

# **SD40**

## **4 Ampere Stepper Motor Driver**

## General Description

Driving stepper motor is common necessity in most robotic projects. Stepper motor is a brushless, synchronous electric motor that can drive a full rotation into a large number of steps. Stepper motor is ideally suited for precision control. This motor can operate in forward/reverse with controllable speed from a microcontroller through a driver circuit. There are various kinds of stepper motor. Some example are variable reluctant stepper motor, permanent magnet stepper motor, bipolar/unipolar stepper motor, bifilar stepper motor and hybrid stepper motor.

**SD40** is an easy-to-use professional stepper motor driver, which could control two-phase stepping motor. It's compatible with any CNC breakout board or any micro-based control board such as Arduino boards. **SD40** can drive up to 4 amperes peak current per phase with 4 levels adjustable phase current 1A, 2A, 3A and 4A via DIP switch. Micro-step resolution is also adjustable using DIP switch.

One of the most important features of **SD40** driver is controlling the holding current (holding torque) as a percent of the nominal operating current (working torque) to overcome excessive driver heating during motor stopping. **SD40** driver features over temperature alarm for thermal protection. All input signals are opto-isolated to insure safety in industrial applications.

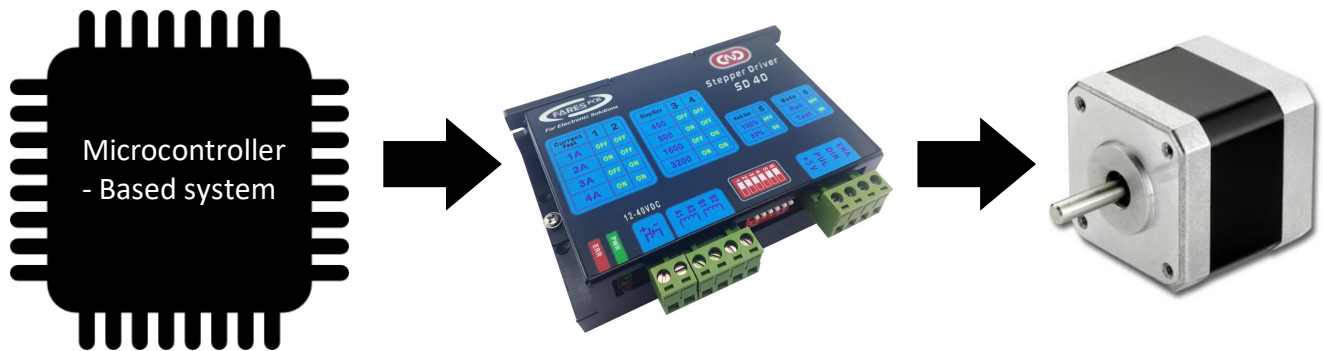
## SD40 features

- Single input power (12–40VDC)
- 4 Amps/phase maximum output motor driving current.
- 4 Selectable work current (1A, 2A, 3A, 4A).
- Optional auto idle current reduction (30%).
- Step, direction and enable input signals are TTL compatible.
- Steps/Revolution 400,800,1600, 3200.
- Test mode operation.
- All controlling input signals are opto-isolated for safety.
- High speed opto-coupler isolator on step and direction.
- Over temperature and over current protection.
- LED indicator for power input (green) and fault (red).
- Large area heat sink.
- Dimensions: 118\*76\*33 mm.

