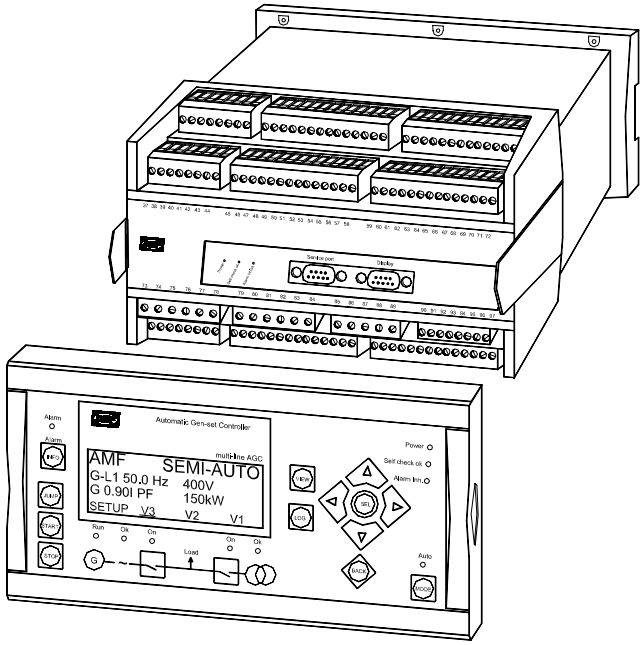
DEIF A/S

Description of options

Option G3,
Load sharing
Automatic Gen-set Controller

4189340389B
SW version 2.3X.X



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1. Warnings and legal information

Legal information and responsibility

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

The units are not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Electrostatic discharge awareness

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

Safety issues

Installing the unit implies 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.

Definitions

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

Notes

The notes provide general information which will be helpful for the reader to bear in mind.

Warning

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

2. Description of option

G3 option

Option G3 is a hardware option, and therefore a separate PCB is installed in slot #3 in addition to the standard installed hardware.

Option G3 covers the following ANSI code:

Function	ANSI no.
Load sharing between gen-sets	90

If option M12 is already installed in the unit, then option G3 is a software upgrade.

Terminal description

Term.	Function	Technical data	Description	Comment
37	-5…0…5V DC	Analogue I/O	Active load sharing line	Requires option G3
38	Com.	Common	Common	
39	-5…0…5V DC	Analogue I/O	Reactive load sharing	Requires option D1/G3
40	-10…0…10V DC	Analogue I/O	f/P set point	Requires option G3
41	Com.	Common	Common	
42	-10…0…10V DC	Analogue I/O	U/Q set point	Requires option D1/G3
43	Not used		**Used for the option M12**	
44	Not used			
45	Not used			
46	Not used			
47	Not used			
48	Not used			
49	Not used			
50	Not used			
51	Not used			
52	Not used			
53	Not used			
54	Not used			
55	Not used			
56	Not used			
57	Not used			
58	Not used			
59	Not used			
60	Not used			
61	Not used			
62	Not used			
63	Not used			
64	Not used			

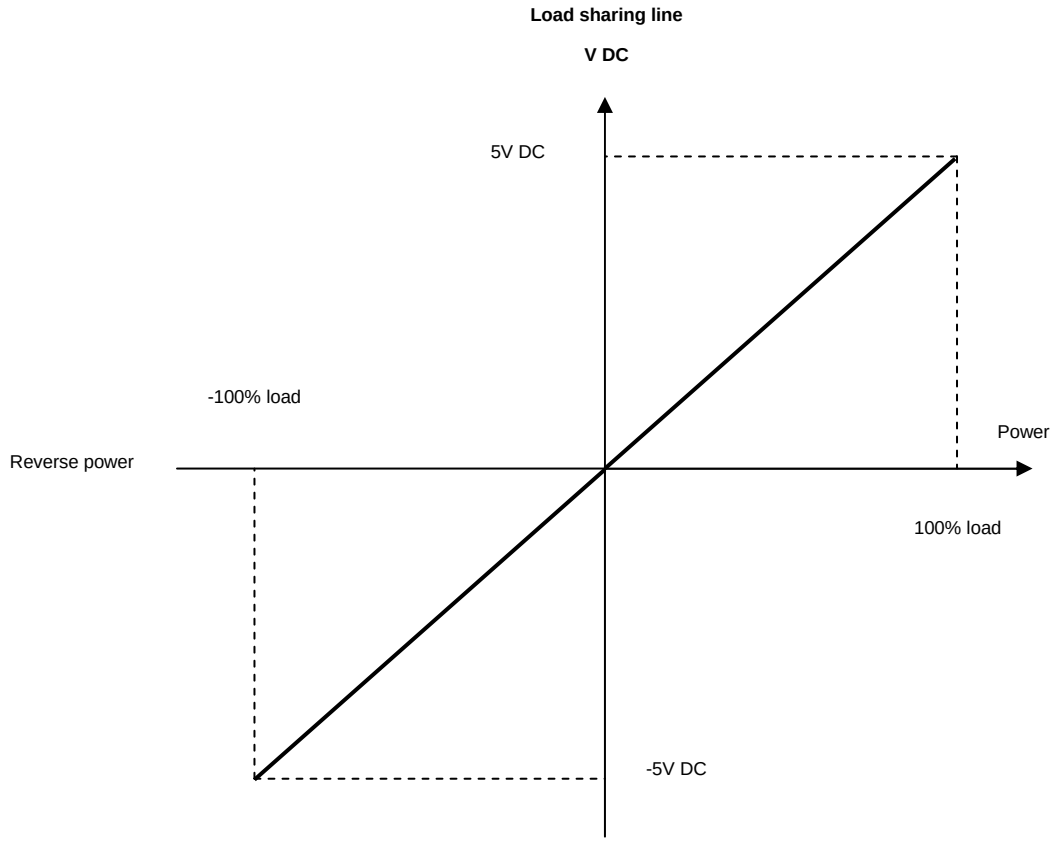
3. Functional description

Load sharing

Option G3 is an option that enables the unit to share the active load (and reactive load (option D1)) equally in percentage of the nominal power. The load sharing is active, when the gen-set is running in island mode and the generator breaker is closed.

