Installing and Operating

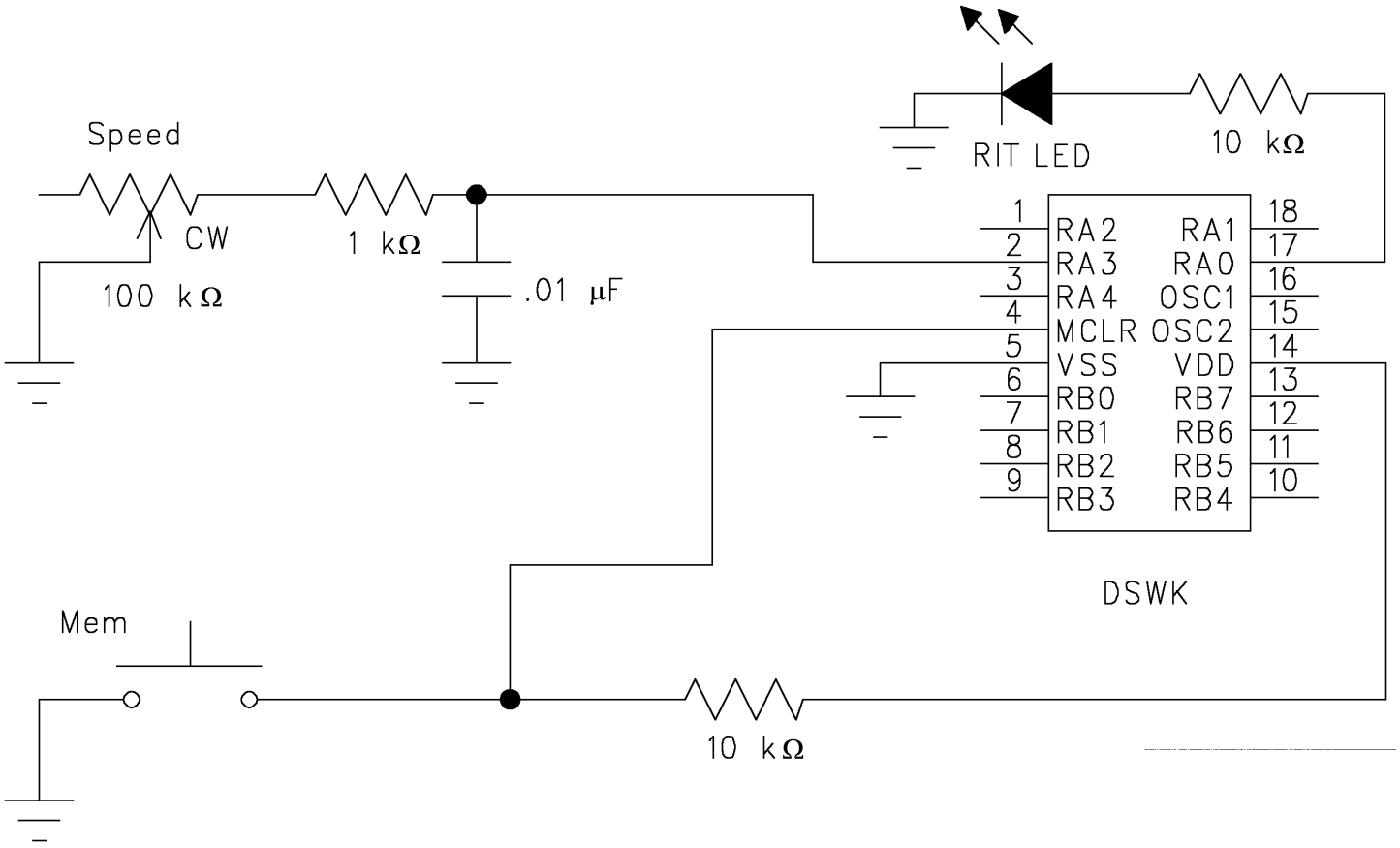
The DSWK
from Jackson Harbor Press
A memory keyer chip with pot speed control for the DSW series

The DSWK is an outgrowth of the RMK keyer chip for the Rock Mite by Small Wonder Labs. One of the RMK users suggested that I transmigrate the RMK to the controller for the DSW series of rigs (also from Small Wonder Labs). The DSWK is available in versions for all bands on the DSW and DSW-II. The DSWK has many features to make the DSW a more convenient rig to use - all parameters and memories are stored in non-volatile EEPROM memory which retains its contents even when the power has been disconnected.

