Using RoboPi

RoboPi User Manual v0.85

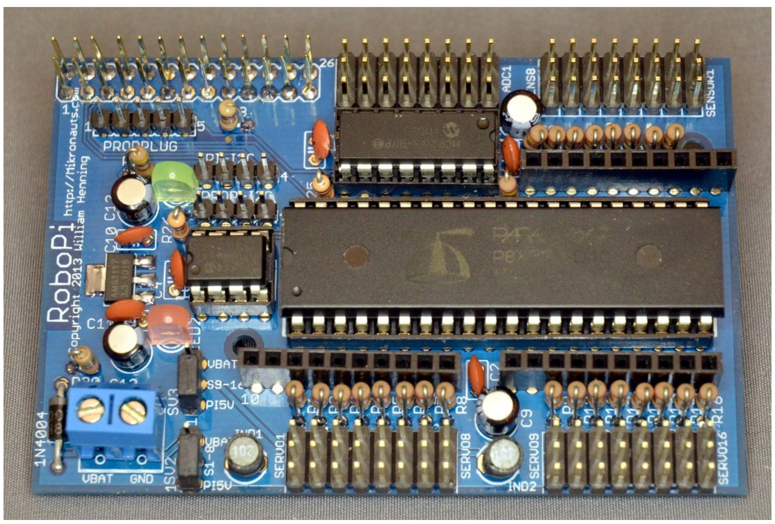


Photo 1: Fully assembled RoboPi v1.00

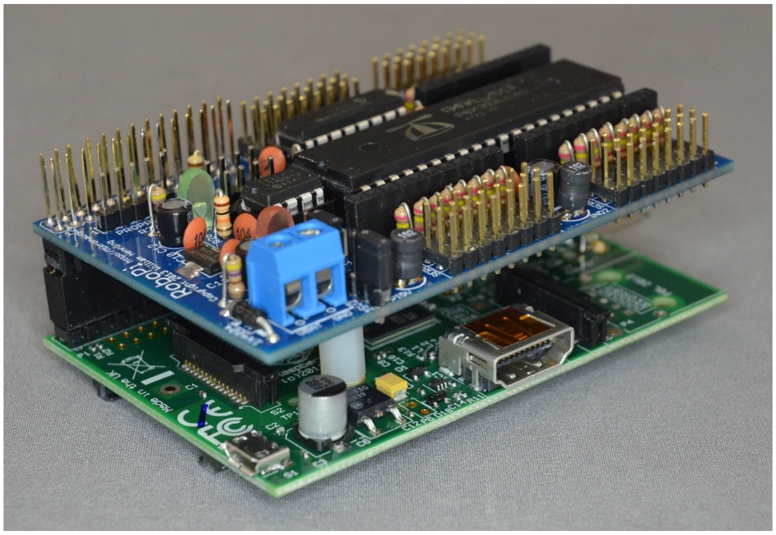
The most up to date documentation will always be available at:

http://www.mikronauts.com/raspberry-pi/robopi/

Table of Contents

Introduction

RoboPi is the most advanced robot controller add-on board for the Raspberry Pi available at this time. RoboPi adds an eight-core 32-bit microcontroller running at 100Mhz to the Raspberry Pi in order to off-load hard real time I/O and allow more precise timing than Linux running on the Pi allows.



