

AWC 500

Advanced controller

Data sheet



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Tomorrow



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1. AWC 500 system

1.1 System specifications

System specifications

The AWC 500 is designed as a highly flexible, modular process controller covering the special demands of for example wind power plants in terms of reliability, robustness and flexibility.

Technical specifications



Default rack sizes	Rack5-0, Rack5-1, Rack5-2, Rack5-3, Rack5-5 and Rack5-8 All racks have one slot reserved for a PCM5-x or PDM5-1 and a variable number of I/O modules. The maximum number of I/O modules is indicated in the name of the rack. For example; the rack named Rack5-2 has two available slots for I/O modules.	
Temperature	Operating: -40 to 70 °C Storage: -40 to 85 °C Reference: 15 to 30 °C	IEC 60068-2-1 IEC 60068-2-2
Climate	All modules are conformal coated, hence protected against moisture, mold, dust, corrosion and other environmental stresses. 55 °C / 97 % relative humidity, condensing	IEC 60068-2-30, test Db
Altitude	Up-to 4,000 m without de-rating For deployment above 4,000 m contact Product Management	
Vibration	3 to 13.2 Hz: 6 mm _{peak-peak} 13.2 to 50 Hz: 2.1 g 3 to 13.2 Hz: 2.85 mm _{peak-peak} 13.2 to 100 Hz: 1.0 g	IEC 60068-2-6, DNV C IEC 60068-2-6, DNV A IACS E10
Shock	50 g, 11 ms, half sine Tested with 3 impacts in each direction in all 3 axes A total of 18 impacts per test	IEC 60068-2-27, test Ea
Bump	25 g, 6 ms, half sine 1,000 bumps in each direction. 2 directions in each axis A total of 6,000 bumps	IEC 60068-2-27, test Ea

Technical specifications

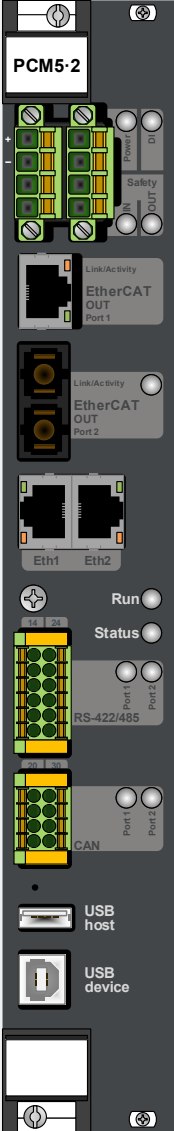
EMC/CE	Electromagnetic compatibility (EMC)	EN 61000-6-1/2/3/4
	Electrostatic discharge (ESD): Contact: 7.2 kV Air: 9.6 kV	EN 61000-4-2
	Radiated E-field emission: 30 to 230 MHz: 40 dB (µV/m) 230 to 1,000 MHz: 47 dB (µV/m) 1 to 3 GHz: 70 dB (µV/m) peak 1 to 3 GHz: 50 dB (µV/m) average 3 to 6 GHz: 74 dB (µV/m) peak 3 to 6 GHz: 54 dB (µV/m) average	IEC 61000-6-3 (not PCM5-2), IEC 61000-6-4, IEC 60255-26
	Conducted emission:	IEC 60255-26
	Fast transients (burst): Power: 2.4 kV _p Signal: 1.2 kV _p	IEC 60255-22-4, GL, LR, DNV, EN 61000-4-4
	Slow transients (surge): AC power: DM 2 kV _p , CM 4 kV _p DC power: DM 1 kV _p , CM 2 kV _p Signal and I/O: DM 1 kV _p , CM 2 kV _p Frequency input: DM 1 kV _p , CM 1.2 kV _p	IACS E10, IEC60533, EN 60945, IEC 60255-26, EN 61000-4-5
	RF E-field (electric) immunity: 80 to 2,000 MHz: 12 V/m 2 to 3 GHz: 10 V/m	IEC 60255-26, EN60945, GL, LR, BV, DNV, EN 61000-4-3
	RF conducted immunity 0.15 to 80 MHz: 12 V _{RMS}	IEC 60255-26, EN 60945, GL, LR, BV, DNV, EN 61000-4-6
	Power frequency H-field (magnetic) immunity: Field: 400 A/m	IEC 60051, EN 61000-4-8
Safety	Installation (over-voltage) category III, 600 V, pollution degree 2.	EN 61010-1
Protection class	IP30	IEC/EN 60529
Material	Aluminium case and cover plates. All plastic parts are self-extinguishing.	UL94 (V1)
UL/cUL Listing	UL applications: Maximum surrounding temperature 60 °C. Use min. 75/90 °C copper conductors only. Terminal tightening torque 5-7 lb-in or equivalent. Use AWG 30-12 or equivalent wire size. To be installed in accordance with the NEC (United States) or the CEC (Canada).	UL/cUL Listed to UL508 & CSA C22.2 No. 142-M1987

2. Power and Control Modules

2.1 PCM5•2 module specifications

PCM5•2 module specifications

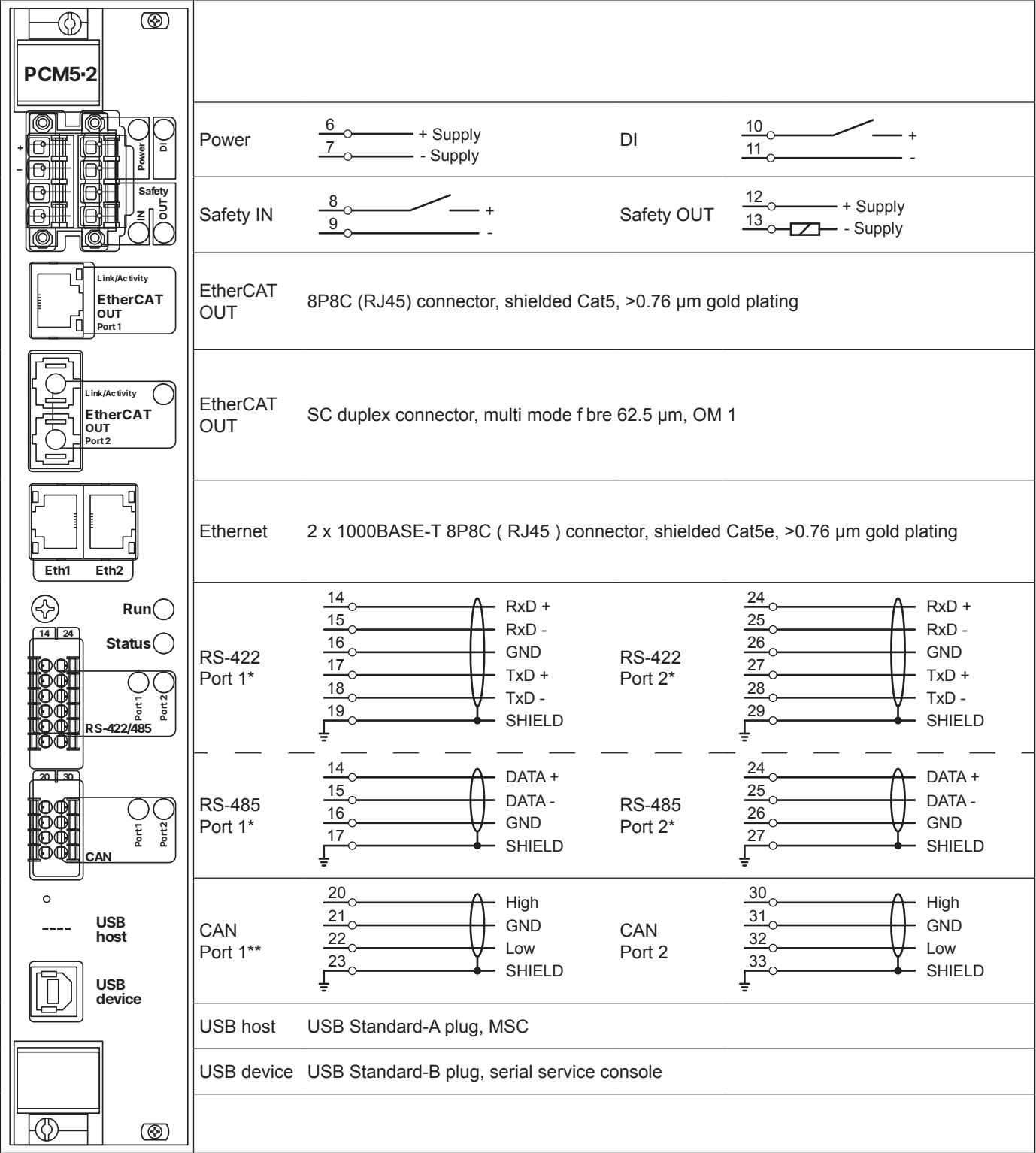
The PCM5•2 module offers a powerful dual core 1 GHz application CPU. It is well suited for extremely demanding C/C++ and CODESYS applications, ultra fast data logging as well as redundant hot-standby solution for land applications.

