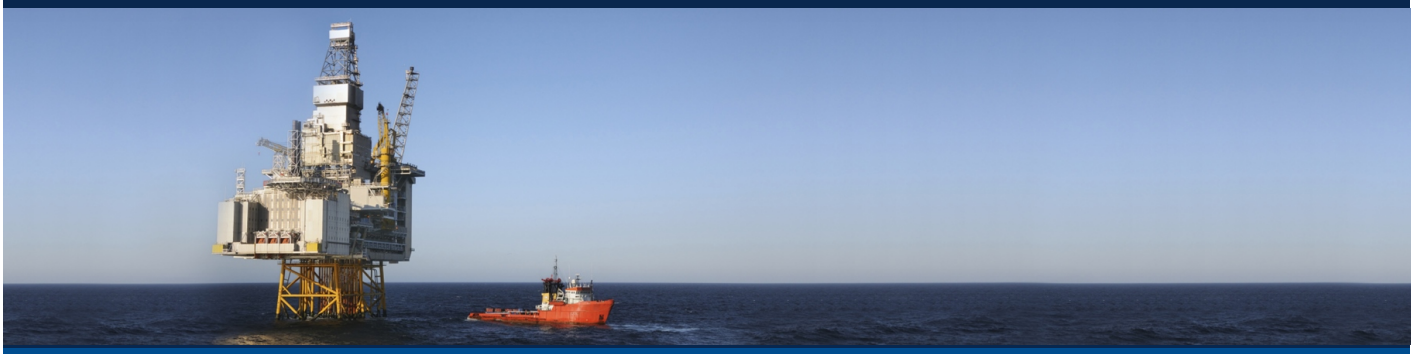
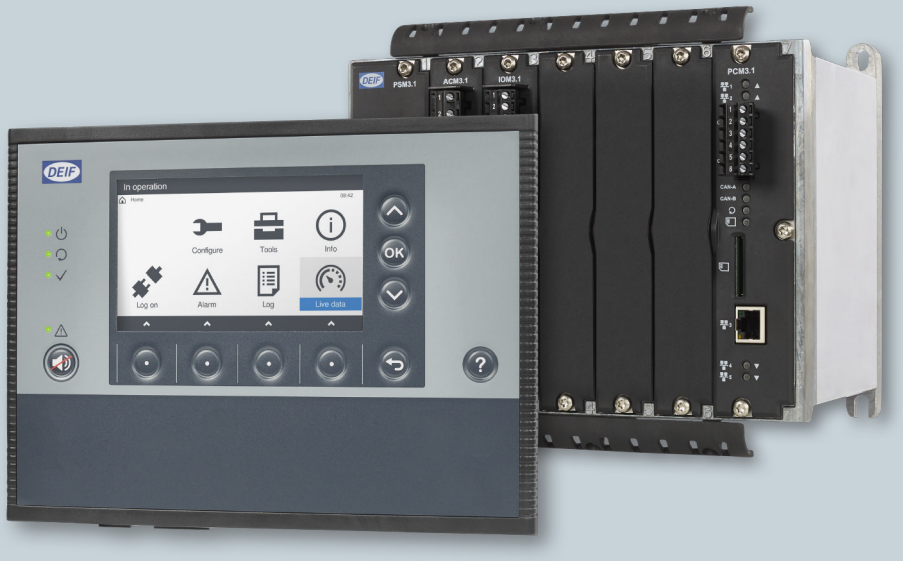
INSTALLATION INSTRUCTIONS



Generator Protection Unit
GPU 300



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1. Introduction

1.1 About the Installation instructions

1.1.1 General purpose

These are the installation instructions for DEIF's Generator Protection Unit, GPU 300. The installation instruction provide information for the correct installation of GPU 300. The primary focus of these instructions is the physical installation of the equipment.

DANGER!
Read these instructions before you install the GPU 300 controllers, to avoid personal injury and damage to the equipment.

The information in the installation instructions is for default configurations. If the system deviates from the default configuration, record the differences, and communicate this information as part of the system documentation.

The data sheet includes all the hardware and system technical specifications. Design information is included in the designer's handbook, while commissioning information is included in the commissioning guidelines.

INFO
The installation instructions include nominal hardware ratings. Refer to the data sheet for the most accurate and complete specifications.

1.1.2 Intended users of the Installation instructions

The Installation instructions are primarily for the people who mount and wire up the controllers and display units. The Installation instructions can be used during commissioning to check the installation. Designers may also find it useful to refer to the Installation instructions when developing the system's wiring diagrams. Operators may find it useful to refer to the Installation instructions while troubleshooting.

1.1.3 Technical support

You can read about service and support options on the DEIF website, www.deif.com. You can also find contact details on the DEIF website.

You have the following options if you need technical support:

- Help: The display unit includes context-sensitive help.
- Technical documentation: Download all the product technical documentation from the DEIF website: www.deif.com/documentation
- Training: DEIF regularly offers training courses at the DEIF offices worldwide.
- Support: DEIF offers 24-hour support. See www.deif.com for contact details. There may be a DEIF subsidiary located near you. You can also e-mail support@deif.com.
- Service: DEIF engineers can help with design, commissioning, operating and optimisation.

1.1.4 List of technical documentation for GPU 300

Document	Contents
Data sheet	• Controller application, functions, hardware and protections • Technical specifications • Hardware modules, display unit, and accessories • Ordering information
Quick start guide	• Mounting • Connecting wiring • PICUS (PC software) ◦ Download and install ◦ Controller configuration • Display unit overview
Designer's handbook	• Controller principles and functions • Alarms • AC configuration and nominal settings • Breaker • Hardware characteristics • PICUS parameters, alarms and passwords • Modbus
Installation instructions	• Tools and materials • Mounting • Minimum wiring for the controller • Wiring for hardware module terminals • Wiring for controller functions • Wiring communication • Wiring the display unit
Commissioning guidelines	• Tools, software and information required • Controller and equipment checks • Testing • Troubleshooting
Operator's manual	• Controller equipment • Operating the controller • Alarms and log • Using the display unit • Troubleshooting and maintenance
PICUS manual	Using PICUS and CustomLogic

1.2 Warnings and safety

1.2.1 Safety during installation and operation

Installing and operating the equipment may require 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. Touching the terminals could lead to injury or death.

1.2.2 Metal fragments and other objects

Do not allow metal fragments or other objects to fall into the controller rack or display unit. Be especially careful during installation, for example, when shortening wires.

To prevent metal fragments from falling into the controller rack, it is recommended to place a cover over the top ventilation holes of the controller rack. The controller is supplied with a disposable cover to protect it from metal fragments and other objects during the first installation.

CAUTION
Keep metal fragments out of the controller. Metal fragments can damage the controller.

CAUTION
Remember to remove the cover for the controller rack ventilation holes after work has been completed. Failure to do so can damage the controller.

1.2.3 Electrostatic discharge

You must protect the equipment terminals from static discharge during handling, including installation and dismounting. Once the equipment is correctly installed and the frame ground is connected, it is no longer necessary to protect the terminals from static discharge.

1.2.4 Controller power supply

If the controller has no power supply, it is OFF and does not provide any protection to the system. The controller cannot enforce any trip, block, or latch when it is off. All the controller relays de-energise.

The controller must have a reliable power supply, which must include a backup power supply. In addition, the switchboard design must ensure that the system is sufficiently protected if the controller power supply fails.

1.2.5 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.

1.2.6 Do not use unsupported hardware modules

CAUTION
Only use the hardware modules that are listed in the controller data sheet. Unsupported hardware modules can make the controller malfunction.

1.3 Legal information

1.3.1 Third party equipment

DEIF takes no responsibility for the installation or operation of any third party equipment, including the **genset**. Contact the **genset company** if you have any doubt about how to install or operate the genset.

1.3.2 Warranty

CAUTION
The rack may only be opened to remove, replace, and/or add a hardware module. The procedure in the **Installation instructions** must be followed. If the rack is opened for any other reason, and/or the procedure is not followed, then the warranty is void.

CAUTION
If the display unit is opened, then the warranty is void.

1.3.3 Open source software

This product contains open source software licensed under, for example, the GNU General Public License (GNU GPL) and GNU Lesser Public License (GNU LGPL). The source code for this software can be obtained by contacting DEIF at support@deif.com. DEIF reserves the right to charge for the cost of the service.

1.3.4 Trademarks

DEIF, power in control and the DEIF logo are trademarks of DEIF A/S.

Modbus is a registered trademark of Schneider Automation Inc.

Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

All trademarks are the properties of their respective owners.

1.3.5 Copyright

1.3.6 Disclaimer

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

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

2. Preparing for the installation

2.1 Tools

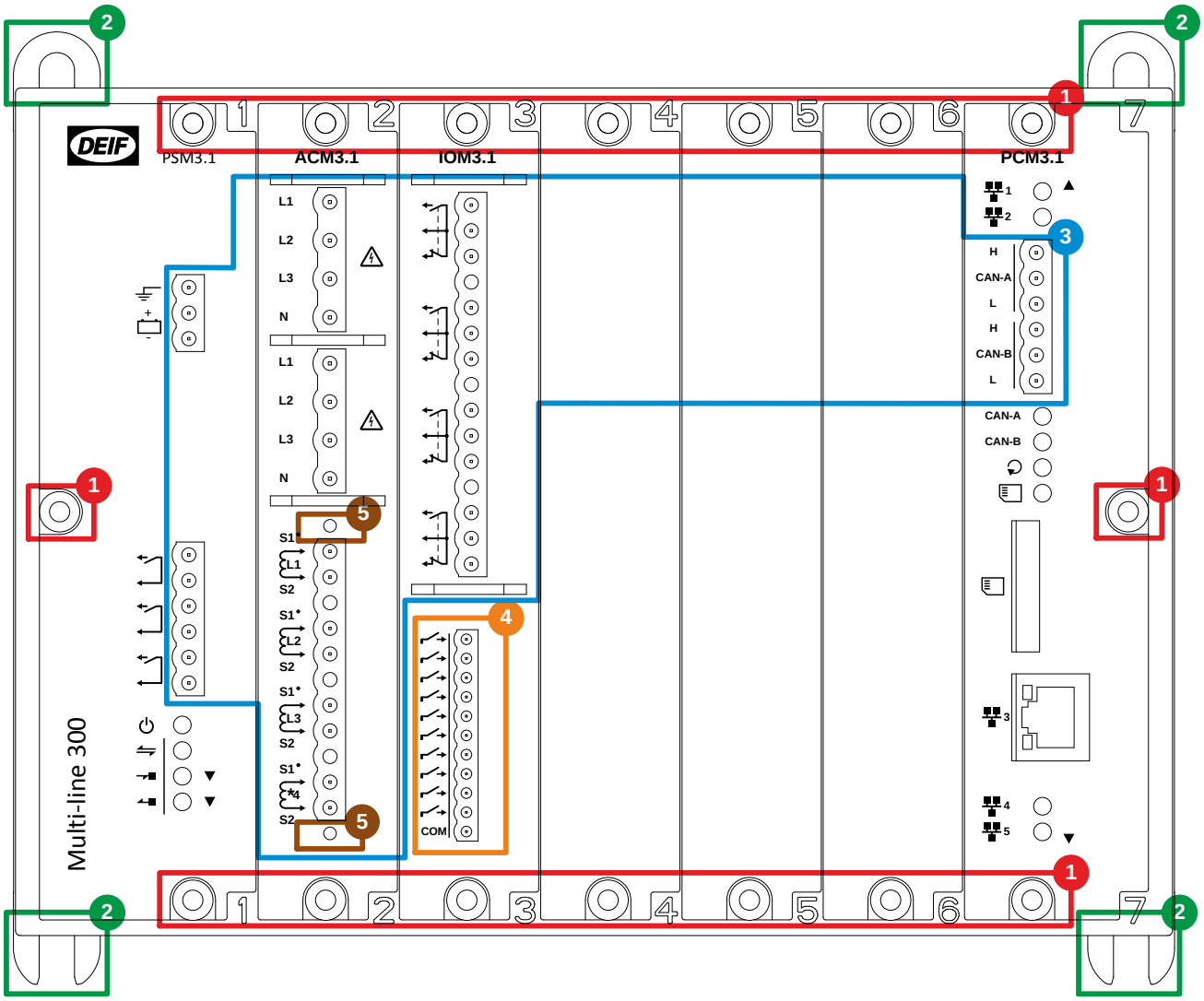
2.1.1 Tools required for mounting and installation

Tool	Attachment	Torque	Used to	Diagram
Safety equipment	-	-	Personal protection, according to local standards and requirements.	-
Conducting wrist strap	-	-	Prevent electrostatic discharge damage to modules during mounting.	-
Optional: Torque screwdriver	TX20 bit	0.5 N·m (4.4 lb-in)	Remove modules, or screw extra modules into the rack. Not required if the required modules are already mounted in the rack.	1 (red)
Optional: Torque screwdriver	TX10 bit	0.5 N·m (4.4 lb-in)	Remove, or remount the cable strain relief plates. The rack is delivered with the cable strain relief plates already mounted.	-
Torque wrench*	10 mm hex socket for 6 mm nuts (7/16 in hex socket for 1/4 in nuts)	5 N·m (44 lb-in)	Tighten the nuts on the rack mounting bolts.	2 (green)
Torque screwdriver	PH2 bit or a 5 mm (0.2 in) flat-bladed bit	0.15 N·m (1.3 lb-in)	Tighten the display unit fixing screw clamps.	-
Torque screwdriver	3.5 mm (0.14 in) flat-bladed bit	0.5 N·m (4.4 lb-in)	Connect the wiring to all the 2.5 mm² terminals.	3 (blue)
Torque screwdriver	2.5 mm (0.1 in) flat-bladed bit	0.25 N·m (2.2 lb-in)	Connect the wiring to the 1.5 mm² terminals.	4 (orange)
Optional: Torque screwdriver	3.5 mm (0.14 in) flat-bladed bit	0.5 N·m (4.4 lb-in)	Remove or secure the current measurement terminal block to the ACM3.1 module faceplate. ACM3.1 is delivered with the current measurement terminal block already secured.	5 (brown)
Wire stripper, pliers and cutters	-	-	Prepare wiring Trim cable ties	-

*Note: The size of the torque wrench attachment depends on the nut and bolt size of the mounting bolts. These parts are not supplied by DEIF and the sizes mentioned are only a recommendation.

CAUTION
Do not use power tools during the installation. Too much torque will damage the equipment.

Figure 2.1 Tools required to install a controller rack



2.2 Materials

2.2.1 Materials required

The following materials are required to install the controllers and display units.

Installation step	Materials	Purpose	More information
Mounting	Four fasteners per rack	Mount the controller rack	See **Mounting the rack** for more information.
	Grounding wire	Ground the controller rack	See **Grounding the rack** for more information

Installation step	Materials	Purpose	More information
Wiring	Wires	Wire the measurement points, switchboard and/or third party equipment to the controller/display unit terminals	See the **Data sheet** for the wiring specifications for each terminal See the drawings from the system designer
	Ethernet cables	Connect the controller communication to: • The display unit • Between controllers • External systems	See the **Data sheet** for the Ethernet cable specifications See the communication drawings from the system designer
	Cable ties	Secure the rack wiring and Ethernet cables Secure the display unit wiring and Ethernet cables	See **Rack cable strain relief** and **Display unit cable strain relief** for more information

2.3 Site

2.3.1 Site requirements

The controller is designed to be installed and operated in a clean and dry environment as specified in the data sheet. If the controller is installed in an area subject to constant high vibrations sufficient precautions should be taken to isolate the controller from the vibrations. As a minimum requirement it is recommended that the installation environment complies with the electrical, mechanical and environmental specifications of the product as described in the data sheet.

CAUTION
If during or after installation of the product the electrical, mechanical or environmental specifications are exceeded, the lifetime of the product will be reduced.

3. Mounting the equipment

3.1 Introduction

3.1.1 Introduction to mounting the equipment

The controller rack should be delivered from the factory with all the required hardware modules. However, if you need to mount an additional hardware module, or to replace a hardware module, read this chapter.

INFO
Hardware modules are standardised, replaceable printed circuit boards that are mounted in the rack. For example, PSM3.1 is a hardware module that supplies power to the rest of the rack.

The controller rack is mounted in an enclosure, while the display unit is mounted in a panel.

This chapter describes how to mount or replace hardware modules, as well as mount the rack and display unit.

Deviating from the default configuration
You can mount the hardware modules in a different order from that recommended in these instructions. If you choose to do this, DEIF recommends that you document where you have chosen to deviate from the default configuration and ensure that this information is included in the system documentation. Record the following for each hardware module:

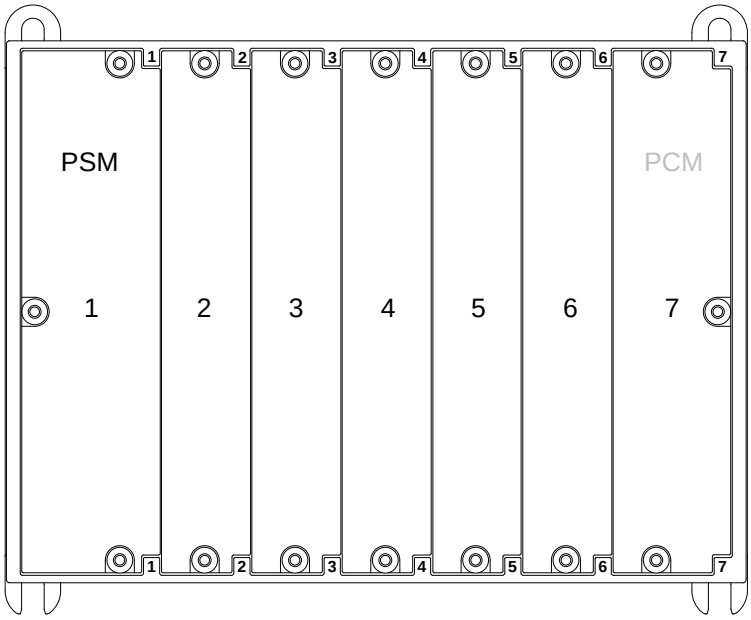
- Module name
- Module's rack slot number in the default configuration
- Module's rack slot number in your customised configuration

INFO
CAD drawings for both the controller rack and display unit can be download from the DEIF homepage. The download is available as either an AutoCAD file or a stp file.

3.2 Mounting modules

3.2.1 Rack slots and their requirements

The following diagram shows the slot numbering in the rack. The power supply module (PSM) is always mounted in slot 1. If a processor and communication module (PCM) is present, it is always mounted in slot 7.



The controller hardware modules can be arranged in any order in the rack, as long as they comply with these requirements:

- Apart from PSM and PCM, the hardware modules are slotted into the rack from slot 2 onwards, without leaving any empty slots between the hardware modules.
- If a PCM is not present, slot 7 may be used for other hardware modules.
- "Blind" modules (these consist of the module faceplates only) must be installed over empty slots, to protect the controller electronics.

INFO
If there are one or more **empty slots between the hardware modules** in the rack, the hardware modules after the empty slot(s) **cannot communicate** with the PCM module. The software will not recognise or communicate with these hardware modules either.

INFO
If you rearrange the order of the hardware modules, you may lose some/all of the module configuration information. You should therefore always make a backup of the configuration before rearranging the hardware modules.

3.2.2 Mounting hardware modules in the rack

The controller will normally be supplied with the hardware modules already mounted. However, it may occasionally be necessary for you to add or replace a hardware module. If you need to add a hardware module, you can use the first empty slot from the left of the rack.

Legal

INFO
The manufacturer's warranty will not apply if the rack has been opened by unauthorised persons. However, you are allowed to replace or add hardware modules (dedicated printed circuit boards) supplied by DEIF. To retain the warranty, each hardware module must be mounted by a qualified person, in accordance with these written instructions.

Safety: Hazardous live currents and voltages

DANGER!
Hazardous live currents and voltages may be present in a rack that is already installed. Contact with these could kill you. Only authorised personnel, who understand the precautions needed and the risks involved in working with live electrical equipment, may do this work.

Safety: Disrupting control

DANGER!
Working on the rack may disrupt the control of the generator, busbar or connection. Take the necessary precautions.

Protecting equipment: No hot swapping

CAUTION
Disconnect all power supplies before removing or adding a hardware module. The hardware modules are not designed for hot swapping.

Electrostatic precautions when mounting hardware modules

CAUTION
Protect the hardware modules against static discharge during installation. Protect the rack against static discharge if it has not yet been mounted and the frame ground has not yet been connected.

Caution: No unsupported hardware modules

CAUTION
Only use the hardware modules that are listed in the controller data sheet. Unsupported hardware modules can make the controller malfunction.

Physical mounting of hardware modules

1. Disconnect all power supplies (that is, the PSM and, if present, other modules with independent power supplies), to protect the hardware modules and personnel.
2. Test the resistance of the wrist strap and the resistance of the wrist strap connection. Do not continue if the wrist strap connection is faulty. Use the wrist strap at all times while installing or uninstalling the hardware modules to protect them against static discharge.
3. If applicable, remove the hardware module to be replaced from the rack:
   a. Remove the terminal blocks, and make sure that there are no wires in the way of removing the hardware module.
      • Where relevant, disconnect the Ethernet cables from the top and bottom of the hardware module.
   b. Loosen the hardware module faceplate screws using a screwdriver with a TX20 bit.
      • Do not force the screws to unscrew completely. The screws are built-in and therefore normally remain attached to the faceplate.
   c. Use pliers or your fingers to pull the faceplate screws, and carefully slide the hardware module out of the rack.
      • Only pull the screws. Do not pull any other part of the faceplate.
   d. If you want to re-use the hardware module, or send it in for testing, be careful to only handle it by its faceplate. Put the hardware module in ESD protective packaging after removing it.
4. To install the new hardware module:
   a. Open the ESD protective packaging, and remove the new hardware module, holding it only by its faceplate.
   b. Make sure that the hardware module is the right way up, and slide it into the correct slot. The hardware module should slide in easily.

