Building	The PK-4
and	from Jackson Harbor Press
Operating:	A PIC based keyer kit with pot speed control

General notes about building: The components should be inserted a few at a time, soldered in place and then the leads are clipped. All the leads for any particular pad should be inserted prior to soldering to prevent clogging the holes. The pads and traces are small and delicate - a small tipped, low power (25 watts or less) soldering iron should be used.

Also, machined pin SIP sockets (not supplied) can be used to provide the connection points to the off-board components, then the builder will be able to plug the wires (solid not stranded) from the components into the SIP sockets which simplifies moving the unit in and out of the enclosure. One source for these SIP sockets is Mouser, their #506-510-AG90D, these are a little expensive, another cheaper way to use these sockets is to cut up a regular machine pin socket.

Finally, the integrated circuit (IC) and the keying transistor are both 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 the ICs.

Building the PK-4 - Step 1) Get the parts together: All of the board mounted components have been supplied. You will still have to provide off-board items from the stocklist to fully implement the keyer including the enclosure, speed pot, switch, jacks, battery holder and connector, piezo transducer and mounting hardware. Be sure to get the piezo transducer that requires external drive - basically a very high impedance speaker - an excellent, though large, piezo speaker is the Mouser #: 665-AT-142. A different piezo (from the vendor Murata) could also be considered (Mouser #: 81-PKM22EPP-4001).

Step 2) Identify and orient the components: Most of the components should be fairly easy to identify and place. The .01 uF monolithic ceramic bypass capacitors are very small yellow or blue parts with 2 radial leads spaced .1" apart. You may need a magnifying glass to see the markings on these parts. The four .01 uF bypass caps are marked 103. Note that C6, the pot timing capacitor, is also a .01 uF capacitor but that it is reddish brown in color and has a .2” lead spacing. U2, the 5V regulator (LM2936), is laser marked and thus hard to read - try to view U2 at an angle in strong light to see the marking. Q1 is also laser marked with the 2N7000 part number.

Step 3) Mount and solder the components on the board: Use the parts placement diagram for the placement and orientation of the parts.

Start by inserting the 8 pin IC socket with the small notch towards the top of the circuit board and then soldering it in place. Then insert the remaining components at the positions shown on the parts placement diagram. Three of the components should only be inserted one way or they can be damaged by reversed polarity. C2, the 47 uF electrolytic capacitor, should be inserted with the negative stripe to the top side of the board. C2 can also be inserted with the leads bent at a right angle which results in a lower overall height for the board. Q1, the 2N7000 transistor, should be inserted

with the flat face to the right of the board. U2, the LM2936 voltage regulator, should be inserted with the flat face to the top of the board. Be sure to solder all the connections and clip leads.

Step 4) Check your work: 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 electrolytic capacitor, transistor and voltage regulator. After you are convinced that the board is OK and after you have formed the leads of the IC to fit in the sockets, insert the keyer IC into the socket, being sure to follow the parts placement diagram for proper orientation. Now hook up the Piezo transducer (beeper) to the connection points on the left side of the board (including a connection to ground. Also solder the 9V battery snap to the top-left side of the board.

Next, power up the board. An FB should be sent by the keyer at powerup through the sidetone if the keyer is functioning correctly. Note that you will only hear the FB if the voltage across the 47 uF capacitor is fully discharged - since the keyer IC consumes less than 10 uA of current in sleep mode it can take a long time before the capacitor is fully discharged UNLESS a switch is pressed while the power is off. If you don't hear the FB, use a VOM to measure the current drawn. With a regulator, the idle current draw after powerup at 9 V should be less than 10 uA. This will jump up to as much as 1.5 mA or so when the keyer is active.

If you see significantly higher currents, power down immediately and check again for shorts and/or opens. If the currents look reasonable, then power down and hook the unit up to the switch, pot, paddle and output jack and proceed to the Operation section.