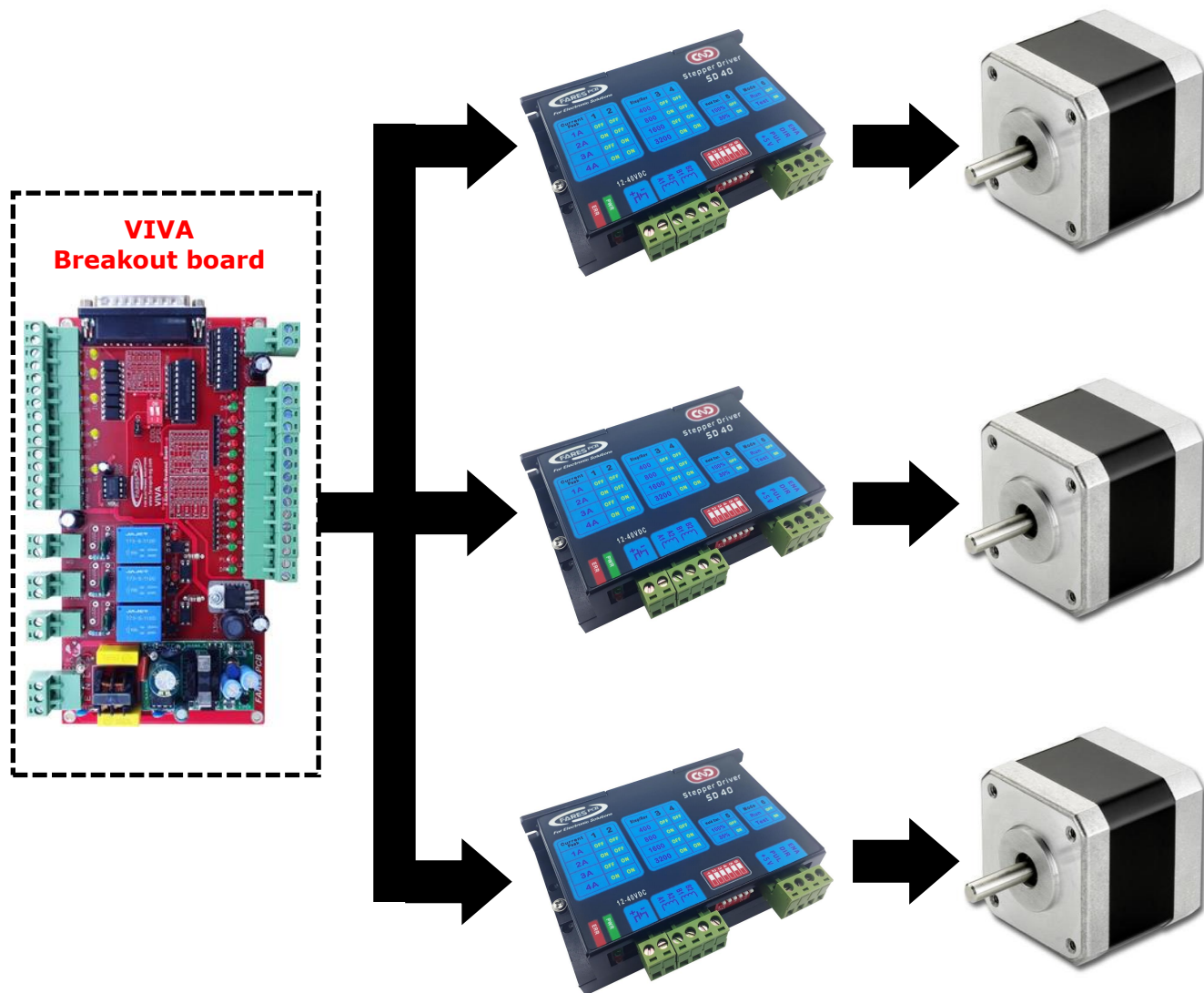
## Electrical specifications

Parameters	Min	Typical	Max	Unit
Supply voltage	12	24	40	V
Output current	1	-	4	A
Input signal current	5	10	20	mA
Pulse Frequency	0	-	200	KHz
Minimum pulse width	2.2	-	-	μS
Thermal shutdown	120	130	140	°C

## System overview



**Single motor control system**



**Three axes motor control system**

## Connector signal definition

Label	Direction	Name	Function
VDC	Power	Driver supply power	Power supply for both motor power and internal control circuit
A1	Output	Motor Winding A	Motor coil A terminals
A2	Output		
B1	Output	Motor Winding B	Motor coil B terminals
B2	Output		
+5V	Input	Positive common for external control signals	Supply power for opto-couplers. Usually come from breakout board or microcontroller biasing voltage
PUL	Input	Stepping input pulse	Input to drive the stepper motor. This pin is TTL logic. Each pulse (logic change from 0 to 1) will drive the stepper motor one step
DIR	Input	Stepper driver rotation direction input	Input for stepper motor driver to rotate CW (clockwise) or CCW (counterclockwise). This pin is TTL logic. The direction depends on the connection sequence of stepper motor terminals
ENA	Input	Stepper driver enable input	Input pin to enable SD40 driver. This pin is TTL logic. "5V" or float input (not connected) will enable the motor driver further hold the shaft of stepper motor while "0V" will disable the motor driver and release the shaft of the stepper motor <b>By default, the driver is enabled. Don't connect any enable signal if your driver is always enabled</b>

