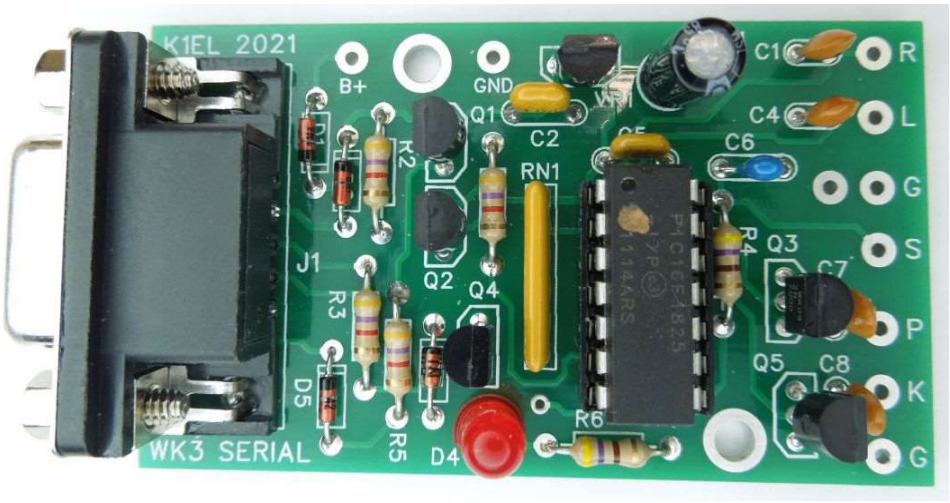
# WinKeyer 3
# Serial

## Assembly Manual




## For PC board version R01

**K1EL Systems**

**www.k1el.com**

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## Introduction

This document describes the assembly, checkout, and hook up of the K1EL WinKeyer3 Serial Kit with a version R01 PCB. This keyer is powered directly off the PC's serial port and does not require an external power source. Current draw is minimal, a low dropout, low quiescent current 3.3V voltage regulator helps in this regard. Open collector keying and PTT outputs are provided as well as speed pot and iambic paddle interfaces.

### WK3 Serial PCB Bill of Materials

| | |
|---|---|
| __ R1, R2, R3, R5 | 4.7K ¼W resistor (yellow violet red) |
| __ R4, R6 | 470 ohm ¼W resistor (yellow violet brown) |
| __ RN1 | 6 pin 4.7K SIP bussed resistor network |
| __ Rx | 10K Linear Taper Speed potentiometer |
| __ Q1 | 2N3906 PNP transistor TO92 |
| __ Q2 | 2N3904 NPN transistor TO92 |
| __ Q4 | PN2222A NPN transistor TO92 |
| __ Q3, Q5 | 2N7000 MOSFET TO92 (2N2222A may be substituted) |
| __ D2, D5 | BAT42 Schottky Diode |
| __ D1, D3 | 1N4148 silicon diode |
| __ D4 | LED |
| __ VR1 | ST L4931CZ33 or equivalent TO92 3.3V LDO Regulator |
| __ U1 | WinKeyer3 PIC processor (serial WK version) |
| __ C2, C5 | .1 uF ceramic capacitor (104) |
| __ C3 | 22 or 33 uF electrolytic capacitor |
| __ C1, C4, C7, C8 | .001 uF ceramic disc capacitor (102) |
| __ C6 | .0047uF dipped ceramic capacitor (472 blue) |
| __ J1 | DB9 9 pin female D connector |
| __ S1 | 14 pin DIP socket |

### Kit Assembly

1) Verify and check off components against the bill of materials listed above. If there are any parts missing, notify K1EL by email and we will send them to you.

2) The WK3 Serial PCB does have a solder mask but it is quite easy to inadvertently bridge two etches or pads together. 95% of all kits returned for repair have had soldering errors.

3) Use the pictures on pages 4 and 5 to help identify components and where they go.

4) Carefully check the PC board for any defects, although it's very rare it has happened.

5) Follow the silkscreen and carefully install all six resistors (R1 – R6) then solder and trim leads. Note that the 470 ohm resistor (yellow violet brown) is easily confused with the 4.7K resistors (yellow violet red).

