Welcome!

Thank you very much for purchasing our AZ-Delivery 4-channel L293D motor shield for ATmega328p, Mega2560 R3 and Nano V3.0. On the following pages, we will introduce you to how to use and setup this handy device.

Have fun!

The 4-channel L293D motor driver shield is simply plugged onto an microcontroller board and allows up to 4 DC motors, 2 stepper motors or 2 servo motors to be controlled. The powerful and reliable L293D chip that distributes the load serves as an H-bridge. This allows you to easily use DC motors and power supplies up to 36V.

The proven design allows motors to be easily connected and controlled by a microcontroller boardand is particularly suitable for fast prototyping. This shield is also suitable for beginners, there are numerous libraries, instructions and example sketches that make controlling the direction or speed of motors child's play. We especially recommend the Adafruit Motor Shield Library (AFM), which you can download from the Arduino-IDE.

The most important information in a nutshell

» Labeled connections for easy connection
» Compatible with microcontrollers Mega 2560 R3, Diecimila, Duemilanove and ATmega328p » 2 connections for 5V servo motors with connection to the microcontroller timer for smooth control
» For controlling 4 DC motors, 2 stepper motors or 2 servo motors » Up to 4

bidirectional DC motors with individual 8-bit control » Up to 2 stepper motors (unipolar or bipolar) with single coil, double coil or interleaved stepping

» 4 H-bridges: 0.6A (1.2A peaks) with thermal protection for motors from 4.5V to 36V DC

» Pull-down resistors to stop the motors when switched on » 2 connections for external power supply, separate for logic and motor supply

» Status LED for operation indication

» Reset button

» Dimensions:70*55mm

All links at a glance

Programming interfaces

» Arduino-IDE: https://www.arduino.cc/en/Main/Software »
Web-Editor: https://create.arduino.cc/editor

» Extension for SublimeText: https://github.com/Robot-Will/Stino

» Extension "VisualMicro" for Atmel Studio or Microsoft Visual Studio:
http://www.visualmicro.com/page/Arduino-for-Atmel-Studio.aspx

Arduino Tutorials, References, Community

» https://www.arduino.cc/en/Tutorial/HomePage

» https://www.arduino.cc/en/Reference/HomePage

Interesting from AZ-Delivery

» Accessories:

https://www.az-delivery.com/en/collections/weiteres-zubehoer

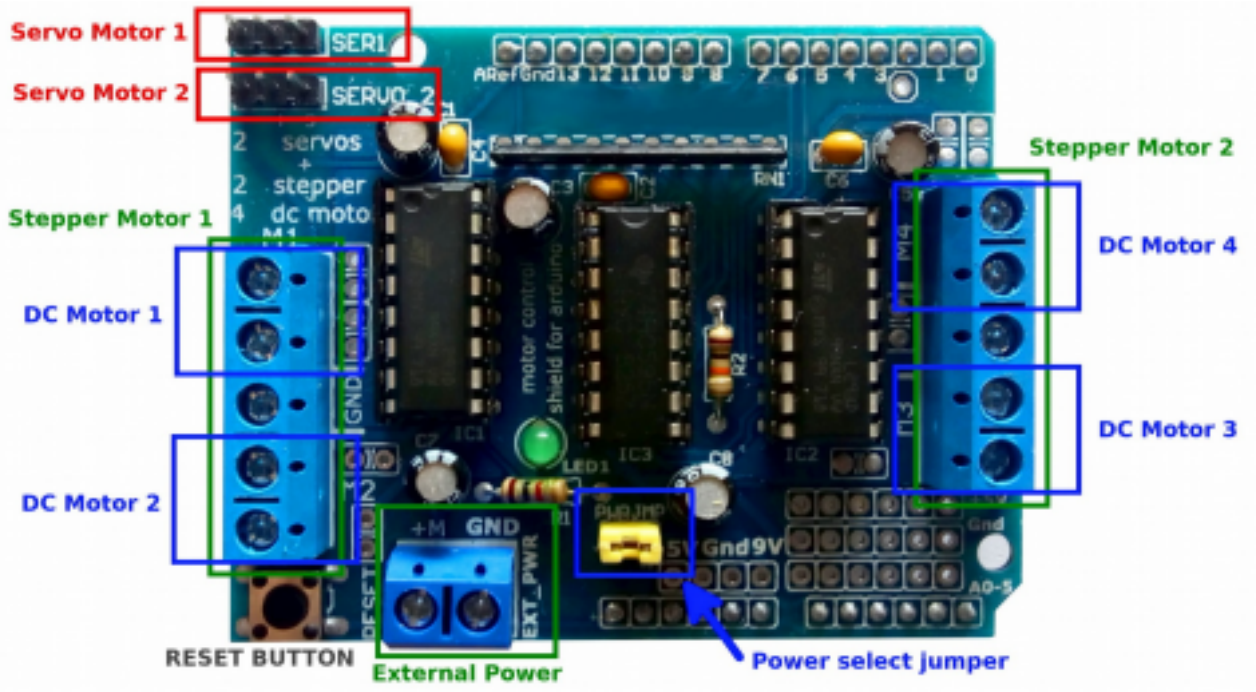
» AZ-Delivery G+Community:

