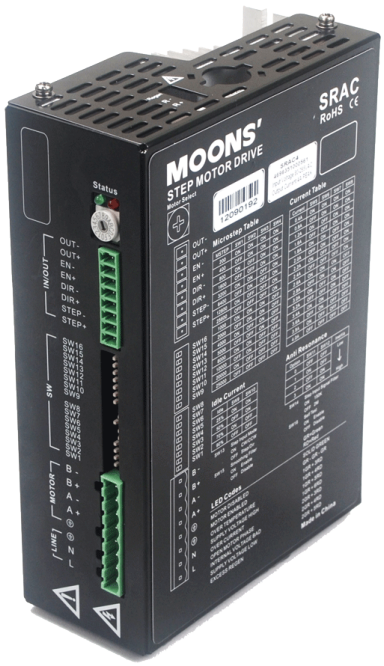
SRAC4

AC Input Step Motor Drive



User Manual

Rev. 1.1

AMP & MOONS' Automation

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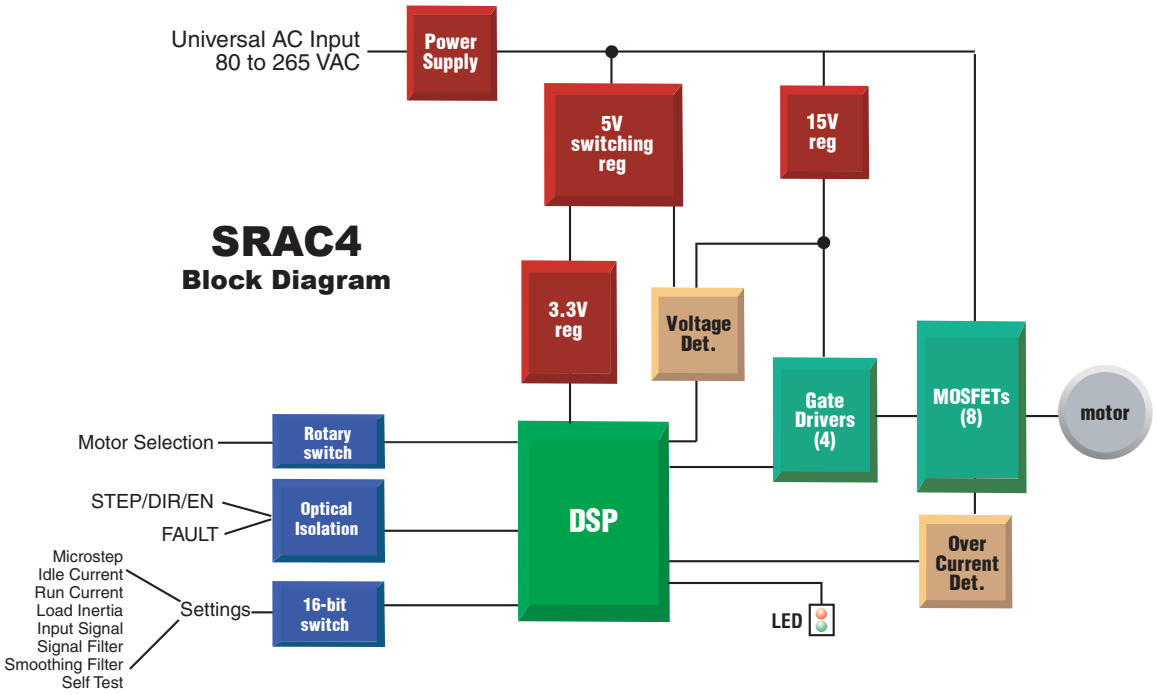
1 Introduction

Thank you for selecting the MOONS' SRAC4 Step Motor Drive. The SRAC4 series AC input drives are based on advanced digital current control technology and provide high torque, low noise and low vibration. Many of the operational paramteres are switch selectable. We hope our dedication to performance, quality and economy will make your motion control project successful.

1.1 Features

- Advanced digital current control provides excellent high speed torque
- Auto Setup measures motor parameters and configures motor current control and anti-resonance gain settings
- Uses universal AC input 80 to 265 VAC
- Speed Range - up to 50 rps
- Microstep Resolution - switch selectable, 16 settings: 200, 400, 800, 1600, 3200, 6400, 12800, 25600, 1000, 2000, 4000, 5000, 8000, 10000, 20000, 25000 steps/rev
- Running Current - peak setting, switch selectable, 16 settings: 0.4A, 0.8A, 1.2A, 1.6A, 1.8A, 2.0A, 2.2A, 2.4A, 2.6A, 2.8A, 3.0A, 3.2A, 3.4A, 3.6A, 3.8A, 4.0A
- Idle Current - automatic reduction of running current 1 second after the motor stops, switch selectable, 4 settings: 25%, 50%, 70%, 90% of running current
- Anti Resonance - raises the system-damping ratio to eliminate midrange instability and allow stable operation throughout the speed range of the motor, switch selectable, 4 settings for low to high inertia loads
- Control Modes - Step/Direction pulse input or CW/CCW pulse input, switch selectable
- Input Signal Filter - filters out unwanted noise that can cause extra steps, switch selectable, 2MHz or 150KHz
- Step Smoothing Filter (Microstep Emulation) - performs high resolution stepping by synthesizing coarse steps into fine micro-steps, switch selectable, ON or OFF
- Self Test - performs a 2 rev, 0.5RPS, CW/CCW move test, switch selectable, ON or OFF
- Motor Selection - a 16 bit rotary switch is used to select the desired motor database which is pre-loaded at the Factory

1.2 Block diagram



2 Mounting the Drive

The SRAC4 drive can be mounted only on the narrow side of the chassis. M4 screws should be used in the two holes at the back of the drive.

