INSIDE THE
PI FACTORY

Les Pounder bought a Raspberry Pi and inside
was a golden ticket to the secret Pi factory.

he Sony UK Technology Centre in Pencoed, Wales, is the home of Sony's manufacturing operations for professional television broadcast equipment, but by sheer volume the biggest product manufactured there is the Raspberry Pi, with some 50,000 units being produced each week – roughly one new Raspberry Pi every 5.5 seconds.

We asked Pete Lomas, the designer of the Pi, to explain how they can make so many models in one factory, including the newly released model A+

Process 1 and 2 – bottom SMT and top SMT

A Raspberry Pi starts life as one of six Pis in a panel for the model B+ (it's 8 per panel for the A+, making it about 30% faster to make) to reduce the handling of the bare PCBs (Printed Circuit Boards) and to group the boards into batches. Each panel is loaded into a hopper and in turn each panel makes its way through

the vast line of machinery. First, the boards receive an application of solder paste via an extremely thin steel stencil. An optical check of each board ensures that the application has been done correctly.

With the solder paste in place, the Pis make their way through Sony's specially designed SMT (Surface Mount) mounting machine, which is home to hundreds of reels containing thousands of SMT components such as resistors, capacitors etc. These components are removed from sealed pockets on the reels by advanced pick-and-place machines operating in parallel at tremendous speeds to ensure a smooth operation. These are then gently pressed into the solder paste on the board.

With all the SMT parts in place, the board is then run through the reflow oven to heat the solder paste and the components so that they are bonded together. The SMT process is repeated for the underside and
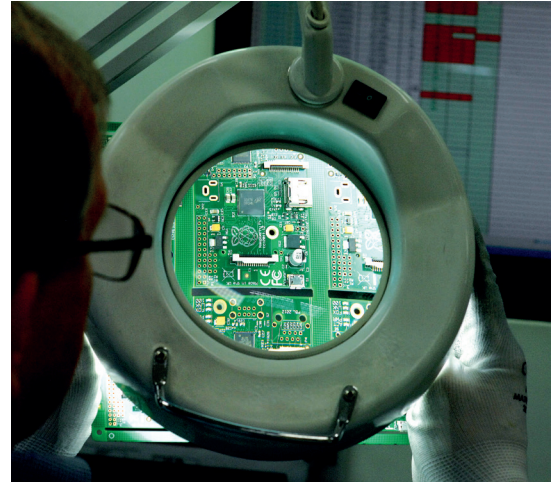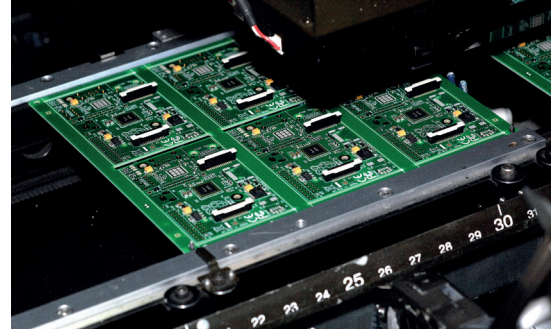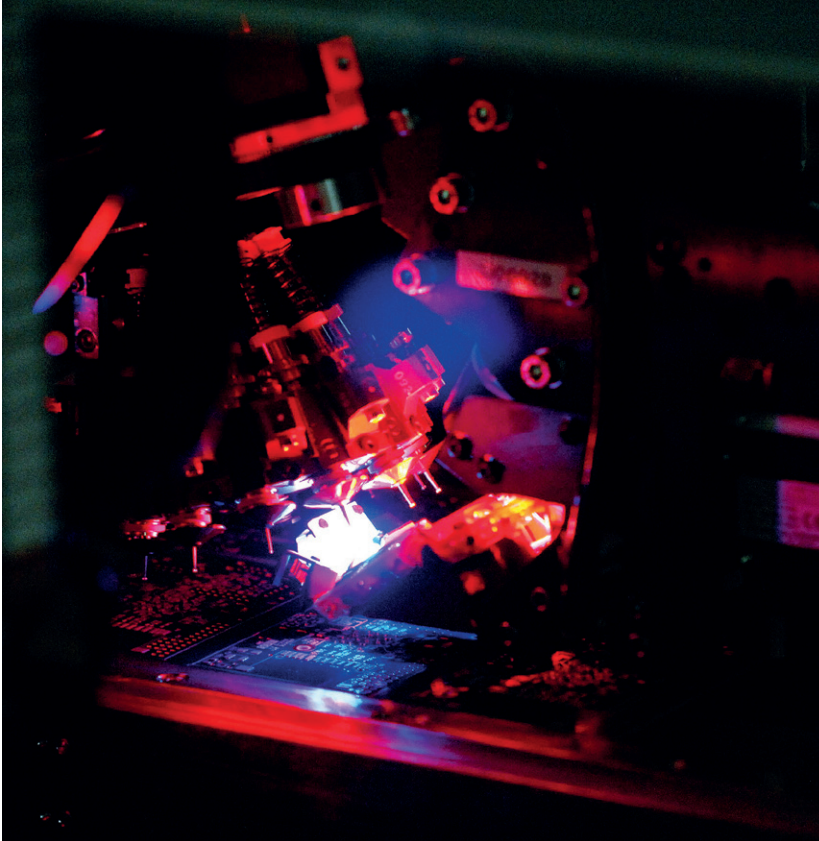
top of the Raspberry Pi, with special attention being paid to the BCM2835 processor unit, which requires a memory chip to be installed on top of it using a specialist package-on-package (or PoP) applicator that adds a small amount of solder paste to the balls of solder on the bottom of the memory chip; this is then lowered onto the BCM2835 to make the connections.

Process 3 – PTH (through-hole)

The Raspberry Pi has only a handful of through-hole components (such as the Ethernet jack) which are added to the panel by a team of skilled operatives. The panel is then placed into a heat-resistant frame to protect the SMT components from desoldering in the next stage. After a quick spray of flux to the underside of the Pis the panel is sent through a wave soldering machine, which will solder the PTH components to the Pis via a wave of molten solder. Using the wave soldering station takes a high level of accuracy to get right, as too much power to the wave can cause the molten solder to flow over the board and ruin a batch of Pis.

Once the PTH stage is complete the Pis are broken from their panels and passed to the test teams who perform automated tests of each Pi. For each testing station there are two Pis being tested at any one time and where a defect is found (this is very uncommon) they are placed into a fail box and an operative will investigate to see if any optimisations can be made to the production process to reduce or remove this fault from the process. Sony take these optimisations very seriously and there is a wall of fame out in the 200 metre long corridor where staff are rewarded for their

improvements and there were quite a few Raspberry Pi flavoured awards on the board.

After the tests are completed each of the Raspberry Pis are placed into an anti-static bag and boxed into the correct packaging for the distributor, either RS (Allied) and Farnell (element14). For all of the above processes there are three production lines which are working together to produce around 10,000 Raspberry Pi per day – and all made in the UK.

From here the Raspberry Pi is sent to stores ready for you to purchase, where it will be taken home and used to power projects both big and small, lighting the fire of imagination inside a child's mind and enabling them to enjoy learning not just about computer science but about the worlds of science, engineering and technology that can benefit greatly from this small PCB. ⬛

Top Placing the SMT components is a precise and rapid part of the process, with thousands of components loaded on to massive reels ready to be used.
Top-right A panel is made up of six Raspberry Pis (eight for the A+) and they will go through all of the processes as a group.

Using a thin steel mask, solder paste is applied to the Raspberry Pi PCB.