

Additional Laboratory Information

Dr. Daniel Pack
Department of Electrical Engineering
USAF Academy, CO
Daniel.Pack@usafa.af.mil

Evaluation Boards: We currently use two different boards for our microcontroller courses at the AF Academy. During the first course, we use the 68HC812A4 board made by Motorola with the XC68HC812A4CPV8 controller. This board is similar to the CMD12-A4 board from the Axiom Company. We designed a controller box which contains the board, an area to build external circuits, and a power source for each cadet. A mobile robot is controlled using a tether cord connected to the controller box. This board is ideal if you want your students to (1) learn to program the controller, (2) understand how the functional parts of the controller work, and (3) interface simple devices to the controller without an extensive analysis of timing issues on external buses. If you want to create the same system that we use in this course, here is the info you need to get the parts.

Microcontroller Board: Newark Electronics
<http://www.newark.com/>
P/N 92F88 MFR P/N MC68HC12A4 \$448.70 ea

Breadboard: AGCO Electronics 719-687-6875
P/N USAFA99215, Woodland Park, CO

Ribbon Cable: 60 conductor, Jameco Electronics
800-831-4242 P/N 103481

Ribbon Connectors: Jameco Electronics
<http://www.jameco.com/> P/N 32758(need 4 each)
P/N 167409 (4 each)

You'll also need a five volt (DC) power supply of some sort. Capable of putting out at least 2 A DC.

In the second course, we use the 68HC912B32 board made by Motorola with the XC68HC912B32CFU8 controller. The objective of this course is to provide cadets with opportunities to expand the functional components of the controller by physically connecting external memory, ports, and devices to the controller. It is a more hardware intensive course and we also teach them how to program the built-in EEPROM and FLASH memory. Students perform extensive timing analysis in this course. Our experience shows that this board satisfies the objectives of our second microcontroller course. Since the board is one of the first ones that came out on the market and various companies continue to develop new boards with this controller, we are currently considering the CME-12B32 board from Axiom to replace this board.

The info to purchase our current board for this class is

Newark Electronics P/N 88F4407 68HC912B32 Eval board
<http://www.newark.com/find/searchResults.jsp;jsessionid=1211761032370191611?action=0&First=0&QText=88F4407>

Robot Platform:

You can construct the exact replica of the robot body by following the engineering diagrams shown in Appendix E of the book. Only items that we did not explicitly mention in our book were motors and IR sensors. We purchased the motors from the C & H Sales Company (1-800-325-9465): Barber-Colman (#FYQF-63310-9) 12V DC permanent magnet motor. The sensor board can be constructed using the diagram found in the back of the A/D converter chapter. The actual IR components for each sensor are a couple of resistors, a High-Output Infrared Led (Catalogue # 276-143c), and an Infrared Phototransistor (Catalogue #276-145A). Again the aforementioned diagram will show the exact setup we used. The IR led and phototransistor were purchased from the RadioShack company.