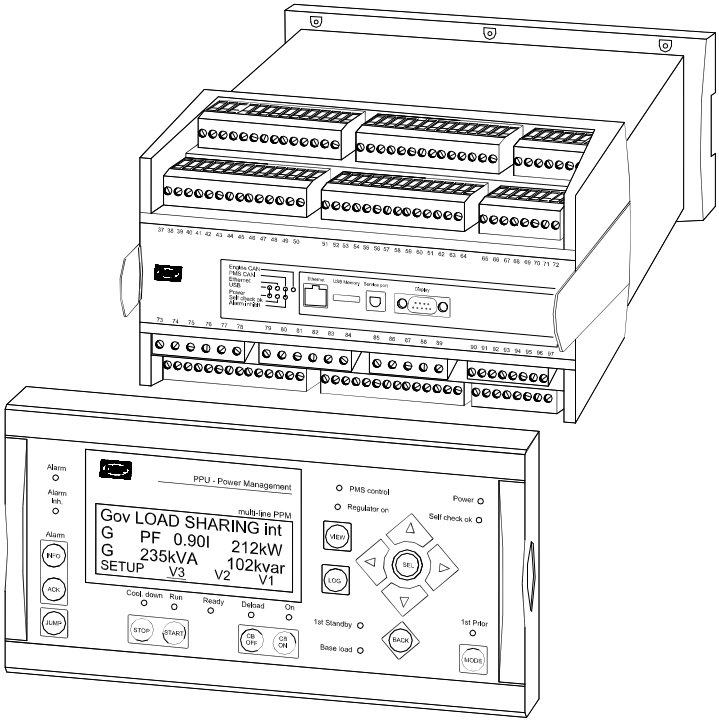
DEIF A/S

Installation Instructions

PPU Power Management (PPM)

4189340409I (UK)



- *Diesel generator I/Os*
- *Shaft generator/Shore connection I/Os*
- *Bus tie generator I/Os*
- *Wiring*

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1. About this document

This document is the Installation Instructions for DEIF's PPU Power Management system PPM. The document mainly includes general hardware description, I/O lists for diesel, shaft and bus tie generator, wiring descriptions and FAT information.

The general purpose of these installation instructions is to give the user important information to be used in the installation of the PPM system.

Please make sure that you read this manual before starting to work with the PPM system. Failure to do this could result in damaging the equipment or even worse injury of personnel.

Intended users

These installation instructions are mainly intended for the panel builder designer in charge. On the basis of this document, the panel builder designer will give the electrician the information he needs in order to install the PPM system, e.g. detailed electrical drawings. In some cases the electrician may use these installation instructions himself.

Contents/overall structure

This document is divided into chapters, and in order to make the structure simple and easy to use, each chapter will begin from the top of a new page.

Definitions

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

Notes

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

Warnings

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

2. Warnings and legal information

Legal information and responsibility

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

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

Electrostatic discharge awareness

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

Safety issues

Installing the system implies work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.

Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

3. General hardware description

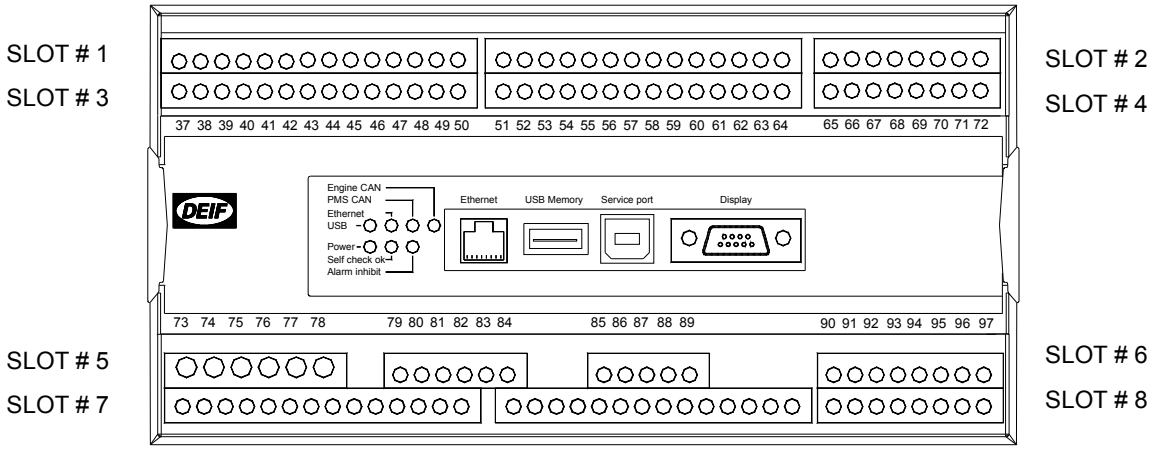
Hardware

The unit housing is divided into board slot positions. This means that the unit consists of a number of printed circuit boards (PCBs) mounted in numbered slots. The green terminal blocks are then mounted in the PCBs. Some of these board slots are standard, and some are intended for options. The board slot positions are arranged as illustrated below.

	Term.	DG	SG/SC	TB	Description
Slot #1	1-28	Standard	Standard	Standard	Power supply board
Slot #2	29-36	H2	H2	H2	Option: External comm.
Slot #3	37-64	Standard	Standard	Standard	Load sharing and input/output board
Slot #4	65-72	Standard	**Not used**	**Not used**	Outputs for governor/AVR according to choice of types
Slot #5	73-89	Standard	Standard	Standard	AC measuring
Slot #6	90-125	F1, M15, M16, M18	F1, M15, M16, M18	F1, M15, M16, M18	Option: F1 analogue transducer outputs, M15 (4 x 0(4)…20 mA inputs), M16 (7 x binary inputs), M18 (4 x relay outputs)
Slot #7	98-125	Standard	Standard	**Not used**	Engine interface board
Slot #8	126-133	Standard	Standard	Standard	Internal CANbus

Unit top side overview

An overview of the terminals is presented below. The slot positions are as follows:

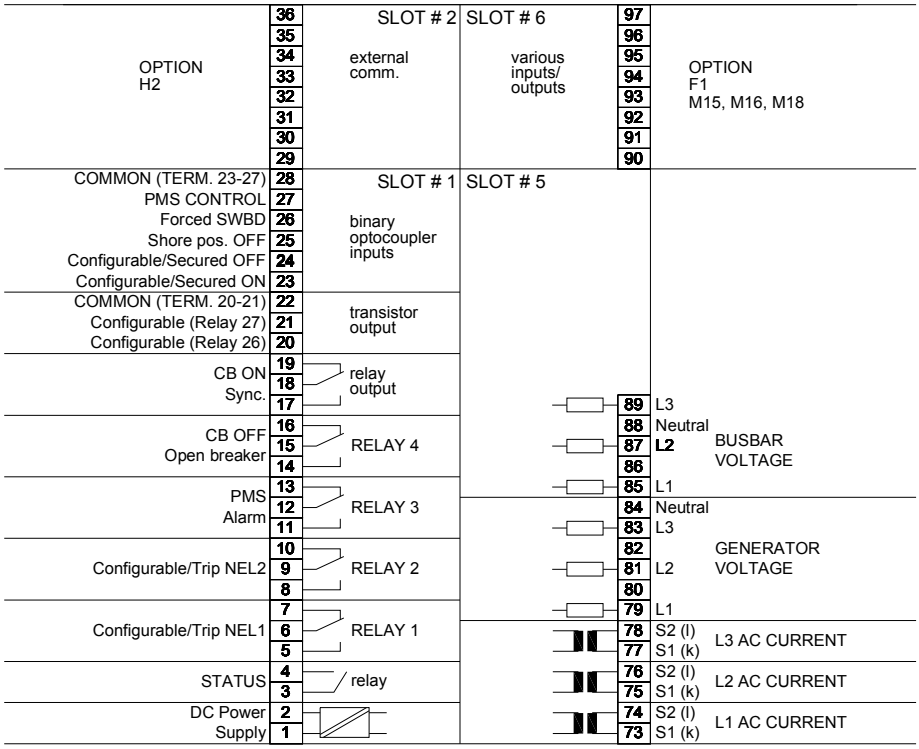


4. Diesel generator I/Os

DG unit with PMS processor

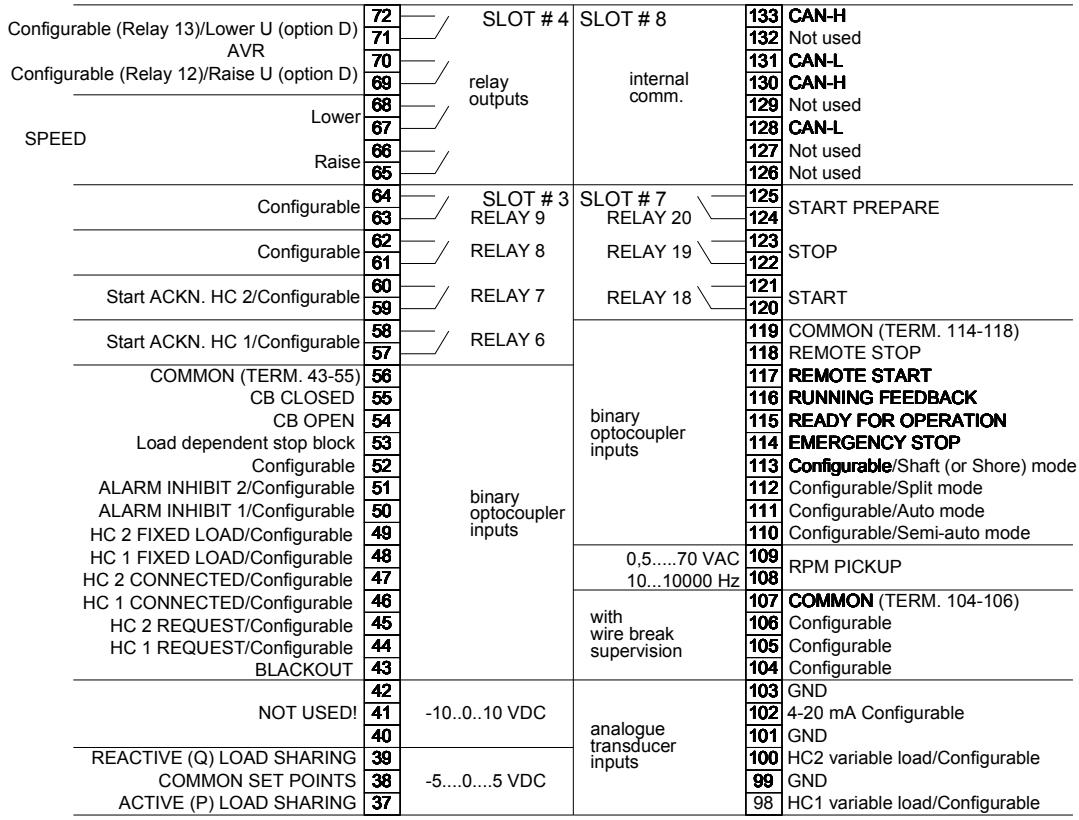
Terminal strip overviews

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



The functionality of the boards in slot #2 and slot #6 is optional.

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



The functionality of the boards in slot #4 is optional.

Terminal strip description

Slot #1, power supply and binary I/O

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

Term.	Function	Technical data	Description
1	+12/24V DC	12/24V DC -25/+30%	Power supply
2	0V DC		
3	NC	Status relay	Normally closed relay, processor/power supply status supervision
4	Com.	24 V/1A	
5	NO	Relay 1	Configurable/Trip NEL 1
6	Com.	250V AC/8A	
7	NC		
8	NO	Relay 2	Configurable/Trip NEL 2
9	Com.	250V AC/8A	
10	NC		
11	NO	Relay 3	PMS alarm
12	Com.	250V AC/8A	
13	NC		
14	NO	Relay 4	CB OFF Open breaker (deload)/trip
15	Com.	250V AC/8A	
16	NC		
17	NO	Relay 5	CB ON Close breaker (synchronising)
18	Com.	250V AC/8A	
19	NC		
20	Open collector 1	Transistor out	configurable as standard relay output (relay number 26)
21	Open collector 2	Transistor out	configurable as standard relay output (relay number 27)
22	Com.	Common	Common terminal for terminals 20 and 21
23	Binary input	Optocoupler	Configurable/Secured mode ON
24	Binary input	Optocoupler	Configurable/Secured mode OFF
25	Binary input	Optocoupler	Shore connection breaker position OFF
26	Binary input	Optocoupler	Forced switchboard control
27	Binary input	Optocoupler	PMS control
28	Com.	Common	Common for terminals 23-27

The power supply must be protected with a 1A fuse.

Slot #2, external communication (option)

Option H2 (RS485 Modbus RTU).

Term.	Function	Description
29	DATA + (A)	Modbus RTU, RS485
30	Not used	
31	DATA - (B)	
32	Not used	
33	DATA + (A)	
34	Not used	
35	DATA - (B)	
36	Not used	

The serial communication line should be terminated between DATA + and DATA - with a resistor equal to the cable impedance.

Slot #3, binary I/O

Term.	Function	Technical data	Description
37	-5…0…5V DC	Analogue I/O	Active load sharing line
38	Com.	Common	Common for load sharing lines
39	-5…0…5V DC	Analogue I/O	Reactive load sharing
40	-10…0…10V DC	Analogue input	NOT USED
41	Com.	Common	
42	-10…0…10V DC	Analogue input	
43	Binary input	Optocoupler	Blackout input from external relay (all breakers in position OFF)
44	Binary input	Optocoupler	Heavy consumer 1 request/configurable
45	Binary input	Optocoupler	Heavy consumer 2 request/configurable
46	Binary input	Optocoupler	Heavy consumer 1 connected/configurable
47	Binary input	Optocoupler	Heavy consumer 2 connected/configurable
48	Binary input	Optocoupler	Heavy consumer 1 fixed load/configurable
49	Binary input	Optocoupler	Heavy consumer 2 fixed load/configurable
50	Binary input	Optocoupler	Alarm Inhibit 1/configurable
51	Binary input	Optocoupler	Alarm Inhibit 2/configurable
52	Binary input	Optocoupler	Configurable. User programmable
53	Binary input	Optocoupler	Load dependent stop blocking
54	Binary input	Optocoupler	CB open
55	Binary input	Optocoupler	CB closed
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 6	Start acknowledge Heavy consumer 1/configurable
58	Com.	250V AC 8A	
59	NO	Relay 7	Start acknowledge Heavy consumer 2/configurable
60	Com.	250V AC 8A	
61	NO	Relay 8	Configurable. User programmable
62	Com.	250V AC 8A	
63	NO	Relay 9	Configurable. User programmable
64	Com.	250V AC 8A	

Slot #4, GOV/AVR (standard)

GOV/AVR relay output card *(GOV standard) (voltage control option D).*

Term.	Function	Technical data	Description
65	NO	Relay 10 250V AC, 8A	Generator GOV Increase frequency
66	Com.		
67	NO	Relay 11 250V AC, 8A	Generator GOV Decrease frequency
68	Com.		
69	NO	Relay 12 250V AC, 8A	Generator AVR (option D) Increase voltage/configurable
70	Com.		
71	NO	Relay 13 250V AC, 8A	Generator AVR (option D) Decrease voltage/configurable
72	Com.		

Option E1

GOV/AVR analogue output card.

Term.	Function	Description
65	Not used	
66	+/-20 mA out	Speed governor setpoint output
67	0	
68	Not used	
69	Not used	
70	+/-20 mA out	AVR voltage setpoint output
71	0	
72	Not used	

If necessary the current outputs can be converted to voltage using a resistor across the terminals (250 Ω will convert the +/-20 mA into +/-5V DC).

Voltage control setpoint to AVR is an option. If a combination of analogue signals and relay signals is needed, then option EF4 is to be used.

Option EF2

Analogue speed governor output and one transducer output.

