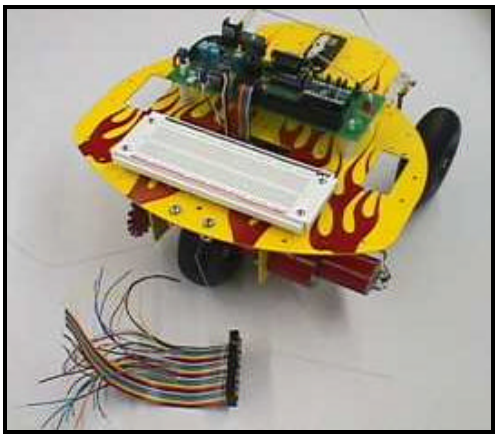
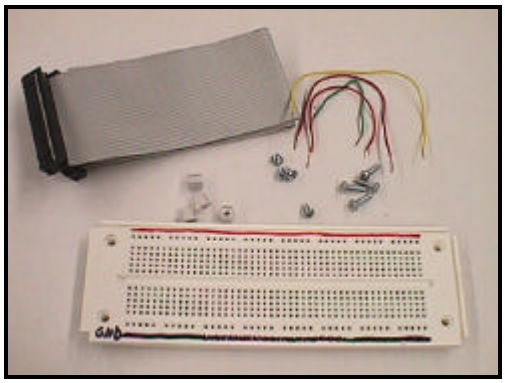
This application note explains the basics of expanding ARobot using a breadboard. The breadboard makes it easy to add circuitry to ARobot without soldering components. A cable will be used to connect ARobot's controller board to the breadboard. With the breadboard, expansion possibilities are endless.



Parts

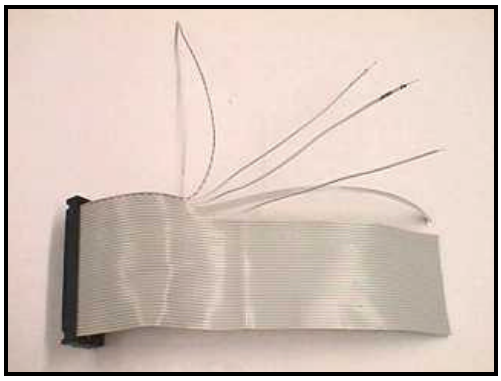
The parts you'll need can be purchased at most electronic supply stores including Radio Shack http://www.radioshack.com , Mouser Electronics http://www.mouser.com , and DigiKey http://www.digikey.com. The main item is the breadboard itself which has a series of holes that allow you to insert electronic components without soldering. A matching perf board is also available for circuits you choose to solder permanently. The breadboard will require 24 AWG solid core wire in order to make connections between components. The cable can be constructed using an ordinary 40 pin hard disk drive cable such as the one listed in the parts list.



Part	RS Part #	Price
Solderless Breadboard	#276-174	$12.49
Perf Board	#276-170	$2.99
Solid core wire kit	#276-173	$5.49
40 pin flat ribbon cable	#278-780	$6.99
Screws, nuts, spacers		

Cable

The expansion connector on ARobot's controller card is a 40 pin dual row header connector. You can make a cable between ARobot's controller and the breadboard using an ordinary 40 pin hard disk drive flat cable. Make sure the connectors do not have any holes plugged. Most computer stores carry such cables. Cut the cable to about 6" in length using sharp scissors. Peel the wires back 4 inches from the end and strip them about 1/4". Then tin each wire with a coating of solder so they will plug into the breadboard without bending. You can also make your own cable using connectors and flat cable. Multiple breadboards/perf boards can be used by placing multiple connectors on a single cable in daisy-chain fashion.



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Mounting

ARobot's body has mounting holes to accept the Radio Shack breadboard #276-174 which has the same mounting hole pattern as ARobot's controller board. Radio Shack also offers a perf board #276-170 which can be used if you wish to solder components permanently. Mount the breadboard directly to the body using 4-40 x 5/8 screws and 4-40 nuts. You can also drill holes in a different location if needed . Perf boards and breadboards can be stacked using spacers.

Usage

The breadboard makes it easy to prototype circuits. It does this by allowing the experimenter to insert components directly into the small holes in the breadboard. It then has electrical connections already made to reduce the number of jumper wires needed. There are two types of electrical connections on the breadboard. The first type is the power lines. These are two lines of holes that run length-wise along the breadboard. The lines are located near the edge of the board on opposite sides. I would advise marking one side with a black line to signify the ground wire. The other side should be marked with a red line. The red holes are not electrically connected to the black holes. The other type of electrical connections run width-wise across the board. Each set has 5 holes connected together. There are two sets of five holes on each line, the left and the right. These sets are not connected from left side to right side. We advise that you take a voltmeter and test for continuity on the breadboard to will help familiarize you with the connections. Connection arrangements may differ depending on the type of breadboard you have.

Each tinned wire of the expansion cable can be inserted into the breadboard to connect signals to ARobot's controller board. The connector usually has a mark to indicate pin 1 (wire #1). One wire on the cable is often red to denote pin 1. Pin 1 on the cable should be put at the same end as the "1" on ARobot's controller board. Once pin 1 is found, the rest of the cable is numbered in increasing numbers starting from wire #1 (i. e. the wire next to wire 1 is wire 2, the one next to that is wire 3, etc). The pinout of the expansion cable can be found on the ARobot controller board schematic in the user guide.

Basic Skills

Other basic skills are needed to expand ARobot. Learning to read electronic schematics is important. There are several different symbols that represent resistors, capacitors, transistors, ICs, etc. These symbols must be understood to correctly prototype circuits. Soldering is also needed in many robotic applications. Radio Shack and book stores have several books on these topics.