Power and control module		
 The image shows the front panel of the PCM5•2 module. It features a variety of ports and indicators: a power supply connector at the top, a digital input (DI) terminal, a safety output terminal, two EtherCAT OUT ports (Port 1 and Port 2), two Ethernet ports (Eth1 and Eth2), a Run button, a Status indicator, RS-422/485 ports (Port 1 and Port 2), a CAN port, a USB host port, a USB device port, and a small display screen at the bottom.	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.
	Programming	ANSI C/C++ and IEC 61131-3 via CODESYS version 3 (optional)
	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.

2.1.1 PCM5-2 wiring



*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.

2.1.2 PCM5-2 terminal specifications

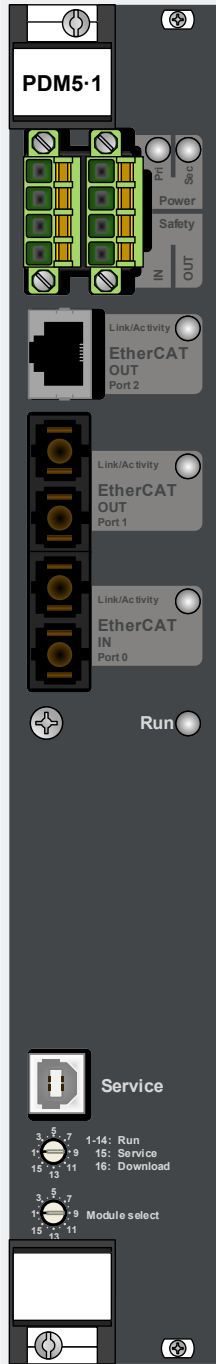
	Terminal	Description
1	ECAT OUT P1	EtherCAT OUT Port 1
2	ECAT OUT P2	EtherCAT OUT Port 2
3	Eth1, Eth2	Ethernet 1 and 2
4	USB host	USB, Mass Storage Class
5	USB device	USB, Media Transfer Protocol, serial service console
6	Power supply +	Power supply input, 24 V
7	Power supply -	Power supply input, GND
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

3. Power and Distributed communication Modules

3.1 PDM5•1 module specifications

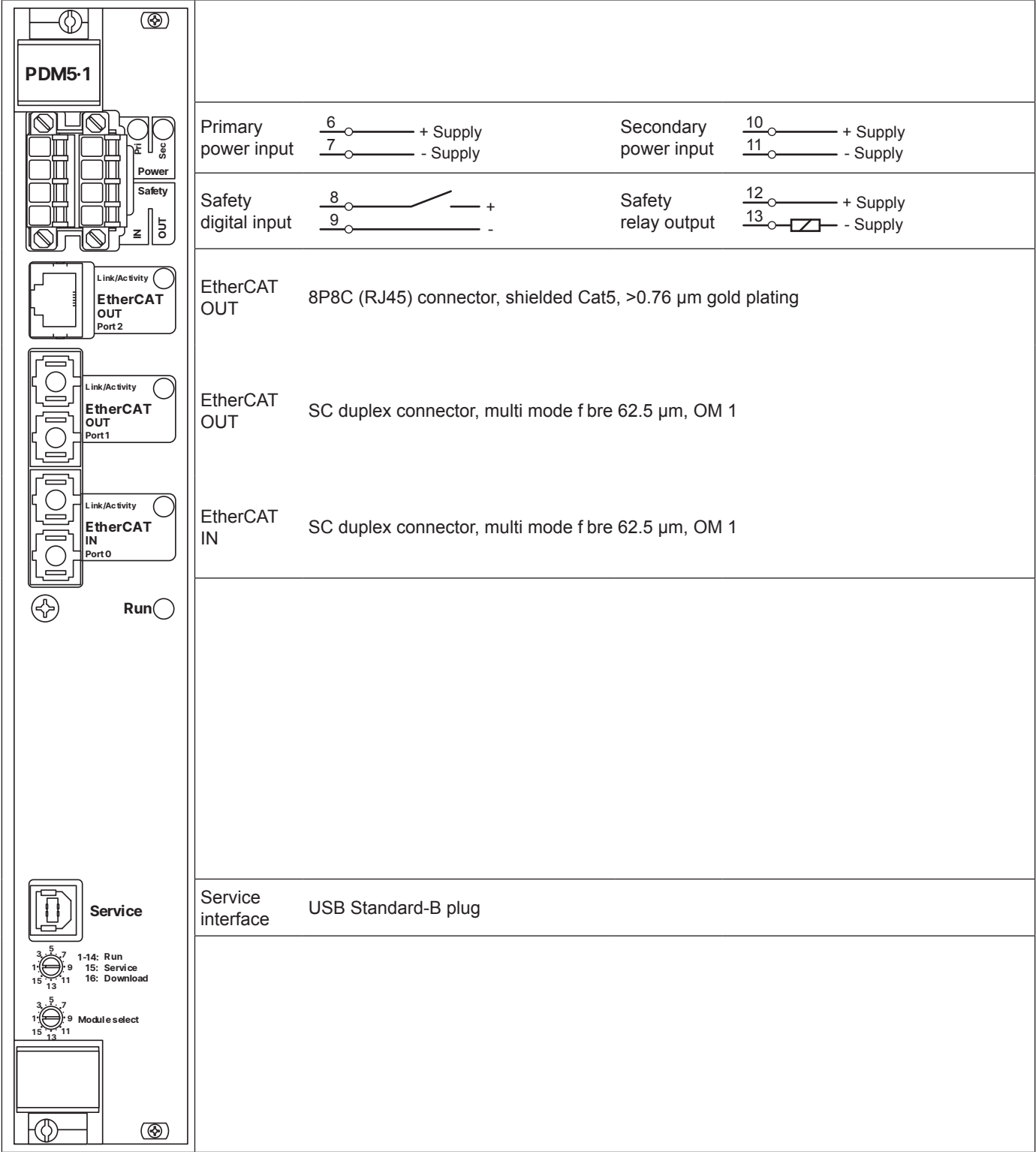
The PDM5•1 module is used as an EtherCAT interface for distributed I/O nodes via fibre optical Ethernet.

