

AWC

**PAK-Vb/c PWM
Coprocessor
Data Sheet**

© 1998-2003 by AWC

AWC
310 Ivy Glen
League City, TX 77573
(281) 334-4341

<http://www.al-williams.com/awce.htm>

V1.8 23 Oct 2003

Table of Contents

Overview.....	1
If You Need Help	2
Registering Your PAK-Vb.....	2
Pin Connections	3
Software Commands	4
Typical Circuits and Software.....	5
Sample Basic Stamp II Code	6
Frequently Asked Questions	6
Q: Can I run the Pak Vb from a different clock source?	6
Q: Is there a second source for the PAK Vb?	6
Q: What is the state of the PAK at startup?	7
Q: How do I connect the resonator?	7
Specifications	8
Absolute Maximum Ratings	8

Overview

The Stamp PAK Vb is a Pulse Width Modulation (PWM) coprocessor. It has an easy-to-use serial interface that allows it to connect to a variety of microcontrollers including the Parallax Basic Stamp.

The PAK Vb can generate 8 channels of PWM at one time using one of two methods, proportional PWM and equal area PWM.

Here are some of the PAK Vb's major features:

- Serial interface uses TTL level RS232 at 9600 or 2400 baud (true or inverted)
- Uses as few as 1 pin to connect to the host
- Can connect multiple devices to the same pin with one additional pin per device
- Asynchronous operation - all 8 channels active at one time with no overhead on host computer
- The PAK-Vc can share a single pin with 31 other PAK-Vc chips (a total of 32 chips and 256 outputs).

The PAK Vb is a standard 28-pin IC. In order to operate it must have a regulated supply of 5V and connection to a clock element. The Stamp PAK Vb includes a 50MHz ceramic resonator that you can use to clock the chip.

Other than the power and clock connections, the PAK Vb requires at least one wire to connect between your microcontroller (the host) and itself. Depending on the host's capabilities and your application, you may want to use a few additional pins to control the PAK

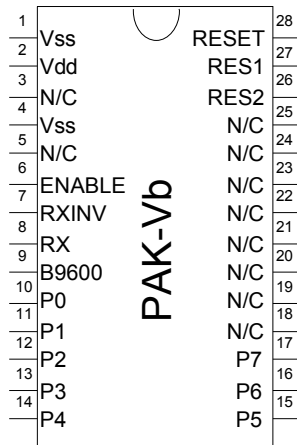
PWM is useful for motor control, or for generating voltages using an RC network. With the PAK-Vb you can generate continuous PWM with no intervention from the host processor, making PWM easy and useful.

If You Need Help

If you require assistance with your PAK Vb, please feel free to contact us. The best way to get support is via e-mail (stamp@al-williams.com). However, you may also call between 9AM - 4PM Central Time at (281) 334-4341. You can also fax to (281) 538-2147. Be sure to check out our Web page for updates at www.al-williams.com/awce.htm.

Registering Your PAK-Vb

Please take a moment to register your e-mail address with AWC. Simply send an e-mail message to pakreg@al-williams.com. AWC will not make your address available to other companies, but we may periodically send you updated technical notes. You'll also receive information about new microcontroller products and specials.



WARNING: The PAK Vb is a static-sensitive, CMOS device. Observe static precautions when handling. Operating the device without both Vss pins grounded or with RES1 or RES2 disconnected may damage the chip.

Pin Connections

Pin	Name	Type	Description
8	RX	Input	TTL-level RS232 input
9	B9600	Input	If this pin is not connected or pulled high at reset, the PAK uses 9600 baud; if this pin is low at reset, the PAK uses 2400 baud
6	Enable	Input	If this pin is not connected or high, the PAK responds to commands; if this pin is low, the PAK ignores all input
7	RXINV	Input	If this pin is not connected or high, the PAK expects inverted serial I/O (e.g., through a line driver). If this pin is low, the PAK expects true serial I/O.
28	RESET	Input	Hardware resets the PAK when low. Must be high for normal operation
1,4	Vss	Power	Ground (please ground both pins)
2	Vdd	Power	+5V
27	RES1	Clock	Connects to resonator
26	RES2	Clock	Connects to resonator
10-17	P0-P7	Output	PWM Channels
25	Multi	Input	PAK-Vc only: If floating or tied high, operate as PAK-Vb. If grounded, enable addressing (this pin must be set before reset)
18-22	Address	Input	PAK-Vc only: If Multi is low at reset, these pins set the address for this PAK. Disconnected pins are set high, so with no connections, the PAK uses address \$1F. Pin 18 is the least significant bit and pin 22 is the most significant bit.