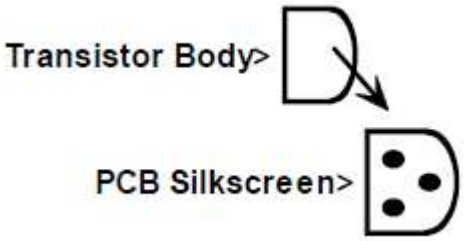
6) Install resistor network RN1, ***pin one of the network is marked with a dot***. If you are unsure you can verify pin one with an ohmmeter. You will measure 4.7K between pin 1 and 2. Between pin 5 and 6 you will measure 9.4K. Orient the network so that pin 1 goes into the square pad.

7) Observe polarity band markings and install diodes D1, D2, D3, D5. Solder and trim leads.

8) Install the keying indicator LED. There is a flat on the body of the LED that must align with the flat on the silkscreen.

9) Install and solder the 14 pin socket, so that top notch matches the silkscreen.

10) Install the transistors and voltage regulator VR1, making sure the flat side of the component body lines up with the silkscreen, as shown in the picture. Try to keep all transistors the same height above the board for a professional appearance. Solder and trim leads.




11) Install the disc capacitors then solder and trim leads. The .001uF caps (C1, C4, C7, and C8) are marked as 102 while the .1uF caps (C2, C5) are marked as 104.

12) Install C6, a blue dipped ceramic capacitor marked 472.

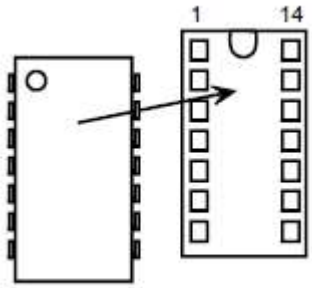
13) Install the electrolytic cap C3, the longer lead is positive (+), and goes in the square hole, (silkscreen '+') Solder & trim.

14) Next, install the DB9 connector being careful not to bend any of the leads and solder. Make sure to solder the ground lugs, it will take some extra time and solder.

15) Now wire up the speed pot. Only two lugs are connected, one to ground **G** and the center lug to the **S** pad. Looking at the pot from the back the lug clockwise from the center goes to ground. Please refer to Fig, 4 on page 6. ***If you are not using a speed pot be sure to install and solder a piece of resistor lead between pads S and G.***

16) Now is a good time to wire up the paddle interface, there are three leads; left paddle to **L**, right paddle to **R**, and common ground to **G**. (See Fig 5. page 6 for more details)

17) Finally install the WK3 chip U1, making sure the dimple (dot) at the top of the IC body lines up with pin 1 on the socket.



