

DESIGNER'S HANDBOOK

ALC-4 Automatic Load Controller



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1. Introduction

1.1 Automatic Load Controller, ALC-4

The Automatic Load Controller is a micro-processor-based controller containing all necessary functions for controlling and prioritising load groups. All values and alarms are presented on the LCD display.

The concept of the ALC is to offer a cost-effective load management solution. As part of the Multi-line 2 product family, the standard functions can be supplemented with a variety of optional functions. Multi-line 2 is a complete range of multi-function generator protection and control products, integrating all the functions you need into one solution.

1.2 About the Designer's handbook

1.2.1 General purpose

This Designer's Handbook includes function descriptions, a presentation of display unit and menu structure, 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 controller and its applications. This document also offers the user the information needed to successfully set up the parameters needed in the specific application.



1.2.2 Software version

This document describes ALC-4 software version 4.13.0.

NOTE The PC utility software parameter files are only partially compatible with software version 4.0.x.

1.2.3 Options

The ALC can be supplemented with flexible options to provide the optimum solution. The options include inputs, outputs, serial communication, additional operator display, and so on.



More information

A complete list of options is included in the data sheet. See www.deif.com/products/alc-4

1.2.4 Parameters



More information

See the ALC-4 Parameter list on https://www.deif.com/products/alc-4#documentation

1.2.5 Glossary

Term	Abbreviation	Explanation
Additional Operator Panel	AOP	
AGC-4	AGC-4	A genset, BTB, or mains controller.
Automatic Load Controller	ALC-4	
Automatic Sustainable Controller	ASC-4	
Busbar	BB	
Bus tie breaker	BTB	
Connect	On	A load group is connected (on) when the load breaker is closed.
Consumer feeder		Another term for load group.
Disconnect	Off	A load group is disconnected (off) when the load breaker is open.
Display unit	DU-2	
Heavy consumer	НС	A special type of load group. Heavy consumers are only connected on request. The ALC-4 ensures that enough power is available before connecting a heavy consumer.
Load breaker	LB	The breaker that connects/disconnects a load group.
Load group	LG	One or more power consumers connected to the busbar by one breaker. The ALC-4 controls the breaker.
Mains load point		The load groups are connected between a mains breaker and tie breaker.
M-Logic		The PLC-type tool accessible from the utility software.
Multiline-2	ML-2	A DEIF platform, which includes the ALC-4.
Nominal power	P nom	
PC utility software	USW	
Priority		The assigned order in which the load groups can connect. Priority 1 is the highest priority (that is, the load group will be connected first). Priority 64 is the lowest priority (that is, the load group will be connected last).
Software	SW	The ALC-4 software.

1.3 Warnings, legal information and safety

1.3.1 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



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.

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

1.3.2 Factory settings

The Multi-line 2 unit is delivered from the factory with default settings. These are not necessarily correct for the engine/generator set. Check all the settings before running the engine/generator set.

1.4 Legal information and disclaimer

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

NOTE 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.

2. Functions

2.1 Single-line diagrams

2.1.1 Application illustration

The Automatic Load Controller (ALC-4) is designed to take part in the control of a power plant together with other controllers, typically in a critical power installation. It works with AGC-4, AGC 150, and/or ASC-4 (Solar and/or Battery) to provide a total solution.

The ALC-4 can control up to 8 consumer feeders (that is, load groups) per controller. The ALC-4 controls the feeder breaker, and receives breaker feedback, as well as analogue signals for consumption (1 per feeder).

Using a priority list, the ALC-4 calculates which load groups can be supplied by the available power in the system.



2.1.2 Application configuration

To include an ALC in the power management system, it has to be added in the application configuration, using the PC utility software. Remember to broadcast the new application to all the controllers.

Connected to the busbar

The load groups and ALC can be connected to the busbar. For this connection, the power management system does not automatically start the first genset. The first genset must be started manually. After that the ALC and the power management system work together to ensure that load groups have enough power.



Connected to a mains load point

If the load groups and ALC are connected to a mains load point, the power management system ensures that the load groups are supplied.

When adding the load controller to an area next to a mains in the PC utility software, an option appears to connect the load controller to a mains load point. If the load controller is between two mains connections, *left* connects the load controller to the load point of the mains connection on the left. *right* connects the load controller to the load point of the mains connection on the right.





2.2 Running mode

2.2.1 AUTO mode

The controller should be operated in AUTO mode. AUTO means that the controller initiates all sequences automatically. The ALC uses the power management information to automatically connect and disconnect load groups. The operator cannot open or close the load group breakers in AUTO mode.

NOTE If a breaker position failure is present and the fail class is *Warning*, the ALC-4 still attempts to open or close the LG breaker.

2.2.2 SEMI-AUTO mode

The controller can be operated in SEMI-AUTO mode. SEMI-AUTO means that the controller does not start any sequences automatically. The controller only starts sequences if external signals are given.

An external signal may come from:

1. A selection on the display

- 2. A digital input
- 3. An M-Logic event
- 4. A Modbus command



More information

The standard controller has a limited number of digital inputs. See the ALC-4 Data sheet for more information.

The following sequences can be activated in SEMI-AUTO mode:

Command	Description
Close LG breaker	The controller closes the load group breaker.
Open LG breaker	The controller opens the load group breaker.

NOTE If a position failure is present and the fail class is *Warning*, the ALC-4 still attempts to open or close the LG breaker.

Using the display to connect or disconnect a load group

In SEMI-AUTO mode, in the Load group view for the load group, press the breaker push-button on the display unit to connect the load. If the load group breaker is closed, pressing the push-button disconnects the load group.

