

SMA & SMB

Nov. 2017

User Manual

Voltage Control Miniature Integrated Stepper Motor Controller



SMA/SMB Voltage Control Integrated Stepper Motor Controller

SMA/SMB Voltage Control Miniature Integrated Stepper Motor Controller

Miniature Integral Design

- Miniature size 42.3mm x 42.3mm x 16.5mm (L x W x H)
- Integrally designed to fit onto motors seamlessly, as well as work standalone
- Die-cast aluminium enclosure, improved heat dissipation and durability

Motor Driver Features

- 10 – 30VDC input voltage, Max 2A adjustable phase current
- 16th micro-stepping
- Dual full H-bridge with PWM constant current control

Control features

- Embedded microcontroller
- Self pulse generation, automatic run on power-up
- Speed control through on-board trimmer 0.15- 500 RPM (SMA)
- Speed control through external potentiometer 0.15- 500 RPM (SMB)
- Speed control through 0-5V voltage input 0.15- 500 RPM (SMB)
- Acceleration function
- Switch control run/stop, direction, enable/shutdown
- Automatic current reduction/power saving

Description

The SMA/SMB stepper motor controller is a microprocessor embedded, voltage control, miniature stepper motor controller.

With the SMA/SMB, the motor speed can be controlled by an analogue voltage in three optional ways:

1) The on-board trimmer, 2) an external potentiometer or, 3) an external voltage. Run/stop, direction, high/low speed range and, enable/disable can be controlled simply by shorting the corresponding terminal to the ground. The controller can run the motor without user control device.

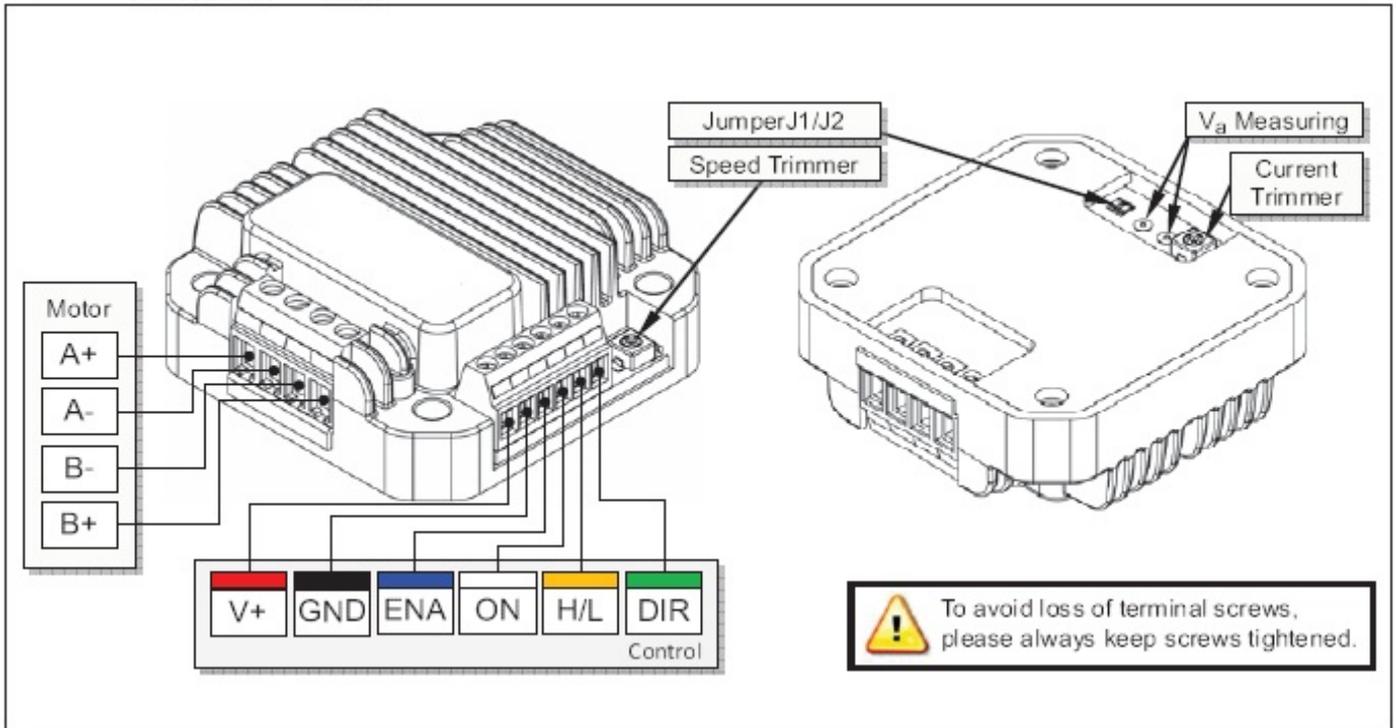
The microprocessor of the controller is capable of ramping up the current speed to the desired speed within 0.3 seconds, even when the speed control voltage is changing. This feature makes the sudden increase of the desired speed possible.

