WinKey USB Assembly and Operation Guide Version 1.F 9/26/2006

This document describes the assembly, checkout, and hook up of the K1EL Winkey USB Keyer Kit with a version V1 PCB. This design can be powered off the PC's USB port or by batteries. When disconnected from the PC the WKUSB will go into power saving sleep mode when not in use. Because of this, a power on/off switch is not required. Two key output ports are provided which allows one of two rigs to be keyed from one keyer. The KEY/PTT outputs are optically isolated. A speed pot and four pushbuttons are also included.

WinKey PCB Bill of Materials

QTY	Ref Designator	Value	Description	Package	Chk
2	C4,C5	.01uF 10V (103)	Capacitor	Ceramic Disc	
6	C1, 2, 3, 6, 7, 9	.001uF 500V (102)	Capacitor	Ceramic Disc	
6	C10,11,12,13,15,16	.1uF (104)	Capacitor	Ceramic Orange	
1	C8	.0047uF	Capacitor	Mylar 10%	
1	C14	100 uF	Capacitor	Electrolytic	
4	S1,S2,S3,S4	SPST	Pushbutton Switch	PC mount	
3	Plastic Push Cap		Cap for push button	Black Square	
1	Plastic Push Cap		Cap for push button	Red Square	
1	J1	1/8 phone jack	Connector	Paddle Input	
1	J2	4 way RCA Jack	Connector	Key/PTT Out	
1	J3	USB connector	Connector	USB_B	
1	Unmarked	3 pin	Power selector	.1" pin to pin	
1	PX	2 pin	Jumper plug	.1" plastic	
1	L1	Inductor	Ferrite Bead	Axial lead	
1	Q1	2N2222A	Transistor	TO92	
1	R1	100Ω	Resistor	¼ W 5%	
4	R2,R3,R8,R11	2.4KΩ standard 680Ω HV option	Resistor	¼ W 5%	
5	R4,5, 6, 10, 15	4.7KΩ	Resistor	1/8 W 5%	
1	R7	4.7KΩ	Resistor	¼ W 5%	
2	R12,R13	27Ω	Resistor	1/8 W 5%	
1	R14	1.5KΩ	Resistor	1/8 W 5%	
1	R17	1MΩ	Resistor	1/8 W 5%	
2	R9, R16	470Ω	Resistor	1/8 W 5%	
1	RN1	10 pin 2.2KΩ	Resistor Network	10 pin SIP	
1	SP1	Piezo	Speaker	Plastic Can	
1	U2	PIC16F688	PIC Micro	14 pin DIP	
2	U1,U3 (standard) U1,U3 (HV option)	Toshiba TLP627 NAIS AQW210EH	Optocoupler Solid state relay	8 pin DIP	
1	U4 (pre-mounted)	FT232BM	USB Interface	32 pin SMT	
1	X1	6 MHz	Ceramic Resonator	3 pin Blue	
2		8 pin	Sockets	8 pin DIP	
1		14 pin	Socket	14 pin DIP	
1	RX1	10K	Potentiometer		
1	KX1	Knob	Speed pot knob		
1	WK-USB PCB	V2	PC Board		
2	WK_USB Enclosure		Aluminum Box		
1	Misc	3xAAA	Battery holder		
4	Screws	4-40 by ¼ inch			

4	Rubber Feet	Push on style			
1	Misc.	Velcro Tape	Adhesive		
1	Misc	USB cable			

Kit Assembly

1) Verify and check off all components against the bill of materials listed above. If there are any shortages notify K1EL by email as soon as possible and we will send them to you. Note that the surface mount IC, U5, is already mounted on the board.
2) The WK USB PCB does have a solder mask but it is still easy to inadvertently bridge two etches or pads together. Please solder carefully and use the checkplots below to resolve any connections in question. 95% of all kits returned for repair have had soldering errors.
3) Carefully check the PC board for any defects, although it's rare there have been problems reported.
4) Follow the silkscreen and carefully install all 17 resistors, then solder, and trim leads
5) Install and solder two 8 pin sockets and one 14 pin socket, make sure the alignment marking matches the silkscreen. Note that the 8 pin sockets are installed in reverse from the 14 pin socket. This will become important when you install the ICs.
6) Install the resistor network RN1, align the end with the dot to pin 1 (square pad)
7) Install and solder the six .001uF ceramic disc caps, trim leads. For HV builders: Note that C3,C6,C7,C9 call out parts with a 500V rating, these parts are labeled "500V"
8) Install and solder the two .01uF ceramic disc caps, trim leads.
9) Install and solder the six small orange .1uF ceramic caps.
10) Install and solder the leaded ferrite bead L1 and the 3 pin resonator X1, trim leads
11) Install transistor Q1, making sure that the flat side of the component body lines up with the silkscreen. Solder and trim leads.

