

**Simplex Motions SE-Serie is a compact integrated servomotor series that incorporates brushless DC motor and control electronics in an open frame configuration. This enables a simple to use and cost optimized solution for OEM motion control applications.**

The motor is of outer rotor design to optimize high torque and efficiency, thus eliminating the gearbox in many applications. The dynamic capabilities are substantially higher than continuous operation, which makes this product especially suitable for dynamic loads with high acceleration rates.

The control electronics is based on a digital signal processor to enable precise closed loop control of motor position and speed. The PID regulator also applies feed forward control to optimize performance. Ramping of position moves are supported with specified maximum speed, acceleration and deceleration. Output torque can be limited by a configurable value.

Control input can be obtained through several different interfaces:

- RS485 serial bus Modbus RTU protocol
- CAN protocol
- Quadrature encoder
- Step/dir interface (e.g. step motor emulation)
- Analog input
- Digital I/O

There are also a number of digital and analog inputs available to connect external sensors and actuators.

The Modbus and CAN interfaces are used for control and configuration of the motors. The interfaces allows for a robust means of connecting several units to the same interface bus.

Setup and configuration is further simplified with a PC software, Simplex Motion Tool, that enables readout and setting of all configuration data, as well as easy testing of drive functions. Together with a built-in signal recorder it is possible to investigate dynamic behavior closely.

Integration of motor and electronics into the same unit minimizes issues with electromagnetic interference and cabling and simplifies configuration and initial setup.

By utilizing the motor's microprocessor it is possible to run the motor as a stand-alone device, replacing costly and complicated PLC and control systems. Use the built in logic Events programming or make more advanced C-code Applications, to get full control of the motor and its behavior.

- Integrated controller, driver and position feedback electronics
- PID regulator for control of torque, speed or position.
- Ramp controlled motion with set speed and acceleration
- Protection features for current, torque, voltage and temperature
- Serial RS485 (or RS232) interface with Modbus RTU protocol.
- CAN interface
- Step/direction interface. (step motor emulation)
- Up to 8 digital inputs and 4 analog inputs
- 4 digital outputs with pulse, PWM or RC servo pulse output.
- PC based software for setup and testing
- Replace PLC and control systems
- Simple logic Event programming for controlling behavior of I/Os, functions etc.
- C-code applications for more complex functionality
- Cost efficient

For more information on the control of the motors, download the Technical Manual from [www.simplexmotion.com](http://www.simplexmotion.com)

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## 1. Technical data

Important characteristics and limits for the Simplex Motion SE010A, SE020A and SE040A motors.