Installing the DSWK:

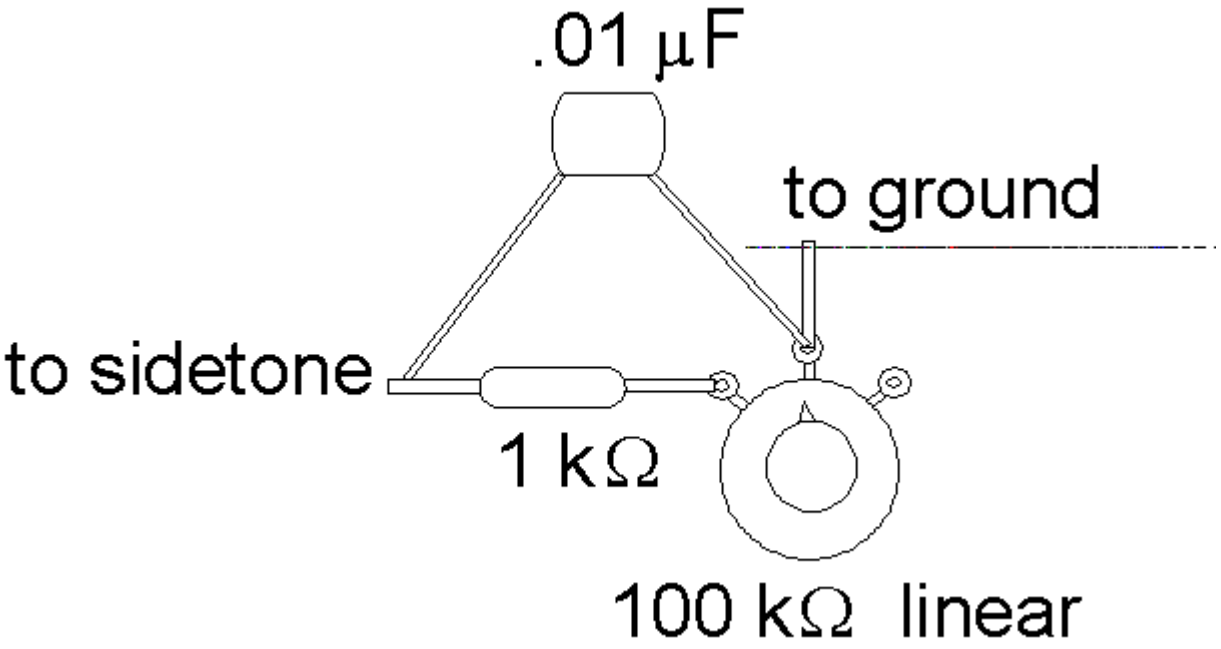
The DSWK is a CMOS (Complementary Metal Oxide Semiconductor) device. This oxide is very thin which means that the chip should be handled as little as possible to prevent static damage. The installer should use a grounding strap and anti-static mat if available or at the very least, work on a grounded metal surface and be sure to touch ground prior to touching the chip.

Step 1: Optional Hardware Modifications: There are four optional hardware mods that can make using the DSWK more enjoyable, however none are required. A schematic of the mods is shown here with most of the other PIC circuitry removed. The Mem switch shown is different from the encoder switch of the DSW and the RIT/Freq switch in the DSW-II. It is also NOT the Mem switch mentioned in previous keyer documentation.



The first is pot speed control. A .01 µF polyester timing cap and a 1 kΩ resistor were supplied with the DSWK. The user will have to supply a 100 kΩ linear pot and knob to finish this mod. The user will also need to find an appropriate place to put the pot on the rig. The best position will depend on the size of the pot and the user's preference, but generally the shorter the wires to the pot, the better!

The way I modified my DSW-40 was to mount the .01 µF cap and the 1 kΩ resistor on the speed pot as shown in this pictorial diagram:



Connect the wire labeled "to sidetone" to the PIC pin 2 at the input side (facing RFC3) of C23 (DSW) or C17 (DSW-II) I was able to make this connection on the top of the circuit board by tack soldering the wire to the capacitor circuit board pad. Connect the wire labeled "to ground" to a ground point either near the pot or on the citcuit board. I made this ground connection at the ground side of C101 (towards RFC3) on the DSW.

