DEIF A/S

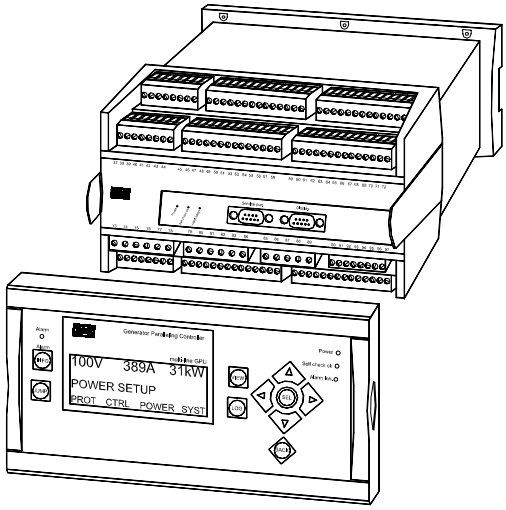
User's manual

Generator Protection Unit Type GPU

multi-line 2

4189340228D

Software ver. 1.4X



- *Compact protection system in one unit*
- *3-phase AC_{RMS} measurements*
- *Calculation of complex AC values*
- *DIN-rail unit with separate display*
- *Easy operator programming via display or PC*
- *Reliable self-monitoring system*

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This document is the user's manual for the standard Deif Multi-line 2 GPU.

INDEX:

Warnings and legal information

This manual gives guidelines to installation of the DEIF Multi-line 2 generator control and protection units. It is, however, not a complete installation instruction. Therefore, even if terminal numbers are shown in the drawings, the drawings are to be used as guidance only.

Installing and operating the Multi-line 2 products implies work with dangerous currents and voltages, and therefore it should be done by qualified personnel only.

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

DEIF takes no responsibility for operation or installation of the generator set. If there is any doubt about how to install or operate the system on which the Multi-line 2 products are measuring, the company responsible for installation or operation must be contacted.

Standard functions

The GPU is a protection unit for a generator driven by a diesel / gas engine or a turbine. The GPU will carry out all necessary tasks to protect a generator, regardless of the use of the generator. This means that the GPU can be used for several application types such as:

- Stand-alone generator
- Multiple generator load sharing control
- Fixed load to mains / base load

The GPU measuring system is true RMS 3-phase measurement of generator voltage, generator current and BUS (mains) voltage.

Language

German or English language may be chosen via the system menu structure.

Generator protection functions

- Reverse power
- Overcurrent (2 levels)

Protective functions can be selected to activate one of 5 configurable relays.

Optional function list

Note: Option A and B cannot be chosen at the same time as they contain common functions.

Option A, mains failure supervision

- Vector jump
- Df/dt (ROCOF)
- Overvoltage (2 levels)
- Undervoltage (2 levels)
- Overfrequency (2 levels)
- Underfrequency (2 levels)

Option B, voltage / frequency protection package

- Overvoltage (2 levels)
- Undervoltage (2 levels)
- Overfrequency (2 levels)
- Underfrequency (2 levels)

Option C, generator add-on protection package

- Over load (2 levels)
- Current asymmetry (1 level)
- Voltage asymmetry (1 level)
- Loss of excitation (1 level)
- Over excitation (1 level)

Option F1, 2 x transducer output

Selecting option F1 means that an additional board will be placed in slot #6 (terminals 90 to 97) where 2 analogue 0(4)…20 mA outputs will be present. The outputs are galvanically separated from each other and the rest of the GPU. The outputs are active outputs (does not require external power supply). The use of the analogue outputs can be selected via the menu system or the PC programming interface.

Option F2, 4 x transducer output

Option F2 will, in addition to the 2 analogue outputs in slot #6 as described under Option F1, place 2 analogue outputs in slot # 4 (terminals 65 to 72). The technical data are the same.

Option G, Start / stop of next generator

If option G is selected, an additional relay board is mounted in slot #8 (terminals 126-133). Start signal is on terminals 126-127, stop signal is on terminals 128-129. Both are normally open relays.

The settings of level and timers can be carried out in the menu system or via PC interface.

Option H1, CAN-bus serial interface

If option H1 is selected, an additional communication board is mounted in slot #2 (terminals 29-36).

For technical details regarding the CAN-bus interface, please see the CAN-bus manual.

Option H2, MOD-bus serial interface

If option H2 is selected, an additional communication board is mounted in slot #2 (terminals 29-36).

For technical details regarding the MOD-bus interface, please see the MOD-bus manual.

Option J1, display cable, 3 m

Cable with male / female DUB-D plugs.

Option J2, display cable, 6 m

Cable with male / female SUB-D plugs.

Option K, IP 54 display

Rubber gasket for display.

Hardware

The GPU unit housing is divided into board slot positions, some of which are standard (non-changeable) and some intended for options. The unit is divided like this:

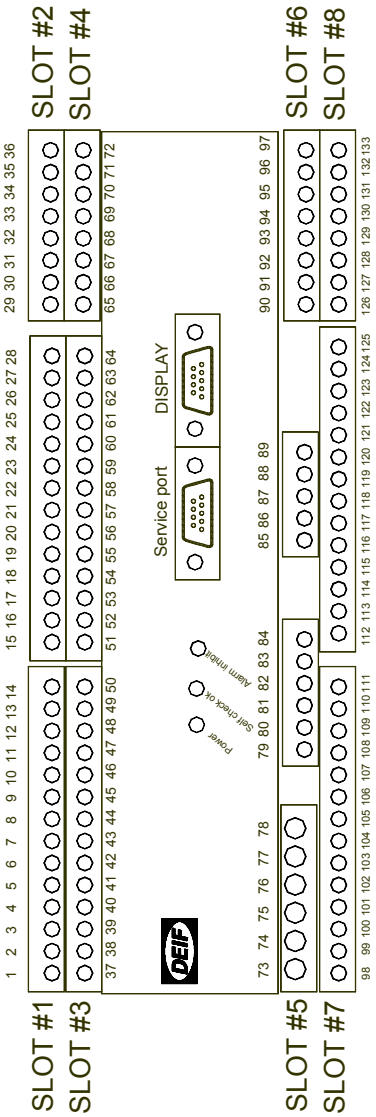
Slot #1: Standard	Terminal 1-28
Slot #2:	Terminal 29-36
Slot #3: Not used	Terminal 37-64
Slot #4:	Terminal 65-72
Slot #5: Standard	Terminal 73-89
Slot #6:	Terminal 90-97
Slot #7: Not used	Terminal 98-125
Slot #8:	Terminal 126-133

In the standard GPU, the only slots used are as standard slot #1, #3, #5 and #8. Slots #2, #4 and #6 are used for options, slot # 7 is not used.

Besides the slots, there is an additional board where the communication (RS 232 PC service port for programming of set-points and timers etc. and display) is placed.

