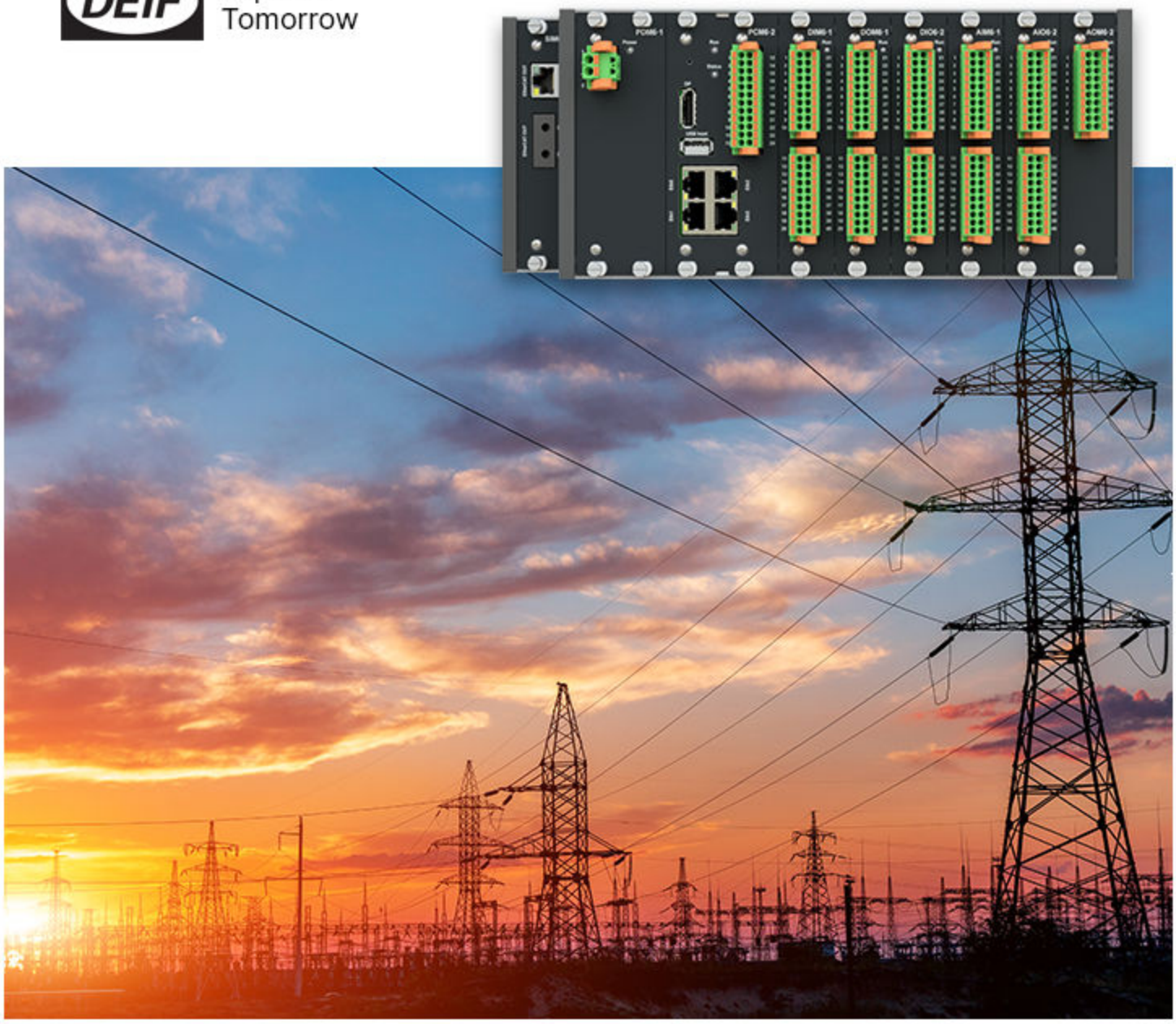
iE 650 PLC

4921240662-G

Programmable Automation Controller

Data sheet

DEIF Improve Tomorrow



1. iE 650 PLC

2. Technical specifications

3. Application development

4. Legal information

1. iE 650 PLC

1.1 About the controller

The iE 650 PLC is a PLC-based programmable automation controller (PAC) suitable for land, marine, and wind power control applications. It is class approved, designed to marine specifications and can withstand very harsh operating conditions.

The controller is a highly flexible, modular PLC and I/O system that is designed for usage across a wide range of industrial applications. It is reliable, robust and flexible.

EtherCAT is used as native communication protocol both as the backplane communication and as interconnection between multiple iE 650 PLC racks via electrical or fibre optical connections. Other DEIF EtherCAT I/O modules or third party EtherCAT I/O modules can also be connected.

1.1.1 Software versions

The information in this document relates to software versions:

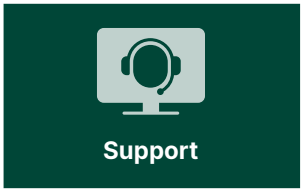
Software	Details	Version
iE PLC bundle	Signed Software bundle with components:	2.0.16.1
BSP	Board Support Package (Operating System)	5.0.9.1
CODESYS CONTROL	CODESYS Control run-time	3.5.21.40
CODESYS IDE	PC software for development of CODESYS applications	3.5.21.40
CODESYS TSP	iE x50 CODESYS TSP (Target Support Package)	1.3.8.0 (SP21)

1.1.2 Need more information?

Get direct access to the resources you need by using the links below.

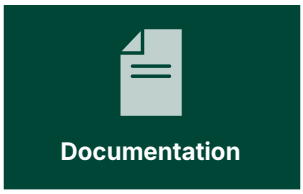
Official DEIF homepage.

iE 650 PLC product page.



Self-help resources and how to contact DEIF for assistance.

Online software documentation.



Download related documentation.

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DWG Drawings

www.deif.com/rtd/ie650plc/mdwg www.deif.com/rtd/ie650plc/rdwg

STP STEP-file

www.deif.com/rtd/ie650plc/maistp

www.deif.com/rtd/ie650plc/mptstp

www.deif.com/rtd/ie650plc/rstp

2D PDF

www.deif.com/rtd/ie650plc/m2dpdf

3D PDF *

www.deif.com/rtd/ie650plc/m3dpdf

* To view a 3D PDF you must enable multimedia and 3D content in your PDF viewer.

SVG Drawings

www.deif.com/rtd/ie650plc/msvg

www.deif.com/rtd/ie650plc/rsvg

PNG Drawings

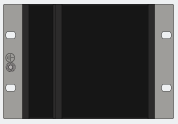
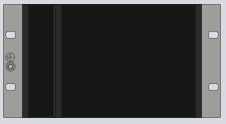
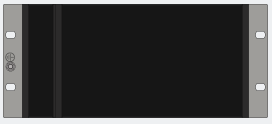
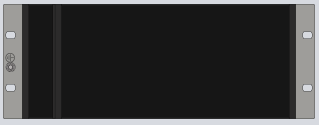
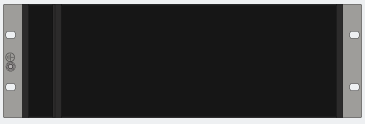
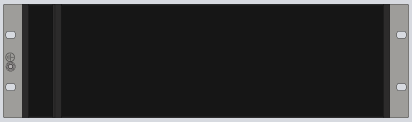
www.deif.com/rtd/ie650plc/mpng

www.deif.com/rtd/ie650plc/rpng

2. Technical specifications

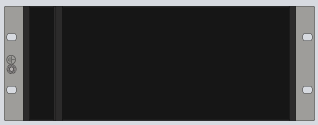
2.1 Dimensions

Rack sizes

Rack	Slots	Ground plate dimensions HxDxW (mm)	Weight (g)	Rack
Rack6·4	4	122.0 x 113.9 x 182.4	715	
Rack6·6	6	122.0 x 113.9 x 233.2	870	
Rack6·8	8	122.0 x 113.9 x 284.4	1020	
Rack6·10	10	122.0 x 113.9 x 334.8	1175	
Rack6·12	12	122.0 x 113.9 x 385.6	1335	
Rack6·14	14	122.0 x 113.9 x 436.4	1500	

Example

Rack6·10:



The rack has:

- 1x slot for SIM6·1, SIM6·2 or SIM6·3
- 1x slot for PDM6·1 or PDM6·2
- 8x slots for I/O modules

NOTE The PCM6·2 uses 2 slots (3 and 4) and requires PDM6·1 as Power Supply Module in Slot 2.

2.2 System specifications

Environment

Category	Specification	Standard
Operating temperature	-40 to 70 °C	IEC 60068-2-1 IEC 60068-2-2
Storage temperature	-40 to 85 °C	
Reference temperaure	15 to 30 °C	
Altitude	Up-to 4000 m without de-rating (for deployment above 4000 m, contact Product Management).	
Climate	All modules are conformal coated, hence protected against moisture, mold, dust, corrosion and other environmental stresses.	IEC 60068-2-30 test Db
	55 °C at 97 % relative humidity, condensing	
	Dry heat test	IEC 60068-2-2
	Cold test	IEC 60068-2-1

Tests

Category	Specification		Standard
Performance test and performance check	Criteria/standard: All inputs, outputs and interfaces are functional.		
Radiated E-field emission	• 30 to 230 MHz: 50 dB (µV/m) Qp 10 m • 230 to 1,000 MHz: 57 dB (µV/m) Qp 10 m • 1 to 3 GHz: 76 dB (µV/m) Q peak 3 m • 1 to 3 GHz: 56 dB (µV/m) average 3 m • 3 to 6 GHz: 80 dB (µV/m) Q peak 3 m • 3 to 6 GHz: 60 dB (µV/m) average 3m		IEC 61000-6-4 IEC 60255-26
Conducted emission			IEC 61000-6-4 IEC 60255-26
Electrical fast transients test (EFT)	Criteria B	Levels extended to: • DC-power port: ±4 kV • Functional Earth port: ±4 kV • Signal input and output ports: ±2 kV • Communication ports: ±2 kV • Repetition frequencies: 5 KHz and 100 KHz • Duration each polarity: 1 min.	EN 61000-4-4 EN 61000-6-2
RF E-Field immunity	Criteria: A	80 to 2,000 MHz: 12 V/m 2 to 3 GHz: 10 V/m	EN 61000-4-3 EN 61000-6-2
Electrostatic discharge (ESD)	Criteria: B	Level extended to: Contact 6 kV	EN 61000-4-2 EN 61000-6-2
Slow transients test, surge	Criteria: B	Levels extended to: • Digital inputs: ±1 kVp DM and ±2 kVp CM • Digital outputs: ±1 kVp DM and ±2 kVp CM • Analogue inputs: ±3 kVp DM and ±3 kVp CM • Analogue outputs: ±1 kVp DM and ±2 kVp CM • Temperature inputs: ±3 kVp DM and ±3 kVp CM • Main power supply: ±3 kVp DM and ±3 kVp CM • Dig output power supply: ±3 kVp DM and ±3 kVp CM	EN 61000-4-5 EN 61000-6-2

Category	Specification		Standard
		• RS-422, RS-485, Profibus DP, CAN, Ethernet, SSI: ±2 kVp CM	
RF common mode conducted test	Criteria: A	0.15 to 80 MHz: 12 VRMS	EN 61000-4-6 EN 61000-6-2
Power frequency H-field (magnetic) immunity	Criteria: A	Field: 30 A/m	EN 61000-4-8 EN 61000-6-2
Vibration Test	Operational	3 to 13.2 Hz 2.85 mm peak-peak 13.2 to 100 Hz 1 *g*	DNV-GL test A
		3 to 15 Hz 5 mm peak-peak 15 to 50 Hz 2.3 *g*	DNV-GL test C
	Response	10 to 58.1 Hz 0.15 mm peak-peak 58.1 to 150 Hz 1 *g*	IEC 60255-21-1 class 2
	Endurance	10 to 150 Hz 2 *g*	IEC 60255-21-1 class 2
	Seismic	3 to 8.15 Hz 15 mm peak-peak 8.15 to 35 Hz 2 *g*	IEC 60255-21-3 class 2
Shock (Base mounted)	10 g, 11 ms, half sine		IEC 60255-21-2 Response class 2
	30 g, 11 ms, half sine		IEC 60255-21-2 Endurance class 2
	50 g, 11 ms, half sine		IEC 60068-2-27
	Tested with 3 impacts in each direction in all 3 axes, a total of 18 impacts per test		
Bump	25 g, 16 ms, half sine		IEC 60255-21-2 class 2
	1,000 bumps in each direction, 2 directions in each axis, a total of 6,000 bumps		

NOTE *g* = gravitational force (g-force).