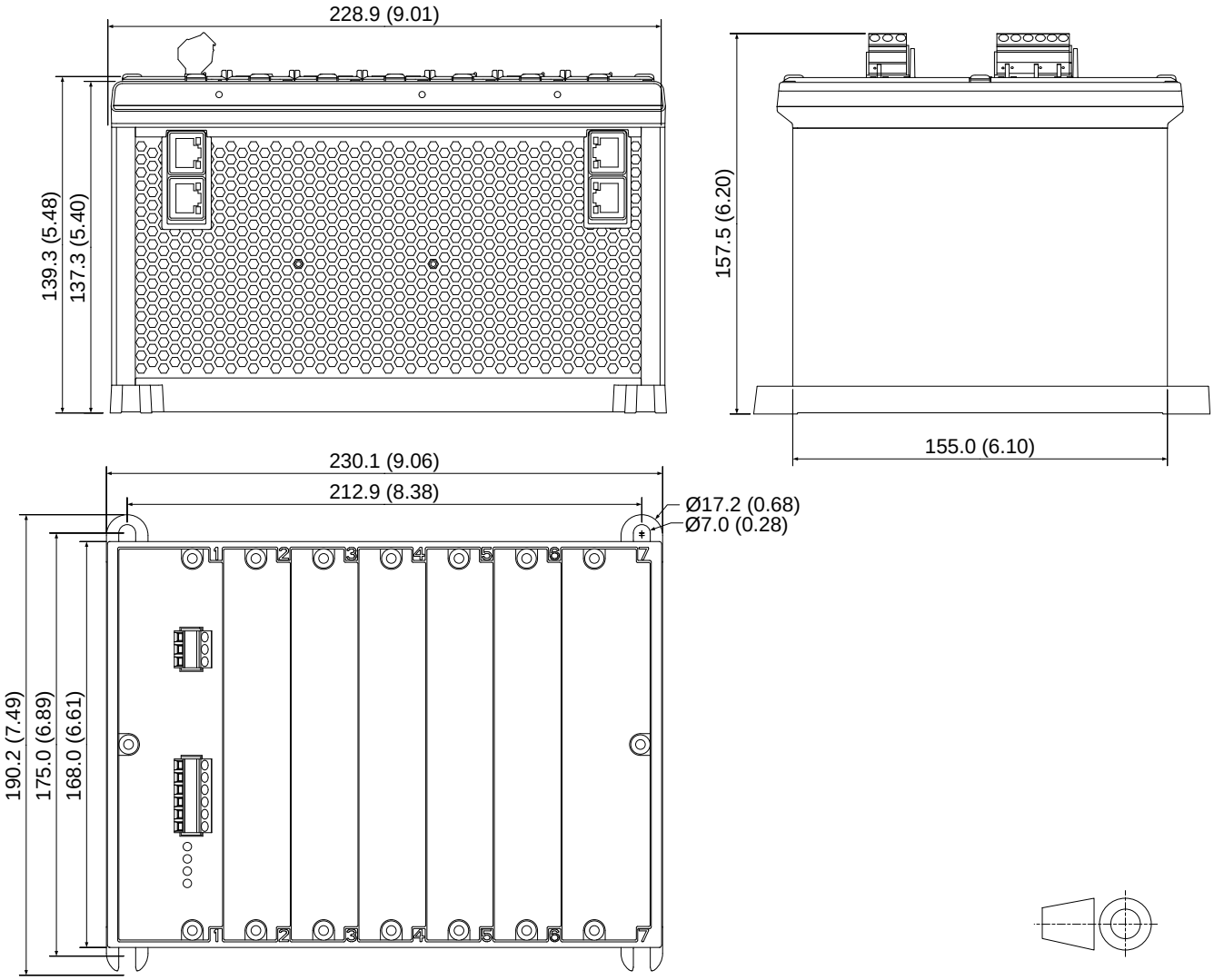
c. Tighten the screws on the hardware module faceplate using a screwdriver with a TX20 bit, and 0.5 N·m (4.4 lb-in) of torque.
d. Replace all the terminal blocks, including any Ethernet cables to the module.

5. If the rack has not yet been mounted, return the rack to its protective packaging.

3.3 Mounting the controller rack

3.3.1 Rack dimensions

The following drawing shows a first-angle projection of the rack, with dimensions. Dimensions are in mm (followed by approximate dimensions in inches). The rack is supplied with the cable strain relief plates mounted (not shown on the drawing).



3.3.2 Rack drilling drawing

The diagram below can be used to make a drilling template for the four bolt holes required to mount the rack. Dimensions are in mm (followed by approximate dimensions in inches).

CAUTION
This drilling drawing is given as a guideline, and the dimensions will not be correct when printed. Use the dimensions given to create your drilling template.

3.3.3 Mounting the rack

The rack is designed to be mounted in an enclosure.

For UL/cUL listing, the rack must be mounted on a flat surface of a type 1 enclosure. For UL/cUL listing, the rack must be installed in accordance with the NEC (US) or the CEC (Canada). See the **Data sheet** for more details.

CAUTION
Dust accumulation may damage the controller or cause overheating. DEIF recommends mounting the rack in a cabinet with a filter on the air supply.

CAUTION
Protect the controller terminals from static discharge during installation, especially while the frame ground is not connected.

Cable requirements

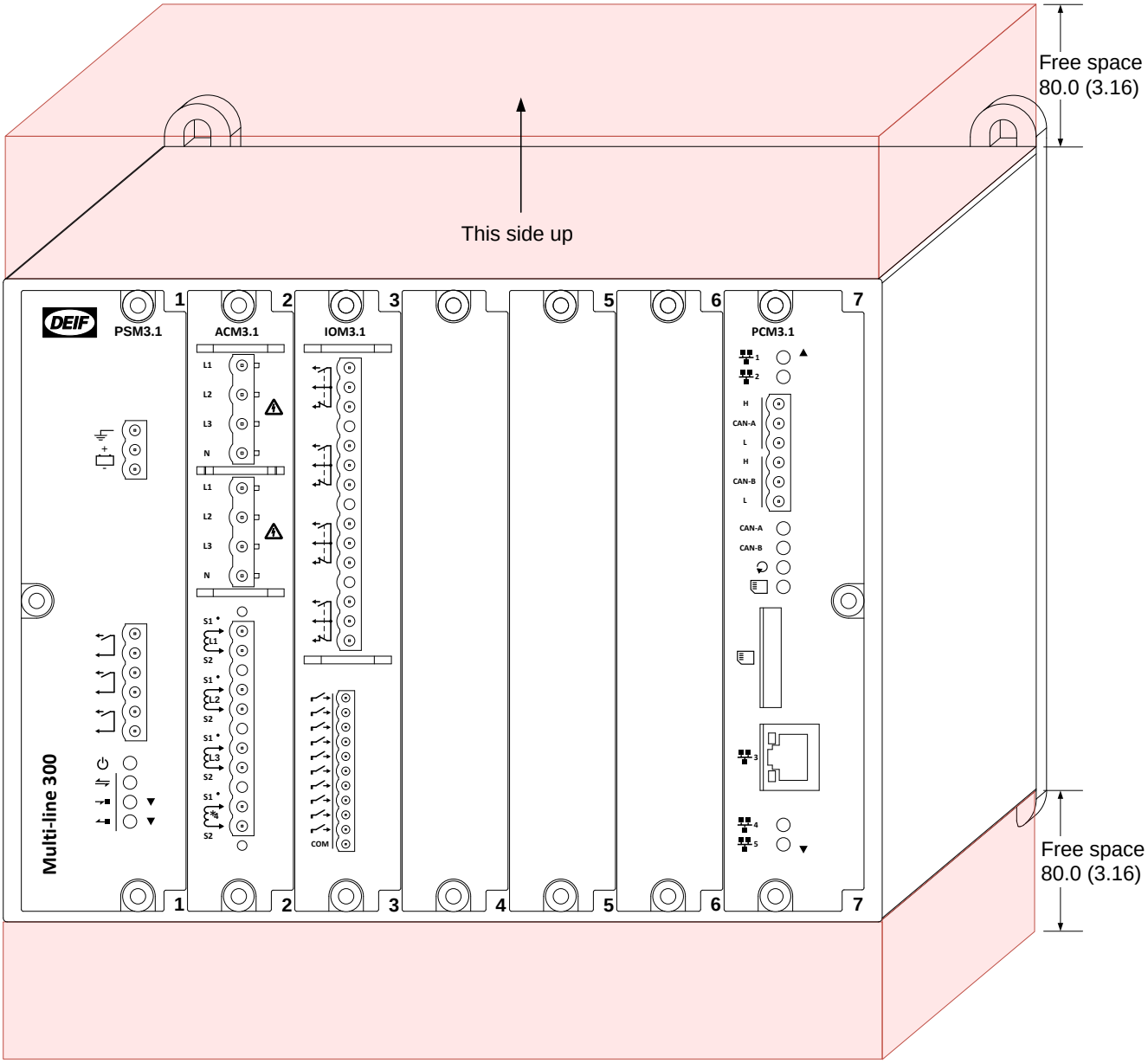
Ensure that there is enough space in front of, above and below the rack for the cables.

INFO
DEIF recommends that you always follow the cable manufacturer's bend radius requirements. As a guideline, Ethernet cables may require a minimum bend radius of around 40 mm (1.6 in). Load sharing and CAN bus cables may require a minimum bend radius of around five times the cable diameter.

Ethernet cables

Allow enough space for the Ethernet cable plug and the Ethernet cable minimum bend radius. In addition, allow enough working space above and below the rack to connect the Ethernet cables.

Figure 3.1 Example of the minimum space above and below the rack for an Ethernet cable (plug = 40 mm, plus cable bend radius = 40 mm)



Ventilation requirements

For ventilation, there must be a minimum of 20 mm (0.8 in) free space above and below the rack frame.

Fasteners for mounting the rack

Fasteners for mounting the rack are **not** supplied with the rack. The rack fasteners must be able to support the weight of the rack and the wiring.

You can, for example, mount the rack using four Ø6 mm (1/4 in) bolts, four nuts and eight Ø6 mm (1/4 in) washers.

Calculating minimum bolt length example

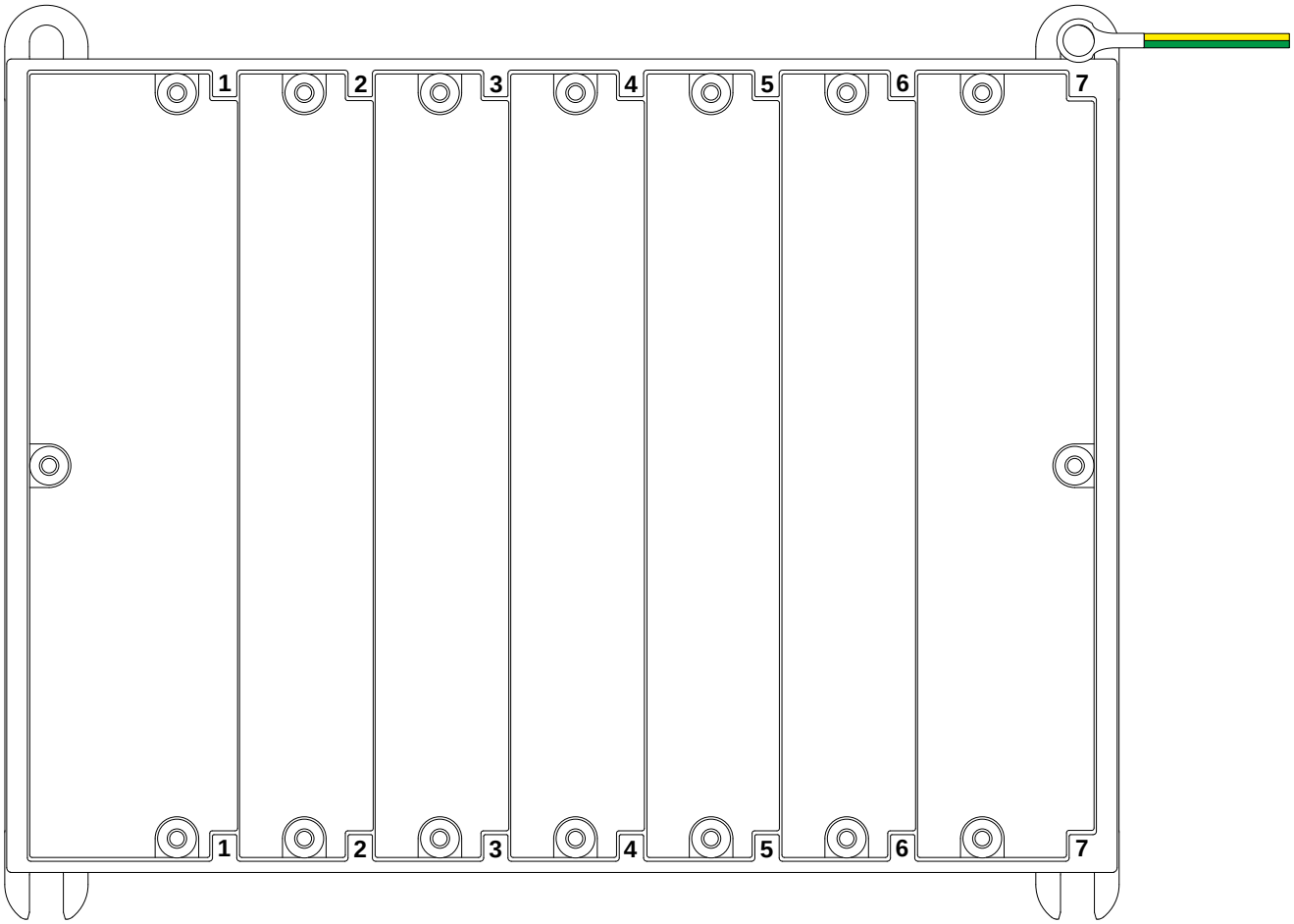
For bolts, the minimum length is 12 mm (0.47 in) for the rack mounting loop. Length is also needed for the washer thickness (typically 1.5 mm), the nut (typically 4 mm) and the cabinet back plate thickness.

If the cabinet back plate is 2.5 mm (0.10 in) thick, then the minimum bolt length is 20 mm (0.79 in). For grounding, a slightly longer bolt is required.

Mounting the rack

To mount the rack (using bolts, nuts and washers):

1. Check the rack orientation.
2. Check that the free space required for ventilation and cables is available.
3. Drill the holes required in the vertical surface on which the rack will be mounted. The rack must be mounted with its back vertical, and its long axis horizontal. The writing on the modules must be horizontal.
4. Mount the four bolts on the vertical surface that the rack will be mounted on, and put a washer on each bolt.
5. Slide the rack onto the bolts, and put a washer on three of the bolts.
6. Screw the nuts onto the three bolts, and tighten them, using 5 N·m (44 lb-in) of torque.
7. Put a toothed lock washer on the remaining bolt, teeth facing the rack mounting loop. The washer must cut into the rack mounting loop, to ensure there is a good galvanic connection.
8. Put one end of the grounding wire on the bolt.
9. Screw the nut onto the bolt, and tighten it, using 5 N·m (44 lb-in) of torque.
10. Galvanically connect the other end of the grounding wire to the cabinet.



3.3.4 Rack cable strain relief

Use the cable strain relief plates or the cable tie slots to secure cables and wiring.

Cable strain relief

You can use the cable strain relief plates mounted at the top and bottom of the front of the rack to hold cables in place. Thread cable ties through the slots in the plates and secure cables to these.

The rack is delivered with cable strain relief plates already mounted.

- You can remove a cable strain relief plate by unscrewing the three 3 mm screws using TX 10 screwdriver.
- You can remount the cable strain relief plate using the three 3 mm TX 10 screws and 0.5 N·m (4.4 lb-in) of torque.

Cable tie slots

There are six cable tie slots at the top of the rack, and six cable tie slots at the bottom of the rack, as shown in the figures below.
The maximum cable tie width that can be used in the slots is 2.5 mm (0.1 in).

The cable ties and cable routing must not block more than 20 % of the ventilation holes.

INFO
Before the cable tie slots at the top of the rack are used, the foil cover must be removed completely.

Figure 3.2 Cable tie slot positions shown on the top of the rack by red cable ties (Slot detail shown in A)

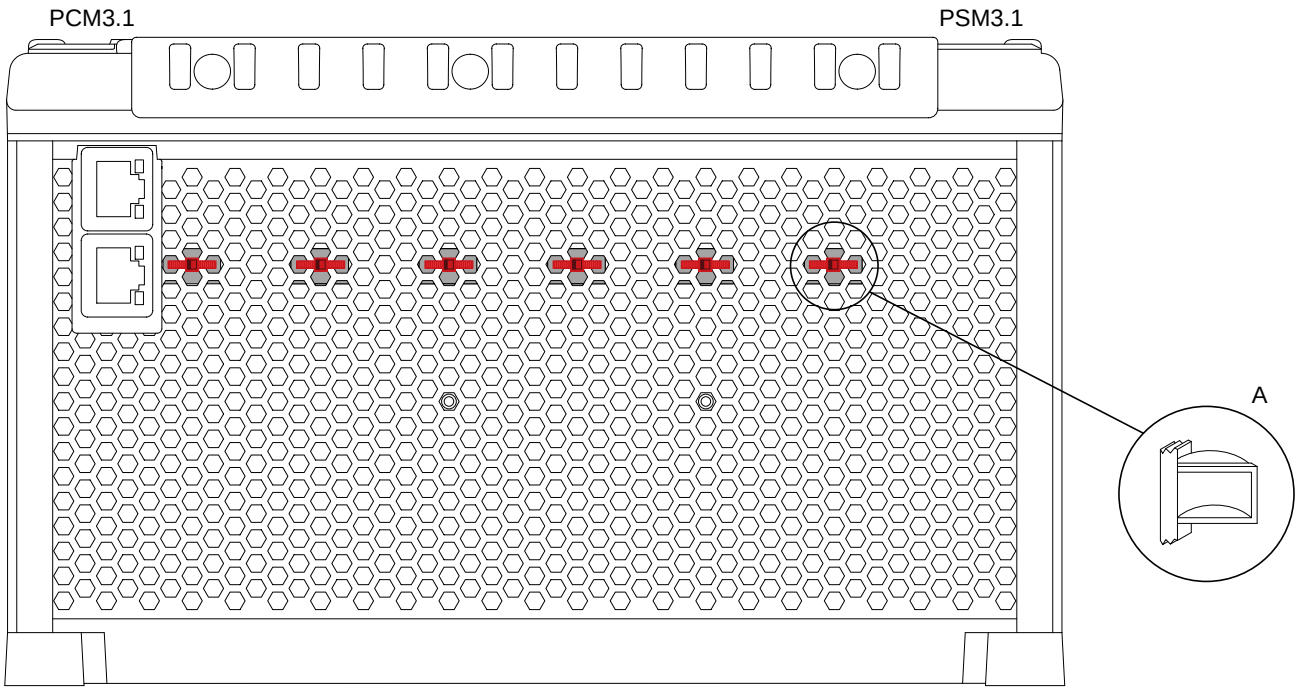
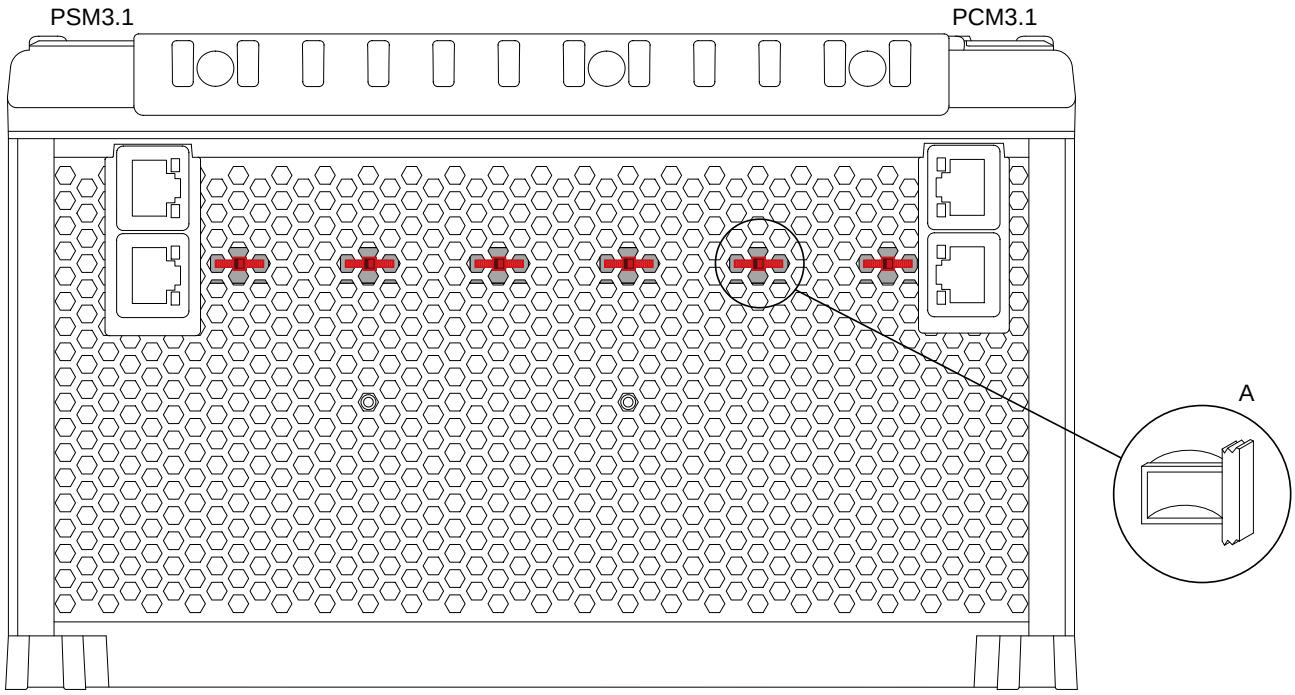


