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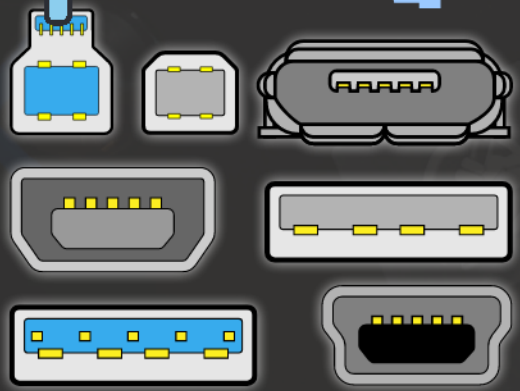
RIGHT TO REPAIR

THE ABILITY TO REPAIR YOUR OWN DEVICES

Advanced GPS Computer

The History of USB



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Contents

Vol.34, No.6 June 2021

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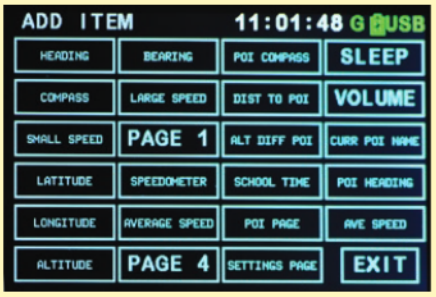
Features & Reviews

Constructional Projects

Your Favourite Columns

Everything Else



Our Advanced GPS Computer uses a Micromite BackPack V3 to provide real-time speed and location readouts. It even has a speaker to deliver sampled audio or synthesised speech – Page 24

CERTIFIED USB™

USB was designed to make connecting devices simple, but over time, a plethora of different types of connectors and protocols have developed. USB-C is the first USB connector that can be inserted in either orientation, and provides very fast transfer speeds – Page 32

Pong was a hugely popular game back in the day, so here's a way to recreate it, accurate to the original, using nearly identical components – Page 38

The PIC Programming Helper comes in two versions, one just for 8-pin PICs and a larger one that covers 8, 14 and 20-pin PICs. It doesn't just help you program micros, but also to breadboard and debug them – Page 64

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Bao Smith, B.Sc.
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Technical Contributor
Duraid Madina, B.Sc, M.Sc, PhD

Reader Services
Rhonda Blythman, BSc, LLB, GDLP

Advertising Enquiries
Glyn Smith
Phone (02) 9939 3295
Mobile 0431 792 293
glyn@siliconchip.com.au

Regular Contributors
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David Maddison B.App.Sc. (Hons 1), PhD, Grad.Dip.Entr.Innov.
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Phone (02) 9939 3295.

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Editorial Viewpoint

Semiconductor shortages are becoming serious

When the news of COVID-19 hit, it was evident that there would be widespread effects on industry from factory shutdowns, reduced capacity due to mitigation efforts, etc. It was almost a miracle that so many sectors seemed to be marching on throughout 2020 and early 2021, somewhat unaffected.

There was plenty of talk about semiconductor shortages, but that mainly seemed to be related to desktop CPUs and graphics processors, many of which have been essentially unobtainable for the past year.

But now we are noticing many ICs being out of stock and with very long lead times. The worst-hit appear to be microcontrollers, more-or-less across the board. Many PICs are out of stock at all major retailers, as are micros from NXP, ST Micro and many others.

To get an idea of how bad it is getting, at the time of writing Digi-Key lists 91,292 different microcontrollers on their website, but only 21,176 or 23.2% are in stock. And many of those listed have single-digit quantity in stock. During better times, I would expect that figure to be closer to 50%.

It isn't just microcontrollers, either. We're having trouble getting some of the other semis that we sell in our kits, such as regulators and Mosfets.

For those parts which are out of stock, the wait for the next batch can be very long indeed. Some parts are showing expected delivery dates in 2022!

I don't know why the situation has degraded recently, but it has. There's no easy way to tell how long it will continue, but I suspect it won't be resolved anytime soon, or even this year.

So don't be surprised if you have difficulty sourcing specific components required for some of our designs (or perhaps your own). For devices like Mosfets, it is sometimes possible to find an equivalent device. But often, we are finding that most or all of the compatible devices are also out of stock.

I wouldn't be surprised to see a shortage of many consumer electronics lines in the next few months, due to the manufacturers finding it impossible to get all the parts they need.

The right to repair

It should not come as a surprise that we are generally supportive of the efforts of many people to secure the legal 'right to repair'. We see this as a way to push back against companies that deliberately (or perhaps through incompetence) make it difficult or overly expensive for people to repair their possessions when they go wrong.

Given that automobiles are one of the most expensive (and often troublesome) purchases that an individual can make, it's no surprise that some of the earliest (and strictest) right to repair legislation has involved that sector (back in 2012, in the USA).

New laws, proposed to come into effect in Australia from the 1st of July next year (assuming they are legislated), will require car-makers to provide service and repair information to independent repairers. This is a step in the right direction, as manufacturer-authorised dealers can be costly. And despite this expense, in my experience, they can provide worse service than a good independent mechanic.

More on this at:
http://consumersfederation.org.au/morrison-government-levels-the-playing-field-for-independent-repairers/

by Nicholas Vinen

Cover Image: *https://unsplash.com/photos/C1r9pODhfQ4*


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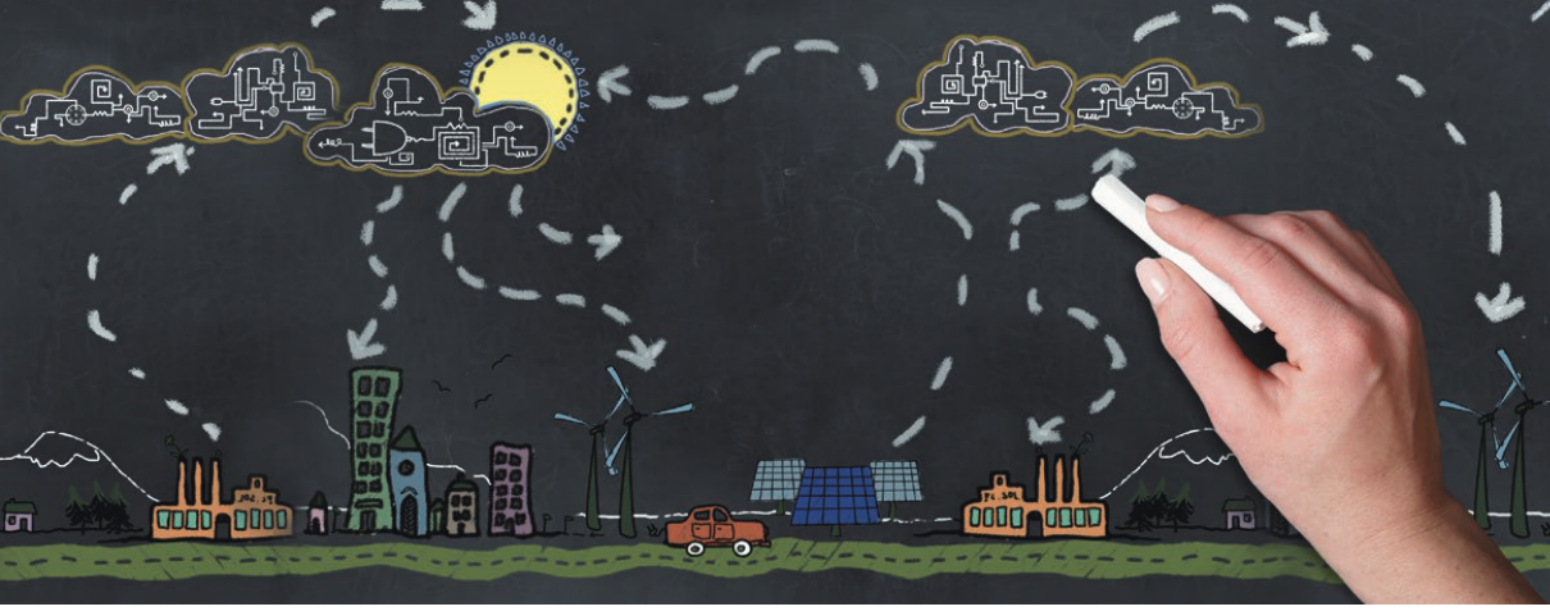

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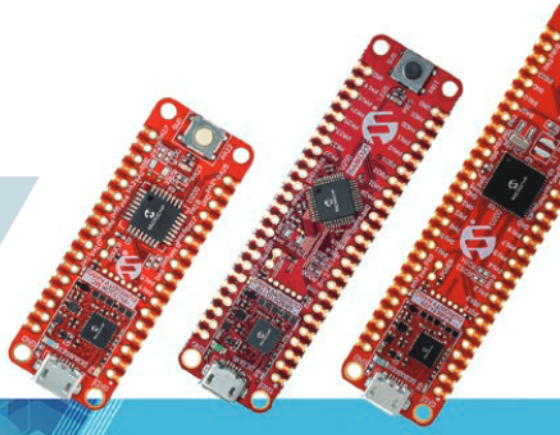

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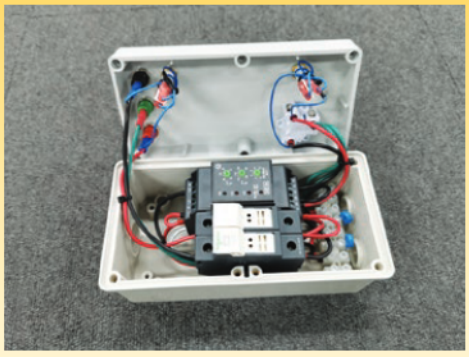

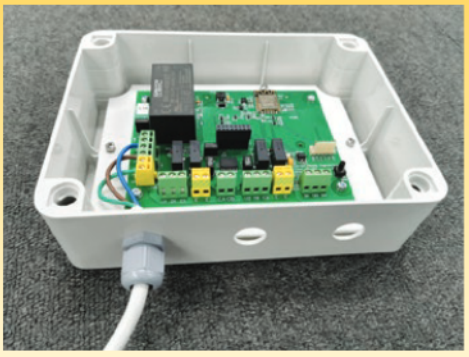

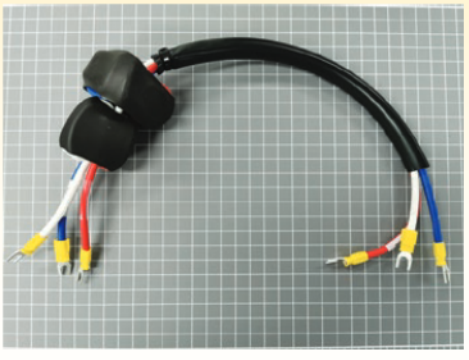

Ampec Technologies Pty Ltd
Tel: (02) 8741 5000
Email: sales@ampec.com.au Web: www.ampec.com.au

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The Right To Repair (and Modify)

The "Right to Repair" broadly refers to consumers (and presumably, businesses) having the legal right to repair their own equipment, or get non-factory service agents to do so, if desired or necessary.

By Dr David Maddison

Proponents argue that this 'right' comes from the fact that they are (apparently) the legal owners of the equipment in question.

It is spurred on by the fact that many manufacturers won't sell or otherwise provide spare parts, service documentation such as circuit diagrams, specialised tools and the software required to service equipment.

Consider that a manufacturer could go out of business, or decide to stop servicing a particular product. This would leave owners with no means to repair or modify that equipment should it become necessary.

And even if the manufacturer does offer service, it could be limited in scope, overpriced, slow, require long-distance transport of the equipment in question etc.

So there are many reasons why owners of equipment could argue that they need the ability to repair it themselves, or have a third party do it for them.

"Right to modify" in this context refers to enhancing a device's performance or capabilities by modifying software settings alone.

A device might have a certain capability, but it is disabled in software unless a payment is made for the additional features.

Note that generally, this equipment is out of its warranty period; this is not about a manufacturer avoiding an obligation to repair equipment for whatever reason.

Companies that are currently in the right to repair spotlight include:

- Apple (and other phone and computer manufacturers), for not providing spare parts to non-authorised service agents.
- Tractor manufacturer John Deere in the United States, for not providing the software to diagnose, repair or integrate new accessories into the tractor system to individual farmers or mechanics.

Another example is companies (including automotive manufacturers) using "tamper-proof" fasteners on their products, making them more challenging to repair.

Fortunately, though, third party manufacturers now make appropriate driver bits so that this is less of a problem.

Other ways manufacturers can restrict non-factory repairs include:

- requiring proprietary software (possibly available to manufacturer representatives only) for service, such as requiring dealer tools to install a new starting battery in a vehicle.
- "serialising" components, so that replacement parts can only work if their particular serial number is programmed into the device's firmware.

An identical replacement part with a non-matching serial will simply not work or will give an error message. This was a strategy introduced by Apple in their iPhones, even including batteries.

