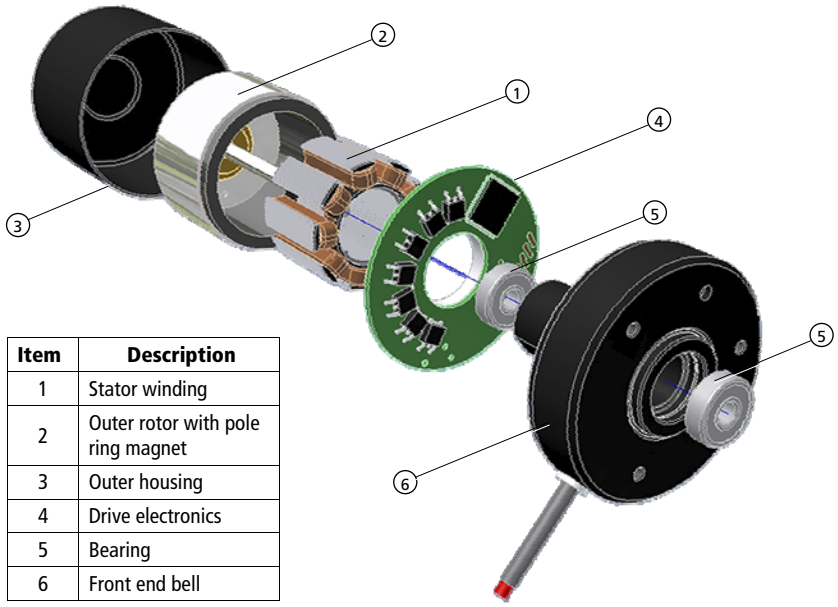
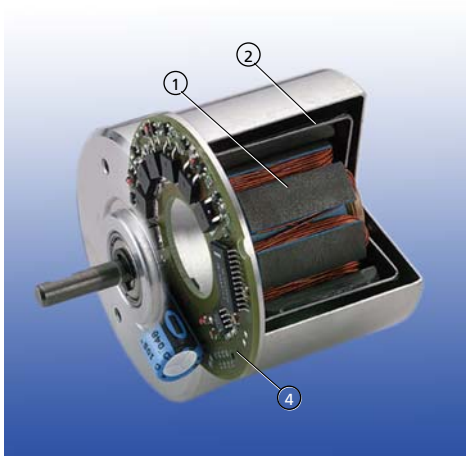
Outer Rotor Brushless DC Motors



Item	Description
1	Stator winding
2	Outer rotor with pole ring magnet
3	Outer housing
4	Drive electronics
5	Bearing
6	Front end bell



Cutaway view of a KinetiMax brushless DC Motor

Outer Rotor Brushless DC Motor Technology

Outer rotor brushless DC motors differ from typical brushless DC motors in that the rotor (item 2 above) is situated outside, instead of inside, the stator (item 1).

The stator consists of a multiphase winding on a laminated core, and the rotor consists of permanent magnet segments or a molded ring affixed to the inner surface of a steel cup-like component that is attached at one end to the motor's shaft.

The stator windings are fed with currents controlled in magnitude and sequence (commutated) to effect rotation of the rotor element just as in a typical brushless motor.

Many Allied Motion outer rotor brushless DC motors include integrated drive electronics (item 4). The sophistication of the integral drive can range from a simple unidirectional fixed speed control to one with bidirectional, variable speed characteristics.

Advantages of Outer Rotor Brushless DC Motors

Allied Motion's outer rotor brushless DC motors posses desirable attributes that make them an excellent choice for many applications:

- Higher inertia and optimized magnetic design of outer rotor technology minimizes cogging
- Outer rotor motors' larger air gap radius maximizes output torque
- Outer rotor's larger inertia helps "ride through" torque variations in pump applications
- Polygon mirrors can be directly mounted to the rotor for more robust and compact scanner equipment
- Higher pole count and inertia mean more stable low speed performance without feedback
- Lower audible noise due to greater inertia and reduced cogging is ideal for use in "quiet" applications
- Outer rotor designs are axially shorter than inner rotor designs for the same performance level

Outer Rotor Brushless DC Motor Applications

Here are some types of applications that benefit from the advantages of outer rotor brushless DC motors:

Medical Equipment

- Gas analyzer membrane pumps
- Dialysis peristaltic blood pumps and clean-cycle gear pumps
- CPAP sleep apnea machine membrane pump
- Anesthesia ventilator breathing system pump
- Dental instruments pumps
- Automated stirrers for medical (and chemical) instruments

Industrial Equipment

- Inkjet high-speed marking machine gear pumps
- Laser scanning instruments
- Industrial laser bar code readers

