DEIF

-power in control

CE

INSTALLATION INSTRUCTIONS

Protection and Power Management, PPM-3

- Mounting
- Board slot positions
- Generator I/Os
- Wirings

DEIF A/S · Frisenborgvej 33 · DK-7800 Skive
Tel.: +45 9614 9614 · Fax: +45 9614 9615
info@deif.com · www.deif.com

Document no.: 4189340741E
SW version:

9. Wirings

10. General data

1. General information

1.1 Warnings, legal information and safety

1.1.1 Warnings and notes

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

Warnings

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

Notes

Notes provide general information, which will be helpful for the reader to bear in mind.

1.1.2 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator controlled by the Multi-line 2 unit, the company responsible for the installation or the operation of the set must be contacted.

The Multi-line 2 unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

1.1.3 Safety issues

Installing and operating the Multi-line 2 unit may imply 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.

1.1.4 Electrostatic discharge awareness

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

1.1.5 Factory settings

The Multi-line 2 unit is delivered from factory with certain factory settings. These are based on average values and are not necessarily the correct settings for matching the engine/generator set in question. Precautions must be taken to check the settings before running the engine/generator set.

1.2 About the installation instructions

1.2.1 General purpose

These Installation Instructions mainly include general product and hardware information, mounting instructions, terminal strip descriptions, I/O lists and wiring descriptions.

The general purpose of this document is to give the user important information to be used in the installation of the unit.

Please make sure to read this document before starting to work with the Multi-line 2 unit and the genset to be controlled. Failure to do this could result in human injury or damage to the equipment.

1.2.2 Intended users

These Installation Instructions are mainly intended for the person responsible for the design and installation. In most cases, this would be a panel builder designer. Naturally, other users might also find useful information in the document.

1.2.3 Contents and 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.

2. Mounting

2.1 Mounting and dimensions

2.1.1 Mounting of the unit

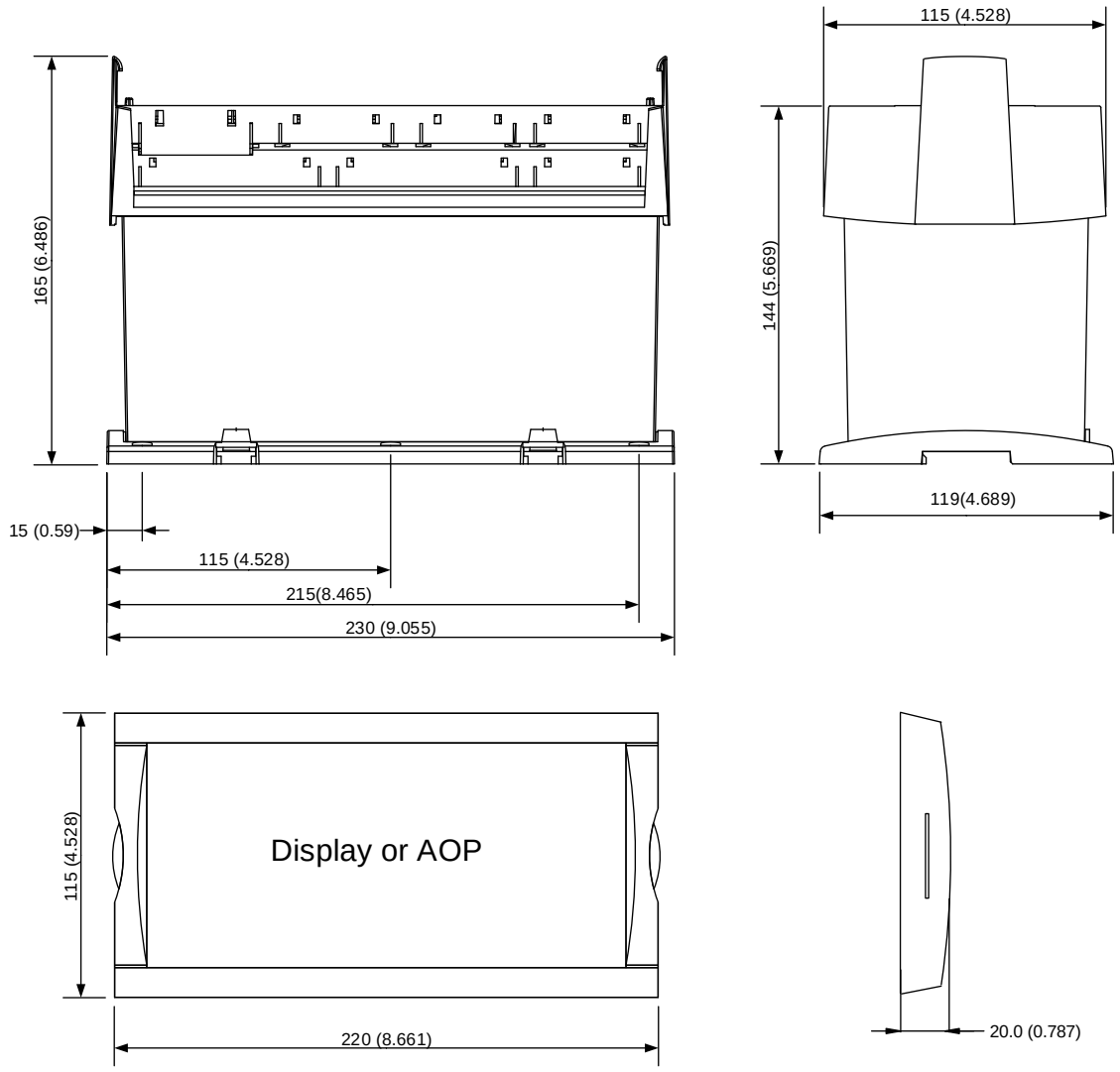
The unit is designed for mounting inside the panel. The display can be installed on the panel door and connected to the main unit with a display cable.

The unit is primarily used in marine applications and must be mounted with screws to the rear side of the cabinet. Six screw holes are available for this mounting method.

DEIF recommends using the screw hole fastening.

Do not use chemicals or oils (cutting oil, lubricating oil/grease) on or near the surfaces of the controller housing or display panel. These may cause serious damage to the plastic parts and render the warranty void.

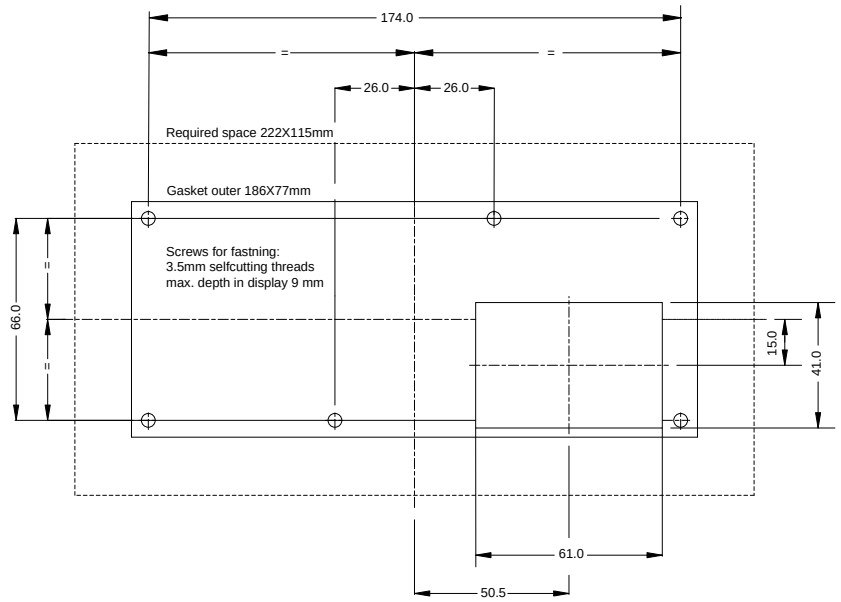
2.1.2 Unit dimensions



Dimensions are given in mm (inches).

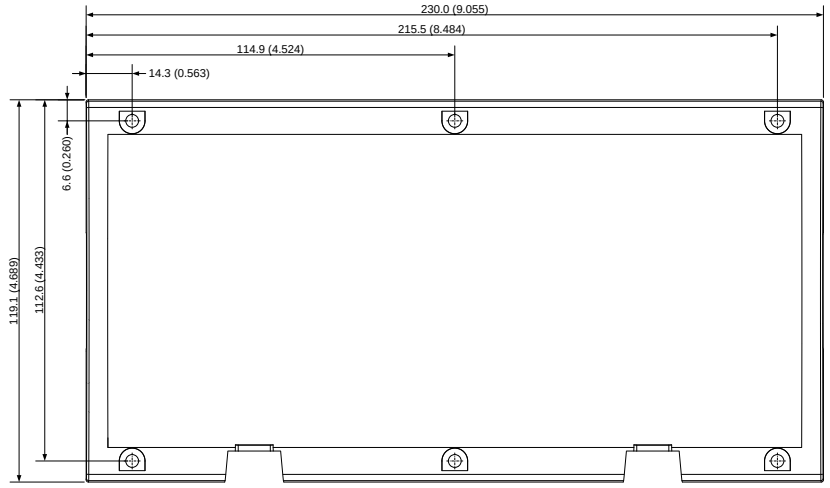
2.1.3 Panel cutout

In order to ensure optimum mounting, the panel door must be cut out according to the panel cutout illustration.



Dimensions are given in mm.

2.1.4 Drilling template in mm (inches)

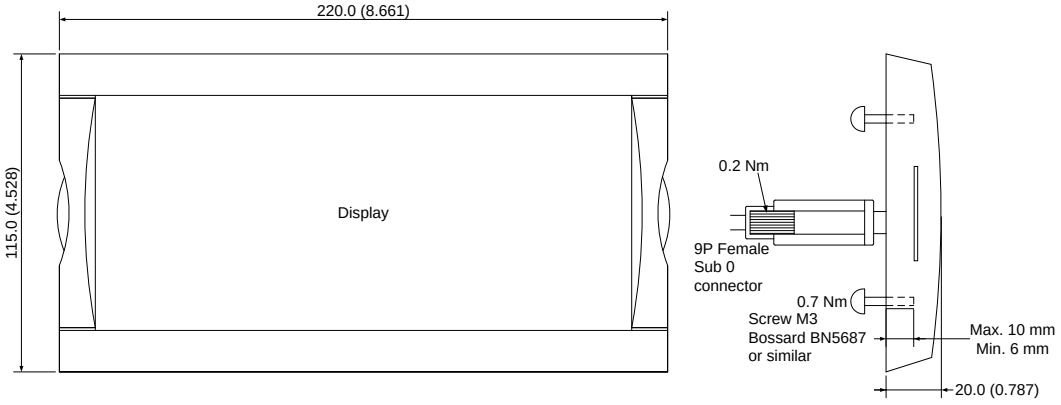


2.1.5 Tightening torques

Base unit mounting:	0.3 Nm, 2.7 lb-in
Plug connections (terminals):	0.5 Nm, 4.4 lb-in

Display, AOP-1 and AOP-2 (see diagram below)

Panel door mounting:	0.7 Nm, 6.2 lb-in
Sub-D screw:	0.2 Nm, 1.8 lb-in
DC-DC converter terminals:	0.5 Nm, 4.4 lb-in

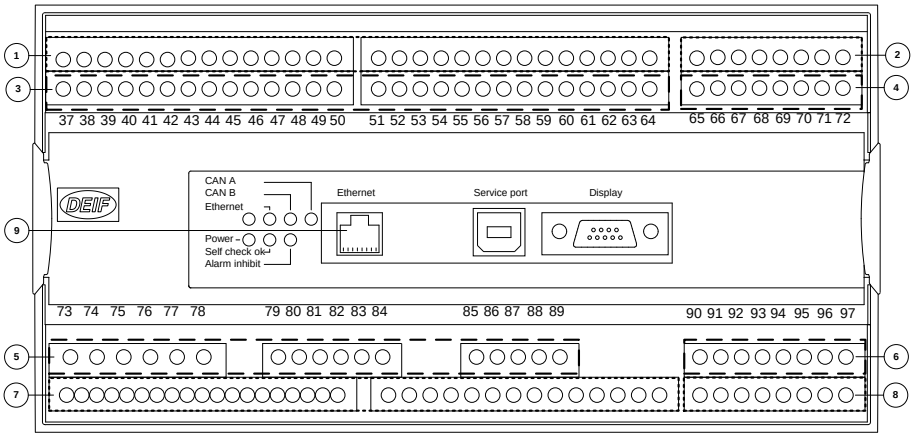


3. General hardware description

3.1 Hardware

3.1.1 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.



Slot #	Term.	DG	SG	EDG	SHORE	BTB	Description
1	1-28	Standard	Standard	Standard	Standard	Standard	Power supply board
2	29-36	Option	Option	Option	Option	Option	Serial communication, H2, H3, H8.2
3	37-64	Standard	Standard	Standard	Standard	Standard	Load sharing and input/output board
4	65-72	4× Relay (standard) Option	Not used	4× Relay (standard) Option	Not used	Not used	GOV/AVR outputs, Options: E1, E2, EF2, EF4, EF5
5	73-89	Standard	Standard	Standard	Standard	Standard	AC measuring
6	90-97	Option	Option	Option	Option	Option	Option: F1, M13.6, M14.6, M15.6
7	98-124	Standard Option	Standard	Standard Option	Standard	Standard	Power management, Engine interface, Option: H7
8	126-133	Option	Option	Option	Option	Option	Option: M13.8, M14.8, M15.8

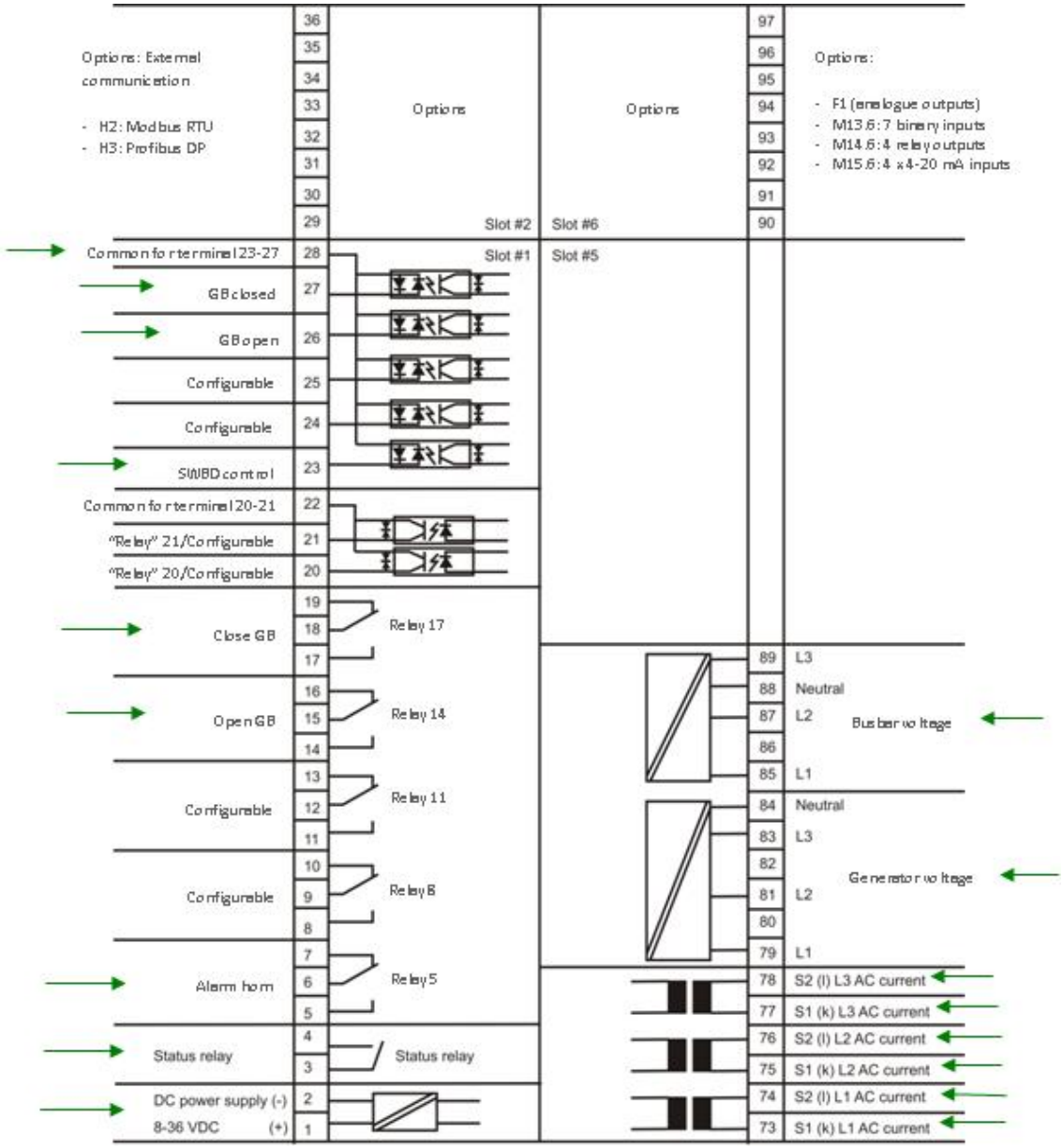
Only hardware options, which will affect the hardware of the unit, are represented in the table. The software options will be seen through the PC utility software. The software options that are not represented in the above table can be found in the data sheet.

