General Description

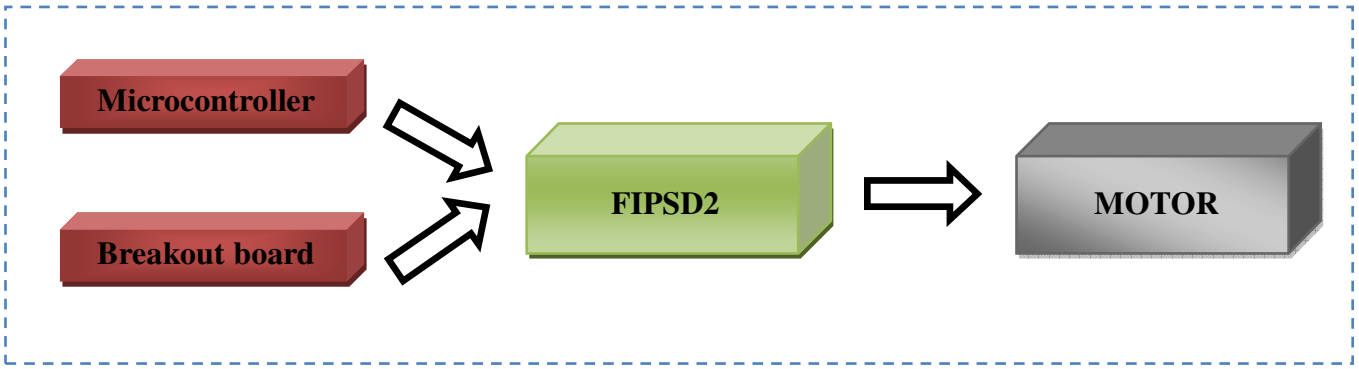
Driving stepper motor is common necessity in most robotic projects. A stepper motor is a brushless, synchronous electric motor that can drive a full rotation into a large number of steps. Stepper motor is ideally suited for precision control. This motor can operate in forward/reverse with controllable 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. For more description of stepper motors refer to Wikipedia at:
http://en.wikipedia.org/wiki/Stepper_motor

FIPSD2 step motor driver is designed to drive bipolar stepper motor. It offers step and direction control with full-step or half-step capability. Phase current could be adjusted up to 2A maximum. Full-step/half-step resolution is also switch selectable.
This driver is compatible with any micro-based control system or any breakout board.

