CC-230-3500

Single-phase AC powered frequency converter for driving permanent-magnet synchronous motors (PMSM) and brushless DC motors (BLDC).

- Single-phase PFC input from 108 V_{AC} to 264 V_{AC} (50 Hz/60 Hz)
- Maximum output power of 3.5 kW
- Integrated EMI filter (complies with IEC 61800-3, Category C1), no output filter required
- Sensorless speed control (closed-loop) from 7,000 rpm up to 500,000 rpm
- User definable setup for different motor parameters
- Torque- or speed-control
- Internal or external braking chopper
- User-friendly PC control software (CelerotonPilot)
- Safe torque off interface
- Communication interfaces USB-C, RS232/RS485, CAN

Input specifications

	Min	Typ	Max
Input voltage U_{AC}	108 VAC_{rms}	120 VAC_{rms}	150 VAC_{rms}
	150 VAC_{rms}	230 VAC_{rms}	264 VAC_{rms}
Input frequency f_{AC}	48 Hz		63 Hz
Input current I_{AC}		for U_{AC} < 120 VAC_{rms}	20 A_{rms}[1]
		for U_{AC} > 150 VAC_{rms}	16 A_{rms}[2]
Max. power factor[3]		> 0.99	
Earth leakage current[4]		2 mA_{rms}	
Inrush current			30 A_{peak}
Input protection	30A / 500V fast blow fuse integrated in the converter[5]		
Electric supply system (at AC input, port X15)		TN, TT	

[1] For input voltages below 120 $V_{AC,rms}$. From 120 $V_{AC,rms}$ to 150 $V_{AC,rms}$, input power limited to 2,400 W (see).

[2] For input voltages from 150 $V_{AC,rms}$ to 230 $V_{AC,rms}$. Above 230 $V_{AC,rms}$, input power limited to 3,600 W (see).

[3] Measured at max. input power for input voltages 120 $V_{AC,rms}$ and 230 $V_{AC,rms}$ (see Figure 4).

[4] Measured at 230 $V_{AC,rms}$ with a CT-25-10000 compressor. The total earth leakage current also depends on the load used.

[5] Replacement must be carried out by Celeroton AG.

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Output specifications

		Min	Max
Active output power	for U_{AC} > 120 VAC_{rms}		2,200 W[6]
	for U_{AC} > 230 VAC_{rms}		3,500 W[7]
Apparent output power			6,600 VA[8]
Output frequency / speed[9]	PAM operation	5 Hz / 300 rpm	8,333 Hz / 500,000 rpm
	PWM operation	0 Hz / 0 rpm	500 Hz / 30,000 rpm
Output phase-to-phase peak voltage			380 V_{pp}
Output phase-to-phase RMS voltage[10]	PAM operation		256 V_{rms}
	PWM operation (sinusoidal modulation)		232 V_{rms}
Output phase current[11]			15 A_{rms}
Inverter PWM switching frequency		5,000 Hz	
Chopper switching frequency		5,000 Hz	
Chopper switching voltage		420 V	450 V
External chopper resistance		45 Ω	
External chopper power			3,500 W
Internal chopper power			40 W

[6] For input voltages from 120 $V_{AC,rms}$ to 150 $V_{AC,rms}$. Below 120 $V_{AC,rms}$, input current limited to 20 A_{rms} (and Figure 2).

[7] For input voltages above 230 $V_{AC,rms}$. From 150 $V_{AC,rms}$ to 230 $V_{AC,rms}$, input current limited to 16 A_{rms} (and Figure 2).

[8] Consider that active output power is limited depending on input voltage ().

[9] Speed calculation in rpm assumes two pole machine. Accordingly, lower speeds obtained for higher pole pair numbers.

[10] Fundamental component of phase-to-phase voltage.

[11] Fundamental component of phase current.

