DEIF

-power in control

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INSTALLATION INSTRUCTIONS

Generator Paralleling Controller, GPC-3 + variants
Generator Protection Unit, GPU-3 + variants
Paralleling and Protection Unit, PPU-3

- Mounting
- Board slot positions
- I/O lists
- Wiring

7. Technical information

1. Delimitation

1.1 Scope of Installation Instructions

1.1.1 GPC-3, GPU-3 and PPU-3

This document covers the following products and product variants:

GPC	Software version 3.06.x
GPC Gas	Software version 3.06.x
GPC Hydro	Software version 3.06.x
GPU	Software version 3.06.x
GPU Gas	Software version 3.06.x
GPU Hydro	Software version 3.06.x
PPU	Software version 3.06.x

2. General information

2.1 Warnings, legal information and safety

2.1.1 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.**

2.1.2 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.

2.1.3 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.**

2.1.4 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.

2.1.5 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.

2.2 About the installation instructions

2.2.1 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.

⚠️ **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.**

2.2.2 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.

2.2.3 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.

3. Mounting and dimensions

3.1 Mounting of the unit

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

3.1.1 Unit dimensions
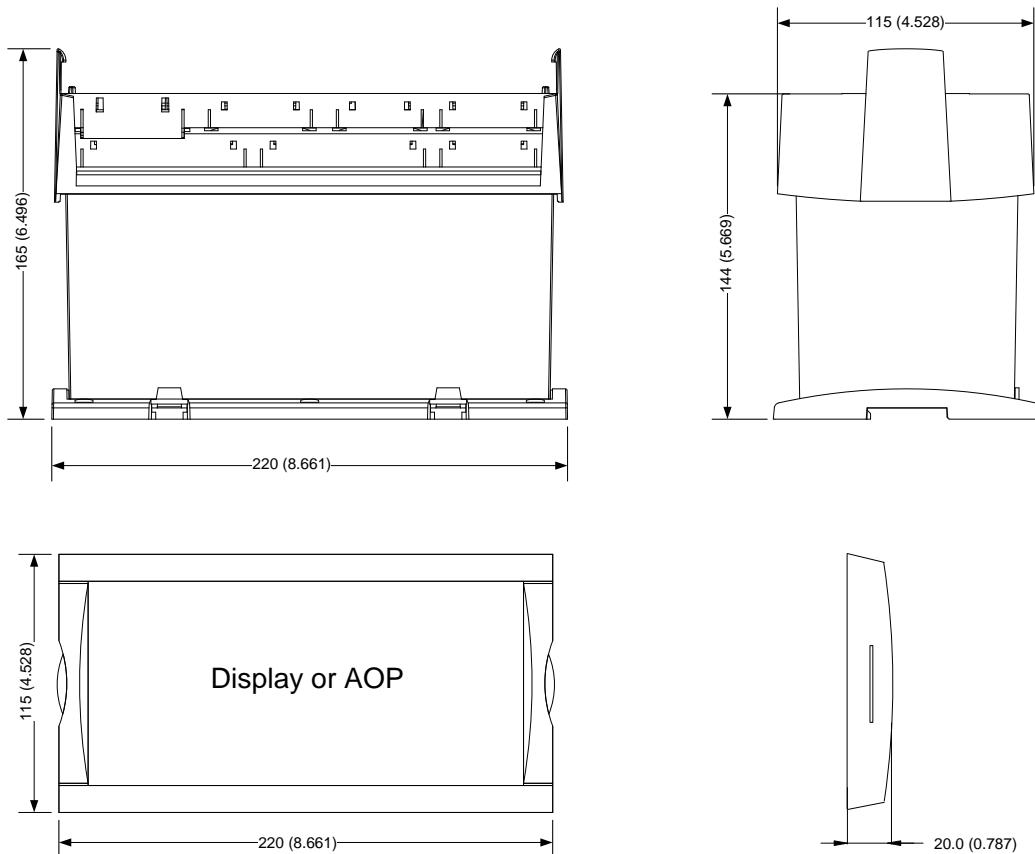
ⓘ **Dimensions are given in mm (inches).**

3.1.2 Panel cutout

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

Required space 222X115mm

Gasket outer 186X77mm

Screws for fastning:
3.5mm selfcutting threads
max. depth in display 9 mm
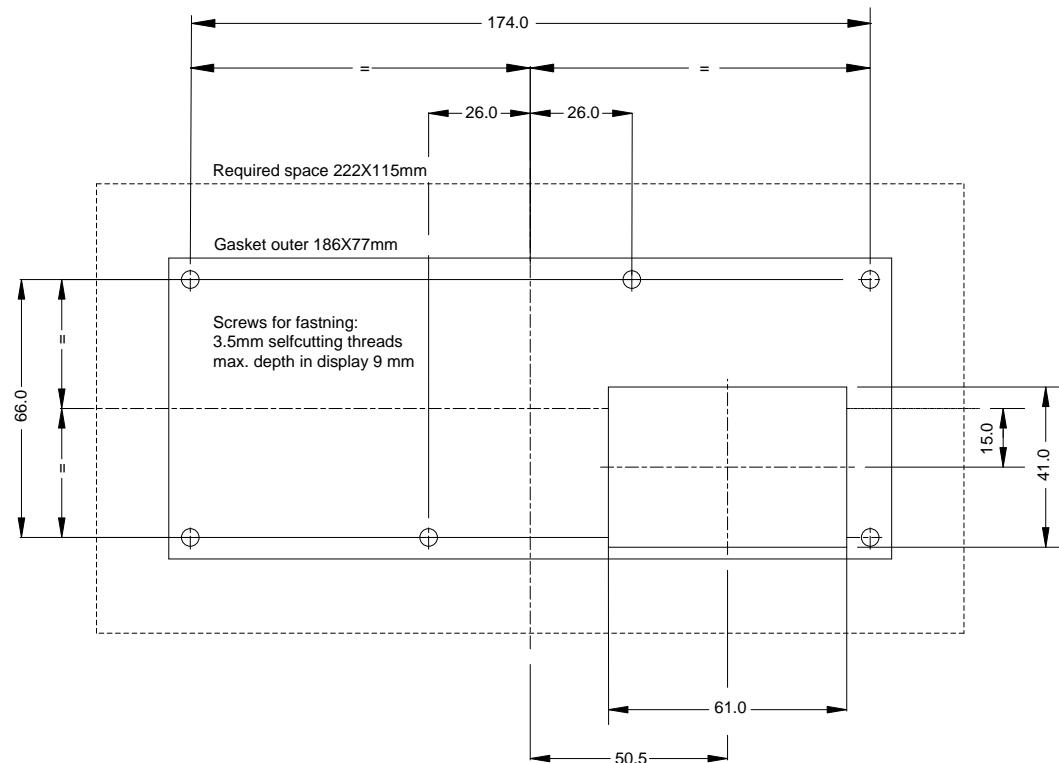
3.1.3 Drilling template
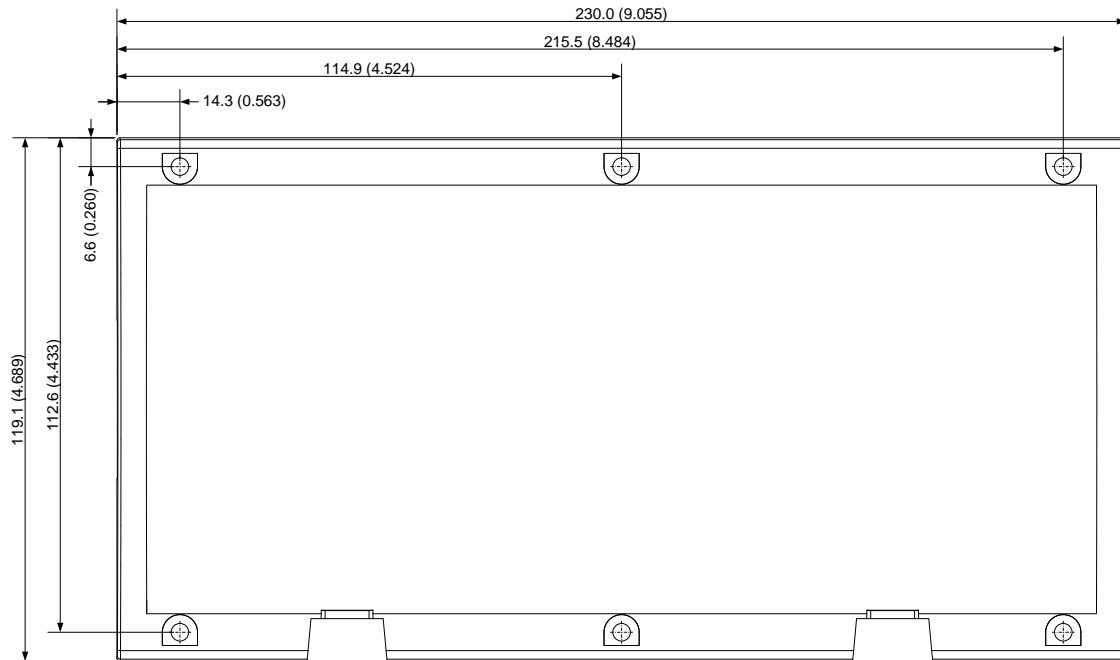
ⓘ **Dimensions are given in mm (inches).**

3.1.4 Mounting instructions

For land applications, the units can be either DIN-rail or base mounted.

