Building   The MegaPK-**II**
and   from Jackson Harbor Press
Using: PIC based keyer kit with pot speed control and code practice

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 keyer "chip" (integrated circuit or IC), optional Solid State Relay (SSR), optional voltage regulator and the keying transistor 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 the ICs.

Building the MegaPK-II :

Step 1) Get the parts together: All of the required board mounted components have been supplied. The voltage regulator and Solid State Relay are optional and not included in the base kit. 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 – contact Jackson Harbor Press if you'd like to purchase a piezo with your keyer.

Step 2) Identify and orient the components: Most of the components should be fairly easy to identify and place. The .1 uF and .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. The .1 uF caps are marked 104. Note that C6, the speed pot timing capacitor, is a .015 uF capacitor, reddish brown in color, marked 153 and has a .2" lead spacing. Q1 is laser marked (view in strong light, at an angle) with the 2N7000 part number.

Step 3) Mount and solder the components on the board: Use the parts placement diagram (annotated picture) for the placement and orientation of the parts. There are two diagrams, one for the standard MegaPK-II kit and the other for the MegaPK-II with optional SSR and 3V voltage regulator.

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. Some of the components should only be inserted one way or they can be damaged by reversed polarity. C2, the optional 2.2 uF Tantalum electrolytic capacitor, should be inserted with the positive lead (marked with a + sign and which is longer than the other lead) towards the keyer chip. Q1, the 2N7000 transistor, should be inserted with the flat face to the right of the board. U2, the optional 3 volt regulator should be inserted with the flat face away from the top edge 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 battery holder leads 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 bypass capacitor is fully discharged - since the keyer IC consumes less than 1 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 about 1 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 as an option a micropower +3V 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 below 4 volts).   The standby power drawn will be roughly 1 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 normal operation with even lower sleeping currents, the regulator can be removed and replaced with a 3 volt (2 AA cell) battery.   Note that the optional SSR will increase the active current by 5-10 mA or so.

Construction Notes: 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 3V 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.   Contact Jackson Harbor Press about purchasing a small pot with the MegaPK-II kit.

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 MegaPK-II keyer with a vacuum tube transmitter (either grid block or cathode keyed) without an appropriate outboard circuit - consider purchasing the optional on-board SSR OR the Keyall kit (from Jackson Harbor Press) or consult older ARRL handbooks for these circuits.

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 (PAH) for two seconds (duration adjustable by user). 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 enter command mode.

4 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.

Note that the keyer sidetone defaults to a frequency of about 990 Hz (pitch adjustable by user) for keyer commands such as the menu prompts, recording a memory or the FB sent at powerup. The default frequency for routine sending or practice is lower at about 600 Hz and can be set by the user from 250 to 990 Hz in 10 Hz increments.

A function table of the MegaPK-II keypress combinations:

keys used	PAR (press and release)	PAH (press and hold for 2 seconds)
mem switch	send mem 1	beacon start (BE) and record mem 1 (M?)
mem + dit	send speed or mem 4	paddle set of speed (S)
mem + dah	send mem 3	tune mode (TU) and record mem 3 (?)
mem + both	send mem 2	command entry (CE) and record mem 2 (T?)

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, tap the dit lever and finally release the mem switch.

Speed Control and Menu: There are 2 options for controlling the speed of the MegaPK-II. An optional speed pot can be used OR the speed can be controlled using the paddle.

The MegaPK-II has a speed pot derived from the PK-x series of keyers and uses a 100K linear pot with an external .015 uf capacitor and a series 1k resistor. The speed can be adjusted by just turning the pot. Maximum speed is 67 WPM, minimum speed is 5 WPM. Note that with the speed pot, the minimum speed can be affected by component tolerances on the timing capacitor and the speed pot, with a 90k ohm maximum value pot and a .015 uF timing cap, the minimum speed will be something like 15 wpm – either change the values of the timing resistance/capacitance OR see the pot calibration command item if a lower 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. After pot calibration the SR (Speed Range) command can be used to set the low and high speeds of the speed pot range.

If you disconnect the speed pot from the circuit, the keyer will powerup at a default speed of 16 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 (in other words, I treat the mem switch like a shift key on a computer keyboard). 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 ca continuously adjust the speed by holding either lever but note that if you run the keyer "off the scale" at either 5 or 67 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 SS command item (SSF) to turn off this speed send). Also note that with the default of the command speed set at 15 wpm, the dits and dahs will always be sent at the same speed (15 wpm), to hear the changing speed of the dits/dahs the command speed (command entry item CS) needs to be set to 00.

Mem + dit menu (PAR mem to advance to the next menu item)			
	Menu item	pressing a dit:	pressing a dah:
S	Speed set from paddle	increases speed by 1 WPM	decreases speed by 1 WPM

Playing Mem 3: Play mem 3 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. PAH the mem key during playback to pause the message at the end of the play of the current character, then let go of the mem switch and then you can then send manually with the paddles - re-enter the message play with a PAR of the mem key.   If the memory is empty an E will be sent via the sidetone.

