Simplex Motions SM-Serie is an integrated servomotor unit. It incorporates a brushless DC motor and control electronics within the same enclosure.
This enable a simple to use and cost optimized solution to 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.
Target control values can be obtained from several different interfaces; USB interface, RS485 serial bus using the Modbus RTU protocol, quadrature encoder, step/dir interface (for step motor emulation) or analog input.
There are also a number of digital and analog inputs available to connect external sensors and actuators.

The interface for control and configuration relies on the full speed USB interface or the Modbus RTU protocol with serial RS485 or RS232 physical connection. The RS485 support allows for a robust means of connecting several units to the same interface bus.
Setup and configuration is further simplified with a PC software 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 enclosure 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.

o   Integrated drive and position electronics

o   Continuous output of 100W and 0.32Nm torque at 3000rpm

o   Brushless outer rotor motor with high torque, up to 2.0Nm

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   Interface signals for step motor emulation (step/direction)

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   API libraries for custom software control (Windows .NET, Labview, Linux)

o   Low cost

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2 Technical data

The following table specifies important characteristics and limits for the SimplexMotion 100A product.

| Motor specifications		
Torque	Nominal at 3000 rpm	0.32 Nm (45 oz-in)
	Continuous stall	0.55 Nm (78 oz-in)
	Peak	2.0 Nm (280 oz-in)
Speed	Nominal	3000 rpm
	Peak	6000 rpm
Power	Continuous	100 W
	Peak	400 W
Efficiency	Up to	80%
Rotor inertia		$78 * 10^{-6}$ kgm^2
Electrical specifications		
Supply voltage	Min	12 V (absolute minimum 10V)
	Typical	24 V
	Max	28 V (absolute maximum 30V)
Supply Current	Idle	0.1 A
	Continuous	5 A
	Peak	25 A
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
	Step motor interface	direction/step 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)	74 x 64 x 72 mm
	Shaft	D8 x 18 mm
Mounting		M4x6mm screws in front, square nut slots in bottom
Weight		650 g (23.0 oz)
Shaft loading	Radial load	200 N
	Axial load	100 N
Ambient specifications		
Protection class		IP40
Temperature	Operating	0..+40ºC
	Derating of output power	1.7 W/ºC above 40ºC
	Thermal time constant	450 seconds
	Storage	-40..+85 ºC

2.1 Motor output power

The device handles up to 100W 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.
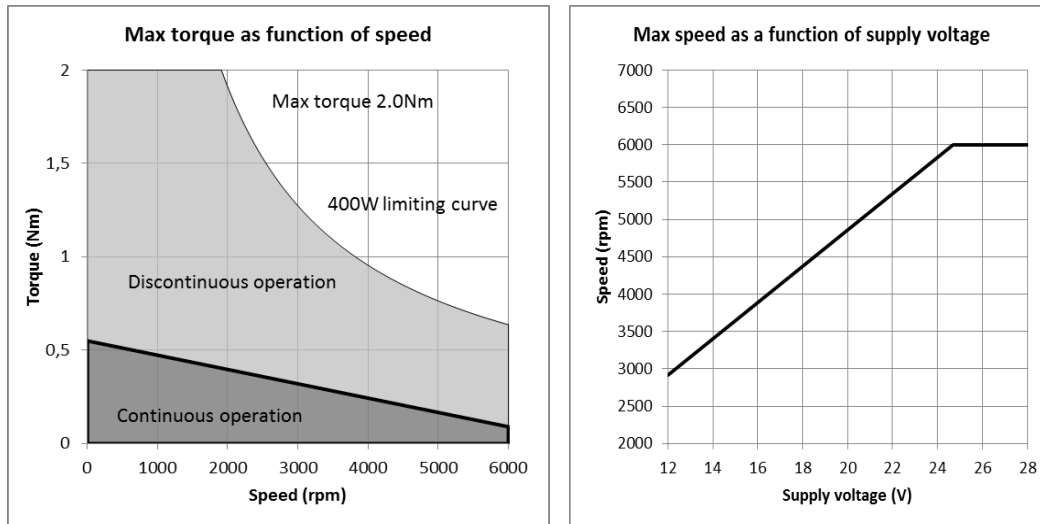
It is possible to extract higher continuous output power levels if the cooling is optimized, for example by fixing the unit to a large metallic structure that can conduct heat away from the unit.

