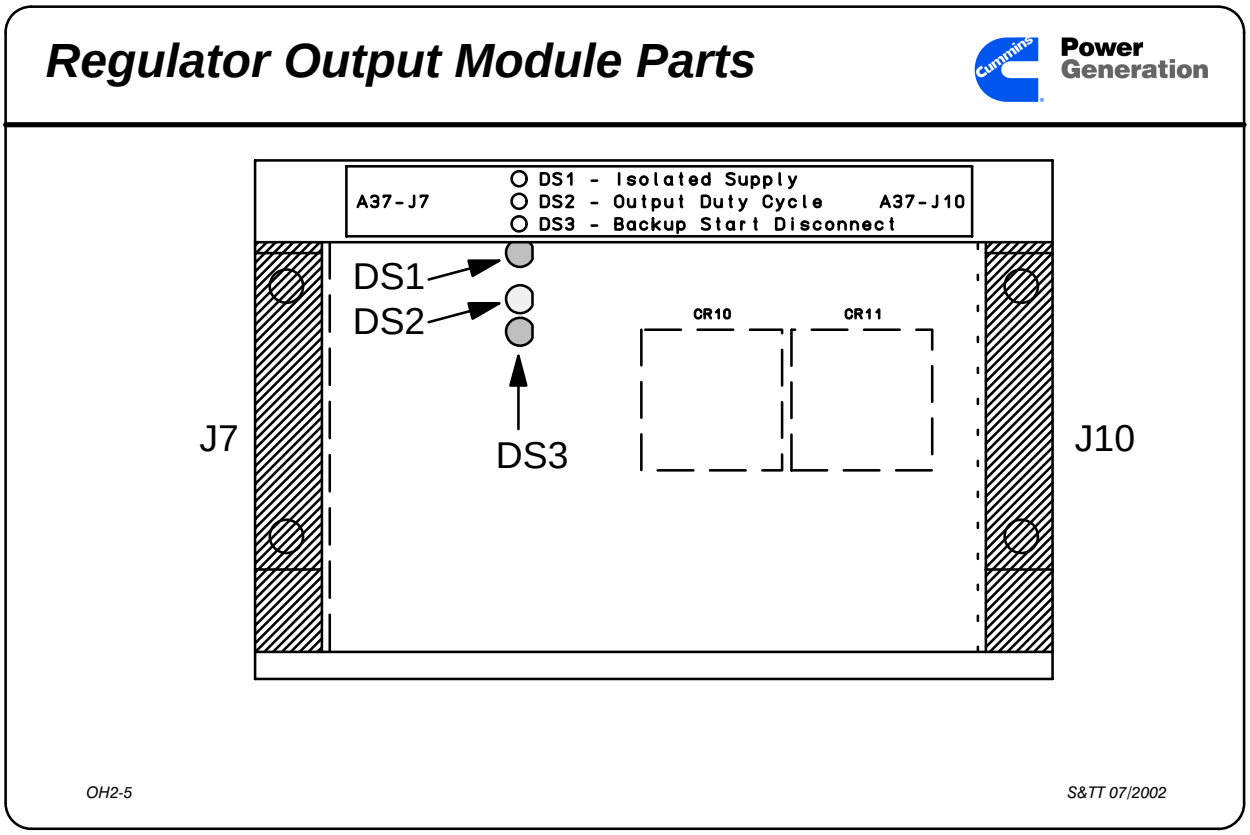
When the RUN signal is sent to the Governor Output Module, DS2 will light at full brightness. At this time, K1 will energize and send the Switched B+ signal to engine terminal 26 and A40 TB1-2.

Your Notes

Participant's Guide

When the engine starts to accelerate, the PCC will send a low-level PWM signal to the Governor Output Module. This will cause DS1 to light to a relative brightness equal to the Duty Cycle of the Governor Drive signal.

Your Notes



Slide 2-5 A37 Regulator Output Module

Participant's Information

When the RUN signal is sent to the Governor Output Module, the RUN signal is sent on to the Regulator Output Module. DS1 on the Regulator Output Module will light at full brightness.

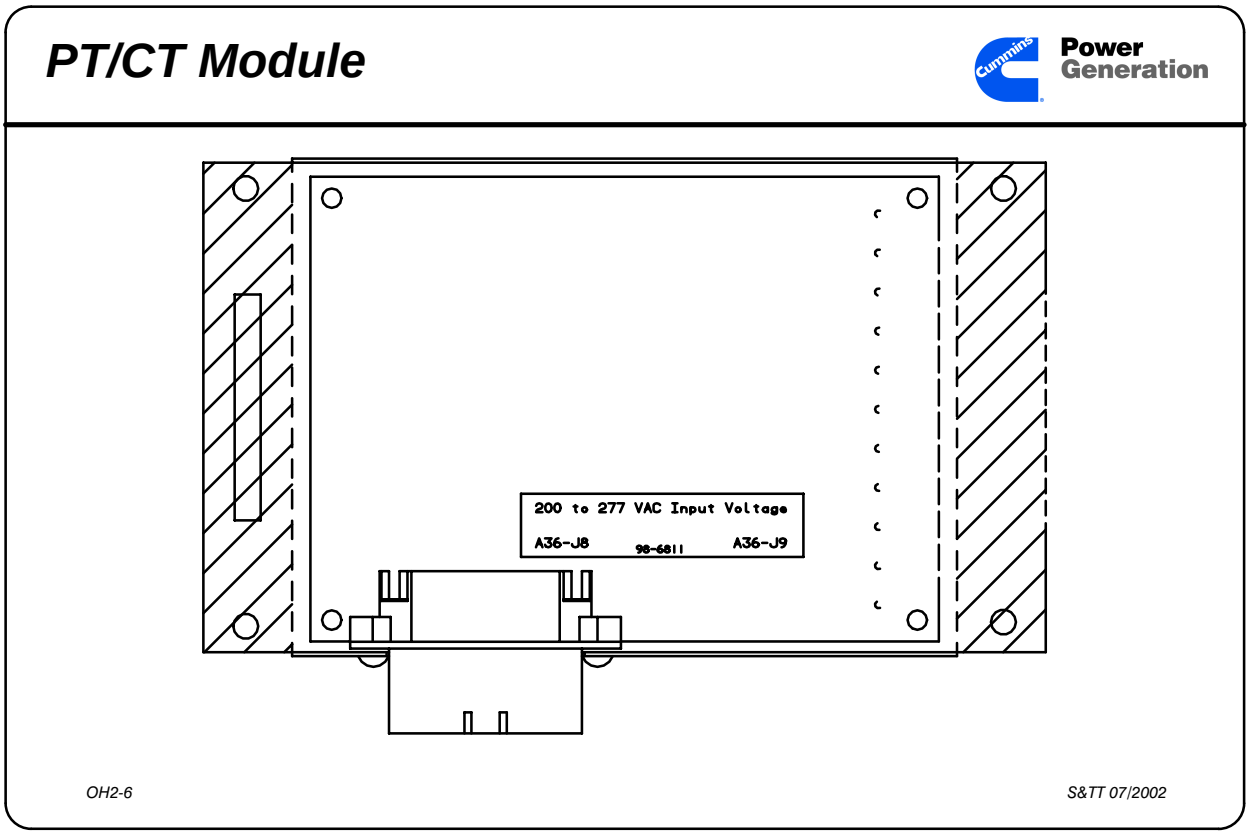
When the engine starts to accelerate, the PCC will send a low-level PWM signal to the Regulator Output Module. This will cause DS2 to light to a relative brightness equal to the Duty Cycle of the Regulator Drive signal.

Your Notes

Participant's Guide

When the engine starts to accelerate, the PMG output voltage will start to increase. When the engine reaches approximately 850 rpm, the PMG output will be at 105 VAC, and energize a relay on the A37 module. This relay will open a normally closed set of contacts that function as the secondary start disconnect. When this relay energizes, DS3 will light at full brightness level.

Your Notes



Slide 2-6 A36 PT/CT Module

Participant's Information

Each phase of output voltage is sensed and the output of the generator is stepped down in a transformer on the PT/CT module to a maximum of 18 VAC to represent the output voltage to the microprocessor inside the PCC. This version of the PT/CT Module will be used for most PCC installations.

Each phase of output current goes into the PT/CT module through a 0.55 Amp. current transformer which is connected to a burden resistor on the PT/CT Module. The burden resistor develops a maximum voltage of 1.65 VAC at full current.

The neutral leg of the generator is connected to the PT/CT module when the generator output is a Wye connection.

Your Notes

Activity 2-1: Find these generator set components:

Working with the participants who were assigned to the same PCC demonstrator as you, walk around the generator set and find the following components.

Locate the component on the generator set.

Write the location below the component name on this worksheet.

The first group with the correct answers will win a prize.

Engine Components

❑ Low Coolant Level Switch (3 second delay)

_____

❑ Low Engine Temperature Switch (same switch, new position)

_____

❑ Engine Temperature Sender (2 for V-type engines)

_____

❑ Oil Pressure Sender (capacitive element)

_____

❑ Engine Wiring Harness (new plugs on harness)

_____

❑ Oil Temperature Sender

_____

❑ Exhaust Gas Temperature Sender(s) [optional]

_____

Generator Components

❑ Accessory Box

_____

❑ TB1 Customer Connection Terminals
Remote Start Terminal _____
Idle Input Terminal _____

❑ Auxiliary Relay mounting rail

_____

❑ A36 PT/CT Module

_____

❑ A37 Regulator Output Module

_____

❑ A38 Governor Output Module

_____

Control Components

❑ PowerCommand Control 3100

_____

❑ LED Display Panel

_____

❑ Emergency Stop Switch

_____

Activity 2-2: Demonstration of a PCC 3100–Equipped Generator Set in the shop

Explain the increase in current drain on the generator set batteries in service (awake) mode -vs- standby (sleep) mode.

What terminals are used to connect the remote start wires from the OTIII transfer switch to the genset?

B+	TB1- _____
Ground	TB1- _____
Remote Start	TB1- _____

The trainer will set the Start Delay and Stop Delay to 10 seconds.

Insert or turn on your hearing protection and set it to the proper channel before the set is started.

After the Remote Start signal is received by the PCC the PCC should count down from 10 to zero and the set will start.

Watch the Governor Output Module and Regulator Output Module LEDs as the set starts and comes up to speed. Describe the LED light pattern.

Describe how to Adjust Frequency and Voltage of the PCC.

After the transfer switch re-transfers and removes the Remote Start signal, the set will stop. How long did it take for the set to stop after the transfer switch removed the remote start signal?

Introduction to the Service Manual for generator sets equipped with the PowerCommand® Control 3100.

This lesson presents an introduction to the new Service Manual which covers the 200-1500 kW generator sets produced after August 5, 1994

Objectives

After completing this lesson, you should be able to:

- Locate the sections in the Service Manual as needed.
- Locate the Access Code needed to use the setup and calibration menus.
- Locate the Light Emitting Diodes (LEDs) on the circuit boards inside the PCC and on the modules in the Accessory Box.
- Locate information on the PCC menus and how to change information in the PCC memory using the menus.
- Identify the “operator-level” and the “technician-level” troubleshooting sections in the service manual.
- Locate information on replacement and adjustment of PCC hardware and software.
- Locate information on testing and drying of the generator windings.
- Locate and identify the wiring diagrams used with the PCC.

PCC Service Manual Sections

1- Introduction

2- Control Operation

3- Circuit Boards and Modules

4- Troubleshooting

5- Control Service and Calibration

6- Servicing the Generator

7- Day Tank, Transfer Pump & Control

8- Wiring Diagrams

OH 3-1 S&TT 02/2003

Slide 3-1 Service Manual Sections

Participant's Information

How is this Service Manual different from the 960-0504 Service Manual for the 200-1500 kW integrated generator sets?

The 960-0507 Service Manual covers only the 200-1500 kW generator sets with a PowerCommand™ Control. The 960-0504 Service Manual covers only the 200-1500 kW generator sets with the Detector series of controls.

Table of Contents

Section 1: Introduction

Specific instructions on test equipment needed to work on the PCC-equipped generator sets, and an overview of the PowerCommand™ System.

Your Notes

Participant's Guide

Section 2: Control Operation
Modes of operation, front panel controls, Main Menu, Engine Menu, Gen Menu

Section 3: Circuit Boards and Modules
Circuit boards inside the PCC and modules in the Accessory Box, genset system architecture,LED and connector location and function on the circuit boards and modules used with the PCC.

Section 4: Troubleshooting
Status indicators, warning and shutdown codes, "operator-level" troubleshooting table, oil pressure warning and shutdown limits, "technician-level" troubleshooting tables.

Section 5: Control Service and Calibration
Adjustments required when replacing circuit boards, circuit board removal safety precautions, Initial Startup Menu, Adjust Menu, Version and Setup/Cal Menus, calibration procedure, accessory control box components, engine sensors.

Section 6: Servicing the Generator
Testing the generator, insulation resistance testing, drying windings, removal, testing, and reassembly of generator components, generator alignment.

Section 7: Day Tank Fuel Transfer Pump and Control

Section 8: Wiring Diagrams

Your Notes

Activity 3-1: Finding Information in the PCC 3100-Equipped genset Service Manual

Using the Service Manual (960-0507) answer the following questions:
Answer questions 1 through 7 in class, and the rest for homework tonight.

Section 1: Introduction

1. What is the technician required to have to prevent electrostatic discharge (ESD) damage to the PCC

   _____

2. What is the basic component that runs the PCC?

   _____

3. What voltage does the PT/CT Module reduce the generator output of 277/480 to before sending the voltage to the PCC?

   _____

Section 2: Control Operation

4. What is the highest voltage inside the standard (non-networked) PCC control box?

   _____

5. What precaution should you use when moving S5 on the digital board from “ON” to “OFF” or vice-versa?

   _____

6. What shutdown can only be reset from the front panel “RESET” button?

   _____

7. What buttons must you push to see the RPM of the engine on the LED Display panel?

   _____

Section 3: Circuit Boards and Modules

8. What board inside the PCC connects to the Regulator Output Module?

_____

9. What does A31 DS4 being lit tell you?

_____

10. What does A31 DS5 being lit tell you?

_____

11. What does A31 DS11 being lit tell you?

_____

12. What does A32 DS5 tell you?

_____

13. What does A34 DS4 being lit tell you?

_____

14. What does A34 DS14 being lit tell you?

_____

15. What does A37 DS1 being lit tell you?

_____

Section 4: Troubleshooting

16. What is the code displayed on the LED Display Panel when an Emergency Stop input is received by the Customer Interface Board (A34)?

_____

17. Where would you find the Low Oil Pressure Shutdown limit for a K19 engine at Idle?

_____

18. If the LED Display Panel shows “FAIL TO CRANK / 221” and A31 DS11 does NOT light, what would you check second—and where?

_____

Section 5: Control Service and Calibration

19. What is the access code for the Setup and Calibration Menus of the PCC?

_____

20. What buttons do you have to press at the same time to get the Initial Start Setup Menu to appear on the LED Display Panel?

_____

21. What does the Voltage Adjust Menu display when the genset is in the Idle mode??

_____

22. Which menu is calibrated first, Displays or Meters?

_____

Section8: Wiring Diagrams

23. Through what connector and pin does the Low Coolant Level signal enter the PCC?

_____

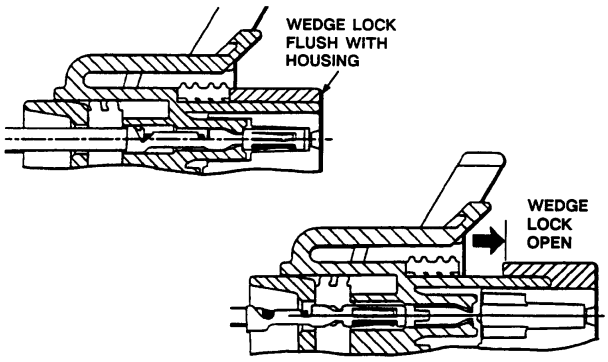
24. Which of these is removable—A31 J1 or A32 J4?

_____

25. Through which connector and terminal does the Neutral output lead enter the PCC?

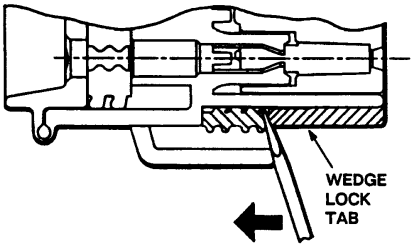
_____

Repairing PowerCommand™ Control Engine Harnesses



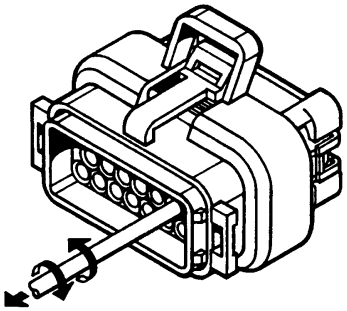
The connectors used on the PowerCommand™ Control are AMP AMPSEAL® connectors. They use a different method of holding the pins inside the connector shell and do not require a pin extractor to remove the pins from the connector shell.

The “wedge lock” is the red part of the connector. This part holds the pins inside the connector by squeezing the wedges together. The wedges are made in two parts. When these two parts are squeezed together, they keep the pins in the connector.

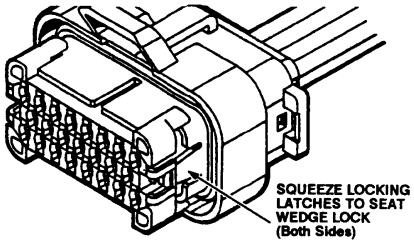


The first step in removing or inserting pins with this type connector is to move the “wedge lock” to the open position.
This is accomplished by prying at the corners of the wedge lock. There is no need to pull on the shipping stops to open the wedge lock.

The wedge lock should never be removed from the housing for insertion or removal of contacts.



Once the wedge lock is in the open position, you can remove any wire and its pin.
While rotating the wire back and forth over a half turn (1/4 turn in each direction) gently pull the wire until the contact is removed.



When all required contacts have been inserted, the wedge lock must be closed to its locked position to hold the pins in the connector.
Release the locking latches by squeezing them inward.
Then slide the wedge lock into the housing until it is flush with the housing.

This procedure will work with all the connectors on the PowerCommand™ Control engine harness, and the connectors which are used with the A36, A37 and A38 modules.

In case you need parts or advice, the AMP hotline is 1–800–772–1111

The Onan part number for the pins used with these connectors is 323-1614-01

DigiKey stocks the tool to crimp these sockets to the wires.
Digi-Key# A9999-ND Tel: 1-800-344-4539
AMP# 601884-1

This page intentionally left blank

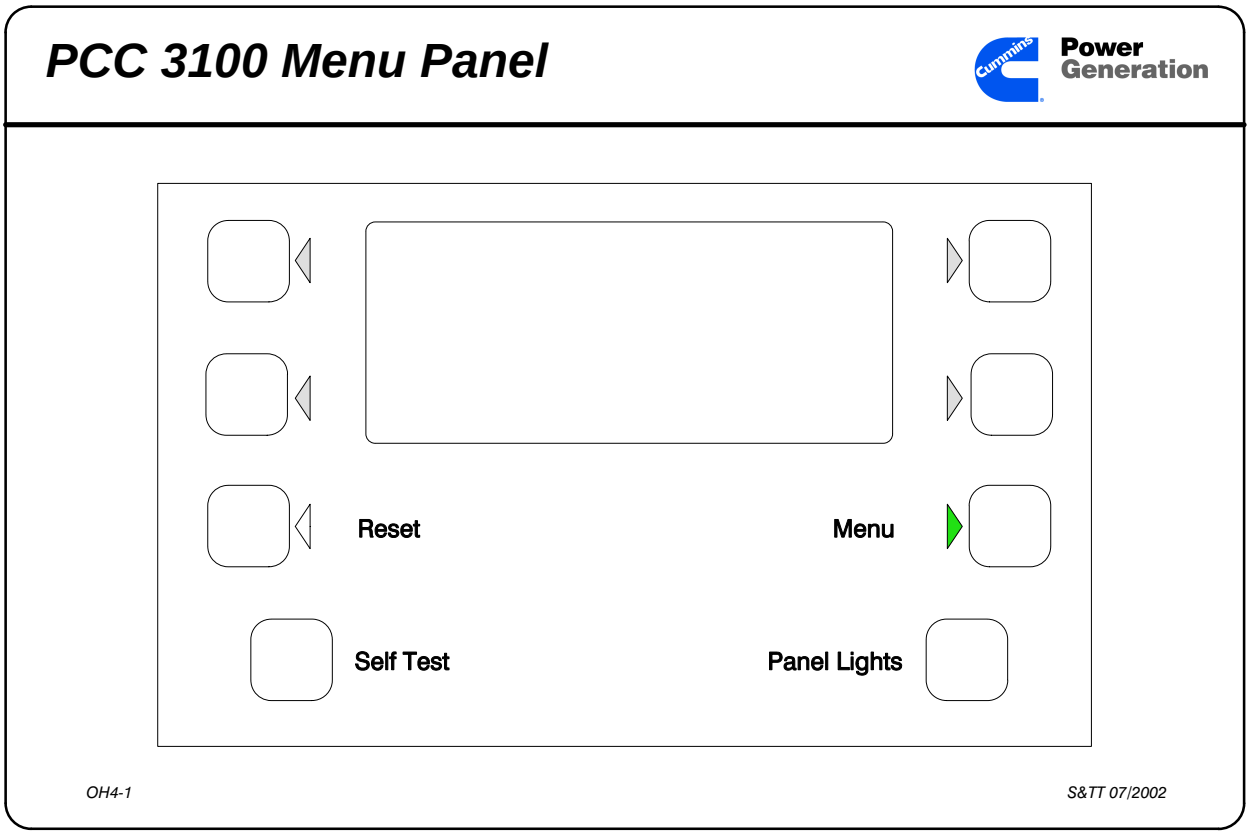
PowerCommand® Control 3100 Menus

This lesson presents an introduction to the menus used by the Operator and Technician with the PowerCommand Control 3100.

Objectives

After completing this lesson, you should be able to:

- Locate and identify the front panel buttons used in navigating the PCC menus.
- Identify the menu choices accessible without using the Access Code.
- Use the Engine Menu to determine engine parameters when the genset is running and stopped.
- Use the Adjust Menu to change engine and generator parameters when the genset is running.
- Use the Generator Menu to determine generator and engine parameters when the genset is running.
- Determine PCC genset setup parameters, and what software version is installed in the PCC.
- Use the Setup / Calibration Menus to change Digital and Analog metering, Governor and Regulator parameters, and setup parameters for a generator set.



Slide 4-1 Menu Panel Buttons and LED signals

Participant's Information

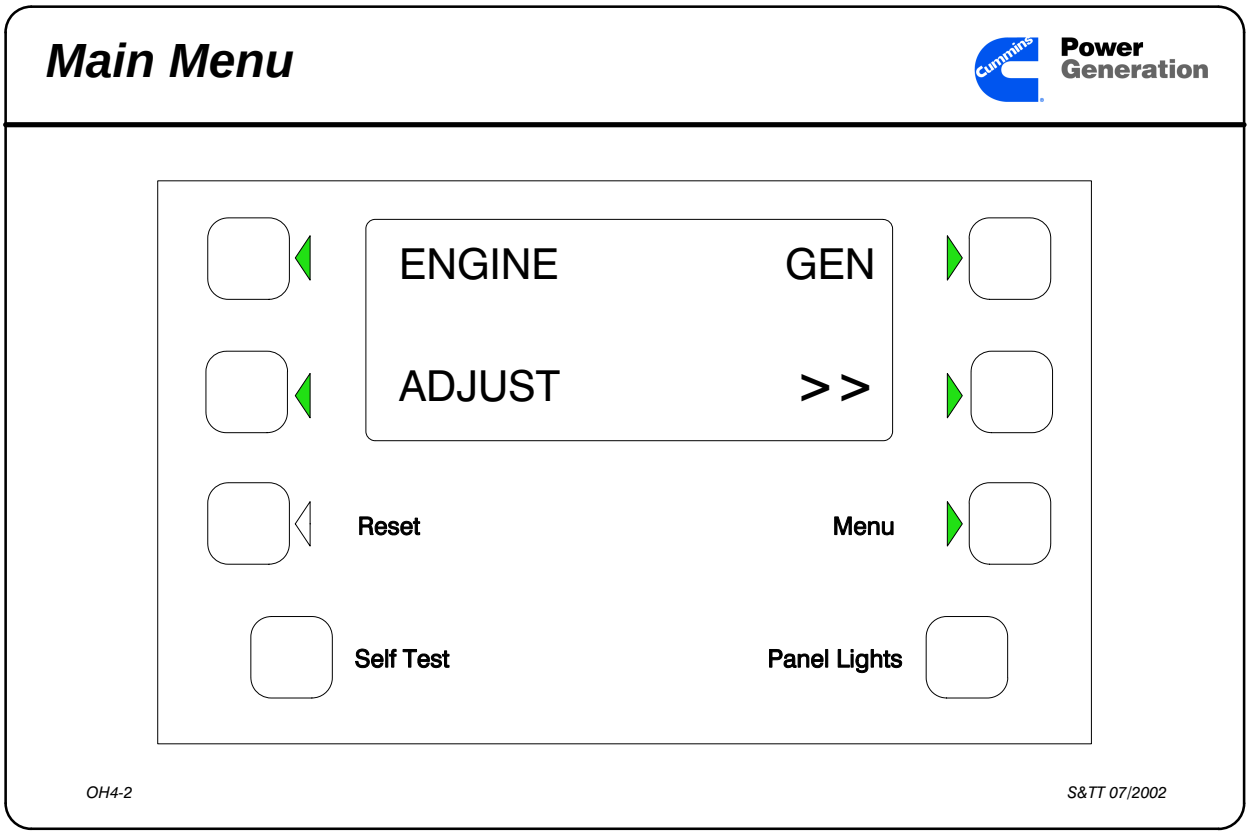
The top four buttons next to the LED Display Panel are used to navigate through the PCC menus. These buttons will perform different actions as you navigate through the PCC menus. Because of this, they are sometimes referred to as "soft buttons."