Term.	Function	Description
65	Not used	
66	+/-20 mA	Speed governor setpoint output
67	0	
68	Not used	
69	Not used	
70	0(4) - 20 mA out	Analogue output 3
71	0	
72	Not used	

These outputs are **active** outputs, meaning that they have an internal power supply. The outputs are galvanically separated from each other and from the rest of the unit. Via the display or the PC programming software individual outputs can be selected to represent any AC measuring value and related values e.g. power, power factor, frequency etc. Outputs can be selected to be either 0…20 mA or 4…20 mA in the PC utility software. If necessary, the current outputs can be converted to voltage using a resistor across the terminals (500 Ω will convert the 0-20 mA into 0-10V DC).

Option EF4

Combination output for governor and AVR (option EF4).

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

In the menu system it is possible to set the speed governor to either binary or analogue output. With option D this selection regarding AVR control is also possible.

On the PCB there is only one set of relay outputs and one analogue output. This means that if the relay outputs are used for speed control, then the analogue output will be used for the AVR, and vice versa.

Slot #5, AC measuring

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. 690V AC phase - phase value
80	*Not used*		
81	U L2	Generator voltage L2	Max. 690V AC phase - phase value
82	*Not used*		
83	U L3	Generator voltage L3	Max. 690V AC phase - phase value
84	U neutral	Generator voltage neutral	For land-based applications only
85	U L1	Bus voltage L1	Max. 690V AC phase - phase value
86	*Not used*		
87	U L2	Bus voltage L2	Max. 690V AC phase - phase value
88	U neutral	Bus voltage neutral	For land-based applications only
89	U L3	Bus voltage L3	Max. 690V AC phase - phase value

Current inputs are galvanically separated. Max. 0.3 VA per phase. Voltage measurements are available (phase to phase) from 100V AC to 690V AC.

Slot #6, inputs/outputs (I/Os)

Option F1

Analogue transducer output.

Term.	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	0(4) - 20 mA out	
97	Not used	

These outputs are **active** outputs, meaning that they have an internal power supply. The outputs are galvanically separated from each other and from the rest of the unit. Via the display or the PC programming software individual outputs can be selected to represent any AC measuring value and related values e.g. power, power factor, frequency etc. Outputs can be selected to be either 0…20 mA or 4…20 mA in the PC utility software. If necessary, the current outputs can be converted to voltage using a resistor across the terminals (500 Ω will convert the 0-20 mA into 0-10V DC).

Option M15

4 x analogue 4-20 mA inputs.

Term.	Function	Description
90	Input 90 common	Common
91	Analogue input 91+	4-20 mA in
92	Input 92 common	Common
93	Analogue input 93+	4-20 mA in
94	Input 94 common	Common
95	Analogue input 95+	4-20 mA in
96	Input 96 common	Common
97	Analogue input 97+	4-20 mA in

Option M16

7 x binary inputs.

Term.	Function	Description
90	Common	Common
91	Digital input	Configurable
92	Digital input	Configurable
93	Digital input	Configurable
94	Digital input	Configurable
95	Digital input	Configurable
96	Digital input	Configurable
97	Digital input	Configurable

Option M18

4 x relay outputs.

Term.	Function	Description
90	Relay output 14	Configurable
91	250V AC, 8A max.	
92	Relay output 15	Configurable
93	250V AC, 8A max.	
94	Relay output 16	Configurable
95	250V AC, 8A max.	
96	Relay output 17	Configurable
97	250V AC, 8A max.	

Slot #7, engine interface board

Term.	Function	Technical data	Description/preconfiguration
98	Analogue input 1 +	+4…20 mA in	Heavy consumer 1 variable load/configurable
99	Analogue input 1 -	GND	
100	Analogue input 2 +	+4…20 mA in	Heavy consumer 2 variable load/configurable
101	Analogue input 2 -	GND	
102	Analogue input 3 +	+4…20 mA in	Configurable. User-programmable
103	Analogue input 3 -	GND	
104	Binary input	With wire break supervision Wire break resistor: 100 Ω	Configurable. User-programmable
105	Binary input		Configurable. User-programmable
106	Binary input		Configurable. User-programmable
107	Common		Common terminals for 104-106
108	Tacho input	0.5…70V AC 10…10.000 Hz	RPM/magnetic pick-up/overspeed
109	Tacho input		
110	Binary input	Optocoupler	Configurable/Semi-auto mode
111	Binary input	Optocoupler	Configurable/Auto mode
112	Binary input	Optocoupler	Configurable/Split mode
113	Binary input	Optocoupler	Configurable/Shaft (or Shore) mode
114	Binary input	Optocoupler	External emergency stop activated
115	Binary input	Optocoupler	Ready for operation (ON = ready, OFF = blocked)
116	Binary input	Optocoupler	Running feedback
117	Binary input	Optocoupler	Remote start (only active in SEMI-AUTO plant mode)
118	Binary input	Optocoupler	Remote stop (only active in SEMI-AUTO plant mode)
119	Com.	Common	Common for terminals 114-118
120	NO	Relay 18 250V AC/8A	Start
121	Com.		
122	NO	Relay 19 250V AC/8A	Stop coil/running coil (selectable)
123	Com.		
124	NO	Relay 20 250V AC/8A	Start prepare
125	Com.		

The engine interface board consists of configurable inputs and outputs. The configuration is performed via the PC utility software, and the default settings can be changed to the relevant settings. For input configuration, upload the parameter list from the unit and select the input in question. Then a configuration dialog box will appear, and the settings can be changed. The standard title (e.g. 4-20 mA in no. 1) can be changed, and the new title will also be shown in the display. The minimum and maximum values of the 4-20 mA input can be adjusted:

- Value: Nominal heavy consumer power (e.g. 400 kW)
- Min.: Value corresponding to 4 mA (e.g. 0 kW)
- Max.: Value corresponding to 20 mA (e.g. 400 kW)

The inputs can be used as high or low alarms. As a 'high alarm' the alarm will appear, when the measured value is higher than the alarm limit, and as a 'low alarm' the alarm will appear, when the measured value is lower than the alarm limit.

Slot #8, internal communication

Term.	Function	Description
126	Not used	CANbus communication line between the units For internal use only!
127	Not used	
128	Can-L	
129	Not used	
130	Can-H	
131	Can-L	
132	Not used	
133	Can-H	

Binary inputs

Term.	Name	Function
23	Configurable/Secured mode ON	This input is programmable from the PC utility software/Input for activating the secured mode (pulse signal)
24	Configurable/Secured mode OFF	This input is programmable from the PC utility software/Input for deactivating the secured mode (pulse signal)
25	Shore connection breaker position OFF	The shore connection breaker is in position OFF. When the shore connection breaker is connected, the generator breaker ON sequence is blocked.
26	Forced switchboard control	If the input is set, the entire system will be forced into switchboard control. (Regulation is deactivated).
27	PMS control	The unit is set to be in power management control or in switchboard control.
43	Blackout	Signal from an external relay. All generator breakers are in position OFF. This signal is used for the blackout start sequence in case of missing power management.
44	HC 1 request/configurable	When this input is active, the heavy consumer has been requested for operation. The power management is calculating the power demand and starts the necessary number of diesel generators (not in SEMI-AUTO mode). The HC request information is also indicated at the AOP-2/Configurable. User-programmable.
45	HC 2 request/configurable	
46	HC 1 connected/configurable	The heavy consumer in question is in operation and connected to the busbar/Configurable. User-programmable.
47	HC 2 connected/configurable	
48	HC 1 fixed load/configurable	When this input is activated (ON), then the heavy consumer in question is using 100% of its load and 0% is reserved. A deactivated input (OFF) means that 0% of the load is used and 100% is reserved/ Configurable. User-programmable.
49	HC 2 fixed load/configurable	
50	Alarm inhibit 1/configurable	External input for inhibit of selected alarms/ Configurable. User-programmable.
51	Alarm inhibit 2/configurable	External input for inhibit of selected alarms/ Configurable. User-programmable.
52	Configurable. User-programmable	This input is programmable from the PC utility software.
53	Load dependent stop block	The load dependent stop function is blocked when the binary input is set. This will also be indicated at the AOP-2.
54	CB open	Breaker feedback signal. The connection breaker is in position ON.
55	CB closed	Breaker feedback signal. The connection breaker is in position OFF.
104	Configurable. User-programmable	This input is programmable from the PC utility software. **This input has wire break supervision and therefore needs a potentially free contact. The wire break resistor is 100 Ω.**
105	Configurable. User-programmable	This input is programmable from the PC utility software. **This input has wire break supervision and therefore needs a potentially free contact. The wire break resistor is 100 Ω.**

106	Configurable. User-programmable	This input is programmable from the PC utility software. **This input has wire break supervision and therefore needs a potentially free contact. The wire break resistor is 100 Ω.**
110	Configurable/Semi-auto mode	This input is programmable from the PC utility software/Input for activating the semi-auto mode (pulse signal).
111	Configurable/Auto mode	This input is programmable from the PC utility software/Input for activating the auto mode (pulse signal).
112	Configurable/Split mode	This input is programmable from the PC utility software/Input for activating the split mode (pulse signal).
113	Configurable/Shaft (or shore) mode	This input is programmable from the PC utility software/Input for activating the shaft (or shore) mode (pulse signal).
114	Emergency stop	The emergency stop input has been activated. The engine is shutting down.
115	Ready for operation	The diesel engine is ready for operation. When this input is OFF, the diesel engine is blocked for start/CB ON.
116	Running feedback	The diesel engine has achieved the running status = ON.
117	Remote start	Remote input for start + CB ON. (Only available in SEMI-AUTO mode).
118	Remote stop	Remote input for CB OFF + stop. (Only available in SEMI-AUTO mode).

Analogue transducer inputs

Term.	Name	Function
98	HC 1 power feedback/configurable	Analogue power feedback for heavy consumer no. 1 regarding the adjustable setpoint. 4..20 mA (0 kW…HC 1 max. kW)/Configurable. User-programmable.
100	HC 2 power feedback/configurable	Analogue power feedback for heavy consumer no. 2 regarding to the adjustable setpoint. 4..20 mA (0 kW…HC 2 max. kW)/Configurable. User-programmable.
102	Configurable. User programmable	Configurable analogue alarm input. Adjustable setpoint (4..20 mA).

Relay outputs

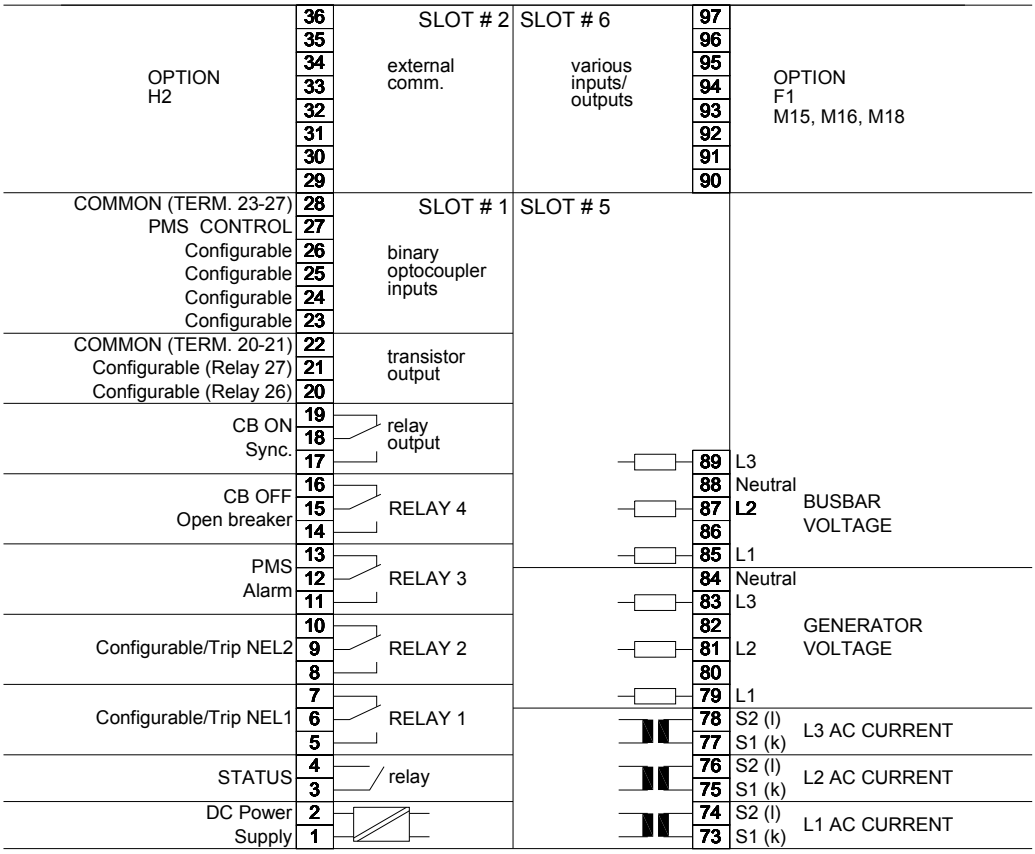
Term.	Name	Function
3 4	Status relay	The status relay on the power supply board is a normally closed relay with the purpose of processor and power supply supervision.
5 6 7	Configurable/ Trip NEL 1/(RELAY 1)	Configurable. User-programmable/Trip of the NEL (Non Essential Load) group no. 1 due to measured underfrequency, overcurrent or push load on the busbar. The output can be selected to be normally open (NO, terminal 5-6) or normally closed (NC, terminal 6-7).
8 9 10	Configurable/ Trip NEL 2/(RELAY 2)	Configurable. User-programmable/Trip of the NEL (Non Essential Load) group no. 2 due to measured underfrequency, overcurrent or push load on the busbar. The output can be selected to be normally open (NO, terminal 8-9) or normally closed (NC, terminal 9-10).
11 12 13	PMS alarm (RELAY 3)	A PMS alarm has been activated. All alarms in the system activate the PMS alarm output. The output will be reset when the alarm condition disappears The output can be selected to be normally open (NO, terminal 11-12) or normally closed (NC, terminal 12-13).
14 15 16	CB OFF (RELAY 4)	Connection breaker OFF signal. When this output is active, the generator breaker will open. The output can be selected to be normally open (NO, terminal 14-15) or normally closed (NC, terminal 15-16).
17 18 19	CB ON (RELAY 5)	Connection breaker ON signal. When this output is active, the generator breaker will close. The output can be selected to be normally open (NO, terminal 17-18) or normally closed (NC, terminal 18-19).
20	Configurable (RELAY 26)	Configurable digital output (transistor output type)
21	Configurable (RELAY 27)	Configurable digital output (transistor output type)
57 58	START ACKN. HC 1/configurable (RELAY 6)	The heavy consumer is ready for operation as long as this output is active. The available power on the busbar is above max. HC power Configurable. User-programmable.
59 60	START ACKN. HC 2/configurable (RELAY 7)	
61 62	Configurable (RELAY 8)	This output is user-programmable.
63 64	Configurable (RELAY 9)	This output is user-programmable.
65 66	Increase of speed (RELAY 10)	Increase of speed. The signal is connected to the speed governor. A speed droop of 4% (+/-2%) has to be adjusted in the speed governor.
67 68	Decrease of speed (RELAY 11)	Decrease of speed. The signal is connected to the speed governor. A speed droop of 4% (+/-2%) has to be adjusted in the speed governor.
69 70	Increase of voltage (Option D)/configurable (RELAY 12)	Increase of voltage. The signal is connected to the AVR. A voltage droop of 4% (+/-2%) has to be adjusted in the AVR/Configurable. User-programmable.
71 72	Decrease of voltage (Option D)/configurable (RELAY 13)	Decrease of voltage. The signal is connected to the AVR. A voltage droop of 4% (+/-2%) has to be adjusted in the AVR/Configurable. User-programmable.
120 121	START (RELAY 18)	Start output to the diesel engine is activated = ON.
122	STOP	Stop output to the diesel engine is activated. Stop coil or running

123	(RELAY 19)	coil can be selected.
124 125	START PREPARE (RELAY 20)	The start prepare output is activated, before the start output is activated. This could be preglow or preheating of the engine.

