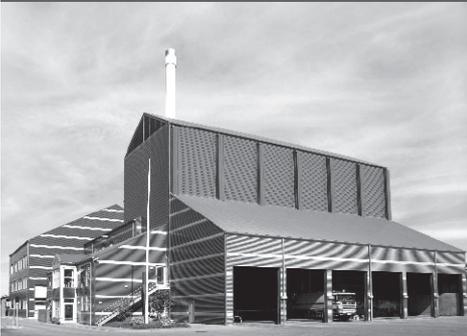




-power in control



OPERATOR'S MANUAL



Generator Paralleling Controller, GPC-3 - Generator Protection Unit, GPU-3/GPU-3 Hydro - Paralleling and Protection Unit, PPU

- Display and push-button functions
- Alarm handling
- Log list



DEIF A/S · Frisenborgvej 33 · DK-7800 Skive
Tel.: +45 9614 9614 · Fax: +45 9614 9615
info@deif.com · www.deif.com

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1. General information

1.1 Warnings, legal information and safety

1.1.1 Warnings and notes

Throughout this document, a number of warnings and notes with helpful user information will be presented. To ensure that these are noticed, they will be highlighted as follows in order to separate them from the general text.

Warnings



Warnings indicate a potentially dangerous situation, which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

Notes



Notes provide general information, which will be helpful for the reader to bear in mind.

1.1.2 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator controlled by the Multi-line 2 unit, the company responsible for the installation or the operation of the set must be contacted.



The Multi-line 2 unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

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

1.1.3 Safety issues

Installing and operating the Multi-line 2 unit may imply work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.



Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

1.1.4 Electrostatic discharge awareness

Sufficient care must be taken to protect the terminal against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

1.1.5 Factory settings

The Multi-line 2 unit is delivered from factory with certain factory settings. These are based on average values and are not necessarily the correct settings for matching the engine/generator set in question. Precautions must be taken to check the settings before running the engine/generator set.

1.2 About the Operator's Manual

1.2.1 General purpose

This Operator's Manual mainly includes general product information, display readings, push-button and LED functions, alarm handling descriptions and presentation of the log list.

The general purpose of this document is to give the operator important information to be used in the daily operation of the unit.



Please make sure to read this document before starting to work with the Multi-line 2 unit and the generator set to be controlled. Failure to do this could result in human injury or damage to the equipment.

1.2.2 Intended users

This Operator's Manual is mainly intended for the daily user. On the basis of this document, the operator will be able to carry out simple procedures such as start/stop and control of the generator set.

1.2.3 Contents and overall structure

This document is divided into chapters, and in order to make the structure simple and easy to use, each chapter will begin from the top of a new page.

2. Display unit

2.1 General

This chapter deals with the display unit including the push-button and LED functions.

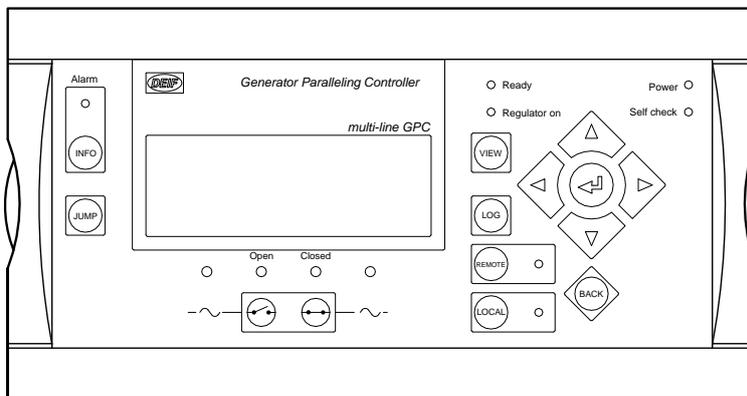
2.2 Display (DU-2) layouts



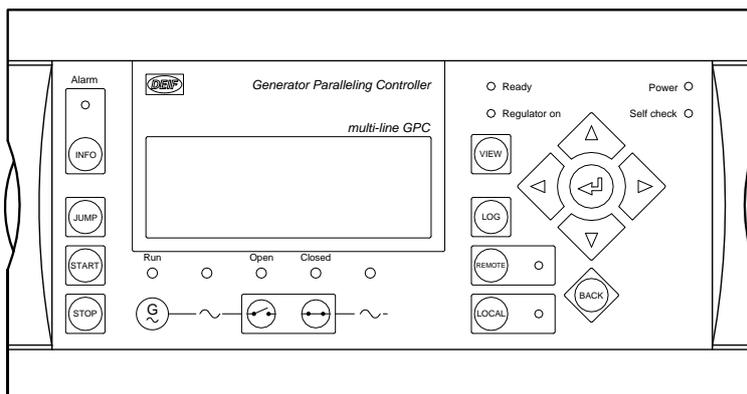
The display dimensions are H × W = 115 × 220 mm (4.528" × 9.055").