Table of memory attributes:

memory	Switch combination	Memory size, characters	Memory preloaded contents
Mem 1	Mem alone	60	HI
Mem 2	Mem + both	120 (60 when mem 4 is used)	OK
Mem 3	Mem + dah	60	TEST
Mem 4	Mem + dit	60	Not preloaded

General notes on recording any of the memories: You can 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 - the message play will then be resumed automatically after a word space elapses. 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-dah-dah-dit.   Note that spaces do count as characters in the capacity of a memory. You can insert the pause or space multiple times - each insertion takes up one character in memory. DX operators, see the I command for alternate (7 element) characters for the pause insert.

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 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	toggle powerup beacon on/off
M?	Record Mem 1	records a dit	records a dah

BE   -   Beacon Mode: Beacon mode will send the contents of mem 1 continuously with a selectable (see BD command on next page) 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. Pressing a dah will toggle the powerup beacon mode on and off - default is off. Note that after the dah is pressed, the keyer will proceed to normal operation. The next time the keyer is powered up, the change will take effect. The powerup beacon mode will start the beacon right after the FB is sent after turning on the power to the keyer.

M?   -   Record Mem 1:   Start sending your message. when complete, press the mem key. The memory is 60 characters long - recording will terminate automatically after the 60th character.

Playing Mem 2: First, hold the mem switch down, next, squeeze both paddle levers (they can be touched in sequence for single paddle users) 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.

Recording Mem 2 and Menu: The second message of up to 120 characters long can be recorded by a PAH of the mem switch and both paddle levers for 2 seconds. Hold the mem switch down, then squeeze both paddle levers simultaneously (they both must be down at the same time), then release the paddle, keep holding the mem switch until after 2 seconds 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:

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

	Menu item	pressing a dit:	pressing a dah:
CE	Command Entry	enter commands via the paddle	enter commands via the paddle
T?	Record mem 2	records a dit	records a dah

CE   -   Command Entry:
This item is the primary way to change the various parameters of the MegaPK-II. There are two basic actions with CE, first the user can query the keyer about the state of any parameter by sending the one or two character parameter abbreviation by itself. Second, the user can change the parameter setting by sending the one or two character parameter abbreviation along with an N (for oN) or an F (for oFf). OR, the user can send the parameter along with a numerical entry (such as weight percentage or tone frequency). The available commands are listed here in two sections, the first are the numerical entry commands, the second are the on/off commands. Each of the commands is also explained by itself.

Note that the keyer will default to exiting the CE loop after a command but staying in the loop after a query. Also note that the keyer will send an error (8 dits) if there is a problem with the command as sent.   The user must eliminate extra space between characters of a command (avoid "Farnsworthing") or the keyer will misinterpret the command as a query or simply send an error.

Numerical entry commands:

Command	Query	Explanation
Txx	T	Sidetone frequency, xx => 25 to 99 (250 - 990 Hz), default is 600 Hz
Wxx	W	Weight percentage, xx => 20 to 80 percent, default is 50 %
DDxx	DD	Debounce Delay, xx => 01 to 99 ms, default is 25 ms
BDxx	BD	Beacon Delay time, xx = 00 to 60 seconds, default is 0
CTxx	CT	Command Tone frequency set, xx = 25 to 99, default is 99
CSxx	CS	Command Speed set, xx = 00 or 05 to 67, default: 15 wpm
Hxx	H	press and Hold delay time, xx = 01 to 99 (tenths of second) - default is 20 (2 seconds)
SRxxyy	SR	Speed Range set, xx = low limit, yy = high limit, default is speed range OFF

Txx / T   -   sideTone frequency set / query: Txx allows the operator to set the sidetone frequency for normal operation.   The frequency can range from 250 Hz to 990 Hz - the frequency is entered in 10 Hz steps (drop the third digit).   A frequency entered below 25 results in a 250 Hz sidetone setting. A T sent alone will result in the sending of the current sidetone frequency setting followed by a loop back to CE.

Wxx / W   -   Weight set / query: Consider a dit or dah as the mark (key down) plus the space (key up) after it.   Normally a dit mark and space are equal in length - this 1:1 ratio can be expressed as a percentage (50%) mark (key down) duty cycle. Wxx allows the operator to vary this percentage from 20 to 80 percent. Lowering the duty cycle results in a "lighter" sound - Increasing the duty cycle results in a heavier sounding element. Note that the percentage refers to the dit, but also affects the dah, too. A dah can be thought of as three dit marks (key down) run together followed by a dit space (key up). The weight setting affects only the third dit mark (key down) and the following dit space of the dah. Code speed is unaffected by the weight setting, the same number of dits and dahs will be sent at a given code speed, they will just sound differently. A W sent alone will result in the sending of the current weight setting followed by a loop back to CE.