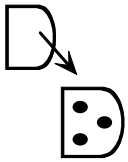


Fig 1 – Transistor Orientation

12) Install the USB connector J3. Bend over the holding tabs and make sure it is flush to the board before soldering. It helps to tack solder one of the tabs first to hold it in place. The signal pins on this connector are very easy to bridge together if you use too much solder.
13) Install the paddle connector J1, make sure it's flush and that the front of the connector is lined up with the front edge of the PC board. Be sure to hold it in place while you solder.
14) Install and solder piezo speaker S1, observe polarity and align speaker + to silkscreen + Be sure to remove adhesive paper covering the top of the speaker.
15) Install the electrolytic cap, C14, again align + markers. (The long lead goes into the square hole) Install the .0047uF mylar cap C8, Solder and trim leads.
16) Install the 3 pin power option jumper. This is located just to the right of S3 and is marked ABC. Be sure to install the short pin end into the PCB. We will install the jumper plug PX later, leave it off for now.
17) Now install the four-way phono connector block, make sure the connector is flush against the PC board before soldering in place. Trim the leads after soldering.
18) Now install the pushbutton switches on the **BACK** side of the PC board. Make sure the switches are flush to the board before soldering. After soldering, attach the square push-button caps, red on S1 which is to your left when the phono jacks are away from you and the board is upside down. Press firmly until they snap in place, not much force is required.

19) You can now wire the speed pot to the PC board, the center lug of the pot goes to PC board pad marked **W.** Cut two 7 inch lengths of wire. Looking at the pot from the back, the lug counterclockwise from the center goes to pad **G** while the center goes to **W**.

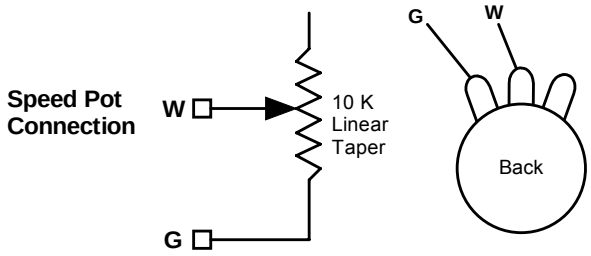


Figure 2 – Speed pot Connection

20) Don't install any ICs yet, we will do this as part of the kit bring up.
21) If you are using the battery option wire the battery holder to the PC board. Be sure to connect the red wire to the square (+) pad of J4. The black wire goes to the round pad.
22) That completes the circuit board assembly. Now proceed to bring up and final assembly.

Kit Checkout

Take a look at the Winkey USB PCB schematic on pages 5, 6, & 7 to familiarize yourself with the circuitry on the PCB. It is a fairly simple design. The WK PIC requires a positive power supply which is sourced either from a 4.5V battery pack or 5V USB port. Jumper block ABC determines the power source. Never connect WK2 to a battery supply greater than 5V, a lower battery voltage will work but not higher. To insure that the power down mode current is as small as possible a voltage regulator is not utilized. The WK2 PIC is USB compliant in that it will go into a power down mode when the USB port goes into standby. The WK2 PIC monitors USB status by looking at the USB interface IC's SLEEP output pin.

The WKUSB keyer has two modes, a host mode and a standalone mode. In host mode, WKUSB is connected to a PC which has issued an open command from a running application. If WKUSB is connected to a host but the host has not issued an open command, WKUSB will stay in standalone mode. In standalone mode WKUSB will operate as a full featured keyer with message pushbuttons and a Morse command interface. In host mode WKUSB will not respond to Morse commands, instead it is under control of the PC. This is covered more completely in the WKUSB manual.

Getting back to WKUSB bring up, the first thing is to test the USB interface. Before doing this you must install the USB driver on your PC. Carefully follow the instructions found on the CD to do this. Make sure you do as instructed or the driver will not be installed correctly and WKUSB may not work. As part of the procedure you will attach WKUSB to the PC USB port with the supplied USB cable. This will apply power to the USB interface IC, the WK IC is not installed for this test. Once the driver is installed and WKUSB is attached, the PC will assign a com port. You need to know what the port number is in order to configure applications to run with WKUSB. Here is the steps to follow to get the assigned com port:

Left Click on ***START ->*** right click on ***My Computer*** then select ***Properties*** this brings up the ***System Properties*** dialog box. Select ***Hardware*** then select ***Device Manager.*** Look for ***Ports (COM & LPT)*** and click on the + to the left of it. This will show all the communications ports installed. One of them will be ***USB COM.*** Write down the port number By clicking on that selection and clicking on ***Advanced*** you can change to port to a different value.

