

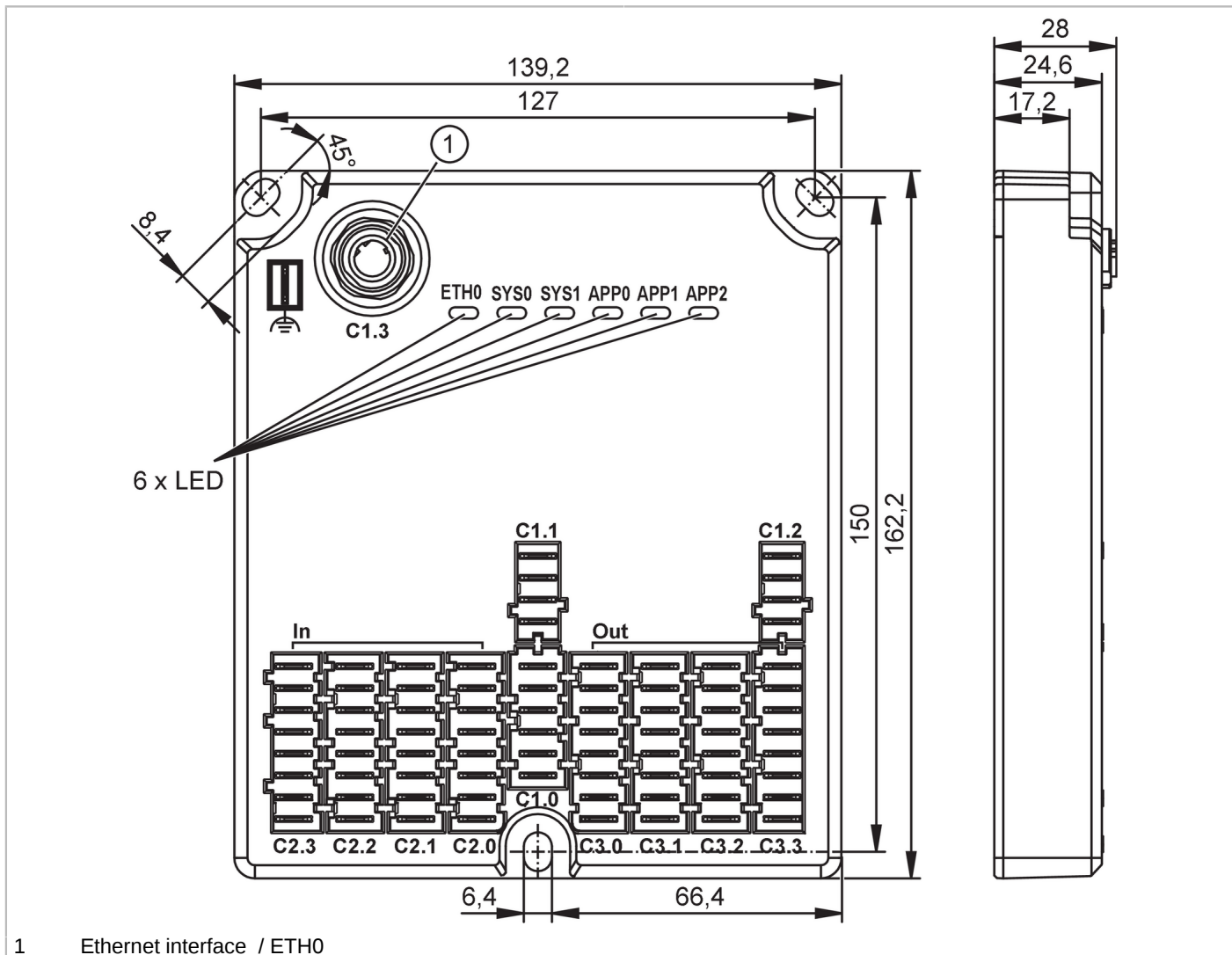
# CR413S



## 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)

### Inputs / outputs

Total number of inputs and outputs	32
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## Programmable controller for mobile machines

ecomatBasic/32

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	± 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



