# Practically Speaking

## Robert Penfold looks at the Techniques of Actually Doing it!

ALTHOUGH electronic project construction is an all-year-round pastime, at the time of writing this piece the children are going back to school after the summer holidays, the day lengths are rapidly shortening, and it is what some regard as the beginning of the 'electronics season'. I suppose it makes sense to make use of any good summer weather while the opportunity is there, and leave indoor hobbies for times when conditions are not conducive to most outdoor pursuits. As the days shorten, it is time to dust off the soldering iron.

This is also the time of year when an indoor hobby such as electronic project construction tends to get an influx of new recruits. Any hobby can be a little intimidating for newcomers, but a highly technical hobby such as electronics is perhaps more daunting than most.

It would be misleading to say that 'there is nothing to it', but it is probably not as difficult as it might at first appear. While it makes sense to 'do your homework', and gain a basic understanding of what is involved before starting your first project, the only way of learning to build electronic projects is to 'grasp the nettle' and try building a few.

### Problem of scale

As with practically any creative hobby, it will be necessary to obtain some 'tools of the trade' before getting started. Although some of the tools required are the type of thing that can be found in the toolbox of an average household, many are not. What are the tools that will be needed before work can be started on a few simple projects?

I think it is worth pointing out straight away that while many of the tools in the average toolbox will be the right type of thing for building electronic projects, they may be too large for working on most projects. There is more than a grain of truth in the old joke about the electronics company that was so successful it moved to smaller premises!

Electronic projects have become much more sophisticated and complex over the years, but most of the complexity is in the minute silicon chips at the heart of integrated circuits. Circuit boards, and the gadgets that contain them, are mostly quite small these days.

### Practical consequence

The practical consequence of this is that things like the files and screwdrivers in a typical toolbox are out of proportion to many electronic projects. These tools might still be very useful from time to time, especially when building the occasional large project, but it will probably be necessary to buy something smaller for use when building small and medium-sized gadgets.

A set of miniature files, or 'needle' files (Fig.1) as they are sometimes called, are very useful. They can be used to make minor adjustments to holes that are drilled slightly off-centre, to make rectangular or odd shaped cut-outs in panels, and for tidying any slightly rough edges.

*Fig.1. Needle files are often sold in sets containing a variety of shapes, but a round type is all that is needed for making cutouts. Other types can be used for tidying assorted holes*

Probably most people have an electrician's screwdriver that is suitable for fitting plugs to mains leads and the like, and one of these can be very useful when building electronic projects. One or two of the very small types are likely to be even more useful though. These are needed for such things as tightening the grub screws that fix control knobs in place, and adjusting some types of preset control.

### Hole truth

While virtually any hand or power drill can be used for drilling holes in cases, some are much better than others. The small size of most projects is again something that has to be borne in mind, and the fact that many projects are housed in cases made from a fairly soft plastic is also an important factor. Many projects have metal cases or plastic cases that have metal front panels, but the metal is usually aluminium, which is a relatively soft metal.

A large electric drill that is designed for making holes in brick walls is not well suited to most electronic project work. It would definitely be an example of 'using a sledgehammer to crack a nut'.

A large power drill that has speed control will probably provide good results if the speed control is set towards the slower end of its range. This is especially important when working on plastic cases. Drilling plastic using a high-speed drill is not a good idea, and you even have to be careful when cutting plastic by hand using something like a hacksaw or a coping saw.

Drilling or cutting soft plastics tends to produce a lot of friction, and the heat generated can melt the plastic. This usually produces some very rough

looking results, and the drill bit can become caked with plastic. In an extreme case, you can end up with the drill bit or saw blade welded to the case by solidified plastic.

With any power drill, mounting it in a good quality stand should give much better control, making it relatively easy to obtain precise results. If the drill has to be used hand-held, then a small cordless electric drill is a better choice.

Once again, one that has a slow speed setting or a variable speed control is likely to be easier to use and provide better results. A hand drill is relatively slow in use and may seem a bit old-fashioned, but it provides the high degree of control needed when working on the softer plastics.

When I first became interested in electronics, which was many years ago, drill bits of just three or four well chosen sizes were sufficient. However, modern components come in all shapes and sizes, and drilling their mounting holes requires drill bits in a wide range of sizes. A set of HSS drill bits from about 2mm to 10mm in diameter is the type of thing that might already be present in your set of tools, but if not, it is something that should be obtained at the outset.