You will need the com port number later when you attempt to run WKUSB from a host application.

If you ran into problems and the host was not able to recognize the WKUSB device, carefully recheck all components in the USB interface to make sure none were installed incorrectly or perhaps there is a soldering problem. With WKUSB attached to the USB port, you should see +5V on the ferrite and if you have a scope you should see a 6 MHz oscillation on resonator X1.

Once you have been able to get the PC to recognize WKUSB as a valid USB device, disconnect WKUSB from the PC and we will now test the keyer portion of the design. First install the 14 pin PIC U2 and then install the two 8 pin DIPs U1 and U3. For both ICs observe pin 1 as shown:

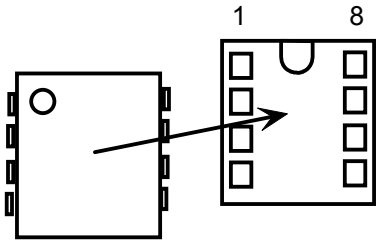


Fig 3 - IC Orientation

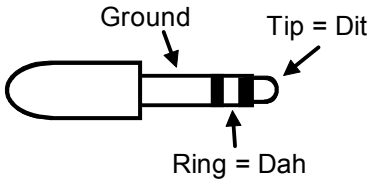


Fig 4 - Paddle Connector Pinout

Connect a paddle to J1 and power up WKUSB, the expected paddle connections are shown above. If you have dit and dah reversed this is not a problem since the paddles can be swapped by software control. If you are using batteries, install 3 AAA cells in the battery holder and place the power jumper on B-C. If you aren't using batteries place the power jumper on A-B and plug WKUSB back into one of your PC's USB ports. Press the paddle and you should hear dits and dahs on the sidetone speaker. Turning the speed pot should change the WPM rate. The keyer is in standalone mode so you should be able to press the command button and WKUSB will respond with an 'R' then you can enter a command. Read the standalone keyer section of the WKUSB manual for complete information. If WKUSB is not responding to paddle input, check the orientation of the WK IC to make sure it's not in backwards. Then measure the voltage between pin 1 and 14 on the WK IC. You should see 5 volts if you are USB powered or 4.5 volts if you are battery powered. There could be a problem with the speaker driver transistor circuit which is preventing sidetone from working. If the WKUSB is sending out a series of dits or dahs check the paddle circuit and also the speed pot circuit. If WKUSB periodically sends out an **R** followed by a **?** or an **MT** you may have a problem with the pushbutton network.

Here are instructions on installing the WK_USB assembly into the enclosure.

1) Using spray cleaner, clean the inside bottom surface of the base enclosure half to remove any dirt or grease.
2) Attach speed pot to the single hole on the front of the enclosure.
3) A Velcro adhesive pad is attached to the bottom of the battery pack. Peel back the plastic film to expose the adhesive and carefully locate the holder as shown below. The adhesive is very difficult to remove so make sue you install the battery pack correctly with the wires oriented as shown. The battery pack needs to almost touch the speed pot.

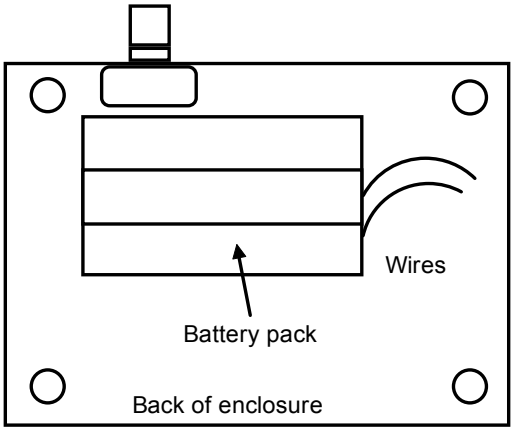


Figure 12 – Installation of battery pack

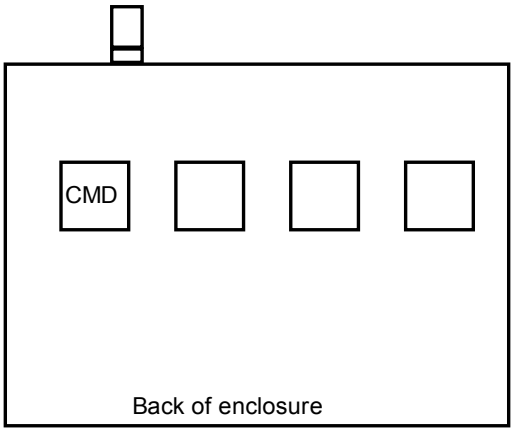


Figure 13 – Command button location

4) Install the PC board in the top half of the enclosure using four 4-40 screws. Remember the pushbuttons protrude through the top of the case.
5) Assemble the two halves of the enclosure by tilting the top and inserting the connectors into their respective holes in the back panel of the bottom half.
6) It is a tight fit, you may need to press firmly to make sure the paddle connector protrudes through the back panel. Also you may need to adjust the position of the quad RCA jacks to be centered in the back panel holes. Install four 4-40 screws to hold the top cover in place.
7) This completes the assembly.

