Info:
The TA series is a sensorless motor driver, and only consists of electronics. It is used to control small PMSM or BLDC motors in the range 10-200W.

Sensorless control:
Brushless motors need electronics to perform the commutation of the motor windings. To do this there is 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 TA motor driver there are only the 3 motor phase cables that needs to be routed between the driver and the motor.

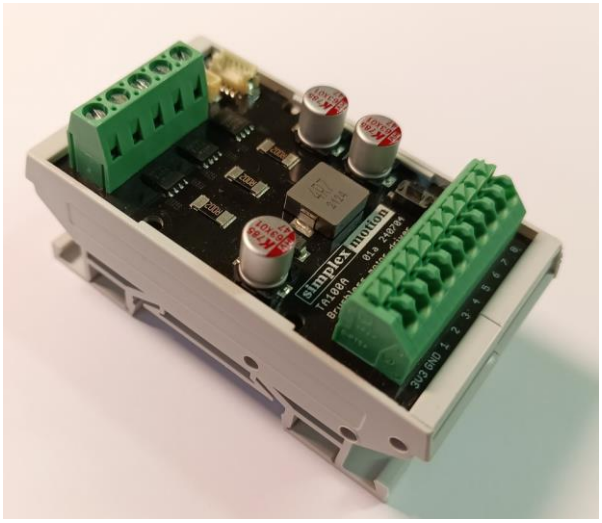
Motor speed regulation:
The TA motor driver is mainly intended for constant speed applications, and it performs constant speed regulation so that average speed is not dependant on motor torque load.

Easy control:
The typical control interface to the TA 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 20A.

Flexible design:
The TA motor driver is delivered in a plastic DIN rail mountable frame.
For a more compact solution the plastic frame can be removed and there are slots for mounting with 4xM3 screws instead.

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	10 A (at 24V)
	Peak	20 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 0-10V	The actual speed range is set in firmware. 10V output available to use potentiometer as control input.
Start input	Digital 24V input	Active high level 10-30V Low level 0-
Rotational direction input	Digital TTL input	One direction at 3.3V input, the opposite at 0V input. Pullup to 3.3V so that switch to GND 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.
	Quadrature encoder	Encoder input can help low speed performance of the motor.
	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	
Power	Up to 200W mechanical	
Mechanical specifications		
Dimensions	Body (L x W x H)	83 x 46 x 41 mm (with DIN rail enclosure)
Weight		50g
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 TA100A board:

Connector	Description
Power	Connection of powersupply 12-48V and to motor phases M1-M3. Utilizes screw terminals for high power rating wire connections.
Interface	Low voltage control interface. Utilizes spring terminals for wire connections.
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.

Power connector

Pin	Name	Description
1	48V	Power supply input, 12-48V
2	GND	Power supply ground
3	M1	Motor phase 1
4	M2	Motor phase 2
5	M3	Motor phase 3

Interface connector

Pin	Name	Description
1	3.3V	3.3V supply output, to be used for potentiometer or similar. Max 100mA
2	GND	Supply ground
3	1 – Speed	Analog speed input 0-3.3V
4	2 – Analog	Spare Analog input, could be used for torque limiting.
5	3 – Start	Start motor by connecting this input to GND

6	4 – Dir	Change motor direction by connecting this input to GND
7	5 – ENCA	Future input for Encoder
8	6 – ENCB	Future input for Encoder
9	7 – RS485A	Future input for RS485 Modbus RTU communication
10	8 – RS485B	Future input for RS485 Modbus RTU communication

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.

2.1 Low speed operation

There are options to improve low speed operation and allow operation below 10% of motor nominal speed. Some of these methods are listed below.

Method	Description
Using a quadrature encoder	A high resolution encoder provides additional information to improve low speed operation and smoother start/stop sequence. A minimum of 200PPR (pulses per rotation) resolution is recommended.
Measuring stator inductance	If the motor has a high saliency (when inductance has a large variation with rotor position), the driver can inject high frequency current into the motor and measure stator inductance. This can allow a better startup sequence and lower speed operation. But it is not available for all motors, and may produce audible noise from the motor.

3 Change history

Revision	Note
01a	First release
01b 241022	Changing interface to 24V signals