DDxx / DD   -   Debounce Delay set / query: DD allows the operator to set the debounce delay time for the straight key modes.   Mechanical telegraph keys and iambic paddles have contacts which will bounce for a time after the switch is actuated or released. DD defaults to a 25 ms debounce delay time before checking a switch for make/break. This allows the operator to send Morse code at up to 49 WPM or so. However, this delay may be either too short (key bounces for longer than 25 ms) or too long (external keying apparatus may operate at higher than 49 wpm). The Debounce Delay may be set from 0 to 99 ms. To change the debounce delay to nine milliseconds, enter: DD09 (the leading zero is required for debounce delays of less than 10 ms). Note that if the delay is set to zero, the actual resulting delay will be more than 250 ms long which will result in a maximum code speed of less than 5 wpm. A DD sent

alone will result in the sending of the current debounce delay setting followed by a loop back to CE.

BDxx / BD   -   Beacon Delay set / query: The beacon delay defaults to a single word space (0 seconds). The maximum beacon delay is 60 seconds. After entering a BD query, the keyer will send the current beacon delay length through the sidetone. To change the beacon delay to five seconds, enter: BD05 (yes, the zero is needed for delays of less than 10 seconds, including 00). Note that the delay times are approximate, roughly 10% long.

CTxx / CT   -   Command sideTone frequency set / query: CTxx allows the operator to set the sidetone frequency for command entry or annunciation. The frequency can range from 250 Hz to 990 Hz - the frequency is entered in 10 Hz steps (drop the third digit).   A frequency entered below 25 results in a 250 Hz sidetone setting. Setting a command sidetone frequency completely different than the normal sidetone frequency makes it easy to distinguish when the keyer is in command mode versus normal mode. The default for CT is 99 (990 Hz). A CT sent alone will result in the sending of the current command sidetone frequency setting followed by a loop back to CE.

CSxx / CS   -   Command Speed set / query: CSxx allows the operator to set the speed for command entry or annunciation. The default for CS is 15 wpm. A CS setting of 00 (zero) means that the command speed is the same as the normal speed (adjustable by the pot or paddle). To change the command speed to 9 (nine) wpm, enter: CS09 (the leading zero is needed for speeds of less than 10 wpm, including 00). The allowable command speeds range from 5 to 67 wpm with the addition of 00 for the default tracking command speed. Setting a command speed completely different (usually slower) than the normal speed can make it easier to enter commands or understand keyer annunciations such as the code speed. A CS sent alone will result in the sending of the current command speed setting followed by a loop back to CE (note that if CS was set to 00, the keyer will send 0 and then it will send the speed set with either the pot or paddle).

Hxx / H   -   press and Hold delay set / query: The press and hold delay defaults to 2 seconds. Some users may find this either too long or too short, so the delay can be set from .1 to 9.9 seconds. After entering an H query, the keyer will send the current press and hold delay time through the sidetone. To change the press and hold delay to .9 seconds, enter: H09 (yes, the zero is needed for delays of less than 1 second). Note that if the press and hold delay is set to 00, the actual press and hold delay will be well over 20 seconds. Note that the delay times are approximate.

SRxxyy / SR   -   speed pot Speed Range set / query: SRxxyy allows the operator to set the speed range of the speed pot if the pot has already been calibrated (see CN/CF). SR defaults to OFF. To change the speed range to 9 to 29 wpm (and turn on the speed range), enter: SR0929 (the leading zero is needed for speeds of less than 10 wpm). An SR sent alone will result in the sending of OFF if the speed range isn't in use OR if the speed range is being used, the sending of the current pot speed range setting followed by a loop back to CE. Note that wide settings may result in inaccuracy at the limits of the settings, for example, SR0567 might result in an

actual range of 6 to 66 wpm.   To turn the speed range off, enter SR00, this will give the operator the full 5 to 67 wpm range if the pot has been calibrated. Note that even if the speed range has been set, it will NOT be in effect until the pot has been calibrated.

Table of On / Off Commands:

Command	Query	Explanation
E		Exits command entry mode (PAR the mem switch to advance to T?)
5N 5F	5	5 ditdah tune mode - hold both paddles for 5 dit/dah cycles, enter tune, default: off
FMN FMF	FM	Fourth Memory on / off (the mem + dit press will send this memory) , default: off
BN BF	B	Bug mode (Ele-bug) oN or oFf (dit is normal, dah is straight key) , default: off
UN UF	U	Ultimatic mode oN or oFf (non-iambic dual lever keying mode),default: off
LN LF	L	Live recording mode oN or oFf, default: off
PN PF	P	Practice mode oN or oFf (keyer output is turned OFF) , default: off
AN AF	A	Iambic mode A oN or oFf (when mode A is off, mode B is ON), default is off (mode B)
RN RF	R	Reverse paddles oN or oFf (the dit lever becomes the dah lever), default: off
STN STF	ST	SideTone oN or oFf (sidetone will still occur during commands),default: on
SFN SFF	SF	Sidetone Float oN or oFf (reduces thump in transceiver installations), default: off
DIN DIF	DI	DIt memory oN or oFf, default: on
DAN DAF	DA	DAh memory oN or oFf, default: on
AUN AUF	AU	AUtospace oN or oFf, default: off
SSN SSF	SS	Speed Send after paddle speed set oN or oFf, default: on
PON POF	PO	POt speed control oN or oFf, default: on
KN KF	K	Key down beacon delay oN or oFf, default: off
BAN BAF	BA	Beacon Alternate oN or oFf, default: off
MN MF	M	Multiple commands oN or oFf, allows CE loop for commands, default: off
FN FF	F	Fast command entry, turns off the CE, ON => E, OFF => T, default: off
	V	sends firmware version
SKN SKF	SK	Straight Key input oN or oFf, default: off
IN IF	I	International character set on /off, default: off
CN CF	C	Calibrate speed pot oN or oFf, default: off
SPN SPF	SP	Stuck Paddle timeout test oN or oFf, default on
BCN BCF	BC	iambic mode B for Cmos super keyer, default off
1N 1F	1	Single paddle tune mode, default off

E - Exit command entry mode: If the operator enters an E alone the keyer will exit the command entry (CE) routine. An alternate way to exit the CE routine is to PAR the mem switch, this will advance to the T? menu item (record the mem + both memory), another mem PAR will exit T? without recording and re-enter the normal keying mode.

5N 5F / 5 - 5 ditdah tune mode oN / oFf / query: 5N allows the operator to turn on the 5 ditdah tune mode. This 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 MegaPK-II will then enter tune mode (keyer output & sidetone on).   Since there aren't any

normally used characters of this length, this mode should not be actuated during normal sending. Toggle tune off and on with a PAR of the dit or dah paddle. Exit with a PAR of the mem switch OR by pressing both dit & dah paddles at the same time. 5F allows the operator to return to the default state of having the 5 ditdah mode off.   5 alone will result in the keyer sending the current status of the 5 ditdah mode, ON or OFF. This mode was requested by a PK-3 user as a quick way to put his transmitter into tune for adjusting his antenna tuner. Note that tune mode will time out after about 12 seconds (see SP).

FMN FMF / FM   -   Fourth Memory oN / oFf / record / disable   query: This option enables   then records OR disables an optional 4th memory. Memory 2 is split into two 60 character memories. This new fourth memory is then played with a mem+dit PAR simulpress. After a FMN command is entered the keyer will send O? to signify that recording can start. Record memory 4 in the same fashion as the other 3 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. To change or re-record the fourth memory, re-enter the FMN command.

BN BF / B - Bug mode oN / oFf / query: Bug mode (also known as Ele-bug) is where dits are sent normally but dahs are sent like a straight key. A BN will turn on bug mode, BF turns it off (default) and B alone inquires whether bug mode is currently on or off. Note that bug mode is mutually exclusive with straight key mode - if the operator attempts to enter bug mode when SK mode is on, the keyer will send an error.

UN UF / U - Ultimatic mode oN / oFf / query: 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 the iambic modes.   A UN will turn on ultimatic mode, UF turns ultimatic off (default) and U alone queries the keyer as to whether ultimatic mode is currently in use.

LN LF / L - Live or Dead recording oN / oFf / query: 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). LN will turn on live recording, LF turns it off (default) and L alone will inquire whether the keyer is currently in live recording mode or not. Note that LN will also turn on (and LF turn off) Live code practice for the J, M, O, Q and Z commands. Live code practice allows the user to listen to an external keyed code practice oscillator which may have a more pleasing tone than the MegaPK-II.

PN PF / P - Practice mode oN / oFf / query: Practice mode is where the output transistor is not keyed but the sidetone is retained.   This allows the user to get used to the MegaPK-II without having to disconnect the rig. Note that practice mode takes precedence over the ST menu item - even if the sidetone is turned off with ST, turning on the practice mode will re-enable the sidetone.   Similarly, PN will override LN (live recording).   PN turns on practice

mode, PF turns it off (default) and P alone inquires whether the keyer is currently in practice mode.
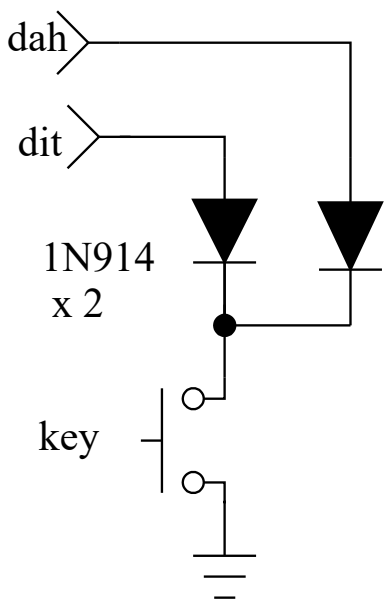
AN AF / A   -   Iambic mode A or B oN / oFf / query: The A mentioned above signifies the mode A/B select menu item. The iambic mode of the keyer can be set to either mode using this routine.   Check the JHP web site for an Acrobat (.pdf) file which explains the difference between the A and B keying modes. AN turns on mode A, AF returns the keyer to mode B (the default) and A alone inquires whether the mode A is on or off. Note that either iambic mode is overridden if ultimate mode is turned on.

