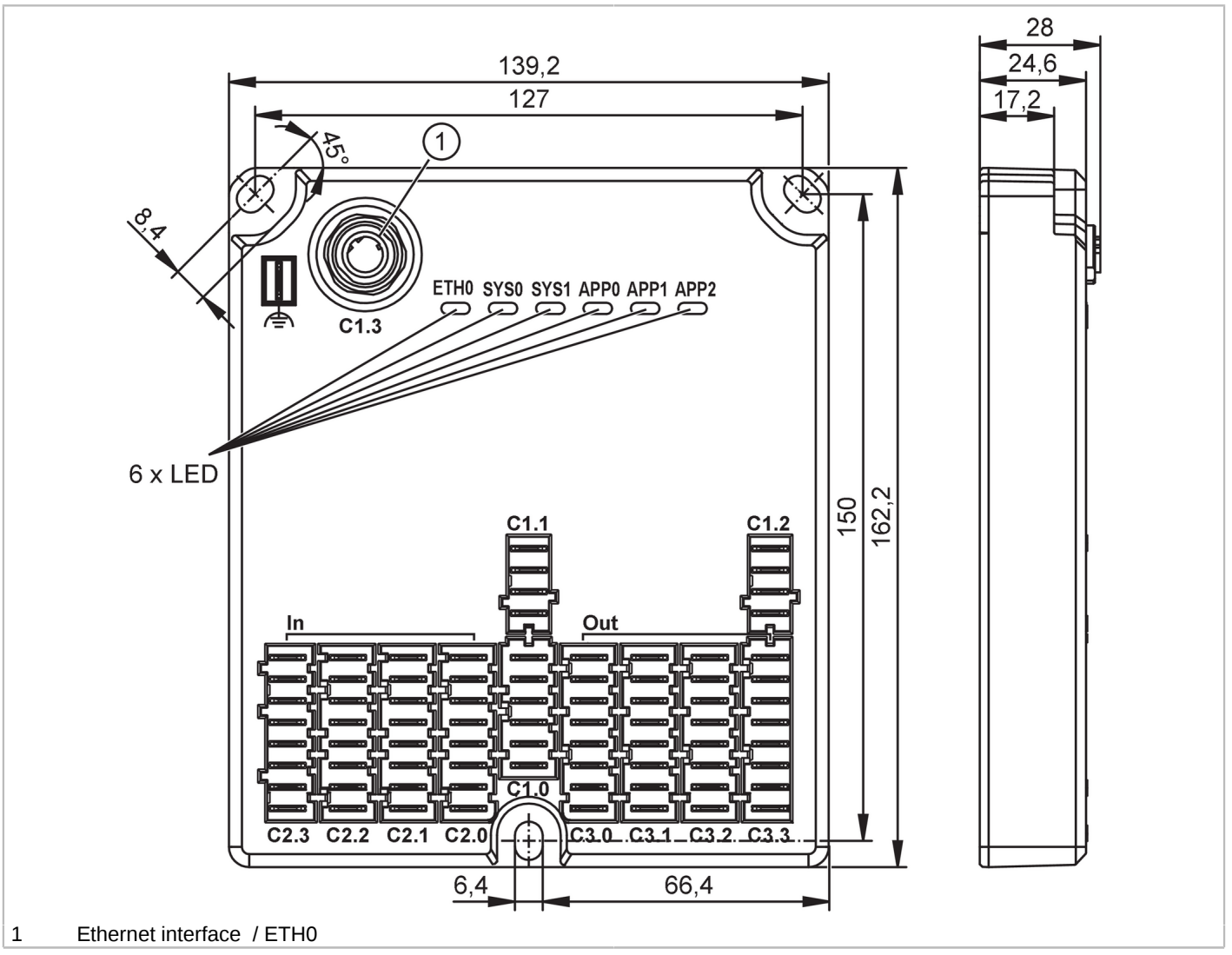
CR413S

Programmable controller for mobile machines

ecomatBasic/32

for use as a safety controller, a separately available licence (CP100S) is required



1 Ethernet interface / ETH0

Product characteristics		
Total number of inputs		16
Total number of outputs		16
Communication interface		CAN; Ethernet
Protection		IP 20
Electrical data		
Operating voltage	[V]	8...32 DC
Nominal voltage DC	[V]	12 / 24
Power consumption	[W]	4; (VBB30)
Reverse polarity protection		yes; (VBB30; VBB0, VBB1, VBB2: in case of supply via the on-board system / battery)
Overvoltage category		II
Inputs / outputs		
Total number of inputs and outputs		32

