PICAXE Power!

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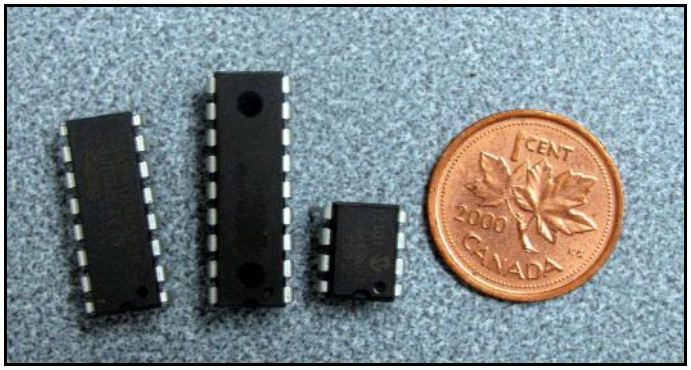
I'm not talking about the versatile pickaxe hand tool but the versatile PICAXE PIC microcontroller integrated circuit. This article is to introduce the computer programming and electronic use of this powerful series of microchips and the other products developed specifically for them.



From left to right: 14-pin, 18-pin and 8-pin PICAXE chips, compared to a penny. They are small but very powerful!

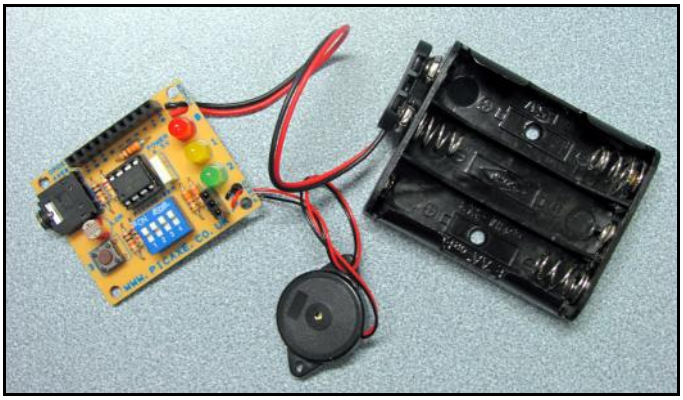
Background

The PICAXE was created in 1999, by the British company Revolution Education (Rev Ed) as a method of teaching computer programming and electronics in schools. The first microchip (PIC16F872) could be programmed using 5 volts instead of 12 volts and didn't require a special chip "burner". In 2002, the company introduced the PICAXE-08 microcontroller and hasn't looked back! Rev Ed provides the free computer program (a form of Visual Basic) for creating PICAXE specific programs and related design software.

The PICAXE operates between a low of 1.8 volts (M2 series) to 3.6 volts (M series) up to a maximum of 5 volts and can be programmed in circuit instead of having to remove and reprogram it. They are built upon the older PIC (peripheral interface controller) chip that includes a special loader program that executes your program and the chip can be burned over and over until you get it right.

They come in various sizes with increasing memory capacity and abilities, from the 8-pin to the 40-pin PICAXE. Most start learning on the 8-pin M series and new M2 series as they have a smaller selection of available functions and are easier to use in building circuits. Affordable PICAXE kits for the novice and pro are available from various sources.

The Rev Ed website (www.picaxe.com) will get you started and you can download free software and tutorials. You may have to invest in some basic equipment but many electronic hobbyists have most everything they need to get started except for the PICAXE chips and special programming cable.



Rev Ed Schools Experimenter Board (AXE092) is a self-contained kit to program and experiment with the 8-pin PICAXE. It is available as a single unit and also sold in 5-packs for schools and groups. The kit contains the common building blocks for programming the PICAXE 08(M and M2) chips to turn LEDs on and off, output sounds, detect changes in light levels, etc. The majority of PICAXE projects and add-on boards are sold as kits, so basic soldering tools and skills are needed.

Getting Started

First, download the free programming software and documentation from www.picaxe.com. If you have used Visual Basic or any other high-level programming language, you'll find PICAXE programming a breeze. I highly recommend getting Rev Ed's Schools Experimenter Kit (AXE092). You'll also need to purchase the USB programming cable and a couple of 8-pin M or M2 series chips. Here's a short list of suppliers of PICAXE products: Aztec MCU (www.aztecmcu.com) based in Ontario; HVW Tech (www.hvwtech.com) is an Alberta based company; Robot Shop (www.robotshop.com/ca) serviced from Quebec, and Spark Fun (www.sparkfun.com), a U.S. based company with a Canadian web store.