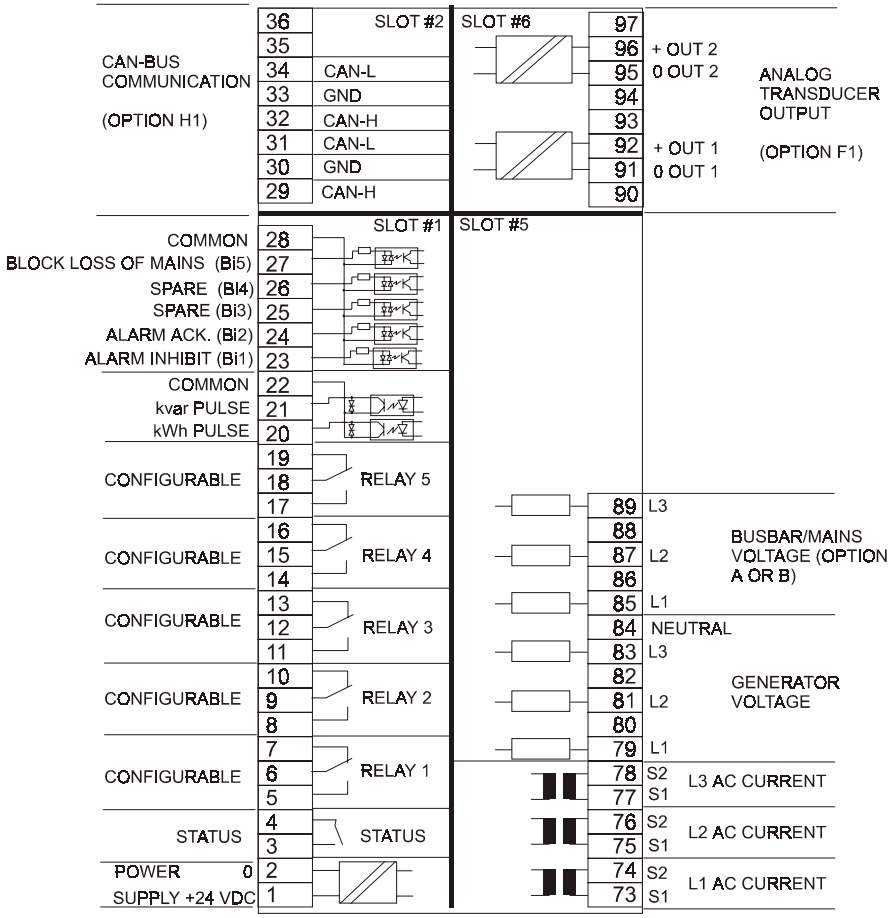
NOTE:
For slots #1 and 5, only specific boards can be mounted.
For slots #2, 4, 6 and 8, the boards are interchangeable.

The slots are positioned in the unit as follows (seen from the top of the unit):

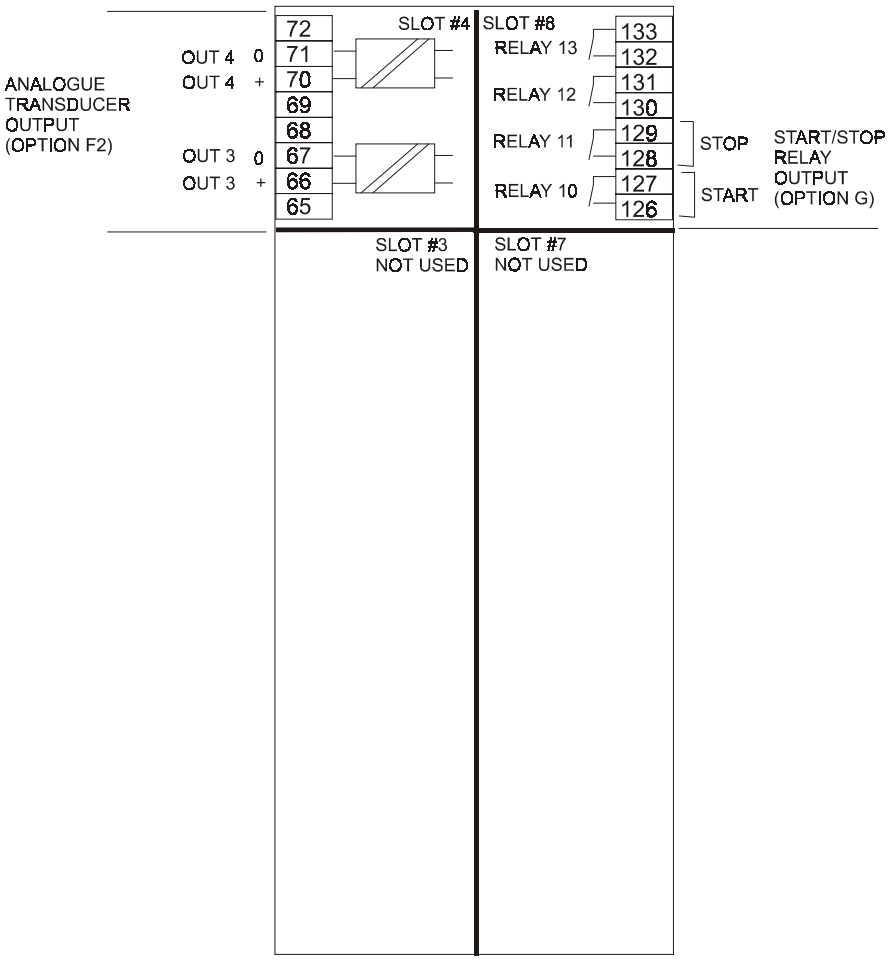


Terminal strip overview

Slots 1,2,5 and 6



Slots 3,4 and 8



Terminal strip, explanation

For the relay outputs, following terms will be used:
NO means **N**ormally **O**pen
NC means **N**ormally **C**losed
Com. means common terminal for the relay in question

Slot #1, power supply and binary I/O

Standard board (always needed):

Term	Function	Technical data	Description
1	+24 VDC	24 VDC +20 / - 30 %	Power supply.
2	0 VDC		
3	NC	Status relay 24V / 1A	Normally closed relay, processor /power supply status supervision
4	Com		
5	NO	Relay 1, 250 VAC / 8A	Configurable
6	Com.		
7	NC		
8	NO	Relay 2, 250 VAC / 8A	Configurable
9	Com.		
10	NC		
11	NO	Relay 3, 250 VAC / 8A	Configurable
12	Com.		
13	NC		
14	NO	Relay 4, 250 VAC / 8A	Configurable
15	Com.		
16	NC		
17	NO	Relay 5, 250 VAC / 8A	Configurable
18	Com.		
19	NC		
20	Open collector 1	Transistor out	Pulse output 1, kWh counter
21	Open collector 2	Transistor out	Pulse output 2, kvarh counter
22	Com.	Common	Common terminal for terminals 21 and 22
23	Digital input 1	Optocoupler	Remote alarm inhibit
24	Digital input 2	Optocoupler	Remote alarm acknowledge
25	Digital input 3	Optocoupler	Spare
26	Digital input 4	Optocoupler	Spare
27	Digital input 5	Optocoupler	Block loss of mains (Vector jump and df/dt (ROCOF) only) (option A)
28	Com	Common	Common for terminals 24 to 27

The GPU monitors the energy production of each unit and it has pulse-outputs for kWh and kVARh measurement. The number of pulses depends on the nominal output of the generator as follows:

P_{nom}	< 100 kW →	1 pulse/kW
P_{nom}	100-1000 kW →	1 pulse/10 kW
P_{nom}	> 1000 kW →	1 pulse/100 kW

The pulse length is 1 s/pulse.

