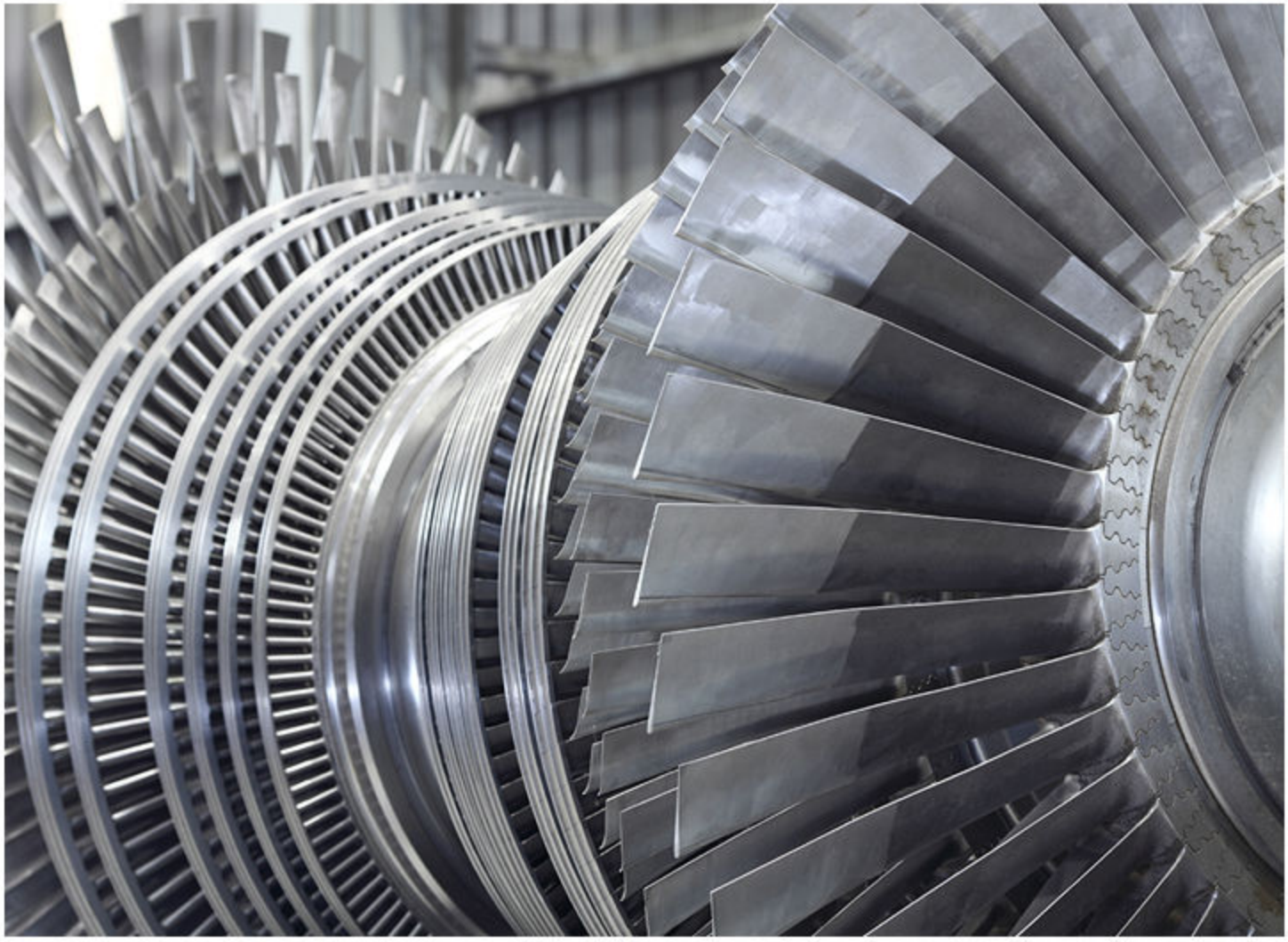
Turbo Control (TC)

4189341445-A

Steam | Turbine

Installation instructions

DEIF Improve Tomorrow



1. About the installation instructions

2. Prepare for installation

3. Mount the equipment

4. Wire the equipment

5. Maintenance

1. About the installation instructions

1.1 Intended users of the Installation instructions

The Installation instructions are intended for the installer and cabinet designer who mounts and wires up the equipment. The Installation instructions can also be used for commissioning to check the installation.

You can find other technical documentation at www.deif.com/documentation/

1.2 Symbols for hazard statements

DANGER!

This shows dangerous situations.

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

WARNING

This shows potentially dangerous situations.

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

CAUTION

This shows low level risk situation.

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

NOTICE

This shows an important notice

Make sure to read this information.

1.3 Symbols for general notes

NOTE This shows general information.

More information
This shows where you can find more information.

Example

This shows an example.

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

1.4 Warnings and safety

Safety during installation and operation

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

DANGER!

Hazardous live currents and voltages

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

Recommendations for data security

To minimise the risk of data security breaches we recommend to:

- As far as possible, avoid exposing controllers and controller networks to public networks and the Internet.
- Use additional security layers like a VPN for remote access, and install firewall mechanisms.
- Restrict access to authorised persons.

Metal fragments and other objects

Keep metal fragments and other objects out of the controller, as these can damage the equipment. Be especially careful when you install the equipment.

Electrostatic discharge

Protect the equipment terminals from electrostatic discharge when not installed in a grounded rack.

Electrostatic discharge could damage the equipment.

Connect the controller (or extension rack) protective earth

DANGER!

Failure to ground

Failure to ground the controller (or extension rack) could lead to injury or death.

You must ground the controller (or extension rack) to a protective earth.

Do not use unsupported hardware modules

Only use the hardware modules that are listed in the Technical specifications. Unsupported hardware modules can make the controller malfunction.

1.5 Legal information

Open source software

This product contains open source software licensed under, for example, the GNU General Public License (GNU GPL) and GNU Lesser General 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.

General warranty

The warranty period for the purchased product is defined in the contract and order acknowledgement. In general, DEIF's Terms and Conditions of Sale and Delivery apply.

The product continuously monitors the operating temperature and stores this information in a log file on the device. DEIF uses this information for service purpose and to validate if issues with the product are covered by the warranty.

The software packages supplied are believed to be of the highest quality. Due to the nature of the software development process, it is possible that there are hidden defects in the software which may affect its use, or the operation of any software or device developed with this software package.

DEIF does not undertake responsibility for determining whether this package is suitable for the application, nor for ensuring the correct operation of the application software and hardware.

The warranty does not cover product wear parts, such as:

- Internal flash disc
- If applicable, SD card (purchased separately)
- Replaceable coil-cell battery, used for the real-time clock (available as a spare part)

