

# Electronic Kits Still in the Picture

*Many remember the 1950s, '60s and '70s when kits were in most ham shacks. We don't have to look back; there are still many radio kits available.*

**Mark A. Lacy, W5TXR**

I was 12 years old when I ordered my first Heathkit with the money I saved delivering newspapers in the very small town of Converse, Texas. It was an SW-717 general coverage (550 kHz to 30 MHz) receiver and when it arrived it felt like Christmas! Ever since junior high school in 1972, I was hooked on kit building and looked forward to getting the next issue of Heathkit, Lafayette Electronics and Radio Shack catalogs.

The SW-717 was hooked up to a long wire antenna put up in our back yard. It worked very well and gave me countless hours of listening pleasure. I lived very near to an Air Force base during the Viet Nam conflict, allowing me to hear some really cool stuff on HF radio. This was followed by many visits to the USAF MARS station on Randolph AFB.

I've built many Heathkit products, mostly test and Amateur Radio equipment, most of which I still have to this day. Unfortunately, my SW-717 was stolen during a move.

At the age of 13 or 14, out of necessity, I found myself working on TVs, eight track and cassette tape players and radios the neighbors would bring over. I had a shop set-up in our garage for my kit building, homebrew projects and for electronic repairs. Those successful repairs enabled my addiction to the Heathkit Builder's Syndrome! The only known cure at that time was an empty savings account!

## Kit Technology Has Come a Long Way

Over the years kits have transitioned from tubes to transistors, to integrated circuits and now some use surface mount technology (SMT). Figures 1 through 3 show a modern kit, a 222 MHz transverter from Elecraft. I still like working with vacuum tubes. There is nothing like the smell of a hot 5Y4 rectifier tube, a couple of 6V6 power pentodes and a 12AT7 dual triode all glowing in the morning.

If you have never had the opportunity to build a kit I would recommend that you give it a whirl.

## Essential Guidelines for the Future "Kit Master"

**Kit Selection.** Consider a kit that you will actually use and enjoy. Look for reviews and articles on the kit you are interested in constructing. Know exactly what you are get-

ting into when you order a kit. Don't get in over your head! Before you order, download the construction/assembly and the operator's manual and review them before you buy.

Kits are like software never buy version 1.0 of anything. When a new kit comes out wait and see how the kit does. Look for reviews from other kit builders.

**Soldering.** Your ability to solder and desolder well is first and foremost for most kits. This means using the correct soldering iron, or better a soldering station with temperature adjustment (see Figure 4), correct tips for each job and the proper size and chemistry of solder (see Figure 5). Heat is the enemy of electronic components. Overheating, cold solder joints, unintended solder bridges, loose flecks of solder and feed-through failure can all ruin your kit building day.

**Your Abilities and Experience.** Consider your current kit building abilities, skill level and experience. Consider your technical expertise, and availability of the proper tools, test equipment and safety equipment from start to finish. Can you read and understand schematics? Errors in kit manuals are uncommon but do occur and your ability to read a schematic can help you keep the maker honest.

Don't be too proud to ask for technical assistance from the manufacturer or another kit building wizard. If you are not up for the challenge of the desired kit, have a knowledgeable friend/ham operator complete the project. Or,

consider a "builder for hire" option.

Some kits have surface mount (SMT) components. Some manufacturers offer the kit with the SMTs already installed. This option would be a wise choice even for the most experienced technician.

**Stay Alert.** Don't try to work on your kit if you're tired or distracted. Trying to do precision work requires concentration. All it takes is one diode or capacitor installed backward then you have made more work for yourself later.

## Receiving and Assembling Your New Kit

When your long-awaited kit is delivered, inspect the exterior of the box for damage. When you open your kit do a complete inventory of parts and manuals. Make sure everything is accounted for, including any options you elected to order.

Make sure that any and all ESD (electrostatic discharge) sensitive devices are packaged in proper ESD protective packaging and are not just loose in a bag or box. This can include the mother board and sub boards, particularly until all connections are completed.

Non sensitive parts such as resistors, coils, capacitors and toroids can be neatly organized by placing them into Styrofoam blocks for easy access and identification. Also it will keep those small parts from falling victim to gravity and becoming part of the carpeting. Observe the polarity and orientation while

