



# Operator Manual

Our energy working for you.™



## PowerCommand® 2.2



## FOREWORD

The purpose of this manual is to provide the Operator with sound, general information for the use and daily maintenance of the generator set. Refer to the Operator's engine specific manual for additional engine information which must also be read before operating the set.

It is for guidance and assistance with recommendations for correct and safe procedures. Cummins Power Generation Limited cannot accept any liability whatsoever for problems arising as a result of following recommendations in this manual.

The information contained within the manual is based on information available at the time of going to print. In line with Cummins Power Generation Limited policy of continuous development and improvement, information may change at any time without notice. The Operators must therefore ensure that before commencing any work, they have the latest information available.

Operators are respectfully advised that it is their responsibility to employ competent persons to carry out any installation work in the interests of good practice and safety. Consult your Authorised Distributor for further installation information. It is essential that the utmost care is taken with the application, installation and operation of any diesel engine due to their potentially dangerous nature. Careful reference must also be made to other Cummins Power Generation Limited literature, in particular the Health and Safety Manual 0908-0110.

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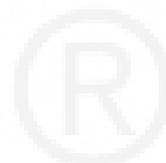
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## Engine Specific Publications

**CAUTION:** *Important, additional engine specific information is contained within the Engine Operator's Manual. This information must be read in conjunction with the Control Manual before attempting to run the generator set.*

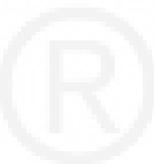
The relevant engine specific manual must be read in conjunction with this manual for the safe operation and maintenance of this generator set. The Engine Operator's Manual – Operator Level - will be supplied with the documentation package for your generator set.

## Supplementary Publications

The Supplementary Publications appropriate to your system will also be supplied. Where appropriate the corresponding Instruction Manual(s) will also be supplied with any accessory that you order.

Title	Publication No
Lead Acid Battery	0908-0101
Radiator Information	0908-0107
Health and Safety (Diesel Generator Sets)	0908-0110

If further, more detailed information is required, Engine Operation and Maintenance Manuals, and Service Manuals are available. Contact your authorised distributor.



## DISCLAIMER

**ALTHOUGH THIS GENERATOR SET MAY BE SUPPLIED WITH AN EARTHING ROD IT WILL NOT BE SUITABLE FOR ALL LOCAL CONDITIONS.**

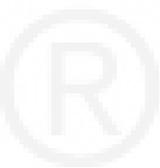
**THE END USER IS RESPONSIBLE FOR ENSURING THAT AN EARTHING ARRANGEMENT THAT IS COMPLIANT WITH LOCAL CONDITIONS IS ESTABLISHED AND TESTED BEFORE THE EQUIPMENT IS USED.**

## TRANSPORTATION



**WARNING:** BEFORE ANY TRANSPORTATION, THE FLUID CONTAINMENT AREA (IF APPLICABLE) MUST BE INSPECTED AND EMPTIED OF ANY SPILLAGE OR ENGINE WASTE.  
THE GENERATOR SET DOOR(S) (IF THE GENERATOR SET IS ENCLOSED) MUST BE LOCKED BEFORE TRANSPORTATION AND MUST REMAIN LOCKED DURING TRANSPORTATION AND SITING.

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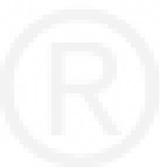
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## Schedule of Abbreviations

AC	Alternating Current	MCB	Miniature Circuit Breaker
ACB	Air Circuit Breaker	MCCB	Moulded Case Circuit Breaker
ACH	Anti-Condensation Heaters	MF	Mains Failed
ATS	Automatic Transfer Switch	MFSS	Master First Start Sensor
AVR	Automatic Voltage Regulator	MR	Mains Returned
		MST	Mains Sensing Transformer
BHP	Brake Horsepower	MSU	Mains Sensing Unit
BMS	Building Management System	MV	Medium Voltage
BST	Busbar Sensing Transformer		
		NEC	Neutral Earthing Contact
CB	Circuit Breaker		
CCA	Cold Cranking Amps	PC	PowerCommand®
CHP	Combined Heat and Power	PF	Power Factor
COP	Continuous Power Rating	PFC	Power Factor Controller
CT	Current Transformer	PLC	Programmable Logic Controller
		PMG	Permanent Magnet Generator
		PRP	Prime Power Rating
dB(A)	Unit of noise level	PSU	Power Supply Unit
DC	Direct Current	PT/CT	Potential Transformer / Current Transformer
DIP	Dual In-line Package		
DMC	Digital Master Control		
DMSU	Demand Load Standby Unit	QCC	Quadrature Current Control
EMCU	Engine Monitoring and Control Unit	RFI	Radio Frequency Interference
EMF	Electromotive Force	RMS	Root Mean Square
EPU	Engine Protection Unit	RPM	Revolutions Per Minute
		RTD	Resistance Temperature Detector
FSS	First Start Sensor		
GCP	Generator Control Panel	V	Volts
Genset	Generator set	VAC	Volts, Alternating Current
GKWT	Global Kilowatt Transducer	VCB	Vacuum Circuit Breaker
		VDC	Volts, Direct Current
HMI	Human/Machine Interface	VF	Volt-free
HV	High Voltage	VT	Voltage Transformer
IC	Integrated Circuit		
I/O	Input / Output		
kVA	Apparent Power		
kVAR	Reactive Power		
kW	Active / Real Power		
kWh	Unit of electrical energy or work		
LED	Light-Emitting Diode		
LTP	Limited Time Power Rating		
LTA	Low Temperature Aftercooling		
LV	Low Voltage		

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## SECTION 1 – PRELIMINARY AND SAFETY

### 1. Preliminary and Safety

#### 1.1 Warning, Caution and Note Styles Used In This Manual

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



**WARNING:** WARNS OF A HAZARD THAT MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH.



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



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

#### 1.2 General Information

This manual should form part of the documentation package supplied by Cummins Power Generation Limited with specific generator sets. In the event that this manual has been supplied in isolation please refer to other Cummins Power Generation Limited literature, in particular the Health and Safety Manual (0908-0110).



*Note:* It is in the Operator's interest to read and understand all Health and Safety information together with all Warnings and Cautions contained within the documentation relevant to the generator set, its operation and daily maintenance.

#### 1.3 Generator Plant Safety Code

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



**WARNING:** IMPROPER OPERATION AND MAINTENANCE CAN LEAD TO SEVERE PERSONAL INJURY OR LOSS OF LIFE AND PROPERTY BY FIRE, ELECTROCUTION, MECHANICAL BREAKDOWN OR EXHAUST GAS ASPHYXIATION. READ AND FOLLOW ALL SAFETY PRECAUTIONS, WARNINGS AND CAUTIONS THROUGHOUT THIS MANUAL AND THE HEALTH AND SAFETY MANUAL 0908-0110.



**WARNING:** LIFTING AND REPOSITIONING ON THE GENERATOR SET MUST ONLY BE CARRIED OUT USING SUITABLE LIFTING EQUIPMENT, SHACKLES AND SPREADER BARS IN ACCORDANCE WITH LOCAL GUIDELINES AND LEGISLATION BY SUITABLY TRAINED AND EXPERIENCED PERSONNEL. INCORRECT LIFTING CAN RESULT IN SEVERE PERSONAL INJURY, DEATH AND/OR EQUIPMENT DAMAGE. FOR MORE INFORMATION CONTACT YOUR AUTHORISED DISTRIBUTOR.

##### 1.3.1 Positioning of Generator Set

The area for positioning the set must be adequate and level and the area immediately around the set must be free of any flammable material.



**WARNING:** ON AN ENCLOSED GENERATOR SET, THE CANOPY DOORS MUST BE LOCKED BEFORE RE-POSITIONING AND MUST REMAIN LOCKED DURING TRANSPORTATION AND SITING.

## 1.3.2 AC Supply and Isolation

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



*Note: A separate disconnecting device is required by BS EN 12601:2001.*

*Note: The AC supply must have the correct over current and earth fault protection according to local electrical codes and regulations.*

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

## 1.3.3 Spillage

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

## 1.3.4 Fluid Containment

If fluid containment is incorporated into the bedframe it must be inspected at regular intervals. Any liquid present should be drained out and disposed of in line with local health and safety regulations. (See Health and Safety manual 0908-0110). Failure to perform this action may result in spillage of liquids which could contaminate the surrounding area.

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

## 1.3.5 Exhaust Precautions



**WARNING: EXHAUST PIPES AND CHARGE AIR PIPES ARE VERY HOT AND THEY CAN CAUSE SEVERE PERSONAL INJURY OR DEATH FROM DIRECT CONTACT OR FROM FIRE HAZARD.**

The exhaust outlet may be sited at the top of the set, or at the bottom, make sure that the exhaust outlet is not obstructed. Personnel using this equipment must be made aware of the exhaust position.



**WARNING: CONTAMINATED INSULATION IS A FIRE RISK WHICH CAN RESULT IN SEVERE PERSONAL INJURY.**

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

To minimise the risk of fire ensure the following steps are observed:

- Ensure that the engine is allowed to cool thoroughly before topping up the oil or draining the fuel filters.
- Clean the exhaust pipe thoroughly.



## 2.3 After Sales Services

We offer a full range of after sales services as detailed below:

### 2.3.1 Maintenance



**WARNING: INCORRECT SERVICE OR PARTS REPLACEMENT CAN RESULT IN SEVERE PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE TRAINED AND EXPERIENCED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.**

For customers who wish to have their generator sets expertly serviced at regular intervals your local distributor offers a complete maintenance contract package. This covers all items subject to routine maintenance and includes a detailed report on the condition of the generator set. In addition, this can be linked to a 24-hour call-out arrangement, providing assistance 365 days a year if necessary. Specialist engineers are available to maintain optimum performance levels from customer's generator sets, and it is recommended that maintenance tasks are only undertaken by trained and experienced engineers provided by your authorised distributor.

### 2.3.2 Warranty

All generator sets have a twelve months warranty from the commissioning date as standard. Extended warranty coverage is also available. In the event of a breakdown prompt assistance can normally be given by factory trained service engineers with facilities to undertake all minor and many major repairs to equipment on site.

For further warranty details contact your authorised distributor.



*Note: Any damage caused to the generator set as a direct result of running in the Battle Short mode will not be covered by the Warranty.*



*Note: Damaged to any component will be rejected if the incorrect mix of anti-freeze has been used. Please contact your authorised Cummins distributor.*

#### 2.3.2.1 Warranty Limitations

Cummins Power Generation Limited is not responsible for the repair or replacement of Product required because of normal wear; accident; misuse; abuse; improper installation; lack of maintenance; unauthorised modifications; improper storage; negligence; improper or contaminated fuel; or the use of parts that do not meet Cummins Power Generation Limited's specifications.

### 2.3.3 Spares

An extensive Spare Parts Department is available for any emergency breakdown and for the engineer who carries out his own routine maintenance. Please contact your authorised Cummins distributor. Please quote Plant Nos., Serial Nos., and Part Nos. when ordering spares.

### 2.3.4 Overseas

Agents and representatives in almost 100 countries throughout the world offer installation and after sales service for the equipment provided. We can provide the name and address of the agent for your specific location.

For details on any of the above services contact your authorised distributor.

### 2.3.5 Additional Literature

Should you require further, more detailed information regarding the engine or alternator please contact your authorised distributor. Please quote Plant Nos., and Serial Nos.

## SECTION 3 – SYSTEM OVERVIEW

### 3. System Overview

The PowerCommand® 2.2 control consists of a control board with integral AVR, and a separate display panel (HMI). These units are contained within the control housing which is mounted on the bedframe at the rear of the generator set. This complete assembly may be housed within a SilentPower® canopy.

The PowerCommand® 2.2 also provides the opportunity for remote display panels; bargraphs; and annunciators. Please contact your authorised distributor for further information.

#### 3.1 SilentPower™ Canopy – Standard Set Main Features



Figure 3 Typical SilentPower™ Canopy for Standard Set

**KEY**

- |    |                |    |                                |
|----|----------------|----|--------------------------------|
| 1. | Display Panel  | 3. | External Emergency Stop Button |
| 2. | Lifting Points | 4. | Lockable Doors for Security    |

### 3.2 SilentPower™ Canopy – Rental Set Main Features

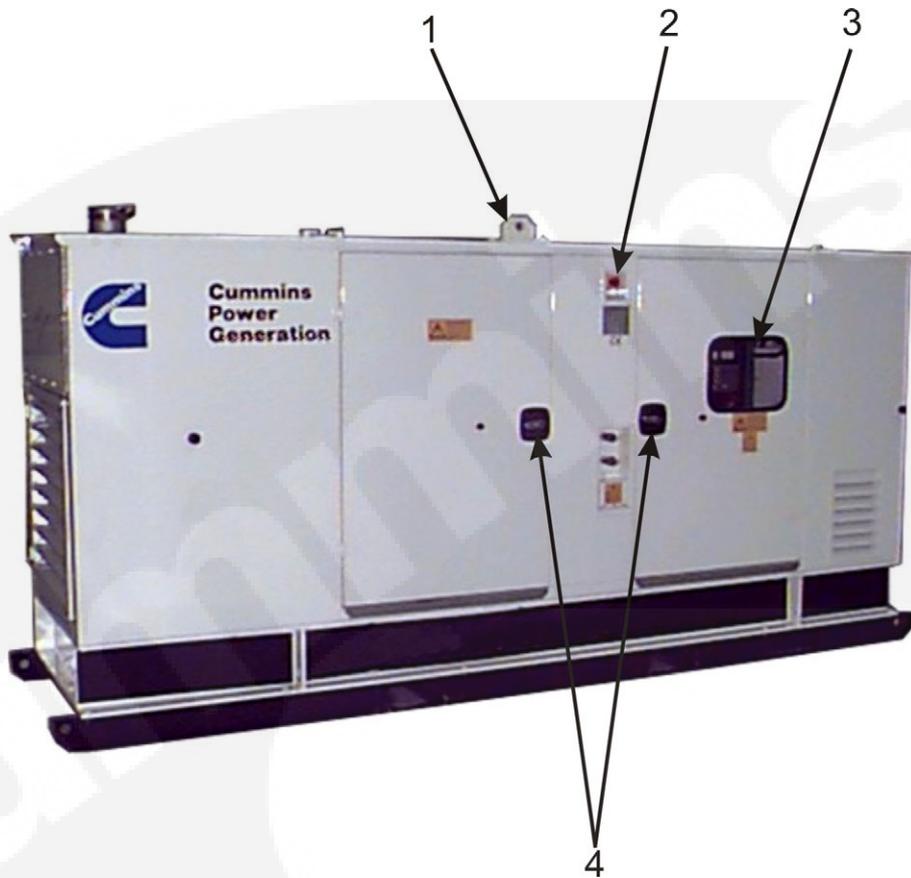


Figure 4 Typical SilentPower™ Canopy for Rental Set

**KEY**

- |    |                                |    |                             |
|----|--------------------------------|----|-----------------------------|
| 1. | Lifting Points                 | 3. | Display Panel               |
| 2. | External Emergency Stop Button | 4. | Lockable Doors for Security |

### 3.3 Generator Components – Typical Generator Set

The main components of a typical C500 (QSX15) Generator Set are shown below, and referred to within this section. Refer to the Operator's engine specific manual for additional, generator set specific information.

Various options are listed although they may not be available for all models.

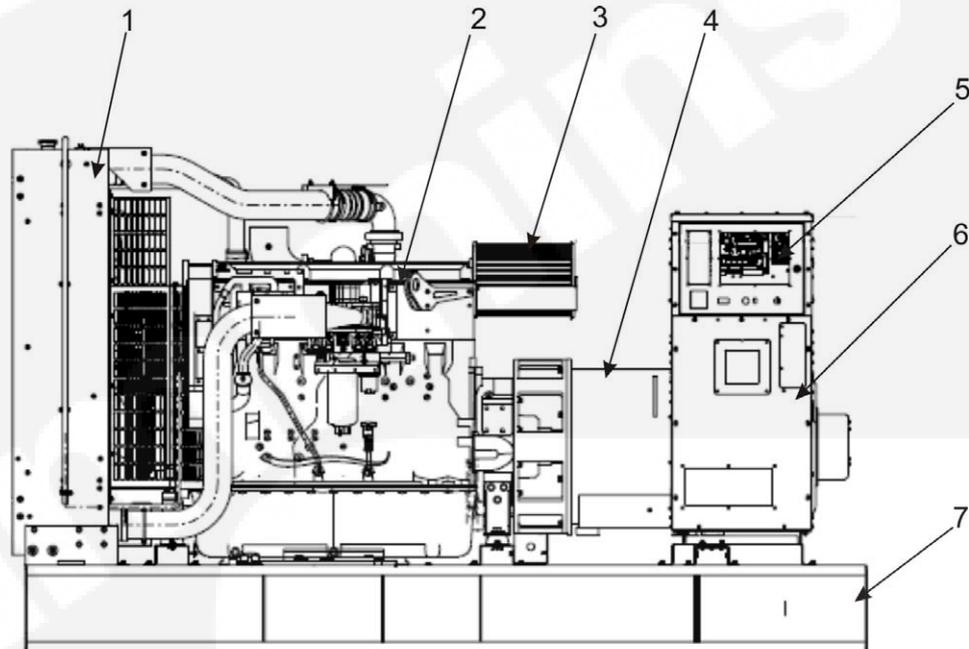


Figure 5 Typical C500 Generator Set

#### KEY

1. Radiator
2. Engine
3. Air Cleaner
4. Alternator
5. PC® 2.2 Display Screen
6. Control Housing
7. Bedframe

#### OPTIONS

- Battery and Tray
- Alarm Module
- Battery Charger
- Engine Coolant Heater
- Alternator Heater

### 3.3.1 Generator Rating

For details of your generator set rating refer to the Generator Set Rating Plate. Refer to [Section 5.4](#) for operation at temperatures or altitudes above those stated on the Rating Plate.

### 3.3.2 Engine

For engine specific information please refer to the relevant Operator's specific engine manual supplied with the generator set document package.

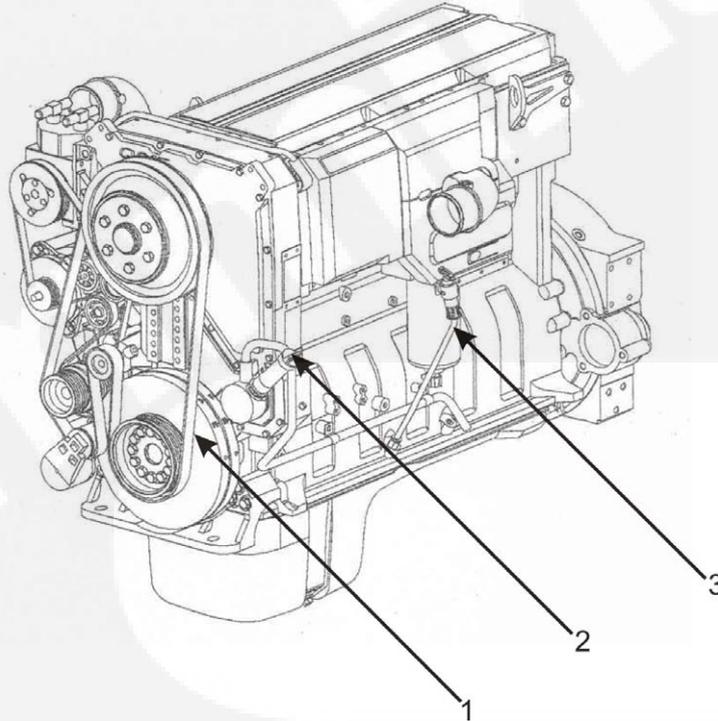


Figure 6 Typical Engine Components (QSX15)

**KEY**

- 1. Fan belt
- 2. Oil filler
- 3. Dipstick

### 3.3.3 Fuel Changeover System – Rental Only

A 3-way fuel valve system is provided to enable the generator set to be fuelled directly from an external tank.

Where the system comprises two valves it is essential that both valves are in the same position to prevent the following:

- Fuel spillage from the generator set tank vent when fuel is drawn from the external tank and spill returned to the generator set tank.
- Fuel shortage when fuel is drawn from the generator set tank and spill returned to the external tank.



**WARNING: DO NOT ATTEMPT TO OPERATE THE GENERATOR SET WITH THE VALVES SET TO EXTERNAL TANK SUPPLY AND WITH THE BLANKING PLUGS FITTED AS THIS WILL CAUSE DAMAGE TO THE ENGINE'S FUEL SYSTEM.**



*Note: Consult your authorised distributor to establish the maximum head of fuel allowable at the generator set fuel pump.*

### 3.3.4 Mains Powered Battery Charger – Set Mounted (Option)

Optional single phase, mains powered battery charger, which is panel mounted, is available to maintain the battery in a charged condition when the generator set is not running.



*Note: It is the sole responsibility of the Customer to provide the power supply and the means to isolate the supply to the charger. Cummins Power Generation Limited accepts no responsibility for providing the means of isolation.*



*Note: The AC supply must have the correct over current and earth fault protection according to local electrical codes and regulations.*

### 3.3.5 Battery Isolator – Rental Only

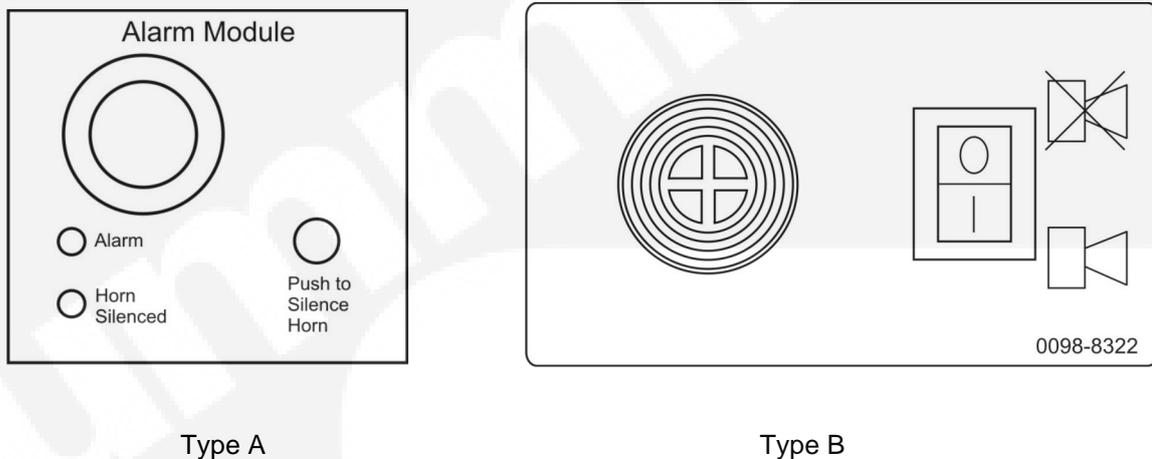
A battery isolator is provided which isolates the negative feed from the battery to the engine. This can be used to isolate the battery to prevent battery drain through prolonged periods of generator set inactivity or where static battery charging is not available.



