Programming a Microchip PIC

I'm probably safe in assuming that you've heard about the Microchip PIC microcontrollers. You may have surfed a few web sites or read an article about them. You might have even used a Basic Stamp and learned it is built around a Microchip PIC microcontroller. No matter what road you took to understand what a Microchip PIC is, at some point you'll want to get your hands on a PIC and actually program it. To program a PIC requires a PIC part, a program and a PIC programmer. Because Microchip PIC's are so popular you have many programmer options to choose from. To cover every option available would be impossible. Instead I decided to focus on four programmer packages to get you started. From these you should be able to guide yourself down the path that is right for you. Let's start at the top with Microchip.

Microchip Picstart Plus

As the PIC's have evolved so have the programmers from Microchip. The Picstart Plus is Microchip's current "low-cost" offering for development work. It could be called affordable at $199.00 but you can usually find a deal through Microchip that will let you buy it for $149.00. Just keep an eye on their web site or contact a local Microchip representative. The main advantage to the Picstart Plus is the support from Microchip. When any new part is released, free updated Picstart Plus software is available for download at the Microchip web site. This is important to me because Microchip is constantly releasing new parts. The Picstart Plus programmer is very easy to use and is controlled through your computer's serial port. The Picstart Plus also comes with everything you need to get started right away (except a windows based computer). The serial port cable, power supply and a 16F84 flash memory PIC that can be reprogrammed multiple times are included. Also included is a CD that has sample programs, application notes, data sheets in acrobat .PDF format and the Microchip MPLAB simulator ready to install. MPLAB is a great environment to develop your PIC assembly code on. It is actually the same software Microchip uses for their high cost professional emulation system. It's the emulator software without the emulator hardware so its called a simulator and it simulates really well. You can also download MPLAB for free from the Microchip website or request the CD ROM if you choose a programmer other than the Picstart Plus. The Picstart Plus is fully supported through the MPLAB which simplifies using the Picstart Plus to a few mouse clicks. You can write your code or use a sample file, assemble it and program it into a PIC part without out ever leaving MPLAB. The Picstart Plus supports all the 8 pin to 40 pin PIC's with a 40 pin zero insertion force (ZIF) socket that accepts dual in-line packages (DIP) only. To program other parts such as surface mount devices (SMD) requires a SMD to DIP adapter. You'll find most PIC programmers include DIP sockets. The one drawback to the PicStart Plus involves the Serial In-Circuit Programming (SICP) feature available on most PICs. With just five PIC pins RB7, RB6, /MCLR, Vdd (5 v) and Vss (ground) the PIC can be programmed while still connected in a circuit. Unfortunately the Picstart Plus does not have any expansion connector for (SICP). The drivers within the PicStart Plus won't even allow you to make a custom ZIF socket jumper that will work. Despite this, if you can afford it, the Picstart Plus is a great

option and you'll know your always going to be supported by the makers of the PIC. Check it out at www.microchip.com.