https://plus.google.com/communities/115110265322509467732 » AZ-Delivery on Facebook:

https://www.facebook.com/AZDeliveryShop/

Overview

4 DC motors or 2 stepper motors can be connected, the voltage range is 4.5 - 13.5 V. Additionally there are 2 connections for standard servo motors for 5V.



The shield uses the standard PWM pins of the microcontroller board to control the connected motors and servos. The Shield is compatible with every microcontroller board (e.g. ATmega328p, Nano V3.0, Mega 2560 R3). One microcontroller board can use only Motor Shield at a time.

Used pins of the microcontroller

PIN 11: DC Motor 1 / Stepper motor 1 (Activation / Speed)
PIN 3: DC Motor 2 / Stepper motor 1 (Activation / Speed)
PIN 5: DC Motor 3 / Stepper motor 1 (Activation / Speed)
PIN 6: DC Motor 4 / Stepper motor 1 (Activation / Speed)

PINs **4**, **7**, **8** and **12** are used to control the DC / stepper motors via the 74HC595.

These PINs are only used for the servo motors.
PIN 9: Servo motor 1 control
PIN 10: Servo motor 2 control

The six analog inputs (PINs 14 to 19) and the digital inputs (PIN 2 and 13) are not used.
Selection of motors; hardware
Motor voltage
Most motors require voltages from 6V to 12V. These can
be operated with the microcontroller shield.
Motors with voltages from 1.5V to 3V cannot b operated.

Hardware motor voltage

Most motors require voltages from 6V to 12V. These can be operated with the motor shield. Motors with voltages from 1.5V to 3V can not be used.

Current range

The shield is designed for 0.6 A per motor. The peak value may behe peak value may be up to 1.2 A for a short time. If a large amount of current is required, the ICs used become so hot and must be cooled.

NiMH batteries are the best power supply. An operation on e.g. 9V battery blocks is not recommended. It is best to disconnect the power supply of the motors from the power supply of the microcontroller board(2 power supplies).

Many problems during the operation of a microcontroller system come from disturbances generated by motors on a common power supply. Large fluctuations in power consumption caused by different loads on the motors result in voltage fluctuations that can "confuse" a microcontroller program.

