SILICON CHIP

FEBRUARY 2021
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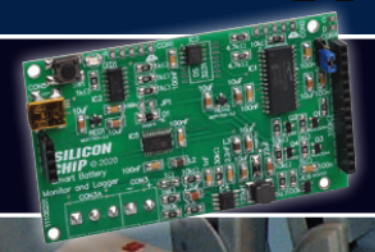
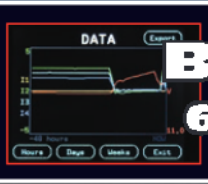
The VERY BEST DIY Projects!

RADIO TIME SIGNALS
keeping tracking of time without GPS or the internet

Making Android Apps using App Inventor

How to Upgrade your Computer





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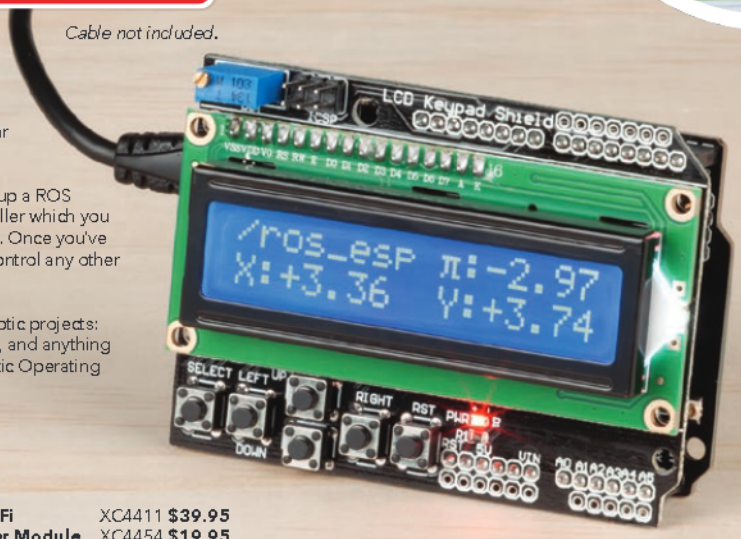

Do you build robots and need a neat and easy way to control them? Perhaps you've heard of the Robotic Operating System (ROS) but don't know where to begin to create your own? Then have a look at our new project utilising our popular UNO with Wi-Fi board and LCD controller.

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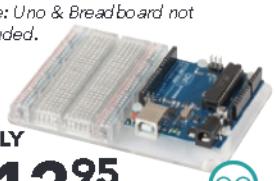

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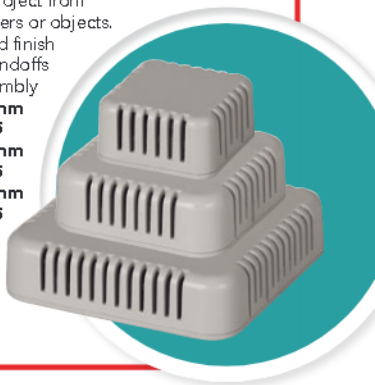

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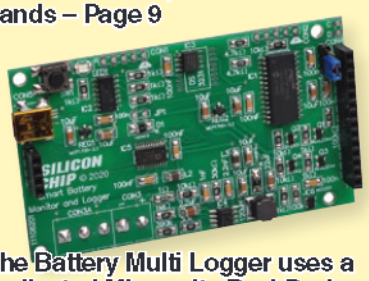

The Battery Multi Logger uses a dedicated Micromite BackPack, and can monitor a battery from 6-100V at up to 10A, or much more (100A+) with an external shunt – Page 28

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Editorial Viewpoint

New computer technology

We haven't published articles on personal computers in quite some time. The last one that I can find, in May 2012, is on optimising ADSL internet connections. There was also an article on the Linux operating system in July 2011 and a Macbook review in March 2010.

Partly that's because SILICON CHIP isn't a computer magazine, but of course, computers are made from silicon chips. The most advanced, powerful and flexible chips ever made are computer processors of various types. They contain billions of transistors and result from countless hours of engineering and testing, plus extremely impressive manufacturing techniques.

One reason we've published so few computer articles of late is that computer technology has been somewhat stagnant over the last decade. There have been plenty of improvements in that time, but they've mostly been incremental. I think that's starting to change now, so I plan to give computers some coverage, If you aren't into computers, don't worry, we'll still have plenty of DIY and other articles. We'll just be occasionally adding a computer-themed article into the mix.

As evidence of the recent advances in computing technology, three major product series launches at the end of last year saw stocks of these new products almost immediately exhausted as production could not keep up with demand. Those were AMD's Ryzen 5000 CPUs and Radeon 6000 series GPUs (graphics cards), and Nvidia's RTX 3000 series GPUs.

Apple also just released a line of Macs using their own ARM-based processors (the Apple Silicon M1) which have incredible levels of power efficiency and some other impressive features.

The lack of availability was partly due to these new devices being so much more capable than the previously available equivalents, at similar prices (if you can find one). There were also supply problems due to COVID-19 (and many people being forced to stay at home also increased demand).

It's mind-boggling to realise that for a couple of thousand dollars, you can put together a computer that can perform over 30 **trillion** (3×10^{13}) calculations per second!

Solid-state data storage has also come a long way in the last year or two, with incredible speeds (more than four gigabytes per second for consumer-level parts!), very high capacities and relatively low costs.

So, we will likely have a handful of computer how-to articles this year. The first, in this issue, shows how to upgrade a PC to the latest AMD Ryzen 5000 series of CPUs (it is also mostly applicable to Intel CPU-based systems). We'll also have some in-depth stories on the technology behind the incredible power of modern computers.

The articles we have planned will describe some fascinating technology that I think many of our readers will not have heard of, or if they have, won't know a lot about.

To throw another almost unbelievable number out there, it is now possible to build a computer with over ten thousand computing units, each capable of executing instructions and performing calculations. We plan to do that and describe some of the challenges involved.

By the way, SILICON CHIP used to run quite a few computer columns in the early days, including one called "Computer Bits" from July 1989 to December 1998. We also had all sorts of other articles on topics like setting up a network, upgrading computer CPUs, computer reviews etc.

Of course, PCs were not as mainstream back then and required a lot more DIY. So I don't plan to go back to that sort of content. But the odd article on computer technology and some interesting computers you can build or modify yourself should be part of the mix of a magazine named after the very technology behind them.

Nicholas Vinen

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Radio time signals throughout the world

Wouldn't it be great if all your watches and clocks would adjust themselves automatically to the current time and also adjust themselves for daylight saving? There is a simple way to do this in many countries – and possibly even in Australia. It doesn't require internet access or even a GPS receiver!

Many people today use a phone, or a smartwatch linked to their phone, to tell the time. The time on most phones is very accurate, being derived from atomic clocks and associated time servers which is then broadcast over the mobile network.

But some people still use a conventional watch or a clock to tell the time. Most digital watches are very accurate, only gaining or losing around 15-30 seconds per month, but they still have to be set manually. That is difficult to do precisely.

Some clocks connect to WiFi networks and are synchronised to atomic clocks via time servers, and we have published several such designs in the past. Others synchronise to GNSS satellites such as GPS, which carry atomic clocks; again, we have published quite a few projects which do that.

But some watches and clocks synchronise their time with atomic clocks via radio signals, and that is the subject of this article.

Timekeeping devices can receive radio signals through several methods. One is dedicated LF (low-frequency, 30-300kHz) signals from dedicated transmitters, which are operated in Europe, the United States, Japan and China.

Another method is by dedicated signals transmitted on the shortwave band, with transmitters broadcasting on a variety of frequencies from 2.5MHz to 25MHz. These dedicated LF and SW time signals contain the time, date, leap second and other information encoded in digital form.

Some stations such as DFC77 also encode weather or other information.

Many of these time signals can also be used as basic frequency standards.

You can hear audio samples of a variety of LF and SW time signals at www.sigidwiki.com/wiki/Category:Time

Many normal AM (medium-wave) broadcast band stations also broadcast hourly "pips" at 1kHz, usually on the hour. These pips were first introduced by the BBC in 1924, and they were originally synchronised to Greenwich Mean Time (which varies slightly due to wobbles in the Earth) but since 1971 have been synchronised to International Atomic Time (which is more consistent).

For those interested in those signals, there is additional information at www.miketodd.net/other/gts.htm

No commercial receivers appear to take advantage of these pips, which

by Dr David Maddison

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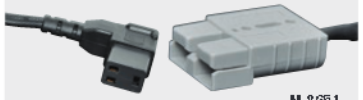

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Great for automotive wiring - requires no special crimpers to terminate! Use a standard automotive crimper, pliers or solder terminate. 14A rated.

$139
T 5088

Fitted with secure lid clips unlike most others on the market!

Powerhouse® Portable Power Battery Box

Fits a standard automotive battery up to 200AH 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.

Table Lamp With Wireless Charger

A stylish glossy white table lamp with adjustable dimming, colour temperature & wireless charging. Great for the desk or bedside table. Powered by any USB wall charger - 2A minimum (M 8862A $13.95).

NEW!
$39.95
X 4221

A great bedside or study lamp

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.

SAVE 20%
$63
D 0511B

Jumbo QC3.0/USB C Power Bank

Offering both the latest QuickCharge 3.0 charging and 18W USB-C PD output, this enormous 20,000mAh power bank will keep your devices charged away from mains power. 136x70x25mm

NEW!
$79.95
N 2019A

Lithium/Lead Acid Solar Charge Controller

Suitable for 12/24V systems with either lead acid or lithium chemistry batteries. Supports Li-NiCoMn & LiFePO4. 30A max charge current.

Portable Battery Bank Jump Starter

An all round portable charging device - plus vehicle jump starter!

Not just for car battery emergencies, this high capacity battery bank also wirelessly charges your phone, powers laptops and other devices. Jumpstarts most 4-6 cylinder vehicles.

NEW!
$249
M 8193

Keeps devices charged with wireless & USB charging!

NEW!
$34.95
N 2005

5A Waterproof Charge Controller

Provides a max charge current up to 5A (suits solar panels up to 60W). The entire PCB assembly is housed in an epoxy filled housing. 80Wx37Dx22Hmm. IP67.

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These panels can be easily surface mounted to custom panels to provide power to your devices & portable appliances. Both have 15A DC breaker.
P 0697: 50x130x70mm.
P 0698: 50x187x70mm.

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P 0697 Car Acc + USB $36.95

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Recharges 10xAA/AAA or 2x9V batteries. Includes mains power supply & car adapter. Suits NiMH only.

Top deal!

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$44
M 8881

Charge 8 USB devices at once.

Got a family full of devices? This handy charger outputs up to 12A or charging current to keep all your tablets and phones juiced up! Includes power cord.

M 8863

SAVE 32%
$20

Home QC3.0 Wall Charger

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

Build your electronics workbench.

T 1461

Ultimate Flexible Helping Hands

Upgrade to the ultimate in soldering helper hands. Includes magnifier to assist with those fiddly jobs. Arm length ≈30cm.

T 2168A

69pc Dual Ratchet Driver Kit

Superb quality ratchet driver with a wide selection of bits for most electronic jobs. Includes both a 1/4" adjustable angle (<90°) ratchet handle and a smaller 4mm ratchet handle. Great for the home handyman or enthusiast.

Bargain 40W Soldering Station

The perfect balance of value for money and features for beginners or cash strapped students and enthusiasts. Slim, lightweight non-slip handle with tip cleaning sponge and iron safety holder. Full range of spare tips also available.

19 Range DMM

With in-built AC mains detection. Featuring true RMS measurement, transistor and diode testing and backlit display. A great general electronics multimeter.

Q 1126A

Handy Auto Ranging DMM

Simplicity & functionality in one compact test device. 10A DC current. 1Hz-30MHz counter. Includes test leads & temp probe. Great for students! **Q 1133A**

Space Saver Multimeter

Not much bigger than your average mobile phone (16mm thickness), this auto ranging meter saves space in your tool box. Easy to use with volts, current, amps and resistance. **Q 1064**

Feature Packed 28 Range DMM

Includes temperature probe at no extra cost! Excellent for service technicians or enthusiasts. Easy to use with an on screen guide for test lead connection. Massive 20A rating AC/DC to 1000V. **Q 1067**

800A AC & DC Clamp Meter

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Do-It-All Multimeter

With in-built AC mains detection. This is one of the best DMMs we have evaluated when it comes to build quality and features. Its perfect for the serious enthusiast or tradesperson

- LCD bargraph
- 3.75 digit display
- Mode assistance indicators.
- Includes case, temp probe & insulated test leads. **Q 1068**

T 2367

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$45

Multi-Angle Bench Vice

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T 1289

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Provides 300W of hot air for quick and easy desolder and re-work of surface mount boards. 200-500°C adjustable. Includes desk stand - plus narrow, medium and wide nozzles for different tasks.

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T 2164

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$26

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T 2486

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$33

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Heavy weight base with solder guide. All metal construction.

T 1302A

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T 4018

Magnetic Bowl

A handy 4" stainless steel bowl with magnetic base to keep screws from straying while you work

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A handy plastic tool set for prying open adhesive surfaces on phones, laptops etc.

T 1498

Audio Visual Savers.