4. Diesel generator (DG) I/Os

4.1 DG I/Os

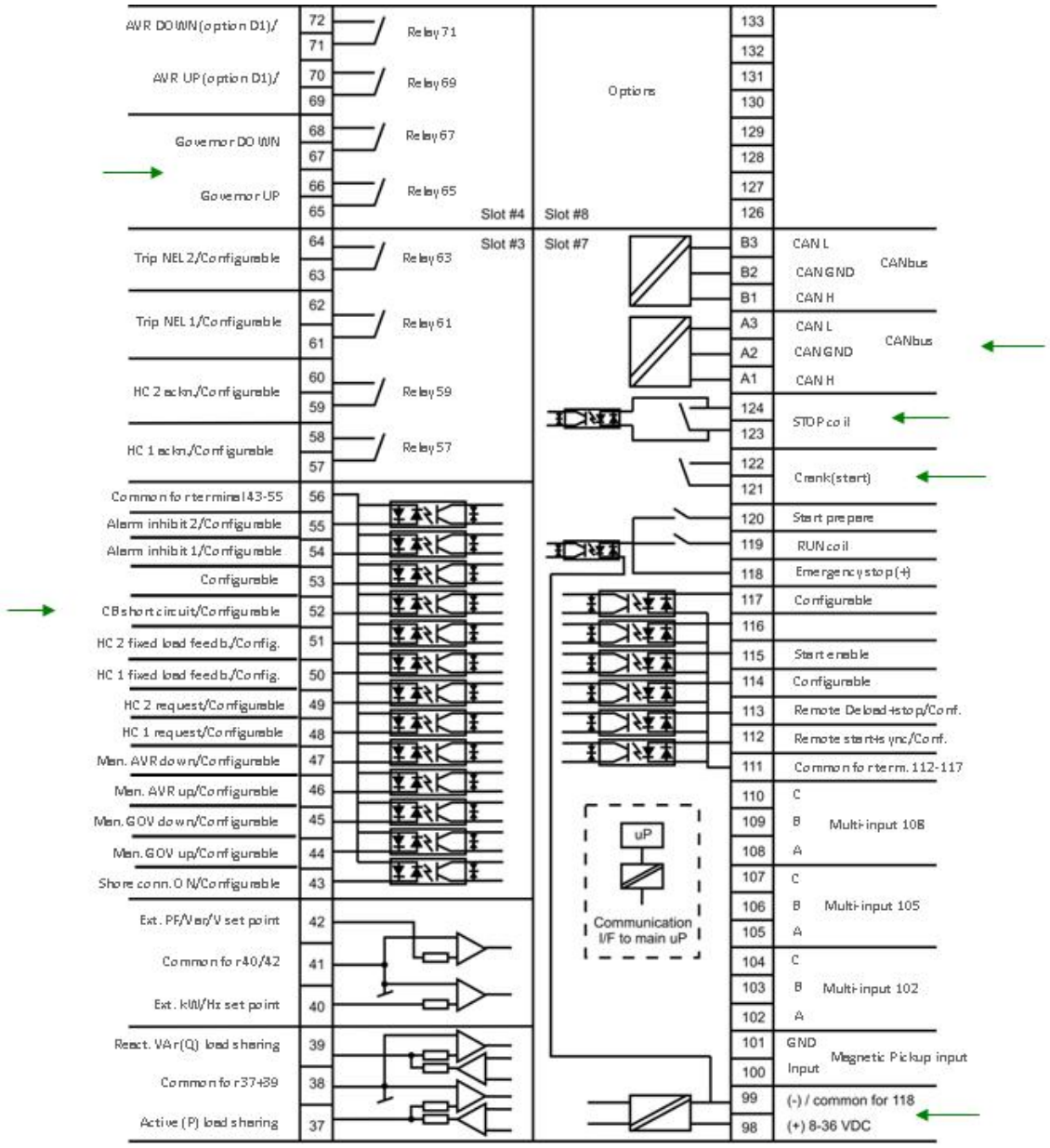
4.1.1 Terminal strip overviews

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



Multi-inputs 102, 105 and 108 are as default set to digital input with wire break detection.

The functionality of the board in slot #4 and slot #6 is optional. Relays are standard in slot #4, but analogue outputs (options E1 and E2) or combination outputs (options EF) are also available.

4.1.2 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	+12/24 V DC	8 to 36 V DC	Power supply
2	0 V DC		
3	NC	Status relay	Normally closed relay, processor/power supply status supervision
4	Com.	24 V/1 A	
5	NO	Relay 5	Alarm horn
6	Com.	250 V AC/8 A	
7	NC		
8	NO	Relay 8	Configurable
9	Com.	250 V AC/8 A	
10	NC		
11	NO	Relay 11	Configurable
12	Com.	250 V AC/8 A	
13	NC		
14	NO	Relay 14	GB OFF Open breaker (deload)/trip
15	Com.	250 V AC/8 A	
16	NC		
17	NO	Relay 17	GB ON Close breaker (synchronising)
18	Com.	250 V AC/8 A	
19	NC		
20	Open collector 1	Transistor out (relay 20)	Configurable as standard relay output
21	Open collector 2	Transistor out (relay 21)	Configurable as standard relay output
22	Com.	Common	Common terminal for terminals 20 and 21
23	Binary input	Optocoupler	SWBD (switchboard manual) control
24	Binary input	Optocoupler	Configurable
25	Binary input	Optocoupler	Configurable
26	Binary input	Optocoupler	GB open feedback
27	Binary input	Optocoupler	GB closed feedback
28	Com.	Common	Common for terminals 23-27

The power supply must be protected with a 2 A slow-blow fuse.

Slot #2, external communication (option)
Option H2 (RS-485 Modbus RTU).

Term.	Function	Description
29	DATA + (A)	Modbus RTU, RS-485
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.
Terminals 29/33 and 31/35 are internally connected.

Option H3 (Profibus DP)

Term.	Function	Description
29	DATA + (B)	Pin 3 on 9 pole sub-D connector
30	GND	Pin 5 on 9 pole sub-D connector
31	DATA - (A)	Pin 8 on 9 pole sub-D connector
32	DATA + (B)	
33	GND	
34	DATA - (A)	
35	Not used	
36	Not used	

Option H8.2
CAN bus interface for external I/O modules.

Term.	Function	Description
29	CAN-H	CAN bus card option H8.2
30	CAN GND	
31	CAN-L	
32	CAN-H	
33	CAN GND	
34	CAN-L	
35	Not used	
36	Not used	

Slot #3, binary I/O

Term.	Function	Technical data	Description
37	-5 to 0 to 5 V DC	Analogue I/O	Active load sharing line
38	Com.	Common	Common for load sharing lines
39	-5 to 0 to 5 V DC	Analogue I/O	Reactive load sharing
40	-10 to 0 to 10 V DC	Analogue input	f/P set point (passive)
41	Com.	Common	Common for 40/42
42	-10 to 0 to 10 V DC	Analogue input	U/Q set point (passive)
43	Binary input	Optocoupler	Shore connection breaker position ON/configurable
44	Binary input	Optocoupler	Man. GOV UP/configurable
45	Binary input	Optocoupler	Man. GOV DOWN/configurable
46	Binary input	Optocoupler	Man. AVR UP/configurable
47	Binary input	Optocoupler	Man. AVR DOWN/configurable
48	Binary input	Optocoupler	Heavy consumer 1 request/configurable
49	Binary input	Optocoupler	Heavy consumer 2 request/configurable
50	Binary input	Optocoupler	Heavy consumer 1 fixed load feedback/configurable
51	Binary input	Optocoupler	Heavy consumer 2 fixed load feedback/configurable
52	Binary input	Optocoupler	GB short circuit/configurable
53	Binary input	Optocoupler	Configurable
54	Binary input	Optocoupler	Alarm inhibit 1/configurable
55	Binary input	Optocoupler	Alarm inhibit 2/configurable
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 57 6	Start acknowledge heavy consumer 1/configurable
58	Com.	250 V AC 8 A	
59	NO	Relay 59 7	Start acknowledge heavy consumer 2/configurable
60	Com.	250 V AC 8 A	
61	NO	Relay 61 8	Trip NEL 1/configurable
62	Com.	250 V AC 8 A	
63	NO	Relay 63 9	Trip NEL 2/configurable
64	Com.	250 V AC 8 A	

Slot #4, GOV/AVR (standard)
GOV/AVR relay output card *(GOV standard) (voltage/var/PF control option D1)*.

Term.	Function	Description
65	Relay 65 250 V AC, 8 A	Generator GOV Increase frequency
6		
67	Relay 65 250 V AC, 8 A	Generator GOV Decrease frequency
68		
69	Relay 69 250 V AC, 8 A	Generator AVR (option D) Increase voltage/configurable
70		
71	Relay 71 250 V AC, 8 A	Generator AVR (option D) Decrease voltage/configurable
72		

Option E1
GOV/AVR analogue output card.

Term.	Function	Description
65	Not used	
66	+/-20 mA out	Speed governor set point output or transducer. (Analogue output 66)
67	0	
68	Not used	
69	Not used	
70	+/-20 mA out	AVR voltage set point output or transducer. (Analogue output 70)
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 +/-5 V DC).

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

Option E2
GOV/AVR analogue output card.

Term.	Function	Description
65	Not used	
66	0 to 20 mA out	Speed governor set point output or transducer. (Analogue output 66)
67	0	
68	Not used	
69	Not used	
70	0 to 20 mA out	AVR voltage set point output or transducer. (Analogue output 70)
71	0	
72	Not used	

Option EF2
Analogue speed governor output and one transducer output.

Term.	Function	Description
65	Not used	
66	+/-20 mA	Speed governor set point output or transducer (Analogue output 66)
67	0	
68	Not used	
69	Not used	
70	0(4) to 20 mA out	Analogue output 70
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, for example power, power factor, frequency, and so on. Outputs can be selected to be either 0 to 20 mA or 4 to 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 to 20 mA into 0 to 10 V DC).

Option EF4
Combination output for governor and AVR.

Term.	Function	Description
65	ANA +	Analogue +/-20 mA for GOV or AVR (analogue output 65)
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, the analogue output will be used for the AVR, and vice versa

Option EF5
PWM output for governor and combination output for AVR.

Term.	Function	Description
65	+/- 25 mA out	AVR set point output
66	0	
67	PWM +	PWM speed governor signal
68	PWM -	
69	Relay	Relay output for AVR Raise voltage
70	Relay	
71	Relay	Relay output for AVR Lower voltage
72	Relay	

Slot #5, AC measuring

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

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

Slot #6, inputs/outputs (I/Os)
Option F1
Analogue transducer output.

Term.	Function	Description
90	Not used	
91	0	Analogue output 91, selectable
92	0(4) to 20 mA out	
93	Not used	
94	Not used	
95	0	Analogue output 95, selectable
96	0(4) to 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, for example pow-

er, power factor, frequency, and so on. Outputs can be selected to be either 0 to 20 mA or 4 to 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 to 20 mA into 0 to 10 V DC).

Option M13.6
7 × binary inputs.

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

Option M14.6
4 × relay outputs.

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

Option M15.6
4 × analogue 4 to 20 mA inputs.

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

Slot #7, engine interface board

Term.	Function	Technical data	Description/preconfiguration
98	+12/24 V DC	8 to 36 V DC	DC power supply
99	0 V DC		
100	MPU input	0.5 to 70 V AC/	Magnetic pickup (RPM)
101	MPU GND	10 to 10000 Hz	
102	A	0(4) to 20 mA Digital w/wire break Pt100 Pt1000 RMI 0 to 40 V DC	Multi-input 1 Pre-selected to digital input with wire break detection
103	B		
104	C		
105	A		Multi-input 2 Pre-selected to digital input with wire break detection
106	B		
107	C		
108	A		Multi-input 3 Pre-selected to digital input with wire break detection
109	B		
110	C		
111	Com.	Common	Common for terminals 112 to 117
112	Digital input 112	Optocoupler	Remote start + sync./configurable
113	Digital input 113	Optocoupler	Remote deload + stop/configurable
114	Digital input 114	Optocoupler	Configurable
115	Digital input 115	Optocoupler	Start enable
116	Digital input 116	Optocoupler	Running feedback/configurable
117	Digital input 117	Optocoupler	Configurable
118	Digital input 118	Optocoupler	Emergency stop and common for 119 and 120
119	NO	Relay 24 V DC/5 A	Run coil
120	NO	Relay 24 V DC/5 A	Start prepare
121	Com.	Relay 24 V DC/5 A	Crank (starter)
122	NO		
123	Com.	Relay 24 V DC/5 A	Stop coil w/wire break detection
124	NO		
A1	CAN-H	CAN bus interface #1	Internal power management communication (redundant to CAN bus interface #2) or option H7 J1939 engine interface.
A2	CAN GND		
A3	CAN-L		

Term.	Function	Technical data	Description/preconfiguration
B1	CAN-H	CAN bus interface #2	Internal power management communication (redundant to CAN bus interface #1).
B2	CAN GND		
B3	CAN-L		

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 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, communication and I/O options
Option H5
CAN bus engine interface.

Term.	Function	Description
126	Not used	CAN bus communication for Engine interface J1939 or MTU MDEC/MTU ADEC
127	Not used	
128	CAN-L	
129	Not used	
130	CAN-H	
131	CAN-L	
132	Not used	
133	CAN-H	

Option H8.8
CAN bus interface for external I/O modules.

Term.	Function	Description
126	Not used	CAN bus communication for Beckhoff external I/O modules
127	Not used	
128	CAN-L	
129	Not used	
130	CAN-H	
131	CAN-L	
132	Not used	
133	CAN-H	

Option M13.8
7 × binary inputs.

Term.	Function	Description
126	Common	Common
127	Digital input 127	Configurable
128	Digital input 128	Configurable
129	Digital input 129	Configurable
130	Digital input 130	Configurable
131	Digital input 131	Configurable
132	Digital input 132	Configurable
133	Digital input 133	Configurable

Option M14.8
4 × relay outputs.

Term.	Function	Description
126	Relay output 126 250 V AC, 8 A max.	Configurable
127		
128	Relay output 128 250 V AC, 8 A max.	Configurable
129		
130	Relay output 130 250 V AC, 8 A max.	Configurable
131		
132	Relay output 132 250 V AC, 8 A max.	Configurable
133		

Option M15.8
4 × analogue 4 to 20 mA inputs.

Term.	Function	Description
126	Input 90 common	Common
127	Analogue input 91+	4 to 20 mA in
128	Input 92 common	Common
129	Analogue input 93+	4 to 20 mA in
130	Input 94 common	Common
131	Analogue input 95+	4 to 20 mA in
132	Input 96 common	Common
133	Analogue input 97+	4 to 20 mA in

4.1.3 Digital inputs

Term.	Name	Function
23	SWBD control	If the input is set, the unit will be forced into switchboard control. (Regulation is deactivated)
24	Configurable	This input is programmable from the PC utility software
25	Configurable	This input is programmable from the PC utility software
26	GB open	Breaker feedback signal. The connection breaker is in position OFF
27	GB closed	Breaker feedback signal. The connection breaker is in position ON
43	Shore connection position OFF/configurable	The shore connection breaker is in position OFF. When the shore connection breaker is connected, the generator breaker ON sequence is blocked./ Programmable from the PC utility software
44	Manual GOV UP/ configurable	Increase engine speed (SWBD mode only)./Programmable from the PC utility software
45	Manual GOV DOWN/configurable	Decrease engine speed (SWBD mode only)./Programmable from the PC utility software
46	Manual AVR UP/ configurable	Increase generator voltage(option D1) (SWBD mode only).
47	Manual AVR DOWN/ configurable	Decrease generator voltage (option D1) (SWBD mode only)./Programmable from the PC utility software
48	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 which are selected for AUTO mode./Programmable from the PC utility software.
49	HC 2 request/configurable	
50	HC 1 fixed load feedback/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./Programmable from the PC utility software.
51	HC 2 fixed load feedback/configurable	
52	GB short circuit/ configurable	GB tripped by external short circuit protection./Programmable from the PC utility software
53	Configurable	This input is programmable from the PC utility software.
54	Alarm inhibit 1/ configurable	External input for inhibit of selected alarms./Programmable from the PC utility software.
55	Alarm inhibit 2/ configurable	
102	Multi-input 1/configurable	Multi-function inputs selectable as either 0(4) to 20 mA, digital with wire break supervision, Pt100, Ptt000, RMI or 0 to 40 V DC. The default selection is digital with wire break detection (resistor across contacts 270 Ω)./ Programmable from the PC utility software
105	Multi-input 2/configurable	
108	Multi-input 3/configurable	

Term.	Name	Function
112	Remote start + sync/ configurable	This function is only active in Semi-Auto mode. A pulse input will start the engine and subsequently synchronise the generator./Programmable from the PC utility software.
113	Remote deload + stop/configurable	This function is only active in Semi-Auto mode. A pulse input will de-load and open the generator breaker. After cool-down the generator will stop./ Programmable from the PC utility software.
114	Configurable	This input is programmable from the PC utility software
115	Start enable	This input must be set to be able to start the engine
116	Running feedback/ configurable	The diesel engine has achieved the running status = ON and the starter is removed./Programmable from the PC utility software.
117	Configurable	This input is programmable from the PC utility software
118	Emergency stop	The emergency stop input has been activated.The engine is shutting down.

4.1.4 Relay outputs

Term.	Name	Function
3	Status relay	The status relay on the power supply board is a normally closed relay with the purpose of processor and power supply supervision.
4		
5	Alarm horn relay	The relay is activated on any alarm that appears. The output can be normally open (term. 5-6) or normally closed (term. 6-7).
6		
7		
8	Configurable	Programmable from the PC utility software.
9		
10		
11	Configurable	Programmable from the PC utility software.
12		
13		
14	Open GB	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).
15		
16		
17	Close GB	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).
18		
19		
20	Configurable	Configurable digital output (transistor output type).
21	Configurable	Configurable digital output (transistor output type).
57	HC 1 acknowledge/configurable	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/programmable from the PC utility software.
58		
59	HC 2 acknowledge/configurable	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/programmable from the PC utility software.
60		
61	Trip NEL 1/ configurable	Trip of the NEL (Non Essential Load) group no. 1 due to measured under-frequency, over-current or push load on the busbar/ Programmable from the PC utility software.
62		
63	Trip NEL 2/ configurable	Trip of the NEL (Non Essential Load) group no. 2 due to measured under-frequency, over-current or push load on the busbar/ Programmable from the PC utility software.
64		
65	Gov up	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.
66		
67	Gov down	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.
68		
69	AVR up/configurable	Option D1: Increase of voltage. The signal is connected to the AVR. A voltage droop of 4 % (+/-2 %) has to be adjusted in the AVR./Programmable from the PC utility software.