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 k Ω 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 μ m gold plating 1 x EtherCAT® OUT (Port 1), optical: 100Base-FX, SC connectors, multimode fibre 62.5 μ m, OM1 1 x EtherCAT® IN (Port 0), optical: 100Base-FX, SC connectors, multimode fibre 62.5 μ m, 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

3.1.1 PDM5-1 wiring



3.1.2 PDM5-1 terminal specifications

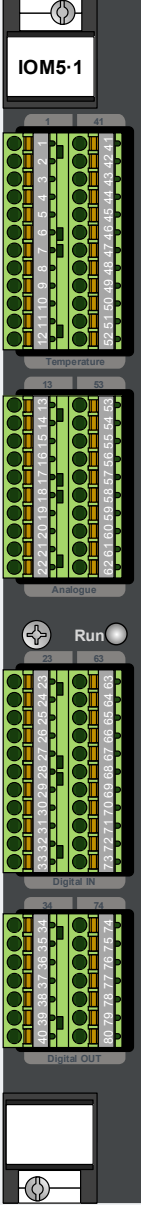
	Terminal	Description
1	ECAT OUT P1	EtherCAT OUT Port 1
2	ECAT OUT P2	EtherCAT OUT Port 2
3	ECAT OUT P0	EtherCAT OUT Port 0
4		
5	Service	USB Service interface
6	Power supply + (Pri)	Primary power supply input, 24 V
7	Power supply - (Pri)	Primary power supply input, GND
8	Safety IN	Safety chain digital 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. Input and Output Modules

4.1 IOM5•1 module specifications

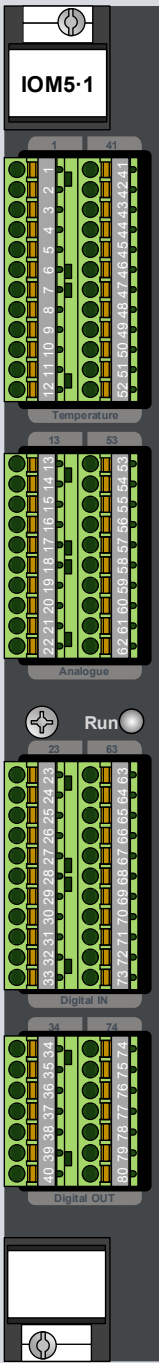
IOM5•1 is a highly flexible I/O module which holds the most commonly used I/O signals in a wind power plant. IOM5•1 is designed for the rough electrical environments, and all inputs and outputs are protected by optical isolation from other potentials.

40 channel multi-function I/O module with analogue inputs, temperature inputs, digital inputs, frequency counter inputs, analogue outputs and digital outputs

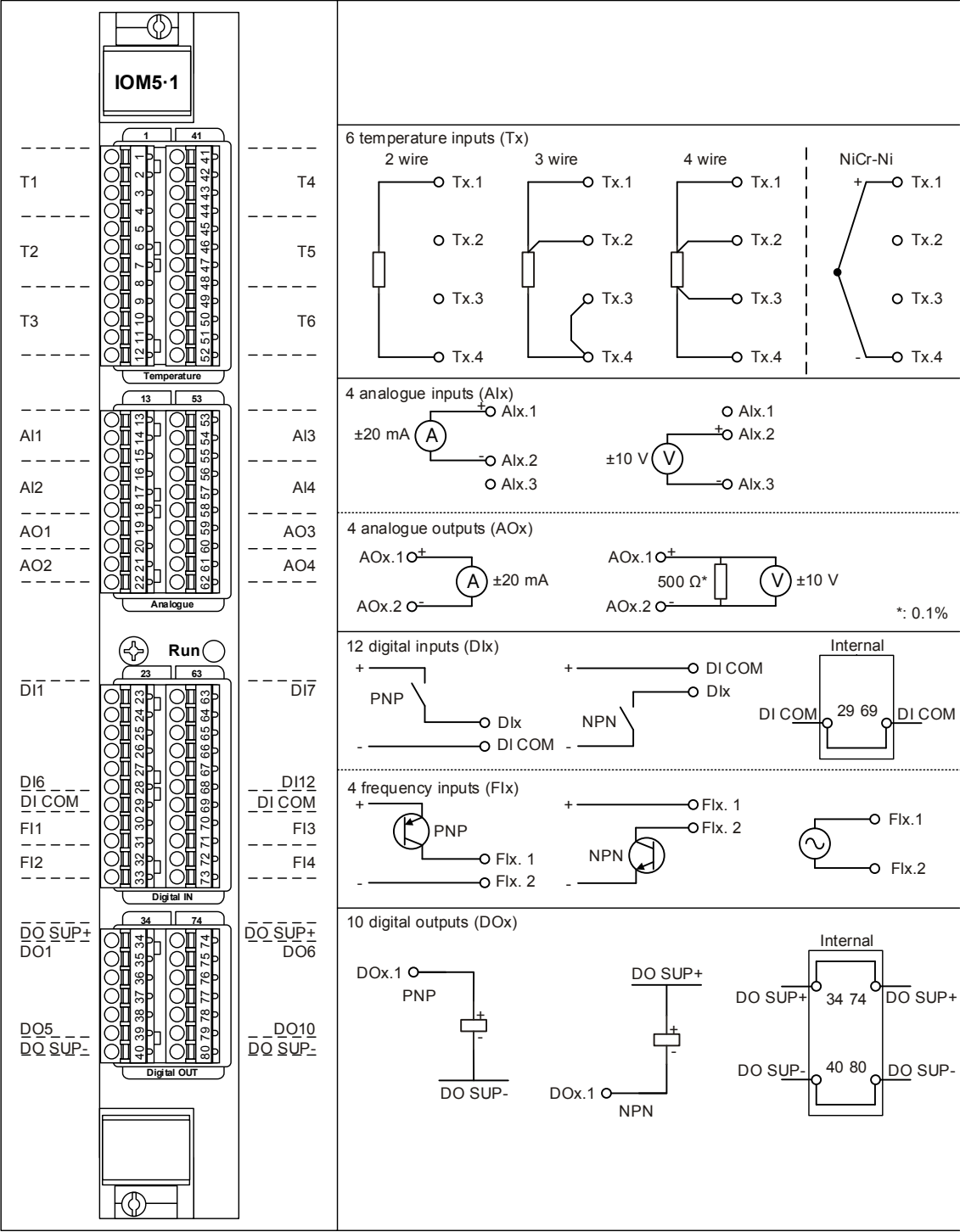
	12 digital inputs	Input	High*: 9 to 36 V or -9 to -36 V with reference to common Low: 5 to -5 V with reference to common
		Impedance	Approximately 2.4 kΩ
		Isolation	Optically isolated from other potentials, 550 V 50 Hz
	4 frequency/digital inputs	Input	High*1: 9 to 36 V Low: 0 to 5 V
		Impedance	Approximately 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
	10 digital outputs	Resolution	0.8 μs
		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)	

4.1.1 IOM5-1 wiring



4.1.2 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

Terminals		Description
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
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