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D 2038

Portable Summer Tunes
Dynalink® BT5.0 Can Speaker

The outdoor entertainer! Pump up the tunes around the BBQ or pool this summer with this nifty little speaker offering 3-4 hours listening time with great audio quality thanks to Bluetooth 5.0. Pairs to a second unit using True Wireless Stereo for even more sound! Water resistant design (IP65 rated) Includes charging cable.

Dynalink® F2 Pro Gaming Headset

Multi-platform ready! Suits PC, Playstation, Xbox and Switch with included TRRS adaptor. Offers excellent comfort for long gaming sessions with RGB lighting effects (when USB is plugged in). 2m cable.

SAVE 27% $50

C 9042

SAVE $20 $39

A 1112

Experience wireless sound while you game.

Also works with laptops!

This tiny USB type C adaptor provides wireless audio streaming for two pairs of headphones for two player gaming on Switch, PS4 or watching media on PC & Mac. *Accessories for illustration purposes.

D 0980

SAVE $30 $119

Pro condenser mic - clear, crisp sound

USB Podcast Microphone

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

SAVE 35% $20

P 6815A

SAVE 22% $65/m

W 2140

Don't forget the cabling!

Full 50m cable rolls only. Wallplate features easy back to back connectors.

Includes easy to mount ball joint bracket

C 5285

SAVE $40 $99

Premium sound in a tiny package.

Redback® 2.75" Mini Satellite Speakers. Deliver full and rich sound you'd hardly believe these speakers are only 10cm tall! They're the perfect home and small commercial sound solution. Ideally paired with a Bluetooth amplifier (such as A4201). 8Ω 10W rated.

A 4201

SAVE $50 $199

Bluetooth® 2x50W Amplifier

Stream audio directly from your device to your speakers in the study or entertaining area. 3.5mm and RCA inputs. Class D design. Internal headphone amplifier. Includes power supply, banana speaker plugs & 3.5mm to RCA cable.

SAVE $50 $135

A 1116

Add Bluetooth® audio to your favourite speakers!

Why buy new bluetooth speakers when you can add this module to existing speakers? Streams music direct from your phone! 2 x 25W RMS output. Bluetooth 4.1. Includes power supply.

Great for caravans!

SAVE 24% $45

A 2809A

12V/240V HD Set Top Box

This mini digital TV receiver features HDMI output for connection to any monitor. Runs off a 12V power source making it perfect for use in caravans etc. USB recording & playback. Includes plugpack, car adaptor & IR remote.

With stylish RGB light!

SAVE 24% $30

X 0604B

Bluetooth FM Audio Player

Transmits bluetooth audio from your phone (music, routes phone calls etc) to your cars FM radio. **Plus it's also a QC3.0 & USB C charger.**

Broken remote? No problem!

Dog ate your remote? Enthusiastic toddler binged too hard on Paw Patrol? This handy replacement features IR learning plus pre-programmed codes for 100's of popular equipment brands.

SAVE 20% $27

A 1012A

3.5mm Lapel Mic

Ideal for audio recording on smartphones, laptops, vlogging cameras. 3.5mm TRRS or TRS connection. 2m lead. Condenser type.

D 0982

$29.95

Electret Lapel Mic

Need to record high quality audio for YouTube or live demos? This 6m electret mic offers excellent audio clarity and 3.5mm TRRS or 6.35mm TS connections.

$49.95

D 0984

A 3134E

SAVE $16 $76

2 Way HDMI Splitter

4K@60Hz compatible splitter allowing a single HDMI source to be connected to two displays without signal loss. Includes power supply.

SAVE 20% $59

A 3039

5 Way HDMI Switcher

A handy switcher for up to 5 HDMI sources to a 4k/2k or HD display. Includes plugpack.

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B 0091

FOLLOW-UP

BY DR SANKIT RAMKRISHNA KASSA,
SNDT WOMEN'S UNIVERSITY, MUMBAI, INDIA

Quantum-Dot Cellular Automata

We introduced QCA technology in the August 2019 issue (siliconchip.com.au/Article/11774) as a possible future alternative to CMOS digital logic. It could possibly operate much faster than traditional logic and at a much smaller scale, but has not yet been made to work in commercial processes. This article investigates a more energy-efficient approach to QCA than the traditional 3-input majority gate structure.

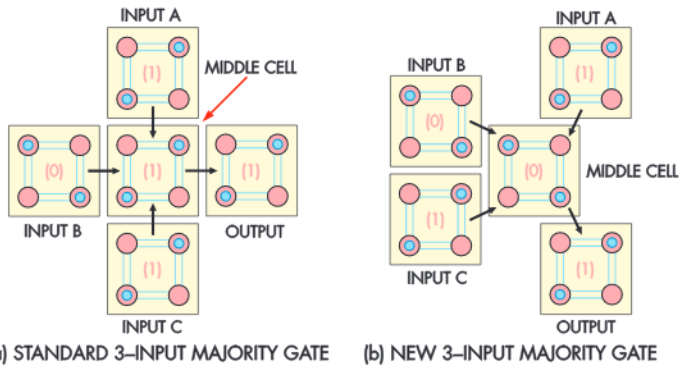
As described in the previous article, Quantum-dot Cellular Automata (QCA) is an emerging nanotechnology-based approach for designing and implementing electronic circuits. The aim is to beat the well-developed Complementary Metal Oxide Semiconductor (CMOS) technology.

QCA has the possibility of running at exceptionally fast speeds (in the terahertz range – 1000GHz plus!), at smaller sizes and with extremely low power consumption (in the picowatts).

The two basic gates used in QCA logic are the inverter and the 3-input majority gate. Any digital circuit can be designed using these two gates. The majority voting function can be written in Boolean logic as M(A,B,C) = AB + BC + AC.

This article describes a new style of 3-input majority gate (MG) structure, which is analysed with the help of mathematical modelling. Fig.1(a) shows the standard 3-input majority gate, while Fig.1(b) shows the proposed new structure. Fig.1(c) is the truth table for both gates (they are logically equivalent).

The main advantage of the new structure is that it gives the designer the flexibility to move all of the cells utilised by a certain amount.



A	0	1	0	1	0	1	0	1
B	0	0	1	1	0	0	1	1
C	0	0	0	0	1	1	1	1
MIDDLE CELL	1	1	1	0	1	0	0	0
OUTPUT	0	0	0	1	0	1	1	1

(c) TRUTH TABLE

Fig.1: a comparison of the 'standard' QCA 3-input majority gate (a), the novel one described here (b), along with its truth table (c).

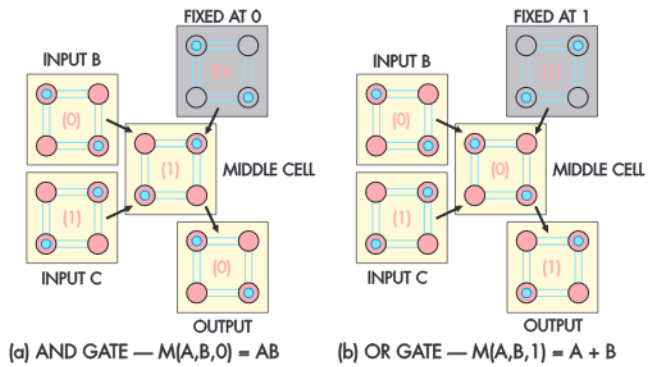


Fig.2: here's how a two-input AND gate (a) or OR gate (b) can be formed from a single 3-input majority gate. Note that the fixed input (zero or one, shown in grey) can be any of the three. It's up to the logic designer, and depends on the best routing for the other signals. Also note that the whole thing can be rotated or flipped to suit the design.

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Off grid? On grid with battery backup? How do you monitor the state of your batteries?

BATTERY MULTI LOGGER

By TIM BLYTHMAN

Knowing the condition of your batteries is essential for keeping them healthy long-term. A system that can monitor and log vital battery statistics is a great aid, and can help you to avoid having to shell out for expensive replacements. It can also be used for troubleshooting, such as when you don't know which device is responsible for periodically discharging a battery.

Solar and wind power is growing in use and getting cheaper, so there is a need to maintain batteries associated with such systems. You might also have a large battery in a shed, caravan, boat or another vehicle that you need to monitor. Backup batteries for mains power failures are another case where you might need a battery monitor or logger.

Our new Battery Monitor Logger is versatile and capable, being able to handle a charger and two separate loads out-of-the-box. It is based on a Micromite LCD BackPack, so can be reprogrammed in MMBasic, Micromite's variant of the BASIC language. But as we have written software with many useful features, you don't need to do any programming.

We last published a Battery Capacity Meter in June & July 2009 (www.siliconchip.com.au/Series/44).

It featured a PIC microcontroller capable of monitoring a battery's voltage and current via an external current measuring shunt. It could log data as well as calculate such things as battery capacity and estimated battery run time.

New features

The 2009 Battery Capacity Meter used a single shunt so it could only monitor the overall current moving into or out of the attached battery.

Our new design supports up to three shunts, so it can monitor three separate current paths, helping you to split out the charging or discharging figures across multiple loads and/or generators.

It even includes a fourth internal shunt for monitoring its own power usage.

For example, you might have a solar panel array and a wind generator (or several) and want to keep track of the energy they generate separately.

Or you might have several loads like a fridge, lights and a kettle and want to see which one is consuming the most energy.

The old design was also limited to around 60V at its input (compared to 100V for this one) and could also store a minimal amount of data in the PIC. The PIC32 we have used in this design has much more storage space, so it can record more data for longer.

The battery voltage and currents are sampled at 10-second intervals. That data is averaged every hour to give up to two days of hourly samples. The hourly samples are also averaged over each day to give about a fortnight of daily values.

The flow of both charge and energy is logged, to provide capacity values in Ah (amp-hours) and Wh (watt-hours). You specify the full and empty voltages of your battery, plus the battery capacity, so that the unit can self-calibrate when the battery is either fully charged or discharged.

A simple, linear voltage state-of-charge value is also calculated, giving a rough indication of battery state when the more accurate information is not available.

Operating concept

Fig.1(a) shows the simplest way to use the Battery Monitor Logger. The battery connects to a two-way screw terminal (CON3) while the positive ends of up to three loads or charging sources connect to the contacts of three-way screw terminal CON3a.

The negative ends of those loads/charging sources connect directly to the battery negative (ground).

This allows the Battery Monitor Logger to independently measure and display the current flowing to or from each load or charging source.

It also produces a total current in/out figure and uses this to keep track of the battery's state-of-charge in amp-hours (Ah). Multiplying this by the battery's current voltage gives a nominal watt-hours (Wh) figure for the current state of charge.

If you have more than three external devices to connect, they can share terminals on CON3a, as shown in Fig.1(b). For example, one terminal is shared by two loads (LOAD1 & LOAD2). The measurement on that channel will be the total load current for these two devices. Another terminal is shared by two charging sources (SOLAR & WIND), and likewise, their currents will be summed.

The third terminal is shared by LOAD3 and a mains charger. In this case, the unit will measure the net current flow in/out – ie, it will see a flow into the battery if the charger current exceeds the current drawn by LOAD3, a flow out if the situation is reversed, and will measure zero if the two currents are equal (ie, the LOAD3 current is supplied by the charger).

If you need to monitor currents over 10A, you can use the same arrangement except with external shunts.

These will typically have a lower resistance and also can handle higher dissipation, both factors allowing greater currents to flow safely. For example, you can get 100A shunts quite easily, or even 500A shunts.

Circuit design

The circuit of the Battery Monitor Logger is shown in Fig.2. It has been designed as a complete Micromite-compatible board, rather than an add-on board for a Micromite LCD BackPack.

This allows us to control its power usage better, reducing the current drawn from the battery.

