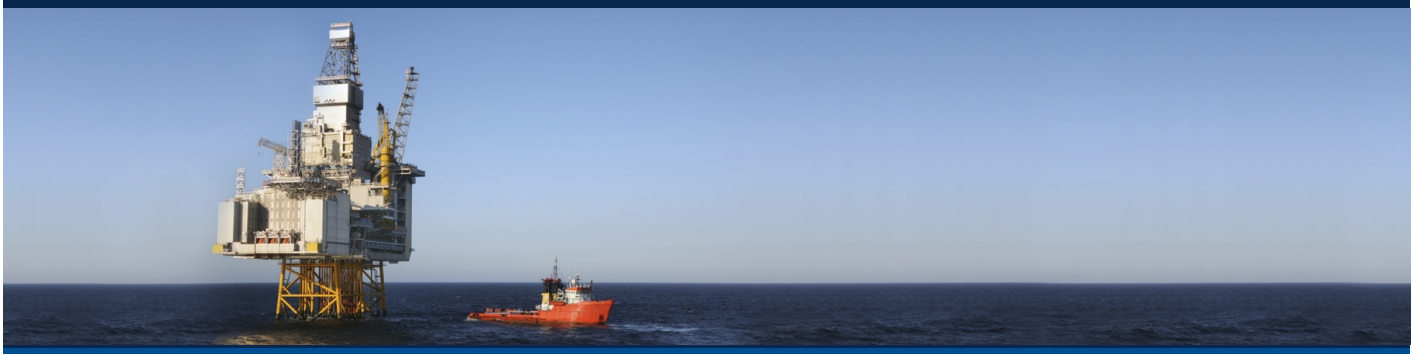
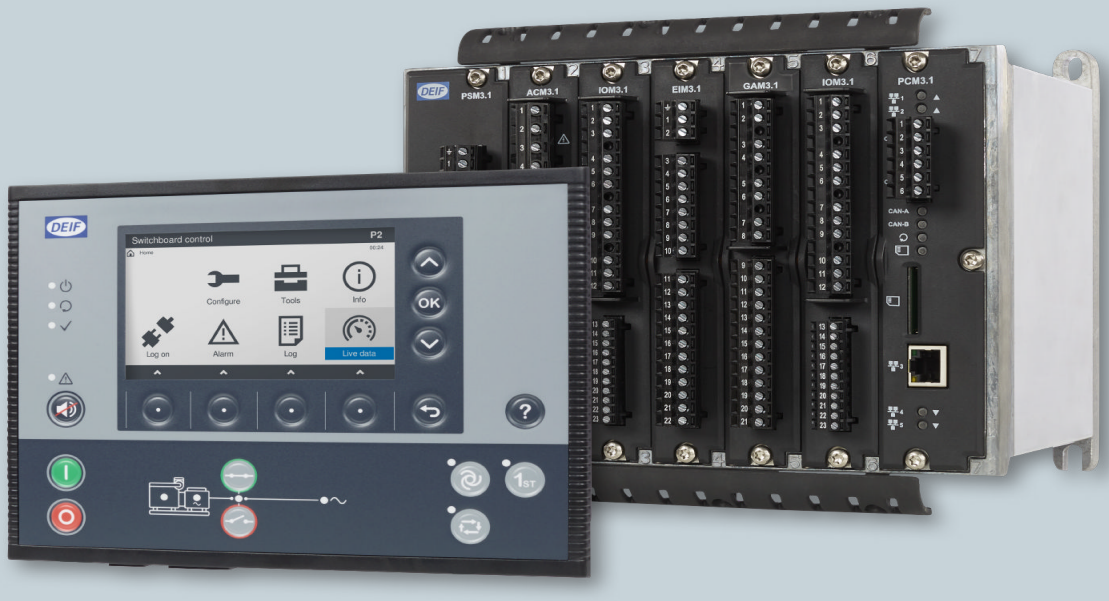
-power in control

OPERATOR'S MANUAL



Protection and Power Management
PPM 300



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Document no.: 4189340910B

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1. Introduction

1.1 About the Operator's manual

1.1.1 Intended users of the Operator's manual

This is the operator's manual for DEIF's Protection and Power Management controller, PPM 300. The manual is for the operator who uses the controller display unit. The manual includes an introduction to the display unit (LEDs, push-buttons and screen), basic operator tasks, alarms, logs, more advanced operator tasks, and trouble shooting. The information in this manual is simplified and general.

See the **Designer's handbook** for more detailed information and descriptions..

DANGER!
Read this manual before you operate the system. Failure to do this could result in personal injury and damage to the equipment.

1.1.2 Software version

The information in this document corresponds to software version 1.0.0.0.

1.1.3 Technical support

You can read about service and support options on the DEIF website, www.deif.com. You can also find contact details on the DEIF website.

You have the following options if you need technical support:

- Help: The display unit includes context-sensitive help.
- Technical documentation: Download all the product technical documentation from the DEIF website: www.deif.com/documentation
- Training: DEIF regularly offers training courses at the DEIF offices worldwide.
- Support: DEIF offers 24-hour support. See www.deif.com for contact details. There may be a DEIF subsidiary located near you. You can also e-mail support@deif.com.
- Service: DEIF engineers can help with design, commissioning, operating and optimisation.

1.1.4 List of technical documentation for PPM 300

Document	Contents
Data sheet	• System description and functions • Technical specifications • Each controller type ◦ Applications, hardware, functions and protections • Hardware modules, display unit, and accessories • Ordering information
Designer's handbook	• System principles • AC configuration and nominal settings • Protections and alarms • Breakers, synchronisation and de-loading • Regulation • Power management • Each controller type ◦ Principles, sequences, functions and protections • Hardware characteristics • PICUS (PC software) • CustomLogic • Communication protocols
Installation instructions	• Tools and materials • Mounting • Minimum wiring for each controller type • Wiring for hardware module terminals • Wiring for controller functions • Wiring communication • Wiring the display unit
Commissioning guidelines	• Tools, software and information required • Controller, system and equipment checks • Regulator tuning • System testing • Troubleshooting
Operator's manual	• Controller equipment (push-buttons and LEDs) • Operating the system • Alarms and log • Using the display unit • Troubleshooting and maintenance

1.2 Warnings and safety

1.2.1 Safety during installation and operation

Installing and operating the equipment may require work with dangerous currents and voltages. The installation must only be carried out by authorised personnel who understand the risks involved in working with electrical equipment.

DANGER!
Hazardous live currents and voltages. Do not touch any terminals, especially the AC measurement inputs and the relay terminals. Touching the terminals could lead to injury or death.

1.2.2 Automatic and remote-controlled starts

The power management system automatically starts gensets when more power is needed. It can be difficult for an inexperienced operator to predict which gensets will start. In addition, gensets can be started remotely (for example, by using an Ethernet connection, or a digital input). To avoid personal injury, the genset design, the layout, and maintenance procedures must take this into account.

1.2.3 Switchboard control

The controllers are designed to normally run under power management system control. When switchboard control is activated, the controller functions as follows:

- It responds if an alarm situation arises, and carries out the alarm action, since the protections are still active.
- It does not respond to a blackout.
- It does not provide any power management.
- It does not prevent any operator actions.

The switchboard design must therefore ensure that the system is sufficiently protected when the controller is under switchboard control.

1.2.4 Controller power supply

If the controller has no power supply, it is OFF and does not provide any protection to the system. The controller cannot enforce any trips, shutdowns or latches when it is off. The controller does not provide any control or power management. All the controller relays de-energise.

The controller must have a reliable power supply, which must include a backup power supply. In addition, the switchboard design must ensure that the system is sufficiently protected if the controller power supply fails.

1.2.5 Factory settings

The controller is delivered pre-programmed from the factory with a set of default settings. These settings are based on typical values and may not be correct for your system. You must therefore check all parameters before using the controller.

1.2.6 Electrostatic discharge

You must protect the equipment terminals from static discharge during handling, including installation and dismounting. Once the equipment is correctly installed and the frame ground is connected, it is no longer necessary to protect the terminals from static discharge.

1.3 Legal information

1.3.1 Disclaimers

DEIF takes no responsibility for the installation or operation of the **genset**. Contact the **genset company** if you have any doubt about how to install or operate the genset.

CAUTION
The DEIF equipment must not be opened by unauthorised personnel. If opened, the warranty is void.

INFO
You may remove, replace, or add a hardware module to the controller rack without losing the warranty. However, you must follow DEIF's procedure.

Disclaimer
DEIF A/S reserves the right to change any of the contents of this document without prior notice.

1.3.2 Open source software

This product contains open source software licensed under, for example, the GNU General Public License (GNU GPL) and GNU Lesser Public License (GNU LGPL). The source code for this software can be obtained by contacting DEIF at support@deif.com. DEIF reserves the right to charge for the cost of the service.

1.3.3 Trademarks

DEIF, power in control and the DEIF logo are trademarks of DEIF A/S.

EtherCAT® is a registered trademark and patented technology, licenced by Beckhoff Automation GmbH, Germany.

Modbus is a registered trademark of Schneider Automation Inc.

Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

All trademarks are the properties of their respective owners.

1.3.4 Copyright

2. Overview of the system

2.1 Overview

2.1.1 Operating the PPM 300 controllers

The PPM 300 controllers ensure that the power required is available and that the system is protected for typical marine applications.

Only qualified people may install and commission the controllers. After the controllers are installed and commissioned, they are easy to operate.

Power management system (PMS) control
As far as possible, the controllers should all normally run under PMS control.

As far as possible, the GENSET controllers should all normally run in automatic mode (AUTO). In this mode, the PMS automatically starts and stops gensets, according to the power requirements. The PMS also automatically closes and opens the genset breakers to the busbar, to connect and disconnect the gensets as needed.

The SHAFT generator, SHORE connection and BUS TIE breaker controllers normally run under PMS control. For safety reasons, these controllers will not normally automatically connect to a shaft generator or shore connection, or automatically close a bus tie breaker. An operator action is needed to start these actions. Once the operator starts the action, the controller automatically follows a pre-programmed sequence of actions.

The GENSET and EMERGENCY genset controllers can run in either AUTO or a semi-automatic (SEMI) mode. These are both PMS modes. SEMI mode is a type of service mode. In SEMI mode, an operator action is needed to start or stop the genset. An operator action is also needed to start the pre-programmed sequence to close or open the genset breaker to the busbar.

Switchboard control
Each controller can also be put under switchboard control. The operator then manually controls the genset speeds and opens and closes breakers. Switchboard control is useful for troubleshooting. It can also be useful in extreme circumstances if the operator needs to override the control system. Under switchboard control, all the controller functions are disabled. However, the controller protections are still active. The controller monitors the operation, and if an alarm condition arises, the controller activates the alarm action.

Push-buttons and LEDs
The operator can use the display unit push-buttons to operate the system. This includes changing modes, selecting actions to start pre-programmed sequences, changing genset priority, and silencing alarms. The push-buttons to start or stop the genset, or close or open the breaker(s), are only active in SEMI mode.

The operator can look at the display unit LEDs to see the status of each part of the system.

Display unit screen *
The operator can monitor system operation on the display unit screen. The operator can also use the soft key buttons and the display unit screen to log into the controller. The operator can then see the alarm lists and logs, and acknowledge and unlatch alarms. The operator can also see or change the controller configuration.

PICUS *
PICUS - Power In Control Utility Software

PICUS is the PC programming and monitoring tool, available from DEIF free of charge. The operator can connect a computer with PICUS to the controller by using a direct connection. The operator can then log into the controller. When the operator logs on, they can use PICUS to monitor operation, send commands that correspond to the push-button actions, manage alarms, and see or change the controller configuration. *

* Both the display unit and PICUS are controlled by user level permissions which grant or restrict access to features of the controller. Some features or functions may not be accessible to an operator depending upon the design of the controller permissions.

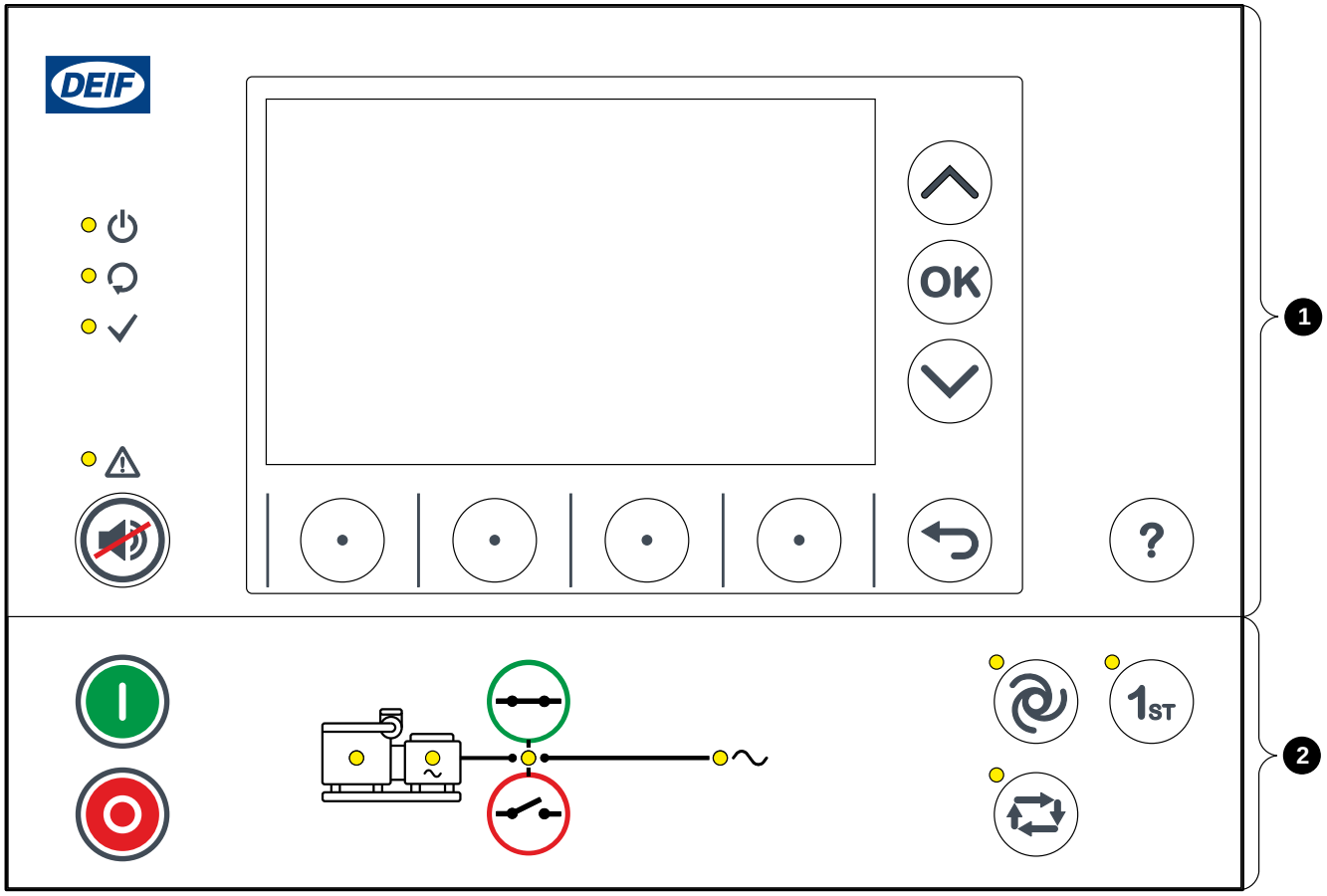
3. Controller equipment

3.1 Display unit

3.1.1 Introduction to the display unit

The front of the display unit consists of a top part and a bottom strip.

Figure 3.1 Display unit for a GENSET controller



No.	
1	Top part
2	Bottom strip

The LEDs and push-buttons for the top part are the same for all controller types. The LEDs, push-buttons and picture on the bottom strip vary according to the controller type. These are described below.

3.1.2 Display unit LEDs and push-buttons

The top part of the front of the display unit is the same for all controller types. It includes LEDs that show the controller status and a push-button to silence the alarm horn. The other push-buttons allow the operator to see controller information on the display unit screen. The actual information available to the operator depends upon the permission access for the operator's log on profile.* Using the push-buttons and the screen, the operator can see Live Data, or see, acknowledge and unlatch alarms. If the operator logs in with the right permission level, he can also change the controller configuration.

* Some features or functions of the display unit may only be accessible if the user profile logged on has the necessary permission access.

Figure 3.2 Display unit LEDs and push-buttons

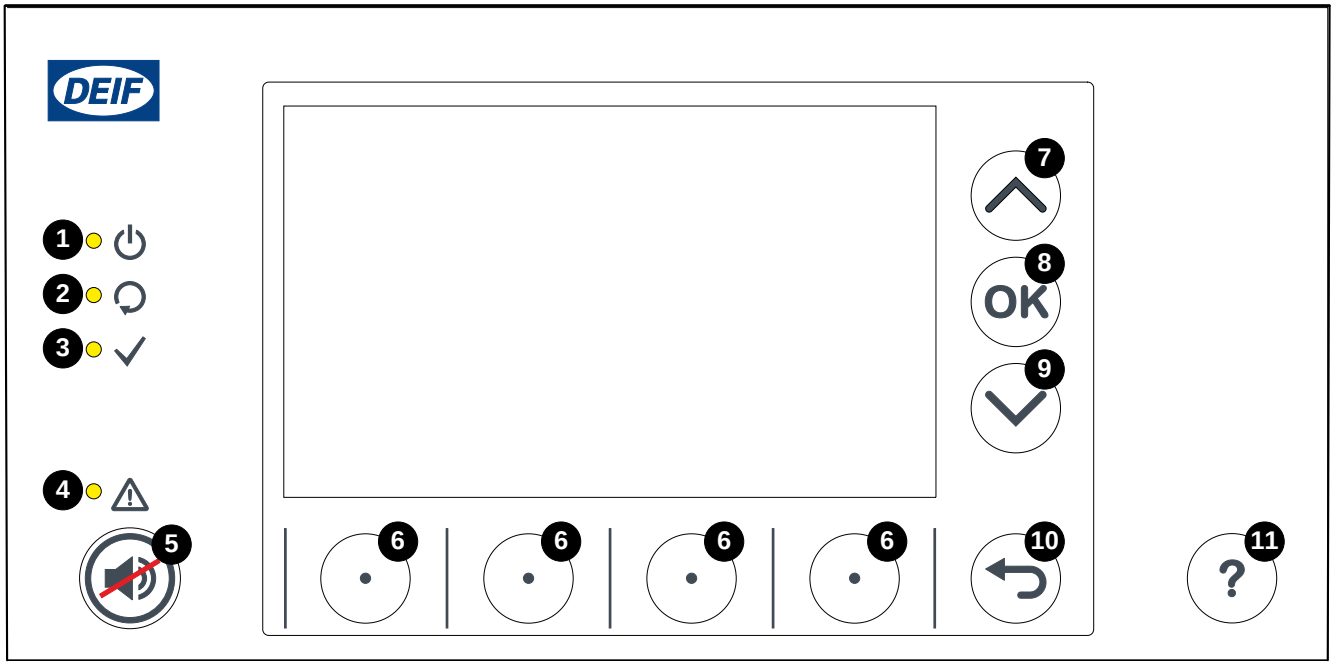


Table 3.1 Display unit LED functions

No.	Name	Function
1	Display unit power OK	**Green**: the display unit power is OK. **OFF**: the display unit power is not OK.
2	Self-check OK	**Green**: the controller self-check is OK. **OFF**: the controller self-check is not OK, or there is no connection to the controller
3	Ready for operation	**Green**: the controller is in AUTO or SEMI mode, and there is no alarm action (for example, shutdown, trip or block) that prevents the controlled equipment from supplying power. **OFF**: the controller is under SWBD control, or there is an alarm action that prevents the controlled equipment from supplying power.
4	Alarm	**Red (constant)**: Alarm(s) active, and all alarms acknowledged **Red (flashing)**: Unacknowledged alarm(s) **Yellow**: Unlatched alarms can be reset (when no other alarms require action) **Green (flashing)**: Only unacknowledged alarm(s) where the alarm condition has cleared **Green (constant)**: No alarms

INFO
The display unit LEDs show the status of the controller, and not the status of the display unit. The display unit screen is lit if the display unit has power. The display unit screen is not lit if there is no power supply.

Table 3.2 Display unit push-button functions

No.	Name	Button	Function
5	Horn silence		Stop the alarm output immediately. Long press (> 0.5 s): Go to the alarms page.
6	Soft key		Move the selector to a different column, or select the soft key shown on the screen.
7	Up		Move the selector up on the screen.
8	OK		Confirm the selection on the screen.
9	Down		Move the selector down on the screen.
10	Back		Short press (< 0.5 s): Go to the previous page. Long press (> 0.5 s): Go to the home page.
11	Help		Short press (< 0.5 s): Display help. Long press (> 0.5 s): Go to Live data.

3.1.3 GENSET controller LEDs and push-buttons

The bottom strip of the front of the display unit is customised for the GENSET controller. It includes LEDs that show the equipment and controller status, as well as push-buttons for operator actions.

GENSET controller LEDs

Figure 3.3 GENSET controller display unit LEDs

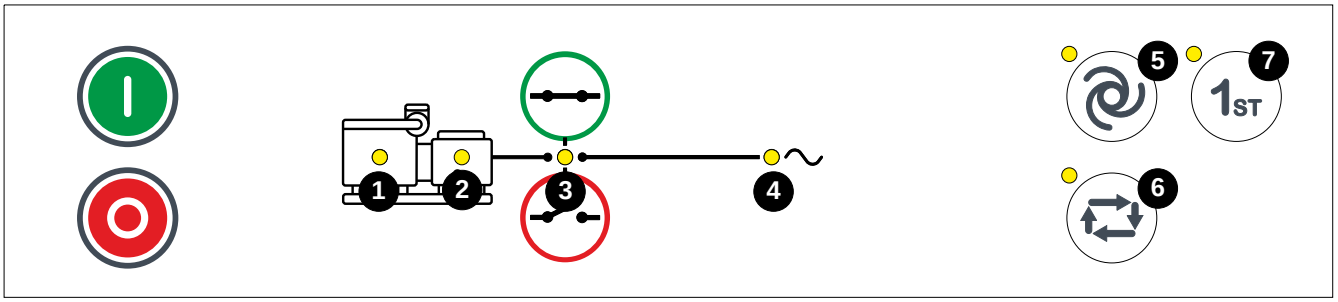


Table 3.3 GENSET controller LED functions

No.	Name	Function
1	Engine	**Green**: There is running feedback. Oil pressure, RPM, frequency above configured limit. **Green (flashing)**: Engine is becoming ready. **OFF**: The engine is not running, or there is no running feedback.
2	Generator	**Green**: The generator voltage and frequency are OK, and the controller can synchronise and close the breaker. **Green (flashing)**: The generator voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. **Yellow**: The generator voltage and frequency are measurable, but not OK. The controller cannot close the breaker. **OFF**: The generator voltage is too low to measure.
3	Breaker	**Green**: The breaker is closed. **Yellow**: The breaker spring is charging (only applies to a compact breaker). **Yellow (flashing)**: The controller is synchronising or de-loading the breaker. **Red**: The controller tripped the breaker, and the trip alarm is unacknowledged and/or the alarm condition is still present. **OFF**: The breaker is open.
4	Busbar	**Green**: The busbar voltage and frequency are OK, and the controller can synchronise and close the breaker. **Green (flashing)**: The busbar voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. **Yellow**: The busbar voltage and frequency are measurable, but not OK. **Red**: The busbar voltage is too low to measure (for example, during a blackout). The controller can close the breaker.
5	AUTO mode	**Green**: The controller is in AUTO mode. **OFF**: The controller is not in AUTO mode.
6	SEMI mode	**Green**: The controller is in SEMI mode. **OFF**: The controller is not in SEMI mode.
7	1st priority	**Green**: The genset has the first priority in the genset start order in the power management system. **Yellow**: The genset is next in the genset start order in the power management system. **OFF**: Another genset has first priority, or the power management system automatically calculates the genset priority, or the controller is under SWBD control.

GENSET controller push-buttons

Figure 3.4 GENSET controller display unit push-buttons

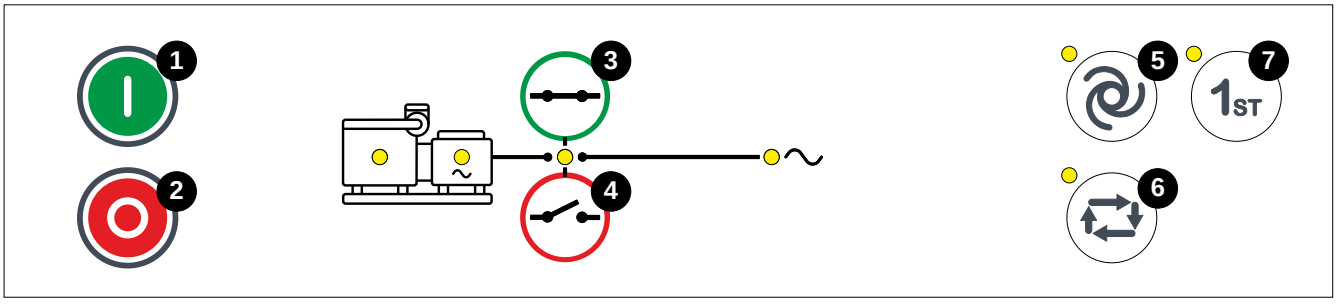


Table 3.4 GENSET controller push-button functions

No.	Name	Function
1	Genset start	**SEMI mode**: The controller starts the genset start sequence. **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.
2	Genset stop	**SEMI mode**: The controller starts the genset stop sequence. **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.
3	Close breaker	**SEMI mode**: The controller starts the breaker close sequence. **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.
4	Open breaker	**SEMI mode**: The controller starts the breaker open sequence (if the PMS allows this). **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.
5	AUTO mode	**SEMI mode**: The controller changes to AUTO mode. **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.
6	SEMI mode	**AUTO mode**: The controller changes to SEMI mode. **SEMI mode or Switchboard control**: The controller ignores the input from this push-button.
7	1st priority	The controller gives the genset the first priority in the genset start order in the power management system.