DG unit without PMS processor

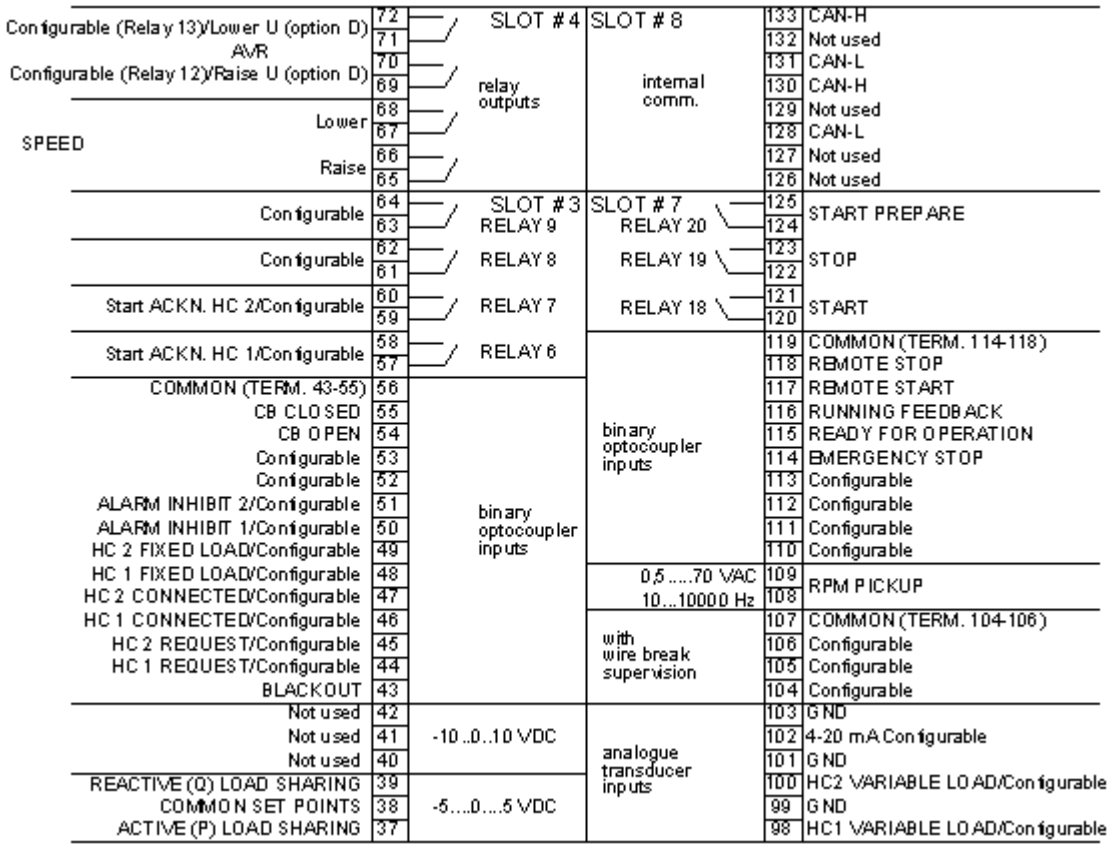
Terminal strip overviews

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



The functionality of the boards in slot #2 and slot #6 is optional.

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



The functionality of the boards in slot #4 is optional.

Terminal strip description

Slot #1, power supply and binary I/O

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

Term.	Function	Technical data	Description
1	+12/24V DC	12/24V DC -25/+30%	Power supply
2	0V DC		
3	NC	Status relay	Normally closed relay, processor/power supply status supervision
4	Com.	24 V/1A	
5	NO	Relay 1	Configurable/Trip NEL 1
6	Com.	250V AC/8A	
7	NC		
8	NO	Relay 2	Configurable/Trip NEL 2
9	Com.	250V AC/8A	
10	NC		
11	NO	Relay 3	PMS alarm
12	Com.	250V AC/8A	
13	NC		
14	NO	Relay 4	CB OFF Open breaker (deload)/trip
15	Com.	250V AC/8A	
16	NC		
17	NO	Relay 5	CB ON Close breaker (synchronising)
18	Com.	250V AC/8A	
19	NC		
20	Open collector 1	Transistor out	Configurable as standard relay output (relay number 26)
21	Open collector 2	Transistor out	Configurable as standard relay output (relay number 27)
22	Com.	Common	Common terminal for terminals 20 and 21
23	Binary input	Optocoupler	Configurable. User-programmable
24	Binary input	Optocoupler	Configurable. User-programmable
25	Binary input	Optocoupler	Configurable. User-programmable
26	Binary input	Optocoupler	Configurable. User-programmable
27	Binary input	Optocoupler	PMS control
28	Com.	Common	Common for terminals 23-27

The power supply must be protected with a 1A fuse.

Slot #2, external communication (option)

Option H2 (RS485 Modbus RTU)

Term.	Function	Description
29	DATA + (A)	Modbus RTU, RS485
30	Not used	
31	DATA - (B)	
32	Not used	
33	DATA + (A)	
34	Not used	
35	DATA - (B)	
36	Not used	

The serial communication line should be terminated between DATA + and DATA - with a resistor equal to the cable impedance.

Slot #3, binary I/O

Term.	Function	Technical data	Description
37	-5…0…5V DC	Analogue I/O	Active load sharing line
38	Com.	Common	Common for load sharing lines
39	-5…0…5V DC	Analogue I/O	Reactive load sharing
40	-10…0…10V DC	Analogue input	NOT USED
41	Com.	Common	
42	-10…0…10V DC	Analogue input	
43	Binary input	Optocoupler	Blackout input from external relay. (All breakers in position OFF)
44	Binary input	Optocoupler	Heavy consumer 1 request/configurable
45	Binary input	Optocoupler	Heavy consumer 2 request/configurable
46	Binary input	Optocoupler	Heavy consumer 1 connected/configurable
47	Binary input	Optocoupler	Heavy consumer 2 connected/configurable
48	Binary input	Optocoupler	Heavy consumer 1 fixed load/configurable
49	Binary input	Optocoupler	Heavy consumer 2 fixed load/configurable
50	Binary input	Optocoupler	Alarm inhibit 1, external input for inhibit of selected alarms/configurable
51	Binary input	Optocoupler	Alarm inhibit 2, external input for inhibit of selected alarms/configurable
52	Binary input	Optocoupler	Configurable. User-programmable
53	Binary input	Optocoupler	Configurable. User-programmable
54	Binary input	Optocoupler	CB open
55	Binary input	Optocoupler	CB closed
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 6	Start acknowledge heavy consumer 1/configurable
58	Com.	250V AC 8A	
59	NO	Relay 7	Start acknowledge heavy consumer 2/configurable
60	Com.	250V AC 8A	
61	NO	Relay 8	The relay is user configurable and can be used as both alarm and limit relay
62	Com.	250V AC 8A	
63	NO	Relay 9	The relay is user configurable and can be used as both alarm and limit relay
64	Com.	250V AC 8A	

Slot #4, GOV/AVR (standard)

GOV/AVR relay output card *(GOV standard) (voltage control option D).*

Term.	Function	Technical data	Description
65	NO	Relay 10 250V AC, 8A	Generator GOV Increase frequency
66	Com.		
67	NO	Relay 11 250V AC, 8A	Generator GOV Decrease frequency
68	Com.		
69	NO	Relay 12 250V AC, 8A	Generator AVR (option D) Increase voltage/configurable
70	Com.		
71	NO	Relay 13 250V AC, 8A	Generator AVR (option D) Decrease voltage/configurable
72	Com.		

Option E1

GOV/AVR analogue output card.

Term.	Function	Description
65	Not used	
66	+/-20 mA out	Speed governor setpoint output
67	0	
68	Not used	
69	Not used	
70	+/-20 mA out	AVR voltage setpoint output
71	0	
72	Not used	

If necessary the current outputs can be converted to voltage using a resistor across the terminals (250 Ω will convert the +/-20 mA into +/-5V DC).

Voltage control setpoint to AVR is an option. If a combination of analogue signals and relay signals is needed, then option EF4 is to be used.

Option EF2

Analogue speed governor output and one transducer output.

Term.	Function	Description
65	Not used	
66	+/-20 mA	Speed governor setpoint output
67	0	
68	Not used	
69	Not used	
70	0(4) - 20 mA out	Analogue output 3
71	0	
72	Not used	

These outputs are **active** outputs, meaning that they have an internal power supply. The outputs are galvanically separated from each other and from the rest of the unit. Via the display or the PC programming software individual outputs can be selected to represent any AC measuring value and related values, e.g. power, power factor, frequency etc. Outputs can be selected to be either 0…20 mA or 4…20 mA in the PC utility software. If necessary the current outputs can be converted to voltage using a resistor across the terminals (500 Ω will convert the 0-20 mA into 0-10V DC).

Option EF4

Combination output for governor and AVR (option EF4).

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

In the menu system it is possible to set the speed governor to either binary or analogue output. With option D this selection regarding AVR control is also possible.

On the PCB there is only one set of relay outputs and one analogue output. This means that if the relay outputs are used for speed control, then the analogue output will be used for the AVR, and vice versa.

Slot #5, AC measuring

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. 690V AC phase - phase value
80	*Not used*		
81	U L2	Generator voltage L2	Max. 690V AC phase - phase value
82	*Not used*		
83	U L3	Generator voltage L3	Max. 690V AC phase - phase value
84	U neutral	Generator voltage neutral	For land-based applications only
85	U L1	Bus voltage L1	Max. 690V AC phase - phase value
86	*Not used*		
87	U L2	Bus voltage L2	Max. 690V AC phase - phase value
88	U neutral	Bus voltage neutral	For land-based applications only
89	U L3	Bus voltage L3	Max. 690V AC phase - phase value

Current inputs are galvanically separated. Max. 0.3 VA per phase. Voltage measurements are available (phase to phase) from 100V AC to 690V AC.

Slot #6, optional I/Os

Option F1

Analogue transducer output.

Term.	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	0(4) - 20 mA out	
97	Not used	

These outputs are **active** outputs, meaning that they have an internal power supply. The outputs are galvanically separated from each other and from the rest of the unit. Via the display or the PC programming software individual outputs can be selected to represent any AC measuring value and related values, e.g. power, power factor, frequency etc. Outputs can be selected to be either 0…20 mA or 4…20 mA in the PC utility software. If necessary the current outputs can be converted to voltage using a resistor across the terminals (500 Ω will convert the 0-20 mA into 0-10V DC).

Option M15

4 x analogue 4-20 mA inputs.

Term.	Function	Description
90	Input 90 common	Common
91	Analogue input 91+	4-20 mA in
92	Input 92 common	Common
93	Analogue input 93+	4-20 mA in
94	Input 94 common	Common
95	Analogue input 95+	4-20 mA in
96	Input 96 common	Common
97	Analogue input 97+	4-20 mA in

Option M16

7 x binary inputs.

Term.	Function	Description
90	Common	Common
91	Digital input	Configurable
92	Digital input	Configurable
93	Digital input	Configurable
94	Digital input	Configurable
95	Digital input	Configurable
96	Digital input	Configurable
97	Digital input	Configurable

Option M18

4 x relay outputs.

Term.	Function	Description
90	Relay output 14	Configurable
91	250V AC, 8A max.	
92	Relay output 15	Configurable
93	250V AC, 8A max.	
94	Relay output 16	Configurable
95	250V AC, 8A max.	
96	Relay output 17	Configurable
97	250V AC, 8A max.	

Slot #7, engine interface board

Term.	Function	Technical data	Description/preconfiguration
98	Analogue input 1 +	+4…20 mA in	Heavy consumer 1 variable load/configurable
99	Analogue input 1 -	GND	
100	Analogue input 2 +	+4…20 mA in	Heavy consumer 2 variable load/configurable
101	Analogue input 2 -	GND	
102	Analogue input 3 +	+4…20 mA in	Configurable. User-programmable
103	Analogue input 3 -	GND	
104	Binary input	With wire break supervision Wire break resistor: 100 Ω	Configurable. User-programmable
105	Binary input		Configurable. User-programmable
106	Binary input		Configurable. User-programmable
107	Common		Common terminals for 104-106
108	Tacho input	0.5…70V AC 10…10.000 Hz	RPM/magnetic pick-up/overspeed
109	Tacho input		
110	Binary input	Optocoupler	Configurable. User-programmable
111	Binary input	Optocoupler	Configurable. User-programmable
112	Binary input	Optocoupler	Configurable. User-programmable
113	Binary input	Optocoupler	Configurable. User-programmable
114	Binary input	Optocoupler	External emergency stop activated
115	Binary input	Optocoupler	Ready for operation (ON = ready, OFF = blocked)
116	Binary input	Optocoupler	Running feedback
117	Binary input	Optocoupler	Remote start (only active in SEMI-AUTO plant mode)
118	Binary input	Optocoupler	Remote stop (only active in SEMI-AUTO plant mode)
119	Com.	Common	Common for terminals 114-118
120	NO	Relay 18 250V AC/8A	Start
121	Com.		
122	NO	Relay 19 250V AC/8A	Stop coil/running coil (selectable)
123	Com.		
124	NO	Relay 20 250V AC/8A	Start prepare
125	Com.		

The engine interface board consists of configurable inputs and outputs. The configuration is performed via the PC utility software, and the default settings can be changed to the relevant settings. For input configuration, upload the parameter list from the unit and select the input in question. Then a configuration dialog box will appear, and the settings can be changed. The standard title (e.g. 4-20 mA in no. 1) can be changed, and the new title will also be shown in the display. The minimum and maximum values of the 4-20 mA input can be adjusted:

- Value: Nominal heavy consumer power (e.g. 400 kW)
- Min.: Value corresponding to 4 mA (e.g. 0 kW)
- Max.: Value corresponding to 20 mA (e.g. 400 kW)

The inputs can be used as high or low alarms. As a 'high alarm' the alarm will appear, when the measured value is higher than the alarm limit, and as a 'low alarm' the alarm will appear, when the measured value is lower than the alarm limit.

Slot #8, internal communication

Term.	Function	Description
126	Not used	CANbus communication line between the units For internal use only!
127	Not used	
128	Can-L	
129	Not used	
130	Can-H	
131	Can-L	
132	Not used	
133	Can-H	

Binary inputs

Term.	Name	Function
23	Configurable. User-programmable	This input is programmable from the PC utility software.
24	Configurable. User-programmable	This input is programmable from the PC utility software.
25	Configurable. User-programmable	This input is programmable from the PC utility software.
26	Configurable. User-programmable	This input is programmable from the PC utility software.
27	PMS control	The unit is set to be in power management control or in switchboard control.
43	Blackout	Signal from an external relay. All generator breakers are in position OFF. This signal is used for the blackout start sequence in case of missing power management.
44	HC 1 request/configurable	When this input is active, the heavy consumer has been requested for operation. The power management is calculating the power demand and starts the necessary number of diesel generators (not in SEMI-AUTO mode). The HC request information is also indicated at the AOP.
45	HC 2 request/configurable	
46	HC 1 connected/configurable	The heavy consumer in question is in operation and connected to the busbar/Configurable. User-programmable.
47	HC 2 connected/configurable	
48	HC 1 fixed load/configurable	When this input is activated (ON), then the heavy consumer in question is using 100% of its load and 0% is reserved. A deactivated input (OFF) means that 0% of the load is used and 100% is reserved/Configurable. User-programmable.
49	HC 2 fixed load/configurable	
50	Alarm inhibit 1/configurable	External input for inhibit of selected alarms/Configurable. User-programmable.
51	Alarm inhibit 2/configurable	External input for inhibit of selected alarms/Configurable. User-programmable.
52	Configurable. User-programmable	This input is programmable from the PC utility software.
53	Configurable. User-programmable	This input is programmable from the PC utility software.
54	CB open	Breaker feedback signal. The connection breaker is in position ON.
55	CB closed	Breaker feedback signal. The connection breaker is in position OFF.
104	Configurable. User-programmable	This input is programmable from the PC utility software. **This input has wire break supervision and therefore needs a potentially free contact. The wire break resistor is 100 Ω.**
105	Configurable. User-programmable	This input is programmable from the PC utility software. **This input has wire break supervision and therefore needs a potentially free contact. The wire break resistor is 100 Ω.**
106	Configurable. User-programmable	This input is programmable from the PC utility software. **This input has wire break supervision and therefore needs a potentially free contact. The wire break resistor is 100 Ω.**
110	Configurable. User-programmable	This input is programmable from the PC utility software.
111	Configurable. User-programmable	This input is programmable from the PC utility software.
112	Configurable. User-programmable	This input is programmable from the PC utility software.
113	Configurable. User-programmable	This input is programmable from the PC utility software.