### Caution:

**Don't connect or disconnect the motor while the driver is energized. This may cause permanent damage to the Driver.**

## LED indicator description

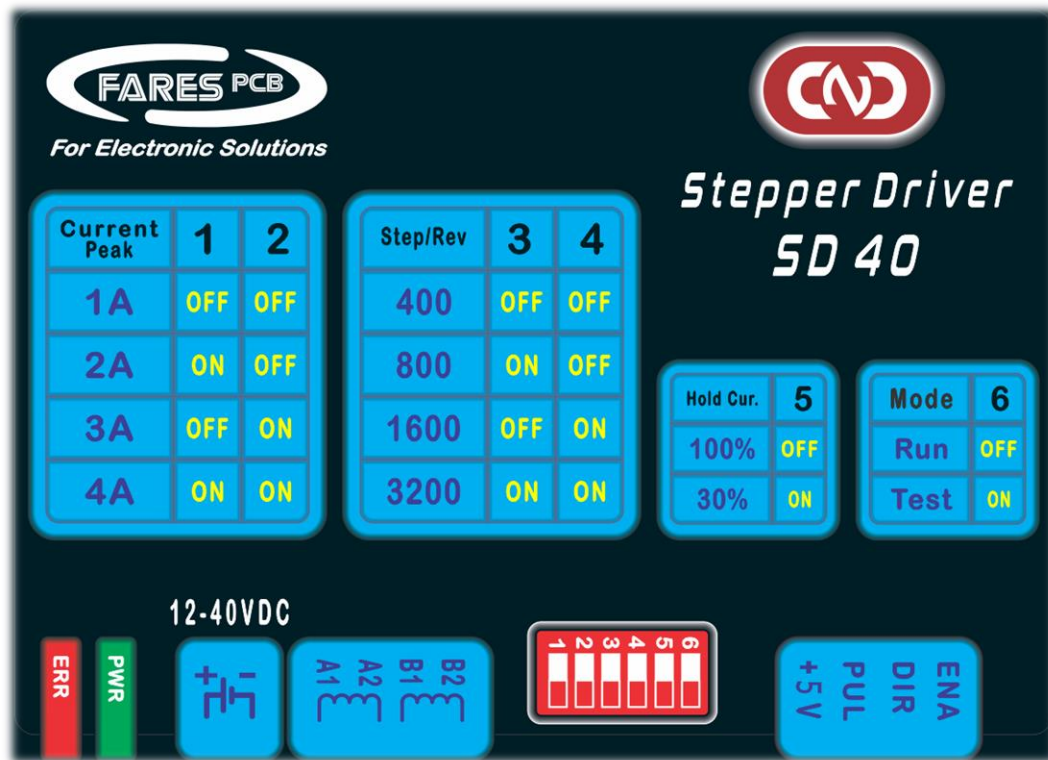
LED	Color	State	Function
<b>Power</b>	Green	OFF	No power connected
		ON	Power supply connected
<b>ERR</b>	RED	OFF	No error (Normal operation)
		Flash	Thermal shutdown alarm
		ON	Over current alarm

## Buzzer operation description

Buzzer State	Function
<b>OFF</b>	No error (Normal operation)
<b>Fast</b> <b>300 msec on</b> <b>300 msec off</b>	Thermal shutdown alarm
<b>Slow</b> <b>700 msec on</b> <b>700 msec off</b>	Over current alarm

### Note:

**If an alarm is initiated, SD40 driver is halted and it must be power restarted to resume working.**



## Resolution setting

Steps / rev	DIP switch setting	
	3	4
400	OFF	OFF
800	ON	OFF
1600	OFF	ON
3200	ON	ON

### Note:

Any changing in resolution setting will not be activated until power restarting.



## Current setting

Peak current	DIP switch setting	
	1	2
1A	OFF	OFF
2A	ON	OFF
3A	OFF	ON
4A	ON	ON

## Hold current adjustment

Stepper motor doesn't necessary require the full operating current during idle state where the driver is enabled but no pulses produced.

**SD40** can be set to reduce the holding current automatically to 30% of the nominal operating current. So it saves power consumption and reduces heating of driver and motor.