For marine applications, the units have to 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.**

3.1.5 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
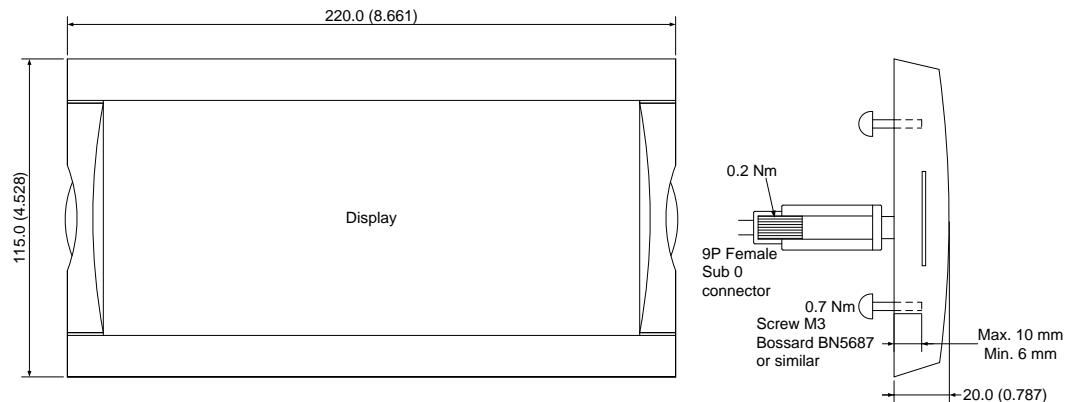
4. Hardware

4.1 General hardware description

4.1.1 Board slot positions

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.	GPU/GPU Hydro	GPC/PPU	Description
Slot #1	1-28	Standard	Standard	Power supply board
Slot #2	29-36	Option	Option	Option: H2 (Modbus RS-485) H3 (Profibus) H8.2 (Beckhoff ext. I/Os) H9.2 (Modbus RS-232) M14.2 (4 × relay outputs)
Slot #3	37-64	Option M12	Standard	GPC/PPU: Load sharing and I/O board GPU/GPU Hydro: I/O extension
Slot #4	65-72	Option	Standard (4 × relay outputs)	Option: E1 (2 × +/-25 mA outputs) E2 (2 × 0(4) to 20 mA outputs) EF2 (1 × +/-25 mA, 1 × 0(4) to 20 mA) EF4 (1 × +/-25 mA, 2 × relay outputs) EF5 (1 × PWM, +/-25 mA, 2 × relay outputs) EF6 (1 × PWM, 2 × +/-25 mA outputs) M14.4 (4 × relay outputs)
Slot #5	73-89	Standard	Standard	AC measuring
Slot #6	90-97	Option	Option	Option: F1 (2 × analogue outputs) M13.6 (7 × digital inputs) M14.6 (4 × relay outputs) M15.6 (4 × analogue inputs)
Slot #7	98-B3	Option	Option	M4 (engine interface board or I/O extension) - CAN I/F A (H7 - J1939) - CAN I/F B (reserved)
Slot #8	126-133	Option	Option	Option: G9 (CAN bus load sharing) M13.8 (7 × digital inputs) M14.8 (4 × relay outputs) M15.8 (4 × analogue inputs) H5, H6 (engine communication) H8.8 (Beckhoff ext. I/Os)

Only hardware options, which will affect the hardware of the unit, are represented in the table. The software options can be seen through the PC utility software. The software options are described in the data sheets.

4.1.2 Unit topside overview
An overview of the terminals is presented below. The slot positions are the following:
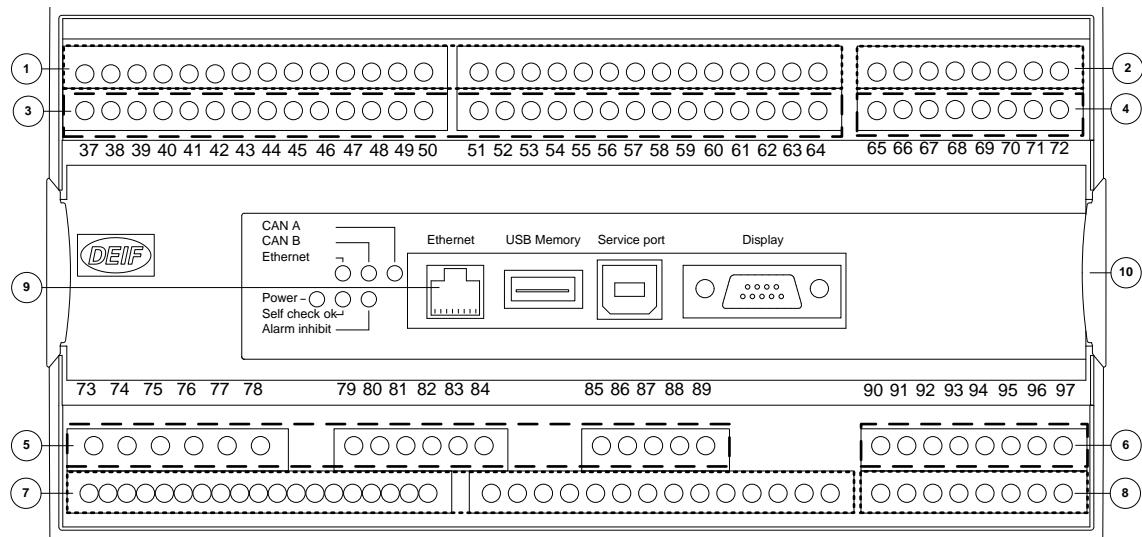
5. I/O lists

5.1 I/O list and terminal strip description - GPU, GPU Hydro

5.1.1 Slot #1, power supply and binary I/O

For the relay outputs, the following terms will be used:

NO means Normally Open
NC means Normally Closed
Com. means common terminal for the relay in question

Terminal	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/configurable
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	Open GB
15	Com.	250 V AC/8 A	Configurable if GB is configured as continuous
16	NC		
17	NO	Relay 17	Configurable
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	Digital input	Optocoupler	Alarm inhibit 1/configurable
24	Digital input	Optocoupler	Remote alarm acknowledge/configurable
25	Digital input	Optocoupler	Configurable
26	Digital input	Optocoupler	Configurable
27	Digital input	Optocoupler	Configurable
28	Com.	Common	Common for terminals 23-27

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

5.1.2 Slot #2, external communication (optional)

Option H2 (Modbus RS-485)

Terminal	Function	Description
29	DATA + (A)	Modbus RTU/ASCII, 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. The terminals 29/33 and 31/35 are internally connected.**

Option H3 (Profibus DP)

Terminal	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.

Terminal	Function	Description
29	Not used	CAN bus communication for Beckhoff external I/O modules
30	Not used	
31	CAN-L	
32	Not used	
33	CAN-H	
34	CAN-L	
35	Not used	
36	CAN-H	

Option H9.2 (Modbus RS-232)

Terminal	Function	Description
29		Modbus RTU/ASCII, RS-232
30	DATA GND	
31		
32	TxD	
33		
34	RxD	
35		
36		

5.1.3 Slot #3, digital I/Os (option M12)

Terminal	Function	Technical data	Description
37			Not available
38			Not available
39			Not available
40			Not available
41			Not available
42			Not available
43	Digital input	Optocoupler	Configurable
44	Digital input	Optocoupler	Configurable
45	Digital input	Optocoupler	Configurable
46	Digital input	Optocoupler	Configurable
47	Digital input	Optocoupler	Configurable
48	Digital input	Optocoupler	Configurable
49	Digital input	Optocoupler	Configurable
50	Digital input	Optocoupler	Configurable
51	Digital input	Optocoupler	Configurable
52	Digital input	Optocoupler	Configurable
53	Digital input	Optocoupler	Configurable
54	Digital input	Optocoupler	Configurable
55	Digital input	Optocoupler	Configurable
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 57 6	GOV/AVR control or configurable
58	Com.	250 V AC/8 A	
59	NO	Relay 59 7	GOV/AVR control or configurable
60	Com.	250 V AC/8 A	
61	NO	Relay 61 8	GOV/AVR control or configurable
62	Com.	250 V AC/8 A	
63	NO	Relay 63 9	GOV/AVR control or configurable
64	Com.	250 V AC/8 A	

(i) **GOV control requires option G2.**

(i) **AVR control requires options G2 and D1.**

5.1.4 Slot #4, GOV/AVR (optional)

(i) **GOV control requires option G2.**

(i) **AVR control requires options G2 and D1.**

Option M14.4
GOV/AVR or configurable relay output card.

Term.	Function	Description
65	Relay 65	GOV/AVR or configurable
66	250 V AC/8 A	
67	Relay 67	GOV/AVR or configurable
68	250 V AC/8 A	
69	Relay 69	GOV/AVR or configurable
70	250 V AC/8 A	
71	Relay 71	GOV/AVR or configurable
72	250 V AC/8 A	

Option E1
GOV/AVR or transducer output card.

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

Option E2
GOV/AVR or transducer output card.

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

Option EF2
GOV/AVR or transducer output card.

Term.	Function	Description
65	Not used	
66	+/-20 mA	Speed governor/AVR set point output or transducer (Analogue output 66)
67	0	
68	Not used	
69	Not used	
70	0(4) to 20 mA out	Speed governor/AVR set point output or transducer (Analogue output 70)
71	0	
72	Not used	

Option EF4
GOV/AVR or transducer combination output card.

Term.	Function	Description
65	ANA +	Speed governor/AVR set point output or transducer (Analogue output 66)
66	ANA -	
67	Not used	
68	Not used	
69	Relay 69 250 V AC, 8 A	GOV/AVR control or configurable
70		
71	Relay 71 250 V AC, 8 A	GOV/AVR control or configurable
72		

Option EF5
PWM GOV and AVR combination output card.

Term.	Function	Description
65	+/-25 mA out	AVR set point output
66	0	
67	PWM +	PWM speed governor signal
68	PWM -	
69	Relay 69	GOV/AVR control or configurable
70	250 V AC, 8 A	
71	Relay 71	GOV/AVR control or configurable
72	250 V AC, 8 A	

5.1.5 Slot #5, AC measuring

Terminal	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	
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	
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.**

5.1.6 Slot #6, I/O extension (optional)

Option F1

Transducer output card.

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	

Option M13.6

7 × digital 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 90	Configurable
91	250 V AC, 8 A max.	
92	Relay 92	Configurable
93	250 V AC, 8 A max.	
94	Relay 94	Configurable
95	250 V AC, 8 A max.	
96	Relay 96	Configurable
97	250 V AC, 8 A max.	

