simplex motion

Simplex Motions SH-Serie is an 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.

Description:

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 is limited to a configurable value.

Control input can be obtained through several different interfaces:
- o RS485 serial bus Modbus RTU protocol
- o CAN (SMCAN and CANOpen 301)
- o Quadrature encoder
- o Step/dir interface (e.g. step motor emulation)
- o Analog input.

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

The Modbus and CANOpen 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 also simplifies configuration and initial setup. In a minimal setup for external control only 2 wires of power and 3 wires of serial communication have to be routed to the motor.
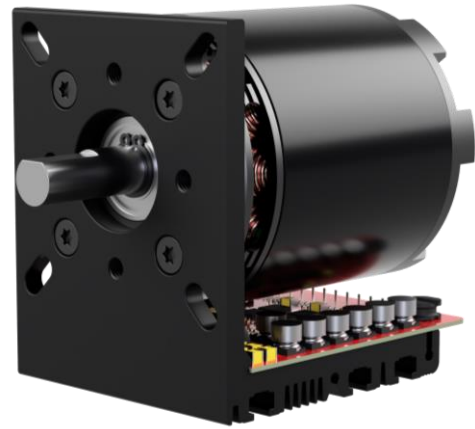
By utilizing the motor's micro processor it is possible to run the motor as a stand alone device, replacing costly and complicated PLC and control systems. Use the built in Events programming or make more advanced C-code Applications, to get full control of the motor and its behavior.

- o Integrated drive and position electronics
- o PID regulator for control of torque, speed or position.
- o Ramp controlled moves in position with set speed and acceleration
- o Protection features for current, torque, voltage and temperature
- o USB interface
- o Serial RS485 (or RS232) interface with Modbus RTU protocol.
- o CAN interface supporting SMCAN andCANOpen 301 protocols
- o Step/direction interface. (step motor emulation)
- o Up to 8 digital inputs and 4 analog inputs
- o 4 digital outputs capable of 30V/1A, with pulse, PWM or RC servo pulse output.
- o PC based software for setup and testing
- o Replaces PLC and control systems
- o Simple Event programming for controlling behavior of I/Os, functions etc.
- o C-code applications for more complex functionality
- o Cost efficient

For more information on the control of the motors, download the Technical Manual from
www.simplexmotion.com

1   Table of contents

2   Technical data

Important characteristics and limits for the Simplex Motion SH100C and SH200B products.

| Motor specifications		SH100C	SH200B
Torque	At nominal rpm	0.51 Nm (72 oz-in)	0.72 Nm (100 oz-in)
	Continuous stall	0.55 Nm (78 oz-in)	1.1 Nm (150 oz-in)
	Peak	2.0 Nm (280 oz-in)	4.0 Nm (565 oz-in)
Speed	Nominal	3000 rpm	4000 rpm
	Peak	6000 rpm	6000 rpm
Power	Continuous	160 W (in open air)	300 W (in open air)
	Peak	400 W	900 W
Efficiency	Up to	80%	86%
Rotor inertia		$78 * 10^{-6}$ kgm^2	$300 * 10^{-6}$ kgm^2
Electrical specifications			
Supply voltage	Min	12 V (absolute minimum 10V)	12 V (absolute minimum 10V)
	Typical	24 V	48 V
	Max	52 V (absolute maximum 55V)	52 V (absolute maximum 55V)
Supply Current	Idle	0.1 A (at 24V)	0.05 A (at 48V)
	Continuous	8 A (at 24V)	8 A (at 48V)
	Peak	25 A (at 24V)	25 A (at 48V)
Controller specifications			
Integrated incremental encoder solution	Counts per revolution	4096	
	Resolution	0.09º	
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	USB	Full speed 12Mbit/s	
	RS485/RS232 TTL	max 115kBit/s, Modbus RTU protocol	
	CAN	max 1Mbit/s - SMCAN / CANOpen CiA DS 301	
	Step/direction	Step/direction inputs, 5V logic inputs, max 2.2MHz.	
	Quadrature encoder	5V logic inputs, max 2.2MHz	
	Analog control	voltage 0…+5V	
Digital Inputs, IN1-4	Maximum voltage	-0.5..+30V	
	Low/high threshold	Configurable 0..+5V	
	Pull up/down resistor	10kOhm to +3.3V or GND, or disabled	
Digital inputs, IN5-8	Maximum voltage	-0.5..+8.0V	
	Low/high threshold	Low < 0.7V, high > 2.4V	
	Pull up resistor	none	
Analog inputs, IN1-4	Maximum voltage	-0.5..+30V	
	Input range	0..+5V	
	Resolution	16bits	
	Accuracy	10bits	
	Input impedance	300kOhm with pullup/down disabled	
Digital outputs, OUT1-4	Control	Logic, single pulse, PWM, RC servo control	
	Output circuit	Open collector, transistor.	
	Maximum voltage	-0.5..+30V	
	Maximum current	1A	
	Pull up/down resistor	10kOhm to +3.3V or GND, or disabled	
Mechanical specifications			
Dimensions	Body (L x W x H)	71 x 50 x 65 mm	83.5 x 64 x 80 mm
	Shaft	D8 x 16 mm	D10 x 22 mm
Mounting/recommended fastening torque		M4x6mm screws in front / 2.1 Nm, square M4 nut slots in bottom	M5x6mm screws in front / 3.4 Nm, square M4 nut slots in bottom
Weight		490 g (17.3 oz)	1130 g (39.9 oz)
Shaft loading	Radial load	200 N	300 N
	Axial load	100 N	150 N
Ambient specifications			
Protection class		IP00, needs external protection	IP00, needs external protection
Temperature	Operating	0..+40ºC	0..+40ºC
	Derating of output power	2.7 W/ºC above 40ºC	5.0 W/ºC above 40ºC
	Thermal time constant	340 seconds	600 seconds
	Storage	-40..+85 ºC	-40..+85 ºC