Usually you will see four choices from which to select on each menu display screen.

The button inputs will only be used by the PCC when the green triangular LED by the button is lit (shown darkened).

Menu Button - The Menu button on the front panel of the PCC will always be active, and its green triangular LED lit when the PCC is in the "awake" or service mode of operation.

Your Notes



Slide 4-2 PCC Main Menu

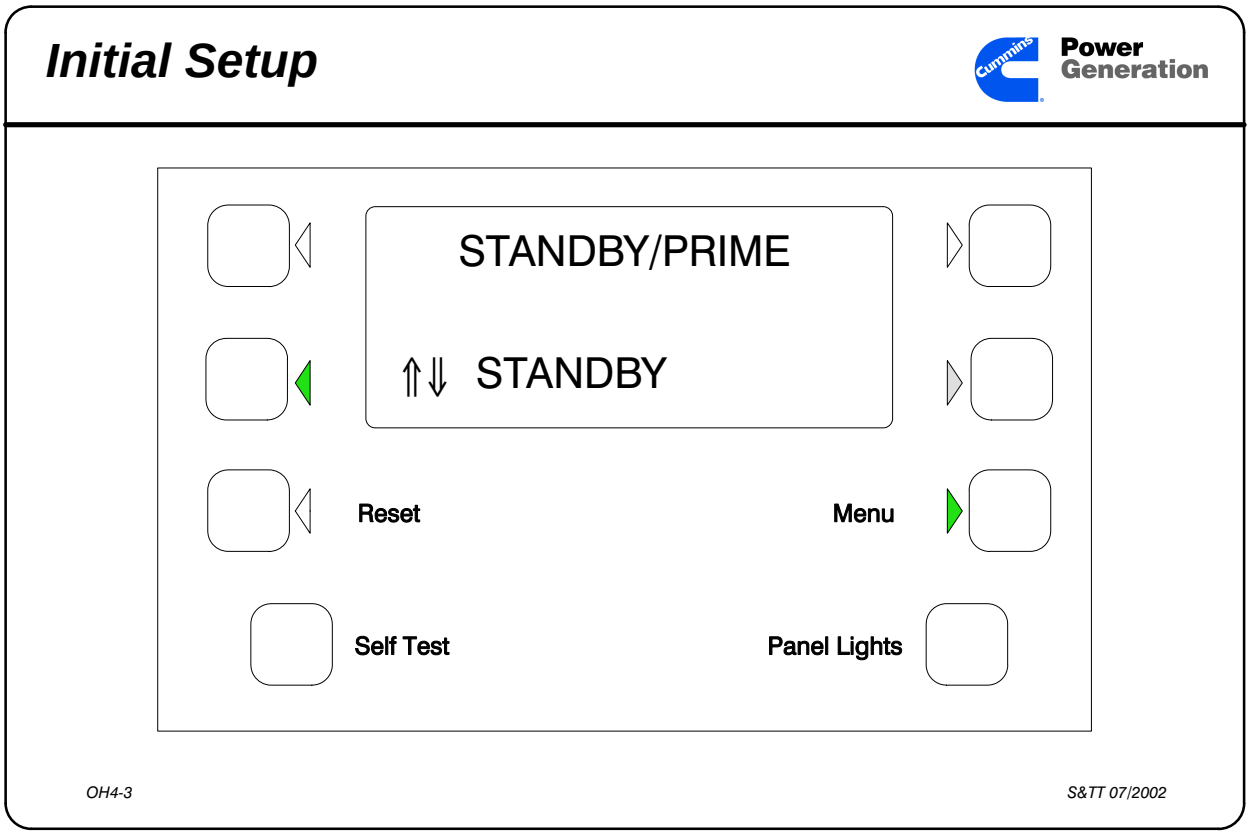
Participant's Information

The Main Menu is the menu that is displayed when the PCC wakes up, or when you press the "MENU" button on the front of the PCC.

The Main menu displays three of the different sub-menus available to the Operator and Service Technician with the PCC:

ENGINE Engine parameters
GENERATOR Generator, Governor & Regulator parameters
ADJUST Change Voltage, Frequency, Start & Stop delays
>> Go on to Version and Setup / Cal submenus Continuing to press and release this button will take you deeper into the menu system and away from the Main Menu.

Your Notes



Slide 4-3 Initial Setup

Participant's Information

When you get a PCC that has not been installed on a generator set, you will have to perform the initial setup of the PCC memory. This consists of four steps.

For the Simulator, Select:

STANDBY/PRIME Standby

MODEL/kW/Frequency 500DFGA 60 Hz

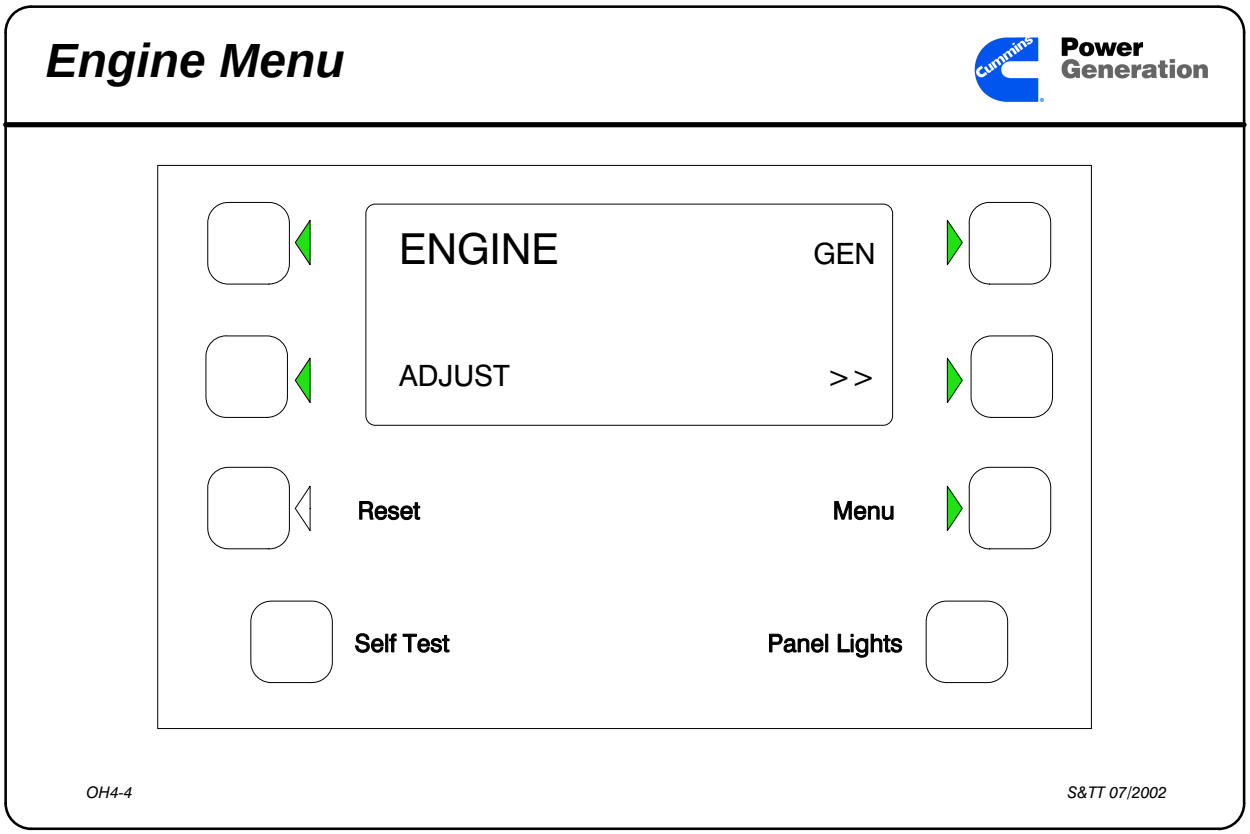
Output VOLTAGE 120/208

Output Reconnection Wye

SAVE the choices or press the lower right-hand button to wrap around to the top of this menu and select again.

These selections must match the data on the Model/Spec plate data attached to the generator set.

Your Notes



Slide 4-4 Engine Menus

Participant's Information

Oil Pressure and Temperature

Coolant Temperature

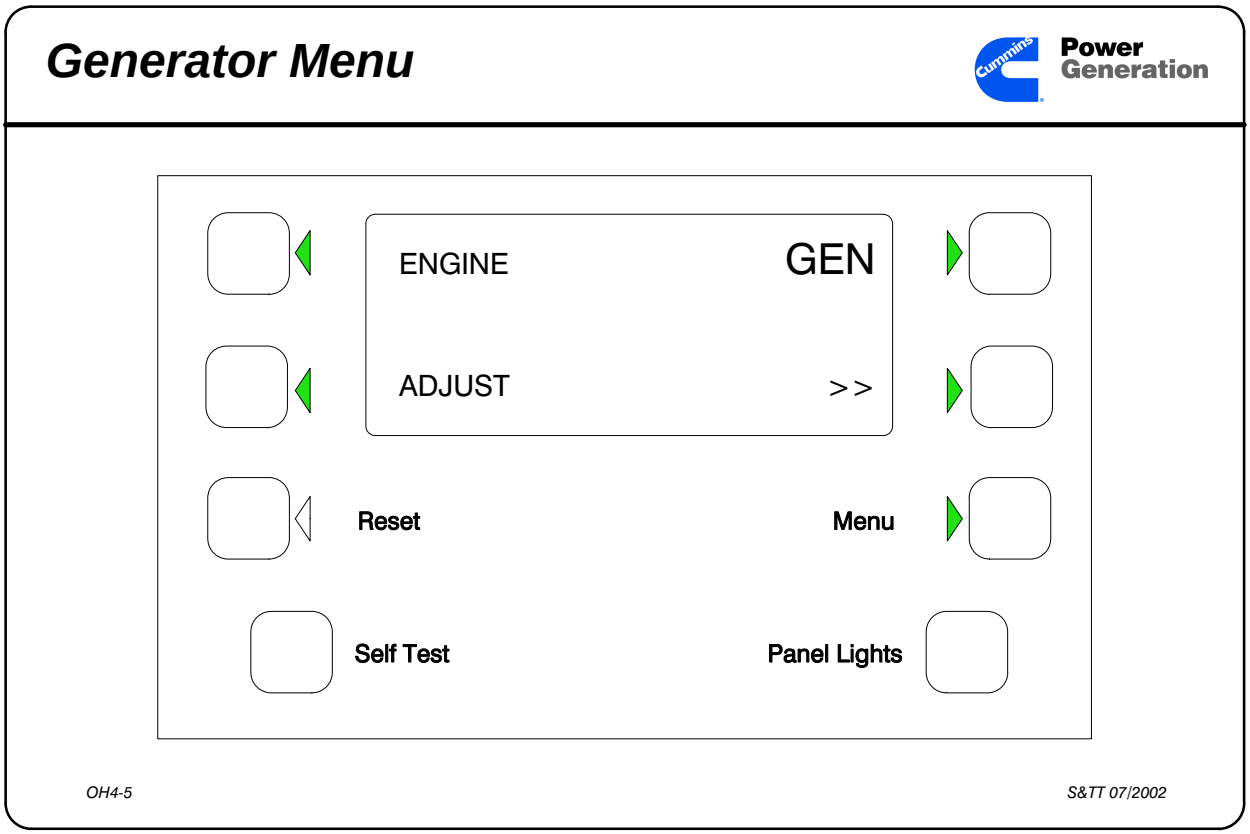
Battery Voltage

Number of Starts and Hour meter

RPM (from magnetic pickup)

Exhaust temperature (if EGT sensors are installed and selected)

Your Notes



Slide 4-5 Generator Menus

Participant's Information

Volts Line-Line and Line-Neutral

- Wye only

Volts Line-Line only

- Delta only

Amps L1, L2, and L3

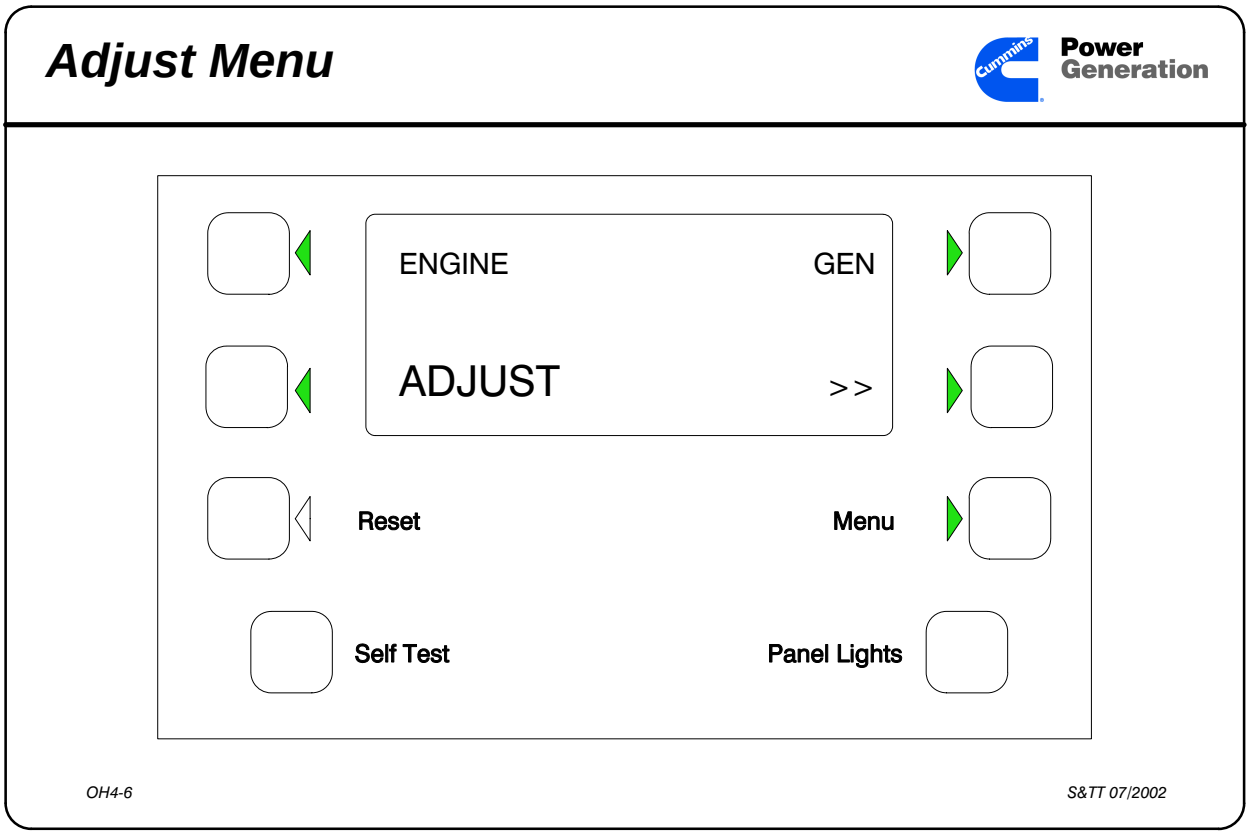
Power in kilowatts and Power Factor

kW Hours the set has produced

Governor and Regulator Duty Cycle

Alternator output frequency

Your Notes



Slide 4-6 Adjust Menu

Participant's Information

Adjust Menu

Adjust output voltage up or down 5%

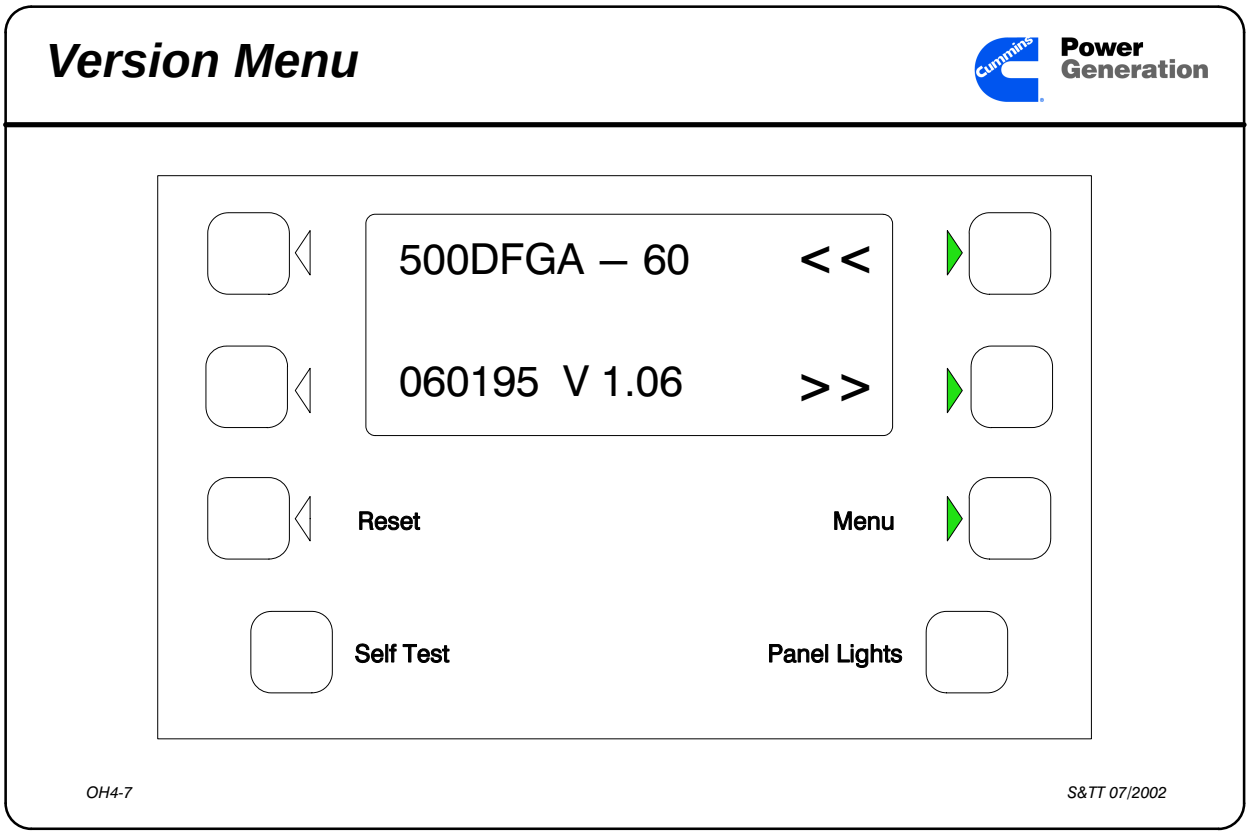
Adjust frequency up or down 5%

Set Start Delay between 0 and 300 seconds

Set Stop Delay between 0 and 600 seconds

Adjust Idle Speed from 700 to 900 RPM

Your Notes



Slide 4-7 Version Menu

Participant's Information

Version

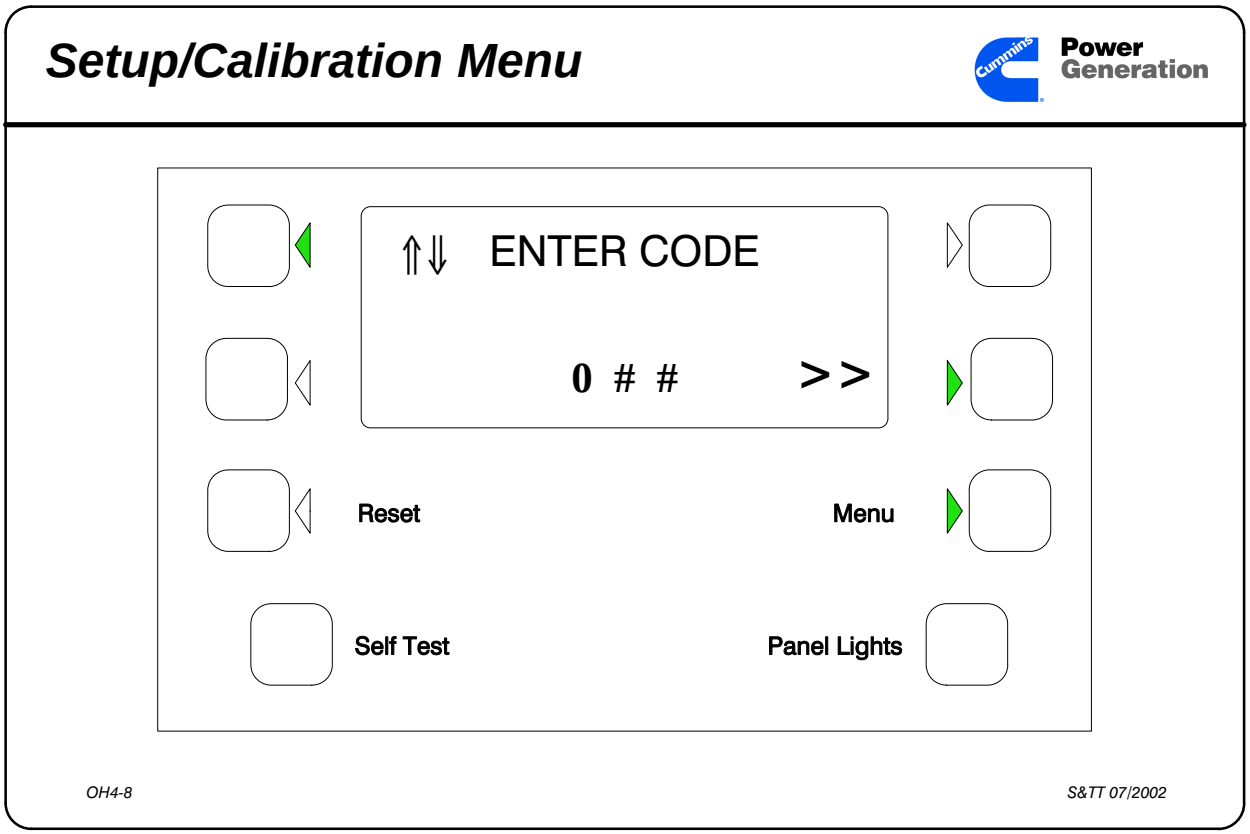
When you select this menu choice, the PCC displays the following information:

Genset Model Number	500DFGA
Frequency	60 Hz
S/ware Release Date	060195
Software Version #	1.06

When you press the lower right-hand button you go to the next setup menu:

208V WYE
STANDBY (or PRIME)
SINGLE (PARALLEL will be available in future software revisions)

Your Notes



Slide 4-8 SETUP/CAL Menu

Participant's Information

Access Code

The left buttons control the scrolling of the numbers from 0 to 9 in the left, center or right position.

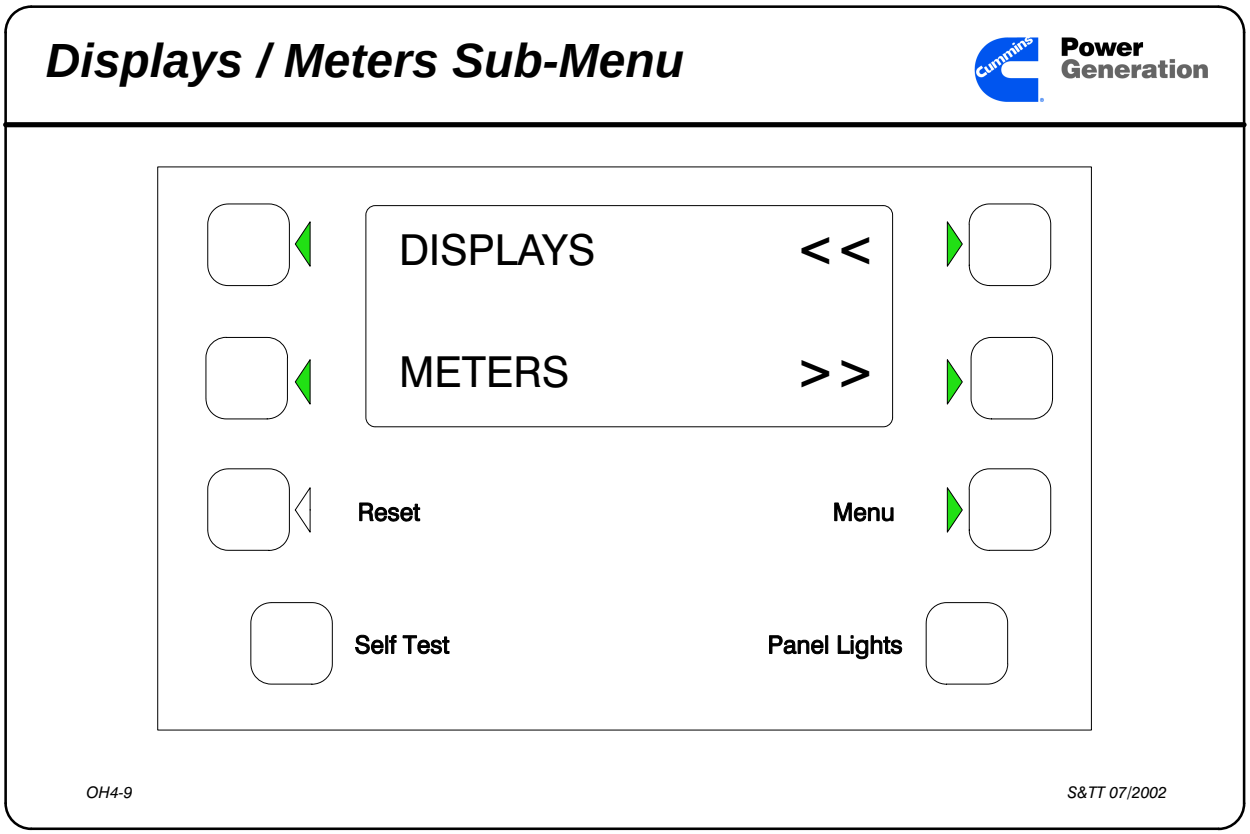
The lower right-hand button controls the movement of the active number position from left to right.