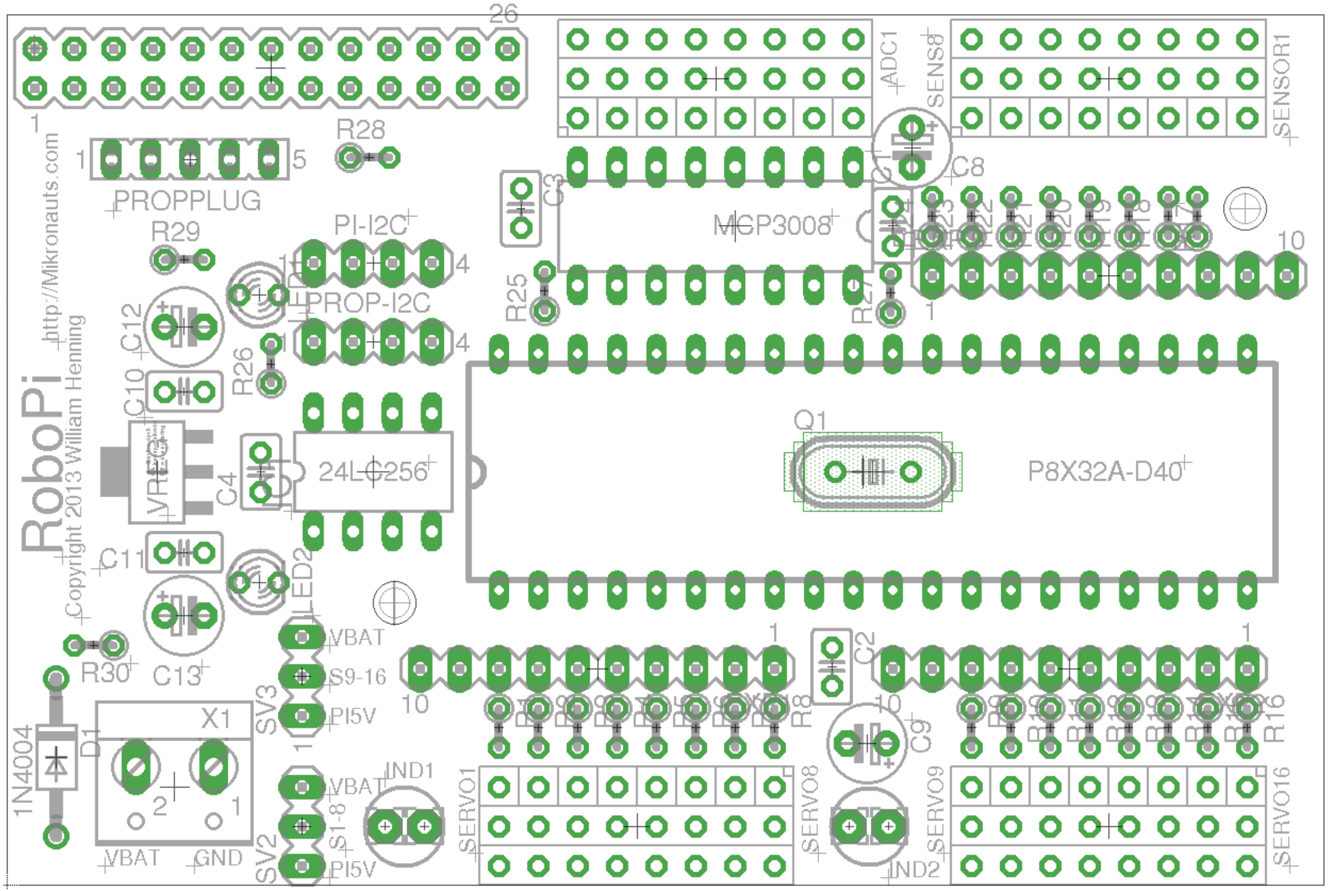
RoboPi stacked on top of a Model A Raspberry Pi

RoboPi can also be stacked on top of Model B Raspberry Pi's

RoboPi Features

- Parallax Propeller P8X32 eight core 32 bit Risc microcontroller running at 100Mhz
- Each of the eight cores provides up to 25MIPS as most instructions take only 4 clock cycles
- three ten-pin Mikronauts I/O module expansion connectors (P0-P7, P8-P15, P16-P23)
- 24 servo compatible headers on P0..P23
  - P0-P7 jumper selectable power from Pi's 5VDC supply or external servo power supply
  - P8-P15 jumper selectable power from Pi's 5VDC supply or external servo power supply
  - P16-P23 is powered by 5V from the Pi expansion header for sensors
- Screw terminal for providing external power for Servo connectors P0-P15
- 8 servo compatible headers for an eight channel 0-5V analog to digital converter with choice of
  - MCP3008 for 10 bit A/D conversion
  - MCP3208 for 12 bit A/D conversion
- Choice of 256Kbit or 512Kbit boot EEPROM for the Propeller
- On-board voltage regulation providing 3.3V with power on LED from the 5V on the Pi header
- 4 pin I2C expansion header for the Raspberry Pi
- 4 pin I2C expansion header for the Propeller
- 5 pin HCOM connector for use with PropPlug in stand alone operation (optional)
- Mikronauts EZasPi prototyping board can stack below RoboPi
- Mikronauts Pi Jumper can stack on top of RoboPi
- Mikronauts SchoolBoard][and other Propeller products are compatible with RoboPi

RoboPi Printed Circuit Board



Here is a top view of where parts are located on the RoboPi printed circuit board:

You can refer to this image while wiring your robot after assembling your RoboPi.

PLEASE NOTE

The “**PROPPLUG**” connection is for stand-alone RoboPi operation (where RoboPi is NOT stacked on top of a Raspberry Pi. Pins 1-4 are the same as PropPlug (Pin 1 is GND), Pin 5 adds 3.3V for SerPlug.

