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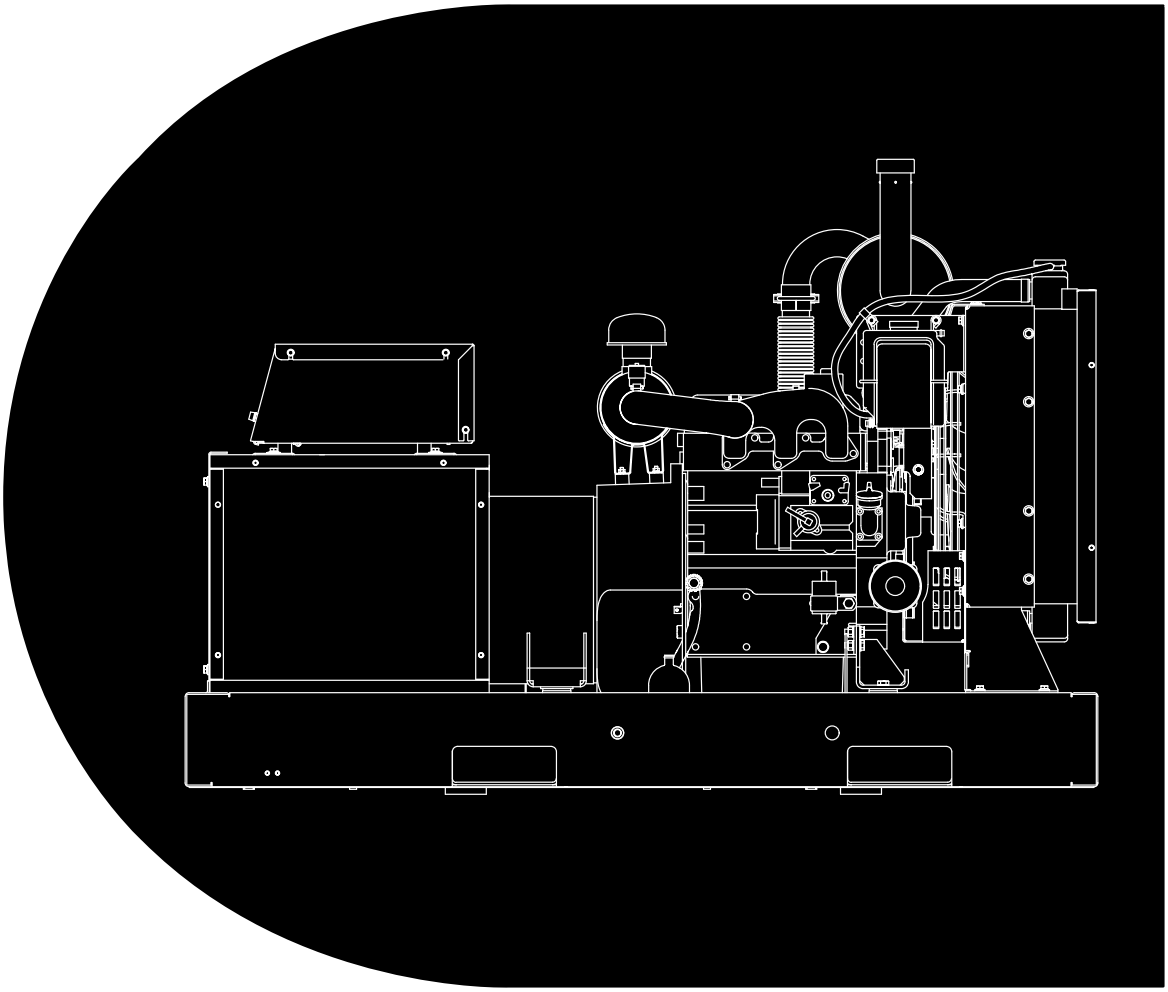
Power Generation

Power Generation

Service Manual

GenSet Model
DKAC, DKAE, DKAF

with PowerCommand® Control
PCC1301



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961-0507 04-2006

Table of Contents

IMPORTANT SAFETY INSTRUCTIONS

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

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

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

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

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

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

FUEL AND FUMES ARE FLAMMABLE

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

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

EXHAUST GASES ARE DEADLY

- Provide an adequate exhaust system to properly expel discharged gases away from enclosed or sheltered areas and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust daily for leaks per the maintenance schedule. Make sure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.
- Engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

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

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

GENERAL SAFETY PRECAUTIONS

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. To prevent severe scalding, let engine cool down before removing coolant pressure cap. Turn cap slowly, and do not open it fully until the pressure has been relieved.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth; Class B fires, combustible and flammable liquid fuels and gaseous fuels; Class C fires, live electrical equipment. (ref. NFPA No. 10).
- Make sure that rags are not left on or near the generator set.
- Make sure generator set is mounted in a manner to prevent combustible materials from accumulating under or near the unit.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.
- Substances in exhaust gases have been identified by some state or federal agencies as causing cancer or reproductive toxicity. Take care not to breath or ingest or come into contact with exhaust gases.
- Do not store any flammable liquids, such as fuel, cleaners, oil, etc., near the generator set. A fire or explosion could result.
- Wear hearing protection when going near an operating generator set.
- To prevent serious burns, avoid contact with hot metal parts such as radiator system, turbo charger system and exhaust system.

KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE

1. Introduction

ABOUT THIS MANUAL

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

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

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

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

GENERATOR SET CONTROL

There are two versions of the PCC 1301 that can be configured with this genset. For reference only, they are referred to as PCC 1301 (Without Display) and PCC 1301 (With Display) in this manual (Figure 1-1).

Sections in this manual that are specific to either PCC 1301 control are noted in the section title. All other sections apply to both versions.

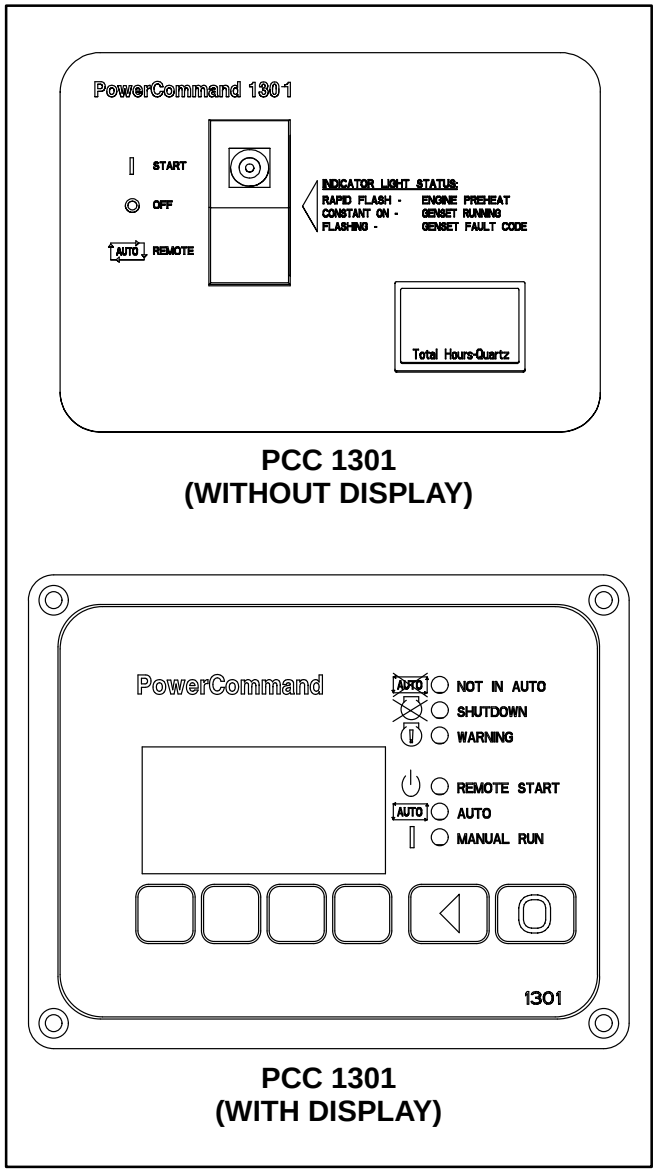

FIGURE 1-1. CONTROL PANEL CONFIGURATIONS

SYSTEM OVERVIEW

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

The operating software provides control of the generator set and its performance characteristics, and displays performance information on a digital display panel. It accepts menu-driven control and set-up input from the push button switches on the front panel.

TEST EQUIPMENT

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

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

HOW TO OBTAIN SERVICE

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

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

2. Control Operation (Without Display)

GENERAL

The following describes the function and operation of the PowerCommand® 1301 Control (without display). The switch/indicator and hour meter are located on the face of the control panel as illustrated in Figure 2-1.

CONTROL PANEL

Figure 2-1 shows the features of the front panel. It includes one–three position rocker switch to operate the genset and a total hours genset meter.

Start/Off/Remote (Auto) Switch

This rocker switch is used to select the three operating modes of the genset (Start-PreHeat/Off/Remote). This switch also contains a lamp which is used to indicate engine preheat, genset running and genset fault codes.

OFF Mode: The OFF mode is enabled by moving the control rocker switch to the middle position. The OFF mode will disable the control Auto or Manual modes.

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

The OFF mode is also used to acknowledge shutdown messages after the fault has been corrected. Moving the switch to the OFF position clears the switch fault indication and resets the control.

REMOTE (Auto) Mode: The Remote (Auto) mode is enabled by moving the control rocker switch to the bottom position. The Remote mode enables start/stop control of the genset from a remote location.

START-PREHEAT Mode: The Start-PreHeat mode is enabled by moving the control rocker switch to the top position. When moved to this position, the control will preheat the engine (if required) and activate the starting system.

Switch Indicator

Used to indicate the following genset status:

- Engine preheat – rapid flash.
- Genset running – constant on
- Genset fault code – flashing (refer to *Section 5* to interpret fault code indicator)

Total Hours Meter

Displays the total hours of genset operation.

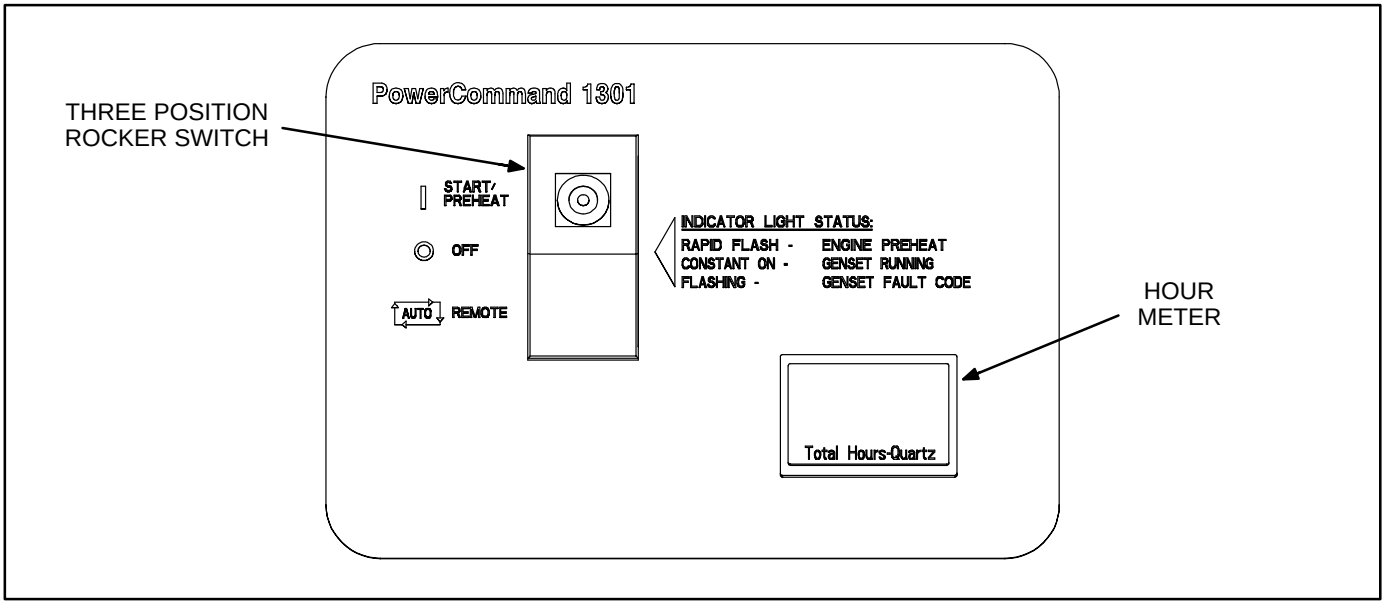

FIGURE 2-1. FRONT PANEL (WITHOUT DISPLAY)

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3. Control Operation (With Display)

GENERAL

The following describes the function and operation of the PowerCommand® 1301 Control (with display). All indicators, control buttons and graphical display are located on the face of the control panel as illustrated in Figure 3-2.

CONTROL PANEL POWER ON/OFF MODES

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

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

Sleep Mode: In the Sleep mode, the control's operating software is inactive and the LEDs and the graphical display on the control panel are all off. Sleep mode is a feature used to reduce battery power consumption when the control is not being used and is in either the Off or Auto mode.

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

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

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

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

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

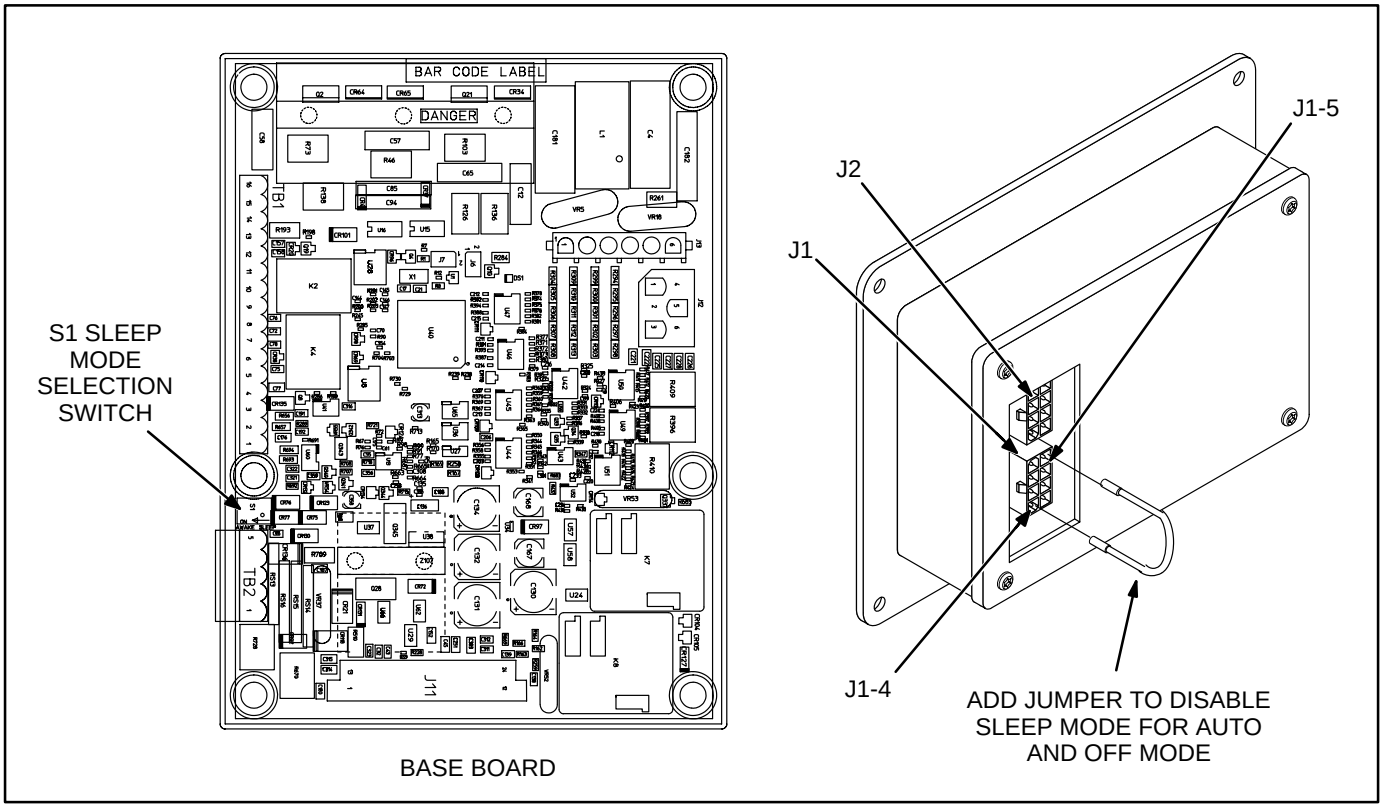

FIGURE 3-1. SLEEP MODE ACTIVATION SETTINGS

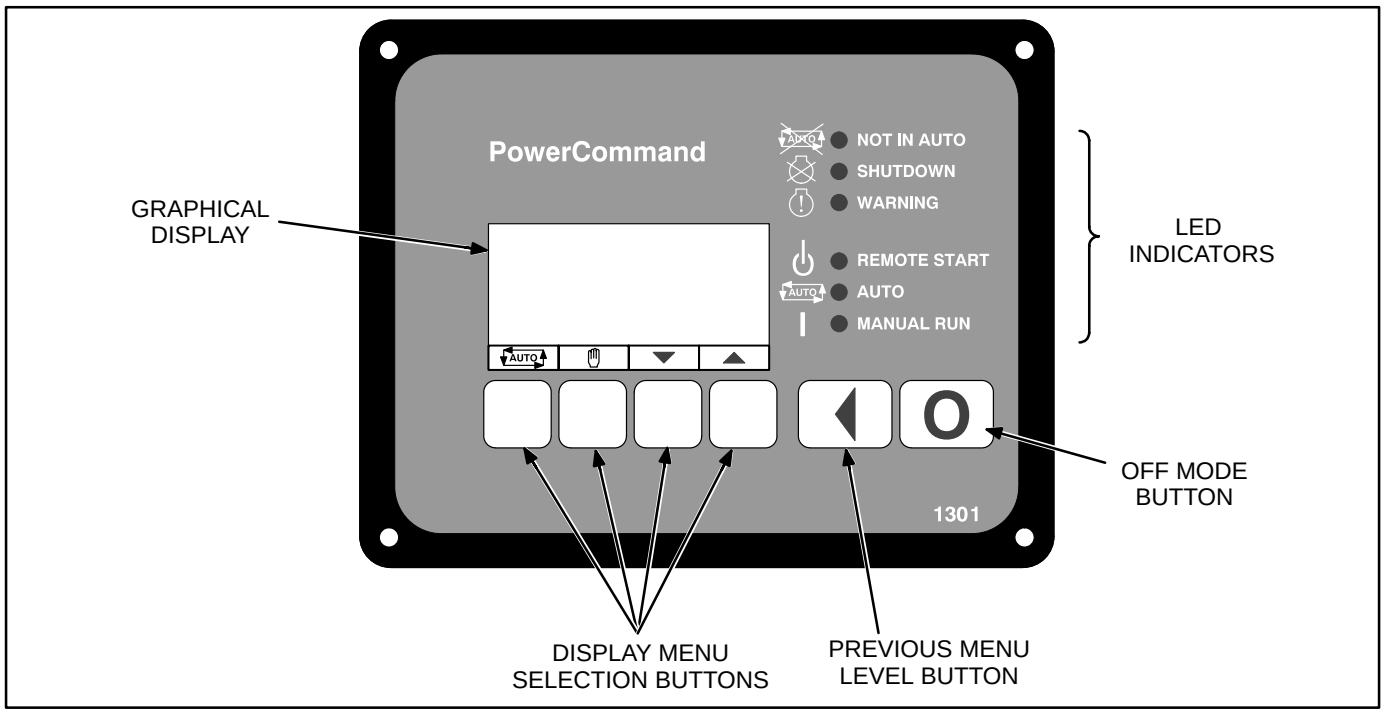

FIGURE 3-2. FRONT PANEL (WITH DISPLAY)

CONTROL PANEL

Figure 3-2 shows the features of the front panel. It includes six LED indicators, the graphical display, and six buttons used to navigate through the menus and adjust parameters.

Graphical Display

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

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

Display Text / Symbolic Versions

This graphical display can be set up to show either text or symbolic versions for fault messages, some Operator menus, and the Mode Change menu. A description of commonly used symbols used are included in Table 3-1. Combinations of symbols are used to display some fault conditions. Additional specialized symbols are also used for some faults (see *Section 5*).

When shipped from the factory, symbolic display is selected. (Refer to Setup menu in *Section 6* to change to text or symbolic display.)

TABLE 3-1. SYMBOLS

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

Display Menu Selection Buttons

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

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

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

  NOTE: When any Operator menu (Figure 3-12 is displayed, a series of Service menus can be viewed by simultaneously pressing the ▲ and ▼ selection buttons for two seconds.

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

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

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

Previous Main Menu Button

Press the ◀ button to view the previous main menu.

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

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

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

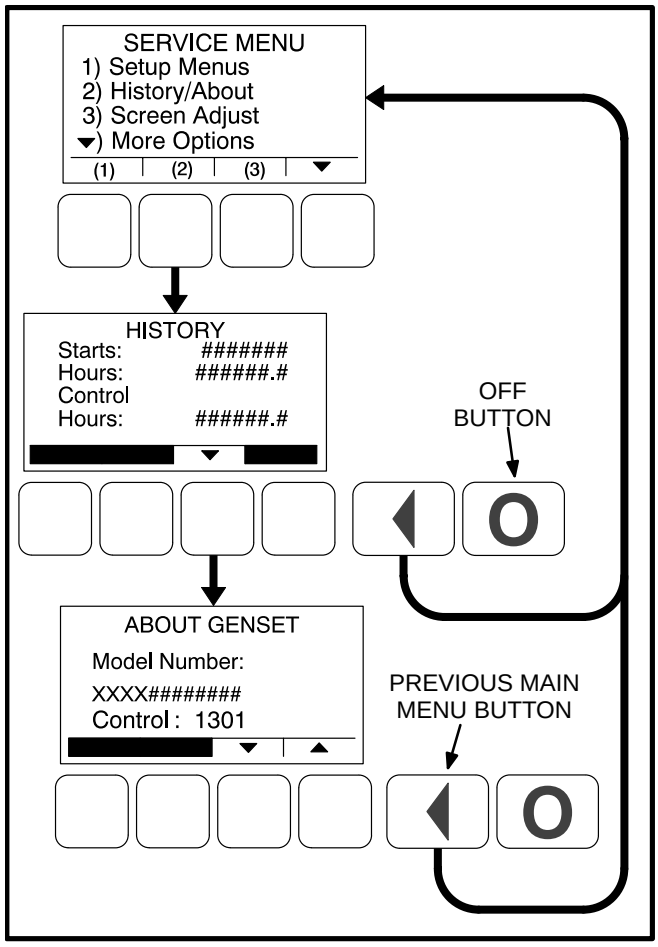

FIGURE 3-3. PREVIOUS MAIN MENU AND OFF BUTTONS

Off Button

Press the O button to switch to the **Off** mode. The Off mode will disable the control Auto or Manual modes.

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

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

Not in Auto Indicator

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

Shutdown Status Indicator

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

Warning Indicator

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

Remote Start Indicator

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

Auto Indicator

This green lamp indicates the control is in Auto mode. Auto mode can be selected by pressing the AUTO selection button from any of the Operator menus (see Figure 3-12).

Manual Run Indicator

This green lamp indicates the control is in the Manual Run mode. Manual Run mode can be selected by pressing the ✋ selection button from any of the Operator menus (see Figure 3-12).

SYSTEM MESSAGES

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

Communication Messages

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

Upon initial power-up, the message “Establishing communication with control” is displayed (see Figure 3-4). This menu also displays the screen’s software number and version.

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

If communications are lost, the message “Re-establishing communication with control” is displayed until communications have been re-established (see Figure 3-5). The LEDs then return to the state determined by the control.

If either communication message remains displayed (cannot view other menus), this indicates that communications between the control panel and the control logic is lost.

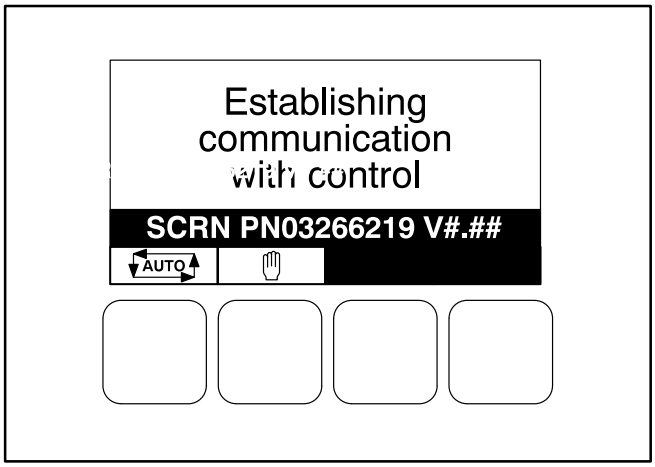

FIGURE 3-4. ESTABLISHING COMMUNICATION WITH CONTROL

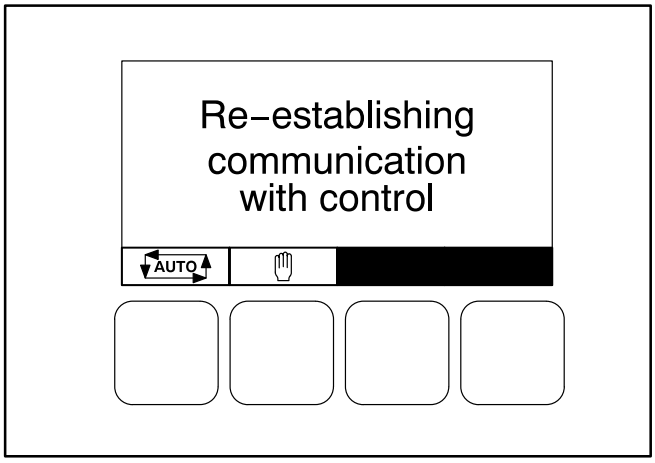

FIGURE 3-5. RE-ESTABLISHING COMMUNICATION WITH CONTROL

Event Messages

When pre-set events (time delay to start or stop) are activated, Event messages are displayed showing the time remaining until the event occurs (see Figure 3-6).

Fault Messages

A Fault message is an indicator of a Warning or Shutdown condition. It includes the fault number, a short description, and when the fault occurred (see Figure 3-7). Symbolic fault messages include the fault code number and symbols, indicating the type of fault (see Figure 3-8). With the symbolic versions of fault messages, the ⏱ and ⏰ symbols flash. *Section 5* provides a list of fault codes, fault types, messages displayed, and descriptions of the faults.

Five of the most recent faults are placed in a fault history file that can be viewed using the Fault History Menus (see Figure 3-18).

Fault Acknowledgement

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

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

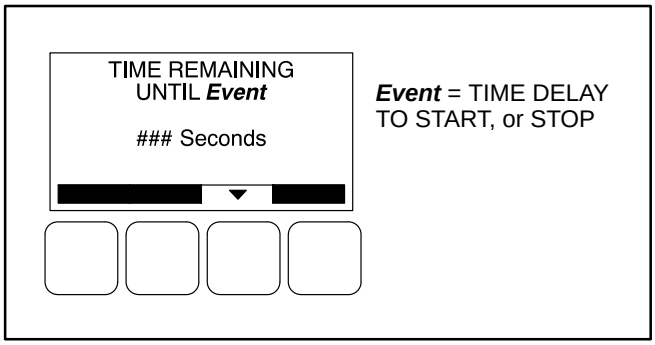

FIGURE 3-6. EVENT MESSAGE

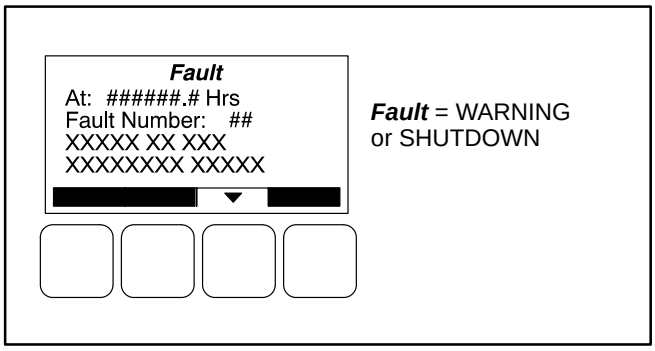

FIGURE 3-7. FAULT MESSAGE

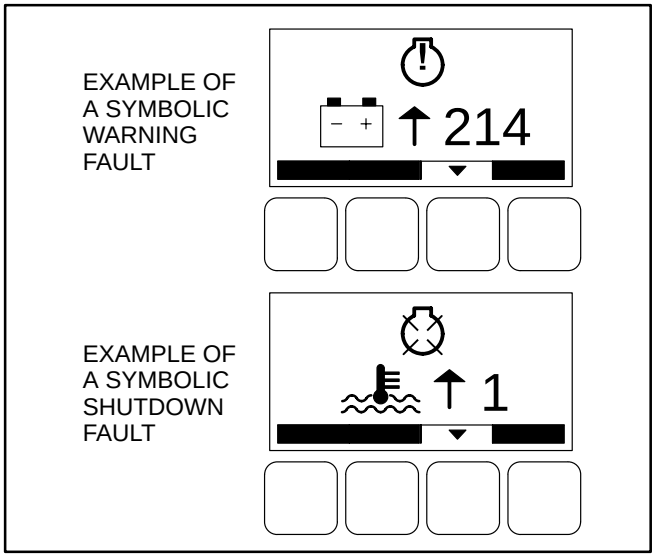

FIGURE 3-8. FAULT MESSAGES – SYMBOLIC VERSION

SELECTING AUTO, MANUAL RUN AND OFF MODES

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

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

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

The InPower service tool or access to the Genset Service submenu is required to enable/disable the mode change “Access Code” feature. Refer to *Section 6.*

Entering the Mode Change Access Code

If the mode change access code feature is enabled, an access code must be entered to switch to Auto, Manual Run, or Off mode. The text and symbolic versions of the Mode Change menu are shown in Figure 3-9.

To enter the mode change access code,

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

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

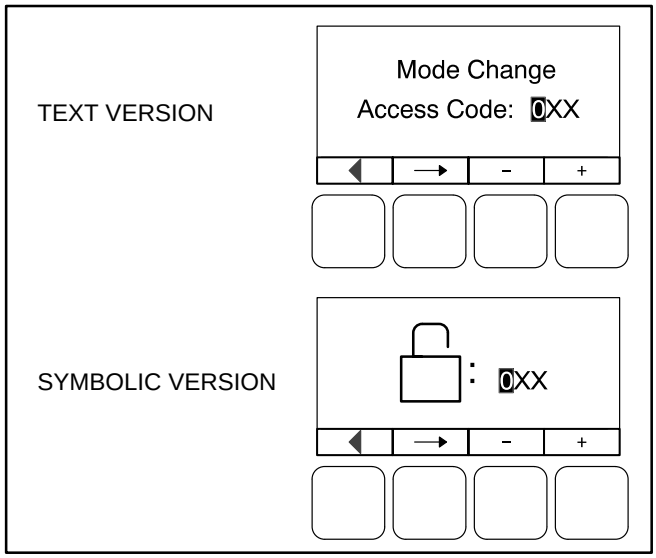

FIGURE 3-9. MODE CHANGE MENU

Selecting Auto Mode

To switch to Auto mode (see Figure 3-10):

1. Press the AUTO button on any of the Operator menus or the “Establishing/Re-establishing communication with control” menus.
2. If the mode change access code feature is enabled, the Mode Change Access Code menu is displayed. Enter the mode change access code as described above.
3. A menu with alternating arrows is displayed above a second AUTO symbol. Press the second AUTO button. The Operator menu that was displayed before Auto mode was selected is redisplayed and the Auto indicator is lit.
4. To disable auto mode, press the O button.

NOTE: Manual Run mode can also be selected while in Auto mode.

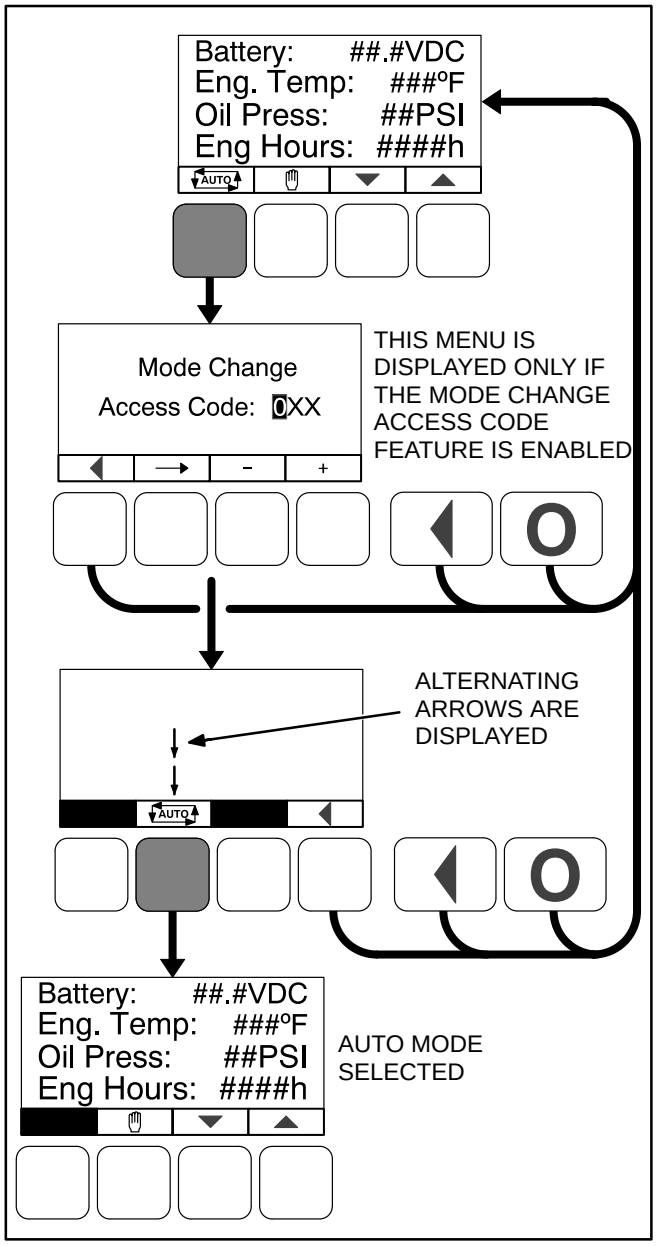

FIGURE 3-10. SELECTING AUTO MODE

Selecting Manual Run Mode

To switch to Manual Run mode (see Figure 3-11):

1. Press the ✋ button on any of the Operator menus or if displayed, the “Establishing/Re-establishing communication with control” menus.

2. If the mode change access code feature is enabled, the Mode Change Access Code menu is displayed. Enter the mode change access code as described on the previous page.

3. A menu with alternating arrows is displayed above a second ✋ symbol. Press the second ✋ button to start the genset.

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

To disable Manual Run mode, press the O button.

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

Aborting the Transition to Auto or Manual Run Mode

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

- Either the ◀, ◀, or O button is pressed.
- The AUTO or ✋ button is not pressed within ten seconds.

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

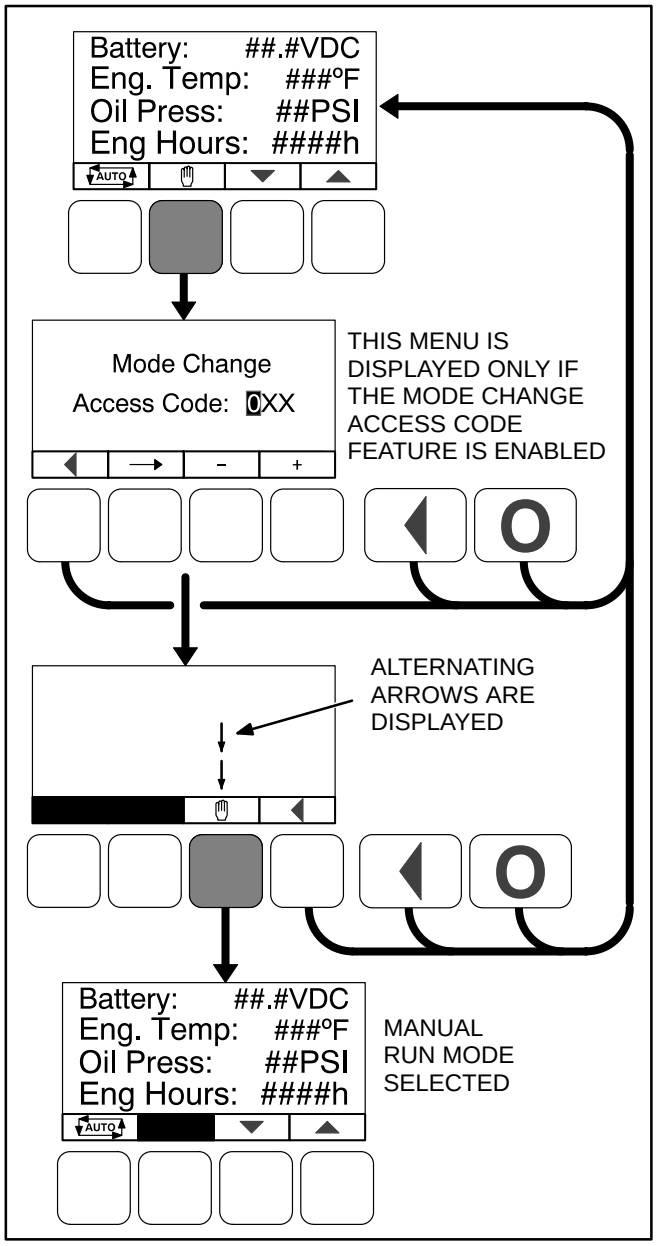

FIGURE 3-11. SELECTING MANUAL RUN MODE

OPERATOR MENUS

Figures 3-12 and 3-13 show block representations of the following Operator menus.

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

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

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

Appendix A provides a block diagram that illustrates the sequence of how the Operator Menus are displayed.

