

WANSARC NEWS

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The monthly magazine of the club celebrating its 35th year,

Western & Northern Suburbs Amateur Radio Club



Melbourne, Australia

146.450 MHz FM

VK3AWS

28.470 MHz USB

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2005

NEXT MEETING Friday 1st July 2005 Commencing 19.30 hours, Or earlier if you're hungry!

This months meeting will be at **Tina's Pizza**, 445 Plenty Rd Preston,

Tina's Phone: 9478 7950, talk in on 146.450 MHz FM



If not delivered within 7 days, please return to:
WANSARC P.O. Box 336 Reservoir 3073



Graeme serving up the birthday cake

Hal, VK3EKF, cutting the cake last meeting, 90 years young!
Who says that RF harms you...



**This month, Surface Mount Technology,
Where our author makes the claim,**

*"Whilst there are exceptions,
it is rare to see the use of leaded resistors,
capacitors, transistors or integrated circuits in modern consumer electronics.
Since the demand for these types of leaded parts is low and decreasing,
their cost will rise over the next few years and sourcing them will become difficult.
Eventually, supplies will dry up and leaded components will join the domain of valves".*

Is he right? Read on and decide for yourself...

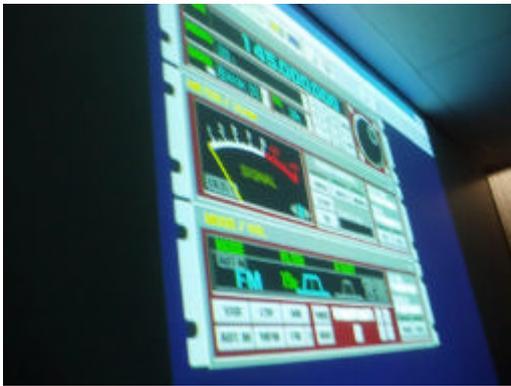
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NEXT MEETING AT TINA'S PIZZA

Don't forget 1st July's meeting is NOT at the TAFE, it's at Tina's. I reckon every club member knows where it is, but just in case, it's on the western side of Plenty Road, between Murray Road and Pender Street, if you heading north and cross Wood Street, you have gone too far. If you are heading south on Plenty Road and cross Murray Road, you have gone too far! 7.30pm start.

Editors Ravings – Mick VK3CH

Well done to Mark VK3PI for a very informative June club lecture on computer software for the shack and a look at some other modes, also the shot of the orbiting satellites in 3-D was brilliant!



I have downloaded it off the 'net' and kids find it quite amazing. Even had CD's of all the demo software to give away – good stuff. The screen wall 'projector' works quite well. Nice to see demonstrations that actually work on the night!



Also **Happy 90th Birthday** to Hal VK3EKF, with a card and cake presented by Graeme and consumed by all as we watched the presentation. A well attended meeting with many rare faces seen.

Thanks to members that sold and purchased Reservoir Rotary Club Raffle tickets again this year, good luck in the prize draw, which was drawn on 18th June.

Your editor is now webmaster for our club website, which is being updated. Take a look, report any problems so I can check it out. Any ideas for items to include let me know, I need your input.

Club Magazine has gone back to and staying at 8 pages, so we don't get overcharged for the postage, 10 pages is pushing the limit for weight and size for 50 cents with the post office I'm told!

VK TRANS TASMAN CONTEST 160 Meter Phone Sat 9th July
Don't forget Graeme VK3NE will be hosting a 4.30pm start BBQ (BYO Meat) at his QTH and then invite all there to have a round of chasing the DX on 160 meters from 6.00pm to Midnight, in the VK Trans Tasman Contest. He has the logging software all set to go and has an RF quiet location. Be prepared to help erect the 160 meter aerial on the day however if it's not yet up! I miss out as I will be attending the GippsTech Microwave Conference in Morwell.

ATV BUILT & FINISHED, UP AND RUNNING ON 1250 MHZ,
Well it was for a while; PLL needs some "tweaking"...

The following is a bit dated as it was held over for a month, but as my PLL stalled for reasons as yet unknown...

