Building and Operating: PICCPO kit
                         from Jackson Harbor Press

Introduction:

The usual starting point for anyone interested in learning how to send Morse code is a manual key with a Code Practice Oscillator (CPO). The PICCPO kit combines the key (now a touch switch) and CPO into one circuit board. Add a piezo speaker and a 3 cell battery and the beginner is ready to start sending code with a simple/inexpensive kit. In addition, the kit can be used to key other CPOs or two could be used as a paddle for a keyer.

General notes on building the PICCPO

The integrated circuit (U1) and the output transistor (Q1) are MOS devices. This means that they should be handled as little as possible to prevent static damage. The builder should use a grounding strap and anti-static mat if available or at the very least, work on a grounded metal surface and be sure to touch ground prior to touching these parts.

One decision the builder should make before starting construction of the PICCPO kit is how the project will be mounted in the case. Ideally if the PICCPO will be used with a transmitter as a key or as a keyer paddle the PICCPO should be mounted in an all metal case to minimize RF pickup - an Altoids tin will work fine. The circuit board can be mounted to the case with 4-40 (1/8 inch) sized hardware. If two PICCPO kits are going to be used as a keyer paddle, then 4-40 sized right angle brackets can be used to mount the boards vertically, back to back. If the PICCPO will be used as an off the air code practice oscillator, then it and the piezo speaker and battery holder could be attached to a board.

The components should be inserted a few at a time, soldered in place and then clip the leads. The pads and traces are small and delicate - a small tipped, low power (25 watts or less) soldering iron should be used.

Building the PICCPO

Step 1) Get the parts together: All of the board mounted components have been supplied but you will still have to provide off-board items to fully implement the kit. These items include:

          Output connector, optional to external keyed device
          metal case,   an Altoids or other candy tin will work fine
          mounting hardware, 4-40 sized
          piezo transducer, external drive type
          4.5V battery holder, three AA cells are fine
          output jack if the PICCPO will be used to key a transmitter, keyer or another CPO

Step 2) Identify and orient the components: Most of the components should be fairly easy to identify and place - see the parts list and the parts placement diagram for descriptions. The MOSFET should be inserted as shown with the flat side away from the PIC device (U1).

step 3) Place and solder the components on the main circuit board: Use the parts placement diagram for information on the placement and orientation of the parts. Clip the leads after soldering. Here is a suggested sequence for installing the parts:

a) DIP socket - should be inserted with the notch towards the top of the board
b) C1 - marked 104 - located just to the top of the 8 pin socket
c) R1 - yellow-violet-yellow-gold - located just to the left of the 8 pin socket, bend one lead over fully (180 degrees) and install vertically
d) C2 - marked 103 - located just to the bottom of the 8 pin socket
e) Q1 - marked 2n7000 - located to the bottom of the C2, flat side towards the bottom edge of the board

Step 4) Check the board: Before proceeding, take the time to check the bottom of the board for solder bridges. Use the bottom view diagram as a guide to visually check for these shorts. It may help to clean the flux from the board and then use a strong light in conjunction with a magnifying glass to see these problems. Also, double check the orientation of the critical components such as the

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MOSFET. After you are convinced that the board is OK, form the leads of IC U1 to fit in the socket, insert the IC the socket, being sure to follow the parts placement diagram for proper orientation (pin 1 indicated by a notch or dimple should be towards the top of the board and C1.

Step 5) Solder connecting wires from the board to the piezo, output jack and battery holder. See the hookup diagram for a visual of these connections. Powerup the PICCPO by inserting the cells into the battery holder. The PICCPO should respond with an FB played through the piezo. If the FB is not heard, power should be removed immediately and all the connections should be re-checked. Soldering problems are the main source of most problems with kits. Also, make sure that the cap, C1, is fully discharged before inserting the cells.

Step 6) Although the plating on the circuit board is believed to be tin, the builder should use some kind of self adhesive tape to cover the touch pad. This will prevent continuing direct contact with the plated touch pad. Direct contact with the metal is NOT required for this type (capacitive) of touch switch, so a thin layer of tape should not affect the operation of the switch that much.

Operation:

The PICCPO is operated by applying power, waiting for the turn on FB send to finish, and then just by touching the pad (on the component side) to hear the tone (and key the output transistor).

The PICCPO will enter a "sleep" mode after about 45 seconds of inactivity to save power. At 5 volts, the supply current will go from about 0.75 mA when active to 9 uA when sleeping. At 3.8 volts (3 AA Nimh cells), the supply current will go from about .55 mA to 4 uA. The PICCPO will awake with the next press of the touch pad, note that this wake up may take a little longer than the normal press.

Notes:

If a pair of PICCPO kits are used for a keyer paddle, the builder can hook up a piezo between the two boards (no ground is required, connect one wire of the piezo to the piezo output of one board and the other wire to the piezo output of the other board) and hear the effect of touching the switches. As each touch pad is contacted in turn, the normal sidetone will be heard. If both touch pads are contacted at the same time, the user will hear a wavering tone. Normally the user will want to use this piezo connection just for testing and switch it out of the circuit when connected to a keyer.

Mounting the kits back to back will make for a conventional style of keyer paddle. First, trim the soldered leads on the bottom of the board (including the socket pins) as flush as possible. Next, cut a small piezo of heavy paper or thin cardboard to roughly the shape of the half of the board with circuitry. Third, using 4-40 sized hardware, a nut and a ½ inch bolt, attach a right angle bracket, on the component side of the board, using one of the two mounting holes in the middle of the board, the nut should be on the solder side of the board. Next, use another 4-40 sized nut and ½ inch bolt on the other hole, again with the nut on the solder side. Next, fit the other board over the two ½ inch bolts, solder side towards solder side, use the heavy paper/thin cardboard as an insulator between the two boards. Next, use two more 4-40 sized nuts to attach another right angle bracket and the top bolt. The assembly can now be mounted to an appropriate base or box (such as a candy tin) using the pre-threaded holes of the right angle brackets.

Please feel free to email with any questions, comments, suggestion or problems with this kit. My email address is:
        jacksonharbor@att.net

Thanks for choosing the PICCPO kit and
Best Regards,

Chuck Olson, WB9KZY   Copyright © 2009 by Charles J. Olson

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List of parts included with the PICCPO kit

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Ref    marking                      Description
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C1     104                          .1 uf multilayer ceramic capacitor
C2     103                          .01 uf multilayer ceramic capacitor
R1     yellow-violet-yellow-gold    470 k ohms 1/4 watt resistor
Q1     2n7000                       2n7000 n channel MOSFET transistor
U1     PIC12F629                    8 pin DIP,programmed PIC microcontroller
                                    8 pin machined pin socket (for  U1)
                                    circuit board


Items you'll need to provide to complete the PICCPO kit
      optional Metal case (an Altoids tin is fine)
      4-40 sized (1/8 inch) mounting hardware
      optional output jack
      3 cell battery holder
      piezo speaker, external drive type
      solder, wire
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