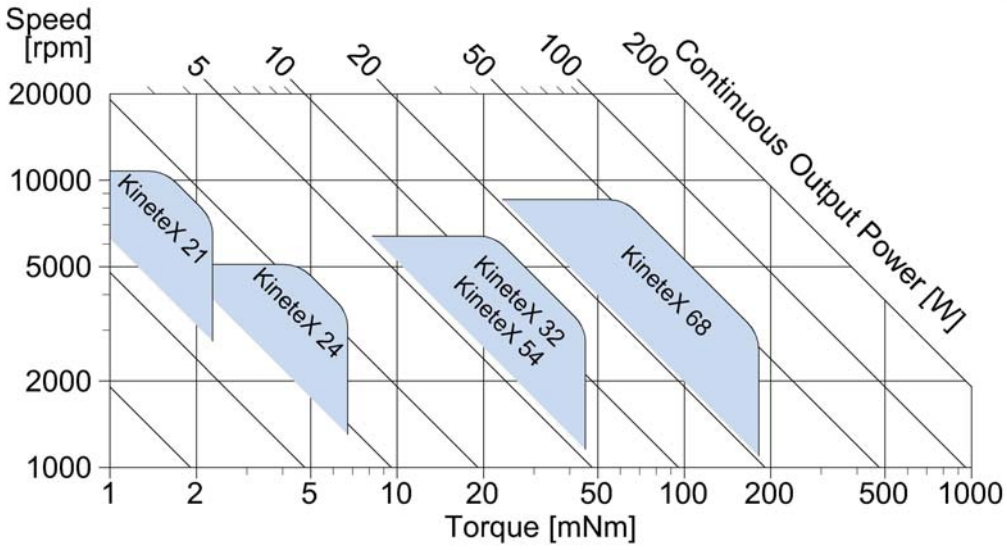
Other

- Liquid Petroleum Gas (LPG) fuel pumps for "green" vehicles
- Pilot flight suit microclimate cooling system pump
- Conveyor system check weighers

Outer Rotor Brushless DC Motors

	Size (OD) [mm (in)]	Power[1] [Watt]	Torque [mNm (oz-in)]	Speed No-load [RPM]	Inertia [kgm² (oz-in-s²)]	Voltages (VDC)	Options
KinetiMax 24 	21 (0.827) [EE] 24 (0.945) [EB]	1.5 2.7	6 (0.85)	Up to 10000 RPM Up to 7070 RPM	0.53E-6 (0.75E-4) 0.77E-6 (1.09E-4)	6, 12, 24	• Gearhead • IP30 protection • Custom leads and connector configuration • Custom shaft / flange
KinetiMax 32 EB 	31.2 (1.29)	12, 16	32 (4.53)	4600, 6000	4.7E-6 (6.66E-4)	12, 24	• Gearhead • IP54 protection • Custom leads and connector configuration • Custom shaft / flange
KinetiMax 54 EB 	54 (2.13)	8 12	22 (3.12) 30 (4.25)	4600	22E-6 (3.1E-3) 31E-6 (4.4E-3)	12, 24	• Gearhead • IP30 protection • Custom leads and connector configuration • Custom shaft / flange
KinetiMax 68 EB 	68 (2.68)	35 50 50	80 (11.3) 114 (16.2) 170 (24.1)	6000 6000 3650	0.75E-4 (1.06E-2) 1.2E-4 (1.7E-2) 1.2E-4 (1.7E-2)	24	• Gearhead • IP54 protection • Custom leads and connector configuration • Custom shaft / flange

1. Continuous ratings



Note: Blue-shaded area indicates optimum operational area for the motor

KinetiMax 24 EB Brushless DC Motors with Integral Drive

24 mm diameter, 6 mNm max. torque, up to 2.7 W output power

The KinetiMax 24 EB is an extremely compact brushless DC motor with integrated drive electronics. This motor is an outer rotor motor with a robust bearing system capable of handling high side loads.

The KinetiMax 24 EB series employs an external rotor and iron core stator to minimize cogging and maximize output torque.

High quality components ensure an operating life of 20,000 hours minimum. The KinetiMax 24 EB is a good choice for many types of pumps, laser scanners, small high performance fans, blowers and medical applications.

Features & Benefits

- Two wire version is as simple to control as a DC motor, needing only a DC voltage to operate
- Protected against reverse supply voltage
- Low EMI – complies with EN 55014-1/2, 61000-6-1/3
- IP30 level protection sealing

5 Wire version

- Integrated controller with speed adjustment input
- Tachometer output (18 pulses per rev) for speed monitoring
- Input to enable direction reversal

Options

- Customized shaft
- Customized mounting flange
- Custom leads and connector configurations
- Special winding configurations
- Gearbox

- Small precision 24 mm diameter brushless DC motors with integrated drive electronics
- Rated up to 2.7W power output at 4300 RPM nominal speed
- 6, 12 or 24 VDC winding choice

