

TOOLS FOR THE ELECTRONIC HOBBYIST

***A wide variety of
tools are
available to
help you
do the job right***

By DON LANCASTER

THE success or failure of every piece of electronic equipment you build depends on the tools you have and how you use them. Beginner or old-timer, professional technician or experimenter, you need certain tools, each of which requires an investment. An unused tool is a waste of money. A missing tool means lost time and occasionally a botched-up job.

What are the essential tools for electronics work? Who makes them and how much do they cost? There are four categories of tools we should consider: (1) basic tools absolutely essential for the beginner; (2) "luxury" tools for the beginner, but otherwise generally useful and convenient; (3) special tools required for serious home-brew work, magazine construction projects, equipment modifications, custom audio work, etc.; and (4) the "there must be an easier way" tools that greatly simplify

work and improve results, but are not really necessary.

Suppose you're just getting started in electronics. Table 1 on page 68 lists the essential tools you will need. This selection of tools will ultimately become the set around which your whole collection is built.

Soldering Tools. Foremost is something to solder with. Solder is the glue of electronics. Without it, you'd be as bad off as if you tried to build a house without nails. You must choose between an iron or a gun. A soldering iron is low in cost, holds a fairly uniform temperature, and in general enables you to do neater work, particularly on connectors and printed circuits. On the other hand, a gun is much more convenient. It heats and cools quickly and needs no stand. It lights its way into dark corners. Some models provide dual heat. The gun is much better suited for installation work, to get inside speaker enclosures and television sets that can be serviced in the living room.

Eventually you'll want both a gun and at least one iron (two if you do heavy work). The rule on the initial choice is this: If you are going to do most of your work on a bench, or if you are somewhat restricted financially, get an iron. If you are going to work on a kitchen table, get a gun.

A good choice to start out with in a gun is something in the 100-watt range such as the Weller Model 8200 which offers a dual-heat capacity of 100/140 watts. The best choice in an iron is a handle and cord assembly with a removable tip. Tips with heats of 37½ watts and 47½ watts are available (among others) and will prove eminently practical for general-purpose work. Less wattage is needed in an iron for the same soldering job because the thermal mass of the tip stores heat better than the small gun tip.

Dikes, Pliers, and Screwdrivers. You'll need a pair of diagonal cutters ("dikes"), and a pair of needle-nose pliers. Dikes are used for cutting component leads and wire, and for stripping wire. Needle-nose pliers are used for bending and positioning component leads and wires prior to soldering. Watch the quality of

the tools you buy. The 88-cent variety just doesn't cut properly or hold up well. A very good choice is the so-called "jeweler's pliers" (4½" size, Krauter #81, #83, Crescent 942, etc.) instead of the larger, more cumbersome "electronic" pliers.

The jeweler's pliers are cheaper, have soft cushion-grip vinyl handles, and are easier to use, especially in tight areas and on printed circuits. Of course, you can't bend ¼" steel or cut bolts with this size tool, but the small size is otherwise perfect for all electronic work.

You'll need two screwdrivers, a large one with a 3/16" blade for general assembly work, and a small one with a 1/8" blade for knobs and smaller hardware. Two types of screwdriver blades are the cabinet tip (straight) and keystone tip (keystone shaped). The cabinet tip is much better suited for electronic work, and is a bit less common than the keystone tip. Watch for it when you buy.

Again, avoid the bargain basement screwdrivers. There is a definite relationship between the quality of your tools and the quality of the work you do. Further, cheap screwdrivers tend to slip and mar cabinets and finished panels.

Top, left: Various specialized types of cutters and pliers are available as well as straight "dikes" and needle-nose pliers as Crescent Tool Co. photo shows.

Second photo: Soldering options include gun, iron, or soldering pistol. See text for discussion of merits.

Third photo: Weller D550PK kit includes dual-heat gun and specially shaped tips for hard-to-reach work.

Bottom: Brand-new is Blixt automatic iron sold by Currin Electronics. Squeezing trigger advances solder.

