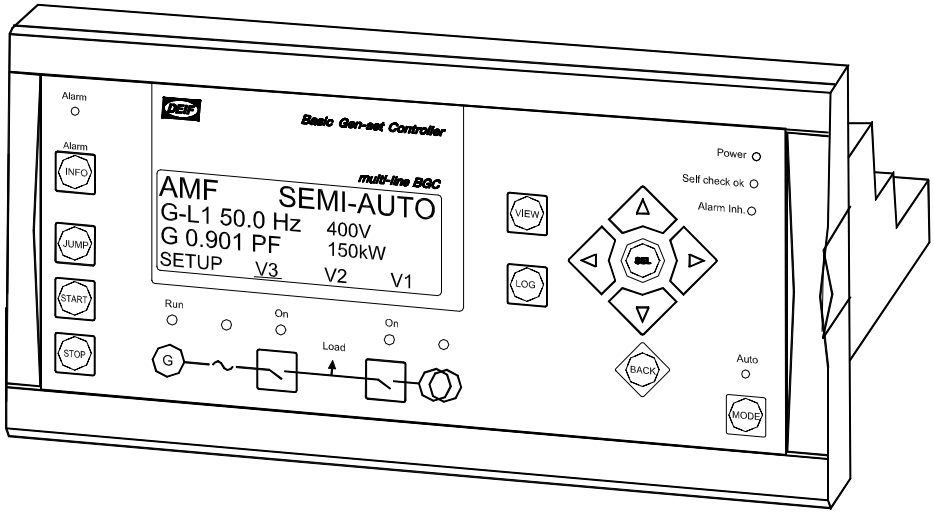
DEIF A/S

Description of options

Options A and B,
Loss of mains protection package
Basic Gen-set controller

4189340303C



- *Description of options*
- *Functional descriptions*
- *Parameter list*
- *Etc.*

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***DEIF A/S**, Frisenborgvej 33*
DK-7800 Skive, Denmark

Tel.: +45 9614 9614, Fax: +45 9614 9615
E-mail: deif@deif.com, URL: www.deif.com

Table of contents

1. WARNINGS AND LEGAL INFORMATION 3

LEGAL INFORMATION AND RESPONSIBILITY 3
ELECTROSTATIC DISCHARGE AWARENESS 3
SAFETY ISSUES 3
NOTES 3

2. DESCRIPTION OF OPTIONS 4

A OPTIONS, FUNCTIONS INCLUDED 4
B OPTIONS, FUNCTIONS INCLUDED 4

3. FUNCTIONAL DESCRIPTIONS 5

VOLTAGE AND FREQUENCY PROTECTIONS 5
VECTOR JUMP AND DF/DT PROTECTIONS 5

4. PARAMETER LIST 8

PARAMETER TABLE DESCRIPTION 8
PROTECTION 8

5. INHIBIT 13

INHIBIT RELATIONS, VOLTAGES AND FREQUENCIES 13
INHIBIT RELATIONS, VECTOR JUMP AND DF/DT 13

6. RELAY FUNCTIONS 14

RELAY SETUP 14

1. Warnings and legal information

This chapter includes important information about general legal issues relevant in the handling of DEIF products. Furthermore, some overall safety precautions will be introduced and recommended. Finally, the highlighted notes, which will be used throughout this document, are presented.

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 controlled by the BGC unit, the company responsible for the installation or the operation of the set must be contacted.

The BGC units are not to be opened by unauthorized 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 BGC unit implies work with dangerous currents and voltages. Therefore, the installation of the BGC should only be carried out by authorized personnel who understand the risks involved in the working with live electrical equipment.

Notes

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

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2. Description of options

This document describes options **A** (loss of mains protection package) and **B** (generator/busbar/mains protection package).

A Options, functions included

The A options are software options and therefore not related to any hardware apart from the standard installed hardware.

The A options are a mix of frequency, voltage, vector jump and df/dt protections.

Option A1

- Over- and undervoltage (generator and busbar/mains)
- Over- and underfrequency (generator and busbar/mains)
- Vector jump
- df/dt (ROCOF)

Option A2

- Over- and undervoltage (generator and busbar/mains)
- Over- and underfrequency (generator and busbar/mains)
- df/dt (ROCOF)

Option A3

- Over- and undervoltage (generator and busbar/mains)
- Over- and underfrequency (generator and busbar/mains)
- Vector jump

B Options, functions included

The B options are software options and therefore not related to any hardware apart from the standard installed hardware.