See the videos titled "*Apple's NEXT move in the war on repair*" at https://

youtu.be/GlvlgmjMi98 and "*An important message from Louis Rossmann*" at https://youtu.be/PPnz7DjM4CE

Valid reasons to restrict service

For fairness, we should present both sides of this story. Manufacturers might offer some or more of the following points:

- They wish to maintain certain performance standards (and thus reputation) for their equipment, so they want control of the repair processes and software, including updates.

  It is arguably beyond the scope of third-party technicians to diagnose and repair the complicated software used in many products today (although some specialists are well-qualified).
- Using "hacked" software or other unauthorised repair procedures might compromise the safety of a machine, or cause it to operate illegally (such as transmitting on an unlicensed frequency).
- Botched repairs or modifications by third parties of devices under warranty could cause extra warranty service work down the track for the manufacturer (although in this case, they could refuse service if they realise what happened)
- A manufacturer repair ensures a service record is maintained for equipment maintained by them (but it's questionable how important this is).

Reasons for self-repair

Individuals might want to repair their own equipment, or have an independent repairer do it for them, especially if manufacturer repairs are expensive or take too long.

If the item is within warranty, you would typically expect the manufacturer to repair it (although, in our experience, they don't always do so successfully).

There are many experienced ex-factory technicians and other highly-experienced individuals who can competently make repairs, as long as they have access to the required tools and software.

A manufacturer might declare a part or device to be unrepairable. Louis Rossman and Jessa Jones have both repaired devices that Apple said were unrepairable. See the following videos:

- "*Apple REFUSED to fix our iMac Pro*" at https://youtu.be/9-NU7yOSElE
- "*Fixing the Unfixable iMac Pro with Louis Rossmann!*" at https://youtu.be/EdwDvz47lNw
- "*An incredibly sad case: iPad 4 found on body of deceased hiker*" at https://youtu.be/zMuap2fgGuY

There is also a concern that an item becomes useless once a manufacturer stops supporting it. A device could be even made useless by a forced software upgrade or a built-in end-of-life counter.

Those who advocate the right to repair are against such actions. For example, read the news article headlined "*Apple fined for slowing down old iPhones*" at www.bbc.com/news/technology-51413724

Some examples of repairability concerns follow.

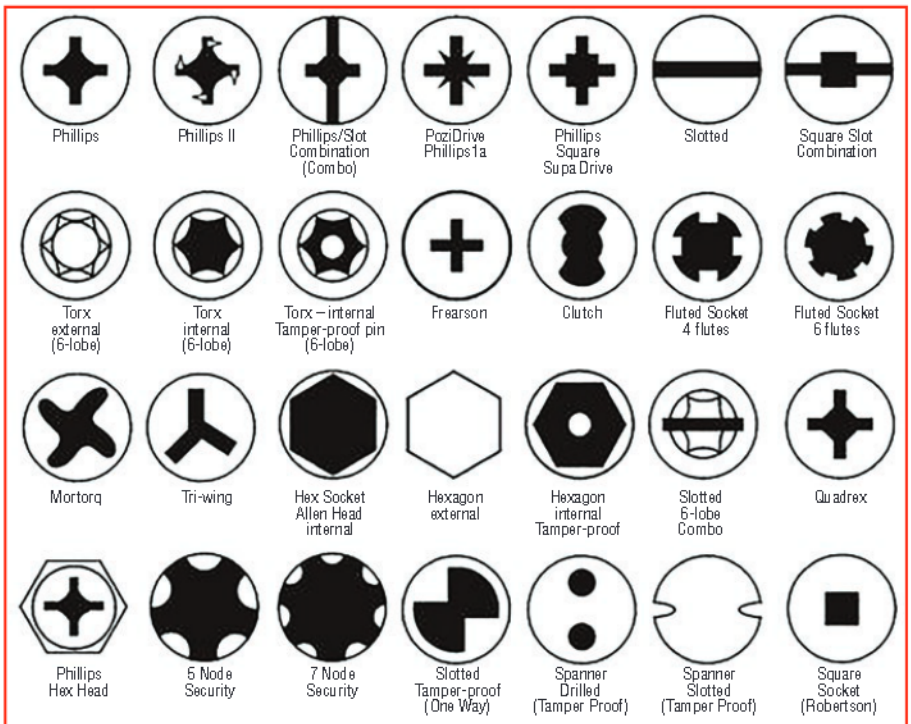

Fig.1: a selection of screw head shapes; most are security types designed to prevent easy removal.

1. Security screws

Many manufacturers use screws with special heads to prevent repair or modification of their products (see Figs.1 & 2). Drivers to fit so-called security or tamper-resistant types were not always readily available.

Fig.2: the pentalobe screw head. Apple first used this on the MacBook Pro to secure the battery in 2009 – then used from 2011 on the iPhone 4.
Source: Wikimedia user Ruudjah2.

When communication was much slower, these were somewhat effective in preventing access to devices. But with widespread access to the internet, it's much easier to find suitable drivers.

As soon as a new security screw is released, a manufacturer produces a driver for it. These are typically available at low cost from eBay, as well as electronics and hardware stores.

An early example of a tamper-proof fastener was used on original Macintosh computers. It was impossible to remove the back without a special tool, which a third party eventually made.

This was a combination of a long-handled Torx T15 driver, uncommon at the time, and a "spudger" used to pry the case apart without damaging it (as a flat-bladed screwdriver would).

Another example is the pentalobe screws on an iPhone. These were used in an attempt to prevent non-Apple repairers working on the phones, but appropriate drivers were soon released onto the market by third parties.

Sometimes when a security bit is used and the screw is recessed deeply in a narrow hole, a typical driver bit won't be long enough, so the screw might be inaccessible.

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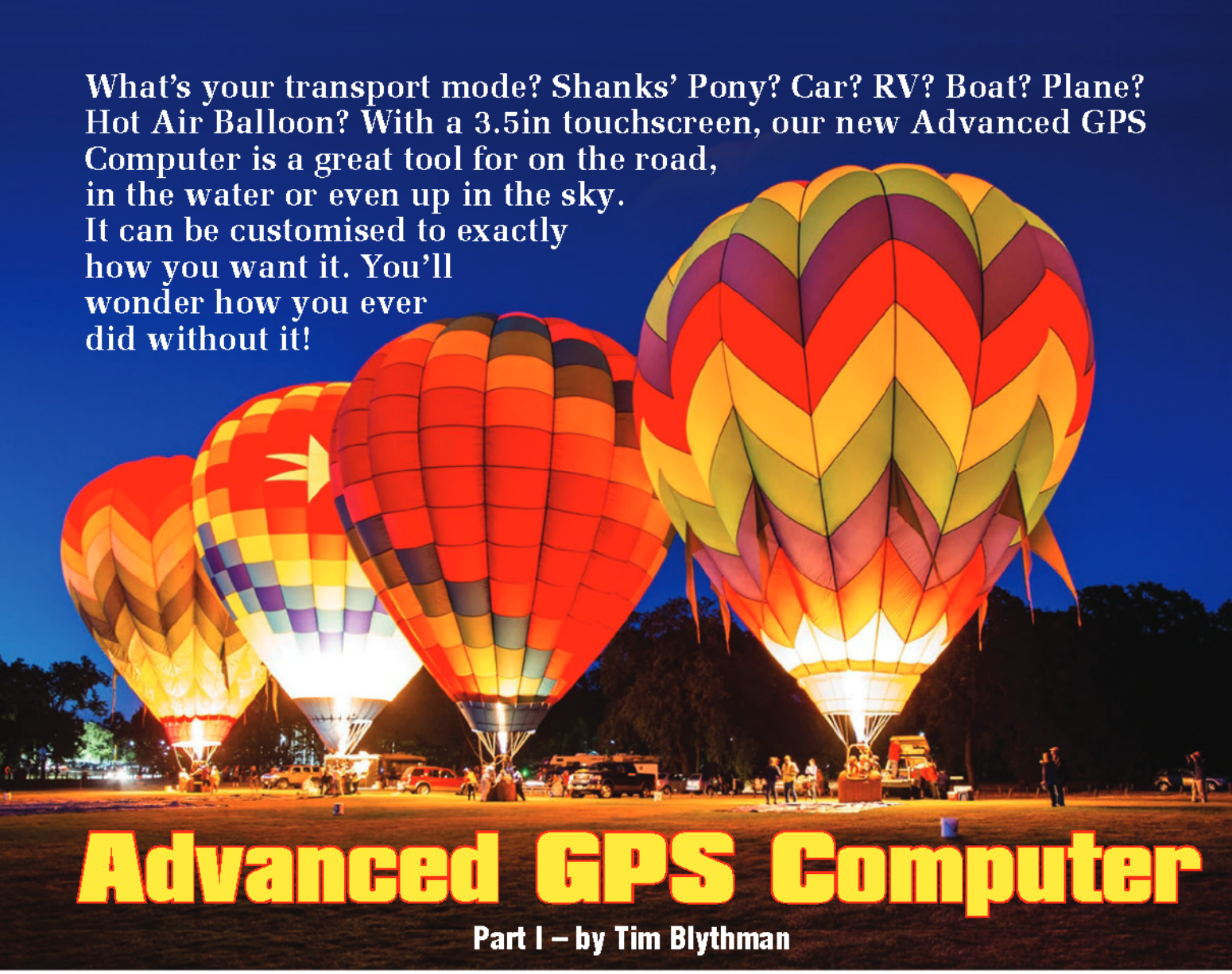
What's your transport mode? Shanks' Pony? Car? RV? Boat? Plane? Hot Air Balloon? With a 3.5in touchscreen, our new Advanced GPS Computer is a great tool for on the road, in the water or even up in the sky. It can be customised to exactly how you want it. You'll wonder how you ever did without it!



Advanced GPS Computer

Part I – by Tim Blythman

The Touchscreen Boat Computer with GPS has been a phenomenally popular project.

First released five years ago (April 2016; siliconchip.com.au/Article/9887), it became one of the first projects to show just how handy and versatile the first Micromite LCD BackPack could be.

Over the years, we've had numerous requests for features to be added. It was clear that people weren't just using it in their boats, but on the road, in the bush and even in the sky.

The latest minor revisions came in November last year, with two contributors to Circuit Notebook each adding their own touches (see siliconchip.com.au/Article/14644).

One example was tweaked to provide three simple screens for use on the road. One screen provides GPS ground speed and a compass display, while the others show the time, date and satellite data.

The second example is also designed as a speedometer, and adds automatic backlight control.

So we thought, why not combine all these features (and more) into a newer and even better unit? It could use the larger 3.5in touchscreen to make the display more visible, with software changes so that users could adjust the displays to their liking.

While doing this, it also made sense to integrate the features of our GPS Finesaver with Automatic Volume Control from June 2019 (siliconchip.com.au/Article/11673).

That project also needed an update, mainly to give it a larger display.

So the Advanced GPS Computer supersedes both the GPS Boat Computer and the GPS Finesaver, combining the features of both and adding new capabilities and refinements.

The new GPS Computer

The GPS Computer is a culmination of all these features and advancements. Naturally, it incorporates the POI (Point Of Interest) feature from the Boat Computer. This allows GPS coordinates to be 'bookmarked'. The GPS Computer can then display the heading and distance to the POI, allowing simple navigation, or perhaps helping you to find that favourite fishing spot again!

It won't give you turn-by-turn navigation, but it can at least point you in the right direction.

The large speedometer display is also present, as are numerous other GPS and time-related data. These include latitude, longitude, altitude, compass heading and average speed.

The automatic volume control feature from the GPS Finesaver works precisely like it did in that device.

You can feed audio through the device, via a 3.5mm stereo jack socket, and it will automatically adjust the volume according to vehicle speed. The output is louder at higher speeds, to help overcome increased noise from the vehicle.

Our GPS Finesaver article goes into more detail about why this is a handy feature to have.

Our revised design adds many more new functions. An audio synthesiser can inject warning sounds, alerts and even spoken words to the audio path, which can be fed either to the 3.5mm output jack or a small onboard amplifier and speaker.

An RTC (real-time clock) IC provides accurate timekeeping, even if the GPS receiver has not locked onto enough satellites. A rechargeable battery provides an integrated power supply. The battery state is displayed onscreen, and the unit allows low-power sleep operation, which keeps the GPS active as well as a complete power-off mode.

But we think that the most important new feature is the high degree of customisation that is possible. Four user-customisable displays are available that can be changed to show various parameters in different units. The displayed screens are also fully customisable to show exactly the combination of information that you want.

As the user interface is written in MMBasic, it can be further tweaked by advanced users as needed.

Features & Specifications

- Based on Micromite LCD BackPack V3 with 3.5in LCD touchscreen
- Custom display and information screens including current and average speed along with time
- Powered by a rechargeable battery and/or DC supply
- Adds automatic volume control to vehicle entertainment systems
- Automatic backlight control
- Programmed in MMBasic
- Points of interest (POIs) can be saved and navigated to
- Internal speaker for warning announcements and tones

Hardware

Our photos show the main electronics for the GPS Computer consisting of three boards sandwiched together. This stack fits neatly into a plastic UB3 Jiffy box. The top two boards will be familiar to readers as the Micromite V3 BackPack and its accompanying 3.5in LCD touchscreen.