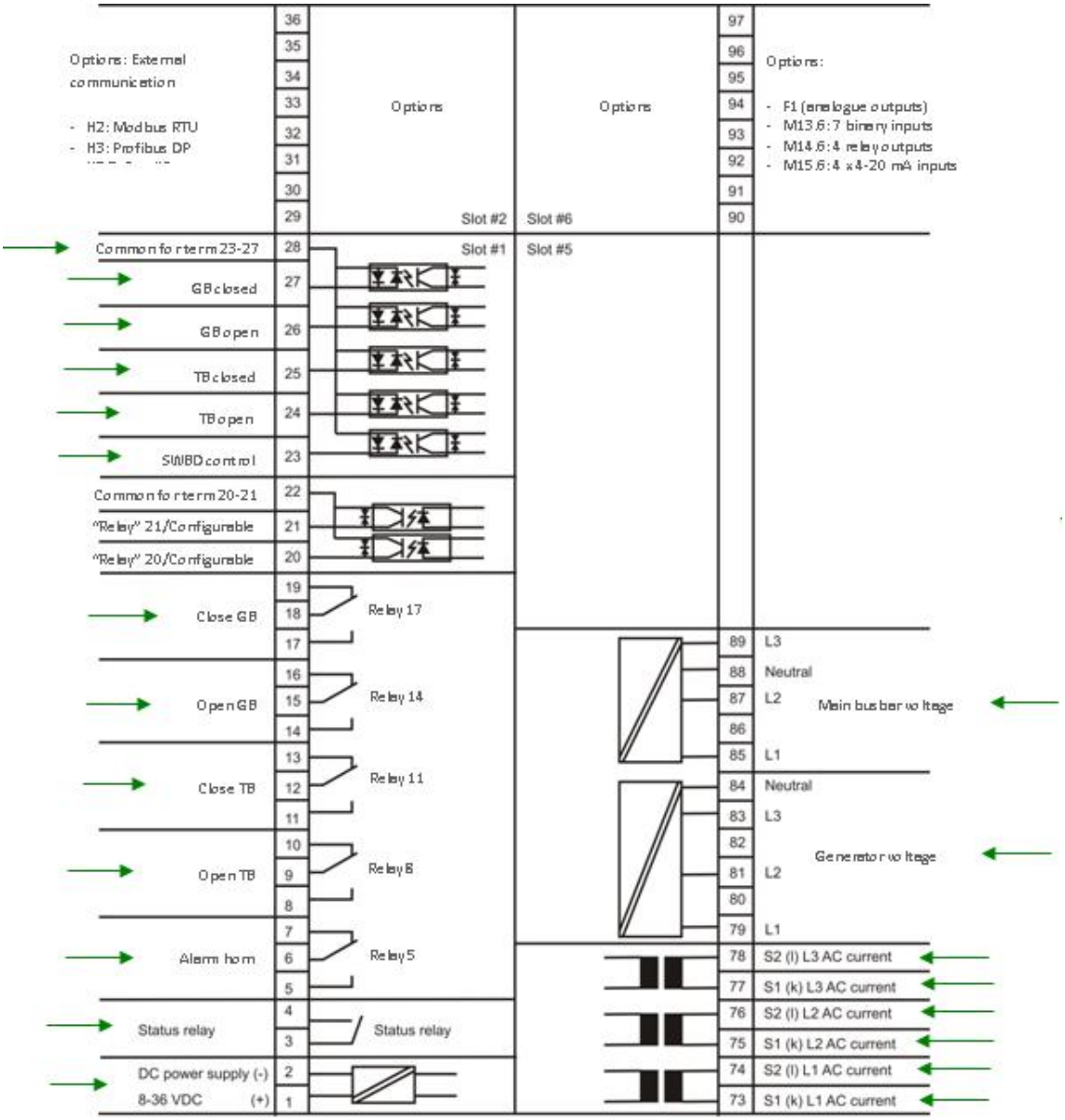
Term.	Name	Function
70		
71	AVR down/ configurable	Option D1: Decrease of voltage. The signal is connected to the AVR. A voltage droop of 4 % (+/-2 %) has to be adjusted in the AVR./Programmable from the PC utility software.
72		
119	Run coil	ON when engine running is required. OFF when the engine is to stop.
120	Start prepare	The start prepare output is activated, before the crank (start) output is activated. This could be preglow or preheating of the engine.
121	Crank	Activation of the engine cranking (starter motor).
122		
123	Stop coil	Activates when the engine is to stop. Remains activated during the “extended stop” time period. This output is monitored for wire break (12/24 V DC only).
124		

5. Emergency diesel generator (EDG) I/Os

5.1 EDG I/Os

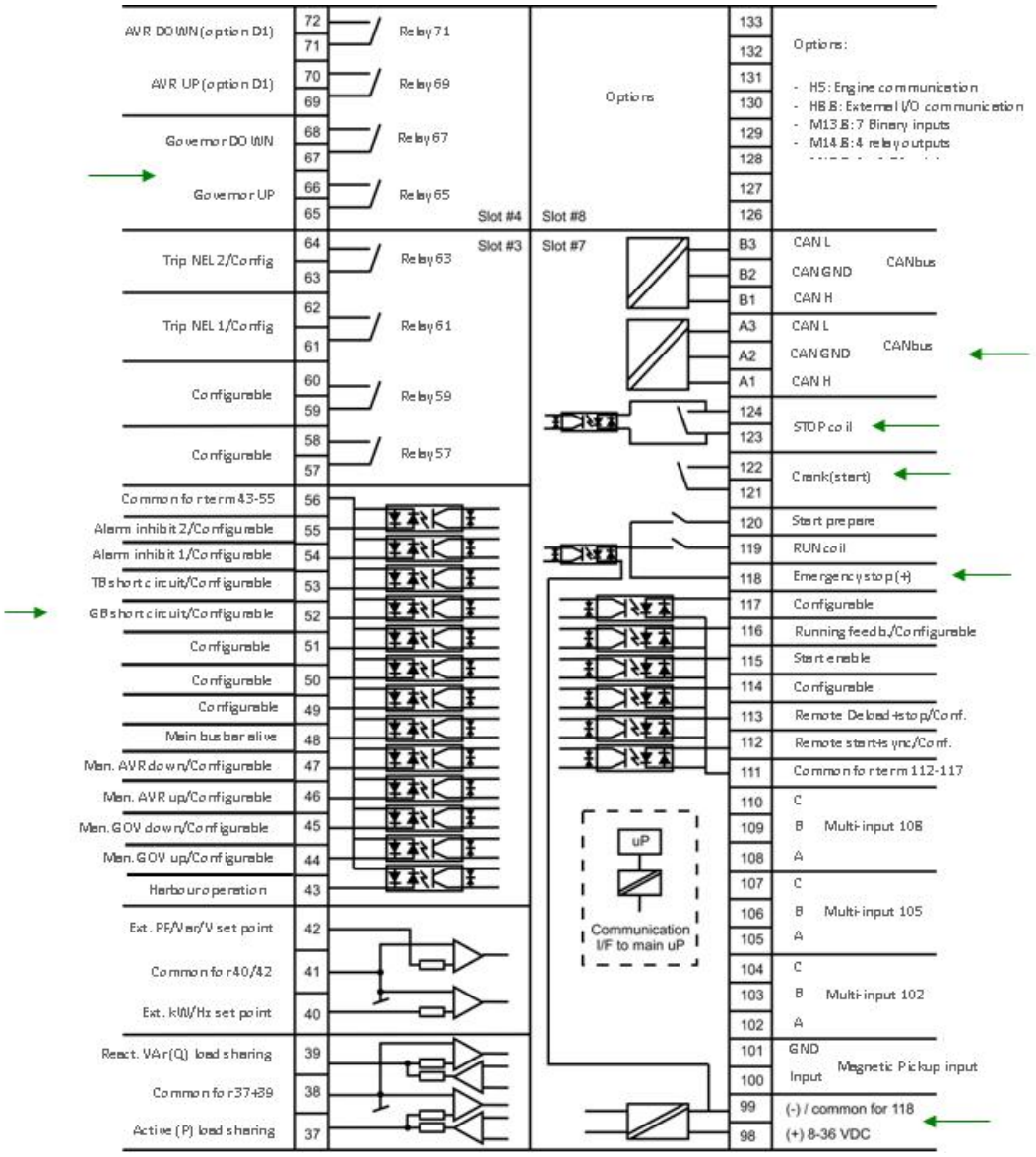
5.1.1 Terminal strip overviews

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



Multi-inputs 102, 105 and 108 are as default set to digital input with wire break detection.

The functionality of the board in slot #4 and slot #6 is optional. Relays are standard in slot #4, but analogue outputs (options E1 and E2) or combination outputs (options EF) are also available.

5.1.2 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	+12/24 V DC	8 to 36 V DC	Power supply
2	0 V DC		
3	NC	Status relay	Normally closed relay, processor/power supply status supervision
4	Com.	24 V/1 A	
5	NO	Relay 5	Alarm horn
6	Com.	250 V AC/8 A	
7	NC		
8	NO	Relay 8	TB OFF. Open tie breaker (trip)
9	Com.	250 V AC/8 A	
10	NC		
11	NO	Relay 11	TB ON. Close tie breaker (synchronising)
12	Com.	250 V AC/8 A	
13	NC		
14	NO	Relay 14	GB OFF. Open breaker (deload/trip)
15	Com.	250 V AC/8 A	
16	NC		
17	NO	Relay 17	GB ON. Close breaker (synchronising)
18	Com.	250 V AC/8 A	
19	NC		
20	Open collector 1	Transistor out (relay 20)	Configurable as standard relay output
21	Open collector 2	Transistor out (relay 21)	Configurable as standard relay output
22	Com.	Common	Common terminal for terminals 20 and 21
23	Binary input	Optocoupler	SWBD (switchboard manual) control
24	Binary input	Optocoupler	TB open feedback
25	Binary input	Optocoupler	TB closed feedback
26	Binary input	Optocoupler	GB open feedback
27	Binary input	Optocoupler	GB closed feedback
28	Com.	Common	Common for terminals 23-27

The power supply must be protected with a 2 A slow-blow fuse.

Slot #2, external communication (option)
Option H2 (RS-485 Modbus RTU).

Term.	Function	Description
29	DATA + (A)	Modbus RTU, RS-485
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.
Terminals 29/33 and 31/35 are internally connected.

Option H3 (Profibus)

Term.	Function	Description
29	DATA + (B)	Pin 3 on 9 pole sub-D connector
30	GND	Pin 5 on 9 pole sub-D connector
31	DATA - (A)	
32	DATA + (B)	Pin 8 on 9 pole sub-D connector
33	GND	
34	DATA - (A)	
35	Not used	
36	Not used	

Option H8.2
CAN bus interface for external I/O modules.

Term.	Function	Description
29	CAN-H	CAN bus card option H8.2
30	CAN GND	
31	CAN-L	
32	CAN-H	
33	CAN GND	
34	CAN-L	
35	Not used	
36	Not used	

Slot #3, binary I/O

Term.	Function	Technical data	Description
37	-5 to 0 to 5 V DC	Analogue I/O	Active load sharing line
38	Com.	Common	Common for load sharing lines
39	-5 to 0 to 5 V DC	Analogue I/O	Reactive load sharing
40	-10 to 0 to 10 V DC	Analogue input	f/P set point (passive)
41	Com.	Common	Common for 40/42
42	-10 to 0 to 10 V DC	Analogue input	U/Q set point (passive)
43	Binary input	Optocoupler	Harbour operation
44	Binary input	Optocoupler	Man. GOV UP/configurable
45	Binary input	Optocoupler	Man. GOV DOWN/configurable
46	Binary input	Optocoupler	Man. AVR UP/configurable
47	Binary input	Optocoupler	Man. AVR DOWN/configurable
48	Binary input	Optocoupler	Main busbar alive
49	Binary input	Optocoupler	Configurable
50	Binary input	Optocoupler	Configurable
51	Binary input	Optocoupler	Configurable
52	Binary input	Optocoupler	GB short circuit/configurable.
53	Binary input	Optocoupler	TB short circuit/configurable
54	Binary input	Optocoupler	Alarm inhibit 1/configurable
55	Binary input	Optocoupler	Alarm inhibit 2/configurable
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 57 6	Configurable
58	Com.	250 V AC, 8 A	
59	NO	Relay 59 7	Configurable
60	Com.	250 V AC, 8 A	
61	NO	Relay 61 8	Trip NEL 1/configurable
62	Com.	250 V AC, 8 A	
63	NO	Relay 63 9	Trip NEL 2/configurable
64	Com.	250 V AC, 8 A	

Slot #4, GOV/AVR (standard)
GOV/AVR relay output card (GOV standard) (voltage control option D).

Term.	Function	Description
65	Relay 65, 250 V AC, 8 A	Generator GOV. Increase frequency.
66		
67	Relay 67, 250 V AC, 8 A	Generator GOV. Decrease frequency.
68		
69	Relay 69, 250 V AC, 8 A	Generator AVR (option D). Increase voltage/configurable.
70		
71	Relay 71, 250 V AC, 8 A	Generator AVR (option D). Decrease voltage/configurable.
72		

Option E1
GOV/AVR analogue output card.

Term.	Function	Description
65	Not used	
66	+/-20 mA out	Speed governor set point output or transducer. (Analogue output 66).
67	0	
68	Not used	
69	Not used	
70	+/-20 mA out	AVR voltage set point output or transducer. (Analogue output 70).
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 +/-5 V DC).

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

Option E2
GOV/AVR analogue output card.

Term.	Function	Description
65	Not used	
66	0 to 20 mA out	Speed governor set point output or transducer. (Analogue output 66).
67	0	
68	Not used	
69	Not used	
70	0 to 20 mA out	AVR voltage set point output or transducer. (Analogue output 70).
71	0	
72	Not used	

Option EF2
Analogue speed governor output and one transducer output.

Term.	Function	Description
65	Not used	
66	+/-20 mA	Speed governor set point output or transducer. (analogue output 66).
67	0	
68	Not used	
69	Not used	
70	0(4) to 20 mA out	Analogue output 70
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, for example power, power factor, frequency, and so on. Outputs can be selected to be either 0 to 20 mA or 4 to 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 to 20 mA into 0 to 10 V DC).

Option EF4
Combination output for governor and AVR (option EF4).

Term.	Function	Description
65	ANA +	Analogue +/-20 mA for GOV or AVR, (analogue output 65).
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, the analogue output will be used for the AVR, and vice versa.

Option EF5
PWM output for governor and combination output for AVR.

Term.	Function	Description
65	+/- 25 mA out	AVR set point output
66	0	
67	PWM +	PWM speed governor signal
68	PWM -	
69	Relay	Relay output for AVR. Raise voltage.
70	Relay	
71	Relay	Relay output for AVR. Lower voltage
72	Relay	

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

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

Slot #6, inputs/outputs (I/Os)
Option F1
Analogue transducer output.

Term.	Function	Description
90	Not used	
91	0	Analogue output 91, selectable
92	0(4) to 20 mA out	
93	Not used	
94	Not used	
95	0	Analogue output 95, selectable
96	0(4) to 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, for example pow-

er, power factor, frequency, and so on. Outputs can be selected to be either 0 to 20 mA or 4 to 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 to 20 mA into 0 to 10 V DC).

Option M13.6
7 × binary inputs.

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

Option M14.6
4 × relay outputs.

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

Option M15.6
4 × analogue 4 to 20 mA inputs.

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

Slot #7, engine interface board

Term.	Function	Technical data	Description/preconfiguration
98	+12/24 V DC	8 to 36 V DC	DC power supply
99	0 V DC		
100	MPU input	0.5 to 70 V AC/ 10 to 10000 Hz	Magnetic pickup (RPM)
101	MPU GND		
102	A	0(4) to 20 mA Digital w/wire break Pt100 Pt1000 RMI 0 to 40 V DC	Multi-input 1 Pre-selected to digital input with wire break detection
103	B		
104	C		
105	A		Multi-input 2 Pre-selected to digital input with wire break detection
106	B		
107	C		
108	A		Multi-input 3 Pre-selected to digital input with wire break detection
109	B		
110	C		
111	Com.	Common	Common for terminals 112-117
112	Digital input 112	Optocoupler	Remote start + sync./configurable
113	Digital input 113	Optocoupler	Remote deload + stop/configurable
114	Digital input 114	Optocoupler	Configurable
115	Digital input 115	Optocoupler	Start enable
116	Digital input 116	Optocoupler	Running feedback/configurable
117	Digital input 117	Optocoupler	Configurable
118	Digital input 118	Optocoupler	Emergency stop and common for 119 and 120
119	NO	Relay 24 V DC/5 A	Run coil
120	NO	Relay 24 V DC/5 A	Start prepare
121	Com.	Relay 24 V DC/5 A	Crank (starter)
122	NO		
123	Com.	Relay 24 V DC/5 A	Stop coil w/wire break detection
124	NO		
A1	CAN-H	CAN bus interface #1	Internal power management communication
A2	CAN GND		
A3	CAN-L		

Term.	Function	Technical data	Description/preconfiguration
B1	CAN-H	CAN bus interface #2	Internal power management communication (redundant to CAN bus interface #1) or Option H7 J1939 engine interface
B2	CAN GND		
B3	CAN-L		

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 dialogue box will appear, and the settings can be changed.
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, communication and I/O options
Option H5
CAN bus engine interface.

Term.	Function	Description
126	Not used	CAN bus communication for Engine interface J1939 or MTU MDEC/MTU ADEC.
127	Not used	
128	CAN-L	
129	Not used	
130	CAN-H	
131	CAN-L	
132	Not used	
133	CAN-H	

Option H8.8
CAN bus interface for external I/O modules.

Term.	Function	Description
126	Not used	CAN bus communication for Beckhoff external I/O modules.
127	Not used	
128	CAN-L	
129	Not used	
130	CAN-H	
131	CAN-L	
132	Not used	
133	CAN-H	

Option M13.8
7 × binary inputs.

Term.	Function	Description
126	Common	Common
127	Digital input 127	Configurable
128	Digital input 128	Configurable
129	Digital input 129	Configurable
130	Digital input 130	Configurable
131	Digital input 131	Configurable
132	Digital input 132	Configurable
133	Digital input 133	Configurable

Option M14.8
4 × relay outputs.

Term.	Function	Description
126	Relay output 126 250 V AC, 8 A max.	Configurable
127		
128	Relay output 128 250 V AC, 8 A max.	Configurable
129		
130	Relay output 130 250 V AC, 8 A max.	Configurable
131		
132	Relay output 132 250 V AC, 8 A max.	Configurable
133		

Option M15.8
4 × analogue 4 to 20 mA inputs.