Slot #2, Serial communication (option H)

CAN-bus (Option H1):

Term.	Function	Description
29	CAN-H	The CAN-bus is based on CAN 2.0 B passive. The protocol is adapted for Deif use and can be provided. Contact Deif for further details.
30	GND	
31	CAN-L	
32	CAN-H	
33	GND	
34	CAN-L	
35	Not used	
36	Not used	

MOD-bus (Option H2):

Term.	Function	Description
29	DATA + (A)	
30	GND	
31	DATA - (B)	
32	DATA + (A)	
33	GND	
34	DATA - (B)	
35	Not used	
36	Not used	

The serial communication line should be terminated with a resistor equal to the cable impedance.

Use shielded twisted pair cable.

Slot #4, 2 x analogue transducer output (option F2)

These outputs are **active** outputs i.e. they use the internal power supply. The outputs are galvanically separated from each other and the rest of the unit. The individual output can be selected (in display or via PC programming software) to represent any AC measuring value and related values (e.g. power, power factor, frequency, etc.…).

For actual selection refer to the programming manual.

Via software selection, the outputs can be selected to be 0…20 mA or 4…20 mA.

The current output can if needed be converted to voltage using a resistor across the terminals (250 Ω will convert the 0 - 20 mA into 0 - 5 VDC).

The outputs can, by moving a jumper on the board, be selected to be +/- 20 mA if needed.

Term.	Function	Description
65	Not used	
66	0(4)…20 mA out	Analogue output 3
67	0	
68	Not used	
69	Not used	
70	0(4)…20 mA out	Analogue
71	0	
72	Not used	

Slot #5, AC measuring

Term.	Function	Technical description	Description
73	I L1 s1	Generator current L1	1/5 A AC input.
74	I L1 s2		
75	I L2 s1	Generator current L2	1/5 A AC input.
76	I L2 s2		
77	I L3 s1	Generator current L3	1/5 A AC input.
78	I L3 s2		
79	U L1	Generator voltage L1	Max. 690 VAC phase - phase value
80		Not used	
81	U L2	Generator voltage L2	Max. 690 VAC phase - phase value
82		Not used	
83	U L3	Generator voltage L3	Max. 690 VAC phase - phase value
84	U Neutral	Generator voltage neutral	For land-based applications only.
85	U L1	Busbar/mains voltage L1	Max. 690 VAC phase - phase value (options A or B only)
86		Not used	
87	U L2	Busbar/mains voltage L2	Max. 690 VAC phase - phase value (options A or B only)
88		Not used	
89	U L3	Busbar/mains voltage L3	Max. 690 VAC phase - phase value (options A or B only)

Note: Current inputs are galvanically separated. Max. 0.3 VA per phase.

Voltage measurements are available in 4 levels:

100 to 110 VAC
200 to 240 VAC
380 to 480 VAC
660 to 690 VAC

Voltage level to be defined when ordering, but can be changed on site.

Slot #6, analogue transducer output (option F1)

These outputs are **active** outputs i.e. they use the internal power supply. The outputs are galvanically separated from each other and the rest of the unit. The individual output can be selected (in display or via PC programming software) to represent any AC measuring value and related values (e.g. power, power factor, frequency, etc.…).

For actual selection refer to the programming manual.

Via software selection, the outputs can be selected to be 0…20 mA or 4…20 mA.

The current output can if needed be converted to voltage using a resistor across the terminals (250 Ω will convert the 0 - 20 mA into 0 - 5 VDC).

The outputs can, by moving a jumper on the board, be selected to be +/- 20 mA if needed.

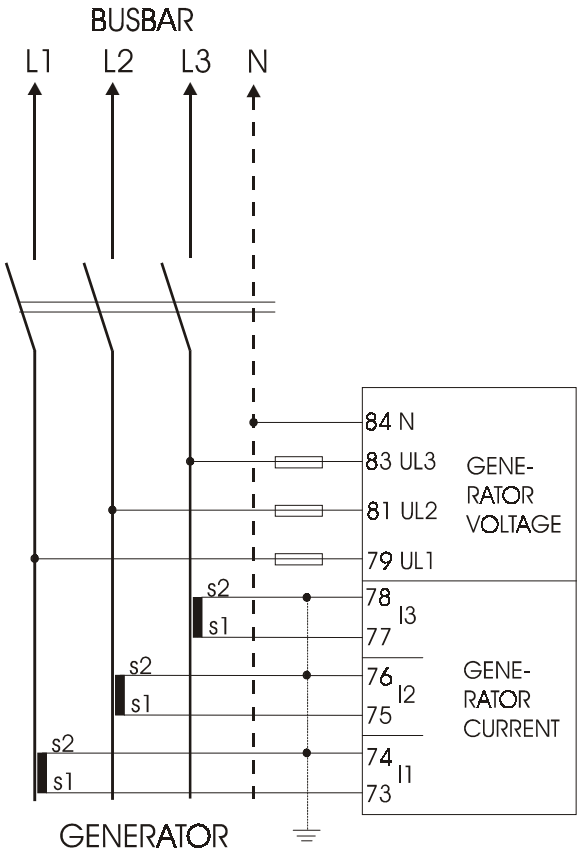
Term. Slot #6	Function	Description
90	Not used	
91	0	Analogue output 1, selectable.
92	0(4) - 20 mA out	
93	Not used	
94	Not used	
95	0	Analogue output 2, selectable.
96	(4) - 20 mA out	
97	Not used	

Slot #8, start/stop relay outputs (option G)

Term. Slot #6	Function	Technical data	Description
126	NO	Relay 10 250 VAC, 8A	Start signal at high generator load = CC
127	Com		
128	NO	Relay 11 250 VAC, 8A	Stop signal at low generator load = CC
129	Com		
130	Not used		
131	Not used		
132	Not used		
133	Not used		

Wirings

AC connections



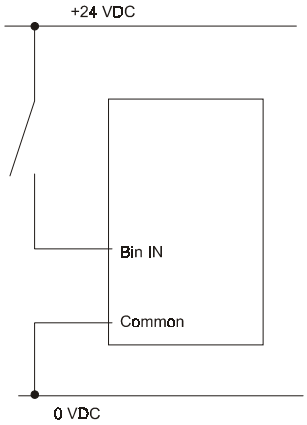
Notes: The neutral line (N) connection is not necessary for correct measurement. 3-phase without neutral is also possible.

The current transformers ground connection can be on s1 or s2 connection, whichever is preferred.

Fuses: 2A slow-blow.

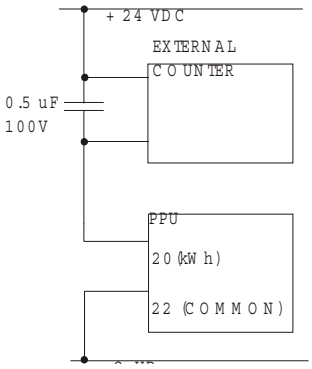
Binary inputs

All binary inputs are 24 VDC bi-directional optocoupler. Typical input is:



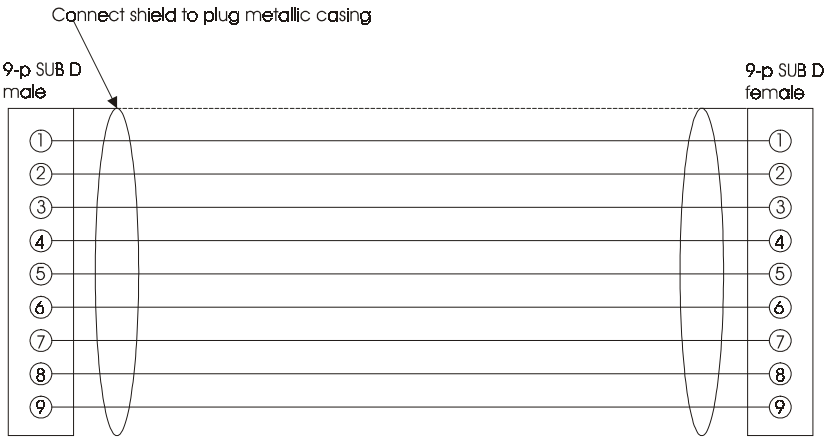
Optocoupler outputs for external counter