The B options are a mix of frequency and voltage protections.

Option B1

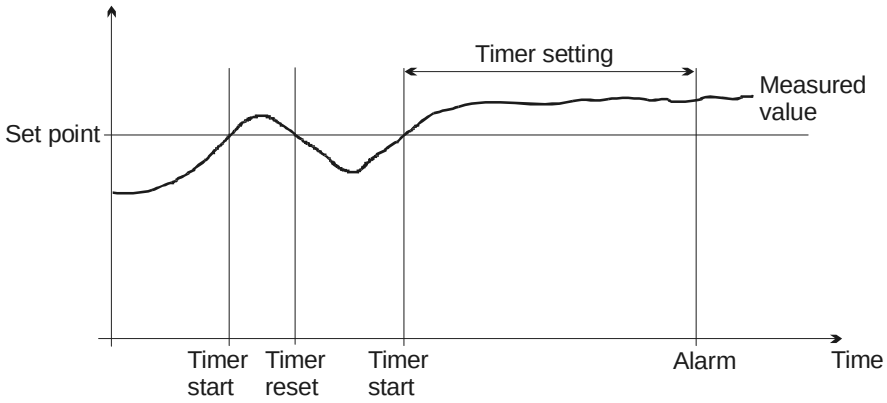
- Over- and undervoltage (generator and busbar/mains)
- Over- and underfrequency (generator and busbar/mains)

3. Functional descriptions

Voltage and frequency protections

The voltage and frequency protections are all of the definite time type, i.e. a set point and time is selected.

If the function is e.g. overvoltage, the timer will be activated, if the set point is exceeded. If the voltage value goes below the set point value, before the timer runs out, then the timer will be stopped and reset.



When the timer runs out, the output is activated.

Vector jump and df/dt protections

These functions are intended for detection of a mains failure and subsequent opening of the mains breaker. The reasons are:

1) The generator will, in case of mains failure, be running “stand-alone” on the grid, attempting to supply power to all the consumers. Naturally, this is not possible and an overload/overcurrent situation is likely to be the end result, as the mains consumption normally exceeds the generator capacity.

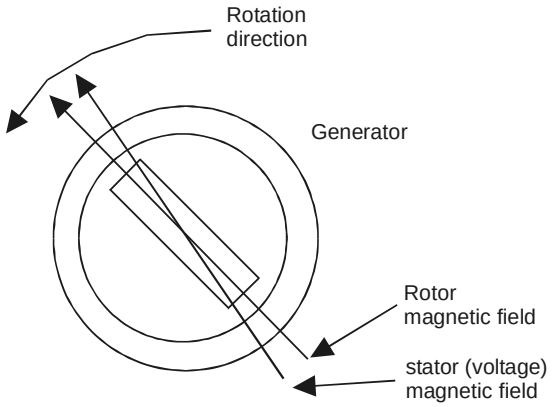
2) Mains transformer protection systems are constructed with a so-called ‘fast re-closing’ feature. This means that if a failure occurs (e.g. a short circuit), the transformer protection system will open the transformer breaker, but after a while (the time is country dependent - in Denmark we use 300 ms) the breaker will be re-closed to check if it was a short-time failure (2 overhead wires meeting shortly, a lightning strike, a branch falling down from a tree or the like). If the failure is still there, the breaker will be re-opened and remain there.

The above-mentioned re-closing combined with the high overload on the generator means that the generator and mains will be paralleled again without synchronisation, and this will most likely damage the gen-set.

Ordinary protections will not identify the above mains failure, before it is too late (300 ms). Therefore, the vector jump and/or df/dt are used, because these functions can detect the mains failure and open the breaker fast (vector jump: 30 ms, df/dt: 100 ms).

