SERVICEMAN'S LOG

When in doubt, swap it out

Dave Thompson

I've had a few cases recently where components tested OK with the usual procedures, but they were still far enough out of spec that they fell over when put back into use. This can be a very frustrating aspect of troubleshooting; dud components can throw up all sorts of red herrings, without having any really obvious signs that they're toast.

Items Covered This Month

- The art of troubleshooting
- Chromagen water heater repair
- Multiple capacitor replacements

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Servicemen are much like detectives, in that we are always looking for evidence to explain why something doesn't work or isn't performing as expected. The majority of the time, we are familiar enough with the job we are doing (whether from experience or just dumb luck), so we don't need to overwork our 'little grey cells'. But there are times we need to think outside the box to fix a problem.

Most of the electronics repair jobs that come through my workshop are too mundane to mention. The most common ailment in many of these devices is dodgy soldering. Regardless of whether it is the result of mass-production quality control or the solder breaking down over years of use, if any one of those joints fails, things stop working.

This means that a simple clean-up and re-solder may be all that is required to resolve a seemingly complex problem. Anybody with a little soldering experience should not be afraid to give this a try.

Coming a close second would have to be faulty capacitors; leaking and bulging electrolytics, and those which have gone high-ESR due to the electrolyte drying up, have felled many a gadget over the years. Computer motherboards are notorious for this, but any device which operates at an elevated temperature is at particular risk. Plastic film caps can also go bad, especially those on the mains input side.

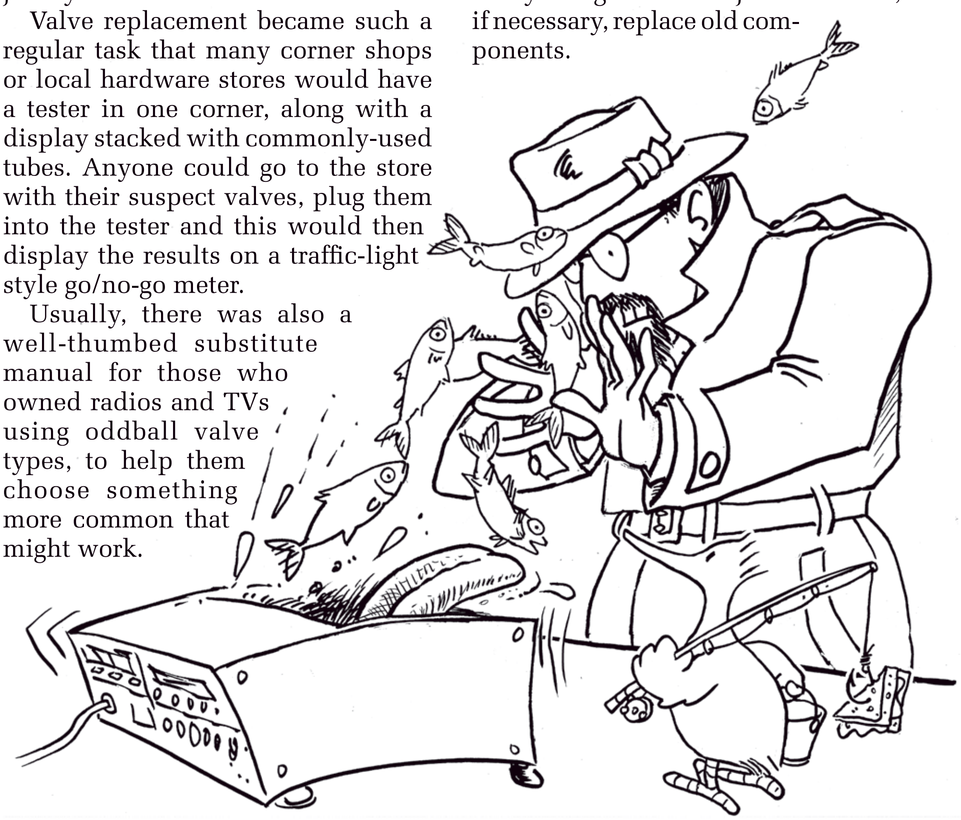
But back in the golden age of electronics, there was a whole other class of electronic component failures. Often, fixing a device would require replacing parts that had 'worn out'. In the days of valves, this meant pulling the tubes, plugging them into a tester (which any workshop worth its salt had on hand), and if the machine told us the valve was 'weak' or 'gassy', we'd simply replace it with a new one.

Over-reliance on such machines put one at risk of being labelled a "valve jockey"!

