Info:
The TB series is a sensorless motor driver, and only consists of electronics. It is used to control small PMSM or BLDC motors in the range 100-1000W.

Sensorless control:
Brushless motors need electronics to perform the commutation of the motor windings. To do this there are typically sensors in the motor to know the rotor position. But it is also possible to estimate rotor position be measuring on the motor phases, and this scheme is called sensorless control.
It has the advantage of being robust and low cost, since there are no sensors in the motor and less cabling.
But it also has disadvantages, the main being that there is a limit to how slow the motor can operate. Typically operation below 10-20% of the rated motor speed is not possible.
Another disadvantage is that the driver software needs to be matched with the particular motor that will be used.

Motor and electronics separation:
In some cases it is an advantage to have the electronics placed in another location than the motor. With the TB motor driver there are only the 3 motor phase cables that needs to be routed between the driver and the motor.

Motor speed regulation:
The TB motor driver is mainly intended for constant speed applications, and it performs constant speed regulation so that average speed is not dependant on motor torque load.

Easy control:
The typical control interface to the TB motor driver is an analog input for speed, and two digital inputs used for start/stop and rotational direction.

Wide operating conditions:
The nominal supply voltage is 24V, but it can operate in the range 12-48V. The driver can withstand continuous motor currents up to 30A.

Mechanical design:
The TB motor driver is delivered with an aluminium base plate that is intended to be mounted on a metallic structure to conduct heat away from the driver. If the driver is not mounted for good thermal conduction, output power has to be derated.

Customer adaptable:
The control interface to the driver can be reconfigured on request. The hardware supports interfaces such as RS485 Modbus RTU, RS232 TTL, QWICC/I2C.

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1 Technical data

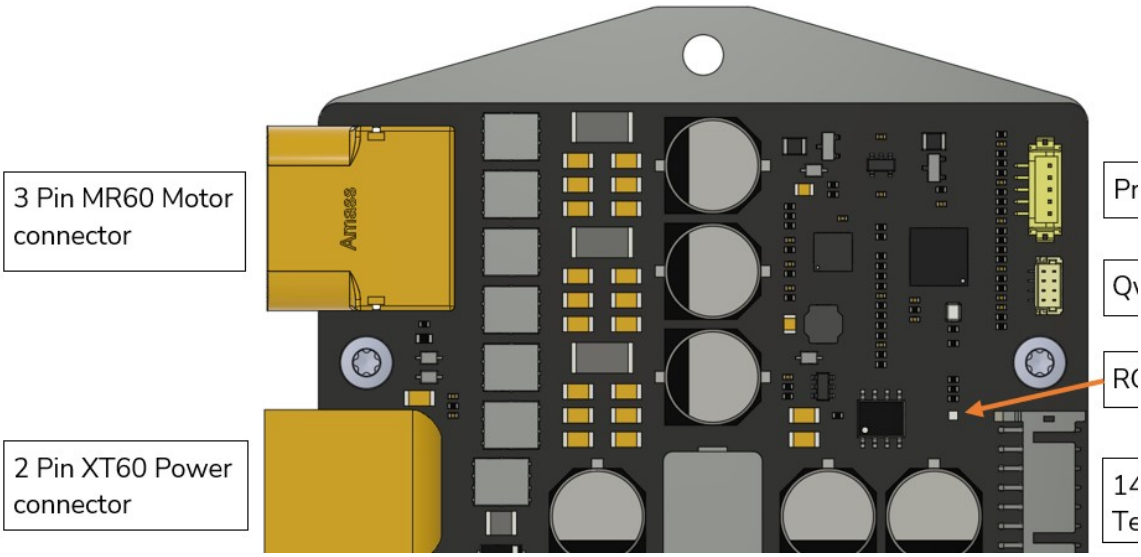
Important characteristics and limits for the Simplex Motion TA100 products.