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General and environmental specifications

	Min	Typ	Max
Efficiency (at max. power)[12]		94 %	
Converter weight		4.26 kg	
Dimensions (L x W x H)		329 x 210 x 88 mm (12.95 x 8.27 x 3.45 inch)	
Climatic class (according to IEC 60721-3-3)		Class 3K3	
Operating ambient temperature	0 °C		40 °C
Humidity (non-condensing)	5% R.H.		85% R.H.
Location type		Indoor use only (Not for use in wet or salt water-wet locations)	
Cooling		Forced Air Cooling	
DVC classification (according to IEC 61800-5-1)		DVC As (for ports X1-X12) DVC C (for ports X13-X15)	
Overvoltage category (according to IEC 61800-5-1)		OVC III	
Protective class (according to IEC 61140)		Class III (for ports X1-X12) Class I (for ports X13-X15)	
Protection rating		IP30	
Pollution degree (according to IEC 61800-5-1)		2	
Operating altitude		< 2,000 m	
Vibration		Class 3M1 (vibration: 1m/s^2)	

EMC emissions

Phenomenon	Standard	Test level
Conducted	IEC 61800-3 (CISPR 11 / EN 55011) IEC 61000-6-3, FCC Part 15	Category C1, C2&C3 (Class B)
Radiated	IEC 61800-3 (CISPR 11 / EN 55011) IEC 61000-6-3, FCC Part 15	Category C1, C2&C3 (Class B)
Harmonic currents	EN 61000-3-2	Class A
Voltage fluctuation and flicker	EN 61000-3-3	
Commutation notches	IEC 61800-3	

[12] See Figure 3 for measured efficiency with a CT-25-1000 compressor operated at input voltages V_{in}=120 V_{rms} and V_{in}=230 V_{rms}.

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EMC immunity			
Phenomenon	**Standard**	**Test level**	**Criterion**
ESD immunity	IEC 61000-4-2	± 4 kV Contact, ± 8 kV Air Discharge	A
Radiated	IEC 61000-4-3	10 V/m	A
EFT/burst	IEC 61000-4-4	± 2 kV	A
Surge	IEC 61000-4-5	± 2 kV	A
Conducted	IEC 61000-4-6	10 V	A
Dips and interruptions	IEC 61000-4-11	Dip to 0%, 40%, 70%	C
		Dip to 80%	A
Voltage variations	IEC 61000-4-11	± 15% @ 120 V / 230 V	A
Harmonics and interharmonics	IEC 61000-4-13	Class 3	A
Supply frequency variation	IEC 61000-4-28	± 4%	A
Total harmonic distortion	IEC 61000-2-4	Class C, Level 12%	A
Commutation notches	IEC 61800-3	Depth 40%, 250% degree	A

Electrical safety	
Passive discharge	< 60 V_{DC}, 3 min
Electrical safety standard	According to IEC 61800-5-1
Functional safety	Must be ensured by external measures

Communication interfaces	
Communication interfaces	CAN 2.0A/B, RS-232, RS-485, USB-C

Operation of the frequency converter outside its specification may damage the frequency converter, the connected motor, the turbo compressor, or the entire system.

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Input operating area

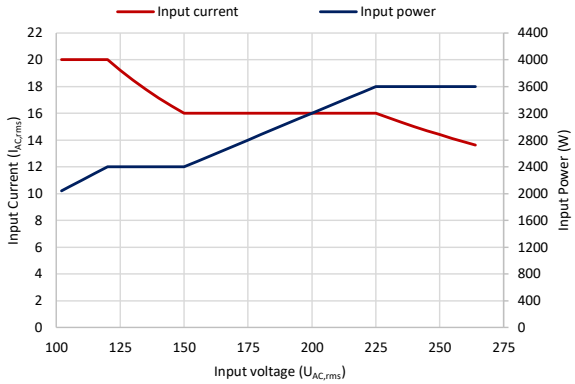

Figure 1: Input current and input power as a function of input voltage.

Output operating area

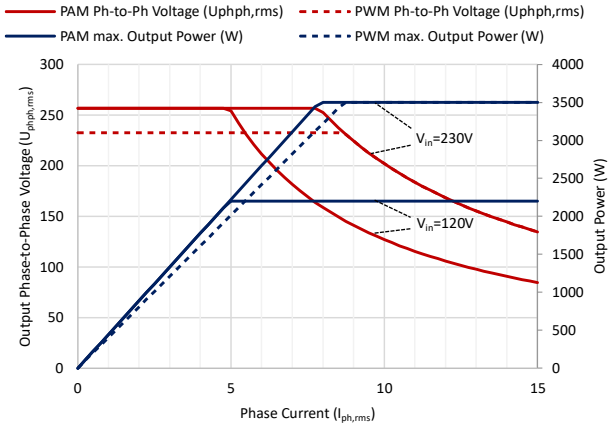

Figure 2: Output phase-to-phase voltage and output power as a function of phase current with power limits for U_{in}=120V_{rms} and U_{in}=230V_{rms}.