I can't remember when I have been doing so much soldering and testing. From soldering and drilling in the bit of a backyard with the dog under my feet to my wife complaining about the ever decreasing space in the computer room, where the amateur equipment is slowly taking over, to another broken promise "...Yes, no more antennas are going on the roof that was the last one..." (ATV 444.25 RX + 1250.000 TX installed, with a 70cm loop yagi planned once 70cm AM ATV Transmitter is going and associated coax runs through the roof). But at least the kids think its cool to be seen on real TV, even if not many people in Melbourne know its there, but you would be surprised who is actually watching. Most non hams I know that know about it found it, VK3RTV, by "accident" while tuning up a newly purchased TV that has the "seek and lock" type scan set up function.

ATV was going along fine, with some test transmissions, the first real test going over a hour on 5th April was the club net, going to air with good signal reports to be had from various areas of Melbourne, without the linear module getting too hot at all, about 65 degrees 'C'. I have found that in putting signals to air, when dealing with video and the leads carrying it treat it like RF. I tried using split RCA adapter leads, but when I did my video signals were degraded to the point where VK3RTV would drop out and reset. I must have been upsetting the 75 ohms and also losing video signal into other devices, even though they are not powered on. On some ATV boards connections supplied with stand off pins are offered – don't use them! Solder your coax direct to the boards always, preferably underneath it – take it from someone who tried otherwise and failed! I even put the +12 (13.8) power in coax to be sure, in case RF caused problems. I used coax for the audio in as well. I might even replace the twin feeding the 13.8 into the rack with coax type cable that can handle 10 amps, not so much for the ATV unit, but for the shack, reduce the RF getting out at 1250MHz that might annoy some of the other gear. I also had 3 diodes to drop the power from 13.8 to 12 volts, but they got so hot I took them out and just ran the lot from 13.8 volts and wound the bias back to 4.3 volts (8.8 Amps on transmit), still going OK, 1 1/2 hours the most I have ran it for continuously with no problems.

A simple project to try out SMD soldering would be the ERA 3 Wideband Amplifier. I use it to boost the TV reception of VK3RTV, a picture of it is here, built in under one hour easy. Just hangs in mid air supported by the coax, top one is 13.8 DC power via RCA plug. It probably does not need the shielding but the box was a spare so I used it.



ERA3
Wideband Amplifier

ATV EXTRAS FOR THOSE WHO ARE KEEN

Another nifty thing you can do is put up your computer output to your monitor via a RGB video to composite video converter unit; these can be picked up for under \$100. I got mine from Jaycar, I tried to get one at the computer swap meets, but I could not find one, most of the traders did not even know what I was asking for! I also use an AV Selector to switch between the (3) video inputs, a bit of a luxury at \$148, but my pictures were being seriously degraded with all the 75 ohm video cables going everywhere, you just can't have multiple things plugged, even when they are

powered off. I can switch (via remote control) my camera, DVD player or computer video output, all 75 ohm matched and isolated. All this tested, going first time on 10th April, installed under 1 hour. All this was demonstrated a couple of months ago at the club meeting at the TAFE.

ADDING THE PHASE LOCKED LOOP OPTION

Next day I added the PLL unit and lost about 200mA in current due to the 7dB loss of putting it in circuit, but no difference looking at the picture coming back from VK3RTV. I actually wound back the bias until I was only drawing 7.0 Amps with a perfect picture, so I will leave it there, running nice and cool. I did not see any change in picture quality between 7 to 9 Amps, with a poor picture only appearing after I wound it under 6.5 Amps. I simply tuned the PLL unit for 1250 MHz output by placing the scanner on 1250 MHz and setting full attenuation (with no antenna connected) and peaking for full 'S' meter reading, done in a minute if that! Don't have any sound or picture connected while you do the adjustment. Make sure you remove the Tune potentiometer from the EME75 board if you add the PLL option. Many operators that have "been around" on ATV say that the PLL option is not really necessary as VK3RTV is fairly wide in accepting a signal. Later I might put Audio and Video level controls to the front panel so it can be adjusted to suit different inputs from cameras, DVD players, computer RGB converters and the like. If you do go for this option, use shielded cable; I just used the thin coax for the lot.

However a comment on the PLL for now, from Andrew, VK3FCR,

"I reckon that there might be too much capacitance between the xtal and the PLL pins. From the circuit, there is a fixed 10pF cap and a 10pF trimmer in parallel. If it was me, the first thing I'd try is to remove the 10pF fixed capacitor, and see if the oscillator fires up. I note that the micro has its own oscillator, so even if the micro and LCD display are working, and does not mean the PLL is. You really need an oscilloscope to see what's happening.

