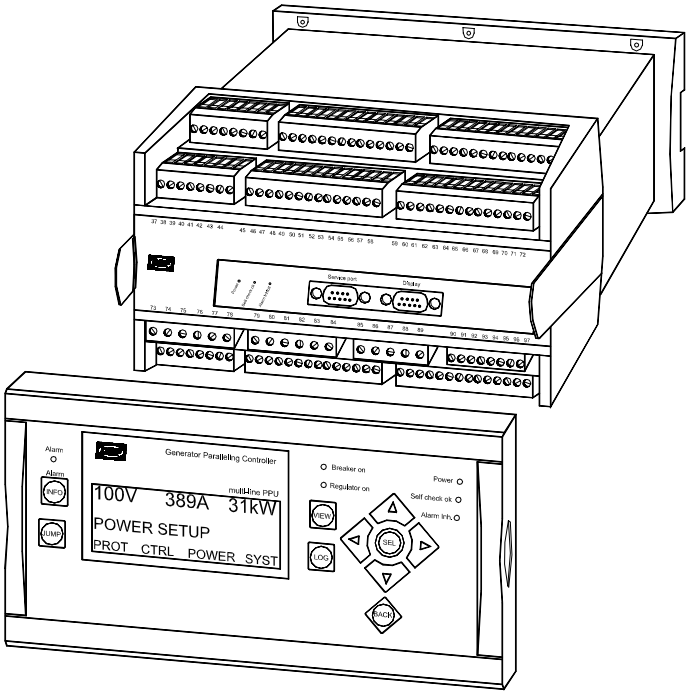
DEIF A/S

Designers Reference Handbook

multi-line 2 – version 2

4189340265B



- *Compact system in one unit*
  - *dynamic synchronisation*
  - *load sharing*
  - *generator protection*
- *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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INDEX:

This manual is valid for standard multi-line 2 PPU/GPU/GPC units with application software version 2.10.0 or later.

This can be identified by the label text where version 2.10.0 or later will be identified with version 2 (e.g. PPU/2) and the version indication on the display.

1 Warnings and legal information

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

Installing and operating the multi-line 2 units implies work with dangerous currents and voltages, and therefore only qualified personnel should do it.

During the installation care must be taken to protect the terminals against static discharges. Once the units are 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 units are measuring, the company responsible for the installation or the operation must be contacted.

The multi-line 2 units are not to be opened by unauthorized personnel. If opened anyway, the warranty will be lost.

2 Standard functions

The multi-line 2 is a protection and/or control unit for a generator driven by a diesel/gas engine or a turbine. It will carry out all necessary tasks to control and protect a generator, regardless of the use of the generator. This means that the multi-line 2 can be used for several application types such as:

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

The multi-line 2 measuring system is true RMS 3-phase measurement of generator voltage, generator current and bus (mains) voltage.

2.1 Language

English, German, French or Spanish language can be chosen via the system menu structure.

2.2 Standard control functions (GPC and PPU only)

- Static synchronisation
- Dynamic synchronisation
    - Frequency matching
    - Voltage check
    - Breaker delay time compensation
    - Check phase sequence
- Fixed load (base load) running of the generator
- Fixed frequency running of a stand-alone generator
- Load sharing between generators with power and frequency control
- Relay outputs for speed governor
- Relay outputs to close/open generator breaker
- Adjustable ramp up/down of generator load
- Relay outputs for start/stop of next generator (high/low load) – GPC only

2.3 Generator protection functions

Protective functions can be selected to activate one or two of the configurable relays:

- GPU 4 configurable relays (standard)
- GPC 8 configurable relays (standard)
- PPU 8 configurable relays (standard)

Up to 13 relays can be available depending on the options selection. Please refer to separate description of the relevant option.

The standard protection functions in all units are:

- Reverse power (inverse or definite characteristic)
- Overcurrent (2 levels) (definite characteristic)
- Overcurrent (1 level) (inverse characteristic)

3 Options

For available options of the multi-line 2 – please see the relevant data sheet.

4 AC voltage measuring systems available

2 different systems can be used. A system which is not galvanically separated and one which is galvanically separated:

- Not galvanically separated: On the unit label the name (GPU/PPU/GPC) will be followed by / 2. These units have AC voltage measurements which are not separated from each other (generator and busbar voltages), but from the other inputs/outputs.
- Galvanically separated: On the unit label the name (GPU/PPU/GPC) will be followed by / 2 / GS.These units have AC voltage measurements which are separated from each other (generator and busbar voltages) and from the other inputs/outputs. For these units a busbar neutral input is added.

For both systems: Neutral connection is possible, but not required for marine installations (and others). For land installations where neutral is present, it is recommended to use the neutral input.

5 Hardware

The multi-line 2 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:

	Terminal	**GPU**	**GPC**	**PPU**
Slot #1	1-28	Standard	Standard	Standard
Slot #2	29-36	Option H1, H2, H3	Option H1, H2, H3	Option H1, H2, H3
Slot #3	37-64	Option D, M12	Standard	Standard
Slot #4	65-72	Outputs for governor/AVR acc. to choice of types	Outputs for governor/AVR acc. to choice of types	Outputs for governor/AVR acc. to choice of types
Slot #5	73-89	Standard	Standard	Standard
Slot #6	90-125	Option F1, F2	Option F1, F2	Option F1, F2
Slot #7	98-125	Option M1, M2	Option M1, M2	Option M1, M2
Slot #8	126-133	Option H4, M14, G1	Option H4, M14, M15	Option H4, M14
Slot #9	RJ45 conn.	Option N1	Option N1	Option N1

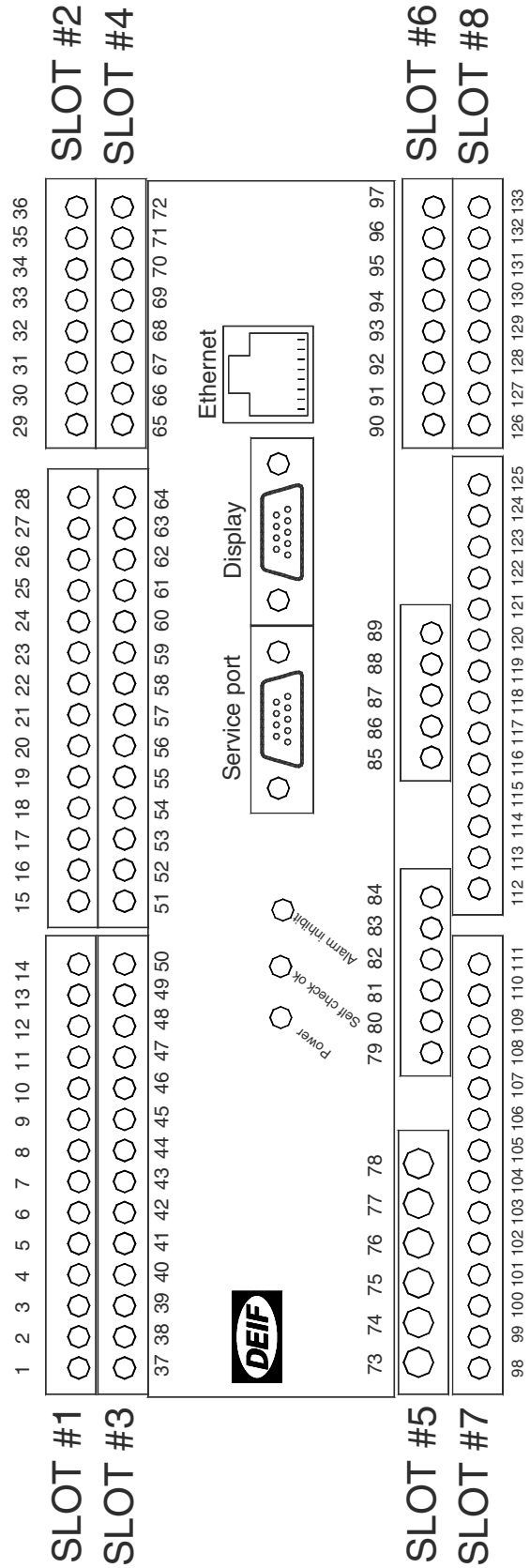
Besides the slots there is an additional board where the communication ports are placed. I.e. RS232 PC service port for the utility software and the display port.

NOTE:
For slots #1, #3, #5, #7 and #9: Only specific boards can be mounted.
For slots #2, #6 and #8: The boards are interchangeable.

Slot #4 in the GPC/PPU can be configured according to choice as:

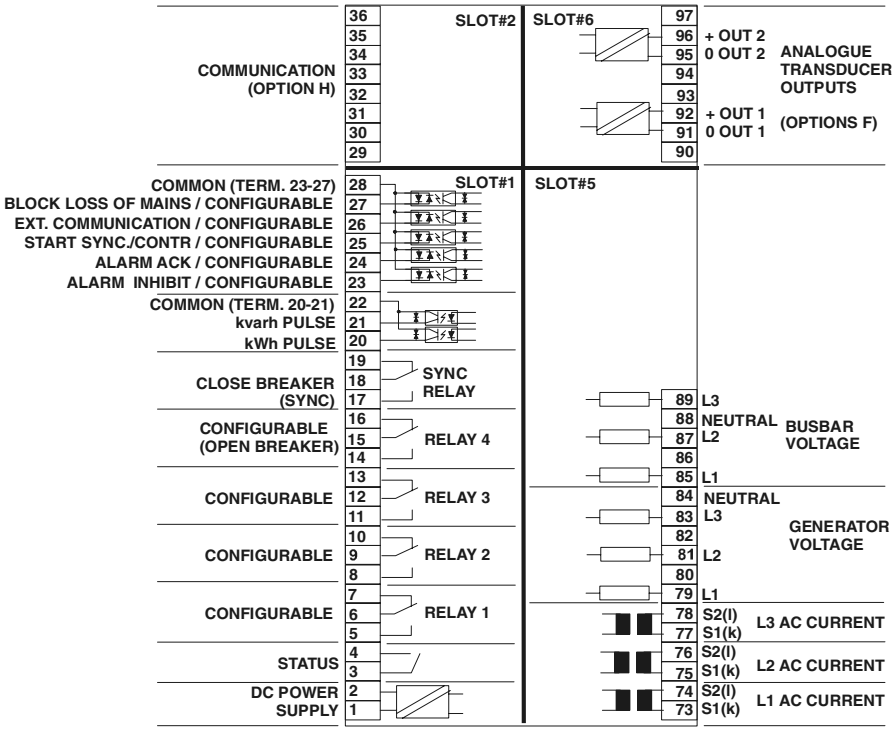
- 2 x relay outputs for Governor and 2 x relay outputs for AVR (standard hardware, if AVR is to be controlled option D must be chosen)
- 1 x +/- 20 mA output for Governor and 1 x +/- 20 mA output for AVR (if AVR is to be controlled option D must be chosen)
- 1 x +/- 20 mA output for Governor and 2 x relay outputs for AVR (if AVR is to be controlled option D must be chosen)
- 2 x relay outputs for Governor and 1 x +/- 20 mA output for AVR (if AVR is to be controlled option D must be chosen)
- 1 x PWM output for CAT Governor and 1 x +/- 20 mA output for AVR (if AVR is to be controlled option D must be chosen)
- 1 x PWM output for CAT Governor and 2 x relay outputs for AVR (if AVR is to be controlled option D must be chosen)

An overview of the terminals can be seen below. The slots are positioned in the unit as follows (seen from the top of the unit):

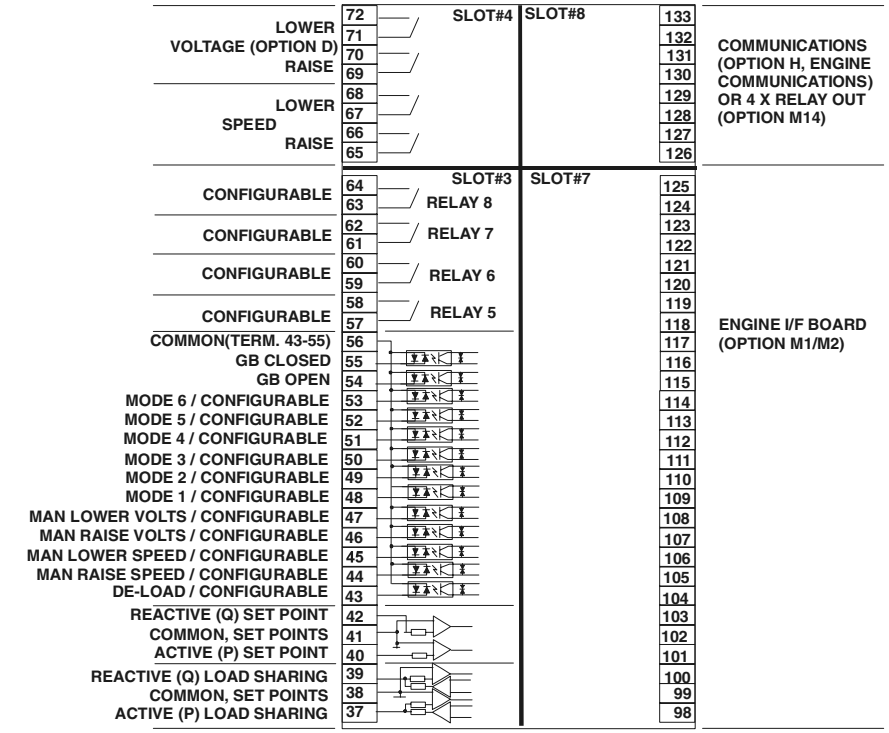


5.1 Terminal strip overview (GPC/PPU)

5.1.1 Slots #1, #2, #5 and #6



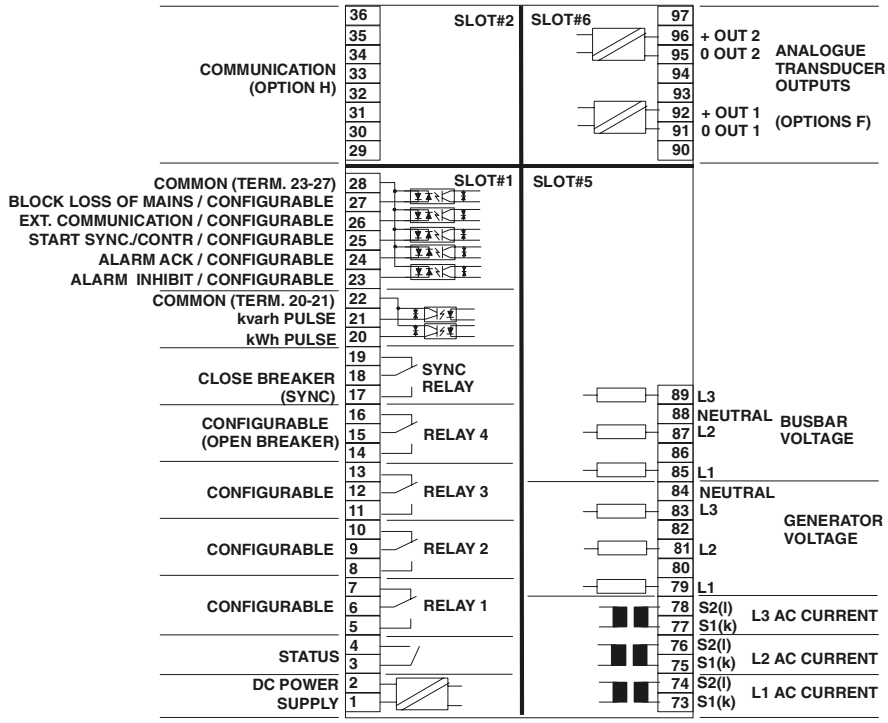
5.1.2 Slots #3, #4, #7 and #8



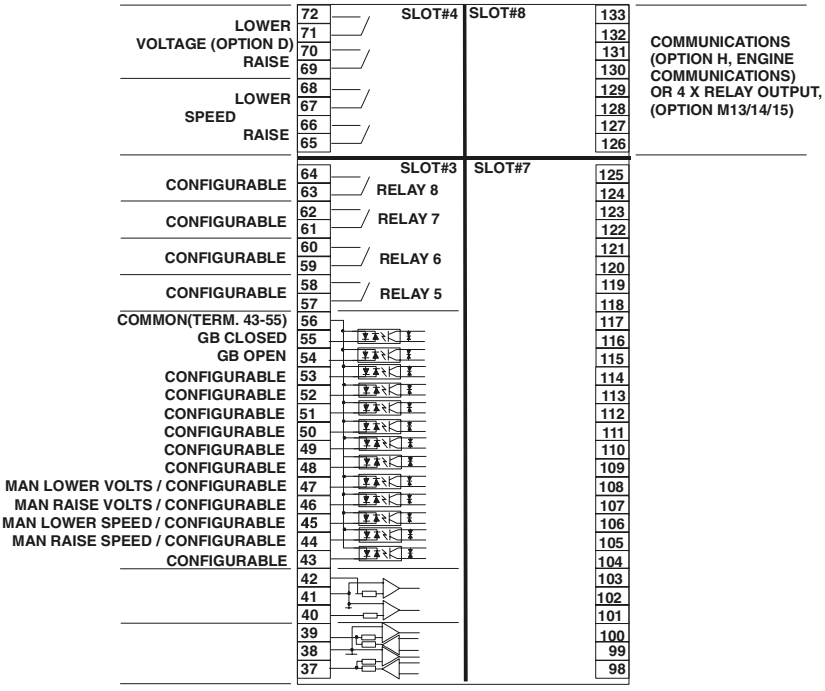
NOTE:
Busbar neutral measurement is only available in type 2/GS (galvanically separated) units.
Slots #7 and/or #8 are only mounted if the related options (7: M (engine), 8: H4 (engine comms.) or M14 (4 x relays)) are chosen.
The inputs on terminals 23-27 and 43-53 are as default set to have the function indicated. If the function is not used, the input can, via PC software, be chosen to be used as alarm inputs instead.