Efficiency

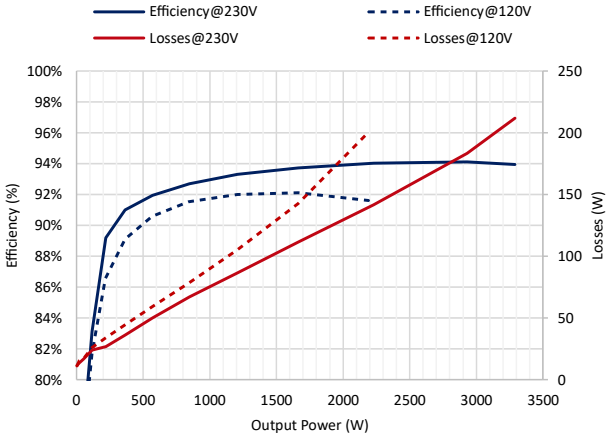

Figure 3: Typical converter efficiency as a function of output power measured with a CT-25-10000 compressor as load for U_{in}=120V_{rms} and U_{in}=230V_{rms}.

Power factor

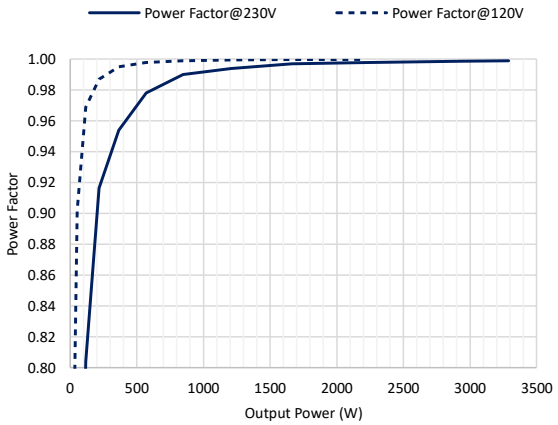

Figure 4: Measured power factor as a function of output power for U_{in}=120V_{rms} and U_{in}=230V_{rms}.

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User interfaces (X4, X5, X6, X7, X8, X9, X10, X11, X12)

Connector X4 – digital output	
4 × Digital outputs	0 – 24 V (relay, normally open contacts)

Connector X5 – digital input	
4 × Digital inputs	0 – 24 V (software adjustable thresholds 0.8 – 24 V)
1 × Power supply	24 V, 100 mA

Connector X6 – rotor angle	
4 × Rotor position signals (SA, SB, SC, SI)	5 V level

Connector X7 – analog output	
4 × Analog outputs	0 – 10 V

Connector X8 – analog input	
4 × Analog inputs	0 – 10 V
1 × Power supply	10 V, 100 mA

Connector X9 – hall motor [13]	
1 × Power supply	5 V, 100 mA
3 × Digital hall sensor inputs	(open collector), pull up to 5 V

Connector X10 – encoder motor[13]	
1 × Power supply	5 V, 100 mA
3 × Differential encoder inputs	5 V level

Connector X11 – temperature sensor	
1 × Temperature measurement input	Thermocouple type K
1 × Temperature measurement input	PTC or NTC

Connector X12 – STO	
1 × Power supply	24 V, 100 mA
2 × Safety switching input and interlock	STO – 24 V level

[13] Optional, on request.

