

PowerXL™

DC1
Frequency Inverter



EATON

Powering Business Worldwide

1 DC1 device series

1.1 Introduction

DC1 series frequency inverters are ideally suited to applications involving the simple frequency control of three-phase motors within an output range of 0.37 kW (at 230 V) to 11 kW (at 400 V) and AC motors within an output range of 0.37 to 1.1 kW (at 230 V).

DC1 series devices feature a compact and rugged design and are available in three sizes (FS1, FS2, FS3), as well as with protection types IP20 and IP66. For protection type IP66, there is also a model with a mains switch and controls for local control available.

Due to their ease of use and handling, the innovative technology behind them, and a high level of reliability, DC1 frequency inverters are particularly suitable for use in general applications. In addition, an integrated radio interference suppression filter and a flexible interface ensure that the inverters meet a number of important needs in the machine building industry when it comes to the optimization of production and manufacturing processes.

The computer-supported parameter configuration software ensures data integrity and reduces the time required for commissioning and maintenance.

In addition, the comprehensive accessories available increase the inverters' flexibility in all areas of application.

1.2 System overview

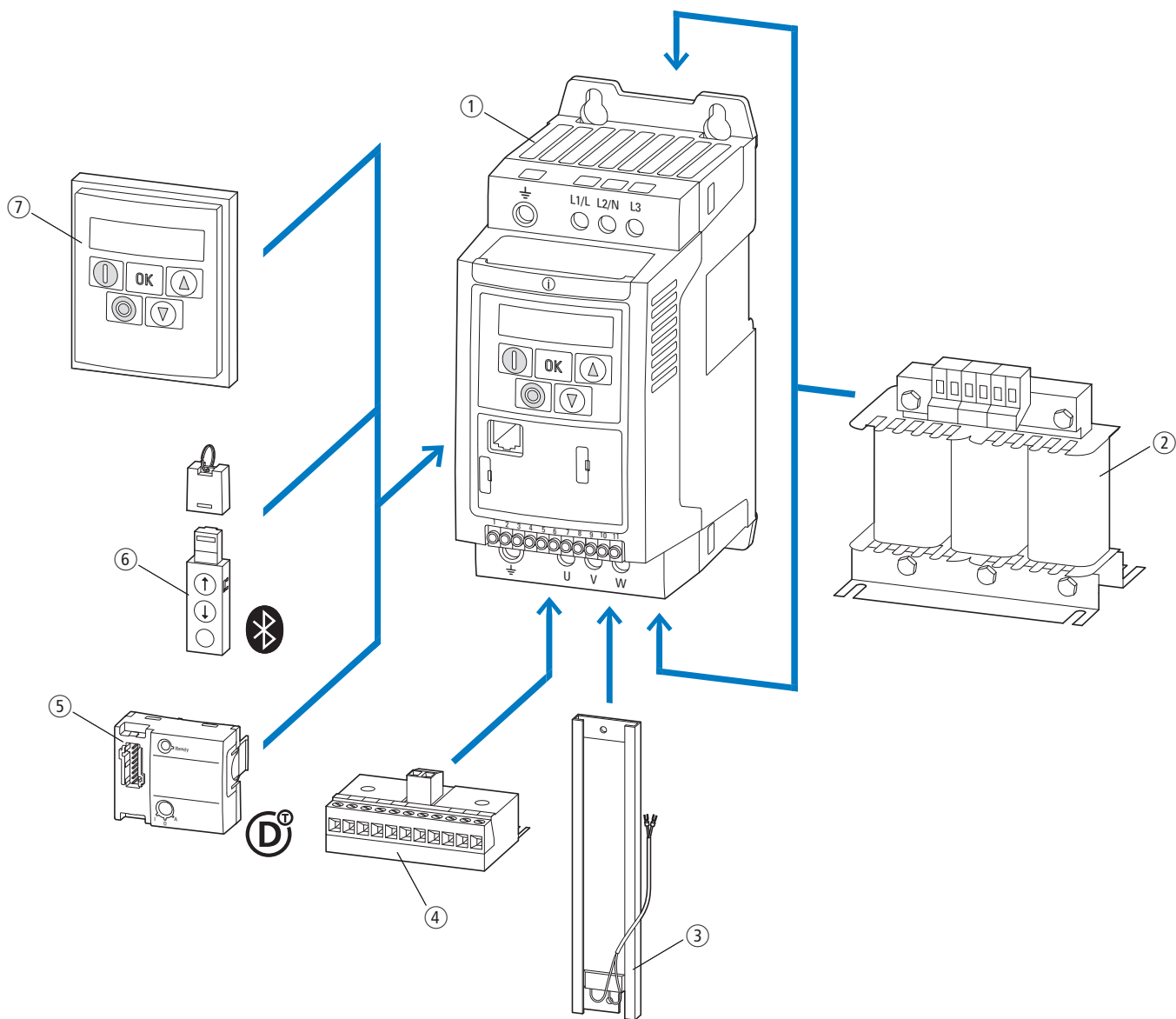


Figure 1: DC1 frequency inverters system overview