Safety and protection

Category	Specification	Standard
Safety	Installation (over-voltage) category III, 600 V, pollution degree 2	EN 61010-1
Protection	IP30	IEC/EN 60529/A1/A2
Materials	Aluminium case and cover plates (all plastic parts are self-extinguishing)	UL94 (V1)

Approvals

These approvals apply to the controller rack (with all the modules properly installed).

Standards
CE
UKCA
UL/ULC Listed to UL6200:2019 1st edition controllers for use in Power Production

Marine certificates	Cybersecurity IACS UR E27
ABS	Yes
BV	Yes
DNV	Yes
LR	Yes
RINA	Yes

More information
See Approvals/certifications for the most recent certificates www.deif.com/documentation/ie-650-plc/.

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Help us improve our documentation by giving us feedback.

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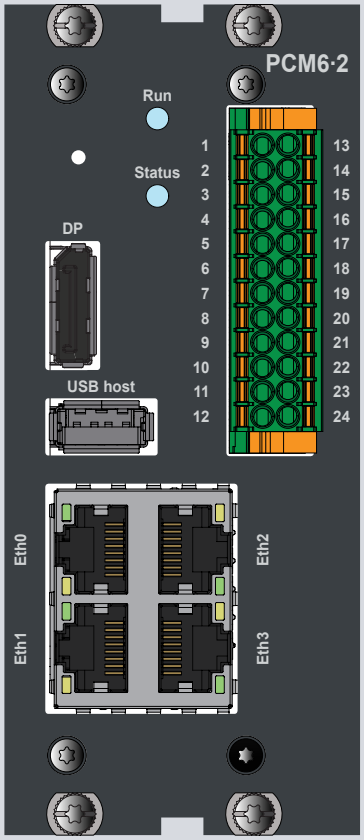
2.3 Computer modules

2.3.1 PCM6·2 computer module specifications

The PCM6·2 module comes with a powerful 1.6 GHz quad-core (64 bit) CPU, well suited for demanding C/C++ and CODESYS applications. Use the network functions for energy and power applications, for example, wind turbines, power parks, hybrid solutions, and battery storage.

The module has a 1 Gbps TSN network interface port for power management networks that are plant-wide and real-time. The module also features a managed 10/100 Mbps switch with 3 ports for local networks.

The DisplayPort connector allows you to connect standard LED/LCD monitors. CAN/CANopen and RS-422/485 connections are available as on-module interfaces using the common snap-locked (or screw-locked) connector.

Computer module	
	
Power supply	From backplane using PDM6·1 module or PDM6·2 module
Backplane interfaces	1 x EtherCAT OUT (Port 1) – LVDS 1 x EtherCAT OUT (Port 2) – LVDS
Digital input (In)	1 x DI 24 V DC High: 13 to 30 V Low: -30 to +5 V with reference to common Load: Typically 6 mA (Vin > 7 V) Isolation: Optically isolated from other potentials, 500 V DC
Digital output (Out)	1 x DO 24 V DC Solid State Relay with external watchdog, 24 V, maximum 1 A resistive
Ethernet	1 x Ethernet with TSN support (Eth0): 100/1000BASE-T, 8P8C (“RJ45”), shielded Cat5e, gold plating 3 x Ethernet, managed switches (Eth1, Eth2, Eth3): 10/100BASE-T, 8P8C ("RJ45"), shielded Cat5e, gold plating
CAN	2 x CAN (CAN 1, CAN 2): ISO 11898, shielded twisted copper cable, 50 to 1,000 kbit/s, software controllable 120 Ω termination resistor
UART	2 x RS-422/485 (COM1, COM2): ANSI/TIA/EIA-422-B and TIA/EIA-485, shielded twisted copper cable, 4.8 to 921.6 kbit/s (full duplex), software controllable 120 Ω termination resistor and 500 Ω bias resistor
Display port	1 x DisplayPort (DP) v1.3 1080 p (full-size connector)
USB host	1 x USB 3.0 (Type-A connector), mass storage class power, delivery up to 4.5 W

Computer module	
LED	RUN: Green, EtherCAT in operation STATUS: Red/Blue/Green, software controllable
Pin-hole switch	Factory reset or provisioning of module (software configurable)
Processor	1.6 GHz quad-core industrial grade ARMv8 64 bit CPU with ECC protected cache
Memory	4 GB LPDDR4 with inline Error Code Correction (ECC)
Internal storage	32 GB 3D TLC NAND flash running in pseudo SLC mode. ~8 GB available for user application data
Persistent storage	128 kB user available from CODESYS (256 kB FRAM installed)

Computer module	
Expandable storage	MicroSD slot: High speed (max. 25 MB/s). The MicroSD slot is accessible when the PCM6·2 is not mounted in the rack.
Real-Time Clock (RTC) battery	Real-time clock with replaceable coin-cell battery (replacement recommended every 5 years). CR2430 3V battery, rated for operation at -40 to 85 °C (-40 to 185 °F). This is not a standard CR2430 battery.
Cooling	Passive
Temperature	CPU junction temperature measurement Software reset when the CPU temperature is too high
Operating system	GNU/Linux customized with PREEMPT real-time patch and system drivers C/C++ and CODESYS applications operate in user space mode Fail-safe remote SW update Power fail-safe, self-monitoring and error correcting file system (EXT-4) Secure boot (chain-of-trust)
Cybersecurity	Specification: Conforming to IACS UR E27 Connections to untrusted networks may require additional equipment or security countermeasures not included in the product.
System configuration	On-device web-based configuration System information Simplified update procedures (no special tools, same for OS and firmware) User access management (multi-user access), rights and credentials Network configuration of the build-in 4 port managed switch (VLAN) IPv4 and IPv6 support (static/dynamic) Network Time protocol support as Client Discover the device via hostname (mDNS services) Device configuration backup and restore
System network protocols	• Network Time Protocol (NTP), server and client • Dynamic Host Configuration Protocol (DHCP), client • IGH Master (native for C/C++ applications/system network scan)
PLC run-time	CODESYS V3 runtime : CODESYS V3 SP18 or later iE 650 PLC (CODESYS Multi Core support)
Programming	IEC 61131-3: LD, SFC, FBD, CFC, ST (CODESYS V3.5 SP18+ IDE) ANSI C/C: + ANSI C/C using Linux SDK Python: As containerised software component
Visualisation	CODESYS web visualisation
Application protocols	See section **Supported software features**
Size	50.80 mm (2 slots)
Weight	241 g (incl. connectors)
Power consumption	Max 17.5 W, hereof 5.6 W reserved for USB3.0 host
Connector, grip (included by default)	2 x 12 terminals: DFMC 1.5/12-ST-3.5-LR – 1790580
Connector, screw	2 x 12 terminals: DFMC 1.5/12-STF-3.5 – 1790399

LED specifications

Run LED		Description
OFF		Initialisation
Green blinking		Pre-operational
Single green blink		Safe-operational
Green		Operational
Green flickering		Boot loader

Status LED		Description
OFF		Off.
Green		Normal operation

Ethernet

The CPU module can be used as a gateway between the network segments for plant-wide power management and the local network segments. To do this, two independent network interfaces must be made. Eth0 is an Ethernet port connected directly to the CPU, and Ethernet ports Eth1, Eth2, and Eth3 are connected to the CPU using a managed switch. The Eth0 port supports TSN on hardware level.

The module also supports PROFINET controllers (master) and PROFINET devices (slave) with CODESYS stacks.

CAN

The two independent CAN ports provide CAN (layer II) support. CANopen Master/Slave communication is done using the CODESYS protocol stacks. The ports are configured using the CODESYS applications. The applications also provide the CAN layer II and CANopen Master/Slave protocol stacks. Enable the termination resistors using the software, mapped to the Linux device interface.

UART

The two UART serial ports can be configured as RS-422 or RS-485. Enable the termination and bias resistors using the software, mapped to the Linux device interface.

DisplayPort

The DisplayPort connector standard for the graphical display port supports LED/LCD monitors. The standard is very robust in on-site operations in comparison to other commodity standards.

NOTICE

External third-party non-DEIF displays

External third-party non-DEIF displays should be configured to fixed DisplayPort input mode instead of Automatic detection.

USB host

The USB host is needed to export data, log files, and so on. The host supports the connection of USB 3.0 mass storage devices. Use the Linux operating system to add support for other USB devices.

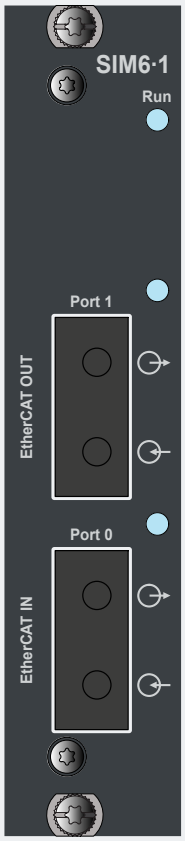
2.3.2 EtherCAT interface

The PCM6·2 module has an EtherCAT connection to local I/O modules in the rack through the backplane. You can expand the EtherCAT network with the SIM6·2, SIM6·4, or SIM6·5, which allows you to connect to remote or distributed I/O racks. It is also possible to access the digital inputs and outputs in the PCM6·2 module with the EtherCAT slave interface.

The digital output can be used as a CPU watchdog. If the EtherCAT network in your application is not controlled by the EtherCAT Master, then the watchdog function automatically opens the digital output after 100 ms. The watchdog function is applicable to all EtherCAT Slave modules. If the EtherCAT Master is not in operation, then the slave modules go to a default state (EtherCAT: SAFEOP). Digital outputs are set to LOW and analogue outputs are set to 0 mA or 0 V.