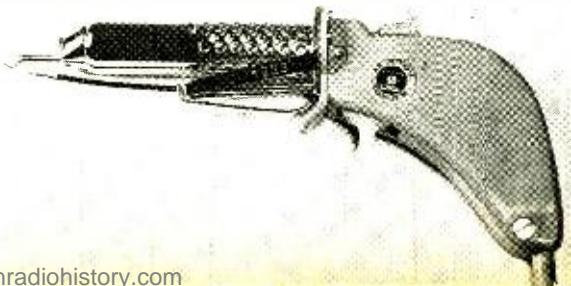
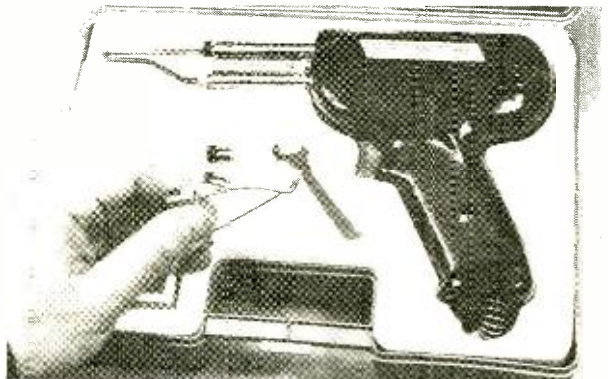
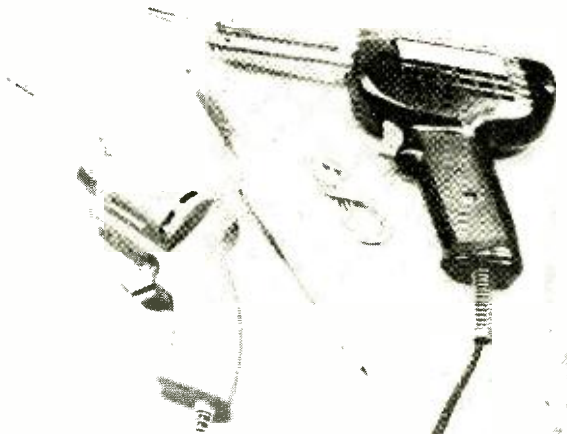
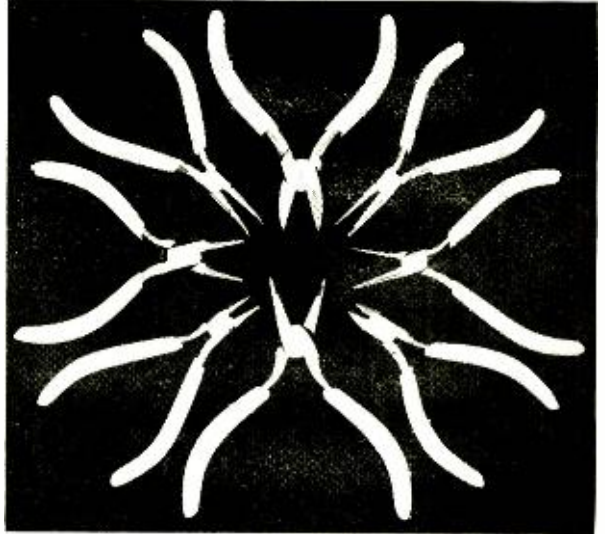
Top, right: Basic tools include large and small screwdrivers, diagonal cutters, and needle-nose pliers. A 6" adjustable wrench helps handle control nuts, etc.

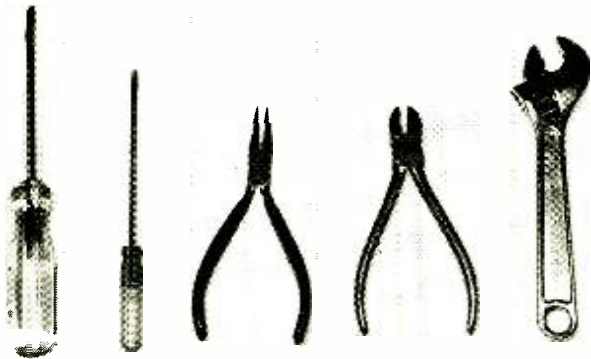
Second photo, right: Worthwhile is an assortment of screwdrivers with regular and Phillips head blades.