3.1.4 EMERGENCY genset controller LEDs and push-buttons

The bottom strip of the front of the display unit is customised for the EMERGENCY genset controller. It includes LEDs that show the equipment and controller status, as well as push-buttons for operator actions.

EMERGENCY genset controller LEDs

Figure 3.5 EMERGENCY genset controller display unit LEDs

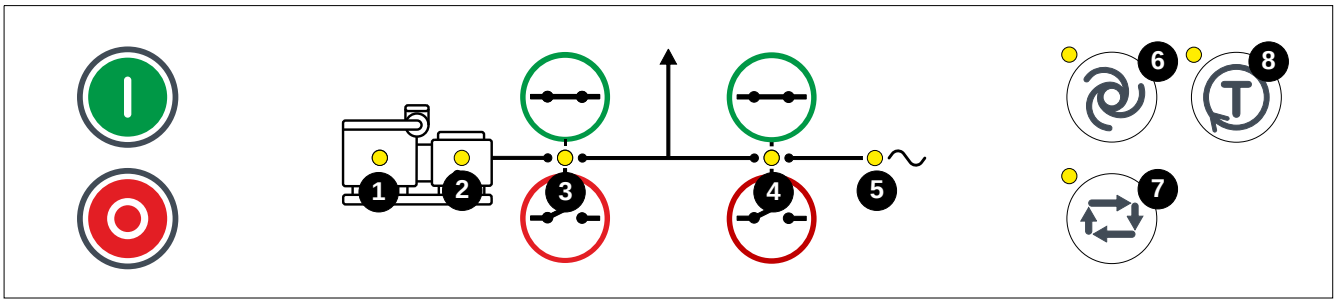


Table 3.5 EMERGENCY genset controller LED functions

No.	Name	Function
1	Engine	**Green**: There is running feedback. **OFF**: The engine is not running, or there is no running feedback.
2	Generator	**Green**: The generator voltage and frequency are OK, and the controller can synchronise and close the breaker. **Green (flashing)**: The generator voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. **Yellow**: The generator voltage and frequency are measurable, but not OK. The controller cannot close the breaker. **OFF**: The generator voltage is too low to measure.

No.	Name	Function
3	Breaker	**Green**: The breaker is closed. **Yellow**: The breaker spring is charging (only applies to a compact breaker). **Yellow (flashing)**: The controller is synchronising or de-loading the breaker. **Red**: The controller tripped the breaker, and the trip alarm is unacknowledged and/or the alarm condition is still present. **OFF**: The breaker is open.
4	Tie breaker	**Green**: The tie breaker is closed. **Yellow**: The tie breaker spring is charging (only applies to a compact breaker). **Yellow (flashing)**: The controller is synchronising or de-loading the tie breaker. **Red**: The controller tripped the tie breaker, and the trip alarm is unacknowledged and/or the alarm condition is still present. **OFF**: The tie breaker is open.
5	Busbar	**Green**: The busbar voltage and frequency are OK, and the controller can synchronise and connect to the busbar. **Green (flashing)**: The busbar voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot connect to the busbar. **Yellow**: The busbar voltage and frequency are measurable, but not OK. **Red**: The busbar voltage is too low to measure (for example, during a blackout). The controller can connect to the busbar.
6	AUTO mode	**Green**: The controller is in AUTO mode. **OFF**: The controller is not in AUTO mode.
7	SEMI mode	**Green**: The controller is in SEMI mode. **OFF**: The controller is not in SEMI mode.
8	Test	**Green**: The controller is running a test sequence (starts the emergency generator, and synchronises and closes the generator breaker). The actual test depends on the test configuration in the controller. **OFF**: The controller is not running a test.

EMERGENCY genset controller push-buttons

Figure 3.6 EMERGENCY genset controller display unit push-buttons

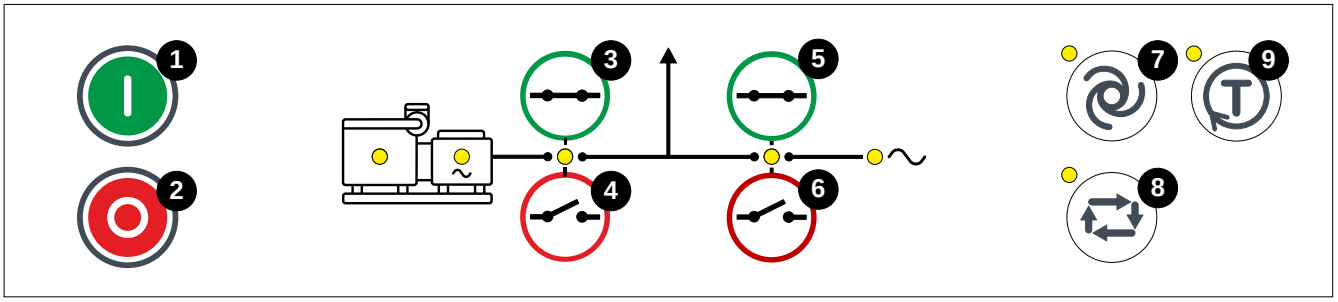


Table 3.6 EMERGENCY genset controller push-button functions

No.	Name	Function
1	Genset start	**SEMI mode**: The controller starts the genset start sequence. **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.
2	Genset stop	**SEMI mode**: The controller starts the genset stop sequence. **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.

No.	Name	Function
3	Close breaker	**SEMI mode**: The controller starts the breaker close sequence. **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.
4	Open breaker	**SEMI**: The controller starts the breaker open sequence (if the PMS allows this). **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.
5	Close tie breaker	**SEMI mode**: The controller starts the tie breaker close sequence. **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.
6	Open tie breaker	**SEMI mode**: The controller starts the tie breaker open sequence. **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.
7	AUTO mode	**SEMI mode**: The controller changes to AUTO mode. **AUTO mode or Switchboard control**: The controller ignores the input from this push-button.
8	SEMI mode	**AUTO mode**: The controller changes to SEMI mode. **SEMI mode or Switchboard control**: The controller ignores the input from this push-button.
9	Test	**SEMI mode**: The controller starts a test of the emergency generator and breakers. The actual test depends on the test configuration in the controller.

3.1.5 SHAFT generator controller LEDs and push-buttons

The bottom strip of the front of the display unit is customised for the SHAFT generator controller. It includes LEDs that show the equipment and controller status, as well as push-buttons for operator actions.

SHAFT generator controller LEDs

Figure 3.7 SHAFT generator controller display unit LEDs

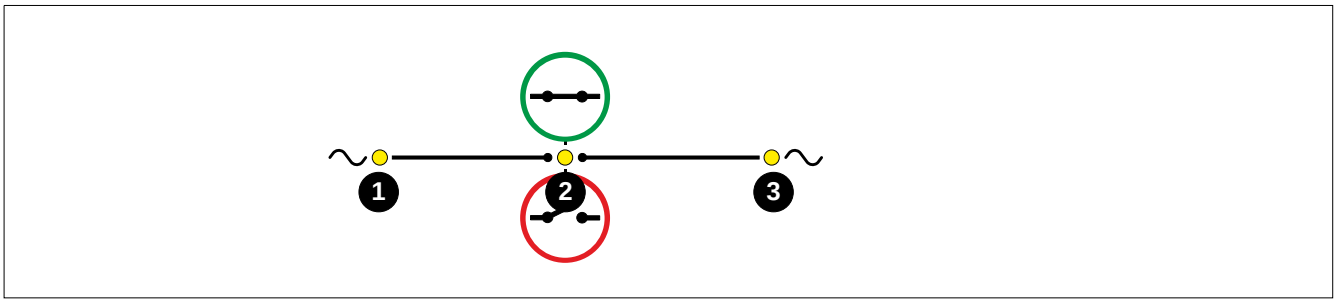


Table 3.7 SHAFT generator controller LED functions

No.	Name	Function
1	Shaft generator	**Green**: The generator voltage and frequency are OK, and the controller can close the breaker. **Green (flashing)**: The generator voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. **Yellow**: The generator voltage and frequency are measurable, but not OK. The controller cannot close the breaker. **OFF**: The generator voltage is too low to measure.
2	Breaker	**Green**: The breaker is closed. **Yellow**: The breaker spring is charging (only applies to a compact breaker). **Yellow (flashing)**: The controller is synchronising or de-loading the breaker. **Red**: The controller tripped the breaker, and the trip alarm is unacknowledged and/or the alarm condition is still present. **OFF**: The breaker is open.
3	Busbar	**Green**: The busbar voltage and frequency are OK, and the controller can close the breaker. **Green (flashing)**: The busbar voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. **Yellow**: The busbar voltage and frequency are measurable, but not OK. **Red**: The busbar voltage is too low to measure (for example, during a blackout). The controller can close the breaker.

SHAFT generator controller push-buttons

Figure 3.8 SHAFT generator controller display unit push-buttons

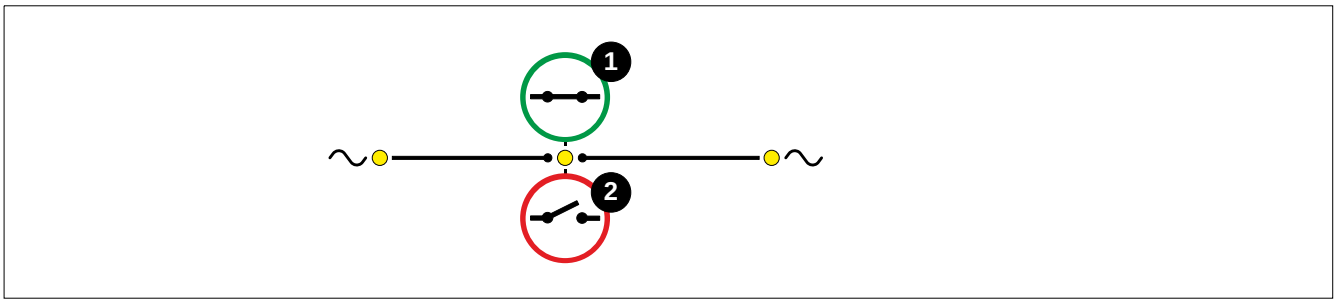


Table 3.8 SHAFT generator controller push-button functions

No.	Name	Function
1	Close breaker	**PMS control**: The controller starts the breaker close sequence. **Switchboard control**: The controller ignores the input from this push-button.
2	Open breaker	**PMS control**: The controller starts the breaker open sequence. **Switchboard control**: The controller ignores the input from this push-button.

3.1.6 SHORE connection controller LEDs and push-buttons

The bottom strip of the front of the display unit is customised for the SHORE connection controller. It includes LEDs that show the equipment and controller status, as well as push-buttons for operator actions.

SHORE connection controller LEDs

Figure 3.9 SHORE connection controller display unit LEDs

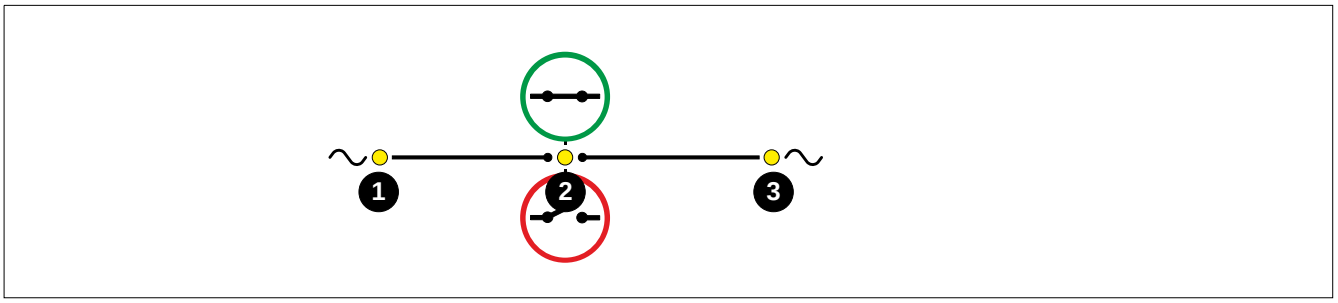


Table 3.9 SHORE connection controller LED functions

No.	Name	Function
1	Shore connection	**Green**: The connection voltage and frequency are OK, and the controller can close the breaker. **Green (flashing)**: The connection voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. **Yellow**: The connection voltage and frequency are measurable, but not OK. The controller cannot close the breaker. **OFF**: The connection voltage is too low to measure.
2	Breaker	**Green**: The breaker is closed. **Yellow**: The breaker spring is charging (only applies to a compact breaker). **Yellow (flashing)**: The controller is synchronising or de-loading the breaker. **Red**: The controller tripped the breaker, and the trip alarm is unacknowledged and/or the alarm condition is still present. **OFF**: The breaker is open.
3	Busbar	**Green**: The busbar voltage and frequency are OK, and the controller can close the breaker. **Green (flashing)**: The busbar voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. **Yellow**: The busbar voltage and frequency are measurable, but not OK. **Red**: The busbar voltage is too low to measure. The controller can close the breaker.

SHORE connection controller push-buttons

Figure 3.10 SHORE connection controller display unit push-buttons

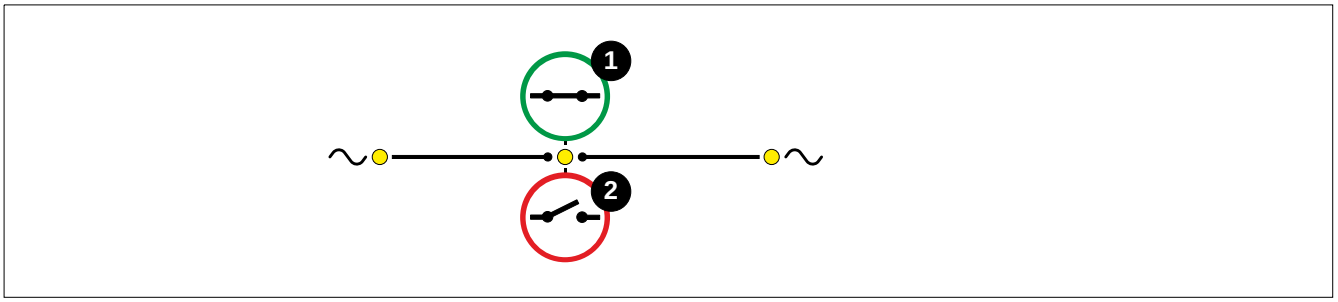


Table 3.10 SHORE connection controller push-button functions

No.	Name	Function
1	Close breaker	**PMS control**: The controller starts the breaker close sequence. **Switchboard control**: The controller ignores the input from this push-button.
2	Open breaker	**PMS control**: The controller starts the breaker open sequence. **Switchboard control**: The controller ignores the input from this push-button.

3.1.7 BUS TIE breaker controller LEDs and push-buttons

The bottom strip of the front of the display unit is customised for the BUS TIE breaker controller. It includes LEDs that show the equipment and controller status, as well as push-buttons for operator actions.

BUS TIE breaker controller LEDs

Figure 3.11 BUS TIE breaker controller display unit LEDs

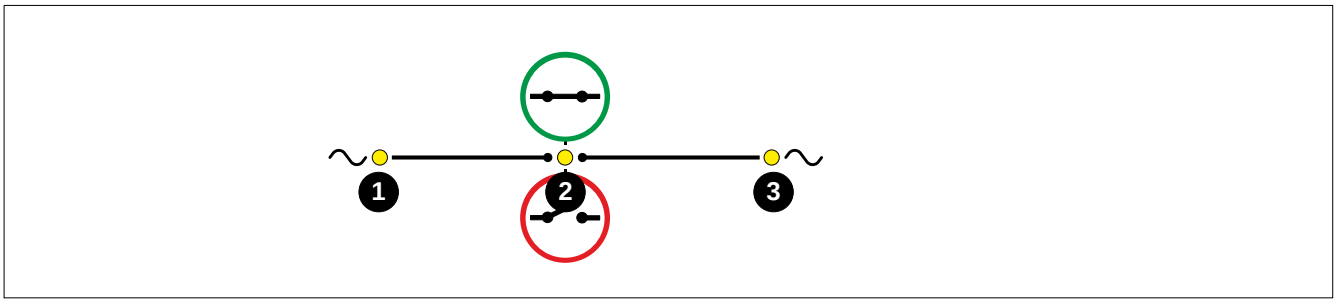


Table 3.11 BUS TIE breaker controller LED functions

No.	Name	Function
1	Busbar A	**Green**: The busbar A voltage and frequency are OK, and the controller can close the breaker. **Green (flashing)**: The busbar A voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. **Yellow**: The busbar A voltage and frequency are measurable, but not OK. The controller cannot close the breaker. **Red**: The busbar A voltage is too low to measure. The controller can close the breaker.
2	Bus tie breaker	**Green**: The breaker is closed. **Yellow**: The breaker spring is charging (only applies to a compact breaker). **Yellow (flashing)**: The controller is synchronising or de-loading the breaker. **Red**: The controller tripped the breaker, and the trip alarm is unacknowledged and/or the alarm condition is still present. **OFF**: The breaker is open.
3	Busbar B	**Green**: The busbar B voltage and frequency are OK, and the controller can close the breaker. **Green (flashing)**: The busbar B voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. **Yellow**: The busbar B voltage and frequency are measurable, but not OK. **Red**: The busbar B voltage is too low to measure. The controller can close the breaker.

BUS TIE breaker controller push-buttons

Figure 3.12 BUS TIE breaker controller display unit push-buttons

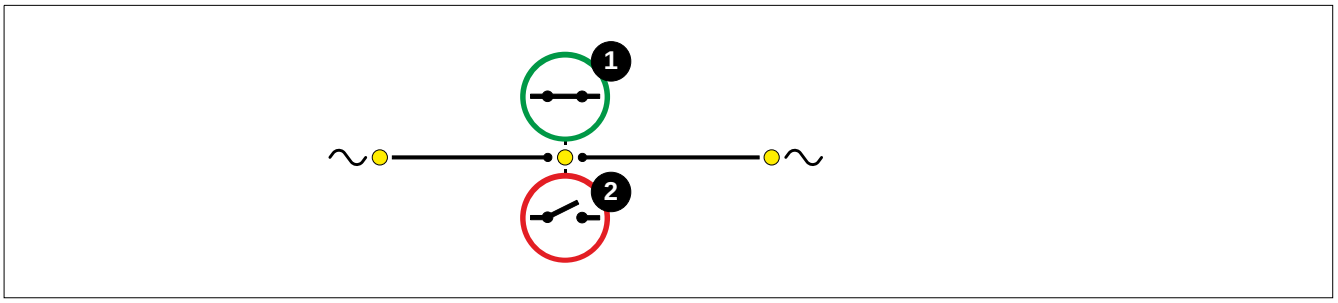


Table 3.12 BUS TIE breaker controller push-button functions

No.	Name	Function
1	Close bus tie breaker	**PMS control**: The controller starts the breaker close sequence. **Switchboard control**: The controller ignores the input from this push-button.
2	Open bus tie breaker	**PMS control**: The controller starts the breaker open sequence. **Switchboard control**: The controller ignores the input from this push-button.

3.2 Controller rack

3.2.1 Rack LEDs

You will normally not be able to see the controller rack, since it is normally in an enclosed switchboard. However, the controller rack includes LEDs that can be useful for troubleshooting, and these are described here.

Module LEDs

PSM3.1, ACM3.1, EIM3.1, GAM3.1 and PCM3.1 each have a red status LED. The module status LED lights if the hardware module self-check is not OK. If the controller power supply LED on PSM3.1 is red, the LED(s) at the top of the hardware module(s) that failed the self-check may be red.

These LEDs are at the top of the hardware module inside the rack frame, and may be hidden by wiring or other equipment. If there is not too much light, the glow from the LED(s) should be visible at the top of the rack.

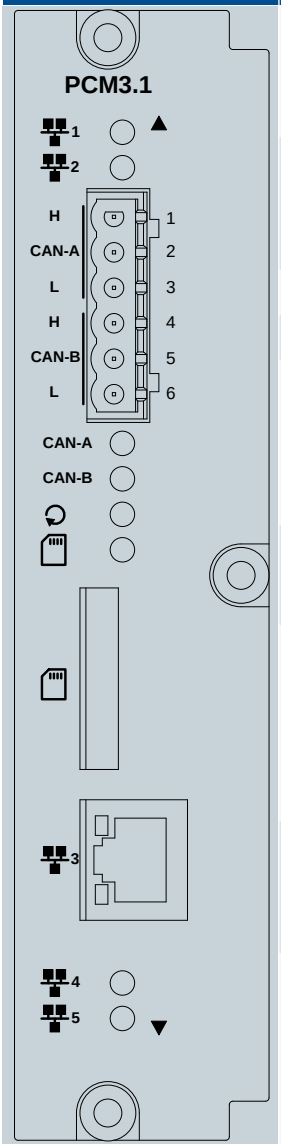
INFO
The hardware modules' LEDs may be red while the controller is starting up, or during a software update. This is normal, and does not mean that the hardware modules failed the self-check.

3.2.2 PSM3.1 LEDs

PSM3.1 supplies power to the controller.

Symbol	Name	Function
⏻	Power	**Green**: The power supply to PSM3.1 is OK, and all of the controller hardware module self-checks were OK. **Red**: The power supply to PSM3.1 is OK, but one or more controller hardware module self-checks were not OK. **OFF**: No power.
⇆	Internal EtherCAT communication	**Green**: The internal EtherCAT communication between the hardware modules in the controller is OK. **Green (flashing)**: There is internal EtherCAT communication, however, the controller is starting up, or there are internal EtherCAT communication problems. **OFF**: There is no internal EtherCAT communication between the hardware modules in the controller.
→■	Controller extension rack EtherCAT communication in	For future use to connect extension rack.
←■	Controller extension rack EtherCAT communication out	For future use to connect extension rack.

3.2.3 PCM3.1 LEDs

	Symbol	Name	Function
	1	DEIF network port 1*	**Green**: The Ethernet connection is OK. **Green (flashing)**: There is data traffic in the Ethernet connection. **OFF**: There is no Ethernet connection, or the Ethernet connection is not OK.
	2	DEIF network port 2*	**Green**: The Ethernet connection is OK. **Green (flashing)**: There is data traffic in the Ethernet connection. **OFF**: There is no Ethernet connection, or the Ethernet connection is not OK.
	CAN A	CAN bus A	For future use with engine communication.
	CAN B	CAN bus B	For future use with engine communication.
		Self-check OK	**Green**: The controller self-check is OK. **Red (flashing fast)**: The power supply to a PSM or EIM has failed. **Red (flashing slowly)**: One or more hardware module self-check is not OK. **OFF**: There is no power on the rack backplane.
		SD card status	**Green**: SD card OK. **Green (flashing)**: The controller is writing to the SD card. **OFF**: No SD card, or SD card not OK.
	3	DEIF network port 3	**Green**: The Ethernet connection is OK. **Green (flashing)**: There is data traffic in the Ethernet connection. **Orange**: The data traffic in the Ethernet connection is over 1000 Mbps. **OFF**: There is no Ethernet connection, or the Ethernet connection is not OK.
	4	DEIF network port 4*	**Green**: The Ethernet connection is OK. **Green (flashing)**: There is data traffic in the Ethernet connection. **OFF**: There is no Ethernet connection, or the Ethernet connection is not OK.
	5	DEIF network port 5*	**Green**: The Ethernet connection is OK. **Green (flashing)**: There is data traffic in the Ethernet connection. **OFF**: There is no Ethernet connection, or the Ethernet connection is not OK.

*Note: For ports 1, 2, 4 and 5, the green LED on the front of the module works in the same way as the green LED on the actual port. The actual Ethernet ports at the top (ports 1 and 2) and bottom (ports 4 and 5) of the rack also have an orange LED.

4. Operating the system

4.1 Introduction

4.1.1 About the operator actions

This chapter describes the basic tasks that the operator can do using the display unit push-buttons.

4.2 GENSET controller basic actions

4.2.1 Introduction to operating the GENSET controllers

Normal operation
The GENSET controllers should normally be in AUTO mode. When one or more GENSET controllers are in AUTO mode, the power management system automatically starts and connects gensets, or disconnects and stops gensets, according to the power required and the genset priority order.

Blackout response
If there is a blackout, the power management system automatically follows the blackout recovery sequence to start and connect gensets, in order to restore power. If there is a blackout and a GENSET controller is in SEMI mode, the power management system will automatically change the controller to AUTO mode. No operator actions are needed.

However, if there is a blackout while the GENSET controller is under switchboard control, the power management system will not attempt to start or connect that genset. If the operator wants the power management system to start and connect the genset, the operator needs to change the switchboard control selector to PMS control.

4.2.2 Changing modes

The GENSET controller can run under PMS control in AUTO or SEMI mode. The controller can also run under switchboard control. The following procedures describe how to change the controller's operating mode and control.

Mode	Procedure
AUTO	To change to AUTO mode from SEMI mode: 1. Operator action: Press  to select AUTO mode. • System response: The LED next to  is green when the controller is in AUTO mode. You cannot change from switchboard control to AUTO mode using the display unit push-buttons. If the controller is under switchboard control, you must first change to AUTO/SEMI mode by changing the switchboard control selector (on the switchboard) to PMS.
SEMI	To change to SEMI mode from AUTO mode: 1. Operator action: Press  to select SEMI mode. • System response: The LED next to  is green when the controller is in SEMI mode. You cannot change from switchboard control to SEMI mode using the display unit push-buttons. If the controller is under switchboard control, you must first change to AUTO/SEMI mode by changing the switchboard control selector (on the switchboard) to PMS control.
Switchboard control	To change to switchboard control, the controller can be in either AUTO or SEMI mode. To change to switchboard control: 1. Operator action: Change the switchboard control selector (on the switchboard) to switchboard control. • System response: For safety reasons, whenever there is a **connected** GENSET controller under switchboard control (that is, the genset is running and the generator breaker is closed), all the GENSET controllers in AUTO mode are automatically changed to SEMI mode. ◦ This means that the automatic power management functions (automatic genset start or stop, and automatic breaker close and open) are no longer active for any GENSET controllers. ◦ Each controller will however still trip the breaker(s) and/or stop the genset if the operating conditions activate an alarm that trips the breaker(s) and/or stops the genset.

