4S-Link Assembly Manual

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Introduction

Thank you for purchasing a 4S-Link kit. We hope you will enjoy building it and find it a useful addition to your amateur station. With the ever increasing popularity of computer soundcard-based digital modes, this kit was conceived to fill a need within the hobby for an inexpensive interface between transceiver and computer. The 4S-Link provides transformer isolation between computer and transceiver, eliminating ground loops and hum. Its simple analog signal detection and keying permits seamless operation.

High quality, double sided, printed circuit board construction is used, with solder mask and silk screened component reference designators. All components are through-hole for easy assembly. The 4S-Link can be constructed by beginners as well as experienced builders. Construction time is approximately 2 hours, depending on experience level.

First Steps

Before getting started with building the 4S-Link, take some time to organize and familiarize yourself with the parts provided and check them against the Bill of Material. Building over a cookie sheet is recommended to minimize parts being lost. If parts are missing in your kit, send an email to the kitter whose email address is near the bottom of the kit's home page http://www.4sqrp.com/kits/4S-Link/4S-Link.php He will promptly provide replacements.

Schematic and parts-placement files are provided as part of documentation package. It is highly recommended to print a couple of copies for reference during construction. As you build, use a highlighter to mark off parts that have been soldered onto the PCB on one copy. When you think you are done, you can check that copy to verify that all of the parts have been installed.

Step 1 - Capacitors

( )	C1	0.1u	104
( )	C2	0.1u	104
( )	C3	0.1u	104
( )	C4	0.1u	104

Step 2 – Resistors

( )	R1	10k	brown-black-orange
( )	R3	10k	brown-black-orange
( )	R5	10k	brown-black-orange
( )	R7	10k	brown-black-orange
( )	R2	100k	brown-black-yellow

( ) R4 100k brown-black-yellow
( ) R6 100 brown-black-brown

Save three of the resistor leads, and solder them onto the terminals of R8, the 10k pot. When done, set this aside for the time being

Step 3 – Semiconductors
( ) D1 1N5817
( ) D2 1N5817
( ) D3 1N5817
( ) D4 1N5817
( ) Q1 2N3904
( ) Q2 2N3904

Step 4 – Miscellaneous
When installing T1 and T2, be certain that the side marked 'P' lines up with the label on the board. When installing T3, be sure that the polarity dot on the transformer corresponds to the marking on the board.
( ) T1
( ) T2
( ) T3

When installing the audio connectors J1 – J5, be certain they are seated flat against the circuit board before soldering.
( ) J1
( ) J2
( ) J3
( ) J4
( ) J5

Cut the stranded wire provided in half. Strip 1/4" (6mm) of insulation from each end of both pieces. Solder one section into each of the "Speaker" terminals on the board.

Step 5 - Final Assembly
Install the transmit level control R8 in the front panel. Then insert the wire leads from R8 through the corresponding holes in the PCB. Place the remaining rear and side panels in position around the PCB, being certain that the silk-screened text faces outward, and that the vertical tinned stripes on the boards meet at the inside corners. Place a rubber band or adhesive tape around the four side sections to hold them in place.

Use a soldering iron to apply a pea-sized solder fillet in the upper corner of each inside corner. When all four upper corners have been soldered, flip the assembly upside-down, and repeat with the lower corners. Inspect the finished results – if the joints are uneven or not square, they should be readjusted.

Solder the three leads of the pot R8 into the PC board at this time.

Attach the speaker to the tinned side of the top cover sections using four 3/8"x 6-32 screws, flat washers, and nuts. The flat washers should go between the nut and the speaker. Tighten until slightly snug, but not bottomed out, so that the speaker does not shift, but the board material is not deformed.

Add a drop of fingernail polish or other adhesive to the exposed threads to prevent the fasteners from loosening.

Solder the speaker leads to the speakers.

Insert the four 3/4" x 6-32 screws through the bottom cover, and place it on your work surface tinned side up. Place the four 1/4" spacers over the screw threads, and carefully place the PC board-side panel assembly over the bottom cover, lining up the screws with the four holes in the corner of the PC board. Screw the four 1.5" standoffs over the exposed screws until finger tight, holding the screw head on the bottom of the bottom cover if necessary.