The amplifiers in the drive generate heat. To operate the drive continuously at maximum power forced air cooling, as from a fan, should be provided.

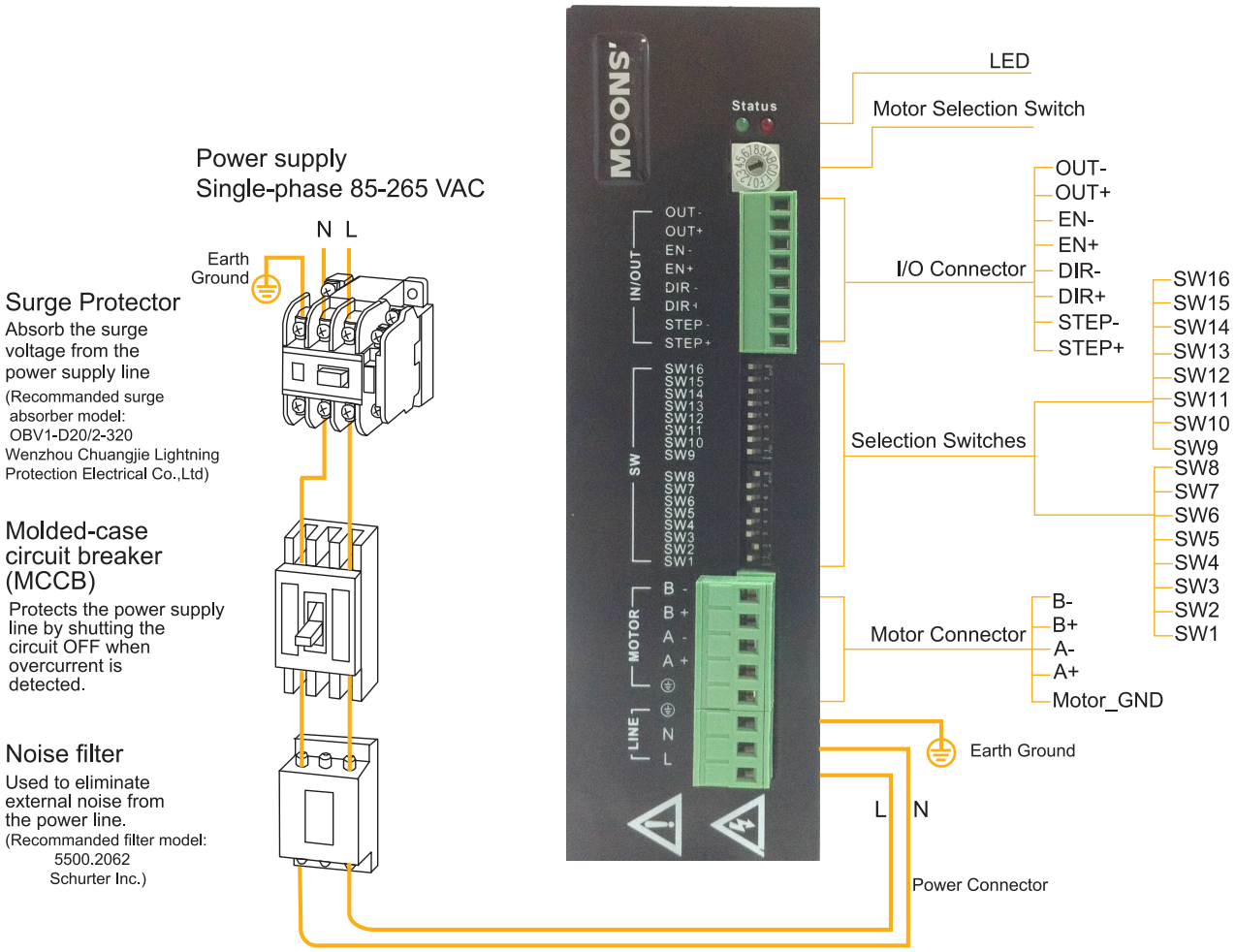
Never use the drive in a space where there is no air flow or where other devices can cause the surrounding air to be more than 40 °C. Never put the drive where it can get wet or where metal particles can fall into it.

3 Connections

To use the SRAC4 Step Drive, the following items are needed:

- Universal AC input of 80 to 265 VAC
- Pulse & Direction signal
- A compatible step motor

SRAC4 Wiring Diagram



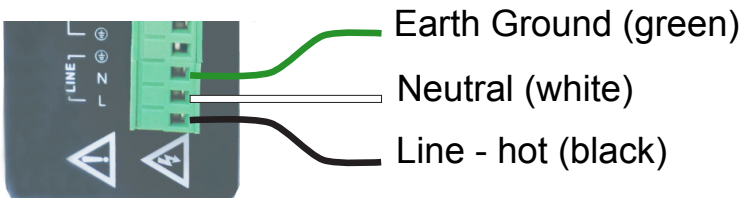
3.1 Connecting to Power

Use the supplied connector to connect to the AC supply according to the diagram below. Use 16 AWG wire for Line (L) and Neutral (N). Use 14 AWG for Earth Ground (G).