The controller can provide 0-2A adjustable phase current. The mixed-decay current control reduces the back-EMF effect under high motor speed and improves the performance.

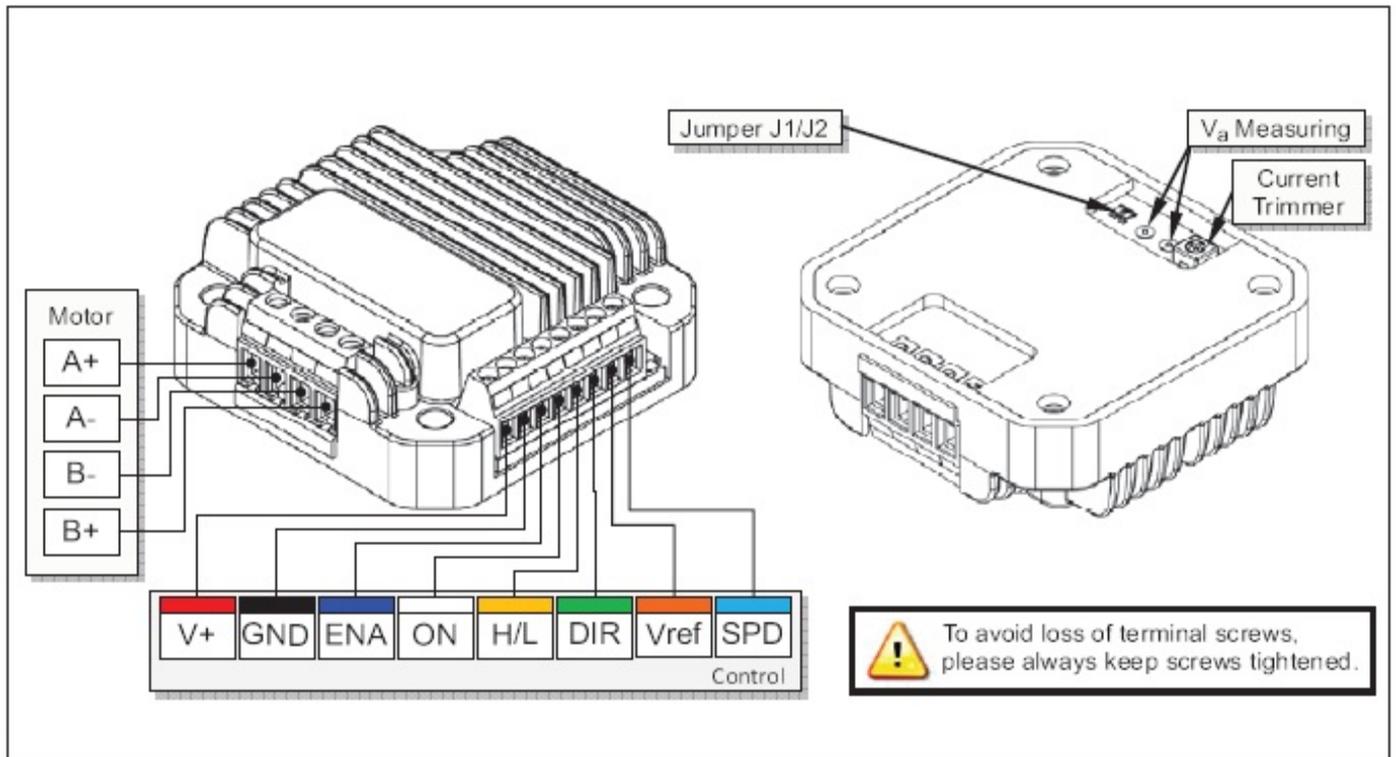
The controller can be mounted onto a NEMA 17 series stepper motor seamlessly. The enclosure is made of die-cast aluminium which provides a rugged durable protection and improves the heat dissipation.

