



INSTALLATION INSTRUCTIONS

ALC-4 Automatic Load Controller



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1. General information

1.1 Warnings, legal information and safety

1.1.1 Warnings and notes

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

Warnings



DANGER!

This highlights 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 potentially dangerous situations. If the guidelines are not followed, these situations could result in personal injury or damaged equipment.

Notes

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

1.1.2 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set 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.

1.1.3 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.



DANGER!

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

1.1.4 Electrostatic discharge awareness

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

1.1.5 Factory settings

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

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.

NOTICE
Incorrect wiring Read this document before starting to work with the Multi-line 2 unit and the equipment to be controlled. Failure to do this could result in human injury or damage to the equipment.

1.2.2 Intended users

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

1.2.3 Contents and overall structure

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

2. General product information

2.1 ALC-4 product information

2.1.1 Introduction

The ALC is part of the DEIF Multi-line 2 product family. Multi-line 2 is a complete range of multi-function generator protection and control products integrating all the functions you need into one compact and attractive solution.

The concept of the ALC is to offer a cost-effective solution to plant designers who need a flexible load controller as part of their power management system. Being part of the Multi-line product family, the standard functions can be supplemented with a variety of optional functions.

2.1.2 Type of product

The Automatic Load Controller is a micro-processor based control unit containing all necessary functions for controlling and prioritising load groups.

It contains all necessary 3-phase measuring circuits, and all values and alarms are presented on the LCD display.

2.1.3 Options

The Multi-line 2 product range consists of different basic versions, which can be supplemented with the flexible options needed to provide the optimum solution. The options cover for instance various outputs, power management, serial communication, additional operator display and so on.

2.2 Standard functions

2.2.1 Display

- Prepared for remote mounting
- Push-buttons for breaker operations
- Push-button for changing running mode
- Status texts

2.2.2 M-Logic

- Simple logic configuration tool
- Selectable input events
- Selectable output commands