2.4 Station interface modules

2.4.1 SIM6·1 module specifications

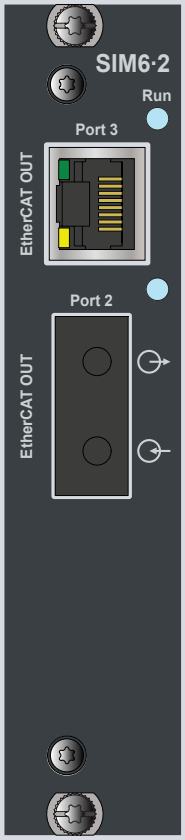
EtherCAT interface		
	Power supply	From backplane
	Backplane interfaces	1 x EtherCAT OUT (Port 3) - LVDS
	Interfaces	1 x EtherCAT IN (Port 0) Optical: 100BASE-FX, SC connectors, multimode fibre glass 50 µm (OM2,OM3,OM4, 1310 nm)
		1 x EtherCAT OUT (Port 1) Optical: 100BASE-FX, SC connectors, multimode fibre glass 50 µm (OM2,OM3,OM4, 1310 nm)
	Size	25.40 mm
	Weight	83 g
	Power consumption	Typical 3.5 W (2 active fibre channels)

Terminal specifications

Configuration: Slave station

Terminal	Description
EtherCAT IN	EtherCAT Logic Port 0
EtherCAT OUT	EtherCAT Logic Port 1

2.4.2 SIM6·2 module specifications

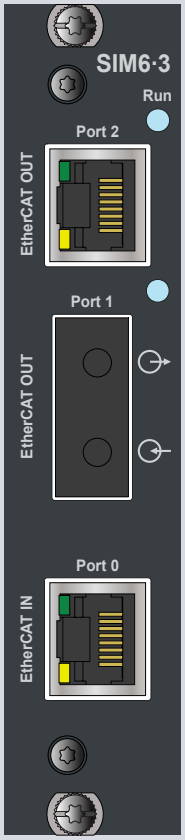
EtherCAT interface		
	**For rack holding EtherCAT master**	
	Power supply	From backplane
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS
	Interfaces	1 x EtherCAT OUT (Port 2) Electrical: 100Base-TX, 8P8C (“RJ45”), shielded Cat 5, >0.76 µm gold plating
		1 x EtherCAT OUT (Port 1) Optical: 100BASE-FX, SC connectors, multimode fibre glass 50 µm (OM2,OM3,OM4, 1310 nm)
	Size	25.40 mm
	Weight	83 g
	Power consumption	Typical 2.5 W (1 active fibre channel)

Terminal specifications

Configuration: Master station

Terminal	Description
EtherCAT OUT	EtherCAT Logic Port 2
EtherCAT OUT	EtherCAT Logic Port 1

2.4.3 SIM6·3 module specifications

EtherCAT interface		
	Power supply	From backplane
	Backplane interfaces	1 x EtherCAT OUT (Port 3) - LVDS
	Interfaces	1 x EtherCAT IN (Port 0) 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 glass 50 µm (OM2,OM3,OM4, 1310 nm)
		1 x EtherCAT OUT (Port 2) Electrical: 100Base-TX, 8P8C (“RJ45”), shielded Cat 5, >0.76 µm gold plating
	Size	25.40 mm
	Weight	83 g
	Power consumption	Typical 2.5 W (1 active fibre channel)

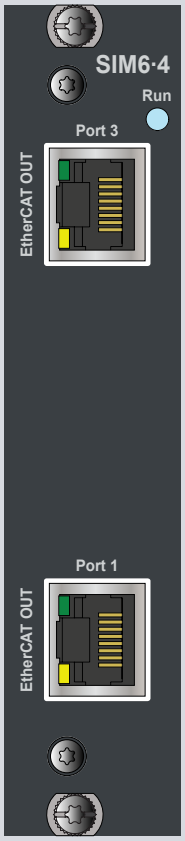
Terminal specifications

Configuration: Slave station

Terminal	Description
EtherCAT IN	EtherCAT Logic Port 0
EtherCAT OUT	EtherCAT Logic Port 1 EtherCAT Logic Port 2

2.4.4 SIM6·4 module specifications

The SIM6·4 module allows EtherCAT redundancy for the interconnection of multiple racks in a system via electrical connections. The Network Interface (NIC) is used for the EtherCAT master.

EtherCAT interface		
	**For rack holding EtherCAT master**	
	Power supply	From backplane
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS
	Interfaces	1 x EtherCAT OUT (Port 3) Electrical: 100Base-TX, 8P8C ("RJ45"), shielded Cat 5, >0.76 µm gold plating
		1 x EtherCAT OUT (Port 1) Electrical: 100Base-TX, 8P8C ("RJ45"), shielded Cat 5, >0.76 µm gold plating
	Size	25.40 mm
	Weight	83 g
	Power consumption	Typical 1.1 W

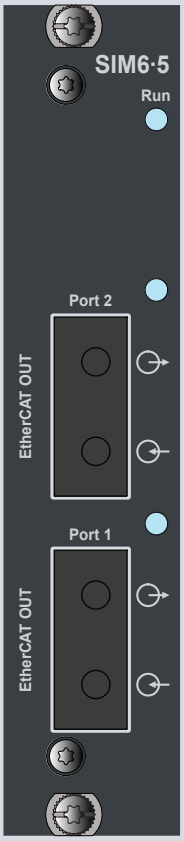
Terminal specifications

Configuration: Master station

Terminal	Description
EtherCAT OUT	EtherCAT Logic Port 3
EtherCAT OUT	EtherCAT Logic Port 1

2.4.5 SIM6·5 module specifications

The SIM6·5 module allows EtherCAT redundancy for the interconnection of multiple racks in a system via fibre optical connections. The Network Interface (NIC) is used for the EtherCAT master.

EtherCAT interface		
	**For rack holding EtherCAT master**	
	Power supply	From backplane
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS
	Interfaces	1 x EtherCAT OUT (Port 2) Optical: 100BASE-FX, SC connectors, multi-mode fibre glass 50 µm (OM2, OM3, OM4, 1310 nm)
		1 x EtherCAT OUT (Port 1) Optical: 100BASE-FX, SC connectors, multi-mode fibre glass 50 µm (OM2, OM3, OM4, 1310 nm)
	Size	25.40 mm
	Weight	83 g
	Power consumption	Typical 3.0 W (2 active fibre channels)

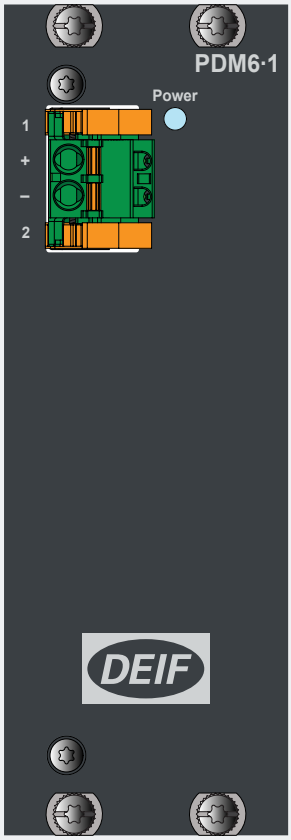
Terminal specifications

Configuration: Master station

Terminal	Description
EtherCAT OUT	EtherCAT Logic Port 2
EtherCAT OUT	EtherCAT Logic Port 1

2.5 Power modules

2.5.1 PDM6·1 module specifications

Power module	
	
Power supply	30 W power supply Input level: 24 V (18 to 32 V) Black-out hold-up for 10 ms Polarity protection
Backplane power source	Power output to backplane
Backplane interfaces	Not used
Size	40.64 mm
Weight	201 g (incl. connectors)
Power consumption	Standby typical 1.25 W
EMI filter	Common mode EMI input filter
Isolation	Input galvanic isolated from other potentials, 500 V DC
Connector, grip (included by default)	2 terminals: 1792517
Connector, screw	2 terminals: 1873207

LED specifications

Power LED		Description
Green		The voltage is above the operating threshold and power is sourced from this input.

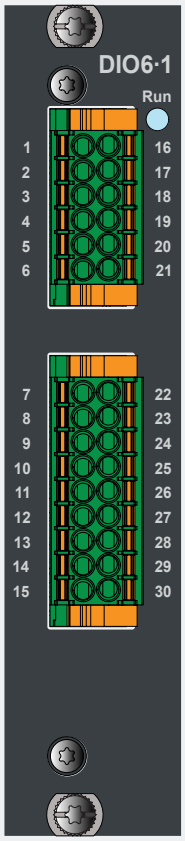
Terminal specifications

Terminal		Description
1	Power supply +	Power supply input, 24 V (18 to 32 V)
2	Power supply -	Power supply input, common

2.6 Digital input and output modules

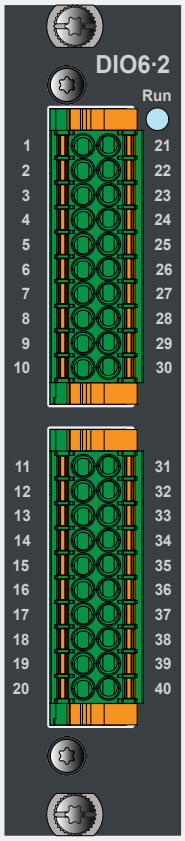
2.6.1 DIO6·1 module specifications

DIO6·1 is designed for the rough environment in a wind turbine, and all inputs and outputs are protected and isolated from other potentials.

Digital input and output module			
	Power supply	From backplane Output from external supply	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	10 digital outputs	Supply	External supply 24V (12 to 32 V)
		Type	Solid-state high side driver
		Voltage	High > Supply voltage -1 V
		Current	Max. 0.5 A per channel (UL: Max. 0.25 A per channel) Maximum total for all outputs: 2 A per group
		Response time	Max. 1 ms
		Isolation	10 outputs in one group Isolated from other potentials, 500 V DC
		Protection	Short circuit protection Inverse supply voltage protection
	16 digital inputs	Input	High: 13 to 30 V Low: -30 V to +5 V Reference to common
		Load	Typically 6 mA (Vin >7 V)
		Bandwidth	~3 ms filter (200 Hz hardware low pass)
		Isolation	16 Inputs in 2 groups (8+8) Isolated from other potentials, 500 V DC
	Size	25.40 mm	
	Weight	91 g (incl. connectors)	
	Power consumption	Typical 0.75 W	
	Connector, grip (included by default)	2 x 6 terminals: 1790522 2 x 9 terminals: 1790551	
	Connector, screw	2 x 6 terminals: 1790331 2 x 9 terminals: 1790360	

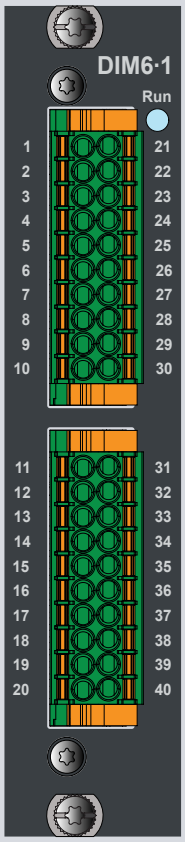
2.6.2 DIO6·2 module specifications

DIO6·2 has 16 x digital inputs and 16 x digital outputs. All the inputs and outputs are protected and isolated from other potentials.