Figure 3.3 Cable tie slot positions shown on the bottom of the rack by red cable ties (Slot detail shown in A)

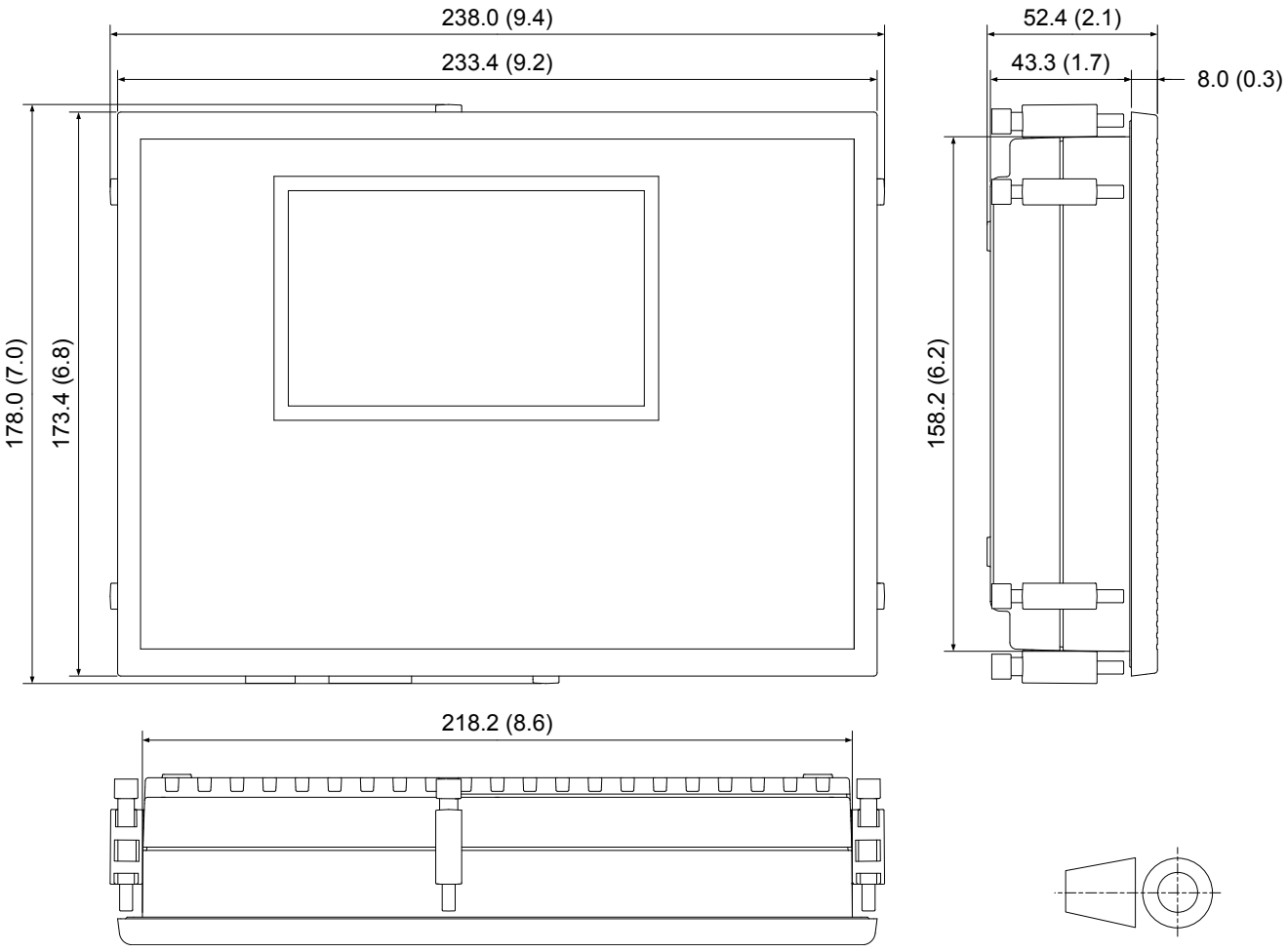


INFO
The cable tie slots are inside the rack's aluminium frame. Only use them if the class society rules allow the wiring to be secured directly to metal. Alternatively, you can use extra insulation between the rack's frame and the wire.

3.4 Mounting the display unit

3.4.1 Display unit dimensions

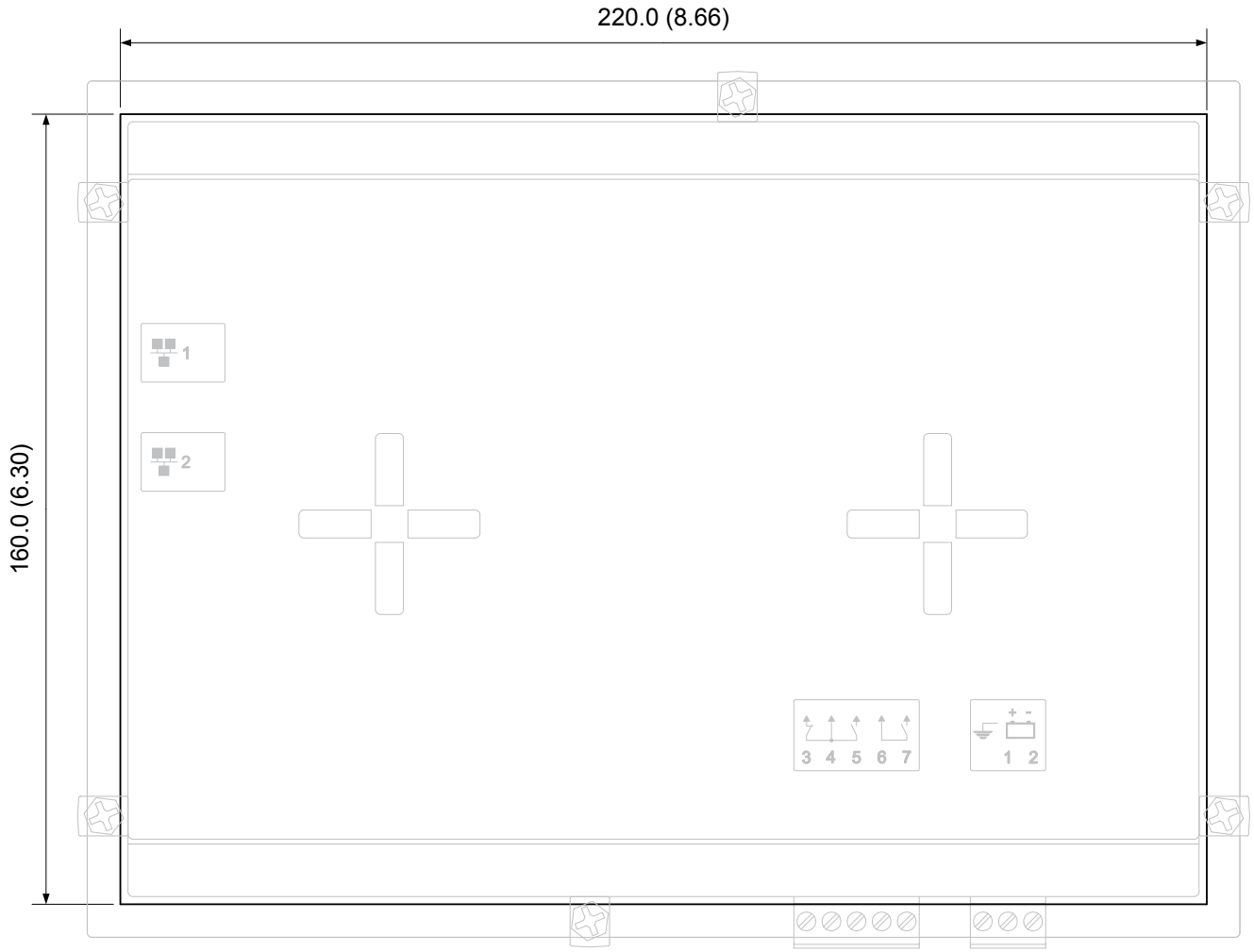
The diagram below shows a first-angle projection of the display unit, with dimensions. Dimensions are in mm (followed by approximate dimensions in inches).



3.4.2 Display unit panel cutout

The panel cutout required is L 220.0 mm × H 160.0 mm, with tolerance +0.4 mm and -0.0 mm (L 8.66 in × H 6.30 in, +0.02 in and -0.00 in).

The following drawing shows the panel cutout with a shadow of the display unit as viewed from the back (that is, from inside the panel).



CAUTION
This panel cutout drawing is given as a guideline, and the dimensions will not be correct when printed. Use the dimensions given to create your panel cutout template.

3.4.3 Mounting the display unit

The display unit is designed to be mounted in a panel, with its back in an enclosure.

For UL/cUL listing, the display unit must be mounted on a flat surface of a type 1 enclosure. For UL/cUL listing, the display unit must be installed in accordance with the NEC (US) or the CEC (Canada). See the **Data sheet** for more details.

The display unit is mounted using six fixing screw clamps (supplied with the display unit).

CAUTION
The back of the display unit is not protected against dust. Dust accumulation may damage the display unit or lead to overheating. DEIF recommends mounting the display unit so that its back is in a cabinet with a filter on the air supply.

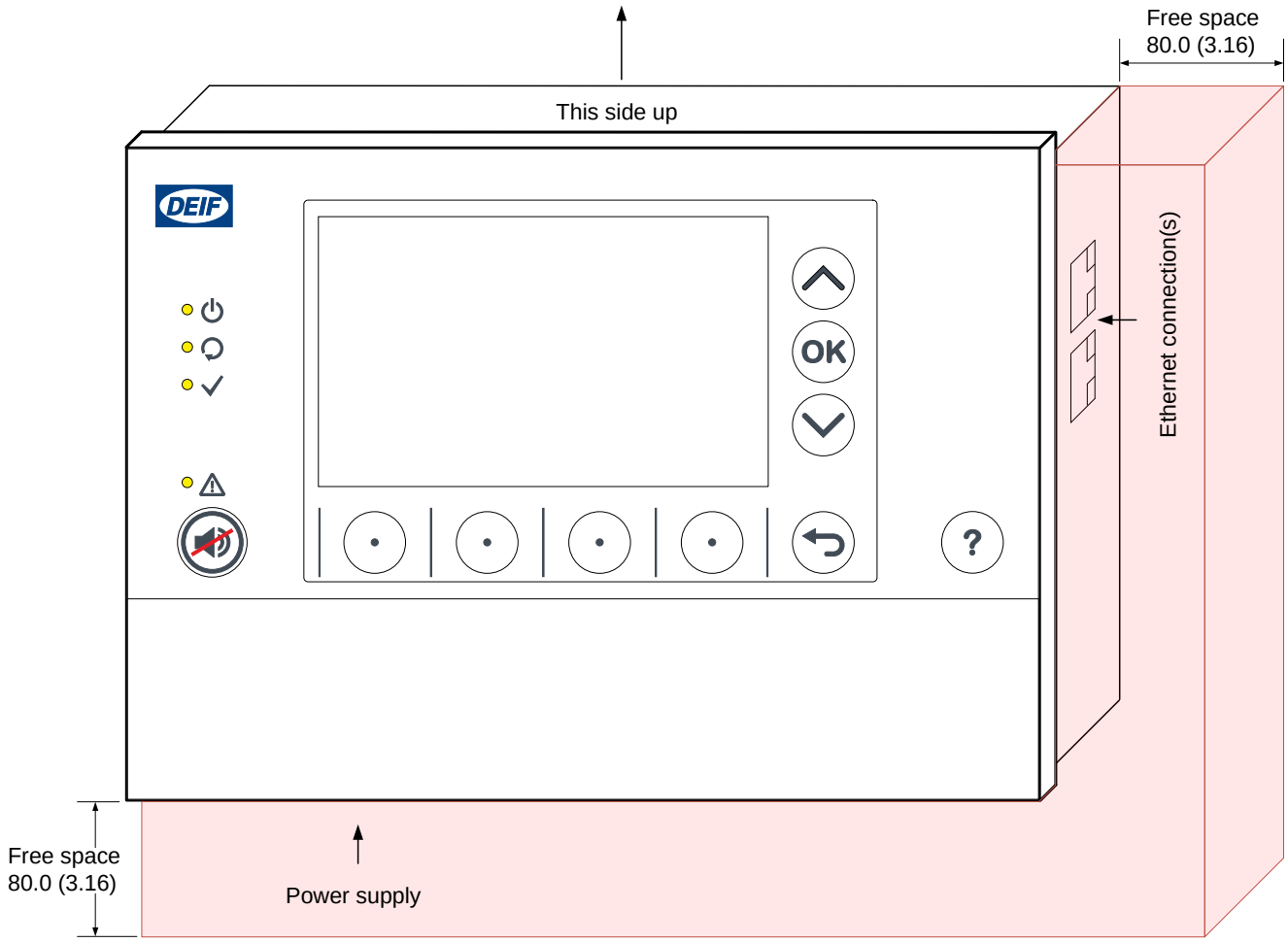
CAUTION
Protect the display unit terminals from static discharge during installation. Protecting the terminals is very important while the frame ground is not connected.

Ventilation requirements and spacing

For proper ventilation, the display unit must be mounted with its back vertical, and its long axis horizontal. The writing on the front of the display unit must be horizontal. Inside the cabinet, there must be a minimum of 20 mm (0.8 in) free space above, below and behind the display unit.

Cable requirements and spacing

Figure 3.4 Example of the minimum space to the right and below the display for Ethernet and power supply cables (plug = 40 mm, plus cable bend radius = 40 mm)



For the Ethernet cables, the bends must not be tighter than the minimum bend radius specified by the cable manufacturers. You must therefore ensure that there is enough space to the right of the display unit (as seen from the front) for the Ethernet cables.

INFO
DEIF recommends that you always follow the cable manufacturer's bend radius requirements. As a guideline, Ethernet cables may require a minimum bend radius of around 40 mm (1.6 in).

Cable strain relief

You can use the two "+" shaped slots on the back of the display units for cable strain relief and hold cables in place. Thread a cable tie (maximum 4 mm (0.15 in) wide) through the horizontal or vertical slot.

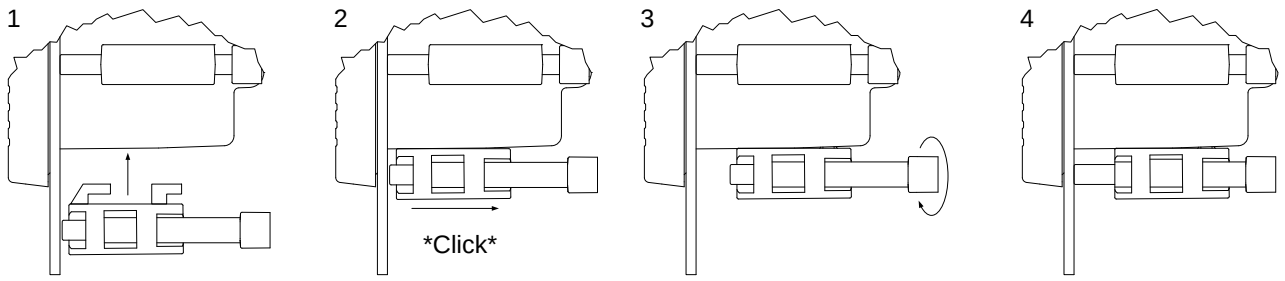
The cable routing must not block more than 20 % of the ventilation holes.

Mounting the display unit

To mount the display unit:

1. Check that a correctly sized panel cutout is available.
2. Check that there is enough space for the display unit.
   - The display unit extends 44 mm (1.7 in) behind the panel.
   - The wiring to the display unit terminals may also require some space.
   - Ventilation space is required, as described above.
3. Flush mount the display unit using the six fixing screw clamps, which are included with the display unit.
   a. Place the display unit in the panel cutout.
   b. Hook and click a screw clamp into the screw clamp holes at the right-top position of the display unit. Turn the screw until the display unit is secure. See the figure below for a graphical example of the step.
   c. Repeat step 3b for the five remaining screw clamp positions.
   d. If necessary, use your fingers or a screwdriver to tighten the screws. However, be careful not to exceed the recommended torque (0.15 N·m (1.3 lb-in)).
4. Position the terminal connection blocks correctly, then press them firmly into the terminal connection slots.
   - The terminal connection blocks are keyed to prevent incorrect mounting.
   - The two terminal connection blocks are included in the box with the display unit.

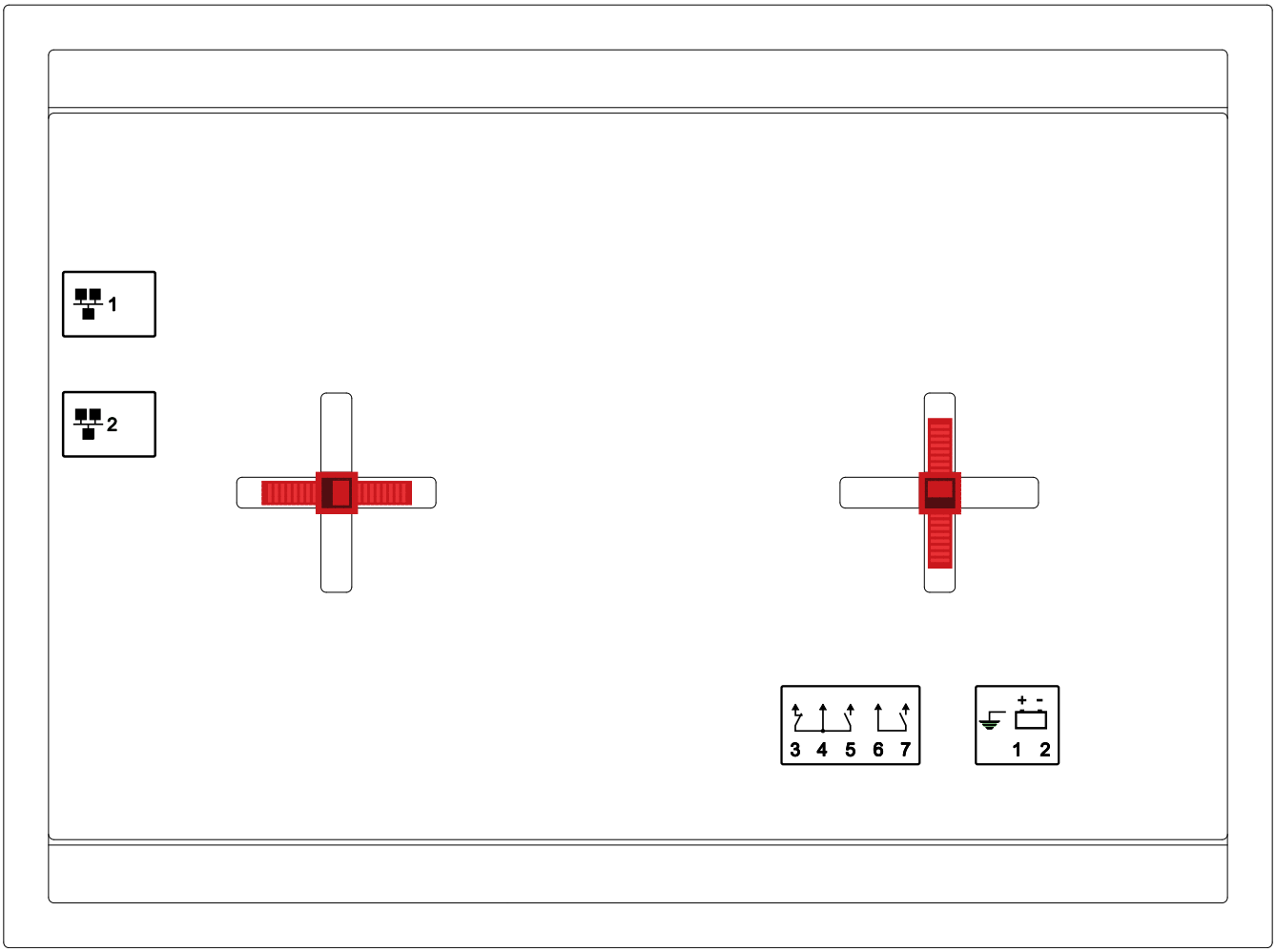
Figure 3.5 Example of how to install the fixing screw clamp on the display unit.



3.4.4 Display unit cable strain relief

Use the cable tie slots on the display unit for cable strain relief.

The back of the display unit has four 4 mm wide cable tie slots. The cable ties can either be placed horizontally or vertically in the cable tie slots. To use a slot, bend the end of the cable tie, then slide it through the slot.


1
2
3 4 5 6 7
+ -
1 2

4. Default wiring for the controller

4.1 Introduction

4.1.1 Introduction to default wiring

The default terminal connections are shown using a *. Other connections that you might want to use are listed in the tables for each unit. Note that these other connections are optional and/or configurable. Some of the default terminal connections are also optional, configurable, or the function may be achieved using other terminals.

Wiring

The **Wiring for the hardware modules** chapter contains detailed information for each terminal of the hardware modules, including examples of how these terminals can be connected to external hardware.

DANGER!
Only use the terminal blocks supplied by DEIF. Do not use substitutes.

CAUTION
Remove the foil cover placed over the top of the controller as close to the end of the installation as possible. Failing to remove the foil cover before the controller is operational will damage the controller.

Specifications

The **Data sheet** contains the authoritative list of technical specifications for each set of terminals. For ease of use, some simplified specifications are listed in this chapter.

Default configuration

This section also provides drawings of the default wiring for the relevant hardware modules for each unit. The drawing symbols are included in the glossary. Drawings are not given for the hardware modules with no default wiring.