Term.	Function	Description
126	Input 90 common	Common
127	Analogue input 91+	4 to 20 mA in
128	Input 92 common	Common
129	Analogue input 93+	4 to 20 mA in
130	Input 94 common	Common
131	Analogue input 95+	4 to 20 mA in
132	Input 96 common	Common
133	Analogue input 97+	4 to 20 mA in

5.1.3 Digital inputs

Term.	Name	Function
23	SWBD control	If the input is set, the unit will be forced into switchboard control. (Regulation is deactivated).
24	TB open	Breaker feedback signal. The tie breaker is in position OFF.
25	TB closed	Breaker feedback signal. The tie breaker is in position ON.
26	CB open	Breaker feedback signal. The connection breaker is in position OFF.
27	CB closed	Breaker feedback signal. The connection breaker is in position ON.
43	Harbour operation	The emergency generator is used as normal generator. Shutdowns are enabled. The max. parallel timer is not active and the emergency generator will be treated as an ordinary diesel generator in the system. If the input is not set, the tie breaker between main busbar and emergency busbar will be tripped after 30 sec. (adjustable) when the emergency generator is running in parallel with a diesel generator/shaft generator/shore connection.
44	Manual GOV UP/ configurable	Increase engine speed (SWBD mode only)/programmable from the PC utility software.
45	Manual GOV DOWN/configurable	Decrease engine speed (SWBD mode only)/programmable from the PC utility software.
46	Manual AVR UP/ configurable	Increase generator voltage (option D1) (SWBD mode only)/programmable from the PC utility software.
47	Manual AVR DOWN/ configurable	Decrease generator voltage (option D1) (SWBD mode only)/programmable from the PC utility software.
48	Main busbar alive	This input is used in case of the emergency generator is operating as stand alone unit to ensure the correct opening of the bus tie breaker.
49	Configurable	This input is programmable from the PC utility software.
50	Configurable	This input is programmable from the PC utility software.
51	Configurable	This input is programmable from the PC utility software.
52	GB short circuit/ configurable	GB tripped by external short circuit protection/programmable from the PC utility software.
53	TB short circuit/ configurable	TB tripped by external short circuit protection/programmable from the PC utility software.
54	Alarm inhibit 1/ configurable	External input for inhibit of selected alarms/programmable from the PC utility software.
55	Alarm inhibit 2/ configurable	
102	Multi-input 1/configurable	Multi-function inputs selectable as either 0(4) to 20 mA, digital with wire break supervision, Pt100, Pt1000, RMI or 0 to 40 V DC. The default selection is digital with wire break detection (resistor across contacts 270 Ω)./ programmable from the PC utility software.
105	Multi-input 2/configurable	
108	Multi-input 3/configurable	

Term.	Name	Function
112	Remote start + sync/ configurable	Semi-Auto mode only. A pulse input will start the engine and subsequently synchronise the generator/programmable from the PC utility software.
113	Remote deload + stop/configurable	Semi-Auto mode only. A pulse input will decrease the load and the breaker opened. After cool-down, the generator will stop/programmable from the PC utility software.
114	Configurable	This input is programmable from the PC utility software.
115	Start enable	This input must be set to be able to start the engine.
116	Running feedback/ configurable	The diesel engine has achieved the running status = ON and the starter is removed./programmable from the PC utility software.
117	Configurable	This input is programmable from the PC utility software.
118	Emergency stop	The emergency stop input has been activated. The engine is shutting down.

5.1.4 Relay outputs

Term.	Name	Function
3	Status relay	The status relay on the power supply board is a normally closed relay with the purpose of processor and power supply supervision.
4		
5	Alarm relay	The relay activates on any alarm that appears. The output can be normally open (term. 5-6) or normally closed (term. 6-7).
6		
7		
8	Open TB	Tie breaker OFF signal. When this output is active, the tie breaker will open. The output can be selected to be normally open (NO, terminal 14-15) or normally closed (NC, terminal 15-16).
9		
10		
11	Close TB	Tie breaker ON signal. When this output is active, the tie breaker will close. The output can be selected to be normally open (NO, terminal 17-18) or normally closed (NC, terminal 18-19).
12		
13		
14	Open GB	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).
15		
16		
17	Close GB	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).
18		
19		
20	Configurable	Configurable digital output (transistor output type).
21	Configurable	Configurable digital output (transistor output type).
57	Configurable	Configurable digital output (transistor output type).
58		
59	Configurable	Configurable digital output (transistor output type).
60		
61	Trip NEL 1/ configurable	Trip of the NEL (Non Essential Load) group no. 1 due to measured under-frequency, over-current or push load on the busbar/ programmable from the PC utility software.
62		
63	Trip NEL 2/ configurable	Trip of the NEL (Non Essential Load) group no. 2 due to measured under-frequency, over-current or push load on the busbar/ programmable from the PC utility software.
64		
65	Gov up	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.
66		
67	Gov down	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.
68		
69	AVR up/ configurable	Option D1: Increase of voltage. The signal is connected to the AVR. A voltage droop of 4 % (+/-2 %) has to be adjusted in the AVR/ programmable from the PC utility software.
70		

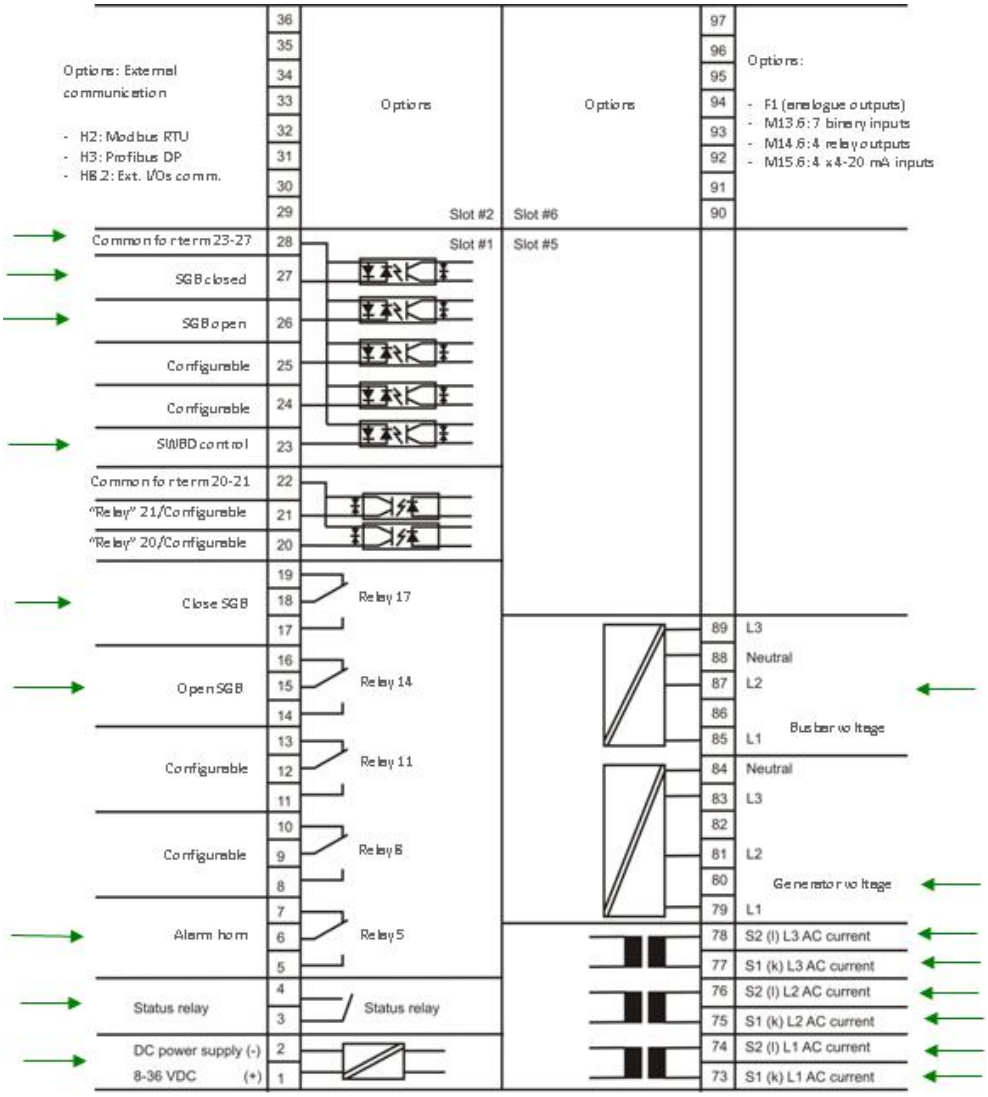
Term.	Name	Function
71	AVR down/ configurable	Option D1: Decrease of voltage. The signal is connected to the AVR. A voltage droop of 4 % (+/-2 %) has to be adjusted in the AVR/ programmable from the PC utility software.
72		
119	Run coil	ON when engine running is required. OFF when the engine is to stop.
120	Start pre-pare	The start prepare output is activated, before the crank (start) output is activated. This could be preglow or preheating of the engine.
121	Crank	Activation of the engine cranking (starter motor).
122		
123	Stop coil	Activates when the engine is to stop. Remains activated during the “extended stop” time period. This output is monitored for wire break (12/24 V DC only).
124		

6. Shaft generator (SG) I/Os

6.1 SG I/Os

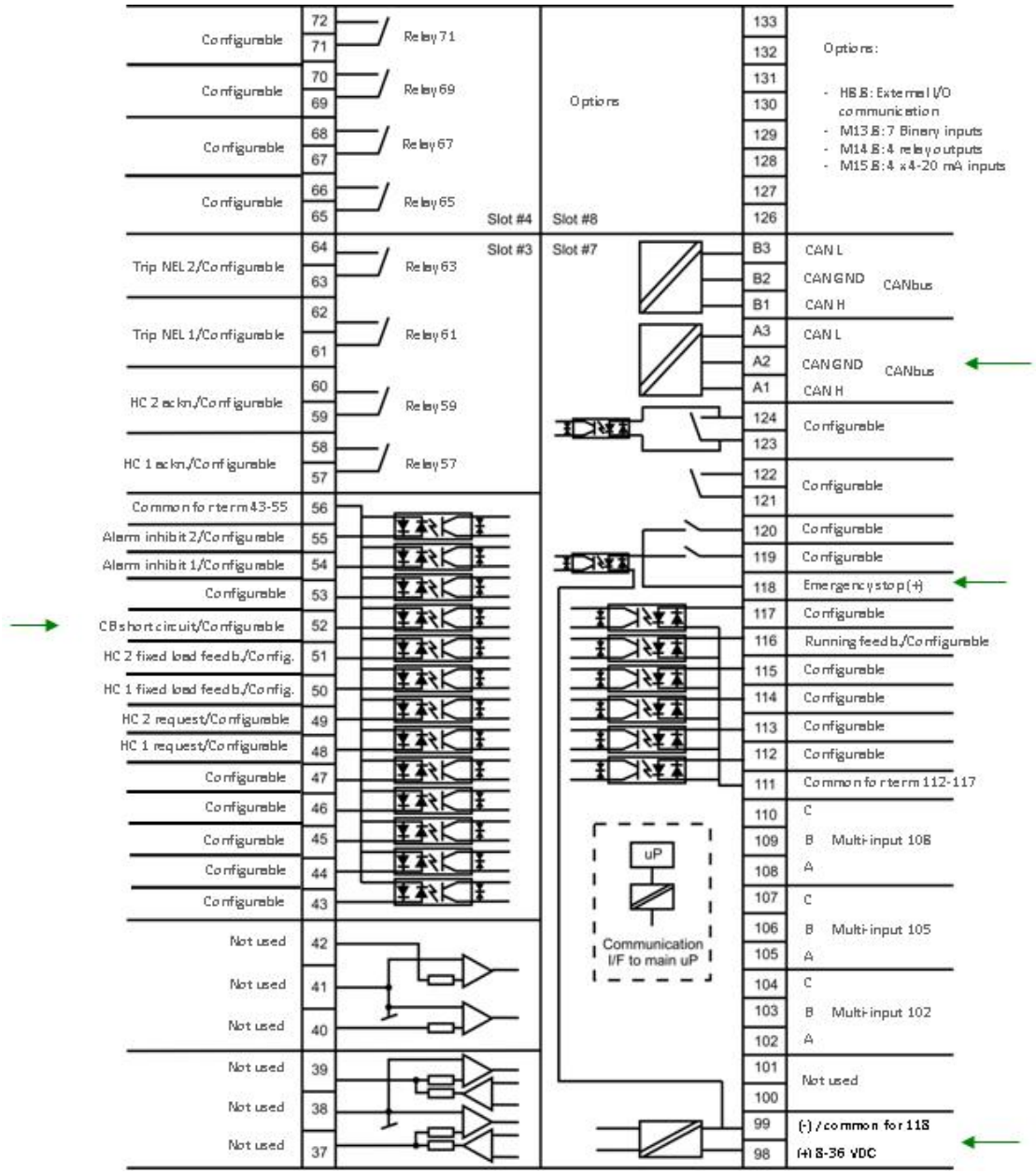
6.1.1 Terminal strip overviews

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 board in slot #8 is optional.

Multi-inputs 102, 105 and 108 are as default set to digital input with wire break detection.

6.1.2 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	+12/24 V DC	8 to 36 V DC	Power supply
2	0 V DC		
3	NC	Status relay	Normally closed relay, processor/power supply status supervision
4	Com.	24 V/1 A	
5	NO	Relay 5	Alarm horn
6	Com.	250 V AC/8 A	
7	NC		
8	NO	Relay 8	Configurable
9	Com.	250 V AC/8 A	
10	NC		
11	NO	Relay 11	Configurable
12	Com.	250 V AC/8 A	
13	NC		
14	NO	Relay 14	SGB OFF, Open breaker (deload)/trip
15	Com.	250 V AC/8 A	
16	NC		
17	NO	Relay 17	SGB ON, Close breaker (synchronising)
18	Com.	250 V AC/8 A	
19	NC		
20	Open collector 1	Transistor out (relay 20)	Configurable as standard relay output
21	Open collector 2	Transistor out (relay 21)	Configurable as standard relay output
22	Com.	Common	Common terminal for terminals 20 and 21
23	Binary input	Optocoupler	SWBD (switchboard manual) control
24	Binary input	Optocoupler	Configurable
25	Binary input	Optocoupler	Configurable
26	Binary input	Optocoupler	SGB open feedback
27	Binary input	Optocoupler	SGB closed feedback
28	Com.	Common	Common for terminals 23-27

The power supply must be protected with a 2 A slow-blow fuse.

Slot #2, external communication (option)
Option H2 (RS-485 Modbus RTU).

Term.	Function	Description
29	DATA + (A)	Modbus RTU, RS-485
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.
Terminals 29/33 and 31/35 are internally connected.

Option H3 (Profibus)

Term.	Function	Description
29	DATA + (B)	Pin 3 on 9 pole sub-D connector
30	GND	Pin 5 on 9 pole sub-D connector
31	DATA - (A)	
32	DATA + (B)	Pin 8 on 9 pole sub-D connector
33	GND	
34	DATA - (A)	
35	Not used	
36	Not used	

Option H8.2
CAN bus interface for external I/O modules.

Term.	Function	Description
29	CAN-H	CAN bus card option H8.2
30	CAN GND	
31	CAN-L	
32	CAN-H	
33	CAN GND	
34	CAN-L	
35	Not used	
36	Not used	

Slot #3, binary I/O

Term.	Function	Technical data	Description
37	-5 to 0 to 5 V DC	Analogue I/O	NOT USED
38	Com.	Common	
39	-5 to 0 to 5 V DC	Analogue I/O	
40	-10 to 0 to 10 V DC	Analogue input	NOT USED
41	Com.	Common	
42	-10 to 0 to 10 V DC	Analogue input	
43	Binary input	Optocoupler	Configurable
44	Binary input	Optocoupler	Configurable
45	Binary input	Optocoupler	Configurable
46	Binary input	Optocoupler	Configurable
47	Binary input	Optocoupler	Configurable
48	Binary input	Optocoupler	Heavy consumer 1 request/configurable
49	Binary input	Optocoupler	Heavy consumer 2 request/configurable
50	Binary input	Optocoupler	Heavy consumer 1 fixed load feedback/configurable
51	Binary input	Optocoupler	Heavy consumer 2 fixed load feedback/configurable
52	Binary input	Optocoupler	SGB short circuit/configurable
53	Binary input	Optocoupler	Configurable
54	Binary input	Optocoupler	Alarm inhibit 1/configurable
55	Binary input	Optocoupler	Alarm inhibit 2/configurable
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 57 6	Start acknowledge Heavy consumer 1/configurable
58	Com.	250 V AC 8 A	
59	NO	Relay 59 7	Start acknowledge Heavy consumer 2/configurable
60	Com.	250 V AC 8 A	
61	NO	Relay 61 8	Trip NEL 1/configurable
62	Com.	250 V AC 8 A	
63	NO	Relay 63 9	Trip NEL 2/configurable
64	Com.	250 V AC 8 A	

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

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

Slot #6, inputs/outputs (I/Os)
Option F1
Analogue transducer output.

Term.	Function	Description
90	Not used	
91	0	Analogue output 91, selectable
92	0(4) to 20 mA out	
93	Not used	
94	Not used	
95	0	Analogue output 95, selectable
96	0(4) to 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, for example pow-

er, power factor, frequency, and so on. Outputs can be selected to be either 0 to 20 mA or 4 to 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 to 20 mA into 0 to 10 V DC).

Option M13.6
7 × binary inputs.

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

Option M14.6
4 × relay outputs.

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

Option M15.6
4 × analogue 4 to 20 mA inputs.

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

Slot #7, engine interface board

Term.	Function	Technical data	Description/preconfiguration
98	+12/24 V DC	8 to 36 V DC	DC power supply
99	0 V DC		
100	MPU input	0.5 to 70 V AC/10 to 10000 Hz	Magnetic pickup (RPM)
101	MPU GND		
102	A	0(4) to 20 mA	Multi-input 1
103	B	Digital w/wire break	Pre-selected to digital input with wire break detection
104	C		
105	A	Pt100	Multi-input 2
106	B	Pt1000	Pre-selected to digital input with wire break detection
107	C		
108	A	RMI	Multi-input 3
109	B	0 to 40 V DC	Pre-selected to digital input with wire break detection
110	C		
111	Com.	Common	Common for terminals 112-117
112	Digital input 112	Optocoupler	Configurable
113	Digital input 113	Optocoupler	Configurable
114	Digital input 114	Optocoupler	Configurable
115	Digital input 115	Optocoupler	Configurable
116	Digital input 116	Optocoupler	Running feedback/configurable
117	Digital input 117	Optocoupler	Configurable
118	Digital input 118	Optocoupler	Emergency stop and common for 119 and 120
119	NO	Relay 24 V DC/5 A	Configurable
120	NO	Relay 24 V DC/5 A	Configurable
121	Com.	Relay 24 V DC/5 A	Configurable
122	NO		
123	Com.	Relay 24 V DC/5 A	Configurable
124	NO		
A1	CAN-H	CAN bus interface #1	Internal power management communication
A2	CAN GND		
A3	CAN-L		
B1	CAN-H	CAN bus interface #2	Internal power management communication (redundant to CAN bus interface #1)
B2	CAN GND		
B3	CAN-L		

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 dialogue box will appear, and the settings can be changed.