Motor specifications		SE010A	SE020A	SE040A
Torque	At nominal rpm	60 mNm (8.5 oz-in)	120 mNm (17 oz-in)	280 mNm (30 oz-in)
	Continuous stall	50 mNm (7.1 oz-in)	100 mNm (14 oz-in)	280 mNm (30 oz-in)
	Peak	200 mNm (28.0 oz-in)	500 mNm (71 oz-in)	800 mNm (113 oz-in)
Speed	Nominal	4000 rpm	4000 rpm	4000 rpm
	Peak	6000 rpm	6000 rpm	6000 rpm
Power	Continuous	25 W (in open air)	50 W (in open air)	120 W (in open air)
	Peak	75 W	150 W	360 W
Efficiency	Up to	70%	75%	80%
Rotor inertia		3.43 E-6 kgm <sup>2</sup>	12.60 E-6 kgm <sup>2</sup>	33.00 E-6 kgm <sup>2</sup>
Electrical specifications				
Supply voltage	Min	8 V	8 V	8 V
	Typical	24 V (12-48 V)	24 V (12-48 V)	24 V (12-48 V)
	Max	55 V (absolute maximum 60V)	55 V (absolute maximum 60V)	55 V (absolute maximum 60V)
Supply Current	Idle	0.03A	0.03A	0.03A
	Continuous	1.5A	3.0A	6.3A
	Peak	4.5A	9.0A	19A
Controller specifications				
Integrated incremental encoder solution	Counts per revolution	4096 / 8192 / 16384		
	Resolution	0.09° / 0.044° / 0.022°		
Switching frequency		32 kHz		
Motor commutation	Method	space vector modulation with field orientation control		
	Rate	16 kHz		
PID controller	Sample rate	2 kHz		
	Control	Torque, Position, Speed		
Ramping control	Speed	speed limit + controlled acceleration/deceleration		
	Position	controlled speed + acceleration/deceleration		
Protection		overcurrent, torque, voltage, temperature, locked shaft		
Status indicator		green + red light, blink pattern provides status		
Interfaces	RS485/RS232 TTL	max 115kbit/s, Modbus RTU protocol		
	CAN	SMCAN / CANOpen max 1Mbit/s, CiA DS 301		
	Step/direction	Step/direction inputs, 3.3/5V logic inputs, max 2.2MHz.		
	Quadrature encoder	3.3/5V logic inputs, max 2.2MHz		
	Analog control	voltage 0...+3.3V		
Digital Inputs, IN1-4	Maximum voltage	-0.5..+6.0V		
	Low/high threshold	Configurable 0...+3.3V		
	Pull up/down resistor	10kOhm to +3.3V or GND, or disabled		
Digital Inputs, IN5-8	Maximum voltage	-0.5..+6.0V		
	Low/high threshold	Low < 0.7V, High > 2.4V		
	Pull up/down resistor	10kOhm to GND always		
Analog inputs, IN1-4	Maximum voltage	-0.5..+6.0V		
	Input range	0...+3.3V		
	Resolution	16bits		
	Accuracy	10bits		
	Input impedance	>1MOhm with pullup/down disabled.		
Digital outputs, OUT1-4	Control	Logic, single pulse, PWM, RC servo control		
	Output circuit	3.3V TTL 4700hm		
	Maximum voltage	-0.5..+6.0V		
	Maximum current	5mA		
	Pull up/down resistor	10kOhm to +3.3V or GND, or disabled		
Mechanical specifications				
Dimensions	Body (L x W x H)	38 x 28 x 36 mm	46 x 35 x 45 mm	54 x 42 x 52.5 mm
	Shaft	ø5 x 20 mm	ø5 x 24 mm	ø5 x 24 mm
Nema size		Nema 11	Nema 14	Nema 17
Mounting/fastening torque		M2.5 screws / 0.6 Nm	M3 screws / 1.7 Nm	M3 screws / 1.7 Nm
Weight		80 g (2.85 oz)	160 g (5.65 oz)	280 g (8.9 oz)
Shaft loading	Radial load	75N	100N	125N
	Axial load	20N	30N	40N
Ambient specifications				
Protection class		IP00	IP00	IP00
Temperature	Operating	0...+40°C	0...+40°C	0...+40°C
	Derating output power	0.42 W/C.	0.84 W/C.	1.34 W/C
	Storage	-40...+85 °C	-40...+85 °C	-40...+85 °C

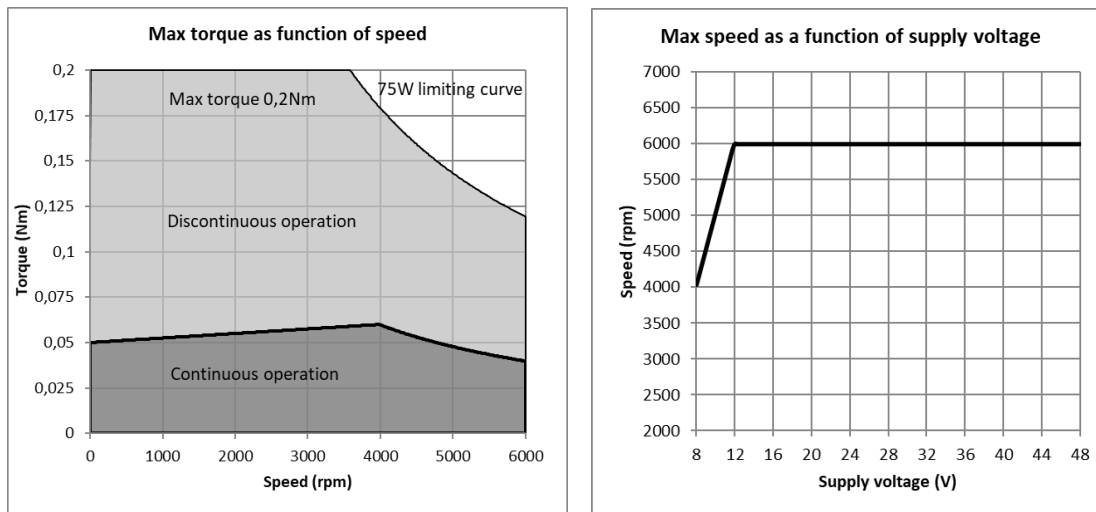
## 2. SE010A Technical data

### 2.1. SE010A Motor output power

The SE010A delivers 25W continuous mechanical output power in normal conditions (mounted with free flowing air around the unit, ambient temperature below 40°C). But it is possible to extract several times more power during short intervals. These higher power ratings are limited by:

- Total power limited to 75W (3 times nominal continuous operating limits)
- The maximum provided torque from the motor (0.2Nm)
- The maximum rotational speed, dependent on supply voltage.

