USB I2C Interface (BETA) Project

Project Introduction

General

These documents are currently in BETA and are subject to additional modifications/changes

This kit is based upon an original design by Jan G0BBL and provides a multi-faceted replacement for the older "Rocky" serial interface kit. The kit includes:

- the 0.6 inch by 1.5 inch circuit board
- all components that go on the circuit board
- a three foot long USB cable with male connector on one end
- an 8-pin plug for the I2C interface to the PIC socket on the application board
- and a piece of heat shrink to cover the USB I2C board.

Its functionality is in three areas:

- It enables control of the programmable local oscillator, Si570, on the V8.3 RX and the V6.3 RXTX kits, over a USB cable, using the I2C protocol of two serial streams (the clocking stream, named "SCL", and the data stream, named "SDA"). With the proper software drivers, this kit removes the 16 frequency constraint of the RX V8.3 and RXTX V6.3 kits
- It accepts dash, dot, and common inputs from a keyer for input to Rocky's embedded keyer module
- It provides PTT switching signals from Rocky to the interfaced RXTX V6.3 rig,
- An additional application could be with existing v6.2 RXTX boards where only the PTT control function and the paddles input function are desired.

This is an initial set of documentation of the build process for the USB I2C Interface kit.

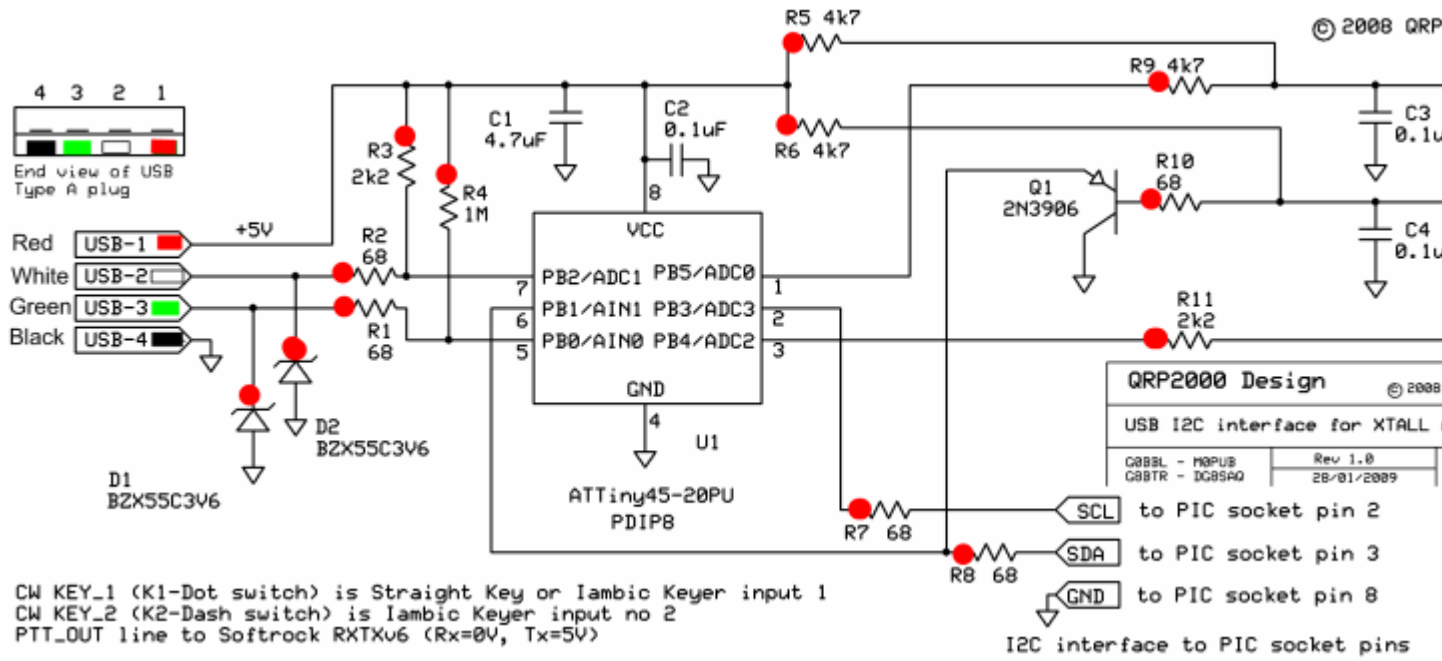
The build is in three stages:

- Component installation ("build")
- External Connection installation
- and final operation/testing with a connected rig

The builder should read each page completely, taking care to compare the "bare board" photos with the completed stage photos, before undertaking actual construction.

Project Schematic

(Resistor testpoints (hairpin, top, or left-hand lead), as physically installed on the board, are marked in the schematic with red dots)



Project Bill of Materials

See Project Bill of Materials

Project Expert's (terse) Build Notes

- Inventory Bill of Materials (BOM) < single>
- Interface to RX or RXTX

Project Detailed Build Notes

For the non-expert builders among us, this site takes you through a stage-by-stage build of the kit. Each stage is self-contained and outlines the steps to build and test the stage. This ensures that you will have a much better chance of success once you reach the last step, since you will have successfully built and tested each preceding stage before moving on to the next stage.

Each stage is listed below, in build order, and you can link to it by clicking on its name below (or in the header and/or footer of each web page).