## Programmable controller for mobile machines

ecomatBasic/32

Frequency input	function type	pulse, incremental
	software mode	IN_INC_ENCODER_CSO
		IN_INC_ENCODER_CSI
	input range [V]	0...32
	Frequency [Hz]	0...5000
	Switching level high [V]	> 70 % VBB30
	Switching level low [V]	< 30 % VBB30
	input resistance [ $\Omega$ ]	10000
	Accuracy	$\pm 10 \mu\text{s}$
	Frequency input	function type
software mode		IN_PHASE_CSO
		IN_PHASE_CSI
input range [V]		0...32
Frequency [Hz]		0,0625...5000
Switching level high [V]		> 70 % VBB30
Switching level low [V]		< 30 % VBB30
input resistance [ $\Omega$ ]		10000
Accuracy		$\pm 10 \mu\text{s}$
Analog input		function type
	software mode	IN_VOLTAGE_10
	input range [V]	0...10
	input resistance [ $\Omega$ ]	87600
	Resolution	12 Bit
	Accuracy	$\pm 100 \text{ mV}$
	input frequency [Hz]	< 330
	diagnostic level low	0 V; (configurable)
	diagnostic level high	10 V; (configurable)
	Digital input	function type
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		$\pm 960 \text{ mV}$
input frequency [Hz]		< 330
input resistance [ $\Omega$ ]		10000
diagnostic level low		0 % VBB30; (configurable)
diagnostic level high	100 % VBB30; (configurable)	



## Programmable controller for mobile machines

ecomatBasic/32

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)
<b>Multifunction inputs, analog / digital (IN MULTIFUNCTION-A)</b>		
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)	



## Programmable controller for mobile machines

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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	± 100 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
	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)	
<b>Digital / resistor inputs (IN RESISTOR-A)</b>		
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)	

<b>Outputs</b>	
Total number of outputs	16
Number of digital outputs	16



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Number of PWM outputs	12	
Number of PWM-I outputs	4	
<b>Output groups (OutputGroup-B)</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)
	<b>Output group (OutputGroup-A)</b>	
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)
<b>Digital / PWM outputs; 2,5 A (OUT PWM-25-A)</b>		
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)



## Programmable controller for mobile machines

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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 [ $\Omega$ ]	12 V: 4,8 $\Omega$ / 24 V: 9,6 $\Omega$
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...4
	accuracy of the current measurement [mA]	$\pm 37,5$
	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
software mode		OUT_DIGITAL_CSO
Voltage range [V]		6...32
switching current [A]		0,025...2,5
Min. load resistance [ $\Omega$ ]		12 V: 4,8 $\Omega$ / 24 V: 9,6 $\Omega$
protective circuitry		inductive load; thermal protection
current measurement [A]		0...4
accuracy of the current measurement [mA]		$\pm 37,5$
Diagnostic function		wire break; short circuit; current monitoring
lower limit of current monitoring [mA]		0; (configurable)
upper limit of current monitoring [mA]		2500; (configurable)
<b>Digital / PWM outputs; 2,5 A (OUT PWM-25-B)</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 [ $\Omega$ ]	12 V: 4,8 $\Omega$ / 24 V: 9,6 $\Omega$
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...4
	accuracy of the current measurement [mA]	$\pm 188$
	Diagnostic functions	wire break; short circuit; current monitoring
	lower limit of current monitoring [mA]	0; (configurable)
	upper limit of current monitoring [mA]	2500; (configurable)



## Programmable controller for mobile machines

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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 [ $\Omega$ ]	12 V: 4,8 $\Omega$ / 24 V: 9,6 $\Omega$
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...4
	accuracy of the current measurement [mA]	$\pm 188$
	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 [ $\Omega$ ]	12 V: 3 $\Omega$ / 24 V: 6 $\Omega$
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...6
	accuracy of the current measurement [mA]	$\pm 300$
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 [ $\Omega$ ]	12 V: 3 $\Omega$ / 24 V: 6 $\Omega$
	protective circuitry	inductive load; thermal protection
	current measurement [A]	0...6
	accuracy of the current measurement [mA]	$\pm 300$
	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	



## Programmable controller for mobile machines

ecomatBasic/32

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 [ $\Omega$ ]	12 V: 12 $\Omega$ / 24 V: 24 $\Omega$
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 [ $\Omega$ ]	12 V: 12 $\Omega$ / 24 V: 24 $\Omega$
	protective circuitry	inductive load; thermal protection

### Software / programming

Parameter setting options	CODESYS 3.5
PLC function to IEC 61131-3	yes
Operating system	Echtzeit-Betriebssystem

### 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
Degree of soiling		2
Chemical media	ISO 16750-5	AA, BB, BD, CC, DB, DC, DD, ED
		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
	IEC 61326-1	
	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 A (12 V)
	ISO 7637-2 pulse 4	severity level 4 / function state A (24 V)
	ISO 7637-2 pulse 5	severity level 3 / function state A (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
Fast temperature changes	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
Vibration resistance	ISO 16750-3 Test VII	random, mounting place car body
	EN 60068-2-6 Sinus	10...500 Hz / 10 cycles/axis, sine
Electrical safety	IEC 61010-1	safety requirements: general requirements
	IEC 61010-2-201	safety requirements: particular requirements for control equipment
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
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