SPECIFICATIONS

Model	2 Wire CW[1]	4322 016+	21492	21512	21532
	2 Wire CCW[1]	4322 016+	21502	21522	21542
	5 Wire	4322 016+	21513	21523	21533
Nominal Voltage		V	6	12	24
Voltage Range[2]		V	5.5 - 9	7 - 17	10 - 28
Nominal Output Power		W	2.2	2.7	2.7
Nominal Torque		mNm (oz-in)	5 (0.70)	6 (0.85)	
Max. Torque		mNm (oz-in)	7 (0.99)	9 (1.27)	
Nominal Speed		RPM	4200	4250	4300
No-Load Speed		RPM	7150	7050	7070
Nominal Current		mA	750	445	230
Max. Current		mA	950	630	330
No-Load Current		mA	105	62	40
Torque Constant		mNm/A (oz-in/A)	7.6 (1.07)	15.7 (2.16)	31.4 (4.45)
Rotor Inertia		kgm^2 ($oz\text{-}in\text{-}s^2$)	0.77 E-6 (1.09 E-4)		
Mechanical Time Constant		ms	47	35	35
Thermal Resist. Housing-Ambient		°C/W	25.5		
Weight		g (oz)	30 (1.06)		
Protection		-	IP30		
Speed Control Input Range[3]		V	0 - 5		
Speed Control Input Threshold[3]		V	1		
Speed Output Signal[3]		PPR	18		
Operating temperature range		°C (F)	0 - 90 (32 - 194)		
Thermal Limit Protection		°C	N/A (Maximum motor housing temperature = 90 °C)		

Notes: Values valid for nominal voltage and T_{amb} = 22 °C ; (1) CW for clock rotation, CCW for counter clockwise rotation; (2) Power supply provided with appropriate 68 µF buffer capacitor between supply voltage and common to comply with EN 55014-1/2; (3) Applicable for 5 wire versions only

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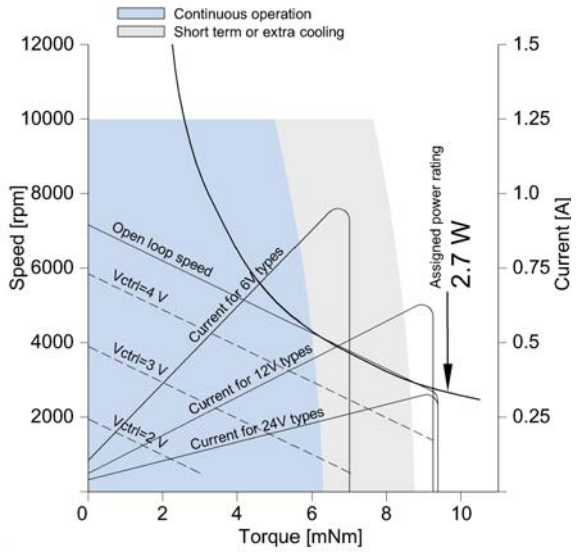
Specifications subject to change without notice

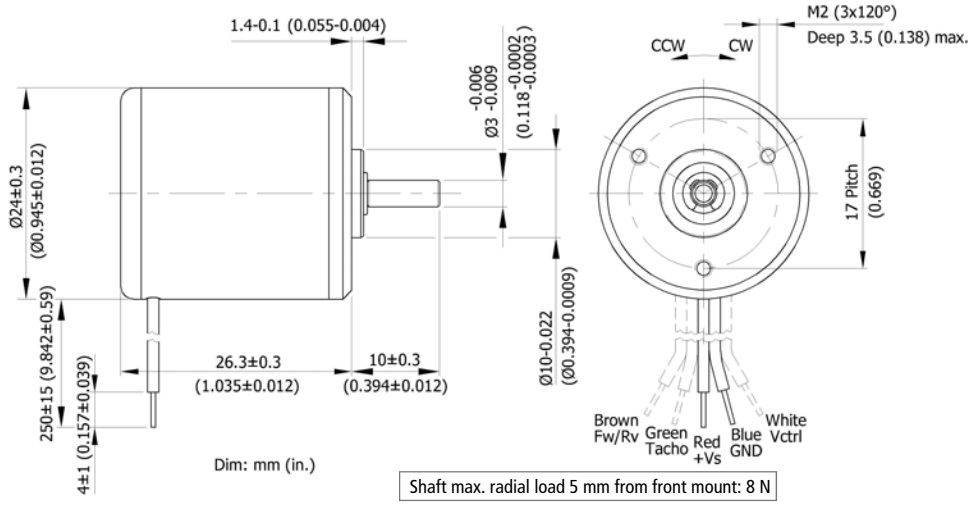
Small Brushless DC Motor

KinetiMax 24 EB Series BLDC Motors

PERFORMANCE



DIMENSIONS



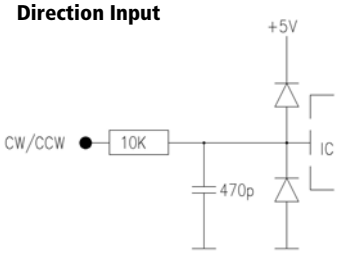
Shaft max. radial load 5 mm from front mount: 8 N