2.2.1 GPC

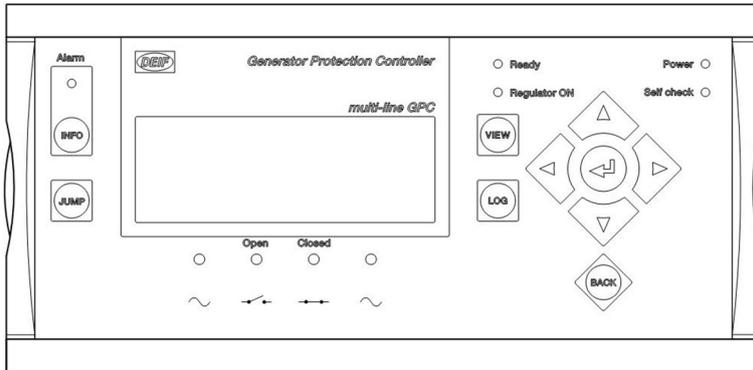
GPC – standard



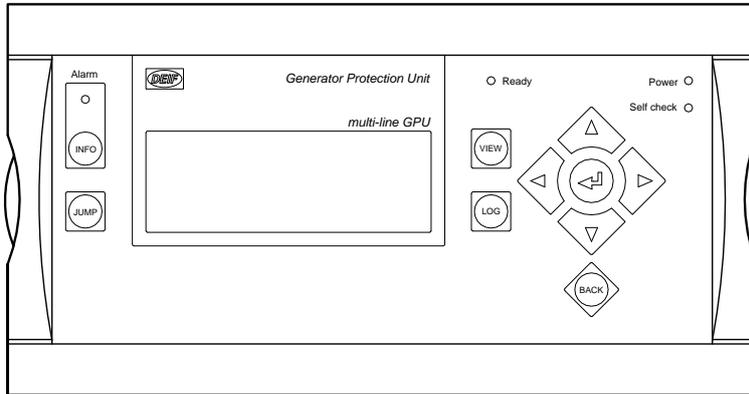
GPC – options M4 and Y1



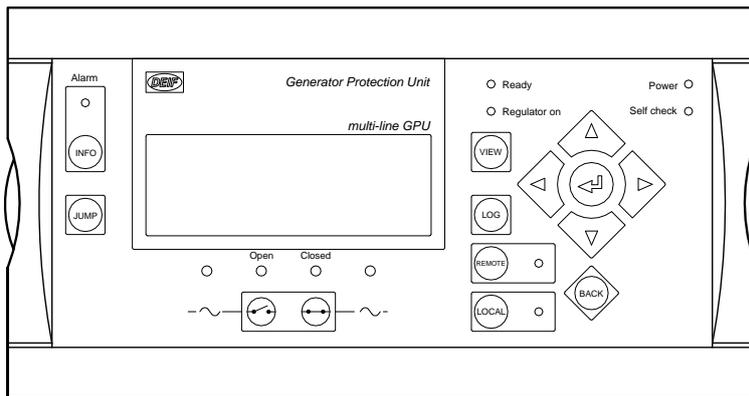
GPC – option Y11



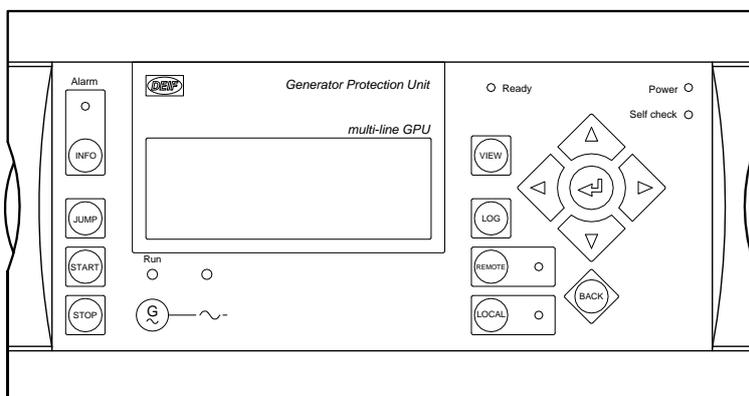
2.2.2 GPU GPU – standard



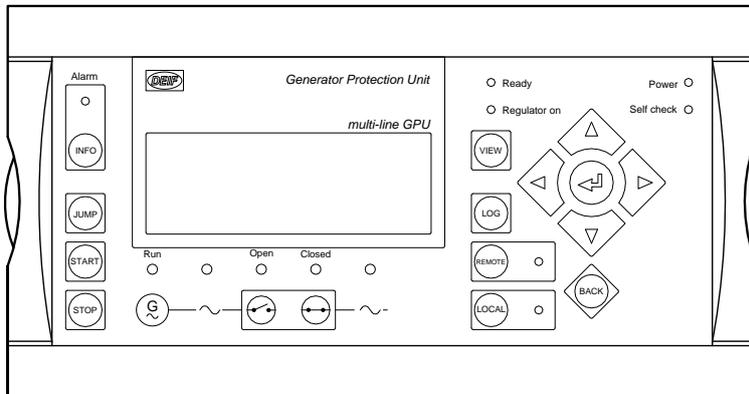
GPU – options G2 and Y5



GPU – options M4 and Y7

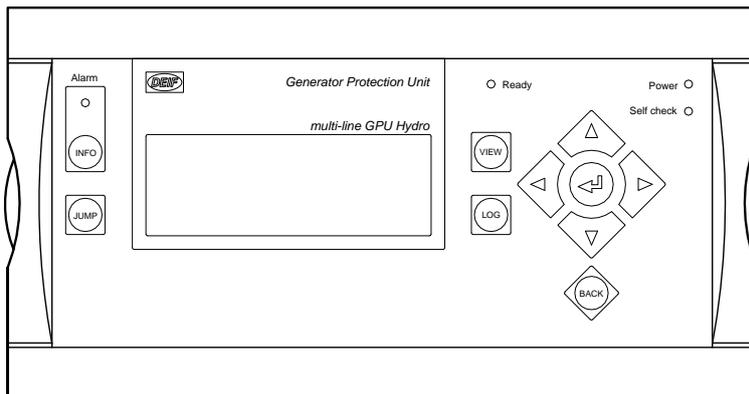


GPU – options G2, M4 and Y1

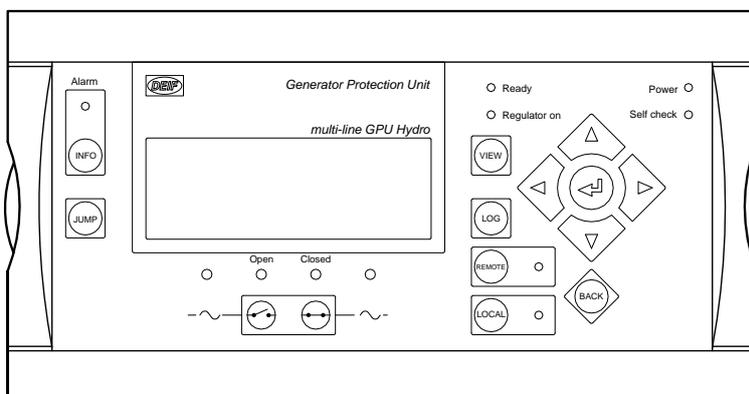


2.2.3 GPU Hydro

GPU Hydro – standard

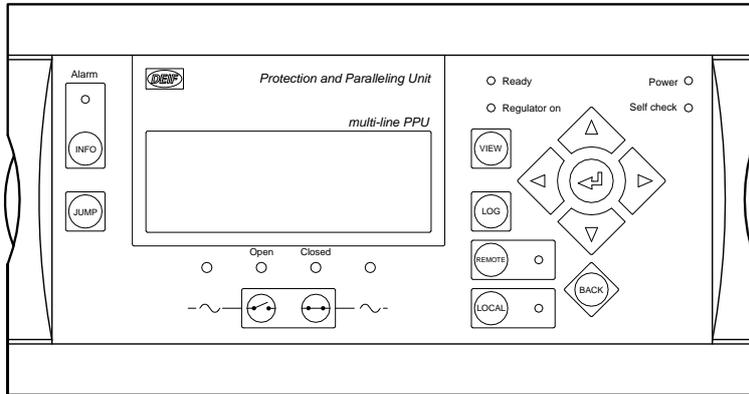


GPU Hydro – options G2 and Y5

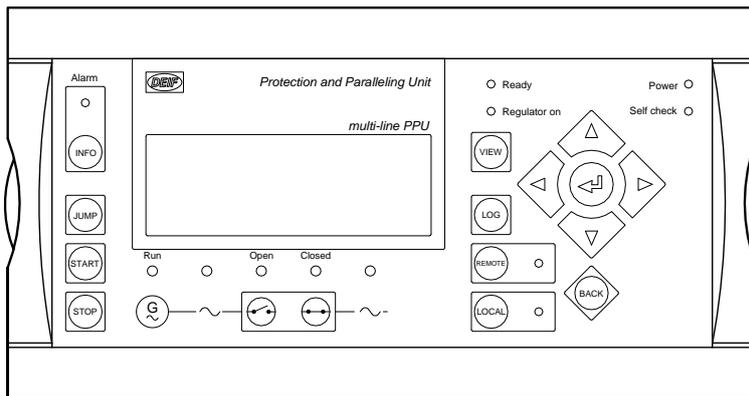


2.2.4 PPU

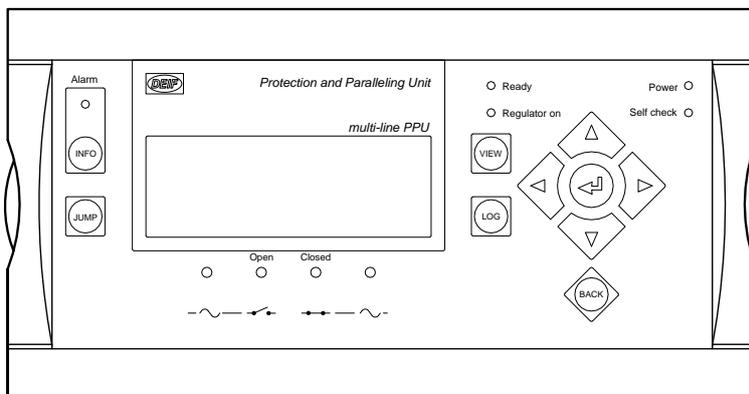
PPU – standard



PPU – options M4 and Y1



PPU – option Y11



2.3 Display push-buttons and LEDs

2.3.1 Push-button functions

The functions for all display push-buttons are described below:

INFO: Moves directly to the alarm list where all unacknowledged and present alarms are displayed.

JUMP: Enters a specific menu number selection. All settings have a specific number attached to them. The JUMP button enables the user to select and display any setting without having to navigate through the menus.

VIEW: Shifts the first line displaying in the setup menus. Push two seconds to switch to master display in case more than one display is connected (master password is required).

LOG: Jumps directly to the event and alarm log.



Moves the cursor left for manoeuvring in the menus.



Increases the value of the selected set point (in the setup menu). In daily use, this button function is used to switch between displayed percentage or real value of produced power (kW), reactive power (kvar) and apparent power (kVA) in View 3 (V3).



Selects the underscored entry in the fourth line of the display.



Decreases the value of the selected set point (in the setup menu). In daily use, this button function is used to switch between displayed percentage or real value of produced power (kW), reactive power (kvar) and apparent power (kVA) in View 3 (V3).



Moves the cursor right for manoeuvring in the menus.