Hold current is set by switch 5.

If switch 5 is off , hold current = 100% of work current. i.e. if stepper motor work current is adjusted to 2 Ampere (Switch 1 = ON : Switch 2 = OFF) , Then Motor hold current during stopping is also 2 Ampere.

If switch 5 is on , hold current = 30% of work current. i.e. if stepper motor work current is adjusted to 2 Ampere (Switch 1 = ON : Switch 2 = OFF) , Then Motor hold current during stopping is also 0.6 Ampere.

## Hold current setting

Hold current %	DIP switch setting
	5
100	OFF
30	ON



table below show hold current values when switch 5 is on (30%)

### Hold current value (Switch 5 "ON")

Hold current Ampere	DIP switch setting	
	1	2
0.3A	OFF	OFF
0.6A	ON	OFF
1A	OFF	ON
1.3A	ON	ON

### Test mode operation

**SD40** can be tested without external control signals (Pulse or Direction signals). Just set DIP switch 6 to "ON" and connect power to driver.

### Test mode setting

Operating Mode	DIP switch setting
	6
Run	OFF
Test	ON

Test mode sequence is :

One turn in one direction with 2500 us interval between pulses then stop for 1 second and make another turn in the opposite direction with the same interval time between pulses. Test mode is performed in any resolution setting , **SD40** Auto detects the resolution and recalculate the required number of pulses to make exactly one turn for testing operation.

#### Note:

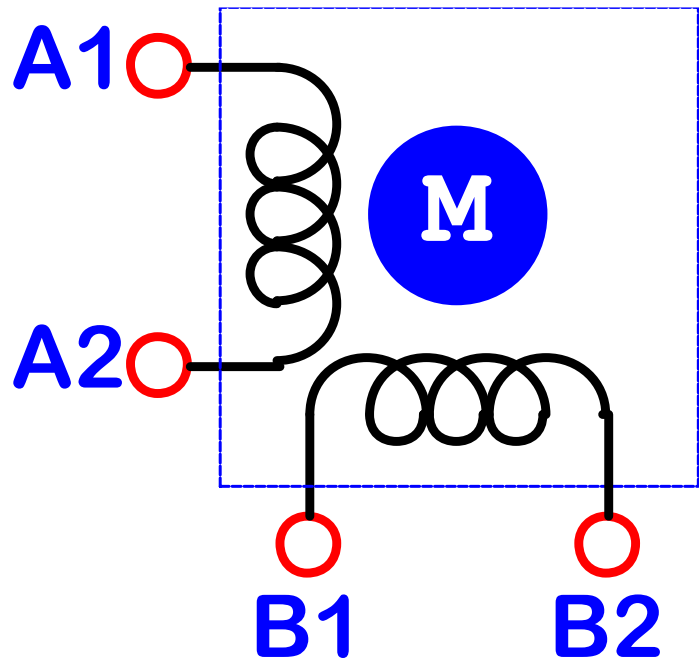
In test mode any changing in resolution setting will not be activated until power restarting.

## Stepper Motor Wiring Diagram

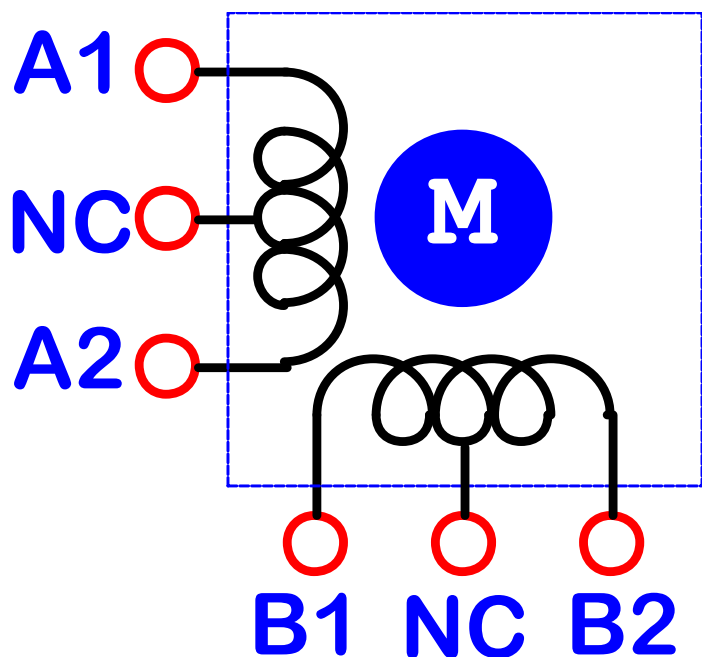
**SD40** may drive 4, 6 or 8 lead stepper motors. Some motor wiring provides high torque and some other provides high speed.