SPECIFICATIONS

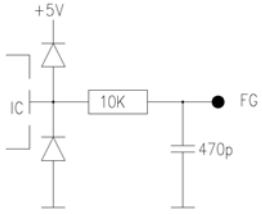
Version	Connection	Color	Size
2-wire	Supply Voltage (Vs)	Red	AWG 26
	Common (ground)	Blue	AWG 26
5-wire	Supply Voltage (Vs)	Red	AWG 26
	Common (ground)	Blue	AWG 26
	Control input (Vin)	White	AWG 26
	Speed output (FG)	Green	AWG 26
	Direction input[1]	Brown	AWG 26

Notes:
(1) CW @ ≥ 3.5V, CCW @ ≤ 1.5V

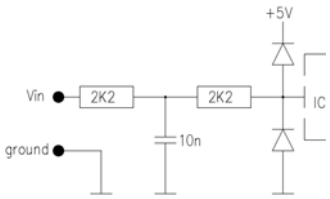
Direction Input



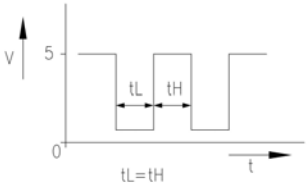
Speed Output



Control Input



Speed Output Signal



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KinetiMax 32 EB Brushless DC Motors with Integral Drive

32 mm diameter, 32 mNm cont. torque, up to 16 W output power

The KinetiMax 32 EB is an extremely compact brushless DC motor with integrated drive electronics. This motor is an outer rotor motor with a robust bearing system capable of handling high side loads.

High quality components ensure a minimum operating life of 20000 hours. The continuous output torque of 32 mNm at a constant speed of 4750 RPM makes this motor ideal for small membrane and peristaltic pumps, laser scanners, blower-fan and medical applications.

Features & Benefits

- Integrated speed control loop with a speed set input to adjust motor speed from 200 to 6000 RPM
- Two-wire version is as simple to control as a DC motor, needing only a DC voltage to operate
- Four-wire version with tachometer output (18 pulses per rev) for speed monitoring
- IP54 level protection sealing
- Thermal overload protection with automatic recovery
- Reverse supply voltage protection
- Low EMI – complies with EN 55014-1/2, 61000-6-1/3

Options

- Customized shaft
- Customized mounting flange
- Custom leads and connector configurations
- Special winding configurations
- Encoder and/or gearbox

- 32 mm dia., outer rotor, brushless DC motor with integrated drive and robust bearing system
- Rated 32 mNm (4.5 oz-in) and 16 W output at 4750 RPM
- 12 or 24 VDC winding choice

SPECIFICATIONS

Model		2-Wire		4-Wire	
CW	4322 016+	30421	30423	30425	30427
CCW	4322 016+	30422	30424	30426	30428
Nominal Voltage	V	12	24	12	24
Voltage Range(1)	V	10 - 18	10 - 28	10 - 18	10 - 28
Nominal Output Power	W	12	16	12	16
Nominal Torque	mNm (oz-in)	32 (4.67)			
Max. Torque	mNm (oz-in)	40 (5.66)	50 (7.08)	40 (5.66)	50 (7.08)
Nominal Speed	RPM	3450	4750	3450	4750
No-Load Speed	RPM	4600	6000	4600	6000
Nominal Current	mA	1420	920	1420	920
Max. Current	mA	1600	1300	1600	1300
No-Load Current	mA	160	130	160	130
Torque Constant(3)	mNm/A oz-in/A)	26 (3.68)	41 (5.81)	N/A	N/A
Rotor Inertia	kgm^2 ($oz\text{-}in\text{-}s^2$)	4.7 E-6 (7 E-4)			
Mechanical Time Constant	ms	12	9	12	9
Thermal Resistance Housing-Ambient	°C/W	13			
Weight	g (oz)	113 (4)			
Protection	-	IP54			
Speed Command Ratio(4)	RPM/V	N/A		1000	
Speed Command Range(4)	V	N/A		0 - 7	
Speed Command Threshold(4)	V	N/A		0.2	
Speed Output Signal(4)	PPR	N/A		18	
Speed Output Signal Low Time(4)	µsec	N/A		195	
Thermal limit Protection	°C (F)	90°C (194) flange temp. / 80°C (176) restart			

Notes: Values valid for nominal voltage and T_{amb} = 22 °C ; (1) Power supply provided with 1000 µF buffer capacitor between supply voltage and common to comply with EN 55014-1/2; (2) ?; (3) ?; (4) ?