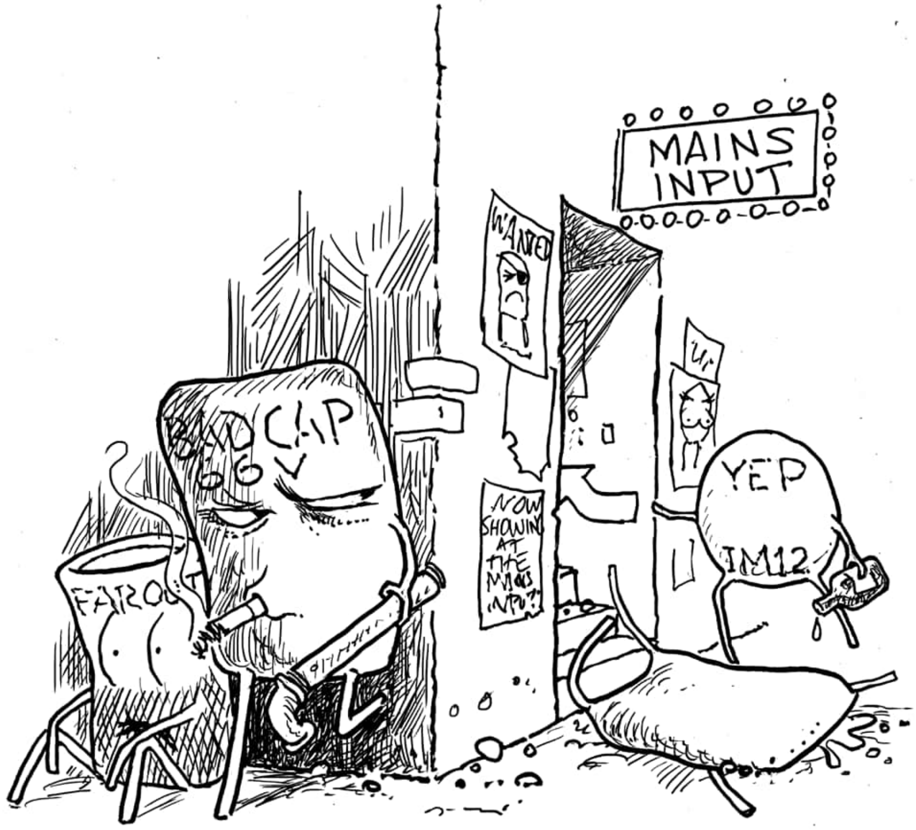
Valve replacement became such a regular task that many corner shops or local hardware stores would have a tester in one corner, along with a display stacked with commonly-used tubes. Anyone could go to the store with their suspect valves, plug them into the tester and this would then display the results on a traffic-light style go/no-go meter.

Usually, there was also a well-thumbed substitute manual for those who owned radios and TVs using oddball valve types, to help them choose something more common that might work.

In cases where the tubes weren't the problem, it became a job for the serviceman. More than likely, some capacitors, inductors or resistors would need replacing, typically failing due to the high voltages and operating temperatures valve gear could reach. The point-to-point wiring commonly used at the time meant it was a relatively straight-forward job to test and, if necessary, replace old components.



DUD COMPONENTS CAN THROW UP ALL SORTS OF RED HERRINGS...



~ PLASTIC FILM CAPS CAN ALSO GO BAD, ESPECIALLY THOSE ON THE MAINS INPUT SIDE

When we transitioned to transistor circuits, PCB construction became commonplace, making troubleshooting more challenging. Circuit boards enabled complex circuits to be crammed into smaller areas, and often these were not laid out logically as tube gear often was, requiring more attention to detail and an increasing reliance on documentation.

A behemoth arrives on my workbench

I recently had a large, 70s-era Pioneer transistor amplifier through the workshop. Like many decent amps of the time, this beast weighed a ton. Most of this weight came from the massive power transformer, although the heavy steel chassis and polished walnut case also contributed significantly.

Crucially, it also came with a comprehensive service manual and dinner-table-sized fold-out circuit diagram, all of which makes working on these older devices so much easier.

The amp's main symptom was an increasing trend for the anti-thump/speaker connection relay not to kick in, meaning zero sound output. If the relay did engage, it would then drop out at various times. Usually, this points to either the relay itself getting tired, or perhaps a related capacitor failing. So those components were the obvious place to begin troubleshooting.

I first confirmed the fault before proceeding; while I did not doubt that after 40 years, the amp's owner knew every little thing about it, there is nothing as informative to a trouble-shooter as witnessing the actual fault in action. So when possible, this is what I prefer to do.

I plugged the amp in and toggled the seriously solid power switch to on. I found the relay wouldn't kick in at all most of the time. The odd time it did click in, it would soon let go again. At one point, it chattered, engaging and quickly disengaging, so I quickly powered it down. Something was obviously wrong in there somewhere (that's a really technical statement, I know).

