AWC 500 Installation instruction

DEIF A/S · Friesenborgvej 33 · DK-7800 Skive
Tel: +45 9614 9614 · Fax: 9614 9615
Info@deif.com · www.deifwindpower.com

Language: EN-GB

Table of Contents

1. Revision 1
2. Installation instruction 2
3. System installation 2
    3.1. Precautions regarding the ambient temperature of the AWC 500 system 2
    3.2. Installing the Rack. 2
    3.3. Recommended screws/bolts for mounting 4
    3.4. Grounding the Rack 4
    3.5. Ensuring the AWC 500 system’s electromagnetic compatibility (EMC) 5
    3.6. Connecting the power supply 5
    3.7. Establishing the network communication 5
4. How to wire 5
    4.1. PCM5·2/PDM5·1 module 5
    4.2. IOM5·1 module 10
    4.3. GPM5·1 module 11
    4.4. IFM5·1 module 12
5. Module replacement instructions 13
    5.1. General precautions 13
    5.2. Handling of modules 13
    5.3. Adding/replacing mSATA cards on the PCM5·2 module 13
    5.4. Replacing the RTC Battery on the PCM5·2 module 13

1. Revision

Revision	Author	Date	Description
A	SJE	2012-07-03	Initial release
B	LVI	2018-03-05	Updated to PCM5·2

2. Installation instruction

This Installation instruction document contains both general and specific information on how to carry out the installation of the AWC 500 system. By observing the advice given in this document, a safe and correct installation of the AWC 500 system is ensured.

The Installation instruction consist of three parts:

- A *System installation*, which contains general precautions that should be observed during installation
- Information on *How to wire* the individual hardware modules
- and *Replacement instructions*

3. System installation

The system installation consists of the following four main parts:

- Pre-installation considerations regarding the AWC 500 system
- Installation of the Rack in the cabinet
- Connecting power supply to the Rack
- Establishing the network communication

3.1. Precautions regarding the ambient temperature of the AWC 500 system

The ambient temperature T_{AMB} as seen from the perspective of the AWC 500 (that is; T_{AMB} is the temperature within the control cabinet) has a decisive influence on the minimum expected lifetime for the electronic circuits in the rack.

Table 1. Expected life time

AMBIENT TEMPERATURE	MIN. EXPECTED LIFETIME
T_{AMB} < 40 °C	20 years

3.2. Installing the Rack

The AWC 500 rack is available in different sizes - Rack5·0 (TE 12), Rack5·1 (TE 18), Rack5·2 (TE 24), Rack5·3 (TE 30), Rack5·5 (TE 42) and a Rack5·8 (TE 60) rack. See the Figure 1 and Table 2 for dimensions for each of the racks.

During installation of the Rack observance of the practical precautions show in Figure 2 is necessary in order to avoid problems regarding free space in front of the rack as well as cooling.

During operation, the connectors must be clear of the front door of the cabinet. The recommended distance from the mounting plate of the cabinet to the inside of the closed cabinet door must be larger than the specified "A" measure in Figure 2.

Furthermore, the distance from the mounting plate of the cabinet to any fixed objects in front of the rack (with an open cabinet door) should as a minimum be the specified "B" measure in Figure 2. This is necessary in order to ensure sufficient working space for replacing and inspection of the AWC 500 hardware modules.

Due to air circulation, it is not recommended to place objects within 150 mm from the top and bottom of the Rack.