Engine Status Menu

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

Alternator Status Menu

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

Alternator Line-to-Line Voltage Menu

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

Alternator Line-to-Neutral Voltage Menu

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

Alternator Single Phase Voltage Menu

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

Alternator Amperage Menu

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

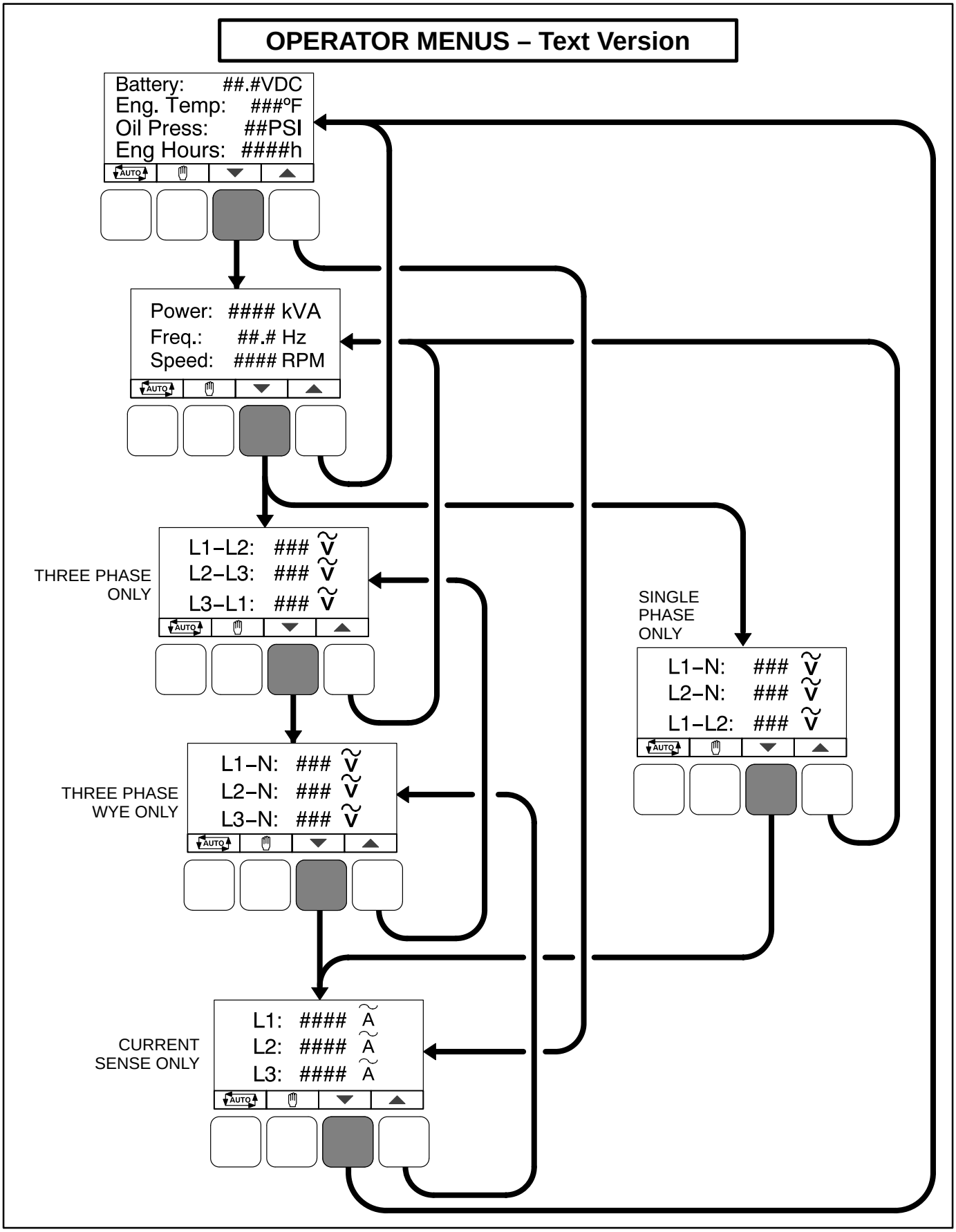

FIGURE 3-12. OPERATOR MENUS (TEXT VERSION)

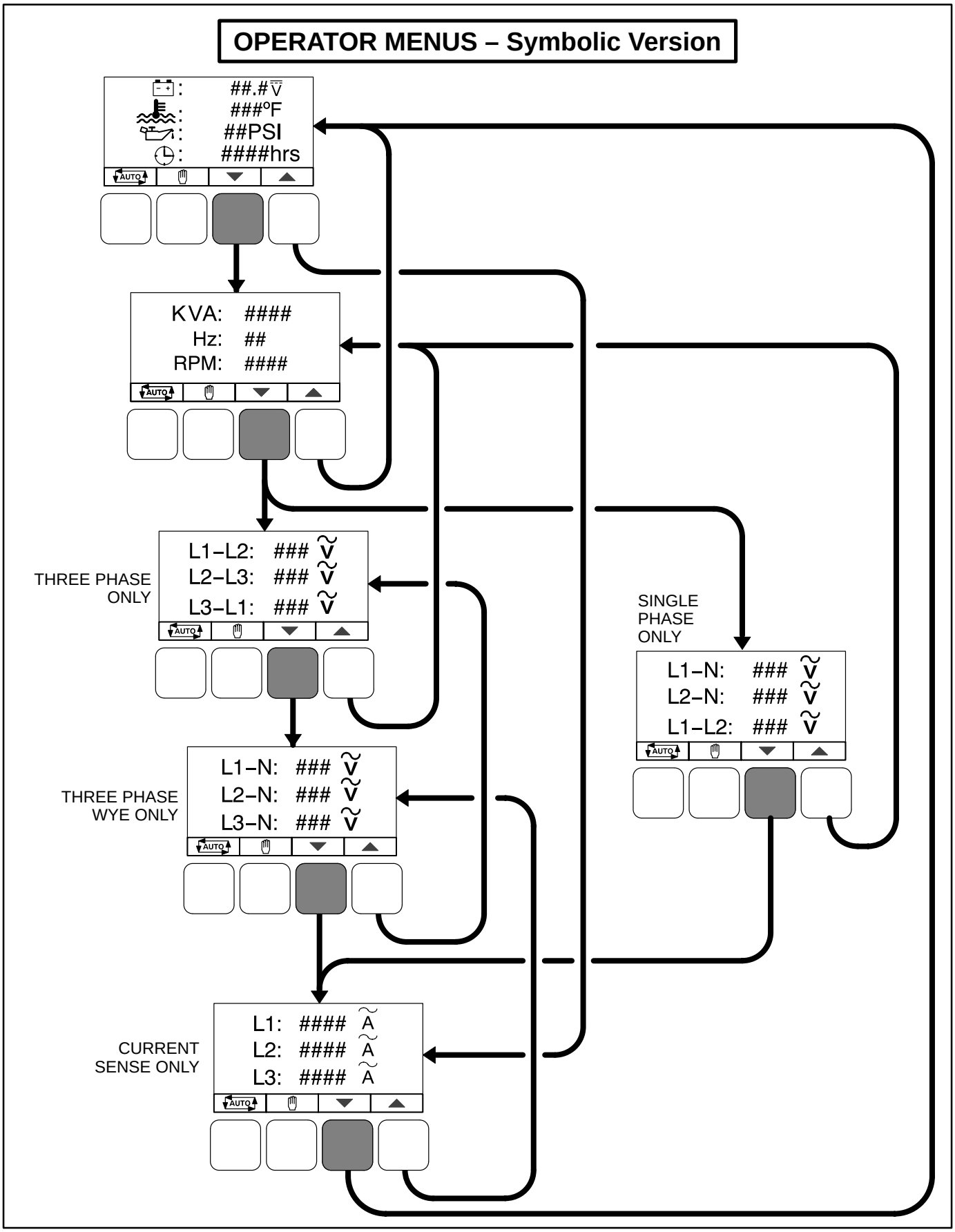

FIGURE 3-13. OPERATOR MENUS (SYMBOLIC VERSION)

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SERVICE MENUS

Figure 3-14 shows a block representation of the menus available from the Service Menus.

Appendix A provides a block diagram that illustrates the sequence of how the Service Menus are displayed.

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

- Setup Menus – Used by Service personnel. Adjusting the Setup menus is restricted by a password and is described in *Section 6*. To view the Setup menus only, press the VIEW button on the Setup password menu.
- History / About – see page 3-16
- Screen Adjust – see page 3-18

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

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

- Fault History – see page 3-20
- Status – see below
- Lamp Test – The six LEDs on the control panel should light as long as the **(6)** button is pressed.

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

Status Menu

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

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

Network Status Menus

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

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

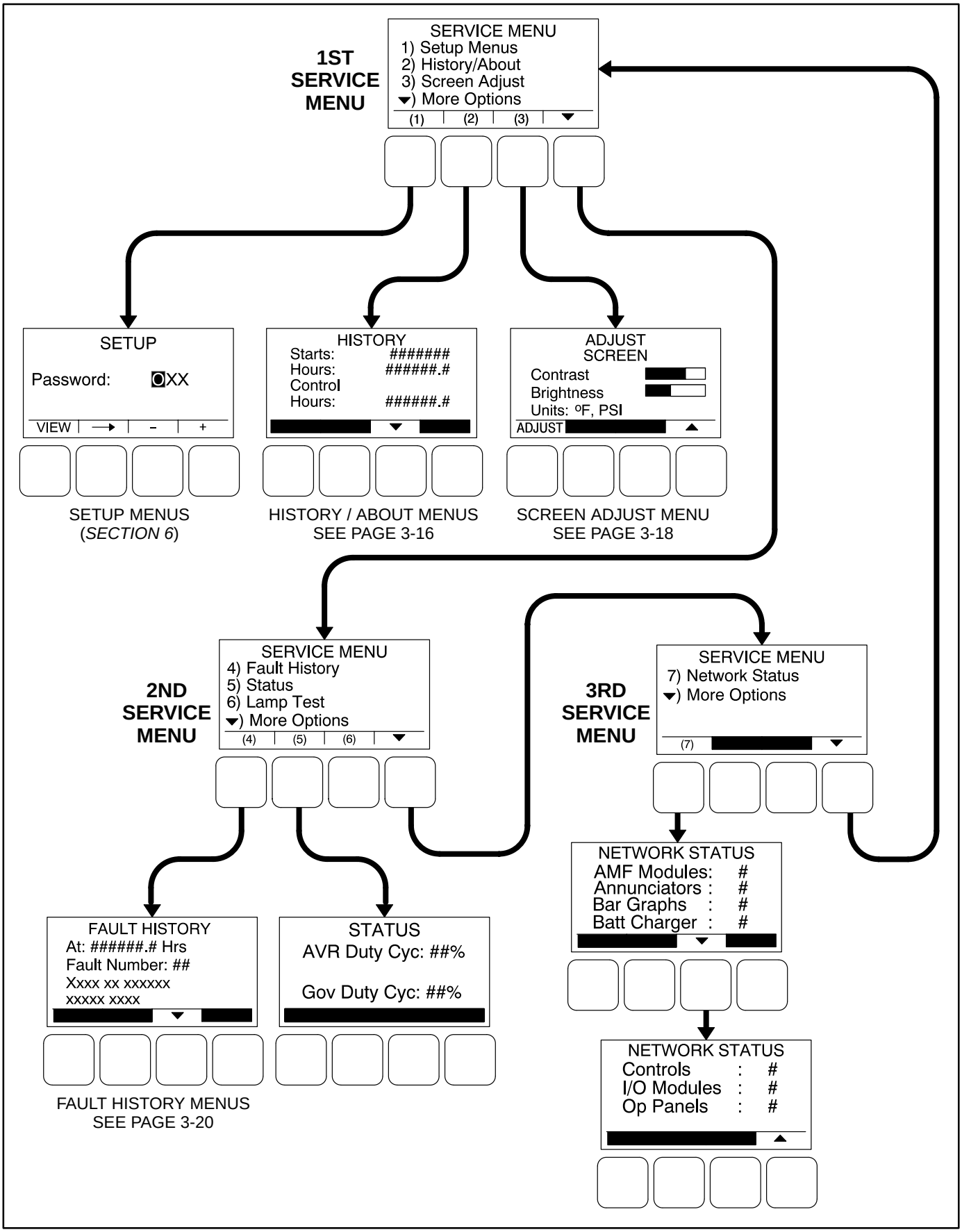

FIGURE 3-14. SERVICE MENUS

HISTORY / ABOUT MENUS

Figure 3-15 shows a block representation of the History / About menu. The first History / About submenu is displayed when the **(2)** button is pressed on the Service Menu.

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

History Submenu

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

About Genset Submenu

This submenu displays the generator set model number and rating.

About Control Submenu

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

About Display Submenu

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

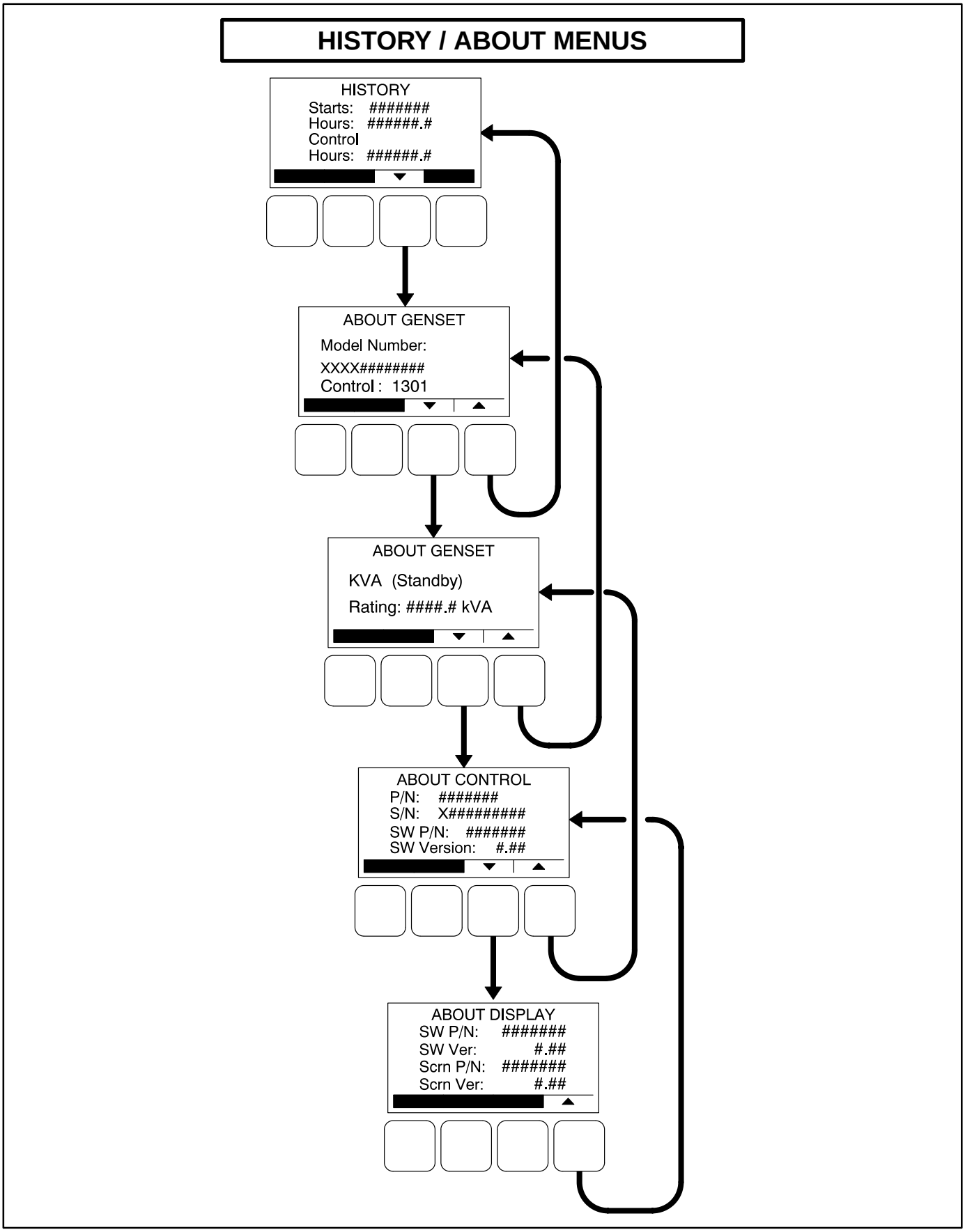

FIGURE 3-15. HISTORY / ABOUT MENUS

SCREEN ADJUST MENU

Figure 3-16 shows a block representation of the Screen Adjust menu. The Screen Adjust submenu is displayed when the **(3)** button is pressed in the first Service Menu.

Adjusting Values/Parameters

1. Press the **ADJUST** selection button to select the first parameter or value to be changed.
2. Press the **+** or **–** selection buttons to adjust values or select parameters.
3. Press the arrow selection button ⟶ to navigate to the next or previous adjustable value or parameter.
4. After adjusting values/selecting parameters, press the **SAVE** button to save your settings.

   NOTE: If the Previous Menu button ◀ is pressed before pressing the SAVE button, the changes are not saved.
5. Press the ◀ button to return to the Service Menu.

Screen Adjust Menu

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

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

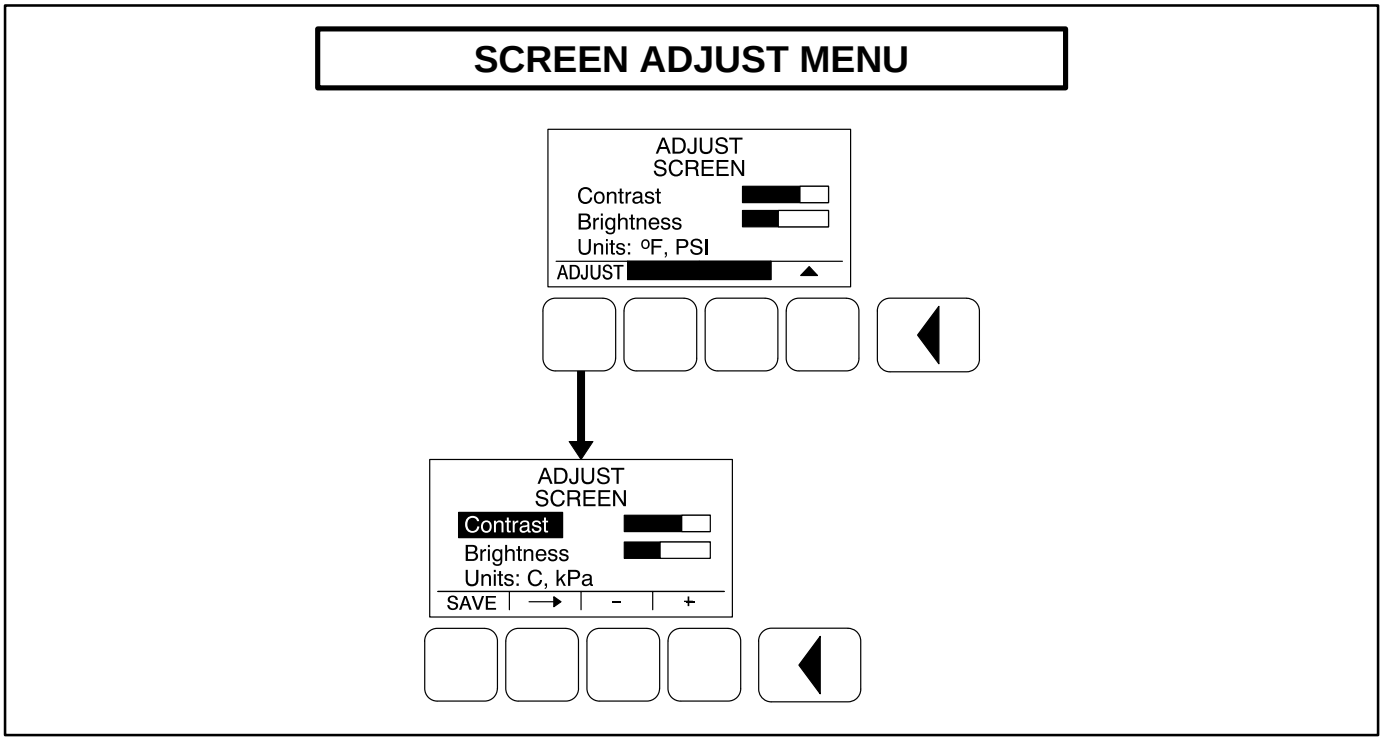

FIGURE 3-16. SCREEN ADJUST MENU

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FAULT HISTORY MENU

Figure 3-18 shows a block representation of the Fault History menu. The first Fault menu is displayed when the **(4)** button is pressed on the second Service Menu. If there are any active fault submenus, an “Active Fault” heading is displayed for the most recent active fault. All other fault submenus display a “Fault History” heading. Five of the most recent faults can be viewed. An example of how a fault code is displayed is shown in Figure 3-17.

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

Press the ◄ button to return to the Service Menu.

Information on faults is found in *Section 5*.

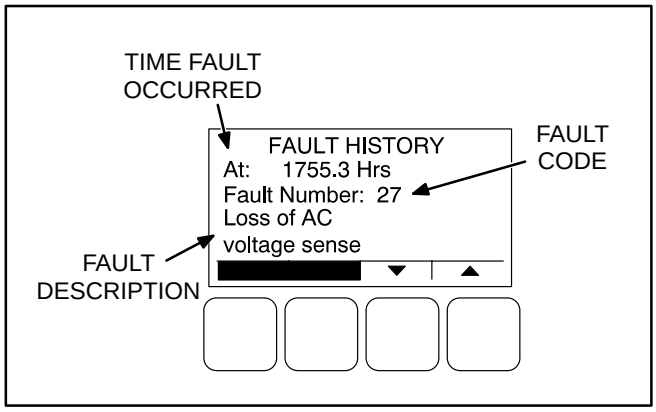

FIGURE 3-17. FAULT HISTORY MENU EXAMPLE

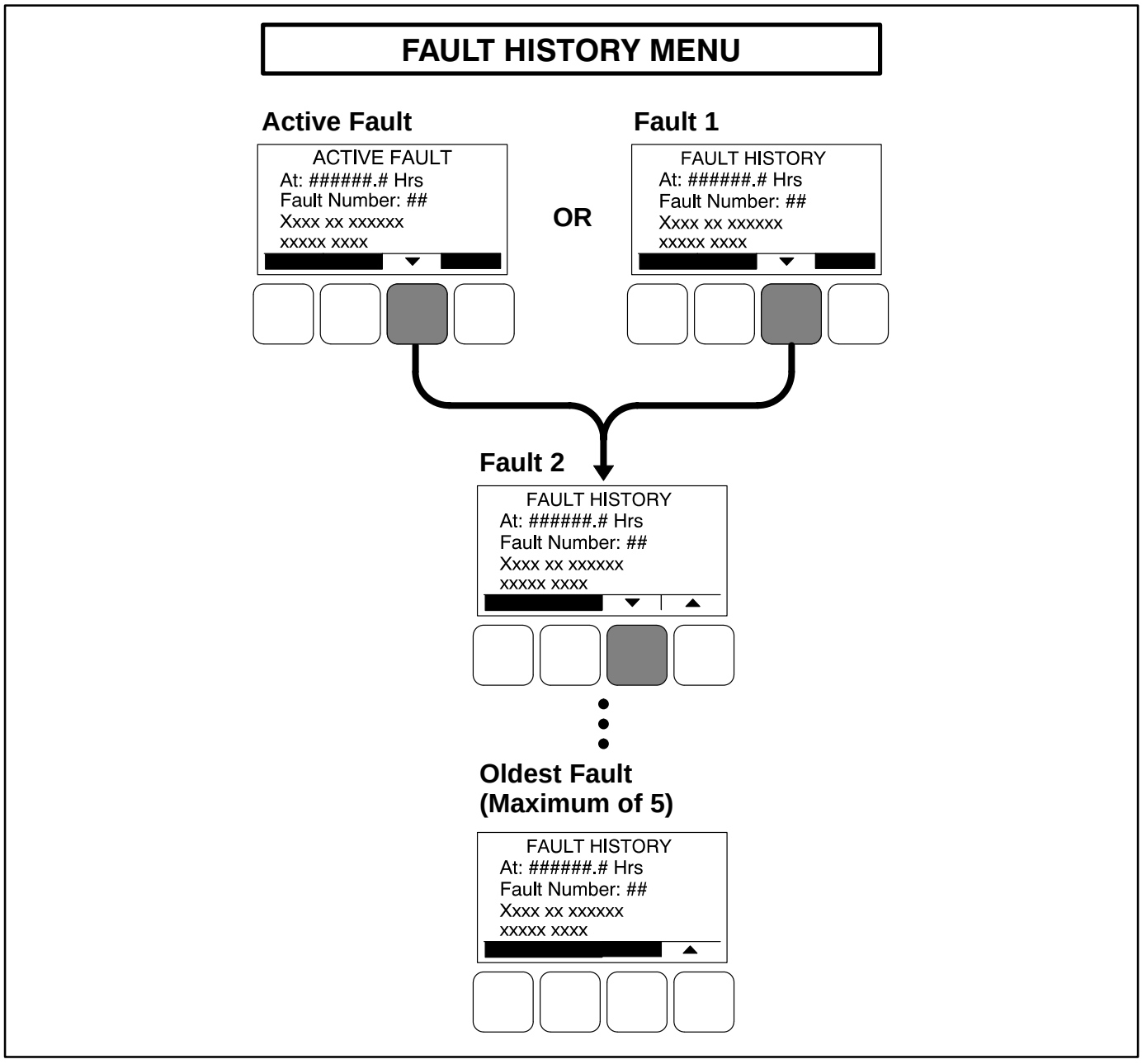

FIGURE 3-18. FAULT HISTORY MENU

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4. Circuit Board

GENERAL

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

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

This section describes the function of the PowerCommand® 1301 Control (PCC) Base board that is contained in the control box (Figure 4-1). The block diagram in Figure 4-2, shows the external connections of the PCC system. The system schematics are provided in *Section 9* of this manual.

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

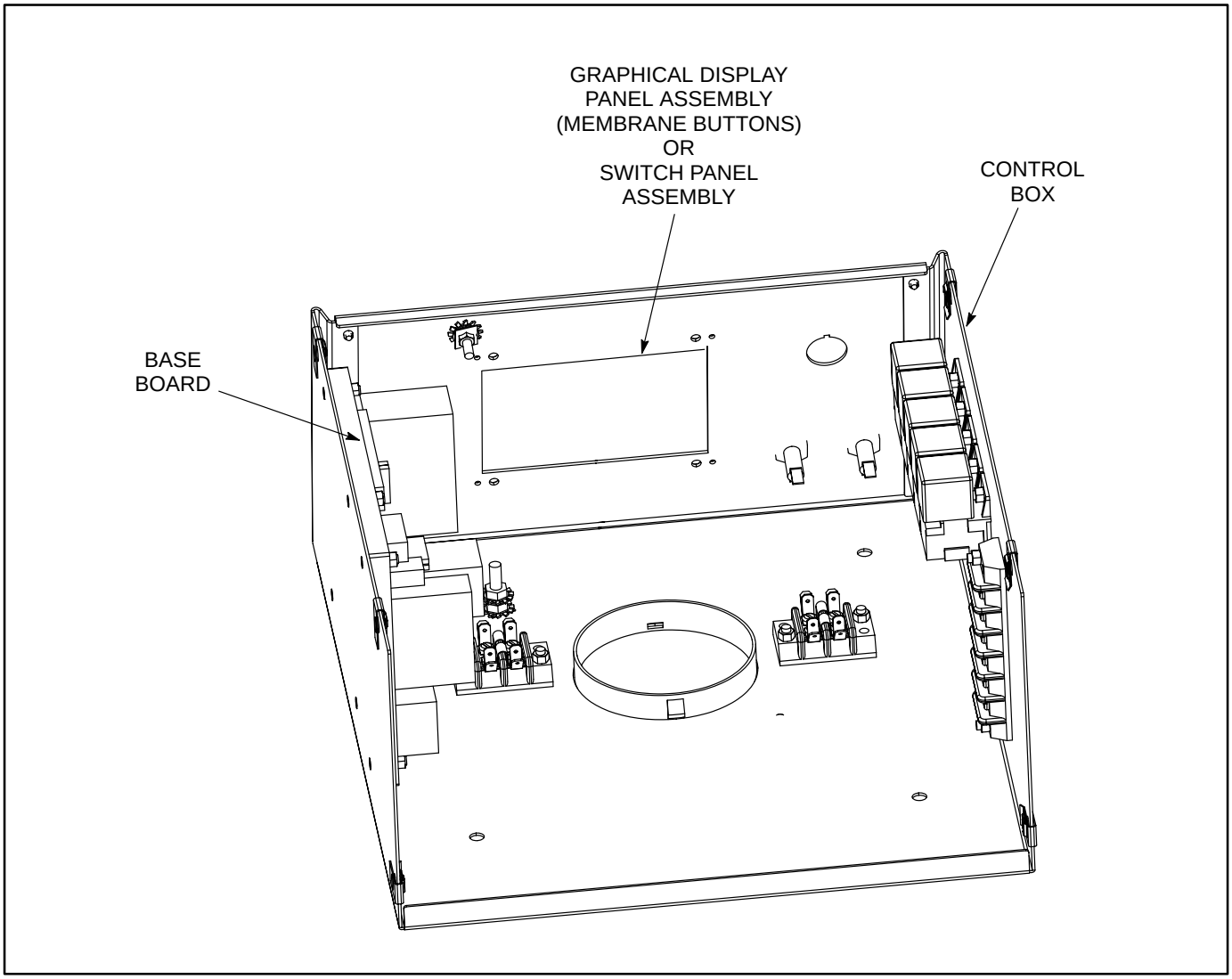
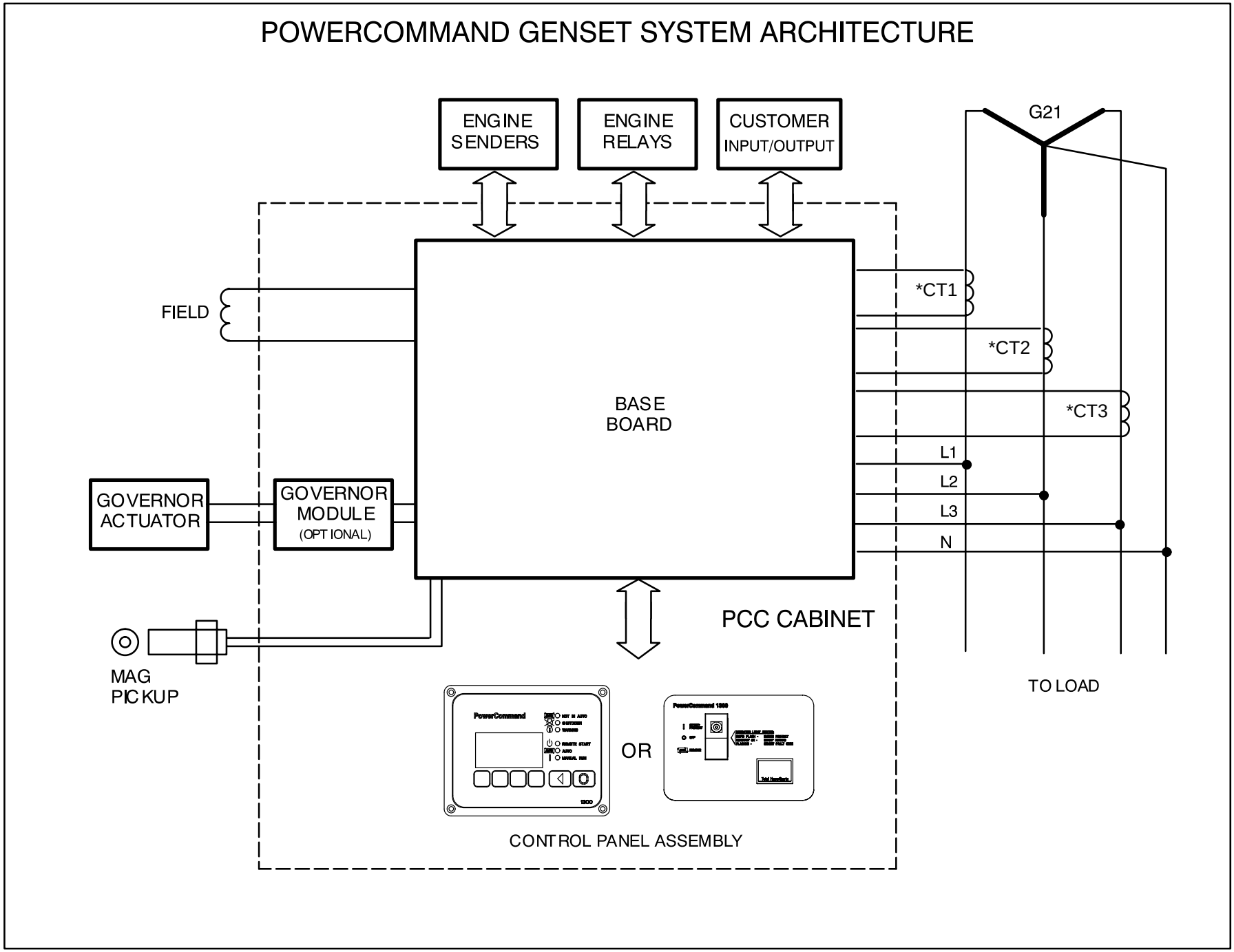


FIGURE 4-1. BASE BOARD LOCATION

FIGURE 4-2. BLOCK DIAGRAM



BASE BOARD

The Base board (Figure 4-3) contains all of the electronic circuitry required to operate the generator set. The Base board provides fuel control, main alternator voltage output regulation and complete generator set control and monitoring.

The following paragraphs describe the connectors (J), terminal board (TB), relays (R) and the LED status indicator. Figure 4-3 shows the pin locations for all Base board connectors. Refer to Block diagram in *Section 9* for each connector pin input/output signal.

TB1 Customer Connections

Display panel B+/data link and customer monitor/control connections are attached to terminal board TB1. Optional equipment such as sensing devices used to monitor genset operation, remote start/stop switches and etc. are attached to this terminal. Refer to Block Diagram and Customer Connections diagram in *Section 9* for TB1 connections.

DS1 LED Status Indicator

The status indicator lamp is illuminated when the Base board is in the Power On mode (processor is operating).

S1 Sleep Mode Selection

Refer to *Control Panel On/Off Modes* in Section 3.

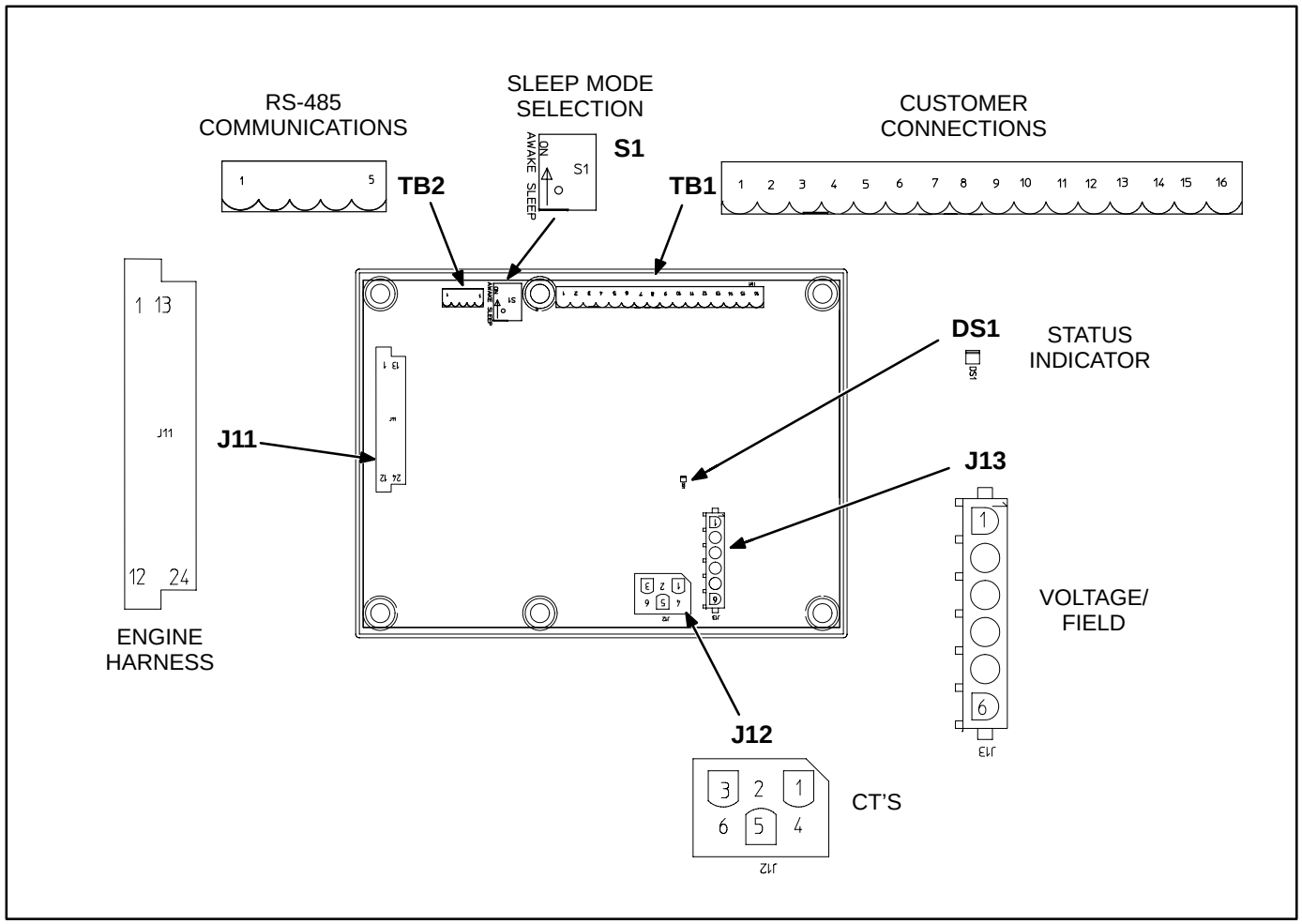


FIGURE 4-4. BASE BOARD CONNECTOR/TERMINAL PIN LOCATIONS

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5. Troubleshooting

GENERAL

The PowerCommand® 1301 Control (PCC) continuously monitors engine sensors for abnormal conditions when genset is operating, such as low oil pressure and high coolant temperature. If any of these conditions occur, the control (with graphical display) will light a yellow Warning lamp or a red Shutdown lamp and display a message on the graphical display. A control without the graphical display indicates a shutdown condition by intermittent flashing of the status indicator.

INPOWER SERVICE TOOL

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

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

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

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

CAUTION ***Using the wrong calibration file can result in equipment damage. Do not swap Base boards from another genset model and only use the calibration file shown on the nameplate.***

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

NETWORK APPLICATIONS AND CUSTOMER INPUTS

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

SAFETY CONSIDERATIONS

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

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

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

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

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

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

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

1. Without Display: Move the StartOff/Remote switch on the control panel to the OFF position.

   With Display: Press the **O** button to switch to the **Off** mode.

2. Turn off or remove AC power from the battery charger.

3. Remove the negative (**–**) battery cable from the generator set starting battery.

READING FAULT CODES

If the genset contains the graphical display and a fault occurs, the fault code/message can be viewed in the display. If the control does not contain the graphical display, the fault code is read from the control switch indicator.

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

Reading Fault Codes Using Graphical Display: Refer to *Fault History Menu* in *Section 4*, which describes how to view fault codes using the graphical display.

Reading Fault Codes Using Control Switch Indicator (PCC without display): The control panel rocker switch contains a status indicator lamp. This lamp is used to flash genset status and shutdown fault codes. (Only the last shutdown fault code is flashed.)

Warning fault codes are not displayed by the status indicator lamp. The InPower service tool is needed to read warning fault codes.

The following describes how to interpret the status indicator light.

Do not move the control switch to the OFF position before interpreting the fault code. Moving the switch to OFF will clear the fault indication.

- Constant On = Genset running.
- Intermittent Flashing = A genset *Shutdown* fault condition exists (*Warning* conditions are not displayed). All of the Shutdown faults described in Table 5-1 can be announced with the status indicator lamp.

An example of a **single digit** fault code – Two blinks, followed by a two-second pause indicates a fault code of “2”.

An example of a **two digit** fault code – first digit in the code is flashed, followed by a half-second pause, and then the second digit is flashed, followed by a two-second pause.

TROUBLESHOOTING PROCEDURE

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

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

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

This section contains the following information:

- **Table 5-1 and 5-2:** Describes how to troubleshoot a local/remote fail to crank problem when control panel does not indicate fault condition.
- **Table 5-3:** Describes how to troubleshoot engine problems that are not within the detectable range of the PCC control.
- **Table 5-4:** Describes each status, warning and shutdown code, warning and shutdown limits where applicable, and basic corrective actions, such as, checking fluid levels, control reset functions, battery connections, etc.
- **Fault Code Tables:** Provide detailed troubleshooting procedures. In the following tables, the fault codes are used as the table reference number and are arranged in numeric order.

Figure 5-1 shows the location of the components within the control panel that are referenced in the following troubleshooting procedures. Connector locations for the Base board are provided in *Section 3*. The control wiring and circuit board connections are shown in *Section 9*.

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

⚠ CAUTION ***Electrostatic discharge will damage circuit boards. Always wear a wrist strap when handling circuit boards or when disconnecting or connecting harness connectors. See Circuit Board Removal/Replacement in Section 6.***

Voltage/Continuity Testing

Voltage and continuity tests are required in the following tables. In some cases, it is necessary to remove a plug to complete the test.