Third photo, right: Add to your basic tools a 1/4" nut-driver, a set of Allen wrenches, a nut starter, Phillips screwdriver, wire stripper, and a shop knife.

Fourth photo, right: Several sizes of nut-drivers or a set will add much to working convenience.

Bottom, right: Basic tools for chassis layout include a ball peen hammer, a scribe, a center punch, and a combination square. Good tools are an asset here.

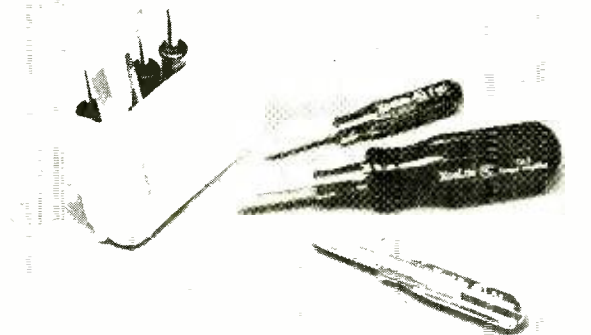




and have caused more than one gouged finger. A quality screwdriver costs 88 cents (Proto, Xcelite, Craftsman, etc.) and is well worth it.

The final basic tool is a 6" adjustable wrench. This tool enables you to remove and fasten everything from a sheet metal screw to a volume control nut. You get a lead and bracket bending tool, a small vise, and a changer mechanism repair tool free in the bargain. Make sure your wrench is drop-forged; any other type just won't last. The chrome-colored variety is a bit more expensive than a black wrench, but has a better "feel."

This minimum collection will get you started. If you only do occasional electronic work, it may be all you will ever need. But if you're like most electronic "types," you'll start adding "luxury" tools to your basic collection. These tools are not absolutely necessary, but are extremely helpful. Some of them are listed in Table 2 (on page 70). Tables 1 and 2 together will give you a good, well-rounded, basic electronic tool set.



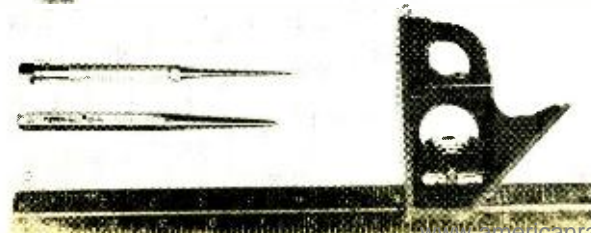
Additional Tools. The first addition should be a $\frac{1}{4}$ " nut-driver, either a pocket- or full-sized one. Virtually every radio, television set, and phonograph is held together with sheet metal screws that have a $\frac{1}{4}$ " head. Also, all of the #4 hardware and almost all of the #6 hardware use nuts that are $\frac{1}{4}$ " across the flats. As these are the two most common electronic hardware sizes, the $\frac{1}{4}$ " nut-driver is a most useful tool. You can buy nut-drivers individually or in sets (Xcelite PS120, etc.).



You may want a wire stripper of the low-cost variety. They do neater stripping than dikes and there is much less of a tendency to nick the wire. They are also much easier on the hands than dikes. The strippers with vinyl handles are a better choice at twice the cost of the inexpensive variety. There are also "automatic" strippers available which may be a good investment if you do considerable work in electronics.

A soldering aid and a heavy-duty shop knife are two tools that everybody has his own special uses for and are generally well worth their price.

A nut starter is usually provided free with your first kit from at least one kit manufacturer (Heath). This 25-cent



piece of plastic tubing can save you hours of frustration trying to get nuts on elusive #4 and #6 screws in tight locations.