Custom configurations

You can connect the inputs and outputs to terminals other than the terminals specified in the default configuration. DEIF recommends that you keep a record of where the wiring deviates from the default configuration.

In addition to the default wiring, the designer may specify inputs and outputs, according to the specific system's requirements. These may use the available configurable connections in the basic unit's hardware, and/or the additional connections made available by installing additional modules. These additional connections are not included in these default wiring drawings, since they are specific to the system. These connections must be shown on the designer's drawings for the system.

If there is space in the rack, you can mount additional modules for additional inputs and outputs. These inputs and outputs are not described in these **Installation instructions**. The details of these connections are specific to the installation, and must be included in the system designer's drawings.

Wire up the controller rack from right to left

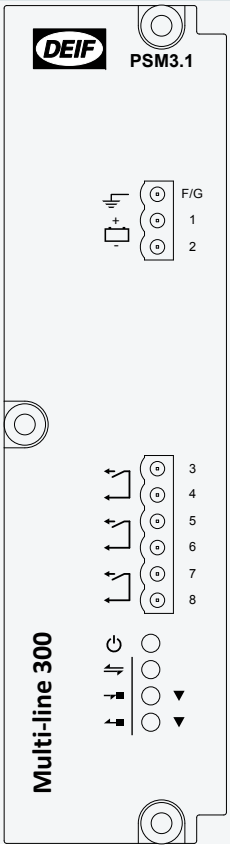
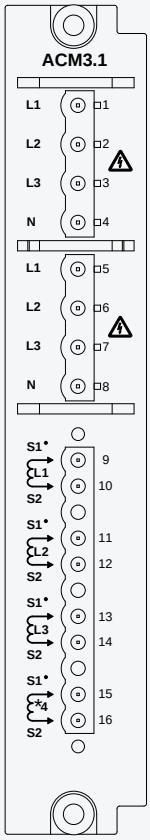
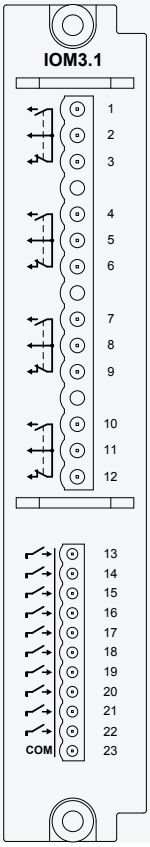
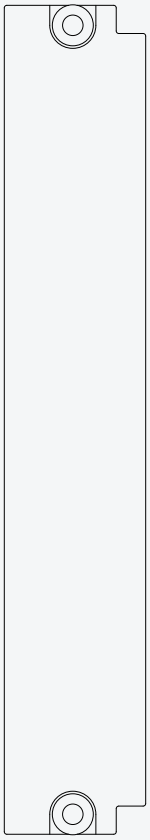
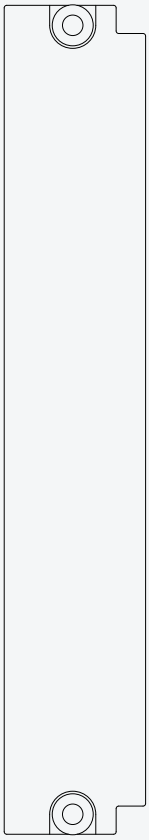
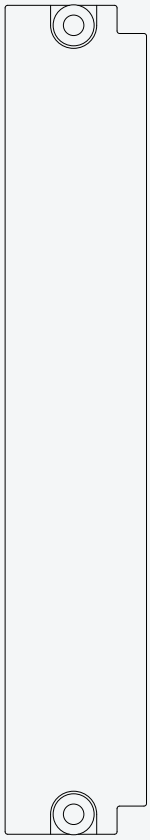
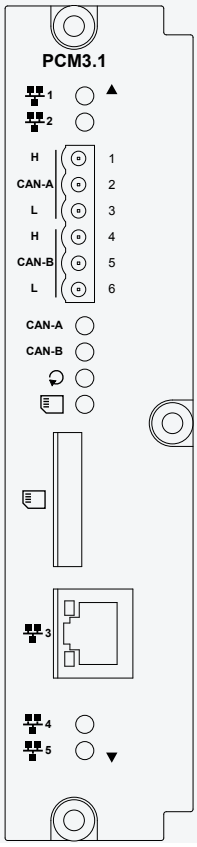
DEIF recommends that you wire up the controller rack from right to left, because of the 45º terminal blocks.

4.2 Hardware configurations

4.2.1 Hardware configuration

The controller minimum hardware is described below. Up to three additional IOM3.1 hardware modules can be ordered, and installed in the empty slots. Spare hardware modules may also be ordered for installation in the field.

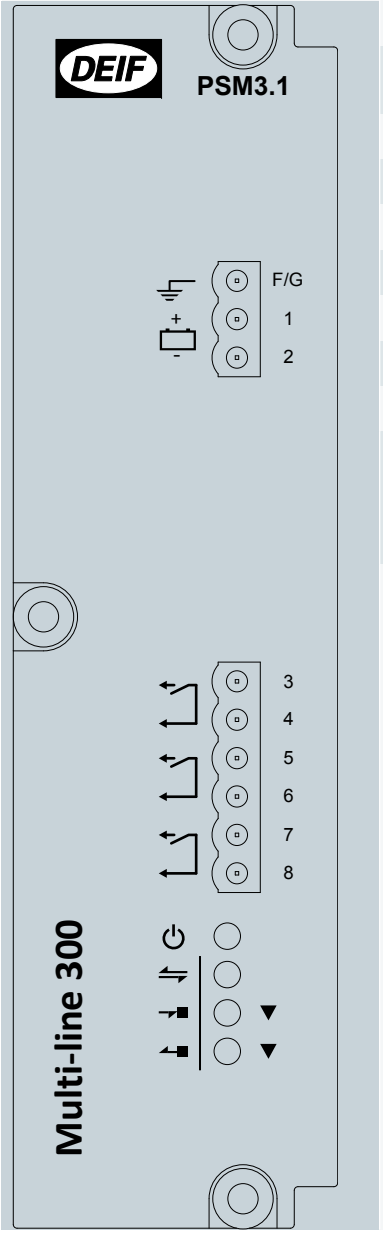
Table 4.1 Default hardware configuration

Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7
PSM3.1	ACM3.1	IOM3.1	Blind module	Blind module	Blind module	PCM3.1
Power supply module	Alternating current module	Input output module				Processor and communication module
						

Weight	Controller and display unit: 3180 g (7.0 lb) Controller (including the default hardware modules): 2345 g (5.2 lb) Display unit: 835 g (1.8 lb) Ethernet cable: ±110 g (4 oz)

4.3 PSM3.1 terminal connections and default wiring

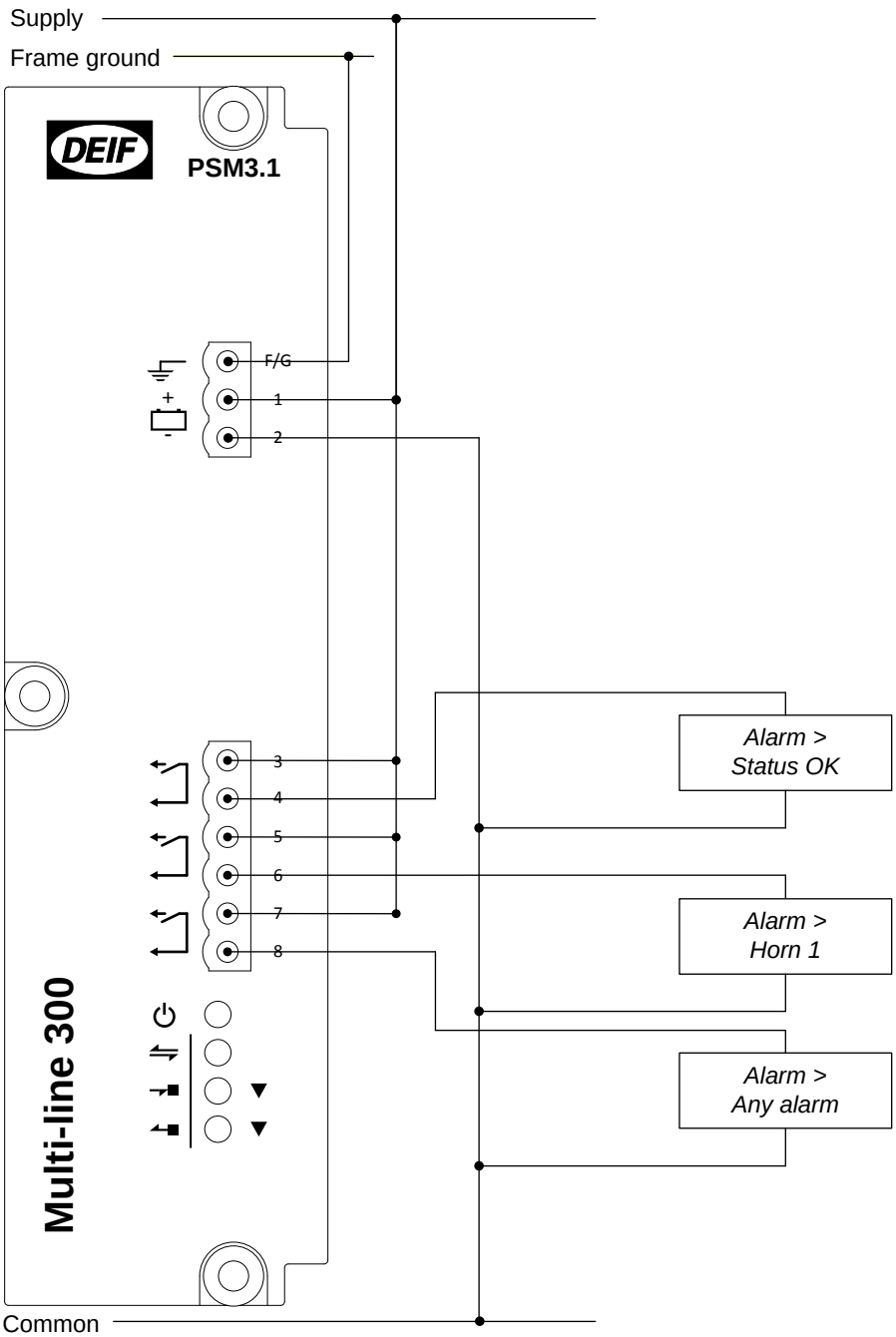
4.3.1 PSM3.1 terminal connections



Terminal	Name	Type	Function
F/G	F/G	Ground	Frame ground*
1	+	12 or 24 V DC (nominal)	Power supply*
2	-	0 V DC	
3	Normally open	Relay output (30 V DC and 1 A)	*Alarm* > *Status OK**
4	Common		
5	Normally open		*Alarm* > *Horn 1**, or configurable
6	Common		
7	Normally open		*Alarm* > *Any alarm**, or configurable
8	Common		
Internal communication input	IO extension	RJ45 (bottom of module, front)	DEIF internal communication connection for future use
Internal communication output	IO extension	RJ45 (bottom of module, back)	DEIF internal communication connection for future use

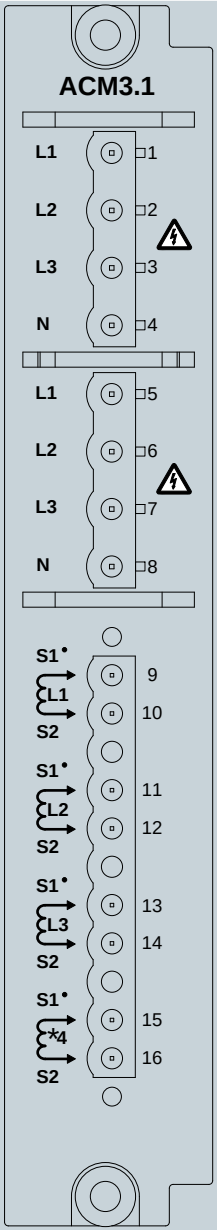
*Note: The default terminal connections.

4.3.2 Default wiring for controller PSM3.1



4.4 ACM3.1 terminal connections and default wiring

4.4.1 ACM3.1 terminal connections



Terminal	Name	Type	Function
1	L1 voltage	Voltage** 100 to 690 V AC phase-to-phase (nominal)	Busbar L1*
2	L2 voltage		Busbar L2*
3	L3 voltage		Busbar L3*
4	N voltage		Busbar N (optional)
5	L1 voltage	Voltage** 100 to 690 V AC phase-to-phase (nominal)	Generator L1*
6	L2 voltage		Generator L2*
7	L3 voltage		Generator L3*
8	N voltage		Generator N (optional)
9	Current in (European: S1; US: ·)	Current 1 or 5 A AC (nominal)	Generator L1*
10	Current out (European: S2)		
11	Current in (European: S1; US: ·)	Current 1 or 5 A AC (nominal)	Generator L2*
12	Current out (European: S2)		
13	Current in (European: S1; US: ·)	Current 1 or 5 A AC (nominal)	Generator L3*
14	Current out (European: S2)		
15	Current in (European: S1; US: ·)	Current 1 or 5 A AC (nominal)	Generator N, or configurable (4th current measurement for future use)
16	Current out (European: S2)		

* Shows the default terminal connections.

**These two sets of voltage measurements must not be swapped around. The controller uses the second set of voltage measurements together with the current measurements in a number of very important calculations.

DANGER!
The current measurement terminal block MUST always be screwed onto the module. Do not connect or disconnect any current transformer (CT) while there is current in the line.

CAUTION
Only wire the neutral terminal if it is available on both the Busbar and Generator. If neutral is only wired on one side of the equipment it causes a difference in the reference of a star connection. The difference causes an error during synchronisation.

CAUTION
To prevent the voltage measurements from being swapped around, DEIF recommends that the voltage measurement terminals are fitted with voltage encoding pins. Check that the wiring to the terminals has not been swapped around during installation if voltage encoding pins are used.

4.4.2 Mounting voltage encoding pins

Voltage encoding pins are provided with the controller to prevent voltage terminal blocks from being mounted in incorrect positions. Using the voltage encoding pins is not mandatory.

CAUTION
Swapping the voltage measurement terminals around can lead to dangerous situations. Check that the wiring to the terminals has not been swapped around during installation if voltage encoding pins are used.

Optional installation equipment

Tool	Function
Long nose pliers	Improves the handling and placement of the voltage encoding pins.

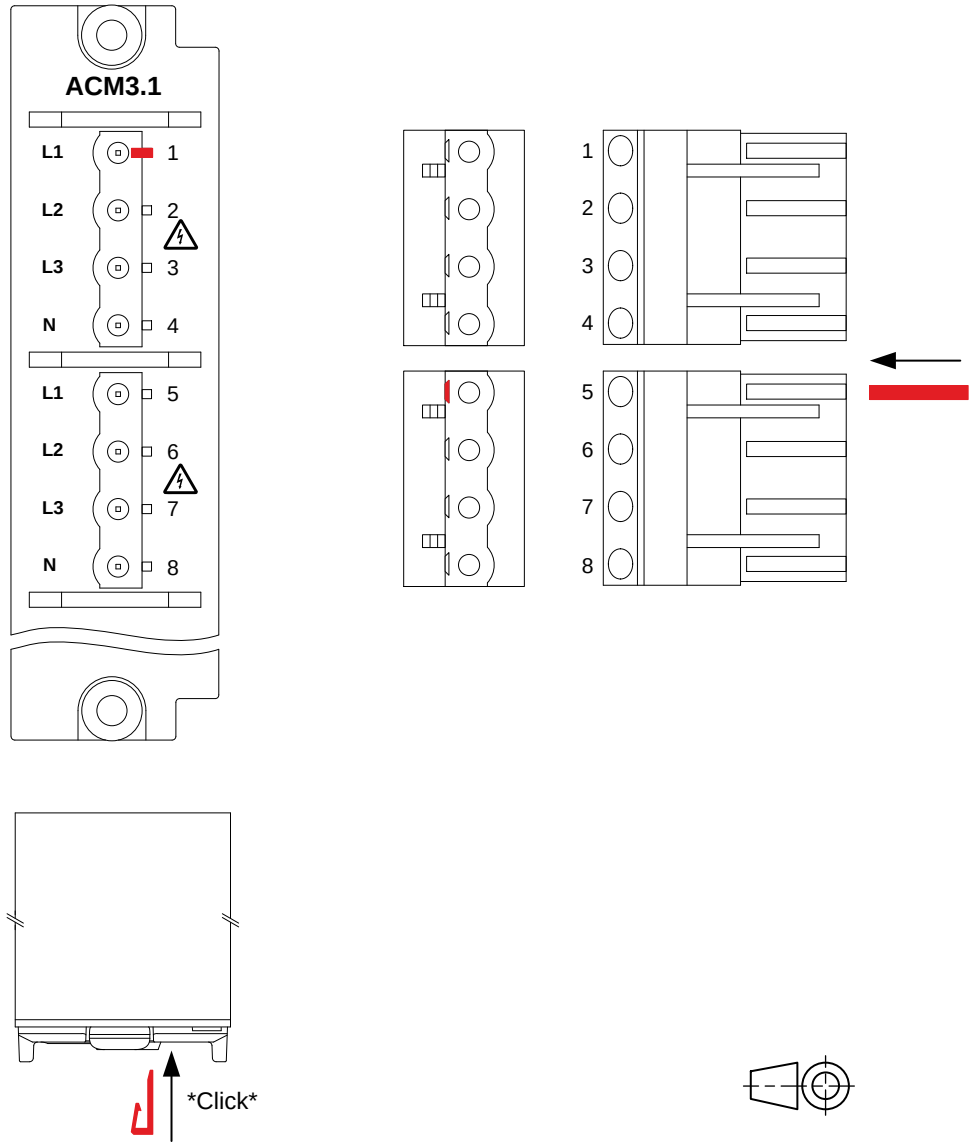
Installing voltage encoding pins

Follow the procedure described below to install the voltage encoding pins.

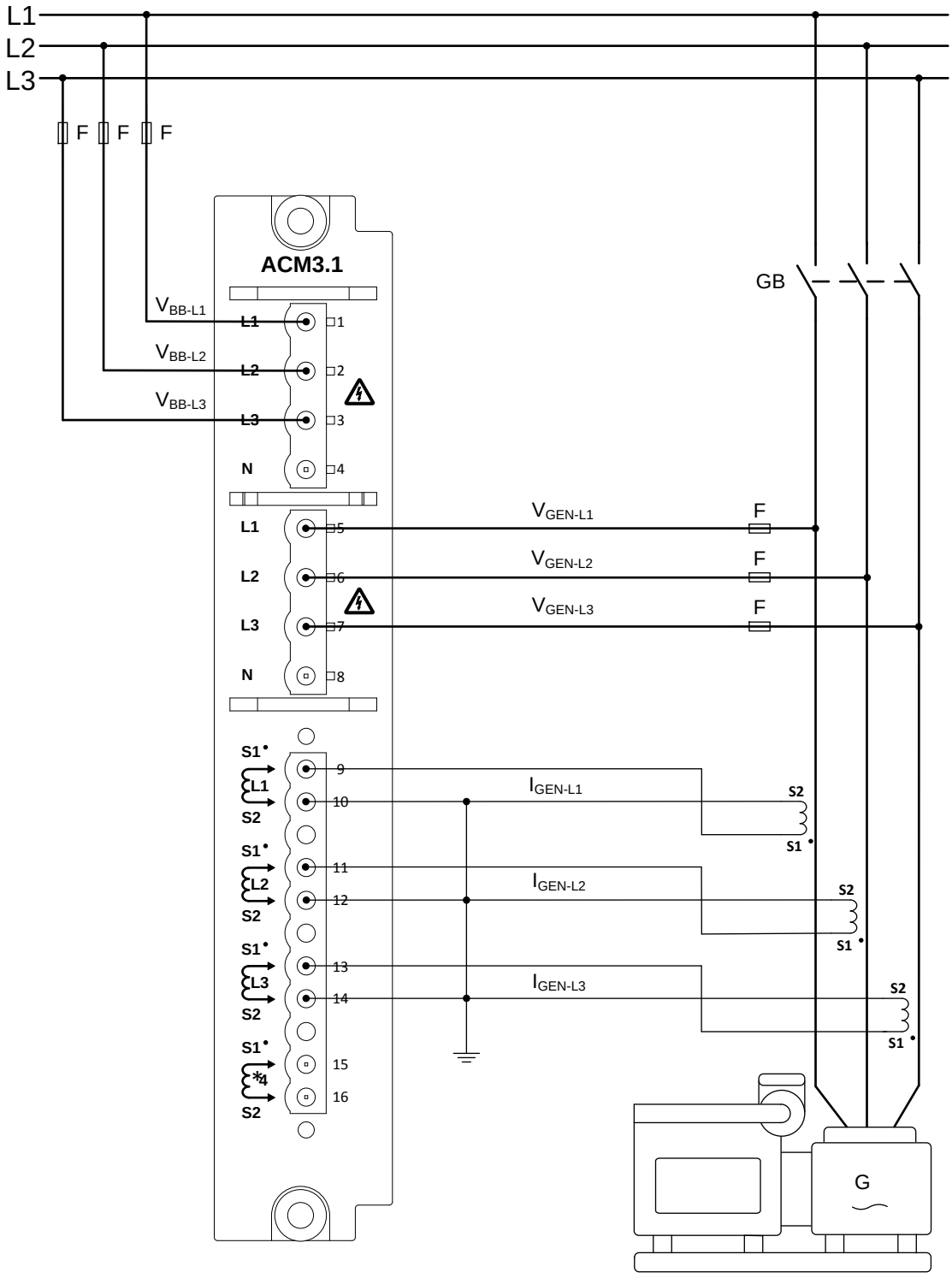
INFO
For safety reasons the voltage encoding pins are not designed for reuse. Once they are installed it is difficult to remove the pins without damaging the equipment. Ensure the voltage encoding pins are installed in the correct positions the first time.

