

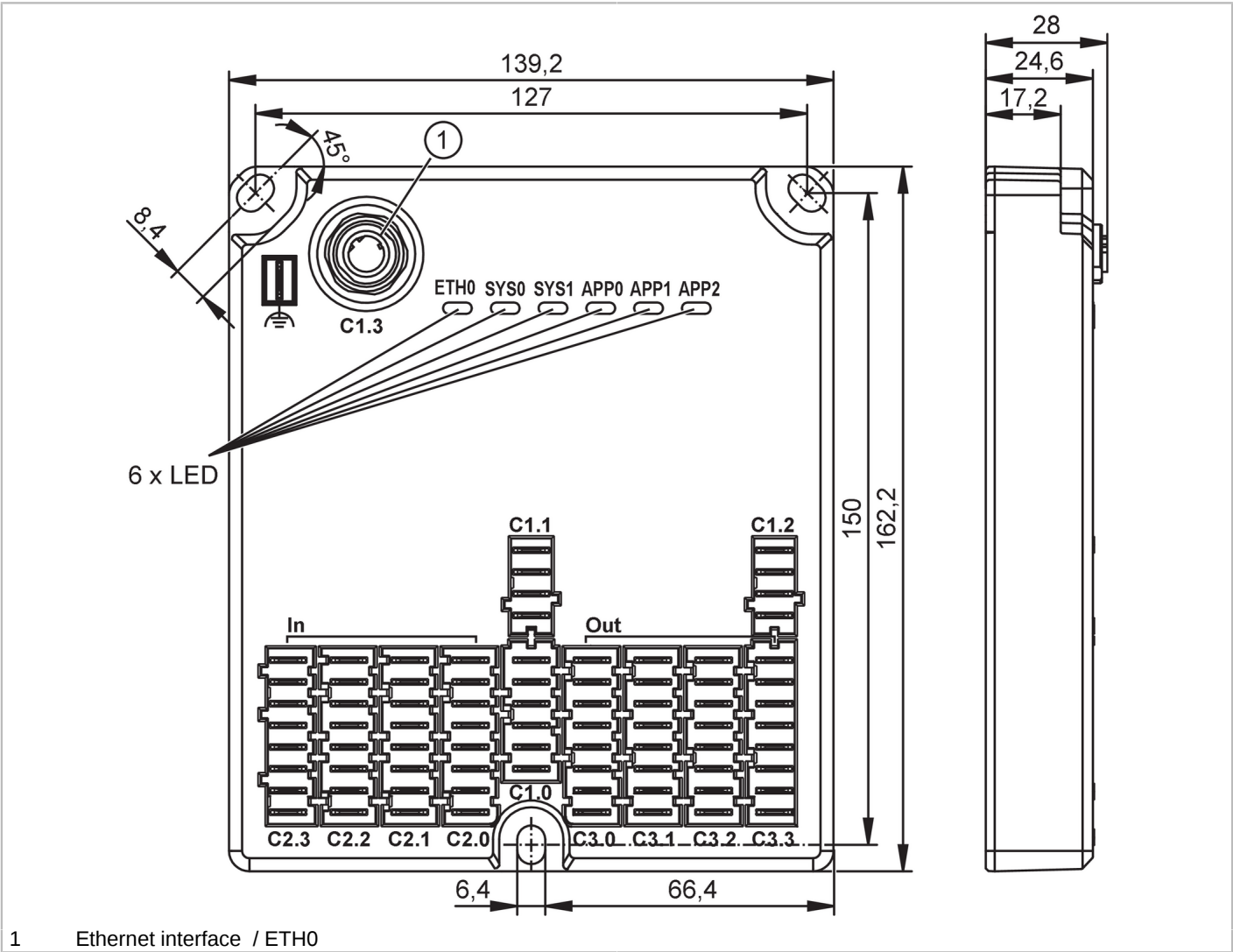
CR413S



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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Inputs		
Total number of inputs		16
Number of frequency inputs		4
Number of resistor inputs		4
Number of digital inputs		16
Number of analog 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	$\pm 10 \mu\text{s}$
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	$\pm 10 \mu\text{s}$
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	$\pm 10 \mu\text{s}$
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	$\pm 10 \mu\text{s}$