Terminal Description

SMA Wiring Terminal



SMB Wiring Terminal



SMA/SMB Voltage Control Integrated Stepper Motor Controller

Control Terminal

Terminal	Symbol	Description
1	V+	Supply voltage 10-30 VDC
2	GND	Supply voltage ground
3	ENA	Enable/Disable H-bridge, internally pulled up
4	ON	Run/Stop, internally pulled up
5	H/L	High/Low speed range selection, internally pulled up
6	DIR	Direction input, internally pulled up
7*	Vref	5V Reference Voltage Output (NEVER link Vref to GND)
8*	SPD	Speed control voltage input (controls over 0.5v to 4.5v)

*NOTICE: Only SMB provides with port

Motor Terminal

Terminal	Description
A+/A-	Connect to the stepper motor phase A
B+/B-	Connect to the stepper motor phase B



To avoid damaging, make sure the phase winds are connected correctly.

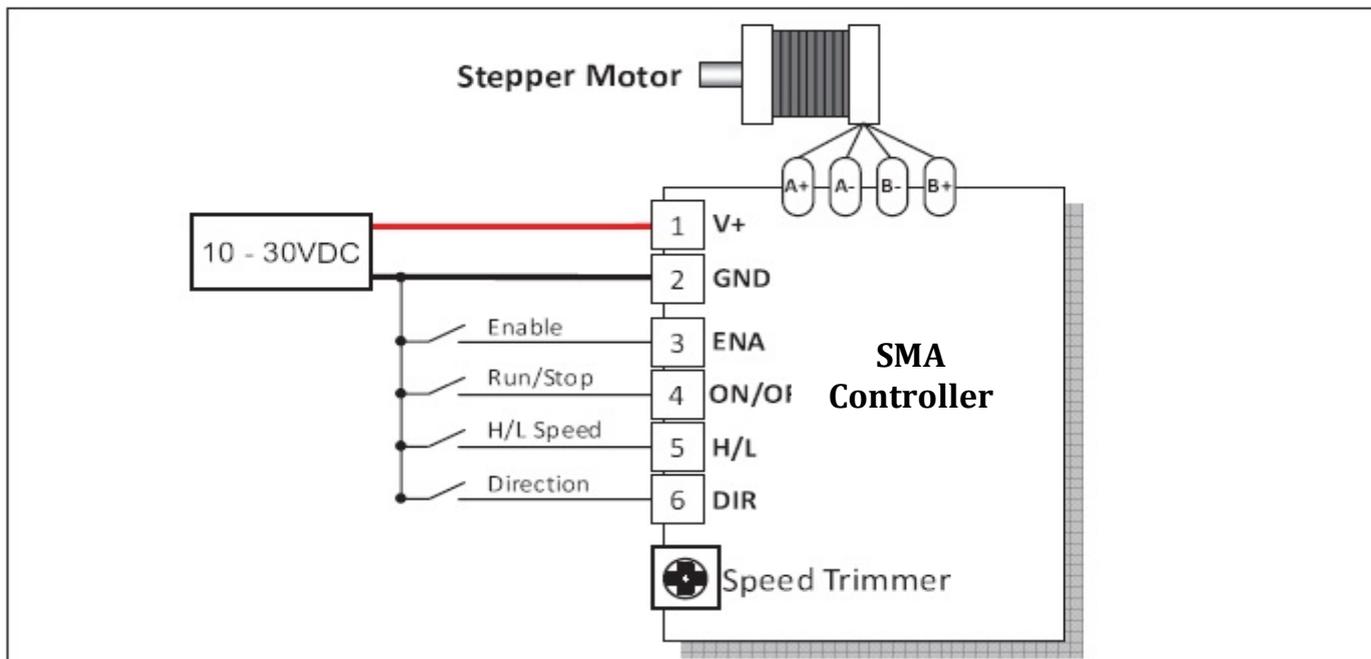
Resistance between leads of different phases is usually $> 100\text{K}\Omega$.