CAUTION
If you change the last GENSET controller that is in AUTO mode to SEMI mode, the power management system cannot automatically start or stop any gensets, or open or close any breakers.

INFO
The switchboard equipment is third-party equipment. The switchboard control selector labels may therefore be different from the names used above.

4.2.3 Starting the genset

Mode	Procedure
AUTO	When the controller is in AUTO mode, the genset start is controlled automatically and the display unit push-buttons are disabled. If the power management system calculates that more power is required, the controller automatically starts the genset(s), according to the genset priority order.
SEMI	To start the genset: 1. Operator action: Press  to start the genset. • System response: The controller runs the start sequence. ◦ If everything is OK, the genset starts. ◦ If the genset does not start, the display unit shows an info message.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The genset can only be started locally and/or from the switchboard.

INFO
The switchboard equipment is third-party equipment. The switchboard might not include a button to start the genset.

4.2.4 Stopping the genset

Mode	Procedure
AUTO	When the controller is in AUTO mode, the genset stop is controlled automatically and the display unit push-buttons are disabled. If the power management system calculates that power is not required, the controller will automatically stop the genset(s), according to the genset priority order.
SEMI	The genset breaker must be open to stop the genset. If the genset breaker is not open, press  to open the breaker before stopping the genset. See **Opening the genset breaker** for more information. To stop the genset: 1. Operator action: To stop the genset with a cooldown time, press  once. • System response: The controller stops the genset after the cooldown time. • System response: If the genset does not stop, the controller activates an alarm. 2. Operator action: Press  again to skip the cooldown time and stop the genset immediately. • Note: A genset stop without cooldown time increases the mechanical wear of the genset. The genset may also have problems if it needs to restart immediately. The genset should only be stopped without cooldown time in emergencies. Contact the genset manufacturer for more information. • System response: If the genset does not stop, the controller activates an alarm.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The genset can only be stopped locally and/or from the switchboard.

INFO
The switchboard equipment is third-party equipment. The switchboard might not include a button to stop the genset.

4.2.5 Closing the genset breaker

Mode	Procedure
AUTO	When the controller is in AUTO mode, the genset breaker is controlled automatically and the display unit push-buttons are disabled. If the power management system calculations show that more power is required, the controller automatically starts the genset(s) and closes the breaker(s), according to the genset priority order.
SEMI	The genset must be running to close the genset breaker. If the genset is not running, press  to start the genset. See **Starting the genset** for more information. To close the breaker: 1. Operator action: Press  to close the genset breaker. a. System response: The power management system synchronises the genset with the busbar. During synchronisation, the breaker LED is yellow (flashing). b. System response: When the genset and busbar are synchronised, the controller closes the breaker. When the breaker is closed, the breaker LED is green. • If the genset and busbar are not synchronised before the synchronisation timer expires, the breaker does not close. The synchronisation failure alarm is activated.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The genset breaker can only be closed using the switchboard.

4.2.6 Opening the genset breaker

Mode	Procedure
AUTO	When the controller is in AUTO mode, the genset breaker is controlled automatically and the display unit push-buttons are disabled. If power is not required, the controller will automatically open the genset breaker as part of the genset stop sequence.
SEMI	To open the genset breaker: 1. Operator action: Press  to open the genset breaker. a. System response: The power management system calculates whether there will be enough power available after the genset breaker is opened. If not, the power management system will not allow the genset breaker to open, and the controller display unit will show an info message. b. System response: The power management system de-loads the breaker until the load is less than the de-load open point. During de-loading, the breaker LED is yellow (flashing). c. System response: The controller opens the genset breaker. The breaker LED is OFF when the breaker is open.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The breaker can only be opened using the switchboard.

4.2.7 Setting genset start and stop priority

For efficiency or maintenance reasons, you might want certain gensets to automatically run as much as possible, and others to run at little as possible. The power management system has a priority order for the gensets to enable you to do this. If a genset start is needed, the power management system starts the first non-running genset in the priority order. Similarly, if a genset stop is needed, the power management system stops the last running genset in the priority order.

The operator can determine the genset priority. Alternatively, the power management system determines the genset priority.

Press 1ST on a GENSET controller display unit to manually move its genset to the first position in the priority order. The LED next to 1ST lights when a GENSET controller has first priority.

If you have a system with multiple gensets, you can use the 1ST button to set the priority for each genset:

1. To prevent unwanted automatic genset starts and stops, you can put all the GENSET controllers into SEMI mode before you set the genset priority.
2. Decide on the genset priority order.
   - For example, in a system with four gensets (A, B, C and D), you may want the priority order to be A, B, C and then D.
3. Working from the back to the front of the order, press 1ST on the display unit of the relevant GENSET controller, and wait for the 1st priority LED to turn green.
   - For the example, you will press 1ST in the order: genset D, C, B, and then A. The genset priority order will then be A, B, C, and then D.
     - If all the controllers are in AUTO, and gensets A and B are running and connected, if the power management system needs to start another genset, it will start genset C.
     - If gensets A and B are running and connected and the power management system needs to stop a genset, it will disconnect and stop genset B.
4. Starting with the GENSET controller at the front of the priority order, put all the GENSET controllers that you want to run in AUTO mode into AUTO mode.

4.3 EMERGENCY genset controller basic actions

4.3.1 Introduction to operating the EMERGENCY genset controller

Normal operation

The EMERGENCY genset controller is normally in AUTO mode. During normal operation, apart from emergency genset tests, the emergency genset does not run.

Blackout response

If there is a blackout, the power management system automatically follows the blackout recovery sequence to start and connect gensets, in order to restore power. If the gensets do not supply power within the time allowed (the default is 30 seconds), the power management system automatically opens the tie breaker, starts the emergency genset and closes the emergency genset breaker.

If there is a blackout and the EMERGENCY genset controller is in SEMI mode, the controller automatically changes to AUTO mode. No operator actions are needed.

However, if there is a blackout while the EMERGENCY genset controller is under switchboard control, the power management system does not attempt to start or connect the emergency genset. If the operator wants the power management system to start and connect the emergency genset, the operator needs to change the switchboard control selector to PMS control.

Harbour operation

When harbour operation is active, the emergency genset breaker and the tie breaker are closed. The emergency genset runs, and supplies power as if it were an ordinary diesel genset. The power management system controls the system, and starts and stops the other gensets as needed. When harbour operation is active, the emergency genset is first in the genset priority order, and is therefore always running and connected when the EMERGENCY genset controller is in AUTO mode.

4.3.2 Changing modes

The EMERGENCY genset controller can run in AUTO or SEMI mode, or under switchboard control. The EMERGENCY genset controller can also run a test sequence (see **Emergency genset test function**).

Mode	Procedure
AUTO	To change to AUTO mode from SEMI mode: 1. Operator action: Press  to select AUTO mode. • System response: The LED next to  is green when the controller is in AUTO mode. You cannot change from switchboard control to AUTO mode using the display unit push-buttons. If the controller is under switchboard control, you must first change to AUTO/SEMI mode by changing the switchboard control selector (on the switchboard) to PMS control.
SEMI	To change to SEMI mode from AUTO mode: 1. Operator action: Press  to select SEMI mode. • System response: The LED next to  is green when the controller is in SEMI mode. You cannot change from switchboard control to SEMI mode using the display unit push-buttons. If the controller is under switchboard control, you must first change to AUTO/SEMI mode by changing the switchboard control selector (on the switchboard) to PMS control.
Switchboard control	To change to switchboard control, the controller can be in either AUTO or SEMI mode. To change to switchboard control: 1. Operator action: Change the switchboard control selector (on the switchboard) to switchboard control. • System response: For safety reasons, whenever there is a **connected** EMERGENCY genset controller under switchboard control (that is, the genset is running and the generator breaker and tie breaker are closed), all the GENSET controllers in AUTO mode are automatically changed to SEMI mode. ◦ This means that the automatic power management functions (automatic genset start or stop, and automatic breaker close and open) are no longer active for any genset controllers. ◦ Each controller will however still trip the breaker(s) and/or stop the genset if the operating conditions activate an alarm that trips the breaker(s) and/or stops the genset.

CAUTION
If you change the last controller that is in AUTO mode to SEMI mode, the power management system cannot automatically start or stop any gensets, or open or close any breakers.

INFO
The switchboard equipment is third-party equipment. The switchboard control selector labels may therefore be different from the names used above.

4.3.3 Starting the emergency genset

Mode	Procedure
AUTO	When the controller is in AUTO mode, the emergency genset start is controlled automatically and the display unit push-buttons are disabled.
SEMI	To start the emergency genset: 1. Operator action: Press  to start the emergency genset. • System response: The controller runs the start sequence. ◦ If everything is OK, the emergency genset starts. ◦ If the emergency genset does not start, the display unit shows an info message.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The genset can only be started locally and/or from the switchboard.

INFO
The switchboard equipment is third-party equipment. The switchboard might not include a button to start the genset.

4.3.4 Stopping the emergency genset

Mode	Procedure
AUTO	When the controller is in AUTO mode, the emergency genset stop is controlled automatically and the display unit push-buttons are disabled. After a blackout, the controller will automatically disconnect and stop the emergency genset when there is a stable voltage on the main busbar.
SEMI	The emergency genset breaker must be open to stop the emergency genset. If the emergency genset breaker is not open, press  to open the breaker before stopping the emergency genset. See **Opening the emergency genset breaker** for more information. To stop the genset: 1. Operator action: To stop the emergency genset with a cooldown time, press  once. • System response: The controller stops the emergency genset after the cooldown time. • System response: If the emergency genset does not stop, the controller activates an alarm. 2. Operator action: Press  again to skip the cooldown time and stop the emergency genset immediately. • Note: A genset stop without cooldown time increases the mechanical wear of the genset. The genset may also have problems if it needs to restart immediately. The genset should only be stopped without cooldown time in emergencies. Contact the genset manufacturer for more information. • System response: If the emergency genset does not stop, the controller activates an alarm.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The emergency genset can only be stopped locally and/or from the switchboard.

INFO
The switchboard equipment is third-party equipment. The switchboard might not include a button to stop the genset.

4.3.5 Closing the emergency genset breaker

INFO
The EMERGENCY genset controller display unit has two sets of breaker push-buttons. The emergency genset breaker push-buttons are on the left, closest to the genset pictogram.

Mode	Procedure
AUTO	When the controller is in AUTO mode, the emergency genset breaker is controlled automatically and the display unit push-buttons are disabled.
SEMI	The emergency genset must be running to close the genset breaker. If the emergency genset is not running, press  to start the emergency genset. See **Starting the emergency genset** for more information. To close the emergency genset breaker: 1. Operator action: Press  to close the emergency genset breaker. a. System response: The power management system synchronises the emergency genset with the busbar. During synchronisation, the breaker LED is yellow (flashing). b. System response: When the emergency genset and busbar are synchronised, the controller closes the breaker. When the breaker is closed, the breaker LED is green. • If the emergency genset and busbar are not synchronised before the synchronisation timer expires, the breaker does not close. The synchronisation failure alarm is activated.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The emergency genset breaker can only be closed using the switchboard.

4.3.6 Opening the emergency genset breaker

INFO
The EMERGENCY genset controller display unit has two sets of breaker push-buttons. The emergency genset breaker push-buttons are on the left, closest to the genset pictogram.

Mode	Procedure
AUTO	When the controller is in AUTO mode, the emergency genset breaker is controlled automatically and the display unit push-buttons are disabled. After a blackout, the controller will automatically disconnect and stop the emergency genset when there is a stable voltage on the main busbar.
SEMI	To open the emergency genset breaker: 1. Operator action: Press  to open the emergency genset breaker. a. System response: The power management system calculates whether there will be enough power available after the emergency genset breaker is opened. If not, the power management system will not allow the emergency genset breaker to open, and the controller display unit will show an info message. b. System response: The power management system de-loads the emergency genset breaker until the load is less than the de-load open point. During de-loading, the breaker LED is yellow (flashing). c. System response: The controller opens the genset breaker. The breaker LED is OFF when the breaker is open.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The emergency genset breaker can only be opened using the switchboard.

4.3.7 Closing the tie breaker

The tie breaker is normally closed. This means that the emergency busbar is normally connected to the main busbar. The emergency busbar and main busbar normally act as one busbar (and not as two independent busbars).

The tie breaker may be opened and closed automatically for a limited time as part of the test function.

The emergency genset breaker and the tie breaker are both closed for an unlimited time when harbour operation is active.

INFO
The EMERGENCY genset controller display unit has two sets of breaker push-buttons. The tie breaker push-buttons are on the right.

Mode	Procedure
AUTO	When the controller is in AUTO mode, the tie breaker is controlled automatically and the display unit push-buttons are disabled. After a blackout, when stable power is restored on the main busbar, the power management system automatically synchronises to the main busbar and closes the tie breaker.
SEMI	To close the tie breaker: 1. Operator action: Press  to close the tie breaker. a. System response: The power management system synchronises the emergency busbar and the main busbar. During synchronisation, the breaker LED is yellow (flashing). • For the tie breaker to close, the busbar LED must be green. If there has been a blackout on the main busbar, the EMERGENCY genset controller cannot close the tie breaker until one or more ordinary gensets have started and there is stable power on the main busbar. b. System response: When the tie breaker is synchronised, the controller closes the tie breaker. When the tie breaker is closed, the breaker LED is green. • If the tie breaker is not synchronised before the synchronisation timer expires, the breaker does not close. The synchronisation failure alarm is activated. • System response: If there is no blackout and the emergency genset breaker is closed, the maximum parallel timer starts running when the tie breaker is closed. If harbour operation is not activated, when the timer runs out, the controller will try to open the emergency genset breaker.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The tie breaker can only be closed using the switchboard.

4.3.8 Opening the tie breaker

The tie breaker is normally closed.

As part of the blackout procedure, if power cannot be restored from the gensets within the specified time, the tie breaker opens automatically, and the main busbar is split from the emergency busbar. The emergency genset then supplies power to the emergency busbar. The main busbar and the emergency busbar run as two independent busbars until stable power is restored on the main busbar.

INFO
The EMERGENCY genset controller display unit has two sets of breaker push-buttons. The tie breaker push-buttons are on the right.

Mode	Procedure
AUTO	When the controller is in AUTO mode, the tie breaker is controlled automatically and the display unit push-buttons are disabled.
SEMI	To open the tie breaker: 1. Operator action: Press  to open the tie breaker. a. System response: The power management system calculates whether the emergency genset can supply the load on the emergency busbar after the tie breaker is opened. The power management system also checks whether the gensets can supply the load on the main busbar after the tie breaker is opened. If not, the power management system does not allow the tie breaker to open, and the controller display unit shows an info message. b. System response: The power management system de-loads the tie breaker. During de-loading, the breaker LED is yellow (flashing). c. System response: When the tie breaker is de-loaded, the controller opens the tie breaker. When the breaker is open, the breaker LED is OFF. • If the tie breaker is not de-loaded before the de-load timer expires, the breaker does not open. The de-load failure alarm is activated. • If the gensets do not have the capacity to supply the load on each busbar, the controller does not open the tie breaker, and displays an info message. • System response: If there is a blackout on the main busbar, the tie breaker opens without de-loading, to protect the supply to the emergency busbar.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The tie breaker can only be opened using the switchboard.

4.3.9 Emergency genset test function

To run the emergency genset test sequence:

1. Operator action: Press  to start the test sequence.
   a. System response: The controller starts the test sequence that was configured in the controller.
   b. System response: When the test sequence is completed, the controller automatically changes to the mode configured in the test sequence.

   • System response: If there is a blackout during the test sequence, the EMERGENCY genset controller automatically stops the test sequence, and starts to supply the emergency busbar.

4.4 SHAFT generator controller basic actions

4.4.1 Introduction to operating the SHAFT generator controller

Normal operation

The SHAFT generator controller normally runs under power management system (PMS) control.

Blackout response

If there is a blackout, the PMS automatically follows the blackout recovery sequence to start and connect gensets, in order to restore power. If this does not succeed, as part of the blackout recovery, if auto close is enabled, the PMS attempts to close the shaft generator breaker. No operator actions are needed.

However, if there is a blackout while the SHAFT generator controller is under switchboard control, the PMS will not attempt to connect the shaft generator. If the operator wants the PMS to connect the shaft generator, the operator needs to change the switchboard control selector to PMS control.

Parallel operation

The shaft generator can run in parallel with the diesel gensets to transfer the load. However, the shaft generator will not normally run in parallel with the diesel gensets.

Power take home function

When the power take home function is active, the diesel gensets supply the power, and the shaft generator is used as a motor.

4.4.2 Closing the shaft generator breaker

Control	Procedure
PMS control	When the operator closes the shaft generator breaker, the power management system transfers the load from the gensets to the shaft generator. The shaft generator must therefore be running and have enough capacity to take over the genset load. To close the shaft generator breaker: 1. Operator action: Press  to close the shaft generator breaker. a. System response: The power management system synchronises the busbar with the shaft generator. During synchronisation, the breaker LED is yellow (flashing). b. System response: When the shaft generator and busbar are synchronised, the controller closes the breaker. When the breaker is closed, the breaker LED is green. • If the shaft generator and busbar are not synchronised before the synchronisation timer expires, the breaker does not close. The synchronisation failure alarm is activated. • If the shaft generator does not have the capacity to take over the genset load, the controller does not close the shaft generator breaker, and displays an info message. c. System response: After the shaft generator breaker is closed, the power management system automatically de-loads and opens the genset breakers of all the GENSET controllers that are in AUTO mode. After the genset cooldown period, the power management system then automatically stops the gensets of all the GENSET controllers that are in AUTO mode.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The shaft generator breaker can only be closed using the switchboard.

4.4.3 Opening the shaft generator breaker

Control	Procedure
PMS control	When the operator opens the shaft generator breaker, the power management system transfers the load from the shaft generator to the gensets. There must therefore be enough gensets available, with enough capacity to take over the shaft generator load. To open the shaft generator breaker: 1. Operator action: Press  to open the shaft generator breaker. a. System response: The power management system calculates whether there will be enough power available after the shaft generator breaker is opened. If not, the power management system will not allow the shaft generator breaker to open, and the controller display unit will show an info message. • If GENSET controllers in AUTO mode are ready for operation, but not connected, the power management system starts and connects the required gensets so that the required power is available. • If the gensets do not have the capacity to take over the shaft generator load, the controller does not open the shaft generator breaker, and displays an info message. b. System response: The power management system de-loads the shaft generator breaker. During de-loading, the breaker LED is yellow (flashing). c. System response: When the shaft generator breaker is de-loaded, the controller opens the shaft generator breaker. When the breaker is open, the breaker LED is OFF. • If the shaft generator breaker is not de-loaded, the breaker does not open. The de-load failure alarm is activated when the de-load timer expires.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The shaft generator breaker can only be opened using the switchboard.

4.5 SHORE connection controller basic actions

4.5.1 Introduction to operating the SHORE connection controller

Normal operation
The SHORE connection controller normally runs under power management system (PMS) control.

Blackout response
If there is a blackout, the PMS automatically follows the blackout recovery sequence to start and connect gensets, in order to restore power. If this does not succeed, as part of the blackout recovery, if auto close is enabled, the PMS attempts to close the shore connection breaker. No operator actions are needed.

However, if there is a blackout while the SHORE connection controller is under switchboard control, the PMS will not attempt to connect the shore connection. If the operator wants the PMS to connect the shore connection, the operator needs to change the switchboard control selector to PMS control.

Parallel operation
The shore connection can run in parallel with the diesel gensets to transfer the load. However, the shore connection will not normally run in parallel with the diesel gensets.

4.5.2 Closing the shore connection breaker

Control	Procedure
PMS control	When the operator closes the shore connection breaker, the power management system transfers the load from the gensets to the shore connection. The shore connection must therefore be live and have enough capacity to take over the genset load. To close the shore connection breaker: 1. Operator action: Press  to close the shore connection breaker. a. System response: The power management system synchronises the busbar with the shore connection. During synchronisation, the breaker LED is yellow (flashing). b. System response: When the shore connection and busbar are synchronised, the controller closes the breaker. When the breaker is closed, the breaker LED is green. • If the shore connection and busbar are not synchronised before the synchronisation timer expires, the breaker does not close. The synchronisation failure alarm is activated. • If the shore connection does not have the capacity to take over the genset load, the controller does not close the shore connection breaker, and displays an info message. c. System response: After the shore connection breaker is closed, the power management system automatically de-loads and opens the genset breakers of all the GENSET controllers that are in AUTO mode. After the genset cooldown period, the power management system then automatically stops the gensets of all the GENSET controllers that are in AUTO mode.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The shore connection breaker can only be closed using the switchboard.

4.5.3 Opening the shore connection breaker

Control	Procedure
PMS control	When the operator opens the shore connection breaker, the power management system transfers the load from the shore connection to the gensets. There must therefore be enough gensets available, with enough capacity to take over the shore connection load. To open the shore connection breaker: 1. Operator action: Press  to open the shore connection breaker. a. System response: The power management system calculates whether there will be enough power available after the shore connection breaker is opened. If not, the power management system will not allow the shore connection breaker to open, and the controller display unit will show an info message. • If GENSET controllers in AUTO mode are ready for operation, but not connected, the power management system starts and connects the required gensets so that the required power is available. • If the gensets do not have the capacity to take over the shore connection load, the controller does not open the shore connection breaker, and displays an info message. b. System response: The power management system de-loads the shore connection breaker. During de-loading, the breaker LED is yellow (flashing). c. System response: When the shaft generator breaker is de-loaded, the controller opens the shore connection breaker. When the breaker is open, the breaker LED is OFF. • If the shore connection breaker is not de-loaded, the breaker does not open. The de-load failure alarm is activated when the de-load timer expires.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The shore connection breaker can only be opened using the switchboard.

4.6 BUS TIE breaker controller basic actions

4.6.1 Introduction to operating the BUS TIE breaker controller

Normal operation
The BUS TIE breaker controller normally runs in under power management system (PMS) control.

Blackout response
If there is a blackout, the PMS automatically follows the blackout recovery sequence in order to restore power. As part of the blackout recovery, if one of the busbars is live and auto close is enabled, the PMS attempts to close the tie breaker. No operator actions are needed.

However, if there is a blackout while the BUS TIE breaker controller is under switchboard control, the PMS will not attempt to connect the busbars. If the operator wants the PMS to connect the busbars, the operator needs to change the switchboard control selector to PMS control.

4.6.2 Closing the bus tie breaker

When the bus tie breaker is closed, the busbar is reconnected. The reconnected busbar acts as one busbar, and not as two independent busbars.

Control	Procedure
PMS control	To close the bus tie breaker: 1. Operator action: Press  to close the bus tie breaker. a. System response: The power management system synchronises busbar A and busbar B. During synchronisation, the breaker LED is yellow (flashing). b. System response: When the bus tie breaker is synchronised, the controller closes the bus tie breaker. When the breaker is closed, the breaker LED is green. • If the bus tie breaker is not synchronised before the synchronisation timer expires, the breaker does not close. The synchronisation failure alarm is activated. c. System response: After the bus tie breaker is closed, the power management system may automatically start certain gensets, and stop others, according to the genset start and stop priority order. Automatic start and stop only applies to the gensets of all the GENSET controllers that are in AUTO mode.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The bus tie breaker can only be closed using the switchboard.

4.6.3 Opening the bus tie breaker

When the bus tie breaker is open, the busbar is split into two independent busbars (busbar A and busbar B). There must therefore be enough gensets available (on each busbar) to supply the load required (on each busbar) before the operator can open the bus tie breaker.

Control	Procedure
PMS control	To open the bus tie breaker: 1. Operator action: Press  to open the bus tie breaker. a. System response: The power management system calculates whether there will be enough power available on each busbar after the bus tie breaker is opened. If not, the power management system will not allow the bus tie breaker to open, and the controller display unit will show an info message. • If GENSET controllers in AUTO mode are ready for operation, but not connected, the power management system starts and connects the required gensets so that the required power is available. b. System response: The power management system de-loads the bus tie breaker. During de-loading, the breaker LED is yellow (flashing). c. System response: When the bus tie breaker is de-loaded, the controller opens the bus tie breaker. When the breaker is open, the breaker LED is OFF. • If the bus tie breaker is not de-loaded before the de-load timer expires, the breaker does not open. The de-load failure alarm is activated.
Switchboard control	When the controller is under switchboard control, the display unit push-buttons are disabled. The bus tie breaker can only be opened using the switchboard.

5. Alarms and log

5.1 Introduction

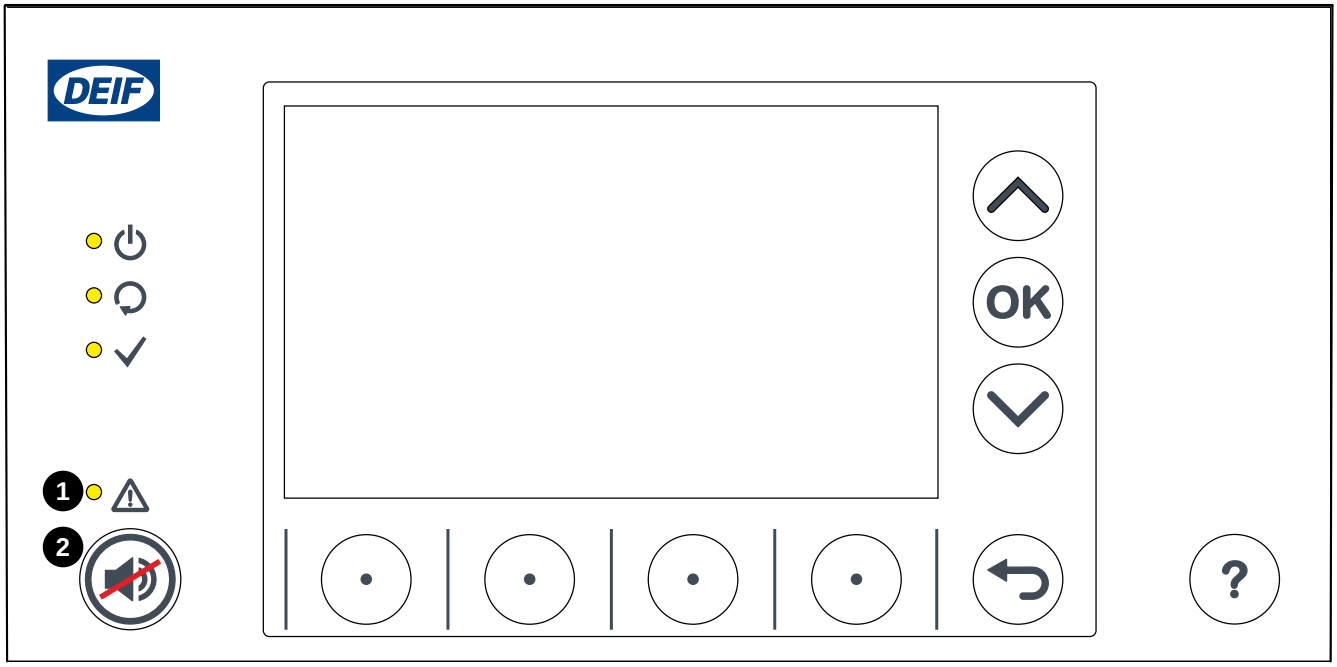
5.1.1 Alarm indication

When an alarm protection becomes active in the system, an active alarm is add to the alarm list. The alarm can give both a visual and audible indication (subject to design of system).

