

Application Notes for the PK-2 keyer

by Charles J. Olson, WB9KZY

Jackson Harbor Press

RR1, Box 91C

Washington Island, WI 54246

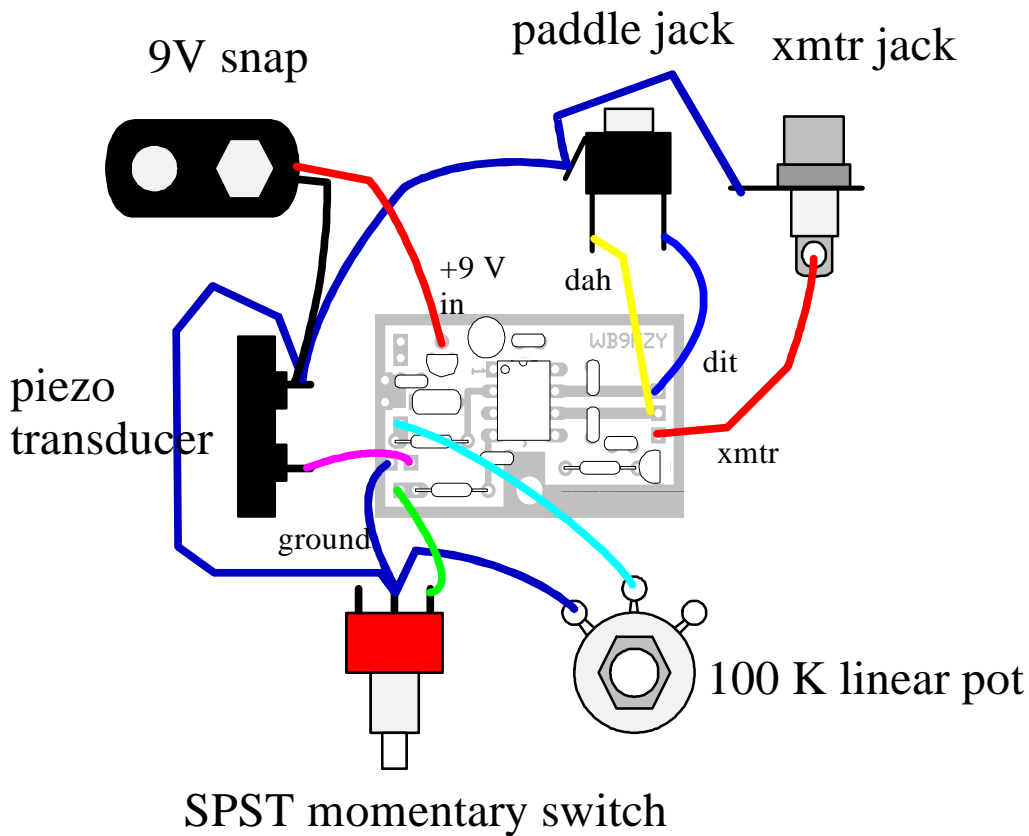
jacksonharbor@worldnet.att.net

<http://home.att.net/~jacksonharbor>

Here are a few ideas for packaging, modifying and using the PK-2 keyer - some of the ideas are applicable to any keyer.

Hookup diagram: Here is a pictorial view of how to hook up your PK-2 keyer board to the other components:

Hookup diagram for PK-2 Keyer



Debugging the hardware:

One of the virtues of using an 8 pin PIC microcontroller chip is that the hardware is relatively simple - but if your PK-2 doesn't function correctly and give you that friendly FB through the sidetone at powerup, use the following data to help find the trouble.

1) voltage checks - performed while the power is connected - the keyer should be inactive.

U1 pin #	U1 inserted	U1 removed
1	5	5
2	0	0
3	0	0
4	4.25	0
5	0	0
6	5	0
7	5	0
8	0	0

Current checks: The supply current can be measured by hooking a VOM in series with either the positive or negative lead to the 9V battery. Active current should be less than 1.5 ma. Larger active currents may be due to oscillation on the regulator output, a reversed component or solder shorts. Standby current should be about 6 uA.

Battery Usage:

I like to use 9 volt batteries to drive the regulator of the PK-2 keyer. Often I'll use a battery rescued from a beeping smoke alarm. I've noticed with an old GE smoke alarm that the unit draws about 10 uA and will begin to beep when the battery has discharged to about 7.5 volts. This usually takes over 1 year - the PK-2 will probably last at least as long depending on usage. The LM2936 regulator used in the PK-2 is a low-dropout regulator which means that it will continue to provide a fairly steady 5 volt output even as the battery voltage drops below 6 volts. Note that if the PK-2 is left running continuously (such as in beacon mode) it will discharge a 9 volt battery completely in a couple of weeks.