If you aren't familiar with that device, we recommend reading the article describing it in the August 2019 issue (siliconchip.com.au/Article/11764).

The Micromite V3 BackPack used here is close to its minimum configuration. JP1 is fitted so it will draw power from its USB socket, and it is set up for pulse-width modulation (PWM) backlight control. This is necessary to allow for automatic backlight adjustment.

The only optional parts fitted to the V3 BackPack board are to enable the RTC feature, and include the DS3231 clock IC and its accompanying passives; two 4.7kΩ I^2C pull-up resistors and a 100nF bypass capacitor. Also, a two-pin header is fitted to the BackPack's CON9 to supply power to the battery input of the RTC IC.

The other optional parts supported by the V3 BackPack should not be fitted as they might conflict with some pin assignments. In particular, the parts in the flash IC box must not be fitted, nor should the IR receiver. The latter won't cause a conflict, but the receiver is unusable from within MMBasic when programmed with this project's software.

Add-on PCB

The third board in the stack mentioned earlier is the custom add-board for this project. It just plugs into the Micromite BackPack, and the circuit for this board is shown in Fig.1.

One of the frequently suggested improvements we had for the GPS Finesaver from June 2019 was that its display was too small. The Advanced GPS Computer offers a speed display which takes up most of the 3.5in LCD. And if you don't want a speed display, you can customise it to include a selection of other information.

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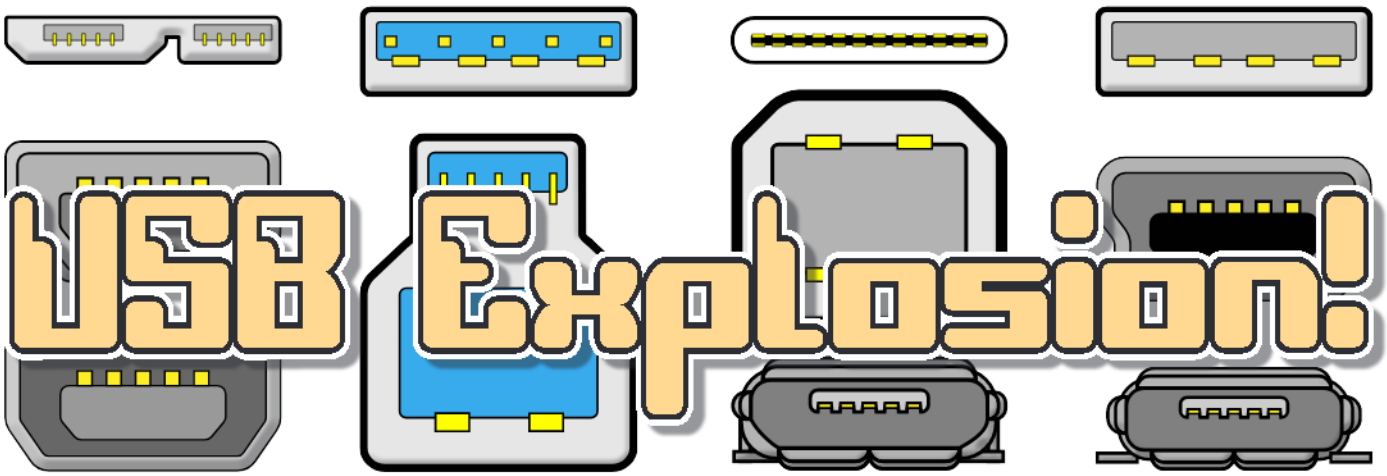
The History of the Universal Serial Bus



USB Explosion!

About 26 years ago, a group of companies developed the Universal Serial Bus or USB to make it easier to connect external devices to PCs, replacing the plethora of connectors and interfaces that had been used previously. It also greatly increased communications speed compared to existing serial protocols. Since then, the performance and uses of USB have grown dramatically.

By Jim Rowe

When the first generation of PCs or personal computers appeared in the 1970s – machines like the MITS Altair, the Commodore PET, the Tandy TRS-80 and the Apple][– they were somewhat limited in their ability to connect to peripheral devices like printers, modems and external tape or disk drives.

But when IBM released their first PC (the 5150) in 1981, things started to change. The IBM 5150 PC was available with up to two built-in floppy disk drives, 16KB of RAM and a colour graphics card (for which a colour monitor was available). Importantly, it also had slots at the rear for plug-in interface cards to provide a Centronics parallel printer port and one or two RS-232C serial ports.

Before long, you could also connect the PC to a 10MB hard disk.

Many new PCs then started to appear, most of them offering similar features. By about 1990, just about every available PC had around 64KB of RAM, a built-in 20MB hard disk, a colour graphics card or adaptor and both a Centronics printer port and a couple of RS-232C serial ports. Many could also take a plug-in Ethernet card, so that they could be connected to a LAN (local area network).

A variety of more specialised interfaces started to appear as well; for example, one to connect to the GPIB bus to control test instruments from a computer. There was also "FireWire" (IEEE1394), a high-bandwidth serial bus designed to efficiently connect peripherals like high-speed disk drives. Soon, the back of many PCs had a multitude of different interface connectors, to connect many peripherals.

USB is born

The development of USB began in 1994, when a group of companies that were heavily involved in the PC industry (Compaq, DEC, IBM, Intel, Microsoft, NEC and Nortel) got together and decided to make it easier to connect external devices to PCs.

This would involve replacing all of the different interface connectors with a group of simpler, identical multipurpose connectors which could each be configured by software to perform a variety of interfacing tasks. So was born the Universal Serial Bus, almost immediately identified by the acronym USB.

The official USB 1.0 specification was introduced in January 1996, and it defined two data rates: 1.5Mb/s (187.5KB/s), called Low Speed or Low Bandwidth (designed for peripherals like keyboards, mice and joysticks)

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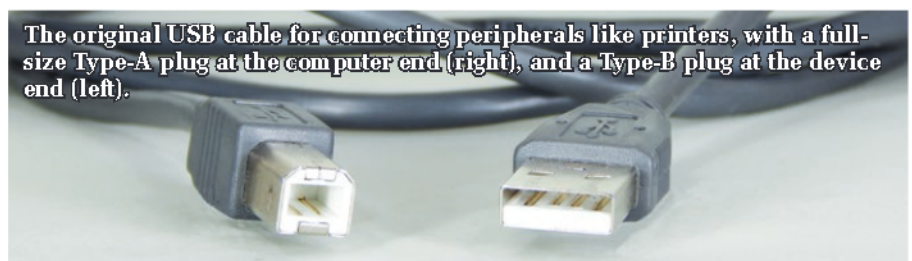

The original USB cable for connecting peripherals like printers, with a full-size Type-A plug at the computer end (right), and a Type-B plug at the device end (left).

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Preview only.

MINI ARCADE PONG
WITH SIX 'CLASSIC' BUGS FIXED

BY DR HUGO HOLDEN

Pong was one of the first commercially successful video games, and I reckon that Arcade Pong was the best version ever made. So I decided to make a fun home version of the game, copying the arcade version as closely as possible, but on a significantly smaller board. While I was at it, I thought I'd fix six bugs that were in the original design!

Arcade Pong is the most sophisticated and brilliant version of Pong ever created. Mr Allan Alcorn created this masterpiece at Atari in 1972. It completely outclasses any coded or software-based Pong, and also outclasses any hardware-based Pong on a single LSI chip.

Editor's note: there was also the Magnavox Odyssey, a home video games console which was released a few months before Atari released the Pong arcade machine. The Odyssey featured a "table tennis" game.

Original Arcade Pong boards are large and becoming rarer, so for history's sake, I decided that I wouldn't modify one. Instead, I would create my own, more compact version based on that design. I used discrete logic ICs placed in a neat grid, in the same arrangement as the original. This way, when an IC is referred to at a particular location in the Atari documentation, it matches up with my board.

My design eliminates the six bugs present in the original, and it also provides some simple onboard diagnostics via two TIL311 hexadecimal displays.

I have seen PCB designs from others aiming to recreate Arcade Pong, but they have the ICs in a completely different configuration, and they are generally larger than my design.

The bugs in the original design did not detract at all from the brilliance and creativity of the original circuit from 1972. For a circuit of such complexity, needing to get to market quickly, some unresolved problems are to be expected.

How a Pong machine works

The original circuit (including bugs, which as described below, I fixed) is shown in Fig.1. It also includes an onboard rectifier and regulator, which I didn't bother with in my version, since regulated DC power supplies are now readily available and inexpensive.

The paddle architecture alone in Pong's arcade version was more complicated than any home Pong version, with 42 possible states of ball motion. The ball motion "vector" (to think of ball motion in analog terms) is formed from combined horizontal and vertical motion components.

On the vertical side, there are three up and three down ball motion components. There is also a state of zero vertical motion, leaving a horizontal motion component only in that condition.

There are three horizontal motion components too, determined by the HIT counter, which combine with the vertical motion components to produce an overall perceived motion vector for the ball that a player observes on the video screen.

Although the ball motions are generated digitally, the player perceives the motion in a more analog manner, due to the persistence of the phosphor on the CRT screen and other factors.

The three horizontal and three vertical motion components combine to produce a motion vector, and this occurs in four screen quadrants because the ball could be travelling up or down, or left or right. So this gives 36 states of motion or ball 'velocity vectors' (4 quadrants x 3 x 3 components).

However, there are three additional states of motion that have zero vertical velocity. These are the horizontal states of motion on their own, determined by the HIT counter during gameplay. This adds another six states of possible ball motion during gameplay (3 x 2), giving 42 total unique ball velocity vectors.

This is more than enough to convince the player that the game is functioning in a smooth and analog fashion.

The genius of the game was that the vertical components of ball motion were determined by where on the paddle the ball made contact. When this interaction occurs, data relating to the condition is clocked into the vertical velocity encoder circuitry, one of the many very clever sub-circuits.

The further away from the paddle centre that the ball and paddle interact, the higher a vertical velocity is encoded. The upper half of the paddle is encoded for increasing vertical velocity upwards, while the lower half is encoded for increasing downward motion. The paddle centre is encoded for zero vertical velocity.

Also, the horizontal motion speeds up in a volley when there are no misses by either player. After four consecutive hits, the horizontal component of ball velocity increases. By 12 hits with no misses, the horizontal velocity component speeds up yet again.

These ball motion features, combined with the sound effects and score-keeping, make for a version of Pong that outclasses all other versions.

Clever design

Out of all the circuits I have seen after a lifetime of interest in electronics, Pong is up there in the top two most impressive. One reason for this is the combination of technical creativity and fun, making the best out of the current technology of the time, seldom seen together, all wrapped up in one design.

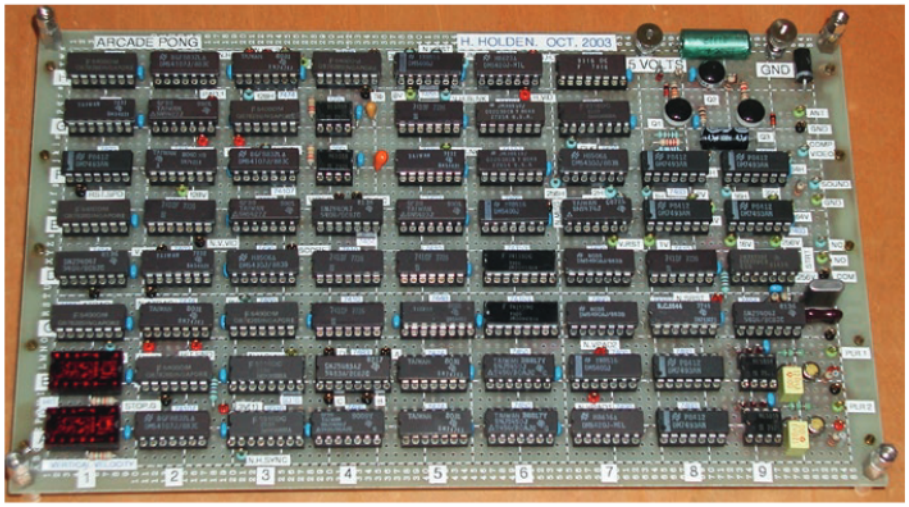
To give you an idea of how cleverly the sub-circuits are implemented, a single standard binary-to-7-segment display encoder IC is multiplexing the video for both players' on-screen score displays.

Also, the size of the player paddles and score segments on the screen in the arcade game were a well-proportioned use of the video display area; much better than in some home Pong versions where the scores and paddles (bats) appeared larger.