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Programmable controller for mobile machines

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Inputs		
Total number of inputs	16	
Number of frequency inputs	4	
Number of resistor inputs	4	
Number of digital inputs	16	
Number of analogue inputs	12	
Digital inputs, frequency signal (IN FREQUENCY-B)		
Number	4	
Plug C2.0	IN0400, IN0401	
	IN0500, IN0501	
Frequency input	function type	frequency, cycle time
	software mode	IN_PERIOD_RATIO_CSO
		IN_PERIOD_RATIO_CSI
	input range [V]	0...32
	frequency [Hz]	0,01...5000
	switching level high [V]	> 70 % VBB30
	switching level low [V]	< 30 % VBB30
	input resistance [Ω]	10000
	accuracy	± 10 µs
Frequency input	function type	frequency, cycle time
	software mode	IN_PERIOD_RATIO_US_CSO
		IN_PERIOD_RATIO_US_CSI
	input range [V]	0...32
	frequency [Hz]	0,1...5000
	switching level high [V]	> 70 % VBB30
	switching level low [V]	< 30 % VBB30
	input resistance [Ω]	10000
	accuracy	± 10 µs
Frequency input	function type	frequency, cycle time
	software mode	IN_FREQUENCY_CSO
		IN_FREQUENCY_CSI
	input range [V]	0...32
	frequency [Hz]	0,5...30000
	switching level high [V]	> 70 % VBB30
	switching level low [V]	< 30 % VBB30
	input resistance [Ω]	10000
	accuracy	± 10 µs
Frequency input	function type	pulse
	software mode	IN_COUNT_CSO
		IN_COUNT_CSI
	input range [V]	0...32
	frequency [Hz]	0...30000
	switching level high [V]	> 70 % VBB30
	switching level low [V]	< 30 % VBB30
	input resistance [Ω]	10000
	accuracy	± 10 µs

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Frequency input	function type	pulse, incremental
	software mode	IN_INC_ENCODER_CSO
		IN_INC_ENCODER_CSI
	input pair	A: IN0400 + B: IN0401
		A: IN0500 + B: IN0501
	input range [V]	0...32
	frequency [Hz]	0...5000
	switching level high [V]	> 70 % VBB30
	switching level low [V]	< 30 % VBB30
	input resistance [Ω]	10000
	accuracy	± 10 µs
Frequency input	function type	phase
	software mode	IN_PHASE_CSO
		IN_PHASE_CSI
	input pair	A: IN0400 + B: IN0401
		A: IN0500 + B: IN0501
	input range [V]	0...32
	frequency [Hz]	0,0625...5000
	switching level high [V]	> 70 % VBB30
	switching level low [V]	< 30 % VBB30
	input resistance [Ω]	10000
	accuracy	± 10 µs
Analogue input	function type	Voltage
	software mode	IN_VOLTAGE_10
	input range [V]	0...10
	input resistance [Ω]	87600
	Resolution	12 Bit
	accuracy	± 100 mV
	input frequency [Hz]	< 330
	diagnostic level low	0 V; (parameterisable)
	diagnostic level high	10 V; (parameterisable)
Digital input	function type	binary, high side
	software mode	IN_DIGITAL_CSO
	input range [V]	0...32
	switching level high [V]	> 65 % VBB30; (parameterisable)
	switching level low [V]	< 25 % VBB30; (parameterisable)
	Resolution	12 Bit
	accuracy	± 960 mV
	input frequency [Hz]	< 330
	input resistance [Ω]	10000
	diagnostic level low	0 % VBB30; (parameterisable)
	diagnostic level high	100 % VBB30; (parameterisable)

