Newcomers and Elmers Net Notes: Kit Building/Experimenting 08.20.17   Robert AK3Q

In talking about kit building I will cover some of the basics for tools and techniques, as well as cover some of the types of kits you can find on the market or through plans on the internet

There are three main types of building techniques
- Through hole soldering
- Surface mount soldering
- Spring loaded breadboards

Through hole soldering boards were the most common throughout most of radio's history
- Like it sounds, the leads from an electrical component go through a circuit board and are soldered on the bottom – some parts may be soldered on the top of the board if the design requires it
- On the bottom of the circuit board there are metal traces connecting the various pieces into the circuit design—the solder acts as the bridges between the various components whose traces are like a roadmap of interconnected streets
- Some of the advantages to through hole design is the ability to work with larger components and longer leads – makes soldering much easier
- Easy to remove bad pieces without risking other good components around it; less chance of overheating a component while soldering
- Some of the disadvantages of through hole designs are that the pieces are larger, and therefore the circuit board itself must be larger
- Also longer leads mean components can possible pick up interference through those long leads at really high frequencies, making the leads act as little antennas
- That does not generally affect HF or VHF/UHF frequencies, but can impact microwave frequencies
- Larger components usually require greater power, whereas tiny components can run with much less power since the efficiency is greater

Surface Mount Soldering
Advantages:
- Lower power requirements and smaller boards; tiny leads so less likely to pick up interference; parts are cheap and easy to get
- For some people after they become proficient at working with SMCs, they find it faster to finish projects

Disadvantages
- Smaller components very hard to handle with specialized tools
- Specialized tools are ones not likely in your tool kit already
- Small circuits and components mean your eyesight had better be really good or you need to have high levels of magnification
- Requires very steady hands, almost like a surgeons!
- Parts are easily confused because of their small size and lack of markings; their larger cousins can have color codes or writing on them, but on SMCs there's no room!
- As technology progresses SFCs are getting even smaller, compounding the problem
- Even your test equipment has to be designed for SMC work, as typical probes on a voltmeter or oscilloscope can be too large or too unwieldy to work on SMC boards
- All of this is not to say don't try your hand at SMC work, but be aware this isn't your grandfather's tube radio repair shop!

Spring-loaded Breadboards
These are useful for prototyping or testing a circuit because they do not require soldering.
- The boards are designed to take non-SMC, with the leads pressure fitting into holes in the board and help by spring-type pressure.
- Components can be taken in and out of the board easily, and there is plenty of room to space things out.
- The boards are designed with a grip pattern with each row and column numbered or lettered to indicate the precise point where a component lead has been inserted
- There are rails along the top and bottom for power and ground connections
- If you have seen electronics learning labs such as the ones from Radio Shack and Elenco then you have probably seen these breadboards
- As these are just for prototyping and testing circuit designs, there are no real disadvantages to them, and of course their main advantage is not having to solder things at this stage – great for trial and error testing, or for learning how different components affect a circuit

Building radios, test equipment, and antennas has been a mainstay of amateur radio from the beginning
- Earliest radios were all home-built, or "homebrew" as we say
- Many advancements in the field of electronics have come from amateur radio folks
- Still today radio amateurs are on the forefront of technological advancements in electronics, communications, and even cancer treatment

What follows are some homebrew project suggestions to hopefully whet your appetite for exploring this aspect of the hobby

- You might wonder why someone would build their own radio or test equipment since there's a lot of commercial equipment available
- Pride of ownership
- Cool to use your own stuff!
- First regenerative receiver I built still holds a special place in my heart
- First piece of test equipment recently was a real thrill, especially when it worked the first time, and it is a quality piece of equipment
- Sometimes we think homebrew means low quality – that is definitely not the case
- building your own takes you behind the scenes of what's happening and increases your understanding
- It's never too soon to start building things
- One of the best ways to understand radio, electronics, and antennas is by building projects
- You can start out as simply or as aggressively as you want to, but I recommend starting out simply and building upon that
- I always recommend antennas as a practical place to start, but I really do want to encourage you to get into kit building
- Eventually you may even decide to design your own "kit", and who knows, it might be something others want to build as well!

Skills

The main skill you will need is patience and having a sense of curiosity will go a long way to making the whole process more fun

-- Learning to solder properly is the first skill to acquire; it is best to do this with some practice parts and boards, or else de-solder something and re-solder it

-- There are numerous soldering tutorials online, or you can get someone to show you how it should be done; also most books on circuits and building electronics have a section on soldering technique

-- as we talked about last week, you want to have a soldering iron for small parts/thin solder, and a soldering gun for larger parts like building antenna coax connections

-- if doing surface mount work (tiny parts/no through hole boards, 15 watts will do; for larger parts/through-hole construction, 25-35 watts is enough

-- danger of cold solder joints when solder does not get hot enough means that it is a weak connection likely to fail

-- too hot and things will melt that you don't want to melt!