- ① DC1-... frequency inverters
- ② DX-LN-... main chokes, DX-LM3-... motor reactors, DX-SIN3-... sinusoidal filters
- ③ DX-BR... braking resistance
- ④ DXC-EXT-... expansion module
- ⑤ DXC-NET-... fieldbus connection
- ⑥ DX-COM-STICK communication module and accessories (e. g. DX-CBL-... connection cable)
- ⑦ DE-KEY-... keypad (external)

1.3 Checking the delivery



Before opening the package, please check the label on it to make sure that you received the correct frequency inverter.

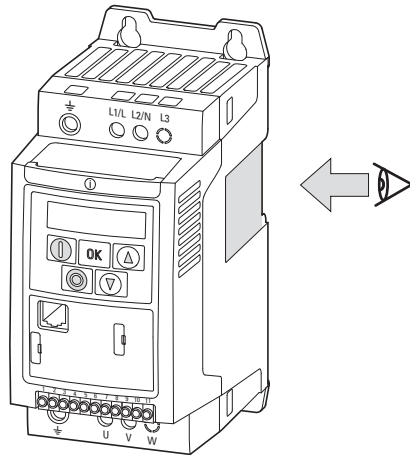


Figure 2: Location of nameplate on DC1 frequency inverter

The DC1 series frequency inverters are carefully packaged and prepared for delivery. The devices should be shipped only in their original packaging with suitable transportation materials. Please take note of the labels and instructions on the packaging, as well as of those meant for the unpacked device.

Open the packaging with adequate tools and inspect the contents immediately after receipt in order to ensure that they are complete and undamaged.

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1.3 Checking the delivery

The packaging must contain the following parts:

- DC1 series frequency inverter,
- an instructional leaflet
 - IL04020009Z,
 - IL04020013Z for devices with protection type IP66
 - IL04020014Z for DC1-S2... series frequency inverters for single-phase AC motors
- A data carrier (CD-ROM) containing documentation for DC1 series frequency inverters

