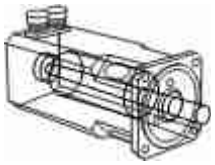

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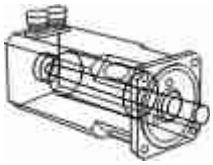

Electronics skills series

Surface mount soldering with a standard soldering iron

Abstract:

Most surface mount devices (smd) can be removed and replaced using commonplace electronics tools. An infra red heater, a SMD oven and/or hot air soldering station are only necessary on rare occasions. Ball grid array chips found on many computer mainboards need that kind of equipment for a proper repair.

This tutorial is written for amateurs and engineers who want some ideas about how to do smd work without expensive tools. It is certainly not an exhaustive treatise on how to solder every type of Surface Mount Device: it is assumed that the reader will develop their own techniques once they have soldered some of the simpler devices.

The document takes the reader through the minimum essential tools and consumables, how to interpret smd codes before replacing the component(s), how to use the tools to dismount and mount SMDs and how to repair PCB tracks around SMDs.

Obviously Quality Servomotor Repairs Ltd accepts no responsibility or liability for any damage to your components, circuit boards, equipment, health, continued life, death, burnt fingers, inhalation lead poisoning, sticky fingers, dermatological problems, peace of mind, piece of mind, etc, etc, etc. Guideline prices are taken from UK internet sources in 2012, as well as non-UK Ebay sources.

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Minimum essential tools:

Soldering iron:

25W soldering iron. Ideally, an adjustable soldering iron station around 48W. These stations can be bought for about £40 . If you can justify the cost, a soldering station is certainly easier to use than a simple stick soldering iron.

3.2mm sloped oval soldering iron bit.

You should also keep a couple of chisel tips or very thin tips, but a fairly large oval tip is often the best for smd work.

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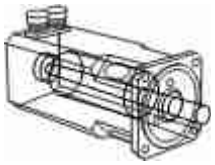

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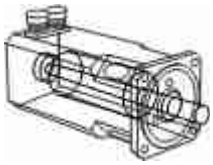

Electronics skills series

Surface mount soldering with a standard soldering iron

Illuminated desk magnifier.

It is certainly possible to solder smd components without magnification, but it is usually possible to distinguish between smd work which has been done by the naked eye and that done using magnification. A desk magnifier can usually be bought for around £20.00. If you can justify the cost, a long arm stereo microscope (10X magnification) can be bought for £240 upwards. 10X is ideal for viewing a single smd integrated circuit.

Soldering aid tools:

a thin screwdriver tip soldering aid tool is useful, as is a 45° screwdriver tip soldering aid tool. They are usually coated with anti-solder, but that rapidly gets eroded when you sharpen the side. This is necessary to be able to fit the tool tip under an edge of a surface mounted component as well as to get more PCB scratching power.

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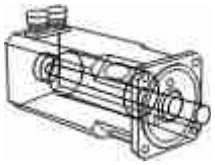

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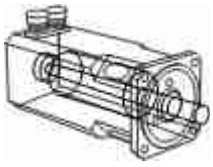

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Surface mount soldering with a standard soldering iron

Desk edge mounted mini vice with rubber jaw covers.
Can be bought for around £20.00. 'Helping Hands' (generally only have two crocodile clips to hold the work-piece) are not as useful for surface mount work. A desk mounted vice holds the PCB more securely.

Vernier calliper gauge:

sufficiently accurate vernier calliper gauges can be bought for £8.00 upwards. Some people prefer digital rather than those with a vernier scale.

Multimeter:

there are multimeters available now which can measure more than the usual current, voltage and resistance.... a £25 meter may also be able to measure voltage drop over a diode junction, capacitance, inductance, frequency and duty cycle.

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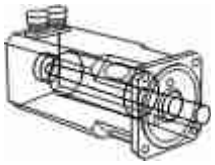

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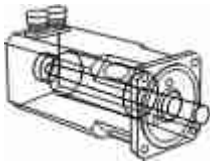

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Surface mount soldering with a standard soldering iron

Bright white LED or halogen light source

the LED torches available from pound shops are ideal. You might like to play with ultra-violet LED lighting, as well.

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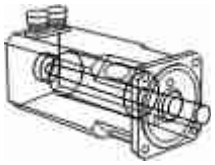

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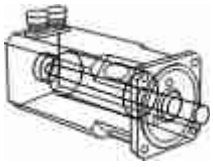

Electronics skills series

Surface mount soldering with a standard soldering iron

Important consumables:

Solder: thin (eg, 1mm external diameter), fairly low melting point (180°C to 200°C), rosin cored.