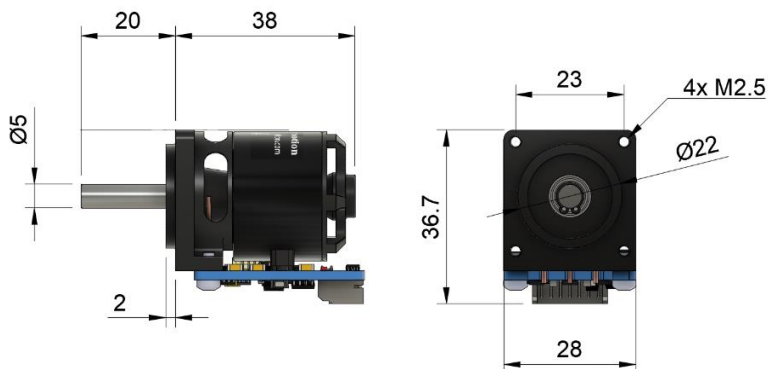
The diagram below shows the operating region of the unit.



Specified technical data has been verified with minimal heat conduction and free air flowing around the drive. It is possible to extract higher continuous output power levels if the cooling is optimized. Mounting should be done to facilitate free air moving around the unit or by mounting the unit onto a large metallic structure that can conduct heat away from the drive.

To prevent motor damage, the thermal protection feature will shut the motor down if the output power levels are too high.

### 2.2. SE010A Physical dimensions



Positive rotational direction is clockwise rotation when looking at the motor front plate (as shown above in the picture to the right). Unit is mounted by four M2.5 screws in the front.

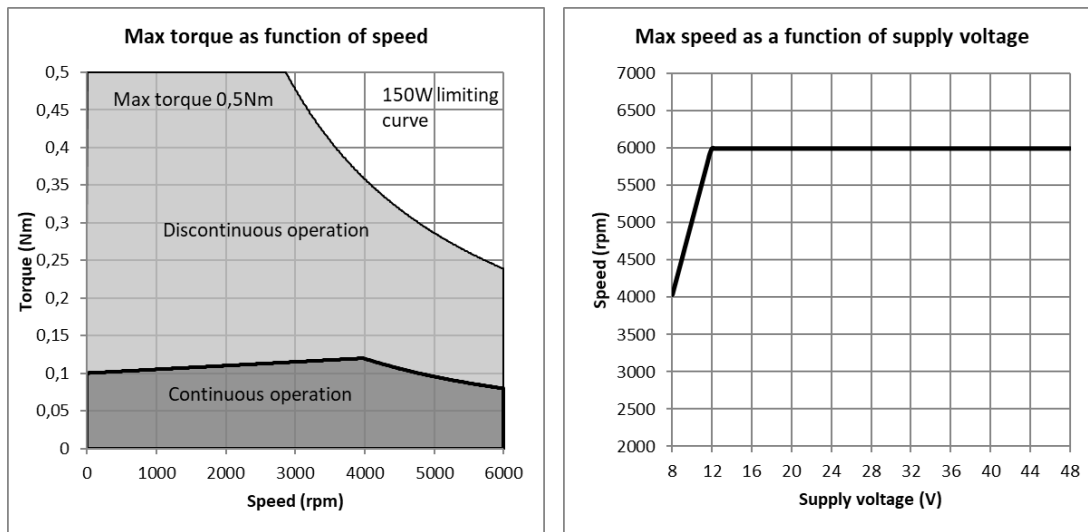
## 3. SE020A Technical data

### 3.1. SE020A Motor output power

The SE020A delivers 50W continuous mechanical output power in normal conditions (mounted with free flowing air around the unit, ambient temperature below 40°C). But it is possible to extract several times more power during short intervals. These higher power ratings are limited by:

- Total power limited to 150W (3 times nominal continuous operating limits)
- The maximum provided torque from the motor (0.5Nm)
- The maximum rotational speed, dependent on supply voltage.