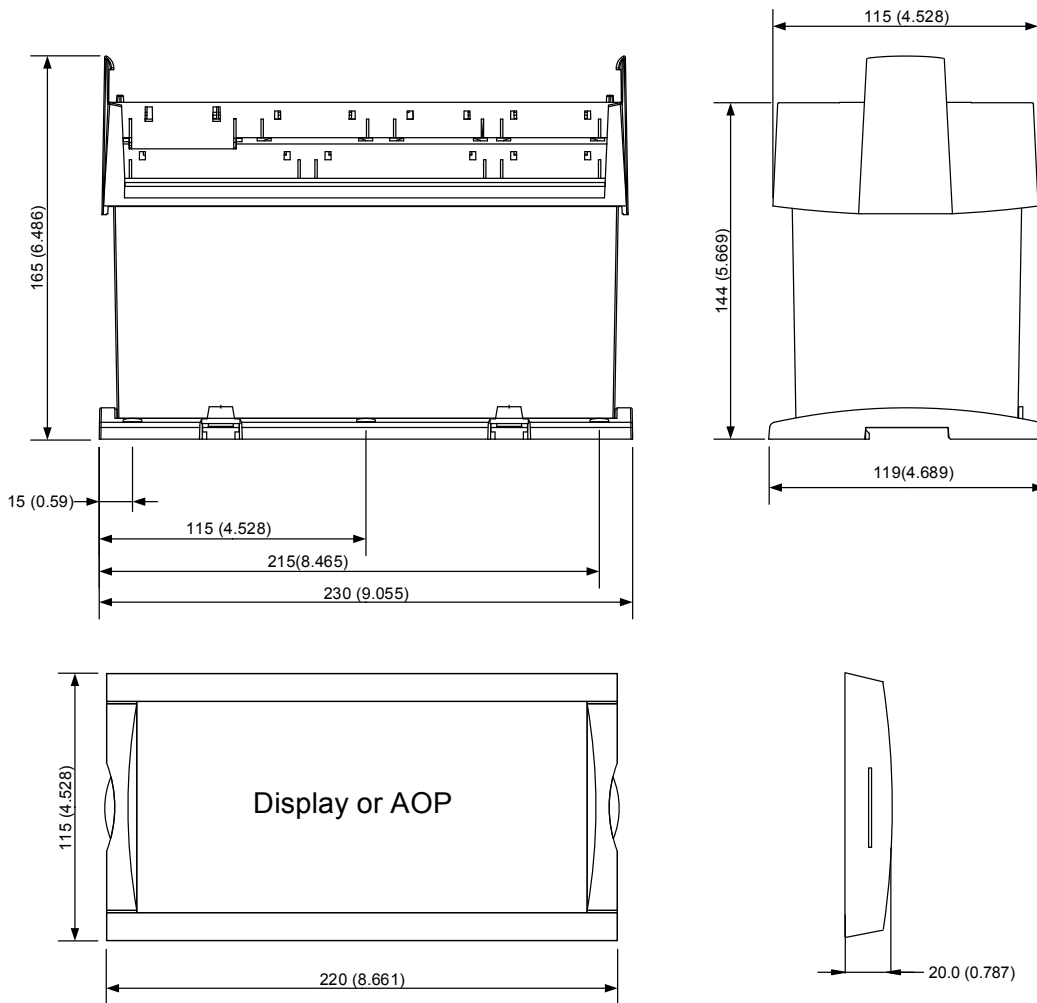
3. Mounting

3.1 ALC mounting and dimensions

3.1.1 Mounting of the unit

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

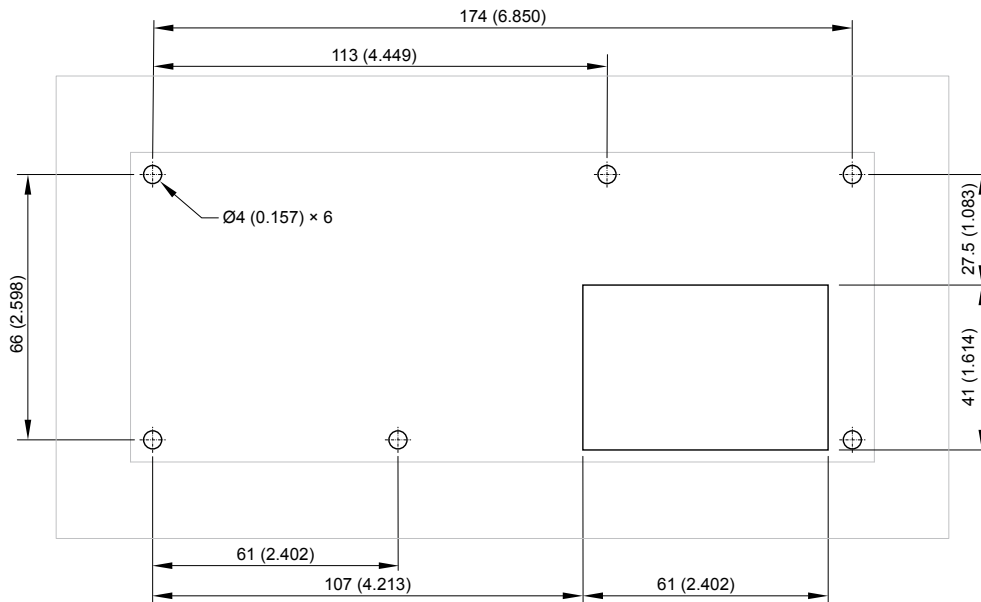
3.1.2 Unit dimensions



Dimensions are given in mm (inches).

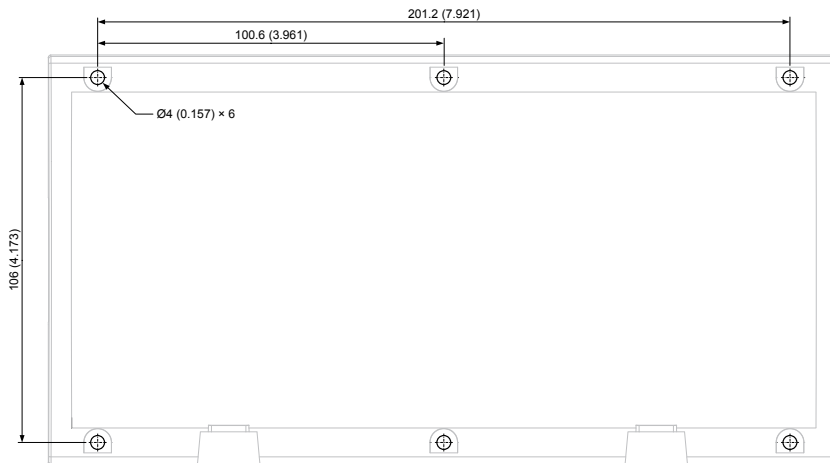
3.1.3 Panel cutout

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



Dimensions are given in mm.

3.1.4 Drilling template



Dimensions are given in mm (inches).

3.1.5 Mounting instructions

The unit can be mounted in two different ways:

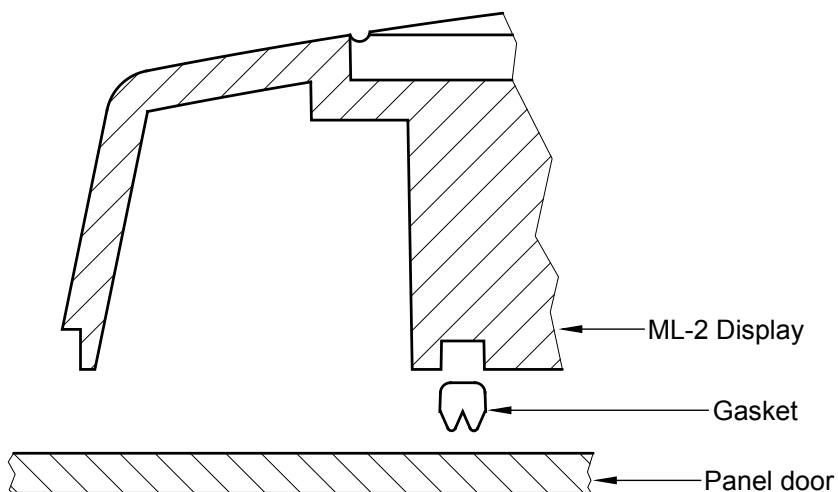
1. Directly mounted on a DIN rail.
2. Fastened with screws to the rear side of the cabinet. Six screw holes are available for this mounting method.

NOTE DEIF recommends using the screw hole fastening.

3.1.6 Mounting of gasket (option L1)

It is important that the gasket is mounted correctly; otherwise the IP65 tightness will not be obtained.

Mount the gasket as shown in the illustration below.



Furthermore, it is necessary to use all six screw holes to ensure IP65 tightness.

3.1.7 Tightening torques

Controller unit: 1.5 Nm for the six M4 screws (countersunk screws are not to be used)

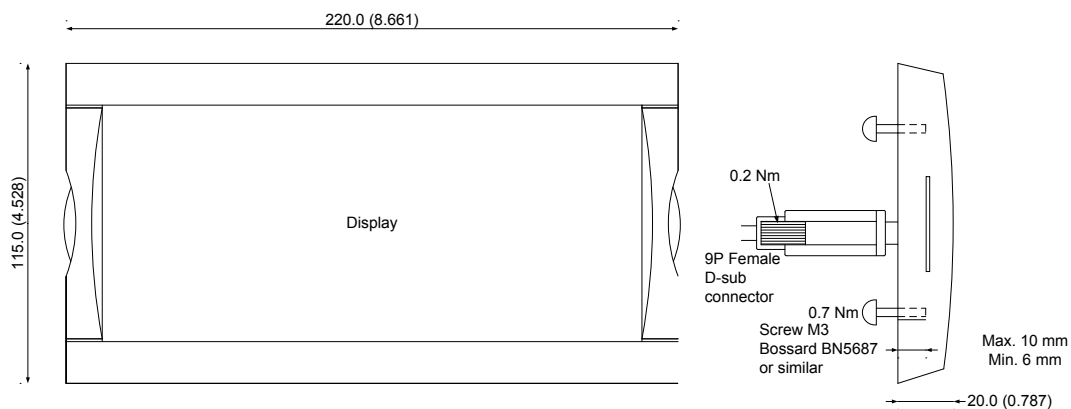
Plug connections (terminals): 0.5 Nm, 4.4 lb-in

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 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 (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 illustrated below.