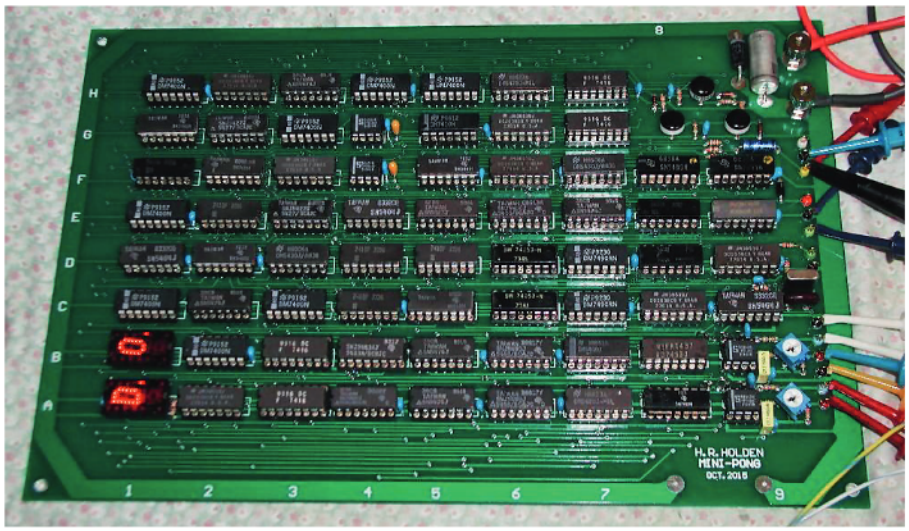
Clearly, some compromises were made when this arcane circuit of around 66 TTL ICs was miniaturized down into a single integrated circuit for home Pong versions.

Bugs in original Pong

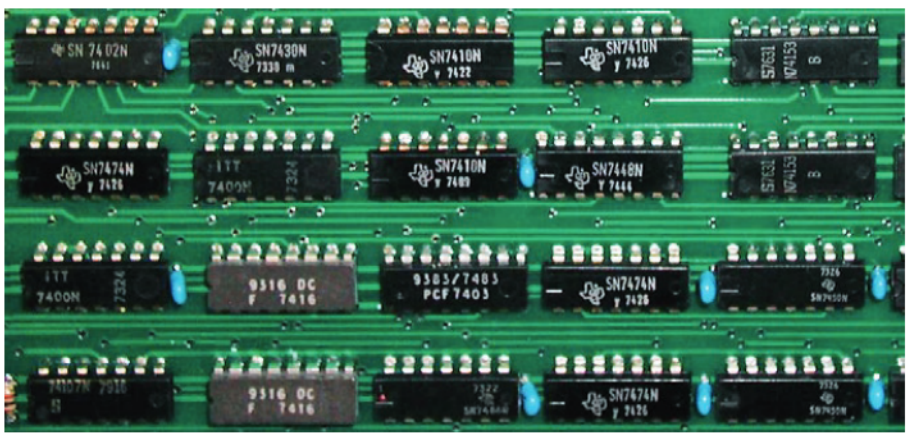
The original Arcade Pong "Syzygy E" PCB contains six known bugs. My version, besides being considerably smaller, also addresses and fixes all six.



One of the earliest prototypes made for the Pong circuit.



Another later revision prototype PCB being tested before the final design.



1960s and 70s plastic TTL ICs aren't made of the same kind of plastic as modern chips; it is a much harder type of resin. I find them reliable; these new-old-stock parts were 35-45 years old, but worked perfectly the first time I powered it up.

60Hz displays on 50Hz mains power

Like the original Arcade Pong, this design produces a more-or-less NTSC-compatible composite video signal, using the American frequencies of 59.97Hz for vertical sync and around 15,750Hz for horizontal sync. But many small monochrome PAL (50Hz/15,625Hz) monitors have sufficient horizontal and vertical hold adjustment range to lock onto this signal. Sometimes with vintage 50Hz CRT monitors, you need to reduce the value of the vertical oscillator timing capacitor a tad to get the vertical hold control into range.

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The History of Videotape – part 4
Camcorders and Digital Video

By Ian Batty, Andre Switzer & Rod Humphris

As detailed in the previous three articles in this series, videotape recording culminated in the incredibly popular VCR format. But it was not really suitable for portable recording, being too bulky. Before digital video totally replaced tape, there were still some significant technological developments, mainly in the field of miniaturised tape formats for more practical handheld video recording.

The camcorder began with Sony's record-only Betamovie. But what led Sony to design such an oddball machine?

Impressive as Betamax and VHS were, their portable versions left much to be desired. Lugging a klutzy VCR-plus-camera kit was far from ideal. Aside from colour recording and a longer running time, these weren't much better than the old half-inch reel-to-reel Portapak.

The revolutionary 'camcorder' design put the camera and VCR together into one case. The unit would have to sit on the operator's shoulder, which gave improved stability over previous wobbly hand-held cameras.

So, leaving aside the inconvenience of post-processing, why not stick with a (smaller) 8mm movie camera with colour film?

That is a question that users of Sony's Betamovie must have asked themselves. Sony has a history of going out on a limb, and in this case, they appear to have prioritised compactness over practicality in their first camcorder.

It was a unitised design, but it had no playback facility. To find out just what you had (or had not!) recorded, you had to remove the tape from the Betamovie and play it in a 'proper' Beta machine.

National Panasonic's first outing, the full-size M3 VHS camcorder, did offer standard recording and playback. But it was way bigger than a shoebox, and so it was never going to be madly popular.

The VHS-C cassette, at less than 30% the size of a standard cassette, and giving 20 minutes of recording time, helped to shrink the VHS camcorder. Reducing the size of the head

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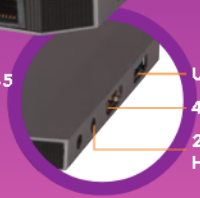

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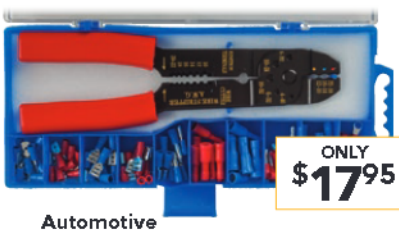

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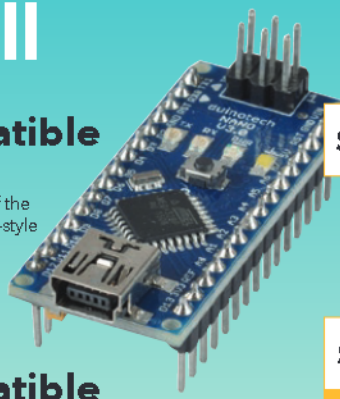

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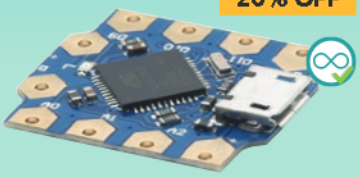

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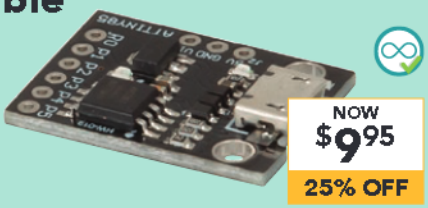

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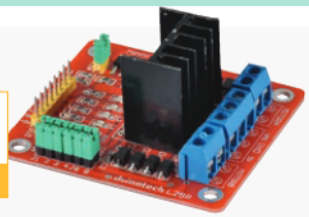

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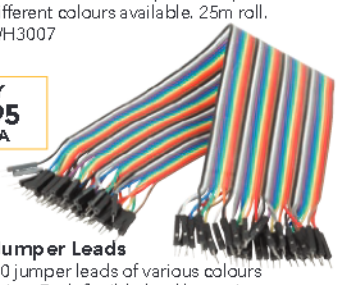

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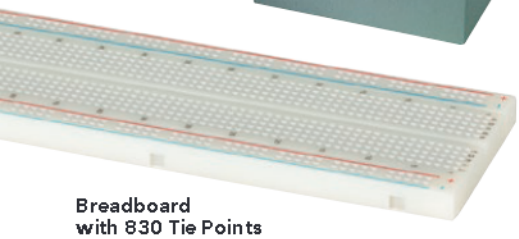

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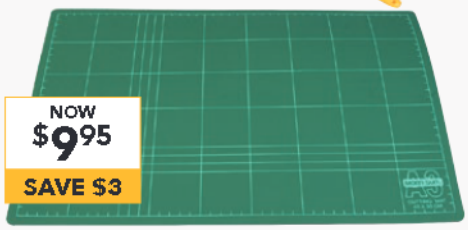

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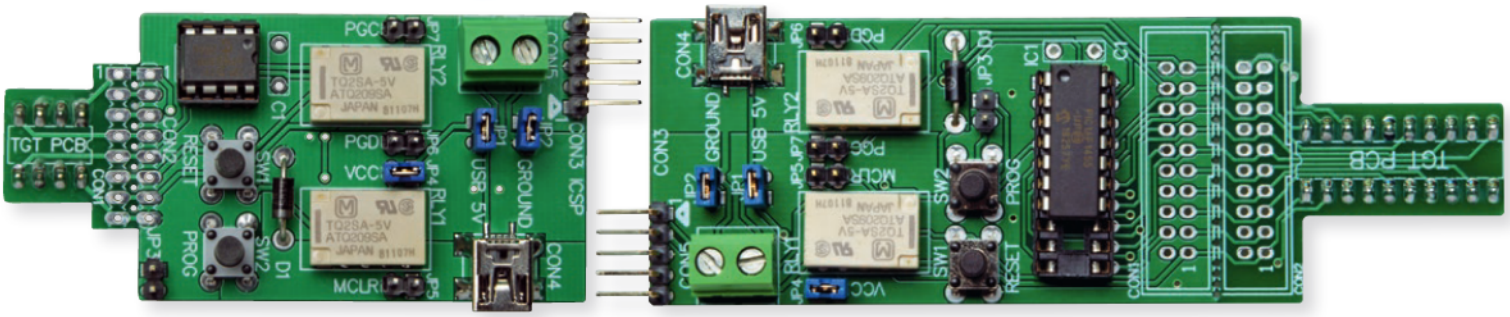
8-PIN 14-PIN 20-PIN PIC PROGRAMMING HELPER



It's incredible what you can achieve with an 8-pin microcontroller. However, programming and debugging these chips can be a challenge due to the need to use the programming and reset pins for other purposes. This little board makes working with these (and some larger) PICs much easier!

We include 8-pin PIC microcontrollers in many of our projects because they are very handy for doing certain jobs, and cheap to boot. Apart from a handful of 6-pin parts, which are only available in SMD packages, they are some of the smallest microcontrollers around.

For example, we used a PIC12F1572 8-pin micro in our LED Christmas Ornaments project (November 2020; siliconchip.com.au/Article/14636). In that case, despite only having eight pins with two dedicated to power, it was able to control twelve LEDs and light them up in patterns.

We have also used parts like the PIC12F617 in projects such as the Car Radio Dimmer Adapter (August 2019; siliconchip.com.au/Article/11773), the MiniHeart heartbeat simulator (January 2021; siliconchip.com.au/Article/14706) and the Refined Full-wave Universal Motor Speed Controller (April 2021; siliconchip.com.au/Article/14814).

If you only need five or six I/O pins, then devices like these are handy and compact, while still being computationally very capable. John Clarke even used one to replace a hard-to-get rotary switch with a potentiometer in the Digital Effects Pedal from April 2021 (siliconchip.com.au/Series/361)

But consider that once you subtract the power pins, you're left with at most six I/Os, and you usually need three of these ($\overline{\text{MCLR}}$, PG[E]D and PG[E]C) for programming and debugging. Unless your application only needs three I/Os, you will inevitably end up sharing some of these pins' functions. These shared connections can cause significant hassles.

This became apparent as we worked on an upcoming project that pushes a PIC12F1572 to its limits, using five I/O pins and running the processor at its highest operating frequency.

Some background

Microchip PIC microcontrollers have long used a five-wire programming interface. The voltages and protocol have varied over the years, but these five wires have always performed broadly the same roles.

The PICkit 2 and PICkit 3 programmers both sport six-way headers; the later PICkit 4 and Snap programmers have eight-way headers. This is because these programmers now support Microchip parts that do not belong to the PIC family, such as AVR and SAM devices which came into Microchip's stable with their 2016 purchase of Atmel.

While the exact pin mapping of these five wires varies between PIC families and pin counts, the small number of pins on the 8-pin parts means that there are not many permutations.

The purpose of the Helper device we have developed is to switch the function of some pins on your micro between programming/debugging and application-specific I/Os during development. This will make your life much easier.

While we can't promise that this Helper will work with all 8-pin PICs, it should work with most. The main exception we're aware of is PIC10F parts (some of which come in 8-pin packages, but only six are connected).

Table.1 shows the five connections used for PIC programming, their order on the programming header and what pins they connect to on an 8-pin PIC. Note that the ground pin is located in the centre of the group, reducing the chance of damage if the header is reversed.

One way to re-use pins 4, 6 & 7 on an 8-pin PIC is to mount it in a socket on the board, then when you need to program it, unplug it and insert it into a programming socket. After programming, it can be re-inserted into the original socket on the board.

But this can quickly become tedious as the chip is repeatedly moved between the programming socket and the test circuit. It also means you can't perform in-circuit debugging (ICD).