The kWh counter (terminals 21-23) and kvarh counter (terminals 21-22) outputs are low-power outputs. For that reason the following circuit must be applied:



Display I/F cable

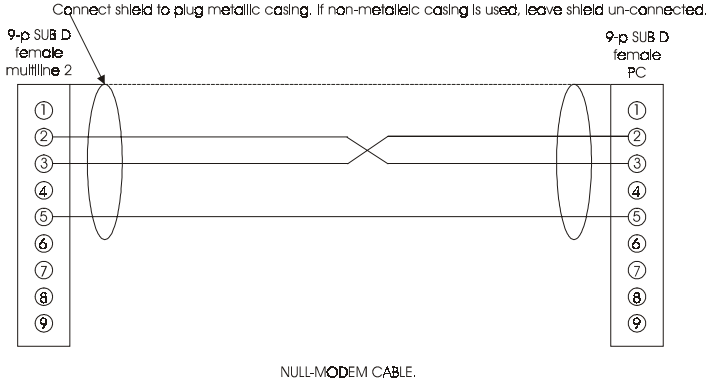
A standard computer extension cable can be used (9-pole SUB-D male / female plugs) or a cable can be tailored:



Wires min 0.22 mm^2, max cable length 3m.
Cable types: Belden 9540, BICC H8146, Brand Rex BE57540 or equivalent.

PC I/F cable

A standard computer null-modem cable can be used (9-pole SUB-D female / female plugs) or a cable can be tailored:

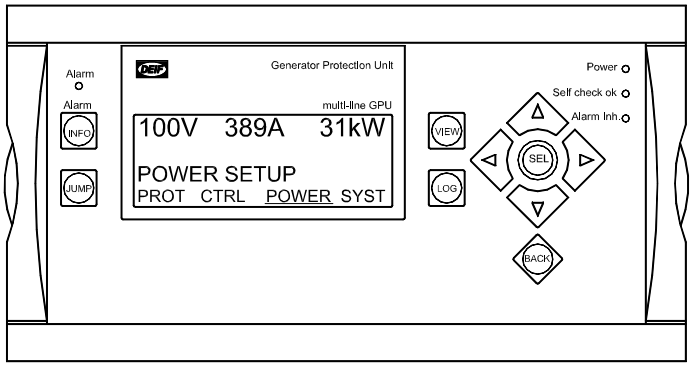


NULL-MODEM CABLE.

Display unit

The display unit used in multi-line 2 communicates and receives power supply via a 9-pole Sub-D plug. The plug fits directly onto the main unit, so the display can be mounted on the top of the main unit.

If the display is to be used as remote display, a standard computer extension cable with male / female plug can be used for the connection. Cable length 3 m.



Display dimensions HxWxD = 115 x 220 x 20 mm

Push-button functions

There are 10 pushbuttons on the display unit with the following functions:

INFO: Shifts the display 3 lower lines to show the alarm list (up to 30 alarms can be in the list).

JUMP: Enters a menu number selection. All settings have a specific number attached to it. Using the JUMP button enables the user to select and display any setting without navigating all the way through the menus (see later).

VIEW: Shifts the upper line displaying. The following values can be shown:
- 3 generator voltages (phase-to-phase)
- 3 generator currents
- Generator power factor and produced power (kW)
- Generator apparent power (VA) and reactive power (kvar)
- Generator L1 frequency and voltage

LOG: Shifts the display 3 lower lines to show the event and alarm list

 : Moves the cursor left for manoeuvring in the menus.

 : Increases the value of the selected set-point (in the setting menus). In the daily use display it is used for scrolling the second line displaying of generator values.

SEL: Is used to select the chosen function (underscored selection in the lower line of the display).

 : Decreases the value of the selected set-point (in the setting menus). In the daily use display it is used for scrolling the second line displaying of generator values.

ESC: Jumps backwards one step in the menu (to previous display).

 : Moves the cursor right for manoeuvring in the menus.

Display functions

First line in display (daily use display functions)

The first line is used to display generator and BUS values. Typically the line will show 2 or 3 different values at the same time The following line values can be seen:

- Generator voltage L1 L2 L3 (VAC)
- Generator current L1 L2 L3 (A)
- Generator Power Factor and active power (kW)
- Generator apparent power (kVA) and reactive power (kvar)
- Generator L1 frequency (Hz) and voltage (VAC)

Second line in display (daily use display)

The second line is a service line where various values can be shown. Scrolling is done using the  and  keys. The values available are:

For generator:
voltage L1-N (VAC)
voltage L2-N (VAC)
voltage L3-N (VAC)
voltage L1-L2 (VAC)
voltage L2-L3 (VAC)
voltage L3-L1 (VAC)
voltage max. (VAC)
voltage min. (VAC)
current L1 (A)
current L2 (A)
current L3 (A)
frequency L1 (Hz)
frequency L2 (Hz)
frequency L3 (Hz)
active power (kW)
reactive power (kvar)
apparent power (kVA)
energy counter (kWh)
power factor
voltage angle between L1-L2 (deg.)
voltage angle between L2-L3 (deg.)
voltage angle between L3-L1 (deg.)

Second line in display (menu system)

When entering the menu system, the second line in the display is used for information about which function (with function identifying number) is chosen.

Using the  and  keys will scroll through the settings.

Second line in display (alarm and event list)

When selecting the alarm (and event) list, the second line will display the latest alarm / event.

Using the  and  keys will scroll through the list.

Third line in display (daily use display)

The third line is an indication line. If no system messages are shown (e.g. "Synchronising"), the third line contains an explanation for the lower line selection of setup.

Third line in display (parameter menu display)

In the parameter menu, the third line indicates the present setting of the function in question, and, if changes are to be made, the max. and min. possible value for the setting.

Fourth line in display (daily use display)

In the daily use display, the fourth line is the entry selection for the parameter menu. If "SEL" is pressed, the selection of menu indicated with an underscore will be entered.

Choices are:

"PROT", protection setup
"SYST", system setup

The settings related to the setup can be seen in the paragraph "Menu overview", where the specific function numbers (related to the "JUMP" function) can be seen.

Fourth line in display (parameter menu display)

When entering the parameter menus, the first (entry) display uses the fourth line to select a sub-function for the parameter. What the selections are is dependent on the function selected.

Examples:

For protective function, the first entry shows the "BUS high volt 1" setting (provided the option is chosen). In this case the fourth line shows:

"LIM", setting of switch point
"DEL", setting of time delay
"RL", selection of which relay the function must activate.
"ACT", activate / de-activate the function.

For system setup, the first entry shows the "Nominal settings". In this case the fourth line shows:

"F", nominal frequency setting.
"P", nominal generator power setting.
"PF", nominal generator power factor setting.
"U", nominal generator voltage setting.

The above settings are used by the GPU to calculate nominal apparent power and current.