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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
Analog 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; (configurable)
	diagnostic level high	10 V; (configurable)
Digital input	function type	binary, high-side
	software mode	IN_DIGITAL_CSO
	input range [V]	0...32
	Switching level high [V]	> 65 % VBB30; (configurable)
	Switching level low [V]	< 25 % VBB30; (configurable)
	Resolution	12 Bit
	Accuracy	± 960 mV
	input frequency [Hz]	< 330
	input resistance [Ω]	10000
	diagnostic level low	0 % VBB30; (configurable)
	diagnostic level high	100 % VBB30; (configurable)



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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; (configurable)
	Switching level low [V]	< 30 % VBB30; (configurable)
	Resolution	12 Bit
	Accuracy	± 320 mV
	input frequency [Hz]	< 330
	input resistance [Ω]	10000
	diagnostic level low	0 % VBB30; (configurable)
	diagnostic level high	400 % VBB30; (configurable)
Multifunction inputs, analog / digital (IN MULTIFUNCTION-A)		
Number	8	
Plug C2.2	IN0000, IN0001	
	IN0100, IN0101	
Plug C2.3	IN0600, IN0601	
	IN0700, IN0701	
Analog 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; (configurable)
	diagnostic level high	20 mA; (configurable)
Analog 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; (configurable)
	diagnostic level high	10 V; (configurable)
Analog 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; (configurable)
	diagnostic level high	32 V; (configurable)



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Analog 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 ‰; (configurable)
	diagnostic level high	1000 ‰; (configurable)
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; (configurable)
	Switching level low [V]	< 30 % VBB30; (configurable)
	Resolution	12 Bit
	Accuracy	± 320 mV
	input frequency [Hz]	< 330
	input resistance [Ω]	9500
	diagnostic level low	1 V; (configurable)
	diagnostic level high	400 % VBB30; (configurable)
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; (configurable)
	Switching level low [V]	< 30 % VBB30; (configurable)
	Resolution	12 Bit
	Accuracy	± 320 mV
	input frequency [Hz]	< 330
	input resistance [Ω]	3200
	diagnostic level low	0 % VBB30; (configurable)
	diagnostic level high	400 % VBB30; (configurable)
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; (configurable)
	diagnostic level high	30000 Ω; (configurable)
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
	voltage measurement accuracy [mV]	± 360
	Current rating [A]	12
	lower limit of current monitoring [mA]	0; (configurable)
	upper limit of current monitoring [mA]	12000; (configurable)
Output group (OutputGroup-A)		
Number	1	
Plug C1.2	VBB2	
Output group switch	function type	second independent switch-off mode of the output group
	software mode	OUT_DIGITAL
	Voltage range [V]	6...32
	voltage measurement [V]	0...36
	voltage measurement accuracy [mV]	± 360
	Diagnostic function	current monitoring voltage monitoring
	Current rating [A]	10
	lower limit of current monitoring [mA]	0; (configurable)
	upper limit of current monitoring [mA]	10000; (configurable)
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 ‰; (configurable)
	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; (configurable)
	upper limit of current monitoring [mA]	2500; (configurable)



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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; (configurable)
	upper limit of current monitoring [mA]	2500; (configurable)
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; (configurable)
	upper limit of current monitoring [mA]	2500; (configurable)
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 ‰; (configurable)
	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; (configurable)
	upper limit of current monitoring [mA]	2500; (configurable)



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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; (configurable)
	upper limit of current monitoring [mA]	2500; (configurable)
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 ‰; (configurable)
	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; (configurable)
	upper limit of current monitoring [mA]	4000; (configurable)
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; (configurable)
	upper limit of current monitoring [mA]	4000; (configurable)
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 ‰; (configurable)
	Resolution	1 ‰; (20...250 Hz)
	Min. load resistance [Ω]	12 V: 12 Ω / 24 V: 24 Ω
Digital output	protective circuitry	inductive load; thermal protection
	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



Programmable controller for mobile machines

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Tests / approvals		
EMC	IEC 61000-6-2	noise 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	earth-moving and construction machines
	UN/ECE-R10	Noise emission and noise interference:
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 requirements: general requirements
	IEC 61010-2-201	safety requirements: 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
Material		housing: PPE + PS
Displays / operating elements		
Display	Ethernet (ETH0)	1 LED, green
	status (SYS0)	1 LED, multi-color
	status (SYS1)	1 LED, multi-color
	status (APP0)	1 LED, multi-color programmable
	status (APP1)	1 LED, multi-color programmable
	status (APP2)	1 LED, multi-color 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
Working memory	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