**WARNING: THE BATTERY ISOLATOR SWITCH MUST NOT BE OPERATED WHILST THE GENERATOR SET IS RUNNING, AND MUST NOT BE USED TO STOP THE GENERATOR SET.**

### 3.3.6 Alarm Module (Option)

The Alarm Module provides audible warnings. Two versions are available, dependent on generator set configuration. The Type B Alarm provides a manual rocker switch to switch the alarm on or off.



Type A

Type B

Figure 7 Typical Alarm Modules Front Panel



**Note:** *If the Type B module has been switched off after giving an audible warning it will not be automatically re-set from the Control Panel after correcting the fault. **Ensure that the manual rocker switch reflects the On or Off mode that is required.***

### 3.3.7 Sensors

Various generator set parameters are measured by sensors, and the resulting signals are processed by the control board.

Engine-mounted sensors are able to monitor the following systems:

- Lube Oil Pressure
- Cooling System Temp
- Miscellaneous Areas.

## 3.4 AC Supply and Isolation

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



*Note:* A separate disconnecting device is required by BS EN 12601:2001.

*Note:* The AC supply must have the correct over current and earth fault protection according to local electrical codes and regulations.



**WARNING:** THE DISCONNECTING DEVICE IS NOT PROVIDED AS PART OF THE GENERATOR SET, AND CUMMINS POWER GENERATION LIMITED ACCEPTS NO RESPONSIBILITY FOR PROVIDING THE MEANS OF ISOLATION.

## 3.5 Heaters



*Caution:* Heater(s) must not be energised if the coolant system has been drained.

### 3.5.1 Heater Supply and Isolation

A heater supply is required for the operation of the engine and alternator heaters (if fitted). See [Section 3.4](#).



*Note:* This disconnecting device is not provided as part of the generator set.

*Note:* It is the sole responsibility of the customer to provide the power supply and the means to isolate the AC input to the terminal box. Cummins Power Generation Limited accepts no responsibility for providing the means of isolation.

## 3.6 Mains Powered Battery Charger (Option)



*Caution:* Isolate the charger before disconnecting the battery.

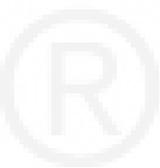
### 3.6.1 Operation

This unit maintains the battery in a fully charged condition without over-charging. The unit also provides rapid charging, when necessary, at a current up to the rated output.

The charger's electronic control circuit allows the charger to be left in circuit during engine cranking and to operate in parallel with the charge alternator.

The charger will supply current to the battery system when the battery terminal voltage is equal to the set float voltage, at which point only a trickle charge current is present. When the battery becomes discharged due to a load being present and the terminal voltage falls, the charger will again supply current to restore the voltage of the battery to the float voltage.

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## SECTION 4 – CONTROL SYSTEM

### 4. Control System

#### 4.1 Control System Description

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

All indicators, control buttons and the display screen are on the face of the display module as illustrated in [Figure 8](#).

There are two fault level signals generated by the control system as follows:

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

The standard control system operates on 12 or 24VDC battery power. The auxiliary equipment operates on LV AC power. The history data is stored in non-volatile memory and will not be deleted due to loss of battery power.

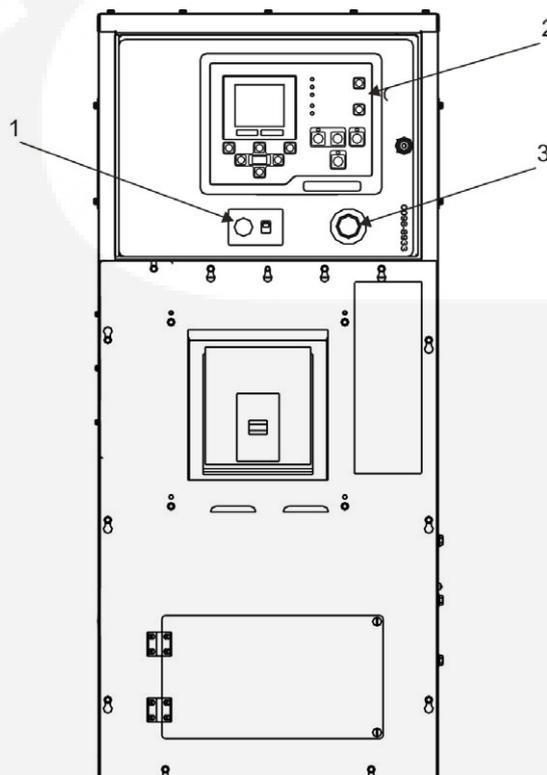


Figure 8 Typical Control System Panel

#### KEY

1. Alarm Module (option)
2. Display Module
3. Emergency Stop Button

## 4.1.1 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 lamps/graphical display will remain active until the Sleep mode is activated.

### Sleep Mode

Sleep mode is used to reduce battery power consumption when the control is not being used and it is in the Off or Auto mode. In this mode, the control's operating software is inactive and the lamps and graphical display on the control panel are all off.

When all conditions are met (i.e. no unacknowledged faults and the control is in the Off/Auto mode) the sleep mode is activated after five minutes of keypad inactivity. This length of time is configurable.

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



*Note: Sleep mode can be enabled/disabled, contact your authorised distributor for options.*

## 4.1.2 Operating Modes

The PowerCommand® 2.2 is operated by the Start/Stop/Manual/Auto buttons on the display module face. Refer to [Figure 9](#).



*Note: If Mode Change access code feature is enabled, a password is required to use these buttons to change the mode of operation. Contact you authorised distributor for options.*

### 4.1.2.1 Stop Button



Press this button to put the generator set into the Off mode. This will disable Auto and Manual modes. The green lamp above this button is lit when the generator set is in the Off mode.

If the generator set is running, in either Manual or Auto mode, and the Stop button is pressed, the engine will shut down.

Refer to Sections [4.10.4](#) and [5.7](#) for more information on stopping in Auto or Manual mode.



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

### 4.1.2.2 Manual Button



Press this button to put the generator set into the Manual mode. The Start button must then be pressed within ten seconds. Failure to do this will result in the PowerCommand® 2.2 control putting the generator set into the Off mode.

The green lamp above this button is lit when the generator set is in Manual mode.



*Note: If Mode Change access code feature is enabled, the password must be entered before pressing the Start button.*

### 4.1.2.3 Start Button



When the Manual button has been pressed, this Start button must be pressed within ten seconds to start the generator set. The generator set will start up normally but without the Time Delay to Start.

In other modes, this button has no effect.



**Note:** *If the Start button is not pressed within the ten seconds of pressing the Manual button, the generator set will change to the Off mode automatically.*

### 4.1.2.4 Auto Button



Press this button to put the generator set into the Auto mode. In this mode the generator is controlled by a remote switch or device (e.g. transfer switch).

The green lamp above this button is lit when the generator set is in Auto mode.

### 4.1.2.5 Battle Short Mode

Battle Short Mode is not a distinct mode of operation. The PowerCommand®2.2 is still in the Off, Manual or Auto mode while Battle Short mode is active. The PowerCommand®2.2 still follows the appropriate sequence of operation to start and stop the generator set. Battle Short mode is a generator set mode of operation that prevents the generator set from being shutdown by all but a few, select, critical shutdown faults.

The purpose of Battle Short Mode is to satisfy local code requirements, where necessary. To use this feature, the necessary software must be installed at the factory when the PowerCommand®2.2 is purchased. A qualified service personnel is required to enable this feature. When shipped from the factory, this feature is disabled.



**Note:** *The Battle Short feature must be enabled or disabled using the PC Service tool.*



**WARNING: USE OF THE BATTLE SHORT MODE FEATURE CAN CAUSE A FIRE OR ELECTRICAL HAZARD, RESULTING IN SEVERE PERSONAL INJURY OR DEATH AND/OR PROPERTY AND EQUIPMENT DAMAGE. OPERATION OF THE SET MUST BE SUPERVISED DURING BATTLE SHORT OPERATION.**

This feature must only be used during supervised, temporary operation of the generator set. The faults that are overridden when in Battle Short mode can affect generator set performance, or cause permanent engine, alternator or connected equipment damage.



**Caution:** *If this mode of operation is selected, the protection of load devices will be disabled. Cummins Power Generation Limited will not be responsible for any claim resulting from the use of this mode.*



**Caution:** *All shutdown faults, including those overridden by Battle Short, must be acted upon immediately to ensure the safety and well being of the operator and the generator set.*

Battle Short is turned on or off with an external switch connected to one of the two customer configured inputs or a soft switch on the display module.

When enabled, Battle Short switch input can be set using a Setup menu. To turn Battle Short mode on using the soft switch in the display module, Battle Short must be set to Operator Panel and enabled using the PC Service Tool. (Default is Inactive).

When Battle Short mode is enabled, the Warning status indicator lights, and code 1131 – Battle Short Active – is displayed.

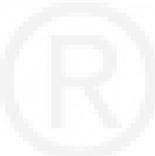
The PC2.2 generates warning fault 2942 – Shutdown Override Fail – if the Battle Short Switch is active but any of the other conditions are not met.

When Battle Short mode is enabled and an overridden shutdown fault occurs, the shutdown lamp remains lit even though the set continues to run. Fault code 1416 – Fail to Shutdown – is displayed. If the fault is acknowledge, the fault message is cleared from the display but remains in the Fault History file as long as Battle Short mode is enabled.

Battle Short is suspended and a shutdown occurs immediately if any of the following critical shutdown faults occur:

Table 1 Critical Shutdown Faults

EVENT/FAULT CODE	DESCRIPTION
115	Eng Crank Sensor Error
234	Crankshaft Speed High
236	Both Engine Speed Signals Lost
359	Fail To Start
781	CAN data link failure
1245	Engine Shutdown Fault
1336	Cooldown Complete
1433	Local Emergency Stop
1434	Remote Emergency Stop
1438	Fail to Crank
1992	Crankshaft Sensor High
2335	AC Voltage Sensing Lost (Excitation Fault)
2914	Genset AC Meter Failed



## 4.2 Display Module - Front Panel

Figure 9 shows the features of the front panel. It includes eight lamp indicators; the graphical display with nine buttons used to navigate through the menus; and six control mode buttons. This display panel enables the Operator to look at the status, adjust the settings, and start and stop the generator set.

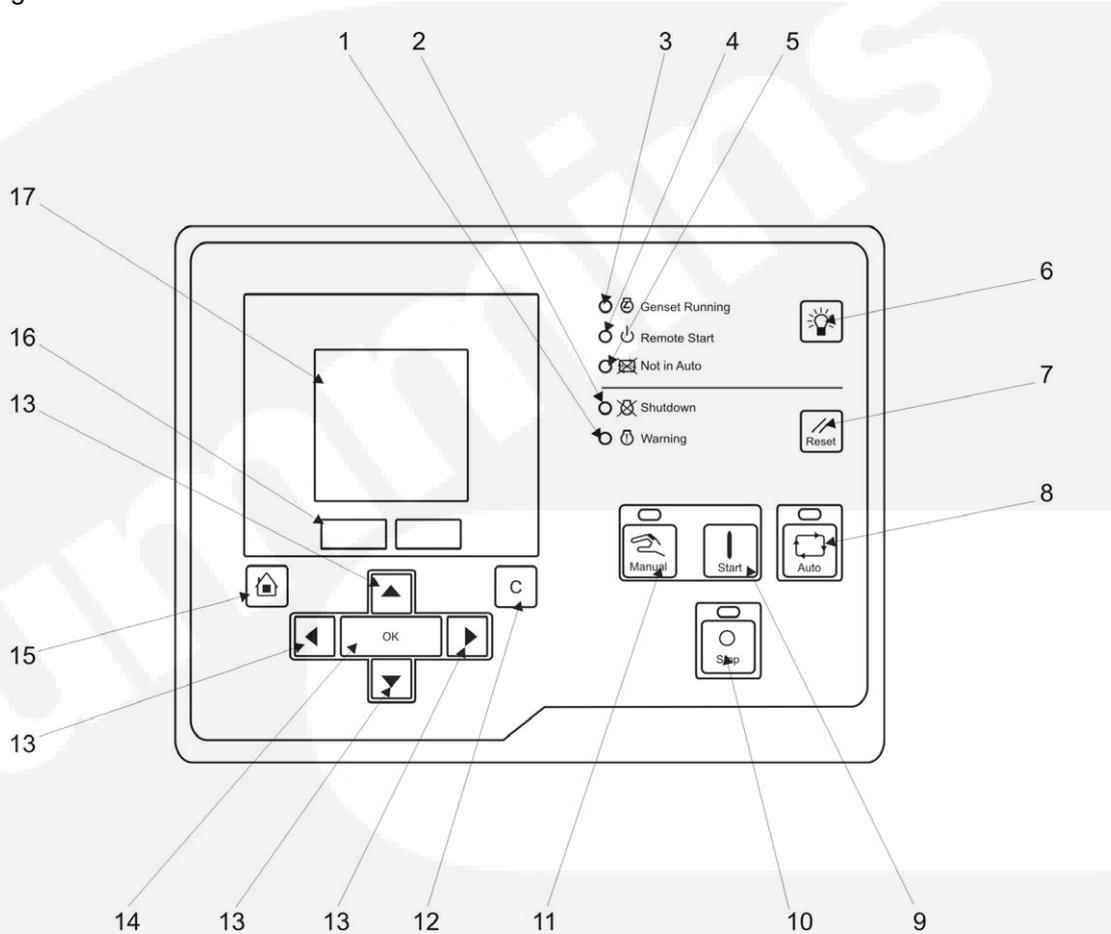


Figure 9 Display Module – Front Panel

### KEY

- |                                    |  |
|------------------------------------|--|
| 1. Indicator Lamp – Warning        | 10. Stop Button  |
| 2. Indicator Lamp – Shutdown       | 11. Manual Button  |
| 3. Indicator Lamp – Genset Running | 12. Previous Menu Button   |
| 4. Indicator Lamp – Remote Start   | 13. Four Change Selection Buttons (Up, Down, Left, Right)          |
| 5. Indicator Lamp –Not in Auto     | 14. Item Select Button   |
| 6. Lamp Test Button                | 15. Home Button  |
| 7. Reset Button                    | 16. Two Selection Buttons (page up or down) (for use with Item 17) |
| 8. Auto Mode Button                | 17. Graphical Display  |
| 9. Start Button                    |  |

## 4.2.1 Lamp Indicators

[Figure 9](#) shows the front panel of the Display Module with the five lamp indicators:

### Warning

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.

### Shutdown Status

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

### Not in Auto

This red lamp will flash when the control is NOT in Auto.

### Remote Start

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

### Genset Running

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

## 4.2.2 Lamp (LED) Test Button



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

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

## 4.2.3 Reset Button



Press this to reset any active faults.

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

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

## 4.2.4 Graphical Display and Buttons

Figure 10 shows the graphical display and the relevant menu selection buttons.

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

Two momentary soft-key buttons (item 5) are used to change pages within each screen. These selection buttons are “active” when the up and down triangles (▲ and ▼ in Section 4) are displayed in the graphical display. Some sub-menus do not include any active buttons.

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

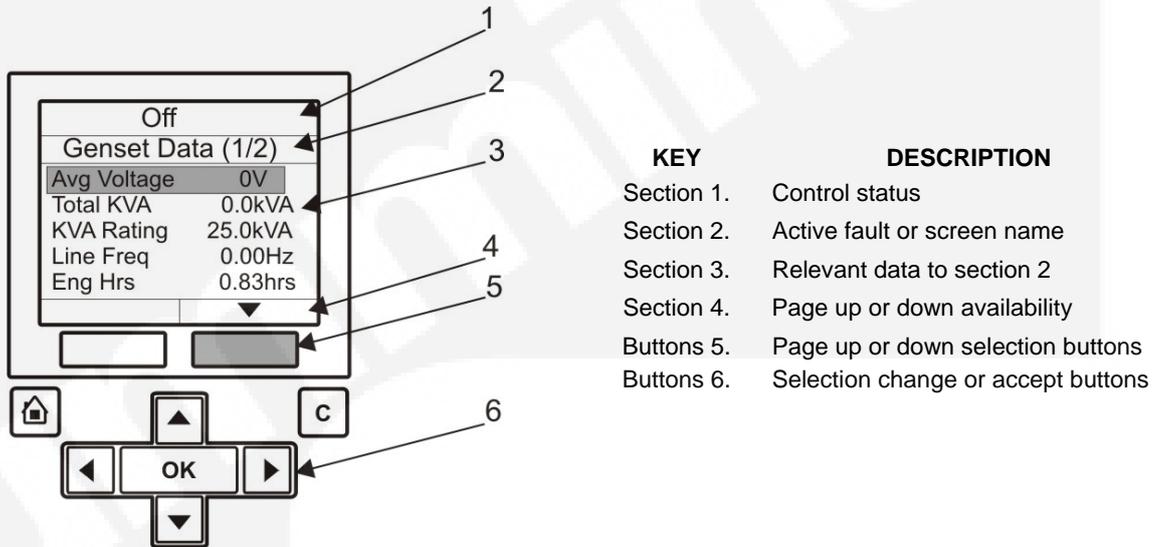


Figure 10 Graphical Display with Typical Screenshot

### Section 1 Control Status

Section one displays the status of the controller.

STATUS	DESCRIPTION
Ready	This is the default state. The controller is ready to start the generator set, or it has started one of the start sequences but has not started the engine yet.
Starting	The controller is starting the engine in one of the start sequences. The generator set has not reached idle speed (if applicable) or rated speed and voltage, and the controller is not raising the engine speed to idle or rated speed.
Idle Warmup	The controller is raising the engine speed to idle speed, or the engine is running at idle speed in one of the start sequences.
Rated Freq and Voltage	The controller is raising the engine speed to rated speed; the generator set is running at rated speed and voltage; or the controller has started one of the stop sequences but has not started reducing the engine speed yet.
Idle Cooldown	The controller is reducing the engine speed to idle speed, or the engine is running at idle speed in one of the stop sequences.
Stopping	The controller is stopping the engine.
Emergency Stop	There is an active shutdown fault.
Setup Mode	The controller is in Setup mode.
Wait to Powerdown	The controller is ready to enter Powerdown mode, but another device is sending a System Wakeup signal.
Demo Mode	The controller is running a demonstration. Every screen is available in the demonstration, and any changes you make in the demonstration have no effect on the controller. To end the demonstration, the Operator Panel must be turned off.

## Section 2 Active Fault or Screen Name

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

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

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

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

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

FAULT TYPE	DESCRIPTION
Warning	This is a warning fault. (See Section 7 – <a href="#">Troubleshooting</a> )
Derate	This is a derate fault. (See Section 7 – <a href="#">Troubleshooting</a> )
Shutdown	This is a shutdown fault that initiates a Shutdown Without Cooldown sequence. (See Section 7 – <a href="#">Troubleshooting</a> )

## Section 3 Interactive Screen or Menu

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

The default screen is the Genset Data screen.

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

OPERATOR PANEL	DESCRIPTION
NWF	There is a PCCNet network failure or a CAN (ECM) failure.
OORL	The value is less than the lowest allowed value for this parameter.
OORH	This value is greater than the highest allowed value for this parameter.
-- -- --	This value is not applicable.

## Section 4 Additional Functions Indicators

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

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

### 4.2.4.1 Menu Navigation Buttons

#### Home Button

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

#### Previous Menu Button

Press this button to return to the previous menu.



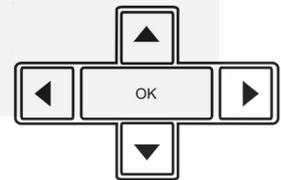
*Note:* If you have not pressed the **OK** button before pressing the  button, any changes made will not be saved.

### 4.2.5 Selection Buttons

Four momentary (soft-key) buttons are used to change the selection in the graphical display.

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

- If the selected item is a menu item, this opens the sub-menu or screen.
- If the selected item is a parameter, this lets you adjust the parameter (if possible) or prompts you for a password.
- If the selected item is a value you have just adjusted, this saves the change.
- If the selected item is an action, the graphical display runs the action or prompts you for a password.



### 4.2.6 Default Settings

The control panel can display SAE or Metric units of measurement and should be set during the initial setup of the generator set. Qualified service personnel are required to change the default settings. Contact your authorised distributor.

## 4.3 Fault Messages

A Fault message is an indicator of a Warning or Shutdown condition. It includes the fault type (Warning or Shutdown), fault number, and a short description. It also includes where the fault occurred if the generator set control did not detect the fault and is simply reporting the fault. [Table 3](#) (Section 7.6) provides a list of the fault codes, types, messages displayed, and descriptions of the faults.

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



### 4.3.1 Fault Acknowledgement

Shutdown faults must be acknowledged after the fault has been corrected. If in Auto or Manual mode, the control must be set to Stop mode (Off). Faults are cleared from the control panel display by pressing the Reset button.

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

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

## 4.4 Display Module – Initial Operator Menu

Figure 11 shows the initial menu which is displayed over three pages. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.



Pressing the Home button from any screen will return the display to the main menu screens.

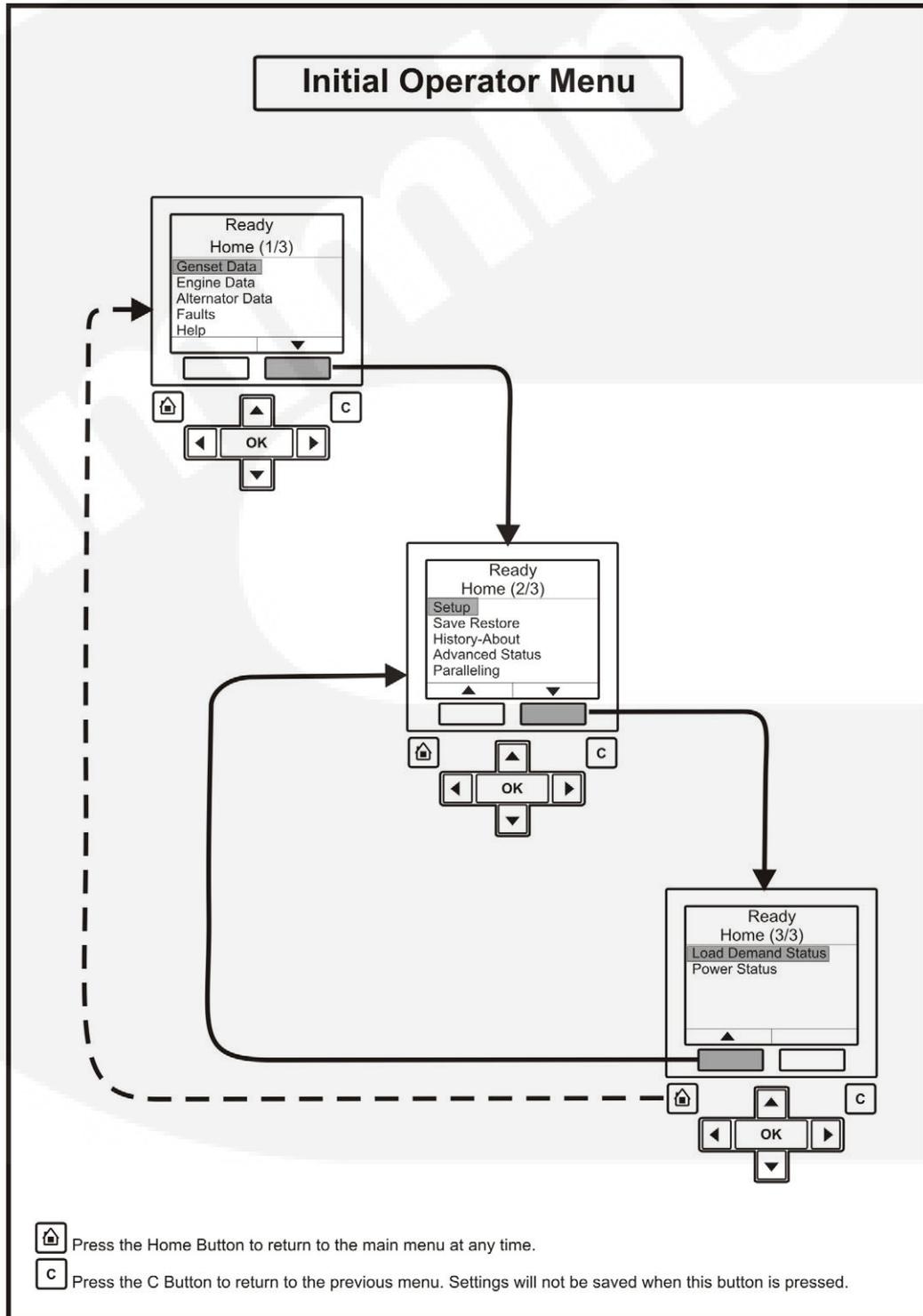
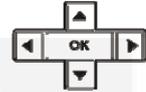


Figure 11 Initial Operator Menu

## 4.5 Display Module – Genset Data Operator Menu

The Genset Data menu is displayed on five pages. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.