No power management

In SEMI-AUTO mode, the ALC does not request power from the power management system. This applies to both normal load groups and heavy consumers.

Heavy consumers

The ALC ignores heavy consumer requests in SEMI-AUTO mode. However, the operator can manually connect the heavy consumer load group by starting a *Close LG breaker* sequence.

The ALC also ignores the *HC disconnect* input in SEMI-AUTO mode. The operator can manually disconnect the heavy consumer load group by starting an *Open LG breaker* sequence.

2.3 Load group configuration

Many of the parameters for configuring the load groups can be accessed from the display or the PC utility software. The rest of the configuration must be done from the PC utility software.

2.3.1 Load group parameters

Parameters for load group 1

Parameter*	Name	Range	Default	Note
8001	Pnom - LG1	1 to 10,000 kW	400 kW	The nominal power required by the load group. This power, plus the hysteresis, must be available for the ALC to connect the load group. For enabled load groups that are not yet connected, the ALC-4 requests the nominal power from the power management system.
8002	Grp 1 Input	Multi input 102 Multi input 105 Multi input 108 Off	Off	Input for measurement of the load group power consumption. Off: The ALC uses the nominal power.
8003	Disconnect kW	1 to 20,000 kW	100 kW	The busbar section available power limit for disconnecting the load group. Ignored if <i>Disconnect in pct</i> is selected in parameter 8082.
8004	Disconnect LG 1	5 to 200 % 0 to 999 s	100 % 5 s	The busbar section consumed power limit for disconnecting the load group. Ignored if <i>Disconnect in kW</i> is selected in parameter 8082.

Parameter*	Name	Range	Default	Note
				This parameter uses the total consumed power as a percent of the nominal power of the gensets connected to the busbar.
8006	Enable Group 1	Off, On	Off	Off: The ALC cannot connect the load group. The ALC ignores the load group.On: The load group is included in the priority list, and connected if power is available.
8500	LG1 type	Normal LG HC digital HC variable	Normal LG	HC digital/variable: See Heavy consumers.

*Note: For load group 2, use parameters 8011, 8012, 8013, 8014, 8016 and 8510, and so on for load groups 3 to 8.

2.3.2 Load input

An analogue input can be configured for load feedback for each load group. For example, for load group 1, use parameter 8002. This requires an external transducer to measure the power consumption of the load group.

For how to scale the input, see Multi-inputs.

2.3.3 Breaker configuration

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

	×
🖬 🤔 🤔 🖾 🖄	
Relay 5	^
I/O number / function Not used	
Relay 8	
I/O number / function Open load breaker 1	
Relay 11	
I/O number / function Open load breaker 2 ~	
Relay 14	
I/O number / function Open load breaker 3 ~	
Relay 17	
I/O number / function Open load breaker 4 V	
Relay 20	
I/O number / function Not used	
Relay 21	
I/O number / function Not used	
Relay 29	
I/O number / function Close load breaker 1 ~	
Relay 31	~
	Close

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

Ø I/O settings	×
Inputs Outputs	
Open Feedback - Group 1	^
I/O number / function Dig. input 23, Term 23 v	
Close Feedback - Group 1	
I/O number / function Dig. input 43, Term 43 v	
Open Feedback - Group 2	
I/O number / function Dig. input 24, Term 24 v	
Close Feedback - Group 2	
I/O number / function Dig. input 44, Term 44 v	
Open Feedback - Group 3	
I/O number / function Dig. input 25, Term 25 🗸	
Close Feedback - Group 3	
I/O number / function Dig. input 45, Term 45 v	
Open Feedback - Group 4	
I/O number / function Dig. input 51, Term 51 🗸	
Close Feedback - Group 4	
I/O number / function Dig. input 46, Term 46 🗸 🗸	
Open Feedback - Group 5	¥
	Close

For a load group, breaker position failure does not require a breaker trip. Any fail class can be selected for the load group position failure alarm (for example, menu 2130 for load group 1).

The breakers can be configured as: Pulse, Continuous NE or Continuous ND. See the table below on how to configure each type by selecting relays and feedbacks.

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

2.3.4 Load group close on dead busbar

To connect a load group to a dead busbar:

- The controller must be in AUTO mode.
- Allow close LG's on dead busbar in AUTO (parameter 2361) must be enabled.
- The function must be activated for the load group by Modbus or the M-Logic Output Command ALC > Close Loadgroup # on dead busbar AUTO, where # is 1 to 8.

2.4 Load control

2.4.1 Principle

The ALC-4 connects and disconnects the load groups depending on the available power. In AUTO mode, each load group is automatically connected or disconnected based on the configured priority and parameters.

2.4.2 Priorities

The ALC uses priorities to decide which load group to connect or disconnect first. All load groups in the power management system participate in the same priority order.

Priority parameters

Parameter	Name	Range	Default
8091	Priority 1	ALC 1 - LG 1 to ALC 8 - LG 8	ALC 1 - LG 1
8212	Priority 64	ALC 1 - LG 1 to ALC 8 - LG 8	ALC 8 - LG 8

ALC 1 is the ALC with the lowest power management ID. The second lowest ID is ALC 2, and so on.

Priorities in the power management system

The priority list must be set in each controller, and is not shared between the controllers. Use the same priority list in each controller to avoid unexpected performance. Each priority must be set for all load groups in each load controller.

Busbar sections and the priority list

When a bus tie breaker is opened, two busbar sections are created. Each section has its own independent available power, load groups and priority list. The section priority list only includes the load groups in the section. A lower priority load group can be connected in one busbar section even though a higher priority load group is not connected in another busbar section.