BACK: Jumps one step backwards in the menu (to previous display or to the entry window).

REMOTE: Activates the remote mode. The push-buttons for START/STOP/GB open/GB close are deactivated. The control is external.

LOCAL: Activates the local mode. The push-buttons for START/STOP/GB open/GB close are activated.

START: Activates the engine start sequence (only active in LOCAL mode).

STOP: Activates the stop sequence (only active in LOCAL mode) including cooling down. When the STOP push-button is pressed during cooling down, the cooling down time is interrupted immediately and the ext. stop timer starts running.

2.3.2 LED functions

Each LED located on the display has its own function. The colour is green, red or yellow (fixed or flashing) dependent on its function. The functions for all display LEDs are described below:

- Alarm: LED **red flashing** indicates that unacknowledged alarms are present.
LED **red fixed** light indicates that ALL alarms are acknowledged, but one or more alarms are still present.
LED **off** when no alarm is present.
- Run: LED **yellow** when a running feedback failure is active. (G V/Hz OK, but no running feedback).
LED **green** indicates that the generator is running and the voltage and frequency are OK.
LED **off** when no running feedback and no voltage and frequency are measured.
- G V/Hz (~): LED **yellow** when the DG is running and V/Hz not OK.
LED **green** when the DG is running and the V/Hz OK timer has expired.
- Open: LED **red** when the breaker is tripped by a protection function.
LED **yellow** when the breaker is deloaded.
LED **green** when the breaker is open.
LED **off** when the breaker is closed.
- Closed: LED **yellow** indicates that the synchronisation function is active.
LED **green** when the breaker is closed.
LED **off** when the breaker is open.
- BB V/Hz (~): LED **green** when BB V/Hz OK.
LED **yellow** when BB V/Hz not OK.
LED **red** when BB voltage is zero (dead bus).
- Ready: LED **green** when the unit is ready for operation.
LED **off** when the unit is not ready (for example, the start enable is not activated or an active block, trip or shutdown alarm is present).