1. Identify the terminals where you want to place the encoding pins.
   a. For example, terminal 1 in terminal group 1-2-3-4 and terminal 5 in terminal group 5-6-7-8 on the ACM3.1 module.
2. Remove the terminal blocks from the module.
3. Place the J-shaped encoding pin in one of the slots next to a terminal pin on the module. The encoding pin is secured when you hear it click into position.
   a. For example, next to the pin for terminal 1 on the ACM3.1 module.
4. Slide the flat encoding pin into the groove on the terminal block of second terminal group that matches the position of the encoding pin placed in step 3.
   a. For example, the groove at terminal 5 of the terminal block for terminal group 5-6-7-8 for the ACM3.1 module.

Figure 4.1 Where and how to fit voltage encoding pins, shown in red, on the voltage measurement terminals



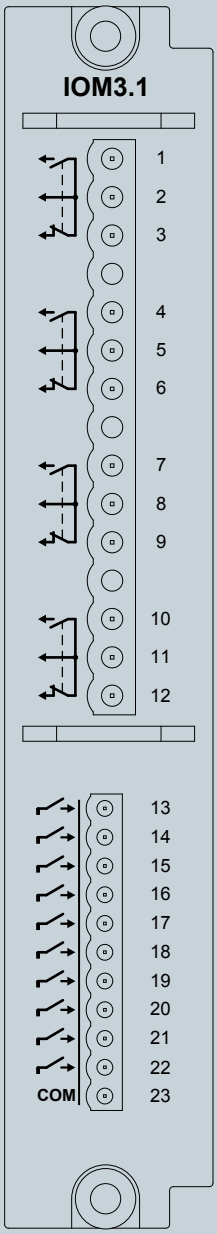
4.4.3 Default wiring for controller ACM3.1



INFO
Alternatively, you can ground the S1 side of the current transformers, instead of S2 as shown.

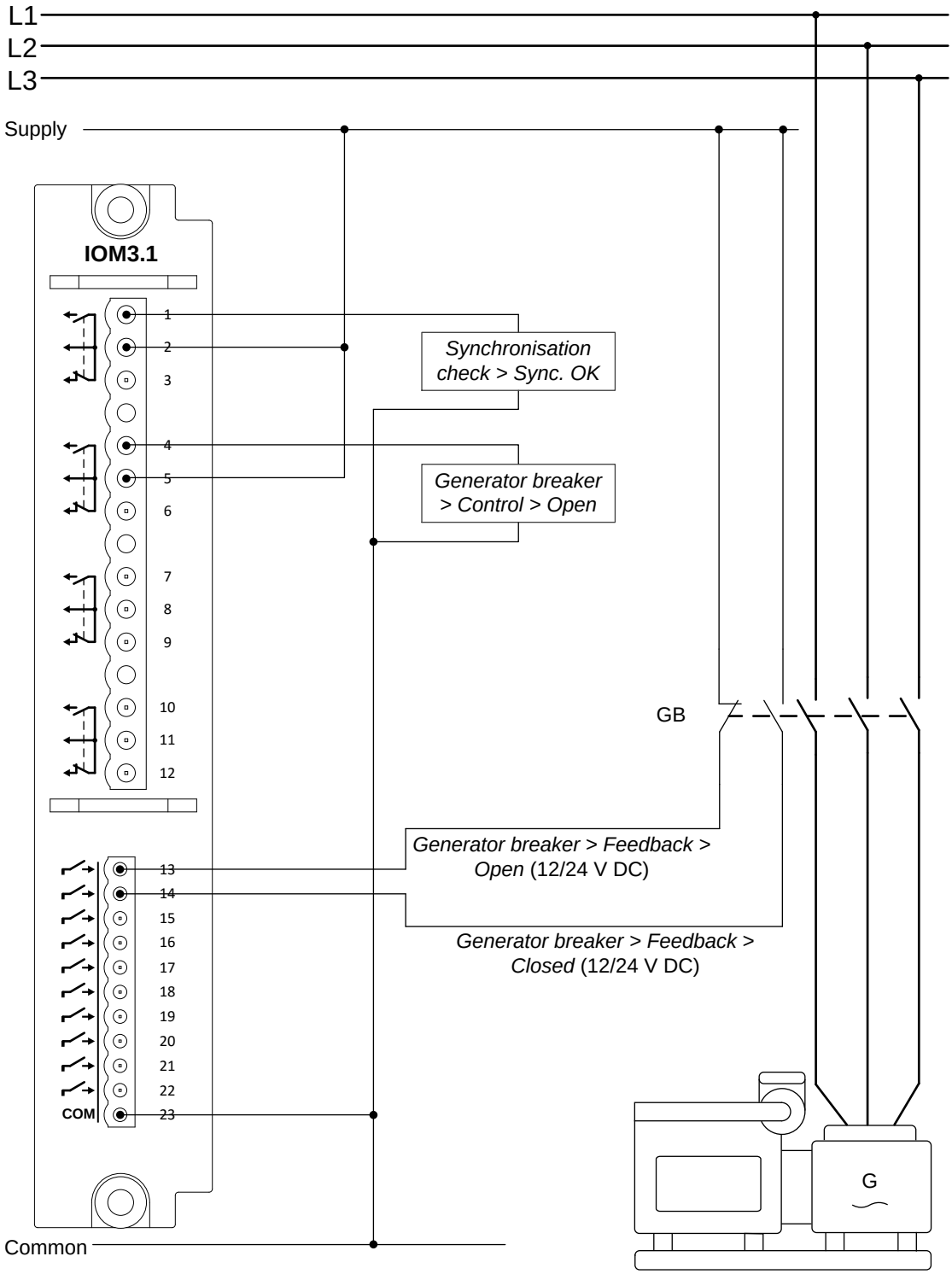
4.5 IOM3.1 terminal connections and default wiring

4.5.1 IOM3.1 slot 3 terminal connections

	Terminal	Name	Type	Function
	1	Normally open	Relay output (250 V AC or 30 V DC, and 6 A)	*Synchronisation check* > *Sync. OK** or configurable
	2	Common		
	3	Normally closed		
	4	Normally open		*Generator breaker* > *Control* > *Open**, or configurable
	5	Common		
	6	Normally closed		
	7	Normally open		Configurable
	8	Common		
	9	Normally closed		
	10	Normally open		Configurable
	11	Common		
	12	Normally closed		
	13		Digital input (OFF: 0 to 2 V DC, ON: 8 to 36 V DC, Impedance: 4.7 kΩ)	*Generator breaker* > *Feedback* > *Open**, or configurable
	14			*Generator breaker* > *Feedback* > *Closed**, or configurable
	15			*Generator breaker* > *Feedback* > *Short circuit*, or configurable
	16			*Generator breaker* > *Command* > *Activate breaker close*, or configurable
	17			*Generator breaker* > *Command* > *Deactivate breaker close*, or configurable
	18			Configurable
	19			Configurable
	20			Configurable
	21			Configurable
	22			Configurable
	23		Digital input	Common

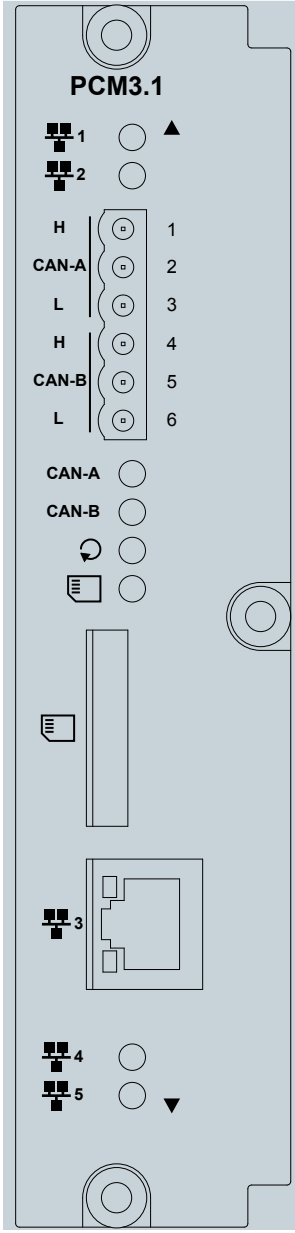
*Note: The default terminal connections.

4.5.2 Default wiring for controller IOM3.1



4.6 PCM3.1 terminal connections and default wiring

4.6.1 PCM3.1 terminal connections



Terminal	Name	Function
1	CAN high	CAN bus A (for future use)
2	CAN cable shield	
3	CAN low	
4	CAN high	CAN bus B (for future use)
5	CAN cable shield	
6	CAN low	
	SD card	External memory (for future use)

4.6.2 PCM3.1 Ethernet connections

Ethernet port number	Position	Recommended default connections
1	Top of rack, back port	Previous controller in the DEIF network*
2	Top of rack, front port	Next controller in the DEIF network

Ethernet port number	Position	Recommended default connections
3	Front of rack, on the module faceplate	Service PC
4	Bottom of rack, front port	Display unit*
5	Bottom of rack, back port	DEIF network / SCADA / AMS / Modbus TCP/IP

*Note: The default Ethernet connections.

The Ethernet ports on the controllers are not assigned to a particular service. The controllers detect the equipment connected to the port. You therefore do not have to follow the list above. However, we recommend that you use the default connections to simplify testing and troubleshooting.

See **Wiring the controller hardware modules, Processor and communication module PCM3.1, Ethernet connections** for more information.

INFO
The Ethernet lines must not be longer than 100 metres, point-to-point.

5. Wiring for the hardware modules

5.1 Introduction

5.1.1 Introduction

This chapter describes the wiring for each of the controller hardware modules in detail. Each terminal's wiring is described, with examples. However, wiring the system communication (including the connection to the display unit) is described in another chapter.

The **Data sheet** contains all the technical specifications for all the terminals.

The default wiring is described in the chapter **Default wiring for the unit**.

DANGER!
You must only use the terminal blocks supplied with the controller and display unit. Do not use substitutes.

5.2 Power supply module PSM 3.1

5.2.1 PSM3.1 terminal overview

Terminal	Symbol	Name	Type
F/G		F/G	Ground
1		+	12 or 24 V DC (nominal)
2		-	0 V DC
3		Normally open	Relay output (30 V DC and 1 A)
4		Common	
5		Normally open	
6		Common	
7		Normally open	
8		Common	

Table 5.1 PSM3.1 Internal communication connections

Connection	Symbol	Name	Type
Bottom of rack, front		Internal communication connection for future use to connect extension racks.	Internal communication input
Bottom of rack, back		Internal communication connection for future use to connect extension racks.	Internal communication output

INFO
Internal communication connections are for future use to connect extension racks. These are not to be used for the Ethernet DEIF network connections.

5.2.2 Frame ground wiring

Connect the frame ground terminal to ground/earth.

INFO
DEIF recommends that both the frame ground terminal and the equipment casing are connected to the cabinet.

INFO
Connection of the frame ground is required by JEM-TR177.

5.2.3 Power supply wiring

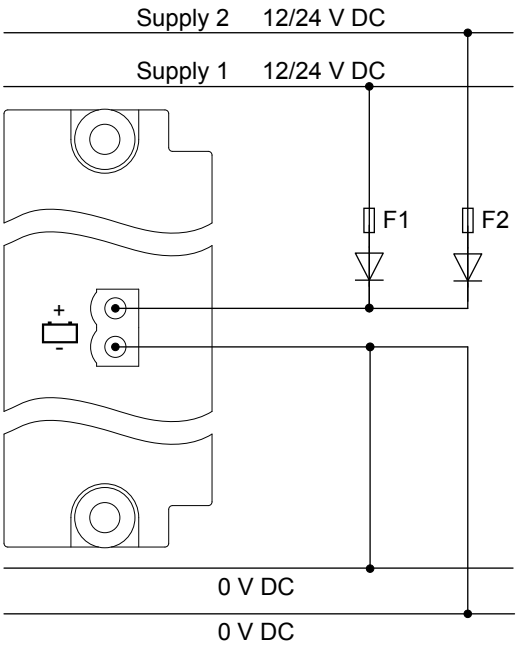
Connect the power supply (+) to the 12 or 24 V DC power supply.

Connect the power supply (-) to the 0 V DC power supply.

Backup power supply

The DEIF equipment does not contain a backup power supply. The power supply source must therefore include the power backup needed.

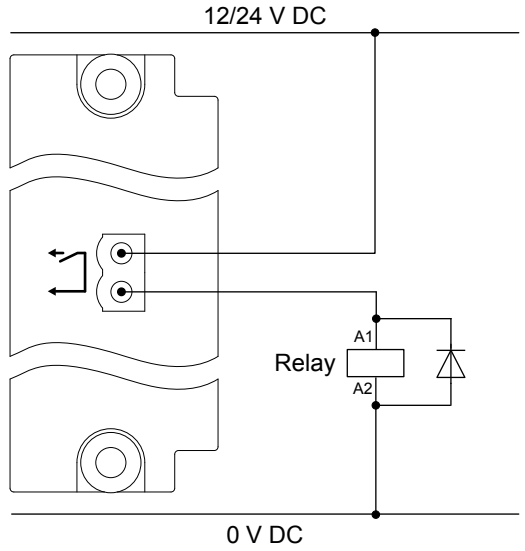
Figure 5.1 Example of a power supply and backup connected to the power supply terminals



INFO
DEIF recommends that a 2A slow blow fuse is used for F1 and F2, and that the diodes are rated 50V or higher.

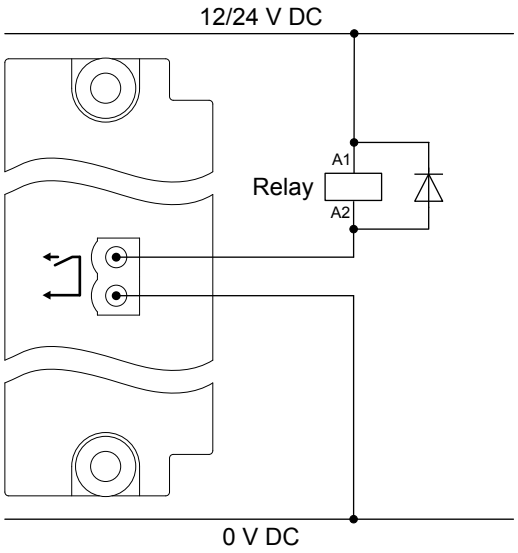
5.2.4 Relay output wiring

The following diagram shows the connection of the relay output to an external relay. For the wiring shown, there is no voltage on the external relay when the controller relay is open.



INFO
Use a diode size as recommended by the relay supplier.

The terminal connections can be switched around without affecting the performance.



INFO
Remember to install the freewheeling diode ( ). This diode prevents a sudden voltage spike across the inductive load when the voltage source is removed.

5.2.5 Internal communication connections

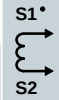
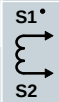
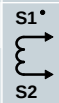
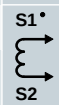
For future use.

INFO

Do not try to use these connections for Ethernet communication (for example, over the DEIF network to other controllers, or to a service PC). There will be no communication, since these connections are dedicated to DEIF internal communication.

5.3 Alternating current module ACM3.1

5.3.1 ACM3.1 terminal overview

Terminal	Symbol	Name	Type
1	L1	L1 voltage	Voltage 100 to 690 V AC phase-to-phase (nominal)
2	L2	L2 voltage	
3	L3	L3 voltage	
4	N	N voltage	
5	L1	L1 voltage	Voltage 100 to 690 V AC phase-to-phase (nominal)
6	L2	L2 voltage	
7	L3	L3 voltage	
8	N	N voltage	
9		Current in (European: S1; US: ·)	Current 1 or 5 A AC (nominal)
10		Current out (European: S2)	
11		Current in (European: S1; US: ·)	Current 1 or 5 A AC (nominal)
12		Current out (European: S2)	
13		Current in (European: S1; US: ·)	Current 1 or 5 A AC (nominal)
14		Current out (European: S2)	
15		Current in (European: S1; US: ·)	Current 1 or 5 A AC (nominal)
16		Current out (European: S2)	

CAUTION

Only wire the neutral terminal if it is available on both the [Busbar] and [Controlled equipment]. If neutral is only wired on one side of the equipment it causes a difference in the reference of a star connection. The difference causes an error during synchronisation.

5.3.2 Voltage measurements wiring

See **Default wiring for unit**, **ACM3.1 terminal connections and default wiring** for more information about the default wiring for voltage measurements.

DANGER!
DEIF recommends that you install fuses (2 A rating) on the voltage measurement lines, as close to the busbar as possible. These fuses protect the voltage measurement lines.

5.3.3 Current measurements wiring

See **Default wiring for unit**, **ACM3.1 teminal connections and default wiring** for more information about the default wiring for current measurements.

INFO
The current inputs are galvanically separated.

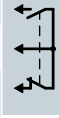
INFO
Mount each current transformer and connect it to the controller terminals so that each measurement current flows through the controller in the correct direction. Incorrect mounting and wiring will result in incorrect current measurements. See the controller wiring diagrams for the correct mounting direction and wiring.

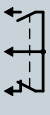
DANGER!
Do not connect or disconnect any current transformer (CT) while there is current in the line. If a CT is disconnected when there is current in the line, a high voltage is generated across the secondary of the CT. This can cause arcing, personal injury or death, or damage to the controller.

DANGER!
The current measurement terminal block MUST always be screwed onto the module. If for some reason the terminal block is unscrewed, secure it using a 0.5 N·m (4.4 lb-in) torque screwdriver with a 3.5 mm (0.14 in) flat-bladed bit.

5.4 Input output module IOM3.1

5.4.1 IOM3.1 terminal overview

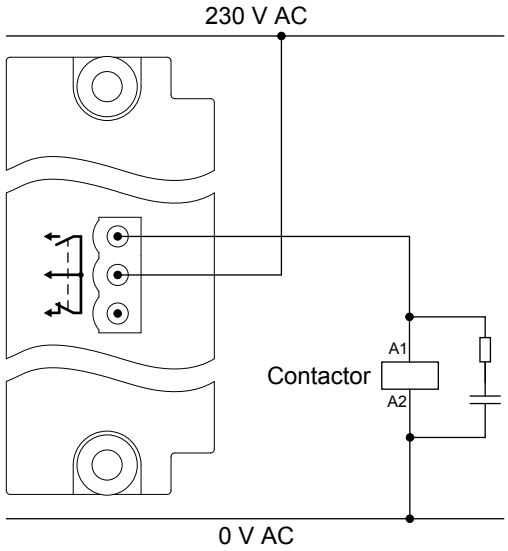
Terminal	Symbol	Name	Type
1		Normally open	Relay output (250 V AC or 30 V DC, and 6 A)
2		Common	
3		Normally closed	
4		Normally open	
5		Common	
6		Normally closed	

Terminal	Symbol	Name	Type
7		Normally open	Relay output (250 V AC or 30 V DC, and 6 A)
8		Common	
9		Normally closed	
10		Normally open	
11		Common	
12		Normally closed	
13		Bi-directional input	Digital input (OFF: 0 to 2 V DC, ON: 8 to 36 V DC, Impedance: 4.7 kΩ)
14		Bi-directional input	
15		Bi-directional input	
16		Bi-directional input	
17		Bi-directional input	
18		Bi-directional input	
19		Bi-directional input	
20		Bi-directional input	
21		Bi-directional input	
22		Bi-directional input	
23	COM		Digital input common

5.4.2 Relay output wiring

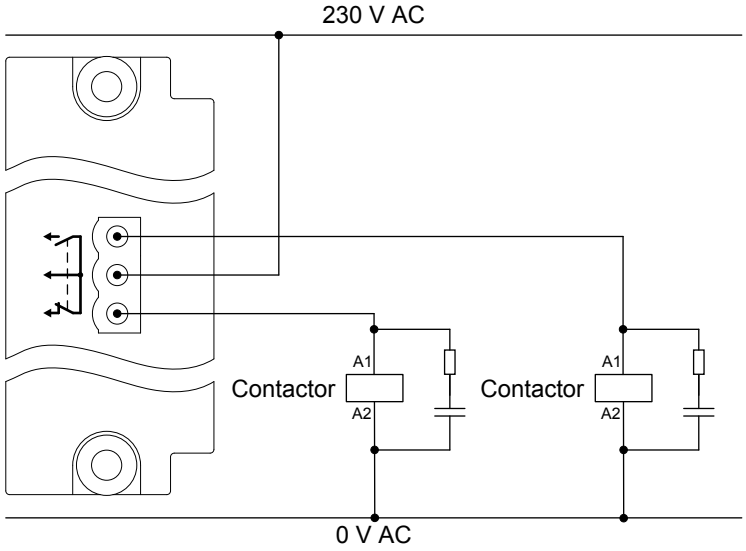
This relay has three terminals: normally closed, common and normally open (changeover relay). You can connect wiring to all three terminals. Alternatively, you can connect wiring to only the common and normally open terminals, or only the common and normally closed terminals.

For example, you can connect equipment to the normally closed terminal and the common. The following diagram shows an example of a relay output where the normally open relay terminal is connected to an 230 V AC contactor. For this example, the terminal connections can be swapped around without affecting the performance.



Similarly, you can connect equipment to the normally closed terminal and the common.

You can also connect equipment to both the normally open and the normally closed terminals, as shown in the following diagram. For this configuration, current will flow through the equipment connected to the normally closed terminal when the relay is de-energised. The current will flow through the equipment connected to the normally open terminal when the relay is energised.



INFO
For 230 V AC contactors, DEIF strongly recommends that you use an RC snubber for noise suppression across the contactor.

5.4.3 Digital inputs wiring

The digital inputs are bi-directional inputs. This means that wiring to the input and common terminals may be swapped around without affecting their operation.