Figures below shows some motor types and its connections to obtain high torque and speed.

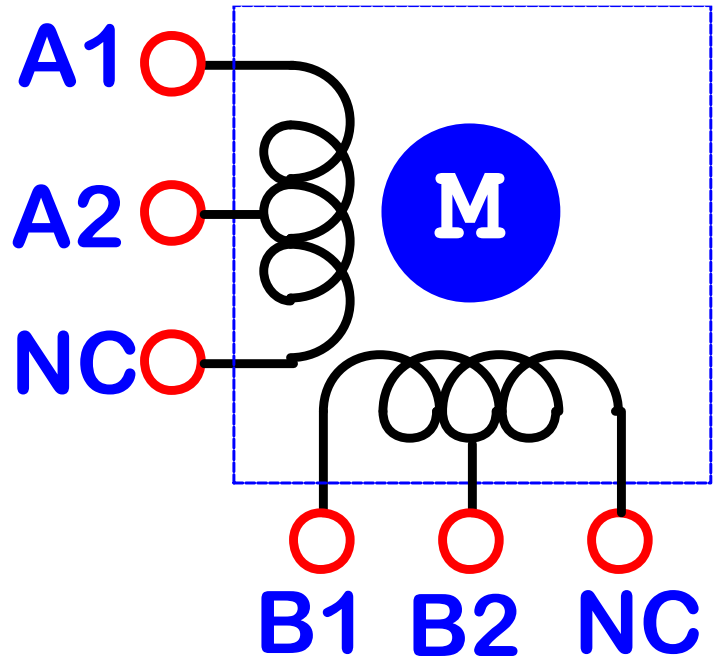
**Four leads motor connection**



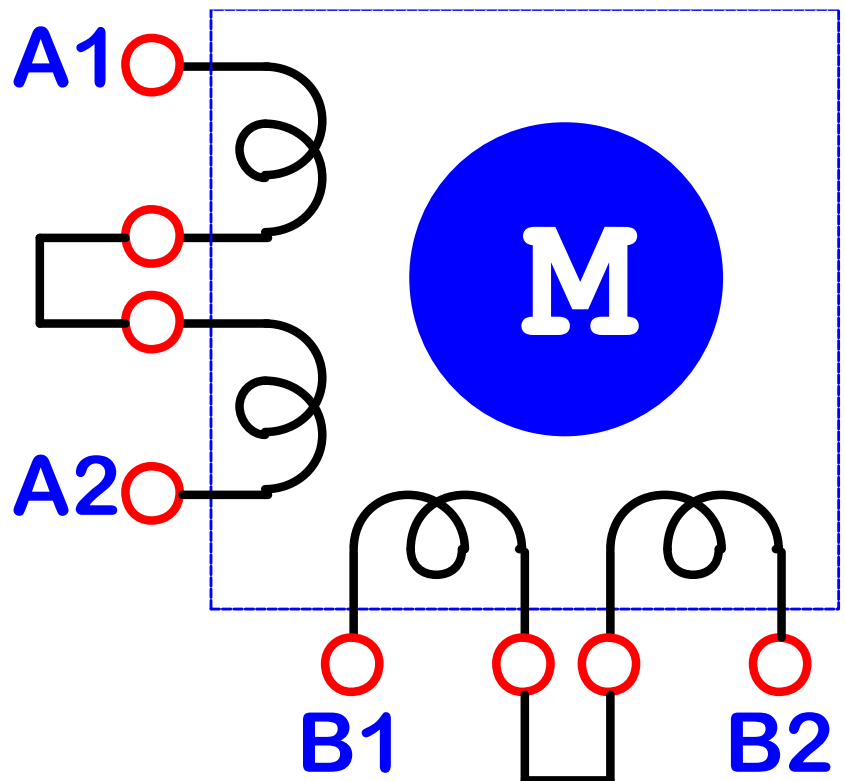
**Six leads motor  
(High torque connection)**