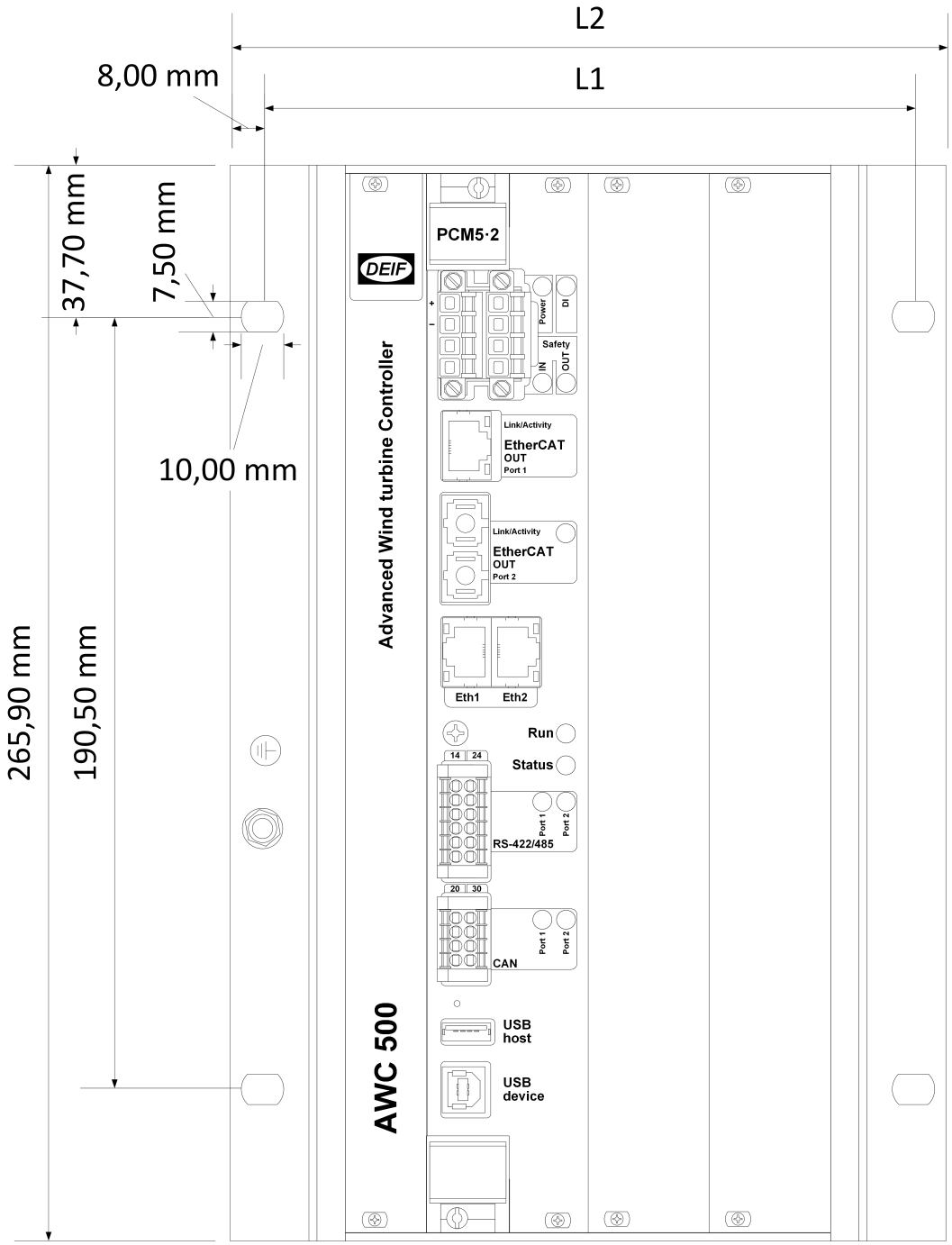

Figure 1. AWC 500 rack dimensions.

Table 2. Overall dimensions for rack variants

Rack width	L1 [mm]	L2 [mm]
Rack5·0 (TE 12)	100.1	116.1
Rack5·1 (TE 18)	130.5	146.5
Rack5·2 (TE 24)	161.0	177.0
Rack5·3 (TE 30)	191.5	207.5
Rack5·5 (TE 42)	252.5	268.5
Rack5·8 (TE 60)	343.9	359.9

