BarCampMilwaukee3 Robot Kit

Your kit contains the parts needed to create a fully operational robot that can optically follow a line on the ground. Experienced robot builders will be on hand to assist you in assembling your kit. Basic assembly and soldering will be covered and you will have a chance to try out your robot when it is complete.

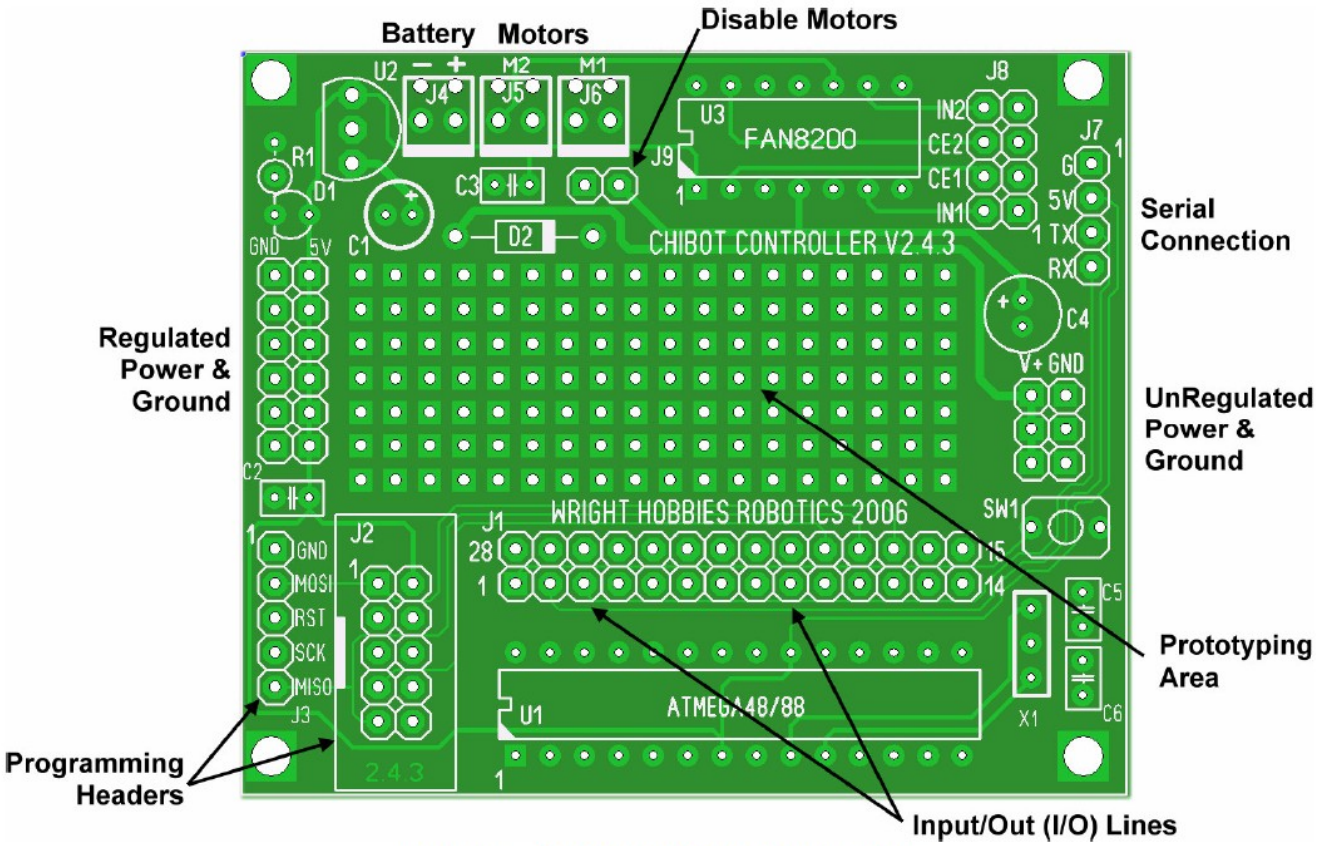
Your kit includes:

- Tamiya Double Gearbox
- Tamiya Truck Tire Set
- Tamiya Universal Plate Set
- Chibot Robotic Controller
- Battery Pack
- Line Following Module
- Programming Cable Kit
- Mounting Hardware
- Solid Hookup wire
- Stranded wire

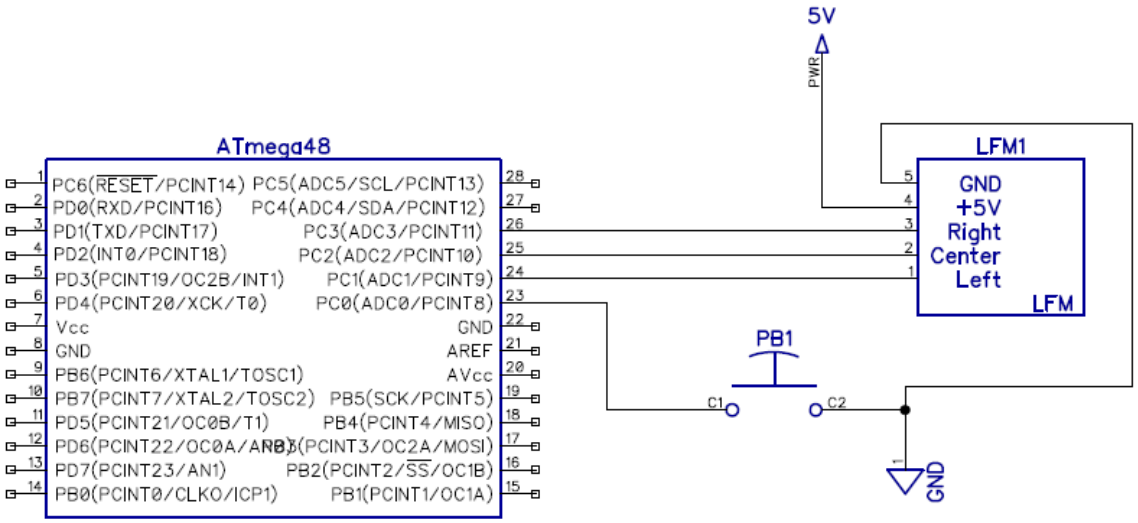
Your robot can be programmed using a free version of Bascom Basic Compiler for AVR microcontrollers. Please visit http://www.wrighthobbies.net/download to download the latest version of the software.

The BCM3Bot has a brain called the Chibot Controller. This circuit board contains most of the electronics needed to make your robot work plus extra capacity so you can expand it in the future. The Chibot Controller has a small computer on a chip called a microcontroller. This chip is programmable and can control external devices like motors and LEDs and can receive information through switches and other input devices.

The Chibot Controller also has a motor driver chip on it to manage the large amounts of power required to run the motors. Below is a diagram of the connectors present on the Chibot Controller. To start with, we will only use a couple of these connections. As you learn more about robotics and microcontrollers, you can use the other connections to control more devices or to attach additional sensors so the BCM3Bot can be more aware of it's surroundings. Look over your controller board to become familiar with the different parts and the location of connection points.



BarCampMilwaukee3 Bot Schematics



The schematic above depicts how we will connect the Line Following Module and an input switch to the microcontroller on the Chibot controller board. The Line Following Module uses three input lines of the microcontroller to signal the microcontroller whether or not there is a reflective surface (the line) under the left, center and/or right line sensors of the line following module. This information will be

used by the microcontroller's program to slightly speed up or down the left and right motors independently to steer the robot. The goal is the keep the line under the center sensor while the robot moves generally forward, thereby following the line. We'll use the button to signal to the microcontroller that it should stop idling and start following the line. This will allow us to power up the robot, place it on the line and confirm via the LFM LEDS that the LFM actually sees the line prior to the robot spinning the motors.