- Inventory the Bill of Materials (BOM)
- Build and Test the Build Stage Stage

- Build and Test the External Connections Stage
- Build and Test the Interface to Rig(s) Stage

Background Info

Tools

Winding Inductors

To learn how to wind coils and transformers, please read the

- tips from the experts and then
- view the excellent videos on KC0WOXs Website
- or take a read of Dinesh's VU2FD guidelines.

Soldering

The video below describes techniques for soldering SOIC 14 (and 16 and 8) SMDs

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View the above in full-screen mode on Youtube.

- Read the Primer on SMT Soldering at the Sparkfun site. It is a very good read and it speaks great truths. Then take the time to watch the video tutorial on soldering an SOIC SMD IC.
- Solder Stations. Don't skimp here. Soldering deficiencies account for 80 percent of the problems surfaced in troubleshooting. It is preferable to have an ESD-safe station, with a grounded tip. A couple of good stations that are relatively inexpensive are:

o 

Velleman VTSS5U 50W Solder Station (approx $20 at Frys)

o 

Harbor Freight ESD Solder Station (under $50)

ESD Protection

- Avoid carpets in cool, dry areas.
- Leave PC cards and memory modules in their anti-static packaging until ready to be installed.
- Dissipate static electricity before handling any system components (PC cards, memory modules) by touching a grounded metal object, such as the system unit unpainted metal chassis.
- If possible, use antistatic devices, such as wrist straps and antistatic mats (see Radio Shack's Set for $25 or the JameCo AntiStatic mat for $15)).
- Always hold a PC card or memory module by its edges. Avoid touching the contacts and components on the memory module.
- Before removing chips from insulator, put on the wrist strap connected to the ESD mat. All work with CMOS chips should be done with the wrist strap on.
- As an added precaution before first touching a chip, you should touch a finger to a grounded metal surface.
- If using a DMM, its outside should be in contact with the ground of the ESD mat, and both leads shorted to this ground before use.
- See the review of ESD Precautions at this link.

Work Area

- You will need a well-lit work area and a minimum of 3X magnification (the author uses a cheap magnifying fluorescent light with a 3X lens. This is supplemented by a hand-held 10 X loupe - with light - for close-in inspection of solder joints and SMT installation.
- You should use a cookie sheet or baking pan (with four sides raised approximately a half an inch) for your actual work space. It is highly recommended for building on top of in order to catch stray parts, especially the tiny SMT chips which, once they are launched by an errant tweezer squeeze, are nigh on impossible to find if they are not caught on the cookie sheet.

Misc Tools

- It is most important to solidly clamp the PCB in a holder when soldering. A "third-hand" (e.g., Panavise or the Hendricks kits PCB Vise) can hold your board while soldering. In a pinch, you can get by with a simple third-hand, alligator clip vise. Jan G0BBL suggests "A very cheap way is to screw a Large Document Clip to a woodblock which will clamp the side of a PCB."
- Magnifying Head Strap
- Tweezers (bent tip is preferable).
- A toothpick and some beeswax - these can be used to pickup SMT devices and hold them steady while soldering.
- Diagonal side cutters.
- Small, rounded jaw needle-nose pliers.
- Set of jewelers' screwdrivers
- An Exacto knife.
- Fine-grit emery paper.

Project Completed Stage

Top of the Board

Bottom of the Board

Project Testing

Each stage will have a "Testing" Section, outlining one or more tests that, when successfully completed, provide you with the confidence and assurance that you are heading in the right direction towards a fully tested and built transceiver.

When you perform a test, you should always record the results of the test where indicated in the Testing section. This will make troubleshooting via the reflector much easier, since you will be communicating with the experts using a standard testing and measurement regime.

When comparing measurements to those published in these notes, the builder should be aware that actual and expected values could vary by as much as +/- 10%. The idea behind furnishing "expected/nominal" measurement values is to provide the builder with a good, "ballpark" number to determine whether or not the test has been successful. If the builder has concerns about his measurements, he should by all means pose those concerns as a query in the Softrock reflector so the experts can provide assistance.

It goes without saying that you should ALWAYS precede any tests with a very careful, minute inspection (using the best light and magnification available to you) to be sure all solder joints are clean and there are no solder bridges or cold joints.

This kit can be built and reliably tested using nothing more than a common multimeter. Tests assume that the builder has a decent digital multimeter of sufficiently high input impedance as to minimize circuit loading issues. Measurements will be taken of current draws, test point voltages, and resistances.

Most stages will have a current draw test, in which the builder tests the stage's current draw in two different ways:

- **First, testing the draw through a current-limiting resistor**
- **Then, when that test is OK, removing the current-limiting resistor and measuring the real current draw.**

Some tests will require you to use your ham radio to receive or generate a signal of a specified frequency in order to test transmitters, oscillators, dividers, and/or receivers.
Optional testing. If the builder has (access to) a dual channel oscilloscope, along with an audio signal generator and an RF signal generator, and feels the need to perform tests beyond the basic DMM tests, certain stages will include in their testing section some optional tests involving this advanced equipment.

The IQGen or DQ-Gen programs available free from Michael Keller, DL6IAK, can be used in a pinch to get the sound card to produce audio tones for injection into the circuit.

You can always use Rocky to generate I and Q signals for tests requiring these audio signals (this is the author's preferred way)