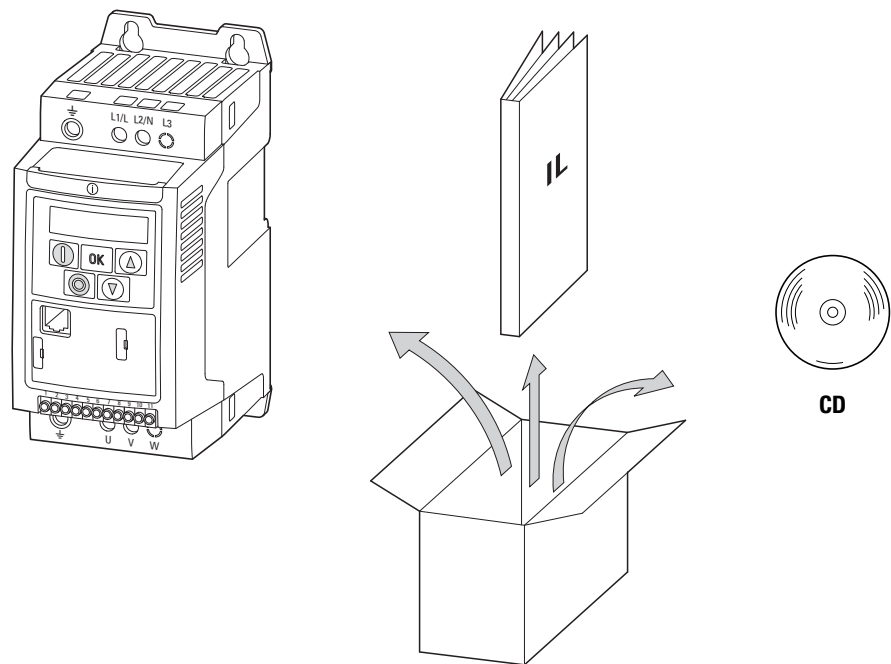


Figure 3: Equipment supplied with DC1 frequency inverter

1.4 Rated data

Voltage categories


DC1 frequency inverters are divided into following voltage categories:

- 110 V: DC1-1**D**...
- 230 V: DC1-1**2**..., DC1-S**2**..., DC1-**32**...
- 400 V: DC1-**34**...

1.4.1 Rating data on the nameplate

The device-specific rated operational data for the DC1 frequency inverter is listed on the nameplate on the right side of the device.

The inscription of the nameplate has the following meaning (example):

Inscription	Meaning
DC1-344D1FB-A20N	Part no.: DC1 = DC1 series frequency inverter 3 = Three-phase mains connection / three-phase motor connection 4 = 400 V mains voltage category 4D1 = 4.1 A rated operational current (4-decimal-1, output current) F = Integrated radio interference suppression filter B = Integrated brake chopper A = LED display (7-segment text display) 20 = IP20 protection type N = Standard basic device
Input	Power connection rating: Three-phase AC voltage (U_e 3~ AC), 380 - 480 V voltage, 50/60 Hz frequency, input phase current (5.1 A).
Output	Load side (motor) rating: Three-phase AC voltage (0 - U_e), output phase current (4.1 A), output frequency (0 - 500 Hz)
Power	Assigned motor output: 1.5 kW at 400 V/2 HP at 460 V for a four-pole, internally cooled or surface-cooled three-phase asynchronous motor (1500 min ⁻¹ at 50 Hz/1800 rpm at 60 Hz)
S/N	Serial number
	Frequency inverter is an electrical apparatus. Read the manual (in this case MN04020003Z-EN) before making any electrical connections and commissioning.
IP20/Open type	Protection type of the housing: IP 20, UL (cUL) Open type
25072012	Manufacturing date: 25.07.2012

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1.4 Rated data

1.4.2 Key to part numbers

The catalog no. or part no. for the DC1 series of frequency inverters is made up of four sections.

Series – Power section – Model – Version

The following figure shows it in greater detail:

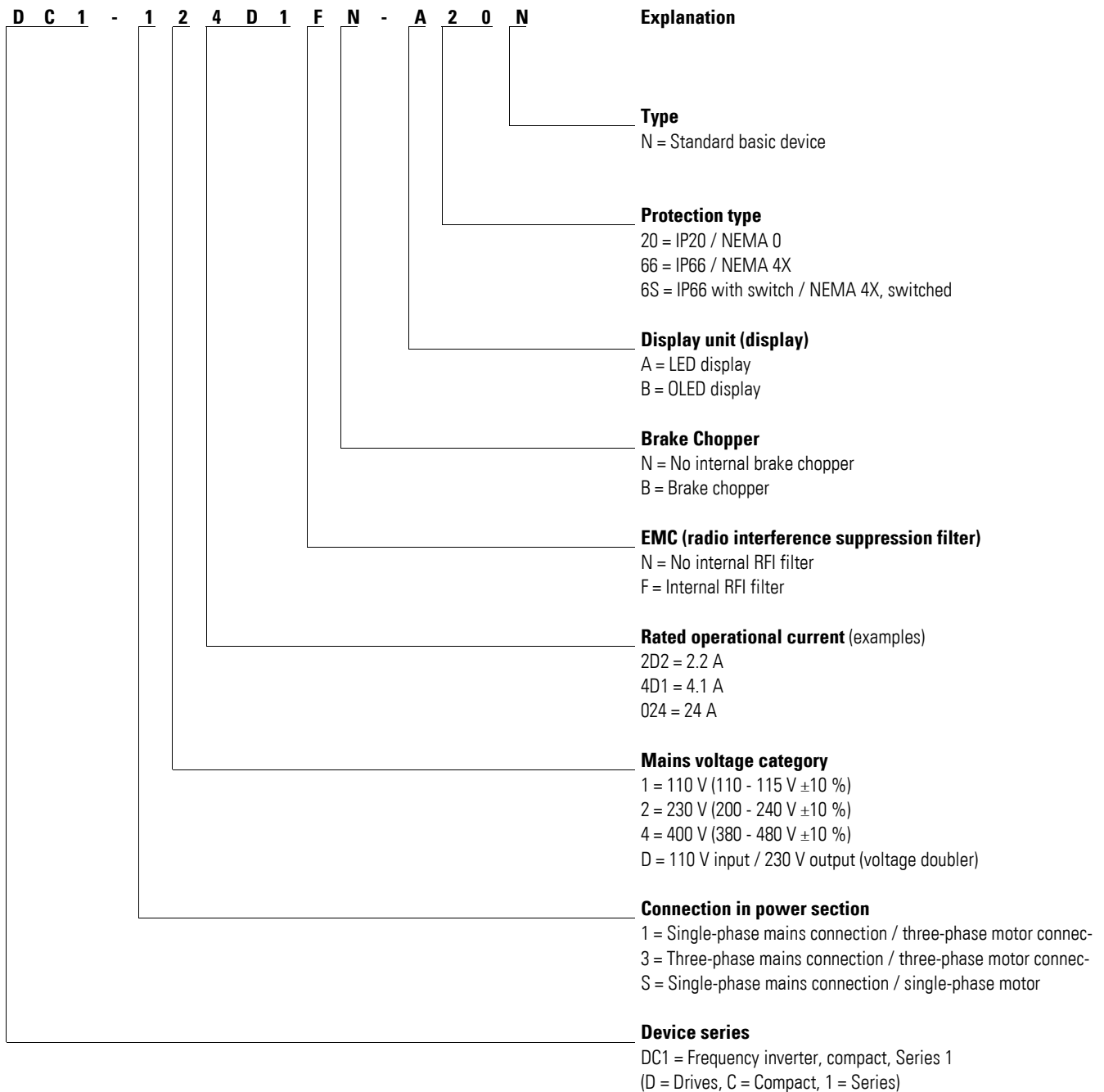


Figure 4: Key to part numbers of the DC1 frequency inverters

Catalog number examples

Inscription	Meaning
DC1-124D1FN-A20N	DC1 = DC1 series frequency inverter 1 = Single-phase mains connection / three-phase motor connection 2 = 230 V mains voltage category (200 - 240 V \pm 10 %) 4D1 = 4.1 A rated operational current (output current) F = Internal radio interference suppression filter (RFI, EMC measure) N = No internal brake chopper A = LED display (7-segment) on operating unit 20 = Protection type IP20 / NEMA 0 N = Standard basic device ¹⁾
DC1-S27D0FB-A20N	DC1 = DC1 series frequency inverter S = Single-phase mains connection / single-phase motor connection for AC motors 2 = 230 V mains voltage category (200 - 240 V \pm 10 %) 7D0 = 7 A rated operational current (output current) F = Internal radio interference suppression filter (RFI, EMC measure) B = Internal brake chopper. An external braking resistor (optional) is required for this function. A = LED display (7-segment) on operating unit 20 = Protection type IP20 / NEMA 0 N = Standard basic device ¹⁾
DC1-34024NB-A20N	DC1 = DC1 series frequency inverter 3 = Three-phase mains connection / three-phase motor connection 4 = 400 V mains voltage category (380 - 480 V \pm 10 %) 024 = 24 A rated operational current (output current) N = No internal radio interference suppression filter (RFI) ²⁾ B = Internal brake chopper. An external braking resistor (optional) is required for this function. A = LED display (7-segment) on operating unit 20 = Protection type IP20 / NEMA 0 N = Standard basic device ¹⁾
DC1-342D2FN-A6SN	DC1 = DC1 series frequency inverter 3 = Three-phase mains connection / three-phase motor connection 4 = 400 V mains voltage category (380 - 480 V \pm 10 %) 2D2 = 2.2 A rated operational current (output current) F = Internal radio interference suppression filter (RFI, EMC measure) N = No internal brake chopper A = LED display (7-segment) on operating unit 6S = Protection type IP66 / NEMA 4X with switches (mains switch, enable/phase sequence, potentiometer) for local control N = Standard basic device ¹⁾