Resistance between leads of the same phase is usually $< 100\Omega$.

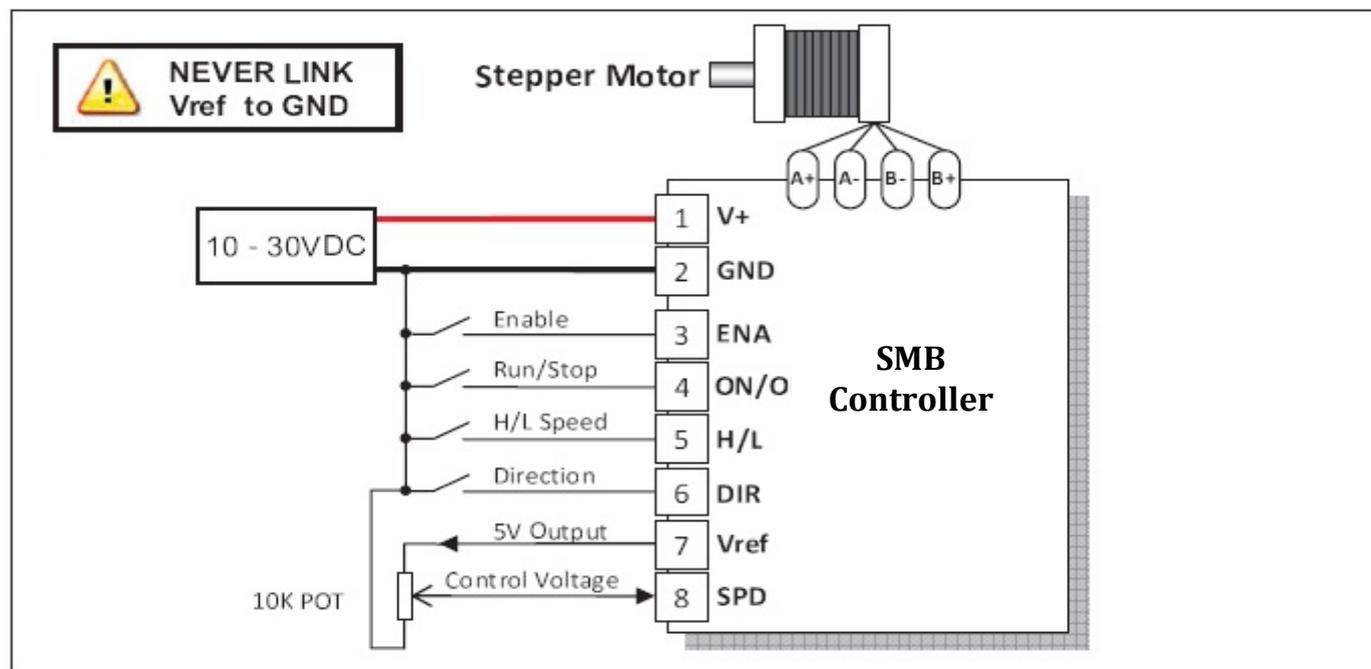
Typical Application

The SMA controller is equipped with a speed adjusting trimmer. SMB allows the user to use an external potentiometer or external voltage to control the speed.