The alternative is so-called ICSP (in-circuit serial programming), which allows the chip to stay in place and be programmed 'in circuit'. But

By Tim Blythman

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The New Arduino IDE 2.0

Review by Tim Blythman

The Arduino boards and software are incredibly popular, mainly because of the free, powerful and easy-to-use integrated development environment (IDE) for developing code. Now there has been a significant revision of the IDE with the beta release of version 2.0. Here is what you can expect from it.

It was just in March last year that we took an in-depth look at the Arduino ecosystem (siliconchip.com.au/Article/12575). That article included details on the history of the Arduino software; primarily, the IDE.

Tracing its history back almost 20 years to the Wiring IDE (http://wiring.org.co/), it has been nearly 10 years since the official version 1.0 release of the Arduino IDE.

It is open-source, which means that it is easy to write libraries, add support for new boards and even make clones of existing boards.

Some people have noted that the Arduino IDE lacks some features that experienced programmers have come to expect from other development environments. These include features such as debugging, auto-completion and source code management.

Arduino IDE 2.0

The Arduino IDE 2.0 was released in February, and not long after that, we downloaded it and tried it out. If you don't wish to switch over fully, it can run alongside the current version 1.8.13 (and older versions). We downloaded the .zip installer version from siliconchip.com.au/link/ab85

Note that Arduino IDE 2.0 is still in the beta stage of development. This means that it is essentially complete, but still has some minor bugs and glitches.

The blog announcement (found at siliconchip.com.au/link/ab84) indicates that the new version will include some of the requested features that we mentioned above.

In the March 2020 article, we noted that some Arduino software variants had popped up, such as the command-line-based Arduino-cli (command-line interface) and the Arduino Pro IDE. We understand that a lot of what has gone into the new IDE has been informed by those programs.

First look

Opening up the IDE after installation opens a window as shown in Screen 1. The overall appearance is similar to older versions, but with a few extra buttons down the left-hand side and a new drop-down list near the top.

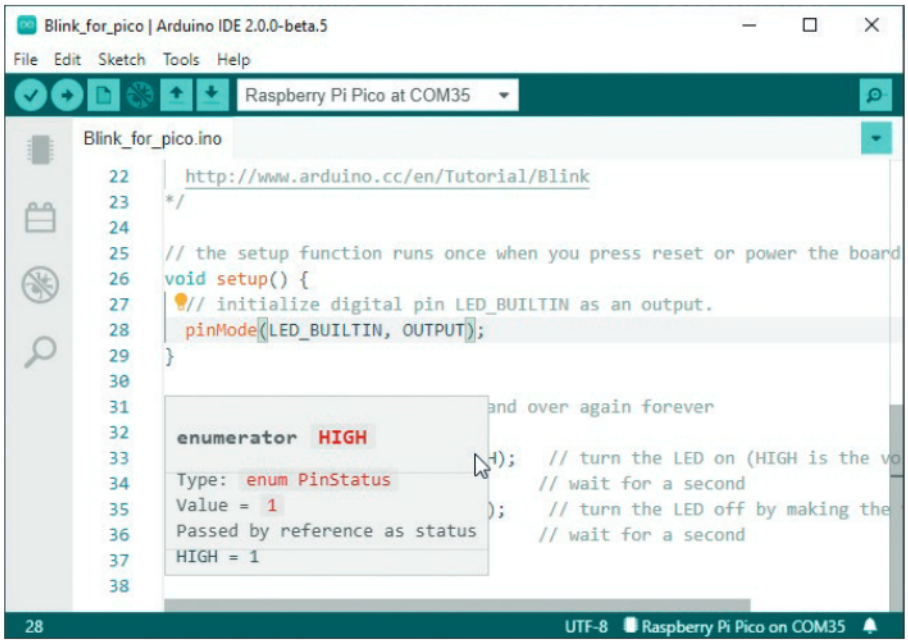
These extra buttons are to access the Boards Manager, Library Manager and the debugging and search functions. These are features we expect to use a lot, so it's handy to have them just one click away.

The new drop-down selects a board and port combination. This makes it easier to work with different projects, as the board and port can be changed easily and together, meaning less chance of getting these mixed up or changing one and not the other.

At this stage, the debugging function only works with some SAMD and Mbed boards and requires a separate debugging probe. So we weren't able to test that feature out.

The debugging console and controls are visible in Screen 2. We also found a comprehensive list of keyboard shortcuts; they are accessed from the File → Advanced → Keyboard Shortcuts menu item.

The Output window is hidden by default, so pressing the Verify or Upload buttons doesn't immediately



Screen 1: simply hovering your mouse over a keyword will bring up a tooltip, pressing F12 will open the file where the keyword is declared.

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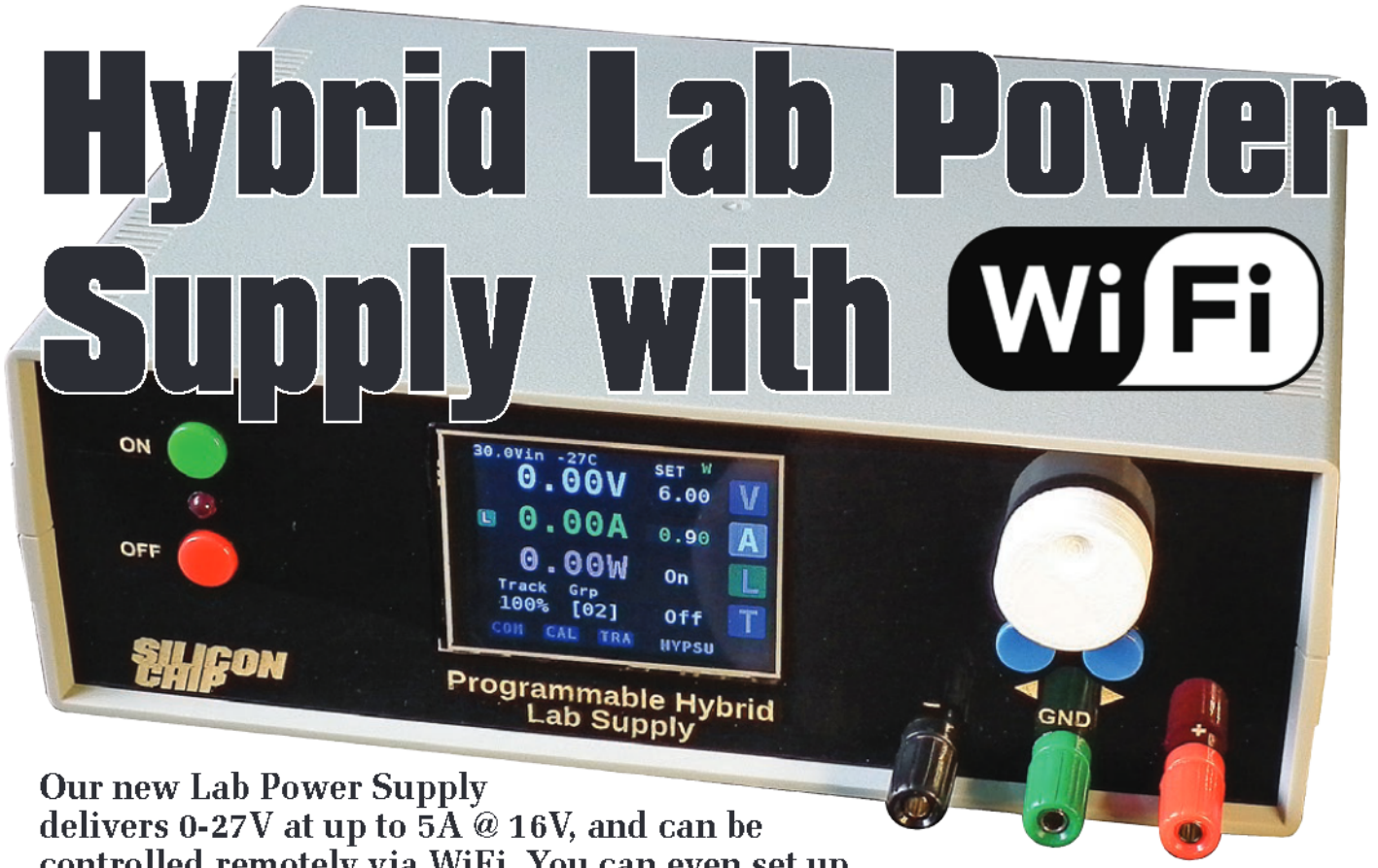
PROGRAMMABLE

Part II – by Richard Palmer

Hybrid Lab Power Supply with WiFi



Our new Lab Power Supply delivers 0-27V at up to 5A @ 16V, and can be controlled remotely via WiFi. You can even set up multiple units to track automatically and connect them in series or parallel. After describing the configuration and circuitry last month, this follow-up article shows how to build the two PCBs and wire up everything neatly into a modestly-sized plastic instrument case.

As previously explained, this supply uses a three-stage hybrid arrangement, with two switch-mode supplies followed by a final linear stage. This gives excellent efficiency and keeps the whole thing compact and light, while still delivering very good performance.

It has quite a few useful features, such as soft-starting and a fast settling time with minimal overshoot.

With these features, plus its programmability, it can produce controlled pulses of power or voltage steps for testing how devices handle transients.

The AC-DC switch-mode supply is a prebuilt module, but the other two modules in the device must be assembled before the whole thing can be fitted into its case and wired up. So let's get onto building those two boards.

Construction

The first step is to assemble the boards. Fig.6 is the PCB overlay diagram for the Regulator board, while Fig.7 is the diagram for the Control board.

All the parts on the Regulator board mount on one side, and most are surface-mount types. The Control board has components on both sides, but just a few SMDs, and they are all on the same side. It's best to solder the SMDs first, then move on to the through-hole components.

If you have a solder reflow oven, (or make your own! See

Control board features & specs

- Dual core ESP-32 240MHz, 32-bit processor
- Onboard 2.8in or 3.5in colour LCD touchscreen display
- 520kB RAM, 4MB flash memory
- Full-size and micro SD card sockets
- Touch interface plus detachable switches, LED and rotary encoder
- 20-pin expansion header with I^2C x 2, SPI, DAC x 2, ADC x 2, serial communications and GPIOs
- Maximum of 17 GPIO/PWM pins can be used
- WiFi (802.11 b/g/n) with 150Mbps throughput
- Bluetooth & BLE support
- USB-serial port
- Web server and web client functions
- Over-the-air (OTA) or USB reprogramming

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REVIEW BY TIM BLYTHMAN

WELLER T0053298599 SOLDERING STATION

Any serious electronics enthusiast needs a proper temperature-controlled soldering iron; ideally, one with interchangeable tips, to suit working with different sizes and types of components. We were given the chance to try out the Weller T0053298599 Soldering Station (previously known as the WE1010).

We probably all started with a simple iron that plugs directly into a wall socket. But once you get good at soldering, you're much better off with a station that offers temperature control and less resistance to movement, with a supple cable connecting to the pencil.

We do a lot of soldering at SILICON CHIP; probably more than most people. But likely not as much as anyone working in a production environment.

The Weller T0053298599 is pitched at 'prosumer', trade and professional users, so it is designed to be used for long periods on a regular basis. Therefore, it should have no trouble handling our sort of usage.

Power station

The power unit, labelled WE1, is what we know as a soldering station base. It has an IEC mains receptacle at the rear and a 7-pin socket at the front, accompanied by an LCD screen. There are three control buttons on the right side of the screen, and a mains on/off rocker switch on the left.

The station is marketed as a 70W device. It is weighty and contains a transformer, just visible through the vents. Four rubber feet prevent the base from sliding around.

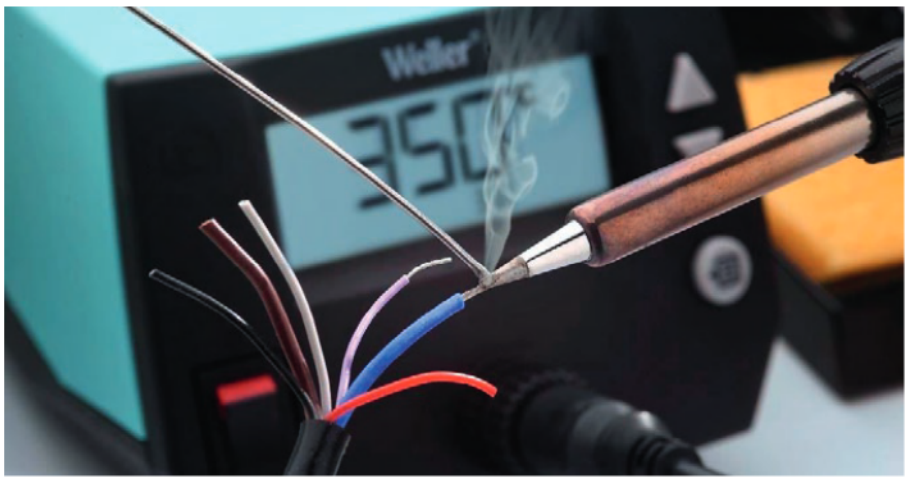
The underside vents are complemented by another set at the rear, providing simple convective cooling.