2.2 Electrical connections

There are two electrical connections to the device:
- 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	Description
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 (0…+5V)
6	IN6/ENCB	Digital input or Encoder input (0…+5V)
7	IN7/RS485A	Digital input or RS485 Modbus communication (0…+5V). RX for RS232 usage.
8	IN8/RS485B	Digital input or RS485 Modbus communication (0…+5V). TX for RS232 usage.
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	+24V	Power supply input +24V

2.3 Physical dimensions

The enclosure is made of black anodized aluminum. 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.
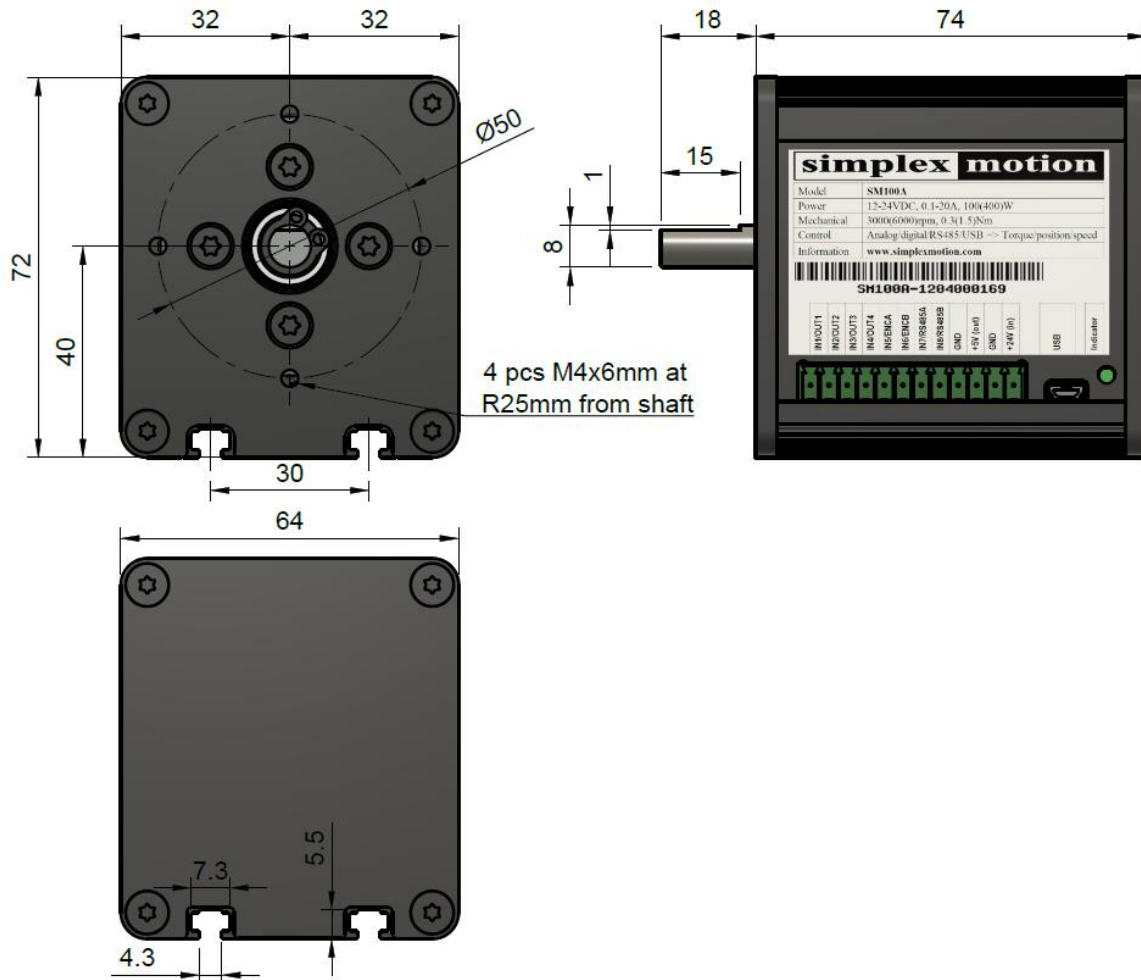
Positive rotational direction is clockwise rotation when looking at the motor front plate (as shown above in the top left picture).

Mounting of the unit can be done in two ways:
1. Mounting by M4 screws in the front. There are 4pcs of M4 threaded holes of depth 6mm for this purpose.
2. Mounting by slots in the bottom of the unit. These slots accommodate M4 nuts (preferable square nuts) in two slots that run along the unit length at a separation distance of 30mm (+/-15mm from the unit centerline).