The second optional hardware mod is the addition of a momentary switch and 10 kΩ pullup resistor to pin 4 of the DSWK chip. This mod allows the user to switch between two frequencies with a PAR (press and release) of the Mem switch. Pin 4 is directly connected to the power supply pin (14) - unfortunately this connection is made via a circuit board trace routed underneath the socket so the trace cannot easily be cut. However, it is possible to do this mod easily by bending out pin 4 of the DSWK slightly so that it doesn't insert into the corresponding socket pin. A wire to the 10 kΩ pullup resistor is soldered to the supplied machined socket pin. This pin can then be connected to pin 4 prior to putting the DSWK into the socket. The momentary switch will also have to be located somewhere on either the front or rear panel of the DSW per the user's preference. Solder one end of the 10 kΩ resistor on the +V side of C111 (DSW) or C107 (DSW-II). The +V side is connected to pin 14 of the PIC socket. Solder the other end of the 10 kΩ resistor to a wire to the momentary Mem switch. Connect the other side of the switch to ground. Finally, solder a short wire from the 10 kΩ resistor to the supplied machined socket pin (cut the 3 pins apart with a diagonal cutter) and connect it as mentioned above to the DSWK pin 4. One way of doing this mod was developed by Steve Lawrence, WB6RSE. Steve used an 18 pin socket plus an 18 pin header to do a no-fuss mod, for more details on Steve's mod, please see the pdf file on the DSWK web page.. Another no fuss approach is shown on the web page of Lew Paceley, N5ZE: <http://paceley.com>. Lew uses a socket in between the DSWK chip and the DSW socket which has pin 4 clipped, a wire is soldered to the remaining stub of pin 4 of the socket.

A third optional mod is presented here: In the DSW-II the RIT/XIT on status is annunciated with an LED. DSW users can add this LED to their rig if desired. A series 10 kΩ resistor is connected from pin 17 of the DSWK to the LED anode. The cathode of the LED is connected to ground.

The fourth optional mod goes along with mod 3: The default selection of the menu item RI (covered later) is set at the time of order to the correct radio, but it could be changed to the other if needed. An example:

say you have an original DSW, you can change to the new DSW-II RIT by adding the LED and also change the RIT switch from a SPST to a SPDT (momentary, center off). This would allow the switch to do double duty as RIT and also as the Mem switch to change between the two frequency memories. You can also leave out the LED as the RIT and XIT are annunciated with the R and X prefix to the frequency readout.

Step 2: Insert the DSWK chip With the original DSW rig, there are two cable headers (connectors) which will have to be removed to get access to the stock PIC chip - be sure to remember which one goes where! The stock PIC controller chip should be carefully removed from its socket, the installer should first note the orientation of the PIC. The DSWK can then be installed in the same orientation as the stock PIC. Be sure to keep the stock PIC in the anti-static bag and packing materials provided with the DSWK.

Step 3: Check your work The optional hardware mods and the orientation of the DSWK should be double-checked. With the original DSW, the cable plugs located near the DSWK chip should be replaced in their sockets.

Step 4: Try it out ! Power up the rig. An FB should be sent at powerup through the sidetone if the keyer is functioning correctly. If you don't hear the FB, check the insertion of the DSWK, make sure that none of the pins are bent underneath the body of the DSWK. Also double check that the "flying" lead to the frequency switch is not in contact with any other component.

Radio Operation:

The DSWK chip controls the rig in much the same way as the stock PIC chip, however there may be some differences in the exact operations of the rig. For example, pressing the KEYER switch at powerup will enter the BFO calibration mode, but it will also perform a full keyer reset (parameters to their default values, memories untouched) - use this procedure:

1) remove power to the rig
2) press and hold the KEYER switch
3) powerup the rig, keeping the switch depressed until a C (for Calibration/BFO) is sent.

The only way to exit the BFO calibration mode is by turning the rig power off. Yes the calibration tone is loud and there isn't any way to decrease the volume that I am aware of.