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

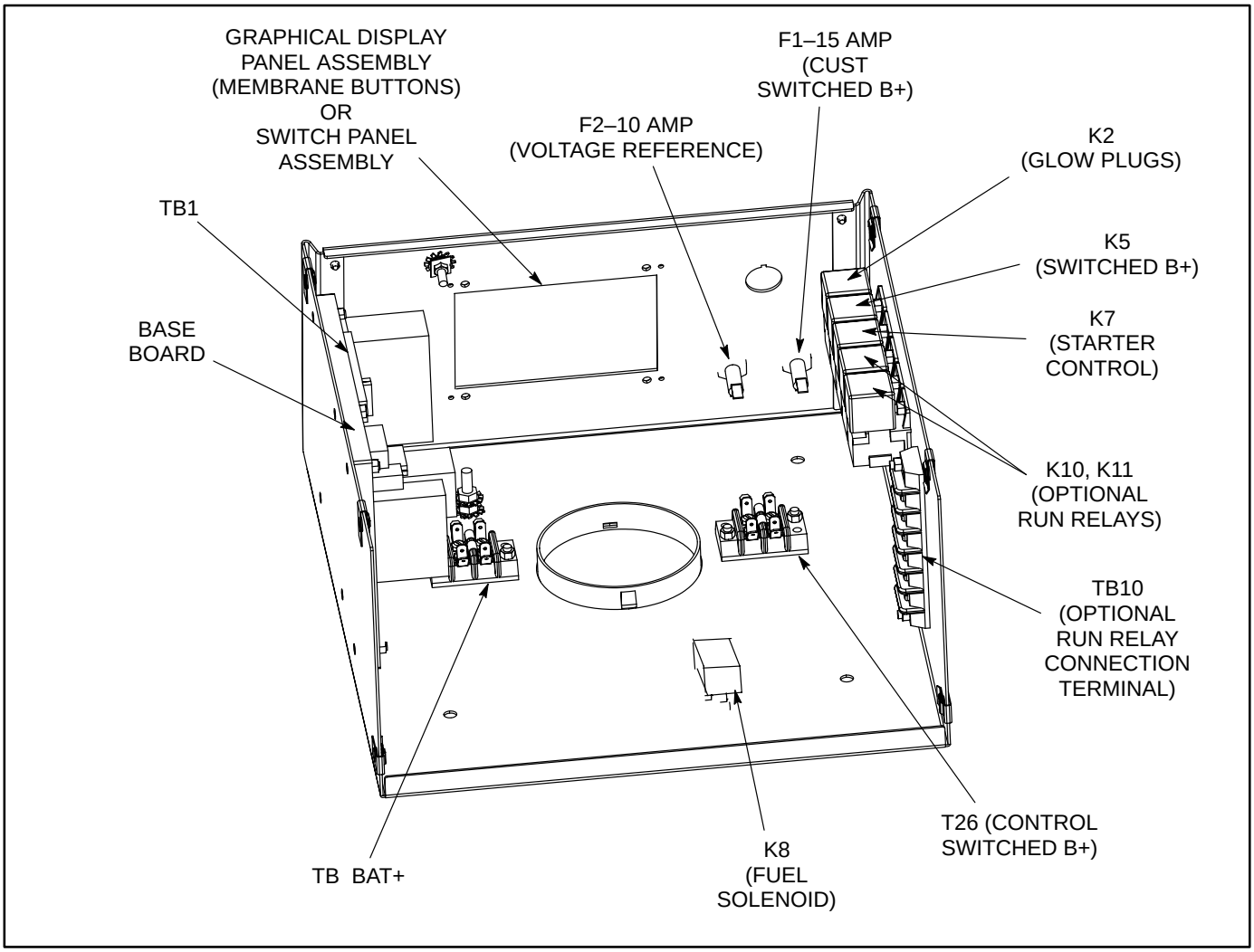

FIGURE 5-1. PCC 1301 COMPONENTS

Relay K2

The Glow Plug Pilot relay is used by the Base board to control the energizing of the glow plugs. The Base board determines at what engine block temperature and duration of time that the glow plugs will be energized. K2 is part of the engine harness assembly.

Relay K5

This relay is used by the Base board to control switched B+ (battery voltage). The relay is energized when the control receives a run command. Customer Switched B+ is a fused 15 amp circuit (F1). SW B+ quick connect terminal for customer use is located by the engine block ground terminal. Wire color is Red/Orange stripe. Do not use T26 for customer connections (not fused). K5 is part of the engine harness assembly.

Relay K7

The Starter Control relay is used by the Base board to energize the starter solenoid. K7 is part of the engine harness assembly.

Relay K8

The Fuel Control relay is used by the Base board to control battery B+ to the fuel solenoid(s). K8 is part of the engine harness assembly.

Run Relays K10, K11

The optional Run relays are used to control auxiliary equipment such as fans, pumps and motorized air dampers. The relays are energized when the control receives a run command.

***WARNING** Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.*

TABLE 5-1. ENGINE DOES NOT CRANK IN MANUAL MODE (NO FAULT MESSAGE)

Reason: This indicates that the PCC has not received or recognized a manual start signal.
Effect: Engine will not start.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. No power supplied to control.	a. Poor battery cable connections. Clean the battery cable terminals and tighten all connections. b. Remove connector P11 and check for B+ at P11-3 & 15 and GND at P11-9 & 10. If B+ or ground missing, isolate to harness and TB BAT terminal mounted on engine block. If B+ and ground check OK, cycle power to Base board by reconnecting P11 and retry operation.
2. PCC with display: No power supplied to front membrane panel.	Check for B+ at TB1-1 and GND at TB1-4. If B+ or ground missing, the Base board is bad. If B+ and ground check OK, remove P1 from back of front membrane panel. Check for B+ at P1-3 and ground at P1-5. If B+ or ground missing, repair harness.
3. Base board not properly calibrated or corrupt calibration.	Confirm that the installed calibration part number matches the serial plate information. Re-enter calibration file if necessary.
4. The Emergency Stop switch or wiring is defective.	With Emergency Stop push button not activated (switch closed), remove customer leads from TB1-15 and TB1-16 and check for continuity between these two leads. If circuit is open, isolate to Emergency Stop switch and wiring. If there is continuity, go to next step.
5. Base board not properly calibrated or corrupt calibration.	Confirm that the installed calibration part number matches the serial plate information. Re-enter calibration file if necessary.
7. **PCC without display**: The Manual input is not getting from the Manual select switch (S12) to the Base board indicting that S12, Base board or the harness is bad.	Remove connector P11 from the Base board. With S12 in START/PREHEAT position, check for continuity between P11-4 (RUN) to P11-8 (GND). If no continuity, isolate to switch and wiring. If there is continuity, the Base board is bad.
8. **PCC with display**: The menu display manual Run button, harness or the Base board is bad.	Check for continuity between P11-4 (RUN) to P11-8 (GND). If no continuity when pressing the manual Run button, isolate to front membrane panel and wiring. If there is continuity, the Base board is bad.
9. Oil pressure “sender”, setup or wiring is defective.	a. Remove P11 connection and check wiring between P11-5, P11-6 and P11-17 (for three wire sender) to the sender. b. Verify control is configured for the type of sender. c. Verify operation of the sender.

TABLE 5-2. ENGINE DOES NOT CRANK IN REMOTE MODE (NO FAULT MESSAGE)

Reason: This indicates that the PCC has not received or recognized a remote start signal.
Effect: Engine will not start in remote mode, but starts in manual mode.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. The remote start switch or customer wiring is faulty.	Reset the control. Attempt to start, and check for ground at TB1-16. If ground level is not present, isolate to the remote switch or customer wiring. Repair as necessary. If ground is present, go to next step.
2. **PCC without display:** The Auto mode input is not getting from the Remote (Auto) select switch (S12) to the Base board indicting that S12, Base board or the harness is bad.	Remove connector P11 from the Base board. With S12 in Remote (Auto) position, check for continuity from P11-16 (AUTO) to P11-8 (GND). If no continuity, isolate to switch or wiring harness. If there is continuity, the Base board is bad.
3. **PCC with display:** The menu display Auto button, harness or the Base board is bad.	Check for continuity between P11-16 (AUTO) to P11-8 (GND). If no continuity when pressing the menu display Auto button, isolate to front membrane panel or wiring harness. If there is continuity, the Base board is bad.

⚠ WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

TABLE 5-3. WARNING AND SHUTDOWN CODES

FAULT CODE	CORRECTIVE ACTION
1 **HIGH COOLANT TEMP** Lamp: Shutdown	Indicates engine has overheated (coolant temperature has risen above the shutdown trip point). Allow engine to cool down completely before proceeding with the following checks: a. Check coolant level and replenish if low. Look for possible coolant leakage points and repair if necessary. b. Check for obstructions to cooling airflow and correct as necessary. c. Check fan belt and repair or tighten if necessary. d. Check blower fan and circulation pumps on remote radiator installations. e. Reset control and restart after locating and correcting problem.
2 **LOW OIL PRESSURE** Lamp: Shutdown	Indicates engine oil pressure has dropped below the shutdown trip point. Check oil level. If oil level is low, replenish. Reset control and restart.
12 **HIGH AC VOLTAGE** Lamp: Shutdown	Indicates that one or more of the phase voltages has exceeded 130% of nominal for 1.0 second, or has exceeded 110% of nominal for 10 seconds.
13 **LOW AC VOLTAGE** Lamp: Shutdown	Indicates that one or more of the phase voltages has dropped below 85% of nominal for 10 seconds.
14 **OVER FREQUENCY** Lamp: Shutdown	Indicates frequency is 10% above base frequency for 10 seconds.
15 **UNDER FREQUENCY** Lamp: Shutdown	Indicates that engine speed has dropped below 90% of nominal for 10 seconds. Check fuel supply, intake air supply and load.
27 **EXCITATION FAULT** Lamp: Shutdown	Indicates a loss of all three voltage sense leads or failure in excitation circuit. Check field wiring (X1 and X2) for shorts or opens. (Refer to *Section 7*.)
31 **OVERSPEED** Lamp: Shutdown	Indicates engine has exceeded normal operating speed. The threshold is 1725 RPM (50 Hz) or 2075 RPM (60 Hz). Possible causes are single step large block load removal or flammable vapors drawn into the intake air passage. Reset control and restart after locating and correcting problem.
38 **FIELD OVERLOAD** Lamp: Shutdown	Indicates that the Field AVR Duty Cycle has been at the maximum for at least 15 seconds.
45 **SPEED SIGNAL LOST** Lamp: Shutdown	Indicates that no magnetic pickup pulses are sensed for a Loss of Speed delay. (If a magnetic pickup is not installed, then speed sensing is performed by monitoring AC line frequency and this fault cannot occur.)

⚠ WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

TABLE 5-3. WARNING AND SHUTDOWN CODES (CONT.)

FAULT CODE	CORRECTIVE ACTION
46 **HIGH AC CURRENT** Lamp: Shutdown	Indicates that an individual phase of alternator output current has exceeded 150% of the rated output current continuously for more than 10 seconds. Check load and load lead connections.
61 **EMERGENCY STOP** Lamp: Shutdown	Indicates remote Emergency Stop. To reset the remote Emergency Stop button: 1. Open (disable) remote emergency stop button. 2. Move the rocker switch to the OFF position or press the OFF button. 3. Select the desired operating mode (manual or remote).
71 **SPEED HZ MATCH** Lamp: Shutdown	Indicates that measured speed and measured AC output frequency do not agree. Check genset setup for number of flywheel teeth.
72 **FAIL TO CRANK** Lamp: Shutdown	The genset has failed to sense rotation for two start attempts. Indicates possible fault with control, speed sensing or starting system.
73 **FAIL TO START** Lamp: Shutdown	Indicates possible fuel system or air induction problem. (Engine cranks but fails to start) a. Check for empty fuel tank, fuel leaks, or plugged fuel lines and correct as required. b. Check for dirty fuel filter and replace if necessary. c. Check for dirty or plugged air filter and replace if necessary. d. Reset the control and restart after correcting the problem.
75, 76 **CUSTOMER INPUT #1 & #2** Lamp: Shutdown	The nature of the fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, etc. Each of the fault functions can be programmed (using service tool), as follows: • Warning or Shutdown (Default: Warning) (See fault code **204/205** for Warning) • Change display name using up to 32 characters.
81, 82, 83 **ANNUNCIATOR FAULT 1, 2, 3** Lamp: Shutdown	The nature of the annunciator fault is an optional customer selection.
84 – 91 **BASE I/O MODULE INPUT 1 – 8** Lamp: Shutdown	The nature of the Base I/O Module fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, etc. Each of the fault functions can be programmed (using InPower service tool or access to Setup menu), as follows: • Warning, Shutdown or Event (Default = Warning) (See fault code **226–233** for Warning and code **163–170** for Event) • Change display name using up to 32 characters.

⚠ WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

TABLE 5-3. WARNING AND SHUTDOWN CODES (CONT.)

FAULT CODE	CORRECTIVE ACTION
92 – 95 **AUX i/O MODULE INPUT 9 – 12** Lamp: Shutdown	The nature of the Aux I/O Module fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, etc. Each of the fault functions can be programmed (using InPower service tool or access to Setup menu), as follows: • Warning, Shutdown or Event (Default = Warning) (See fault code **234–237** for Warning and code **171–174** for Event) • Change display name using up to 32 characters.
96 **OIL TEMP HIGH** Lamp: Shutdown	Indicates that the engine oil temperature is above normal and has reached the shutdown trip point. (I/O Module option.)
98 **AMBIENT TEMP HIGH** Lamp: Shutdown	Indicates ambient temperature is above normal and has reached the shutdown trip point. (I/O Module option.)
99 **FUEL LEVEL LOW** Lamp: Shutdown	Indicates that fuel level has reached the shutdown trip point. (I/O Module option.)
102 **VOLTAGE BIAS OOR** Lamp: Shutdown	Indicates the voltage bias circuit output is out of range (OOR), high or low. (I/O Module option.)
103 **SPEED BIAS OOR** Lamp: Shutdown	Indicates the speed bias circuit output is out of range (OOR), high or low. (I/O Module option.)
106 **I/O MODULE LOST** Lamp: Shutdown	Indicates the data link between the I/O module and the Base board is lost.
163 – 170 **BASE I/O MODULE INPUT 1 – 8** Lamp: None	The nature of the Base I/O Module event is an optional customer selection. Each event function can be programmed (using InPower service tool or access to Setup menu), as follows: • Change display name using up to 32 characters. • Select active low or high input.
171 – 174 **AUX I/O MODULE INPUT 9 – 12** Lamp: None	The nature of the Aux I/O Module event is an optional customer selection. Each event function can be programmed (using InPower service tool or access to Setup menu), as follows: • Change display name using up to 32 characters. • Select active low or high input.
202 **PRE-HIGH COOL TMP** Lamp: Warning	Indicates engine is operating near cooling system capacity (monitor condition). Increase in load or higher ambient temperature may cause High Coolant Temp (**1**) shutdown. Review code **1** correction list for other possible causes.

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TABLE 5-3. WARNING AND SHUTDOWN CODES (CONT.)

FAULT CODE	CORRECTIVE ACTION
203 **LOW COOLANT TEMP** Lamp: Warning Set is not operating. Warning occurs when engine coolant temperature is 70° F (21° C) or lower. **NOTE: In applications where the ambient temperature falls below 40° F (4° C), Low Coolant Temp may be indicated even though the coolant heaters are operating.**	Indicates engine coolant heater is not operating or is not circulating coolant. Check for the following conditions: a. Coolant heater not connected to power supply. Check for blown fuse or disconnected heater cord and correct as required. b. Check for low coolant level and replenish if required. Look for possible coolant leakage points and repair as required. c. Open heater element. Check current draw of heater. Coolant temperature must be below 70° F (default setting) for one minute to activate warning and be above 70° F for five minutes before the warning can be cleared.
204, 205 **CUSTOMER INPUT #1, #2** Lamp: Warning	The nature of the fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, etc. Each of the fault functions can be programmed (using service tool), as follows: • Warning or Shutdown (Default: Warning) (See fault code **75/76** for Shutdown) • Change display name using up to 32 characters.
212 **COOL SENSOR OUT OF RANGE** Lamp: Warning	Indicates that the control has sensed that the engine coolant temperature sensor output is out of range (high or low). Check sender/connectors/wires.
213 **LOW BATTERY** Lamp: Warning	Indicates battery voltage supply to the control is approaching a low level at which unpredictable operation will occur. a. Discharged or defective battery. Check the battery charger fuse. Recharge or replace the battery. b. Poor battery cable connections. Clean the battery cable terminals and tighten all connections. c. Check battery wiring/calibration. d. Check engine DC alternator. Replace engine DC alternator if normal battery charging voltage is not obtained. e. Check battery charge voltage float level if applicable (raise float level).
214 **HIGH BATTERY** Lamp: Warning	Indicates battery voltage supply to the control is approaching a high level at which damage to the control can occur. Check float level on battery charger if applicable (lower float level). Check battery wiring/calibration.
215 **PRE-LOW OIL PRESSURE** Lamp: Warning	Indicates engine oil pressure has dropped below the warning trip point. If generator is powering critical loads and cannot be shut down, wait until next shutdown period and then follow code **2** procedure.
216 **HIGH AC CURRENT** Lamp: Warning	Indicates that one or more of the phase currents has exceeded 110% of nominal for 60 seconds. Check load and load lead connections.

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TABLE 5-3. WARNING AND SHUTDOWN CODES (CONT.)

FAULT CODE	CORRECTIVE ACTION
217 **OIL PRESS SENSOR OUT OF RANGE** Lamp: Warning	Indicates that the control has sensed that the engine oil pressure sensor output is out of range (high or low). Check sender/connectors/wires.
219 **CHARGER FAILURE** Lamp: Warning	Indicates the battery charging alternator has not reached an acceptable voltage range within the selected period (default = 120 seconds). Refer to engine service manual.
221 **WEAK BATTERY** Lamp: Warning	Indicates that during cranking, the battery voltage is at or below the weak battery warning trip point for a time greater than or equal to the weak battery set time. See code **213** for corrective action.
222, 223, 224 **ANNUNCIATOR FAULT 1, 2, 3** Lamp: Warning	The nature of the annunciator fault is an optional customer selection.
225 **ANNUNCIATOR OUTPUT CONFIGURATION ERROR** Lamp: Warning	Indicates a mismatch in the configuration of one of the annunciator relay outputs.
226 – 233 **BASE I/O MODULE INPUT 1 – 8** Lamp: Warning	The nature of the Base I/O Module fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, etc. Each of the fault functions can be programmed (using InPower service tool or access to Setup menu), as follows: • Warning, Shutdown or Event (Default = Warning) (See fault code **84–91** for Shutdown and code **163–170** for Event) • Change display name using up to 32 characters.
234 – 237 **AUX I/O MODULE INPUT 9 – 12** Lamp: Warning	The nature of the Aux I/O Module fault is an optional customer selection. Example inputs: Low Fuel Day Tank, Water In Fuel, Ground Fault, etc. Each of the fault functions can be programmed (using InPower service tool or access to Setup menu), as follows: • Warning, Shutdown or Event (Default = Warning) (See fault code **92–95** for Shutdown and code **171–174** for Event) • Change display name using up to 32 characters.
238 **OIL TEMP HIGH** Lamp: Warning	Indicates engine has begun to overheat (oil temperature has risen to an unacceptable level). Increase in load or higher ambient temperature may cause High Oil Temp (**code 96**) shutdown. (I/O Module option.)
239 **OIL TEMP OOR** Lamp: Warning	Indicates the oil temperature sensor output is out of range (OOR), high or low. (I/O Module option.)
242 **AMBIENT TEMP HIGH** Lamp: Warning	Indicates the ambient temperature has exceeded the warning threshold for genset room temperature. Increase in load may cause Ambient Temp High (**code 98**) shutdown. (I/O Module option.)

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TABLE 5-3. WARNING AND SHUTDOWN CODES (CONT.)

FAULT CODE	CORRECTIVE ACTION
243 **AMBIENT TEMP OOR** Lamp: Warning	Indicates the ambient temperature sensor output is out of range (OOR), high or low. (I/O Module option.)
244 **FUEL LEVEL LOW** Lamp: Warning	Indicates that the fuel level has dropped below the low fuel level trip point. Allows time to refill before Fuel Level Low (**code 99**) shutdown occurs. (I/O Module option.)
245 **FUEL LEVEL OOR** Lamp: Warning	Indicates the fuel level sensor output is out of range (OOR), high or low. (I/O Module option.)
252 **I/O MODULE LOST** Lamp: Warning	Indicates an intermittent data link between the I/O module and the Base board.

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CODE 1/202 – HIGH OR PRE-HIGH COOLANT TEMPERATURE (SHUTDOWN/WARNING)

Reason: Engine coolant temperature has exceeded the warning threshold for pre-high/high coolant temperature.
Effect: Calibration-dependent. No action is taken by the PCC for code **202**. Engine will shut down for code **1**.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault simulation was enabled with InPower.	1. With InPower, verify that the fault simulation is not enabled for the coolant sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
2. Engine or sensor circuitry problem.	2. Check the sensor accuracy with a thermocouple or similar temperature probe. • If the PCC coolant temperature reading is accurate, the engine may be overheating. Refer to the engine service manual. • If the PCC coolant temperature reading is not accurate, go to next step.
3. The sensor could be bad.	3. Disconnect the sensor and connect a coolant temperature sensor simulator to the harness. If the control responds to the simulator, replace the sensor. If control does not respond, go to next step.
4. The harness or Base board could be bad.	4. Measure the resistance of the coolant sensor and reconnect harness to sensor. Remove connector P11 from Base board and check resistance between pins P11-18 (H20) and P11-6 (H20 COM). • If resistance is not the same, harness is bad. • If resistance is the same, Base board is bad.

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CODE 2/215 – LOW OIL OR PRE-LOW PRESSURE (WARNING/SHUTDOWN) OIL PRESSURE SENSOR TYPE: SENDER

Reason: Engine oil pressure has dropped below the warning/shutdown threshold for low/high oil pressure.
Effect: Calibration-dependent. No action is taken by the PCC for code **215**. Engine will shut down for code **2**.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault simulation was enabled with InPower.	1. With InPower, verify that the fault simulation is not enabled for the oil pressure sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
2. Low oil level. Clogged lines or filters.	2. Check oil level, lines and filters. If oil system is OK but oil level is low, replenish.
3. Sensor or oil pump could be bad. Or the generator set may be shutting down on another fault.	3. Disconnect the oil pressure sensor leads, and connect an oil pressure sensor simulator to the harness. a. If the control responds to the simulator, reconnect the sensor, disconnect the + signal wire at the fuel solenoid, and crank the engine. Check the oil pressure reading on the digital display. • If the display shows an acceptable oil pressure, the problem may not be in the oil or oil sensing system. The genset may be shutting down on another fault (out of fuel, intermittent connector). Restart the genset and monitor the PCC display panel for other faults. • If the display does not show an acceptable oil pressure, replace the sensor. If the PCC still doesn't display an oil pressure while cranking, the oil pump may be bad. Refer to the engine service manual. b. If the control does not respond to the simulator, go to next step.
4. Harness or Base board could be bad.	4. If the control does not respond to the simulator, the Base board or the harness is bad. Check for +5 VDC at the sensor (lead marked S1). If there is no 5 VDC at the sensor: • Check for 5 VDC at P11-17. • If yes, harness is bad. If no, Base board is bad. If there is 5 VDC at the sensor, use the sensor simulator to generate a signal to P11-17 (OP OUT) and P11-5 (OP COMM). If the pressure signal (.5 to 4.5 VDC) does not get to P11, isolate to the harness. If the pressure signal does go to P11, the Base board is bad.

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CODE 12 – HIGH AC VOLTAGE (SHUTDOWN)

Reason: One or more of the phase voltages has exceeded 130% of nominal for 1.0 second, or has exceeded 110% of nominal for 10 seconds.
Effect: Engine will shut down.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault simulation was enabled with InPower.	1. With InPower, verify that the related fault simulation is not enabled. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
2. Single step large block load removal.	2. Clear fault and restart genset.
3. Fault threshold is not set correctly with InPower.	3. Reset the threshold to the highest allowable setting. Determine the required operating range before adjusting the threshold.
4. Base board or generator is bad.	4. Refer to *Generator/Base Board Isolation Procedure* in *Section 7* to determine if the generator or the Base board is causing the high AC voltage shutdown fault.

CODE 13 – LOW AC VOLTAGE (SHUTDOWN)

Reason: One or more of the phase voltages has dropped below 85% of nominal for 10 seconds.
Effect: Engine will shut down.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault simulation was enabled with InPower.	1. With InPower, verify that the related fault simulation is not enabled. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
2. Fault threshold is not set correctly with InPower.	2. Reset the threshold to the lowest allowable setting. Determine the required operating range before adjusting the threshold.
3. Overload.	3. Check the load and correct any overload. Check operation by disconnecting load and restarting generator set.
4. Improper connections have been made at the generator output terminals.	4. Reconnect according to the appropriate reconnection diagram. See *Section 9*.
5. Voltage sense wiring connection could be incorrect.	5. Check that excitation inputs P13-5 and P13-6 are connected to the correct voltage. If misconnected to a high voltage, the AVR fault will shut down excitation and cause Low AC Voltage condition. (*refer to Section 9*).
6. The rotating rectifier assembly (diodes CR1 through CR6) is faulty.	6. Check each diode (*refer to Section 7*).
7. Loose connector or Base board is bad.	7. Repair connections (P13) or replace the Base board if necessary.

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CODE 14 – OVER FREQUENCY (SHUTDOWN)

Reason: Generator AC output frequency is high.
Effect: Generator set will shut down.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault threshold is not set correctly with InPower.	1. Reset the threshold to the highest allowable setting. Determine the required operating range before adjusting the threshold.
2. Fuel or air delivery problem.	2. Refer to the engine service manual.
3. Governor fault.	3. Check governor frequency adjustment (refer to *Section 8*).
4. Loose connector or Base board is bad.	4. Repair connections (P13) or replace the Base board if necessary.

CODE 15 – UNDER FREQUENCY (SHUTDOWN)

Reason: Generator AC output frequency is low.
Effect: Generator set will shut down.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault simulation was enabled with InPower.	1. With InPower, verify that the related fault simulation is not enabled. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
2. Fault threshold is not set correctly with InPower.	2. Reset the threshold to the lowest allowable setting. Determine the required operating range before adjusting the threshold.
3. Overload.	3. Check the load and correct any overload. Check operation by disconnecting load and restarting generator set.
4. Fuel or air delivery problem.	4. Refer to the engine service manual.
5. Governor fault.	5. Check fuel shutoff solenoid adjustment (refer to *Section 8*).
6. Loose connector or Base board is bad.	6. Repair connections (P13) or replace the Base board if necessary.

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CODE 31 – OVERSPEED (SHUTDOWN)

Reason: Engine speed signal indicates an engine speed greater than shutdown threshold.
Effect: Engine will shut down.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Cold engine (no coolant heaters)	1. Overspeed can occur when starting a very cold engine. Clear fault and restart genset.
2. Single step large block load removal.	2. Clear fault and restart genset.
3. Fault simulation was enabled with InPower.	3. With InPower, verify that the fault simulation is not enabled for the coolant sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
4. Fault threshold is not set correctly with InPower.	4. Reset the threshold to the highest allowable setting. Determine the required operating range before adjusting the threshold.
5. Monitor the engine rpm using InPower.	5. If the RPM is not correct, refer to fault code **45** for corrective action.
6. Governor fault.	6a. Check fuel shutoff solenoid adjustment (refer to *Section 8*). 6b. Check governor frequency adjustment (refer to *Section 8*). 6c. Replace defective injection pump unit.

CODE 45 – SPEED SIGNAL LOST (SHUTDOWN)

Reason: This indicates that the PCC is not sensing the magnetic pickup signal.
Effect: Engine will shut down.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Loose or damaged magnetic pickup (MPU) wires/connector pins.	1. Inspect the wires/connector pins, and repair or replace as necessary.
2. The magnetic pickup, harness or Base board could be bad.	2. To isolate the problem, reset the control and attempt to start the set. If **72** (Fail To Crank) is displayed, or if the engine starts, but then shuts down on **45** (Speed Signal Lost), the MPU sender could be bad. Remove the MPU connectors and check for 3.5 to 15 VAC at the MPU while cranking. • If no output, check for damage or debris. Also check for improper adjustment of the MPU. (Refer to *Section 6*.) If there is still no output, replace the MPU sender. • If the MPU output is OK, check for MPU voltage at P11–12 (MAG PICK+) to P11-24 (MAG PICK–) while cranking. If OK, replace the Base board. If not OK, use continuity checks to isolate connectors/harness.

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CODE 46 – HIGH AC CURRENT (SHUTDOWN)

Reason: Indicates that an individual phase of alternator output current has exceeded 150% of the rated output current continuously for more than 10 seconds.
Effect: Generator set will shut down.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault threshold is not set correctly with InPower.	1. Reset the threshold to the highest allowable setting. Determine the required operating range before adjusting the threshold.
2. Short or overload.	2. Check the load and load cables. Repair if necessary. Check operation by disconnecting load and restarting generator set.
3. Incorrect CTs or CT connections.	3. Check CTs and CT connections. Correct if necessary. Refer to *Current Transformer Installation* in *Section 6*.
4. The problem may be the Base board or harness connections.	4. Remove connector P12 from the Base board. Check continuity from P12 to CTs. P12-1 (CT1) to P12-4 (CT1-COM) P12-2 (CT2) to P12-5 (CT2-COM) P12-3 (CT3) to P12-6 (CT3-COM)

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CODE 72 – FAIL TO CRANK (SHUTDOWN) (LOCAL OR REMOTE)

Reason: This indicates that the engine failed to crank after the PCC received a start signal.
Effect: Engine will not start.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Starter is bad.	1. Reset the control. Attempt to start, and test for B+ at the starter. If there is B+ at the starter, the starter could be bad. Test starter (see engine service manual). Replace the starter. If B+ is not present at the starter, go to next step.
2. Starter not energized due to: a. Starter Output Relay K7 is bad. b. Base board is bad.	2a. Isolate to defective K7 relay/wiring. 2b. Remove lead from K7-85. Attempt to start and check for ground at K7-85 lead. If circuit remains open, Base board is bad.
3. The Emergency Stop switch or wiring is defective.	3. With Emergency Stop push button not activated, remove customer leads from TB1-15 and TB1-16 and check for continuity between these two leads. If circuit is open, isolate to Emergency Stop switch and wiring. If there is continuity, go to next step.
4. MPU/circuit or Base board is bad.	4. Refer to Code **45** instructions.

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CODE 73 – FAIL TO START (SHUTDOWN)
MECHANICAL GOVERNED ENGINE

Reason: This indicates that the engine failed to start after expiration of last crank time.
Effect: Engine will not start.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Restricted fuel supply due to: a. Fuel level below pickup tube in tank. b. Closed shutoff valve in supply line. c. Engine fuel system not primed. d. Fuel injectors clogged. e. Air in fuel system.	1a. Add fuel if low. Prime the fuel system. 1b. Open any closed shutoff valve in the fuel line supplying the engine. 1c. Refer to engine service manual. 1d. Refer to engine service manual. 1e. Bleed air from fuel system. Refer to engine service manual.
2. Glow plugs are not heating due to: a. Glow plug(s) is bad. b. K2 Glow Plug Relay is bad. c. Base board is bad.	The Base board determines at what temperature and duration of time that the glow plugs will be energized. Using sensed coolant temperature, the glow plugs are energized at 77° F (25° C) and colder. The glow plugs are energized for up to 15 seconds when the coolant temperature is –5° F (–20.5° C) or colder. Time duration (15–0 seconds) is linear between –5° F and 77° F. *With coolant temperature colder than 77°F (25°C):* 2a. Each glow plug should be warm to the touch if the engine has just been cranking. First clean and tighten the terminal of any cold glow plug and then replace it if necessary. 2b. Isolate to defective K2 relay/wiring. 2c. Remove lead from K2-85. While cranking, check for ground at K2-85 lead. If circuit remains open, Base board is bad.
3. Fuel solenoid (K1) on the injection pump not energized due to: a. Fuel solenoid (K1) is bad. b. K8 Fuel Shutoff Relay is bad. c. Base board is bad.	Isolate to K1 solenoid, K8 relay, or Base board. 3a. Attempt to start and check for B+ at the fuel solenoid coil K1. • If B+ is present, fuel solenoid is bad. • If B+ is not present, go to step b. 3b. Isolate to defective K8 relay/wiring. 3c. Remove lead from K8-6. While cranking, check for ground at K8-6 lead. If circuit remains open, Base board is bad.
4. The engine fuel system is worn or malfunctioning or has lost prime (fuel lift pump, injection pump, injectors, timing).	4. Service according to the engine service manual.
5. The engine is worn or malfunctioning mechanically.	5. Service according to the engine service manual.

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CODE 73 – FAIL TO START (SHUTDOWN)
ELECTRONIC GOVERNED ENGINE

Reason: This indicates that the engine failed to start after expiration of last crank time.
Effect: Engine will not start.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Restricted fuel supply due to: a. Fuel level below pickup tube in tank. b. Closed shutoff valve in supply line. c. Engine fuel system not primed. d. Fuel injectors clogged. e. Air in fuel system.	1a. Add fuel if low. Prime the fuel system. 1b. Open any closed shutoff valve in the fuel line supplying the engine. 1c. Refer to engine service manual. 1d. Refer to engine service manual. 1e. Bleed air from fuel system. Refer to engine service manual.
2. Glow plugs are not heating due to: a. Glow plug(s) is bad. b. K2 Glow Plug Relay is bad. c. Base board is bad.	The Base board determines at what temperature and duration of time that the glow plugs will be energized. Using sensed coolant temperature, the glow plugs are energized at 77° F (25° C) and colder. The glow plugs are energized for up to 15 seconds when the coolant temperature is –5° F (–20.5° C) or colder. Time duration (15–0 seconds) is linear between –5° F and 77° F. *With coolant temperature colder than 77° F (25° C):* 2a. Each glow plug should be warm to the touch if the engine has just been cranking. First clean and tighten the terminal of any cold glow plug and then replace it if necessary. 2b. Isolate to defective K2 relay/wiring. 2c. Remove lead from K2-85. While cranking, check for ground at K2-85 lead. If circuit remains open, Base board is bad.
3. The governor linkage needs adjustment.	3. Repair and adjust the linkage as necessary (refer to *Section 8*).

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CODE 73 – FAIL TO START (SHUTDOWN) (CONT.)
ELECTRONIC GOVERNED ENGINE

Reason: This indicates that the engine failed to start after expiration of last crank time.
Effect: Engine will not start.

POSSIBLE CAUSE	CORRECTIVE ACTION
4. Injection pump actuator not energized due to: the harness, Electronic Governor Power module, governor actuator or the Base board is bad. a. Base board is bad. b. Wiring harness is bad. c. Governor actuator is bad. d. K8 Fuel Shutoff Relay is bad. e. Electronic Governor Power Module/wiring is bad.	Isolate to harness, governor actuator or Base board. 4a. Display "Governor Duty Cycle" menu. Attempt to start and check for duty cycle (44% is about average). If percentage of duty cycle is displayed. (Duty cycle displayed indicates processor is functioning, but output circuitry of Base board could still be defective, continue with this procedure.) If the duty cycle is not displayed, the Base board is bad. 4b. Check wiring continuity of actuator circuit. Repair as necessary. If continuity is OK, go to step c. 4c. Disconnect the actuator leads and attach jumper leads to the actuator terminals. Connect the ACT+ lead to the BAT terminal on the starter solenoid and touch the ACT– lead to a good ground on the block. Replace the actuator unit if it does not drive the linkage through its full travel when power is connected or return it when power is disconnected. If actuator is OK, reconnect actuator leads and go to step d. 4d. Attempt to start and check for CNTL B+ at terminal lead ACT + of governor actuator (use engine block for meter ground). If not present: • Isolate to defective K8 relay/wiring. • Isolate to defective Base board. Remove lead from K8-6. While cranking, check for ground at K8-6 lead. If circuit remains open, Base board is bad. If CNTL B+ is present, attempt to start and check for GOV PWM (pulse width modulated) signal. Measure across terminals of actuator using a high impedance analog voltmeter. If not present, Base board or Electronic governor Power Module is bad. Go to step e. 4e. Disconnect P1 from the Electronic Governor Power Module. Check for continuity between P1-3 to T-26 and P1-5 to control ground. If circuit is open, repair wiring. If there is continuity, attempt to start and check for GOV PWM signal at J11-7 (GOV DR +) and J11-14 (GOV DR –). • If there is no GOV PWM signal, replace the Base board. • If the GOV PWM signal is present, replace the Electronic Governor Power Module.

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CODE 73 – FAIL TO START (SHUTDOWN) (CONT.)
ELECTRONIC GOVERNED ENGINE

Reason: This indicates that the engine failed to start after expiration of last crank time.
Effect: Engine will not start.

POSSIBLE CAUSE	CORRECTIVE ACTION
5. The engine fuel system is worn or malfunctioning or has lost prime (fuel lift pump, injection pump, injectors, timing).	5. Service according to the engine service manual.
6. The engine is worn or malfunctioning mechanically.	6. Service according to the engine service manual.

CODE 75/76 – CUSTOMER INPUT (SHUTDOWN)

Reason: The nature of the fault is an optional customer selection.
Effect: Shutdown.

POSSIBLE CAUSE	CORRECTIVE ACTION
If there is no actual fault, the problem may be an external wiring problem.	Disconnect the signal lead from TB1 and reset the control. • CUST_IN1 – TB1-14 • CUST_IN2 – TB1-12 If the message drops out, the external wiring has a short circuit. Grounding of either input activates fault.

CODE 202 – PRE-HIGH COOLANT TEMP (WARNING)

Reason:
Effect:

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Refer to code **1**.	1. Refer to code **1**.

⚠WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

CODE 203 – LOW COOLANT TEMPERATURE (WARNING)

Reason: Engine coolant temperature has dropped below the warning threshold for low coolant temperature.
Effect: No action is taken by the PCC. Engine may not start due to slow cranking speed.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Fault simulation was enabled with InPower.	1. With InPower, verify that the fault simulation is not enabled for the coolant sensor. If you do not have InPower, remove battery power from the control to disable fault simulation overrides.
2. Fault threshold is not set correctly with InPower.	2. Reset the threshold to the lowest allowable setting. Determine the required operating range before adjusting the threshold.
3. The engine coolant heater could be bad. (Radiant heat should be felt with hand held close to outlet hose.)	3. Coolant heater not operating due to: • Coolant heater not connected to power. Check for blown fuse, or disconnected heater cord and correct as required. • Low coolant level. Look for possible coolant leakage points and repair as required. • Defective heater element/thermostat. With coolant heater removed from engine and power disconnected, flush with cold tap water for two minutes to close internal heater thermostat (opens at 100° F and closes at 80° F). Check resistance across input power leads: a. Open – replace coolant heater. b. Closed – coolant heater OK (coil resistance of 10 to 60 ohms)
4. The sensor connections could be bad.	4. Inspect the sensor and engine harness connector pins. Repair or replace as necessary.
5. The sensor could be bad.	5. Disconnect the sensor, and plug in a resistive sensor simulator to isolate the fault. If the control responds to the simulator, replace the sensor. If control does not respond, harness or Base board is bad.
6. The harness or Base board could be bad.	6. Measure the resistance of the coolant temperature sensor and reconnect harness to sensor. Remove connector P11 from Base board and check resistance between pins P11-18 (H20) and P11-6 (H20 COM). • If resistance is not the same, harness is bad. • If resistance is the same, Base board is bad.

⚠WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

CODE 204/205 – CUSTOMER INPUT (WARNING)

Reason: The nature of the fault is an optional customer selection.
Effect: Warning.

POSSIBLE CAUSE	CORRECTIVE ACTION
If there is no actual fault, the problem may be an external wiring problem.	Disconnect the signal lead from TB1 and reset the control. • CUST_IN1 – TB1-14 • CUST_IN2 – TB1-12 If the message drops out, the external wiring has a short circuit. Grounding of either input activates fault.

CODE 212 – COOLANT SENSOR OUT OF RANGE (HIGH/LOW) (WARNING)

Reason: This indicates that the coolant temperature sensor signal is out of range – shorted high or low.
Effect: No engine protection for coolant temperature during genset operation. Possible white smoke.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. The sensor connections could be bad.	1. Inspect the sensor and engine harness connector pins. Repair or replace as necessary.
2. The sensor could be bad.	2. Disconnect the sensor, and plug in a resistive sensor simulator to isolate the fault. If the control responds to the simulator, replace the sensor. If control does not respond, go to next step.
3. The harness or Base board could be bad.	3a. Remove connector P11 from Base board and disconnect sensor. Check pins P11-18 (H20) and P11-6 (H20 COM) for short circuit as follows: • Check for a short circuit to the engine block ground (more than 200k ohms OK). • Check for a short circuit from pin to pin (more than 200k ohms OK). Repair or replace as necessary. 3b. Measure the resistance of the coolant sensor and reconnect harness to sensor. Remove connector P11 from Base board and check resistance between pins P11-18 (H20) and P11-6 (H20 COM). • If resistance is not the same, harness is bad. • If resistance is the same, Base board is bad.

⚠WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

CODE 213 – LOW BATTERY (WARNING)

Reason: Low voltage has been detected for battery.
Effect: PCC voltage supply approaching level at which unpredictable operation may occur.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Weak or discharged battery.	1. Recharge or replace the battery. Specific gravity for a fully charged battery is approximately 1.260 at 80° F (27° C).
2. Low electrolyte level in battery.	2. Replenish electrolyte and recharge battery.
3. Battery connections loose or dirty.	3. Clean and tighten or replace the battery cable connectors and cables at the battery and the set.
4. Insufficient battery charging voltage.	4. Adjust charge rate of AC powered battery charging circuit, according to manufactures instructions.
5. Engine DC alternator could be bad.	5. Replace engine DC alternator if normal battery charging voltage (12 to 14 VDC) is not obtained.
6. If the batteries are OK, the problem may be the harness or the Base board.	6. Remove connector P11 from Base board and check battery voltage at P11–3 & 15 (B+) to P11-9 & 10 (GND). • If the voltage at P11 is not the same as the battery voltage, the harness is bad. • If the voltage at P11 is OK, the Base board is bad.
7. Fault threshold setting incorrect.	7. Check fault threshold against requirement of the application.

CODE 214 – HIGH BATTERY VOLTAGE (WARNING)

Reason: High voltage has been detected for battery.
Effect: PCC damage will occur.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Excessive battery charging voltage.	1. Adjust charge rate of AC powered battery charging circuit according to manufacturers instructions.
2. Engine DC alternator could be bad.	2. Replace engine DC alternator if normal battery charging voltage (12 to 14 VDC) is not obtained.
3. Fault threshold setting incorrect.	3. Check fault threshold against requirement of the application.