BarCampMilwaukee3 Bot Program

Let's go over a basic program for the robot. Its intentionally simple to help you get up and running for the first time. Control will not be smooth but you can improve it through experimentation.

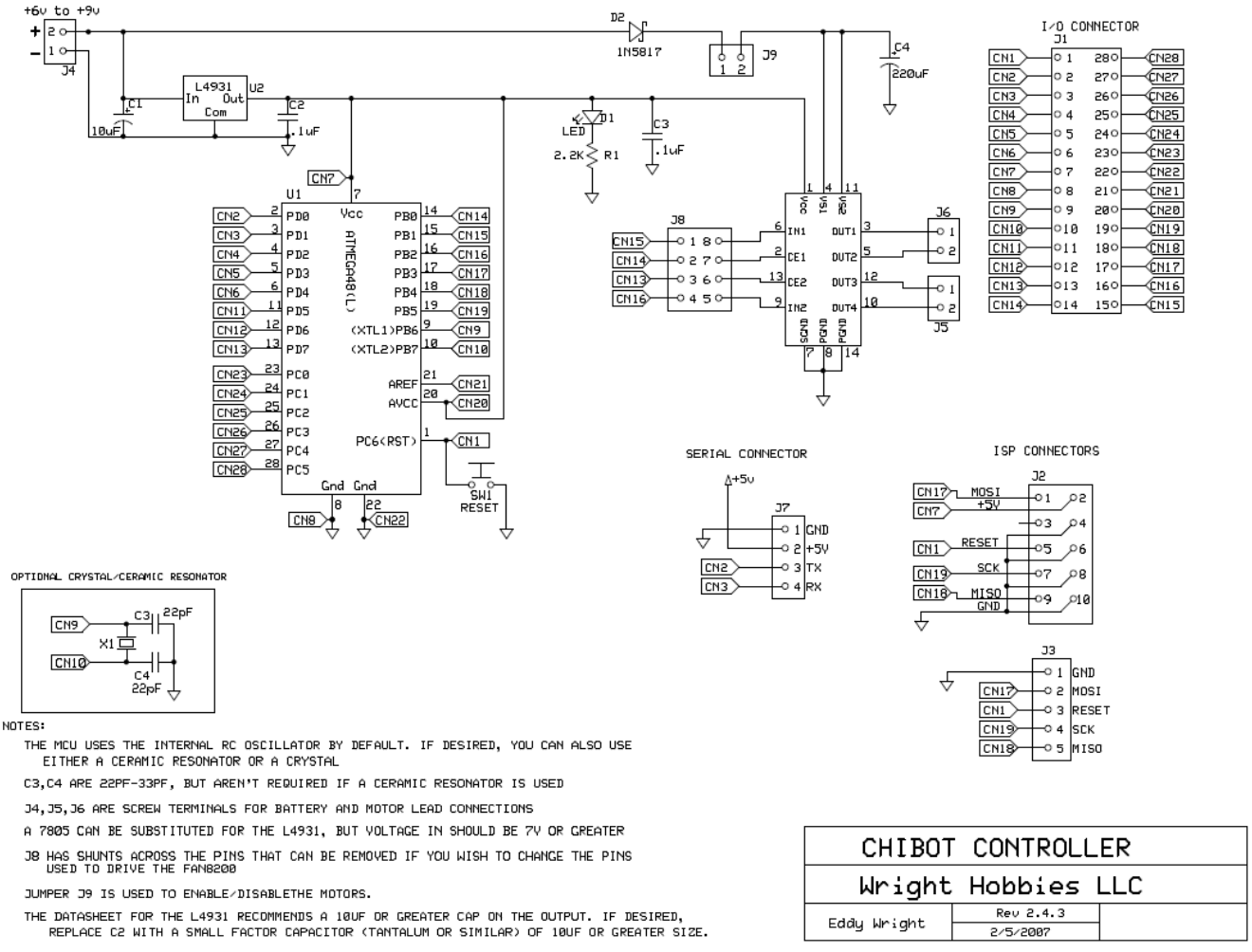
Starting from the moment the controller is reset:

