

Elmer 160

Introduction

This is the web site for the Elmer 160 PIC course. On this page you will find an overview of the course, as well as information about the PIC-EL project board and links to the course material.

What is Elmer 160

Elmer 160 is an online introductory course for the PIC microcontroller from Microchip. In this course we will start off with very basic principles, and take you to the point of designing your own PIC applications. While we will focus on the PIC 16F84, the principles are applicable to the entire range of microcontrollers from Microchip.

Although the session is aimed at amateur radio homebrewers, it could be of interest to anyone who is interested in learning how these microcontrollers work.

We will start with very basic principles, then proceed through writing some simple programs and testing them on a simulator. We will then graduate to programming a PIC chip with our program and testing it in a real circuit.

The course incorporates a project board, called the PIC-EL board. This board will provide the platform for our tests, but could also become any of a number of different tools when the course is complete.

The course will be centered around the PIC 16F84, a very popular PIC among hobbyists. Toward the end of the course, we will discuss some of the many other varieties of PIC parts. All the PIC microcontrollers share the same instruction set and the same programming techniques, so students should be able to choose a microcontroller right for their project.

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Why?	<p>Over the past few years a large number of amateur radio projects have appeared using the PIC microcontroller from Microchip. This micro has the advantage of a FLASH program memory, which allows the part to be reprogrammed many times, and a simple architecture. In addition, the chip needs only minimal support circuitry. This combination makes it easy to apply, and thus a good candidate for many applications.</p> <p>Sadly, many homebrewers have been reluctant to dive in. In spite of the simplicity of application and the relative simplicity of programmers, the whole concept of having a "computer" in the radio has been alien to many homebrewers. This, along with the barrier of needing to buy or build a programmer has provided a good excuse for many amateurs to avoid incorporating the micro into their projects.</p> <p>However, the PIC can greatly reduce circuit complexity, especially when the builder wants some sort of display beyond a few lights. The learning curve of using a PIC has led many builders to avoid projects which could be very satisfying.</p> <p>Over the past few years there have been a number of successful "Elmer" projects on QRP-L to help folks get past their fear of doing certain types of projects. It seems like the time is past due for a series to help folks apply microcontrollers to their projects.</p>
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What do I need?	<p>The course will be conducted online, so most obviously, you need a PC with an Internet connection. The course material will be produced in Adobe's Portable Document Format, so you will need a copy of Acrobat Reader or some other program capable of reading Version 3 or later PDF files. Some of the supporting materials from Microchip may require the ability to read later versions of Adobe's Portable Document Format.</p> <p>Early on in the course we will begin using Microchip's Integrated Development Environment called MPLAB. In order to use the latest version of MPLAB you will need to have a PC with Windows 98 Second Edition or later, Microsoft Internet Explorer version 5 or later, and about 80 Mb of available disk space.</p> <p>Earlier versions of MPLAB are available from Microchip, and can run on earlier Windows versions. Most also require significantly less disk space and versions prior to 6.0 do not require Internet Explorer. However, there are some operational differences with these earlier versions, so the step by step instructions included in the course might not apply. Still, all the major capabilities exist as far back as version 4.21.</p> <p>A little later we will begin programming the 16F84 microcontroller and using it in a number of test circuits. You will need to be able to program the PIC and test it in a variety of circuits. The American QRP Club is offering a board which deals with many of these issues. See the section on the PIC-EL board below. The PIC-EL board requires that you have an available serial port on your PC and a 12 volt power supply.</p>
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Course Conduct	<p>The Elmer 160 course will consist primarily of a series of PDF documents which will be posted on the AmQRP web site. Each document will cover a particular topic. Except for an occasional lesson to introduce some basic concepts, most of the lessons will introduce a topic and then run some experiments to demonstrate that topic. The initial experiments will use the Microchip MPLAB SIM simulator. Later experiments will be performed on actual hardware.</p> <p>The hardware experiments will assume the PIC-EL board. Although there is nothing on the board that a reasonably equipped experimenter is unlikely to have on hand, or be able to easily get, the PIC-EL board provides a convenient and inexpensive platform for the experiments.</p> <p>Students will undoubtedly have questions as the course progresses. These questions will be fielded and answered on QRP-L. From time to time, the QRP-L discussions will be summarized and posted on the AmQRP web site.</p>
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Elmer 160 (continued)**Course Outline**

The course is planned to begin on November 23rd. There will be approximately one lesson per week, with some stretching out around holidays to allow folks to keep up with family duties.

Coursework requiring the actual hardware will begin around the end of January.