Digital input and output module			
	Power supply	From backplane using PDM6·1 module or PDM6·2 module	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	16 digital outputs	Supply	External supply 24 V (12 to 32 V)
		Type	Solid-state high side driver
		Voltage	High > Supply voltage -1 V
		Current	Max. 0.5 A per channel Maximum total for all outputs: 2 A per group
		Response time	Max. 1 ms
		Isolation	16 outputs in 2 groups (8+8) Isolated from other potentials, 500 V DC
		Protection	Short circuit protection with feedback signal from each group Inverse supply voltage protection
	16 digital inputs	Input	High: 13 to 30 V Low: -30 V to +5 V Reference to common
		Load	Typically 6 mA (Vin >7 V)
		Bandwidth	~3 ms filter (200 Hz hardware low pass)
		Isolation	16 inputs in 2 groups (8+8) Isolated from other potentials, 500 V DC
	Size	25.40 mm	
	Weight	93 g (incl. connectors)	
	Power consumption	Typical 0.75 W	
	Connector, grip (included by default)	2 x 10 terminals: DFMC 1.5/10-ST-3.5-LR – 1790564	
	Connector, screw	2 x 10 terminals: DFMC 1.5/10-STF-3.5 – 1790373	

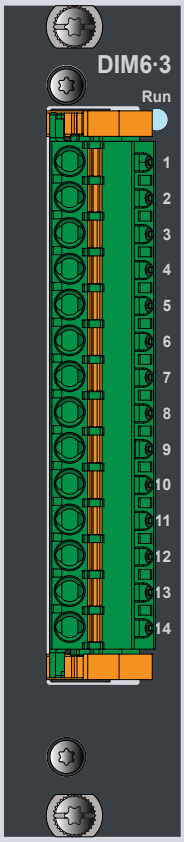
2.6.3 DIM6·1 module specifications

DIM6·1 has 32 x digital inputs. All the inputs are protected and isolated from other potentials.

Digital input module			
	Power supply	From backplane using PDM6·1 module or PDM6·2 module	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	32 digital inputs	Input	High: 13 to 30 V Low: -30 V to +5 V Reference to common
		Load	Typically 6 mA (Vin >7 V)
		Bandwidth	~3 ms filter (200 Hz hardware low pass)
		Isolation	32 inputs in 4 groups (8+8+8+8) Isolated from other potentials, 500 V DC
	Size	25.40 mm (1 slot)	
	Weight	89 g (incl. connectors)	
	Power consumption	Typical 1.1 W	
	Connector, grip (included by default)	2 x 10 terminals: DFMC 1.5/10-ST-3.5-LR – 1790564	
	Connector, screw	2 x 10 terminals: DFMC 1.5/10-STF-3.5 – 1790373	

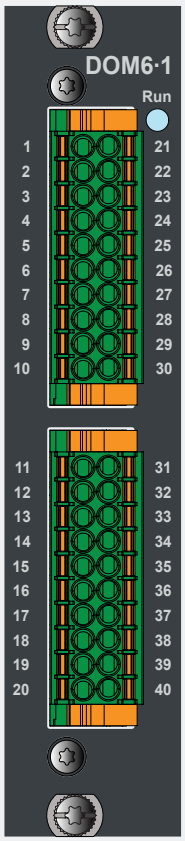
2.6.4 DIM6·3 module specifications

DIM6·3 has 8 x digital inputs. The 8 digital inputs are grouped in two groups, and isolated from other potentials.

Digital input module			
	Power supply	From backplane using PDM6·1 module or PDM6·2 module	
	Backplane interfaces	1 x EtherCAT IN (Port 1) - LVDS 1 x EtherCAT OUT (Port 2) – LVDS	
	8 digital inputs	Input	High: 40 to 220 V DC (DC input) / 70 to 240 V AC (AC input) Low: <40 V DC (DC input) / 40 V AC (AC input) Reference to common
		Load	Typically 1 mA (Vin < 120 V DC / AC) or 2 mA (Vin < 220 V DC / AC) Zin = 119 kOhm
		Response time	ON < 5 mS OFF < 20 mS
		Isolation	8 inputs in two groups Isolated from other potentials, 3250 V 50 Hz for 1 minute
	Size	25.40 mm (1 slot)	
	Weight	115 g (incl. connectors)	
	Power consumption	Typical 0.65 W	
	Connector, grip (included by default)	14 pole connector, push-in terminals, with snap lock FKC 2,5/14-ST-5,08-LR	
	Connector, screw	14 pole connector, push-in terminals, with screw lock FKC 2,5/14-STF-5,08	

2.6.5 DOM6·1 module specifications

DOM6·1 has 32 x digital outputs. All the outputs are protected and isolated from other potentials.

Digital output module			
	Power supply	From backplane using PDM6·1 module or PDM6·2 module	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	32 digital outputs	Supply	External supply 24 V (12 to 32 V)
		Type	Solid-state high side driver
		Voltage	High > Supply voltage -1 V
		Current	Max. 0.5 A per channel Maximum total for all outputs: 2 A per group
		Response time	Max. 1 ms
		Isolation	32 outputs in 4 groups (8+8+8+8) Isolated from other potentials, 500 V DC
		Protection	Short circuit protection with feedback signal from each group Inverse supply voltage protection
	Size	25.40 mm	
	Weight	97 g (incl. connectors)	
	Power consumption	Typical 0.5 W	
	Connector, grip (included by default)	2 x 10 terminals: DFMC 1.5/10-ST-3.5-LR – 1790564	
	Connector, screw	2 x 10 terminals: DFMC 1.5/10-STF-3.5 – 1790373	

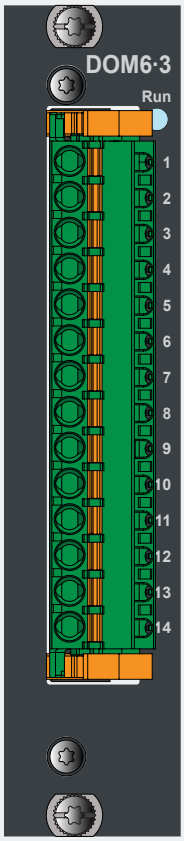
2.6.6 DOM6·3 module specifications

DOM6·3 has 8 x high current digital outputs in two groups.

Each output can deliver up to 2 A continues, and 8 A in total per group. They are all configured in Current sourcing (PNP) mode. The outputs have individual over-current protection (thermal shutdown) with feedback to application.

The individual outputs have current sensing feedback (>10 mA) for load detection when output is active as well as wire break detection (< 1 mA) when output is non-active (always enabled). Additionally, over-current detection with feedback to the application for handling.

The digital outputs in each group are isolated from other potentials up to 500 V DC.

Digital output module			
	Power supply	From backplane using PDM6·1 module or PDM6·2 module	
	Backplane interfaces	1 x EtherCAT IN (Port 1) - LVDS 1 x EtherCAT OUT (Port 2) – LVDS	
	8 High Current Digital Outputs	Supply	External supply 24 V (18 to 32 V DC)
		Type	Solid-state high side (PNP, Sourcing)
		Voltage	High > Supply voltage -1 V
		Current	Max. 2 A per channel continues. * Maximum total for all outputs: 8 A per group
		Response time	Max. 1 ms Delay On : <50 us Delay Off : <80 us
		Isolation	8 outputs in 2 groups (4+4) Isolated from other potentials, 500 V DC
		Protections / Special functions	Short circuit protection (thermal) with feedback signal from each output. Overcurrent sensing signal from each digital output (2.06 A ± 20 %) Current sensing feedback signal for load detection on each digital output (>10 mA) - Active DO State Reverse DO supply protection Supply OK feedback signal (within 18..32 V DC) for each group Wire break detection (test current ~2.4 mA) for each digital output
	Size	25.40 mm	
	Weight	112 g (incl. connectors)	
	Power consumption	Typical 1.5 W	
	Connector, grip (included by default)	14 pole connector, push-in terminals, with snap lock FKC 2,5/14-ST-5,08-LR	
	Connector, screw	14 pole connector, push-in terminals, with screw lock FKC 2,5/14-STF-5,08	

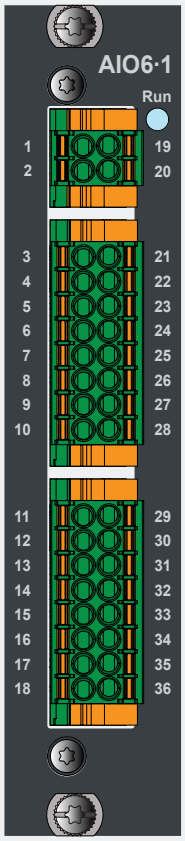
NOTE * The maximum output current is derated to 1.5 A if the ambient temperature exceeds 55°C otherwise the module must be installed in a ventilated environment.

There is always +24 V DC on outputs if they are not loaded due to wire break detection current.

2.7 Analogue input and output modules

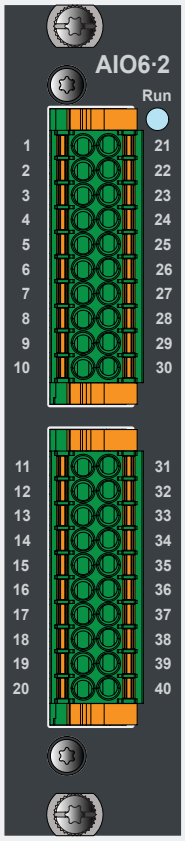
2.7.1 AIO6·1 module specifications

AIO6·1 is designed for the rough environment in a wind turbine, and all inputs and outputs are protected and isolated from other potentials.

Analogue input and output module			
	Power supply	From backplane	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	2 analogue outputs	Output type	Current mode : 0 to 20 mA, 4 to 20 mA, 0 to 24 mA Voltage mode : 0 to 10 V, -10 to 10 V. Software selectable.
		Output range	Current mode: 0 to 20 mA, 4 to 20 mA, 0 to 24 mA Voltage mode: 0 to 10 V, -10 to 10 V
		Load	Current mode: < 500 Ω Voltage mode: ≥ 1000 Ω
		Resolution	16 bit
		Accuracy	0.2 % of full range output (20 mA/10 V) at reference temperature 0.4 % of full range output (20 mA/10 V) at operational temperature
		Isolation	2 outputs in one group Isolated from other potentials, 500 V DC
	16 analogue inputs	Input type	Current mode: -20 to 20 mA, 0 to 20 mA, 4 to 20 mA, 4 to 20 mA (NAMUR NE43) and 4 to 24 mA Voltage mode: -10 to 10 V, 0 to 10 V, -12 to 12 V and 0 to 12 V Software selectable.
		Impedance	Current mode: Max. 50 Ω Voltage mode: Min. 10 kΩ
		Filter	250 Hz hardware low-pass filter
		Sampling	< 2 ms
		Resolution	16 bit
		Accuracy	0.2 % of full range input (20 mA/10 V) at reference temperature 0.4 % of full range input (20 mA/10 V) at operational temperature
		Isolation	16 inputs (8+8) in 2 groups Isolated from other potentials, 500 V DC
	Size	25.40 mm	
	Weight	96 g (incl. connectors)	
	Power consumption	Typical 2.75 W (2 analogue outsourcing 20 mA)	
	Connector, grip (included by default)	2 x 2 terminals: 1790483 2 x 8 terminals: 1790548	
	Connector, screw	2 x 2 terminals: 1790292 2 x 8 terminals: 1790357	

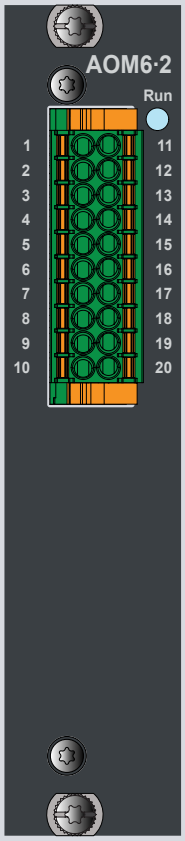
2.7.2 AIO6·2 module specifications

AIO6·2 has 8 analogue inputs and 8 analogue outputs. The voltage and current modes for the inputs and outputs are individually software configurable. All the inputs and outputs are protected and isolated from other potentials.