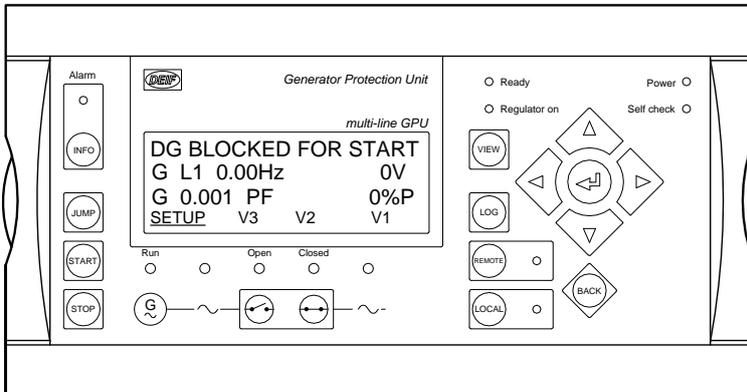


This indication is to tell the user whether the controller (not the engine) is ready or not.

- Regulator ON: LED **green** when the regulator is activated.
LED **off** when the regulator is off.
- Remote: LED **green** when remote mode is active.
LED **off** when local or SWBD mode is active.
- Local: LED **green** when local mode is active.
LED **off** when remote or SWBD mode is active.
- Power: LED **green** indicates that the auxiliary supply is switched on.
- Self check: LED **green** indicates that the unit is OK.

2.4 Lamp test and dimmer functions

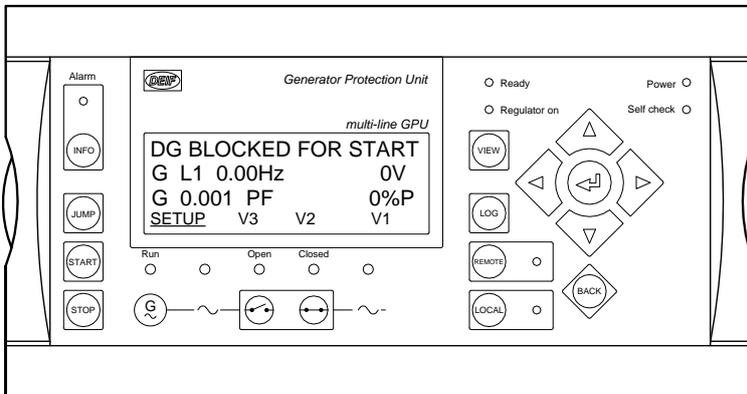
2.4.1 Lamp test



Place the cursor under SETUP and press the  push-button to activate the DU-2 lamp test.

All LEDs on the DU-2 and AOP-1 will turn yellow except the power LED.

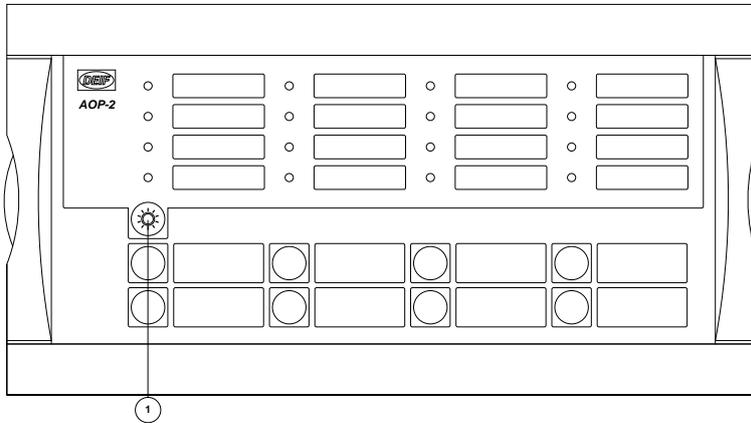
2.4.2 Dimmer function



The dimmer function of the display backlight and LEDs is accessed via the JUMP menu 9150.

The illumination intensity of the backlight and the LEDs of each display panel is adjustable by using the JUMP push-button. This adjustment is done by means of the  and  push-buttons on the display, and the level of the adjustment will be saved in the display internal memory by pressing the ENTER push-button.

2.4.3 AOP-2 lamp test and dimmer function



The AOP-2 has a separate push-button (1) for the combined lamp test and dimmer functionality. A short activation of the push-button will activate the lamp test function. If no further action is taken within three seconds, the AOP-2 will turn back to normal indication.

To activate the dimmer function, the push-button must be pressed several times or continuously to reach the desired light intensity.

3. Menu systems and structure

3.1 Display menu systems

The display includes two menu systems which can be used without password entry:

View menu system

This is the commonly used menu system. 15 windows are configurable and can be entered by using the arrow push-buttons.

Setup menu system

This menu system is used to set up the unit, and if the user needs detailed information that is not available in the view menu system. Changing of parameter settings is password protected.

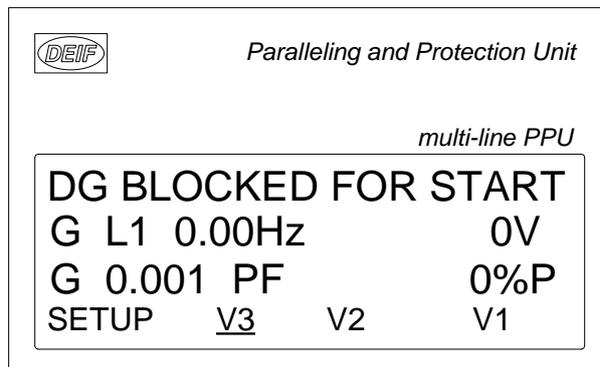
3.2 Menu structure

3.2.1 Entry window

When the unit is powered up, an entry window appears. The entry window is the gateway to the other menus. It can always be reached by pressing the BACK push-button three times.

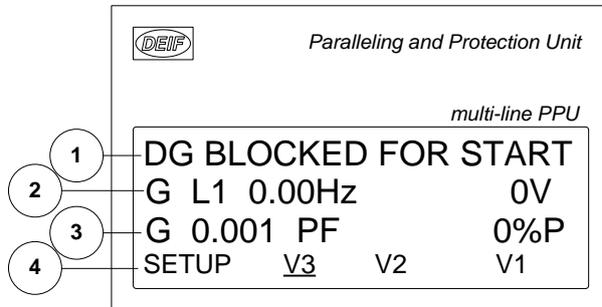


The event and alarm list will appear at power up, if an alarm is present.