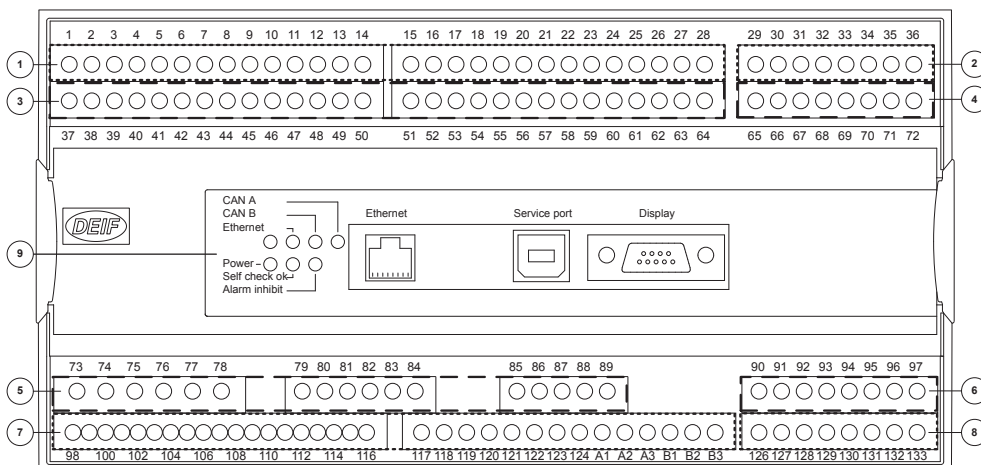
Slot type	Option	Slot #1	Slot #3	Slot #5	Slot #7
Terminals		1-28	37-64	73-89	98-125
Power supply	Standard	X			
AC measurements	Standard			X	
Power management	Standard				X
I/O extension	M12		X		

Slot type	Option	Slot #2	Slot #4	Slot #6	Slot #8
Terminals		29-34	65-72	90-97	126-133
Serial communication	H2	X			
I/O extension cards	M13.2/M14.2	X			
I/O extension cards	M14.4		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 Only hardware options, which will affect the hardware of the unit, are represented in the table. The software options will be seen through the PC utility software. The software options that are not represented in the above table can be found in the data sheet.

4.1.1 Unit top side overview

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



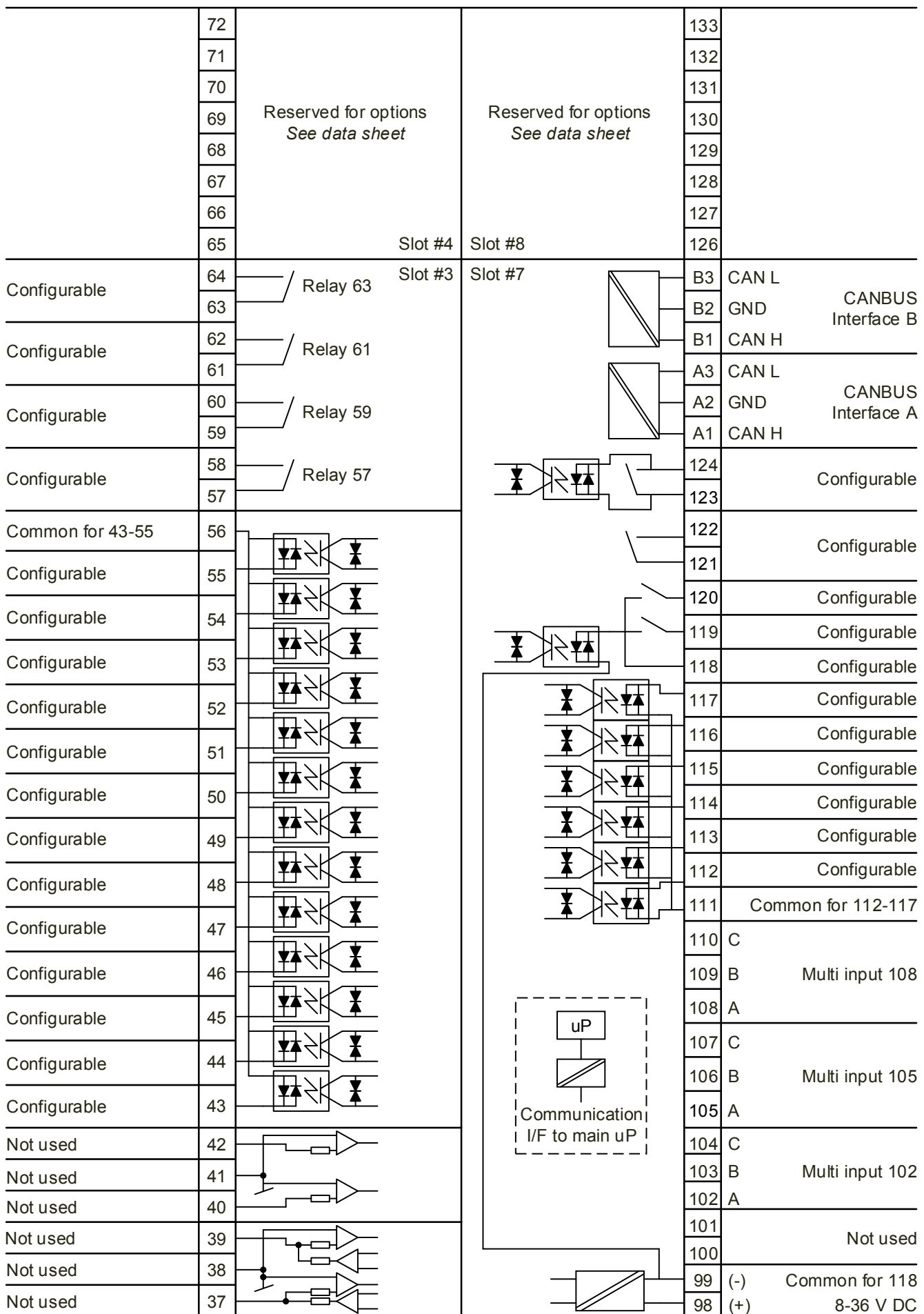
The numbers in the drawing above refer to the slot numbers indicated in the table below.