The transmit frequency is annunciated with a PAR (down press and release) of the RIT/Freq switch (on the original DSW, PAR the encoder knob). With the 200 Hz step size the frequency is sent to a 1 kHz resolution. With the 50 or 10 Hz step sizes, the frequency is sent to 10 Hz resolution. In RIT mode an R is sent first, then the transmit frequency is sent to the current step resolution. In XIT mode an X is sent first followed by the transmit frequency sent to the current step resolution.. The frequency sent will not change as the encoder is turned in RIT mode since the transmit frequency is not altered. Note that the MHz and any leading zero 100 kHz digits will NOT be sent by the DSWK so save a little time. So with a 200 Hz step, 7.04000 MHz will be sent as 40. Note that when the DSWK normally sends the frequency in the 200 Hz step mode, it is sending a truncated reading to 1 kHz. The actual transmit frequency may be up to 800 Hz higher. To know the transmit frequency more precisely, just put the DSWK into 50 or 10 Hz step mode, the readout will then be to 10 Hz. and is not truncated (7.04000 MHz will be sent as: 4000 in 50 or 10 Hz step mode).

A down press and hold, (PAH) of the RIT/Freq switch (in the DSW the encoder switch) will change the encoder step size from 200 Hz to 50 Hz. The two step sizes will alternate each time the RIT/Freq switch (encoder switch in the DSW) is down PAH. The change is annunciated by a 5 for 50 Hz and a 2 for 200 Hz. A 10 Hz step size (annunciated with a 1) can be added to the 200 and 50 Hz steps with the 10 menu item mentioned later in this manual. The RIT and XIT modes both will use the current step size. The step size can be changed while in RIT or XIT modes.. The encoder step size selection is NOT stored in non-volatile memory.

RIT and XIT modes are both entered by either a flip up of the RIT switch (orignal DSW) or an up PAR of the RIT/Freq switch (DSW-II). The DSW or DSW-II should be selected using the RI item of the KEYER + dah menu (see the expanation in the following section). When the RIT/XIT mode is exited (by flipping the RIT switch in the original DSW or another down PAR of the RIT/Freq switch with the DSW-II) the frequency will revert to the previous transmit frequency (prior to entering RIT/XIT). Note that the rig is either in the RIT or XIT modes, to change between the modes, a multipress down PAR of the RIT/Freq (encoder switch in the DSW) and KEYER switches will change the current mode from RIT to XIT or from XIT to RIT mode. The change is annunciated with a Morse R for RIT and an X for XIT.

When the RIT (or XIT) is currently in use, a change to the opposite mode (RIT to XIT or XIT to RIT) will also swap the receive and transmit frequencies. This allows the operator to quickly check to see, for example, if the XIT frequency chosen has any current occupants by changing to RIT mode and listening on that XIT frequency.

The DSWK has a VFO memory that will remember the last frequency the rig is set to prior to power down.

Changes between the two different frequencies are annunciated with an E for memory 1 and an I for memory 2. The frequency memories can be written to by dialing the rig to the frequency desired and then doing a PAH of the Mem switch. A successful write to the memory will be annunciated with an E or I depending on the memory then in use.

If the RIT/Freq switch is pressed and held up at powerup (RIT switch flipped up on the DSW), the rig will change frequency to the nearest frequency standard station, such as CHU (annunciated with a Morse C) on 40 meters at 7335 kHz or WWV (annunciated with a Morse W) on 20 meters at 15 000 kHz. Note that this frequency will NOT be saved in the VFO memory. No check of transmit band limits is made so don't start transmitting until you've checked the frequency ! To get back to the band of interest, turn off the rig and power up again.

Keyer Operation: General notes on using the dit, dah and KEYER switch to control the keyer: Multiple functions result from multiple switch-press combinations (KEYER alone, KEYER+dit, KEYER+dah, KEYER+both dit and dah or finally KEYER + down RIT/Freq for DSW-II or KEYER + encoder press for DSW). Also, the switches can be pressed and released (PAR) OR pressed and held for two seconds (PAH). The two second delay can be changed with the PH menu item (see below). Multipresses double the number of combinations of these three control switches.

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.

4 menus are used for setting various options - they are activated by a PAH of the KEYER switch alone or plus a simulpress of dit or dah or both. The menu selections are made by pressing either the dit or dah switches - 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 KEYER switch.