The kit has a micropower +5V regulator which allows a user to connect a 9V battery and leave it connected without a power switch. Note that the operator can also use a nominal 12 volt supply (13.8 volts) or a lower voltage battery (down to roughly 6 volts). The standby power drawn will be roughly 7 uA. Active power is about 1.5 mA maximum with both paddle switches pressed - a MOSFET is used as the output transistor and this minimizes the active current - also, the sidetone should be connected to a piezo transducer which uses only 50 uA or so. For even lower sleeping currents, the regulator can be removed and replaced with either a 3 volt or 4.5 volt (2 or 3 AA cell) battery.

<u>**Construction Notes:**</u> If the keyer is to be packaged in the same case as the transceiver, it is possible to inject the sidetone directly into the audio chain of the radio instead of using a piezo transducer for the sidetone. The circuitry needed for this injection is a fairly simple RC circuit to decrease the level of the sidetone from 5V peak to peak and also to filter the square wave slightly (see the FREQ-Mite article in the December 1998 issue of QST OR the Norcal 20 article in the Spring 1999 issue of QRPp for more details on this type of circuit). Note that the Sidetone Float option in the mem + dah sub menu will be useful for an injected sidetone to minimize thumping. I prefer to mount the keyer in a separate box so that it can be disconnected from the rig and used for practice anywhere.

The keyer will fit into small metal boxes such as Altoids mint tins. One possible problem area for this type of enclosure is finding a pot that is small enough to fit. Mouser (800 346 6873) sells a 13 mm diameter, 100k pot (# 31CX501) that fits nicely into one of these types of tins. The small 4 mm shaft size of the pot requires a special knob - Mouser also has these (# 45KN050).

If damaged, Q1, the 2N7000 MOSFET output transistor, can be directly replaced by the more common 2N2222 or 2N3904 type NPN transistor. The orientation is the same, however the NPN transistor will require more drive current than the 2N7000 MOSFET.

Note that the output transistor circuit is designed to switch key inputs of 13.8 volts positive or less. Don't attempt to use the PK-4 keyer with a vacuum tube transmitter (either grid block or cathode keyed) without an appropriate outboard circuit - consider purchasing the Keyall kit (from Jackson Harbor Press) or consult older ARRL handbooks for these circuits.

The minimum pot speed will increase if the power supply voltage decreases below 5 volts.

Operation: General notes on using the switches to control the keyer: To give the keys multiple functions, multiple key-press combinations are used. Also, the memory switch can be pressed and released (PAR) OR pressed and held for two seconds (PAH). This also gives more combinations of the three control switches (dit, dah and memory switch).

Generally, PAR is used for actions: send the code speed or send a memory. PAH is used for settings: change the code speed (no pot) or record a memory or change the iambic mode.

Four menus are used for setting various options - they are activated by a PAH of the memory switch alone or plus a simulpress of dit or dah or both. The menu selections are made by pressing either the dit or dah levers - you will then normally hear a corresponding dit or dah via the sidetone, the selection will be made and you are then returned back to normal keyer mode. In general, the operator can skip a menu item by a PAR of the mem switch. The operator can "bailout" from a menu to normal keyer operation with a PAH of mem, then hit both dit and dah, then release mem (single lever paddle users can hit dah and dit in turn).

Note that the keyer sidetone will be lower in pitch for keyer commands such as the menu prompts, recording a memory or the FB sent at powerup. The normal pitch for routine sending or practice is higher and can be adjusted in frequency.

A function table of the PK-4 keypress combinations:

keys used	PAR (press and release)	PAH (press and hold)
mem switch	send mem 1	record mem 1 and beacon options
mem + dit	send speed or mem 3	paddle set of speed, pot options, record mem 3
mem + dah	send CQ or callsign alone	Tune, record callsign & CQ options
mem + both	send mem 2	record mem 2 and miscellaneous options

Powerup: Roughly one half second after powerup the keyer will send an FB through the sidetone to signal correct operation.

Speed Readout: The speed (in WPM) will be played through the sidetone if the mem switch is simulpressed with the dit lever and then both are released. I normally press the memory switch first and hold it, press the dit lever and finally release both.

