DEIF

-power in control

CE

DESIGNER'S REFERENCE HANDBOOK

Automatic Load Controller, ALC-4

- Functional description
- Display unit and menu structure
- Procedure for parameter setup
- Parameter list

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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.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

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 Designer's Reference Handbook

1.2.1 General purpose

This Designer's Reference Handbook mainly includes functional descriptions, presentation of display unit and menu structure, information about the PID controller, the procedure for parameter setup and reference to parameter lists.

The general purpose of this document is to provide useful overall information about the functionality of the unit and its applications. This document also offers the user the information he needs in order to successfully set up the parameters needed in his specific application.

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

1.2.2 Intended users

This Designer's Reference Handbook is mainly intended for the panel builder designer in charge. On the basis of this document, the panel builder designer will give the electrician the information he needs in order to install the Multi-line 2 unit, for example detailed electrical drawings. In some cases, the electrician may use these installation instructions himself.

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. General product information

2.1 Introduction

This chapter will deal with the unit in general and its place in the DEIF product range.

The ALC is part of the DEIF Multi-line 2 product family. Multi-line 2 is a complete range of multi-function generator protection and control products integrating all the functions you need into one compact and attractive solution.

The concept of the ALC is to offer a cost-effective load management solution to genset builders. Being part of the Multi-line product family, the standard functions can be supplemented with a variety of optional functions.

2.2 Type of product

The Automatic Load Controller is a micro-processor based control unit containing all necessary functions for controlling and prioritising load groups.
It contains all necessary 3-phase measuring circuits, and all values and alarms are presented on the LCD display.

2.3 Options

2.3.1 Options

The Multi-line 2 product range consists of different basic versions, which can be supplemented with the flexible options needed to provide the optimum solution. The options cover for example various outputs, serial communication, additional operator display and so on.

A complete list of available options is included in the data sheet. Please see www.deif.com.

3. Functional descriptions

3.1 Load control

3.1.1 Principle

The purpose of this controller is to open and close the load groups depending on the available power on the busbar when the load is only supplied by gensets. By prioritising the load groups, the controller can secure supply for the vital load groups. The prioritising is only active in AUTO mode. The load group opening and closing will automatically be carried out according to the adjusted set points and priority selection.

3.1.2 Load control

The load controller can handle up to eight load groups, and there can be up to eight controllers in a power management system. That gives 64 load groups that can be prioritised based on how critical they are. When the available power on the busbar increases, the load controllers will start to close the breakers to the load groups starting with the group with the highest priority (which is the lowest number.). If available power starts to decrease, the load controller will start to disconnect the loads again, starting with the lowest priority. In case a high priority load again becomes available in the priority order, the ALC will not open a lower priority to allow the higher priority group to connect again. The limits for disconnecting load can be set in either a percentage of the total power on the busbar or a fixed value in available kW on the busbar. An example of the sequence is given below.

Connecting load

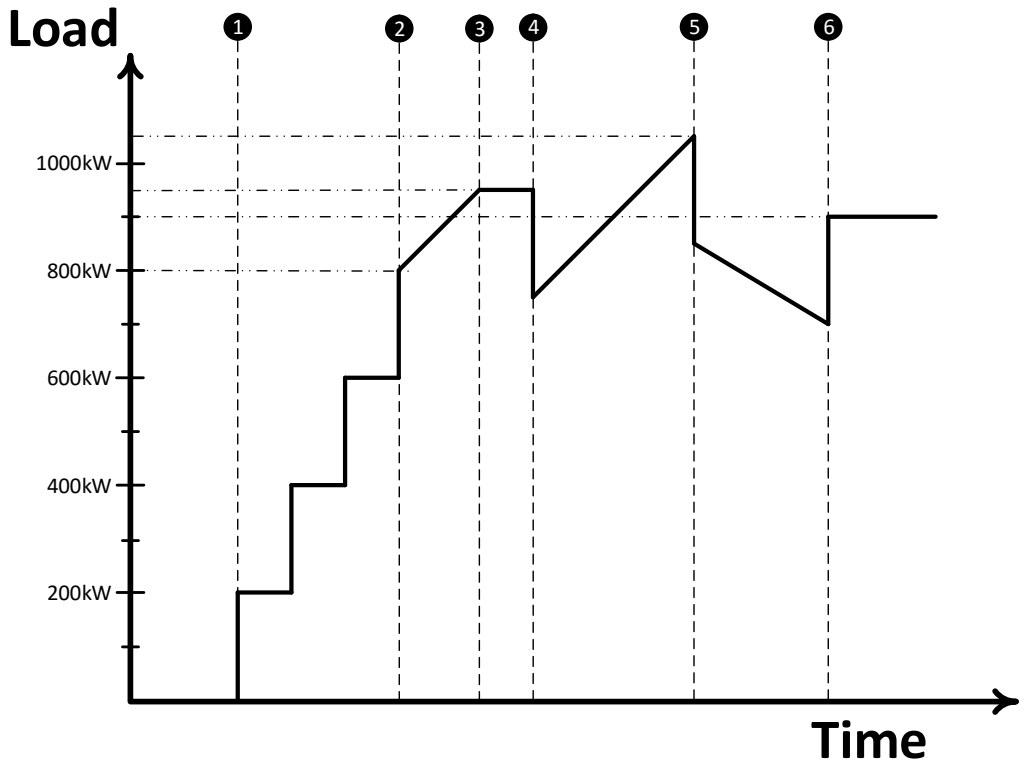
The ALC starts to connect the load with highest priority first. All load groups in a section will be part of the priority order, even if there are several load controllers. To ensure that the gensets are not overloaded too fast, there is a variable timer between the connection of each load group. This timer can be configured at parameter 8083. Every time the controller wants to close a load group, it checks that the nominal load will not bring the total load on the busbar above the load group's disconnect limit plus and hysteresis set in parameter 8081. This hysteresis is a percentage of the total power connected to the busbar.

Disconnecting load

When available power on the busbar starts to decrease, the load controller will start to disconnect load groups when disconnect limit is reached. When disconnecting load groups, it is still the priority order that sets precedent. In this way, a group with a higher priority will not open until the lowest priority is opened, even if it has a lower disconnect limit. If multiple gensets are connected to the busbar, the load-dependent start/stop is still active. As load increases on the busbar, more gensets will start up, and the total available power will increase. Therefore it is important that the disconnect limit of the load groups is higher than the load-dependent start limit. If not, it can end up in a situation where the last load groups will not connect, because the nominal load will bring the load over the disconnect limit, but the next genset will not start, because the load is below the start limit for the gensets. It is also recommended to either use disconnect limit in value or percentage depending on the genset's load-dependent start/stop.

Parameter	Item	Range	Default	Note
8081	Load group Hysteresis	0 % 100 %	10 %	
8082	Disconnect set	Disconnect in pct Disconnect in kW	Disconnect in pct	
8083	Connect timer	1 s 100 s	5 s	

Genset	Load group 1	Load group 2	Load group 3	Load group 4
Nom. U/f: 400 V/50 Hz Nom. P: 1000 kW	Nom load: 200 kW disc. lim.: 100 %	Nom load: 200 kW disc. lim.: 100 %	Nom load: 200 kW disc. lim.: 95 %	Nom load: 200 kW disc. lim.: 95 %
	Connect delay: 5 sec. Connect hysteresis: 5 % disconnect set: percentage			



1. Hz/V is OK on the busbar.
2. All four load groups close the breakers because their nominal power is lower than the available power on the busbar.
3. The load increases and passes LG 3 and 4's disconnect limit.
4. The disconnect delay timer runs out, and the controller opens the load group with the lowest priority (load group 4).
5. The load keeps increasing, the timer runs again and the next load group is opened (load group 3).
6. The load has dropped below LG 3's disconnect set point including the hysteresis, and LG 3 can close again.

3.2 Load group configuration

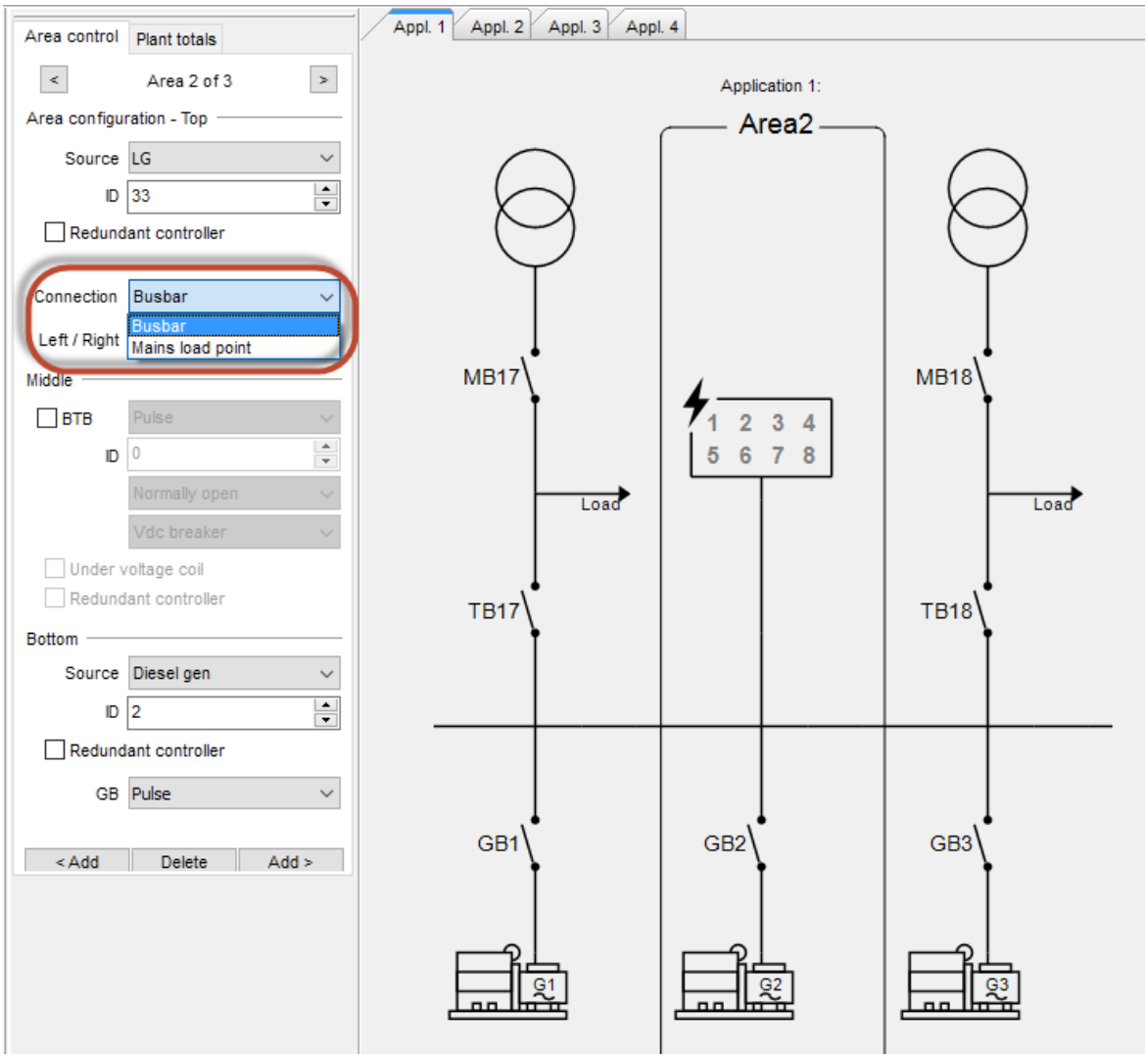
Most of the parameters for configurating the load groups can be accessed from the display, but some of the configurations need to be done from the utility software.

3.2.1 Application configuration

To include an ALC in the power management system, it has to be added in the application configuration. The ALC can be placed in the system in two ways. It can be placed directly on the busbar or in the load point, if a mains is available.