Note that the keyer sidetone will be lower in pitch (about 400 Hz) for keyer commands such as the menu prompts, recording a memory or the FB sent at powerup. The normal pitch for routine sending is higher at about 800 Hz.

A function table of the DSWK switch combinations:

switches used	PAR (press and release)	PAH (press and hold)
KEYER	send memory 3	beacon items: BE, BA, records memory 3, O?
KEYER + dit	send speed	paddle set of speed, pot options, main menu
KEYER+ dah	send memory 2	DSW options, record memory 2: M?
KEYER+both	send memory 1	record memory 1: T?

KEYER+down RIT/Freq or KEYER + encoder switch	toggles RIT and XIT	toggles RIT and XIT

Powerup: Immediately after powerup the keyer will send an FB through the sidetone to signal correct operation. However, if either paddle is pressed at powerup, the DSWK will enter a straight key mode. The paddle opposite to the one pressed at powerup will act as a straight key. The KEYER switch functions may not work correctly if the paddle pressed at powerup is held continuously. Note that the paddle must be pressed each time the transceiver is powered up to enter the straight key mode - it is NOT stored in EEPROM as the other mode changes are.

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

Speed Control and Menu:

Initially the keyer will powerup at a default speed of 16 WPM in paddle speed set mode. The speed can be adjusted by pressing and holding the KEYER switch along with the dit switch. Usually I PAH the KEYER switch and then tap the dit switch. After 2 seconds, the keyer will send an S (for speed set). Press the KEYER switch to advance to the next menu item without changing the speed. Or, pressing the dit switch will increase the speed by 1 WPM and send a dit. Pressing the dah switch will decrease the speed by 1 WPM and send a dah. You can continuously adjust the speed by holding either switch but note that if you run the keyer "off the scale" at either 4 or 49 WPM, the keyer will "wrap around" to the opposite speed extreme. Exit the speed adjust routine by pressing and releasing the KEYER switch.

If the pot circuitry is connected AND the P menu is invoked to turn on the pot speed control the speed can be adjusted by turning the pot. Maximum possible speed is 48 WPM, minimum possible speed is 4 WPM. Note that the minimum and maximum speed can be affected by component tolerances on the speed pot and the resistors - see the pot calibration menu item if a 4 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.

KEYER + dit menu (PAR KEYER switch 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
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
B	Bug / straight key mode	enables bug mode (dah = key)	disables bug mode (default)
A	iambic mode A or B	enables iambic mode A	enables mode B (default)
R	Reverse paddle mode	reverse dit and dah switches	return dit and dah to normal
AU	Autospace on / off	turns on character autospace	turns off autospace (default)
CT	Command speed Tracking	turns on command speed tracking	turns off command speed track
CS	Command Speed	increases command speed 1 wpm	decreases command speed 1 wpm
PH	Press and Hold delay set	increases PAH delay by .1 sec	decreases PAH delay by .1 sec

P - Select Pot or Paddle speed control: Allows the keyer to be switched between pot or paddle speed control. The keyer defaults to paddle speed control.

C - Calibrating the Pot speed control: Due to the variation in resistors and pots it is likely that the minimum setting of the pot will result in a minimum speed higher than 4 WPM. This menu item will compensate and store an updated calibration value. Before entering the menu, be sure to turn the pot to the minimum speed. Then press the dit to go into the calibration routine - then one dit will be sent after a short delay and the keyer will exit from the menu. If the pot calibration is run with the pot not set at the minimum, rerun the cal with the pot correctly set. Pressing a Dah will restore the default powerup calibration value.

B - Bug / Straight-key mode: Dits are sent normally but dahs are sent like a straight key.

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.

R - Reverse paddle mode: Reverses the dit and dah switches (easier than resoldering a jack). Remember that the pot speed control will be changed to the dit paddle which means that pot speed control changes while the dit is pressed will be ignored until the dit is released.

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).

CT - Command speed Tracking on/off: The command speed tracking allows the user to set the keyer speed during commands (recording, speed send and menus) to track the "normal" speed setting. Turning the tracking off allows the user to set a separate command speed which is unaffected by the pot or paddle speed setting. This is handy especially when the keyer is in paddle speed set mode, to allow the user to "speed" through menus or frequency annunciations or speed sends. With a pot speed control it is easy enough to just turn the pot to a higher or lower speed while in the command mode.