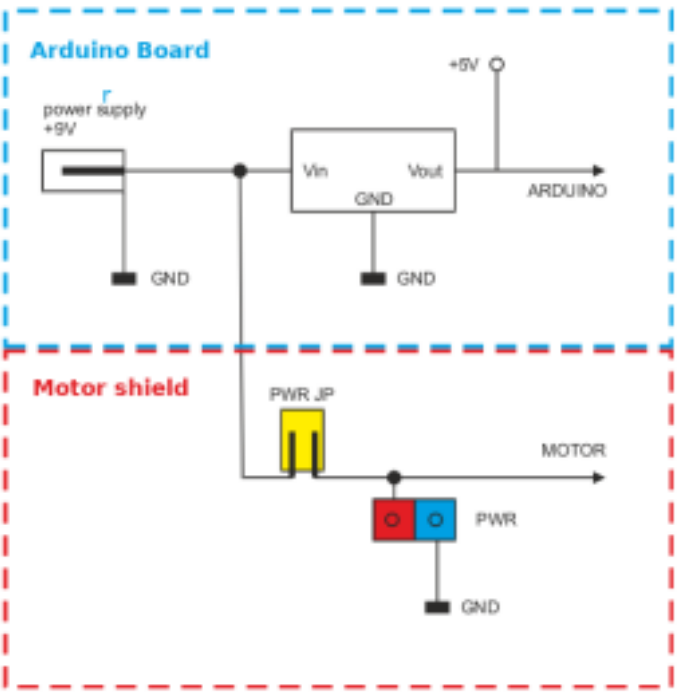
Separation of power supplies can be done by removing Power select jumper, and connecting external power supply on motor shield (image

above). This way, the board has its own power supply, and motor shield has external power supply.

If jumper is not removed, power for motors and driver, will be used from board (microcontroller board and motor shield have the same power supply).

Power supply of motors

DC motors must be supplied with their own power supply, as some of them draw high currents. They must not be connected to the 5V pins of the microcontroller board. This could destroy the microcontroller board or the USB port.



There are two possibilities for connection:

1. The DC plug (power supply) on the board.
   There is a protective diode on the plug. This protects the microcontroller board against incorrect voltage.
2. The 2-pole screw terminal PWR on the Motor Shield.
   There is also a protective circuit on the screw terminal which prevents damage to the motor shield.

Option 1: Same power supply for the Board and Motor Shield (1 battery)

A voltage source 6 - 12V e.g. battery is connected to the plug of the microcontroller board or to the screw terminals of the motor shield.

IMPORTANT: The jumper Power selection jumper must be plugged into the motor shield! This can lead to interference, as the voltage can fluctuate, depending on the current consumption of the motors. This operating mode is only recommended if a strong battery pack is used.

Option 2: Different power supply for the Board and Motor Shield (2 batteries)

The microcontroller board is supplied either via the USB cable or via the power connector. An additional power supply is connected to the screw

terminals of the Motor Shield.

IMPORTANT: The jumper Power selection jumper on the Motor Shield must not be plugged in! This is the recommended method when motors or larger loads are used. Logic voltage and load voltage are decoupled.

Connection for servo motors

The connectors of the microcontroller Shields are designed for small model servos. They are powered directly by the 5V of the microcontroller board. If larger servos are used (more power), then the tracks have to be disconnected from the servo connections to the pin header and cables have to be soldered to the external 5V supply for servo motors.

Model servo motors are very easy to use.

They have a 3-pin female cable. The signals are transmitted as PWM signals, there is a PULS connector on 3-pin cable for this purpose (often designed as orange or white wire). Power is supplied via the microcontroller board. The other two wires of 3-pin cable are for the power supply: Red = Vcc (+5V) and Black or Brown = GND.