However, all the digital inputs on a module share a common terminal. The digital input common for a module may be either low (connected to 0 V), or high (connected to 12 or 24 V). If the common is low, all the digital input signals connected to the module must be high (connected to 12 or 24 V). Similarly, if the common is high, all the digital input signals connected to the module must all be low (connected to 0 V).

The digital input common does not act as the common for any of the other terminals on the same module. The digital input common is also not affected by the digital input commons on other modules.

The digital inputs are designed for a nominal voltage of 12 to 24 V DC.

Figure 5.2 Example of digital input wiring (common = 0 V)

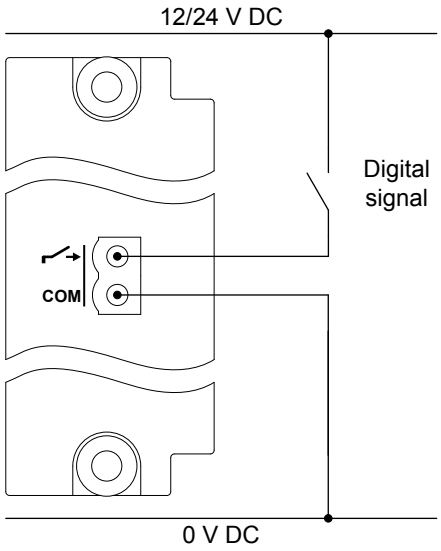
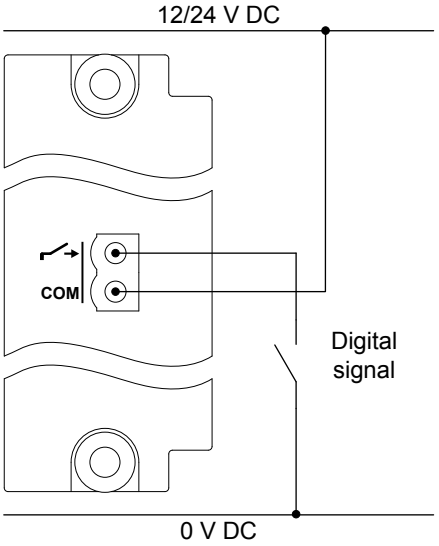


Figure 5.3 Example of digital input wiring (common = 12 or 24 V)



Safety function wiring

The controller function *Emergency stop* is safety function that requires a normally closed digital signal to be wired to the controller.

Figure 5.4 Example of digital input wiring for safety functions (common = 0 V)

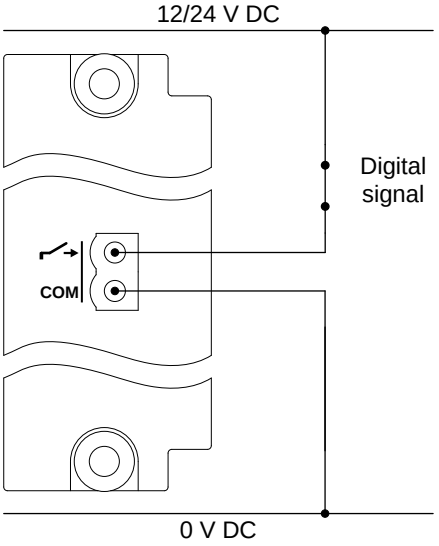
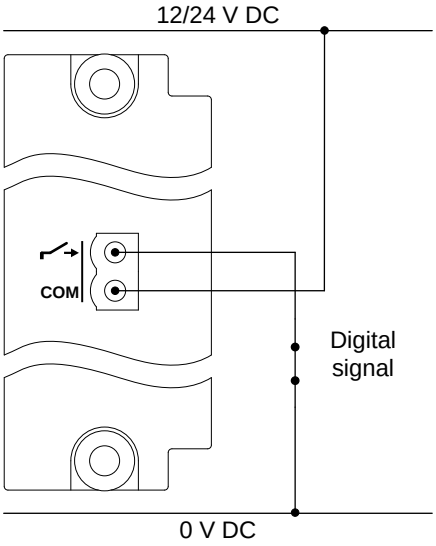


Figure 5.5 Example of digital input wiring for safety functions (common = 12 or 24 V)



5.5 Processor and communication module PCM3.1

5.5.1 PCM3.1 terminal overview

Terminal	Symbol	Name	Type
1	H	CAN bus A (Future use for engine communication)	CAN high
2	CAN-A		CAN signal ground
3	L		CAN low
4	H	CAN bus B (Future use for engine communication)	CAN high
5	CAN-B		CAN signal ground
6	L		CAN low

Table 5.2 PCM3.1 Recommended Ethernet connections

Connection	Symbol	Name	Type
1		DEIF network to another controller	RJ45
2		DEIF network to another controller	RJ45
3		Service PC	RJ45
4		Display unit	RJ45
5		DEIF network / SCADA / AMS / Modbus TCP/IP	RJ45

The Ethernet connections listed above are the recommended defaults, to help troubleshooting. The Ethernet ports are in fact fully interchangeable.

INFO
Only one display unit may be connected to each controller rack. DEIF recommends mounting the display unit close to the controller rack.

5.5.2 CAN bus communication wiring

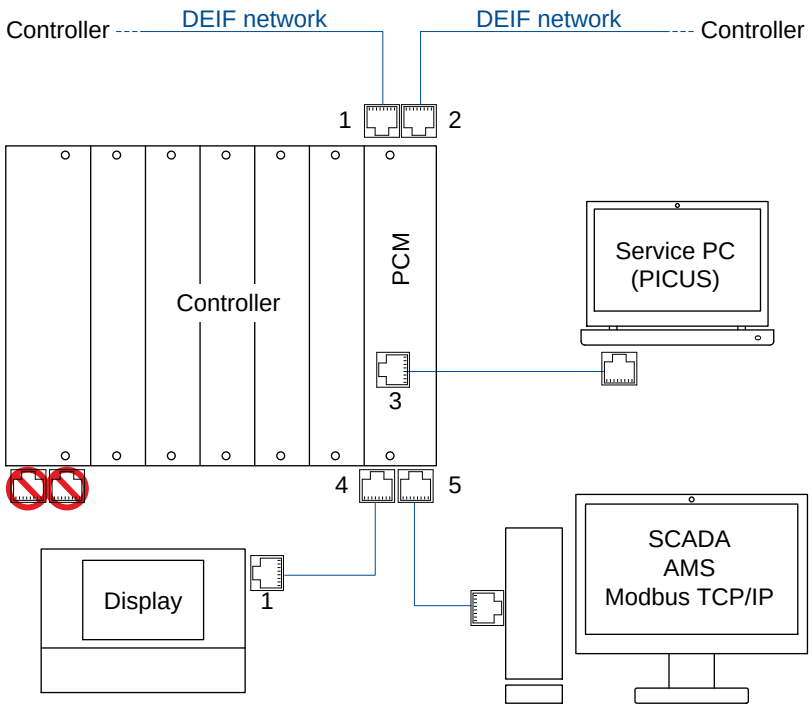
The CAN bus terminals on the PCM3.1 module are reserved for future use for communication with a Engine Control Unit (ECU) or a digital Automatic Voltage Regulator (AVR).

5.5.3 Ethernet connections

As a minimum, only one connection from the controller to another controller in the DEIF network is required.

The following diagram shows the recommended default connection of the Ethernet cables. The controller is connected to adjacent controllers using the DEIF network connection.

INFO
The Ethernet lines must not be longer than 100 metres, point-to-point.



See **Wiring the communication** for more information.

6. Wiring examples for functions

6.1 Introduction

This chapter includes wiring diagrams for a variety of controller functions.

See the **Designer's handbook** for more information about each controller function.

6.2 AC measurement wiring

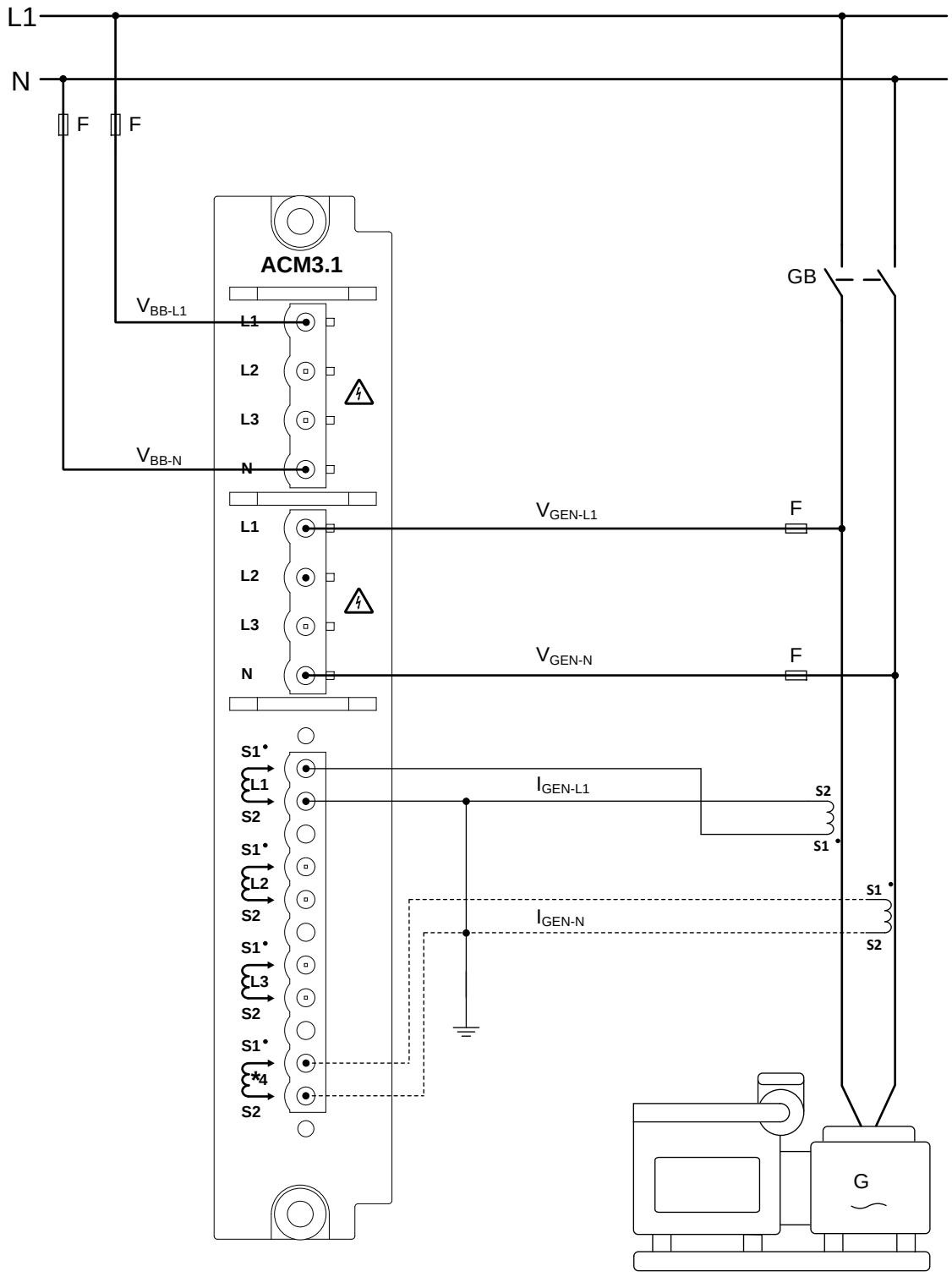
6.2.1 System AC configuration

See **AC configuration and nominal settings**, **AC configuration**, **System** in the **Designer's handbook** for information about setting the parameters for these configurations.

Dashed lines show optional wiring.

Single-phase wiring

Figure 6.1 Example of single-phase L1 AC wiring

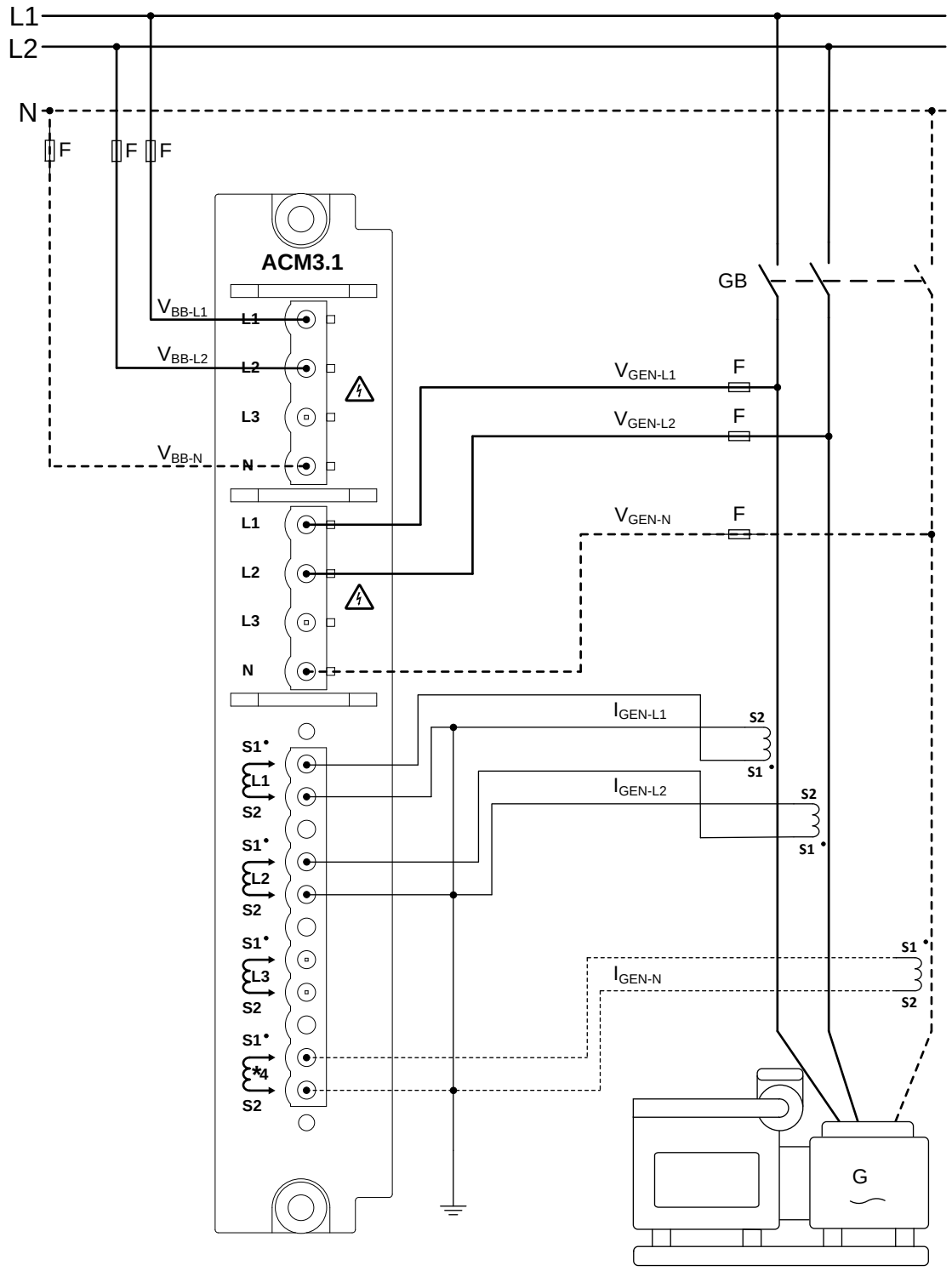


INFO
Single-phase does NOT mean split-phase (where the waveforms are offset by a half-cycle (180 degrees) from the neutral wire).

INFO
Alternatively, you can ground the S1 side of the current transformers, instead of S2 as shown.

Split-phase wiring

Figure 6.2 Example of split-phase L1-N-L2 wiring

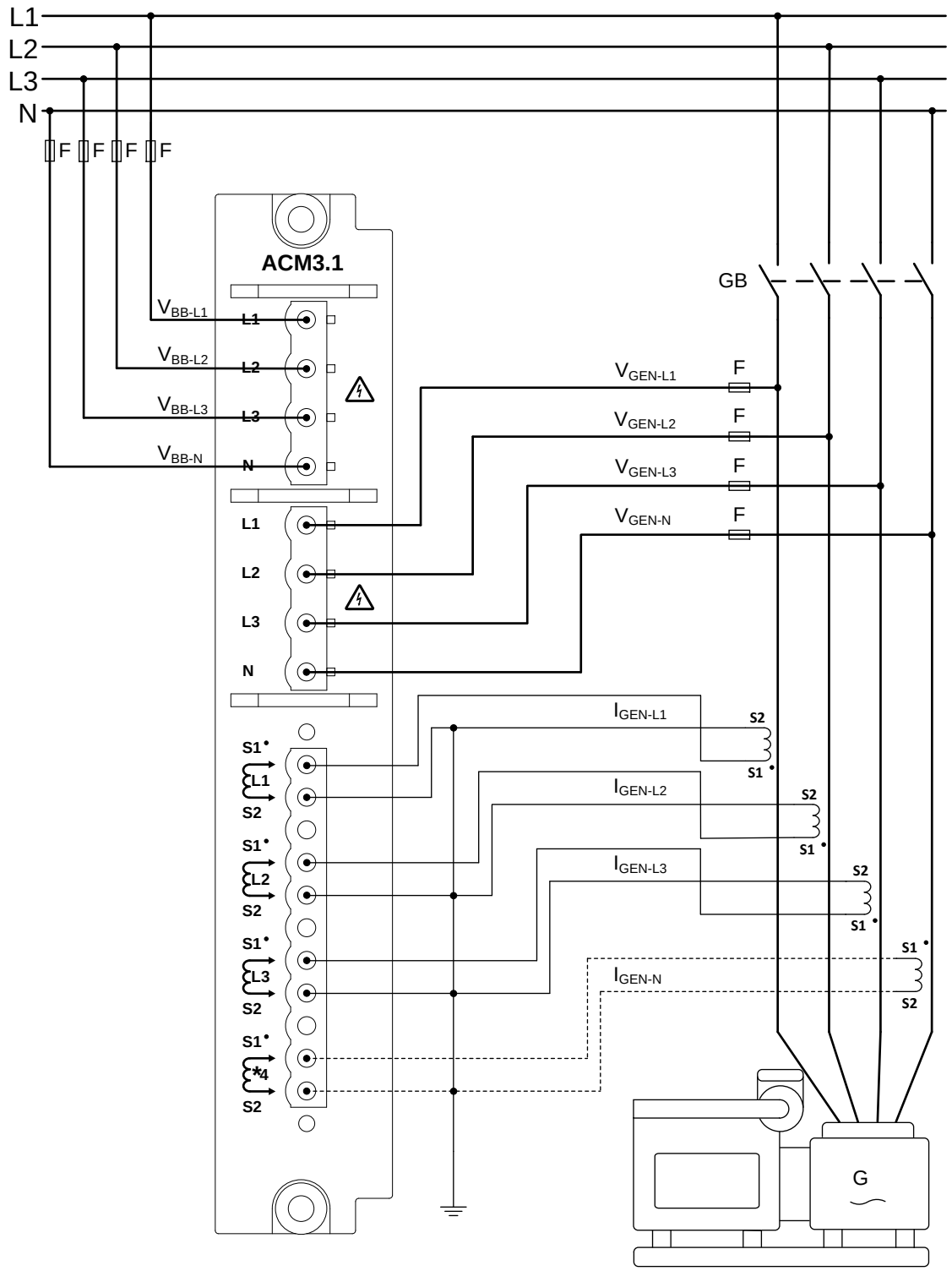


INFO
For split-phase, the waveforms are offset by a half-cycle (180 degrees) from the neutral wire. Split-phase is sometimes called L1-N-L2, or single-phase in the USA.

INFO
Alternatively, you can ground the S1 side of the current transformers, instead of S2 as shown.