5.2 Terminal strip overview (GPU)

5.2.1 Slots #1, #2, #5 and #6



5.2.2 Slots #3, #4, #7 and #8



NOTE:
Busbar neutral measurement is only available in type 2/GS (galvanically separated) units.
Speed and AVR outputs (slot #4) and slot #3 are only mounted when option G2 is chosen. When G2 is not chosen, the position can be used for analogue transducer outputs.
Slots #7 and/or #8 are only mounted if the related options (7: M (engine), 8: H4 (engine comms.), M13 (7 x binary inputs), M14 (4 x relays) or M15 (4 x 4…20 mA inputs)) are chosen.
The inputs on terminals 23-27 and 43-53 are as default set to have the function indicated. If the function is not used, the input can, via PC software, be chosen to be used as alarm inputs instead.

5.3 Terminal strip, explanation

For the relay outputs the 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

5.3.1 Slot #1, power supply and binary I/O (GPC/PPU)

Standard board (always needed):

Term.	Function	Technical data	Description
1	+12/24 VDC	12/24 VDC -25/+30%	Power supply
2	0 VDC		
3	NC	Status relay 24 V/1 A	Normally closed relay, processor/power supply status supervision
4	Com.		
5	NO	Relay 1 250 VAC/8 A	Configurable
6	Com.		
7	NC		
8	NO	Relay 2 250 VAC/8 A	Configurable
9	Com.		
10	NC		
11	NO	Relay 3 250 VAC/8 A	Configurable
12	Com.		
13	NC		
14	NO	Relay 4 250 VAC/8 A	Open breaker (de-load) Can be configured for tripping also
15	Com.		
16	NC		
17	NO	Relay sync. 250 VAC/8 A	Close breaker (synchronising)
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 20 and 21
23	Binary input	Optocoupler	Remote alarm inhibit/configurable
24	Binary input	Optocoupler	Remote alarm acknowledge/configurable
25	Binary input	Optocoupler	Start sync./control functions/configurable
26	Binary input	Optocoupler	Bus communication control (H options). Enables writing of commands to the multi-line 2 unit. When not activated, reading of values etc. is still possible/configurable
27	Binary input	Optocoupler	Block loss of mains (vector jump and df/dt (ROCOF) only) (option A)/configurable
28	Com.	Common	Common for terminals 23-27

NOTE:
If using the start battery as power supply, the power supply must be connected directly to the battery, not on the start motor or the charging alternator, to ensure a stable supply to the multi-line 2.

NOTE:
The inputs terminal 23-27 as default have the indicated function(s). If not used, they can, via PC software, be set to be alarm inputs instead.

5.3.2 Slot #1, power supply and binary I/O (GPU)

Standard board (always needed):

Term.	Function	Technical data	Description
1	+12/24 VDC	12/24 VDC -25/+30%	Power supply
2	0 VDC		
3	NC	Status relay 24 V/1 A	Normally closed relay, processor/power supply status supervision
4	Com.		
5	NO	Relay 1 250 VAC/8 A	Configurable
6	Com.		
7	NC		
8	NO	Relay 2 250 VAC/8 A	Configurable
9	Com.		
10	NC		
11	NO	Relay 3 250 VAC/8 A	Configurable
12	Com.		
13	NC		
14	NO	Relay 4 250 VAC/8 A	Configurable
15	Com.		
16	NC		
17	NO	Relay sync. 250 VAC/8 A	Sync. relay with option D2/G2
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	Binary input	Optocoupler	Remote alarm inhibit/configurable
24	Binary input	Optocoupler	Remote alarm acknowledge/configurable
25	Binary input	Optocoupler	Start sync./control functions (only used with option G2/D2)/configurable
26	Binary input	Optocoupler	Bus communication control/configurable
27	Binary input	Optocoupler	Block loss of mains (vector jump and df/dt (ROCOF) only) (option A)/configurable
28	Com.	Common	Common for terminals 23-27

NOTE:
If using the start battery as power supply, the power supply must be connected directly to the battery, not on the start motor or the charging alternator, to ensure a stable supply to the multi-line 2.

NOTE:
The inputs terminal 23-27 as default have the indicated function(s). If not used, they can, via PC software, be set to be alarm inputs instead.

5.3.3 Inputs, slot #1

This is an overview of the input functionality.

5.3.3.1 Standard functions

Term.	Standard functions	Function
23	Alarm inhibit	Alarm suppression of selected alarms
24	Alarm ack.	Remote alarm acknowledgement
25	Start sync./control	Activates synchronising and control of the governor/AVR
26	External communication	Input used with Modbus and Profibus
27	Block loss of mains	Inhibits the vector jump and ROCOF (df/dt) protection

The inhibit LED is flashing if the block loss of mains input is activated.

5.3.3.2 Selectable functions

The inputs on slot #1 are used as control inputs. Each has a standard configuration, but three inputs can be reconfigured. This reconfiguration is made in the PC utility software.

Fields left blank means that there are no function but the standard one.

Term.	Standard functions	Function 2	Function 3	Function 4
23	Inhibit			
24	Alarm ack.	Island mode	Reset governor output	Parameter shift
25	Start sync./control			
26	External communication	Island mode	Reset governor output	Parameter shift
27	Block loss of mains	Island mode	Reset governor output	Parameter shift

Description	Terminal	Function	Chapter
Island mode	24, 26, 27	Ignores the busbar measurements	7.2.2
Reset	24, 26, 27	Resets analogue governor output	
Parameter shift	24, 26, 27	Enables the second level of protection	7.1.5

5.3.4 Alarm relays

The 4 alarm relays on slot #1 can be configured to alarm relays or limit contacts. Refer to the relay configuration chapter. The sync. relay (terminal 17/18/19) is not configurable.

5.3.5 Status relay, slot #1

The status relay on the power supply board is a normally closed relay with the purpose of processor and power supply supervision. This relay cannot be configured to any alarms.

5.3.6 kWh and kvarh counter

The multi-line 2 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/kWh
P_{nom}	100-1000 kW	1 pulse/10 kWh
P_{nom}	> 1000 kW	1 pulse/100 kWh

The pulse length is 1 s/pulse.

5.4 Slot #3, load sharing/synchronising control

5.4.1 Slot #3, load sharing control (GPC/PPU)

Term.	Function	Technical data	Description
37	-5…0…5 VDC	Analogue I/O	Active load sharing line
38	Com.	Common	Common for load sharing lines
39	-5…0…5 VDC	Analogue I/O	Reactive load sharing
40	-10…0…10 VDC	Analogue input	Frequency/active load set-point. Passive (requires external power supply)
41	Com.	Common	Common for terminals 40 and 42
42	-10…0…10 VDC	Analogue input	Voltage/var/power factor/reactive load set-point. Passive (requires external power supply)
43	Binary input	Optocoupler	De-load (not possible in freq. control mode)/configurable
44	Binary input	Optocoupler	Manual raise speed */configurable
45	Binary input	Optocoupler	Manual lower speed */configurable
46	Binary input	Optocoupler	Manual raise voltage */configurable
47	Binary input	Optocoupler	Manual lower voltage*/configurable
48	Binary input	Optocoupler	Mode 1/configurable
49	Binary input	Optocoupler	Mode 2/configurable
50	Binary input	Optocoupler	Mode 3/configurable
51	Binary input	Optocoupler	Mode 4/configurable
52	Binary input	Optocoupler	Mode 5/configurable
53	Binary input	Optocoupler	Mode 6/configurable
54	Binary input	Optocoupler	Generator breaker open
55	Binary input	Optocoupler	Generator breaker closed
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 5	Configurable
58	Com.	250 VAC 8 A	
59	NO	Relay 6	Configurable
60	Com.	250 VAC 8 A	
61	NO	Relay 7	Configurable
62	Com.	250 VAC 8 A	
63	NO	Relay 8	Configurable
64	Com.	250 VAC 8 A	

Mode 1-6: These controls are only active when the breaker is closed and the start sync. input is ON.

NOTE:
*: Only active when “start sync./control” is OFF.
Inputs terminal 43-53 are as default set to the function indicated. The input(s) can be changed to alarm function via the PC software.

Control selections with mode 1-6 inputs: See chapter 5.4.4.

5.4.2 Manual operation

The manual binary inputs can be used when the start/sync. input 25 is not activated. They respond to both relay and analogue outputs.

5.4.3 Deload input

The deload input (terminal 43) is only functioning when the start/sync. input 25 is ON.

	Function	
Running mode	**Deloading**	**Open breaker**
Fixed frequency		X
Fixed power	X	
Droop	X	
Load sharing	X	

The GPC/PPU has a deload function which is used when the generator breaker has to be opened with no load. The deload function is primarily used when running parallel with generators or the mains.

NOTE:
When the deload is activated in load sharing operation with only one generator on line, the multi-line 2 will still attempt to deload, but because the generator is running stand-alone the effect will be decreasing frequency and the breaker will not open.

If the deload input is left ON after opening of the breaker, it will prevent resynchronisation. If the deload input is used in the GPU with options G2/D2, it will open the breaker instantly, as the GPU can only run in fixed frequency mode.

5.4.4 Mode selections and external input (GPC/PPU)

Power/frequency mode selection	**Mode 1 (term. 48)**	**Mode 2 (term. 49)**	**Description**
Fixed frequency	OFF	OFF	Holds the generator at nominal frequency. No power control, no load sharing. Controls the generator frequency to internal set-point (setting 4011) if mode 3 (term. 50) is OFF or external analogue input on terminals 40-41 when mode 3 (term. 50) is ON. Load sharing line OFF.
Base load (fixed power)	ON	OFF	Controls the generator produced power to internal set-point (setting 4031) if mode 3 (term. 50) is OFF or external analogue input on terminals 40-41 when mode 3 (term. 50) is ON. No frequency control, no load sharing (load sharing line OFF).
Droop	OFF	ON	Enables droop load sharing with older generator without control facilities and a droop higher than the available value on the newer generator's governor (special function, seldom used).
Load sharing	ON	ON	Load and frequency control at the same time (mixed). Controls the generator frequency to internal set-point (setting 4011) if mode 3 (term. 50) is OFF or external analogue input on terminals 40-41 when mode 3 (term. 50) is ON. Load sharing line ON.

Power/frequency modes	
Internal set-point	Mode 3 OFF
External (terminals 40 (signal) and 41 (gnd)) set-point	Mode 3 ON

External set-point values		
Mode	**Input**	**Value**
Fixed frequency	-10…0…+10 VDC	-5…0…+5 Hz related to nominal frequency
Base load (fixed power)	0…10 VDC	0…100% load related to nominal power
Droop	-10…0…+10 VDC	-5…0…+5 Hz related to nominal frequency
Load sharing	-10…0…+10 VDC	-5…0…+5 Hz related to nominal frequency

External set-point inputs are passive and require an external power source (+/-10 VDC).

5.5 Slot #4, governor control outputs

Slot #4 is used for either governor/AVR (option) outputs or transducer (option) outputs.

5.5.1 Slot #4, relay outputs for governor (standard)

Term.	Function	Description
65	GOV relay up	Relay output for GOV raise speed
66	GOV relay up	
67	GOV relay down	Relay output for GOV lower speed
68	GOV relay down	
69		AVR voltage raise (option)
70		
71		AVR voltage lower (option)
72		

5.6 Slot #5, AC measuring - GPU, GPC, PPU

Term.	Function	Technical data	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	Bus voltage L1	Max. 690 VAC phase - phase value
86		Not used	
87	U L2	Bus voltage L2	Max. 690 VAC phase - phase value
88	U neutral *	Bus voltage neutral	For land-based applications only
89	U L3	Bus voltage L3	Max. 690 VAC phase - phase value

* Available in type 2/GS (galvanically separated voltage measurements) only.

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

5.6.1 Voltage measurement ranges

For units without galvanic separation (type /2):

4 levels (phase to phase):

1) 100 to 110 VAC
2) 200 to 240 VAC
3) 380 to 480 VAC
4) 660 to 690 VAC

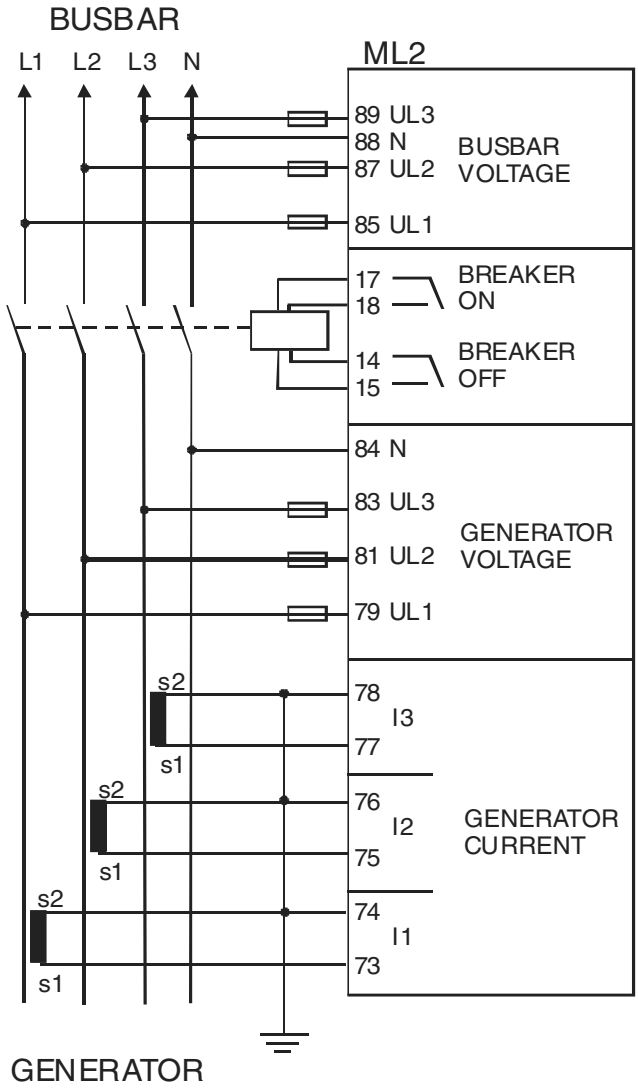
The voltage level is to be defined when ordering.

For units with galvanic separation (type /2/GS):

The voltage measurements are freely configurable in the range 100-690 VAC.

5.7 Wirings

5.7.1 AC connections (3 phases)



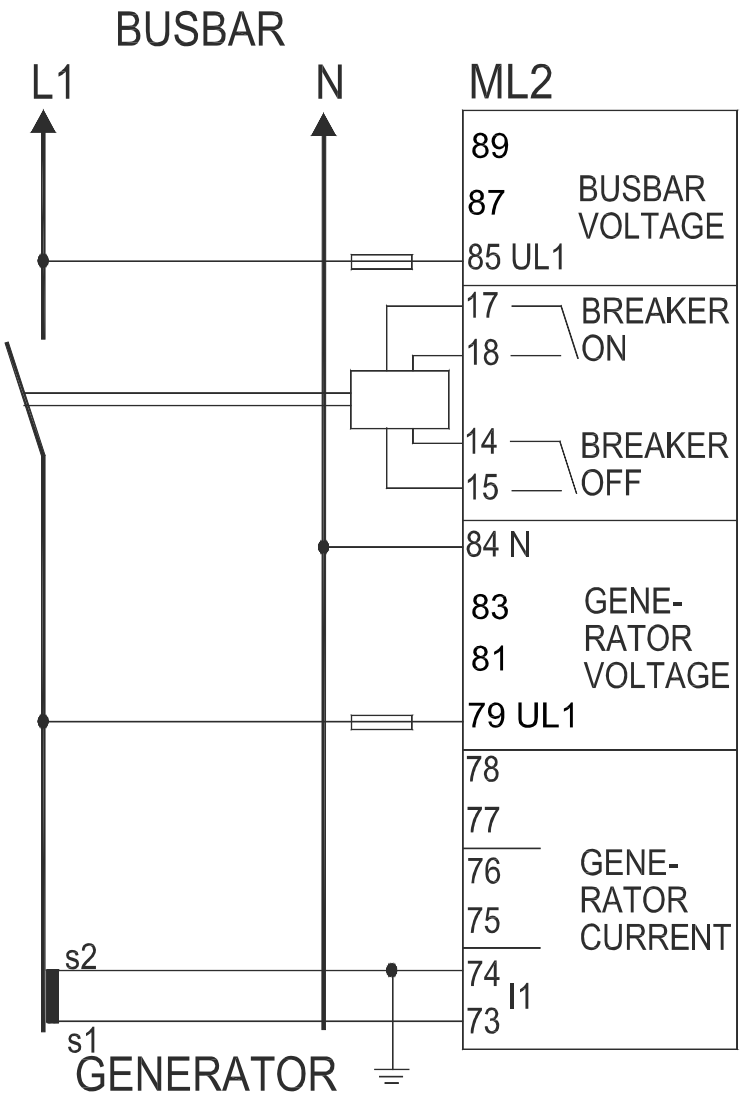
NOTE:
The busbar neutral connection is only available for type 2/GS (galvanically separated) units.

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: 2 A slow-blow.