[Figure 12](#) shows a block representation of a typical Genset Data menu. To navigate from the Home menu, ensure that the Genset Data line of text is highlighted, and press the OK button.



### 4.5.1 Generator Data

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

NAME	DESCRIPTION
Avg Voltage	Genset Line-to-Line average voltage.
Avg Current	Genset average current.
Total kW	Genset total kW.
Total PF	Genset power factor.
Frequency	Genset frequency.
Coolant Temp	Monitor point for the Coolant Temperature.
Engine Hrs	Total engine run time.
Oil Pressure	Monitor point for the Oil Pressure. Allowed values: 0~145 psi.
Batt Voltage	Battery voltage value.
% Torq/Duty	Monitor point for the percent engine torque output and the governor percent duty cycle output when used with the HM ECM. Allowed values: -125~125%.
Fuel Rate	Monitor point for Fuel Rate. Allowed values: 0~845 gal/hr.
Fuel Cons.	Fuel consumption since last reset.
Total Fuel C.	Total fuel consumption since start of engine.
<b>Genset Application Rating</b>	
kW rating	The genset kW rating.
kVA Rating	The genset kVA Rating.
Rated Current	The value of the genset application nominal current.
<b>Genset Standby Rating</b>	
kW rating	kW rating for the genset in Standby configuration.
kVA Rating	kVA rating for the genset in Standby configuration.
Rated Current	The value of the genset Standby nominal current.

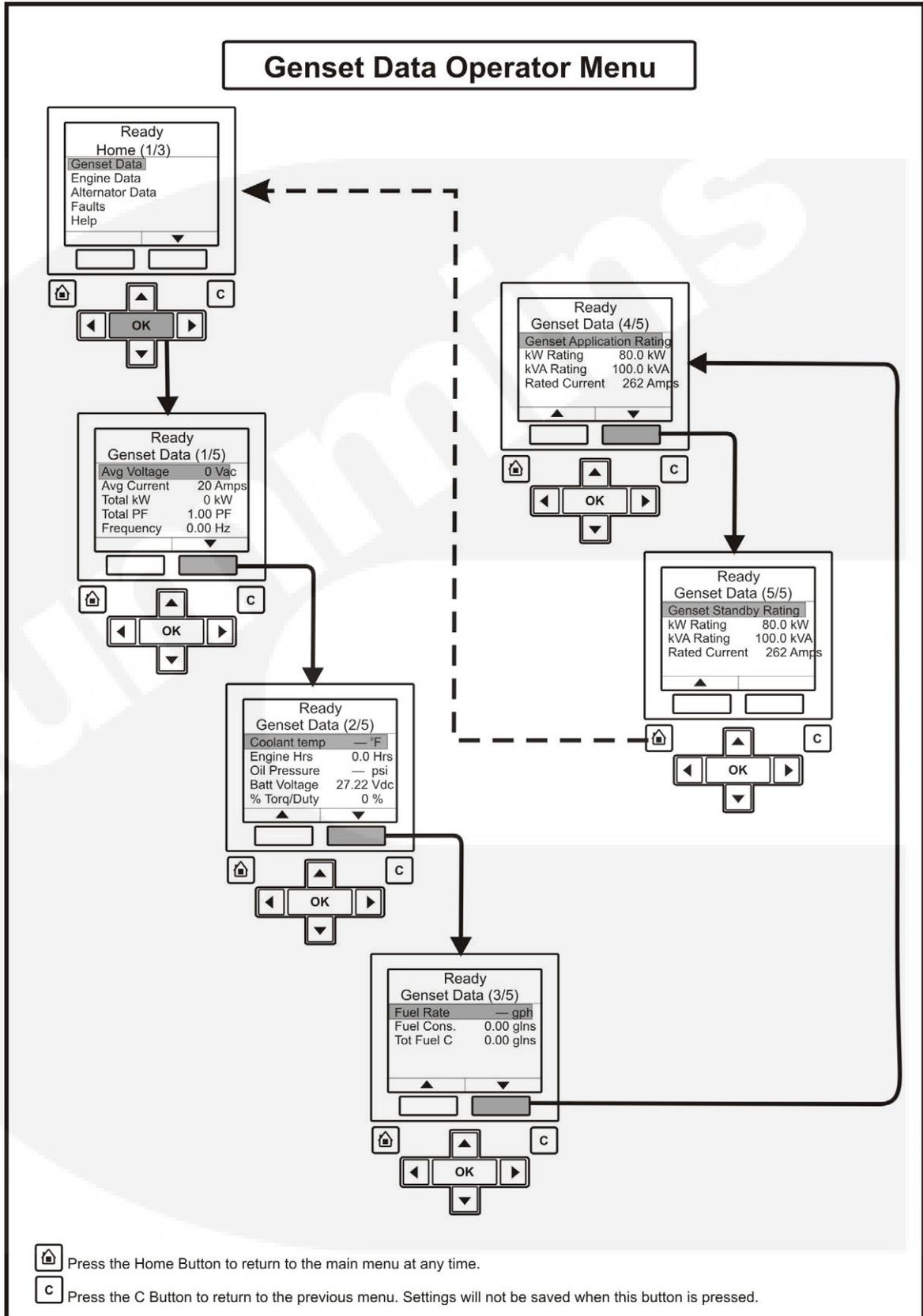


Figure 12 Genset Data Menu – Typical Data

## 4.6 Display Module – Engine Data Operator Menu

The Engine Data menu is displayed on three pages. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.

[Figure 13](#) shows a block representation of a typical Engine Data menu. To navigate from the Home menu, toggle down until the Engine Data line of text is highlighted, and press the OK button.



### 4.6.1 Engine Data

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

NAME	DESCRIPTION
Engine Hours	Total engine run time.
Coolant Temp	Monitor point for the Coolant Temperature.
Engine Speed	Monitor point for the Average Engine Speed.
Batt Voltage	Battery voltage value.
Oil pressure	Monitor point for the Oil Pressure. Allowed values: 0~145 psi
Oil Temp	Monitor point for the Oil Temperature. Allowed values: -40~410°F
Manf Temp	Monitor point for the Intake Manifold Temperature Allowed values: -40~410°F
Boost Pres	Monitor point for the Boost Absolute Pressure. Allowed values: 0~148 psi.
Rail Press Abs	Monitor point for the Fuel Outlet Pressure. Allowed values: 0~36404 psi.
Fuel Inlet Temp	Monitor point for the Fuel Temperature. Allowed values: -40~410°F
Coolant Press	Monitor point for the Coolant Pressure. Allowed values: 0~145 psi.
Pump Press Abs	Monitor point for the Fuel Supply Pressure. Allowed values: 0~145 psi.
Crank Press	Monitor point for the Crankcase Pressure. Allowed values: -35.67~38 psi.
Aftercooler Temp	Monitor point for the Aftercooler Temperature. Allowed values: -40~410°F
Ambient Press	Monitor point for the Barometric Absolute Pressure. Allowed values: 0~37 psi.

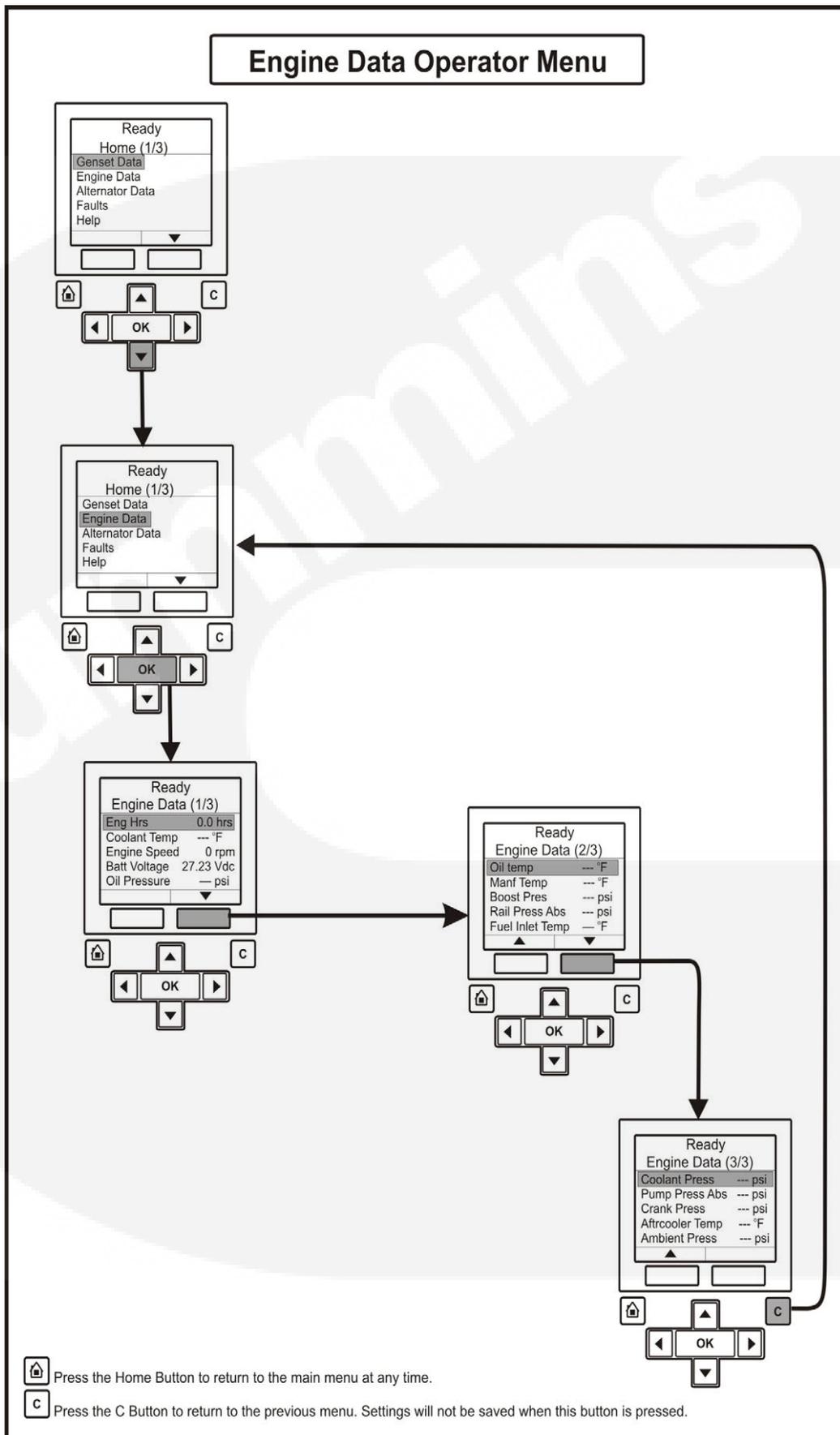
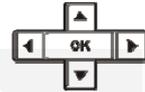


Figure 13 Engine Data Menu – Typical Data

## 4.7 Display Module – Alternator Data Operator Menu

The Alternator Data menu is displayed on three pages. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.

[Figure 14](#) shows a block representation of a typical Alternator Data menu. To navigate from the Home menu, toggle down until the Alternator Data line of text is highlighted, and press the OK button.



### 4.7.1 Alternator Data

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

NAME	DESCRIPTION
L1 L2 L3	Alternator terminals.
LL(Vac)	Genset L1L2 voltage. Genset L2L3 voltage. Genset L3L1 voltage.
LN(Vac)	Genset L1N voltage. Genset L2N voltage. Genset L3N voltage.
Amps	Monitors the genset L1 current value. Genset L2 current value. Genset L3 current value.
kW	Genset L1 kW. Genset L2 kW. Genset L3 kW.
kVA	Genset L1 kVA. Genset L2 kVA. Genset L3 kVA.
PF	Genset L1 power factor. Genset L2 power factor. Genset L3 power factor.
Total kW	Genset total kW.
Total kVA	Genset total kVA.
Total PF	Genset power factor.
Frequency	Genset frequency.
AVR Duty Cycle	The AVR PWM software command. Linear relationship between counts and % duty cycle with 10000 counts = 100% duty cycle.

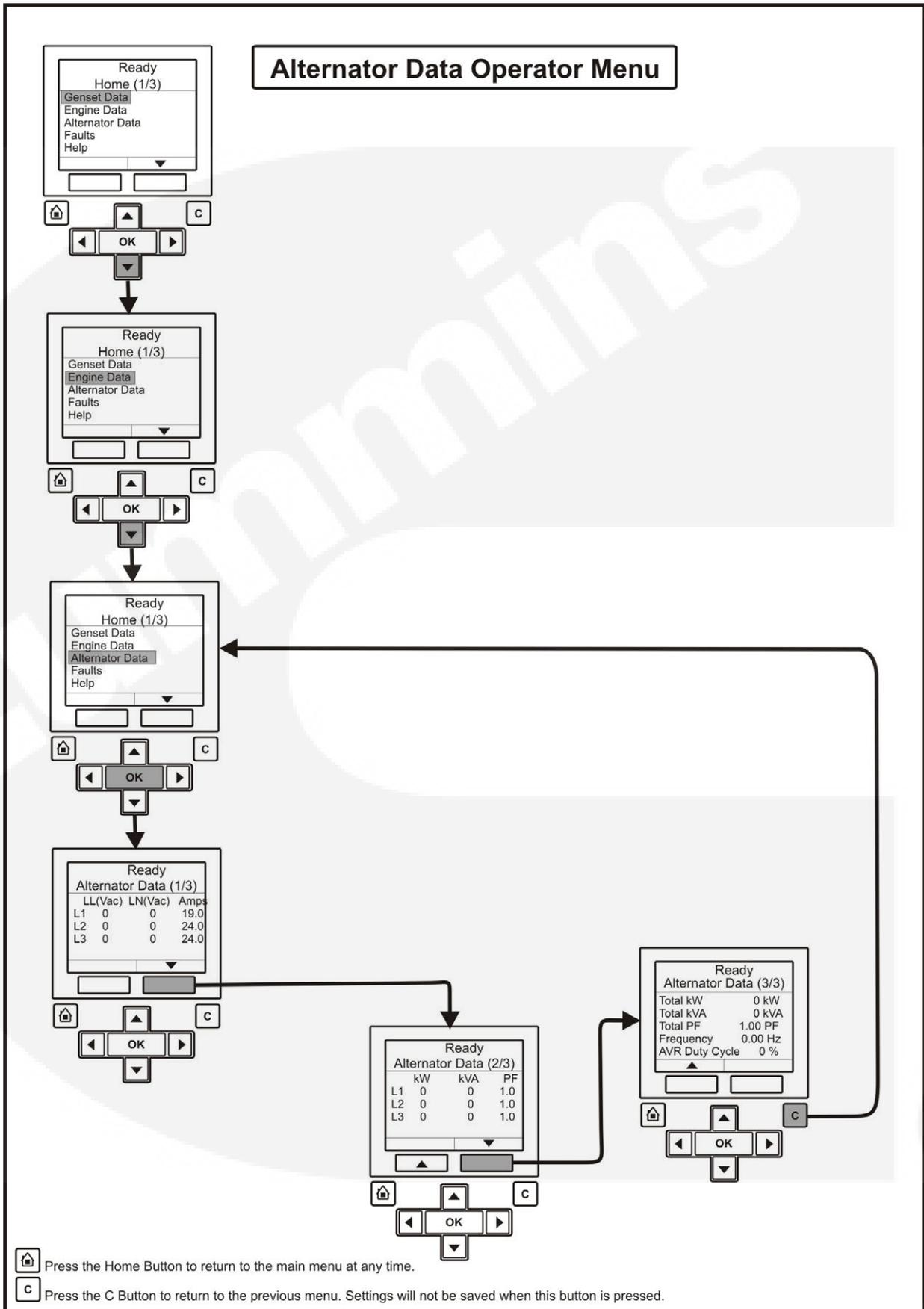


Figure 14 Alternator Data Menu – Typical Data

## 4.8 Display Module –Faults and Warnings Menus

The Faults and Warning menu is divided into three main sub-sections; Shutdown Faults (Active Shutdowns); Warning Faults (Active Warnings); and Faults History (showing up to thirty-two faults that have been cleared).

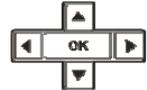
### 4.8.1 Shutdown Fault Menu

This screen displays up to five faults. The same event/fault code may appear multiple times if detected by different sources.

NAME	DESCRIPTION
Fit #	This is the Fault code.
SA	This is the controller that identified the fault. It is blank if the PC2.2 identified the fault.
Gen Response	This is the type of fault (Shutdown or Warning) that was generated.
Engine Hours	This is how many hours the engine had run (not necessarily continuously) when the fault was generated.
mm/dd/yy	This is the date the fault was generated.
Hh/mm/ss	This is the time the fault was generated.

[Figure 15](#) shows a block representation of a typical Shutdown Fault menu.

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



With the Shutdown Fault line of text highlighted press the OK button. This will display information regarding the Shutdown fault(s). Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.

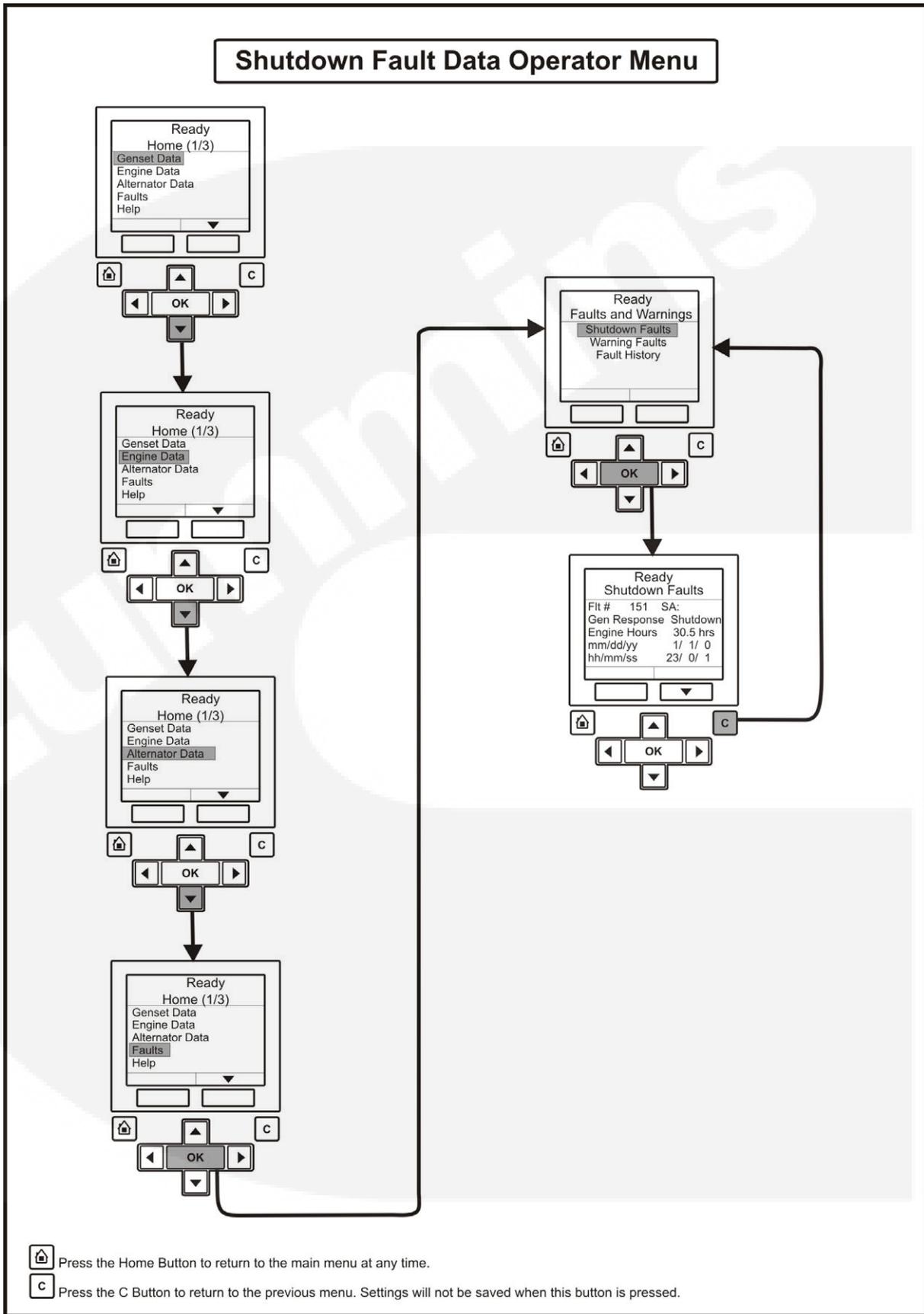


Figure 15 Shutdown Faults menu – Typical Data

## 4.8.2 Warning Fault Menu

This menu displays up to thirty-two faults. The same event/fault code may appear multiple times if detected by different sources.

NAME	DESCRIPTION
Fit #	This is the Fault code.
SA	This is the controller that identified the fault. It is blank if the PC2.2 identified the fault.
Gen Response	This is the type of fault (Shutdown or Warning) that was generated.
Engine Hours	This is how many hours the engine had run (not necessarily continuously) when the fault was generated.
mm/dd/yy	This is the date the fault was generated.
Hh/mm/ss	This is the time the fault was generated.