Terminals		Description
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

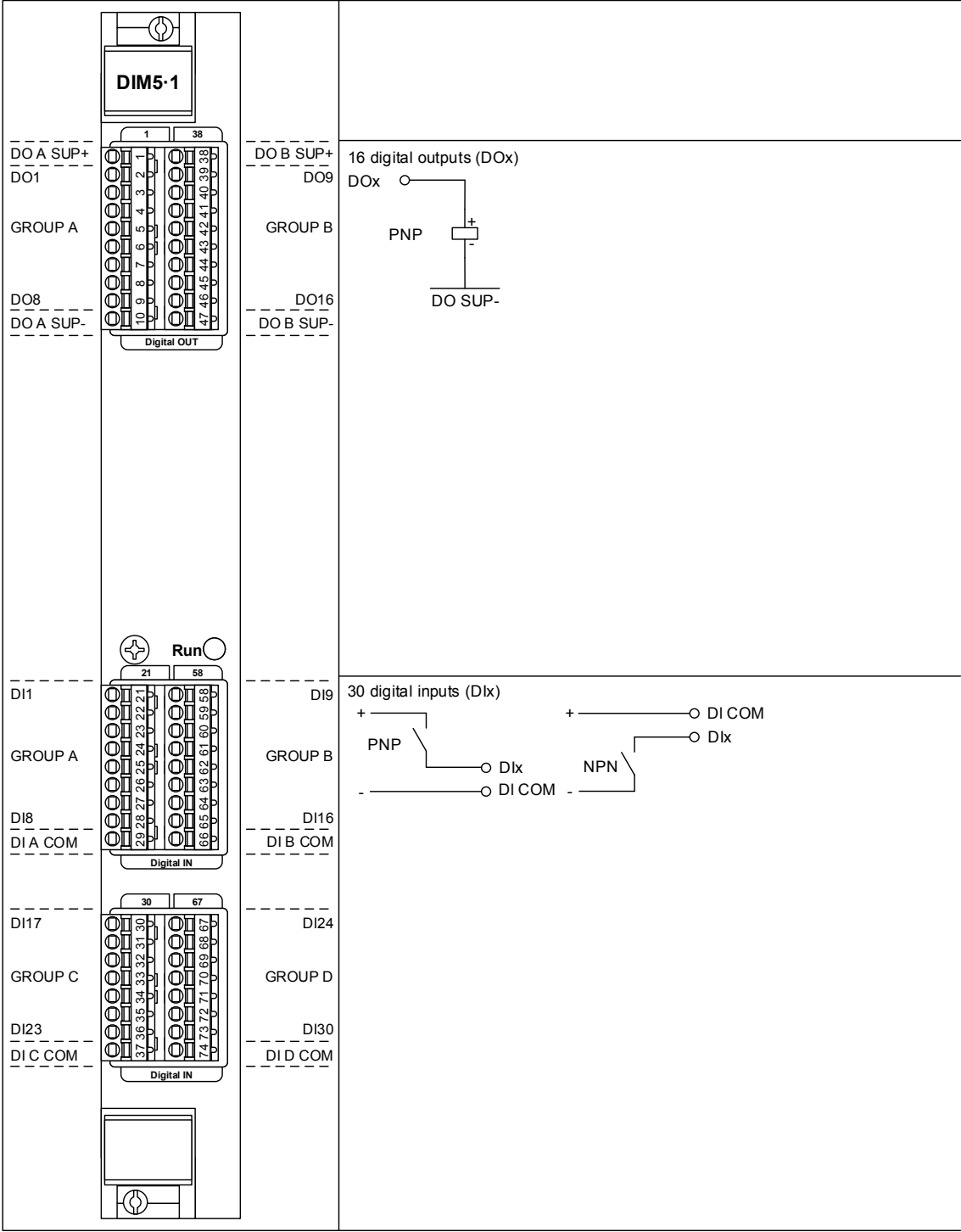
4.2 DIM5· 1 module specifications

The Digital I/O Module, DIM5·1, is a dedicated digital I/O module offering 30 digital inputs as well as 16 digital outputs. The 30 digital inputs are divided into four individually galvanically separated groups, and the 16 digital outputs are divided into two individually galvanically separated groups.

46 channel digital I/O module			
	16 digital outputs (split in two groups with 8 DO in each; A and B)	Supply	External supply 12 to 36 V The status of the external supply can be monitored.
		Voltage	Voltage drop <1 V according to external supply
		Current	For each output: 0 to 500 mA source Maximum total for all outputs in same group: 2 A
		Isolation	Optically isolated from other potentials, 550 V 50 Hz
		Protection	Current limited for short-circuit protection or thermal overload. The status of the protection can be monitored.
	30 digital inputs (split in four groups with 8 DI in groups A and B; and 7 DI in groups C and D)	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
	Size	6 TE (30.48 mm)	
	Power consumption	Maximum 2 W	

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

4.2.1 DIM5-1 wiring



4.2.2 DIM5-1 terminal specifications

Terminals		Description
1	DO A SUP+	24 V digital output supply for DO1-DO8; Group A
2	DO1	Digital output 1
3	DO2	Digital output 2
4	DO3	Digital output 3
5	DO4	Digital output 4
6	DO5	Digital output 5

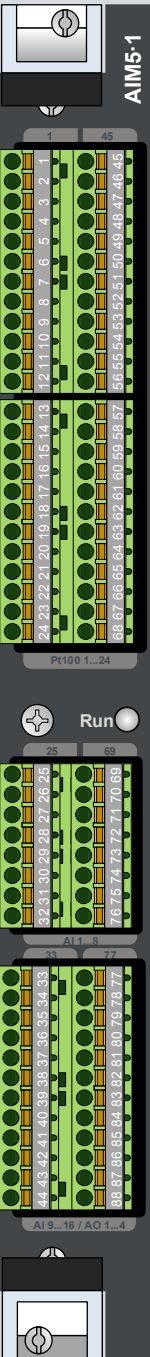
Terminals		Description
7	DO6	Digital output 6
8	DO7	Digital output 7
9	DO8	Digital output 8
10	DO A SUP-	GND digital output supply for DO1-DO8; Group A
38	DO B SUP+	24 V digital output supply for DO9-DO16; Group B
39	DO9	Digital output 9
40	DO10	Digital output 10
41	DO11	Digital output 11
42	DO12	Digital output 12
43	DO13	Digital output 13
44	DO14	Digital output 14
45	DO15	Digital output 15
46	DO16	Digital output 16
47	DO B SUP-	GND digital output supply for DO9-DO16; Group B
21	DI1	Digital input 1
22	DI2	Digital input 2
23	DI3	Digital input 3
24	DI4	Digital input 4
25	DI5	Digital input 5
26	DI6	Digital input 6
27	DI7	Digital input 7
28	DI8	Digital input 8
29	DI A COM	Digital common input reference supply (DI1-DI8). 24 V for NPN input signal, GND for PNP input signal.
58	DI9	Digital input 9
59	DI10	Digital input 10
60	DI11	Digital input 11
61	DI12	Digital input 12
62	DI13	Digital input 13
63	DI14	Digital input 14
64	DI15	Digital input 15
65	DI16	Digital input 16
66	DI B COM	Digital common input reference supply (DI9-DI16). 24 V for NPN input signal, GND for PNP input signal.
30	DI17	Digital input 17
31	DI18	Digital input 18
32	DI19	Digital input 19
33	DI20	Digital input 20
34	DI21	Digital input 21
35	DI22	Digital input 22
36	DI23	Digital input 23

Terminals		Description
37	DI C COM	Digital common input reference supply (DI17-DI23). 24 V for NPN input signal, GND for PNP input signal.
67	DI24	Digital input 24
68	DI25	Digital input 25
69	DI26	Digital input 26
70	DI27	Digital input 27
71	DI28	Digital input 28
72	DI29	Digital input 29
73	DI30	Digital input 30
74	DI D COM	Digital common input reference supply (DI24-DI30). 24 V for NPN input signal, GND for PNP input signal.