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, communication and I/O options
Option H8.8
CAN bus interface for external I/O modules.

Term.	Function	Description
126	Not used	CAN bus communication for Beckhoff external I/O modules.
127	Not used	
128	CAN-L	
129	Not used	
130	CAN-H	
131	CAN-L	
132	Not used	
133	CAN-H	

Option M13.8
7 × binary inputs.

Term.	Function	Description
126	Common	Common
127	Digital input 127	Configurable
128	Digital input 128	Configurable
129	Digital input 129	Configurable
130	Digital input 130	Configurable
131	Digital input 131	Configurable
132	Digital input 132	Configurable
133	Digital input 133	Configurable

Option M14.8
4 × relay outputs.

Term.	Function	Description
126	Relay output 126, 250 V AC, 8 A max.	Configurable
127		
128	Relay output 128, 250 V AC, 8 A max.	Configurable
129		
130	Relay output 130, 250 V AC, 8 A max.	Configurable
131		
132	Relay output 132, 250 V AC, 8 A max.	Configurable
133		

Option M15.8
4 × analogue 4 to 20 mA inputs.

Term.	Function	Description
126	Input 90 common	Common
127	Analogue input 91+	4 to 20 mA in
128	Input 92 common	Common
129	Analogue input 93+	4 to 20 mA in
130	Input 94 common	Common
131	Analogue input 95+	4 to 20 mA in
132	Input 96 common	Common
133	Analogue input 97+	4 to 20 mA in

6.1.3 Digital inputs

Term.	Name	Function
23	SWBD control	If the input is set, the unit will be forced into switchboard control. (Regulation is deactivated).
24	Configurable	This input is programmable from the PC utility software.
25	Configurable	This input is programmable from the PC utility software.
26	SGB open	Breaker feedback signal. The connection breaker is in position OFF.
27	SGB closed	Breaker feedback signal. The connection breaker is in position ON.
43	Configurable	This input is programmable from the PC utility software.
44	Configurable	This input is programmable from the PC utility software.
45	Configurable	This input is programmable from the PC utility software.
46	Configurable	This input is programmable from the PC utility software.
47	Configurable	This input is programmable from the PC utility software.
48	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/programmable from the PC utility software.
49	HC 2 request/ configurable	
50	HC 1 fixed load feedback/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/programmable from the PC utility software.
51	HC 2 fixed load feedback/configurable	
52	SGB short circuit/ configurable	CB tripped by external short circuit protection/programmable from the PC utility software.
53	Configurable	This input is programmable from the PC utility software.
54	Alarm inhibit 1/ configurable	External input for inhibit of selected alarms/programmable from the PC utility software.
55	Alarm inhibit 2/ configurable	
102	Multi-input 1/ configurable	Multifunction inputs selectable as either 0(4) to 20 mA, digital with wire break supervision, Pt100, Pt1000, RMI or 0 to 40 V DC. The default selection is digital with wire break detection (resistor across contacts 270 Ω)./programmable from the PC utility software.
105	Multi-input 2/ configurable	
108	Multi-input 3/ configurable	
112	Configurable	This input is programmable from the PC utility software.
113	Configurable	This input is programmable from the PC utility software.
114	Configurable	This input is programmable from the PC utility software.
115	Configurable	This input is programmable from the PC utility software.

Term.	Name	Function
116	Running feedback/ configurable	The main engine has achieved the running status = ON/programmable from the PC utility software.
117	Configurable	This input is programmable from the PC utility software.
118	Emergency stop	The emergency stop input has been activated. The engine is shutting down.

6.1.4 Relay outputs

Term.	Name	Function
3	Status relay	The status relay on the power supply board is a normally closed relay with the purpose of processor and power supply supervision.
4		
5	Alarm relay	The relay activates on any alarm that appears. The output can be normally open (term. 5-6) or normally closed (term. 6-7).
6		
7		
8	Configurable	Programmable from the PC utility software.
9		
10		
11	Configurable	Programmable from the PC utility software.
12		
13		
14	Open SGB	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).
15		
16		
17	Close SGB	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).
18		
19		
20	Configurable	Configurable digital output (transistor output type).
21	Configurable	Configurable digital output (transistor output type).
57	HC 1 acknowledge/configurable	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/programmable from the PC utility software.
58		
59	HC 2 acknowledge/configurable	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/programmable from the PC utility software.
60		
61	Trip NEL 1/configurable	Trip of the NEL (Non Essential Load) group no. 1 due to measured under-frequency, over-current or push load on the busbar/ programmable from the PC utility software.
62		
63	Trip NEL 2/configurable	Trip of the NEL (Non Essential Load) group no. 2 due to measured under-frequency, over-current or push load on the busbar/ programmable from the PC utility software.
64		
65	Configurable	Programmable from the PC utility software.
66		
67	Configurable	Programmable from the PC utility software.
68		
69	Configurable	Programmable from the PC utility software.
70		

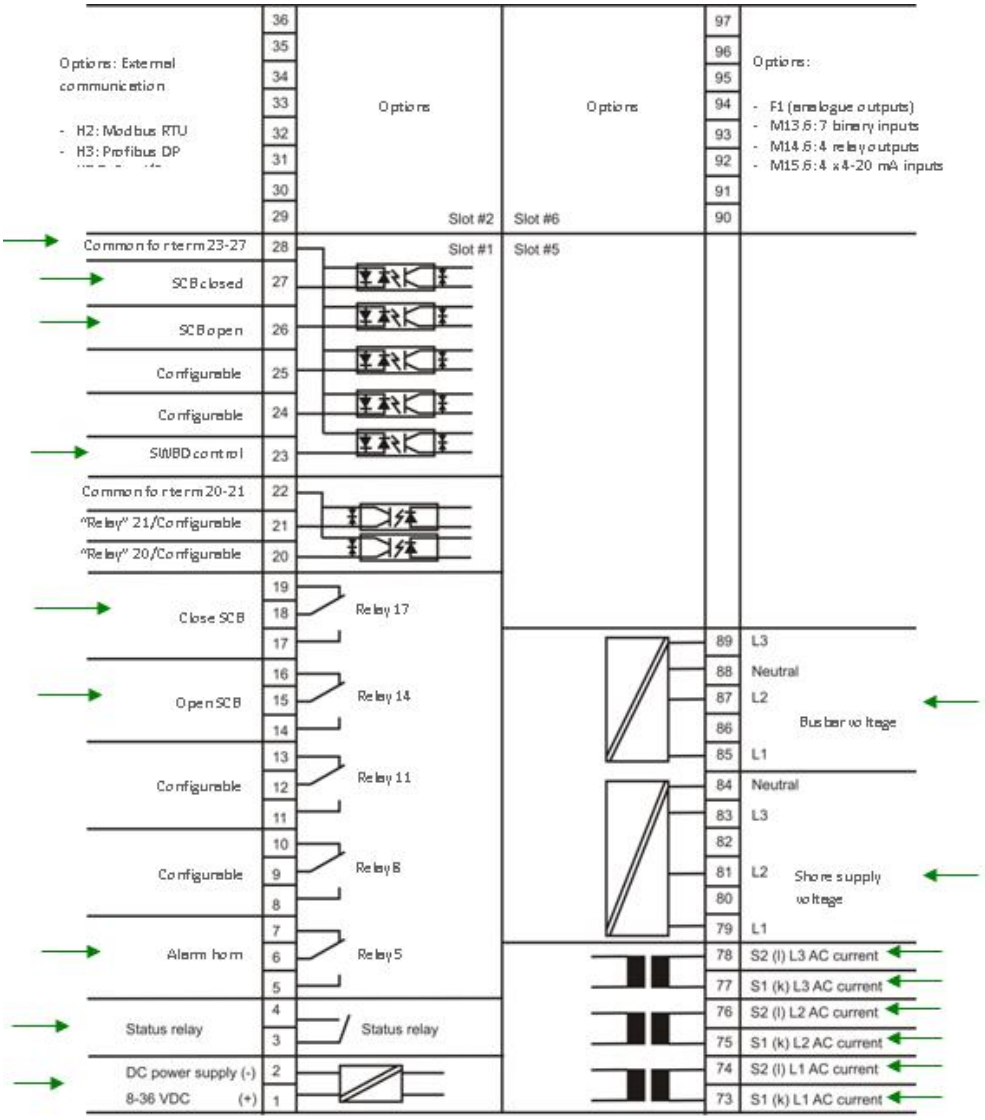
Term.	Name	Function
71	Configurable	Programmable from the PC utility software.
72		
119	Configurable	Programmable from the PC utility software.
120	Configurable	Programmable from the PC utility software.
121	Configurable	Programmable from the PC utility software.
122		
123	Configurable	Programmable from the PC utility software.
124		

7. Shore connection (SC) I/Os

7.1 SC I/Os

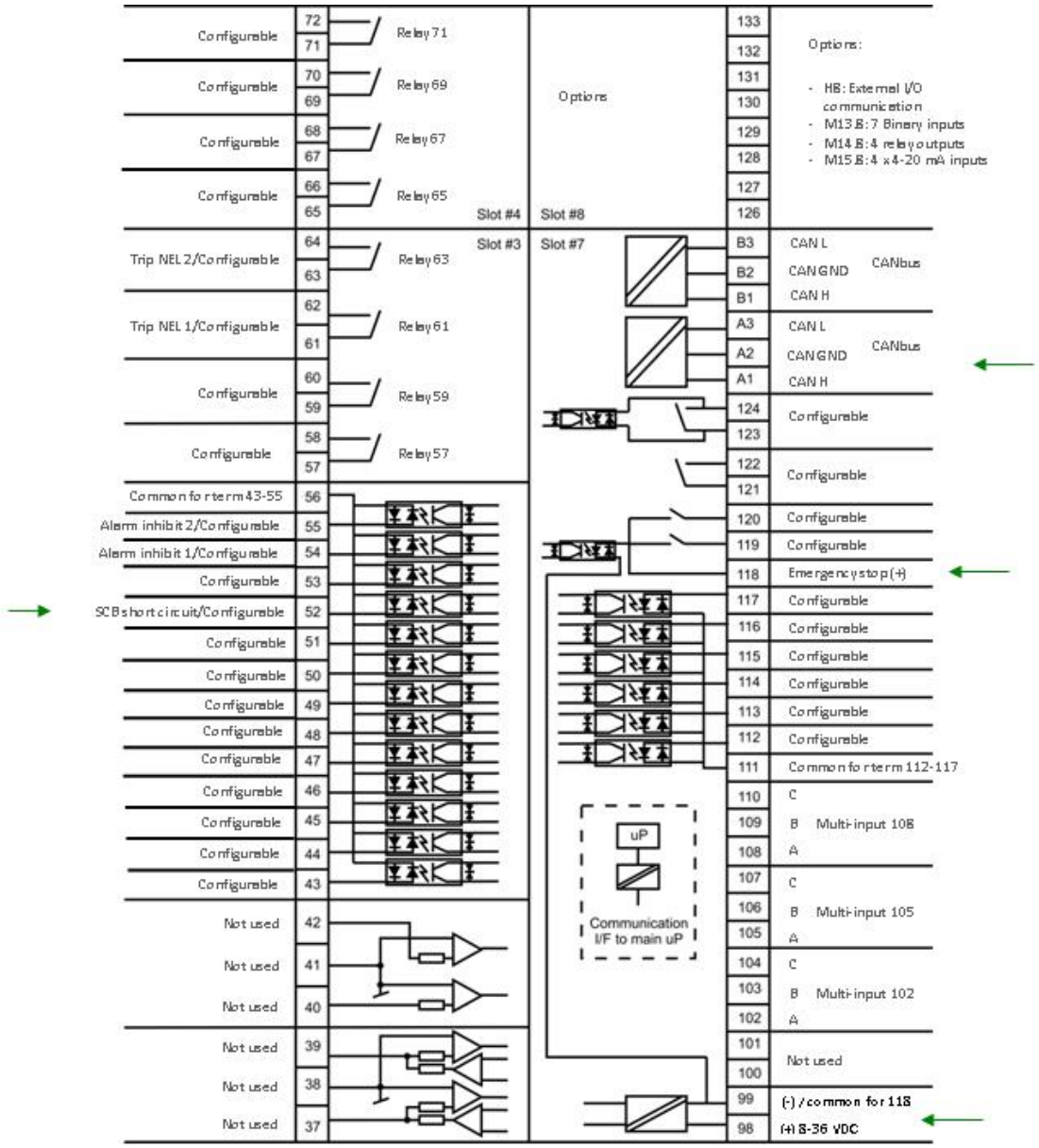
7.1.1 Terminal strip overviews

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 board in slot #8 is optional.

Multi-inputs 102, 105 and 108 are as default set to digital input with wire break detection.

7.1.2 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	+12/24 V DC	8 to 36 V DC	Power supply
2	0 V DC		
3	NC	Status relay	Normally closed relay, processor/power supply status supervision
4	Com.	24 V/1 A	
5	NO	Relay 5	Alarm horn
6	Com.	250 V AC/8 A	
7	NC		
8	NO	Relay 8	Configurable
9	Com.	250 V AC/8 A	
10	NC		
11	NO	Relay 11	Configurable
12	Com.	250 V AC/8 A	
13	NC		
14	NO	Relay 14	SCB OFF, Open breaker (deload)/trip
15	Com.	250 V AC/8 A	
16	NC		
17	NO	Relay 17	SCB ON, Close breaker (synchronising)
18	Com.	250 V AC/8 A	
19	NC		
20	Open collector 1	Transistor out, (relay 20)	Configurable as standard relay output
21	Open collector 2	Transistor out, (relay 21)	Configurable as standard relay output
22	Com.	Common	Common terminal for terminals 20 and 21
23	Binary input	Optocoupler	SWBD (switchboard manual) control
24	Binary input	Optocoupler	Configurable
25	Binary input	Optocoupler	Configurable
26	Binary input	Optocoupler	SCB open feedback
27	Binary input	Optocoupler	SCB closed feedback
28	Com.	Common	Common for terminals 23-27

The power supply must be protected with a 2 A slow-blow fuse.

Slot #2, external communication (option)
Option H2 (RS-485 Modbus RTU).

Term.	Function	Description
29	DATA + (A)	Modbus RTU, RS-485
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.
Terminals 29/33 and 31/35 are internally connected.

Option H3 (Profibus)

Term.	Function	Description
29	DATA + (B)	Pin 3 on 9 pole sub-D connector
30	GND	Pin 5 on 9 pole sub-D connector
31	DATA - (A)	
32	DATA + (B)	Pin 8 on 9 pole sub-D connector
33	GND	
34	DATA - (A)	
35	Not used	
36	Not used	

Option H8.2
CAN bus interface for external I/O modules.

Term.	Function	Description
29	CAN-H	CAN bus card option H8.2
30	CAN GND	
31	CAN-L	
32	CAN-H	
33	CAN GND	
34	CAN-L	
35	Not used	
36	Not used	

Slot #3, binary I/O

Term.	Function	Technical data	Description
37	-5 to 0 to 5 V DC	Analogue I/O	NOT USED
38	Com.	Common	
39	-5 to 0 to 5 V DC	Analogue I/O	
40	-10 to 0 to 10 V DC	Analogue input	NOT USED
41	Com.	Common	
42	-10 to 0 to 10 V DC	Analogue input	
43	Binary input	Optocoupler	Configurable
44	Binary input	Optocoupler	Configurable
45	Binary input	Optocoupler	Configurable
46	Binary input	Optocoupler	Configurable
47	Binary input	Optocoupler	Configurable
48	Binary input	Optocoupler	Configurable
49	Binary input	Optocoupler	Configurable
50	Binary input	Optocoupler	Configurable
51	Binary input	Optocoupler	Configurable
52	Binary input	Optocoupler	SCB short circuit/configurable
53	Binary input	Optocoupler	Configurable
54	Binary input	Optocoupler	Alarm inhibit 1/configurable
55	Binary input	Optocoupler	Alarm inhibit 2/configurable
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 57 6	Configurable
58	Com.	250 V AC 8 A	
59	NO	Relay 59 7	Configurable
60	Com.	250 V AC 8 A	
61	NO	Relay 61 8	Trip NEL 1/configurable
62	Com.	250 V AC 8 A	
63	NO	Relay 63 9	Trip NEL 2/configurable
64	Com.	250 V AC 8 A	

Slot #4, Not used

Slot #5, AC measuring

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

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

Slot #6, inputs/outputs (I/Os)
Option F1
Analogue transducer output.

Term.	Function	Description
90	Not used	
91	0	Analogue output 91, selectable
92	0(4) to 20 mA out	
93	Not used	
94	Not used	
95	0	Analogue output 95, selectable
96	0(4) to 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, for example pow-

er, power factor, frequency, and so on. Outputs can be selected to be either 0 to 20 mA or 4 to 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 to 20 mA into 0 to 10 V DC).

Option M13.6
7 × binary inputs.

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

Option M14.6
4 × relay outputs.

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

Option M15.6
4 × analogue 4 to 20 mA inputs.

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

Slot #7, engine interface board

Term.	Function	Technical data	Description/preconfiguration
98	+12/24 V DC	8 to 36 V DC	DC power supply
99	0 V DC		
100	MPU input	0.5 to 70 V AC/10 to 10000 Hz	NOT USED
101	MPU GND		
102	A	0(4) to 20 mA Digital w/wire break Pt100 Pt1000 RMI 0 to 40 V DC	Multi-input 1 Pre-selected to digital input with wire break detection
103	B		
104	C		
105	A		Multi-input 2 Pre-selected to digital input with wire break detection
106	B		
107	C		
108	A		Multi-input 3 Pre-selected to digital input with wire break detection
109	B		
110	C		
111	Com.	Common	Common for terminals 112-117
112	Digital input 112	Optocoupler	Configurable
113	Digital input 113	Optocoupler	Configurable
114	Digital input 114	Optocoupler	Configurable
115	Digital input 115	Optocoupler	Configurable
116	Digital input 116	Optocoupler	Configurable
117	Digital input 117	Optocoupler	Configurable
118	Digital input 118	Optocoupler	Emergency stop and common for 119 and 120
119	NO	Relay 24 V DC/5 A	Configurable
120	NO	Relay 24 V DC/5 A	Configurable
121	Com.	Relay 24 V DC/5 A	Configurable
122	NO		
123	Com.	Relay 24 V DC/5 A	Configurable
124	NO		
A1	CAN-H	CAN bus interface #1	Internal power management communication
A2	CAN GND		
A3	CAN-L		

Term.	Function	Technical data	Description/preconfiguration
B1	CAN-H	CAN bus interface #2	Internal power management communication (redundant to CAN bus interface #1)
B2	CAN GND		
B3	CAN-L		

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 dialogue box will appear, and the settings can be changed.
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, communication and I/O options
Option H8.8
CAN bus interface for external I/O modules.