⚠WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

CODE 215 – PRE-LOW OIL PRESSURE (WARNING)
OIL PRESSURE SENSOR TYPE: SENDER

Reason: This indicates engine oil pressure has dropped below the warning trip point.
Effect: Warning.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Refer to code **2** for Oil Pressure Sender.	1. Refer to code **2** for Oil Pressure Sender.

CODE 216 – HIGH AC CURRENT (WARNING)

Reason: This indicates that one or more of the phase currents has exceeded 110% of nominal for 60 seconds.
Effect: Warning.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Refer to code **46**.	1. Refer to code **46**.

CODE 217 – OIL PRESSURE SENSOR OUT OF RANGE (HIGH/LOW) (WARNING)
OIL PRESSURE SENSOR TYPE: SENDER

Reason: This indicates that the engine oil pressure sensor signal is out of range – shorted high or low.
Effect: No engine protection for oil pressure during genset operation.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. The sensor connections could be bad.	1. Inspect the sensor and engine harness connector pins. Repair or replace as necessary.
2. The sensor could be bad.	2. Disconnect the oil pressure sensor leads, and connect an oil pressure sensor simulator to the harness. **"OIL PRESSURE SENSOR OOR" warning is displayed after the fault condition is sensed for 10 seconds.** If the control responds to the simulator, replace the sensor. If control does not respond, go to next step.
3. The harness could be bad.	3. Remove connector P7 from Base board and connector from sensor. Check P7-5, 6 & 17 as follows: • Check for a short circuit from pin to pin (more than 200k ohms OK). • Check for an open circuit (10 ohms or less OK). Repair or replace as necessary.
4. The Base board could be bad.	4. With all connectors attached, check pressure signal (.5 to 4.5 VDC) at P7-13 (OP OUT) and P7-17 (OP COM). If in range, replace Base board.

⚠WARNING ***Hazards present in troubleshooting can cause equipment damage, severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Read Safety Precautions page and observe all instructions and precautions in this manual.***

CODE 221 – WEAK BATTERY (WARNING)

Reason:
Effect:

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Refer to code **213**.	1. Refer to code **213**.

CODE 222 THRU 224 – ANNUNCIATOR FAULT #1 THRU #4 (WARNING)

Reason: The nature of the fault is an optional customer selection.
Effect: Warning.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. If there is no actual fault, the problem may be an external wiring problem.	1. Disconnect the signal lead from TB1 and rewet the control. Check the following pins. These connections are on the Universal Annunciator. • CUST_FAULT #1 – TB1-1 • CUST_FAULT #2 – TB1-2 • CUST_FAULT #3 – TB1-3 If the message drops out, the external wiring has a short circuit. Grounding of either input activates fault.

CODE 225 – ANNUNCIATOR OUT CONFIGURATION ERROR (WARNING)

Reason: Indicates that more then one network device is configured to activate one of the annunciator output relays.
Effect: Warning.

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Network configuration is bad.	1. Check setup of devices on the network against duplicate use of the same annunciator relay output.
2. Bad device on network.	2. Troubleshoot network for malfunctioning devices.

6. Control Adjustment and Service

GENERAL

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

This section also describes the function and operation of engine sensors, genset options, and other special features of the genset control system, such as, customer connection points, magnetic speed pickup unit and current transformers. Installation information is also provided for these items where necessary.

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

WARNING ***HAZARDOUS VOLTAGE. The PCC1301 control box must be opened only by technically qualified personnel. Voltages of up to 600 VAC are present in the PCC box. These voltages can cause electrical shock, resulting in personal injury.***

CIRCUIT BOARD REMOVAL/REPLACEMENT

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

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

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

Refer to INPOWER User's Guide for specifics.

Circuit Board Removal Safety Precautions

Turn off or remove AC power from the battery charger and then remove the negative (–) battery cable from the set starting battery. This is to make sure that the set will not start while working on it and to avoid circuit board damage, caused by voltage spikes when removing and replacing circuit board connectors.

To prevent circuit board damage due to electrostatic discharge (ESD), a grounding wrist strap must be worn when handling circuit boards or socket-mounted IC's. (The wrist strap **does not** provide a direct short to ground, but is typically rated at approximately 1 megohm to ground.)

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

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

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

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

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

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

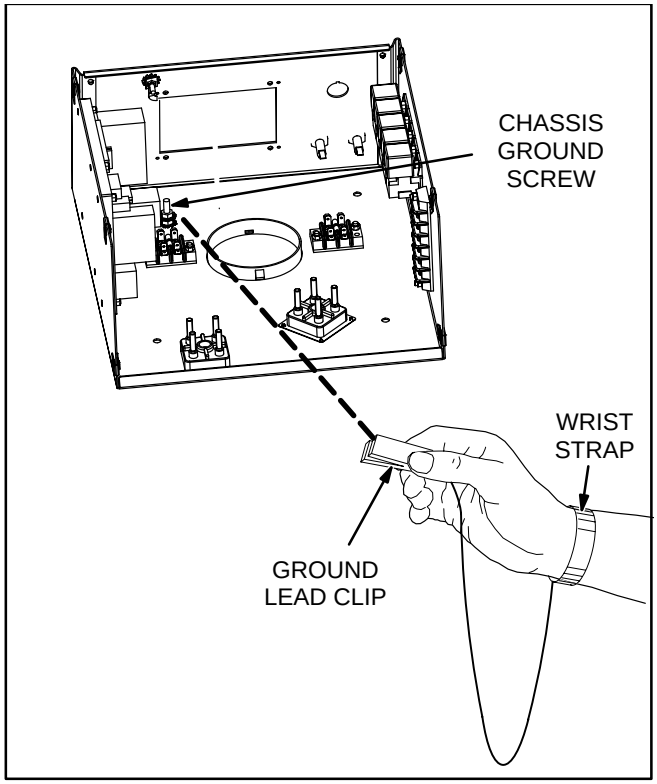

FIGURE 6-1. WRIST STRAP

SETUP MENU

The Setup Menus menu (Figure 6-2) provides access to genset menus with system parameters that can be viewed and, if a password is entered, adjusted. The Setup “Password” menu is displayed when the **“1**“ button is pressed on the Service Menu (Figure 3-14).

Pressing the VIEW button in the Setup “Password” menu, will display the 1st Genset Service menu (see Figure 6-3). Note that when viewing the Genset Service menus, the ADJUST button will not be displayed as shown in Figure 6-3.

After entering the password from the Setup “Password” menu, a second Setup menu is displayed that provides access to the following two categories of genset adjust menus.

- Genset Service menus – Go to page 6-4.
- Genset Setup menus – Go to page 6-27.

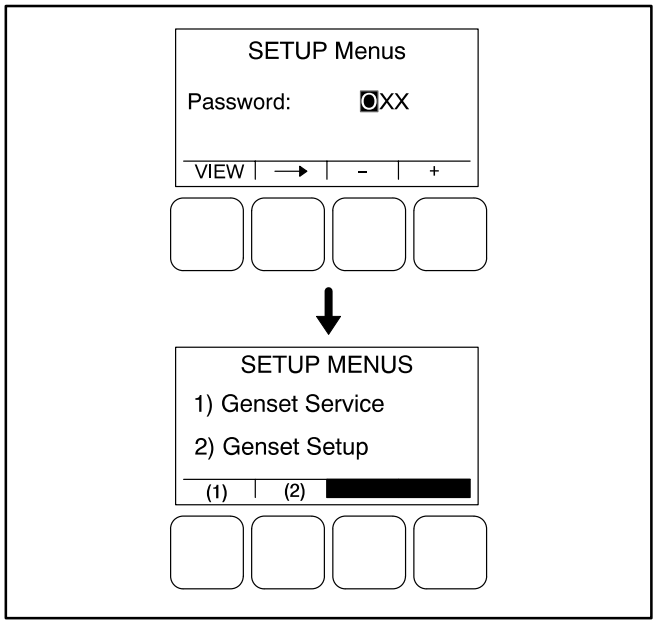

FIGURE 6-2. SETUP MENUS

GENSET SERVICE MENUS

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

The Genset Service menus are available by pressing the **(1)** button in the Setup menu (see Figure 6-3).

This section covers Genset Service menus only. For information on Genset Setup menus, go to page 6-27.

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

Viewing and Adjusting

Figure 6-3 is a block representation of the two Genset Service menus that are available from the Setup menu after the correct password has been entered. The Genset Service menus provide access to the following categories.

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

- Genset
- Customer I/O
- Meter Calibration

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

- Annunciator

Setup Password Menu

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

When the Password menu is displayed, the first numeric character (0) is highlighted (see Figure 6-3).

NOTE: When selected (highlighted), each character initially turns to “0” and the remaining characters turn to “X”.

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

To enter the Genset Service Menus password **574**:

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

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

Adjusting Values/Parameters

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

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

   NOTE: If the ◀ button is pressed before pressing the SAVE button, the changes are not saved.
6. Press the ◀ button to return to the Service Menu.

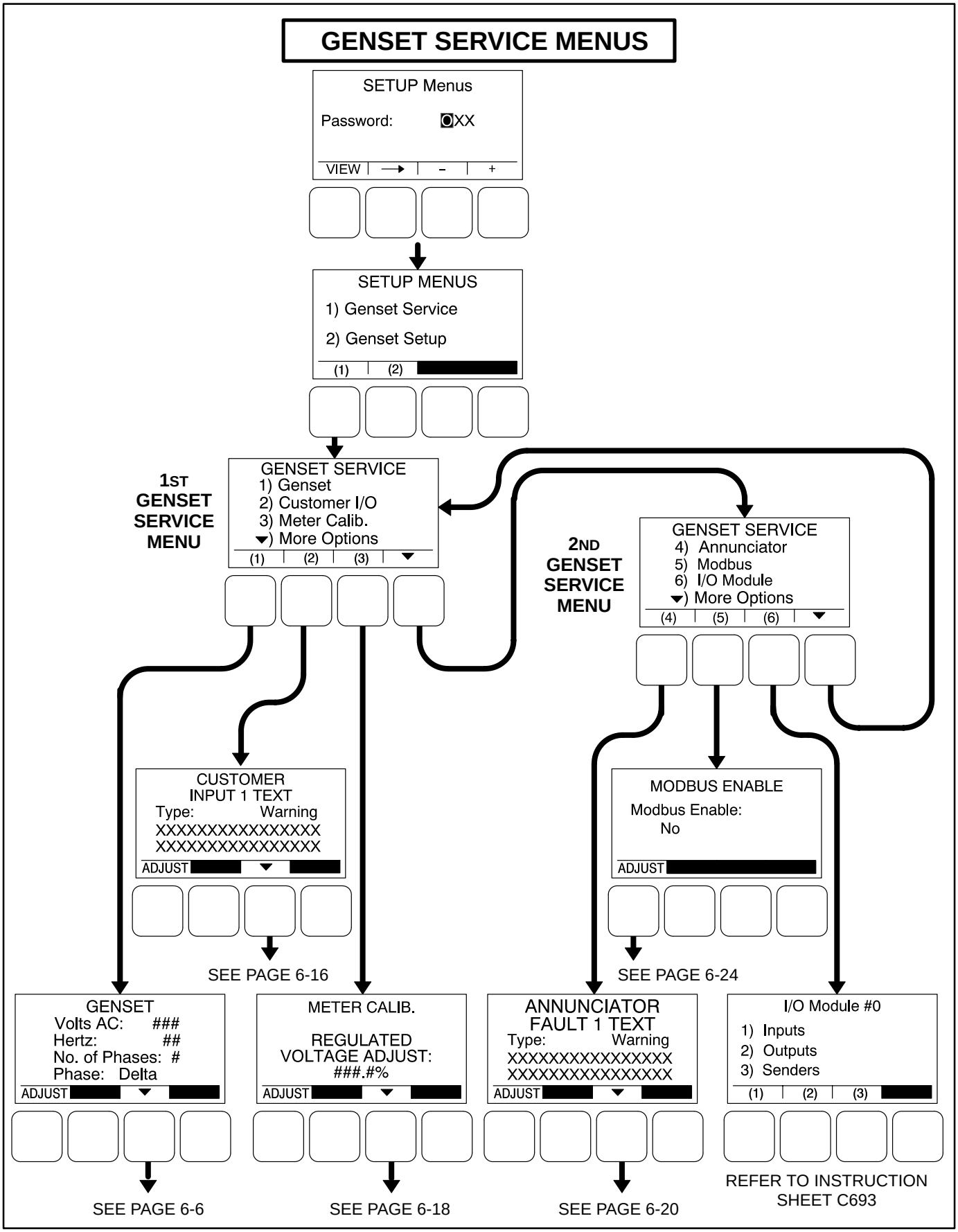

FIGURE 6-3. GENSET SERVICE MENUS

GENSET SERVICE SUBMENUS

The Genset Service submenus are available by pressing the **(1)** button on the first Genset Service menu (see Figure 6-3).

Appendix A provides a block diagram that illustrates the sequence of how the Genset Service Submenus are displayed.

The Genset Service submenus consist of ten basic menus.

- Genset, Part 1
- Genset, Part 2
- Fuel System
- Start/Stop Time Delays
- Cycle Crank
- Battle Short
- Automatic Voltage Regulator Setup*
- Electronic Governor*
- Genset Model and Serial Number
- Display Setup

Genset Menu, Part 1

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

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

Genset Menu, Part 2

The second genset menu allows for enabling or disabling charging alternators.

- *Charging Alt. Enable:*

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

  – The average engine speed (if a magnetic pickup unit is installed)

  – The average frequency

  – The charging alternator voltage (if the Charging Alt feature is enabled)

  The Charging Alt. Enable menu is used to enable or disable the Charging Alt feature. This menu provides a means to disable the control's charging alternator logic if it is not supported by the alternator. If the alternator does not support this functionality, the Charger Failure warning (fault code 219) will constantly be displayed unless this setting is changed to "No." When disabled (set to "No"), the start disconnect signal is based only on the average engine speed or frequency and the Charger Failure warning is disabled.

Fuel System

The Fuel System menu allows for selecting fuel type and, depending on the type selected, enabling/disabling glow plugs or setting a fuel burn time delay.

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

If Fuel System is set to "Diesel"

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

If Fuel System is set to "Gas"

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

Start/Stop Delay Menu

The time delay after receiving a valid start signal, until the genset starts, can be adjusted. The time delay that the genset is allowed to run at rated speed after receiving a stop signal, until the genset stops, can also be adjusted. These time delays do not apply to manual start/runs.

- *Start:* The genset start time delay can be adjusted from 0 to 300 seconds.
- *Stop:* The genset stop time delay can be adjusted from 0 to 600 seconds.

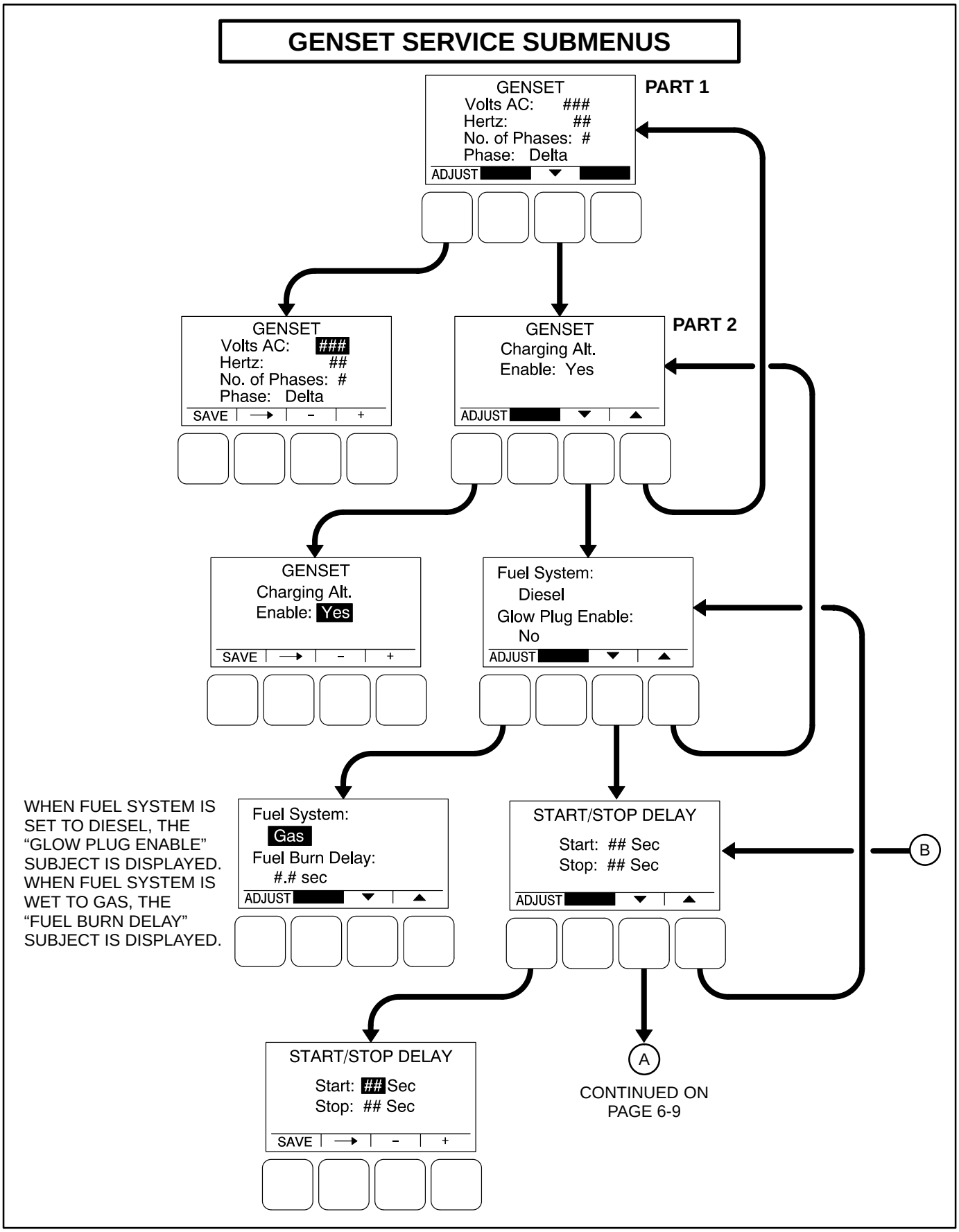

FIGURE 6-4. GENSET SERVICE SUBMENUS (SHEET 1 OF 3)

Cycle Crank Menu

The Cycle Crank menu allows for configuring the generator for all starting modes (manual and remote), as follows:

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

AVR Setup Menu

The AVR Setup menu is used to enable or disable the automatic voltage regulator. If enabled, two additional menus are displayed that can be used to adjust the AVR settings (see page 6-13).

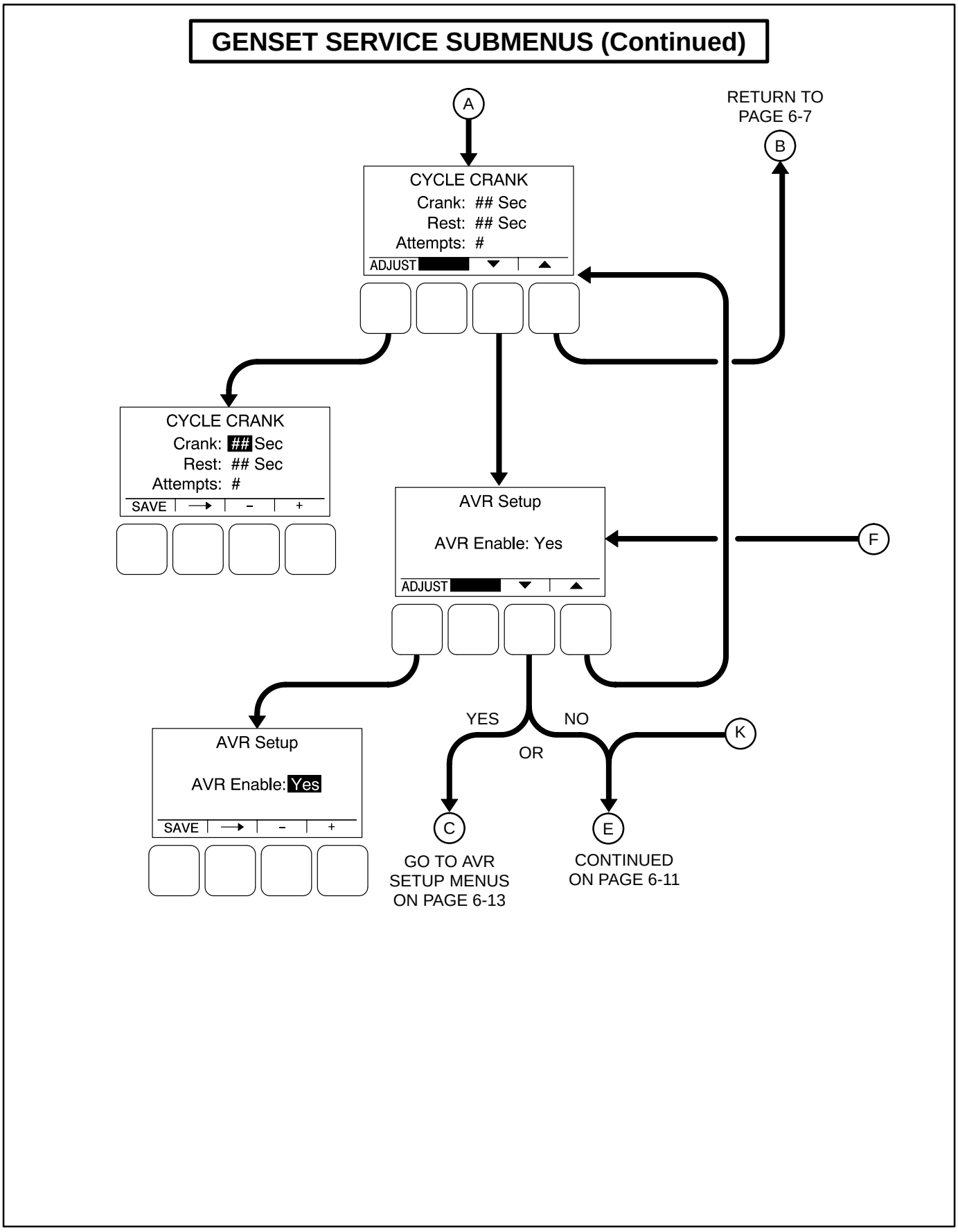

FIGURE 6-4. GENSET SERVICE SUBMENUS (SHEET 2 OF 3)

Electronic Governor Menu

The engine Electronic Governor Enable menu is used to enable or disable the electronic governor on gensets with electronic governors and magnetic pickup sensors. If enabled (set to “Yes”), four additional menus are displayed that can be used to adjust governor settings (see page 6-15).

Genset Number Menu

The Genset Number menu is used to enter the genset’s model and serial numbers. Each allow up to 16 characters to be entered.

Display Setup Menu

The Display Setup menu is used to set the display for **Local** (Auto/Off/Manual Run switch functions on the operator panel are turned on) or **Remote** (Auto/Off/Manual Run switch functions on the operator panel are turned off).

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

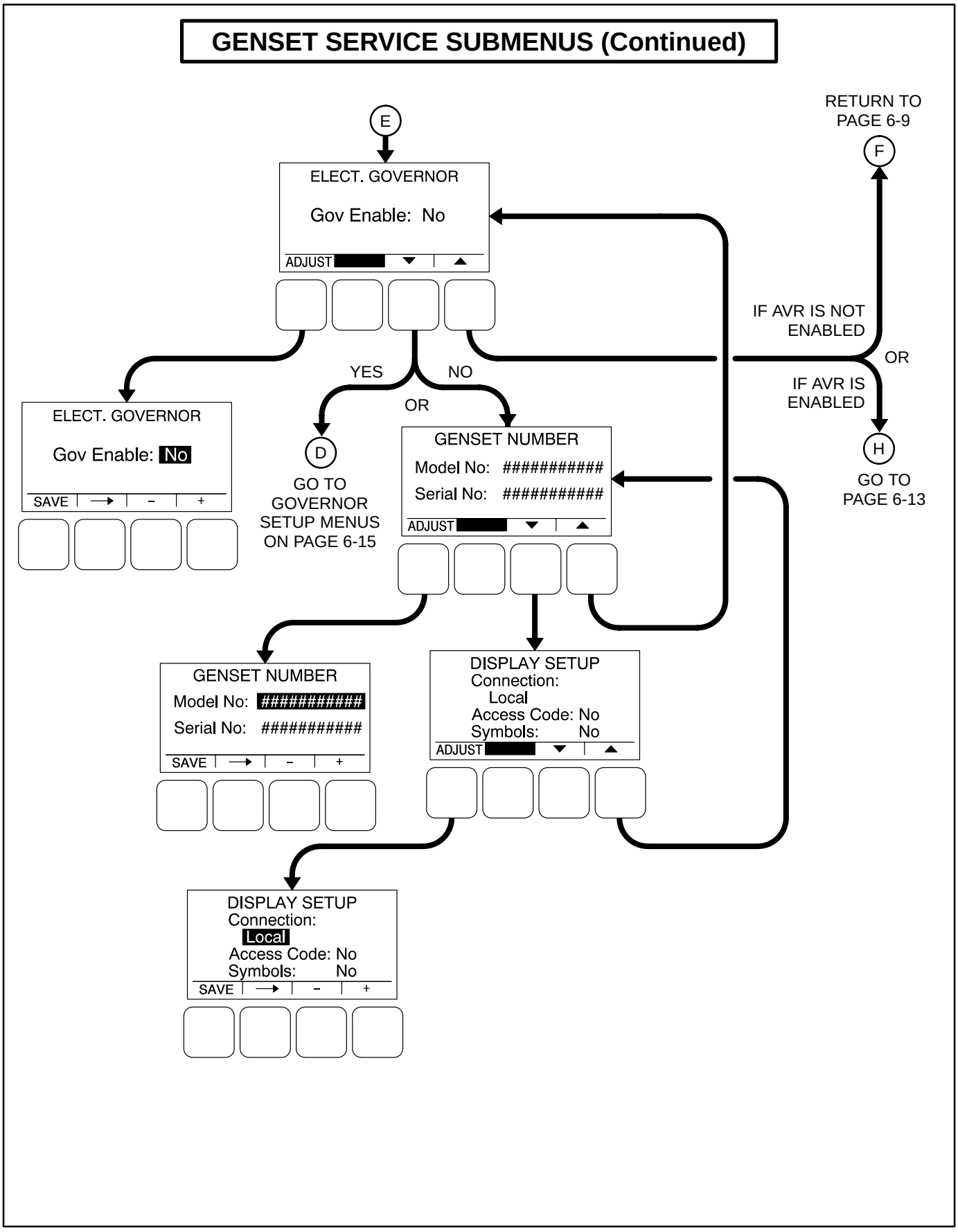

FIGURE 6-4. GENSET SERVICE SUBMENUS (SHEET 3 OF 3)

AUTOMATIC VOLTAGE REGULATOR SUBMENUS

The Automatic Voltage Regulator (AVR) submenus are available only if the AVR is enabled (see page 6-9).

Two Automatic Voltage Regulator (AVR) submenus (see Figure 6-6) can be used to adjust Volts/Hz Rolloff and Regulator Gains settings.

Volts/Hz Rolloff Menu

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

This menu allows for adjusting the knee frequency and voltage setpoint slope parameters. The knee frequency is the value below nominal frequency at which the rolloff function begins. For example, if the knee frequency is set to 5 Hz on a 60 Hz genset, this function begins when the frequency drops below 55 Hz.

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

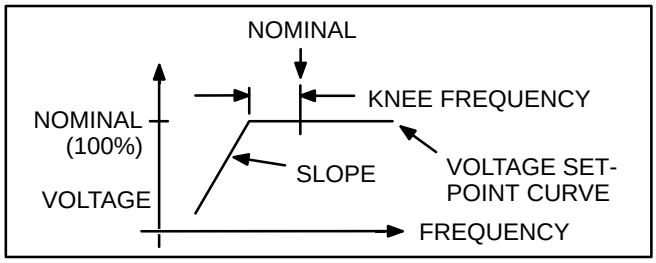

FIGURE 6-5. KNEE FREQUENCY AND SLOPE

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

Regulator Gains Menu

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

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

AUTOMATIC VOLTAGE REGULATOR SUBMENUS

NOTE: These menus are only available if the Automatic Voltage Regulator (AVR) is enabled (see page 6-9).

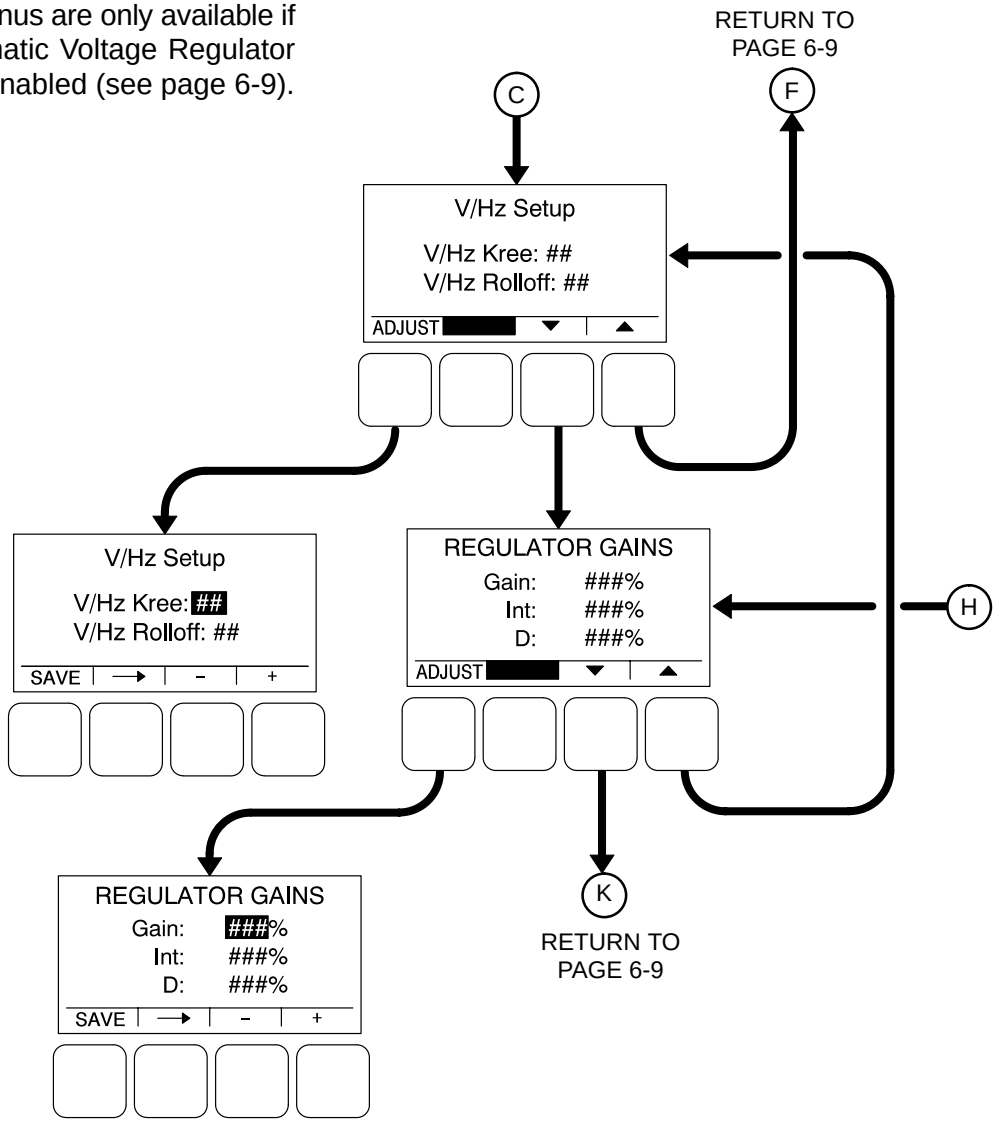

FIGURE 6-6. AUTOMATIC VOLTAGE REGULATOR SUBMENUS

ELECTRONIC GOVERNOR SUBMENUS

The Electronic Governor submenus are available only if the governor is enabled (see page 6-9).

Four Electronic Governor submenus (see Figure 6-7) can be used to adjust governor settings.

Governor Crank Fuel Menu

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

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

Electronic Governor Regulator Menu

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

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

Electronic Governor Menu

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

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

Electronic Governor Enable Speed Menu

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

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

ELECTRONIC GOVERNOR SUBMENUS

NOTE: These menus are only available if the governor is enabled (see page 6-9).

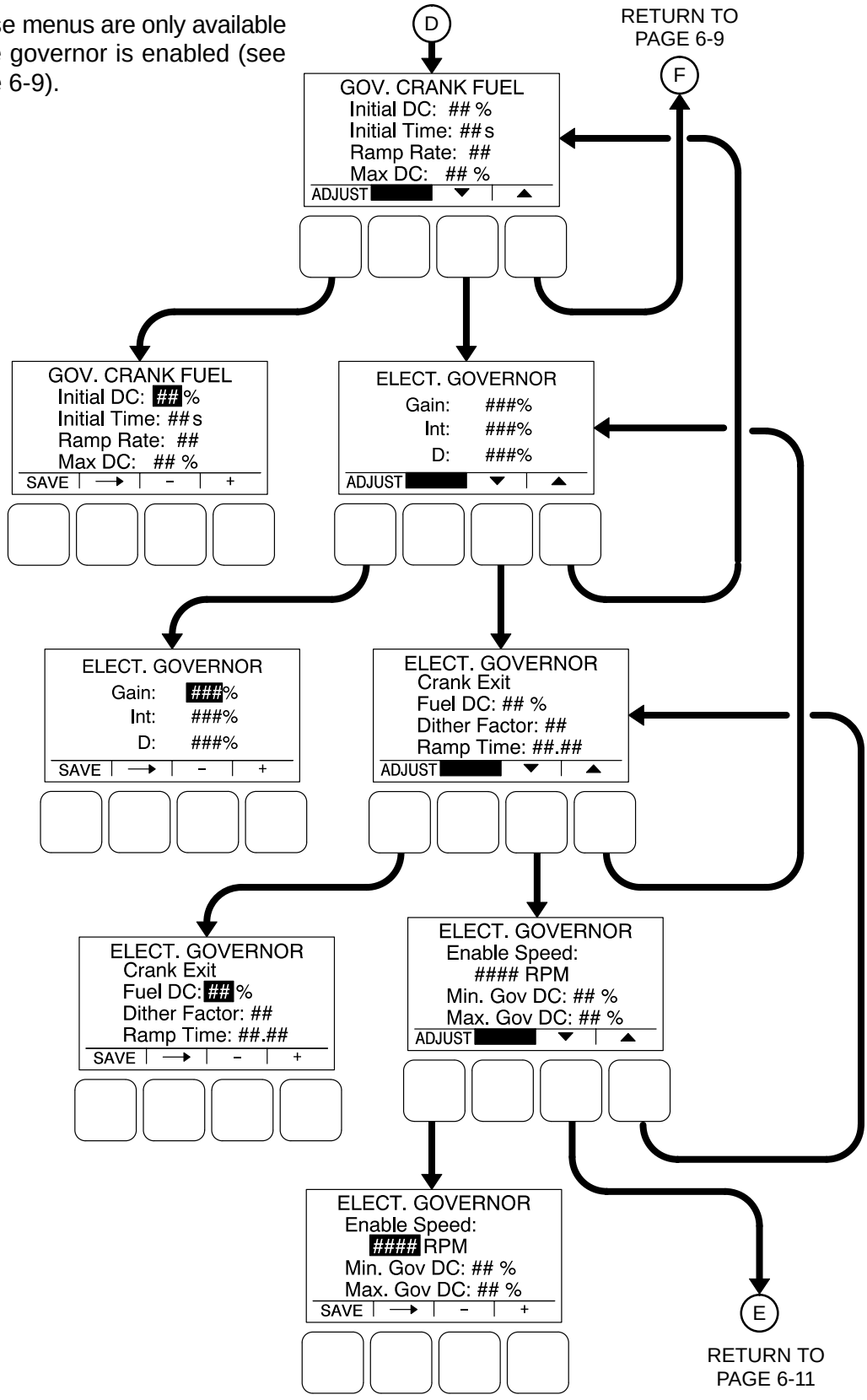

FIGURE 6-7. ELECTRONIC GOVERNOR SUBMENUS

CUSTOMER I/O SUBMENUS

The Customer I/O submenus are available by pressing the **(2)** button on the first Genset Service menu (see Figure 6-3).

Four Customer I/O submenus (see Figure 6-8) can be used to define customer input messages and output maps.

Customer Inputs

The Customer Input Text message menus are used to enter an event type and description for two events.

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

Customer Outputs

Two Customer Outputs are configurable to display common warning alarms. The two Customer Output Map menus allow for entering a fault number and fault name to be displayed for the two configurable customer outputs.

- *Number:* Enter a code number 0 to 255 for the event. Refer to *Table 5-3* which provides a list of all warning and shutdown codes. The following list contains event codes that are not shown in *Table 5-3*.
- A brief description of the event is automatically displayed.

EVENT CODES

CODE	DESCRIPTION
150	READY TO LOAD
151	UTILITY CONNECTIONS
152	GENSET CONNECTED
153	NOT IN AUTO
155	COMMON ALARM
156	COMMON WARNING
157	COMMON SHUTDOWN
158	CUSTOMER FAULT INPUT 1
159	CUSTOMER FAULT INPUT 2
160	ANNUNCIATOR FAULT 1
161	ANNUNCIATOR FAULT 2
162	ANNUNCIATOR FAULT 3

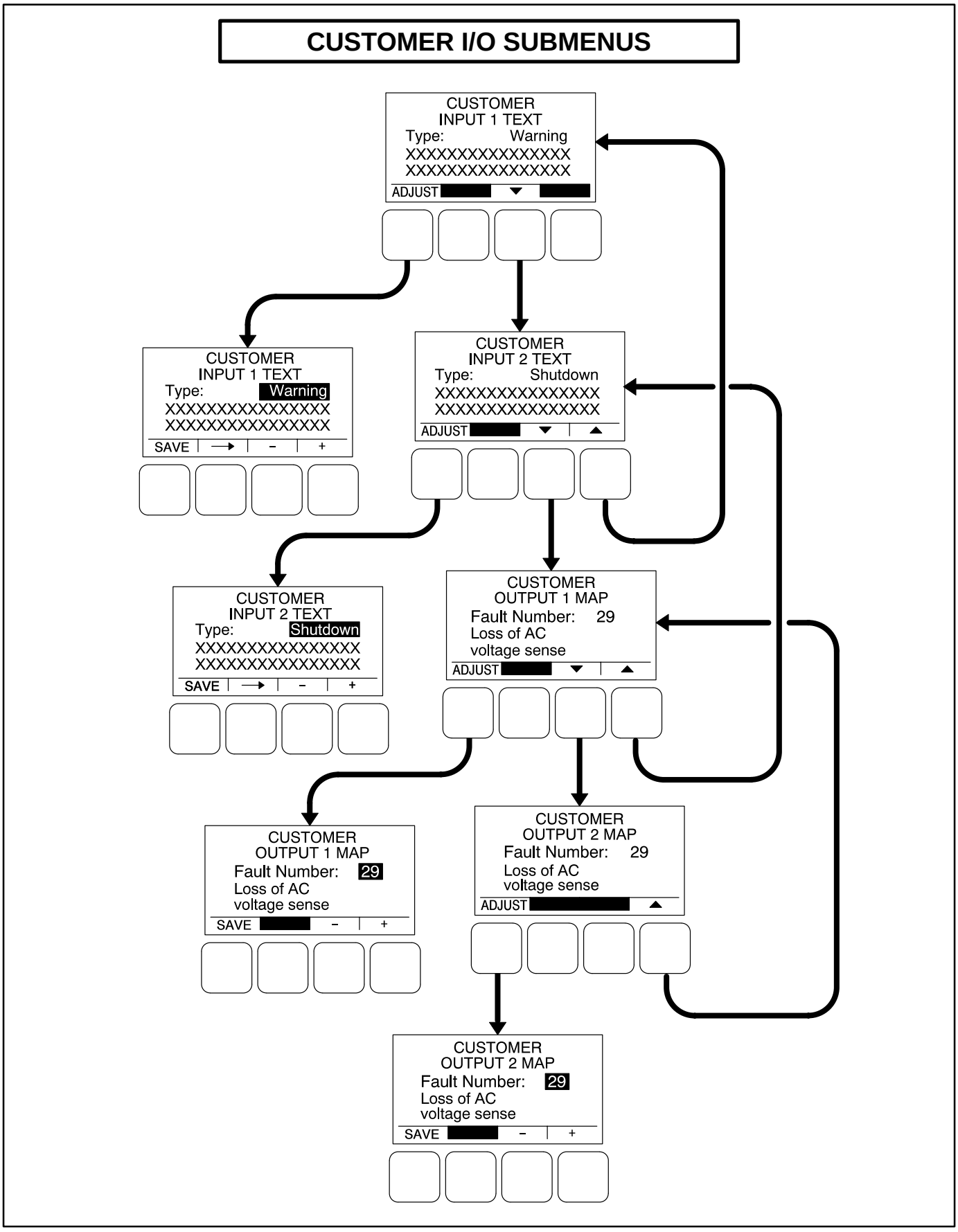

FIGURE 6-8. CUSTOMER I/O SUBMENUS

METERING SUBMENUS

The Metering submenus are available by pressing the **(3)** button on the first Genset Service menu (see Figure 6-3).