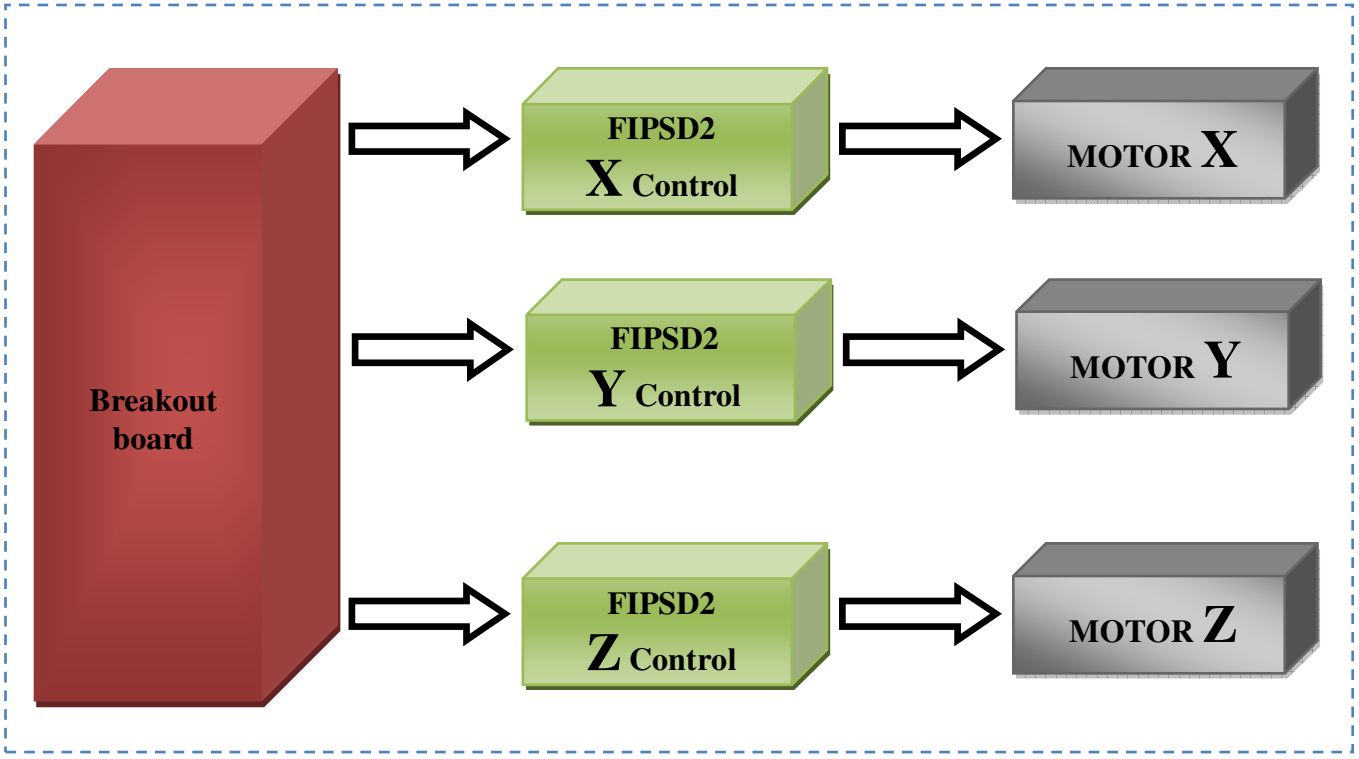
FIPSD2 features

- Speed, direction and half/full step control.
- Up to 2 Ampere adjustable current per phase.
- High efficient control technique (Switch Mode Load Current Regulation).
- All inputs are 5V logic level compatible.
- Power and input signals are brought out via pin header.
- Driver output compatible with 2 or 4 phase, 4, 6 or 8 lead stepper motors, 2A max.
- Suitable for unipolar or bipolar stepper motors.
- 0.5 usec minimum width for CLK input pulse.
- Operating Supply voltage range (12V to 46V), the higher the voltage, the higher and the torque at high speeds.
- 2A fuse for over current protection.
- Two Separated LEDs for Logic circuit and motor power supplies
- Dimension: 45 x 75 x 50 mm.