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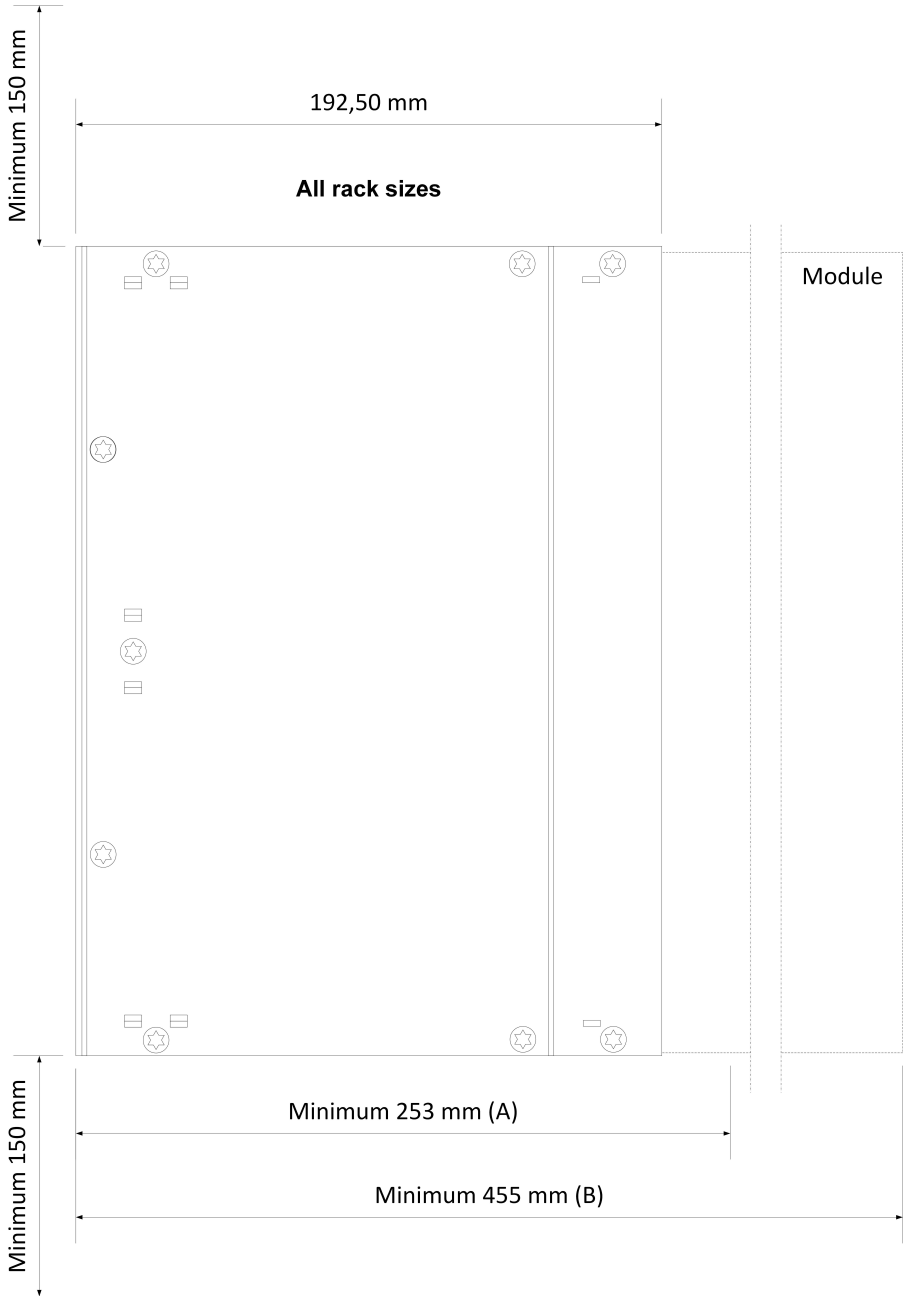
2. Prepare for installation

2.1 Installation location

As the product is designed for pollution degree 2, the product must be installed in sealed non ventilated enclosure or air filtered ventilated enclosures. This is required for UL/ULC compliant installations.

2.2 Ventilation and free space

When installing the controller in an enclosure, ensure a minimum of 150 mm of free space above and below the controller to maintain sufficient ventilation.



Minimum distance	Notes
A : 253 mm (9.96 in)	Recommended minimum distance from the mounting plate of the cabinet to the inside of the closed cabinet door.
B : 455 mm (17.9 in)	Recommended minimum distance from the mounting plate of the cabinet to any fixed objects in front of the rack (with an open cabinet door).

During operation, the connectors must be clear of the front door of the cabinet.

Free space is necessary to ensure correct ventilation and sufficient working space when replacing or inspecting the hardware modules.

2.3 Precaution on ambient cabinet temperature

The ambient temperature T_{AMB} for the controller (the temperature within the control cabinet) dictates the design lifetime of the electronic circuits in the rack.

Ambient temperature	Minimum expected lifetime
T_{AMB}up to 40 °C	20 years

2.4 Separation for noisy modules and cables

When noisy modules (that is for example inverters) are placed in the same cabinet we recommend to place power and motor cables in separate cable trays. Keep at least 100 mm distance to the controller and signal cables.

2.5 Rack electromagnetic compatibility (EMC)

The controller system is CE marked. The system's electrical noise immission and emission comply with the EN for electromagnetic compatibility (EMC).

The rack (with hardware modules and cover plates) with a grounded metal cage, are part of the approved EMC. In order to ensure an intact EMC, the rack frame and the metal front covers must be in a solid electrical connection.

Modules that have been out of the rack must be checked that they are firmly mounted in the rack frame. Check all the screws in the front covers are tightened with 0.5 N·m.

2.6 Recommended screws/bolts for mounting

DEIF recommends to mount the controller using a stainless steel M6 screw/bolt and matching plain washer of A2-70 ISO 3506 quality or better. The screw/bolt should be tightened with 0.5 N·m.

NOTICE

Torque damage to equipment

Do not use power tools during the installation. Too much torque damages the equipment.

Follow the instructions for the correct amount of torque to apply.

2.7 Personal Protective Equipment (PPE)

Follow all local requirements and regulations for wearing PPE while you install or wire the product.

Example PPE but not limited to:

 Ear protection

 Eye protection

 Wear gloves

 Protective clothing

2.8 Safety and precautions

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

Example safety precautions but not limited to:

 Isolate power supply.

 Ground the equipment.

 Protect against static discharge.

 Do not alter state during installation.

More information
See Warnings and safety for full details of all precautions to take during installation.

3. Mount the equipment

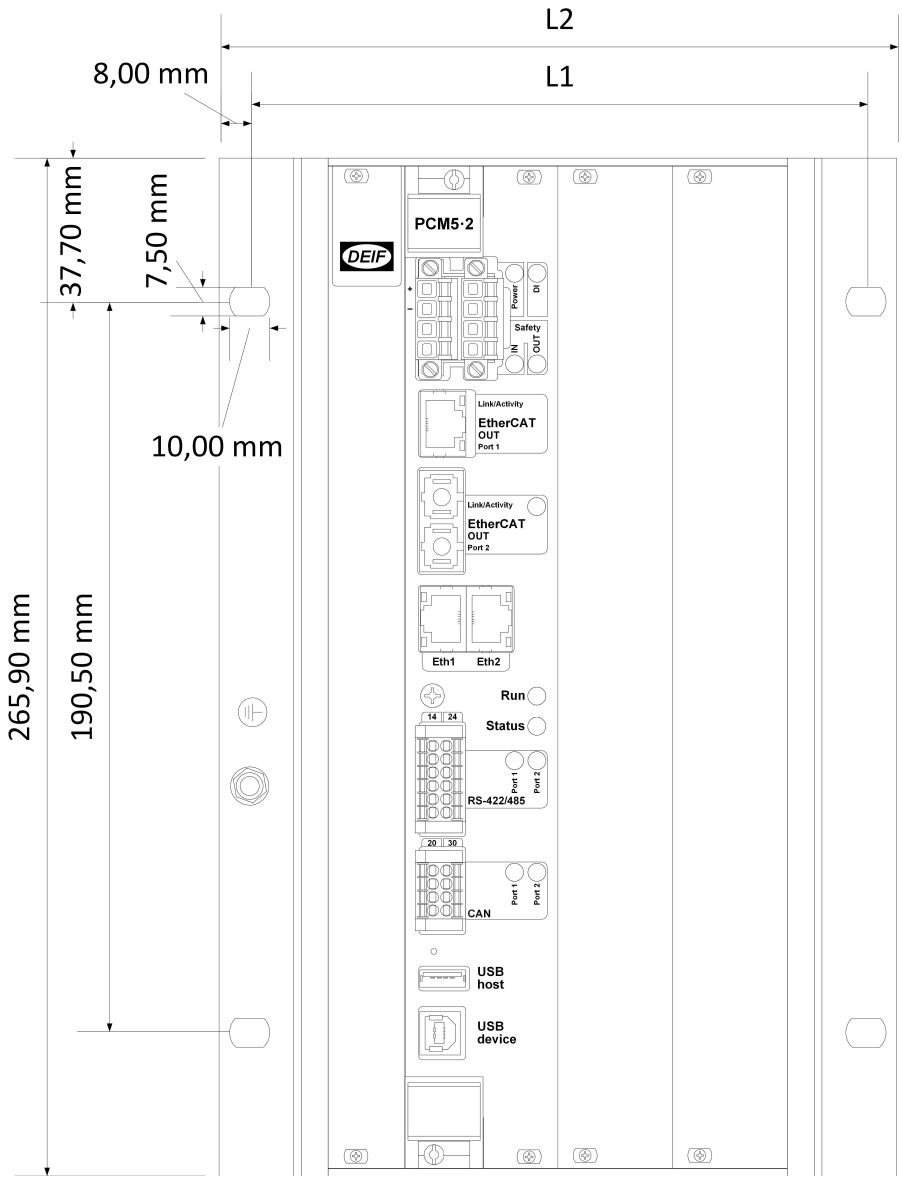
3.1 Before you begin the installation

The controller comes with the ordered hardware modules pre-installed. Additional modules can be added or removed in factory or on site.