Menu overview

The following is the menu structure when entering settings of the GPU. If no entry has taken place before, the first display to appear is the password display. Enter the factory setting password to gain access to the menus.

If no actions have been taken within 30 seconds, the password entry will be de-activated, and a new password entry will be needed.

The menu overview is divided according to the daily use display selections in the fourth line ("PROT", "SYST".)

Password setting

The password setting falls outside the menu structure and can only be entered via the "JUMP" pushbutton.

Select no. 4976 to enter password setting and select your own password. Use the  and the  buttons to change the setting and the "SEL" button to store the new setting. **Beware:** Write down the new password. If you forget it entering the menus will not be possible.

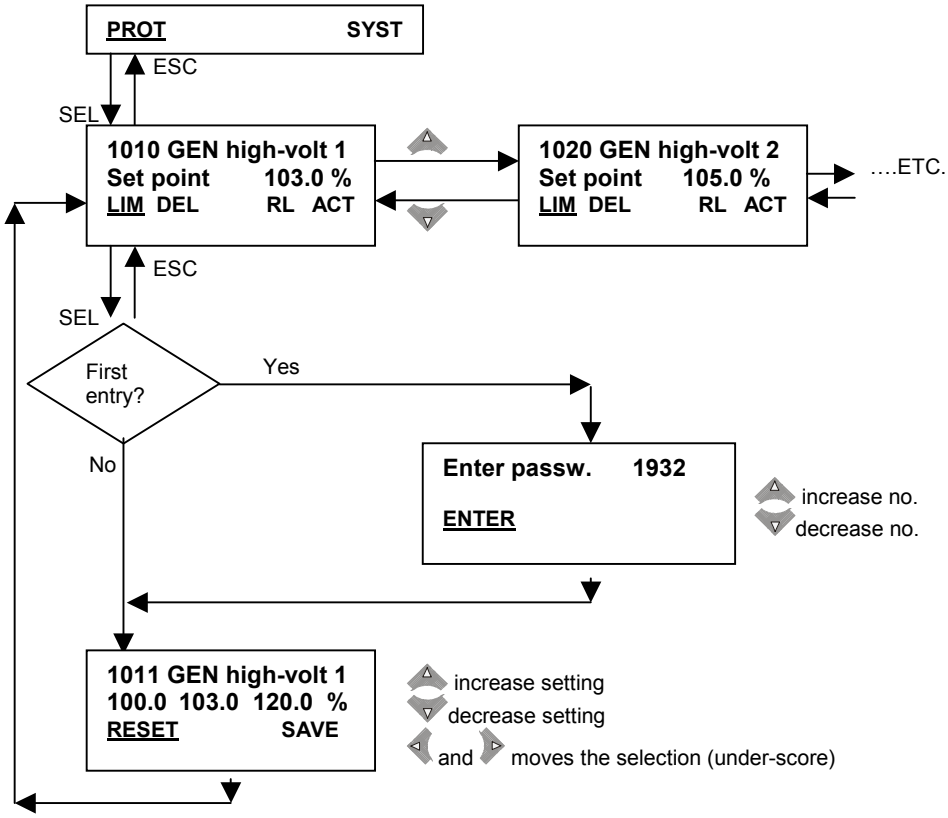
Navigating in the menus

The menu navigating starts from the daily use display fourth line and is carried out from there using the "SEL", , , , and "ESC" pushbuttons.

Setup menu system

The following is an example, but all menus operate in the same manner.

Starting from the daily use display fourth line, select the menu indicated with underscore:
(move the underscore with the and pushbuttons)



Menu set-points

The following lists are in numerical order, i.e. the set-points and timers appear acc. to the given number.

Protections

Voltage protection option A or B

Voltage selections relate to nominal phase – to phase voltage

No.	Setting		Min. setting	Max. setting	Factory setting
1010	BUS high volt 1	Selection display	-	-	-
1011	BUS high volt 1	Set-point	100.0%	120.0%	103.0%
1012	BUS high volt 1	Time	0.0s	100.0s	10.0s
1013	BUS high volt 1	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1014	BUS high volt 1	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1015	BUS high volt 1	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1020	BUS high volt 2	Selection display	-	-	-
1021	BUS high volt 2	Set-point	100.0%	120.0%	105.0%
1022	BUS high volt 2	Time	0.0s	100.0s	5.0s
1023	BUS high volt 2	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1024	BUS high volt 2	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1025	BUS high volt 2	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1030	BUS low volt 1	Selection display	-	-	-
1031	BUS low volt 1	Set-point	80.0%	100.0%	97.0%
1032	BUS low volt 1	Time	0.0s	100.0s	10.0s
1033	BUS low volt 1	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1034	BUS low volt 1	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1035	BUS low volt 1	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1040	BUS low volt 2	Selection display	-	-	-
1041	BUS low volt 2	Set-point	80.0%	100.0%	95.0%
1042	BUS low volt 2	Time	0.0s	100.0s	5.0s
1043	BUS low volt 2	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1044	BUS low volt 2	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1045	BUS low volt 2	Enable	OFF	ON	OFF

Frequency protection option A or B

Frequency settings relate to nominal frequency setting.

No.	Setting		Min. setting	Max. setting	Factory setting
1050	BUS high freq. 1	Selection display	-	-	-
1051	BUS high freq. 1	Set-point	100.0%	110.0%	103.0%
1052	BUS high freq. 1	Time	0.0s	100.0s	10.0s
1053	BUS high freq. 1	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1054	BUS high freq. 1	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1055	BUS high freq. 1	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1060	BUS high freq. 2	Selection display	-	-	-
1061	BUS high freq. 2	Set-point	100.0%	110.0%	105.0%
1062	BUS high freq. 2	Time	0.0s	100.0s	5.0s
1063	BUS high freq. 2	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1064	BUS high freq. 2	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1065	BUS high freq. 2	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1070	BUS low freq. 1	Selection display	-	-	-
1071	BUS low freq. 1	Set-point	90.0%	100.0%	97.0%
1072	BUS low freq. 1	Time	0.0s	100.0s	10.0s
1073	BUS low freq. 1	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1074	BUS low freq. 1	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1075	BUS low freq. 1	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1080	BUS low freq. 2	Selection display	-	-	-
1081	BUS low freq. 2	Set-point	90.0%	100.0%	95.0%
1082	BUS low freq. 2	Time	0.0s	100.0s	5.0s
1083	BUS low freq. 2	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1084	BUS low freq. 2	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1085	BUS low freq. 2	Enable	OFF	ON	OFF

Generator reverse power protection

Reverse power settings relate to nominal power setting.

No.	Setting		Min. setting	Max. setting	Factory setting
1090	Reverse power	Selection display	-	-	-
1091	Reverse power	Set-point	-50.0%	0.0%	-5.0%
1092	Reverse power	Time	0.0s	100.0s	10.0s
1093	Reverse power	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1094	Reverse power	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1095	Reverse power	Enable	OFF	ON	ON

Generator overcurrent protection

Settings relate to nominal generator current.