RN RF / R   -   Reverse paddle mode oN / oFf / query: Reverses the dit and dah levers (easier than resoldering a jack). RN reverses the dit and dah paddles, RF returns the dit and dah paddles to the default (wired) state and R alone inquires whether the paddle reverse has been turned on.

STN STF / ST   -   SideTone oN / oFf / query: 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. STN turns on the keyer sidetone (default), STF turns off the keyer sidetone and ST alone inquires whether the sidetone is now on or off.

SFN SFF / SF   -   Sidetone Float oN / oFf / query: The reason for floating the sidetone pin is to minimize thump from the sidetone when the MegaPK-II 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 in a PK-x keyer to prevent excessive power supply current in the sleep mode.   SFN turns on the sidetone float condition, SFF turns the sidetone float off (default) and SF inquires whether the sidetone float is now on or off.

SKN SKF / SK   -   Straight Key oN / oFf / query: The circuit at left may be used along with this command option to allow the connection of a telegraph or "straight" key to the MegaPK-II. The diodes are used in effect to close both the dit and dah paddles at exactly the same time. The diodes also isolate the dit and dah inputs from each other.   This allows the MegaPK-II to distinguish between a key press and a dit/ dah squeeze since it is hard to close the contacts of both the dit and dah paddles at exactly the same instant.   This option is mutually exclusive with the Bug mode. If an SKN is entered with Bug mode already enabled, the MegaPK-II will send an error character. Contact bounce on the key can be compensated with the DD set option. This feature was made optional so that if the user finds that normal paddle squeezes result in a key press rather than a dit/dah combination, the straight key mode can be turned off. This feature was suggested by a PK-3 user based on his experience with the Elecraft K2 transceiver. SKN turns on the straight key mode, SKF turns it off (default) and after an SK alone, the keyer will send on or off to indicate the current state of SK. Once the key is pressed, the MegaPK-II will enter a straight key loop and stay there for roughly 6

seconds (it depends on the debounce delay setting, DD) after the last key press. Also note that once in the straight key loop, a dah press alone can act as the key input.

DIN DIF / DI   -   DIt memory oN / oFf / query:
DAN DAF / DA   -   DAh memory oN / oFf / query: 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. DIN turns on the dit memory (default) - DAN turns on the dah memory which is also the default state of the keyer. DIF or DAF will turn off the respective memory and DI or DA alone will query the keyer as to whether the memory is now on or off.

AUN AUF / AU   -   AUtospace oN / oFf / query: 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). An AUN turns on the autospace mode, AUF turn it off (default) and AU alone asks the keyer whether autospace is now on or off.

SSN SSF / SS   -   Speed Send oN / oFf / query: This menu item controls the speed send at the end of the paddle speed set menu item. This was requested by a PK-3 user who felt the speed send took too long and was not needed. An SSN will turn on the speed send (default), an SSF will turn it off and SS alone inquires as to the current status (on or off) of speed send.

PON POF / P   -   Select Pot or Paddle speed control oN / oFf / query: If the keyer is accidentally put into the paddle speed control mode the pot speed control can be resumed with a PON.   POF turns off the pot speed control.   PO alone will ask the keyer if the pot speed control is now on or off.

KN KF / K   -   Key down beacon delay oN / oFf / query: Enter KN to turn oN the key down beacon delay mode. This will enable the sending of a constant key down during the interval between sending the beacon message. Enter KF to turn oFf (return to the default) the key up beacon delay. K alone asks the keyer if the key down beacon is now on or off.

BAN BAF / BA   -   Beacon Alternate between mem 1 and mem 2 mode oN / oFf / query:
BAN will turn oN alternating the beacon between mem 1 and mem 2. BAF will turn oFf the alternation - the beacon will repeat mem 1 only.   BA alone asks the keyer if the beacon alternate mode is now on or off.

MN MF / M   -   Multiple command entry oN / oFf / query: MN will turn on the multiple command entry mode - after a command is entered the user will hear CE which means that another command can be entered. This can be handy if a number of changes are required at the same time. Exit the multiple command mode with an E. MF turns off the multiple command mode (default) - after a command is entered the keyer immediately returns to normal keying mode. M alone asks the keyer whether the multiple command mode is on or off.