3.2.2 View menu

The view menus (V1, V2 and V3) are the most commonly used menus of the unit.



1. First display line: Operational status or measurements
2. Second display line: Measurements relating to operational status
3. Third display line: Measurements relating to operational status
4. Fourth display line: Selection of setup and view menus

In the view menus, various measured values are on the display.

3.2.3 View menu navigation

Views and setup are all selected by moving the cursor in the fourth display line (please notice the underscore of V3 in the drawing above – this indicates the position of the cursor).

The cursor is moved by means of the  and  push-buttons on the right side of the display.

View window 1 (V1)

 **For detailed information about configuration, please see the Designer's Reference Handbook.**

V1 contains up to 20 different windows that can be selected using the  and  push-buttons.

View window 2 (V2)

V2 is a copy of V1 and contains up to 20 different windows that can be selected using the  and  push-buttons.

View window 3 (V3)

The V3 display changes with the running mode:

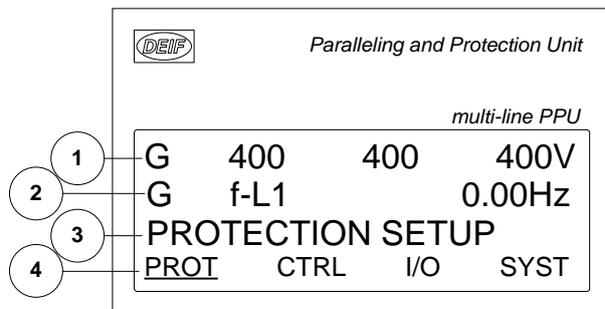
The first display line indicates the status of the unit.

The second and third display lines display power consumption in kW or percentage. This is changed by

pressing the  or  push-button.

3.2.4 Setup menu

The setup menu is used for parameter setup or to get detailed information that is not available in the view menu system. In this way, this menu can be used for both daily use and setup purposes. The menu is entered from the entry window by selecting the entry SETUP in the fourth display line.



First display line:

(Daily use) The first line is used to display generator and busbar values

Second display line:

(Daily use) Various values can be displayed
 (Menu system) Information about the selected channel number
 (Alarm/event list) The latest alarm/event is displayed

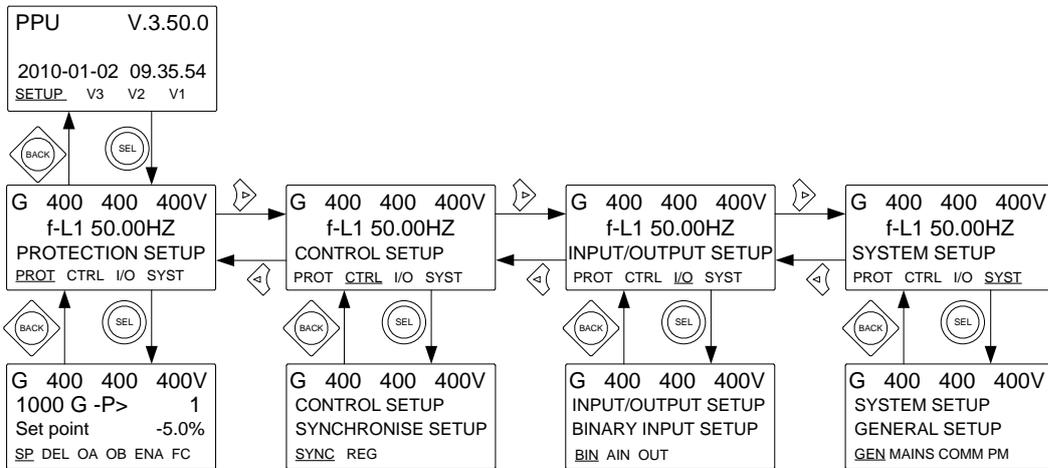
Third display line:

(Daily use) Explanation for the fourth line cursor selection presents setting of the selected function,
 (Setup menu) and if changes are made, the possible max. and min. values for the setting

Fourth display line:

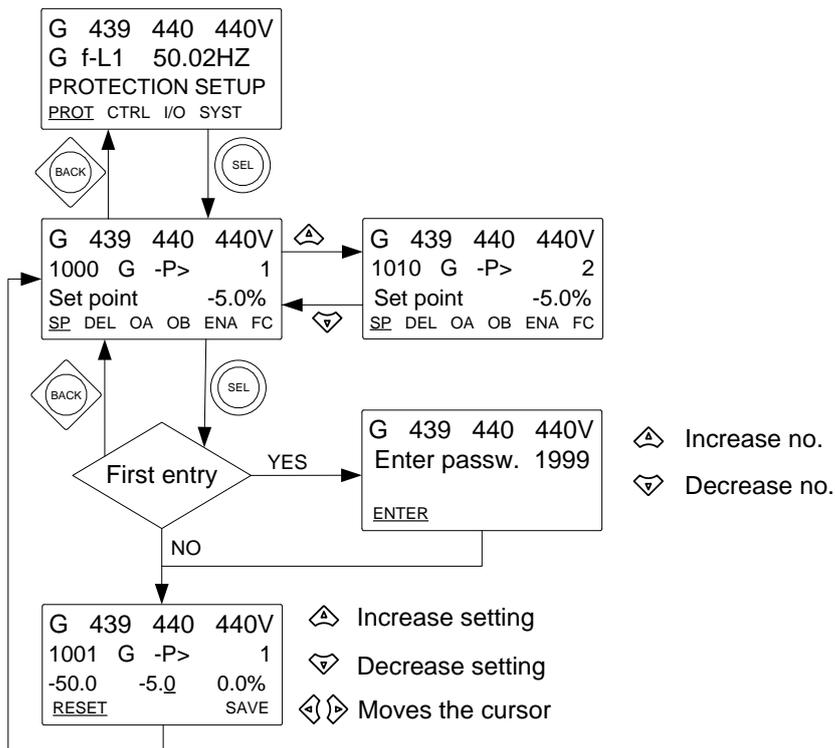
(Daily use) Entry selection for the setup menu
 Press SELECT to select the underscored menu
 (Setup menu) Sub-functions for the individual parameters, for example limit

Setup structure



Setup example

The following example illustrates how a specific setting is changed in the setup menu. In this case, **Reverse power** is the selected parameter.