A Phillips screwdriver should be bought when you need it. A #2 or #3 tip is best suited for the screws occasionally found on some consumer electronic items and certain car radios. These screws are not too common, but when encountered, a Phillips driver must be used.

A pair of pliers of either the low-cost slip-joint "gas" plier variety or else the multiple slip-joint "water pump" variety makes a good addition. These are used for positioning, holding, bending, and cramping. They also will do heavy cutting (busbar, appliance wire, etc.). The

water pump variety (Channellock, etc.) at \$2.60 or so is much more expensive than the 69-cent pair of gas pliers, but is more useful in some instances.

You will probably never run across an Allen head screw until you try to take apart your first piece of military surplus gear or do an industrial service job. Then you will find dozens of the little monsters staring at you. At this point there is only one answer—go buy a quality set of Allen wrenches. Contrary to popular belief, a file tang just won't work! The bargain basement Allen wrench sets are worthless on three counts: They are not hardened, they are not small enough, and the sloppy plating job makes them murder on the screw heads themselves. Be

TABLE 1: Essential Tools for the Beginner

Tool	Typical Brands	Use	Approximate Cost
Adjustable open-end wrench, 6"	Craftsman Industro Utica	Volume control nuts, sheet metal screws, bending, tightening	\$2.75
Diagonal cutting pliers, 4½"	Channellock Craftsman Crescent M. Klein Knight Kraeuter Lafayette	Cutting wire and component leads stripping wire and cutting insulation	2.75
Needle-nose pliers, 4½"	(See list for diagonal cutting pliers)	Parts positioning, wire bending, and lead forming	2.50
Neon test light 55-600 volt, a.c.-d.c.	—	Measuring voltage and polarity; testing for "hot" circuits and chassis	.35
Resin core solder	Ersin Kester	Soldering	2.00 per lb.
Screwdriver, ⅜" blade 6" long, cabinet tip	Knight Lafayette Proto Vaco Xcelite	Mounting hardware, positioning parts, general mechanical assembly	.60
Screwdriver, ⅛" blade 3" long	(See list for ⅜" screwdriver)	Mounting small parts, particularly knobs; also for tight work and probing circuits	.40
Soldering gun 100 watts or dual capability	Weller Wen	Soldering	5.00 up
Soldering Iron, 30-40 watts or multiple capability	American Beauty Ungar Wall Weller	Soldering	1.00 up

sure your set is hardened or tempered steel, and not the plated variety.

Tools for Home-Brew Work. You now have a rather complete collection of electronic tools, well suited to most experimental work, almost all service work, and certainly all kit building. But you still can't build anything of your own! You have no way of cutting and laying out chassis and panels, or of handling cases and cabinets. Table 3 (on page 88) shows the tools you'll need if you decide to do serious home-brew work or try to duplicate magazine construction projects. Here the cost of your tool collection will go up considerably. The best rule to follow before you buy is to wait until you have a definite need for each item and are certain that you will need the same tool again in the future.

A basic set of layout tools consists of a combination square, a scribe, a ball peen hammer, and a center punch. A bit of common sense at this point may save you some money. If you are only occasionally going to be doing construction work, then by all means get the low-cost tools. But if you're going to do any serious work, get the best-quality tools you possibly can.

To cut your brackets, panels, and chassis, you will need two more tools, a 12" hacksaw with a fine-tooth blade, and a pair of shears. You have a choice between conventional "tin snips" or the more expensive double-action aircraft shears.

Now to put the holes in. You *must* have an electric drill if you are at all

Top: If you plan to do much home-brew work, an electric drill is a must. Also essential are a reamer, and rattle, half-round, triangular, and round files.

Second photo: "Easier way" tools include a riveting tool, vise grip pliers, traverse cutting pliers, a terminal crimping tool, and a chassis nibbling tool.

Third photo: Wire strippers are handy to have. Unit at left is "automatic" type—good if you do a lot of wiring. Inexpensive stripper (right) will also serve.

Bottom, left: Circle cutter is also essential if you do much metal work. It's used with carpenter's brace for cutting out round holes for meters, dials, etc.