## Assembly Pictures


Figure 1 – Assembled WK3 Serial

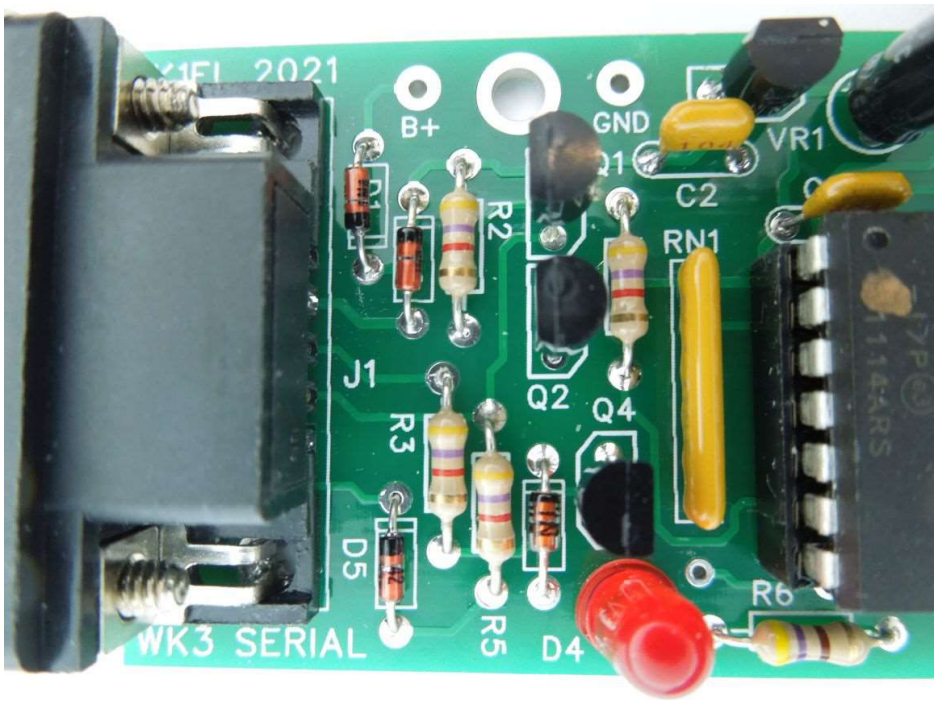



Figure 2 – Component Close Up, Left Half

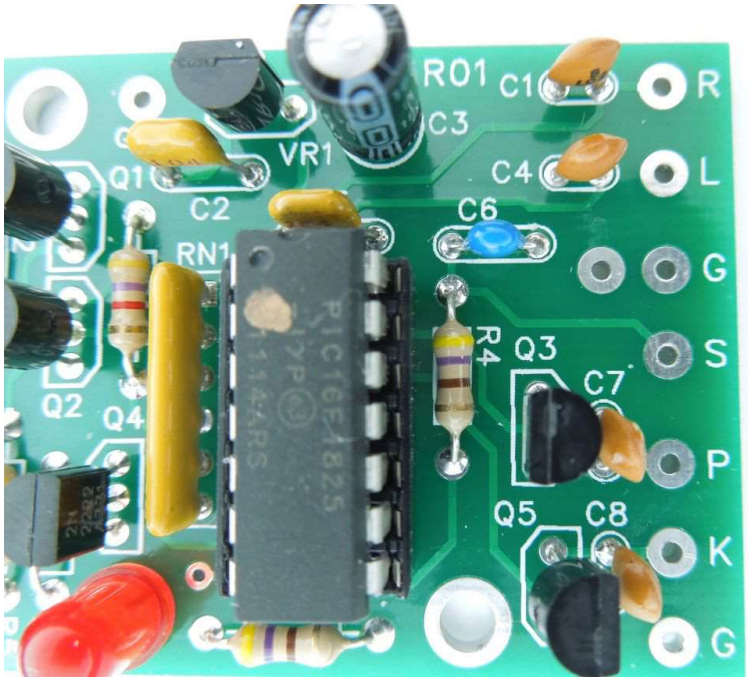



Figure 3 – Component Close Up, Right Half

## WK3 Serial PCB Wiring

Here is a handy table of all PCB connections:

| Pad Label | Wire Connection |
|---|---|
| **R** | Right Paddle |
| **L** | Left Paddle |
| **G** | Paddle and Speed Pot Grounds |
| **S** | Speed Pot Wiper (10K Linear Taper) |
| **P** | Open collector PTT output (50 VDC max) |
| **K** | Open collector keying output (50 VDC max) |
| **G** | Keying Ground |
| **B+** | Optional Battery Connection |
| **Gnd** | Battery Ground Connection |

Table 1 – WK3 Serial PCB Connection List

A battery interface is provided for those that want to run WK3 serial in a limited standalone mode. This would be with a paddle and speed pot only with no means to enter commands or trigger messages.

### Speed Pot Hookup

Here is a simplified schematic showing the speed pot hookup:

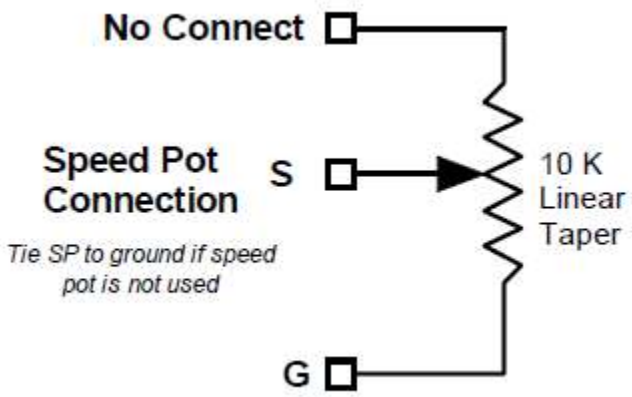



Figure 4 – Speed pot Connection

### Iambic Paddle Cable Wiring

The builder must decide the best way to connect a set of paddles to WK3serial. We recommended that an external connector be used to allow the paddleset to be disconnected easily. Usually this connector is an 1/8” phone jack but 1/4” versions are common as well.

Fig 5 illustrates the most common way paddleset plugs are wired. The mating jack on WK3serial should be wired to work with this convention.