3.3 Display texts

3.3.1 Information texts

This table explains the different information text messages on the display. The information messages are active for three seconds after a push-button has been pressed.

Info text message	GPC/GPU/PPU	GPU Hydro	Condition
NOT IN LOCAL	X	X	The system is in remote control
DG RUNNING	X	NA	The generator is already running (option M4 only)
DG NOT RUNNING	X	NA	The generator is not running (option M4 only)
GB IS CLOSED	X	X	The generator breaker is closed
GB IS OPEN	X	X	The generator breaker is open
WRONG PASSWORD	X	X	Wrong password has been entered

3.3.2 Status texts

The following table explains the different status text messages in the display. Status messages are automatically shown during operation without the operator activating any push-buttons.

Status text	GPC/ PPU	GPU/ GPU Hy- dro	Condition
READY	X	X	The generator is not running, and the unit is ready for operation
NOT READY	X	X	The generator is not running, and for example an active "Trip GB" or "Shutdown" alarm is blocking operation
MANUAL	X	X	Regulation is in MANUAL mode
FIXED FREQUENCY INT.	X	X	Fixed frequency using internal set point
FIXED FREQUENCY EXT.	X	X	Fixed frequency using external set point
STATIC SYNC.	X	X	Static synchronisation in progress
DYNAMIC SYNC.	X	X	Dynamic synchronisation in progress
ASYNCHRONOUS SYNC.	X	X	Synchronising asynchronous generator
FIXED RPM	X	X	Asynchronous generator - GB open and sync. not activated
LOAD SHARING INT.	X	-	Load sharing using internal set point
LOAD SHARING EXT.	X	-	Load sharing using external set point
FIXED POWER INT.	X	-	Fixed power using internal set point
FIXED POWER EXT.	X	-	Fixed power using external set point
DROOP INT.	X	-	Droop mode active using internal set point
DROOP EXT.	X	-	Droop mode active using external set point
RAMP DOWN	X	-	Deloading the genset before opening of the GB
RAMP TO ###kW	X	-	Increasing or decreasing the load of the genset to a specific set point
START PREPARE	X	X	The start prepare relay is activated
START RELAY ON	X	X	The start relay is activated
START RELAY OFF	X	X	The start relay is deactivated during the start sequence
COOLING DOWN ###s	X	X	Cooling down period is activated
GENSET STOPPING	X	X	This info is shown when cooling down has finished
EXT. STOP T. ###s	X	X	Extended stop time after the running signal has disappeared
TOO SLOW 00<-----	X	X	Generator running too slow during synchronising
-----> 00 TOO FAST	X	X	Generator running too fast during synchronising
SWBD CONTROL	X	X	SWBD control input activated

Status text	GPC/ PPU	GPU/ GPU Hy- dro	Condition
U GEN too low	X	X	Generator voltage is too low compared to the BB voltage during synchronisation
U GEN too high	X	X	Generator voltage is too high compared to the BB voltage during synchronisation
PREPARING ETHER- NET	X	X	The TCP/IP connection is initialising

3.4 Unit operation modes and password

3.4.1 Mode overview

The unit has two different operation modes and one switchboard (blocked) mode.

Mode	Description
LOCAL	<ul style="list-style-type: none"> The display push-buttons (START, STOP, GB ON, GB OFF) are active and can be used by the operator. The regulators are also active, that is the speed control will bring the generator to nominal speed upon start. When pushing a breaker button for closing, the unit will synchronise the breaker (if allowed).
RE- MOTE	<ul style="list-style-type: none"> The display control push-buttons (START, STOP, GB ON, GB OFF) are disabled. The genset can be controlled via the digital inputs, for example "Start sync./control".
SWBD	<ul style="list-style-type: none"> Display push-buttons are disabled. The generator can only be controlled using the switchboard. The protection functions are still active. The regulators are not active, that is speed control has to take place from the switchboard.

3.4.2 Mode selection

The mode selection is carried out using the LOCAL or REMOTE push-buttons on the display.

3.4.3 Password

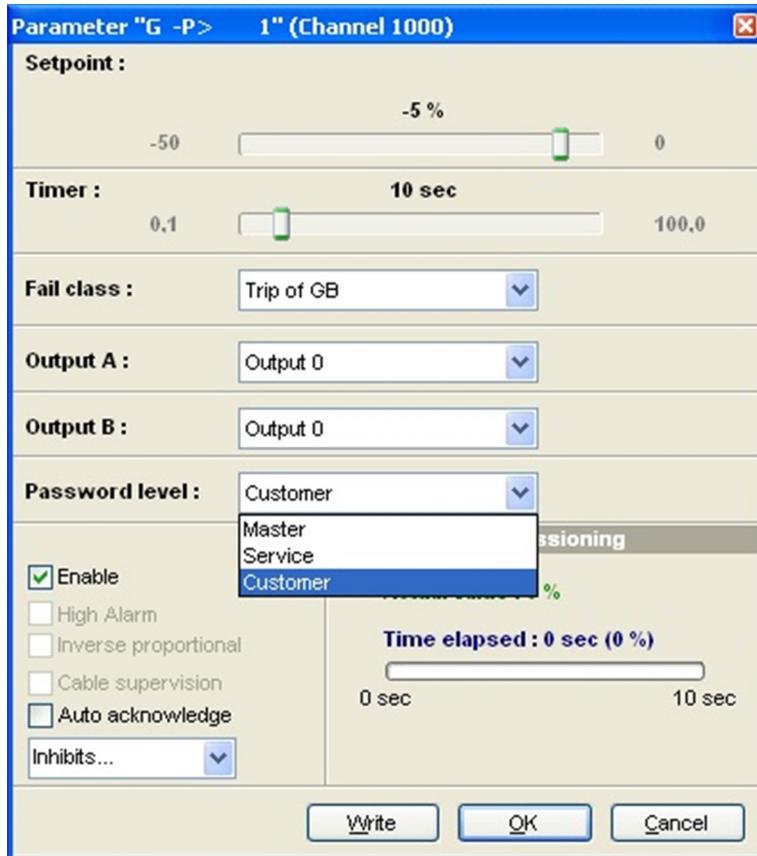
The unit includes three password levels. All levels can be adjusted in the PC software.