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Digital input	function type	binary, low-side
	software mode	IN_DIGITAL_CSI
		IN_DIGITAL_CSI_NAMUR
		IN_DIGITAL_CSI_BLANKING
	input range [V]	0...32
	switching level high [V]	> 70 % VBB30; (parameterisable)
	switching level low [V]	< 30 % VBB30; (parameterisable)
	Resolution	12 Bit
	accuracy	± 320 mV
	input frequency [Hz]	< 330
	input resistance [Ω]	10000
	diagnostic level low	0 % VBB30; (parameterisable)
	diagnostic level high	400 % VBB30; (parameterisable)
Multi-function inputs, analogue / digital (IN MULTIFUNCTION-A)		
Number		8
Plug C2.2		IN0000, IN0001
		IN0100, IN0101
Plug C2.3		IN0600, IN0601
		IN0700, IN0701
Analogue input	function type	Current
	software mode	IN_CURRENT_CSI
	input range [mA]	0...20
	input resistance [Ω]	298
	Resolution	12 Bit
	accuracy	± 345 µA
	input frequency [Hz]	< 330
	diagnostic level low	0 mA; (parameterisable)
	diagnostic level high	20 mA; (parameterisable)
Analogue input	function type	Voltage
	software mode	IN_VOLTAGE_10
	input range [V]	0...10
	input resistance [Ω]	67600
	Resolution	12 Bit
	accuracy	± 100 mV
	input frequency [Hz]	< 330
	diagnostic level low	0 V; (parameterisable)
	diagnostic level high	10 V; (parameterisable)
Analogue input	function type	Voltage
	software mode	IN_VOLTAGE_32
	input range [V]	0...32
	input resistance [Ω]	51000
	Resolution	12 Bit
	accuracy	± 320 mV
	input frequency [Hz]	< 330
	diagnostic level low	0 V; (parameterisable)
	diagnostic level high	32 V; (parameterisable)

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Analogue input	function type	Voltage, ratiometric
	software mode	IN_VOLTAGE_RATIO
	input range [V]	0...1000 ‰ VBB30
	input resistance [Ω]	51000
	Resolution	12 Bit
	accuracy	± 320 mV
	input frequency [Hz]	< 330
	diagnostic level low	0 ‰; (parameterisable)
	diagnostic level high	1000 ‰; (parameterisable)
Digital input	function type	binary, low-side
	software mode	IN_DIGITAL_CSI
		IN_DIGITAL_CSI_NAMUR
	input range [V]	0...32
	switching level high [V]	> 70 % VBB30; (parameterisable)
	switching level low [V]	< 30 % VBB30; (parameterisable)
	Resolution	12 Bit
	accuracy	± 320 mV
	input frequency [Hz]	< 330
	input resistance [Ω]	9500
	diagnostic level low	1 V; (parameterisable)
	diagnostic level high	400 % VBB30; (parameterisable)
Digital / resistor inputs (IN RESISTOR-A)		
Number		4
Plug C2.1		IN0200, IN0201
		IN0300, IN0301
Digital input	function type	binary, low-side
	software mode	IN_DIGITAL_CSI
		IN_DIGITAL_CSI_NAMUR
	input range [V]	0...32
	switching level high [V]	> 70 % VBB30; (parameterisable)
	switching level low [V]	< 30 % VBB30; (parameterisable)
	Resolution	12 Bit
	accuracy	± 320 mV
	input frequency [Hz]	< 330
	input resistance [Ω]	3200
	diagnostic level low	0 % VBB30; (parameterisable)
	diagnostic level high	400 % VBB30; (parameterisable)
Resistor input	function type	binary, high side
	software mode	IN_RESISTOR
	input range [Ω]	16...30000
	measuring current [mA]	< 2,0
	Resolution	12 Bit
	accuracy	16...3000 Ω: ± 60 Ω
		3000...15000 Ω: ± 750 Ω
		15000...30000 Ω: ± 3000 Ω
	diagnostic level low	0 Ω; (parameterisable)
	diagnostic level high	30000 Ω; (parameterisable)
Outputs		
Total number of outputs		16