114	Emergency stop	The emergency stop input has been activated. The engine is shutting down.
115	Ready for operation	The diesel engine is ready for operation. When this input is OFF, the diesel engine is blocked for start/CB ON.
116	Running feedback	The diesel engine has achieved the running status = ON.
117	Remote start	Remote input for start + CB ON. (Only available in SEMI-AUTO mode).
118	Remote stop	Remote input for CB OFF + stop. (Only available in SEMI-AUTO mode).

Analogue transducer inputs

Term.	Name	Function
98	HC 1 power feedback/configurable	Analogue power feedback for heavy consumer no. 1 regarding the adjustable setpoint. 4..20 mA (0 kW…HC 1 max. kW/Configurable. User-programmable.
100	HC 2 power feedback/configurable	Analogue power feedback for heavy consumer no. 2 regarding the adjustable setpoint. 4..20 mA (0 kW…HC 2 max. kW)/Configurable. User-programmable.
102	Configurable. User-programmable	Configurable analogue alarm input. Adjustable setpoint (4..20 mA).

Relay outputs

Term.	Name	Function
3 4	Status relay	The status relay on the power supply board is a normally closed relay with the purpose of processor and power supply supervision.
5 6 7	Configurable/ Trip NEL 1/(RELAY 1)	Configurable. User-programmable/Trip of the NEL (Non Essential Load) group no. 1 due to measured underfrequency, overcurrent or push load on the busbar. The output can be selected to be normally open (NO, terminal 5-6) or normally closed (NC, terminal 6-7).
8 9 10	Configurable/ Trip NEL 2/(RELAY 2)	Configurable. User-programmable/Trip of the NEL (Non Essential Load) group no. 2 due to measured underfrequency, overcurrent or push load on the busbar. The output can be selected to be normally open (NO, terminal 8-9) or normally closed (NC, terminal 9-10).
11 12 13	PMS alarm (RELAY 3)	A PMS alarm has been activated. All alarms in the system activate the PMS alarm output. The output will be reset when the alarm condition disappears The output can be selected to be normally open (NO, terminal 11-12) or normally closed (NC, terminal 12-13).
14 15 16	CB OFF (RELAY 4)	Connection breaker OFF signal. When this output is active, the generator breaker will open. The output can be selected to be normally open (NO, terminal 14-15) or normally closed (NC, terminal 15-16).
17 18 19	CB ON (RELAY 5)	Connection breaker ON signal. When this output is active, the generator breaker will close. The output can be selected to be normally open (NO, terminal 17-18) or normally closed (NC, terminal 18-19).
20	Configurable (RELAY 26)	Configurable digital output (transistor output type)
21	Configurable (RELAY 27)	Configurable digital output (transistor output type)
57 58	START ACKN. HC 1/ configurable (RELAY 6)	The heavy consumer is ready for operation as long as this output is active. The available power on the busbar is above max. HC power/Configurable. User-programmable.
59 60	START ACKN. HC 2/ configurable (RELAY 7)	
61 62	Configurable (RELAY 8)	This output is user-programmable.
63 64	Configurable (RELAY 9)	This output is user-programmable.
65 66	Increase of speed (RELAY 10)	Increase of speed. The signal is connected to the speed governor. A speed droop of 4% (+/-2%) has to be adjusted in the speed governor.
67 68	Decrease of speed (RELAY 11)	Decrease of speed. The signal is connected to the speed governor. A speed droop of 4% (+/-2%) has to be adjusted in the speed governor.
69 70	Increase of voltage (Option D)/configurable (RELAY 12)	Increase of voltage. The signal is connected to the AVR. A voltage droop of 4% (+/-2%) has to be adjusted in the AVR/Configurable. User-programmable.
71 72	Decrease of voltage (Option D)/configurable (RELAY 13)	Decrease of voltage. The signal is connected to the AVR. A voltage droop of 4% (+/-2%) has to be adjusted in the AVR/Configurable. User-programmable.
120 121	START (RELAY 18)	Start output to the diesel engine is activated = ON.
122	STOP	Stop output to the diesel engine is activated. Stop coil or running

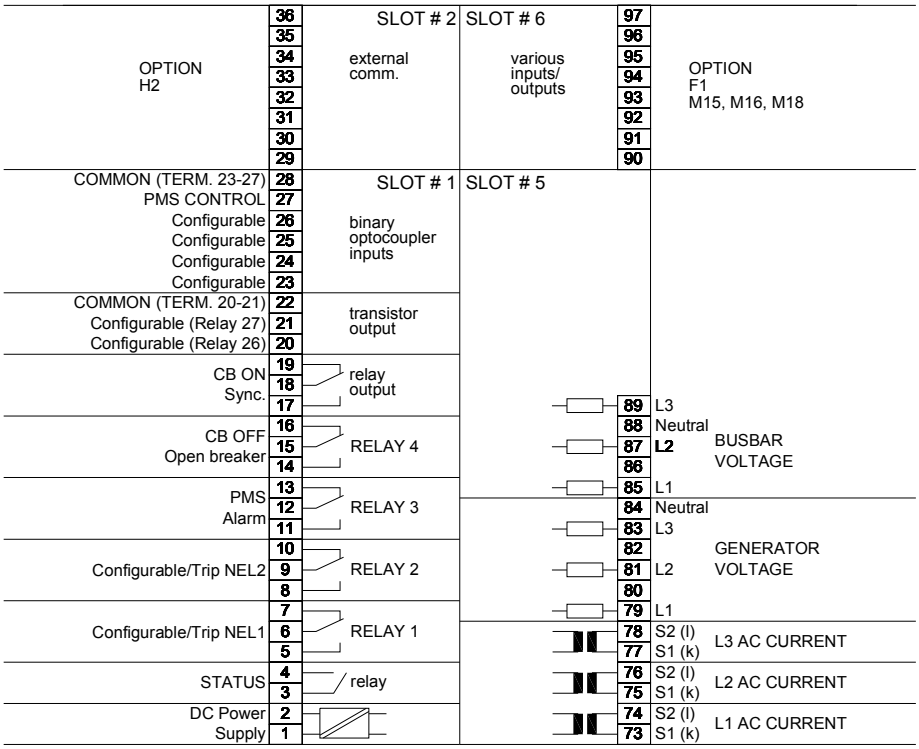
123	(RELAY 19)	coil can be selected.
124 125	START PREPARE (RELAY 20)	The start prepare output is activated, before the start output is activated. This could be preglow or preheating of the engine.

5. Shaft generator I/Os

SG with fixed frequency

Terminal strip overviews

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



The functionality of the boards in slot #2 and slot #6 is optional.

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

NOT USED	72	SLOT # 4	SLOT # 8	133	CAN-H
	71			132	Not used
	70		internal comm.	131	CAN-L
	69			130	CAN-H
	68			129	Not used
	67			128	CAN-L
	66			127	Not used
	65			126	Not used
Configurable	64	SLOT # 3	SLOT # 7	125	Not used
	63	RELAY 9	RELAY 20	124	
Configurable	62	RELAY 8	RELAY 19	123	Not used
	61			122	
Start ACKN. HC 2/Configurable	60	RELAY 7	RELAY 18	121	Not used
	59			120	
Start ACKN. HC 1/Configurable	58	RELAY 6	binary optocoupler inputs	119	COMMON (TERM. 114-118)
	57			118	Not used
COMMON (TERM. 43-55)	56	binary optocoupler inputs		117	Not used
CB CLOSED	55			116	RUNNING FEEDBACK
CB OPEN	54			115	READY FOR OPERATION
Configurable	53			114	EMERGENCY STOP
Configurable	52			113	Configurable
PTH mode/alarm inh.2.	51			112	Configurable
ALARM INHIBIT 1/ Configurable	50			111	Configurable
HC 2 FIXED LOAD/Configurable	49			110	Configurable
HC 1 FIXED LOAD/Configurable	48		0,5.....70 VAC 10...10000 Hz	109	RPM PICKUP
HC 2 CONNECTED/Configurable	47			108	
HC 1 CONNECTED/Configurable	46		with wire break supervision	107	COMMON (TERM. 104-106)
HC 2 REQUEST/Configurable	45			106	Configurable
HC 1 REQUEST/Configurable	44			105	Configurable
Configurable	43			104	Configurable
Not used	42	-10..0..10 VDC	analogue transducer inputs	103	GND
Not used	41			102	4-20 mA Configurable
Not used	40			101	GND
REACTIVE (Q) LOAD SHARING	39	-5....0....5 VDC		100	HC2 variable load/Configurable
COMMON SET POINTS	38			99	GND
ACTIVE (P) LOAD SHARING	37			98	HC1 variable load/Configurable

Terminal strip description

Slot #1, power supply and binary I/O

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

Term.	Function	Technical data	Description
1	+12/24V DC	12/24V DC (-25/+30%)	Power supply
2	0V DC		
3	NC	Status relay	Normally closed relay, processor/power supply status supervision
4	Com.	24 V/1A	
5	NO	Relay 1	Configurable/Trip NEL 1
6	Com.	250V AC/8A	
7	NC		
8	NO	Relay 2	Configurable/Trip NEL 2
9	Com.	250V AC/8A	
10	NC		
11	NO	Relay 3	PMS alarm
12	Com.	250V AC/8A	
13	NC		
14	NO	Relay 4	CB OFF Open breaker (deload)/trip
15	Com.	250V AC/8A	
16	NC		
17	NO	Relay 5	CB ON Close breaker (synchronising)
18	Com.	250V AC/8A	
19	NC		
20	Open collector 1	Transistor out	Relay 26, configurable
21	Open collector 2	Transistor out	Relay 27, configurable
22	Com.	Common	Common terminal for terminals 20 and 21
23	Binary input	Optocoupler	Configurable. User-programmable
24	Binary input	Optocoupler	Configurable. User-programmable
25	Binary input	Optocoupler	Configurable. User-programmable
26	Binary input	Optocoupler	Configurable. User-programmable
27	Binary input	Optocoupler	PMS control
28	Com.	Common	Common for terminals 23-27

The power supply must be protected with a 1A fuse.

Slot #2, external communication (option)

Option H2 (RS485 Modbus RTU).

Term.	Function	Description
29	DATA + (A)	Modbus RTU, RS485
30	Not used	
31	DATA - (B)	
32	Not used	
33	DATA + (A)	
34	Not used	
35	DATA - (B)	
36	Not used	

The serial communication line should be terminated between DATA + and DATA - with a resistor equal to the cable impedance.

Slot #3, binary I/O

Term.	Function	Technical data	Description
37	-5…0…5V DC	Analogue I/O	Active load sharing line
38	Com.	Common	Common for load sharing lines
39	-5…0…5V DC	Analogue I/O	Reactive load sharing
40	-10…0…10V DC	Analogue input	Not used
41	Com.	Common	
42	-10…0…10V DC	Analogue input	
43	Binary input	Optocoupler	Configurable. User-programmable
44	Binary input	Optocoupler	Heavy consumer 1 request/configurable
45	Binary input	Optocoupler	Heavy consumer 2 request/configurable
46	Binary input	Optocoupler	Heavy consumer 1 connected/configurable
47	Binary input	Optocoupler	Heavy consumer 2 connected/configurable
48	Binary input	Optocoupler	Heavy consumer 1 fixed load/configurable
49	Binary input	Optocoupler	Heavy consumer 2 fixed load/configurable
50	Binary input	Optocoupler	Alarm inhibit 1, external input for inhibit of selected alarms/configurable
51	Binary input	Optocoupler	Selection of PTH mode/Alarm Inhibit 2
52	Binary input	Optocoupler	Configurable. User-programmable
53	Binary input	Optocoupler	Configurable. User-programmable
54	Binary input	Optocoupler	CB open
55	Binary input	Optocoupler	CB closed
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 6	Start acknowledge heavy consumer 1/configurable
58	Com.	250V AC 8A	
59	NO	Relay 7	Start acknowledge heavy consumer 2/configurable
60	Com.	250V AC 8A	
61	NO	Relay 8	Configurable. User-programmable
62	Com.	250V AC 8A	
63	NO	Relay 9	Configurable. User-programmable
64	Com.	250V AC 8A	

Slot #4, not used

Slot #5, AC measuring

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. 690V AC phase - phase value
80	Not used		
81	U L2	Generator voltage L2	Max. 690V AC phase - phase value
82	Not used		
83	U L3	Generator voltage L3	Max. 690V AC phase - phase value
84	U neutral	Generator voltage neutral	For land based applications only
85	U L1	Bus voltage L1	Max. 690V AC phase - phase value
86	Not used		
87	U L2	Bus voltage L2	Max. 690V AC phase - phase value
88	U neutral	Bus voltage neutral	For land based applications only
89	U L3	Bus voltage L3	Max. 690V AC phase - phase value

Current inputs are galvanically separated. Max. 0.3 VA per phase. Voltage measurements are available (phase to phase) from 100V AC to 690V AC.

Slot #6, optional I/Os

Option F1

Analogue transducer output.

Term.	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	0(4) - 20 mA out	
97	Not used	

These outputs are **active** outputs, meaning that they have an internal power supply. The outputs are galvanically separated from each other and from the rest of the unit. Via the display or the PC programming software individual outputs can be selected to represent any AC measuring value and related values, e.g. power, power factor, frequency etc. Outputs can be selected to be either 0…20 mA or 4…20 mA in the PC utility software. If necessary the current outputs can be converted to voltage using a resistor across the terminals (500 Ω will convert the 0-20 mA into 0-10V DC).

Option M15

4 x analogue 4-20 mA inputs.

Term.	Function	Description
90	Input 90 common	Common
91	Analogue input 91+	4-20 mA in
92	Input 92 common	Common
93	Analogue input 93+	4-20 mA in
94	Input 94 common	Common
95	Analogue input 95+	4-20 mA in
96	Input 96 common	Common
97	Analogue input 97+	4-20 mA in

Option M16

7 x binary inputs.

Term.	Function	Description
90	Common	Common
91	Digital input	Configurable
92	Digital input	Configurable
93	Digital input	Configurable
94	Digital input	Configurable
95	Digital input	Configurable
96	Digital input	Configurable
97	Digital input	Configurable

Option M18

4 x relay outputs.

Term.	Function	Description
90	Relay output 14	Configurable
91	250V AC, 8A max.	
92	Relay output 15	Configurable
93	250V AC, 8A max.	
94	Relay output 16	Configurable
95	250V AC, 8A max.	
96	Relay output 17	Configurable
97	250V AC, 8A max.	