2.1   SH100C Technical data

2.1.1   SH100C Motor output power

The SH100C handles up to 160W 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 400W (4 times nominal continuous operating limits)
- The maximum provided torque from the motor (2.0Nm)
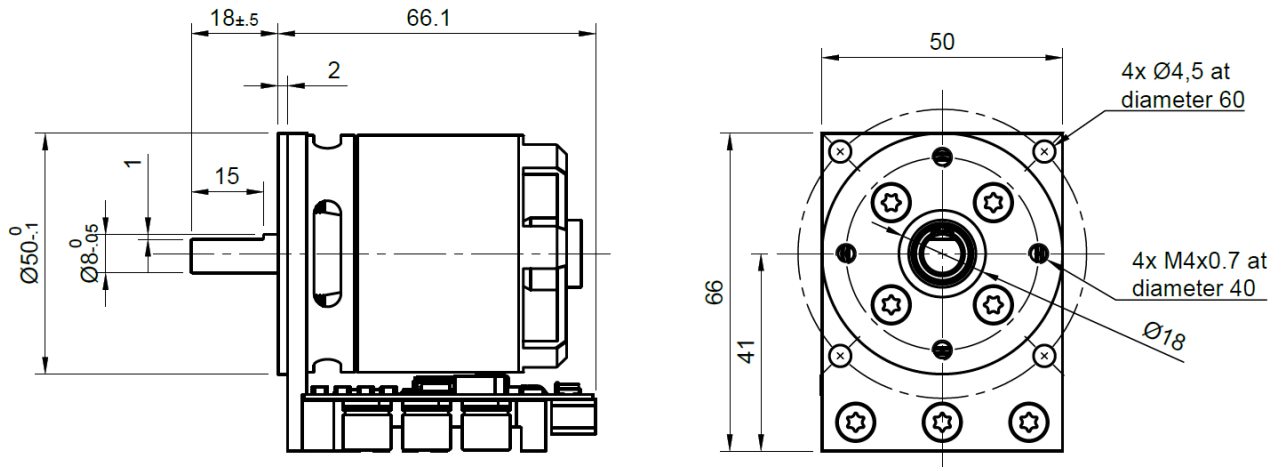- The maximum rotational speed, dependent on supply voltage.

The diagram below shows the operating region of the unit.
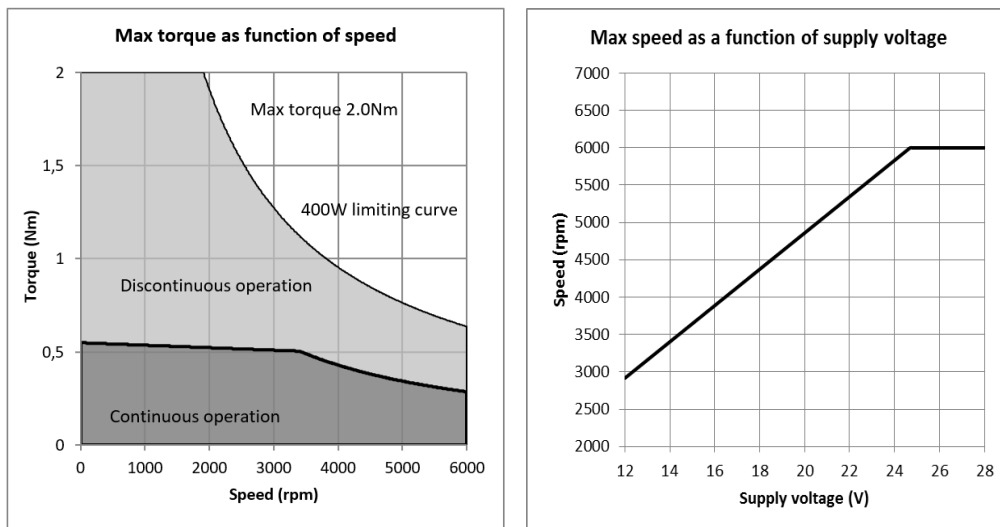
It is possible to extract higher continuous output power levels if the cooling is optimized, for example by fixing the unit to a large metallic structure that can conduct heat away from the unit.