Comments on the regulator output capacitor

Generally a circuit using a low standby current, low dropout regulator like the LM2936 will call for a tantalum capacitor from the output pin to ground. This capacitor is needed to insure stability of the regulator - without enough capacitance, the regulator may break into oscillation which could destroy either the regulator, the circuit or both. The PK-2 uses a 47 uF electrolytic capacitor on the output - this capacitor has the required ESR capability and should work well under normal operating conditions. One of the major advantages of

tantalum capacitors over electrolytic capacitors is that tantalum will retain it's excellent characteristics even under very high temperature conditions over the long term (such as decoupling a Pentium processor) - electrolytic capacitors will often degrade under higher temperatures and thus not offer enough capacitance to quell circuit oscillations. However, a PIC based keyer which uses a maximum of 1.5 mA and is normally operated at a nominal room temperature won't affect the useful life of the electrolytic cap. Those who like to operate with both a belt and suspenders can put a 10 uF tantalum cap either in place of or in parallel with the 47 uF cap in the PK-2. Yes, the tantalum caps are a lot more expensive - that's one of the reasons why they weren't used. Also, they are easy to install backwards (which isn't good for their life expectancy) since their polarity is rarely marked as clearly as it is on an electrolytic cap.

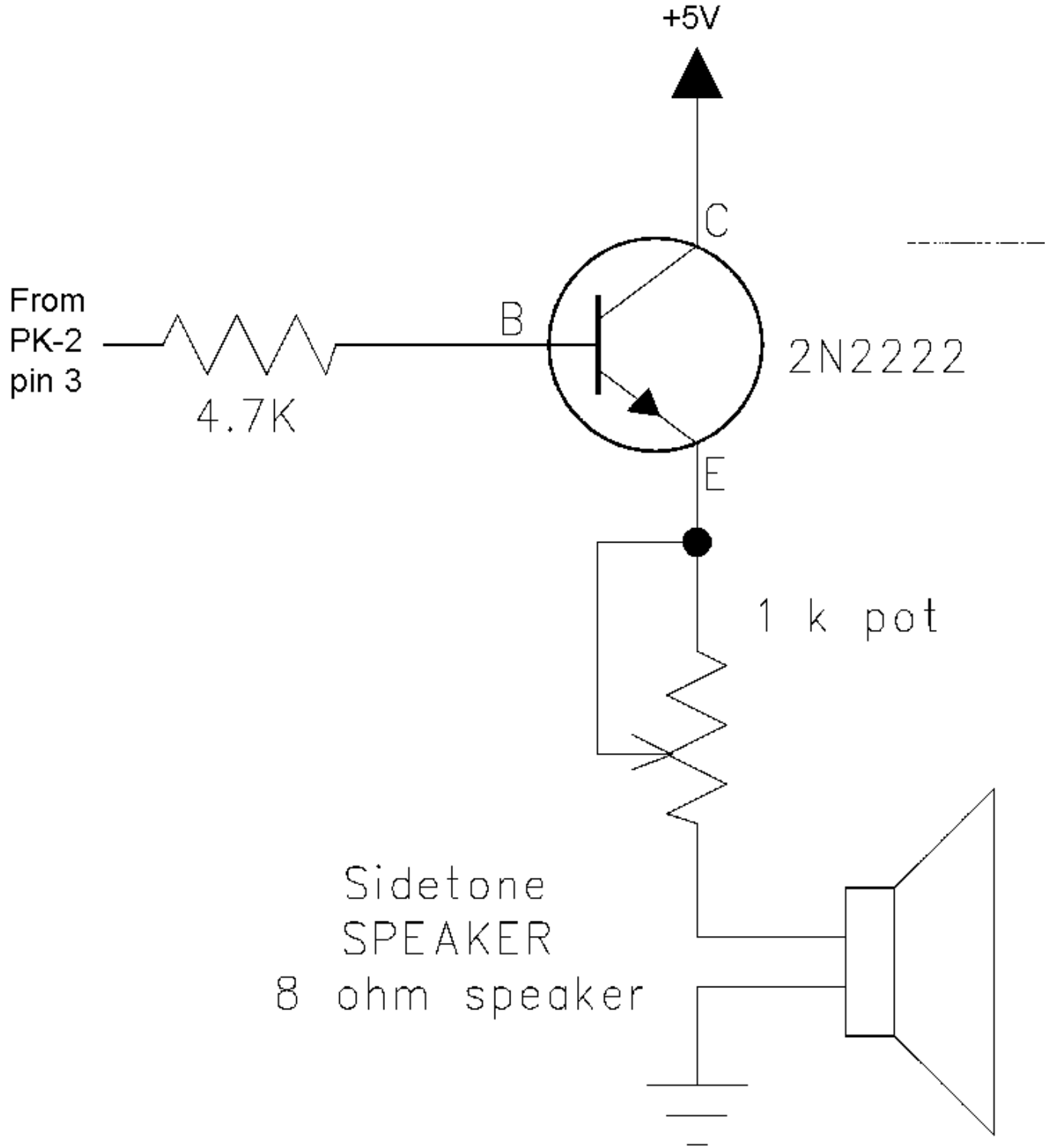
Potentiometer selection:

I really like to be able to set the code speed via a potentiometer (pot). This allows the operator to change speeds easily and quickly, even while sending or playing a memory. However, all pots are not created equal. Most inexpensive (and some expensive) linear pots are only linear through part of their range - generally at least 180 degrees of rotation provides linear change of resistance. This means that the speed control will also be linear only when the pot itself is linear. This nonlinearity at the ends of the pot range may be partially due to the fact that the pot may have been designed for use with an attached rotary switch - this switch takes a certain amount of rotation during which it is reasonable to assume that the user won't really care if the resistance is changing linearly or not.

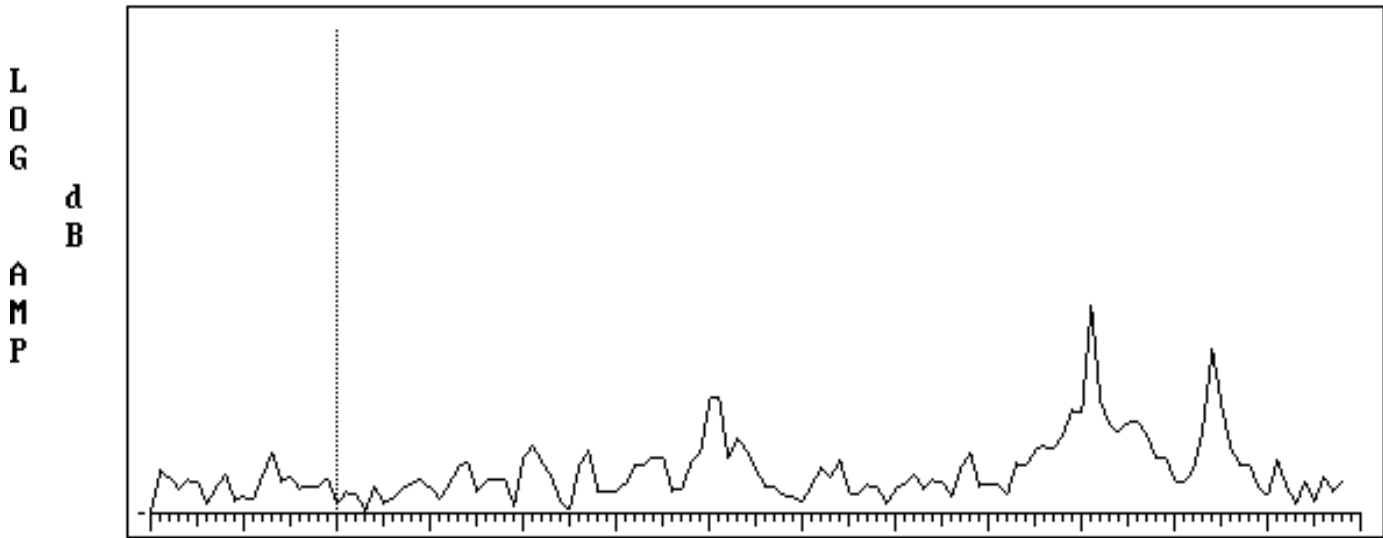
Another problem with inexpensive pots is that generally the maximum resistance values are below the stated tolerance spec for the pot. This means that the minimum keyer speed will generally be higher than 5 WPM - this is the reason for including the calibrate pot option on the menu for the PK-2 keyer.