No.	Slot
1	#1, terminal 1-28, power supply (standard)
2	#2, terminal 29-36, communication and I/O extensions
3	#3, terminal 37-64, in-/outputs
4	#4, terminal 65-72, in-/outputs
5	#5, terminal 73-89, AC measuring (standard)
6	#6, terminal 90-97, in-/outputs
7	#7, terminal 98-125, in-/outputs/power management (standard)
8	#8, terminal 126-133, in-/outputs.
9	LED I/F

4.1.2 Terminal strip overviews

ALC Standard unit

	36			97	
	35			96	
	34			95	
	33	Reserved for options See data sheet	Reserved for options See data sheet	94	
	32			93	
	31			92	
	30			91	
	29	Slot #2	Slot #6	90	
Common for 23-27	28		Slot #1	Slot #5	
Configurable	27				
Configurable	26				
Configurable	25				
Configurable	24				
Configurable	23				
Common for 20/21	22				
kVArh pulse / Relay 20	21				
kWh pulse / Relay 20	20				
Configurable	19				
	18		Relay 17		
	17				
Configurable	16				
	15		Relay 14		
	14				
Configurable	13				
	12		Relay 11		
	11				
Configurable	10				
	9		Relay 08		
	8				
Alarm horn / configurable	7				
	6		Relay 05		
	5				
Status relay	4		Status relay		
	3				
DC power supply (-)	2				
8-36 VDC (+)	1				
				89	L3
				88	Neutral
				87	L2
				86	
				85	L1
				84	Neutral
				83	L3
				82	
				81	L2
				80	
				79	L1
				78	
				77	
				76	
				75	
				74	
				73	



NOTE The hardware shown in slot #3 is option M12. For a detailed description of this option, please refer to the option manual.

4.1.3 Input/output lists

In the I/O lists, the following terms will be used in connection with the relay outputs:

- **NO**: Normally Open
- **NC**: Normally Closed
- **NE**: Normally Energised
- **ND**: Normally Deenergised
- **Com.**: common terminal

4.1.4 Slot #1, power supply PCB

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		
9	Com.	Relay 08 250V AC/8 A	Configurable
10	NC		
11	NO	Relay 11 250 V AC/8 A	Configurable
12	Com.		
13	NC		
14	NO		
15	Com.	Relay 14 250 V AC/8 A	Configurable
16	NC		
17	NO	Relay 17 250 V AC/8 A	Configurable
18	Com.		
19	NC		
20	Open collector 1	Transistor output/Relay 20 36 V DC, 10 mA	Pulse output 1, kWh counter/configurable
21	Open collector 2	Transistor output/Relay 21 36 V DC, 10 mA	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	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

4.1.5 Slot #2, serial communication (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!

4.1.6 Slot #2, 7 digital inputs (option M13.2)

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

4.1.7 Slot #2, 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.		

4.1.8 Slot #3, 13 binary inputs and 4 relay outputs (option M12)

Term.	Function	Technical data	Description
37			Not used
38			
39			
40			
41			
42			
43	Binary input	Optocoupler	Configurable
44	Binary input	Optocoupler	Configurable
45	Binary input	Optocoupler	Configurable
46	Binary input	Optocoupler	Configurable
47	Binary input	Optocoupler	Configurable
48	Binary input	Optocoupler	Configurable
49	Binary input	Optocoupler	Configurable
50	Binary input	Optocoupler	Configurable
51	Binary input	Optocoupler	Configurable
52	Binary input	Optocoupler	Configurable
53	Binary input	Optocoupler	Configurable
54	Binary input	Optocoupler	Configurable
55	Binary 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.		

4.1.9 Slot #4, relay outputs (option M14.4)

Term.	Function	Technical data	Description
65	NE/ND	Relay 65 250 V AC/5 A	Configurable
66	Com.		
67	NE/ND	Relay 67 250 V AC/5 A	Configurable
68	Com.		
69	Not used	Relay 69 250 V AC/5 A	Configurable
70	Com.		

Term.	Function	Technical data	Description
71	Not used	Relay 71 250 V AC/5 A	Configurable
72	Com.		

4.1.10 Slot #5, AC measuring - ALC

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	Not used		
80			
81			
82			
83			
84			
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

4.1.11 Slot #6, 7 digital inputs (option M13.6)

Term.	Function	Technical data	Description
90	Com.	Common	Common for terminals 90-97
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

4.1.12 Slot #6, 4 relay outputs (option M14.6)

Term.	Function	Technical data	Description
90	NE/ND	Relay 90 250 V AC 5 A	Configurable
91	Com.		

Term.	Function	Technical data	Description
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.		

4.1.13 Slot #6, 4 analogue inputs (option M15.6)

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

4.1.14 Slot #6, 4 multi-inputs (option M16.6)

Term.	Function	Technical data	Description
90	Multi-input 91	Common	Configurable: 4-20 mA/0-5 V/Pt100
91	Multi-input 91	Analogue in	
92	Multi-input 93	Common	Configurable: 4-20 mA/0-5 V/Pt100
93	Multi-input 93	Analogue in	
94	Multi-input 95	Common	Configurable: 4-20 mA/0-5 V/Pt100
95	Multi-input 95	Analogue in	
96	Multi-input 97	Common	Configurable: 4-20 mA/0-5 V/Pt100
97	Multi-input 97	Analogue in	

4.1.15 Slot #7, engine interface card (std.) ALC

Term.	Function	Technical data	Description
98	+12/24 V DC	12/24 V DC ±30 %	DC power supply
99	0 V DC		
100	Not used		
101			

Term.	Function	Technical data	Description
102	A	0(4)-20 mA Digital Pt100 Pt1000 RMI 0-40 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	Configurable
119	NO	Relay 24 V DC/5 A	Configurable
120	NO	Relay 24 V DC/5 A	Configurable
121	Com.	Relay 250 V AC/5 A	Configurable
122	NO		
123	Com.	Relay 24 V DC/5 A	Configurable
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		

4.1.16 Slot #8, 7 digital inputs (option M13.8)

Term.	Function	Technical data	Description
126	Com.	Common	Common for terminals 127-133
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

Term.	Function	Technical data	Description
132	Digital input 132	Optocoupler	Configurable
133	Digital input 133	Optocoupler	Configurable

4.1.17 Slot #8, 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.		

4.1.18 Slot #8, 4 analogue inputs (option M15.8)

Term.	Function	Technical data	Description
126	Analogue input 127 -	Common	Configurable
127	Analogue input 127 +	4-20 mA in	
128	Analogue input 129 -	Common	Configurable
129	Analogue input 129 +	4-20 mA in	
130	Analogue input 131 -	Common	Configurable
131	Analogue input 131 +	4-20 mA in	
132	Analogue input 133 -	Common	Configurable
133	Analogue input 133 +	4-20 mA in	

4.1.19 Slot #8, 4 multi-inputs (option M16.8)

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

5. Wirings

5.1 AC connections

The Multi-line 2 unit can be wired up in 1-phase, 2-phase or 3-phase configuration.