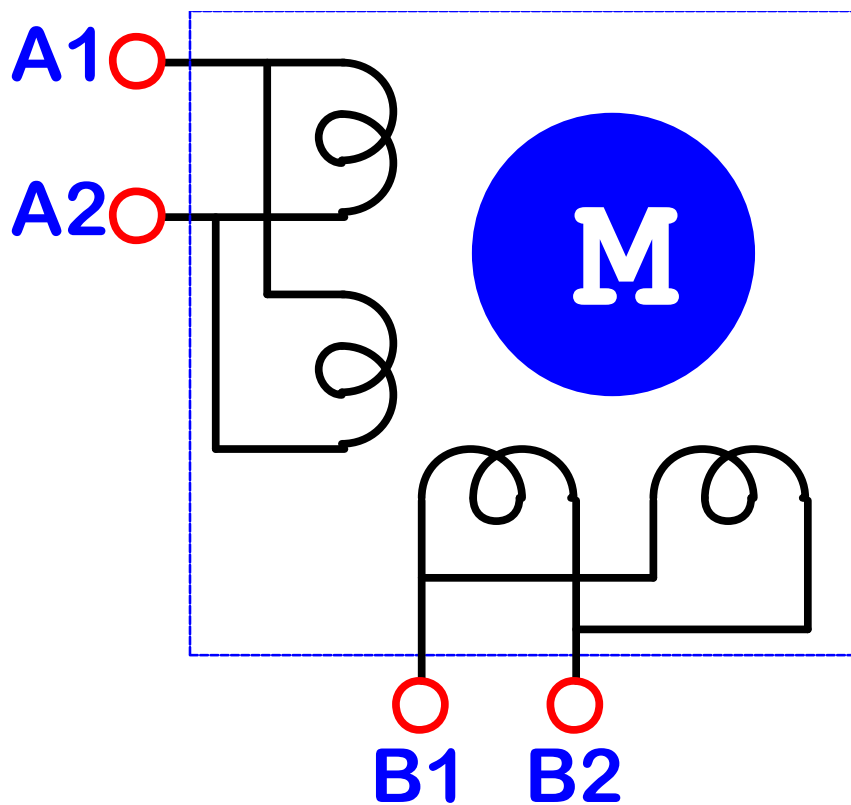
**Six leads motor**  
**(High speed connection)**