Plugging in a PropPlug while RoboPi is stacked on the Raspberry Pi may damage your Raspberry Pi, PropPlug and/or RoboPi.

RoboPi I/O Pin Definitions

Before you can write programs for your RoboPi based robot, you have to learn what resources are available for you to connect to sensors, motors and other devices or boards.

P0-P7: SERVO 1 – SERVO 8

- 10 pin EXP1 connector connected directly to processor pins, 3v3 I/O only
- connects to signal pin on SERVO1-8 through a 2k4 current limiting resistor, 5V I/O safe
- For the servo header, SV2 selects between the Pi's 5V and VBat from the screw terminal

P8-P15: SERVO 9 – SERVO 16

- 10 pin EXP2 connector connected directly to processor pins, 3v3 I/O only
- connects to signal pin on SERVO9-16 through a 2k4 current limiting resistor, 5V I/O safe
- For the servo header, SV3 selects between the Pi's 5V and VBat from the screw terminal

P16-P23: SENSOR 1 – SENSOR 8

- 10 pin EXP3 connector connected directly to processor pins, 3v3 I/O only
- connects to signal pin on SENSOR1-8 through a 2k4 current limiting resistor, 5V I/O safe
- the Pi's 5V is used for SENSOR1-8 to provide cleaner power to Ping's etc

P24-P27: SPI port for MCP3008/MCP3208

- P24 is MISO, connected to DO on ADC through a 2k4 current limiting resistor
- P25 is MOSI
- P26 is CLK
- P27 is /CS

ADC1-ADC8: 0-5V Analog inputs

- connects to the signal pin on ADC1-8 servo style header
- the Pi's 5V is used for ADC1-8 to provide cleaner power to Ping's etc

RoboPi Expansion Connectors

Raspberry Pi I/O header pins

- RoboPi requires exclusive use of RX/TX
- RoboPi makes the Raspberry Pi I2C available on a Mikronauts four-pin 3v3 I2C header
- **All other Raspberry Pi I/O pins are available for your use**
- Mikronauts **EZasPi** was designed to stack between RoboPi and Raspberry Pi for expansion
- Mikronauts **EZasPi (B)** was designed to stack below the Raspberry Pi for more expansion

EXP1/EXP2/EXP3 3v3 Expansion Connectors

- EXP1 is for Propeller pins P0-P7, and servo connectors 1-8
- EXP2 is for Propeller pins P8-P15, and servo connectors 9-16
- EXP3 is for Propeller pins P16-P23, and sensor connectors 1-8
- Mikronauts 3v3 10 pin modules can be used in EXP1/EXP2/EXP3
- You must not use the 3 pin servo connectors for pins used by a 10 pin module

PI-I2C Header

- For using 3v3 I2C expansion modules with RoboPi

PROP-I2C Header

- For using 3v3 I2C expansion modules with the Raspberry Pi

PROPPLUG Header

- For programming RoboPi when it is not mounted on a Raspberry Pi
- Intended for stand-alone RoboPi applications
- **DO NOT USE WHEN MOUNTED ON A RASPBERRY PI**

Using RoboPi with the Raspberry Pi

Downloading & Installing Raspbian (Debian for the Pi)

If you already have Raspbian running on your Raspberry Pi, you can skip to Step 4

Installing Raspbian on your Raspberry Pi is required before you can use and control RoboPi with your Raspberry Pi. The Raspberry Pi Foundation has made this easy, by providing downloadable images of the Raspbian operating system, with instructions for using PC's, Mac's and Linux computers to make a bootable Raspbian SD card.

Step 1: Get a compatible Class 10 speed SD card, 8GB – 32GB in size.

You can find a database of SD cards that are known to work with the Raspberry Pi at:

http://elinux.org/RPi_SD_cards

Other SD cards are likely to work as well, I suggest Class 10 for speed.

Step 2: Download the latest Raspbian image

You can find the latest version of Raspbian at:

http://www.raspberrypi.org/downloads/

Step 3: Install Raspbian

The Raspberry Pi foundation provides excellent instructions on how to make a bootable Raspbian SD card for your Raspberry Pi with your PC/Mac/Linux computer at:

http://www.raspberrypi.org/documentation/installation/installing-images/README.md

Step 4: Using the Raspberry Pi serial port with RoboPi

The Raspberry Pi has 3.3V serial RX and TX signals available on its 26 pin header.
Normally this port is configured to display boot messages, after which it becomes a serial console.