# CR413S



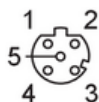
## Programmable controller for mobile machines

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Ethernet (ETH0)		
Display	connection	LED, green lights
	Data transmission	LED, green flashing
<b>Hardware</b>		
Processor	32-Bit Triple-Core	
Working memory	2,7 MByte RAM	
Mass storage	9 MByte Flash	
Non-volatile memory	10 kByte	
<b>Remarks</b>		
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

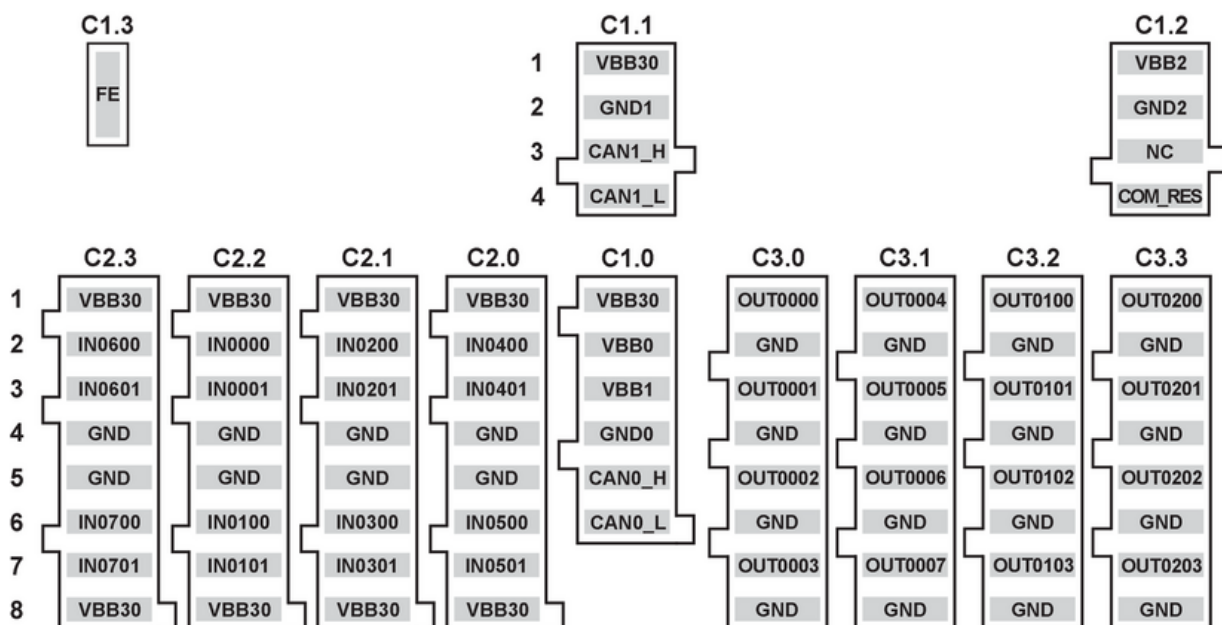


### ETH0

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

### Electrical connection

#### Connection





## Programmable controller for mobile machines

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### 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

### 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

# CR413S



## Programmable controller for mobile machines

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### 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