1) Standard version = with Modbus

2) For frequency inverters without an internal EMC filter, external measures for complying with the relevant limits concerning electromagnetic compatibility (EMC) must be taken for operation as per IEC/EN 61800-3 (e.g., external radio interference suppression filter).



An external radio interference suppression filter is required for DC1... N... for operation as per IEC/EN 61800-3.

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1.4 Rated data

1.4.3 General rated operational data

Technical Data	Formula sign	Unit	Value
General			
Standards			EMC: EN 61800-3:2004+A1-2012 Radio interference: EN 55011: 2010 Safety: EN 61800-5: 2007 Protection type: EN 60529: 1992
Certifications and manufacturer's declarations on conformity			CE, UL, cUL, c-Tick
Production quality			RoHS, ISO 9001
Climatic proofing	ρ_w	%	< 95 %, average relative humidity (RH), non-condensing (EN 50178)
Ambient air temperature			
Operation			
IP20 (NEMA 0)	θ	°C	-10 - +50 (frost-free and condensation-free) -10 - +45 for DC1-12011... and DC1-32011..., for UL compliance over a period of 24 hours
IP66 (NEMA 4X)	θ	°C	-10 - +40 (frost-free and condensation-free)
Storage	θ	°C	-10 - +60
Electrostatic discharge (ESD, EN 61000-4-2:2009)	V	kV	±4, contact discharge ±8, air discharge
Fast transient burst (EFT/B, EN 61000-4-4: 2004)	V	kV	±1, at 5 kHz, control signal terminal ±2, at 5 kHz, motor connection terminals, single-phase mains connection terminals ±4, at 5 kHz, three-phase mains connection terminals
Overvoltage (surge, EN 61000-4-5: 2006)			
110 - 115 V, 200 - 240 V	V	kV	±1, phase to phase/neutral conductor ±2, phase/neutral conductor to earth
380 - 480 V	V	kV	±2, phase to phase ±4, phase to earth
Dielectric strength (flash, EN 61800-5-1: 2007)			
110 - 115 V, 200 - 240 V	V	kV	1.5
380 - 480 V	V	kV	2.5
Radio interference class (EMC)			
Category and maximum screened motor cable length			
C1	l	m	1, only with sizes FS1 and FS2 for single-phase mains voltages (110 - 115 V, 200 - 240 V)
C2	l	m	5
C3	l	m	25
Mounting position			Vertical, max. ±30 °
Altitude	H	m	0 - 1000 above sea level, > 1000 with 1% load current reduction every 100 m, maximum 2000 with UL approval, maximum 4000 (without UL)
Degree of protection			IP20 (NEMA 0) / IP66 (NEMA 4X)
Busbar tag shroud			BGV A3 (VBG4, finger- and back-of-hand proof)