The cheapest sets should be avoided as they are prone to snapping and soon become too blunt to use. A mid-range set should be adequate for drilling plastic and aluminium panels, but something more upmarket will probably be needed if you use steel cases. Working on steel cases is relatively difficult, so initially at any rate, it is probably best to avoid using them.

## Stripping off

It is tempting to simply use scissors or a penknife for cutting wires or removing the plastic insulation from connecting leads, but using scissors is unlikely to give the degree of precision needed for project construction. Cutting wires with them will soon render the scissors useless for cutting anything at all. Also, removing plastic insulation using anything other than proper wire strippers is likely to damage and seriously weaken the wire.

The cheapest type of wire stripper implement is one that combines wire stripping and cutting in one tool. These tools are usually excellent for stripping insulation, but sometimes struggle when cutting very fine wires. They make a good 'first buy' though, and if necessary a pair of wire cutters can be purchased later. Some quite sophisticated wire cutters are available, such as the spring-loaded type (Fig.2 – bottom). A pair of 'bog standard' miniature wire cutters (Fig.2 – top) will suffice though.

Wire strippers have notched blades that leave an aperture for the wire (Fig.3). The size of the aperture can usually be adjusted to suit the particular wire in use. The strippers should be set to almost cut through the insulation so that the unwanted section is easily broken free, leaving the wire or wires undamaged.

The aperture control might have some form of wire gauge calibration, but in practice this is not usually very helpful because multistrand connecting wire is used in most projects. These leads are more flexible because they have several fine wires rather than one thick one. Finding the best setting is usually a matter of trial and error.

## Hot topic

It is unlikely that a soldering iron suitable for electronic work will be found in the average toolbox. A small electric iron having a rating of about 15W to 20W is the usual choice for electronic project building.

The very cheap irons that I have tried have been short-lived or simply did not generate enough heat to complete even the smallest of joints in a satisfactory manner. The operating temperature of one was barely enough to melt solder!

It is not necessary to go to the opposite extreme and buy an expensive temperature controlled iron. An iron of this type will do an excellent job, but is perhaps a bit 'over the top' for occasional project building. An iron of this type could cost more than the parts for your first few projects!

A name which is synonymous with soldering is Antex, and their soldering irons are widely available in the UK. I have been using Antex irons from their 'C' series for longer than I


*Fig.2. The spring-loaded wire cutters (bottom) and the conventional type (top) will both do the job well, but the conventional type is all that is really needed for electronic project work*

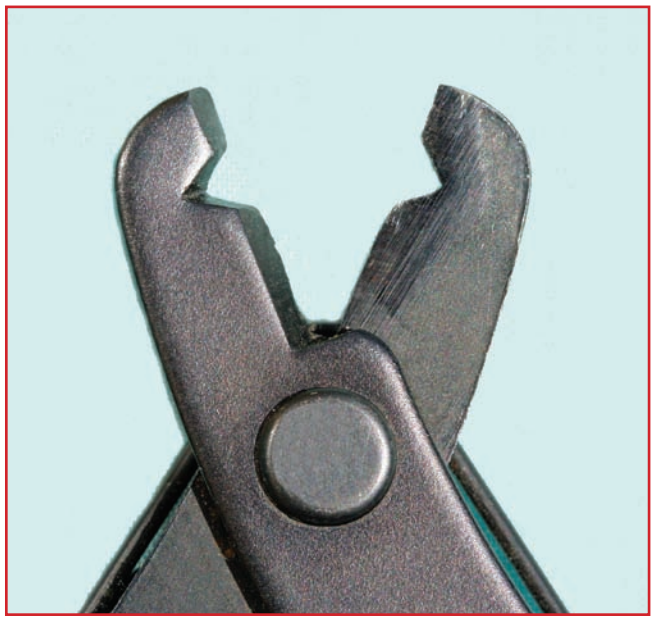

*Fig.3. The notched blades of wire strippers should prevent damage to the wires. It is usually possible to adjust the size of the aperture formed when the blades are fully closed*


care to remember, and they represent a safe choice that is reasonably inexpensive and will do a good job. An Antex soldering kit, which includes an iron, some solder, instructions, and the all-important soldering iron stand, is ideal for beginners.