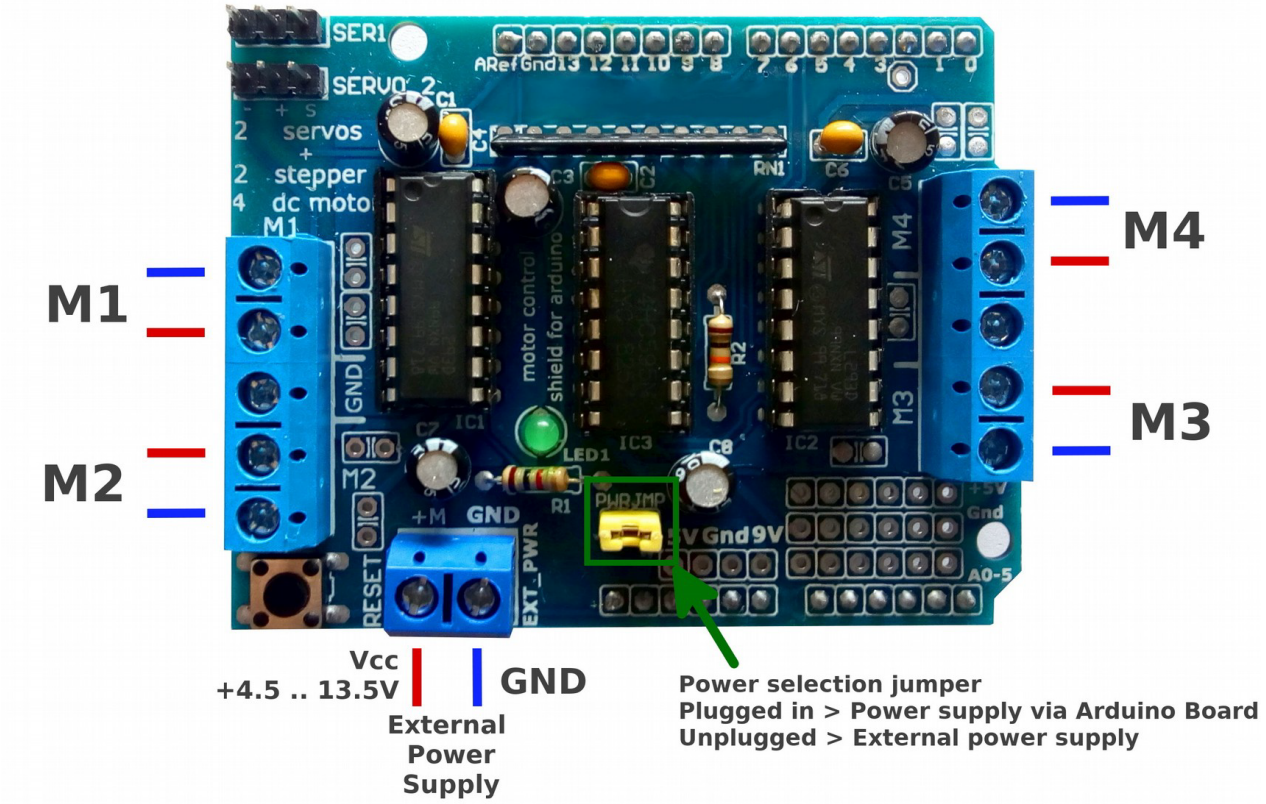
PIN Assignment

Pin 9 PWM Servo 1

Pin 10 PWM Servo 2

Connection of DC motors (2 wire)

4 bidirectional DC motors can be connected: M1, M2, M3, M4. The speed can be changed in steps of 0.5%. The motors can run in both directions depending on the control.