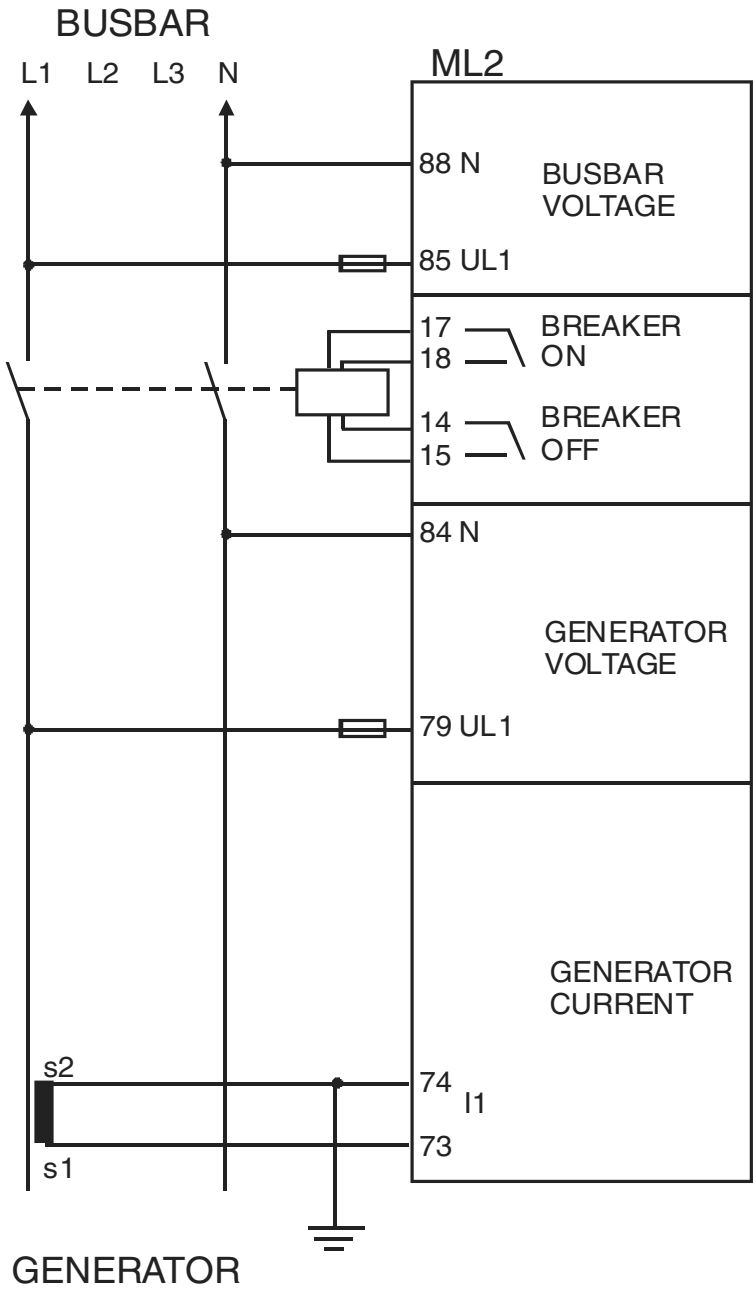
5.7.2 AC connections (single phase) without galvanic separation (type 2/)



NOTE:
The current transformer ground connection can be on s1 or s2 connection, whichever is preferred.

Fuses: 2 A slow-blow.

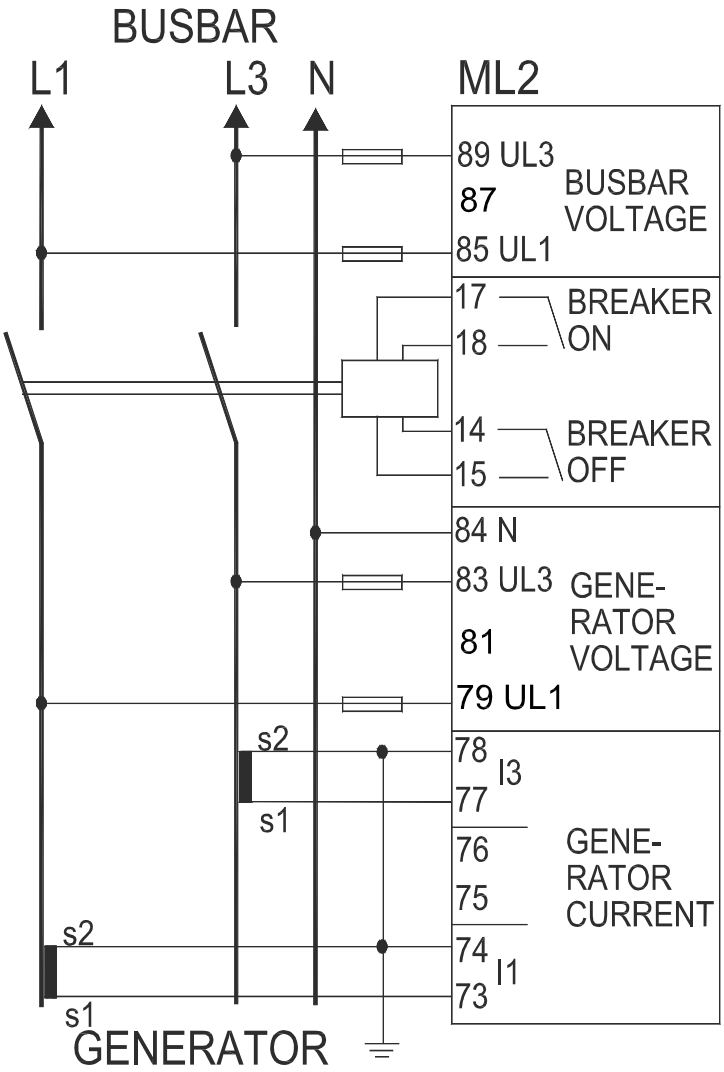
5.7.3 AC connections (single phase) with galvanic separation (type 2/GS)



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

Fuses: 2 A slow-blow.

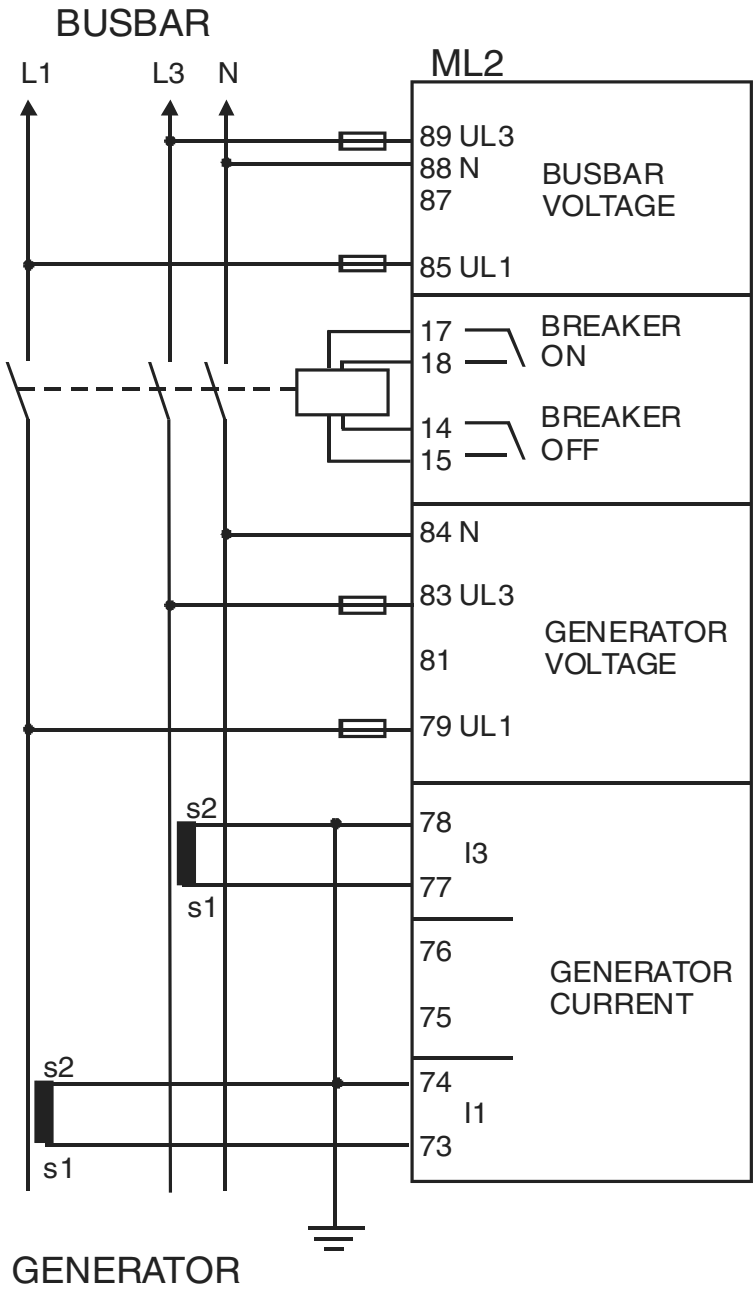
5.7.4 AC connections (split phase) without galvanic separation (type 2/)



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

Fuses: 2 A slow-blow.

5.7.5 AC connections (split phase) with galvanic separation (type 2/GS)

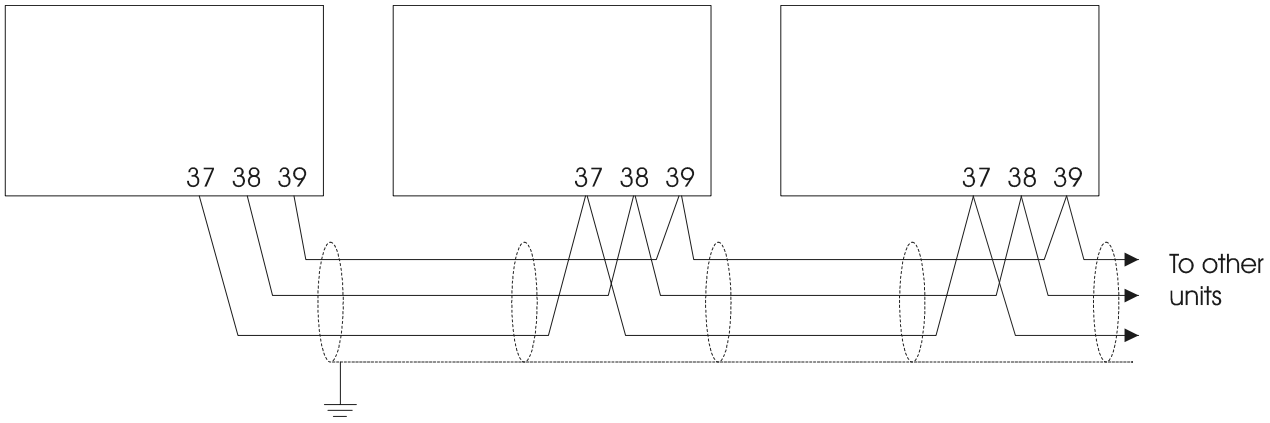


NOTE:
The current transformers ground connection can be on s1 or s2 connection, whichever is preferred.

Fuses: 2 A slow-blow.

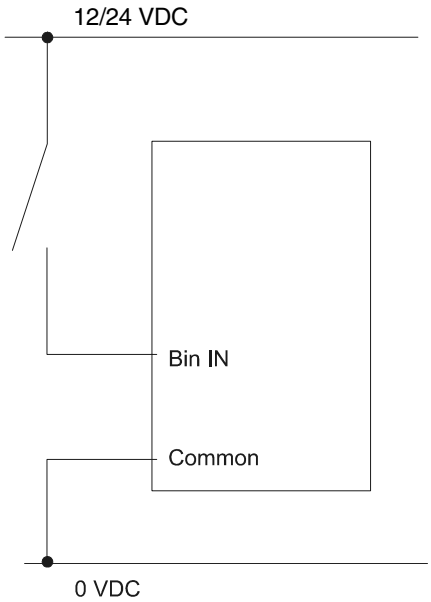
5.7.6 Load sharing lines (GPC/PPU)

Even though screened cable is not needed, it is recommended if the cable run is longer than 5 m between units.



5.7.7 Binary inputs

All binary inputs are 12/24 VDC bi-directional optocoupler. Typical input is:

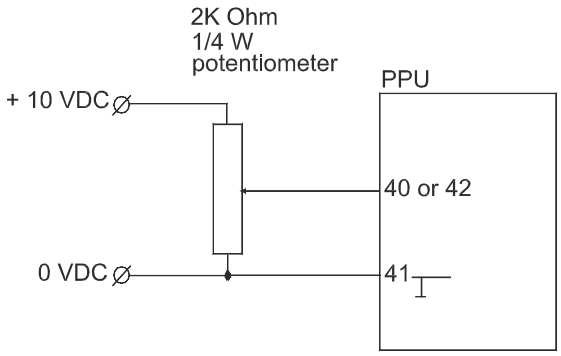


The binary inputs use fixed signals. They do not use pulse signals.

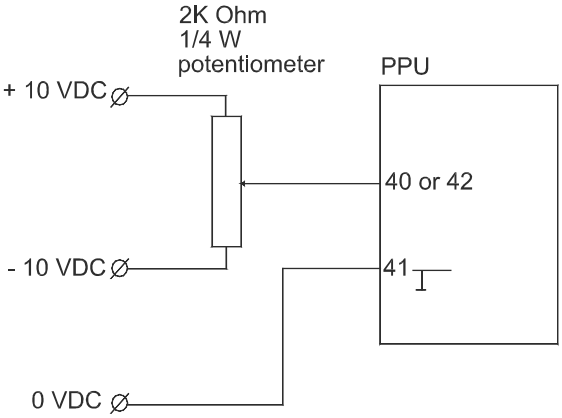
5.7.8 Analogue inputs (external set-points) (GPC/PPU)

The set-point inputs are passive, i.e. an external power source is needed. This can be an active output from e.g. a PLC, or a potentiometer can be used.

5.7.8.1 0…10 VDC input using potentiometer

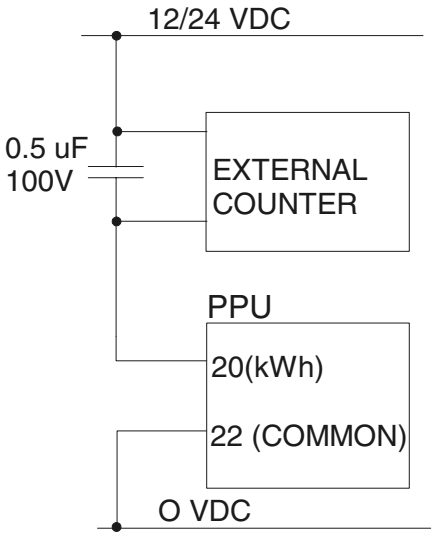


5.7.8.2 +/-10 V input using potentiometer



5.7.9 Optocoupler outputs for external counter

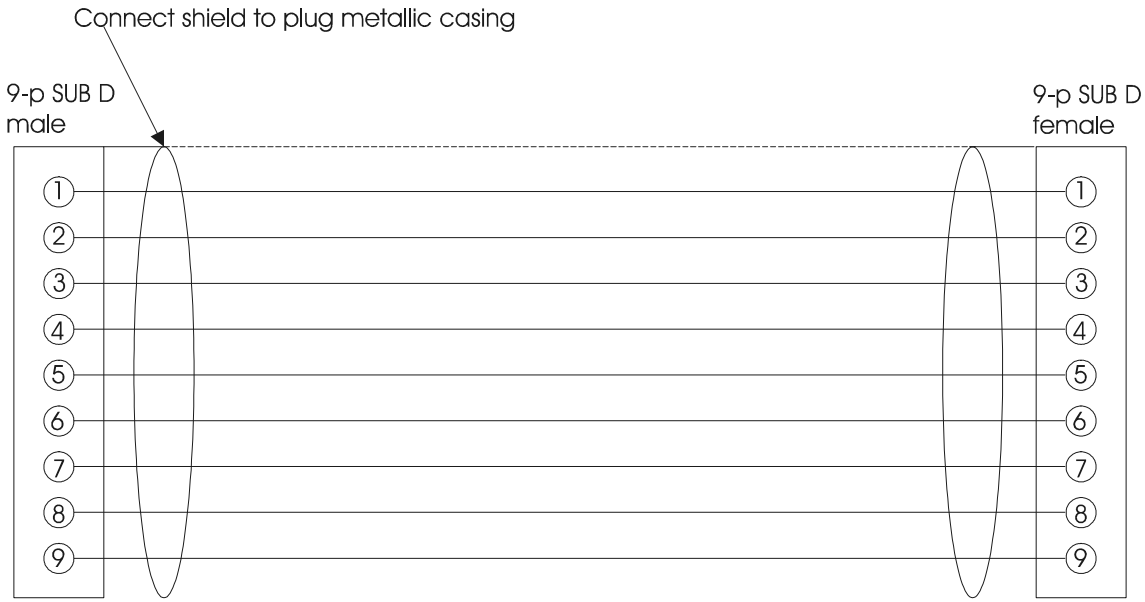
The kWh counter (terminals 20-22) and kvarh counter (terminals 21-22) outputs are low-power outputs. For that reason the following circuit must be applied:



5.8 I/F cables

5.8.1 Display I/F cable (option J)

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

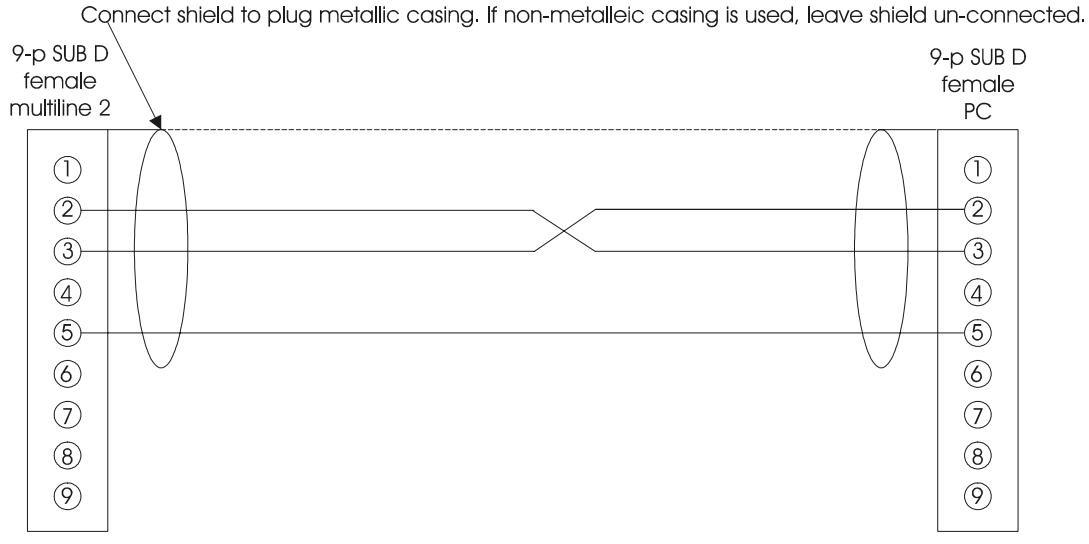


Wires min. 0.22 m^2, max. cable length 6 m.
Cable types: Belden 9540, BICC H8146, Brand Rex BE57540 or equivalent.
Option J1: Cable length 3 m.
Option J2: Cable length 6 m.