Care should always be taken when working with high voltages.

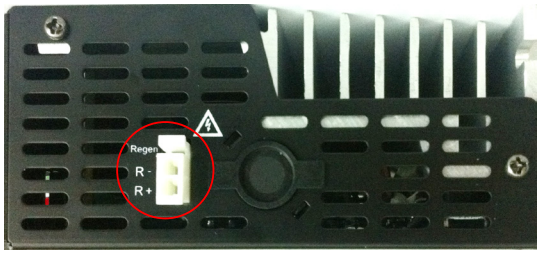
In regions where the single-phase supply is higher, an auto transformer can be used to drop the voltage to the correct level.

The SRAC4 contains an internal 10A fast acting fuse.



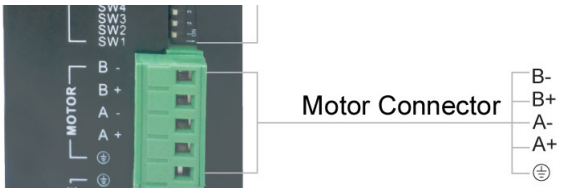
Regeneration Clamping Circuit

High speed motion generates high voltage which can be transferred to the drive during rapid deceleration, and the drive may indicate an over-voltage error condition after stopping from a high speed motion. The SRAC4 has regeneration clamping circuitry built in but requires an external resistor for operation. To protect the drive in a high speed, high load inertia application MOONS' recommends connecting a 40ohm 50W resistor to the regen connector located on the side of the SRAC4 drive.



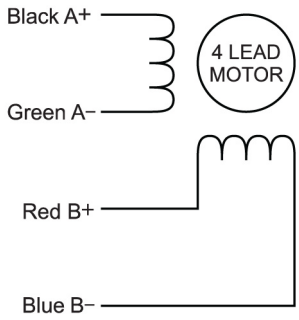


3.2 Connecting to a Motor

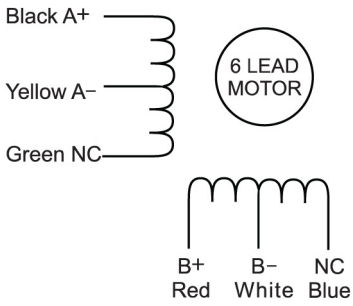


Motor connections should be made according to the following diagrams.

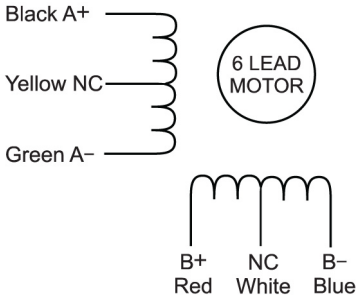
4 Lead Bipolar Motor



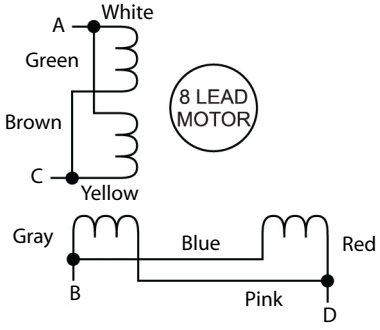
6 Lead Center Tap



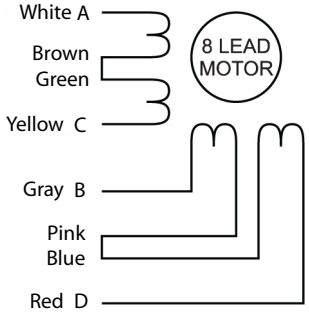
6 Lead Series



8 Lead Parallel



8 Lead Series



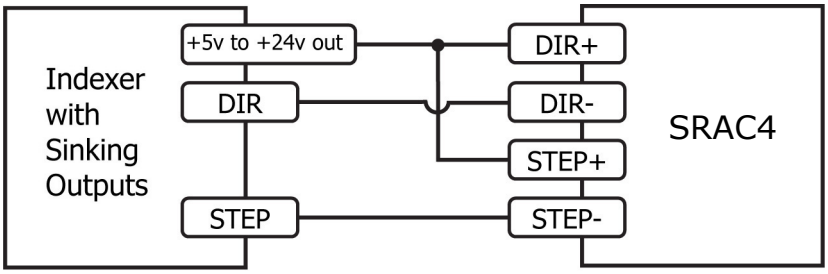
3.3 Connecting the Inputs and Outputs

3.3.1 Step & Direction Inputs

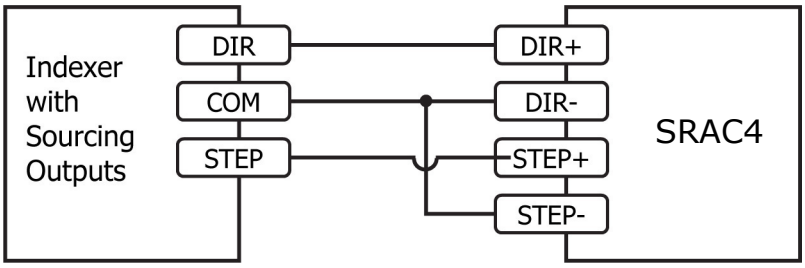
The SRAC4 Step Drive has two high speed optically isolated inputs called STEP and DIR. They accept 5 to 24 volt single-ended or differential signals, up to 2MHz. The maximum voltage that can be applied to the input is 28V.

The motor executes one step when the STEP input closes.