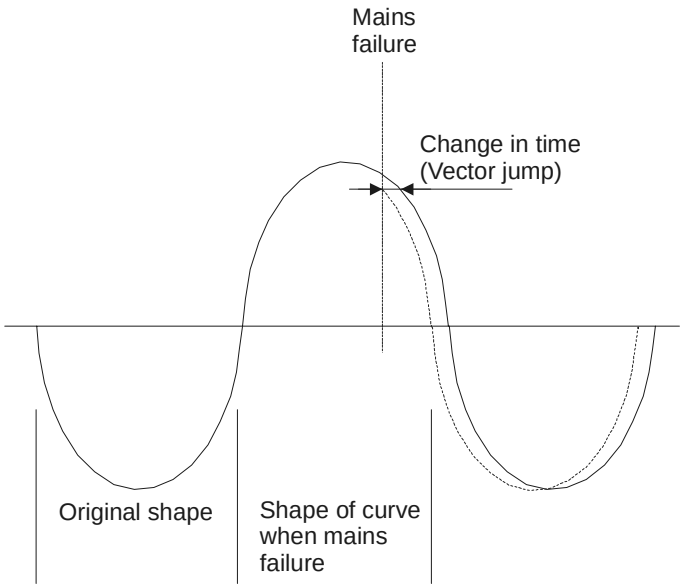
Vector jump

Vector jump is based on the fact that the stator magnetic field, and as a result, the 3 phase voltage coming out of a generator, is lagging a little behind the rotor magnetic field (in time and position).



If a mains failure occurs, the time lagging of the stator magnetic field (and the output voltage) will change (jump). This is called a vector jump.

Sine wave illustration:

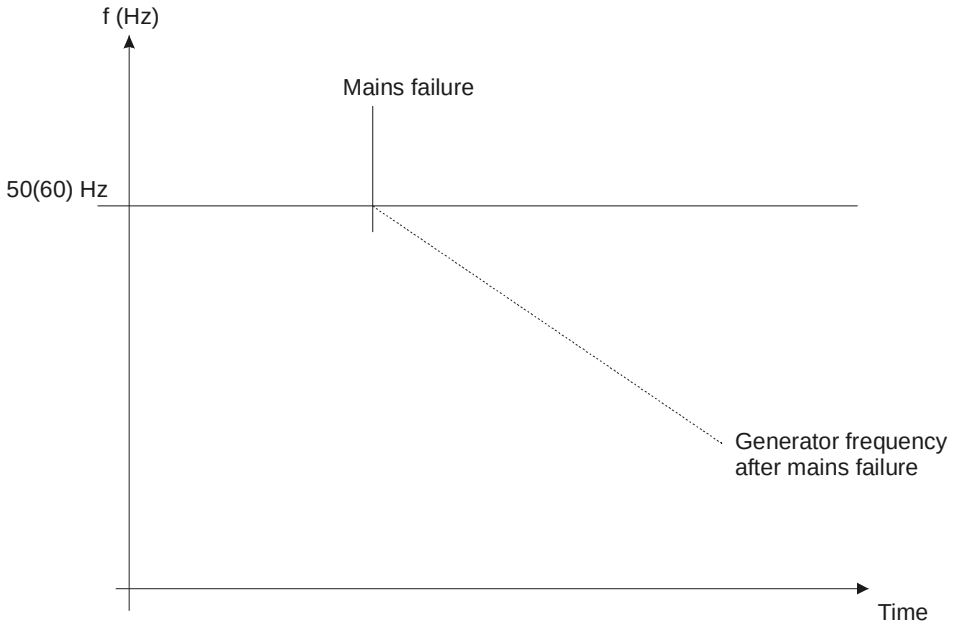


So, by comparing the half-sine curve time duration with the previous ones, a sudden change in time can be detected. This is the vector jump.

The vector jump setting is made in electrical degrees.

df/dt (ROCOF)

The df/dt function (ROCOF: Rate Of Change Of Frequency, change of frequency over time) is based on the fact that the generator, if overloaded, will loose speed dramatically.



So, a dramatic drop (or increase) of frequency over time is a mains failure.

The df/dt setting is made in Hz/sec.

4. Parameter list

This chapter includes a complete parameter list for the options A and B.

Parameter table description

The table consists of the following possible adjustments.

Set point: The alarm set point is adjusted in the set point menu. The setting is in Hz/sec.