Connected to the busbar

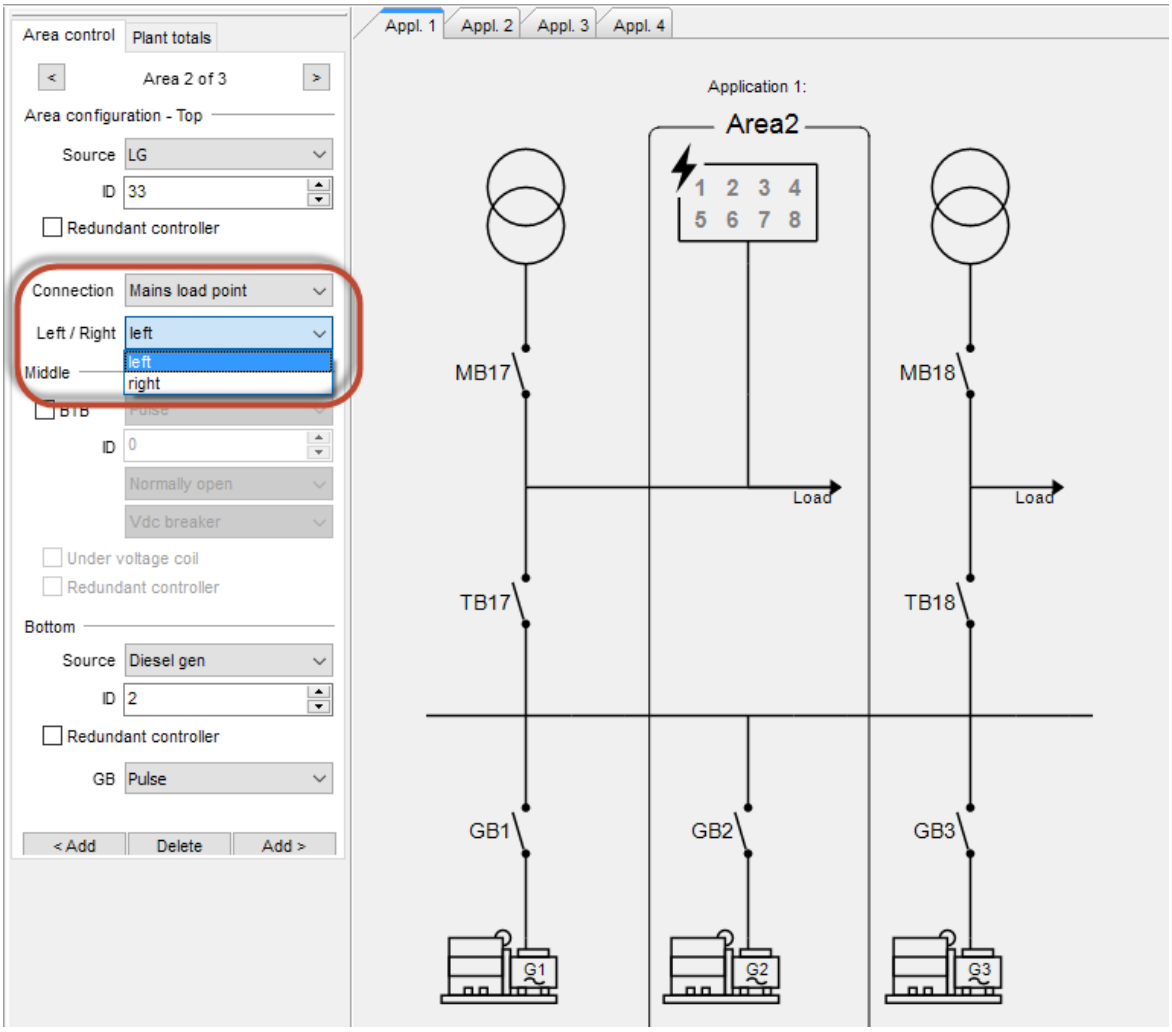
The load controller can be connected directly to the busbar. When the load controller is connected like this, the power management system will not ensure that load groups have power. The busbar will only be supplied if the gensets are running or the mains is configured without tie breaker.

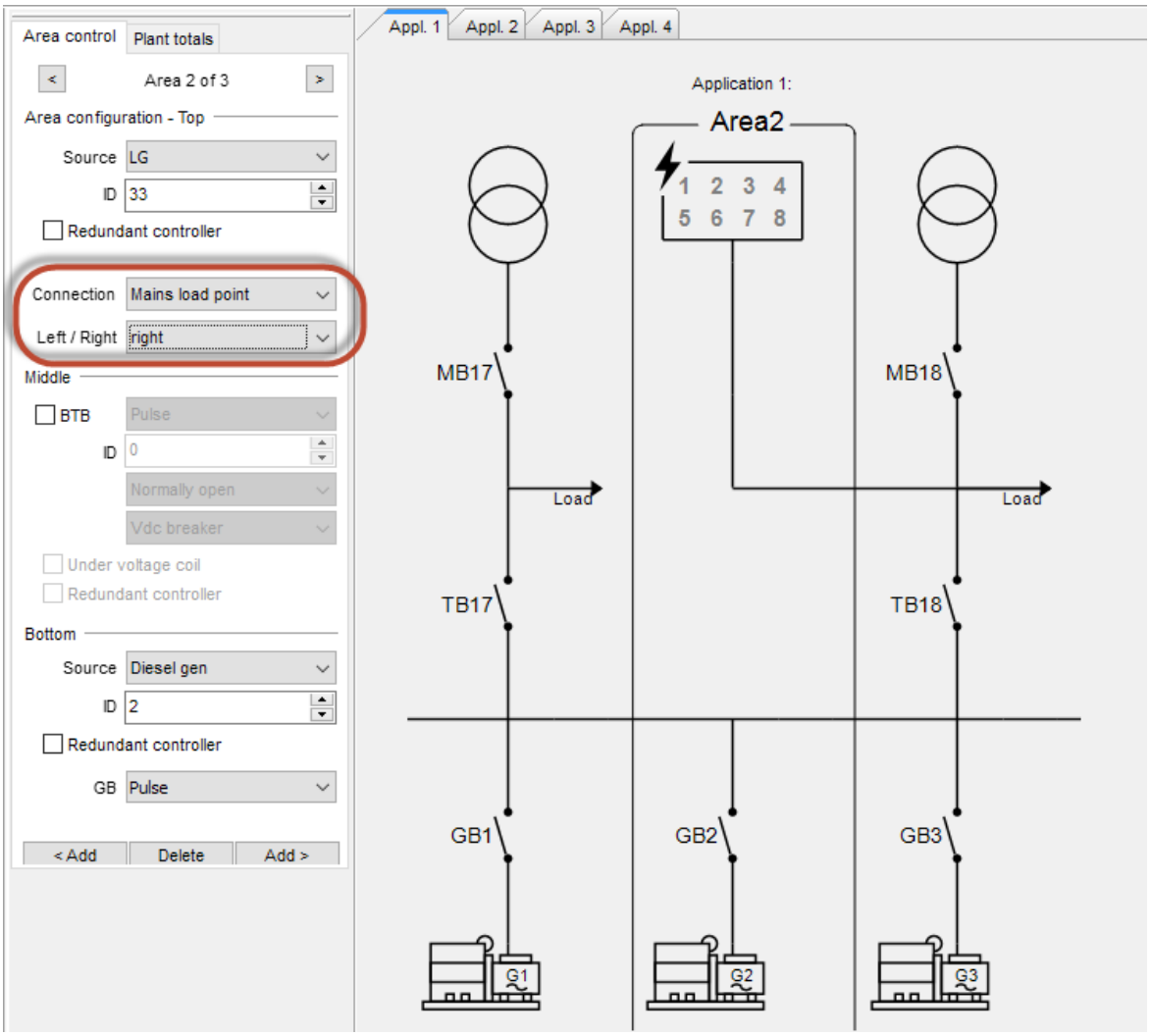


Connected to a load point

If the load controller is connected to a mains load point, the power management system will ensure that the load groups are supplied at all time.

When adding the load controller to an area next to a mains, an option appears to connect the load controller to a mains load point.




Area control
Plant totals
Area 2 of 3
Area configuration - Top
Source
LG
ID
33
Redundant controller
Connection
Mains load point
Left / Right
right
Middle
BTB
Pulse
ID
0
Normally open
Vdc breaker
Under voltage coil
Redundant controller
Bottom
Source
Diesel gen
ID
2
Redundant controller
GB
Pulse
< Add
Delete
Add >
Appl. 1
Appl. 2
Appl. 3
Appl. 4
Application 1:
Area2
1 2 3 4
5 6 7 8
MB17
MB18
Load
Load
TB17
TB18
GB1
GB2
GB3
G1
G2
G3

3.2.2 Load group parameters

Parameter	Item	Range	Default	Note
8001	Power Nominal	1 kW 10000 kW	400 kW	The nominal load of the load group
8002	Grp 1 Input	Analogue 91 Analogue 133	Analogue 102	Analogue input for power transducer
8003	Grp 1 Ena Input	OFF ON	OFF	Enabling the analogue input. If not enabled, the controller will use the nominal load for reference.
8004	Disconnect grp	5 % 500 %	100 %	Disconnect limit for the group. The group will be disconnect when the total busbar load surpasses this limit.
8005	Delay timer	0.1 s 100.0 s	5.0 s	The disconnect delay after the disconnect limit has been reached.
8006	Enable group 1	OFF ON	OFF	Enabling the load group.

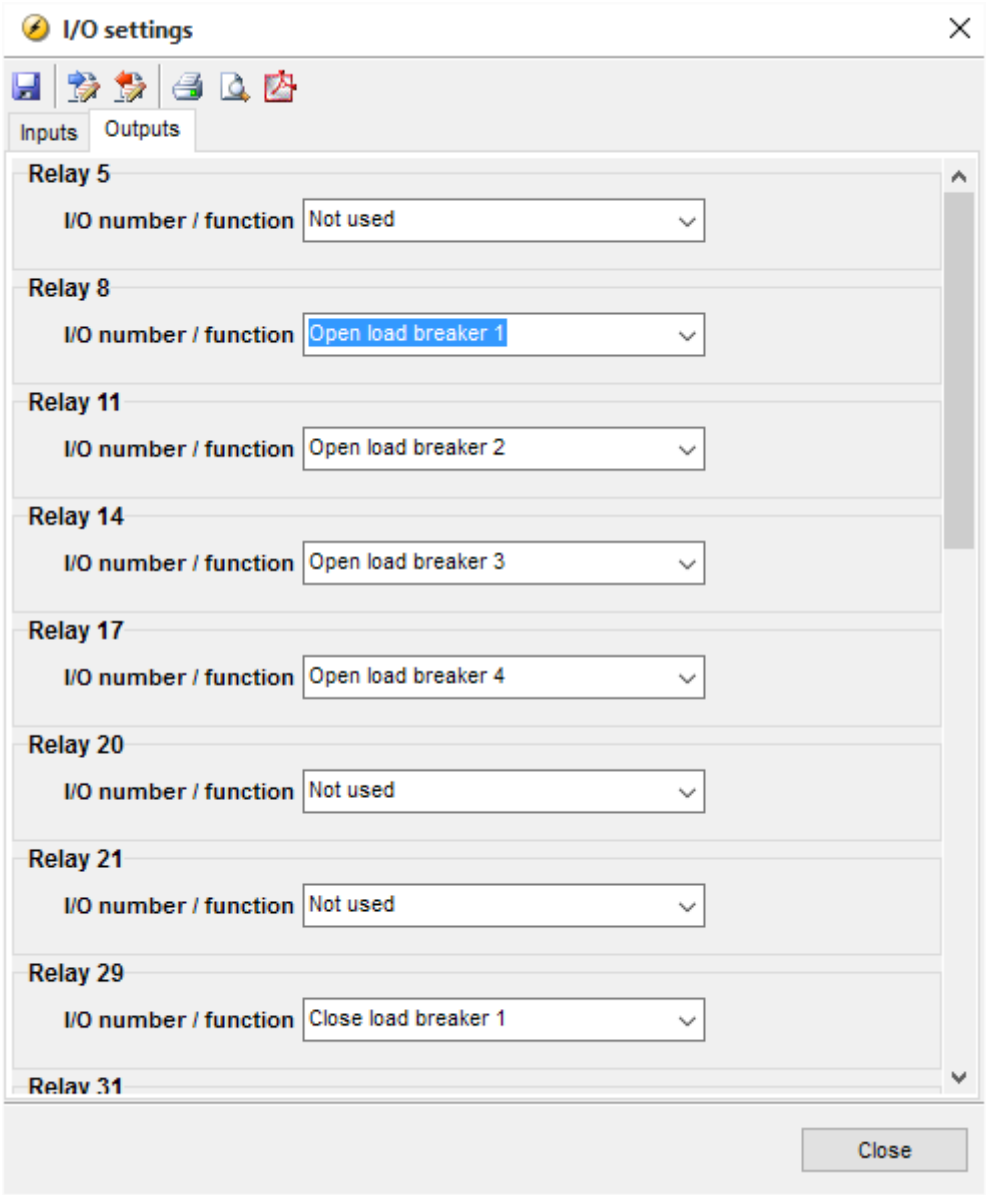
For load group 2-8, identical parameters are located at 8010-8079.