Heavy consumers and priorities

The ALC only connects a heavy consumer when there is a heavy consumer request. If a heavy consumer is not active, the ALC can connect lower priority loads if there is enough power. If the heavy consumer sends a request and the power management system cannot supply enough power, the power management system starts additional gensets. If there are no more gensets to start but still not enough power, the ALC starts to disconnect lower priority loads, so that the heavy consumer can connect.

2.4.3 Load control

One ALC-4 can handle up to eight load groups. There can be up to eight ALC-4 controllers in a power management system. That gives 64 load groups that can be prioritised based on how critical they are.

In AUTO mode, the ALC-4s request the power required by the enabled load groups. When the available power on the busbar increases, the ALC-4s start to close the breakers to the load groups starting with the group with the highest priority (Priority 1). If available power decreases, the ALC-4s disconnect the loads, starting with the lowest priority (Priority 64).

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.

Connecting load

All load groups in a section are part of one priority order (even if there are several load controllers). To prevent genset overloading, there is a timer (configurable in parameter 8083) between the connection of each load group. Every time the ALC wants to connect a load group, it checks that the nominal load plus a hysteresis (parameter 8081) will not bring the total load on the busbar above the load group's disconnect limit. 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 starts to disconnect load groups when the disconnect limit is reached. When disconnecting load groups, the ALC uses the priority order. In this way, a group with a higher priority will not disconnect until the lower priorities are disconnected (even if the higher priority 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.

2.4.4 Load control parameters

Parameter	Name	Range	Default	Note
8081	Connect Hysteresis	0 to 100 % of the nominal power connected to the busbar	10 %	Before a load group connects, the load group nominal power plus this hysteresis must be available.
8082	Disconnect set	Disconnect in pct Disconnect in kW	Disconnect in pct	 Disconnect in pct: For example, load group 1 is disconnected based on parameter 8004. Disconnect in kW: For example, load group 1 is disconnected based on parameter 8003.
8083*	Connect timer	0.2 to 100 s	5 s	The minimum time required between connection load groups.
8300	LG swap delay	0.1 to 320 s	10 s	Delay before disconnecting lower priority load groups if a higher priority load group is waiting for power, but the power management system cannot provide the required power. When the timer runs out, the ALC disconnects all lower priority load groups.
8310	Not enough Pow.	0.1 to 3200 s	30 s, Not enabled	The alarm timer starts when a load group is waiting for power, but the power management system cannot provide the required power.

NOTE * The Connect timer settings can be overruled by the M-Logic output **Command - ALC > Overrule connect timer (8083) AUTO**.

2.4.5 Genset start limits and load group disconnect limits

The disconnect limit of the load groups must be higher than the load-dependent start limit for disconnect in percentage. If not, 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.

Similarly, the disconnect limit of the load groups must be lower than the load-dependent start limit for disconnect in kW. Use disconnect limit in kW or percentage depending on the gensets' load-dependent start/stop configuration.



Percentage example

The gensets have a load-dependent start limit of 90 %, while the load groups have a disconnect limit of 95 %.

The ALC can connect a load group so that the load on the busbar exceeds 90 % of the available nominal power. The power management system then starts another genset.



kW example

The gensets have a load-dependent start limit of 200 kW, while the load groups have a disconnect limit of 50 kW.

The ALC can connect a load group so that the available power on the busbar is less than 200 kW. The power management system then starts another genset.

2.4.6 Load control example

Genset configuration (in AGC-4)

Nominal U/f: 400 V/50 Hz Nominal P: 1000 kW

Load control configuration (in ALC-4)

Connect timer (8083): 5 s Connect hysteresis (8081): 5 % Disconnect set (8082): Percentage

Configuration of load groups



- 1. The ALC measures that the Hz/V is OK on the busbar, and the genset is connected.
- 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.

2.5 Heavy consumers

The ALC-4 heavy consumer (HC) function communicates with the power management system. The power management system ensures that enough power is available when the heavy consumers need it. This minimises the disruption to the rest of the system when the heavy consumers connect.

A heavy consumer is created by selecting the heavy consumer load group type. Each ALC-4 can have up to eight heavy consumers.

The heavy consumers function is only active if the ALC-4 is in AUTO mode. Heavy consumers are only connected to the busbar if there is a request.

2.5.1 Heavy consumer request

A heavy consumer request can be a:

- ALC-4 digital input
 - This is selected in Inputs/Outputs.
- Modbus command bit
 - See ALC-4 Option H2, Modbus communication for details.
- M-Logic command
 - · You can configure M-Logic so that an event activates the heavy consumer request.
 - For example, use a CAN Cmd in M-Logic to respond to an input elsewhere in the power management system for the request.

2.5.2 Priority for heavy consumers

When there is a heavy consumer (HC) request, the HC is connected according to its load group priority. An HC will not "jump the queue" over load groups with higher priorities. An HC can however be connected before another HC with a higher priority if the higher priority HC does not have an active HC request.

After acknowledgement and/or the connection timer runs out, an HC digital is included in the automatic priority-based disconnection of the load groups. An HC variable is not automatically disconnected.

2.5.3 Heavy consumer connection

When a heavy consumer connection is requested:

- 1. All higher priority load groups (including higher priority heavy consumer requests) must first be connected.
- 2. The ALC-4 compares the heavy consumer start power plus the hysteresis (parameter 8081), to the available power.
 - If the available power is lower than the heavy consumer start power plus the hysteresis, then the power management system automatically starts more generators.
 - If the power management system cannot supply enough power, it disconnects load groups with a lower priority.
- If the available power exceeds the heavy consumer start power plus the hysteresis, the heavy consumer load group is connected.
- 4. According to the load group type, see HC digital or HC variable.

2.5.4 Inputs and outputs

is the heavy consumer number (1 to 8).