Working on this type of amp is a real pleasure. They are designed to come apart easily, and everything inside is laid out so it can be worked on. Everything is clearly identified with part numbers, track outlines and board designations all screen-printed on the PCBs.

Wire-wrapped connections

This amplifier also used the now mostly forgotten technique of solderless wire-wrapping. Individual, colour-coded single-core wires are laid out and then the ends are twisted a dozen times or so around numbered PCB pins, usually mounted on the edges of the boards, connecting the different sub-systems together.

This makes it relatively easy to logically track inputs and outputs and also helps to relate everything to the circuit diagram.

Admittedly, there are downsides to this method of construction; over time, vibration can wreak havoc with this type of connection, though this is not too much of an issue with a big heavy amplifier (unless it is sitting on a subwoofer!).

It also becomes a pain if we want to remove or replace one of these wrapped wires, because once it is un-twisted from its post, it is almost impossible to reattach it in the same manner without a proper wire-wrapping tool.

Another potential problem is that over time, dissimilar metal or galvanic corrosion between the wire and post can cause even the most tightly-wrapped wire to go high-resistance, or fail altogether. In their defence, the designers probably didn't anticipate their amps would still be in regular use 40 years later!

Fortunately, the PCB pins are tinned and thus readily soldered, so reconnecting the wires is easy. You just need to trim off the old wrapped part of the wire, strip about a centimetre of insulation and tin the core before twisting it around the post a few times and then sweating it all together.

Wrapping it the old way would retain the vintage vibe of the amp, but two things prevented me from doing this. One, I don't have the wrapping tools needed. And two, I'd need about 25mm of wire to wrap it back onto the post, and while most of these wires had some extra length, there wasn't enough spare for me to chop them down and still have it run nicely in the existing looms.

While the owner didn't care about that aspect of the repair, I did make it a point to ask him, as some people can be very finicky about such details.

Tracing the fault

I started by working backwards from the speaker connectors. The next component in line was the anti-thump relay. Getting it out was as easy as desoldering the relevant wires from the terminals at the bottom, and removing a single mounting screw. The relay cover and relay then lifted out through the upper section of the amp.

Basic tests on the coil and contacts using a multimeter and my benchtop power supply proved the relay was still very much alive and working correctly. This was fortunate; according to my research, it was hard to get a direct replacement. I'd have needed to substitute it with a relatively expensive type, with modifications to the relay's cover, terminals and the chassis to make it fit and work.

The next step was to check the relay driver board. This, according to the circuit diagram, should have 24V present on a couple of the output pins. While I measured a voltage on those pins, it was low and variable. I disconnected the relay coil wires and measured again, with the same result.

There were about half a dozen electrolytic capacitors on this board; several of the larger caps had distorted plastic jackets, a sure sign of excessive heat and/or possible damage.

So the board would have to come out, but there were 25 wire-wrapped connections divided between the input and output sides of the board. I therefore took several detailed photographs before removing it. I didn't want to have to rely on the circuit diagram to track every connection in and out of that board if I didn't have to!

The various satellite boards in the amplifier are held in using white plastic 'AT' style standoffs, similar to those used back in the day to attach motherboards to a computer case.

These have an expanding clip at the end that pop into place once the board is seated down. The PCBs have a 3mm hole in each corner that fit onto the clips. These simple fasteners work so well in anchoring the PCBs, that they can be a pain if you want to release the board.

Many people use a pair of sidecutters or long-nose pliers to pinch the expanded splines together, one by one, so they can ease the board up off the clips. I use an ancient pair of Xcelite transverse end-cutter pliers that I poached from dad about 45 years ago.

While once probably sharp on the cutting edges, they certainly aren't now. As they fit perfectly over the clips, it's really easy to pinch the splines without fear of mangling them, or worse still, accidentally chopping one off flush with the board.

Finding more faulty components

With the driver board out, I removed and measured the suspect caps to work out which ones might be failing. I use one of those little Peak LCR40 meters to test capacitors, resistors and inductors. I won it years ago in some competition or other, and it was such a useful device that I went out and bought another one, just in case.

That one has never been out of the box, except for me to take the battery out for storage. I suppose I should pass it on to someone who could get some use out of it. Perhaps Silicon Chip can dream up some reason for a giveaway…

Anyway, to test a component, I clip the leads on, hit a button and read the results. While they claim this machine can be used in-circuit, I've found it not as accurate as if the component is tested off the board. In this case, half the capacitors were well out of tolerance, with some obviously very leaky. I replaced them all.