3.2.3 Load input

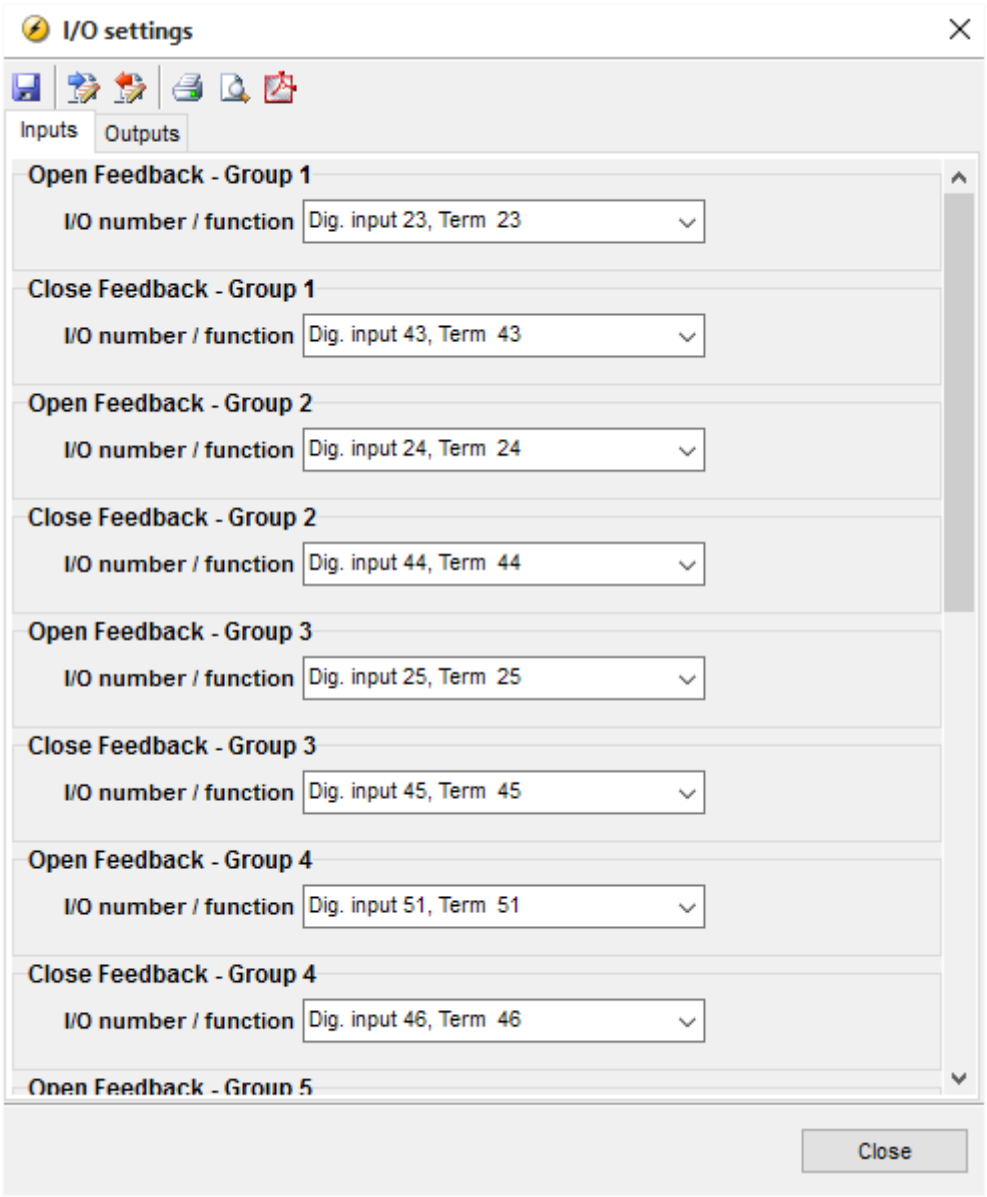
Each load group has the option of an analogue input for indication of the load on the individual load group. This requires an external transducer to measure the power consumption on the load group. This is only used displaying the load.
See the section "Multi-inputs" on how to scale the input.

3.2.4 Breaker assignment

The relays for the breakers are assigned in the I/O settings menu.



Breaker position feedbacks are assigned in the I/O settings menu.



The breakers can be configured as: Pulse breakers, Continuous NE or continuous ND. See the table below on how each type is configured.

Breaker type	Input configuration	Output configuration
Pulse breakers	Assign both a close and an open feedback	Assign both a close and an open relay
Continuous NE breakers	Assign a close feedback	Assign a close relay
Continuous NE breakers	Assign an open feedback	Assign an open relay

3.2.5 Load group priority

All load groups in the power management system participate in the same priority order. Parameter 8081-8202 are all the priorities from 1-64, and each priority must be set for all load groups in each load controller.

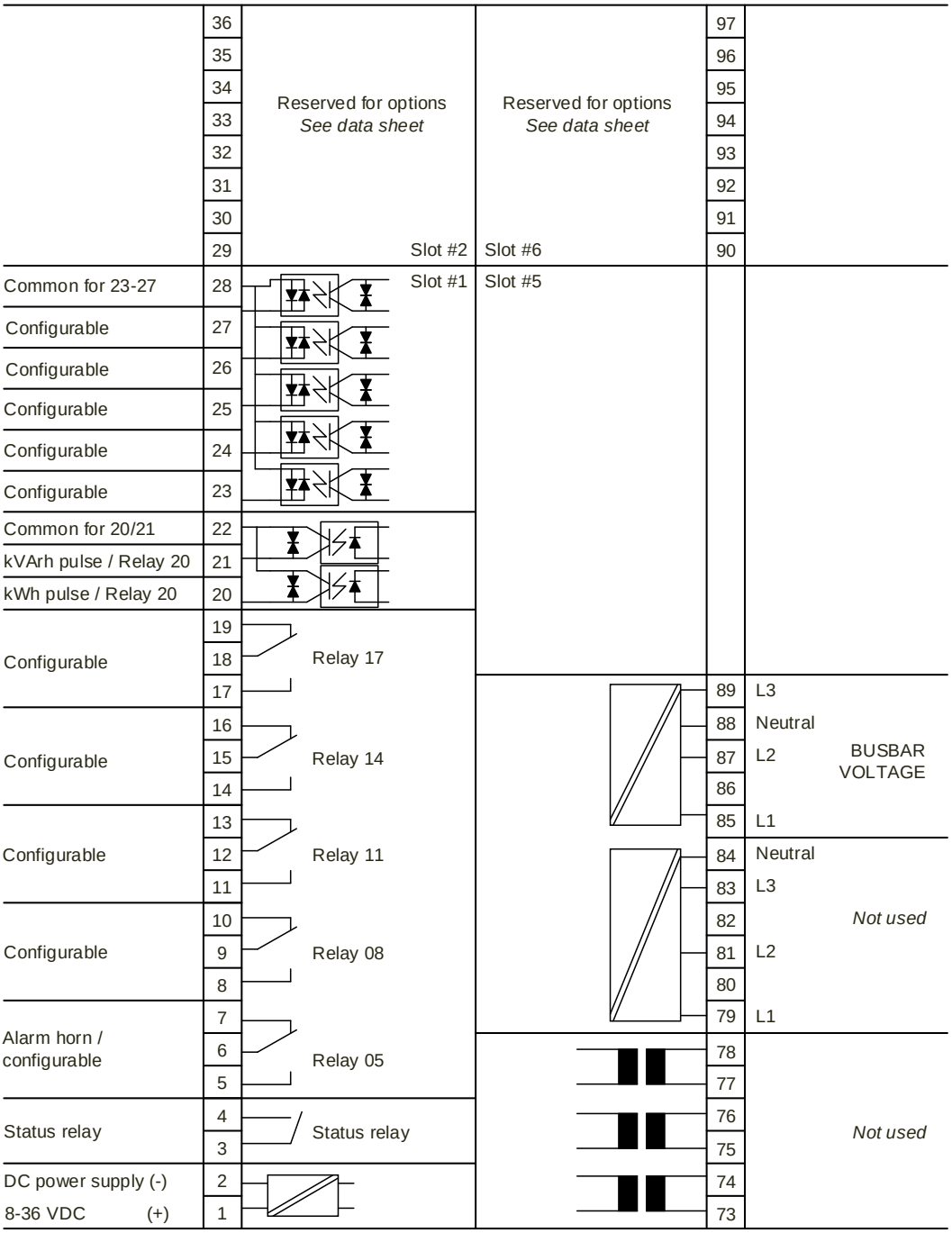
3.3 Terminal strip overview

The terminal strip overview shows I/Os for selectable standard and optional hardware.

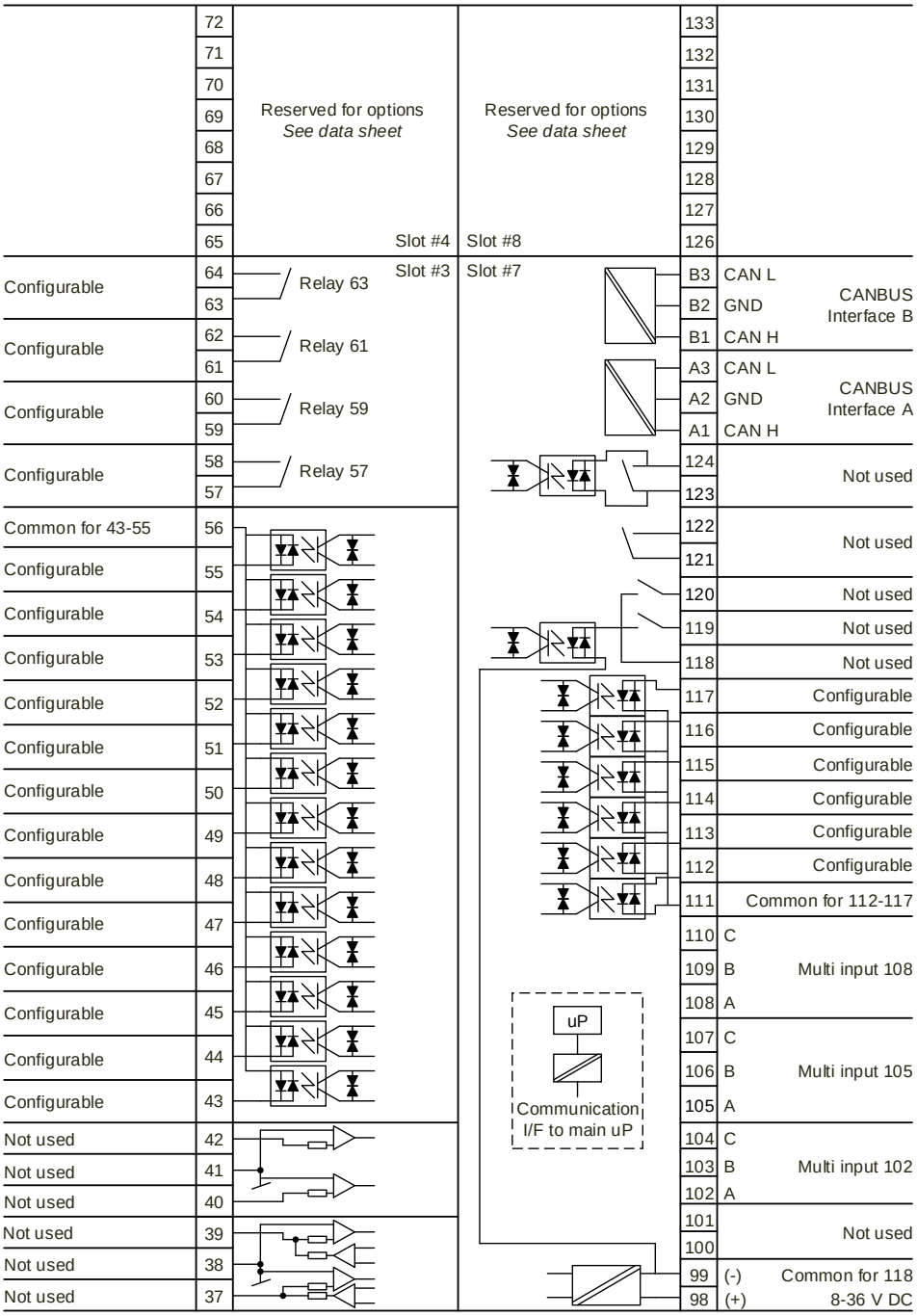
Refer to the data sheet for accurate information about possible configurations for the ALC.

Refer to the input/output lists in the installation instructions for detailed information about the I/Os of the specific options.

3.3.1 Slot #1, #2, #5 and #6



3.3.2 Slot #3, #4, #7 and #8



The hardware shown in slot #3 is option M1. For a detailed description of this option, please refer to the option descriptions.

3.4 Measurement systems

The ALC is designed for measurement of voltages between 100 and 690 V AC. For further reference, the AC wiring diagrams are shown in the Installation Instructions.

3.4.1 Three-phase system

When the ALC is delivered from the factory, the three-phase system is selected. When this principle is used, all three phases must be connected to the ALC.

The table below contains the parameters to make the system ready for split phase measuring.
In the example below is an example with 230/400 V AC, which can be connected directly to the ALC's terminals without the use of a voltage transformer. If a voltage transformer is necessary, the nominal values of the transformer should be used instead.

Setting	Adjustment	Description	Adjust to value
6004	Nom. voltage	Phase-phase voltage of the busbar	400 V AC
6051	BB transformer set 1	Primary voltage of the BB voltage transformer (if installed)	400 V AC
6052	BB transformer set 1	Secondary voltage of the BB voltage transformer (if installed)	400 V AC
6053	BB nom. voltage set 1	Phase-phase voltage of the busbar	400 V AC

The ALC has two sets of BB transformer settings, which can be enabled individually in this measurement system.

3.5 Nominal settings

3.5.1 Nominal settings

The ALC holds two sets of nominal settings for the busbar, configured in channels 6051 to 6064. Each set consists of a nominal as well as a primary and secondary voltage value. The "U primary" and "U secondary" are used to define the primary and secondary voltage values, if any measurement transformers are installed. See paragraph "Switch between the nominal settings" for more information about this feature.