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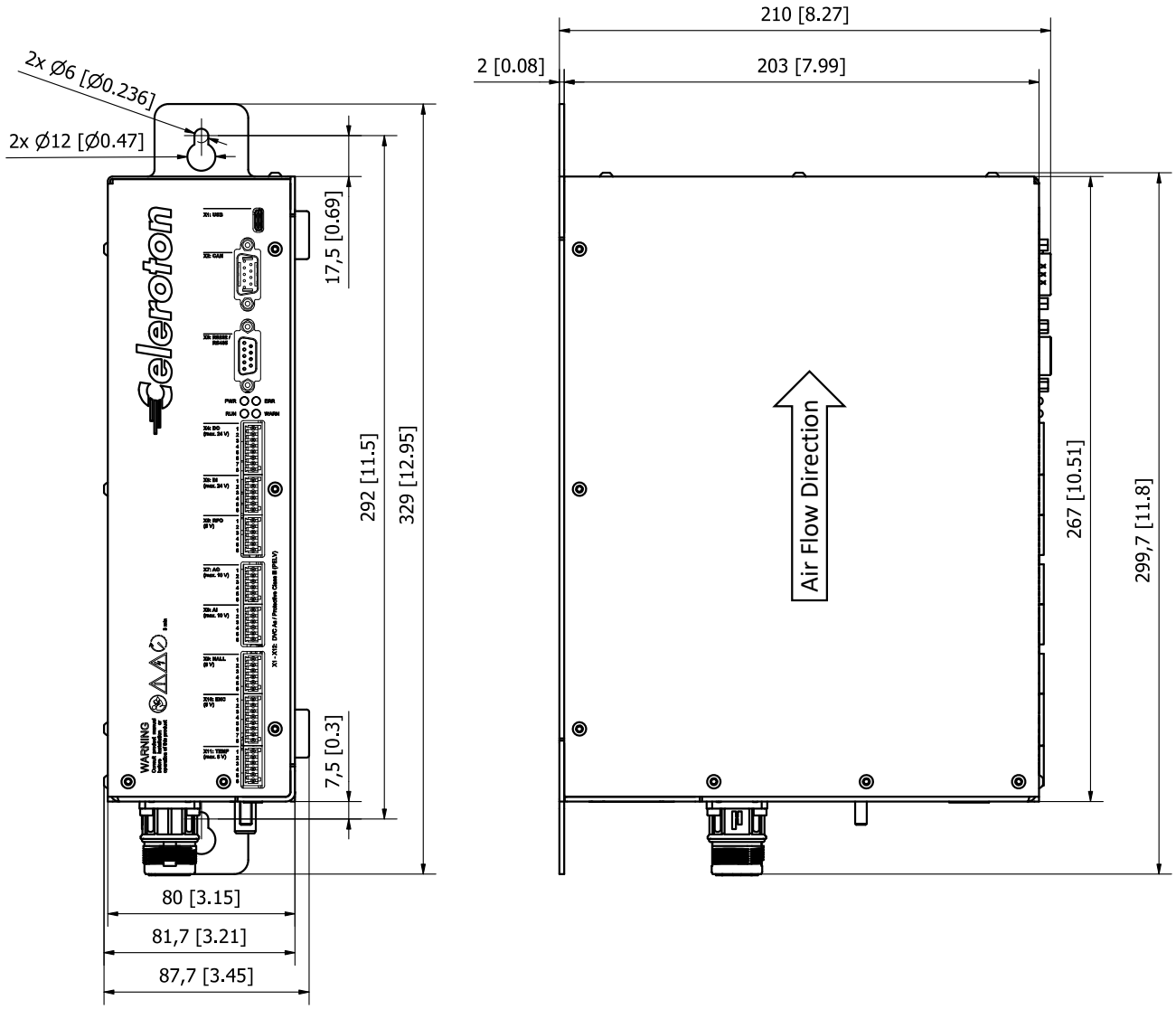
Order codes: CC-230-3500

Ordering information	Article number
Frequency converter CC-230-3500	4030101
Supply cable CC-230-3500 CH T23	4080060
Supply cable CC-230-3500 EU	4080061
Supply cable CC-230-3500 US	4080062
Connector set CC-230-3500 (for communication interfaces)	4080075
Universal motor cable Hummel M23 to Phoenix Contact connector, 1.5 m	4080076
Emergency stop push button CC-230-3500 (pre-wired with 1 m cable and connector for STO-Interface)	4080077

Drawing in mm (inch)



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