Now proceed to application checkout, connect WKUSB to your PC's USB port.

The best application to use to check out the WKUSB kit is the K1EL Winkeyer2 Application. Although the interface is daunting at first look, there are only a few controls that need to be played with. A version is on the CD but here is a link to the application.

http://www.k1el.com/wk2_setup.exe

There is a good help file included with the app that give details on how to run it but here is a brief procedure to follow:

1) Install the application and Start it up
2) Tell the app which com port WKUSB is attached to, pull down the Setup selection from the MenuBar and select ComPort to do this. Select the COM port that you wrote down when you

installed the USB driver. You can find this by looking at: Control Panel->System->Hardware->Device Manager->Ports. After selecting the port click Done

3) Click on WK on the menu bar and OpenWK and select WKopen.
4) The app will attempt to open WKUSB and it will display a status message to let you know if it was successful. If successful it will tell you the version of the Winkey chip it found. If it wasn't successful it will tell you what the error is.
   Comport open error: You may have not have selected the correct port or there is another device using that port.
   Echo or No Response error: The com port opened properly but WKUSB did not respond. This means there is probably a problem on the WKUSB PC board, follow Step 5.
5) Since we have already checked out the USB interface and WKUSB in standalone mode the problem must be in either the serial link or Sleep status between the USB IC and the WK PIC. A good strategy at this point is to carefully go over the circuitry between the USB interface IC and the WInkey IC. Look for bad or missing solder connections, solder shorts, missing or wrongly installed components. That is the most common problem at this stage. If you have a scope you can trace the receive data path from the USB interface to Winkey pin 5. Click on WKopen while probing: a short burst of serial data is sent every time you click on WKopen. If you see it reach the Winkey chip, trace transmit on Winkey pin 6.
6) Once you get Winkey to open properly you can test various controls on the application. Place the cursor into the Keyboard Entry Window and enter some characters, this will cause Winkey to transmit what you type. Go to the Setup->Mode dialog box and make sure the paddle and serial echo checkboxes are checked. Winkey will then echo what's sent to the Outgoing Morse Window. You can test the paddles at this point and you will see BreakIn status reported and also entered letters will be echoed. The last thing to check is the speed pot, In the Setup._Mode dialog box click on PotLock and click Done. Now when you twist the speed pot, the WPM readout should track the twist.

Precautions when connecting kit to a rig

NOTE !!! : Unless you have the high voltage keying option installed, the on-board keying circuit on the WinKey PCB is only capable of keying positive voltages up to 50 VDC and is not compatible with transmitters that use negative keying voltages.

Now install the two optocoupler ICs U1 and U3 and you should now be able to key your transmitter. Key port one output is the lower left RCA jack as you look at the connector from the plug-in side. The upper left is PTT one. Lower right is Key port two and upper right PTT two. You can change output ports in the WInkeyer2 app in the output setup dialog. In standalone mode the O command toggles the output port.