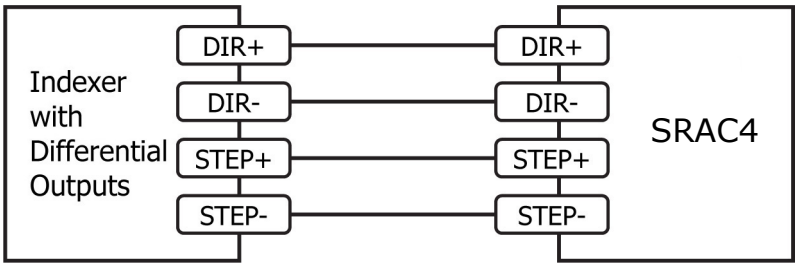
The direction of rotation is controlled by the DIR input state. A closed input (logic “0”) will result in clockwise rotation, and an open input (logic “1”) will result in counterclockwise rotation.



Connecting to Indexer with Sinking Outputs



Connecting to Indexer with Sourcing Outputs



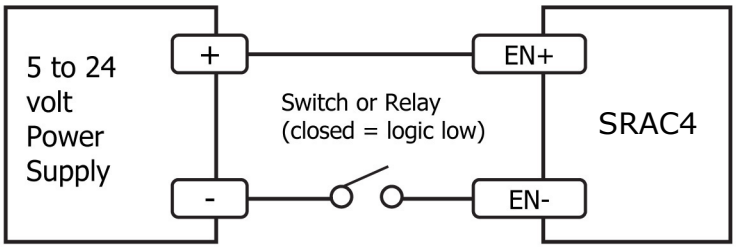
Connecting to Indexer with Differential Outputs
Many high-speed indexers have differential outputs

3.3.2 EN input

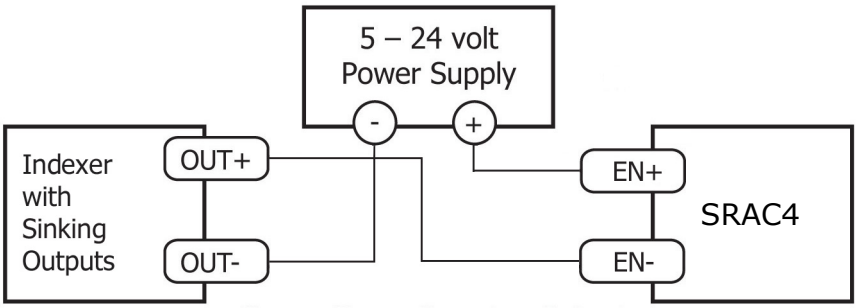
The EN input enables or disables the drive amplifier. It is an optically isolated input that accepts a 5 to 24 volt single-ended or differential signal. The maximum voltage that can be applied to the input is 28V.

When EN input is closed, the driver amplifier is deactivated, all the MOSFETs will shut down, and the motor will be free. When EN input is open, the drive is activated.

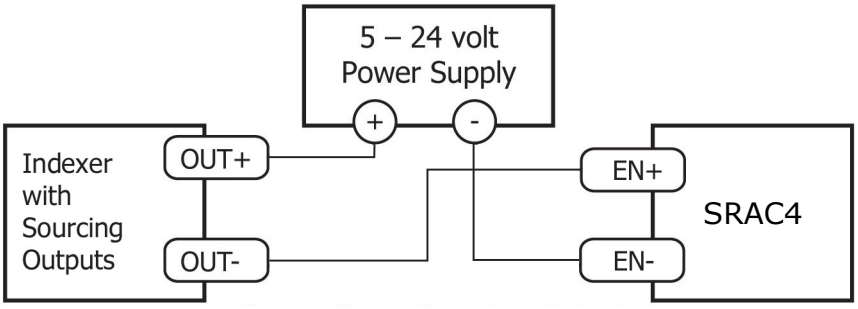
When the drive has encountered an error and the fault is removed from the system, a falling signal into the EN input will reset the error status and activate the drive amplifier again.