2 points worth noting:

1) The application circuit in the datasheet specifies an 18pF capacitance in series with the xtal. It also specifies a crystal series resistance of < 200 ohms. I suspect that if the external xtal series resistance is too high, then the negative resistance in the PLL oscillator circuit may not be enough to overcome it and sustain oscillation.

2) The data sheet does say that the PLL chip may be driven from an external 4MHz source by capacitively coupling into Pin 2.

This will be a better way to go, if there's any trouble with the oscillator firing"

As Andrew designs and plays with these things for a living, its probably good advice! He has also given me a data sheet as well. The datasheet is available to download from the club website.

20 ms Audio delay kit to stop feedback when full duplex

To stop feedback running ATV full duplex you can build up the 20 millisecond (fixed) delay kit, 63mm x 60mm size PCB, Altronics Kit **K5595** \$44.95, from the shop at 172 High St Preston.

MARINE RADIO EXAM

While having a regular afternoon QSO with Max VK3ZCW, some months ago, he made mention of the requirement of boat operators using radio equipment to communicate, other than the 27MHz marine stuff that a Marine Radio Operators Certificate of Proficiency must be held by the operator. This got me interested in doing the exam, Max said any Amateur Radio operator that has passed the full call type exams should find the Marine exam fairly straight forward as the in main it is for the public to know the basic operating procedures and guidelines on how to conduct themselves when using the service and on what channels or frequencies various services are allocated and how to handle distress or emergency traffic, log keeping, etc.

The book you study from is the Marine Radio Operators Handbook, which I ordered via the internet. But if you sit the exam (1 hour, multiple choice, 70% required correct) with a registered examiner you usually pay and get the book and study it for a few weeks, then ring and book your exam at a date that suits you and the examiner. I did my exam (and ate a nice lunch) at the yacht club that Max attends very regularly, he is "part of the furniture" you might say, even has his name on some of it!

My certificate, which looks a lot like a driver type license arrived within 2 weeks after doing the exam, you don't pay annual license fees – a once off exam charge and you hold it for "life".

If you want to know more ask Max VK3ZCW any afternoon on 146.450MHz, he will set you 'sailing' in the right direction!

The Push Telegraph – Mobile Phones Become "Handhelds"

Just when you thought there couldn't possibly be anything more your mobile phone could do, another feature has emerged. The novelty of being able to make phone calls from virtually anywhere wore off a long time ago, before our obsession with text messaging took hold. Though text messaging is still going strong, a new mode of communication has just been introduced. Push to Talk (PTT), a new feature on the Optus and Telstra networks, enables compatible handsets to be used like walkie-talkies. Now, instead of typing a short SMS or making a call, you simply push a dedicated button on the side of the handset to communicate instantly. The person -- or persons -- at the other end hear your voice through the loudspeaker without their phone even ringing. And you can talk to up to five people at the same time. Market research conducted by Optus before it launched its PTT service revealed some interesting facts about consumers' communication needs. The research showed customers were looking for a simple service that could make it easier for them to contact several friends without having to make multiple calls.

It also showed that many of the calls made by customers were very short. Getting hold of someone quickly in an emergency also concerned consumers. If you make a regular voice call, you must wait to be connected. You don't know if the person you're calling is going to answer, or whether they are in a meeting or watching a movie.

A voice call is also limited to two people.

SMS, though a handy and cheap way to communicate, can be time-consuming as you type messages back and forth. PTT addresses all these issues in a simple service that is also fun to use. It also lets you set your availability if you don't want to be disturbed.

Though the closest comparison with PTT is the walkie-talkie, there is one big difference. A walkie-talkie can be used only within a very limited range, but PTT is covered by the GSM and CDMA networks.

This means you can talk simultaneously to a friend in Perth, another in Melbourne and a third in Brisbane, as if all were just across the road. Replies can be relayed to everyone in the group, also simultaneously. The Optus research showed that customers aged 18-34 wanted to be able to communicate quickly with their peers.

Allen Lew, Optus Mobile managing director, says PTT is the first innovative personal communication service for young people in the past two years. "It is great for groups who regularly meet and want more interactive group communication than is currently possible with SMS," he says. But it not purely for socializing. Businesses will also be able to take advantage of the service. Whether you are on a construction site, part of a large sales team or just need to be in constant touch with your office, the convenience of PTT is obvious.