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

5.1.7 Slot #7, engine interface board (option M4)

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 Preselected to digital input with wire break detection
103	B		
104	C		
105	A		Multi-input 2 Preselected to digital input with wire break detection
106	B		
107	C		
108	A		Multi-input 3 Preselected 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	Configurable
113	Digital input 113	Optocoupler	Configurable
114	Digital input 114	Optocoupler	Shutdown override/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	Run coil/configurable
120	NO	Relay 24 V DC/5 A	Start prepare/configurable
121	Com.	Relay 24 V DC/5 A	Crank (starter)/configurable
122	NO		
123	Com.	Relay 24 V DC/5 A	Stop coil w/wire break/configurable
124	NO		
A1	CAN-H	CAN bus	CAN bus J1939 engine interface (option H7)
A2	CAN GND		
A3	CAN-L		
B1	CAN-H	CAN bus	CAN bus external Axiomatic module interface (option H7/H5)
B2	CAN GND		
B3	CAN-L		

Relays 119, 121, 120 and 123 are only configurable when engine logic is disabled (menu 9080). The engine logic can be switched on or off via the display or the utility software. If engine logic is enabled/disabled via the utility software, the controller requires a manual power cycle in order for relays to be unconfigurable/configurable.

5.1.8 Slot #8, communication and I/O (optional)

Option H5

CAN bus engine interface card.

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 × digital 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 126 250 V AC, 8 A max.	Configurable
127		
128	Relay 128 250 V AC, 8 A max.	Configurable
129		
130	Relay 130 250 V AC, 8 A max.	Configurable
131		
132	Relay 132 250 V AC, 8 A max.	Configurable
133		

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

Term.	Function	Description
126	Input 127 common	Common
127	Analogue input 127+	4 to 20 mA in
128	Input 129 common	Common
129	Analogue input 129+	4 to 20 mA in
130	Input 131 common	Common
131	Analogue input 131+	4 to 20 mA in
132	Input 133 common	Common
133	Analogue input 133+	4 to 20 mA in

5.1.9 Digital inputs

Term.	Name	Function
23	Alarm inhibit 1/configurable	External input for inhibit of selected alarms
24	Remote alarm acknowledge/configurable	
25	Configurable/start sync./control (option G2)	Option G2: Activates synchronisation. The Deload function is used to open the breaker
26	Configurable/GB open (option G2)	Option G2: Breaker feedback signal. The connection breaker is in position OFF
27	Configurable/GB closed (option G2)	Option G2: Breaker feedback signal. The connection breaker is in position ON

5.1.10 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/configurable	The relay is activated on any alarm that appears. The output can be normally open (terminal 5-6) or normally closed (terminal 6-7)
6		
7		
8	Configurable	
9		
10		
11	Configurable	
12		
13		
14	Open GB	Generator breaker OFF signal. The output can be selected to be normally open (NO, terminal 14-15) or normally closed (NC, terminal 15-16)
15		
16		
17	Configurable/close GB	Option G2: Generator breaker ON signal. 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)

5.2 I/O list and terminal strip description - GPC, PPU

5.2.1 Slot #1, power supply and binary I/O
For the relay outputs, the following terms will be used:

NO means Normally Open
NC means Normally Closed
Com. means common terminal for the relay in question

Terminal	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
4	Com.	24 V/1 A	status supervision
5	NO	Relay 5	Alarm horn/configurable
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	Open GB
15	Com.	250 V AC/8 A	Configurable if GB is configured as continuous
16	NC		
17	NO	Relay 17	Close GB
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	Digital input	Optocoupler	Alarm inhibit 1/configurable
24	Digital input	Optocoupler	Remote alarm acknowledge/configurable
25	Digital input	Optocoupler	Start sync./control/configurable
26	Digital input	Optocoupler	GB open
27	Digital input	Optocoupler	GB closed
28	Com.	Common	Common for terminals 23-27

(i) **The power supply must be protected with a 2 A slow-blow fuse.**

5.2.2 Slot #2, external communication (optional)

Option H2 (Modbus RS-485)

Terminal	Function	Description
29	DATA + (A)	Modbus RTU/ASCII, RS-485
30	Not used	
31	DATA - (B)	
32	Not used	
33	DATA + (A)	
34	Not used	
35	DATA - (B)	
36	Not used	

(i) **The serial communication line should be terminated between DATA + and DATA - with a resistor equal to the cable impedance. The terminals 29/33 and 31/35 are internally connected.**

Option H3 (Profibus DP)

Terminal	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.

Terminal	Function	Description
29	Not used	CAN bus communication for Beckhoff external I/O modules
30	Not used	
31	CAN-L	
32	Not used	
33	CAN-H	
34	CAN-L	
35	Not used	
36	CAN-H	

Option H9.2 (Modbus RS-232)

Terminal	Function	Description
29		Modbus RTU/ASCII, RS-232
30	DATA GND	
31		
32	TxD	
33		
34	RxD	
35		
36		

Option M14.2 (4 × relay outputs)

Terminal	Function	Description
29	Relay 29	Configurable
30	250 V AC, 8 A	
31	Relay 31	Configurable
32	250 V AC, 8 A	
33	Relay 33	Configurable
34	250 V AC, 8 A	
35	Relay 35	Configurable
36	250 V AC, 8 A	

5.2.3 Slot #3, digital I/Os

Terminal	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	Digital input	Optocoupler	Deload/configurable
44	Digital input	Optocoupler	Man. GOV UP/configurable
45	Digital input	Optocoupler	Man. GOV DOWN/configurable
46	Digital input	Optocoupler	Man. AVR UP/configurable
47	Digital input	Optocoupler	Man. AVR DOWN/configurable
48	Digital input	Optocoupler	Fixed frequency/configurable
49	Digital input	Optocoupler	P load sharing/configurable
50	Digital input	Optocoupler	Ext. GOV set point/configurable
51	Digital input	Optocoupler	Fixed voltage/configurable
52	Digital input	Optocoupler	Q load sharing/configurable
53	Digital input	Optocoupler	Ext. AVR set point/configurable
54	Digital input	Optocoupler	Configurable
55	Digital input	Optocoupler	Configurable
56	Com.	Common	Common for terminals 43-55
57	NO	Relay 57 6	GOV/AVR control or configurable
58	Com.	250 V AC/8 A	
59	NO	Relay 59 7	GOV/AVR control or configurable
60	Com.	250 V AC/8 A	
61	NO	Relay 61 8	GOV/AVR control or configurable
62	Com.	250 V AC/8 A	
63	NO	Relay 63 9	GOV/AVR control or configurable
64	Com.	250 V AC/8 A	

(i) AVR control requires option D1.

5.2.4 Slot #4, GOV/AVR

ⓘ **AVR control requires option D1.**

Standard
GOV/AVR or configurable relay output card.

Term.	Function	Description
65	Relay 65	GOV/AVR or configurable
66	250 V AC, 8 A	
67	Relay 67	GOV/AVR or configurable
68	250 V AC, 8 A	
69	Relay 69	GOV/AVR or configurable
70	250 V AC, 8 A	
71	Relay 71	GOV/AVR or configurable
72	250 V AC, 8 A	

Option E1
GOV/AVR or transducer output card.

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

Option E2
GOV/AVR or transducer output card.

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

Option EF2
GOV/AVR or transducer output card.

Term.	Function	Description
65	Not used	
66	+/-20 mA	Speed governor/AVR set point output or transducer (Analogue output 66)
67	0	
68	Not used	
69	Not used	
70	0(4) to 20 mA out	Speed governor/AVR set point output or transducer (Analogue output 70)
71	0	
72	Not used	

Option EF4
GOV/AVR or transducer combination output card.

Term.	Function	Description
65	ANA +	Speed governor/AVR set point output or transducer (Analogue output 66)
66	ANA -	
67	Not used	
68	Not used	
69	Relay 69 250 V AC, 8 A	GOV/AVR control or configurable
70		
71	Relay 71 250 V AC, 8 A	GOV/AVR control or configurable
72		

Option EF5

PWM GOV and AVR combination output card.

Term.	Function	Description
65	+/-25 mA out	AVR set point output
66	0	
67	PWM +	PWM speed governor signal
68	PWM -	
69	Relay 69	GOV/AVR control or configurable
70	250 V AC, 8 A	
71	Relay 71	GOV/AVR control or configurable
72	250 V AC, 8 A	

Option EF6

PWM GOV and AVR combination output card.

Term.	Function	Description
65	Not used	
66	Not used	
67	0	Speed governor, AVR or transducer output 68
68	+/-25 mA out	
69	PWM +	PWM speed governor signal
70	PWM -	
71	0	Speed governor, AVR or transducer output 72
72	+/-25 mA out	

(i) **Option EF6 is not available for PPU.**

5.2.5 Slot #5, AC measuring

Terminal	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	Mains bus voltage L1	Max. 690 V AC phase-phase value
86	Not used		
87	U L2	Mains bus voltage L2	Max. 690 V AC phase-phase value
88	U neutral	Mains bus voltage neutral	For land-based applications only
89	U L3	Mains 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.**

5.2.6 Slot #6, I/O extension (optional)
Option F1
Transducer output card.

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	

Option M13.6
7 × digital 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	Configurable
91	250 V AC, 8 A max.	
92	Relay output 92	Configurable
93	250 V AC, 8 A max.	
94	Relay output 94	Configurable
95	250 V AC, 8 A max.	
96	Relay output 96	Configurable
97	250 V AC, 8 A max.	

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

5.2.7 Slot #7, engine interface board (option M4)

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 Preselected to digital input with wire break detection
103	B		
104	C		
105	A		Multi-input 2 Preselected to digital input with wire break detection
106	B		
107	C		
108	A		Multi-input 3 Preselected 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	Configurable
113	Digital input 113	Optocoupler	Configurable
114	Digital input 114	Optocoupler	Shutdown override/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	Run coil/configurable
120	NO	Relay 24 V DC/5 A	Start prepare/configurable
121	Com.	Relay 24 V DC/5 A	Crank (starter)/configurable
122	NO		
123	Com.	Relay 24 V DC/5 A	Stop coil w/wire break/configurable
124	NO		
A1	CAN-H	CAN bus	CAN bus J1939 engine interface (option H7)
A2	CAN GND		
A3	CAN-L		
B1	CAN-H	CAN bus	CAN bus external Axiomatic module interface (option H7/H5)
B2	CAN GND		
B3	CAN-L		

Relays 119, 121, 120 and 123 are only configurable when engine logic is disabled (menu 9080). The engine logic can be switched on or off via the display or the utility software. If engine logic is enabled/disabled via the utility software, the controller requires a manual power cycle in order for relays to be unconfigurable/configurable.