Do not underestimate the importance of a proper stand for the iron. The stand keeps the hot iron safe when you are not actually soldering connections, and it also acts as a heatsink that helps to prevent the iron from overheating.

Some useful information about soldering and soldering equipment can be found at the Antex website (**www.antex.co.uk**) in the Technical – Papers section. Another 'must' to checkout is Alan Winstanley's widely acclaimed *Soldering Guide* at **www.epemag.wimborne.co.uk/solderfaq.htm**

A small but important point is that with most soldering irons it is essential to apply a small amount of solder to the tip of the bit as soon as it reaches its operating temperature for the first time. Otherwise the bit might oxidise, causing molten solder to run straight off it. This makes it impossible to produce good joints until the tip has been cleaned and some solder has been applied. Cleaning the bit properly without damaging it can be difficult, and is best avoided.

## Desoldering

In an ideal world, we would all get everything right first time, but in the real world a desoldering tool is something that most of us need soon after completing our first soldered connection. Experience suggests that the only inexpensive type of desoldering tool that works really well is a desoldering pump.

Having first used a soldering iron to melt the solder, the spring-powered pump is then used to suck the molten solder from the joint. Provided it is not allowed to get seriously clogged with bits of solder, an inexpensive desoldering pump should last for many years.

## Age-old problem

In the past, tweezers and some form of magnifying glass were sometimes recommended for electronics enthusiasts who were 'not as young as you used to be'. Due to the ever decreasing size of modern components, I would guess that most project builders would find these useful from time to time. Due to the small size of modern components it can also be difficult to pick them up, and even more difficult to accurately manoeuvre them into position.

Practically any small tweezers will do, but metal ones are better than the plastic variety in the current context. Plastic tweezers tend to be less durable, and might melt if used to hold something that gets hot.

The type of magnifier that has the lens on a flexible arm is certainly worth trying. These are mounted on the edge of the worktop using something that is a bit like an outsize crocodile clip, thus permitting hands-free use. It usually takes a while to get used to working with a magnified view of things, and the exaggerated hand movements you see via the magnifier, but you get the hang of things after a little practice.

An 8× or 10× magnifying loupe is useful when searching for short-circuits on circuit boards, and trying to read minute lettering on miniature components. These can be obtained from some suppliers of craft and hobbyist tools, and from photography shops.

## Finally

Most households are probably equipped with at least one pair of pliers, and this is a tool that will certainly be needed when building projects. Ideally, you should have at least a pair of electricians' pliers and a small long-nosed type.

Many modern semiconductors are vulnerable to damage by static charges in the environment. This is a topic that has been covered recently, so it will not be considered in detail here. However, before using any expensive semiconductors it is worth investing in an earthed wristband (Fig.4), and perhaps an earthed work mat as well in due course.

Although, strictly speaking, they are not tools, before embarking on your first project it is a good idea to purchase some multistrand insulated connecting wire and some single strand non-insulated wire. The usual choice for connecting wire is the 7/0.2 variety, which has seven strands of 0.2mm diameter wire. Some 20swg (0.914mm) or 22swg (0.711mm) tinned copper wire is useful for making link-wires on printed circuit boards.

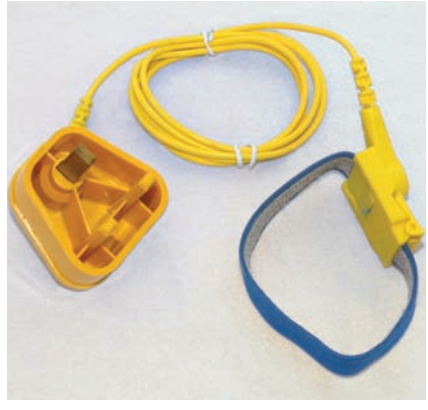

*Fig.4. An earthing wristband can be obtained quite cheaply these days, and enables sensitive components to be handled without fear of 'zapping' them*

Before making a start on your first project it makes sense to ensure that you have the tools and materials for the job. Building electronic projects should be fun, but it will become tedious if you have to keep stopping to buy a new tool, some more wire, and so on.

On the other hand, avoid getting overzealous. There is no point in purchasing a huge collection of tools and gadgets, some of which may never be needed. Only buy the less general and expensive tools as the need arises.