Parallax PIC Programmer

Parallax, makers of the Basic Stamp, also offer a PIC programmer. It's offered in two versions: a complete package and the hobbyist pack. The complete package costs $199.00 and includes programmer, printed manual, PC cable, software and power adapter. The hobbyist pack costs $109.00 and includes programmer, software and manual on disk so you have to build your own cable, find a power source and read or print the manual from disk. The programmer is pretty easy to use so having the manual on disk is not a big hassle. Parallax also includes some sample files so you can use the programmer but you have to supply the PIC part or buy one from Parallax since that's not included. The programmer cable connects from the PC parallel port to the programmer through a modular phone jack plug. This makes it more difficult to find your own cable if you get the hobbyist package. You can use a 25-pin header to modular jack converter (Radio Shack part no. 276-1405a) on the PC parallel port and a normal phone cable to connect the programmer. With the hobbyist package you also have to supply 12-18 volt from a power supply or power adapter. I just used my Datarase EPROM eraser's power adapter. The Parallax programmer has separate 18-pin and 28-pin DIP sockets to cover the most common packages. To program larger or smaller pin count packages requires additional adapters. Parallax has the adapters for an additional cost. Parallax's programmer has an expansion connector that is used for SICP and adapters. I like that feature. Parallax's programmer relies on both hardware and software (called firmware) upgrades to support new parts from Microchip. Update packages currently cost $49.95. The programmer software runs on DOS or in a DOS window. With the added costs associated with this programmer you may wonder why I mention it. If your just writing PIC code then the Picstart Plus is a more complete programming package. However, if your writing Basic Stamp 1 (BS1) code the Parallax programmer has a hidden feature. It will take your BS1 code and program a 16C58A PIC with a simple ALT-I key press. For a real novice this can be a great feature. Develop your code using a BS1. When your done disconnect the BS1 cable and replace it with the Parallax programmer. Install a PIC 16C58A into the programmer and then press ALT-I instead of the ALT-R BS1 editor command. It will program the 16C58A with the BS1 code. Install the 16C58A into a circuit with resonator, /MCLR pullup resistor, Vdd (5 volts) , Vss (gnd) and your BS1 program is now running in a PIC. You can check out the Parallax programmer at www.parallaxinc.com.

Micro Engineering Labs EPIC Plus Pocket PIC Programmer

Micro Engineering Labs offer a lower cost PIC programmer. Its a very small package that will actually fit in your pocket (hence the name Pocket PIC Programmer). The programmer will run off two 9 volt batteries which makes it very portable. It costs $59.95 for the fully assembled programmer or you can buy just the circuit board, parts list and software for $34.95. An optional AC adapter is available for $9.95. The original software included is a DOS version but a new WIN95/NT version is available as I write this. The programmer is controlled through the PC parallel port. An optional cable costs $9.95 but any standard parallal cable should work. The programmer uses the Serial In-Circuit

Programming (SICP) feature that most PIC's offer. The 16C5X parts are the only PIC's that don't support the SICP feature so the EPIC programmer does not support these parts. The programmer has an 18 pin DIP socket built in which programs 8 and 18 pin PIC's. To program larger pin count PIC's or SMD PIC's will require additional adapters. The EPIC programmer has an expansion connector similar to the Parallax programmer. Micro Engineering Labs offer several varieties of adapters including a SICP cable/socket adapter for 16F84 flash PIC's. Micro Engineering Labs is the same company that offers the PicBasic compilers for programming PIC's in a higher level BASIC language. The PicBasic compilers work off an instruction list very similiar to the Basic Stamp commands. This allows you to write code in PicBasic and never have to learn Microchip assembly. I hope to cover programming with PicBasic in another Nuts & Volts article as I'm quickly running out of room here. Micro Engineering Labs does update their programmer software to keep up with the latest PIC parts. It is available for a small update fee. The EPIC programmer is a handy little programmer. You can check out the EPIC programmer at www.melabs.com.

