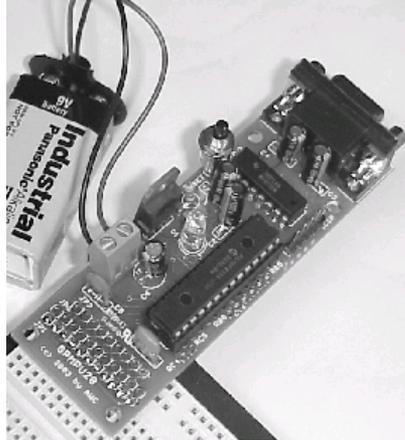


# AWC

## APP-III PIC Development Kit

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V1.1 30 Aug 2003



# Table of Contents

Overview.....	1
If You Need Help.....	1
What Else You'll Need.....	1
Features.....	2
Assembly.....	2
Programming.....	3
Internals.....	5
Resources.....	6
Figure 1. Circuit Diagram.....	7
Connections to JP1.....	8
Connection to ICSP Header.....	8



## Overview

The APP-III allows you to develop PIC code for the powerful PIC18F252 microcontroller. The kit includes a special PIC18F252 (28 pin microprocessor) that operates at 20MHz and a 20MHz crystal. The kit includes a PC board (the GPMPU28) which allows you to provide power to the board, connect an RS-232 cable to the board, and optionally plug the board into a standard solderless breadboard. See the enclosed manual for the GPMPU28 for more information about this board (including assembly instructions).

## If You Need Help

If you require assistance, please feel free to contact us. The best way to get support is via e-mail ([stamp@al-williams.com](mailto:stamp@al-williams.com)). However, you may also call between 9AM - 4PM Central Time at (281) 334-4341. You can also fax to (281) 754-4462. Be sure to check out our Web page for updates at [www.al-williams.com/awce](http://www.al-williams.com/awce).

## What Else You'll Need

In addition to the APP-III kit, you'll also need a few other easy to obtain items:

- A solderless breadboard
- An unregulated power supply (DC between 8 and 13V) or a 5V regulated power supply.
- MPLAB, the free software from Microchip (or another development tool that produces 8-bit hex files)
- A serial cable (a DB9 male to female, if you are using a PC).

## Features

The PIC18F252 core of the APP-II has 5 channels of 10-bit A/D, up to 19 digital I/O, and a hardware serial port usable by your programs. The device has 1.5K bytes of RAM, 256 bytes of EEPROM, and nearly 16K of program words (32K bytes minus 512 bytes). This processor is much more powerful than, for example, the older PIC16F87x series. It includes a more sophisticated interrupt system, an accessible stack, hardware multiply, and more.

## Assembly

Please refer to the enclosed GPMPU28 manual for assembly instructions. There is only one modification required on the board. Place a two pin male header in pins 3 and 4 of the ICSP connector. Leave the other holes of this connector empty. Remember, pin 1 of the ICSP connector is closest to the DB9 – be careful not to get this connector backwards.

The two-pin header you install will allow you to select programming mode or execution mode by placing (or removing) a jumper on these two pins. With the jumper in place, the APP-III will allow programming (via the download software). When the jumper is not present, the APP-III will run your program.

The APP-III is shipped with a test program already on board. Remove the shorting cap on the programming header and observe the onboard LED. When you apply power to the circuit, the LED will blink indefinitely. If this doesn't happen, disconnect the power immediately and check all connections.

Once the test is successful, connect your PC to the board's connector. Start a terminal program (such as Hyperterminal, which comes with Windows). Make sure that the port you want to use is not in use, and that the complimentary port is also not in use (many PCs can't use COM1 and COM3 or COM2 and COM4 at the same time).

The rest of this discussion will assume you are using Hyperterminal. When you start Hyperterminal it will ask you to create a new connection. Call it APPIII (or any name you like). The prompt will ask you to enter a phone number and will show a box that contains the ID of your modem. You can also select a direct COM port in this box, and that's what you'll do. Pick the COM Port you are using to connect to the APP-III.

Next, Hyperterminal will prompt you for serial port parameters. Select 19200 baud (19.2 kBaud), 8 bits, 1 stop bit and no parity. Most importantly, you must set the handshaking or flow control to none.

Once you've set up the connection, you should be able to see hex numbers displaying on the terminal. This shows that your RS-232 connection is working. If you don't see the output (but the LED is still pulsating) check the MAX232 wiring and the settings on the terminal program (for example, some programs require you to use a connect command to start communications).

Congratulations! Your APP-III is working. Now you can do some programming.

## **Programming**

To assist you further in programming, you can download a few sample HEX files from our Web site ([www.al-williams.com/app3.htm](http://www.al-williams.com/app3.htm)). One of these is the test program that is running on the APP-III right now. To test the programming feature of the APP-III, replace the shorting cap on the ICSP header and press the RESET button. The LED should quit blinking (because the PIC is in program mode and not running your program).

You'll need to download the app3 program from the AWC web site. This program is a Windows console program (other downloaders may be available on the web site). The easiest way to run it is from a command prompt. If you are connected to COM1,

here's the command to program 1st.HEX (downloaded from the web site):

```
app3 com1 1st.HEX
```

If you want to verify that the device was programmed correctly you can issue this command:

```
app3 -v com1 1st.HEX
```

To run the new program, remove the jumper cap and press the reset button. This is the basic steps you'll use to program the APP-III each time you want to run a program.

