

Coding the Arduino

Software

- Computers do exactly what you tell them, no more, no less
- Arduino uses the C programming language
- You can go a long ways with just a few instructions
- See the Arduino Guide (2011 web site)

On the Arduino

Programming cable

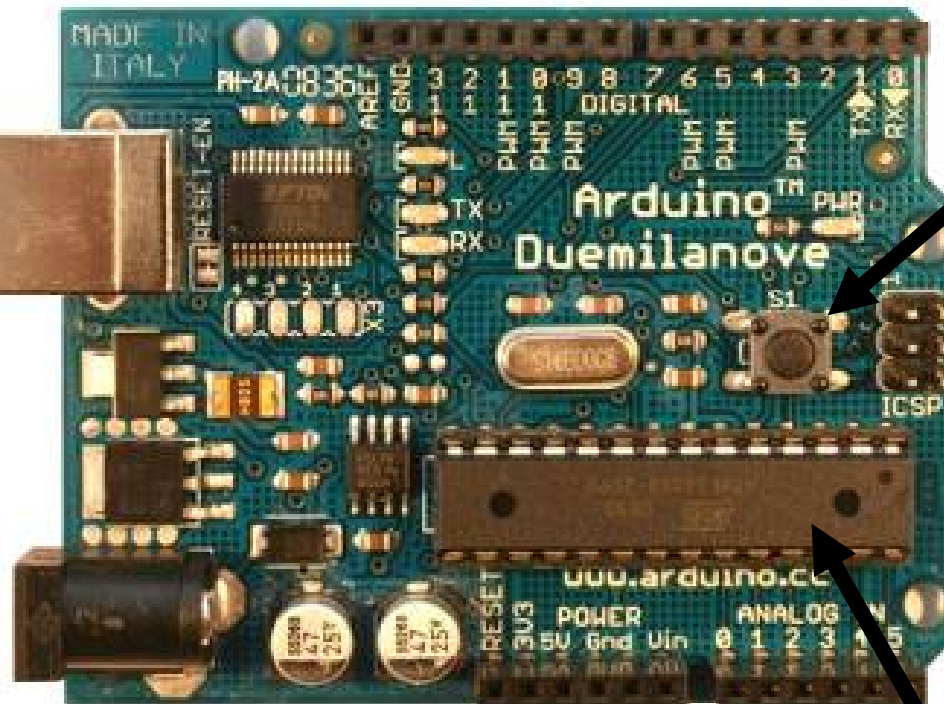
I/O pins

Reset

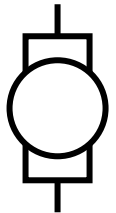
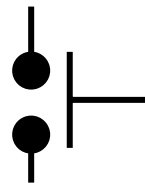
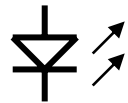
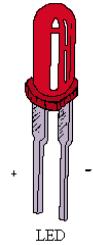
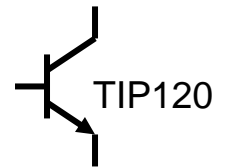
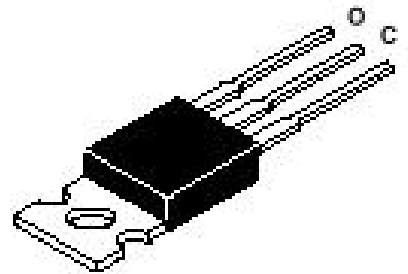
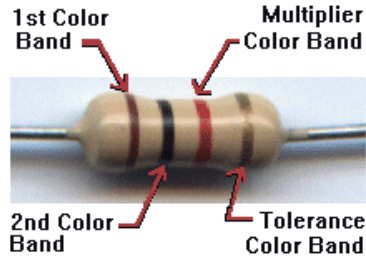
9V or 12V battery

Power pins

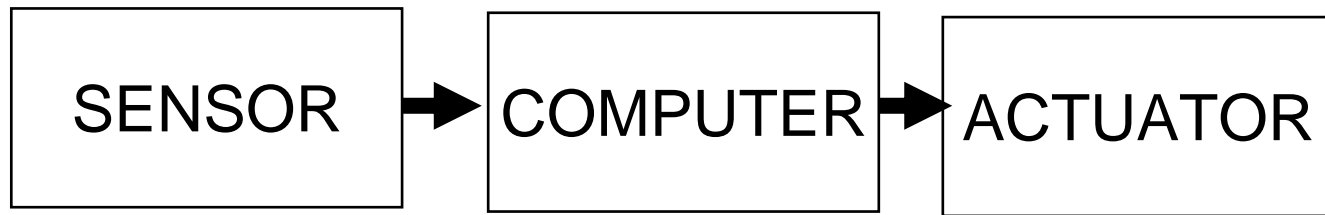
Brain



Schematic Icons



Dealing With the Outside World



Switch
Light beam
Potentiometer
Encoder
Temperature
...

Lamp
Relay
Motor
Solenoid
...