Term.	Function	Description
126	Not used	CAN bus communication for Beckhoff external I/O modules
127	Not used	
128	CAN-L	
129	Not used	
130	CAN-H	
131	CAN-L	
132	Not used	
133	CAN-H	

Option M13.8
7 × binary inputs.

Term.	Function	Description
126	Common	Common
127	Digital input 127	Configurable
128	Digital input 128	Configurable
129	Digital input 129	Configurable
130	Digital input 130	Configurable
131	Digital input 131	Configurable
132	Digital input 132	Configurable
133	Digital input 133	Configurable

Option M14.8
4 × relay outputs.

Term.	Function	Description
126	Relay output 126, 250 V AC, 8 A max.	Configurable
127		
128	Relay output 128, 250 V AC, 8 A max.	Configurable
129		
130	Relay output 130, 250 V AC, 8 A max.	Configurable
131		
132	Relay output 132, 250 V AC, 8 A max.	Configurable
133		

Option M15.8
4 × analogue 4 to 20 mA inputs.

Term.	Function	Description
126	Input 90 common	Common
127	Analogue input 91+	4 to 20 mA in
128	Input 92 common	Common
129	Analogue input 93+	4 to 20 mA in
130	Input 94 common	Common
131	Analogue input 95+	4 to 20 mA in
132	Input 96 common	Common
133	Analogue input 97+	4 to 20 mA in

7.1.3 Digital inputs

Term.	Name	Function
23	SWBD control	If the input is set, the unit will be forced into switchboard control. (Regulation is deactivated)
24	Configurable	This input is programmable from the PC utility software
25	Configurable	This input is programmable from the PC utility software
26	SCB open	Breaker feedback signal. The connection breaker is in position OFF
27	SCB closed	Breaker feedback signal. The connection breaker is in position ON
43	Configurable	This input is programmable from the PC utility software
44	Configurable	This input is programmable from the PC utility software
45	Configurable	This input is programmable from the PC utility software
46	Configurable	This input is programmable from the PC utility software
47	Configurable	This input is programmable from the PC utility software
48	Configurable	This input is programmable from the PC utility software
49	Configurable	This input is programmable from the PC utility software
50	Configurable	This input is programmable from the PC utility software
51	Configurable	This input is programmable from the PC utility software
52	SCB short circuit/ configurable	CB tripped by external short circuit protection/programmable from the PC utility software
53	Configurable	This input is programmable from the PC utility software
54	Alarm inhibit 1/configurable	External input for inhibit of selected alarms/programmable from the PC utility software
55	Alarm inhibit 2/configurable	
102	Multi-input 1/configurable	Multifunction inputs selectable as either 0(4) to 20 mA, digital with wire break supervision, Pt100, Pt1000, RMI or 0 to 40 V DC. The default selection is digital with wire break detection (resistor across contacts 270 Ω)/programmable from the PC utility software.
105	Multi-input 2/configurable	
108	Multi-input 3/configurable	
112	Configurable	This input is programmable from the PC utility software
113	Configurable	This input is programmable from the PC utility software
114	Configurable	This input is programmable from the PC utility software
115	Configurable	This input is programmable from the PC utility software
116	Configurable	This input is programmable from the PC utility software
117	Configurable	This input is programmable from the PC utility software
118	Emergency stop	The emergency stop input has been activated. The engine is shutting down.

7.1.4 Relay outputs

Term.	Name	Function
3	Status relay	The status relay on the power supply board is a normally closed relay with the purpose of processor and power supply supervision.
4		
5	Alarm relay	The relay activates on any alarm that appears. The output can be normally open (term. 5-6) or normally closed (term. 6-7).
6		
7		
8	Configurable	Programmable from the PC utility software.
9		
10		
11	Configurable	Programmable from the PC utility software.
12		
13		
14	Open SCB	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).
15		
16		
17	Close SCB	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).
18		
19		
20	Configurable	Configurable digital output (transistor output type).
21	Configurable	Configurable digital output (transistor output type).
57	Configurable	Programmable from the PC utility software.
58		
59	Configurable	Programmable from the PC utility software.
60		
61	Trip NEL 1/configurable	Trip of the NEL (Non Essential Load) group no. 1 due to measured under-frequency, over-current or push load on the busbar/ programmable from the PC utility software.
62		
63	Trip NEL 2/configurable	Trip of the NEL (Non Essential Load) group no. 2 due to measured under-frequency, over-current or push load on the busbar/ programmable from the PC utility software.
64		
65	Configurable	Programmable from the PC utility software.
66		
67	Configurable	Programmable from the PC utility software.
68		
69	Configurable	Programmable from the PC utility software.
70		
71	Configurable	Programmable from the PC utility software.

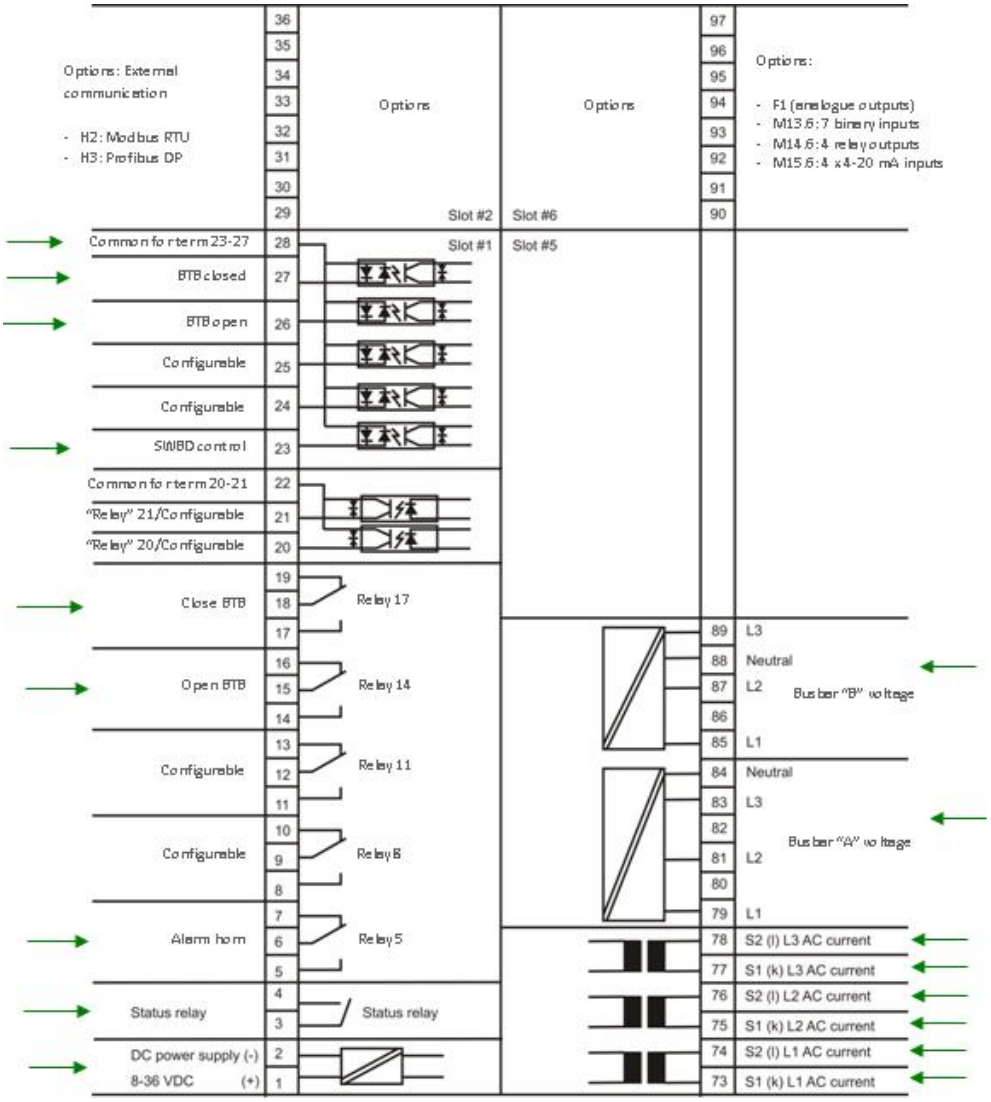
Term.	Name	Function
72		
119	Configurable	Programmable from the PC utility software.
120	Configurable	Programmable from the PC utility software.
121	Configurable	Programmable from the PC utility software.
122		
123	Configurable	Programmable from the PC utility software.
124		

8. Bus tie breaker (BTB) I/Os

8.1 BTB I/Os

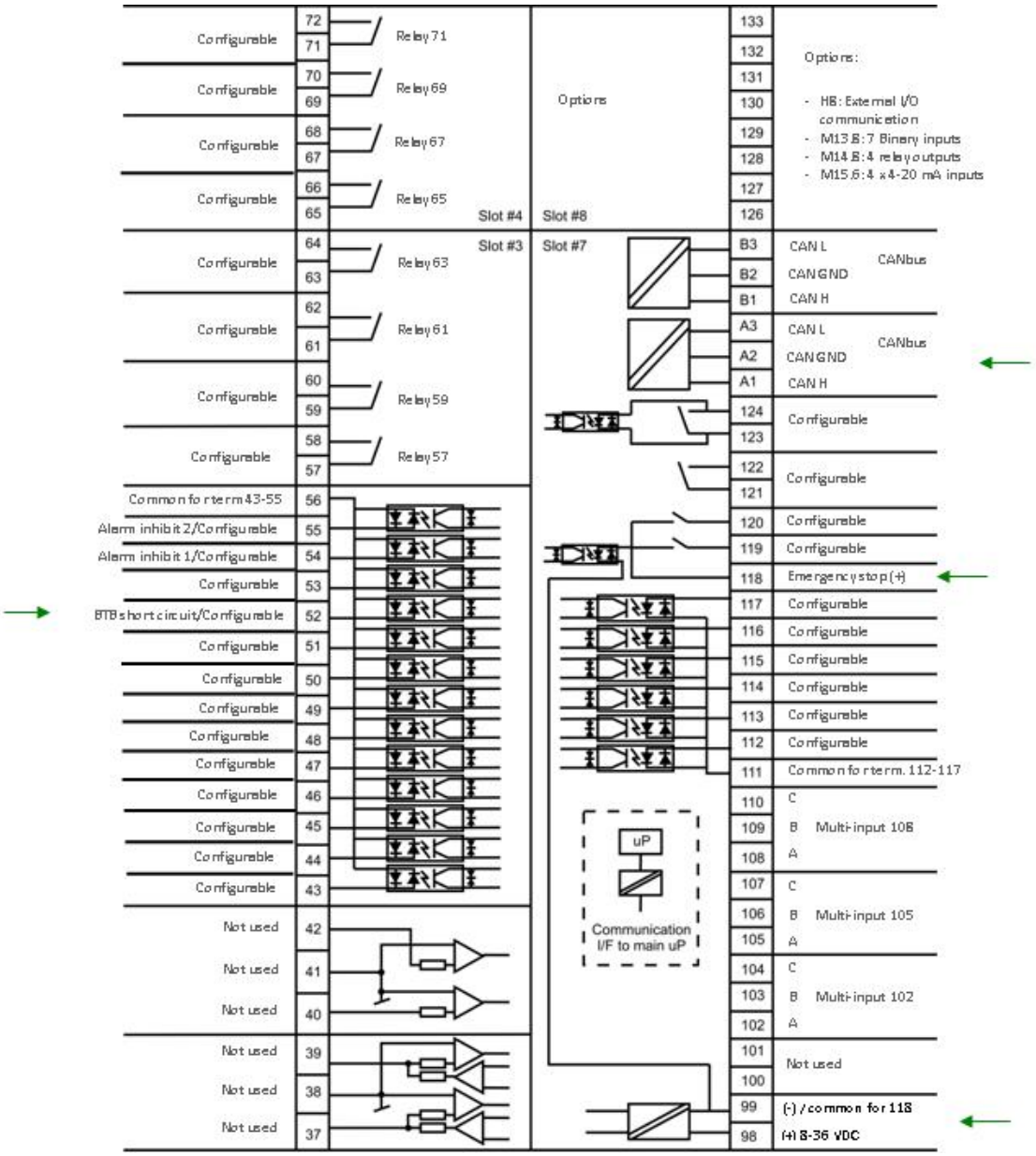
8.1.1 Terminal strip overviews

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 board in slot #8 is optional.

Multi-inputs 102, 105 and 108 are set to digital input with wire break detection.

8.1.2 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	+12/24 V DC	8 to 36 V DC	Power supply
2	0 V DC		
3	NC	Status relay	Normally closed relay, processor/power supply status supervision
4	Com.	24 V/1 A	
5	NO	Relay 5	Alarm horn
6	Com.	250 V AC/8 A	
7	NC		
8	NO	Relay 8	Configurable
9	Com.	250 V AC/8 A	
10	NC		
11	NO	Relay 11	Configurable
12	Com.	250 V AC/8 A	
13	NC		
14	NO	Relay 14	SCB OFF, Open breaker (deload)/trip
15	Com.	250 V AC/8 A	
16	NC		
17	NO	Relay 17	SCB ON, Close breaker (synchronising)
18	Com.	250 V AC/8 A	
19	NC		
20	Open collector 1	Transistor out (relay 20)	Configurable as standard relay output
21	Open collector 2	Transistor out (relay 21)	Configurable as standard relay output
22	Com.	Common	Common terminal for terminals 20 and 21
23	Binary input	Optocoupler	SWBD (switchboard manual) control
24	Binary input	Optocoupler	Configurable
25	Binary input	Optocoupler	Configurable
26	Binary input	Optocoupler	SCB open feedback
27	Binary input	Optocoupler	SCB closed feedback
28	Com.	Common	Common for terminals 23-27

The power supply must be protected with a 2 A slow-blow fuse.

Slot #2, external communication (option)
Option H2 (RS-485 Modbus RTU)

Term.	Function	Description
29	DATA + (A)	Modbus RTU, RS-485
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.
Terminals 29/33 and 31/35 are internally connected.

Option H3 (Profibus)

Term.	Function	Description
29	DATA + (B)	Pin 3 on 9 pole sub-D connector Pin 5 on 9 pole sub-D connector Pin 8 on 9 pole sub-D connector
30	GND	
31	DATA - (A)	
32	DATA + (B)	
33	GND	
34	DATA - (A)	
35	Not used	
36	Not used	

Option H8.2
CAN bus interface for external I/O modules.

Term.	Function	Description
29	CAN-H	CAN bus card option H8.2
30	CAN GND	
31	CAN-L	
32	CAN-H	
33	CAN GND	
34	CAN-L	
35	Not used	
36	Not used	

Slot #3, binary I/O

Term.	Function	Technical data	Description
37	-5 to 0 to 5 V DC	Analogue I/O	NOT USED
38	Com.	Common	
39	-5 to 0 to 5 V DC	Analogue I/O	
40	-10 to 0 to 10 V DC	Analogue input	NOT USED
41	Com.	Common	
42	-10 to 0 to 10 V DC	Analogue input	
43	Binary input	Optocoupler	Configurable
44	Binary input	Optocoupler	Configurable
45	Binary input	Optocoupler	Configurable
46	Binary input	Optocoupler	Configurable
47	Binary input	Optocoupler	Configurable
48	Binary input	Optocoupler	Configurable
49	Binary input	Optocoupler	Configurable
50	Binary input	Optocoupler	Configurable
51	Binary input	Optocoupler	Configurable
52	Binary input	Optocoupler	BTB short circuit/configurable
53	Binary input	Optocoupler	Configurable
54	Binary input	Optocoupler	Alarm inhibit 1/configurable
55	Binary input	Optocoupler	Alarm inhibit 2/configurable
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 57 6	Configurable
58	Com.	250 V AC 8 A	
59	NO	Relay 59 7	Configurable
60	Com.	250 V AC 8 A	
61	NO	Relay 61 8	Configurable
62	Com.	250 V AC 8 A	
63	NO	Relay 63 9	Configurable
64	Com.	250 V AC 8 A	

Slot #4, Not used

Slot #5, AC measuring

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

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

Slot #6, inputs/outputs (I/Os)
Option F1
Analogue transducer output.

Term.	Function	Description
90	Not used	
91	0	Analogue output 91, selectable
92	0(4) to 20 mA out	
93	Not used	
94	Not used	
95	0	Analogue output 95, selectable
96	0(4) to 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, for example pow-

er, power factor, frequency, and so on. Outputs can be selected to be either 0 to 20 mA or 4 to 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 to 20 mA into 0 to 10 V DC).

Option M13.6
7 × binary inputs.

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

Option M14.6
4 × relay outputs.

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

Option M15.6
4 × analogue 4 to 20 mA inputs.

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

Slot #7, engine interface board

Term.	Function	Technical data	Description/preconfiguration
98	+12/24 V DC	8 to 36 V DC	DC power supply
99	0 V DC		
100	MPU input	0.5 to 70 V AC/ 10 to 10000 Hz	NOT USED
101	MPU GND		
102	A	0(4) to 20 mA Digital w/wire break Pt100 Pt1000 RMI 0 to 40 V DC	Multi-input 1 Pre-selected to digital input with wire break detection
103	B		
104	C		
105	A		Multi-input 2 Pre-selected to digital input with wire break detection
106	B		
107	C		
108	A		Multi-input 3 Pre-selected to digital input with wire break detection
109	B		
110	C		
111	Com.	Common	Common for terminals 112-117
112	Digital input 112	Optocoupler	Configurable
113	Digital input 113	Optocoupler	Configurable
114	Digital input 114	Optocoupler	Configurable
115	Digital input 115	Optocoupler	Configurable
116	Digital input 116	Optocoupler	Configurable
117	Digital input 117	Optocoupler	Configurable
118	Digital input 118	Optocoupler	Emergency stop and common for 119 and 120
119	NO	Relay 24 V DC/5 A	Configurable
120	NO	Relay 24 V DC/5 A	Configurable
121	Com.	Relay 24 V DC/5 A	Configurable
122	NO		
123	Com.	Relay 24 V DC/5 A	Configurable
124	NO		
A1	CAN-H	CAN bus interface #1	Internal power management communication
A2	CAN GND		
A3	CAN-L		
B1	CAN-H	CAN bus interface #2	Internal power management communication (redundant to CAN bus interface #1)
B2	CAN GND		
B3	CAN-L		

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 dialogue box will appear, and the settings can be changed.