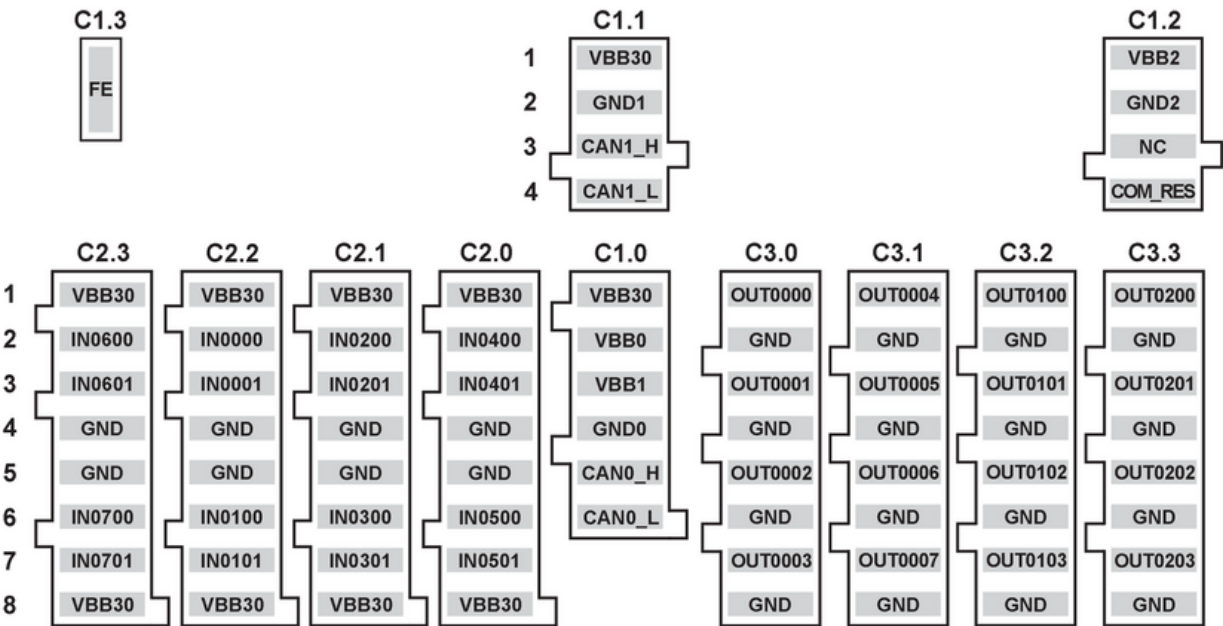


ETH0	
1	TD+
2	RD+
3	TD-
4	RD-
5	n.c.