Slot #7, engine interface board

Term.	Function	Technical data	Description/preconfiguration
98	Analogue input 1 +	+4…20 mA in	Heavy consumer 1 variable load/configurable
99	Analogue input 1 -	GND	
100	Analogue input 2 +	+4…20 mA in	Heavy consumer 2 variable load/configurable
101	Analogue input 2 -	GND	
102	Analogue input 3 +	+4…20 mA in	Configurable. User-programmable
103	Analogue input 3 -	GND	
104	Binary input	With wire break supervision Wire break resistor: 100 Ω	Configurable. User-programmable This input will need a potential free contact
105	Binary input		Configurable. User-programmable This input will need a potential free contact
106	Binary input		Configurable. User-programmable This input will need a potential free contact
107	Common		Common terminals for 104-106
108	Tacho input	0.5…70V AC 10…10.000 Hz	RPM/magnetic pick-up/overspeed
109	Tacho input		
110	Binary input	Optocoupler	Configurable. User-programmable
111	Binary input	Optocoupler	Configurable. User-programmable
112	Binary input	Optocoupler	Configurable. User-programmable
113	Binary input	Optocoupler	Configurable. User-programmable
114	Binary input	Optocoupler	External emergency stop activated
115	Binary input	Optocoupler	Ready for operation (ON = ready, OFF = blocked)
116	Binary input	Optocoupler	Running feedback
117	Binary input	Optocoupler	Configurable. User-programmable
118	Binary input	Optocoupler	Configurable. User-programmable
119	Com.	Common	Common for terminals 114-118
120	NO	Relay no. 18 250V AC/8A	Not used
121	Com.		
122	NO	Relay no. 19 250V AC/8A	Not used
123	Com.		
124	NO	Relay no. 20 250V AC/8A	Not used
125	Com.		

The engine interface board consists of configurable inputs and outputs. The configuration is performed via the PC utility software, and the default settings can be changed to the relevant settings. For input configuration, upload the parameter list from the unit and select the input in question. Then a configuration dialog box will appear, and the settings can be changed. The standard title (e.g. 4-20 mA in no. 1) can be changed, and the new title will also be shown in the display. The minimum and maximum values of the 4-20 mA input can be adjusted:

- Value: Nominal heavy consumer power (e.g. 400 kW)
- Min.: Value corresponding to 4 mA (e.g. 0 kW)
- Max.: Value corresponding to 20 mA (e.g. 400 kW)

The inputs can be used as high or low alarms. As a 'high alarm' the alarm will appear, when the measured value is higher than the alarm limit, and as a 'low alarm' the alarm will appear, when the measured value is lower than the alarm limit.

Slot #8, internal communication

Term.	Function	Description
126	Not used	CANbus communication line between the units For internal use only!
127	Not used	
128	Can-L	
129	Not used	
130	Can-H	
131	Can-L	
132	Not used	
133	Can-H	

Binary inputs

Term.	Name	Function
23	Configurable. User-programmable	This input is programmable from the PC utility software.
24	Configurable. User-programmable	This input is programmable from the PC utility software.
25	Configurable. User-programmable	This input is programmable from the PC utility software.
26	Configurable. User-programmable	This input is programmable from the PC utility software.
27	PMS/SWBD control	The unit is set to be in power management control or in switchboard control.
43	Configurable	This input is programmable from the PC utility software.
44	HC 1 request/configurable	When this input is active, the heavy consumer has been requested for operation. The power management is calculating the power demand and starts the necessary number of diesel generators (not in SEMI-AUTO mode). The HC request information is also shown at the AOP/Configurable. User-programmable.
45	HC 2 request/configurable	
46	HC 1 connected/configurable	The heavy consumer in question is in operation and connected to the busbar/Configurable. User-programmable.
47	HC 2 connected/configurable	
48	HC 1 fixed load/configurable	When this input is activated (ON), then the heavy consumer in question is using 100% of its load and 0% is reserved. A deactivated input (OFF) means that 0% of the load is used and 100% is reserved/ Configurable. User-programmable.
49	HC 2 fixed load/configurable	
50	Alarm inhibit 1/configurable	External input for inhibit of selected alarms/Configurable. User-programmable.
51	PTH/Alarm inhibit 2	PTH (Power Take Home) mode activation input/External input for inhibit of selected alarms.
52	Configurable. User-programmable	This input is programmable from the PC utility software.
53	Configurable. User-programmable	This input is programmable from the PC utility software.
54	CB open	Breaker feedback signal. The connection breaker is in position ON.
55	CB closed	Breaker feedback signal. The connection breaker is in position OFF.
104	Configurable. User-programmable	Configurable. This input has wire break supervision and therefore needs a potentially free contact. The wire break resistor is 100 Ω.
105	Configurable. User-programmable	Configurable. This input has wire break supervision and therefore needs a potentially free contact. The wire break resistor is 100 Ω.
106	Configurable. User-programmable	Configurable. This input has wire break supervision and therefore needs a potentially free contact. The wire break resistor is 100 Ω.
110	Configurable. User-programmable	This input is programmable from the PC utility software.
111	Configurable. User-programmable	This input is programmable from the PC utility software.
112	Configurable. User-programmable	This input is programmable from the PC utility

		software.
113	Configurable. User-programmable	This input is programmable from the PC utility software.
114	Emergency stop	The emergency stop input has been activated. If running on the SG, the CB for the SG will be tripped. If the TB is opened due to a blackout, then the mode will change to AUTO, and the generators will perform a blackout start.
115	Ready for operation	The SG is ready for operation. When this input is OFF, the SG is blocked for start/CB ON.
116	Running feedback	The SG has achieved the running status = ON.
117	Configurable. User-programmable	This input is programmable from the PC utility software
118	Configurable. User-programmable	This input is programmable from the PC utility software

Analogue transducer inputs

Term.	Name	Function
98	HC 1 power feedback/configurable	Analogue power feedback for heavy consumer no. 1 regarding the adjustable setpoint. 4..20 mA (0 kW…HC 1 max. kW)/Configurable. User-programmable.
100	HC 2 power feedback/configurable	Analogue power feedback for heavy consumer no. 2 regarding the adjustable setpoint. 4..20 mA (0 kW…HC 2 max. kW)/Configurable. User-programmable.
102	Configurable	Configurable analogue alarm input. Adjustable setpoint. 4..20 mA.

Relay outputs

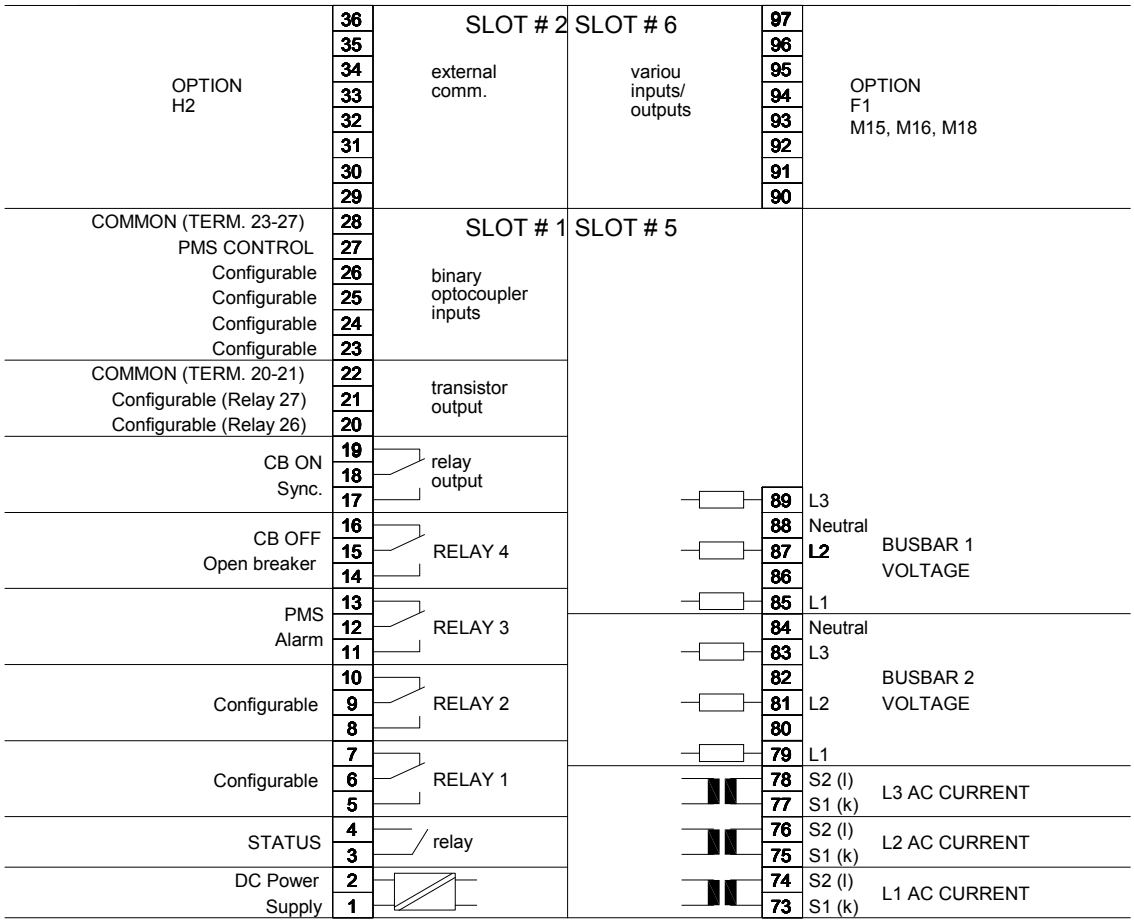
Term.	Name	Function
3 4	Status relay	The status relay on the power supply board is a normally closed relay with the purpose of processor and power supply supervision.
5 6 7	Configurable/ Trip NEL 1/(RELAY 1)	Configurable. User-programmable. Trip of the NEL (Non Essential Load) group no. 1 due to measured underfrequency, overcurrent or push load on the busbar. The output can be selected to be normally open (NO, terminal 5-6) or normally closed (NC, terminal 6-7).
8 9 10	Configurable/ Trip NEL 2 (RELAY 2)	Configurable. User-programmable. Trip of the NEL (Non Essential Load) group no. 2 due to measured underfrequency, overcurrent or push load on the busbar. The output can be selected to be normally open (NO, terminal 5-6) or normally closed (NC, terminal 6-7).
11 12 13	PMS alarm (RELAY 3)	A PMS alarm has been activated. All alarms in the system activate the PMS alarm output. The output will be reset when the alarm condition disappears. The output can be selected to be normally open (NO, terminal 5-6) or normally closed (NC, terminal 6-7).
14 15 16	CB OFF (RELAY 4)	Connection breaker OFF signal. When this output is active the generator breaker will open. The output can be selected to be normally open (NO, terminal 5-6) or normally closed (NC, terminal 6-7).
17 18 19	CB ON (RELAY 5)	Connection breaker ON signal. When this output is active, the generator breaker will close. The output can be selected to be normally open (NO, terminal 5-6) or normally closed (NC, terminal 6-7).
20	Configurable (RELAY 26)	Configurable digital output (transistor output type)
21	Configurable (RELAY 27)	Configurable digital output (transistor output type)
57 58	START ACKN. HC 1/ configurable (RELAY 6)	The heavy consumer is ready for operation as long as this output is active. The available power on the busbar is above max. HC power/Configurable. User-programmable.
59 60	START ACKN. HC 2/ configurable (RELAY 7)	
61 62	Configurable (Relay 8)	The relay is user-configurable and can be used as both alarm and limit relay.
63 64	Configurable (Relay 9)	The relay is user-configurable and can be used as both alarm and limit relay.
120 121	Configurable (Relay 18)	The relay is user-configurable and can be used as both alarm and limit relay.
122 123	Configurable (Relay 19)	The relay is user-configurable and can be used as both alarm and limit relay.
124 125	Configurable (Relay 20)	The relay is user-configurable and can be used as both alarm and limit relay.

6. Bus tie breaker I/Os

Bus tie between DG and SG

Terminal strip overviews

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



The functionality of the boards in slot #2 and slot #6 is optional.

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

NOT USED	72	SLOT # 4	SLOT # 8	133	CAN-H
	71			132	Not used
	70		internal comm.	131	CAN-L
	69			130	CAN-H
	68			129	Not used
	67			128	CAN-L
	66			127	Not used
	65			126	Not used
Configurable	64	SLOT # 3 RELAY 9	SLOT # 7	NOT USED	
	63				
Configurable	62	RELAY 8			
	61				
Configurable	60	RELAY 7			
	59				
Configurable	58	RELAY 6			
	57				
COMMON (TERM. 43-55)	56	binary optocoupler inputs			
CB CLOSED	55				
CB OPEN	54				
Configurable	53				
Configurable	52				
ALARM INHIBIT 2/Configurable	51				
ALARM INHIBIT 1/Configurable	50				
Configurable	49				
Configurable	48				
Configurable	47				
Configurable	46				
Configurable	45				
Configurable	44				
Configurable	43				
Not used	42	-10..0..10 VDC			
Not used	41				
Not used	40				
Not used	39	-5....0....5 VDC			
Not used	38				
Not used	37				

Terminal strip description

Slot #1, power supply and binary I/O

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

Term.	Function	Technical data	Description
1	+12/24V DC	12/24V DC -25/+30%	Power supply
2	0V DC		
3	NC	Status relay	Normally closed relay, processor/power supply status supervision
4	Com.	24 V/1A	
5	NO	Relay 1	Configurable. User-programmable
6	Com.	250V AC/8A	
7	NC		
8	NO	Relay 2	Configurable. User-programmable
9	Com.	250V AC/8A	
10	NC		
11	NO	Relay 3	PMS alarm
12	Com.	250V AC/8A	
13	NC		
14	NO	Relay 4	CB OFF Open breaker (deload)/trip
15	Com.	250V AC/8A	
16	NC		
17	NO	Relay 5	CB ON Close breaker (synchronising)
18	Com.	250V AC/8A	
19	NC		
20	Open collector 1	Transistor out	Relay 26, configurable Relay 27, configurable Common terminal for terminals 20 and 21
21	Open collector 2	Transistor out	
22	Com.	Common	
23	Binary input	Optocoupler	Configurable. User-programmable
24	Binary input	Optocoupler	Configurable. User-programmable
25	Binary input	Optocoupler	Configurable. User-programmable
26	Binary input	Optocoupler	Configurable. User-programmable
27	Binary input	Optocoupler	PMS control
28	Com.	Common	Common for terminals 23-27

The power supply must be protected with a 1A fuse.

Slot #2, external communication (option)

Option H2 (RS485 Modbus RTU).

Term.	Function	Description
29	DATA + (A)	Modbus RTU, RS485
30	Not used	
31	DATA - (B)	
32	Not used	
33	DATA + (A)	
34	Not used	
35	DATA - (B)	
36	Not used	

The serial communication line should be terminated between DATA + and DATA - with a resistor equal to the cable impedance.

Slot #3, binary I/O

Term.	Function	Technical data	Description
37	-5…0…5V DC	Analogue I/O	Not used
38	Com.	Common	
39	-5…0…5V DC	Analogue I/O	
40	-10…0…10V DC	Analogue input	Not used
41	Com.	Common	
42	-10…0…10V DC	Analogue input	
43	Binary input	Optocoupler	Configurable. User-programmable
44	Binary input	Optocoupler	Configurable. User-programmable
45	Binary input	Optocoupler	Configurable. User-programmable
46	Binary input	Optocoupler	Configurable. User-programmable
47	Binary input	Optocoupler	Configurable. User-programmable
48	Binary input	Optocoupler	Configurable. User-programmable
49	Binary input	Optocoupler	Configurable. User-programmable
50	Binary input	Optocoupler	Alarm inhibit 1, external input for inhibit of selected alarms
51	Binary input	Optocoupler	Alarm inhibit 2, external input for inhibit of selected alarms/configurable.
52	Binary input	Optocoupler	Configurable. User-programmable
53	Binary input	Optocoupler	Configurable. User-programmable
54	Binary input	Optocoupler	CB open
55	Binary input	Optocoupler	CB closed
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 6	User-configurable
58	Com.	250V AC 8A	
59	NO	Relay 7	User-configurable
60	Com.	250V AC 8A	
61	NO	Relay 8	User-configurable
62	Com.	250V AC 8A	
63	NO	Relay 9	User-configurable
64	Com.	250V AC 8A	

Slot #4, not used

Slot #5, AC measuring

Term.	Function	Technical data	Description
73	I L1 s1	Busbar current L1	1/5 A AC input
74	I L1 s2		
75	I L2 s1	Busbar current L2	1/5 A AC input
76	I L2 s2		
77	I L3 s1	Busbar current L3	1/5 A AC input
78	I L3 s2		
79	U L1	Bus 1 voltage L1	Max. 690V AC phase - phase value
80	Not used		
81	U L2	Bus 1 voltage L2	Max. 690V AC phase - phase value
82	Not used		
83	U L3	Bus 1 voltage L3	Max. 690V AC phase - phase value
84	U neutral		Not used
85	U L1	Bus voltage L1	Max. 690V AC phase - phase value
86	Not used		
87	U L2	Bus voltage L2	Max. 690V AC phase - phase value
88	U neutral		Not used
89	U L3	Bus voltage L3	Max. 690V AC phase - phase value

Current inputs are galvanically separated. Max. 0.3 VA per phase. Voltage measurements are available (phase to phase) from 100V AC to 690V AC.