2.1.2 SH100C Physical dimensions

The mechanical implementation utilizes an aluminum extrusion that holds the motor and electronics and allows mounting of the unit. Mounting should be done to facilitate free air moving around the unit to allow sufficient cooling. Thermal properties can also be enhanced by mounting the unit onto a large metallic structure that can conduct heat away from the drive. Specified technical data has been verified with minimal heat conduction and free air flowing around the drive. With efficient conduction of heat from the drive it is possible to extract higher output power ratings. Make sure to use the thermal protection feature to not damage the drive when running close to its limits.

Positive rotational direction is clockwise rotation when looking at the motor front plate (as shown above in the left picture).

Mounting of the unit can be done in 2 ways:
1. Mounting by M4 screws in the front. There are 4pcs of M4 threaded holes of depth 6mm for this purpose.
2. Mounting with M4 screws through the front, there are 4pcs holes with Ø4.5mm in the outer corners.

2.2 SH200B Technical data

2.2.1 SH200B Motor output power

The SH200B handles up to 300W 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 900W (3 times nominal continuous operating limits)
- The maximum provided torque from the motor (4.0Nm)
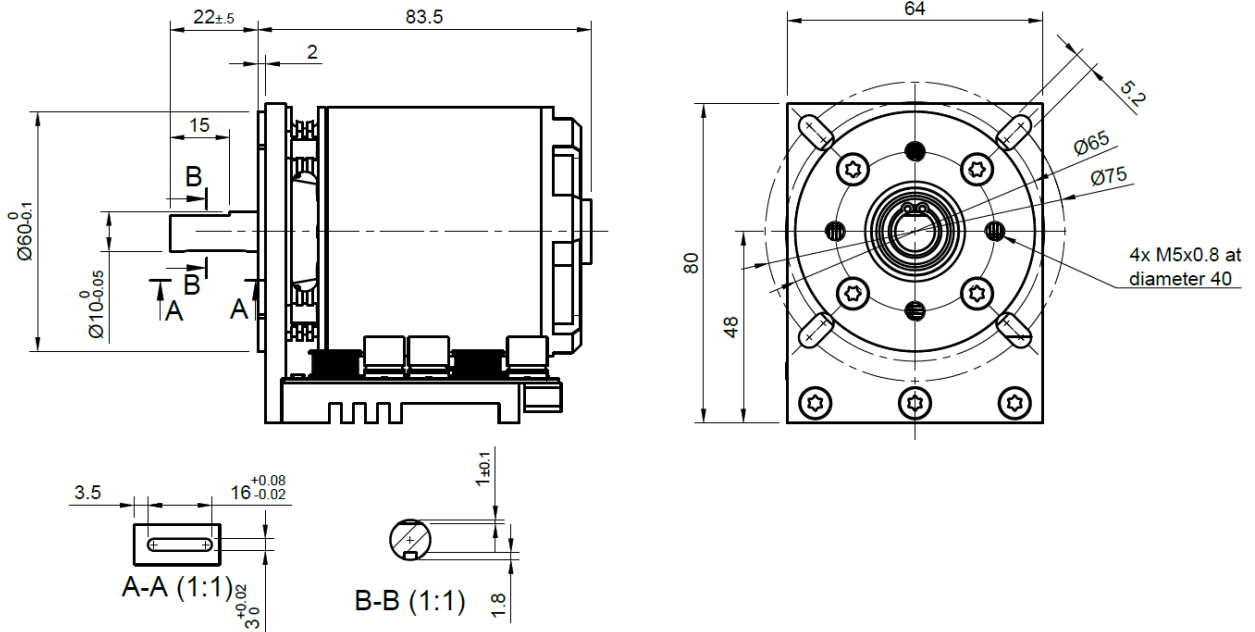- The maximum rotational speed, dependent on supply voltage.

