DEIF A/S

Description of options

Option D1 and D2, Generator voltage controls Multi-line 2 – version 2

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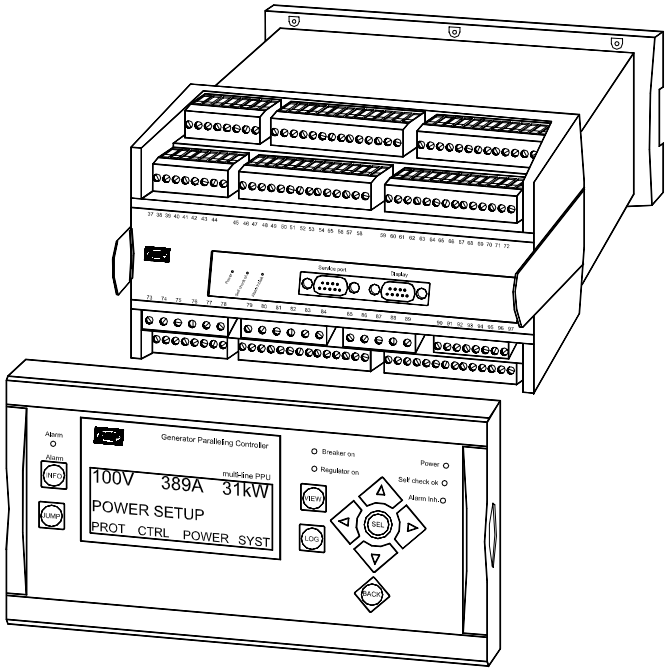
SW version 2.4X.X



- *Description of option*
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This manual is valid for standard multi-line 2 PPU/GPU/GPC units with firmware version 2.00.0 or later.

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

Option D1

Option D1 is a combined software and hardware option. The specific hardware selection depends on the required interfacing to the automatic voltage regulator.

Option D1 can only be used in the Generator Paralleling Controller, GPC, and the Paralleling and Protection Unit, PPU.

Option D1 includes the following:

Function	ANSI no.
Voltage synchronisation matching	25, 90
Constant voltage control for stand-alone generator	90
Constant reactive power control for paralleling generator	90
Constant power factor control for paralleling generator	90
Reactive power load sharing for paralleling with other generators	90

Option D2

The option D2 can be used in the Generator Protection Unit, GPU. Option D2 can only be selected if option G2 (synchronising with relay outputs for governor control) is selected too.

Option D2 can only be used in the Generator Protection Unit, GPU.

Function	ANSI no.
Voltage synchronisation matching	25, 90
Constant voltage control for standalone generator	90

Terminal description for GPC/PPU

The regulation output for the AVR depends on the specific option selection, i.e. the combination of D1 and E1/EF options.

Relay outputs for AVR control

GPC/PPU with standard supplied governor card.

Term. Slot #4	Function	Technical data	Description
65	*Used for governor controls*		
66			
67			
68			
69	NO	Relay 250 VAC, 8 A	Generator AVR: Raise voltage (option D only)
70	Com.		
71	NO	Relay 250 VAC, 8 A	Generator AVR: Lower voltage (option D only)
72	Com.		

Analogue outputs for AVR control

GPC/PPU with option E1 selected.

Term. Slot #4	Function	Description
65	Not used	
66	*Used for governor controls*	
67		
68	Not used	
69	Not used	
70	+/-20 mA out	AVR voltage set point output
71	0	
72	Not used	

Selectable output for AVR control (analogue/relay)

GPC/PPU with option EF3/EF5 selected.

Term. Slot #4	Function	Description
65	ANA +	Analogue +/-20 mA for AVR
66	ANA -	
67	*Used for governor controls*	
68		
69	Relay	Relay output for AVR. Lower voltage
70	Relay	
71	Relay	Relay output for AVR. Raise voltage
72	Relay	

Selectable output for AVR control (analogue/relay)

GPC/PPU with option EF4 selected.