Bottom, right: Two chassis punches are a good investment. Common sizes— $1\frac{5}{32}$ " and $\frac{5}{8}$ "—take care of most socket and capacitor mounting problems.

TABLE 2: "Luxury" Tools for the Beginner

Tool	Typical Brands	Use	Approximate Cost
Allen wrench set	Craftsman Lafayette Walsco	Disassembly of military surplus electronics and some knobs; also for some industrial electronics equipment	\$1.00
Nut-driver, 1/4" x 6", hollow shaft	Craftsman Knight Lafayette	Tightening and removing sheet metal screws and all #4 and #6 nuts; needed for disassembly of most radio, TV sets	1.00
Screwdriver, Phillips #2 or #3, 6" long	Xcelite Craftsman Knight Lafayette Proto Vaco Xcelite	Removing and replacing Phillips screws	.60
Shop knife, heavy-duty	X-acto	Cutting insulation and lacing twine, removal of insulation, scraping	.35 up
Slip joint or "gas" pliers	Craftsman Crescent M. Klein Knight Kraeuter	Holding and positioning heavy cutting (busbar, etc.), bending	.60
Soldering aids	Beauchaine & Sons Clauss GC Electronics Ungar	Bending and positioning leads prior to soldering, removing unsoldered components	1.00
Wire stripper	GC Electronics Miller Walsco	Stripping insulation off wires, cutting component leads	1.00

serious. Otherwise you'll be wasting your time. At least a 1/4"—or better yet—a 3/8" chuck should be chosen. The only difference between a \$15 and a \$30 drill is the quality of the bearings (bushings vs. ball bearings) and the ruggedness and "burn-out-proofness" of the motor. For occasional work, choose the cheaper models. For professional or production work, get the finest drill you can buy (Skil, Black and Decker, etc.). It will pay for itself many times over.

A drill index with some drills is next. Here there should be no compromise. Even if you are only going to drill one hole, get a quality drill. The bargain basement drills dull quickly, cut a ragged hole, and walk all over the place.

The same goes for files. Stick to the quality brands (Nicholson, etc.). You'll need these for enlarging holes, cutting square holes for sockets and transformers, and finishing panel edges. A basic

set consists of a 1/4" "rat-tail" file, a small triangular one, a large half round, and a large flat file. Another important rule: When a file gets dull (not clogged, but just plain *dull*), do one of two things with it—either use it as a paint stirrer, or throw it away. But don't try to file with it. You'll be wasting your time.

Two cold chisels and a taper reamer for enlarging holes complete the basic construction tools you'll need. The chisels are fine for transformer holes. The reamer is required to get a 1/4" hole large enough to accommodate a volume control or a pilot light.

"Easier Way" Tools. Maybe you already have most of the tools listed in Tables 1, 2, and 3, and are considering getting the rest. But Table 4 lists a new breed of tools. They are the "there must be an easier way" tools that make child's play
(Continued on page 88)

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out of some rather boring and hard jobs, or else improve results and quality considerably. Or maybe they just make life easier. You may want to add some of these nonessential tools to your collection.

Foremost on this list is a pair of locking (vise grip) pliers. This tool is just plain wonderful. It serves as a third hand, a vise, cuts bolts, wire, and rod, positions parts, and holds small parts for soldering. Next is a crimping ("Champ") tool. Outside of its obvious use for crimping solderless connectors and terminals, it makes a fine wire stripper, and a bolt cutter *that does not damage the threads while cutting*. It also cuts wire along with its other functions.