Figure 1. System Overview



Single motor control system diagram



Three axis motor control system diagram

Figure 2. FIPSD15 schematic view

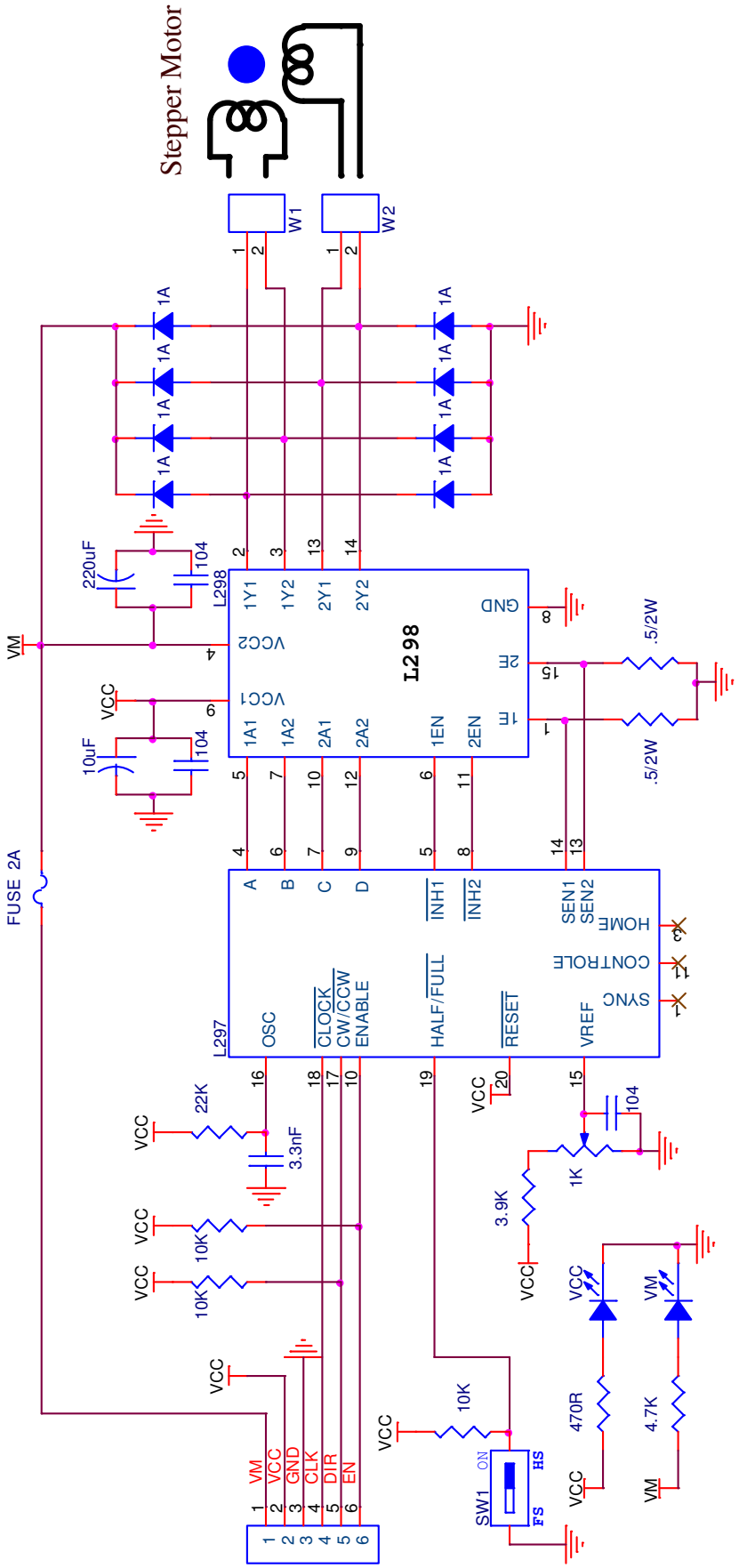


Figure 3. FIPSD15 layout view

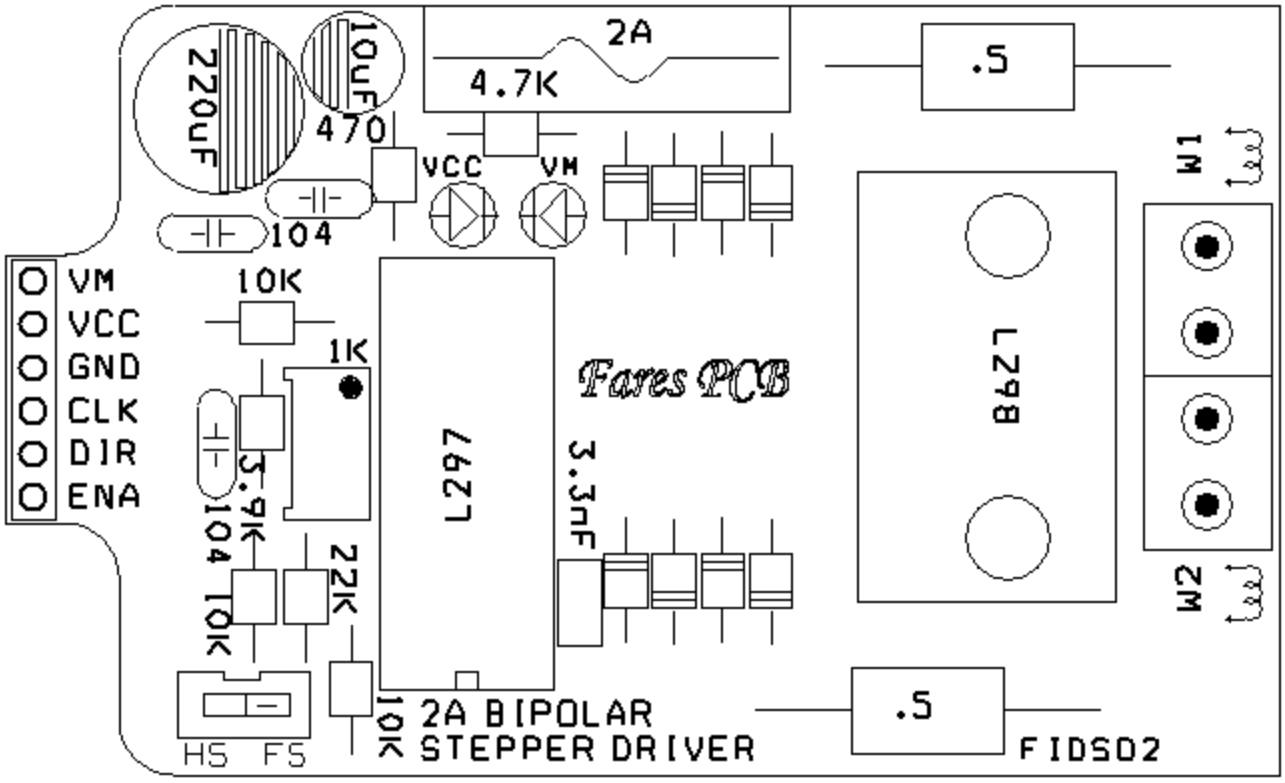
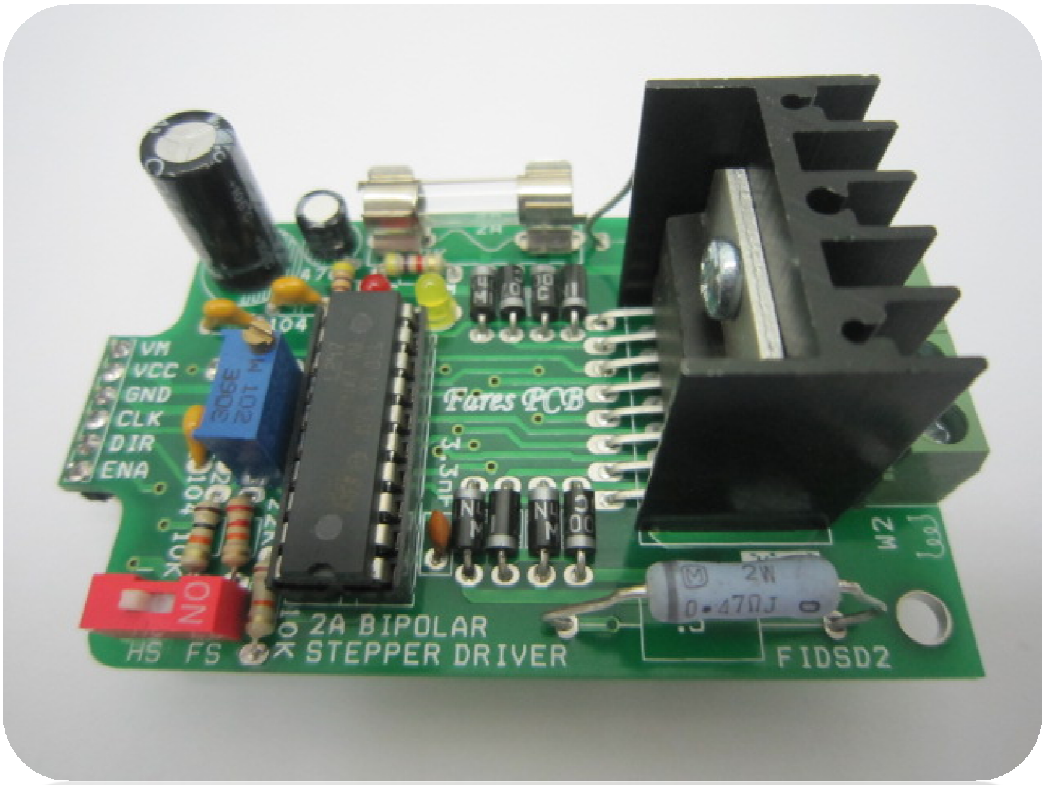