Herald Sun Media

New ATV Repeater in Adelaide

There is a new ATV repeater for the Adelaide Metropolitan Area. Details are 1283MHz FM Output 16Watts. (Optional Digital DVBS swichable output 5Watts with DTMF) Antenna is a Slotted Waveguide 3350MHz Input FM 2dB noise figure.

From Mark VK5EME (Mini-Kits)

It is my sad duty to inform that one of WANSARC's former members, joining in April 1990, One of Victoria's first licensed amateur radio operators, is now a silent key. Eulogy from the funeral supplied by his family members, reprinted with their kind permission.

Reginald Talbot Busch 1907 - 2005

A celebration of a lifetime of contributions to the Victorian Community, to his family and to his friends. Reg was born on the 29th January 1907 to Edgar and Annie Busch (nee Philips) at Moonee Ponds. His parents ran a butcher shop in Puckle Street for many years in the 20's and 30's. The business was ultimately sold to Gilbertsons.

Reg's middle name, Talbot, was in recognition of the time his parents spent in Talbot, central Victoria, running the local butcher shop. At an early age, Reg developed an interest in the world of wireless. As a teenager he persuaded his father, on many occasions, to take him down to the Port of Melbourne to inspect the Radio Rooms of the visiting ships.

From this humble beginning, he began an 80-year love affair with amateur radio as well as setting the direction of a distinguished career in the Communication Sector of the State Electricity Commission of Victoria.

There are several notable aspects to Reg's life and it would be appropriate to deal with each separately:

From a Professional Perspective he gained his technical education at Melbourne Technical College in the 1920's and with these skills he gained a position in the State Electricity Commission of Victoria, commencing at the Yarraville Laboratory on 5th August 1924. His career at the Commission continued for a period of some 46 years until his retirement in July 1970. During his time at the Commission, he pioneered a range of then new technologies to provide communications service for the control and protection of Victoria's Power System.

The development of highly reliable, voice frequency protection signalling systems and the introduction of microwave radio systems for power line protection were just two of the innovations introduced by Reg.

He was also a national expert on the traditional power line carrier systems used by power companies throughout the world. In this regard, he managed the introduction to Australia of the then very modern power line carrier systems from Fujitsu in Japan.

This relationship between the Commission and Fujitsu resulted in two technical visits to Japan.

His service with the State Electricity Commission was interrupted during the war at which time he joined the RAAF Reserve in a training role with the rank of Flying Officer for a period of 5 years.

From a Wireless Perspective

In the mid 20's his growing passion for matters wireless resulted in his studying for and passing an examination for Radio Telegraphy. As a result he was issued with Certificate No 157 on 17th August 1925 at the age of 18 years and was allocated the call sign VK3LS, which he retained for his life-time.

At this time he built his first radio shack at the back of the family property, "Stratford", in Wordsworth Street, Moonee Ponds. In later years this room was to prove a fascination for his two nephews, Allan & Ray when they visited their grand-parents.

Some few years later, in November 1936, he studied for and passed the examination resulting in the issue of his Radiotelephony Certificate No 286.

In August 1949, as an active amateur radio operator, he provided valuable assistance to the Victorian Police at Omeo; conveying voice messages for them when the conventional telephone services were knocked out by flood waters. This activity was recognised by a personal commendation from Alex Duncan, the then Chief Commissioner of Police.

His association with amateur radio also led him to play an active and valuable role in the operation and management of the Wireless Institute of Australia. He was a Life Member of the WIA.

This relationship with amateur radio continued up until the early part of this year when he was admitted to hospital. Today, his rig remains ready for use in his shack at Hillside Parade.

From a Personal Perspective

Reg developed two more loves; motor cars and his wife-to-be, Hilda.

In 1932 Reg acquired a red Riley sports/touring car which he used in a variety of motor sport activities, such as reliability trials and economy runs in which he proved to be quite successful.

In addition he joined the Light Car Club of Australia where he met one Bern Horsley another Riley fan, to whom he introduced his sister Mavis, who was often Reg's navigator.

Subsequently Mavis Busch and Bern Horsley were married and produced two sons, Allan and Ray.

About this time, Reg met Hilda Sayers and they were married on 12th February 1938 at Essendon. Together they designed and built their home at Hillside Parade, Strathmore, not surprisingly with one room identified as the radio shack.

Travel was not far from their mind; however, cars became much more conventional. Reg took over ownership of his father's black Austin 10 and then progressed via a Vanguard and Chrysler to a Ford.