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Number of digital outputs	16	
Number of PWM outputs	12	
Number of PWM-I outputs	4	
Output groups (OutputGroup-B)		
Number	2	
Plug C1.0	VBB0, VBB1	
Output group switch	function type	virtual switch
	software mode	OUT_DIGITAL_VIRT
	voltage range [V]	6...32
	voltage measurement [V]	0...36
	accuracy of the voltage measurement [mV]	± 360
	Current rating [A]	12
	lower limit of current monitoring [mA]	0; (parameterisable)
	upper limit of current monitoring [mA]	12000; (parameterisable)
Output group (OutputGroup-A)		
Number	1	
Plug C1.2	VBB2	
Output group switch	function type	second independent option for safety shut-down of the output group
	software mode	OUT_DIGITAL
	voltage range [V]	6...32
	voltage measurement [V]	0...36
	accuracy of the voltage measurement [mV]	± 360
	diagnostic function	current monitoring voltage monitoring
	Current rating [A]	10
	lower limit of current monitoring [mA]	0; (parameterisable)
	upper limit of current monitoring [mA]	10000; (parameterisable)
Digital / PWM outputs; 2,5 A (OUT PWM-25-A)		
Number	4	
Plug C3.0	OUT0000, OUT0001	
Plug C3.3	OUT0200, OUT0201	
PWM output	function type	binary, high side
	software mode	OUT_PWM_CSO
	voltage range [V]	6...32
	switching current [A]	0,025...2,5
	output frequency [Hz]	20...2000
	pulse/pause ratio	0...1000 ‰; (parameterisable)
	Min. load resistance [Ω]	12 V: 4,8 Ω / 24 V: 9,6 Ω
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...4
	accuracy of the current measurement [mA]	± 37,5
	diagnostic functions	wire break; short circuit; current monitoring
	lower limit of current monitoring [mA]	0; (parameterisable)
	upper limit of current monitoring [mA]	2500; (parameterisable)

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PWM-I output	function type	current-controlled
	software mode	OUT_CURRENT_CSO
	voltage range [V]	6...32
	switching current [A]	0,025...2,5
	output frequency [Hz]	20...2000
	control range [A]	0,05...2,5
	control resolution [mA]	2
	Min. load resistance [Ω]	12 V: 4,8 Ω / 24 V: 9,6 Ω
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...4
	accuracy of the current measurement [mA]	± 37,5
	diagnostic functions	wire break; short circuit; current monitoring
	lower limit of current monitoring [mA]	0; (parameterisable)
	upper limit of current monitoring [mA]	2500; (parameterisable)
Digital output	function type	binary, high side
	software mode	OUT_DIGITAL_CSO
	voltage range [V]	6...32
	switching current [A]	0,025...2,5
	Min. load resistance [Ω]	12 V: 4,8 Ω / 24 V: 9,6 Ω
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...4
	accuracy of the current measurement [mA]	± 37,5
	diagnostic function	wire break; short circuit; current monitoring
	lower limit of current monitoring [mA]	0; (parameterisable)
	upper limit of current monitoring [mA]	2500; (parameterisable)

Digital / PWM outputs; 2,5 A (OUT PWM-25-B)		
Number	6	
Plug C3.0	OUT0002, OUT0003	
Plug C3.2	OUT0100, OUT0101	
Plug C3.3	OUT0202, OUT0203	
PWM output	function type	binary, high side
	software mode	OUT_PWM_CSO
	voltage range [V]	6...32
	switching current [A]	0,025...2,5
	output frequency [Hz]	20...2000
	pulse/pause ratio	0...1000 ‰; (parameterisable)
	Min. load resistance [Ω]	12 V: 4,8 Ω / 24 V: 9,6 Ω
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...4
	accuracy of the current measurement [mA]	± 188
	diagnostic functions	wire break; short circuit; current monitoring
	lower limit of current monitoring [mA]	0; (parameterisable)
	upper limit of current monitoring [mA]	2500; (parameterisable)

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Digital output	function type	binary, high side
	software mode	OUT_DIGITAL_CSO
	voltage range [V]	6...32
	switching current [A]	0,025...2,5
	Min. load resistance [Ω]	12 V: 4,8 Ω / 24 V: 9,6 Ω
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...4
	accuracy of the current measurement [mA]	± 188
	diagnostic function	wire break; short circuit; current monitoring
	lower limit of current monitoring [mA]	0; (parameterisable)
	upper limit of current monitoring [mA]	2500; (parameterisable)
Digital / PWM outputs; 4,0 A (OUT PWM-40-B)		
Number	2	
Plug C3.2	OUT0102, OUT0103	
PWM output	function type	binary, high side
	software mode	OUT_PWM_CSO
	voltage range [V]	6...32
	switching current [A]	0,025...4,0
	output frequency [Hz]	20...2000
	pulse/pause ratio	0...1000 ‰; (parameterisable)
	Min. load resistance [Ω]	12 V: 3 Ω / 24 V: 6 Ω
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...6
	accuracy of the current measurement [mA]	± 300
	diagnostic functions	wire break; short circuit; current monitoring
	lower limit of current monitoring [mA]	0; (parameterisable)
	upper limit of current monitoring [mA]	4000; (parameterisable)
Digital output	function type	binary, high side
	software mode	OUT_DIGITAL_CSO
	voltage range [V]	6...32
	switching current [A]	0,025...4,0
	Min. load resistance [Ω]	12 V: 3 Ω / 24 V: 6 Ω
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...6
	accuracy of the current measurement [mA]	± 300
	diagnostic function	wire break; short circuit; current monitoring
	lower limit of current monitoring [mA]	0; (parameterisable)
	upper limit of current monitoring [mA]	4000; (parameterisable)
Digital / PWM outputs; 1,0 A (OUT PWM-10-D)		
Number	4	
Plug C3.1	OUT0004...OUT0007	