A voltage signal equal to the load produced by the gen-set is sent to the load sharing line. When the generator load is 0%, 0V DC is sent to the load share line. When the load is 100%, the voltage will be 5V DC.

This is illustrated in the drawing below.



The active load sharing line is illustrated above, and the characteristics of the reactive load sharing line are equivalent to it.

Working principle

The controller unit will supply a voltage on the load sharing line equal to the actual load. This voltage comes from an internal power transducer. At the same time the actual voltage on the load sharing line will be measured.

> *If the measured voltage is higher than the voltage from the internal power transducer, then the unit will increase its load in order to match the voltage on the load sharing line.*
> *If the measured voltage is lower than the voltage from the internal power transducer, then the unit will decrease its load in order to match the voltage on the load sharing line.*

The voltage on the load sharing line will only be different from the voltage from the internal power transducer, if two or more controller units are connected to the load share line.

When the option G3 is activated in an AGC, the load share line will be active at all times no matter if one generator is running in a single application, or a number of generators are actually sharing the load. In case a generator is running alone it is recommended to disable the load share line and this way keep the frequency regulator active.

To disable the load share line use the M-logic category Output/Inhibits in the PC utility software.

To improve the handling of several generators in the same application, the option G3 is working as backup system for the power management option G5. This means that if both option G3 and option G5 are available in the same AGC unit, the load sharing will be done by the CAN communication as the primary choice, but if a CAN error is made, the load sharing will continue on the analogue load sharing line. The generators will stay stable even though the power management is lost.

Please refer to the description of option G5 for further information about the power management.

Example 1:

Two generators are running in parallel. The loads of the generators are:

Generator	Actual load	Voltage on load sharing line
Generator 1	100%	5V DC
Generator 2	0%	0V DC

The voltage level on the load sharing line can be calculated to:

U_{LS}: (5 + 0) / 2 = 2.5V DC

Now generator 1 will decrease the load in order to match the voltage on the load sharing line (in this example 2.5V DC). Generator 2 will increase the load in order to match the 2.5V DC.

The new load share situation will be:

Generator	Actual load	Voltage on load sharing line
Generator 1	50%	2.5V DC
Generator 2	50%	2.5V DC

Example 2:

In case of generators of different size, the load sharing will still be carried out on the basis of a percentage of the nominal power.

Two generators supply the busbar. The total load is 550 kW.

Generator	Nominal power	Actual load	Voltage on load sharing line
Generator 1	1000 kW	500 kW	2.5V DC
Generator 2	100 kW	50 kW	2.5V DC

Both generators are supplying 50% of their nominal power.

External analogue set points

The gen-set can be controlled from internal as well as from external set points. The external set points are activated with a digital signal.

The inputs are only available, if option G3 is selected.

Five inputs can be selected, and their function depends on the mains breaker position.

Input	Frequency	Power	Voltage	Reactive power	Power factor
Island mode, stand-alone	X		X		
Island mode, load sharing	X		X		
Parallel to the mains		X		X	X

The controller set points will be ignored, if the running condition is not present. It is for instance not possible to use the frequency controller when paralleling to the mains.

The table below shows the possible set points.

Controller	Input voltage	Description	Comment
Frequency	+/-10V DC	f_{NOM} +/-5Hz	Active when MB is OFF
Power	+/-10V DC	+/-100% *P_{NOM}	
Voltage	+/-10V DC	U_{NOM} +/-10%	Active when GB is OFF
Reactive power	+/-10V DC	+/-100% *Q_{NOM}	
Power factor	0…10V DC	0.6…1.0	

The external set points can be used in all gen-set modes, when auto or semi-auto mode is selected.

Only a limited number of digital inputs are available in the standard unit. The unit should be installed with the sufficient number of options to get the desired digital inputs.

If the option H2 is available in the unit, the external set points can be controlled from the control registers in the modbus protocol. Please refer to the description of option H2 for further information.

4. Parameter list

Load share

6380 Load share output

No.	Setting		Min. setting	Max. setting	Factory setting
6381	Load share out	Load share out	1.0 V	5.0	5.0 V

This function enables the user to set the voltage level of the active power load share line. This is only possible, if the load share type 'adjustable' is chosen (menu 6391). Menu 6381 is only visible, if 'adjustable' is selected in menu 6391.

6390 Load share type

No.	Setting		Type 1	Type 2	Type 3	Factory setting
6391	L. share type	L. share type	DEIF	Selco T4800	Adjustable	DEIF

This function enables the user to set up the specific type of active power load share.

The settings are only adjusted in special cases, where the usual DEIF 5V DC range is too high.

Controller

2520 Power controller

No.	Setting		Min. setting	Max. setting	Factory setting
2521	Power control	Dead band	0.2%	10.0%	2.0%
2522	Power control	P K_P	0	1000	10
2523	Power control	P K_I	0	1000	10

The power controller needs to be adjusted, when load sharing is used.

2590 var controller (option D1)

No.	Setting		Min. setting	Max. setting	Factory setting
2591	var control	Dead band	0.0%	10.0%	2.0%
2592	var control	Q K_P	0	1000	10
2593	var control	Q K_I	0	1000	10

The var controller needs to be adjusted, when var sharing is used.

Please refer to the Designer's Reference Handbook for a description of the controller function and to the General Guidelines for Commissioning for a description of tuning in the controller.