NOTE:
The metallic parts of the plugs (screen) must not touch the panel metallic parts. If they do, a communication error will appear in the display.

5.8.2 PC I/F cable (option J3)

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



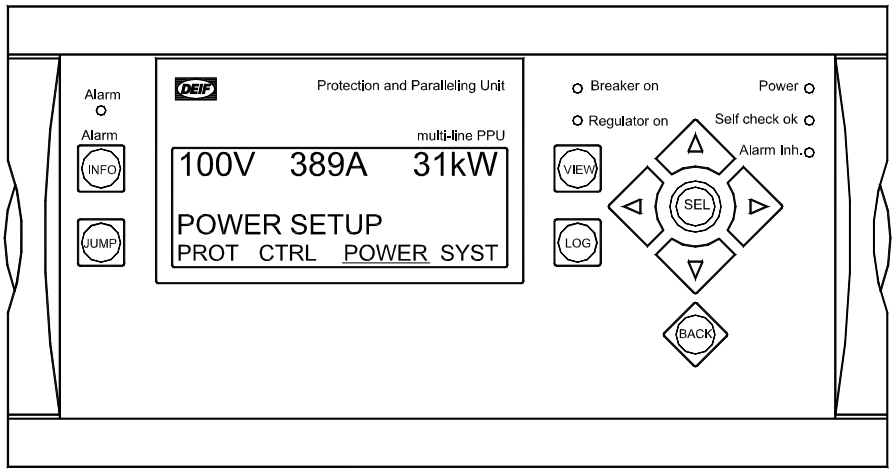
NULL-MODEM CABLE.

The cable length is 3 m.

6 Display unit

The display unit used in the 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.



Display dimensions H x W x D = 115 x 220 x 20 mm.

6.1 Pushbutton 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 them. Using the JUMP button enables the user to select and display any setting without navigating all the way through the menues (see later).

VIEW: The VIEW button is when the SETUP menu is entered. When in the SETUP menu, the VIEW button shifts the readings in the first line of the display.

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

: Moves the cursor left for manoeuvring in the menues.

: Increases the value of the selected set-point (in the setting menues). 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/alarm acknowledge).

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

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

: Moves the cursor right for manoeuvring in the menues.

6.2 Display functions

There are different uses of the display depending on what display window is used. The VIEW windows or the SETUP menu windows can be used.

6.2.1 Setup menu windows

	First line in display
Daily use display	Generator voltage L1 L2 L3 (VAC) Bus/mains 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) Bus/mains 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. The values are listed in the table below. Scrolling is done using the ▲ and ▼ keys. The values available are shown in the table on the next page.
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. Scrolling through the settings is done using the ▲ and ▼ keys.
Alarm and event list	When selecting the alarm (and event) list, the second line will display the latest alarm/event. Scrolling through the list is done using the ▲ and ▼ keys.

Parameters shown in the second line in the display:

For generator:	**For bus:**	**For analogue input:**
Date and time	Voltage L1-N (VAC)	Analogue 1
Voltage L1-N (VAC)	Voltage L2-N (VAC)	Analogue 2
Voltage L2-N (VAC)	Voltage L3-N (VAC)	Analogue 3
Voltage L3-N (VAC)	Voltage L1-L2 (VAC)	Analogue 4
Voltage L1-L2 (VAC)	Voltage L2-L3 (VAC)	Pt 100 no. 1
Voltage L2-L3 (VAC)	Voltage L3-L1 (VAC)	Pt 100 no. 2
Voltage L3-L1 (VAC)	Voltage max. (VAC)	Tacho
Voltage max. (VAC)	Voltage min. (VAC)	VDO no. 1
Voltage min. (VAC)	Frequency (Hz)	VDO no. 2
Current L1 (A)	Voltage angle between L1-L2 (deg.)	VDO no. 3
Current L2 (A)	Frequency deviation (df/dt) (Hz/sec.)	Analogue 5
Current L3 (A)	Voltage angle between generator	Analogue 6
Frequency L1 (Hz)	voltage and bus voltage (deg.)	Analogue 7
Frequency L2 (Hz)	Power supply voltage (VDC)	Analogue 8
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.)		
Run time (h)		
Number of CB operations		

	Third line in display
Daily use display	The third line is an indication line. The third line contains an explanation for the lower line selection of setup.
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
Parameter menu display	When entering the parameter menues the first (entry) display uses the fourth line to select a sub-function for the parameter. What the selections are depends on the function selected.
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. Choises are: “PROT”, protection setup “CTRL”, controls setup “INPUT”, inputs control setup “SYST”, system setup

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
“OA” and “OB”, selection of which relay the function must activate
“ACT”, activate/de-activate the function

For control functions one entry shows the “Synchronisation” function. In this case the fourth line shows:

“fMax”, max. allowed positive frequency deviation when synchronising
“fMin”, min. allowed negative frequency deviation when synchronising
“Umax”, max. allowed voltage deviation (positive or negative) when synchronising
“tCB”, closing time delay for generator circuit breaker

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
“I”, nominal generator current setting
“U”, nominal generator voltage setting

The above settings are used by the multi-line 2 to calculate nominal apparent power.

6.2.2 View windows

The menu navigating starts from the fourth line in the entrance window and is carried out using the “SEL”,  ,  ,  , and “BACK” pushbuttons. It is also possible to use the “JUMP” pushbutton and then enter the specific channel number (e.g. 1011) or channel group number (e.g. 1010).

The entry window shows the software version in the first line. The second line shows date and time. In line four it is possible to select one of four menus:

6.2.2.1 Parameter setup menu

In the setup menu the following sub-menues and settings can be selected:

NOTE:
The table shows all settings including options. Some will not be shown unless the option in question is selected.

Protection	Control	Input	System
1010 Reverse power	2010 Sync. type	3010 4-20 mA input 1	4010 Nominal settings
1020 Overcurrent 1	2020 Synchronisation	3020 4-20 mA input 2	4020 Transformer generator
1030 Overcurrent 2	2040 Sync. blackout	3030 4-20 mA input 3	4030 Transformer busbar
1040 Overcurrent inverse	2050 Sync. window	3040 4-20 mA input 4	4040 Controller settings
1050 Overcurrent inverse	2060 Sync. failure	3050 4-20 mA input 5	4050 Communication control
1060 Overcurrent inverse	2070 General failure	3060 4-20 mA input 6	4060 External comm. ID
1070 Fast overcurrent	2110 Modes (GOV + AVR)	3070 4-20 mA input 7	4090 External comm. error
1080 High overcurrent	2120 Frequency control (PI)	3080 4-20 mA input 8	4100 Date and time
1100 Gen. high voltage 1	2130 Power control (PI)	3090 Pt100 input 1 alarm	4120 Counters
1110 Gen. high voltage 2	2140 Power ramp up	3100 Pt100 input 2 alarm	4130 Water level input
1120 Gen. low voltage 1	2150 Power ramp down	3110 Overspeed	4220 Battery low
1130 Gen. low voltage 2	2160 Analogue gov. offset	3120 Digital input term. 23	4230 Language
1140 Gen. high frequency 1	2180 Governor reg. fail.	3130 Digital input term. 24	4240 Loadshare out
1150 Gen. high frequency 2	2190 Voltage control (PI)	3140 Digital input term. 25	4250 Load sharing type
1160 Gen. low frequency 1	2200 var control (PI)	3150 Digital input term. 26	4260 Start next generator
1170 Gen. low frequency 2	2210 Analogue AVR offset	3160 Digital input term. 27	4270 Stop next generator
1080 Bus high voltage 1	2230 AVR reg. fail.	3170 Digital input term. 43	4350 Tacho config.
1190 Bus high voltage 2	2280 Water control (PI)	3180 Digital input term. 44	4360 Start prepare
1200 Bus low voltage 1		3190 Digital input term. 45	4370 Start attempts
1210 Bus low voltage 2		3200 Digital input term. 46	4380 f/U OK time
1220 Bus high frequency 1		3210 Digital input term. 47	4390 f/U failure
1230 Bus high frequency 2		3220 Digital input term. 48	4400 Coil/cooldown
1240 Bus low frequency 1		3230 Digital input term. 49	4410 Stop failure
1250 Bus low frequency 2		3240 Digital input term. 50	4420 Run status
1260 Overload 1		3250 Digital input term. 51	4430 Remote status
1270 Overload 2		3260 Digital input term. 52	4440 Generator ready
1280 Unbalance current		3270 Digital input term. 53	4500 Power output
1290 Unbalance voltage		3330 Digital input term. 115	4510 Apparent power output
1300 var import		3340 Digital input term. 116	4520 Reactive power output
1310 var export		3350 Engine failure term. 117	4530 Power factor output
1320 Gen. neg. seq. current		3360 Emergency stop term. 118	4540 Frequency output
1330 Gen. neg. seq. voltage		3370 Digital input term. 127	4550 Voltage output
1350 df/dt (ROCOF)		3380 Digital input term. 128	4560 Current output
1360 Vector jump		3390 Digital input term. 129	4600 Relay 0 virtual
		3400 Digital input term. 130	4610 Relay 1
		3410 Digital input term. 131	4620 Relay 2
		3420 Digital input term. 132	4630 Relay 3
		3430 Digital input term. 133	4640 Relay 4
		3440 Oil pressure (VDO)	4650 Relay 5
		3450 Cool water temp. (VDO)	4660 Relay 6
		3460 Fuel level (VDO)	4670 Relay 7
			4680 Relay 8

6.2.2.2 View windows

The view windows are used for reading of values:

- **View 1** – enters up to 15 selectable windows showing selectable measurements
- **View 2** – window shows selectable measurements
- **View 3** – window shows operational status and selectable measurements

Windows	View 1	View 2	View 3
Window 1 (used in V2, V3)	Manual selection with key UP or key DOWN pushbuttons	Changes automatically between the 5 first windows: 1. window 1 (Manual) 2. window 2 (Sync.) 3. window 3 (Ramp up) 4. window 4 (Ramp down) 5. window 5 (Default*) No manual selection. All three lines show measuring values	Changes automatically between the 5 first windows: 1. window 1 (Manual) 2. window 2 (Sync.) 3. window 3 (Ramp up) 4. window 4 (Ramp down) 5. window 5 (Default*) No manual selection. Line 1 shows the running mode of the unit (MANUAL, AUTO, etc.). Line 2 and line 3 show measurements
Window 2 (used in V2, V3)			
Window 3 (used in V2, V3)			
Window 4 (used in V2, V3)			
Window 5 (used in V2, V3)			
Window 6			
Window 7			
Window 8			
Window 9			
Window 10			
Window 11			
Window 12			
Window 13			
Window 14			
Window 15			

* The default window is automatically selected when the genset is in normal operation, e.g. fixed power mode, but after the ramping up.

When the display shows the entry window or one of the view windows the fourth line always gives access to the setup menu or one of the view windows. When working in the setup menu it is possible to enter the view windows by using the “BACK” pushbutton until the entry window is displayed.

The configuration of the “VIEW” windows is done through the utility software. It is not possible to configure the windows through the display. Refer to the chapter Utility software configuration 7.2.

During synchronisation view 3 will show a synchronoscope in the first line. The synchronoscope can also be selected in all the configurable windows. This is useful during manual synchronising.

In the standard GPU it is only possible to enter “SETUP” and “V1”. In the GPU with option G2/D2 it is also possible to enter “V2” and “V3”.

The selectable values and measurements are shown in the table in chapter 6.2.1 in this handbook. In the GPC and PPU it is also possible to select information about running modes and internal or external set-points.

If the text “No text” is selected in all three lines in a window it will not be displayed. This is to get a continuous displaying if a window is no longer to be shown.

7 Parameter setting

7.1 Menu overview

The following is the menu structure when entering settings of the multi-line 2. The settings can be entered through the setup menu. 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 menues. The factory password is 2000.

If no actions have been taken within 3 minutes, 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", "CTRL", "INPUT", "SYST").

7.1.1 Jump functions

The "JUMP" pushbutton is used to enter an exact channel number, and all channels can be entered using this button.

The following menues can only be reached using the "JUMP" or the "VIEW" pushbutton:

Use the and buttons to change the settings and the "SEL" button to store the new setting.

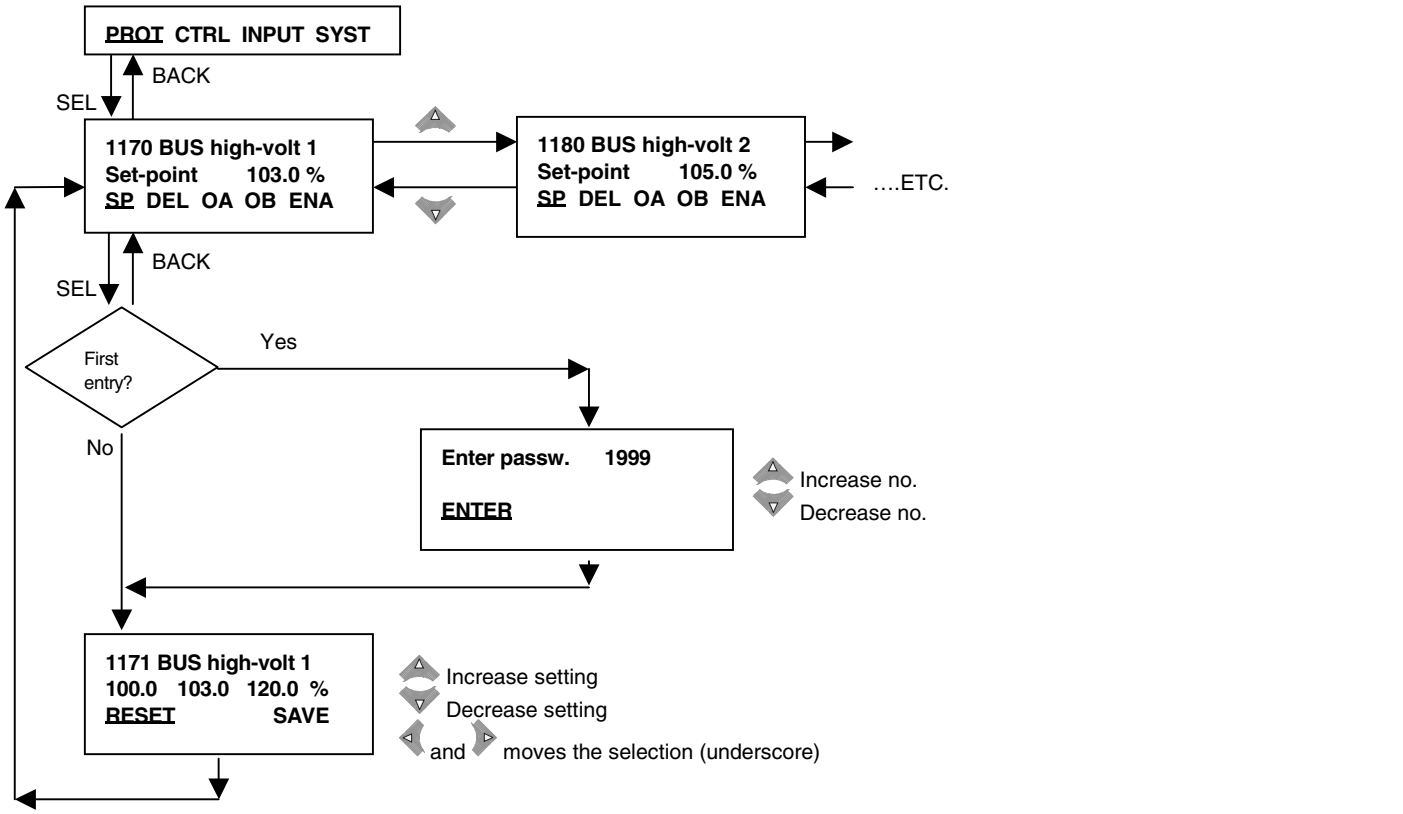
Password setting:	Channel 4971
Service menu:	Channel 4980
Software version:	Channel 6000
Application menu:	Channel 6100
Phase compensation:	Channel 6200

Beware: Write down the new password. If you forget it, contact DEIF Support for details.