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PWM output		function type	binary, high side
		software mode	OUT_PWM_CSO
		voltage range [V]	6...32
		switching current [A]	0,025...1,0
		output frequency [Hz]	20...2000
		pulse/pause ratio	1...1000 ‰; (parameterisable)
		Resolution	1 ‰; (20...250 Hz)
		Min. load resistance [Ω]	12 V: 12 Ω / 24 V: 24 Ω
		protective circuitry	inductive load; thermal protection
Digital output		function type	binary, high side
		software mode	OUT_DIGITAL_CSO
		voltage range [V]	6...32
		switching current [A]	0,025...1,0
		Min. load resistance [Ω]	12 V: 12 Ω / 24 V: 24 Ω
		protective circuitry	inductive load; thermal protection

Software / programming		
Parameter setting options		CODESYS 3.5
PLC function to IEC 61131-3		yes
Operating system		real-time operating system
Interfaces		
Communication interface		CAN; Ethernet
Number of CAN interfaces		2
Number of Ethernet interfaces		1
CAN		
Transmission rate		20 kBit/s... 1 MBit/s
Protocol		CANopen; SAE J1939
Interface		CAN Interface 2.0 A/B ISO 11898
Ethernet		
Transmission standard		10Base-T; 100Base-TX
Transmission rate		10 MBit/s; 100 MBit/s
Protocol		TCP/IP; UDP/IP; Modbus TCP
Operating conditions		
Ambient temperature	[°C]	-40...85
Note on ambient temperature		for further details see section Diagrams and graphs
Storage temperature	[°C]	-40...85
Max. relative air humidity	[%]	90; (non condensing)
Max. height above sea level	[m]	5000
Protection		IP 20
Pollution degree		2
Chemical media	ISO 16750-5	AA, BA, BD, CC, DB, DC, DD
		chemical resistance of the plastics
		only one chemical permitted at a time

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Tests / approvals			
EMC		IEC 61000-6-2	immunity
		IEC 61000-6-4	noise emission
		ISO 7637-2 pulse 1	severity level 4 / function state C (24 V)
		ISO 7637-2 pulse 2a	severity level 4 / function state A (24 V)
		ISO 7637-2 pulse 2b	severity level 4 / function state C (24 V)
		ISO 7637-2 pulse 3a	severity level 4 / function state A (24 V)
		ISO 7637-2 pulse 3b	severity level 4 / function state A (24 V)
		ISO 7637-2 pulse 4	severity level 3 / function state B (12 V)
		ISO 7637-2 pulse 4	severity level 4 / function state B (24 V)
		ISO 16750-2 (load dump)	function state D (24 V)
		DIN EN ISO 13766-1	earthworks and construction machines
		UN/ECE-R10	noise emission and noise immunity:
Continuous shock resistance		ISO 16750-3	30 g 6 ms / 24000 shocks
Vibration resistance		ISO 16750-3 Test VII	random, mounting place car body
		EN 60068-2-6 sine	10...500 Hz / 10 cycles/axis, sine
Climatic tests		EN 60068-2-30 damp heat: cyclical	55 °C upper temperature limit / 6 cycles
		EN 60068-2-78 damp heat: constant	40 °C 93 % rH / test period 21 days
Electrical safety		IEC 61010-1	safety requirement: general requirements
		IEC 61010-2-201	safety requirement: particular requirements for control equipment
UL approval		Enclosure type	Open Type
		File number UL	E205959
		digital / PWM outputs C3.0	2.5 A / 24 V DC / Pilot Duty (DC-13)
		digital / PWM outputs C3.1	1.0 A / 24 V DC / Pilot Duty (DC-13)
		digital / PWM outputs C3.2	4.0 A / 24 V DC / Pilot Duty (DC-13)
Railway applications		EN 50121-3-2	
		EN 50155	
Mechanical data			
Weight	[g]	560	
Housing		rectangular	
Type of mounting		screw mounting; (3 x M4)	
Dimensions	[mm]	162.2 x 139.2 x 25.5	
Materials		housing: PPE + PS	
Displays / operating elements			
Display		Ethernet (ETH0)	1 LED, green
		status (SYS0)	1 LED, multi-colour
		status (SYS1)	1 LED, multi-colour
		status (APP0)	1 LED, multi-colour programmable
		status (APP1)	1 LED, multi-colour programmable
		status (APP2)	1 LED, multi-colour programmable
Operating states - system / hardware			
Display		no operating system loaded	LED (SYS0), green flashing 5 Hz
		hardware error fatal error+	LED (SYS0), red lights
		system error fatal error	LED (SYS0/SYS1), red lights
		update	LED (SYS0/SYS1), yellow/green flashing 2 Hz
		sleep mode	LED (SYS0), blue lights