Speed Control and Menu: The speed can be adjusted by just turning the pot. Maximum speed is 50 WPM, minimum speed is 5 WPM. Note that the minimum speed can be affected by component tolerances on the timing capacitor and the speed pot - see the pot calibration menu item if a 5 WPM minimum speed is required. The pot position is read continuously when the keyer is sending code, just before each dit, dah or space is sent. This allows the operator to adjust the code speed even in the middle of a memory send or record.

If you disconnect the pot from the circuit, the keyer will powerup at a default speed of 21 WPM. The speed can be adjusted by pressing and holding the memory switch along with the dit lever. Usually I PAH the memory switch and then tap the dit lever. After 2 seconds, the keyer will send an S (for speed set). Press the memory switch to advance to the next menu item without changing the speed. Or, pressing the dit lever will increase the speed by 1 WPM and send a dit. Pressing the dah lever will decrease the speed by 1 WPM and send a dah. You can continuously adjust the speed by holding either lever but note that if you run the keyer "off the scale" at either 5 or 50 WPM, the keyer will "wrap around" to the opposite speed extreme. Exit the speed adjust routine by pressing and releasing the memory switch - the code speed will be sent via the sidetone upon exit (see the SO menu item below to turn off this speed send).

<div align="center">Mem + dit menu (PAR mem to advance to the next menu item)</div>

	Menu item	pressing a dit:	pressing a dah:
S	Speed set from paddle	increases speed by 1 WPM	decreases speed by 1 WPM
W	Weight	increases the "weight"	decreases the "weight"
P	Pot / paddle speed control	selects pot speed control	selects paddle speed control
C	Calibrate pot speed control	enters the calibration routine	restores default pot calibration
TM	Third Memory	selects the optional 3rd memory - O? is sent and then the third memory is recorded.	returns to 2 memories and exits menu (default)
SO	Speed (send) Off	turns off the speed send at the exit of the S menu item above	turns on the speed send at exit of S menu item (default)

W - Weight: Normally the PK-4 will send dits and dahs with a 1:3 ratio. The W menu item will allow the user to change this ratio. Pressing a dah will decrease the weight, making both the dits and dahs shorter by about 0.8 % of a dit length - an N is sent for the user to judge the change in weighting.. Pressing a dit will increase the weight making the dits and dahs longer by about 0.8 % of a dit length- an A is sent.. Simulpressing the dit/dah will send an R and reset the weighting to zero and re-establish the 1:3 ratio (single lever paddle users can send a quick N to reset the weighting). Exit the weight routine with a PAR of the mem switch. The maximum weight is about +/- 50 percent of the current dit length, 63 total steps higher or lower in weight.

P - Select Pot or Paddle speed control: If the keyer is accidentally put into the paddle speed control mode the pot speed control can be resumed by pressing dit.

C - Calibrating the Pot speed control: Due to the variation in capacitors and pots it is possible that the maximum setting of the pot will result in a minimum speed higher than 14 WPM. This menu item will compensate and store an updated calibration value. Before

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entering the menu, be sure to turn the pot to the minimum speed. Then press the dit to go into the calibration routine - you then may hear one or more dits and the keyer will exit from the menu. If the pot calibration is run with the pot above midscale, the keyer may jump into paddle speed control if the pot is then turned below mid-scale after calibration is complete. It won't be possible to exit paddle speed control because the calibration value is too low. Pressing a Dah will restore the default powerup calibration value and thus allow normal pot speed control again.

TM - Third Memory (enable / record / disable): This option enables (then records) OR disables an optional 3rd memory. The callsign memory is then split into two 40 character memories, the third memory is now what was the second half of the callsign memory. This new third memory is then played with a mem+dit PAR simulpress. Record memory 3 in the same fashion as the other 2 memories. The speed send is moved into the mem+dit menu as the first item. Press either dit or dah to exit the mem + dit menu after the speed has been sent.

SO - Speed (send) Off: With a dit press, this menu item turns off the speed send at the end of the paddle speed set menu item. A dah press will reinstate the speed send.