DANGER!

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

5.1.1 Neutral line (N)

When three-phase distribution systems are used, the neutral line (N) is only necessary if it is a three-phase + neutral system. If the distribution system is a three-phase system without neutral, then leave terminal 84 empty.

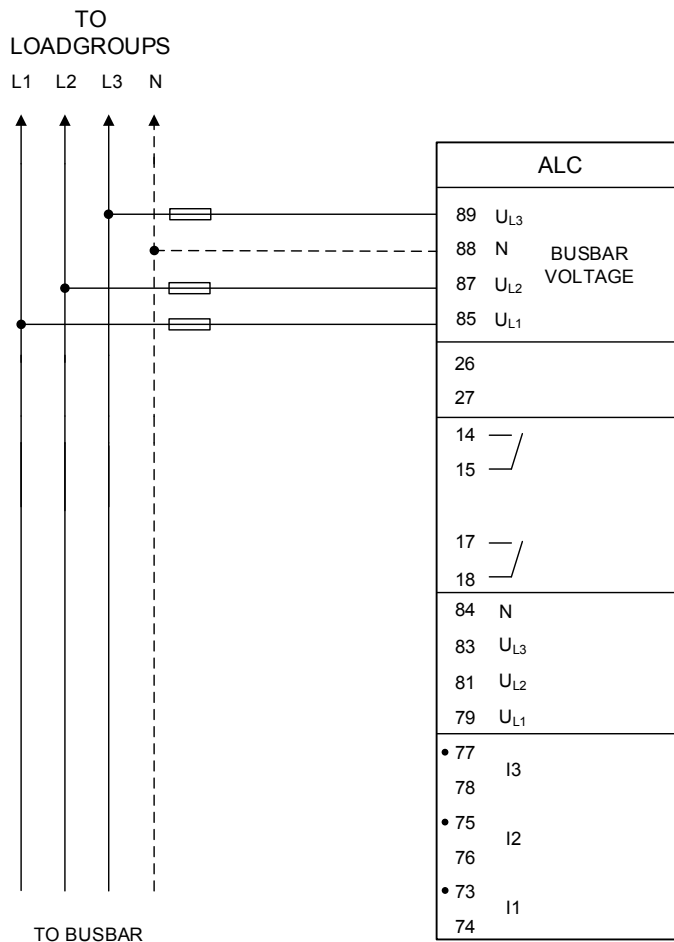
5.1.2 Current transformer grounding

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

5.1.3 Fuses

If the cables are protected with fuses, then use 2 A, slow blow.

5.1.4 ALC 3-phase



5.2 DC connections

5.2.1 Digital inputs

Figure 5.1 Battery positive to input

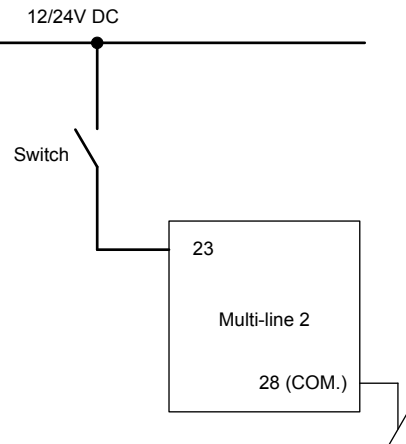


Figure 5.2 Battery negative to input

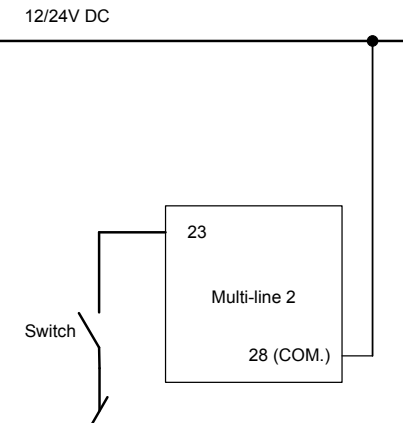
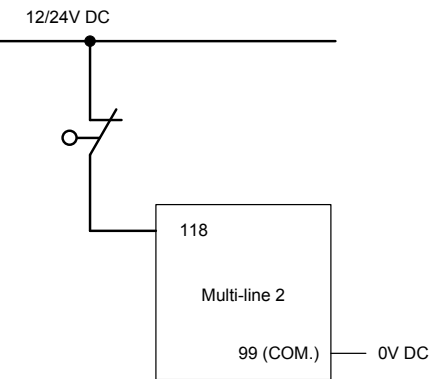


Figure 5.3 Emergency stop



5.2.2 Analogue inputs (option M15.X)

Figure 5.4 4-20 mA, active transducer

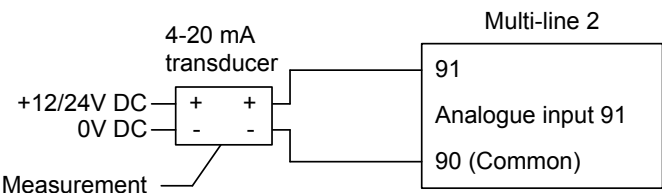


Figure 5.5 4-20 mA, passive transducer

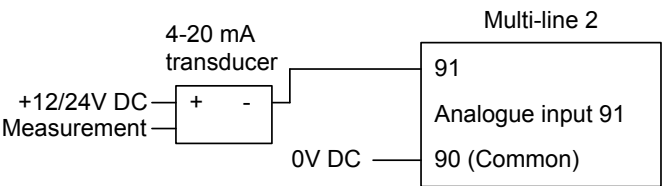
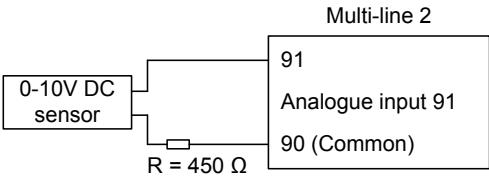