Connecting the Input to a Switch or Relay



Connecting the Input to Sinking Outputs

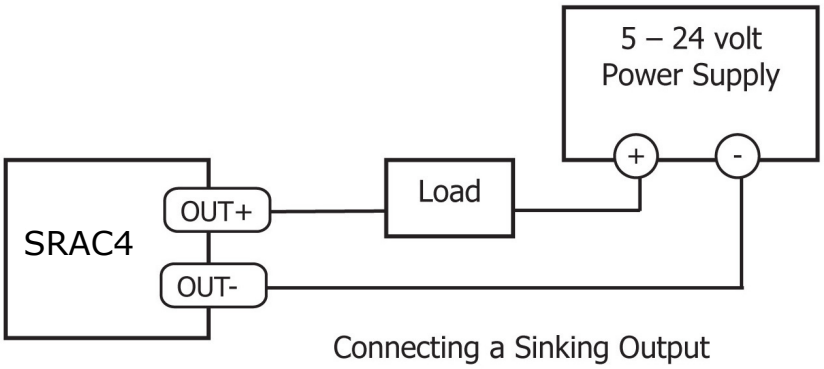


Connecting the Input to Sourcing Outputs

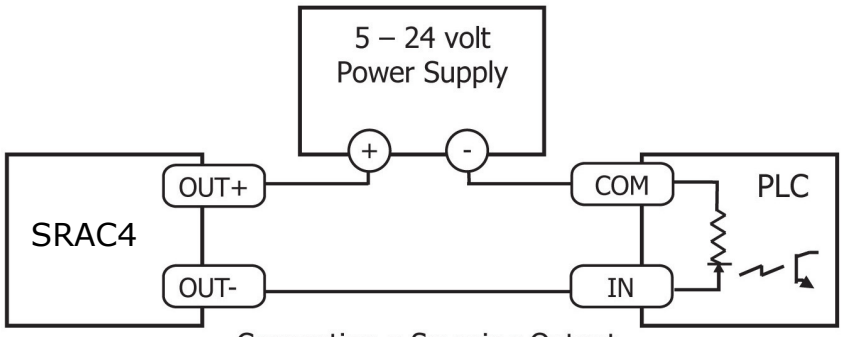
3.3.3 Fault Output

The FAULT Output is optically isolated. The maximum collector current is 100mA, and the maximum collector to emitter voltage is 30 volts. The output can be wired to sink or source current.

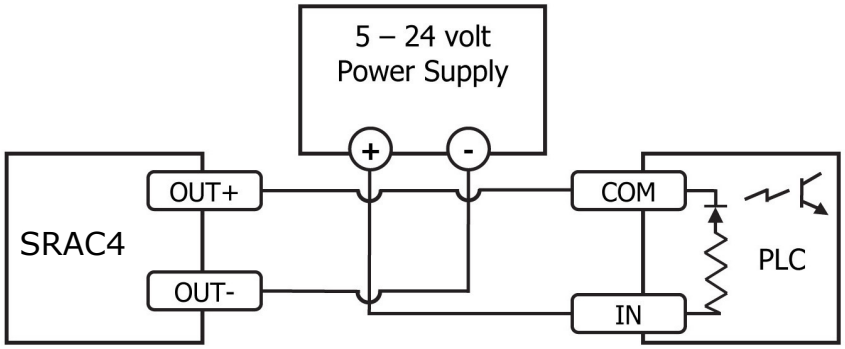
When drive is working normally, the output is open. When the drive encounters an error, the output closes.



