Name: **Dual DC Motor Shield**
Code: **MR007-001.1**

The *Dual DC Motor Shield* is a shield that has been projected to enable an Arduino board to drive two brushed DC motors or one 4-wire two-phase stepper motor, controlling the speed and direction of each one independently.

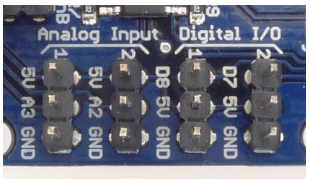

Fig.1 – Digital and Analog ports

Some applications may need to control the motor speed or a servo angular position by a potentiometer; for these reasons in this shield two digital I/O ports and two analog input ports have been added (see Fig.1).

Analog input ports can be used to read potentiometers or any other analogic sensor, while digital I/O ports can be used to drive servos or interface other digital devices.

This shield is based on the L298, a famous integrated circuit producted by STMicroelectronics. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. To prevent board damages, all driver lines are diode protected from back EMF. The maximum supply voltage supported by this board is 46V.

To ensure safely operating condition you can measure the motor current absorption of each motor; this allow to avoid stall conditions. On this shield it has been included an integrated I2C digital temperature sensor to monitor the shield temperature in order to prevent overtemperature threat.

In fact when the L298 chip works at high current values it may become very hot and this heat can flow through all the shield. To avoid dangerous overheating condition you can use the integrated I2C digital temperature sensor mounted close to the L298 chip. This allows the temperature monitoring via the I2C bus using the Arduino pins SCL and SDA. The sensor is the integrated circuit TCN75A and you can refer to its datasheet to better understanding its communication protocol.

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The logic of the *Dual DC Motor Shield* is powered directly from the Arduino board, whereas motor outputs can be powered both from Arduino Vin pin or from external power source, even if it is strongly encouraged to use external power supply.

On this shield the selection of the power source for motor outputs is accomplished by a jumper. Moving the jumper from one side to the other the power source can be changed (see Fig. 2).

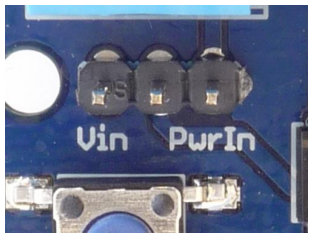

Fig. 2 – Power selection

This board also provides direction LED indicators for both channels and this is very usefull during setup stage to verify the firmware behaviour; the led indicators work also without appling a real motor to the output.

!!! CAUTION !!!
The Driver IC may become very hot when working with current more than 1A.

INSTRUCTIONS

This shield has two separate channels, called A and B. Each channel use 4 Arduino pins to drive and sense the motor. You can use each channel separately to drive two DC motors or combine them to drive one stepper motor.

The shield pins, divided by channel, are shown in the table below:

Channel A		**Channel B**	
Arduino pin	***Function***	***Arduino pin***	***Function***
9	Input 1	2	Input 3
10	Input 2	6	Input 4
3	EnA (PWM)	5	EnB (PWM)
A0	Current sense	A1	Current sense

Tab.1 - Connections

To understand the meaning of these signals and their use you can read the following table (Tab.2), where all conditions are reported. Note that there are reported only the conditions for channel A because those for channel B are just alike them, you only have to replace Input 1 with Input 3, Input 2 with Input 4 and EnA with EnB.

Inputs			**M1+ (M2+) and M1- (M2-) output**
EnA(B)	**Input 1(3)**	**Input 2(4)**	
1	1	1	HIGH state for both output (motor stopped)
1	0	0	LOW state for both uotput (motor stopped)
1	1	0	Current flows from M1+ to M1- (direction 1)
1	0	1	Current floes from M1- to M1+ (direction 2)
0	X	X	High impedance (motor is in free running)

Tab.2 - Conditions

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An important characteristic of the *EnA* and *EnB* signals is that they have pull-down resistors; in this way at power-up event motors will not run out of control.

This *Dual DC Motor Shield* is able to monitor the current absorption of both motors; the current value is converted in a voltage signal proportional to the current with a ratio of 2.4. This means that for each Ampere that flows through a channel, the current sensing signal will output 2.4V. The maximum analog output will be 4.8V at 2A current absorption.

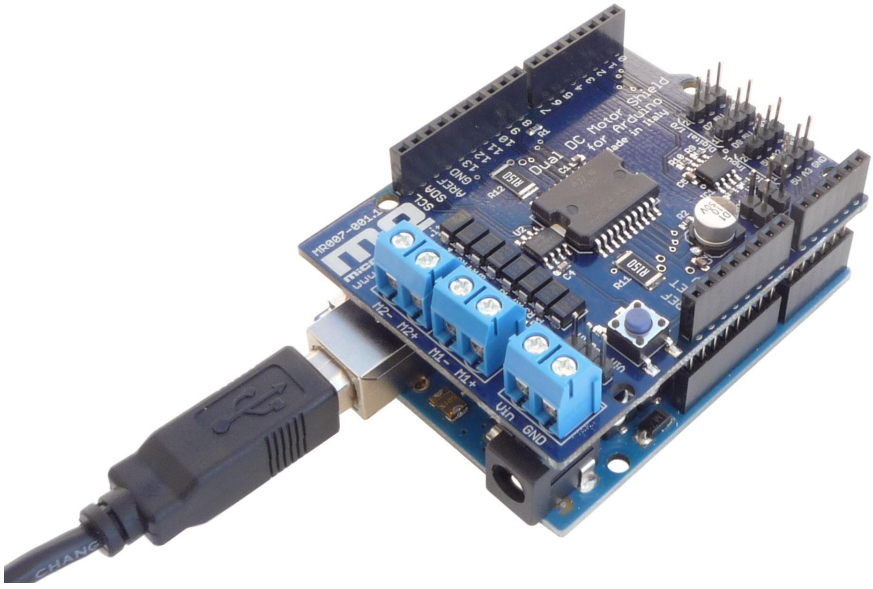
Channel A current can be monitored on Arduino analog pin A0 and Channel B current can be monitored on pin A1.

If you don't need the current sensing and above all if you need more pins for your application you can disable this feature by removing the two jumpers on the SenA and SenB strip connectors (see Fig.3).

Fig.3 - Current sensing jumpers

SPECIFICATIONS

Supply voltage (logic)	5V from Arduino board
Supply current (logic)	25mA(typ.) 37mA(max.)
Supply voltage (for motors)	46Vmax.
Output current	2Amax. per channel
Data I/O voltage	TTL (5V)
Dimensions	2.7" x 2.1" (68 x 53 mm)
Weight	0.92oz / 26g
Operating temperature	–25°C to 125°C
TCN75A slave address	1001000 (binary)
Current sensing	4.8V @ 2A



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