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PLC application (SYS0 / SYS1)		
Display	no application	LED, green lights
	run	LED, green flashing 2 Hz
	fault	LED, red flashing 10 Hz
	debug run	LED, yellow flashing 2 Hz
	debug stop	LED, yellow lights
Ethernet (ETH0)		
Display	connection	LED, green lights
	data transmission	LED, green flashing

Hardware	
Processor	32-Bit Triple-Core
RAM	2,7 MByte RAM
Mass storage	9 MByte Flash
Non-volatile memory	10 kByte
Boot time	≤ 3 s
Remarks	
Notes	for use as a safety controller, a separately available licence (CP100S) is required
Pack quantity	1 pcs.

Electrical connection

Connector: 1 x M12; coding: D; Contacts: 5



ETH0	
1	TD+
2	RD+
3	TD-
4	RD-
5	n.c.

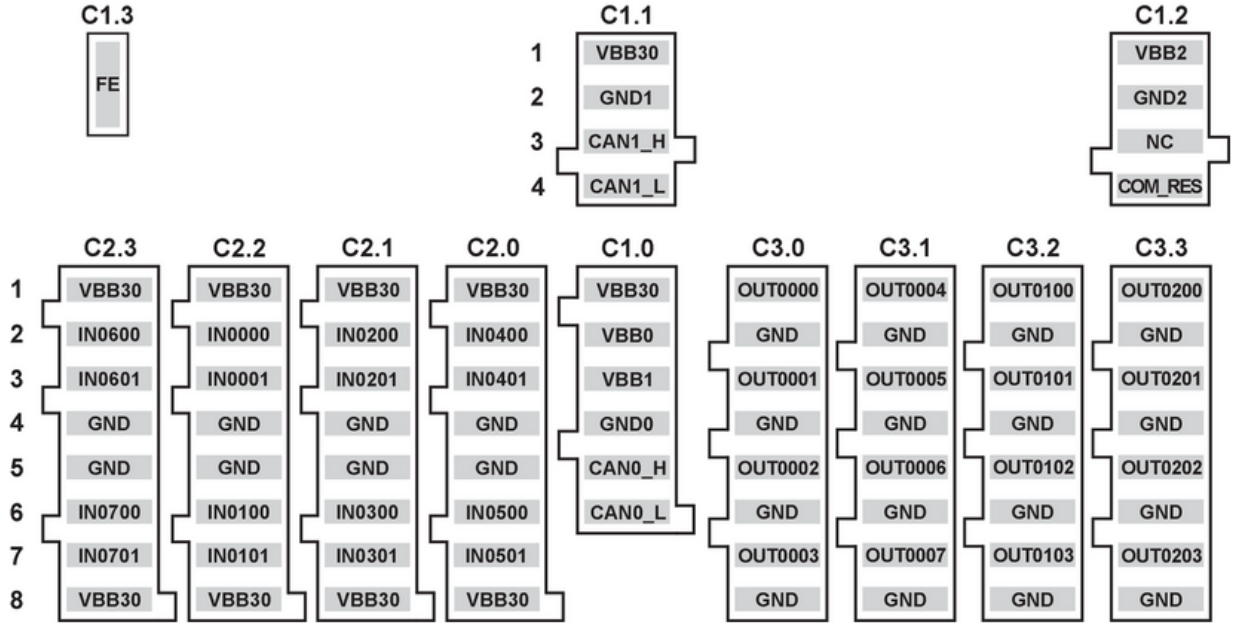
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Electrical connection