[Figure 16](#) shows a block representation of a typical Warning Fault menu.

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



Toggle down again until the Warning Faults text is highlighted.

With the Warning Fault line of text highlighted press the OK button. This will then display information regarding the current fault. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.



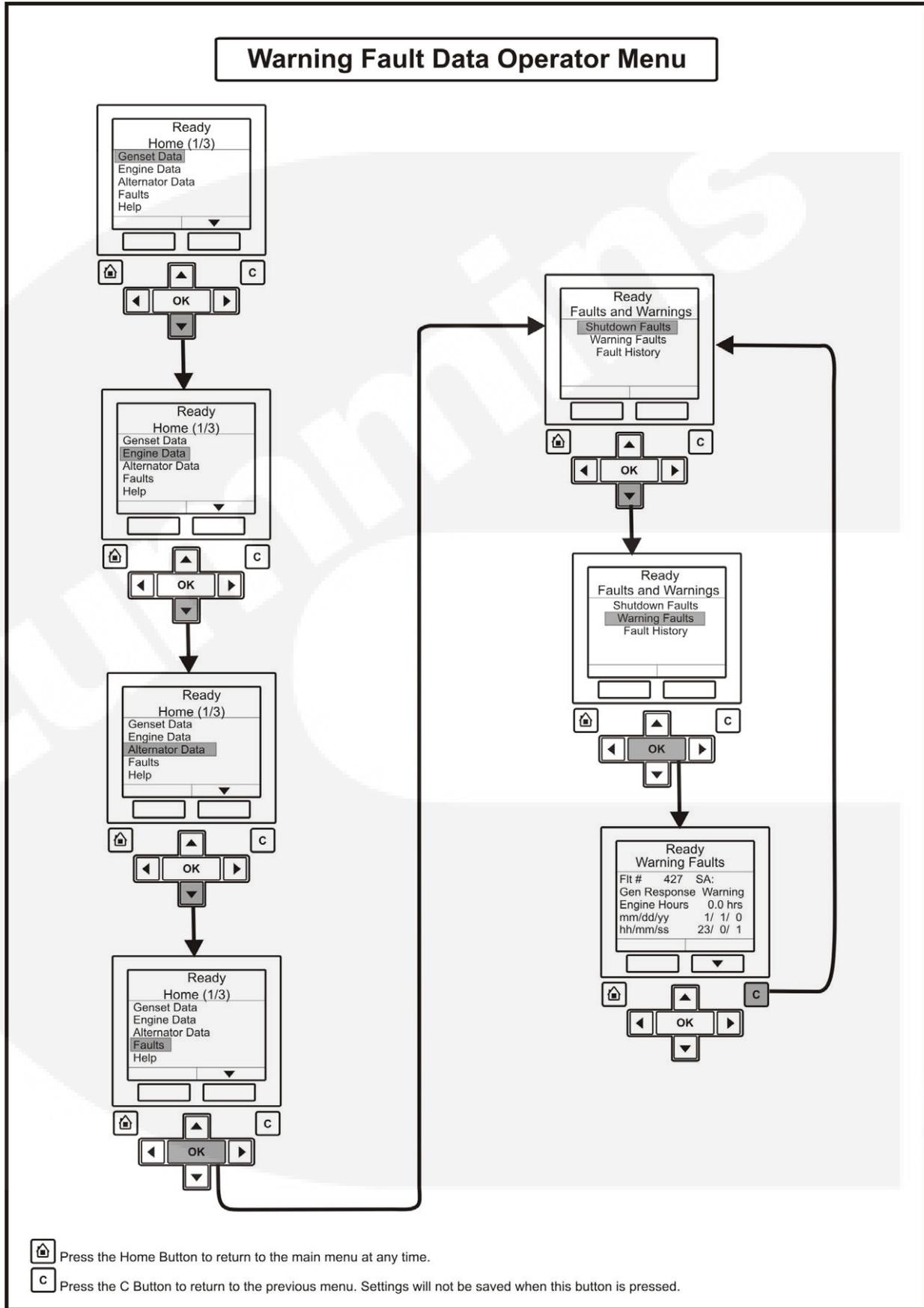


Figure 16 Warning Fault Menu – Typical Data

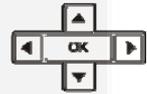
### 4.8.3 Faults History Data Operator Menu

This menu displays up to thirty-two faults. The same event/fault code may appear multiple times if detected by different sources.

NAME	DESCRIPTION
Fit #	This is the Fault code.
SA	This is the controller that identified the fault. It is blank if the PC2.2 identified the fault.
Engine Hours	This is how many hours the engine had run (not necessarily continuously) when the fault was generated.
mm/dd/yy	This is the date the fault was generated.
Hh/mm/ss	This is the time the fault was generated.

[Figure 17](#) shows a block representation of a typical Fault History menu.

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



Toggle down again until the Fault History text is highlighted.

With the Fault History line of text highlighted press the OK button. This will then display information regarding the fault(s) history. Use the two soft-key buttons below the up and down arrows (▲ and ▼) to toggle between the pages.



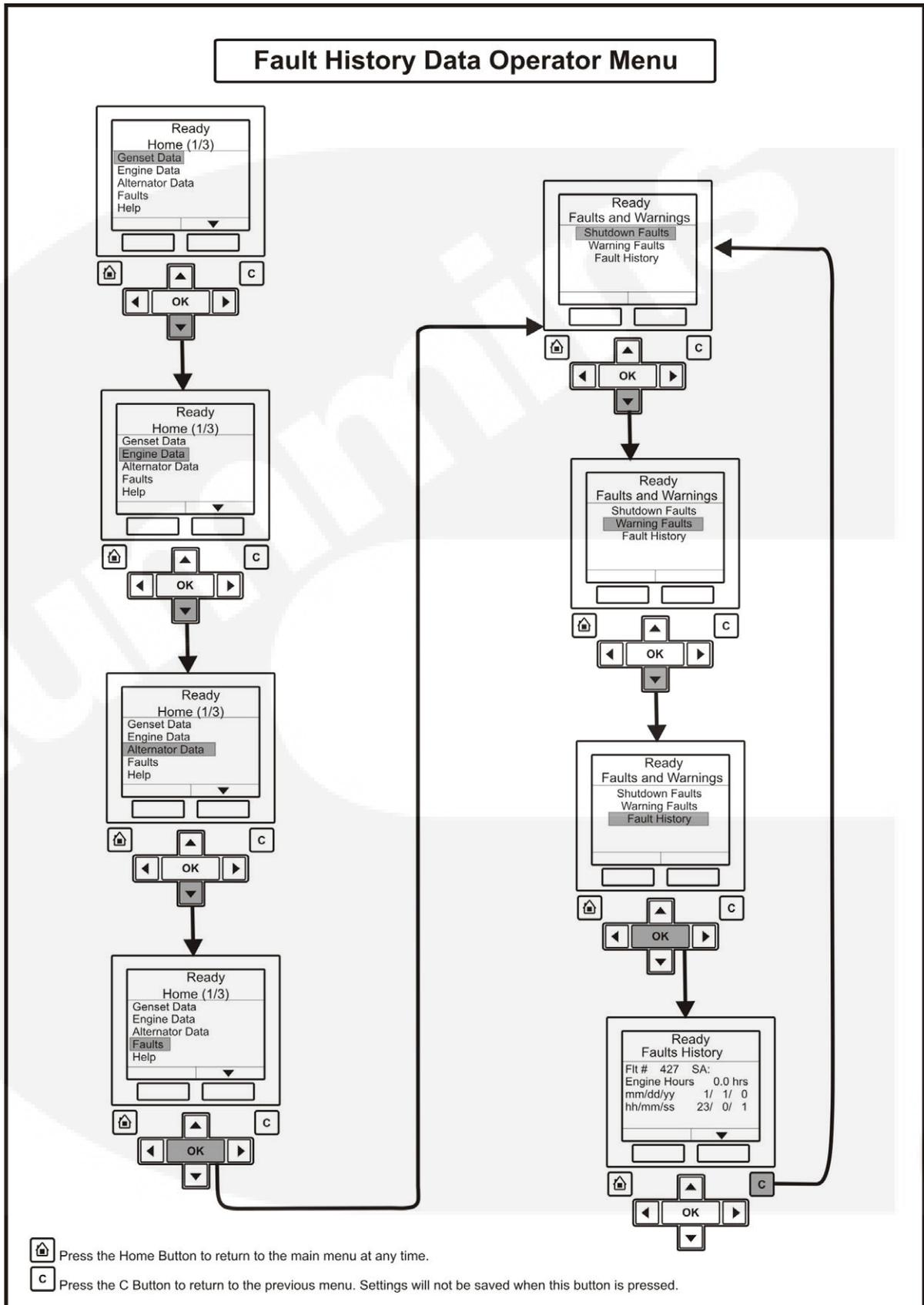


Figure 17 History Fault Menu – Typical Data

## 4.9 Display Module – Genset Setup Data Operator Menu

[Figures 18, 19](#) and [20](#) show block representations of the Genset Setup Data menu.

Page down to the second page of the Home menu (using the two soft-key buttons below the up and down arrows [▲ and ▼]). See [Section 4.4](#).

With the Setup line of text highlighted, press the OK button. This will display the Setup Menu (1/2).



Page down to the second page of the Setup menu (using the two soft-key buttons below the up and down arrows [▲ and ▼]).

Toggle down again until the Genset Setup text is highlighted.

With the Genset Setup line of text highlighted, press the OK button. This will display the Setup/Genset Data Menu (1/19).



Use the two soft-key buttons below the up and down arrows [▲ and ▼] to page through the nineteen pages of the generator setup data.

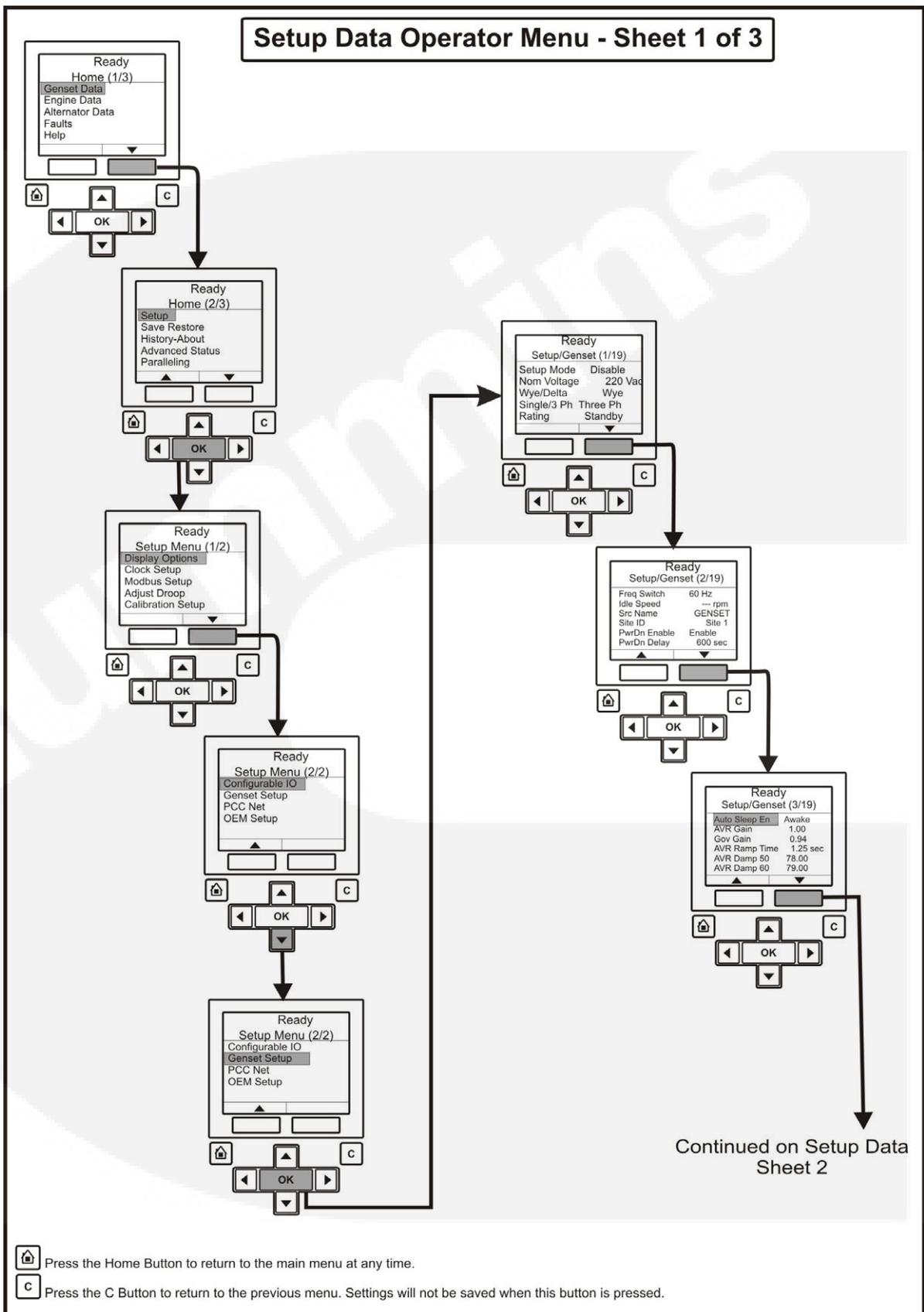


Figure 18 Setup Data Menu Sheet 1 of 3 – Typical Data

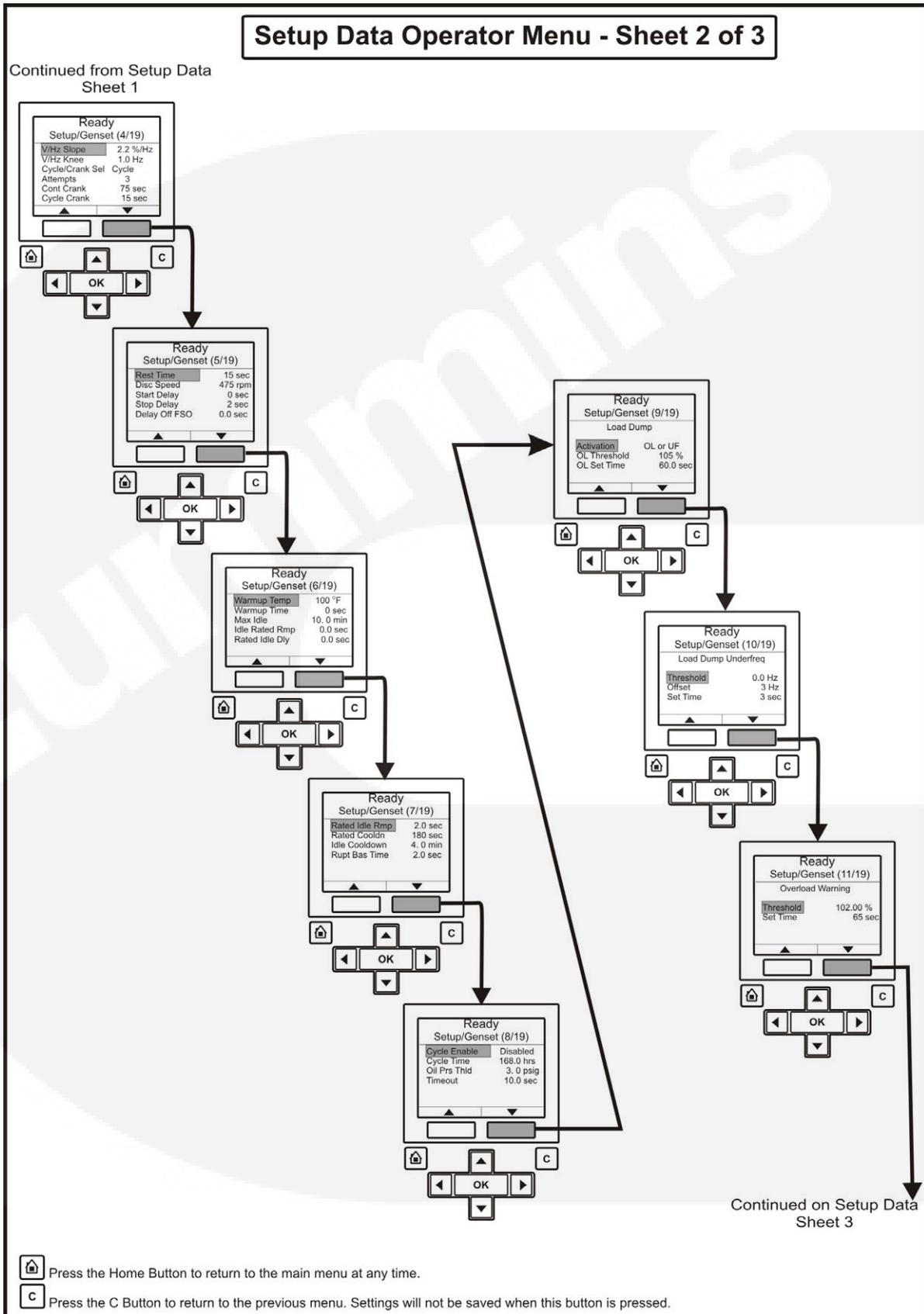


Figure 19 Setup Data Menu Sheet 2 of 3 – Typical Data

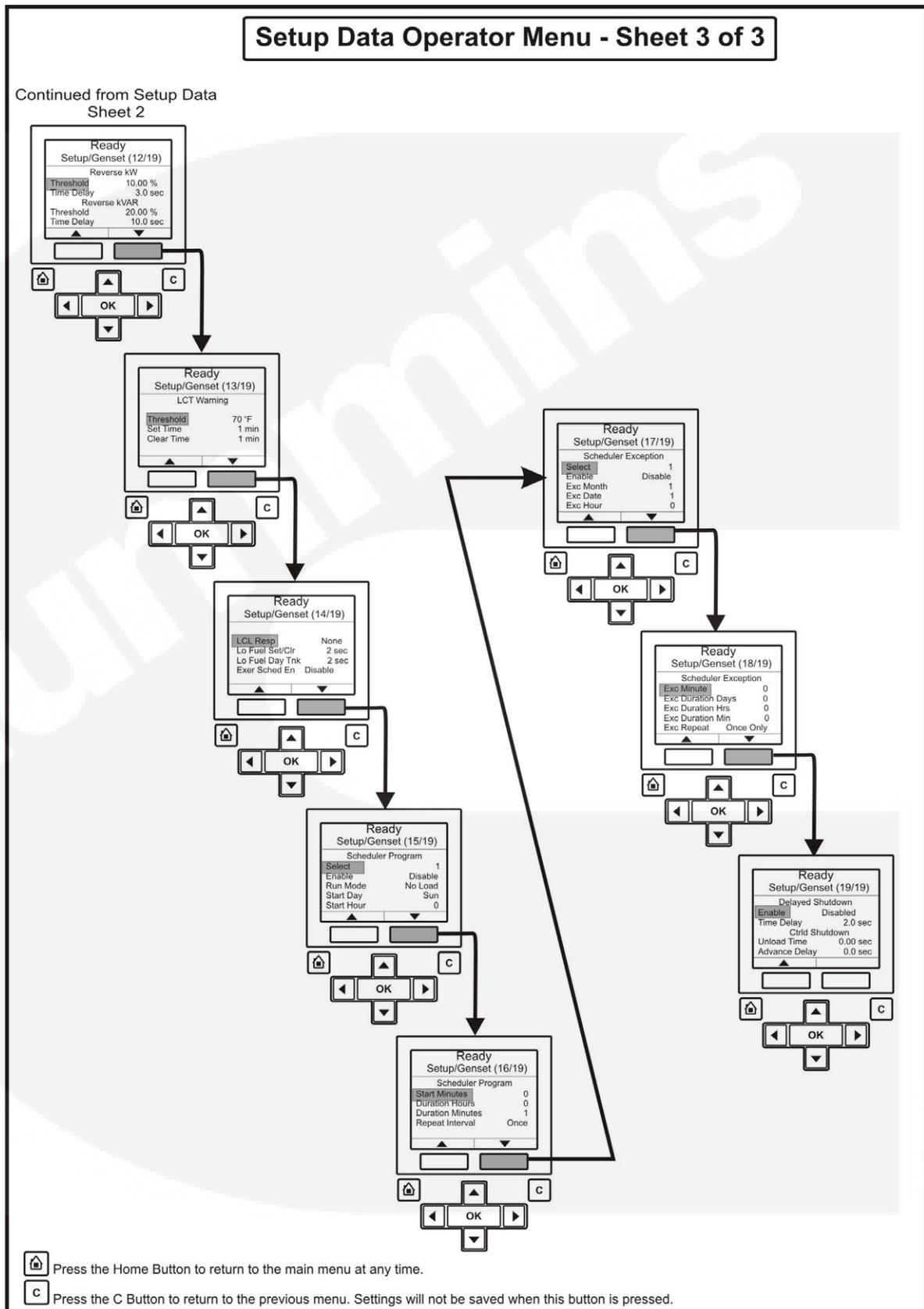


Figure 20 Data Menu Sheet 3 of 3 – Typical Data

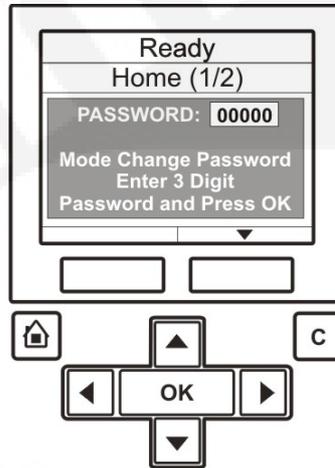
## 4.10 Selecting Operating Modes

### 4.10.1 Entering the Mode Change Access Code

The Mode Change submenus are intended for qualified service personnel and site personnel only, and by default will require an Access password. If a password is required the Mode Change – Access Code menu will appear when you try to switch between Auto, Manual Run, or Stop modes.

To enter the mode access code:

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



*Note: If an incorrect password is entered, the Operator menu that was displayed before Auto, Manual Run, or Stop mode was selected is re-displayed.*

#### 4.10.1.1 Passwords

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

LEVEL	DESCRIPTION	COMMENT
0	No password	None required
1	Operator password	Restricted
2	Service password	Restricted
3	Engineering password	Restricted

## 4.10.2 Selecting Manual Run Mode



**WARNING:** WHEN CHANGING MODES, THE GENERATOR SET MAY START OR STOP WITHOUT WARNING. ENSURE THERE IS NO DANGER TO PERSONNEL OR EQUIPMENT SHOULD THE GENERATOR SET START OR STOP WHEN CHANGING MODES.



**Caution:** Ensure that it is safe to do so before proceeding to change the mode.



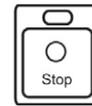
Press the Manual button and then the Start button (within ten seconds). This will bypass the Time Delay to Start; activate the engine control system and the starting system.

If the engine does not start, the starter will disengage after a specified period of time, and the control will indicate a Fail to Start shutdown.