The pencil

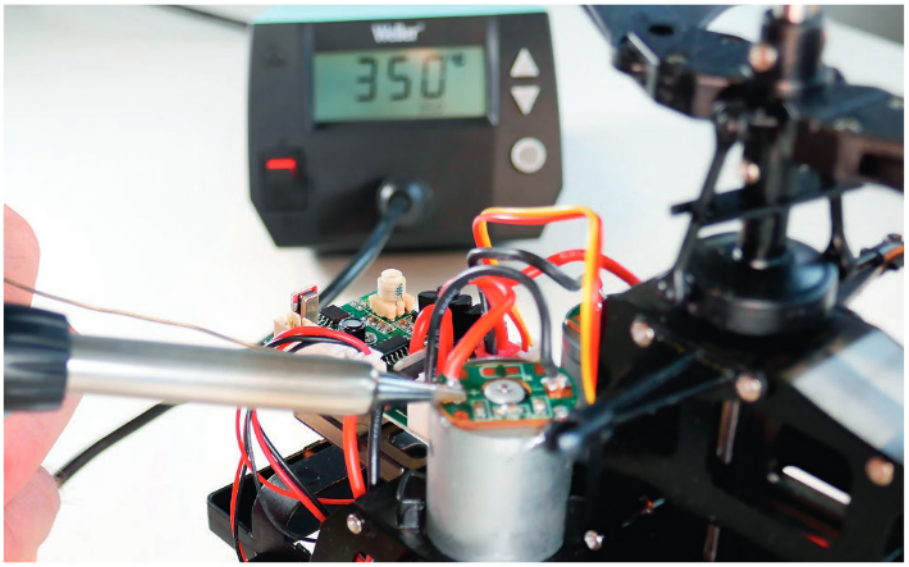
The supplied WEP70 pencil has a 7-pin plug to suit the power unit and an approximately 120cm-long lead. The lead is coated in heat-resistant silicone and feels light and unobtrusive.

The included tip is a 1.6mm ETA 'screwdriver' tip (like a cut-off chisel tip), with other ET types being compatible with the iron. The pencil is slim too, and has a textured foam grip. There are various types of tips optional to this tool that you can purchase, including conical, chisel, bevel and knife tips in various sizes.

We reckon that it's helpful to purchase a few different tips when you get a station like this, as they are useful in different situations. Sometimes you need a long, narrow tip to reach a part on a packed board. Other times you need a big tip to solder heavy leads or large components. Tips with flat edges



The Weller soldering station includes a 1.6mm 'screwdriver' tip.



The T0053298599 is well-suited for heavy-duty usage. It is solid and includes a settings lock feature to prevent tampering in production environments.

can be beneficial when working with solder wick.

So having a good variety of tips available at reasonable prices (around $8 each) is definitely a plus in our books.

Safety rest

Included with the station is a PH70 safety rest, which is also equipped with rubber feet. Like the power unit, the safety rest feels weighty and is not likely to slide around. The rest has a generous space for the included sponge and several holes to store spare tips.

Controls

The three buttons form a simple and intuitive interface. The menu button cycles between standby time, offset, units and lock, with the up and down buttons changing the selected value.

The lock feature is intended for a production environment, to prevent operators from adjusting the settings, although you might also find it useful to avoid accidental changes.

The manual is quite thick, but mostly from including almost 30 languages. There are detailed pictograms, so even if there weren't any words, the unit would be easy to use.

Hands-on testing

The manual states that the iron can heat from 50°C to 350°C in 28 seconds. We timed it at 50 seconds from ambient (around 20°C) to 380°C; perhaps this varies depending on the type of tip fitted. The nominal operating range is 100°C to 450°C with a stability of ±6°C.

That's a reasonably wide range, and if you need to work with a range of low-melt solders, for example, in constructing white-metal models, then the Weller T0053298599 should have the range and accuracy to do so.

We had no trouble using the iron with a typical 99.3% tin/0.7% copper lead-free solder, which has a much higher melting point than standard tin/lead solder. Even working along rows of closely spaced pins, the iron was able to keep up the heat.

Having said that, our work typically doesn't involve really heavy-duty soldering. But based on our experience, we think that it would handle larger jobs reasonably well, as long as you used a suitable tip.

We found that the default standby timeout of two-minutes was a little short, but it can be increased to 99 minutes, which we think should be sufficient for most cases.

Conclusion

We would certainly have no complaints about using this station for our everyday soldering tasks.

It is sturdy, adjustable and responsive, and would be well suited to duties much more intensive than we could throw at it.

The Weller T0053298599 kit is available at Bunnings Warehouse for $249, including GST. This unit was provided for review by Weller Tools.

Visit www.bunnings.com.au/weller-70w-240v-soldering-station_p0248144 to purchase the station and/or spare parts, including tips. Here's a short link to the above: siliconchip.com.au/link/ab8n SC

Arcade Pong: the ANT terminal (continued from page 46)

You might be wondering about the purpose of the "ANT" terminal on the PCB. It's close to the VID terminal, so you might think it's meant to drive a TV set's antenna input. But that is not its purpose.

In the arcade machine, the ANT terminal was connected to a wire about a meter long, leading nowhere in the arcade cabinet.

It connects to the base of the transistor that resets the game, which is floating, except for the tiny leakage of a diode. So the base voltage can float to be just on the verge of causing the transistor to conduct.

Back in the 1970s, it was surprising how resourceful teenagers were at trying to get free credits on arcade games.

One trick was to deliver an electrostatic charge, or burst of RF, into the machine to clock up credits, as though multiple coins had been put in the coin mechanism.

It was possible to prevent this with extensive RF filtering on all the logic circuits and wires leading to coin mechanism, switches etc.

In Pong, however, one coin gave one game play credit. Atari decided to simply detect any electrostatic or RF burst, using that antenna wire, and reset the game, making it impossible to get a free credit. That is one reason why the original transistors used (2N3643 and 2N3644) in the game's reset circuit were RF types.

I left the "ANT" connection on my design so that my PCB could be used to replace/repair a genuine arcade game console.

It is surprising how few people can fix the original boards and run around in circles until they have replaced nearly every IC. The originals were not socketed, and many original arcade machine PCBs have been destroyed by botched repair jobs. SC

PRODUCT SHOWCASE

Achieving water authority compliance with automated wastewater treatment

Wastewater usually contains various contaminants (ie, acids, alkalis, copper, lead, arsenic, antimony, ammonium, solvents etc).

Fortunately, automated wastewater treatment systems can help semiconductor manufacturers remain in compliance with EPA and local standards, while significantly reducing the cost of treatment, labour and disposal.

These automated systems can eliminate the need to monitor equipment in-person. It can separate suspended solids, heavy metals, emulsified oil and encapsulate the contaminants, producing an easily de-waterable sludge in minutes.

The water is typically separated using a de-watering table or bag filters before it is discharged into sewer systems or further filtered for re-use as process water. Other options for de-watering include using a filter press or rotary drum vacuum. When dried, the resulting solids will pass the TCLP leaching test and are considered non-hazardous and can be disposed of in a landfill.

The treatment systems are available in batch, semi-automatic, or fully automatic form and can be designed to be part of a closed loop system for water reuse or to provide legally dischargeable effluent suitable for disposal in a municipal sewer system.

A new, fully customised system is not always required. In many cases, it can be faster and more cost effective to add to, or modify, a facility's current wastewater treatment when feasible.

Sabo Industrial
2 Little Britain Road
Newburgh, NY 12550 USA
Tel: (845) 562 5751
mail: info@saboindustrial.com
Web: https://saboindustrial.com

Maxim's MAX78000 & Aizip bring ultra-low-power human figure detection to IoT

Maxim's MAX78000 neural-network microcontroller can detect people in an image using Aizip's Visual Wake Words (VWW) model, consuming just 0.7mJ per inference, with greater than 85% accuracy.

That is 100 times less power consumption than conventional software solutions, making it the most efficient IoT person-detection solution available, providing up to 13 million inferences from a single AA/LR6 battery.

That means significantly longer operation for battery-powered IoT systems that require human-presence detection, such as building energy management and smart security cameras.

Extreme model compression enables accurate smart vision with a memory-constrained, low-cost AI-accelerated microcontroller and budget-friendly image sensors.

For details about VWW visit **www.aizip.ai** – you can view a demonstration at **http://bit.ly/DetectVideo**

The MAX78000 microcontroller and MAX78000EVKIT# evaluation kit are available now from Maxim's website (**siliconchip.com.au/link/ab8o**) for US$8.50 and US$168.00 respectively.

Create the Future Design Contest

Mouser Electronics announced its sponsorship of the 19th Create the Future Design Contest, a global challenge to engineers and innovators around the world to design the next great thing.

The contest is open for submissions until July 1, 2021. The grand prize winner receives worldwide recognition and a cash prize of US$25,000 for an innovative product that benefits society and the economy.

Previous grand prize-winning entries include a small, self-contained device for organ and limb transport and an economical rapid screening device to prevent food-borne illness.

The contest was created in 2002 by the publishers of Tech Briefs magazine. For more information, go to **https://www.mouser.com/createthefuture/**

Tax Time DEALS!

ALTRONICS
Build It Yourself Electronics Centres®

EOFY savings throughout the range.
Sale prices valid until June 30th.

Handy kit to get started in online content creation!

D 0890
SAVE $40
$199

All-In-One Mini Audio Studio For Creators

The MaonoCaster Lite provides everything you need to get started in podcasting, live streaming, YouTube & Twitch. Get top quality audio from the included XLR cardioid pick up condenser mic, control all your device levels, effects and music using the mixer buttons. Includes mic, mixer console, USB C cable, tripod, windsock, 3 x TRRS jack cables and monitor earphones.

Pro grade condenser mic for a clear, crisp sound

D 0830
SAVE $30
$119

USB Podcast Mic

A premium finish USB microphone with all metal case, stand and protective grille. Adds high clarity sound to your desktop for live streams & podcasts.

D 0854
SAVE $40
$99

4K USB Web Cam

Provides 4K @ 30fps performance from a compact package with monitor clip. Great for meetings during the day & game streaming at night!

LED base light shows when your mic is on

D 0831
NEW!
$69.95

USB Gooseneck Mic

Great for gaming, YouTube and livestreaming. Quality omnidirectional mic insert. Mic gain and mute control knob with LED lighting.

INCLUDES:
- Conical tip • Hot air blower
- Hot knife/plastic finishing tip
- USB cable • 1m solder
- Tip sponge.

T 2694A
SAVE $50
$165

30W Lithium 'Go Anywhere' Soldering Iron

45 minute run time. 600°C max. Ideal for occasional soldering jobs or light duty repairs and field servicing. Recharge by USB power adaptor in your car or at home - or USB battery bank. Includes replaceable 18650 battery.

SAVE $90
$99
S 9442

Add on an MicroSD card 16GB $10.95 (DA0328).

1.5" screen on rear

1080p GPS WiFi Dash Cam

A must have for all drivers to protect themselves in accident insurance claims. 1080p footage and includes high end features such as GPS, wi-fi footage transfer, G-sensor triggering & parking mode. Theft deterrent magnetic bracket.

SAVE $25
$80
Q 1080

9999 Count True RMS Multimeter

With in-built AC mains detection. Featuring a striking easy to read reverse backlit screen and a massive 9999 count readout. Auto ranging with easy push button operation.

NEW!
$18.50
T 2237

Take quick notes while you work

Write a reminder, take a phone message or leave a note for your family with our handy eWriter LCD board. Ultra thin, portable design is also great for kids to draw on.
Size: 226x146mm.

- Isolated for electrical safety.
- Pure AC sine wave output.
- AS/NZS 4763.2011 approved.
- LCD stats display*

*Not available on 300W

$155
M 8060 300W
$289
M 8062 600W
$429
M 8064 1000W
$625
M 8065 1500W

Power mains appliances on the road

The Powerhouse® BlackMax Inverter range is here!
Housed in a rugged aluminium extrusion, this new range delivers robust reliability and unwavering performance - even under severe operating conditions. For peace of mind all models have been certified to Australian Standard AS/NZS 4763.2011. Ideal for tricky loads, such as laptops, & game consoles. Perfect for 4WDs, campers, caravans & trade vans.

*Solder not included.

Dual Solder Reel Holder

Heavy weight base with solder guides.
T 1302A
$24.95

SAVE 26%
$44
D 0515

Wireless Charging Battery Bank

• Slim 10,000mAH battery • QI wireless charging pad for iPhone/Android + USB.

Home QC3.0 Wall Charger

QC 3.0 for 4x faster charging 3A output. Compact case doesn't block outlets.

SAVE $10
$19
M 8863

The Pocket Hero is here!

This nifty 12 in 1 pocket saviour helps you fix life's little problems then folds up to the size of a pack of gum! Includes belt pouch.

T 2282
SAVE 28%
$10

Order online @ altronics.com.au | **Sale pricing ends June 30th 2021.**

For the workbench.

T 2128A

Repair faster with a lithium screwdriver.