Recording the Callsign Memory or using the Menu: A callsign (or regular memory) of up to 80 characters long can be recorded (40 if TM is used). This can be handy for things like: `WB9KZY/9` . The callsign memory menu is entered by simulpressing the memory and the dah keys and holding them for 2 seconds. I usually PAH the memory switch and then tap the dah key.

Mem + dah menu (PAR mem to advance to the next menu item)

	Menu item	Pressing a dit:	Pressing a Dah
TU	TUne mode	starts/ends key down	enter sub menu (see next menu)
CL	Cq Loop mode on/off	turns on the CQ loop mode	turns off CQ loop (default)
?	Record callsign memory	records a dit	records a dah
CS	Cq Select	increases CQs sent by 1	decreases CQs sent by 1
Q	/QRP after last callsign	selects the /QRP option	deselects /QRP (default)
RP	RePeat of CQ+callsign	increases CQ+CS repeat by 1	decreases CQ+CS repeat by 1
CR	Callsign Repeat select	increases callsigns sent by 1	decreases callsigns sent by 1
PS	PSe suffix to CQ	turns on PSE send after CQ	turns off PSE send (default)

CL - Cq Loop mode: After 2 seconds the keyer will send CL. Press the dit lever to turn on the CQ loop mode. Then a mem+dah PAR will start a continuous send of the CQ sequence, spaced apart by the beacon delay set in the D item of the mem switch menu. Press the dah to turn off the CQ loop mode. Then the mem+dah PAR will play the CQ sequence only one time.

TU - Tune mode: After a mem switch PAR the keyer will send TU. Press the dit lever to enter tune mode (key down). Exit tune mode by a PAR of dit or dah. Tune mode can also be entered using the 5 didah tune mode (see the notes at the end of this manual).

? - Record the Callsign Memory: The callsign can now be recorded. When complete, press the memory switch. The routine will be exited automatically after the 80th character is

sent. The callsign memory is saved in EEPROM - it will still be there even if power is removed. If the mem+dit memory is enabled, it will be possible to overrun it during the callsign record since the mem+dit memory starts at the 41st character of the callsign memory.

CS   -   Cq select: The number of CQs sent during the CQ + callsign can be varied from 0 to 7 with this menu item. PAR of dah will decrease the number of times CQ is sent by 1 - PAR of dit will increase the number of times CQ is sent by 1. PAR of mem will exit the menu and send the number of CQ repeats. The setting will wraparound the opposite limit when the count goes above 7 or below 1. The reset (default) count is 4 CQs.

Q   -   /QRP after last callsign: This option will allow the operator to append a /QRP to the last callsign sent - for example: `CQ CQ CQ CQ DE WB9KZY WB9KZY/QRP K`

Press dit to select the /QRP option, press dah to return to the default non-/QRP CQ. The keyer will send either a dit or dah and then exit the menu.

RP   -   RePeat of CQ+callsign send: The number of times the CQ+callsign is repeated can be varied from 1 to 4 with this menu item (the default count is 1). PAR of dah will decrease the number of times the CQ+callsign is sent by 1 - PAR of dit will increase the number of times the CQ+callsign is sent by 1. PAR of mem will exit the menu and send the number of CQ+callsign repeats. The setting will wraparound the opposite limit when the count goes above 4 or below 1.

CR   -   Callsign Repeat: The number of callsigns sent during the CQ + callsign can be varied from 1 to 4 with this menu item (the default count is 2). PAR of dah will decrease the number of times the callsign is sent by 1 - PAR of dit will increase the number of times the callsign is sent by 1. PAR of mem will exit the menu and send the number of callsign repeats. The setting will wraparound the opposite limit when the count goes above 4 or below 1.

PS   -   PSe cq mode: A PAR of the mem switch will advance to PS. Press the dit lever to turn on the PSE cq mode. This will send a PSE before the final K in the CQ sequence. Press the dah lever to turn off the PSE send in the CQ sequence (off is the default state).