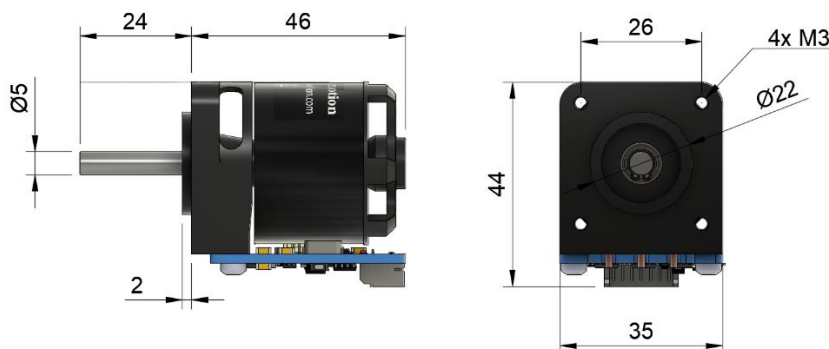
The diagram below shows the operating region of the unit.



Specified technical data has been verified with minimal heat conduction and free air flowing around the drive. It is possible to extract higher continuous output power levels if the cooling is optimized. Mounting should be done to facilitate free air moving around the unit by mounting the unit onto a large metallic structure that can conduct heat away from the drive.

To prevent motor damage, the thermal protection feature will shut the motor down if the output power levels are too high.

### 3.2. SE020A Physical dimensions



Positive rotational direction is clockwise rotation when looking at the motor front plate (as shown above in the picture to the right). Unit is mounted by four M3 screws in the front.

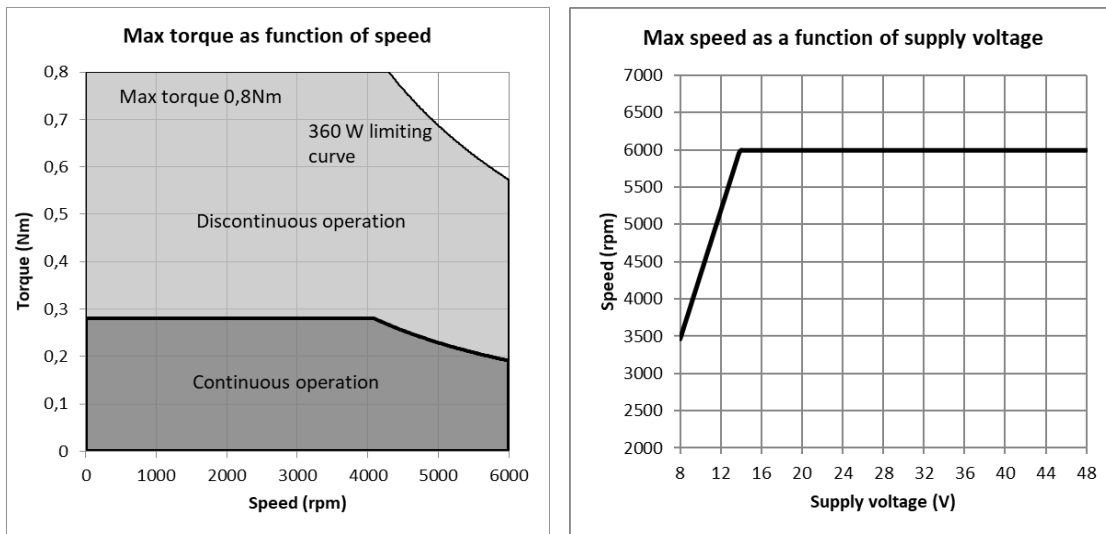
## 4. SE040A Technical data

### 4.1. SE040A Motor output power

The SE040A delivers 120W continuous mechanical output power in normal conditions (mounted with free flowing air around the unit, ambient temperature below 40°C). But it is possible to extract several times more power during short intervals. These higher power ratings are limited by:

- Total power limited to 360W (3 times nominal continuous operating limits)
- The maximum provided torque from the motor (0.8Nm)
- The maximum rotational speed, dependent on supply voltage.

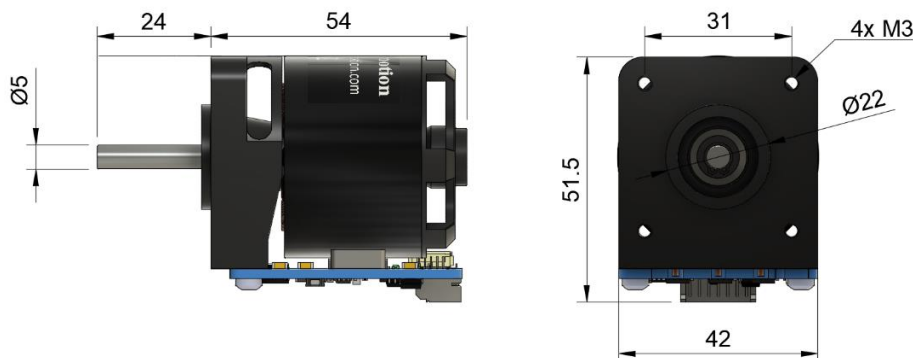
The diagram below shows the operating region of the unit.