When the correct access code is put into the PCC, pressing the lower right-hand button again will get the technician into the SETUP/CAL menus.

Use the access code in the preliminary service manual, get into the SETUP/CAL sub-menus.

What is the PCC 3100 Access Code?

Your Notes



Slide 4-9 Setup / Calibration Menus

Participant's Information

There are four sub-menus in the SETUP/ CALIBRATION menus:

1- DISPLAYS

- LED Display calibration

2- METERS

- Meter indications

Pressing the ">>" button will allow you to see the next two menu headings:

3- GOV/REG

- Governor & AVR settings

4- SETUP

- Setup of general PCC functions

Your Notes

Participant's Guide

NOTE: If you do not SAVE your changes, they will only affect the operation of the PCC 3100 until you stop the set.

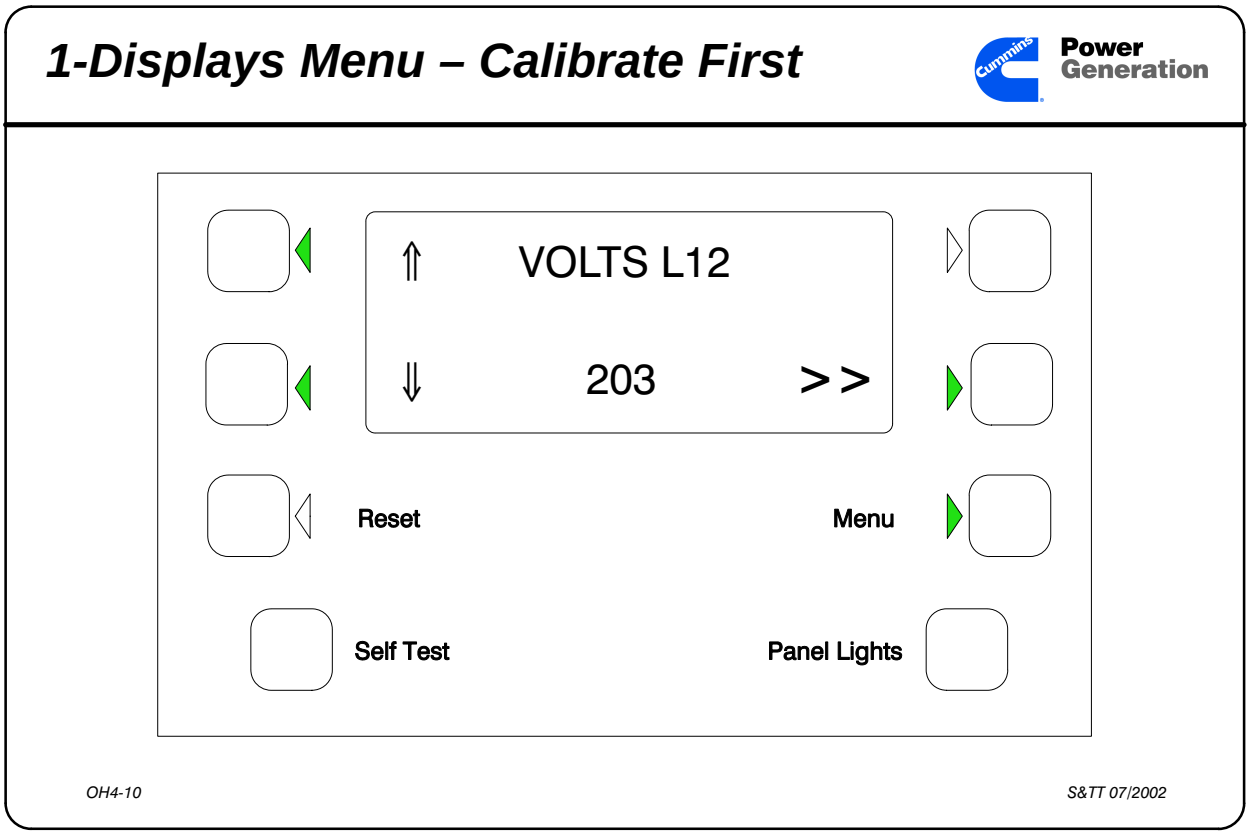
When the set is started again, the PCC will operate from the information that was last saved into its memory. The PCC will not save inputs of "0" volts.

In the Displays and Meters menus, the display is set to match the indication of a calibrated true-RMS reading meter.

If these readings are set wrong, the rest of the PCC operation that is based on them will also be wrong:

- Percent of Load meter
- Percent of Current meter
- KW HOURS
- Power Factor
- Overvoltage
- Undervoltage
- Underfrequency
- Overcurrent
- Voltmeter

Your Notes



Slide 4-10 DISPLAYS MENU

Participant's Information

Volts Line-Line

This menu sets the display to indicate proper Line-to-Line voltage.

Volts L1 - L2,
Volts L2 - L3,
Volts L3 - L1

When adjusting the display, make sure you are measuring the same phases of voltage with a true-RMS meter.

Volts Line-Neutral

This menu sets the display to indicate proper Line-to-Neutral voltage.

Line-to-Neutral is not used when the control is set for a Delta reconnection.

Your Notes

Participant's Guide

Amperes per Phase

This menu sets the display to indicate proper line current.

Amps L1
Amps L2
Amps L3

When adjusting the display, make sure you are measuring the same phase of current with a true-RMS clamp-on meter.

Power Factor per Phase

This menu sets the display to indicate the power factor of the load on each phase.

PF L1
PF L2
PF L3

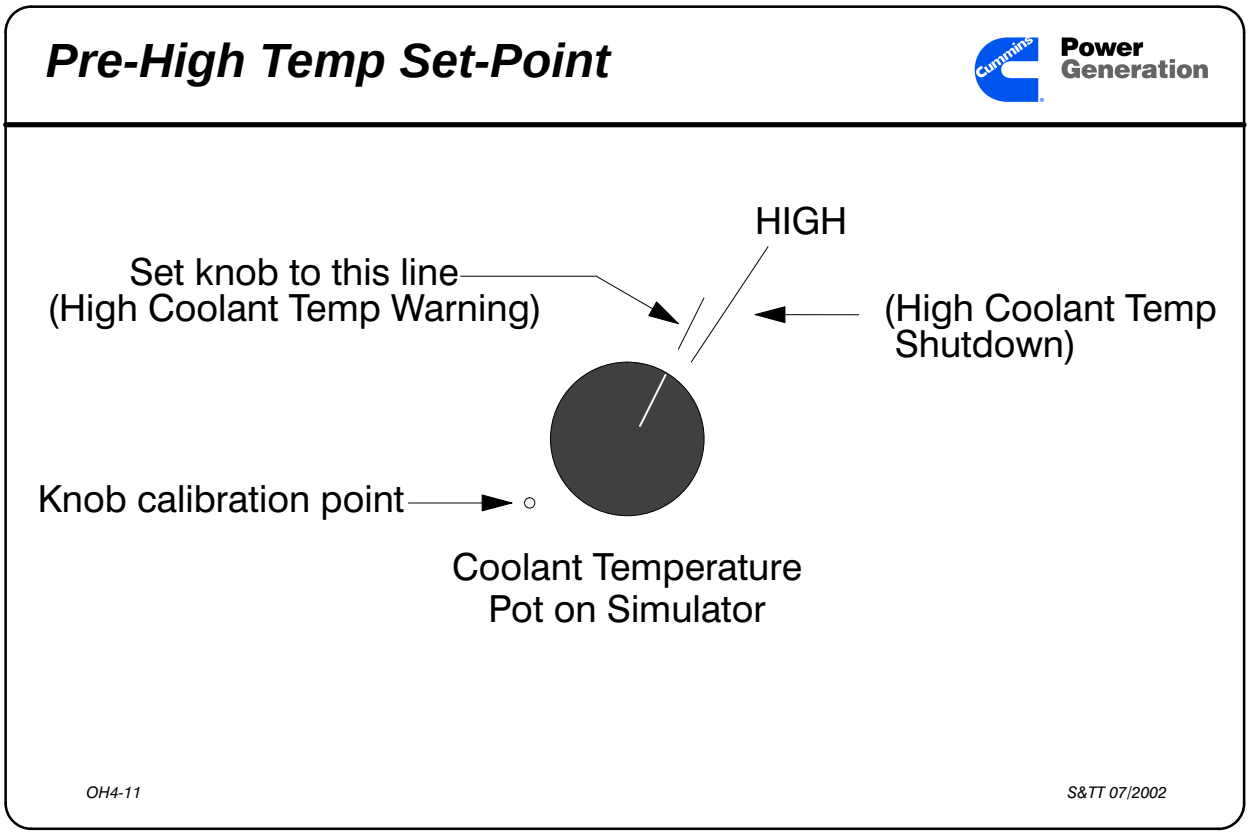
When adjusting the display, make sure you are measuring the power factor of the load on that phase.

Before continuing with Coolant Temp sensor circuit calibration, Save your choices so far, and turn S12 to the "OFF" position. This will prevent your PCC from displaying a High Coolant Temperature Warning.

To do this, press the button by the >> display until you see "**SAVE**" displayed on the LED display panel.

Press the button by SAVE, then press the button by >> until you see Coolant Temp #1 and Coolant Temp #2 again. Now turn S12 to the "OFF" position.

Your Notes



Slide 4-11 Coolant Temp Pre-High Setpoint and Shutdown lines

Participant's Information

NOTE: Before continuing with the calibration of the Displays

- SAVE the changes you have made already.
- Push the >> button until you see the Coolant Temp. #1 display again.
- Turn the S12 (Run - Off - Auto) switch to OFF

THESE CALIBRATIONS MUST BE DONE WITH THE ENGINE STOPPED

These menus set the display to indicate proper high engine shutdown temperature. They must be calibrated when the analog board is changed.

Your Notes

Participant's Guide

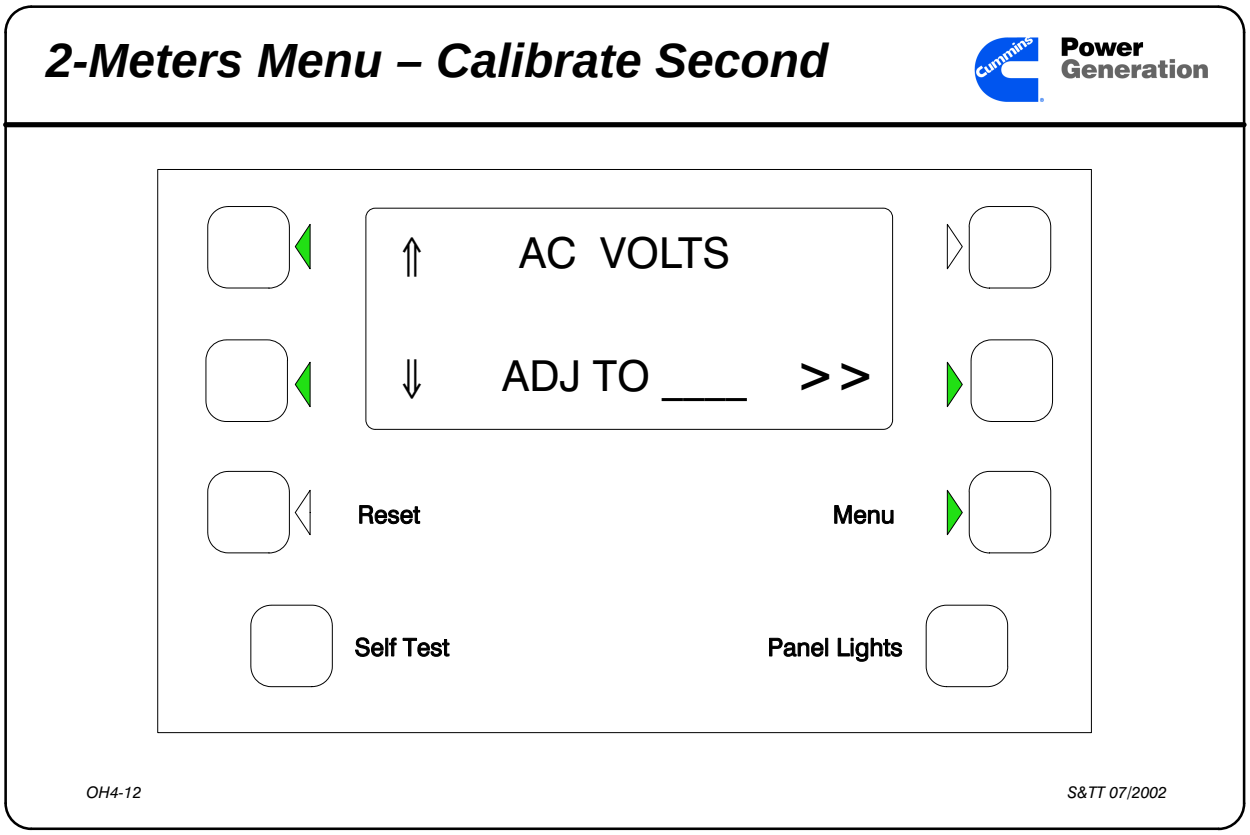
Turn the engine temperature potentiometer on the PCC simulator to 215° F (Engine Temperature Warning – see figure below). Calibrate Engine Temp #1 and 2 readings to 215° F.

Using the sender simulator from the tool kit you would calibrate the Engine Temp #1 and 2 indications to 219° F.

This calibration actually changes the PCC software so the LED Display Panel indicates the proper temperature at the Warning and Shutdown points.

After calibrating the Coolant Temperature circuits inside the PCC, save these changes also, and then go back to the ENGINE menu and set the Coolant Temperature pot on the simulator until the PCC Coolant Temp. display reads 165° F.

Your Notes



Slide 4-12 METERS MENU

Participant's Information

AC VOLTS

NOTE: The voltmeter selector LED will indicate which phases of voltage, and what phase of current the PCC is measuring at that time.

The Meter indication for the three phases of voltage will be different since you set the LED Display to three different voltage indications.

Use the left-hand buttons (INCREASE / DECREASE) so the voltmeter needle points to the reading shown in the LED Display panel.

Your Notes

Participant's Guide

% AMPERES

NOTE: The voltmeter selector LED will indicate which phases of voltage, and what phase of current the PCC is measuring at that time. The Meter indication for the three phases of current will be different since you set the LED Display to different current indications. However, you only have to perform this calibration once.

Use the left-hand buttons (INCREASE / DECREASE) so the Percent of Current meter indicates the reading shown in the LED Display panel.

100% current occurs at 100% KVA load (.8 PF), not 100% kW load (1.0 PF).

% LOAD

Use the left-hand buttons (INCREASE / DECREASE) so the Percent of Load meter indicates the reading shown in the LED Display panel.

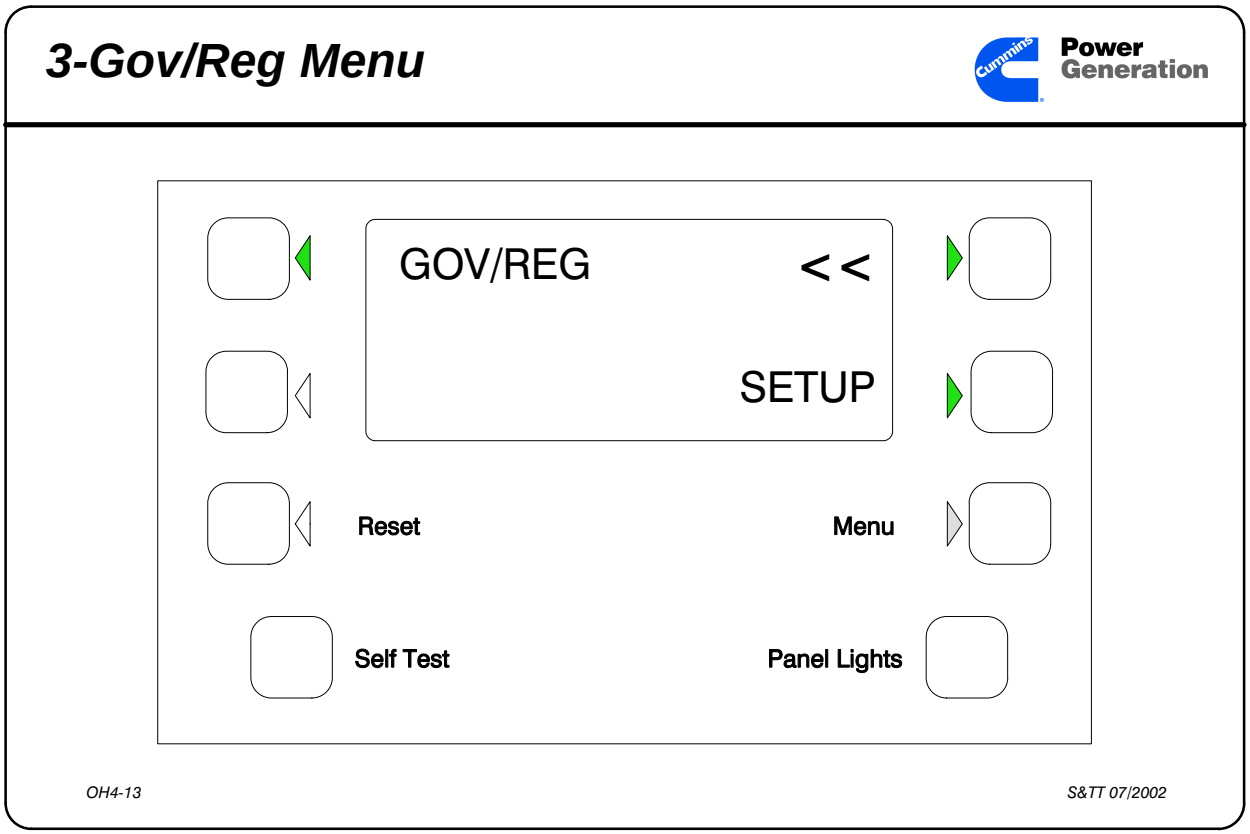
This meter will indicate in percentage of total KW load.

HERTZ

Use the left-hand buttons (INCREASE / DECREASE) so the Frequency meter indicates the reading shown in the LED Display panel.

This meter indication comes from the generator AC output frequency.

Your Notes



Slide 4-13 Gov/Reg Menus

Participant's Information

NOTE: The PCC automatically sets Governor and AVR operating points when the initial setup is performed on the PCC. These menus will indicate governor and AVR Gain and Damping as percentages of 100% (normal setting).

Gov Gain

If set too high the governor will oscillate, just like with the previous electronic governor.

Normal (default) setting is 100%.

NOTE: If the engine temperature is below 150° F, the indicated setting will be 50% of the setting in memory, and you will not be able to adjust the Gov Gain.

Your Notes

Participant's Guide

Gov Integral

The lower the setting, the slower the PCC will respond to load changes. If Gov Integral is set too high the frequency will be unstable.

Gov Ramp

This sets the time for the set to get to operating speed from start disconnect or IDLE speed.

Gov Ramp is adjustable from ZERO to 10 seconds.

The governor Ramp affects startup ramp from starter disconnect, and ramping from Idle to rated speed.

Reg Gain

This is an adjustment that Onan has not previously had on its AVRs. The older Newage LA-32 / LA-33 AVRs had a GAIN pot. If the Reg Gain is adjusted too high, the voltage will be unstable.

If the Reg Gain is set too low, the PCC response to a load change will be affected. The output voltage may overshoot or go so low that the set shuts down on Undervoltage.

Your Notes

Participant's Guide

Reg Integral

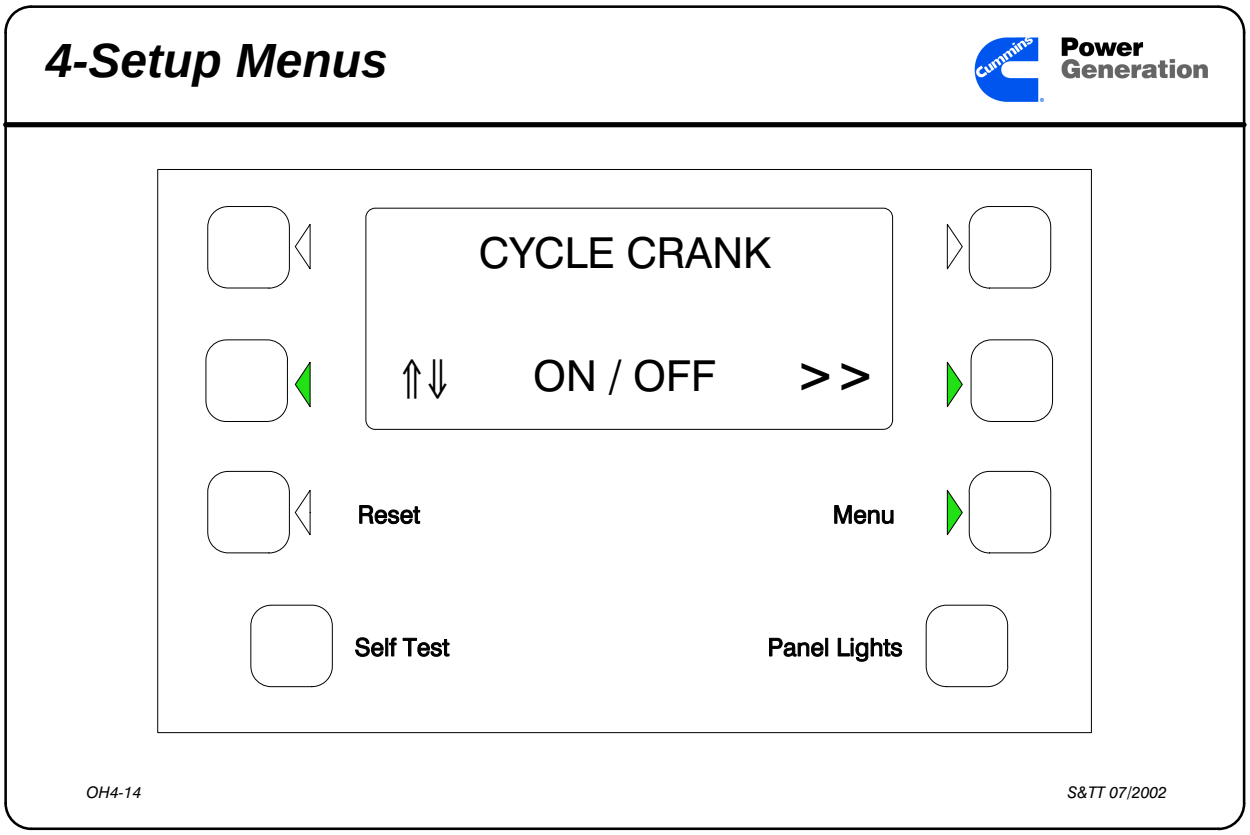
The lower the setting, the slower the PCC will respond to load changes. If Reg Integral is set too high the output voltage will be unstable.

Reg VHZ

This sets the response curve of the PCC to a load application; where the excitation starts to get cut off to lower the output voltage and lessen the load on the engine. This setting is approximately like the DIP adjustment on the Newage MX-321 AVR which changes the slope of the excitation decay curve.

If set too low, excitation will be cut too fast and the output voltage will dip too far. If set too high, excitation will not be cut soon enough and the engine may not be able to pick up the rated load in one step.

Your Notes



Slide 4-14 SETUP MENUS

Participant's Information

Cycle Crank

Selects cycle crank or continuous crank.

If cycle crank is "ON" this allows the technician to select:

- Number of Crank/Rest cycles
  3, 4, or 5
- Crank time
  7 to 20 seconds
- Rest time
  7 to 20 seconds
  Rest time cannot be lower than crank time.

Your Notes

Participant's Guide

System Of Units

Selects Metric or Imperial unit systems

Metric displays pressure in kPa, temperature in °Celsius.

Imperial displays in pressure PSI, temperature in °Fahrenheit.

Customer Fault Menus

As shown in your preliminary service manual on page 2-20, the display for the four Customer Fault menus will be able to be set to read a message that the customer wants displayed when that specific fault is sensed by the PCC. The display will show 0-9, A-Z, and spaces.

Customer Fault 1 - defaults to "CUSTOMER FAULT 1"

Customer Fault 2 - defaults to "GRND FAULT"

Customer Fault 3 - defaults to "DAY TANK" (rupture basin)

Customer Fault 4 - defaults to "HIGH GEN TEMP"

You can select the PCC 3100 response to Customer Fault inputs as a Warning or Shutdown.

The input signal for all four Customer Faults is ground potential.

Your Notes

Participant's Guide

Your Notes

EGT #1

Select Yes if the EGT sender is installed, select No if the EGT sender is not installed.

EGT #2

Select Yes if the EGT sender is installed, select No if the EGT sender is not installed.

Low Coolant Lvl

Select the desired PCC response to the Low Coolant Level input.

This defaults to a shutdown.

Language

The customer may want the PCC to display a different language than English. If you do not speak that language, you need to know how to change the PCC to an English display.

What is the procedure for changing the display to English or Spanish?

NOTE: In the initial release of the PCC, menu language selections will be limited to English and Spanish. These languages will also be supported by the technical publications system.

Activity 4-1: PCC 3100 Menu Worksheet

Using your DF Generator Sets Service Manual (960-0507) and the worksheet that follows, work through the Engine, Generator, Adjust and Setup/Calibration menus on the PCC demonstrator at your work station.