Electrical specifications		
Power Supply voltage	Min	10 V
	Typical	24 V
	Max	50 V (absolute maximum 55V)
Supply Current	Idle	0.01 A (at 24V)
	Continuous	20 A (at 24V)
	Peak	30 A (at 24V)
Controller specifications		
Switching frequency		20 kHz
Motor commutation	Sensorless	space vector modulation with field orientation control
Motor control	Constant speed regulator	
Speed input	Analog 0-3.3V	The actual speed range is set in firmware. 3.3V output available to use potentiometer as control input.
Start input	Digital TTL input	Active high level 2-30V Low level 0-1V
Rotational direction input	Digital TTL input	One direction at 2-30V input, the opposite at 0-1V input. Pulldown to GND so that a switch to 3.3V is sufficient.
Interfaces	RS485	Not implemented yet, can be used for Modbus RTU
	RS232 TTL	Not implemented yet, can be used for Modbus RTU
	I2C bus	Not implemented yet. There is a standard QWICC connector that makes it compatible with a large range of functions.
	Motor temperature	Input for thermistor connected to GND to monitor motor temperature. Not implemented yet.
	Error output	Digital TTL output 0/3.3V to signal errors or status.
Motor requirements		
Motor type	PMSM or BLDC	Both conventional inrunners and outrunners.
Pole pairs	4-14 tested	
Speed	Up to 10 000 rpm	Less for large number of poles
Power	Up to 1000W mechanical	
Mechanical specifications		
Dimensions	Body (L x W x H)	86 x 70 x 20 mm
Weight		115g
Ambient specifications		
Protection class		IP00, needs external protection
Temperature	Operating	-20..+60°C, power derating above 40°C
	Storage	-40..+85 °C

1.1 Electrical connections

There are several connectors on the TB200A board:

Connector	Description
Power	Connection of powersupply 12-48V and to motor phases M1-M3. Utilizes XT60 type of connectors. Mating connectors: • Power input: Amass XT60H-F • Motor connection: Amass MR60-F
Interface	Low voltage control interface. Utilizes 14-pol JST PHD connector. Mating connector is PHDR-14VS.
QWIIC	I2C connector. Follows QWIIC standard to be compatible with hundreds of commercial boards for sensors and control.
Programming	Connector to firmware upgrade tool. Also allows RS232 TTL connection for possible communication.



Interface connector

Pin	Standard	Use	Color
1	IN1 / Analog / Speed	Connect to potentiometer 0-3.3V	White
2	IN2 / Analog		Grey
3	IN3 / Digital / Start-Stop	Pusgbutton to 3.3V, push to start/stop.	Purple
4	IN4 / Digital / Direction	Switch to 3.3V	Pink
5	Thermistor, motor temperature	Not implemented	Brown
6	OUT / Error	Not implemented	Yellow
7	RS485A	Not implemented	Green
8	RS485B	Not implemented	Blue
9	GND		Black
10	+3.3V out (100mA)	Output to use for analog/digital inputs	Orange
11	GND		Black
12	GND		Black
13	+12V - +48V	These connections can power the device, but only up to 3A current for each pin.	Red
14	+12V - +48V		Red

Qwiic connector

Pin	Name	Description
1	GND	Ground
2	3.3V	Logic supply output, max 100mA
3	SDA	I2C bus data
4	SCL	I2C bus clock

Programming connector

Pin	Name	Description
1	MCLR	Reset input
2	3.3V	Logic supply
3	GND	Ground
4	PGD/TX	Programming pins, future use for RS232 TX
5	PGC/RX	Programming pins, future use for RS232 RX

2 Operation

The motor driver performs constant speed control of a brushless motor in a speed range of typically 10-100% of the motor nominal speed. The actual minimum and maximum speed is configured in the driver firmware.
At motor start a specific startup sequence is performed to get the motor rotating and bring it up to the minimum speed of typically 10% of nominal speed. This startup sequence is configured in the firmware.

The firmware also needs to know basic motor settings such as number of pole pairs, the motor constant and nominal/maximum motor current.

At the current time these settings need to be done at compile time for the firmware, and thus SimplexMotion creates a custom firmware for each motor and customer case.

3 Change history

Revision	Note
01a	First release