Term. Slot #4	Function	Description
65	ANA +	Analogue +/-20 mA for GOV or AVR
66	ANA -	
67		Not used
68		Not used
69	GOV relay up	Relay output for GOV or AVR. Raise speed or voltage
70	GOV relay up	
71	GOV relay down	Relay output for GOV or AVR. Lower speed or voltage
72	GOV relay down	

Terminal description for GPU

The regulation output for the AVR is fixed to be relay outputs.

Relay outputs for AVR control

GPU with option G2 and D2.

Term. Slot #4	Function	Technical data	Description
65	*Used for governor controls*		
66			
67			
68			
69	NO	Relay 250 VAC, 8 A	Generator AVR: Raise voltage (option D only)
70	Com.		
71	NO	Relay 250 VAC, 8 A	Generator AVR: Lower voltage (option D only)
72	Com.		

3. Functional description, GPC/PPU

Regulators

The working principle of the PI regulator is described in the Designer's Reference Handbook.

The outputs for the AVR can be either analogue or digital. Please refer to the data sheet for further information about possible selections.

Set points

The set points for voltage, reactive power and power factor are normally set by the switchboard manufacturer during commissioning.

Voltage

No.	Setting		Min. setting	Max. setting	Factory setting
4014	Nominal settings	Generator volt.	100 V	25000 V	440 V

Controller settings

No.	Setting		Min. setting	Max. setting	Factory setting
4042	Contr. settings	var set point	0 %	250 %	30 %
4043	Contr. settings	PF set point	0.60	1.00	0.90

The set point used depends on the specific running mode selection.

External set point

The external set points can be used if the set point comes from another source, e.g. a PLC. In order to activate the external set point, the mode input called mode 6 (terminal 52) is used. When the input is high, the external set point is used and when it is low then the internal set point is used.

The inputs for the external set points are terminal 41 (common) and 42 (+) and the signal level is +/-10 VDC.

The available running modes and their respective adjustment ranges are described in the table below:

Mode	Mode 6 (terminal 52) = ON	Comment
Fixed voltage	+/-10V DC input ~ nominal voltage +/-10%	Stand-alone generator or GB opened
Fixed var	0…10V DC input ~ 0…100% reactive power	Fixed reactive power
Fixed PF	0…10V DC input ~ 1…0.6 inductive PF	Fixed power factor
VAr sharing	+/-10V DC input ~ nominal voltage +/-10%	Reactive power sharing

0…100% relates to the nominal power (menu 4012) of the generator.

Running mode selection

To activate the regulation, the digital input terminal 25 must be activated.

The running mode selection is done in the GPC/PPU using binary inputs. The inputs called mode 4 and mode 5 (terminals 51 and 52) can be used to change the control method of the AVR as described in the table below:

Input / Mode	Mode 4 (terminal 51)	Mode 5 (terminal 52)	Comment
Fixed voltage	OFF	OFF	Stand-alone generator
Fixed VAr	ON	OFF	Fixed reactive power
Fixed PF	OFF	ON	Fixed power factor
VAr sharing	ON	ON	Reactive power sharing

Mode 1, 2 and 3 are used for selecting the for the governor control.

Alarms

The AVR regulation failure in menu 2230 is part of option D1. The alarm occurs when the regulation is activated but the set point cannot be reached.

The alarm will appear when the set point is reached. The deviation is calculated in percent:

Example:

U_{ACTUAL} = 400V AC
$U_{NOMINAL}$ = 440V AC

Difference in percent: (440-400)/440*100 = 9.1%

If the alarm setting is lower than 9.1 % in this example, then the alarm appears.

Adjust the alarm setting “Deadband” to 100% to deactivate the alarm.

4. Functional description, GPU

Regulators

The working principle of the PI regulator is described in the Designer's Reference Handbook.

The outputs for the AVR are always digital.

Set points

The set point for the voltage is normally set by the switchboard manufacturer during commissioning.