Four Metering submenus (see Figure 6-9) can be used to adjust regulated voltage, frequency, line-to-neutral voltage, and line current settings.

Meter Calib Menu

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

Freq. Adjust Menu

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

Metering Voltage Adjust Menu

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

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

Metering Current Adjust Menu

The Metering Current Adjust menu allows for adjusting metered amps.

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

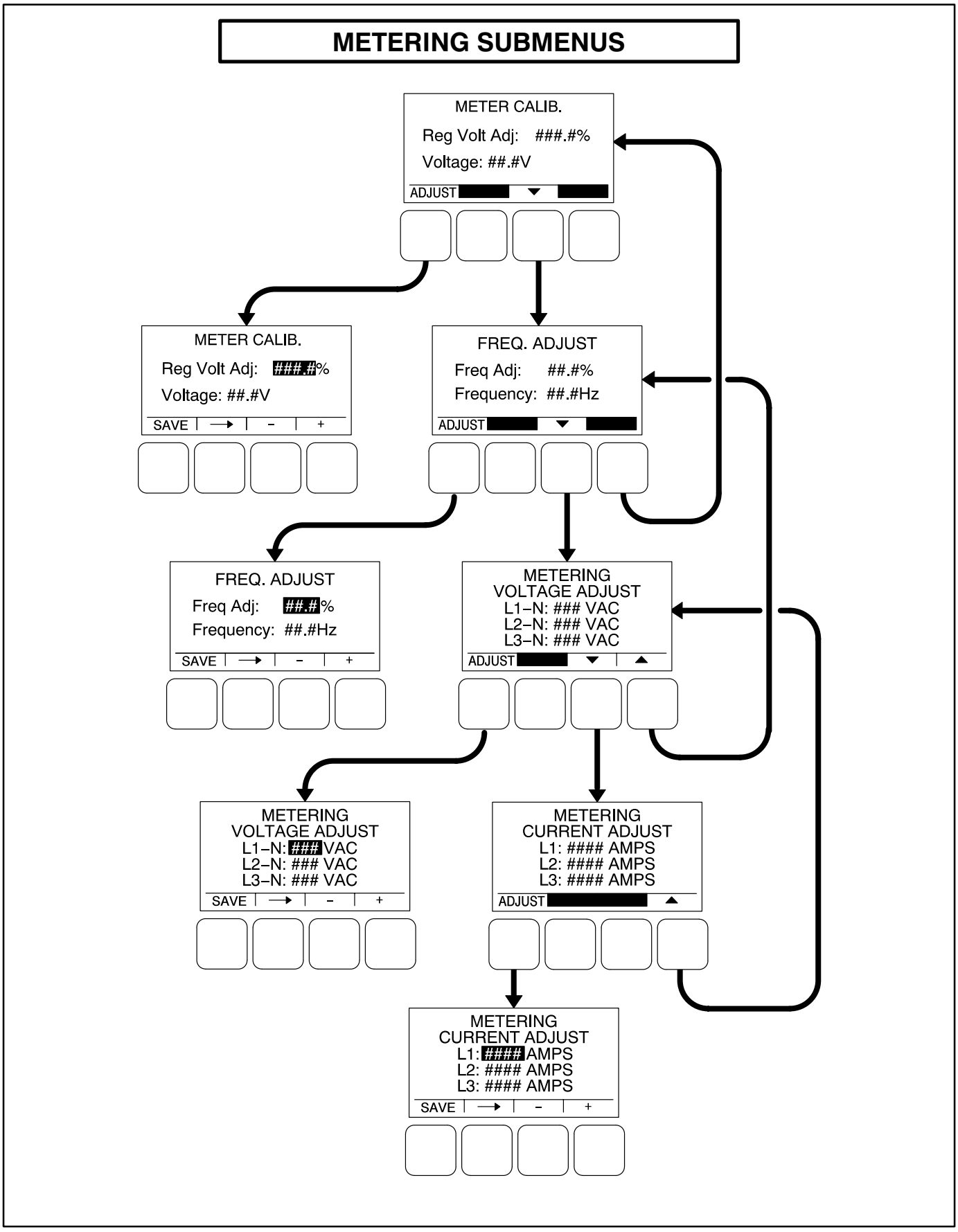

FIGURE 6-9. METERING SUBMENUS

ANNUNCIATOR SUBMENUS

The Annunciator submenus are available by pressing the **(4)** button on the second Genset Service menu (see Figure 6-3).

Seven annunciator submenus (see Figure 6-10) can be used to define three Annunciator Fault Text messages and four Annunciator Output Maps.

Annunciator Inputs

The annunciator has three possible customer-defined fault conditions that can be shown on the PCC 1301 display. The Annunciator Fault Text message menus are used to enter an event type and description for those three customer-defined annunciator faults.

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

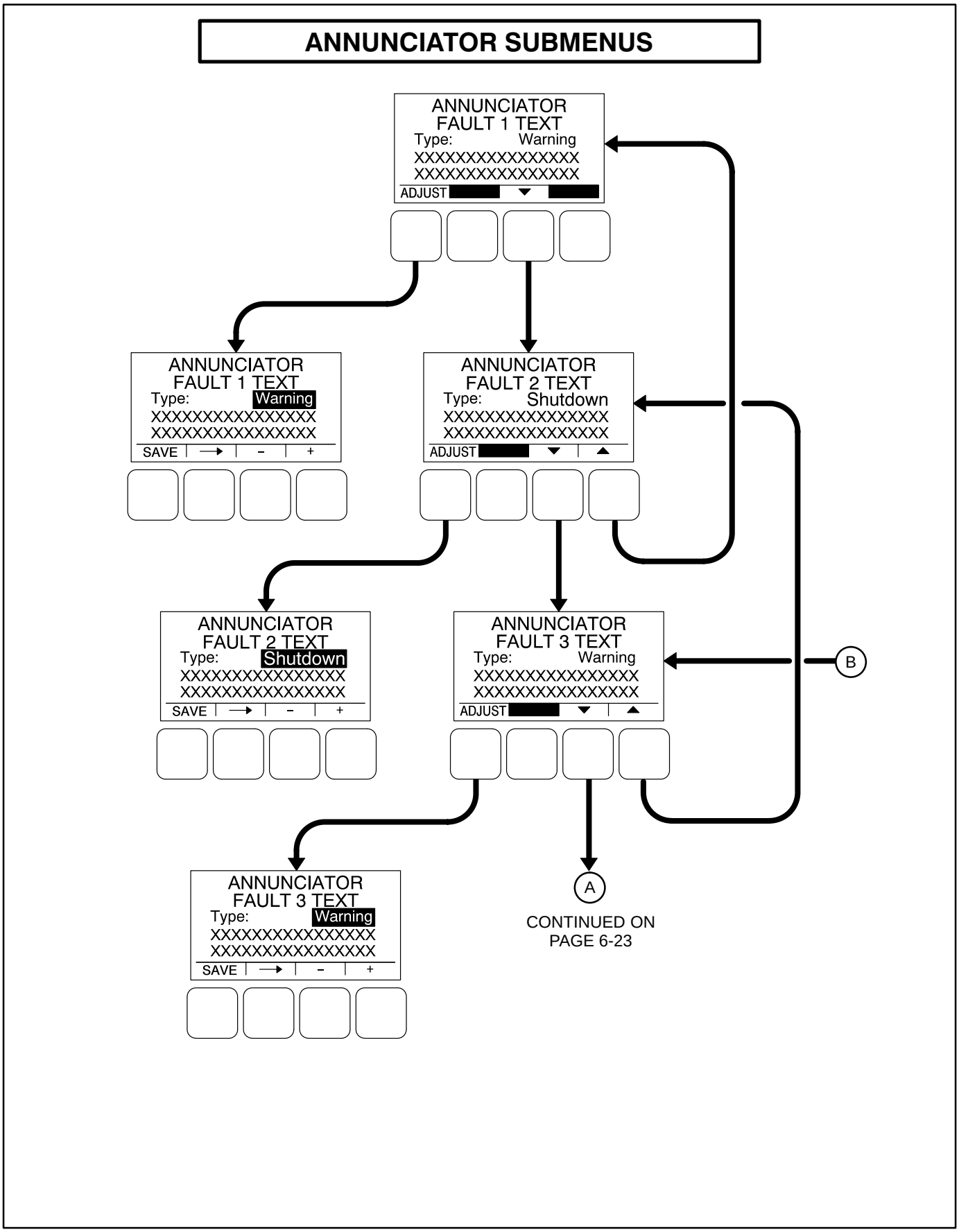

FIGURE 6-10. ANNUNCIATOR SUBMENUS (SHEET 1 OF 2)

Annunciator Outputs

An annunciator has four custom (N.O.) relays that can be controlled by the PCC 1301. When a specified event becomes active, a message can be sent by the PCC 1301 to the annunciator to turn the relay on or off. Only one event per relay is allowed.

The four annunciator outputs of the PCC 1301 are configurable to display common warning alarms. The four Annunciator Output Map menus allow for entering a fault number and fault name to be displayed for the configurable annunciator outputs.

- *Number:* Enter a code number 0 to 255 for the event. Refer to *Table 5-3* which provides a list of all warning and shutdown codes. The following list contains event codes that are not shown in *Table 5-3*.
- *Description:* A brief description of the event is automatically displayed.

EVENT CODES

CODE	DESCRIPTION
150	READY TO LOAD
151	UTILITY CONNECTIONS
152	GENSET CONNECTED
153	NOT IN AUTO
155	COMMON ALARM
156	COMMON WARNING
157	COMMON SHUTDOWN
158	CUSTOMER FAULT INPUT 1
159	CUSTOMER FAULT INPUT 2
160	ANNUNCIATOR FAULT 1
161	ANNUNCIATOR FAULT 2
162	ANNUNCIATOR FAULT 3

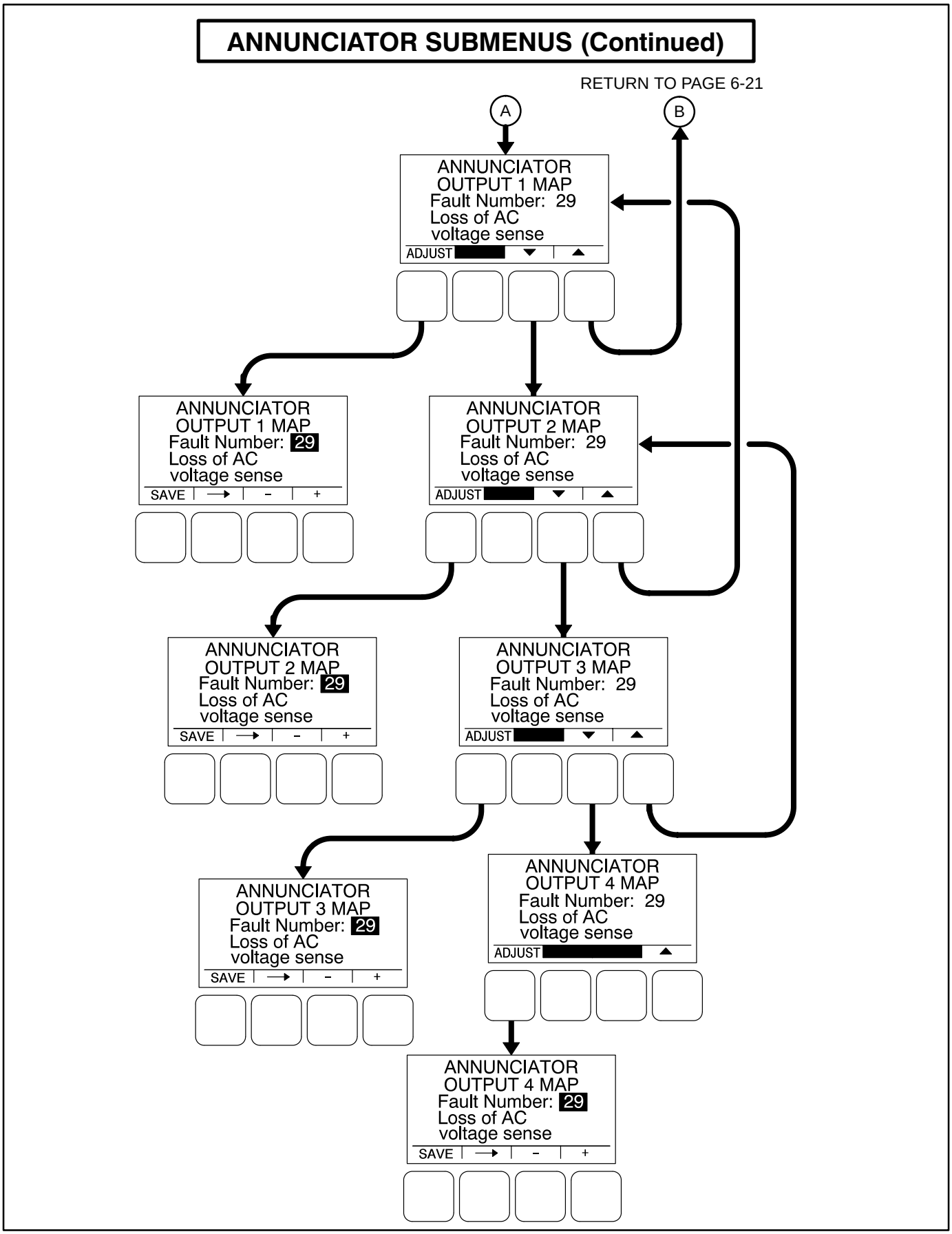

FIGURE 6-10. ANNUNCIATOR SUBMENUS (SHEET 2 OF 2)

Modbus Submenus

The Modbus submenus are available by pressing the **(5)** button on the second Genset Service menu (see Figure 6-3).

Modbus Enable Menu

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

If set to “Yes,” the Modbus Setup menu is made available.

Modbus Setup Menu

The Modbus Setup menu allows for setting a numeric address and a baud rate. The parity value is automatically displayed.

- *Address:* Enter a numerical value (up to three digits) for the address.
- *Baud Rate:* Select one of the four available baud rates (2400, 4800, 9600, or 19200).
- *Parity:* This value is automatically displayed.

MODBUS SUBMENUS

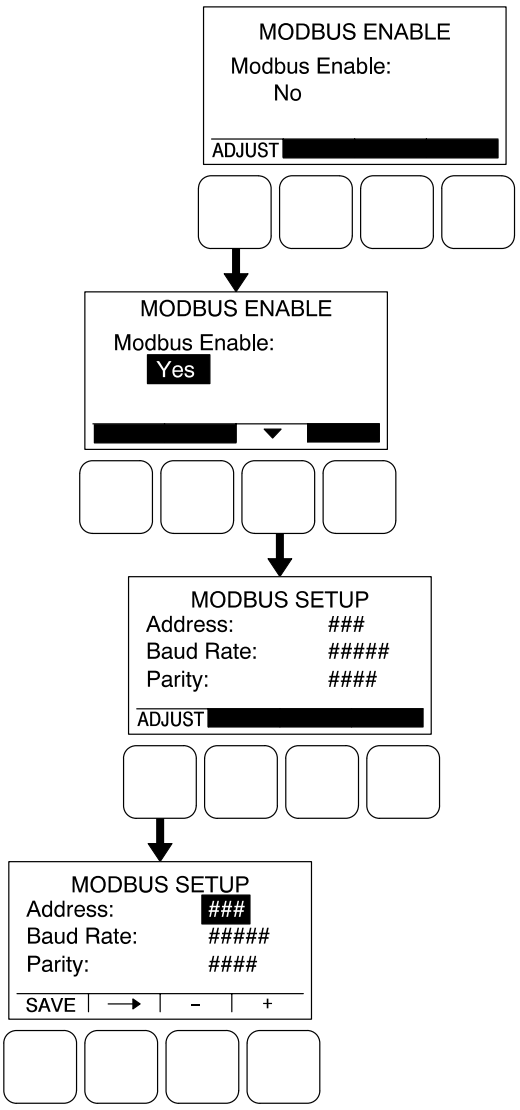

FIGURE 11. MODBUS SUBMENUS

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GENSET SETUP SUBMENUS

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

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

- Genset Service menus – Go to page 6-4
- Genset Setup menus

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

1. Enter the password into the Setup Password Menu. Refer to page 6-4 to enter password.
2. Press the **2** button in the Setup Menus to display the Genset Setup Password Menu.
3. Enter the password into the Genset Setup menu – go to page 6-28 or press the View only button.

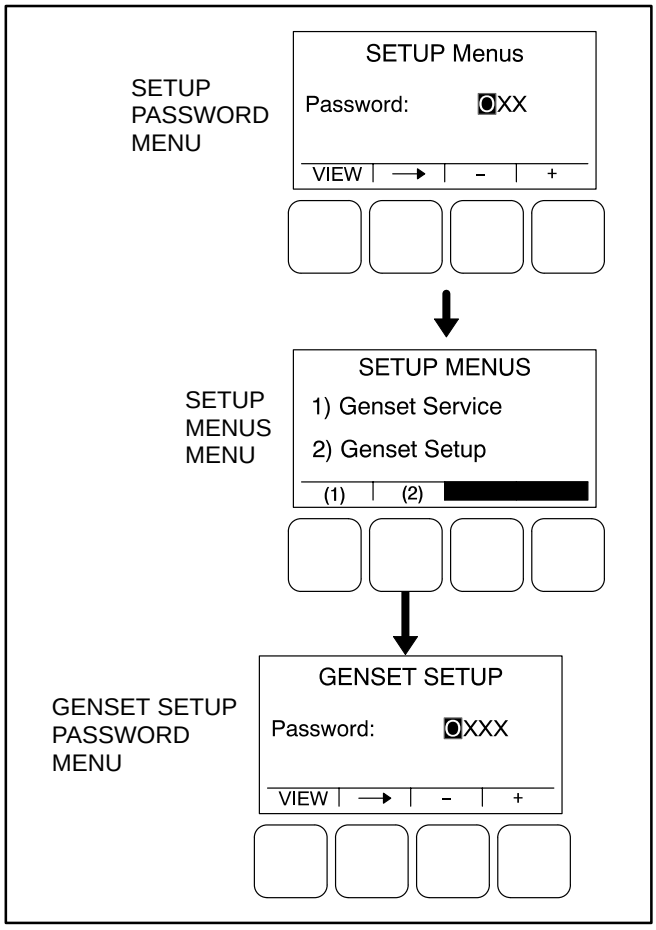

FIGURE 6-12. SETUP PASSWORD MENUS

Viewing and Adjusting

Figure 6-13 is a block representation of the two Genset Setup menus that are available after the correct password has been entered or the View button is pressed in the Genset Setup Password menu. The Genset Setup menus provide access to the following categories.

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

- Genset
- Voltage Protection
- Current Protection

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

- Engine Protection

Genset Setup Password Menu

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

Once the Genset Setup button **(2)** is selected on the Setup Menus menu (see Figure 6-12), the Genset Setup Password menu is displayed.

When the Genset Setup Password menu is displayed, the first numeric character (0) is highlighted (see Figure 6-13).

NOTE: When selected (highlighted), each character initially turns to “0” and the remaining characters turn to “X”.

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

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

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

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

Adjusting Values/Parameters

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

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

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

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

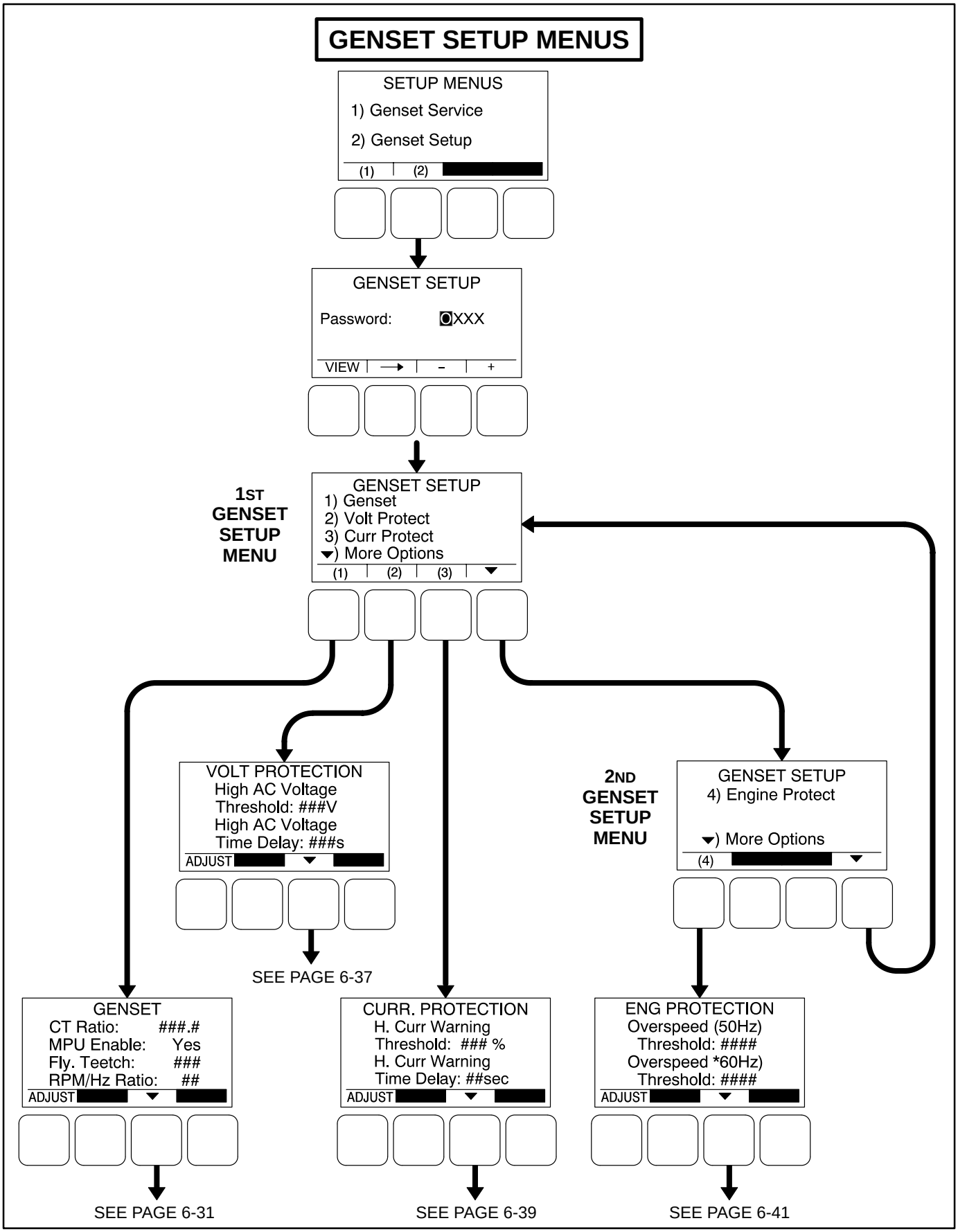

FIGURE 6-13. GENSET SETUP MENUS

GENSET SUBMENUS

The Genset submenus are available by pressing the **(1)** button on the first Genset Setup menu (see Figure 6-13).

Appendix A provides a block diagram that illustrates the sequence of how the Genset Setup Submenus are displayed.

Figure 6-14 (3 sheets) is a block representation of the Genset Submenus.

Genset Menu

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

- *CT Ratio:* The CT Ratio value must be set to match the CT Ratio of the current transformers on the genset.
- *MPU Enable:* Displays whether or not the Magnetic Pickup Unit is installed (Yes or No).
- *Fly. Teeth:* The total number of teeth pulses per revolution on the flywheel (used for electronic governed systems) can be set from 0 to 256.
- *RPM/Hz Ratio:* Allows for setting the Speed/Frequency Ratio to 20, 30, or 60 RPM/Hz.

Application Rating Select Menu

The genset application rating can be set to either Standby or Prime.

Standby kVA Rating Menu

The kVA Rating menu displays the kVA rating of single-phase or three-phase, 50 or 60 hertz standby genset systems. These value are used by the control to determine what is 100% load. The values must match the kVA rating of the genset application and cannot be more than 2000 kVA.

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

Prime kVA Rating Menu

The kVA Rating menu displays the kVA rating of single-phase or three-phase, 50 or 60 hertz prime genset systems. These value are used by the control to determine what is 100% load. The values must match the kVA rating of the genset application and cannot be more than 2000 kVA.

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

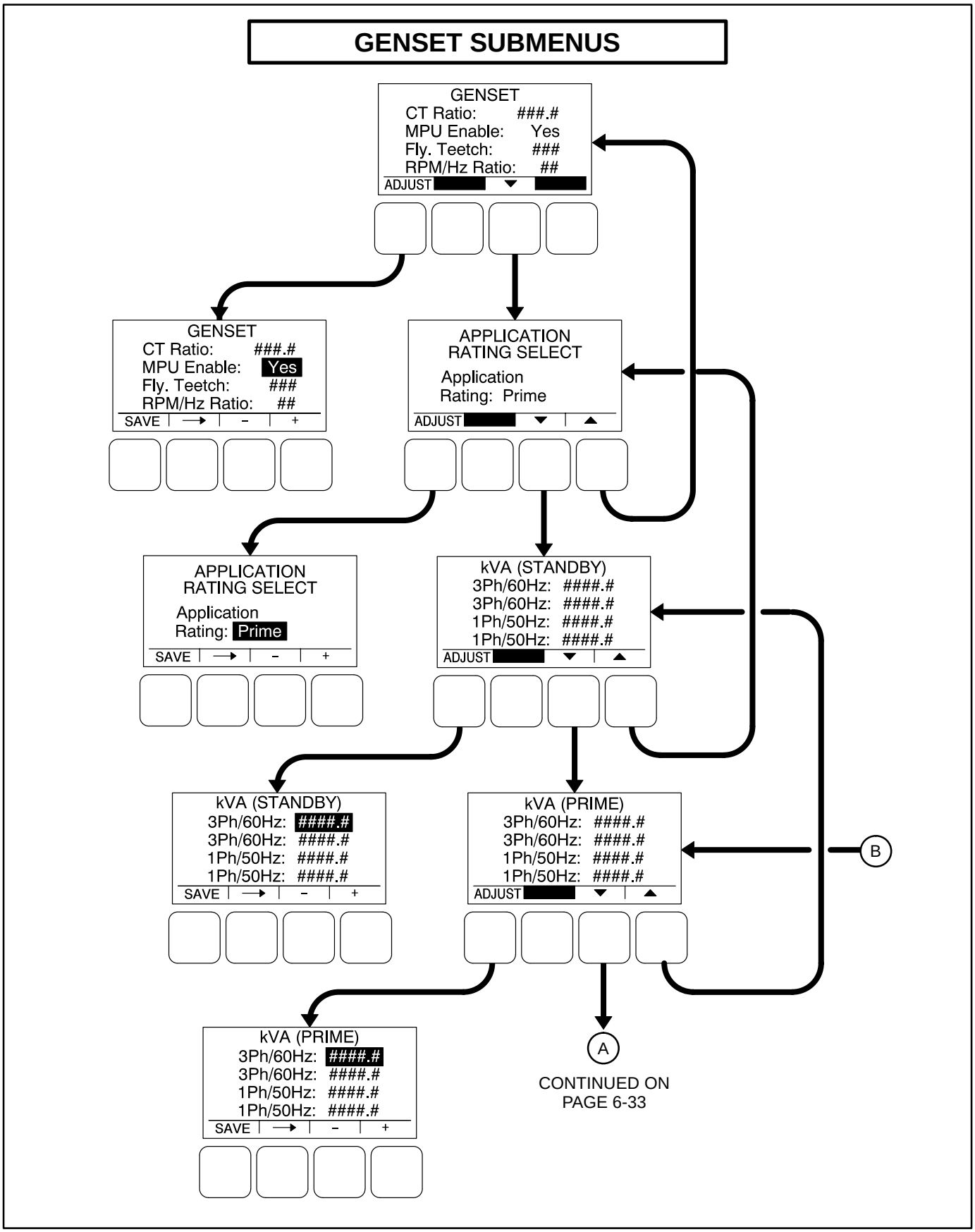

FIGURE 6-14. GENSET SETUP SUBMENUS (SHEET 1 OF 3)

Battery Select Menu

The Battery Select menu is used to set the nominal battery voltage.

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

Battery Thresholds Menus

The Battery Thresholds menu is used to set the low and high voltage values to determine when the battery voltage is out of the set range during normal operation. This menu is also used to determine when the battery voltage is below weak battery thresholds during cranking. The Battery Thresholds menu that is displayed is dependent upon the battery voltage entered in the Battery Select menu.

- *Low Batt:* The low battery voltage threshold can be set from 11.0 to 13.0 VDC for 12 volt batteries and from 22.0 to 27.0 VDC for 24 volt batteries, in 0.1 VDC increments.
- *High Batt:* The high battery voltage threshold can be set from 14.0 to 17.0 VDC for 12 volt batteries and from 28.0 to 34.0 VDC for 24 volt batteries, in 0.1 VDC increments.
- *Weak Batt:* The weak battery voltage threshold can be set from 6.0 to 10.0 VDC for 12 volt batteries and from 12.0 to 16.0 VDC for 24 volt batteries, in 0.1 VDC increments.

Battery Delay Setup Menu

This menu is used to determine when, after determining that the battery condition is out of the preset operating range, a warning message is announced.

- *L. Batt TD:* A time delay from 2 to 60 seconds can be set before the Low Battery warning message (fault code 213) is announced.
- *H. Batt TD:* A time delay from 2 to 60 seconds can be set before the High Battery warning message (fault code 214) is announced.
- *Wk Batt TD:* A time delay from 1 to 5 seconds can be set before the Weak Battery warning message (fault code 221) is announced.

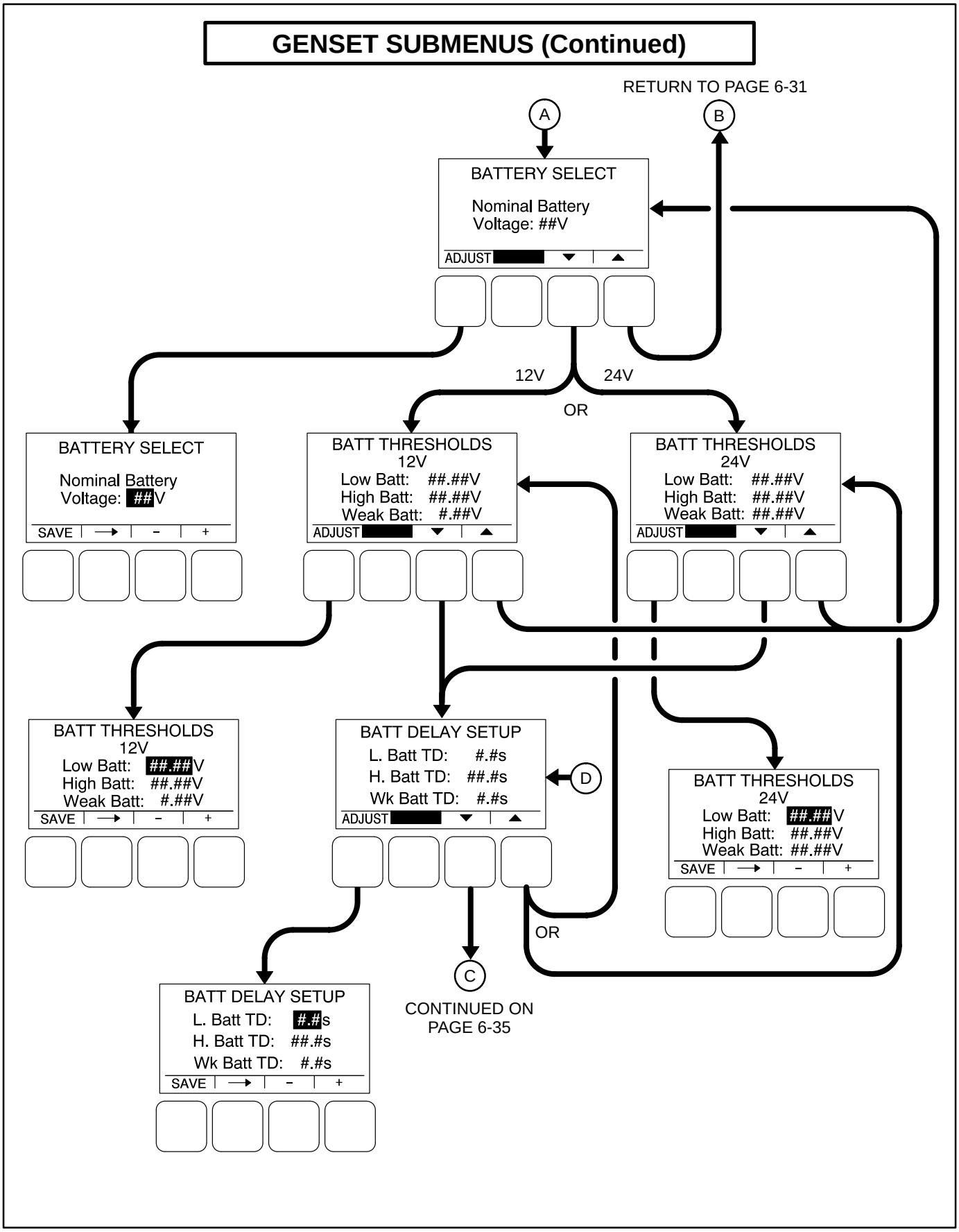

FIGURE 6-14. GENSET SETUP SUBMENUS (SHEET 2 OF 3)

Oil Pressure Setup Menus

A menu is available to set the sensor type. If the sensor type is Switch, then another menu is available to set the sensor polarity. If the sensor type is Sender, then another menu is available to set the sender type.

- *Sensor Type:* The sensor type can be set for either Switch or Sender.
- *Sensor Polarity:* This menu is displayed only if the sensor type is set to Switch. Sensor polarity can be set to either Active Low or Active High.
- *Sender Type:* This menu is displayed only if the sensor type is set to Sender. The sender type can be set to either 2 Wire or 3 Wire.
- *OOR Startup Delay:* This menu is displayed only if the sensor type is set to Sender. This menu allows for setting a time delay (0 to 400 seconds, default = 0 seconds) that prevents the oil pressure out-of-range fault warning (fault code 217) from being displayed for the specified time period when the genset is starting. Setting this time delay is useful with gensets that build up more than 100 psi oil pressure during start-up and warm-up.

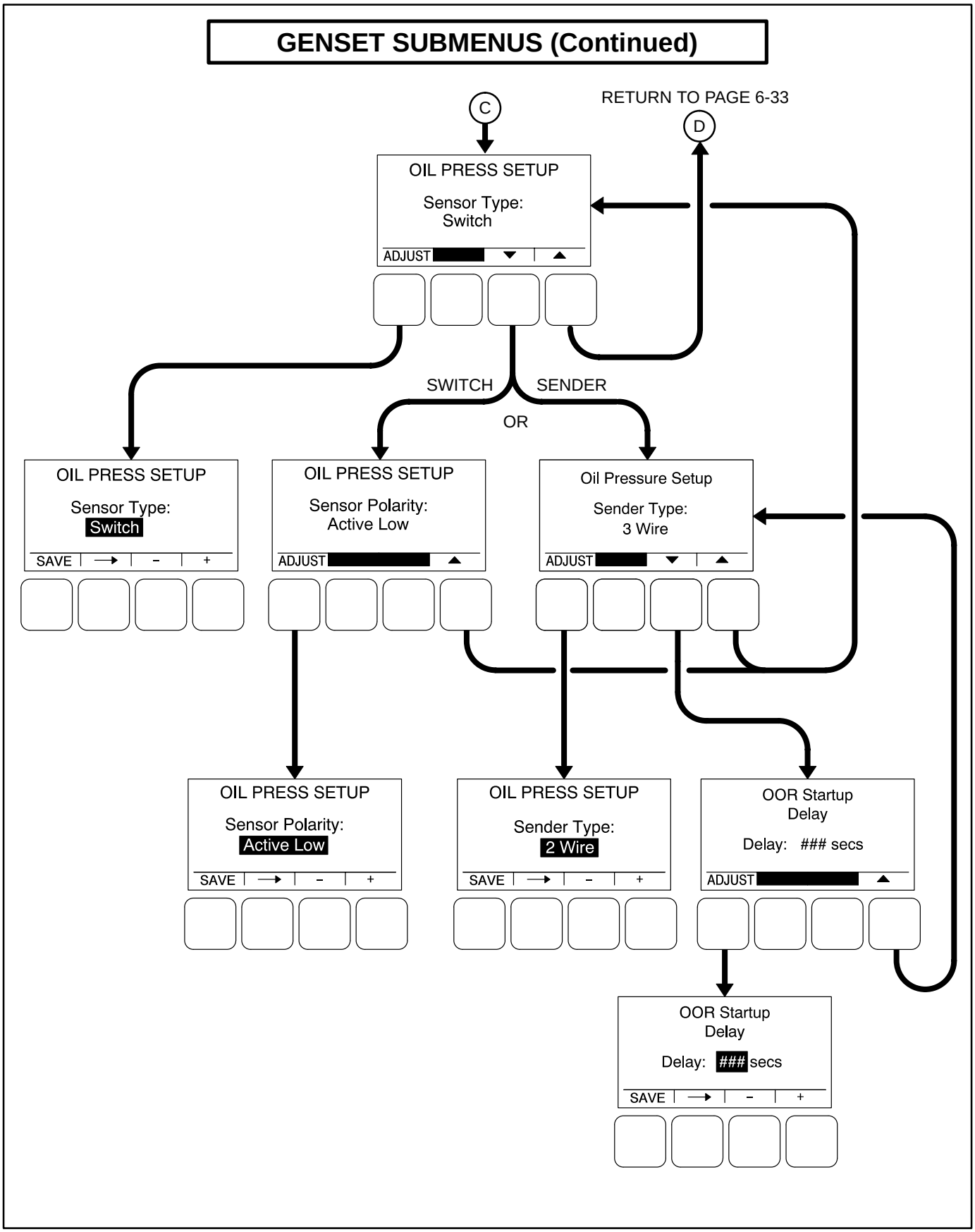

FIGURE 6-14. GENSET SETUP SUBMENUS (SHEET 3 OF 3)

VOLTAGE PROTECTION SUBMENUS

The Voltage Protection submenus are available by pressing the **(2)** button on the first Genset Setup menu (see Figure 6-13).

Figure 6-15 is a block representation of the four Voltage Protection submenus that are available.

High AC Voltage Menu

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

- *High AC Voltage Threshold:* This threshold is used to set the percentage of desired voltage necessary to activate a High AC Voltage fault condition. This value can be set from 105 to 125%.
- *High AC Voltage Time Delay:* A time delay of 1 to 10 seconds must expire before the engine shuts down because of a high AC voltage fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the High AC Voltage shutdown message (fault code 12) is announced.

Low AC Voltage Menu

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

- *Low AC Voltage Threshold:* This threshold is used to set the percentage of desired voltage necessary to activate a Low AC Voltage fault condition. This value can be set from 50 to 95%.
- *Low AC Voltage Time Delay:*A time delay of 2 to 20 seconds must expire before the engine shuts down because of a low AC voltage fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the Low AC Voltage shutdown message (fault code 13) is announced.

Overfrequency Menu

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

- *Overfrequency Threshold:* This threshold is used to set the amount of Hertz that the alternator line frequency can be over to activate an Overfrequency fault condition. This value can be set from 2 to 10 Hz.
- *Overfrequency Delay:* A time delay of 100 to 2000 half cycles must expire before the engine shuts down because of an overfrequency fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the Overfrequency shutdown message (fault code 14) is announced.

Underfrequency Menu

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

- *Underfrequency Threshold:* This threshold is used to set the Hertz number that the alternator line frequency can be under to activate an Underfrequency fault condition. This value can be set from 2 to 10 Hz.
- *Underfrequency Time Delay:* A time delay of 500 and 2000 half cycles must expire before the engine shuts down because of an underfrequency fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the Underfrequency shutdown message (fault code 15) is announced.