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



**Note:** The InPower service tool or access to the Setup menu is required to change the cycle number, and the crank and rest times. Contact an authorised service centre for assistance.



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



Before attempting to restart, wait two minutes for the starter motor to cool and then repeat the starting procedure. If the engine does not run after a second attempt, refer to the Troubleshooting section.

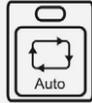
### 4.10.3 Selecting Auto Mode



**WARNING:** WHEN CHANGING MODES, THE GENERATOR SET MAY START OR STOP WITHOUT WARNING. ENSURE THERE IS NO DANGER TO PERSONNEL OR EQUIPMENT SHOULD THE GENERATOR SET START OR STOP WHEN CHANGING MODES.



**Caution:** Ensure that it is safe to do so before proceeding to change the mode.



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

In response to the Remote Start, the control lights the Remote Start indicator and initiates the starting sequence as shown in [Figure 21](#). This start will incorporate the Time Delay to Start function.



**Note:** The InPower service tool or access to the Setup menu is required to change the cycle number, and the crank and rest times. Contact an authorised service centre for assistance.



**WARNING:** SHOULD A REMOTE START SIGNAL BE RECEIVED, THE GENERATOR SET WILL START AUTOMATICALLY. ENSURE THERE IS NO DANGER TO PERSONNEL OR EQUIPMENT SHOULD THE GENERATOR SET START WITHOUT WARNING.

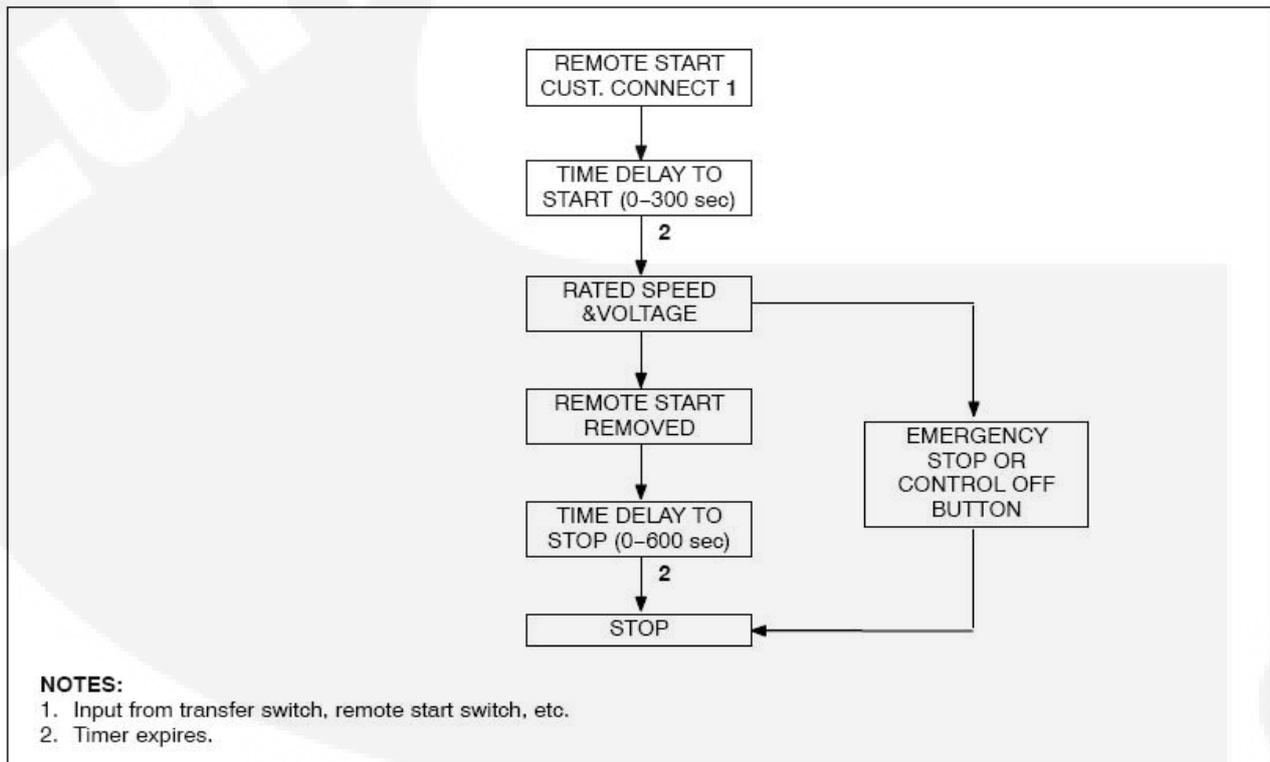


Figure 21 Starting in Auto Mode

#### 4.10.4 Selecting Off Mode



**WARNING:** WHEN CHANGING MODES, THE GENERATOR SET MAY STOP WITHOUT WARNING. ENSURE THERE IS NO DANGER TO PERSONNEL OR EQUIPMENT SHOULD THE GENERATOR SET STOP WHEN CHANGING MODES.



**Caution:** *Ensure that there is no danger to personnel or equipment if the generator set is stopped.*



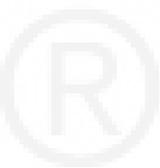
Press the Stop button to put the generator set into the Off mode. This will disable Auto and Manual modes.

If the generator set is running, in either Manual or Auto mode, and the Stop button is pressed, the engine will shut down. This action may include a Cooldown run. Refer to [Section 5.7](#).



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

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## SECTION 5 – SYSTEM OPERATION

### 5. Operation

#### 5.1 Safety

Personnel must be suitably qualified and experienced before operating a generator set. Before operating the system, the operator must become familiar with [Section 1](#) of this manual – Preliminary and Safety Instructions, together with the Health and Safety Manual (0908-0110). Observe all of the WARNINGS and CAUTIONS at all times.



**WARNING: BEFORE OPERATING THE PLANT BECOME FAMILIAR WITH THE EQUIPMENT AND HOW IT IS OPERATED (INCLUDING ALL CONTROLS, MANUALLY OPERATED VALVES AND ALARM DEVICES). SAFE AND EFFICIENT OPERATION CAN ONLY BE ACHIEVED IF THE PLANT IS OPERATED CORRECTLY.**



**WARNING: CONTACTING HIGH VOLTAGE COMPONENTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH BY ELECTROCUTION. DO NOT OPEN THE GENERATOR OUTPUT BOX WHILE THE GENERATOR SET IS RUNNING. READ AND OBSERVE ALL WARNINGS AND CAUTIONS IN YOUR GENERATOR SET MANUALS.**



*Caution: Personnel must be technically qualified before opening the control housing. Voltages are present which can cause electrical shock, resulting in personal injury. Even with the power removed, improper handling of components can cause electrostatic discharge and damage circuit board components.*

#### 5.2 Introduction

This section describes the operation of the generator set. The text must be read in conjunction with [Section 3](#) – the System Overview, and [Section 4](#) – the Control System sections of this manual, together with the Operator's specific engine manual supplied as part of the documentation pack. This latter manual will contain further information regarding the running and care of the generator set and also specific equipment instructions that may differ from the standard generator set.

All indicators, control switches/buttons, and graphical display are located on the face of the Control Panel as illustrated in [Figure 9](#).

#### 5.3 Maintenance

To ensure maximum performance and reliability from your generator set it is essential that certain components are inspected periodically and, where necessary, maintenance procedures carried out as detailed in [Section 6](#) – Maintenance.

## **5.4 Operating Recommendations**

### **5.4.1 Running –in**

Special 'running-in' oils are not recommended for new or rebuilt Cummins' engines. Use the same type of oil during 'running-in' as is used in normal operation.

### **5.4.2 No Load Operation**

Periods of off-load operation must be held to a minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a load of at least 30% rated load, but not to exceed rated load. Such a load could consist of heater element or load bank.

### **5.4.3 Exercise Period**

Generator sets on continuous standby must be able to go from a cold start to being fully operational in a matter of seconds. This can impose a severe burden on engine parts.

Regular exercising keeps engine parts lubricated, prevents oxidation of electrical contacts, and in general helps provide reliable engine starting.

Exercise the set for a minimum of ten minutes off-load at least once a week and for a minimum of 30 minutes with load at least once each month so the engine reaches normal operating temperatures.

### **5.4.4 Low Operating Temperatures**

Use a coolant heater if a separate source of power is available. The optional heater available from Cummins Power Generation Limited will help provide reliable starting under adverse weather conditions. Be sure the voltage of the separate power source is correct for the heater element rating.

### **5.4.5 High Operating Temperatures**

Refer to the generator set nameplate for the maximum operating temperature, if applicable.

## 5.4.6 Operating Conditions for Prime, Standby and Continuous Power Ratings



*Note: All generator sets supplied by Cummins Power Generation Limited must be run under the following operating conditions, and in accordance with the operating information contained within the manuals' documentation package supplied with each generator set.*

### 5.4.6.1 Continuous Power rating (COP) for constant load applications

The Continuous Power Rating is applicable to utility parallel and other non-variable load applications for supplying power continuously to a load of up to 100% of the continuous rating for an unlimited number of hours per year between the stated maintenance intervals and under stated ambient conditions. All maintenance must be carried out as prescribed in the generator set operating manuals. No sustained overload capability is available at this rating. This rating is applicable for utility base load operation. In these applications, generator sets are operated in parallel with a utility source and run under constant loads for extended periods of time.

### 5.4.6.2 Prime power rating

The prime power rating is the maximum power available during a variable load sequence which may be run for an unlimited number of hours per year, between the stated maintenance intervals and under the stated ambient conditions. All maintenance must be carried out as prescribed in the generator set operating manuals. Prime power applications fall into one of the following two categories:

- Unlimited time prime power (for variable load applications)

Prime power is available for an unlimited number of annual operating hours in variable load applications. The permissible average power output under variable load shall not exceed a 70% average of the prime power rating during any operation of 250 hours. The total operating time at 100% prime power shall not exceed 500 hours per year. A 10% overload capability is available for a period of 1 hour within a 12-hour period of operation, in accordance with ISO 3046-3:2006. Total operating time at the 10% overload power shall not exceed 25 hours per year.

- Limited running time prime power (for constant load applications)

Prime power is available for a limited number of hours in a non-variable load application. It is intended for use in situations where power outages are contracted, such as utility power curtailment. Generators may be operated in parallel with the public utility up to 750 hours per year at power levels never to exceed the prime power rating. No sustained overload capability is available at this rating. The customer should be aware, however, that the life of any generator will be reduced by constant high load operation. Any operation exceeding 750 hours per year at the prime power rating should use the Continuous Power Rating.

### 5.4.6.3 Standby power rating (for variable load applications)

The standby power rating is applicable for supplying emergency power for the duration of a utility power interruption, between the stated maintenance intervals and under the stated ambient conditions. All maintenance must be carried out as prescribed in the generator set operating manuals. No overload capability is available for this rating and utility parallel operation is not permitted at the standby power rating. For applications requiring sustained utility parallel operation the limited time prime power rating or continuous power rating must be utilised as applicable.

This rating is applicable to installations served by a reliable normal utility source. Generators should be sized for a maximum average load factor of 80% of the standby power rating with a maximum of 200 hours of operation per year, which includes less than 25 hours per year at the standby power rating. In installations served by unreliable utility sources (where outages last longer or occur more frequently), where operation is likely to exceed 200 hours per year, the prime power rating should be applied. The standby rating is only applicable for emergency and standby applications where the generator set serves as the back up to the normal utility source. Negotiated power outages are not considered as emergencies.

### 5.4.6.4 Notes applicable to all ratings

The following notes are applicable to all ratings, unless otherwise agreed by the Regional Sales Manager of Cummins Power Generation Limited in writing:

- When determining the actual average power output of a variable power sequence in any of the ratings above, powers of less than 30% of the emergency standby power shall be taken as 30% and time at standstill shall not be counted.
- Variable load is calculated in accordance with methods and formulae given in ISO 8528-1-2005.
- All three-phase generators are rated for 0.8 power factor lag. Single-phase generators are rated for 1.0 power factor.
- All ratings are based on the following reference conditions:
  - a) Ambient temperature — 27°C (80°F)
  - b) Altitude above sea level — 150 metres
  - c) Relative humidity — 60%
  - d) Output power may be subject to de-rate if the above conditions are exceeded
- If any of the above conditions are not satisfied, the operational life of the generating set may be reduced.
- Short term parallel operation with the utility for load transfer purposes only is permitted with all ratings.

### 5.4.7 De-Rating Factors

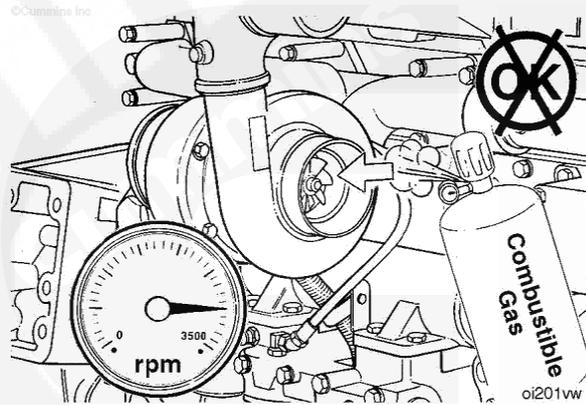
For de-rating factors applicable at specific sites please contact your authorised distributor.

## 5.5 Generator Set Operation

Correct care of your engine will result in longer life, better performance, and more economical operation.

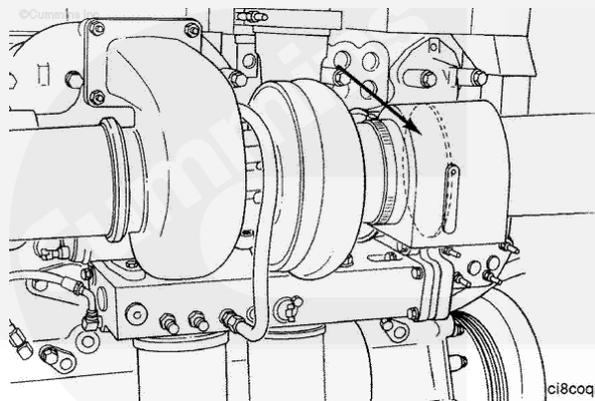


**WARNING:** DO NOT OPERATE A DIESEL ENGINE WHERE THERE ARE, OR CAN BE, COMBUSTIBLE VAPOURS. THESE VAPOURS CAN BE SUCKED THROUGH THE AIR INTAKE SYSTEM AND CAUSE ENGINE ACCELERATION AND OVERSPEEDING, WHICH CAN RESULT IN A FIRE, AN EXPLOSION, AND EXTENSIVE PROPERTY DAMAGE. NUMEROUS SAFETY DEVICES ARE AVAILABLE, SUCH AS AIR INTAKE SHUTOFF DEVICES, TO MINIMIZE THE RISK OF OVERSPEEDING IN WHICH AN ENGINE, BECAUSE OF APPLICATION, MIGHT OPERATE IN A COMBUSTIBLE ENVIRONMENT (FROM A FUEL SPILL OR GAS LEAK, FOR EXAMPLE). CUMMINS ENGINE COMPANY, INC. DOES NOT KNOW HOW YOU WILL USE YOUR ENGINE. THE EQUIPMENT OWNER AND OPERATOR, THEREFORE, IS RESPONSIBLE FOR SAFE OPERATION IN A HOSTILE ENVIRONMENT. CONSULT YOUR CUMMINS AUTHORISED DISTRIBUTOR FOR FURTHER INFORMATION.



Note:

*Cummins Power Generation Limited recommends the installation of an air intake shutoff device or a similar safety device to minimise the risk of overspeeding where an engine will be operated in a combustible environment.*



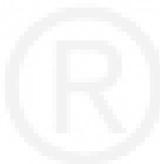


**Caution:** *Do not idle the engine for excessively long periods. Long periods of idling (more than ten minutes) can damage an engine because combustion chamber temperatures drop so low the fuel will not burn completely. This will cause carbon to clog the injector spray holes and piston rings, and can cause the valves to stick. If the engine coolant temperature becomes too low (60°C [140°F]), raw fuel will wash the lubricating oil off the cylinder walls and dilute the crankcase oil. This will result in the moving parts of the engine not receiving the correct quality of lubrication.*

### 5.5.1 Sequence of Operation

The generator set is run Automatically using a Remote Start signal, or Manually using the generator set control panel buttons. LEDs are provided on the display module front panel to indicate the operating run mode of the generator set. The PowerCommand® 2.2 initiates a starter cranking signal and will perform an automatically sequenced manual start, under a complete engine protection system combined with full monitoring capability. If a fault is sensed at Start-up, the engine is locked out and will not start.

The choice of Auto or Manual run mode is decided by authorised personnel during the generator set initial setup. An access code is required to switch between the Auto, Manual, or Stop modes, and this facility may be permitted or denied by the authorised personnel during the initial setup of the generator set.



## 5.6 Starting



**Caution:** *One operator must be in complete charge, or working under the direction of someone who is. Remember that, upon starting the engine, cables and switchgear will become energised, possibly for the first time. Furthermore, equipment that does not form part of the generator set installation may become electrically charged. Ensure that only authorised and competent personnel carry out this work.*



**Caution:** *Do not use the Emergency Stop switch to shut down an engine unless a serious fault develops. The Emergency Stop push-switch must not be used for a normal shut-down as this will prevent a cooling down run in which the lubricating oil and engine coolant carry the heat away from the engine combustion chamber and bearings in a safe manner.*



**Caution:** *Avoid off-load running for other than short periods. A minimum loading of 30% is recommended. This loading will help to prevent the build up of carbon deposits in the injectors, due to unburnt fuel, and reduce the risk of fuel dilution of the engine lubricating oil. The engine must be shut down as soon as possible after the appropriate functions have been checked.*

Before attempting to start the generator set, the operator must read through this entire manual, together with the Health and Safety manual and the specific engine manual provided as part of the documentation pack supplied with the generator set. It is essential that the operator be completely familiar with the generator set and the PowerCommand® 2.2 control.

The following sub-sections cover the systems used to start and stop the generator set.

Before starting the generator set, make sure that exhaust and fuel fittings are tight and properly positioned, and that proper maintenance and pre-start checks have been performed.

During starting, automatic checks are carried out for the integrity of various protection systems. The PowerCommand® 2.2 will not allow the generator set to continue the starting sequence if the integrity of a sensor is considered to be in doubt.

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



**Note:** *The number of starting cycles, and the crank and rest times are set from within the Setup menu. Qualified service personnel are required to change the default setting. Contact your authorised distributor.*

## 5.6.1 Initial Pre-Start Checks



**WARNING:** VOLTAGE PRESENTS SPECIAL HAZARDS OF SEVERE PERSONAL INJURY OR DEATH. EVEN AFTER GENERATOR SET SHUTDOWN AN ELECTRICAL SHOCK HAZARD MAY STILL EXIST, CAUSED BY INDUCED OR RESIDUAL VOLTAGE WITHIN THE ALTERNATOR OR CABLES. SERVICE PERSONNEL MUST BE WELL TRAINED/QUALIFIED TO WORK WITH DISTRIBUTION VOLTAGES.

Before starting, be sure competent personnel have made the following checks to ensure that the unit is ready for operation:

- Generator Set Grounding Procedure – This must be followed prior to performing service or inspection procedures that may expose personnel to conductors normally energized with voltages greater than 600 volts. Contact your authorised distributor.
- Megger and Insulation Testing – This must be performed on all generator sets before initial start-up and after the generator set Grounding Procedure has been completed. Insulation testing for low voltage (less than 600 volts) generator sets is recommended by Cummins Power Generation Limited. These tests are used to verify that the windings are dry before the generator set is operated, and to develop a base line for future test comparisons. Contact your authorised distributor.



**Caution:** *When Megger testing an alternator, failure to protect the voltage regulator, control, and diodes could result in permanent damage to one or more of the electronic components.*

- Lubrication - Check the engine lubrication oil level and ensure that the correct level is always maintained.



**Note:** *Generator sets may be shipped dry. They must be filled with the correct type and quantity of oil before use. Be sure to check oil level before initial start.*

- Coolant - Check the engine coolant level and ensure that the level is always maintained at the coolant expansion tank. Fill the cooling system to the bottom of the fill neck in the radiator fill or expansion tank. Do not check while the engine is hot.



**Note:** *Generator sets may be shipped dry. They must be filled with the correct type and quantity of coolant before use. Be sure to check coolant level(s) before initial start.*



**Caution:** *It is essential that Cummins Power Generation Limited's recommendations for the correct type and concentration of anti-freeze and DCA inhibitor are complied with. Warranty claims for damage will be rejected if the incorrect mix has been used. Consult your authorised distributor for the correct anti-freeze specifications and concentration for your operating conditions.*



**Note:** *Some radiators have two fill necks, both of which must be filled when the cooling system has been drained.*



**Caution:** *Do not attempt to remove a radiator pressure cap while the generator is running, or is stationary but hot. Always allow it to cool before removing the cap.*

## 5.6.2 Operator's Pre-Start Checks



**WARNINGS: WINDINGS OF HIGH VOLTAGE, 601 TO 15,000 VOLTS, GENERATOR SETS MUST BE DRY BEFORE THE GENERATOR SET IS OPERATED. FAILURE TO ENSURE DRY WINDINGS BEFORE START-UP MAY RESULT IN CATASTROPHIC FAILURE, SEVERE PERSONAL INJURY OR DEATH.**

Before starting, be sure competent personnel have made the following checks to ensure that the unit is ready for operation:

- Fuel Supply - Ensure that the fuel tank is filled to the normal level and that the fuel system is primed and all the valves required for operation are open. Ensure that there are no leaks and that all fittings are tight.
- Lubrication - Check the engine lubrication oil level and ensure that the correct level is always maintained.
- Coolant - Check the engine coolant level and ensure that the level is always maintained at the coolant expansion tank. Fill the cooling system to the bottom of the fill neck in the radiator fill or expansion tank. Do not check while the engine is hot.



*Note: Some radiators have two fill necks, both of which must be filled when the cooling system has been drained.*



*Caution: Do not attempt to remove a radiator pressure cap while the generator is running, or is stationary but hot. Always allow it to cool before removing the cap.*

- Cooling Air Inlet/Outlets - Ensure that the cooling air inlets/outlets are unobstructed.
- Exhaust Outlet - Ensure that exhaust components are secured and not warped; that the exhaust outlet is unobstructed; that no combustible materials are near the system, and gases are discharged away from building openings. Ensure that there are no leaks and that all fittings are tight.
- Batteries – Ensure that the batteries are charged, that the electrolyte is at the correct level and that all connections are correct.
- Auxiliary AC Supplies - Ensure that all auxiliary equipment is receiving power from the customer's supply.
- Emergency Stop/Fire Detection Equipment - Ensure that all related equipment is fully operational.

### 5.6.3 Starting at Display Panel (Manual Run Mode)



**WARNING:** ENSURE THAT ALL PRE-START CHECKS ARE CARRIED OUT BEFORE STARTING THE GENERATOR SET. DO NOT ATTEMPT TO START THE GENERATOR UNTIL IT IS SAFE TO DO SO. WARN ALL OTHERS IN THE VICINITY THAT THE SET IS ABOUT TO START.