Mem + dah sub menu (PAR mem to advance to the next menu item)

	Menu item	Pressing a dit:	Pressing a dah
TO	TimeOuts on/off	turns off the dit/dah/tune timeouts	turns on dit/dah/tune timeouts
SP	Single paddle tune on/off	turns on single paddle tune mode	turns off single paddle tune (default)
H	Half PAH delay	sets PAH delay to 1 second	resets PAH to 2 second (default)
SF	Sidetone Float mode	floats pin 3 between characters	turns off float (default)
ST	SideTone on / off	turns off the sidetone	turns on the sidetone (default)
AS	Accukeyer/CMOS III	selects Accukeyer mode B	selects CMOS Super III (def)

TO   -   TimeOuts on/off: To prevent neverending strings of dits/dahs or didahs caused by a stuck paddle, a timeout mode has been added to the PK-4 which will put the keyer to sleep

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if the paddle is held for 128 straight dits, dahs or dits and dahs. Also, tune mode will be automatically exited after about 14 seconds. These timeouts default to ON but can be turned off with a dit press.

SP - Single lever Paddle tune mode: Users of single lever paddles will find it hard to use the 5 didah tune mode unless an extra switch is used to enable pressing both the dit/dah at the same time. This menu item allows the single lever paddle user to turn on the ability to enter tune mode after either 10 dits or 10 dahs in a row.

H - Half PAH delay length: Some operators may desire a shorter PAH (Press and Hold) delay time to speed up the entry into the various menus. Press a dit to shorten the delay to 1 second. Press a dah to restore the PAH delay back to 2 seconds.

SF - Sidetone Float on/off: The reason for floating the sidetone pin is to minimize thump from the sidetone when the PK-4 chip is used to inject sidetone into a rig audio chain (example: 38 Special or Norcal 20). The float should normally be DISABLED when using a piezo sidetone to prevent excessive power supply current in the sleep mode.

ST - SideTone on/off: The sidetone will still be engaged during any menu or recording entry and during practice mode even if it is turned off with this menu item - this item allows the user to employ his rig sidetone.

AS - Accukeyer or Super CMOS iambic mode B: There are at least two varieties of iambic mode B. The Super CMOS keyer (see QST, October 1981) ignores the dit input during the first 1/3 of a dah. The idea is that the operator has a little extra time to release the dit paddle before a dit is appended to the dah being sent. The Accukeyer (see QST, August 1973) latches in a dit during the whole of the dah period.

Playing the CQ + Callsign Memory: Play the CQ memory by simulpressing and releasing the memory and the dah keys. I usually PAH the memory switch and then tap the dah lever - the memory starts to play after the memory switch is released.

General notes on playing any of the memories: A tap of either the dit or dah lever will stop the message play (except during the playing of /QRP). PAH the mem key during playback to pause the message at the end of the play of the current character, you can then send manually with the paddles and the PK-4 will automatically resume message play.

General notes on recording Mem 1 and 2: Note that you can insert the callsign memory at any given point in the message by sending 6 dahs in a row. You can also insert a pause into the memory by recording the AS (di-dah-di-di-dit) character. Message play will stop when an embedded pause is reached - the paddle can then be used to send something manually - message play will then resume after a word space length delay. This is useful for inserting an RST or a serial number into a message. You can also embed a space of 6 dits in length by entering a special character of di-dah-dah-dah-dit. Note that spaces do count as characters in the capacity of a memory. You can insert the callsign memory, pause or space multiple times - each insertion takes up one character in memory. Also, the operator can

"backspace" the memory while recording by a PAR of mem+dit. The PK-4 will play the character backspaced over. Note that the three special characters above will be played as recorded (6 dahs, AS and AG) rather than as their functions. Normally the PK-4 will play a word space (AG) as the first character to be backspaced over. If the operator needs to insert a word space, it can be sent as an AG or the character previous to the word space can be backspaced over and resent, then the word space will be automatically inserted after allowing an appropriate time to wait before proceeding with the rest of the recording.

Playing Mem 1: Play the memory with a PAR of the memory switch. The memory will start to play right after the memory switch is released. Mem 1 is preloaded with the callsign memory at powerup but can be re-recorded using the M? Item in the mem menu (see M? explanation).