Fill in all the blanks as you go through the worksheet so you can discuss any differences between your answers and the Trainer's answers.

ENGINE MENUS

Oil Pressure

Adjust the Oil pressure knob on the simulator until the PCC displays the Pre-Low Oil Pressure warning lamp.

What is the maximum oil pressure for the Pre-LOP alarm?_____ psi

What pressure do you have to adjust the oil pressure to read after resetting the alarm to not have the alarm lamp light?_____ psi

Set the oil pressure to 45 psi.

Engine Temperature

Can you adjust the Engine Temperature on the simulator to get the High Engine Temperature display? Yes / No; What minimum temperature is displayed? _____

Can you adjust the Engine Temperature on the simulator to get the Low Coolant Temperature Alarm display? Yes / No; What Temp ? _____ / _____

Adjust the engine temperature for 165 °F.

Battery Voltage

When the battery voltage goes down too low, the PCC starts to give erratic displays.

How low can you adjust the battery voltage before the LOW BATTERY alarm is displayed? _____ volts

How high can you adjust the battery voltage before the HIGH BATTERY alarm is displayed? _____ volts

Set the battery voltage for 26.0 volts.

Starts and Hours

This menu tells how many times the set has started, and the accumulated hours on the set.

Can you change the number of starts or the total hours from the front panel? Yes / No

Where is this data stored? (EPROM), (EEPROM), (RAM)

How would you get these changed when replacing the PCC in the field?

RPM

This display will indicate 0 (zero) if the set is not running.

This display is calculated from the size of the flywheel for the generator set in the SETUP menus, and the frequency from the magnetic pick-up (MPU) if the set is running.

Exhaust

This display will indicate N/A if the EGT senders are not selected in the setup menus.

Where would you find the instructions to change this display from N/A to a real reading if the customer had the EGT senders installed? Do not change this information at this time, just find the procedure in the Service Manual. page _____

This display will indicate engine exhaust temperature in Imperial (Fahrenheit) or Metric system units (Celsius).

Where would you find the instructions to change this display from °F to °C if the customer wanted the readings in the Metric system units? Do not change this information at this time, just find the procedure in the Service Manual. page _____

GENERATOR MENUS

Volts and Amps

These menus will indicate 0 (zero) if the set is not operating., and will indicate 0 (zero) if the set is operating in IDLE mode.

Start the PCC and select LINE-LINE after the VOLTS / AMPS menu.

Select the OVERVOLTAGE shutdown on the simulator.

What is the time delay before the set shuts down? _____ seconds. What was the voltage on the LED Display Panel just before shutdown? _____

Reset the simulator and the PCC. Restart the PCC.

Select the UNDERVOLTAGE shutdown on the simulator.

What is the time delay before the set shuts down? _____ seconds. What was the voltage on the LED Display Panel just before shutdown? _____

Reset the simulator and PCC.

Power and kW Hours

The POWER menu shows the present load on the genset in KW and the Power Factor of the load.

What is the present load on the set, and its power factor? ____ / ____ .

NOTE: With the simulator the KW and PF may change quite a bit.

KW HOURS shows the total load in KW Hours that has been on the set since it was put in commission.

What is the total load the set has carried? _____ kwh.

%Gov/Reg and Frequency

%GOV/REG shows the percent of maximum of the Governor and AVR output signals. As the load on the engine and generator increases, these indications will increase toward their maximums of 90% for the Governor and 60% for the Regulator.

What is the Governor Duty Cycle? _____

What is the Regulator Duty Cycle? _____

FREQUENCY shows the output frequency of the generator. This indication is calculated from the actual output frequency from the main alternator.

What is the Frequency reading? _____

ADJUST MENUS

NOTE: To make any selection permanent, you must continue to the *SAVE/EXIT* menu and select *SAVE* to save your changes. Otherwise any changes will only be effective until the set is shut off.

Voltage

- If set is off, or in Idle mode, this display will be N/A.

The left-hand buttons allow the operator to adjust the output voltage up or down 5% from the mid-point output voltage.

Adjust the output voltage to its maximum value.

What is that maximum value? _____

Adjust the output voltage to its minimum value.

What is that minimum value? _____

Adjust the voltage indication to 208 VAC.

Frequency

- If set is off, or in Idle mode, this display will be N/A.

The left-hand buttons allow the operator to adjust the output frequency up or down 5% from the mid-point frequency.

Adjust the frequency to its maximum value.

What is that maximum value? _____

Adjust the frequency to its minimum value.

What is that minimum value? _____

This indication comes from the MPU.

Set the Frequency to 61.1 Hz.

Start Delay & Stop Delay

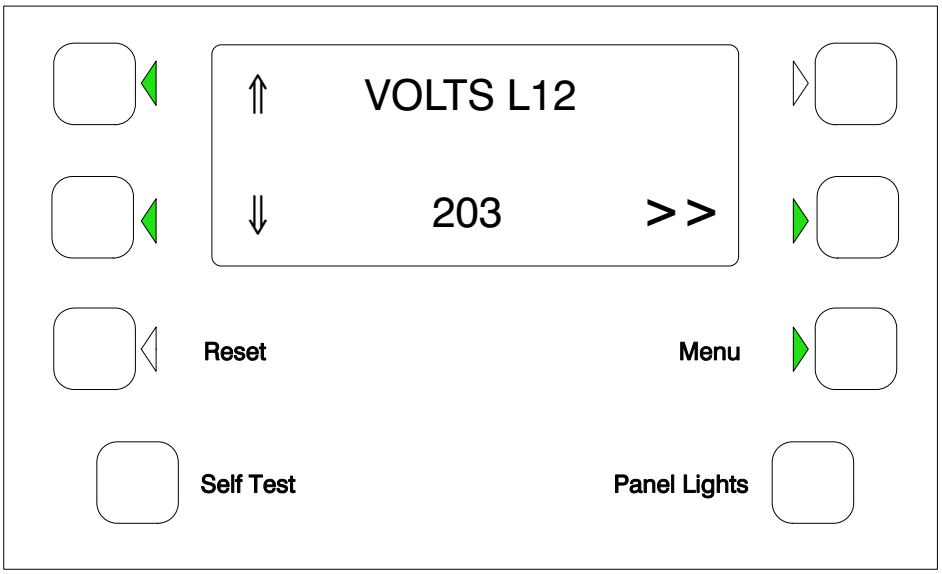
- only effective when the PCC is operated in the AUTO mode.

Idle Speed Adjust

- only effective when the PCC is in Idle mode (700-900 RPM)

Save these choices and return to the Main Menu.

1-Displays Menu – Calibrate First



OH4-15 S&TT 07/2002

DISPLAYS MENU

Volts L1 - L2

Set this to 203 VAC.

Volts L2 - L3

Set this to 208 VAC.

Volts L3 - L1

Set this to 213 VAC.

Amps L1

Set this to 1500 Amps.

Amps L2

Set this to 1250 Amps.

Amps L3

Set this to 1000 Amps.

PF L1

DO NOT ADJUST

PF L2

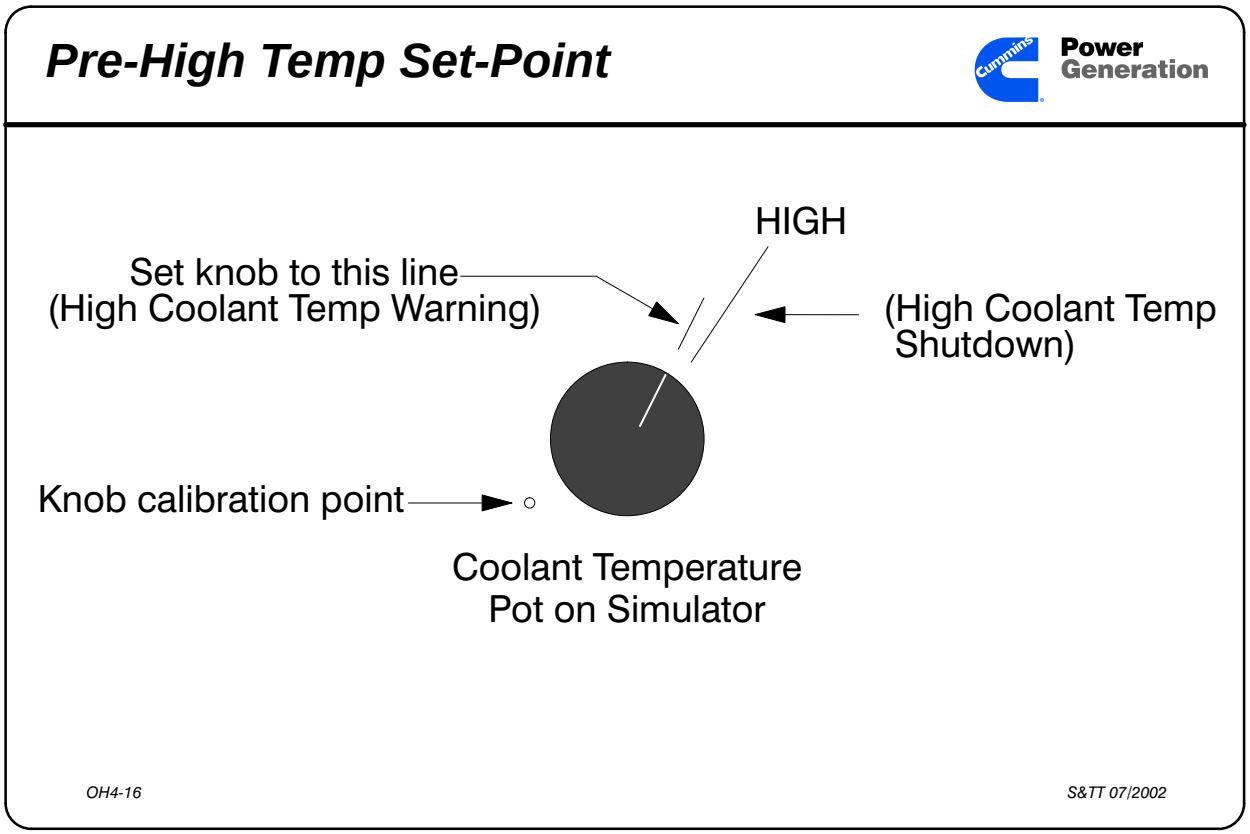
DO NOT ADJUST

PF L3

DO NOT ADJUST

Before continuing with Coolant Temp sensor circuit calibration, Save your choices so far, and turn S12 to the "OFF" position. This will prevent your PCC from displaying a High Coolant Temperature Warning.

To do this, press the button by the >> display until you see "SAVE" displayed on the LED display panel. Press the button by SAVE, then press the button by >> until you see Coolant Temp #1 and Coolant Temp #2 again. Now turn S12 to the "OFF" position.



Coolant Temp #1 (left bank) and Coolant Temp #2 (right bank)

NOTE: Before continuing with the calibration of the Displays:

SAVE the changes you have made already.

Push the >> button until you see the Coolant Temp. #1 display again.

Turn the S12 (Run - Off - Auto) switch to OFF

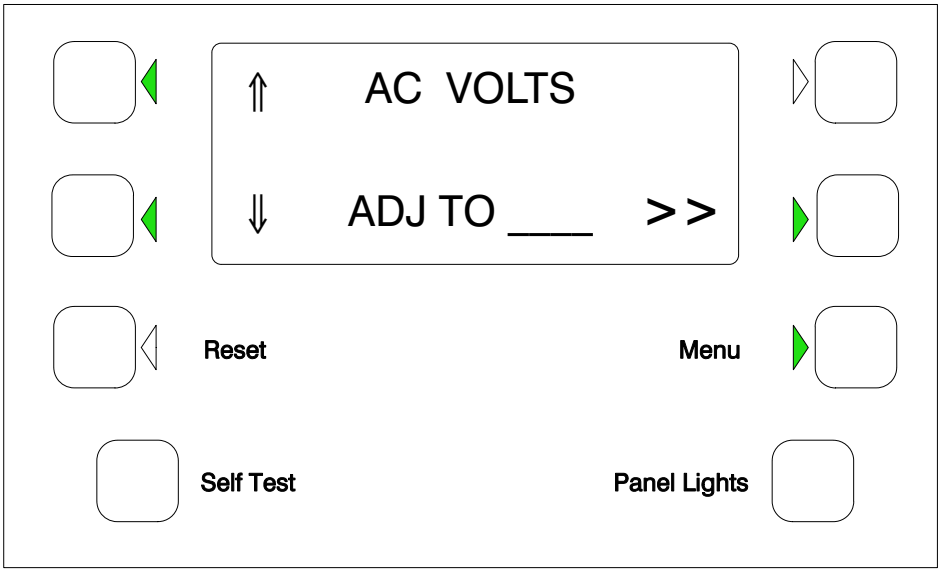
These menus set the display to indicate proper high engine shutdown temperature. They must be set when the analog board is changed.

Turn the engine temperature potentiometer on the PCC simulator to 215 ° F (Engine Temperature Warning – see figure above). Calibrate Engine Temp #1 and 2 readings to 215 ° F.

Using the sender simulator from the tool kit you would calibrate the Engine Temp #1 and 2 indications to 219° F. This calibration actually changes the PCC software so the LED Display Panel indicates the proper temperature at the Warning and Shutdown points.

After calibrating the Coolant Temperature circuits inside the PCC, save these changes also, and then go back to the ENGINE menu and set the Coolant Temperature pot on the simulator until the PCC Coolant Temp. display reads 165° F.

2-Meters Menu – Calibrate Second



OH4-17 S&TT 07/2002

METERS MENU

AC VOLTS

Adjust to _____ (write in LED Display indication)

NOTE: The voltmeter selector LED will indicate which phases of voltage, and what phase of current the PCC is measuring at that time.

The Meter indication for the three phases of voltage will be different since you set the LED Display to three different voltage indications.

Use the left-hand buttons so the voltmeter needle points to the reading shown in the LED Display panel.

% AMPERES

Adjust to _____ (write in LED Display indication)

NOTE: The voltmeter selector LED will indicate which phases of voltage, and what phase of current the PCC is measuring at that time. The Meter indication for the three phases of current will be different since you set the LED Display to different current indications. However, you only have to perform this calibration once.

Use the left-hand buttons so the Percent of Current meter indicates the reading shown in the LED Display panel.

100% current occurs at 100% KVA load (.8 PF), not 100% kW load (1.0 PF).

% LOAD

Adjust to _____ (write in LED Display indication)

Use the left-hand buttons so the Percent of Load meter indicates the reading shown in the LED Display panel.

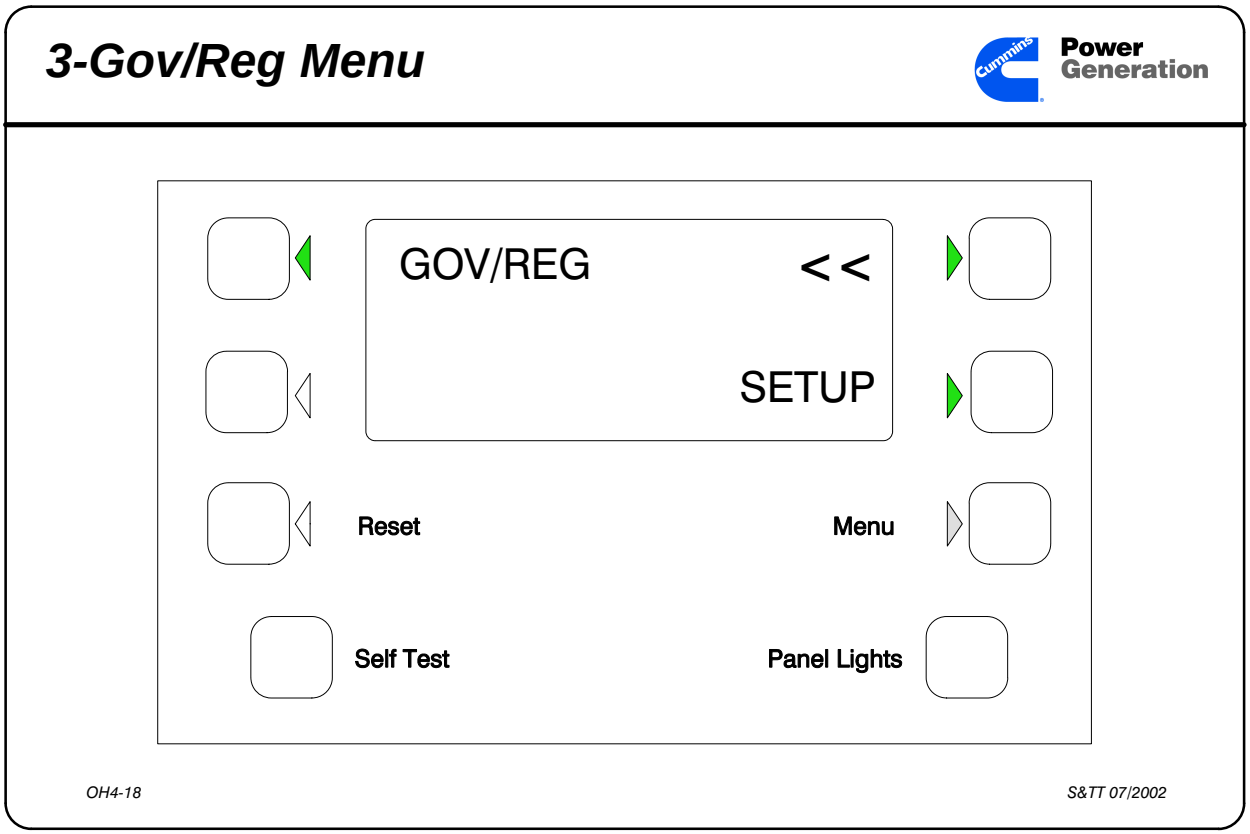
This meter will indicate in percentage of total KW load.

HERTZ

Adjust to _____ (write in LED Display indication)

Use the left-hand buttons so the Frequency meter indicates the reading shown in the LED Display panel.

This meter indication comes from the generator AC output frequency.



GOV / REG MENUS

NOTE: The PCC automatically sets Governor and AVR operating points when the initial setup is performed on the PCC. These menus will indicate governor and AVR Gain and Damping as percentages of 100% (normal setting).

Gov Gain

If set too high the governor will oscillate, just like with the previous electronic governor.

Normal (default) setting is 100%.

NOTE: If the engine temperature is below 150° F, the indicated setting will be 50% of the setting in memory, and you will not be able to adjust the Gov Gain.

Adjust Gov Gain to 110%.

Gov Integral

The lower the setting, the slower the PCC will respond to load changes. If Gov Integral is set too high the frequency will be unstable.

Adjust Gov Integral to 110%.

Gov Ramp

This sets the time for the set to get to operating speed from start disconnect or IDLE speed.

Gov Ramp is adjustable from ZERO to 10 seconds.

Adjust Gov Ramp to 10 seconds.

Reg Gain

This is an adjustment that Onan has not previously had on its AVRs. The older Newage LA-32 / LA-33 AVRs had a GAIN pot. If the Reg Gain is adjusted too high, the voltage will be unstable.

If the Reg Gain is set too low, the PCC response to a load change will be affected. The output voltage may overshoot or go so low that the set shuts down on Undervoltage.

Adjust Reg Gain to 110%.

Reg Integral

The lower the setting, the slower the PCC will respond to load changes. If Reg Integral is set too high the output voltage will be unstable.

Adjust Reg Integral to 110%.

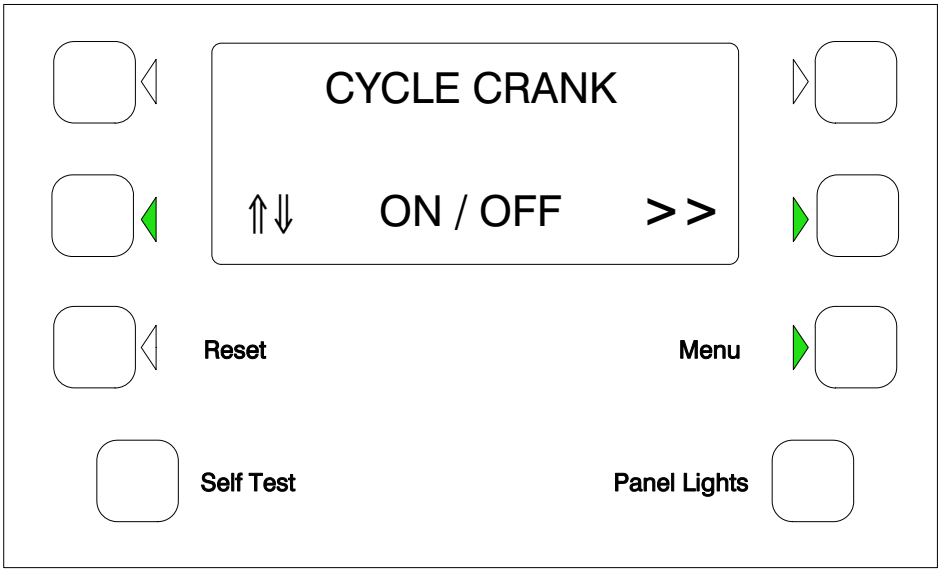
Reg VHZ

This sets the response curve of the PCC to a load application; where the excitation starts to get cut off to lower the output voltage and lessen the load on the engine. This setting is approximately like the DIP adjustment on the Newage MX-321 AVR which changes the slope of the excitation decay curve.

If set too low, excitation will be cut too fast and the output voltage will dip too far. If set too high, excitation will not be cut soon enough and the engine may not be able to pick up the rated load in one step.

Adjust Reg VHZ to 7.

4-Setup Menus



OH4-19 S&TT 07/2002

SETUP MENUS

Cycle Crank

Selects cycle crank or continuous crank.

If cycle crank is “ON” this allows the technician to select:

Number of Crank/Rest cycles	3, 4, or 5
Crank time	7 to 20 seconds
Rest time	7 to 20 seconds

Rest time cannot be lower than crank time.

Set Number of Crank cycles to 5.

Set Crank Time to 10 seconds.

Set Rest time to 10 seconds.

System Of Units

Selects Metric or Imperial unit systems

Metric displays pressure in kPa, temperature in °Celsius.

Imperial displays in pressure PSI, temperature in °Fahrenheit.

Select Imperial unit systems.

Customer Fault Menus

As shown in your preliminary service manual on page 2-20, the display for the four Customer Fault menus will be able to be set to read a message that the customer wants displayed when that specific fault is sensed by the PCC. The display will show 0-9, A-Z, and spaces.

Customer Fault 1 - defaults to “CUSTOMER FAULT 1”

Selects the PCC response to this input as a Warning or Shutdown.

The input signal is ground potential.

Select WARNING.

Change the display to “*LATE GEN PAYMENT*.” When you are finished with the setup procedure, you will be able to test this customer fault with the Customer Fault switch on the simulator.

When you are finished with the setup procedure, you will not be able to test the next three customer faults with the simulator.

Customer Fault 2 - defaults to “GRND FAULT”

Selects the PCC response to this input as a Warning or Shutdown.

The input signal is ground potential.

Select WARNING.

Customer Fault 3 - defaults to “DAY TANK” (rupture basin)

Selects the PCC response to this input as a Warning or Shutdown.

The input signal is ground potential.

Select WARNING.

Customer Fault 4 - defaults to “HIGH GEN TEMP”

Selects the PCC response to this input as a Warning or Shutdown.

The input signal is ground potential.

Select WARNING.

EGT #1

Select Yes if the EGT sender is installed, select No if the EGT sender is not installed.

Select Yes for EGT #1.

EGT #2

Select Yes if the EGT sender is installed, select No if the EGT sender is not installed.

Select NO for EGT #2.

Low Coolant Lvl

Select the desired PCC response to the Low Coolant Level input.

This defaults to a shutdown.

Change the Low Coolant response to a WARNING.

Language

The customer may want the PCC to display a different language than English. If you do not speak that language, you need to know how to change the PCC to an English display.

What is the procedure for changing the display to English or Spanish?

Where is this procedure located in the Service Manual? Section: ____ Page: _____

What command tells the PCC to stay in the Spanish Menu system after power is removed from the set? _____

How many (minimum) total presses of the menu selection buttons — from the MAIN MENU — does it take to change to the Spanish Menu system, save the selection, exit, and return to the main menu?

Total number of presses _____

NOTE: In the initial release of the PCC, menu language selections will be limited to English and Spanish. These languages will also be supported by the technical publications system.

Activity 4-2: Completion Worksheet

In setting up the PCC, your group made some changes to the saved data in the EEPROM memory chip.

Now we want your group to test these changes you have made and verify that they are saved into the PCC memory.

Place the PCC in the "sleep mode."

Turn S12 on your PCC to the OFF position, then back to RUN.

The PCC should take approximately 25 seconds (with 10 second GOV RAMP) to get to full RPM. This is part of the simulator operation.

Generator Menus

The Voltmeter and ammeter should indicate:

L1-L2 203 VAC 1500 Amps
L2-L3 208 VAC 1250 Amps
L3-L1 213 VAC 1000 Amps
Frequency should be 61.1 Hz

Engine Menus

The engine oil pressure should indicate 45 psi
The engine temperature should indicate 165° F
The battery voltage should be 26.0 Volts DC
RPM should be approximately 1830
Left EGT should indicate a reading, right EGT should indicate N/A

Adjust Menus

The START DELAY should be 10 seconds
The STOP DELAY should be 10 seconds
The Idle Speed should be N/A

Setup / Cal Menus

Try each of the switches on the simulator with S12 on the PCC in the OFF position and also in the RUN position.