No.	Setting		Min. setting	Max. setting	Factory setting
1100	Overcurrent 1	Selection display	-	-	-
1101	Overcurrent 1	Set-point	50.0%	200.0%	115.0%
1102	Overcurrent 1	Time	0.0s	100.0s	10.0s
1103	Overcurrent 1	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1104	Overcurrent 1	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1105	Overcurrent 1	Enable	OFF	ON	ON

No.	Setting		Min. setting	Max. setting	Factory setting
1110	Overcurrent 2	Selection display	-	-	-
1111	Overcurrent 2	Set-point	50.0%	200.0%	120.0%
1112	Overcurrent 2	Time	0.0s	100.0s	5.0s
1113	Overcurrent 2	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1114	Overcurrent 2	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1115	Overcurrent 2	Enable	OFF	ON	ON

Generator overload protection option C

Settings relate to nominal power setting.

No.	Setting		Min. setting	Max. setting	Factory setting
1160	Overload 1	Selection display	-	-	-
1161	Overload 1	Set-point	10.0%	200.0%	100.0%
1162	Overload 1	Time	0.0s	100.0s	10.0s
1163	Overload 1	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1164	Overload 1	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1165	Overload 1	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1170	Overload 2	Selection display	-	-	-
1171	Overload 2	Set-point	10.0%	200.0%	110.0%
1172	Overload 2	Time	0.0s	100.0s	5.0s
1173	Overload 2	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1174	Overload 2	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1175	Overload 2	Enable	OFF	ON	OFF

Generator current unbalance protection option C

Settings relate to nominal generator current.

No.	Setting		Min. setting	Max. setting	Factory setting
1220	Current unbalance	Selection display	-	-	-
1221	Current unbalance	Set-point	0.0%	100.0%	30.0%
1222	Current unbalance	Time	0.0s	100.0s	10.0s
1223	Current unbalance	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1224	Current unbalance	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1225	Current unbalance	Enable	OFF	ON	OFF

Generator voltage unbalance protection option C

Settings relate to nominal generator voltage.

No.	Setting		Min. setting	Max. setting	Factory setting
1230	Voltage unbalance	Selection display	-	-	-
1231	Voltage unbalance	Set-point	0.0%	50.0%	10.0%
1232	Voltage unbalance	Time	0.0s	100.0s	10.0s
1233	Voltage unbalance	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1234	Voltage unbalance	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1235	Voltage unbalance	Enable	OFF	ON	OFF

Generator reactive power import (loss of excitation) protection option C

Settings relate to nominal generator power value (kW).

No.	Setting		Min. setting	Max. setting	Factory setting
1240	var import	Selection display	-	-	-
1241	var import	Set-point	0.0%	150.0%	50.0%
1242	var import	Time	0.0s	100.0s	10.0s
1243	var import	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1244	var import	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1245	var import	Enable	OFF	ON	OFF

Generator reactive power export (overexcitation) protection option C

Settings relate to nominal generator power value (kW).

No.	Setting		Min. setting	Max. setting	Factory setting
1250	var export	Selection display	-	-	-
1251	var export	Set-point	0.0%	100.0%	60.0%
1252	var export	Time	0.0s	100.0s	10.0s
1253	var export	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1254	var export	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1255	var export	Enable	OFF	ON	OFF

Loss of mains protection option A

Df/dt (ROCOF) **NOTE:** Time delay is in periods (per)

No.	Setting		Min. setting	Max. setting	Factory setting
1260	Df/dt (ROCOF)	Selection display	-	-	-
1261	Df/dt (ROCOF)	Set-point	0.1 Hz/s	10.0 Hz/s	5.0 Hz/s
1262	Df/dt (ROCOF)	Time	0 per	99 per	6 per
1263	Df/dt (ROCOF)	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1264	Df/dt (ROCOF)	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1265	Df/dt (ROCOF)	Enable	OFF	ON	OFF

Vector Jump

No.	Setting		Min. setting	Max. setting	Factory setting
1270	Vector jump	Selection display	-	-	-
1271	Vector jump	Set-point	1.0 deg.	90.0 deg.	10.0 deg.
1272	Vector jump	Time	No delay (immediate trip)		
1273	Vector jump	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1274	Vector jump	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1275	Vector jump	Enable	OFF	ON	OFF

The alarm inhibit lamp is flashing in case of loss of mains.

Generator voltage protection options A and B

No.	Setting		Min. setting	Max. setting	Factory setting
1310	DG high volt 1	Selection display	-	-	-
1311	DG high volt 1	Set-point	100%	120%	103%
1312	DG high volt 1	Delay	0.0s	100.0s	10.0s
1313	DG high volt 1	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1314	DG high volt 1	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1315	DG high volt 1	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1320	DG high volt 2	Selection display	-	-	-
1321	DG high volt 2	Set-point	100%	120%	105%
1322	DG high volt 2	Delay	0.0s	100.0s	5.0s
1323	DG high volt 2	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1324	DG high volt 2	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1325	DG high volt 2	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1330	DG low volt 1	Selection display	-	-	-
1331	DG low volt 1	Set-point	80%	100%	97%
1332	DG low volt 1	Delay	0.0s	100.0s	10.0s
1333	DG low volt 1	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1334	DG low volt 1	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1335	DG low volt 1	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1340	DG low volt 2	Selection display	-	-	-
1341	DG low volt 2	Set-point	80%	100%	95%
1342	DG low volt 2	Delay	0.0s	100.0s	5.0s
1343	DG low volt 2	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1344	DG low volt 2	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1345	DG low volt 2	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1350	DG high freq. 1	Selection display	-	-	-
1351	DG high freq. 1	Set-point	100%	110%	103%
1352	DG high freq. 1	Delay	0.0s	100.0s	10.0s
1353	DG high freq. 1	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1354	DG high freq. 1	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1355	DG high freq. 1	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1360	DG high freq. 2	Selection display	-	-	-
1361	DG high freq. 2	Set-point	100%	110%	105%
1362	DG high freq. 2	Delay	0.0s	100.0s	5.0s
1363	DG high freq. 2	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1364	DG high freq. 2	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1365	DG high freq. 2	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1370	DG low freq. 1	Selection display	-	-	-
1371	DG low freq. 1	Set-point	90%	100%	97%
1372	DG low freq. 1	Delay	0.0s	100.0s	10.0s
1373	DG low freq. 1	Relay output	R0 (None)	R5 (relay 5)	R2 (relay 2)
1374	DG low freq. 1	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1375	DG low freq. 1	Enable	OFF	ON	OFF

No.	Setting		Min. setting	Max. setting	Factory setting
1380	DG low freq. 2	Selection display	-	-	-
1381	DG low freq. 2	Set-point	90%	100%	95%
1382	DG low freq. 2	Delay	0.0s	100.0s	5.0s
1383	DG low freq. 2	Relay output	R0 (None)	R5 (relay 5)	R1 (relay 1)
1384	DG low freq. 2	Relay output	R0 (None)	R5 (relay 5)	R0 (None)
1385	DG low freq. 2	Enable	OFF	ON	OFF

Load dependent start/stop of next generator option G

The relay outputs for start next and stop next are placed in the optional relay output board in slot #8.

Start next generator: Relay 10, terminals 126-127, normally open.

No.	Setting		Min. setting	Max. setting	Factory setting
3010	Start next gen.	Selection display	-	-	-
3011	Start next gen.	Start point	0%	100%	80%
3012	Start next gen.	Timer	0 s	100 s	10 s
3015	Start next gen.	Enable	OFF	ON	ON

Stop next generator: Relay 11, terminals 127-128, normally open.