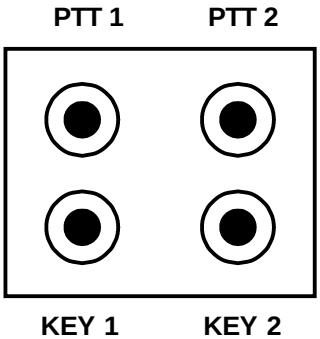
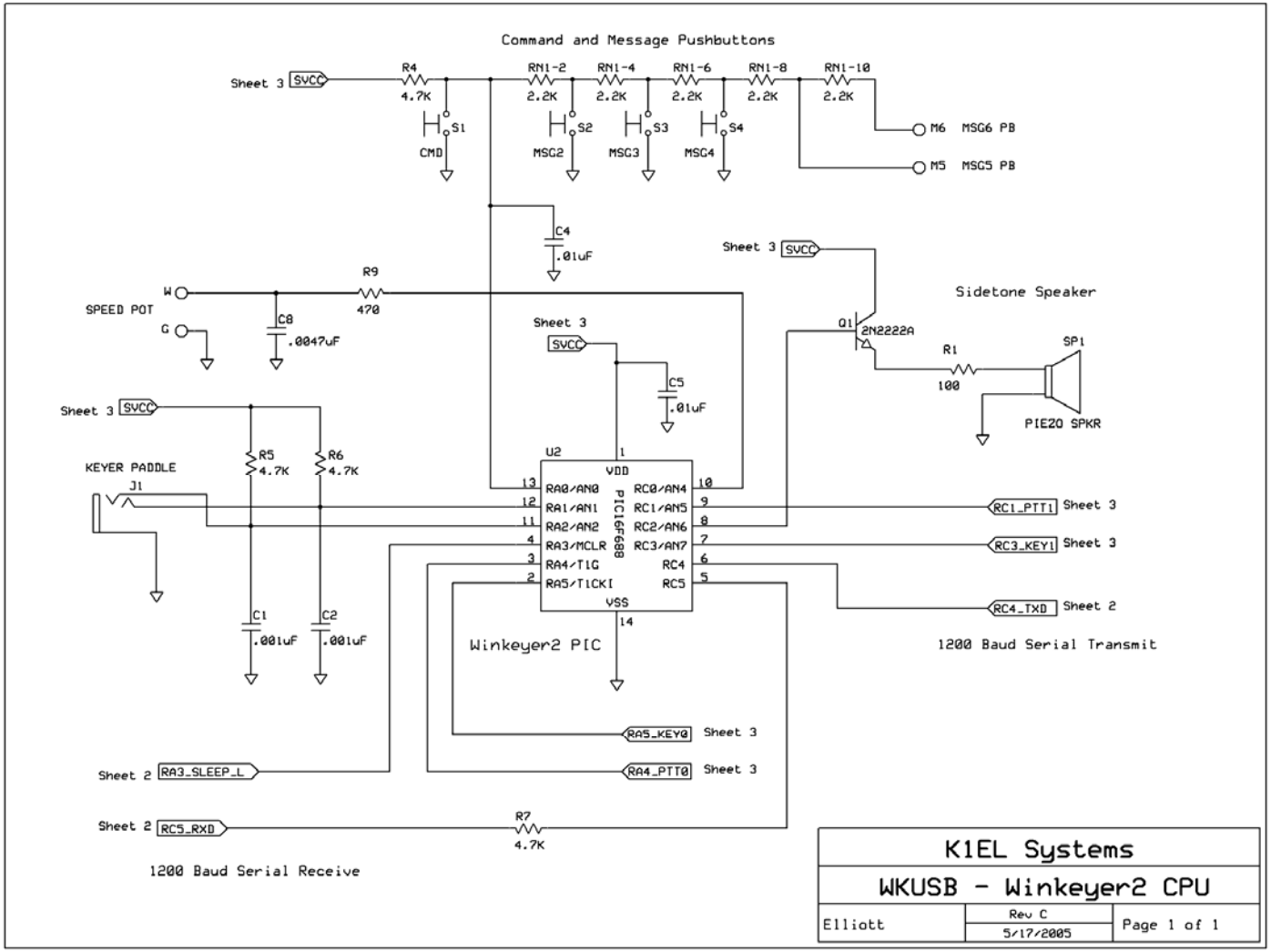


Fig 6 – Back Panel

There are several RF filter points included in the WinKey circuit design. Capacitors on the key and PTT lines shunt RF from coming back through those lines. C1 and C2 shunts any RF arriving over the paddle leads. C8 shunts any RF arriving over the speed pot leads. These components also reduce RF radiation from WinKey.

Even with good filtering the Winkey PCB is susceptible to problems caused by high RF potentials in the shack. Please observe standard RF grounding precautions to reduce RF at the operation position. This includes but is not limited to: multiple connection paths to a good earth ground, common grounding for all equipment, quarter wave stubs at particularly troublesome frequencies, and double checking all mechanical ground connections for oxidation.