To start the generator set in the Manual Run mode, press the Manual button  on the display

module front panel, and then press the Start button  within ten seconds. Failure to press the Start button within this time will result in the generator set changing to the Off mode. (Refer also to [Section 4.10.2](#))



*Note:* If the mode change access code feature has been enabled, enter the access code when prompted. (See [Section 4.10.1](#)).

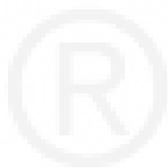
The PowerCommand® 2.2 will initiate a starter cranking signal and will perform an automatically sequenced manual start, under a complete engine protection system combined with full monitoring capability. This will activate the engine control system and the starting procedure. The starter will begin cranking, and after a few seconds the engine will start and the starter will disconnect.

Should the engine fail to start, the starter will disengage after a specified period of time and the control will indicate a Fail to Start shutdown.

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

Reset button.  Before attempting to re-start wait a minimum of two minutes for the starter motor to cool and then repeat the starting procedure. If the engine does not run after a second attempt, refer to [Section 7](#) – Troubleshooting.

To disable Manual mode, change to Auto or Stop mode. If the generator set is running when it leaves Manual mode, it will continue to run if Auto mode has been selected and the remote start signal is active. If there is no active remote start signal, the generator set will stop.



## 5.6.4 Starting from Remote Location (Auto Mode)



**WARNING:** ENSURE THAT ALL PRE-START CHECKS ARE CARRIED OUT BEFORE STARTING THE GENERATOR SET. DO NOT ATTEMPT TO START THE GENERATOR UNTIL IT IS SAFE TO DO SO. WARN ALL OTHERS IN THE VICINITY THAT THE SET IS ABOUT TO START.



To start the generator set in the Auto Run mode, select the Auto button from the display module front panel. (Refer also to [Section 4.10.3](#)).

Only on receipt of a remote start signal, and after a Time Delay to Start, will the PowerCommand® 2.2 initiate the starting sequence as above.

The Remote Start LED will be lit.



*Note:* If the mode change access code feature has been enabled, enter the access code when prompted. (See [Section 4.10.1](#)).

To disable Auto mode, change to Manual or Stop mode.

## 5.6.5 Cold Starting with Loads



**WARNING:** ENSURE THAT ALL PRE-START CHECKS ARE CARRIED OUT BEFORE STARTING THE GENERATOR SET. DO NOT ATTEMPT TO START THE GENERATOR UNTIL IT IS SAFE TO DO SO. WARN ALL OTHERS IN THE VICINITY THAT THE SET IS ABOUT TO START.

Use a coolant heater if a separate source of power is available. The optional heater available from Cummins Power Generation Limited will help provide reliable starting under adverse weather conditions. Be sure the voltage of the separate power source is correct for the heater element rating.

Cummins Power Generation Limited recommends equipping diesel standby generator sets (life safety systems) with engine water jacket coolant heaters to maintain the coolant at a minimum of 32°C (90°F) and, for most applications, accept the emergency load in ten seconds or less. Although most Cummins Power Generation Limited generator sets will start in temperatures down to -32°C (-25°F) when equipped with engine water jacket coolant heaters, it might take more than ten seconds to warm the engine up before a load can be applied when ambient temperatures are below 4°C (40°F).

To advise the Operator of a possible delay in accepting the load, the Low Coolant Temp (code 1435) message, in conjunction with illumination of the Warning LED, is provided. The engine cold sensing logic initiates a warning when the engine water jacket coolant temperature falls below 21°C (70°F). In applications where the ambient temperature falls below 4°C (40°F), a cold engine may be indicated even though the coolant heaters are connected and functioning correctly. Under these conditions, although the generator set may start, it may not be able to accept load within ten seconds. When this condition occurs, check the coolant heaters for correct operation. If the coolant heaters are operating correctly, other precautions may be necessary to warm the engine before applying a load.

## 5.7 Stopping



**Note:** The access code may be required before initiating the Stop button sequence to put the generator set into the Off mode. Refer to [Section 4.10.1](#).



**Caution:** Run the generator set at no load for three to five minutes before stopping. This allows the lubricating oil and engine coolant to carry heat away from the combustion chamber and bearings.

### 5.7.1 Stopping at Display Panel (Manual Mode)

If the generator set was started at the control panel in Manual mode, press the



Stop button once to put the generator set into a Cooldown run after which the set will enter the Off mode.



Pressing the Stop button twice will stop the generator set immediately, without a Cooldown run, after which the set will enter the Off mode.



**Note:** If possible, hot shutdown under load should be avoided to help prolong the reliability of the set. A hot shutdown may result in a Hot Shutdown Warning.

### 5.7.2 Stopping from Display Panel (Auto Mode)



If the generator set was started in Auto mode, press the Stop button once to stop the generator set immediately after which the set will enter the Off mode.



**Note:** If possible, hot shutdown under load should be avoided to help prolong the reliability of the set. A hot shutdown may result in a Hot Shutdown Warning.

### 5.7.3 Stopping from Remote Location (Auto Mode)

If the control receives a remote stop signal, the generator set completes its normal shutdown sequence incorporating a Cooldown run (Refer to [Figure 21](#)). (The remote stop signal is actually the removal of the remote start signal to the control).

The generator set stops after completing the Time Delay to Stop function (zero to 600 seconds).

The set will remain in the Auto mode, and subject to a remote start signal, unless the Stop button is pressed. If this button is pressed the set will enter the Off mode.

**Note:** The InPower service tool or access to the Setup menus is required to enable and change the time delay start/stop settings. Contact an authorised service centre for assistance.

## 5.7.4 Emergency Stop (Code 1433)

The Local Emergency Stop Button is situated on the front of the Control Panel. This is a mechanically latched switch that will unconditionally stop the engine when pressed, bypassing any time delay to stop. Push this button in for Emergency Shutdown of the engine.



*Note: If the engine is not running, pushing the button in will prevent the starting of the engine, regardless of the start signal source (Manual or Auto - remote).*

When the Emergency Stop Button is pressed the display panel will indicate the Shutdown condition by illuminating the red Shutdown status LED  and displaying the following message on the graphical LCD display:

**Fault Number: 1433  
EMERGENCY STOP**

A Remote Emergency Stop Button may be incorporated within the installation. If this Stop Button is activated the following message will be displayed;

**Fault Number: 1434  
REMOTE EMERGENCY STOP**

To reset:

1. Pull, or twist and pull, the button out.
2. Press the Stop button on the Display Module to acknowledge this action.
3. Press the Reset button.
4. Press the Auto or Manual Run Button, as previously determined. (See Section 4.10).



*Caution: Do not use an Emergency Stop button to shut down an engine unless a serious fault develops.*



*Note: Ensure the remote start control is not active or when the Emergency Stop is reset the generator set could start running.*



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



*Note: An external Emergency Stop button is situated in close proximity to the control panel viewing window. (Rental Units only).*

## 5.8 Frequency Changing – Rental Only

Within the PowerCommand® 2.2 Set-up menu is the option to select 50 Hz or 60Hz running. This option is Password protected and is determined at the initial setting up of the set.

The Set-up menu is used to control the displaying of a further menu that allows for adjusting the generator set frequency settings.

The Frequency menu is designed only for use with rental sets. Changing the parameters on this menu **MUST ONLY** be done by trained service personnel.

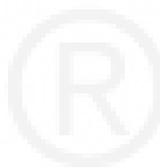


**WARNING: ANY CHANGE TO THE FREQUENCY SETTINGS MUST ONLY BE CARRIED OUT BY THE RENTAL FLEET OWNER.**



**WARNING: ADJUSTING THE FREQUENCY SETTINGS MUST ONLY BE DONE BY TECHNICALLY TRAINED AND EXPERIENCED SERVICE PERSONNEL. THE FREQUENCY SETTINGS MUST ONLY BE ADJUSTED TO CORRESPOND TO THE PARAMETERS OF THE INSTALLED INPUT POWER SUPPLY. SAVING SETTINGS THAT DO NOT CORRESPOND TO THE POWER SUPPLY CAN CAUSE SEVERE PERSONAL INJURY AND EQUIPMENT OR PROPERTY DAMAGE.**

Refer to the Frequency Changing Manual specific to your Generator Set for further information.



## SECTION 6 – MAINTENANCE

### 6. Maintenance

All maintenance tasks must be assessed for health and safety risks, the preventative measures identified must be actioned. Accompaniment is required for tasks where the presence of someone else will add significantly to the safety of the task.

Read, understand and comply with all Caution and Warning notes in this section, those contained within Section 1 - Preliminary and Safety, and those contained within the Health and Safety Manual (0908-0110). Refer also to the Operator's engine specific manual supplied as part of the generator set documentation pack. This latter manual will contain further information regarding the running and care of the generator set and also specific equipment instructions that may differ from the standard generator set.



Ensure adequate lighting and staging (where required) are installed.

*Caution: Maintenance must only be carried out by authorised and qualified maintenance engineers, who are familiar with the equipment and its operation.*



**WARNING: DEPENDENT UPON THE CONTROL SYSTEM FITTED, THIS UNIT MAY OPERATE AUTOMATICALLY AND COULD START WITHOUT WARNING.**



*Caution: Before carrying out any maintenance work, become familiar with the Generator Plant Safety Code given in Section 1 of this manual, together with the Health and Safety Manual (0908-0110).*



*Caution: Always disconnect a battery charger from its AC source before disconnecting the battery leads. Failure to do so can result in voltage spikes high enough to damage the DC control circuits of the generator set.*



**WARNING: ACCIDENTAL STARTING OF THE GENERATOR SET WHILE WORKING ON IT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. PREVENT ACCIDENTAL STARTING BY DISCONNECTING THE STARTING BATTERY LEADS (NEGATIVE [-] FIRST).**

**ENSURE BATTERY AREA HAS BEEN WELL-VENTILATED BEFORE SERVICING THE BATTERY. SPARKS OR ARCING CAN IGNITE EXPLOSIVE HYDROGEN GAS GIVEN OFF BY BATTERIES, CAUSING SEVERE PERSONAL INJURY. ARCING CAN OCCUR WHEN LEADS ARE REMOVED OR REPLACED, OR WHEN THE NEGATIVE (-) BATTERY LEAD IS CONNECTED AND A TOOL USED TO CONNECT OR DISCONNECT THE POSITIVE (+) BATTERY LEAD TOUCHES THE FRAME OR OTHER GROUNDED METAL PART OF THE GENERATOR SET.**

**INSULATED TOOLS MUST BE USED WHEN WORKING IN THE VICINITY OF THE BATTERIES.**

**ALWAYS REMOVE THE NEGATIVE (-) LEAD FIRST AND RECONNECT LAST.**

**ENSURE HYDROGEN FROM THE BATTERY, ENGINE FUEL AND OTHER EXPLOSIVE FUMES ARE FULLY DISSIPATED. THIS IS ESPECIALLY IMPORTANT IF THE BATTERY HAS BEEN CONNECTED TO A BATTERY CHARGER.**



**WARNING: TO COMPLETE MAINTENANCE TASKS AT HEIGHT REFER TO LOCAL LEGISLATIVE REQUIREMENTS. SUITABLE EQUIPMENT FOR PERFORMING THESE TASKS MUST BE USED IN ACCORDANCE WITH THE LOCAL GUIDELINES AND LEGISLATION. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN SEVERE PERSONAL INJURY OR DEATH.**



**WARNING:** DO NOT USE THE SKID (BEDFRAME) OR ANY PART OF THE GENERATOR SET AS A MEANS OF ACCESS. USE OF THE GENERATOR SET AS ACCESS MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH AND/OR PROPERTY AND EQUIPMENT DAMAGE.



**WARNING:** BEFORE CARRYING OUT ANY MAINTENANCE WORK, LOCK OFF FOR SAFE WORKING:

1. PRESS THE OFF MODE SWITCH ON THE GENERATOR SET CONTROL PANEL.
2. AS AN ADDITIONAL PRECAUTION, PRESS THE EMERGENCY STOP BUTTON, AND HOLD IN FOR 30 SECONDS.
3. ISOLATE ALL SUPPLIES TO THE GENERATOR SET.
4. ISOLATE THE BATTERY CHARGER.
5. DISCONNECT THE BATTERY.
6. REMOVE THE STARTER CONTROL WIRES.
7. A SUITABLE WARNING PLATE STATING 'MAINTENANCE IN PROGRESS' SHOULD BE DISPLAYED PROMINENTLY.



**WARNING:** SOME PANEL INTERNAL COMPONENTS MAY HAVE LIVE EXPOSED TERMINATIONS EVEN IF THE GENERATOR SET IS NOT RUNNING. ISOLATE (LOCK AND TAG) ALL EXTERNAL ELECTRICAL SUPPLIES PRIOR TO ACCESS OF THE CONTROL PANEL.

## 6.1 Locking the Generator Set Out of Service

### 6.1.1 Introduction

Before any work is carried out for maintenance, etc., the plant must be immobilised. Even if the plant is put out of service by pressing the Off switch on the control panel, the plant cannot be considered safe to work on until the engine is properly immobilised as detailed in the following procedures.



**Caution:** Refer also to the Operator's engine specific manual included in the documentation package supplied with the generator set. This manual will contain specific equipment instructions that may differ from the standard generator set.



**WARNING:** BEFORE CARRYING OUT ANY MAINTENANCE, ISOLATE ALL SUPPLIES TO THE GENERATOR SET AND ANY CONTROL PANELS. RENDER THE SET INOPERATIVE BY DISCONNECTING THE PLANT BATTERY.



**Caution:** If the engine has been running recently explosive gases (given off during battery charging) may be present in the vicinity of the batteries. Ensure the area is well ventilated before disconnecting batteries.

### 6.1.2 Immobilising the Generator Set for Safe Working



**Note:** Shutdown the engine first, as described in Section 5.7 - Stopping.

To immobilise the engine:

1. Press the Off Mode switch on the display panel.
2. Press the Emergency Stop Button, (and hold in for 30 seconds). This will prevent the starting of the generator set regardless of the Start signal source and will therefore provide an additional safety step for immobilising the generator set. (See also Section 5.7).



**Note:** When this Stop Button is pressed the display panel will indicate the Shutdown condition by illuminating the red Shutdown status LED  and displaying the following message on the graphical LCD display:

**Fault Number: 1433  
EMERGENCY STOP**

or

**Fault Number: 1434**  
**REMOTE EMERGENCY STOP**



*Note: This Fault will affect the Fault History memory bank.*

3. As an additional precaution, thoroughly ventilate the plant room before disconnecting any leads.
4. Isolate and lock off the supply to the heater, where fitted.
5. Isolate and lock off the supply to the battery charger, where fitted.
6. Isolate the fuel supply to the engine.
7. Disconnect the starting batteries and control system batteries, (if separate). Disconnect the negative (-) lead first. Attach a padlock through one of the battery leads and tag for safe working.
8. Fit warning notices at each of the above points to indicate Maintenance in Progress - Plant Immobilised for Safe Working.

## 6.2 General

The maintenance procedures covered in this manual are intended for Operator-level service only and must be performed at whichever interval occurs first. At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.

Table 1 covers the recommended service intervals for a generator set on Standby service. If the generator set will be subjected to Prime usage or extreme operating conditions, the service intervals should be reduced accordingly. Consult your authorised distributor.

Some of the factors that can affect the maintenance schedule are:

- Use for continuous duty (prime power)
- Extremes in ambient temperature
- Exposure to elements
- Exposure to salt water
- Exposure to windblown dust or sand.

Consult with an authorised distributor if the generator set will be subjected to any extreme operating conditions and determine a suitable schedule of maintenance. Use the running time meter to keep an accurate log of all service performed for warranty support. Perform all service at the time period indicated, or after the number of operating hours indicated, whichever comes first. Use Table 1 to determine the maintenance required and then refer to the sections that follow for the correct service procedures.

Refer also to the Operator's engine manual supplied with the generator set.

Table 2 Periodic Maintenance Schedule

MAINTENANCE ITEMS		Daily or after 8 Hours	Weekly or after 50 Hours <sup>7</sup>	Monthly or after 100 Hours <sup>7</sup>	3 Months or after 250 Hours <sup>5, 7</sup>
<b>Perform maintenance tasks as specified using Daily or Hourly periods – whichever is the sooner</b>					
<b>Check:</b>	Fuel tank level	■			
	Fuel lines and hoses	■ <sup>1</sup>			
	Bedframe fluid containment (where fitted), drain if necessary	■ <sup>8</sup>			
	Engine oil level	■ <sup>1</sup>	■ <sup>6</sup>		
	Coolant level of radiator(s) (water jacket & LTA)	■ <sup>4</sup>			
	Coolant lines and radiator hoses for wear and cracks	■ <sup>1</sup>			
	Cooling fan blades	■			
	All exhaust components, and hardware (fittings, clamps, fasteners, etc.)	■ <sup>1</sup>			
	Drive belt, condition and tension		■ <sup>2</sup>		
	Air cleaner restriction indicator (where fitted)	■			
	Air intake system for leaks	■			
	Electrical connections (battery, starter motor and alternator connections)		■		
	Safety controls and alarms	■			
	Operation of Emergency Stop Button		■		
<b>Drain:</b>	Water from fuel pre-filter (where fitted)	■ <sup>3</sup>			
<b>Clean:</b>	Radiator matrix			■ <sup>4,5</sup>	

- 1 – Check for oil, fuel, coolant and exhaust system leaks. Check exhaust system audibly and visually with generator set running. (Refer to [Sections 6.8](#) and [6.9](#)).
- 2 – Visually check belt for evidence of wear or slippage. Replace if hard or brittle (to be undertaken by a Service Engineer).
- 3 – Drain one cup, or more, of fuel to remove water and sediment.
- 4 – Refer to Section 6.4 of this manual and to the Radiator Information Manual 0908-0107-00 supplied with this generator set.
- 5 – To be undertaken by a Service Engineer. Please refer to your Authorised Distributor.
- 6 – Engine oil and filter must be replaced after the initial running-in period of 50 hours. Please refer to your authorised distributor.
- 7 – All maintenance checks and inspections listed at lesser maintenance intervals must also be carried out at this time.
- 8 – For generator sets with QSB7 engines refer to Engine Operators manual for that model.

## 6.3 Daily or Refuelling Maintenance Procedures

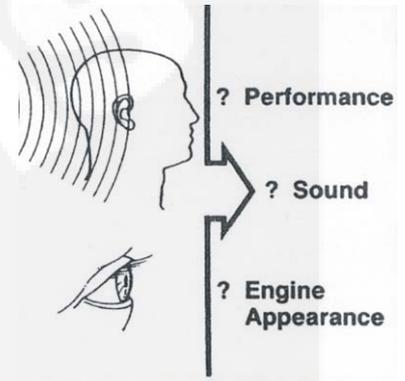
Monitor fluid levels, oil pressure, and coolant temperature frequently. During operation, be alert for mechanical problems that could create unsafe or hazardous conditions. The following sections cover areas that must be frequently inspected for continued safe operation.

### 6.3.1 General Information

Preventative maintenance begins with day-to-day awareness of the condition of the generator set.

Before starting the generator set check the oil and coolant levels and look for:

- Leaks
- Loose or damaged parts
- Worn or damaged belts
- Any change in engine or generator set appearance.



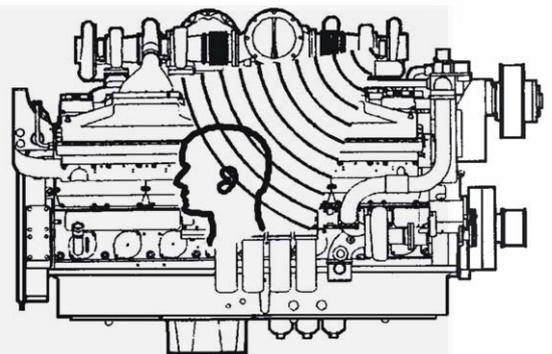
### 6.3.2 Engine Operation Report

The engine must be maintained in good mechanical condition if the operator is to obtain optimum satisfaction from its use. Running reports are necessary to enable programmed or emergency servicing to be carried out.

Comparison and intelligent interpretation of the running report, together with a practical follow-up action will eliminate most failures and emergency repairs.

Most engine problems give an early warning. Look and listen for changes in engine performance, sound, or appearance that can indicate service or repair is needed. Some engine changes to look for and report on are:

- Low lubricating oil pressure
- Low power
- Abnormal water or oil temperature
- Unusual engine noise
- Excessive exhaust smoke
- Excessive use of coolant, fuel or lubricating oil
- Any coolant, fuel or lubricating oil leaks.
- Misfire
- Vibration



## 6.4 Cooling System



**WARNING:** CONTACT WITH HOT COOLANT CAN RESULT IN SERIOUS SCOLDING. ALLOW COOLING SYSTEM TO COOL BEFORE RELEASING PRESSURE AND REMOVING WATER JACKET RADIATOR CAP OR LTA EXPANSION TANK CAP.



**Caution:** Loss of coolant can allow engine to overheat without protection of shutdown device, and cause severe damage to the engine. Maintain coolant level for proper operation of high engine temperature shutdown system.

## 6.4.1 Coolant Level - Check



**WARNING:** DO NOT REMOVE THE RADIATOR CAP FROM A HOT ENGINE; WAIT UNTIL THE TEMPERATURE IS BELOW 50°C (122°F) BEFORE REMOVING PRESSURE CAP. FAILURE TO DO SO CAN RESULT IN PERSONAL INJURY FROM HEATED COOLANT SPRAY OR STEAM. REMOVE FILLER CAP SLOWLY TO RELEASE COOLANT SYSTEM PRESSURE.

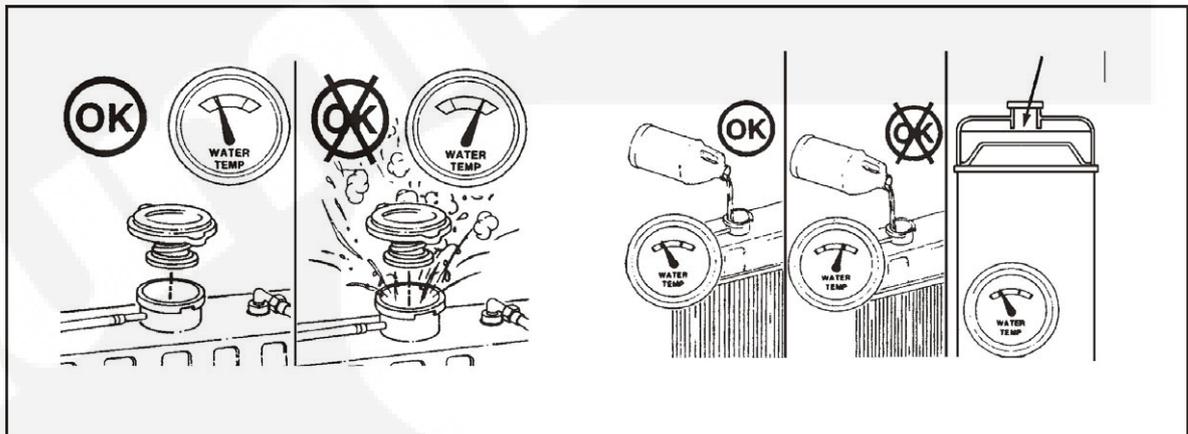


**Caution:** Avoid prolonged or repeated skin contact with antifreeze. Refer to the Health and Safety Manual 0908-0110 for handling and disposal of antifreeze.