7.1.2 Setup menu system

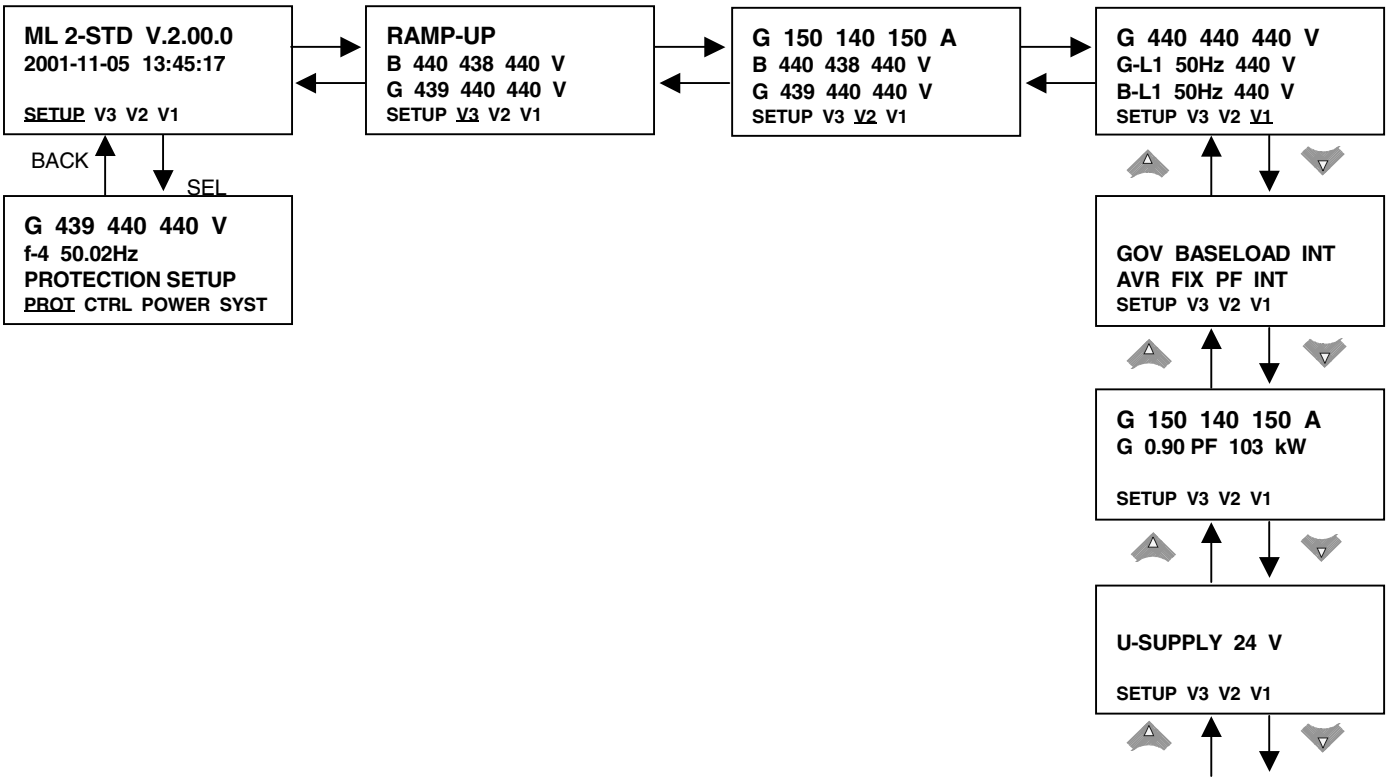
The following is an example, but all menues operate in the same manner.

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



7.1.3 View menu system

The following is an example of a configuration. In this example 4 of 15 windows have been configured in view 1.



....ETC. (MAX. 15)

7.1.4 Alarm function

When the multi-line 2 is used for protection purposes, the unit will detect and display the enabled alarms which arise. Further it is possible to activate relays for alarm purposes. The alarms can be configured to any of the available relay outputs. Each alarm function has two output settings, output A and output B.

Since each alarm can be configured to two relays you can combine the use, e.g. output A to an alarm panel and output B to drop a non essential load group.

Acknowledgement of the alarms is done in one of two ways. Either the binary input terminal 24 is used if this is configured as alarm acknowledge (standard), or the select button on the display:

- The alarm acknowledge input acknowledges all present alarms, and the alarm LED will change from flashing to steady light.
- The display can be used in the alarm information window. This is shown if the “INFO” pushbutton is pressed. The alarm information window displays one alarm at a time and the alarm state. (Alarm acknowledged or not). If it is unacknowledged, move the cursor to “ACK” and press select to acknowledge it. Use the up and down pushbuttons to step in the alarm list.

The alarm LED is flashing if there are unacknowledged alarms present.

The GPC and PPU control the speed governor output and the AVR output in protection alarm conditions. This means that if an alarm has been configured to relay 4 (opening of breaker), it will automatically start synchronising after a 10 second delay. To avoid this situation, the start/sync. input terminal 25 must be removed or the deload input terminal 43 must be applied. This also applies for the GPU with options D2 and G2.

In synchronisation failure and general failure conditions the regulation stops and the running situation is frozen. The synchronisation failure can be disabled to avoid this situation.

The alarm relay will deactivate when the alarm situation is gone and the alarm is acknowledged.

7.1.5 Parameter shifting

The binary inputs terminal 24, 26 and 27 can be configured to parameter shift. This enables a second level of alarm set-points. The extra level of set-points can only be configured through the multi-line 2 utility software, and only if parameter shift is chosen as a function for one of the binary inputs.

Table: Second level of set points.

Channel numbers	Alarm description
1410	Reverse power
1420-1430	Overcurrent
1440-1510	Generator alarms
1520-1590	Busbar
1600-1610	Overload
1620-1630	Unbalance alarms
1640-1650	Reactive import/export

Example:
Input terminal 26 is configured to parameter shift. Two levels of overload alarms are wanted.

	Primary level	Secondary level
Channel group number	1260/1270	1600/1610
Input terminal 26 OFF	ACT	-
Input terminal 26 ON	-	ACT

The table shows that when the parameter shift input is OFF, the active channel groups are 1260 and 1270, and when the parameter shift is ON, the active channel groups are 1600 and 1610.

7.1.6 Relay configuration

The relays can be configured through the utility software or the system setup in the display. The number of available relays varies according to multi-line 2 type and the options selected. The standard available relays are:

- GPU 4 relays (R1, R2, R3, R4)
- GPC 8 relays (R1, R2, R3, R4, R5, R6, R7, R8)
- PPU 8 relays (R1, R2, R3, R4, R5, R6, R7, R8)

Optional relays are:

- All units 4 relays (R10, R11, R12, R13) (option M14, placed in slot #8)

The relays below cannot be configured to any alarm:

- Relay sync., terminal 17/18/19
- Status relay, terminal 3/4

Be aware that relay 4 is used as “breaker open” relay and the alarms configured to this relay will also open the breaker.

The relay configuration is done in the setup menues.

7.1.6.1 Relay functionality

Each relay can be used with one of the following functions:

Function	Description
Alarm	The relay is activated until the alarm that caused the activation is acknowledged and gone. Alarm LED is flashing or constant
Alarm + sync. block	The relay is activated until the alarm that caused the activation is acknowledged and gone. When the relay is activated the synchronising is blocked but the regulation is still on
Limit	The relay will activate at the limit set-point. No alarm will appear. After the condition activating this relay has returned to normal, the relay will deactivate when the “Off delay” has expired

7.1.6.2 Relay parameter setting

No.	Setting		First/min. setting	Second/max. setting	Third setting	Factory setting
4610	Relay 1	Selection display	-	-	-	-
4611	Relay 1	Function	Alarm	Alarm/sync. block	Limit	Alarm
4612	Relay 1	Off delay	0.0 s	999.9 s	-	5.0 s

Similar settings are possible for the relays when available:

No.	Relay
4620	2
4630	3
4640	4
4650	5
4660	6
4670	7

No.	Relay
4680	8
4690	9
4700	10
4710	11
4720	12
4730	13

7.1.6.3 Relay overview

The table shows the available relay outputs. The optional relay outputs require additional hardware except relays 8 and 9 in the GPC and PPU.

Relay	Slot	GPU	GPC	PPU
Relay 1	Slot #1	Standard	Standard	Standard
Relay 2	Slot #1	Standard	Standard	Standard
Relay 3	Slot #1	Standard	Standard	Standard
Relay 4	Slot #1	Standard	Standard	Standard
Relay 5	Slot #3	Option G2	Standard	Standard
Relay 6	Slot #3	Option G2	Standard	Standard
Relay 7	Slot #3	Option G2	Standard	Standard
Relay 8	Slot #3	Option G2	Standard	Standard
Relay 9	Slot #7	Option M1, M2	Option M1, M2	Option M1, M2
Relay 10	Slot #8	Option M14	Option M14	Option M14
Relay 11	Slot #8	Option M14	Option M14	Option M14
Relay 12	Slot #8	Option M14	Option M14	Option M14
Relay 13	Slot #8	Option M14	Option M14	Option M14

7.1.6.4 Relay standard functions

The table shows the standard factory configuration of the relay outputs. The relay configuration has the following limitations:

NOTE:
If the “Start/stop next generator” option G1 is selected, all configurable relays can be used as start/stop relays.

Relay	Slot	GPU	GPC	PPU	Comments
Relay 1	Slot #1	Configurable	Configurable	Configurable	
Relay 2	Slot #1	Configurable	Configurable	Configurable	
Relay 3	Slot #1	Configurable	Configurable	Configurable	
Relay 4	Slot #1	Config. and open breaker	Config. and deload	Config. and deload	Open breaker signal activates relay 4
Relay 5	Slot #3	Configurable	Configurable	Configurable	
Relay 6	Slot #3	Configurable	Configurable	Configurable	
Relay 7	Slot #3	Configurable	Configurable	Configurable	Option O, water turbine: Start relay
Relay 8	Slot #3	Not available	Configurable	Configurable	
Relay 9	Slot #7	Configurable	Configurable	Configurable	Activates engine stop (only mounted with option M, engine)
Relay 10	Slot #8	Configurable	Configurable	Configurable	Option
Relay 11	Slot #8	Configurable	Configurable	Configurable	Option
Relay 12	Slot #8	Configurable	Configurable	Configurable	Option
Relay 13	Slot #8	Configurable	Configurable	Configurable	Option

7.2 Utility software configuration

7.2.1 Inhibit configuration

The inhibit functionality can be changed from the factory configuration if required. The tables below show whether the alarm is active or inhibited. (The tables show the default settings).

ACT = alarm active.

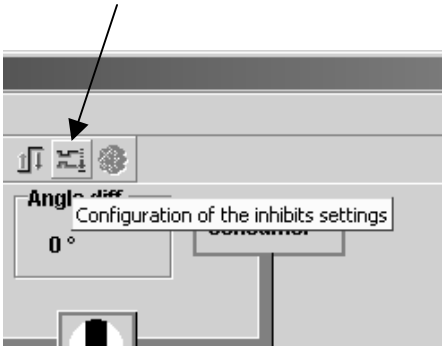
GPU (option G2 is not selected)		
Inhibit input	**ON**	**OFF**
Generator low f	-	ACT
Generator low U	-	ACT
Generator high f	ACT	ACT
Generator high U	ACT	ACT
Bus low f	-	ACT
Bus low U	-	ACT
Bus high f	-	ACT
Bus high U	-	ACT
4...20 mA input	-	ACT
Binary input	-	ACT
Pt 100 input	-	ACT
Tacho input	-	ACT

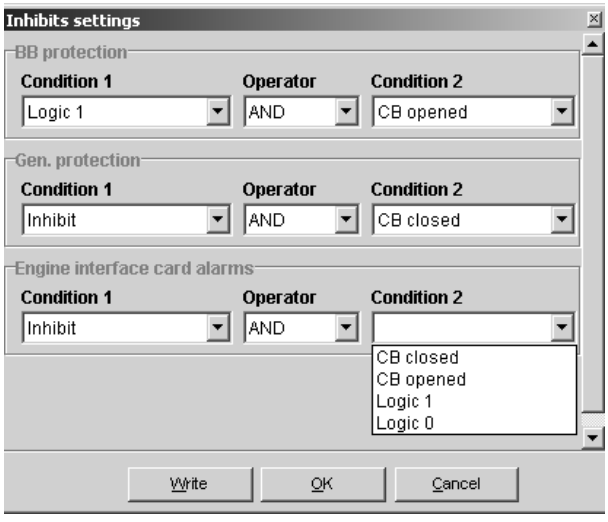
GPU (option G2 is selected)/GPC/PPU				
Breaker position	**OFF**		**ON**	
Inhibit input	ON	OFF	ON	OFF
Generator low f	-	ACT	-	ACT
Generator low U	-	ACT	-	ACT
Generator high f	ACT	ACT	ACT	ACT
Generator high U	ACT	ACT	ACT	ACT
Bus low f	-	-	ACT	ACT
Bus low U	-	-	ACT	ACT
Bus high f	-	-	ACT	ACT
Bus high U	-	-	ACT	ACT
4...20 mA input	-	ACT	-	ACT
Binary input	-	ACT	-	ACT
Pt 100 input	-	ACT	-	ACT
Tacho input	-	ACT	-	ACT

To make a reconfiguration enter the utility software and upload the parameters of the multi-line 2 unit.

The functionality of the functions “Inhibit” in the setting menu:

Use this button to get to the setting menu.





It is possible to configure the inhibitation of the protections and alarms:

- Busbar protection
- Generator protection
- Engine interface card alarms (input/output extension board)
- Df/dt vector jump

The configuration is done selecting the desired conditions in the roll down panels. In the above example the busbar protection will be inhibited only when the inhibit input terminal 23 is high and the circuit breaker is open.

The “Logic 0” and “Logic 1” selection is used to be able to make all possible configurations. They are defined as:

- Logic 0 = FALSE
- Logic 1 = TRUE

Example 1: “Inhibit and logic 1”.

GEN protection inhibit by:

INHIBIT	**AND**	**LOGIC 1**	**RESULT**
TRUE*	AND	TRUE	TRUE (inhibit)
FALSE	AND	TRUE	FALSE (no inhibit)

***** Inhibit = TRUE: 24 volt on Bi01/terminal 23 (apply 0 VDC on terminal 28).

Example 2: “Not inhibit or logic 0”.

GEN protection inhibit by:

NOT INHIBIT	**AND**	**LOGIC 0**	**RESULT**
FALSE *	OR	FALSE	FALSE (no inhibit)
TRUE	OR	FALSE	TRUE (inhibit)

***** Not inhibit = FALSE: 24 volt on Bi01/terminal 23 (apply 0 VDC on terminal 28).

Example 3: “Logic 1 and logic 0”.

Engine interface cards alarm inhibit by:

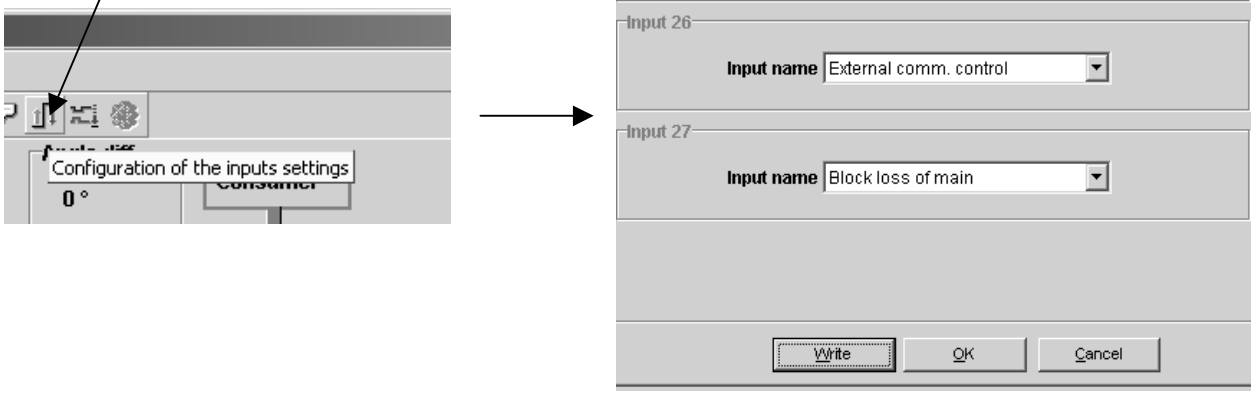
LOGIC 1	**AND**	**LOGIC 0**	**RESULT**
TRUE	AND	FALSE	FALSE (no inhibit)

7.2.2 Input configuration

It is possible to configure the inputs shown in the table. The numbers refer to the terminal numbers.

Terminal 23: Normally alarm inhibit
Terminal 24: Normally alarm acknowledge
Terminal 25: Normally “Start sync./control”
Terminal 26: Normally external communication control
Terminal 27: Normally block loss of mains
Terminal 43: Normally de-load
Terminal 44: Normally manual raise speed
Terminal 45: Normally manual lower speed
Terminal 46: Normally manual raise voltage
Terminal 47: Normally manual lower voltage
Terminal 48: Normally mode 1
Terminal 49: Normally mode 2
Terminal 50: Normally mode 3
Terminal 51: Normally mode 4
Terminal 52: Normally mode 5
Terminal 53: Normally mode 6

Use this button to get to the menu.

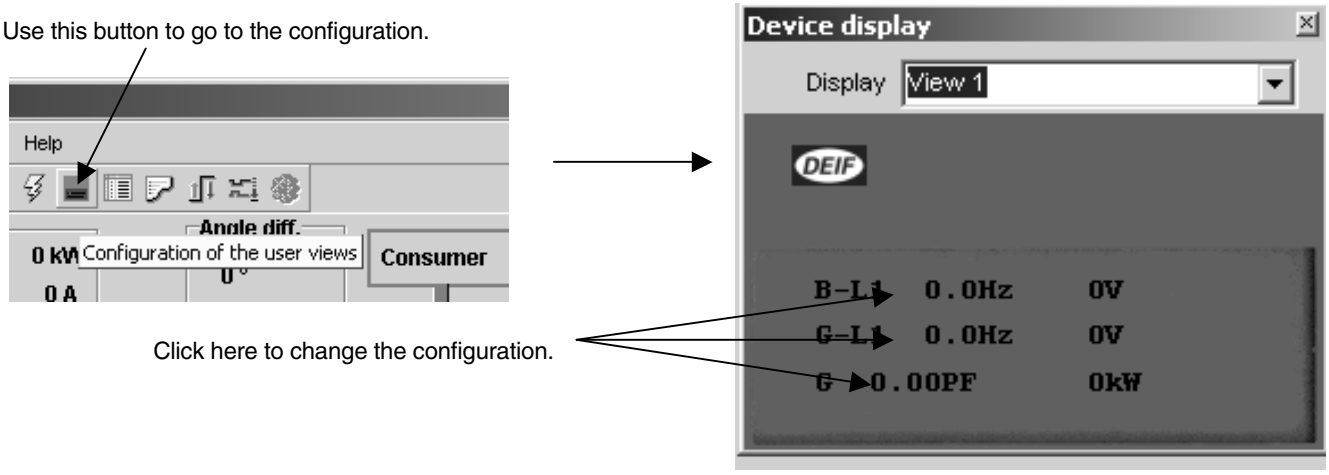


It is possible to use the input for the normal factory configuration. If the inputs are not used for these purposes, the following additional selections are possible:

- Blackout close enable
  When this selection is made, blackout closing of the breaker is accepted (blackout: U<30%), and the busbar alarms are disabled when synchronising
- Reset of analogue governor output (options E1, EF1, EF3 and EF4)
  The analogue governor output (+/- 20 mA) is reset to initial setting 2161 or 2273 by activating this input
- Parameter shift
  The second level alarm set-points are enabled by using this input

7.2.3 Configuration, view windows

The view windows are configured through the dialogue box below. Select the view window number and the required measurements from the roll down panels.