Also, get a copy of the book Programming and Customizing the PICAXE Microcontroller; besides being a complete tutorial on the new M2-series chips, it has an entire section devoted to the Experimenter Kit, with simple and easy to follow instructions, sample programs and experiments. There are very few external parts required for most projects as the PICAXE contains many built-in hardware components and devices besides its internal microprocessor.

Initial cost is under $50 (you can save a bit with a group bulk order). If you have one of those 300-in-1 electronics kits, you can build a clone of the Experimenter Kit (and many other PICAXE projects). You'd need to purchase a few PICAXE chips, USB programming cable, and a Breadboard Programming Adapter, AXE029 ($5.00).

The First PICAXE Program!

```
REM Flash a LED on and off (connected to output 4)

Do                  ; start of do ... loop

   High 4           ; turn LED on
   Pause 1000       ; keep it on for 1000 ms (1 sec)
   Low 4            ; turn LED off
   Pause 1000       ; keep it off of 1000 ms (1 sec)

Loop                ; repeat do ... loop
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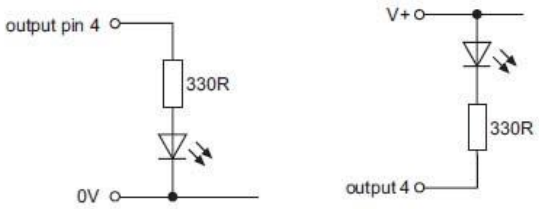
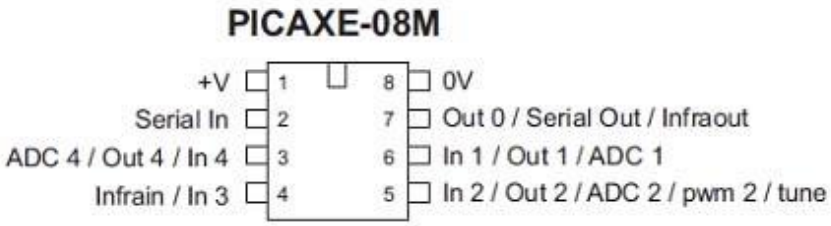
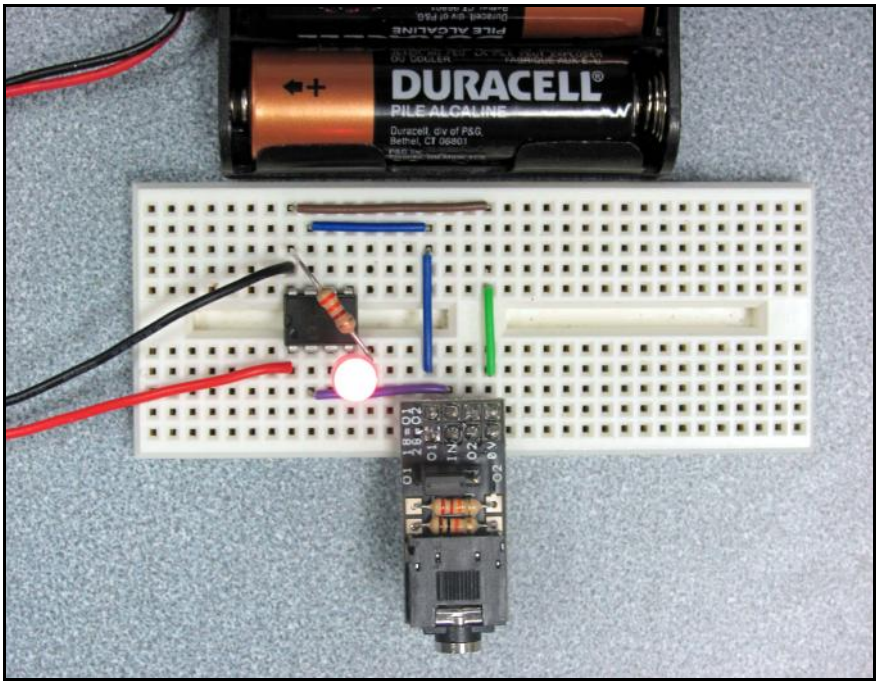


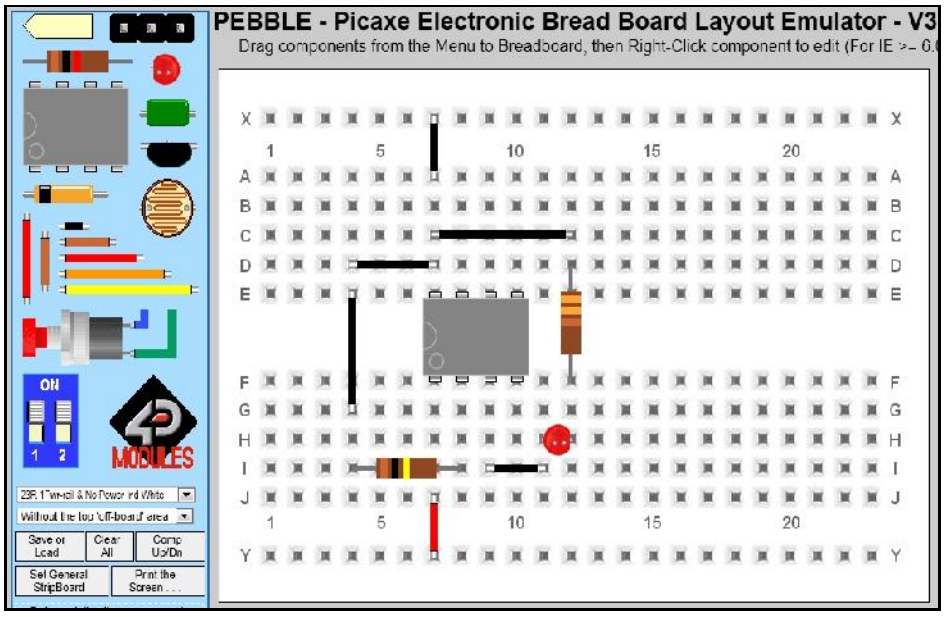