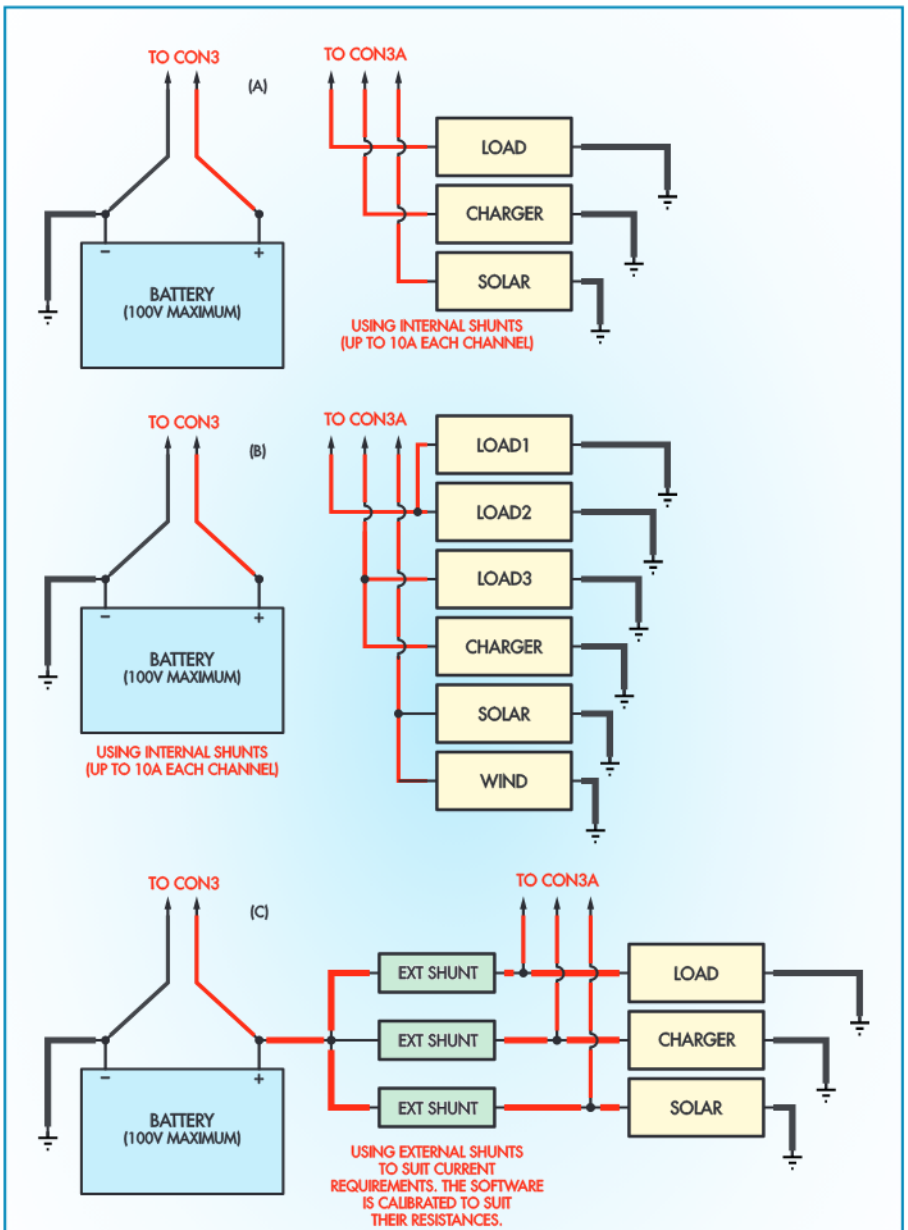

Fig.1: three examples of how you could use the Battery Logger/Monitor. The simplest configuration, at top, uses its internal shunts to monitor the currents (up to 10A) into or out of three loads/charging sources. Or as shown in (B), you can connect more than three loads/charging sources, with some of them sharing shunts. For higher-current applications (up to hundreds of amps), external shunts can be used, as in (C).

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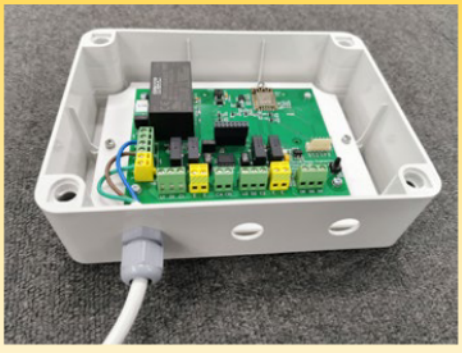

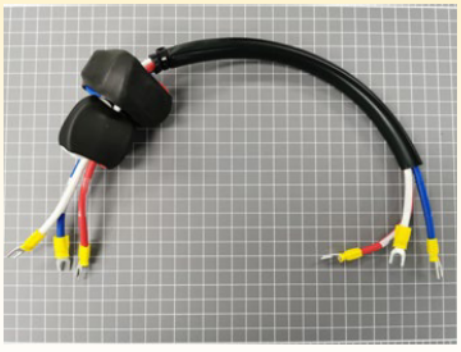

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ARDUINO

0-14V, 0-1A Output – controlled from your PC!

Arduino-based Adjustable Power Supply

By Tim Blythman

We have published all sorts of fancy bench supplies over the years: linear, switchmode, hybrid, high-voltage, high-current, dual-tracking... But sometimes, all you need is a basic power supply with voltage and current monitoring and limiting; something that's convenient and easy to set up and use. That's exactly what this is – a very useful little power supply built on an Arduino shield!

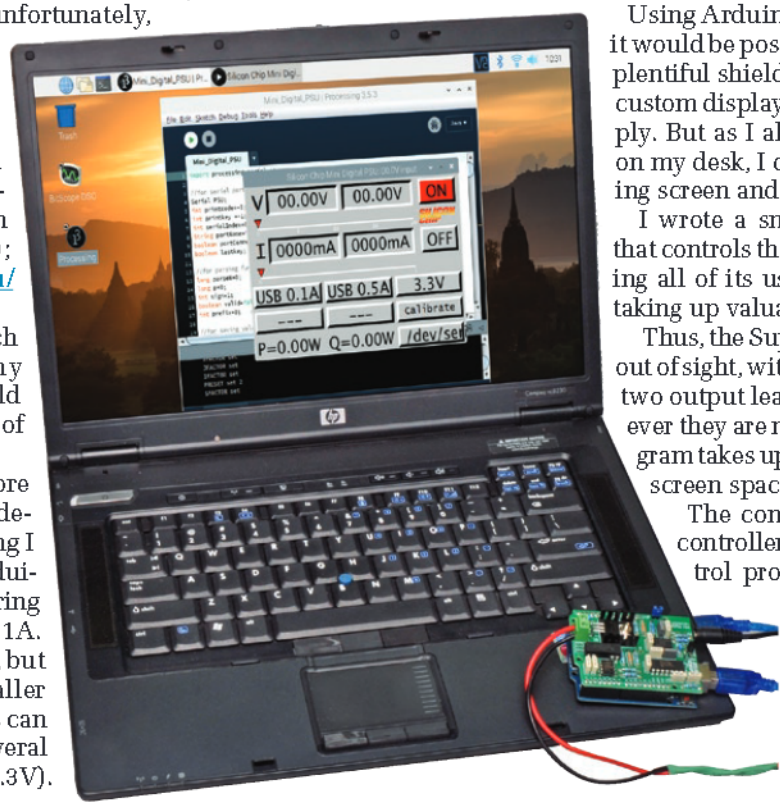
Lately, like many others, I have mostly been working from home. But unfortunately, my home workshop is not equipped to the same degree as the SILICON CHIP office/lab.

I could bring my 45V 8A Linear Bench Supply prototype home (published in October-December 2019; see siliconchip.com.au/Series/339).

It would do pretty much everything I need, but my space is limited, and it would be a rare event to make use of its full capabilities.

So I need something more compact but still useful. I decided to base it on something I already had at home, an Arduino Uno. It's capable of delivering up to 14V at a maximum of 1A.

That is modest, to be sure, but handy enough for most smaller projects. And multiple units can be combined if you need several different voltages (eg, 5V & 3.3V).



Arduino considerations

Using Arduino hardware means that it would be possible to add one of many plentiful shields and modules to add a custom display or controls for the Supply. But as I already have a computer on my desk, I decided to use the existing screen and keyboard to control it.

I wrote a small computer program that controls the Power Supply, providing all of its useful functions without taking up valuable bench space.

Thus, the Supply can sit tucked away out of sight, with nothing more than the two output leads snaking out to wherever they are needed. The control program takes up only a small amount of screen space.

The combination of the microcontroller on the Uno and the control program allows many features to be added with no extra hardware.

For example, the control program allows five preset combinations of voltage and current to be created

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SERVICEMAN'S LOG

A feline-themed cautionary tale

Dave Thompson

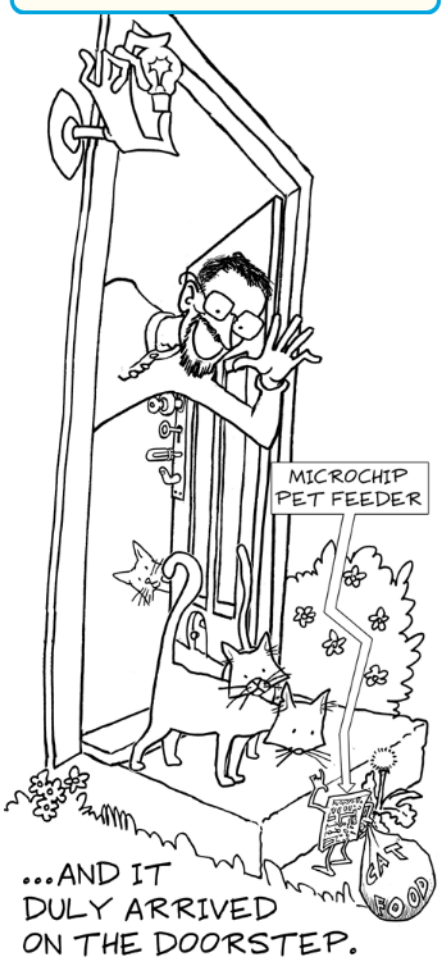
Cats can be quite difficult to manage, especially if they each need specialised food. With modern tech you now have devices like a microchip pet feeder, which allow only certain cats access to a particular food/medicine bowl. However, there's always a caveat with all-encompassing one-trick problem solvers.

Items Covered This Month

- Do (not) feed the cat
- Tektronix TDS744A oscilloscope repair
- Restoring an electronic organ

*Dave Thompson runs PC Anytime in Christchurch, NZ.

Website: www.pcanytime.co.nz
Email: dave@pcanytime.co.nz



It's no secret we own a few cats (or should I say that we serve a few cats?). I have mentioned them before in this column.

One of the problems with having multiple cats is that they are very much individual characters, with their own preferences for food and attention. So it is hard to implement a strategy for one cat without affecting the others.

For example, one of our cats has allergies to something in the soil around our cat run. Every spring, these allergies flare up, but the other two cats aren't affected at all. Having to dish out special food or medication to one cat and not the others can be a lesson in frustration, as they all graze on each others' food.

So when we saw an advertisement for "Microchip Pet Feeders", we thought it might be the answer to our problems. Our cats are all microchipped within a few weeks of birth (as all pets should be). Having the ability to allow one cat to feed from a particular food/medicine bowl while the others have no access is very appealing.

That is exactly what these devices claim in their advertising bumf; apparently, you can program access for up to 30 individual animals into each feeder using their unique microchip ID tag. In our situation, we only needed to register the one cat to it.

To shop online or not

We ordered one of these units online, and it duly arrived on the doorstep. I'm a modern guy; I like this 'new' way of buying products; not because I'm lazy, but these days one tries to avoid going out of the house (if one is even allowed!).

Clearly, online shopping is booming at the moment. I have to wonder whether many people will go back to the 'old ways' even when restrictions are lifted. Who wants to deal with the hassle of driving to a shopping centre, finding a parking space and pushing your way through crowds to the shop, only to be disappointed that what you want isn't even in stock?

It's quite convenient just to have stuff show up at your door a couple of days after clicking some buttons on the computer, and overall it doesn't cost that much more since you are saving on petrol, stress and (perhaps more importantly) time.

However, there are still problems with this approach. If you know what you want, or have used the products before, or they are the sort of items you can buy based on specifications (like a lot of electronic devices), it's perfect because you know exactly what you are getting. But online shopping isn't that suitable for buying the likes of clothes or shoes, for example.

Unless you have gone to a bricks-and-mortar store to try on the same product beforehand, and know it fits, buying these things over the Internet can be fraught with problems. What if it doesn't fit? You are then in a position where you have to go through the hassle of contacting the vendor, returning the item, and possibly paying the return shipping costs.

That can mean that your item ends up costing you more than if you had just gone down to the store and purchased it in the first place. At worst, you have no usable product and are out of pocket for all the related expenses.

Defects and warranty returns can also be a can of worms. Some online sellers are great about returns, such as

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Or take out an online subscription for access to the latest issues.

Home Projects for Summer

Hardcore electronics by **jaycar** think. possible.

On Sale 27 December 2020 to 23 January, 2021

MICRO:BIT SMART ROBOT KIT

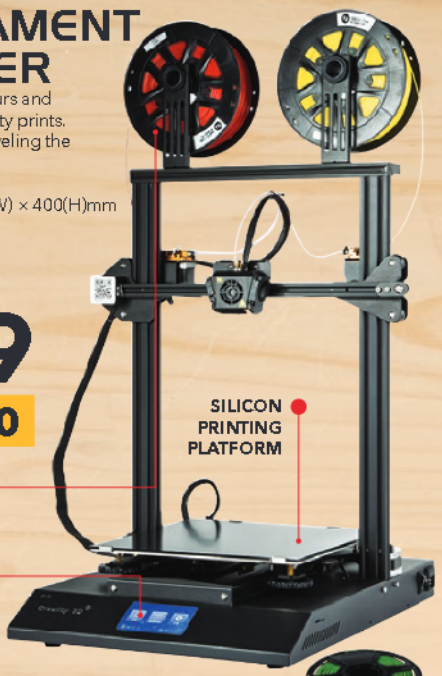
A fun to build robot that uses a micro:bit microcontroller board (sold separately XC4320 **$34.95**) that kids can code or control using their Smartphone via Bluetooth®. No soldering required, plug and play. KR9262
WAS $99.95

NOW
$69.95
SAVE $30

DUAL FILAMENT 3D PRINTER

Allows you to combine colours and materials creating high-quality prints. Oversized bed screws for leveling the print bed. Dual cooling fans. SD memory card slot.
• Prints up to: 300(L) × 300(W) × 400(H)mm
TL4410 **WAS $1299**
See website for details.