CS - Command Speed set: The command speed set allows the user to set the keyer speed during commands as mentioned in the CT item above. A dit increases the command speed by 1 wpm, a dah decreases the command speed by 1 wpm. If CT is on and the CS menu is entered, the user will be sent to the CT item first to allow command tracking to be turned off.

PH - Press and Hold delay set: Allows the user to specifiy the Press and Hold delay time in the range from .5 to 9.5 seconds. Pressing a dit increases the delay by .1 second, pressing a dah decreases the delay by .1 second.

KEYER + dah menu (PAR KEYER switch to exit)

	Menu item	Pressing a dit:	Pressing a Dah
RI	RIt mode	selects DSW-II momentary RIT sw	selects original DSW toggle switch
EN	ENcoder mode	enables the DSW encoder	enables the DSW-II encoder
10	10 Hz step enable	adds 10 Hz to 200 and 50 Hz steps	removes 10 Hz from allowable steps
CA	CAlibrate the DDS	enters DDS calibrate mode	restores DDS default calibration
M?	Record memory 2	records a dit	records a dah

RI - RIt mode select: A PAR of the KEYER switch will advance to the RI menu item - this allows the user to select the RIT mode of the DSWK. Pressing a dit will change the DSWK to the momentary RIT switch used by the newer DSW-II. Pressing a dah will change the DSWK to the toggle switch of the original DSW series.

EN - ENcoder mode select: A PAR of the KEYER switch will advance to the EN menu item - this allows the user to select the appropriate tuning encoder for the rig if the current setting seems incorrect. A dit will select the 2 pulse per detent encoders used in the original DSW series. A dah will select the 4 pulse per detent used in the new DSW-II.

10 - 10 Hz step size enable: A PAR of the KEYER switch will advance to the 10 menu item - this allows the user to add or remove the 10 Hz encoder tuning step size from the stock 200 Hz and 50 Hz step sizes. A dit will add the 10 Hz step size. After this addition, the DSW will cycle through the 200, 50 and 10 Hz step sizes when the RIT/Freq switch (in the DSW the encoder switch) is PAH. A dah will remove the 10 Hz step size from the 200 and 50 Hz steps.

CA - CAlibrate the DDS: A PAR of the KEYER switch will advance to the CA menu item - this allows the user to calibrate the DDS to an accuracy of roughly 10 Hz. For example, when my DSW-40 is set to

7.0400 MHz , it will actually transmit on 7.0409 MHz per my Elecraft K2. This difference of 90 Hz may be traced to a number of causes but the main cause seems to be the frequency tolerance of the 32 MHz oscillator used to drive the DDS chip. The DSWK software can complensate for an inaccuracy in this oscillator with this CA menu item. To perform the calibration the user should first turn on the DSW and let it warm up for at least 5 minutes. Next, set the DSW for 50 or 10 Hz step size and readout the frequency to the 10 Hz digit. A well calibrated receiver should be set to CW mode and then tuned to the same frequency as the DSW. The user should then enter the CA menu item and then press the dit to start the calibration. The DSW will then emit a calibration output via the DDS chip on the frequency noted above. This output should be audible on the "well calibrated" receiver, if not, a short antenna wire can be connected to the receiver antenna input with the other end in the near vicinity of the DSW (with the case open). The user should then adjust the DSW encoder until the "well calibrated" receiver is outputting a tone which is equal to its CW offset frequency (this will normally be specified in the manual). Be prepared for a lot of knob twisting as the calibration constant is pretty fine. The Son of Zerobeat kit can be used to make this adjustment quite easy. Also very useful for this kind of tone matching are the many DSP programs for PC soundcards such as Spectrogram. After the DDS seems calibrated, PAR the KEYER switch to exit this mode and store the calibration in the EEPROM of the DSWK. Note that pressing the dah will restore the default calibration of the DSWK. A reset of the DSWK chip will also reset the calibration constant. Finally, the calibration output is not transmitted by the DSW, it is a low level output which can also be heard on a companion receiver when the DSWK is sending command output such as the keyer speed or the frequency readout

M? - Record Memory 2: A memory of up to 33 characters long can be recorded. The memory is recorded by sending normally. Note that the keyer output is off during the recording and that the lower command sidetone is used. When recording is complete, PAR the KEYER switch. The routine will be exited automatically if the last character in the memory is sent. The memory is saved in flash memory which means that it will still be there even if power is removed. If this menu item is entered by mistake, PAR the KEYER switch to exit without changing the memory.