### 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

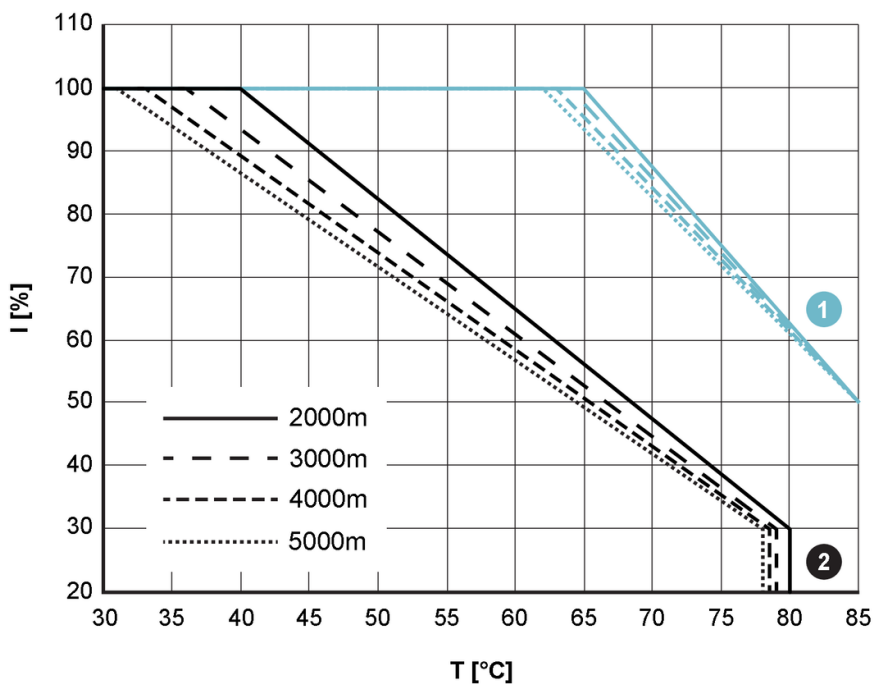
### OUT PWM-25-B / C3.3

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 I [%]

1: installation on painted metal plate

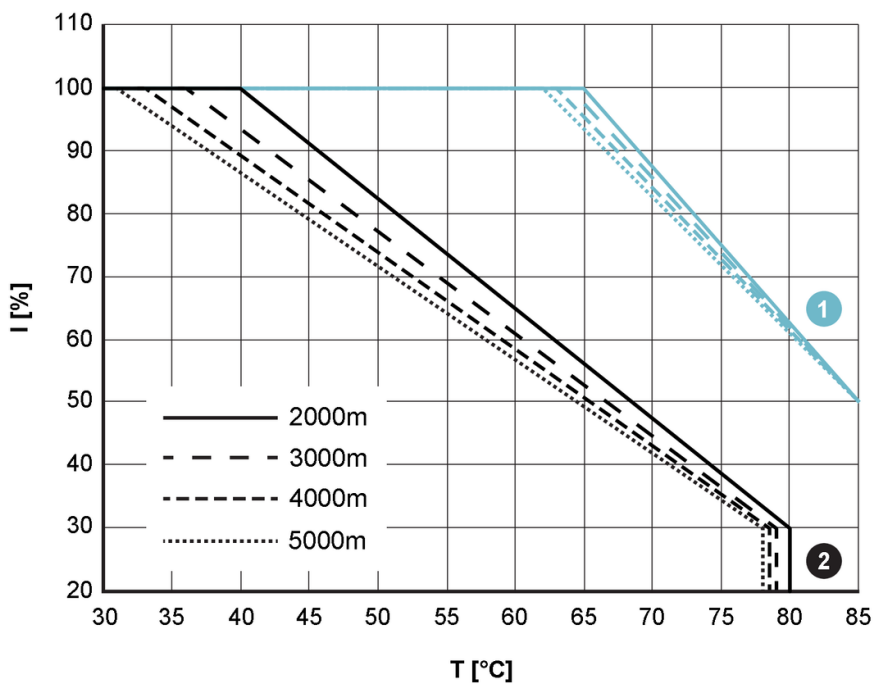
2: installation in a standard cabinet on a surface with low thermal conductivity (e.g. wood/plastic)



## Programmable controller for mobile machines

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### characteristics switching current



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

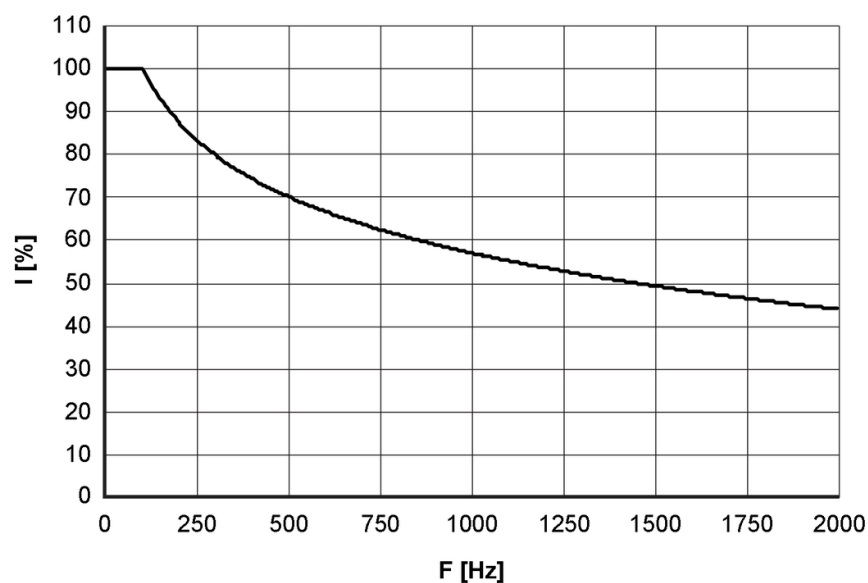
X: Ambient temperature T [°C]

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 [%]