SMA using On-board Trimmer



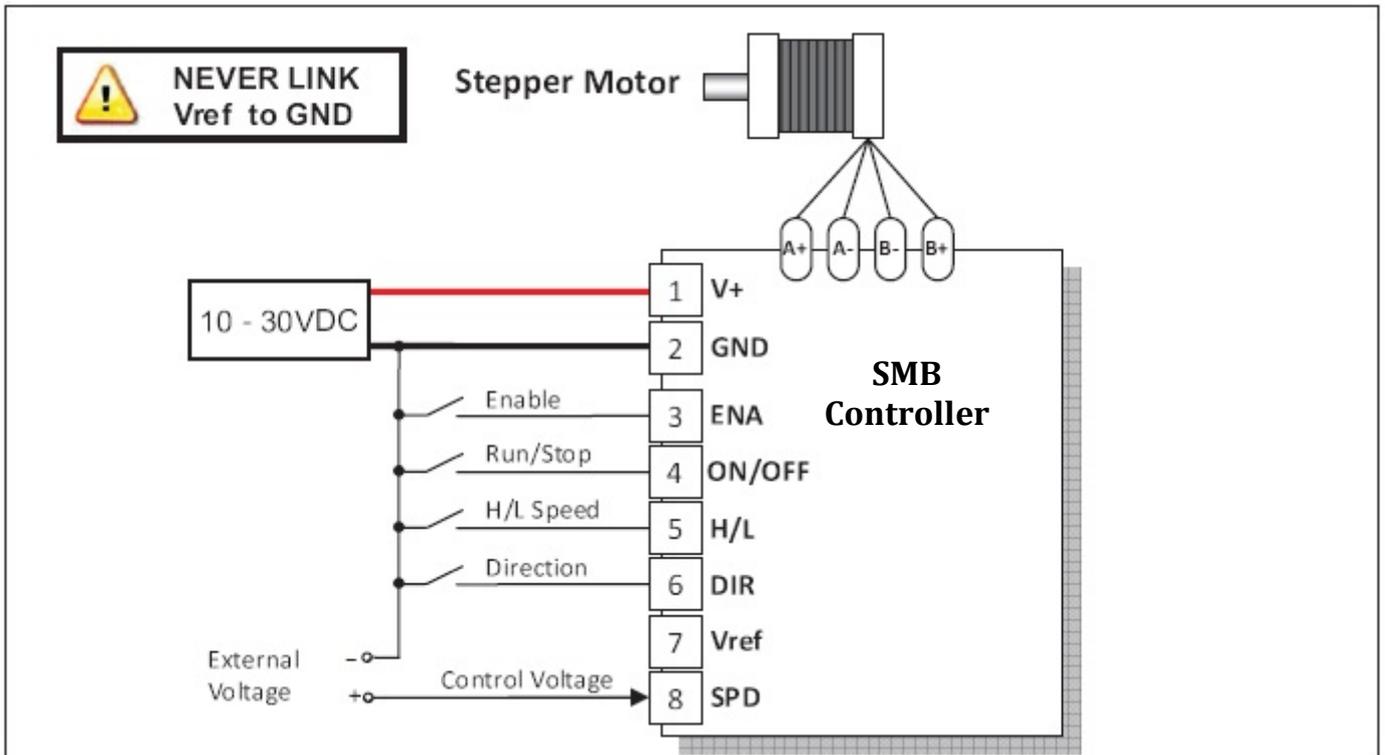
SMB with External Potentiometer



For users that need to use an external potentiometer (POT) to control the speed, SMB provides a 5V reference voltage output, and a speed control voltage input port. The resistance of the POT should be between 5K and 10K ohms. Less than 5K will result in excessive power consumption, and larger than 10K will cause inaccurate measurement.

SMA/SMB Voltage Control Integrated Stepper Motor Controller

SMB with External Control Voltage



For users who want to use an external voltage to control the speed to facilitate needs such as microprocessor D/A control, SMB provides a speed control voltage input port. The external control voltage must share common ground with the controller. In other words, the ground of the external control voltage must be linked to the terminal 2. In addition, the external control range must be between -0.3V and 5.3V. Voltage outside the range could cause damage.

Note: When controlling the speed with an external voltage the speed range operates over 0.5 to 4.5 v. Any voltage between -0.3v and 0.5v will cause the motor to run at minimum speed and any voltage above 4.5 will cause the motor to run at maximum speed.