NOW
$1199
SAVE $100



ARDUINO® STARTER KIT

This official kit from Arduino® includes all the essentials to get you started in the exciting world of Arduino®. Kit includes UNO board, breadboard and plenty of prototyping accessories. Perfect gift for a young electronics enthusiast or maker in the making. XC9200
See website for details.

JUST
$169

10% OFF FLASHFORGE FILAMENT 600G/1KG.

NOW FROM $22.45

BLACK	TL4260/TL4270
BLUE	TL4261/TL4271
GREEN	TL4262/TL4272
RED	TL4263/TL4273
CLEAR	TL4264/TL4274
ORANGE	TL4265/TL4275
WHITE	TL4266/TL4276

PCB HOLDER WITH LED MAGNIFIER

• 2X magnifying lens, soldering iron holder, 2 x strong adjustable alligator clips
• Heavy cast iron base
TH1987

ONLY
$24.95

27-PCE SMARTPHONE REPAIR KIT

Contains all necessary tools you need to fix your Smartphone from 4mm bits, tweezers & more.
TD2118

JUST
$29.95

110-PCE 12V ROTARY TOOL KIT

Drill, saw, sand, polish, carve or grind in your workshop or out on the road.
• 12V @ 12,000RPM
TD2451

JUST
$39.95

SUPER PRO GAS SOLDERING TOOL KIT

Adjustable tip temperature up to 580°C. Equivalent power of between 25 and 125W.
• 3 Tips included
• Quality storage case
TS1328 **WAS $169**

portasol

NOW
$149
SAVE $20

SHD DASH CAM WITH REAR VIEW CAMERA

Automatically records on impact. Wide 140° lens. 12/24VDC operation. Auto on/off. Records to microSD card (sold separately). QV3849

• SUPER HD RECORDING
• DOUBLES AS A REVERSING CAMERA

JUST
$199

32GB microSD Card XC4992 **RRP $36.95** bonus free gift

12V FOLDING SOLAR PANELS

Get free electricity from the sun for your campsite. Supplied with charge controller, 5m power lead with alligator clamps for easy connection and carry bag.
110W ZM9175 **$199**
130W ZM9177 **$239**
160W ZM9178 **$289**

Charge controller included.

FROM
$199

HIGH QUALITY MONOCRYSTALLINE CELLS

ZM9175

SAVE 15% ON TV MOUNTING BRACKETS

We have a HUGE range of high quality brackets to suit virtually all TV screens at affordable prices. CW2805-CW2883
NOW FROM $25.45

See our full range online or in-store.

SUITS MOST TV BRANDS FROM 23"-100"

Shop the catalogue online!

Free delivery on online orders over $99*
*Exclusions apply - see website for full T&Cs.

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Upgrade your Home Theatre with the latest tech!

4K ANDROID MEDIA PLAYER

Allows you to browse the web, run Android games and apps, or watch your favourite media collection in stunning 4K resolution. Connects to a TV via Wi-Fi or HDMI.
- Includes remote, mains power adaptor & HDMI lead

XC6012

JUST **$69.95**

Multiple TV's but only 1 cable box? No problem. Split the signal and watch TV in different rooms with this easy switcher.

HELPFUL HINT

Need to multiple HDMI devices but your TV or Display has only 1 HDMI port? A Splitter is your answer.

HELPFUL HINT

JUST **$42.95**

3-WAY HDMI SWITCHER

Switch HDMI signals from multiple sources to a single output.
- Input: 3 x HDMI
- Output: 1 x HDMI

AC1705

FROM **$52.95**

HDMI SPLITTERS

Split a HDMI input to multiple HDMI outputs.
2 Output AC1710 **$52.95**
4 Output AC1712 **$84.95**

HDMI DONGLE

Stream content from your Smartphone/Tablet to your TV.
- USB powered

AR1922

ONLY **$39.95**

AMPLIFIED HDMI LEADS

Ideal for long runs and designed to compensate for any loss of signal. Suitable for Full HD, 4K, 3D, and UHD signals.
10m WQ7437 **$79.95**
15m WQ7438 **$99.95**
20m WQ7435 **$119**
30m WQ7439 **$139**

CONCORD

FROM **$79.95**

50M* 1080P HDMI EXTENDER WITH INFRARED

Extends HDMI connections over a single Cat5e/6 cable. Ideal for running HDMI signals to new locations or connecting through existing building cables. Includes HDMI loop output. AC1783

*Cat6 cable up to 50m, Cat5e up to 40m.

JUST **$129**

HDMI cable doesn't reach? No problem, use this handy extender!

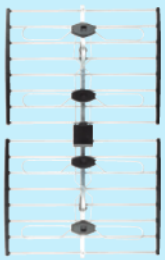
HELPFUL HINT

UHF PHASED ARRAY TV ANTENNA

Ideal for problem digital reception areas. Capable of receiving either horizontal or vertical signals. Built-in LTE filter to stop interference from mobile phone towers.
- 12.5dB Gain

LT3147

PRICE BREAKTHROUGH **$49.95**



INDOOR TV AMPLIFIER/SPLITTERS

Simple and neat solution to boost your TV antenna signals.
Single LT3285 **$44.95**
2-Way LT3288 **$59.95** (shown)
4-Way LT3287 **$99.95**

FROM **$44.95**

TV COAX CABLE

Great for domestic TV & Pay TV installations! 75 ohm RG6 quad shield in a handy 30m roll. BELDEN Brand. WB2014

JUST **$49.95**

HEX RATCHET CRIMPING TOOL

Crimps F, N, BNC, TNC, UHF, ST, SC & SMA connectors onto RG6 or RG58 coax cable.

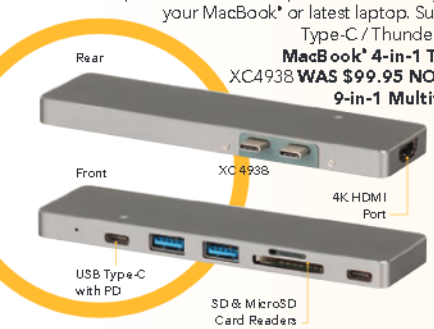
TH1833

JUST **$39.95**

Home Office Refresh

EXPAND YOUR LAPTOP OR MACBOOK®

Expand the number of ports and connect just about anything to your MacBook® or latest laptop. Suitable for devices with Type-C / Thunderbolt™ 3 connections.
MacBook® 4-in-1 Thunderbolt™ 3 Hub
XC4938 **WAS $99.95 NOW $79.95 SAVE $20**
9-in-1 Multifunction Type-C Hub
XC4975 **$99.95**
See website for details.



NOW FROM **$79.95**

SAVE UP TO $20

5MP HIGH DEFINITION WEB CAMERA WITH DUAL MICROPHONES

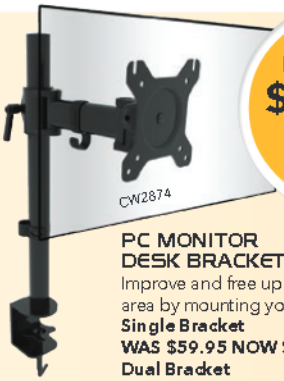
Clear crisp sound and 1080p HD video for Skype, Zoom, or other video conferencing applications. Easy installation.

QC3207 **WAS $129**

AUTO ADJUSTS FOR LOW LIGHT

NOW **$99**

SAVE $30



NOW FROM **$49.95**

SAVE 15%

PC MONITOR DESK BRACKETS

Improve and free up your desk area by mounting your monitor.
Single Bracket CW2874
WAS $59.95 NOW $49.95
Dual Bracket CW2875
WAS $79.95 NOW $67.95
Articulating Mount CW2900
WAS $79.95 NOW $67.95

LED ILLUMINATED MAGNIFIER

- Powerful 125mm dia. 3 dioptre lens
- High / low light setting
- Fully adjustable arm with clamp mount
- Large diameter magnifier
- Interchangeable lens option

QM3554 **WAS $119**

NOW JUST **$109**

SAVE $10

2CH POWERED PC STEREO SPEAKERS WITH RGB LIGHTS

Great sounding speakers with RGB LED backlights for colourful rainbow effects! USB powered. XC5171

JUST **$24.95 PR**

ONLY **$19.95**

DUAL POWERBOARD WITH USB

Features 2 x mains power outlets & 4 x USB ports (3.4A shared) to charge up to 4 USB devices at the same time. MS4104

FROM **$7.95**

MONITOR CABLES

DVI, VGA and XVGA cables are designed for computer monitors. Use the most suitable for your application. Available in 0.5m to 15m lengths. WC7500-WC7588

See in store or online for full range

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smart home operations

4K UHD

amazon alexa

4-WAY 4K SMART HDMI SWITCHER WITH VOICE ASSIST

Support Alexa smart voice command. Includes infrared remote control and mains power adaptor.
- High-Dynamic-Range (HDR) video support
- Inputs: 4 x HDMI
- Outputs: 1 x HDMI, 1 x TOSLINK Optical

AC5014 **WAS $149**

NOW **$119**

SAVE $30

SMART WI-FI BATTERY CAMERA

For temporary or permanent security applications around the home or workplace, without the need for messy cables!
- Rechargeable
- IR night vision

QC3890 **$199**

CAMERA + SOLAR PANEL BUNDLE DEAL

$249

SAVE $9.95

Add solar charging capability to your Smart Wi-Fi camera (QC3890) for off-grid power. QC3896 **$59.95**

JUST **$69.95**

works with the Google Assistant

amazon alexa

SMART COLOUR CHANGING STRIP LIGHT - 5M

Use your Smartphone to adjust the lights colour to suit your mood from a comforting warm colour to cool white for reading. Dimmable. IP65 rated. ST3992

ONLY **$39.95**

WI-FI UNIVERSAL SMART REMOTE

Replaces your appliance's remote control and allows you to control your appliance such as TVs, air conditioners, heaters, etc from your Smartphone or tablet. AR1974

SMART WI-FI LED BULBS WITH COLOUR CHANGE

Manage your lights with your smartphone or voice commands, including colour, brightness, setting schedules, etc. Bayonet/Edison fitting.

Single SL2250/54
WAS $19.95 EA
NOW $14.95 EA
SAVE $5
3 Pack SL2252/56
WAS $49.95 PK
NOW $39.95 PK
SAVE $10

NOW FROM **$14.95 EA**

SAVE UP TO $10

SMART WI-FI PLUG

Easily manage your household electronic devices using your Smartphone. Control via app or voice command. MS6106
RRP $19.95 EA
Smartphone not included.
ALSO AVAILABLE: with 2 x USB MS6104
RRP $34.95 EA
2 FOR $50
SAVE $19.90

2 FOR **$30**

SAVE $9.90

JUST **$89.95**

DOOR ENTRY ALERT

Features a send & receive unit that transmits a beam. Buzzer sounds when the beam is broken. Effective range up to 6 metres. Mains power adaptor & mounting hardware included. LA5193

HIGH VOLUME WIRELESS DOOR BELL

Loud volume with built-in strobe light. 7 selectable melodies. Medium & loud volume control. LA5002

JUST **$59.95**

ONLY **$19.95**

WINDOW & DOOR ENTRY ALARM

- Security alarm or entry chime
- Quick installation
- Includes self-adhesive strips

LA5209

Home Security

8 CHANNEL 4K NVR KIT WITH 4 X 5MP CAMERAS

Versatile 5MP surveillance package for home, office, or commercial applications.
- Smart viewing and notification
- Audio recording
- Power-over-Ethernet
- Expandable up to 8 cameras
- Built-in infrared LEDs for night vision up to 30m

QV5600

4K UHD | 2TB HDD | 5MP

CONCORD

JUST **$999**

LINE INTERACTIVE UPS WITH LCD

- Easy to read LCD which displays battery and load values
- 2 x RJ11 sockets for telephone and fax
- USB socket

650VA 390W
MP5205 **$149**
1500VA 900W
MP5207 **$349**

FROM **$149**

CCTV EXTENSION CABLES

Great for connecting surveillance cameras up to 60m. Video & Power. Compatible with most DVR systems.
30m WQ7283 **$19.95** (Shown)
60m WQ7287 **$39.95**

FROM **$19.95**

BALUN KIT

Simplify your CCTV installation by combining composite video, audio and power for transmission over one UTP CAT5 cable. QC3667
ALSO AVAILABLE: BNC/RCA/ Power to Cat5e/6 QC3669 **$32.95**

JUST **$16.95**

SECURITY ALARM REED SWITCH

- Reed switch and magnet
- Normally CLOSED (NC) per pair
- Self adhesive or screw mount

LA5072

ONLY **$5.25**

ALARM CABLES

- 30m roll length

4-Core WB1591 **$24.95**
6-Core WB1596 **$49.95**

FROM **$24.95**

QUAD ELEMENT PIR DETECTOR

- Compact, reliable and effective
- Built-in automatic temperature to help eliminate false triggers
- Swivel bracket for quick position adjustment

LA5046 **$44.95 EA**

3 FOR **$99**

SAVE OVER $35

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home solar

12V FIXED SOLAR PANELS

High performance monocrystalline panels designed for environmental conditions with a durable anodised aluminium frame and 3.2mm low iron tempered glass. Junction box included.