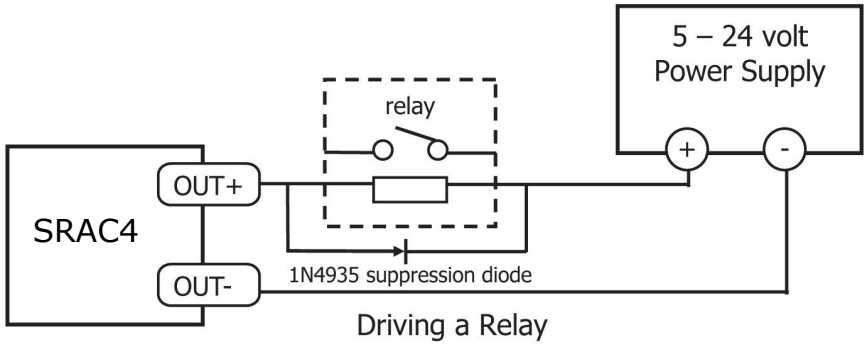
Connecting a Sinking Output



Connecting a Sourcing Output



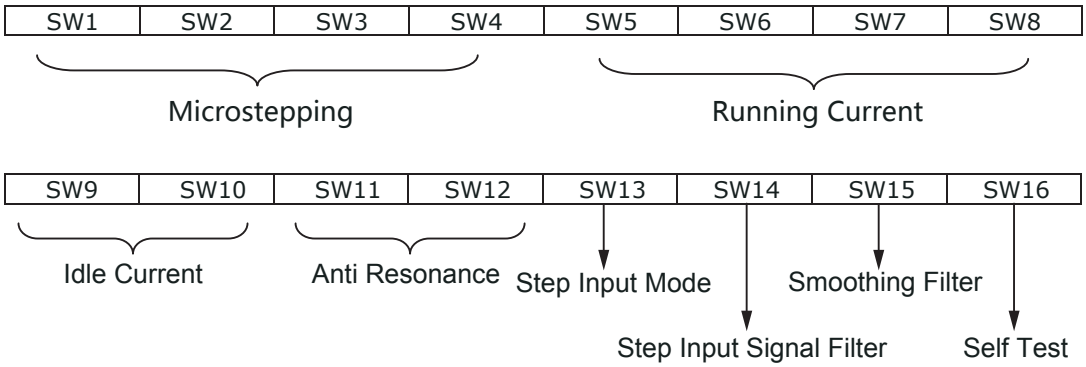
Connecting a Sourcing Output again



Driving a Relay

4 Switch Selection

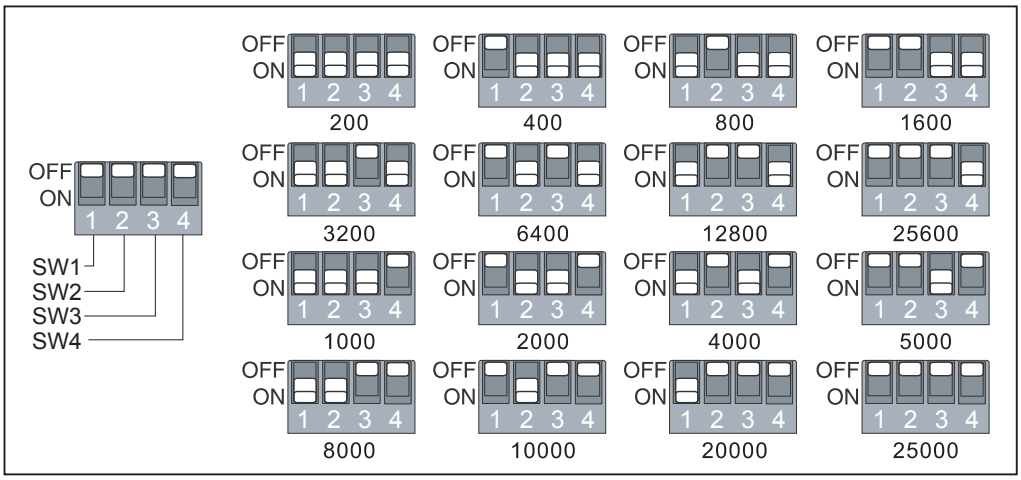
Many of the operational parameters of the SRAC4 can be set or changed by position switches - either by a single switch or a combination of ON/OFF settings of 2 or more switches.



4.1 Microstep Resolution

The microstep resolution is set by the SW1, SW2, SW3 and SW4 switches. There are 16 settings.

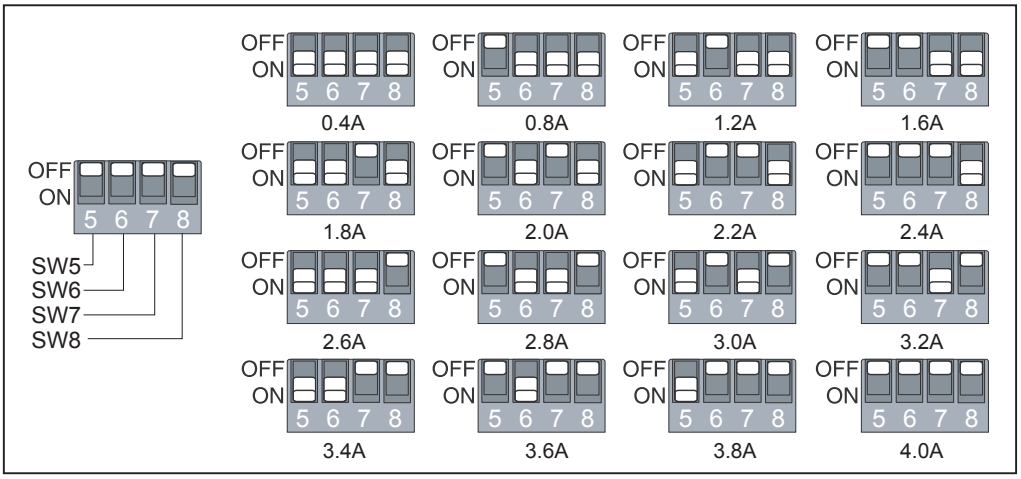
Microstep(steps/rev)	SW1	SW2	SW3	SW4
200	ON	ON	ON	ON
400	OFF	ON	ON	ON
800	ON	OFF	ON	ON
1600	OFF	OFF	ON	ON
3200	ON	ON	OFF	ON
6400	OFF	ON	OFF	ON
12800	ON	OFF	OFF	ON
25600	OFF	OFF	OFF	ON
1000	ON	ON	ON	OFF
2000	OFF	ON	ON	OFF
4000	ON	OFF	ON	OFF
5000	OFF	OFF	ON	OFF
8000	ON	ON	OFF	OFF
10000	OFF	ON	OFF	OFF
20000	ON	OFF	OFF	OFF
25000	OFF	OFF	OFF	OFF



4.2 Running Current

The output current is set by the SW5, SW6, SW7and SW8 switches. There are 16 settings.

Current (Peak)	SW5	SW6	SW7	SW8
0.4A	ON	ON	ON	ON
0.8A	OFF	ON	ON	ON
1.2A	ON	OFF	ON	ON
1.6A	OFF	OFF	ON	ON
1.8A	ON	ON	OFF	ON
2.0A	OFF	ON	OFF	ON
2.2A	ON	OFF	OFF	ON
2.4A	OFF	OFF	OFF	ON
2.6A	ON	ON	ON	OFF
2.8A	OFF	ON	ON	OFF
3.0A	ON	OFF	ON	OFF
3.2A	OFF	OFF	ON	OFF
3.4A	ON	ON	OFF	OFF
3.6A	OFF	ON	OFF	OFF
3.8A	ON	OFF	OFF	OFF
4.0A	OFF	OFF	OFF	OFF



4.3 Idle Current

The running current of the SRAC4 drive is automatically reduced whenever the motor isn't moving. The SW9 and SW10 switches control the percentage of the running current the idle current is reduced to. The 90% setting is useful when a high holding torque is required. To minimize motor and drive heating it is highly recommended that the idle current reduction feature be set as low as the application can tolerate.

Idle	SW9	SW10
25%	ON	ON
50%	OFF	ON
70%	ON	OFF
90%	OFF	OFF

4.4 Anti Resonance

The SW11 and SW12 switches select the load inertia. There are 4 settings. The inertia selection can help the SRAC4 drive to calculate the current control parameter. If the load inertia is close to that of the motor rotor, the low setting should be selected. If the load inertia is higher than that of the rotor, a proportionally higher setting should be selected.