Figure 4. FIPSD15 real PCB view



Signal Input Pins Function Description

Table1. Connector signal definition

Label	Definition	Function
VM	Motor supply voltage	Supply power to motor
VCC	Circuit supply voltage	Supply power to control circuit
GND	System ground	Common ground for both logic control circuit and stepper motor power source.
CLK	Stepping input pulse	Input to drive the stepper motor. This pin is TTL/CMOS logic (5V and 0V). Each pulse (logic change from 1 to 0) will drive the stepper motor one step of half step according to switch setting.
DIR	Stepper driver rotation direction input	Input for stepper motor to rotate CW (clockwise) or CCW (counterclockwise). This pin is TTL/CMOS logic (5V and 0V). The direction is depends on the connection sequence of stepper motor
ENA	Stepper driver enable input	Input pin to enable FIPSD2. This pin is TTL/CMOS logic (5V and 0V). 5V input 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. By default, the driver is enabled.

Wiring diagram

FIPSD2 may drive 4, 6 or 8 lead stepper motors. Some motor wiring provides high torque and some other provides high speed.
Figures1-4 shows many motors types and its connections to obtain high torque and speed.

Figure 5. 4 Leads motor connection

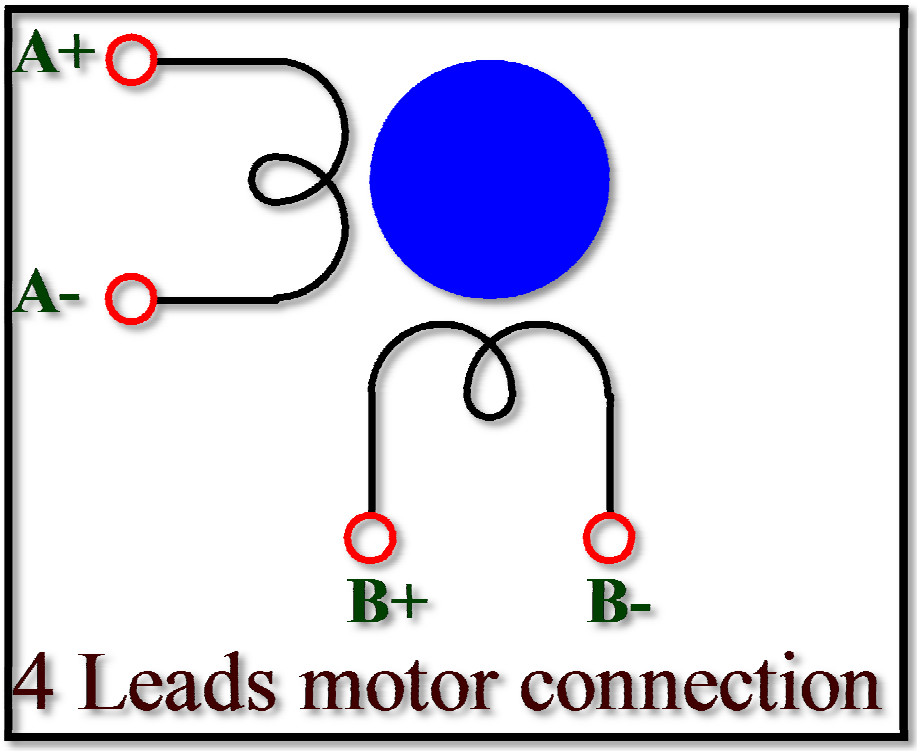


Figure 5. 6 Leads motor (High torque connection)