No.	Setting		Min. setting	Max. setting	Factory setting
3020	Stop next gen.	Selection display	-	-	-
3021	Stop next gen.	Stop point	0%	50%	20%
3022	Stop next gen.	Timer	0 s	200 s	30 s
3025	Stop next gen.	Enable	OFF	ON	ON

Nominal Settings

No.	Setting		Min. setting	Max. setting	Factory setting
4010	Nominal settings	Selection display	-	-	-
4016	Nominal settings	Frequency	48.0 Hz	62.0 Hz	60.0 Hz
4017	Nominal settings	Generator Power	10 kW	99 MW	480 kW
4018	Nominal settings	Generator current	0 A	9000 A	787 A
4019	Nominal settings	Generator volt	100 V	25000 V	440 V

Transformer

Voltage transformer: If no voltage transformer is present, the primary and secondary side values are set to generator nominal value.

No.	Setting		Min. setting	Max. setting	Factory setting
4020	Transformer	Selection display	-	-	-
4026	Transformer	Volt prim	100 V	25000 V	440 V
4027	Transformer	Volt sec	100 V	690 V	440 V
4028	Transformer	Current prim	5 A	9000 A	1000 A
4029	Transformer	Current sec	1 A	5 A	5A

Control settings

No.	Setting		Min. setting	Max. setting	Factory setting
4030	Control settings	Selection display	-	-	-
4031	Control settings	Power set	0%	100%	100%
4032	Control settings	var set	0%	100%	30%
4033	Control settings	PF set	0.6	1.0	0.9

Communication control enable/disable control (option H)

No.	Setting		Min. setting	Max. setting	Factory setting
4040	Comm. control	Selection display	-	-	-
4041	Comm. control	Power	OFF	ON	OFF
4042	Comm. control	Frequency	OFF	ON	OFF
4043	Comm. control	Voltage	OFF	ON	OFF
4044	Comm. control	var	OFF	ON	OFF
4045	Comm. control	PF	OFF	ON	OFF
4046	Comm. control	Mode selections	OFF	ON	OFF

NOTE: Selecting Communication control ON will overrule external and internal settings.

External communication control (option H)

No.	Setting		Min. setting	Max. setting	Factory setting
4050	External comm.	Selection display	-	-	-
4051	External comm.	ID	1	247	1
4052	External comm.	19200 Baud	OFF	ON	OFF

External communication control (option H)

No.	Setting		Min. setting	Max. setting	Factory setting
4090	External comm. error	Selection display	-	-	-
4091	External comm. error	Delay	1.0 s	100.0 s	10.0 s
4092	External comm. error	Relay output	R0 (None)	R4 (relay 4)	R1 (relay 1)
4093	External comm. error	Relay output	R0 (None)	R4 (relay 4)	R0 (None)
4094	External comm. error	Enable	OFF	ON	OFF

Date and time (internal clock) setting

No.	Setting		Min. setting	Max. setting	Factory setting
4100	Date and time	Selection display	-	-	-
4101	Date and time	Year	These settings have no practical limit. Factory settings will be present date and time in Denmark when produced.		
4102	Date and time	Month			
4103	Date and time	Date			
4104	Date and time	Hour			
4105	Date and time	Minute			

Auto detection of running signal (option B)

No.	Setting		Min. setting	Max. setting	Factory setting
4110	Auto detection run	Selection display	-	-	-
4111	Auto detection run	Auto det. run	OFF	ON	OFF

The voltage and frequency alarms are inhibited when the measurements are under 30% of the nominal values.

Battery undervoltage alarm

No.	Setting		Min. setting	Max. setting	Factory setting
4220	Battery low V	Selection display	-	-	-
4226	Battery low V	Set-point	15.0 V	24.0 V	18.0 V
4227	Battery low V	Time	0.0s	10s	1.0s
4228	Battery low V	Relay output	R0 (None)	R5 (relay 5)	R0 (no relay)

Language

No.	Setting		Min. setting	Max. setting	Factory setting
4230	German language	Selection display	-	-	-
4231	German language	Language	OFF	ON	OFF

Analogue output option F1 and F2

The analogue output option consists of 2 independent 0(4)…20 mA outputs. Re-configured hardware can enable a –20…0…+20 mA output, but this is special.

Each of the 2 outputs can be chosen to represent any of the following values.

Power (P kW) output

No.	Setting		Min. setting	Max. setting (option F1)	Max. setting (option F2)	Factory setting
4500	Power output	Selection display	-	-	-	-
4501	Power output	Analogue out. no.	0	2	4	0
4502	Power output	Type	0-20 mA	4-20 mA		4-20 mA
4503	Power output	Max. value	0 kW	99 MW		500 kW
4504	Power output	Min. value	-99 MW	99 MW		0 kW

Apparent Power (S kVA) output

No.	Setting		Min. setting	Max. setting (option F1)	Max. setting (option F2)	Factory setting
4510	S output	Selection display	-	-	-	-
4511	S output	Analogue out. no.	2	2	4	0
4512	S output	Type	0-20 mA	4-20 mA		4-20 mA
4513	S output	Max. value	0 kVA	99 MVA		600 kVA
4514	S output	Min. value	-99 MVA	99 MVA		0 kVA

Reactive Power (Q kvar) output

No.	Setting		Min. setting	Max. setting (option F1)	Max. setting (option F2)	Factory setting
4520	Q output	Selection display	-	-	-	-
4521	Q output	Analogue out. no.	0	2	4	0
4522	Q output	Type	0-20 mA	4-20 mA		4-20 mA
4523	Q output	Max. value	0 kvar	99 Mvar		400 kvar
4524	Q output	Min. value	-99 Mvar	99 Mvar		0 kvar

Power factor (PF) output

No.	Setting		Min. setting	Max. setting (option F1)	Max. setting (option F2)	Factory setting
4530	PF output	Selection display	-	-	-	-
4531	PF output	Analogue out. no.	0	2	4	0
4532	PF output	Type	0-20 mA	4-20 mA		4-20 mA
4533	PF output	Max. value	0.6	1		0.8
4534	PF output	Min. value	-0.6	1		-0.8

Frequency output

No.	Setting		Min. setting	Max. setting (option F1)	Max. setting (option F2)	Factory setting
4540	Freq. output	Selection display	-	-	-	-
4541	Freq. output	Analogue out. no.	0	2	4	0
4542	Freq. output	Type	0-20 mA	4-20 mA		4-20 mA
4543	Freq. output	Max. value	0 Hz	70 Hz		55 Hz
4544	Freq. output	Min. value	0 Hz	70 Hz		45 Hz

Voltage output

The voltage output represents the L1-L2 voltage.

No.	Setting		Min. setting	Max. setting (option F1)	Max. setting (option F2)	Factory setting
4550	Voltage outp.	Selection display	-	-	-	-
4551	Voltage outp.	Analogue out. no.	0	2	4	0
4552	Voltage outp.	Type	0-20 mA	4-20 mA		4-20 mA
4553	Voltage outp.	Max. value	0 V	28000 V		500 V
4554	Voltage outp.	Min. value	0 V	28000 V		0 V

Current output

The current output represents the L1 current

No.	Setting		Min. setting	Max. setting (option F1)	Max. setting (option F2)	Factory setting
4560	Current outp.	Selection display	-	-	-	-
4561	Current outp.	Analogue out. no.	0	2	4	0
4562	Current outp.	Type	0-20 mA	4-20 mA		4-20 mA
4563	Current outp.	Max. value	0 A	9000 A		1000 A
4564	Current outp.	Min. value	0 A	9000 A		0 A

User password

Unlike all other settings, the user password can only be entered using the "JUMP" pushbutton.