Alarms, typically, require action and acknowledgement before they clear from the alarm list.

An alarm may also have a latch as an extra level of protection, so that in addition to acknowledging the alarm, you also have to unlatch the alarm before the alarm action can be deactivated.

Figure 5.1 Example display unit



1. Alarm LED
2. Alarm output (horn/siren) silence push-button

Alarm LED
The alarm LED shows the current alarm situation for the system.

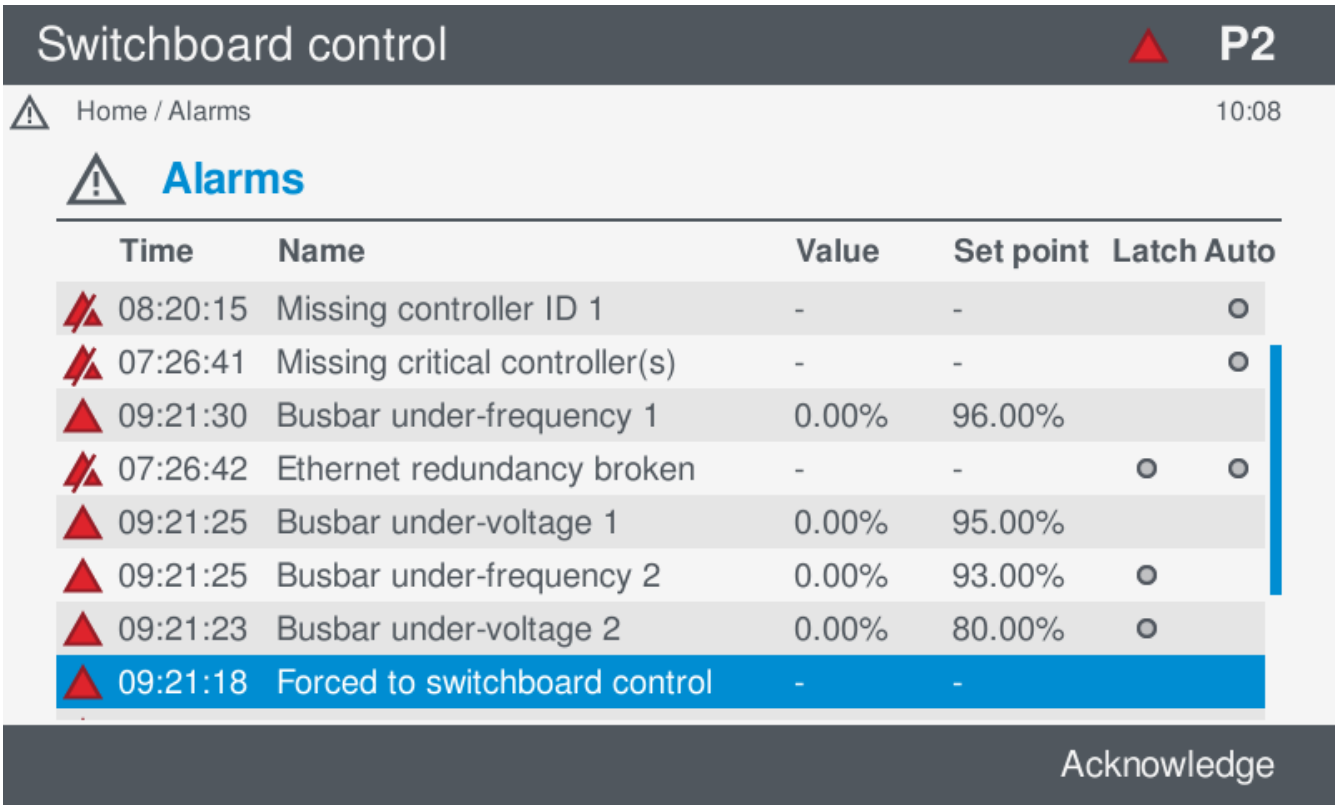
LED	Notes
Red (flashing)	Unacknowledged alarm(s)
Red (constant)	Active alarm(s), and all alarms acknowledged
Yellow (constant)	Unlatched alarms can be reset (when no other alarms require action)

LED	Notes
Green (flashing)	Only unacknowledged alarm(s) where the alarm condition has cleared
Green (constant)	No alarms

5.1.2 About the alarm list

The alarm list allows you to review all the current alarms for the controller.

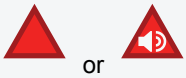
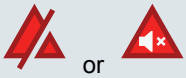
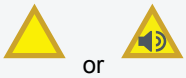
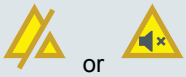
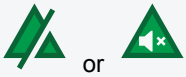
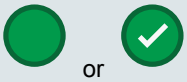
Figure 5.2 Example alarm list



View the alarm list under **Alarms**.

The alarms in the list are denoted with an symbol to show the alarm status.

Table 5.1 Alarm list symbols

Symbol	Alarm condition*	Alarm action**	Acknowledge	Notes
	Active	Active	Unacknowledged	• Alarm condition is occurring. • Alarm action is active. • Alarm requires acknowledgement. • Alarm requires action to clear the alarm condition.
	Active	Active	Acknowledged	• Alarm condition is occurring. • Alarm action is active. • Alarm is acknowledged. • Alarm requires action to clear the alarm condition.
	Inactive	Active	Unacknowledged	• Alarm condition has cleared. • Alarm action is active. • Alarm requires acknowledgement. • Alarm latch requires reset.
	Inactive	Active	Acknowledged	• Alarm condition has cleared. • Alarm action is active. • Alarm is acknowledged. • Alarm latch requires reset.
	Inactive	Inactive	Unacknowledged	• Alarm condition occured but has cleared. • Alarm action is inactive. • Alarm requires acknowledgement.
	Inactive	Inactive	-	Normal state.
	Active or Inactive	Inactive	-	• Alarm has been shelved for a period of time. • Alarm returns automatically after the period has expired.
	Active or Inactive	Inactive	-	• Alarm has been marked *out of service* for an indefinite period. • Alarm does not return automatically and requires returning to service.
	Active or inactive	Inactive	-	Alarm has been inhibited from occuring.

* Alarm condition is typically where the *Set point* has been exceeded.

** Alarm action (protection) is the configured action taken to protect the situation. When active, this action occurs in the controller. For example, the alarm action could be *Open breaker and stop engine*, where the breaker is deloaded and opened, and the engine is cooled down and stopped.

See **Protections**, **Alarm handling** in the Designer's handbook for more information about alarm handling.

Table 5.2 Typical alarm actions

Action	Notes
Acknowledge	Unacknowledged alarms must be acknowledged. Acknowledging an alarm does not remove the alarm or active protection if the *Alarm condition* continues.
Silence	You can silence the alarm (horn/siren) output from the display unit.
Reset latches	Alarms can be configured with a *Latch* as an extra layer of protection. Latched alarms require resetting after they have been acknowledged.
Shelve	Most alarms can be shelved for a selected period of time. During this period the alarm protection is not active. Once the period of time has expired, the *Alarm condition* is rechecked and may become active again if the *Alarm condition* remains active.
Out of service	Most alarms can be removed from service. No period of time needs to be given. The system does not automatically return the alarm to service, and this requires action to do so.

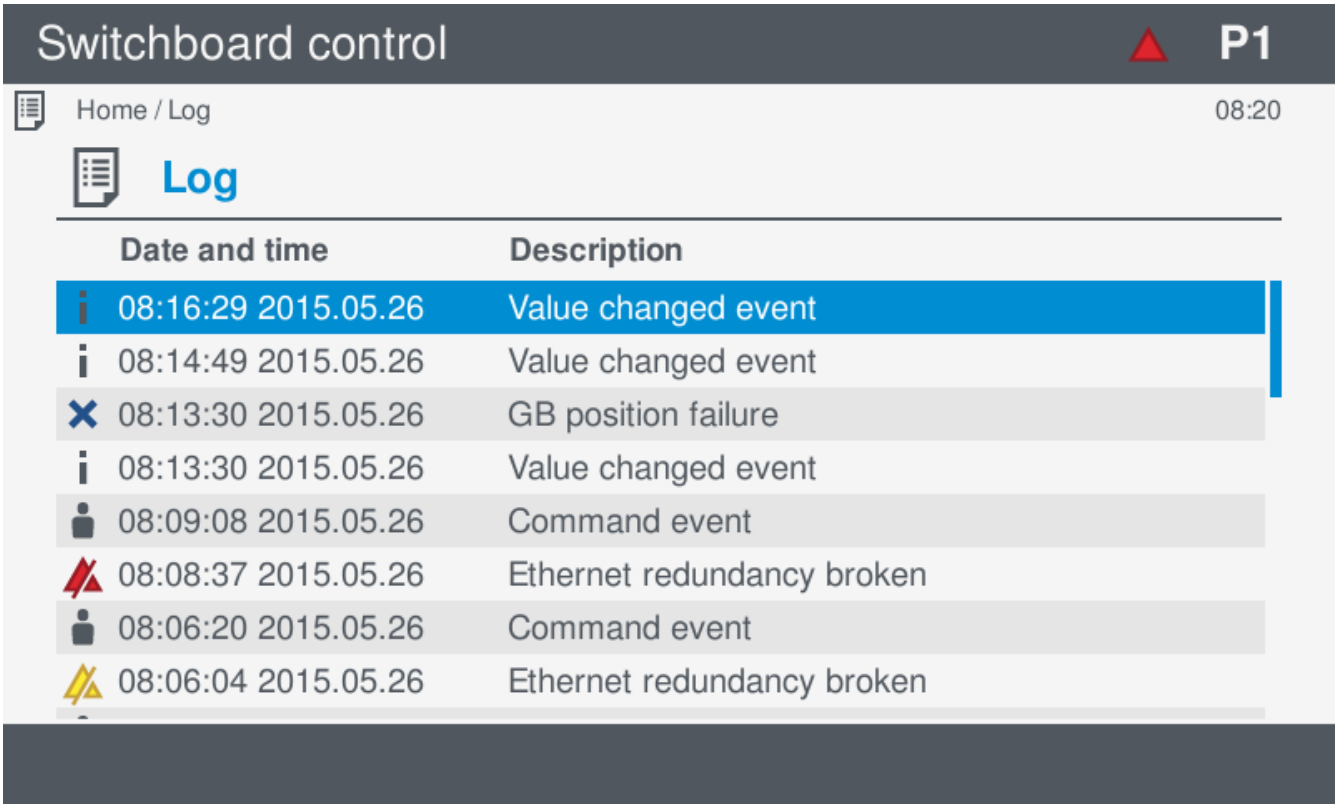
INFO
Some alarms can be inhibited from occurring depending on the designer's configuration of the system.

See **Protections**, **Alarm handling** in the Designer's handbook for more information about alarm handling and actions.

5.1.3 About the log

The log records activities and events that occur during the operation of the system. You can view the log to see all the events that occurred during operation. This includes any actions taken.

Figure 5.3 Example log display



Event	Icon	Examples
General	Automatic Manual	• System commands • Breaker open • Engine start
System		• Power up • Download firmware • I/O hardware modules installed in controller, serial number, software, hardware version and revision.
Test		• Battery test • Motor test • Parallel test • Load take over test
Alarms	Varies by alarm state	• Alarms occurring in the system • Alarms being acknowledged by the user • Alarm condition going back to normal
Parameters		• Parameter change(s)
Command		• Push-button actions • Commands from Modbus

5.2 Alarm actions

5.2.1 Operator actions

An operator of the display unit can perform the following actions:

- Acknowledge
- Silence alarm(s)
- Reset alarm latches (if applicable)
- Shelve
- Out of service

INFO
Available operator actions are controlled by the permissions of the logged on user profile.

5.2.2 Acknowledge

All unacknowledged alarms must be acknowledged. Some alarms can be configured with *Auto acknowledge*, which will automatically acknowledge the alarm. The alarm does not require acknowledging again.

INFO
Acknowledging an alarm that has a *Latch* configured, does not remove the alarm from the alarm list. These alarms must be reset before the alarm protection becomes inactive.

Acknowledging an alarm

To acknowledge an alarm, perform the following steps:

1. Select **Alarms** to view the alarm list.
2. Highlight the alarm to acknowledge by using the push-buttons **Up** or **Down** .
3. Select the soft key **Acknowledge** Acknowledge by using the appropriate push-button to acknowledge the alarm.
4. If the alarm condition clears and the alarm has no *Latch* configured:
   - The acknowledged alarm is removed from the alarm list.
5. If the alarm condition clears and the alarm has a *Latch* configured:
   - The acknowledged alarm remains on the alarm list and requires a reset before the alarm is removed.*
6. If the alarm condition remains active:
   - The acknowledged alarm remains on the alarm list, but is now marked as acknowledged.

* Until the latched alarm is reset the alarm action (protection) remains active even though the alarm condition has cleared.

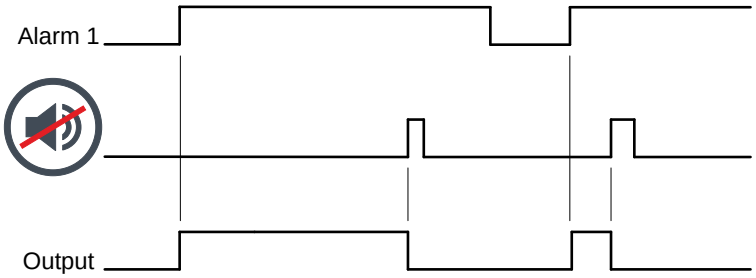
5.2.3 Silencing alarms

INFO
The following information only applies if the controller has been configured with alarm output(s) to either audible or visual equipment.

When an active alarm condition occurs, the *Alarm output* is activated by the controller. The audible or visual equipment is also activated.

You can silence the equipment by pressing the horn silence push-button on the display unit ( ). The controller immediately deactivates all alarm outputs. However, the horn silence push-button does NOT have any other effect on the alarm system. If a new alarm is activated after the push-button is pressed, the alarm output restarts.

Figure 5.4 Example of the effect of the horn silence push-button on the alarm output



INFO
The horn silence push-button on the display unit does not affect the acknowledgement status of any alarms.

See **Protections**, **Alarm outputs** in the Designer's handbook for more information on the configuration of these outputs.

5.2.4 Reset latches

Latched alarms that have been already acknowledged, can be reset. Until a latched alarm is reset the *Alarm action* (protection) remains active.

INFO
You cannot reset any latched alarms if the *Alarm condition* remains active and alarms exist that have not been acknowledged. All alarms must be acknowledged before you can reset (unlatch) the latched alarms.

Reset all cleared alarm latches

INFO
Resetting clears all alarm latches for all the latched alarms where the *Alarm condition* has cleared. Latched alarms where the alarm condition has not cleared are not affected by the reset.

To reset all cleared alarm latches, perform the following steps:

1. Select **Alarms** to view the alarm list.
2. Select the soft key **Reset latches** Reset latches by using the appropriate push-button .
3. All alarm latches, that can be reset, are reset.

5.2.5 Shelve

Most alarms on the alarm display can be shelved for a given period of time, if required. After the period of time expires the controller automatically returns the alarm to the previous state and rechecks the alarm condition.

CAUTION
Shelving alarms is useful during commissioning or service. Do not shelve alarms without good reasoning, as the alarm protection becomes inactive during the shelving.

Shelve an alarm

To shelve an alarm, perform the following steps:

1. Select **Alarms** to view the alarm list.
2. Highlight the alarm to shelve by using the push-buttons **Up** or **Down**.
3. Select the alarm to shelve by using the push-button **OK**.
4. Select **Service** by using the push-buttons up or down, and use the push-button **OK** to open the service menu.
5. Select **Shelve** by using the push-buttons **Up** or **Down**, and use the push-button **OK** to open the shelve options.
6. A list of available shelve periods are shown.
7. Select the required period to shelve the alarm by using the push-buttons **Up** or **Down**, and use the push-button **OK** to select.
8. The alarm is shelved for the period of time that was selected (or).

INFO
After the shelve period has expired, the controller automatically re-checks the alarm protection. If the alarm condition is still present in the system, the alarm protection becomes active again.

5.2.6 Out of service

Most alarms on the alarm list can be marked as *Out of service* for an indefinite period. The alarm will not automatically return to the system and requires action to bring the alarm back into service.

CAUTION
Marking alarms as *Out of service* is useful during commissioning or service. It is not recommended to mark alarms *Out of service* without good reasoning, as the alarm protection remains inactive while the alarm is marked as *Out of service*.

Remove an alarm from service

To remove an alarm from service, perform the following steps:

1. Select **Alarms** to view the alarm list.
2. Highlight the alarm to remove from service by using the push-buttons **Up** or **Down**.
3. Select the alarm details by using the push-button **OK**.
4. Select **Service** by using the push-buttons **Up** or **Down**, and use the push-button **OK** to open the service menu.
5. Select **Remove from service** by using the push-buttons **Up** or **Down**, and use the push-button **OK** to remove the alarm.
6. The alarm protection becomes inactive and the alarm is marked as *Out of service* (or).

Return an alarm to service

To return an alarm to service, perform the following steps:

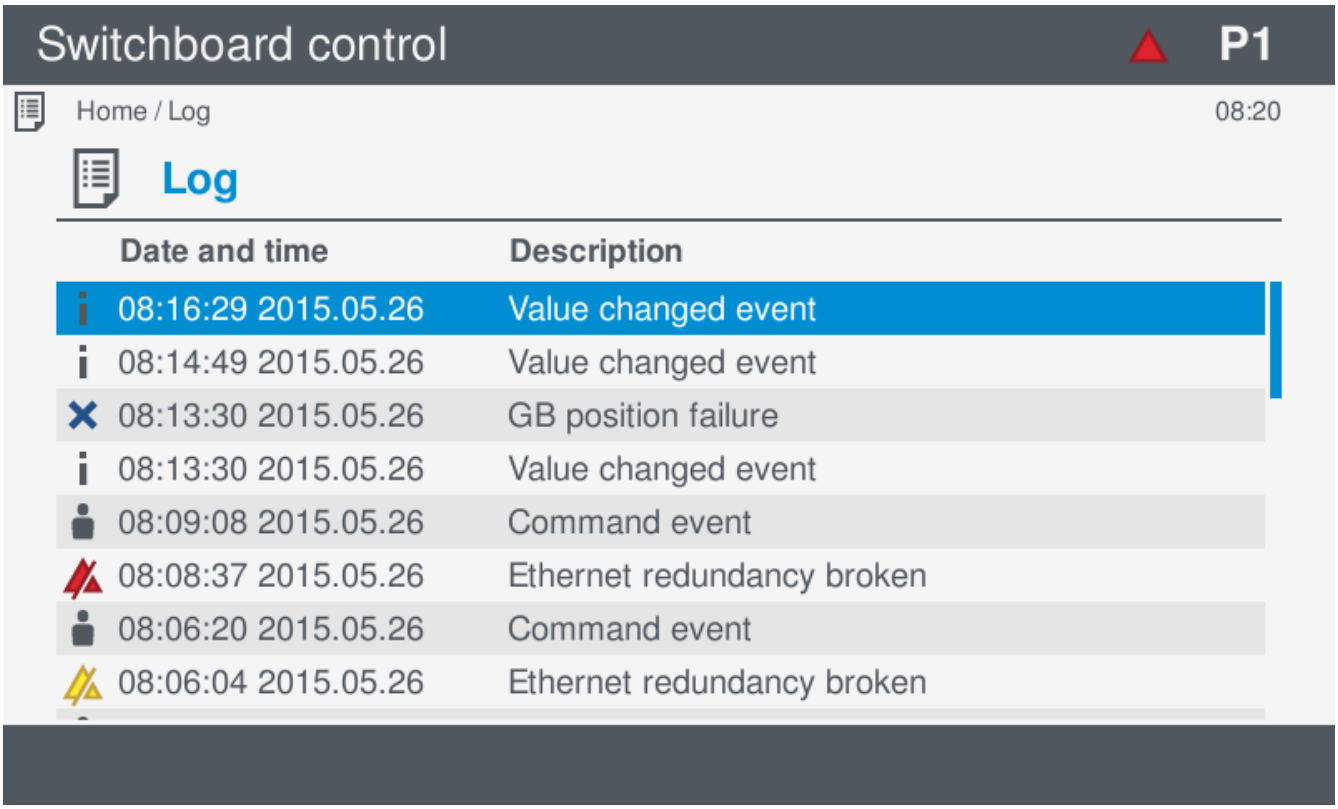
1. Select **Alarms** to view the alarm list.
2. Highlight the *Out of service* alarm by using the push-buttons **Up** or **Down** .
3. Select the alarm details by using the push-button **OK** .
4. Select **Service** by using the push-buttons **Up** or **Down** , and use the push-button **OK** to open the service menu.
5. Select **Return to service** by using the push-buttons **Up** or **Down** , and use the push-button **OK** to return the alarm.
6. The alarm protection is checked by the controller and may become active again.

5.3 Event log

5.3.1 Reviewing log events

Events that occur during the operation of the controller are recorded in the event log.

Figure 5.5 Example log display



View the events that have occurred in the system under **Log**.

Reviewing log events

To view an event log entry, perform the following steps:

1. Select **Log** to view the event log.
2. Scroll through the event log by pressing the push-button **Up** or **Down**.
3. Select an event by pressing the push-button **OK**.
4. Select either **Info** or **Diagram** by pressing the push-button **Up** or **Down** and pressing **OK**.
5. Further details of the event are shown on the display.

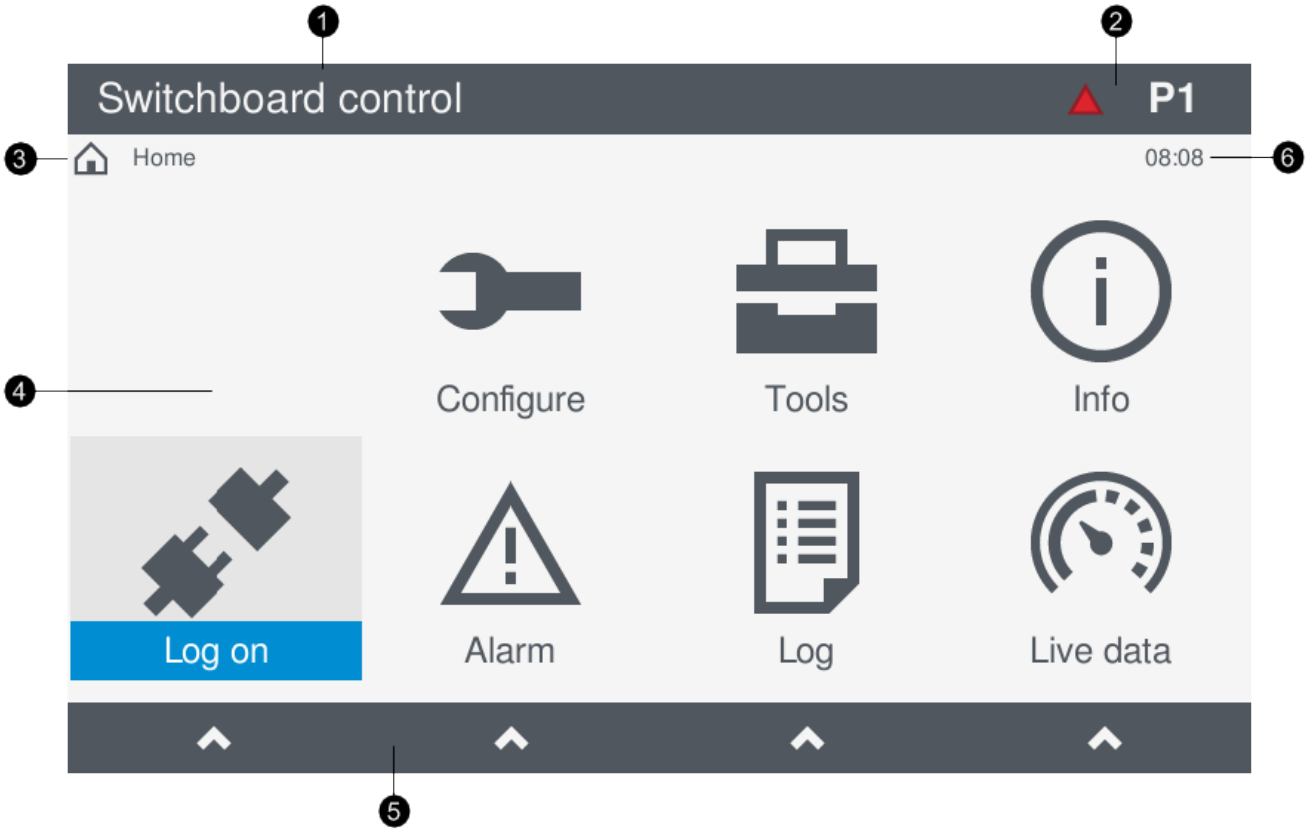
6. Using the display unit

6.1 Introduction

6.1.1 About the display unit

The display unit provides you quick and easy access to both operating information and configuration of the controller.