FN FF / F   -   Fast command entry oN / oFf / query: FN turns on the fast command mode where the sending of CE is eliminated - also, now the keyer will send an E instead of ON and the keyer will send a T instead of OFF. The operator still needs to send an N or F to perform

the on or off command entry. FF turns off the fast command mode and F alone asks the keyer to send either the on or off state of fast command mode.

V - Version query: V asks the keyer to send the current version of the firmware.

IN IF / I - International character set oN / oFf / query: Per a user of the PK-3, one of the special characters used in the PK-3 for storing a pause was identical to a Morse character used by DX operators. IN will use an alternate character (7 code elements long) that is not used by DX operators, so that they can store this special character in a memory. IF will return the keyer to the default character usage and I alone will ask the keyer to send on or off depending on whether the international characters set usage is on or off. The embedded word space character is now a dit-dah-dah-dah-dah-dah-dit (JG) for either character mode.

Table of normal and international embedded characters

Normal Character mode	International Character mode	character function
di-dah-di-di-dit (AS)	di-di-di-dah-di-di-dit (7 elements)	embedded pause

CN CF / C - Calibrating the Pot speed control oN / oFf: Due to the variation in capacitors and pots it is probable that the maximum setting of the pot will result in a minimum speed higher than 5 WPM.   CN will compensate and store an updated calibration value.   Before entering CN, be sure to turn the pot to the minimum speed. Then enter CN 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. CF will restore the default powerup calibration value and thus allow normal pot speed control again. A C sent alone will query whether a calibrate has already been done (ON) or not been done (OFF).

SPN SPF / SP - Stuck Paddle timeout oN / oFf / query: This item puts the keyer to sleep after 128 consecutive dits, dahs or didahs - which normally will only occur when one or both of the paddles are stuck on. SPN turns on the stuck paddle timeout test (default), SPF turns off the stuck paddle timeout test and SP alone inquires whether the stuck paddle test is now on or off. Note that SPN will also turn on the approximately 12 second tune mode timeout.

BCN BCF / BC - iambic mode B emulation of Cmos super keyer: This item attempts to emulate the iambic B keying mode of the CMOS Super Keyer from QST of October of 1981. The difference between the default iambic mode B and the CMOS Super keyer iambic mode B is that dit input is ignored during the first 1/3 of a dah period. This is supposed to allow the operator a little more time to "get off" the dit paddle without latching in another dit after the dah currently being sent.

1N 1F / 1 - Single paddle tune mode oN / oFf / query: 1N allows the operator to turn on the single paddle tune mode. Press and hold either the dit/dah or both for 10 elements (10 dits/dahs or 5 didahs) in a row and then release the paddles - the MegaPK-II will then enter tune mode (keyer output / sidetone on).   Since there aren't any normally used characters of this length, this mode should not be actuated during normal sending. Toggle tune off and on with a

PAR of the dit or dah paddle. Exit with a PAR of the mem switch OR by pressing both the dit & dah at the same time.   1F allows the operator to return to the default state of having the single paddle tune mode off. 1 alone will result in the keyer sending the current status of the single paddle tune mode, ON or OFF. Note that 1N also effectively turns on 5 didah tune mode (see 5N 5F 5 above). Note that the tune mode will time out after about 12 seconds (see item SP).

Recording mem 3 or using the Menu: Mem 3 (a memory of up to 60 characters long) can be recorded using the mem+dah menu.   The mem + dah 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	advance to ? menu item
?	Record memory 3	records a dit	records a dah

TU - Tune mode: After 2 seconds the keyer will send TU. Press the dit lever to enter tune mode (key down). Press the dah lever to go to the ? Menu item. While the keyer is in tune mode, the output can be toggled on and off with dit or dah presses. Exit tune mode by a PAR of mem.

? - Record Memory 3: Memory 3 can now be recorded. When complete, press the memory switch. The routine will be exited automatically after the last character is sent. The memory is saved in EEPROM - it will still be there even if power is removed.

Code Practice on/off, toggle and numerical entry commands:

Command	Query	Explanation
FOx	FO	Forward advance through random code practice, x => 0 to 7, default is 0
G		pseudo random code practice, single letter or number
J		pseudo random code practice, letters only
N		pseudo random code practice, letters and numbers
O		pseudo random code practice, letters, numbers and symbols
Q		code practice, common words/fragments, arranged 3,3,3,4,5 char groups
X		toggle reverse send of ARRL/Signal Corps 5 char. groups on and off (Z)
YN / YF	Y	turn oN or oFf the send practice for items G,J,N,O, Q and Z
Z		code practice, ARRL/Signal Corps 5 character groups
LN/LF	L	Live recording (and Live code practice) mode oN or oFf, default: off

FOx / FO - FOrward set / query: FOx allows the operator to set a forward starting point for the random code practice modes G, J, N and O. A zero (0) turns off the forward and starts the random code at the normal point. A one (1) to seven (7) starts the random code practice at different places in the pseudo random sequence, effectively giving 8 different sets of random code practice for the operator.