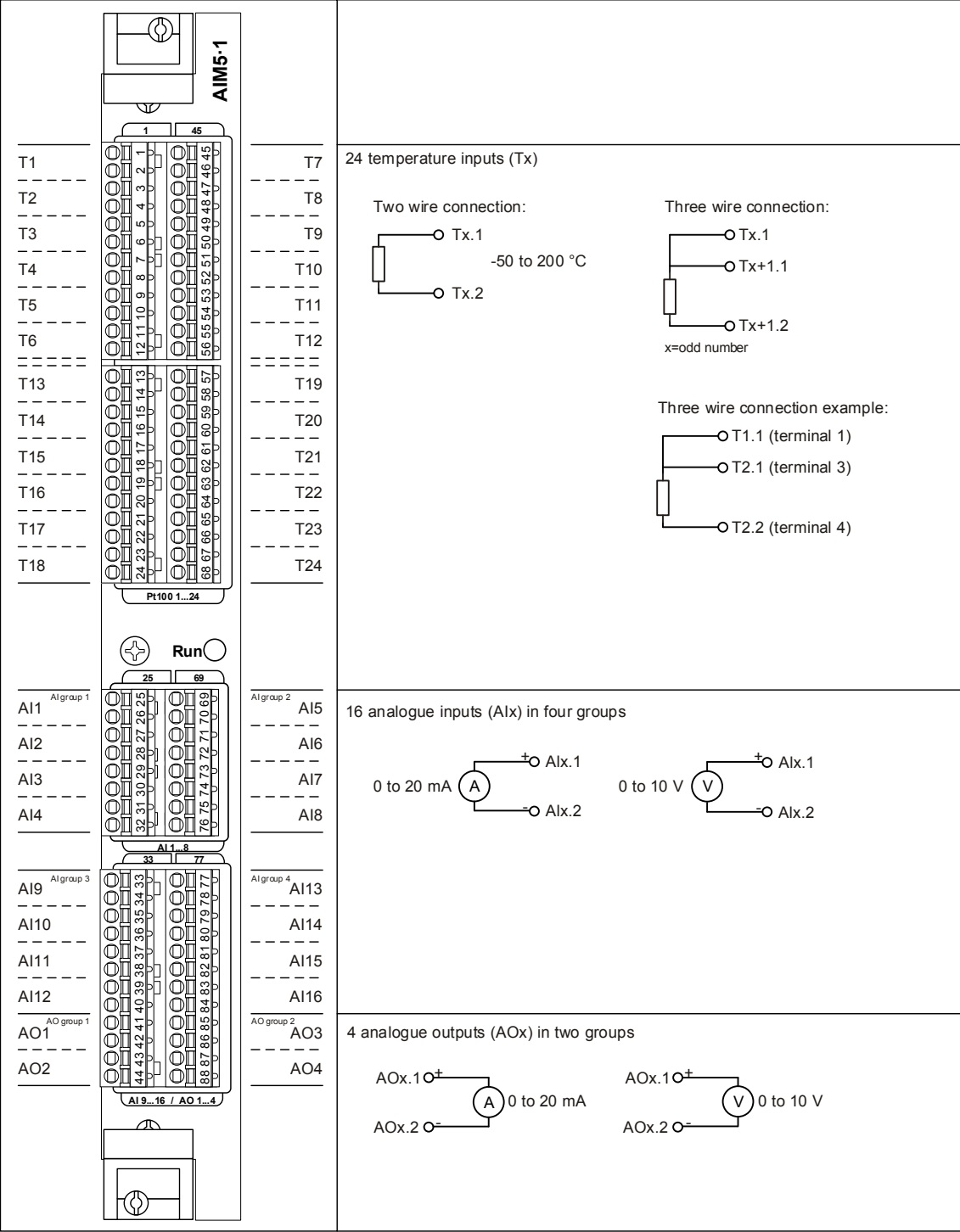
4.3 AIM5-1 module specifications

AIM5-1 module specifications

AIM5-1 is a high density I/O module which offers 24 2-wire Pt100 temperature inputs, 16 analogue inputs and 4 analogue outputs. Both the analogue inputs and outputs support both current and voltage, which can be configured in software.

44 channel multi-function I/O module with 24 temperature inputs, 16 analogue inputs and 4 analogue outputs		
 24 2-wire temperature inputs Two 2-wire inputs can be converted into one 3-wire input	Sensor type	Pt100
	Range	-50 to 200 °C
	Wire	2-wire and 3-wire
	Cable error	Open input and short-circuit are detected
	Resolution	0.1 °C
	Accuracy	1.0 °C at reference temperature 2.0 °C at operational temperature
	Isolation	One group. Galvanic isolated from other potentials, 550 V 50 Hz.
16 analogue inputs	Input type	0 to 20 mA or 0 to 10 V
	Impedance	≤50 Ω (mA-input) / ≥10 kΩ (V-input)
	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
4 analogue outputs	Isolation	Four groups. Galvanic isolated from other potentials, 550 V 50 Hz.
	Output	Range: 0 to 20 mA or 0 to 10 V
	Load	≤500 Ω (mA-output) / ≥1 kΩ (V-output)
	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	Two groups. Galvanic 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)	

4.3.1 AIM5-1 wiring



4.3.2 AIM5-1 terminal specifications

Terminals		Description
1-2	T1	Temperature 1
3-4	T2	Temperature 2 (supports 3-wire together with T1)
5-6	T3	Temperature 3
7-8	T4	Temperature 4 (supports 3-wire together with T3)
9-10	T5	Temperature 5
11-12	T6	Temperature 6 (supports 3-wire together with T5)

Terminals		Description
45-46	T7	Temperature 7
47-48	T8	Temperature 8 (supports 3-wire together with T7)
49-50	T9	Temperature 9
51-52	T10	Temperature 10 (supports 3-wire together with T9)
53-54	T11	Temperature 11
55-56	T12	Temperature 12 (supports 3-wire together with T11)
13-14	T13	Temperature 13
15-16	T14	Temperature 14 (supports 3-wire together with T13)
17-18	T15	Temperature 15
19-20	T16	Temperature 16 (supports 3-wire together with T15)
21-22	T17	Temperature 17
23-24	T18	Temperature 18 (supports 3-wire together with T17)
57-58	T19	Temperature 19
59-60	T20	Temperature 20 (supports 3-wire together with T19)
61-62	T21	Temperature 21
63-64	T22	Temperature 22 (supports 3-wire together with T21)
65-66	T23	Temperature 23
67-68	T24	Temperature 24 (supports 3-wire together with T23)
25-26	AI1	Analogue input 1
27-28	AI2	Analogue input 2
29-30	AI3	Analogue input 3
31-32	AI4	Analogue input 4
59-70	AI5	Analogue input 5
71-72	AI6	Analogue input 6
73-74	AI7	Analogue input 7
75-76	AI8	Analogue input 8
33-34	AI9	Analogue input 9
35-36	AI10	Analogue input 10
37-38	AI11	Analogue input 11
39-40	AI12	Analogue input 12
77-78	AI13	Analogue input 13
79-80	AI14	Analogue input 14
81-82	AI15	Analogue input 15
83-84	AI16	Analogue input 16
41-42	AO1	Analogue output 1
43-44	AO2	Analogue output 2
85-86	AO3	Analogue output 3
87-88	AO4	Analogue output 4