The PICAXE physical pins don't match up with the logical (programming) pins; in this case, logical output 4 is physical pin 3. Many PICAXE books often confuse the two and the reader by saying Pin 4 when they really mean Out 4 or they combine them as in the above (left) LED schematic. Many pins have multiple functions and with the new M2 chips these can be changed to whatever you like with your program code!

Here's a basic flash LED circuit built on a solderless breadboard, using the AXE029 and a PICAXE 08M. You can eliminate the 330-ohm resistor by using an LED with an internal one. A handful of parts can make many interesting & useful projects. You don't need to spend a lot of money, to get started, as most hobbyists already have a well-stocked parts box. The USB programming cable is about the only thing you can't make as it uses a special built-in chip.

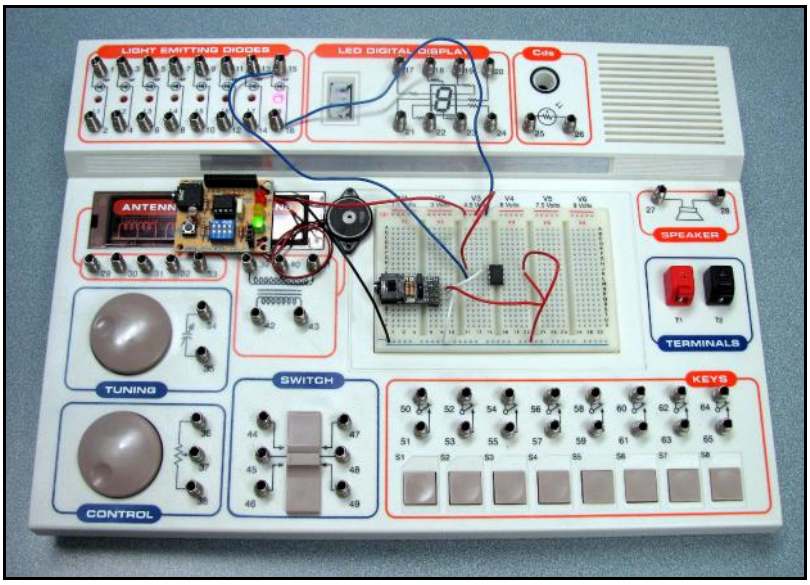


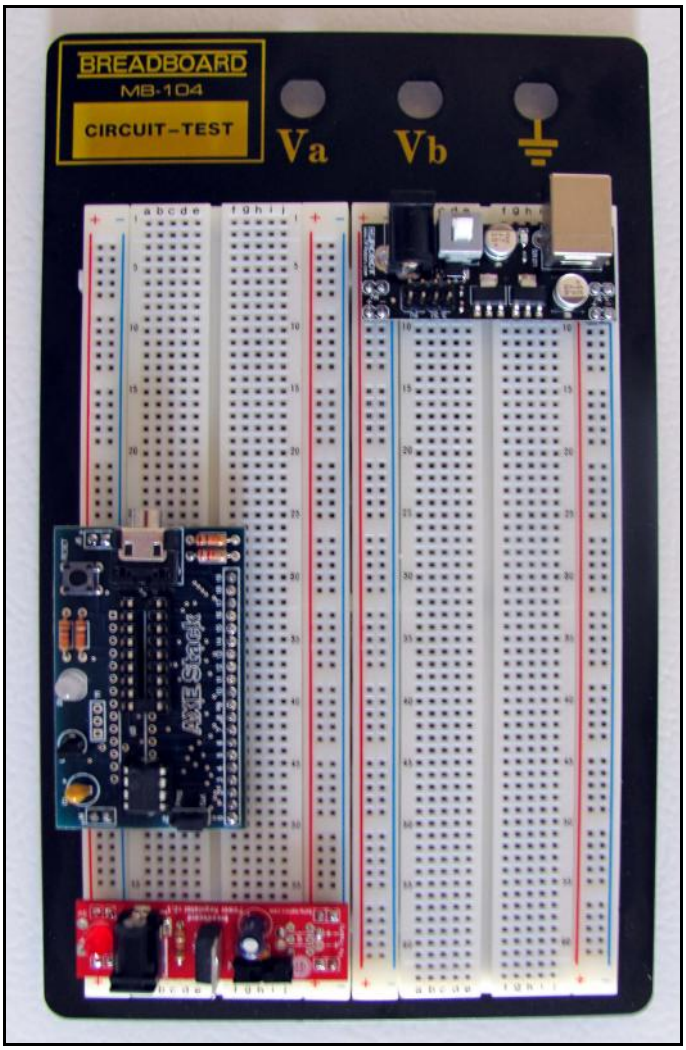
Equivalent layout designed with PEBBLE, a Java program that runs via a web browser; you can download it from www.picaxe.com. I've removed the AXE029 and replaced it with a 100k resistor to ground (X), as the chip's serial input can't be left "floating". Many circuits leave in the programming resistors (10k and 22k) and 3.5mm stereo jack.



You don't need to be a computer programming "guru" or electronics "wizard" to start using this amazing little chip. Each generation continues to get better and more powerful. The new M2 series is replacing the older M-series chips but the programming code is backwards compatible, so you can continue build and add-to your expertise with each generation of chips and not have to rewrite a lot of code!.

I've mounted the Schools Experiment Board (with double-sided foam tape) to my "300-in-1 Electronic Lab kit" and operate it via the internal battery power. I'm also using an AXE029 Breadboard Adapter, on the solderless breadboard side with another 08M chip. These types of electronics kits supply the components for basic experiments but allow you to easily add other parts. An inexpensive way to get started using what you may already have!





The AXE Stack-18 Starter Kit with dual solderless breadboards and power rails; includes the Stack-18; and breadboard voltage regulators. The dual voltage regulator (upper right) can be powered from your computer's USB port and supplies either 3.3 or 5 volts. The Stack-18 programming/circuit board (just above the red voltage regulator) can be modified for 8-pin M or M2 chips by adding a DIP 8-pin socket and SIP 3-pin header with shorting jumper. I noticed that the board already had the silk-screen and holes for the parts but you can only use one chip type at a time. This is just another approach & shows you the versatility of the PICAXE system. You can start out very simply and build up as your needs dictate. There are various competing development systems such as the Arduino and BASIC Stamp but for ease of learning, programming and starting costs the PICAXE can't be beat. Anyone with very little programming and/or electronic skills can quickly learn to use it!