NOTE:
To be able to configure these parameters, the present parameter settings must be uploaded from the multi-line 2 (the upload button).

After the configuration of

- Display view
- Inhibit
- Inputs

is done, the parameters must be downloaded to the multi-line 2 (the download button).

7.3 Menu set-points

The maximum relay setting is depending on the options selected. The maximum relay settings are described in the table in chapter 7.1.6.1.

Up to 13 configurable relays can be used.

As the relays have been given a unique number, the number of relays available is not always the same as the max. number shown on the display. An example could be if M1 is not selected in the GPC/PPU, the relay R9 is still selectable on the display but it cannot be used. If it is attempted to select a relay number which is not available, an alarm will occur on the display, and the relay number will be set to R0 (none).

8 Protection configuration

8.1 Generator reverse power protection. ANSI code 32

The reverse power protection protects the generator against “motoring” which may damage the prime mover (diesel/gas engine, steam/gas turbine).

The setting relates to the setting of generator nominal power (setting 4012).

No.	Setting		Min. setting	Max. setting	Factory setting
1010	Reverse power	Selection display	-	-	-
1011	Reverse power	Set-point	-50.0%	0.0%	-5.0%
1012	Reverse power	Time	0.10 s	100.00 s	10.00 s
1013	Reverse power	Relay output A	R0 (none)	R11 (relay 11)*	R1 (relay 1)
1014	Reverse power	Relay output B	R0 (none)	R11 (relay 11)*	R0 (none)
1015	Reverse power	Enable	OFF	ON	ON
1016	Reverse power	Characteristic	Inverse	Definite	Definite

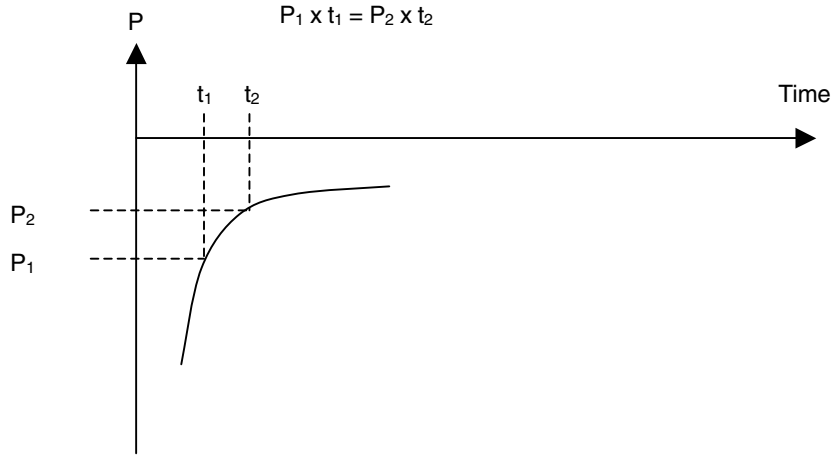
*GPU: Relay 4.

NOTE:
If the relay for normal breaker open command is to be used, select relay no. 4 on one of the outputs A or B.

8.1.1 Inverse characteristic

If inverse characteristic is selected, the tripping time is dependent on the excession of the set-point:

When the set-point is exceeded, the energy going through the breaker is calculated according to the set-point (1091) and the time delay (1012). IF exceeded, the trip will take place. The maximum energy (kWh) will never be exceeded, so if the reverse power increases, the time delay will decrease and vice versa.



8.2 Generator overcurrent protection. ANSI code 50/51

Settings relate to nominal generator current (setting 4013).

No.	Setting		Min. setting	Max. setting	Factory setting
1020	Overcurrent 1	Selection display	-	-	-
1021	Overcurrent 1	Set-point	50.0%	200.0%	115.0%
1022	Overcurrent 1	Time	0.10 s	100.00 s	10.00 s
1023	Overcurrent 1	Relay output A	R0 (none)	R11 (relay 11) *	R2 (relay 2)
1024	Overcurrent 1	Relay output B	R0 (none)	R11 (relay 11) *	R0 (none)
1025	Overcurrent 1	Enable	OFF	ON	ON

No.	Setting		Min. setting	Max. setting	Factory setting
1030	Overcurrent 2	Selection display	-	-	-
1031	Overcurrent 2	Set-point	50.0%	200.0%	120.0%
1032	Overcurrent 2	Time	0.10 s	100.00 s	5.00 s
1033	Overcurrent 2	Relay output A	R0 (none)	R11 (relay 11) *	R1 (relay 1)
1034	Overcurrent 2	Relay output B	R0 (none)	R11 (relay 11) *	R0 (none)
1035	Overcurrent 2	Enable	OFF	ON	ON

*GPU: Relay 4.

8.2.1 Generator overcurrent protection, inverse

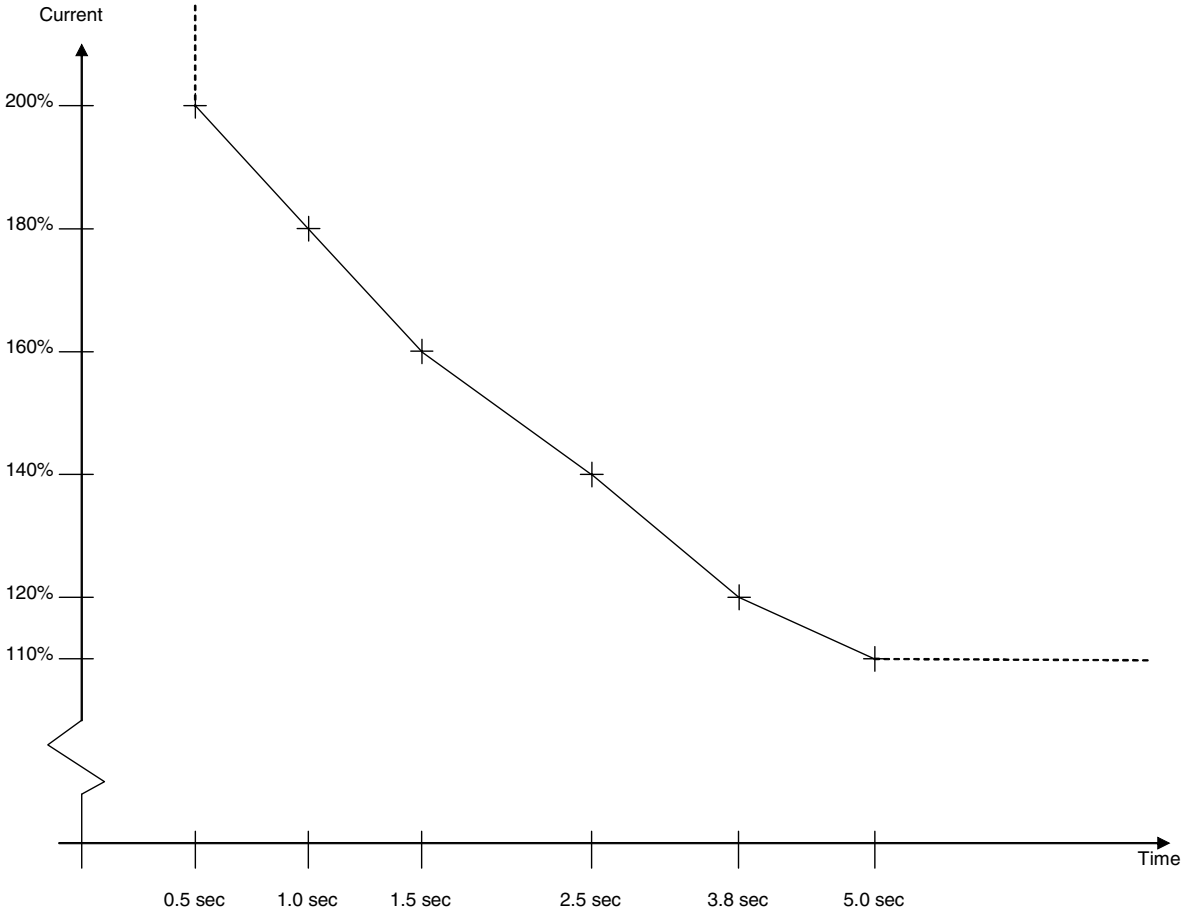
Settings relate to nominal generator current (setting 4013).

No.	Setting		Min. setting	Max. setting	Factory setting
1040	Overcurr. inverse	Selection display	-	-	-
1041	Overcurr. inverse	Current set-point 1	100%	200%	110%
1042	Overcurr. inverse	Time set-point 1	0.1 sec	200.0 sec	5.0 sec
1043	Overcurr. inverse	Current set-point 2	100%	200%	120%
1044	Overcurr. inverse	Time set-point 2	0.1 sec	200.0 sec	3.8 sec
1045	Overcurr. inverse	Current set-point 3	100%	200%	140%
1046	Overcurr. inverse	Time set-point 3	0.1 sec	200.0 sec	2.5 sec

No.	Setting		Min. setting	Max. setting	Factory setting
1050	Overcurr. inverse	Selection display	-	-	-
1051	Overcurr. inverse	Current set-point 4	100%	200%	160%
1052	Overcurr. inverse	Time set-point 4	0.1 sec	200.0 sec	1.5 sec
1053	Overcurr. inverse	Current set-point 5	100%	200%	180%
1054	Overcurr. inverse	Time set-point 5	0.1 sec	200.0 sec	1.0 sec
1055	Overcurr. inverse	Current set-point 6	100%	200%	200%
1056	Overcurr. inverse	Time set-point 6	0.1 sec	200.0 sec	0.5 sec

No.	Setting		Min. setting	Max. setting	Factory setting
1060	Overcurr. inverse	Selection display	-	-	-
1061	Overcurr. inverse	Relay output A	R0 (none)	R11 (relay 11) *	R1 (relay 1)
1062	Overcurr. inverse	Relay output B	R0 (none)	R11 (relay 11) *	R1 (relay 1)
1063	Overcurr. inverse	Activate	OFF	ON	ON

Drawing, example of inverse overcurrent trip settings:



8.3 Binary inputs

When one of the binary inputs term. 23-27 and 43-53 are not used for the function set as default, the input can be selected to be an alarm input instead.

In this case, the following settings are to be used:

NOTE:
If an input is used as the original function, and the alarm on the input is set ON at the same time, an alarm will occur whenever the input is activated.

No.	Setting		Min. setting	Max. setting	Factory setting
3120	Binary input term. 23	Selection display	-	-	-
3122	Binary input term. 23	Time	0.10 s	100.00 s	5.00 s
3123	Binary input term. 23	Relay output A	R0 (none)	R11 (relay 11) *	R1 (relay 1)
3124	Binary input term. 23	Relay output B	R0 (none)	R11 (relay 11) *	R0 (none)
3125	Binary input term. 23	Enable	OFF	ON	OFF

The same setting possibilities are present for these binary inputs:

No.	Binary input
3130	Term. 24
3140	Term. 25
3150	Term. 26
3160	Term. 27
3170	Term. 43
3180	Term. 44
3190	Term. 45
3200	Term. 46

No.	Binary input
3210	Term. 47
3220	Term. 48
3230	Term. 49
3240	Term. 50
3250	Term. 51
3260	Term. 52
3270	Term. 53

9 Control setup (GPC/PPU/GPU with options G2/D2)

9.1 Synchronisation type

No.	Setting		First setting	Second setting	Factory setting
2010	Sync. type	Selection display	-	-	-
2011	Sync. type	Sync. type	Static sync.	Dynamic sync.	Dynamic sync.

If dynamic synchronisation is chosen, the next menu will be 2010. If static synchronisation is chosen, the next menu will be 2140.

NOTE:
Static synchronisation can only be chosen for GPC/PPU/GPU with options G2/D2.

9.1.1 Dynamic synchronisation

The setting of df max. (max. allowable generator frequency compared to busbar/mains) and df min. (min. allowable generator frequency compared to busbar/mains) decides whether the generator synchronises when running faster or slower than nominal frequency.

The “dU max.” setting is related to nominal generator voltage (setting 4014). The “dU max.“ setting is +/- nominal generator voltage.

The multi-line 2 compensates for the breaker delay time when synchronising.

No.	Setting		Min. setting	Max. setting	Factory setting
2020	Dynamic sync.	Selection display	-	-	-
2021	Dynamic sync.	Df max.	0.0 Hz	0.5 Hz	0.3 Hz
2022	Dynamic sync.	Df min.	-0.5 Hz	0.5 Hz	0.0 Hz
2023	Dynamic sync.	DU max.	2%	10%	5%
2024	Dynamic sync.	Breaker delay	40 ms	300 ms	50 ms

The synchronisation pulse is 400 ms.

For dynamic synchronisation, the controller settings for frequency (2053-2054) are used for speed control of the incoming generator.

9.1.2 Static synchronisation

The following parameters are used for the static synchronisation:

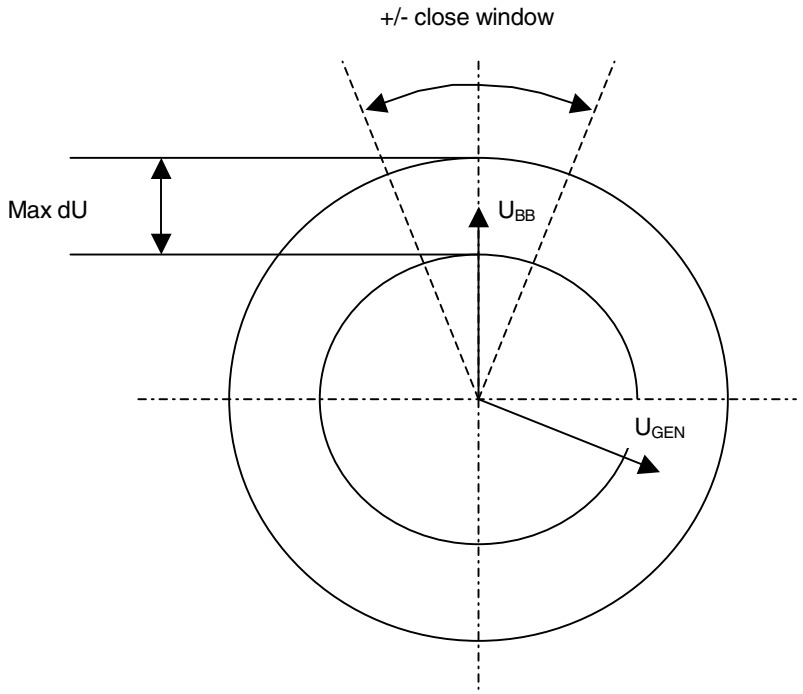
Setting	Description	Note
Maximum df	The maximum allowed frequency difference between the busbar/mains and the generator	+/- value
Maximum dU	The maximum allowed voltage difference between the busbar/mains and the generator	+/- value, related to the generator nominal voltage (setting 4014)
Close window	The size of the window where the synchronisation pulse can be released	+/- value
Phase K_P	Adjustment of the proportional factor of the PI phase controller	Only used during static synchronisation
Phase K_I	Adjustment of the integral factor of the PI phase controller	

No.	Setting		Min. setting	Max. setting	Factory setting
2030	Static sync.	Selection display	-	-	-
2031	Static sync.	Maximum df	0.00 Hz	1.00 Hz	0.25 Hz
2032	Static sync.	Maximum dU	2%	10%	5%
2033	Static sync.	Close window	0.1 deg.	20.0 deg.	10.0 deg.
2034	Static sync.	Phase K_P	0	400	250
2035	Static sync.	Phase K_I	0	400	160

Refer to paragraph 9.4 for further explanation of the PI controller settings (K_P and K_I).

The synchronisation pulse is 400 ms.

Synchronisation will happen when the generator voltage is within the close window and the frequency difference is within the df and dU settings.



9.1.3 Blackout closing of breaker

Settings are accepted limits (generator voltage and frequency) for closing the breaker. The “dU max.” setting is related to nominal generator voltage (setting 4014).

No.	Setting		Min. setting	Max. setting	Factory setting
2040	Sync. blackout	Selection display	-	-	-
2041	Sync. blackout	Df max.	0.0 Hz	5.0 Hz	3.0 Hz
2042	Sync. blackout	DU max.	2%	10%	5%
2043	Sync. blackout	Enable	OFF	ON	OFF

WARNING:
If blackout closing of breaker is enabled on more units, external precautions must be taken to avoid two or more generators closing on a black busbar. In that case synchronism will not be present.

9.1.4 Synchronising window, enabling and disabling of synchronising

The function deactivates the synchronisation if the voltage level on the busbar is out of range according to the nominal generator voltage. The purpose of the delay function is that a short intermittent voltage dive does not block the synchronising.

No.	Setting		Min. setting	Max. setting	Factory setting
2050	Sync. window	Selection display	-	-	-
2051	Sync. window	Set-point +/-	2.0%	20.0%	15.0%
2052	Sync. window	Delay	0.1 s	2.0 s	0.5 s
2053	Sync. window	Output A	R0 (none)	R11 (relay 11) *	R0 (none)
2054	Sync. window	Output B	R0 (none)	R11 (relay 11) *	R0 (none)
2055	Sync. window	Enable	OFF	ON	OFF

Even though the maximum output setting is R11, the setting is limited by the options selected.