SIMULATOR SWITCH with S12 in OFF position	**Indication:**
Overvoltage	_____
Undervoltage	_____
Overspeed	_____
Low Coolant	_____
Oil Sensor Failure	_____
Customer Fault	_____
Overcrank	_____
Fail To Crank	_____
MPU Failure	_____
Low Fuel	_____
Coolant Sensor Failure	_____
Low Engine Temp	_____

SIMULATOR SWITCH with S12 in RUN position	**Indication:**
Overvoltage	_____
Undervoltage	_____
Overspeed	_____
Low Coolant	_____
Oil Sensor Failure	_____
Customer Fault	_____
Overcrank	_____
Fail To Crank	_____
MPU Failure	_____
Low Fuel	_____
Coolant Sensor Failure	_____
Low Engine Temp	_____

This page intentionally left blank

PowerCommand® Control Ventura for DFH-Series Gensets

This lesson presents an introduction to the PowerCommand® Control v used on the QST30-powered gensets.

Objectives

After completing this lesson, you should:

- know what model gensets require Ventura PowerCommand Control.
- be able to locate and identify PCCv menus and displays.
- be able to perform PCCv Initial Set Up.
- be able to use the Rack Test Diagnostic Tool.
- be able to use the % Torque Adjustment Tool.
- recognize PCCv related fault codes.
- understand the PCCv governor drive process.
- recognize PCCv by hardware attributes.
- recognize DFH Series gensets by physical attributes.

DFH-Series Genset Models

DFHA – 60Hz
750kW – Standby
680kW – Prime

DFHB – 60Hz
800kW – Standby
720kW – Prime

DFHA – 50Hz
620kW – Standby
560kW – Prime

DFHB – 50Hz
700kW – Standby
640kW – Prime

DFHC – 60 Hz
900kW – Standby

OH4v-1 S&TT 07/2003

Slide 4v-1 DFH-Series Genset Models

Participant's Information

The DFH Series genset is a new model designation. It is specifically for the QST30 engine model and PCCv 3100 control.

Future DFH models include DFHD for 1000kW @ 60Hz, Standby.

Your Notes

PCCv Menus and Displays

Power Generation

Initial Startup Menu

Rack Test Menu

% Torque Adjustment

Rack Position Fault – Customer Fault #1

OH4v-2 S&TT 02/2003

Slide 4v-2 PCCv Menus and Displays

Participant's Information

Initial Start Setup Menu may require Digital Board calibration if the control is replaced. This is unique to PCCv.

Rack Test Menu is a diagnostic tool for verifying proper operation of the PCCv, governor module and RE30 actuator assembly.

% Torque Adjustment allows the operator to increase genset output to compensate for electronic variances in pumps, governor modules or PCCv.

Rack Position Fault is Customer Fault #1. This setting is unique to PCCv.

Your Notes

Initial Start Setup Menu

Resistor Cut	Model	Standby 50/60Hz	Prime 50/60Hz
None	DFHA	620/750kW	560/680kW
R36	DFHB	700/800kW	640/720kW
R37	DFHC	900kW 60Hz only	
R38	future		

OH4v-3 S&TT 07/2003

Slide 4v-3 Digital Board (A32) Calibration

Participant's Information

The digital board contains three resistors that are used to calibrate the digital board for different generator set models. One of these resistors may need to be removed in order to calibrate/initialize the PowerCommand Control Ventura to the generator set model.

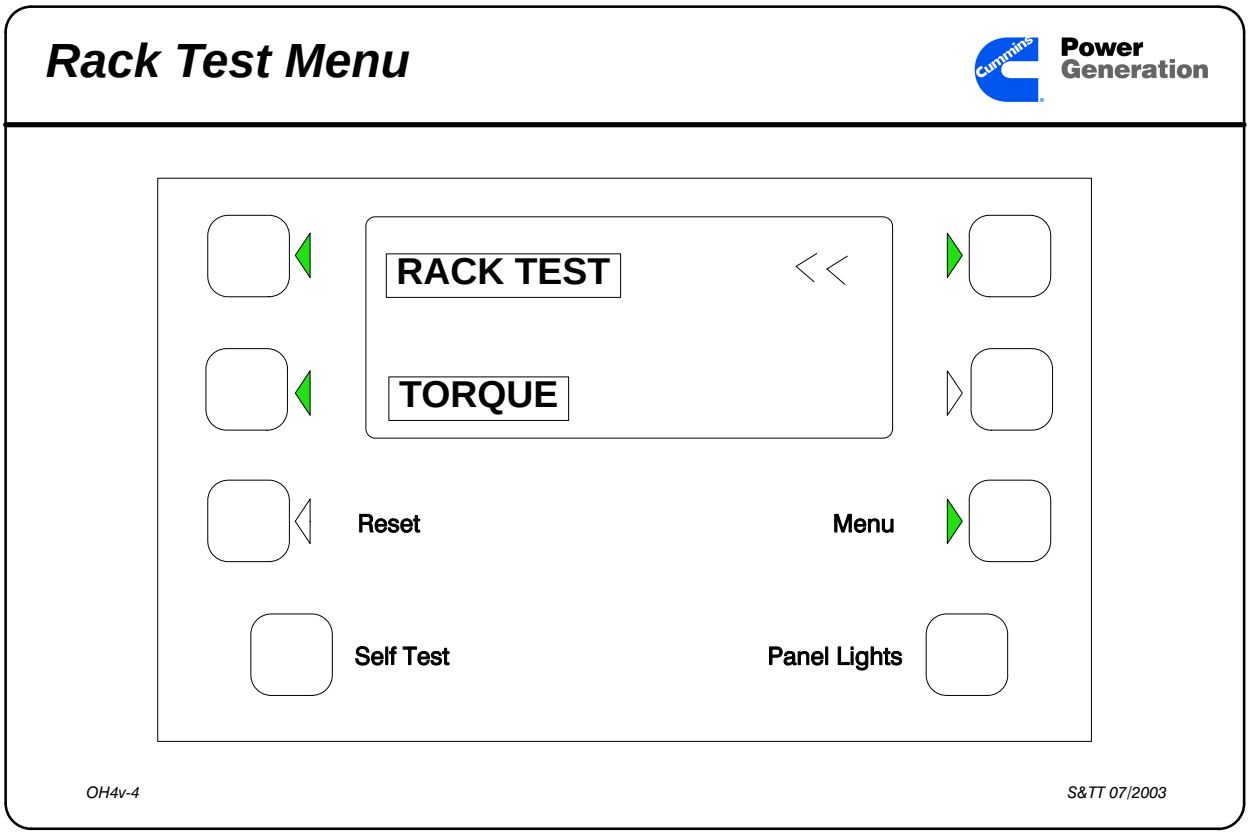
After the appropriate resistor selection is made, the PowerCommand Control Ventura must be re–initialized. When the initial setup save button is pushed, the PowerCommand Control Ventura will compare the calibration selection to the initial setup and perform one of the following:

Your Notes

Participant's Guide

1. If the model numbers corresponding to the cut resistor and the initial setup are compatible, the calibration is validated.
2. If the model number corresponding to the cut resistor and the initial setup are not compatible the control will display the fault ”INVALID SETUP”. No initial set-up data is saved and the control will not leave the initial setup menu until this fault condition is corrected.
3. If the control senses that more than one resistor has been cut, the control will display the fault “INVALID CAL”. No initial setup data is saved and the control will not leave the initial setup menu until this fault condition is corrected.

Your Notes



Slide 4v-4 Rack Test

Participant's Information

This test is used to determine if the PCCv Control, Governor Output Module and fuel pump actuators are functional.

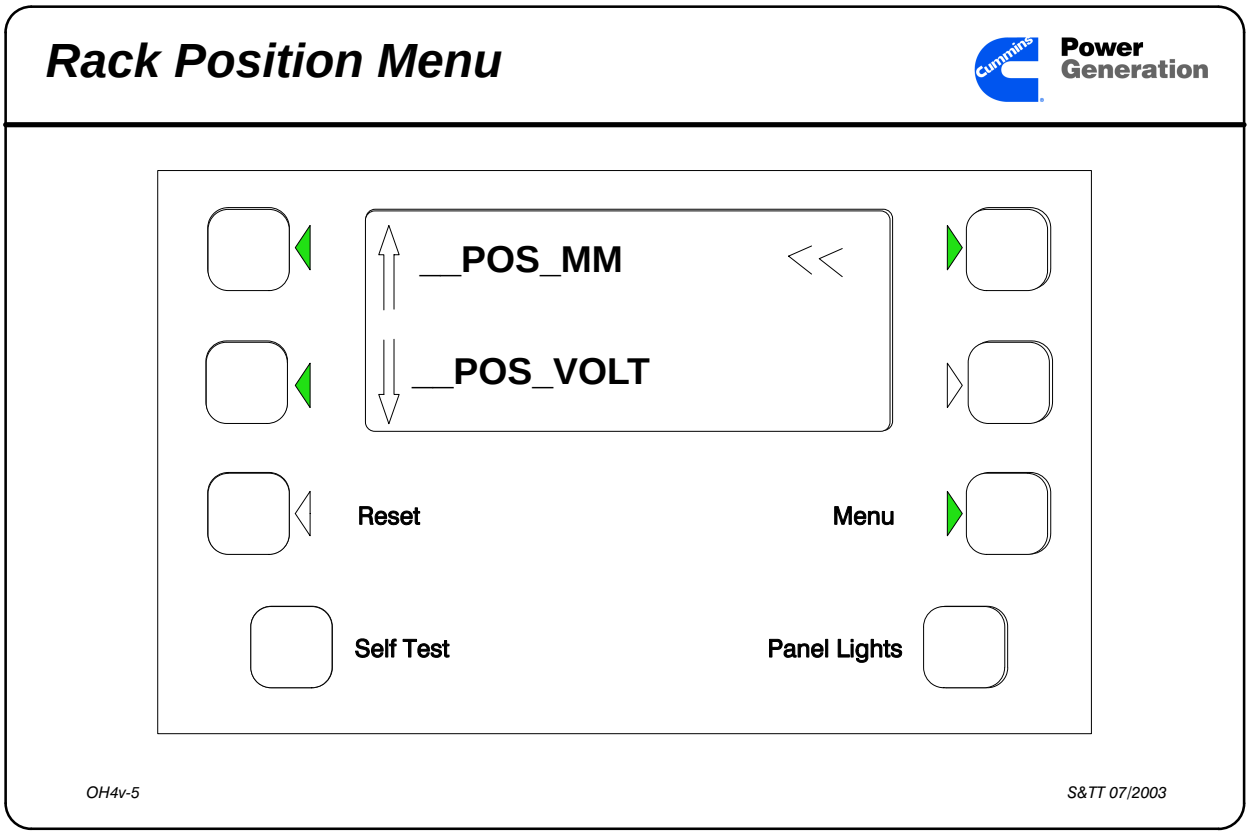
The Run/Off/Auto switch must be in the Off position before the test can be initiated.

When exiting this test or if the Run/Off/Auto switch is moved to either the Run or Auto position, the PCC software will re–initialize the governor duty cycle to 2 (0%) and allow the engine starting sequence to proceed as normal.

The operator adds a test jumper to make the control think that it is running.

The next display is "Rack Position."

Your Notes



Slide 4v-5 Rack Position Test

Participant's Information

POS__MM is rack position in millimeters

POS__VOLT is rack position in volts DC.

The rack position at stop is minimum mm/volt.

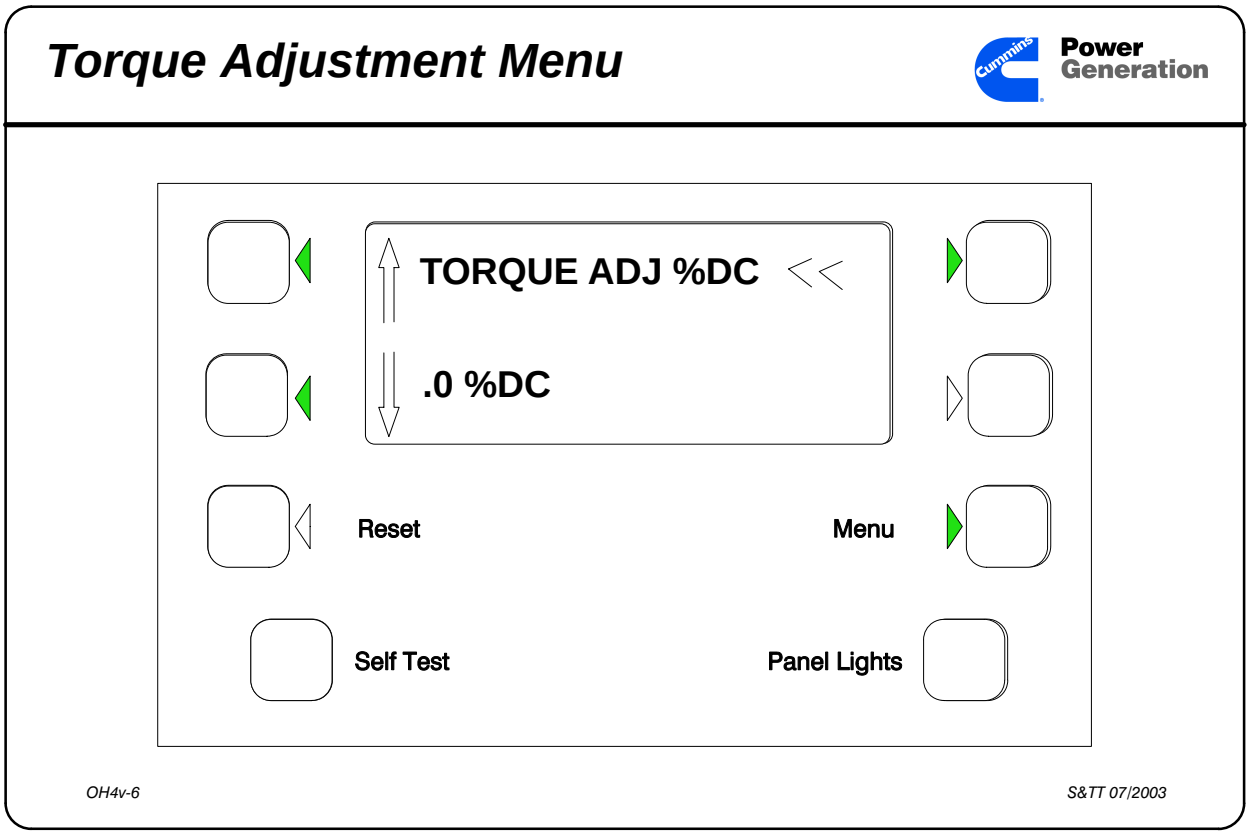
As the operator pushes the buttons associated with the up/down arrows, the rack moves.

A diagnostic harness in the Accessory Control Box is used to measure the DC Volts from the actuators. This value can be compared to the PCCv VDC value at each mm increment.

This control check should be performed by factory trained and qualified personnel only.

Your Notes

See Rack Test procedure on page 4–45 of 960–0509 Service Manual.



Slide 4v-6 Torque Adjustment

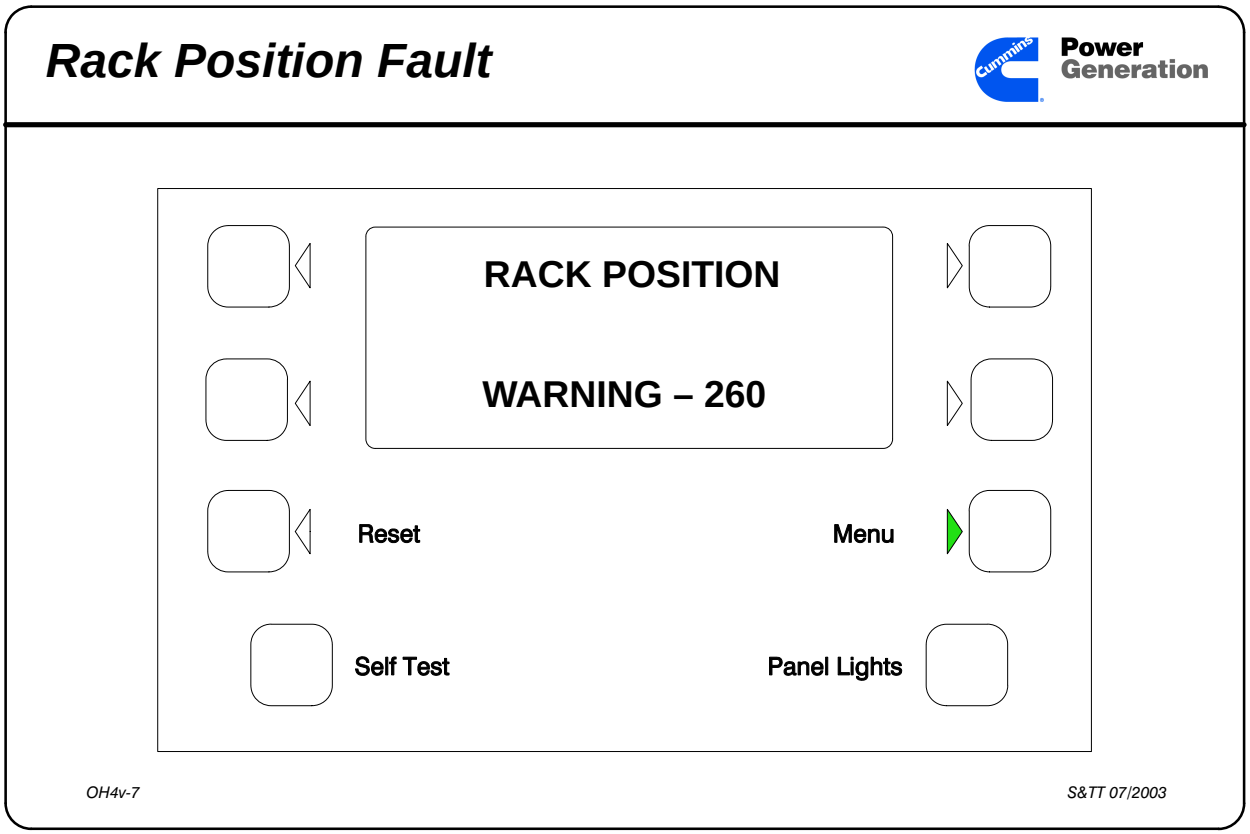
Participant's Information

Torque adjustment is used to compensate for engine/electronic variations.

If the generator set is not providing the name plate kilowatt rating, the torque limit can be adjusted through the digital display at this menu.

Your Notes

See page 5–22 of 960–0509 Service Manual for this calibration procedure.



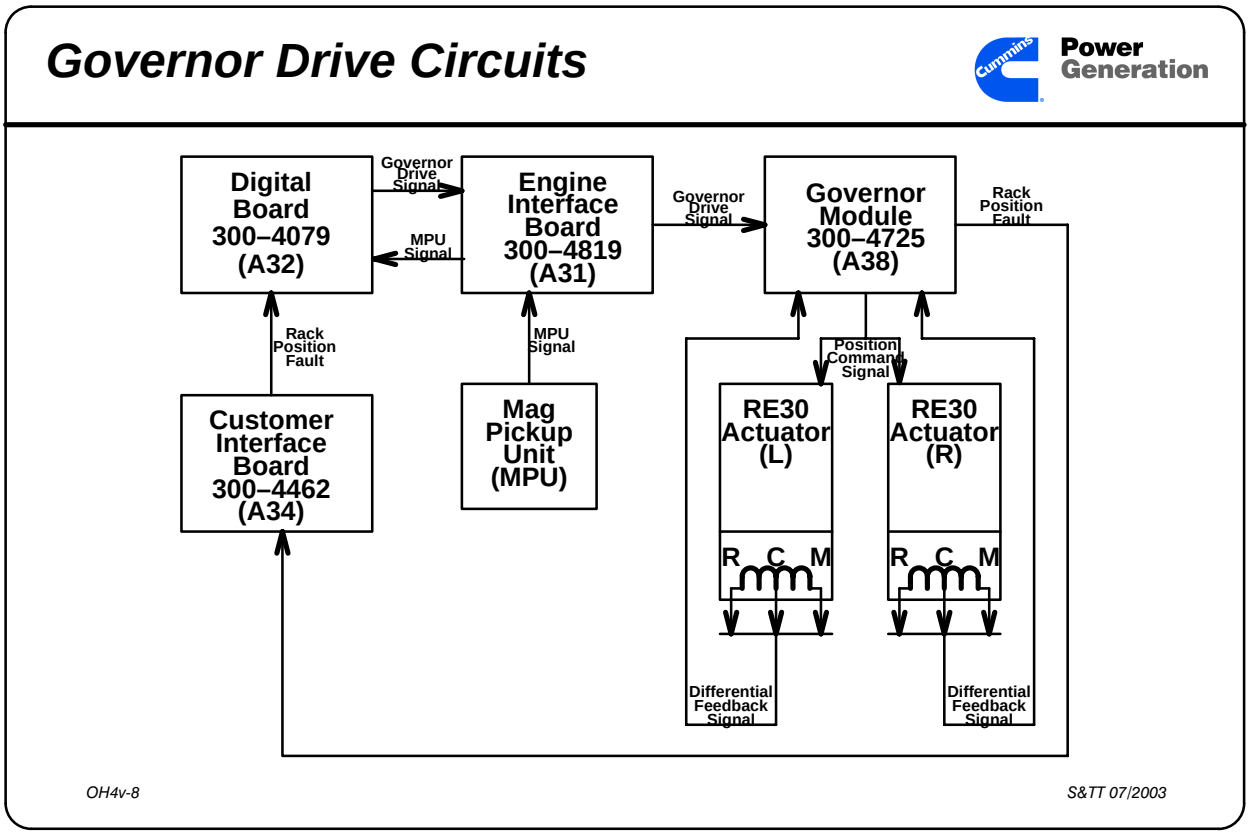
Slide 4v-7 Rack Position Fault

Participant's Information

Customer Fault 1 is reserved for the RACK POSITION fault. Do not modify this fault name or change the fault condition (WARNING to SHUTDOWN).

This fault indicates a PowerCommand control fault, harness problem, defective governor control circuitry or fuel pump problem.

Your Notes



Slide 4v-8 Governor Drive Signal

Participant's Information

A MPU signal is passed to the Digital Board via the Engine Interface Board. The Digital Board derives a governor drive signal from this MPU signal. The governor drive signal goes back through the engine interface board to the Governor Module.

The governor drive signal is applied to both RE30 actuator modules. This is also converted to a 0–5 VDC voltage level (VposL for left bank and VposR for right bank), which is compared to the feedback value from the RE30 actuator sensor coils, which is between 0–5VDC, depending on rack potion.

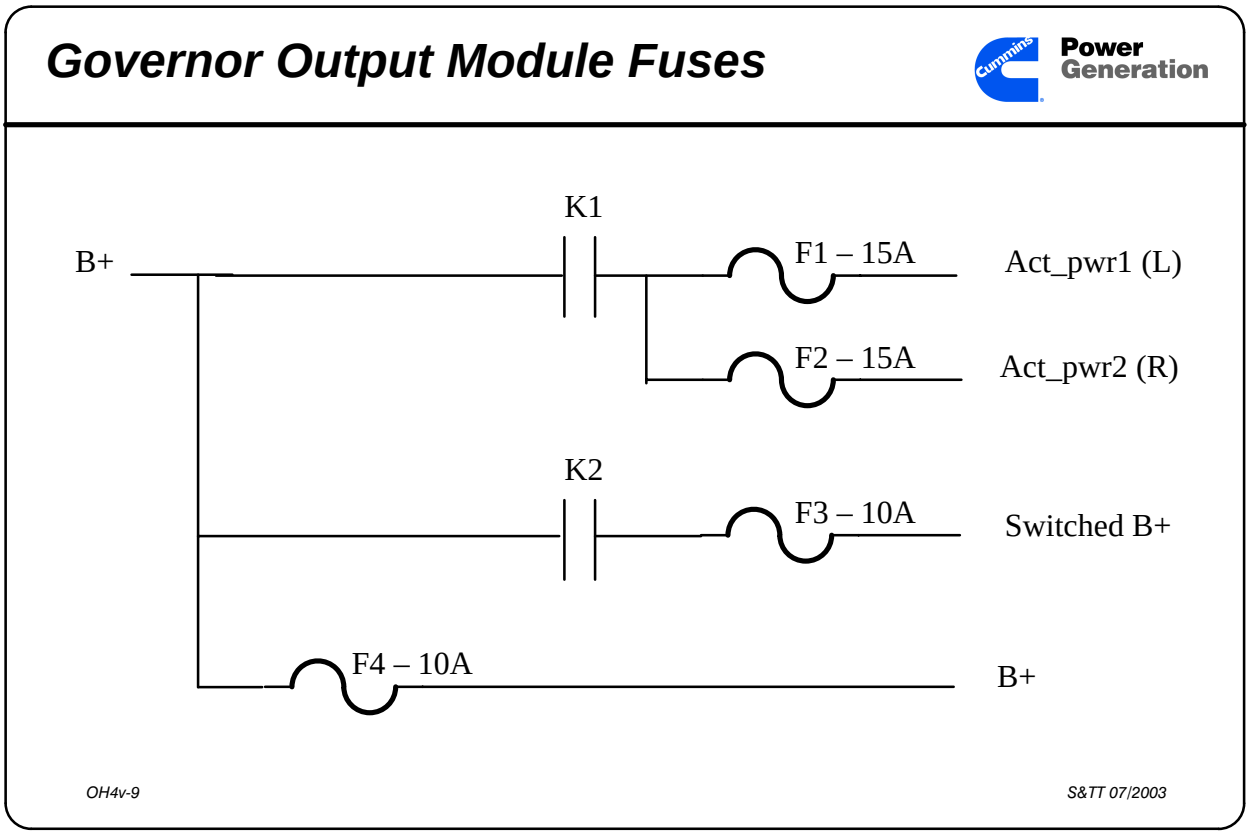
Your Notes

Participant's Guide

Each actuator includes two sensor coils — a reference coil and a measured coil. The Governor Module uses the reference coil value to determine a measured coil value. The left and right measured coil values are compared to VposL and VposR respectively. If the values are not within an acceptable tolerance, a Rack Position fault is sent to the Digital Board via the Customer Interface Board.