Connection



voltage supply / C1.0

1	VBB30
2	VBB0
3	VBB1
4	GND0
5	CAN0_H
6	CAN0_L

voltage supply / C1.1

1	VBB30
2	GND1
3	CAN1_H
4	CAN1_L

voltage supply / C1.2

1	VBB2
2	GND2
3	NC
4	COM_RES

IN FREQUENCY - B / C2.0

1	VBB30
2	IN0400
3	IN0401
4	GND
5	GND
6	IN0500
7	IN0501
8	VBB30

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IN RESISTOR - A / C2.1	
1	VBB30
2	IN0200
3	IN0201
4	GND
5	GND
6	IN0300
7	IN0301
8	VBB30

IN MULTIFUNCTION - A / C2.2	
1	VBB30
2	IN0000
3	IN0001
4	GND
5	GND
6	IN0100
7	IN0101
8	VBB30

IN MULTIFUNCTION - A / C2.3	
1	VBB30
2	IN0600
3	IN0601
4	GND
5	GND
6	IN0700
7	IN0701
8	VBB30

OUT PWM-25-A / C3.0	
1	OUT0000
2	GND
3	OUT0001
4	GND

OUT PWM-25-B / C3.0	
5	OUT0002
6	GND
7	OUT0003
8	GND

OUT PWM-10-D / C3.1	
1	OUT0004
2	GND
3	OUT0005
4	GND
5	OUT0006
6	GND
7	OUT0007
8	GND

OUT PWM-25-B / C3.2	
1	OUT0100
2	GND
3	OUT0101
4	GND

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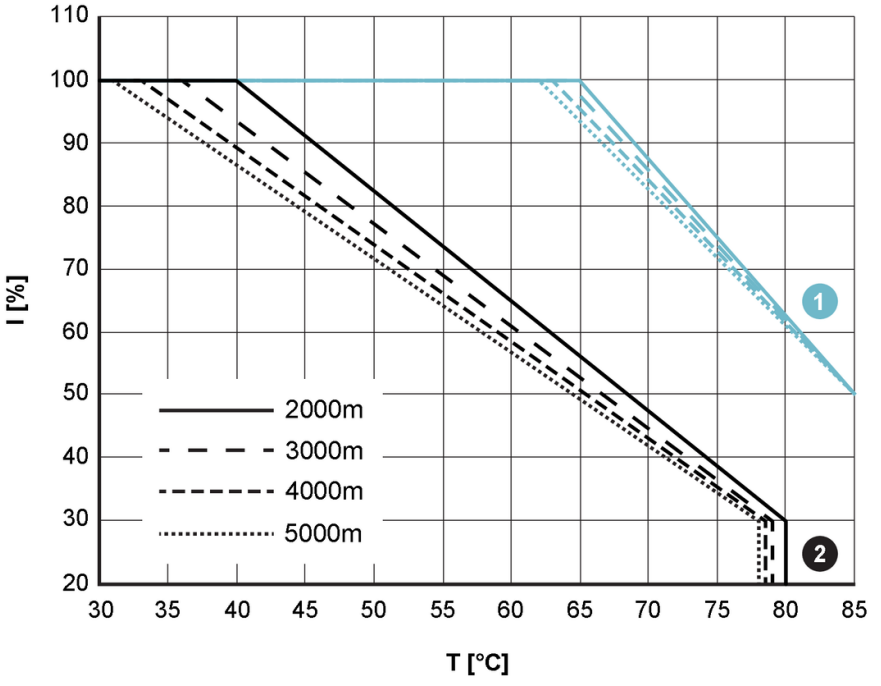
OUT PWM-40-B / C3.2	
5	OUT0102
6	GND
7	OUT0103
8	GND

OUT PWM-25-A / C3.3	
1	OUT0200
2	GND
3	OUT0201
4	GND

OUT PWM-25-B / C3.3	
5	OUT0202
6	GND
7	OUT0203
8	GND

Diagrams and graphs

characteristics current rating



characteristics for the current rating depending on the temperature and operating altitude

X: Ambient temperature T [°C]