The diagram below shows the operating region of the unit.
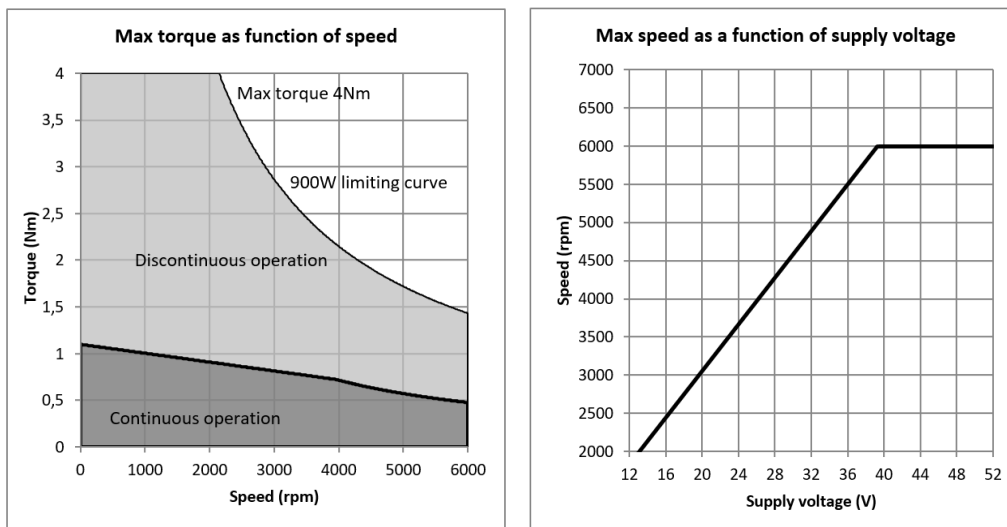
It is possible to extract higher continuous output power levels if the cooling is optimized, for example by fixing the unit to a large metallic structure that can conduct heat away from the unit.

2.2.2 SH200B Physical dimensions

The mechanical implementation utilizes an aluminum extrusion that holds the motor and electronics and allows mounting of the unit. Mounting should be done to facilitate free air moving around the unit to allow sufficient cooling. Thermal properties can also be enhanced by mounting the unit onto a large metallic structure that can conduct heat away from the drive. Specified technical data has been verified with minimal heat conduction and free air flowing around the drive. With efficient conduction of heat from the drive it is possible to extract higher output power ratings. Make sure to use the thermal protection feature to not damage the drive when running close to its limits.

Positive rotational direction is clockwise rotation when looking at the motor front plate (as shown above in the left picture).

Mounting of the unit can be done in 2 ways:

1. Mounting by M5 screws in the front. There are 4pcs of M5 threaded holes of depth 6mm for this purpose.
2. Mounting with M5 screws through the front, there are 4pcs holes with D5.2mm in the outer corners.

2.3 Electrical connections

There are two electrical connections to the SH-Series:
- USB connector, type B mini
- 12 polarity pluggable terminal with screw terminal block

The pluggable screw terminal block is from On ShoreTechnology Inc, part number OSTTJ1211530 (Available as ED10560-ND from www.digikey.com). These accept wire sizes AWG16-26 (0.13-1.3mm^2).

Pin	Name	SH100B	SH200B
1	IN1/OUT1	Digital/Analog input and/or output (open collector type, max 30V/1A)	
2	IN2/OUT2	Digital/Analog input and/or output (open collector type, max 30V/1A)	
3	IN3/OUT3	Digital/Analog input and/or output (open collector type, max 30V/1A)	
4	IN4/OUT4	Digital/Analog input and/or output (open collector type, max 30V/1A)	
5	IN5/ENCA	Digital input or Encoder input/output (0…+5V)	
6	IN6/ENCB	Digital input or Encoder input/output (0…+5V)	
7	IN7	Digital input (0…+5V)	
	RS485A	RS485 Modbus signal A (−7…+12 V)	
	RS232 TTL	RX (0…+5V)	
	CAN L	CAN L	
8	IN8	Digital input (0…+5V)	
	RS485B	RS485 Modbus signal B (−7…+12 V)	
	RS232 TTL	TX (0…+5V)	
	CAN H	CAN H	
9	GND	Ground reference for all input/outputs	
10	+5V	+5V supply voltage output, max 100mA.(Not intended as voltage input).	
11	GND	Power supply ground	
12	+48V	Power supply input +24V	Power supply input +48V

3 Change history

Revision	Note
200121	SH200A is replaced by SH200B with the following differences between the versions: -CAN protocol -Axis length changed from 20mm to 22mm and a key slot for feather keys have been added. SH100A – No changes.
210630	SH100A is replaced by SH100B. In the new version CAN has been added. No other changes to the specifications were made. -General description of SH series is updated and CAN is added -Mounting torque added for all models -Electrical connection chart is updated and CAN is added
230712	-Document revision changed to 04a -SH100B upgraded to SH100C. The major changes are that the maximum voltage is increased from 24 to 48V and that a centering ring has been added to the front. The means of attachment using slots in the profile under the PCBA has been removed. -SH200B has been upgraded with a centering ring in the front. The means of attachment using slots in the profile under the PCBA has been removed.