Digital inputs for load groups

Digital input	Туре	Details
Close Feedback - Group #	Continuous	Tells the ALC-4 that the load group breaker is closed.
Open Feedback - Group #	Continuous	Tells the ALC-4 that the load group breaker is open.

Digital inputs for heavy consumers

Digital input	Туре	Details
HC# Activate	Pulse	Commands the ALC-4 to activate the heavy consumer request. Ignored in SEMI-AUTO mode.
HC# Acknowledge	Pulse	Tells the ALC-4 that the heavy consumer has been acknowledged.
HC# Disconnect	Pulse	Commands the ALC-4 to disconnect the heavy consumer. Ignored in SEMI-AUTO mode.

Digital outputs for load groups

Digital output	Туре	Details
Open load breaker #	Pulse	The ALC-4 activates this relay to open the load breaker.
Close load breaker #	Pulse	The ALC-4 activates this relay to close the load breaker.

Analogue input for power

Use parameter 80x2 (Grp # Input) to select the power transducer analogue input. This is required for a variable power heavy consumer.

For both variable and digital heavy consumers, the ALC uses the power measurement to offset the start power requirement. For a digital heavy consumer, this can be useful if the heavy consumer acknowledgement take a long time.



Analogue input example

A heavy consumer has a start power of 600 kW, and a nominal power of 450 kW.

- After the heavy consumer request and before connection, the ALC asks the power management system for an extra 600 kW.
- After connection but before acknowledgement, the analogue input corresponds to a load of 400 kW. The ALC asks the power management system for an extra 200 kW (Start power Actual load).
- **Digital HC**: After acknowledgement, the ALC does not ask the power management system for extra power for the heavy consumer.
- Variable HC: After acknowledgement, the analogue input corresponds to a load of 150 kW. The ALC asks the power management system for an extra 300 kW (Nominal power Actual load).

2.5.5 M-Logic outputs

The following M-Logic is dedicated to heavy consumers. # is the heavy consumer number (1 to 8).

M-Logic outputs for heavy consumers

M-Logic output group	Command	Details
HC command	HC# Activate	Commands the ALC-4 to activate the heavy consumer request.
HC command	HC# Disconnect	Commands the ALC-4 to disconnect the heavy consumer.
HC command	HC# Acknowledge	Tells the ALC-4 that the heavy consumer has been acknowledged.

2.5.6 Heavy consumer parameters

In addition to the load group parameters, there are a number of heavy consumer parameters.

Heavy consumer parameters for load group 1

Parameter	Name	Range	Default	Details
7001	HC1 Start Power	0 to 10 000 kW	500 kW	The heavy consumer function requires this power to be available before the heavy consumer connects.

Parameter	Name	Range	Default	Details
				During the heavy consumer sequence, the ALC keeps requesting this power until the heavy consumer is acknowledged. If there is a power consumption measurement, the ALC reduces the start power request by this amount. The load group nominal power in parameter 8001 must also be configured.
7002	HC1 Acknowledge	Timer only Input only Timer or input	Timer or input	 Timer only: The heavy consumer is automatically acknowledged when the timer (7003) runs out. Input only: The heavy consumer must be acknowledged by an input. Alarm 7010 is recommended. Timer or input: Whichever is first acknowledges the heavy consumer.
7003	Delay	0.1 to 3200 s	30 s	The <i>Timer</i> in parameter 7002.
7010	HC1 Ack. fail	0.1 to 3200 s	30 s	Only active if parameter 7002 is <i>Input only</i> . The timer starts when the start power is available and the heavy consumer has connected.
8500	LG1 type	Normal LG HC digital HC variable	Normal LG	HC digital : A heavy consumer with only an acknowledge signal. HC variable : A heavy consumer with a power consumption measurement.

General heavy consumer parameter

Parameter	Name	Range	Default	Details
7400	HC StartP <nomp< td=""><td>0.1 to 3200 s</td><td>30 s, Enabled</td><td>Alarm activates if any HC start power is lower than its nominal power, to highlight configuration errors.</td></nomp<>	0.1 to 3200 s	30 s, Enabled	Alarm activates if any HC start power is lower than its nominal power, to highlight configuration errors.

2.5.7 HC digital

The load group type can be HC digital. This type of heavy consumer does not require power consumption measurement.

If the ALC is in AUTO mode, activating the heavy consumer request activates the HC connection sequence.

HC digital sequence

- 1. An external signal activates the heavy consumer request (HC# Activate). The ALC requests the heavy consumer's start power plus the hysteresis (parameter 8081).
- 2. If possible, the power management system makes the required power available. When the power is available, the ALC activates the *Close load breaker* # relay.
- 3. An external signal sends the heavy consumer acknowledgement (HC# Acknowledge). Alternatively, the configured acknowledgement timer runs out.
- 4. The ALC stops requesting power for the heavy consumer.
- 5. ...
- 6. When the heavy consumer is no longer needed, an external signal activates a disconnection request.
- 7. The ALC activates the Open load breaker # relay, and the heavy consumer is disconnected.

	1	2	3	4	5	6	7
Power requested	Start p	ower plus hys	teresis	0	0	0	0
HC Activate	Pulse	-	-	-	-	-	-
Load breaker							

	1	2	3	4	5	6	7
HC Acknowledgement	-	-	Pulse	-	-	-	-
HC Disconnect	-	-	-	-	-	Pulse	-

2.5.8 HC variable

The load group type can be HC variable. Power consumption measurement is useful for this type of heavy consumer.