CAD drawings for the controller rack can be downloaded from www.deif.com

3.2 Dimensions

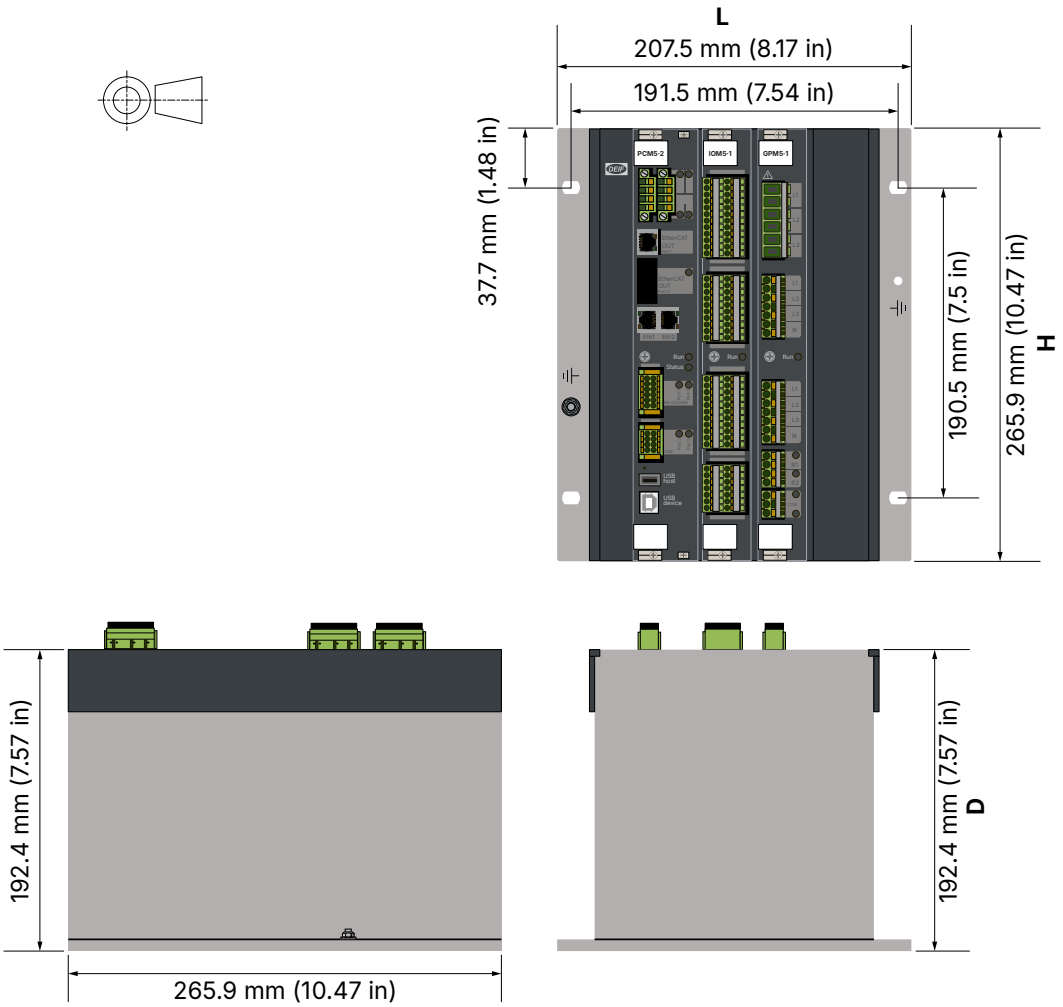
3.2.1 All rack sizes



Rack width	L1	L2
Rack5·0 (TE 12)	100.1 mm (3.95 in)	116.1 mm (4.57 in)
Rack5·1 (TE 18)	130.5 mm (5.14 in)	146.5 mm (5.77 in)
Rack5·2 (TE 24)	161.0 mm (6.34 in)	177.0 mm (6.97 in)

Rack width	L1	L2
Rack5·3 (TE 30)	191.5 mm (7.54 in)	207.5 mm (8.17 in)
Rack5·5 (TE 42)	252.5 mm (9.94 in)	268.5 mm (10.57 in)
Rack5·8 (TE 60)	343.9 mm (13.54 in)	359.9 mm (14.17 in)

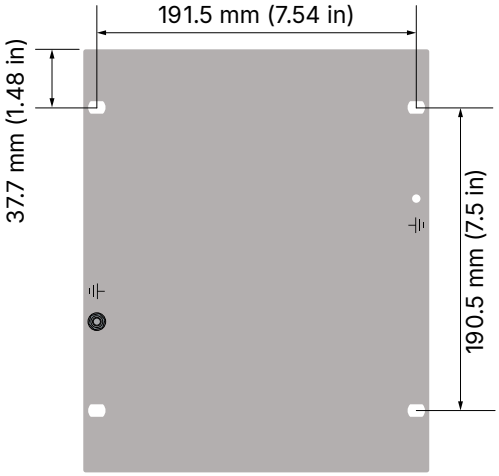
3.2.2 Rack 5·3 (TE 30)



Category	Specification
Type	Rack 5·3 (TE 30)
Dimensions	L 207.5 mm x H 265.9 mm x D 192.4 mm (8.17 in x 10.47 in x 7.57 in) (outer frame)

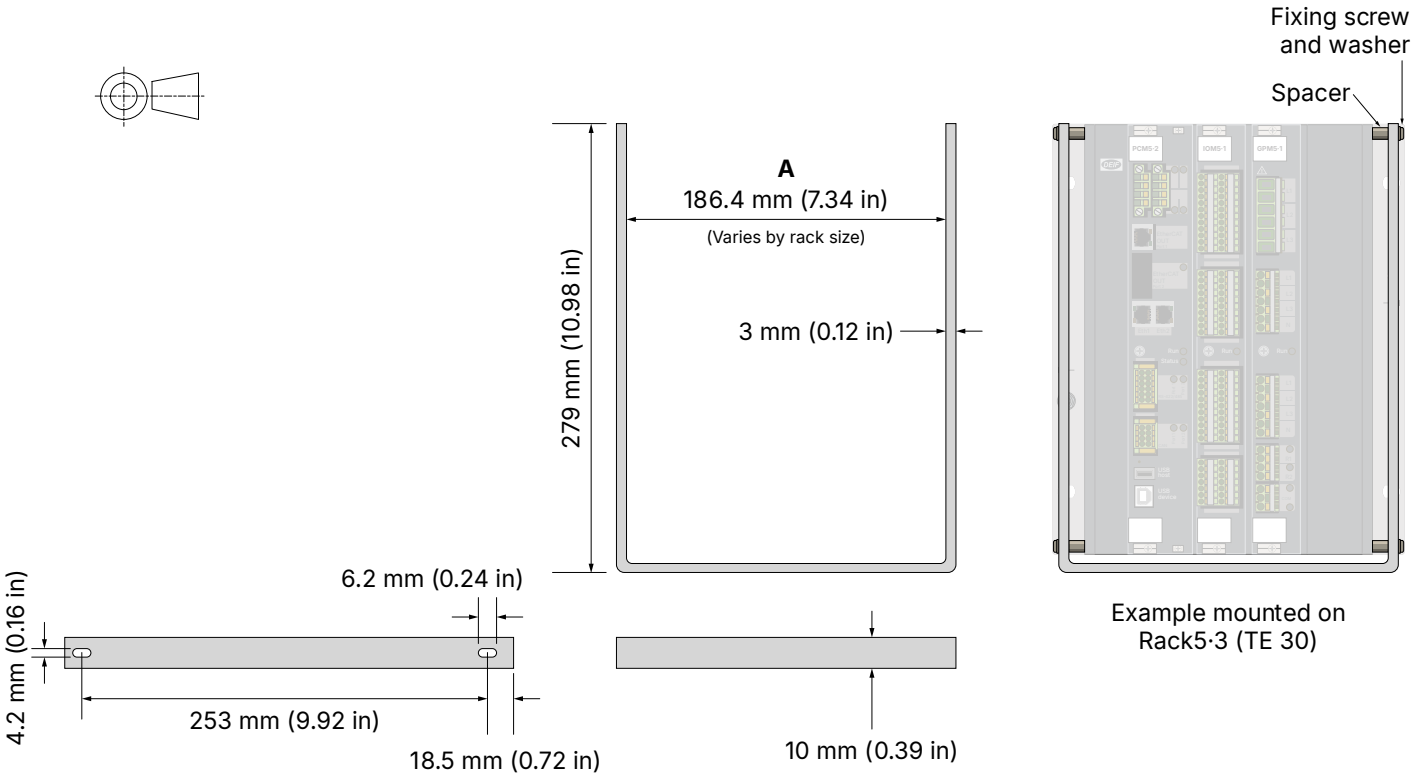
3.3 Example drilling template for Rack5·3