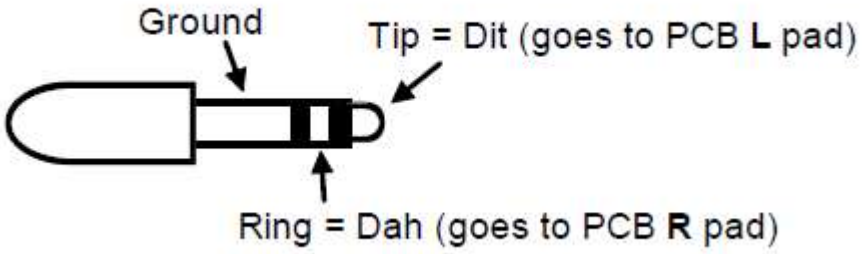



Figure 5 – Paddle Connector Pinout

Note that paddle connectors are not included in the kit.

### RS232 Interface Cable

WK3 Serial should be connected via a straight through cable (not null modem). The cable will need a male DB9 plug at one end (WK3 Serial end) and a female DB9 at the other. This assumes that a DB9 male is at the PC end.

If you make up your own cable, note that WiK3 Serial uses both DTR and RTS to derive power, so these lines must be connected in addition to the normal TxD, RxD and Ground.

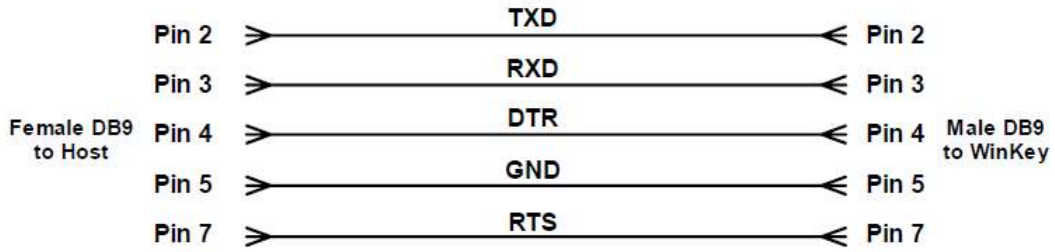



Figure 6 – WK3 Serial RS232 Interface Cable Schematic

A WK3 Serial PCB does not require external power since it is powered from the PC's RS232 serial interface. This means that WK3 Serial will not work unless it is driven by a PC application which asserts the RTS and DTR lines that in turn provide power for the keyer.

For Mac users, be sure your interface is RS232 not RS422..

## Kit Checkout

Take a look at the WK3 Serial schematic on page 13 to familiarize yourself with the circuitry. It is a fairly simple design. The PCB requires a positive and a negative power supply to operate. The positive supply comes from the RS232 signal DTR on Pin 4 of the DB9. This voltage is connected to a 3.3 volt regulator (VR1) that powers the WinKeyer3 controller IC. It also provides the positive bias for the plus swing of RS232 transmit back to the PC. The negative supply comes from the RS232 signal RTS on pin 7 of the DB9. This supply is used only to provide negative swing on RS232 transmit. Transistor Q4, diode D3, and resistor R3 level convert the incoming bipolar RS232 receive signal to 3.3 volt LVTTL suitable to drive the Winkeyer3 IC. The circuit made up of Q1, Q2 and associated resistors convert the 3.3 volt LVTTL output of the WinKeyer3 serial transmit pin to a bipolar RS232 level which swings plus and minus around ground.

WinKeyer3 IC senses paddle action on pins 2 and 4, SIP network pullup resistors set the off state to a high. The paddle input lines go low (ground) on paddle press. Two open drain FET transistors Q3 and Q5 provide a high current sinking capability for the Key and PTT outputs of the Winkeyer3 chip. Note that the keying outputs are open drain and act only as a switch to ground. In other words there is no active output voltage level on either the **K** or **P** outputs that can be measured, instead use ohmmeter mode and measure continuity to ground.

## Let’s Test WinKeyer3 Serial

The best application to use to check out the WK3 Serial kit is K1EL’s WKtest which can be downloaded from the software area of the k1el website. It is not an actively supported application but it is the only one that has a debug mode that allows you to turn the RS232 DTR and RTS lines on so you can statically test voltages on the board.

Once you verify that WK3 serial is operational, you probably won't need to use WKtest again and you can move on to WK3demo for further testing or a full featured logging or contest app like N1MM, HRD, N3FJP, Fldigi, WinTest, or countless others.

Here is a link to the setup file for WKtest:

https://k1el.com/WKTESTX.html

Here is a link to the setup file for WK3demo:

https://www.k1elsystems.com/WK3demo.html

We don't recommend using WK3tools since it is a WKUSB standalone mode editor and WK3serial does not support standalone mode. Without a command pushbutton and audio sidetone output, there really is no point in running WK3serial in standalone mode. It can be run on battery power but only in a very limited mode.