5.2.8 Slot #8, communication and I/O (optional)

Option H5

CAN bus engine interface card.

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 × digital 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 126	Configurable
127	250 V AC, 8 A max.	
128	Relay 128	Configurable
129	250 V AC, 8 A max.	
130	Relay 130	Configurable
131	250 V AC, 8 A max.	
132	Relay 132	Configurable
133	250 V AC, 8 A max.	

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

Term.	Function	Description
126	Input 127 common	Common
127	Analogue input 127+	4 to 20 mA in
128	Input 129 common	Common
129	Analogue input 129+	4 to 20 mA in
130	Input 131 common	Common
131	Analogue input 131+	4 to 20 mA in
132	Input 133 common	Common
133	Analogue input 133+	4 to 20 mA in

5.2.9 Digital inputs

Term.	Name	Function
23	Alarm inhibit 1/configurable	External input for inhibit of selected alarms
24	Remote alarm acknowledge/configurable	Remote alarm acknowledge
25	Start sync./control/configurable	Activates the regulation and synchronisation. Works together with "Deload" (43)
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	Deload/configurable	Activates the deload sequence. Works together with start sync./control (25)
44	Manual GOV UP/configurable	Increase engine speed
45	Manual GOV DOWN/configurable	Decrease engine speed
46	Manual AVR UP/configurable	Option D1: Increase generator voltage
47	Manual AVR DOWN/configurable	Option D1: Decrease generator voltage
48	Fixed frequency/configurable	Activates frequency controller
49	P load sharing/configurable	Activates load sharing controller
50	Ext. GOV set point/configurable	The nominal frequency set point will be controlled from the analogue inputs terminal 40/41. The internal set point will not be used
51	Fixed voltage/configurable	Activates voltage controller
52	Q load sharing/configurable	Activates Q load sharing controller
53	Ext. AVR set point/configurable	The nominal voltage set point will be controlled from the analogue inputs terminal 41/42. The internal set point will not be used
54	Configurable	
55	Configurable	

5.2.10 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/ configurable	The relay is activated on any alarm that appears. The output can be normally open (terminal 5-6) or normally closed (terminal 6-7)
6		
7		
8	Configurable	
9		
10		
11	Configurable	
12		
13		
14	Open GB	Generator breaker OFF signal. 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	Generator breaker ON signal. 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)
65	Configurable	GOV/AVR control or configurable
66		
67	Configurable	GOV/AVR control or configurable
68		
69	Configurable	GOV/AVR control or configurable
70		
71	Configurable	GOV/AVR control or configurable
72		

6. Wirings

6.1 AC connections

6.1.1 3-phase

BUSBAR

Terminal	Label	Section
89	U_{L3}	BUSBAR VOLTAGE
88	N	
87	U_{L2}	
85	U_{L1}	
17		
18		
14		
15		
84	N	GENERATOR VOLTAGE
83	U_{L3}	
81	U_{L2}	
79	U_{L1}	
78	I3	GENERATOR CURRENT
77		
76	I2	
75		
74	I1	
73		

ML2

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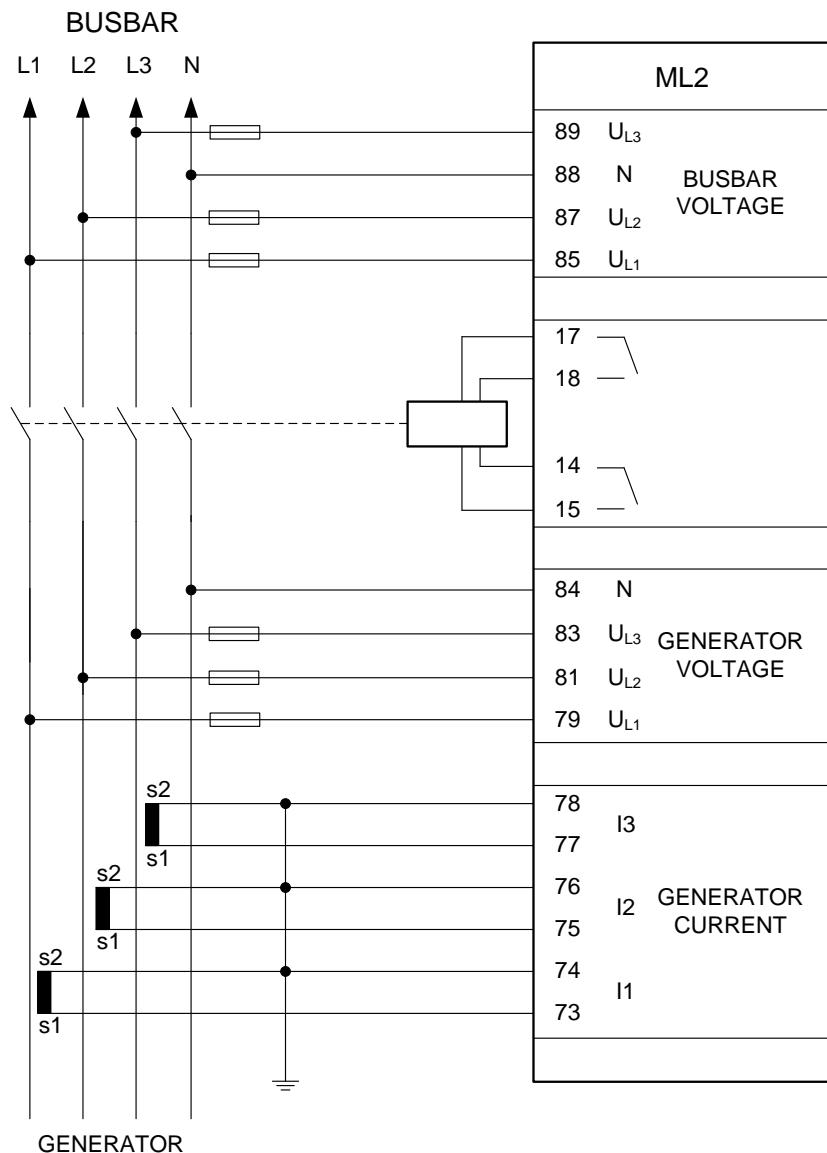
> **The neutral line (N) connection is not necessary for correct measurement. 3-phase without neutral is also possible. The current tranformer ground connection can be on the s1 or s2 connection, whichever is preferred. Fuses: 2 A slow-blow.**

6.1.2 3-phase, 2-phase voltage, 1-phase current
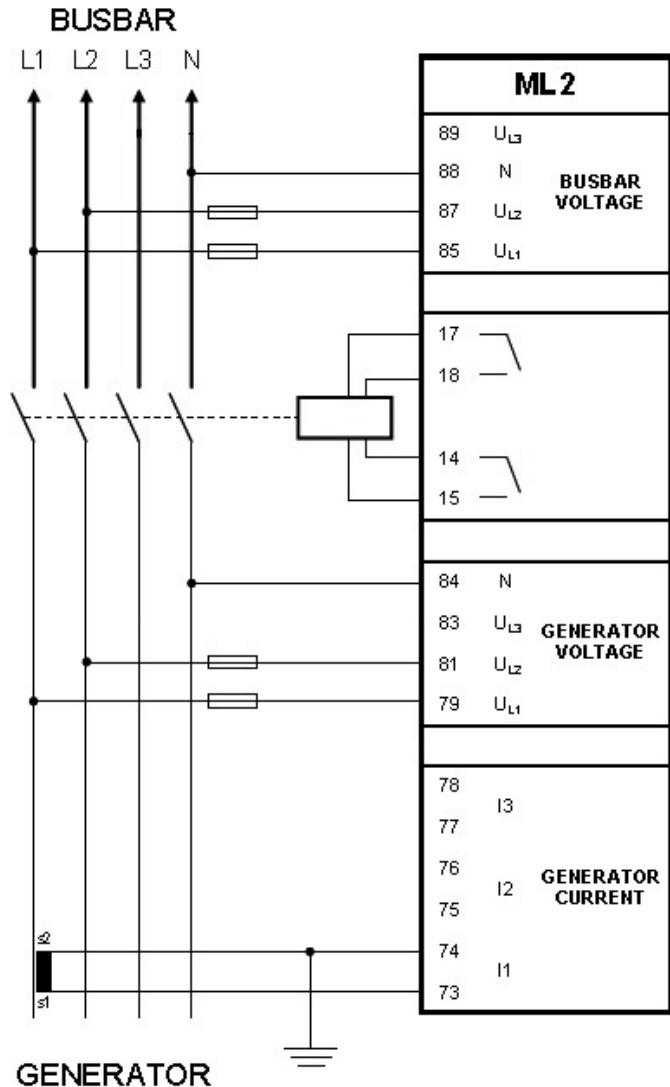
3 phase measurement is possible with only two voltage measurements and one current measurement. But it is only possible to use this method if the distribution of power is the same on all 3 phases. Fuses: 2 A slow-blow.