There is a diagnostic harness in the Accessory Control Box that allows the operator to test fuel rack operation. The "RACK TEST" allows the operator to compare one bank with respect to the other as well as compare the governor drive position value to the RE30 sensor coil value.

Your Notes



Slide 4v-9 Governor Output Module – Power Supply

Participant's Information

K1 and K2 relays are resident on the Governor Output Module and energize when the module receives a Run Signal.

F1 is for the 24VDC, 15A Actuator Drive power supply for the left bank actuator.

F2 is for the 24VDC, 15A Actuator Drive power supply for the right bank actuator.

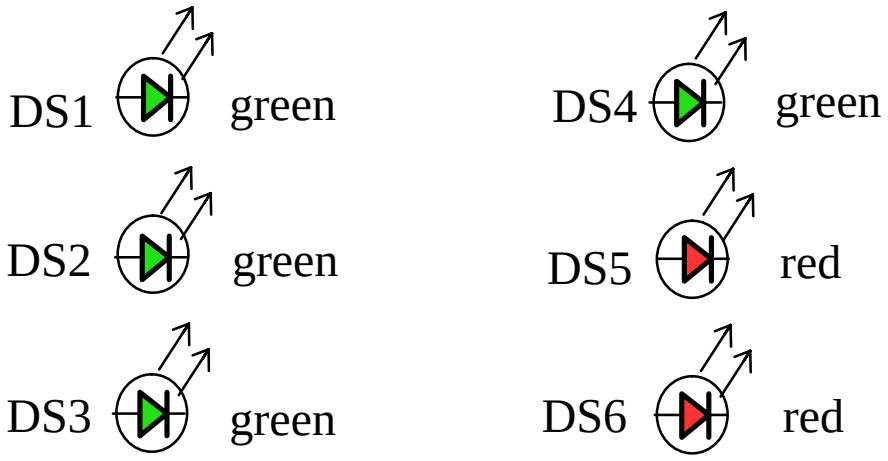
F3 is for the Switched B+ which connects to the T26 tie point on the engine.

F4 provides a fused B+ output which supplies the 5VDC regulator used for the actuator drive logic and feedback loop comparison logic.

All four fuses are sealed automotive type fuses.

Your Notes

Governor Output Module LEDs



OH4v-10 S&TT 07/2003

Slide 4v-10 Governor Output Module – LEDs

Participant's Information

DS1 is ON when the Governor Output Module receives a Run Signal.

DS2 is ON when the 5VDC regulated voltage supply on the Governor Output Module is activated.

DS3 is ON when the left bank fuel pump actuator is activated.

DS4 is ON when the right bank fuel pump actuator is activated.

DS5 is ON when a left bank fuel rack position fault is detected.

DS6 is ON when a right bank fuel rack position fault is detected.

Your Notes

PCCv Component Changes

Component	PCCv	PCC
J5 (Engine Interface Board)	Blue	Gray
Engine Interface Board	300–4819	300–4083
Governor Module	300–4724	300–4307

OH4v-11 S&TT 07/2003

Slide 4v-11 PowerCommand Control Ventura

Participant's Information

J5 is the Engine Interface connector. It is blue and keyed differently than the gray J5 connector on the original PowerCommand Control. This was done to help prevent the possibility of installing a PowerCommand Control Ventura on a standard PowerCommand genset and from installing a standard PowerCommand Control on a DFH Series genset.

The only difference between the two Engine Interface Boards, besides the part number, is the J5 connector.

The Governor Output Module has the most significant changes, which were required to allow the PowerCommand Control to drive the two fuel pumps.

Your Notes

DFH Hardware Attributes

Power Generation

Engine

Fuel Pump

Footprint

Control

OH4v-12 S&TT 02/2003

Slide 4v-12 DFH Series Gensets

Participant's Information

Engine

- Cummins QST30, 30 litre, 12 cylinder, 140mm Bore.

Fuel Pump

- 2, Bosch, electronic

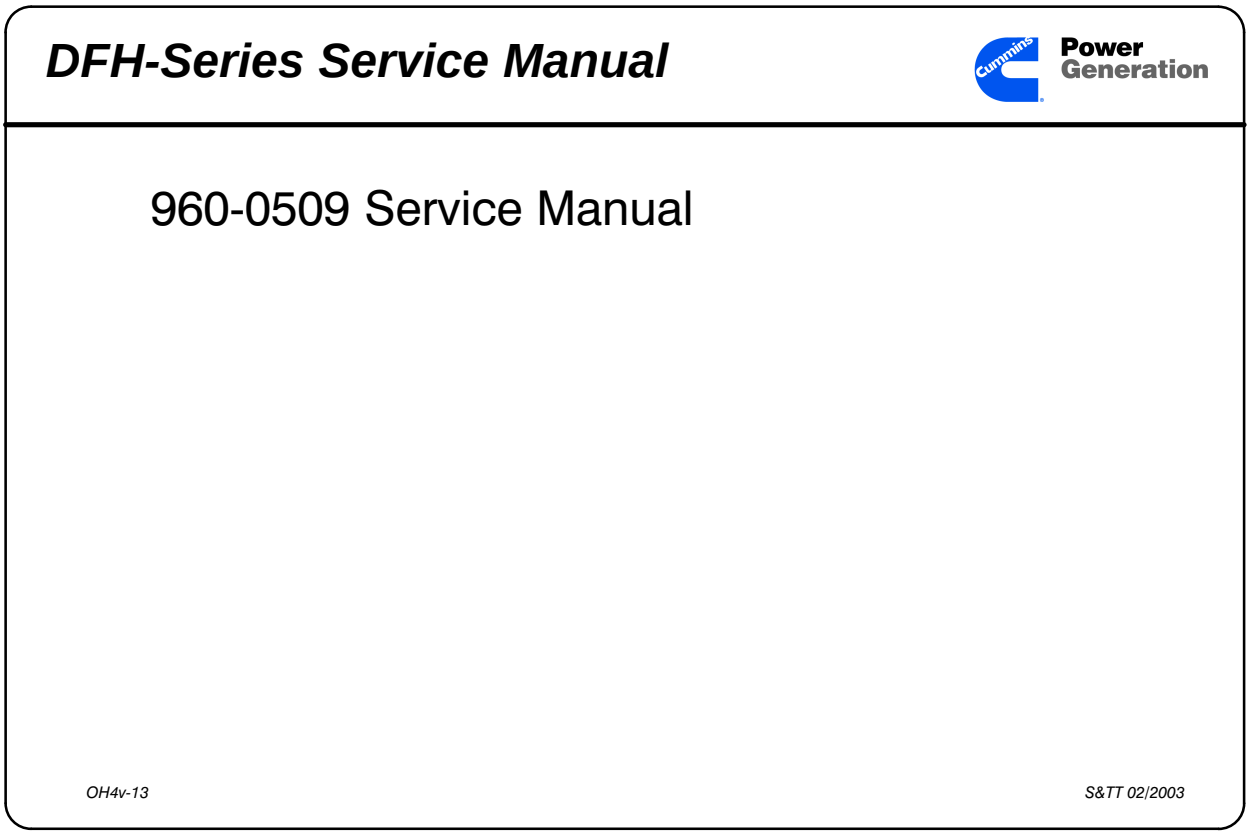
Footprint

- narrow skid base

Control

- PowerCommand Control Ventura

Your Notes



Slide 4v-13 DFH Series Service Manual

Participant's Information

The PowerCommand Control for DFH series gensets is unique as is the base engine, therefore it is imperative, when servicing a DFH series genset that the appropriate service manual be available and used.

Your Notes

Activity 4v-1: PCCv Quiz

Fill in the blanks.

1. The Governor Drive signal is a solitary signal until it reaches the _____ and becomes _____ signals.

2. A Rack Position fault is indicated on the PCCv display. It is determined that only the right bank voltage is out of tolerance with the display. The possible problems, according to the troubleshooting procedure, are _____ or _____.

3. Referring back to question two – explain why the two possible problems are obvious even without the troubleshooting procedure. (Hint: see question 1.).
   _____
   _____
   _____

4. A Rack Position fault is indicated on the PCCv display. It is determined that both the right and left bank voltages are out of tolerance with the display.
   The possible problems, according to the troubleshooting procedure, are _____, _____, or _____.

5. Neither A38–DS5 (left position fault) or A38–DS6 (right position fault) LEDs is lit, yet a Rack Position fault persists.
   The _____, _____ or _____ could be causing the problem, according to the troubleshooting procedure.

6. The Governor Drive signal is derived by the _____ board from the _____ input.

7. The _____ procedure should be performed after replacement of the Governor Output Module or a fuel pump(s).

8. The engine torque adjustment provides a maximum additional ____ % engine horsepower to compensate for engine/electronic variation.

9. What fault appears if too many resistors are cut off of the Digital board during the Initial Start Setup procedure. _____

10. What fault appears if the model selection does not match the number of the resistor cut from the Digital Board during the Initial Start Setup procedure. _____

This page intentionally left blank

PowerCommand® Control 3100 Operation

This lesson introduces you to the sequence of operation of the PowerCommand Control. During this lesson you will color a print which can be used to help you remember the sequence of operation, and the inputs and outputs to be checked in Start and Run modes.

Objectives

After completing this lesson, you should be able to:

- List the main signals used by the PCC for operation cues.
- State two uses by the PCC for the Magnetic Pickup signal.
- State two uses by the PCC for the PMG signal.
- Select from a list, the eight signals that will wake-up the PCC when it is in the Standby mode.
- Describe the Inputs and Outputs for the Run-Off-Auto and Emergency Stop switches.
- Show where to check for specific operation signals during the Start and Run modes of operation.
- Describe the sequence of operation of the PCC and what signals are present at any point in the sequence.

Activity 5-1: Detector Control Sequence of Operation Quiz

Work as teams to complete this activity. Write the numbers 1 through 11 in the spaces provided in the order of operation of the Detector-12 genset control.

_____ Generator set continues to run until S12 is placed in OFF or REMOTE positions.

_____ A11 K7 energizes; A11 K2 and K3 energize.

_____ Generator reaches 80% of output voltage. AC voltage from TB21-21 to TB21-32 reaches 90 to 120 VAC. A11 K10 energizes for AC Start Disconnect

_____ A11 K3 sends Starter signal through A11 F1 to A11 TB1-8 and starter solenoid.

_____ A11 K14 N/C contacts open removing ground from A11 K3. Starter signal disappears from A11 TB1-8 and starter disengages.

_____ Governor actuator moves to full fuel position.

_____ A11 K2 sends Switched B+ signal through A11 F2 to A11 TB1-10 and Engine Terminal 26. (Governor and Fuel systems)

_____ S12 is placed in the RUN position

_____ Starter turns the flywheel. Flywheel moving past Mag Pickup creates signal for the Governor Control.

_____ When the Governor Control sees the Mag Pickup signal it sends a “full fuel position” signal to the governor actuator.

_____ Engine starts and reaches 350 RPM. DC Alternator produces 14 VDC and A11 K14 energizes (DC Start Disconnect).

Similarities to the Detector Control

Power Generation

Start the Engine

Switched B+ to T26

Use PMG as Secondary Start Disconnect

S12 Position

OH5-3 S&TT 10/00

Slide 5-1 Similarities to the Detector Control

Participant's Information

Start the engine when commanded by a local or remote start signal.

Provide Switched B+ when cranking or running to:.

- Fuel solenoid,
- DC Alternator, and
- Governor Module

Monitor PMG voltage (instead of main generator output voltage) as secondary method of start disconnect.

Local and Remote indication of S12 Position.

Your Notes

PCC 3100 Added Features

Power Generation

Mag Pickup Failure

Switched B+ only after rotation

Steady “Not-in-Auto” signal

Over/Under Voltage and Frequency

Overcurrent, Overload, Short Circuit.

CT Phasing – Reverse Power Fault

Display 4 Customer Faults

Run Genset in Idle

OH5-4 S&TT 10/00

Slide 5-2 PCC 3100 Added Features

Participant’s Information

Monitor Mag Pickup signal for use a Primary Start Disconnect signal and to see if the starter turned the flywheel. Compare the Mag Pickup frequency against the generator output frequency. If the relationship is not correct, the PCC will shut the set down on Mag Pickup Failure.

Not send the Switched B+ (Run) signal to the Fuel Solenoid until the Mag Pickup signal is received at the Digital board.

Display an LED on the front panel when S12 is not in the Auto position, and send a steady signal out as a “Not In Auto” signal to an annunciator.

Your Notes

Participant's Guide

Monitor Over and Under Voltage and Frequency conditions.

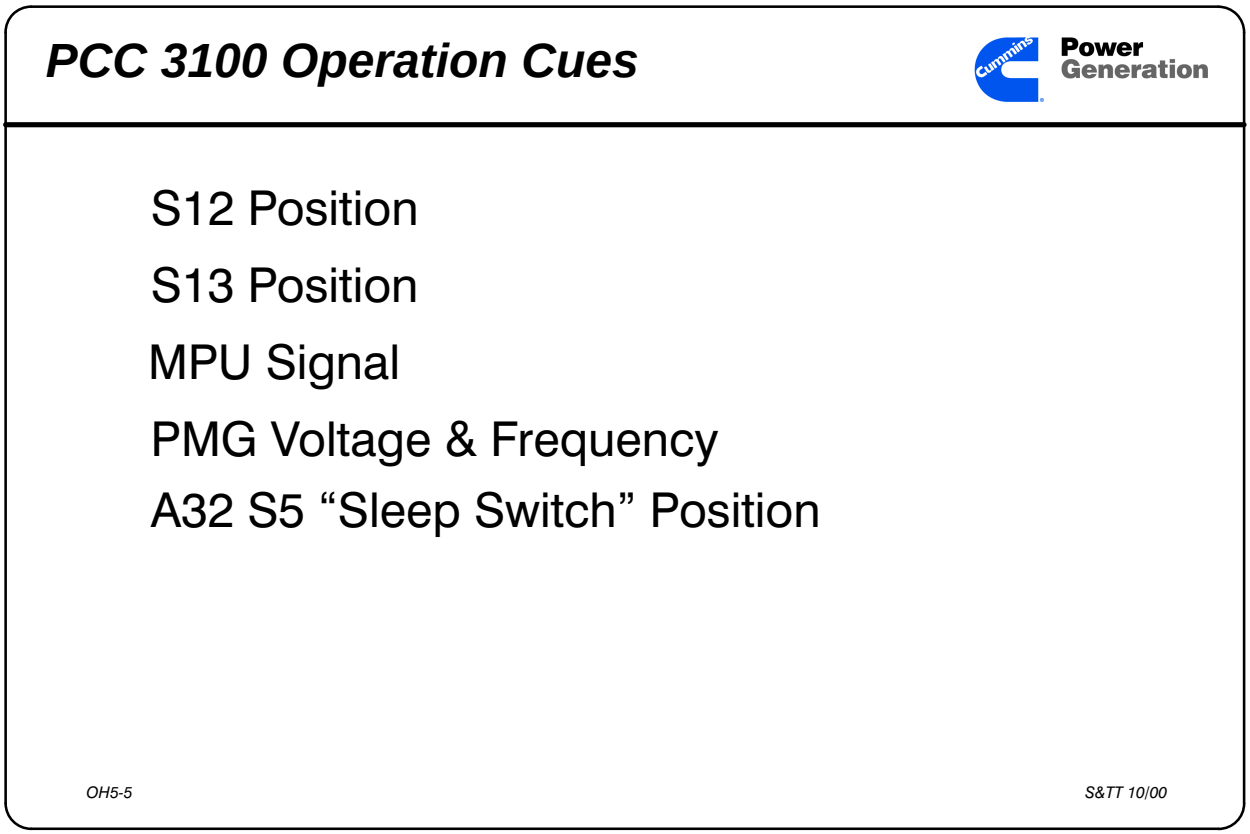
Monitor Overcurrent, Overload, and Short Circuit conditions.

Monitor phasing of CTs, and shut down on Reverse Power if one is connected in reverse.

Monitor and display four Customer-selected Warnings or Shutdowns.

Run the generator set in Idle mode with the regulator automatically disconnected.

Your Notes



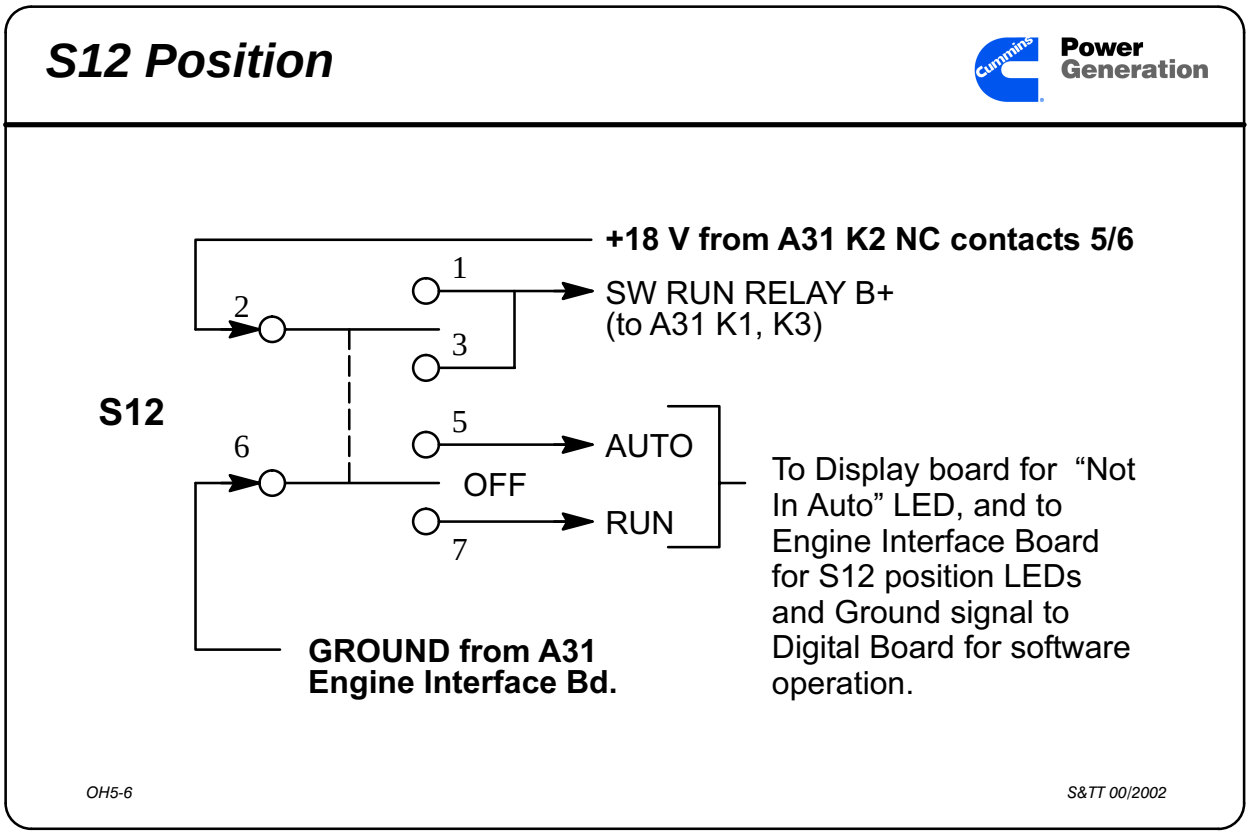
Slide 5-3 PCC 3100 Operation Cues

Participant’s Information

The PCC 3100 uses five specific signals for its operation cues:

- S12 (Run – Off – Auto switch) position
- S13 (Emergency Stop switch) position
- Magnetic Pickup input signal
- PMG output voltage & Frequency
- Digital Board S5 (Sleep / Awake switch) position

Your Notes



Slide 5-4 S12 Position

Participant's Information

This input tells the PCC what the generator set should be doing:

RUN – Manual operation

- Idle only available here.

OFF– Not Available for operation

- Cannot start or run

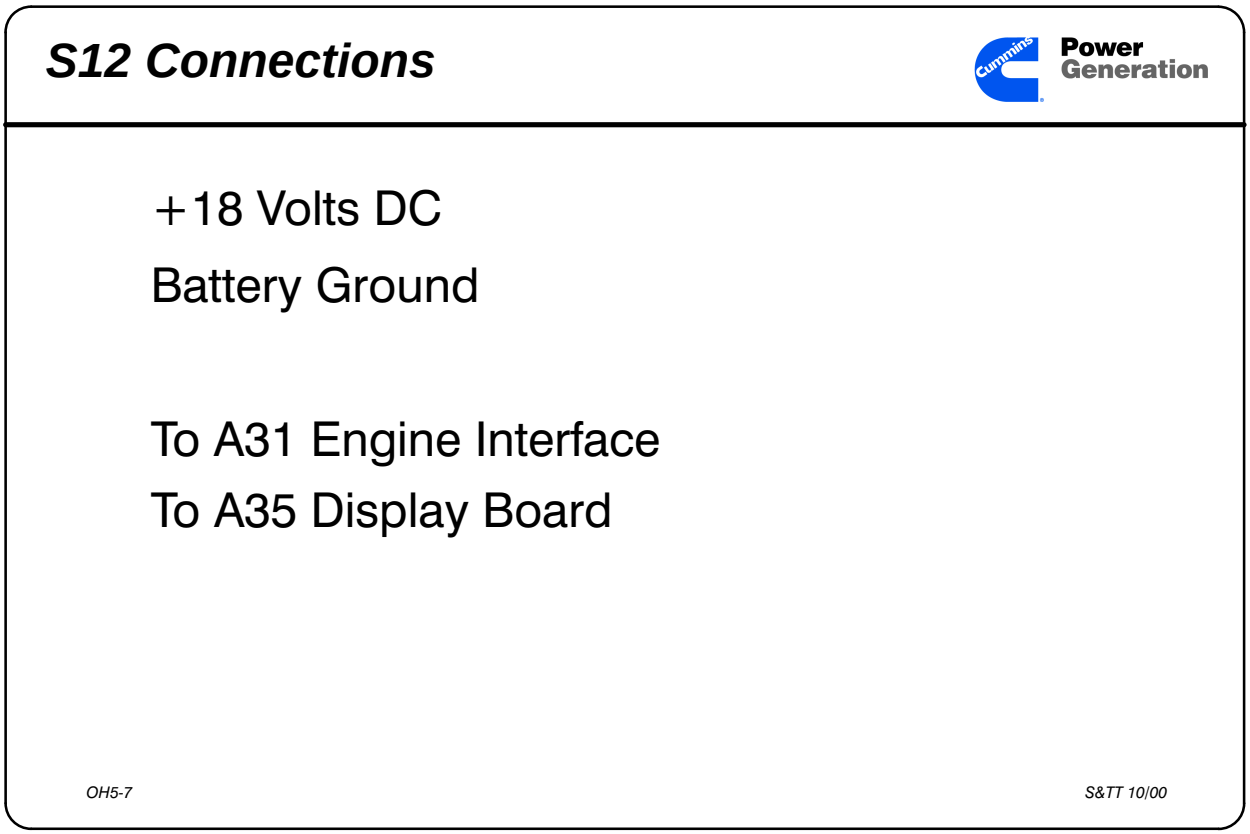
AUTO – Remote operation

- Runs on Remote Start input only

+18 V DC from EIB & A32 Power Supply

Ground from EIB

Your Notes



Slide 5-5 S12 Connections

Participant's Information

Battery Ground

The Ground signal comes to S12 from the A31 EIB and passes through S12 back to the A31 EIB and also goes to the A35 Display Board.

The Display Board uses the Ground signal in Run or Off positions of S12 to flash the Non- Automatic LED on the PCC front panel.

Battery ground connects through A31 J3-11 to S12-6. S12-6 has GND to signal S12 position

Your Notes

Participant's Guide

S12 in Auto position. S12-5 sends GND signal to A31 J3-13 which sends a ground signal to the A32 board through an isolation device.

S12 in Run position. S12-7 sends GND signal to A31 J3-12 which sends a ground signal to the A32 board through an isolation device, and also energizes A32 K1 and the +18 Volt DC power supply on the Digital Board.

+18 Volts DC

+18 VDC is produced by a power supply on the A32 Digital Board, then sent to the A31 Engine Interface Board and then to S12-2. S12-2 then has +18 VDC to energize relays on A31 board.