Place the top cover with speaker over the assembly, and attach using the remaining four 3/8"x 6-32 screws. With a phillips screwdriver, tighten all eight cover attachment screws.

Attach the knob to the shaft of the volume control knob. You're completed!

Theory of Operation

There are many computer programs available that employ a computer's soundcard signal processing capability to permit operation in any of the numerous digital modes in use by amateurs. Internet links to many of the programs can be found at http://www.ac6v.com/software.htm#DIGITAL and at http://www.dxzone.com/catalog/Software/PSK31/ However, FLDIGI is the software around which the 4S-Link was designed and is suggested so as take advantage of the 4S-Link's features

These programs demodulate audio signals received in the soundcard microphone input jack, and encode and create modulated audio tones at the soundcard headphone output jack. The function of the 4S-Link is to pass these signals between the transceiver and computer at appropriate amplitudes, while maintaining electrical isolation to prevent ground loops and hum.

The headphone or auxiliary speaker output of the transceiver is to be connected to the 4S-Link 'SPKR' jack. This signal is attenuated, and transformer-isolated before being fed to the 'MIC' jack to be fed to the soundcard input. The 4S-Link featured a built-in monitor speaker, so that when the transceiver's internal speaker is disabled by plugging in a headphone cables to the 4S-Link, the user can still monitor in band audio signals.

When operating in the CW mode, the soundcard software generates pulsed tones corresponding to the CW characters. Operating with a SSB transceiver, these tones become the CW characters to be transmitted. However, for operators using a CW-only transceiver, or those who may wish to take advantage of the tighter filtering of a transceiver's CW filter an operate their SSB transceiver in the CW mode. In this case, a keying line is required to key the transceiver. For this purpose, a second audio detector and switching transistor is included for creating a CW-keying line.

In operation, the FLDIGI program generates a steady 'PTT Tone' on the right audio channel, while the soundcard is generating modulated audio for transmission in the left audio channel. The 4S-Link contains audio detection circuitry to detect this, and drives an open collector switching transistor that is used to key the 'PTT' line of the transceiver. Meanwhile, the modulated audio is fed into the microphone input of a SSB transceiver. Programs other than FLDIGI may not provide this PTT tone, so alternate transmit keying means must be used.

If operating software that does not have the PTT tone feature, the CW KEY line may be tied to the PTT

input of the transceiver to key the transmission. Alternately, the transceivers VOX function may be used.

For the sake of simplicity, all connectors used on the 4S-Link are standard ⅛" (3.5mm) stereo jacks. Double-ended, shielded, stereo patch cords are commonly and inexpensively available wherever consumer electronics are sold. Two of these cables are used to connect between the computer and the 4S-Link.

There are many different combinations of connectors used on transceivers. While many newer radios, especially QRP, have standardized use of ⅛" jacks, many others have not.

The headphone input to the 4S-Link takes its signal from the tip of the plug, while the shell is grounded. The ring terminal is floating. Many older transceivers utilize a ¼" jack for headphones. For these, an ⅛" to ¼" converter plug is required. These too are commonly available at consumer electronics stores.

The KEY jack of the 4S-Link has the shell of the connector grounded, while the tip is the keyed line. The ring terminal is left floating. Many transceivers utilize a ¼" jack for the key input, again a ⅛" to ¼" adapter may be used. The keying switch is a generic NPN transistor capable of handling +30v and 50mA. This will not work with most older tube-type or hybrid transceivers using grid-block keying, so please check your rig before attempting to use it with the 4S-Link.

The MIC/PTT jack has its shell grounded, the ring is the switched PTT line, and the tip is the microphone input. Some older TenTec and Collins gear used ¼" microphone jack with this pinout, so if that's what you run, you are in luck. Otherwise, a custom connector will have to be fabricated. As with the keying line, the PTT switch is a generic NPN transistor capable of handling +30v and 50mA. Check your rig's manual to be certain of the connections.

The various software packages available all have extensive set-up instructions and help files. Check these to be sure your computer and transceiver are configured properly.