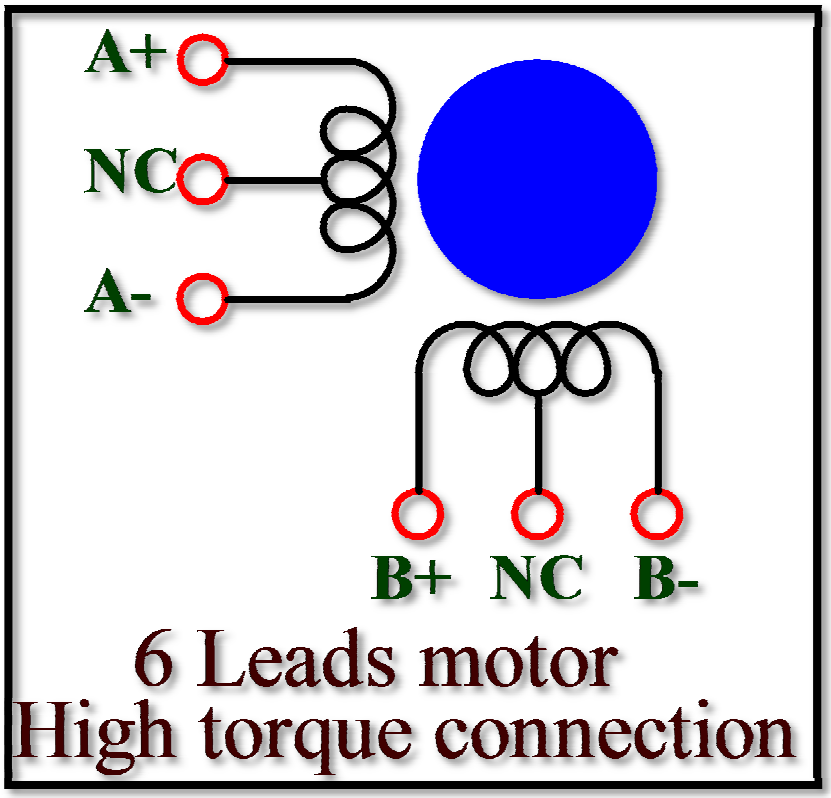


Figure 5. 6 Leads motor (High speed connection)