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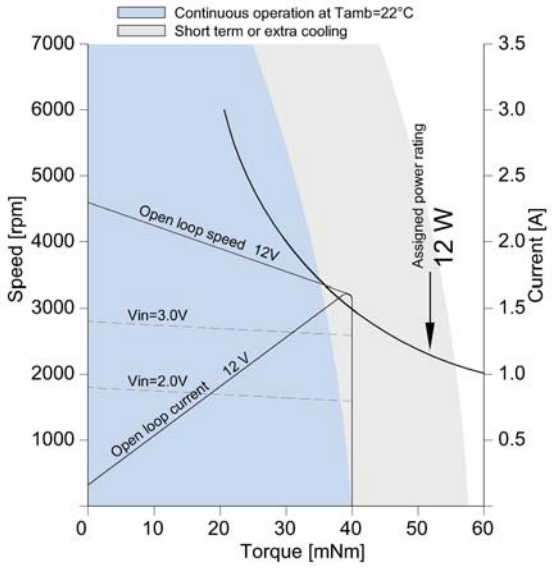
Small Brushless DC Motors

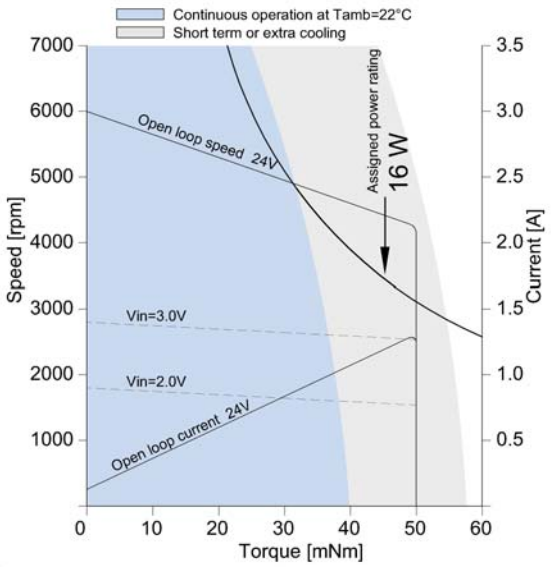
KinetiMax 32 EB Series BLDC Motors

PERFORMANCE

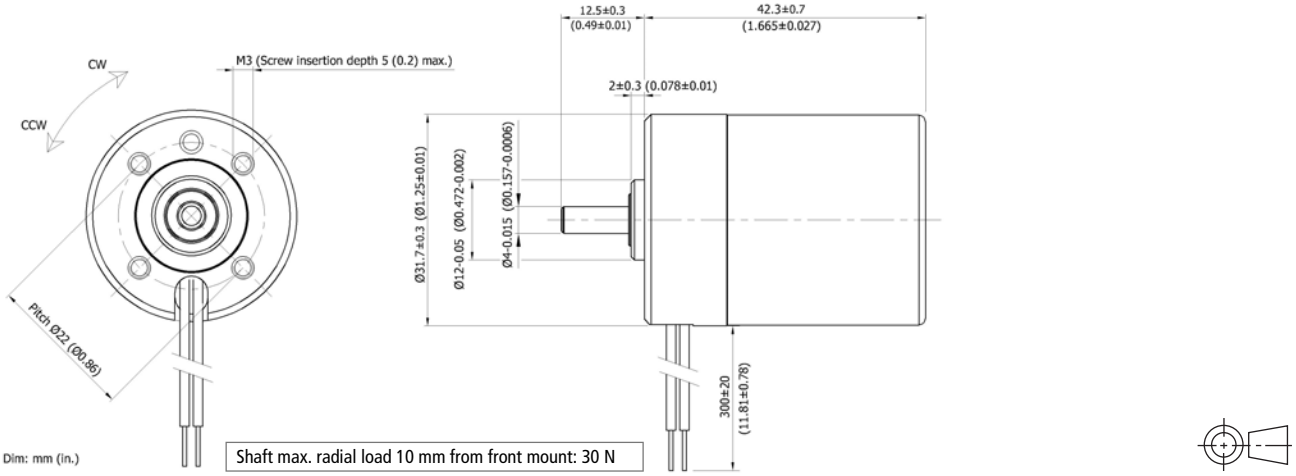
KinetiMax 32 EB 12 W



KinetiMax 32 EB 16W



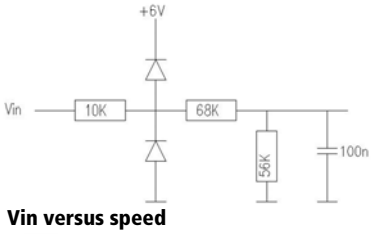
DIMENSIONS



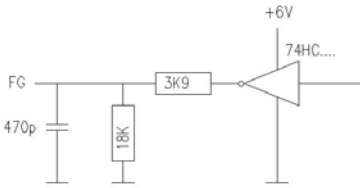
ELECTRICAL INTERFACE

Version	Connection	Color	Size
2-wire	Supply Voltage	Red	AWG24
	Common (ground)	Black	AWG24
4-wire	Supply Voltage	Red	AWG24
	Common (ground)	Black	AWG24
	Speed Input (Vin)	White	AWG24
	Speed Output (FG)	Green	AWG24