Isopropol Alcohol (IPA): used for diluting the solder rework flux and for cleaning the PCB after mounting the replacement SMDs.

Rework flux: can spray some into a spray can lid, or other container, and dilute with IPA. Can then be applied with a cotton bud.

Solder braid: 1.5mm wide or less.

Cotton buds and tooth brush: can be used to apply solder rework flux and to scrub the PCB clean (using IPA) after mounting the new SMD.

A little pot for holding diluted rework flux: the plastic lid from the can of IPA or the solder rework flux usually serves this purpose.

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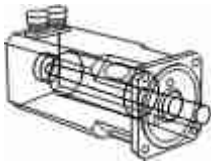

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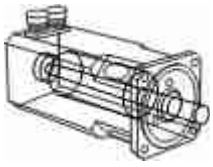

Electronics skills series

Surface mount soldering with a standard soldering iron

Identifying surface mounted devices:

You must assume that you will accidentally destroy a SMD whilst you are removing it. So it is very important to identify it before removing it from the PCB. Identification is often a matter of reducing the possibilities until only one or two remain.....

Electrical analysis: pick a twin of the suspect device, if one exists on the PCB. It will be the same size, colour and exactly the same markings as the suspect device. Use the resistance scale and the diode tester on your multimeter to map out the anodes, cathodes, resistance or capacitance of the twin device. Draw the probably internal components into an outline drawing of the overall device.

Physical analysis: measure the length, width and height of the device. Put these dimensions onto your drawing, together with the legs/ solder connections.

Markings and logo on device: the logo is often fairly unimportant, but there are websites devoted to electronics components logos. Any numbers or letters are, of course, extremely important. Sometimes the markings are not very visible. Tilt the device under the magnifier, shining a bright white light or UV light onto it at different angles. A desperation measure is dabbing IPA onto the component, shining bright white light onto it and blowing gently across the component. It is surprising how the marking briefly come into view, before disappearing again.

Theoretical analysis: you may be able to trace power lines (+ve, -ve and 0V), decoupling capacitors, biasing resistors, etc. These will give you clues about the identity of the component. Is it likely to be a FET, an NPN or PNP transistor? An op-amp? A capacitor? A micro inductor? A resistor? What are the power lines to the device? TTL (5V), CMOS? Dual or single supply?

You should now have an outline drawing, with dimensions and some guesses about the internal components and probable type of device. There are a lot of internet sites devoted to SMD markings and outlines. Search for SMD codes on a search engine. There is a particularly good website at http://www.marsport.org.uk/smd/mainframe.htm which gives some package dimensions, 'bases' (component configurations) and a comprehensive list of markings.

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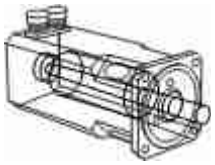

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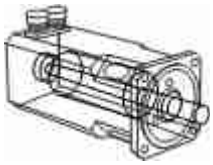


Electronics skills series

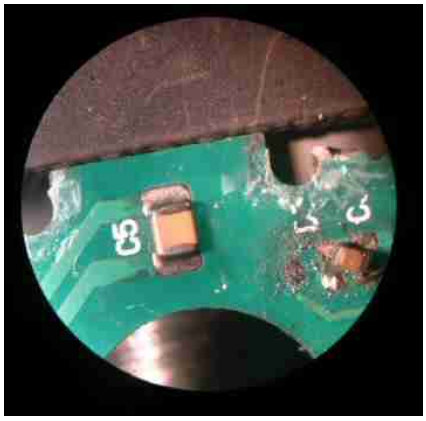
Surface mount soldering with a standard soldering iron

Removing old surface mount devices:

The aim is to remove the SMD without damaging the PCB tracks underneath. It may be necessary to give the component and surrounding area a light scrub with IPA and even a dilute mixture of IPA and rosin rework flux. This will ensure that the soldering iron tip has a good chance of melting the solder on the device contacts.

There are many ways of removing a SMD, but a relatively safe way is to blob additional solder onto the pins/ contacts, insert a soldering aid tool tip underneath a side of the component, then dance the soldering iron across the SMD contacts, keeping gentle upwards pressure on the device as the solder on each set of contacts is melted. You will not need to exert much upwards force (if you use too much force, the PCB pads under the device may lift off the PCB substrate). It is likely that little solder towers will build underneath the SMD contacts as more solder is added and melted over the contacts. At some point, however, the soldering iron will sever the solder tower and free one side of the device.

Some SMDs have a smear of locating glue underneath their main body. This gives the illusion of the SMD being really well soldered onto the PCB. Experience will tell you how much upwards or sideways force to put onto a SMD: the locating glue often gets a little softer as the SMD heats up from the soldering iron. Change between the square ended soldering aid tool and the 45° soldering aid tool to get the best leverage with least possibility of damage to the PCB underneath the component.