In his time he built two caravans, one a micro teardrop type with a lift-up back to reveal a tiny kitchen, the other was a more conventional type. Both were built from timber and plywood at Hillside Parade and served them well.

Not having children and being close to Mavis & Bern, Reg & Hilda took a special interest in Allan & Ray and on many occasions performed the role of defacto parents, much to the benefit of the two boys.

During retirement, spanning 35 years, Reg & Hilda enjoyed many traveling adventures until Hilda's ill health resulted in her moving into a nursing home. Reg visited her each day, tending to her every need.

After Hilda's passing, Reg looked after Hilda's twin sister, Dorrie.

In more recent years, with the well known Busch independence, Reg looked after himself with the assistance of meals on wheels and under the watchful eyes of his two nephews, up until March of this year when he was admitted to hospital and then the Roxburgh Nursing Centre.

Reg has had a great life, actively contributing to many worthwhile activities and positively influencing the lives of the many people with whom he came in contact.

He made a difference and leaves this world a better, but sadder, place.



Hints and Tips for using Surface Mount Technology (SMT) Components

With many WANSARC members putting together the ATV kits and having to grapple with this newer technology, I thought this article by Luke Enriquez, VK3EM would assist in the effort. Many thanks to Luke for kindly letting me reproduce it here.

Introduction

A lot of people avoid dealing with surface mount technology (SMT) because of a lack of good information about it. Whilst there are several good references for commercial assembly, very little is written about hand soldering and prototyping with SMT. This article has been written to introduce the amateur radio operator and experimenter to this interesting technology.

What is Surface Mount Technology?

Put Simply - It is a type of electronic component package. Most electronic components can be divided into two categories - through hole (TH) and surface mount (SM). Through-hole components have been used for many years and are designed to be loaded on one side of a printed circuit board (PCB) and soldered on the other. SM components are designed to be loaded and soldered on the same side of the PCB.

Why is SMT used in industry?

SMT has several important benefits over through hole technology. They are;

- | | |
|--|---|
| * Faster for automatic machines to place | * Have a smaller physical size for the same electrical function |
| * Less parasitic (unwanted) effects | * Cheaper in terms of raw material cost |

Why should you care about Surface Mount Technology?

"Black Box Operators" aside, SMT is increasingly affecting people involved in the repair, modification or development of electronics. Through hole components are being replaced by their SMT equivalents at a rapid rate as manufacturers increase their investment in SMT production equipment to cash in on the benefits. Whilst there are exceptions, it is rare to see the use of leaded resistors, capacitors, transistors or integrated circuits in modern consumer electronics. Since the demand for these types of leaded parts is low and decreasing, their cost will rise over the next few years and sourcing them will become difficult. Eventually, supplies will dry up and leaded components will join the domain of valves. Those of you who doubt these warnings should spend some time and have a look at a modern mobile phone, computer motherboard or amateur radio. An alert observer will note that connectors and electrolytic capacitors are usually among the only leaded parts used. This is mainly because connectors often rely on their leads for mechanical strength and electrolytic capacitors have a shape that does not lend itself towards easy implementation as a surface mount device (SMD). Eventually the solutions to these problems will become cheaper and they too will disappear from electronic equipment in their leaded form.

SMT Myths

Many new facets of amateur radio and experimentation with electronics in general are hampered by the myths that surround them. Some of these myths are;

- SMT needs special and expensive equipment
- SMT components are hard to find
- SMT requires professional PCBs
- SMT requires special training and skills

To use SMT and not get too stressed about it does require the following:

- To have a steady hand
- To practice your technique
- To be invest in a good pair of tweezers
- To have reasonable eyesight or use magnification

Unfortunately, there is not much you can do about the steadiness of your hand, but all the other obstacles can be easily overcome. The main emphasis of this article is to explain how you can work with SMT with the smallest possible investment of special equipment.

Common SMT Packages >>>

There are three popular package styles used for most passive components. Their names refer to their size (in thousands of an inch or just thou).

They are;

- 0603 (60 thou long, 30 thou wide)
- 0805 (80 thou long, 50 thou wide)
- 1206 (120 thou long, 60 thou wide)

Common discrete SMT components - picture details the common discrete SMT packages. Diodes, Transistors and IC's all use the SOT package and often measurement with a multi-meter and the two or three character marking on the top of the package is the only way to guess what the component is. Some IC's use larger packages as shown in next picture. Several good web sites exist for determining SMT parts from their markings and these are detailed on the VK3EM website.