5. Grid Protection Module

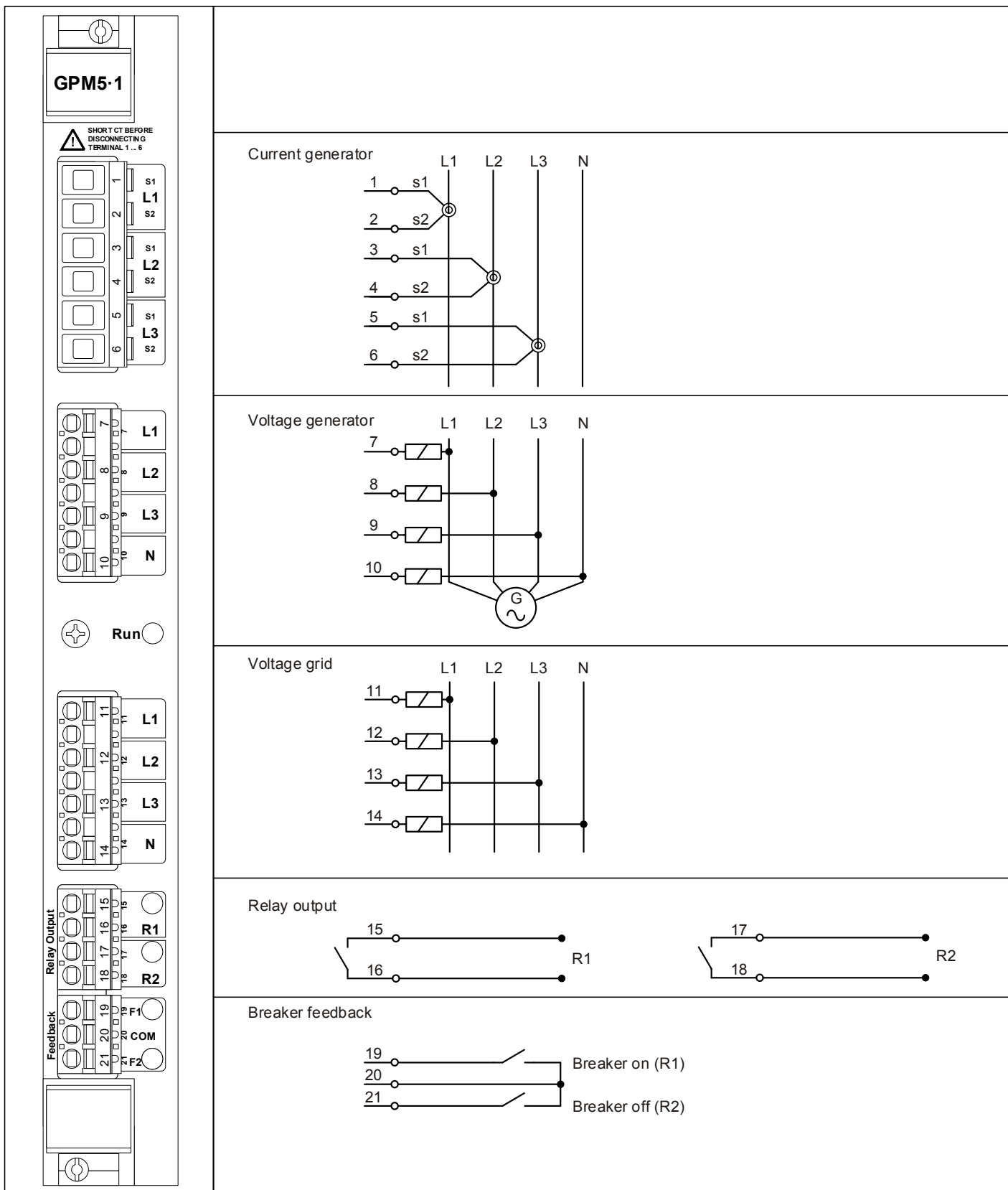
5.1 GPM5•1 module specifications

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

 GPM5-1 SHORT CT BEFORE DISCONNECTING TERMINAL 1...6 Inputs: 1-6 (S1, L1, S2, L2, S1, L3, S2, L3) Outputs: 7-10 (L1, L2, L3, N) Relay Output: 11-14 (L1, L2, L3, N) Feedback: 15-18 (R1, R2, COM, R2) Power consumption: 19-21 (2F1, 2F2, COM)	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
	Outputs	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