G - random code practice, single letters and numbers only: G starts the play of 1 character groups of pseudo random code practice. The characters being sent are restricted to letters and numbers only. Normally G would be used in conjunction with item Y=N, send practice. The unique thing about item G send practice is that the operator must send the next character in the alphabet or the next highest digit. For example, if the MegaPK-II sends A, the operator must send a B, if something other than a B is sent, the MegaPK-II will send an error character and then send a B, the operator must then still send a B or another error will occur. If letter Z is sent, the operator must send a 0 (zero). Similarly, if number 9 is sent, the operator must send letter A. The idea of this change is to eliminate parroting of the last character sent, the operator must hear, decode, think and then send the next character. Exit this item with a PAR of dit or dah during the character play or character replay after an error. A PAR of the mem switch will also exit the practice when done as the keyer is waiting for input from the user (see Y=N below). The keyer will then send CE and wait for the next command. The FOx menu item can be used to start the random code practice at some forward point from 1 to 7. This can be useful if the operator starts to memorize the random groups being sent.

J - random code practice, letters only: J starts the play of 5 letter groups of pseudo random code practice.   The characters being sent are restricted to letters only.   If YN was executed before the J, the keyer will wait after the 5 characters have been sent for the operator to repeat them using the dit/dah paddles at the same speed they were sent. If the keyer detects any error in the 5 characters sent by the operator, an error character will be sent and the 5 characters will be resent by the keyer and the operator will have another chance to enter the 5 characters.   The operator can exit the code practice by a PAR of the dit or dah during the

character play. A PAR of the mem switch will also exit the practice when done as the keyer is waiting for input from the user (see Y=N below). The keyer will then send CE and wait for the next command. The FOx menu item can be used to start the random code practice at some forward point from 1 to 7. This can be useful if the operator starts to memorize the random groups being sent.

M - random code practice, letters and numbers only: M starts the play of 5 character groups of pseudo random code practice. The characters being sent are restricted to letters and numbers only. In all other respects, M is similar to item J above.

O - random code practice, letters, numbers and symbols/prosigns: O starts the play of 5 character groups of pseudo random code practice. The characters being sent are unrestricted. The symbols and prosigns include the period (didahdidahdidah), comma (dahdahdididahdah), question mark (dididahdahdidit), slash (dahdididahdit), double slash (dahdidididah), AS (didahdididit), AR (didahdidahdit) and SK (didididahdidah). In all other respects, O is similar to item J above.

Q - common words/fragments code practice: Q starts the play of common words and common fragments of words as tabulated by the ARRL in the pamphlet called Learning the Radiotelegraph code.   The words and fragments are arranged in lines of 3, 3, 3, 4 and 5 character groups.   The idea is to listen to these groups at high speed so that they can be recognized as words rather than groups of characters. All contesters know the sound of the word TEST and recognize it immediately. The idea of the Q item is to extend this familiarity to other common words and fragments.   If YN was executed before the Q, the keyer will wait after the 3, 4 or 5 characters have been sent for the operator to repeat them using the dit/dah paddles at the same speed they were sent. If the keyer detects any error in the word sent by the operator, an error character will be sent and the word will be resent by the keyer and the operator will have another chance to enter the word. The operator can exit the code practice by a PAR of the dit or dah during the character play, the keyer will then send CE and wait for the next command. The keyer will exit sending back to command entry after the last word, RADIO, has been sent.   See the entire group of words and fragments in the second page after the parts list of this manual.

X – toggle the reverse send of the ARRL/Signal Corps random groups: X will toggle (successively turn on and off) the reverse sending of the ARRL / Signal Corps 5 character groups in command Z (see below). This allows the user who has become too familiar with the forward play of the groups some un-memorized practice. X defaults to off, so the first time it is sent the keyer will turn on the reversal and send ON. The state of X will be lost if the keyer power is turned off.   Note that X reverses both the characters in a group and the groups themselves, so instead of sending the first group, OKICQ, first, it is sent last.

YN YF / Y – turn send practice oN or oFf: All of the practice modes will send code practice continuously until either the operator exits with a dit/dah PAR OR the end of the groups is reached. The YN command allows the operator to turn on send practice: the keyer will then send a group and then wait for the user to send the group back to the keyer using the dit and

dah. If the keyer thinks the operator has sent the correct group, the next group is sent. If the keyer thinks the operator got it wrong, the group is resent and the operator is allowed to re-send the group, this repeats until the operator gets it right or exits (PAR of dit or dah during the group play by the keyer).