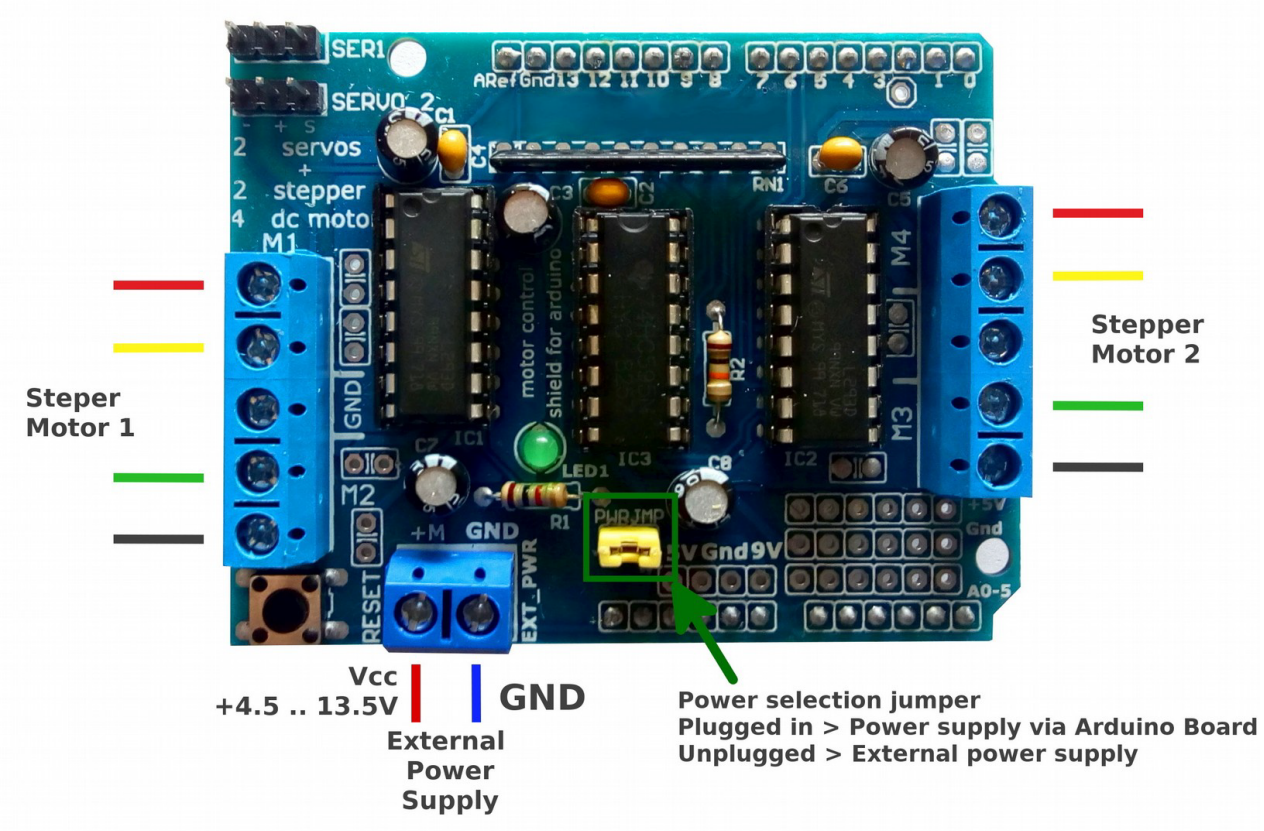
The Motor Shield does not have a heat sink. It is not designed for a constant motor current of 0,6 A. For larger motors or long running times it is recommended to glue a heat sink onto the driver IC.

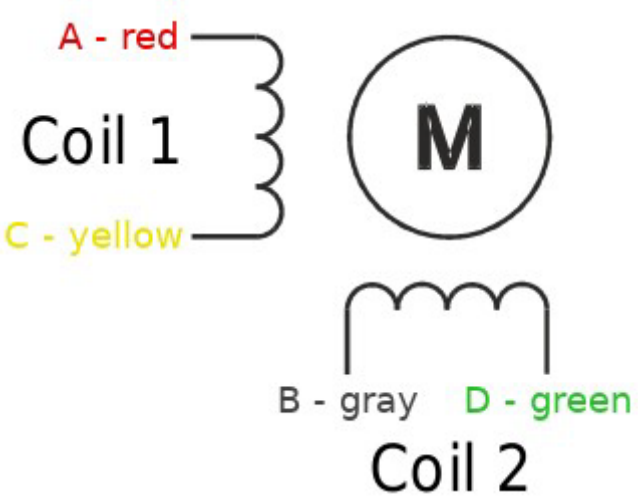
Both wires of the motor are connected to the corresponding terminals.