1. Configure the AVR peripherals (motor PWM, UART, General I/O pins, etc.)
2. Stop the motors.
3. Wait until the button on PC0 is pressed.
4. Turn on both motors at maximum speed.
5. Begin the main loop.
6. Read the values of the Left, Center and Right sensors.
7. If the Left Sensor detects the line then
    - Set the right motor to maximum speed
    - Set the left motor to reduced speed
    - Return to the top of the main loop
8. If the Right Sensor detects the line then
    - Set the left motor to maximum speed
    - Set the right motor to reduced speed
    - Return to the top of the main loop
9. Otherwise set Both Motors to maximum Speed.
10. Repeat the main loop. (Goto Step 5)

Try to convert the above steps into a BASCOM program and get it working. Make sure that you keep your maximum speed low to allow the robot time to overcome the momentum of the chassis. Otherwise your robot may lose the line altogether and become lost with no sensors reporting a line position.

Once you have that working you can try to improve the control by making a finer estimate of the lines position relative to the sensors. For example, instead of just reducing speed based on Left or Right you can reduce a motors speed by larger amount if **only** the left sensor detects the line, indicating the the line is well to the left of center, but reduce the motors speed by a smaller amount if **both** the left and the center sensors detect the line indicating the sensor is only slightly to the left of center.

Schematics—ChiBot Controller



NOTES:

THE MCU USES THE INTERNAL RC OSCILLATOR BY DEFAULT. IF DESIRED, YOU CAN ALSO USE EITHER A CERAMIC RESONATOR OR A CRYSTAL

C3,C4 ARE 22PF-33PF, BUT AREN'T REQUIRED IF A CERAMIC RESONATOR IS USED

J4,J5,J6 ARE SCREW TERMINALS FOR BATTERY AND MOTOR LEAD CONNECTIONS

A 7805 CAN BE SUBSTITUTED FOR THE L4931, BUT VOLTAGE IN SHOULD BE 7V OR GREATER

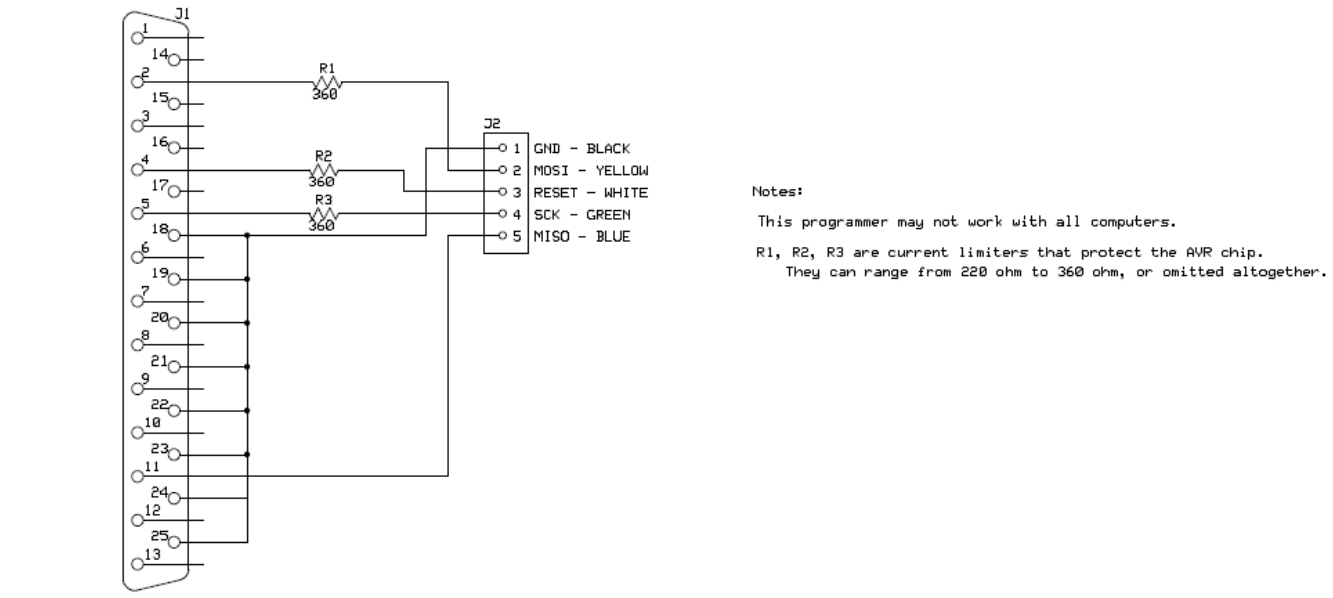
J8 HAS SHUNTS ACROSS THE PINS THAT CAN BE REMOVED IF YOU WISH TO CHANGE THE PINS USED TO DRIVE THE FAN8200