Common SOIC package >>>

For the purposes of illustration, only a very small selection of SMT packages has been shown in this article. A more detailed listing including color pictures can be found on the VK3EM website (See end of article). This may be useful for those who you who recycle parts from junk equipment that uses SMT.



How can SMT help you?

SMT has many benefits over leaded components. These are;

- Where component value tweaking (i.e.: small changes) are needed. SMT capacitors and resistors are easy to parallel together and quick to solder and de-solder. The chances of "lifting" circuit board tracks are reduced and so is the frustration of trying to work on both sides of a PCB at the same time.
- Where RF signals are being used. Unwanted (i.e.: parasitic) effects in SMT parts are smaller when compared to leaded parts, which results in better predictability of component characteristics. Leaded packages do not lend themselves to microwave use. However, there are exceptions.
- A significant number of modern components are only available in SMT form. If you want to play with them, then you have no choice but to use SMT!
- Where space is limited. This is dependent on the circuit type and layout, but SMT parts like decoupling capacitors and pull up resistors can be used to reduce the space required on the PCB. SMT parts fit neatly across the gaps on VERO board and can be mixed with designs using leaded parts.
- Where drilling holes is a problem. Anyone who has made a PCB understands the frustration of trying to work on two sides at once. SMT simplifies this because you load and solder all on the same side. Components can be used on both sides of the PCB without interference, or a solid ground plane can be used on one side with holes drilled only for ground connections.
- Where a pre existing circuit needs modification. Forgot to add that series capacitor, diode or resistor. Cut the track and insert a SMT. The solution is simple, small and tidy (no holes)!

Tips for soldering SMT Parts

Good soldering technique will come with practice, but these tips will guide you in the right direction. If you need to practice use SMT resistors as they are not damaged easily.

- Keep the circuit board clean. Isopropanol or wood alcohol is suitable for removing light oils and grease. PCB's should always be washed under warm water, and then oven dried at 60 degrees Celsius for 10 to 15 minutes. Handle the PCB by the edge only and avoid touching copper with your bare hands.
- Use the right soldering iron for the job. You don't need to purchase a temperature controlled iron, special SMT tip or SMT hot gas reflow station. These tools might be used in industry, but only to save time and increase reliability.

All sorts of SMT soldering jobs can be done with the common Weller workstation. The important point is selecting the right tip (i.e.: have several tips on hand). As with any soldering job, the general idea is to have the joint up to temperature and soldered in a few seconds. Think about how much of a "heat sink" the joint will be and choose the tip based on that. Use of larger tips should be limited to areas of large solid copper plane (i.e.: ground plane). For all jobs except very small parts, I use a common Weller PT-8 7 tip as shown. With practice, you will learn what tip suits you best.

Soldering Iron and Tip suitable for SMT

Use L.M.P (Low Melting Point Solder) if you are experimenting. LMP solder is very similar to 60/40 solder, except that it contains 2% Silver. This Silver "loading" has two effects. It lowers the melting point (a few degrees) and it reduces the rate at which component metallization leeches into the solder itself. SMT resistors, capacitors, ferrite beads, etc. all make their electrical connections via metalised pads deposited on a substrate (Alumina, ceramic, ferrite, etc). The metal used is often Nickel or a related alloy. One problem with soldering the same joint several times is that each time the joint is heated, some of the Nickel leaves the component and joins the solder.

This is called "leeching". Leeching is only a problem when the solder joint of a metalised component is heated several times. Leeching occurs at a faster rate with standard 60/40 solder than what it does with LMP solder.

The downside of LMP solder is that it is about 3 times the price of 60/40 solder and harder to obtain, although sources of supply have been quoted at the back of this article. If a kit was being built, where the component values are known, then 60/40 solder will be fine. If component changes are often and likely, then LMP would be more advantages for a long term reliable solder connection.

Some people use "solder cream" sold by various shops. The advantage of solder cream is that it has more flux than regular solder. The solder cream is made up of very fine balls of solder mixed with a water based flux. Unfortunately, solder cream was never intended to be used with a soldering iron. In fact, because the solder sits in a water based flux solution, the cream needs to be "dried" out (i.e.: the water has been driven off) before the solder can be melted. This can be done by moving the iron tip close to the joint for a few seconds prior to moving onto the joint. In experimentation quantities, solder cream is only available as 60/40 mix. In my opinion, the SMT experimenter would be better off to use LMP solder and extra flux (from a tube or a pen) rather than solder paste. It is a matter of personal preference. If you like using the paste, then go for it!