Characteristics

Absolute Maximum Ratings ^(*)

Supply Voltage.....	10V to 30V
Ambient temperature under bias.....	-40°C to +85°C
Storage temperature.....	-50°C to +150°C

†NOTICE: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Electrical Characteristics (Ambient Temperature 25°C)	
Supply Power Voltage	10-30VDC
Motor Output Current	Max 2A per phase (adjustable through on-board trimmer)
Driving Mode	PWM constant current
Stepping Resolution	16 th fixed
Insulation Resistance	>1000MΩ
Dielectric Strength	0.5KV in one minute
Speed Range	8 Hz-102K Hz, 0.15-500 RPM (1.8° Motor)

Environmental Requirements		
Cooling		Free Air
Working Environment	Environment	Avoid dust, oil mist and corrosive gases
	Temperature	-40°C - +85°C
	Humidity	<80%RH, no condensation, no frosting
	Vibration	3G Max
Storage Temperature		-40°C - +150°C

Size and Weight	
Size	42.3mm x 42.3mm x 16.5mm (L x W x H)
Weight	0.1KG

SMA/SMB Voltage Control Integrated Stepper Motor Controller

Functional Description

Supply Voltage

SMA/SMB controller accepts a wide range input voltage from 10 to 30 VDC. In general, higher supply voltage improves motor performance under high speed situations, but also increases the power loss and temperature rise.

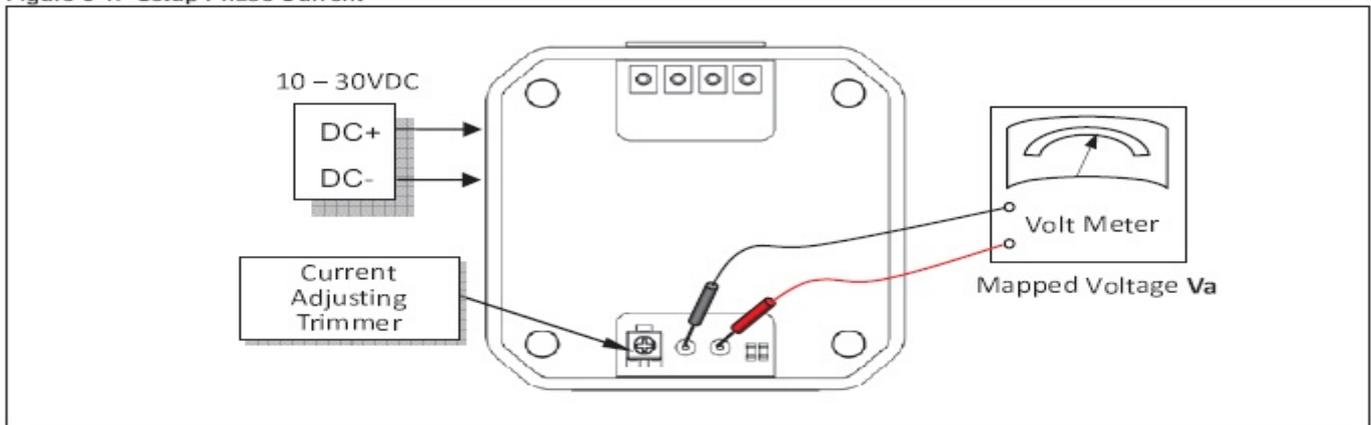
Output Phase Current

The controller is capable of providing a maximum 2A phase output current. In specific application, the peak output current needs to be adjusted to meet the rated motor current. A trimmer (potentiometer) is provided to serve this purpose at the bottom of the controller, as show in the figure 3-1. Measuring the mapped voltage (Va) when tuning the trimmer provides an easy way to set the output current.

A mapped voltage “Va” of 0-4V proportionally represents 0 ~ 2A

Please note that, the controller needs to be powered before mapped voltage “Va” can be measured. Reboot of the controller is required after the setup of the phase current.

Figure 3-1: Setup Phase Current



Speed Control

The controller's on-board processor is able to produce 8Hz – 102KHz step driving pulses. Under 16th micro stepping, that pulse rate equal to 0.15-500 RPM for a speed for a 1.8 degree stepper motor. The controller provides three methods to adjust the speed.

On-board trimmer

For SMA, adjusting the on-board trimmer will give the desired motor speed.