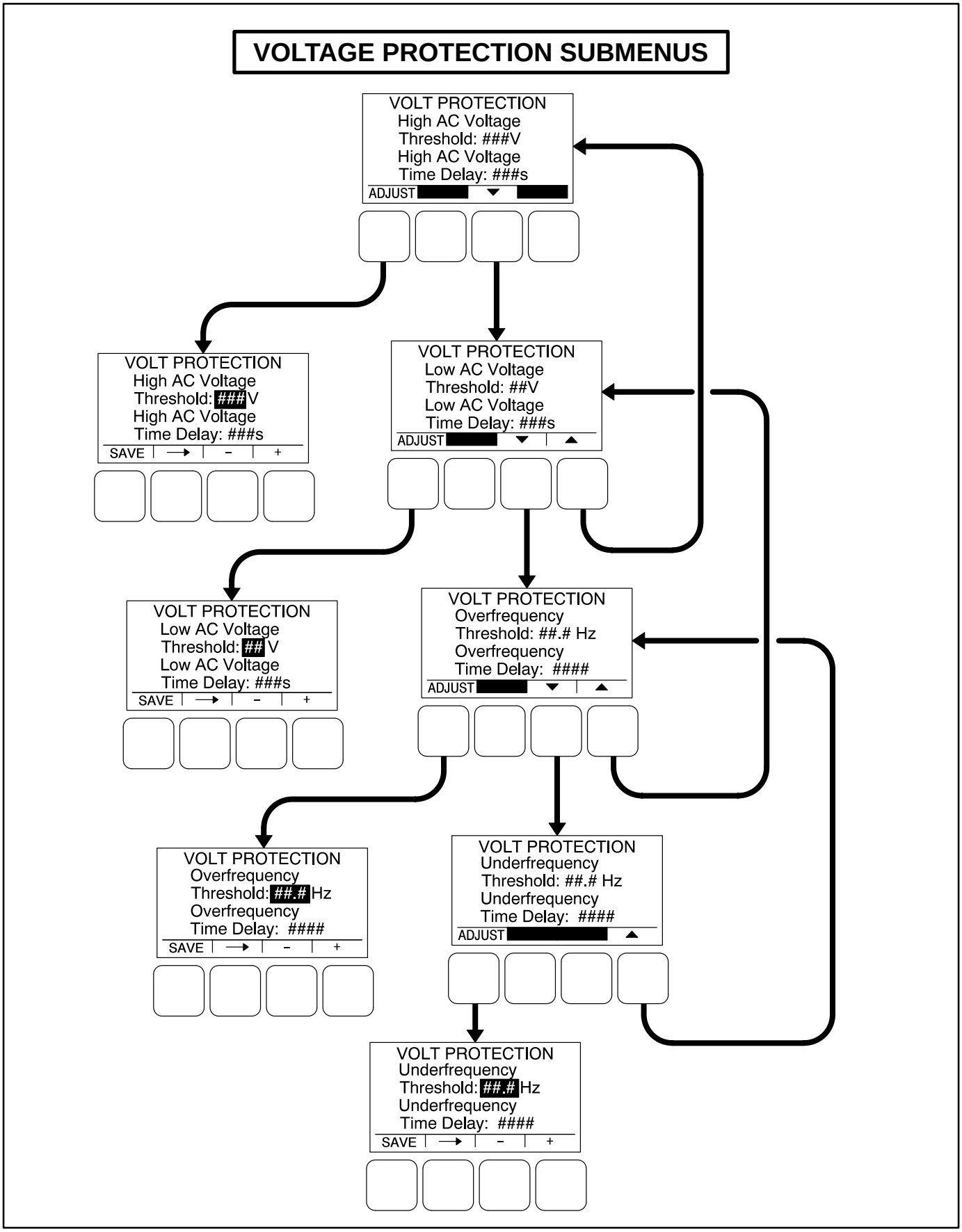

FIGURE 6-15. VOLTAGE PROTECTION SUBMENUS

CURRENT PROTECTION SUBMENUS

The Current Protection submenus are available by pressing the **(3)** button on the first Genset Setup menu (see Figure 6-13).

Figure 6-16 is a block representation of the two Current Protection submenus.

High AC Current Warning Menu

This menu is used to determine when a high AC current warning fault condition exists and for how long the fault condition should be present before the High AC Current warning message is announced.

- *H. Curr Warning Threshold:* This threshold is used to set the percentage of rated AC current at which the High AC Current warning fault condition becomes active. This value can be set from 110 to 130%.
- *H. Curr Warning Time Delay:* A time delay of 10 to 60 seconds must expire before a warning message is announced. If the fault condition is active for the duration of this time delay, the High AC Current warning message (fault code 216) is announced.

High AC Current Shutdown Menu

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

- *H. Curr Shutdown Threshold:* This threshold is used to set the percentage of rated AC current at which the High AC Current shutdown fault condition becomes active. This value can be set from 130 to 190%.

- *H. Curr Shutdown Time Delay:* A time delay of 2 to 60 seconds must expire before the engine shuts down because of a high AC current fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the High AC Current shutdown message (fault code 46) is announced.

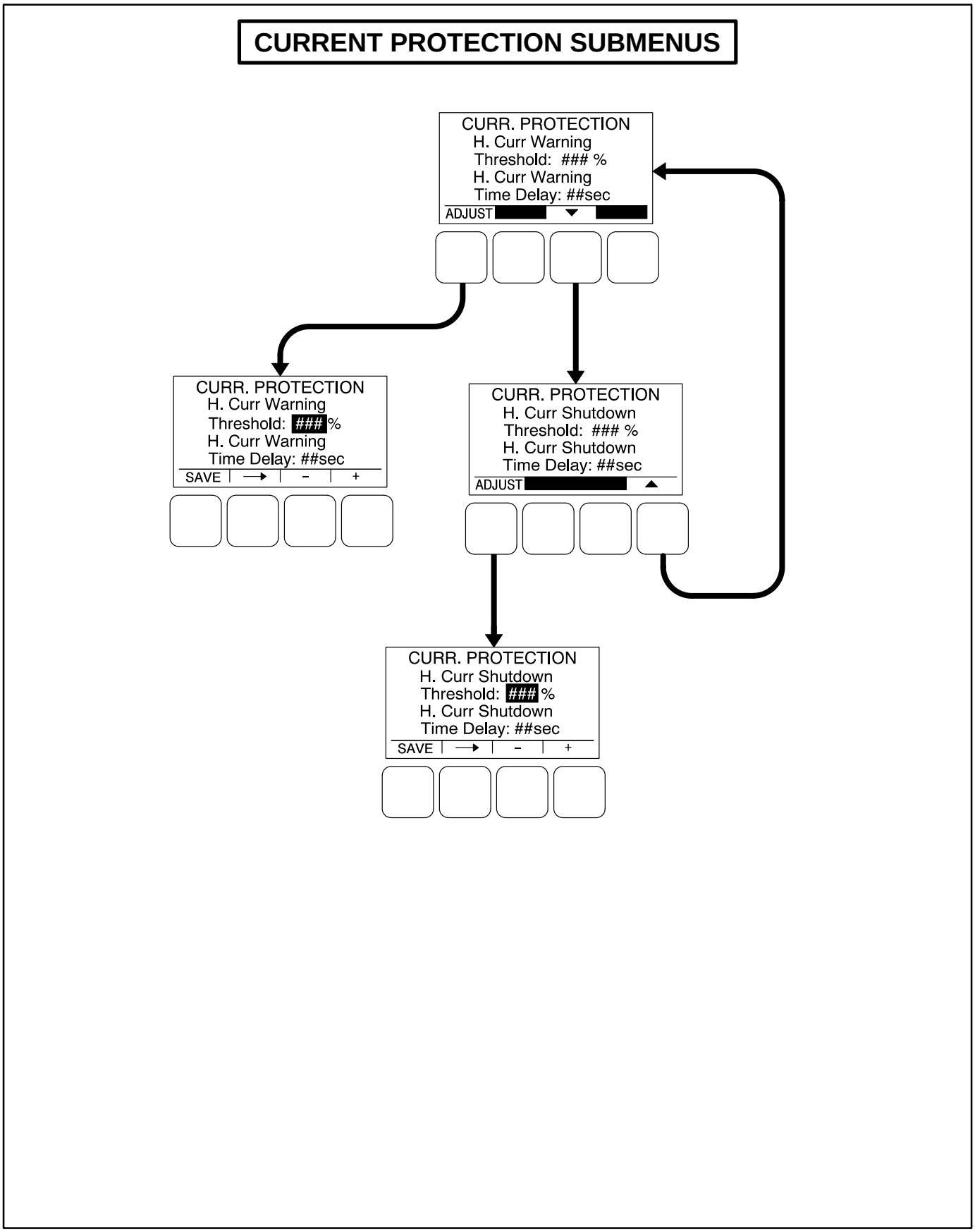

FIGURE 6-16. CURRENT PROTECTION SUBMENUS

ENGINE PROTECTION SUBMENUS

The Engine Protection submenus are available by pressing the **(4)** button on the second Genset Setup menu (see Figure 6-13).

The Engine Protection submenus (see Figure 6-17) are used to set thresholds to determine when engine fault conditions exist and time delays to determine how long a fault condition is present before the fault message is announced and, if necessary, shut down the engine.

Engine Protection Overspeed Menu

This menu is used to set the value necessary to shut down the genset and activate an Overspeed shutdown message (fault code 31) on 50 and 60 Hz gensets, indicating that the engine has exceeded normal operating speed.

- *Overspeed (50Hz) Threshold:* This threshold is used to set the overspeed value necessary to activate an Overspeed shutdown fault condition on 50 Hz gensets. This value can be set from 0 to 8192 RPM, in 25 RPM increments.

- *Overspeed (60Hz) Threshold:* This threshold is used to set the overspeed value necessary to activate an Overspeed shutdown fault condition on 60 Hz gensets. This value can be set from 0 to 24,096 RPM, in 25 RPM increments.

Engine Protection Speed/Frequency Menu

This menu is used to determine when a speed/frequency conflict shutdown fault condition exists and for how long the fault condition should be present before the engine is shut down.

- *Speed/Freq Fault Threshold:* This threshold is used to set the value necessary to activate the speed/frequency conflict shutdown fault condition. This value can be set from 0.1 to 20.0 Hz.

- *Speed/Freq Fault Time Delay:* A time delay of 0.2 to 10.0 seconds must expire before the warning message is announced because of a speed/frequency conflict shutdown fault condition. If the fault condition is active for the duration of this time delay, the genset is shut down and the Speed Hz Match shutdown message (fault code 71) is announced.

Low Oil Pressure Warning Menu

This menu is used to determine when a low oil pressure warning fault condition exists and for how long the fault condition must be present before the warning message is announced.

- *LOP Warning Threshold:* This threshold is used to set the oil pressure value necessary to activate a Pre-Low Oil Pressure warning fault condition. This value can be set from 0 to 100 psi.

- *LOP Warning Time Delay:* A time delay of 2 to 15 seconds must expire before the warning message is announced because of a low oil pressure warning fault condition. If the fault condition is active for the duration of this time delay, the Pre-Low Oil Pressure warning message (fault code 215) is announced.

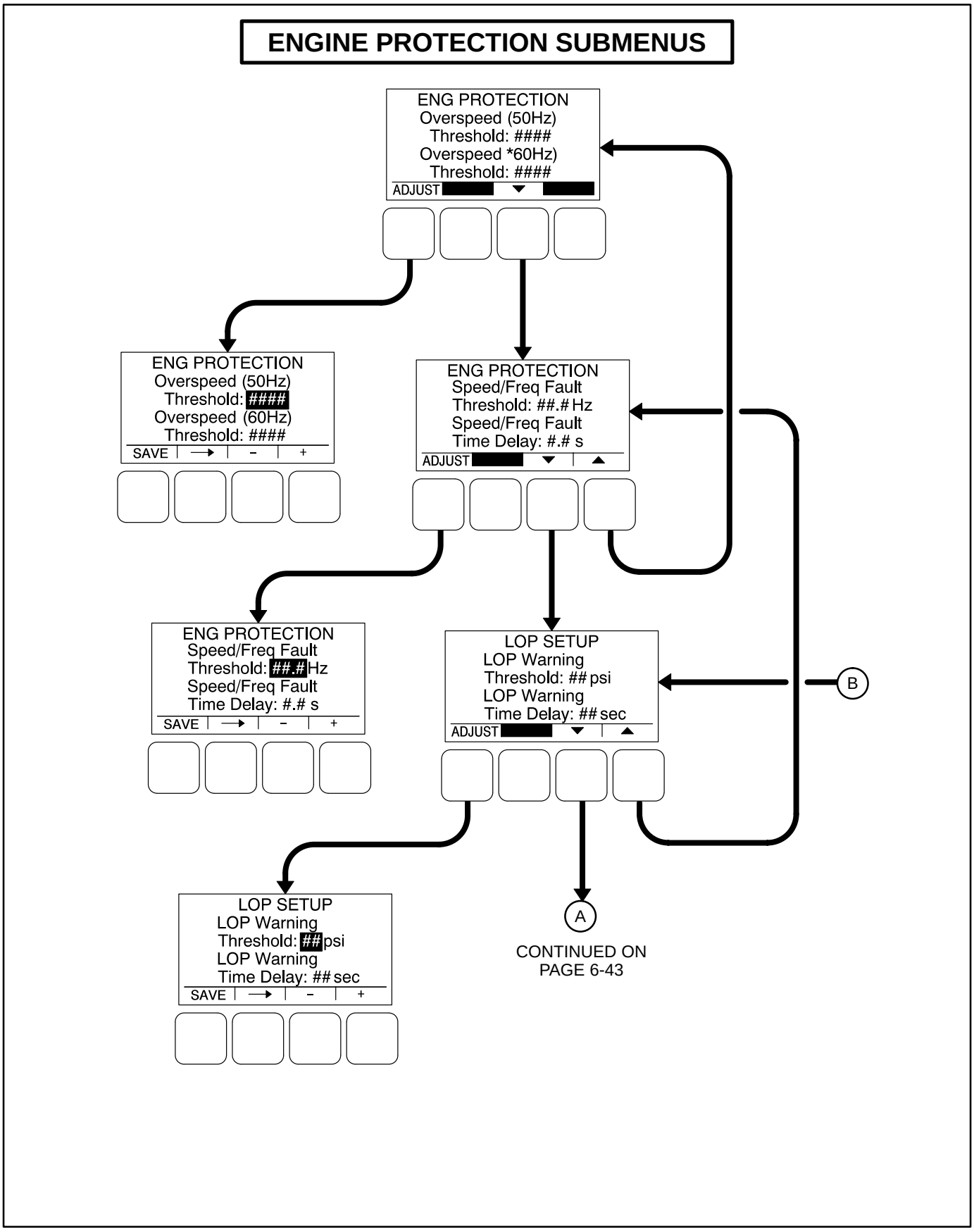

FIGURE 6-17. ENGINE PROTECTION SUBMENUS (SHEET 1 OF 3)

Low Oil Pressure Shutdown Menu

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

- *LOP Shutdown Threshold:* This threshold is used to set the oil pressure value necessary to activate a Low Oil Pressure Shutdown fault condition. This value can be set from 0 to 100 psi.
- *LOP Shutdown Time Delay:* A time delay of 2 to 15 seconds must expire before the engine shuts down because of a low oil pressure fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the Low Oil Pressure shutdown message (fault code 2) is announced.

High Coolant Temperature Warning Menu

This menu is used to determine when a high coolant temperature warning fault condition exists and for how long the fault condition should be present before the warning message is announced.

- *HCT Warning Threshold:* This threshold is used to set the temperature value necessary to activate a High Coolant Temperature Warning fault condition. This value can be set from 180 to 220 degrees F.
- *HCT Warning Time Delay:* A time delay of 2 to 10 seconds must expire before the warning message is announced. If the fault condition is active for the duration of this time delay, the High Coolant Temperature warning message (fault code 202) is announced.

High Coolant Temperature Shutdown Menu

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

- *HCT Shutdown Threshold:* This threshold is used to set the temperature value necessary to activate a High Coolant Temperature Shutdown fault condition. This value can be set from 200 to 230 degrees F.
- *HCT Shutdown Time Delay:* A time delay of 2 to 10 seconds must expire before the engine shuts down because of a high coolant temperature fault condition. If the fault condition is active for the duration of this time delay, the engine shuts down and the High Coolant Temperature shutdown message (fault code 1) is announced.

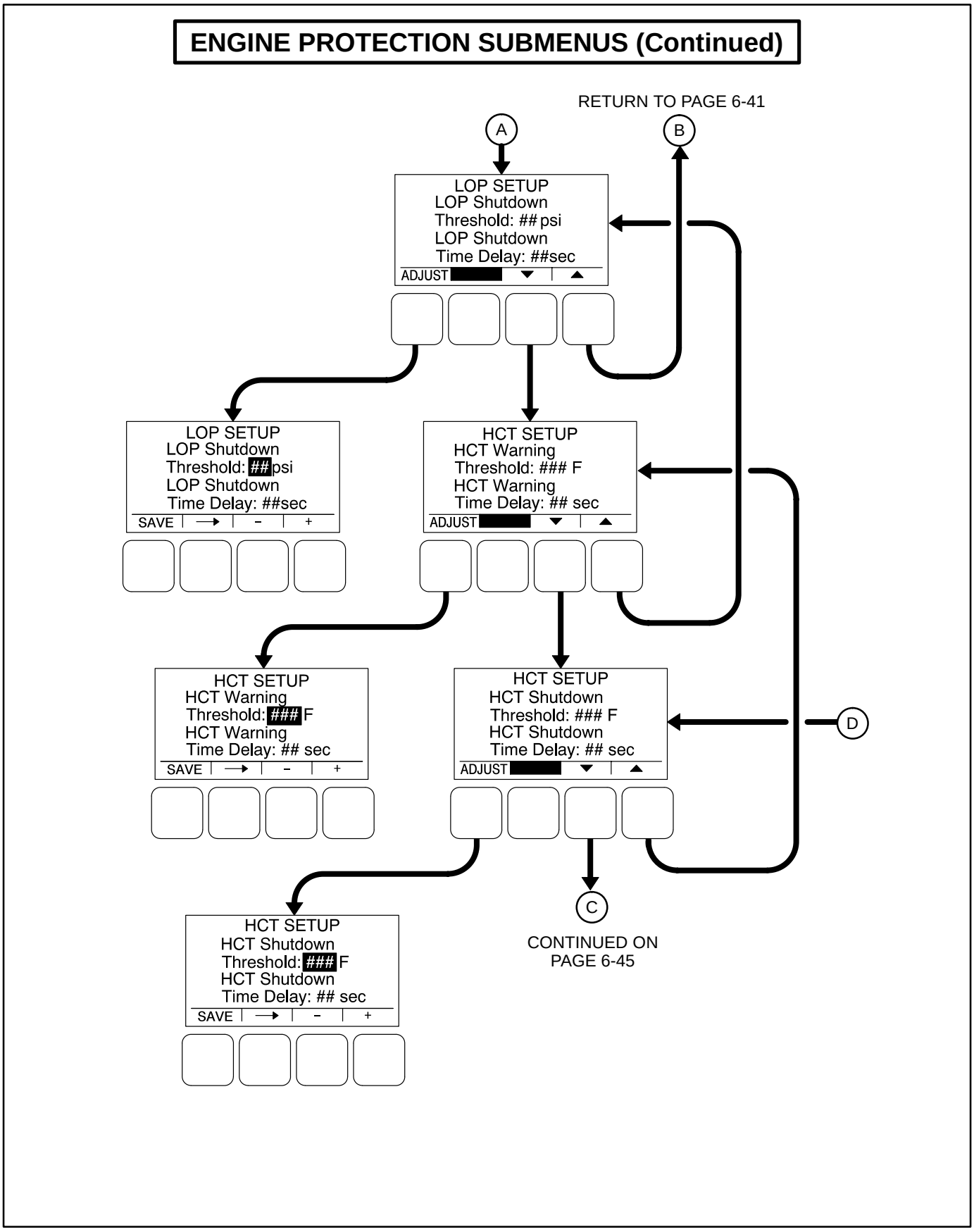

FIGURE 6-17. ENGINE PROTECTION SUBMENUS (SHEET 2 OF 3)

Engine Protection Low Coolant Temperature and Battery Charger Menus

The low coolant temperature menu is used to determine when the genset's coolant temperature is too low and a Low Coolant Temperature warning message (fault code 203) is announced. This warning message is not announced unless the coolant temperature has been determined to be low for one minute.

- *LCT Warning Threshold:* This threshold is used to set the temperature value necessary to activate a Low Coolant Temperature Warning fault condition. This value can be set from 32 to 100 degrees F.

The battery charger menu is used to determine when the alternator charger failure condition exists and when the warning message should be announced. The fault condition exists when either the low or high threshold is reached.

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

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

- *Charger Failed Time Delay:* A time delay of 2 to 300 seconds must expire before the warning message is announced. If the fault condition is active for the duration of this time delay, the Charger Failure warning message (fault code 219) is announced.

ENGINE PROTECTION SUBMENUS (Continued)

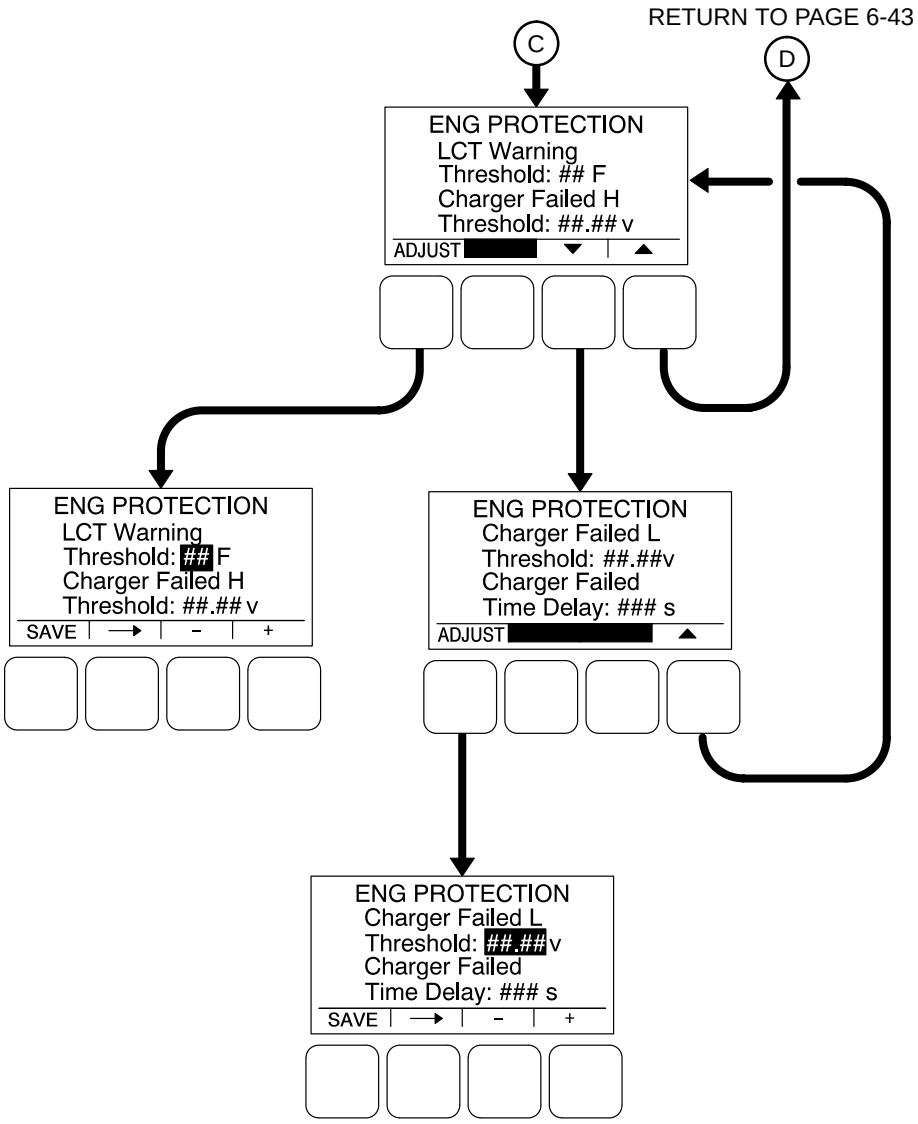

FIGURE 6-17. ENGINE PROTECTION SUBMENUS (SHEET 3 OF 3)

TB1 BASE BOARD CUSTOMER CONNECTIONS

The PCC Base board (Figure 6-18) provides connection points (TB1) for remote control and monitor options.

TB1 Customer Inputs

Available options will vary between PCC1301 control models (PCC with or without display).

Refer to Page 9-6 for typical connections to TB1.

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

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

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

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

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

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

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

The InPower service tool or access to the Genset Service Menus is required to modify the customer fault inputs.

TB1 Customer Outputs

Available options will vary between PCC1300 control models (PCC with or without display).

Refer to Page 9-6 for typical connections to TB1.

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

The nature of the customer output signal (contacts closed) is an optional customer selection. Example outputs: Genset running (event), common warning, common shutdown, etc. (Refer to Table 5-3 for the warning and shutdown code listing and page 5-3 for the event code listing.)

Each relay can be independently programmed to energize by entering the a code number (0 through 255, default = 0) for the desired event.

The InPower service tool or access to the Genset Service Menus is required to modify the customer outputs.

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

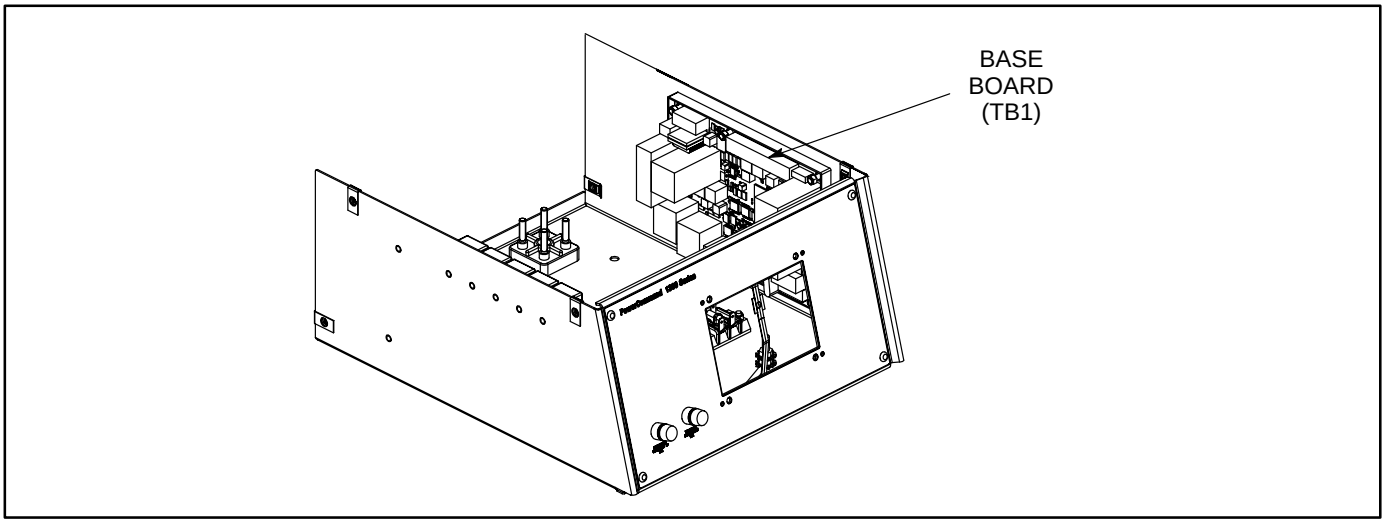

FIGURE 6-18. CONTROL BOX

ENGINE SENSORS

Figure 6-19 shows the locations of the coolant temperature and oil pressure senders.

Coolant Temperature Sensor

The coolant temperature sensing device is a variable resistive sensor (700 to 1804 ohms [0 to 230 degree F]). The coolant sensor enables the Base board to detect low, pre-high and high coolant temperatures.

Oil Sensor

The oil pressure sensing device is a capacitive oil pressure sender.

The output signal of the capacitive sensor is approximately 0.5 VDC at 0 psi and 4.5 VDC at 100 psi. This sensor enables the Base board to detect pre-low (Warning) and low oil pressure (Shutdown).

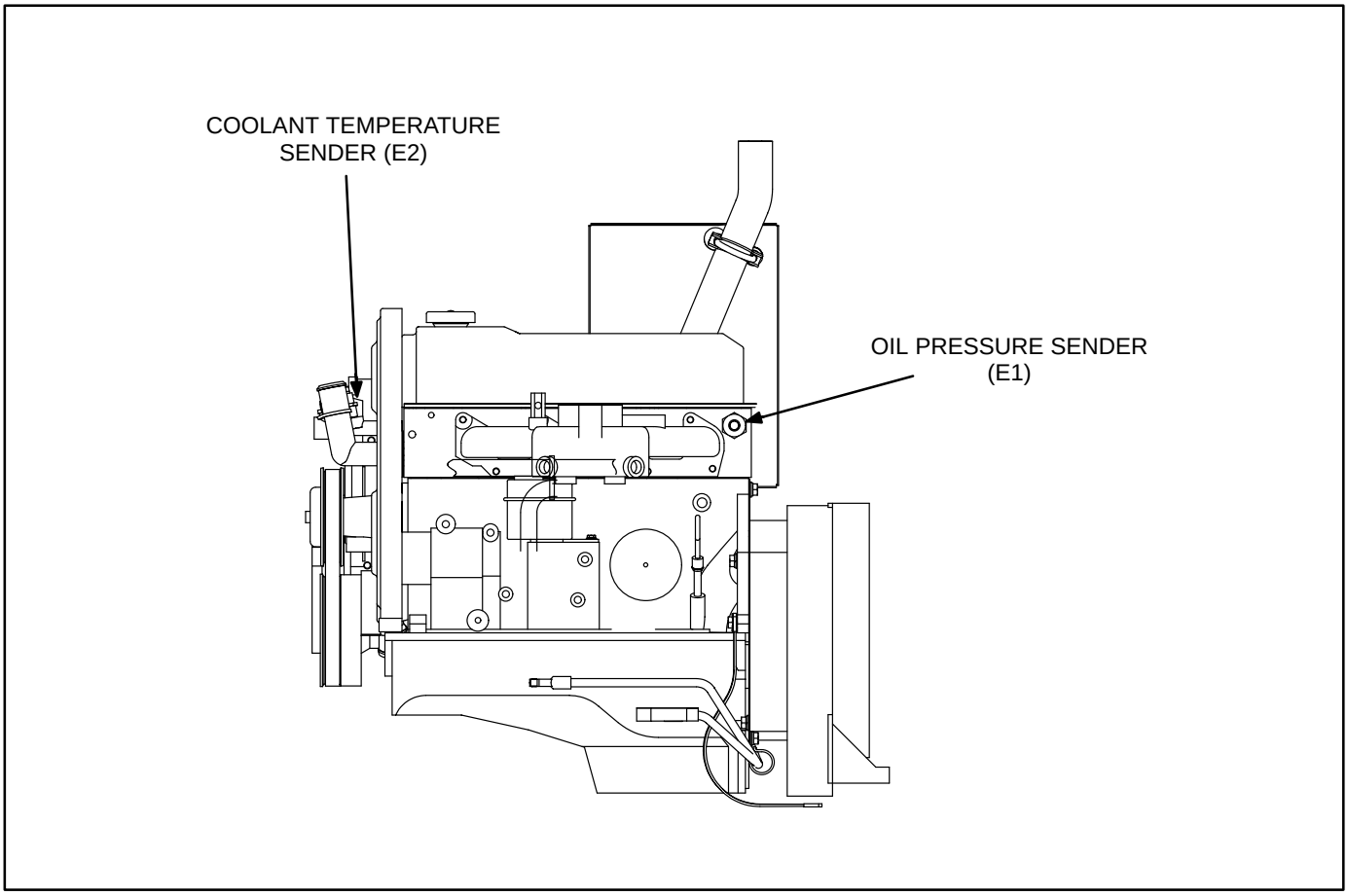

FIGURE 6-19. FOUR CYLINDER ENGINE SENSOR LOCATIONS

MAGNETIC SPEED PICKUP UNIT (MPU) INSTALLATION

To install the MPU sensor, bar the engine until a gear tooth on the flywheel lines up in the center of the mounting hole. Thread the sensor in gently by hand until it just touches the gear tooth. Back it out one quarter turn and set the locknut.

To troubleshoot the MPU, refer to fault code **45** in Section 5.

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

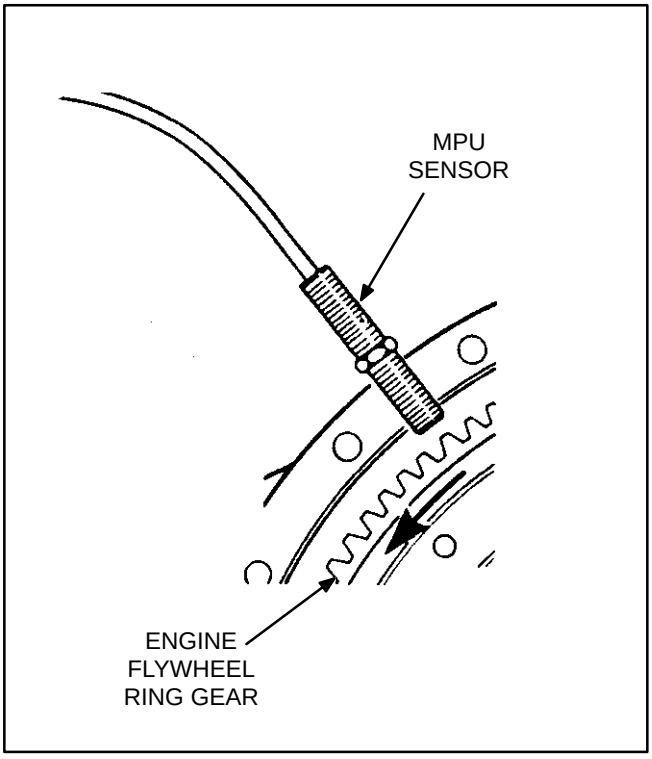

FIGURE 6-20. MPU SENSOR

CURRENT TRANSFORMER (CT) INSTALLATION

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

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

CT Installation Requirements:

A. The CT has a dot on one side. This dot must be facing toward the generator reconnection terminal block. A dot is also used to indicate pin 1 of the CT.

B. Route the load lead (U, V or W) through the appropriate CT (refer to Reconnection Diagram).

C. The CT's have dual secondaries (3 pins marked X1, X2 & X3). (Refer to Reconnection Diagram.)

   X1 & X2 for above 300 volts L–L

   X1 & X3 for below 300 volts L–L

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7. Servicing the Generator

GENERAL

This section describes how to isolate a voltage fault to the Base board or generator, test the generator windings, and disassemble and reassemble the generator (Figure 7-1).

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

WARNING ***HAZARDOUS VOLTAGE. The PCC1301 control box must be opened only by technically qualified personnel. Voltages of up to 600 VAC are present in the PCC box. These voltages can cause electrical shock, resulting in personal injury.***

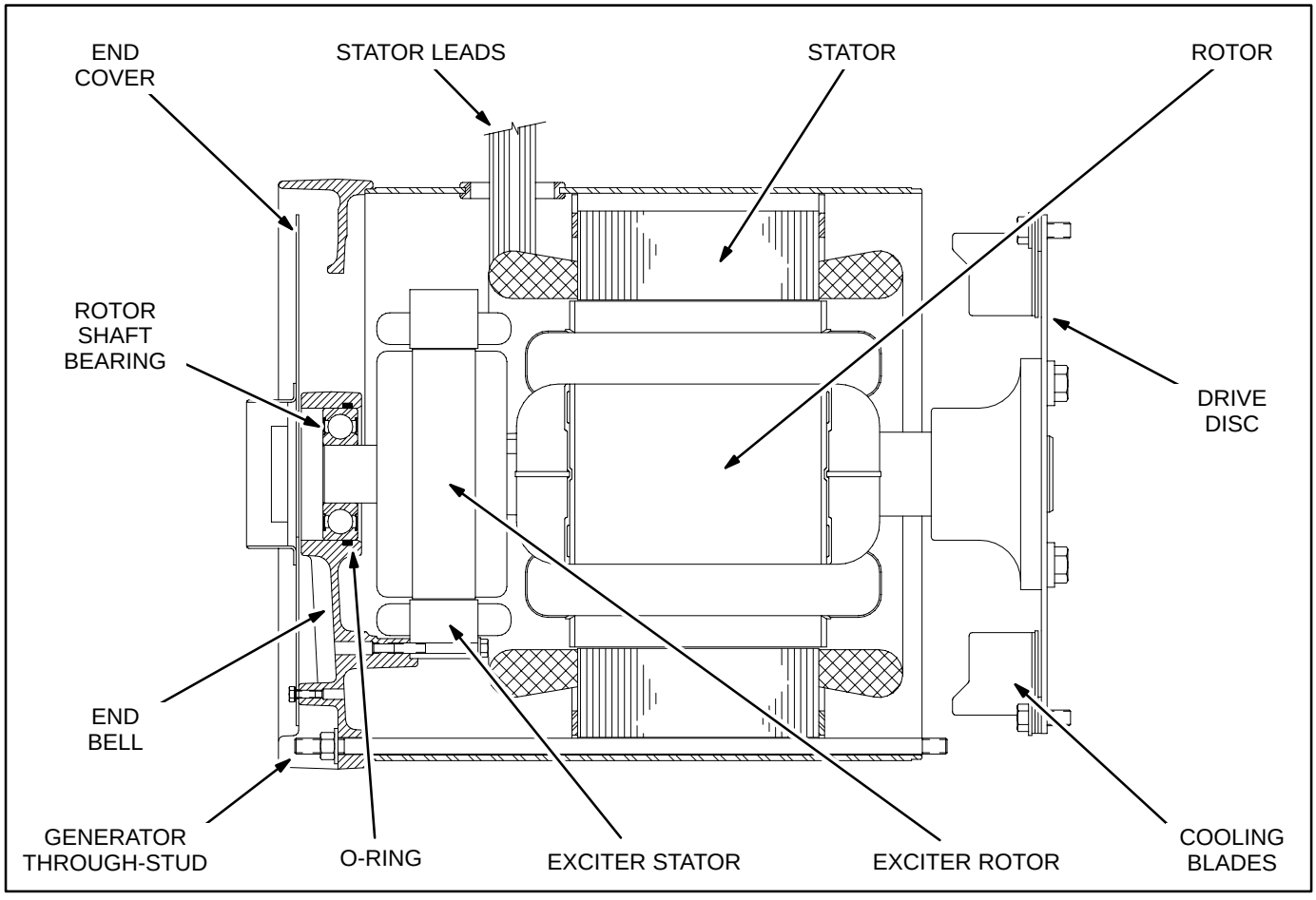


FIGURE 7-1. GENERATOR

GENERATOR/BASE BOARD ISOLATION PROCEDURE

The following procedure is used to determine if the generator or the control Base board is causing a high AC voltage shutdown fault.

1. Throw the line circuit breaker **OFF** and shut down the set.

   ⚠CAUTION ***This test involves unregulated excitation of the generator. To prevent damage to the generator due to overcurrent, make sure that all loads have been disconnected and that all faults have been cleared from the power output terminals of the generator.***

   ⚠WARNING ***HAZARDOUS VOLTAGE. Touching uninsulated parts inside the control housing and power output boxes can result in severe personal injury or death. Measurements and adjustments must be done with care to avoid touching hazardous voltage parts.***

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

2. Remove the side access cover of the power output box to access the exciter stator leads (**F1** and **F2**). Disconnect the **F1** and **F2** leads from the AC harness (quick connect type connectors).
3. Prepare to measure output voltage across the generator terminals while the set is running.
4. Bring two jumpers from a 12 volt battery for connection to the excitor stator **F1** (Field +) and **F2** (Field –) leads.

   Connect the jumper from the positive (**+**) post of the battery to the **F1** lead. Be prepared to connect the jumper from the negative (**–**) post of the battery to the **F2** lead. If one of the 12 volt cranking batteries is used, bring the jumpers from the battery connected on the grounded side of the system to avoid inadvertently imposing 24 volts on the system.
5. Check polarity again. Polarity must be correct or this test will be inconclusive because the induced and residual magnetic polarities in the exciter stator will be opposed.

   Genset may shut down on a fault condition within 5 to 15 seconds due to the excitor stator leads being disconnected from the Base board. Clear fault and start genset to check next phase.

6. Start the set and connect the jumper from the battery negative (**–**) terminal to the **F2** lead.
7. The generator circuitry is probably okay if rated output voltage or higher is obtained and the voltages for all phases are balanced when the exciter is powered by a 12 volt battery. Refer to *Section 4* to troubleshoot the PCC control circuitry. (Normal excitation voltage ranges from approximately 10 VDC at no-load to approximately 40 VDC at full–load.)
8. If the voltages are unbalanced, troubleshoot the main stator first. If the voltages are uniformly low, troubleshoot the exciter and field circuits first. Perform the *Winding Resistance Test* procedure for the desired windings as noted in this section.