Software Commands

Code	Name	Argument	Description
\$21	DUTY0	Duty cycle	Sets duty cycle (0-255) for channel 0
\$23	DUTY1	Duty cycle	Sets duty cycle (0-255) for channel 1
\$25	DUTY2	Duty cycle	Sets duty cycle (0-255) for channel 2
\$27	DUTY3	Duty cycle	Sets duty cycle (0-255) for channel 3
\$29	DUTY4	Duty cycle	Sets duty cycle (0-255) for channel 4
\$2B	DUTY5	Duty cycle	Sets duty cycle (0-255) for channel 5
\$2D	DUTY6	Duty cycle	Sets duty cycle (0-255) for channel 6
\$2F	DUTY7	Duty cycle	Sets duty cycle (0-255) for channel 7
\$81	EQUAL	None	Sets equal-area PWM
\$83	PROP	None	Sets proportional PWM
\$85	RESET	None	Restores PAK to power up conditions
\$87	SETOUT	Direction byte	0 in direction byte sets pin to output, 1 sets pin to high impedance (default = 0)
\$A0-\$BF	SELECT	None	PAK-Vc only: When Multi is low, the PAK's input is disabled by default and will remain disabled until you send \$A0 plus the PAK's address (set on the Address pins). Sending another address byte will deselect the current PAK and select another one. Note that when the PAK is deselected, its outputs continue to operate.

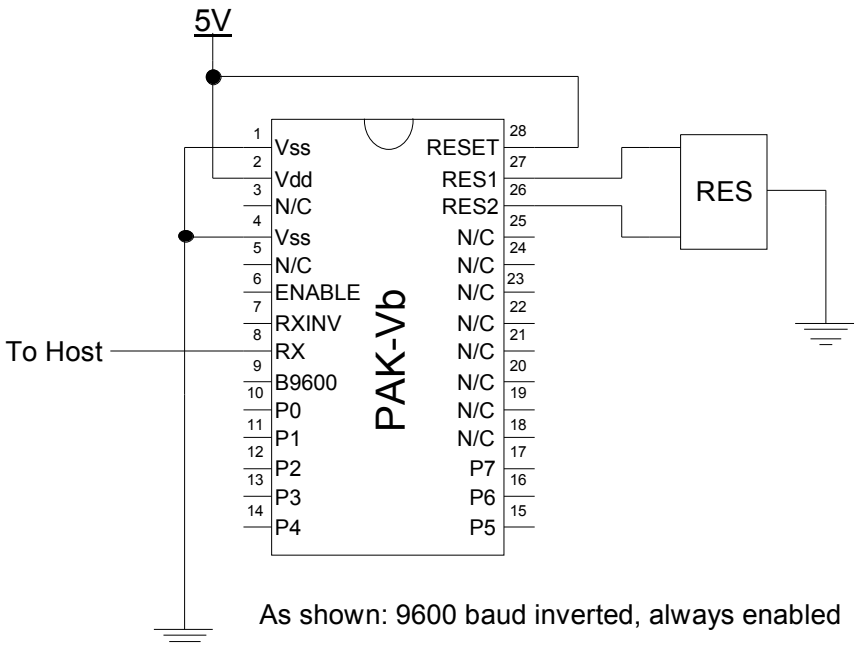
Notes and Key:

- The EQUAL and PROP commands affect all channels
- When using EQUAL, the time period is about 512uS, so a duty cycle of 1 will generate a 2uS pulse every 512uS. A duty cycle of 128 will generate a 256uS pulse every 512uS.
- PROP PWM uses a 2uS time base. A duty cycle of 1 will generate a 2uS pulse every 512uS. However, a duty cycle of 128 will generate a 2uS pulse every 4uS.