I/O Commands

`DigitalWrite(n,HIGH);` set pin *n* to +5 V

`DigitalWrite(n,LOW);` set pin *n* to 0 V

`DigitalRead(n);` read state of pin *n*

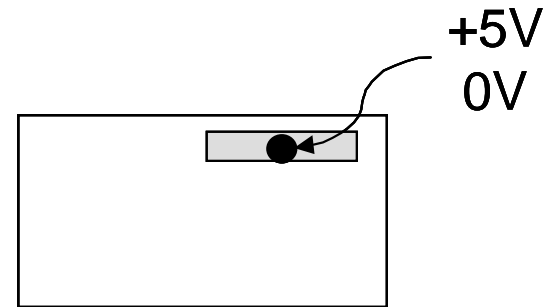
Driving Outputs

Program sets pin
high/low (1/0)

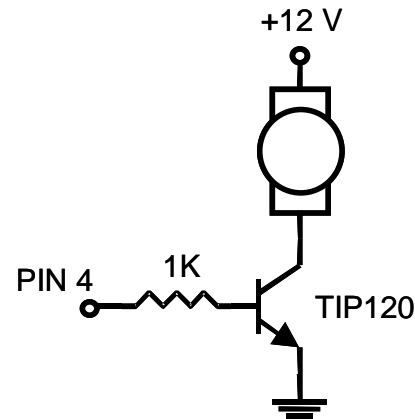
```
digitalWrite(4,HIGH);  
digitalWrite(4,LOW);
```



Board pin
set to +5V/0V



Interface
electronics use
signal voltages and
power supply to
switch motor
on/off



Reading Sensors

Program reads
value of pins (1/0)

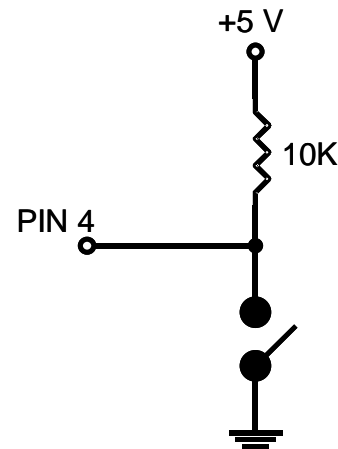
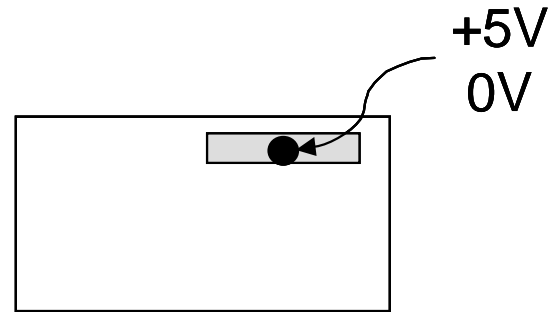


Board pins
set to +5V/0V



Interface
electronics change
sensor signals into
+5V/0V

```
digitalRead(4);
```



Program Structure

```
void setup()  
{  
    // commands to initialize go here  
}  
void loop()  
{  
    // commands to run your machine go here  
}
```

Anatomy of a Program

```
/*-----  
Blinking LED, 1.0 Hz on pin 2  
-----*/
```

```
void setup()
```

```
{
```

```
  pinMode(2,OUTPUT);  
  digitalWrite(2,HIGH);  
  delay(500);  
  digitalWrite(2,LOW);
```

```
}
```

```
void loop()
```

```
{  
  
}
```

```
// one-time actions
```

```
// define pin 2 as an output  
// pin 2 high (LED on)  
// wait 500 ms  
// pin 2 low (LED off)
```

```
// loop forever
```

Digital Numbers

A bit is one binary digit: 0/1

A byte is 8 bits



00000011 (binary) = 3 (decimal)

11111111 = 255

<u>Type</u>	<u>#bits</u>	<u>Number range</u>
bit	1	0-1
byte	8	0-255
word	16	0-65,535

Arduino Data Variables

Declare at top of program

byte i; *0 to 255*

word k; *0 to 65,536*

int length; *-32,768 to 32,767*

int width;

Use byte variables unless expecting
large numbers

Symbols

```
#define LED 2 // define the LED pin
void setup()
{
  pinMode(LED OUTPUT);
}
void loop()
{
  digitalWrite(LED, HIGH);
  delay(500);
  digitalWrite(LED, LOW);
  delay(500);
}
```

Setting Pin Direction

```
void setup()  
{  
    pinMode(2, OUTPUT);  
    pinMode(3, INPUT);  
}  
void loop() {}
```

Printing to the Terminal

```
void setup()  
{  
  Serial.begin(9600);  
  Serial.println("Hello World");  
}  
void loop() {}
```

Debugging an Input

```
void setup()  
{  
  Serial.begin(9600);  
}  
void loop()  
{  
  Serial.println(digitalRead(2));  
  delay(100);  
}
```


Want More?

- “Arduino Microcontroller Guide”
- Language Reference section of Arduino site