Command and Message Pushbuttons
Sheet 3
SVCC
R4
4.7K
RN1-2
RN1-4
RN1-6
RN1-8
RN1-10
2.2K
S1
CMD
S2
MSG2
S3
MSG3
S4
MSG4
M6 MSG6 PB
M5 MSG5 PB
C4
.01uF
R9
470
W
SPEED POT
G
C8
.0047uF
Sheet 3
SVCC
C5
.01uF
Sheet 3
SVCC
Q1
2N2222A
Sidetone Speaker
R1
100
SP1
PIE20 SPKR
Sheet 3
SVCC
KEYER PADDLE
J1
R5
4.7K
R6
4.7K
U2
VDD
PIC16F688
VSS
RA0/AN0
RA1/AN1
RA2/AN2
RA3/MCLR
RA4/T1G
RA5/T1CKI
RC0/AN4
RC1/AN5
RC2/AN6
RC3/AN7
RC4
RC5
RC1_PTT1 Sheet 3
RC3_KEY1 Sheet 3
RC4_TXD Sheet 2
C1
.001uF
C2
.001uF
Winkeyer2 PIC
1200 Baud Serial Transmit
RA5_KEY0 Sheet 3
RA4_PTT0 Sheet 3
Sheet 2 RA3_SLEEP_L
Sheet 2 RC5_RXD
R7
4.7K
1200 Baud Serial Receive
K1EL Systems
WKUSB - Winkeyer2 CPU
Elliott
Rev C
5/17/2005
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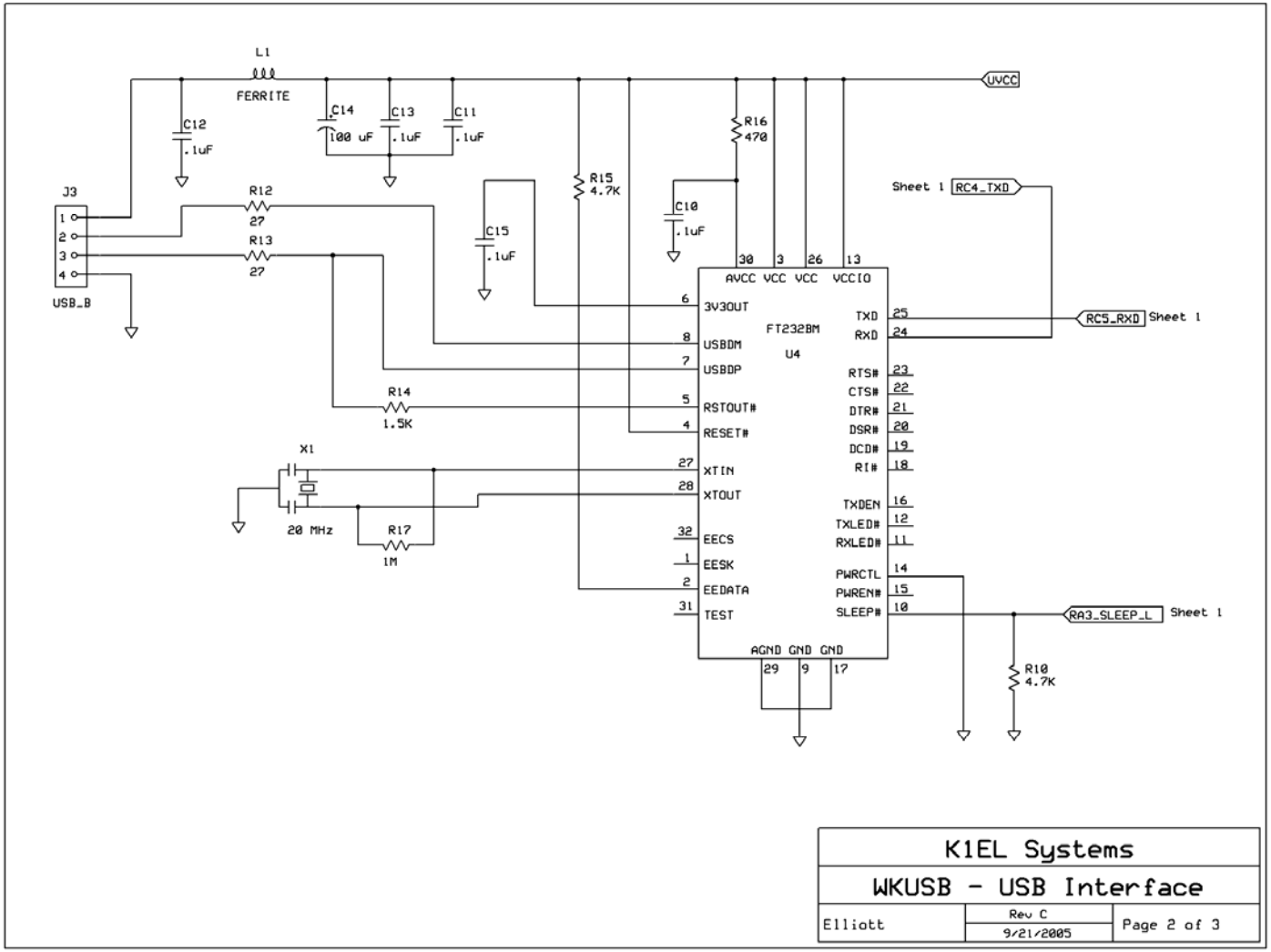