-- don't be afraid of soldering – you can do it!!

Kits are like recipes—they will give you instructions, images, and all the parts needed – you have to follow the instructions carefully and not hurry
-- most kits will also tell you what you need to get the job done as far as tools or supplies
-- some kits are basic enough that they assume you already know what you need
-- there are also kits which do not require soldering, but they will tell you that as part of the kit description; if nothing is said, assume soldering is needed

--the biggest problem most people have with kits is thinking they understand what they are supposed to do without really understanding – don't rush through a kit
-- I use to build model planes as a kid and invariably I would get moving too fast and think I had read the right instruction, only to have put a wrong part together
-- usually reading through the whole instruction set can give you an idea of the flow of things, and then go back and do things in step by step order

Radios
- Numerous radio kits abound from simple Morse code radios to multi-band HF SSB radios and beyond
- Two different but useful routes would be to build a traditional AM/FM or Shortwave receiver, or one of the Software-defined radio kits available, such as the SoftRock kit.
- The merging of computers and radio has produced some amazing opportunities not available even a few short years ago
- Arduino (are-dwee-no) microprocessor is all the rage right now, as it is relatively cheap and programming software is available to do all kinds of things with it
- A similar movement merging computers and radio right now is the raspberry Pi board which runs Linux and can interface with a lot of radio equipment depending on how it is set up
- It is basically a computer on a single board
- If you want to go classic, "old-school" there are many plans and kits available to build crystal radios, vacuum tube radios and the like

Test Equipment and Tools
- You can also build your own test equipment, such as an SWR meters, power meters, volt meters, and even oscilloscope kits
- Test equipment can be as basic or as hi-tech as you want to go in terms of building kits

- Some kits are designed as project boards where things snap in – these are designed for education more than making a finished product
- Radio Shack, Amazon, and other places sell educational electronic kits like this, as well as basic radio kits
- More advanced kits are designed to have you solder in parts, run some basic wiring, and other assembly
- Some kits used through-the-board components while others use what is known as surface-mount components
- While through-the-board kits are still readily available, many kits are using surface mount components which require some experience for assemble—most parts need a magnifying glass and a really, really steady hand and light touch
- I would recommend working with through-the-board components for a while until you are really comfortable with the larger components, then try tackling a simple surface mount kit

Kit building has taken a bit of a side path recently in that some folks are finding a lot of enjoyment designing modular systems to accomplish tasks
- For example, by taking an Arduino processor and combining it with motors or sensors or other components, folks are building some very interesting tools
- Likewise folks are using Raspberry Pi computers and combining them with GPS, and TNC boards or modules to make APRS trackers, or beacon stations or dedicated digital stations for ham radio
- There's a fellow who has created a breakout board to make use of the Raspberry Pi's clock function which allows it to become a direct conversion low-power transmitter
- There are folks using the Pi to run a Packet BBS, and others use it to build your own ADS-B Ground Station for monitoring aircraft and then post to sites like Flightaware or FlightRadar

Some Useful Web Sites:
www.partsexpress.com
www.qrpme.com
http://fofio.blogspot.com/2013/02/radio-kit-guide.html
http://www.sdr-kits.net/
http://fivedash.com/
http://www.radio-kits.co.uk/hunter/
http://wb5rvz.com/sdr/New_SR_Lite/
http://ae9rb.com/
http://www.sdr-cube.com
www.ramseyelectronics.com/
https://www.midnightscience.com/kits.html

http://www.tentec.com/categories/Kits/
http://www.mtmscientific.com/swradio.html
http://www.raspberrypi.org/
Franzis Franzis Cardboard Tube Radio Kit
Midnight Science Midnight Science XSS-MMSW – My Marconi Shortwave Radio Kit

List from the excellent QRP resource QRPARCI.org:
http://www.qrparci.org/links/qrp-kits-bits-and-supplies

4SQRP

The Four State QRP Group (4SQRP) produce a great range of quality kits to support their OzarkCon QRP conference. The range is regularly updated, support is available from the designers and fellow builders. These are absolute gems - visit the website regularly !

AlexLoop

A compact loop antenna for the HF bands. Easy to set up and works very well for the size. It has become a firm favorit for use when there is no time (or no trees) to put up a wire.

Dan's Small Parts and Kits

Source of QRP parts and kits

Debco Electronics

A source of QRP components.