Available password levels:

Password level	Factory setting	Access		
		Customer	Service	Master
Customer	2000	X		
Service	2001	X	X	
Master	2002	X	X	X

A parameter cannot be entered with a password that is ranking too low, but the settings can be displayed without password entry.

Each parameter can be protected by a specific password level by means of the PC utility software. Enter the parameter to be configured and select the correct password level.



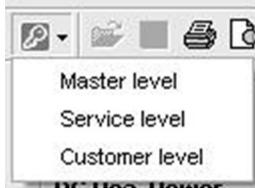
The password level can be found in the column "Level" in the parameter view.

OutputA	OutputB	Enabled	High alarm	Level	FailClass
0	0	<input checked="" type="checkbox"/>		Customer	Trip GB
0	0	<input checked="" type="checkbox"/>		Master	Trip GB
0	0	<input checked="" type="checkbox"/>		Service	Warning
0	0	<input checked="" type="checkbox"/>		Customer	Trip GB
0	0	<input checked="" type="checkbox"/>		Customer	Trip GB
0	0	<input checked="" type="checkbox"/>		Customer	Trip GB

A red arrow points from the left towards the "Level" column in the table.

Parameter access

To gain access to adjust the parameters, the password level must be entered:



If the password level is not entered, it is not possible to enter the parameters.

-  **The customer password can be changed in menu 9116.**
The service password can be changed in menu 9117.
The master password can be changed in menu 9118.
-  **The factory passwords must be changed, if the operator of the genset is not allowed to change the parameters.**
-  **It is not possible to change the password at a higher level than the password entered.**

4. Alarm handling and log list

4.1 Alarm handling

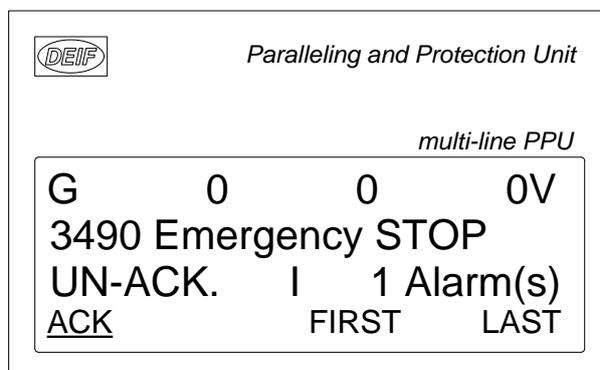
When an alarm occurs, the unit will automatically go to the alarm list for display of the alarm. This function can be disabled or enabled. For further explanation, please see the Designer's Reference Handbook.

If you do not want to read the alarms, use the BACK push-button to exit the alarm list.

If you want to enter the alarm list later, use the INFO push-button to jump directly to the alarm list reading.

The alarm list contains both acknowledged and unacknowledged alarms, provided that they are still active (that is the alarm condition is still present). Once an alarm is acknowledged and the condition has disappeared, the alarm will no longer be displayed in the alarm list.

This means that if there are no alarms, the alarm list will be empty.



This display example indicates an unacknowledged alarm. The display can only show one alarm at a time. Therefore, all other alarms are hidden.

Use the  and  push-buttons to scroll in the display and see the other alarms.

Place the cursor (underscore) under ACK and then press SELECT to acknowledge an alarm.

Place the cursor under the selection FIRST or LAST and then press SELECT to jump to the first (oldest) or the last (most recent) alarm.

4.2 Log list

An event is for example closing of breaker and starting of engine. An alarm is for example over-current or high cooling water temperature. A battery test is for example test OK or test failed.

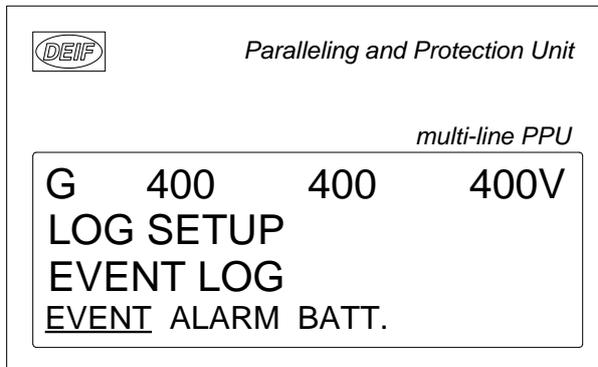
The logging of data is divided into three different groups:

- Event log containing 150 loggings
- Alarm log containing 30 loggings
- Battery test log containing 52 loggings

The logs can be viewed in the display or in the PC utility software. When the individual logs are full, each new event will overwrite the oldest event according to the “first in – first out” principle.

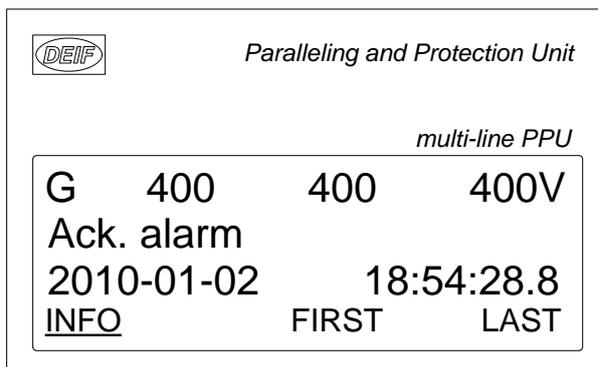
Display

When the LOG push-button is pressed, the display looks like this:



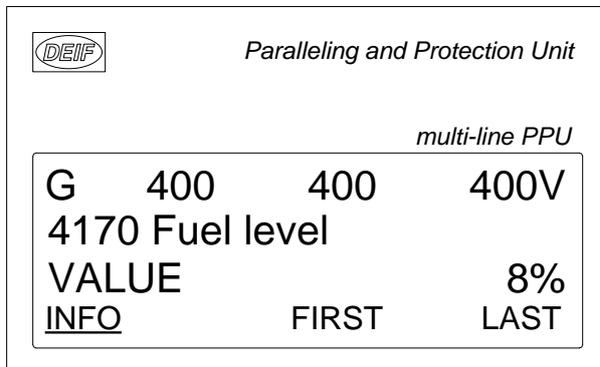
Now it is possible to select one of the three logs.