No.	Setting		Min. setting	Max. setting	Factory setting
4976	User password	Setting	0	32000	2000

Service menu

No.	Setting		Description
4980	Service menu	Selection display	
4981	Service menu	Alarm	Shows remaining time
4982	Service menu	Digital input	Shows input status
4983	Service menu	Digital output	Shows output status

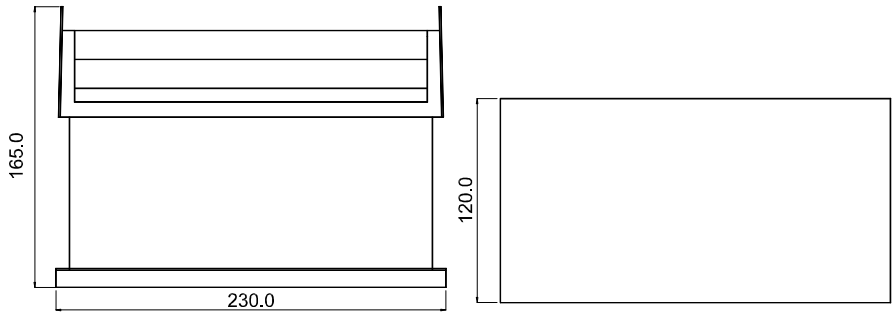
General data

Technical specifications

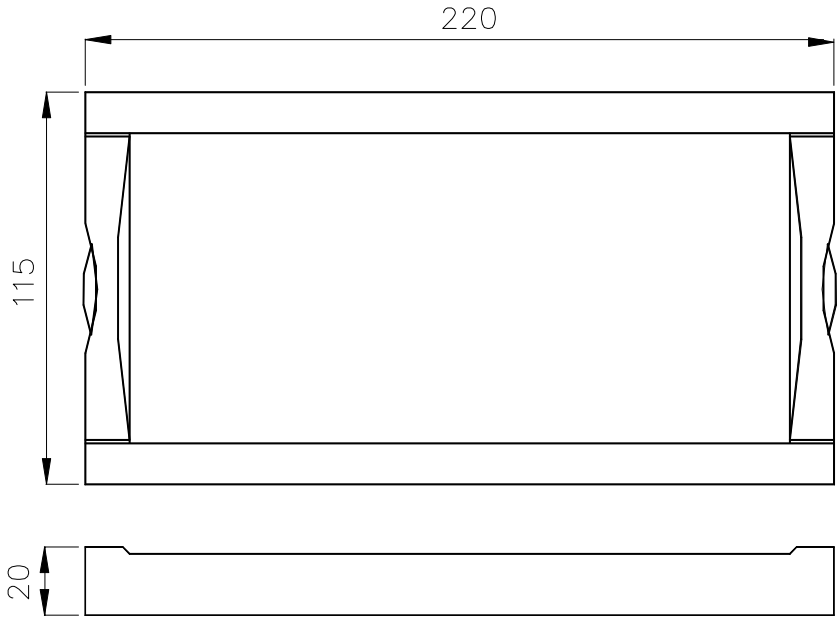
Accuracy:	Class 1.0 acc. to IEC 688
Operating temp.:	-20…70 °C
Aux. supply:	24 VDC -25 / +30%
Measuring voltage:	100…690 VAC
Frequency:	30…70 Hz
Measuring current:	From current transformers ../1 A or ../5A. Load max. 0.3 VA per phase.
Binary inputs:	Input voltage 12…32 VDC, impedance 2.4 kΩ, bi-directional.
Open collector outputs :	Supply voltage 12…32 VDC. Load max. 10 mA
Load sharing lines:	+/- 5 VDC
Analog inputs:	+/- 10 VDC, impedance 100 kΩ (not galvanically separated).
Relay outputs:	250V/8A or 24VDC/1A. Refer to actual description of I/O's.
Safety:	To EN 61010-1 Installation category (overvoltage category) III, 600V, pollution degree 2.
Galvanic separation:	Between AC voltage, AC current and other I/O's: 3250VAC – 50 Hz – 1 min. Between analogue outputs: 500VDC – 1 min.
EMC / CE:	Acc. to EN-50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.
Type approval:	DNV, GL, LR and ABS for use in unmanned machinery space.
Material:	All plastic parts are self-extinguishing to UL94 (V1).
Climate:	HSE, to DIN 40040.
Connections:	4 mm^2 multi stranded for AC currents, all others 2.5 mm^2 multi stranded.
Response times:	From the setpoint is reached till output signal is active. Frequency: 70-100 ms Current: 70-100 ms Voltage: 70-100 ms Rocof: 100 ms (Rocof time delay no. 1262 = 4 periods) Vector jump: 30 ms

Protection:	Case: IP40. Terminals: IP20. Operator panel: IP 52 (IP54 when mounted with gasket). To IEC 529 and EN 60529.
Mounting:	Base mounted with six screws or DIN rail mounted. If DIN rail mounted in marine applications, additional means against excessive mechanical vibrations must be used.

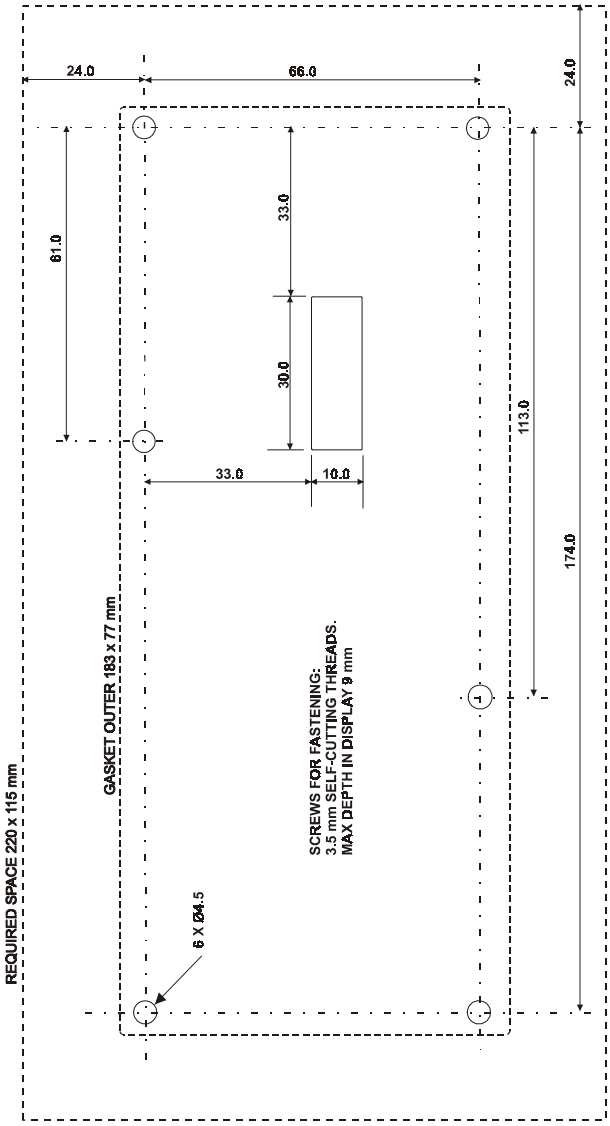
Unit Dimensions



Display dimensions



Panel cutout for display



Errors and changes excepted