3.5.2 Switch between the nominal settings

The two sets of nominal settings can be individually configured. The ALC is able to switch between the different sets of nominal settings, which enables the use of a specific set of nominal settings related to a specific application or situation.

Typically, it is the rental industry that makes use of the possibility to switch nominal parameter settings. The feature is very useful with mobile gensets, where switching in frequency and voltage is required. Stationary gensets can make use of this feature as well. For example, in the event of an AMF situation, it may be desirable to increase the nominal power and current settings to achieve increased tolerance regarding the protections.

Activation
Manual switching between the nominal set points can be done in three ways: digital input, AOP or menu 6054.

When using M-Logic, any event can be used to activate an automatic switching of nominal parameter sets.

Digital input
M-Logic is used when a digital input is needed to switch between the two sets of nominal settings. Select the required input among the input events, and select the nominal settings in the outputs.

Example:

Event A		Event B		Event C	Output
Dig. input no. 23	or	Not used	or	Not used	Set nom. parameter settings 1
Not Dig. input no. 23	or	Not used	or	Not used	Set nom. parameter settings 2

See the "Help" file in the PC utility software for details.

AOP
M-Logic is used when the AOP is used to switch between the two sets of nominal settings. Select the required AOP push-button among the input events, and select the nominal settings in the outputs.

Example:

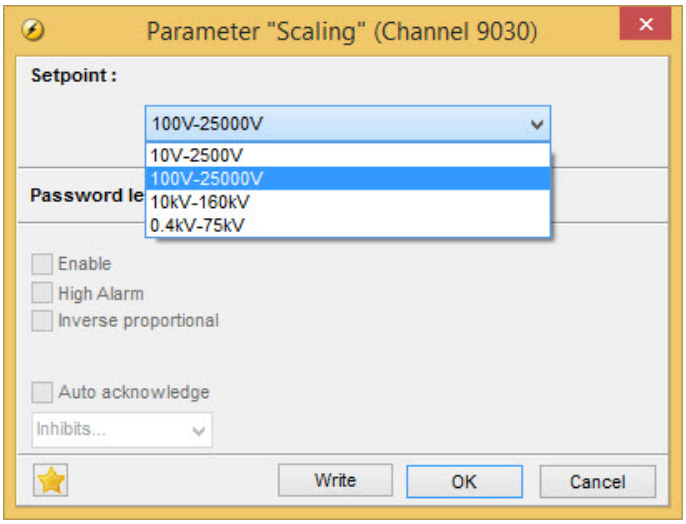
Event A		Event B		Event C	Output
Button07	or	Not used	or	Not used	Set nom. parameter settings 1
Button08	or	Not used	or	Not used	Set nom. parameter settings 2

See the "Help" file in the PC utility software for details.

Menu settings
In menu 6054, the switching between settings 1 to 2 is made simply by choosing the desired nominal setting.

3.5.3 Scaling

Default voltage scaling is set to range 100 V to 25000 V (parameter 9030). To be able to handle applications above 25000 V and below 100 V, it is necessary to adjust the input range so it matches the actual value of the primary voltage transformer. This makes it possible for the unit to support a wide range of voltage and power values. Master password level access is required to change this parameter.



Changing the voltage scaling will also influence the nominal power scaling:

Scaling parameter 9030	Nom. settings 1 to 4 (power) will change according to parameter 9030	Nom. settings 1 to 4 (voltage) will change according to parameter 9030	Transformer ratio settings parameters 6041, 6051 and 6053
10 V to 2500 V	1.0 to 900.0 kW	10.0 V to 2500.0 V	10.0 V to 2500.0 V
100 V to 25000 V	10 to 20000 kW	100 V to 25000 V	100 V to 25000 V
0.4 kV to 75 kV	0.10 to 90.00 MW	0.4 kV to 75.00 kV	0.4 kV to 75.00 kV
10 kV to 160 kV	1.0 to 900.0 MW	10.0 kV to 160.0 kV	10.0 kV to 160.0 kV

All nominal values and the primary VT settings must be corrected after the scaling has been changed in parameter 9030.

3.6 Running mode description

3.6.1 Semi-auto mode

The unit can be operated in semi-auto mode. Semi-auto means that the unit will not initiate any sequences automatically, as is the case with the auto mode. It will only initiate sequences, if external signals are given.

An external signal may be given in three ways:

1. Push-buttons on the display are used
2. Digital inputs are used
3. Modbus command

The standard ALC is only equipped with a limited number of digital inputs, please refer to "Digital inputs" in this document and the data sheet for additional information about availability.

The following sequences can be activated in semi-auto:

Command	Description	Comment
Close LG breaker	The unit will close the load group breaker	The operator needs to navigate to the correct load group view to close the breaker.
Open LG breaker	The unit will open the load group breaker	The operator needs to navigate to the correct load group view to open the breaker.

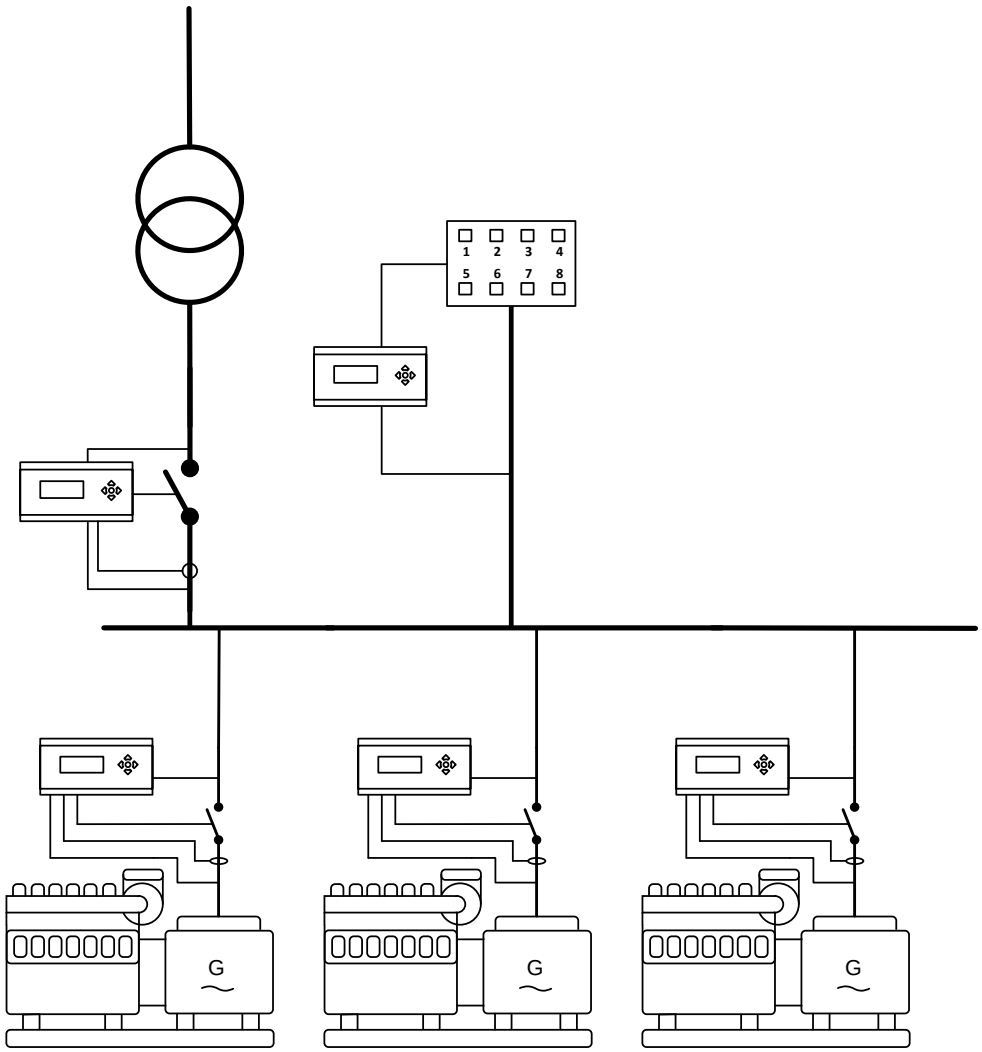
3.6.2 Auto mode

The unit can be operated in auto mode. Auto means that the unit will initiate all sequences automatically. It will open and close load groups automatically according to the settings set in the controller. It is not possible to operate the breakers manually

3.7 Single-line diagrams

3.7.1 Application illustration

In the following, the power management application is illustrated in a single-line diagram.



4. Display unit and menu structure

4.1 Presentation

This chapter deals with the display unit including the push-button and LED functions. In addition, the unit menu structure will be presented.

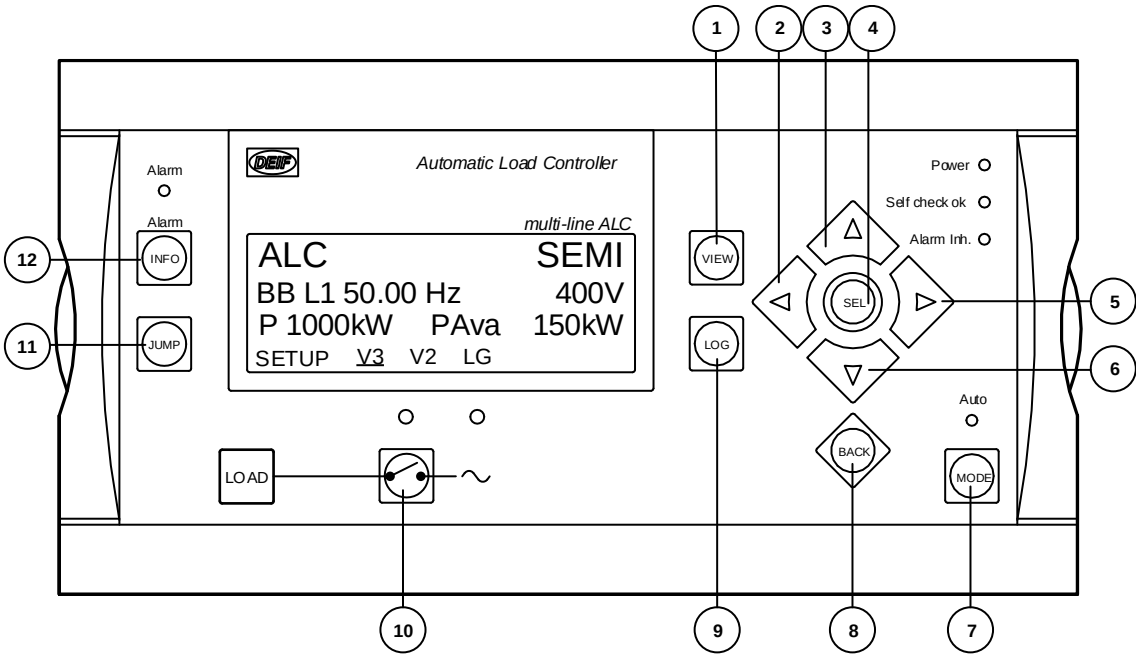
4.2 Display unit (DU-2)

The display has four different lines, each with 20 characters, and holds a number of push-button functions.

Display dimensions are H x W = 115 x 220 mm (4.528” x 9.055”).

4.2.1 Push-button functions

The display unit holds a number of push-button functions which are described below:

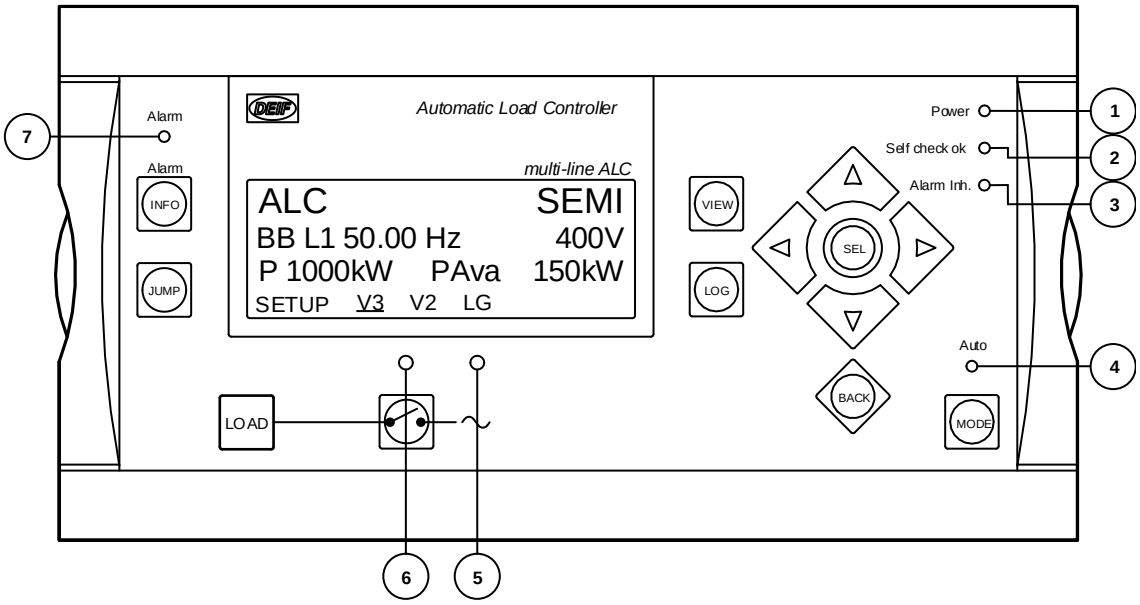


1. Shifts the first line displaying in the setup menus. Push 2 sec. to switch to master display in case more than one display is connected.
2. Moves the cursor left for manoeuvring in the menus.
3. Inreases the value of the selected set point (in the setup menu). In the daily use display, this button function is used for scrolling the View lines in V1 or the second line (in the setup menu) displaying of generator values.
4. Selects the underscored entry in the fourth line of the display.
5. Moves the cursor right for manoeuvring in the menus.
6. Decreases the value of the selected set point (in the setup menu). In the daily use display, this button function is used for scrolling the second line displaying of generator values.
7. Changes the menu line (line four) in the display to mode selection.