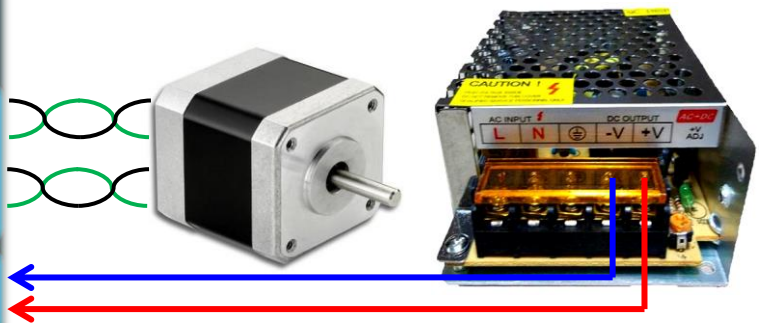
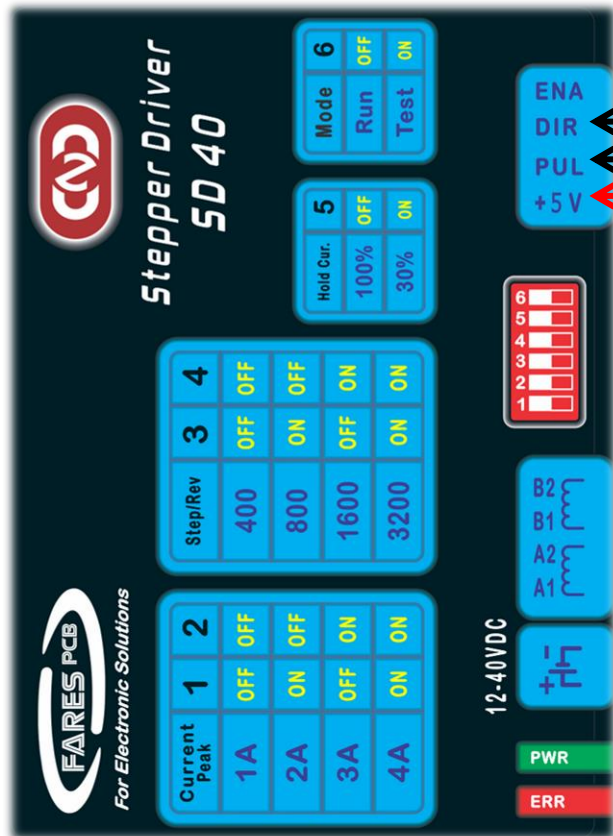
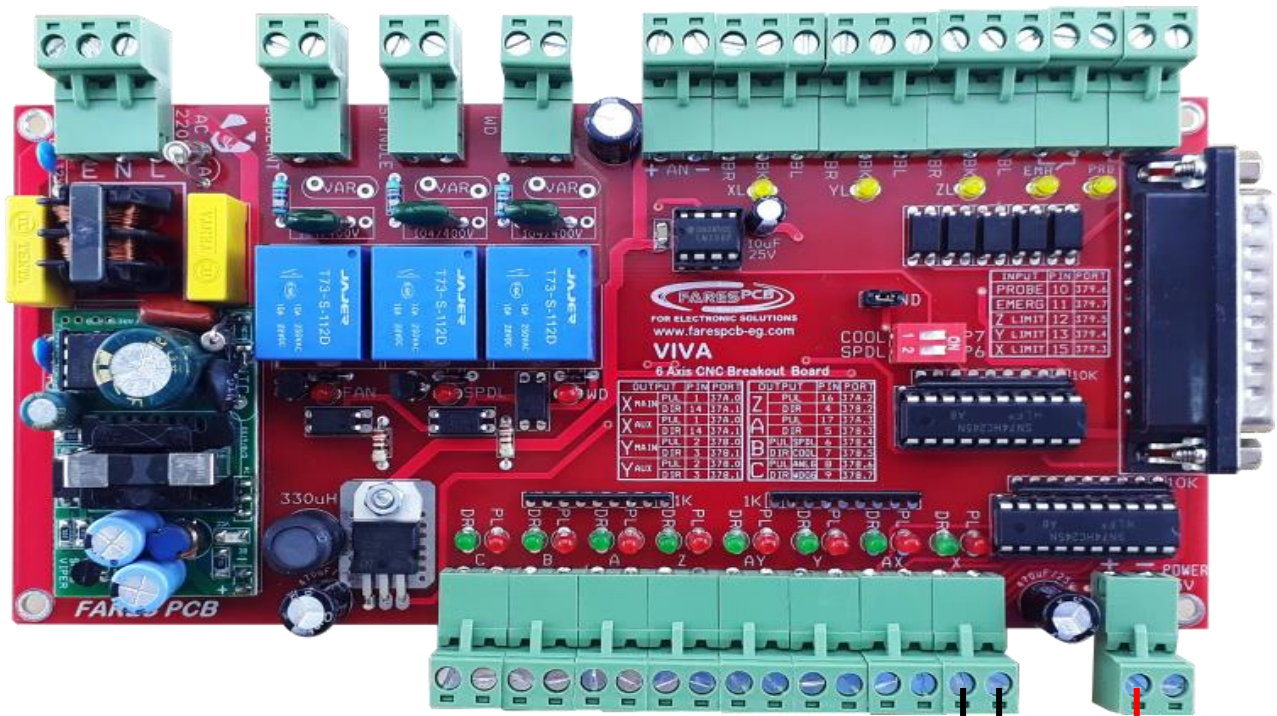
**Eight leads motor**  
**(High torque connection)**