Analogue input and output module			
	Power supply	From backplane using PDM6·1 module or PDM6·2 module	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	8 analogue outputs	Output type	Current mode: 0 to 20 mA, 0 to 24 mA, 4 to 20 mA, -20 to 20 mA and -24 to 24 mA Voltage mode: 0 to 10 V, 0 to 12 V, -10 V to 10 V and -12 to 12 V Software selectable.
		Output range	Current mode: 0 to 20 mA, 0 to 24 mA, 4 to 20 mA, -20 to 20 mA and -24 to 24 mA Voltage mode: 0 to 10 V, -10 to 10 V, 0 to 12 V*, -12 to 12 V* (-11,96 V and 11,96 V respectively).
		Load	Current mode: < 500 Ω Voltage mode: ≥ 1000 Ω
		Resolution	16 bit
		Accuracy	0.2 % of full range output (20 mA/10 V) at reference temperature 0.4 % of full range output (20 mA/10 V) at operational temperature
		Isolation	8 outputs in 2 groups (4+4) Isolated from other potentials, 500 V DC
	8 analogue inputs	Input type	Current mode: 0 to 20 mA, 0 to 24 mA, 4 to 20 mA, 4 to 20 mA (NAMUR NE43), -20 to 20 mA and -24 to 24 mA Voltage mode: 0 to 10 V, 0 to 12 V, -10 V to 10 V and -12 to 12 V Software selectable.
		Impedance	Current mode: Max. 50 Ω Voltage mode: Min. 10 kΩ
		Filter	250 Hz hardware low-pass filter
		Sampling	< 2 ms
		Resolution	16 bit
		Accuracy	0.2 % of full range input (20 mA/10 V) at reference temperature 0.4 % of full range input (20 mA/10 V) at operational temperature
		Isolation	8 inputs in 2 groups (4+4) Isolated from other potentials, 500 V DC
	Size	25.40 mm	
	Weight	118 g (incl. connectors)	
	Power consumption	Typical 5.1 W (8 analogue outsourcing 20 mA)	
	Connector, grip (included by default)	2 x 10 terminals: DFMC 1.5/10-ST-3.5-LR – 1790564	
	Connector, screw	2 x 10 terminals: DFMC 1.5/10-STF-3.5 – 1790373	

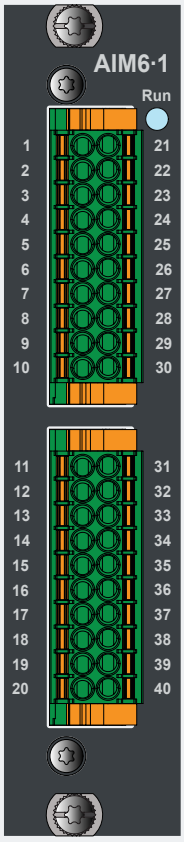
2.7.3 AOM6·2 module specifications

AOM6·2 has 8 analogue outputs. The voltage and current modes for the outputs are individually software configurable. The outputs are protected and isolated from other potentials.

Analogue output module			
	Power supply	From backplane using PDM6·1 module or PDM6·2 module	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	8 analogue outputs	Output type	Current mode: 0 to 20 mA, 0 to 24 mA, 4 to 20 mA, -20 to 20 mA and -24 to 24 mA Voltage mode: 0 to 10 V, 0 to 12 V, -10 V to 10 V and -12 to 12 V Software selectable.
		Output range	Current mode: 0 to 20 mA, 0 to 24 mA, 4 to 20 mA, -20 to 20 mA and -24 to 24 mA Voltage mode: 0 to 10 V, -10 to 10 V, 0 to 12 V∗, -12 to 12 V∗ (-11,96 V and 11,96 V respectively).
		Load	Current mode: < 500 Ω Voltage mode: ≥ 1000 Ω
		Resolution	16 bit
		Accuracy	0.2 % of full range output (20 mA/10 V) at reference temperature 0.4 % of full range output (20 mA/10 V) at operational temperature
		Isolation	8 outputs in 2 groups (4+4) Isolated from other potentials, 500 V DC
	Size	25.40 mm	
	Weight	100 g (incl. connectors)	
	Power consumption	Typical 2.7 W (8 analogue outsourcing 20 mA)	
	Connector, grip (included by default)	1 x 10 terminals: DFMC 1.5/10-ST-3.5-LR – 1790564	
	Connector, screw	1 x 10 terminals: DFMC 1.5/10-STF-3.5 – 1790373	

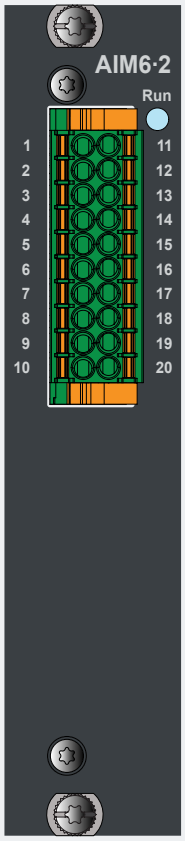
2.7.4 AIM6·1 module specifications

AIM6·1 has 16 analogue inputs. The voltage and current modes for the inputs are individually software configurable. All the inputs are protected and isolated from other potentials.

Analogue input module			
	Power supply	From backplane using PDM6·1 module or PDM6·2 module	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	16 analogue inputs	Input type	Current mode: 0 to 20 mA, 0 to 24 mA, 4 to 20 mA, 4 to 20 mA (NAMUR NE43), -20 to 20 mA and -24 to 24 mA Voltage mode: 0 to 10 V, 0 to 12 V, -10 V to 10 V and -12 to 12 V Software selectable.
		Impedance	Current mode: Max. 50 Ω Voltage mode: Min. 10 kΩ
		Filter	250 Hz hardware low-pass filter
		Sampling	< 2 ms
		Resolution	16 bit
		Accuracy	0.2 % of full range input (20 mA/10 V) at reference temperature 0.4 % of full range input (20 mA/10 V) at operational temperature
		Isolation	16 inputs in 4 groups (4+4+4+4) Isolated from other potentials, 500 V DC
	Size	25.40 mm	
	Weight	115 g (incl. connectors)	
	Power consumption	Typical 2.3 W	
	Connector, grip (included by default)	2 x 10 terminals: DFMC 1.5/10-ST-3.5-LR – 1790564	
	Connector, screw	2 x 10 terminals: DFMC 1.5/10-STF-3.5 – 1790373	

2.7.5 AIM6·2 module specifications

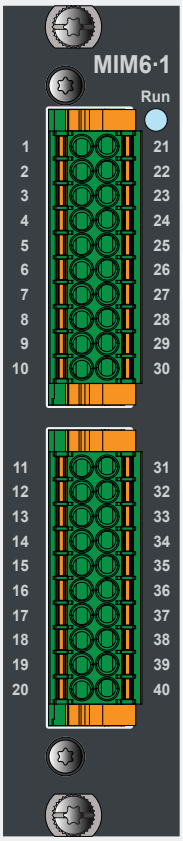
AIM6·2 has 8 analogue inputs. The voltage and current modes for the inputs are individually software configurable. All the inputs are protected and isolated from other potentials.

Analogue input module			
	Power supply	From backplane using PDM6·1 module or PDM6·2 module	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	8 analogue inputs	Input type	Current mode: 0 to 20 mA, 0 to 24 mA, 4 to 20 mA, 4 to 20 mA (NAMUR NE43), -20 to 20 mA and -24 to 24 mA Voltage mode: 0 to 10 V, 0 to 12 V, -10 V to 10 V and -12 to 12 V Software selectable.
		Impedance	Current mode: Max. 50 Ω Voltage mode: Min. 10 kΩ
		Filter	250 Hz hardware low-pass filter
		Sampling	< 2 ms
		Resolution	16 bit
		Accuracy	0.2 % of full range input (20 mA/10 V) at reference temperature 0.4 % of full range input (20 mA/10 V) at operational temperature
		Isolation	8 inputs in 2 groups (4+4) Isolated from other potentials, 500 V DC
	Size	25.40 mm	
	Weight	95 g (incl. connectors)	
	Power consumption	Typical 1.4 W	
	Connector, grip (included by default)	2 x 10 terminals: DFMC 1.5/10-ST-3.5-LR – 1790564	
	Connector, screw	2 x 10 terminals: DFMC 1.5/10-STF-3.5 – 1790373	

2.7.6 MIM6·1 module specifications

MIM6·1 has 16 multifunctional analogue inputs or 8 completely isolated groups. The voltage and current modes for the inputs are individually software configurable. All the inputs are protected against 24 V DC connection failure and isolated from other potentials up to 500 V DC.

The MIM6·1 module provides flexible configuration of analogue input type. The module is designed for projects and installations where the specifications have not yet been finalised or change over time.

Multifunctional input module	
	
Power supply	From backplane using PDM6·1 module or PDM6·2 module
Backplane interfaces	1 x EtherCAT OUT (Port 1) - LVDS 1 x EtherCAT OUT (Port 2) – LVDS
8 analogue input groups	(See information below)
Size	25.40 mm
Weight	128 g (incl. connectors)
Power consumption	Typical 3.6 W
Connector, grip (included by default)	2 x 10 terminals: DFMC 1.5/10-ST-3.5-LR – 1790564
Connector, screw	2 x 10 terminals: DFMC 1.5/10-STF-3.5 – 1790373

8 analogue input groups

Multifunctional input module	
Digital input	High: +13 to +30 V or -13 to -30 V Low: +5 to -5 V with reference to common
Digital inputs	Dry contact inputs, 2.5 V/ 2 mA DC internal supply
1 x differential current input **OR** 2 x current input (common ground)	0 to 20 mA 0 to 24 mA 4 to 20 mA (NAMUR NE43) -20 to +20 mA -24 to +24 mA

8 analogue input groups

Multifunctional input module	
1 x differential voltage input **OR** 2 x voltage input	0 to 10 V -10 to +10 V 0 to 12 V -12 to +12 V Differential mode up to 30 V common mode
1 x resistance measurement input 3-wire, 4-wire (RMI)	0 to 4.5 kΩ
2 x resistance measurement inputs 2-wire (RMI): common reference	0 to 4.5 kΩ
1 x Pt100 (3-wire, 4-wire) 2 x Pt100 (2-wire)	-200 to 590 °C (default range) 0 to 850 °C (extended range) Cable error: Open inputs and short-circuit are detected (under range, over range and error signals in EtherCAT interface) Resolution: 0.1 °C
1 x Pt1000 (3-wire, 4-wire) 2 x Pt1000 (2-wire)	-200 to 590 °C (default range) 0 to 850 °C (extended range) Cable error: Open inputs are short-circuit detected (under range, over range and error signals in EtherCAT interface) Resolution: 0.1 °C
1 x thermocouple **OR** 2 x thermocouples	• E: -200 to +1000 °C • J: -210 to + 1200 °C • K: -200 to +1372 °C • N: -200 to +1300 °C • R: -50 to +1768 °C • S: -50 to +1768 °C • T: -200 to +400 °C Wire break or open inputs are shown as Error bit set, Under and Over range clear and value set to INT16_MAX (32767)

No compensation
 	
OR
 	
Internal cold junction compensation (CJC)
	Internal temperature sensor:
	• Range: 0 to 70 °C
	  ◦ Accuracy: ±1.0 °C
	• Range: -40 to 0 °C
	  ◦ Accuracy: ±2.0 °C

Impedance	Current mode: max. 50 Ω Voltage mode: min. 10 kΩ
Filter	250 Hz hardware low-pass filter
Sampling	< 2 ms - analogue voltage or current mode < 40 ms - temperature or RMI mode
Resolution	16 bit