Slot #6, optional I/Os

Option F1

Analogue transducer output.

Term.	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	0(4) - 20 mA out	
97	Not used	

These outputs are **active** outputs, meaning that they have an internal power supply. The outputs are galvanically separated from each other and from the rest of the unit. Via the display or the PC programming software individual outputs can be selected to represent any AC measuring value and related values, e.g. power, power factor, frequency etc. Outputs can be selected to be either 0…20 mA or 4…20 mA in the PC utility software. If necessary the current outputs can be converted to voltage using a resistor across the terminals (500 Ω will convert the 0-20 mA into 0-10V DC).

Option M15

4 x analogue 4-20 mA inputs.

Term.	Function	Description
90	Input 90 common	Common
91	Analogue input 91+	4-20 mA in
92	Input 92 common	Common
93	Analogue input 93+	4-20 mA in
94	Input 94 common	Common
95	Analogue input 95+	4-20 mA in
96	Input 96 common	Common
97	Analogue input 97+	4-20 mA in

Option M16

7 x binary inputs.

Term.	Function	Description
90	Common	Common
91	Digital input	Configurable
92	Digital input	Configurable
93	Digital input	Configurable
94	Digital input	Configurable
95	Digital input	Configurable
96	Digital input	Configurable
97	Digital input	Configurable

Option M18

4 x relay outputs.

Term.	Function	Description
90 91	Relay output 14 250V AC, 8A max.	Configurable
92 93	Relay output 15 250V AC, 8A max.	Configurable
94 95	Relay output 16 250V AC, 8A max.	Configurable
96 97	Relay output 17 250V AC, 8A max.	Configurable

Slot #7, not used

Slot #8, internal communication

Term.	Function	Description
126	Not used	CANbus communication line between the units For internal use only!
127	Not used	
128	Can-L	
129	Not used	
130	Can-H	
131	Can-L	
132	Not used	
133	Can-H	

Binary inputs

Term.	Name	Function
23	Configurable. User-programmable	This input is programmable from the PC utility software.
24	Configurable. User-programmable	Trip of breaker due to short circuit protection from external device.
25	Configurable. User-programmable	This input is programmable from the PC utility software.
26	Configurable. User-programmable	This input is programmable from the PC utility software.
27	PMS control	The unit is selected to be in power management control or in switchboard control.
43	Configurable. User-programmable	These inputs are programmable from the PC utility software.
44	Configurable. User-programmable	
45	Configurable. User-programmable	
46	Configurable. User-programmable	
47	Configurable. User-programmable	
48	Configurable. User-programmable	
49	Configurable. User-programmable	
50	Alarm Inhibit 1/configurable	External input for inhibit of selected alarms/configurable.
51	Alarm Inhibit 2/configurable	External input for inhibit of selected alarms/configurable
52	Configurable. User-programmable	These inputs are programmable from the PC utility software.
53	Configurable. User-programmable	
54	CB open	Breaker feedback signal. The connection breaker is in position ON.
55	CB closed	Breaker feedback signal. The connection breaker is in position OFF.

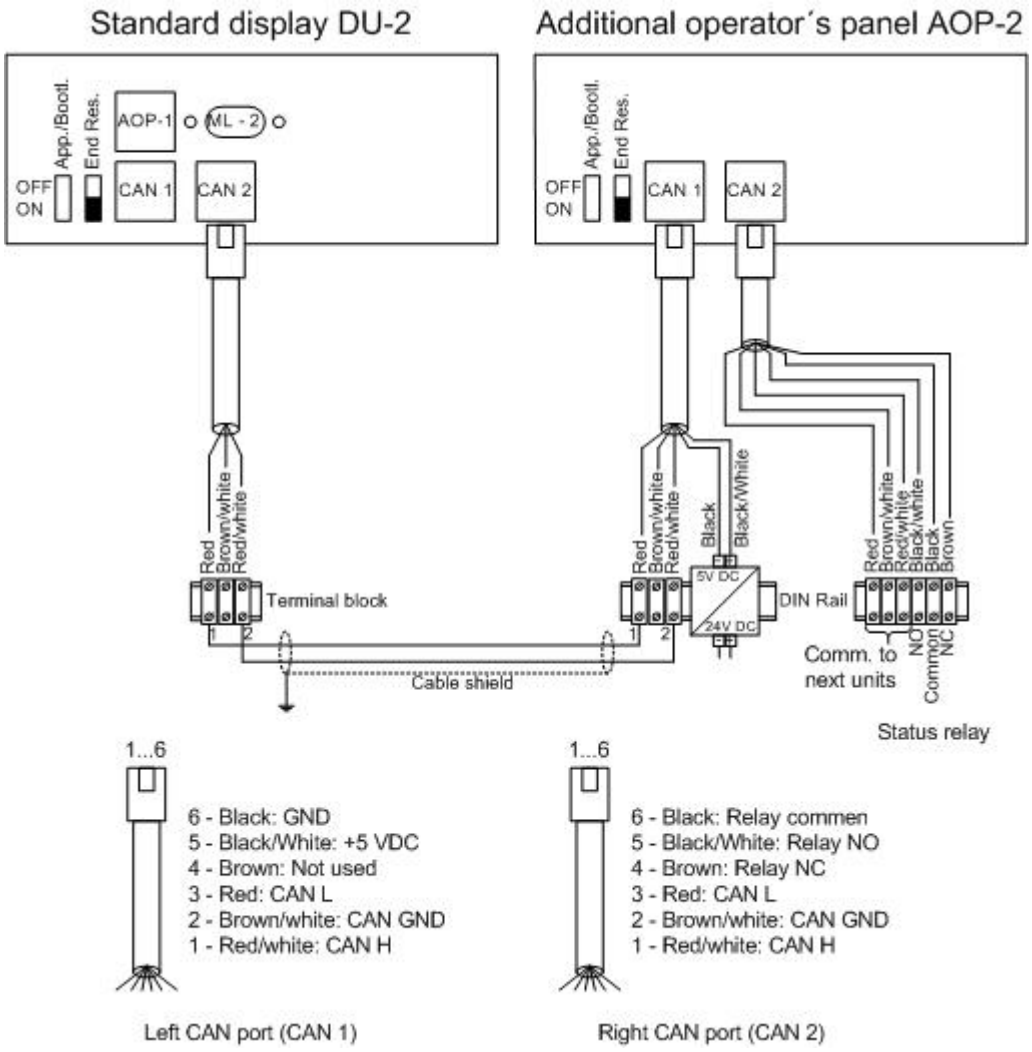
Relay outputs

Term.	Name	Function
3 4	Status relay	The status relay on the power supply board is a normally closed relay with the purpose of processor and power supply supervision.
5 6 7	Configurable (RELAY 1)	The relay is user configurable and can be used as both alarm and limit relay.
8 9 10	Configurable (RELAY 2)	
11 12 13	PMS alarm (RELAY 3)	A PMS alarm has been activated. All alarms in the system activate the PMS alarm output. The output will be reset when the alarm condition disappears. The output can be selected to be normally open (NO, terminal 5-6) or normally closed (NC, terminal 6-7).
14 15 16	CB OFF (RELAY 4)	Connection breaker OFF signal. When this output is active, the generator breaker will open. The output can be selected to be normally open (NO, terminal 5-6) or normally closed (NC, terminal 6-7).
17 18 19	CB ON (RELAY 5)	Connection breaker ON signal. When this output is active, the generator breaker will close. The output can be selected to be normally open (NO, terminal 5-6) or normally closed (NC, terminal 6-7).
20	Configurable (RELAY 26)	Configurable digital output (transistor output type)
21	Configurable (RELAY 27)	Configurable digital output (transistor output type)
57 58	Configurable (Relay 6)	These relays are user-configurable and can be used as both alarm and limit relays.
59 60	Configurable (Relay 7)	
61 62	Configurable (Relay 8)	
63 64	Configurable (Relay 9)	

7. Additional operator panel

Installation of AOP-2

Display CANbus cable connection

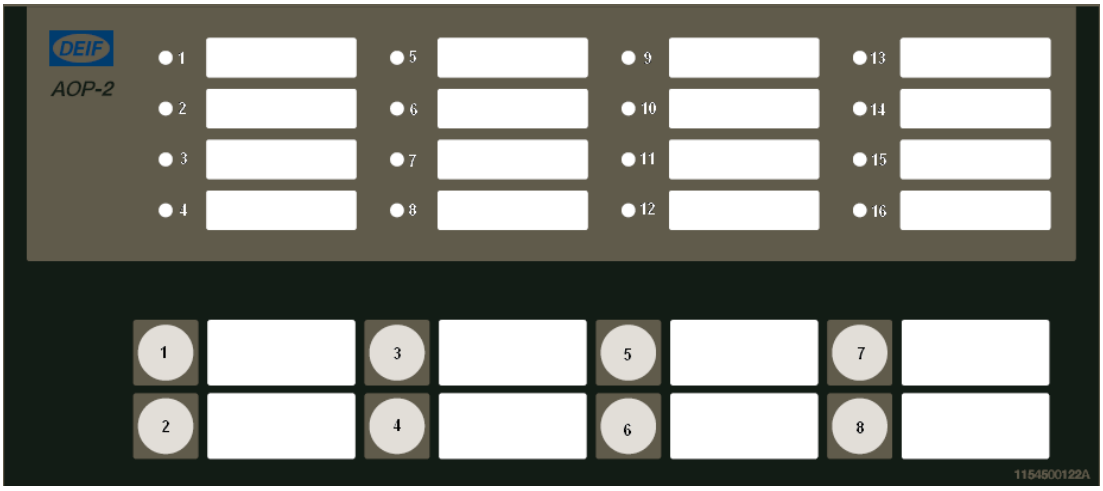


A DC/DC converter for the DC supply voltage and 2 x 3 m cable with an RJ12 plug in one end and stripped wires in the other end is included in the AOP-2 delivery.

The cable between the terminal blocks should be shielded twisted pair.

The maximum length of the CANbus line is 200 m.

CAN ID configuration on AOP-2



The CAN ID for the AOP-2 can be changed by the following procedure:

1. Push button no. 7 and no. 8 at the same time to activate the CAN ID change menu, this will activate the LED for the present CAN ID number, and LED no. 16 will be flashing.
2. Use button no. 7 (increase) and button no. 8 (decrease) to change the CAN ID according to the table below.
3. Press button no. 6 to save the CAN ID and return to normal operation.

Selection of CAN ID:

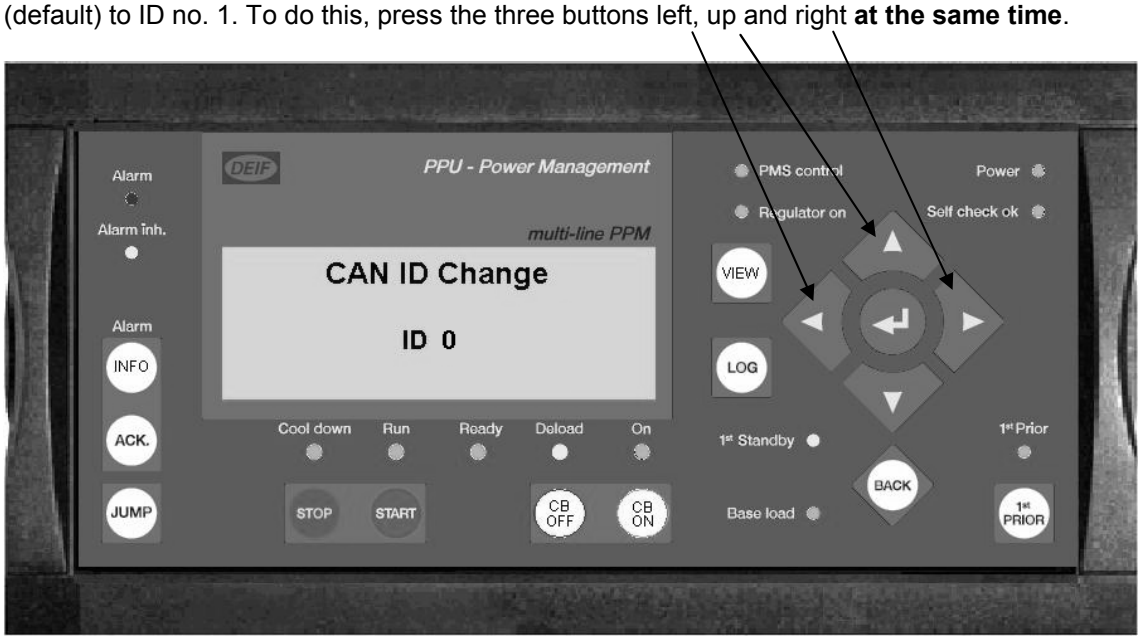
CAN ID	Indication of CAN ID selection
0	CANbus OFF: LED 16 flashes
1	LED 1 light steady + LED 16 flashes (default value)
2	LED 2 light steady + LED 16 flashes
3	LED 3 light steady + LED 16 flashes
4	LED 4 light steady + LED 16 flashes
5	LED 5 light steady + LED 16 flashes

Status relay

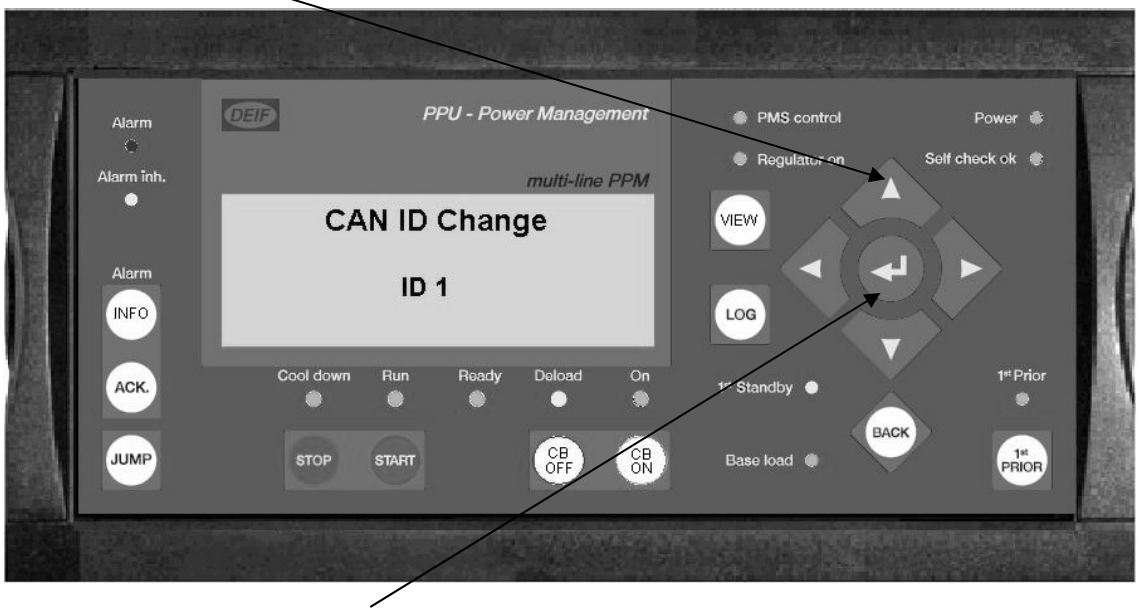
The status relay will activate approximately five seconds after power-up.