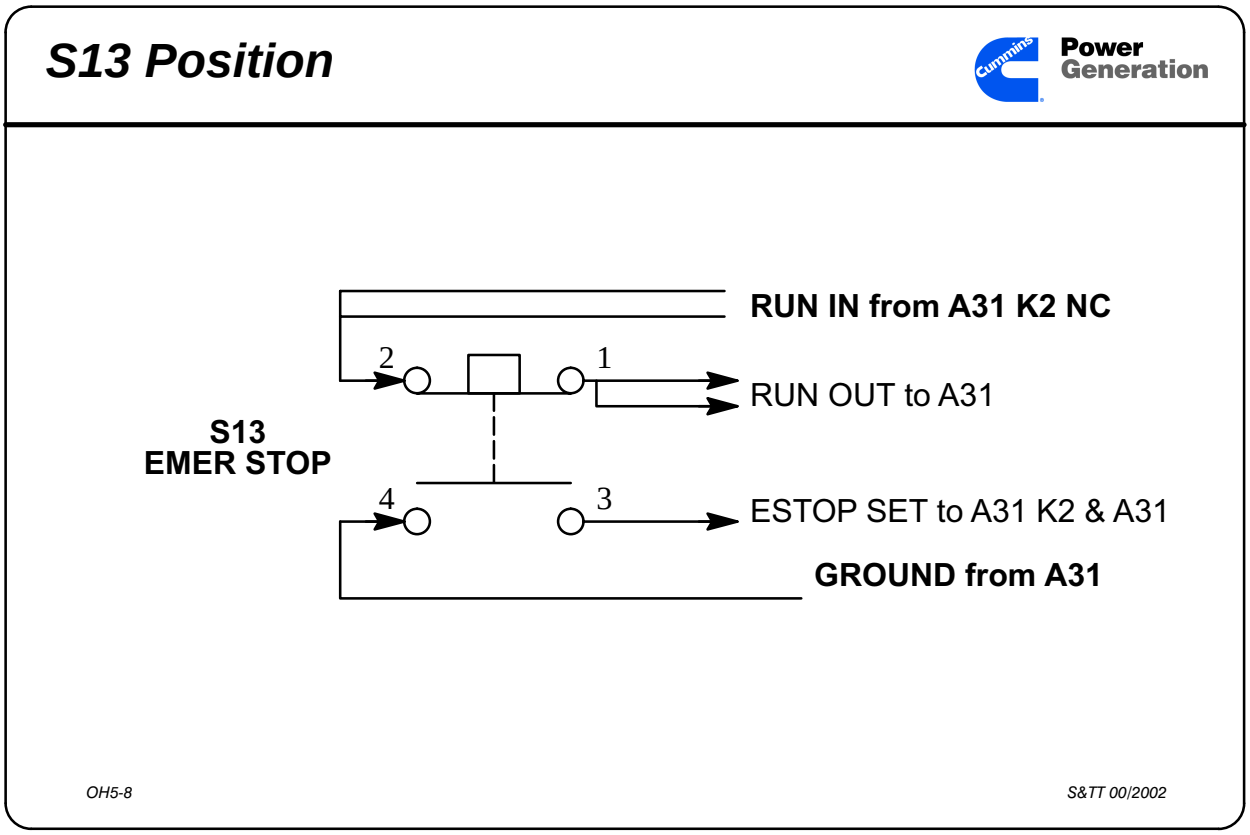
S12 in Auto or Run position

S12-2 connects to S12-1 or S12-3 and S12 sends +18 V signal to A31 J3-4. One side of A31 K1 and A31 K3 connect to A31 J3-4. A31 K1 and A31 K3 are then waiting for a ground input on their other coil pin.

The +18 Volt DC signal is connected to one side of both the Start (A31 K1) and Run (A31 K3) relays on the Engine Interface board.

This voltage comes from the regulated +18 Volt power supply on the Digital Board (A32). This power supply does not operate when the PCC is in the standby mode.

Your Notes



Slide 5-6 S13 Position

Participant's Information

This input tells the PCC if the generator set can crank and start, or if the generator set is locked out of operation.

When the Emergency Stop switch is in the out or RUN position, the Engine Interface Board has a Battery B+ input at the start and run relay NO contacts.

The Emergency Stop relay (A31 K2) is held in the de-energized position.

When the Emergency Stop switch is pushed in to the STOP position, the Battery B+ circuit to A31 K1 and A31 K3 NO contacts is opened.

Your Notes

Participant's Guide

The circuit to A31 K2 (emergency stop relay) is closed.

The A31 K2 relay NC contacts open the Battery B+ circuit to S13.

The A31 K2 relay cannot be reset unless:

- the E-Stop signal is removed,
- S12 placed in Off, and
- the reset switch is pressed on the front panel.

In the "Run" position, S13 provides a Battery B+ signal to the A31 K1 Start relay contacts and the A31 K3 Run relay contacts.

In the "Emergency Stop" position, S13 provides a Ground signal to the A31 K2 Estop relay and also to the Digital Board.

S13 in RUN position

- S13-2 receives Battery B+ from A31 J3-2 & -3 (RUN IN) S13-2 connects to S13-1 and sends Battery B+ to A31 J3-6 & -7 (RUN OUT) to A31 for A31 K1 Start relay signal and A31 K3 Run relay signal
- S13-4 and S13-3 NO contacts are open and there is no Ground signal to A31 K2 (E-Stop Relay).

Your Notes

Participant's Guide

S13 in FAULT position

- S13-4 and S13-3 NO contacts close applying Ground from A31 J3-10 to A31 J3-5 (switched side of A31 K2).
- A31 K2 energizes removing Battery B+ signal from S13 Run Out In and Run Out contacts.
- Battery B+ signal is removed from A31 J3-6 and -7 which opens the circuit path for the Start and Run circuits.
- S13-2 and -3 contacts open when S13 is pushed in.
- This also opens the circuit path for the Start and Run contacts on the A31 board.

Your Notes

MPU Signal Uses

Power Generation

Signals Crankshaft Rotation

Fail to Crank Fault

Primary Starter Disconnect

Speed Regulation

Related to Output Frequency

MPU Fault

OH5-9 S&TT 10/00

Slide 5-7 MPU Signal Uses

Participant's Information

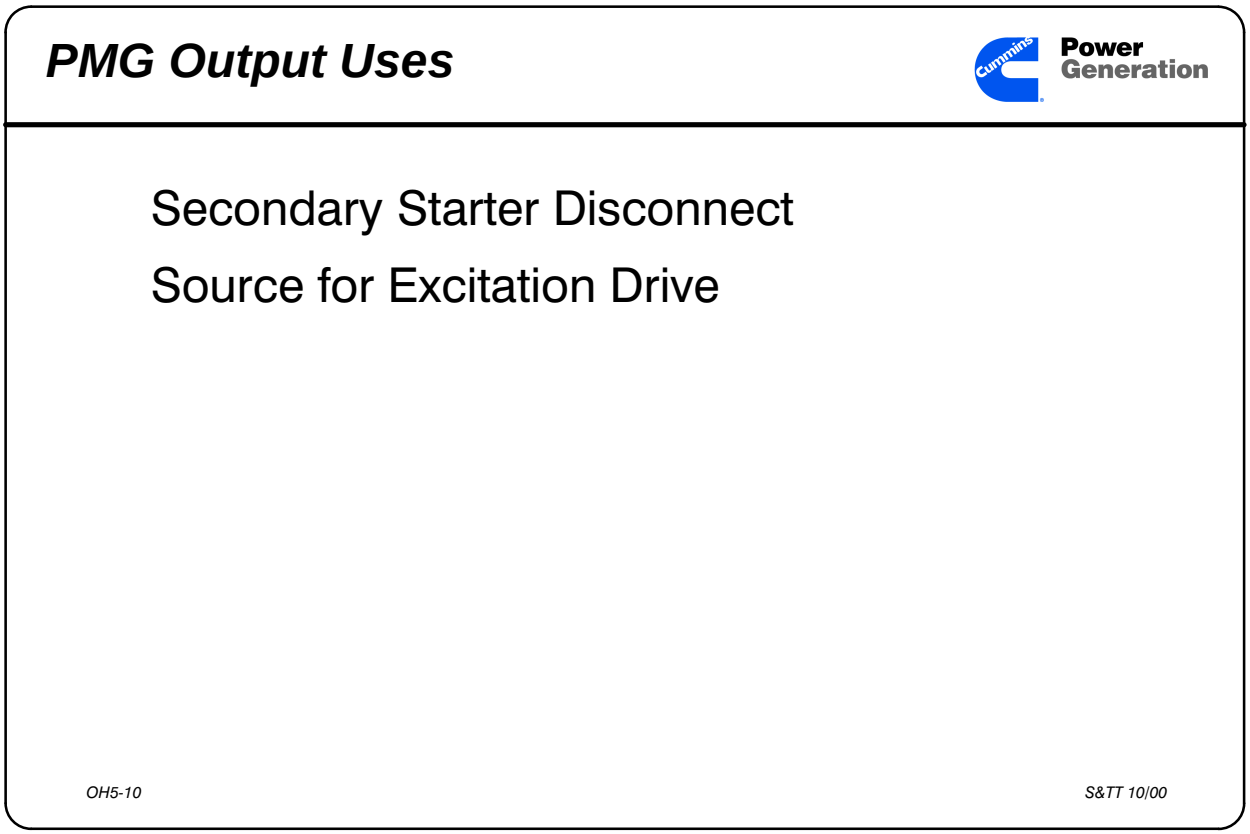
This input signal tells the PCC if the flywheel is turning.

When the START signal is sent to the generator set, the PCC waits for the MPU input before energizing the A31 K3 (RUN) relay.

The MPU input signal is also used by the PCC as:

- the primary starter disconnect signal,
- the signal to start ramping from start disconnect speed to running speed,
- the Idle and running speed regulation signal,
- Magnetic Pickup Fault or Fail to Crank Fault input.

Your Notes



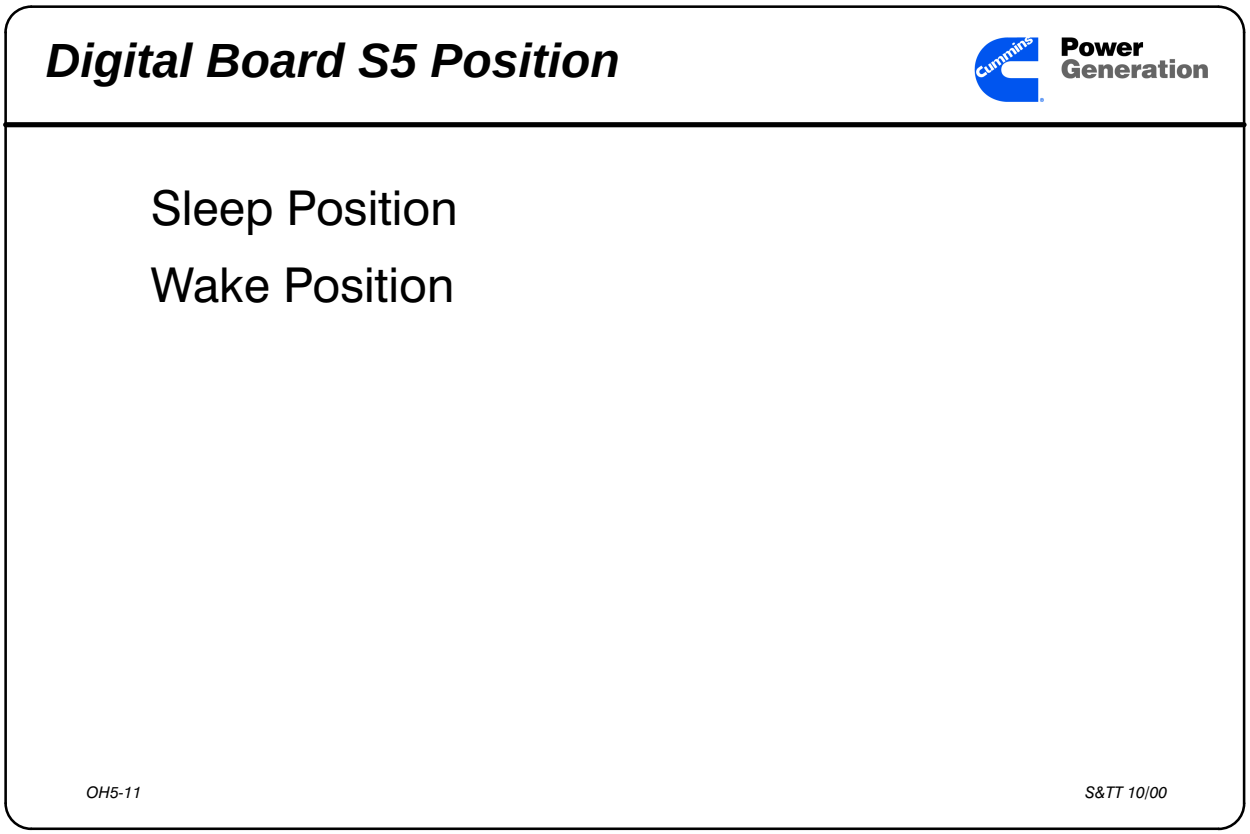
Slide 5-8 PMG Output Uses

Participant's Information

This three-phase signal is used in the Regulator Output Stage to:

- open a set of contacts that act as the AC (backup) Starter Disconnect circuit. This happens when the genset is running at 850 rpm (105 VAC rms output from the PMG).
- develop the pulsating DC excitation voltage.

Your Notes



Slide 5-9 Digital Board S5 Position

Participant's Information

This input tells the PCC what mode the power supplies should be operating in, and what signals to look for.

In the "SLEEP" mode, the PCC will display all wake-up warnings and Shutdowns, and will not return to sleep when the input is removed. The RESET button must be pressed for the PCC to reset. The PCC will start the genset with a remote start input from a transfer switch if S12 is in the Auto position.

With S5 in its right-hand position, the PCC is in the *STANDBY* (SLEEP) mode. The processor is off and the PCC draws 0.05 amps of current from the battery.

Your Notes

Participant's Guide

Only the Panel Lamps Power Supply is running. The PCC will only respond to these eight "Wake–up" signals:

Engine Wakeups

- Low Engine Temperature Switch
- Low Coolant Level Switch
- Low Fuel Level (2 inputs)
- Customer Faults 2 and 3

Control Wakeups

- Remote Start (S12 in AUTO)
- RUN position of S12
- Self Test Switch
- Emergency Stop Switch

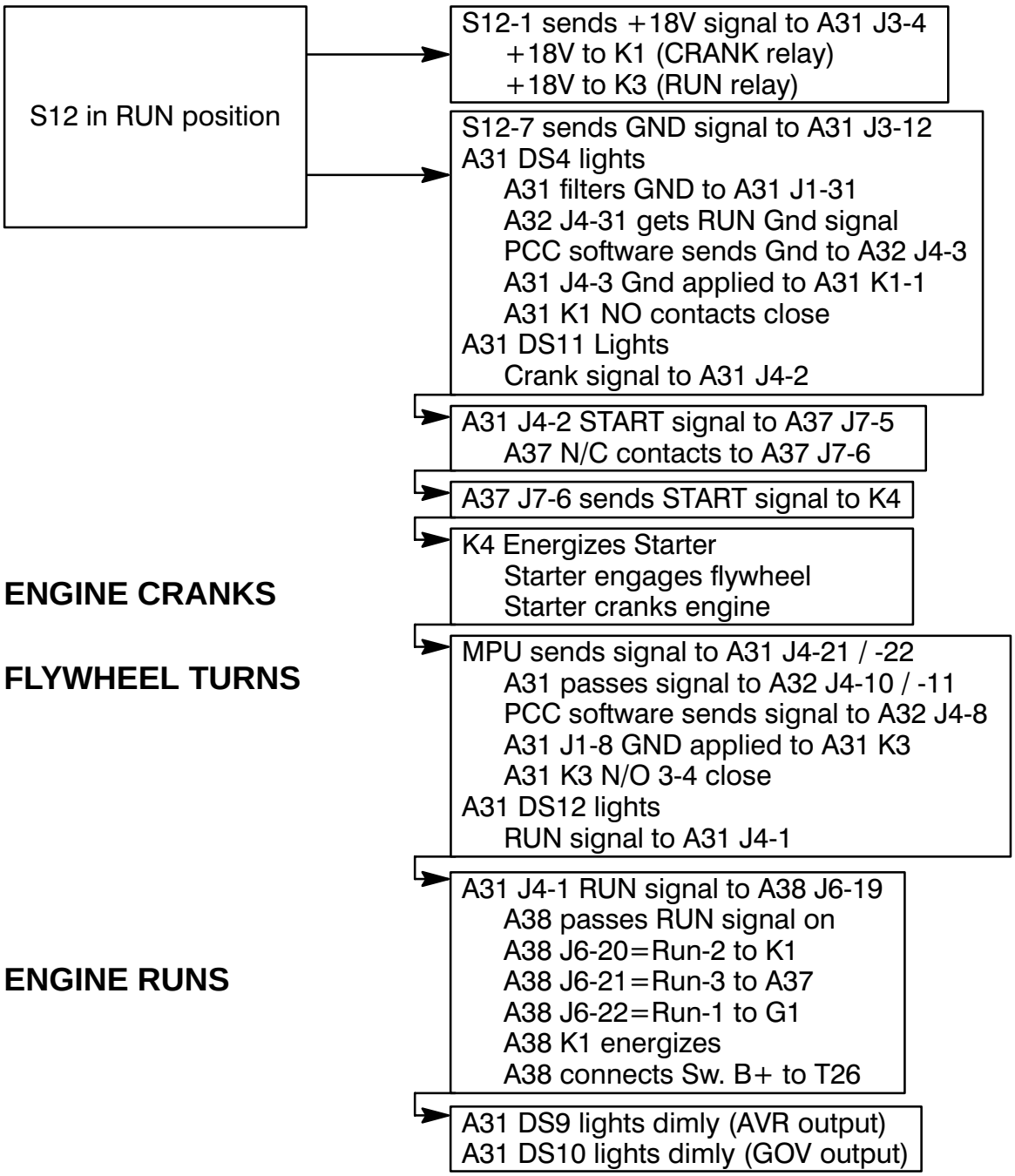
With S5 in its left-hand position, the PCC is in the *SERVICE* (AWAKE) mode. The processor is operating, the power supplies are all running and the PCC draws 0.5 amps of current from the battery. The PCC will respond to ALL input signals and the LED Display Panel will show the proper response to the signal.

When the PCC is in the Service mode, the LED Display Panel will be lit at all times. This may be reassuring for some customers who want some indication from the genset that the control is working and the battery is connected.

The panel lamps can be turned on in either standby or service mode. The panel lamps draw approximately 0.5 amps of current from the battery.

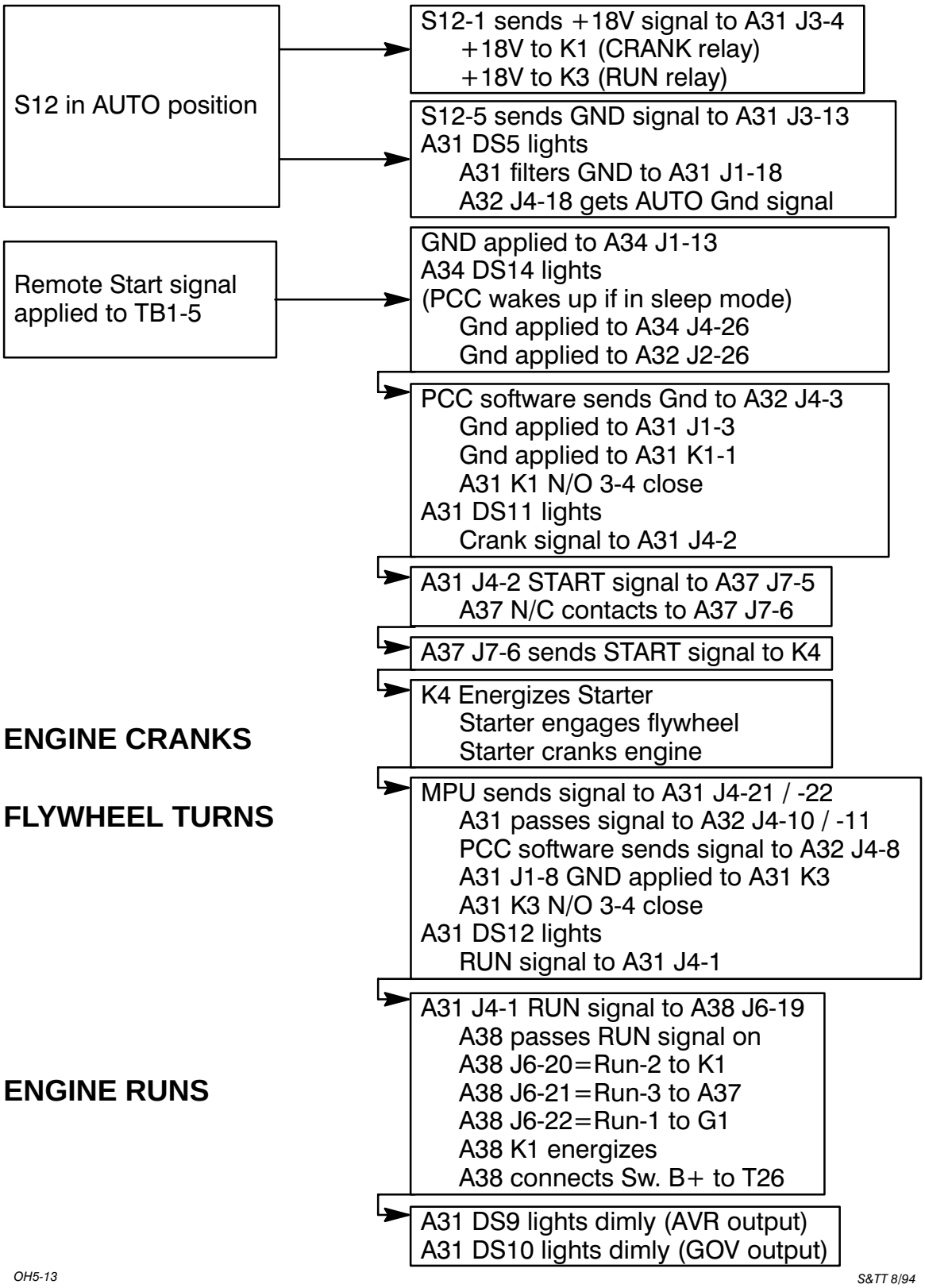
Your Notes

MANUAL RUN SEQUENCE



OH5-12 *S&TT 8/94*

REMOTE RUN SEQUENCE



OH5-13 *S&TT 8/94*

STARTER DISCONNECT SEQUENCE

ENGINE CRANKS

MPU sends signal to A31 J4-21 / -22
- A31 passes signal to A32 J4-10 / -11
- PCC software sends signal to A32 J4-8
- A31 J1-8 GND applied to A31 K3
- A31 K3 N/O 3-4 close

A31 DS12 lights

→ A31 K3 N/O 3-4 = RUN signal to A31 J4-1

→ A31 J4-1 RUN signal to A38 J6-19
- A38 passes RUN signal on
- A38 J6-20 = Run-2 to K1
- A38 J6-21 = Run-3 to A37
- A38 J6-22 = Run-1 to G1
- A38 K1 energizes
- A38 passes Sw. B+ to T26.

ENGINE RUNS

MPU (PRIMARY) START DISCONNECT

→ MPU signal to A31 J4-21 / -22 and
- A31 passes signal to A32 J4-10 / -11
- Frequency increases to 475 RPM
- PCC software removes GND from A32 J4-3

→ GND removed from A32 J4-3
- Removes GND from A31 J1-3
- GND removed from A31 K1
- A31 K1 N/O 3-4 open

A31 DS11 goes out
- START signal removed from K4

AC (BACKUP) START DISCONNECT

PMG signal to A37 J10 -1 / -4 / -5 increases
- to 105 VAC RMS (850 rpm)

A37 start disconnect relay energizes
A37 J7-5-J7-6 N/C contacts open
START signal removed from K4

Activity 5-2: PCC 3100 Operation Quiz

Take approximately five minutes to answer the following questions.

1. *What are the main signals used as operation cues by the PCC 3100?*

_____

_____

_____

_____

_____

2. *What are two uses of the MPU signal in the PCC 3100?*

_____

_____

3. *What are two uses of the PMG output by the PCC 3100?*

_____

_____

4. *Select the signals which will "wake up" the PCC 3100 when it is in the automatic mode of operation.*

- ❑ Low Coolant Temperature
- ❑ Low Fuel Level (local or remote)
- ❑ Customer Faults 1 & 2
- ❑ Moving S12 to Run position
- ❑ Self Test switch
- ❑ Emergency Stop switch
- ❑ Customer Faults 2 & 3
- ❑ Low Coolant Level
- ❑ High battery Voltage
- ❑ Remote start when S12 is in Auto position

5. *When S12 is in the Run or Auto position, what signal is sent to the relays on the Engine Interface Board?*

_____

6. *Why does the Red LED on the front panel flash when S12 is in the Run or Off position?*

_____

7. *When S13 is in the Run position, what circuit is open?*

_____

8. *When S13 is in the ESTOP position, what circuit is open?*

_____

This page intentionally left blank

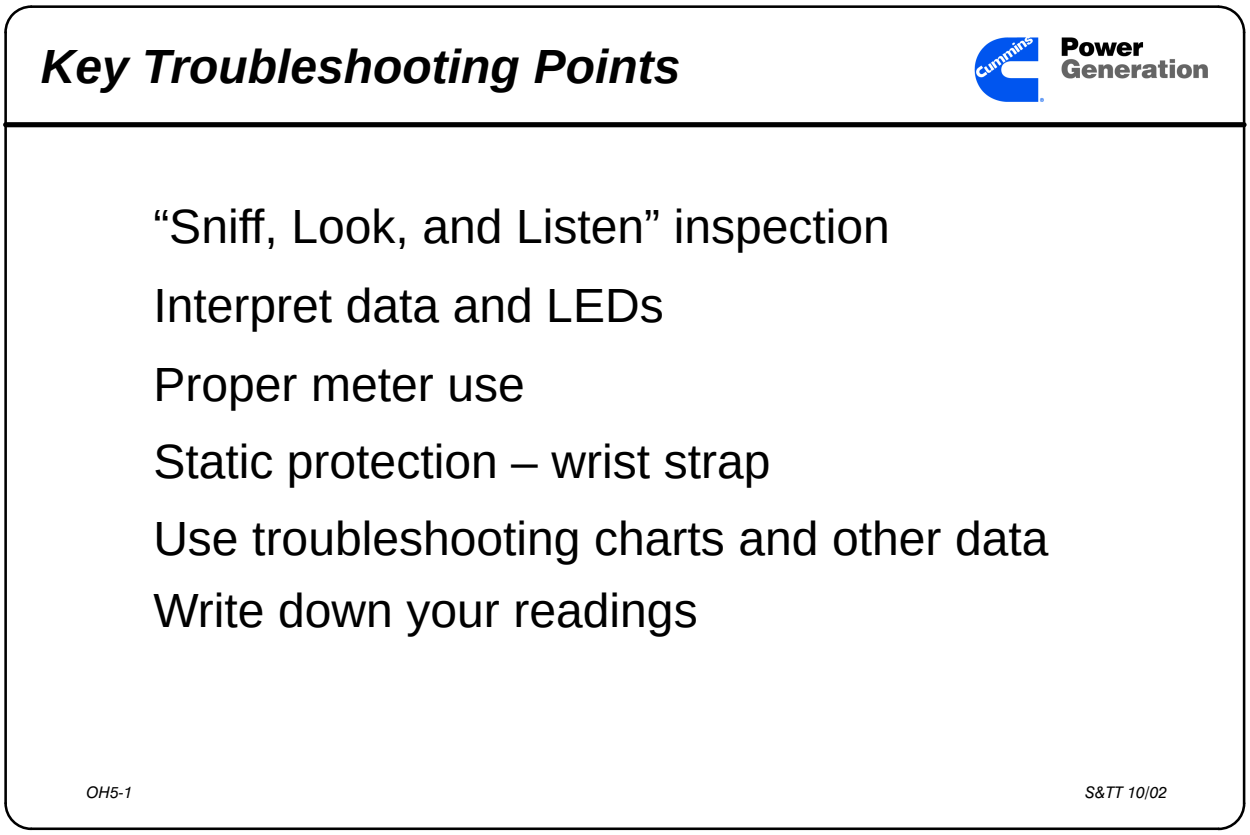
Troubleshooting the PowerCommand® Control 3100.