Power consumption measurement

The analogue power feedback for the heavy consumer is intended for a power transducer with a 4 to 20 mA output corresponding to 0 to 100 % load. If the heavy consumer is of 400 kW, then the power transducer has to be calibrated to 0 to 400 kW = 4 to 20 mA, and the setting has to be set for 400 kW.

If there is no power consumption measurement, the ALC simply requests the start power/nominal power.

HC variable sequence

- 1. An external signal activates the heavy consumer request (HC# Activate). The ALC requests the heavy consumer's start power plus the hysteresis (parameter 8081), minus the power consumption measurement.
- 2. If possible, the power management system makes the required power available. When the power is available, the ALC activates the *Close load breaker* # relay.
- 3. An external signal sends the heavy consumer acknowledgement (HC# Acknowledge). Alternatively, the configured acknowledgement timer runs out.
- 4. The ALC requests the nominal power minus the power consumption measurement. This prevents an overload or blackout if the heavy consumer suddenly requires 100 % of its nominal power.
- 5. ...
- 6. When the heavy consumer is no longer needed, an external signal activates a disconnection request.
- 7. The ALC activates the Open load breaker # relay, and the heavy consumer is disconnected.

	1	2	3	4	5	6	7
Power requested	Start minus powe	power plus hyst r consumption n	eresis neasurement	minus power	0		
HC Activate	Pulse	-	-	-	-	-	-
Load breaker							
HC Acknowledgement	-	-	Pulse	-	-	-	-
HC Disconnect	-	-	-	-	-	Pulse	-

2.5.9 Conditional connection

When a heavy consumer is requested, the power management system reserves the required power. The heavy consumer function prevents the connection of the heavy consumer, until enough power is available.

Example of heavy consumer connection



- 1. Request HC.
- 2. Connect DG2.
- 3. Connect and acknowledge HC.
- 4. Disconnect HC.
- 5. Disconnect DG2.

2.5.10 Load groups and heavy consumers

The ALC only connects a heavy consumer when there is a heavy consumer request. If a heavy consumer is not active, the ALC can connect lower priority loads if there is enough power. If the heavy consumer sends a request and the power management system cannot supply enough power, the ALC starts to disconnect lower priority loads.

Load groups and heavy consumers example

An ALC has the following load groups (in priority order): HC1 variable: Start power 1100 kW, Nominal power 400 kW, Disconnect kW 100 kW Normal LG2: 300 kW, Disconnect kW 100 kW Normal LG3: 300 kW, Disconnect kW 100 kW HC4 digital: Start power 500 kW, Nominal power 200 kW, Disconnect kW 100 kW Normal LG5: 300 kW, Disconnect kW 100 kW Normal LG6: 200 kW, Disconnect kW 100 kW

The application has one 1500 kW genset. The hysteresis (8081) is 10 %. The connect timer (8083) is 5 s. The disconnect (8082) is in kW. The LG swap delay (8300) is 10 s. The ALC is in AUTO mode.

1. The operator starts the genset. 1500 kW is available.

- 2. The ALC connects LG2. Five seconds later the ALC connects LG3. Five seconds later the ALC connects LG5. Five seconds later the ALC connects LG6.
- If the consumed power is 1100 kW, then the available power is 400 kW. There are no more gensets to start. ALC cannot connect LG7, since 550 kW (300 kW nominal power + 150 kW hysteresis +100 kW for the disconnect limit) is required.
- 4. HC4 sends a request. 750 kW (500 kW start power + 150 kW hysteresis +100 kW for the disconnect limit) is required. There is not enough power available, so the LG swap delay timer starts. After 10 s the ALC disconnects LG5 and LG6.
- 5. The available power is now 900 kW. The ALC connects HC4. HC4 sends an acknowledgement and its power consumption drops to 200 kW.
- 6. The available power is now 700 kW. The ALC connects LG5. The available power is now 400 kW. The ALC cannot connect LG6, since 450 kW (200 kW nominal power + 150 kW hysteresis +100 kW for the disconnect limit) is required.
- 7. HC1 sends a request. There is not enough power available, so the LG swap delay timer starts. After 10 s the ALC disconnects LG2, LG3, HC4 and LG5.
- 8. The available power is now 1500 kW. The ALC connects HC1. HC1 sends an acknowledgement and its power consumption drops to 400 kW.
- The available power is now 1100 kW. The ALC connects LG2. Five seconds later the ALC connects LG3. The available power is now 500 kW. The ALC cannot connect LG5, since 550 kW (300 kW nominal power + 150 kW hysteresis +100 kW for the disconnect limit) is required.
- 10. There are no more gensets to start. ALC cannot connect HC4, LG5, LG6 or LG7 while HC1 is connected.

	1	2	3	4	5	6	7	8	9	10
Event	Genset started	ALC	-	HC4 request	ALC	ALC	HC1 request	ALC	ALC	-
Available power (kW)	1500	->	400	->	->	400	->	->	->	500
HC1										
LG2										
LG3										
HC4										
LG5										
LG6										
LG7										

NOTE The load groups do not necessarily consume their nominal power. The power management system calculates the available power based on the actual power consumption.

2.6 Nominal settings

2.6.1 AC measurements

The ALC is designed to measure the three-phase busbar voltage. The ALC uses this measurement to calculate the frequency. The measured voltage must be 100 to 690 V AC. Use voltage transformers if the busbar voltage is outside this range. For the AC wiring diagrams, see the **Installation Instructions**.

2.6.2 Scaling

The default voltage scaling is 100 V to 25000 V. For applications below 100 V, adjust the input range to match the primary of the voltage measurement transformer. Master password level access is required to change this parameter.

Parameter	Name	Range	Default
9030	Scaling	10V-2500V 100V-25000V	100V-25000V

Changing the voltage scaling changes the range for the nominal settings. Correct all nominal values and the primary VT settings after changing the scaling (parameter 9030).