Figure 5.6 4-20 mA, V DC sensor



5.2.3 Multi-inputs (option M16.X)

Figure 5.7 4-20 mA, active transducer

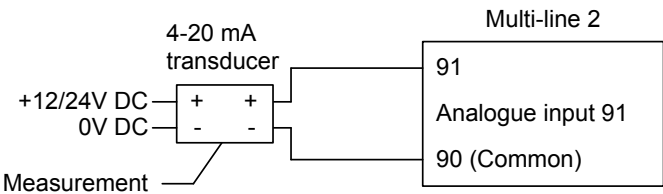


Figure 5.8 4-20 mA, passive transducer

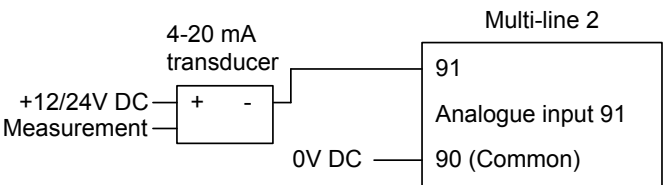


Figure 5.9 4-20 mA, V DC sensor

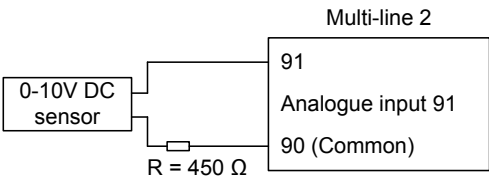


Figure 5.10 0-5 V DC

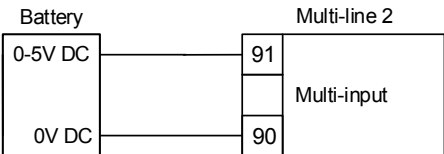
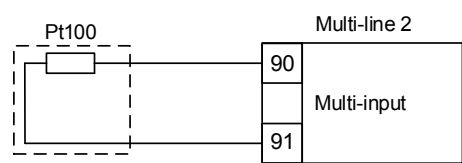


Figure 5.11 Pt100



5.2.4 Multi-inputs (102, 105, 108)

The multi-inputs are placed in slot #7, the terminal numbers for the individual multi-inputs can be seen in the "Input/output list".

Figure 5.12 0(4)-20 mA, active transducer

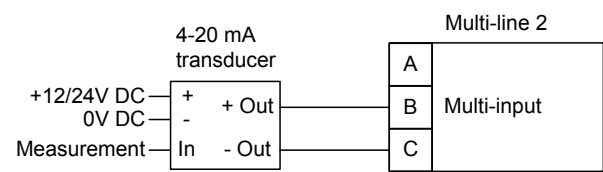
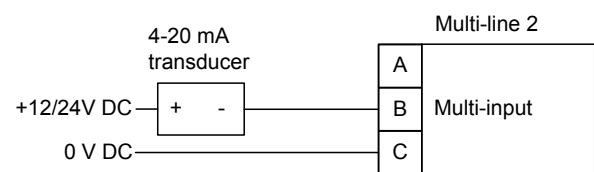
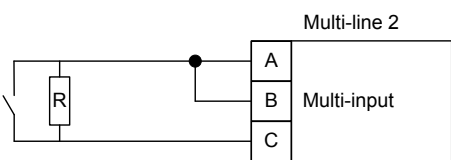


Figure 5.13 0(4)-20 mA, passive transducer



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

Figure 5.14 Digital input



The resistor is only mounted if wire fail supervision is required. The value of the resistor should be $270\ \Omega \pm 10\ %$.

Figure 5.15 Pt100/Pt1000, 2-wire

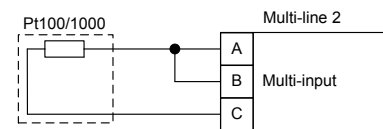


Figure 5.16 Pt100/Pt1000, 3-wire

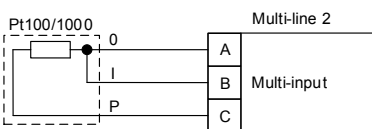


Figure 5.17 RMI, 1-wire

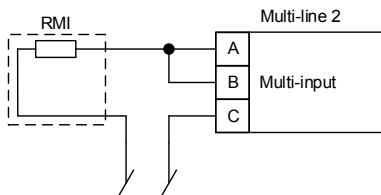


Figure 5.18 RMI, 2-wire

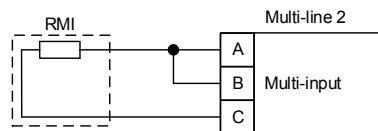
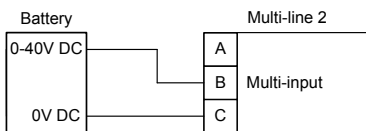


Figure 5.19 0-40 V DC



5.2.5 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.

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

Figure 5.20 External counter

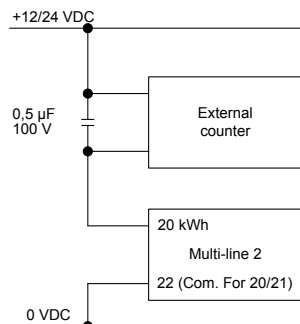
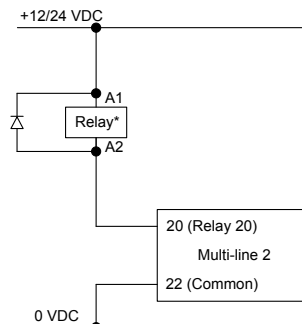
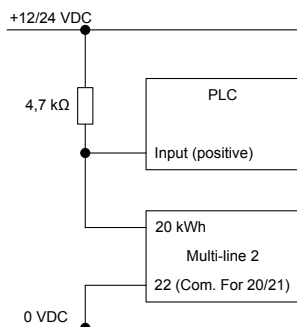


Figure 5.21 Relay outputs



NOTE * Remember to mount the freewheeling diode. If the external relay does not have a built-in diode, you can use a 1N4007 (1000 V/1 A) diode.