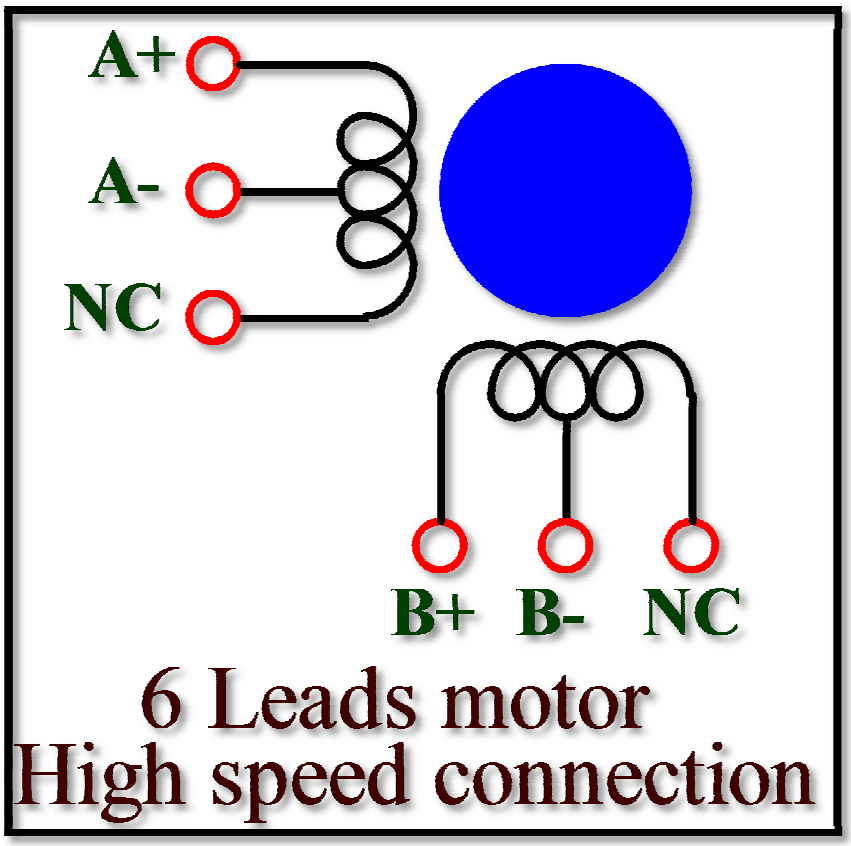


Figure 5. 8 Leads motor (High torque connection)

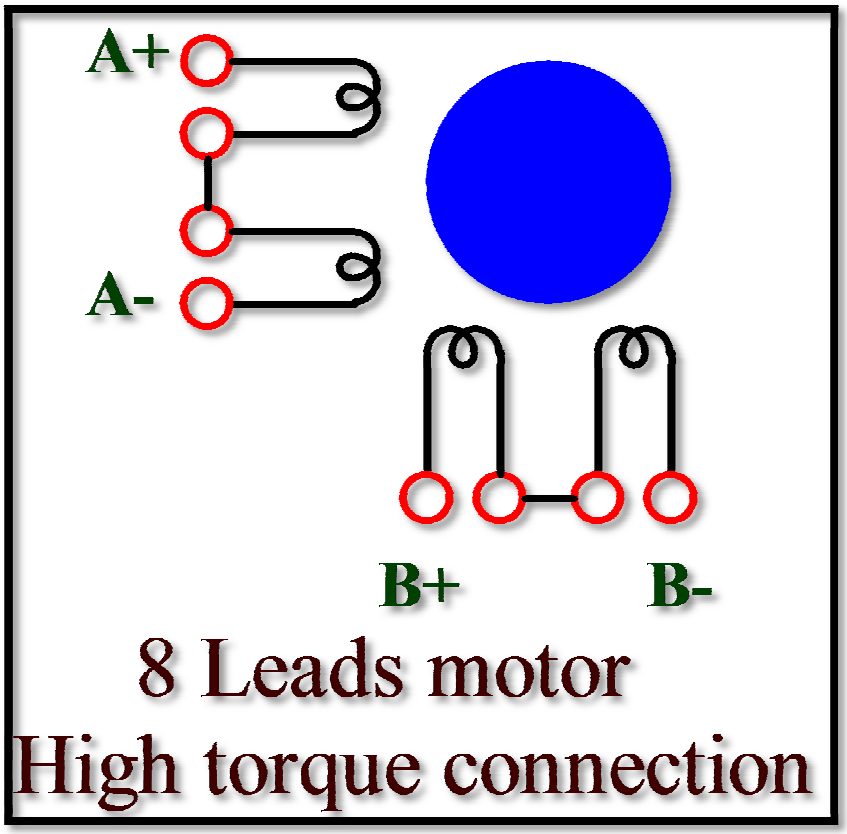
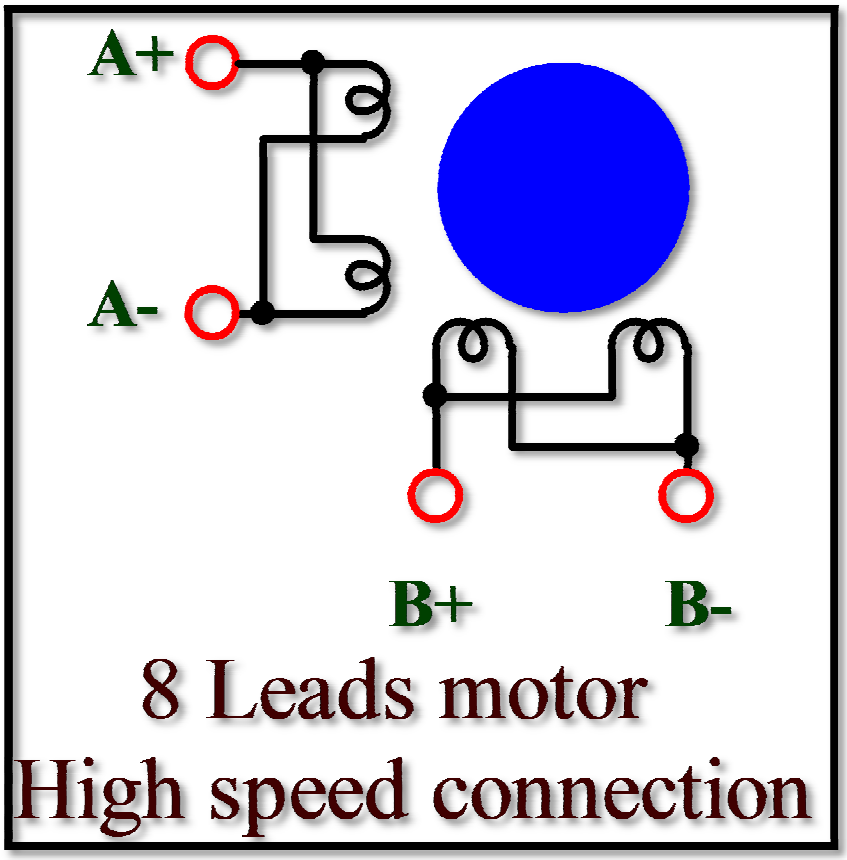