This drilling template drawing is a guideline and not scale 1:1. The dimensions will not be correct when printed. Use the dimensions given to create your template.



Not shown to actual size.

3.4 Wire support / cable relief bracket



Example mounted on Rack5·3 (TE 30)

Rack	Dimensions		Weight
	Internal width (A)	Height	
Rack 5·0 (TE 12)	95 mm (3.74 in)	279 mm (10.98 in)	~155 g (5.47 oz)
Rack 5·1 (TE 18)	125.4 mm (4.94 in)	279 mm (10.98 in)	~157 g (5.54 oz)
Rack 5·2 (TE 24)	156.1 mm (6.15 in)	279 mm (10.98 in)	~162 g (5.7 oz)
Rack 5·3 (TE 30)	186.4 mm (7.34 in)	279 mm (10.98 in)	~174 g (6.13 oz)

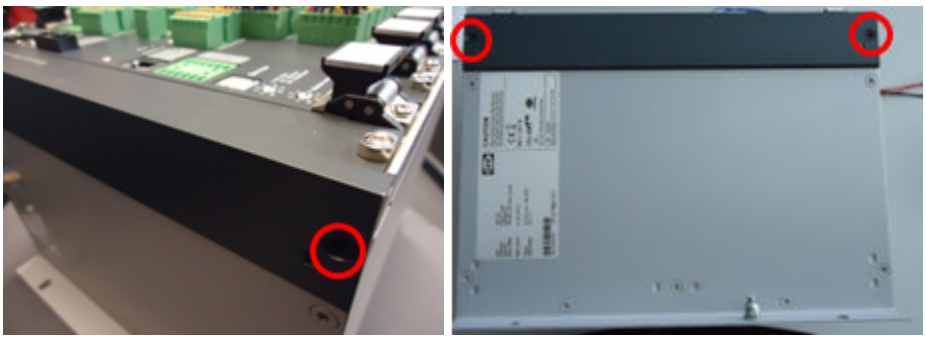
Rack	Dimensions		Weight
	Internal width (A)	Height	
Rack 5·5 (TE 42)	247.5 mm (9.74 in)	279 mm (10.98 in)	~188 g (6.63 oz)
Rack 5·8 (TE 60)	339 mm (13.37 in)	279 mm (10.98 in)	~207 g (7.3 oz)

3.5 Mount the wire support / cable relief bracket

Supplied with Wire support bracket:

- 4x M4 x 8 mm screws
- 8x Washers Ø4 mm (4 pcs. for different distances)
- 4x Spacers M4 x 15 mm
- 1x Wirse support / cable relief bracket

Mount the wire support:

1. Remove the four edge screws and replace with the new screws and spacers.
   - 
2. Use washers and tighten all four screws with 2.1 Nm.
   - 

4. Wire the equipment

4.1 Power supply

The PCM/PDM provides a galvanic insulation between the power source and the controller system.

The PCM/PDM is equipped with a switch mode power supply, which generates supply voltage for the control part of the PCM and for supply voltages to the other modules.

The PCM/PDM has a build-in 20 ms (minimum) power blackout protection. This feature assures that if the power suddenly drops to below the minimum threshold the complete controller; including all IO module within the rack; will continue to operate as normal. If power returns within this 50 ms period the controller will continue uninterrupted. If power continues to be absent after this blackout protection period the controller will enter its Safe Shutdown Cycle in which it will assure that all data addressed to the non-volatile memory is securely written.

The PDM offers two redundant and prioritized power inputs. The PDM will always source its power from the primary input (Pri) until this drop below its operating threshold in which case the PDM; without interruption; will switch to the secondary input (Sec).

The total power consumption of the PCM/PDM depends on the configuration in the rack, as the modules have different power consumption.

More information
See **Data sheet** for the full technical specifications.

4.2 Grounding the Rack

When mounting the rack it is very important to make sure that the metal rack frame gets a solid electrical connection with the presumed grounded cabinet. A firmly grounded Rack is important both with a view to crew/operator safety precautions, and also in order to form a complete grounded metal cage, which is part of the approved EMC.

DANGER!

Failure to ground.

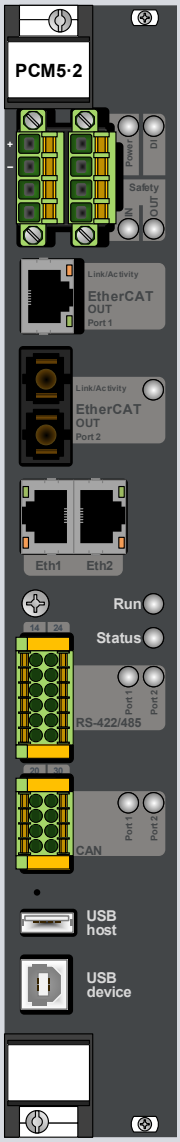
Failure to ground the controller (or extension rack) could lead to injury or death.

You must ground the controller (or extension rack) to a protective earth.

4.3 Computer modules

4.3.1 PCM5·2 module specifications

The PCM5·2 module offers a powerful dual core 1 GHz application CPU. It is well suited for extremely demanding applications, ultra fast data logging as well as redundant hot-standby solution for land applications.

Power and control module		
	Power supply*	50 W internal power supply with 1 s internal UPS. Input level: 24 V, 18 to 32 V
	Input	Digital input (DI): High: 9 to 36 V or -9 to -36 V with reference to common Low: 5 to -5 V with reference to common Impedance: Approximately 4 kΩ Isolation: Optically isolated from other potentials, 550 V 50 Hz
	Safety	Digital input (IN): High: 9 to 36 V or -9 to -36 V with reference to common Low: 5 to -5 V with reference to common Impedance: Approximately 4 kΩ Isolation: Optically isolated from other potentials, 550 V 50 Hz Digital relay output (OUT): 24 V, maximum 1 A resistive
	Interfaces	1 x EtherCAT® OUT (Port 2), electrical: 100BASE-TX, 8P8C (“RJ45”), shielded Cat 5, >0.76 µm gold plating 1 x EtherCAT® OUT (Port 1), optical: 100BASE-FX, SC connectors, multimode fibre 62.5 µm, OM1 2 x Ethernet (Eth1 and Eth2): 1000BASE-T, 8P8C (“RJ45”), shielded Cat 5e, >0.76 µm gold plating 2 x CAN (CAN 1, CAN 2): ISO 11898, shielded twisted copper cable, 50 to 1,000 kbit/s 2 x RS-422/485 (COM1, COM2), Profibus DP slave (COM1) : ANSI/TIA/EIA-422-B and TIA/EIA-485, shielded twisted copper cable 4.8 to 921.6 kbit/s (full duplex)
	USB host	USB 3.0, Mass Storage Class
	USB device	USB 2.0, console on virtual COM port, 115.2 kbit/s (D:8,S:1,P:N,F:N)
	Processor	1 GHz dual-core industrial grade CPU with ECC protected cache
	Operating system	DEIF OS based on real-time embedded Linux. Fail-safe remote SW update.
	Memory	Industrial grade 64 bit ECC protected DDR3 RAM: 1 GB
	Storage	Non-volatile data storage: 2 GB industrial grade flash
	Storage**	SSD, industrial grade: up-to 32 GB (optional)
	Size	8 TE (40.64 mm)
	Power consumption	12 W