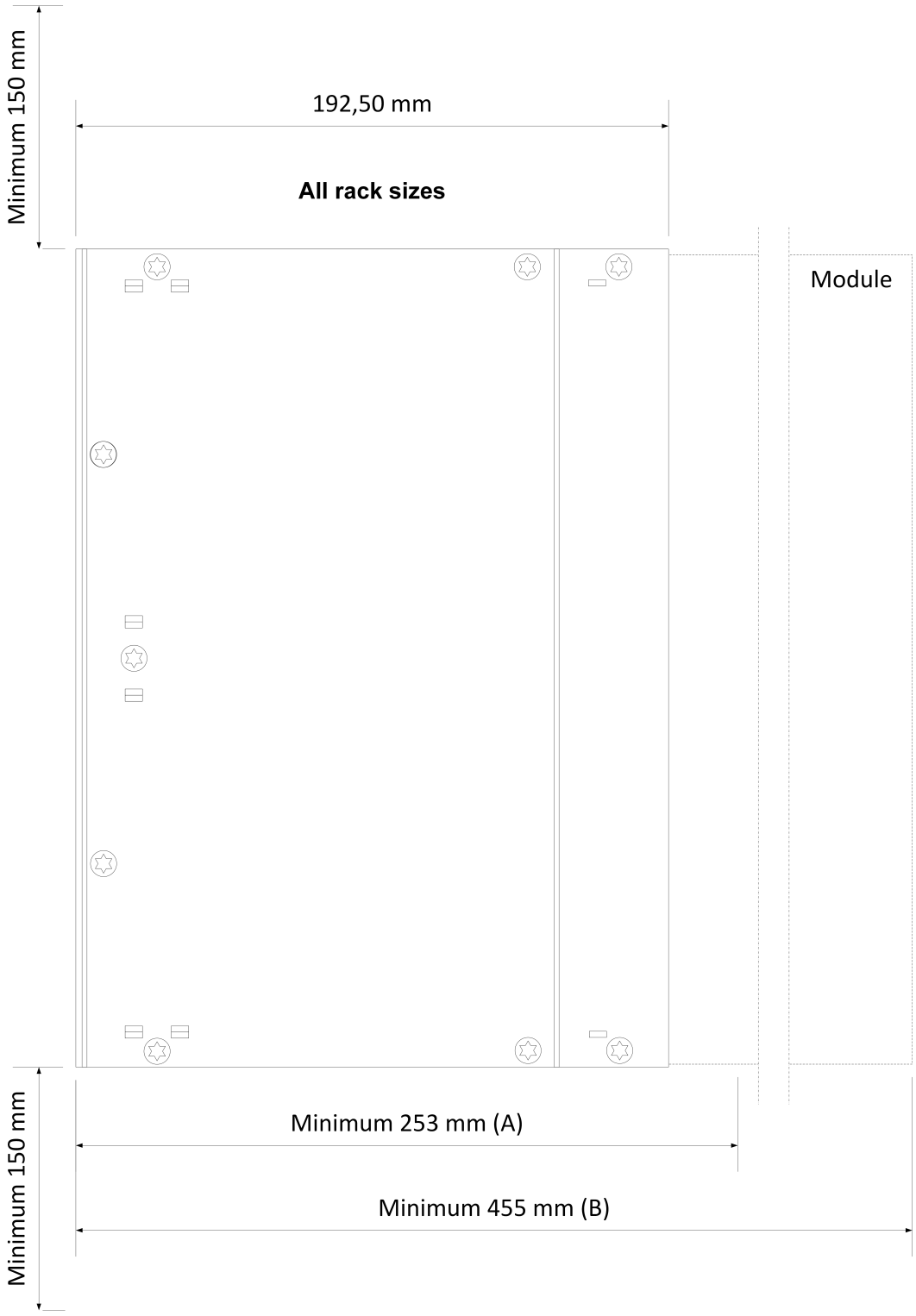

Figure 2. Recommended installation clearance.

3.3. Recommended screws/bolts for mounting

It is recommended to mount the AWC 500 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 5 Nm.

3.4. 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.

3.5. Ensuring the AWC 500 system's electromagnetic compatibility (EMC)

The AWC 500 system is CE marked. In short, this means that the AWC 500 system's electrical noise immission and emission have been examined and found to comply with the EN for electromagnetic compatibility (EMC).

A Rack correctly configured with hardware modules and cover plates, thus forming a complete grounded metal cage, is an important 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.

Hence if modules have been out of the rack it is recommended to assure that they all are firmly mounted in the rack frame. This is done by tightening all screws in the front covers with 0.7…0.8 Nm.

3.6. Connecting the power supply

The AWC 500 system requires 18…36 V (incl. ripple voltage) at the supply terminals on either the PCM5·2 or PDM5·1 modules.

To maintain operation and protection of the turbine, the AWC 500 must be secured to have power supply although the main power supply is faulty. The PDM5·1 supports sourcing from two separate power supplies (a Main Power Supply and a Reserve Power Supply).

3.7. Establishing the network communication

Please refer to the AWC 500 Getting started document for network configuration.

4. How to wire

Please refer to the AWC 500 datasheet for wiring diagrams on specific module.

4.1. PCM5·2/PDM5·1 module

The Power and Control Module (PCM) is the main processing module and supplies the other AWC 500 modules within the Rack with power. Furthermore the PCM in used to connect to distributed racks. The Power and Distributed communication Module (PDM) in used is distributed racks to supply the other AWC 500 modules within the rack with power. The module can also be used to connect to further distributed racks.