Voltage

No.	Setting		Min. setting	Max. setting	Factory setting
4014	Nominal settings	Generator volt.	100V	25000V	440V

Running mode selection

To activate the regulation, the digital input terminal 25 must be activated.

There is no running mode selection in the GPU. It will always operate in fixed voltage control.

Alarms

The AVR regulation failure in menu 2230 is part of the option D2. The alarm occurs when the regulation is activated but the set point cannot be reached.

The alarm will appear when the set point is reached. The deviation is calculated in percent:

Example:

U_{ACTUAL} = 400V AC
$U_{NOMINAL}$ = 440V AC

Difference in percent: (440-400)/440*100 = 9.1%

If the alarm setting is lower than 9.1 % in this example, then the alarm appears.

Adjust the alarm setting "Deadband" to 100% to deactivate the alarm.

5. Parameter list, GPC/PPU

Controller settings

The deadband adjustment is only available if the AVR is controlled with relay outputs from the controller unit.

2190 Voltage control

No.	Setting		Min. setting	Max. setting	Factory setting
2191	Voltage control	Deadband	0.0%	10.0%	0.2%
2192	Voltage control	U K_P	0	1000	250
2193	Voltage control	U K_I	0	1000	160

2200 VAr (reactive power) control

No.	Setting		Min. setting	Max. setting	Factory setting
2201	VAr control	Deadband	0.0%	10.0%	0.2%
2202	VAr control	Q K_P	0	1000	250
2203	VAr control	Q K_I	0	1000	160

The VAr controller is also being used for power factor control.

2250 Relay control

No.	Setting		Min. setting	Max. setting	Factory setting
2253	Relay control	AVR ON time t_N	10 ms	3000 ms	100 ms
2254	Relay control	AVR per. time t_P	50 ms	15000 ms	500 ms

4040 Controller settings

No.	Setting		Min. setting	Max. setting	Factory setting
4042	Contr. settings	VAr set point	0%	250%	30%
4043	Contr. settings	PF set point	0.60	1.00	0.90

The 0…100% VAr relates to the nominal power (P_{nom}, setting 4012) of the generator.

The voltage control uses the nominal voltage (setting 4014) as reference.

Alarm settings

2230 AVR regulation failure

No.	Setting		Min. setting	Max. setting	Factory setting
2231	AVR reg. failure	Deadband	1.0%	100.0%	30.0%
2232	AVR reg. failure	Timer	10.0 s	360.0 s	60.0 s
2233	AVR reg. failure	Output A	R0 (none)	R4 (relay 4)	R2 (relay 2)
2234	AVR reg. failure	Output B	R0 (none)	R4 (relay 4)	R2 (relay 2)

Adjust the alarm setting “Deadband” to 100% to deactivate the alarm.

6. Parameter list, GPU

Controller settings

The deadband adjustment is only available if the AVR is controlled with relay outputs from the controller unit.

2190 Voltage control

No.	Setting		Min. setting	Max. setting	Factory setting
2191	Voltage control	Deadband	0.0%	10.0%	0.2%
2192	Voltage control	U K_P	0	1000	250
2193	Voltage control	U K_I	0	1000	160

2250 Relay control

No.	Setting		Min. setting	Max. setting	Factory setting
2253	Relay control	AVR ON time t_N	10 ms	3000 ms	100 ms
2254	Relay control	AVR per. time t_P	50 ms	15000 ms	500 ms

The voltage control uses the nominal voltage (setting 4014) as reference.

Alarm settings

2230 AVR regulation failure

No.	Setting		Min. setting	Max. setting	Factory setting
2231	AVR reg. failure	Deadband	1.0%	100.0%	30.0%
2232	AVR reg. failure	Timer	10.0 s	360.0 s	60.0 s
2233	AVR reg. failure	Output A	R0 (none)	R4 (relay 4)	R2 (relay 2)
2234	AVR reg. failure	Output B	R0 (none)	R4 (relay 4)	R2 (relay 2)

Adjust the alarm setting “Deadband” to 100% to deactivate the alarm.