## How To Use WKtest

Connect WK3serial to a DB9 serial comport on your PC. Write down the port number of the connector, it's usually COM1 but it could be COM2 or some other port.

Most modern PCs do not have a serial interface. In this case you will need to use a USB to serial adapter and determining the com port is a more complicated. After installing the appropriate USB driver for the adapter, you will need to use either K1EL's WKscan app or Device Manager to determine the USB comport that Windows assigned to the USB to Serial adapter.

After figuring the comport issues out, install the WKtest application and Start it up:

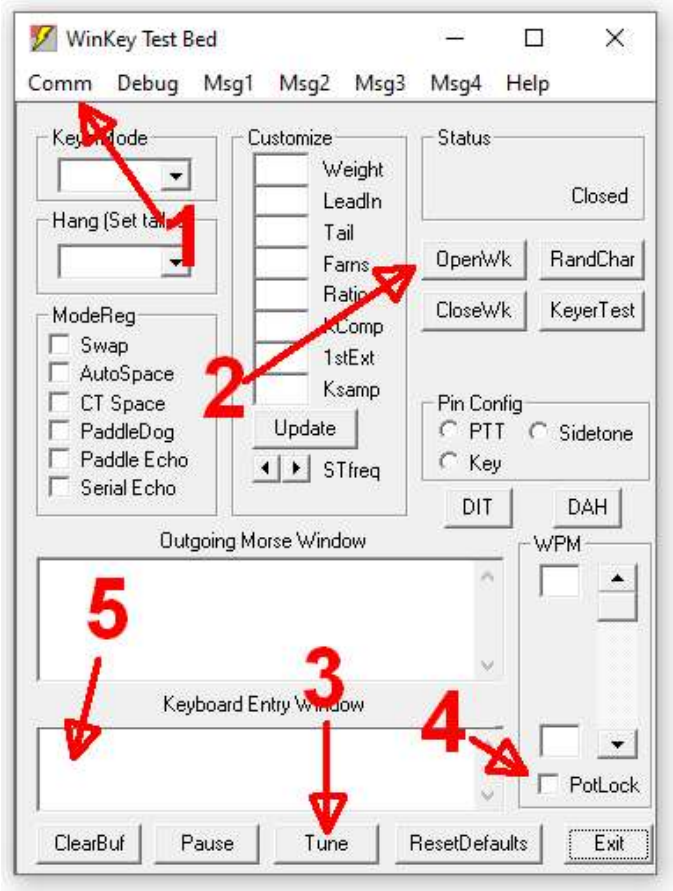



Figure 7 – WKtest Dialog Box after startup

1) Click on the Comm pull down and select the com port from the list.

2) Click OpenWK to connect WKtest to the WK3 serial keyer. It will report WK2 F/W revision 3.

3) Now click Tune and the LED on WK3serial will light, click tune again and it will go out.

4) To test the speed pot, click PotLock on and then you turn the speed control the scroll bar will indicate the change and the speed will update in the WPM window.

5) Click Paddle and Serial echo on and type in the Keyboard Entry Window. As you type, the LED will light as Morse is sent and that text will be echoed in the Outgoing Morse Window.

The next item to test is the paddle interface. Now connect a paddle and try that out, You won't hear anything since there isn't a sidetone speaker but you will see the test LED light. If you encountered problems go to the troubleshooting section on page 12.