2.6.3 Configuring the nominal settings

Configure the nominal settings using the following parameters.

Nominal parameters set 1

Setting	Name	Range	Default	Description
6051	BB primary U 1	100 to 25000V*	400 V*	Nominal primary voltage of the BB voltage transformer (if installed)
6052	BB second. U 1	100 to 25000V*	400 V*	Nominal secondary voltage of the BB voltage transformer (if installed)
6053	BB Nominal U 1	100 to 25000V*	400 V*	Phase-phase voltage of the busbar
6054	Nom. f 1	48 to 62 Hz	50 Hz	Nominal frequency

*Note: The scaling (parameter 9030) affects the voltage range and the default voltage.

Nominal parameters set 2

For set 2, use parameters 6061, 6062, 6063 and 6064.

2.6.4 Selecting a set of nominal settings

The ALC can change the set of nominal settings. To select a set of nominal settings, you can use:

- 1. Parameter 6055
- 2. A digital input (DI)
- 3. A button on an Additional Operator Panel (AOP)
- 4. Any M-Logic event

1. Bus nom. set (parameter 6055)

In parameter 6055, select Nominal setting 1 (default) or Nominal setting 2.

2. Digital input (DI)

Use M-Logic when a digital input selects a set of nominal settings. Select the digital input from the input events, and select the set of nominal settings in the outputs.

Digital input 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	



More information

See Help in the PC utility software for more information.

3. Additional Operator Panel (AOP)

Use M-Logic when the AOP selects a set of nominal settings. Select the AOP push-button from the input events, and select the set of nominal settings in the outputs.

AOP 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



More information

See Help in the PC utility software for more information.

2.7 Wiring



More information

See the **ALC-4 Data sheet** on https://www.deif.com/products/alc-4#documentation for information about possible configurations for the ALC.



More information

See the **ALC-4 Installation instructions** on https://www.deif.com/products/alc-4#documentation for detailed information about all the inputs and outputs.

3. Display unit and menu structure

3.1 Presentation

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

3.2 Display unit (DU-2)

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

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

3.2.1 Push-button functions

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



- 1. Shifts the first line displaying in the setup menus. Push for 2 seconds to switch to master display in case more than one display is connected.
- 2. Moves the cursor left for manoeuvring in the menus.
- 3. Increases 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 values.
- 4. Selects the underscored entry in the fourth line of the display.
- 5. Moves the cursor right for manoeuvring in the menus.
- 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 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 and Alarm 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.

3.2.2 LED functions

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



- 1. LED indicates that the auxiliary supply is switched on.
- 2. LED indicates that the unit is OK.
- 3. See Alarm inhibit.
- 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.

3.3 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. 20 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 controller, and if the user needs detailed information that is not available in the view menu system. Changing of parameter settings is password-protected.

3.3.1 Entry window

When the controller is powered up, an entry window appears.

NOTE The event and alarm list appears at power up if an alarm is present.

ŒF	Automatic Load Controller				
ALC BB L1 BB L1	multi-line ALC V 4.00.0 50.00Hz 400V 50.00Hz 400V				
SETUP	<u>V3</u> V2 LG				

3.3.2 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 \langle



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).

3.3.3 Setup menu

The setup menu system is used for parameter setup of the controller, 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. The menu is entered from the entry window by selecting SETUP in the fourth display line.

Setup menu



1. First display line

(Daily use)

The first line is used to display busbar 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 shows how a specific setting is changed. To access Load group 1 (menu 8000), select $SETUP \rightarrow SYST \rightarrow PM$.



3.3.4 Load group view

For the load group view, use the left or right push-buttons to select LG.



- 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 uses the push-buttons.

3.4 Texts in status line

3.4.1 Standard texts

Status text	Condition	Comment
ACCESS LOCK	The configurable input is activated, and the operator tries to activate one of the blocked keys.	
BROADCAST ABORTED	Broadcast terminated.	
BROADCAST COMPLETED	Successful broadcast of an application.	
BROADCASTING APPL. #	Broadcast an application through the CAN line.	Broadcasts one of the four applications from one controller to the rest of the controllers in the power management system.
HC# FINISHED	The heavy consumer sequence is complete, and the heavy consumer has disconnected.	
HC# REQ. NOM POWER	The variable heavy consumer is requesting its nominal power.	
HC# REQ. START POWER	There is a heavy consumer requesting its start power, but no acknowledgement yet.	
HC# WAITING FOR POW.	There is a heavy consumer request, but there is not enough power to connect. The power management system is trying first to connect more gensets. If that does not provide enough power, the ALC disconnects lower priority loads.	
HC# WAITING FOR TURN	There is a heavy consumer request, but there are higher priority loads to connect first.	
LG BLOCKED	The load group cannot be connected because it is blocked.	
NOT IN AUTO	The controller is not in AUTO mode.	
PREPARING ETHERNET	Preparing Ethernet connection.	
PROGRAMMING LANGUAGE	This info is shown if the language file is downloaded from the PC utility software.	
PROGRAMMING M-LOGIC	Downloading M-Logic to the controller.	
RECEIVE COMPLETED	Application received successfully.	
RECEIVE ERROR	Application is not received correctly.	
RECEIVING APPL. #	ALC receiving an application.	
REDUNDANT CONTROLLER	IF the other redundant controller is active, this message is shown on the redundant controller.	
VOLT/FREQ OK IN ###s	The voltage and frequency is OK.	When the timer runs out it is allowed to operate the load breakers.

3.5 Password

The controller has three password levels. All levels can be adjusted in the PC utility software.