Figure 6.1 Display unit DU 300 main menu example



1. Controller status information
2. Status bar icons
3. Path for menu or feature
4. Menu icons
5. Selection bar
6. Time

6.1.2 About the features

INFO
The actual features available on the display unit are controlled by the *group* and *user* permissions for the controller. Some features may be *read only* or *not visible*, depending upon the permissions assigned to your user profile.

Log on or off				
Log on				
View or configure parameters				
Configure >	**Parameters**			
View or configure I/O				
Configure >	**Input/Output**			
View or action alarms				
Alarms				
View or configure communication				
Tools >	**Communication**			
View or configure brightness level				
Tools >	**Advanced >**	**Brightness >**	**Brightness level**	
View or configure brightness time				
Tools >	**Advanced >**	**Brightness >**	**Brightness time**	
View permission groups				
Tools >	**Advanced >**	**Permissions >**	**Groups**	
View permission users				
Tools >	**Advanced >**	**Permissions >**	**Users**	
View event log				
Log				
View about information				
Info >	**About**			
View production information				
Info >	**Production**			

View Live data information

Live data

See **Operating the system**, in this document for more information regarding the basic controller actions, such as starting or stopping the genset.

INFO
Creation of the single-line diagram or configuration of CustomLogic can only be done by using PICUS in the first release.

6.1.3 About the status bar

There is a status bar at the top of the display unit screen.

Figure 6.2 Status bar example

Controller status text	Notes
Switchboard control	The controller is under switchboard control.

At least one active alarm is present.

The display unit has a user logged on.

Shows the genset priority (only for GENSET controllers).

Shows the live data page number (only on the live data screen).

6.1.4 About the soft keys

The soft key buttons, which are displayed on screen, allow you to perform different features or options for the screen you are viewing. The soft key buttons also allow you to navigate the menus on the display unit.

You select a soft key function by pressing the appropriate push-button .

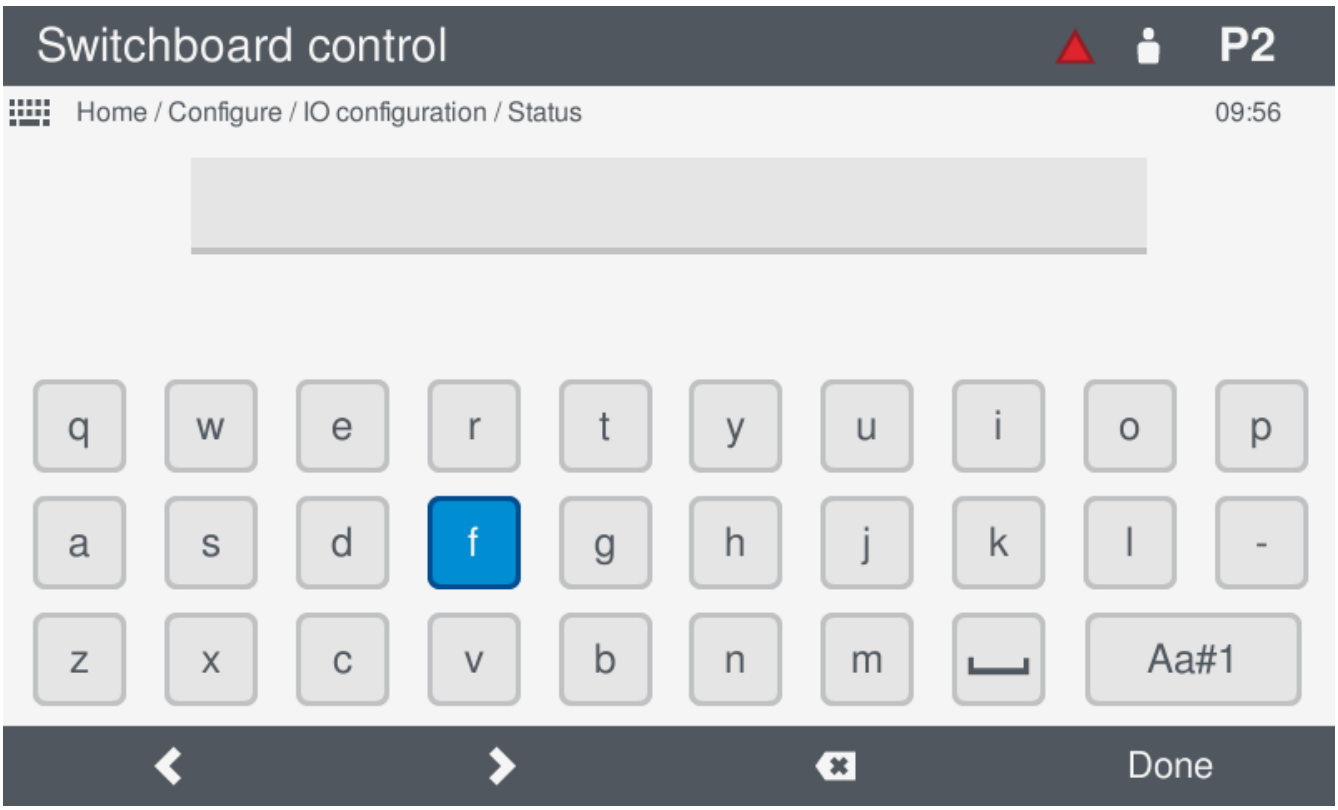
Soft key	Area	Notes
Home	Live data	Returns to the *Home* menu.
Done	Data entry	Confirms the information entered.
Toggle	Data entry	Toggle the option **ON**/**OFF**.
Clear all	Data entry	Clears all selected options.
Reset latches	Alarms	Resets all latched alarms.
Acknowledge	Alarms	Acknowledges an alarm.
▲	All	Moves the highlighted option up.
▼	All	Moves the highlighted option down.
◀	All	Moves the highlighted option left.
▶	All	Moves the highlighted option right.
⌫	Virtual keyboard	Deletes the previous character.
User info	Log on	Views additional user information.
Log off	Log on	Log off the current user.
Alarm	I/O	View selectable alarm.
Functions	I/O	View selectable functions.
I/O Title	I/O	Change the I/O title.
Sensor	I/O	Configure the analogue input (AI) settings.
Output setup	I/O	Configure the analogue output (AO & PWM) settings.
Next	I/O	View next settings page.
Add	I/O	Add a coordinate.
Remove	I/O	Remove a coordinate.
Edit	I/O	Edit the information.
Relay	I/O	View or configure the relay setup

Soft key	Area	Notes
Energize	I/O	Relay energize
De-energize	I/O	Relay de-energize
Write	All	Write information to the controller.

6.1.5 About the virtual keyboard

The display unit features a *virtual keyboard*, which is used to enter the information for the controller settings or features. The virtual keyboard can display characters for *lowercase* and *uppercase* letters, *numbers* or *symbols*.

Figure 6.3 Example virtual keyboard



Move around the virtual keyboard

- To move up or down:
  - Press the push-buttons **Up** or **Down** .
- To move left or right:
  - Select the soft keys **Left** or **Right** , by pressing the appropriate push-button .

Adding or removing a highlighted character

- To add the highlighted character:
  - Press the push-button **OK** OK.
- To delete the last character:
  - Select the soft key **Delete** ⌫, by pressing the appropriate push-button .
- To cycle through the available different keyboard:
  - Select the soft key **Aa#1** Aa#1, by pressing the appropriate push-button .
    - Press the push-button **OK** OK to continue to cycle through the available keyboards.
- To confirm the entered information:
  - Select the soft key **Done** Done, by pressing the appropriate push-button .

6.2 Log on

6.2.1 About permissions

The controller is protected by *group* and *user* permissions, which allow access to the functionality of the controller. To access the controller you must log on by using a *user* and *password*. The *user* has associated permissions to the controller and software.

INFO
Group and *user* permissions can only be created and configured by using PICUS.

The display unit can be used without the need to log on a *user* profile, however this only provides limited access or features.

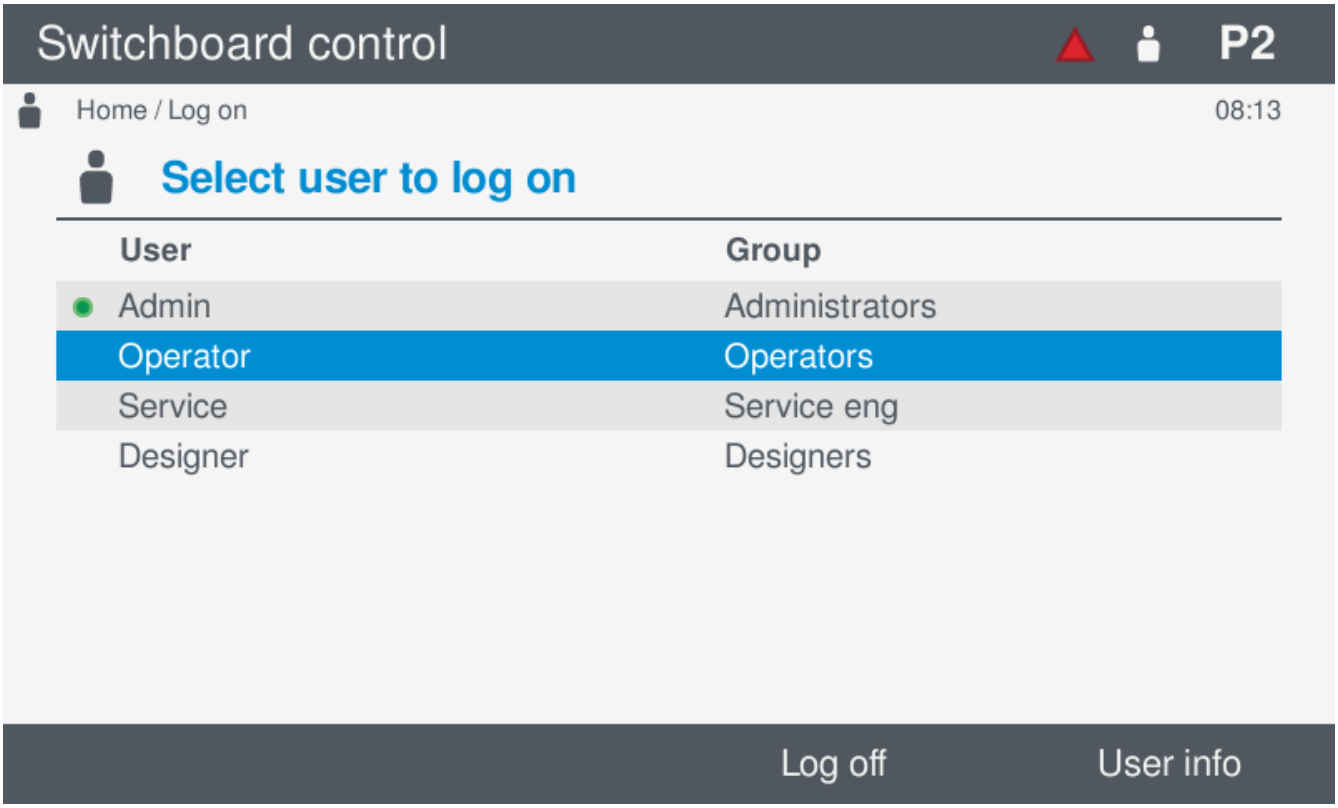
See **PICUS software**, **Group permissions and users** in the Designer's handbook for more information regarding groups and users.

6.2.2 Log on to controller

Log on, log off, or change user logged on under **Log on**.

INFO
You do not need to log on to the controller to view the Live data information.

Figure 6.4 Example log on screen



Log on to controller

To log on the controller, perform the following steps:

1. Select **Log on**, from the *Home* menu, to view the available users for the controller.
   - The currently logged on *user* is shown with a green dot .
2. Highlight the required *user* by pressing the push-button **Up** or **Down** .
3. Select the highlighted *user* by pressing the push-button **OK** .
   - A *virtual keyboard* is displayed on screen.
   - You must enter the *password* for the selected *user*.
4. Enter the *password* by using the virtual keyboard.
5. If the password entered is correct, you are logged on as the new *user* and permissions.

View extra user information

To view extra information about a user, perform the following steps:

1. Select **Log on** to view the available users for the controller.
2. Highlight the required *user* by pressing the push-button **Up** or **Down** .
3. Select the soft key **User info** User info .
   - Further details about the *user* are displayed on screen.
4. Press the push-button **Back** to return to the previous list of users.

6.2.3 Log off controller

To log off the currently logged on user, simply select the soft key **Log off** 

.

You are logged off the controller and the default *user* is now active.

INFO
Any logged on *user* will be automatically logged off after 3 minutes of inactivity. After the 3 minutes have expired the default *user* will become active and have limited access to the display unit features or functions.

6.3 Configure

6.3.1 About configure

The configure menu allows you to do the following:

Configure the I/O settings.

Configure the parameter settings.

6.3.2 Configure parameters

Configure parameter settings under **Configure > Parameters**.

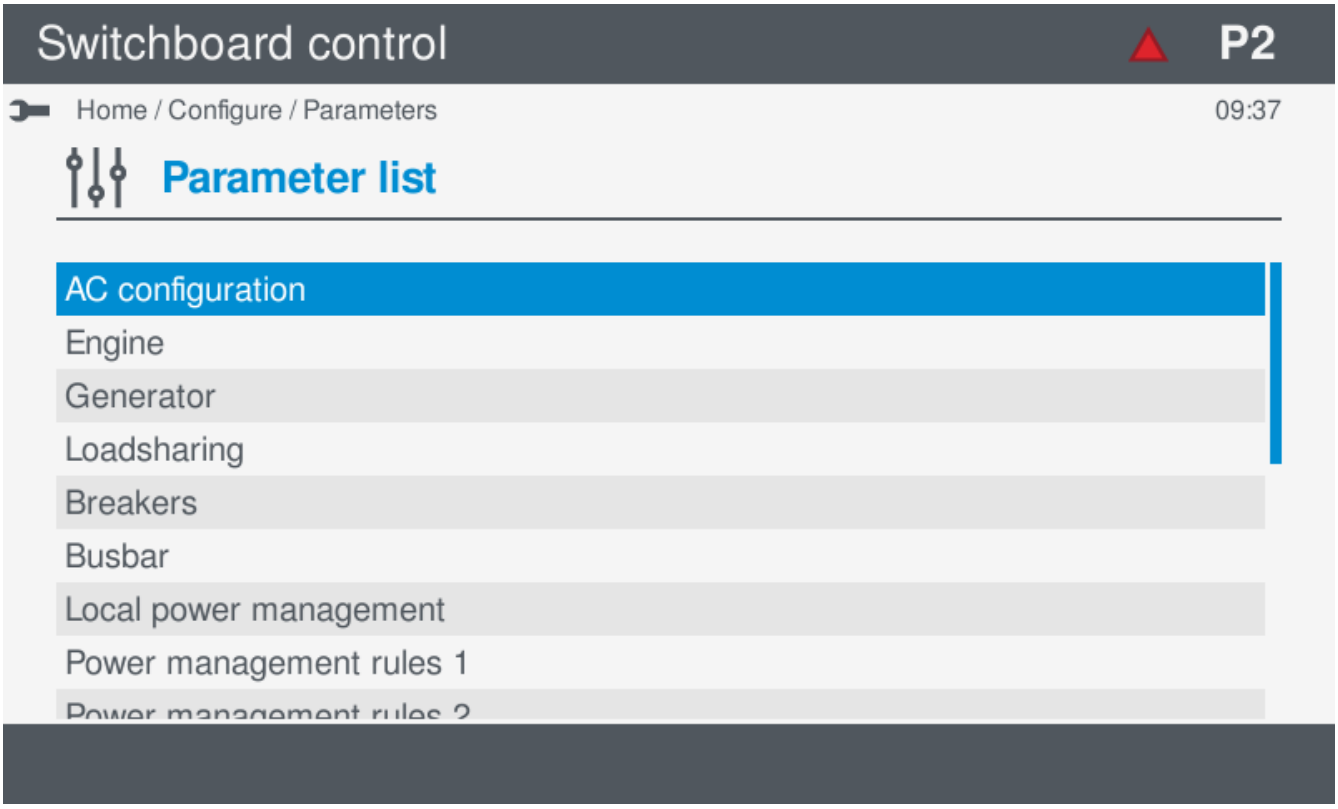
You can configure the parameters for both system settings and alarm settings.

The parameters are organised into categories and groups:

Category
↳ Group
↳ Parameter(s)

Configure parameters

Figure 6.5 Example parameter categories



To configure the parameters, perform the following steps:

1. Select **Configure** , from the *Home* menu.
2. Select **Parameters** to view the controller parameter categories.
   - The parameter categories shown depend upon the type of controller or whether the associated I/O has been configured.
3. Highlight the parameter category you wish to open, by pressing the push-button **Up** or **Down**.
4. Select the highlighted parameter category by pressing the push-button **OK**.
   - The parameter groups under the selected category are shown on the display.
5. Highlight the parameter group you wish to open, by pressing the push-button **Up** or **Down**.
6. Select the highlighted parameter group by pressing the push-button **OK**.
   - The parameter settings are shown on the display.
7. To highlight the parameter, select the soft key **Up** or **Down** , by pressing the appropriate push-button .

8. To highlight the parameter settings, press the push-button **Up** or **Down** .
9. Change the setting, by pressing the push-button **OK** .
   - If the setting can be toggled, you can use the soft key **Toggle** Toggle, by pressing the appropriate push-button .
   - If the setting is text or a value, pressing the push-button **OK** displays the *virtual keyboard* to alter the setting.
     - The parameter settings *minimum*, *maximum* and *default* are also shown.
     - Use the *Virtual keyboard* to make the required changes.
     - To confirm the setting, select the soft key **Write** Write, by pressing the appropriate push-button .
   - If the setting is a selection, pressing the push-button **OK** displays an available list of selection options.
     - Highlight the option required, by pressing the push-button **Up** or **Down** .
     - Select the option, by pressing the push-button **OK** .
     - To confirm the setting, select the soft key **Write** Write, by pressing the appropriate push-button .

6.3.3 Configure I/O setup

Configure I/O settings under **Configure > Input/Output**.

You can configure the I/O settings and terminals for any of the hardware modules within the connected controller.

See **Hardware characteristics**, in the **Designer's handbook** for more information regarding the different hardware modules and their terminal details.

To configure the I/O settings you need to perform the following steps:

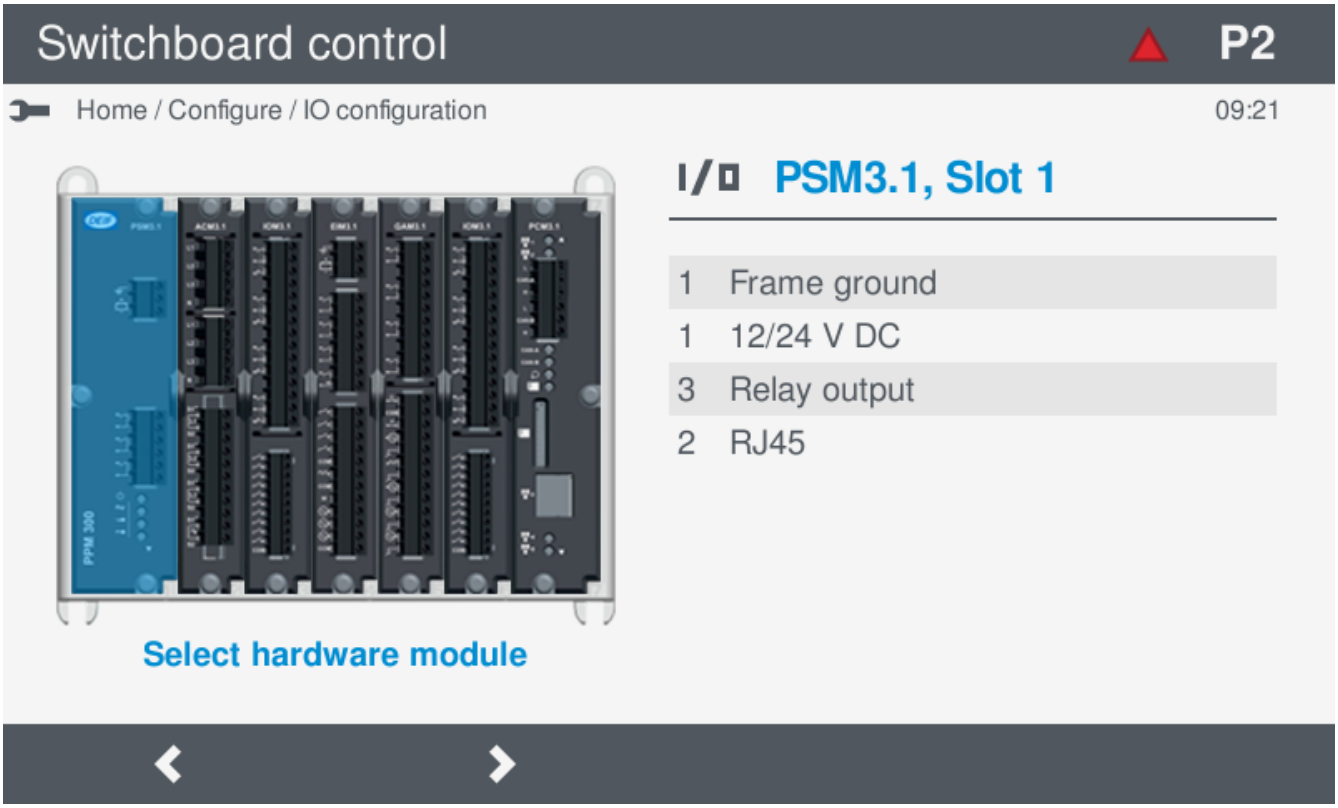
1. Select hardware module to configure
2. Select terminal(s) to configure
3. Configure the terminal(s) settings

6.3.4 Selecting a hardware module

Before you can configure the I/O settings, you first need to select the hardware module in the controller.

INFO
The hardware modules shown vary depending upon controller type or hardware modules installed. The hardware selection screen shows the same hardware modules as you have installed in the controller.

Figure 6.6 Example select hardware module



INFO
Basic details about the available I/Os on the module are shown at the right.

Selecting a hardware module

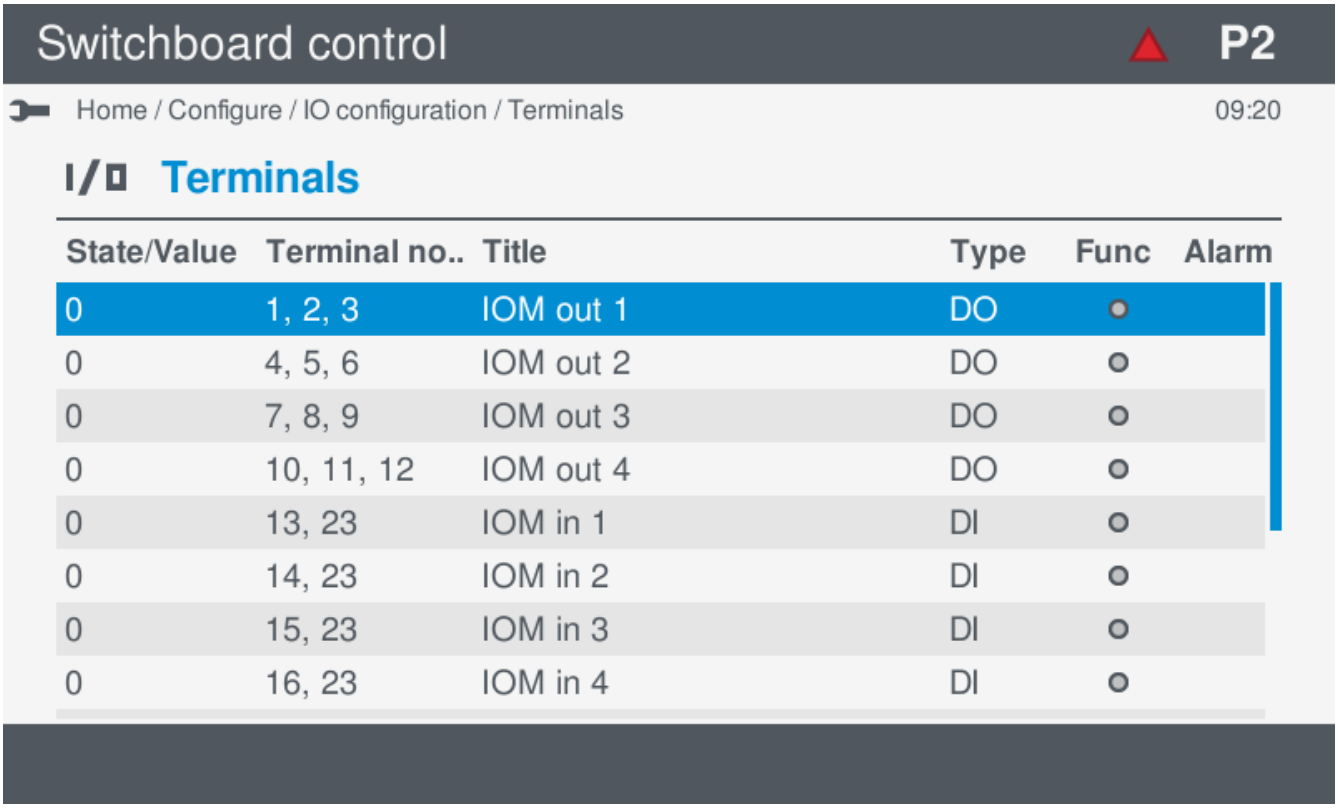
To select the hardware module, perform the following steps:

1. To move between the hardware modules, select the soft key **Left** or **Right**, by pressing the appropriate push-button.
   - Basic information about the selected hardware module is shown at the right.
2. Select the highlighted hardware module by pressing the push-button **OK**.
   - The I/O terminals for the hardware module are displayed on screen.

6.3.5 View or configure hardware module I/O terminals

After selecting the hardware module, the details of the available terminals are shown on the display.

Figure 6.7 Example I/O configuration terminals



If a terminal has already had configured for either a *Function* or *Alarm*, the terminal is marked with grey dot .

INFO
The actual terminal types shown depend upon the type of hardware module selected or installed.