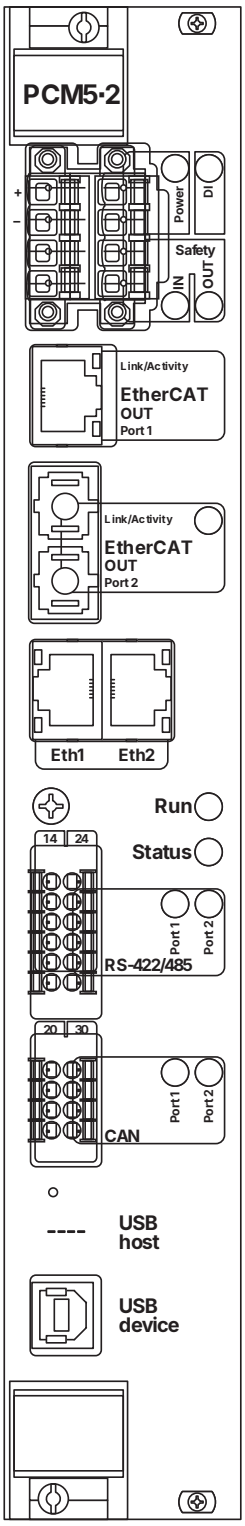
*Note: External branch protection of maximum 10 A shall be provided. Any JDYX 10 A @ minimum 50 V DC may be used. If operated in ambient temperatures above 60 °C it must be installed in an area with forced air ventilation.

**Note: Non-industrial grade (0 to 70 °C): for example 120, 250, 500 or 1000 GB.

4.3.2 PCM5·2 terminal specifications

	Terminal	Description
1	ECAT OUT P1	EtherCAT OUT Port 1
2	ECAT OUT P2	EtherCAT OUT Port 2
3	Eth1, Eth2	Ethernet 1 and 2
4	USB host	USB, Mass Storage Class
5	USB device	USB, Media Transfer Protocol, serial service console
6	Power supply +	Power supply input, 24 V
7	Power supply -	Power supply input, GND
8	Safety IN +	Safety chain digital input
9	Safety IN -	Safety chain digital input
10	Digital IN +	Digital input
11	Digital IN -	Digital input
12	Safety OUT +	Safety chain relay output
13	Safety OUT -	Safety chain relay output
14	RS-422 1: RxD + RS-485 1: Data +	Differential receive signal, '+', non-inverting pin Differential data signal, '+', non-inverting pin
15	RS-422 1: RxD - RS-485 1: Data -	Differential receive signal, '-', inverting pin Differential data signal, '-', inverting pin
16	RS-422 1: GND RS-485 1: GND	Ground Ground
17	RS-422 1: TxD +	Differential transmit signal, '+', non-inverting pin
18	RS-422 1: TxD -	Differential transmit signal, '-', inverting pin
19	RS-422 1: SHIELD RS-485 1: SHIELD	Shield Shield
20	CAN 1 - High	Differential data signal, '+', non-inverting pin
21	CAN 1 - GND	Ground
22	CAN 1 - Low	Differential data signal, '-', inverting pin
23	CAN 1 - SHIELD	Shield
24	RS-422 2: RxD + RS-485 2: Data +	Differential receive signal, '+', non-inverting pin Differential data signal, '+', non-inverting pin
25	RS-422 2: RxD - RS-485 2: Data -	Differential receive signal, '-', inverting pin Differential data signal, '-', inverting pin
26	RS-422 2: GND RS-485 2: GND	Ground Ground
27	RS-422 2: TxD +	Differential transmit signal, '+', non-inverting pin
28	RS-422 2: TxD -	Differential transmit signal, '-', inverting pin
29	RS-422 2: SHIELD RS-485 2: SHIELD	Shield Shield
30	CAN 2 - High	Differential data signal, '+', non-inverting pin
31	CAN 2 - GND	Ground
32	CAN 2 - Low	Differential data signal, '-', inverting pin
33	CAN 2 - SHIELD	Shield

4.3.3 PCM5·2 wiring



Power	6 + Supply 7 - Supply	DI	10 + 11 -
Safety IN	8 + 9 -	Safety OUT	12 + Supply 13 - Supply
EtherCAT OUT	8P8C (RJ45) connector, shielded Cat5, >0.76 µm gold plating		
EtherCAT OUT	SC duplex connector, multi mode f bre 62.5 µm, OM 1		
Ethernet	2 x 1000BASE-T 8P8C (RJ45) connector, shielded Cat5e, >0.76 µm gold plating		
RS-422 Port 1*	14 RxD + 15 RxD - 16 GND 17 TxD + 18 TxD - 19 SHIELD	RS-422 Port 2*	24 RxD + 25 RxD - 26 GND 27 TxD + 28 TxD - 29 SHIELD
RS-485 Port 1*	14 DATA + 15 DATA - 16 GND 17 SHIELD	RS-485 Port 2*	24 DATA + 25 DATA - 26 GND 27 SHIELD
CAN Port 1**	20 High 21 GND 22 Low 23 SHIELD	CAN Port 2	30 High 31 GND 32 Low 33 SHIELD
USB host	USB Standard-A plug, MSC		
USB device	USB Standard-B plug, serial service console		

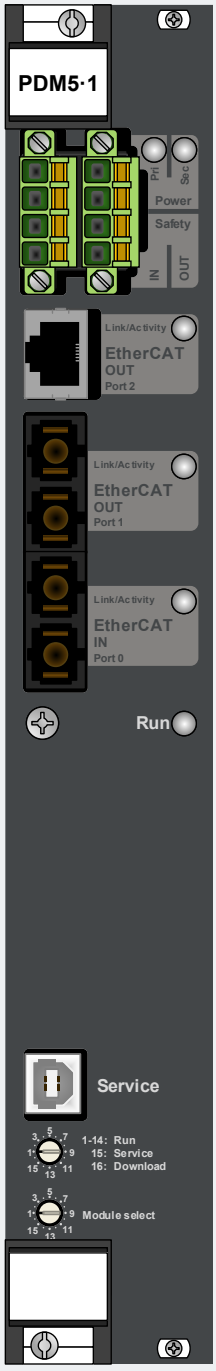
*Note: SW configurable (on/off) termination resistor (120 Ω).
SW configurable (on/off) bias (pull up/pull down, 500 Ω).
GND decoupled to shield through 1.5 MΩ || 1.5 nF.

**Note: SW configurable (on/off) termination resistor (120 Ω).
GND decoupled to shield through 1.5 MΩ || 1.5 nF.

4.4 Power and Distributed communication modules

4.4.1 PDM5·1 module specifications

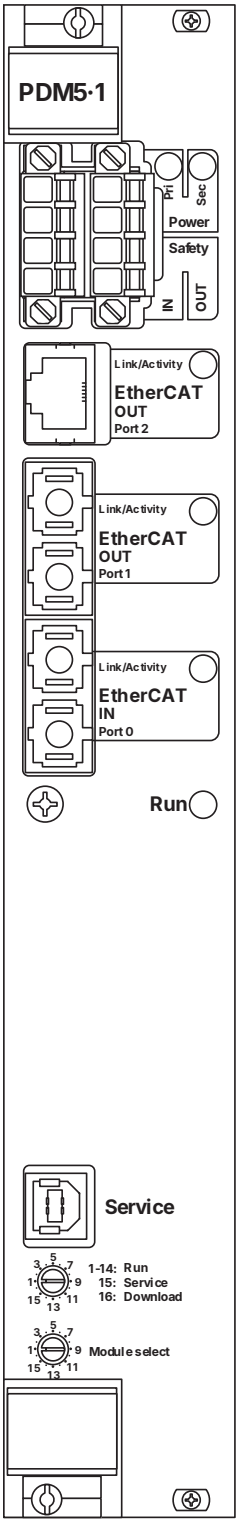
The PDM5•1 module is used as an EtherCAT interface for distributed I/O nodes via fibre optical Ethernet.