While the board was out, I also tested the dozen or so transistors. For these, I used my Peak Atlas semiconductor analyser. This is another extremely useful tool. Whether the component has a part number on it or not, this tool will tell me what it is, the pinouts and whether it is any good.

Obviously, it is better to have a type number so I can refer to a data sheet for specs, but in a pinch, when I haven't been able to identify some ancient TO-92 or TO-18 package device due to age or deliberate part-number obfuscation, it has saved me many times.

I removed each transistor and tested them. I found two that gave "component not detected" on the Atlas, which is always a bad sign. Fortunately, the numbers were clearly visible, though I also had the circuit diagram which clearly stated which part went where. I replaced these older NPN types with a suitable (tested) substitute from my parts bins.

Once that was done, I re-mounted the board onto the standoffs, being careful not to push it down below the clips in case I needed to lift it out again. I stripped, tinned, wrapped and soldered the connection wires back into place.

Something smells a bit off

When I powered it up to test it, the relay didn't click in at all, and I noted the faint-but-familiar smell of something heating up. Old electronics getting hot have a distinct scent, and I am very attuned to it.

After powering the amp down, I broke out my laser thermometer and aimed it around the relay driver board; nothing remarkable there. I then shone it over the main power supply board, which sits adjacent to the relay driver board. I got some high thermal readings from the heavier-duty components near the output of the PSU board.

This PCB contained everything necessary to provide the wide range of voltages the amp needs. Its output voltages range from ±3.5V to just over 50V. One of the four TO-220 heatsink-mounted output transistors and some of its associated components were heating up under load, so it was clear that this board would also have to come out.

More photos and wire-unwrapping followed before I could remove the power supply PCB. While that was disconnected, I measured the outputs of the power transformer, just in case something was wrong with it. All AC outputs measured within a volt of what the circuit diagram specified, so the problem had to be somewhere in this power supply board…

Once again, I worked through the caps and smaller transistors associated with the suspect part of the supply. While some of the voltage outputs were achieved using simple resistive voltage-divider networks, the rest was set out in clearly defined sections of the board, making troubleshooting a bit easier.

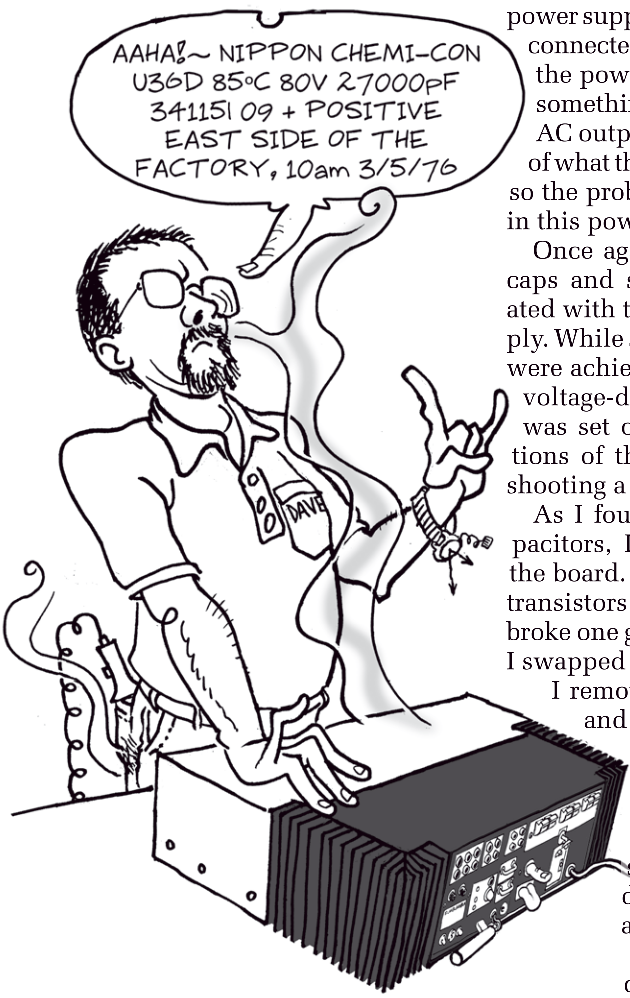
As I found several more dead capacitors, I replaced all of them on the board. A few of the TO-92 driver transistors were also suspect (and I broke one getting it out for testing), so I swapped them all out too.

I removed the output transistors and tested them; one was significantly different in my test results than the other three but still 'passed' according to my tester. I substituted a similar spec device from my parts bins anyway.

One of the more time-consuming parts of this process is tracking down all the different datasheets for these old 2Sx series (Japanese coding scheme) components and finding equivalents. Fortunately, I have Google and a good supply of older transistors so I can replace any dodgy components with similar types.