Multifunctional input module	
Accuracy: Voltage and current	• 0.2 % of full range input (20 mA/ 10 V) at reference temperature • 0.4 % of full range input (20 mA/ 10 V) at operational temperature
Accuracy: RMI (3-wire, 4-wire)	• ±1.0 Ω ±0.25 % of actual reading at reference temperature • ±2.0 Ω ±0.25 % of actual reading at operational temperature

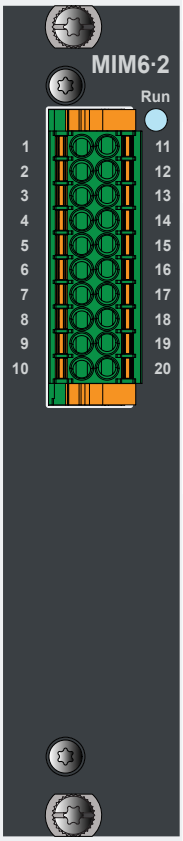
8 analogue input groups

Multifunctional input module	
Accuracy: RMI (2-wire)	• ±2.0 Ω ±0.25 % of actual reading at reference temperature • ±4.0 Ω ±0.25 % of actual reading at operational temperature
Accuracy: Pt100 (3-wire, 4-wire)	• ±1.0 °C ±0.25 % of actual reading at reference temperature • ±2.0 °C ±0.25 % of actual reading at operational temperature
Accuracy: Pt1000 (3-wire, 4-wire)	• ±0.5 °C ±0.25 % of actual reading at reference temperature • ±1.0 °C ±0.25 % of actual reading at operational temperature
Accuracy: Pt100 (2-wire)	• ±1.5 °C ±0.25 % of actual reading at reference temperature • ±2.5 °C ±0.25 % of actual reading at operational temperature
Accuracy: Pt1000 (2-wire)	• ±1.0 °C ±0.25 % of actual reading at reference temperature • ±1.5 °C ±0.25 % of actual reading at operational temperature
Accuracy: Thermocouples type E, J, K, N	• ±2 °C ±0.25 % of actual reading at reference temperature • ±4 °C ±0.25 % of actual reading at operational temperature
Accuracy: Thermocouples type R, S, T	• ±4 °C ±0.25 % of actual reading at reference temperature • ±8 °C ±0.25 % of actual reading at operational temperature
Isolation	8 groups isolated from other potentials, 500 V DC
Protections	Input circuits designed with protection against 24 V DC connection failure

2.7.7 MIM6·2 module specifications

MIM6·2 has 8 multifunctional analogue inputs or 4 completely isolated groups. The voltage and current modes for the inputs are individually software configurable. All the inputs are protected against 24 V DC connection failure and isolated from other potentials up to 500 V DC.

The MIM6·2 module provides flexible configuration of the type of analogue input. The module is designed for projects and installations where the specifications have not yet been finalised or change over time.

Multifunctional input module	
	
Power supply	From backplane using PDM6·1 module or PDM6·2 module
Backplane interfaces	1 x EtherCAT OUT (Port 1) - LVDS 1 x EtherCAT OUT (Port 2) – LVDS
8 analogue input groups	(See information below)
Size	25.40 mm
Weight	106 g (incl. connectors)
Power consumption	Typical 2.1 W
Connector, grip (included by default)	2 x 10 terminals: DFMC 1.5/10-ST-3.5-LR – 1790564
Connector, screw	2 x 10 terminals: DFMC 1.5/10-STF-3.5 – 1790373

4 analogue input groups

Multifunctional input module	
Digital input	High: +13 to +30 V or -13 to -30 V Low: +5 to -5 V with reference to common
Digital inputs	Dry contact inputs, 2.5 V/ 2 mA DC internal supply
1 x differential current input **OR** 2 x current input (common ground)	0 to 20 mA 0 to 24 mA 4 to 20 mA (NAMUR NE43) -20 to 20 mA 0 to 24 mA -24 to 24 mA

4 analogue input groups

Multifunctional input module	
1 x differential voltage input **OR** 2 x voltage input	0 to 10 V -10 to 10 V 0 to 12 V -12 to 12 V Differential mode up to 30 V common mode
1 x resistance measurement input 3-wire, 4-wire (RMI)	0 to 4.5 kΩ
2 x resistance measurement inputs 2-wire (RMI): common reference	0 to 4.5 kΩ
1 x Pt100 (3-wire, 4-wire) 2 x Pt100 (2-wire)	-200 to +300 °C Cable error: open input and short-circuit are detected Resolution: 0.1 °C
1 x Pt1000 (3-wire, 4-wire) 2 x Pt1000 (2-wire)	-200 to +300 °C Cable error: open input and short-circuit are detected Resolution: 0.1 °C
1 x thermocouple **OR** 2 x thermocouples	• E: -200 to +1000 °C • J: -210 to + 1200 °C • K: -200 to +1372 °C • N: -200 to +1300 °C • R: -50 to +1768 °C • S: -50 to +1768 °C • T: -200 to +400 °C Open inputs are detected (internal current source)

External junction compensation using Pt100/Pt1000 on any channel
 	
OR
 	
Internal cold junction compensation (CJC)
	Internal temperature sensor:
	• Range: 0 to 70 °C
	  ◦ Accuracy: ±1.0 °C
	• Range: -40 to 0 °C
	  ◦ Accuracy: ±2.0 °C

Impedance	Current mode: max. 50 Ω Voltage mode: min. 10 kΩ
Filter	250 Hz hardware low-pass filter
Sampling	< 2 ms - analogue voltage or current mode < 40 ms - temperature or RMI mode
Resolution	16 bit
Accuracy: Voltage and current	• 0.2 % of full range input (20 mA/ 10 V) at reference temperature • 0.4 % of full range input (20 mA/ 10 V) at operational temperature
Accuracy: RMI (3-wire, 4-wire)	• ±1.0 Ω ±0.25 % of actual reading at reference temperature • ±2.0 Ω ±0.25 % of actual reading at operational temperature

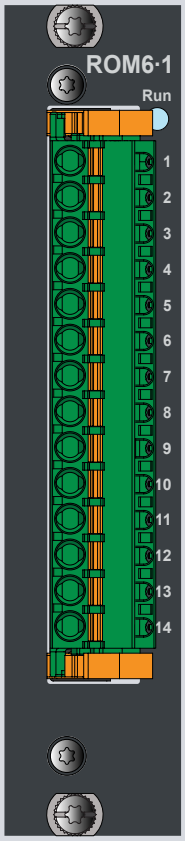
4 analogue input groups

Multifunctional input module	
Accuracy: RMI (2-wire)	• ±2.0 Ω ±0.25 % of actual reading at reference temperature • ±4.0 Ω ±0.25 % of actual reading at operational temperature
Accuracy: Pt100 (3-wire, 4-wire)	• ±1.0 °C ±0.25 % of actual reading at reference temperature • ±2.0 °C ±0.25 % of actual reading at operational temperature
Accuracy: Pt1000 (3-wire, 4-wire)	• ±0.5 °C ±0.25 % of actual reading at reference temperature • ±1.0 °C ±0.25 % of actual reading at operational temperature
Accuracy: Pt100 (2-wire)	• ±1.5 °C ±0.25 % of actual reading at reference temperature • ±2.5 °C ±0.25 % of actual reading at operational temperature
Accuracy: Pt1000 (2-wire)	• ±1.0 °C ±0.25 % of actual reading at reference temperature • ±1.5 °C ±0.25 % of actual reading at operational temperature
Accuracy: Thermocouples type E, J, K, N	• ±2 °C ±0.25 % of actual reading at reference temperature • ±4 °C ±0.25 % of actual reading at operational temperature
Accuracy: Thermocouples type R, S, T	• ±4 °C ±0.25 % of actual reading at reference temperature • ±8 °C ±0.25 % of actual reading at operational temperature
Isolation	8 groups isolated from other potentials, 500 V DC
Protections	Input circuits designed with protection against 24 V DC connection failure

2.8 Relay output modules

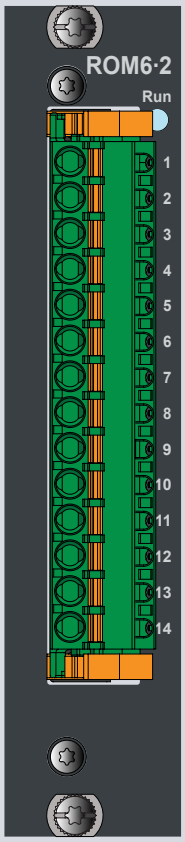
2.8.1 ROM6·1 module specifications

ROM6·1 has 8 x normally open relays.

Relay output module			
	Power supply	From backplane using PDM6·1 module or PDM6·2 module	
	Backplane interfaces	1 x EtherCAT OUT (Port 1) - LVDS 1 x EtherCAT OUT (Port 2) – LVDS	
	8 relay outputs (normally open NO)	Type	Electromechanical
		Electrical rating	Resistive load (continuously): 250 VAC @ 2 A 120 VAC @ 2 A 48 VAC @ 2 A 24 VAC @ 2 A 220 VDC @ 0.2 A 110 VDC @ 0.3 A 48 VDC @ 1 A 24 VDC @ 2 A 12 VDC @ 2 A Inductive load: (AC:B300, DC:R300) Altitude derating 2,000-4,000 m Max. 150 VAC ⚠ **CAUTION:** Relays with working voltages >150 V AC must be operated within the same relay group and not next to relays with 30 V DC working voltage.
		Load type	Resistive, Inductive B300/R300 (power limit specification for inductive loads), Pilot duty
		Operating cycles	Mechanical: >1 x 10^7 cycles Electrical: >50,000 cycles (depending of load)
		Response time (contact on/ brake off)	Operate time (typical): 10 ms Release time (typical): 7 ms
		Isolation	Between relays: 2200 V 50 Hz for 1 minute Between relays and chassis: 3250 V 50 Hz for 1 minute
	Size	25.40 mm	
	Weight	165 g (incl. connectors)	
	Power consumption	Typical 2.6 W (all relays ON)	
	Connector, grip (included by default)	14 pole connector, push-in terminals, with snap lock 1810913 - FKC 2.5/14-ST-5.08-LR	
	Connector, screw	14 pole connector, push-in terminals, with snap lock 1873320 - FKC 2.5/14-ST-5.08-LR	

2.8.2 ROM6·2 module specifications

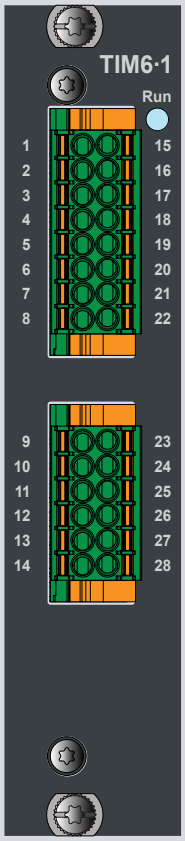
ROM6·2 has 4 x changeover relays.