Password levels

Parameter	Password level	Factory setting	Access		
			Customer	Service	Master
9116	Customer	2000	х		
9117	Service	2001	х	Х	
9118		2002	х	Х	Х

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

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

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

Protecting parameters

Each parameter can be protected by a specific password level. To do so, use the PC utility software. Enter the parameter to be configured and select the password level.

Parameter "4-20mA 102.1" (Channel 4120) ×						
Set point :						
	10					
4		20				
Timer:	120 sec					
0		999				
Fail class :	Warning \checkmark					
Output A	Not used \sim					
Output B	Not used \sim					
Password level :	customer \checkmark					
_	customer service	ing				
Enable	master					
High Alarm	Actual timer value					
Auto acknowledge	0 sec	120 sec				
Inhibits V						
🔶 -	Write VIC	Cancel				

The password level can also be changed from the parameter view. Select the parameter row, then right click the heading in the column *Level*:

Enabled	HighA	arm Level	Mark as favorito	``	38
					Warning
			Clear favorite		Warning
		customer	Change access level	>	Warning
		service	customer		Warning
		master	customer		Warning
			customer		Warning

3.5.1 Parameter access

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

Ø -	💕 🔳 🚑	2
M	aster level	
Si	ervice level	
CI	ustomer level	

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

4. Additional functions

4.1 Alarm inhibit

To select when the alarms are active, there is a configurable inhibit setting for each alarm. The inhibits are only available from the PC utility software. For each alarm, there is a drop-down window where it is possible to select which signals have to be present to inhibit the alarm.



Selections for alarm inhibit:

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

Function	Description
BB voltage < 30 %	Busbar voltage is below 30 % of nominal
Redundant controller	The controller is redundant

The alarm is inhibited as long as one of the selected inhibits is active.

☐ Inhibit 1 ☐ Inhibit 2 ☐ Inhibit 3 ☑ Any LG On ☐ All LG Off ☐ BB voltage > 30 % ☑ BB voltage < 30 % ☐ Redundant controller	
All None	OK Cancel

In this example, the inhibits are *BB voltage < 30 %* and *Any LG On*. The alarm can be activated when all LGs are disconnected and the busbar voltage is above 30 %.

NOTE The inhibit LED on the unit and on the display activates when one of the inhibit functions is active.

4.2 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

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

4.3 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.

4.4 Fail class

All enabled alarms must have a fail class. The fail class defines the category of the alarm and the subsequent alarm action.

The ALC-4 has the following fail classes:

- Warning
- Trip Group [1-8] *
- Trip Group All
- Block Group [1-8] *

Block Group All

NOTE * There is a fail class for each load group. For example, Trip group 5.

Block fail class

The block fail class stops an open breaker from closing while the alarm is active.

If the breaker is closed and the block fail class is activated, the breaker can remain closed.

4.4.1 Fail class configuration

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

To change the fail class using the PC utility software, select the alarm to be configured. Select the fail class from the list.

🧭 Parameter "Dig. input 26" (Channel 3030)				
Timer : 0	10 sec	100		
Fail class :	Warning 💉	/		
Output A	Trip Group 2 / Trip Group 3 Trip Group 4	`		
Output B	Trip Group 5 Trip Group 6			
Password level :	Trip Group 8 Trip Group 8	/		
☐ Enable ☑ High Alarm ☐ Inverse proportional	Commissio Actual value : 0 Actual timer value	e		
Auto acknowledge	0 sec	10 sec		
*	<u>W</u> rite <u>O</u> K	<u>C</u> ancel		

4.5 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".

🥝 Parameter "G	U> 1" (Channel 1 ×		
Setpoint :			
100	103 %		
Timer : 0,1	10 sec 100		
Fail class :	Warning V		
Output A	Terminal 5 V		
Output B	Terminal 5 🗸		
Password level :	customer V		
Enable High Alarm Inverse proportional Auto acknowledge Inhibits	Commissioning Actual value : 0 % Actual timer value 0 sec 10 sec		
	Write OK Cancel		

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.

🥝 Parameter "Relay 05" (Channel 5000) 💌					
Setpoint :					
Limit relay V					
Timer : 0	10 sec 999,9				
Password level :	customer 🗸				
	Commissioning				
Enable	Actual value : 0				
Inverse proportional	Actual timer value				
Auto acknowledge	0 sec 10 sec				
Inhibits V					
	Write OK Cancel				

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..

4.6 Multi-inputs

The ALC 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

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

4.6.1 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.

4.6.2 0-40 V DC

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

4.6.3 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.

4.6.4 Scaling of 4-20 mA inputs

Analogue inputs are scaled to ensure that the input readouts have a resolution that matches the connected sensor. Follow the steps below when changing the scaling of the analogue inputs.

- 1. Set up the multi-input for 4-20 mA. This is done in menus 10980-11000 for multi-input 102-108, and in menus 11120-11190 for option M15 or M16.
- 2. The scaling parameters are now available in menus 11010-11110.
- 3. When setting up the inputs, select the decimals and *Enable* in *4-20 mA inp scale 102* parameter 11010 (or 11020, 11030, and so on) to activate **auto scale**. The reading remains the same, but decimal places are added.
- 4. Deactivating auto scale makes the reading smaller by a factor of 10 for each decimal.
- 5. Then the alarm parameters for the multi-inputs can be configured.
- 6. A parameter file (usw file) should always be saved without auto scale enabled.