This function is mainly used with a relay configured as a limit contact. This is done in the system setup channels 4600 to 4730.

9.1.5 Synchronisation failure

No.	Setting		Min. setting	Max. setting	Factory setting
2060	Sync. failure	Selection display	-	-	-
2061	Sync. failure	Delay	30.0 s	300.0 s	60.0 s
2062	Sync. failure	Relay output A	R0 (none)	R4 (relay 4) *	R2 (relay 2)
2063	Sync. failure	Relay output B	R0 (none)	R4 (relay 4) *	R0 (none)
2064	Sync. failure	Activate	OFF	ON	ON

9.2 General failure

The general failure covers:

- Breaker ON/OFF feedback fail
- Phase sequence error

No.	Setting		Min. setting	Max. setting	Factory setting
2070	General failure	Selection display	-	-	-
2071	General failure	Relay output A	R0 (none)	R4 (relay 4) *	R2 (relay 2)
2072	General failure	Relay output B	R0 (none)	R4 (relay 4) *	R0 (none)
2074	General failure	Activate	OFF	ON	ON

9.3 Mode input activation/deactivation (GPC/PPU)

No.	Setting		Description	Factory setting	PC software setting
2110	Modes active	Selection display	-	-	-
2111	Modes active	Sync. + gov. + AVR	All modes	All modes *	0
	Modes active	Sync. + gov.	Only gov.		1
	Modes active	Sync. + AVR	Only AVR		2
	Modes active	Sync.	Only sync.		3

***** Depending on the options selection of the multi-line 2.

This function lets the user decide the control function of the multi-line 2 after synchronisation. This is done by disabling the mode input functionality.

If e.g. the selection “Sync. + gov.” is chosen, the AVR control is disabled after synchronising. This means that the mode inputs on terminal 51/52/53 have no effect.

The “Sync.” selection disables all the controlling after synchronising.

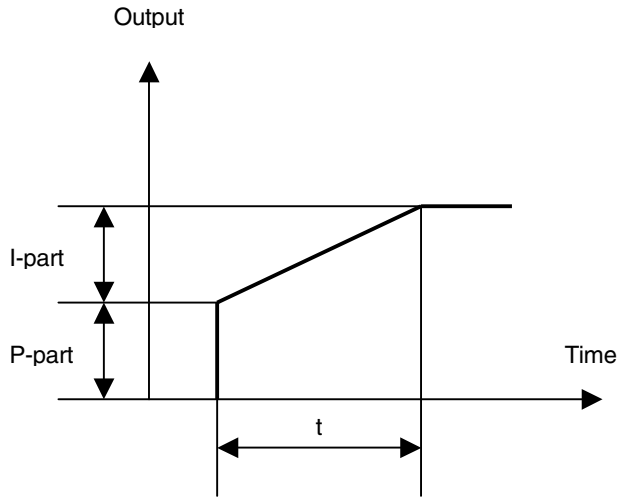
9.4 PI controller, K_p and K_i adjustments

The GPC/PPU includes controllers for the different running modes. The GPU - G2 (- D2) only includes frequency (and voltage) controller(s). The controllers control either a relay output or an analogue output (option).

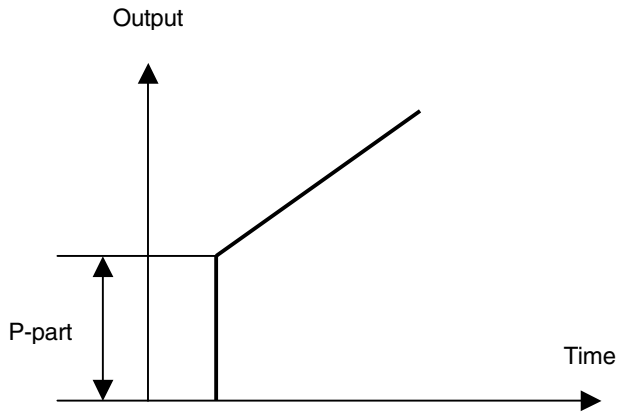
Each controller consists of a proportional factor K_P and an integral factor K_I.

The proportional factor K_P decides the size of the proportional part at a regulation deviation, and the integral factor K_I decides the integral part. The individual function of K_P and K_I is described in the drawings below. The drawings show the change of the output when the input value deviates from the set-point, e.g. because of a frequency change.

Drawing 1

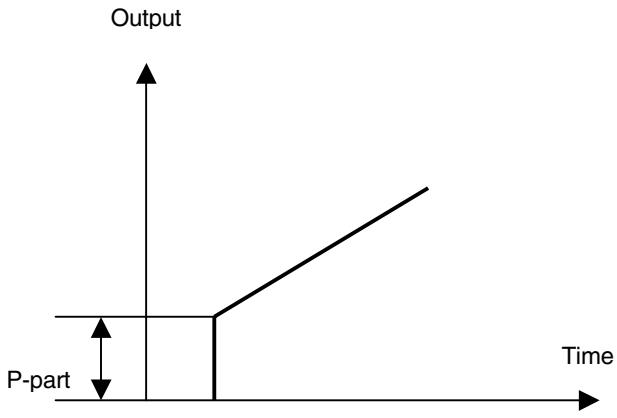


Drawing 2, high K_P setting



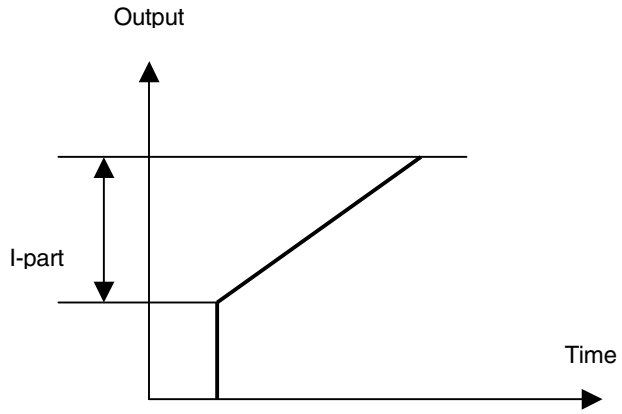
The P-part of the output can be changed by changing the K_P factor. Increasing K_P increases the P-part.

Drawing 3, low K_P setting



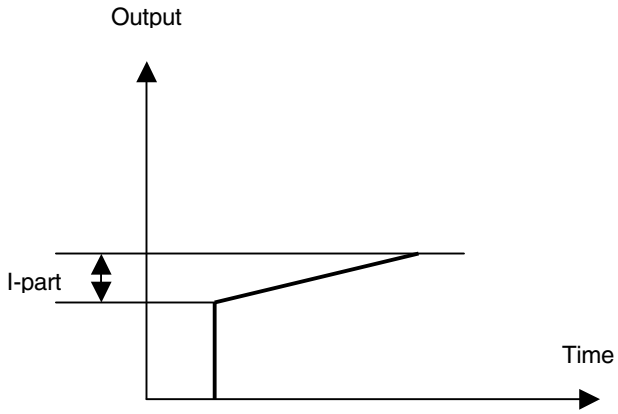
The P-part of the output can be changed by changing the K_P factor. Decreasing K_P decreases the P-part.

Drawing 4, high K_I setting



The I-part of the output can be changed by changing the K_I factor. Increasing the K_I factor makes the regulation faster.

Drawing 5, low K_I setting



The I-part of the output can be changed by changing the K_I factor. Decreasing the K_I factor makes the regulation slower.

From the table below it appears which controllers are active in the different running modes.

Controllers activated:

	Controllers				
	Freq.	Power	Voltage	var	PF
Fixed freq.	X				
Fixed power		X			
Droop		X			
P load sharing	X	X			
Fixed voltage *			X		
Fixed var *				X	
Fixed PF *					X
Q load sharing *			X	X	

*: Option

The mix factors are not controllers, but they indicate the influence of the two controllers in question.

Example:
When running in the generators, the relevant controller must be adjusted in each desired running mode. (Fixed frequency mode set frequency controller).

With the exception of the PF controller, the controllers are active in more running modes depending on the application. Regardless of that, the controller values will be the same.

9.4.1 Frequency controller (GPC/PPU/GPU - G2)

Frequency % settings relate to nominal generator frequency (setting 4011). It is used for frequency control (fixed frequency or load sharing) when the breaker is closed, and for synchronising if the breaker is open.

No.	Setting		Min. setting	Max. setting	Factory setting
2120	Freq. control	Selection display	-	-	-
2121	Freq. control	Deadband	0.2%	10.0%	1.0%
2122	Freq. control	F K_P	0	1000	250
2123	Freq. control	F K_I	0	1000	160
2124	Freq. control	Droop	0.0%	10.0%	4.0%

9.4.2 Power controller (GPC/PPU)

Power % settings relate to nominal generator power (setting 4012).

No.	Setting		Min. setting	Max. setting	Factory setting
2130	Power control	Selection display	-	-	-
2131	Power control	Deadband	0.2%	10.0%	0.2%
2132	Power control	P K_P	0	1000	250
2133	Power control	P K_I	0	1000	160

9.4.3 Power ramp up (GPC/PPU)

This setting is used when ramping up in fixed power mode, and the ramping speed is set in % of nominal power per second.

The delay point and time is the point where the generator stops ramping after closing of breaker to pre-heat the engine before commencing to take load. The time duration of the point is determined by the delay time setting. If the delay function is not needed, set the time to 0.

Power % settings relate to nominal generator power (setting 4012).

No.	Setting		Min. setting	Max. setting	Factory setting
2140	Power ramp up	Selection display	-	-	-
2141	Power ramp up	Speed	0.1%/s	20.0%/s	2.0%/s
2142	Power ramp up	Delay point	1%	100%	10%
2143	Power ramp up	Delay time	0.0 s	180.0 s	10.0 s

9.4.4 Power ramp down (GPC/PPU)

This setting is used when deloading the genset.

The breaker open point is where a relay output (relay 4) is activated to open the generator breaker before reaching 0 kW.

Power % settings relate to nominal generator power (setting 4012).

No.	Setting		Min. setting	Max. setting	Factory setting
2150	Power ramp down	Selection display	-	-	-
2151	Power ramp down	Speed	0.1%/s	20.0%/s	10.0%/s
2152	Power ramp down	Breaker open	1%	20%	5%

9.4.5 Governor regulation failure

This alarm function is activated when the start sync./control input (term. 25) is ON. The alarm is activated if the difference between the measured value and the alarm setpoint is bigger than the alarm deadband.

The dead band setting is related to the generator nominal power (setting 4012).

No.	Setting		Min. setting	Max. setting	Factory setting
2180	Governor reg. failure	Selection display	-	-	-
2181	Governor reg. failure	Deadband	1.0%	100.0%	30.0%
2182	Governor reg. failure	Timer	10.0 s	360.0 s	60.0 s
2183	Governor reg. failure	Output A	R0 (none)	R4 (relay 4) *	R2 (relay 2)
2184	Governor reg. failure	Output B	R0 (none)	R4 (relay 4) *	R2 (relay 2)
2185	Governor reg. failure	Enable	OFF	ON	ON

9.4.6 PI controller, relay output

The relay outputs are made as a PWM (Pulse Width Modulated) output. That means that the time between relay ON points remains constant, whereas the relay ON time varies between constant (far away from set-point) and lowest value (close to set-point).

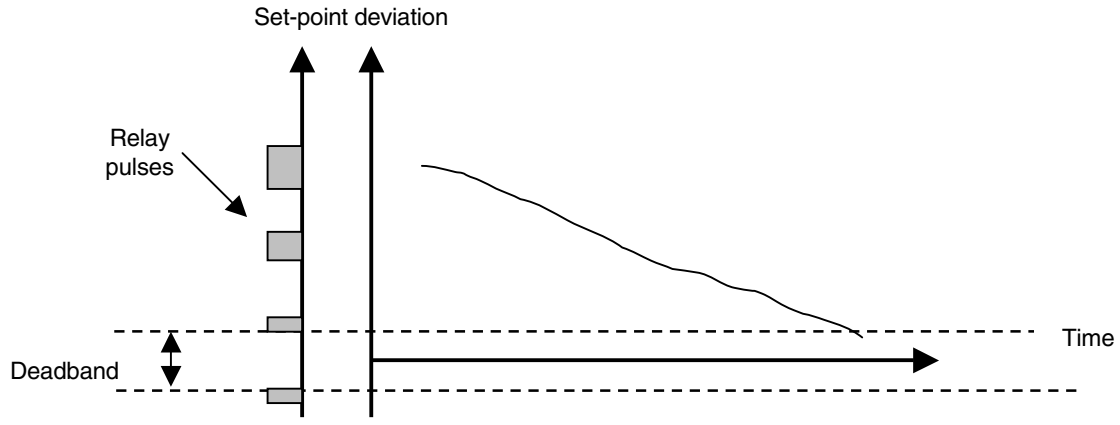
If relay outputs are used, it is necessary to adjust a relay minimum ON time and a regulation period time. This adjustment can be done on both the GOV and the AVR outputs. Diagrams 6 and 7 show the principle of the relay control.

When using relay control outputs it is also necessary to tune in the PI controller set-points, K_P and K_I. Higher value (for both) = faster (and more unstable) control.

This setting is used to tune in the GOV ON time when relay outputs are being used for control. The total relay ON time will depend on the deviation from the setpoint. t_N is the minimum time the relay can be activated.

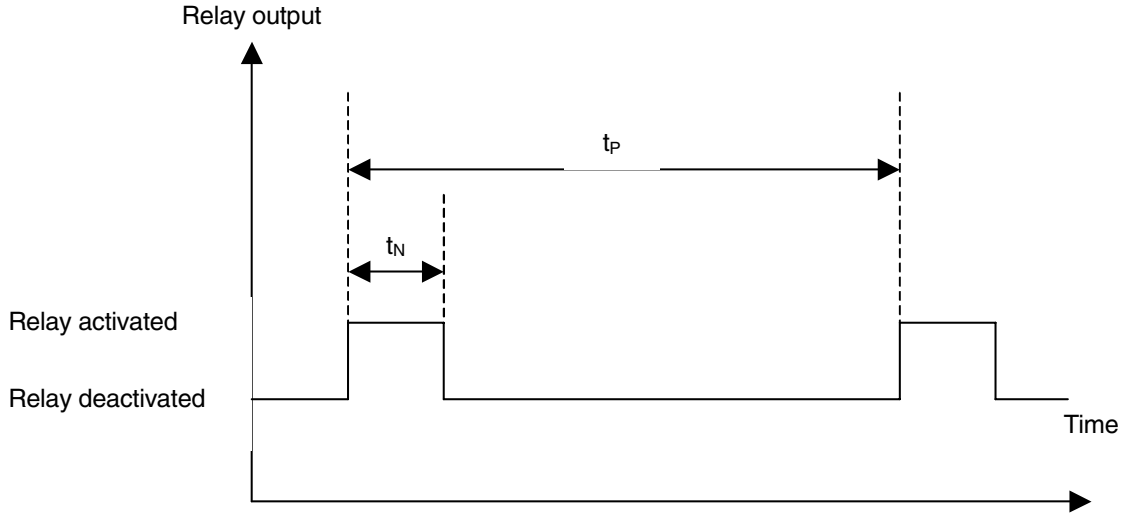
No.	Setting		Min. setting	Max. setting	Factory setting
2250	Relay control	Selection display	-	-	-
2251	Relay control	GOV ON time t_N	10 ms	6500 ms	500 ms
2252	Relay control	GOV per. time t_P	50 ms	32500 ms	2500 ms
2253	Relay control	AVR ON time t_N	10 ms	3000 ms	100 ms
2254	Relay control	AVR per. time t_P	50 ms	15000 ms	500 ms

Diagram 6, relay control signals



The diagram shows that the length of the relay pulses is depending on the deviation from the set-point. The minimum relay output (close to the deadband) is equal to the setting t_N, the maximum relay output is constantly ON.

Diagram 7, relay control signals



9.5 Power setup

9.5.1 Load dependent start/stop of next generator

No.	Setting		Min. setting	Max. setting	Factory setting GPU	Factory setting GPC/PPU
4260	Start next gen.	Selection display	-	-	-	-
4261	Start next gen.	Start point	50%	150%	80%	80%
4262	Start next gen.	Timer	0 s	100 s	10 s	10 s
4263	Start next gen.	Relay output A	R0 (none)	R8 (relay 8)*	R0 (none)	R0 (none)
4264	Start next gen.	Relay output B	R0 (none)	R8 (relay 8)*	R0 (none)	R0 (none)
4265	Start next gen.	Enable	OFF	ON	OFF	OFF

No.	Setting		Min. setting	Max. setting	Factory setting GPU	Factory setting GPC/PPU
4270	Stop next gen.	Selection display	-	-	-	-
4271	Stop next gen.	Stop point	0%	100%	20%	20%
4272	Stop next gen.	Timer	0 s	200 s	30 s	30 s
4273	Stop next gen.	Relay output A	R0 (none)	R8 (relay 8)*	R0 (none)	R0 (none)
4274	Stop next gen.	Relay output B	R0 (none)	R8 (relay 8)*	R0 (none)	R0 (none)
4275	Stop next gen.	Enable	OFF	ON	OFF	OFF

*GPU: Relay 4.

NOTE:
If load dependent start stop is used, the selected relays must be set to function “limit” (see paragraph 7.1.6.1) to avoid unwanted error messages in the display when activated.

9.6 System setup

9.6.1 Nominal settings

All nominal settings relate to the primary side values in the AC system.