Recording Mem 1 and Menu: The Mem 1 menu can be entered by a PAH of the mem switch (alone) for 2 seconds. After 2 seconds the keyer will enter the menu (you'll hear a BE).

Mem switch menu (PAR mem to advance to the next menu item)

	Menu item	pressing a dit:	pressing a dah:
BE	BEacon mode	starts the beacon going	enter sub menu (see next page)
M?	Record Mem 1	records a dit	records a dah
KD	Key Down beacon delay	selects key down during the delay between memory sends	selects key up (default) during delay between memory sends
BA	Beacon Alternate mode	selects alternate beacon sends of mem 1 and mem 2	selects send of mem 1 only (default)
D	change the beacon Delay	increases delay by 1 second	decreases delay by 1 second

BE - Beacon Mode: Beacon mode will send the contents of mem 1 continuously with a selectable (see D below) pause in between each play of the memory. Start the beacon by pressing the dit lever - the beacon starts to play. Exit beacon mode by tapping the dit or dah lever.

M? - Record Mem 1: Start sending your message. when complete, press the mem key. The memory is 80 characters long - recording will terminate automatically after the 80th character.

KD - Key Down beacon delay: Press dit to select the key down beacon delay mode. This will enable the sending of a constant key down during the interval between sending the beacon message. Press dah to return to the default key up beacon delay. The keyer will send either a dit or dah and then exit the menu.

BA - Beacon Alternate between mem 1 and mem 2 mode: This routine selects/deselects alternating the beacon between mem 1 and mem 2.

D   -   increase the beacon delay: The beacon delay will default to 0 seconds (a single word space, a char space for the CQ+callsign loop). The maximum beacon delay is 63 seconds. After pressing either dit or dah the keyer will send a dit or dah through the sidetone. When you get to the desired delay time, press the memory switch to exit from the menu - the keyer will send the delay length through the sidetone. The routine will "wraparound" from high to low OR from low to high delay values similar to the paddle speed control. Note that the delay times are approximate. Pressing both paddles at the same time will reset the beacon delay to zero (single lever paddle users can send a quick N to reset the beacon delay to zero).

<div align="center">Mem switch sub menu (PAR mem to advance to the next menu item)</div>

	Menu item	pressing a dit:	pressing a dah:
SS	Sidetone Set	lowers sidetone frequency	raises sidetone frequency
DD	Debounce Delay set	increases delay by 1.66 ms	decreases delay by 1.66 ms
AU	Autospace on / off	turns on character autospace	turns off autospace (default)
ES	Enable Straight key	turns on the straight key mode	turns off straight key (default)
DI	DIt memory on / off	turns off the dit memory	turns on dit memory (default)
DA	DAh memory on / off	turns off the dah memory	turns on dah memory (default)

SS   -   Sidetone Set: Pressing the dah lever will raise the sidetone frequency, dit will lower the frequency. If either lever is held, the tone will ramp up or down. The tone will "wraparound" at either the top or bottom frequency allowed. The command sidetone frequency is not changed. When the desired frequency is reached, PAR the mem switch to exit the Sidetone set routine. Note that the command sidetone frequency is fixed at about 270 Hz. The normal operating sidetone can be varied from about 390 to 1750 Hz. The powerup reset (default) sidetone frequency is about 580 Hz.

DD   -   Debounce Delay set: This menu item allows the operator to set the debounce delay time for the bug and straight key modes. Mechanical telegraph keys and iambic paddles have contacts which will bounce for a time after the switch is actuated or released. The PK-4 software usually waits for a 20 ms (a count of 12) debounce delay time before checking a switch for make/break. This allows the operator to send Morse code at up to 60 WPM. However, this delay may be either too short (key bounces for longer than 20 ms) or too long (external keying apparatus may operate at higher than 60 wpm?). Each press of the dah lever will decrease the delay by about 1.66 ms - pressing the dit will increase the delay by 1.66 ms. PAR the mem switch will exit the routine - the updated debounce count will be sent - note that the actual delay is 1.66 ms times the count value. The maximum delay is about 104 ms and is annunciated with a count of 63. The minimum delay is roughly a ms or so and is annunciated with a 0. Pressing both paddles at the same time will reset the debounce delay to 20 mS (a count of 12) (single lever paddle users can send a quick N to reset the debounce delay to 20 mS).