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, communication and I/O options
Option H8.8
CAN bus interface for external I/O modules.

Term.	Function	Description
126	Not used	CAN bus communication for Beckhoff external I/O modules
127	Not used	
128	CAN-L	
129	Not used	
130	CAN-H	
131	CAN-L	
132	Not used	
133	CAN-H	

Option M13.8
7 × binary inputs.

Term.	Function	Description
126	Common	Common
127	Digital input 127	Configurable
128	Digital input 128	Configurable
129	Digital input 129	Configurable
130	Digital input 130	Configurable
131	Digital input 131	Configurable
132	Digital input 132	Configurable
133	Digital input 133	Configurable

Option M14.8
4 × relay outputs.

Term.	Function	Description
126	Relay output 126	Configurable
127	250 V AC, 8 A max.	
128	Relay output 128	Configurable
129	250 V AC, 8 A max.	
130	Relay output 130	Configurable
131	250 V AC, 8 A max.	
132	Relay output 132	Configurable
133	250 V AC, 8 A max.	

Option M15.8
4 × analogue 4 to 20 mA inputs.

Term.	Function	Description
126	Input 90 common	Common
127	Analogue input 91+	4 to 20 mA in
128	Input 92 common	Common
129	Analogue input 93+	4 to 20 mA in
130	Input 94 common	Common
131	Analogue input 95+	4 to 20 mA in
132	Input 96 common	Common
133	Analogue input 97+	4 to 20 mA in

8.1.3 Digital inputs

Term.	Name	Function
23	SWBD control	If the input is set, the unit will be forced into switchboard control. (Regulation is deactivated)
24	Configurable	This input is programmable from the PC utility software
25	Configurable	This input is programmable from the PC utility software
26	BTB open	Breaker feedback signal. The connection breaker is in position OFF
27	BTB closed	Breaker feedback signal. The connection breaker is in position ON
43	Configurable	This input is programmable from the PC utility software
44	Configurable	This input is programmable from the PC utility software
45	Configurable	This input is programmable from the PC utility software
46	Configurable	This input is programmable from the PC utility software
47	Configurable	This input is programmable from the PC utility software
48	Configurable	This input is programmable from the PC utility software
49	Configurable	This input is programmable from the PC utility software
50	Configurable	This input is programmable from the PC utility software
51	Configurable	This input is programmable from the PC utility software
52	BTB short circuit/ configurable	BTB tripped by external short circuit protection/programmable from the PC utility software
53	Configurable	This input is programmable from the PC utility software
54	Alarm inhibit 1/configurable	External input for inhibit of selected alarms/programmable from the PC utility software
55	Alarm inhibit 2/configurable	
102	Multi-input 1/configurable	Multi-function inputs selectable as either 0(4) to 20 mA, digital with wire break supervision, Pt100, Pt1000, RMI or 0 to 40 V DC. The default selection is digital with wire break detection (resistor across contacts 270 Ω)/programmable from the PC utility software
105	Multi-input 2/configurable	
108	Multi-input 3/configurable	
112	Configurable	This input is programmable from the PC utility software
113	Configurable	This input is programmable from the PC utility software
114	Configurable	This input is programmable from the PC utility software
115	Configurable	This input is programmable from the PC utility software
116	Configurable	This input is programmable from the PC utility software
117	Configurable	This input is programmable from the PC utility software
118	Emergency stop	The emergency stop input has been activated. The engine is shutting down.

8.1.4 Relay outputs

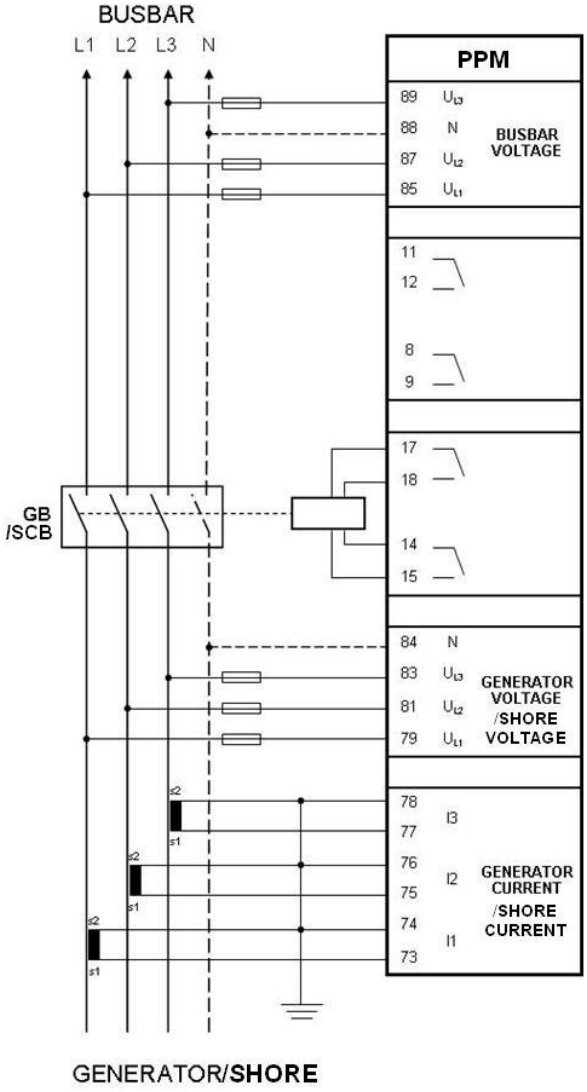
Term.	Name	Function
3	Status relay	The status relay on the power supply board is a normally closed relay with the purpose of processor and power supply supervision.
4		
5	Alarm horn	The relay activates on any alarm that appears. The output can be normally open (term. 5-6) or normally closed (term. 6-7).
6		
7		
8	Configurable	Programmable from the PC utility software.
9		
10		
11	Configurable	Programmable from the PC utility software.
12		
13		
14	Open BTB	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).
15		
16		
17	Close BTB	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).
18		
19		
20	Configurable	Configurable digital output (transistor output type).
21	Configurable	Configurable digital output (transistor output type).
57	Configurable	Programmable from the PC utility software.
58		
59	Configurable	Programmable from the PC utility software.
60		
61	Configurable	Programmable from the PC utility software.
62		
63	Configurable	Programmable from the PC utility software.
64		
65	Configurable	Programmable from the PC utility software.
66		
67	Configurable	Programmable from the PC utility software.
68		
69	Configurable	Programmable from the PC utility software.
70		
71	Configurable	Programmable from the PC utility software.
72		

Term.	Name	Function
119	Configurable	Programmable from the PC utility software.
120	Configurable	Programmable from the PC utility software.
121	Configurable	Programmable from the PC utility software.
122		
123	Configurable	Programmable from the PC utility software.
124		

9. Wirings

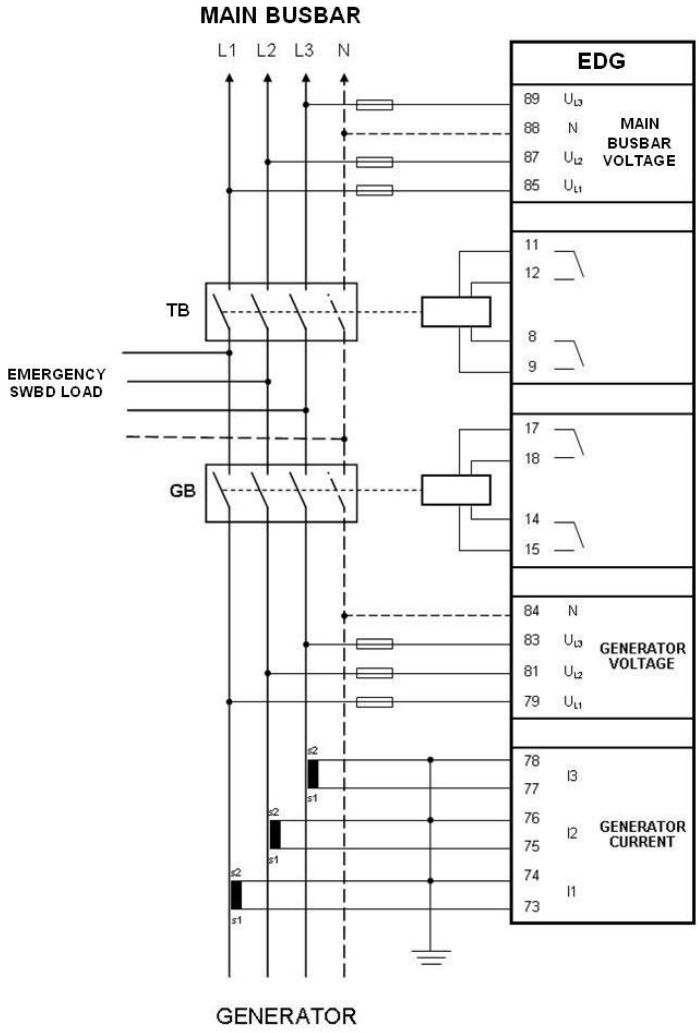
9.1 Wirings

9.1.1 AC connections (3-phase) DG/SG/SHORE unit



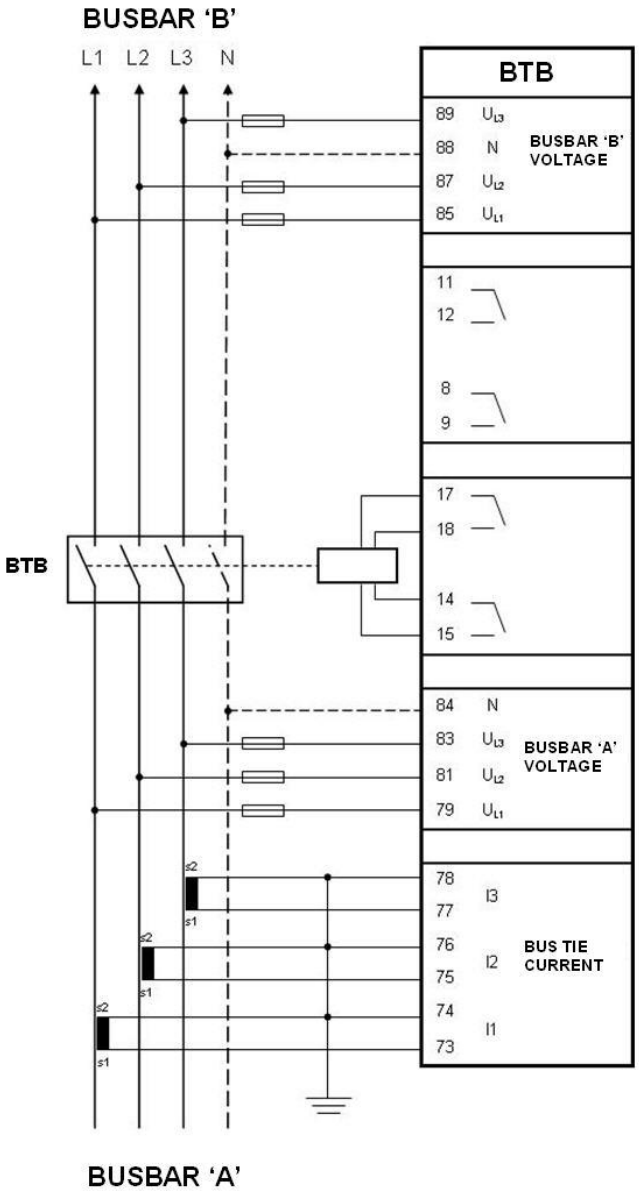
The neutral line (N) connection is not necessary for correct measurement. 3-phase without neutral is also possible. The current transformer ground connection can be on s1 or s2 connection, whichever is preferred. Fuses: 2 A slow-blow.

9.1.2 AC connections (3-phase) EDG unit



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: 2 A slow-blow.

9.1.3 AC connections (3-phase) BTB unit

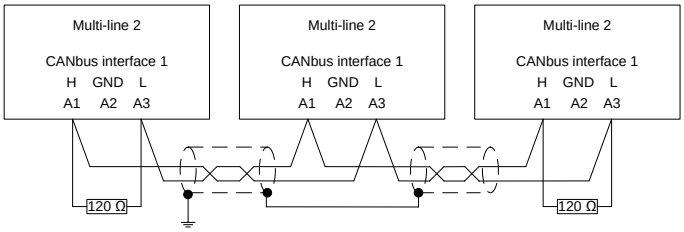


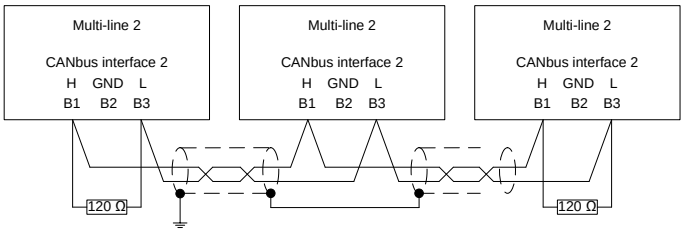
The neutral line (N) connection is not necessary for correct measurement. 3-phase without neutral is also possible. The current transformer ground connection can be on s1 or s2 connection, whichever is preferred. Fuses: 2 A slow-blow.

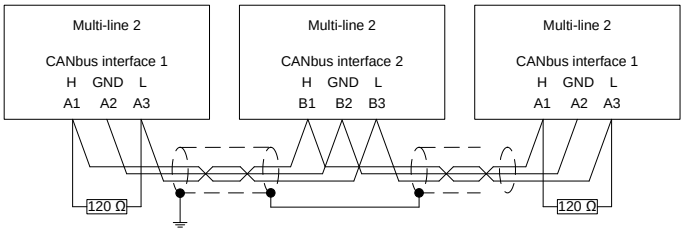
9.2 Internal CAN bus wiring

9.2.1 Internal CAN bus wiring

The wiring for the internal CAN bus communication between units is indicated in the illustrations below.







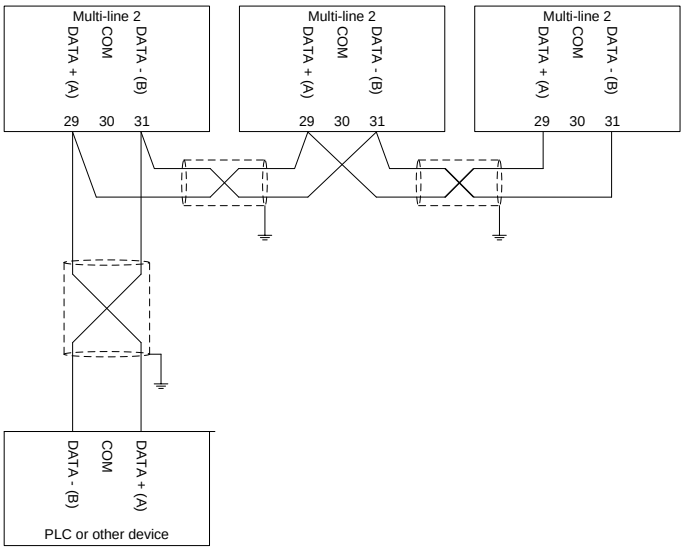
CAN interface 1 and 2 can be used at the same time (redundancy) or a mix can be used, as illustrated above.

Max. internal CAN bus length is 200 m. For distances above 200 m we recommend to use a CAN to fibre converter.

9.3 Option H2, Modbus RTU

9.3.1 Option H2, Modbus RTU

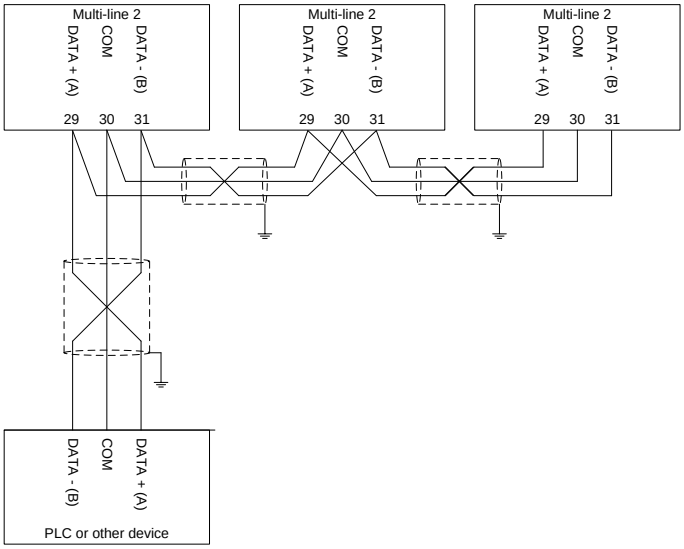
Connection with 2-wire screened cable (recommended):



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.

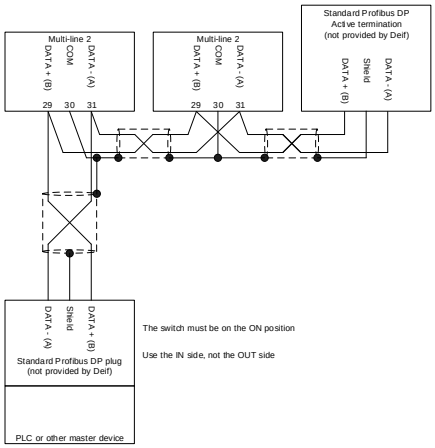
Normally, the Modbus does not need bias resistors (end terminators). These are only needed in case of very long lines and/or many nodes (>32) on the Modbus network. If bias resistors are needed, the calculation should be based on the following data:

- **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.

9.3.2 Profibus DP (option H3)

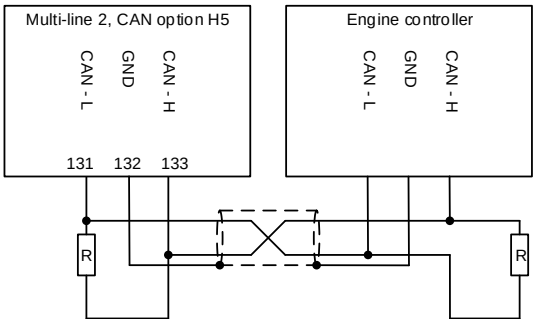
Connection with 2-wire screened cable (recommended):



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

Use shielded twisted cable.

9.3.3 CAN bus engine communication (option H5)



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

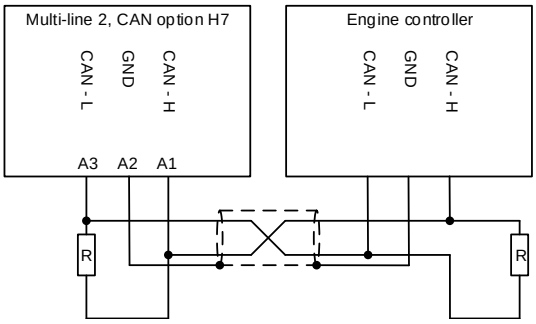
Use shielded twisted cable.