Table 3. Run LED:Tri-coloured diode showing the EtherCAT state as well as Service state

State	Description
Off	INIT
Blinking green (slow)	Pre-operational
Blinking orange/red (slow)	Pre-operational, and module selected
Single Flash green (slow)	Safe-operational
Single Flash orange/red	Safe-operational, and module selected
Solid green	**Normal operational**

State	Description
Solid orange	Normal operational, and module selected
Flickering green	Boot loader
Flickering orange/red	Boot loader, and module selected

Table 4. Status LED(PCM5·2 only): Shows the system state. Controllable from the application.

State	Description
Off	Off
Solid red	**Error in application running (set by application)**
Solid red (One shot 500ms)	Error when running .dupdate or USB hotplug error
Blinking red	Boot loader
Blinking orange	Initialization
Single Flash orange/red	Safe-operational, and module selected
Solid orange	Service
Solid green	**Application running (set by application)**

4.1.1. Power input

The PCM/PDM provides a galvanic insulation between the power source and the AWC 500 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 AWC 500 system; including all IO module within the rack; will continue to operate as normal. If power returns within this 50 ms period the AWC 500 system will continue un-interrupted. If power continues to be absent after this blackout protection period the AWC 500 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.

Supply voltage:	18…36 V An external fuse of 4…10 A is recommended.

LEDs:	Two tri-coloured diodes, one for each power input: **Green** Voltage is above the operating threshold and power is sourced from this input. **Orange** the voltage of the secondary input is above the operating threshold and the PCM is ready to source from this input. **Red** Voltage below threshold.
Terminals:	Spring cage plug-able connectors
Cabling:	0.2…2.5 mm^2 single/multi-stranded wire

4.1.2. Safety

The PCM/PDM module is further equipped with one digital input and one relay output.

The input can be used to notify the PCM/PDM whether or not other systems are OK.

The relay output is typically used in wired safety chains.

IN:	High : 9…36 V or -9…-36 V with reference to common Low : -5…5 V with reference to common. Impedance: approximately 4 kΩ
Terminals:	Spring cage plug-able connectors
Cable:	0.2…2.5 mm^2 single/multi-stranded wire

4.1.3. EtherCAT

The PCM/PDM offers different features to interconnect AWC 500 racks or to connect third party EtherCAT components.

All PCM/PDM modules offer two EtherCAT OUT ports (Port 1 and Port 2). These are used to connect directly to other distributed AWC 500 racks with PDM modules or to third party EtherCAT components. The PDM module additionally offers one EtherCAT IN port (Port 0). The ports are either 100Base-TX (twisted-pair) or 100Base-FX (Fibre). Table 4 shows which modules offer which interfaces.

Table 5. Shows which EtherCAT interfaces are offered on the PCM/PDM modules.

	100Base-TX (twisted-pair)	100Base-FX (Fibre)
PCM5·2	Port 2 (OUT)	Port 1 (OUT)
PDM5·1	Port 2 (OUT)	Port 0 (IN), Port 1 (OUT)

LEDs:	Each interface has a green-coloured diode showing link and/or activity: **Off** No link **Solid** Link, no activity **Blinking** Link and activity (normal operation)
Terminals:	100Base-TX: Shielded 8P8C ("RJ45") 100Base-FX: SC duplex connector 100Base-TX: Shielded Category 5, maximum length 100 m 100Base-FX: Multimode fibre, 62.5 µm, OM1, maximum length 2,000 m
Cabling:	0.2…2.5 mm^2 single/multi-stranded wire

4.1.4. Ethernet

Ethernet at PCM is two standard 1000Base-TX ports that can be used to connect the AWC 500 to a switched Ethernet network. DEIF does not recommend to connected the PCM directly to the Internet, hence it should always be placed behind proper updated and maintained security equipment (firewall etc.) as demanded by the specific use case.

Please consult the AWC 500 Getting started manual for establishing network connection.

LED:	The Ethernet ports has a green-coloured diode showing link and/or activity: **Off** No link **Solid** Link, no activity **Blinking** Link and activity (normal operation)
Terminals:	1000Base-TX: Shielded 8P8C ("RJ45")
Cabling:	Shielded Category 5 or higher, maximum length 100 m

4.1.5. CAN (PCM5·2 only)

The PCM5·2 has two CAN/CANopen ports.