DX Kits

UK based supplier of kits and components. They offer a digital VFO with automatic filter switching. A G6LBQ transceiver kit is in development.

Elecraft

 A company founded by QRPers and good source of kits.

Etherkit

A new company set up by well known designer and tweeter Jason Milldrum NT7S. Etherkit have a great low power beacon kit that runs a variety of modes and can be updated through a USB interface.

Five Dash Inc.

This is the place to go for the popular range of SoftRock SDR receivers. Includes the SoftRock Ensemble transceiver.

Kanga Products (UK)

Supplier of quality kits. Based in UK but ships Worldwide. Notable products include the OpenQRP 40m Transceiver, the new W1REX Rockmite, the Kanga K14 keyer (based on the K1EL K14 I.C.), an 80m SDR receiver and a Stockton power meter. Builders interested in Arduino controlled transceivers will appreciate the M0XPD designed shields for a DDS VFO and a version of the famous 'Sudden' transmitter.

[Kanga US](#)

Project Kits, ARRL books, DK9SQ Masts, crystals, and other QRP items

[Kits and Parts](#)

Great source for toroids, and other very handy to have QRP parts. Also offers a wide variety of kits for the beginner and advanced builders.

[MFJ Enterprises](#)

Source of QRP kits and assembled gear and other ham radio products.

[Mouser Electronics](#)

A good source for parts. No minimum order

[N3ZI Kits](#)

Our products are not for beginners. They are intended for experienced kit builders who know how to solder and have previously assembled other kits, and have a modest level of technical capability. They are intended for licensed amateur radio operators for their own personal use. We may sell to other buyers who feel they have the required technical expertise. You should download and review the technical manual before ordering to make sure you are capable of building the kit. If you receive a kit and decide that you do not have the expertise to assemble it, please return it to us within 10 days and we will refund your payment.

[Netty Electronics](#)

Lots of useful parts for the QRP constructor - toroids, semiconductors, magnet wire. Also stocks some hard to get parts that are discontinued by other suppliers. Business is owned by Earl VE3AB but all prices are in US dollars.

[Nightfire Electronics](#)

Source of small electronic kits and parts.

[Oak Hills Research](#)

Oak Hills Research was founded by Doug DeMaw W1FB, the godfather of QRP. Today OHR is your best source for quality transceiver kits and accessories. On these pages you will find descriptions and photos of our fine QRP products.

[ozQRP](#)

A single band (20m, 40m or 80m) SSB transceiver kit from Australia.

[QRPkits](#)

Hendricks QRP Kits is a company that specializes in high quality, low cost QRP Kits.
[QRP Labs](#)

A very nice beacon transmitter for QRSS and WSPR. Works on any band from 2200m to 2m with an option to operate on up to 6 bands.
[QRPme](#)

QRPme is NOT a club or big time organization! It is THE part time business of 1 guy, Rex Harper, W1REX. All the kits offered on this website are designed, kitted, updated, packed and shipped by 1 guy. At times personal commitments take precedence over kitting & shipping kits so shipping times may vary. QRPme has one of the widest ranges of kits for the QRP community and we strive to ship kits within 2 or 3 weeks from receiving your order.
[Radio-Kits](#)

Well known for the MKARS80 - an 80m SSB transceiver based on the BITX20 design. Now include an SDR receiver and digital SWR meter in the range
[SOTAbeams](#)

"The Portable Radio Specialists". Based in the UK, SOTAbeams is operated by Richard Newstead, G3CWI. There is lots here for the QRP portable operator including HF wire antennas, portable VHF beams and telescoping masts. SOTAbeams also offer the compact Palm morse keys, desk stands for various QRP radios and Antenna Tuners.
[SuperAntenna](#)

Famous for the much loved MP1 SuperStick vertical antenna. The range is now expanded to include a portable HF yagi and wire antennas. Great products for QRP operators when hiking, on the beach or at home where a permanent antenna cannot be deployed.
[Ten Tec](#)

A USA based company with a long history of QRP products. They currently have a range of interesting transceivers including the TenTec Argonaut VI, the unique Arduino based TenTec 506 'Rebel' and the ultra-portable YouKits HB1B.
[W1SFR - KX3Helper and other accessories](#)

A selection of QRP accessories including unique stands for most QRP rigs.
[Wilderness Radio](#)

A range of kits aimed specifically at the outdoor QRP enthusiast. These kits, field-tested by members of the NorCal QRP Club, represent the state of the art in portability, low power consumption, high performance, and flexibility. Wilderness Radio's product line currently includes the newly revised NorCal 40A, the KC1 Keyer/Counter, the KC2 Keyer/Counter/S meter/Wattmeter and the Sierra multiband transceiver.