If EVENT is selected, the log will look like this:



The specific alarm or event is shown in the second line, and the time stamp is shown in the third line.

If the cursor is moved to INFO, the actual value can be read by pressing SELECT:



The first event in the list will be displayed, if the cursor is placed below FIRST and SELECT is pressed.

The last event in the list will be displayed, if the cursor is placed below LAST and SELECT is pressed.

The  and  push-buttons are used for navigating in the list.

5. Service menu

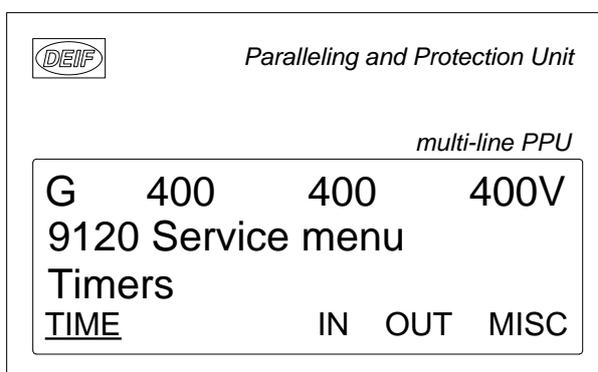
5.1 Purpose of the service menu

The purpose of the service menu is to give information about the present operating condition of the genset. The service menu is entered using the JUMP push-button and selecting menu 9120.

Use the service menu for easy troubleshooting in connection with the event log.

5.2 Entry window

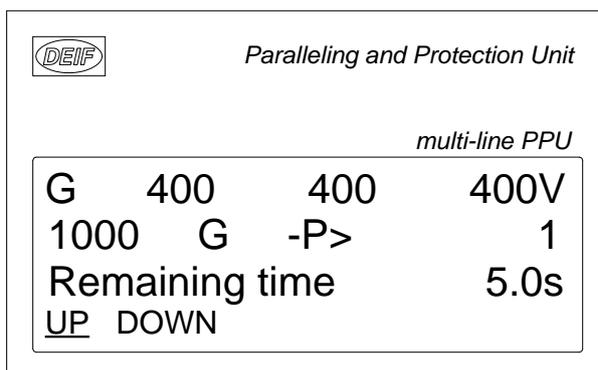
The entry window shows the possible selections in the service menu.



Available selections:

Timers

Shows the alarm timer and the remaining time. The indicated remaining time is the minimum remaining time. The timer will count down when the set point has been exceeded.



IN (digital input)

Shows the status of the digital inputs.


Paralleling and Protection Unit

multi-line PPU

G	400	400	400V
Running			
Input =	0		
<u>UP</u> DOWN			

OUT (digital output)

Shows the status of the digital outputs.


Paralleling and Protection Unit

multi-line PPU

G	400	400	400V
Horn			
Output =	0		
<u>UP</u> DOWN			

MISC (miscellaneous)

Shows miscellaneous messages.


Paralleling and Protection Unit

multi-line PPU

G	400	400	400V
M-Logic enabled			
Various =	0		
<u>UP</u> DOWN			

6. Parameter setup

6.1 Procedures for setup



The complete parameter list is presented in the separate **Parameter List** document of the **Multi-line unit in question: GPC/GPC Gas/GPC Hydro/GPU Hydro** document number **4189340580**, **GPU/GPU Gas/PPU** document number **4189340581**.

This chapter deals with the procedure to be followed when the parameters of the unit are set up from the initial point of finding the individual parameter description to the actual setup. By use of various illustrations, the following will guide the user through the whole procedure of parameter setup step by step.

6.2 Finding the selected parameter

The first step in the parameter setup is to find the correct parameter descriptions. All parameter descriptions in the Parameter List document are intended for reference purposes. The descriptions are structured according to their parameter titles and the main parameter group to which they belong.

6.3 Parameter descriptions

In the parameter list, each parameter description is structured according to the same principles. Under the parameter title heading, the detailed parameter descriptions are illustrated and presented. First, a table indicating the parameter facts related to the individual parameter title is presented:

Menu number indicated in display	Parameter title	Changeable settings indicated in display	Min. and max. set points	Default set point from factory	
1000 G/SG/SC/BA reverse power 1					
1001	G/SG/SC/BA -P> 1	Set point	-50.0 % 0.0 %	-5.0 %	Designer's Reference Handbook
1002	G/SG/SC/BA -P> 1	Delay	0.1 s 100.0 s	10.0 s	
1003	G/SG/SC/BA -P> 1	Relay output A	Not used Option-dependent	Not used	
1004	G/SG/SC/BA -P> 1	Relay output B	Not used Option-dependent	Not used	
1005	G/SG/SC/BA -P> 1	Enable	OFF ON	OFF	
1006	G/SG/SC/BA -P> 1	Fail class	F1...F8	Warning (F2)	



Due to the character of the parameters there may be small differences between the individual tables.

The first column indicates the menu number in the display.

The second column indicates the name of the setting.

The third column describes the function of the parameter.

The fourth column indicates the minimum/maximum set point available for this setting.

The fifth column indicates the default set point of the unit from the factory. When it is necessary, additional information will be supplied below the table in order to make the individual parameter descriptions as informative as possible.

6.4 Setup

At this point of the process, the specific parameter description will have been located. Now, follow the menu structure presented earlier in this manual to set up the individual parameters. (In this overall example, we have chosen to change the set point of the parameter **1000 G -P>**).

- Step 1: Enter the setup menu via SETUP in the fourth display line in the entry window.
- Step 2: Enter the protection menu via PROT in the fourth display line in the setup menu.
- Step 3: Use the  and  push-buttons to locate the selected parameter.
- Step 4: Enter the set point menu via SP in the fourth display line.
- Step 5: Enter password to change the set point.
- Step 6: Use the  and  push-buttons to increase/decrease the set point setting.
- Step 7: Move the “underscore” to save and press SEL; the new set point setting has now been saved.