Use solder flux where possible. One of the biggest problems with soldering SMT parts is that the amount of flux within the solder core is not sufficient for the joint. Professional SMT manufacturers use "solder cream" and controlled temperature ovens. However, soldering iron temperatures are far less controlled and often the flux has evaporated before the joint has solidified, leading to dry joint which is often dull in complexion. Solder flux has other advantages. Because of its liquid nature, it increases the conduction of heat from the iron tip to the joint. It also increases the surface tension of the molten solder which helps to achieve a reliable joint and minimizes the chance of bridging finely spaced pins.



Flux has the disadvantage that it is generally sticky, and can require special flux removers to remove. Soapy water and ultrasonic baths are one solution, but this requires a second wash in fresh water and a bake in the oven. Flux can also carry contaminants which may effect circuits operating in the microwave region or circuits with very high impedance's, especially in VCOs. Some fluxes contain lead based chemicals, and it is wise to use gloves to avoid direct skin contact. Flux is available from several hobby shops and other outlets in syringe and pen application form. In general, the use of extra flux makes SMT soldering much easier and increases solder joint reliability. However, you may not need it at all. Solder Flux is sold insyringes for easy application.



.Use a good magnifying lamp or other magnification source. SMT parts are very small. SMT solder joints are at least four times smaller again. Since its the solder joint that should concern you most (especially if you want to build something reliable) it is useful to have a source of magnification. Some examples are shown.

Cheap and useful magnification sources

Most people with reasonable eyesight should be able to solder without magnification and check the joint under magnification later. For those who have relatively poor eyesight special "jeweler's eyes" that sit on the head can help. Good lighting is essential. Don't work in a cluttered space. Give yourself room to move around, and orientate the PCB so its easy to reach the joint your trying to solder.



Buy a good pair of tweezers. You will be amazed howmuch easier SMT soldering becomes.

In fact, out of all the equipment I have suggested, I feel this is the most important. Both soldering and de soldering will involve your tweezers, so they are a worthwhile investment. If possible, get a quality set where the two ends meet together accurately.

Tweezers come in various shapes and sizes.



Soldering small SMT Parts

The following technique should be used for soldering small SMT parts such as resistors, capacitors, inductors, transistors, etc, with a soldering iron.

- 1.) Add a small amount of flux to the area (if required) and add a small amount of solder to one pad.
- 2.) Pick up component in tweezers making sure component is horizontal. Alternatively, just move the component until it is close to the final position.
- 3.) Whilst holding the component with your tweezers melt the solder on the pad and move the component into position.
- 4.) Remove your iron but continue holding the component until the solder has solidified. Check to see that the component is sitting flat on the PCB. If not, re-melt solder whilst pushing gently on top of the component with tweezers.
- 5.) Solder the other side of the component.
- 6.) Re-melt the first solder joint and let solidify. This ensures both joint are stable during solidification.
- 7.) Check your work under magnification.
- 8.) The joint should be shiny and concave. If you added too much solder, wick up with small solder wick and try again. See Fig 7 for joint quality.

1206 - Insufficient Solder



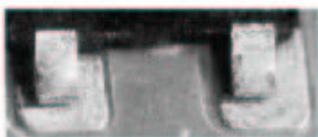
1206 - Adequate Solder



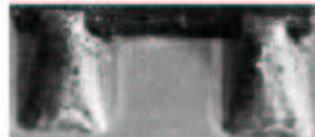
1206 - Excessive Solder



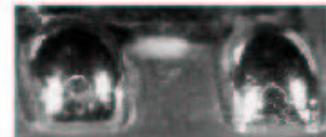
SOT - Insufficient Solder



SOT - Adequate Solder



SOT - Excessive Solder



1206 and SOT Solder Joints. Insufficient, Adequate and Excessive Joints.

Soldering Integrated Circuits

IC's require a similar but slightly different technique.

- 1.) Add flux to the pads where the IC is to be soldered.
- 2.) Add a small amount of solder to one of the corner pin pads.
- 3.) Line up the IC with the pads on the PCB. Double check the IC orientation.
- 4.) Melt the solder with your iron and move the IC into position with your tweezers. Let the solder solidify.
- 5.) Solder the diagonally opposite pin. Check under magnification that all pins line up with there respective pads.
- 6.) Solder the rest of the pins and check work under magnification.
- 7.) Special techniques may be needed for some packages (see next).