5.1.1 GPM5-1 wiring



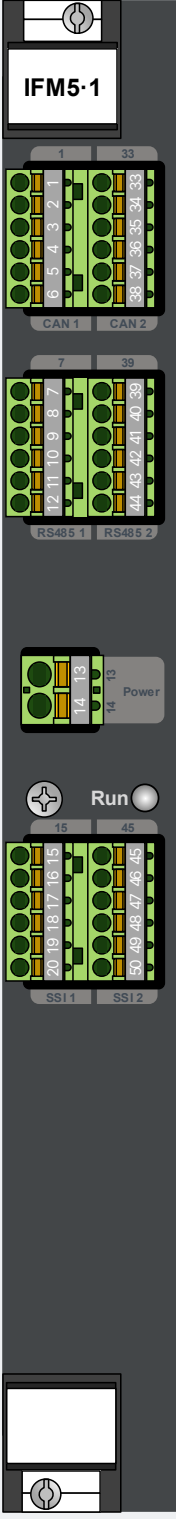
5.1.2 GPM5-1 terminal specifications

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

6. Interface and Fieldbus Modules

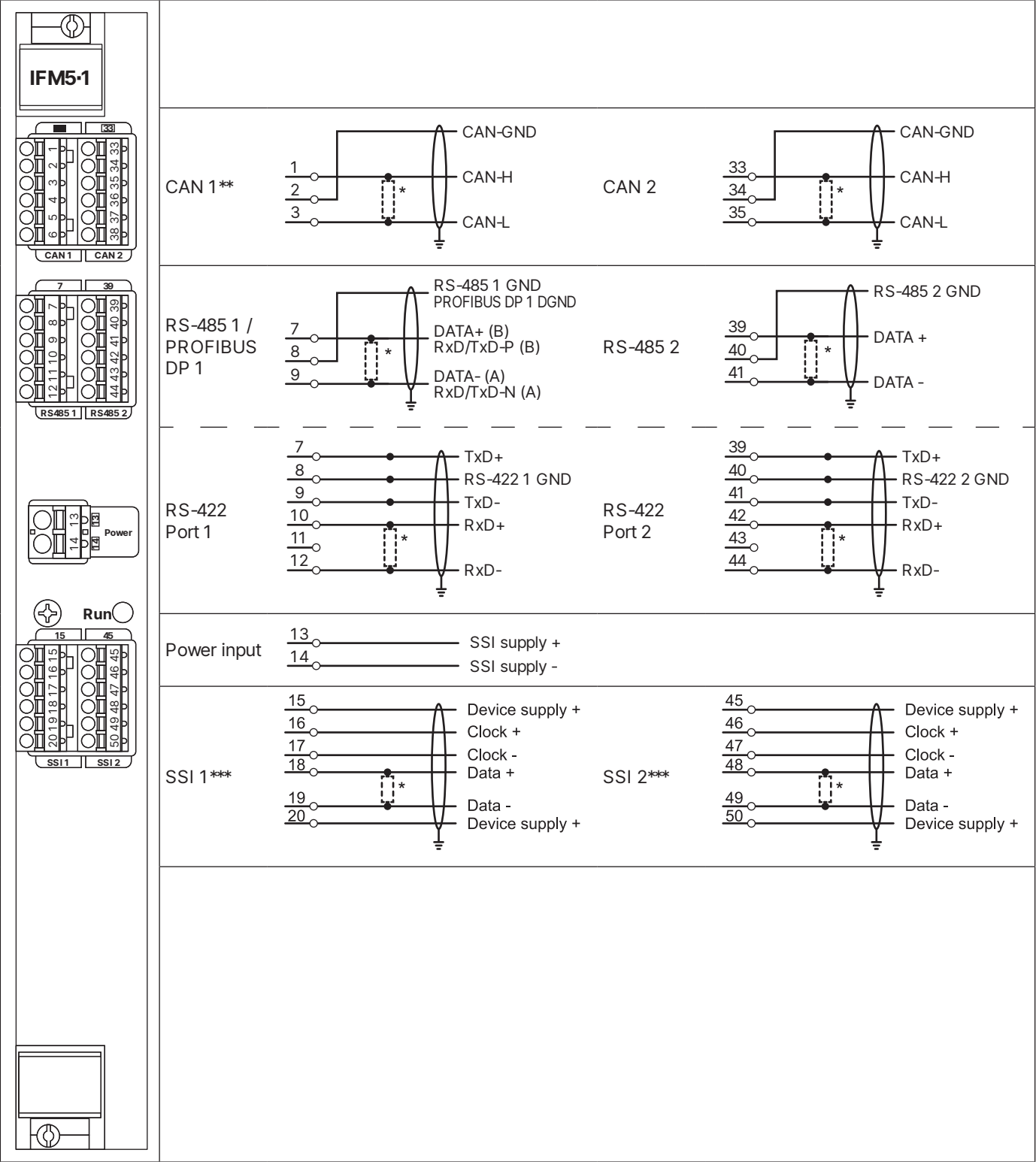
6.1 IFM5•1 module specifications

The IFM5•1 interface and fieldbus module with two firmware variants offers RS-485/422, SSI and CAN interfaces or alternatively PROFIBUS DP Master and SSI interface (as variant IFM5•1 Profi).

RS-485/422, SSI and CAN interfaces		
 IFM5•1 2 RS-485/422 or 1 DP Master interface 2 CAN interfaces* 2 SSI interfaces Size Power consumption	RS-485/422	
	Standards	TIA/EIA-485 ANSI/TIA/EIA-422-B
	Baud rate	4.8 to 921.6 kbit/s
	Word length	5, 6, 7 or 8 bits
	Parity	None, even, odd, mark or space
	Stop bits	1 or 2
	Flow control	None
	Biasing	On or off
	Communication lines	4 wire full duplex or 2 wire half duplex
	DP Master	
	Standards	PROFIBUS DP-V0 (Cyclic data and diagnostics)
	Baud rate	9.6 kbaud to 3 Mbaud
	Max. slaves	4
	Isolation	Optically isolated from other potentials, 550 V 50 Hz.
	Standards	ISO 11898
	Baud rate	20, 50, 125, 250, 500, 800 or 1000 kbit/s sample point at 80 to 87.5 %
	Isolation	Optically isolated from other potentials, 550 V 50 Hz.
	Standards	Synchronous Serial Interface, SSI Stegmann Interface ANSI/TIA/EIA-422-B
	Baud rate	125, 250, 500, 1000, 1250 or 1500 kbit/s
	Word length	8 to 32 bits
	Data delay	Configurable: 0.04 to 50 ms
	Coding	Binary or Gray code
	Frame error suppression	Yes or no
	Isolation	As a group, SSI is optically isolated from other potentials, 550 V 50 Hz.
	SSI device supply	24 V, maximum 100 mA per channel/device.
	SSI power supply input	18 to 36 V, maximum 1 A
Size		6 TE (30.48 mm)
Power consumption		Maximum 4 W

*Note: CAN and UART via RS-485/422 are not functional in firmware variant IFM5•1 Profi.

6.1.1 IFM5-1 wiring



*Note Termination resistor (typically, 120 Ω for twisted pairs).

**Note: SW configurable (on/off) bias (pull up/pull down, 470 Ω).
GND decoupled to shield through 1.5 MΩ || 1.5 nF.

***Note: GND decoupled to shield through 1.5 nF.

6.1.2 IFM5-1 terminal specifications

	Terminal	Description
1	CAN-H	CAN 1: differential data signal, '+', non-inverting pin
2	CAN-GND	CAN 1: reference potential
3	CAN-L	CAN 1: differential data signal, '-', inverting pin
4 to 6	-	Not used
7	DATA +	RS-485 1: differential data signal, '+', non-inverting pin
	RxD/TxD-P	PROFIBUS DP 1: Dataline plus (B conductor) (Red)
	TxD +	RS-422 1: differential receive signal, '+', non-inverting pin
8	GND	RS-485/422 1: reference potential
	DGND	PROFIBUS DP 1 : Data ground
9	DATA -	RS-485 1: differential data signal, '-', inverting pin
	RxD/TxD-N	PROFIBUS DP 1: Dataline minus (A conductor) (Green)
	TxD -	RS-422 1: differential receive signal, '-', inverting pin
10	RxD +	RS-422 1: differential transmit signal, '+', non-inverting pin
11	-	Not connected
12	RxD -	RS-422 1: differential transmit signal, '-', inverting pin
13	+SSI supply	Power input for device supplies, 24 V
14	-SSI supply	Power input for device supplies, GND
15	Device supply +	SSI 1: 24 V
16	Clock +	SSI 1: differential clock signal, '+', non-inverting pin
17	Clock -	SSI 1: differential clock signal, '-', inverting pin
18	Data +	SSI 1: differential data signal, '+', non-inverting pin
19	Data -	SSI 1: differential data signal, '-', inverting pin
20	Device supply -	SSI 1: GND
21 to 32	-	Not used
33	CAN-H	CAN 2: differential data signal, '+', non-inverting pin
34	Shield	CAN 2: reference potential
35	CAN-L	CAN 2: differential data signal, '-', inverting pin
36 to 38	-	Not used
39	DATA +	RS-485 2: differential data signal, '+', non-inverting pin
	TxD +	RS-422 2: differential receive signal, '+', non-inverting pin
40	GND	RS-485/422 2: reference potential
41	DATA -	RS-485 2: differential data signal, '-', inverting pin
	TxD -	RS-422 2: differential receive signal, '-', inverting pin
42	RxD +	RS-422 2: differential transmit signal, '+', non-inverting pin
43	-	Not connected
44	RxD -	RS-422 2: differential transmit signal, '-', inverting pin
45	Encoder supply +	SSI 2: 24 V
46	Clock +	SSI 2: differential clock signal, '+', non-inverting pin

	Terminal	Description
47	Clock -	SSI 2: differential clock signal, '-', inverting pin
48	Data +	SSI 2: differential data signal, '+', non-inverting pin
49	Data -	SSI 2: differential data signal, '-', inverting pin
50	Encoder supply -	SSI 2: GND

6.2 IFM5•2 module specifications

The IFM5•2 is an industrial grade Ethernet switch with extreme robustness and operation temperature range.

The IFM5•2 can serve as a media converter module, securing galvanic isolation of networks in the wind turbine and to external networks.

IFM5•2 offers an advanced, yet simple to use, ring-protection feature which is much faster and more reliable than normally used network equipment in wind turbines and other industrial systems.

The technology behind this feature is the ERPS standard, which is normally used in high-end back-bone switches at professional network operators/providers.

This means that in case of for example cable breaks, the recovery time is much faster than "standard ring-switches".

The IFM5•2 has full support for Virtual LAN configuration (VLAN) in accordance with IEEE 802.1Q and is fully configurable from the application running on the processor module (PCM5•x).