40W ZM9056 **$59.95** (Shown)
80W ZM9102 **$109**
130W ZM9061 **$169**
170W ZM9065 **$209**

FROM JUST **$59.95**

12V SOLAR PANELS WITH CLIPS

High efficiency, small footprint solar panel charger kits with leads and clips to keep your 12V battery topped up at the campsite.

5W ZM9050 **$24.95** (Shown)
10W ZM9051 **$39.95**
20W ZM9052 **$59.95**

FROM **$24.95**

NEED A SOLAR CHARGE CONTROLLER TO SUIT? AVAILABLE FROM 10A TO 50A PRICE FROM $39.95

20A MPPT SOLAR CHARGE CONTROLLER FOR LITHIUM OR SLA BATTERIES

Uses Maximum Power Point Tracking (MPPT) for maximum efficiency and charge rate. Charge lead acid (sealed, gel or flooded) or lithium batteries.

- 3-stage intelligent charging
- 12/24V operation

MP3741 **$199**

BUY BOTH FOR $219
SAVE $39.95

Add Wi-Fi communication to the Solar Charge Controller (MP3741) with this interface, and control your power installation using your Smartphone. MP3746 **$59.95**
Wi-Fi module is not stocked in all stores but can be ordered.

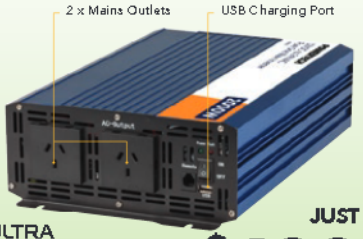
LITHIUM BATTERIES

Lithium iron phosphate (LiFePO4) batteries are the latest in battery technology. Featuring up to 10 times the battery cycle life with only half the weight of its lead-acid equivalent.

12.8V 12AH SB2211 **$149**
12.8V 18AH SB2212 **$199**
12.8V 25AH SB2213 **$299**
12.8V 100AH SB2215 **$799**

FROM **$149**

- MORE POWERFUL
- FASTER RECHARGE
- MORE PORTABLE
- LIGHTER
- SAFER



ULTRA HIGH POWERED 12V 2000W PURE SINE WAVE INVERTER

Designed for mobile or permanent power installations it will run sensitive electronic and power hungry devices such as a microwave, power tools or TV. 12VDC to 230VAC. Short circuit, overload, low/ over voltage, and over temperature protection. MI5740

ALSO AVAILABLE:
24V 2000W MI5742 **$599**

JUST **$499**

ONLY **$9.95** EA

50A HIGH CURRENT ANDERSON CONNECTORS

Used widely in both domestic and industry applications. Supplied as a moulded 2 pole with contacts.

- 50A, 600V (AC or DC) 6 gauge

PT4420-PT4427

JUST **$39.95**

RATCHET CRIMPING TOOL FOR NON-INSULATED LUGS

Comfortable grip & ratchet mechanism relieves strain on hands.

TH1847

ONLY **$7.95** EA

WATERPROOF SOLAR POWER PV CONNECTORS

IP67 rated for maximum environmental protection.

4mm Male PP5102
4mm Female PS5100

FROM **$4.50** /m

SOLAR PANEL POWER CABLES

Dust, age and UV resistant, tinned copper conductors to minimise corrosion.

- IP65 rated 50A 4.0mm²

50A WH3121 **$4.50/m**
70A WH3122 **$6.50/m**

Full range of other wiring hardware available in-store or online.

Power to the Home

REMOTE CONTROLLED

3 OUTLET MAINS CONTROLLER

Turn any standard mains outlet on and off via remote. Good for switching off hard -to-reach power points. Up to 30m range. MS6147

ALSO AVAILABLE:
1 Outlet + remote MS6148 **$19.95**

JUST **$39.95**

10A DOUBLE GPO WITH RCD*

Designed to be a direct replacement to your standard GPO fittings. 2 x 10A GPO. Built-in RCD to prevent electric shock. LED indicators. PS4048 **WAS $49.95**

*Residual Current Device

NOW **$39.95**
SAVE $10

12VDC DIGITAL MAINS TIMER SWITCH MODULE

Ideal for automating your heating & lighting or any other switching application that requires multiple unattended switching cycles.

- Eight on/off settings
- 16A @ 240VAC

AA0361 **WAS $59.95**

NOW **$49.95**
SAVE $10

HIGH POWER
SLIM & LIGHTWEIGHT

HIGH POWER MAINS POWER SUPPLIES

Slim mains power adaptors designed with low energy consumption. Regulated output voltage. Fits side by side on a power board. Supplied with 7 changeable DC tips.

12VDC 5A 65W MP3560
24VDC 2.5A 65W MP3562
48VDC 1.25A 65W MP3564

JUST **$49.95** EA

65W COMPACT UNIVERSAL LAPTOP POWER SUPPLY

Compact size, high power plug pack design. Automatic voltage detect. Compatible with popular laptops from HP, Dell, Toshiba, IBM, Lenovo etc.

- USB socket

MP3342

HIGH POWER
SLIM & LIGHTWEIGHT

JUST **$59.95**

10-WAY SURGE PROTECTED POWERBOARD

10 mains sockets with surge and spike protection. EMI/RFI filter. Data and TV reception protection.

- 2 x USB ports

MS4033 **WAS $84.95**

NOW **$79.95**
SAVE $5

Car Security

FROM
$13.95

DOOR LOCK ACTUATORS
Used on passenger/driver doors. Durable, waterproof, dustproof and supplied with universal mounting hardware. Wiring not included. Input voltage: 9 - 16VDC.
Slave Passenger LR8813 **$13.95** (Shown)
Master Driver LR8815 **$15.95**

JUST
$52.95

REMOTE CONTROLLED CAR CENTRAL LOCKING SYSTEM
Upgrade to a remote keyless entry! Easy to install and comes with two remote key fobs.
• Includes master actuator, wiring and remotes
LR8839

JUST
$94.95

4 DOOR REMOTE CONTROLLED CENTRAL LOCKING KIT WITH KILL SWITCH
Lock and unlock your car doors from a distance without having to fumble around with keys. 9 - 16VDC.
• Frequency: 433.92MHz
LR8842

HEAD-UP DISPLAY SPEEDOMETER
WITH GPS & OBDII DATA
Keep your eyes on the road and read all the important driving info, such as speed, from a head up display reflected off the windscreen.
• Auto brightness adjustment
LA9036
Reversed image reflects correctly onto windscreen.

JUST
$59.95

WIRED REVERSING CAMERA WITH 7" LCD
Ideal for 4WDs, trucks, RVs and larger vehicles. Enables you to monitor the area to the rear of a large vehicle with a wider field-of-view. Remote control included. 12/24VDC. QM3742 **WAS $269**

NOW
$249
SAVE $20

SOUND DEADENER
Self-adhesive and easily moulded. Provides acoustic isolation and insulation for roof, firewall, floor, quarter panels, doors and under bonnets. 330mm wide. **WAS $32.95 EA**
Butyl AX3687
Butyl/Foam Combo AX3689

NOW
$27.95 EA
SAVE $5

COAXIAL SPEAKERS WITH SILK DOME TWEETER
Provides clean, crisp, natural and smooth balance sound. All models are paired with soft dome tweeters. Sold as a pair.
4" 40WRMS CS2400 **$89.95**
5" 50WRMS CS2401 **$119**
6.5" 75WRMS CS2402 **$139**

FROM
$89.95 PR

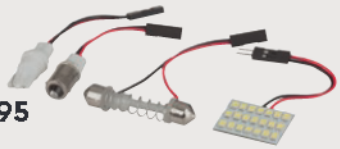
12V REVERSING CAMERAS
Save on buying a whole new reversing camera kit if you have a faulty or damaged camera. IP67 rated. Wide 120° angle view.
Flush Mount QC3530 **$49.95**
With Bracket QC3532 **$49.95** (Shown)
IR LEDs with Bracket QC3536 **$119**

FROM
$49.95

OBDII BLUETOOTH®4.0 ENGINE CODE READER
Diagnose your cars problem. Plugs into OBD-II port and transmits speed, RPM, fuel consumption, etc via Bluetooth® to your Smartphone. PP2145

JUST
$69.95

Car Lighting



FROM
$9.95

INTERIOR LED RETROFIT KITS
Upgrade car/caravan/boat interior lighting with LED technology. Each kit consists of cool white LEDs with 3M adhesive foam backing. 12VDC. Universal T10/211/BA9S.
2.5W 260 Lumen ZD0585 **$9.95**
3.0W 310 Lumen ZD0587 **$12.95**
4.5W 450 Lumen ZD0589 **$14.95**

REPLACEMENT GLOBES
A range of 150 lumens ultra-bright white LED replacement globes for car interior lights. Compatible with modern "CANBus" sytems. 120° wide beam. 12VDC.
3 sizes available.
ZD0750-54

JUST
$12.95 EA

H4 HI/LO LED POWERED HEADLAMP KIT
Bright and efficient. Equipped with advanced Luxeon Z ES LEDs.
• 3800 lumens 40W
• 12/24VDC
SL3524 **WAS $169**

NOW
$149
SAVE $20

AUTOMOTIVE MULTI-FUNCTION CIRCUIT TESTER WITH LCD
Designed to test the electrical system of an automotive vehicle running on 12V or 24V. Tests voltage and polarity of a circuit. Locates misfiring cylinders.
• LED indicator
QM1494 **WAS $64.95**

NOW
$59.95
SAVE $5

AUTOMOTIVE DMM WITH DWELL & TACHO
Perfect for the workshop as an an engine analyser as well as basic DMM. Full dwell angle measurement and tacho. Max/data hold and bright backlit LCD.
• 2000 Display count
• RPM x 10
QM1446

ONLY
$49.95

FROM
$7.95

WATERPROOF DEUTSCH 2-WAY CONNECTOR SET
Perfect for connecting up sensors/lights in the bay due to their superior corrosion protection.
• 13A rated.
2-Way PP2150 **$7.95**
4-Way PP2149 **$9.95**
6-Way PP2148 **$11.95**

FROM
$16.95

HIGH GRADE CIGARETTE POWER SOCKETS
For vehicle and marine use. Includes panel and surface mounts. 10A rating.
Single PS2020 **$16.95**
Double PS2022 **$21.95**
Single with LED Voltmeter PS2024 **$29.95**
Single with Dual USB Charger PS2026 **$29.95**

JUST
$19.95

Micro USB Plug (Mini USB adaptor included)

12V TO 5VDC CONVERTER WIRING KIT
Get rid of unsightly power cables floating around car dash that powers GPS, Dash Cam or mobile device.
• 2.5A continuous current
• Cable length 1.3m
MP3675

IN-CAR BATTERY MONITOR AND TEMPERATURE DISPLAY
Plugs into an available power socket to display system voltage and interior cabin temperature. Easy to read LED display.
QP2222

ONLY
$19.95

keep the kids

ENTERTAINED

...at home

AMAZING SELF-FLYING DRONE!

NEW

LASER GUN & DRONE SET

Launch this amazing 'obstacle avoidance & self-flying drone and watch it fly, then pull out the gun, take aim - shoot! Hit the drone and it shudders, strike it 3 times and it falls safely to ground. Warning - The drone shoots back. Full colour lighting and multiple sound effects. Add up to 3 drones. Ages 8+. GT4082 See website or in-store for details.

Additional Drone to Suit GT4082 GT4084 **$24.95**

Due early January.

JUST **$49.95**

NEW

REMOTE CONTROLLED 2-IN-1 TANK CONSTRUCTION KIT

Assembled into two different tanks. Drive around on caterpillar tracks and raise/lower the turret. Equipped with gunfire sounds. 759 pieces. Ages 6+. Requires 3 x AAA and 6 x AA batteries (sold separately). KR9242

4 PK AAA Batteries SB2413 **$3.25**

12 PK AA Batteries SB2333 **$7.95**

JUST **$99.95**

NEW

REMOTE CONTROLLED 2-IN-1 ROCK & DIRT CRAWLER

Interchangeable 4WD tyres for speed and caterpillar tracks for rough terrain. Speeds up to 10km/h. 2.4GHz remote requires 2 x AA batteries (sold separately). Ages 8+. GT4247

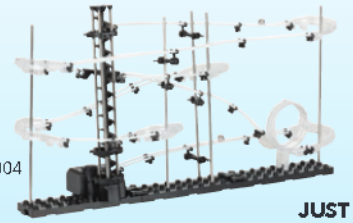
2 PK AA Batteries SB2424 **$1.95**

JUST **$49.95**

SPACE RAIL CONSTRUCTION KIT

Build your own 'marble' roller coaster. The spiral "elevator" lifts the marbles to the top of the rail, and gravity takes care of the rest. 170 piece. Requires 1 x C battery (sold separately). Ages 15+. KJ9004

2 PK C Batteries SB2416 **$4.50**



JUST **$29.95**

NEW

HYDRAULIC CYBORG HAND KIT

Simulates the movements of human hand/fingers, using hydraulic power. It allows every finger joint to adjust at different angles for close-fist/or open-palm precisely. Ages 10+. KR9266

JUST **$49.95**

NOW **$19.95**

SAVE $3

ANYWHERE TABLE TENNIS

- Collapsible net
- Spring-clamp net support posts
- Includes 2 x paddles & 2 x ball

GH1162 **WAS $22.95**

TOBBIE THE ROBOT - HEXAPOD KIT

A 6-legged robot that you can build. Walks and spins in any direction and will beep and flash its eyes. Ages 8+. KJ9031

VIDEO ONLINE

JUST **$49.95**

JUST **$12.95**

POTATO CLOCK KIT

Runs on potatoes or with tomatoes, lemons, apples, even soft drink or beer! Safe and highly educational. Ages 10+. KJ8937

FROM **$9.95**

SNAP-ON ELECTRONIC KITS

All in bright coloured pieces. Parts simply snap together without any screws or soldering. Ages 6+. KJ8970-KJ8985

Full range available in store or online.