Type	Notes
DI	Digital input
DO	Digital output
AI	Analogue input
AO	Analogue output
PWM	Pulse width modulation

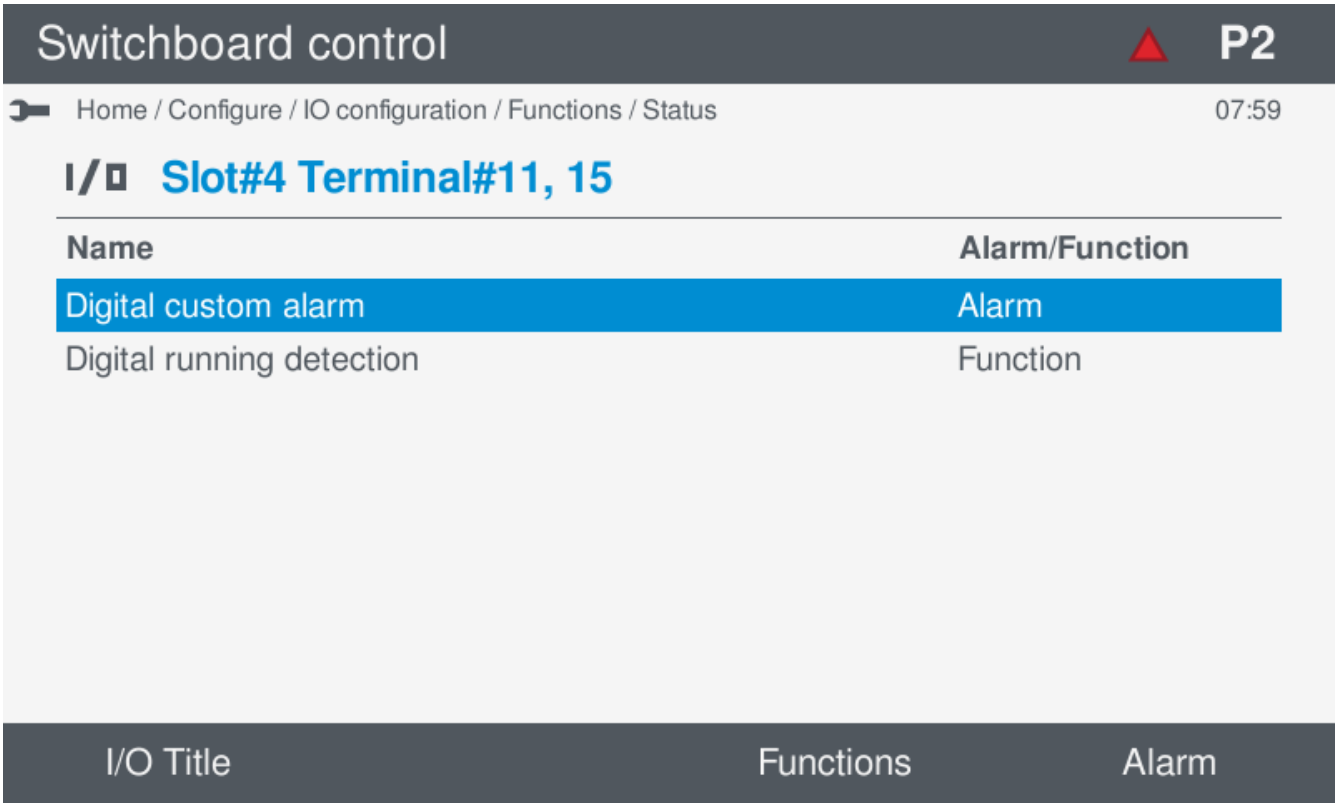
View or configure terminal settings

1. Highlight the required terminal, by pressing the push-button **Up** or **Down** .
2. Select the highlighted terminal by pressing the push-button **OK** .
   - Details of the terminal settings are displayed on the screen.

6.3.6 I/O terminal settings

After selecting the hardware module and the required terminal, the details of the terminal settings are shown on the display.

Figure 6.8 Example hardware module terminals



Here you can configure various settings for the terminal, subject to the type of terminal and hardware module selected. The actual features you can select or configure are also subject to the type of hardware module you have selected.

From this screen you can:	
I/O Title	Configure I/O title (all).
Relay	Configure relay (DO).
Sensor	Configure analogue input settings (AI).
Output setup	Configure analogue output or PWM settings (AO or PWM).
Functions	Assign function(s) to the I/O (all).
Alarm	Assign alarm(s) to the I/O (all).

Configure the I/O title

To rename the input or output title:

1. Select the soft key **I/O Title** I/O Title, by pressing the appropriate push-button.
   - The *virtual keyboard* is displayed on screen to edit the I/O title.
2. Enter the required I/O title and select the soft key **Done** Done, by pressing the appropriate push-button.

Configure relay (if applicable)

1. Select the soft key **Relay** Relay, by pressing the appropriate push-button.
   - The relay configuration is shown on the screen.

See **View or configure I/O relay**, in the following section of this document for more information.

Configure analogue input (AI) sensor (if applicable)

1. Select the soft key **Sensor** Sensor, by pressing the appropriate push-button.
   - The analogue input (AI) sensor settings are shown on the screen.

See **View or configure analogue input (AI)**, in the following section of this document for more information.

Configure analogue output (AO) or pulse width modulation (PWM) (if applicable)

1. Select the soft key **Output setup** Output setup, by pressing the appropriate push-button.
   - The analogue output (AO) or pulse width modulation (PWM) settings are shown on the screen.

See **View or configure analogue output (AO) or pulse width modulation (PWM)**, in the following section of this document for more information.

View or configure alarm(s)

1. Select the soft key **Alarm** Alarm, by pressing the appropriate push-button.
   - The alarm(s) are shown on screen.

See **View or configure alarms**, in the following section of this document for more information.

View or configure function(s)

1. Select the soft key **Functions** Functions, by pressing the appropriate push-button .
   - The functions are shown on screen.

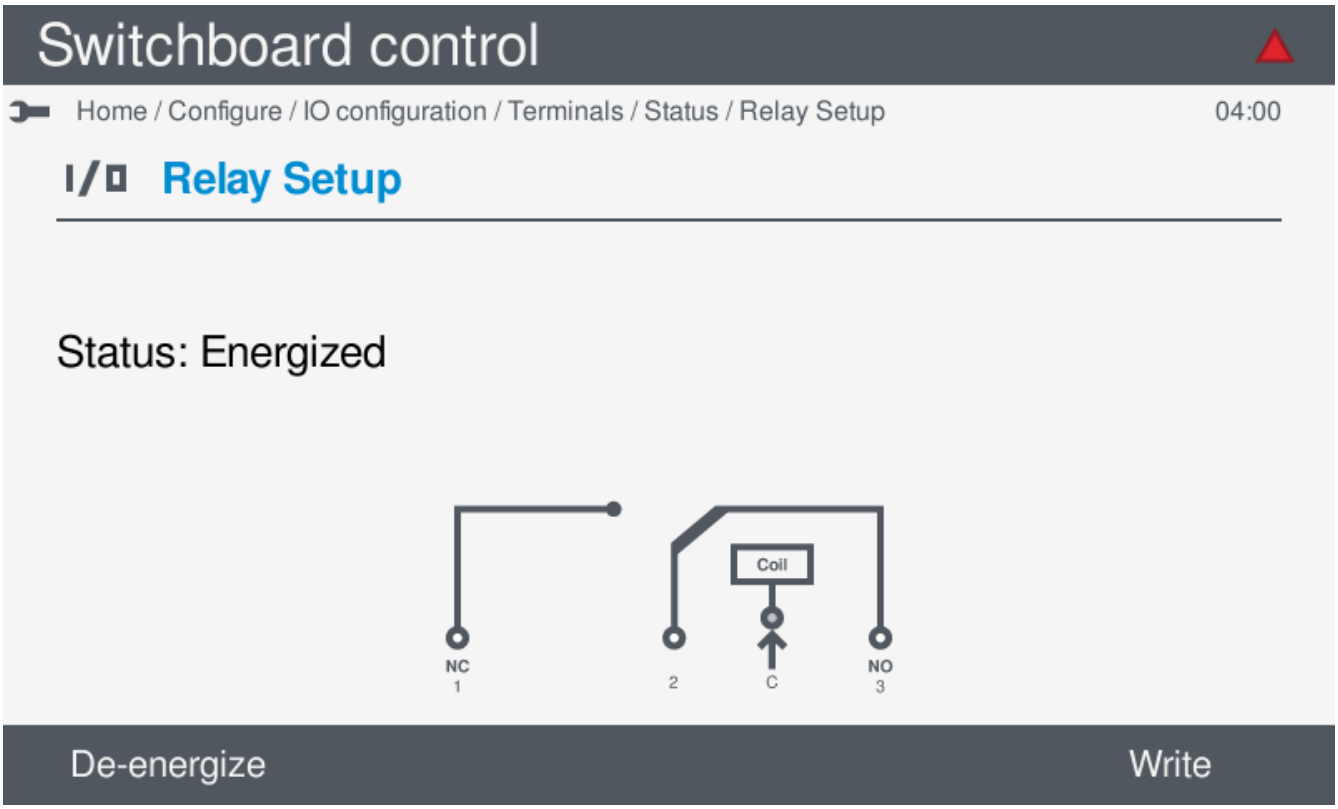
See **View or configure functions**, in the following section of this document for more information.

6.3.7 View or configure I/O relay

You can configure the setting for the relay. The current configure state for the relay is shown on the display. By default all relays are considered to be *Normally open* and in a *De-energized* state.

From this screen you can configure either a standard relay or a changeover relay, depending upon the type of relay that can be connected to the hardware module terminals.t

Figure 6.9 Example relay setup



See **Hardware characteristics**, in the *Designer's handbook* for more information about the hardware modules that support relays.

Configure the relay

1. You can set the relay as either *Energize* or *De-energize*.
   - The current setting is shown on the display.
2. You can set the relay as either *Energize* or *De-energize*.
3. To set as *Energize* select the soft key **Energize** Energize, by pressing the appropriate push-button .
4. To set as *De-energize* select the soft key **De-energize** De-energize, by pressing the appropriate push-button .
5. To save the setting to the controller, select the soft key **Write** Write, by pressing the appropriate push-button .
   - You are returned to the terminal screen.

6.3.8 View or configure analogue input (AI)

To configure the analogue input (AI) you need to perform the following stages:

1. Select the hardware type
2. Select the scale
   - You can reuse a previously created scale if required, subject to limitations
3. Edit the scale
4. Write the sensor settings

Select the hardware type

1. Highlight the required hardware type, by pressing the push-button **Up** or **Down** .
2. Select the highlighted hardware type, by pressing the push-button **OK** OK.
3. To proceed to the next stage, select the soft key **Next** Next.

You can either:

- Select a previously created scale
- Edit a new or previously created scale

INFO
You can reuse any previously created scale on any I/O. However, the configuration settings are the same across all the other I/O terminals. If you alter the settings for a scale this will apply to all I/O terminals where the scale has been used.

Select a scale

1. Highlight the required scale, by pressing the push-button **Up** or **Down** .
2. Select the highlighted scale, by pressing the push-button **OK** OK.
   - Selected scale is shown with a solid box.
   - To remove the selection, simply press the push-button **OK** OK again.

3. To edit the scale, select the soft key **Edit** Edit.
   - Details of the scale settings are shown on the display.
   - See the section *Edit a scale* below.
4. To save the settings to the controller, select the soft key **Write** Write.
   - This only saves the selected settings to the controller. It does not save other I/O settings.

Edit a scale

To configure the scale settings you need to perform the following stages:

1. Configure the unit, minimum, and maximum first.
2. Configure the X and Y coordinates
3. Write the scale settings

1. Highlight the scale setting, by pressing the push-button **Up** or **Down**.
2. Edit the highlighted setting, by pressing the push-button **OK**.
   - If the setting is text or a value, pressing the push-button **OK** displays the *virtual keyboard* to change the setting.
   - If the setting is a selection, pressing the push-button **OK** displays an available list of selection options.
     - Highlight the option required, by pressing the push-button **Up** or **Down**.
     - Select or unselect the option, by pressing the push-button **OK**.
     - To confirm the setting, select the soft key **Done** Done.
   - If the setting is the X Y coordinates, pressing the push-button **OK** displays the coordinate options.
     a. Adding coordinates
        a. To add a coordinate, select the soft key **Add** Add.
           - The *Virtual keyboard* is shown on the display.
        b. Enter the X coordinate using the *Virtual keyboard* and select the soft key **Done** Done.
           - The *Virtual keyboard* is shown on the display.
        c. Enter the Y coordinate using the *Virtual keyboard* and select the soft key **Done** Done.
           - The coordinates are shown on the display.
           - You can, if necessary, remove or edit the coordinates.
        d. Add as many coordinates as you require.
        e. When you have added all the coordinates you require, press the push-button **Back** to return to the scale settings.
     b. Removing coordinates
        a. Highlight the coordinate to remove, by pressing the push-button **Up** or **Down**.
        b. Select the soft key **Remove** Remove.
           - The coordinate is removed from the coordinate list.
        c. When you have added/edited all the coordinates you require, press the push-button **Back** to return to the scale settings.
     c. Editing coordinates
        a. Highlight the coordinate to edit, by pressing the push-button **Up** or **Down**.
        b. To edit coordinates, select the soft key **Edit** Edit.
           - The *Virtual keyboard* is shown on the display.
        c. Edit the X coordinate using the *Virtual keyboard* and select the soft key **Done** Done.
           - The *Virtual keyboard* is shown on the display.
        d. Edit the Y coordinate using the *Virtual keyboard* and select the soft key **Done** Done.
           - The coordinates list is shown on the display.
        e. When you have added/edited all the coordinates you require, press the push-button **Back** to return to the scale settings.
3. To save the settings to the controller, select the soft key **Write** Write.
   - This only saves the selected settings to the controller. It does not save other I/O settings.

6.3.9 View or configure analogue output (AO) or pulse width modulation (PWM)

To configure the analogue output (AO) or pulse width modulation (PWM) you need to perform the following stages:

1. Select the hardware type
2. Select the scale
   - You can reuse a previously created scale if required, subject to limitations
3. Edit the scale
4. Write the sensor settings

Select the hardware type

1. Highlight the required hardware type, by pressing the push-button **Up** or **Down** .
2. Select the highlighted hardware type, by pressing the push-button **OK** .
3. To proceed to the next stage, select the soft key **Next** Next.

You can either:

- Select a previously created scale
- Edit a new or previously created scale

INFO
You can reuse any previously created scale on any I/O. However, the configuration settings are the same across all the other I/O terminals. If you alter the settings for a scale this will apply to all I/O terminals where the scale has been used.

Select a scale

1. Highlight the required scale, by pressing the push-button **Up** or **Down** .
2. Select the highlighted scale, by pressing the push-button **OK** .
   - Selected scale is shown with a solid box.
   - To remove the selection, simply press the push-button **OK** again.
3. To edit the scale, select the soft key **Edit** Edit.
   - Details of the scale settings are shown on the display.
   - See the section *Edit a scale* below.
4. To save the settings to the controller, select the soft key **Write** Write.
   - This only saves the selected settings to the controller. It does not save other I/O settings.

Edit a scale

To configure the scale settings you need to perform the following stages:

1. Configure the unit, minimum, and maximum first.
2. Configure the X and Y coordinates
3. Write the scale settings

1. Highlight the scale setting, by pressing the push-button **Up** or **Down**.
2. Edit the highlighted setting, by pressing the push-button **OK**.
   - If the setting is text or a value, pressing the push-button **OK** displays the *virtual keyboard* to change the setting.
   - If the setting is a selection, pressing the push-button **OK** displays an available list of selection options.
     - Highlight the option required, by pressing the push-button **Up** or **Down**.
     - Select or unselect the option, by pressing the push-button **OK**.
     - To confirm the setting, select the soft key **Done** Done.
   - If the setting is the X Y coordinates, pressing the push-button **OK** displays the coordinate options.
     a. Adding coordinates
        a. To add a coordinate, select the soft key **Add** Add.
           - The *Virtual keyboard* is shown on the display.
        b. Enter the X coordinate using the *Virtual keyboard* and select the soft key **Done** Done.
           - The *Virtual keyboard* is shown on the display.
        c. Enter the Y coordinate using the *Virtual keyboard* and select the soft key **Done** Done.
           - The coordinates are shown on the display.
           - You can, if necessary, remove or edit the coordinates.
        d. Add as many coordinates as you require.
        e. When you have added all the coordinates you require, press the push-button **Back** to return to the scale settings.
     b. Removing coordinates
        a. Highlight the coordinate to remove, by pressing the push-button **Up** or **Down**.
        b. Select the soft key **Remove** Remove.
           - The coordinate is removed from the coordinate list.
        c. When you have added/edited all the coordinates you require, press the push-button **Back** to return to the scale settings.
     c. Editing coordinates
        a. Highlight the coordinate to edit, by pressing the push-button **Up** or **Down**.
        b. To edit coordinates, select the soft key **Edit** Edit.
           - The *Virtual keyboard* is shown on the display.
        c. Edit the X coordinate using the *Virtual keyboard* and select the soft key **Done** Done.
           - The *Virtual keyboard* is shown on the display.
        d. Edit the Y coordinate using the *Virtual keyboard* and select the soft key **Done** Done.
           - The coordinates list is shown on the display.
        e. When you have added/edited all the coordinates you require, press the push-button **Back** to return to the scale settings.
3. To save the settings to the controller, select the soft key **Write** Write.
   - This only saves the selected settings to the controller. It does not save other I/O settings.

6.3.10 View or configure I/O alarms

The alarms available for the I/O are organised in to categories and groups, which is similar to a tree structure view.

INFO
When viewing or configuring a previously configured I/O with an alarm, the display will automatically jump to the alarm settings. You can, if required, use the **Back** to return to the alarm selection screen.

Selecting an alarm

1. Highlight a category or group, by pressing the push-button **Up** or **Down**.
2. Select the highlighted category or group, by pressing the push-button **OK**.
   - A further group may be shown or the alarm list to select the actual alarm(s).
   - If a further group is shown, simply repeat step 1 to locate and open the required group.

You can enable or not enable a pre-configured alarm, edit an existing alarm, or create a new custom alarm. You can also edit alarms that are not enabled.

Enable an alarm

1. Highlight the required alarm, by pressing the push-button **Up** or **Down**.
   - Details of the alarm settings are shown at the right side of the display.
2. Select the alarm, by pressing the push-button **OK**.
   - The selected alarm is shown with a solid box.
   - To remove the selection, simply press the push-button **OK** again.
   - You can also reconfigure the alarm by using the soft key **Edit** Edit (see below for further information).
3. To save the settings to the controller, select the soft key **Write** Write.
   - This only saves the selected alarm(s) and their settings to the controller. It does not save other I/O settings.

Clear all enabled alarm(s)

1. To clear all the selected alarms, select the soft key **Clear all** Clear all.
2. To save the new setting to the controller, select the soft key **Write** Write.
   - This only saves the selected alarm(s) and their settings to the controller. It does not save other I/O settings.

Editing an alarm

1. Highlight the required alarm, by pressing the push-button **Up** or **Down** .
2. Select the soft key **Edit** Edit.
   - Details of the alarm settings are shown on the display for you to configure.
     a. Highlight the required alarm setting, by pressing the push-button **Up** or **Down** .
     b. To change the setting, press the push-button **OK** OK.
        - If the setting is **Enable** or **Not enabled**, pressing the push-button **OK** OK toggles either **Enable** or **Not enabled**.
          - Enabled settings are marked with a solid box.
        - If the setting is text or a value, pressing the push-button **OK** OK displays the *virtual keyboard* to alter the setting.
          - Make the required changes using the *virtual keyboard*.
          - To confirm the changes, select the soft key **Done** Done.
        - If the setting is a selection, pressing the push-button **OK** OK displays an available list of selection options.
          - Highlight the option required, by pressing the push-button **Up** or **Down** .
          - Select or unselect the option, by pressing the push-button **OK** OK.
          - To confirm the setting, select the soft key **Done** Done.
     c. Once you have made all the required changes to the alarm settings, select the soft key **Write** Write.
        - This saves the alarm setting to the controller. This does not save any other settings.
        - The list of available alarms is shown again on the display.
3. To save the new setting to the controller, select the soft key **Write** Write.
   - This only saves the selected alarm(s) and their settings to the controller. It does not save other I/O settings.

Create a new alarm

To create a new alarm, simply edit one of the available *Custom alarms* listed.

INFO
It is recommended to give your created alarms a new descriptive name for easier reference.

1. Highlight a previously unused alarm, typically named digital or analogue custom alarm, by pressing the push-button **Up** or **Down** .
2. Select the soft key **Edit** Edit.
   - Details of the alarm settings are shown on the display for you to configure (see above for further information).

6.3.11 View or configure functions

The functions available are organised in to categories and groups, which is similar to a tree structure view.

Selecting a function

1. Highlight a category or group, by pressing the push-button **Up** or **Down** .
2. Select the highlighted category or group, by pressing the push-button **OK** .
   - A further group may be shown or the function list to select the actual function.
   - If a further group is shown, simply repeat step 1 to locate and open the required group.

Configure functions

1. To select the functions for the terminal:
   - Highlight the required function, by pressing the push-button **Up** or **Down** .
   - Enable the highlighted function, by pressing the push-button **OK** .
     - Selected function(s) are shown with a solid box.
   - To clear all the **Enabled** functions, select the soft key **Clear all** Clear all .
   - To save the setting(s) to the controller, select the soft key **Write** Write .
     - This only applies to the selected functions and does not apply other I/O change(s).

6.4 Tools

6.4.1 About tools

The tools menu allows you to do the following:

View or configure the communication information.

View the advanced setup menu.

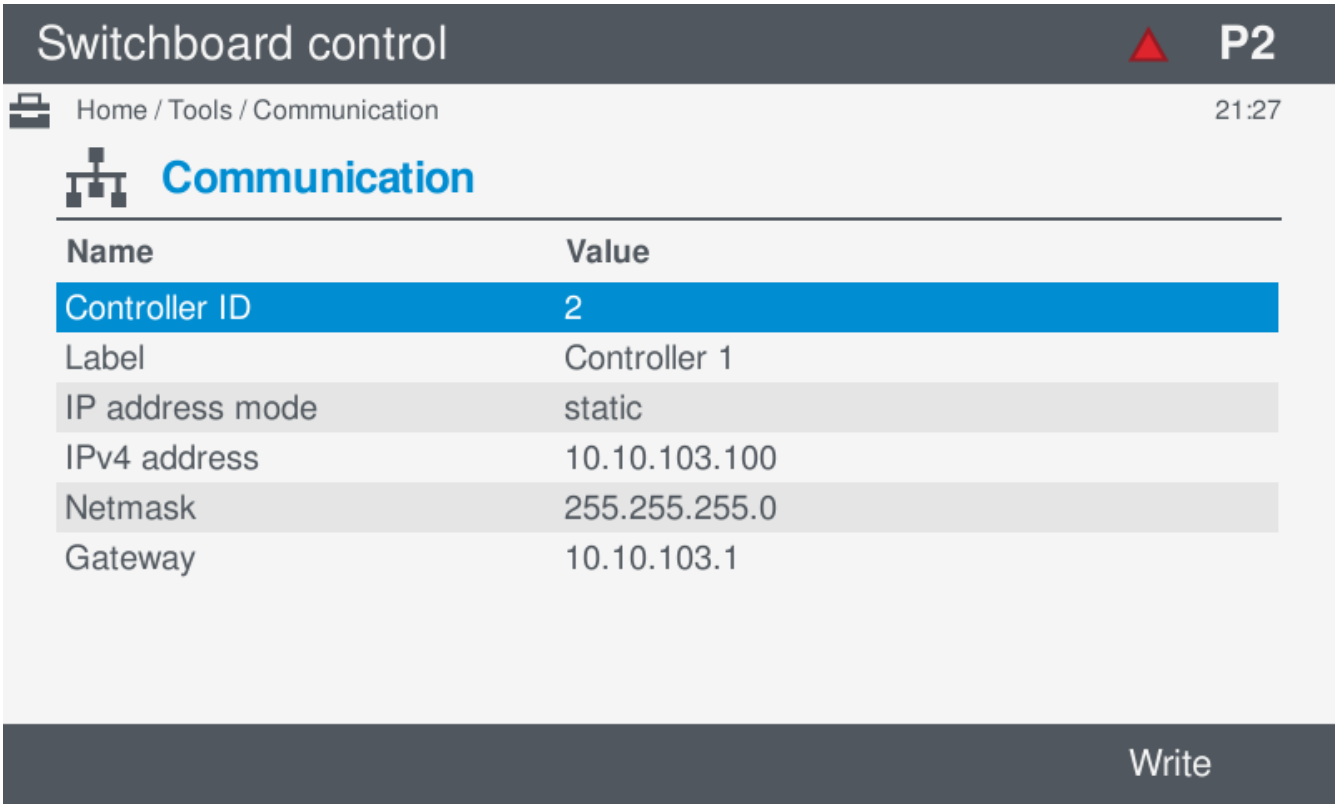
6.4.2 Configure communication

The communication screen displays all of the communication settings for the controller.

Configure the communication information under **Tools > Advanced > Communication**.

CAUTION
The DEIF controllers do not include a firewall or other Internet security measures. It is the customer's own responsibility to protect the network. DEIF therefore recommends only connecting the controllers to local networks.

Figure 6.10 Example communication screen



See **Hardware characteristics**, **DEIF Ethernet network** in the **Designer's handbook** for more information regarding the communication possibilities.

Setting	Range	Default	Notes
Controller ID	1, 64	1	
Label	0, 50 characters	Blank	Textual name for easy reference of the controller.
IP address mode	Static, Auto	Auto	Select *Static* for IPv4.
IPv4 address	0.0.0.0, 255.255.255.255	No default	Static IPv4 address for the controller.
Netmask	0.0.0.0, 255.255.255.255	No default	Depends upon IPv4 address.
Gateway	0.0.0.0, 255.255.255.255	No default	

Reviewing communication information

To view the communication information, perform the following steps:

1. Select **Tools** , from the *Home* menu.
2. Select **Advanced**, from the *Tools* menu.
3. Select **Communication** to view the communication settings for the controller.
4. Scroll through the information by pressing the push-button **Up** or **Down** .