JUMPER J9 IS USED TO ENABLE/DISABLETHE MOTORS.

THE DATASHEET FOR THE L4931 RECOMMENDS A 10UF OR GREATER CAP ON THE OUTPUT. IF DESIRED, REPLACE C2 WITH A SMALL FACTOR CAPACITOR (TANTALUM OR SIMILAR) OF 10UF OR GREATER SIZE.

CHIBOT CONTROLLER		
Wright Hobbies LLC		
Eddy Wright	Rev 2.4.3 2/5/2007	

Schematics—ISP Cable



Assembly Instructions

Start with the DB25 connector. Place it in a vise or helping hands. Turn the DB25 so the bottom row of solder cups are on top and accessible.

Take one of the 360 ohm resistors and lay it across the top of the solder cups from 18 to 25. The tip of the resistor lead should start at pin 18. Solder the lead across the solder cups but do not solder pin 18 yet.

Clip off the resistor at pin 25. This should leave the resistor with a short lead.

Cut one lead on each resistor to be about 1/4” long. The short end will go into the solder cups and be soldered in place.

Put a resistor into pin 2, 4 and 5 and solder.

Now clip the other lead of the resistor to 1/4” long as well. The wires will solder to the short leads.

Strip away about 2” of the wire casing to expose the 6 colored wires inside. Cut off the red wire, this is not used.

Cut about 1/2” off of the yellow, white and green wires. Next, strip about 1/8” of the insulation from each wire.

Using a soldering iron, coat the end of each wire with a small amount of solder. Try not to get too much solder on the wire.

Place the black wire into pin 18 and solder it in place along with the lead that is connected across the other cups.

Next solder the blue wire to pin 11.

Now solder the yellow wire to the resistor connected to pin 2, the white wire to the resistor connected to pin 4 and the green wire to the resistor connected to pin 5.

Place the DB225 and wire into the plastic housing and secure. Use the metal strain relief clamp on the wire to hold it in place.

On the other end of the wire, cut off about 1-1/2” of the wire casing to expose the wires inside. Cut off the red wire since it’s not used.

Strip about 1/8” of the insulation off of each wire.

Fold the exposed copper wire down against the insulation.

Place the end of the wire into one of the female crimp pins and crimp it using a crimping tool or needlenose pliers.

Insert the wires with the pins into the black plastic housing in this order (left to right): Black, Yellow, White, Green Blue.

The cable is now ready to be plugged into your PC’s parallel port.

Errata:
The Chibot Controller version 2.4.3 has 2 capacitors mislabeled. The 2 capacitors near the crystal should be labeled C5 and C6 instead of C3 and C4.