Specified technical data has been verified with minimal heat conduction and free air flowing around the drive. It is possible to extract higher continuous output power levels if the cooling is optimized. Mounting should be done to facilitate free air moving around the unit by mounting the unit onto a large metallic structure that can conduct heat away from the drive.

To prevent motor damage, the thermal protection feature will shut the motor down if the output power levels are too high.

### 4.2. SE040A Physical dimensions

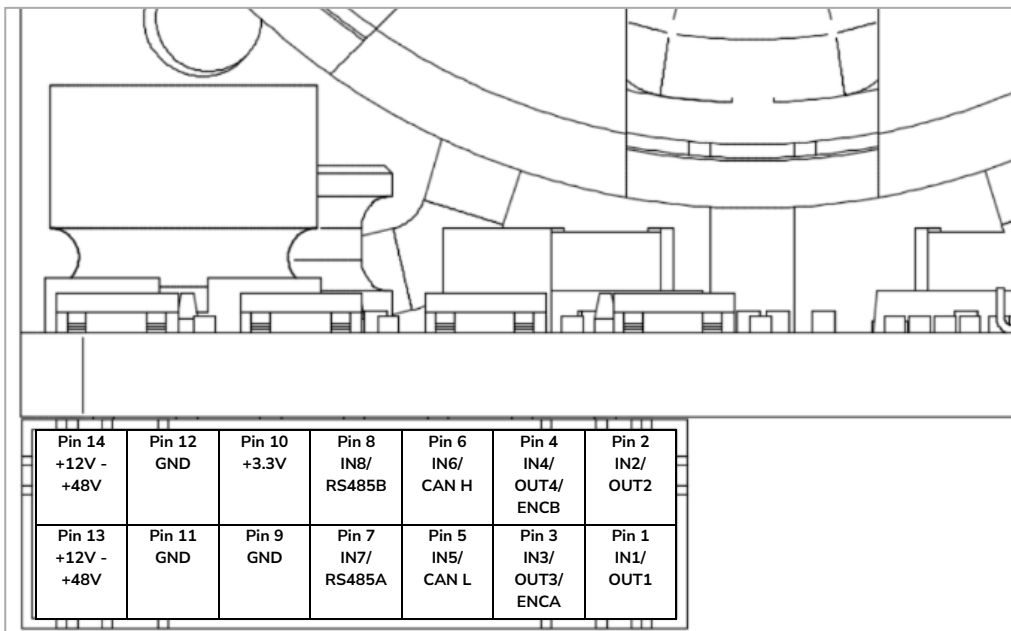


Positive rotational direction is clockwise rotation when looking at the motor front plate (as shown above in the picture to the right). Unit is mounted by four M3 screws in the front.

## 5. Electrical connections

The SE-Series have one common electrical connector:

- 14 polarity housing connector



The housing connector is from JST Sales America Inc, part number PHDR-14VS (Available as 455-1172-ND from [www.digikey.com](http://www.digikey.com)).

Pin	Name	SE010A	SE020A	SE040A
1	IN1/OUT1		Digital/Analog input and/or output (0...+3.3V)	
2	IN2/OUT2		Digital/Analog input and/or output (0...+3.3V)	
3	IN3/OUT3/ENCA		Digital/Analog input and/or output, or Encoder input A (0...+3.3V)	
4	IN4/OUT4/ENCB		Digital/Analog input and/or output, or Encoder input B (0...+3.3V)	
5	IN5/CAN L		Digital input (0...+3.3V) or CAN L	
6	IN6/CAN H		Digital input (0...+3.3V) or CAN H	
7	IN7		Digital input (0...+3.3V)	
	RS485A		RS485 Modbus signal A (-7...+12 V)	
	RS232 TTL		RX (0...+3.3V)	
8	IN8		Digital input (0...+3.3V)	
	RS485B		RS485 Modbus signal B (-7...+12 V)	
	RS232 TTL		TX (0...+3.3V)	
9	GND		Ground reference for all input/outputs	
10	+3.3V		+3.3V supply voltage output, max 100mA	
11	GND		Power supply ground	
12	GND		Power supply ground	
13	+12V - +48V		Power supply input +12V - +48V	
14	+12V - +48V		Power supply input +12V - +48V	

As an alternative to the connector, the motor can also be powered through the terminals marked GND and SUPPLY, Recommended ring terminal size: id 3,2, od 5,5mm.



## Change log

Revision	Note