I used new electrolytic capacitors, but all the replacement transistors were new, old stock (NOS) devices around the same age as the originals.

There wasn't that much else on this power board; no complicated, mysterious, impossible-to-test proprietary ICs or other unknown parts, just meat-and-potatoes analog components. Working on this type of hardware is such a pleasure compared to the stuff manufacturers churn out for today's throwaway culture.



OLD ELECTRONICS GETTING HOT HAVE A DISTINCT SCENT & I AM VERY ATTUNED TO IT

All my effort pays off

I reconnected all the wiring and sat the power supply board in-place, again without clipping it home. This time when I flicked the power switch, nothing happened, until a satisfying clunk from the relay pulling in signalled that the anti-thump was working.

On powering down, the relay dropped instantly. I cycled it about a hundred times over the next few hours; the relay pulled in without fail every time. A scan using my thermometer over the boards revealed nothing was getting warmer than ambient temperature.

I was very happy with the result. But this story serves a cautionary tale that just because any given tester says a component is good doesn't mean it will work properly. My motto is: when in doubt, swap it out!

Editor's note: on a similar theme, I had multiple people test the battery in my wife's car and tell me it was OK, but we continued having problems with certain 12V-powered accessories in the vehicle. Running out of ideas, I decided to replace the battery on a hunch.

Out of the car, I charged it fully and left it to sit overnight. The voltage dropped to 12.68V, when it should have stayed above 12.9V. I suspect that those battery testers only check how much current can be drawn, which will detect some faults but not others.

Now that I have a good battery in there, I realise that it was faulty right from the day she bought the car new. We just weren't familiar enough with it at the time to notice the signs. For example, we can now sit in the car with the radio going for more than two minutes without it shutting down!

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Micromite Plus BackPack – Nov 16

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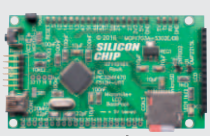
KIT INCLUDES:
PCB, 2.8-inch touchscreen and lid
Programmed PIC32MX470F512H-120/PT
3.3V LDO regulator plus Mosfets for PWM control backlight
MCP120-270 supply supervisor
20MHz low-profile crystal
green SMD LED
micro USB & microSD sockets
Right-angle tactile switch
SMD capacitors and resistors
pin headers and shorting block
mounting hardware

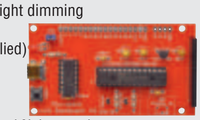


Micromite BackPack PLUS Kit (Cat SC4024) – $70.00

Micromite BackPack V2! – May 17

The V2 version of the Micromite LCD BackPack incorporates the Micro-bridge, which adds a USB interface and the ability to program/reprogram the PIC32 chip while it's onboard. And the BackPack V2 also adds software control over the LCD backlight.

KIT INCLUDES:
PCB (green)
2.8-inch touchscreen with 320x240 pixels
Programmed microcontrollers and IC sockets
Mosfets for PWM-controlled backlight dimming
3.3V low-dropout regulator
All capacitors (ceramic types supplied)
2 1kΩ & 2 10kΩ resistors
Pin headers (male and female)
UB3 lid (laser-cut 3mm acrylic)
Tapped spacers, machine screws and Nylon washers

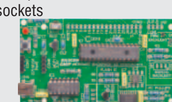


Micromite BackPack V2 Kit (Cat SC4237) – $70.00

Micromite BackPack V3 – Jul 19

The V3 BackPack is the most convenient and powerful yet! It has all the features of the V1 and V2 BackPacks and supports both 2.8in and 3.5in touchscreen displays plus five new optional features: extra memory, a real-time clock, infrared receiver, temperature, humidity and pressure sensors and more!

KIT INCLUDES:
PCB (green)
3.5-inch colour touchscreen with 480x320 pixels
Programmed microcontrollers and IC sockets
3.3V low-dropout regulator
All capacitors (through-hole ceramic types supplied)
2 1kΩ & 2 10kΩ resistors
Pin headers (male and female)
Mosfets for PWM-controlled backlight dimming
Tapped spacers, machine screws and Nylon washers
UB3 lid (laser-cut matte/gloss black 3mm acrylic)



Micromite BackPack V3 Kit (Cat SC5082) – $75.00

For more information search for all Micromite BackPack articles at siliconchip.com.au

Specialised components for MICROMITE BACKPACK projects published in SILICON CHIP

Parking Assistant
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Boat Computer
VK2828U7G5LF GPS module with antenna and cable: siliconchip.com.au/Shop/7/3362 — $25.00