Relay output module			
	Power supply	From backplane using PDM6·1 module or PDM6·2 module	
	Backplane interfaces	1 x EtherCAT OUT (Port 1) - LVDS 1 x EtherCAT OUT (Port 2) – LVDS	
	4 Relay outputs (changeover)	Type	Electromechanical
		Electrical rating	Resistive load (continuously): 250 VAC @ 2 A 120 VAC @ 2 A 48 VAC @ 2 A 24 VAC @ 2 A 220 VDC @ 0.2 A 110 VDC @ 0.3 A 48 VDC @ 1 A 24 VDC @ 2 A 12 VDC @ 2 A Inductive load: (AC:B300, DC:R300) Altitude derating 2,000-4,000 mMax. 150 VAC ⚠ **CAUTION:** Relays with working voltages >150 V AC must be operated within the same relay group and not next to relays with 30 V DC working voltage.
		Load type	Resistive, Inductive B300/R300 (power limit specification for inductive loads), Pilot duty
		Operating cycles	Mechanical: >1 x 10^7 cycles Electrical: >50,000 cycles (depending of load)
		Response time (contact on/ brake off)	Operate time (typical): 10 ms Release time (typical): 7 ms
		Isolation	Between relays: 2200 V 50 Hz for 1 minute Between relays and chassis: 3250 V 50 Hz for 1 minute
	Size	25.40 mm	
	Weight	131 g (incl. connectors)	
	Power consumption	Typical 1.5 W (all relays ON)	
	Connector, grip (included by default)	14 pole connector, push-in terminals, with snap lock 1810913 - FKC 2.5/14-ST-5.08-LR	
	Connector, screw	14 pole connector, push-in terminals, with snap lock 1873320 - FKC 2.5/14-ST-5.08-LR	

2.9 Temperature input modules

2.9.1 TIM6·1 module specifications

TIM6·1 is designed for the rough environment in a wind turbine, and all inputs and outputs are protected and isolated from other potentials.

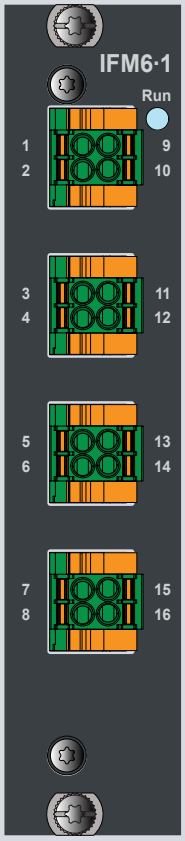
Temperature input module			
	Power supply	From backplane	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	14 (6) temperature inputs	Sensor type	Pt100
		Range	-50 to 200 °C
		Wire	14 (2) x Pt 100 2-wire connection or 0 (6) x Pt 100 3-wire connection, selectable mix
		Sampling	≤ 100 ms
		Cable error	Open input and short-circuit are detected
		Resolution	0.1 °C (16 bit ADC)
		Accuracy	1.0 °C at reference temperature 2.5 °C at operational temperature (2-wire cables must be shorter than 1 m)
		Isolation	14 (6) inputs in one group Isolated from other potentials, 500 V DC
	Size	25.40 mm	
	Weight	90 g (incl. connectors)	
	Power consumption	Typical 1.0 W (all inputs connected)	
	Connector, grip (included by default)	2 x 8 terminals: 1790548 2 x 6 terminals: 1790522	
	Connector, screw	2 x 8 terminals: 1790357 2 x 6 terminals: 1790331	

2.10 Communication interface modules

2.10.1 IFM6·1 module specifications

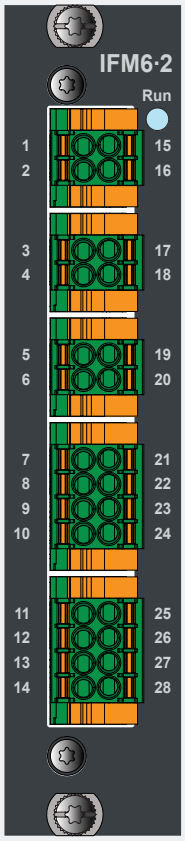
IFM6·1 is designed for the rough environment in a wind turbine, and all inputs and outputs are protected and isolated from other potentials.

The interface and Fieldbus module offer 2 x Profibus DP master and 2 x RS-485 ports.

Communication interface module			
	Power supply	From backplane	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	Processor	196 MHz industrial grade 32 bit microcontroller	
	2 x Profibus DP Master	Supported baud rates	9600, 19200, 45450, 93750, 187500, 500000, 1.5M, 3.0M, 6.0M, 12.0M < 1% error
		Biasing and termination	On or off (software select)
		Standards	PROFIBUS DP-V0 (cyclic data and diagnostics)
		Slaves	Max. 5 per Profibus DP Master
	Com 2 x RS-485 interfaces	Standards	TIA/EIA-485 shielded twisted copper cable
		Baud rate	2400, 4800, 9600, 19200, 38400, 45450, 57600, 115200, 230400 and 460800 < 1 % error
		Word length	7 or 8 bits
		Parity	None, even, odd
		Stop bits	1 or 2
		Flow control	None
		Communication lines	2 wire half duplex
		Biasing and termination	On or off (software selected)
	Isolation	Each communication port isolated from other potentials, 500 V DC	
	Size	25.40 mm	
	Weight	90 g (incl. connectors)	
	Power consumption	Typical 3.25 W (4 ports active)	
	Connector, grip (included by default)	2 x 2 terminals: 1790483	
	Connector, screw	2 x 2 terminals: 1790292	

2.10.2 IFM6·2 module specifications

IFM6·2 is designed for the rough environment in a wind turbine, and communication ports are protected and isolated from other potentials. The IFM6·2 interface and Fieldbus module offer 2 x CAN, 2 x SSI and 2 x High speed counter input.

Communication interface module			
	Power supply	From backplane	
	Power supply, SSI	Input level: 24 V (18 to 32 V) Note 1 : SSI power input must be left unconnected if SSI is unused. Note 2 : SSI power input has a TVS (Transient Voltage Suppression) diode of 33V to shield to protect the connected SSI encoder from damage during surge and burst test. Therefore, the SSI interface is not galvanic isolated from shield.	
	Backplane interfaces	1 x EtherCAT IN (Port 0) - LVDS 1 x EtherCAT OUT (Port 1) – LVDS	
	Processor	240 MHz industrial grade 32 bit microcontroller	
	2 x CAN interfaces	Standards	ISO 11898
		Baud rate	20, 50, 100, 125, 250, 500, 800 or 1000 kbit/s Sample point at 70 to 85 % < 1% error
		Isolation	Isolated from other potentials, 500 V DC
		Termination	Open/120 Ω (software select)
		Protection	24 V DC resistant data lines
	2 x SSI	Standards	TIA/EIA-422 shielded twisted copper cable
		Bit rate	250 kbps and 1000 kbps
		Word length	16 - 32 bit (default 25 bit). Binary or Gray-code configurable in SW
		Termination	Fixed
		Communication lines	4 wire (clock and data)
		Protection	24 V DC resistant data lines
		Isolation	Isolated from other potentials, 500 V DC
		Isolation, SSI	SSI power input has a TVS diode of 33V to shield to protect the connected SSI encoder from damage during surge and burst test. Therefore, the SSI interface is not galvanic isolated from shield.
	2 x digital input with frequency measurement	Input	High: 13 to 30 V Low: -30 V to +5 V
		Load	Typically 6mA (Vin >7V)
		Bandwith	125 kHz hardware low-pass filter
		Isolation	Isolated from other potentials, 500 V DC
	Size	25.40 mm	
	Weight	92 g (incl. connectors)	
	Power consumption	Typical 3.0W	
	Connector, grip (included by default)	2 x 2 terminals: 1790483 2 x 4 terminals: 1790506	
	Connector, screw	2 x 2 terminals: 1790292 2 x 4 terminals: 1790315	

2.11 Condition monitoring modules

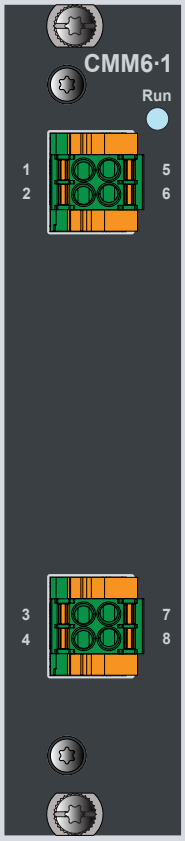
2.11.1 CMM6·x module specifications

Contact DEIF for availability

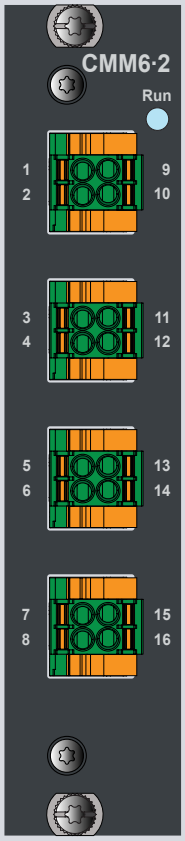
The module has built-in current excitation and all inputs are optically isolated from other potentials. CMM6·1 and CMM6·2 provide up to 4 high frequency analogue inputs. Use the inputs for:

- Measuring voltage signals up to 20 kHz
- Interfacing IEPE vibration sensors

CMM6·1 specifications

2 x high frequency analogue input module			
	Power supply	From backplane	
	Backplane interfaces *	1 x EtherCAT® OUT (Port 0) – LVDS 1 x EtherCAT® OUT (Port 1) – LVDS	
	2 High frequency analogue inputs	Sensor type	IEPE or Voltage input
		Excitation	Current: Selectable 0, 2, 4 and 6 mA Voltage: 24 V (minimum)
		Input range	Selectable range: • DC-mode: -10 to 20, ±10 to ±5, 2.5, 1.25, 0.62, 0.31, 0.16, 0.08, 0.40, 0.20 V (11 steps) • IEPE (AC)-mode: ±10, 5, 2.5, 1.25, 0.62, 0.31, 0.16, 0.08, 0.40, 0.20 V (10 steps)
		Impedance	300 kOhm
		Frequency range	DC- mode: 0.05 to 20.000 Hz (3dB) Anti-aliasing filter (DC/AC mode): Low pass -3 dB, 20 kHz butterworth, 3rd order, 77 dB in stop band @ >30 kHz AC- mode (IEPE): High pass is 0.05 Hz
		Sample rate	Up to 57kHz, 2 channels simultaneous Software selectable sample rate : 57594, 29297,14648 or 7324 Hz Selectable down sampling : 1:2, 1:5, 10, 25, 50, 100, 250, 500, 1000, 2500, 5000
		Resolution	24 bit delta-sigma ΔΣ (including sign) 300 nV (gain 1, Range ±2,5Vp) ENOB = 19 @ OSR=256, 29297 sps
		SNR	Typical > 100 dB @ Range ±2.5 Vp
		Accuracy	± 0.5 % of selected range
		Diagnostic	Wire-break and short circuit
		Isolation	2 inputs in 2 groups, each optically isolated from other potentials, 500 V DC
	Connector, grip	CMM6·1: 2 x 2 terminals: 1790483 (included by default)	
	Size	25.4 mm	
	Weight	110 g (incl. connectors)	
	Power consumption	Max. 4 W	

CMM6·2 specifications

4 x high frequency analogue input module			
	Power supply	From backplane	
	Backplane interfaces *	1 x EtherCAT® OUT (Port 0) – LVDS 1 x EtherCAT® OUT (Port 1) – LVDS	
	4 High frequency analogue inputs	Sensor type	IEPE or Voltage input
		Excitation	Current: Selectable 0, 2, 4 and 6 mA Voltage: 24 V (minimum)
		Input range	Selectable range: • DC-mode: -10 to 20, ±10 to ±5, 2.5, 1.25, 0.62, 0.31, 0.16, 0.08, 0.40, 0.20 V (11 steps) • AC- mode (IEPE):±10, 5, 2.5, 1.25, 0.62, 0.31, 0.16, 0.08, 0.40, 0.20 V (10 steps)
		Impedance	300 kOhm
		Frequency range	DC- mode: 0.05 to 20.000 Hz (3dB)Anti-aliasing filter DC/AC mode: Low pass -3 dB, 20 kHz butterworth, 3rd order, 77 dB in stop band @ >30 kHz IEPE (AC)-mode: High pass is 0.05 Hz
		Sample rate	Up to 57kHz, 4 channels simultaneous (Max 20kHz via EtherCAT for 4 channels) Software selectable sample rate : 57594, 29297,14648 or 7324 Hz Selectable down sampling : 1:2, 1:5, 10, 25, 50, 100, 250, 500, 1000, 2500, 5000
		Resolution	24 bit delta-sigma ΔΣ (including sign) 300 nV (gain 1, Range ±2,5Vp) ENOB = 19 @ OSR=256, 29297 sps
		SNR	Typical > 100 dB @ Range ±2.5 Vp
		Accuracy	± 0.5 % of selected range
		Diagnostic	Wire-break and short circuit
		Isolation	4 inputs in 4 groups, each optically isolated from other potentials, 500 V DC
	Connector, grip	CMM6·2: 2 x 2 terminals: 1790483 (included by default)	
	Size	25.4 mm	
	Weight	110 g (incl. connectors)	
	Power consumption	Max. 6 W	

NOTE * Data is buffered and transferred continuously via EtherCAT® to the EtherCAT® master. Use of data transfer bandwidth on the EtherCAT® bus has to be considered. The number of high speed analogue channels, down sampling rate and collecting intervals, and CPU power of EtherCAT® master has influence on bandwidth used for data transfer.