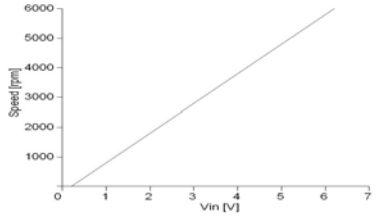
Speed Input



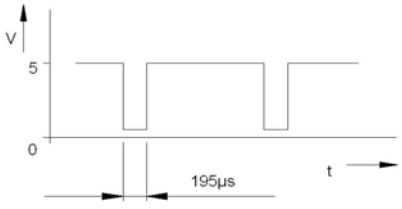
Speed Output



Vin versus speed



Speed Output signal



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BL Series Brushless DC Motors with Integral Drive

24, 54, 68, and 70 mm diameters, 2W up to 110W output power

Allied Motion's BL series of small brushless DC motors are extremely compact, yet incorporate integrated drive electronics (EB models). BL series motors are also available without drive electronics on-board (EE models).

All models except the BL70 employ an external rotor and iron core stator to minimize cogging and maximize output torque.

High quality components ensure BL motor life is in excess of 20,000 hours. Long-life coupled with a torque range from 2.5 to 355 mNm (0.35 to 50 oz-in) and speed range from 1,000 to 10,000 RPM make the BL series ideal for a wide range of small motor applications, including gearpumps, membrane pumps, peristaltic pumps, laser scanners, high performance fans and blowers, and document and package handling.

Features & Benefits

- As simple to control as a DC motor: 2-wire brushless design requires only a DC voltage to operate
- Thermal overload protection with automatic recovery (BL58, BL70)
- Reverse supply voltage protection
- Low EMI: Comply with EN55011, EN55022, EN50082-1*
  (*requires supply filter capacitor)
- Adjustable speed and direction selection (BL58, BL70)
- Low audible noise — ideal for use in "quiet" applications

Options

- Special shaft diameter and machining
- Square or customized mounting flange
- Higher protection level to IP67DS
- 4-wire versions of BL21 and BL48 for speed sensing output and speed adjustment

- Small, high performance brushless DC motor series with integrated drive electronics (EB models)
- Power range from 2W up to 110W and continuous torque range of 4 up to 355 mNm
- Models without integral drive electronics available (EE models)

BL EB SERIES OVERVIEW

Model	BL 21 EB	BL 48 EB	BL 58 EB	BL 70 EB
Type	Outer rotor			Inner rotor
Output Power [W]	2, 1.5	8, 12	35, 50	85, 95, 110
Voltage [VDC]	12, 24	12, 24	12, 24	24, 42
Cont. Torque [mNm (oz-in)]	6 (0.85)	30, 43 (4.25, 6.09)	80, 114, 170 (11.3, 16.1, 24)	300 - 480 (42.5 - 68)
Nom. Speed [RPM]	2500	3200	2800 - 4000	3000 - 3800
Size (D x L) [mm (in)]	24 x 26 (0.945 x 1.02)	54 x 30 (1.18 x 1.46) 54 x 37 (2.13 x 1.46)	68 x 49 (2.68 x 1.93) 68 x 62 (2.68 x 2.44)	69 x 95 (2.72 x 3.74) 69 x 109 (2.72 x 4.29) 69 x 123 (2.72 x 4.84)
Weight [g (oz)]	30 (1.06)	195, 250 (6.88, 8.82)	450, 550 (15.9, 19.4)	1000, 1300, 1600 (35.3, 45.9, 46.4)

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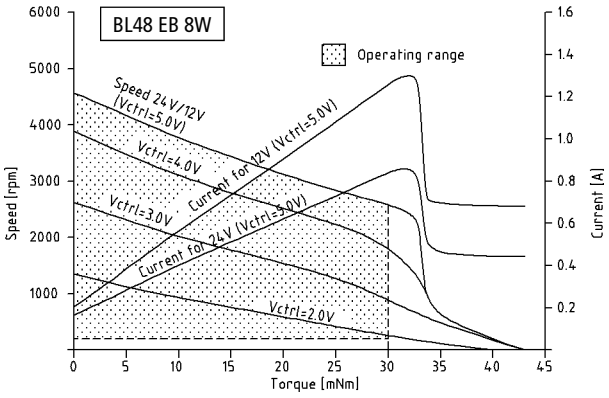
BL48 EB Series 8W and 12W BLDC Motors