My favorite small text editor is 'joe', which you can install with

sudo apt-get install joe

then

sudo joe /boot/cmdline.txt

remove “console=ttyAMA0, 115200 kgdboc=ttyAMA0, 115200”

sudo joe /etc/inittab

Find the line

T0:23:respawn:/sbin/getty -L ttyAMA0 115200 vt100

and insert a '#' in front of T0:23

For the changes to take effect, type

sudo shutdown now -r

Step 5: Installing RoboPiLib

Download the latest version of ***RoboPiLib.zip*** from the RoboPi product page at:

http://www.mikronauts.com/raspberry-pi/robopi/

Step 6: Installing the RoboPi Firmware

Download the latest version of ***RoboPiObj.zip*** from the RoboPi product page at:

http://www.mikronauts.com/raspberry-pi/robopi/

You will also need to download the latest version of ***propeller_load.zip*** from the product page.

Step 7: Installing SimpleIDE for the Raspberry Pi (OPTIONAL)

You only need to install SimpleIde if you want to write your own custom Propeller software for RoboPi on your Raspberry Pi, and do not wish to use the RoboPi firmware and RoboPiLib.

Only advanced users should attempt to program RoboPi from the "bare metal"

Here is how you can install the Propeller SimpleIDE development environment:

Introducing RoboPiLib

RoboPiLib is a library designed to interface the Raspberry Pi with the RoboPi firmware.

RoboPiLib was designed to make it easy to write programs on the Raspberry Pi that use all of the firmware features of RoboPi, and was designed to be familiar to those coming to RoboPi from WiringPi, Arduino or Wiring environments.

RoboPiLib is available for both Python and C, and the native Spin object uses the same API as RoboPiLib.

The Python interface that is almost identical to the C interface – all you have to do is prefix the library function names as follows:

Python Examples:

```
import RoboPiLib as RoboPi

# connect to RoboPi
RoboPi.RoboPiInit("/dev/ttyAMA0",115200)

# set pin 16 to an output and write 1 to it
RoboPi.pinMode(16,RoboPi.OUTPUT)
RoboPi.digitalWrite(16,1)

# set pin 17 to a PWM output and generate a 50% PWM on pin 17
RoboPi.pinMode(17,RoboPi.PWM)
RoboPi.analogWrite(17,127)

# read analog input 0
print RoboPi.analogRead(0)
```

Python RoboLib Constants

Digital pins can be configured for one of the following four modes:

INPUT	pin mode for a digital input
OUTPUT	pin mode for a digital output
PWM	pin mode for a PWM output (0..255)
SERVO	pin mode for a servo output (0..2500)

Python RoboPiLib Functions

RoboPiInit(device, bps)		use RoboPiInit("/dev/ttyAMA0",115200)
RoboPiExit()		close the serial connection with RoboPi
readMode(pin)	returns int	returns INPUT/OUTPUT/SERVO/PWM
pinMode(pin, mode)		set pin to one of INPUT/OUTPUT/SERVO/PWM
digitalRead(pin)	returns int	returns 0 or 1 state of pin
digitalWrite(pin, val)		sets pin to 0 or 1
analogRead(chan)	returns int	returns 0..1023 from specified channel
analogReadRaw(pin)	returns int	returns 0..4095 from specified channel
analogWrite(pin, val)		write 0..255 to PWM pin (off to full on)
servoRead(pin)	returns int	return last servo value written to pin
servoWrite(pin, val)		set servo on pin to val (0..2500 us)
readDistance(int pin)	returns int	return distance to nearest object in milimeters

In your program, include the following at the top:

import RoboPiLib as RoboPi

See the example on the previous page to see how to use the Python interface.

C RoboPiLib Constants

Digital pins can be configured for one of the following four modes:

INPUT	pin mode for a digital input
OUTPUT	pin mode for a digital output
PWM	pin mode for a PWM output (0..255)
SERVO	pin mode for a servo output (0..2500)