6.1.3 1-phase

6.1.4 2-phase

BUSBAR

L1   L3   N

ML2		
89	U$_{L3}$	BUSBAR
88	N	VOLTAGE
87	U$_{L2}$	
85	U$_{L1}$	
17		
18		
14		
15		
84	N	
83	U$_{L3}$	GENERATOR
81	U$_{L2}$	VOLTAGE
79	U$_{L1}$	
78	I3	
77		
76	I2	GENERATOR
75		CURRENT
74	I1	
73		

s2
s1

s2
s1

GENERATOR
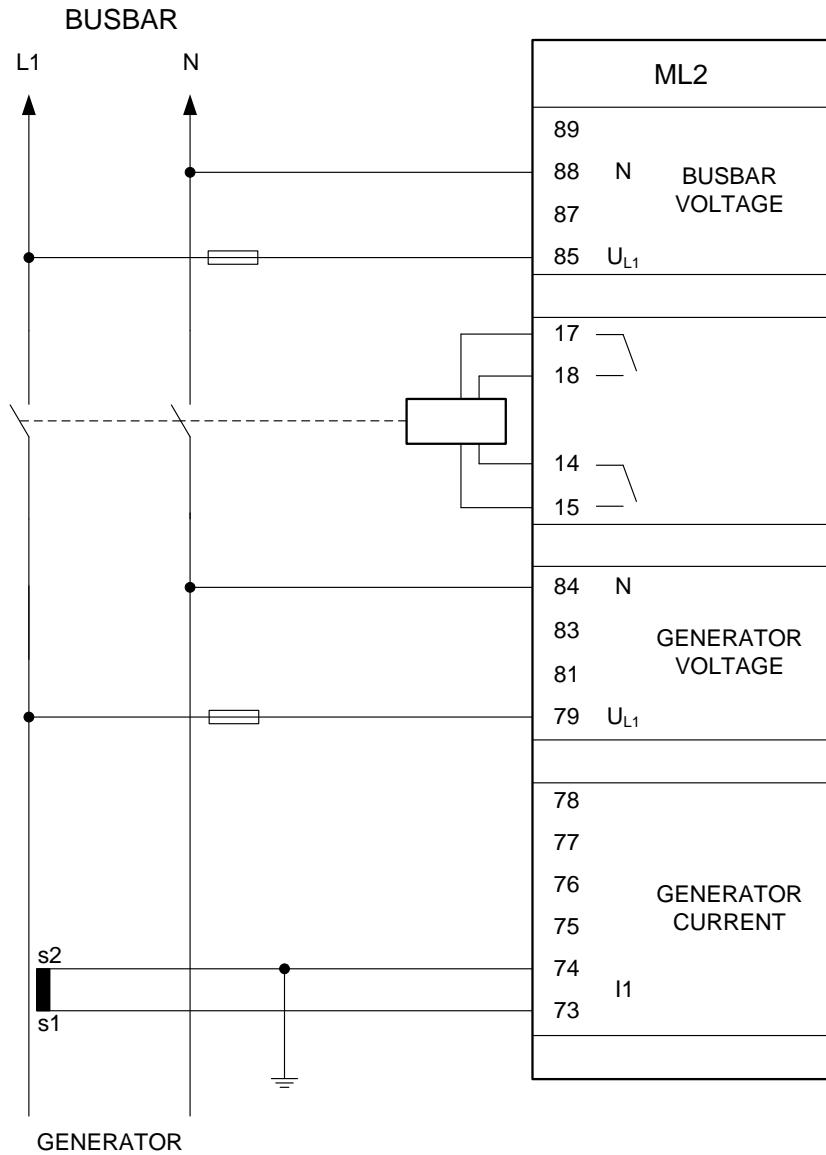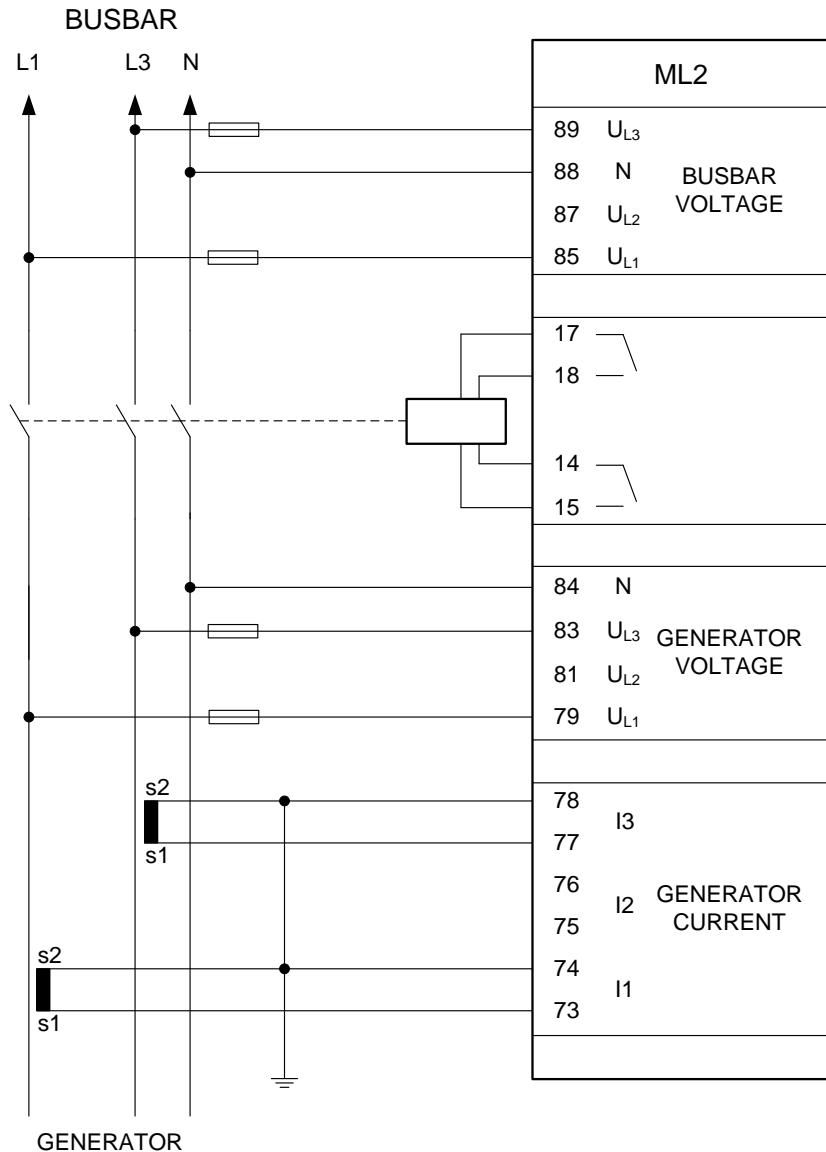
6.1.5 CAN bus load sharing (option G9)
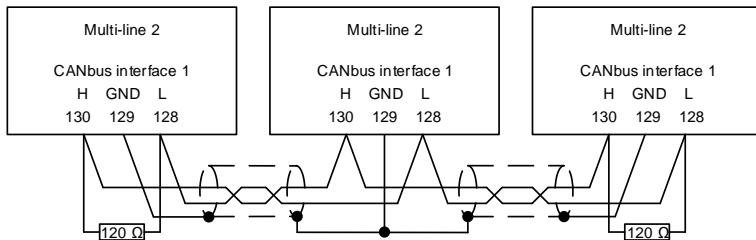
ⓘ **Use shielded twisted cable.**

6.1.6 Modbus, RS-485 (option H2)
Connection with 2-wire screened cable:
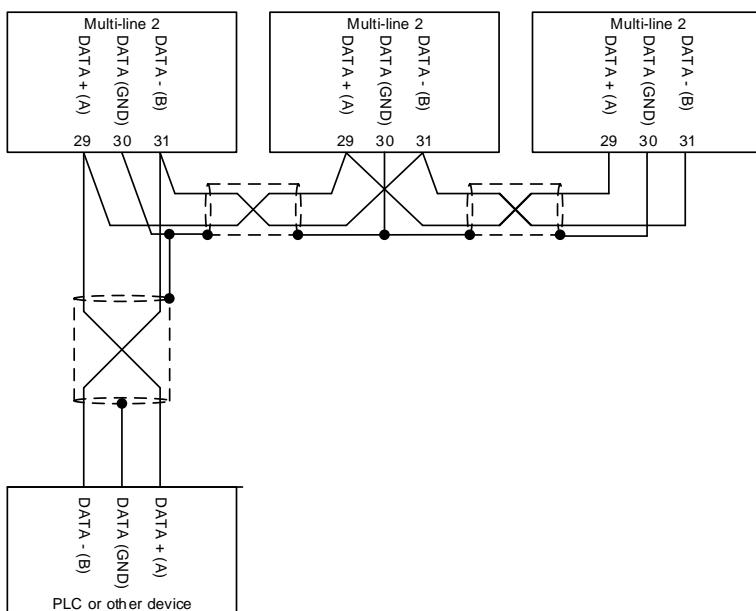
ⓘ **Use shielded twisted cable.**

ⓘ **The RS-485 Modbus lines need end resistors (end terminators) when the bus length exceeds 30 m. If end resistors are needed, we recommend to install them like this:**
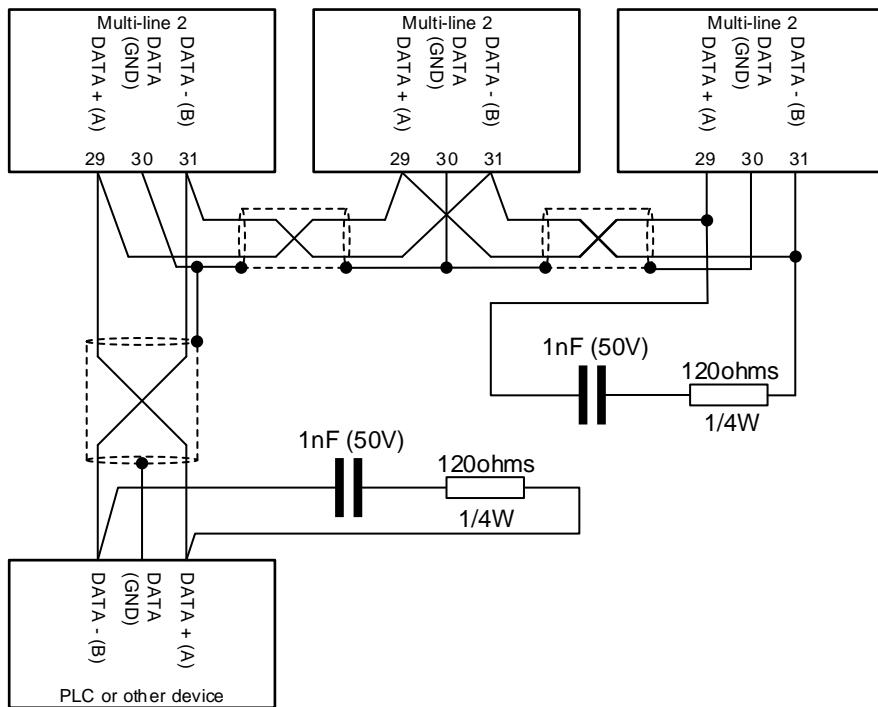
ⓘ **Cable: Belden 3105 A or equivalent. 22 AWG (0.6 mm^2) twisted pair, shielded, <40 mΩ/m, min. 95 % shield coverage.**