Timer: The timer setting indicates the duration of the period between the df/dt and the alarm occurrence

Relay output A: A relay can be activated by the output A

Relay output B: A relay can be activated by the output B

Enable: The alarm can be activated or deactivated. ON means always activated, RUN means that the alarm has run status. This means it is activated when the running signal is present. Parallel means the alarm is only active when both breakers are closed.
1 OFF
2 ON
3 RUN
4 PARALLEL

Fail class: The action to be executed when a fault occurs. See the Designer's Reference Handbook for more information about fail classes.
1 Alarm
2 Warning
3 Trip GB
4 Trip and stop
5 Shut down
6 Trip MB

For further information about the structure of the parameter descriptions, see the Designer's Reference Handbook.

Protection

Loss of mains protections (option A)

1180 df/dt (ROCOF)

No.	Setting		Min. setting	Max. setting	Factory setting
1181	df/dt (ROCOF)	Set point +/-	0.1Hz/s	10.0Hz/s	5.0Hz/s
1182	df/dt (ROCOF)	Timer	1 per	20 per	6 per
1183	df/dt (ROCOF)	Relay output A	R0 (none)	R3 (relay3)	R0 (none)
1184	df/dt (ROCOF)	Relay output B	R0 (none)	R3 (relay3)	R0 (none)
1185	df/dt (ROCOF)	Enable	1 OFF	4 PARALLEL	1 OFF
1186	df/dt (ROCOF)	Fail class	1 Alarm	6 Trip MB	6 Trip MB

1190 vector jump

No.	Setting		Min. setting	Max. setting	Factory setting
1191	Vector jump	Set point	0.0 deg.	90.0 deg.	10.0 deg.
1192	Vector jump	Relay output A	R0 (none)	R3 (relay3)	R0 (none)
1193	Vector jump	Relay output B	R0 (none)	R3 (relay3)	R0 (none)
1194	Vector jump	Enable	1 OFF	4 PARALLEL	1 OFF
1195	Vector jump	Fail class	1 Alarm	6 Trip MB	6 Trip MB

The loss of mains protection includes df/dt (Rate Of Change Of Frequency) protection. This protection is used, when the generator is paralleling with the mains. There is a fixed time delay of 1 second after the mains breaker closes to the protections are activated. The loss of mains function will trip the mains breaker.

Bus voltage protection (option A or B)

1010 Bus high volt1

No.	Setting		Min. setting	Max. setting	Factory setting
1011	Bus high volt. 1	Set point	100.0%	120.0%	103.0%
1012	Bus high volt. 1	Timer	0.10 s	99.99 s	10.00 s
1013	Bus high volt. 1	Relay output A	R0 (none)	R3 (relay3)	R0 (none)
1014	Bus high volt. 1	Relay output B	R0 (none)	R3 (relay3)	R0 (none)
1015	Bus high volt. 1	Enable	1 OFF	4 PARALLEL	1 OFF
1016	Bus high volt. 1	Fail class	1 Alarm	6 Trip MB	2 Warning

1020 Bus high volt2

No.	Setting		Min. setting	Max. setting	Factory setting
1021	Bus high volt. 2	Set point	100.0%	120.0%	105.0%
1022	Bus high volt. 2	Timer	0.00 s	99.99 s	5.00 s
1023	Bus high volt. 2	Relay output A	R0 (none)	R3 (relay3)	R0 (none)
1024	Bus high volt. 2	Relay output B	R0 (none)	R3 (relay3)	R0 (none)
1025	Bus high volt. 2	Enable	1 OFF	4 PARALLEL	1 OFF
1026	Bus high volt. 2	Fail class	1 Alarm	6 Trip MB	2 Warning

1030 Bus low volt 1

No.	Setting		Min. setting	Max. setting	Factory setting
1031	Bus low volt. 1	Set point	80.0%	100.0%	97.0%
1032	Bus low volt. 1	Timer	0.10 s	99.99 s	10.00 s
1033	Bus low volt. 1	Relay output A	R0 (none)	R3 (relay3)	R0 (none)
1034	Bus low volt. 1	Relay output B	R0 (none)	R3 (relay3)	R0 (none)
1035	Bus low volt. 1	Enable	1 OFF	4 PARALLEL	1 OFF
1036	Bus low volt. 1	Fail class	1 Alarm	6 Trip MB	2 Warning