AU   -   AUtospace on/off: The autospace feature inserts a character space (1 dah in length) automatically if the operator has not pressed a paddle switch 1 dit space after the last dit/dah sent. This feature is always on in the memory record routines (needed for the recording process).

ES   -   Enable Straight key mode: A straight key mode is available without the need to use the bug mode menu item mentioned previously. This mode is similar to the one in the Elecraft K2 keyer - the PK-4 will output hand sent Morse code if both paddles are pressed at exactly the same time. The only practical way to do this is to use a simple diode switching circuit shown on the schematic.

The diodes can be 1N914 or 1N4148 or other silicon switching diodes. Note that after the ES mode is entered, the PK-4 will stay in the straight key mode for roughly 5 seconds, pressing the dit alone will be ignored, the dah will be treated as a straight key. ES mode defaults to OFF after a keyer reset.

DI - DIt memory on/off:
DA - DAh memory on/off: Normally the keyer has both dit and dah memories enabled - at higher speeds (30 WPM or more), some users may like "less" memory. The dit and dah memories are evident if the dit and dah paddles are pressed rapidly in order at low speed. If the dah memory is on, an A will be sent. If the dah memory is off, an E (single dit) is sent.

Playing Mem 2: First, hold the mem switch down, next, squeeze both paddle levers (single paddle users can press the dit first and then the dah or vice versa) then release the paddle and finally release the mem switch before 2 seconds elapse. The memory will start to play right after the mem switch release. The menu is entered if the mem switch is held for >2 seconds.

Mem + both menu (PAR mem to advance to the next menu item)

	Menu item	pressing a dit:	pressing a dah:
B	Bug / straight key mode	enables bug mode (dah = key)	disables bug mode (default)
T?	Record mem 2	records a dit	records a dah
PR	Practice mode	disables the output transistor	enables the output (default)
L	Live / dead recording	enables live keyer output	disables live output (default)
A	iambic mode A or B	enables iambic mode A	enables mode B (default)
U	Ultimate mode	turns on Ultimate mode	turns off Ultimate (default)
R	Reverse paddle mode	switches dit and dah levers	switches dit and dah levers

B - Bug / Straight-key mode: Press and hold (PAH) the mem switch and both paddle levers for 2 seconds. Hold the mem switch down, then squeeze both paddle levers simultaneously (single paddle users can press the dit first and then the dah or vice versa), then release the paddle, keep holding the mem switch until after 2 seconds the keyer will send B. Press the dit lever to enter bug mode where dits are sent normally but dahs are sent like a straight key. Press the dah lever to turn off bug mode and return to the default.

T? - Recording Mem 2: The second message of up to 80 characters long can be recorded by a PAR of the mem switch, the keyer will send **T?**. Mem 2 can now be recorded. When recording is complete, press the mem switch. If you wish to skip recording just press and release the mem switch alone to proceed to the next menu item:

PR - Practice mode: The output transistor is not keyed but the sidetone is retained. This allows the user to get used to the PK-4 without having to disconnect the rig. Note that PR takes precedence over the ST menu item - even if the sidetone is turned off with ST, turning on the practice mode with PR will re-enable the sidetone.

L - Live or Dead recording: Normally, the memory or callsign will be recorded by the user off the air (dead) but sometimes it's desirable to be able to record a message on the air (live).

A - Iambic mode A or B: The A mentioned above signifies the mode A/B select menu item. The iambic mode of the keyer can be set to either mode using this routine. Check the JHP web site for an Acrobat (.pdf) file which explains the difference between the A and B keying modes.