8. Jumps one step backwards in the menu (to previous display or to the entry window).
9. Displays the LOG SETUP window where you can choose between the Event, Alarm and Battery logs. The logs are not deleted when the auxiliary supply is switched off.
10. Manual activation of close breaker and open breaker sequence if "SEMI-AUTO" is selected.
11. 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 (see later).
12. Shifts the display three lower lines to show the alarm list.

4.2.2 LED functions

The display unit holds 10 LED functions. The colour is green or red or a combination in different situations. The display LEDs are indicating as follows:



1. LED indicates that the auxiliary supply is switched on.
2. LED indicates that the unit is OK.
3. Please refer to "Alarm inhibit" in the chapter "Additional functions".
4. LED indicates that auto mode is selected.
5. LED green light indicates that the voltage/frequency is present and OK. LED red light indicates voltages are not OK.
6. LED indicates that a load group breaker is closed.
7. LED flashing indicates that unacknowledged alarms are present. LED fixed light indicates that ALL alarms are acknowledged, but some are still present.

4.3 Menu structure

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

View menu system

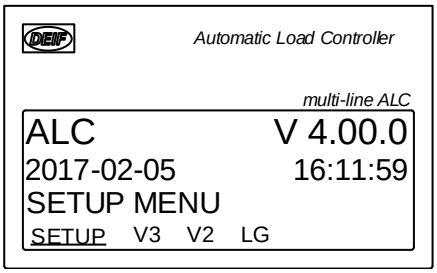
This is the commonly used menu system. 15 windows are configurable and can be entered by using the arrow push-buttons.

Setup menu system
This menu system is used for setting 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.

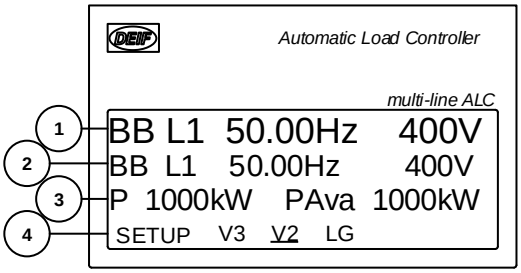
4.3.1 Entry window

When the unit is powered up, an entry window appears. The entry window is the turning point in the menu structure and as such 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.



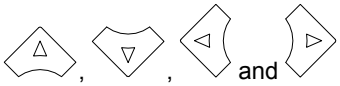
4.3.2 View menu



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 display.

The menu navigating starts from the fourth display line in the entry window and is carried out using the


, , and push-buttons.

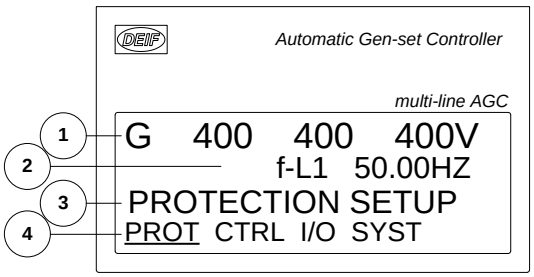
The entry window above displays view 2.

Moving the cursor left or right offers the following possibilities.

- Setup menu – access to the following sub-menus:
  - Protection setup
  - Control setup
  - I/O setup
  - System setup
- View 3 – window displays operational status and selectable measurements
- View 2 – window displays selectable measurements. The same as view 1
- View LG – access to detailed info about the 8 load groups (see: Load group View).

4.3.3 Setup menu

The setup menu system is used for parameter setup of the unit, and if the user needs detailed information that is not available in the view menu system. So, 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.



1.First display line

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

2.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

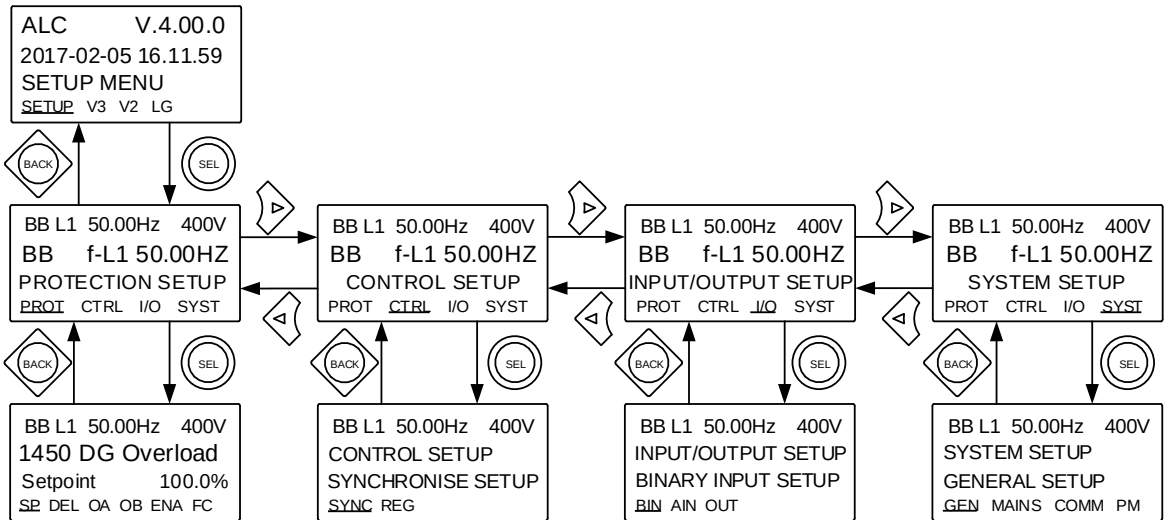
3.Third display line

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

4.Fourth display line

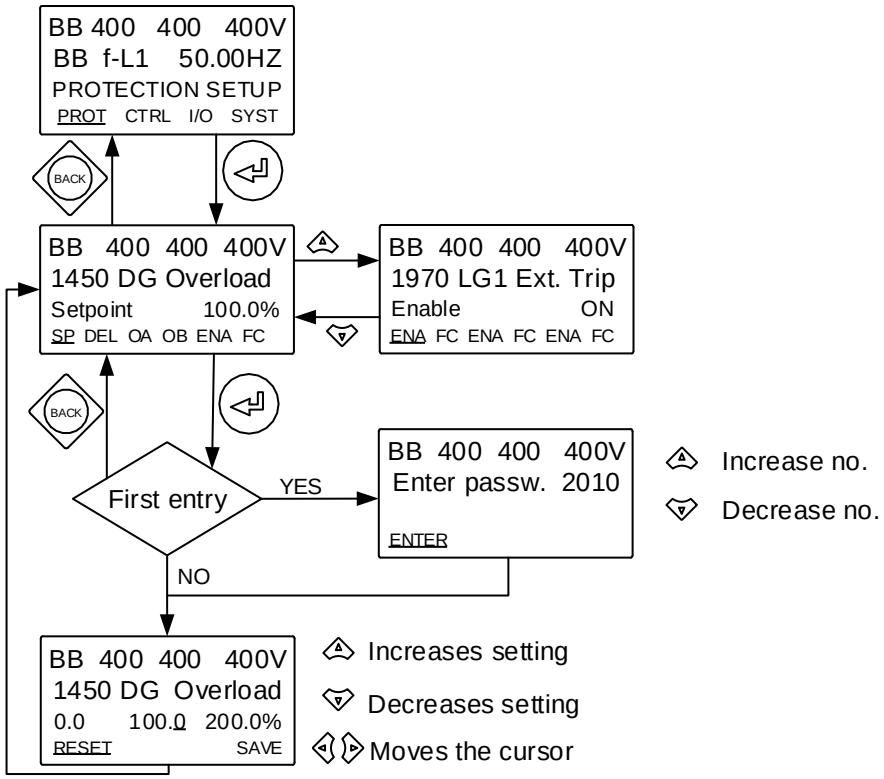
(Daily use)	Entry selection for the setup menu. Press SEL to enter the underscored menu
(Setup menu)	Sub-functions for the individual parameters, for example limit

Setup structure

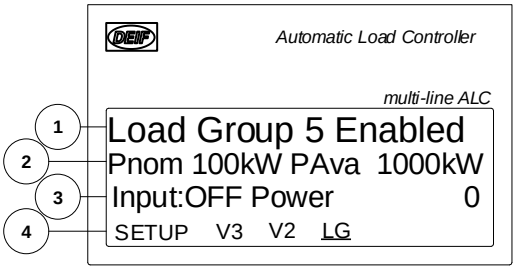


Setup example

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



4.3.4 Load group view



1. First display line: Load group name, and whether it is active.
2. Second display line: Nominal power of load group, and available power on the busbar.
3. Third display line: Status of analogue power measurement.
4. Fourth display line: Selection of setup and view menus.

The menu navigating starts from the fourth display line in the entry window and is carried out using the  and  push-buttons.

4.4 Password

4.4.1 Password

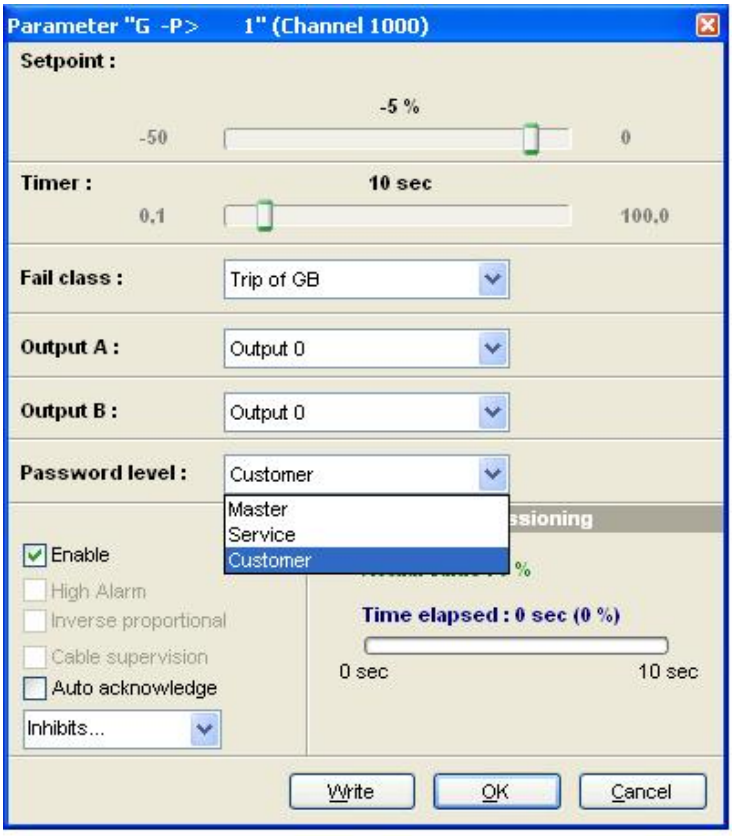
The unit includes three password levels. All levels can be adjusted in the PC software.

Available password levels:

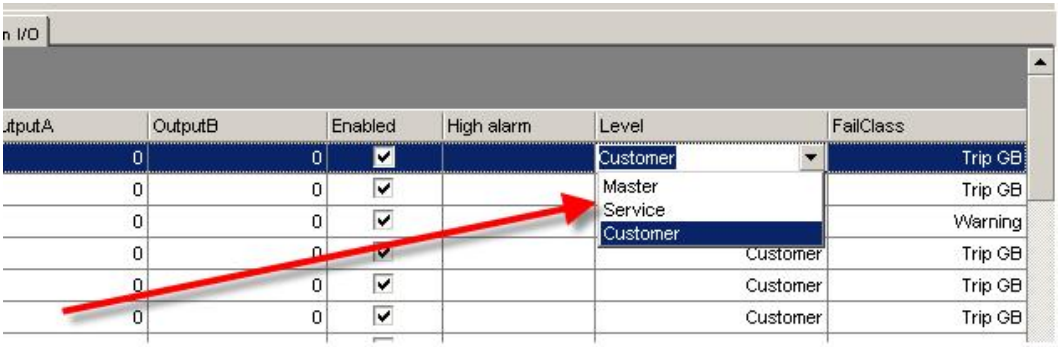
Password level	Factory setting	Access		
		Customer	Service	Master
Customer	2000	X		
Service	2001	X	X	
Master	2002	X	X	X

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. To do so, the PC utility software must be used. Enter the parameter to be configured and select the correct password level.