1040 Bus low volt 2

No.	Setting		Min. setting	Max. setting	Factory setting
1041	Bus low volt. 2	Set point	50.0%	100.0%	95.0%
1042	Bus low volt. 2	Timer	0.00 s	99.99 s	5.00 s
1043	Bus low volt. 2	Relay output A	R0 (none)	R3 (relay3)	R0 (none)
1044	Bus low volt. 2	Relay output B	R0 (none)	R3 (relay3)	R0 (none)
1045	Bus low volt. 2	Enable	1 OFF	4 PARALLEL	1 OFF
1046	Bus low volt. 2	Fail class	1 Alarm	6 Trip MB	2 Warning

Bus frequency protection (option A or B)

Frequency settings relate to nominal frequency setting.

1050 Bus high frequency 1

No.	Setting		Min. setting	Max. setting	Factory setting
1051	Bus high freq. 1	Set point	100.0%	120.0%	103.0%
1052	Bus high freq. 1	Timer	0.10 s	99.99 s	10.00 s
1053	Bus high freq. 1	Relay output A	R0 (none)	R3 (relay3)	R0 (none)
1054	Bus high freq. 1	Relay output B	R0 (none)	R3 (relay3)	R0 (none)
1055	Bus high freq. 1	Enable	1 OFF	4 PARALLEL	1 OFF
1056	Bus high freq. 1	Fail class	1 Alarm	6 Trip MB	2 Warning

1060 Bus high frequency 2

No.	Setting		Min. setting	Max. setting	Factory setting
1061	Bus high freq. 2	Set point	100.0%	120.0%	105.0%
1062	Bus high freq. 2	Timer	0.00 s	99.99 s	5.00 s
1063	Bus high freq. 2	Relay output A	R0 (none)	R3 (relay3)	R0 (none)
1064	Bus high freq. 2	Relay output B	R0 (none)	R3 (relay3)	R0 (none)
1065	Bus high freq. 2	Enable	1 OFF	4 PARALLEL	1 OFF
1066	Bus high freq. 2	Fail class	1 Alarm	6 Trip MB	2 Warning

1070 Bus low frequency 1

No.	Setting		Min. setting	Max. setting	Factory setting
1071	Bus low freq. 1	Set point	80.0%	100.0%	97.0%
1072	Bus low freq. 1	Timer	0.10 s	99.99 s	10.00 s
1073	Bus low freq. 1	Relay output A	R0 (none)	R3 (relay3)	R0 (none)
1074	Bus low freq. 1	Relay output B	R0 (none)	R3 (relay3)	R0 (none)
1075	Bus low freq. 1	Enable	1 OFF	4 PARALLEL	1 OFF
1076	Bus low freq. 1	Fail class	1 Alarm	6 Trip MB	2 Warning

1080 Bus low frequency 2

No.	Setting		Min. setting	Max. setting	Factory setting
1081	Bus low freq. 2	Set point	80.0%	100.0%	95.0%
1082	Bus low freq. 2	Timer	0.00 s	99.99 s	5.00 s
1083	Bus low freq. 2	Relay output A	R0 (none)	R3 (relay3)	R0 (none)
1084	Bus low freq. 2	Relay output B	R0 (none)	R3 (relay3)	R0 (none)
1085	Bus low freq. 2	Enable	1 OFF	4 PARALLEL	1 OFF
1086	Bus low freq. 2	Fail class	1 Alarm	6 Trip MB	2 Warning

Generator voltage protection (option A or B)

1210 Generator high voltage1

No.	Setting		Min. setting	Max. setting	Third setting	Factory setting
1211	Gen. high volt. 1	Set point	100.0%	120.0%	-	103.0%
1212	Gen. high volt. 1	Timer	0.1 s	100.0 s	-	10.0 s
1213	Gen. high volt. 1	Relay output A	R0 (none)	R3 (relay3)	-	R0 (none)
1214	Gen. high volt. 1	Relay output B	R0 (none)	R3 (relay3)	-	R0 (none)
1215	Gen. high volt. 1	Enable	1 OFF	2 ON	3 RUN	1 OFF
1216	Gen. high volt. 1	Fail class	1 Alarm	6 Trip MB	-	2 Warning