This USB rechargeable screwdriver features a fully adjustable torque drive for fast and accurate driving of precision screws found in modern high tech devices. Two way direction control. Standard 4mm driver bits (40 included). 3 hours use per charge. See web for full contents list.

X 0108

Clean & revive tiny parts

Uses water, detergent and ultrasonic waves to remove gunk from small parts, spectacles, jewellery, even DVDs! No solvents required. Stainless steel 18x8x6cm tank.

LED Magnifier for micro tasks

Why pay $300 for a MaggyLamp? The inspect-a-gadget illuminated desk magnifier is an absolute bargain at $69, we believe ours is every bit as useful. An incredible visual aid for detailed inspection and work on fine items with full clarity through the quality glass lens. Tackle complex miniature tasks with confidence!

X 4204 3+12 Dioptre **$60**

X 4205 5 Dioptre **$65**

T 2247A

Accurate Digital Vernier Calipers

Precision measuring with ease! 150mm length, suitable for measuring internal, external and depth dimensions. 0.01mm, 0.0005" and 1/128th" display.

T 2367

Multi-Angle Bench Vice

Made from diecast alloy. Clamps to your work bench and provides total 360° freedom when working. Jaws open to 55 mm. Includes soft jaws for holding delicate connectors.

Compact 30V Lab Power Supplies

Great for servicing, repair and design of electronics. Low noise switchmode design. Fine & coarse voltage and current controls. Size: 85Wx160Hx205Dmm.

$119 M 8303 3A

$149 M 8305 5A

T 1528A

Wire Stripper & Kwik Crimper

Combines a ratchet wire stripper, cutting blade & kwik crimper (red, blue and yellow sheaths). Suits 10-24 AWG cable.

T 2351

6pc Soldering Helper Tool Kit

A 6 piece set of tools for reworking solder joints, cleaning pad surfaces and removing debris.

T 1439

Precision Knife Set

Includes aluminium handle with 13 blades to suit different cutting jobs. Includes plastic carry case.

D 0873

750VA UPS Power Protection Board

This quality PowerShield UPS unit will prevent appliance damage caused by power fluctuations, PLUS keep power on during a blackout! Also protects phone lines.

M 8332A*

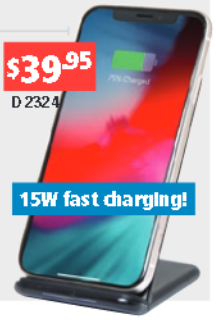
Charge 10 USB devices at once!

- Great for families, classrooms & business.
- Massive 19A charge output • QC3.0 on 2 ports
- Includes adjustable dividers & power supply. *Devices & charging leads not included

A 0290

USB NiMH & NiCad Charger

Charges 4 x AAA/AA batteries via USB. Great for use at home or in the car.



D 2324

Don't miss a message while you charge!

Handy upright 15W wireless charging stand allows you to read incoming notifications at a glance without having to stop charging. Requires QC3.0 USB wall charger (such as our M8863, $20)

Bare Conductive Paint

Draw real circuits on almost any surface! Great for repairing tracks or experimenting with DIY circuits on different materials. Also available in 50ml jar (T 3133).

T 3066A

Electronic Cleaning Spray

A do-it-all cleaning spray for electronic parts and boards. A workbench must have! 175g.

T 3063

Famous DeoxIT® Spray

The gold standard in electronic servicing sprays. Deoxidises, cleans, preserves contacts & joins. 142g.

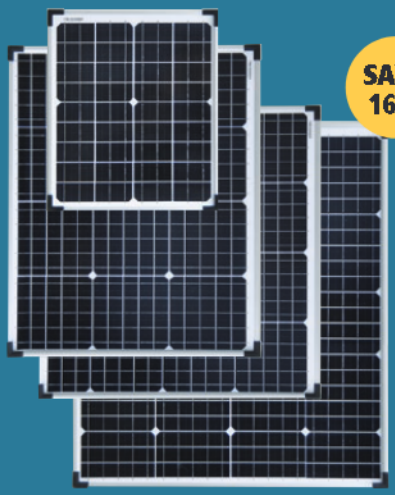
GREAT FOR:
- Motorbikes
- Caravans
- Boats
- Jet Skis & more!

SAVE $10 **$49** N 0704A 10W

SAVE $10 **$69** N 0706A 15W

Solar Battery Charger/Maintainers

These compact solar panels are designed for keeping your vehicle batteries topped up when parked. Easy croc clip or car accessory plug connection. Can even be permanently installed outdoors. 10W: 377L x 212W x 17D mm. 15W: 40L x 343W x 17Dmm.



SAVE 16%

$45 N 0020F 20W

$55 N 0040F 40W

$90 N 0065G 65W

$108 N 0080G 80W

Solar Panels for DIY remote & mobile power projects.

Sourced from one of the worlds leading solar manufacturers.
Aluminium frames, waterproof junctions,
tempered glass panels.
25 year output warranty.
5 year workmanship warranty.

SAVE $50 **$219** M 8197

Carry 240V Power Anywhere!

This air travel friendly portable power generator is fitted with 6Ah battery bank, 80W 240V mains inverter, 18W power delivery USB C charger & QC3.0 USB charger. Offers you cable free power for both AC and DC appliances! Recharge by USB or included power adaptor.

Power it up.

SAVE $46 **$99** M 8534A 6/12V 4.5A

SAVE $70 **$199** M 8536A 12V 10A

NEW: Now suits LiFePo4, lead acid & calcium type batteries!

Multi-Stage Vehicle Battery Chargers

Each model utilises a microprocessor to ensure your battery is maintained in tip-top condition whenever you need it. Helps to extend battery service life. Suitable for permanent connection. Great for caravans & seldom used vehicles. Weatherproof casing.

$42.95 Corner Mounts P 8073

Side Mounts P 8067 **$26.95**

ABS 'No Drill' Solar Panel Mounts

These tough surface mount brackets offer a way to mount solar panels without penetrating the roof of the caravan or boat. They can be attached using a silastic or similar adhesive.

Easy DIY install! Great for 4WDs

$49.95 N 2099A

Monitor your car battery from your phone!

Ensure your battery doesn't go flat with this handy Bluetooth® battery monitor. Provides live feedback on your vehicle or auxiliary battery, plus handy long term stats.

$45.95 N 2008 10A

$54.95 N 2009 20A

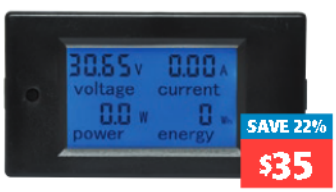
PWM Waterproof Solar Chargers

Compact sealed design. Easy to connect to 12V battery systems. IP68 rated. 10A for <120W panels, 20A for <240W panels. Size: 82Wx45Dx21Hmm

NEW! **$34.95** P 0696

USB C Power Delivery Charger

A combination QC 3.0 and 18W USB C power delivery charger for the car, 4WD or caravan. 29mm mounting hole.



SAVE 22% **$35** Q 0589

Easy Read DC Energy Meter

Simultaneous display of voltage, current, power and energy (Wh) readings. Ideal for DC battery monitoring and small solar systems. Requires 85x45mm cutout. 20A max.

$139 T 5098

Top mount connections, breaker & voltmeter.

Powerhouse® Portable Power Battery Box

Fits a standard 90-120Ah automotive battery for powering appliances at your camp site - a totally self contained power unit! Fitted with 2.4A USB charger, dual Anderson sockets, volt meter, car acc. socket & battery terminals.

NEW! **$8.95**

Trailer Plugs & Sockets

New range of flat and round connectors for hooking up your trailer.

P 8092 7 Pin Flat Plug
P 8093 7 Pin Flat Skt
P 8094 7 Pin Round Skt
P 8095 7 Pin Round Plug

P 7810 NEW! **$14.95**

Anderson Style Connector Panel

A handy connection point for 4WD & camper installation. 60Wx40Hx42Dmm.

NEW! **$36.95**

12V DC+USB Power Panel

Can be easily surface mounted to custom panels to provide power to your devices & portable appliances. 15A DC breaker. 50x130x70mm. P 0697

P 7824 SAVE 28% **$4ea**

XT60 DC Plugs
Male & female included. 60A rated.

P 7823 SAVE 26% **$5ea**

EC5 Style DC Power Plugs
60A rated 5mm battery plugs.

P 7828 SAVE 33% **$3ea**

Deans Style Plugs
Offset 2 pin DC power plugs. 60A rated.

High Current Twin Flex Figure 8 Cable
Rated up to 20A this handy 12AWG cable is ideal for automotive power cabling.

$40 per 10m W 4154

SAVE 25%

30A 10 Metre Handy Hook Up Reels
Popular 30A high current. Tinned for reduced corrosion.

W 2426 Red
W 2427 Black

SAVE 23% **$25.95**

Top maker parts.

Raspberry Pi Pico is here!

The new Pi Pico is a tiny, fast and versatile board using RP2040 - a brand new microcontroller!
Programmable in C and MicroPython this handy board can be used to integrate into any project of your own making!

Z 6421

$8.95

PiicoDev Expansion Board

Great for experimenting with Pico it breaks out all pins to sockets which can be used without soldering.

$7.95

Z 6419

Create Amazing LED Light Effects!

1.3m length of addressable RGB 5050 LED strip - this means you can program the colour of every individual LED using an Arduino/Raspberry Pi. 60 LEDs per m. WS2812B chip on board. 10mm width, adhesive backed. 5V, 3.6A/m (max).

Quartz DIY Clock Kits

A much requested item by our builders and makers, this handy clock kit comes with 3 different styles of hands to suit your DIY clock design. Requires 1xAA battery.

X 1010A: Suits 2-6mm panel.
X 1014A: Suits 16-21mm panel.

K 9642

Jumper Header Kit

Single row header connectors. Includes male & female pin headers, plus 2.54mm housings.

Z 0003

LED Assortment Pack

3mm and 5mm LEDs in green, red, blue, yellow and white. 300pcs.

DIY Tinkerers Kit For Arduino

Includes an Arduino UNO compatible board, proto-shield, LCD, LED module, 7 segment displays, breadboards, stepper motor, servo, IR remote, battery box and a variety of parts and sensors.

SAVE $36

$79

Z 6314

P 1018A 350pc P 1014A 140pc

Prototyping Wire Packs

Handy packs of pre cut and trimmed solid core wire for breadboarding your next design!

Z 6442

LN298 Dual Motor Module

designed to drive inductive loads, such as relays, solenoids, DC and stepping motors. 2 channels. 5V input.

Z 6432

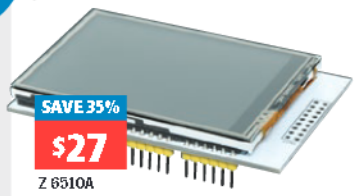
LoRa Arduino Shield

Allows long range communication with an Arduino without the need for a GSM 4G network - even over distances of up to several kilometres! 3.3/5V input.

Z 6315

165pc Sensor Parts Pack

Includes a huge selection of sensor boards, LEDs, pots, jumper wires, a breadboard, LCD screen and much more! A handy storage case keeps it neat when you're finished building. Includes links to projects and example code.



Z 6510A

2.8" Touch Arduino Shield

A 240x320px touchscreen shield for Arduino utilising the ILI9341 chipset. 3.3/5V input.

W 2431 Stranded.
W 2430 Solid Core.

Hobby Wire Packs

6 colour hobby pack for project building. 10m of each colour.

Z 6426

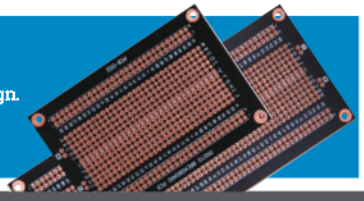
CAN-BUS Arduino Shield

Allows you to interface Arduino's with CAN-BUS control systems found in automotive electronics. Use an Arduino to build your own vehicle monitors.

20% OFF Prototyping PCBs

Allows you to keep the same PCB layout as your breadboard design. Soldermasked for easy soldering.

H 0701 94x64mm **$6.40 ea** **H 0703** 164x64mm **$9 ea**



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B 0092

SERVICEMAN'S LOG

Trying to fix unbranded, generic equipment


Dave Thompson

The first step in sourcing spare parts for a faulty piece of equipment is to take the manufacturer and model details and do some searching to find out if the manufacturer or a third party has spare parts available. But what do you do when there is no apparent manufacturer or model number? Go on a wild goose chase, it seems...

Sometimes a job comes through the workshop that is a bit out of left-field. I'll take a look at anything; if nothing else, it's all experience. Recently, I received a call about an electric scooter that had failed. This was one of these 'friend of a client' type deals, and I, for one, appreciate such referrals. In business, getting work this way sure beats paying for expensive advertising.

This 'scooter' was a cheap import. While this doesn't necessarily indicate that it will be a tricky job, I've been down this path too many times before to assume it will be an easy repair. According to the customer, in the 18 months they've owned it, the thing has spent more time off the road than on it.

The tyres were the first problem, with the rear tyre blowing early on. It was apparently paper-thin and not fit for our rough roads. A replacement tyre took many months to source, and had to come from Europe. Not an auspicious start! Then it simply stopped working.