TESTING THE GENERATOR

These tests can be performed without removing the generator. Before starting tests, disconnect the negative (–) cable from the battery to make sure the engine will not start while performing these tests.

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

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

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

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

Insulation Resistance Testing

The insulation resistance test should be performed before the initial start-up of the generator set or when low insulation is suspected, e.g. damp or wet windings.

A 500 VAC megger is recommended for insulation testing. A test consists of applying the test potential between the winding and ground (winding laminations).

Resistance values of at least 5 megohms should be obtained for a new generator with dry windings. For a set that has been in service, the resistance reading should not be less than 1 megohm.

If low readings are obtained, the cause should be investigated and corrected before the generator set is returned to service.

If moisture is determined to be the cause of low test readings, a winding drying process will be required.

Megger Testing: Disconnect plugs **P12** and **P13** from the Base board and perform the insulation resistance test for the desired windings as noted in this section.

Drying the Windings: If low readings are obtained or the set has been in standby for a long time in high humidity conditions, the windings should be dried out and the test repeated. Use the generator standby heaters (if so equipped) or blow warm air through the generator with a fan.

Exciter Stator

Testing Winding Insulation Resistance: Disconnect the exciter stator leads **F1** and **F2** from their connectors in the AC harness and isolate them from ground. Using an ohmmeter, measure resistance between either lead and the stator laminations. Replace the stator if insulation resistance is less than 1 megohm (1,000,000 ohms)

Testing Winding Resistance: Measure winding resistance with a Wheatstone bridge or digital ohmmeter. Replace the stator if winding resistance is not 13 to 16 ohms.

Flashing the Field (Self-Excited Generators Only): If necessary, flash the exciter field before or after installation. Apply 110 to 220 VAC for one to two seconds to the **F1** and **F2** leads of the exciter stator. **The generator must be shut down, the Base board disconnected, a diode used to establish correct polarity and a 3 amp fuse to prevent over-excitation.** See the diagram.

Alternatively, while the set is running and disconnected from all loads, apply a 12 VDC battery for one to two seconds as shown in the diagram. **Polarity must be correct: + to F1, – to F2**.

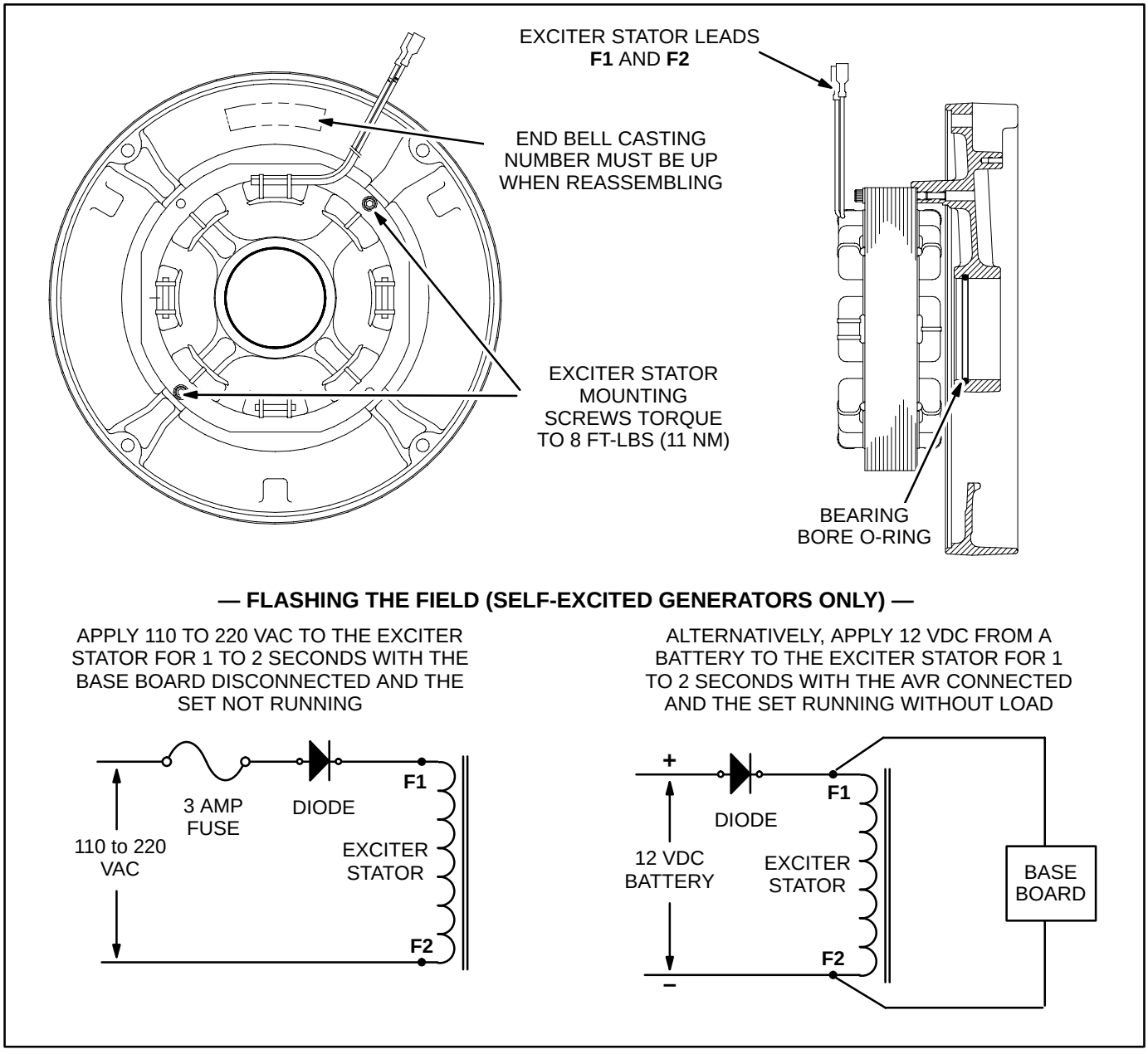


FIGURE 7-2. EXCITER STATOR AND END BELL

Exciter Rotor and Rotating Rectifiers

Testing Exciter Rotor Winding Insulation Resistance: Disconnect all six exciter rotor leads from diode terminals **CR1** through **CR6** and isolate them from ground. Using an ohmmeter, measure the resistance between any rotor winding lead or the terminal to which it is connected and the rotor laminations. Replace the whole rotor shaft assembly if insulation resistance is less than 1 megohm.

Testing Exciter Rotor Winding Resistance: With a Wheatstone bridge, measure electrical resistance across each pair of rotor windings: **T11-T12**, **T21-T22**, **T12-T13**, **T22-T23**, **T13-T11** and **T23-T21**. See the connection schematic. Replace the whole rotor shaft assembly if the resistance of any winding is not 0.58 to 0.71 ohms.

Exciter Rectifier Bridge (Rotating Rectifier Assembly)

The rotating rectifier assembly is mounted on the back face of the exciter rotor. It consists of one positive (**+**) and one negative (**–**) diode assembly. Each assembly carries three diodes in an epoxy potting. Each diode has a terminal for connecting the appropriate lead from the exciter rotor (**CR1** through **CR6**). Each assembly has a field terminal (**F1+** or **F2–**) for connecting the leads from the main rotor (generator field) and voltage suppressor.

Diode Resistance Test: Using a digital ohmmeter, measure electrical resistance between diode terminals **CR1**, **CR2** and **CR3** and field terminal **F1+** on the positive diode assembly and between diode terminals **CR4**, **CR5** and **CR6** and field terminal **F2–** on the negative diode assembly. Reverse the meter test probes and repeat the tests. The electrical resistance across each diode should be high in one direction and low in the other. If the resistance is high or low in both directions, replace the whole diode assembly.

Replacing a Diode Assembly: Make sure the replacement diode assembly is of the correct polarity, positive (**+**) or negative (**–**). Then disconnect all leads from the defective diode assembly and remove the two mounting screws. Mount the new diode assembly, reconnect all leads and torque the terminal screws to 24 in-lbs (2.6 Nm).

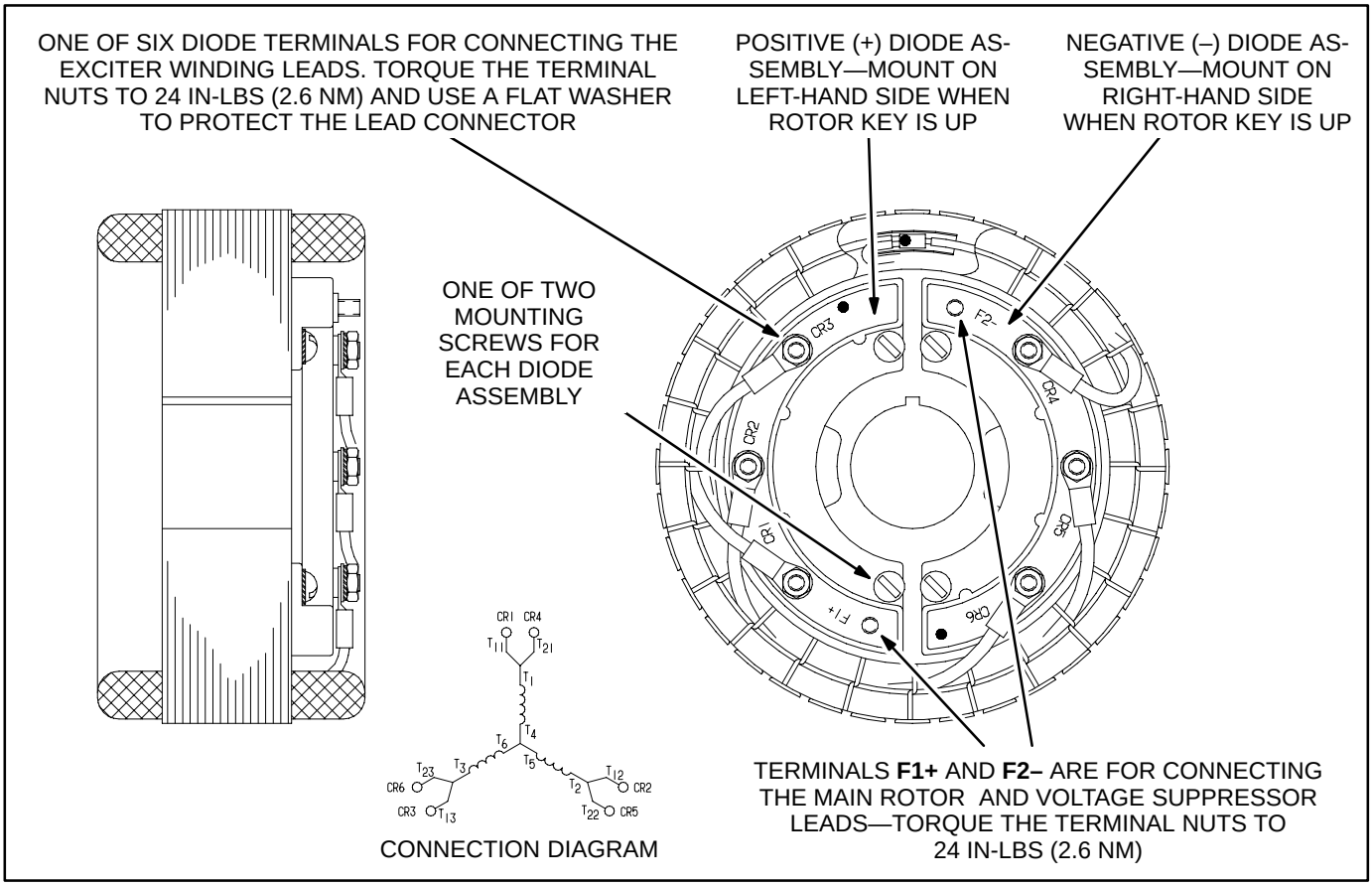


FIGURE 7-3 TESTING THE ROTATING RECTIFIER ASSEMBLY

Main Rotor And Surge Suppressor

Testing Main Rotor Winding Insulation Resistance: Disconnect the main rotor and voltage suppressor leads from terminals **F1+** and **F2+** on the rotating rectifier assemblies and isolate them from ground. Tag and mark each lead with its terminal number (**F1+** or **F2+**).

CAUTION ***Because of the opposing residual magnetism of the rotor, it might be difficult to re-establish self excitation if the polarity of the main rotor leads is reversed upon reassembly.***

Using an ohmmeter, measure the resistance between any rotor winding lead or the terminal to which it is connected and the rotor laminations. Replace the whole rotor shaft assembly if insulation resistance is less than 1 megohm.

Testing Main Rotor Winding Resistance:

Measure electrical resistance between the two main rotor leads with a digital ohmmeter. Replace the rotor if the resistance is not as specified in Table 7-1.

Surge Suppressor Testing: A voltage suppressor is mounted on the rotor shaft between the main rotor and the exciter rotor. Its leads are connected to terminals **F1+** and **F2–** on the rotating rectifier assemblies. Disconnect the leads from their terminals and measure resistance between the leads with a digital ohmmeter. Replace the entire rotor assembly if resistance is not infinite on the highest scale of the meter.

Reconnect the the rotor and surge suppressor leads and torque the terminals to 24 in-lbs (2.7 Nm) when reassembling.

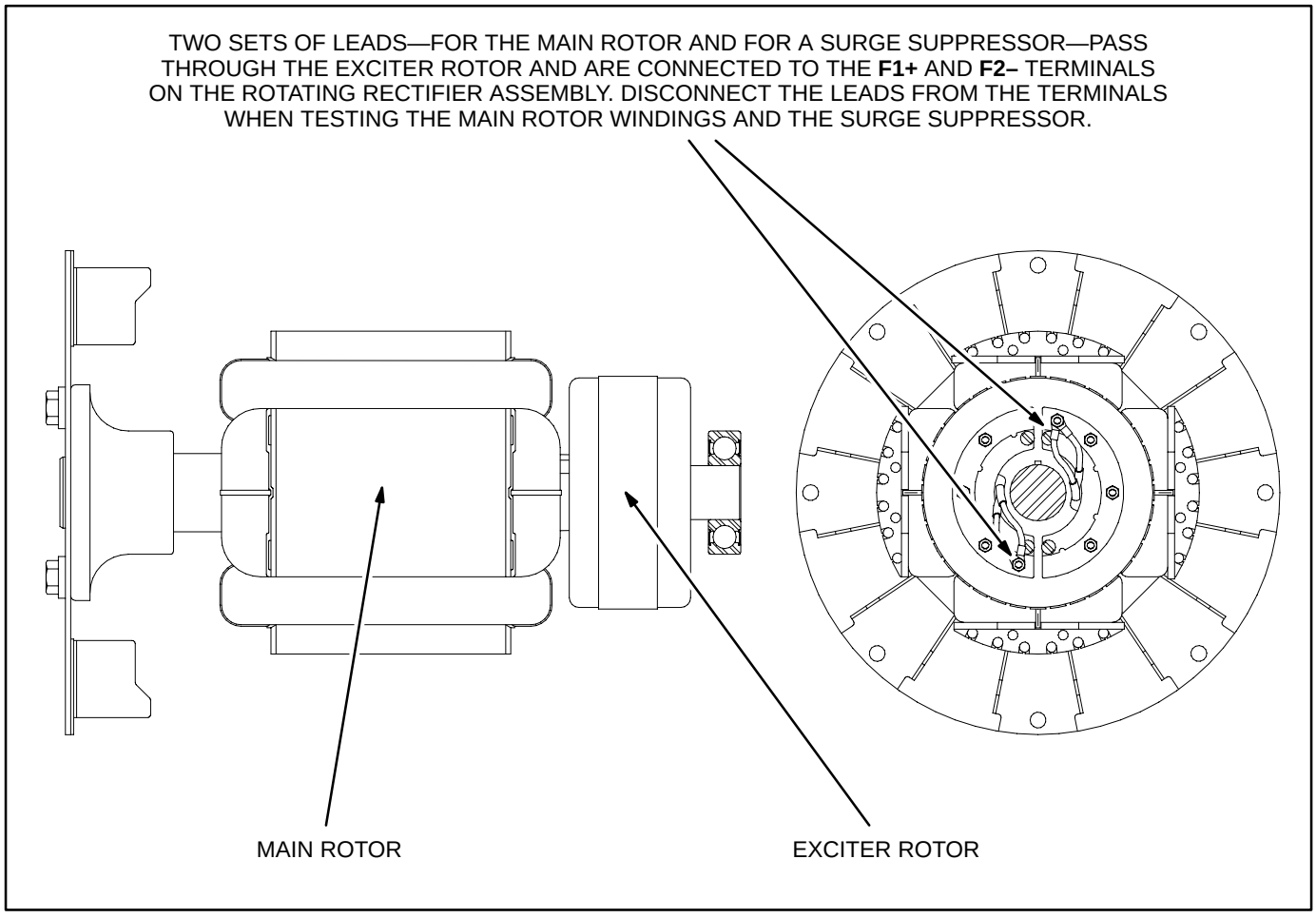


FIGURE 7-4. TESTING THE MAIN ROTOR

Main Stator

To complete the following tests, disconnect all stator leads and winding taps from their respective terminals and make sure the ends do not touch the generator frame.

Testing Main Stator Winding Insulation Resistance: Using an ohmmeter, measure electrical resistance between any stator lead and the stator laminations. Replace the stator if insulation resistance is less than 1 megohm.

Testing Main Stator Winding Resistance: Using a Wheatstone bridge having at least 0.001 ohm precision, measure electrical resistance across each pair of stator leads: **U1-U2**, **V1-V2**, **W1-W2**, **U5-U6**, **V5-V6** and **W5-W6**. Replace the stator if the resistance of any winding is not as specified in Table 7-1.

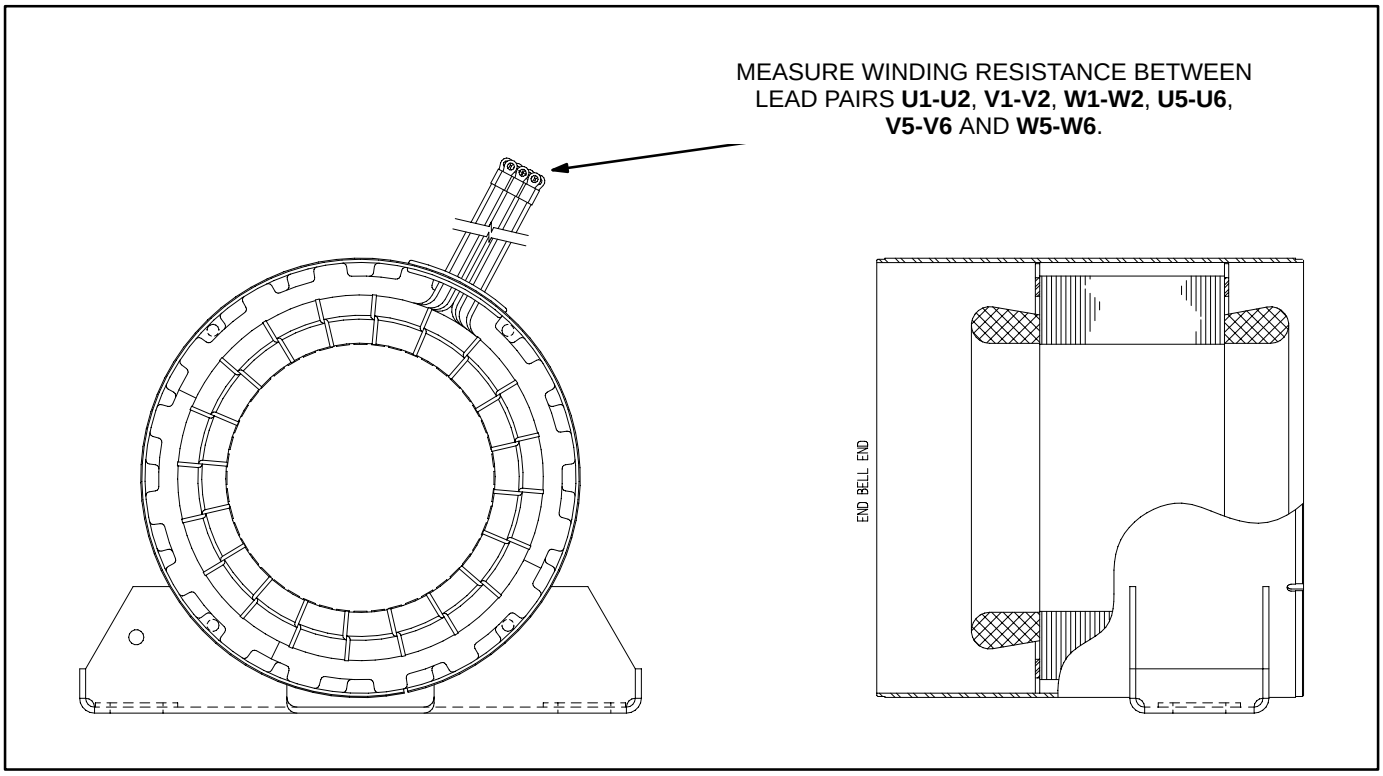


FIGURE 7-5. TESTING THE MAIN STATOR WINDINGS

TABLE 7-1. MAIN STATOR AND ROTOR WINDING RESISTANCES

GENERATOR RATING / STATOR STACK LENGTH			MAIN STATOR WINDING RESISTANCE OHMS[2]	MAIN ROTOR WINDING RESISTANCE OHMS[2]
3–PHASE, 0.8 PF kW	1–PHASE, ΔΔ, 1.0 pf kW	STACK LENGTH[1] mm (inches)		
12	–	87.3 (3.4)	0.486-0.594	1.88-2.30
15	12	109.5 (4.3)	0.296-0.362	2.12-2.59
17.5	–	127 (5.0)	0.275-0.337	2.30-2.81
20	15	146 (5.75)	0.200-0.244	2.48-3.03
25	20	177.8 (7.0)	0.164-0.200	1.78-2.18
30	25	219 (8.62)	0.105-0.129	2.02-2.46
–	30	263.5 (10.37)	0.090-0.110	2.62-3.20

1 – These are for reference only, to help identify the generator. The corresponding rotors have slightly greater (3 mm) stack lengths.

2 – These values are ±10% of nominal at 77° F (25° C).

GENERATOR DISASSEMBLY AND REASSEMBLY

Disassembly

The generator is heavy. You will need an assistant and a hoist of sufficient capacity to remove and service the generator.

⚠WARNING ***Accidentally dropping the generator can damage it and cause severe personal injury and death. The hoist and straps must have sufficient capacity and be attached properly so that the load cannot shift.***

Before starting, disconnect the starting battery cables (negative (-) first) to make sure the set will not start while working on it.

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

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

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

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

4. If the generator set has a housing, remove the roof, rear housing posts, grills and door.
5. Remove the side access cover on the power output box and disconnect and withdraw the generator output cables and exciter leads. For easier reconnections later, make sure each cable and lead is marked clearly.
6. Remove the saddle on which the control box is mounted to and carefully set aside control box/saddle. Support control box so that no stress is applied to control harness.
7. Remove the grill in front of the generator end bell.
8. Disconnect the air tube from the air cleaner assembly. (Remove the air cleaner from the generator adaptor casting if the adaptor is going to be replaced.)
9. Remove the magnetic speed pickup unit from the generator adaptor casting.

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

10. The generator rotor will be carried inside the stator when the generator is withdrawn from the engine. Bar the engine until one of the four poles of the rotor points straight down so that the rotor will rest on the pole face when the generator is withdrawn.

    ⚠ CAUTION ***The rotor can be damaged if it rests on the edges of the winding slot between two poles.***

11. Using a hoist of sufficient capacity, cinch a lifting strap around the generator, take up hoist slack and remove the two through bolts securing the generator to the rubber isolation mounts.

12. Raise the generator end approximately 1 inch (12 mm) and securely block the engine under the full length and width of the oil pan to distribute the weight. Lower the generator slightly so that the blocks carry most of the weight.

13. Remove the bolts securing the generator drive discs to the flywheel. (They are accessible by removing the screen on the adaptor casting outlet.)

14. Loosen all the bolts and nuts securing the generator adapter to the engine. Adjust the hoist to carry the full weight of the generator, remove the bolts and pull the generator away, keeping it level so that the rotor does not fall out.

    ⚠ CAUTION ***Never withdraw the generator leaving the rotor to hang by the drive discs. The weight of the rotor will damage the drive discs.***

15. Remove the generator end bell cover plate.

16. Remove the four nuts and washers on the generator through-studs and tap the end bell free of the stator assembly.

17. If necessary, remove the exciter stator from the generator end bell by removing the two mounting screws.

18. Remove the rotor from the stator with the help of an assistant. Support both ends of the rotor and guide it out. Be careful not to damage the windings.

19. Rest the rotor in a cradle, solidly supporting it on two pole faces—not on the drive discs, blower fan or exciter.

20. Tap the generator adaptor casting free of the stator assembly.

21. Use a gear puller if it is necessary to replace the rotor bearing.

Reassembly

Reassemble the generator in the following order:

1. Press the rotor bearing on flush with the end of the shaft. (The end of the shaft must not extend more than 0.020 inches (0.5 mm) beyond the side of the bearing. Apply force to the inner race of the rotor bearing when pressing it onto the shaft, otherwise, it will be damaged.

2. Mount the drive disc on the rotor and torque the eight bolts to 68 ft-lbs (92 Nm). Make sure that:

    A. The chamfered edge of the drive disc perimeter faces away from the rotor to make assembly to the flywheel easier.

    B. The fan blade assembly goes on first. (It will be secured with the disc-to-flywheel bolts.)

    C. The rounded edges of the washers are on the disc side.

3. Mount the exciter stator in the end bell, and torque the two mounting screws to 8 ft-lbs (11 Nm). The leads must exit away from the end bell and be in the top half of the assembly (see Figure 7-2).

4. Wipe the bearing bore in the end bell lightly with molybdenum disulfide grease and make sure the rubber O-ring is in place.

5. Fit the generator adaptor and stator assembly together and thread the four generator through-studs into the adaptor casting (the ends with the shorter length of thread). Make sure the stud threads bottom.

6. With the help of an assistant, supporting both ends of the rotor, insert the rotor assembly inside the stator assembly. Rest the rotor on a pole face.

7. Mount the end bell to the stator assembly, making sure the rotor bearing is fully seated in the bore and that the end bell part number is at the top. Pull the field leads out the same opening as the main stator leads and lightly snug down the four stud washers and nuts to keep the assembly together while mounting it to the engine. Do not torque the nuts at this time as it might be necessary to make adjustments as instructed in Step 9.

8. Cinch a lifting strap around the generator and hoist it up to and and in line with the engine. Thread in the eight disc-to-flywheel bolts by hand. They will be torqued in Step11. Secure the generator adaptor and engine together and torque the bolts to 40 ft-lbs (54 Nm).

9. Take up the hoist slightly and remove the blocks under the engine. Then lower the assembly so that it rests on the skid cross member, re-cinch the hoist strap around the generator adaptor and raise the assembly approximately 1/2 inch (12 mm). Next, at the radiator end of the generator set, measure the vertical distance between each **engine** foot (attachment points for the vibration isolators) and the skid cross member below it. If the measured distances are not equal, lower the engine and re-cinch the strap or realign the hoist so that it pulls straight up, and try again. The distances must be equal. Then, measure the vertical distance between each **generator** foot and the skid cross member below it. The distances must be equal. If they are not, rotate the generator with respect to the engine until the two distances are equal, thus placing all four mounting feet in the same plane. (It may be necessary to loosen the nuts on the generator through-studs slightly in order to rotate the generator.) Once the engine and generator are aligned, torque the nuts on the generator through-studs to 28 ft-lbs (38 Nm).

   If the engine and generator are being installed as an assembly, first secure the engine mounts to the front skid cross member, cinch the lifting strap around the generator adaptor and then align the generator feet as instructed in Step 9.

10. Secure the generator to the skid with the rubber isolation mounts. Torque the through bolts to 68 ft-lbs (92 Nm).

    The vibration isolators for the engine end are color coded red/white; and for the generator end, yellow/white or green/white.

11. Torque the eight drive disc-to-flywheel bolts to 39 ft-lbs (52 Nm).

12. Secure the end bell cover plate and torque the four screws to 8 in-lbs (3.8 Nm).

13. Reconnect or remount all the other components that were disconnected or removed under Disassembly.

8. Governor

MECHANICAL GOVERNOR ADJUSTMENTS

50/60 Hertz Selector Lever

These generator sets have a 50/60 Hertz selector lever which must be in the proper position for the application (to the right for 60 Hertz and to the left for 50 Hertz). If it is necessary to move the handle; remove the stop bracket, move the lever over and then bolt the bracket on again to prevent the handle from being moved accidentally. See Figure 8-1.

Frequency Adjustment

With the 50/60 Hertz selector lever in the proper position, adjust frequency (speed) by turning the speed adjusting screw while the engine is running at its normal operating temperature under full load. Set the locknut on the adjusting screw when the adjustment is satisfactory.

There is no adjustment for droop. If droop is not within five percent of nominal frequency (3 Hertz for 60 Hertz sets and 2.5 Hertz for 50 Hertz sets), refer to the engine service manual.

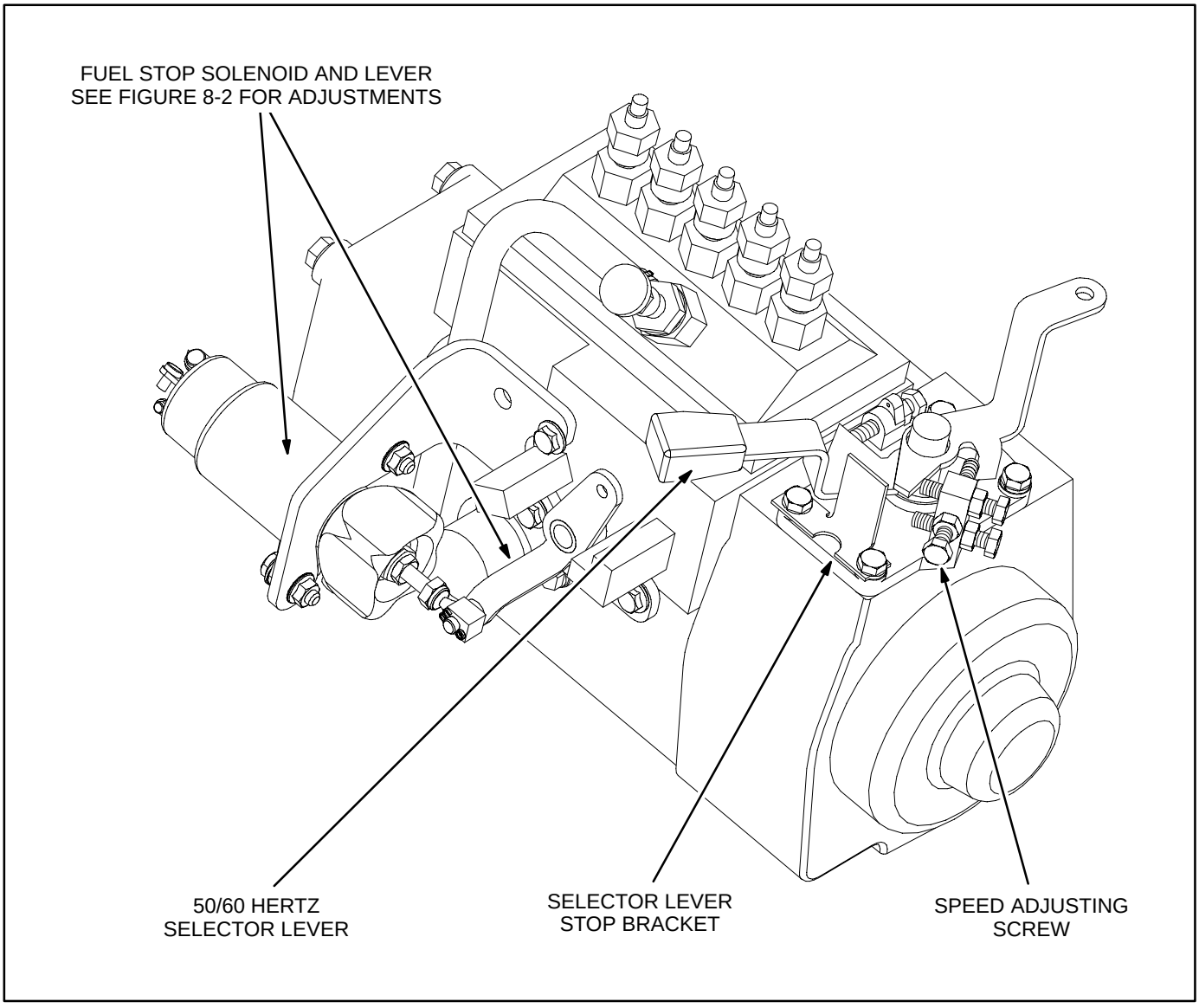


FIGURE 8-1. GOVERNOR AND FUEL INJECTION UNIT

Fuel Shutoff Solenoid

A solenoid is mounted by means of a bracket on the fuel injection unit to actuate the fuel shutoff lever, as shown in Figure 8-2. After mounting the solenoid, it is necessary to check the clearance between the fuel shutoff lever and the lever stop when the solenoid is energized. The clearance must be 1.5 to 3.0 mm (0.06 to 0.12 inches).

⚠ CAUTION ***The solenoid will burn out, leading to a shutdown failure, if lack of clearance prevents the solenoid from bottoming. Too much clearance may prevent the set from starting or may prevent full power.***

If necessary, adjust the clearance as follows:

1. Loosen the locknut on the solenoid plunger (the plunger has a 14 mm wrench flat). Turn the hinge link screw as necessary to cause the lever clearance to increase or decrease.
2. Check the clearance again and repeat the adjustment until the specified clearance is obtained.
3. Set the locknut.

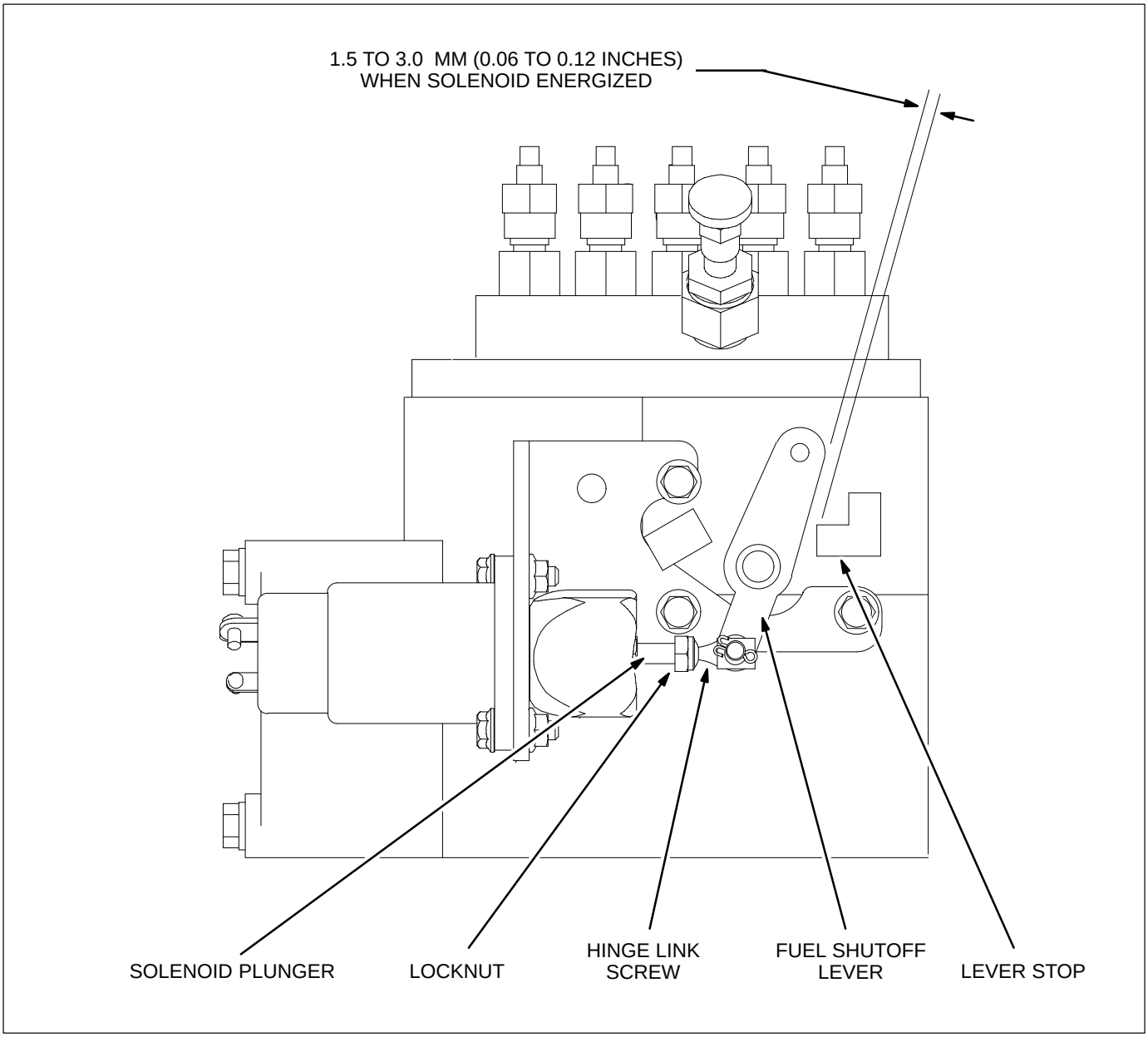


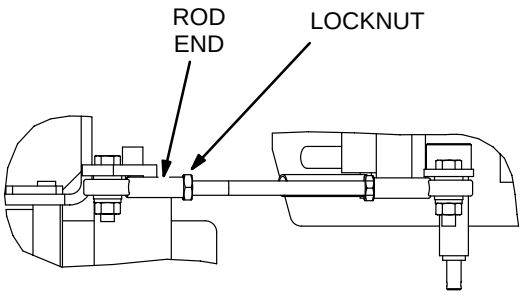
FIGURE 8-2. FUEL SHUTOFF LEVER ADJUSTMENT

ELECTRONIC GOVERNOR ADJUSTMENTS

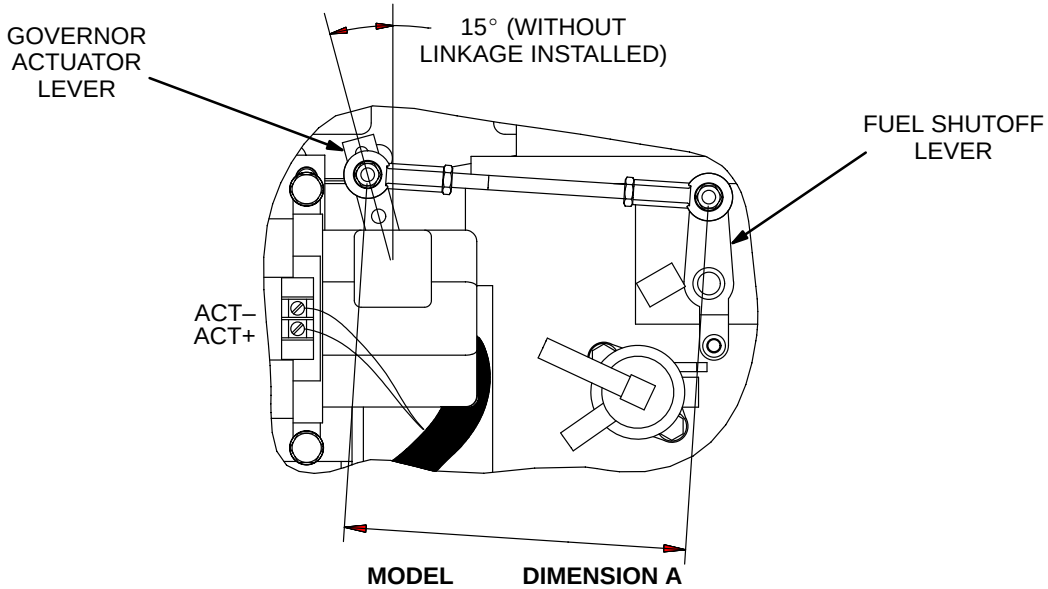
If necessary, adjust the governor linkage as follows:

1. With the linkage removed from the governor actuator lever, make sure that the actuator lever is installed at a 15° degree angle. If adjustment is required, loosen the screw on the governor actuator lever. Adjust lever and tighten the lever's screw. (Rod end is mounted to the second hole from the top of the governor actuator lever.)

2. Check dimension A. If adjustment is required, remove the linkage from either end and loosen locknut to adjust the rod end.