Configuring communication information

To change the communication information, perform the following steps:

1. Select **Tools** , from the *Home* menu.
2. Select **Advanced**, from the *Tools* menu.
3. Select **Communication** to view the communication settings for the controller.
4. Select the information to configure by pressing the push-button **OK** OK.
   - Either the *virtual keyboard* or a selection choice is displayed on screen.
   - Make the required changes or selection.
   - Select the soft key **Done** Done, by pressing the appropriate push-button .
5. When all change(s) have been made, select the soft key **Write** Write by pressing the appropriate push-button to save the settings to the controller.

6.4.3 About advanced setup

The advanced setup menu allows you to do the following:

View the *Permissions* menu.

6.4.4 About permissions

The permissions menu allows you to do the following:

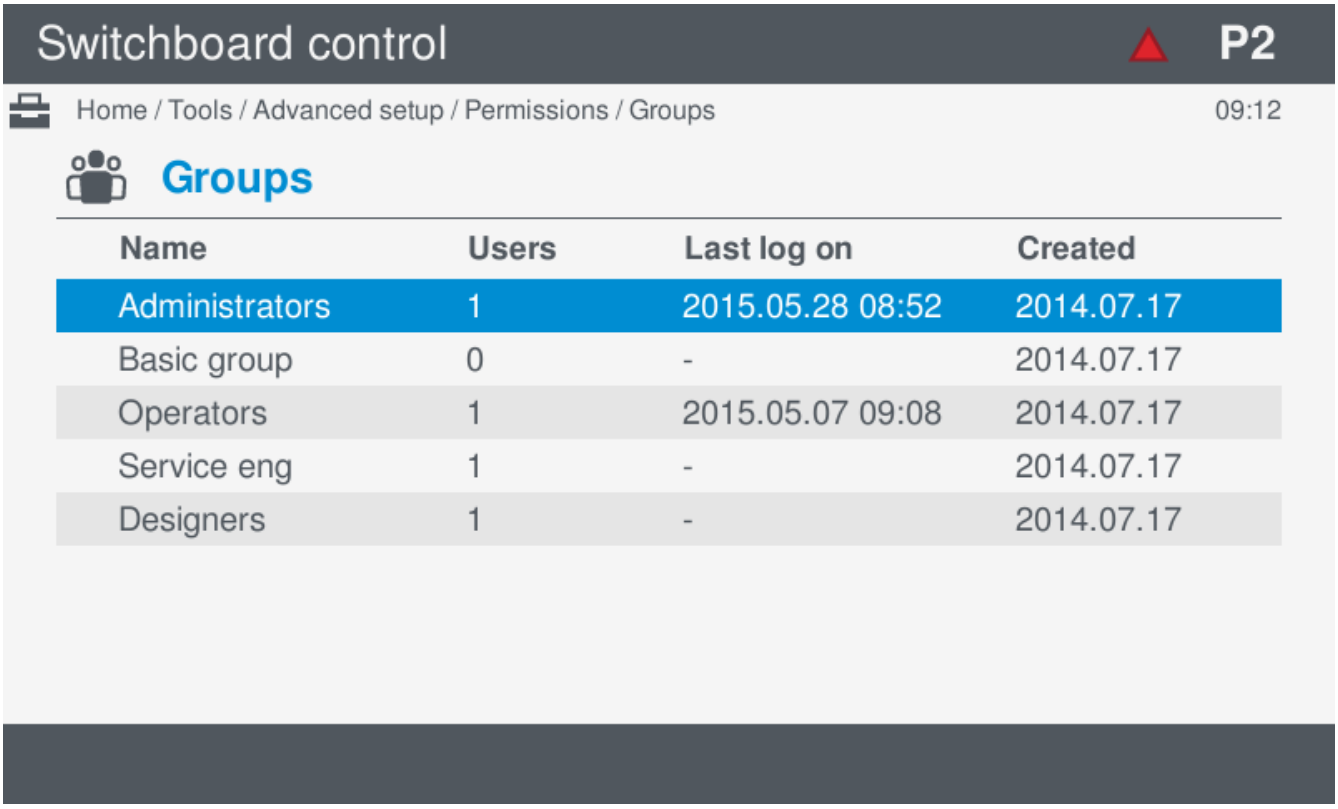
View the *Group* information.

View the *User* information.

6.4.5 View groups

View the *Group* information under **Tools > Advanced > Permissions > Groups**.

Figure 6.11 Example groups screen



See **PICUS software**, **Group permissions and users** in the **Designer's handbook** for more information regarding permissions.

Reviewing group information

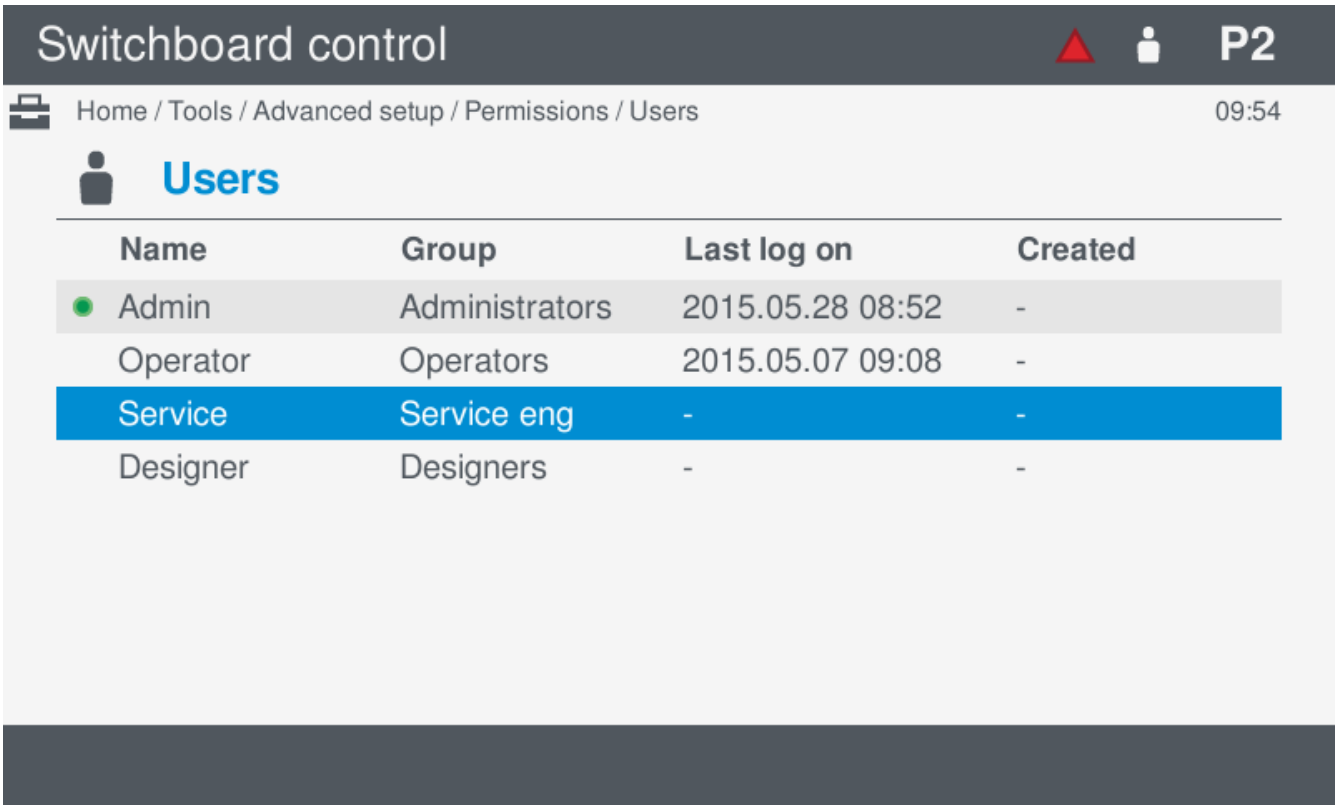
To view the group information, perform the following steps:

1. Select **Tools**, from the *Home* menu.
2. Select **Advanced**, from the *Tools* menu.
3. Select **Permissions**, from the *Advanced* menu.
4. Select **Groups**, from the *Permissions* menu, to view the group information.
   - Details of the groups setup on the controller are displayed on screen.
   - The group for the currently logged on user is shown with a green dot .
5. Scroll through the information by pressing the push-button **Up** or **Down** .
6. Further information is displayed by pressing the push-button **OK** on a highlighted group.
   - This includes all the associated users for the selected group.

6.4.6 View users

View the *User* information under **Tools > Advanced> Permissions > Users**.

Figure 6.12 Example user screen



See **PICUS software**, **Group permissions and users** in the **Designer's handbook** for more information regarding permissions.

Reviewing user information

To view the user information, perform the following steps:

1. Select **Tools**, from the *Home* menu.
2. Select **Advanced**, from the *Tools* menu.
3. Select **Permissions**, from the *Advanced* menu.
4. Select **Users**, from the *Permissions* menu, to view the group information.
   - Details of the users setup on the controller are displayed on screen.
   - The user currently logged on is shown with a green dot .
5. Scroll through the information by pressing the push-button **Up** or **Down** .
6. Further information is displayed by pressing the push-button **OK** on a highlighted user.

6.4.7 About brightness menu

The brightness menu allows you to do the following:

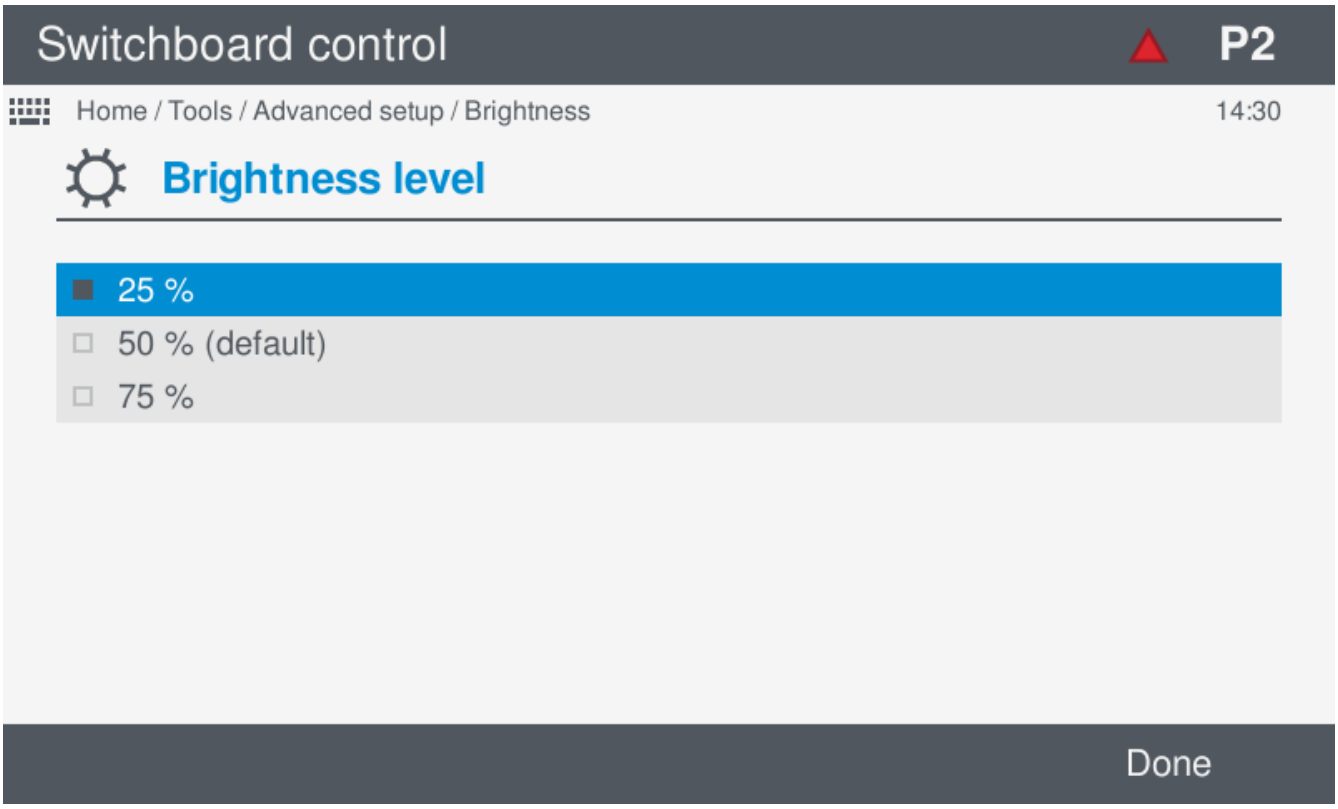
View or configure the *Brightness level* setting.

View or configure the *Brightness time* setting.

6.4.8 View or configure brightness level setting

View or configure the *Brightness level* setting under **Tools > Advanced > Brightness > Brightness level**.

Figure 6.13 Example brightness level screen



Changing brightness level setting

To change the brightness level setting, perform the following steps:

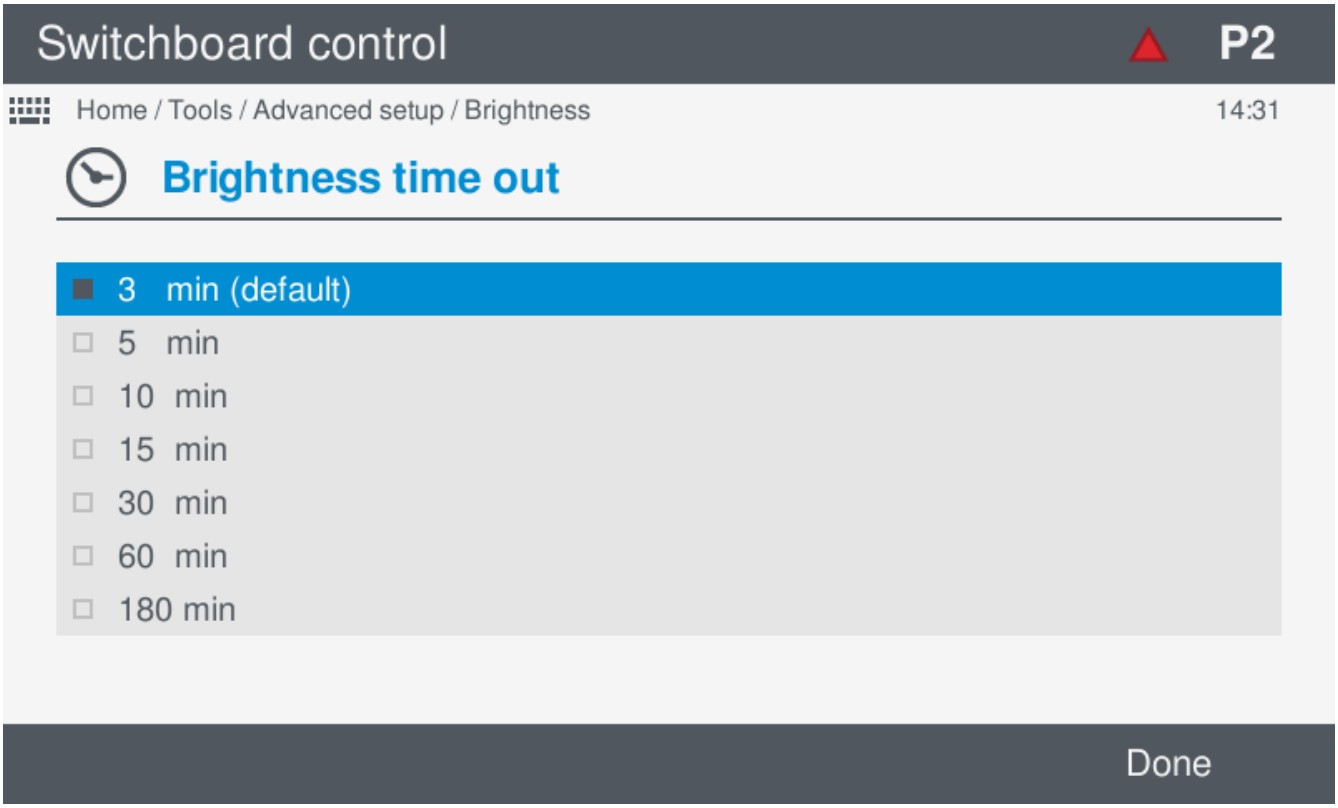
1. Select **Tools**, from the *Home* menu.
2. Select **Advanced**, from the *Tools* menu.
3. Select **Brightness**, from the *Advanced* menu.

4. Select **Brightness level**, from the *Brightness* menu.
   - The currently configured brightness level is shown with a solid box.
5. Highlight the required brightness level by pressing the push-button **Up** or **Down**.
6. Select the brightness level by pressing the push-button **OK**.
   - The selected brightness level is shown with a solid box.
7. To confirm the change, select the soft key **Done** Done.
   - The setting becomes saved to the display unit.
   - After the brightness time setting expires, due to inactivity with the display unit, the display becomes the brightness level.

6.4.9 View or configure the brightness time setting

View or configure the *Brightness time* setting under **Tools > Advanced > Brightness > Brightness time**.

Figure 6.14 Example brightness time screen



Changing brightness time setting

To change the brightness time setting, perform the following steps:

1. Select **Tools**, from the *Home* menu.
2. Select **Advanced**, from the *Tools* menu.
3. Select **Brightness**, from the *Advanced* menu.

4. Select **Brightness time**, from the *Brightness* menu.
   - The currently configured brightness time is shown with a solid box.
5. Highlight the required brightness time by pressing the push-button **Up** or **Down**.
6. Select the brightness time by pressing the push-button **OK**.
   - The selected brightness time is shown with a solid box.
7. To confirm the change, select the soft key **Done** Done.
   - The setting becomes saved to the display unit.
   - After the brightness time setting expires, due to inactivity with the display unit, the display becomes the brightness level.

6.5 Alarm

6.5.1 About alarms

View the alarms under **Alarms**.

You can view or action alarms from the alarm display.

See **Alarms and log**, in this document for more information regarding the alarm list and actions.

6.6 Log

6.6.1 About log

View the log under **Log**.

View details of the events that have occurred during the operation of the controller. This includes changes to the configuration, for example changes to parameter settings.

See **Alarms and log**, in this document for more information regarding the event log.

6.7 Live data

6.7.1 Viewing the Live data

View the current state of the system under **Live data**.

The Live data display contains many different information screens showing the current operation information for the controller.

Reviewing Live data

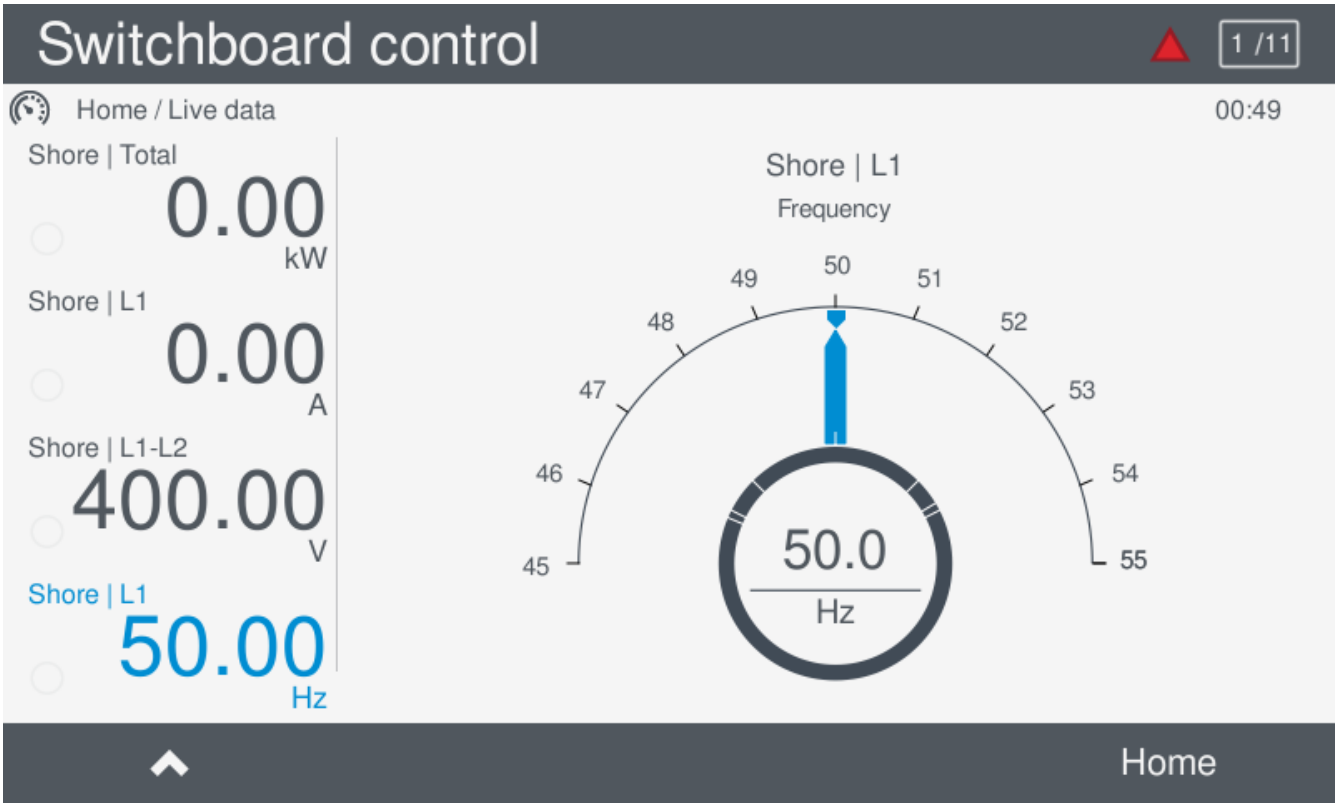
To view the different Live data screens, perform the following steps:

1. Select **Live data** to view the current operating information.
2. Scroll through the screens by pressing the push-button **Up** or **Down**.

Changing Live data display (if applicable)

Some screens in the Live data display can be changed to view alternative information.

Figure 6.15 Example Live data screen



To cycle through the different information on a specific screen, perform the following steps:

1. Select **Live data** to view the current operating information.
2. Scroll to the required screen by pressing the push-button **Up** or **Down** .
3. Select the soft key **Up** by pressing the appropriate push-button to cycle through the different information.

You can return to the main menu by using the soft key **Home** Home by pressing the appropriate push-button .

Alternatively, press and hold the push-button **Back** for > 0.5 seconds to return to the main menu.

6.8 Info

6.8.1 About info

The info menu allows you to do the following:

View production information for the controller.

View the about information, including firmware versions.

6.8.2 View production

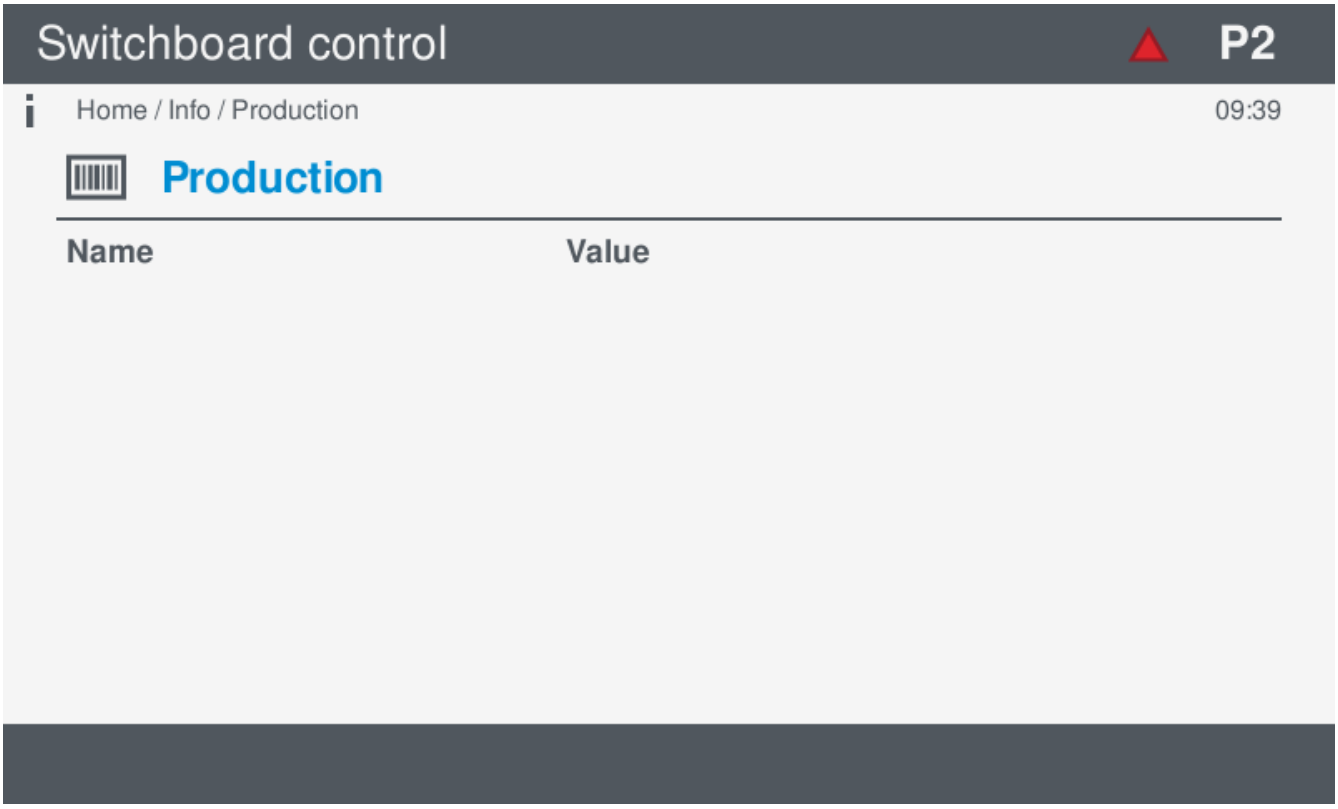
View the production information under **Info > Production**.