Wiring phase-to-neutral voltage measurements

Figure 6.3 Example of wiring required for the phase-to-neutral voltage measurements

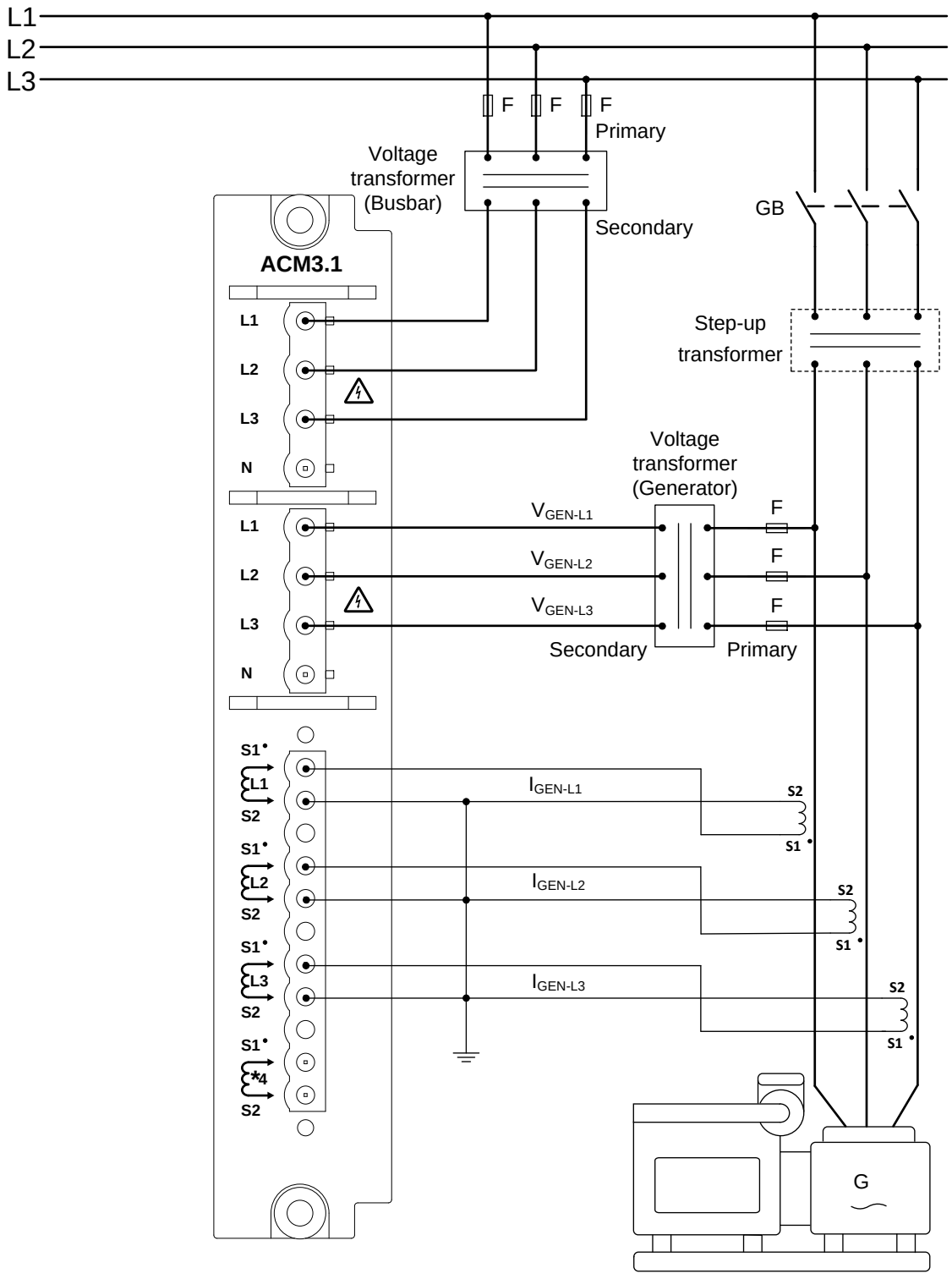


INFO
Alternatively, you can ground the S1 side of the current transformers, instead of S2 as shown.

6.2.2 [Controlled equipment] AC configuration

See **AC configuration and nominal settings**, **AC configuration**, **[Controlled equipment]** in the **Designer's handbook** for information about setting the parameters for this configuration.

Figure 6.4 Example of generator voltage transformer wiring

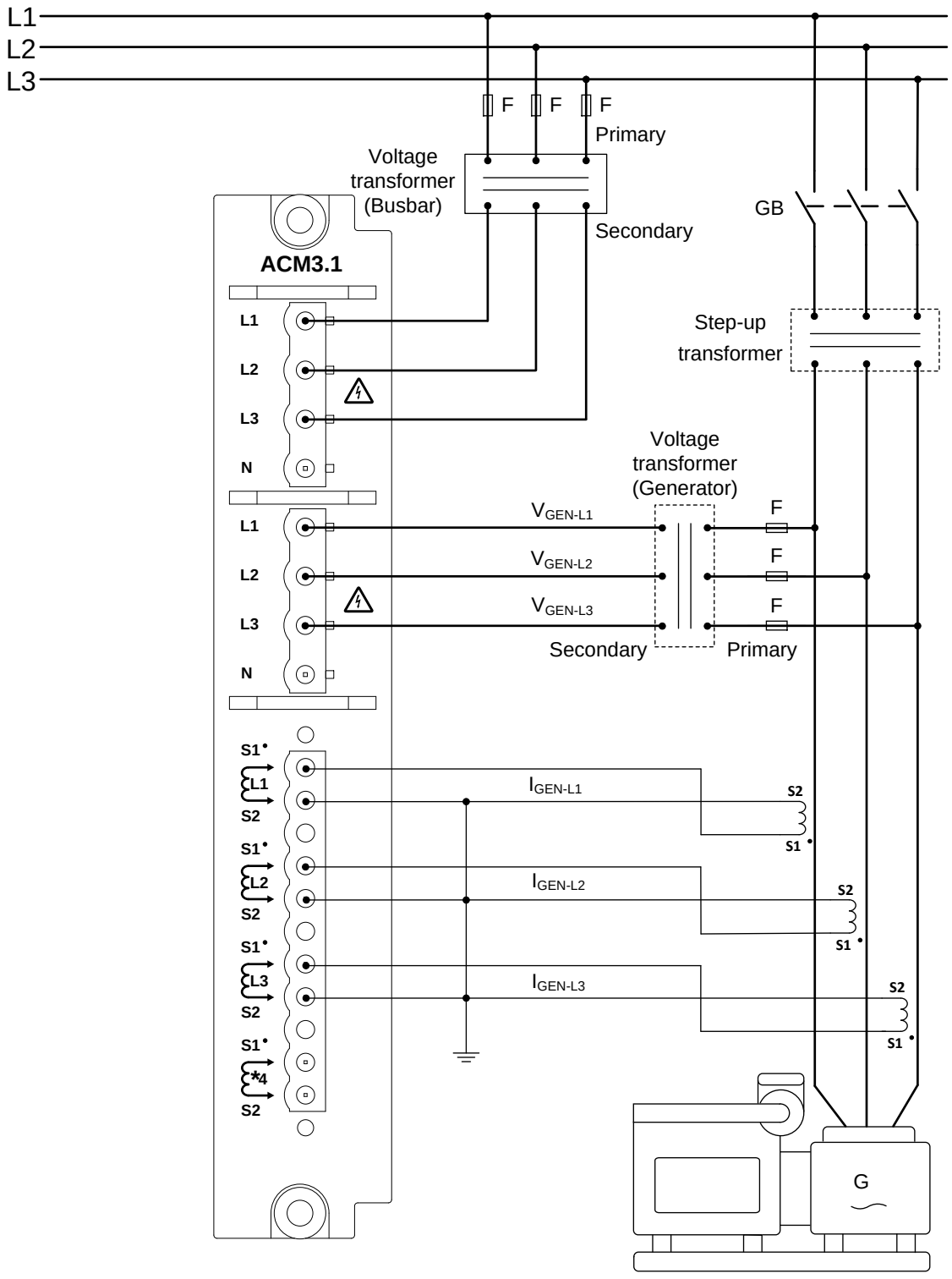


INFO
Alternatively, you can ground the S1 side of the current transformers, instead of S2 as shown.

6.2.3 [Busbar] AC configuration

See **AC configuration and nominal settings**, **AC configuration**, **[Busbar]** in the **Designer's handbook** for information about setting the parameters for this configuration.

Figure 6.5 Example of busbar voltage transformer wiring



INFO
Alternatively, you can ground the S1 side of the current transformers, instead of S2 as shown.

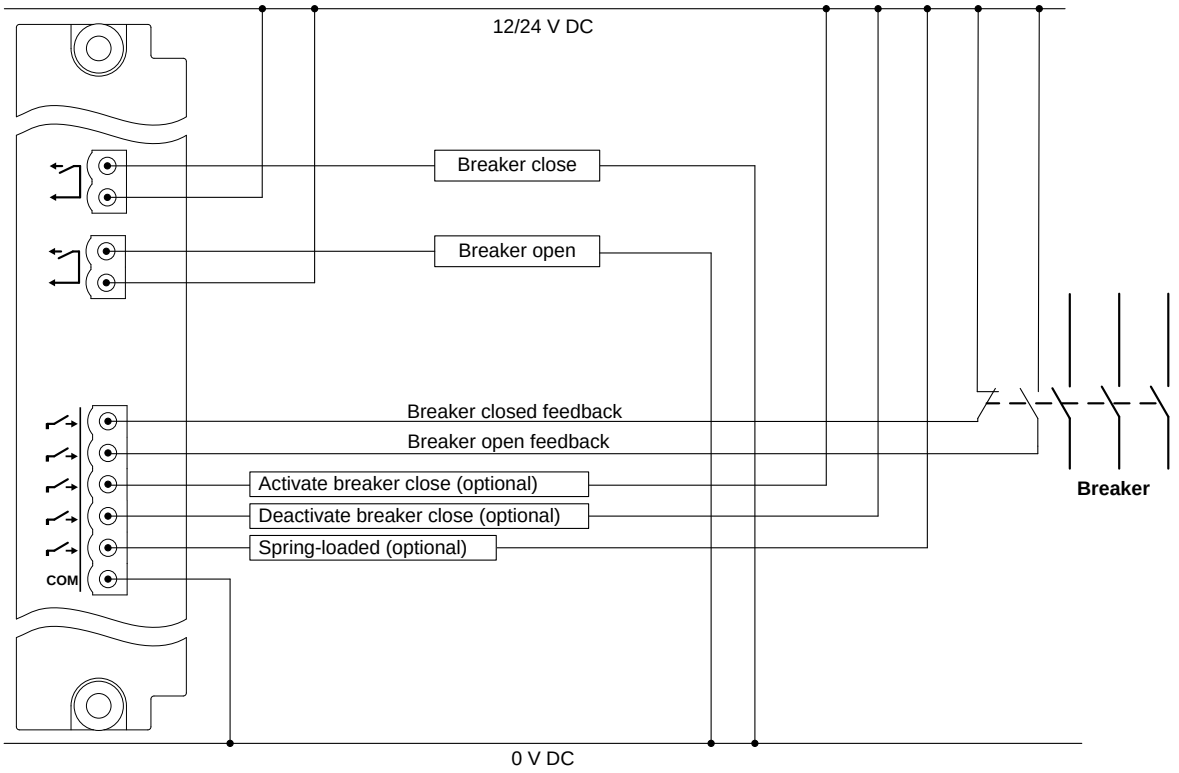
6.3 Breaker wiring

6.3.1 Breaker

An example of the wiring for the *Activate breaker close* function is shown below.

See **Breaker** in the **Designer's handbook** for information about configuring the inputs, outputs and parameters.

Figure 6.6 Example of breaker wiring



7. Wiring the communication

7.1 DEIF Ethernet network communication

7.1.1 Communication

An Ethernet network allows the controllers to communicate.

Table 7.1 DEIF network characteristics

Category	Details
Specifications	• Supports Internet Protocol version 6 (IPv6) and Internet Protocol version 4 (IPv4)
Functions	• Connects the controller(s) to: ◦ Controller display unit ◦ PICUS ◦ Modbus • Password protection ◦ Customisable permission levels

7.1.2 Connecting the communication

Restrictions

- The Ethernet lines must not be longer than 100 metres, point-to-point.
- The Ethernet lines must meet or exceed the SF/UTP CAT5e specification.

CAUTION
The internal communication ports on the PSM must not to be used for the DEIF Ethernet network communication. They are for future use for connecting extension racks together. Do not use either of the internal communication ports in your communication setup. These are marked in red.

INFO
For marine applications, a marine-approved managed switch should be used to connect the DEIF network to your own network. (An ordinary Ethernet switch is not recommended).

CAUTION
The switch must support Rapid Spanning Tree Protocol (RSTP) and RSTP must be enabled to prevent a broadcast storm.

Ethernet port connections

The Ethernet ports on the controllers are not assigned to a particular service. The controllers detect the equipment connected to the port. You can therefore use any port for any service.

However, the recommended default connection of the controllers is as follows:

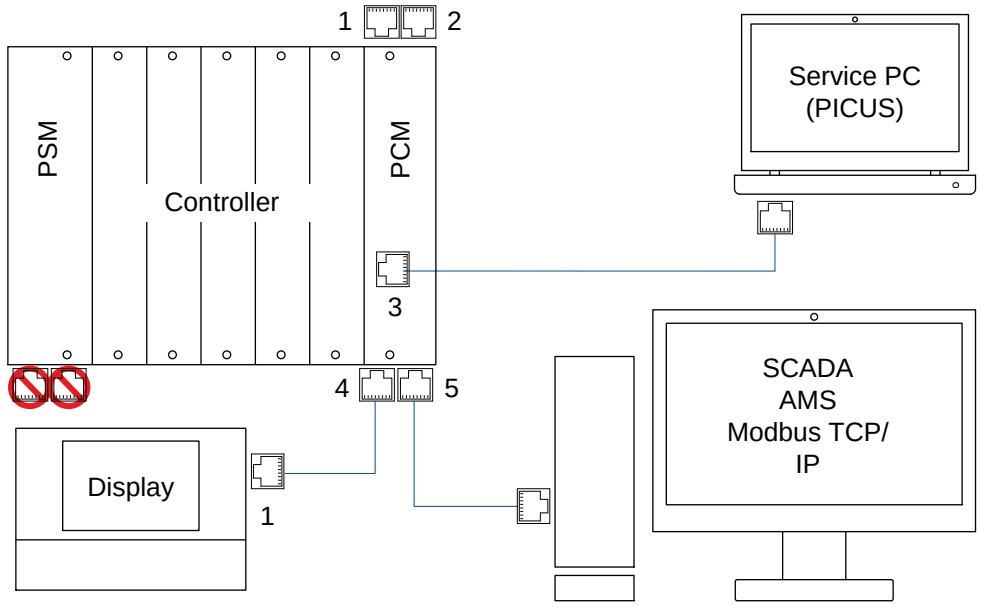
Table 7.2 Recommended default controller connection to the rack

Connection	Symbol	Ethernet port position	Recommended default connection
1		Top of rack, back port	DEIF network
2		Top of rack, front port	DEIF network
3		Front of rack	Service PC / PICUS
4		Bottom of rack, front port	Display unit
5		Bottom of rack, back port	DEIF network / SCADA / AMS / Modbus TCP/IP

Table 7.3 Recommended default display unit connection to the controller

Connection	Symbol	Ethernet port position	Recommended default connection
1		Right side, top port	Controller
2		Right side, bottom port	Additional display unit

The following diagram shows the recommended default connection for the Ethernet cables.



Ethernet port protectors

The controllers are provided with two Ethernet port protectors that can be used as blanks for the Ethernet ports on the top of the controller.

INFO

DEIF recommends that the Ethernet port protectors remain installed in the top Ethernet ports (connection 1 and 2) when these are not in use. The Ethernet port protectors protects the ports from dust and foreign objects.

Cable bend radius

Bends in the Ethernet cables must not be tighter than the minimum bend radius specified by the cable manufacturers.

INFO

DEIF recommends that you always follow the cable manufacturer's bend radius requirements. As a guideline, Ethernet cables may require a minimum bend radius of 40 mm (1.6 in).

Redundancy and routing

Each controller can be connected so that there is redundant communication (that is, two independent Ethernet connections) to other controllers. If you need redundant communication, you should route the Ethernet cables for redundancy. A single failure (for example, damage to a cable rack) should not damage both of the Ethernet connections to the other controllers.

Wiring the Ethernet cable

The controllers and display units use any type of Ethernet cable, provided it meets or exceeds SF/UTP CAT5e specification.

CAUTION

Modifying Ethernet cables improperly may cause loss of network connectivity and EMC problems.

Table 7.4 Ethernet wire colours

Cable colour	Description	Notation
	White / Green	g
	Green	G
	White / Orange	o
	Orange	O
	White / Blue	b
	Blue	B
	White / Brown	br
	Brown	BR

Figure 7.1 T-568A "Straight-through" Ethernet cable wiring

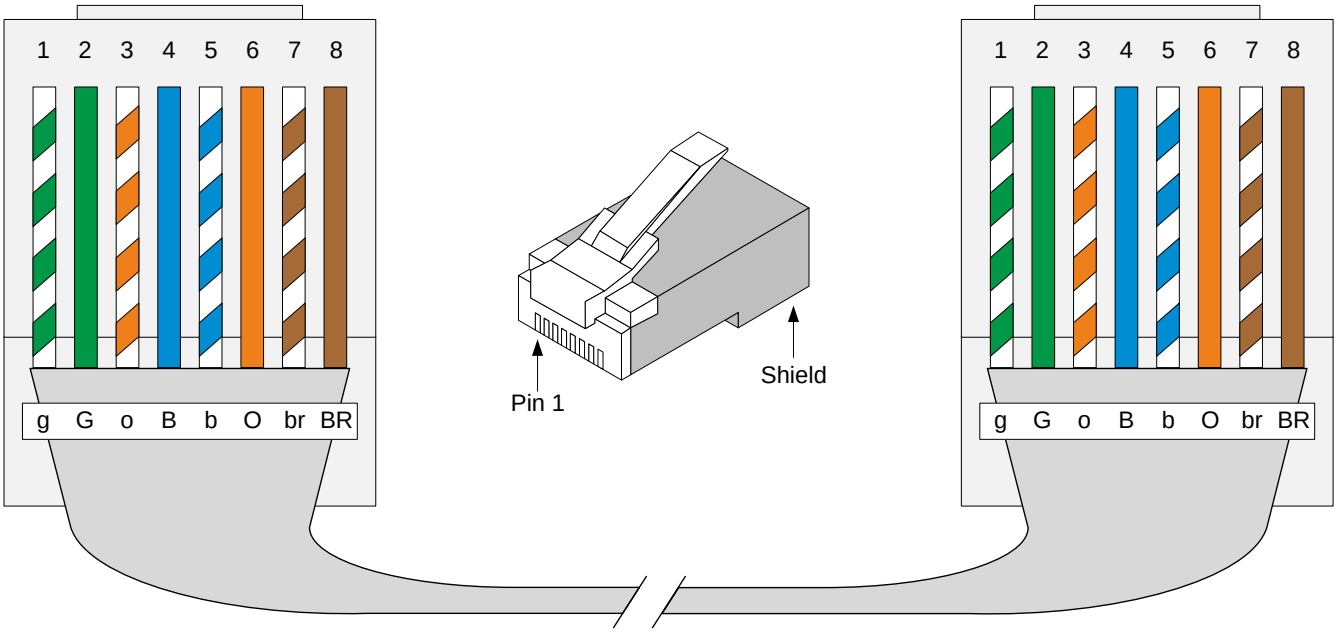


Figure 7.2 T-568B "Straight-through" Ethernet cable wiring

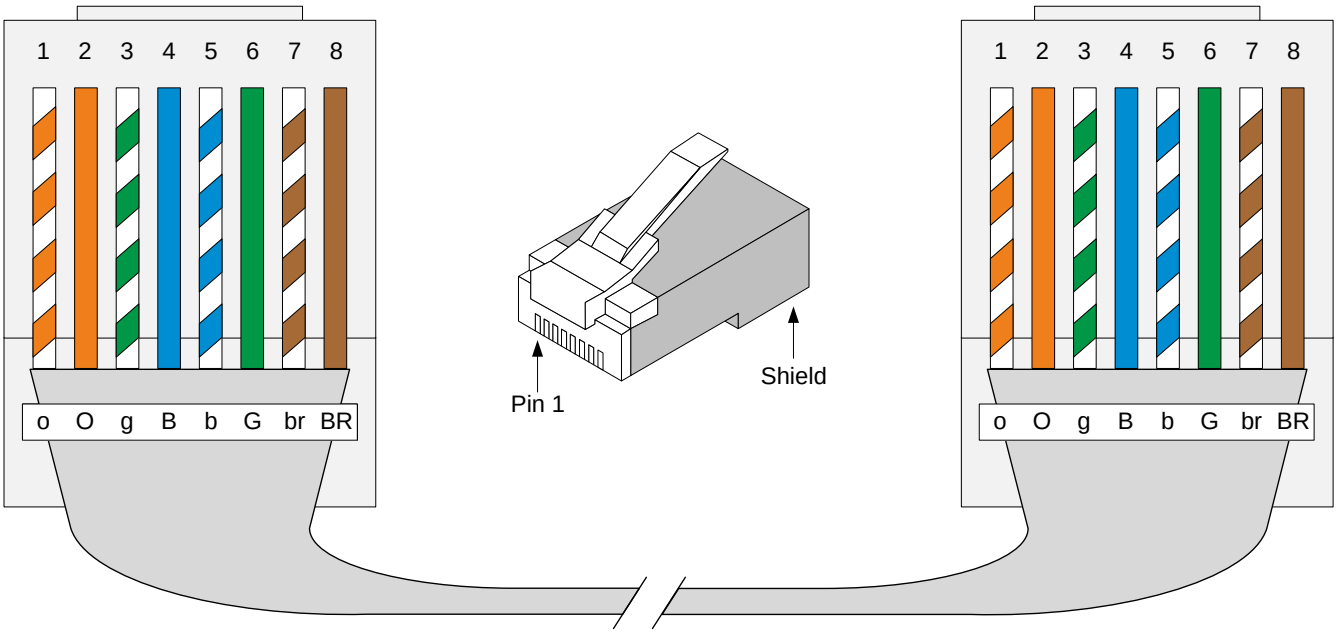
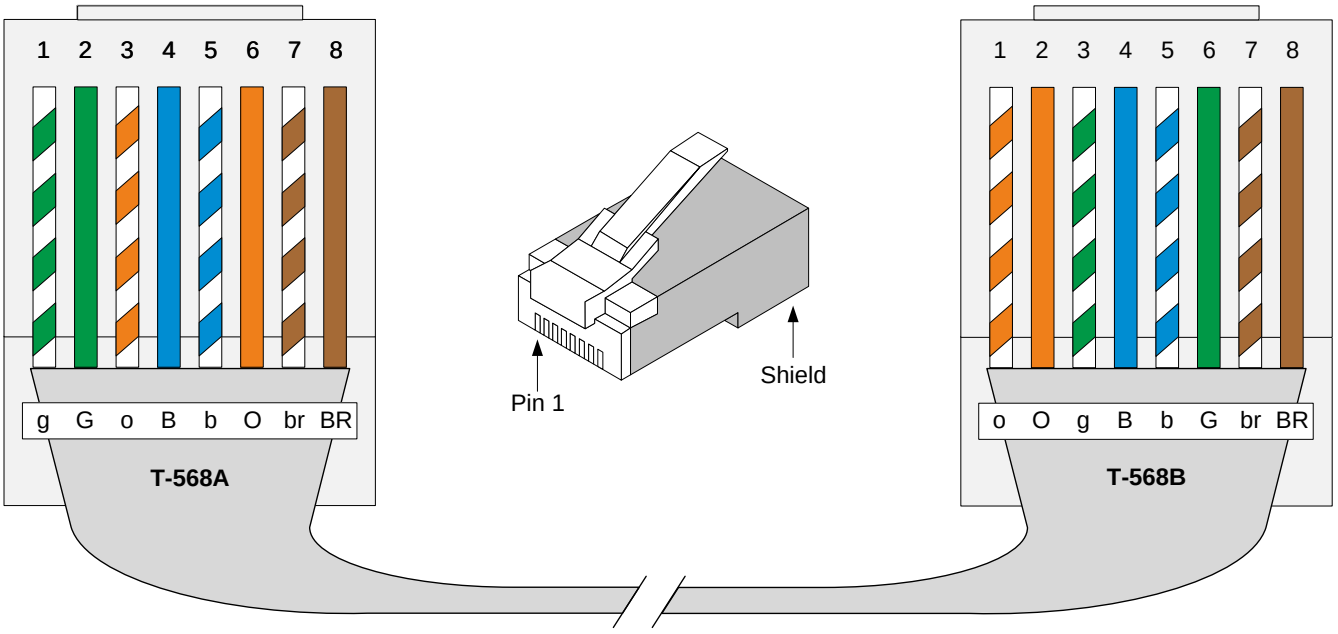