Power module and EtherCAT interface		
	Power	50 W internal power supply with redundant inputs and 50 ms full power fail protection. Supporting direct battery and/or UPS supply. Input level: 24 V, +50 %, -25 % (18 to 36 V)
	Safety	Input (IN): High: 9 to 36 V or -9 to -36 V with reference to common Low: 5 to -5 V with reference to common Impedance: Approximately 4 kΩ Isolation: Optically isolated from other potentials, 550 V 50 Hz Digital relay output (OUT): 24 V, maximum 1 A resistive
	Interfaces	1 x EtherCAT® OUT (Port 2), electrical: 100Base-TX, 8P8C (“RJ45”), shielded Cat 5, >0.76 µm gold plating 1 x EtherCAT® OUT (Port 1), optical: 100Base-FX, SC connectors, multimode fibre 62.5 µm, OM1 1 x EtherCAT® IN (Port 0), optical: 100Base-FX, SC connectors, multimode fibre 62.5 µm, OM1
	Service	USB service interface: USB 2.0, console on virtual COM port, 115.2 kbit/s (8/N/1), no flow control
	Size	8 TE (40.64 mm)
	Power consumption	Maximum 6 W

4.4.2 PDM5·1 terminal specifications

	Terminal	Description
1	ECAT OUT P1	EtherCAT OUT Port 1
2	ECAT OUT P2	EtherCAT OUT Port 2
3	ECAT OUT P0	EtherCAT OUT Port 0
4		
5	Service	USB Service interface
6	Power supply + (Pri)	Primary power supply input, 24 V
7	Power supply - (Pri)	Primary power supply input, GND
8	Safety IN	Safety chain digital input
9	Safety IN	Safety chain digital input
10	Power supply + (Sec)	Secondary power supply input, 24 V
11	Power supply - (Sec)	Secondary power supply input, GND
12	Safety OUT	Safety chain relay output
13	Safety OUT	Safety chain relay output

4.4.3 PDM5·1 wiring



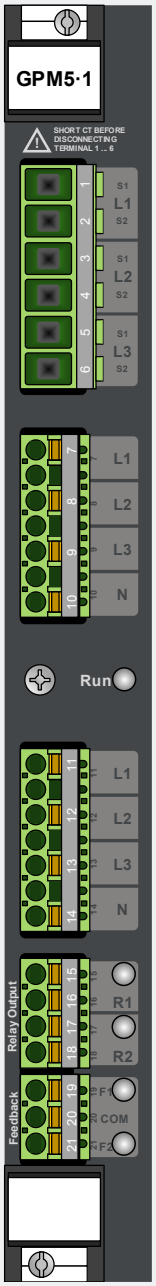
Primary power input	6 + Supply 7 - Supply	Secondary power input	10 + Supply 11 - Supply
Safety digital input	8 + 9 -	Safety relay output	12 + Supply 13 - Supply

EtherCAT OUT	8P8C (RJ45) connector, shielded Cat5, >0.76 µm gold plating
EtherCAT OUT	SC duplex connector, multi mode f bre 62.5 µm, OM 1
EtherCAT IN	SC duplex connector, multi mode f bre 62.5 µm, OM 1
Service interface	USB Standard-B plug

4.5 Digital input and output modules

4.5.1 GPM5·1 module specifications

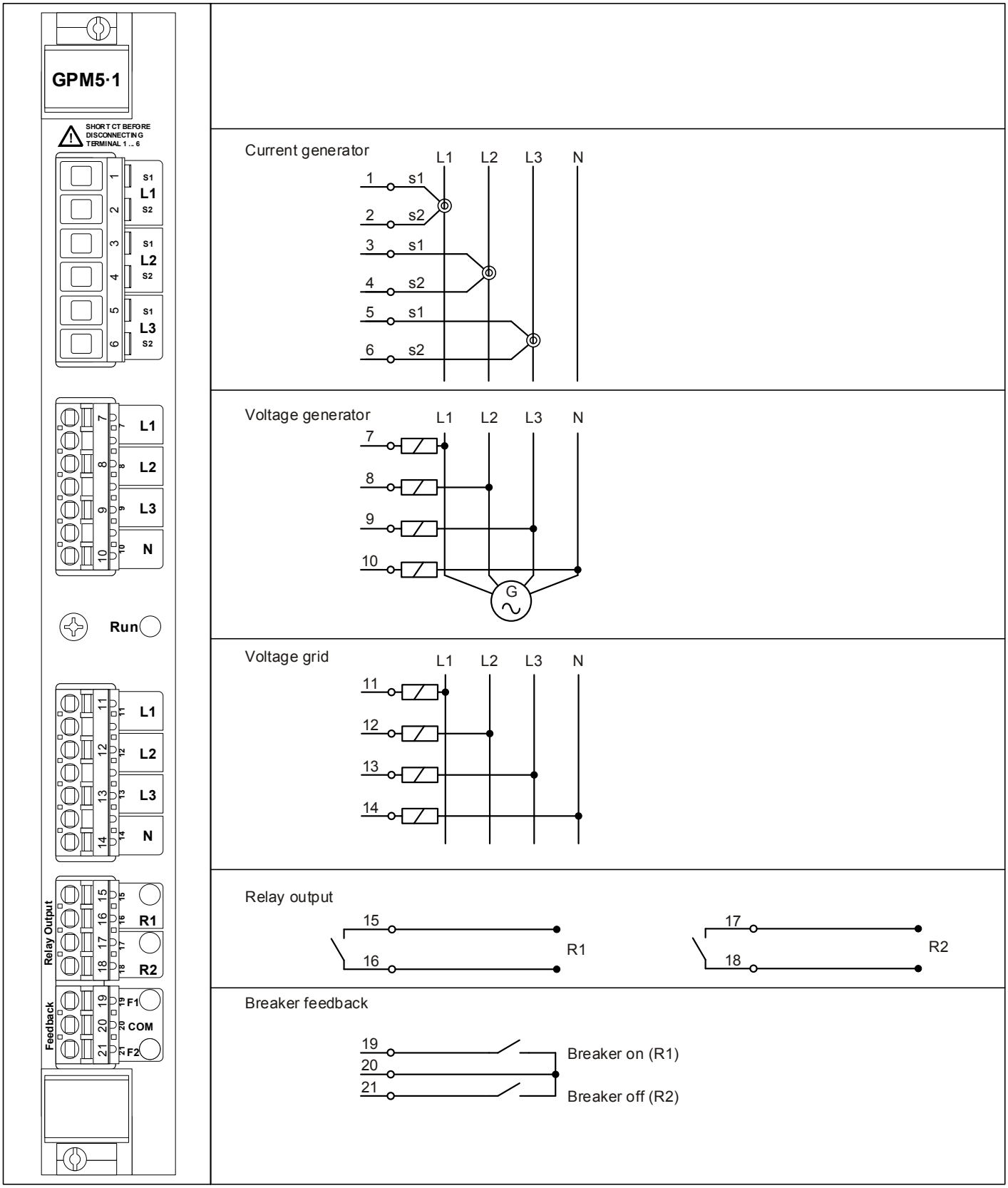
The GPM5•1 module is a class 0.5 grid measurement and protection module which can be fully configured from the main application. For each period of the connected grid, all measurements are available for the main application.