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

None Prot Sync Reg Di	ig 🔲 Ain 📋 Out 📕 Ge	n 🔲 Mains 🚺 Comm 📋 Pm	Jump USW VDO	102 VDO 105 0 VDO
Orag a column header here to group by that c				
Category	Channel A	Text	Address	Value
Ain	4000	4-20mA 91.1	256	10
Ain	4010	4-20mA 91.2	257	10
Ain	4020	W. fail ana 91	264	N/A.
Ain	4030	4-20mA 93.1	258	10
Ain	4040	4-20mA 93.2	259	10
Ain	4050	W. fallana 93	265	N/A.
Ain	4060	4-20mA 95.1	260	10
Ain	4070	4-20mA 95.2	261	10
Ain	4080	W, fail ana 95	266	N/A.
Ain	4090	4-20mA 97.1	262	10
Ain	4100	4-20mA 97.2	263	10
Ain	4110	W. fail ana 97	267	N/A.

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 settings.

Analog 127				4mA
Analog	129			4mA
Analog	131			4mA
SETUP	<u>V3</u>	V2	V1	P01

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

Setting up decimals: One decimal

0-5 bar oil pressure transducer (4-20 mA) Decimals = 1 Auto scale = Enable

Parameter "4-20mA inp scale 127" (Channel 11080)	_]	
Setpoint :		
One decimal 👻	Analog 127	4.0mA
Password level : customer	Analog 129	4mA
	Analog 131	4mA
V Enable	SETUP <u>V3</u> V2	V1 P01

Decimals = 1, Auto scale = enabled

Analog		0	.4mA	
Analog 129				4mA
Analog	131			4mA
SETUP	<u>V3</u>	V2	V1	P01

Decimals = 1, Auto scale = disabled

NOTE Regarding auto scale: If the number of decimals is changed without enabling the set point, then 4-20 mA is presented as 0.4-2.0 mA (0.0-0.5 bar). In other words, auto scaling 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:

9 Parameter "4-20m	A 127.1" (Channel 4800)	
Setpoint :		
	10	
4	0	20

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

Parameter "4-20mA 127.1" (Chann	el 4800)
Setpoint :	
	1
0	5

The display then shows 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:

Parameter "4-20mA 127.1" (Channel 4800)		
Setpoint :		
	0.1	
0	<u> </u>	0.5

Change it to match the new selection of decimals.

Parameter "4-20mA 127.1" (Char	nnel 4800)	L_X
Setpoint :		
	1	
0		5

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:

Ø Parameter "4-	20mA 127.1" (Channel 4800)	×
Setpoint :		
	1,4	
0		5

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 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, auto scale is 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 auto scale enabled, then the minimum and maximum values of the alarm can be affected (multiplied by 10 or 100) at the next use of the parameter file (under certain conditions).

4.6.5 Digital

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

4.7 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.





4.8 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 De-energised), NE (Normally Energised), Limit or Horn.



4.9 Language selection

The controller can 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 using 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.

4.10 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:

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

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



DANGER!

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.

4.11 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.

DEIF	Automatic Load Controller	
BB L1 9120 Se	50.00Hz ervice menu	400V
TIME	IN	OUT MISC

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.

ŒF	Automatic Load Controller
BBL1 & OVERLO Remainin	multi-line ALC 50.00Hz 400V AD ALARM g time ##.#s

IN (digital input)

Shows the status of the digital inputs.

DEIF	Automatic Load Controller	
		multi-line ALC
BB L1	50.00Hz	400V
Digital i	nput 26	
Input =	0	
UP DO	WN	

OUT (digital output)

Shows the status of the digital outputs.

DEIF	Automatic L	oad Controller
BB L1 Relay 5 Output A	50.00Hz	400V

MISC (miscellaneous)

Shows miscellaneous messages.

Ø	Automatic L	oad Controller
BB L1 M-Logic Various	50.00Hz enabled = 0	Multi-line ALC
	/VN]

4.12 Event log

4.12.1 Logs

The logging of data is divided into:

- Event log containing 500 entries.
- Alarm log containing 500 entries.

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.

4.12.2 Display

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

Ø	Automatic Load Controller		
BB L1 9120 Se Timers	50.00Hz ervice menu	multi-line ALC 400V	
TIME	IN	OUT MISC	

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

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

Øef	Automatic Load Controller	
	multi-line ALC	
BB L1	50.00Hz 400V	
4980 U<	< aux. term. 98	
16-01-0	7 03:29:10.9	
INFO	<u>FIRST</u> LAST	

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":

ØEF	Automatic Lo	Automatic Load Controller		
		multi-line ALC		
BB L1	50.00Hz	400V		
4980 U<	aux. term. 🧐	98		
VALUE	(0.0V		
INEO	FIRS	ST LAST		

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.

4.13 Parameter ID

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

Parameter "Parameter "Parameter"	ter name" (Channel 11200)	×	
Setpoint.	··· Parameter name		
			Paramete
Password level :	customer \checkmark		- aramete
Enable			Enter the Paramete
High Alarm Inverse proportional			
Auto acknowledge			
Inhibits 🗸			
*	Write OK (Cancel	

Parameter text for "Parameter n... × Enter the new value below Parameter name OK Cancel

4.14 M-Logic

The M-Logic functionality is included in the controller 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.

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

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

NOTE See the **Help** in the PC utility software for a full description of this configuration tool.

4.15 USW communication

It is possible to communicate with the controller using the PC utility software.

Serial connection

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

NOTE 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 controller 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 controller when it is connected directly to the PC and a modem is not used.

Application settings

See the PC utility software help file.

Safety

If communication fails, the controller 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 controller will use this actual data.

4.16 Differential measurement

With the differential measurement function, it is possible to compare two multi inputs and trigger on the difference between the two values. Six different differential measurements between two analogue input values can be configured.

Differential measurements between two sensors can be configured in menus 4601-4606 and 4671-4676.

The 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.