The direction of rotation can be changed by exchanging the wires. (e.g. all motors should run in the same direction.)

Connection of stepper motors

2 stepper motors can be connected: both uni-polar and bi-polar.



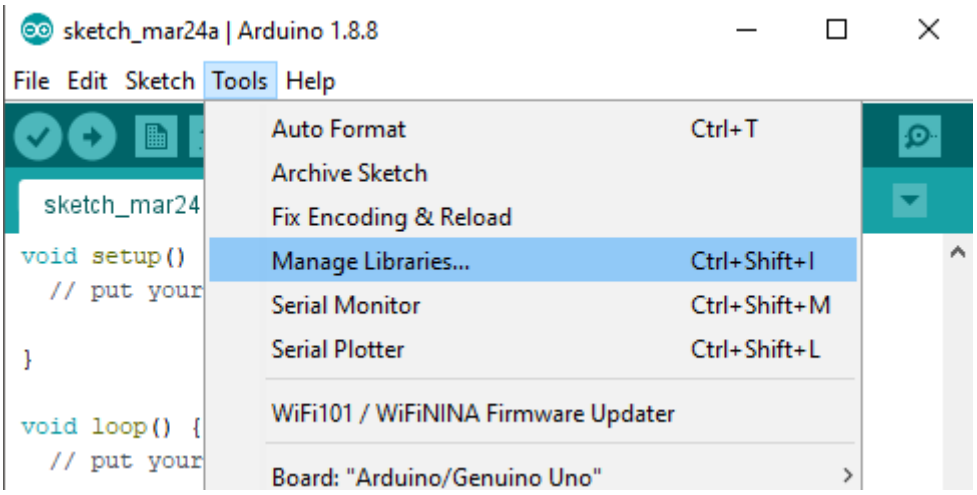


When connecting 2 stepper motors, make sure that the same coils are always connected to one DC Motor connection (the colours used are used just for example, they are different for each stepper motor).

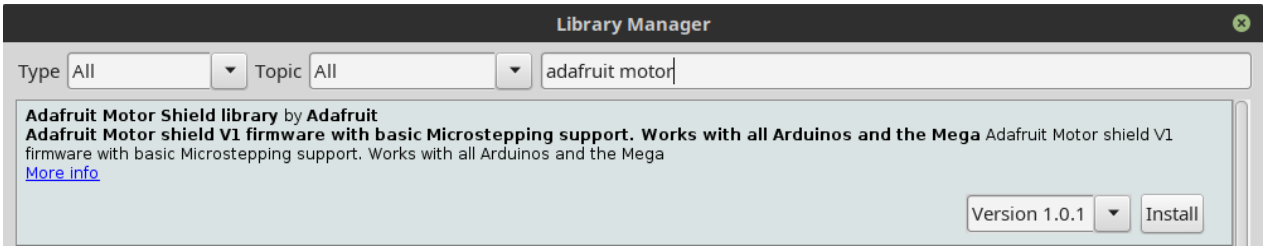
Coil 1 of stepper motor 1 > M1
Coil 2 of stepper motor 1 > M2
Coil 1 of stepper motor 2 > M3
Coil 2 of stepper motor 2 > M4

Loading the library

We recoment the "Adafruit Motorshield v1 library" to be used to program the motor shield. We can download it in Arduino-IDE by going to: *Tools* > *Manage library*