The ports can be configured to operate at speeds from 10000 bps to 1000000 bps.

Terminals:	Spring cage plug-able connectors.

Cabling:	Twisted pair cable with shield. The cable must have a characteristic impedance of 120 Ω. The shield of the cable should be connected to GND. End terminations of 120 Ω; can be configured in software. Max. cable length depends on the communication speed.

4.1.6. Serial (PCM5·2 only)

The PCM5·2 has two RS-485 / RS-422 (ANSI/TIA/EIA-422-B, X.27) ports.

The ports can be configured to operate at speeds from 9.6 to 460.8 kbps.

Terminals:	Spring cage plug-able connectors.
Cabling:	2- or 4-wire twisted pair cable with shield. The cable must have a characteristic impedance of 120 Ω. The shield of the cable should be connected to GND. End terminations of 120 Ω can be configured in software. Max. cable length depends on the communication speed.

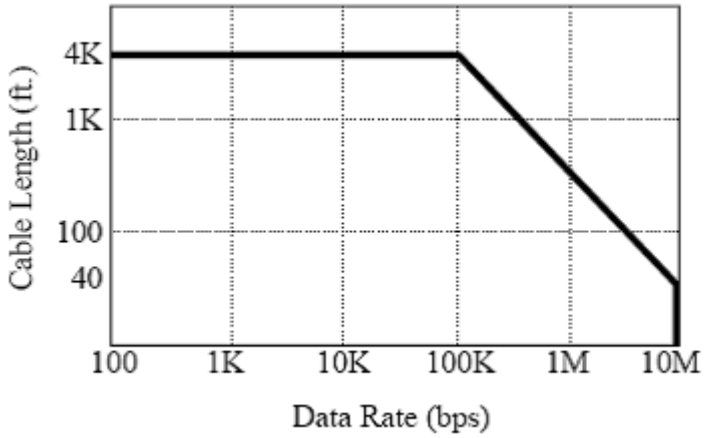

Figure 1.1: Cable lenght

4.1.7. USB Host (PCM5·2 only)

The USB 3.0 host interface can be used for various purposes and the supported features is determined by user enabled settings in the OS and application software running on the PCM5·2 eg. backup of log files when a USB storage is inserted, or upload of new application.

Terminals:	Standard USB A
Cabling:	Standard USB cable (max. 3 m)

4.1.8. USB device (service interface)

The USB interface is used as a serial service port.

Terminals:	Standard USB B
Cabling:	Standard USB cable (max. 5 m)

It is default configured to:

Speed:	115,200 bps

Data bits:	8
Stop bits:	1
Parity:	None
Flow control:	None

Related to PCM5·2: When connected the service port provides console access to the OS. Related to PDM5·1: When a given module is selected (and the USB cable is connected to a PC), the Run LED on that module overlays its red colour to the currently status of the LED.

4.1.9. PDM service

The PDM modules do not offer any service possibilities except as interface to the other IO modules in the distributed Rack. Connecting the USB cable with the Module select switch set to an IO module will offer these features:

Run

No interface

Service

Modbus interface

Download

Manuel firmware update

4.2. IOM5·1 module

IOM5·1 is a highly flexible IO module which holds the most commonly used IO signals used in a wind power plant. IOM5·1 is designed for the rough environment in a wind turbine and all input and output are protected by optical insulation from other potentials.

The IOM offers 26 input channels:

- 12 digital inputs
- 4 frequency/digital inputs
- 6 temperature inputs
- 4 analogue inputs (-20…20 mA or -10…10 V)

and 14 output channels:

- 10 digital outputs
- 4 analogue outputs (-20…20 mA)

Table 6. Run LED:Tri-coloured diode showing the EtherCAT state as well as Service state

State	Description
Off	INIT or no power
Blinking green (slow)	Pre-operational
Blinking orange/red (slow)	Pre-operational, and module selected
Single Flash green (slow)	Safe-operational
Single Flash orange/red	Safe-operational, and module selected

State	Description
Solid green	**Normal operational**
Solid orange	Normal operational, and module selected
Flickering green	Boot loader
Flickering orange/red	Boot loader, and module selected

Terminals:	Spring cage plug-able connectors
Cable:	0.2…1.5 mm^2 single/multi-stranded wire

4.3. GPM5·1 module

The Grid and Protection Module GPM is a class 0.5 grid measurement and protection module which can be fully configured from the main application. All measurements are available for the main application each period of the connected grid. The module offers:

- 1 x Current input
- 2 x Voltage inputs
- 2 x Digital relay outputs
- 2 x Digital inputs

Table 7. Run LED:Tri-coloured diode showing the EtherCAT state as well as Service state

State	Description
Off	INIT or no power
Blinking green (slow)	Pre-operational
Blinking orange/red (slow)	Pre-operational, and module selected
Single Flash green (slow)	Safe-operational
Single Flash orange/red	Safe-operational, and module selected
Solid green	**Normal operational**
Solid orange	Normal operational, and module selected
Flickering green	Boot loader
Flickering orange/red	Boot loader, and module selected

4.3.1. Current input

The GPM has one direct three phase current input. The class 0.5 accuracy is kept within each range.

Current range:	0…1 or 0…5 A
Frequency:	40…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
Terminals:	Screw connection
Cable:	0.2…2.5 mm^2 single/multi-stranded wire

4.3.2. Voltage inputs

The GPM offers two direct three phase voltage inputs. The class 0.5 accuracy is kept within each

range. Please note that at altitudes above 2000 m the UL approval limits the input range to a maximum of 520 V.

Input range:	0…690 V
Measure range:	40…100, 40…240 or 40…690 V
Frequency:	40…70 Hz
Load max.:	0.5 mA or 0.3 VA per phase
Overload:	130 % of Un continuously, 200 % of Un for 10 s
UL/cUL:	Max 600V L-L External fuse maximum 2 A slow-blow.
Terminals:	Spring cage plug-able connectors
Cable:	0.2…1.5 mm^2 single/multi-stranded wire

4.3.3. Relay outputs/inputs

The GPM has two relay outputs as well as two digital input designed for potential-free contacts.

Relay output:	Rating: 24 V, maximum 1 A resistive
Terminals:	Screw connection
Cable:	0.2…2.5 mm^2 single/multi-stranded wire

4.4. IFM5·1 module

The Interface and Fieldbus Module offers:

- 2 x RS-485/422
- 2 x CAN
- 2 x SSI

Table 8. Run LED:Tri-coloured diode showing the EtherCAT state as well as Service state

State	Description
Off	INIT or no power
Blinking green (slow)	Pre-operational
Blinking orange/red (slow)	Pre-operational, and module selected
Single Flash green (slow)	Safe-operational
Single Flash orange/red	Safe-operational, and module selected
Solid green	**Normal operational**
Solid orange	Normal operational, and module selected
Flickering green	Boot loader
Flickering orange/red	Boot loader, and module selected

4.4.1. SSI power supply

The IFM module can be used to supply power to the connected SSI encoders.

Power input:	18…36 V, max. 1 A
Device supply:	Maximum 100 mA per channel/device
Terminals:	Spring cage plug-able connectors

Cable:	0.2…1.5 mm^2 single/multi-stranded wire

5. Module replacement instructions

5.1. General precautions

Before handling the boards there are a few, but important instructions that must be observed:

Throughout the whole process of 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).

Consequently, we ask you to observe certain rules when handling our products - otherwise our efforts may be wasted:

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.

BE AWARE OF STATIC ELECTRICITY WHEN HANDLING!

5.2. Handling of modules

Each module is fastened to the rack with M2.5 Pozidriv® 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 Pozidriv® collar screws must be tightened with 0.7…0.8 Nm to assure the products robustness towards vibration as well as shocks.

5.3. Adding/replacing mSATA cards on the PCM5·2 module

The PCM5·2 module has a mSATA card slot placed inaccessible from the outside. This placement is to prevent disruption of operation of the card during production. Adding/replacement of the mSATA module is done by removing the PCM5·2 module from the racks as described above.

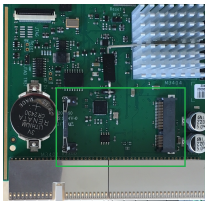

Figure 3. mSATA expansion slot

5.4. Replacing the RTC Battery on the PCM5·2 module

The PCM5·2 has a lithium battery for maintaining the real-time clock, when not power is applied. The life time of the battery is 10 years, thus the battery needs to be replaced on scheduled basis.

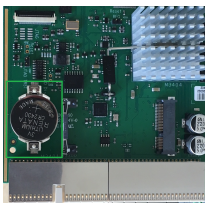

Figure 4. Battery for the RTC

DEIF A/S reserves the right to change any of the above.