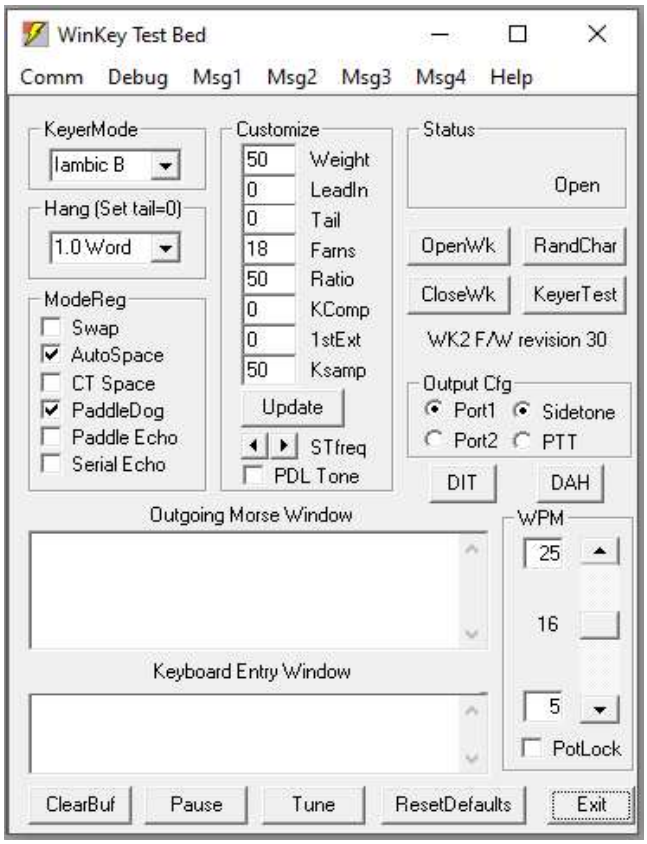



Figure 8 – WKtest Dialog Box after a successful open

### Transmit Keying Cable Wiring

Most amateur transceivers use a stereo ¼ inch phone jack as a keying input connector. The universal keying plug pin out is shown in Fig. 9. WK's Key output **(K)** would be connected to the plug's tip and WK's ground **(G)** to plug's ground. To be compatible with all radios, please leave the Ring unconnected. Note that many radios now use a 1/8" keying jack. Very few installations will use the WK's PTT **(P)** output. In this case, PTT can be configured as a second keying output so that WK3serial can be shared between two radios.

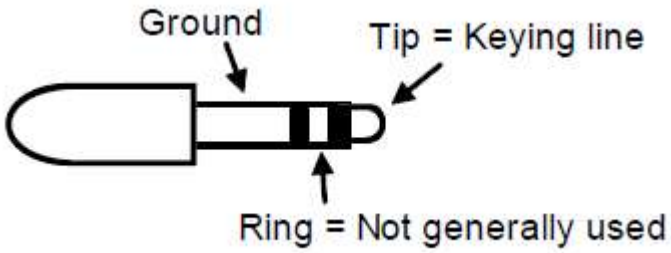



Figure 9 – Keying Cable Connections

If you are connecting to a transceiver that has an internal keyer, you will need to configure the radio to operate in straight key mode. In almost all cases, when you set the radio to straight key mode, the TIP and Ground plug pins are used to key the radio. Again, check you manual to be sure. Note that a keying connector is not included in the kit.

## IMPORTANT NOTICE !!!

### The on-board keying circuit on the WK3 Serial PCB is only capable of keying positive voltages up to 50 VDC and is not compatible with transmitters that use negative or higher than 50 V keying voltages.

### RFI Immunity

There are several RF filter points included in the WK3 Serial circuit design. Caps C7 and C8 on the Key and PTT lines bypass RF coming in through the keying leads. C4 and C1 bypass RF arriving over the paddle leads to ground. C7 attenuates RF arriving over the speed pot leads. These components also reduce RF radiation from WK3 Serial. No bypass is provided on the RS232 interface leads. For maximum RF immunity a shielded RS232 cable is recommended.

Even with good filtering the WK3 Serial PCB is susceptible to problems if exposed to 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. It is highly recommended that WK serial is housed in a metal enclosure that is grounded to shack ground.

## In case of difficulties

There are two possible errors that will be displayed if OpenWK fails:

***WK Fail: comm open not open*** means that WKtest was not able to open the selected com port. Double check to be sure you entered the correct number.

***WK Fail: no echo*** means that WKtest was able to acess the selected com port but was not able to find a WK3serial connected to it. Again check that you entered the right com port. This can also happen of there is a problem with the WK3serial hardware. Make sure you have Wk3 Serial connected to the configured port with a straight through cable, if you don't have a cable or unsure of it, you can remove the screw lugs on the WK DB9 connector and plug the PC board right into the PC comport.

After doing this and you still can't connect successfully, you can test the board using the diagnostic features of WKtest. Click on the Debug menu pick and select power on. This will drive the DTR pin on the port interface and you can use a voltmeter to see if the voltage regulator is working. You should be able to measure 3.3 volts between pin 1 and 14 on the WinKeyer3 IC. If 3.3V is not present, carefully check the voltage supply circuitry for a problem.