Technical Data	Formula sign	Unit	Value
Main circuit / power section			
Power supply system			
Rated operational voltage			
DC1-1D...	U_e	V	1~ 110 (110 V - 0 % - 115 V +10 %, $\rightarrow U_2 = 230$ V)
DC1-S2..., DC1-12...	U_e	V	1~ 230 (200 V -10 % - 240 V +10 %)
DC1-32...	U_e	V	3~ 230 (200 V -10 % - 240 V +10 %)
DC1-34...	U_e	V	3~ 400 (380 V -10 % - 480 V +10 %)
Mains frequency	f	Hz	50/60 (48 Hz - 62 Hz)
Power factor	p.f.		> 98
Phase Imbalance		%	max. 3
Maximum short-circuit current (supply voltage)	I_q	kA	5
Mains switch-on frequency			Maximum of one time every 30 seconds
Mains network configuration (AC power supply network)			TN and TT earthing systems with directly earthed neutral point. IT earthing systems with PCM insulation monitors only. Operation on phase-earthed networks is only permissible up to a maximum phase-earth voltage of 300 VAC.
Motor feeder			
Output voltage			
DC1-1D...	U_2	V	3~ 0 - 2 x U_e (voltage doubler)
DC1-S2...	U_2	V	1~ 0 - U_e (for single-phase AC motor)
DC1-12..., DC1-32..., DC1-34...	U_2	V	3~ 0 - U_e
Output Frequency			
Range, parameterizable	f_2	Hz	0 - 50/60 (max. 500 Hz)
Resolution		Hz	0.1
Overload current			
for 60 s		%	150
for 2 s		%	175
Pulse frequency			
FS1	f_{PWM}	kHz	16 (max. 32)
FS2, FS3	f_{PWM}	kHz	8 (max. 32)
Operating mode			V/Hz control, slip compensation
DC braking			
Time before start	t	s	0 - 25, at stop, only with size FS1
Motor pick-up control function (for catching spinning motors)			only for sizes FS2 and FS3
Brake chopper			only for sizes FS2 and FS3
Braking current during continuous operation		%	100 (I_e)
Maximum braking current		%	150 for 60 s

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1.4 Rated data

Technical Data	Formula sign	Unit	Value
Control section			
Control Voltage			
Output voltage (control terminal 1)	U_C	V	24, DC
Load rating (control terminal 1)	I_1	mA	100
Reference voltage (control terminal 5)	U_S	V	10, DC
Load rating (control terminal 5)	I_5	mA	20
Digital input (DI)			
Count			3 (4)
Logic (level)			Increase
Response time	t	ms	< 4
Input voltage range High (1)	U_C	V	8 - 30, DC
Input voltage range Low (0)	U_C	V	0 - 4, DC
Analog Input (AI)			
Count			1 (2)
Resolution			12-bit
Accuracy		%	< 1 to the final value
Response time	t	ms	< 4
Input voltage range	U_S	V	0 - 10, DC ($R_i \sim 72 \text{ k}\Omega$)
Input current range	I_S	mA	0/4 - 20 ($R_B \sim 500 \Omega$)
Digital Output (DO)			
Count			1 (analog/digital) / 1 relay
Output voltage	U_{out}	V	0 - 10, DC
Output current	I_{out}	mA	0/4 - 20
Relays			N/O contact, 6 A (250 V AC) / 5 A (30 V DC)
Interface (RJ45)			RS485, Modbus RTU
Control level			Control signal terminal/operating unit/interface

1.4.4 Features

Part no.	Rated current I_e [A]	Assigned motor power				EMV filter (integrated) N = No F = Yes	Brake chopper (integrated) N = No B = Yes	Degree of protection IP	Size FS
		P (230 V, 50 Hz)		P (220 - 240 V, 60 Hz)					
		[kW]	[A] ¹⁾	[HP]	[A] ¹⁾				

Mains supply voltage: 1 AC 230 V

Motor connection voltage: 1 AC 230 V, 50/60 Hz (AC motor)

DC1-S24D3...	4.3	0.37	3	1/2	4.9	N, F	N	IP20, IP66	FS1
DC1-S27D0...	7	0.75	5	1	8	N, F	N	IP20, IP66	FS1
DC1-S2011...	11	1.1	7.5	1-1/2	10	N, F	N, B	IP20, IP66	FS2

Mains supply voltage: 1 AC 115 V, 50/60 Hz (voltage doubler), EMC: no internal radio interference suppression filter

Note: The 115 V mains supply voltage is increased to 230 V (output voltage) by an internal voltage doubler.