C RoboPiLib Functions

void	RoboPiInit(char *device, int bps)	use RoboPiInit("/dev/ttyAMA0",115200)
void	RoboPiExit()	close the serial connection with RoboPi
int	readMode(int pin)	returns INPUT/OUTPUT/SERVO/PWM
void	pinMode(int pin, int mode)	set pin to one of INPUT/OUTPUT/SERVO/PWM
int	digitalRead(int pin)	returns 0 or 1 state of pin
void	digitalWrite(int pin, int val)	sets pin to 0 or 1
int	analogRead(int chan)	returns 0..1023 from specified channel
int	analogReadRaw(int pin)	returns 0..4095 from specified channel
void	analogWrite(int pin, int val)	write 0..255 to PWM pin (off to full on)
int	servoRead(int pin)	return last servo value written to pin
void	servoWrite(int pin, int val)	set servo on pin to val (0..2500 us)
int	readDistance(int pin)	return distance to nearest object in milimeters

getPacket/putPacket for advanced users only - requires modifying RoboPi firmare

int	putPacket(char c, char *bf, int ln)	send a custom packet to RoboPi
int	getPacket(char *c, char *bf, int *ln)	receive response to custom packet sent to RoboPi

In your program, include "RoboPiLib.h", and add RoboPiLib.o to your command line as follows:
gcc -o myprog myprog.c RoboPiLib.o

Using RoboPi without a Raspberry Pi (stand alone operation)

Installing SimpleIDE on PC/Mac/Linux for stand-alone RoboPi use

Parallax has written an excellent guide for installing SimpleIDE at:

http://learn.parallax.com/propeller-c-set-simpleide

Introducing RoboPiObj

If you want to run RoboPi stand-alone (without a Raspberry Pi) you can still take advantage of the RoboPI API natively.

RoboPiObj.spin is the top-level Spin object for implementing the functionality that is exposed by the firmware; and as such, it can be used directly from Spin programs running on RoboPi's Propeller micrcocontroller.

Please note – this is only recommended for those that want to get to the "bare metal", as it means that your robot will be controlled by RoboPi's propeller – and not by a Raspberry Pi or external computer.

You can ofcourse implement your own protocol, and even ignore RoboPiObj, by writing from the ground up – but I think you will find that RoboPiObj takes care of the low level details for you, and lets you concentrate on your application.

RoboPiObj Constants

INPUT	pin mode for a digital input
OUTPUT	pin mode for a digital output
PWM	pin mode for a PWM output (0..255)
SERVO	pin mode for a servo output (0..2500)

RoboPiObj Methods

start	Initialize RoboPiObj, start service cogs
pinMode(pin, mode)	set digital pin to specified mode
readMode(pin)	read current mode of digital pin
digitalRead(pin)	read current value (0 or 1) at pin, regardless of mode
digitalWrite(pin)	write 0 or 1 to digital pin
analogRead(chan)	read analog input channel, scale to 0..1023 return value
analogReadRaw(chan)	read analog input channel, return raw 0..4095 value
analogWrite (pin, value)	write PWM value to pin, 0 is off, 255 is fully on
servoWrite(pin, value)	write servo position to pin , 0 to 2500 microseconds
servoRead(pin, value)	return last servo position written to pin
readDistance(int pin)	return distance to nearest object in milimeters
delay(ms)	delay for ms milliseconds
delayMicroseconds(us)	delay for us microseconds

RoboPiObj Resource Utilization

RoboPiObj currently uses 4944 bytes of EEPROM/RAM and two cogs for drivers,

ADC_INPUT_DRIVER	MCP3208 driver object
PWM_32_v4	PWM/Servo driver object

How to use Digital Inputs

Reading Bumper Switches

Probably the simplest digital input possible is a switch.

<insert schematic of two bumper switches, 100k pullup to 5v, shorts to ground when closed>

```
#include <stdio.h>
#include “RoboPiLib.h”

#define  LEFT_BUMPER     22
#define  RIGHT_BUMPER  23

#define  PRESSED  0

int main(int argc, char *argv[]) {

        RoboPiInit(“/dev/ttyAMA0”,115200);

        pinMode(LEFT_BUMPER,    INPUT);
        pinMode(RIGHT_BUMPER, INPUT);

        while (1) {

                if (digitalRead(LEFT_BUMPER)==PRESSED)
                        puts(“Left Bumper Pressed”);
                if (digitalRead(RIGHT_BUMPER)==PRESSED)
                        puts(“Right Bumper Pressed”);

                sleep(1); // only check once per second

        }

}
```

How to use Digital Outputs

The simplest way of demonstrating a digital output is to use it to light an LED.