External potentiometer

For users who need to use external potentiometer (POT) to control the speed, SMB provides a 5V reference voltage output, and a speed control voltage in/out port. The resistance of the POT should be between 5K and 10K ohms. Less than 5K will result in excessive power consumption, and larger than 1K will cause inaccurate measurement.

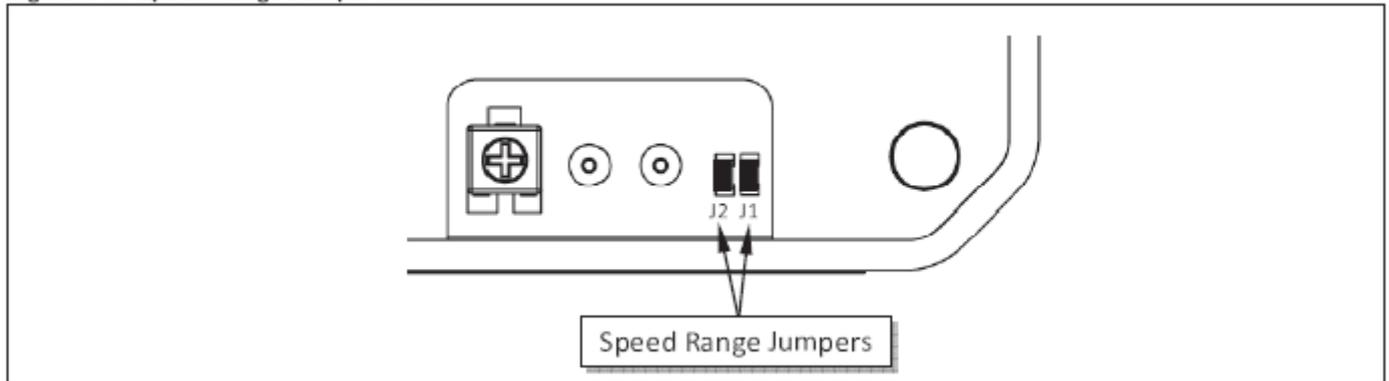
External control voltage

For users who want to use an external voltage to control the speed facilitate the needs such as microprocessor D/A control, SMB provides a speed control voltage input port, The external control voltage must share the common ground with the SMB controller. In other words, the ground of the external control voltage must be linked to the terminal 2. In addition, the external Control range must be between -0.3V and 5.3V or damage could occur.

Speed Range Selection

To preserve the accuracy of the measurements of the speed control voltage, the user should select the proper speed range. Since the voltage measurement accuracy is 8bit, (The controller uses a 10bit A/D converter, and abandon the last two digits to suppress the noise), the speed adjusting is not continuous, but has an incremental of 1/255 of the max speed.

Figure 3-1: Speed Range Jumper J1/J2



High Speed Range

When the desired speed is high, the speed range should be selected, by leaving the terminal 5 open (I.E, not connected) or linking to 5V. In the high speed range, there are two jumpers at the bottom of the controller, which can further limit the range of the speed. The relationship between the two jumpers and the speed range is given in the following table:

J1	J2	Pulse Frequency (Hz)	Speed for 1.8° stepper RPM	Note
-	-	-	-	-
Short	Short	100-102K	1.875- 500	Factory Default
Open	Short	100-51K	1.875- 350	
Short	Open	100-25.5K	1.875- 250	

Low Speed Range

When the desired speed is low, the low speed range should be selected, by linking the terminal 5 to ground (I.E, terminal 2). In the low speed range, there are two jumpers at the bottom of the controller, which can further limit the range of the speed. The relationship between the two jumpers and the speed range is given in the following table:

J1	J2	Pulse Frequency (Hz)	Speed for 1.8° stepper (RPM)	Note
-	-	-	-	-
Short	Short	8-8.16K	0.15- 150	Factory Default
Open	Short	8-4.08K	0.15- 38	
Short	Open	8-1.04K	0.15- 20	