Ultra Cheap PIC Programmer

That title probably got your attention. As mentioned earlier most of the PIC's offer the SICP feature and you can use that to your advantage. With the right software and simple hardware it's possible to program a PIC via three pins of your PC parallel port and a 12v/5v power supply. Thanks again to the popularity of Microchip PIC's you can find free software and hardware schematics to do this on the internet. One good location is David Tait's page at www.man.ac.uk/~mbhstdj/piclinks.html. His site has links to several simple PIC programmers. I built David's Quick and Dirty programmer for the 16F84 PIC. There are so many PIC links on David's site that it may be difficult to find the programmer I refer to. The file that contains everything you want including the control software is "pic84v05.zip". To make things easier, I've added a link on my web site (www.elproducts.com) so you can download the correct file. The programmer circuit contains only a few parts and connects to the PC parallel port. The software runs in DOS or a DOS window. I built the programmer in about 20 minutes on a proto-board. David includes a sample program to test the programmer with called "walk.hex". It illuminates LEDs in a back and forth motion. Build the sample circuit (Figure 1) with the 16F84 and LEDs in place. I added a diode to David's schematic to protect the 5 volt supply and a /MCLR reset switch. Connect the Quick and Dirty programmer circuit (Figure 2) to the sample circuit per the schematic. With 5volts on Vdd and 12 volts at the /MCLR pin, enter the command "MYPP WALK.HEX" at the DOS prompt. When the program displays "Insert PIC", reset the /MCLR pin to ground and release. That puts the PIC in program mode. Press the PC enter key and the PIC will get programmed. Disconnect 12 volts and reset /MCLR again. If your successful, the LEDs will start scrolling back and forth. I was really impressed how easy it was to build this programmer. It cost me nothing because I had the parts but it shouldn't cost more than $10. It really worked great although it could only program the PIC not read or verify the programmed PIC. You can't get much cheaper than this.

Summary

For any PIC programmer your programs have to be in HEX format (designated INHX8M by Microchip) . Almost any PIC assembler will create that file format. The MPASM assembler from Microchip is my choice. It comes with MPLAB. Programming PIC's is fun and easy. Hopefully I've made your path to programming PIC's a little easier as well. The toughest part about PIC's is writing the programs. If your not familiar with Microchip assembly code it will take a little while to figure it out. I find it very powerful and worth the effort to learn. There are only 35 different commands to remember for the most common parts. If your a real beginner or moving up from the Basic Stamps then PicBasic programming language may be the route for you. I'll talk more about this in another article. Until then, pick your PIC programming path and have fun.
Comments or questions can be sent to the author at eproducts@juno.com.

Be sure to check out Chuck Hellebuyck's Electronic Products web site at:

www.elproducts.com

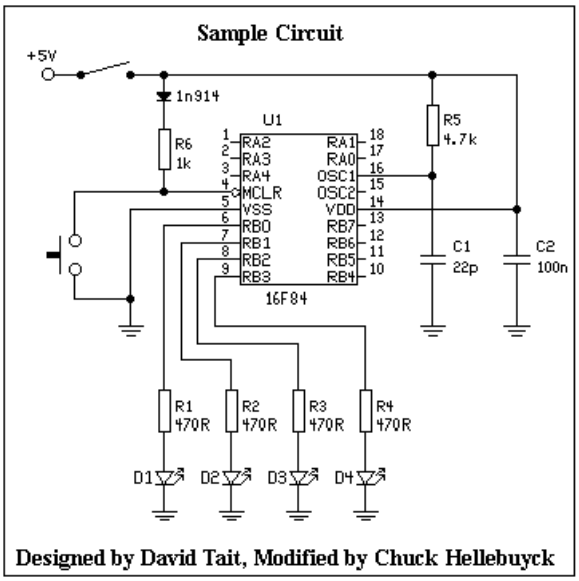

Figure 1

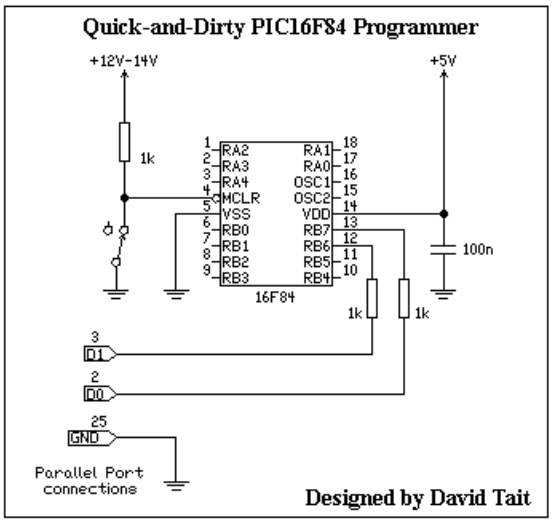

Figure 2