Using LED's to show which bumper is pressed

<insert schematic of two LED's connected to EXP pins through 470R resistors>

```
#include <stdio.h>
#include "RoboPiLib.h"

#define  LEFT_BUMPER    22
#define  RIGHT_BUMPER  23

#define  LEFT_LED     8
#define  RIGHT_LED  9

#define  PRESSED  0

int main(int argc, char *argv[]) {

        RoboPiInit("/dev/ttyAMA0",115200);

        pinMode(LEFT_BUMPER,    INPUT);
        pinMode(RIGHT_BUMPER, INPUT);

        pinMode(LEFT_LED,   OUTPUT);
        pinMode(RIGHT_LED, OUTPUT);

        while (1) {

                digitalWrite(LEFT_LED, ~digitalRead(LEFT_BUMPER));

                digitalWrite(RIGHT_LED, ~digitalRead(RIGHT_BUMPER));

        }

}
```

How to use Analog Inputs

Reading a Potentiometer

Probably the simplest analog input possible is a potentiometer.

<insert schematic of potentiometer as voltage divider going to analog input>

```
#include <stdio.h>
#include “RoboPiLib.h”

#define  POT    0


int main(int argc, char *argv[]) {

        RoboPiInit(“/dev/ttyAMA0”,115200);

        while (1) {

                printf(“Potentiometer value is %d\n”, analogRead(POT));
                sleep(1); // only check once per second

        }

}
```

Reading a CdS Photocell (light sensor)

<insert schematic of CdS circuit>

Connect a 10K pullup to the signal pin of an analog input to +5V, also connect one side of the CdS to the signal pin. Connect the other leg of the CdS to GND.

Use analogRead(ch) to read SirMorph sensors, and you will get a value between 0..1023 representing the amount of light detected by the CdS sensor.

Reading SirMorph (short range distance / line sensor)

SirMorph provides a standard 3-pin Sig/+/GND interface that can be plugged directly into any of the eight analog inputs on RoboPi.

Use analogRead(ch) to read SirMorph sensors, and you will get a value between 0..1023 representing the amount of light reflected into the photo transistor.

How to use Servos

```
#include <stdio.h>
#include "RoboPiLib.h"

#define  LEFT_SERVO       0
#define  RIGHT_SERVO      1

#define  SERVO_MIN        500
#define  SERVO_MAX        2500
#define  SERVO_REV        (SERVO_MIN+SERVO_MAX)

int main(int argc, char *argv[]) {

    int i;

    RoboPiInit("/dev/ttyAMA0",115200);

    pinMode(LEFT_SERVO,  SERVO);
    pinMode(RIGHT_SERVO, SERVO);

    while (1) {

      for(i=SERVO_MIN;i<=SERVO_MAX;i+=100) {

        servoWrite(LEFT_SERVO, i);
        servoWrite(RIGHT_SERVO, SERVO_REV-i);

        printf("LEFT  SERVO = %d\n", servoRead(LEFT_SERVO));
        printf("RIGHT SERVO = %d\n", servoRead(RIGHT_SERVO));
        sleep(1);

      }
    }
}
```

Controlling a Continuous Rotation Servo

If you are using continous rotation servos, the above code will cause the two servos run in one direction, then the opposite direction, at varying speed.

Controlling a Standard Servo

If you are using standard servos, the above code will turn the servos as far as possible in one direction, then the other direction.

How to use PWM to control Gear Motors

Standard motor drivers normally are controlled by two or three digital signals per motor.

EN/A/B Three Wire Driver

The popular L293D and L298 motor drivers are often configured for EN/A/B three wire control.

For three wire drivers, use **digitalWrite()** to set the two direction pins, then use **analogWrite()** to control the motor speed using pulse width modulation. Please note that the minimum speed will be different for different motors.

Some driver boards permanently tie EN high in order to use only two pins, however I do not recommend this practice as it is harder on both the motors and batteries (more later).

EN	Function
0	Disable the motor driver, motor coasts
1	Enable the motor, motor turns in direction specified by A or B

Note:

Some motors have an active low input, in which case 0 enables the motor, and 1 coasts.
Check the data sheet for your motor controller (or motor controller chip) for details.

A B	Function
0 0	Break
0 1	Rotate in one direction
1 0	Rotate in opposite direction
1 1	Break

A/B Two Wire interface

For two wire drivers, use **digitalWrite()** to set the direction you are **NOT** going in to 0, then use **analogWrite()** to control the motor speed using pulse width modulation for the direction you want the motor to turn. Please note that the minimum speed will likely be higher for two wire motors, and different for different motors.

The inexpensive low current L9110S h-bridge is one example of a two wire A/B interface, however many L293D and L298 boards tie EN high to effectively become two pin drivers.

A B	Function
0 0	Break
0 1	Rotate in one direction
1 0	Rotate in opposite direction
1 1	Break

EN/DIR/PWM Three Wire Driver

Some motor drivers will have an EN signal, but use extra logic to to use one pin as motor direction, and another as a PWM input to control the motor speed.