Option	SW11	SW12	Inertia
0	ON	ON	Low ↓ High
1	OFF	ON	
2	ON	OFF	
3	OFF	OFF	

4.5 Step Input Mode

Most indexers and motion controllers provide motion commands in the Step and Direction format. The Step signal pulses once for each motor step and the Direction signal commands direction. Some PLCs use a CW/CCW command signal: one signal pulses once for each desired step in the clockwise direction (CW Step), while a second signal pulses for counterclockwise motion (CCW Step). In the CW/CCW control mode, the CW signal should be connected to the STEP input and the CCW signal to the DIR input.

Setting SW13 to OFF enables the Step & Direction format, the ON position enables the CW/CCW format.

Note: The power must be cycled each time the position of SW13 is changed.

4.6 Step Input Signal Filter

The STEP and DIR signal inputs have a built-in digital filter to reduce the external noise. If the system works on the low microstep, the 150 KHz setting should be selected. If the system works on the high microstep, the 2 MHz setting should be used.

The SW14 switch selects the digital signal filter. ON sets it to 150 KHz, OFF sets it to 2 MHz.

Note: The power must be cycled each time the position of SW14 is changed.

4.7 Step Smoothing Filter

Command signal smoothing can soften the effect of immediate changes in velocity and direction, making the motion of the motor less jerky. An added advantage is that it can reduce the wear on mechanical components. SW15 selects this function - ON enables it, OFF disables it.

This function can cause a small delay in following the control signal, and it should be used with that in mind.

Note: The power must be cycled each time the position of SW15 is changed.

4.8 Self Test

Setting SW16 to ON after the drive is powered up, will cause the drive to perform a Self Test move of 2 revolutions both CW and CCW at .5 rps. Setting SW16 to OFF will disable this feature.

5 Motor selection

Each position of the 16-bit rotary switch selects a different motor, and automatically sets the configuration parameters in the drive. The SRAC4 drive comes programmed with up to 16 typical motors as factory defaults. Drives can be customized with specially selected motors when required.



When the motor selection is changed, the drive power supply will need to be cycled.

Switch Bit	Motor	Wiring	Rated Current Setting(A)
0	AM34HD0802	Series Connected	1.8
1		Parallel Connected	3.6
2	AM34HD1802	Series Connected	1.8
3		Parallel Connected	3.6
4	AM34HD2805	Series Connected	1.8
5		Parallel Connected	3.6
6	AM34HD4802	Series Connected	1.8
7		Parallel Connected	3.6
8	AM34HD6801	Series Connected	1.8
9		Parallel Connected	3.6
A	AM23HS2459	4-lead Bipolar	1
B	AM23HS3466	4-lead Bipolar	1
C	AM24HS5411	4-lead Bipolar	1
D	Reserved	4-lead Bipolar	None
E	Reserved	4-lead Bipolar	None
F	Reserved		2.9

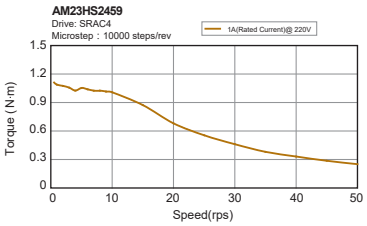
Note: The rated current of motor is RMS value. The output current of MOONS' drive is the peak of sine value. Drive peak current = the rated current of drive * 1.4

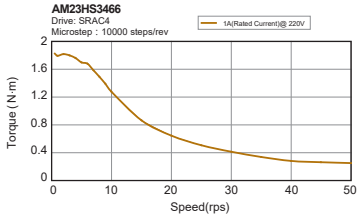
5.1 Recommended motors

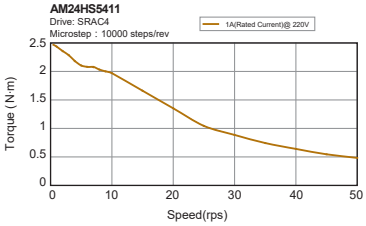
Model	Shaft	Wiring	Length"L"	Holding Torque	Rated Current	Resistance	Rotor Inertia	Motor Mass	Dielectric Strength
			mm	N·m	A/Phase	Ω/Phase	g·cm^2	Kg	
AM23HS2459-01	Single Shaft	4 Leads	54	1.1	1	16.6	260	0.6	1500V AC 1 minute
AM23HS3466-01			76	1.8		25.4	460	1.0	
AM24HS5411-01N	Single Shaft		85	2.5		15.4	900	1.4	
AM34HD0802-01	Single Shaft	8 Leads Series Connected	66.5	3	1.8	3.4	1100	1.6	
AM34HD0802-02	Double Shaft								
AM34HD4802-01	Single Shaft		75	3.5		3.6	1350	1.9	
AM34HD1802-01	Single Shaft		96	5		3.6	1850	2.7	
AM34HD1802-03	Double Shaft								
AM34HD6801-01	Single Shaft		115	6.5		4	2400	3.5	
AM34HD2805-01	Single Shaft		125.5	7.1		4.2	2750	3.8	
AM34HD2805-03	Double Shaft								

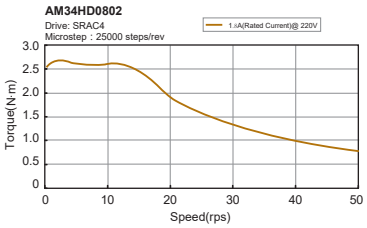
Note: The "Drive Current Setting" shown here differs from the rated current of each motor because the rated current is RMS and the drive current setting is peak sine. If you are using a motor not listed here, for best results set the drive current at the motor's rated current x 1.4.