The password level can also be changed from the parameter view in the column "Level".



4.4.2 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 jump menu 9116. The service password can be changed in jump menu 9117. The master password can be changed in jump menu 9118.

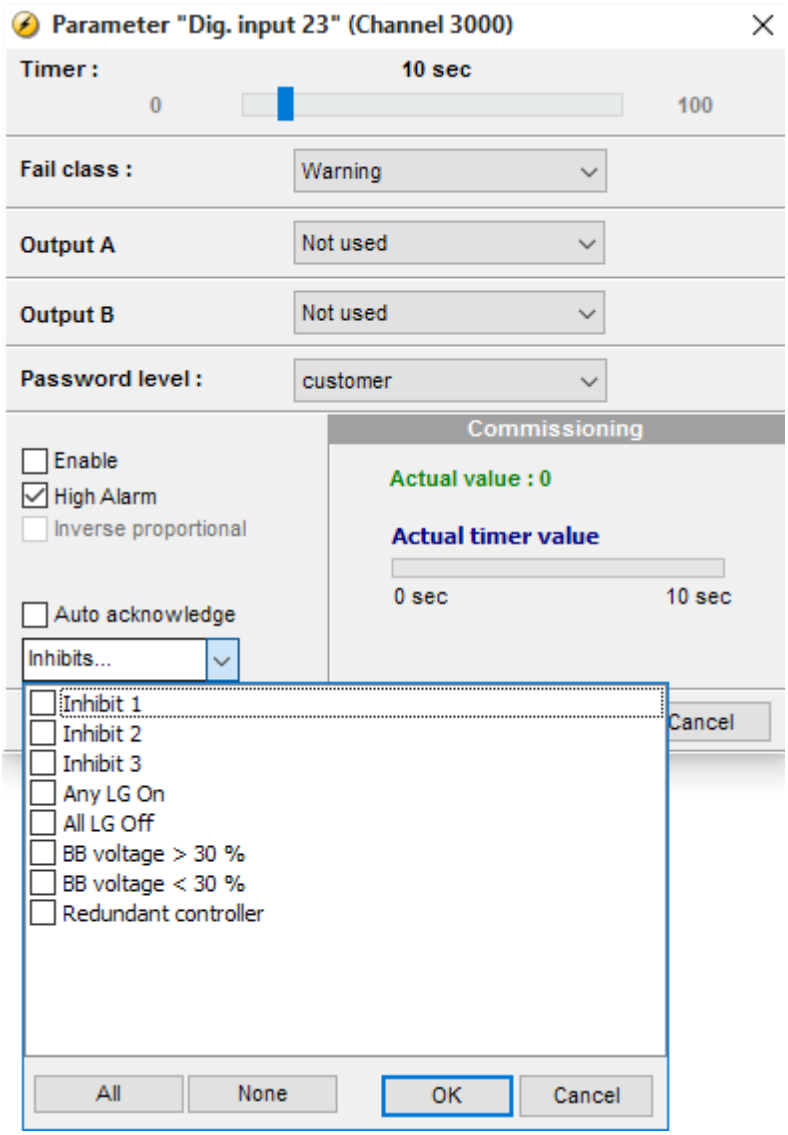
The factory passwords must be changed if the operator of the genset is not allowed to change the parameters.

It is not possible to change the password at a higher level than the password entered.

5. Additional functions

5.1 Alarm inhibit

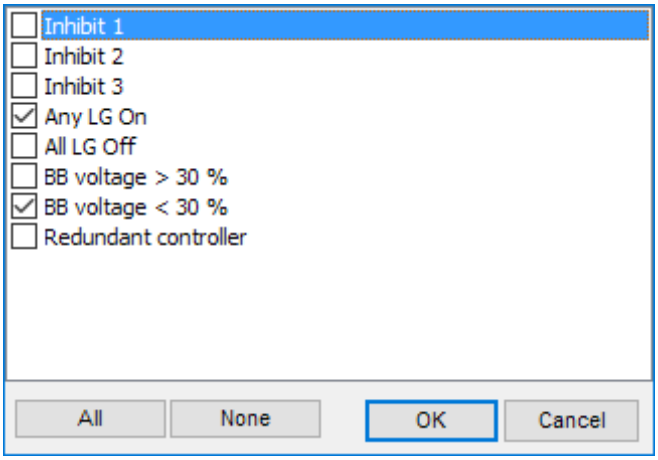
In order to select when the alarms are to be active, a configurable inhibit setting for each alarm has been made. The inhibit functionality is only available via the PC utility software. For each alarm, there is a drop-down window where it is possible to select which signals that have to be present in order to inhibit the alarm.



Selections for alarm inhibit:

Function	Description
Inhibit 1	M-Logic outputs: Conditions are programmed in M-Logic
Inhibit 2	
Inhibit 3	
Any LG ON	Any load breaker is closed
All LG OFF	All load breaker is open
BB voltage > 30 %	Busbar voltage is above 30 % of nominal
BB voltage < 30 %	Busbar voltage is below 30 % of nominal
Redundant controller	The controller is redundant

Inhibit of the alarm is active as long as one of the selected inhibit functions is active.



In this example, inhibit is set to *LG voltage < 30 %* and *LG ON*. Here, the alarm will be active when all LGs are open and the voltage is above 30 %.

The inhibit LED on the unit and on the display will activate when one of the inhibit functions is active.

5.2 Access lock

The purpose of access lock is to deny the operator the possibility to configure the unit parameters and change the running modes.

The input to be used for the access lock function is defined in the ML-2 PC utility software (USW).

Access lock will typically be activated from a key switch installed behind the door of the switchboard cabinet. As soon as access lock is activated, changes from the display cannot be made.

Access lock will only lock the display and will not lock any AOP or digital input. AOP can be locked by using M-Logic.
It will still be possible to read all parameters, timers and the state of inputs in the service menu (9120).

It is possible to read alarms, but not any alarms when access lock is activated. Nothing can be changed from the display.

This function is ideal for a rental generator, or a generator placed in a critical power segment. The operator does not have the possibilitiy to change anything. If there is an AOP-2, the operator will still be able to change up to 8 different predefined things.

The stop push-button is not active in semi-auto mode when the access lock is activated. For safety reasons, it is recommended to install an emergency stop switch.

AOP buttons are not locked when access lock is activated.

5.3 Command timers

The purpose of the command timers is for example able to activate a load group automatically at specific times each weekday or certain weekdays. Up to four command timers can be used for example for open and close. The command timers are available in M-Logic. Each command timer can be set for the following time periods:

- Individual days (MO, TU, WE, TH, FR, SA, SU)
- MO, TU, WE, TH
- MO, TU, WE, TH, FR
- MO, TU, WE, TH, FR, SA, SU
- SA, SU

The time-dependent commands are flags that are raised when the command timer is in the active period.

5.4 Not in auto

This function can be used for indication or to raise an alarm in case the system is not in auto. The function is set up in menu 6540.

5.5 Fail class

5.5.1 Fail class

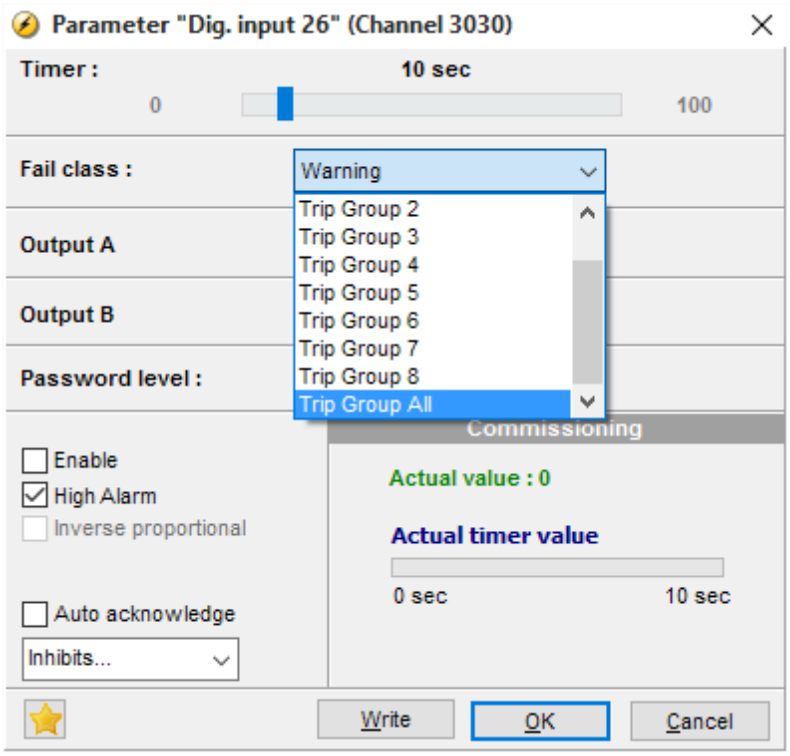
All activated alarms must be configured with a fail class. The fail classes define the category of the alarms and the subsequent alarm action.

The ALC has three options for fail class:
- Warning
- Trip group 1-8
- Trip group all

5.5.2 Fail class configuration

The fail class can be selected for each alarm function either via the display or the PC software.

To change the fail class via the PC software, the alarm function to be configured must be selected. Select the desired fail class in the fail class roll-down panel.

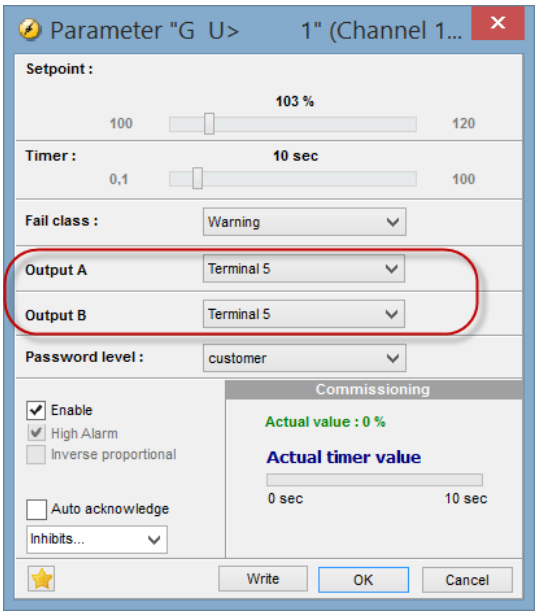


5.6 Limit relay

5.6.1 Limit relay

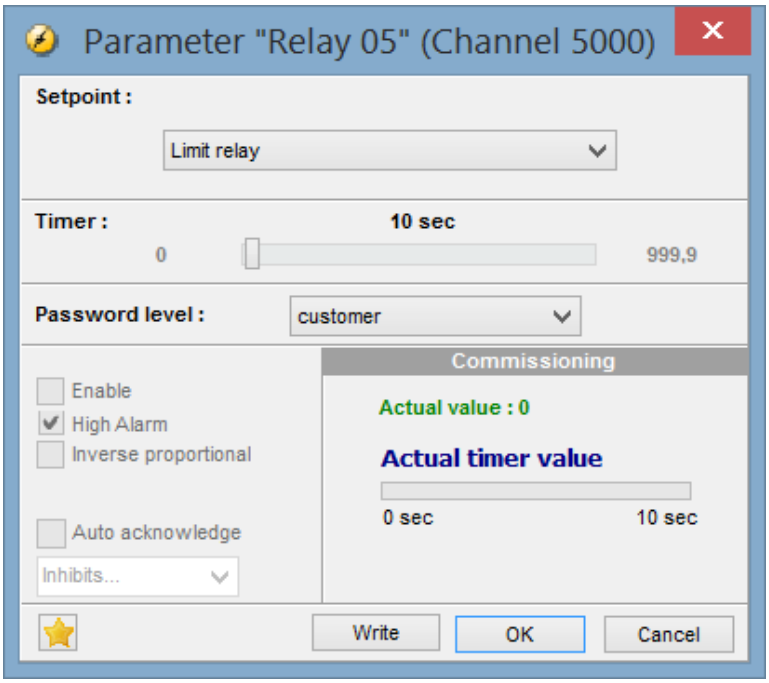
For all alarm functions, it is possible to activate one or two output relays as shown below. This section is used to explain how to use an alarm function to activate an output without any indication of alarm. On and OFF delay timers are described as well.

If no alarm is needed, it is important to fill both output A and B with either the "Limits" output or relays which are configured as "Limit relay". In the example below, the relay will close when the generator voltage is above 103 % for 10 seconds, and no alarm will appear on the screen because both output A and output B are configured to relay 5, which is configured as "Limit relay".



The timer configured in the alarm window is an ON-delay, which determines the time the alarm conditions has to be met before activation of any alarms or output.

When a relay is selected (relay on terminal 5 in this example), it must be set up as a limit relay as shown below, otherwise an alarm indication will still appear.