CAN ID configuration on display unit

The CANbus ID no. for the display unit of generator 1 (Master) has to be changed from ID no. 0 (default) to ID no. 1. To do this, press the three buttons left, up and right **at the same time**.



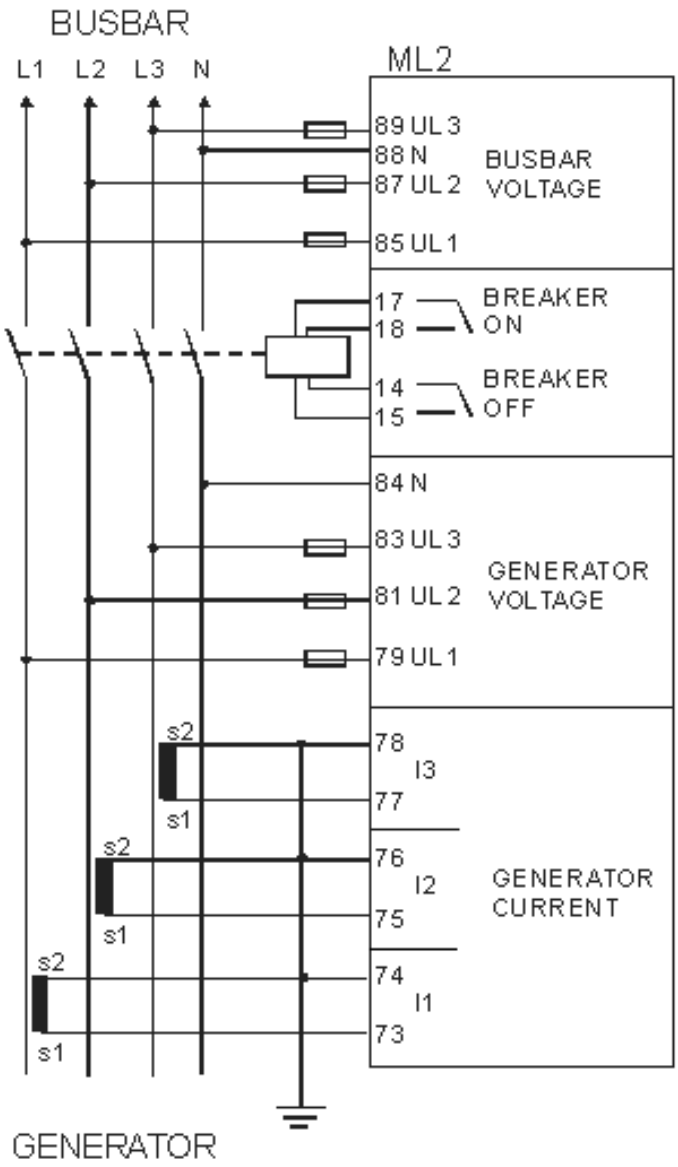
Then press the up button to change the ID no. from 0 to 1.



Acknowledge by pressing 'ENTER'. The display will then automatically reset.

8. Wirings

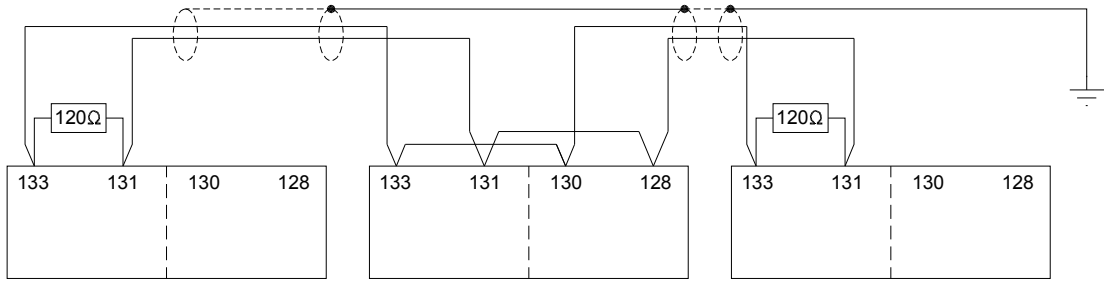
AC connections (3-phase)



The neutral line (N) connection is not necessary for correct measurement. 3-phase without neutral is also possible. The current transformer ground connection can be on s1 or s2 connection, whichever is preferred. Fuses: 2A slow-blow.

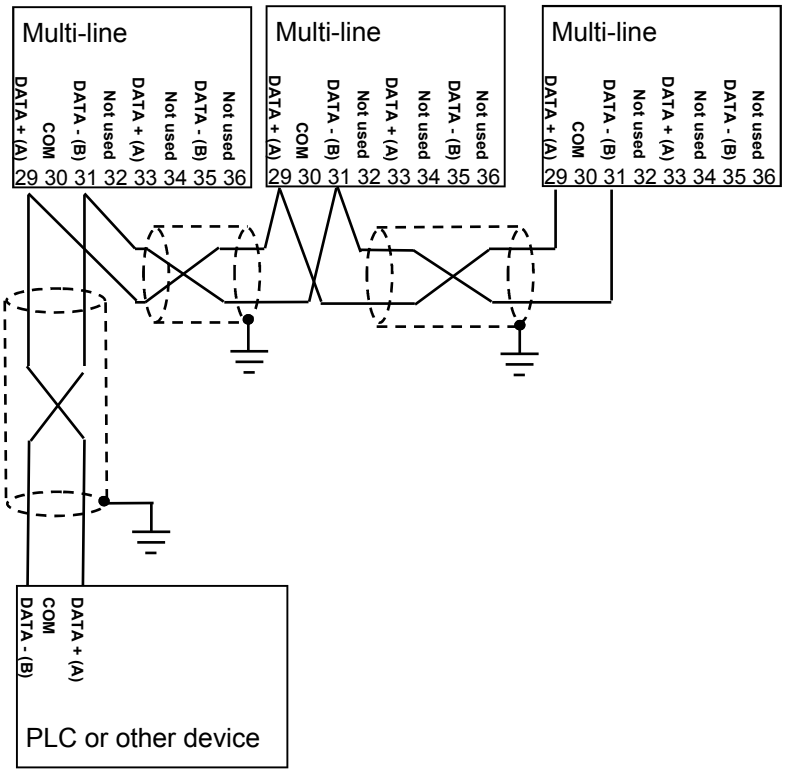
Internal CANbus wiring

The wiring for the internal CANbus communication between units is indicated in the illustration below.



Option H2, Modbus RTU

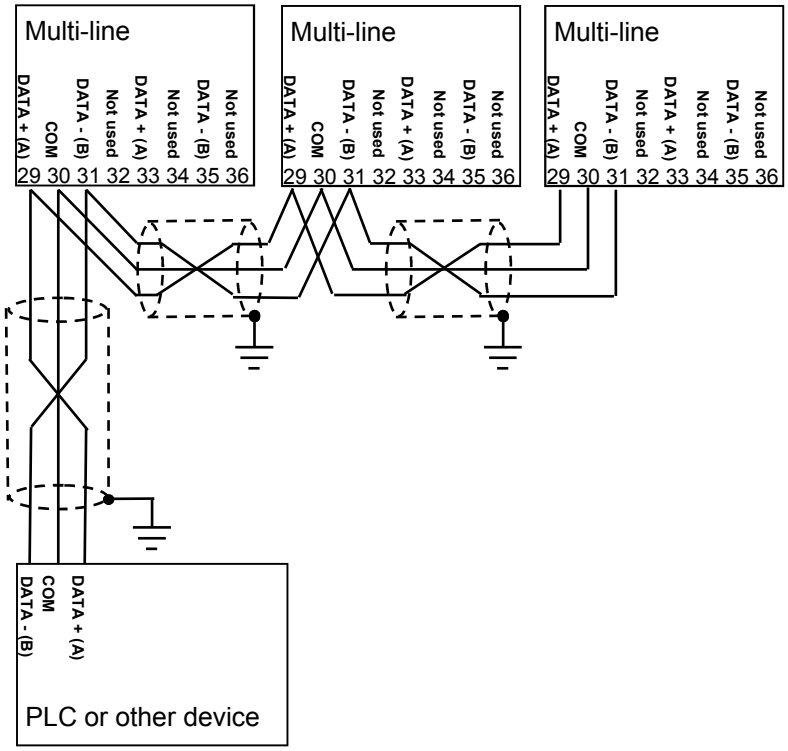
Connection with 2-wire screened cable (recommended):



Connect shield to ground at one end only. Shield ends must be insulated with tape or insulation tubing.

Use shielded twisted cable.

Connection with 3-wire shielded cable:



Connect shield to ground at one end only. Shield ends must be insulated with tape or insulation tubing.

Use shielded twisted cable.

This solution is only feasible if the COM line is insulated. Check PLC/other device before connecting.
Non-insulated COM line may result in damage to the equipment.

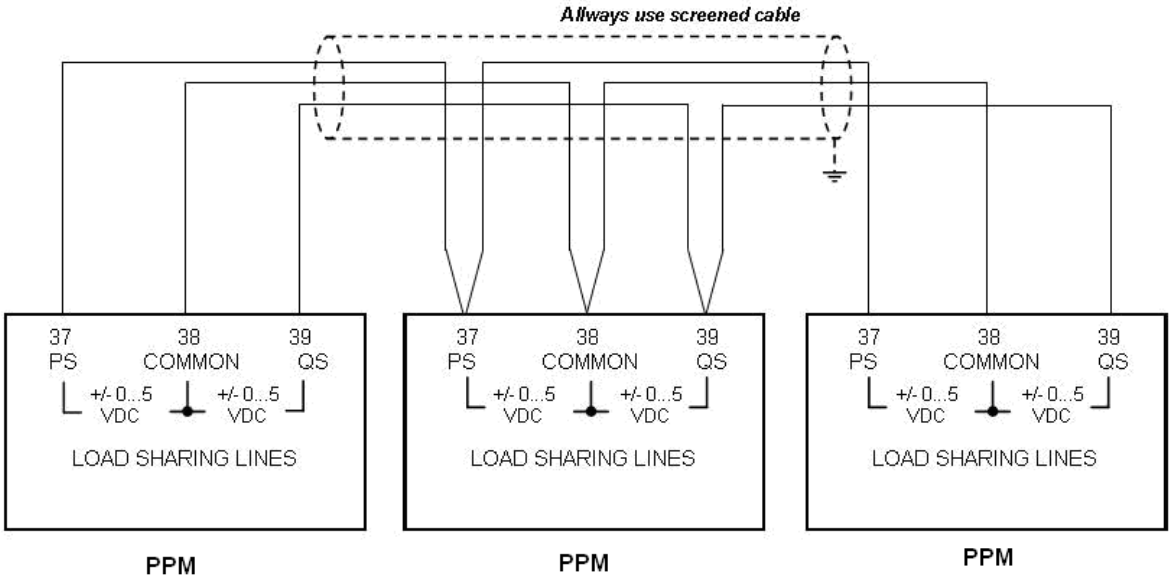
Normally, the Modbus does not need bias resistors (end terminators). These are only needed in case of very long lines and/or many nodes (>32) on the Modbus network. If bias resistors are needed, the calculation should be based on the following data:

- **A line internal pull-up bias resistor: 22 kΩ**
- **B line internal pull-down bias resistor: 22 kΩ**
- **Receiver input sensitivity: +/-200 mV**
- **Receiver input impedance: 12 kΩ**

Cable: Belden 3105A or equivalent. 22 AWG (0.6 mm^2) twisted pair, shielded, <40 mΩ/m, min. 95% shield coverage.

Load sharing lines

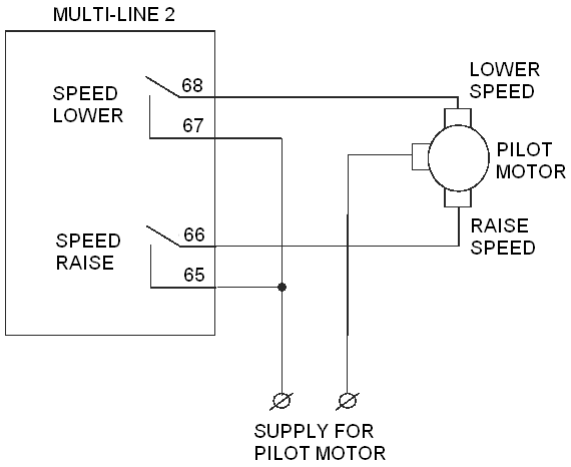
Screened, twisted cable is recommended to prevent disturbances on the load sharing lines.



Max. distance between units: 3 m.

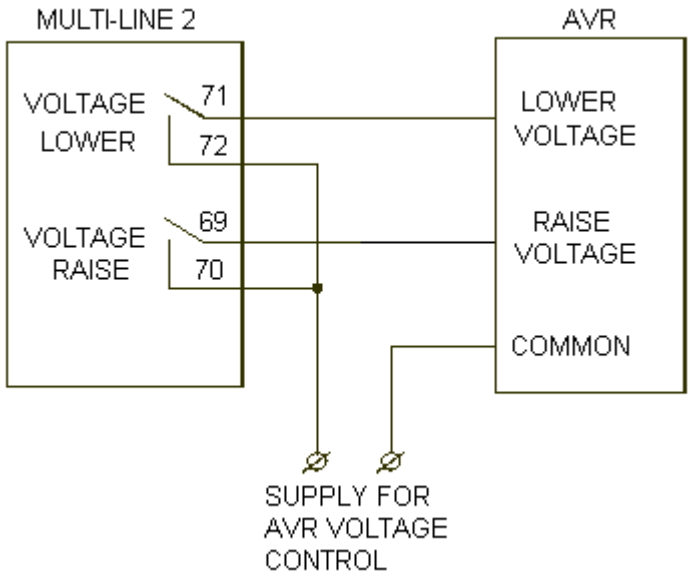
Mechanical speed governor (standard)

The illustration below shows the necessary connections to carry out speed control using relay outputs.

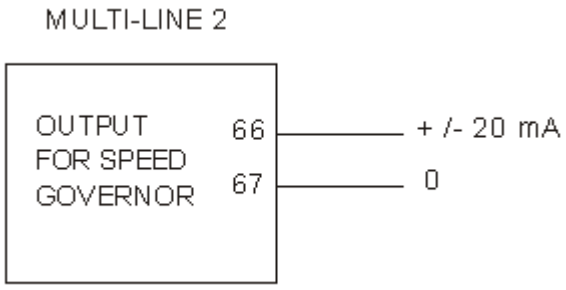


In order to extend the lifetime of the internal relays and prevent unwanted switching noise, it is recommended to use free wheel diodes (1N4007), if a DC voltage is used for the regulation. If an AC voltage is used for the regulation, it is recommended to use a varistor. This applies to both pilot motors and external regulation relays.

AVR with relay outputs



Electronic speed governor

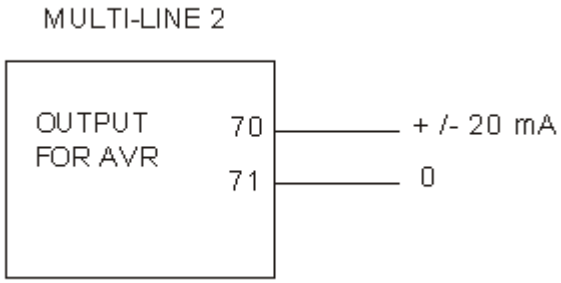


If necessary, the current outputs can be converted to voltage using a resistor across the terminals (250 Ω will convert the +/-20 mA into +/-5V DC).

For further information on how to connect the analogue output to the most common speed governors please refer to:

Application Notes, Interfacing DEIF equipment to governors and AVRs, document number 4189340149 at www.deif.com.