Playing Memory 2: Play memory 2 by simulpressing and releasing the KEYER and the dah switches. I usually PAH the KEYER switch and then tap the dah switch - the memory starts to play after the KEYER switch is released. A tap of either the dit or dah switch will stop the message play.

KEYER switch menu (PAR KEYER switch to advance to the next menu item)

	Menu item	pressing a dit:	pressing a dah:
BE	BEacon mode	starts the beacon going	Exits the menu
BA	Beacon Alternate mode	selects alternate beacon sends of mem 1 and mem 2	selects send of mem 1 only (default)
O?	Record memory 3	records a dit	records a dah

BE - Beacon Mode: Beacon mode will send the contents of mem 1 continuously. Start the beacon by pressing the dit switch - the beacon starts to play. Exit beacon mode by tapping the dit or dah switch. One thing that many operators use the Beacon Mode for is to send a continuous CQ. Since the DSWK doesn't have a programmable delay time for the beacon, one method for creating a delay between CQ sends is to append word spaces at the end of memory 1. The word space can be recorded into memory using the di-dah-dah-dah-dit special character. Note that the recording routine will automatically kerchunk in a word space after any word spaced delay while recording characters including the word space character itself. Also note that the recording routine will chop off the last word space recorded. The word spaces can be recorded in any ot the 3 memories, at any position in the memory. Each recorded word space takes one character of memory.

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

O? - Record Memory 3: The memory is recorded by sending normally. Note that the keyer output is off during the recording and that the lower command sidetone is used. When recording is complete, PAR the KEYER switch. The routine will be exited automatically when the last (37th) character is recorded. The memory is saved in flash memory which means that it will still be there even if power is removed. If this menu item is entered by mistake, PAR the KEYER switch to exit without changing the memory.

Playing Memory 3: Play memory 3 with a PAR of the KEYER switch. - the memory starts to play after the KEYER switch is released. A tap of either the dit or dah switch will stop the message play.

KEYER + both menu (PAR KEYER switch to exit)

	Menu item	pressing a dit:	pressing a dah:
T?	Record memory 1	records a dit	records a dah

T? - Record Memory 1: Enter record mode for memory 1 with a PAH of the KEYER switch and both paddle switches for 2 seconds. Hold the KEYER switch down, then squeeze both paddle switches simultaneously (they both must be down at the same time), then release the paddle, keep holding the KEYER switch until after 2 seconds the keyer will send **T?**. Memory 1 can now be recorded. Start sending your message. when recording is complete, PAR the KEYER switch. The memory is 37 characters long - recording will terminate automatically after the 37th character. If this menu item is entered accidentally, just PAR the KEYER switch to exit without recording.

Playing Memory 1: First, hold the KEYER switch down, next, squeeze both paddle switches (they both must be down at the same time) then release the paddle and finally release the KEYER switch before 2 seconds elapse. The memory will start to play right after the KEYER switch release.

Notes:

One interesting feature of the DSWK is the 5 ditdah tune mode. If both paddles are held for at least 5 ditdahs and then released, the keyer will enter tune mode (key down, sidetone on). To exit, tap either the dit or dah. Thanks to Lew Paceley, N5ZE, for inventing this mode.

Thanks for Bruce Prior, N7RR, for help with the manual and debugging the 80 meter chip.

Thanks to Dave Benson, K1SWL, of Small Wonder Labs for producing the fine DSW series of QRP rigs and for reviving the DSW as the DSW-II.

Thanks to Steve Bauder, NX9Z, for suggesting the idea for the DSWK chip.

Please feel free to email with any questions, comments, suggestions or problems with the DSWK. Email to: jacksonharbor@att.net

Chuck Olson, WB9KZY

Jackson Harbor Press
RR1, Box 91C
Washington Island, WI 54246
jacksonharbor@att.net
http://jacksonharbor.home.att.net/