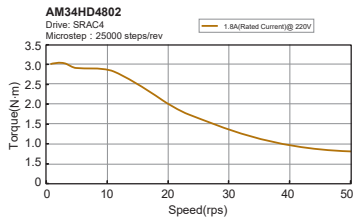
5.2 Torque-Speed Curves

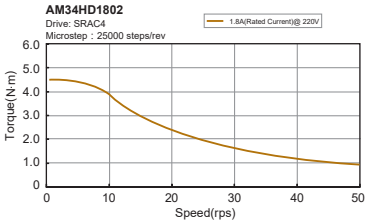


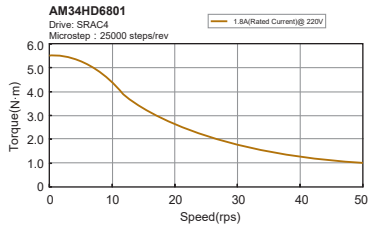


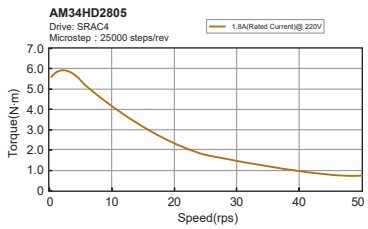












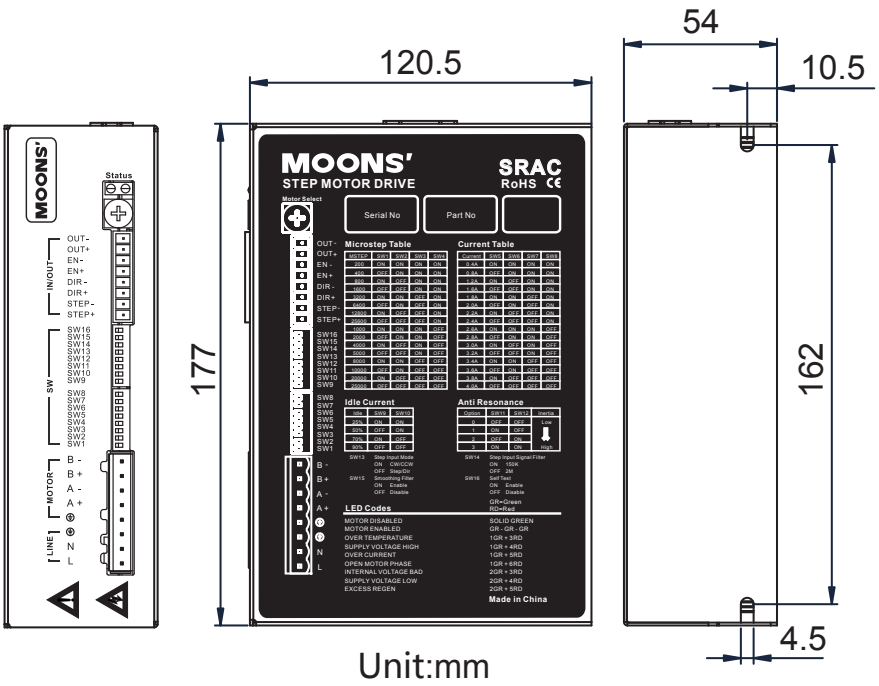
6 Error Codes

The SRAC4 Drive has two LEDs to indicate status. When the motor is enabled the green LED flashes slowly, when the green LED is solid the motor is disabled. If the red LED flashes, an error has occurred. Errors are indicated by combinations of red and green flashes as shown below:

Code		Error
🟢	Solid green	Motor Disabled
🟢🟢	Flashing green	Motor Enabled
🔴🔴🔴🟢	3 red, 1 green	Over Temperature
🔴🔴🔴🟢🟢	3 red, 2 green	Bad Internal Voltage
🔴🔴🔴🔴🟢	4 red, 1 green	Supply Voltage High
🔴🔴🔴🔴🟢🟢	4 red, 2 green	Supply Voltage Low
🔴🔴🔴🔴🔴🟢	5 red, 1 green	Over Current
🔴🔴🔴🔴🔴🟢🟢	5 red, 2 green	Excess Regen
🔴🔴🔴🔴🔴🔴🟢	6 red, 1 green	Open Motor Phase

7 Reference Materials

7.1 Mechanical Outline



7.2 Specifications

7.2.1 Electrical Specifications

Electrical Specifications				
Parameter	Min.	Typ.	Max.	Unit
Power Supply	80	-	265	VAC
Output Current (Peak)	0.4	-	4.0	amps
Step Frequency	2	-	2M	Hz
STEP Minimum Pulse Width Hi and Low	250	-	-	ns
DIR Minimum Pulse Width	62.5	-	-	us
Under Voltage Protection	-	80	-	VAC
Over Voltage Protection	-	295	-	VAC
STEP/DIR Input Signal Voltage	4.0	-	28	V
OUT mxinmum output current	-	-	100	mA
OUT maximum voltage	-	-	30	V

7.2.2 Environmental Specifications

Environmental Specifications	
Heat Sinking Method	Natural cooling or fan-forced cooling
Surrounding Air Conditions	Avoid dust, oily mist and corrosive air
Operating Temperature	0 - 40°C (32 - 104°F)
Maximum Ambient Humidity	90% non-condensing
Shock	5.9m/s² maximum
Storage Temperature	-10 - 70°C (14 - 158°F)

8 Contacting MOONS'

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