C5 is to be replaced.

A cotton bud is used to wipe IPA and rework flux over the solder contacts.

A small soldering iron tip has been chosen to work with this capacitor. Solder is added to the capacitor contacts.

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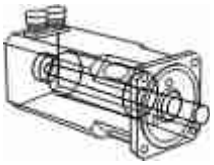

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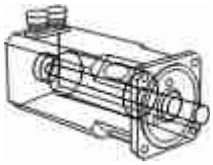

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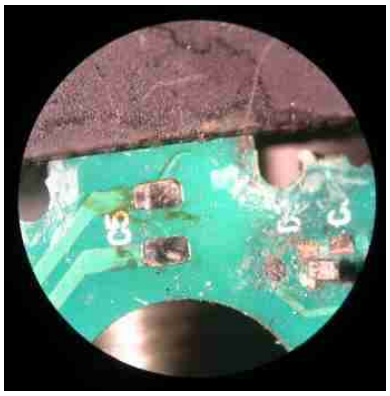
Surface mount soldering with a standard soldering iron

Whilst dancing the soldering iron tip across the component contacts, use the 45° and screwdriver edged soldering tools to lever the component up. Please note: unless the component is glued to the PCB, very little upwards force is necessary

In this case, the capacitor has ended up pushed to the right of its solder pads. It is important to keep a clean work area in case the component pings from its solder pads.

Use solder braid to remove most of the old solder from the solder pads.



The pads after the old solder has been removed.

Wipe IPA and rework flux over the solder pads.

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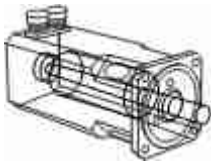

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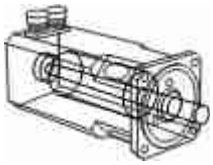

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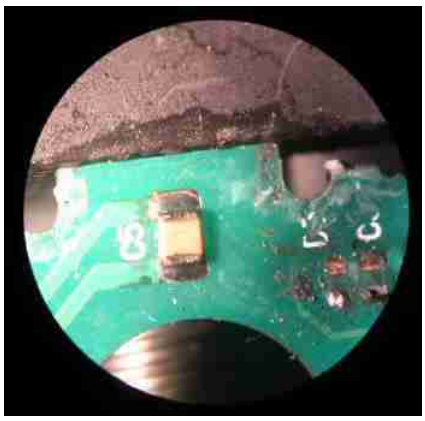
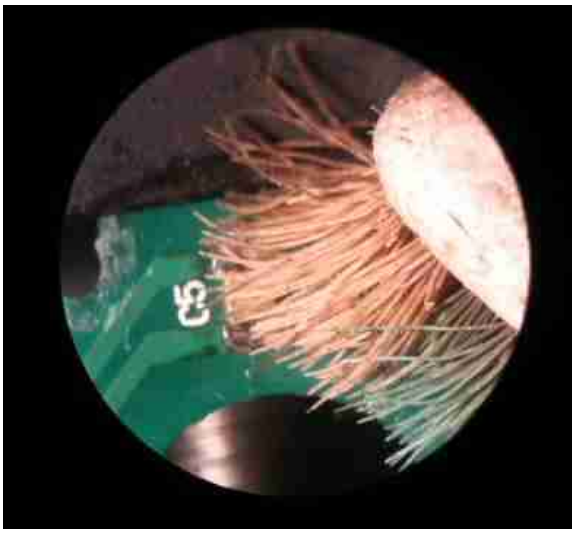
Surface mount soldering with a standard soldering iron

Position the component on its solder pads, hold it firmly under the solder tool and, using a tiny amount of solder held on the soldering iron tip, solder one contact.



Still holding the component with a soldering tool, solder the other contact.



Use a stiff brush and IPA to scrub the rework flux from the component.
A toothbrush is ideal: they are designed to scrub tiny crevices.

It may be sensible to protect the completed PCB with plastic spray.

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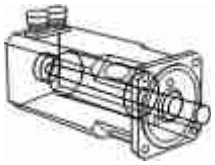

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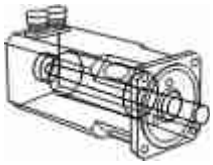

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Surface mount soldering with a standard soldering iron

Some final points:

When dealing with CMOS devices on a PCB, you must use anti-static precautions.

When soldering devices with more contacts (eg, a 14 pin integrated circuit), the removal and replacement procedure is the same as for two-contact components.

If PCB tracks or pads do get damaged, they can be repaired with shredded solder braid, rework flux and solder.

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