Super Clock
VK2828U7G5LF GPS module with antenna and cable: siliconchip.com.au/Shop/7/3362 — $25.00
DS3231 real-time clock (RTC) with mounting hardware: siliconchip.com.au/Shop/7/3491 — $5.00
DS3231+ rechargeable LIR2032 cell: siliconchip.com.au/Shop/7/3519 — $7.50

Energy Meter
DS3231 real-time clock (RTC) with mounting hardware: siliconchip.com.au/Shop/7/3491 — $5.00
DS3231 + rechargeable LIR2032 cell siliconchip.com.au/Shop/7/3519 — $7.50
ACS718 20A isolated current monitor IC: siliconchip.com.au/Shop/7/4022 — $10.00
Main PCB [04116061 RevI]: siliconchip.com.au/Shop/8/4043 — $15.00
Matte black UB1 lid: siliconchip.com.au/Shop/19/3538 — $10.00

Voltage/Current Reference
Short form kit:
All parts including PCB, but not including the BackPack module, case, power supply, PCB pins and wire siliconchip.com.au/Shop/20/3987 — $99.00
Matte black or blue UB1 lid: SC4084/SC4193 — $10.00
Main PCB [04110161] as separate item: siliconchip.com.au/Shop/8/3988 — $12.50

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AD9833 DDS module: siliconchip.com.au/Shop/7/4205 — $25.00

Deluxe eFuse
IPP80P03P4L04 P-channel Mosfet (2 rqd): siliconchip.com.au/Shop/7/4318 — $4.00
LT1490ACN8 op amp (2 rqd): siliconchip.com.au/Shop/7/4319 — $7.50
BUK7909-75AIE N-channel SenseFET (2 rqd): siliconchip.com.au/Shop/7/4317 — $7.50
Main PCB [18106171] siliconchip.com.au/Shop/8/4370 — $12.50
Matte black UB1 lid: siliconchip.com.au/Shop/19/4316 — $7.50

Radio IF Alignment
AD9833 DDS: siliconchip.com.au/Shop/7/4205 — $25.00

Altimeter/Weather Station
DHT22/AM2302 temp. & humidity sensor: siliconchip.com.au/Shop/7/4150 — $7.50
1A/500mA Li-ion/LiPo charger board: siliconchip.com.au/Shop/7/4308 — $15.00
GY-68 pressure/altitude/temperature sensor: siliconchip.com.au/Shop/7/4343 — $5.00
5V 0.8W 160mA solar panel: siliconchip.com.au/Shop/7/4339 — $4.00

Tariff Super Clock
VK2828U7G5LF GPS module with antenna and cable: siliconchip.com.au/Shop/7/3362 — $25.00
DS3231 real-time clock (RTC) with mounting hardware: siliconchip.com.au/Shop/7/3491 — $5.00

GPS-synched Frequency Reference
Short form kit:
All SMD parts and PCB. Not including BackPack module, case, power supply, GPS module, connectors and a few through-hole parts: siliconchip.com.au/Shop/20/4762 — $80.00
VK2828U7G5LF GPS module with antenna and cable: siliconchip.com.au/Shop/7/3362 — $25.00
Main PCB [04107181] as a separate item: siliconchip.com.au/Shop/8/4728 — $7.50

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Previously, I thought that this behaviour was simply due to an over-cautious low battery cutout setting.

Chromagen water heater repair

R. W., of Mount Eliza, Vic noticed a problem with his Chromagen gas/solar water heater. As in past cases of similar faults, the repair was simple once the faulty part had been tracked down. Here is what happened...

How do you know if a solar hot water system is working correctly? I was checking it by seeing if the pump was working and testing the temperature of the return pipe with my hand, to see if it was hotter than the supply pipe to the roof. Because the return pipe was hotter, it appeared that it was working correctly. But I was wrong,

One night, I was by the hot water tank and noticed that the pump was still running even though there was no sun. The supply and return pipes were at the same temperature. This meant that it was pumping the hot water from the tank and dissipating heat energy into the air. No wonder the gas bill was high! I set out to determine the reason for this.

There is a temperature sensor that is mounted on the solar panels on the roof, and a second temperature sensor at the bottom of the hot water tank. A Kanitti Solar Controller mounted on the tank controls the mains-powered water pump.

When the solar panel sensor temperature is at least 4°C above the tank temperature, it switches on the water pump. The pump is switched off when the solar panel sensor temperature is less than 1°C above the tank temperature.

The temperature sensors are connected to the controller via RCA plugs and sockets. I disconnected the sensors and used a multimeter to measure their resistances. The solar panel sensor read 392Ω while the tank sensor read just under 10kΩ.

I e-mailed Kanitti requesting a service manual or a circuit for the solar controller, so I could determine whether these readings were correct. Even though it was midnight, within 10 minutes, I got a reply indicating that I should not try to service the controller as it could be dangerous. They also told me that the problem is more likely to be the temperature sensors and indicated that the sensors are 10kΩ NTC thermistors.