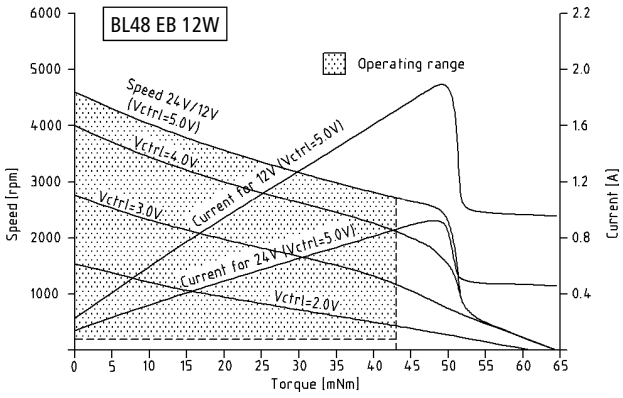
SPECIFICATIONS

Model CW / CCW		4322 016 + / 4322 016 +	48007 / 48003	48017 / 48013	48027 / 48023	48037 / 48033
Housing Length, L	mm		30		36.75	
Nominal Voltage	V		12	24	12	24
Voltage Range	V		10 - 15	14 - 28	10 - 15	14 - 28
Max. Output Power[1]	W		8		12	
Nominal Torque	mNm (oz-in)		22 (3.12)		30 (4.25)	
Max. Continuous Torque[1]	mNm (oz-in)		30 (4.25)		43 (6.09)	
Nominal Speed	RPM		3000		3200	
No-Load Speed	RPM		4550		4600	
Min. Adjustable Speed	RPM		200			
Nominal Current	A		0.98	0.5	1.28	0.66
Max. Continuous Current[1]	A		1.47	0.74	2.13	1.04
No-Load Current	mA		205	125	230	140
Rotor Inertia	kgm² (oz-in-s²)		22E-6 (3.1E-3)		31E-6 (4.4E-3)	
Mechanical Time Constant	ms		65	45	51	41
Thermal Resistance Winding-Housing	°C/W		2			
Thermal Resistance Housing-Ambient	°C/W		8			
Weight	g (oz)		195 (6.88)		250 (8.82)	
Protection	-		IP30			
Gearbox (option)	-		P42A, S64A, S69A			

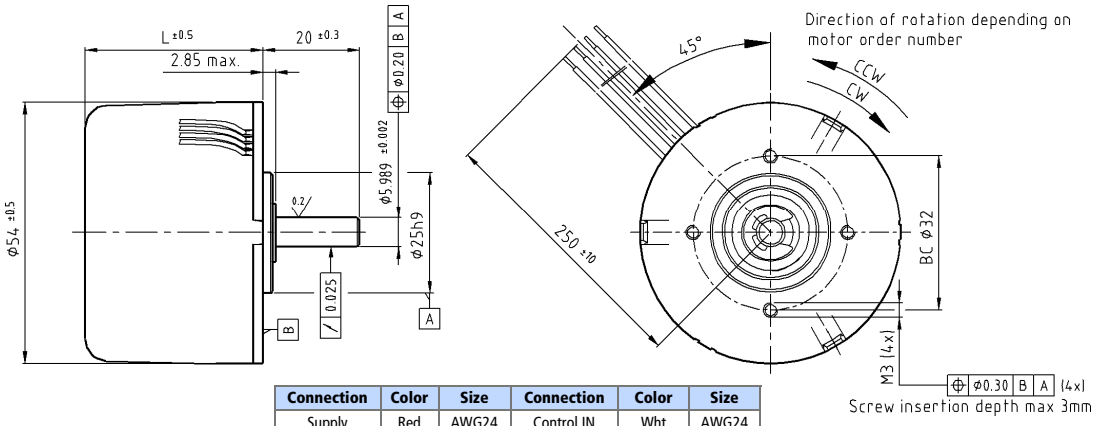
Notes: Values valid for nominal voltage and T_{amb} = 22 °C
1) Motor mounted to heatsink; max. flange temp = 85 °C

PERFORMANCE





DIMENSIONS



Connection	Color	Size	Connection	Color	Size
Supply	Red	AWG24	Control IN	Wht	AWG24
Common	Blu	AWG24	Frequency OUT	Grn	AWG24