Figure 7.3 RJ-45 "Crossover" Ethernet cable wiring



8. Wiring the display unit

8.1 Display unit overview and wiring

8.1.1 Display unit terminal overview

Figure 8.1 Back of display unit DU 300, with the terminal positions

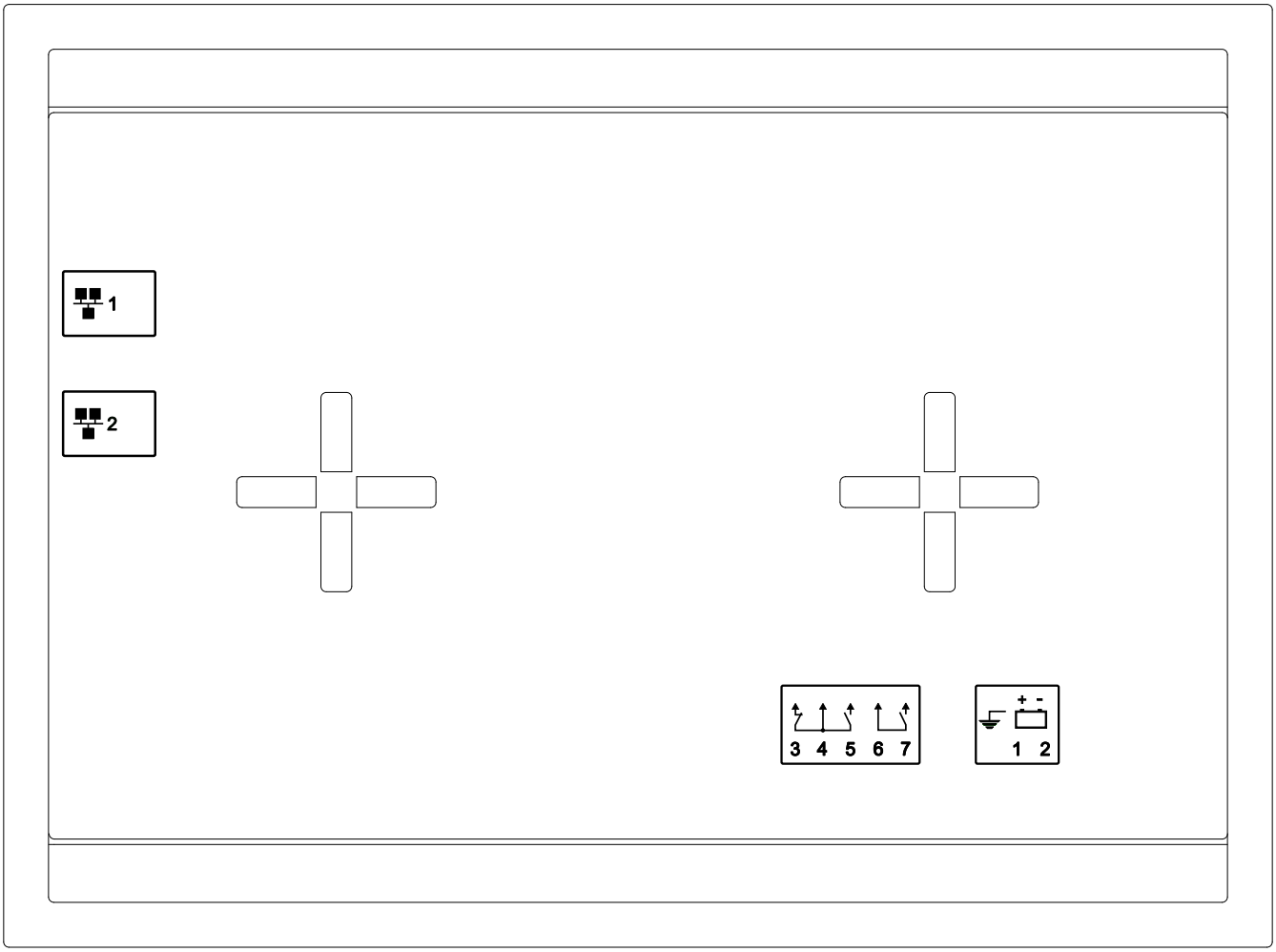


Table 8.1 Display unit electrical terminals

Terminal	Symbol	Type	Name
F/G		Ground	Frame ground
1	+ -	12 or 24 V DC (nominal)	Power supply (+)
2		0 V DC	Power supply (-)
3		Relay output (30 V DC and 1 A)	Future use
4			

Terminal	Symbol	Type	Name
5		Relay output (30 V DC and 1 A)	Future use
6		Relay output (30 V DC and 1 A)	Status OK (+)
7			Status OK (-)

Table 8.2 Display unit Ethernet connections

Connection	Symbol	Type	Name
1		RJ45	DEIF network Ethernet connection to controller (default connection)
2		RJ45	Ethernet future use for additional display units.

CAUTION
The first time a display unit is connected to a controller, it becomes paired to that specific controller for operation. If you later unplug the display unit and plug this into a different controller, the display prompts you to change the paired controller. You can also power the display unit off and unplug the display unit Ethernet cable, connect the Ethernet cable to the required controller, and then power the display back on again.

8.1.2 Frame ground wiring

Connect the frame ground terminal to ground/earth.

INFO
Connection of the frame ground is required by JEM-TR177.

8.1.3 Power supply wiring

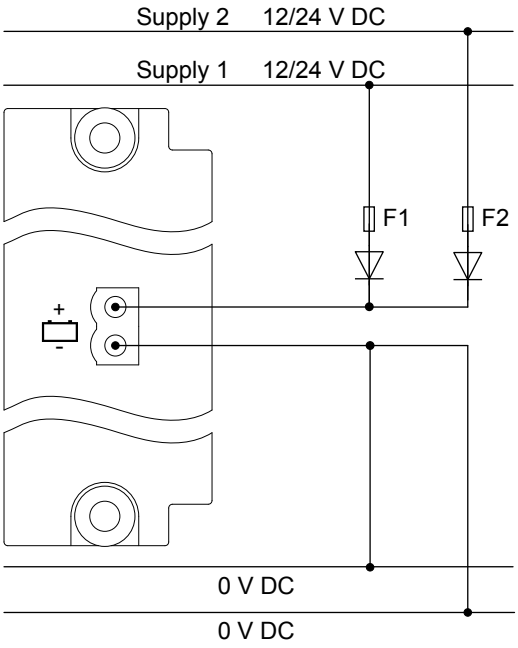
Connect the power supply (+) to the 12 or 24 V DC power supply.

Connect the power supply (-) to the 0 V DC power supply.

Backup power supply

The DEIF equipment does not contain a backup power supply. The power supply source must therefore include the power backup needed.

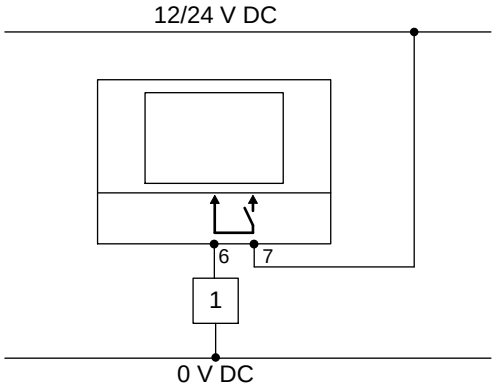
Figure 8.2 Example of a power supply and backup connected to the power supply terminals



INFO
DEIF recommends that a 2A slow blow fuse is used for F1 and F2, and that the diodes are rated 50V or higher.

8.1.4 Relay output wiring

The following diagram shows how the display unit status OK relay can be connected to a third party device ("1"). This could be an alarm monitoring system (AMS), a horn or a light.



INFO
The diagram shows the relay terminals as seen from the back of the display unit.

INFO
It is not currently possible to configure the relay state. Therefore the relay is in a *Normally open (NO)* and *De-energised* state.

8.1.5 Ethernet connections

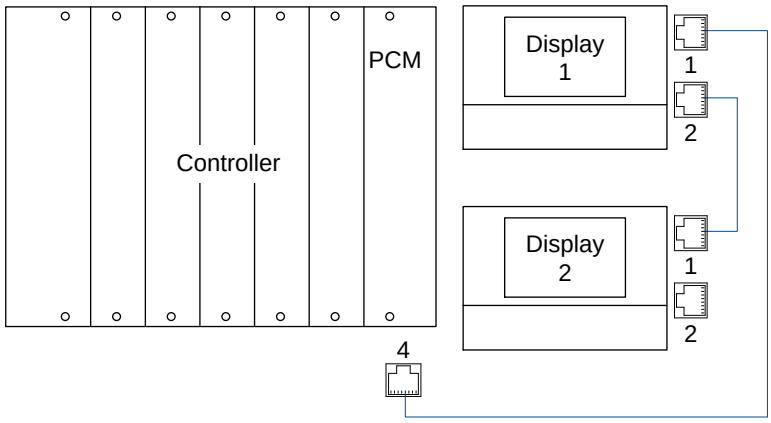
INFO
Please refer to **Wiring the communication** for information regarding the specification of Ethernet cabling type and wiring examples.

Connections

Table 8.3 Recommended default display unit connection to the controller

Connection	Symbol	Ethernet port position	Recommended default connection
1		Right side, top port	Controller
2		Right side, bottom port	Additional display unit (optional)

Figure 8.3 The recommended connection of the DEIF display unit and optional additional display unit to the controller.



9. Glossary

9.1 Terms and abbreviations

Term	Abbreviation	Explanation
Alarm monitoring system	AMS	Third party equipment used to monitor the controller system's alarms, for example, by using Modbus TCP/IP communication.
Alternating current	AC	
Alternating current module 3.1	ACM3.1	A replaceable PCB with voltage and current measurement inputs. Used in the DEIF controller.
Breaker		A mechanical switching device that closes to connect power sources to the busbar, or to connect busbar sections. The breaker opens to disconnect the power sources or to split the busbar.
Busbar		The copper conductors which connect the power sources to the power consumers. Represented on the single-line diagram as the line that connects all the power sources and power consumers. If the bus tie breaker is open, there are two separate and independent busbar sections. Similarly, if the bus tie breaker is closed, there is only one busbar.
Commissioning		The careful and systematic process that takes place after installation and before the system is handed over to the operator. Commissioning must include checking and adjusting the controller.
Common terminal	COM	This is generally connected to either a power source, or the supply return. See the wiring examples for more information.
Configuration		Assigning input and output functions to terminals, and setting parameters, so that the controller is suitable for the application where it is installed.
Connected		A generator is connected to the system if it is running, synchronised with the busbar, and its breaker is closed.
Controller	GPU	GPU 300, DEIF's Generator Protection Unit.
Current transformer	CT	
Digital input	DI	Terminals on a controller hardware module that the controller uses to measure a digital input. A pre-configured digital input function or alarm can be assigned to the input.
Electrostatic discharge	ESD	
Generator breaker	GB	The breaker between a genset and the busbar. The controller can control a generator breaker.
Ground		A connection between the equipment and earth. For marine applications, a ground is a connection to the ship's frame.
Hot swapping		NOT recommended. Changing hardware modules while the equipment is powered, which may damage the equipment.
Input output module 3.1	IOM3.1	A replaceable PCB, with four relay outputs, and 10 digital inputs. Used in the DEIF controller.
Internet Protocol version 4	IPv4	A protocol for communication across networks. IPv4 currently routes the most traffic on the Internet, but will gradually be replaced by IPv6.
Internet Protocol version 6	IPv6	A protocol for communication across networks. Among other things, IPv6 has a much larger address space than IPv4.
Light emitting diode	LED	Used to show the controller and equipment status and alarms.

Term	Abbreviation	Explanation
Liquid crystal display	LCD	The screen of the display unit. The information displayed varies, depending on the equipment operation and the operator input.
Multi-line 300	ML 300	A DEIF product platform. GPU 300 is part of ML 300.
Neutral	N	The neutral line in a three-phase electrical system.
Network ring		An Ethernet connection topology where the controllers are connected in a line, and the last controller is connected back to the first.
Network chain		An Ethernet connection topology where the controllers are connected in a line.
Non-essential load	NEL	A load that is not critical to the system. These may be disconnected by the controller in the event of over-load, over-current, or busbar under-current.
Number	#	Hash represents a number. The description is the same for each item in the range. For example, "Controller ID #" represents any of the possible controller IDs.
Parameter		A value, or set point, used to determine the controller's operation. Parameters include nominal values, the configuration options for the configurable inputs and outputs, and alarm settings. The same set of parameters can be uploaded to several controllers.
Phase L1	L1	The power line for one phase of a three-phase electrical system. Corresponds to R in Germany, Red in the UK and Pacific, Red in New Zealand, Black in the USA, and U on electrical machine terminals. The above colour codes are for guidance only. If uncertain perform a phase measurement.
Phase L2	L2	The power line for one phase of a three-phase electrical system. Corresponds to S in Germany, Yellow in the UK and Pacific, White in New Zealand, Red in the USA, and V on electrical machine terminals. The above colour codes are for guidance only. If uncertain perform a phase measurement.
Phase L3	L3	The power line for one phase of a three-phase electrical system. Corresponds to T in Germany, Blue in the UK and Pacific, Blue in New Zealand, Blue in the USA, and W on electrical machine terminals. The above colour codes are for guidance only. If uncertain perform a phase measurement.
Power in Control Utility Software	PICUS	The DEIF utility software, used to design, configure, troubleshoot and monitor a system.
Power supply module 3.1	PSM3.1	A replaceable PCB that powers the controller. This module includes three relay outputs for status signals. Used in the DEIF controller.
Printed circuit board	PCB	Supports and electrically connects components.
Processor and communication module 3.1	PCM3.1	A replaceable PCB, which contains the controller processor, as well as the CAN bus connections and Ethernet communication connections. Used in the DEIF controller.
Programmable logic controller	PLC	A digital computer used for the automation of electromechanical processes.
Rack		An aluminium box with a rack system that houses the hardware modules. Each controller consists of a rack and a number of hardware modules.
SD card		External memory (future use)
Single-phase		A system where the load is connected between one of the phases and the neutral. Note: Single-phase does NOT mean a 3-wire single-phase distribution system, where the waveforms are offset by a half-cycle (180 degrees) from the neutral wire.
Supervisory control and data acquisition system	SCADA	

Term	Abbreviation	Explanation
Third-party equipment		Equipment other than the DEIF controller. For example: The genset, the genset engine control system, the wiring, the busbars, and the switchboard.
Time	t	
Transmission control protocol/internet protocol	TCP/IP	The Internet protocol suite. It provides end-to-end connectivity by specifying data handling.
Trip		An emergency or fast opening of a breaker. No attempt is made to de-load the breaker before it opens.
Voltage	V	Electrical potential difference. U is used as an abbreviation for voltage in most of Europe, Russia and China.
Voltage transformer	VT	A transformer for the voltage measurements, so that the voltage at the controller is within the controller's specifications.

9.2 Units

The table below lists the units used in the documentation, as well as the US units where these are different. In the documentation, the US units are given in brackets, for example, 80 °C (176 °F).

Table 9.1 Units used in the documentation

Unit	Name	Measures	US unit	US name	Conversion	Alternative units
A	ampere	Current				
bar	bar	Pressure	psi	pounds per square inch	1 bar = 14.5 psi	1 bar = 0.980665 atmosphere (atm) 1 bar = 100,000 Pascal (Pa)
ºC	degrees Celsius	Temperature	ºF	Fahrenheit	T[ºC] = (T[ºF] - 32 º) × 5 / 9	T[ºC] = T[Kelvin (K)] - 273.15
dB	decibel	Noise or interference (a logarithmic scale)				
g	gram	Weight	oz	ounce	1 g = 0.03527 oz	
g	gravitational force	Gravity, *g* = 9.8 m/s^2	ft/s^2		*g* = 32.2 ft/s^2	
h	hour	Time				
Hz	hertz	Frequency (cycles per second)				
kg	kilogram	Weight	lb	pound	1 kg = 2.205 lb	
kPa	kilopascal	Pressure	psi	pounds per square inch	1 kPa = 0.145 psi	
m	metre	Length	ft	foot (or feet)	1 m = 3.28 ft	
mA	milliampere	Current				
min	minute	Time				
mm	millimetre	Length	in	inch	1 mm = 0.0394 in	

Unit	Name	Measures	US unit	US name	Conversion	Alternative units
ms	millisecond	Time				
N·m	newton metre	Torque	lb-in	pound-force inch	1 N·m = 8.85 lb-in	
RPM	revolutions per minute	Frequency of rotation (rotational speed)				
s	second	Time				
V	volt	Voltage				
V AC	volt (alternating current)	Voltage (alternating current)				
V DC	volt (direct current)	Voltage (direct current)				
W	watt	Power				
Ω	ohm	Resistance				

9.3 Symbols

9.3.1 Symbols for notes

Safety notes

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.

General notes

INFO
This highlights general information.

This highlights where to find more information.

Example heading

This highlights examples.

9.3.2 Drawing symbols

The drawings use EU symbols. The US alternative is shown where applicable.

Table 9.2 Electrical symbols

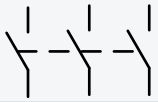
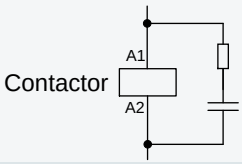
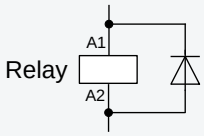
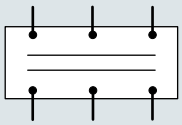
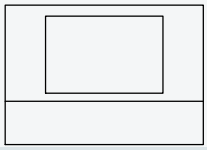
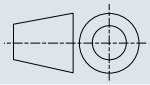
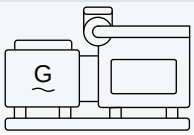
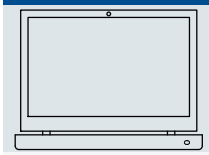
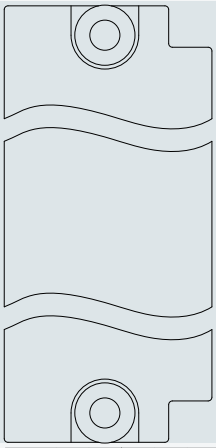
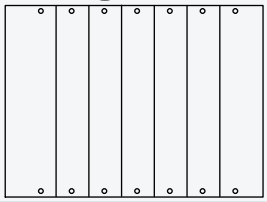
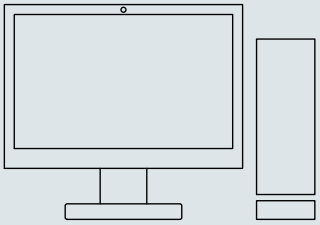
Symbol	Symbol name
	3-phase breaker
	Capacitor
	Contactor with RC snubber
•	Connector dot
	Current transformer (S1 and · show "current in"; S2 shows "current out")
	Diode
	Fuse
	Ohmmeter
	Relay with freewheeling diode
	Resistor (IEC-60617)
	Single-line diagram closed breaker
	Single-line diagram open breaker
○	Temporary connection dot (for example, connection to a meter)
	Voltage transformer. This is a generic voltage transformer, without any information about the transformer connections. These could for example be: open delta, star-star, closed delta, and so on.

Table 9.3 Icons used in drawings

Symbol	Symbol name
	Display unit DU 300
	First-angle projection
	Genset

Symbol	Symbol name
	Laptop
	Non-essential load
	Part of a module faceplate, to show examples of terminal wiring
	Rack R7
	Server or desktop PC

9.3.3 Module faceplate symbols

Table 9.4 Terminals

Symbol	Symbol name
	Frame ground
	Power supply
L1, L2, L3 and N	Three-phase voltage measurements
	Current transformer
COM	Common

Symbol	Symbol name
	Digital input
	Relay output (normally open)
	Relay with wire break detection (normally open)
	Relay output (changeover relay, with normally open and normally closed terminals)
H, CAN-#, L	CAN bus connection

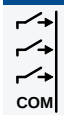
Table 9.5 LEDs

Symbol	Symbol name
CAN-#	CAN bus
	DEIF network
	Internal communication in
	Internal communication out
	Internal communication status
	Power supply status (PSM)
	System status (PCM)

Table 9.6 Other

Symbol	Symbol name
▲	RJ45 connections at the top of the hardware module
▼	RJ45 connections at the bottom of the hardware module
	SD card

Table 9.7 Terminal sets

Example	Explanation
	The vertical line to the right of the symbols shows terminal sets. In the example, the digital inputs have the same common.