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WKUSB - USB Interface		
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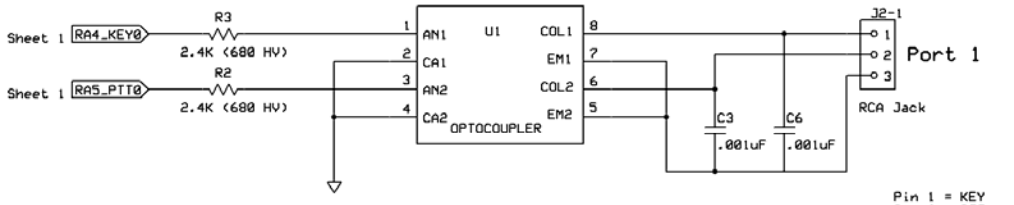
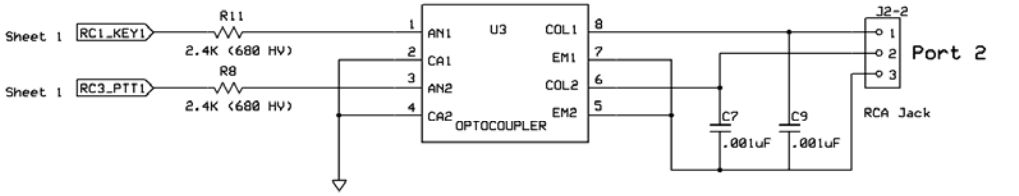
Port 1 Key and PTT Interface



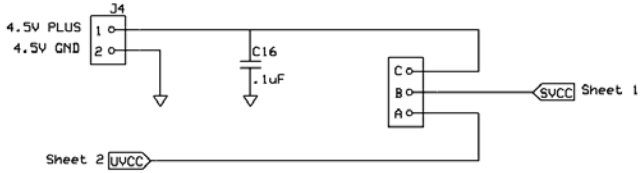
Pin 1 = KEY
Pin 2 = PTT
Pin 3 = Ground

Port 2 Key and PTT Interface



Note: Output ground is isolated from WK2 ground

Battery Connector



POWER JUMPER

K1EL Systems		
Output Ports & Power Supply		
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Figure 7 - WinKey V4 Schematic