Shaft max. radial load 15mm from front mount: 40 N

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Small Brushless DC Motors

BL58 EB Series 35W and 50W BLDC Motors

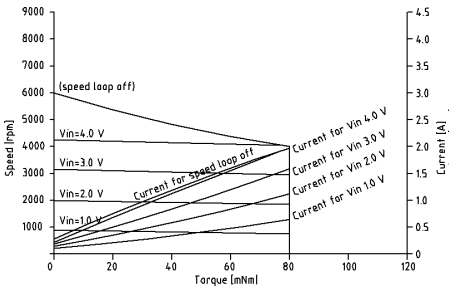
SPECIFICATIONS

Model	Shaft L = 25 mm	4322 016 +	58041	58013	58023
	Shaft L = 20 mm	4322 016 +	58042	58014	58024
Housing Length, L		mm	49	62.1	
Nominal Voltage		V	24		
Max. Output Power[1]		W	35	50	
Nominal Torque		mNm (oz-in)	80 (11.3)	114 (16.1)	170 (24)
Max. Continuous Torque[1]		mNm (oz-in)	80 (11.3)	114 (16.1)	170 (24)
Nominal Speed		RPM	4000		2700
No-Load Speed		RPM	6000		3650
Nominal Current		A	2	3	
Max. Continuous Current[1]		A	2	3.4	3
No-Load Current		mA	215	260	265
Rotor Inertia		kgm^2 ($oz\text{-}in\text{-}s^2$)	0.75E-4 (0.0106)	1.2E-4 (0.017)	1.2E-4 (0.017)
Mechanical Time Constant		ms	30	40	25
Thermal Resistance Housing-Ambient		°C/W	4	3.7	3.7
Weight		g (oz)	450 (15.9)	550 (19.4)	550 (19.4)
Protection		-	IP54		
Gearbox (option)[2]		-	P50A, P59A, S69A		

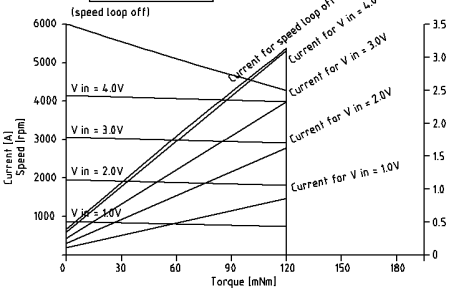
Notes: Values valid for nominal voltage and T_{amb} = 22 °C
1) Motor mounted to heatsink; max. flange temp = 90 °C
2) Requires 20 mm shaft length model

PERFORMANCE

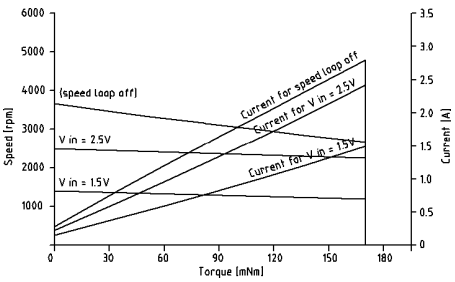
BL58 EB 35W



BL58 EB 50W



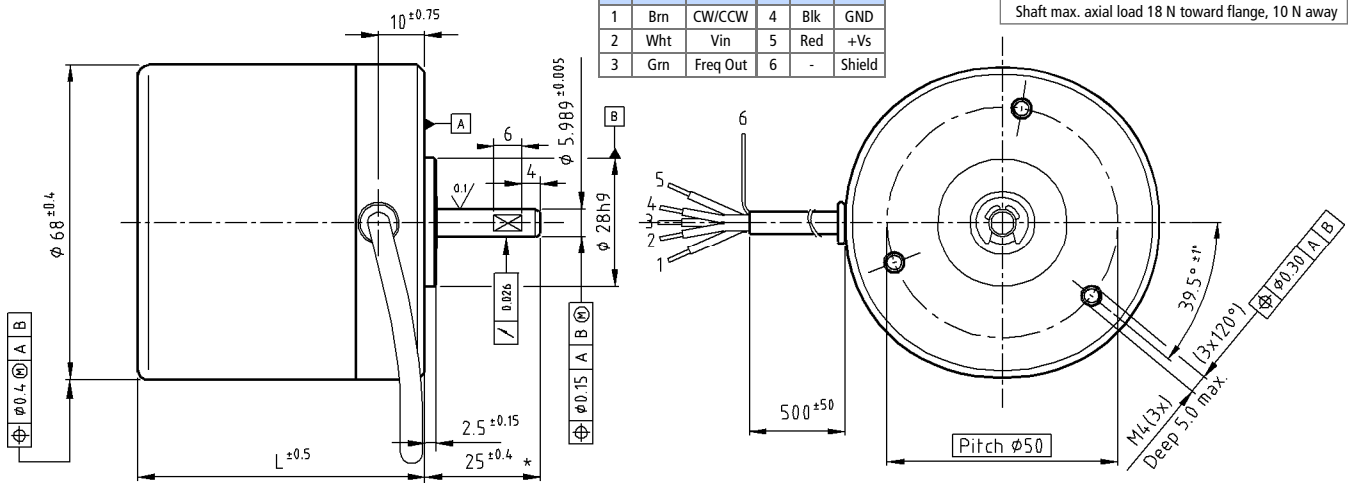
BL58 EB 50W High Torque



DIMENSIONS

Pin	Lead	Fct	Pin	Lead	Fct
1	Brn	CW/CCW	4	Blk	GND
2	Wht	Vin	5	Red	+Vs
3	Grn	Freq Out	6	-	Shield

Shaft max. radial load 20 mm from front mount: 40 N
Shaft max. axial load 18 N toward flange, 10 N away



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Issued: October 24, 2007

Specifications subject to change without notice