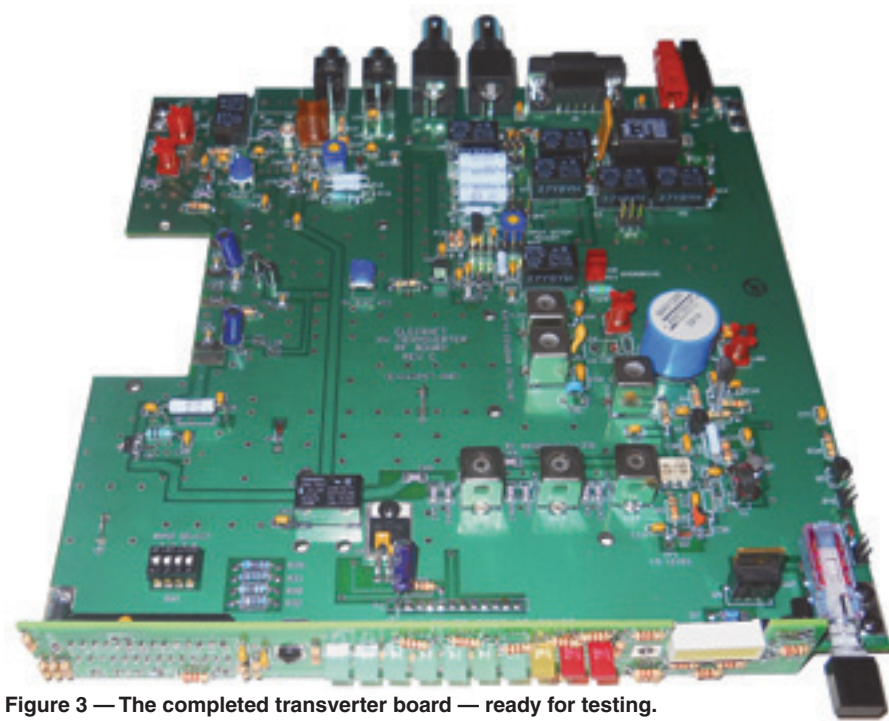




**Figure 1 — First step — open the box. This is an Elecraft XV222, 222 MHz transverter kit — appropriate for an experienced kit builder.**



**Figure 2 — Make sure you identify all the parts and that everything on the packing list is there, before you go on.**



**Figure 3 — The completed transverter board — ready for testing.**



**Figure 4 — A temperature controlled soldering station, such as this Weller WESD51, is highly recommended for kits that require soldering of solid state devices.**

installing components and parts.

Plenty of light is needed for kit building. I have found that besides normal room light an inexpensive desk lamp with a 100 W equivalent compact fluorescent lamp works well and makes it easier to read color codes.

While soldering or desoldering do so in a well ventilated area. I use a school bus defroster fan mounted on a small piece of wood. It works very well. You can pick one up at an auto parts store.

If you don't know your resistor and capacitor value codes and schematic symbols you can download a chart ([www.jaycar.com.au/images\\_uploaded/rescode.pdf](http://www.jaycar.com.au/images_uploaded/rescode.pdf)) and keep it handy. While installing resistors and capacitors, double check the values before you install and solder. Kit construction is good practice in learning schematic symbols, resistor color codes and capacitor codes.

Your kit parts and board should be laid out on and constructed on a properly grounded antistatic mat. The antistatic mat is usually constructed of a single layer of homogeneous static dissipative vinyl material. Surface resistivity should be on the order of  $10^8$ - $10^9 \Omega$ . You should be wearing the matching antistatic wristband. Safety glasses are recommended too. The clipped off lead of a resistor or diode could fly up and get you in the eye. Solder can splatter and get in your eye too. Protect your eyes!

Antistatic wristbands are specially designed with a built-in resistance on the order of 5-10 M $\Omega$ . The resistance allows for safe static discharge. Without the 5 or 10 M $\Omega$  resistor, if you come into accidental contact with ac power or with high voltage in your kit, you become part of the low resistance path to ground.

## Let's Talk Solder

Solder is an alloy or mixture of tin and lead — typically 60% tin and 40% lead. It melts at



a temperature of about 365°F. Coating a surface with solder is called “tinning” because of the tin content of solder. Lead is poisonous and you should always wash your hands thoroughly after using solder. Solder for electronics use contains tiny cores of flux. The flux is

corrosive to clean the metal surfaces as the solder melts. This is why you must melt the solder actually on the joint, not on the iron tip. Without flux most joints would fail because metals quickly oxidize and the solder itself will not flow properly onto a dirty, oxidized, metal surface.

Common solder alloys, tin and lead respectively:

- 63/37% melts at exactly 361.4°F (this is my preference).
- 60/40 melts over a range of 361-375°F.
- 50/50 melts over a range of 365-419°F.
- Lead-free solder alloys melt at around 485°F depending on their composition.

For environmental reasons, lead free solders are becoming more widely used, and are required by the laws of many countries. Unfortunately, most lead free solders make it more difficult to create reliable solder joints so I recommend avoiding them if you can.



**Figure 5 — Not all solder is created equal. Avoid lead-free solder — unless the kit manufacturer recommends it. Different tin-lead alloys have different melting points — make sure that you get the one that is appropriate for your kit (see text).**

## Test Equipment and Tools

A digital multimeter can be a life saver while kit building or homebrewing. The multimeter can be used to measure the value

of a resistor with colors difficult to read. It can also be used to measure the output voltage of a regulator or to identify a transistor type or to determine the cathode or anode of a diode.

You will also need a selection of insulated, electronic size hand tools. Many kits will identify exactly the types and sizes needed. You can expect to need a set of small slotted and Phillips screwdrivers, needle nose pliers, diagonal cutters and wire strippers. You may also need a jewelers size screwdriver set, crimpers, torx driver set, nutdriver set (English and metric), conductive SMD tweezer set and a clip-on heat sink.