Direct class 0.5 3-phase grid, generator voltage and current measurement		
	Inputs	2 x direct three phase voltage inputs (L1, L2, L3, N) Input range: 0 to 690 V Measure range: 40 to 690 V Frequency: 40 to 70 Hz Load max.: 0.5 mA or 0.3 VA per phase Overload: 130 % continuously, 200 % for 10 s External fuse, maximum 2 A slow-blow UL/cUL: Maximum 600 V L-L, above 2000 m altitude maximum 520 V 1 x direct three phase current input (L1, L2, L3) Input range: 0 to 1 or 0 to 5 A Frequency: 40 to 70 Hz Load max.: 0.4 VA per phase Overload: 20 A for 60 s, < 75 A for 10 s, < 300 A for 1 s UL/cUL: From listed or R/C (XODW2.8) current transformers
	Outputs	2 x digital relay outputs (normally open) with feedback supervision 24 V, maximum 1 A resistive
	Certification class	0.5 measurement of voltage, frequency, current, power, reactive power, phase angle.
	Galvanic separation	3.25 kV 50 Hz isolation between voltage measurement inputs individually and between voltage measurement inputs and all other potentials. 550 V 50 Hz isolation between relay outputs, digital inputs (feedback supervision) and all other potentials.
	Safety	Installation (over-voltage) category III, 600 V, pollution degree 2. EN 61010-1 tested at 50 Hz, 60 s. Each galvanic group tested to other galvanic groups and to Protective Earth, PE.
	Accuracy	0.5 % at reference temperatures 1.0 % at operational temperatures IEC 60688
	Size	6 TE (30.48 mm)
	Power consumption	Maximum 4 W

4.5.2 GPM5·1 terminal specifications

Terminal		Description
1	L1-S1	Generator Line 1 S1 connection of current transformer
2	L1-S2	Generator Line 1 S2 connection of current transformer
3	L2-S1	Generator Line 2 S1 connection of current transformer
4	L2-S2	Generator Line 2 S2 connection of current transformer
5	L3-S1	Generator Line 3 S1 connection of current transformer
6	L3-S2	Generator Line 3 S2 connection of current transformer
7	L1	Generator Line 1 voltage input
8	L2	Generator Line 2 voltage input
9	L3	Generator Line 3 voltage input
10	N	Generator Neutral input
11	L1	Grid Line 1 voltage input
12	L2	Grid Line 2 voltage input
13	L3	Grid Line 3 voltage input
14	N	Grid Neutral input
15-16	R1	Relay output 1
17-18	R2	Relay output 2
19	1	R1 feedback input
20	COM	Common
21	2	R2 feedback input

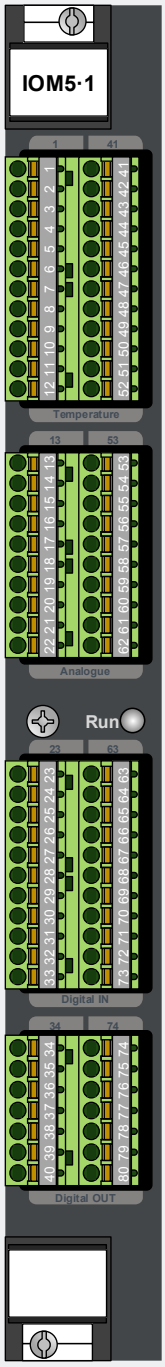
4.5.3 GPM5·1 wiring



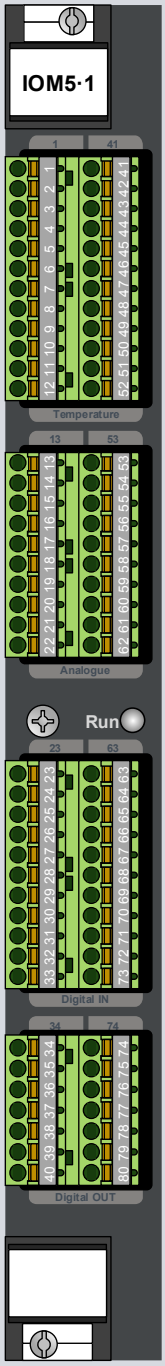
4.6 Input and output modules

4.6.1 IOM5·1 module specifications

IOM5•1 is a highly flexible I/O module which holds the most commonly used I/O signals in a wind power plant. IOM5•1 is designed for the rough electrical environments, and all inputs and outputs are protected by optical isolation from other potentials.

40 channel multi-function I/O module with analogue inputs, temperature inputs, digital inputs, frequency counter inputs, analogue outputs and digital outputs			
	12 digital inputs	Input	High*: 9 to 36 V or -9 to -36 V with reference to common Low: 5 to -5 V with reference to common
		Impedance	Approximately 2.4 kΩ
		Isolation	Optically isolated from other potentials, 550 V 50 Hz
	4 frequency/digital inputs	Input	High*[1]: 9 to 36 V Low: 0 to 5 V
		Impedance	Approximately 2.4 kΩ
		Isolation	Optically isolated from other potentials, 550 V 50 Hz
		Frequency	0 to 125 kHz. (Internal frequency divider for frequency >1 kHz)
		Duty cycle	48 to 52 % at 20 to 125 kHz 40 to 60 % at 1 to 20 kHz 20 to 80 % at 0 to 1 kHz
		Resolution	0.8 µs
	10 digital outputs	Supply	External supply 9 to 36 V
		Voltage	Voltage drop <1 V according to external supply
		Current	For each output: 0 to 2 A source or sink Maximum total for all outputs: 2 A
		Isolation	Optically isolated from other potentials, 550 V 50 Hz
		Protection	Current limited for short-circuit protection or thermal overload

*Note: Above 30 V, some de-rating based on temperature is specified. See the Installation Instruction documentation for details.