TABLE 3: Special Tools for Home-Brew Work

Tool	Typical Brands	Use	Approximate Cost
Bits: 1/16" to 1/4" by 32nds; 3/16"; 3/8"	Century Champion Craftsman Lafayette	Drilling holes, enlarging holes	\$.25 up
Center punch	Craftsman General Hardware Stanley	Locating holes for drilling and setting eyelets and rivets	.60
Cold chisels; 1/4", 1/2"	Craftsman Veeco	Cutting large holes, transformer mounts, etc.	1.00
Electric drill 1/4" or 3/8"	Black & Decker Disston Electro Lafayette Millers Falls Ram Rockwell Skil SpeedWay Stanley Thor Wen	Drilling holes, cutting circles, polishing, etc.	8.00 up
Files: Small triangular Small rat tail Medium half round Medium mill flat	Lafayette Nicholson Simonds Vaco	Enlarging and shaping holes for sockets, transformers, etc.; also for deburring	.20 up
Hacksaw, 12"	Craftsman Forsberg Lafayette Stanley	Cutting chassis, brackets and panels	3.00
Hammer, ball peen	Craftsman Stanley	Layout and cutting	3.00
Scriber	General Hardware Lufkin Moody Starret	Marking hole centers, punch locations, etc.	.50
Square, combination, 12"	Craftsman Stanley	Layout of all panels, chassis, etc.	4.00
Taper reamer, 1/8" to 1/2"	General Hardware Henry Hanson	Enlarging holes for volume controls, etc.	1.50
Tin snips or shop shears	Wiss	Cutting metal panels, insulation and brackets	3.00

TABLE 4: "There Must Be an Easier Way" Tools

Tool	Typical Brands	Use	Approximate Cost
Chassis punches: 1 $\frac{1}{32}$ " and $\frac{3}{8}$ "	Greenlee	Cutting tube socket and capacitor holes in chassis	\$2.50
Circle Cutter	General Hardware Stanley Wyco	Cutting large, round holes for meters, dials, etc.	2.00 up
Crimping tool	Klein-Amp Lafayette Super-Champ Vaco Waldom	Setting stake-on terminals, neatly cutting bolts, wire stripping, cutting	4.00 up
Nibbling tool	Adel	Neatly cutting large holes in panels and sheet metal chassis	4.00
Nut driver set, $\frac{3}{16}$ " to $\frac{9}{16}$ "	Craftsman Knight Lafayette Xcelite	Mounting hardware, tightening and removing nuts and components	6.50
Riveting tool	"POP" Rivetool (United Shoe) or Rivet-All (Lafayette)	Cheaper, quicker, better way of mounting semi-permanent components, sockets, brackets, etc.	5.00
Socket and ratchet set (automotive)	Proto	Tightening volume control and switch nuts, etc.	3.00 up
Traverse cutting pliers, 5"	M. Klein Kraeuter	For close cutting of leads in tight corners; perfect for printed circuit work	3.00
"Vise Grip" pliers, 7"	Vise Grip	Holding and clamping, positioning large parts prior to soldering, heavy cutting	1.60

A nibbling tool has to be seen to be appreciated. This little known tool neatly chomps its way through a chassis to provide a smooth-edged hole. It takes a small bite each time. The little bites all line up to give any size hole you want in any shape—rectangular, round, or free form. Nibbling one power transformer hole will pay for the tool.

One or two chassis punches in the common 1 $\frac{1}{32}$ " and $\frac{3}{8}$ " sizes makes tube socket and capacitor mounting hole punching a snap.

Another little known tool is the traverse cutting plier. This is a cutting plier that looks like a pair of "needle noses," but *cuts clear out at the tip* (as a dog would bite, not on the side as the cutters on some needle-nose combinations). There is nothing like this tool for close cropping of printed circuit leads, and tight, "down under" cutting of any type.

The cutting plier neatly cuts off leads that a pair of dikes can't get near.

A final special tool is a relatively new item. Five dollars will get you a "POP" Rivetool that will enable you to rivet electronic assemblies together. This is done from one side at the squeeze of a handle. The cost is less than that of standard hardware. You can use a Rivetool in blind or nearly blind locations where a nut cannot be backed up. The rivets will not shake loose, but they can be drilled out easily if you have to remove them. And you can fasten two thin sheets of metal together where a sheet metal screw will not hold. The resulting appearance is "professional."

Of course there are other tools that could be mentioned, but they are not too widely used. What we have listed here should represent a good setup for anyone in electronics.