No.	Setting		Min. setting	Max. setting	Factory setting
4010	Nominal settings	Selection display	-	-	-
4011	Nominal settings	Frequency	48.0 Hz	62.0 Hz	60.0 Hz
4012	Nominal settings	Generator power	10 kW	99 MW	480 kW
4013	Nominal settings	Generator current	0 A	9000 A	787 A
4014	Nominal settings	Generator volt.	100 V	25000 V	440 V

9.6.2 Transformer generator

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 gen.	Selection display	-	-	-
4021	Transformer gen.	Volt. prim.	100 V	25000 V	440 V
4022	Transformer gen.	Volt. sec.	100 V	690 V	440 V
4023	Transformer gen.	Current prim.	5 A	9000 A	1000 A
4024	Transformer gen.	Current sec.	1 A	5 A	5 A

9.6.3 Transformer busbar

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
4030	Transformer bus.	Selection display	-	-	-
4031	Transformer bus.	Volt. prim.	100 V	25000 V	440 V
4032	Transformer bus.	Volt. sec.	100 V	690 V	440 V

9.6.4 Controller settings (GPC/PPU)

The setting values are used if external set-point or serial communication set-point is not chosen. That means that the mode inputs (terminals 50 and 53) for external set-points are OFF.

The multi-line 2 will control the generator according to these set-points:

Fixed power mode:	Mode 1 ON/mode 2 OFF	Set-point 4041
Fixed var mode:	Mode 4 ON/mode 5 OFF	Set-point 4042
Fixed PF mode:	Mode 4 OFF/mode 5 ON	Set-point 4043

Power setting relates to generator nominal power (kW). var setting is inductive reactive power and relates to generator nominal power (kW ~ var). Power factor setting is inductive value.

No.	Setting		Min. setting	Max. setting	Factory setting
4040	Controller	Selection display	-	-	-
4041	Controller	Power	-100%	100%	100%
4042	Controller	var	0%	100%	30%
4043	Controller	Power factor (ind.)	0.60	1.00	0.90
4044	Controller	Water level regulation	0%	250%	100%

Water level regulation is used if option O, water turbine control, is selected. Otherwise it is disregarded.

9.6.5 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	2001	2100	Present year
4102	Date and time	Month	1	12	1
4103	Date and time	Date	1	31	1
4104	Date and time	Hour	0	23	0
4105	Date and time	Minute	0	59	0

9.6.6 Run time and breaker operations

The function running time counts the hours the generator has been running (voltage on generator present).

The function “CB operations” counts how many times the generator circuit breaker has been closed.

The counters can be reset/set.

No.	Setting		Min. setting	Max. setting	Factory setting
4120	Counters	Selection display	-	-	-
4121	Counters	Running time	0	20000	0
4122	Counters	CB operations	0	20000	0
4123	Counters	Reset kWh counter	OFF	ON	OFF

9.6.7 Battery undervoltage alarm

No.	Setting		Min. setting	Max. setting	Factory setting
4220	Battery low V	Selection display	-	-	-
4221	Battery low V	Set-point	8.0 V	32.0 V	18.0 V
4222	Battery low V	Time	0.0 s	10.0 s	1.0 s
4223	Battery low V	Relay output A	R0 (none)	R4 (relay 4) *	R0 (none)
4224	Battery low V	Relay output B	R0 (none)	R4 (relay 4) *	R0 (none)
4225	Battery low V	Enable	OFF	ON	ON

9.6.8 Language

No.	Setting		Factory setting
4230	Language	Selection display	-
4231	Language	English	English
		Deutsch	-
		Français	-
		Español	-

9.6.9 Loadshare output

This function enables the user to set the voltage level of the active power loadshare line. This is only possible if the loadshare type Pow-R-Con is chosen (menu 4250).

No.	Setting		Min. setting	Max. setting	Factory setting
4240	Loadshare out	Selection display	-	-	-
4241	Loadshare out	Loadshare out	1.0 V	5.0	5.0 V

9.6.10 Loadshare type

This function enables the user to set the type of active power loadshare.

No.	Setting		Type 1	Type 2	Type 3	Factory setting
4250	L. share type	Selection display	-	-	-	-
4251	L. share type	L. share type	DEIF	Selco T4800	Pow-R-Con	DEIF

9.6.11 Alarm setup (no relay output)

No.	Setting		Min. setting	Max. setting	Factory setting
4600	Relay 0 virtual	Selection display	-	-	-
4601	Relay 0 virtual	Function	Alarm	Alarm/sync. block	Alarm
4602	Relay 0	Off delay	0.0 s	999.9 s	5.0 s

The relay 0 is a virtual relay (R0 in the setup menues). This means that all the alarm functions will react depending on the setting in this channel group.

Configured as “Alarm” the alarms will be displayed in the alarm info window as long as the alarm is present and unacknowledged.

Configured as “Alarm/sync. block” the alarms will be displayed in the alarm info window as long as the alarm is present and unacknowledged. Further it blocks the synchronising function.

9.7 User password

The user password menu can only be entered using the “JUMP” pushbutton.

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

If you forget the password, contact DEIF Support for details.

9.8 Service menu

The service menu can only be entered using the “JUMP” pushbutton. This menu is used in service situations.

In the alarm selection you can see all the alarm timers and their remaining time if they are counting.

The input and output selections show the present status of the inputs and outputs. E.g. mode inputs, relay outputs and load sharing lines.

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

9.9 Application menu, 3- , 2- or single phase measuring

This menu can only be entered using the “JUMP” pushbutton.

The purpose of this menu is to change the measuring principle of the multi-line 2, if it is used in different distribution systems.

No.	Setting		Description	Factory setting
6100	Application	Selection display	-	-
	Application	Mode 0	Normal (3 phase)	Normal (3 phase)
	Application	Mode 1	Split phase	-
	Application	Mode 2	Single phase	-

The split phase selection is used if the distribution system is one with 2 phases and neutral. The phases are split 180 degrees. The display shows L1 and L3.

The single phase selection is used in a system with one phase (L1) and neutral. The display shows only L1.

9.10 Phase compensation

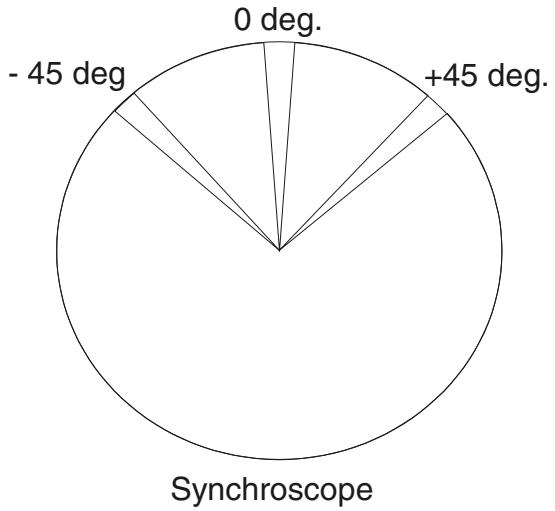
This menu can only be entered using the “JUMP” pushbutton.

The purpose of this menu is to change the measuring principle of the phase between busbar and generator. By jumping to menu 6200, an offset for the synchronise window can be added.

No.	Setting		Min. setting	Max. setting	Factory setting
6200	Phase compensation	Selection display	-	-	-
6200	Phase compensation	Set-point	-45 deg.	45 deg.	0.0 deg.

The offset is active in both static and dynamic synchronisation.

The synchronise window is moved according to the drawing below.



NOTE:
BE CAREFUL - the menu 6200 allows the compensation of the angular gap created by transformers Y1 and Y11. The factory setting is 0° and it will have to remain except for those 2 cases. Any error of setting will involve a "false coupling". After setting 6200, a check of the angular precision of coupling is essential.

10 Technical specifications

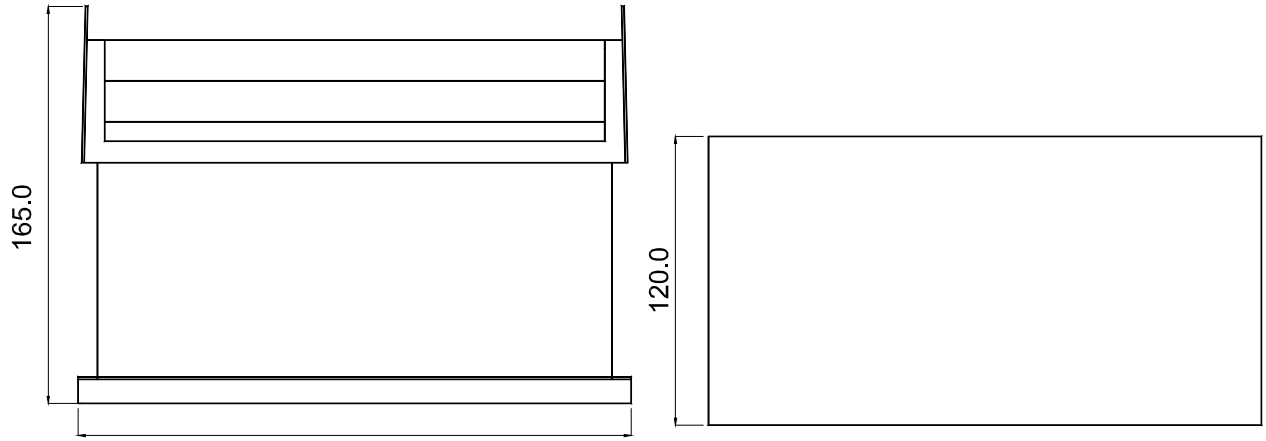
10.1 General data

Accuracy:	Class 1.0 according to IEC 688
Operating temperature:	-25…70°C
Aux. supply:	8...32 VDC, 8 VA max.
Measuring voltage:	100…690 VAC. Consumption max. 0.25 VA per phase
Frequency:	30…70 Hz
Measuring current:	From current transformers …/1 A or …/5 A. Consumption max. 0.3 VA per phase
Binary inputs:	Input voltage: ON: 8…32 VDC. Impedance 2.4 kΩ, bi-directional OFF: <3 VDC
Open collector outputs:	Supply voltage 8…32 VDC. Load max. 10 mA
Load sharing lines:	+/-5 VDC
Analogue inputs:	+/-10 VDC, impedance 100 kΩ (not galvanically separated) 4…20 mA, impedance 50 Ω (not galvanically separated)
Relay outputs:	250 V/8 A or 24 VDC/1 A. Refer to the actual description of I/O's
Safety:	To EN 61010-1 installation category (overvoltage category) III, 600 V, pollution degree 2
Galvanic separation:	Between AC voltage, AC current and other I/O's: 3250 VAC – 50 Hz – 1 min. Between analogue outputs: 500 VDC – 1 min.
EMC/CE:	According to EN-50081-1/2, EN-50082-1/2, SS4361503 (PL4) and IEC 255-3
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 set-point is reached till the output is activated and the delay set to 0 Reverse power: 100-300 ms Current: 100-300 ms
Protection:	Case: IP40 Terminals: IP20 Operator panel: IP52 (IP54 when mounted with gasket) To IEC 529 and EN 60529
Mounting:	Base mounted with six screws or DIN-rail mounted

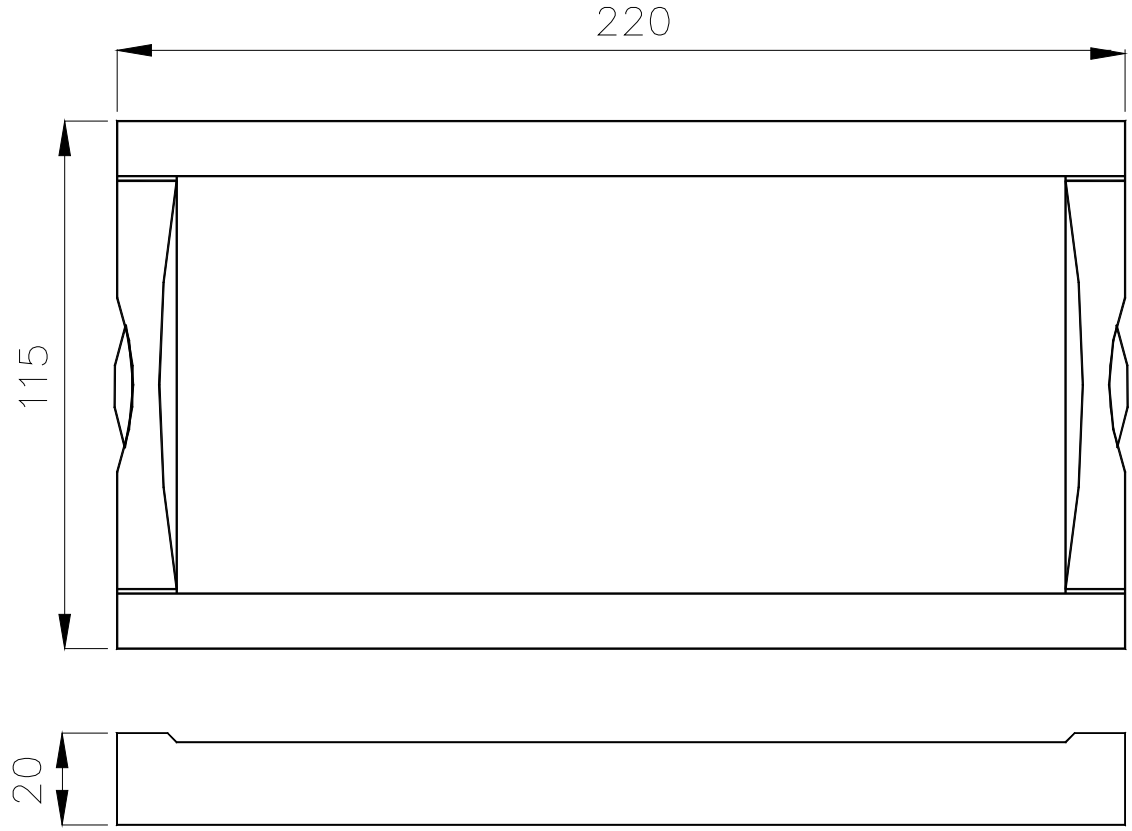
10.2 GPU and PPU - special conditions

Type approval:	DNV, GL, LR and ABS for use in unmanned machinery space
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

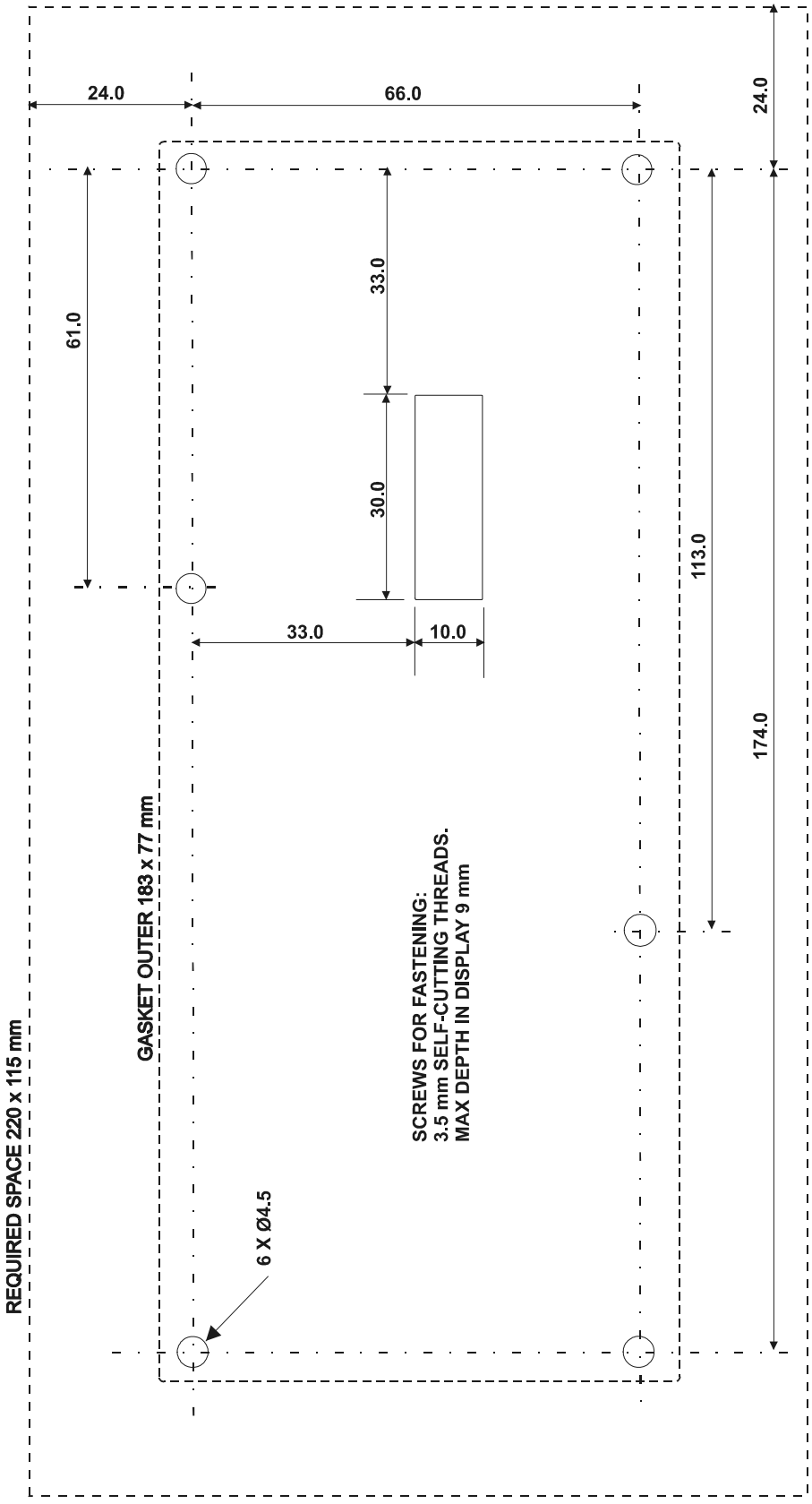
10.3 Unit dimensions



10.4 Display dimensions



10.5 Panel cutout for display



Errors and changes excepted