You can write your own programs using any language that generates 8 bit hex files like MPLAB from Microchip.

The app3 program understands several options:

- v: Verify
- d type: Display (type=all, pgm, id, eeprom, or config)
- e: Erase
- b: Blank check
- m xxxx: Sets top address for -d, -e, and -b

So, for example, to display the contents of the eeprom, issue the command:

```
app3 -d eeprom com1
```

To dump the first 256 bytes of program storage (which starts at location 0x200) you'd write:

```
app3 -m 100 -d pgm com1
```

If you wanted to erase the chip (not necessary when programming) and also wanted to verify that it was blank, you can issue these two commands:

```
app3 -e com1
```

```
app3 -b com1
```

## Internals

The APP-II is actually a PIC18F252 that operates at 20MHz. You can find documentation for this device at the Microchip Web site. However, the APP-III environment makes programming a little different. In particular:

- Your program starts at location 0x200.
- Port B pin 7 is not generally available for your use.
- Port B pull up resistors are enabled briefly on reset – however, if you want them enabled, you must enable them in your own program.

Although you can use the serial port in your own programs, you must be able to configure the two serial port pins for serial I/O to program. Therefore, we don't recommend you use the serial port for anything other than a serial port.

The chip will not allow you to change certain fuse settings (notably the code protect options and the clock selection).

You could use Port B pin 7 as an output in your program with some modification to your circuit. The idea is that you need to be able to remove the connection from pin 7 and hold it low while going into reset to enable programming mode. So if you used an external header, you could disconnect your external circuitry from pin 7 and replace it with a pull down resistor (around 4.7K) to enter programming mode. After programming, you'd return the circuit to its original configuration. Be careful not to short pin 7 directly to ground if you are using it as an output since this could damage the APP-III!

## Resources

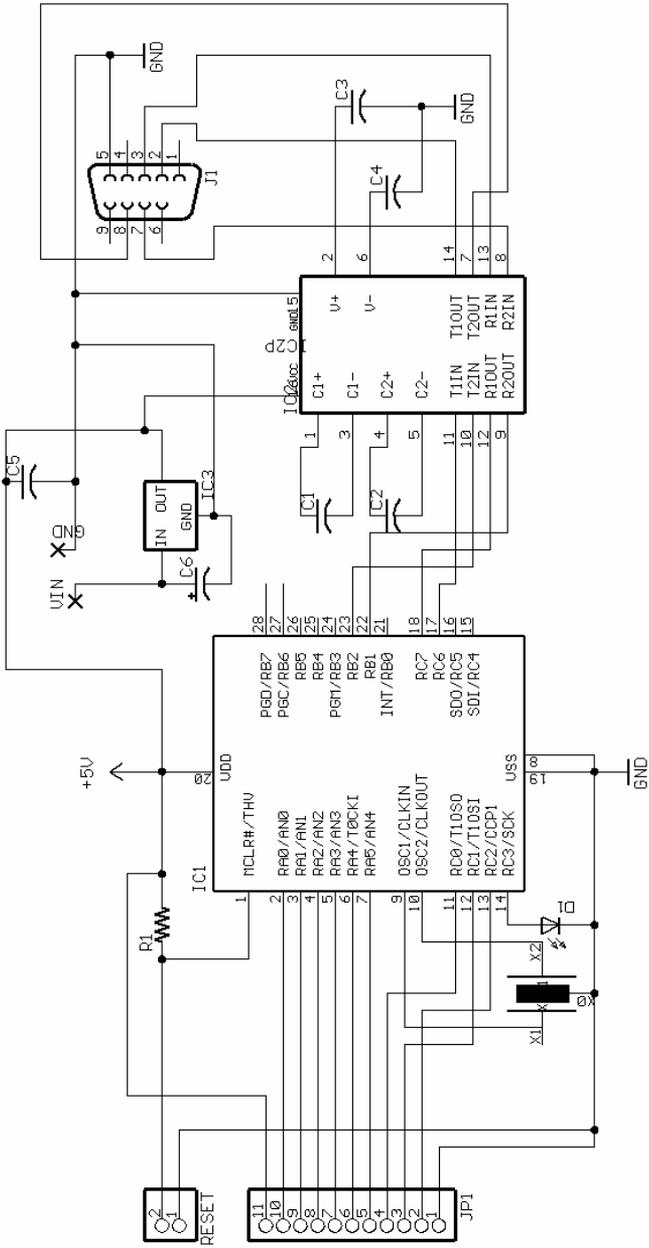
<http://www.al-williams.com/app3.htm> – Examples and include files.

<http://tutor.al-williams.com/pictutor> – Illustrated tutorials.

<http://www.microchip.com> – Download manuals for the PIC and MPLAB for free.

<http://www.piclist.com> – Information and help about the PIC.

**Figure 1. Circuit Diagram**



## Connections to JP1

Pin 1 of JP1 is closest to the JP1 marking on the board:

JP1 pin	Signal	IC1 Pin
1	Ground	
2	RC2	13
3	RC1	12
4	RC0	11
5	RA5	7
6	RA4	6
7	RA3	5
8	RA2	4
9	RA1	3
10	RA0	2
11	5V	

## Connection to ICSP Header

You can use the ICSP header to connect to an in circuit programmer or in circuit debugger. Pin 1 is the pin closest to the DB9 (J1).

Pin	Signal	IC1 Pin
1	MCLR	1
2	5V	
3	Ground	
4	RB7	28
5	RB6	27