Winkey PCB V4 Layout

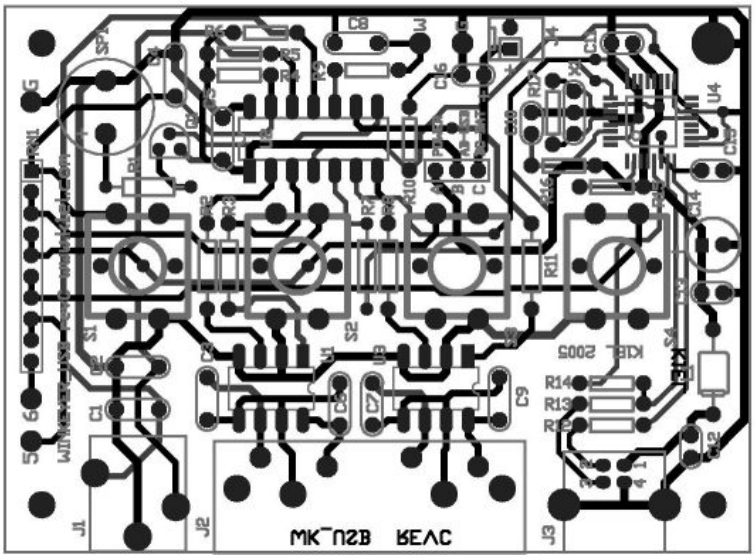

Figure 8 – WinKey USB PCB Check Plot

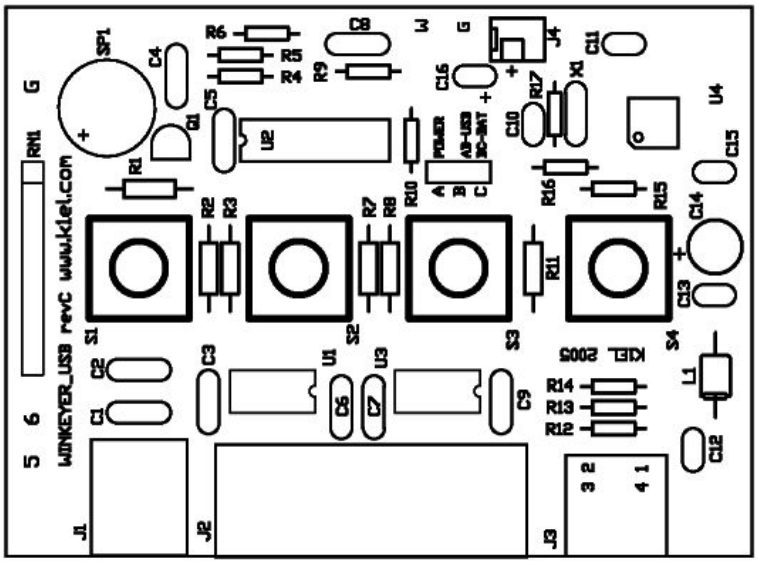

Figure 9 – WinKey USB PCB Silkscreen

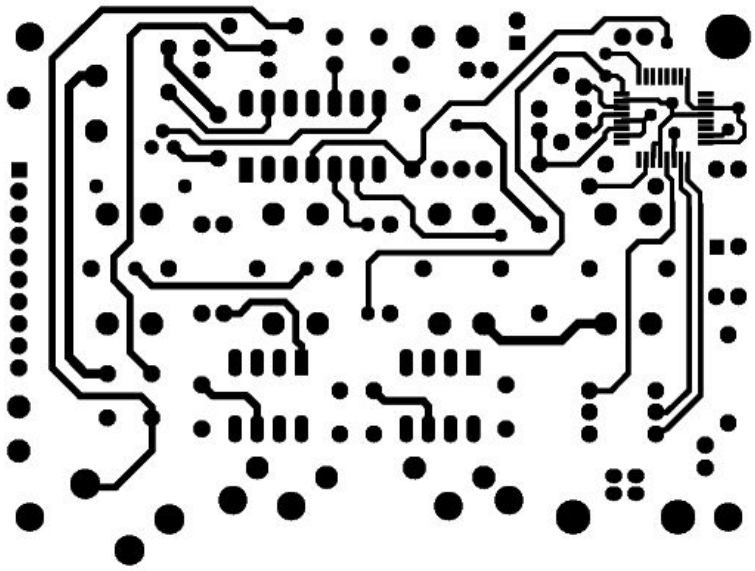

Figure 10 - WinKey USB PCB Component Side

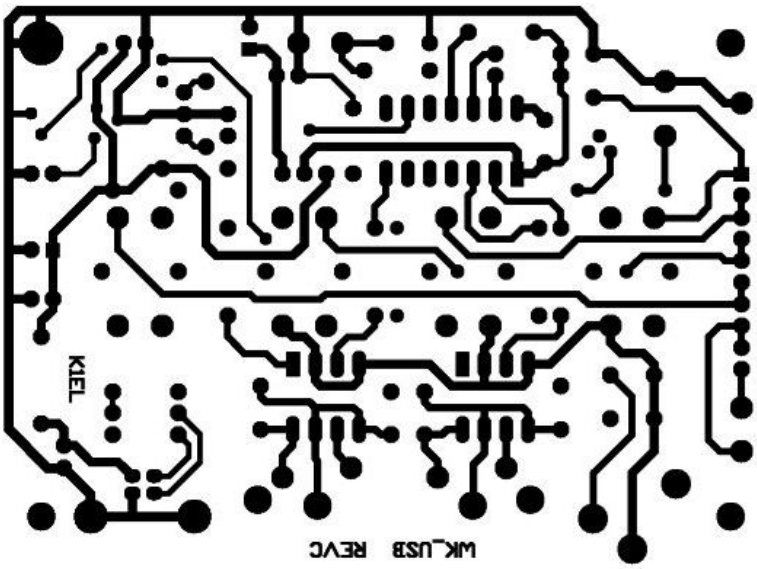

Figure 11 - WinKey USB PCB Solder Side

Standalone Considerations

Standalone operation adds a level of complexity to the system that didn't exist in WK1. Although some folks have put batteries in WK1, it was never officially supported and had problems. Here's a list of things to know about standalone operation.

1) When WK_USB is powered up for the first time it loads a default set of standalone parameters.
2) These parameters can be modified through standalone paddle commands or by hooking WK_USB up to the Windows application WK2MGR.
3) If the user modifies parameters in standalone mode and wants to preserve them, they need to remember to save the settings with the standalone **P** command.
4) When WK_USB is connected to the USB port, the PC recognizes the USB device and registers it but WK_USB remains in standalone mode until an application opens it. The only serial commands WK_USB will accept while in standalone are ADMIN commands.
5) WK2MGR works by directly reading and writing the EEPROM in the WK2 IC. The EEPROM contains all of the standalone settings and local messages. Since the EEPROM is accessed by ADMIN commands, WK_USB can remain in a closed state.
6) When an application opens WK_USB, WK_USB leaves standalone mode and will no longer responds to the command pushbutton making it impossible to enter paddle commands..
7) After opening WKUSB the host application overwrites the standalone settings with settings dictated by the host. This must be done to insure settings listed in the host application's dialog boxes are in sync with those in WKUSB.
8) When the host application closes WK_USB , standalone operation is restored and the EEPROM settings are reloaded.