For these drivers, use **digitalWrite()** to set the enable and direction pins, then use **analogWrite()** to control the motor speed using pulse width modulation. Please note that the minimum speed will be different for different motors.

DIR/PWM Two Wire Driver

Other motor drivers use extra logic to to use one pin as motor direction, and another as a PWM input to control the motor speed.

For these drivers, use **digitalWrite()** to set direction pin, then use **analogWrite()** to control the motor speed using pulse width modulation. Please note that the minimum speed will be different for different motors.

Why the ENABLE signal of three wire drivers is useful

Most motor drivers will actively break the motor if the A and B inputs are at the same level.

When PWM speed control is used, both inputs are guaranteed to be driven low during the “off” period of the PWM signal – which will short the two motor leads, actively breaking.

This is less than ideal for the motor, as it will get short spurts of power, then break, repeatedly.

The practical effect of this is that low speed motor control will not be linear, and the motor will sound like it is grinding.

Two pin motor driver sample code

```
#include <stdio.h>
#include "RoboPiLib.h"

#define MOTORA_IA     12
#define MOTORA_IB     13
#define MOTORB_IA     14
#define MOTORB_IB     15

int main(int argc, char *argv[]) {
  int i;

  RoboPiInit("/dev/ttyAMA0",115200);

  while(1) {
    // set both motors FORWARD
    pinMode(MOTORA_IA,PWM);
    pinMode(MOTORA_IB,OUTPUT);
    digitalWrite(MOTORA_IB,0);

    pinMode(MOTORB_IA,PWM);
    pinMode(MOTORB_IB,OUTPUT);
    digitalWrite(MOTORB_IB,0);

    for(i=0;i<256;i+=16) {
      analogWrite(MOTORA_IA, i);
      analogWrite(MOTORB_IA, i);
      sleep(1);
    }
```

```
    for(i=255;i>0;i-=16) {
      analogWrite(MOTORA_IA, i);
      analogWrite(MOTORB_IA, i);
      sleep(1);
    }

    // set both motors REVERSE
    pinMode(MOTORA_IA,OUTPUT);
    digitalWrite(MOTORA_IA,0);
    pinMode(MOTORA_IB,PWM);

    pinMode(MOTORB_IA,OUTPUT);
    digitalWrite(MOTORB_IA,0);
    pinMode(MOTORB_IB,PWM);

    for(i=0;i<256;i+=16) {
      analogWrite(MOTORA_IB, i);
      analogWrite(MOTORB_IB, i);
      sleep(1);
    }
    for(i=255;i>0;i-=16) {
      analogWrite(MOTORA_IB, i);
      analogWrite(MOTORB_IB, i);
      sleep(1);
    }
  }
}
```

How to Read Analog Distance Sensors

The Sharp GP2Y0A02YK0F is an excellent infrared distance sensor that uses a 5V supply and typically draws only 33mA and can present a new reading every 50ms.

You can find the data sheet at:

http://www.sharpsma.com/webfm_send/1487

It has a very useful range of 20cm to 150cm, and is extremely easy to use. There are other sensors in the same family covering 10cm-80cm, and even 100cm-500cm – but neither are as useful as the 20cm-150cm GP2Y0A02YK0F.

Please note that the analog output of the sensor is unreliable at ranges shorter than 15cm

Unfortunately the output voltage is not linear with respect to the distance to the object, however it is easy to construct a table of voltages corresponding to the distance to object in 10cm increments.

Finer distance measurement can be approximated by using linear interpolation as the line segments between the 10cm data points can be reasonably approximated by straigt line segments.

Dist = analogRead(IR_Channel)

As analogRead returns 0 for 0V and 1023 for 5V, we can scale its output to 1/100th of a volt by

Dist = (500 * Dist)/1024

Giving us Dist as 0 for 0V, and 500 for 5V

Of course, you could do the reading & scaling in one step:

Dist = (500 * analogRead(IR_Channel))/1024

Please see page 5 of the data sheet for the graph of voltage vs. distance.

How to Read Digital Ultrasonic Range Sensors

The RoboPi firmware implements preliminary support ultrasonic range sensors.

All supported ultrasonic distance sensors will use a generic interface

RoboPiLib:

int readDistance(int ch)

RoboPiObj:

readDistance(ch) will return the distance to the nearest object in millimeters.