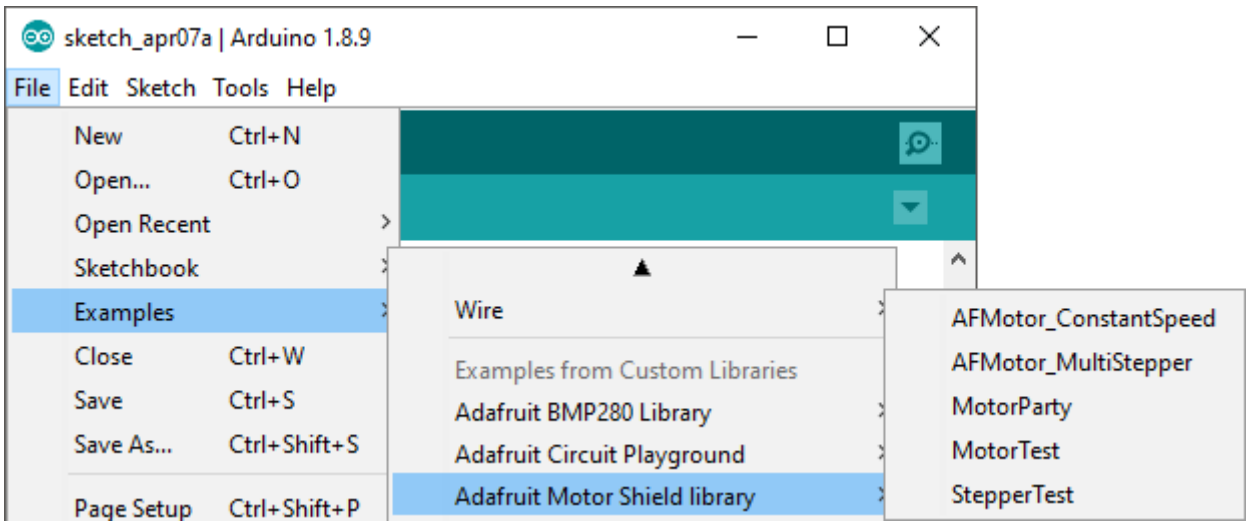
New window will open and in the search box type "*adafruit motor*"



Click on install button and when it is installed "INSTALLED" will be appear near the of library name .

ATTENTION: **Do not load the library for the Motor Shield V2. It is not compatible with the Motor Shield.**

After loading you can have a look at the example sketches.



Example sketch for the control of a servo motor

```
// Adafruit Motor shield library copyright
// Adafruit Industries LLC, 2009
// this code is public domain, enjoy!

#include <AFMotor.h>
#include <Servo.h>
Servo servo1; // DC hobby servo
void setup() {
      Serial.begin(9600); // set up Serial library at 9600 bps Serial.println("Servo Test!");
      servo1.attach(9); // servo switch on
}
int i;
void loop() {
      for(i = 0; i < 255; i++) {
            servo1.write(i);
            delay(3);
      }
      for(i = 255; i != 0; i--) {
            servo1.write(i-255);
            delay(3);
      }
}
```

Functions for the control of a DC motor

```
#include <AFMotor.h>
```

To create the DC motor object:

```
AF_DCMotor motor(number, frequency)
```

This command has 2 arguments:

» number - Motor connection 1,2,3 or 4.

» frequency – Rotation speed control signal

Rotation speed for motors 1 and 2 these frequencies can be selected:

MOTOR12_64KHZ,

MOTOR12_8KHZ,

MOTOR12_2KHZ or

MOTOR12_1KHZ.

And for motors 3 and 4, only 1KHz can be selected.

All other settings are ignored.

Hints: High speeds e.g. 64KHz are not used. The choice of a low speed e.g. 1KHz leads to a lower energy consumption.

To set the speed of the motor, we use:

```
motor.setSpeed(speed)
```

» speed - is integer number which limits are from 0 (motor stop) to 255 (maximum speed).

To move the motor we use:

motor.run(direction)

» direction - can be one of three values:

FORWARD

BACKWARD

RELEASE

The directions "*forwards*" and "*backwards*" are not fixed. They depend on the wiring of the individual motors. They can be changed by simply exchanging the connections.