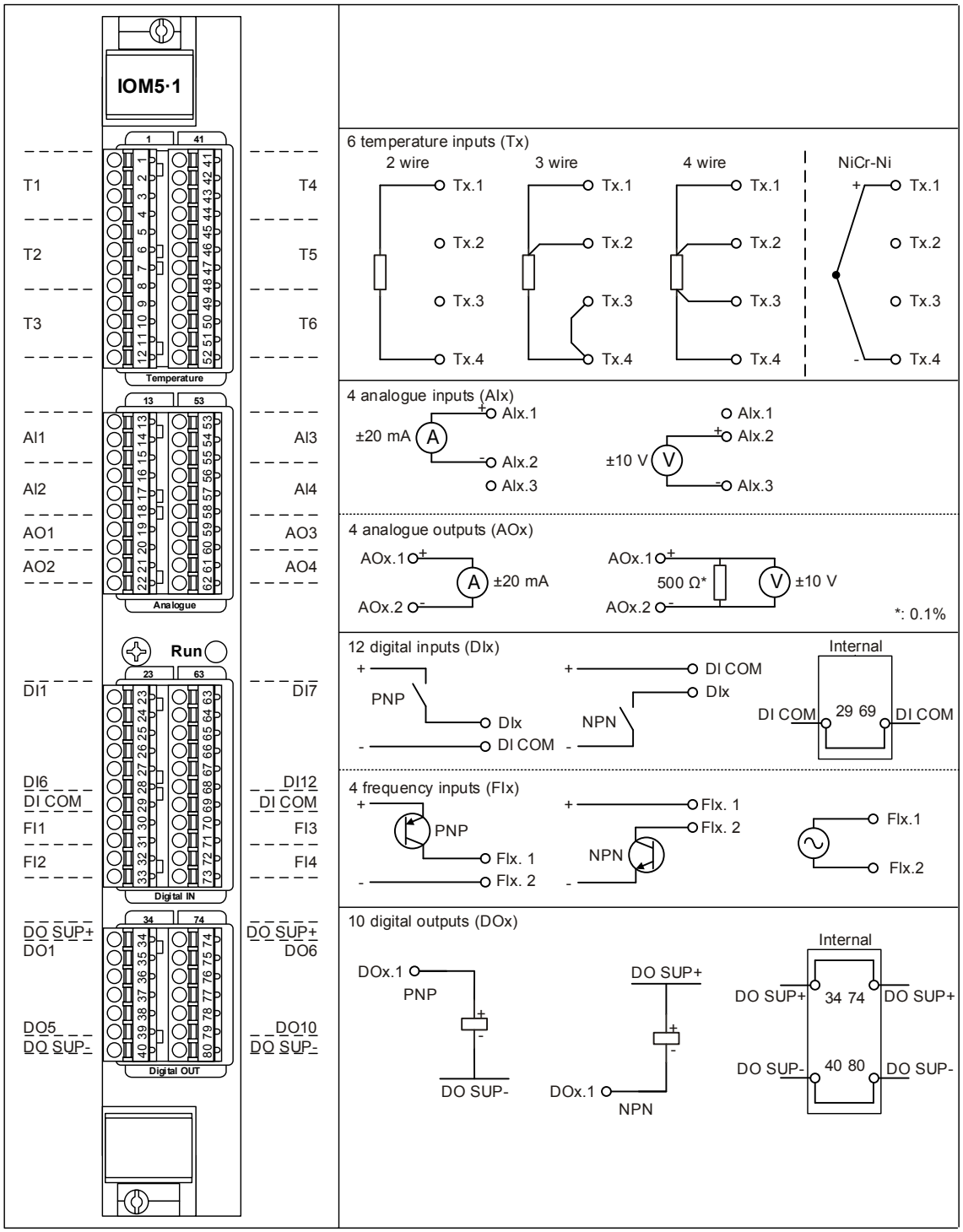
40 channel multi-function I/O module with analogue inputs, temperature inputs, digital inputs, frequency counter inputs, analogue outputs and digital outputs			
	6 temperature inputs	Sensor type	Pt100, Pt1000 or NiCr-Ni sensors
		Range	-50 to 200 °C for Pt sensors -50 to 1000 °C for NiCr-Ni sensors
		Wire	2-, 3- or 4-wire connection for Pt sensors
		Cable error	Open input and short-circuit are detected (only open for NiCr-Ni)
		Resolution	0.1 °C
		Accuracy (Pt100, Pt1000 4-wire)	0.5 °C at reference temperature 2.0 °C at operational temperature
		Accuracy (Pt100, Pt1000 2 or 3-wire)	1.0 °C at reference temperature 2.5 °C at operational temperature (2-wire cables must be shorter than 1 m)
		Accuracy (NiCr-Ni sensor)	5.0 °C at reference temperature 20.0 °C at operational temperature
		Isolation	Same potential as analogue inputs and outputs. Optically isolated from other potentials, 550 V 50 Hz.
	4 analogue inputs	Input type	-20 to 20 mA or -10 to 10 V
		Impedance	Approximately 50 Ω (mA-input)/10 kΩ (V-input)
		Resolution	16 bit
		Accuracy	0.5 % of full range input (40 mA/20 V) at reference temperature 1.0 % of full range input (40 mA/20 V) at operational temperature
		Isolation	Same potential as analogue outputs and temperature inputs. Optically isolated from other potentials, 550 V 50 Hz.
	4 analogue outputs	Output	Configurable ramp time: 5 to 1000 ms Range: -20 to 20 mA
		Load	0 to 500 Ω
		Resolution	12 bit
		Accuracy	0.5 % of full range output (40 mA) at reference temperature 1.0 % of full range output (40 mA) at operational temperature
		Isolation	Same potential as analogue inputs and temperature inputs. Optically isolated from other potentials, 550 V 50 Hz.
	Size	6 TE (30.48 mm)	
	Power consumption	Maximum 5 W (all 4 analogue outputs at full load)	

4.6.2 IOM5·1 terminal specifications

Terminals		Description
1-4	T1	Temperature 1
5-8	T2	Temperature 2
9-12	T3	Temperature 3
41-44	T4	Temperature 4
45-48	T5	Temperature 5
49-52	T6	Temperature 6
13-15	AI1	Analogue input 1. 13-14 using -20 to 20 mA input, 14-15 using -10 to 10 V input
16-18	AI2	Analogue input 2. 16-17 using -20 to 20 mA input, 17-18 using -10 to 10 V input
53-55	AI3	Analogue input 3. 53-54 using -20 to 20 mA input, 54-55 using -10 to 10 V input
56-58	AI4	Analogue input 4. 56-57 using -20 to 20 mA input, 57-58 using -10 to 10 V input
19-20	AO1	Analogue output -20 to 20 mA
21-22	AO2	Analogue output -20 to 20 mA
59-60	AO3	Analogue output -20 to 20 mA
61-62	AO4	Analogue output -20 to 20 mA
23	DI1	Digital input 1
24	DI2	Digital input 2
25	DI3	Digital input 3
26	DI4	Digital input 4
27	DI5	Digital input 5
28	DI6	Digital input 6
29	DI COM	Digital common input reference supply (DI1-DI12). 24 V for NPN input signal, GND for PNP input signal. Note: Terminal 29 and 69 are internally connected.
63	DI7	Digital input 7
64	DI8	Digital input 8
65	DI9	Digital input 9
66	DI10	Digital input 10
67	DI11	Digital input 11
68	DI12	Digital input 12
69	DI COM	Digital common input reference supply (DI1-DI12). 24 V for NPN input signal, GND for PNP input signal. Note: Terminal 29 and 69 are internally connected.
30-31	FI1	Frequency input 1, NPN or PNP coupling Digital input 13, 30+, 31-
32-33	FI2	Frequency input 2 NPN or PNP coupling Digital input 14, 32+, 33-
70-71	FI3	Frequency input 3 NPN or PNP coupling Digital input 15, 70+, 71-
72-73	FI4	Frequency input 4 NPN or PNP coupling Digital input 16, 72+, 73-
34	DO SUP+	24 V digital output supply. Note: terminals 34 and 74 are internally connected
35	DO1	Digital output 1

Terminals		Description
36	DO2	Digital output 2
37	DO3	Digital output 3
38	DO4	Digital output 4
39	DO5	Digital output 5
40	DO SUP-	GND digital output supply. Note: terminals 40 and 80 are internally connected
74	DO SUP+	24 V digital output supply. Note: terminals 34 and 74 are internally connected
75	DO6	Digital output 6
76	DO7	Digital output 7
77	DO8	Digital output 8
78	DO9	Digital output 9
79	DO10	Digital output 10
80	DO SUP-	GND digital output supply. Note: terminals 40 and 80 are internally connected

4.6.3 IOM5·1 wiring



5. Maintenance

5.1 Equipment protection

NOTICE

Correct handling of modules

Failure to follow these instructions could lead to damage to the modules.

Read and follow the instructions to avoid damage to the modules.

NOTICE

Electrostatic discharge

During manufacturing and testing, the products have been kept in static shielding bags, and all personnel handling the products have been protected against static electricity and the subsequent ESD (electrostatic discharge).

Be sure to carry a connection to earth when handling our PCBs. If the correct equipment (bracelet, IC tongs) is not available, you must improvise. You may e.g. place an open wire under your watch and connect this to earth via a heavy resistor (1 MΩ). As to earth connection, it should be possible to use the rack frame or the cabinet. Note that the limit for registration of static electricity for a human being is considerably higher than the limit above which electronics and electronic components are damaged.

5.2 Replace modules

Each module is fastened to the rack with M2.5 collar screws. These should be loosened before the extraction handles are used to lift the module free of the rack. When remounting the modules the M2.5 collar screws must be tightened with 0.5 N·m to assure the products robustness towards vibration as well as shocks.

NOTICE

Torque damage to equipment

Do not use power tools during the installation. Too much torque damages the equipment.

Follow the instructions for the correct amount of torque to apply.

5.3 Replace RTC battery on the PCM5·2 module

The PCM5·2 has a lithium battery for maintaining the real-time clock, for when power is not available. It is recommended to replace the battery every 5th year on a scheduled basis.

The battery is a CR2430 3V battery, rated for operation at -40 to +85 °C (-40 to 185 °F). This is not a standard CR2430.

To replace the battery, you need to remove the PCM module.