End resistor R = 120 Ohm.

For wiring details, please refer to "Wiring instructions" in this section.

The terminating resistor at the engine side might not be needed, please refer to the engine manufacturer’s literature.

9.3.4 CAN bus engine communication (option H7)



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

Use shielded twisted cable.

End resistor R = 120 Ohm.

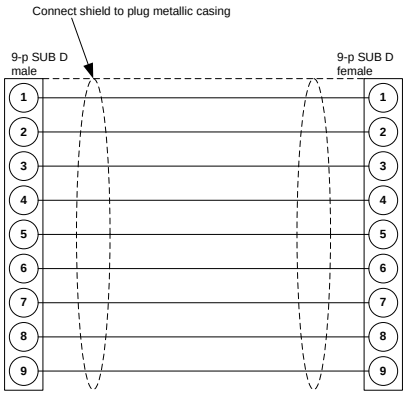
For wiring details, please refer to "Wiring instructions" in this section.

The terminating resistor at the engine side might not be needed, please refer to the engine manufacturer’s literature.

9.4 Display cable (option J)

9.4.1 Display cable (option J)

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



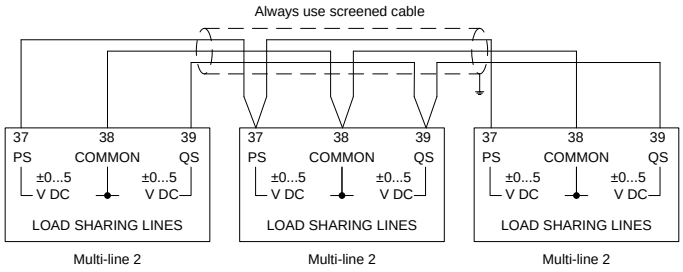
Wires min. 0.22 mm^2, max. cable length 6 m.
Cable types: Belden 9540, BICC H8146, Brand Rex BE57540 or equivalent.

No use of tools or brute force when tightening finger-screws on display cable.

9.5 Load sharing lines (option G3)

9.5.1 Load sharing lines (option G3)

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

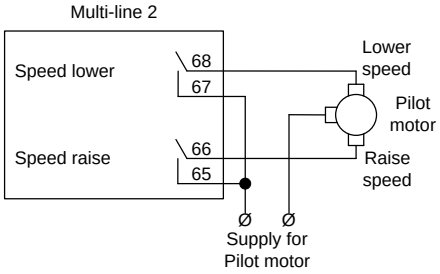


Max. distance between units: 3 m.

9.6 Mechanical speed governor (standard)

9.6.1 Mechanical speed governor (standard)

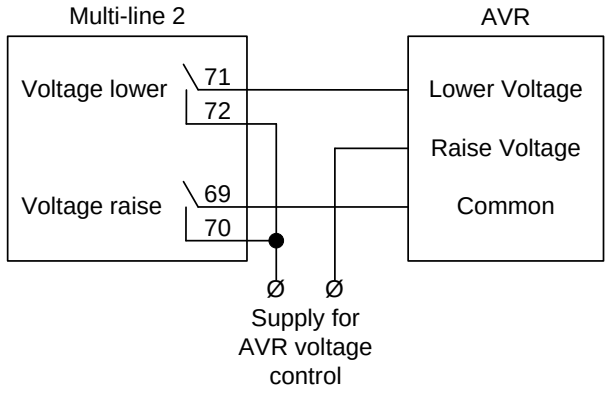
The illustration below shows the necessary connections to carry out speed control using relay outputs.



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. The diode/varistor must be placed across the terminals of the pilot motor/external regulation relay coil.

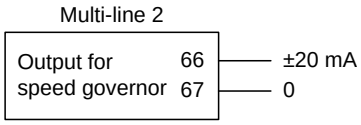
9.7 AVR with relay outputs

9.7.1 AVR with relay outputs



9.8 Electronic speed governor

9.8.1 Electronic speed governor

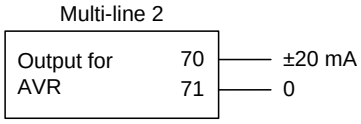


If necessary, the current outputs can be converted to voltage using a resistor across the terminals (250 Ω will convert the +/-20 mA into +/-5 V DC).

For further information on how to connect the analogue output to the most common speed governors, please refer to:
Application notes, Interfacing DEIF equipment, document number 4189340670 at www.deif.com.

9.9 AVR with analogue outputs (requires option D)

9.9.1 AVR with analogue outputs (requires option D)



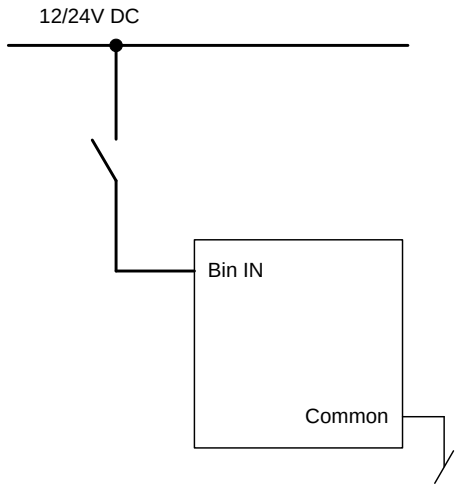
If necessary, the current outputs can be converted to voltage using a resistor across the terminals (250 Ω will convert the +/-20 mA into +/-5 V DC).

For further information on how to connect the analogue output to the most common speed governors, please refer to:
Application notes, Interfacing DEIF equipment, document number 4189340670 at www.deif.com.

9.10 Binary inputs

9.10.1 Binary inputs

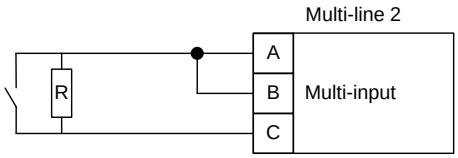
All binary inputs are 12/24 V DC bi-directional optocoupler. Typical input is:



9.11 Binary inputs with wire break supervision

9.11.1 Binary inputs with wire break supervision

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



The resistor value should be 270 Ω +/-10 %.

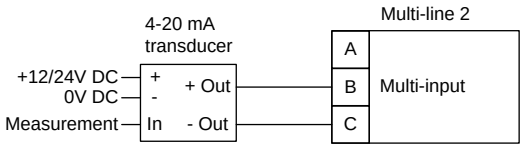
9.12 Multi-functional inputs

9.12.1 Multi-functional inputs

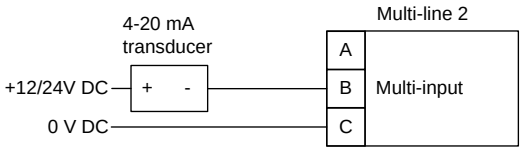
If the pre-defined binary inputs with cable supervision are not used, they can be used for the following.

9.12.2 0(4) to 20 mA

Active transducer



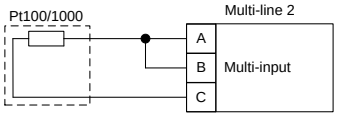
Passive transducer



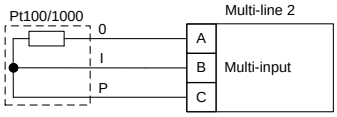
If the passive sensor has its own battery supply, the voltage must not exceed 30 V DC.

9.12.3 Pt100/Pt1000

2-wire

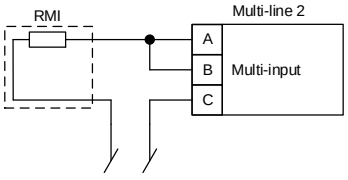


3-wire

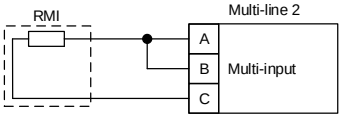


9.12.4 RMI

1-wire



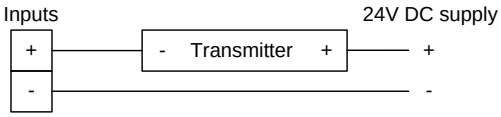
2-wire



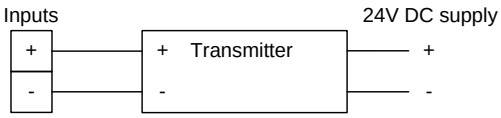
9.13 Analogue inputs (option M15)

9.13.1 Analogue inputs (option M15)

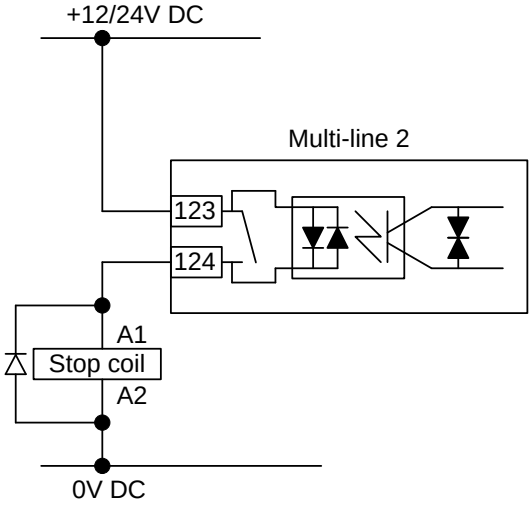
The analogue 0(4) to 20 mA inputs are passive and require an external power supply:



or



9.13.2 Stop coil with wire break detection



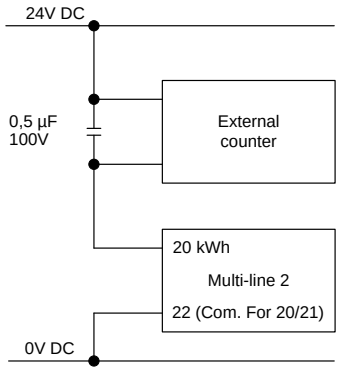
Remember to mount the free wheel diode.

9.14 Transistor outputs

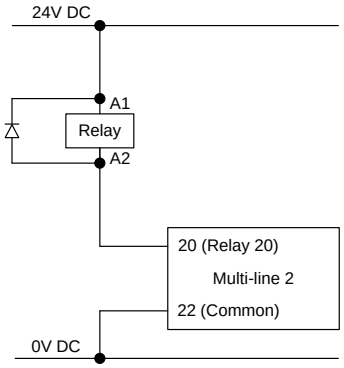
9.14.1 Transistor outputs

The open collector outputs can be used as kWh and kvarh counter outputs or as relay outputs. The outputs are low power outputs. For that reason, one of the following circuits must be applied.

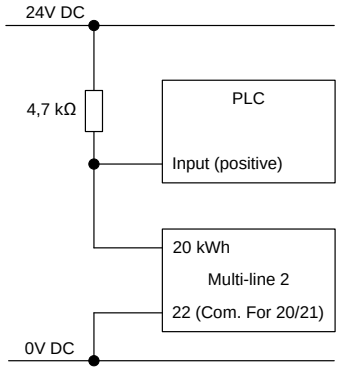
External counter



Relay outputs



Connection to PLC



Remember to mount the free wheel diode.

10. General data

10.1 Technical specifications

Accuracy	Class 1.0 -25 to 15 to 30 to 70 °C Temperature coefficient: +/-0.2 % of full scale per 10 °C Positive, negative and zero sequence alarms: Class 1 within 5 % voltage unbalance Class 1.0 for negative sequence current Fast over-current: 3 % of 350 %*In Analogue outputs: Class 1.0 according to total range Option EF4/EF5: Class 4.0 according to total range To IEC/EN60688
Operating temperature	-25 to 70 °C (-13 to 158 °F) -25 to 60 °C (-13 to 140 °F) if the option N is available in the controller (UL/cUL Listed: Max. surrounding air temperature: 55 °C/131 °F)
Storage temperature	-40 to 70 °C (-40 to 158 °F)
Climate	97 % RH to IEC 60068-2-30
Operating altitude	0 to 4000 m above sea level Derating 2001 to 4000 m above sea level: Max. 480 V AC phase-phase 3W4 measuring voltage Max. 690 V AC phase-phase 3W3 measuring voltage
Measuring voltage	100 to 690 V AC +/-20 % (UL/cUL Listed: 600 V AC phase-phase) Consumption: Max. 0.25 VA/phase
Measuring current	-/1 or -/5 A AC (UL/cUL Listed: From CTs 1-5 A) Consumption: Max. 0.3 VA/phase
Current overload	4 × I_n continuously 20 × I_n, 10 sec. (max. 75 A) 80 × I_n, 1 sec. (max. 300 A)
Measuring frequency	30 to 70 Hz
Aux. supply	Terminals 1 and 2: 12/24 V DC nominal (8 to 36 V DC operational). Max. 11 W consumption Battery voltage measurement accuracy: ±0.8 V within 8 to 32 V DC @ -25 to 70 °C, ±0.5 V within 8 to 32 V DC @ 20 °C Terminals 98 and 99: 12/24 V DC nominal (8 to 36 V DC operational). Max. 5 W consumption 0 V DC for 10 ms when coming from at least 24 V DC (cranking dropout) The aux. supply inputs are to be protected by a 2 A slow blow fuse. (UL/cUL Listed: AWG 24)
Binary inputs	Optocoupler, bi-directional. ON: 8 to 36 V DC. Impedance: 4.7 kΩ. OFF: <2 V DC

Analogue inputs	0(4) to 20 mA: Impedance: 50 Ω. Not galvanically separated RPM (MPU): 2 to 70 V AC, 10 to 10000 Hz, max. 50 kΩ
Multi-inputs	0(4) to 20 mA: 0 to 20 mA, +/-1 %. Not galvanically separated Binary: Max. resistance for ON detection: 100 Ω. Not galvanically separated Pt100/1000: -40 to 250 °C, +/-1 %. Not galvanically separated. To IEC/EN60751 RMI: 0 to 1700 Ω, +/-2 %. Not galvanically separated V DC: 0 to 40 V DC, +/-1 %. Not galvanically separated
Relay outputs	Electrical rating: 250 V AC/30 V DC, 5 A. (UL/cUL Listed: 250 V AC/24 V DC, 2 A resistive load) Thermal rating @ 50 °C: 2 A: Continuously. 4 A: t_{on}= 5 sec., t_{off} = 15 sec. (Unit status output: 1 A)
Open collector outputs	Supply: 8 to 36 V DC, max. 10 mA
Analogue outputs	0(4) to 20 mA and +/-25 mA. Galvanically separated. Active output (internal supply). Load max. 500 Ω. (UL/cUL Listed: Max. 20 mA output) Update rate: Transducer output: 250 ms. Regulator output: 100 ms
Analogue load sharing lines	-5 to 0 to +5 V DC. Impedance: 23.5 kΩ
Galvanic separation	Between AC voltage and other I/Os: 3250 V, 50 Hz, 1 min. Between AC current and other I/Os: 2200 V, 50 Hz, 1 min. Between analogue outputs and other I/Os: 550 V, 50 Hz, 1 min. Between binary input groups and other I/Os: 550 V, 50 Hz, 1 min.
Response times (delay set to min.)	**Busbar:** Over-/under-voltage: <50 ms Over-/under-frequency: <50 ms Voltage unbalance: <250 ms **Generator:** Reverse power: <250 ms Over-current: <250 ms Voltage-dependent over-current: <250 ms Fast over-current: <40 ms Over-/under-voltage: <250 ms Over-/under-frequency: <350 ms Overload: <250 ms Current unbalance: <250 ms Voltage unbalance: <250 ms Reactive power import: <250 ms Reactive power export: <250 ms Overspeed: <500 ms Digital inputs: <250 ms Emergency stop: <200 ms Multi-inputs: <800 ms Wire failure: <600 ms
Mounting	DIN-rail mount or base mount with six screws

Safety	To EN 61010-1, installation category (over-voltage category) III, 600 V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, over-voltage category III, 600 V, pollution degree 2
EMC/CE	To EN 61000-6-2, EN 61000-6-4, IEC 60255-26, IEC 60533 Power distribution zone, IACS UR E10 Power distribution zone
Vibration	3 to 13.2 Hz: $2mm_{pp}$. 13.2 to 100 Hz: 0.7 g. To IEC 60068-2-6 & IACS UR E10 10 to 60 Hz: $0.15mm_{pp}$. 60 to 150 Hz: 1 g. To IEC 60255-21-1 Response (class 2) 10 to 150 Hz: 2 g. To IEC 60255-21-1 Endurance (class 2)
Shock (base mount)	10 g, 11 ms, half sine. To IEC 60255-21-2 Response (class 2) 30 g, 11 ms, half sine. To IEC 60255-21-2 Endurance (class 2) 50 g, 11 ms, half sine. To IEC 60068-2-27
Bump	20 g, 16 ms, half sine. To IEC 60255-21-2 (class 2)
Material	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections Tightening torque	AC current: 0.2 to 4.0 mm^2 stranded wire. (UL/cUL Listed: AWG 18) AC voltage: 0.2 to 2.5 mm^2 stranded wire. (UL/cUL Listed: AWG 20) Relays: (UL/cUL Listed: AWG 22) Terminals 98-116: 0.2 to 1.5 mm^2 stranded wire. (UL/cUL Listed: AWG 24) Other: 0.2 to 2.5 mm^2 stranded wire. (UL/cUL Listed: AWG 24) Display: 9-pole Sub-D female Service port: USB A-B 0.5 Nm (4.4 lb-in)
Protection	Unit: IP20. Display: IP40 (IP54 with gasket: Option L). (UL/cUL Listed: Type Complete Device, Open Type). To IEC/EN 60529
Governors	Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins See interfacing guide at www.deif.com
Approvals	UL/cUL Listed to UL508. UL/cUL Recognized to UL2200
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)
AOP-2 Tightening torque	Maximum ambient temperature: 60 °C Wiring: Use 60/75 °C copper conductors only Mounting: For use on a flat surface of type 3 (IP54) enclosure. Main disconnect must be provided by installer Installation: To be installed in accordance with the NEC (US) or the CEC (Canada) For further information, please refer to the chapter "Mounting"
DC/DC converter for AOP-2 Tightening torque	Tightening torque: 0.5 Nm (4.4 lb-in) Wire size: AWG 22-14 0.5 Nm (4.4 lb-in)

Weight	Base unit: 1.6 kg (3.5 lbs.) Option J1/J3/J6: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.) Display: 0.4 kg (0.9 lbs.)