Supported Ultrasonic Sensors:

HC-SR04	tested, working
PARALLAX_PING	not tested, should function
SEEDSTUDIO_136B	not tested

How to connect your ultrasonic range sensor:

HC-SR04 pin	**RoboPi Pin** **(use any of 24 servo three pin headers)**
Vcc	Servo header red wire (any of 24 servo three pin headers)
Trig	**10 pin female header corresponding to selected pin**
Echo	Servo header white wire
GND	Servo header black wire

Ping pin	**RoboPi Pin** **(use any of 24 servo three pin headers)**
5V	Servo header red wire
SIG	Servo header white wire
GND	Servo header black wire

Seeedstudio 136B pin	**RoboPi Pin** **(use any of 24 servo three pin headers)**
5V	Servo header red wire
SIG	Servo header white wire
GND	Servo header black wire

Stand-Alone Operation Requirements

Supply 5V to RoboPi via one of:

- pins 2 & 4 of the 2x13 pin Pi Header
- "Pi5V" terminal of power selection header SV2 or SV3

Supply GND to RoboPi via one of:

- pins 9 & 14 of the Pi Header
- GND terminal of the external motor power screw terminal

If you will never mount your RoboPi on a Raspbery Pi, you could mount a two pin screw terminal on pins 2 (5V) & 6 (GND) for supplying 5V.

Use a PropPlug to program your stand-alone RoboPi.

Appendix A: Software

- Raspbian Wheezy or later
- SimpleIDE 0.8.4 or later
- propeller-load3 or later
- RoboPi API v1.0 or later
- RoboPiLib v1.0 or later

Appendix B: Data Sheets

http://www.parallax.com/sites/default/files/downloads/P8X32A-Propeller-Datasheet-v1.4.0_0.pdf
http://www.parallax.com/sites/default/files/downloads/P8X32A-Web-PropellerManual-v1.2.pdf

http://ww1.microchip.com/downloads/en/DeviceDoc/21298c.pdf
http://ww1.microchip.com/downloads/en/DeviceDoc/21754M.pdf

You can find the data sheets for the listed Digikey part numbers at Digikey.com by typing in the part number and clicking on the pdf icon on the resulting page.

Appendix C: Support

For Raspberry Pi support, including Raspbian, please see the Raspberry Pi forums at:

http://www.raspberrypi.org/forum/

For Parallax Propeller support, see the Parallax forum at:

http://forums.parallax.com/forumdisplay.php/65-Propeller-1-Multicore-Microcontroller

For RoboPi support, please visit the RoboPi thread in the Propeller forum at:

http://forums.parallax.com/showthread.php/153275-Propeller-add-on-for-Raspberry-Pi-RoboPi..-the-most-advanced-robot-controller-for-Pi

or the new Mikronauts forums:

http://forums.mikronauts.com

Appendix D: RoboProp Software Compatibility:

- use the supplied 6.250Mhz crystal for 100Mhz operation
- use 24LC512 EEPROM
- use MCP3208

While there is no motor driver on RoboPi, if you connect a two channel motor controller as follows it will be RoboProp compatible:

- Tie EN1-2 and EN3-4 high
- P8 to IN1
- P9 to IN2
- P10 to IN3
- P11 to IN4

If you want to have a uSD card compatible with RoboProp, attach it as follows:

- P12 to MISO
- P13 to MOSI
- P14 to CLK
- *P15 to /CS*

Appendix E: Frequently Asked Questions

Q: Where can we buy RoboPi?

A: Currently you can buy RoboPi:

Directly from us – please email us at ***mikronauts@gmail.com*** *with desired quantity and postal address, we will be happy to send you a quote. We accept PayPal from verified buyers.*

From our Ebay store – please visit us at out Mikronauts Ebay store!

<add actual URL>

Distributors and dealers are welcome to contact us for quantity discounts – we would love to have you on-board!

Q: Are quantity and educational discounts available for RoboPi?

A: Yes! We are happy to offer quantity based discounts to our educational users and distributors. Please contact us for a custom quote.

Q: Can we make our own RoboPi printed circuit boards?

A: I am afraid not. While RoboPi is an open platform in that it is fully documented, with source code available for its libraries and demo applications, RoboPi is a commercial product, and may not be copied.

Q: Can we use the less expensive MCP3008 10 bit analog to digical converter instead of the MCP3208?

A: Yes, you can – but the driver needs to be modified, and the RoboPi libraries and demonstration programs assume that an MCP3208 is used. We intend to offer a merged MCP3208/MCP3008 driver soon which will allow a common code base.

Q: Do you have any distributors in <name of country>?

A: We are working hard to set up our distribution network. Please email your favorite web stores and have them contact us if they are interested in RoboPi.