NOW **$14.95**

SAVE $2

MAKE YOUR OWN: CLOCK KIT

Easy to assemble. No batteries required. 31 pieces. Ages 6+. KJ8996 **WAS $16.95**

WEARABLE BADGES & ELECTRONIC DICE KITS

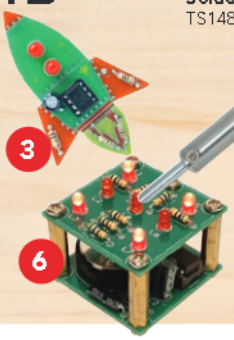
These kits are a great way for your kids and grand kids to start soldering and pick up some electronics on the way. They will also learn about how various components work including LEDs, transistors, integrated circuits and more. Each kit requires a CR2032 battery (SB2522 **$3.25** sold separately). **$19.95 EA**

6 DIFFERENT KITS AVAILABLE:

1. Skull Badge	with Alternating Flashing LEDs	KM1090
2. Owl Badge	with Touch Sensitive LEDs	KM1092
3. Rocket Badge	with Flashing LEDs	KM1094
4. Pirate Badge	with Flashing LED Eye	KM1096
5. Robot Badge	with Touch Sensitive LEDs & Buzzer	KM1098
6. Electronic Dice	with Flashing LEDs	KM1099

ANY 3 KITS FOR **$40**

SAVE $19.85



80W 240V Soldering Iron TS1485 **$24.95**

RETRO STYLE HANDHELD GAME CONSOLE WITH 256 GAMES

Hours of entertainment to keep you and the kids entertained. Features a 2.8" colour screen, built in speaker and a 3.5mm to RCA and USB recharge cable. Available in Black or Red. Ages 15+. GT4280

Due early January.

CONNECT IT TO YOUR TV

NEW ONLY **$29.95**

In the Car

JUST **$129**

7" TFT LCD WIDESCREEN COLOUR MONITOR WITH IR REMOTE

Suitable for in-car and home entertainment, use it to watch video from any composite source such as a DVD player or game console. QM3752

Wireless Headphones AA2047 **RRP $39.95**

bonus free gift

JUST **$39.95**

WIRELESS INFRARED STEREO HEADPHONES

Add these wireless headphones to the monitor on the left and enjoy automotive bliss! Soft cushioned pads. AA2047

CLEARANCE

ORDER ONLINE, COLLECT IN STORE

Listed below are a number of discontinued (but still good) items that we can no longer afford to hold stock.
Please ring your local store or search our website to check stock. At these prices we won't be able to transfer from store to store.
STOCK IS LIMITED. ACT NOW TO AVOID DISAPPOINTMENT. Sorry NO RAINCHECKS.

AUDIO & VISUAL

		Cat. No	WAS	NOW	SAVE
150m 1080p HDMI Cat5e/6 Extender with Infrared	HOT PRICE	AC1746	$219	**$169**	**$50**
2 Channel Mixer with Microphone Preamp	HOT PRICE	AM4201	$69.95	**$39.95**	**$30**
2 Way DisplayPort Splitter		AC1755	$49.95	**$39.95**	**$10**
2 Way DisplayPort Switcher		AC1757	$49.95	**$39.95**	**$10**
2 x 15 WRMS Portable Stereo Amplifier		AA0504	$69.95	**$49.95**	**$20**
2 x HDMI to VGA/Component & Analogue/Digital Audio Converter		AC1721	$119	**$99**	**$20**
3.5mm Plug to Socket Cable with Microphone and Volume Control - 0.5m		WA7120	$14.95	**$9.95**	**$5**
4 Way Digital Audio Switcher		AC1723	$39.95	**$34.95**	**$5**
6 Way Speaker Selector with Internal Protection		AC1683	$129	**$99**	**$30**
6.5" Rechargeable Cube Speaker with Bluetooth® Technology		CS2489	$119	**$89**	**$30**
Concord 50m 4K HDMI Fibre Optic Cable	HOT PRICE	WQ7496	$299	**$249**	**$50**
Economy UHF/VHF Masthead Amplifier		LT3276	$49.95	**$34.95**	**$15**
HDMI 4K Repeater		AC1717	$34.95	**$24.95**	**$10**
Portable 5.8GHz Wireless 1080p HDMI AV Sender	HOT PRICE	AR1901	$229	**$179**	**$50**

SECURITY

		Cat. No	WAS	NOW	SAVE
1080p AHD Dome Camera with IR	HOT PRICE	QC8687	$129	**$89**	**$40**
1080p Wi-Fi IP Camera with Pan/Tilt		QC3858	$89.95	**$69.95**	**$20**
12V AC/DC Door Strike release		LA5078	$49.95	**$29.95**	**$20**
15m CCD Camera Extension Cable		WQ7277	$49.95	**$39.95**	**$10**
4 Door RFID Access Controller	HOT PRICE	LA5359	$199	**$149**	**$50**
720p AHD Dome Camera with IR		QC8639	$99.95	**$69.95**	**$30**
720p AHD Wireless Receiver & Camera Kit		QC8663	$99	**$89**	**$10**
720p Outdoor Trail Camera		QC8041	$149	**$129**	**$20**
Ceiling Mount Alarm with Remote Control		LA5215	$34.95	**$24.95**	**$10**
Concord 8 Ch. 4K DVR Package - 4x5MP Cameras	HOT PRICE	QV5100	$799	**$699**	**$100**
Concord 8 Ch. 4K NVR Package - 6x5MP Cameras	HOT PRICE	QV5602	$1,299	**$1,099**	**$200**
Motion Sensor Camera recorder with 38 IR LEDs		QC8027	$89	**$79**	**$10**
Non-Contact Infrared Door Exit Switch		LA5187	$74.95	**$49.95**	**$25**
Rechargeable Solar Sensor Light		SL3239	$69.95	**$54.95**	**$15**

POWER

		Cat. No	WAS	NOW	SAVE
125A Dual Battery Isolator (VSR)		MB3687	$49.95	**$39.95**	**$10**
12V 8.5A Desktop Power Supply	HOT PRICE	MP3258	$99.95	**$69.95**	**$30**
18W USB Type-C Mains Power Adaptor with Power Delivery		MP3410	$24.95	**$19.95**	**$5**
240VAC Aluminium 48 LED Light Strip with Switch		ST3946	$59.95	**$49.95**	**$10**
240VAC Aluminium 72 LED Light Strip with Switch		ST3948	$69.95	**$59.95**	**$10**
2500 Lumen Rechargeable LED Torch	HOT PRICE	ST3499	$129	**$99**	**$30**
2600mAh Metallic Power Bank Rose Gold		MB3794	$14.95	**$9.95**	**$5**
2600mAh Metallic Power Bank Silver		MB3792	$14.95	**$9.95**	**$5**
2600mAh Metallic Power Bank Space Grey		MB3793	$14.95	**$9.95**	**$5**
3 x Osion Osram LED Torch	1/2 PRICE!	ST3487	$9.95	**$4.95**	**$5**
30W 5V 6A Encapsulated Mini Power Supply		MP3301	$42.95	**$29.95**	**$13**
5VDC 1A USB Mains Adaptor with Micro-B Cable		MP3544	$19.95	**$14.95**	**$5**
6300 Lumen 6.5 Inch Solid LED Driving Light		SL3920	$149	**$129**	**$20**

IT & COMMS

		Cat. No	WAS	NOW	SAVE
0.5W 80 Ch UHF Transceivers		DC1027	$69	**$59**	**$10**
3W UHF CB Radio Tradies Pack - Pair	HOT PRICE	DC1076	$329	**$229**	**$100**
5W UHF CB Radio Tradies Pack IP67	HOT PRICE	DC1069	$449	**$349**	**$100**
Advanced 2 Watt 80 Channel UHF Transceiver with CTCSS		DC1049	$69.95	**$59.95**	**$10**
Ethernet Over Power N300 Wi-Fi Access Point		YN8357	$149	**$129**	**$20**
Ethernet-Over-Power Kit		YN8355	$99.95	**$89.95**	**$10**
VGA To Composite & S-Video Converter		XC4907	$49.95	**$39.95**	**$10**
Waterproof Floating 80 Channel 3W UHF CB Transceiver		DC1074	$129	**$99**	**$30**

AUTO & OUTDOORS

		Cat. No	WAS	NOW	SAVE
1080p Wi-Fi Dash Camera with GPS		QV3865	$189	**$169**	**$20**
3G GPS Vehicle Tracker	HOT PRICE	LA9026	$199	**$149**	**$50**
Bluetooth® In-Car Earpiece with USB Charger		AR3135	$19.95	**$14.95**	**$5**
FM Transmitter with USB & SD Playback		AR3136	$14.95	**$9.95**	**$5**

EDUCATIONAL KITS & GADGETS

		Cat. No	WAS	NOW	SAVE
Circuit Scribe Maker Kit		KJ9310	$89	**$69**	**$20**
Crookes Radiometer		GG2108	$59.95	**$39.95**	**$20**
Draw Circuits Circuit Scribe Basic Kit		KJ9340	$69.95	**$59.95**	**$10**
Draw Circuits Circuit Scribe Ultimate Kit	HOT PRICE	KJ9300	$149	**$109**	**$40**
Makeblock mBot Blue Robot Kit		KR9200	$199	**$169**	**$30**
MakeBlock Neuron Inventor Kit		KJ9190	$99	**$79**	**$20**
MeetEdison Robot Kit		KR9210	$99.95	**$79.95**	**$20**
Motion Drone		GT4224	$34.95	**$24.95**	**$10**
Portable 14L 12V Cooler / Warmer		GH1373	$119	**$89**	**$30**
Puppy Go Al Smart Dog	HOT PRICE	KR9234	$169	**$129**	**$40**
Space Rail Construction Kit - Glow in the Dark		KJ9001	$49.95	**$39.95**	**$10**
Squishy Circuits Deluxe Kit		KJ9352	$129	**$99**	**$30**
Vinyl Record Carry Case		GE4101	$39.95	**$29.95**	**$10**

HARDCORE

		Cat. No	WAS	NOW	SAVE
30 Piece Tool Kit with Case		TD2166	$29.95	**$19.95**	**$10**
3000A True RMS AC High Current Clamp Meter		QM1568	$49.95	**$39.95**	**$10**
300W Hot Air SMD Rework Station	HOT PRICE	TS1645	$159	**$129**	**$30**
8 Piece 1000v VDE Set		TD2031	$59.95	**$39.95**	**$20**
Benchtop 16-Bin Storage Organiser		HB6341	$49.95	**$34.95**	**$15**
2 Bay USB 3.0 SATA HDD RAID Enclosure		XC4688	$99	**$89**	**$10**
Arduino Compatible 16x16 LED Dot Matrix Module		XC4607	$24.95	**$19.95**	**$5**
Arduino Compatible 3W 200 Lumen LED Module		XC4468	$10.95	**$6.95**	**$4**
Arduino Compatible Ultraviolet Sensor Module		XC4518	$29.95	**$24.95**	**$5**
Long Range LoRa IP Gateway		XC4394	$99	**$79**	**$20**
USB Port Voltage Checker Kit		KC5522	$33.95	**$19.95**	**$14**

HOT OFFERS:
SAVE $200

DESKTOP 3D SCANNER V2 WITH SOFTWARE

Watch real life objects become digitized before your eyes. Scans up to 250 x 180mm. Sleek, foldable design for workspace storage. Comes packed with MFStudio software with +Quickscan.

- Scans up to 250(H) x 180(D)mm

TL4420 **WAS $1499**

See website for details.

NOW
$1299
SAVE $200

- **CAPTURES GEOMETRY IN AS FAST AS 1 MINUTE!**
- **SCAN OBJECTS WITH AN ACCURACY WITHIN +/- 0.1MM RESOLUTION.**

THREE FILAMENT 3D PRINTER

COLOUR MIXING TECHNOLOGY

DOBOT

MOOZ-3Z TRIPLE FILAMENT 3D PRINTER

- Equipped with a three-color print head for colour mixing
- Easy-to-use controller and mobile app
- Featured with 3.5" LCD touch pad, Wi-Fi USB connectivity, magnetic heat bed and more
- Supplied with a roll each of cyan, magenta and yellow filament to get you started.
- Prints up to: 100(H) x 100(Dia.)mm

TL4412 **WAS $1499**

See website for details.