Y: current rating for VBB0, VBB1, VBB2 I [%]

1: installation on painted metal plate

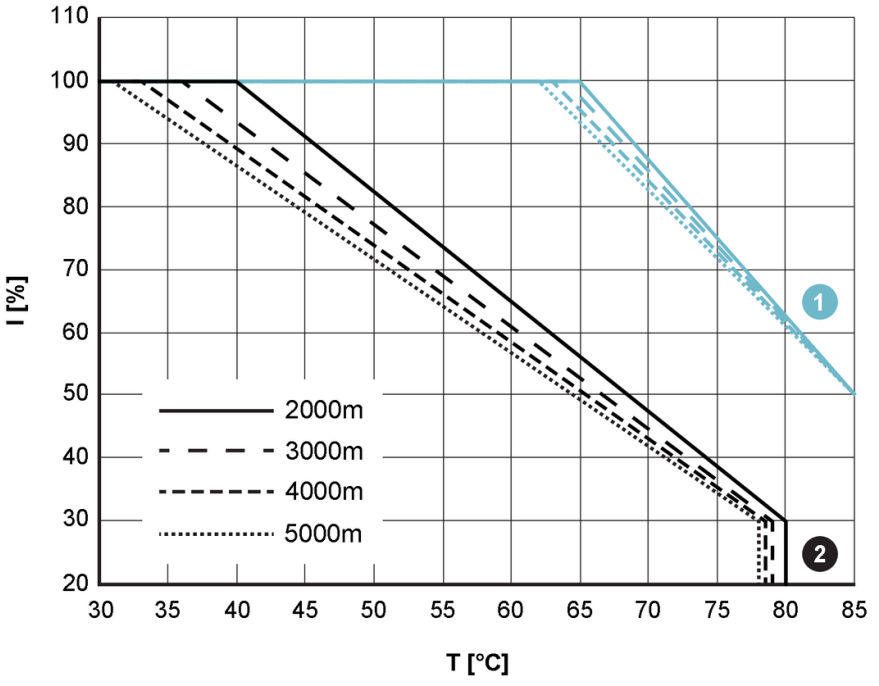
2: installation in a standard cabinet on a surface with low thermal conductivity (e.g. wood/plastic)

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characteristics switching current



characteristics for the switching current depending on the temperature and operating altitude

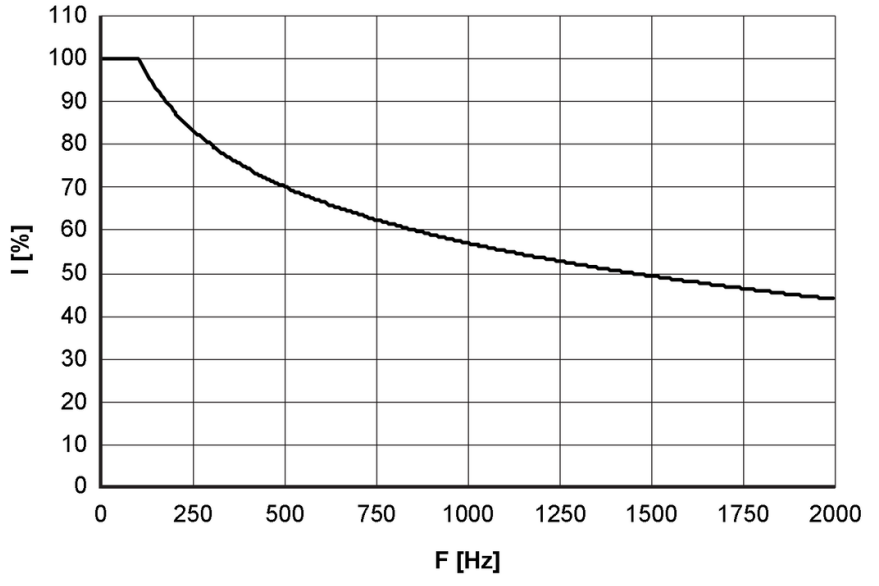
X: Ambient temperature T [°C]

Y: switching current of the outputs I [%]

1: installation on painted metal plate

2: installation in a standard cabinet on a surface with low thermal conductivity (e.g. wood/ plastic)

characteristics output frequency



characteristics for the switching current depending on the output frequency

X: output frequency F [Hz]

Y: switching current of the outputs I [%]