TOP VIEW OF INSTALLED LINKAGE



MODEL	DIMENSION A
DKAC	108 MM (4.25 INCHES)
DKAE	120 MM (4.72 INCHES)
DKAF	145 MM (5.71 INCHES)

FIGURE 8-3. ELECTRONIC GOVERNOR ADJUSTMENT

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9. Wiring Diagrams

GENERAL

This section consists of the schematic and connection wiring diagrams referenced in the text. The following drawings are included.

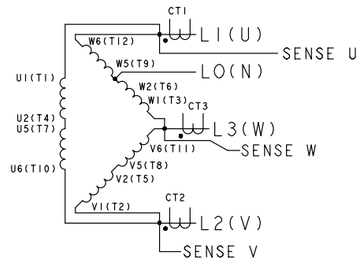
YD GENERATORS

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.

3 PHASE RECONNECTABLE, 12 LEAD

CURRENT TRANSFORMER SECONDARY CONNECTION

X1 X3



SERIES DELTA
3 PHASE
OUTPUT TERMINALS
U,V,W,N

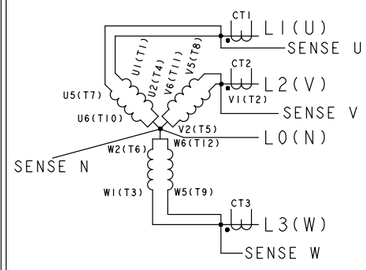
NOTE: SENSE LEAD N IS NOT USED.
TAPE END AND TIE BACK.

-01

FEATURE CODE	VOLTAGE
R106	120/240

CURRENT TRANSFORMER SECONDARY CONNECTION

X1 X3



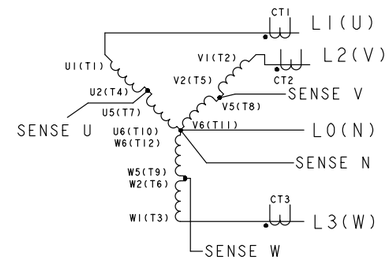
PARALLEL WYE (STAR)
3 PHASE
OUTPUT TERMINALS
U,V,W,N

-02

FEATURE CODE	VOLTAGE
R098	120/208
R067	139/240

CURRENT TRANSFORMER SECONDARY CONNECTION

X1 X2



SERIES WYE (STAR)
3 PHASE
OUTPUT TERMINALS
U,V,W,N

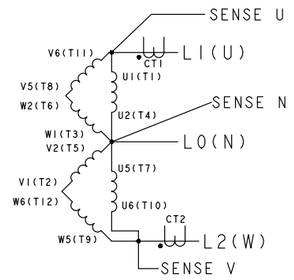
-03

FEATURE CODE	VOLTAGE
R099	220/380
R003	240/416
R002	277/480

1 PHASE RECONNECTABLE, 12 LEAD

CURRENT TRANSFORMER SECONDARY CONNECTION

X1 X3



DOUBLE DELTA
1 PHASE
OUTPUT TERMINALS
U,W,N

NOTE: SENSE LEAD W IS NOT USED.
TAPE END AND TIE BACK.

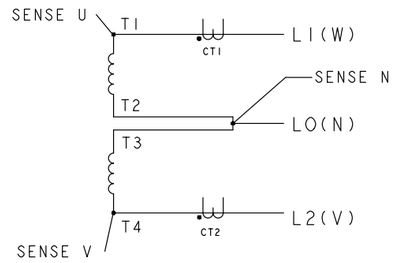
-04

FEATURE CODE	VOLTAGE
R104	120/240

1 PHASE NON-RECONNECTABLE, 4 LEAD

CURRENT TRANSFORMER SECONDARY CONNECTION

X1 X3



1 PHASE
OUTPUT TERMINALS
W,V,N

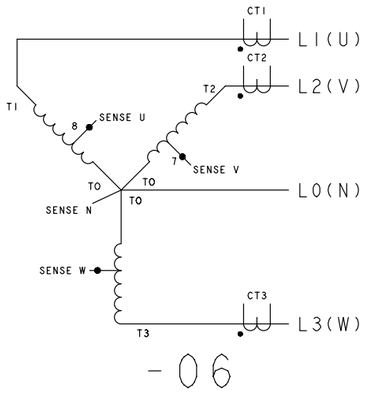
NOTE: SENSE LEAD W IS NOT USED.
TAPE END AND TIE BACK.

-05

FEATURE CODE	VOLTAGE
R104	120/240

347/600V NON-RECONNECTABLE

X1 X2



-06

FEATURE CODE	VOLTAGE
R114	347/600

NOTES:

1. UVW PHASE SEQUENCE WITH C.W. ROTATION FACING DRIVE END.
2. AC HARNESS LEAD MARKING.

LABEL OR COLOR CODE	
CT1-X1	PINK
CT1-X2/X3	GRAY
CT2-X1	PURPLE
CT2-X2/X3	GRAY
CT3-X1	ORANGE
CT3-X2/X3	GRAY
SENSE N(5)	WHITE
SENSE W(6)	BLUE
SENSE V(7)	RED
SENSE U(8)	BLACK
X+(F1)	YELLOW
XX-(F2)	YELLOW/BLACK

TABULATION	
0630_3164_01	FRD24757
0630_3164_02	FRD24757
0630_3164_03	FRD24757
0630_3164_04	FRD24757
0630_3164_05	FRD24757
0630_3164_06	FRD24757

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AC RECONNECT WIRING DIAGRAM

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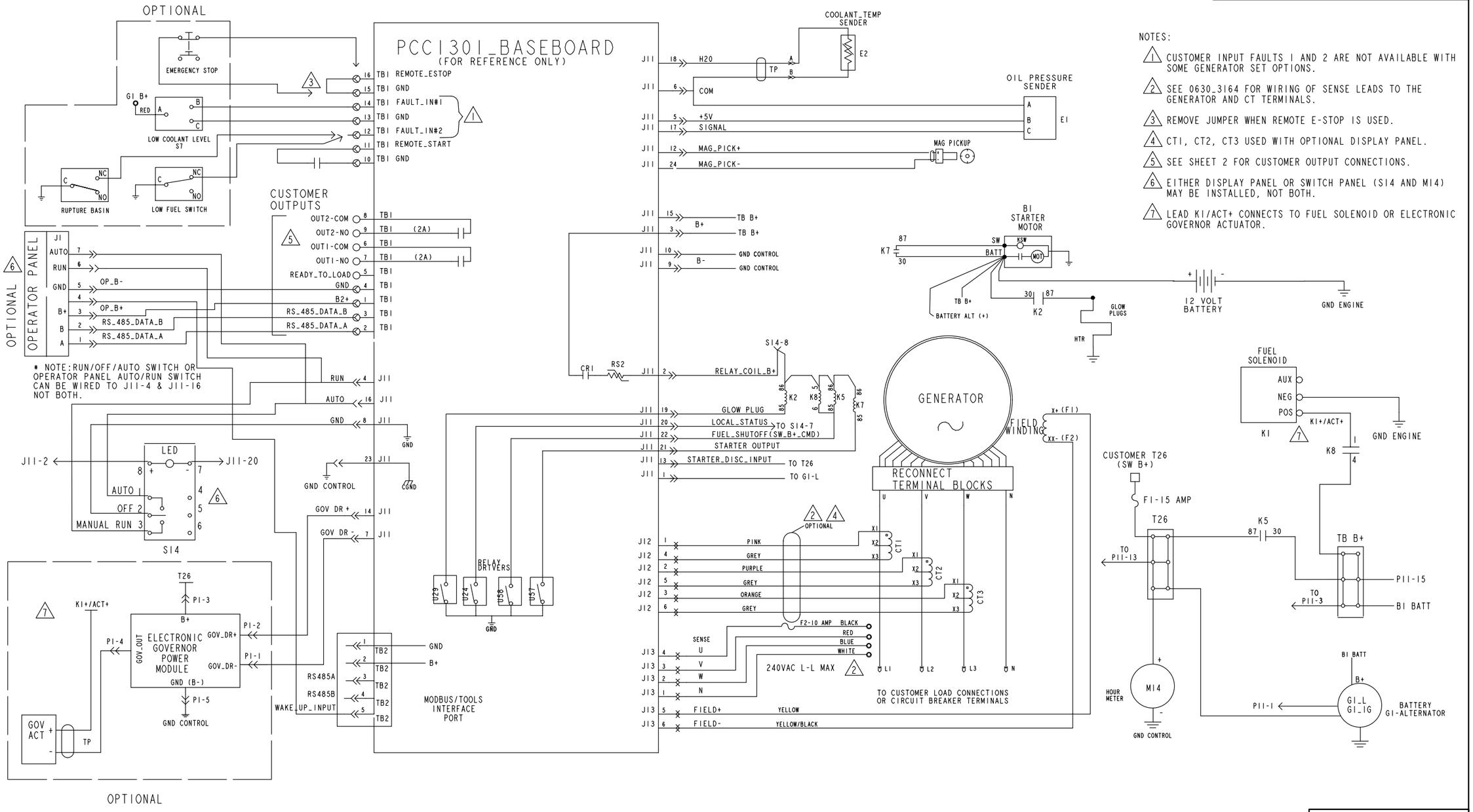

NOTES:

1. CUSTOMER INPUT FAULTS 1 AND 2 ARE NOT AVAILABLE WITH SOME GENERATOR SET OPTIONS.
2. SEE 0630_3164 FOR WIRING OF SENSE LEADS TO THE GENERATOR AND CT TERMINALS.
3. REMOVE JUMPER WHEN REMOTE E-STOP IS USED.
4. CT1, CT2, CT3 USED WITH OPTIONAL DISPLAY PANEL.
5. SEE SHEET 2 FOR CUSTOMER OUTPUT CONNECTIONS.
6. EITHER DISPLAY PANEL OR SWITCH PANEL (S14 AND M14) MAY BE INSTALLED, NOT BOTH.
7. LEAD K1/ACT+ CONNECTS TO FUEL SOLENOID OR ELECTRONIC GOVERNOR ACTUATOR.

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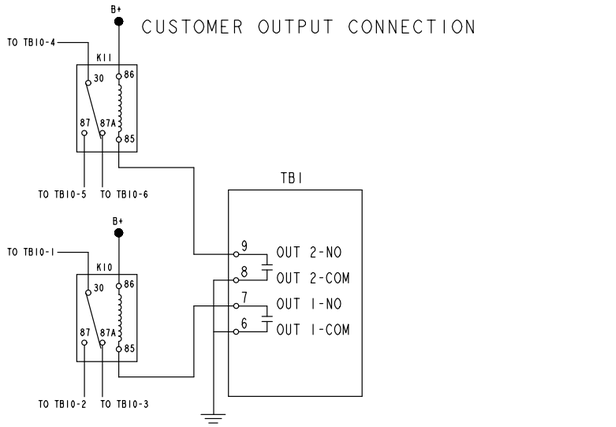
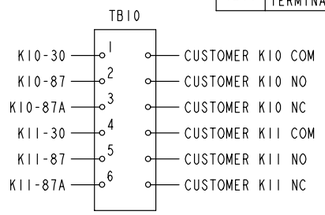
BLOCK DIAGRAM (SHEET 1 OF 2)

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.

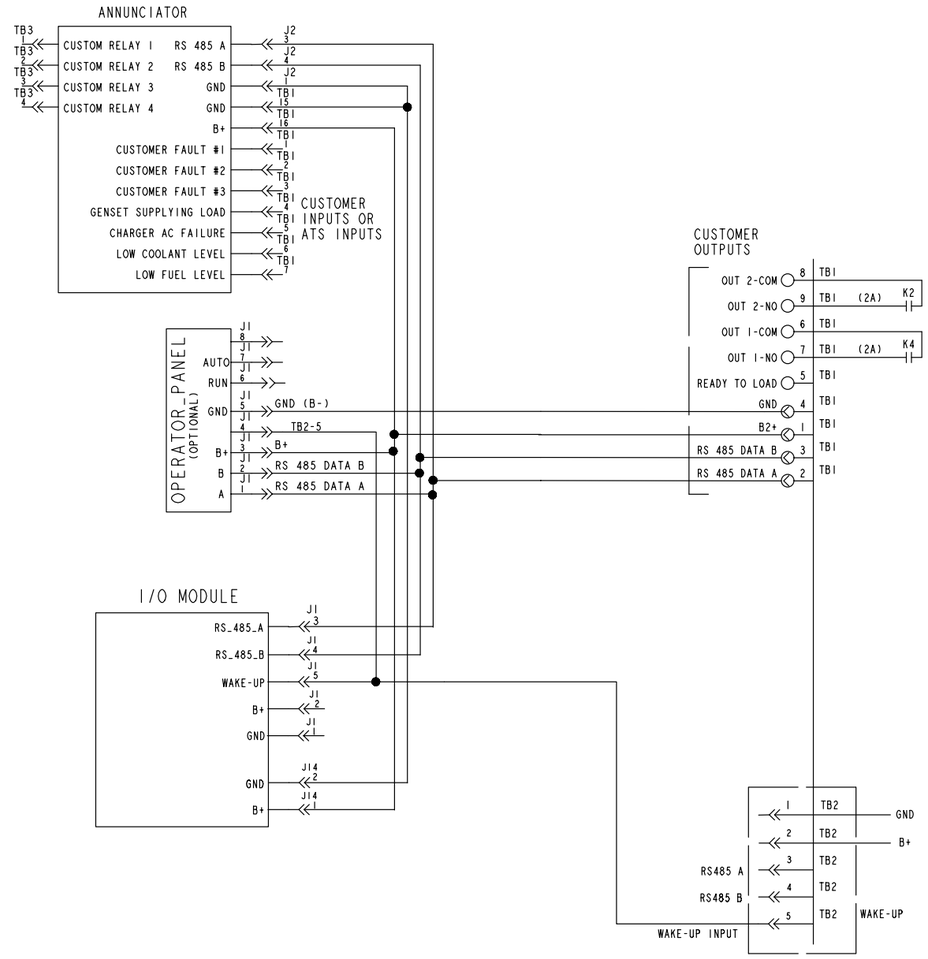
CUSTOMER OUTPUT CONNECTION



TB10	CUSTOMER RELAY CONNECTION TERMINAL BLOCK



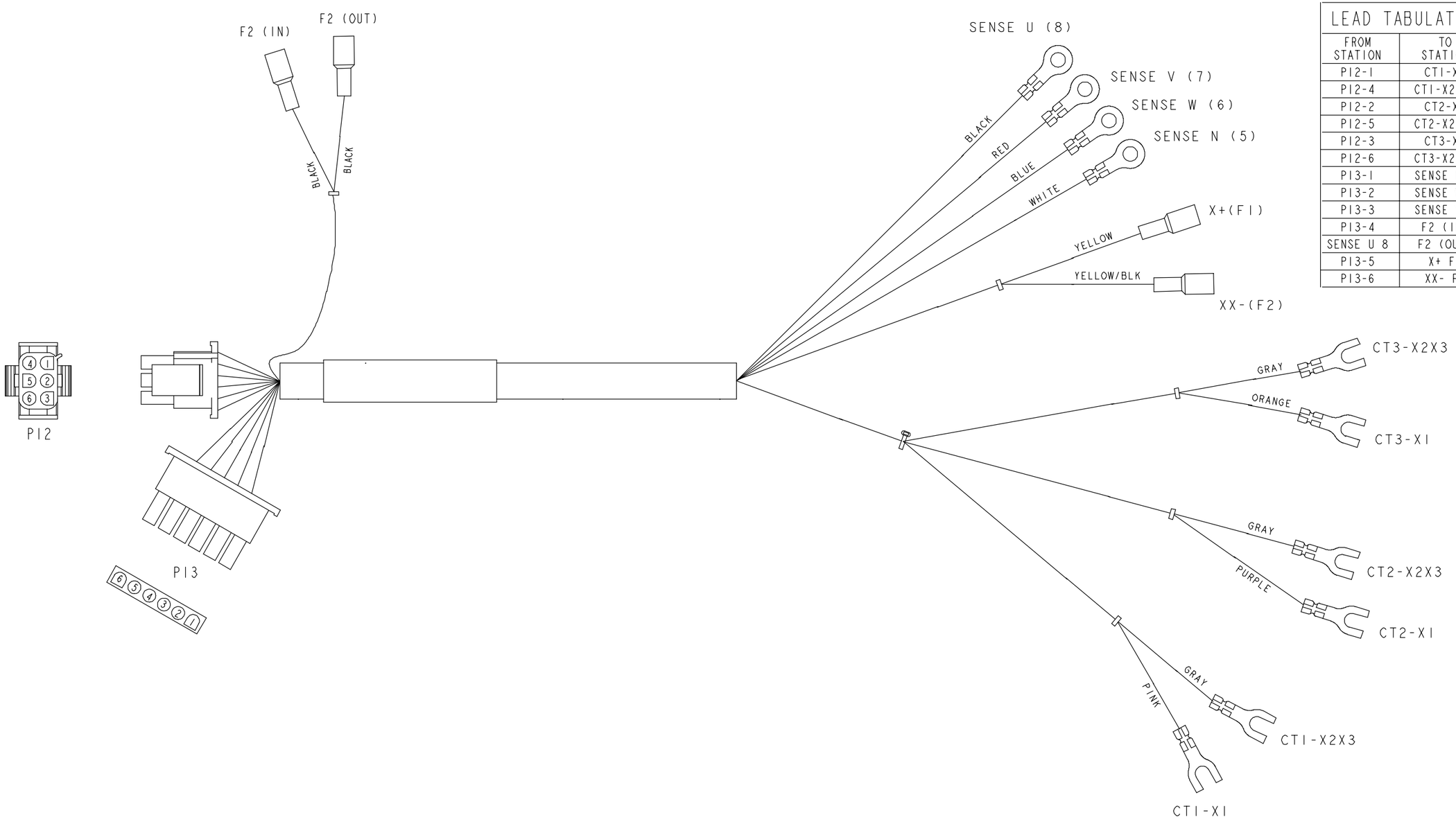
ANNUNCIATOR & I/O MODULE



No. 630-315A sh 2 of 2
Rev. D
Modified 08-05

BLOCK DIAGRAM (SHEET 2 OF 2)

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.



LEAD TABULATION	
FROM STATION	TO STATION
P12-1	CT1-X1
P12-4	CT1-X2/X3
P12-2	CT2-X1
P12-5	CT2-X2/X3
P12-3	CT3-X1
P12-6	CT3-X2/X3
P13-1	SENSE N 5
P13-2	SENSE W 6
P13-3	SENSE V 7
P13-4	F2 (IN)
SENSE U 8	F2 (OUT)
P13-5	X+ F1
P13-6	XX- F2

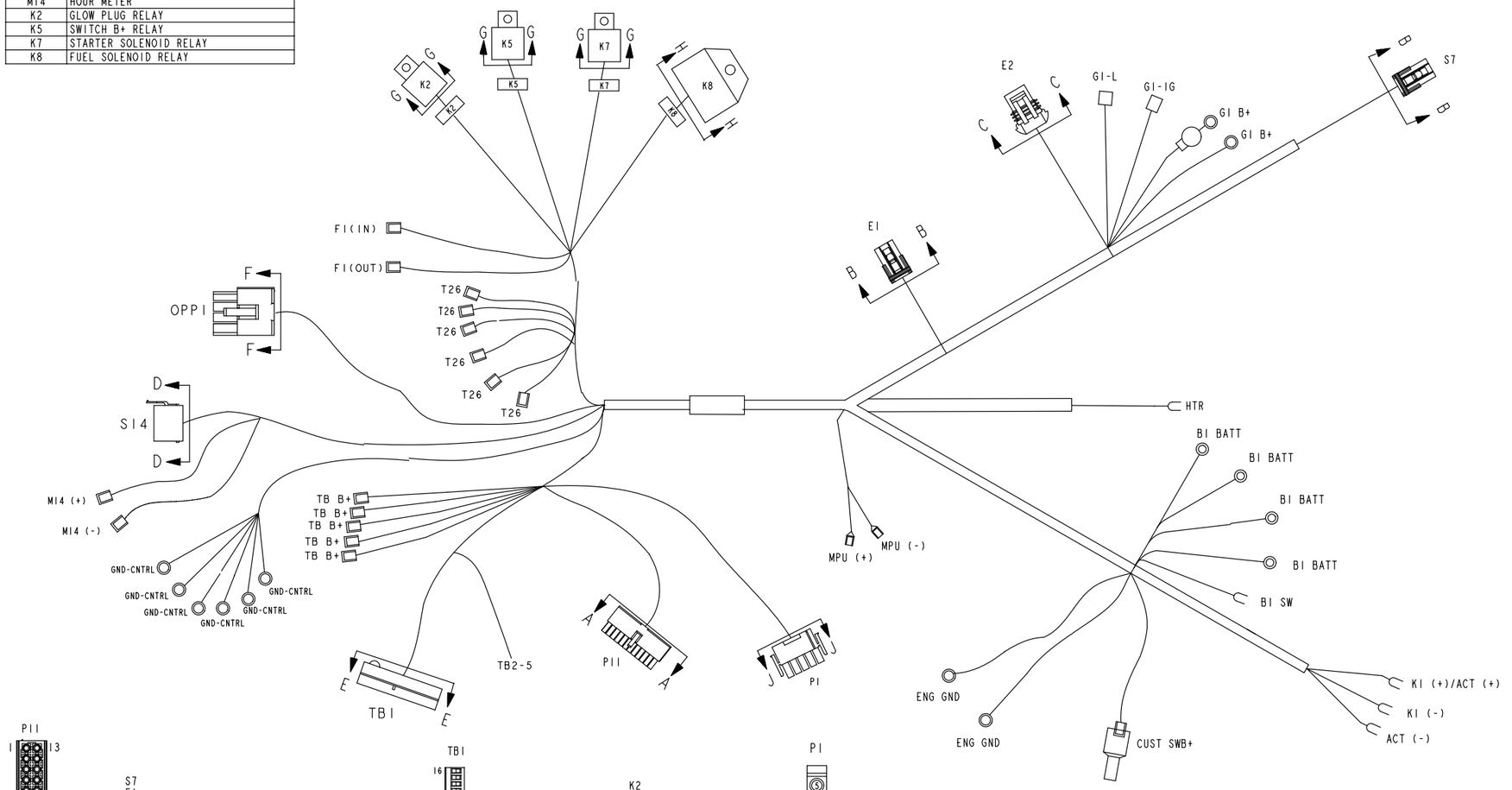
No. 338-4726
Rev. B
Modified 09-05

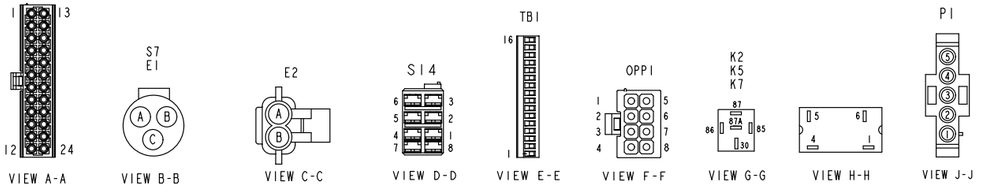
AC HARNESS

Power Generation

THIS IS A REPRESENTATIVE DRAWING. FOR SERVICE, USE DRAWING SUPPLIED WITH GENSET, IF AVAILABLE.

KEY	
T26	SWITCH B+ TERMINAL BLOCK
TB B+	B+ TERMINAL BLOCK
S7	LOW COOLANT LEVEL SENDER
E1	OIL PRESSURE SENDER
E2	COOLANT TEMPERATURE SENDER
MI4	HOUR METER
K2	GLOW PLUG RELAY
K5	SWITCH B+ RELAY
K7	STARTER SOLENOID RELAY
K8	FUEL SOLENOID RELAY





LEAD TABULATION		
FROM STATION	TO STATION	WIRE COLOR
G1 B+	B1 BATT	RED
K7-30	B1 BATT	RED
K2-30	B1 BATT	RED
TB B+	B1 BATT	RED
TB B+	K5-30	RED
TB B+	P11-3	RED
TB B+	P11-15	RED
T26	P1-3	RED
TB B+	K8-4	RED
T26	MI4(+)	RED/ORANGE
T26	P11-13	RED/ORANGE
T26	G1-1G	RED/ORANGE
T26	K5-87	RED/ORANGE
T26	F1 (IN)	RED/ORANGE
F1 (OUT)	CUST SWB+	RED/ORANGE
E2-A	P11-18	WHITE
E2-B	SP1 (OUT)	WHITE
E1-A		WHITE
P11-6	SP1 (IN)	WHITE
K1 (-)	GND-ENG	BLACK
GND-CNTRL	MI4 (-)	BLACK
GND-CNTRL	P11-10	BLACK
GND-CNTRL	P11-9	BLACK
GND-CNTRL	P11-23	BLACK
GND-CNTRL	GND-ENG	BLACK
GND-CNTRL	P1-5	BLACK
E1-B	P11-5	WHITE
E1-C	P11-17	WHITE
P11-22	K5-85	WHITE
K8-6		WHITE
K7-87	B1-SW	BROWN
P11-2	S14-8	RED
K2-86		RED
	K5-86	RED
K7-86		RED
	K8-5	RED
K8-1	K1+/ACT+	RED/BROWN
K7-85	P11-21	WHITE
P11-20	S14-7	WHITE
P11-8	S14-2	BLACK
S14-3	P11-4	WHITE
	OPP1-6	WHITE
S14-1	P11-16	WHITE
	OPP1-7	WHITE
OPP1-5	TB1-4	WHITE
OPP1-3	TB1-1	RED
OPP1-2	TB1-3	WHITE
OPP1-1	TB1-2	WHITE
TB1-16	TB1-15	WHITE
P11-12	MPU (+)	WHITE
P11-24	MPU (-)	BLACK
K2-87	HTR	WHITE
K2-85	P11-19	WHITE
G1-L	P11-1	WHITE
P11-14	P1-2	WHITE
P11-7	P1-1	WHITE
P1-4	ACT (-)	WHITE
G1 B+	S7-A	RED
TB1-13	S7-C	WHITE
TB1-14	S7-B	WHITE
OPP1-4	TB2-5	WHITE

No. 338-4697
Rev. C
Modified 09-05

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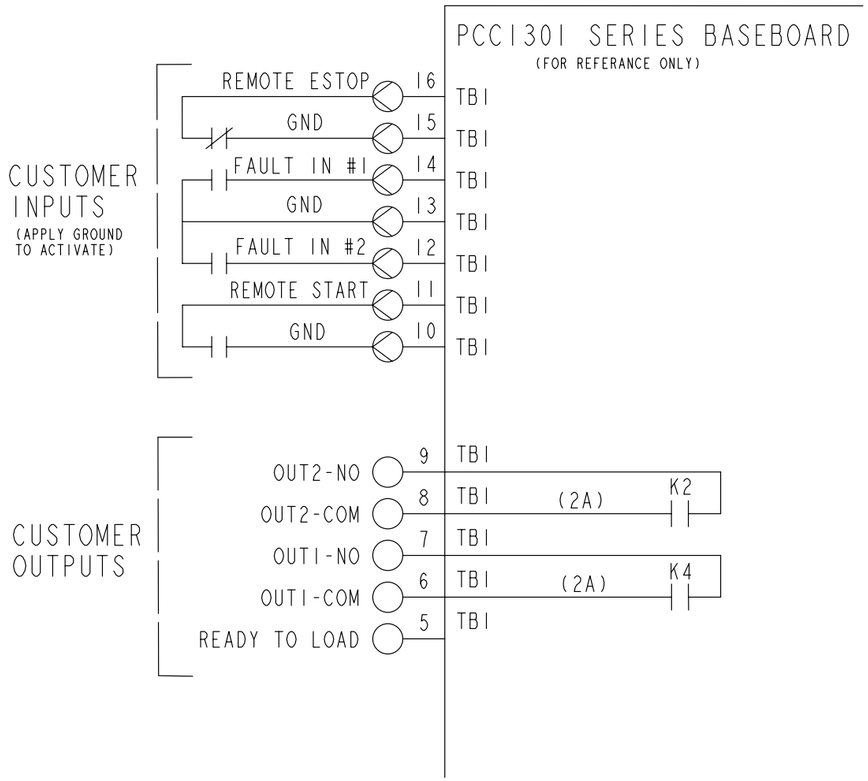


NOTE:

1. TORQUE TERMINALS TO 4.4 IN/LBS (0.5 Nm).
2. WIRE SIZE, 30-12 AWG (0.14-2.5MM) (TB1).
3. WIRE TYPE, USE 60°C RATED MINIMUM. COPPER WIRE (TB1).
4. TERMINAL SCREWS ARE SLOTTED (0.6MM).
5. USE FLAT-BLADED SCREWDRIVER WITH 2.5MM BLADE.
6. STRIP WIRE LENGTH TO 6.0MM.
7. FAULT IN #1 USED FOR OPTIONAL LOW COOLANT LEVEL.
8. FAULT IN #2 USED FOR OPTIONAL LOW FUEL PRESSURE. (GAS)
9. FAULT IN #2 USED FOR OPTIONAL LOW FUEL LEVEL. (DIESEL)

No. 620-0277 sh 1 of 1
Rev. B
Modified 01-05

Appendix A. Menu Sequence Diagrams

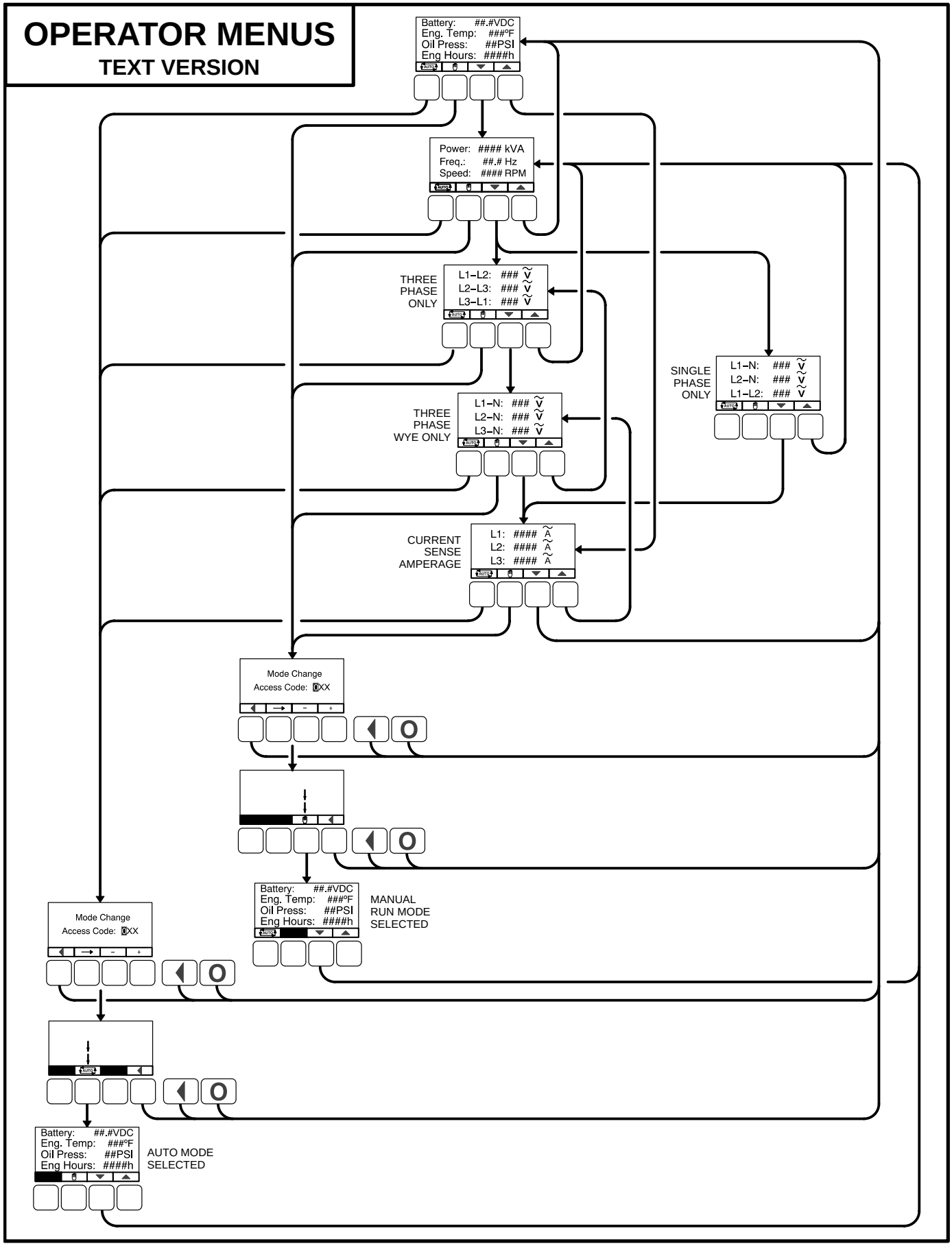
GENERAL

The illustrations in this section show an overview of menu navigation. These illustrations can also be used to locate a submenu and determine how to access it.

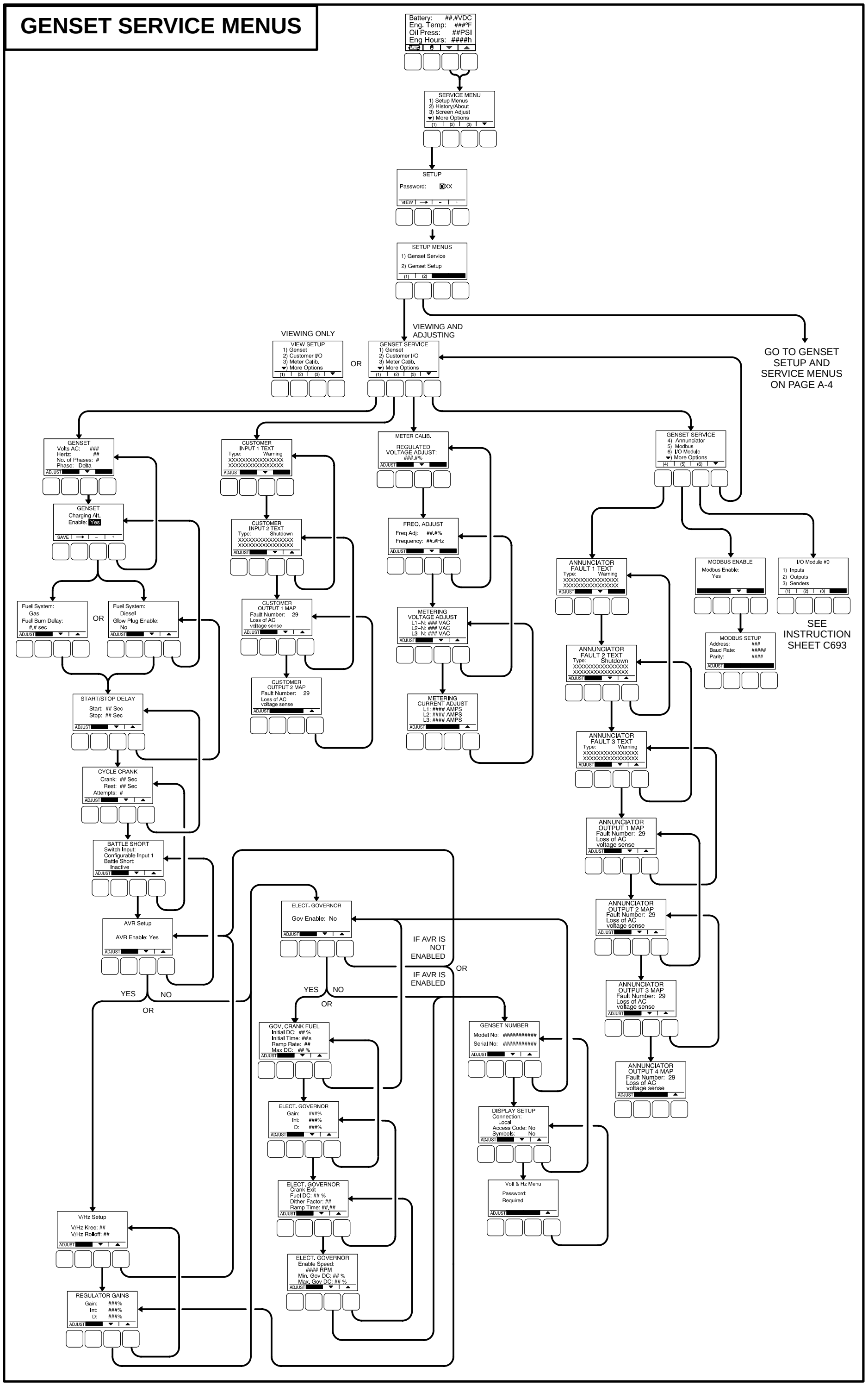
The first illustration shows the basic Operator Menus. The remaining two illustrations show the Service, Genset Setup, and Genset Service menus.

The illustrations only show the text versions of the menus. In addition, the menus shown in the setup and service menus reflect what is displayed if the appropriate passwords are entered for viewing and changing the menus.

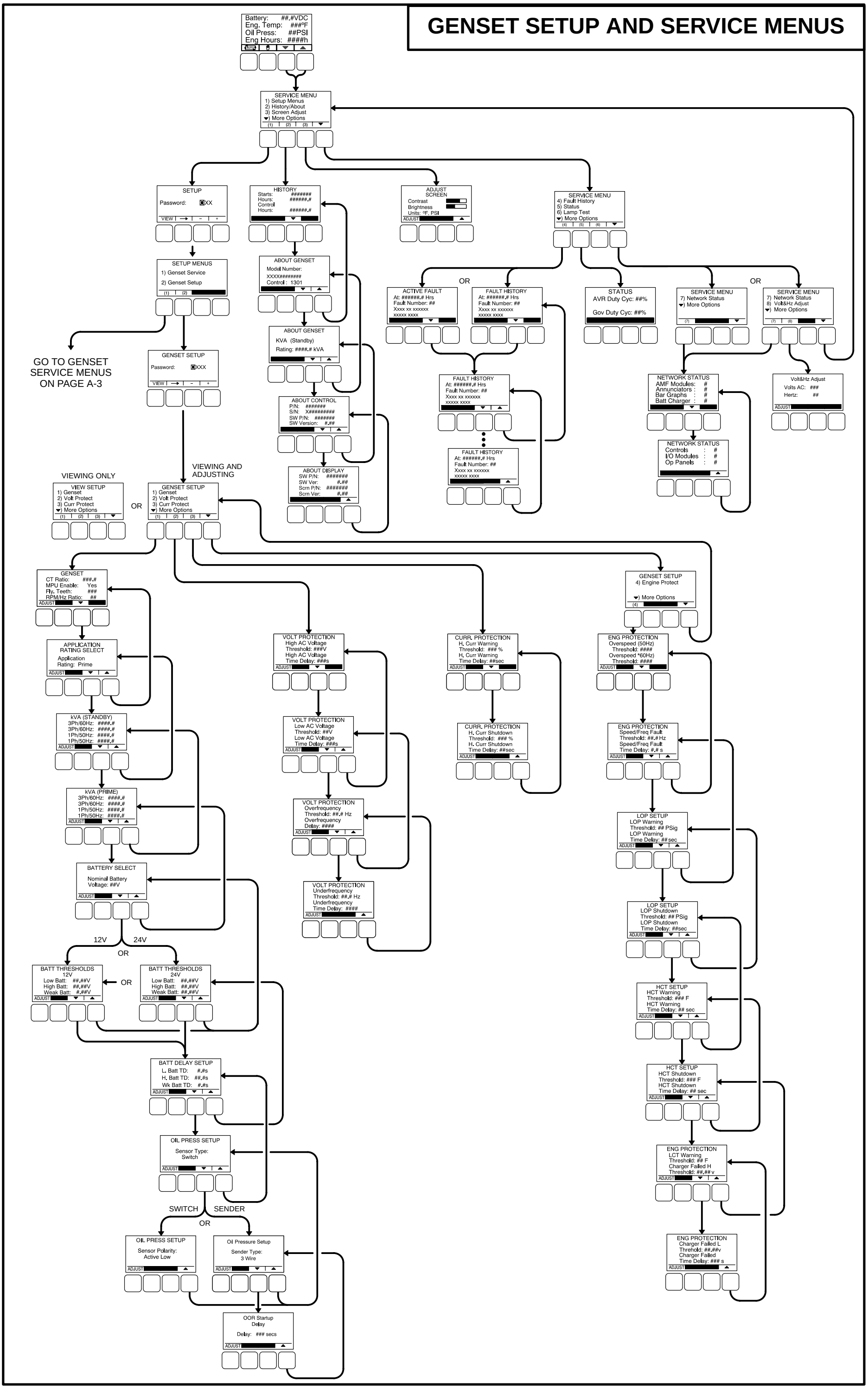
OPERATOR MENUS
TEXT VERSION



GENSET SERVICE MENUS



GENSET SETUP AND SERVICE MENUS



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763-574-5000 International Use
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