Sidetone: Piezo versus Speaker

The PK-2 should normally be used with a piezo transducer to provide the sidetone. Piezo transducers have a couple of virtues: they are small and use little power. However, piezos also have faults - they sound tinny and aren't very loud. Here is a simple 1 transistor circuit taken from the Island Keyer that can be used to add a speaker sidetone to the PK-2:



MicFFT v1.2 - The PC Fourier Spectrum Analyzer
By Craig M. Walsh



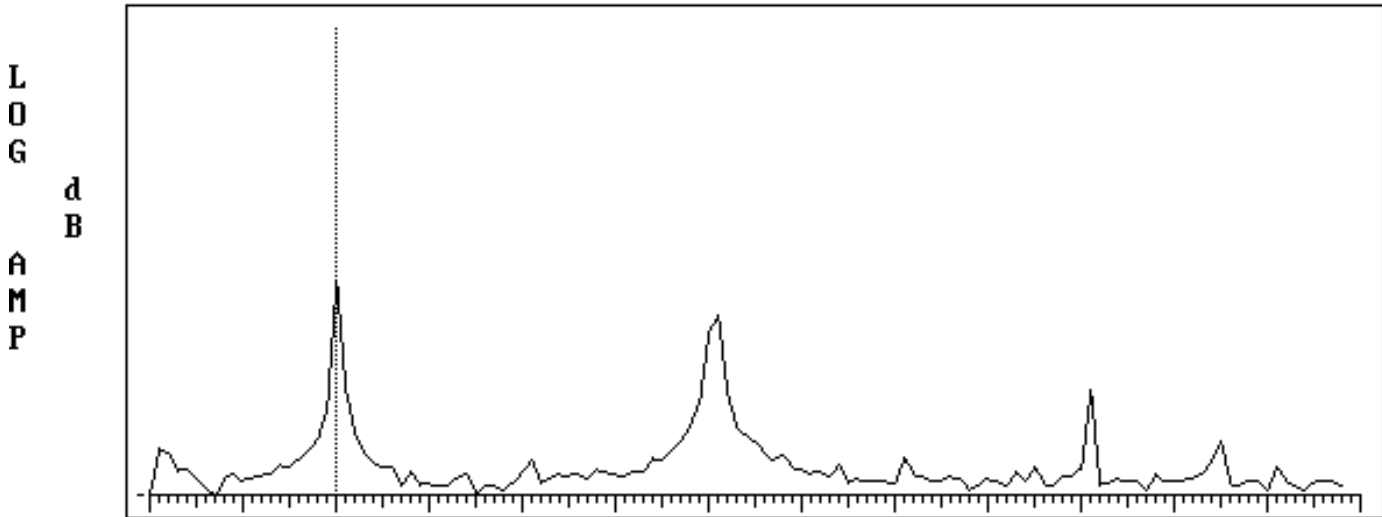
[Frequency: 781.25 Amplitude: 0.144 (1.17 dB) Phase: -0.07]
Cursor keys to move cursor line. SPACE to continue. ESC to exit.

ADC Input Port: Sampling Freq: FFT Window Size: Fundamental:
22f (hex) 10000 Hz 256 samples _____ 39.0625 Hz _____

Above is a spectrum diagram of the PK-2 sidetone with a piezo output.

It's apparent that at the vertical line (781 Hz is the closest FFT point to the 750 hz nominal frequency of the PK-2 sidetone) there is NO signal. There are peaks at 2382, 3945 and 4453 hz which correspond to the 3rd, 5th and 6th harmonics of the fundamental tone. This shows why the piezo sounds tinny - you are hearing mostly the odd harmonics of the square wave - the fundamental tone isn't present to any significant extent.

MicFFT v1.2 - The PC Fourier Spectrum Analyzer
By Craig M. Walsh



[Frequency: 781.25 Amplitude: 11.736 (22.10 dB) Phase: -16.42]
Cursor keys to move cursor line. SPACE to continue. ESC to exit.

ADC Input Port:	Sampling Freq:	FFT Window Size:	Fundamental:
22f (hex)	10000 Hz	256 samples	<u>39.0625 Hz</u>

Above is the PK-2 sidetone with a speaker output.

On this diagram the fundamental tone peak has the highest amplitude - the 3rd, 5th and 6th harmonics are still present but at lower levels than the fundamental - this gives the speaker a much more pleasant tone than with the piezo transducer. However, using a speaker circuit can increase the active current of the keyer as a whole by a factor of 10 or more.

The spectrum diagrams were generated using a generic 8 bit sound card fed by a dynamic microphone to a neat DOS program called MICFFT by Craig Walsh.

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