6.1.7 Modbus, RS-232 (option H9.2)

Connection to an external controller (PLC, PC, and so on) or a modem (GSM or RTC):
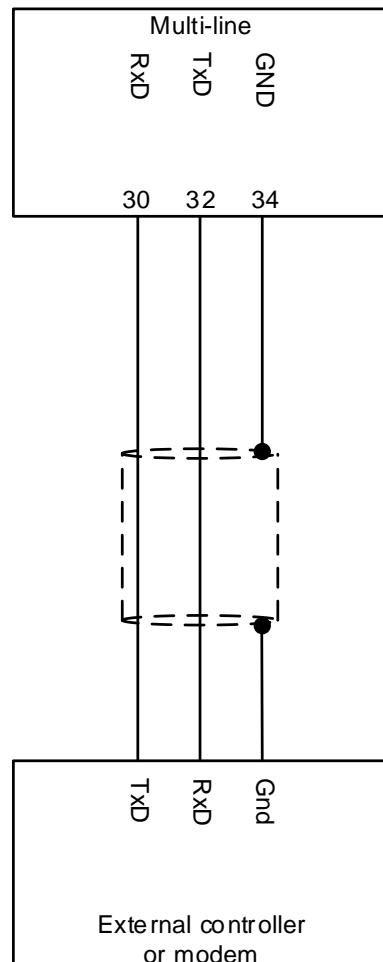
ⓘ **Cable: Belden 3106 A or equivalent. 22 AWG (0.6 mm^2) shielded, <40 mΩ/m, min. 95 % shield coverage.**

6.1.8 Profibus DP (option H3)

Connection with 2-wire screened cable:
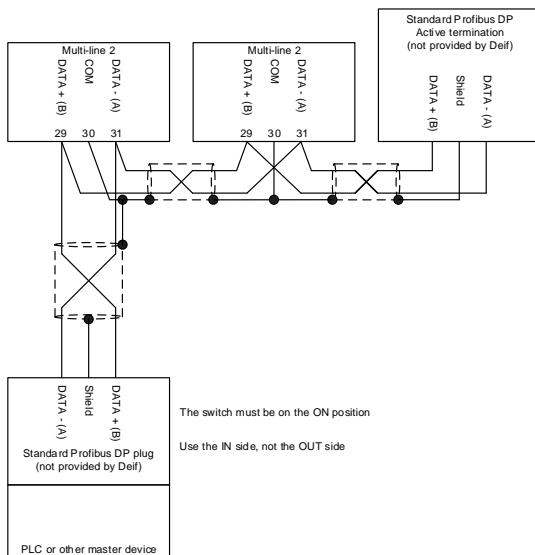
> (i) **Use shielded twisted cable.**

6.1.9 CAN bus engine communication (option H5)
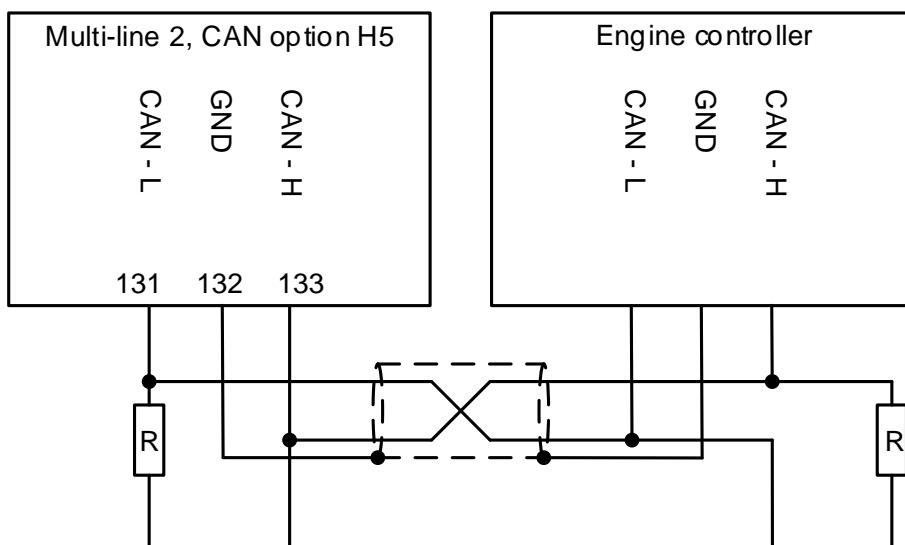
ⓘ **Use shielded twisted cable.**

ⓘ **End resistor R = 120 Ohm.**

ⓘ **The terminating resistor at the engine side might not be needed, see the engine manufacturer's literature.**

6.1.10 CAN bus engine communication (option H7)
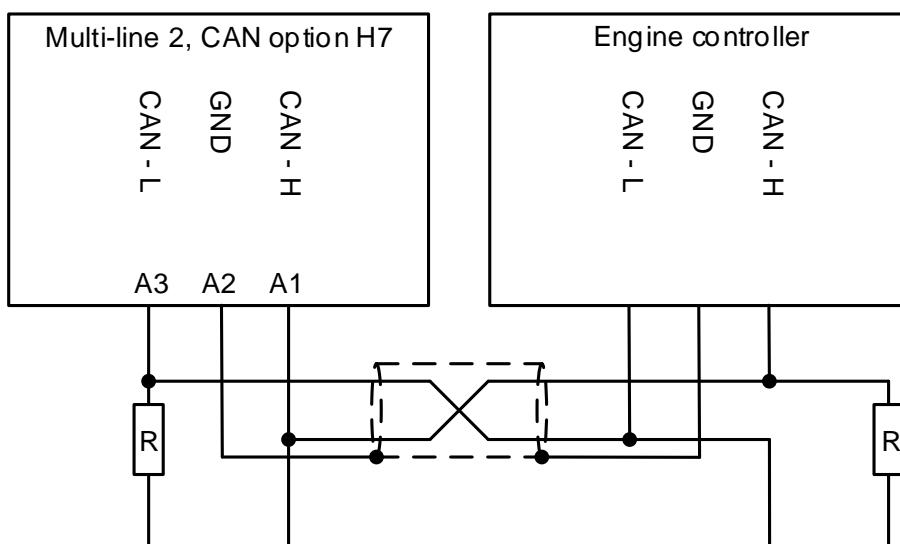
ⓘ **Use shielded twisted cable.**

ⓘ **End resistor R = 120 Ohm.**

ⓘ **The terminating resistor at the engine side might not be needed, see the engine manufacturer's literature.**

6.1.11 CAN bus external I/O communication - Axiomatic
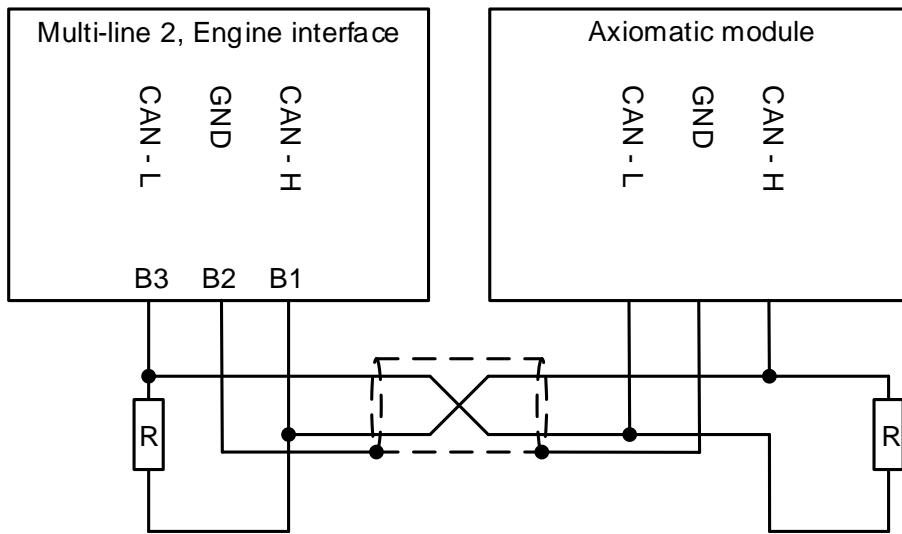
ⓘ **Use shielded twisted cable.**

ⓘ **End resistor R = 120 Ohm.**

ⓘ **The terminating resistor at the external module side might not be needed, see the module manufacturer's literature.**

6.1.12 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.
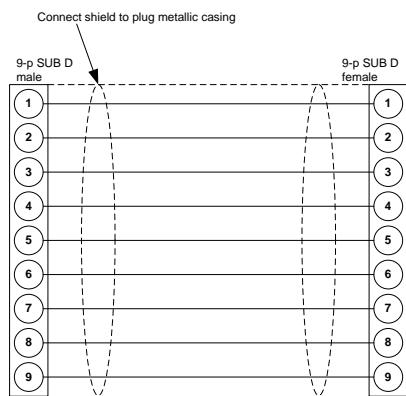
Wires min. 0.22 mm^2, max. cable length 6 m.
Cable types: Belden 9540, BICC H8146, Brand Rex BE57540 or equivalent.

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

6.1.13 Load sharing lines (option G3)

Screened, twisted cable is recommended to prevent disturbances on the load sharing lines.
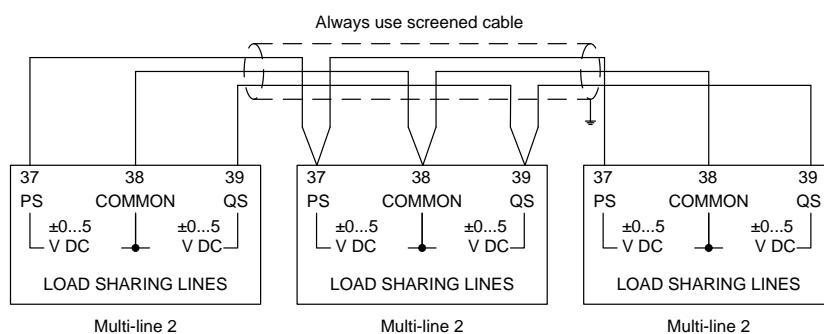
6.1.14 Mechanical speed governor

The illustration below shows the necessary connections to carry out speed control using relay outputs.
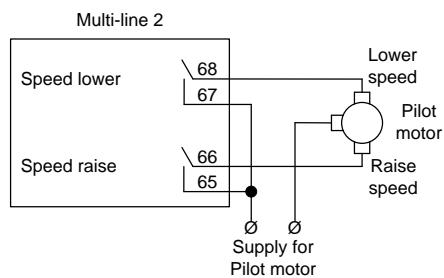
In order to extend the lifetime of the internal relays and prevent unwanted switching noise, it is recommended to use freewheeling diodes (1N4007), if a DC voltage is used for the regulation. If an AC voltage is used for the regulation, it is recommended to use a varistor. The diode/varistor must be placed across the terminals of the pilot motor/external regulation relay coil.

6.1.15 AVR with relay outputs
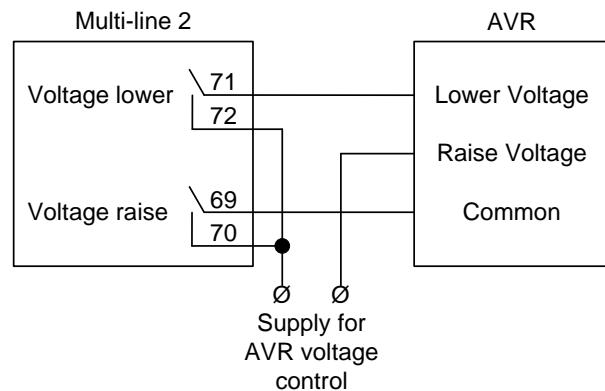
6.1.16 Electronic speed governor
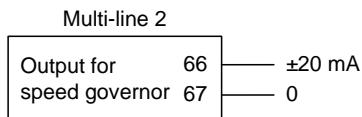
```
        Multi-line 2
┌──────────────────┐
│ Output for      66├───── ±20 mA
│ speed governor  67├───── 0
└──────────────────┘
```

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, see:**
Application notes, Interfacing DEIF equipment, document number 4189340670 at www.deif.com.

6.1.17 AVR with analogue outputs
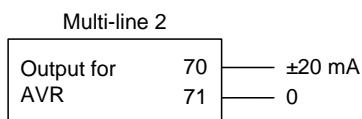
```
        Multi-line 2
┌──────────────────┐
│ Output for      70├───── ±20 mA
│ AVR             71├───── 0
└──────────────────┘
```

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 AVRs, see:**
Application Notes, Interfacing DEIF equipment to governors and AVRs, document number 4189340670 at www.deif.com.

6.1.18 Digital inputs

All digital inputs are 12/24 V DC bi-directional optocoupler. Typical input is:
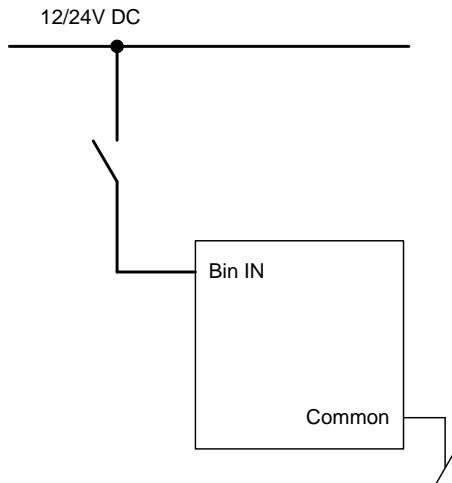
6.1.19 Digital inputs with wire break supervision (option M4)

The digital inputs with wire break supervision only need potential free contacts.
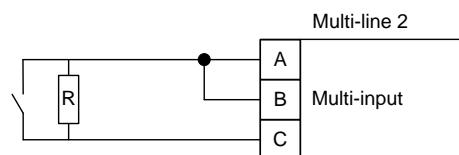
The resistor value should be 270 Ω +/-10 %.

6.1.20 Multi-functional inputs (option M4)

ⓘ **If the predefined digital inputs with cable supervision are not used, they can be used for the following.**

0(4) to 20 mA

Active transducer
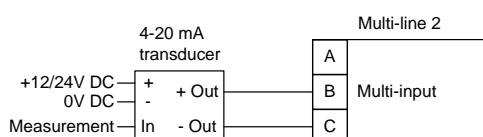
Passive transducer
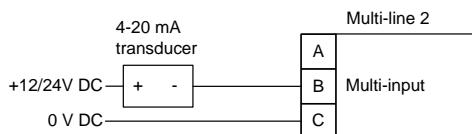
ⓘ **If the passive sensor has its own battery supply, the voltage must not exceed 30 V DC.**

Pt100/Pt1000

2-wire
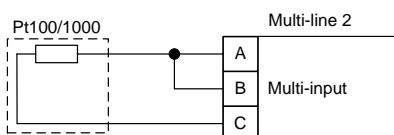
3-wire
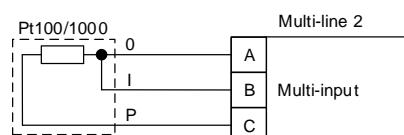

RMI

1-wire
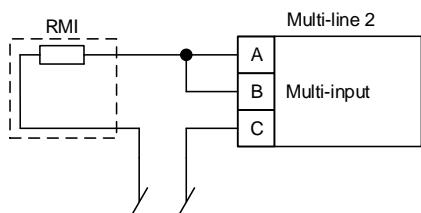
2-wire
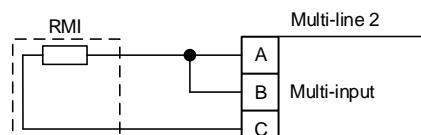
6.1.21 Magnetic pickup (MPU) input (option M4)

Magnetic pickup (MPU)
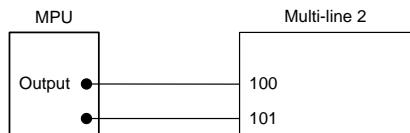
NPN sensor
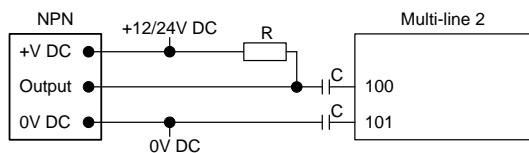
C = 22 nF, 100 V foil type
R = 1200 Ω @ 24 V DC, 600 Ω @ 12 V DC

PNP sensor
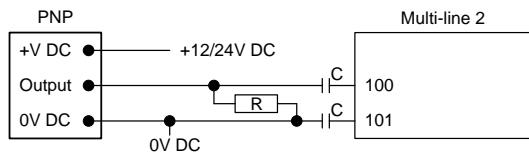
C = 22 nF, 100 V foil type
R = 1200 Ω @ 24 V DC, 600 Ω @ 12 V DC

Charger, W output
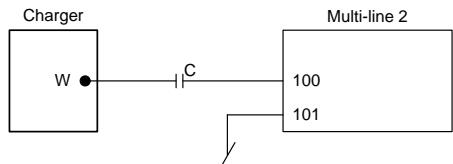
C = 22 nF, 100 V foil type

6.1.22 Analogue inputs (option M15.x)

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

Inputs   24V DC supply

```
+    ┌─ -  Transmitter  + ─┐     +
-    └─────────────────────┘     -
```

or

Inputs   24V DC supply
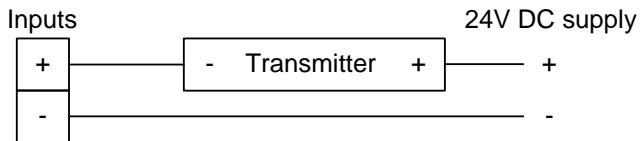
```
+    ┌─ +  Transmitter ─┐     +
-    └─ -               ─┘     -
```
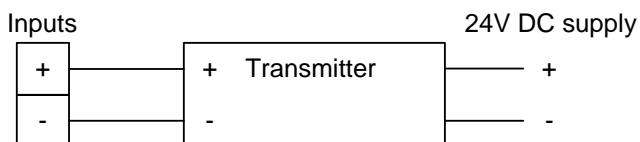
## 6.1.23 Stop coil with wire break detection (option M4)
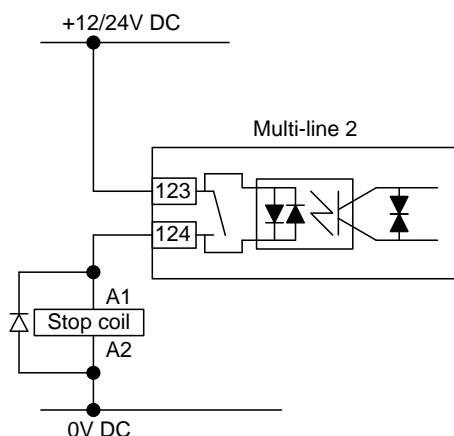
To avoid faulty activation of the stop coil caused by the wire break circuit, use a stop coil with the following specifications:
24 V DC: $I_{ON} > 10$ mA/$R_{COIL} < 1650\ \Omega$
12 V DC: $I_{ON} > 10$ mA/$R_{COIL} < 800\ \Omega$

**Remember to mount the freewheeling diode.**

6.1.24 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:
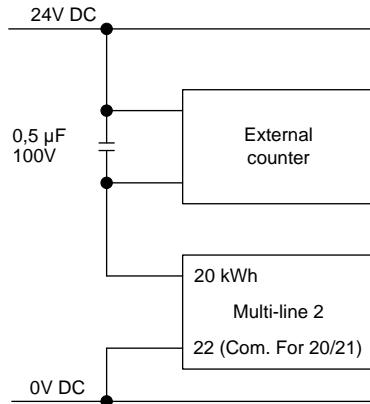
24V DC

0,5 µF
100V

External
counter

20 kWh

Multi-line 2

22 (Com. For 20/21)

0V DC

Relay outputs:

24V DC

A1

Relay

A2

20 (Relay 20)

Multi-line 2

22 (Common)

0V DC

Connection to PLC:

24V DC

4,7 kΩ

PLC

Input (positive)

20 kWh

Multi-line 2

22 (Com. For 20/21)

0V DC
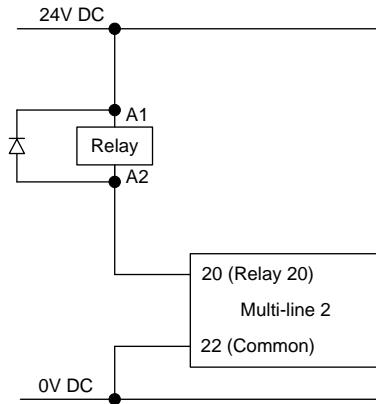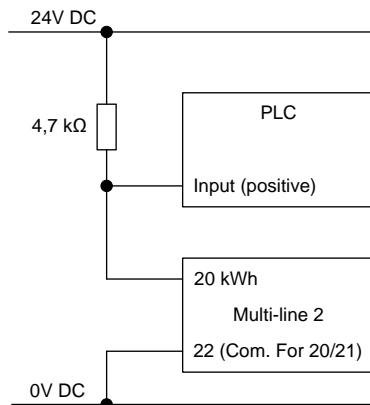
(i) Remember to mount the freewheeling diode.

(i) Max. load: 10 mA.

6.1.25 Additional display unit, DU-2 (option X2)
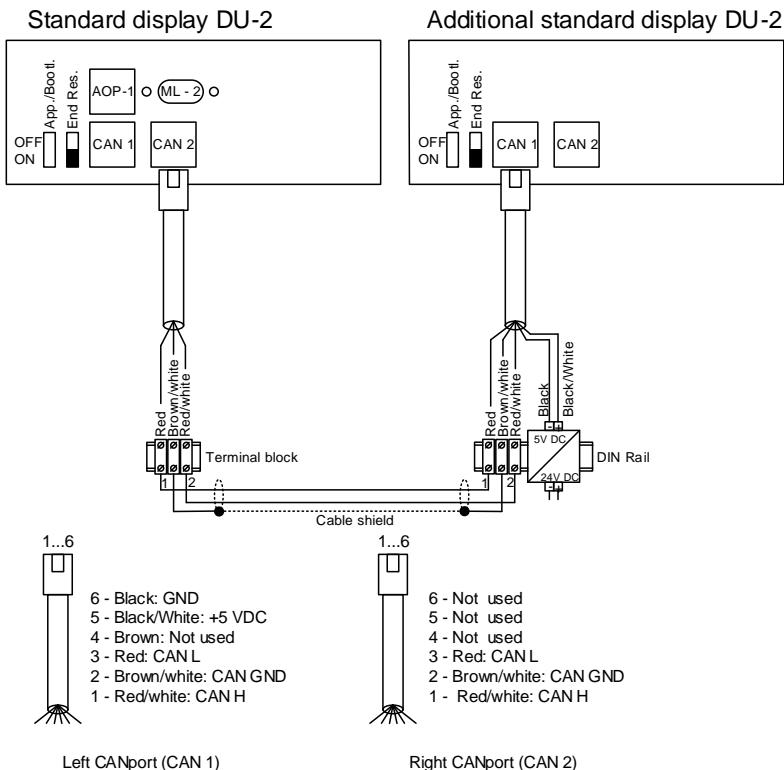
End resistor:

2 units connected: Dip switch no. 1 has to be set to ON on both units.
3 units connected: Dip switch no. 1 has to be set to ON on unit 1 and unit 3.

ⓘ   **The maximum length of the CAN bus line is 200 m.**

ⓘ   **A DC/DC converter for the DC supply voltage and 2 × 1 m cable with an RJ45 plug in one end and stripped wires in the other end are included in the DU-2 (option X2) delivery.**

6.1.26 Additional operator panel, AOP-1 (option X3)
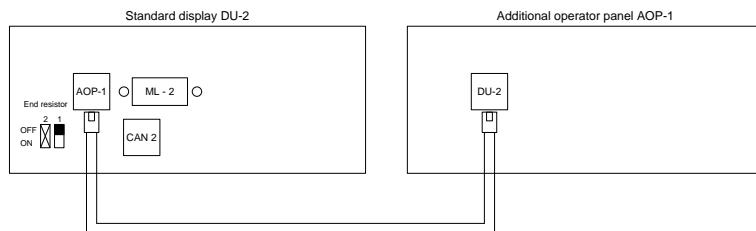

ⓘ **The maximum distance between the DU-2 and the AOP-1 is 0.5 m.**

ⓘ **The cable for connection between the AOP-1 and the DU-2 is included in the AOP-1 delivery.**

6.1.27 Additional operator panel, AOP-2 (option X4)

6 - Black: GND
5 - Black/White: +5 VDC
4 - Brown: Not used
3 - Red: CAN L
2 - Brown/white: CAN GND
1 - Red/white: CAN H

Left CANport (CAN 1)

6 - Black: Relay common
5 - Black/White: Relay NO
4 - Brown: Relay NC
3 - Red: CAN L
2 - Brown/white: CAN GND
1 - Red/white: CAN H

Right CANport (CAN 2)
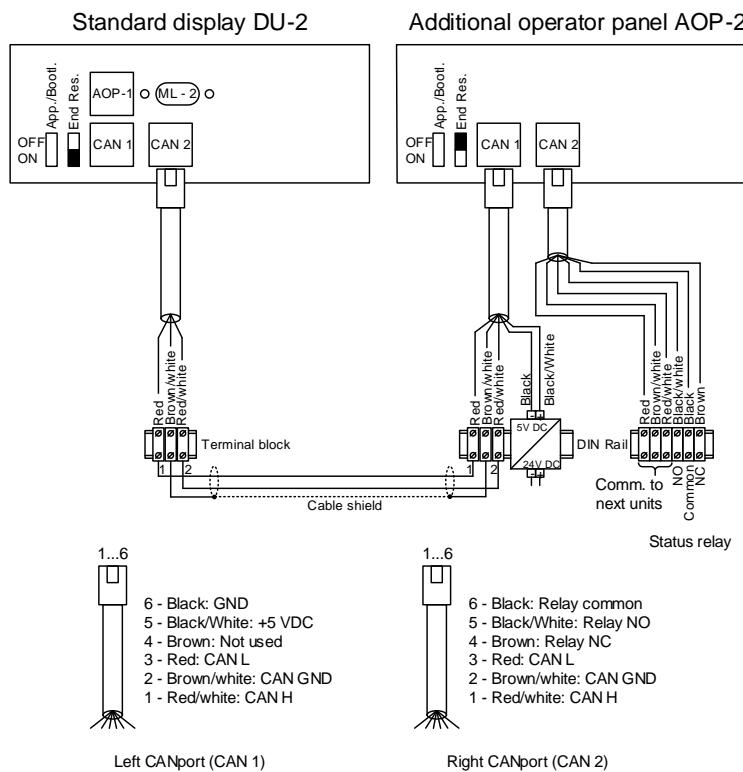
ⓘ **It is recommended to keep a fair distance to power cables.**

(i) **A DC/DC converter for the DC supply voltage and 2 × 1 m cable with an RJ12 plug in one end and stripped wires in the other end are included in the AOP-2 delivery.**

(i) **The cable between the terminal blocks should be shielded twisted pair.**

(i) **The maximum length of the CAN bus line is 200 m.**

7. Technical information

7.1 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/EN 60688
Operating temperature	-25 to 70 °C (-13 to 158 °F) With option N: -25 to 60 °C (-13 to 140 °F) (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 to 5 A) Consumption: max. 0.3 VA/phase
Current overload	$4 \times I_n$ continuously $20 \times I_n$, 10 s (max. 75 A) $80 \times I_n$, 1 s (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, ±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 The aux. supply inputs are to be protected by a 2 A slow-blow fuse (UL/cUL Listed: AWG 24)

Digital in-puts	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 Digital: max. resistance for ON detection: 100 Ω. Not galvanically separated Pt100/1000: -40 to 250 °C, +/-1 %. Not galvanically separated. To IEC/EN 60751 RMI: 0 to 1700 Ω, +/-2 %. Not galvanically separated V DC: 0 to 40 V DC, +/-1 %. Not galvanically separated
Relay out-puts	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 s, t_{OFF} = 15 s (Unit status output: 1 A)
Open col-lector out-puts	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 shar-ing 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 digital 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:	<200 ms	
	Generator:		
	Reverse power:	<200 ms	
	Over-current:	<200 ms	
	Fast over-current:	<40 ms	
	Over-/under-voltage:	<200 ms	
	Over-/under-frequency:	<300 ms	
	Overload:	<200 ms	
	Current unbalance:	<200 ms	
	Voltage unbalance:	<200 ms	
	React. power import:	<200 ms	
	React. power export:	<200 ms	
	Overspeed:	<400 ms	
	Digital inputs:	<250 ms	
	Emergency stop:	<200 ms	
	Multi-inputs:	<800 ms	
	Wire failure:	<600 ms	
	Mains:		
	df/dt (ROCOF):	<130 ms (4 periods)	
	Vector jump:	<40 ms	
	Positive sequence:	<60 ms	
	Time-dependent under-voltage, $U_t<$	<50 ms	
	Under-voltage and reactive power low, $U_Q<$	<250 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	GPC-3 and GPU-3: To EN 61000-6-2, EN 61000-6-4, IEC 60255-26. PPU-3: 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: 2 mm$_{pp}$. 13.2 to 100 Hz: 0.7 g. To IEC 60068-2-6 & IACS UR E10 10 to 60 Hz: 0.15 mm$_{pp}$. 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 con-nections	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 to 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
Tightening torque	See chapter Mounting and dimensions
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	Marine-approved by all major classification societies
	UL/cUL Listed to UL508. UL/cUL Recognized to UL2200
UL mark-ings	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:
	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)
	DC/DC converter for AOP-2:
	Wire size: AWG 22-14
Tightening torque	See chapter Mounting and dimensions
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.)