A circuit board holder is like having another set of hands. They are kind of expensive but may be well worth the price. Also very useful, especially with advanced years, is a magnifying bench lamp. Table 1 lists some sources of tools, test equipment and soldering supplies.

## Desoldering

From time to time, it will be necessary to undo a soldered connection. The trick is to do so without damaging the component or the board it is soldered to. There are two simple choices here and both are good. For desoldering you can use a copper braid product that absorbs melted solder. This is marketed as SolderWick. The other choice is a hand operated vacuum device called a solder sucker.

SolderWick works very well. Just heat the joint and apply the wick. After the solder flows into the wick, remove it and after it cools, cut off and discard the soldered portion. The solder sucker is like a soldering iron with a heat proof tube next to the tip. The tube is connected to a rubber bulb. To use, squeeze the bulb to remove the air and hold it, heat the joint and, with the tip still applied to the joint, release the bulb to suck out the solder. With either technique, multiple applications are usually required.

There is nothing like that feeling you get when your kit is completely assembled, aligned and working properly. It's a sense of pride and accomplishment like no other. Why not give it a try? Table 2 lists the kit providers I am aware of.

*ARRL member and Amateur Extra class licensee Mark A. Lacy, W5TXR, is an ARRL Assistant Technical Coordinator, ARRL Certified Teacher/Instructor and he operates as an ARRL Official Emergency Station. He and his wife Nancy, K5TXR, a USAF nurse, can be reached at 5141 Storm King Dr, PO Box 148, Schertz, TX 78154-0148 or at mark@w5txr.net.*



**Table 1**

### Sources of Tools, Test Equipment and Soldering Supplies

Source	Website	Phone
Allied Electronics	<a href="http://www.alliedelec.com">www.alliedelec.com</a>	866-433-5722
Digi-Key	<a href="http://www.digikey.com">www.digikey.com</a>	800-344-4539
Jameco Electronics	<a href="http://www.jameco.com">www.jameco.com</a>	800-831-4242
Stanley Supply Services	<a href="http://www.stanleysupplyservices.com">www.stanleysupplyservices.com</a>	800-225-5370

**Table 2**

### Author's Alphabetical List of Kit Providers

Company	Contact
Antique Electronic Supply	<a href="http://www.tubesandmore.com">www.tubesandmore.com</a>
Carl's Electronics	<a href="http://www.electronickits.com">www.electronickits.com</a>
Communications Concepts	<a href="http://www.communication-concepts.com">www.communication-concepts.com</a>
Crystal Radio Supply	<a href="http://www.crystalradiosupply.com">www.crystalradiosupply.com</a>
Dan's Small Parts and Kits	<a href="http://www.danssmallpartsandkits.net">www.danssmallpartsandkits.net</a>
Down East Microwave	<a href="http://downeastmicrowave.com">downeastmicrowave.com</a>
The DZ Company	<a href="http://www.dzkit.com/default.htm">www.dzkit.com/default.htm</a>
Elecraft	<a href="http://www.elecraft.com">www.elecraft.com</a>
Electronics USA	<a href="http://electronicsusa.com">electronicsusa.com</a>
Emtech	<a href="http://emtech.steadynet.com">emtech.steadynet.com</a>
FAR Circuits	<a href="http://www.farcircuits.net">www.farcircuits.net</a>
Fox Delta	<a href="http://www.foxdelta.com">www.foxdelta.com</a>
Hendricks QRP Kits	<a href="http://www.qrpkits.com">www.qrpkits.com</a>
HF Projects	<a href="http://www.hfprojectsyahoo.com">www.hfprojectsyahoo.com</a>
K1EL Ham Radio Kits	<a href="http://k1el.tripod.com">k1el.tripod.com</a>
Kits and Parts dot com	<a href="http://kitsandparts.com">kitsandparts.com</a>
Milestone Technologies	<a href="http://www.mtechnologies.com">www.mtechnologies.com</a>
Mini-Kits	<a href="http://www.minikits.com.au">www.minikits.com.au</a>
NØXAS HamGadgets	<a href="http://www.hamgadgets.com">www.hamgadgets.com</a>
North Country Radio	<a href="http://www.northcountryradio.com">www.northcountryradio.com</a>
Ramsey Electronics	<a href="http://www.ramseyelectronics.com">www.ramseyelectronics.com</a>
Small Wonder Labs	<a href="http://www.smallwonderlabs.com">www.smallwonderlabs.com</a>
Spectrum Communications	<a href="http://www.spectrumcomms.co.uk">www.spectrumcomms.co.uk</a>
TAPR Kits	<a href="http://www.tapr.org">www.tapr.org</a>
Ten-Tec	<a href="http://www.tentec.com">www.tentec.com</a>
Vectronics	<a href="http://www.vectronics.com">www.vectronics.com</a>
Xtal set	<a href="http://www.midnightscience.com">www.midnightscience.com</a>