The following are the lessons planned - as we get further along, it is likely that there will be some changes as we see how folks are progressing:

- The PIC Architecture
- Installing MPLAB
- First MPLAB Project
- More fun with W and F
- Let's play with the status register
- Subroutines
- Using that status word
- Building the PIC-EL board
- Installing FPP
- Programming a PIC
- Let's make the PIC do something
- Timing loops
- More simple experiments
- From thought to code
- Still more simple experiments
- Reading the encoder
- Let's play with interrupts
- Using the timer interrupt
- Let's build a keyer
- Would you like memory with that?
- Table lookups
- Controlling an LCD
- Using the LCD with our keyer
- More complex math
- Still more complex math
- Counting frequency
- ICSP and other circuitry issues
- Other PICs
- Controlling the DDS

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The PIC-EL Board	<p>The PIC-EL board provides a platform for the experiments we will run in the Elmer 160 course. Included in the PIC-EL board are:</p> <ul style="list-style-type: none"> • The PIC 16F84 Microcontroller and supporting circuitry • A serial port programmer • Several buttons and LEDs for experiments • A speaker • A rotary encoder • An 8 character liquid crystal display • Jacks for your paddle and rig • A socket for the NJQRP DDS daughtercard • A multi-use RF jack <p>The PIC-EL board also includes a pair of headers to accomodate flexible use of the board. The header allows you to program the PIC-EL's PIC in-circuit with an external programmer in case you don't have a serial port available. In addition, the header allows you to easily use the PIC-EL's on board programmer to program a PIC in your circuit.</p> <p>This little board will provide a platform we will use for many experiments. After the course is over, besides providing you with a PIC programmer, the board can serve as a keyer, or, with the addition of the DDS daughtercard, a complete signal generator or VFO.</p>
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Links	<p>The following links contain the course information:</p> <ul style="list-style-type: none"> • Frequently Asked Questions • Resources from Microchip • Programmer software • Elmer 160 Lessons • Summary of QRP-L Discussions • Details about the PIC-EL board
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What if I don't use Windows? The course material will be built around Microsoft Windows. However, much of the content is not dependent on the particular development platform you choose.

Some members of the QRPLINUX-L reflector have been working to identify the appropriate software to use with Linux. This author is unaware of development software for less popular platforms such as the Macintosh.

Frequently Asked Questions

FAQ

No Frequently Asked Questions have yet been collected.

Resources from Microchip

Development Tools

The following are the URLs for important resources from Microchip.

MPLAB 6.30:

<http://www.microchip.com/1000/pline/tools/picmicro/devenv/mplabi/mplab6/index.htm#mplab2>

16F84A Datasheet:

<http://www.microchip.com/1000/pline/picmicro/category/digictrl/8kbytes/devices/16f84a/index.htm>

Quick Reference Card:

<http://www.microchip.com/1000/pline/tools/picmicro/code/mpasm/index.htm>

Archived versions of MPLAB:

<http://www.microchip.com/1000/pline/tools/archive/mplab/index.htm>

Programming Software

FPP

We will use the FPP software to control our programmer. FPP is available at <http://www.people.man.ac.uk/~mbhstdj/piclinks.html>.

The FPP programming software is configurable to work with a large number of programmers. If you are using a serial or parallel port programmer (including the AmQRP PIC-EL board), and your serial or parallel port is at a standard hardware address, then the FPP software should work for you.

If you are using a USB programmer, or a parallel port programmer with a port at a nonstandard address (see "Finding the port address" below), such as a port on a PCI expansion card, then you will need to use the software that came with your programmer.

Windows NT, 2000 and XP

For users of the Windows NT, including Windows 2000 (NT 5.0) and Windows XP (NT 5.1), a special driver is needed to allow access to the hardware ports.

(These links seem to move around a lot, so I have copied them to another server to make them accessible):

directio: <http://www.zemanszoo.com/Elmer160/directio.zip>

loaddrv: <http://www.zemanszoo.com/Elmer160/loaddrv.zip>

Finding the port address

To determine whether your serial or parallel port is at a standard address:

- Right-click on "My Computer"
 - Select "Properties"
 - Windows 9x - click on the "Device Manager" tab
 - Windows XP Click on the "Hardware" tab, then the "Device Manager" button
 - Click on the "+" to the left of "Ports (COM and LPT)"
 - Highlight the port you intend to use
 - Right-click on the port and select "Properties"
 - Select the "Resources" tab
 - The "I/O Range" should be one of the following:
 - ◆ For serial:
 - ☐ 03F8-03FF
 - ☐ 02F8-02FF
 - ◆ For parallel:
 - ☐ 0378-37F
 - ☐ 03BC-03BF
 - ☐ 0278-027F
 - Click cancel
 - Close the device manager
 - XP only, close the Sysem Properties
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Links to Elmer 160 Lessons

Lessons	<p>The following are the links to the lessons in the PIC Elmer course. These are all PDF documents and require Adobe Acrobat Reader 3.0 or later, or a similar program.</p> <p>No lessons are available yet.</p>
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Summary of QRP-L Discussions

QRP-L	No QRP-L discussions are captured yet.
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The PIC-EL Board

PIC-EL	Marketing material goes here.
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