1220 Generator high voltage 2

No.	Setting		Min. setting	Max. setting	Third setting	Factory setting
1221	Gen. high volt. 2	Set point	100.0%	120.0%	-	105.0%
1222	Gen. high volt. 2	Timer	0.1 s	100.0 s	-	5.0 s
1223	Gen. high volt. 2	Relay output A	R0 (none)	R3 (relay3)	-	R0 (none)
1224	Gen. high volt. 2	Relay output B	R0 (none)	R3 (relay3)	-	R0 (none)
1225	Gen. high volt. 2	Enable	1 OFF	2 ON	3 RUN	1 OFF
1226	Gen. high volt. 2	Fail class	1 Alarm	6 Trip MB	-	2 Warning

1230 Generator low volt1

No.	Setting		Min. setting	Max. setting	Third setting	Factory setting
1231	Gen. low volt. 1	Set point	80.0%	100.0%	-	97.0%
1232	Gen. low volt. 1	Timer	0.1 s	100.0 s	-	10.0 s
1233	Gen. low volt. 1	Relay output A	R0 (none)	R3 (relay3)	-	R0 (none)
1234	Gen. low volt. 1	Relay output B	R0 (none)	R3 (relay3)	-	R0 (none)
1235	Gen. low volt. 1	Enable	1 OFF	2 ON	3 RUN	1 OFF
1236	Gen. low volt. 1	Fail class	1 Alarm	6 Trip MB	-	2 Warning

1240 Generator low volt2

No.	Setting		Min. setting	Max. setting	Third setting	Factory setting
1241	Gen. low volt. 2	Set point	50.0%	100.0%	-	95.0%
1242	Gen. low volt. 2	Timer	0.1 s	100.0 s	-	5.0 s
1243	Gen. low volt. 2	Relay output A	R0 (none)	R3 (relay3)	-	R0 (none)
1244	Gen. low volt. 2	Relay output B	R0 (none)	R3 (relay3)	-	R0 (none)
1245	Gen. low volt. 2	Enable	1 OFF	2 ON	3 RUN	1 OFF
1246	Gen. low volt. 2	Fail class	1 Alarm	6 Trip MB	-	2 Warning

Generator frequency protection (option A or B)

1250 Generator high frequency 1

No.	Setting		Min. setting	Max. setting	Third setting	Factory setting
1251	Gen. high freq. 1	Set point	100.0%	120.0%	-	103.0%
1252	Gen. high freq. 1	Timer	0.2 s	100.0 s	-	10.0 s
1253	Gen. high freq. 1	Relay output A	R0 (none)	R3 (relay3)	-	R0 (none)
1254	Gen. high freq. 1	Relay output B	R0 (none)	R3 (relay3)	-	R0 (none)
1255	Gen. high freq. 1	Enable	1 OFF	2 ON	3 RUN	1 OFF
1256	Gen. high freq. 1	Fail class	1 Alarm	6 Trip MB	-	2 Warning

1260 Generator high frequency 2

No.	Setting		Min. setting	Max. setting	Third setting	Factory setting
1261	Gen. high freq. 2	Set point	100.0%	120.0%	-	105.0%
1262	Gen. high freq. 2	Timer	0.2 s	100.0 s	-	5.0 s
1263	Gen. high freq. 2	Relay output A	R0 (none)	R3 (relay3)	-	R0 (none)
1264	Gen. high freq. 2	Relay output B	R0 (none)	R3 (relay3)	-	R0 (none)
1265	Gen. high freq. 2	Enable	1 OFF	2 ON	3 RUN	1 OFF
1266	Gen. high freq. 2	Fail class	1 Alarm	6 Trip MB	-	2 Warning

1270 Generator low frequency 1

No.	Setting		Min. setting	Max. setting	Third setting	Factory setting
1271	Gen. low freq. 1	Set point	80.0%	100.0%	-	97.0%
1272	Gen. low freq. 1	Timer	0.2 s	100.0 s	-	10.0 s
1273	Gen. low freq. 1	Relay output A	R0 (none)	R3 (relay3)	-	R0 (none)
1274	Gen. low freq. 1	Relay output B	R0 (none)	R3 (relay3)	-	R0 (none)
1275	Gen. low freq. 1	Enable	1 OFF	2 ON	3 RUN	1 OFF
1276	Gen. low freq. 1	Fail class	1 Alarm	6 Trip MB	-	2 Warning