U - Ultimatic mode on/off: Ultimatic is a dual lever keying mode which predates the now popular iambic A/B modes. Ultimatic differs in this way from iambic: instead of an alternation between dit and dah when both levers are pressed, ultimatic will output the element of the last lever pressed. This can be handy for sending characters such as the ? (press and hold the dit for 2 dits, then while keeping the dit pressed, press the dah for 2 dahs, then release the dah for the last two dits). Note that Ultimatic setting takes precedence over either of the iambic modes. A dit will turn on ultimatic mode, a dah turns ultimatic off (default).

R - Reverse paddle mode: Reverses the dit and dah levers (easier than resoldering a jack).

Notes: C2, the 47 uF capacitor, will retain power on the keyer chip for quite a while even without the 9V battery connected. This can cause trouble in rare cases when the keyer gets hung up because any scrambled RAM memory will be retained.   To clear scrambled memory, remove power and then short out this capacitor OR hold down the mem switch for several seconds. Since all the memory contents (including the configuration settings) are contained are contained in EEPROM they will be retained after a full power cycle.

To perform a full keyer reset (all parameters, except memories, to their default values):
    1) remove power to the keyer
    2) PAH the mem switch for several seconds to discharge the capacitors
    3) powerup the keyer keeping the mem switch depressed until the FB is sent.

Quick Tune is a quick way to enter tune mode by sending 5 (or more) ditdahs in a row (hold both paddles for at least 5 ditdahs or dahdits) and then release the paddles - the PK-4 will then enter tune mode. Since there aren't any normally used characters of this length, this mode should not be actuated during normal sending. In Ultimatic mode, PAH both paddles, after 9 code elements have been sent the PK-4 enters tune mode. Exit tune mode with a tap of the dit or dah paddle.

If the PK-4 is used within a rig, there may be times where the operator may want to use an external key, bug, keyer or computer to key the rig. The PK-4 can be bypassed at powerup by holding either paddle until the FB is held. Then the other paddle will function as a straight key input until power is cycled again. One easy way to do this is to insert a mono plug into the stereo paddle jack. This will automatically short the sleeve paddle input to ground while the tip connection can be made to the external keying device.

The memories are preloaded with the following messages:

switches used	Memory	Contents at first powerup:
mem switch	memory 1	72
mem + dit	memory 3 (normally off)	HI
mem + dah	CQ+callsign or callsign alone	VVV
mem + both	memory 2	OK

Most of the features added in the PK-4 keyer were the result of suggestions from PK-3 and PK-2 users.   Please feel free to email with any questions, comments, suggestions or problems with the PK-4 - email to: `jacksonharbor@att.net`

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PK-4 kit parts list

Qty.	Ref.	Part Name	Description
1	U1	12F683	PK-4, 8 pin DIP keyer chip - Microchip Technology
1	U2	LM2936	5V ultra low standby current regulator, TO-92 pkg.
2	C1,C8	.22 uF	marked 224 - axial multi-layer ceramic capacitor
4	C3,C4,C5,C7	.01 uF	marked 103, .1" lead space multi-layer ceramic cap
1	C6	.01 uF	marked 103 - .2" lead space, 5% polyester capacitor
1	C2	47 uF	.079" lead space 25V electrolytic capacitor
1	R2	4.7 K ohm	Yellow-violet-red-gold, 1/4 watt carbon film resistor
1	R3	1 K ohm	Brown-black-red-gold - 1/4 watt carbon film resistor
1	R4	180 ohm	Brown-gray-brown-gold - 1/4 watt carbon film resistor
1	R5	10 k ohm	Brown-black-orange-gold 1/4 watt carbon film resistor
1	Q1	2N7000	TO-92 package MOSFET transistor
1	-	socket	8 pin DIP socket (machine pin)
1	-	PCB	PIC Keyer circuit board

The following items are *NOT* included with the kit:

1	R1	100 K ohm	Linear potentiometer
1			knob for pot R1
1			Piezo transducer Digi-key P9924-ND or equivalent
1	J1,J2		stereo paddle jack
1			xmtr jack
1			9 volt battery "snap" connector
1	SW1		normally open, momentary SPST switch
2			1N914 or 1N4148 switching diodes for straight key mode

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