This lesson presents an introduction to the troubleshooting procedures and tools used with the PowerCommand® Control.

Objectives

After completing this lesson, you should be able to:

- Locate the troubleshooting information in the Service Manual.
- Locate and follow the procedures for installing the PCC 3100 harness tool.
- Locate and follow the procedures for installing the PCC 3100 sensor tool.
- Locate and identify the LEDs on the circuit boards inside the PCC 3100 and those on the modules inside the Accessory Box.
- Use the troubleshooting table “Indications”column and a failed PCC 3100 to determine the most logical testing process for a generator set.



Slide 6-1 Key Troubleshooting Points

Participant's Information

- Smell the area, you will be able to find overheated items easily.
- A good visual inspection of the equipment is a key service point – see what looks bad.
- Listen to the \equipment as it operates. Does it sound like the last one you worked on?
- Look at the LEDs on the Switch panel and in the Control Box.
- Look at the graphical display on the Operator panel.
- Write down what you see before you change the indications.

Your Notes

Participant's Guide

In troubleshooting you will need to read and interpret wiring diagrams. It helps to have your wiring diagrams pre-marked with some of the data you will need in troubleshooting the OTPC transfer switch, especially expected voltages.

Use the troubleshooting charts and other troubleshooting data you receive in school and from other technicians. Some of the troubleshooting tips you receive in the field are worth more than anything you will get in school.

Write down what you see, hear, and measure. When you start taking the same measurement for the third or fourth time – you know you're stuck. Call someone and talk over what you wrote down. It helps!

Your Notes

Troubleshooting Tools

PowerCommand® Control Tool Kit

True RMS meter

Digital Camera

OH5-2 S&TT 10/02

Slide 6-2 Troubleshooting tools

Participant's Information

The PowerCommand® Tool Kit (3824746) works on one of the main connectors in the OTPC.

- The 34-pin connector between the Digital Module and the Power Module works with the breakout tool in the PowerCommand Tool Kit – use it.

True RMS measuring meter indicates true voltage and current with a non-linear load.

Digital Camera to send pictures back for ASTC or Warranty claims.

Your Notes

How is troubleshooting the PCC 3100 the same as troubleshooting other Genset Controls?

- The technician still has to interpret the data given by the customer, operator, and the control.
- The technician still uses a good meter to test voltages, currents, and resistances.
- The technician still uses wiring diagrams to determine if everything is connected properly.

How is troubleshooting the PCC 3100 different than troubleshooting other Genset Controls?

- The technician can be a cause of more damage to the control than the original problem due to static electricity.
- The technician is generally looking for ground signals.
- The technician cannot check for voltage or ground on connections without the PowerCommand® Control Tool Kit.
- The technician cannot ground out the HET and LOP senders to simulate a warning or shutdown. A special tool is needed to check the circuitry of engine sensors.
- The technician cannot just remove A11 F1 to check overcrank problems.
- The technician cannot check the voltage or ground on connections without a special harness tool.
- The technician has to deduce the proper troubleshooting procedure from the front panel LED Display and the LEDs on circuit boards and modules.

Troubleshooting tables in the PCC 3100 Service Manual

There are several different troubleshooting aids and tables in the PCC Service Manual

Section 3 has diagrams of all circuit boards and modules showing the connectors and LEDs present, and listing what the connectors are used for, and what the LEDs indicate when they are lit.

“Operator-Level” troubleshooting which gives an explanation of what could cause a particular problem (pages 4-4 through 4-9).

“Technician-Level” troubleshooting which gives the test points, voltages, resistances, etc. for the technician to isolate the problem to a specific circuit board, module, or wiring harness section (pages 4-11 through 4-39).

These are also supplemented with several one-page charts which will assist the technician in troubleshooting a problem with a PCC-equipped genset.

A listing of fault codes and troubleshooting information locations (page 4-3).

A listing of Low Oil Pressure warning and shutdown limits for normal and idle operation (page 4-10).

Page 2-5 shows the Main Menu and what is available from this menu display.

Remember, just because you have a certain shutdown does not mean that the engine or generator information is not available for troubleshooting. The PCC has an RMS-type metering system built in which can display many different voltages, currents, and pressures to assist you in its troubleshooting.

Section 8 has many different prints that might help you in troubleshooting some problems. Remember, the PCC does the same things as the Detector Control, just differently in some cases.

Do not forget the Operational Schematic diagram in the Operation lesson. It might be one of the best troubleshooting aids in some specific cases.

Activity 6-1: Troubleshooting PCC demonstrators

Using the Service Manual (960-0507) solve the problems on as many demonstrator units as you can. The instructor will be able to change the problems on the demonstrator units as the troubleshooting continues.

Problem #1

What is the problem on this unit?

_____

On what page of the Service Manual did you find an explanation of what could cause this problem?

_____

On what page of the Service Manual did you find a procedure for troubleshooting this problem?

_____

What did you check to solve the problem?

_____

_____

_____

_____

What diagrams did you use to help determine how to troubleshoot the problem if there was no procedure in the Service Manual?

_____

Problem #2

What is the problem on this unit?

_____

On what page of the Service Manual did you find an explanation of what could cause this problem?

_____

On what page of the Service Manual did you find a procedure for troubleshooting this problem?

_____

What did you check to solve the problem?

_____

_____

_____

_____

What diagrams did you use to help determine how to troubleshoot the problem if there was no procedure in the Service Manual?

_____

Problem #3

What is the problem on this unit?

_____

On what page of the Service Manual did you find an explanation of what could cause this problem?

_____

On what page of the Service Manual did you find a procedure for troubleshooting this problem?

_____

What did you check to solve the problem?

_____

_____

_____

_____

What diagrams did you use to help determine how to troubleshoot the problem if there was no procedure in the Service Manual?

_____

Problem #4

What is the problem on this unit?

_____

On what page of the Service Manual did you find an explanation of what could cause this problem?

_____

On what page of the Service Manual did you find a procedure for troubleshooting this problem?

_____

What did you check to solve the problem?

_____

_____

_____

_____

What diagrams did you use to help determine how to troubleshoot the problem if there was no procedure in the Service Manual?

_____

Problem #5

What is the problem on this unit?

_____

On what page of the Service Manual did you find an explanation of what could cause this problem?

_____

On what page of the Service Manual did you find a procedure for troubleshooting this problem?

_____

What did you check to solve the problem?

_____

_____

_____

_____

What diagrams did you use to help determine how to troubleshoot the problem if there was no procedure in the Service Manual?

_____

Problem #6

What is the problem on this unit?

_____

On what page of the Service Manual did you find an explanation of what could cause this problem?

_____

On what page of the Service Manual did you find a procedure for troubleshooting this problem?

_____

What did you check to solve the problem?

_____

_____

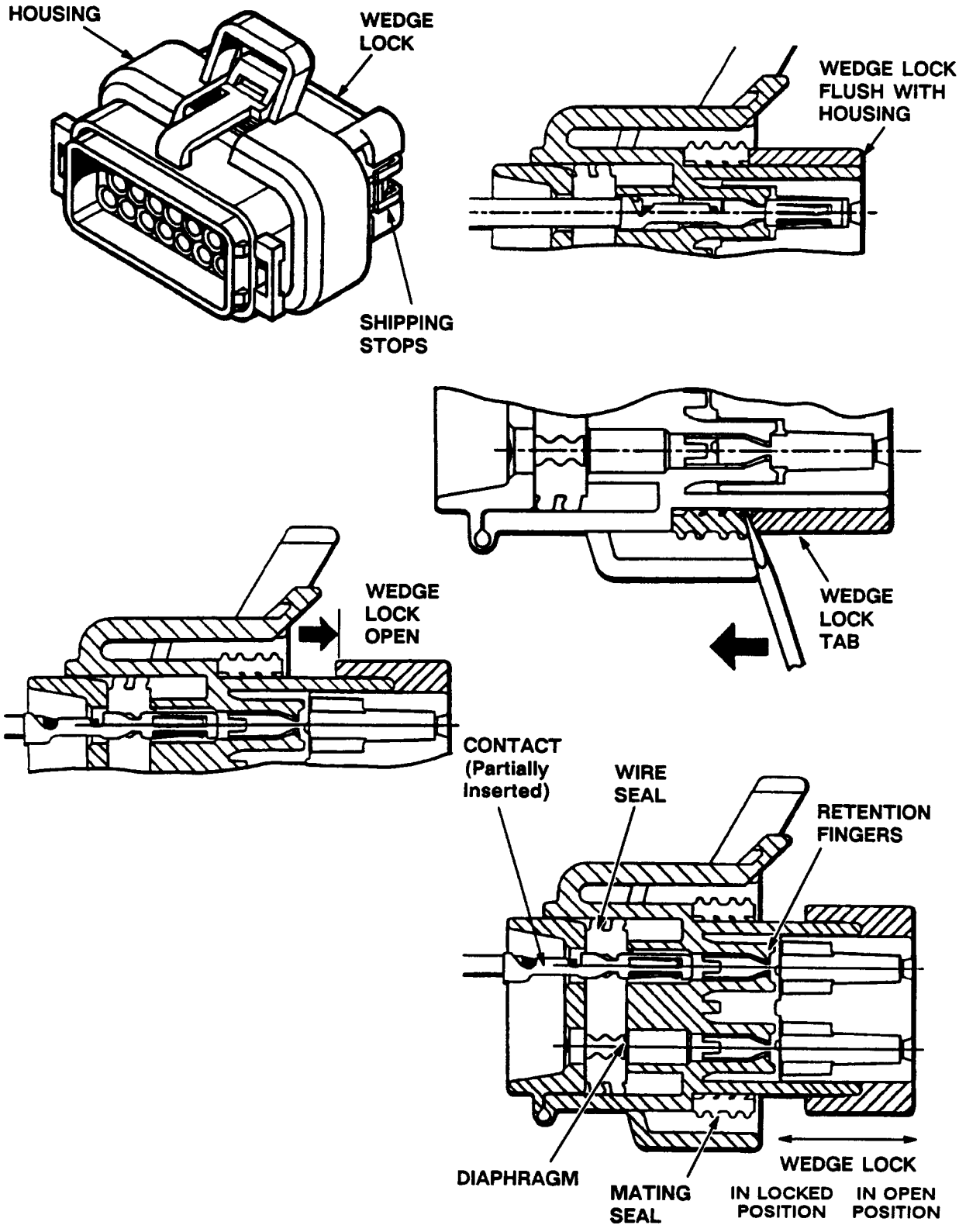
_____

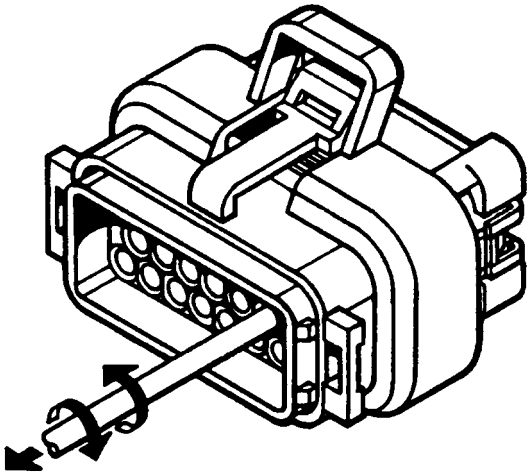
_____

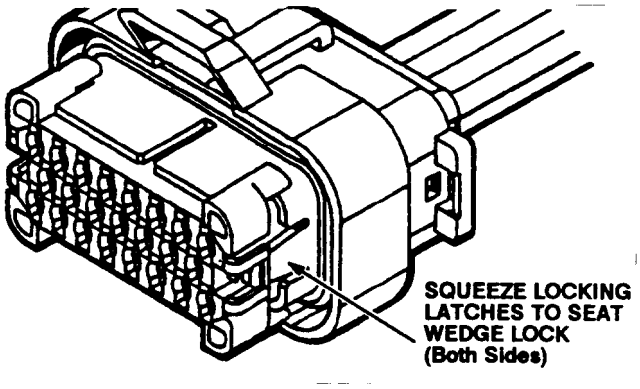
What diagrams did you use to help determine how to troubleshoot the problem if there was no procedure in the Service Manual?

_____

Repairing PowerCommand™ Control Engine Harnesses






SQUEEZE LOCKING
LATCHES TO SEAT
WEDGE LOCK
(Both Sides)

Installing the PowerCommand® Control

This lesson presents an introduction to the new Installation Manual which covers the 200-1500 kW generator sets produced after August 5, 1994. This manual covers the installation of generator sets with detector controls as well as those with PCCs.

Objectives

After completing this lesson, you should be able to:

- Locate the sections in the Installation Manual as needed.
- Locate the generator testing procedures for a medium voltage generator set.
- Install optional relay kits for PCC 3100-equipped generator sets.
- Locate and identify the terminals used on TB1 in the Accessory Box that used with an OTIII transfer switch.
- Modify an OTIII transfer switch for operation with a PowerCommand® Control 3100.

How is this Installation Manual different from the older Installation Manuals for the 200-1500 kW Integrated Generator Sets?

The older installation manuals covered only one generator set family. The 960-0615 Installation Manual covers all 175 kw (50 Hz) to 1500 kW (60 Hz) generator sets with the standard PowerCommand™ Controls as well as the optional Detector series of controls.

Participant's Guide

Table of Contents

Section 1: Introduction

- Overview of the different sections in the manual.

Section 2: Specifications

- Capacities and connection sizes for 175 kW (50 Hz) to 1500 kW (60 Hz) gensets.

Section 3: Mounting the Generator Set

- Mounting hardware requirements, vibration isolators, alignment of generator to engine.

Section 4: Mechanical Connections

- Connecting the fuel, exhaust, ventilation, and cooling systems of the generator set.

Section 5: DC Control Wiring for PowerCommand® Controls

- Customer connections and optional relays.

Section 6: DC Control Wiring for Detector Controls

- Customer connections and optional relays.

Your Notes

Participant's Guide

Section 7: AC Electrical Connections

- Megger and PI testing of generator windings, grounding the generator set, load connections and balancing, heaters, fuel transfer pump.

Section 8: Prestart Preparations for PowerCommand® Controls

- Ventilation, exhaust, electrical, fuel, lubrication system, and PCC configuration checks before starting the set.

Section 9: Prestart Preparations for Detector Controls

- Ventilation, exhaust, electrical, fuel, lubrication system checks before starting the set.
- Installation Checklist
- Wiring Diagrams

Your Notes

Activity 7-1: Introduction to the PCC 3100-Equipped genset Installation Manual

Using the Installation Manual (960-0615) answer the following questions:

Specifications

1. What is the maximum fuel lift of a 400DFEB generator set?

   _____

2. What is the oil capacity of a 900DFJC?

   _____

Mounting the Generator Set

3. What size mounting bolts should be used when installing DF-series generator sets?

   _____

4. What is the maximum height difference between vibration isolator bases allowed?

   _____

5. What kind of misalignment error is usually caused by a shimming error?

   _____

6. What kind of misalignment will cause the most vibration?

   _____

Mechanical Connections

7. What kind of fuel lines may be used on these generator sets?

_____

8. How many hours capacity should the day tank contain?

_____

9. Inlet damper area should have what relationship to the radiator area?

_____

DC Control Wiring (PCC)

10. What kind of wire can be used to connect a transfer switch 1250 feet from a generator set with a PCC?

_____

11. In the larger generator sets, the TB1 terminals run which direction?

_____

DC Control Wiring (Detector Control)

12. What kind of wire can be used to connect a transfer switch 1250 feet from a generator set with a Detector-12 Control?

_____

13. When W8 is in position A, a Low Coolant Level switch input is attached to A11 TB2-1 and the level is low, what indication would the operator see when the set is not running?

_____

AC Electrical Connections

14. What is the lowest voltage generator set that requires a polarization index (PI) check at the time of installation?

_____

15. How long should you leave a grounding cluster connected to discharge any static charge on a generator set?

_____

16. What voltage megger is used to perform a PI test on the main stator of a 13,800 VAC generator set?

_____

Prestart Preparation (PCC Control)

17. With the genset running you adjust the RPM to 1860. Immediately after this you shut the set off. When the PCC is restarted, what will the RPM be?

_____

Wiring Diagrams

18. Where would you connect a jumper to have the Rupture Basin input operate the Customer Fault #3 input?

_____

19. Where does the TB2 jumper connect when using an OTIII transfer switch with a PCC?

_____

20. Where does the TB2 jumper connect when using an OTIII transfer switch with a Detector Control?

_____

Accessory Box

The accessory box is located on the front of the generator output box, toward the engine. This box is made of a front panel and two “L-shaped” pieces of metal that form the body of the box. This box contains the customer connection terminals for the generator set, the Governor Output Module, PT/CT Module, and the Regulator Output Module. There is space inside the box for the installation of optional relays for customer use.

Analog Board (A33)

This board is located in front of the digital board. The Analog board sends 5 Volt DC signals to all pressure and temperature sensors on the engine through the engine interface board. The signals also return through the engine interface board and the analog board passes them to the digital board.

All cables are soldered to the analog board and it is the only circuit board without LEDs.

The Analog board scales all analog inputs to a 0—5 Volt range for the digital board.

Customer Interface Board (A34)

This board is located on the right side of the PCC cabinet. Customer input and output signals pass through this board and the customer connection terminals in the Accessory Box.

Relays on this board latch when signals are sent to the hard-wired annunciator to keep the annunciator LEDs lit.

Digital Board (A32)

This circuit board is located at the back of the PCC control box. It contains the microprocessor that operates the PowerCommand™ Control, several types of memory chips, and an RS232 port for connecting factory service software.

The digital board also contains the “sleep/awake” switch A32 S5 which selects whether the power supplies and microprocessor are running or in standby mode of operation while the generator set is not running. When the PCC microprocessor is operating DS5 on the digital board flashes once per second.

Digital Display Board (A35)

This board is located on the inside of the PCC door. It contains the LED Display Panel, the Panel Lamps, Warning, Shutdown, the Upper/Lower Scale LEDs and a circuit to sense the position of the S12 switch and, if necessary, light the Non-Automatic LED.

The digital board performs the actual analog-to-digital conversions on the scaled inputs from the analog board.

There are three versions of the digital display board for the Standard PCC, Paralleling applications, and Automatic Mains Failure (AMF) applications.

Engine Interface Board (A31)

This circuit board is located on the left side of the PCC control box. All engine pressure, temperature, and level signals come into the Engine Interface Board. Signals to operate the engine governor and voltage regulator output modules also pass through this board.

There are two fuses on this board, (F1) for Control B+ inside the PCC, and (F2) for Panel Lamps and Start and Run contacts. Light Emitting Diodes (LEDs) indicate the position of the Run-Off-Auto switch (S12) on the front panel as well as whether the start and run outputs are available at the appropriate relay contacts.

An optional Network Interface Module (A39 NIM) connects through the Engine Interface Board also to let the PCC communicate with the network. which will be available in late 1994.

EEPROM

Electrically Erasable Programmable Read Only Memory. This memory holds data after the power has been removed, but can be changed by writing new data on top of old data. This is where the PCC stores information that changes, such as Number of starts, Display and Meter calibration data, and what the LED Display Panel shows the customer when a Customer Fault #3 input is received.

EPROM

Erasable Programmable Read Only Memory. This memory is erased with a high-powered ultraviolet lamp. This is where the PCC stores the actual program steps it uses to run the generator set. Information for Prime and Standby operation of all 175 kW 50 Hz to 1500 kW 60 Hz sets are stored in this memory. The Paralleling and AMF applications of the PCC will have different EPROM chips than the standard set.

Genset Communications (GCM) Module (A41)

This module mounts in front of the Analog Board and connects to the Engine Interface (A31) Board. The GCM allows the PCC 3100 to operate as a node on the PowerCommand Network.

The GCM works with PowerCommand software for Windows v 1.10 to allow the customer to monitor and control the genset from a local or remote location.

Governor Output Module (A38) for non DFH Gensets

This module is located in the Accessory Box on the generator reconnection box. The actual governor is in the digital board and this module is just a power amplifier for the governor actuator.

This module contains three fuses:
F1 is for the always available Customer B+
F2 is for Switched B+
F3 is for the governor actuator and wiring.

This module contains two LEDs:
DS1 lights to show the relative intensity of the governor drive signal. As the duty cycle increases, this LED will get brighter.
DS2 lights when the RUN signal is received from the engine interface board.

Governor Output Module (A38) for DFH Gensets

This module is located in the Accessory Box on the generator reconnection box. The actual governor is in the digital board and this module is just a power amplifier for the governor actuator.

This module contains four fuses:
F4 is for the always available Customer B+
F3 is for Switched B+
F1 is for the left injection pump actuator and wiring.
F2 is for the right injection pump actuator and wiring.

This module contains six LEDs:
DS1 lights when the RUN signal is received from the engine interface board.
DS2 lights when the +5 VDC power supply on the module is energized.
DS3 is on when the left bank fuel pump is activated.
DS4 is on when the right bank fuel pump is activated.
DS5 is on when a left bank rack position fault is detected.
DS6 is on when a right bank fuel rack fault is detected.

PowerCommand® Annunciator

A replacement for the existing 300–2751/2752 annunciator models. Required by NFPA110 for Level 1 applications, the annunciator gives visual and audible indication of generator set malfunction or alarm conditions. The new annunciator is configured for hard–wired (non–network) connection to the generator set. It features a single–membrane front face panel and a similar graphic treatment as the PowerCommand Control. A future release will allow the annunciator to interface with the PowerCommand Network.

PowerCommand® Control 3100

The new “standard” control on 200—1500 kW generator sets starting August 5, 1994. This control is controlled by a microprocessor and an internal software program which is stored on an EPROM chip. To update the control, the technician will change the EPROM chip.

The standard version of the PCC 3100 is designed for standby operation hooked to either a transfer switch or a distribution network, and will not be paralleled to a utility source.

The PCC 3100 has several circuit boards inside the control box and three modules located in the Accessory Box which is attached to the generator reconnection box. The governor and voltage regulator actually are in the PCC software and operate inside the PCC, but there are power amplifier modules for the governor and regulator since the PCC internal circuits cannot provide enough power for operation of the governor actuator and exciter stator.

PowerCommand® Network

A communication network for moving information electrically among various Onan on-site power generation modules. The PowerCommand Network will utilize Echelon LonWorks for system module interconnection.

PowerCommand® System (PCS)

The product family name for the new–generation, microprocessor-based Cummins Power Generation control products that will span generator sets, transfer switches and paralleling switchgear. The PowerCommand System will encompass network communications devices and software to provide local and remote monitoring and control of the entire on–site power generation system using PowerCommand Software and/or interface with building management systems provided by external suppliers.

Potential Transformer / Current Transformer (PT/CT) Module (A36)

This module is located in the Accessory Box on the generator reconnection box. The PT/CT module reduces the generator output voltage from 200 to 277 VAC Phase to Neutral to 18 Volts AC for the Analog and Digital boards.

The PT/CT module also receives inputs from the 0.55 Amp current transformers and contains burden resistors for the CTs. When the generator is developing 100% current output the output from the PT/CT module will be 1.65 Volts AC.

RAM

Random-Access Memory. This is the memory area that the PCC uses to actually operate the generator set. This memory requires power to maintain its content. When the PCC is turned on, the RAM is refreshed to clear out any data in memory from the last time the set was run.

Regulator Output Module (A37)

This module is located in the Accessory box on the generator reconnection box. The actual regulation is done on the digital board by the microprocessor, and this module is a power amplifier for the exciter stator.

The Permanent Magnet Generator (PMG) is an input to this module, and serves two functions. The PMG provides the power for the regulator output module to create the excitation drive for the generator; and the PMG input controls a relay which acts as a secondary start disconnect circuit when the PMg output reaches 105 Volts AC at approximately 850 RPM.

This module contains two LEDs:
DS1 lights when the RUN signal is received from the engine interface board.
DS2 lights to show the relative intensity of the regulator drive signal. As the duty cycle increases, this LED will get brighter.

ROM

Read-Only Memory. This type of memory has special data written into it by Onan because that data is used with all gensets.

This page intentionally left blank

Cummins Power Generation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
1-800-888-6266
763-574-5000 International Use
Fax: 763-574-8087

Power Generation