Example sketch for the control of a DC motor

An object with the name "*motor*" is created. All commands refer to <motor>. The sketch is taken from the examples of the "Adafruit Motor shield library".

```
// Adafruit Motor shield library copyright
// Adafruit Industries LLC, 2009
// this code is public domain, enjoy!
#include <AFMotor.h>
AF_DCMotor motor(2, MOTOR12_64KHZ); // Creating an object of  // <motor> class:
                                                              // port 2, 64KHz pwm
```

```
void setup() {
    Serial.begin(9600);
    Serial.println("Motor test!");
    motor.setSpeed(200); // Speed 200 (maximal 255 possible) }
void loop() {
    Serial.print("tick");
    motor.run(FORWARD); // Motor goes forward
    delay(1000);
    Serial.print("tock");
    motor.run(BACKWARD); // Motor goes backwards delay(1000);
    Serial.print("tack");
    motor.run(RELEASE); // Motor stops
    delay(1000);
}
```

Functions for the control of a stepper motor

```
#include <AFMotor.h>
```

To create the stepper motor object we use:

```
AF_Stepper name(steps, stepper)
```

» name - name of the motor object, e.g. "*motor*" is specified for all other commands.

» steps - resolution of the stepper motor

e.g. 7.5 degree stepper motor has 360/7.5 = 48 steps resolution
e.g. 1.8 degree stepper motor has 360/1.8 = 200 steps resolution » stepper - number for connection of the stepper motor

Connection 1 = Terminals M1 and M2

Connection 2 = Terminals M3 and M4

To set the speed of the motor we use:

```
motor.setSpeed(rpm)
```

» rpm - number of revolutions per minute of the stepper motor

To start the motor we use:

```
motor.step(steps, direction, steptype)
```

» steps - number of steps

» direction - rotation direction of motor, can be one of these values:

FORWARD

BACKWARD

» steptype - type of step:

SINGLE - only one coil is active

DOUBLE - both coils are simultaneously active (higher torque) INTERLEAVE - Switching between SINGLE and DOUBLE to double the resolution, thus halving the speed

MICROSTEP - The coils are controled with a PWM signal. This results in a "*soft*" movement between the individual steps.

Stop the engine

By default, the motor keeps its position active after the step is completed. (high power consumption). If you want the motor to move freely (low power consumption), you must order it separately.

```
motor.release()
```

Program flow

The step commands BLOCK the program flow, they are not executed in the background. Program flow waits until the motor movement is completed. (There is no multitasking!)

Example sketch for the control of a stepper motor

An object with the name "*motor*" is created. All commands refer to <motor>. The sketch is taken from the examples of the "Adafruit Motor shield library".

```
// Adafruit Motor shield library copyright
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// this code is public domain, enjoy!
#include <AFMotor.h>
  AF_Stepper motor(48, 2); // 48 Steps / revolution, port 2, M3+M4 // Object name: motor
```

```
void setup() {
      Serial.begin(9600); // Serial Interface with 9600 bps
      Serial.println("Stepper test!");
      motor.setSpeed(10); // 10 revolutions / Minute motor.step(100, FORWARD, SINGLE); // 100
      Steps, forward, single motor.release(); // Motor releaced, low energy consumption
      delay(1000); // wait 1000ms = 1s
}
void loop() {
      // 100 steps each in different modes
      motor.step(100, FORWARD, SINGLE);
      motor.step(100, BACKWARD, SINGLE);
      motor.step(100, FORWARD, DOUBLE);
      motor.step(100, BACKWARD, DOUBLE);
      motor.step(100, FORWARD, INTERLEAVE);
      motor.step(100, BACKWARD, INTERLEAVE);
      motor.step(100, FORWARD, MICROSTEP);
      motor.step(100, BACKWARD, MICROSTEP);
                                                  }
```

You've done it, you can now use your module for your projects.

Now it is time to learn and make the Projects on your own. You can do that with the help of many example scripts and other tutorials, which you can find on the internet.

If you are looking for the high quality microelectronics and accessories, AZ-Delivery Vertriebs GmbH is the right company to get them from. You will be provided with numerous application examples, full installation guides, eBooks, libraries and assistance from our technical experts.

https://az-delivery.de

Have Fun!

Impressum

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