NOW
$1299
SAVE $200

LOTS OF FILAMENT COLOURS & STYLES AVAILABLE PRICE FROM $19.95

PORTABLE BOOM BOX SPEAKER

Stream music from your Smartphone or Tablet via Bluetooth® in true stereo, or connect via 3.5mm Aux input.

- IPX5 Water resistant
- Bluetooth® Wireless Technology
- True Wireless Stereo (TWS)
- Google Assistant & Siri® Support

CS2499 **WAS $149**

NOW
$119
SAVE $30

5 PORT USB CHARGING STATION WITH STORAGE COMPARTMENT

- Charge up to 5 USB devices at the same!
- Maximum power output of 2.4A per port.
- Includes 6 dividers and a 12VDC, 4A power supply.

WC7766 **WAS $59.95**

NOW
$39.95
SAVE $20

7" LCD WIRELESS 2.4GHZ VIDEO DOORPHONE

Modern touch sensitive monitor with clear vision to identify visitors. Provides electronic door strike and gate control, as well as full talk-back to the outdoor unit. QC3884 **WAS $399**

- 2-way audio intercom
- Various melodies
- IP44 rated

NOW
$329
SAVE $70

2 FOR
$70
SAVE $49.90

15,000MAH PORTABLE POWER BANK

- 4 x LEDs show charge status
- Dual USB Type-A ports & 1 x USB Type-C port
- Up to 3A total power output

MB3806 **$59.95 EA.**

WIRELESS TWS SPORT EARPHONES WITH BLUETOOTH®

Fits comfortably and pairs very easily. Up to 3hrs play/talk time.

- Bluetooth® 5.0
- True Wireless Stereo (TWS)
- Built-in Microphone

AA2147 **WAS $69.95**

NOW
$59.95
SAVE $10

WI-FI IP CAMERAS WITH INFRARED LEDS

Suitable for night time use.

720P QC3849 **WAS $69.95**
NOW $49.95 (shown)
1080P QC3862 **WAS $79.95**
NOW $59.95

NOW FROM
$49.95
SAVE $20

R/C MOTORISED ROBOT ARM KIT

Ideal for anyone interested in robotic construction. 100g lift capacity. Supplied as a kit of parts with detailed instructions. Requires 4xD batteries (SB2321 **$8.95** sold separately). Ages 12+.

KJ8995 **WAS $139**

NOW
$99
SAVE $40

TERMS AND CONDITIONS: REWARDS / CLUB MEMBERS FREE GIFT, % SAVING DEALS, & MEMBERS OFFERS requires ACTIVE Jaycar Rewards / membership at time of purchase. Refer to website for Rewards / membership T&Cs. IN-STORE ONLY refers to company owned stores and not available to Resellers. Page 1: 10% OFF Flashforge Filament applies to all colours and sizes. FREE GIFT: Buy DashCam (QV3849) and get 32GB microSD card (XC4992) FREE. 15% OFF TV Mounting Brackets apply to CW2805, CW2811, CW2819, CW2834, CW2840, CW2851-53-59, CW2864-66-67-68-69, CW2874-75-76, CW2880-82-83. Page 3: Buy 1 x QC3890 + 1 x QC3896 for $249. MULTIBUYS: 2 x MS6106 for $30. 2 x MS6104 for $50. 3 x LA5046 for $99. Page 4: Buy 1 x MP3741 + 1 x MP3746 for $219. Page 6: MULTIBUYS: Buy ANY 3 KITS for $40 applies to KM1090, KM1092, KM1094, KM1096, KM1098, KM1099, KM1097 & XC3758 or any combination. FREE GIFT: Buy In-car Monitor (QM3752) and get Headphones (AA2047) FREE. Page 8: MULTIBUYS: 2 x MB3806 for $70. SUPPLY CHAIN DISRUPTION. We apologise for factors out of control which may result in some items may not being available on the advertised on-sale date of the catalogue.

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Arrival dates of new products in this flyer were confirmed at the time of print but delays sometimes occur. Please ring your local store to check stock details. Occasionally there are discontinued items advertised on a special / lower price in this promotional flyer that has limited to nil stock in certain stores, including Jaycar Authorised Resellers. These stores may not have stock of these items and can not order or transfer stock. Savings off Original RRP. Prices and special offers are valid from catalogue sale 27.12.2020 - 23.01.2021.

By John Clarke

ELECTRONIC Wind Chimes

Aaaah . . . wind chimes! They're so soothing . . . listening to the random notes as the wind creates its own melodies. But what do you do if there's no wind? Aim a fan at it? We have a better idea: our Electronic Wind Chimes removes your reliance on the wind, and even gives you the possibility of playing tunes using the wind chime, enriching the experience!

This circuit drives a wind chime using solenoids. It does so in a way that neither affects the tonality of the result, nor prevents the chimes from being operated by the wind in the normal way. So you get the best of both worlds.

More good news is that electronically, it is fairly simple and uses readily-available parts. So you should not have difficulty building it, nor is it likely to break the bank.

However, you will need a degree of mechanical skill to make it. Read on to understand why this is so.

Wind chime basics

Wind chimes play a series of notes that are generated by a clapper striking the sides of chime tubes. These tubes hang freely, so they can resonate at their tuned frequency when struck. The clapper is moved by a sail, which is driven by the wind. Fig.1 shows the basic arrangement.

The notes and sounds are very dependent on chime tube length, thickness and diameter and the hanging point.

The frequency is higher with smaller wind chimes – these tinkle away with a light breeze, producing high-pitched notes at a fast rate. Larger wind chimes produce lower-frequency tones at a slower rate.

Features & Specifications

- Drives wind chimes with up to 12 elements (or multiple smaller chimes)
- Suits a wide range of sizes from miniature chimes up to large ones
- Individual calibration of solenoid drive control parameters
- Sequence recording and playback
- Sequences with long delays can be recorded in shorter periods
- Optional randomisation of the time between chime strikes
- Adjustable randomisation parameters
- Optional automatic switch-off in darkness

SILICON CHIP

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Making Android Apps with App Inventor

The Android logo is Copyright Google Inc.

App Inventor is a free, cloud-based tool that lets you make your own Android apps. It's maintained by MIT and is run through most standard web browsers. Roderick Wall shows you how it can be used to make a simple TDR (time domain reflectometry) calculator for your phone, which can help with testing electrical cables for faults.

By Roderick Wall

The Massachusetts Institute of Technology (MIT) in the USA has released a free "App Inventor". This allows you to use blocks to design applications that run on Android phones and tablets.

I used it to create a TDR (time domain reflectometry) calculator, which calculates the distance to a fault in a transmission line, as in the TDR Dongle project from December 2014 (siliconchip.com.au/Article/8121).

You can download my SILICON CHIP TDR Android calculator app from siliconchip.com.au/Shop/6/5733 – see the end of this article for hints on how to install it on a phone or tablet.

Building an App

I used the following steps to design and create the TDR application. You can use a similar procedure to make your own custom Android application.

App Inventor is a cloud-based tool, which means you can build applications right in your web browser. The website offers all the support you need to learn and how to develop basic applications. Start by opening the following link in your browser: https://appinventor.mit.edu/explore/get-started

MIT also has an App Inventor Community forum where you can ask questions about your project. See https://appinventor.mit.edu/explore/library

While designing your project, if you run into a problem, try doing a Google search like "App Inventor How to X" (where X is replaced with your query) for quick answers to your questions. There is lots of information on how to use App Inventor on the internet.

Fig.1 shows the first window of the MIT App Inventor. To start a new project, click "My Projects" and select "Start new project". Note that you can download a source code file for the project (with a .aia file extension) that can be shared with your friends. It is a good idea to use this method to save

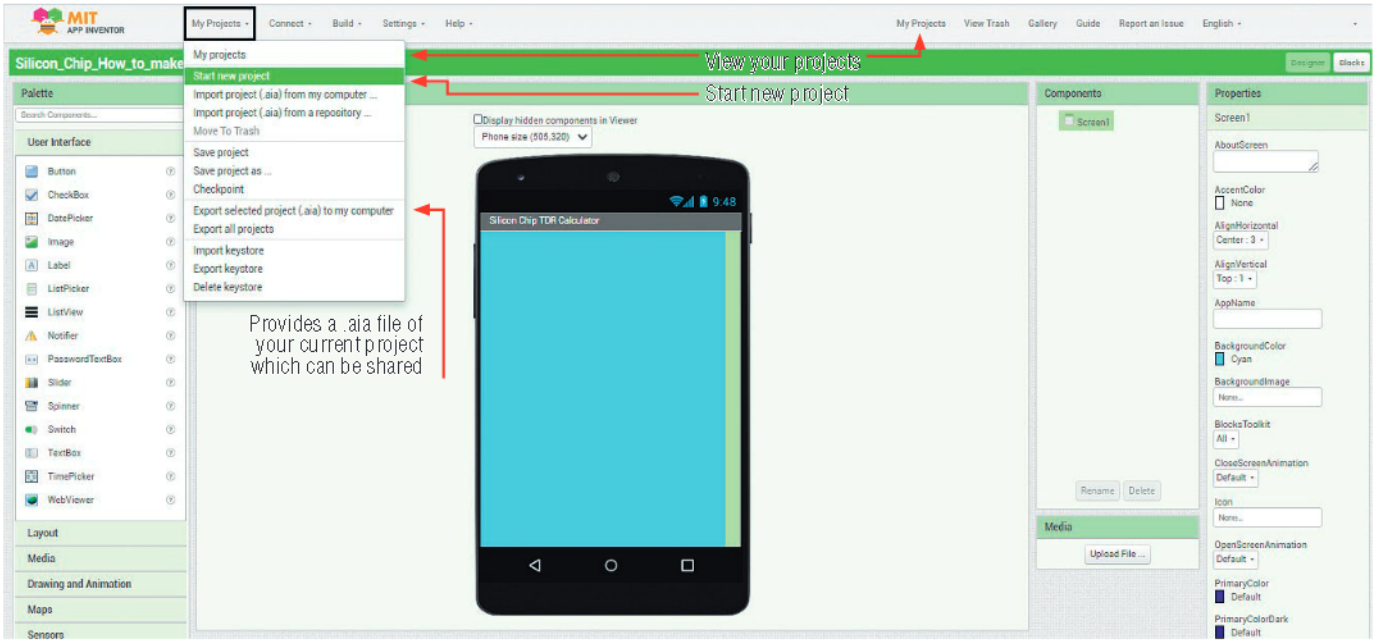

Fig.1: starting a new project in App Inventor is quite simple and the interface isn't as complex as most programming IDEs.

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It's great to work in a well-provisioned electronics lab with lots of bench space and plenty of test instruments and tools. But we don't all have that luxury! So we decided to come up with a way to cram all the most essential electronics tools into a small space, such as a typical desk, sharing space with a computer and possibly other gear. We even managed to keep the cost low!

We noted in our Mini Digital PSU project starting on page 38 that its design was partly driven by the need to create a compact solution that would fit on a small workbench.

Not only is the hardware for that design small, but because it can be controlled from a PC via a USB interface, it can be tucked out of sight altogether, taking up practically zero space on your bench.

We realised that, in addition to a power supply, another vital piece of test gear which usually takes up a lot of bench space is an oscilloscope. USB oscilloscopes have been around for a while now, so we decided to look into adding one to our setup.

BitScope Micro

A 'scope is very handy to have when it is needed, but you might go weeks or even months without touching it. And we wanted to keep the cost low.

After doing a bit of research, the BitScope Micro appeared to be a good option. It has two analog channels with 20MHz bandwidth as well as six digital logic channels – enough for common jobs like sniffing serial, I^2C and/or SPI traffic.

It interfaces with programs that can run on Windows, macOS and Linux, including on the Raspberry Pi. There isn't just one suitable piece of software, but several.

A DSO program allows the BitScope Micro to be used as either a digital or mixed-signal oscilloscope, and it can also generate analog waveforms.

There is also a Logic program which can perform protocol analysis, including SPI, I^2C, CAN and UART and a generator program can be used to generate arbitrary waveforms.

The Micro is only one of an extensive range of BitScope test gear; their products all work with the same software.

In any case, because the BitScope Micro is one of the cheapest USB oscilloscopes, and it can run from a Raspberry Pi, we decided to get one to test. And then we had an idea . . .

The Virtual Workbench

While testing the Mini Digital PSU, it occurred to us that sometimes it would be necessary to isolate the power supply output from the control PC. The grounds may need to be at different potentials; a direct connection cannot work as the ground of the Mini Digital PSU is is plugged into the ground of the USB host it is connected to, which is typically Earthed.

You could use a laptop or notebook computer running from its internal

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Want to (almost!) DOUBLE your computer's performance? by Nicholas Vinen

Upgrading to a Zen 3 CPU

The latest desktop processors from AMD, dubbed Zen 3 but also known as the Ryzen 5000 series, offer a 20% improvement in performance compared to their predecessors, making them the fastest desktop CPUs available at the moment. They are also quite affordable, and upgrading is relatively easy if you have a Ryzen processor on a newer motherboard.