Z – ARRL / Signal Corps 5 character random code practice: Z starts the play of 5 character random Signal Corps groups as tabulated by the ARRL in the pamphlet called Learning the Radiotelegraph code.   If YN was executed before the Z, the keyer will wait after the 5 characters have been sent for the operator to repeat them using the dit/dah paddles at the same speed they were sent. If the keyer detects any error in the word sent by the operator, an error character will be sent and the word will be resent by the keyer and the operator will have another chance to enter the word. The operator can exit the code practice by a PAR of the dit or dah during the character play, the keyer will then send CE and wait for the next command. The keyer will also exit sending back to command entry after the last group, QZASU, has been sent.   See the entire list of 5 character groups on the first page after the parts list of this manual. If the operator exits the Z random code practice in the middle of a group, a subsequent restart of Z will attempt to continue from the exit point (the other modes don't attempt this), the restart point will be affected if another random mode has been tried after the Z random code practice was exited. The OKICQ, AEIOU, 24680 and 13579 groups don't seem very random and the repeat of YOUMK is noted, but that's the way they were in the ARRL pamphlet.

LN LF / L - Live or Dead recording oN / oFf / query: Normally, a memory 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). LN will turn on live recording, LF turns it off (default) and L alone will inquire whether the keyer is currently in live recording mode or not. Note that LN will also turn on (and LF turn off) Live code practice for the J, M, O, Q and Z commands. Live code practice allows the user to listen to an external keyed code practice oscillator which may have a more pleasing tone than the MegaPK-II.

<u>Notes:</u>

To perform a reset (all parameters to their default values):

      1) remove power to the keyer
      2) PAH the mem switch
      3) powerup the keyer with the mem switch depressed
      4) release the mem switch during/after the FB send

The MegaPK-II parameters should now be reset to defaults, the memories will be unchanged.

The bypass capacitors across the power and ground circuits of the keyer can sometimes retain enough voltage to prevent the above keyer reset from being successful. If this occurs, power off the keyer and then short out the bypass capacitors (including the ones on the input of any voltage regulators). This will allow the full keyer reset to take place.

Note that if either paddle (dit or dah but not both) is held at powerup, the other paddle will function as a straight key, similar to bug mode except that the other paddle is not used. This keyer bypass mode can be turned off with the next power cycling of the keyer. The keyer bypass can be useful when the MegaPK-II is used within a rig and the operator wants to use a different keyer, a cable with a mono plug can be plugged into the paddle input (must be done before powerup of the rig) from the external keyer output. This will raise the keyer current used.

An idea for a hardware mod: If the optional voltage regulator is being used, one handy way to monitor the current used by the keyer is to install an LED in series between the positive battery terminal and the voltage regulator input. The LED will light brightly when the keyer is active and it will go out or be very dim when the keyer is "sleeping" (low current mode). Note that an LED, particularly a white LED, can drop a large amount of voltage (over 1.5 volts at full LED current), so be sure that there is enough voltage from the battery to still allow good regulation with the LED installed. This series LED idea won't work well without the optional regulator due to this same large voltage drop.

Some of the features added in the MegaPK-II keyer were the result of suggestions from PK-4 users. Please feel free to email with any questions, comments, suggestions or problems with the MegaPK-II email to: `wb9kzy@wb9kzy.com`

MegaPK-II kit parts list

Qty.	Ref.	Part Name	Description
1	U1	12LF1240	MegaPK-II, 8 pin DIP keyer chip – Microchip Tech.
1	C8	.10 uF	marked 104 or .1, axial multi-layer ceramic cap.
4	C3,C4,C5,C7	.01 uF	marked 103, .1" lead space multi-layer ceramic cap
1	C6	.015 uF	marked 153 - .2" lead space, 5% polyester capacitor
1	R2	4.7 K ohm	Yellow-violet-red-gold, 1/4 watt carbon film resist.
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 resist.
1	Q1	2N7000	TO-92 package MOSFET transistor
1	-	socket	8 pin DIP socket (machine pin)
1	-	PCB	PK-x PIC Keyer circuit board

The following items are **OPTIONALLY** included with the kit:

SSR:

1	U3	PS7141E-1A	Solid State Relay (SSR), 6 pin DIP, 400 V, 120 mA
1	-	socket	6 pin DIP socket (machine pin)
1	R6	180 ohm	brown gray brown gold 1/4 watt carbon film resistor

Voltage regulator:

1	U2	S812C30	3V ultra low standby current regulator, TO-92 pkg.
1	C2	2.2 uF	.1" lead space 16V Tantalum electrolytic capacitor
1	C1	.10 uF	marked 104 or .1, axial multi-layer ceramic cap.

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			3 volt battery holder or 9 volt battery "snap" conn.
1	SW1		normally open, momentary SPST switch
2			1N914 or 1N4148 switching diodes for straight key mode

Thanks for choosing the MegaPK-II and
Best Regards,

Chuck Olson, WB9KZY

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