AVR with analogue outputs (requires option D)



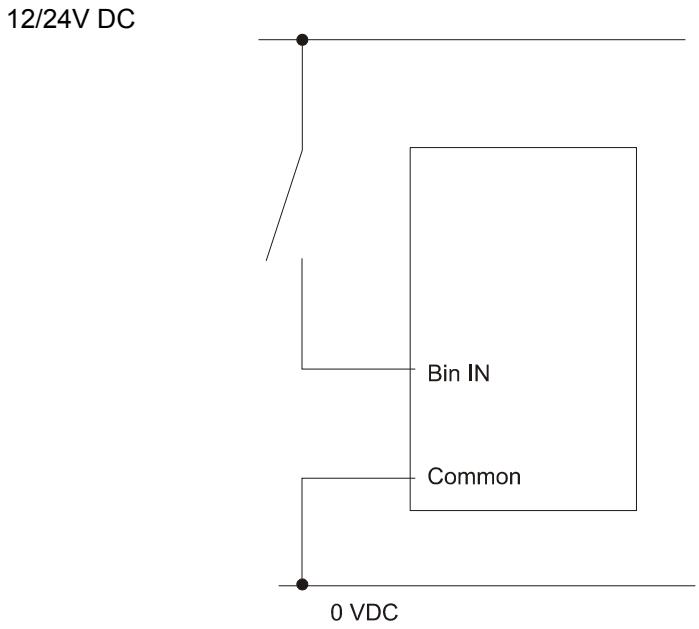
If necessary, the current outputs can be converted to voltage using a resistor across the terminals (250 Ω will convert the +/-20 mA into +/-5V DC).

For further information on how to connect the analogue output to the most common AVRs please refer to:

Application Notes, Interfacing DEIF equipment to governors and AVRs, document number 4189340149 at www.deif.com.

Binary inputs

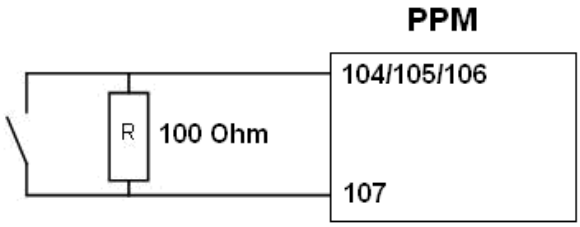
All binary inputs are 12/24V DC bi-directional optocoupler. Typical input is:



The binary inputs use fixed signals - they do not use pulse signals.

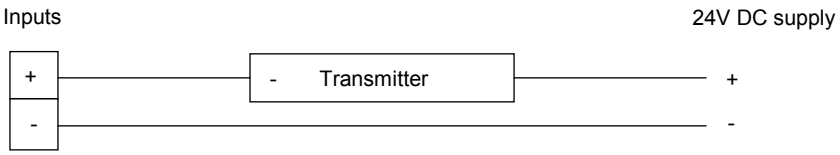
Binary inputs with wire break supervision

The binary inputs with wire break supervision only need potential free contacts.

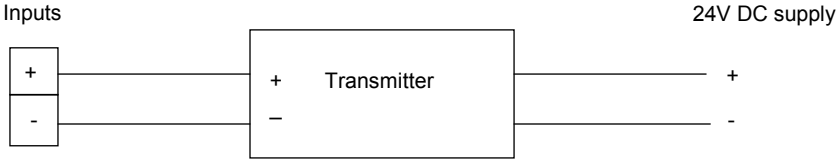


Analogue inputs

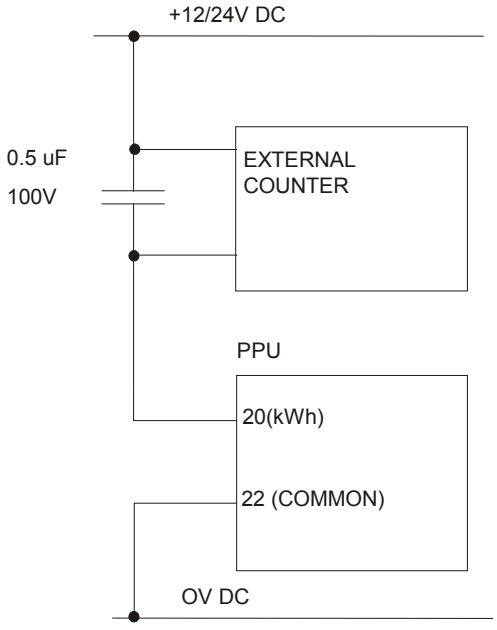
The analogue 0(4)...20 mA inputs are passive and require an external power supply:



or



Optocoupler outputs for external counter



9. General data

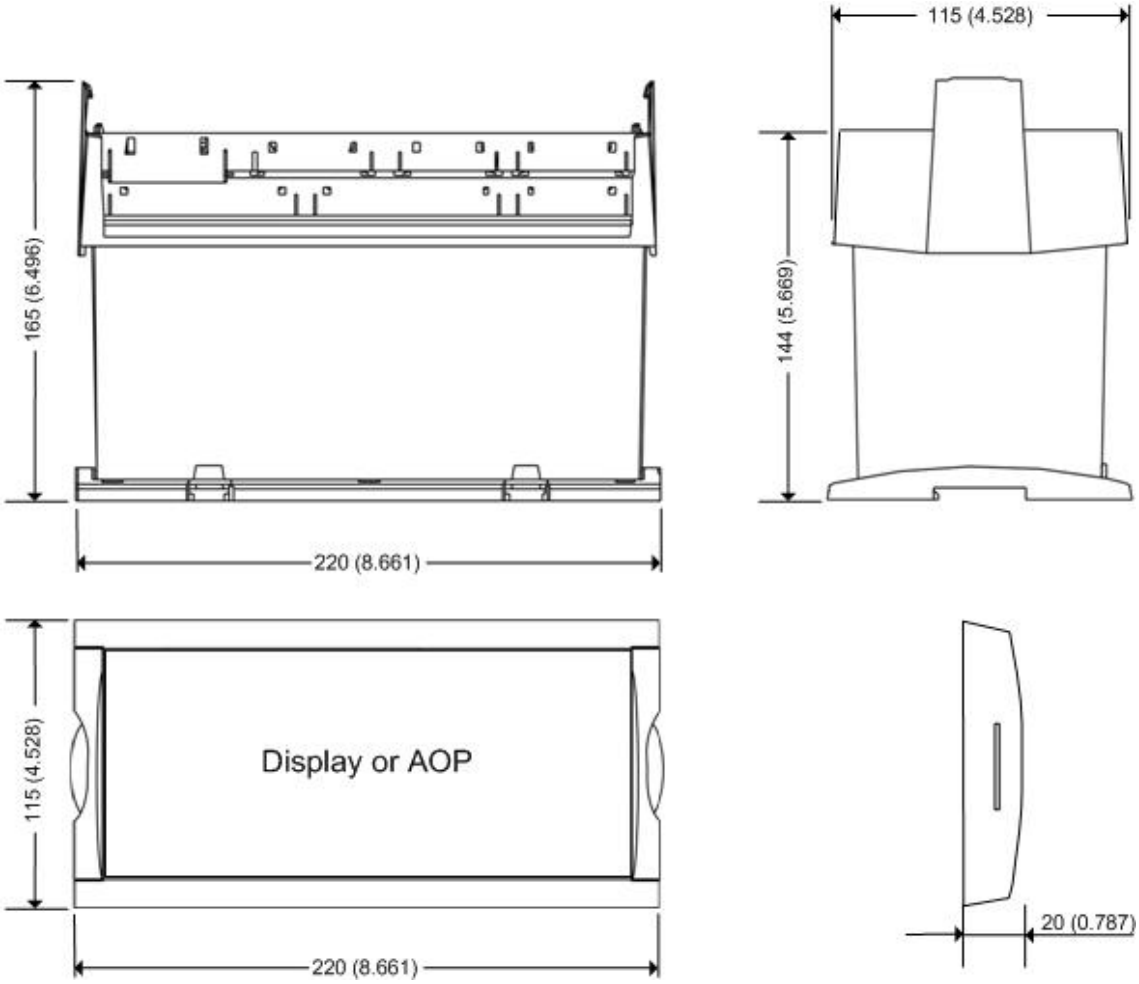
Technical specifications

Accuracy:	Class 1.0, to IEC/EN 60688
Operating temperature:	-25…70°C (-13...158°F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)
Storage temperature:	-40…70°C (-40...158°F)
Climate:	97% RH to IEC 60068-2-30
Measuring voltage:	100-690V AC +/-20% (UL/cUL Listed: 110-480V AC phase-phase) Consumption: Max. 0.25 VA/phase
Measuring current:	-/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A) Consumption: Max. 0.3 VA/phase
Current overload:	4 x I_n continuously 20 x I_n, 10 sec. (max. 75A) 80 x I_n, 1 sec. (max. 300A)
Measuring frequency:	30…70 Hz
Aux. supply:	18-36V DC Max. 11 W consumption The aux. supply inputs are to be protected by a 2A slow blow fuse (UL/cUL Listed: AWG 24)
Binary inputs:	Optocoupler, bi-directional ON: 8…36V DC Impedance: 4.7 kΩ OFF: <2V DC
Relay outputs:	Electrical rating: 250V AC/30V DC, 5A (UL/cUL Listed: 250V AC/24V DC, 2A resistive load) Thermal rating @ 50°C 2A: Continuously 4A: t_{ON} = 5 sec., t_{OFF} = 15 sec. (Unit status output: 1A)
Open collector outputs:	Supply 8…36V DC, max. 10 mA

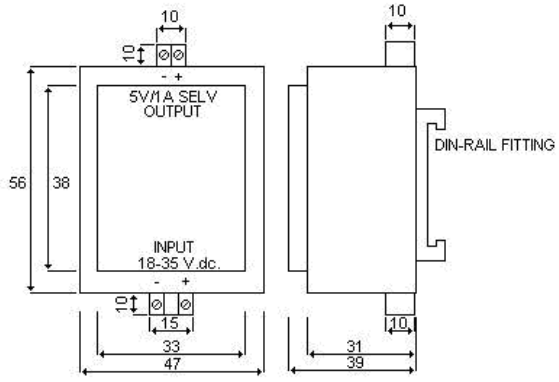
Analogue inputs:	-10…0…+10V DC Not galvanically separated Impedance: 100 kΩ (0)4…20 mA Impedance: 50 Ω Not galvanically separated
Mounting:	DIN-rail mounted or base mounted with six screws. DEIF recommends base mounting for marine applications. **If DIN-rail mounted in marine applications, additional means against excessive mechanical vibrations must be used.**
Load sharing lines:	-5…0…+5V DC Impedance: 23.5 Ω
Analogue outputs:	0(4)...20 mA and +/-25 mA Galvanically separated Active output (internal supply) Load max. 500 Ω (UL/cUL Listed: Max. 20 mA output)
Safety:	To EN 61010-1, installation category (overvoltage category) III, 600 V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300 V, pollution degree 2
Galv. separation:	Between AC voltage, AC current and other I/Os: 3250V AC, 50 Hz, 1 min. Between analogue outputs and other I/Os: 500V DC, 1 min. Between binary input groups and other I/Os: 500V DC, 1 min.
EMC/CE:	To EN 61000-6-1/2/3/4 IEC 60255-26 IEC 60533 power distr. zone IACS UR E10 power distr. zone
Vibration:	3…13.2 Hz: 2 mmpp 13.2…100 Hz:0.7 g To IEC 60068-2-6 & IACS UR E10 10…60 Hz: 0.15 mmpp 60…150 Hz: 1 g To IEC 60255-21-1 Response (class 2) 10…150 Hz: 2 g To IEC 60255-21-1 Endurance (class 2)
Shock (base mount):	10 g, 11 msec, half sine To IEC 60255-21-2 Response (class 2) 30 g, 11 msec, half sine To IEC 60255-21-2 Endurance (class 2) 50 g, 11 msec, half sine To IEC 60068-2-27

Bump:	20 g, 16 msec, half sine To IEC 60255-21-2 (class 2)
Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:	AC current: 0.2-4.0 mm^2 stranded wire (UL/cUL Listed: AWG 18)
	AC voltage: 0.2-2.5 mm^2 stranded wire (UL/cUL Listed: AWG 20)
	Relays: (UL/cUL Listed: AWG 22)
	Other: 2.5 mm^2 multi stranded (UL/cUL Listed: AWG 24)
	Display: 9-pole Sub-D female
	PC: USB A-B
	Ethernet: RJ45
Approvals:	The PPM is approved by the major classification societies. Contact DEIF for details
	UL and cUL
UL markings:	Wiring: Use 60/75°C copper conductors only
	Mounting: For use on a flat surface of type 1 enclosure
	Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
Governors:	Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins
	See interfacing guide at www.deif.com
Weight:	Main unit: 1.5 kg (3.40 lbs.) J1, cable 3 m: 0.2 kg (0.45 lbs.) Option J2: 0.4 kg (0.90 lbs.) Option J7: 0.2 kg (0.45 lbs.) Display: 0.4 kg (0.90 lbs.)
Protection:	Unit: IP20 Display: IP52 (IP54 with gasket, option L)
	(UL/cUL Listed: Type Complete Device, Open Type)
	To IEC 529 and EN 60529

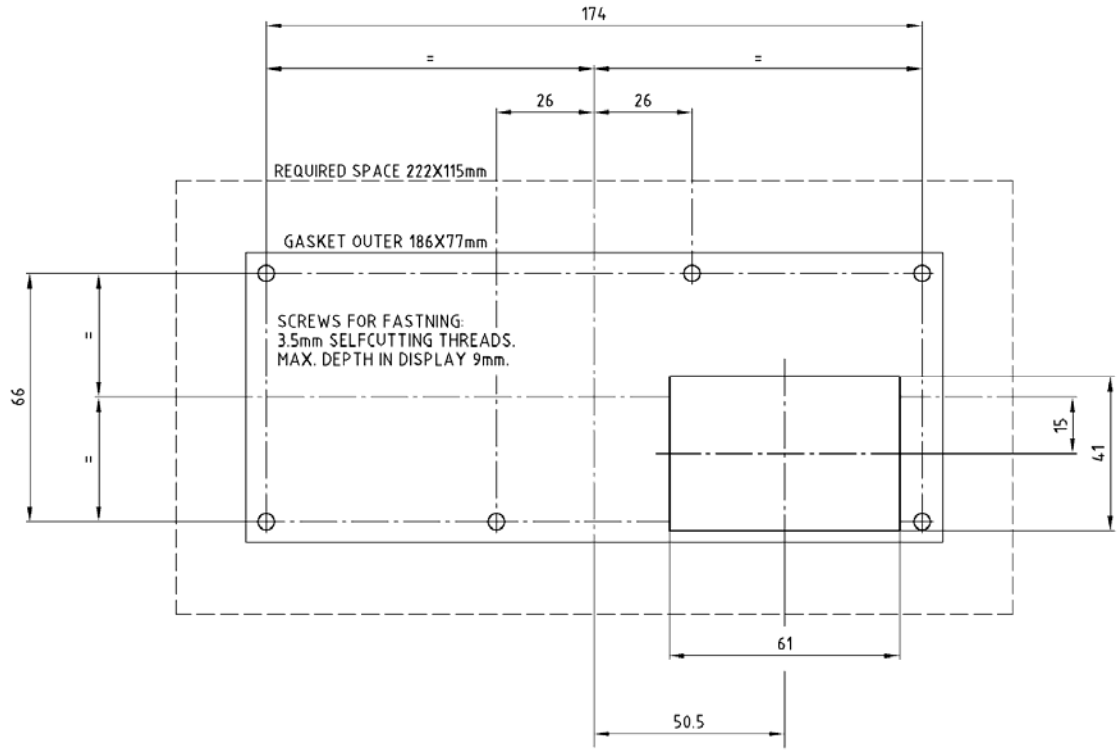
Unit dimensions



External 24V DC to 5V DC converter for the AOP-2



Panel cutout (in mm)



DEIF A/S reserves the right to change any of the above