The timer in the picture above is an OFF-delay, meaning that when the alarm level is OK again, the relay will remain activated until the timer runs out. The timer is only effective together with a configuration as "Limit relay". If configured to any "Alarm relay", the relay is deactivated instantly when the alarm conditions disappear and it is acknowledged..

5.7 Multi-inputs

The ALC unit has three multi-inputs which can be configured to be used as the following input types:

1. 4-20 mA
2. 0-40 V DC
3. Pt100
4. Pt1000
5. Digital

The function of the multi-inputs can only be configured in the PC utility software.

For each input two alarm levels are available. The menu numbers of the alarm settings for each multi-input are controlled by the configured input type as seen in the following table.

Input type	Multi-input 102	Multi-input 105	Multi-input 108
4-20 mA	4120/4130	4250/4260	4380/4390
0-40 V DC	4140/4150	4270/4280	4400/4410
Pt100/Pt1000	4160/4170	4290/4300	4420/4430
Digital	3400	3410	3420

Only one alarm level is available for the digital input type.

5.7.1 4-20 mA

If one of the multi-inputs has been configured as 4-20 mA, the unit and range of the measured value corresponding to 4-20 mA can be changed in the PC utility software in order to get the correct reading in the display.

5.7.2 0-40 V DC

The 0-40 V DC input has primarily been designed to handle the battery asymmetry test.

5.7.3 Pt100/1000

This input type can be used for heat sensor, for example cooling water temperature. The unit of the measured value can be changed from Celsius to Fahrenheit in the PC utility software in order to get the desired reading in the display.

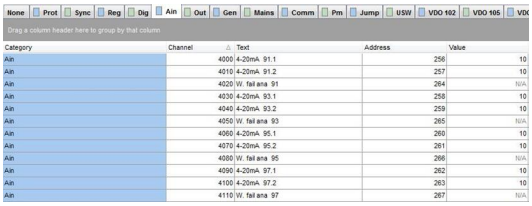
5.7.4 Scaling of 4-20 mA inputs

The scaling of the analogue inputs is made to ensure that the readout of the inputs is made with a resolution that fits the connected sensor. It is recommended to follow the list below when changing the scaling of the analogue inputs.

1. Set up the multi-input for 4-20 mA. This is done in menu 10980-11000 for multi-input 102-108 and in menu 11120-11190 for option M15 or M16.

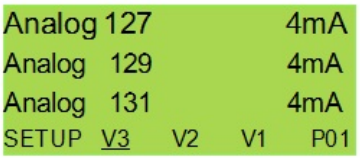
2. Now the scaling parameters are available in menu 11010-11110.
3. Activate the AUTO SCALE enable check box when setting up the inputs. This means that the reading remains the same - but decimals are added.
4. Deactivating AUTO SCALE will make the reading smaller by a factor of 10 for each decimal added.
5. Then the alarm parameters for the multi-inputs can be configured.
6. A parameter file (usw file) should always be saved without the AUTO SCALE enabled.

The setup of the multi-inputs and alarm parameters must be done in the above order. If not, the alarm levels will be wrong.



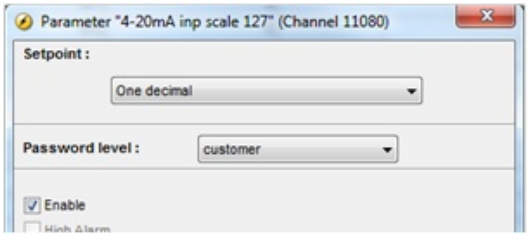
Setting up decimals:
No decimals:
0-5 bar oil pressure transducer (4-20 mA)
Decimals = 0

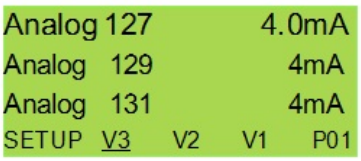
Without use of decimals, the set point can only be adjusted in steps of one bar, which gives a very rough range of setting.



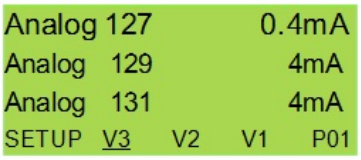
The display will show 0 to 5 bar in the measuring range 4 to 20 mA.

One decimal:
0-5 bar oil pressure transducer (4-20 mA)
Decimals = 1
Auto scale = enable





Decimals = 1, AUTO SCALE = enabled

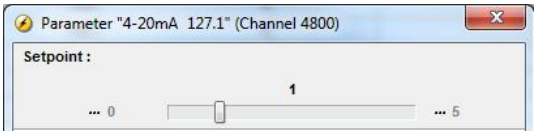


Decimals = 1, AUTO SCALE = disabled

Regarding AUTO SCALE: if the number of decimals is changed without enabling the set point, the 4-20 mA will be presented as 0.4-2.0 mA (0.0-0.5 bar). In other words, the "Auto scaling" bit decides where the decimal point is placed.

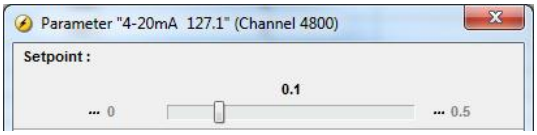
Setting up the measuring range of the sensor:
The measuring range of the multi-input is set up inside the actual alarm:

The three dots to the left of the figures is a button. Scale the input as required, for example 0-5 bar:

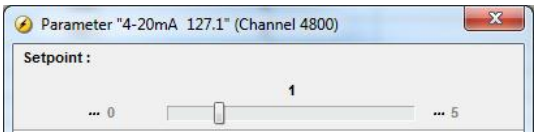


The display will then show 0 at 4 mA.

In order to get the alarm input to work again after changing the "decimal setting", it is necessary to make a readjustment of the alarm:

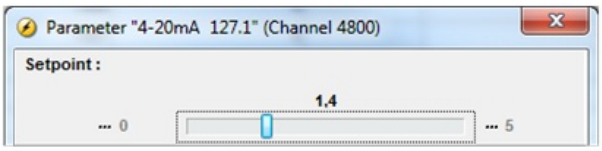


Change it to match the new selection of decimals.



Therefore, when selecting decimals, the selection of AUTO SCALE depends on whether the alarm inputs are already set up. If they are set up, it is a good idea to select AUTO SCALE. If they are not set up, it is voluntary if AUTO SCALE is selected.

Reload parameters
It is necessary to upload the parameters from the device to the computer after changing the scale (no decimal/one decimal/two decimal) settings. This is in order to refresh the parameter list so the alarm settings present the correct value:



In the example shown above, the value can be adjusted with one decimal. If the parameters were not refreshed, it would still only be possible to adjust the set point without decimals.

Save the parameter file
A parameter file (usw file) should always be saved without the AUTO SCALE enabled.

After having set up the 4-20 mA inputs (HW as well as alarms), the parameter file should be uploaded from the device to the PC and then saved. In this way, the AUTO SCALE is then deactivated (automatically cleared by the device), and the settings will not be modified again if the parameters are reloaded to the device.

If the file is saved with the AUTO SCALE enabled, then the minimum and maximum values of the alarm will be affected (multiplied by 10 or 100) at the next use of the parameter file (under certain conditions).

5.7.5 Digital

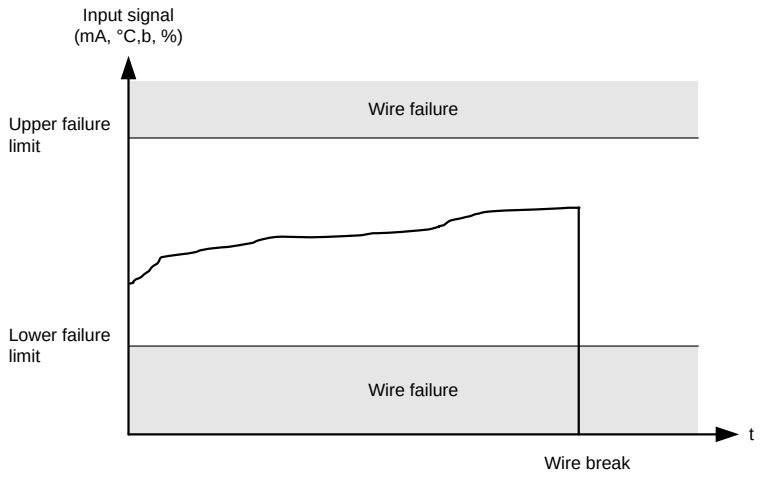
If the multi-inputs are configured to "Digital", they become available as a configurable input.

5.8 Wire fail detection

If it is necessary to supervise the sensors/wires connected to the multi-inputs and analogue inputs, then it is possible to enable the wire break function for each input. If the measured value on the input is outside the normal dynamic area of the input, it will be detected as if the wire has made a short circuit or a break. An alarm with a configurable fail class will be activated.

Input	Wire failure area	Normal range	Wire failure area
4-20 mA	< 3 mA	4-20 mA	> 21 mA
0-40 V DC	≤ 0 V DC	-	N/A
Pt100	< 82.3 ohm	-	> 194.1 ohm
Pt1000	< 823 ohm	-	> 1941 ohm
Level switch	Only active if the switch is open		

Principle
The illustration below shows that when the wire of the input breaks, the measured value will drop to zero. Then the alarm will occur.



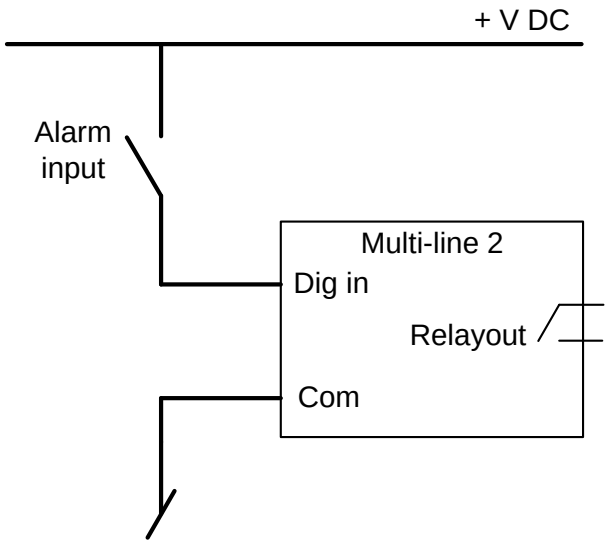
5.9 Input function selection

Digital input alarms can be configured with a possibility to select when the alarms are to be activated. The possible selections of the input function are normally open or normally closed.

The drawing below illustrates a digital input used as an alarm input.

1. Digital input alarm configured to NC, normally closed
   This will initiate an alarm when the signal on the digital input disappears.
2. Digital input alarm configured to NO, normally open
   This will initiate an alarm when the signal on the digital input appears.

The relay output function can be selected to be ND (Normally Deenergised), NE (Normally Energised), Limit or Horn.



5.10 Language selection

The unit has the possibility to display different languages. It is delivered with one master language which is English. This is the default language, and it cannot be changed. In addition to the master language, 11 different languages can be configured. This is done via the PC utility software.

The languages are selected in the system setup **menu 6080**. The language can be changed when connected to the PC utility software. It is not possible to make language configuration from the display, but the already configured languages can be selected.

5.11 Texts in status line

The status texts must be self-explanatory. If the operator does something wrong, then the status line must indicate it. The table below indicates the texts in the status line.

5.11.1 Standard texts

Status text	Condition	Comment
ACCESS LOCK	The configurable input is activated, and the operator tries to activate one of the blocked keys	
VOLT/FREQ OK IN ###s	The voltage and frequency is OK	When the timer runs out it is allowed to operate the load breakers.
PROGRAMMING LANGUAGE	This info is shown if the language file is downloaded from the PC utility software	
PREPARING ETHERNET	Preparing Ethernet connection	
PROGRAMMING M-LOGIC	Downloading M-Logic to the unit	
REDUNDANT CONTROLLER	IF the other redundant controller is active, this message is shown on the redundant unit.	
BROADCASTING APPL. #	Broadcast an application through the CAN line.	Broadcasts one of the four applications from one unit to the rest of the controllers in the power management system.
RECEIVING APPL. #	ALC receiving an application.	
BROADCAST COMPLETED	Successful broadcast of an application.	
RECEIVE COMPLETED	Application received successfully.	
BROADCAST ABORTED	Broadcast terminated.	
RECEIVE ERROR	Application is not received correctly.	

5.12 Internal battery

5.12.1 Memory backup

When changing the internal battery for the memory, all settings will be lost. The memory backup feature gives the possibility to back up the controller settings, and after replacing the battery the settings can be restored.

DEIF recommends that a backup is made at least when the commissioning is tested and done. The following settings will be stored in the backup:

Type	Stored
Identifiers	X
Counters	X
Views configuration	X
Inputs configuration	X
Outputs configuration	X
Translations	
M-Logic configuration	X
AOP-1 configuration	X
AOP-2 configuration	X
Application configuration	X
Parameters	X
Modbus configuration	X
Permissions	X
Logs	

If new firmware is flashed to the controller, the backup will be erased.

The controller will reboot after a backup has been restored.

The backup is found in parameter **9230 Memory backup** with the jump menu. In this parameter, you are able to back up or restore.