Motor connection voltage: 3 AC 230 V, 50/60 Hz

DC1-1D2D3N...	2.3	0.37	2	1/2	2.2	N	N	IP20, IP66	FS1
DC1-1D4D3N...	4.3	0.75	3.2	1	4.2	N	N	IP20, IP66	FS1
DC1-1D5D8N...	5.8	1.1	4.6	1-1/2 ²⁾	6 ²⁾	N	N, B	IP20, IP66	FS2

Mains supply voltage: 1 AC 230 V, 50/60 Hz

Motor connection voltage: 3 AC 230 V, 50/60 Hz

DC1-122D3...	2.3	0.37	2	1/2	2.2	N, F	N	IP20, IP66	FS1
DC1-124D3...	4.3	0.75	3.2	1	4.2	N, F	N	IP20, IP66	FS1
DC1-127D0xN...	7	1.5	6.3	2	6.8	N, F	N	IP20, IP66	FS1
DC1-127D0xB...	7	1.5	6.3	2	6.8	N, F	B	IP20, IP66	FS2
DC1-12011...	10.5	2.2	8.7	3	9.6	N, F	N, B	IP20, IP66	FS2

Mains supply voltage: 3 AC 230 V, 50/60 Hz

Motor connection voltage: 3 AC 230 V, 50/60 Hz

DC1-322D3...	2.3	0.37	2	1/2	2.2	N, F	N	IP20, IP66	FS1
DC1-324D3...	4.3	0.75	3.2	1	4.2	N, F	N	IP20, IP66	FS1
DC1-327D0xN...	7	1.5	6.3	2	6.8	N, F	N	IP20, IP66	FS1
DC1-327D0xB...	7	1.5	6.3	2	6.8	N, F	B	IP20, IP66	FS2
DC1-32011...	10.5	2.2	8.7	3	9.6	N, F	N, B	IP20, IP66	FS2
DC1-32018...	18	4	14.8	5	15.2	N, F	N, B	IP20, IP66	FS3

1) The rated motor currents apply to normal internally and surface-cooled three-phase asynchronous motor (1500 rpm at 50 Hz, 1800 rpm at 60 Hz).

2) Take motor data into account (6 A = normalized rated value as per UL 580 C)
Operation may be limited to a reduced motor load.

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1.4 Rated data

Part no.	Rated current I_e [A]	Assigned motor power				EMC filter (integrated) N = No F = Yes	Brake chopper (integrated) N = No B = Yes	Degree of protection IP	Size FS
		P (400 V, 50 Hz)		P (440 - 480 V, 60 Hz)					
		[kW]	[A] ¹⁾	[HP]	[A] ¹⁾				
Mains supply voltage: 3 AC 400 V, 50 Hz / 480 V, 60 Hz									
Motor connection voltage: 3 AC 400 V, 50 Hz / 440 - 480 V, 60 Hz									
DC1-342D2...	2.2	0.75	1.9	1	2.1	N, F	N	IP20, IP66	FS1
DC1-344D1xN...	4.1	1.5	3.6	2	3.4	N, F	N	IP20, IP66	FS1
DC1-344D1xB...	4.1	1.5	3.6	2	3.4	N, F	B	IP20, IP66	FS2
DC1-345D8...	5.8	2.2	5	3	4.8	N, F	N, B	IP20, IP66	FS2
DC1-349D5...	9.5	4	8.5	5	7.6	N, F	N, B	IP20, IP66	FS2
DC1-34014...	14	5.5	11.3	7-1/2	11	N, F	N, B	IP20, IP66	FS3
DC1-34018...	18	7.5	15.2	10	14	N, F	N, B	IP20, IP66	FS3
DC1-34024...	24	11	21.7	15	21	N, F	N, B	IP20, IP66	FS3

1) The rated motor currents apply to normal internally and surface-cooled three-phase asynchronous motor (1500 rpm at 50 Hz, 1800 rpm at 60 Hz).