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

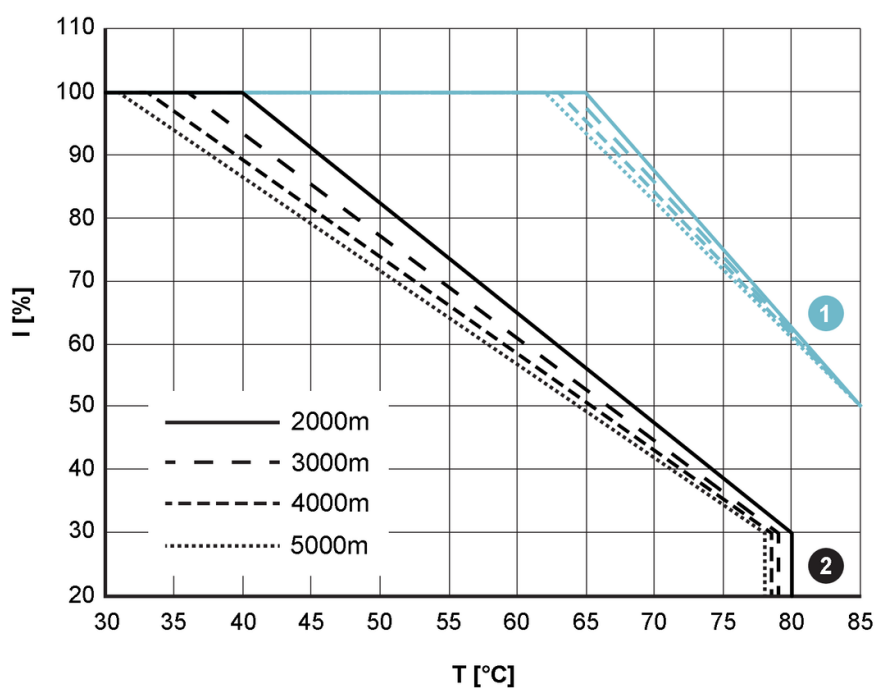
1	OUT0200
2	GND
3	OUT0201
4	GND

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

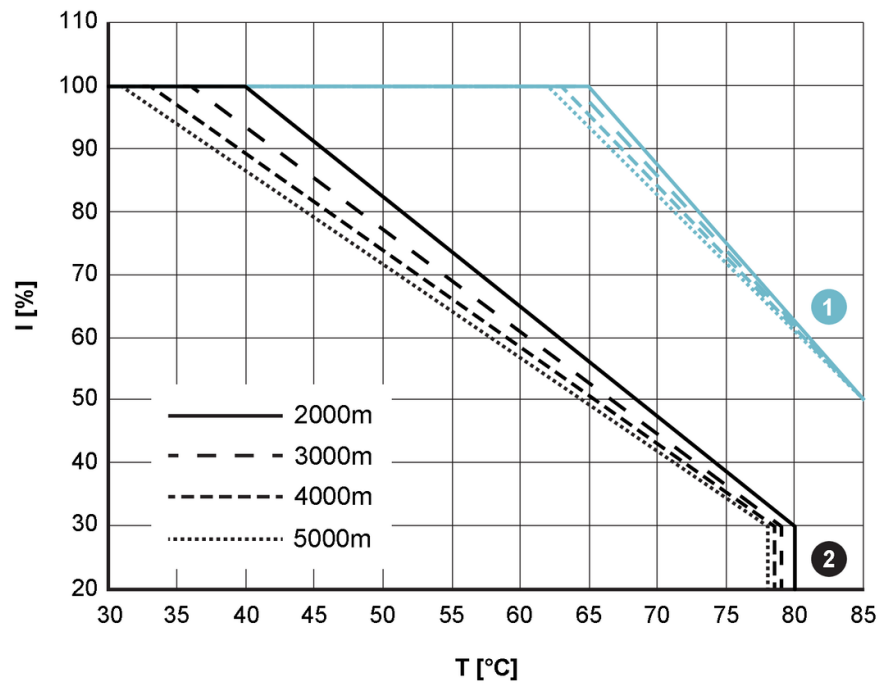
2: installation in a standard cabinet on a surface with low thermal conductivity (e.g. wood/plastic)



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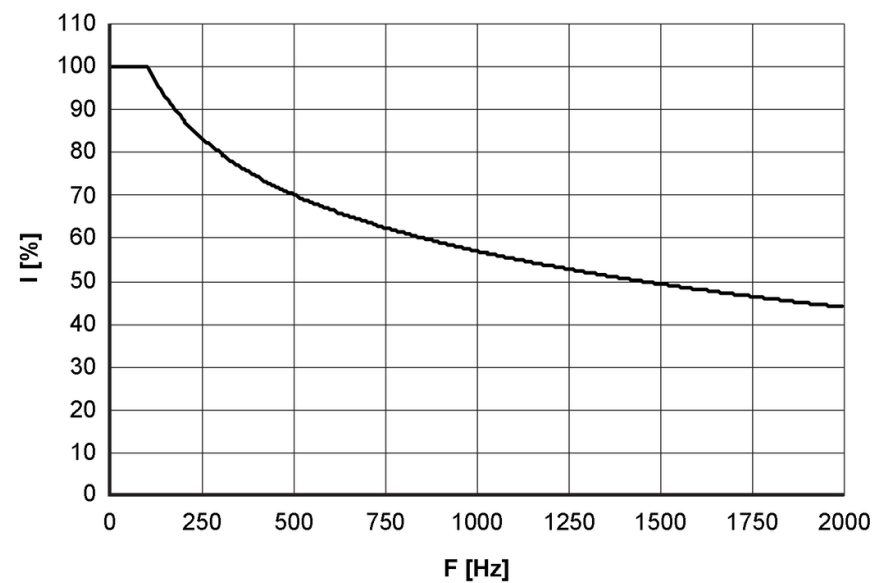
characteristics switching current



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 [%]