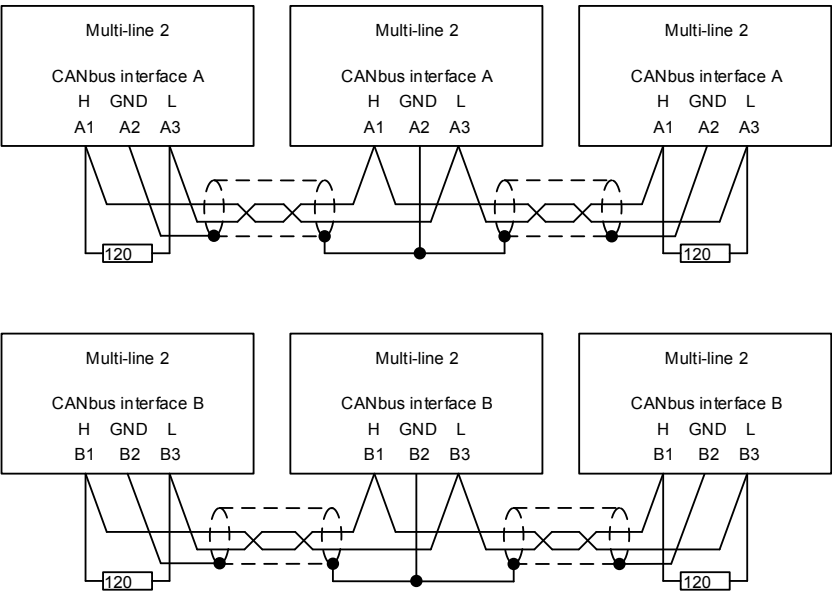
Figure 5.22 Connection to PLC



5.3 Communication

5.3.1 CAN bus (Option G5)

Examples with three ML-2 units connected, for example two AGC units and one ALC unit.

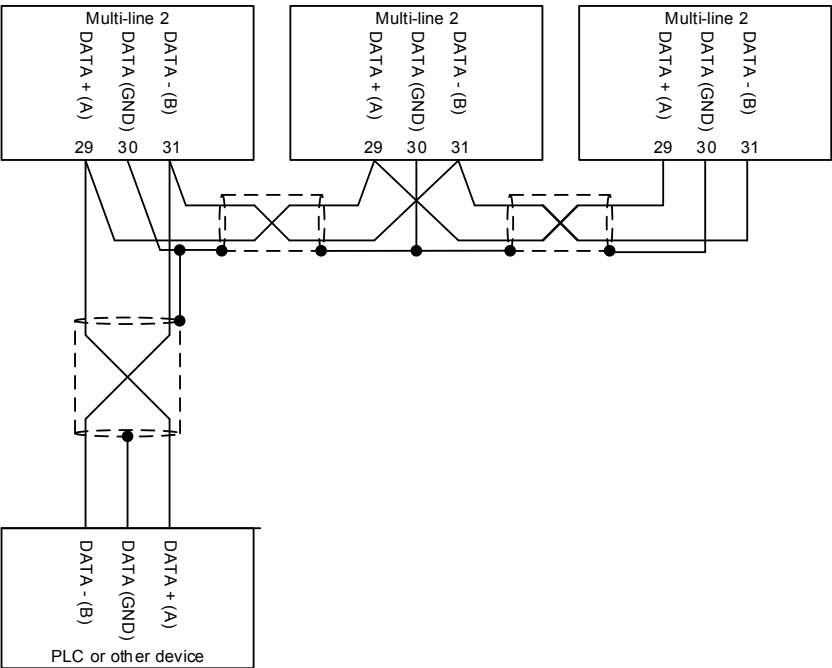


Connect the shield to earth at one end only. The shield ends must be insulated with tape or insulation tubing. Use shielded twisted cable.

NOTE End resistor R = 120 Ohm.

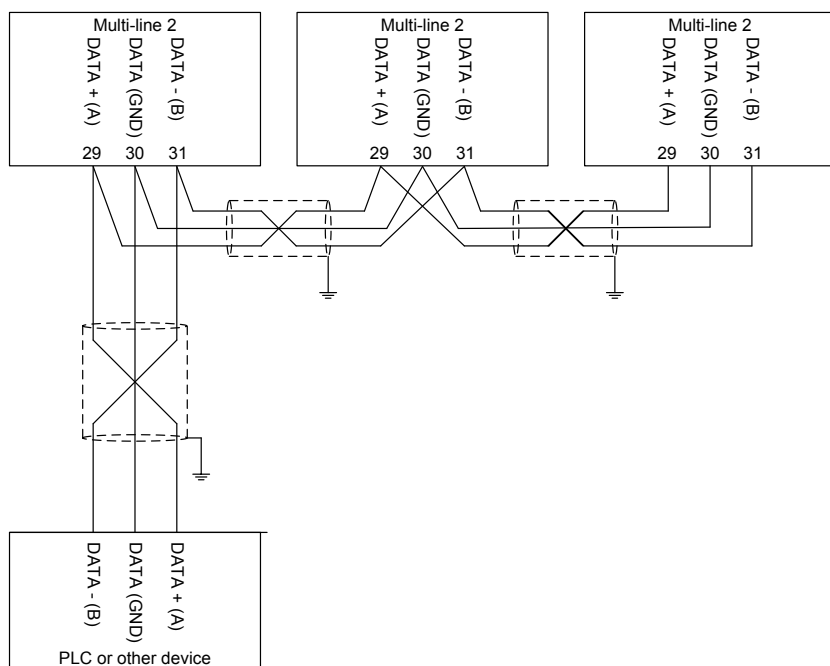
5.3.2 Modbus (option H2)

Connection with 2-wire screened cable (recommended):



Connect the shield to ground at one end only. The shield ends must be insulated with tape or insulation tubing. Use shielded twisted cable.

Connection with 3-wire shielded cable:



Connect the shield to ground at one end only. The shield ends must be insulated with tape or insulation tubing. Use shielded twisted cable.



DANGER!

This solution is only feasible if the COM line is insulated. Check PLC/other device before connecting.



DANGER!