**Note:** Never use a sealing additive to stop leaks in the coolant system. This can result in a blocked coolant system and inadequate coolant flow causing the engine to overheat.

Coolant level must be checked daily. The standard coolant concentration is 50% Ethylene Glycol and water, this concentration must be maintained. Warranty claims for damage will be rejected if the incorrect mix of anti-freeze has been used. Consult your authorised distributor for the correct anti-freeze specifications and concentration for your operating conditions. The recommended antifreeze is Fleetguard® Compleat ES which is a low-silicate antifreeze, or its equivalent.



**Caution:** Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 50°C (122°F) before adding coolant.



**Note:** On applications that use a coolant recovery system, check to ensure the coolant is at the appropriate level on the coolant recovery tank dependent on engine temperature.

Fill the cooling system with coolant to the bottom of the fill neck in the radiator or expansion tank, with the coolant temperature at 50°C (122°F) or lower.



**Note:** Some radiators have two fill necks, both of which must be filled. Refer to the generator set specific drawings supplied with the set.

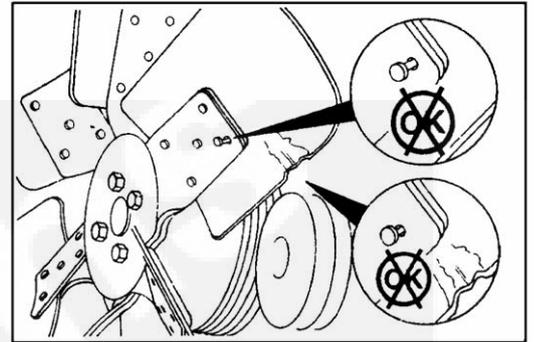
### 6.4.2 Cooling Fan - Inspect



**WARNING: PERSONAL INJURY CAN RESULT FROM A FAN BLADE FAILURE. NEVER PULL OR PRY ON THE FAN, THIS CAN DAMAGE THE FAN BLADE(S) AND CAUSE FAN FAILURE.**

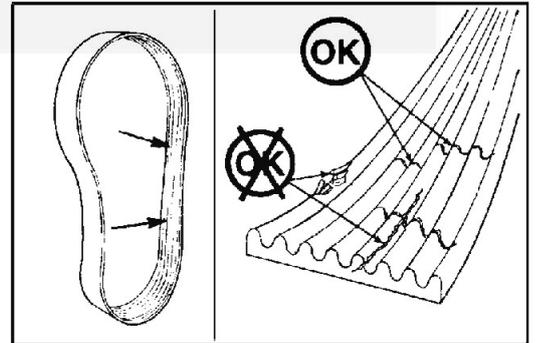
A visual inspection of the cooling fan is required daily. Check for cracks, loose rivets, and bent or loose blades. Check the fan to make sure it is securely mounted.

Contact your authorised distributor if the fan is damaged.



### 6.4.3 Drive Belt - Inspect

Visually inspect the belt through the guarding, checking for intersecting cracks. Small transverse (across the belt width) cracks are acceptable. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are NOT acceptable. Contact your authorised distributor if the belt is frayed or has pieces of material missing.

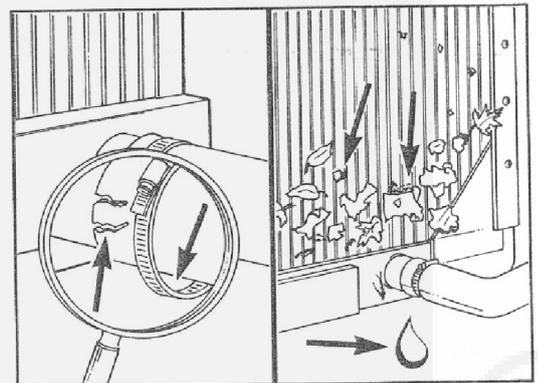


### 6.4.4 Radiator - Check

Check for damaged hoses, and loose and damaged hose clamps.

Inspect the exterior of the radiator (through the guarding) for obstructions. During the service life of a radiator a build up of foreign matter can obstruct the flow of air through the radiator cores, reducing the cooling capability. To ensure the continued efficiency of the radiator, the core will require cleaning.

Refer to the Radiator Information Manual 0908-0107 for further details on cleaning the radiator.



## 6.5 Engine Oil

### 6.5.1 Engine Oil Level – Check



**WARNING:** CRANKCASE PRESSURE CAN BLOW OUT HOT OIL AND CAUSE SEVERE BURNS. DO NOT CHECK OIL WHILE THE GENERATOR SET IS OPERATING.



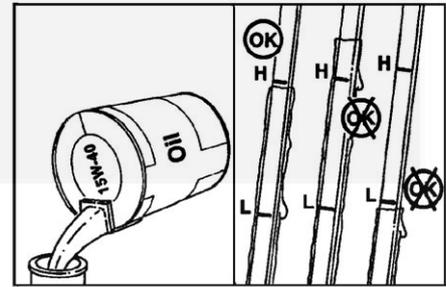
**Caution:** Do not operate the engine with the oil level below the low mark or above the high mark. Overfilling can cause foaming or aeration of the oil while operation below the low mark may cause loss of oil pressure.



**Caution:** Prolonged and repeated skin contact with used engine oils can cause skin disorders or other bodily injury.  
Refer to the Health and Safety Manual (0908-0110-00) supplied with your generator set for precautions when handling or disposing of used engine oil.

Check the engine oil level during engine shutdown periods at the intervals specified in the Maintenance Table 1.

Never operate the engine with the oil level below the L (Low) mark, or above the H (High) mark. Wait at least fifteen minutes, after shutting off the engine, before checking the oil level. This allows time for the oil to drain back to the oil pan.



**Note:** Use high-quality 15W-40 multi-viscosity lubricating oil such as Cummins Premium Blue® or its equivalent. Consult your authorised distributor for the correct lubricating oil for your operating conditions.



## 6.6 Fuel System



**WARNING:** IGNITION OF FUEL CAN CAUSE SERIOUS PERSONAL INJURY OR DEATH BY FIRE OR EXPLOSION. DO NOT PERMIT ANY FLAME, CIGARETTE, OR OTHER IGNITER NEAR THE FUEL SYSTEM, OR IN AREAS SHARING VENTILATION.



**WARNING:** ENGINE FUEL ACTUATORS CAN OPERATE AT VOLTAGES UP TO 140 VOLTS DC.



**WARNING:** DO NOT MIX GASOLINE OR ALCOHOL WITH DIESEL FUEL. THIS MIXTURE CAN CAUSE AN EXPLOSION AND DAMAGE TO THE ENGINE – GASOLINE AND ALCOHOL HAVE INFERIOR LUBRICITY.



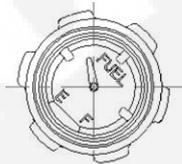
*Caution:* Due to the precise tolerances of diesel injection systems, it is extremely important that the fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the injection pump and the injection nozzles.

Use ASTM No. 2D fuel with a minimum Cetane number of 40. No. 2 diesel fuel gives the best economy and performance under most operating conditions. Fuels with Cetane numbers higher than 40 are often needed in high altitudes, or extremely low ambient temperatures, to prevent misfires and excessive smoke. Contact your authorised distributor for your operating conditions.



*Note:* A diesel fuel to BS 2869:2006; (Fuel oils for agricultural, domestic and industrial engine and boilers), conforming to the requirements and test methods of that specification would be an acceptable alternative to ASTM No. 2D.

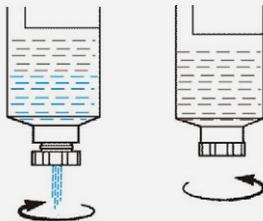
### 6.6.1 Fuel Level



To avoid condensation problems, keep fuel supply tanks as full as possible by filling up each time the engine is used. Condensation (water) can cause clogging of the fuel filters as well as possible freezing problems. In addition, water mixing with the sulphur in the fuel forms acid which can corrode and damage engine parts.

A base fuel tank may be incorporated into the bedframe. This tank is fitted with a large filler cap with in-built coarse filter, and provides a minimum of eleven hours operation at a nominal 100% load.

### 6.6.2 Fuel/Water Separator - Drain



Drain the water and sediment from the separator daily.

Set-mounted fuel/water separators are fitted to provide protection for the engine fuel injection system as water-free fuel supplies cannot be guaranteed.

Turn the valve counterclockwise, four complete turns, until the valve drops down one inch. Drain the filter sump of water until clear fuel is visible.

Push the valve up and turn the valve clockwise to close drain valve.



*Caution:* Do not over tighten the valve. Over tightening can damage the threads.



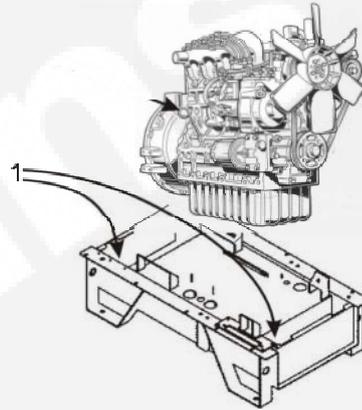
*Note:* If more than 2 oz is drained, refilling of the filter is required to prevent hard starting.

## 6.7 Fluid Containment

The bedframe fluid containment area (if applicable) must be inspected at regular intervals and any liquid must be drained off and disposed off in line with local health and safety regulations. (Refer also to Health and Safety manual 0908-0110-00). Failure to perform this action may result in spillage of liquids likely to contaminate the surrounding area.

### KEY

1. Containment Area



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

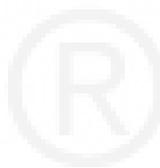
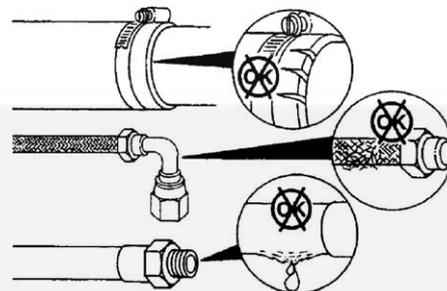
## 6.8 Hoses and Fuel Lines - Check



**WARNING: MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. USE EXTREME CAUTION AROUND HOT MANIFOLDS, MOVING PARTS, ETC..**

**TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT METAL PARTS SUCH AS RADIATOR, TURBOCHARGER AND EXHAUST SYSTEM.**

With the generator set operating, inspect the supply lines, return lines, filters, and fittings for leaks. Check any flexible sections for cuts, cracks and abrasions and ensure they are not rubbing against anything that could cause breakage. If any leaks are detected, shut down the generator set (if possible), contact your authorised distributor and have the leaks corrected immediately.



## 6.9 Exhaust System



**WARNING:** EXHAUST COMPONENTS BECOME VERY HOT WHEN THE GENERATOR SET IS IN USE AND REMAIN HOT FOR A PERIOD OF TIME AFTER THE GENERATOR SET HAS BEEN SHUT DOWN. THESE COMPONENTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH FROM CONTACT. ALLOW THESE COMPONENTS TO COOL COMPLETELY BEFORE PERFORMING ANY MAINTENANCE TASKS.



**WARNING:** INHALATION OF EXHAUST GASES CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH. BE SURE DEADLY EXHAUST GAS IS PIPED OUTSIDE AND AWAY FROM WINDOWS, DOORS OR OTHER INLETS TO BUILDINGS. DO NOT ALLOW TO ACCUMULATE IN HABITABLE AREAS.



**WARNING:** MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. USE EXTREME CAUTION AROUND HOT MANIFOLDS, MOVING PARTS, ETC..

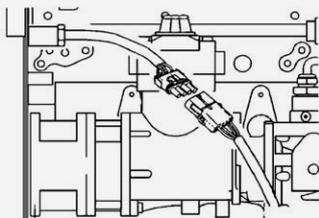
With the generator set operating, inspect the exhaust system visually and audibly where possible checking for leaks within the system, with out removing guarding and panels. If any leaks are detected, shut down the generator set, contact your authorized distributor and have the leaks corrected immediately.

## 6.10 Generator Set Output - AC Electric System

Check the following while the generator set is operating:

- Frequency: The generator set frequency should be stable and the reading should be the same as the generator set nameplate rating (50Hz/1500RPM or 60Hz/1800RPM).
- AC Voltage: At no load, the line-to-line voltage(s) should be the same as the generator set nameplate rating.
- AC Ammeter: At no load, the current readings should be zero. With a load applied, each line current should be similar.
- Panel Lamps: When the Operating Panel is first connected to the DC supply, the system runs a check by illuminating each of the indicator lamps in turn.

## 6.11 DC Electrical System



ignite explosive battery gases.



**WARNING:** IGNITION OF EXPLOSIVE BATTERY GASES CAN CAUSE SEVERE PERSONAL INJURY. DO NOT SMOKE, DO NOT USE NAKED FLAMES OR CAUSE SPARKS WHILE SERVICING BATTERIES.

Refer to Supplementary Publication 0908-0101 for cleaning and safety precautions of the battery

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## SECTION 7 – TROUBLESHOOTING

### 7. Troubleshooting

#### 7.1 Introduction

Fault code information, together with Warning and Shutdown information, is provided in this section to assist in locating and identifying the possible causes of faults in the generator set system. Refer also to the Operator's engine specific manual supplied as part of the generator set documentation pack. This latter manual will contain further information regarding the running and care of the generator set and also specific equipment instructions that may differ from the standard generator set.

#### 7.2 Control Unit

The generator set control system continuously monitors engine sensors for abnormal conditions, such as low oil pressure and high coolant temperature. If any of these conditions occur, the control will light a yellow Warning lamp or a red Shutdown lamp and will display a message on the graphical display panel. In the event of an engine shutdown fault (red Shutdown LED), the control will stop the engine immediately.

This section lists the Warning and Shutdown Fault Codes/Messages ([Table 3](#)), and suggests possible causes of the fault.



**Note:** *Displayed error codes that are not listed in [Table 3](#) will require an authorised service representative to correct the fault. Contact an authorised service centre for assistance.*

## 7.3 Safety Considerations

Fault finding work, particularly in confined areas, must be carried out by two engineers working together. Read, understand and comply with all safety precautions listed within Section 1 – Preliminary and Safety – and observe all instructions and precautions throughout this manual, the Operator's engine specific manual, and the Health and Safety Manual (0908-0110).

The installation of a generator set can be designed for remote starting. When troubleshooting a generator set that is shutdown ensure that the set cannot be accidentally re-started. Refer to [Section 6.2](#) – Locking the Generator Set out of Service.



**WARNING:** HIGH VOLTAGES ARE PRESENT WHEN THE GENERATOR SET IS RUNNING. DO NOT OPEN THE OUTPUT BOX WHILE THE GENERATOR SET IS RUNNING.



**WARNING:** SOME PANEL INTERNAL COMPONENTS MAY HAVE LIVE EXPOSED TERMINATIONS EVEN IF THE GENERATOR SET IS NOT RUNNING. ISOLATE ALL EXTERNAL ELECTRICAL SUPPLIES PRIOR TO ACCESS OF THE CONTROL PANEL.



**WARNING:** CONTACTING HIGH VOLTAGE COMPONENTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH BY ELECTROCUTION. KEEP THE OUTPUT BOX COVERS IN PLACE DURING TROUBLESHOOTING. TESTING AND/OR ADJUSTMENTS MUST ONLY BE CARRIED OUT BY PERSONNEL QUALIFIED TO PERFORM ELECTRICAL SERVICING.



*Caution:* Always disconnect a battery charger from its AC source before disconnecting the battery leads. Failure to do so can result in voltage spikes high enough to damage the DC control circuits of the generator set.



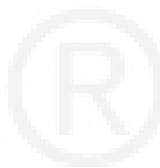
**WARNING:** VENTILATE BATTERY AREA BEFORE WORKING ON OR NEAR BATTERY – WEAR GOGGLES – STOP GENERATOR SET AND DISCONNECT CHARGER BEFORE DISCONNECTING BATTERY CABLES – DISCONNECT NEGATIVE(-) CABLE FIRST AND RECONNECT LAST.



**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 INSPECTION LIGHT ON OR OFF NEAR BATTERY. DISCHARGE STATIC ELECTRICITY FROM BODY BEFORE TOUCHING BATTERIES BY FIRST TOUCHING A GROUNDED METAL SURFACE.



**WARNING:** ACCIDENTAL STARTING OF THE GENERATOR SET WHILE WORKING ON IT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. PREVENT ACCIDENTAL STARTING BY DISCONNECTING THE STARTING BATTERY LEADS (NEGATIVE [-] FIRST).



## 7.4 Fault Finding

Should a fault condition occur during operation follow the procedures in the following tables to locate and correct the problem. For any symptom not listed, contact an authorised service centre for assistance.

Before starting any fault finding, ensure that the following basic checks are carried out:

- All switches and controls are in their correct positions
- The fuel oil level is correct
- The lubricating oil level is correct
- The coolant level is correct
- The radiator matrix is free from obstruction
- The battery charge condition is satisfactory and the connections are secure
- The generator set electrics and alternator connections are secure
- The panel connections are secure
- The protection circuits have been reset
- Blown fuses have been replaced
- Tripped contactors or circuit breakers have been reset.



**WARNING:** MANY TROUBLESHOOTING PROCEDURES PRESENT HAZARDS THAT CAN RESULT IN SEVERE PERSONAL INJURY OR DEATH. SERVICE PROCEDURES MUST ONLY BE CARRIED OUT BY QUALIFIED SERVICE PERSONNEL WITH KNOWLEDGE OF FUELS, ELECTRICITY AND MACHINERY HAZARDS. REVIEW SAFETY PRECAUTIONS LISTED WITHIN [SECTION 1](#) - PRELIMINARY AND SAFETY SECTION - OF THIS MANUAL TOGETHER WITH THE HEALTH AND SAFETY MANUAL (0908-0110).

## 7.5 Status Indicators

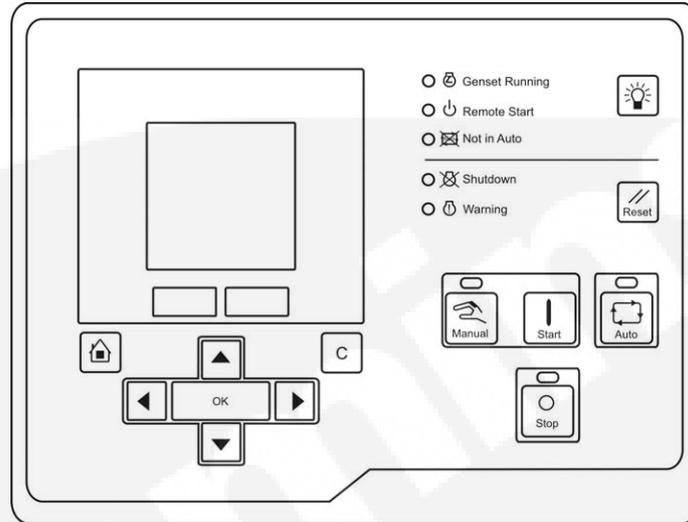


Figure 22 Display Module – Front Panel

### Warning

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.

### Shutdown Status

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

### Not in Auto

This red lamp is will flash when the control is NOT in Auto.

### Remote Start

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

### Genset Running

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

## 7.6 Fault/Status Codes



**WARNING:** MANY TROUBLESHOOTING PROCEDURES PRESENT HAZARDS THAT CAN RESULT IN SEVERE PERSONAL INJURY OR DEATH. SERVICE PROCEDURES MUST ONLY BE CARRIED OUT BY QUALIFIED SERVICE PERSONNEL WITH KNOWLEDGE OF FUELS, ELECTRICITY AND MACHINERY HAZARDS. ACCIDENTAL STARTING OF THE GENERATOR SET WHILE WORKING ON IT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. PREVENT ACCIDENTAL STARTING BY DISCONNECTING THE STARTING BATTERY LEADS (NEGATIVE [-] FIRST).

### 7.6.1 Fault Messages

A Fault message is an indicator of a Warning or Shutdown condition. It includes the fault type (Warning or Shutdown), fault number, and a short description. It also includes where the fault occurred if the generator set control did not detect the fault and is simply reporting the fault. [Table 3](#) provides a list of the fault codes, types, messages displayed, and descriptions of the faults.

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

### 7.6.2 Fault Acknowledgement

Shutdown faults must be acknowledged after the fault has been corrected. If in Auto or Manual mode, the control must be set to Stop mode (Off). Faults are cleared from the control panel display by pressing the Reset button.

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

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



*Note: Gaps in the code numbers are for codes that do not apply to this generator set. Some of the codes listed are feature dependent and will not be displayed by this control.*

### 7.6.3 Fault Categories

The fault codes have been divided into five categories to help you determine what corrective action to take for safe operation of the generator set. Use [Table 3](#) to find the category (CTG) and fault description for all codes.



*Note: Gaps in the code numbers are for codes that do not apply to this generator set. Some of the codes listed are feature dependent and will not be displayed by this control.*

#### **Category A Fault Codes:**

Pertain to engine or alternator shutdown faults that require immediate repair by trained and experienced service personnel (generator set non-operational). The control prevents the set from being re-started if a shutdown fault has not been corrected.

#### **Category B Fault Codes:**

Consists of faults that can affect generator set performance or can cause engine, alternator, or connected equipment damage. Operate the set only when it is powering critical loads and cannot be shut down. Requires repair by trained and experienced service personnel.

#### **Category C Fault Codes:**

Consists of faults that do not affect generator set performance, but require repair by trained and experienced service personnel. These codes indicate a defective harness or wiring problem.

These codes can also indicate a defective engine sensor, leaving no engine protection. (Without this protection, engine damage can occur without detection).



*Caution: Continued operation may void generator set warranty if damage occurs that relates to this fault condition.*

#### **Category D Fault Codes:**

Consist of faults that are repairable by site personnel. Service will be required by trained and experienced service personnel if site personnel cannot resolve the problem after taking the corrective actions suggested in [Table 4](#).

#### **Category E Fault Codes:**

Indicates non-critical operational status of the generator set, external faults, or customer fault inputs. These faults require repair by trained and experienced service personnel.