Typical Circuits and Software

Connecting the Pak to its external components is simple. Supply 5V to Vdd and ground the Vss pins. Connect the two outer pins of the ceramic resonator to the RES1 and RES2 pins (the order does not matter). Ground the center pin of the resonator. Connect the RESET pin to 5V. For the simplest mode of operation leave ENABLE open and jumper B9600 and RXINV for the operating mode you desire. Of course, you'll also need to connect the RX pin to the host microprocessor.

If you are using the Basic Stamp you'll have no problems using the SEROUT command to send codes to the PAK. Many Basic Stamp-compatible compilers have these commands too.



An Example Circuit

Sample Basic Stamp II Code

With the circuit above, connect the RX pin to pin 0 of a Basic Stamp II and an LED (with a 220 ohm resistor in series between P3 and ground).

Then you can use the following code to make the LED grow brighter and brighter:

```
baud con 84
serout 0,baud,[$85] 'reset

top:
for B1=0 to 255
serout 0,baud,[$27,B1]
pause 100
next
goto top
```

Frequently Asked Questions

Q: Can I run the Pak Vb from a different clock source?

A: You may be able to use a lower clock speed or a clock up to 75MHz, but it isn't recommended. The PWM and serial communications depend on specific timing.

If you do run at a different clock speed, you can expect the baud rates to scale accordingly. So using a 25MHz clock, for example, will cause the PAK to communicate at 4800 and 1200 baud. AWC does not support operation at any speed other than 50MHz.

Q: Is there a second source for the PAK Vb?

A: No. However, if you have a high-volume application and you are concerned about availability, contact AWC about obtaining a license to produce your own PAKs or obtain them from third parties.

Q: What is the state of the PAK at startup?

A: Initially all 8 PWM channels are at 0% duty cycle. Also, the initial mode is EQUAL (although it doesn't hurt to select the mode you want first to make sure).

Q: How do I connect the resonator?

A: The center pin of the resonator is ground. The other two pins are interchangeable.

Q: What is the difference between the PAK-Vb and the Vc?

A: In general, you can replace a PAK-Vb with a PAK-Vc. If the Multi pin is left floating (or tied high), the chip will operate identically to a PAK-Vb. However, if you connect Multi to ground the chip will enter a special mode. In this mode, the chip does not respond to any commands other than \$85 and address selection commands (\$A0-\$BF). You set the PAK's address by hardwiring a 5 bit number on pins 18 to 22. To select a PAK, send \$A0 + the required address. At that point, the PAK will respond to commands until you reset it or select another PAK. A deselected PAK's outputs continue to operate as normal.

This allows you to connect up to 32 PAKs on a single serial line. Of course, each PAK must also have the same RXINV and B9600 settings. In addition, if you drive RESET or ENABLE, you should drive all PAKs with the same signal unless you have a special reason to do otherwise.

It is possible to drive multiple PAKs from a single external clock, although doing so will not necessarily result in perfect edge synchronization between PAKs because of internal timing differences. It is perfectly permissible, and highly recommended, to allow each PAK to use its own resonator.

Specifications

Absolute Maximum Ratings

Ambient temperature under bias	-40°C to +85°C
Storage temperature	-65°C to +150°C
Voltage on VDD with respect to VSS	0 to +7.0V
Maximum current out of VSS pin	130 mA
Maximum current into VDD pin	130 mA
Maximum output current sunk by any I/O pin	45 mA
Maximum output current sourced by any I/O pin	45 mA

DC Characteristics

Parameter	Minimum	Typical	Maximum
Supply voltage	3V	5V	5.5V
Vdd rise time on power up	.05V/ms	-	-
Supply current @ 5V/50MHz	-	77mA	