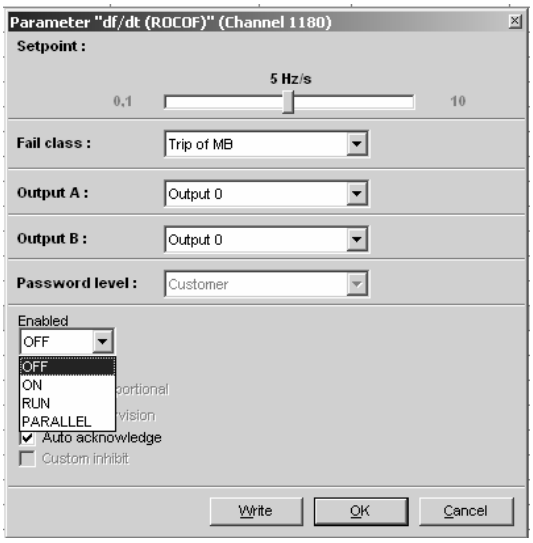
1280 Generator low frequency 2

No.	Setting		Min. setting	Max. setting	Third setting	Factory setting
1281	Gen. low freq. 2	Set point	80.0%	100.0%	-	95.0%
1282	Gen. low freq. 2	Timer	0.2 s	100.0 s	-	5.0 s
1283	Gen. low freq. 2	Relay output A	R0 (none)	R3 (relay3)	-	R0 (none)
1284	Gen. low freq. 2	Relay output B	R0 (none)	R3 (relay3)	-	R0 (none)
1285	Gen. low freq. 2	Enable	1 OFF	2 ON	3 RUN	1 OFF
1286	Gen. low freq. 2	Fail class	1 Alarm	6 Trip MB	-	2 Warning

5. Inhibit

Inhibit relations, voltages and frequencies

Each alarm can be given automatic inhibit status – in order to do this change the relevant alarm setting from 'ON' to 'RUN' like the example below:



This means that the alarm is automatically inhibited, when the gen-set stops, i.e. when no running signal is present, and set parallel the alarm is inhibited, if both breakers are not closed.

All alarms can be given RUN status and not only the alarms in option A and option B.

Inhibit relations, vector jump and df/dt

The loss of mains protections are automatically inhibited for 1 second, when both breakers are being closed. After the 1 second delay the loss of mains protections are active (option dependent).

The purpose of this 1 second delay is to avoid nuisance trips just after breaker operations.

When either the generator breaker or the mains breaker is open, the vector jump and df/dt alarms are inhibited.

	No condition	Run	GB ON	GB OFF	MB ON	MB OFF	Note
1 OFF	Alarms are not activated						
2 ON	X						
3 RUN		X					
4 PARALLEL			X		X		

Selection	Description
1 OFF	Alarms are not enabled.
2 ON	Alarms are activated at all times, and there is not any dependency to breaker position and operation of the engine.
3 RUN	Alarms are activated at all times, and there is not any dependency to breaker position, but the engine must be running.
4 PARALLEL	Alarms are activated when the GB and MB are ON, and the engine must be running.

6. Relay functions

Relay setup

The relays can be configured in the two different ways illustrated below.

1. Alarm relay function:
   When an alarm activates the relay, it will remain activated as long as the alarm is present and unacknowledged.

2. Limit function:
   When an alarm activates the relay, no alarm message is displayed. After the condition activating the relay has returned to normal, the relay will deactivate, when the "Off delay" has expired.

The setup of the relay is done in the setup menu (system). All relays are set up in the same way. This example illustrates relay 6:

No.	Setting		First/min. setting	Second/max. setting	Factory setting
4661	Relay 6	Function	Alarm	Limit	Alarm
4662	Relay 6	Off delay	0.0 s	999.9 s	5.0 s

The 'off delay' is the time between the disappearance of the event that caused the relay to activate and the actual activation of the relay.

PC utility software: