INSTALLATION INSTRUCTIONS

AGC-4 Mk II

4189341269B

1. General information

2. Mounting

3. Hardware

1. General information

1.1 Warnings, legal information and safety

1.1.1 Symbols for hazard statements

DANGER!

This highlights dangerous situations.

If the guidelines are not followed, these situations will result in death, serious personal injury, and equipment damage or destruction.

WARNING

This highlights potentially dangerous situations.

If the guidelines are not followed, these situations could result in death, serious personal injury, and equipment damage or destruction.

CAUTION

This highlights low level risk situation.

If the guidelines are not followed, these situations could result in minor or moderate injury.

NOTICE

This highlights an important notice

Make sure to read this information.

1.1.2 Symbols for general notes

NOTE This highlights general information.

More information
This highlights where you can find more information.

Example

This shows an example.

How to ...
This gives a link to a video for help and guidance.

1.1.3 Legal information and disclaimer

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

NOTE 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.

1.1.4 Safety during installation and operation

When you install and operate the equipment, you may have to work with dangerous currents and voltages. The installation must only be carried out by authorised personnel who understand the risks involved in working with electrical equipment.

DANGER!

Hazardous live currents and voltages

Do not touch any terminals, especially the AC measurement inputs and the relay terminals, as this could lead to injury or death.

1.1.5 Current transformer danger

DANGER!

Electrical shock and arc flash

Risk of burns and electrical shock from high voltage.

Short all current transformer secondaries before breaking any current transformer connections to the controller.

1.1.6 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.

1.1.7 Factory settings

The controller is delivered pre-programmed from the factory with a set of default settings. These settings are based on typical values and may not be correct for your system. You must therefore check all parameters before using the controller.

1.2 About the installation instructions

1.2.1 General purpose

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

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

CAUTION

Installation errors

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

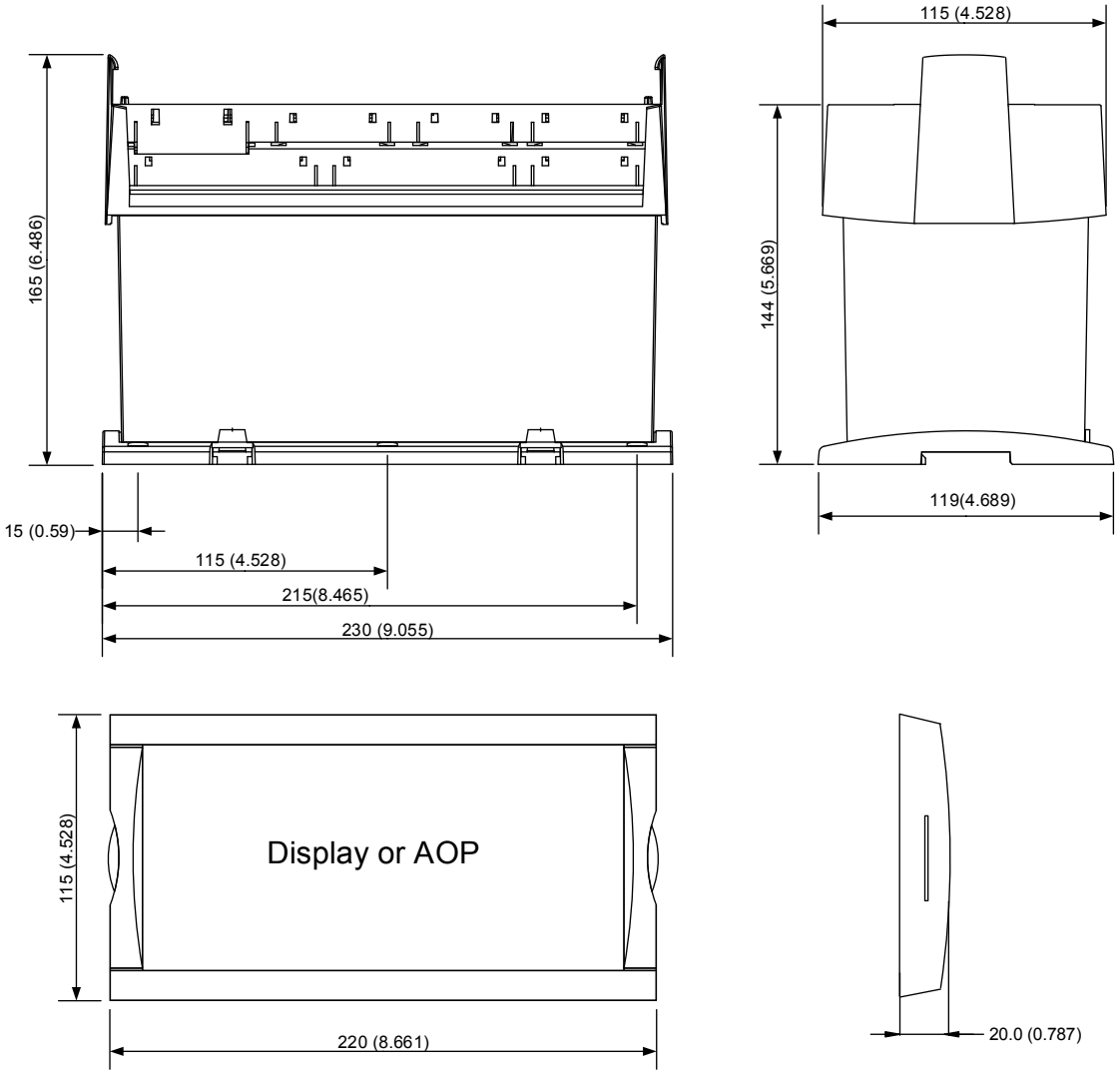
These Installation Instructions are mainly intended for the person responsible for the design and installation. In most cases, this would be a panel builder designer. Naturally, other users might also find useful information in the document.

1.2.3 Drawings

Refer to www.deif.com for the most recent 3D-files, drawings, E-drawings and E-plans.

2. Mounting

2.1 Dimensions



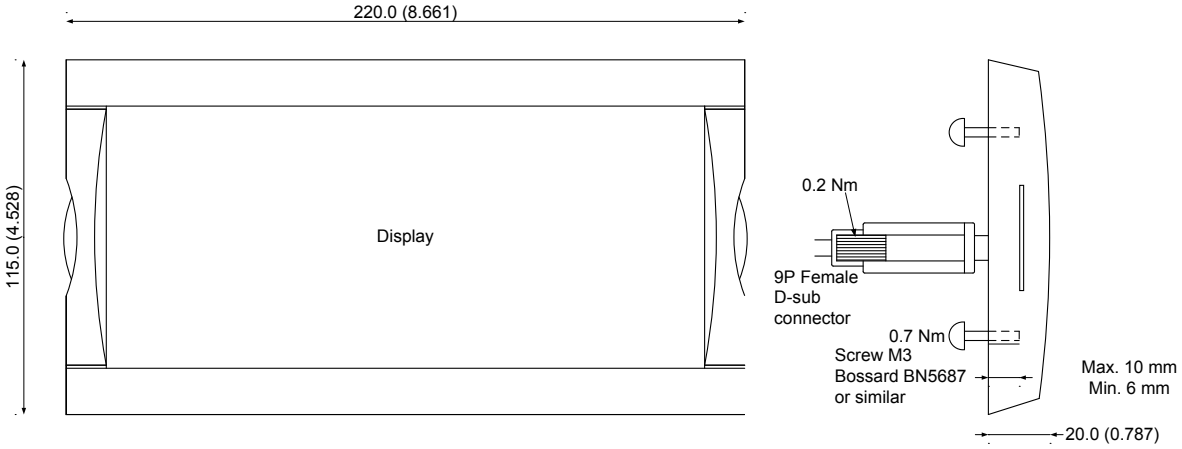
NOTE Dimensions are given in mm (inches).

2.2 Tightening torques

Controller:	1.5 Nm for the six M4 screws (countersunk screws are not to be used)
Plug connections (terminals):	0.5 Nm, 4.4 lb-in

DU-2/AOP-1/AOP-2 (see diagram below)

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



2.3 Mounting of the equipment

The controller is designed for mounting inside the panel. The DU-2 display can be installed on the panel door and connected to the controller with a display cable.

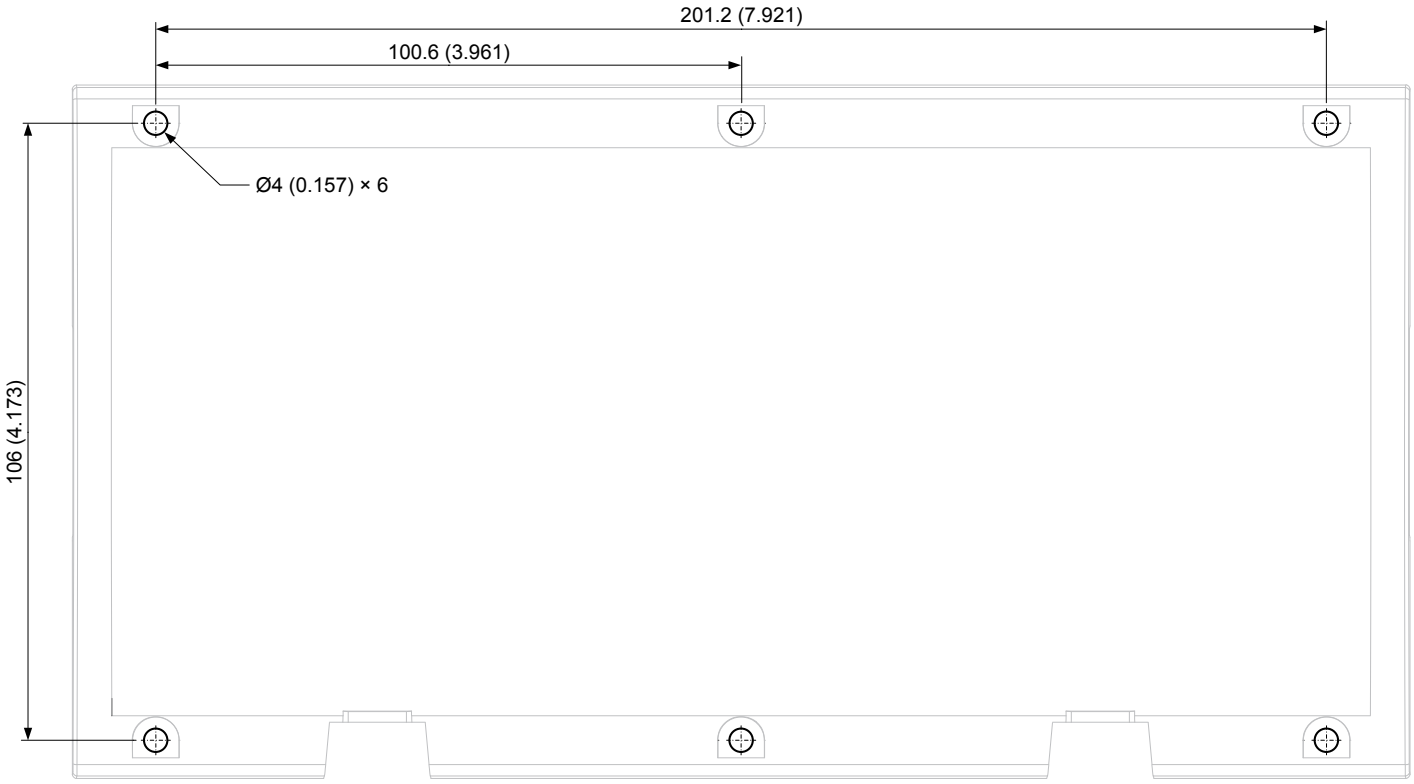
2.3.1 Controller mounting

The controller can be mounted:

1. With screws to the rear side of the cabinet. Six screw holes are available for this.
2. Directly on a DIN rail.

NOTE DEIF recommends using the screw hole fastening.

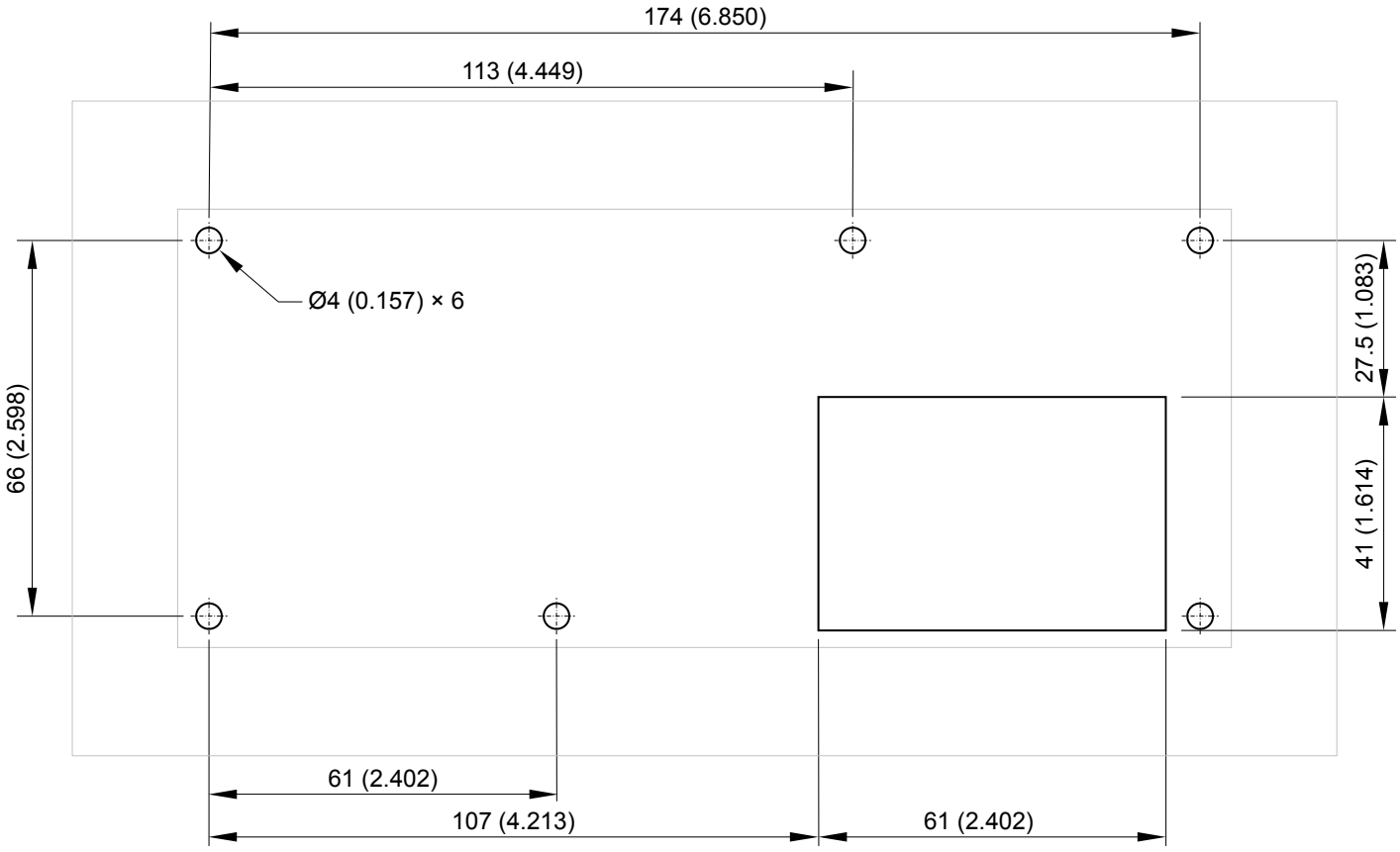
2.3.2 Controller mounting drilling diagram



NOTE Measurements are in mm (inches).

2.3.3 DU-2/AOP display panel cutout

Cut and drill the panel door for the DU-2/AOP according to the diagram below.

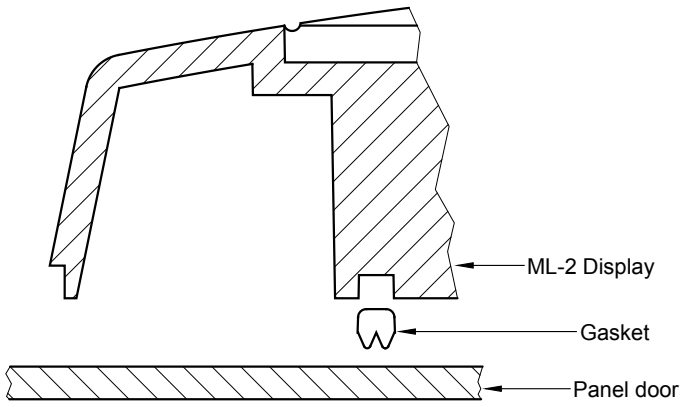


NOTE Dimensions are in mm (inches).

2.3.4 Mounting of DU-2/AOP gasket (option L1)

It is important to mount the gasket correctly to have an IP65 seal. You must use all six DU-2 or AOP screws to ensure IP65.

Mount the gasket as shown below.



3. Hardware

3.1 Board slot positions

The controller housing is divided into board slot positions. This means that the controller consists of a number of printed circuit boards (PCB) 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 shown below.

NOTE Only the controller hardware options are included in the table. The software options are listed in the PC utility software, and can also be seen in the data sheet.

Slot type	Option	Slot #1	Slot #3	Slot #5	Slot #7
Terminals		1-28	37-64	73-89	98-125
Power supply	Standard	X			
AC measurements	Standard			X	
Engine interface	Standard/M4				X
Power management	G5				X
I/O extension/load sharing*	M12		X		

Slot type	Option	Slot #2	Slot #4	Slot #6	Slot #8
Terminals		29-34	65-72	90-97	126-133
Analogue transducer outputs	F1			X	
Combination outputs	EF5/EF6		X		
Serial communication	H2/H3/H9	X			
Engine communication	H6/H13				X
CAN bus communication for engine communication, DVC, and/or external I/O**	H12.2/H12.8***	X			X
I/O extension cards	M13.2/M14.2	X			
I/O extension cards	M13.6/M14.6/M15.6/M16.6			X	
I/O extension cards	M13.8/M14.8/M15.8/M16.8				X

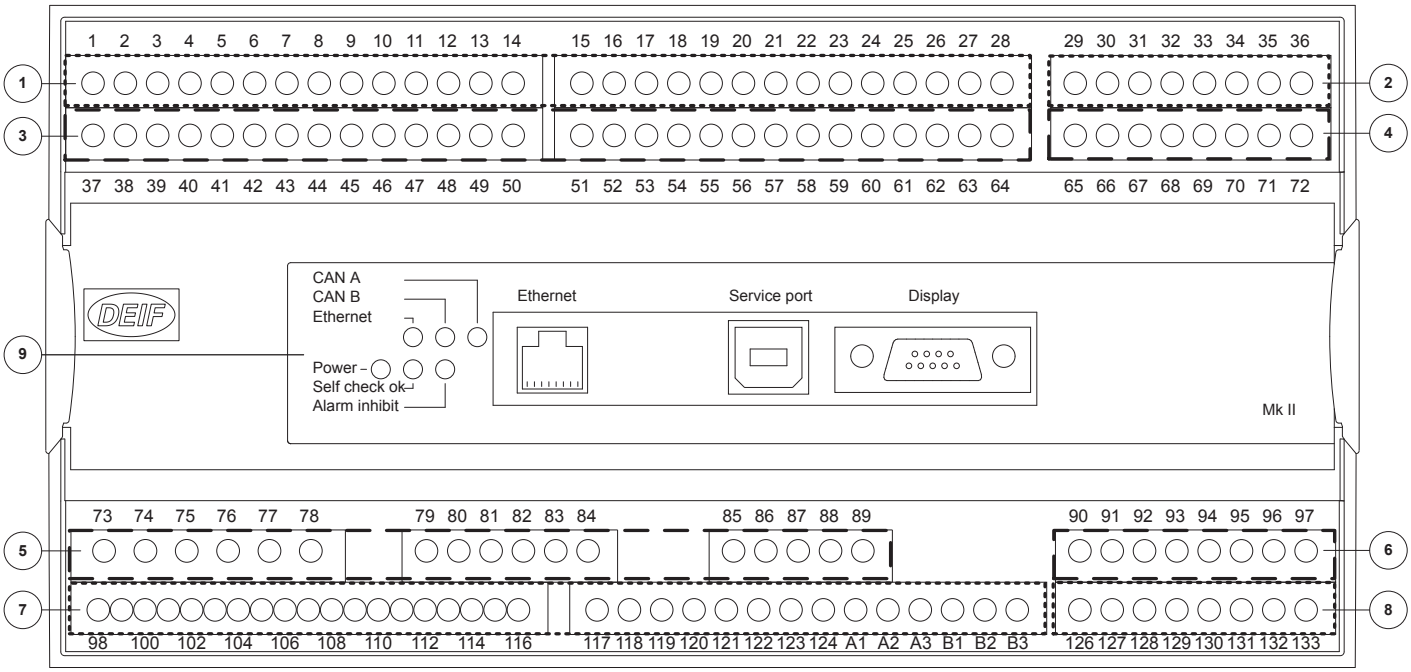
NOTE * Analogue load sharing (option G3) is standard when option M12 is installed.

NOTE ** The CIOs and IOMs can be connected in series with engine or DVC communication. The group controller uses H12.2 or H12.8 for extended power management CAN communication.

NOTE *** Select either H12.2 or H12.8 (not both).

3.2 Controller top side overview

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

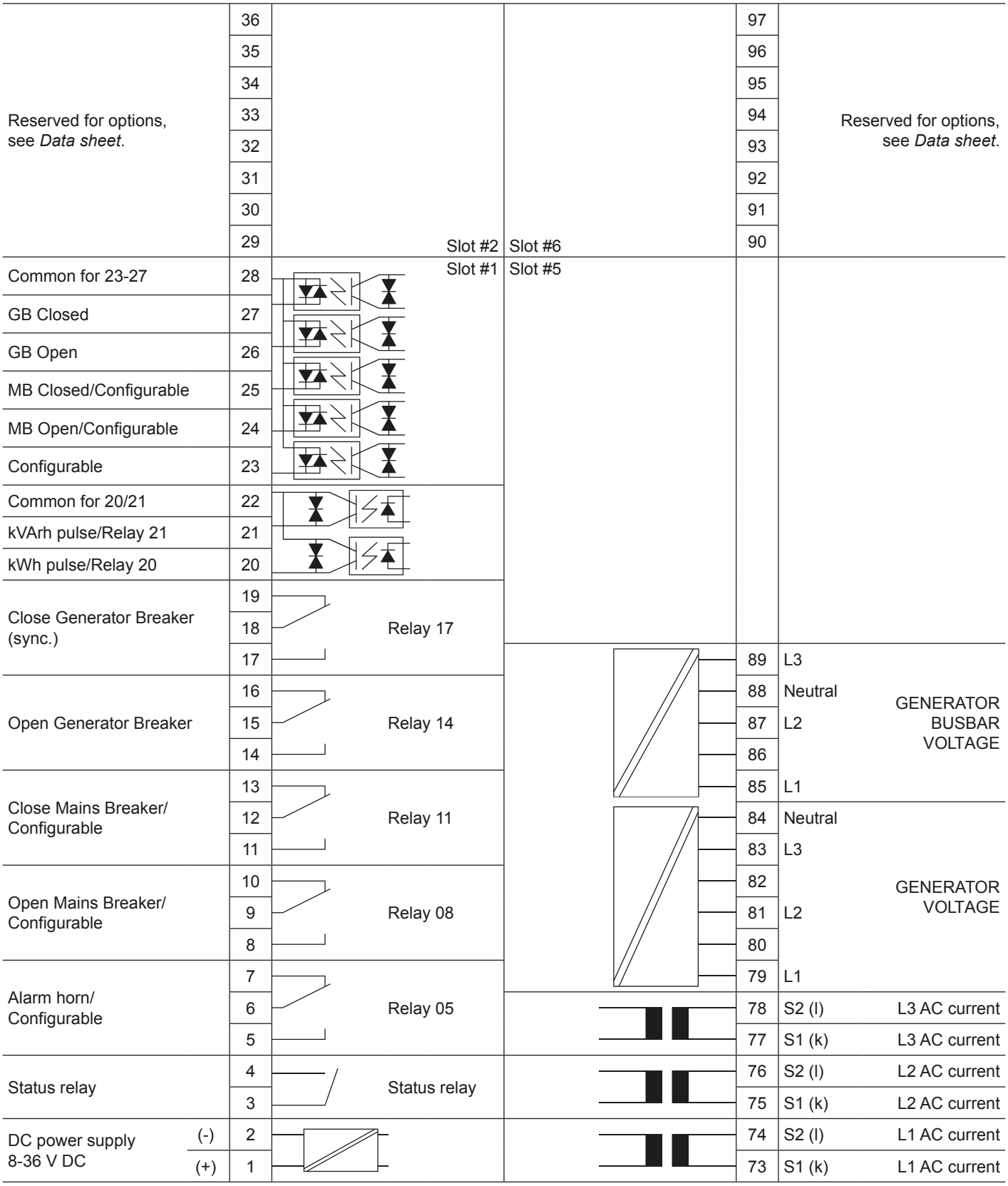


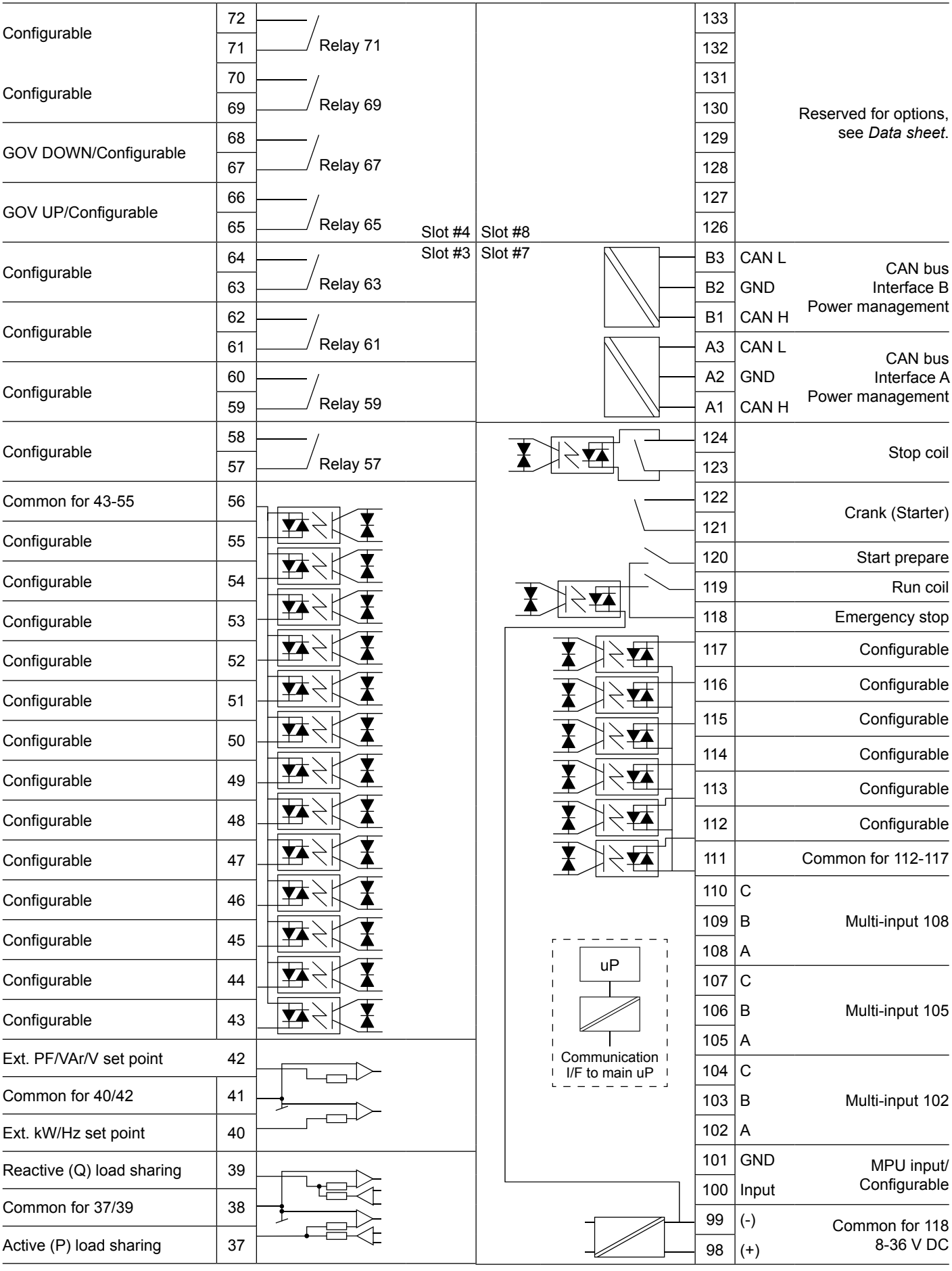
(1): The numbers in the drawing above refer to the slot numbers indicated in the table below.

Slot	Terminals	Function
1	1-28	Power supply (standard)
2	29-36	Communication and I/O extensions
3	37-64	In-/outputs/load sharing
4	65-72	Governor, AVR, in-/outputs (standard)
5	73-89	AC measuring (standard)
6	90-97	In-/outputs
7	98-125	Engine I/F (standard)
8	126-133	Engine communication, in-/outputs
9	-	Interfaces and LEDs

3.3 Terminal strip overviews

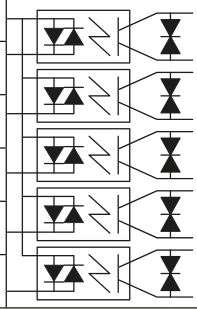
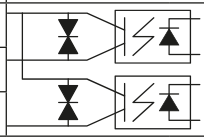
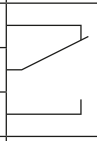
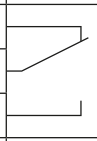
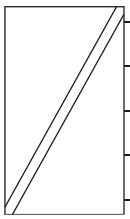
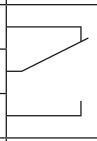
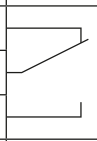
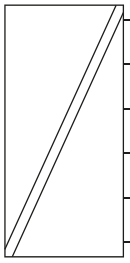
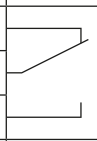
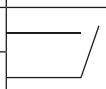
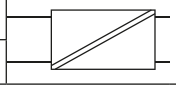
3.3.1 Genset controller

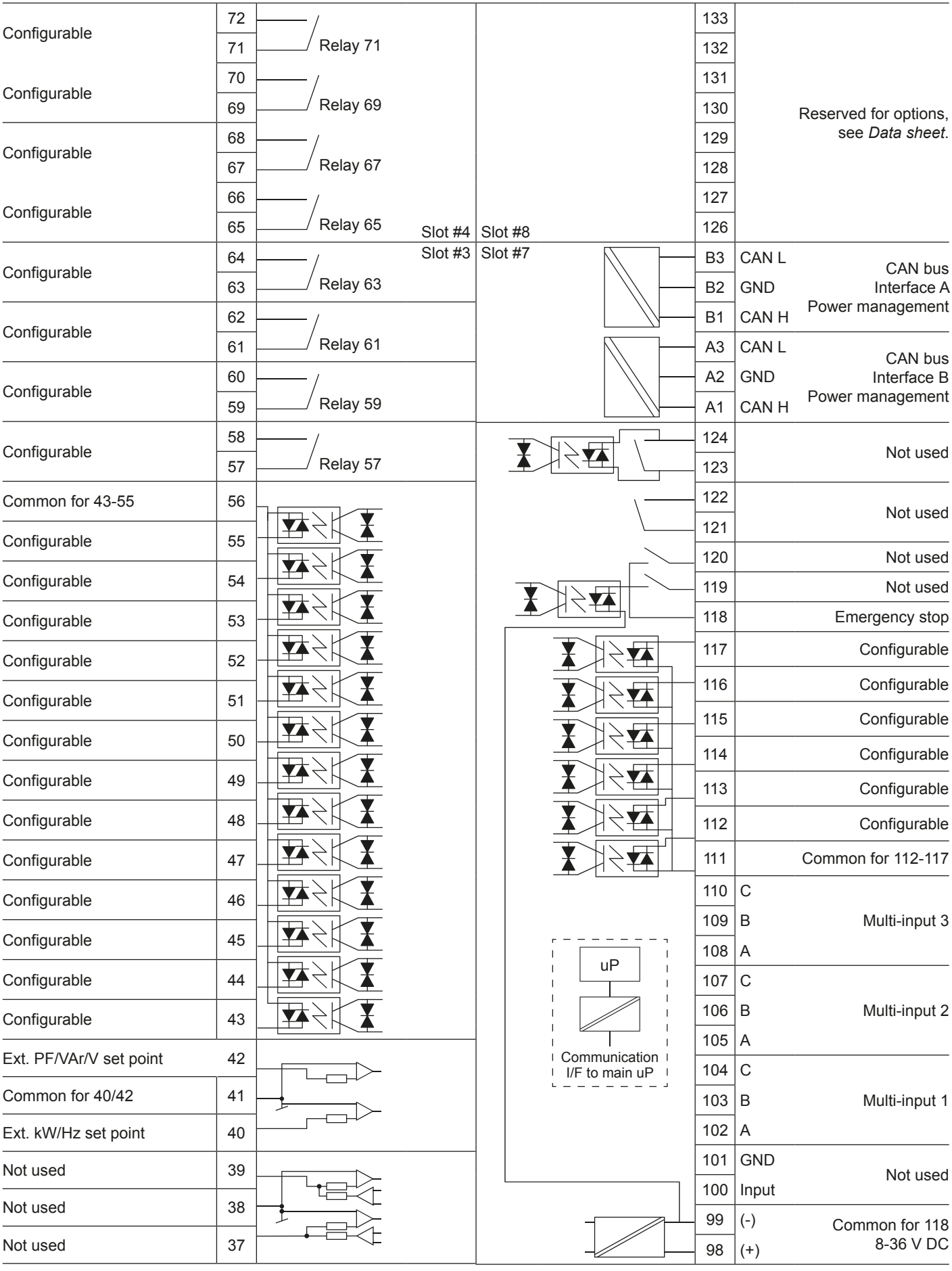




NOTE The hardware shown in slot #3 is option M12. For details, see the option manual.

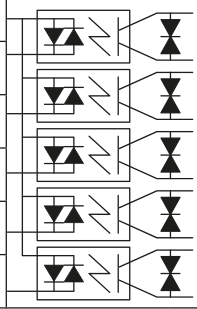
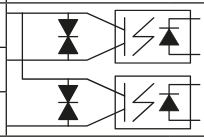
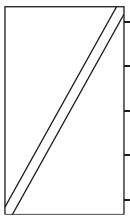
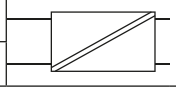
3.3.2 Mains controller

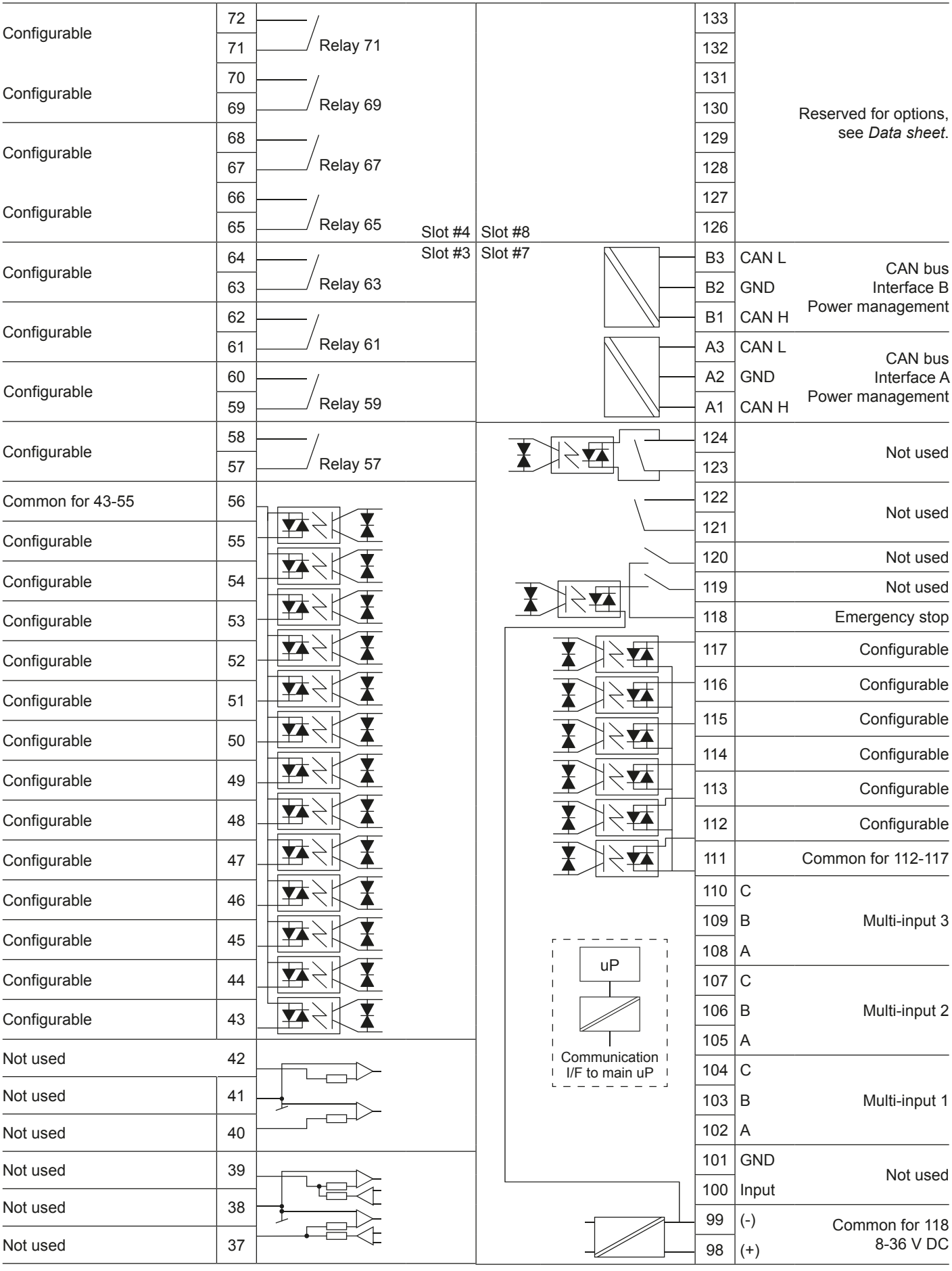
Reserved for options, see *Data sheet*.	36				97	Reserved for options, see *Data sheet*.	
	35				96		
	34				95		
	33				94		
	32				93		
	31				92		
	30				91		
	29		Slot #2	Slot #6	90		
Common for 23-27	28		Slot #1	Slot #5			
TB Closed/Configurable	27						
TB Open/Configurable	26						
MB Closed/Configurable	25						
MB Open/Configurable	24						
Configurable	23						
Common for 20/21	22						
kVArh pulse/Relay 21	21						
kWh pulse/Relay 20	20						
Close Tie Breaker/ Configurable	19		Relay 17				
	18						
	17				89	L3	BUSBAR VOLTAGE
Open Tie Breaker/ Configurable	16		Relay 14		88	Neutral	
	15				87	L2	
	14				86		
Close Mains Breaker/ Configurable	13		Relay 11		85	L1	
	12				84	Neutral	MAINS VOLTAGE
	11				83	L3	
Open Mains Breaker/ Configurable	10		Relay 08		82		
	9				81	L2	
	8				80		
Alarm horn/ Configurable	7		Relay 05		79	L1	
	6				78	S2 (l)	L3 AC current
	5				77	S1 (k)	L3 AC current
Status relay	4		Status relay		76	S2 (l)	L2 AC current
	3				75	S1 (k)	L2 AC current
DC power supply 8-36 V DC (-)	2				74	S2 (l)	L1 AC current
(+)	1				73	S1 (k)	L1 AC current



NOTE The hardware shown in slot #3 is option M12. For details, see the option manual.

3.3.3 BTB controller

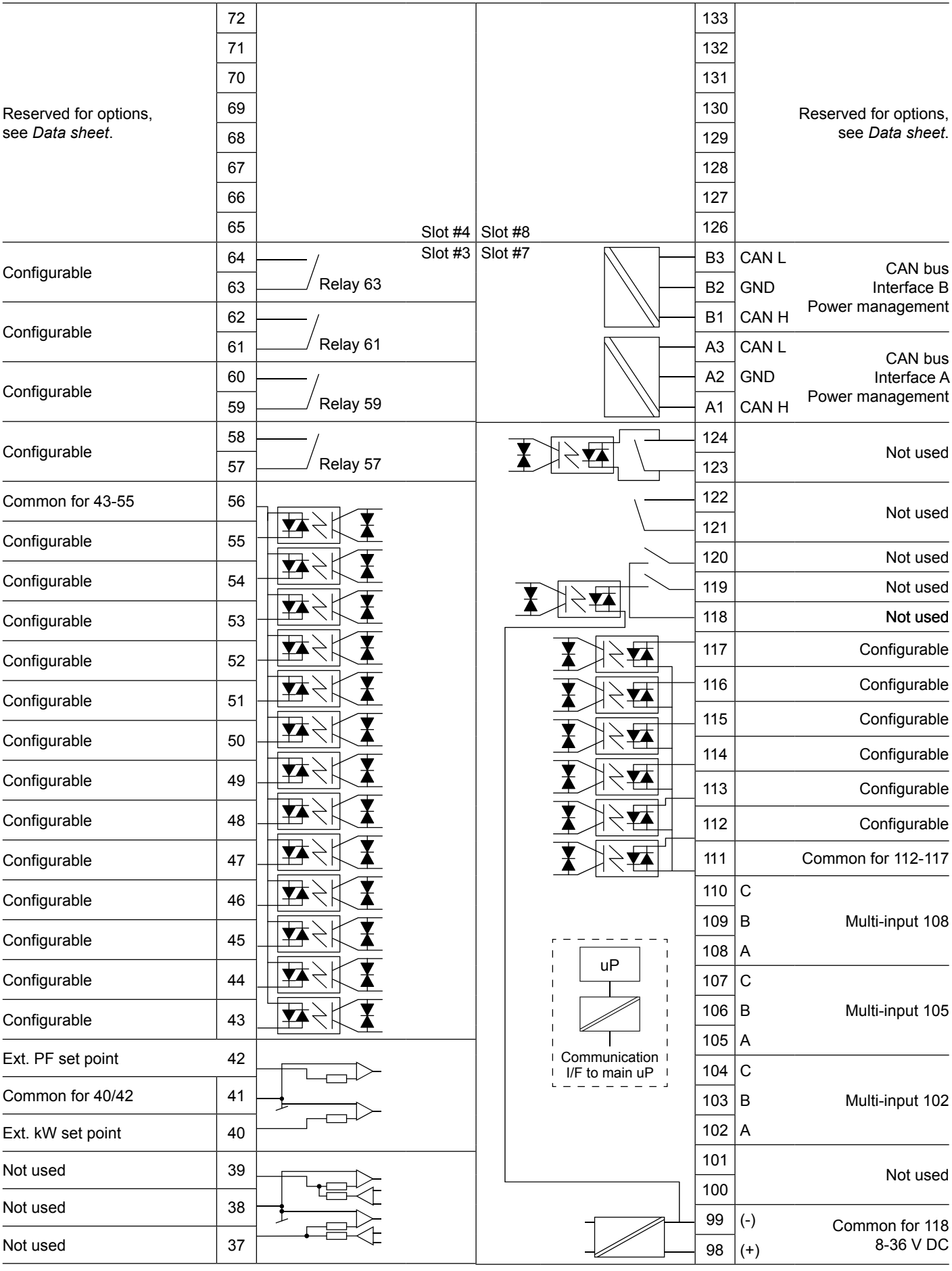
Reserved for options, see *Data sheet*.	36				97	Reserved for options, see *Data sheet*.	
	35				96		
	34				95		
	33				94		
	32				93		
	31				92		
	30				91		
	29		Slot #2	Slot #6	90		
Common for 23-27	28		Slot #1	Slot #5			
BTB Closed/Configurable	27						
BTB Open/Configurable	26						
Configurable	25						
Configurable	24						
Configurable	23						
Common for 20/21	22						
kVArh pulse/Relay 21	21						
kWh pulse/Relay 20	20						
Close Bus Tie Breaker/ Configurable	19		Relay 17				
	18						
	17				89	L3	BUSBAR B VOLTAGE
Open Bus Tie Breaker/ Configurable	16		Relay 14		88	Neutral	
	15				87	L2	
	14				86		
Configurable	13		Relay 11		85	L1	
	12				84	Neutral	BUSBAR A VOLTAGE
	11				83	L3	
Configurable	10		Relay 08		82		
	9				81	L2	
	8				80		
Alarm horn/ Configurable	7		Relay 05		79	L1	
	6				78	S2 (I)	L3 AC current
	5				77	S1 (k)	L3 AC current
Status relay	4		Status relay		76	S2 (I)	L2 AC current
	3				75	S1 (k)	L2 AC current
DC power supply 8-36 V DC (-)	2				74	S2 (I)	L1 AC current
(+)	1				73	S1 (k)	L1 AC current



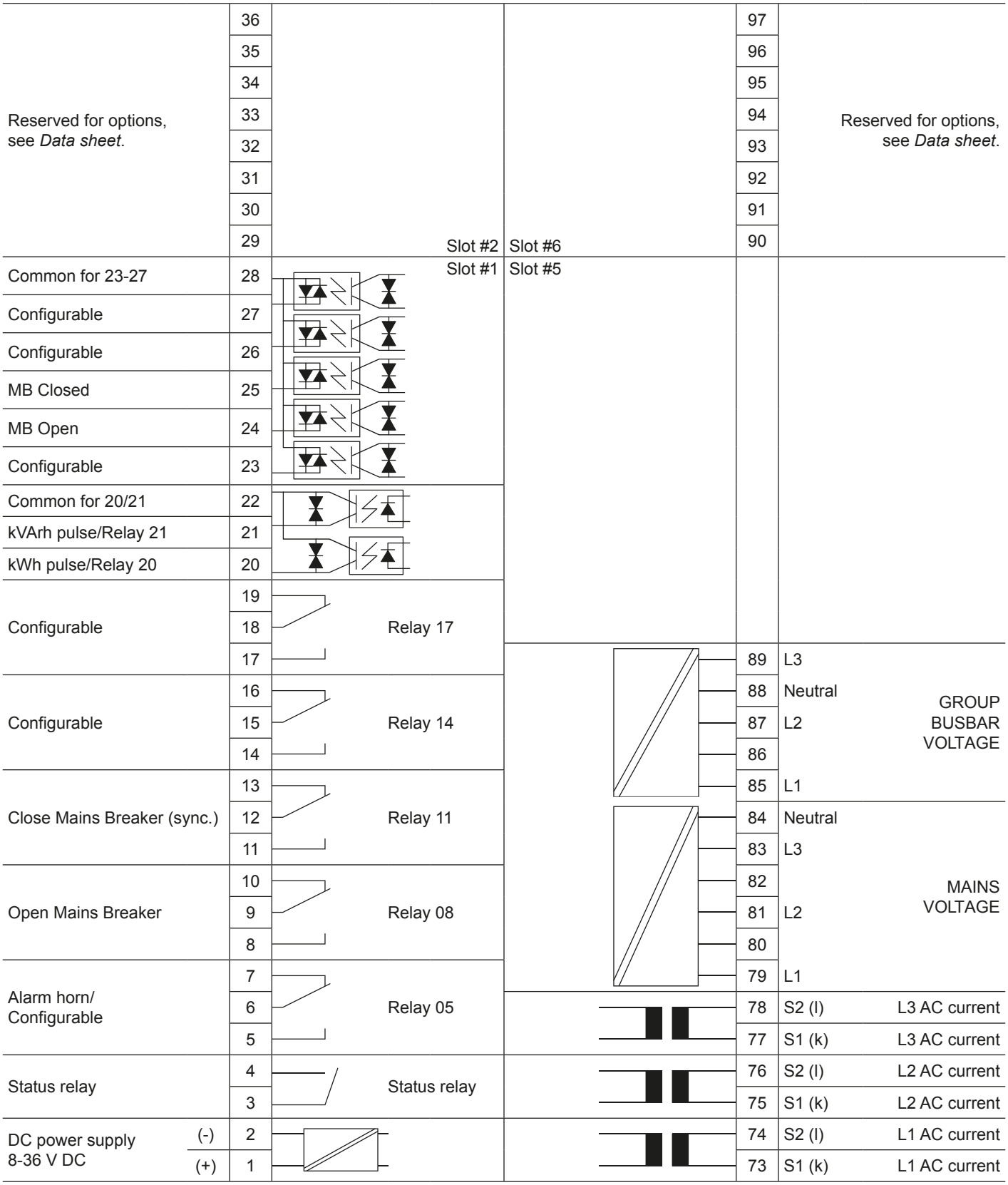
NOTE The hardware shown in slot #3 is option M12. For details, see the option manual.

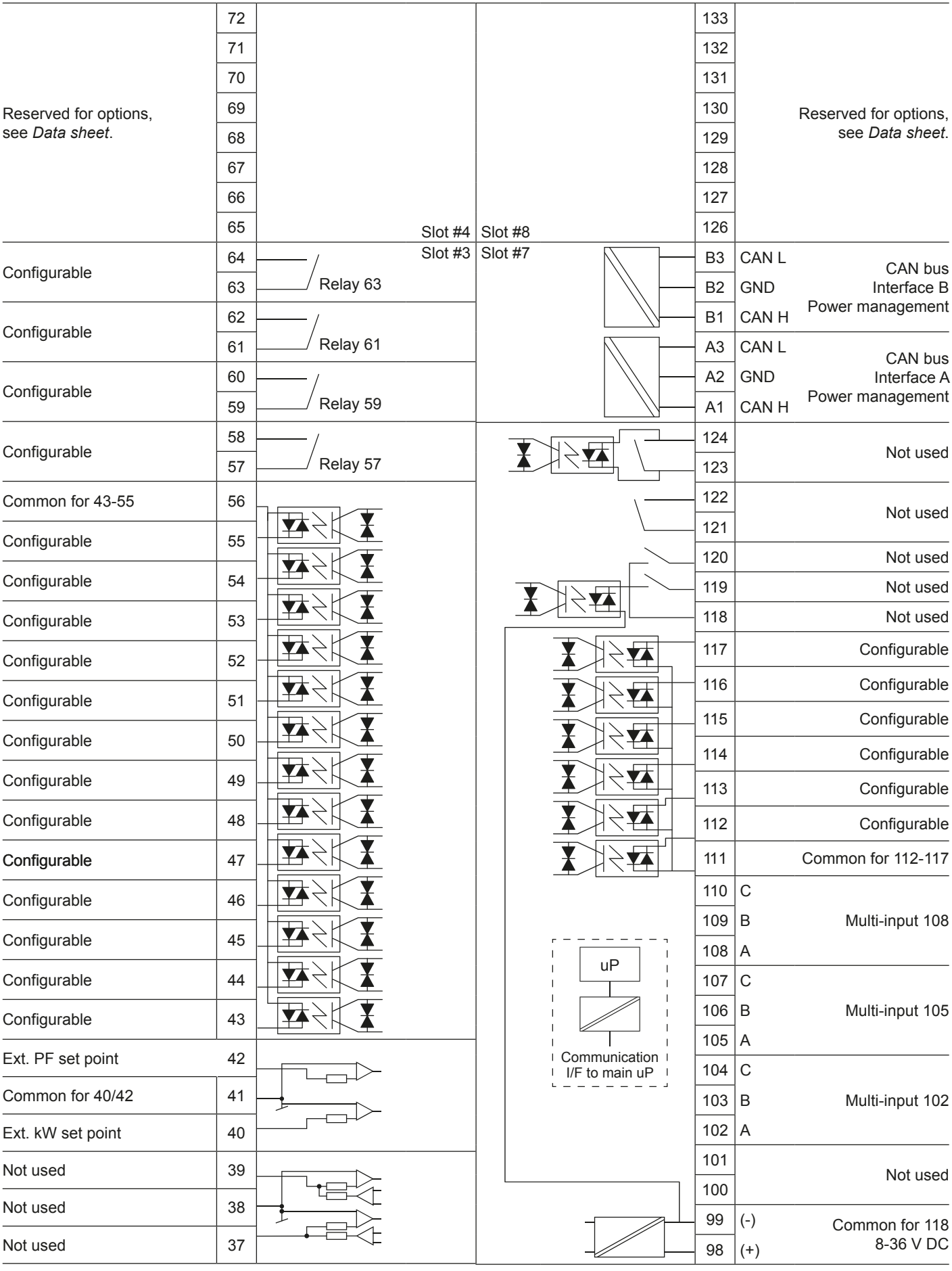
3.3.4 Group controller

3-level application communication to Group/Plant	Not used	36			97	Reserved for options, see *Data sheet*.	
	Not used	35			96		
	CAN L	34			95		
	GND	33			94		
	CAN H	32			93		
	CAN L	31			92		
	GND	30			91		
	CAN H	29	Slot #2	Slot #6	90		
Common for 23-27		28	Slot #1	Slot #5			
TB Closed		27					
TB Open		26					
Configurable		25					
Configurable		24					
Configurable		23					
Common for 20/21		22					
kVArh pulse/Relay 21		21					
kWh pulse/Relay 20		20					
Close Tie Breaker (sync.)		19					
		18	Relay 17				
		17			89	L3	
Open Tie Breaker		16			88	Neutral	GENERATOR BUSBAR VOLTAGE
		15	Relay 14		87	L2	
		14			86		
Configurable		13			85	L1	
		12	Relay 11		84	Neutral	
		11			83	L3	
Configurable		10			82		GROUP BUSBAR VOLTAGE
		9	Relay 08		81	L2	
		8			80		
Alarm horn/ Configurable		7			79	L1	
		6	Relay 05		78	S2 (l)	L3 AC current
		5			77	S1 (k)	L3 AC current
Status relay		4			76	S2 (l)	L2 AC current
		3	Status relay		75	S1 (k)	L2 AC current
DC power supply 8-36 V DC	(-)	2			74	S2 (l)	L1 AC current
	(+)	1			73	S1 (k)	L1 AC current


Reserved for options, see *Data sheet*.
72
71
70
69
68
67
66
65
Slot #4
Slot #8
133
132
131
130
129
128
127
126
Reserved for options, see *Data sheet*.
Slot #3
Slot #7
Configurable
64
63
Relay 63
Configurable
62
61
Relay 61
Configurable
60
59
Relay 59
Configurable
58
57
Relay 57
Common for 43-55
56
Configurable
55
Configurable
54
Configurable
53
Configurable
52
Configurable
51
Configurable
50
Configurable
49
Configurable
48
Configurable
47
Configurable
46
Configurable
45
Configurable
44
Configurable
43
Ext. PF set point
42
Common for 40/42
41
Ext. kW set point
40
Not used
39
Not used
38
Not used
37
B3
B2
B1
CAN L
GND
CAN H
CAN bus Interface B Power management
A3
A2
A1
CAN L
GND
CAN H
CAN bus Interface A Power management
124
123
Not used
122
121
Not used
120
Not used
119
Not used
118
Not used
117
Configurable
116
Configurable
115
Configurable
114
Configurable
113
Configurable
112
Configurable
111
Common for 112-117
uP
Communication I/F to main uP
110
109
108
C
B
A
Multi-input 108
107
106
105
C
B
A
Multi-input 105
104
103
102
C
B
A
Multi-input 102
101
100
Not used
99
98
(-)
(+)
Common for 118 8-36 V DC

3.3.5 Plant controller




Reserved for options, see *Data sheet*.
72
71
70
69
68
67
66
65
Slot #4
Slot #8
133
132
131
130
129
128
127
126
Reserved for options, see *Data sheet*.
Slot #3
Slot #7
Configurable
64
63
Relay 63
Configurable
62
61
Relay 61
Configurable
60
59
Relay 59
Configurable
58
57
Relay 57
Common for 43-55
56
Configurable
55
Configurable
54
Configurable
53
Configurable
52
Configurable
51
Configurable
50
Configurable
49
Configurable
48
Configurable
47
Configurable
46
Configurable
45
Configurable
44
Configurable
43
Ext. PF set point
42
Common for 40/42
41
Ext. kW set point
40
Not used
39
Not used
38
Not used
37
B3
B2
B1
CAN L
GND
CAN H
CAN bus Interface B Power management
A3
A2
A1
CAN L
GND
CAN H
CAN bus Interface A Power management
124
123
Not used
122
121
Not used
120
Not used
119
Not used
118
Not used
117
Configurable
116
Configurable
115
Configurable
114
Configurable
113
Configurable
112
Configurable
111
Common for 112-117
uP
Communication I/F to main uP
110
109
108
C
B
A
Multi-input 108
107
106
105
C
B
A
Multi-input 105
104
103
102
C
B
A
Multi-input 102
101
100
Not used
99
98
(-)
(+)
Common for 118
8-36 V DC

3.4 Input/output lists

The I/O lists use these abbreviations for the relay outputs:

NO: Normally Open
NC: Normally Closed
NE: Normally Energised
ND: Normally De-energised
Com.: Common terminal

3.5 Slot 1

3.5.1 Power supply - Genset controller

Term.	Function	Technical data	Description
1	+12/24 V DC	12/24 V DC +/-30 %	Power supply
2	0 V DC		
3	NO	Status relay 24 V DC/1 A	Normally open relay, processor/power supply status supervision
4	Com.		
5	NO	Relay 05 250 V AC/8 A	Central alarm HORN/configurable
6	Com.		
7	NC		
8	NO	Relay 08 250 V AC/8 A	Open mains breaker/configurable
9	Com.		
10	NC		
11	NO	Relay 11 250 V AC/8 A	Close mains breaker (synchronising)/configurable
12	Com.		
13	NC		
14	NO	Relay 250 V AC/8 A	Open generator breaker
15	Com.		
16	NC		
17	NO	Relay 250 V AC/8 A	Close generator breaker (synchronising)
18	Com.		
19	NC		
20	Open collector 1	Transistor output/Relay 20	Pulse output 1, kWh counter/configurable
21	Open collector 2	Transistor output/Relay 21	Pulse output 2, kvarh counter/configurable
22	Com.	Common	Common terminal for terminals 20 and 21
23	Digital input 23	Optocoupler	Configurable
24	Digital input 24	Optocoupler	Mains breaker open/configurable
25	Digital input 25	Optocoupler	Mains breaker closed/configurable
26	Digital input 26	Optocoupler	Generator breaker open
27	Digital input 27	Optocoupler	Generator breaker closed
28	Com.	Common	Common for terminals 23 to 27

3.5.2 Power supply - Mains controller

Term.	Function	Technical data	Description
1	+12/24 V DC	12/24 V DC +/-30 %	Power supply
2	0 V DC		
3	NO	Status relay 24 V DC/1 A	Normally open relay, processor/power supply status supervision
4	Com.		

Term.	Function	Technical data	Description
5	NO	Relay 05 250 V AC/8 A	Central alarm HORN/configurable
6	Com.		
7	NC		
8	NO	Relay 08 250V AC/8 A	Open mains breaker/configurable
9	Com.		
10	NC		
11	NO	Relay 11 250 V AC/8 A	Close mains breaker (synchronising)/configurable
12	Com.		
13	NC		
14	NO	Relay 14 250 V AC/8 A	Open tie breaker/configurable
15	Com.		
16	NC		
17	NO	Relay 17 250 V AC/8 A	Close tie breaker (synchronising)/configurable
18	Com.		
19	NC		
20	Open collector 1	Transistor output/Relay 20	Pulse output 1, kWh counter/configurable
21	Open collector 2	Transistor output/Relay 21	Pulse output 2, kvarh counter/configurable
22	Com.	Common	Common terminal for terminals 20 and 21
23	Digital input 23	Optocoupler	Configurable
24	Digital input 24	Optocoupler	Mains breaker open/configurable
25	Digital input 25	Optocoupler	Mains breaker closed/configurable
26	Digital input 26	Optocoupler	Tie breaker open/configurable
27	Digital input 27	Optocoupler	Tie breaker closed/configurable
28	Com.	Common	Common for terminals 23 to 27

3.5.3 Power supply - BTB controller

Term.	Function	Technical data	Description
1	+12/24 V DC	12/24 V DC +/-30 %	Power supply
2	0 V DC		
3	NO	Status relay 24 V DC/1 A	Normally open relay, processor/power supply status supervision
4	Com.		
5	NO	Relay 05 250 V AC/8 A	Central alarm HORN/configurable
6	Com.		
7	NC		
8	NO	Relay 08 250 V AC/8 A	Configurable
9	Com.		
10	NC		

Term.	Function	Technical data	Description
11	NO	Relay 11 250 V AC/8 A	Configurable
12	Com.		
13	NC		
14	NO	Relay 250 V AC/8 A	Open bus tie breaker
15	Com.		
16	NC		
17	NO	Relay 250 V AC/8 A	Close bus tie breaker (synchronising)
18	Com.		
19	NC		
20	Open collector 1	Transistor output/Relay 20	Configurable
21	Open collector 2	Transistor output/Relay 21	Configurable
22	Com.	Common	Common terminal for terminals 20 and 21
23	Digital input 23	Optocoupler	Configurable
24	Digital input 24	Optocoupler	Configurable
25	Digital input 25	Optocoupler	Configurable
26	Digital input 26	Optocoupler	Configurable
27	Digital input 27	Optocoupler	Configurable
28	Com.	Common	Common for terminals 23 to 27

3.5.4 Power supply - Group controller

Term.	Function	Technical data	Description
1	+12/24 V DC	12/24 V DC +/-30 %	Power supply
2	0 V DC		
3	NO	Status relay 24 V DC/1 A	Normally open relay, processor/power supply status supervision
4	Com.		
5	NO	Relay 05 250 V AC/8 A	Central alarm HORN/configurable
6	Com.		
7	NC		
8	NO	Relay 08 250 V AC/8 A	Configurable
9	Com.		
10	NC		
11	NO	Relay 11 250 V AC/8 A	Configurable
12	Com.		
13	NC		
14	NO	Relay 250 V AC/8 A	Open tie breaker
15	Com.		
16	NC		

Term.	Function	Technical data	Description
17	NO	Relay 250 V AC/8 A	Close tie breaker (synchronising)
18	Com.		
19	NC		
20	Open collector 1	Transistor output/Relay 20	Configurable
21	Open collector 2	Transistor output/Relay 21	Configurable
22	Com.	Common	Common terminal for terminals 20 and 21
23	Digital input 23	Optocoupler	Configurable
24	Digital input 24	Optocoupler	Configurable
25	Digital input 25	Optocoupler	Configurable
26	Digital input 26	Optocoupler	Tie breaker open
27	Digital input 27	Optocoupler	Tie breaker closed/configurable
28	Com.	Common	Common for terminals 23 to 27

3.5.5 Power supply - Plant controller

Term.	Function	Technical data	Description
1	+12/24 V DC	12/24 V DC +/-30 %	Power supply
2	0 V DC		
3	NO	Status relay 24 V DC/1 A	Normally open relay, processor/power supply status supervision
4	Com.		
5	NO	Relay 05 250 V AC/8 A	Central alarm HORN/configurable
6	Com.		
7	NC		
8	NO	Relay 08 250 V AC/8 A	Open mains breaker/configurable
9	Com.		
10	NC		
11	NO	Relay 11 250 V AC/8 A	Close mains breaker (synchronising)/configurable
12	Com.		
13	NC		
14	NO	Relay 250 V AC/8 A	Configurable
15	Com.		
16	NC		
17	NO	Relay 250 V AC/8 A	Configurable
18	Com.		
19	NC		
20	Open collector 1	Transistor output/Relay 20	Pulse output 1, kWh counter/configurable
21	Open collector 2	Transistor output/Relay 21	Pulse output 2, kvarh counter/configurable
22	Com.	Common	Common terminal for terminals 20 and 21
23	Digital input 23	Optocoupler	Configurable
24	Digital input 24	Optocoupler	Mains breaker open/Configurable

Term.	Function	Technical data	Description
25	Digital input 25	Optocoupler	Mains breaker closed/configurable
26	Digital input 26	Optocoupler	Configurable
27	Digital input 27	Optocoupler	Configurable
28	Com.	Common	Common for terminals 23 to 27

3.6 Slot 2

3.6.1 Serial communication (option H)

Modbus RTU, RS-485 (option H2)

Term.	Function	Description
29	DATA + (A)	Modbus RTU, RS-485
30	GND	
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.

NOTE Never connect the GND terminal 30 to earth. Only connect it to a third wire in the communication cable!

Modbus RTU, RS-232 (option H9)

Term.	Function	Description
29	Not used	Modbus RTU, RS-232
30	GND	
31	Not used	
32	TxD	
33	Not used	
34	RxD	
35	Not used	
36	Not used	

NOTE Never connect the GND terminal 30 to earth. Only connect it to a third wire in the communication cable!

Profibus (option H3)

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

NOTE Never connect the GND terminal 30 to earth. Only connect it to a third wire in the communication cable!

3.6.2 Dual CAN (option H12.2)

Term.	Function	Description
29	CAN-H	The H12 dual CAN bus can be used for: • Engine interface communication • DVC 550 communication • External I/O module (CIO 116/208/308 and/or IOM 220/230) • Group controller: Extended power management (option G7) communication The terminals are configurable: Terminals 29-31: CAN C Terminals 32-34: CAN D
30	CAN-GND	
31	CAN-L	
32	CAN-H	
33	CAN-GND	
34	CAN-L	
35	Not used	
36	Not used	

3.6.3 7 digital inputs (option M13.2)

Term.	Function	Technical data	Description
29	Digital input 29	Optocoupler	Configurable
30	Digital input 30	Optocoupler	Configurable
31	Digital input 31	Optocoupler	Configurable
32	Digital input 32	Optocoupler	Configurable
33	Digital input 33	Optocoupler	Configurable
34	Digital input 34	Optocoupler	Configurable
35	Digital input 35	Optocoupler	Configurable
36	Com.	Optocoupler	Common for terminals 29 to 35

3.6.4 Relay outputs (option M14.2)

Term.	Function	Technical data	Description
29	NE/ND	Relay 29 250 V AC/5 A	Configurable
30	Com.		
31	NE/ND	Relay 31 250 V AC/5 A	Configurable
32	Com.		
33	NE/ND	Relay 33 250 V AC/5 A	Configurable
34	Com.		
35	NE/ND	Relay 35 250 V AC/5 A	Configurable
36	Com.		

3.7 Slot 3

3.7.1 Load sharing, 13 digital inputs, 4 relay outputs (option M12)

Term.	Function	Technical data	Description
37	-5 to 0 to 5 V DC	Analogue load sharing	Active load sharing line
38	Com.	Common	Common for load sharing lines
39	-5 to 0 to 5 V DC	Analogue load sharing	Reactive load sharing
40	-10/+10 V DC	Analogue input	f/P set point
41	Com.	Common	Common for 40/42
42	-10/+10 V DC	Analogue input	U/Q set point
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 to 55
57	NE/ND	Relay 57 250 V AC/5 A	Configurable
58	Com.		
59	NE/ND	Relay 59 250 V AC/5 A	Configurable
60	Com.		
61	NE/ND	Relay 61 250 V AC/5 A	Configurable
62	Com.		
63	NE/ND	Relay 63 250 V AC/5 A	Configurable
64	Com.		

3.8 Slot 4

3.8.1 Relay outputs (option M14.4, standard)

Term.	Function	Technical data	Description
65	NE/ND	Relay 65 250 V AC/5 A	Generator GOV: Increase frequency/configurable
66	Com.		
67	NE/ND	Relay 67 250 V AC/5 A	Generator GOV: Decrease frequency/configurable
68	Com.		
69	Not used	Relay 69 250 V AC/5 A	Configurable
70	Com.		
71	Not used	Relay 71 250 V AC/5 A	Configurable
72	Com.		

3.8.2 PWM, relay and analogue outputs for GOV/AVR (option EF5)

Term.	Function	Description
65	+/-25 mA	AVR set point output
66	0	
67	PWM +	PWM speed governor signal
68	PWM -	
69	NO	Relay output for AVR. Raise voltage
70	Com.	
71	NO	Relay output for AVR. Lower voltage
72	Com.	

NOTE AVR control requires option D1.

3.8.3 PWM and analogue outputs for GOV/AVR (option EF6)

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

NOTE Connect PWM - to the engine battery negative and PWM + to the engine control system S-SPD (speed) input (called RATED SPEED on the ADEM controller and PRIMARY THROTTLE on the PEEC controller).

3.9 Slot 5

3.9.1 AC measuring - Genset controller

Term.	Function	Technical data	Description
73	I L1, s1	Generator current L1	x/1 A or x/5 A input
74	I L1, s2		
75	I L2, s1	Generator current L2	x/1 A or x/5 A input
76	I L2, s2		
77	I L3, s1	Generator current L3	x/1 A or x/5 A 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	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	
89	U L3	Mains/bus voltage L3	Max. 690 V AC phase-phase value

3.9.2 AC measuring - Mains controller

Term.	Function	Technical data	Description
73	I L1, s1	Mains current L1	x/1 A or x/5 A input
74	I L1, s2		
75	I L2, s1	Mains current L2	x/1 A or x/5 A input
76	I L2, s2		
77	I L3, s1	Mains current L3	x/1 A or x/5 A input
78	I L3, s2		
79	U L1	Mains voltage L1	Max. 690 V AC phase-phase value
80		Not used	
81	U L2	Mains voltage L2	Max. 690 V AC phase-phase value
82		Not used	
83	U L3	Mains voltage L3	Max. 690 V AC phase-phase value
84	$U_{NEUTRAL}$	Mains 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

Term.	Function	Technical data	Description
88	$U_{NEUTRAL}$	Bus voltage neutral	
89	U L3	Bus voltage L3	Max. 690 V AC phase-phase value

3.9.3 AC measuring - BTB controller

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

3.9.4 AC measuring - Group controller

Term.	Function	Technical data	Description
73	I L1, s1	Generator current L1	x/1 A or x/5 A input
74	I L1, s2		
75	I L2, s1	Generator current L2	x/1 A or x/5 A input
76	I L2, s2		
77	I L3, s1	Generator current L3	x/1 A or x/5 A 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	BB voltage L1	Max. 690 V AC phase-phase value
86		Not used	

Term.	Function	Technical data	Description
87	U L2	BB voltage L2	Max. 690 V AC phase-phase value
88	$U_{NEUTRAL}$	BB voltage neutral	
89	U L3	BB voltage L3	Max. 690 V AC phase-phase value

3.9.5 AC measuring - Plant controller

Term.	Function	Technical data	Description
73	I L1, s1	Mains current L1	x/1 A or x/5 A input
74	I L1, s2		
75	I L2, s1	Mains current L2	x/1 A or x/5 A input
76	I L2, s2		
77	I L3, s1	Mains current L3	x/1 A or x/5 A input
78	I L3, s2		
79	U L1	Mains voltage L1	Max. 690 V AC phase-phase value
80		Not used	
81	U L2	Mains voltage L2	Max. 690 V AC phase-phase value
82		Not used	
83	U L3	Mains voltage L3	Max. 690 V AC phase-phase value
84	$U_{NEUTRAL}$	Mains voltage neutral	
85	U L1	BB voltage L1	Max. 690 V AC phase-phase value
86		Not used	
87	U L2	BB voltage L2	Max. 690 V AC phase-phase value
88	$U_{NEUTRAL}$	BB voltage neutral	
89	U L3	BB voltage L3	Max. 690 V AC phase-phase value

3.10 Slot 6

3.10.1 7 digital inputs (option M13.6)

Term.	Function	Technical data	Description
90	Com.	Common	Common for terminals 90 to 97
91	Binary input 91	Optocoupler	Configurable
92	Binary input 92	Optocoupler	Configurable
93	Binary input 93	Optocoupler	Configurable
94	Binary input 94	Optocoupler	Configurable
95	Binary input 95	Optocoupler	Configurable
96	Binary input 96	Optocoupler	Configurable
97	Binary input 97	Optocoupler	Configurable

3.10.2 4 relay outputs (option M14.6)

Term.	Function	Technical data	Description
90	NE/ND	Relay 90 250 V AC 5 A	Configurable
91	Com.		
92	NE/ND	Relay 92 250 V AC 5 A	Configurable
93	Com.		
94	NE/ND	Relay 94 250 V AC 5 A	Configurable
95	Com.		
96	NE/ND	Relay 96 250 V AC 5 A	Configurable
97	Com.		

3.10.3 4 analogue inputs (option M15.6)

Term.	Function	Technical data	Description
90	Analogue input 91 -	Common	Configurable
91	Analogue input 91 +	4 to 20 mA in	
92	Analogue input 93 -	Common	Configurable
93	Analogue input 93 +	4 to 20 mA in	
94	Analogue input 95 -	Common	Configurable
95	Analogue input 95 +	4 to 20 mA in	
96	Analogue input 97 -	Common	Configurable
97	Analogue input 97 +	4 to 20 mA in	

3.10.4 4 multi-inputs (option M16.6)

Term.	Function	Technical data	Description
90	Multi-input 91	Common	Configurable: 4 to 20 mA/0 to 5 V/Pt100
91	Multi-input 91	Analogue in	

Term.	Function	Technical data	Description
92	Multi-input 93	Common	Configurable: 4 to 20 mA/0 to 5 V/Pt100
93	Multi-input 93	Analogue in	
94	Multi-input 95	Common	Configurable: 4 to 20 mA/0 to 5 V/Pt100
95	Multi-input 95	Analogue in	
96	Multi-input 97	Common	Configurable: 4 to 20 mA/0 to 5 V/Pt100
97	Multi-input 97	Analogue in	

3.10.5 Analogue outputs for transducer (option F1)

Term.	Function	Description
90	Not used	
91	0	Transducer output
92	0(4) to 20 mA out	
93	Not used	
94	Not used	
95	0	Transducer output
96	0(4) to 20 mA out	
97	Not used	

NOTE The option F1 cannot be used for GOV/AVR outputs.

3.11 Slot 7

3.11.1 Engine interface card - Genset controller

Term.	Function	Technical data	Description
98	+12/24 V DC	12/24 V DC +/-30 %	DC power supply
99	0 V DC		
100	MPU input	0.5 to 70 V AC/ 10 to 10,000 Hz	Magnetic pickup with wire break
101	MPU GND		
102	A	0(4) to 20 mA Digital Pt100 Pt1000 RMI 0 to 40 V DC	Multi-input 1
103	B		
104	C		
105	A		Multi-input 2
106	B		
107	C		
108	A		Multi-input 3
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	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	Run coil
120	NO	Relay 24 V DC/5 A	Start prepare
121	Com.	Relay 250 V AC/5 A	Crank (starter)
122	NO		
123	Com.	Relay 24 V DC/5 A	Stop coil w/wire failure detection
124	NO		
A1	CAN-H		CAN bus interface A (option G4, G5, G8 or H7)
A2	GND		
A3	CAN-L		
B1	CAN-H		CAN bus interface B (option G4 or G5, G8)
B2	GND		
B3	CAN-L		

3.11.2 Engine interface card - Mains/BTB/Group/Plant controller

Term.	Function	Technical data	Description
98	+12/24 V DC	12/24 V DC +/-30 %	DC power supply
99	0 V DC		
100	MPU input	0.5 to 70 V AC/ 10 to 10,000 Hz	Magnetic pickup
101	MPU GND		
102	A	0(4) to 20 mA Digital Pt100 Pt1000 RMI 0 to 40 V DC	Multi-input 1
103	B		
104	C		
105	A		Multi-input 2
106	B		
107	C		
108	A		Multi-input 3
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	Not used
120	NO	Relay 24 V DC/5 A	Not used
121	Com.	Relay 250 V AC/5 A	Not used
122	NO		
123	Com.	Relay 24 V DC/5 A	Not used
124	NO		
A1	CAN-H		CAN bus interface A (option G4 or G5)
A2	GND		
A3	CAN-L		
B1	CAN-H		CAN bus interface B (option G4 or G5)
B2	GND		
B3	CAN-L		

3.12 Slot 8

3.12.1 Cummins engine interface communication (option H6)

Term.	Function	Description
126	Not used	Modbus RTU (RS-485)
127	DATA - (B)	
128	Not used	
129	DATA + (A)	
130	Not used	
131	DATA - (B)	
132	GND	
133	DATA + (A)	

3.12.2 7 digital inputs (option M13.8)

Term.	Function	Technical data	Description
126	Com.	Common	Common for terminals 127 to 133
127	Digital input 127	Optocoupler	Configurable
128	Digital input 128	Optocoupler	Configurable
129	Digital input 129	Optocoupler	Configurable
130	Digital input 130	Optocoupler	Configurable
131	Digital input 131	Optocoupler	Configurable
132	Digital input 132	Optocoupler	Configurable
133	Digital input 133	Optocoupler	Configurable

3.12.3 4 relay outputs (option M14.8)

Term.	Function	Technical data	Description
126	NE/ND	Relay 126 250 V AC/5 A	Configurable
127	Com.		
128	NE/ND	Relay 128 250 V AC/5 A	Configurable
129	Com.		
130	NE/ND	Relay 130 250 V AC/5 A	Configurable
131	Com.		
132	NE/ND	Relay 132 250 V AC/5 A	Configurable
133	Com.		

3.12.4 4 analogue inputs (option M15.8)

Term.	Function	Technical data	Description
126	Analogue input 127 -	Common	Configurable
127	Analogue input 127 +	4 to 20 mA in	

Term.	Function	Technical data	Description
128	Analogue input 129 -	Common	Configurable
129	Analogue input 129 +	4 to 20 mA in	
130	Analogue input 131 -	Common	Configurable
131	Analogue input 131 +	4 to 20 mA in	
132	Analogue input 133 -	Common	Configurable
133	Analogue input 133 +	4 to 20 mA in	

3.12.5 4 multi-inputs (option M16.8)

Term.	Function	Technical data	Description
126	Multi-input 127	Common	Configurable: 4 to 20 mA/0 to 5 V/Pt100
127	Multi-input 127	Analogue in	
128	Multi-input 129	Common	Configurable: 4 to 20 mA/0 to 5 V/Pt100
129	Multi-input 129	Analogue in	
130	Multi-input 131	Common	Configurable: 4 to 20 mA/0 to 5 V/Pt100
131	Multi-input 131	Analogue in	
132	Multi-input 133	Common	Configurable: 4 to 20 mA/0 to 5 V/Pt100
133	Multi-input 133	Analogue in	

3.12.6 Dual CAN (option H12.8)

Term.	Function	Description
126	Not used	The H12 dual CAN bus can be used for: • Engine interface communication • DVC 550 communication • External I/O module (CIO 116/208/308 and/or IOM 220/230) • Group controller: Extended power management (option G7) communication The terminals are configurable: Terminals 128-130: CAN E Terminals 131-133: CAN F
127	Not used	
128	CAN-L	
129	GND	
130	CAN-H	
131	CAN-L	
132	GND	
133	CAN-H	

4. Wiring

4.1 AC connections

The controller can be wired up in a 1-phase, 2-phase or 3-phase configuration. 3-phase examples are included for each controller type.

NOTE Contact the switchboard manufacturer for accurate information about required wiring for the specific application.

Neutral line (N)

For three phases systems, the neutral line (N) is only required if the system is a three-phase + neutral system. If the distribution system is a three-phase system without neutral, do not connect terminals 84 and 88.

Current transformer grounding

The current transformers can be grounded using the s1 or s2 connections.

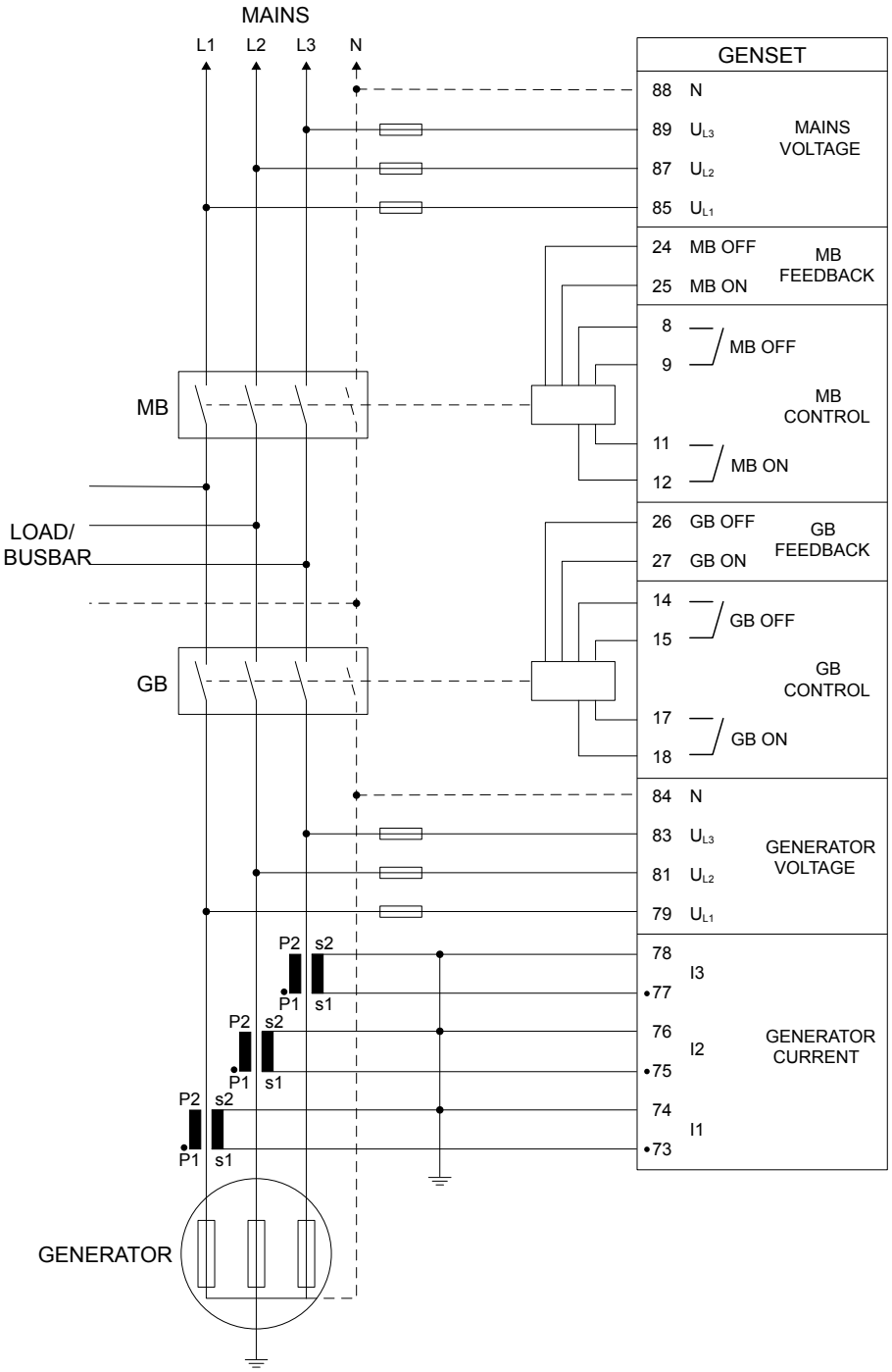
Fuses

Protect the AC voltage measurement cables with 2 A, slow blow fuses.

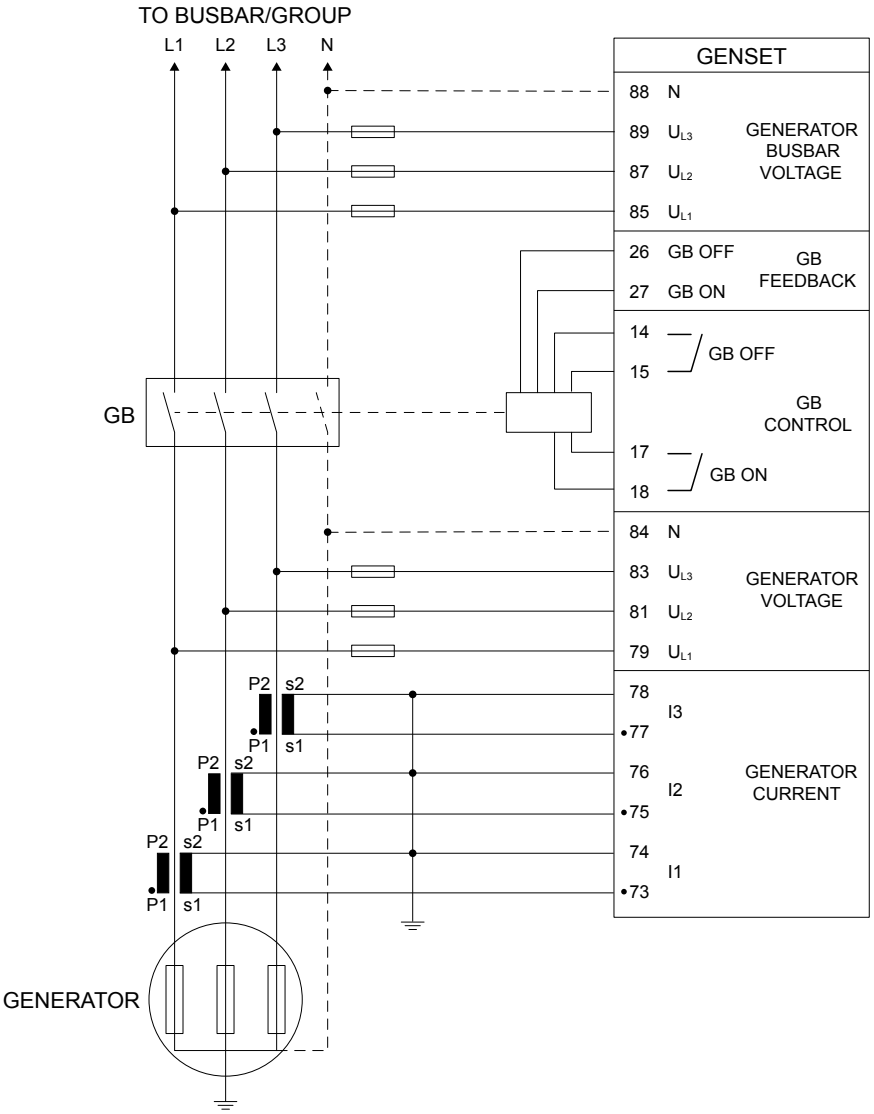
Breaker wiring

The examples are for pulse breakers. Breaker open/off wiring is not required for a continuous breaker.

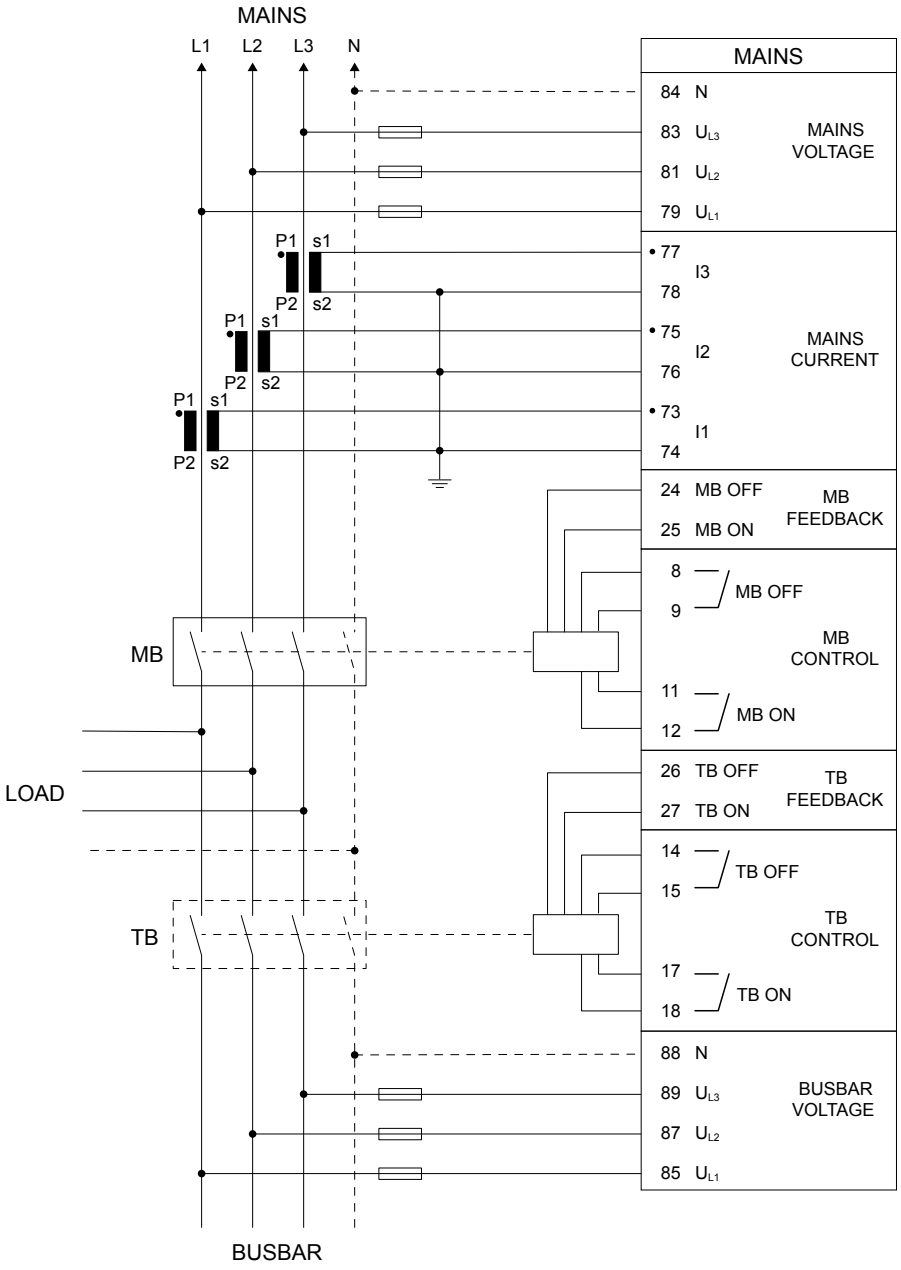
4.1.1 Genset controller (stand-alone)



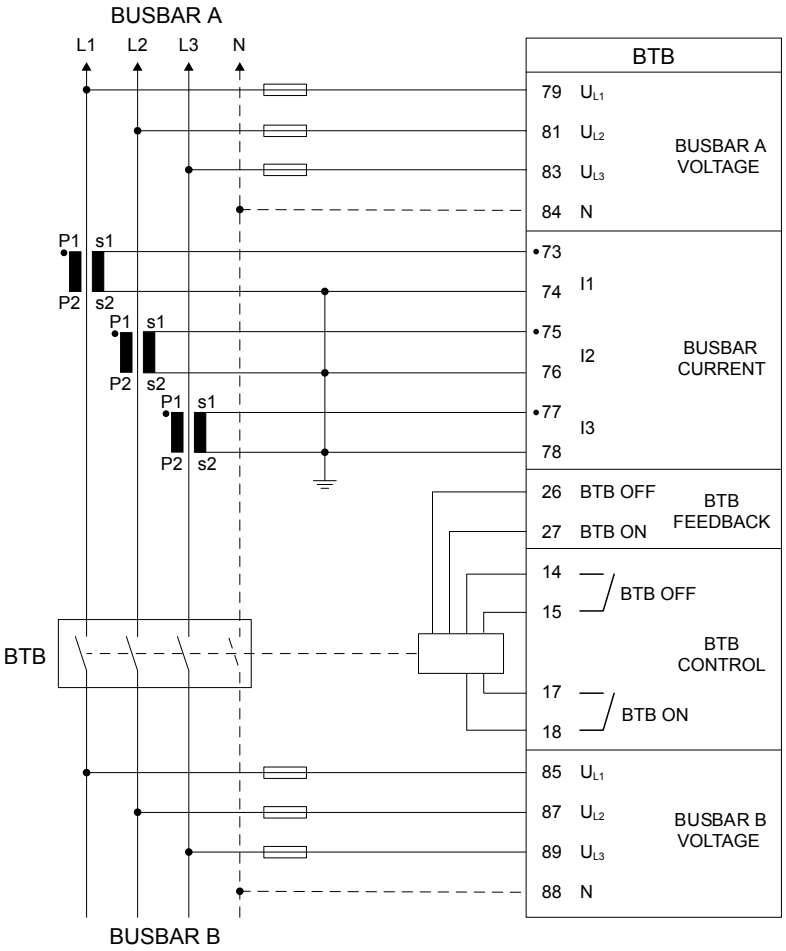
4.1.2 Genset controller (power management/island)



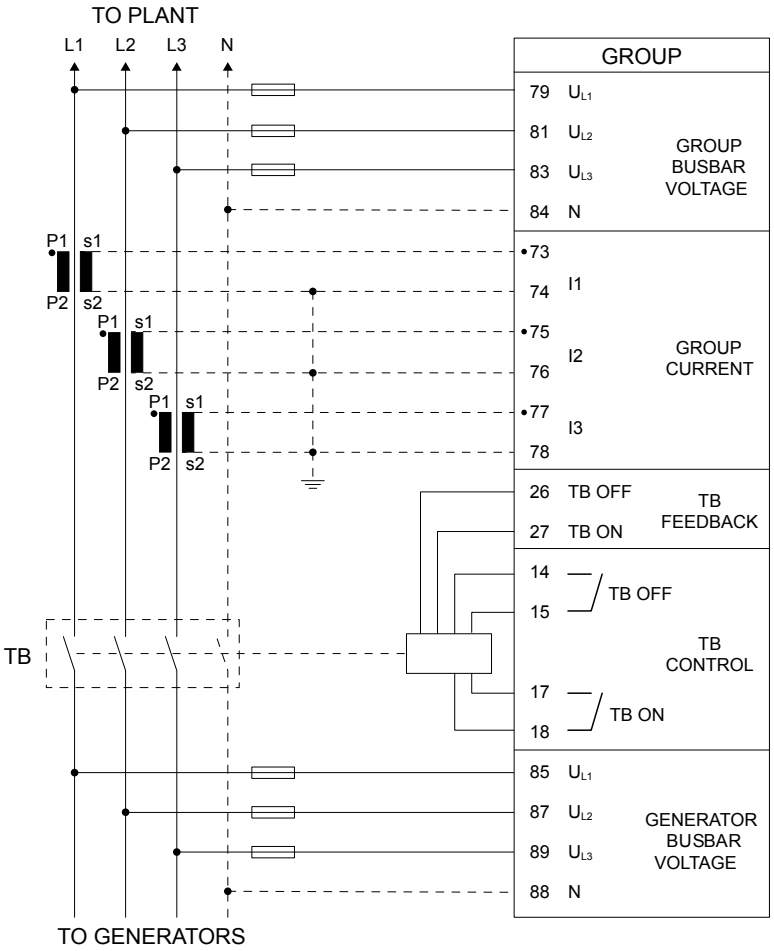
4.1.3 Mains controller



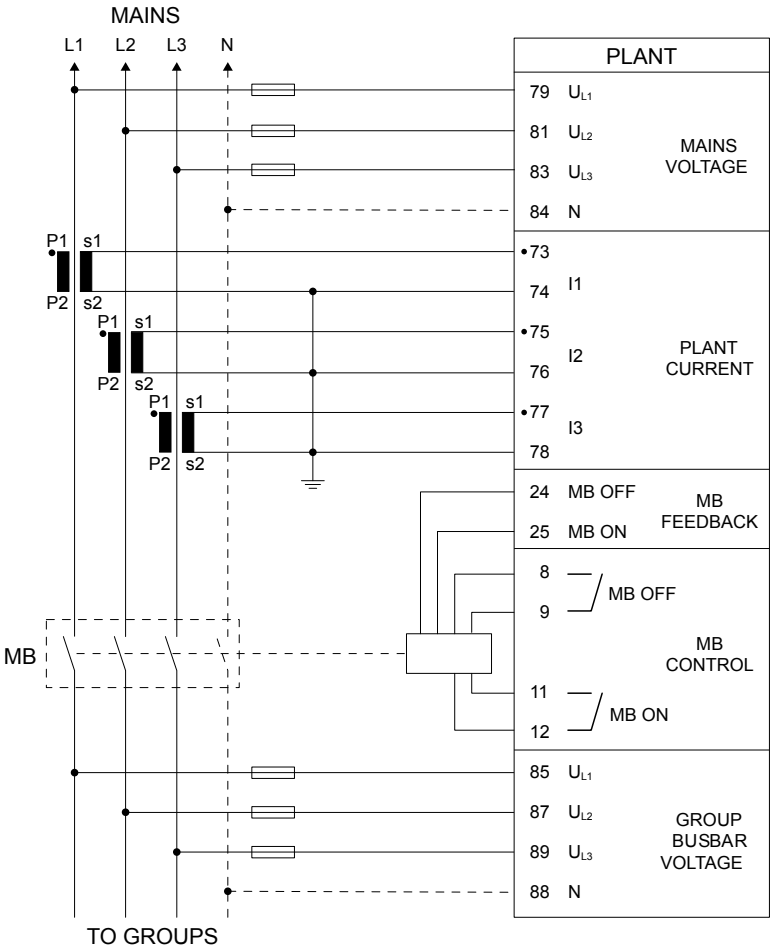
4.1.4 BTB controller



4.1.5 Group controller

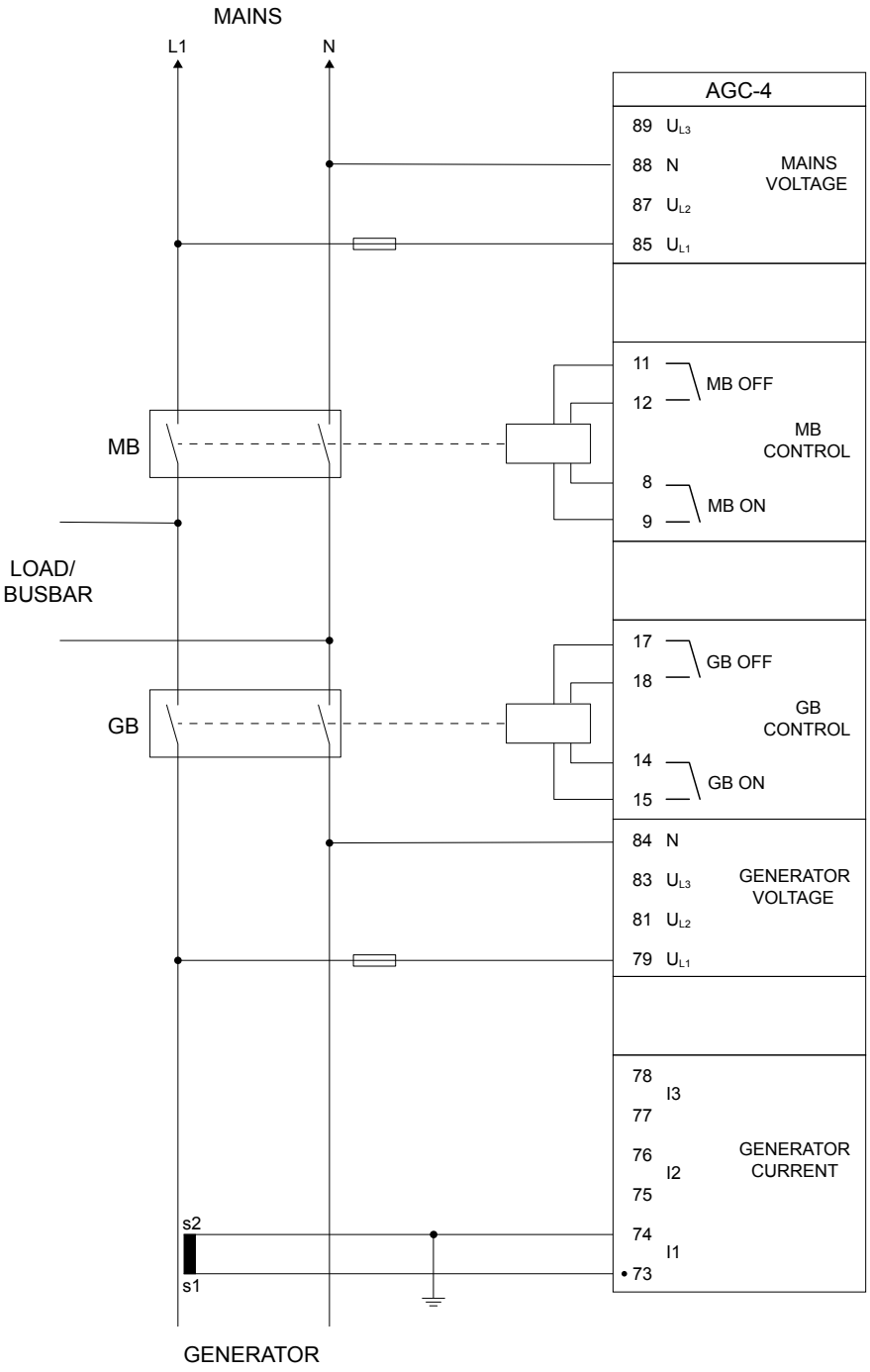


4.1.6 Plant controller

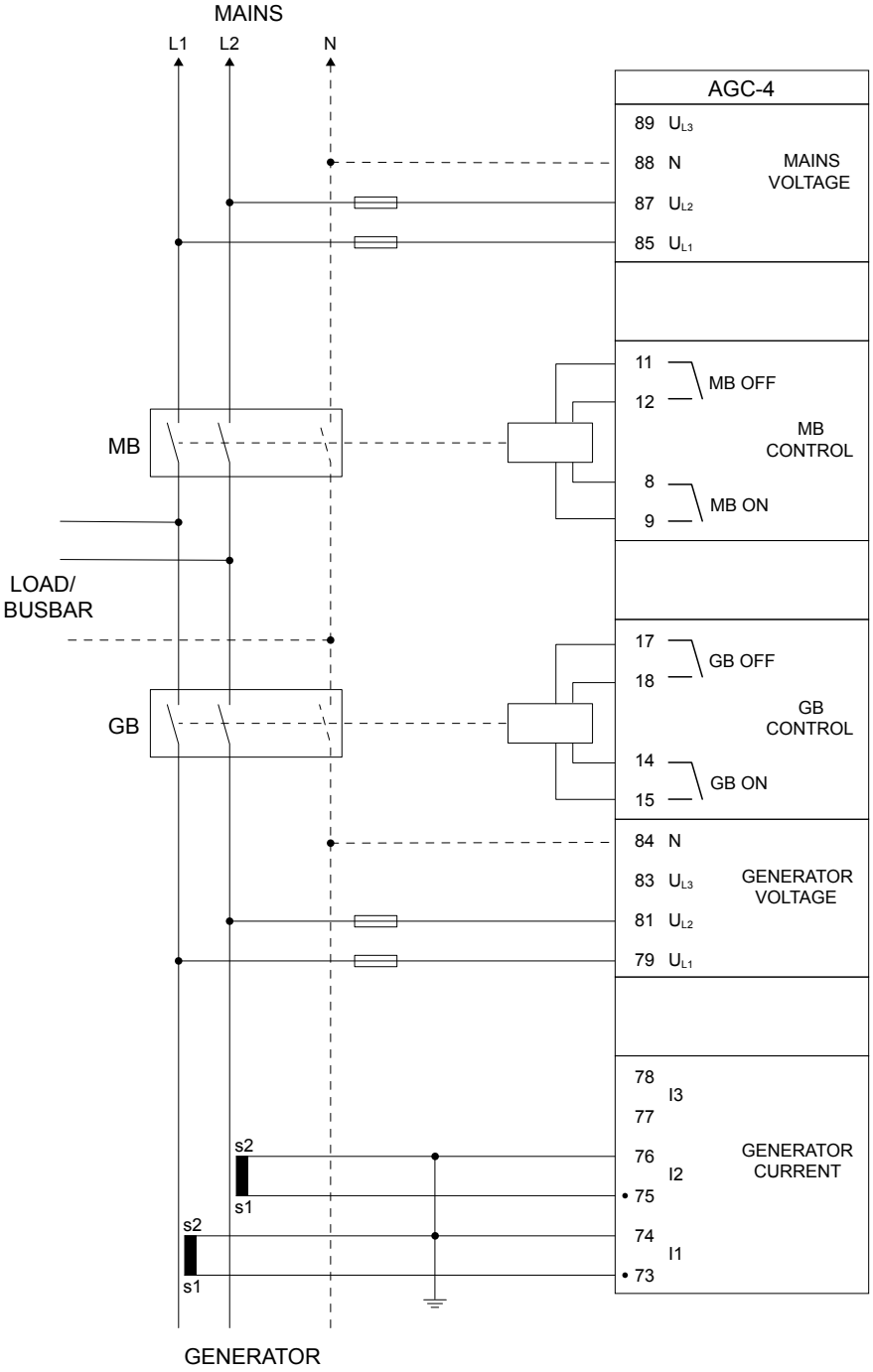


4.1.7 Single-phase and 2-phase AC wiring

Single-phase (stand-alone genset controller)



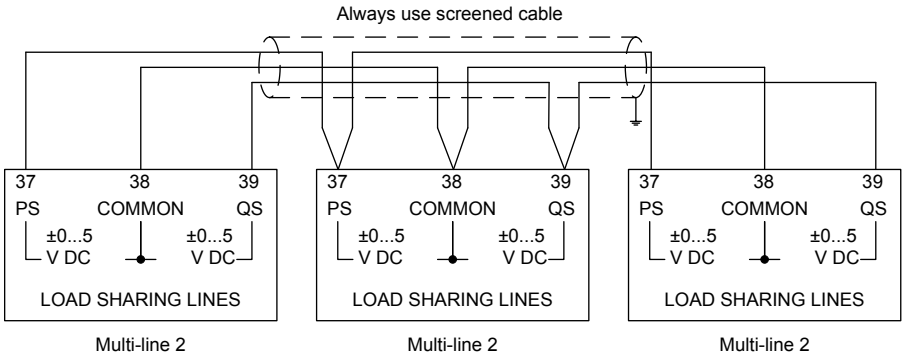
2-phase L1L2 split-phase (stand-alone genset controller)



NOTE For split-phase, the waveforms are offset by a half-cycle (180 °) from the neutral wire. Split-phase is also called L1-N-L2, or single phase in the USA.

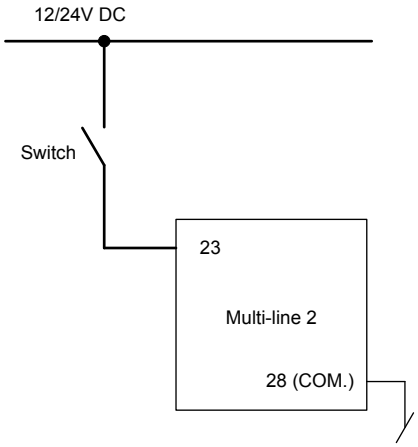
4.2 DC connections

4.2.1 Load sharing lines (option G3)

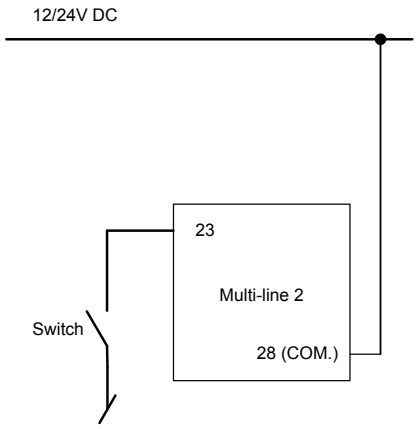


4.2.2 Digital inputs

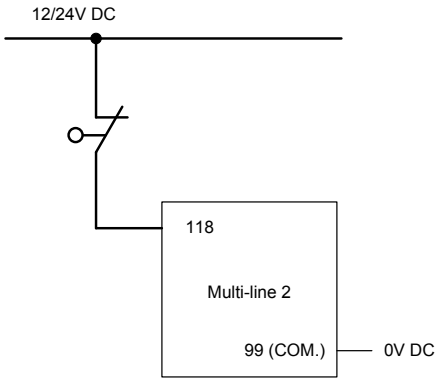
Battery positive to input:



Battery negative to input:



Emergency stop:



Compliance with EN60255-26

If the wire to an open contact is over 10 m long, then additional measures are required for compliance with EN60255-26. You can use a 1 kΩ resistor to common, or you can use a twisted or shielded wire to the open contact.

Figure 4.1 Example: 1 kΩ resistor to common for compliance with EN60255-26

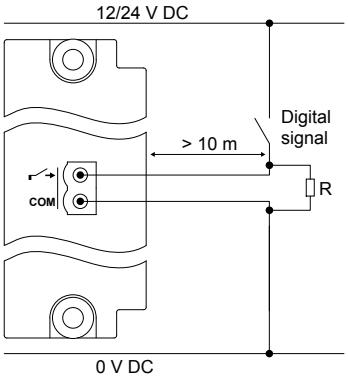


Figure 4.2 Example: Twisted wire for compliance with EN60255-26

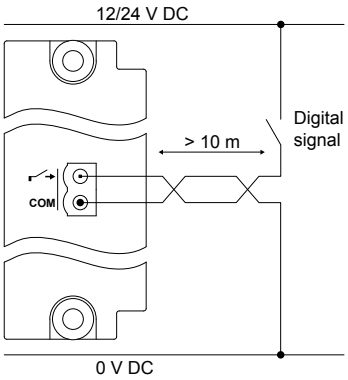


Figure 4.3 Example: Shielded wire for compliance with EN60255-26

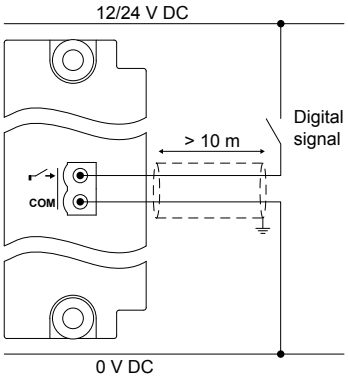
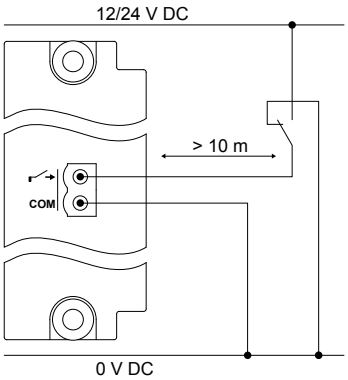
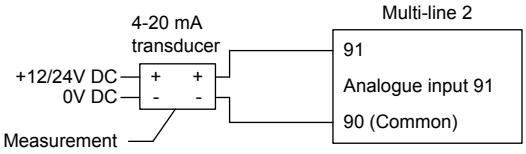


Figure 4.4 Example: Closed contact for compliance with EN60255-26

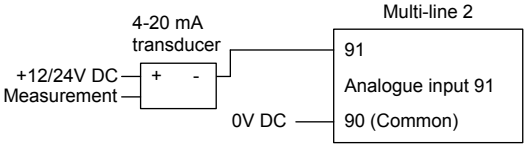


4.2.3 Analogue inputs (option M15.X)

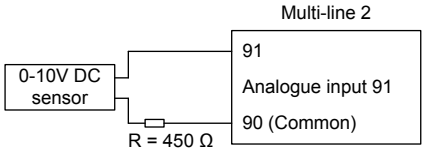
4 to 20 mA - Active transducer



4 to 20 mA - Passive transducer

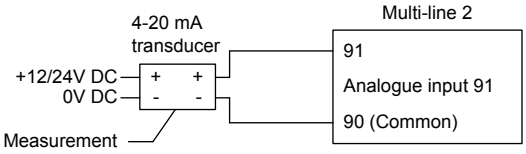


V DC sensor

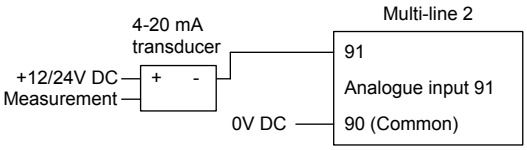


4.2.4 Multi-inputs (option M16.X)

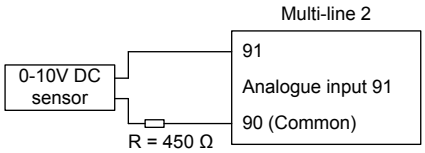
4 to 20 mA - Active transducer



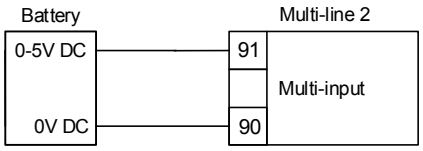
4 to 20 mA - Passive transducer



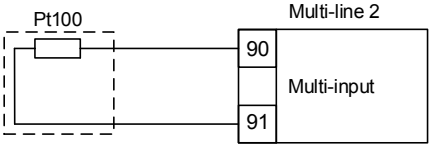
V DC sensor



0 to 5 V DC



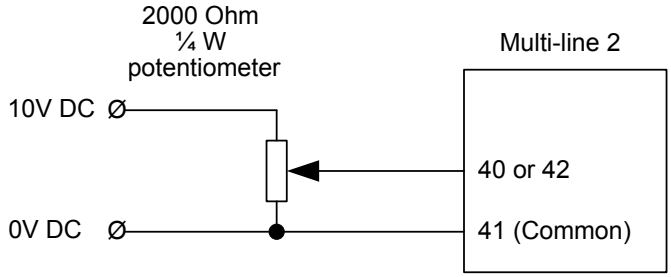
Pt100



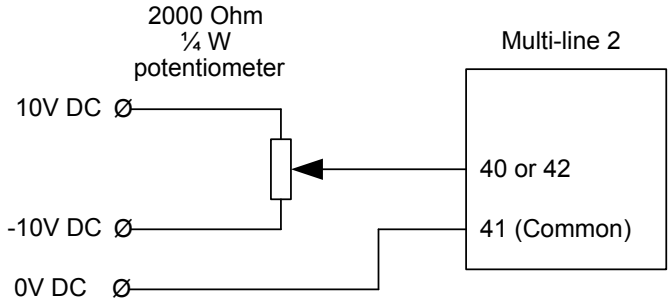
4.2.5 External set points (option G3/M12)

The set point inputs are passive, that is, an external power source is needed. This can be an active output from, for example, a PLC, or a potentiometer can be used.

0 to 10 V DC input using potentiometer



+/-10 V DC input using potentiometer

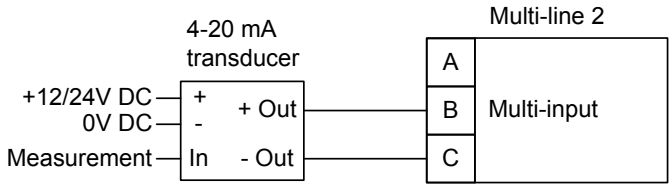


4.2.6 Multi-inputs (102, 105, 108)

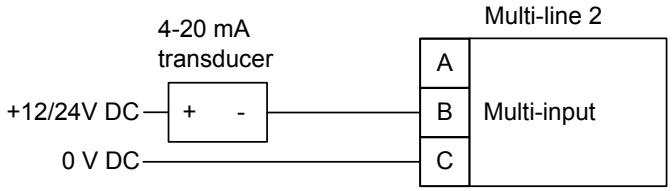
0(4) to 20 mA

The multi-inputs are placed in slot #7. The terminal numbers for the individual multi-inputs can be seen under Slot #7.

Active transducer

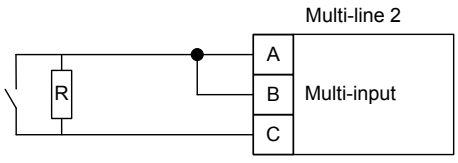


Passive transducer



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

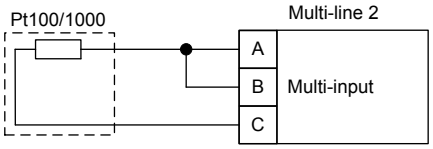
Digital inputs



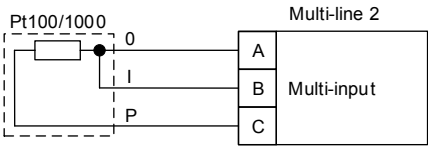
NOTE The resistor is only mounted if wire fail supervision is required. The value of the resistor should be 270 Ω +/-10 %.

Pt100/Pt1000

2-wire

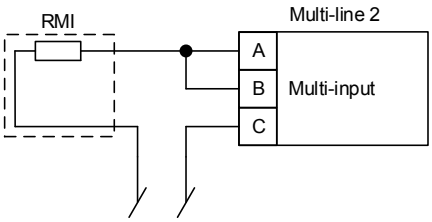


3-wire

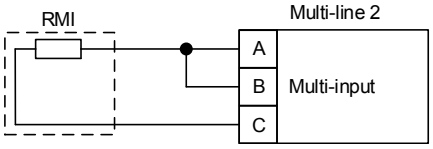


RMI

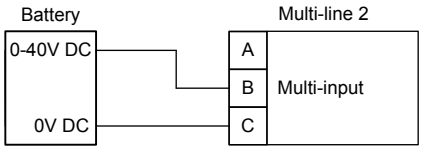
1-wire



2-wire

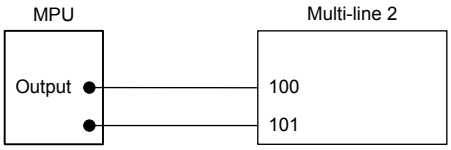


0 to 40 V DC

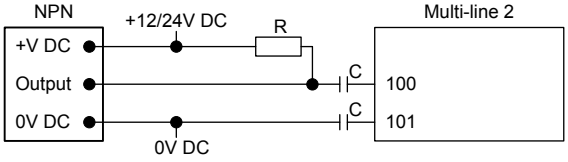


4.2.7 RPM input

Magnetic pickup (MPU)



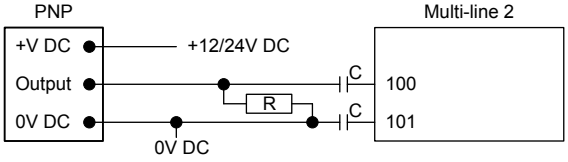
NPN sensor



C = 22 nF, 100 V foil type

R = 1200 Ω @ 24 V DC, 600 Ω @ 12 V DC

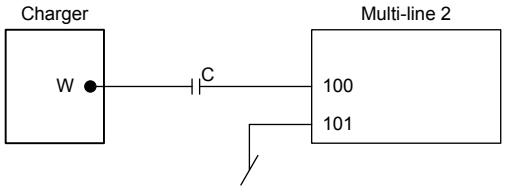
PNP sensor



C = 22 nF, 100 V foil type

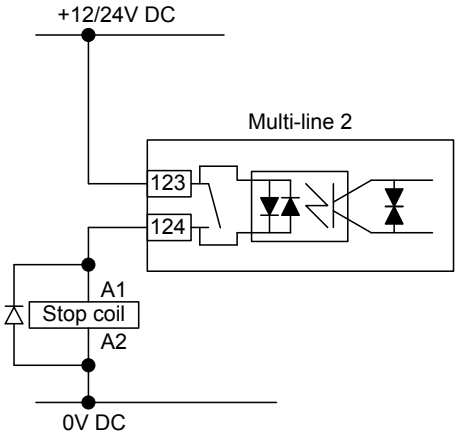
R = 1200 Ω @ 24 V DC, 600 Ω @ 12 V DC

Charger, W output



C = 22 nF, 100 V foil type

4.2.8 Stop coil

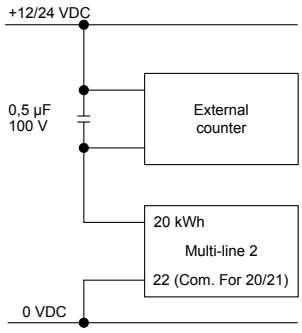


NOTE Remember to mount the freewheeling diode.

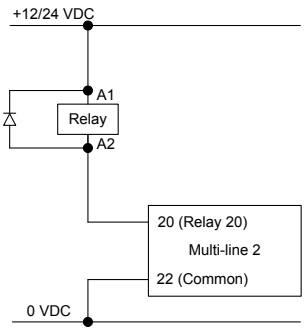
4.2.9 Transistor outputs (open collector outputs)

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.

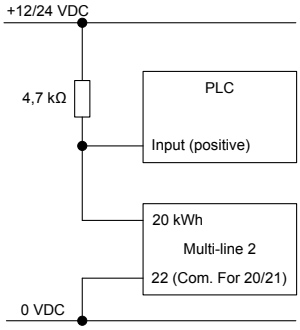
External counter:



Relay outputs:



Connection to PLC:



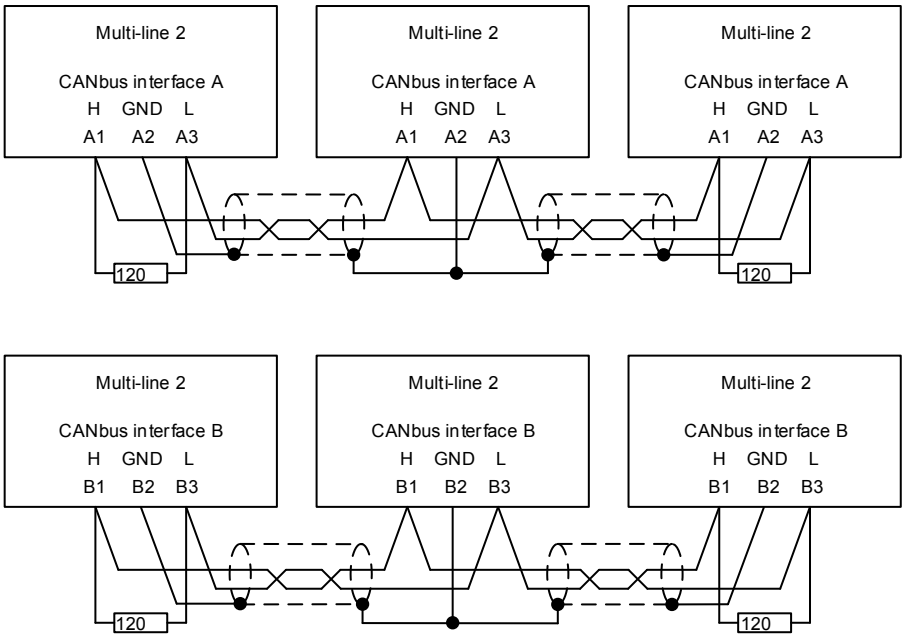
NOTE Remember to mount the freewheeling diode.

NOTE Maximum load on the open collector outputs is 10 mA at 24 V DC.

4.3 Communication

4.3.1 CAN bus for power management (option G5)

Examples with three controllers connected (for example, one mains controller and two genset controllers).



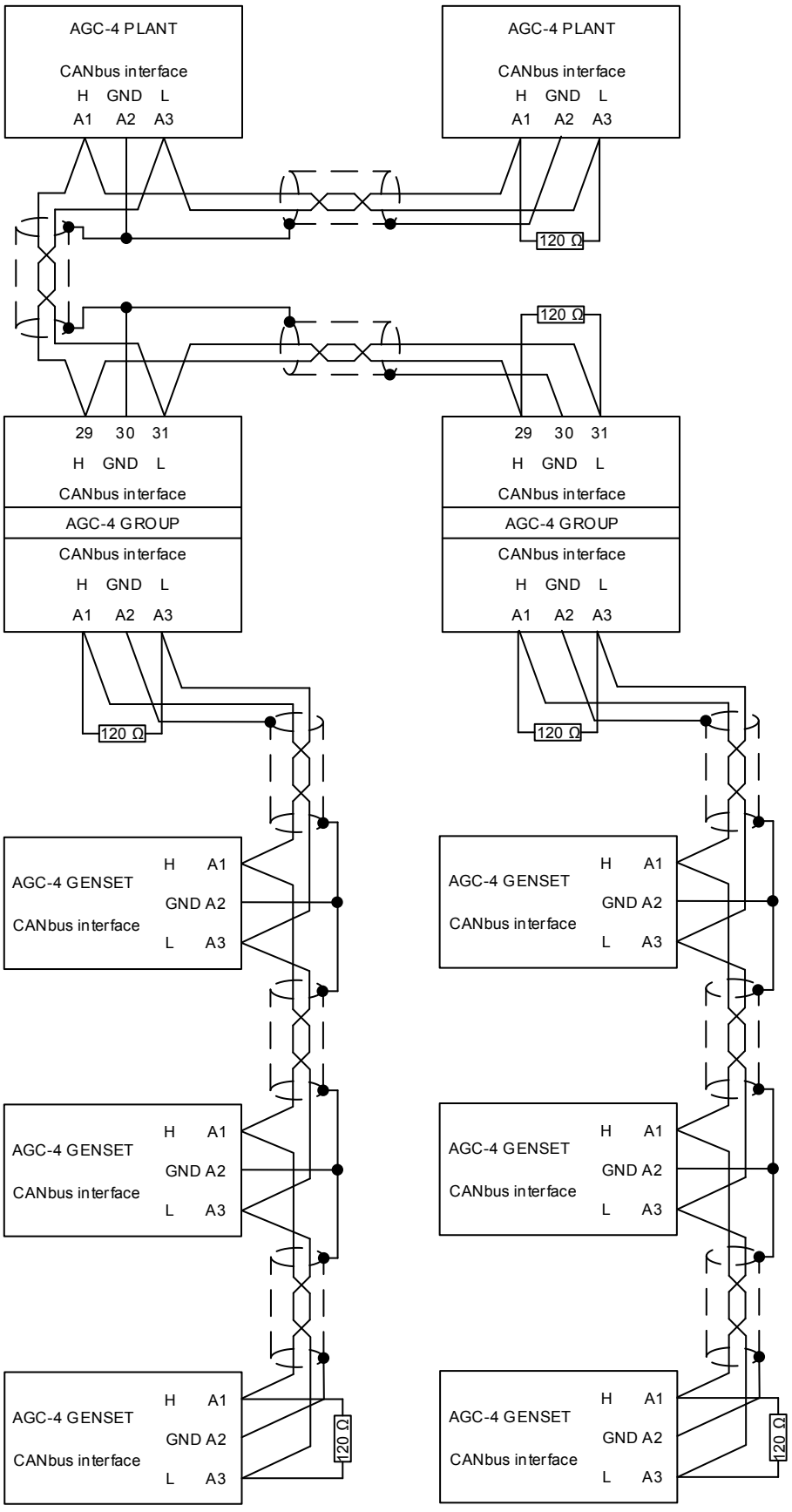
NOTE Use shielded twisted cable.
NOTE End resistor R = 120 Ohm.

4.3.2 CAN bus for extended power management (option G7)

The CAN bus communication and the controllers must be wired as two separate systems.

The first CAN bus is wired between the plant and group controller.

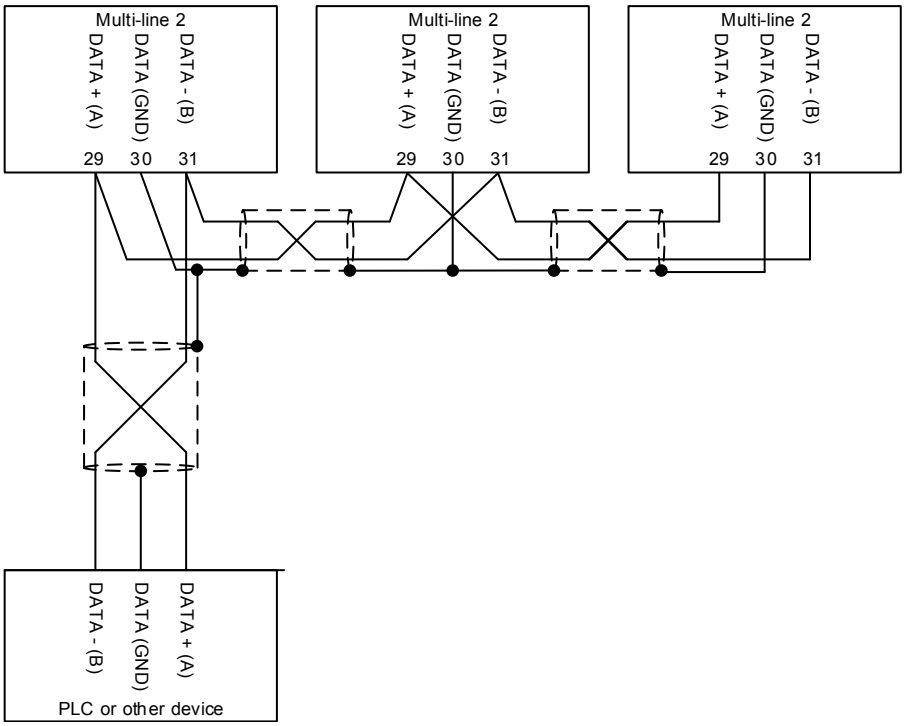
The other CAN bus line is wired from one group controller and down to the gensets in the specific genset group. This must be wired from these terminals:



NOTE Connect shield to earth at one end only. Shield ends must be insulated with tape or insulation tubing.
NOTE Use shielded twisted cable.
NOTE End resistor R = 120 ohm.

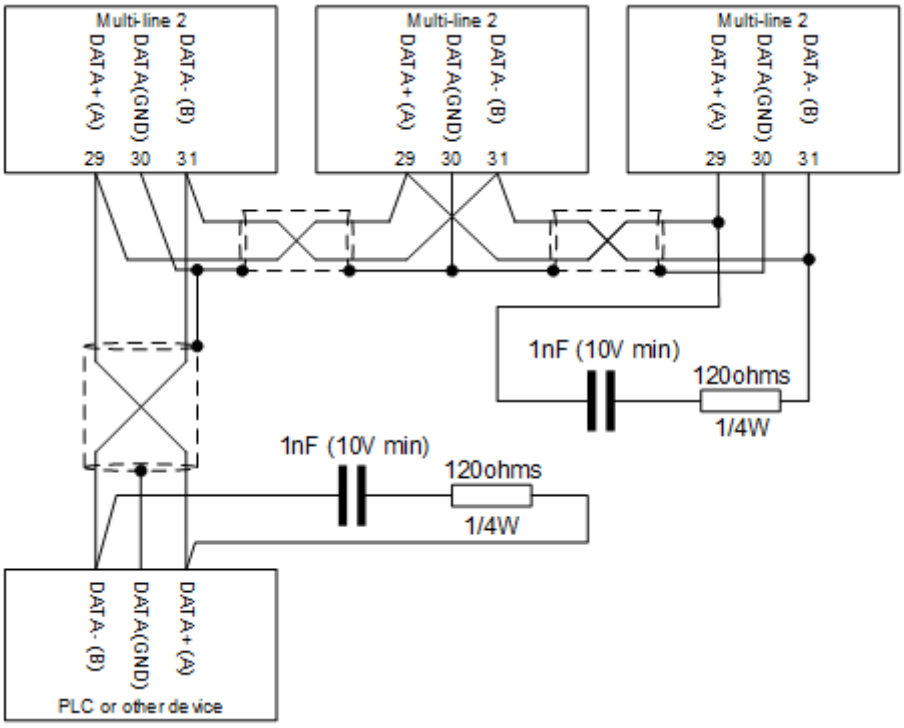
4.3.3 Modbus RS-485 (option H2)

Example with three controllers connected



NOTE Use shielded twisted cable.

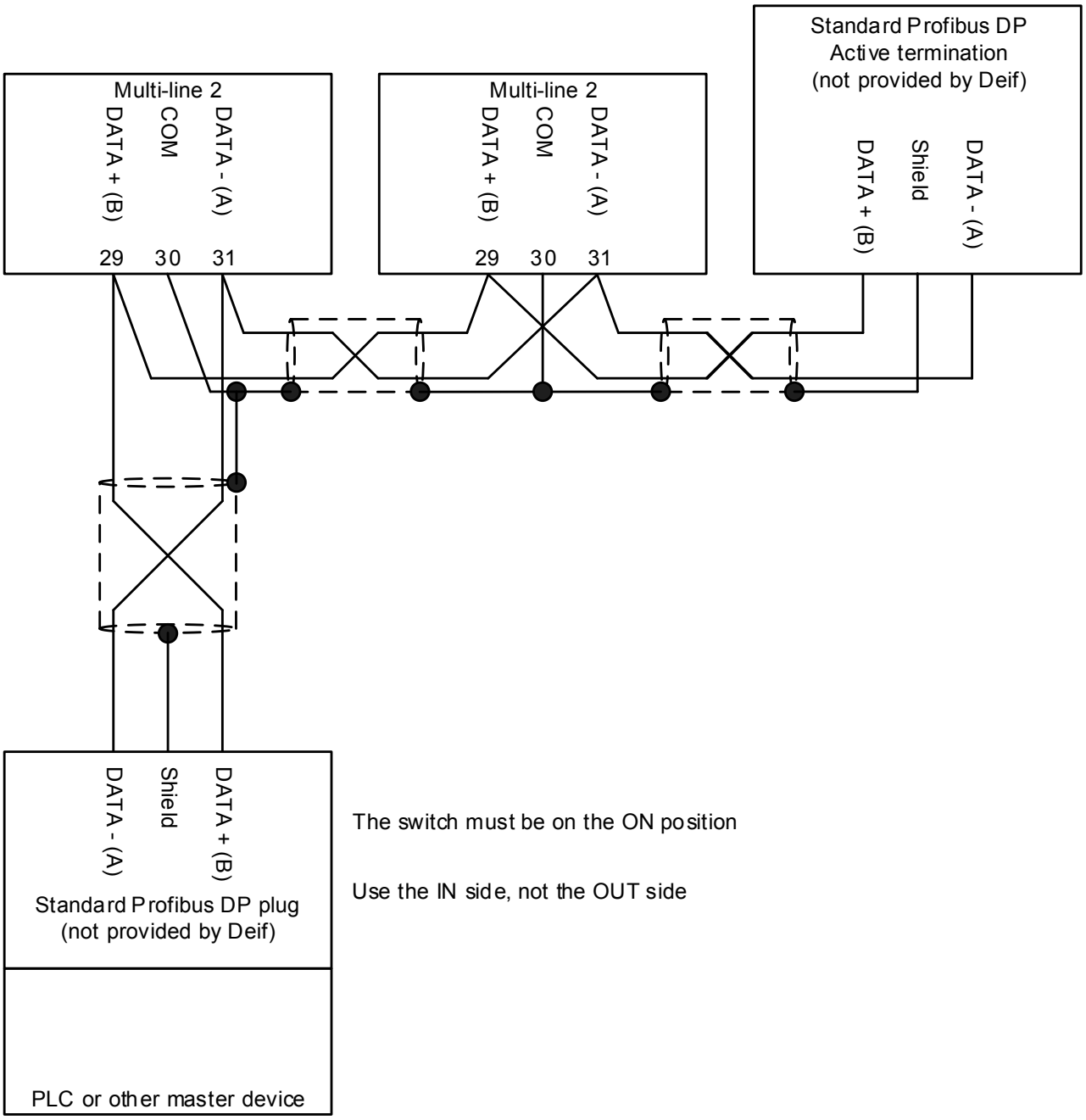
RS-485 Modbus lines need end resistors (end terminators) when the bus length exceeds 30 m: Recommended installation



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

4.3.4 Profibus DP (option H3)

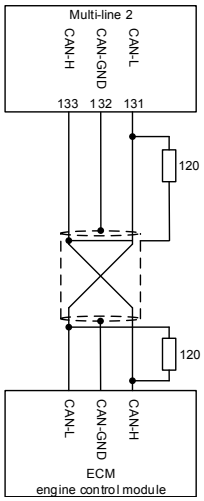
Example with two controllers connected.



NOTE Use shielded twisted cable.

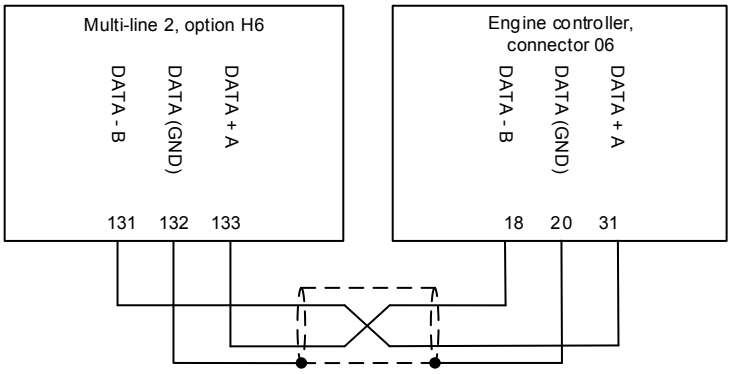
4.3.5 CAN bus engine communication (option H12.2/H12.8)

Wiring example for H12.8



NOTE Use shielded twisted cable.
NOTE End resistor R = 120 Ohm.
NOTE The terminating resistor at the engine side might not be needed, see the engine manufacturer's literature.

4.3.6 Cummins GCS (option H6)



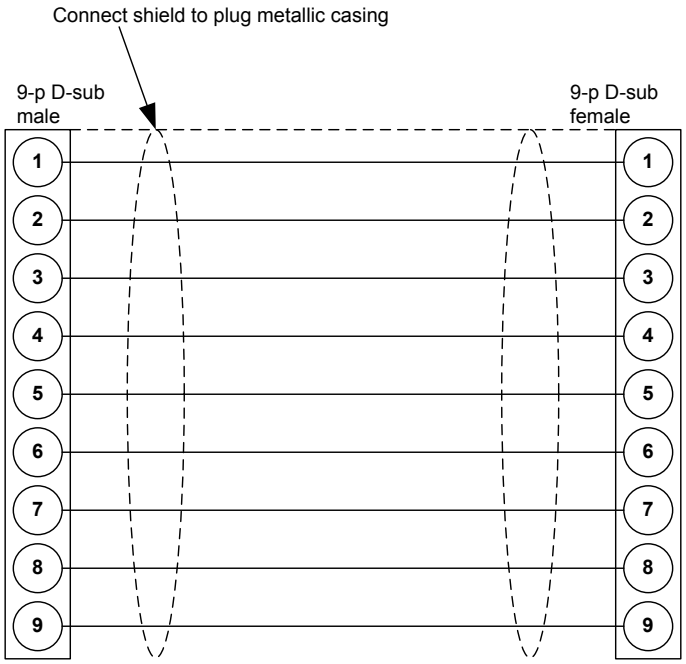
NOTE Use shielded twisted cable.
NOTE Cable: Belden 3105A or equivalent. 22 AWG (0.6 mm^2) twisted pair, shielded, <40 mΩ/m, min. 95 % shield coverage.

4.3.7 External I/O module CIO/IOM (option H12.2/H12.8)

As long as the baud rate is the same, CAN bus communication to external CIOs or IOMs can be connected in series with CAN bus engine communication and DVC communication. That is, a number of CIO 116, 208, 308, and/or IOM 220, 230, can be connected in series on the CAN bus communication line.

4.3.8 Display cable (option J)

A standard computer extension cable can be used (9-pole D-sub 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.

NOTE Do not use tools or brute force when tightening the finger-screws on the display cable.

5. Technical specifications

AC measurements and protections

The controller measures the voltage and current on one side of a breaker, and the voltage on the other side.

Voltage measurements: All voltages are phase-to-phase AC voltages. There are specifications for **Low** and **High** voltage ranges. The voltage range is determined by U_n. For terminals 79 to 84, U_n is the voltage transformer secondary in parameter 6042. For terminals 85 to 89, U_n is the voltage transformer secondary in parameters 6052/6062. For voltages below the truncation level, 0 V is shown.

Current measurements: All currents are AC currents. There are specifications for **Low** and **High** current ranges. The current range is determined by I_N, the current transformer secondary in parameter 6044. For currents below the truncation level, 0 A is shown.

The voltage range is independent of the current range, and vice versa.

All specifications are within the reference conditions, unless otherwise mentioned.

Voltage measurements	Nominal value (U_n): 100 to 690 V. **Low**: 100 ≤ U_n ≤ 240 V **High**: 240 < U_n ≤ 690 V Reference range: **Low**: 65 to 324.0 V **High**: 156.7 to 931.5 V Measurement range: **Low**: 5.0 to 324.0 V, Truncation: 2 V **High**: 12.0 to 931.5 V, Truncation: 5 V Accuracy: **Low**: 5.0 to 324.0 V: ±0.5 % or ±0.5 V (whichever is greater) **High**: 12.0 to 931.5 V: ±0.5 % or ±1.2 V (whichever is greater) UL/cUL Listed: 600 V AC phase-phase Consumption: Maximum 0.25 VA/phase
Voltage and altitude	Operating altitude: 0 to 4000 m above sea level 2001 to 4000 m: Maximum 480 V AC phase-phase for measuring 3W4 voltage. No derating for 3W3.
Voltage withstand	U_n + 35 % continuously U_n + 45 % for 10 seconds
Current measurements	Nominal value (I_N): **Low**: 1 A AC from current transformer **High**: 5 A AC from current transformer Measurement range: **Low**: 0.005 to 4.0 A, Truncation: 4 mA **High**: 0.025 to 20.0 A, Truncation: 20 mA Accuracy: **Low**: 0.005 to 4.0 A: ±0.5 % or ±5 mA (whichever is greater) **High**: 0.025 to 20.0 A: ±0.5 % or ±25 mA (whichever is greater) UL/cUL Listed: From listed or R/C (XODW2.8) current transformers 1 or 5 A Consumption: Maximum 0.3 VA/phase
Current withstand	10 A continuous

	20 A for 1 minute 20 x I_N for 10 seconds (maximum 75 A) 80 x I_N for 1 second (maximum 300 A)
Frequency measurements	Nominal value: 50 Hz or 60 Hz Reference range: 45 to 66 Hz Measurement range: 10 to 75 Hz Accuracy: 45 to 66 Hz ±10 mHz, at the nominal value voltage, within the temperature reference range 45 to 66 Hz: ±15 mHz, within the temperature operating range 10 to 75 Hz: ±50 mHz, within the temperature operating range
Phase angle (voltage) measurement	Measurement range: -179.9 to 180° Accuracy: -179.9 to 180°: 0.2°, within the temperature operating range
Power measurement	Accuracy: ±0.5 % of measured value or ±0.5 % of U_n * I_N , whichever is greater, within the current measurement range
Temperature and accuracy	Reference range: 15 to 30 °C (59 to 86 °F) Operating range: -25 to 70 °C (-13 to 158 °F) Temperature-dependent accuracy outside the reference range: Voltage: Additional: ±0.2 %, or ±0.2 V (**Low**) / ±0.5 V (**High**) per 10 °C (18 °F) (whichever is greater) Current: Additional: ±0.2 %, or ±2 mA (**Low**) / ±10 mA (**High**) per 10 °C (18 °F) (whichever is greater) Power: Additional: ±0.2 %, or ±0.2 % of U_n * I_N per 10 °C (18 °F) (whichever is greater)

General specifications

Aux. supply	Terminals 1 and 2: 12/24 V DC nominal (8 to 36 V DC operational). Maximum 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). Maximum 5 W consumption 0 V DC for maximum 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
Digital inputs	Optocoupler, bi-directional ON: 8 to 36 V DC Impedance: 4.7 kΩ OFF: <2 V DC
Analogue inputs	-10 to +10 V DC: Not galvanically separated. Impedance: 100 kΩ (analogue load sharing lines) 0(4) to 20 mA: Impedance 50 Ω. Not galvanically separated (M15.X)
RPM	RPM (MPU): 2 to 70 V AC, 10 to 10000 Hz, maximum 50 kΩ
Multi-inputs Engine interface board slot #7	0(4) to 20 mA: 0 to 20 mA, ±1 %. Not galvanically separated Digital: Maximum resistance for ON detection: 100 Ω. Not galvanically separated Pt100/1000: -40 to 250 °C, ±1 %. Not galvanically separated. To EN/IEC60751 RMI: 0 to 1700 Ω, ±2 %. Not galvanically separated V DC: 0 to 40 V DC, ±1 %. Not galvanically separated
Multi-inputs (M16.X)	0(4) to 20 mA: 0 to 20 mA, ±2 %. Not galvanically separated Pt100: -40 to 250 °C, ±2 %. Not galvanically separated. To EN/IEC60751 V DC: 0 to 5 V DC, ±2 %. 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 seconds, t_{off} = 15 seconds. (Controller status output: 1 A)
Open collector outputs	Supply: 8 to 36 V DC, maximum 10 mA (terminal 20, 21, 22 (com))
Analogue outputs	0(4) to 20 mA and ±25 mA. Galvanically separated. Active output (internal supply). Load maximum 500 Ω. UL/cUL Listed: Max. 20 mA output

	Update rate: Transducer output: 250 ms. Regulator output: 100 ms Accuracy: Analogue outputs: Class 1.0 according to total range Option EF5: Class 4.0 according to total range To EN/IEC60688
Load sharing lines	-5 to 0 to +5 V DC. Impedance: 23.5 kΩ
Material	All plastic materials are self-extinguishing according to UL94 V1
Plug connections	**Controller** AC current: 0.75 to 4.0 mm^2 stranded wire. UL/cUL Listed: AWG 18 AC voltage: 0.5 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 Tightening torque: 0.5 N·m (5-7 lb-in) Service port: USB B Ethernet/Modbus TCP/IP connector: RJ-45 **DU-2 display** 9-pole D-sub female Tightening torque: 0.2 N·m
Governors and AVRs	Interfaces to all governors and AVRs using analogue, relay control or CAN-based J1939 communication See interfacing guide at www.deif.com
Approvals	UL/cUL Listed to ULC6200:2019 1.ed See www.deif.com for the most recent approvals.
UL/cUL markings	Use 60/75 °C copper conductors only Tightening torque: 5-7 lb-in. Wire Size: AWG 30-12 Flat surface mounting - Type 1 Installation: To be installed in accordance with the NEC (US) or the CEC (Canada) **AOP-2** Maximum ambient temperature: 60 °C UL/cUL Listed: Max. surrounding air temperature: 55 °C/131 °F 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** Tightening torque: 0.5 Nm (4.4 lb-in) Wire size: AWG 22-14 Tightening torque: Panel door mounting 0.7 N·m, D-sub screw 0.2 N·m
Weight	Controller: 1.6 kg (3.5 lbs.) Option J1/J4/J6/J7: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.) Option J8: 0.3 kg (0.58 lbs.) DU-2 display: 0.4 kg (0.9 lbs.)

For the TDU 107 technical specifications, see the **TDU 107 Data sheet**. For more information, see www.deif.com/products/tdu-107

5.1 Environmental specifications

Operating temperature (including display)	-25 to 70 °C (-13 to 158 °F) UL/cUL Listed: Max. surrounding air temperature: 55 °C/131 °F
Storage temperature (including display)	-40 to 70 °C (-40 to 158 °F)
Climate	97 % RH to IEC 60068-2-30
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.
Mounting	DIN-rail mount or base mount with six screws Tightening torque: 1.5 N·m
Safety	To EN/IEC 61010-1, installation category (over-voltage category) III, 600 V, pollution degree 2 To EN/IEC 60255-27 over-voltage category III, 600 V, pollution degree 2 To ULC 6200:2019 1.ed, over-voltage category III, 600 V, pollution degree 2
EMC	To EN/IEC 61000-6-2, EN/IEC 61000-6-4, EN/IEC 60255-26
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 58.1 Hz: 0.15 mm_{pp}. 58.1 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) 3 to 8.15 Hz: 15 mm_{pp}. 8.15 - 35 Hz 2g. To IEC 60255-21-3 Seismic (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)
Protection	Controller: IP20. Display: IP40 (IP54 with gasket: Option L). UL/cUL Listed: Type Complete Device, Open Type. To EN/IEC 60529