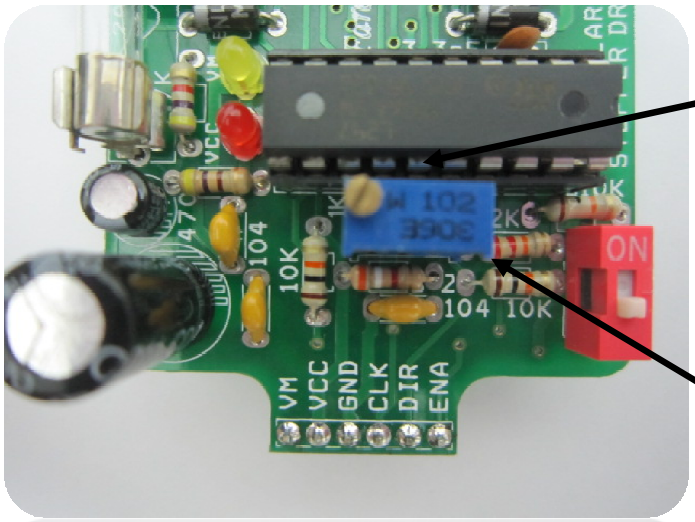
Figure 5. 8 Leads motor (High speed connection)



Phase current Adjustment

Whatever the voltage applied to the motor, the winding current is constant and depends only on the reference voltage and a sensing resistor.
To adjust the maximum motor current per phase set the variable resistor (multi-turn resistor) until the voltage on pin15 of L297 is equal to the required current multiplied by the value of sensing resistor. The next equation is states the relation between the required current per phase and the reference voltage appears on pin15 of L297

Reference Voltage = Current per phase X Sensing resistance

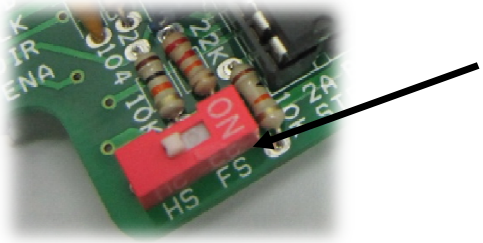


For example:
Suppose a sensing resistor = 0.5R then to set the motor current per phase to be 1A, adjust the variable resistor to set the reference voltage (pin 15 of L297) to

V_{ref} = 0.5 X 1 = 0.5 V

Resolution adjustment

FIPSD2 provides full step or half step resolution. Just set the required resolution by setting DIP switch according to Table 1



Switch setting	Resolution
OFF	Half step
ON	Full step

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