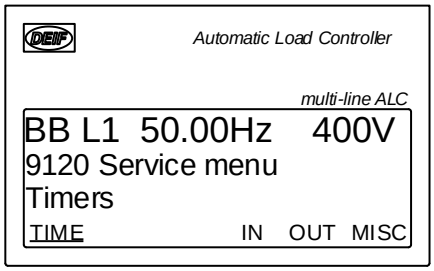
Internal battery alarm
If the internal battery is dismounted during operation, a failure will appear on the display.

5.13 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 **(9120 Service menu).**

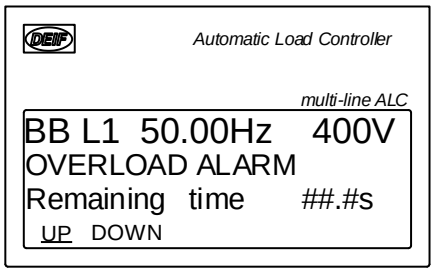
Use the service menu for easy troubleshooting in connection with the event log.

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

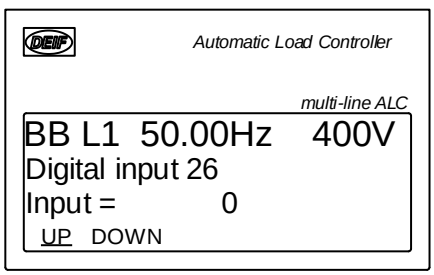


Available selections:

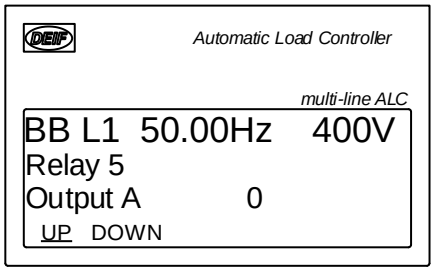
Time
Shows the alarm timer and the remaining time. The indicated remaining time is minimum remaining time. The timer will count downwards when the set point has been exceeded.



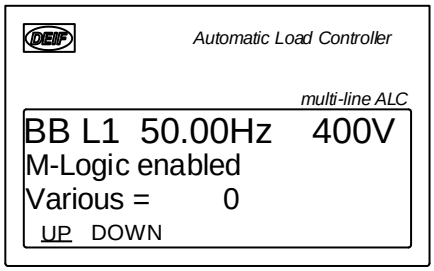
IN (digital input)
Shows the status of the digital inputs.



OUT (digital output)
Shows the status of the digital outputs.



MISC (miscellaneous)
Shows miscellaneous messages.



5.14 Event log

5.14.1 Logs

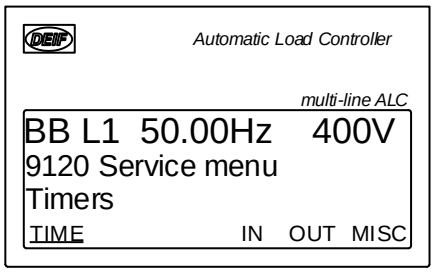
The logging of data is divided in three different groups:

- Event log containing 500 loggings.
- Alarm log containing 500 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 following the "first in - first out" principle.

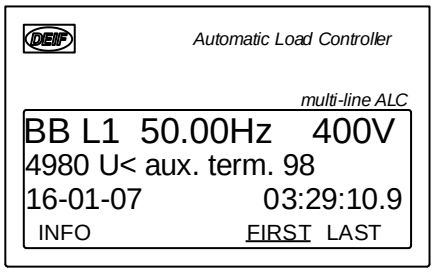
5.14.2 Display

In the display, it looks like this when the "LOG" push-button is pressed:



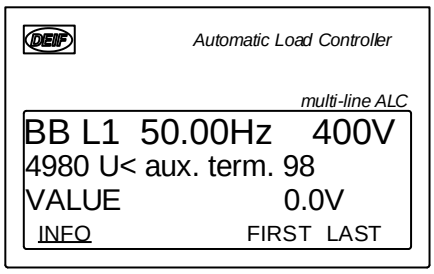
Now it is possible to select one of the three logs.

If the "Alarm" is selected, the log could look like this:



The specific alarm or event is shown in the second line. In the example above, the fuel level alarm has occurred. The third line shows the time stamp.

If the cursor is moved to "INFO", the actual value can be read when pressing "SEL":



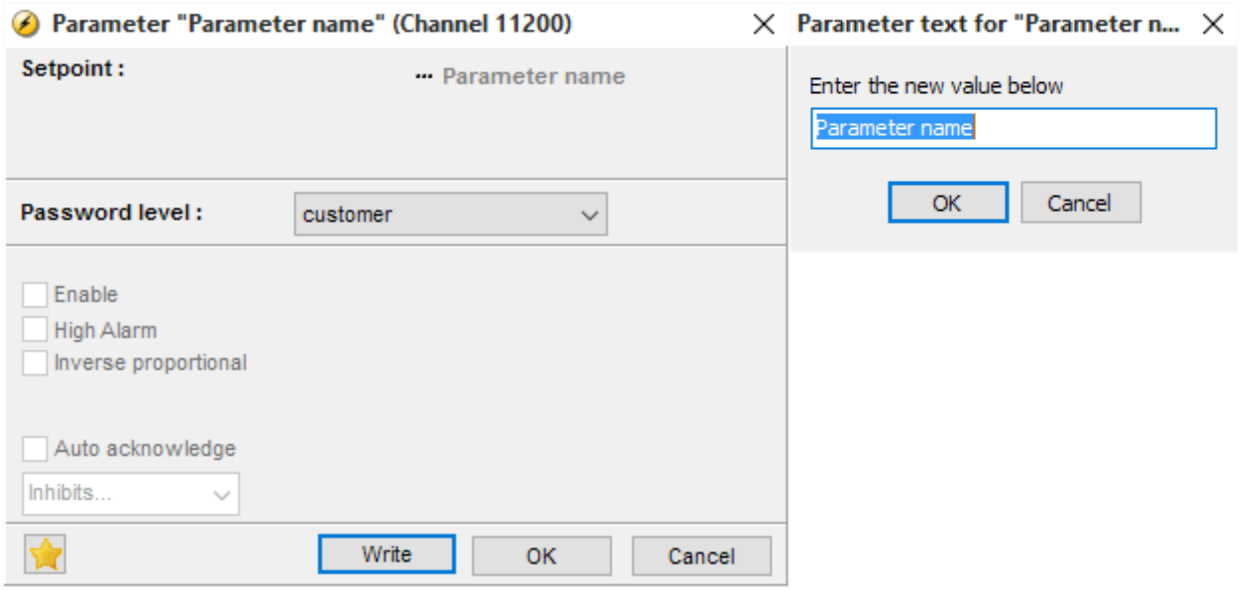
The first alarm in the list will be displayed if the cursor is placed below "FIRST" and "SEL" is pressed.

The last alarm in the list will be displayed if the cursor is placed below "LAST" and "SEL" is pressed.

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

5.15 Parameter ID

This parameter can be used to identify which parameter file is used in the unit.



5.16 M-Logic

The M-Logic functionality is included in the unit and is not an option-dependent function; however, selecting additional options, such as option M12 which offers additional digital inputs and outputs, can increase the functionality.

M-Logic is used to execute different commands at predefined conditions. M-Logic is not a PLC but substitutes one, if only very simple commands are needed.

M-Logic is a simple tool based on logic events. One or more input conditions are defined, and at the activation of those inputs, the defined output will occur. A great variety of inputs can be selected, such as digital inputs, alarm conditions and running conditions. A variety of the outputs can also be selected, such as relay outputs and change of running modes.

The M-Logic is part of the PC utility software, and as such, it can only be configured in the PC utility software and not via the display.

The main purpose of M-Logic is to give the operator/designer more flexible possibilities of operating the controller.

Please refer to the "Help" function in the PC utility software for a full description of this configuration tool.

5.17 USW communication

It is possible to communicate with the unit via the PC utility software. The purpose is to be able to remote-monitor and control the genset application.

It is possible to remote-control the genset from the PC utility software if a modem is used. Take precautions that it is safe to remote operate the genset to avoid personal injury or death.

Serial connection
The serial connection to the GSM modem is via the null-modem cable (option J3).

Because of the RS-232 communication, the GSM function is only available with option H9.2.

Setup
The Modbus protocol type can be changed from RTU to ASCII **(9020 Service port).** This menu can only be reached using the JUMP push-button. When set to 1, the ASCII protocol type is used, and the unit will allow for the slower modem communication.

9020 Service port

No.	Setting		Min. setting	Max. setting	Factory setting
9021	Service port	Set point	0 (normal USW)	1 (modem USW)	0 (normal USW)

If setting 9020 is set to 1, the PC utility software cannot communicate with the unit when it is connected directly to the PC and a modem is not used.

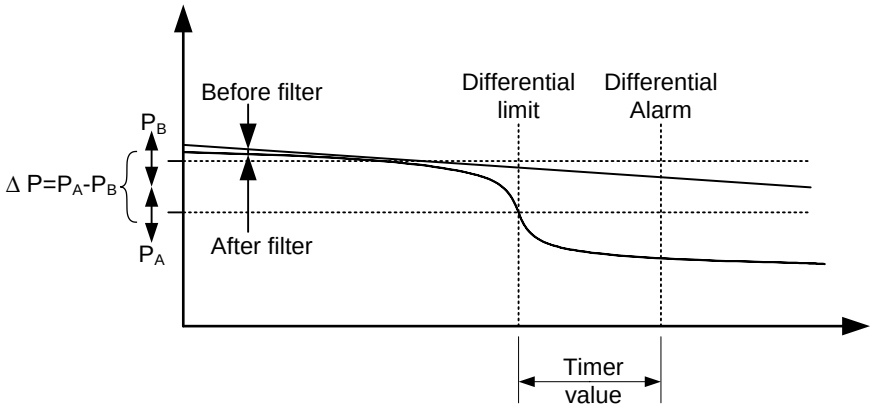
Application settings
Please refer to the PC utility software help file.

Safety
If communication fails, the unit will operate according to the received data. If for example only half of the parameter file has been downloaded when the communication is interrupted, the unit will use this actual data.

5.18 Differential measurement

5.18.1 Differential measurement

With the differential measurement function, it is possible to compare two analogue inputs and trigger on the difference between the two values.
If the differential function is for example air filter check, the timer will be activated if the set point between PA (analogue A) and PB (analogue B) is exceeded. If the differential value drops below the set point value before the timer runs out, the timer will be stopped and reset.



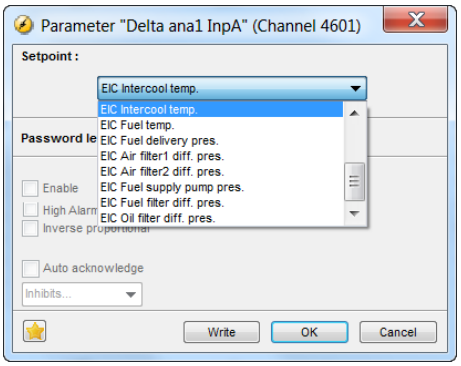
Six different differential measurements between two analogue input values can be configured.

Differential measurements between two sensors can be configured in menus 4600-4606 and 4670-4676. As an example, the figure below shows the two parameters for input selection for differential measurement 1.

Ain	4601	Delta ana1 InpA	1482	4	
Ain	4602	Delta ana1 InpB	1483	4	

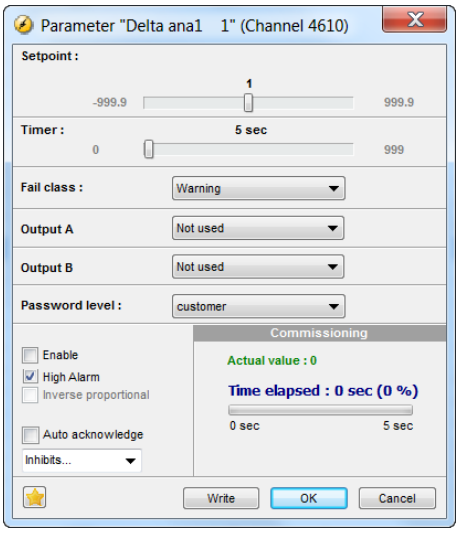
Inputs are selected from the input list as shown below, avaible inputs are:

- Multi-inputs
- EIC measurements
- External inputs (option H8)
- Analogue input
- Multi-inputs



The relevant alarm set point is chosen in parameters 4610-4660 and 4680-4730. Each alarm can be configured in two alarm levels for each differential measurement between analogue input A and input B. The figure below shows the two parameters to configure alarm level 1 and 2, for differential measurement 1.

Ain	4610	Delta ana1	1	1488	1
Ain	4620	Delta ana1	2	1489	1



6. Parameter list

6.1 Related parameters

The Designer’s Reference Handbook relates to the parameters 1000-1980, 2000-2780, 3000-3490, 4120-4990, 5000-5270, 6000-6900, 7000-7120 and 8000-8200.

For further information, please see the separate ALC-4 parameter list, document number 4189341112.