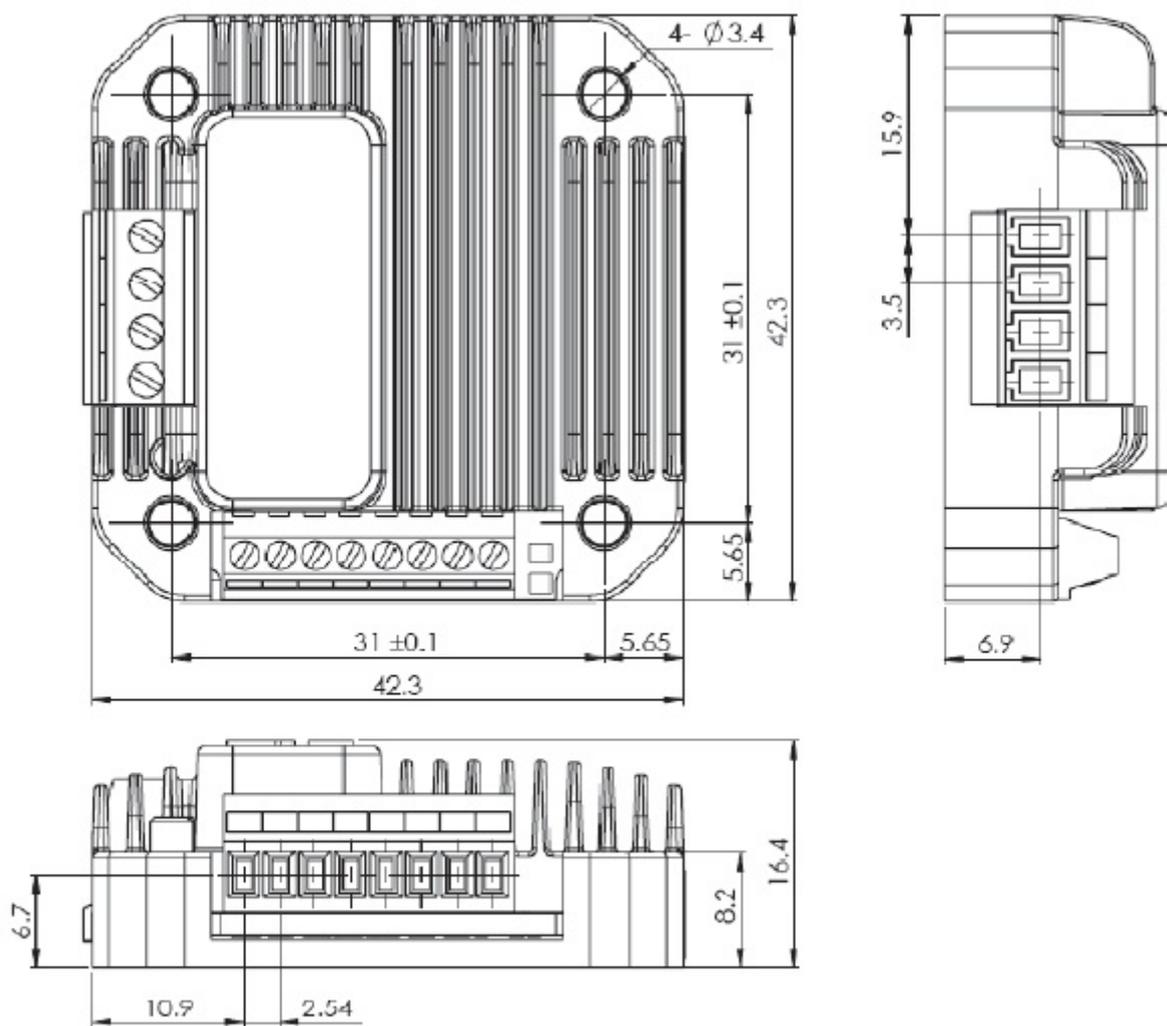
SMA/SMB Voltage Control Integrated Stepper Motor Controller

Functional Description

The microprocessor of the SMA/SMB is capable of ramping up the current speed to the desired speed in 0.3 seconds, even when the speed control voltage is changing. This feature makes the sudden increase of the desired speed become possible.

To guarantee the motor can stop as quick as possible, the deceleration rate is set to infinity, which means the motor will output a desired speed (lower than the current speed) immediately.

Appendix A Dimension



Units: mm