If you have 3.3 volts on the Winkeyer3 IC, you need to figure out why the PC can't talk to it. A good strategy at this point is to carefully go over the whole board looking for bad or missing solder connections, solder shorts or missing 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 connector through Q3 to WinKeyer3 pin 5. Click on Wk open while looking… a short burst of serial data is sent every time you click on Wk open. If you see it reach the WinKeyer3 IC, the next thing to do is trace transmit from the chip back to pin2 on the DB9 connector. You should see a clean swing from about -9 to +9 volts. This could be more or less depending on the PC, but should swing both plus and minus in order for the PC host to see it.

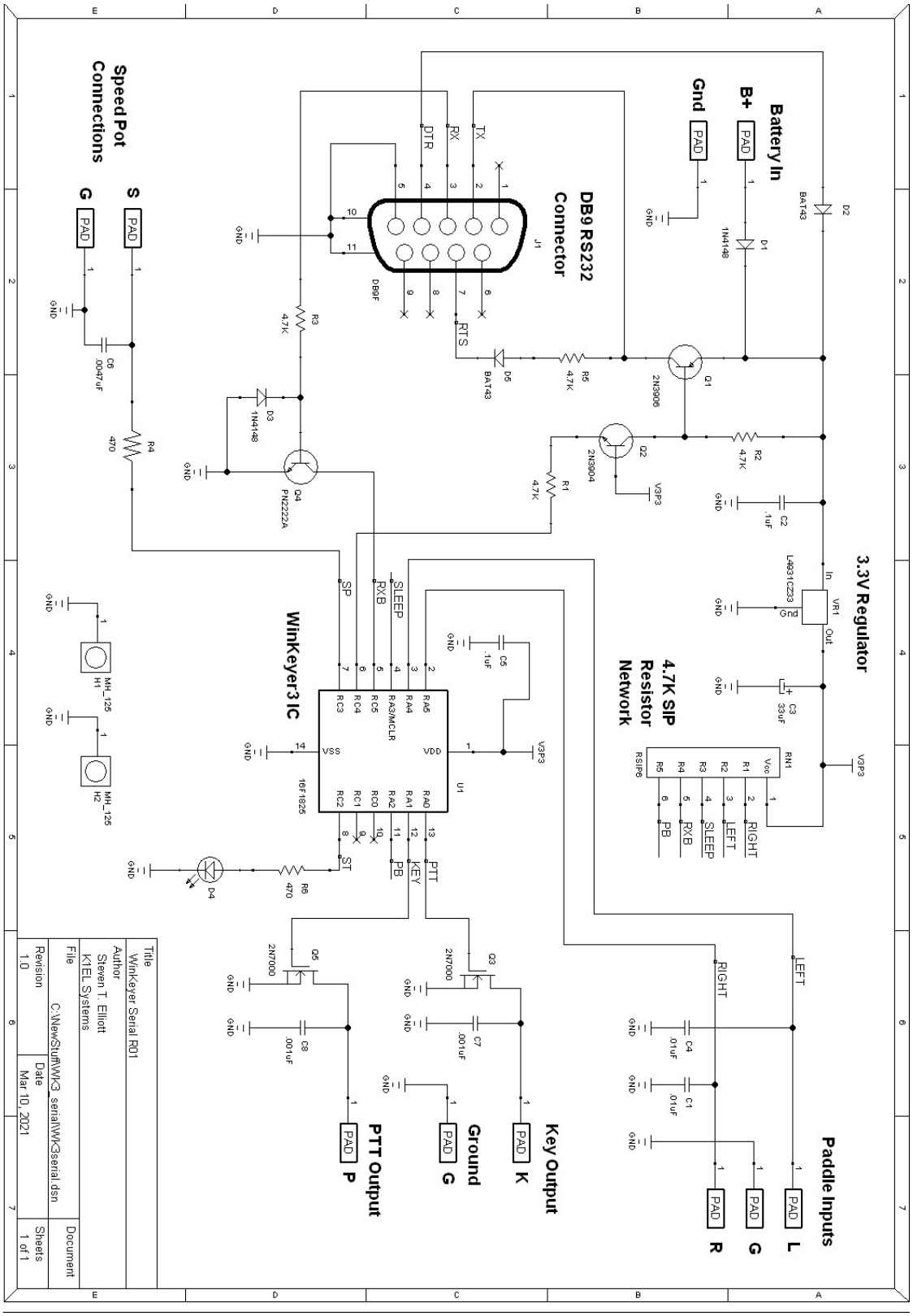



Figure 6 - WK3 Serial Schematic

## What's Next?

Now it's time to make a more permanent installation.