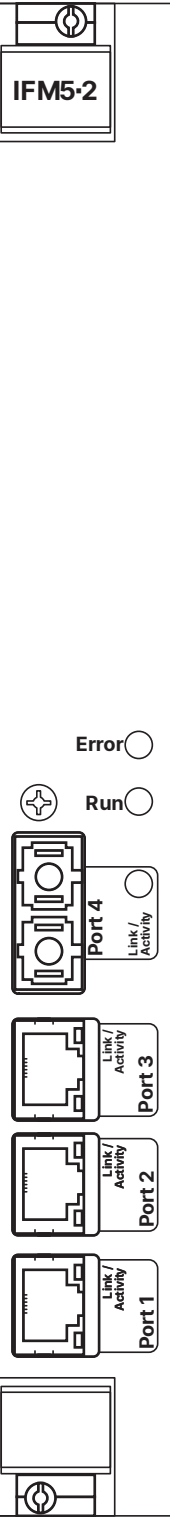
It furthermore supports Ethernet over EtherCAT (EoE), ensuring full distributed integration of the modules, allowing Ethernet to be available at any position in the wind turbine without additional fibre connections.

Four-port Ethernet twisted-pair and fibre module



LAN ports	1 x Ethernet (Port 4) optical: 100Base-FX, SC connectors, multimode fibre 62,5 µm, OM1 1 x Ethernet (Port 3) electrical: 100Base-TX, 8P8C ("RJ45"), shielded Cat5, >0.76 µm gold plating 1 x Ethernet (Port 2) electrical: 100Base-TX, 8P8C ("RJ45"), shielded Cat5, >0.76 µm gold plating 1 x Ethernet (Port 1) electrical: 100Base-TX, 8P8C ("RJ45"), shielded Cat5, >0.76 µm gold plating
Size	6 TE (30.48 mm)
Power consumption	Maximum 4 W

6.2.1 IFM5-2 wiring

	
Port 4	SC duplex connector, multi mode fibre 62.5 µm, OM 1
Port 3	8P8C (RJ45) connector, shielded Cat5, >0.76 µm gold plating
Port 2	8P8C (RJ45) connector, shielded Cat5, >0.76 µm gold plating
Port 1	8P8C (RJ45) connector, shielded Cat5, >0.76 µm gold plating

6.2.2 IFM5-2 terminal specifications

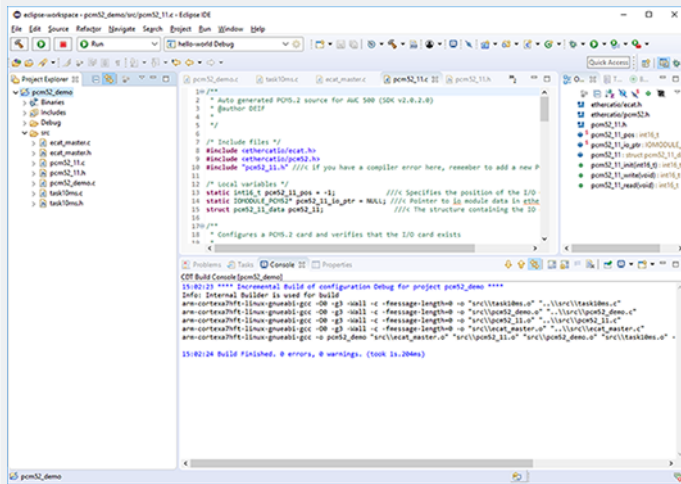
	Terminal	Description
1	Port 1	1 x Ethernet port (electrical): 100Base-TX, 8P8C ("RJ45"), shielded Cat5, >0.76 µm gold plating
2	Port 2	1 x Ethernet port (electrical): 100Base-TX, 8P8C ("RJ45"), shielded Cat5, >0.76 µm gold plating
3	Port 3	1 x Ethernet port (electrical): 100Base-TX, 8P8C ("RJ45"), shielded Cat5, >0.76 µm gold plating
4	Port 4	1 x Ethernet port (optical): 100Base-FX, SC connectors, multimode fibre 62.5µm, OM1

7. Application development

7.1 Software packages

7.1.1 C/C++ programming

Application development



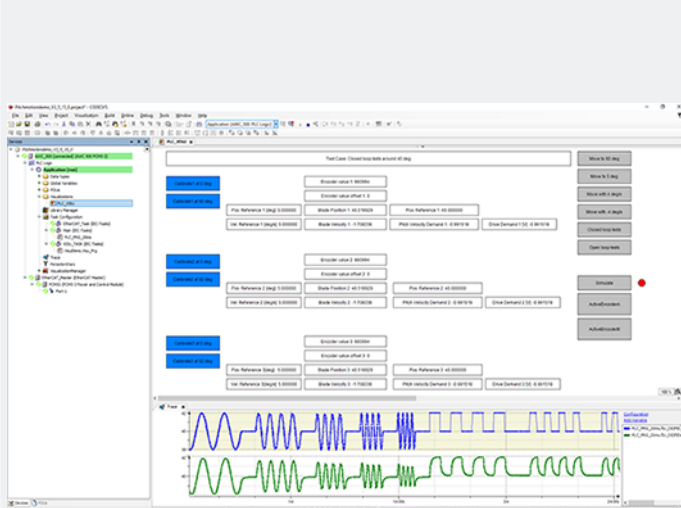
AWC 500 C/C++ development package

Windows and Linux SDK (Software Development Kit) available for use with for example Eclipse IDE, Visual Studio IDE or CODESYS IDE.

- AWC 500 Windows and Linux SDK.
- Eclipse IDE with C/C++ Development Toolkit (CDT).
- Optional : Cygwin64 for External Builder (make) or GNU gcc/gdb toolchain for windows.

7.1.2 IEC61131-3 programming

Application Development



AWC 500 CODESYS package



IEC61131-3 PLC-programmed based on CODESYS Programming languages:

- Sequential Function Chart (SFC)
- Function Block Diagram (FBD)
- Structured Text (ST)
- Ladder Diagram (LD)
- ANSI C/C++ (via AWC 500 C/C++ development package)
- 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

- CODESYS V3.5 IDE
- DEIF AWC 500 TSP (Target Support Package) with device descriptions

7.1.3 Supported software features

Software	AWC 500 C programming	AWC 500 CODESYS and web visualisation
PLC runtime	-	CODESYS V3.5 SP15+
Programming		
IEC61131-3	-	LD, SFC, FBD, ST
	-	CODESYS V3.5 SP15+ IDE
C/C++	ANSI C/C++	Yes as FB components
	Eclipse-based IDE	
Communication drivers	Modbus (TCP/IP)	
	CAN layer 2	
	CANopen master/slave	
	Serial communication	
	Socket communication (UDP, TCP/IP)	
	SSI - Serial Synchronous Interface	
	Profibus DP-V0 Master (CODESYS only)	
Network protocols	File Transfer Protocol (FTP), server and client	
	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	
MATLAB/Simulink interface	DEIF PLC Link	
C code generation	Yes	
IEC 61131-3 structured text generation	Yes	
FLEX/GH bladed interface	Yes	
Visualisation		DEIF HMI solution (TCP/IP) or CODESYS web visualisation
System Configuration	Configuration via file access or shell commands. IP address (static/dynamic), hostname, change root and default password, view module serial numbers.	
Device handling	Software (DEIF I/O Handler)	CODESYS Device handling (EtherCAT Master, CANopen Manager, Profibus Master)
Configuration	Device handling	

Software	AWC 500 C programming	AWC 500 CODESYS and web visualisation
Visualisation designer	Via software (DEIF HMI)	CODESYS V3.5 visualisation
Scope/trace		Yes (trace in CODESYS)

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 (Kiosk mode possible)

External communication	
OPC DA	Via CODESYS Gateway and CODESYS OPC Server
OPC-UA	Via Open62541
Modbus - TCP/IP - RTU	Yes

8. General information

8.1 Legal information and disclaimer

8.1.1 Open source software

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