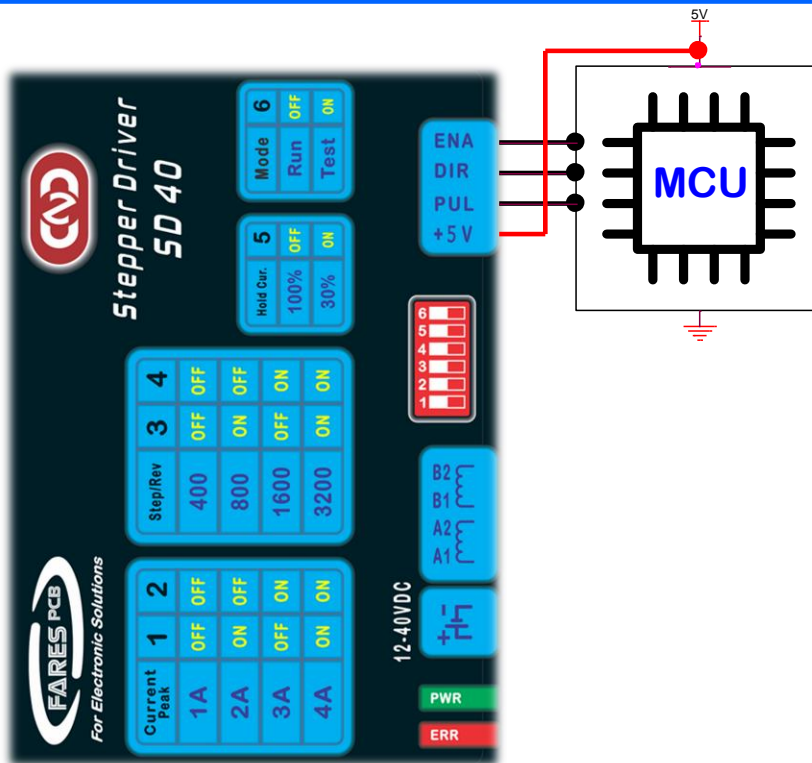


**Eight leads motor  
(High speed  
connection)**

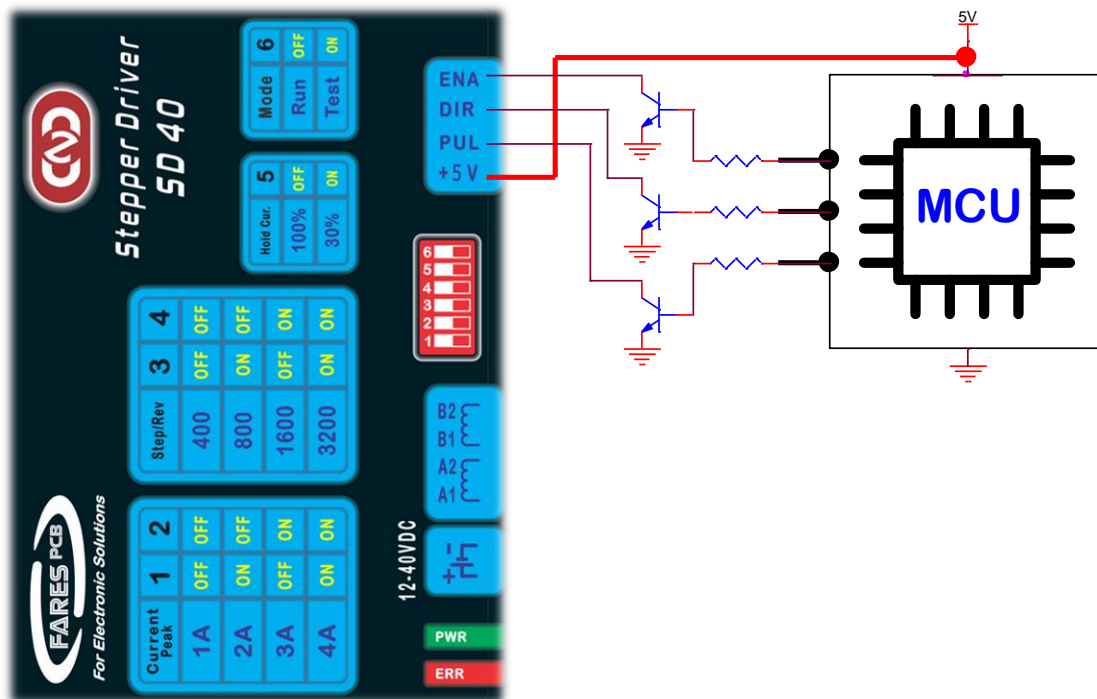


## Interfacing VIVA breakout board to SD40 driver





**Direct microcontroller interfacing to SD40**



**Interfacing microcontroller to SD40 Using transistors**

### Note:

If microcontroller port can sink current of 10mA or more, there's no need for external transistors, Just connect microcontroller port direct to driver.

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