The following diagrams illustrate Winkeyer3 Serial installed in a generic enclosure of your own choosing:

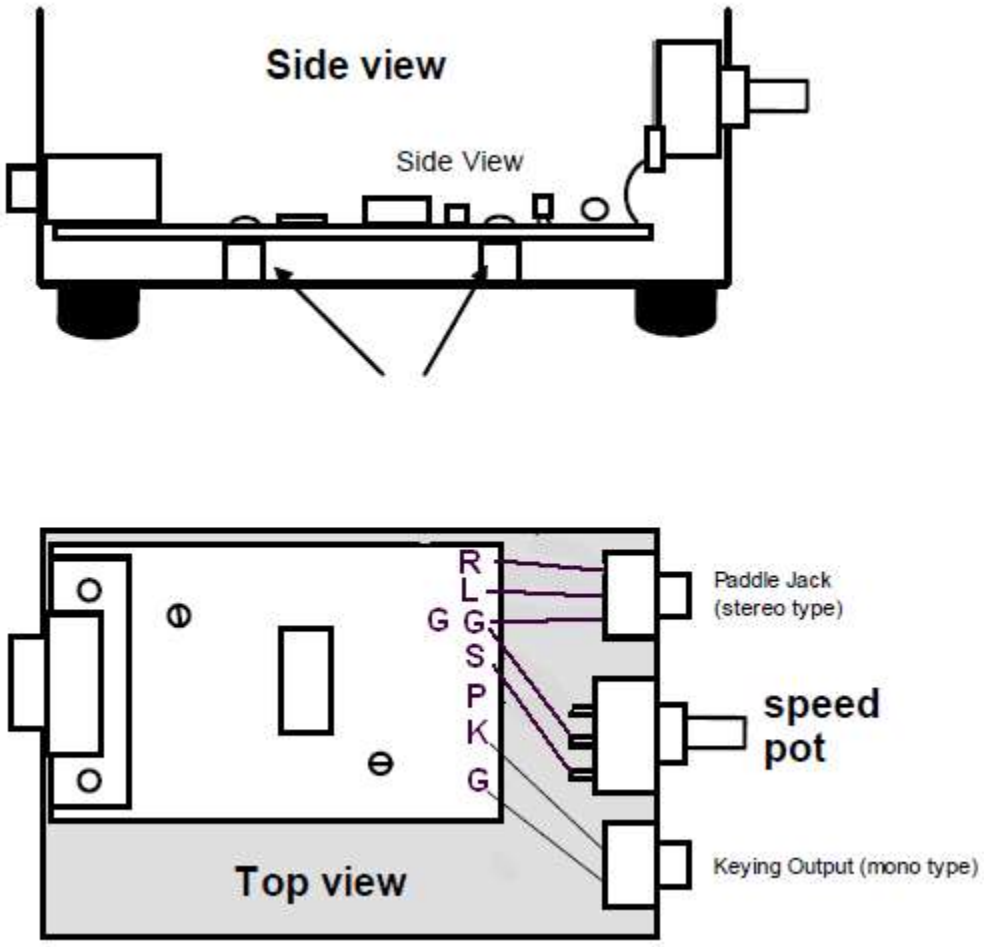



Figure 10 - Winkeyer3 Serial in an Enclosure

## Sidetone Connection

Although most users will want to use their rig's sidetone, it is possible to obtain a sidetone output from the WK PCB. The keying LED is connected to the sidetone output pin. If you remove the LED you can connect those pins to a high impedance mini speaker (600 Ω). Note that Winkeyer3 is powered from the PC's serial port and would not have enough drive capability to run a full size 8 ohm external speaker. In this event, feed the sidetone output through an amplifier stage.

## Product Warranty, Support, and Liability

WKUSB is fully warranted to the original purchaser against defects in materials and workmanship for one year after purchase. This warranty does not cover damage caused by accident, improper care, or lightning damage. Please contact us before returning your WKUSB for repair and we will issue an RMA.

Please submit support questions by e-mail to k1el.kitsinfo@gmail.com

**While every effort has been made to insure that the WKUSB design is safe and the documentation is clear and accurate, it is still possible to cause equipment damage or incur personal injury if:**

**WKUSB is not used as intended, WKUSB is connected incorrectly, Safety guidelines outlined in this document are not followed, or WKUSB is modified in any way.**

**K1EL cannot be held responsible in these or other similar events.**