Table 3 Fault Codes

CTG	CODE	LAMP	DISPLAYED MESSAGE	DESCRIPTION
A	121	Shutdown	SPEED SIGNAL LOST	Indicates that no magnetic pickup pulses were sensed for a Loss of Speed delay. If a magnetic pickup is disabled, this fault is not activated.
B	135	Warning	OIL PRESS SENSOR OOR HIGH	Indicates the oil pressure sensor output is out of range (OOR), high.
C	141	Warning	OIL PRESS SENSOR OOR LOW	Indicates the oil pressure sensor output is out of range (OOR), low.
B	143**	Warning	PRE-LOW OIL PRESSURE	Indicates the engine oil pressure is approaching an unacceptable level.
C	144	Warning	COOLANT SENSOR OOR LOW	Indicates the coolant temperature sensor output is out of range (OOR), low.
C	145	Warning	COOLANT SENSOR OOR HIGH	Indicates the coolant temperature sensor output is out of range (OOR), high.
C	146**	Warning	PRE-HIGH COOLANT TEMP	Indicates that the engine is operating near cooling system capacity. Increase in load or higher ambient temperature may cause High Coolant Temp (code 151) shutdown.
D	151**	Shutdown	HIGH COOLANT TEMP	Indicates that the engine coolant temperature is above normal and has reached the Shutdown trip point.
C	153	Warning	INTAKE MANIFOLD TEMP OOR HIGH	Indicates that the intake manifold temperature sensor is out of range (OOR), high.
C	154	Warning	INTAKE MANIFOLD TEMP OOR LOW	Indicates that the intake manifold temperature sensor is out of range (OOR), low.
D	155	Shutdown	INTAKE MANIFOLD TEMP HIGH	Indicates that the intake manifold temperature sensor is above normal and has reached the shutdown trip point.
C	195	Warning	COOLANT LEVEL OOR HIGH	Indicates that a sensor on the radiator has detected that the coolant level is out of range (OOR), high.
C	196	Warning	COOLANT LEVEL OOR LOW	Indicates that a sensor on the radiator has detected that the coolant level is out of range (OOR), low.
D	197	Warning	COOLANT LEVEL LOW	Indicates that a sensor on the radiator has detected that the coolant level is below normal.
<p>* For more information on these events, refer to the Battle Short Mode description in <a href="#">Section 4</a>.</p> <p>** Any values listed in the Description column for these faults are default values.</p> <p>^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>				

CTG	CODE	LAMP	DISPLAYED MESSAGE	DESCRIPTION
A	234**	Shutdown	OVERSPEED	Indicates that the engine has exceeded normal operating speed. The default thresholds are 1725 RPM (50Hz) or 2075 RPM (60Hz).
A	285	Shutdown	ECM PGN TIMEOUT	Datalink failure. PowerCommand® 2.2 control not responding to the engine control module.
A	286	Shutdown	ECM CONFIGURABLE ERROR	Indicates an engine control module configuration error – out of calibration.
D	359	Shutdown	FAIL TO START	The system has failed to start after a set number of crank attempts. This indicates a possible fuel system or air induction problem (engine cranks but fails to start).
A	415**	Shutdown	LOW OIL PRESSURE	Indicates the engine oil pressure has dropped below normal and has reached the shutdown trip point.
C	421^	Shutdown	OIL TEMP HIGH	Indicates the engine oil temperature is above normal and has reached the shutdown trip point. (I/O Module option).
B	425^	Shutdown	OIL TEMP OOR	Indicates the engine oil temperature output is out of range (OOR). High or low. (I/O Module option).
A	426	Shutdown	DATA LINK ERROR	Datalink failure. No communications between the PowerCommand® 2.2 control and the engine control module.
A	427**	Warning	CAN LINK LOST	Datalink fault. Indicates that important data was lost between the PowerCommand® 2.2 control and the engine control module.
D	441**	Warning	LOW BATTERY	Indicates battery voltage supply to the control is approaching a low level at which unpredictable operation can occur.
D	442**	Warning	HIGH BATTERY	Indicates battery voltage supply to the control is approaching a high level at which damage to the control can occur.
D	488^	Shutdown	INTAKE MANIFOLD TEMP HIGH	Indicates that the intake manifold temperature is above normal and has reached the shutdown trip point. (I/O Module option).
A	689	Shutdown	ENGINE SPEED ERRATIC	Indicates a fault condition in the engine crankshaft sensor circuit.
A	781	Shutdown	CAN LINK LOST	Datalink failure. No communications between the PowerCommand® 2.2 control and the engine control module.
D	1117	Warning	ECM POWER LOST	Indicates battery voltage supply to the engine control module was lost.
B	1123*	Shutdown	SHUTDOWN AFTER BS	A shutdown fault occurred while the Battle Short mode was enabled.
D	1131*	Warning	BATTLE SHORT ACTIVE	Indicates that the control is in Battle Short mode – used to bypass several fault shutdowns for generator set operation during emergencies.
<p>* For more information on these events, refer to the Battle Short Mode description in <a href="#">Section 4</a>.</p> <p>** Any values listed in the Description column for these faults are default values.</p> <p>^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>				

CTG	CODE	LAMP	DISPLAYED MESSAGE	DESCRIPTION
C	1246	Warning	GENERIC ENGINE FAULT	Engine control fault code not recognised by the PowerCommand®2.2 control.
E	1311	Configurable	Customer Fault Input 1	The nature of the fault is an optional customer selection.
E	1312	Configurable	Customer Fault Input 2	The nature of the fault is an optional customer selection.
E	1317	Configurable	Customer Fault Input 3	The nature of the fault is an optional customer selection.
E	1318	Configurable	Customer Fault Input 4	The nature of the fault is an optional generator set input.
B	1416*	Warning	FAIL TO SHUTDOWN	Indicates that a shutdown fault is active, but is being bypassed by Battle Short.
A	1417	Shutdown	FAILURE TO POWER DOWN	Indicates the control is powered up after attempting to go to sleep.
D	1433	Shutdown	LOCAL EMERGENCY STOP	Indicates a Local Emergency Stop has been activated.
D	1434	Shutdown	REMOTE EMERGENCY STOP	Indicates a Remote Emergency Stop has been activated.
D	1435**	Warning	LOW COOLANT TEMP	Indicates that the engine coolant temperature is below the adjusted setpoint. This may indicate that the coolant heater is not operating or is not circulating coolant.
D	1438	Shutdown	FAIL TO CRANK	The generator set has failed to sense rotation for two start attempts. This indicates a possible fault with the control, speed sensing, or the starting system.
D	1442**	Warning	WEAK BATTERY	Indicates that the generator set battery voltage is below battery thresholds during cranking.
A	1446**	Shutdown	HIGH AC VOLTAGE	Indicates that one or more measured AC output voltages have exceeded the threshold for longer than a specified time limit. The threshold and time limits are 130% of nominal for zero seconds or 110% of nominal for ten seconds.
A	1447**	Shutdown	LOW AC VOLTAGE	Indicates that the measured AC output voltage is below the threshold for longer than a specified time limit. The threshold and time limits are 85% of nominal for ten seconds.
A	1448**	Shutdown	UNDER FREQUENCY	Indicates that the alternator frequency is 6 Hz under the nominal frequency.
A	1449**	Shutdown	OVER FREQUENCY	Indicates that the alternator frequency is 6 Hz above the nominal frequency.
A	1469**	Shutdown	SPEED HZ MATCH	Indicates that measured engine speed and measured alternator AC output frequency do not agree.
<p>* For more information on these events, refer to the Battle Short Mode description in <a href="#">Section 4</a>.</p> <p>** Any values listed in the Description column for these faults are default values.</p> <p>^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>				

CTG	CODE	LAMP	DISPLAYED MESSAGE	DESCRIPTION
B	1471**	Warning	HIGH AC CURRENT	Indicates that the alternator output current (one or more phases) has exceeded safe operating limits.
A	1472**	Shutdown	HIGH AC CURRENT	Indicates that the alternator output current (one or more phases) has exceeded the alternator's current rating.
C	1845	Warning	WATER IN FUEL OOR HIGH	Indicates the water in fuel sensor is out of range (OOR), high.
C	1846	Warning	WATER IN FUEL OOR LOW	Indicates the water in fuel sensor is out of range (OOR), low.
D	1852	Warning	WATER IN FUEL	Indicates that the water in fuel is above normal and has reached the warning trip point.
E	1853	Configurable	Annunciator Fault 2	The nature of the annunciator fault is an optional customer selection.
E	1854	Configurable	Annunciator Fault 3	The nature of the annunciator fault is an optional customer selection.
E	1855	Configurable	Annunciator Fault 1	The nature of the annunciator fault is an optional customer selection.
E	1944	Warning	ANNUNCIATOR OUTPUT CONFIGURATION ERROR	Indicates a mismatch in the configuration of one of the annunciator relay outputs.
D	1965^	Warning	EXHAUST TEMPERATURE OOR	Indicates the exhaust temperature sensor is out of range (OOR), high or low. (Aux 101 I/O option).
B	1992	Warning	ENGINE OVERSPEED	Indicates that the engine has exceeded normal operating speed. The default thresholds are 1725 RPM (50Hz) or 2075 RPM (60Hz). (ECM fault code).
C	2224^	Warning	FUEL LEVEL OOR	Indicates the fuel level sensor is out of range (OOR), high or low. (Aux 101 I/O option).
A	2335	Shutdown	EXCITATION FAULT	Indicates that a loss of voltage or frequency sensing from the generator has occurred.
C	2398^	Warning	AMBIENT TEMPERATURE OOR	Indicates the ambient temperature sensor is out of range (OOR), high or low. (Aux 101 I/O option).
<p>* For more information on these events, refer to the Battle Short Mode description in <a href="#">Section 4</a>.</p> <p>** Any values listed in the Description column for these faults are default values.</p> <p>^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>				

CTG	CODE	LAMP	DISPLAYED MESSAGE	DESCRIPTION
C	2542^	Warning	VOLTAGE BIAS OOR	Indicates the voltage bias circuit output is out of range (OOR), high or low. (Aux 101 I/O option).
A	2545	Shutdown	KEYSWITCH RESET REQUIRED	Indicates a datalink failure. Communications are lost between the PowerCommand® 2.2 control and the engine control module.
E	2619^	Diagnostic	AUX 101 ANALOG INPUT 1	The nature of the Base I/O Module event is an optional customer selection. (Aux 101 I/O Module option). Each event function can be programmed (using InPower service tool or access to the Setup menu), as follows: a) Change display name using up to 32 characters b) Select active low or high input.
E	2621^	Diagnostic	AUX 101 ANALOG INPUT 2	See code 2619
E	2622^	Diagnostic	AUX 101 ANALOG INPUT 3	See code 2619
E	2623^	Diagnostic	AUX 101 ANALOG INPUT 4	See code 2619
E	2624^	Diagnostic	AUX 101 ANALOG INPUT 5	See code 2619
E	2625^	Diagnostic	AUX 101 ANALOG INPUT 6	See code 2619
E	2626^	Diagnostic	AUX 101 ANALOG INPUT 7	See code 2619
E	2627^	Diagnostic	AUX 101 ANALOG INPUT 8	See code 2619
E	2628^	Diagnostic	AUX 102 DIGITAL INPUT 9	The nature of the Aux I/O Module event is an optional customer selection. (Aux 102 I/O Module option). Each event function can be programmed (using InPower service tool or access to the Setup menu), as follows: a) Change display name using up to 32 characters b) Select active low or high input.
E	2629^	Diagnostic	AUX 102 DIGITAL INPUT 10	See code 2628
<p>* For more information on these events, refer to the Battle Short Mode description in <a href="#">Section 4</a>.</p> <p>** Any values listed in the Description column for these faults are default values.</p> <p>^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>				

CTG	CODE	LAMP	DISPLAYED MESSAGE	DESCRIPTION
E	2631^	Diagnostic	AUX 102 DIGITAL INPUT 11	See code 2628
E	2632^	Diagnostic	AUX 102 DIGITAL INPUT 12	See code 2628
A	2676	Shutdown	ALTERNATOR FREQUENCY CONFLICT	Indicates the measured alternator line frequency and measured alternator excitation frequency do not agree.
A	2677	Shutdown	FAIL TO STOP	The generator set continues to run after receiving a stop command from the controller.
B	2678**	Warning	CHARGER FAILURE	Indicates the battery charging alternator has not reached an acceptable voltage range within the selected time period (default is 120 seconds). This warning is also displayed if your alternator is a type that does not support the control's charging alternator logic functionality. If this occurs, this warning can be disabled if the Charging Alt. Enable setting is set to "No".
C	2693^	Warning	SPEED BIAS OOR	Indicates the speed bias circuit output is out of range (OOR), high or low. (Aux 101 I/O Module option).
C	2694^	Warning	ALTERNATOR RTD OOR	Indicates the alternator RTD sensor is out of range (OOR), high or low. (Aux 101 I/O Module option).
A	2696^	Shutdown	ALTERNATOR RTD TEMP HIGH	Indicates the alternator temperature is above normal and has reached the shutdown trip point. (I/O Module option).
C	2729^	Warning	I/O MODULE LOST	Indicates an intermittent datalink between the I/O module and the control board. (Aux 101 I/O Module option).
C	2731	Shutdown	I/O MODULE LOST	Indicates the datalink between the I/O module and the control board is lost. (Aux 101 I/O Module option).
<p>* For more information on these events, refer to the Battle Short Mode description in <a href="#">Section 4</a>.</p> <p>** Any values listed in the Description column for these faults are default values.</p> <p>^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>				

CTG	CODE	LAMP	DISPLAYED MESSAGE	DESCRIPTION
A	2897	Shutdown	FACTORY BLOCK CORRUPT	Indicates a fatal software error occurred in the PowerCommand®2.2 control.
A	2898	Warning	PERIODIC/FAULT CORRUPT	Indicates that either the periodic data file or the fault history file has been corrupted. Remove and re-apply power to the control to clear the fault. (Periodic and/or fault history data will be lost after re-setting the control).
A	2899	Shutdown	USER BLOCK CORRUPT	Indicates a fatal software error occurred in the PowerCommand®2.2 control.
A	2911	Shutdown	TRIM BLOCK CORRUPT	Indicates a fatal software error occurred in the PowerCommand®2.2 control.
D	2964	Warning	INTAKE MANIFOLD TEMPERATURE HIGH	Indicates engine has begun to overheat (intake manifold temperature has risen to an unacceptable level). Increase in load or higher ambient temperature may cause Intake Manifold Temp High (code 155) shutdown.
A	2972**	Shutdown	FIELD OVERLOAD	Indicates that the Field Voltage has been above 70V for eight seconds.
<p>* For more information on these events, refer to the Battle Short Mode description in <a href="#">Section 4</a>.</p> <p>** Any values listed in the Description column for these faults are default values.</p> <p>^ These faults are available only if your installation includes the optional I/O Module (Kit 541-1291)</p>				

## 7.6.4 Customer Input Faults

Dependent on Customer Options specified, the Customer Input Faults may indicate the following:

<b>ACTUAL TEXT SHOWN</b>	<b>TRANSLATION</b>
<b>Earth Fault</b>	Earth Fault
<b>Low Fuel</b>	Low Fuel
<b>High Fuel</b>	High Fuel
<b>High Alternator Temperature</b>	High Alternator Temperature

Dependent on the number of Customer Options required, an adjacent display panel may be fitted where these Faults will be displayed.

Table 4 Troubleshooting Procedures for Fault Codes

FAULT CODE		CORRECTIVE ACTION – *(IF IN DOUBT, CALL YOUR AUTHORISED SERVICE ENGINEER)
CODE: LAMP: MESSAGE:	<b>143</b> <b>Warning</b> <b>PRE-LOW OIL PRESSURE</b>	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 the fault code 415 procedure.
CODE: LAMP: MESSAGE:	<b>146</b> <b>Warning</b> <b>PRE-HIGH COOL TEMP</b>	Indicates engine is operating near cooling system capacity. Increase in load or higher ambient temperature may cause High Coolant Temp (151) shutdown. Review fault code 151 correction list for other possible causes.
CODE: LAMP: MESSAGE:	<b>151</b> <b>Shutdown</b> <b>HIGH COOLANT TEMP</b>	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) Look for possible coolant leakage points and repair if necessary. Check coolant level and replenish if low. 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.
CODE: LAMP: MESSAGE:	<b>155</b> <b>Shutdown</b> <b>INTAKE MANIFOLD TEMP HIGH</b>	Indicates engine has overheated (intake manifold temperature has risen above the shutdown trip point). Large load or high ambient temperature may be the cause. Review fault code 151 correction list for other possible causes.
CODE: LAMP: MESSAGE:	<b>197</b> <b>Warning</b> <b>COOLANT LEVEL LOW</b>	Indicates engine coolant level has fallen below the trip point. If generator is powering critical loads and cannot be shut down, wait until next shutdown period. If engine can be stopped allow engine to cool down completely before proceeding: a) Look for possible coolant leakage points and repair if necessary. Check coolant level and replenish if low. b) Reset control and restart after locating and correcting problem.

FAULT CODE		CORRECTIVE ACTION – *(IF IN DOUBT, CALL YOUR AUTHORISED SERVICE ENGINEER)
CODE: LAMP: MESSAGE:	<b>359</b> <b>Shutdown</b> <b>Fail to Start</b>	Indicates possible fuel system or air induction problem. (Engine cranks but fails to start). Allow engine to cool down completely before proceeding with the following checks: a) Check for empty fuel tank, fuel leaks, or blocked fuel lines and correct as required. b) Check for dirty fuel filter and replace if necessary. c) Check for dirty or blocked air filter and replace if necessary. d) Reset control and restart after correcting the problem.
CODE: LAMP: MESSAGE:	<b>415</b> <b>Shutdown</b> <b>LOW OIL PRESSURE</b>	Indicates engine oil pressure has dropped below the shutdown trip point. Allow engine to cool down completely before proceeding with the following checks: a) Check the oil level, lines and filters. b) If the oil system is OK but the oil level is low, replenish. c) Reset control and restart after locating and correcting problem.
CODE: LAMP: MESSAGE:	<b>441</b> <b>Warning</b> <b>LOW BAT VOLTAGE</b>	Indicates battery voltage supply to the control is approaching a low level at which unpredictable operation will occur. If engine can be stopped allow engine to cool down completely before proceeding: a) Poor battery cable connections. Clean the battery cable terminals and tighten all connections. b) Check battery charge voltage float level if applicable (raise float level). c) Discharged or defective battery; Check the battery charger fuse; Recharge or replace the battery.
CODE: LAMP: MESSAGE:	<b>442</b> <b>Warning</b> <b>HIGH BAT VOLTAGE</b>	Indicates battery voltage supply to the control is approaching a high level at which damage to the control can occur. If engine can be stopped allow engine to cool down completely before proceeding: a) Poor battery cable connections. Clean the battery cable terminals and tighten all connections. b) Check battery charge float level if applicable (lower float level).
CODE: LAMP: MESSAGE:	<b>488</b> <b>Shutdown</b> <b>INTAKE MANIFOLD TEMP HIGH</b>	Indicates engine has overheated (intake manifold temperature has risen above the shutdown trip point). Large load or high ambient temperature may be the cause. Review fault code 151 correction list for other possible causes.

FAULT CODE		CORRECTIVE ACTION – *(IF IN DOUBT, CALL YOUR AUTHORISED SERVICE ENGINEER)
CODE: LAMP: MESSAGE:	<b>1117</b> <b>Warning</b> <b>ECM POWER LOST</b>	Indicates that 'Keyswitch' to the ECM was NOT removed for 30 seconds before removing battery power to the ECM (removing battery cable). To reset: a) Press the Stop button and press Emergency Stop button and wait for 30 seconds. b) Re-set Emergency Stop and select operating mode (manual or remote).
CODE: LAMP: MESSAGE:	<b>1131</b> <b>Warning</b> <b>BATTLE SHORT ACTIVE</b>	Indicates that the control is in Battle Short mode – used to bypass several fault shutdowns therefore allowing generator set operation during emergencies.
CODE: LAMP: MESSAGE:	<b>1311, 1312, 1317, 1318</b> <b>Configurable</b> <b>CONFIGURABLE INPUT 1, 2, 3, 4</b>	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 InPower service tool or access to Setup menu), as follows: a) Event, Warning or Shutdown level if Function Select = Fault Input. b) Change display name using up to 32 characters
CODE: LAMP: MESSAGE:	<b>1416</b> <b>Warning</b> <b>FAIL TO SHUTDOWN</b>	The generator set continues to run after receiving a shutdown command from the controller. The Battle Short feature is enabled – this is used to bypass several critical fault shutdowns therefore allowing generator set operation during emergencies.
CODE: LAMP: MESSAGE:	<b>1433/1434</b> <b>Shutdown</b> <b>E-STOP - LOCAL</b> <b>E-STOP - REMOTE</b>	Indicates local or remote Emergency Stop. Emergency Stop shutdown status can be reset only at the local control panel. After locating and correcting problem, reset the local/remote Emergency Stop button as follows: a) De-activate (disable) emergency stop button. b) Press the Stop button. c) Select the desired operating mode (manual or remote).

FAULT CODE		CORRECTIVE ACTION – *(IF IN DOUBT, CALL YOUR AUTHORISED SERVICE ENGINEER)
CODE: LAMP: MESSAGE:	<b>1435</b> <b>Warning</b> <b>LOW COOLANT TEMP</b>	Indicates engine coolant heater is not operating or is not circulating coolant. If engine can be stopped allow engine to cool down completely before proceeding with the following checks: a) The coolant heater is not connected to power supply. Check for blown fuse or disconnected heater cable and correct as required. b) Look for possible coolant leaks and repair as required. Check for low coolant level and replenish if required.  Set is not operating. Warning occurs when engine coolant temperature is 21°C (70°F) or lower. <b>NOTE: In applications where the ambient temperature falls below 4°C (40°F), Low Coolant Temp may be indicated even though the coolant heaters are operating.</b>
CODE: LAMP: MESSAGE:	<b>1438</b> <b>Shutdown</b> <b>FAIL TO CRANK</b>	Indicates a possible fault with control, speed sensing, or starting system. See code 441 for corrective action.
CODE: LAMP: MESSAGE:	<b>1442</b> <b>Warning</b> <b>WEAK BATTERY</b>	Indicates that during cranking, the battery voltage is at, or below, the weak battery warning trip point for a time greater than, or equal to, the weak battery set time. See code 441 for corrective action.
CODE: LAMP: MESSAGE:	<b>1448</b> <b>Shutdown</b> <b>UNDER FREQUENCY</b>	Indicates that the generator set frequency has dropped below 90% of nominal for approximately ten seconds. Allow engine to cool down completely before proceeding with the following checks: a) Check the fuel supply. b) Check the air intake supply. c) Check the load and correct any overload.
CODE: LAMP: MESSAGE:	<b>1852</b> <b>Warning</b> <b>WATER IN FUEL</b>	Indicates that the water in the fuel is above normal and has reached the warning trip point. If engine can be stopped allow engine to cool down completely before proceeding with the following checks: a) Check fuel in tank (local or remote). b) Drain and re-fill if necessary. c) Be aware of all Health and Safety, and environmental issues if draining tank.
CODE: LAMP: MESSAGE:	<b>2964</b> <b>Warning</b> <b>HIGH INTAKE MANIFOLD TEMP</b>	Indicates engine is operating near system capacity. Increase in load or high ambient temperature may cause High Intake Manifold Temperature (155) shutdown. If engine can be stopped allow engine to cool down completely before proceeding with the following checks: a) Review fault code 151 correction list for other possible causes.



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