

AWC

**APP-IVa ATmega
Development Kit**

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Table of Contents

Table of Contents.....	3
Overview.....	1
If You Need Help.....	1
What Else You'll Need.....	1
Features.....	2
Assembly.....	2
Testing.....	3
Programming.....	3
Resources.....	5

Overview

The APP-IV allows you to develop software for the powerful ATmega 328 microcontroller. The kit includes a special CPU (28 pin microprocessor) that operates at 16MHz. It also includes a PC board (the GPMPU40) 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 GPMPU40 for more information about this board (including assembly instructions). The APP-IV is fully compatible with the Arduino and you can use its software and libraries easily.

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@awce.com). Be sure to check out our Web page for updates at www.awce.com.

What Else You'll Need

In addition to the APP-IV 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.
- Development software (assembly and C options are described later in this manual)
- A serial cable (a DB9 male to female, if you are using a PC).

Features

The APP-IV CPU has analog inputs, digital I/O, and a hardware serial port usable by your programs. The device has 2K bytes of RAM, 1K bytes of EEPROM, and nearly 32K of program space (512 bytes are reserved). The chip achieves speeds of 16 MIPS with the supplied crystal.

Assembly

Please refer to the enclosed GPMPU40 manual for detailed assembly instructions.

The APP-IV's CPU is installed so that pin 1 of the IC lines up with pin 1 of IC1. Note that the 28 pin IC fits in the inner set of holes. You can use the outer set of holes along with JP3 and JP4 to make connections between the CPU and other circuitry on the board. Here are the connections you must make from the GPMPU40 subsystems to the APP-IVa CPU:

Connection 1	Connection 2	Note
JP5-T	JP5-2	RS232 connection
JP5-R	JP5-3	RS232 connection
RS-T	IC1-3	TX
RS-R	IC1-2	RX
RST (either pin)	IC1-1	Reset
Vcc	IC1-7, IC1-32*, IC1-33*	+5V
Ground	IC1-8, IC1-34**	Ground
CLK (either pin)	IC1-9	Clock
CLK (either pin)	IC1-10	Clock

*IC1-32 and IC1-33 are AVcc and ARef; you may wish to make custom connections if you are using the A/D.

**IC1-34 is AGnd; you may wish to make a custom connection if you are using the A/D.

In addition, a 5V LED is provided with the kit. To be compatible with the Arduino, you should install the long lead of this LED on pin 15 of the CPU (IC1-31). You can do this in the spare area of the board, use the LED on a connected solderless breadboard, or omit it entirely.

Testing

The APP-IVa is shipped with the open source AdaBoot Arduino bootloader preprogrammed (see <http://www.ladyada.net/library/arduino/bootloader.html> for the original source).

When you power up the board and short the reset pins, the LED (if installed) should blink 3 times rapidly when the short is removed. If it does, then congratulations! Your APP-IVa is working. Now you can do some programming.

Programming

The APP-IVa emulates a standard avrisp serial programmer just as an Arduino does. That means that you can use any compatible download program to send a hex file to it. The baud rate is 19200 baud.

Although you can use any programming tool that can communicate with an avrisp programmer, you'll typically use the open source Arduino software. Download the software from <http://arduino.cc>. The software is available for Linux, Mac, and Windows computers.

To start with, connect the board to your PC and note which serial port you have used (note that if you are using a USB cable or an onboard adapter, your computer will assign it a Windows COM port ID like COM6 or a Linux port name like /dev/ttyUSB1).

From the Arduino File menu select Examples|Basic|Blink. This will open up a simple program that will cause the LED to blink. IF

you didn't install the LED, you may want to temporarily connect it to pin 19 of the CPU.

In the Tools | Serial Port menu select the port you are connected to. Then use the Tools | Board menu and select "Arduino BT w/ATmega328" since this is compatible with the APP-IVa.

Ensure the board has power and briefly short the reset jumper. The LED should blink three times to indicate that the bootloader is active. Note that the bootloader does not activate when power is applied. You must manually reset the device to enter the bootloader.

The bootloader waits about five seconds to receive an upload. The easiest way to ensure the bootloader doesn't time out is to follow this procedure:

1. Place the reset jumper on the reset pins.
2. Remove the reset jumper and quickly proceed to step #3.
3. Press the right-facing arrow on the Arduino editor's toolbar to start downloading the program
4. Observe that the LED on the board will flash rapidly and the Arduino software will eventually show a status of "Done uploading."
5. Observe that the LED begins to blink at the rate specified in the example software.

If you do not wish to use the Arduino software, you can also download software to the board using any programming software that can control an avrisp programmer at 19,200 baud. For example, could program XXX.hex into the device using avrdude:

```
avrdude -p m328p -c avrisp -P com4 -b 19200 -F -U flash:w:XXX.hex
```

Resources

<http://www.al-williams.com/app4.htm> – Examples and files

<http://arduino.cc/> - Arduino home page

<http://www.ladyada.net/library/arduino/bootloader.html> - Modified boot loader used by the APP-IVa.

Connections to JP1/JP2

For the purposes of this table, JP1 and JP2 are numbered sequentially from 1 to 40. The last pin of JP1 is pin 20, and the first pin of JP2 is 21.

JP1/2 pin	Signal	ATMega Pin/Arudion name	Note
1	RESET	1	Connected to reset circuit
2	RX	2 / RX – D0	Connected to RS232
3	TX	3/TX – D1	Connected to RS232
4	PD2	4/ D2	
5	PD3	5/PWM3	
6	PD4	6/D4	
7	Vcc	7	
8	Gnd	8	
9	XTAL1	9	Connected to clock
10	XTAL2	10	Connected to clock
11	PD5	11/PWM5	
12	PD6	12/PWM6	
13	PD7	13/D7	
14	PB0	14/D8	
27	PB1	15/D9	
28	PB2	16/PWM10	
29	PB3	17/PWM11	MOSI
30	PB4	18/D12	MISO
31	PB5	19/D13 LED	SCK
32	AVCC	20	
33	AREF	21	
34	AGND	22	
35	PC0	23/AIN0	PC0-PC5 also analog inputs
36	PC1	24/AIN1	
37	PC2	25/AIN2	
38	PC3	26/AIN3	
39	PC4	27/AIN4	
40	PC5	28/AIN5	