This indicated that the solar panel sensor resistance reading was wrong, because 392Ω for a 10kΩ NTC thermistor corresponds to a temperature of about 120°C! The problem could be either in the sensor itself or in the extension cable. I got up onto the roof and disconnected the sensor, then measured the resistance across the cable wires, which was very high. So it must be a faulty sensor.

I ordered a new sensor from Chromagen for $64 plus $20 postage and received it the next day. I then searched the Chromagen website and found a manual that included (on pages 36 and 37) a test procedure for the controller and temperature sensors. Before replacing the sensor, I turned off the main water tap and mains power to the controller.

I carefully got up on the roof to swap in the new sensor. The connection to the extension cable is under the roof tiles, so I had to slide up a roof tile to gain access. I then disconnected the old sensor and connected the new one. I tied the connectors together to stop them from coming apart, then slid the roof tile back into place.

The installation procedure also shows how to purge any air that might get into the system.

But I used a simpler procedure; I partly screwed in the temperature sensor and turned on the mains water tap. The water pressure allowed the air to escape. When water started to escape too, I completely screwed in the sensor to finish the job.

Back at the solar controller, I used my multimeter to re-check the sensor resistance. I measured 13.46kΩ, which equates to 14°C. The tank sensor measured 11.53kΩ, which corresponds to 17°C. So these readings now seemed sensible. So I plugged them back in and switched on mains power to the controller.

As the temperature difference was less than the 4°C required to activate the pump, I had to wait for the solar panel temperature to rise before the water pump would turn on. Which it did, indicating that it was working correctly.

When reading the manual on how to purge any air that gets into the system, I noticed a section that indicates that the water flow rate should be 0.75L/min for a single solar panel and 1.75L/min for two-panel systems. On checking the flow rate, I found that it was well over 3L/min.

The water pump has a switch to select between three different speeds. It was set at the highest speed. Setting the switch to the lowest speed caused the flow meter to indicate a flow rate of 3L/min. I then rotated a screw above the flow meter to make the final adjustment, setting the flow rate to 1.75L/min as we have two solar panels.

From now on, I will check that the water pump is not working at night when there is no sun. Only Harry Hindsight knows how long the system was not working correctly. He should have told me earlier!

Multiple capacitor replacements

R. E., of Townsville, Qld appears to be cursed because pretty much every motor in his house has failed lately, and in some cases, more than once! Luckily, he is now pretty adept at fixing them…

Some time ago, our clothes drier started acting up. My wife complained that it sometimes rotated and sometimes did not.

After a lifetime of repairing electromechanical devices for the government, none of which I could throw away, I am reluctant to throw out an appliance without attempting a repair first.

So I carried the drier outside to the patio area where I had more room to work. This is as close to using laundry equipment as I am allowed, since the time I tried to wash a red T-shirt with some white socks and ended up with pink socks.

Getting access to the inside of the drier required removing the rear panel, which provides support for the drier drum and some rigidity for the entire structure, as it has no framework. So as soon as the rear was removed, the drum basically fell out, being held in only by the drive belt around the motor pulley.

There is very little inside a drier, apart from the motor, pulley, belt and drum, and the front-mounted control board. I removed the drum and drive belt from the motor, then powered up the drier and selected "dry". The motor did not turn at all. No surprise there.

A large white motor capacitor was quite visible, and as it had a real possibility of affecting the motor operation, I bought a replacement from a local electrical supplier for $15, installed it and tried the unit again. The motor now ran without fail. I then re-fitted the drum, pulley and rear panel, and re-installed the drier in the laundry for my wife to further test it in use.

It operated successfully for several years until my wife rushed into the lounge room one day to tell me that the laundry was filling with black smoke coming from the drier.

I knew that it couldn't be from burning lint, as my wife religiously cleans the lint filter before each use. Flicking off the laundry circuit breaker, I figured that this time the drier was surely finished, and took it outside to air out and cool down, as well as air out the laundry itself. The next day I took it apart again.

Amazingly, everything looked fine inside, with no fire damage or even soot visible. But it was evident that the motor capacitor had ruptured and split, and was obviously the source of the thick black smoke. Replacing it yet again returned the drier to service, and it has been running for another couple of years since with no problem.