I was prompted to upgrade my office PC (and write this article) by the very impressive performance numbers and reasonable prices that were revealed at AMD's Zen 3 launch last November.

At the time of writing this article, this line of CPUs (currently four strong) have taken the performance crown from Intel and are quite reasonably priced, with a choice of 6, 8, 12 or 16 cores.

For most people, the 5600X CPU with six cores for $469 is more than adequate, and will be a significant upgrade from previous generation chips.

If you have an AMD motherboard and upgrade your cooler and memory at the same time as upgrading the CPU, you can get a 30-50% increase in performance for around $600.

You might even get a bigger boost if you are using an earlier processor, and if you are willing to spend a bit more (up to say $1000), the gains can be huge.

I bought my previous CPU only a year ago, in January 2020, for $315 (a Ryzen 3600). It had six cores, with a base clock of 3.6GHz and a boost clock of up to 4.2GHz. It was already a massive upgrade over my previous (quite old) computer.

I decided to upgrade to a 5800X with eight cores, a base clock of 3.7GHz and a boost clock of 4.6GHz, and I am delighted that I did since the difference is very noticeable!

Even better, with the large air cooler I added, I am achieving clock speeds above AMD's specification, with a

base clock of 3.77GHz, a boost clock of 4.84GHz and sustained boost to 4.7GHz on all eight cores under load.

Or to put it in layman's terms, what a little ripper!

Upgrade requirements

To upgrade to one of the new Zen 3 CPUs (Ryzen 5600X, 5800X, 5900X or 5950X), you need an AMD chipset motherboard with a three-digit code starting with a 4 or 5. That means a 450B, 470X, 550B or 570X based board.

Assuming you have one of those, you need to perform a BIOS update to support the new CPUs. Then it's just a matter of swapping over the chips, and away you go.

As I mentioned earlier, unless you have a high-end air cooling or water cooling solution, it's probably also a good time to upgrade that.

With dynamic thermal throttling, the cooler you can keep the CPU, the faster it will perform under load. And also you can get silent operation at idle or moderate loads with a decently efficient cooler.

Air vs water cooling

The 'stock' heatsink/fan combination that came with my original Ryzen 3600 CPU did its job, but I immediately regretted not spending a bit more money on a custom cooler to make the computer quieter and run a bit faster under heavy load (going into thermal throttling later).

Decent third-party air coolers range from about $50 up to $150 or so. Water cooling solutions start at the upper end of that range.

The main advantage of water cooling a CPU is the potential for slightly better and somewhat quieter cooling under heavy load, and a much larger thermal mass which means that they cope well with 'bursty' loads.

But they cost more, and while these days leaks are rare, they can happen. And air coolers are quieter at idle and light loads. So most people will probably stick with air cooling.

We'll cover air vs water cooling more in a future article.

For my system, I bought a Deepcool Assassin III dual tower, dual-fan cooler for around $134 from Amazon as it was considerably cheaper than the other well-regarded large air coolers like the Noctua NH-D14, NH-U14S or NH-DH15. Since then, I have seen the Assassin III on sale for $20 off (about $114), which I think is an excellent deal.

One thing that you should do, which I didn't, is to compare the height specification of the cooler to the amount of space available in your case (ie, from the top of the CPU to the inside panel of the case) to make sure it will fit. This almost caused a disaster, which was narrowly averted, as you shall see.

Choosing faster RAM

Assuming that you have a compatible motherboard and can get your hands on a Ryzen 5000-series CPU, order a suitable cooler and then have a think about upgrading your RAM. Zen 3 CPUs can take advantage of very fast RAM, and 4000MHz DDR4 is ideal.

I had 3200MHz RAM and decided to upgrade to 3600MHz, as I found that to be the best value (faster RAM than that is very expensive).

You could also consider increasing your RAM capacity while you're at it. But don't forget to consider the column address strobe (CAS) latency, generally specified as a number following the letters "CL".

For example, you might see 2 x 8GB (16GB) 3600MHz DDR4 DIMMs for $135 and 2 x 16GB (32GB) 3600MHz DDR4 DIMMs for $239. The 2 x 16GB seems like a better option than two lots of 2 x 8GB (assuming your board has four DIMM slots) as it is $31 cheaper.

But if you look closer, the first option is CL17 and the second option is CL18. That means that the 16GB DIMMs take one clock cycle longer to respond to column address changes compared to the 8GB DIMMs.

How much does that matter? I am not sure. I suspect the CL17 DIMMs will give a couple of percent better performance in some tasks. I don't think that is necessarily worth spending the extra $31 and also halving the maximum RAM you can install in your system, but it is something to keep in mind.

I have seen other cases where doubling the memory per stick takes you from CL17 to CL19, or from CL16 to CL18, which is going to have a more significant impact, and often the price difference is negligible.

Ultimately, you will have to do some shopping around and decide what combination of MHz rating, CL rating,

Obviously (!) not to scale, here are the components which form the heart of my computer upgrade: at lower left is the ZEN 3 CPU; behind that a pair of 8GB 3600MHz DIMM sticks, while at right is the Deepcool Assassin 3 dual tower, dual-fan cooler. The first two items give dramatic improvement in performance; the latter ensures it all keeps its cool.

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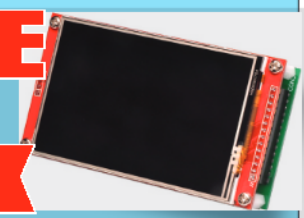
AUSTRALIA'S OWN MICROMITE TOUCHSCREEN BACKPACK



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See August 2019 (Article 11764)

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- 16x2 I²C LCD (Digital RF Power Meter, Aug20) **$7.50**
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02/21

By Jim Rowe

The Geekcreit LCR-T4 Mini Digital Multi-Tester

It's hard to believe, but you can get a compact digital tester which will identify, check and analyse bipolar transistors, JFETs, Mosfets, diodes, LEDs and thyristors, resistors, capacitors and inductors for less than most joints charge for lunch these days! The Geekcreit LCR-T4 does all of the above and will cost you about $12.50, or more if you want it in a case rather than just a bare board.

When I first saw the Geekcreit LCR-T4 advertised on the Banggood website, I thought it was too good to be true.

It was described as a "128x64 LCD Graphical Transistor Tester Resistance Capacitance ESR SCR Meter", priced at only $8.74 plus $3.94 for airmail to Australia – a total of just $12.68! I was curious and so ordered a couple straight away.

When they finally arrived (about five weeks later), unfortunately, I found that one of the two LCR-T4s was damaged in transit. There was a chunk of glass broken off the top right of its LCD panel, and the bottom half of the screen wasn't working. Luckily, the other unit worked fine, so I was able to proceed with the review.

I then discovered that it is also available with an assemble-it-yourself clear plastic shell, for $21.18 plus $3.93 air parcel shipping – a total of $25.11. I ordered one of those as well, based on my positive impression of the 'naked' version, but it hasn't arrived yet.

Components and construction

The multi-tester is built on a single PCB measuring 73 x 60mm. The only components on the front are the 128x64-pixel LCD panel with green LED backlighting, a 14-pin ZIF socket used to connect to the device being tested, and a pushbutton switch to initiate testing.

The rest of the tester's components are on the rear of the PCB, including an ATmega328 MCU (microcontroller unit), an 8MHz crystal, a 78L05 regulator, a TL431AN 2.5V voltage reference, three small SOT-23 bipolar transistors, two 1N4148 diodes and a handful of passive components.

The tester uses a 14-pin ZIF socket because it provides a range of options when it comes to components with different pin configurations and spacing. Although there are only three inputs (logically labelled 1, 2 and 3), the two rows of seven pin positions on the ZIF socket are connected in this order: 1-2-3-1-1-1-1 (left to right). This gives you quite a bit of flexibility for connecting different devices.

There's also a small 'D-PAK' type array of plated copper pads for receiving SMD components, just to the right of the ZIF socket. Presumably, SMD devices to be tested have to be pressed against the PCB to make decent contact during testing.

The complete tester is powered by a standard 9V battery via a battery clip lead.

It's straightforward to use

What, no power switch? Well, the pushbutton switch on the front of the PCB does everything. If it hasn't been pressed, the tester is in 'sleep' mode with its current drain from the battery less than 20nA.

When you do press the button, the tester springs to life. The LCD backlight immediately turns on, and the screen displays the message "Testing ...", together with an indication of the battery voltage, like "[Vbat = 9.15V]".

Then the tester starts checking to see if anything is connected to the inputs. If it doesn't find anything, it displays a large question mark, plus the message "No, unknown or damaged part".

But if it does find an NPN or PNP bipolar transistor, a JFET, a Mosfet, a diode, an SCR, a Triac, a resistor, a capacitor or an inductor connected to the

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VINTAGE RADIO

Philips BX205 B-01 superhet radio

By Charles Kosina

This 1950s valve radio is switchable between AM broadcast band and shortwave reception. Strangely, it uses battery valves but does not have a battery compartment, and it also has no internal antenna. Nor does it have any stations marked on the dial. It's a bit of a head-scratcher!

I bought this radio a couple of years ago on eBay. It didn't work, and as I couldn't immediately figure out why, I got bored with it.

So it sat in a corner (metaphorically speaking) for quite a while. With the previous lockdown in Melbourne, "one of these days" finally arrived, so I decided to resurrect it.

Its tuning covers two bands: the usual medium-wave band from 530kHz to 1600kHz, plus a shortwave band from about 5MHz to 16MHz.

It uses four battery valves with 1.5V filaments, but there is no battery compartment. It came with a cord attached, but no plug on the end. Presumably, the idea was that you wired it up to a pair of batteries hidden away in a nearby cabinet.

As it has no internal loop or ferrite rod antenna, it requires an external antenna. It doesn't seem to be a model made specifically for Australia as the dial does not show radio station names, just a rough indication of frequency and wavelength.

When I got it, the radio was in reasonable condition, with only minor scratches on the Bakelite case. To remove the chassis required removal of the rear heavy cardboard cover, two screws that held the chassis in place, and the knobs. The loudspeaker looked rather moth-eaten with a couple of holes, but seemed workable.

The speaker transformer is in an unusual large cylinder at top right, visible in the top view of the chassis. The bottom view shows the messy wiring which is typical of radios of that era. It makes modifications somewhat tricky.

The circuit diagram (Fig.1) shows that it is a fairly standard design. The copy I managed to download did not have very readable lettering, but with the aid of Photoshop, I cleaned it up. I also added the component values and pin numbers for the valves. That made circuit tracing much easier.

One of the banana sockets on the back of the set is for a ground connection and the other two are the antenna inputs. The top one connects directly to the input coil (S1 or S3) via the band selection switch. The second connection is via 100kΩ resistor R14 and is marked for LOCAL stations. I think that the station would have to be awfully close to get through that much attenuation.

The input transformer secondaries (S2 or S4) are applied to grid 3 of B1, the DK92/1C2 pentagrid valve, again via the band selection switch. The local oscillator uses grids 1 and 2. The tuning capacitor is a two gang unit, C4 and C5.

Band changing

The switching between the two bands is rather complex, and interpreting the diagram is no mean feat! On the antenna coil side, it is essentially a 4-pole, 2-position switch.

Two poles are used for switching the antenna between the medium-wave, S3 coil and the short wave S1 coil. The other two poles switch grid 3 of B1 between the tuned secondary coils, S2 and S4.

The local oscillator gets a bit more complicated. The medium-wave tuning range is 985kHz to 2050kHz, ie, 450 kHz above the tuned input frequency. The padding capacitor C14 (476pF) is

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Notes & Errata

Busy Loo Indicator, January 2021: at the bottom of the left-hand column on p79, where the text says the inputs of IC1b are normally high, it should read IC1d instead.

Mini Digital AC Panel Meters, January 2021: if the current transformer secondary is not terminated with a low impedance, it will generate a very high (and potentially dangerous) voltage if any significant AC current is flowing in the primary. So make sure to connect the secondary leads of the CT to the panel meter before any current is allowed to flow through the primary.

Radiating test antenna for AM Radios, Circuit Notebook, January 2021: the ferrite rod is 200mm long, not 400mm as stated in the text.

Vintage Battery Radio Li-ion Power Supply, December 2020: on page 28, the text refers to a 220µF capacitor being charged via a 220Ω resistor. The capacitor value is actually 10µF.

Colour Maximite 2, July & August 2020: the SD card socket specified for this project (Hirose DM1AA-SF-PEJ(21)) is being discontinued by the manufacturer. Instead, use the DM1AA-SF-PEJ(82) which costs the same and fits the existing footprint on the PCB.

The March 2021 issue is due on sale in newsagents by Thursday, February 25th. Expect postal delivery of subscription copies in Australia between February 23rd and March 12th.

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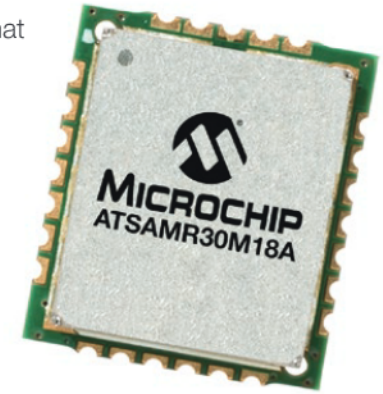

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