Here you can view information about the production of the controller.

Press the push-button **Back** to return to the **Info** menu.

The display shows production information for the controller.

Figure 6.16 Example production screen



6.8.3 View about

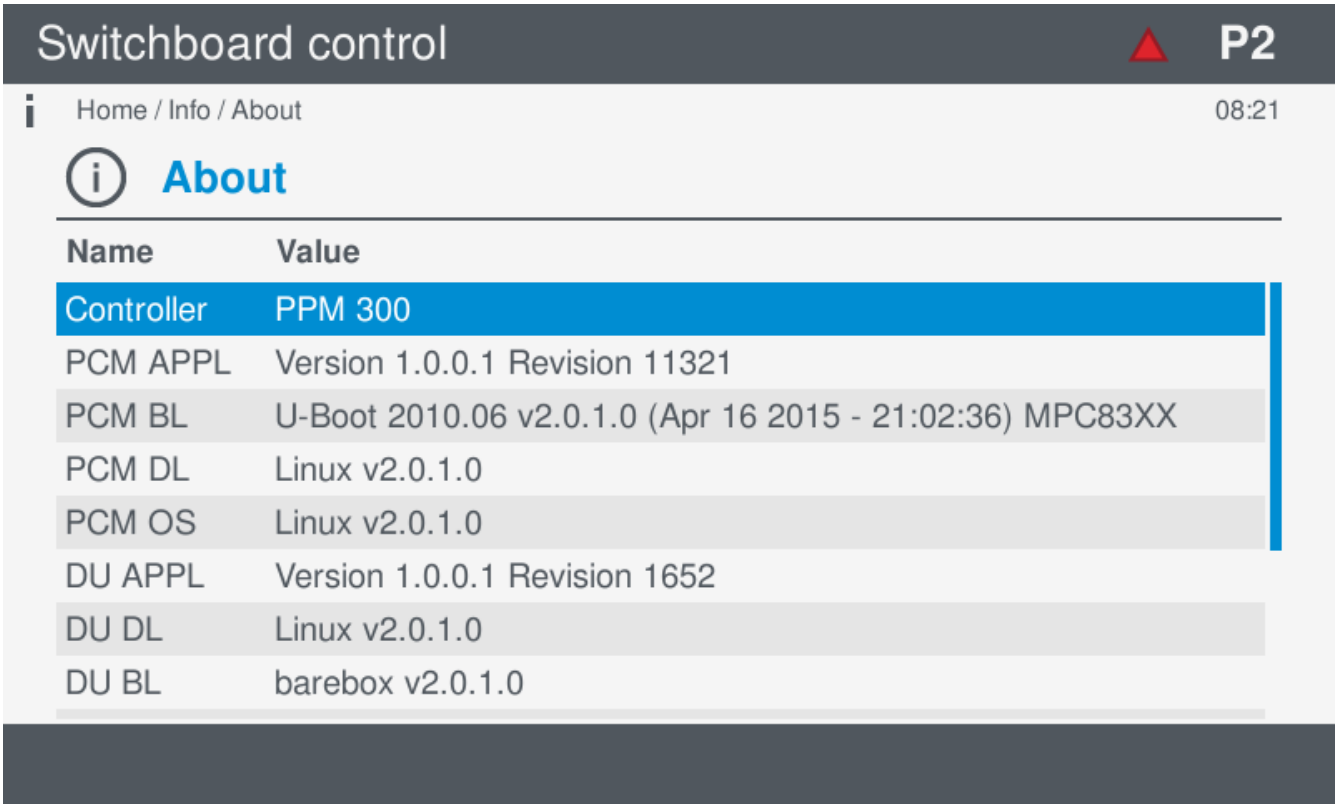
Here you can view the about information for the controller and display unit.

This screen shows:

- Firmware version and revision for the hardware modules.
- Firmware version and revision for the application software.
- Firmware version and revision for the display unit (DU).

View the about information under **Info > About**.

Figure 6.17 Example about screen



Reviewing about information

To view the about information, perform the following steps:

1. Select **Info** , from the *Home* menu to view the information menu.
2. Select **About** to view the about information.
3. Scroll through the information by pressing the push-button **Up** or **Down** .

7. Troubleshooting

7.1 Introduction

7.1.1 Finding the source of the problem

For some system problems, the controller activates an alarm. The operator may therefore think that there is a problem with the controller, even though the actual problem is in the system.

It is not possible to describe every possible system problem. Troubleshooting requires an understanding of the system, a logical and systematic approach, and careful observation of the system reactions to the troubleshooting actions.

This chapter describes using switchboard control for troubleshooting, as well as troubleshooting for some of the most common alarms.

See the **Designer's handbook** for more information regarding alarms.

See **Troubleshooting**, in the **Commissioning guidelines** for troubleshooting regulators and terminal damage.

7.2 Using SWBD control for troubleshooting

7.2.1 Introduction to SWBD control

The exact procedure for operating the system under SWBD control depends on the switchboard design. Follow the guidelines from the switchboard supplier when operating the system under switchboard control. Class societies require that certain minimum protections are included in the switchboard. For example, there must be a synchronisation check before closing a breaker.

DANGER!
Only trained operators should operate the system under switchboard control. Even though the controller protections are active, the operator can create undesirable conditions during switchboard control. The operator actions can also disrupt the power supply.

7.2.2 Troubleshooting the system under SWBD control

Problem	Any unexpected behaviour or situation in the system.
Solutions	Make sure that the problem is not from the power management system or the controller.
Tools	Switchboard inputs and switchboard instruments.

Before you start

As far as possible, ensure that the system will be able to supply the required power while the controller is under SWBD control. You may want to start extra gensets to be sure.

General information about SWBD control

When you place a controller under SWBD control, the controller stops controlling the GOV and AVR regulators. All logic for the genset (start and stop) and breaker (open and close) is deactivated. If any other controllers in the system are in AUTO mode, they are changed to SEMI mode. The controller's protections remain active.

DANGER!
During SWBD control, the controller protections will respond to alarm situations. However, the controller will not prevent you from creating alarm situations.

Method

1. If possible, make sure that there is enough power available for the system. That is, are there enough gensets running to supply the system?
2. Use the *Switchboard control* switch (on the switchboard) to change the controller to SWBD control.
   - The gensets that are running should continue to run. However, any GENSET controllers in AUTO mode will automatically change to SEMI mode. This means that the controllers will not automatically stop or start gensets in response to load changes.
3. Depending on the time of the problem you can use the switchboard to do the following actions. If you cannot do these actions during switchboard control, the controller will not be able to do them either. You will have to continue troubleshooting to find the source of the problem.
   a. Start the genset.
   b. Use the GOV up and GOV down inputs on the switchboard to control the frequency from the genset.
   c. Do a manual synchronisation and close the breaker.
   d. De-load and open the breaker.
   e. Stop the genset.

See **Troubleshooting**, in the **Commissioning guidelines** for troubleshooting regulators and terminal damage.

INFO
This method can be adapted to troubleshoot any controller analogue output.

Problem	Purpose	Tools
Any unexpected behaviour or situation in the power supply.	Make sure that the problem is not from the power management system or the controller.	Switchboard inputs and switchboard instruments

7.3 Troubleshooting alarms

7.3.1 Troubleshooting alarms

The system has many pre-configured and configurable alarm protections. Activated alarms require action to resolve the problem in the system. An active alarm typically has an active alarm protection which is designed to protect the system and equipment.

See **Alarms and log**, in this document for more information about how alarms can be actioned.

7.4 Engine

7.4.1 Start failure

Alarm	Start failure.
Configuration	**Configure > Parameters > Engine > Start sequence > Start failure**
Possible cause(s)	• Fuel supply to engine. • Engine has reached the maximum number of start attempts configured. • Engine failure (electrical/mechanical).
Checks and recovery	• Check fuel supply line. • Check start attempts configuration ◦ **Configure > Parameters > Engine > Start sequence > Start attempts** • Engine starter battery

7.4.2 Overspeed

INFO
This applies to both *Overspeed 1* and *Overspeed 2* alarm protections.

Alarm	Overspeed #
Configuration	**Configure > Parameters > Engine > Protections**

Possible cause(s)
- Engine speed rating is incorrect.
- Incorrect engine speed controller setting.

Checks and recovery
- Check the rated speed of the engine.
- Adjust the speed controller if necessary.

7.5 Network and communication

7.5.1 Ethernet redundancy broken

Alarm
Ethernet redundancy broken

Configuration
Configure > Parameters > System power management > Network

Possible cause(s)
- System never had a redundant Ethernet connection.
- The existing redundant Ethernet connection has become unplugged, damaged or faulty.

Checks and recovery
- For a system with no redundant Ethernet connection configured, you can either:
  - Install a redundant Ethernet connection.
    - 🕮 See **Wiring the communication**, in the **Installation instructions** for more information about installing the Ethernet communication.
  - Alternatively, disable the Ethernet redundancy alarm:
    - Set the alarm to **Not enabled** by configuring the parameter:
    - **Configure > Parameters > System power management > Network > Ethernet redundancy broken**
- For a system with a redundant Ethernet connection already configured:
  - Check the Ethernet cabling has not been accidentally damaged or unplugged.
    - Replace any damaged cables and ensure all Ethernet cables are plugged in securely.
  - Check the Ethernet cabling used for the DEIF network has been correctly plugged in to the PCM hardware module.

    CAUTION
    The Ethernet ports on the PSM are only used for EtherCAT® communication.
  - Check the Ethernet cables used for the connection meet the DEIF Ethernet network cable specification.
    - 🕮 See **Hardware**, **Ethernet cable** in the **Data sheet** for more information about the type of Ethernet cable.

INFO
It is recommended to install a redundant Ethernet connection. This ensures continued operation of the system should one of the Ethernet cables become damaged or faulty.

8. Maintenance

8.1 PCM3.1 internal battery

8.1.1 Changing the battery

The controller has a replaceable battery located in the PCM3.1 module. When the power is low or fails on this battery, a battery failure alarm is activated. To replace the battery you need to remove the PCM module.

See **Processor and communication module PCM3.1**, **PCM3.1 technical specifications** in the Data sheet for more information regarding the type of battery.

Legal

INFO
The manufacturer's warranty will not apply if the rack has been opened by unauthorised persons. However, you are allowed to replace the battery on the PCM3.1 module. To retain the warranty, the battery must be replaced by a qualified person, in accordance with these written instructions.

Safety: Hazardous live currents and voltages

DANGER!
Hazardous live currents and voltages may be present in a rack that is already installed. Contact with these could kill you. Only authorised personnel, who understand the precautions needed and the risks involved in working with live electrical equipment, may do this work.

Safety: Disrupting control

DANGER!
Working on the rack may disrupt the control of the generator, busbar or connection. Take the necessary precautions.

Protecting equipment: No hot swapping

CAUTION
Disconnect all power supplies before replacing the battery.

Electrostatic precautions

CAUTION
Protect the hardware modules against static discharge during the battery replacement.

Replacing the battery

1. Disconnect all power supplies (that is, both PSM and, if present, EIM), to protect the hardware modules and personnel.
2. Test the resistance of the wrist strap and the resistance of the wrist strap connection. Do not continue if the wrist strap connection is faulty. Use the wrist strap at all times while replacing the battery to protect against static discharge.

3. Remove the PCM3.1 hardware module from the rack:
   a. Remove the terminal blocks, and make sure that there are no wires in the way of removing the hardware module.
      • Disconnect any Ethernet cables from the top, middle or bottom of the hardware module.
   b. Loosen the hardware module faceplate screws using a screwdriver with a TX20 bit.
      • Do not force the screws to unscrew completely. The screws are built-in and therefore normally remain attached to the faceplate.
   c. Use pliers to pull the faceplate screws, and carefullly slide the hardware module out of the rack.
      • Only pull the screws. Do not pull any other part of the faceplate.
   d. Hold the hardware module by the faceplate when handling.
   e. Remove the old battery from the holder, taking care not to damage any components.
   f. Insert the correct replacement battery in the correct polarity into the holder, taking care not to damage any components.
4. Replace the PCM3.1 hardware module to the rack:
   a. Hold the PCM3.1 only by its faceplate.
   b. Make sure that the hardware module is the right way up, and slide it back into slot 7.
      • The hardware module should slide in easily.
   c. Tighten the screws on the hardware module faceplate using a screwdriver with a TX20 bit, and 0.5 N·m (4.4 lb-in) of torque.

INFO
After replacing the battery, check that the date and time settings are correct.

Date and time settings

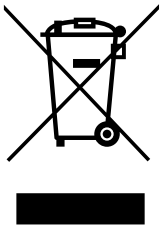
- For a single controller not connected to other DEIF controllers:
  ◦ After the battery is replaced, the date and time settings need to be reentered on the controller. You can use PICUS to enter the correct date and time settings.
- For controllers connected to other controllers:
  ◦ After the battery is replaced, the date and time settings are resynchronised from the time master controller.

See **Processor and communication module PCM3.1**, **PCM3.1 technical specifications** in the Data sheet for more information regarding the type of battery.

9. End-of-life

9.1 Disposal of WEEE

WEEE symbol



All products that are marked with the crossed-out wheeled bin (the WEEE symbol) are electrical and electronic equipment (EEE). EEE contains materials, components and substances that can be dangerous and harmful to people's health and to the environment. Waste electrical and electronic equipment (WEEE) must therefore be disposed of properly. In Europe, the disposal of WEEE is governed by the WEEE directive issued by the European Parliament. DEIF complies with this directive.

You must not dispose of WEEE as unsorted municipal waste. Instead, WEEE must be collected separately, to minimise the load on the environment, and to improve the opportunities to recycle, reuse and/or recover the WEEE. In Europe, local governments are responsible for facilities to receive WEEE. If you need more information on how to dispose of DEIF WEEE, please contact DEIF.

10.Glossary

10.1 Terms and abbreviations

Term	Abbreviation	Explanation
Alarm action		The pre-defined set of actions that an alarm initiates. Also known as fail class.
Alarm output		The controller's digital output(s) that can be connected to a horn, a siren, lights, or other equipment. This alerts the operator that one or more alarms are activated.
Alternating current	AC	
Analogue input	AI	Terminals on a controller hardware module that the controller uses to measure an analogue input. The analogue input type and range are typically selected during commissioning from a list of pre-configured voltage, current, and resistance measurement input ranges. A pre-configured analogue input function or alarm can also be assigned to the input.
Analogue output	AO	Terminals on a controller hardware module that the controller uses to send an analogue output. The analogue output type and range are typically selected during commissioning from a list of pre-configured voltage and current output ranges. A pre-configured analogue output function can also be assigned to the output.
Automatic voltage regulator	AVR	Regulates the genset voltage. The AVR is third-party equipment. The AVR can have a fixed voltage set point. Alternatively, the DEIF controller can control the AVR.
Blackout		The busbar voltage is less than 10 % of the nominal voltage, and all generator breakers are open.
Breaker		A mechanical switching device that closes to connect power sources to the busbar, or to connect busbar sections. The breaker opens to disconnect the power sources or to split the busbar.
Busbar		The copper conductors which connect the power sources to the power consumers. Represented on the single-line diagram as the line that connects all the power sources and power consumers. If the bus tie breaker is open, there are two separate and independent busbar sections. Similarly, if the bus tie breaker is closed, there is only one busbar.
Bus tie breaker	BTB	Physically disconnects two main busbars from each other, so that they operate as two separate (split) busbars. Also reconnects split busbars so that they operate as one busbar.
BUS TIE breaker controller		Controls and protects a bus tie breaker. The controller ensures that opening the bus tie breaker does not lead to a blackout. The controller also ensures that the two busbars are synchronised before closing the bus tie breaker.
Commissioning		The careful and systematic process that takes place after installation and before the system is handed over to the operator. Commissioning must include checking and adjusting the controller.
Configuration		Assigning input and output functions to terminals, and setting parameters, so that the controller is suitable for the application where it is installed.
Connected		A generator is connected to the system if it is running, synchronised with the busbar, and its breaker is closed.
Controller		DEIF equipment that measures system conditions and then uses outputs to make the system respond appropriately.

Term	Abbreviation	Explanation
Digital input	DI	Terminals on a controller hardware module that the controller uses to measure a digital input. A pre-configured digital input function or alarm can be assigned to the input.
Digital output	DO	Terminals on a controller hardware module that the controller uses to send a digital output. A pre-configured digital output function can be assigned to the output.
Direct current	DC	
EMERGENCY genset controller		Controls and protects the emergency genset (normally a diesel generator). If the system loses power, the controller ensures that the emergency genset supplies power to the emergency busbar.
Engine interface module 3.1	EIM3.1	A replaceable PCB, with its own power supply. This module includes 4 relay outputs, 4 digital inputs, an MPU and W input, and 3 analogue inputs. Used in some of the DEIF controller types.
Generator breaker	GB	The breaker between a generator (for example, a genset) and the busbar.
GENSET controller		Controls and protects a genset (normally a diesel generator). The Power Management System can automatically start and stop gensets to ensure that the required power is available.
Governor	GOV	Regulates the engine speed.
Governor and AVR module 3.1	GAM3.1	A replaceable PCB, which includes load sharing capability. This module also includes 4 relay outputs, 2 analogue current or voltage outputs, a pulse width modulation output, and 2 analogue current or voltage inputs. Used in some of the DEIF controller types.
Heavy consumer	HC	When a request is made, the power management system reserves and manages the power required by the heavy consumer(s).
Inhibit		A pre-defined condition that inhibits the alarm action. For example, for the inhibit Not running, if the genset is Not running, the under-frequency alarm is prevented from occurring. Inhibited alarms are not shown in the alarm display.
Input output module 3.1	IOM3.1	A replaceable PCB, with four relay outputs, and 10 digital inputs. Used in the DEIF controller.
Latch		An extra layer of protection that keeps the alarm action activated. When the alarm is not active and acknowledged, it can be unlatched.
Light emitting diode	LED	Used to show the controller and equipment status and alarms.
Liquid crystal display	LCD	The screen of the display unit. The information displayed varies, depending on the controller mode, the equipment operation and the operator input.
Load sharing		The controllers adjust the gensets so that each genset supplies the right amount of the total power. For symmetrical load sharing, each genset supplies the same proportion of its nominal power.
Magnetic pickup	MPU	Measures the genset speed (that is, RPM). This sensor is normally located at the genset flywheel.
Module		A standardised, replaceable printed circuit board that is mounted in the rack. For example, PSM3.1 is a module that supplies power to the rest of the rack.
Neutral	N	The neutral line in a three-phase electrical system.
Nominal setting	nom or NOM	Defines the expected voltage and frequency for the system, along with each power source's maximum load and current. The controller's protections are based on percentages of the nominal settings.
Non-essential load	NEL	A load that is not critical to the system. These may be disconnected by the controller in the event of overload, over-current, or busbar under-current.

Term	Abbreviation	Explanation
Out of service		A state that an alarm can be assigned to by an operator. Out of service alarms are inactive alarms. Out of service alarms do not automatically return to service and require operator action.
Parameter		A value, or set point, used to determine the controller's operation. Parameters include nominal values, the configuration options for the configurable inputs and outputs, and alarm settings. The same set of parameters can be uploaded to several controllers.
Personal computer	PC	Used to run the PICUS software. For example, a laptop computer.
Phase L1	L1	The power line for one phase of a three-phase electrical system. Corresponds to R in Germany, Red in the UK and Pacific, Red in New Zealand, Black in the USA, and U on electrical machine terminals. The above colour codes are for guidance only. If uncertain perform a phase measurement.
Phase L2	L2	The power line for one phase of a three-phase electrical system. Corresponds to S in Germany, Yellow in the UK and Pacific, White in New Zealand, Red in the USA, and V on electrical machine terminals. The above colour codes are for guidance only. If uncertain perform a phase measurement.
Phase L3	L3	The power line for one phase of a three-phase electrical system. Corresponds to T in Germany, Blue in the UK and Pacific, Blue in New Zealand, Blue in the USA, and W on electrical machine terminals. The above colour codes are for guidance only. If uncertain perform a phase measurement.
Power	P	The 3-phase active power, measured in kW.
Power in Control Utility Software	PICUS	The DEIF utility software, used to design, configure, troubleshoot and monitor a system.
Power management system	PMS	The controllers share information and work together to ensure enough power to supply the load.
Power supply module 3.1	PSM3.1	A replaceable PCB that powers the controller. This module includes three relay outputs for status signals. Used in the DEIF controller.
Power take home	PTH	The shaft generator is used as a motor to drive the ship's propellor.
Printed circuit board	PCB	Supports and electrically connects components.
Processor and communication module 3.1	PCM3.1	A replaceable PCB, which contains the controller processor, as well as the CAN bus connections and Ethernet communication connections. Used in the DEIF controller.
Protection and Power Management	PPM	A versatile controller consisting of several modules and display unit designed for marine use.
Pulse width modulation	PWM	Terminals with an output that uses variable pulse widths, and behaves as an analogue output.
	PNP	A type of transistor.
Reactive power	Q	The 3-phase reactive power, measured in kvar.
Resistance measurement input	RMI	Variable resistance device, used for some of the input terminals on genset controllers.
Running		A genset is regarded as running if the engine is started and there is running detection. A running engine does not necessarily have to be synchronised with the busbar.
SEMI mode		A controller operating mode. Operator commands (for example, close breaker) start pre-programmed sequences in the controller. Apart from trips, the controller does not automatically open or close breakers or start or stop equipment.
Shaft generator	SG	A generator installed on the ship's main shaft that produces electricity.

Term	Abbreviation	Explanation
Shaft generator breaker	SGB	The breaker between the shaft generator and the main busbar/switchboard.
SHAFT generator controller		Controls and protects the power supply from the shaft generator.
Shelve		A temporary state that an alarm can be assigned to by an operator. Shelved alarms are inactive alarms, but only for a selected period by the operator. When the period of time expires, the alarm is automatically unshelved by the system restoring the alarm to the previous alarm state. Alarm conditions are checked again.
Shore connection	SC	The ship is supplied with electricity from land while in harbour through the shore connection.
Shore connection breaker	SCB	The breaker between the shore connection and the main busbar/switchboard.
SHORE connection controller		Controls and protects the power supply from the shore connection.
Shutdown		An emergency or fast stop of the genset engine. No cooldown time is allowed.
Switchboard		The cabinet where the power sources are connected to the power consumers. See Busbar too.
Switchboard control	SWBD control	A controller operating mode. Power management and operator commands to the controller are disabled. The operator controls the system using the switchboard. The controller monitors operation and the controller protections are active (that is, if an operating value activates an alarm, the controller does the alarm action).
System		The gensets, the other power sources, all breakers, the busbars, and all their controllers. Within the system, the DEIF controllers work together to supply the power required safely and efficiently.
Third-party equipment		Equipment other than the DEIF controller. For example: The genset, the genset engine control system, the wiring, the busbars, and the switchboard.
Tie breaker	TB	Used to connect/disconnect the emergency busbar from the main busbar. (The breaker between two main busbars is called a bus tie breaker.)
Time	t	
Trip		An emergency or fast opening of a breaker. No attempt is made to deload the breaker before it opens.
Voltage	V	Electrical potential difference. U is used as an abbreviation for voltage in most of Europe, Russia and China.
Voltage and frequency	V & Hz	For certain controller actions, both the voltage and frequency must be within the specified range. For example, for busbar OK, or to start synchronising a genset to the busbar.

10.2 Units

The table below lists the units used in the documentation, as well as the US units where these are different. In the documentation, the US units are given in brackets, for example, 80 °C (176 °F).

Table 10.1 Units used in the documentation

Unit	Name	Measures	US unit	US name	Conversion	Alternative units
A	ampere	Current				
bar	bar	Pressure	psi	pounds per square inch	1 bar = 14.5 psi	1 bar = 0.980665 atmosphere (atm) 1 bar = 100,000 Pascal (Pa)
ºC	degrees Celsius	Temperature	ºF	Fahrenheit	T[ºC] = (T[ºF] - 32 º) × 5 / 9	T[ºC] = T[Kelvin (K)] - 273.15
dB	decibel	Noise or interference (a logarithmic scale)				
g	gram	Weight	oz	ounce	1 g = 0.03527 oz	
g	gravitational force	Gravity, g = 9.8 m/s^2	ft/s^2		g = 32.2 ft/s^2	
h	hour	Time				
Hz	hertz	Frequency (cycles per second)				
kg	kilogram	Weight	lb	pound	1 kg = 2.205 lb	
kPa	kilopascal	Pressure	psi	pounds per square inch	1 kPa = 0.145 psi	
m	metre	Length	ft	foot (or feet)	1 m = 3.28 ft	
mA	milliampere	Current				
mm	millimetre	Length	in	inch	1 mm = 0.0394 in	
ms	millisecond	Time				
N·m	newton metre	Torque	lb-in	pound-force inch	1 N·m = 8.85 lb-in	
RPM	revolutions per minute	Frequency of rotation (rotational speed)				
s	second	Time				
V	volt	Voltage				
V AC	volt (alternating current)	Voltage (alternating current)				
V DC	volt (direct current)	Voltage (direct current)				
W	watt	Power				
Ω	ohm	Resistance				

10.3 Symbols

10.3.1 Symbols for notes

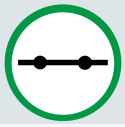
DANGER!
This highlights dangerous situations. If the guidelines are not followed, these situations could result in death, serious personal injury, and equipment damage or destruction.

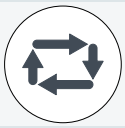
CAUTION
This highlights potentially dangerous situations. If the guidelines are not followed, these situations could result in personal injury or damaged equipment.

INFO
This highlights general information.

This highlights where to find more information.

10.3.2 Display unit symbols and push-buttons

Symbol	Symbol name	Notes
	Controller power OK	
	Self-check OK	
	Ready for operation	
	Alarm	
	Horn silence	
	Soft key	
	Up	
	OK	
	Down	
	Back	
	Help	
	Genset start	
	Genset stop	
	Close breaker	
	Open breaker	

Symbol	Symbol name	Notes
	AUTO mode	ISO 700:2004, symbol 0017.
	SEMI mode	ISO 700:2004, symbol 0026.
	Test	ISO 700:2004, symbol 1942.
	1st priority	