Available on request:

- Sample CODESYS application and library for Basic Signal processing, Frequency Analysis, Statistics, Level detection for Warning and Alarms.
- CMM6·3 and CMM6·4: 2- and 4-channel variants with shielded M12 connectors.

2.12 Accessories

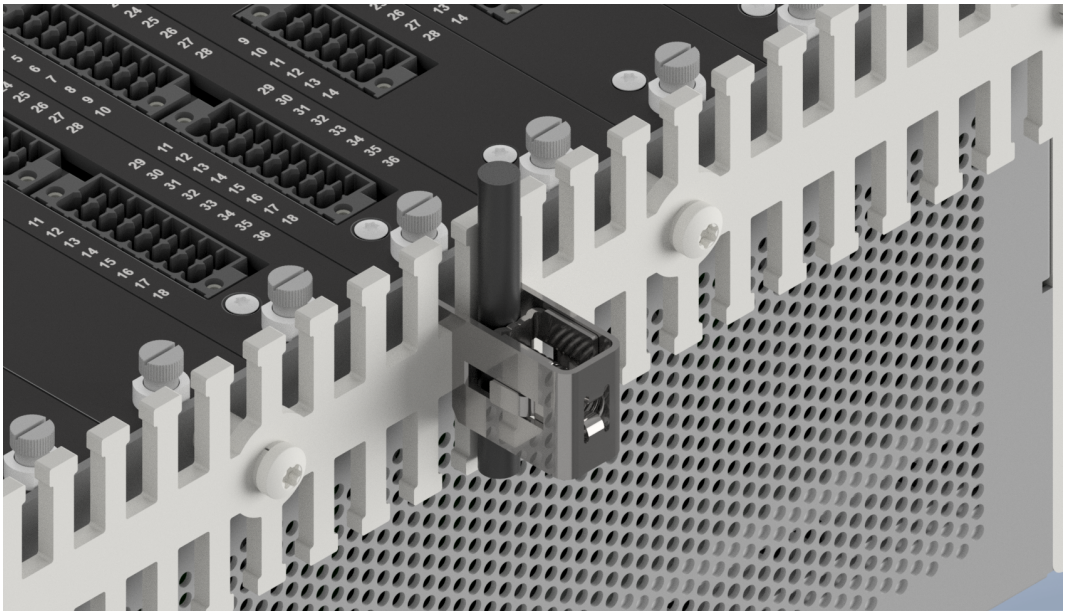
2.12.1 Wire support

The controller rack can be ordered with wire support brackets that are pre-mounted from the factory. The wire support is a 3 x 10 mm metal bar with hooks to secure and support wires, and is mounted at the top and bottom of the rack.

Shield clamps, typically used for communication cables (3 to 10 mm in diameter), can be mounted on the wire support bar. The clamps provide an EMC shield that is close to the input terminals.

Rack	Accessory
Rack6·10	Wiresupport, Rack6·10
Rack6·12	Wiresupport, Rack6·12
Rack6·14	Wiresupport, Rack6·14
Rack6·4	Wiresupport, Rack6·4
Rack6·6	Wiresupport, Rack6·6
Rack6·8	Wiresupport, Rack6·8

Wire support bracket mounted on a controller rack



2.12.2 Optional connector kits

Connector kit	Description
Conn. kit AIO6·1	Connector kit for AIO6·1
Conn. kit CMM6·1	Connector kit for CMM6·1
Conn. kit CMM6·2	Connector kit for CMM6·2
Conn. kit DIO6·1	Connector kit for DIO6·1
Conn. kit IFM6·1	Connector kit for IFM6·1
Conn. kit IFM6·2	Connector kit for IFM6·2
Conn. kit PCM6·2	Connector kit for PCM6·2
Conn. kit PDM6·1	Connector kit for PDM6·1

Connector kit	Description
Conn. kit TIM6·1	Connector kit for TIM6·1
Conn. kit 1..20	Connector kit for I/O module (1 pcs 2 x 20 pin)
Conn. kit 1..40	Connector kit for I/O module (2 pcs 2 x 20 pin)

2.12.3 Blind module

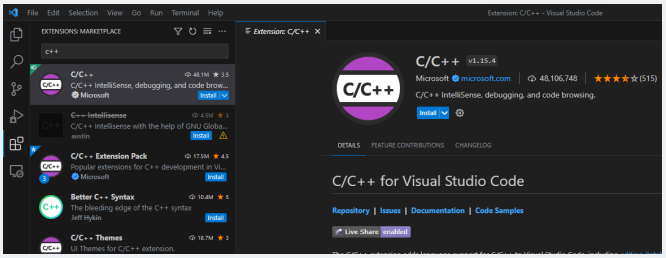
Blank / blind

Specifications	
Size	25.40 mm
Weight	25 g

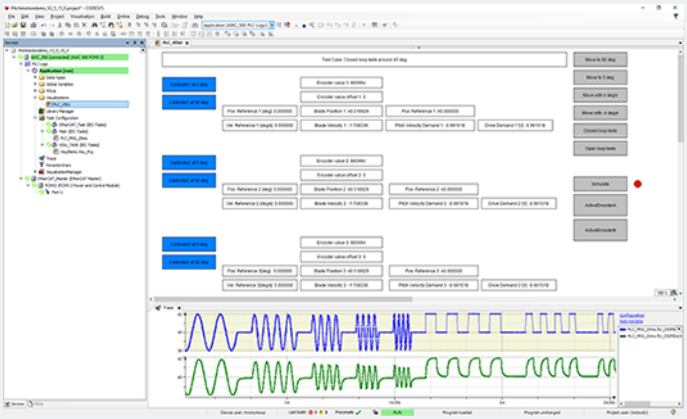
3. Application development

3.1 Software packages

3.1.1 C/C++ programming

Application development	
	Linux® SDK (Software Development Kit) available for use with for example Eclipse IDE, Visual Studio IDE or CODESYS IDE.
Linux SDK	• Docker image with GNU gcc/gdb toolchain installed for remote compilation.

3.1.2 IEC61131-3 programming

Application Development	
	IEC61131-3 PLC-programmed based on CODESYS V3 Programming languages: • Sequential Function Chart (SFC) • Function Block Diagram (FBD) • Structured Text (ST) • Ladder Diagram (LD) • ANSI C/C++ (via Linux SDK) • Multi-language help in Chinese, German and English • Programmed via Ethernet connection (TCP/IP) • Download of boot projects and source code • Integrated PLC and task configuration • Web visualisation on PanelPC or remote via Secure communication (HTTPS) • Online debugging and sampling • Trace-integrated simulation
iE 650 PLC CODESYS package	• CODESYS V3.5 IDE • DEIF TSP (Target Support Package) with EtherCAT device description files.

3.1.3 Supported software features

Software	Linux SDK	CODESYS (with Web visualization)
PLC runtime	-	CODESYS V3.5 SP18+
Programming		
IEC61131-3	-	LD, SFC, FBD, CFC, ST

Software	Linux SDK	CODESYS (with Web visualization)
	-	CODESYS V3.5 SP18+ IDE
Network protocols		
	File Transfer Protocol (FTP), server and client (disabled by default)	
	Secure/SSH File Transfer Protocol (SFTP), server	
	Trivial File Transfer Protocol (TFTP), client	
	Secure Copy (SCP), server and client	
	Secure Shell (SSH), version 2, server and client	
	Network Time Protocol (NTP), client	
	Dynamic Host Configuration Protocol (DHCP), client	
Visualisation		
		CODESYS Web visualisation
System Configuration		
	Webbased system configuration for IP address (static/dynamic), operator, admin, system information etc.	
Device handling		CODESYS Device handling (EtherCAT Master, CANOpen Manager, Profibus Master etc.)
Configuration		
Visualisation designer		CODESYS V3.5 visualisation
Scope/trace		Scope/trace
HMI visualisation tool		CODESYS web visualisation
		Panel PC and remote HMI client (communication via HTTPS) Requires: Browser with HTML5/JavaScript support, such as Chrome, Firefox, Safari, Edge, and more
Controller redundancy	-	Yes - CODESYS Controller Redundancy (Option)

Communication protocols

Software	Linux SDK	CODESYS (with Web visualization)
OPC UA Server	-	Yes - CODESYS OPC UA Server
OPC UA Client	-	Yes - CODESYS OPC UA Client via Single License (purchase separately from CODESYS Store)
Modbus TCP Server	-	Yes - Modbus TCP Server (CODESYS) libModbus (DEIF)
Modbus TCP Client	-	Yes - Modbus TCP Server (CODESYS) libModbus (DEIF)
Modbus RTU Master	-	Yes - Modbus TCP Server (CODESYS) libModbus (DEIF)
Modbus RTU Slave	-	Yes - Modbus RTU Slave (CODESYS)
EtherCAT Master	Yes	Yes - EtherCAT Master (CODESYS)
CAN Layer II	-	Yes - via CODESYS library
CANopen Master	-	Yes - CANopen Master (CODESYS)

Software	Linux SDK	CODESYS (with Web visualization)
CANopen Slave	-	Yes - CANopen Slave (CODESYS)
PROFINET V2.3 Class A RT CONTROLLER	-	Yes - (CODESYS)
PROFINET V2.3 Class A RT DEVICE	-	Yes - (CODESYS)
Others		On request or via CODESYS Single License

4. Legal information

4.1 Disclaimer and copyright

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)

Use of Non-cybersecurity certified software (Developer edition firmware)

The Developer/Engineering Edition Firmware (identified as *iE x50 UPE vX* software bundle) is intended solely for advanced development purposes.

It permits users to edit or remove embedded cybersecurity rules and policies, perform customisations, run own applications or integrate 3rd party software, that inhibits DEIF to take responsibility for the software to comply with product relevant cybersecurity standards.

To the extent that the customer modifies or disables such cybersecurity features, DEIF shall bear no responsibility or liability for any resulting security vulnerabilities, unauthorized external access, data breaches, or any other interference or damages affecting the project. The customer assumes full responsibility for the consequences of any such modifications and has the responsibility for relevant cybersecurity certifications.

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