The owner brought the scooter into my workshop, and after the usual discussions about terms and conditions and possible outcomes, I dug into it.

This isn't one of those thin-line electric scooters you see hipsters riding all over town on. This model is about the size of those mini-bikes Honda used to make back in the 70s, before the powers-that-be decided they were too dangerous for the average citizen.

Items Covered This Month

- Fixing generic equipment is frustrating
- Arlec battery charger repair
- Fixing a 50in Panasonic TV backlight
- Failing capacitor in clothes iron
- Mazda 3 aircon repair

**Dave Thompson runs PC Anytime in Christchurch, NZ.*

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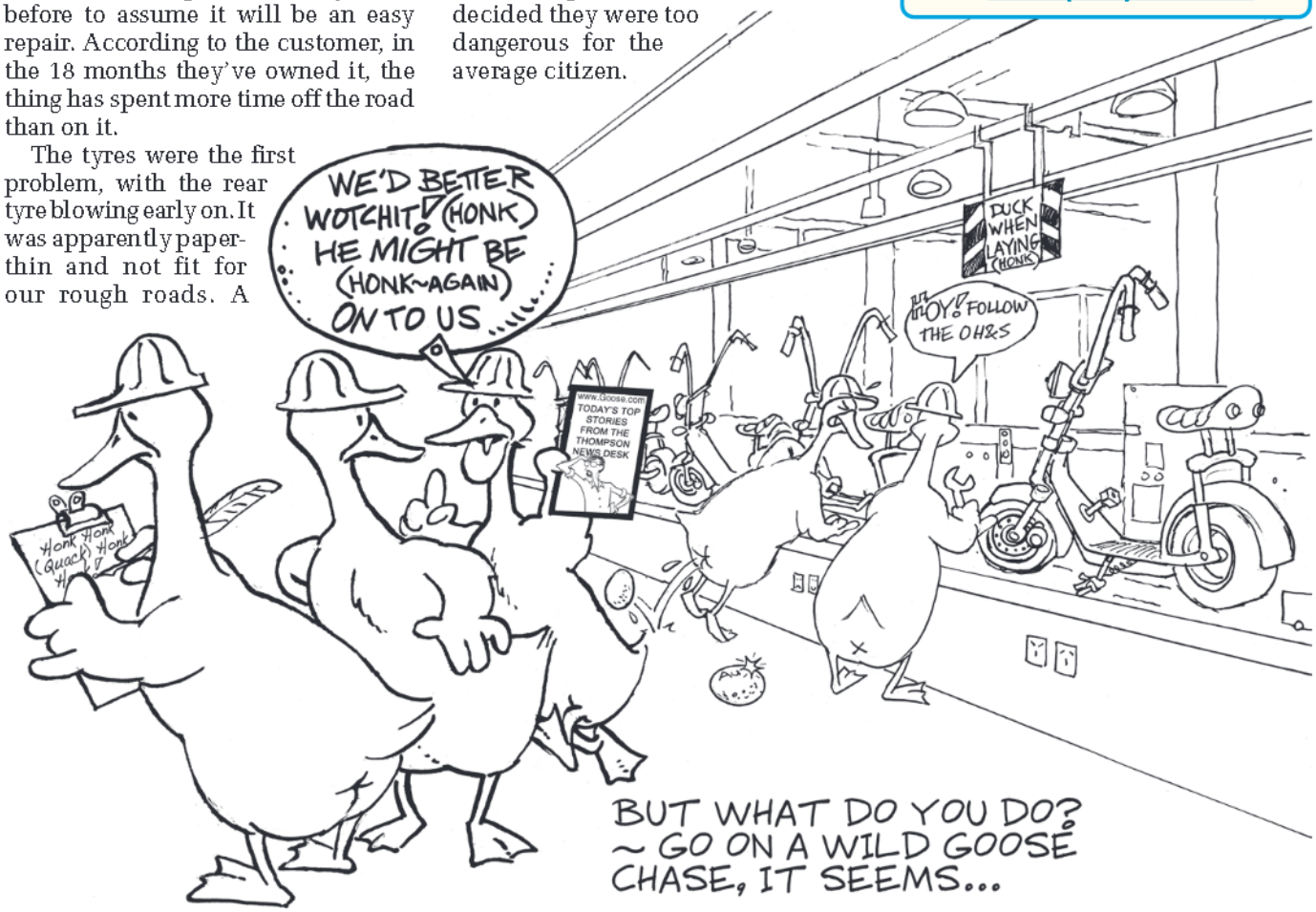

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05/21

VINTAGE RADIO

1940 RME model 69 communications receiver

By Fred Lever

This communications receiver was designed in the mid-1930s. It appears to have been updated by the manufacturer to keep up with competing products. It's a hefty bit of kit, packed with parts, with many functions and some interesting quirks. One of these is a complete lack of labels for the front panel controls! A matching tuned 'pre-selector' unit was eventually acquired; it too required repair and restoration.

I was asked if I would like "an old radio" as the owner, a senior gent, wanted it to go to a good home. I am up for just about anything, so I said yes without even laying eyes on it. When I finally got my hands on the set, I could not get it home fast enough!

It was heavy (15kg), in a steel box with a lift-up lid. The front panel had two big dials and a bunch of knobs, but there were no markings to indicate which knob did what. The only text was on a rear nameplate, advising that this was a Model 69, serial A98 made by Radio Manufacturing Engineers in Peoria, Illinois, USA.

RME radio

Thus I was introduced to RME and a type of receiver I have never had any interest in before, a wideband commercial radio receiver with a pedigree and high performance, at least for 1940. I searched the web and found many references to the model and a history of the company, including model numbers and employees.

At a later stage, I was delighted to receive the matching DB-20 pre-selector unit. I believe these two items were rack-mounted in a complete 'ham' setup, and are the only surviving pieces of what would have been a comprehensive transmit/receive installation.

The pre-selector also came with a treasure trove of books, notes and personal papers belonging to the owner. These items I have simply stored and not investigated at this time.

The 'restored' RME-69 receiver; sadly, the front dials are still cracked.

I downloaded a comprehensive operating manual from a website called "Boat Anchor". This helped me to recognise what I had and figure out what was original.

The handbook describes serial number A98 as a late production unit with a "Lamb Silencer" in the front end. The octal valve types and the history of the company mean that it was manufactured around 1940. The original production radios had 6-pin valves and no Silencer.

My first move was to survey every part of the set and take photos. While parts of it were undisturbed, other parts had been replaced or looked like they had been modified. After some investigation, I elected not to try to refurbish the set but just make it safe to turn on and work in some fashion on the AM 500-1800kHz band only.

I achieved that by replacing obviously faulty parts and removing some strange modifications. I then carried out what I confess to being a cosmetic 'tart up' on the set and the matching pre-selector, by cleaning them and misting with a light coat of gloss black, over the faded wrinkle finish. The insides and chassis were cleaned, masked off and a light coat of silver misted over the rust and patina.

The accompanying photos show the dusty old thing as I received it, then in its cleaned-up state, as well as a view of the underside of the chassis post-cleaning.

Not having any markings on the panel controls intrigued me. It seems that RME never marked their model 69

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Advertising Index

Notes & Errata

Programmable Hybrid Lab Supply with WiFi, May 2021: in the parts list on page 36, the item at the top of the right-hand column should have read VXO7805-500 (5V) rather than VXO7803-500 (3V). The circuit should still work even with the 3V part fitted. Also, the MCP4725 DAC specified comes in several versions; MCP4725A0T-E/CH is the required part.

Arduino-based Power Supply, February 2021: the 51kΩ resistor's five-band colour code is incorrect. It should read "green brown black red brown".

DIY Reflow Oven Controller, April & May 2020: in the May 2020 issue on page 90, Fig.11 shows the 20-wire ribbon cable between the control board and LCD screen connected incorrectly. It is shown correctly in the photo at the top of p89, with the red stripe going to pin 1 on both boards.

Deluxe Touchscreen eFuse, July 2017: The HEX file we have been providing has not had the AUTORUN flag set, meaning eFuses built with a preprogrammed chip or using the HEX file from the Silicon Chip website will not work without being run manually from MMBasic. We've updated the HEX and MMBasic files to fix this and also to fix a bug that may cause the Micromite to crash and reset if the screen timeout was set to certain values.

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EDBD-13 Drill Sharpener

- 3-13mm or 1/8"-1/2"
- CBN grinding wheel
- Split point
- 80W, 240V motor

Order Code: D070
$99

MGP-6R - Ratcheting Gear Puller Set

- Hatchet action jaw lock alignment
- Combination 2 or 3 jaw type system
- Reversible jaws (Internal or External)
- Includes 3 x 100mm & 3 x 175mm legs, a blow mould case

MADE IN TAIWAN

Order Code: P005
$132

RNB40 - Nut & Blind Riveter Set

- 130 piece kit suitable for sheet aluminium or steel

Includes:

- Aluminium rivet nut inserts: M5, M6, M8, M10 - (10 of each size)
- Aluminium blind rivets: Ø3.2, Ø4.0, Ø4.8, Ø6.4mm (20 of each size)
- Mandrel spanner & blow mould case

Order Code: N001
$121

FREE WORK LIGHT WITH PURCHASE

Max output: 360 lumens

VALUE $19.80

(Order Code: T950)

*1 free LED work light per customer. Offer only valid with these advertised items. Valid until 28-06-21

TCS-3 - Mobile Tool Storage Cabinet Seat

- 406mm seat height
- 3 x drawers with ball bearing slides
- 420 x 235mm padded seat
- 2 x magnetic side trays
- 360° swivel wheels

Order Code: A001
$121

VJ-680 - Hydraulic Vehicle Positioning Jacks

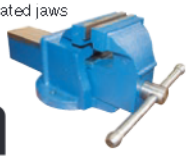
- 680kg hydraulic lift per jack
- 270mm max. tyre width
- 620mm max opening
- Sold in pairs

360° SWIVEL WHEELS

Order Code: A332
$352

No. 5 Cast Iron Bench Vice

- 127mm jaw width
- 150mm max. opening
- Fitted width serrated jaws



Order Code: V089
$132

TBRS-25 Manual Tube Bender

- Includes 8 formers
- 19.05 & 25.4mm square
- Ø9.52, Ø12.7, Ø14.29, Ø15.87, Ø19.05, Ø22.22mm round

Order Code: T055
$352

SHST-1.2H Shrinker & Stretcher

- 1.2mm mild steel
- 254mm throat depth
- Shrinking dies
- Stretching dies

BENCH MOUNT

METALMASTER
Order Code: S2262
$308

SJ-24D - Bead Roller

- 1.2mm mild steel capacity
- 460mm throat depth
- Strengthened frame & stand
- Holler holders on post
- 7 x sets of rolls

OPTIONAL ACCESSORIES ALSO AVAILABLE ONLINE

METALMASTER
Order Code: S641
$495

Metric Alloy Steel Tap & Die Set - 45 Piece

- 45 piece set
- Metric fine & coarse set
- M6 ~ M24 alloy steel
- Includes die holder & 2 x tap wrenches

Order Code: T014
$198

LT-227 - Hydraulic Lifter Trolley

- 227kg load capacity
- 708 x 450mm table
- 225-710mm table height
- 2 fixed & 2 swivel wheels with brakes
- Includes table rubber mat

Order Code: J049
$352

TiGer 2000S - Wetstone Grinder

- German design & technology
- 200mm stone & 225mm hone wheel
- 120rpm grinding stone speed
- 120W, 240V motor
- Includes straight edge jig, setting gauge & honing paste

scheppach
Order Code: W859
$220

SRG-12 - Manual Sheet Metal Curving Rolls-Bench Mount

- 305 x 1mm capacity
- Bench or vice mountable
- Swivel top roller
- Gear driven rollers

Order Code: S267
$242

PB-24 - Manual Panbrake

- 600 x 1mm capacity
- Fabricated steel
- Adjustable clamp blade
- Multiple finger widths

Order Code: S249
$396

WBS-3D Steel Work Bench

- 2000 x 640 x 870mm
- 500kg load capacity
- Bearing slide drawers
- 3 x lockable drawers

OTHER TYPES AVAILABLE

Order Code: A380
$495

VIPER™ ARC 140 - DC TIG & MMA (ARC) Inverter Welder

- 20 ~ 140 Amps
- Thermal overload protection
- Includes 2.5m arc leads
- 15% @ 140A duty cycle
- 240V / 10 amp

UNIMIG
Order Code: W165
$242

X8 Industrial Bench Grinder

- Ø200mm wheels
- Fine/coarse grit
- 1hp, 240V motor

EXTRA MACHINERY
Order Code: G159
$236.50

AA362W8 - Industrial Bench Grinder with Linisher

- Ø200mm x 60 grit wheel
- 50 x 915mm linishing attachment
- Fast belt change design
- Easy belt tracking adjustment
- 0.8hp, 240V motor

NEW RELEASE

Abbott & Ashby
Order Code: G152
$495

5 YEAR WARRANTY

UNIQUE PROMO CODE

SC0621

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