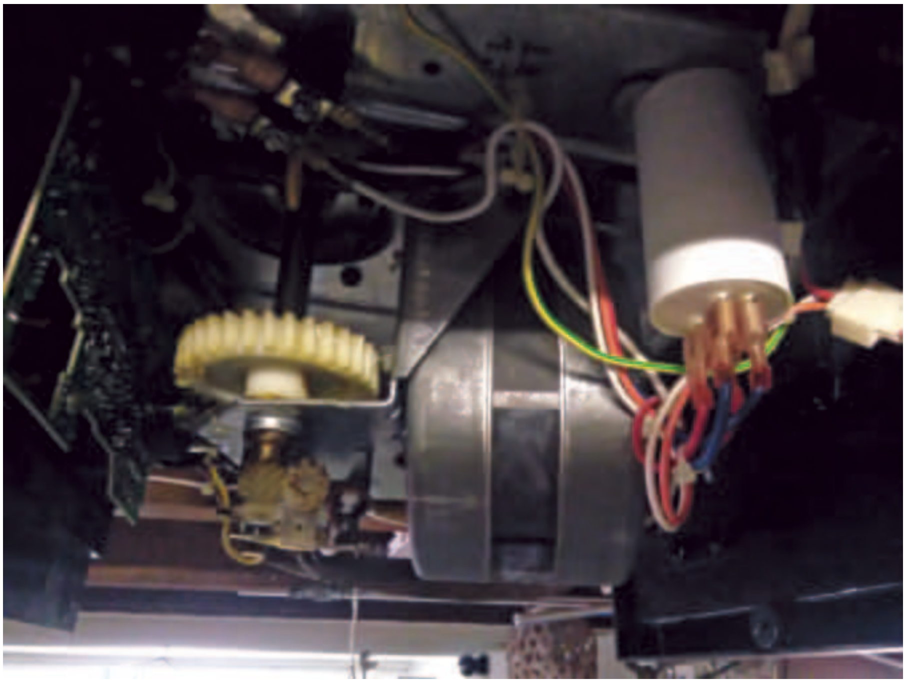
So, when our pool pump motor became intermittent a year or so later, my suspicion naturally fell on any capacitor attached to the motor, if there was one. Removing the terminal cover showed just such a motor capacitor.

Replacing it with an identical unit restored the pool pump to normal action; an expensive pump replacement avoided. The replacement capacitor cost less than $20, whereas a new pump would have been anywhere from $350-600 depending on the quality and power, so I was pleased with the result.

A few years later when it failed again, I found that the replacement capacitor had failed similarly to that of the clothes drier, catching fire and even melting the plastic electrical connection cover, making it very clear where the problem lay. But like the drier, a new capacitor once again returned it to operation.

More recently I had a problem with my electric garage door opener, which became intermittent, sometimes opening, sometimes not. When it wouldn't open, it instead emitted a buzzing noise. Fortunately, it is possible to open the door mechanically by pulling a latch on the mechanism that disconnects the door itself from the chain driven shuttle, but it is hardly an ideal long-term solution.

Not feeling particularly optimistic,



I removed the cover over the drive mechanism mounted to the ceiling of the garage, to see if there was an obvious problem. One of the first things that I saw was the large white motor capacitor. Due to my previous experiences, I decided to look no further and immediately started looking for a replacement.

It was impossible for me to purchase an exact match, as no 12.5µF capacitor was available at our local electrical supplier, but I found one 12µF capacitor in their spares collection, which I had no doubt would be suitable.

For some reason, it is considerably smaller than the original, with a correspondingly smaller slot for the metal mounting screw frame to slide into. So it does not fit as well as the original, and it now sits off to one side of the mounting hole. But that isn't a real problem.

The garage door opener's operation returned to normal as soon as I fitted the new capacitor, with no hesitation by the motor. It now seems to run quieter as well, possibly due to re-tightened cover screws etc.

I have since found a wide selection of motor capacitors at, of all places, a local plumbing supplier, but will leave the current capacitor in place while it continues to function.

Capacitors in our current ceiling fans have also caused me some problems, noticeably slowing their operation. I found the motor capacitor in the cap under the fan where a light could be attached. It was a small, flat black 1.5µF unit.

I found a replacement part at our local spares store, Solex, and have now replaced all the capacitors in the ceiling fans, as many of them were showing signs of slowing down. This is something I never recall needing to do in the past with cheaper ceiling fans.

Repairing so many household items by simply replacing the motor capacitor makes me wonder what people do if they are not capable of doing such work. Do they call in repairmen who offer an economical repair on-site, or do they end up having to buy expensive new appliances?

After all, if you saw thick black smoke pouring out of a clothes drier, would you expect it to be so easy to repair? **SC**

Servicing Stories Wanted

Do you have any good servicing stories that you would like to share in The Serviceman column? If so, why not send those stories in to us?

We pay for all contributions published but please note that your material must be original. Send your contribution by email to: editor@siliconchip.com.au

Please be sure to include your full name and address details.