De-soldering Small SMT Components

1. Add excess solder to one side of the component.
2. Whilst the side with excess solder remains molten, move your iron to the other joint and gently push the component off the pads.
3. Clean up pads with solder wick.

Note: The trick here is make one side of the component a larger thermal mass and heat that side first. This may not work for all parts, especially those sitting on large ground planes.

De-Soldering Small Outline Integrated Circuits

This technique only works for SO-IC (50 thou spaced devices). Smaller devices may require hot air for removal.

- 1.) Apply flux to the IC pins.
- 2.) Use solder wick to remove as much solder as possible from each pin.
- 3.) Thread fine enameled wire under one row of pins.
- 4.) Secure one end of the wire on a nearby component (i.e.: Large Electrolytic).
- 5.) Starting at the loose end, heat each pin and pull wire simultaneously. Pull the wire as close to the PCB as practical. As the solder between the pin and pad melts, the wire will pop out and leave the pin standing free of the pad (and bent up slightly).
- 6.) Repeat steps 3 to 5 for the other side.

What parts can you recycle?

Some SMT parts can be quite expensive when purchased in small quantities. All sorts of SMT parts can be recovered from surplus and junk equipment (providing it uses SMT parts of course!). It will not only save you money, but give you good practice at de-soldering. The VK3EM web site contains color pictures of many SMT components so you can identify them. If you use recycled components, perform an electrical check on them. Ceramic capacitors cause the most problems (they crack easily). Inductors, transistors and resistors can all be verified for correct operation. However, excessive heat may damage but not destroy the device.

Special Techniques

Whilst the purpose of this article is to detail the use of SMT with equipment most amateurs already have, there are a few exceptions. One of these is the use of hot air instead of a soldering iron. Hot air SMD rework stations are very expensive, but a much cheaper source of hot air is a Weller Pyropen with a hot air tip. Usually used for heat shrink, the hot air tip makes removing SMT parts a breeze (albeit a very hot one!). Use of flux around the component to be removed will help the heat conduction into the part and the PCB. One of the drawbacks with this technique is that surrounding components may also become molten and may possibly be blown off their pads. This is more of a problem in high density PCB's with very small components when your trying to remove a large component, such as an IC. This can be overcome by folding up a small piece of brass sheet to fit over the component in question. The brass provides a heat shield, and ensures surrounding components remain on their pads.



Hot air tip on a Pyropen

Surface Tension - Your best friend?

SMT is shrinking the size of component packaging at an alarming rate. How does one possibly avoid shorting pins with spacings like 0.3mm or even less? The answer is simple. You don't! What do I mean by this! With such small pin spacings, you would go crazy trying to solder each pin individually. With the aid of flux, you can increase the surface tension of solder to such a point that it difficult to bridge the gap between pins and cause a short.

Several techniques exist, but an easy one is apply flux and make sure each pin is soldered without caring about shorts. Then, return to the pins with solder wick and soak up the excess solder. This will leave solder between the pin and the pad, but not between the pins. Alternatively, you can simulate a wave soldering action by starting with a ball of molten solder and massaging it down a row of pins. This is the method I use to solder 100 pin TQFP packages onto prototype boards. It helps to have the PCB a slight angle so that the molten solder ball does not need to work against gravity. You must use lots of flux to keep that surface tension up.

The ball of solder quite literally rolls along the fine pins, leaving a nicely formed joint between the PCB pad and the pin, but without shorts between pins. No air or special solder paste needed. I did tell you surface tension was your best friend!

Some soldering iron manufacturers now make special soldering iron tips that are hollow, specifically designed for use with this process. They are called wave tips.

As always, a bit of practice helps. Find a dead mobile phone (full of very finely pitched SMT), and practice yourself.

Conclusion

This article has described some methods which may simplify the use of SMT for the amateur experimenter.

It is by no means complete and further information can be obtained from the VK3EM web site <http://www.geocities.com/vk3em>.

Sources of Parts; Quality Tweezers, Low Melting Point Solder and Flux can be purchased (small quantities) from:

Mextronics Co Pty Ltd, Factory B, 84 Industrial Drive, Braeside Vic 3195, Telephone: 03 9587 3888, Facsimile: 03 9587 3836

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Comments regarding this article or any questions may be sent to VK3EM@hotmail.com or see <http://www.geocities.com/vk3em>.

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