A non-insulated COM line may result in damage to the equipment.

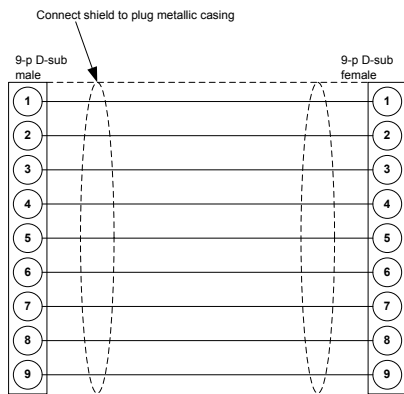
NOTE Normally, the Modbus does not need bias resistors (end terminators). These are only needed in case of very long lines and/or many nodes (>32) on the Modbus network. If bias resistors are needed, the calculation should be based on the following data:

- A line internal pull-up bias resistor: 22 k Ω
- B line internal pull-down bias resistor: 22 k Ω
- Receiver input sensitivity: ± 200 mV
- Receiver input impedance: 12 k Ω

NOTE Cable: Belden 3105A or equivalent. 22 AWG (0.6 mm²) twisted pair, shielded, <40 m Ω /m, min. 95 % shield coverage.

5.3.3 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 mm², 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.

6. Technical information

6.1 Technical information, ALC

6.1.1 Technical specifications

Accuracy	Class 1.0 -25 to 15 to 30 to 70 °C Temperature coefficient: ± 0.2 % of full scale per 10°C
Operating temperature	-25 to 70 °C (-13 to 158 °F) -25 to 60 °C (-13 to 140 °F) if Modbus TCP/IP (option N) is available in the controller (UL/cUL Listed: Max. surrounding air temperature: 55 °C/131 °F)
Storage temperature	-40 to 70 °C (-40 to 158 °F)
Climate	97 % RH to IEC 60068-2-30
Operating altitude	0 to 4000 m above sea level Derating 2001 to 4000 m above sea level: Max. 480 V AC phase-phase 3W4 measuring voltage Max. 690 V AC phase-phase 3W3 measuring voltage
Measuring voltage	100 to 690 V AC ± 20 % (UL/cUL Listed: 600 V AC phase-phase) Consumption: Max. 0.25 VA/phase
Measuring frequency	30 to 70 Hz
Aux. supply	Terminals 1 and 2: 12/24 V DC (8 to 36 V continuously, 6 V 1 sec). 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 (8 to 36 V continuously, 6 V 1 sec). Max. 5 W consumption The aux. supply inputs are to be protected by a 2 A slow blow fuse. (UL/cUL Listed: AWG 24)
Binary inputs	Optocoupler, bi-directional ON: 8 to 36 V DC Impedance: 4.7 k Ω OFF: <2 V DC
Analogue inputs	-10 to +10 V DC: Not galvanically separated. Impedance: 100 k Ω (G3) 0(4) to 20 mA: Impedance 50 Ω . Not galvanically separated (M15.X)
Multi-inputs	0(4) to 20 mA: 0 to 20 mA, ± 1 %. Not galvanically separated Binary: Max. resistance for ON detection: 100 Ω . Not galvanically separated Pt100/1000: -40 to 250 °C, ± 1 %. Not galvanically separated. To IEC/EN60751. V DC: 0 to 40 V DC, ± 1 %. Not galvanically separated
Relay outputs	Electrical rating: 250 V AC/30 V DC, 5 A. (UL/cUL Listed: 250 V AC/24 V DC, 2 A resistive load) Thermal rating @ 50 °C: 2 A: Continuously. 4 A: ton = 5 sec, toff = 15 sec (Unit status output: 1 A)
Open collector outputs	Supply: 8 to 36 V DC, max. 10 mA (terminal 20, 21, 22 (com))
Galvanic separation	Between AC voltage and other I/Os: 3250 V, 50 Hz, 1 min Between analogue outputs and other I/Os: 550 V, 50 Hz, 1 min Between binary input groups and other I/Os: 550 V, 50 Hz, 1 min
Mounting	DIN rail mount or base mount with six M4 screws Tightening torque: 1.5 Nm for the six M4 screws (countersunk screws are not to be used)
Safety	To EN 61010-1, installation category (over-voltage category) III, 600 V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, over-voltage category III, 600 V, pollution degree 2
EMC/CE	To EN 61000-6-2, EN 61000-6-4, IEC 60255-26
Vibration	3 to 13.2 Hz: 2 mmpp. 13.2 to 100 Hz: 0.7 g. To IEC 60068-2-6 & IACS UR E10 10 to 60 Hz: 0.15 mmpp. 60 to 150 Hz: 1 g. To IEC 60255-21-1 Response (class 2) 10 to 150 Hz: 2 g. To IEC 60255-21-1 Endurance (class 2)

Shock (base mount)	10 g, 11 ms, half sine. To IEC 60255-21-2 Response (class 2) 30 g, 11 ms, half sine. To IEC 60255-21-2 Endurance (class 2) 50 g, 11 ms, half sine. To IEC 60068-2-27
Bump	20 g, 16 ms, half sine. To IEC 60255-21-2 (class 2)
Material	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections	AC voltage: 0.2 to 2.5 mm ² stranded wire. (UL/cUL Listed: AWG 20) Relays: (UL/cUL Listed: AWG 22) Terminals 98-116: 0.2 to 1.5 mm ² stranded wire. (UL/cUL Listed: AWG 24) Other: 0.2 to 2.5 mm ² stranded wire. (UL/cUL Listed: AWG 24) Tightening torque: 0.5 Nm (5-7 lb-in) Display: 9-pole Sub-D female Tightening torque: 0.2 Nm Service port: USB A-B
Protection	Unit: IP20. Display: IP40 (IP54 with gasket: Option L). (UL/cUL Listed: Type Complete Device, Open Type). To IEC/EN 60529
Approvals	UL/cUL Listed to UL508 Applies to VDE-AR-N 4105
UL markings	Wiring: Use 60/75 °C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada) AOP-2: 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: 0.5 Nm (4.4 lb-in) Panel door mounting: 0.7 Nm Sub-D screw: 0.2 Nm
Weight	Base unit: 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) Display: 0.4 kg (0.9 lbs)