It is a shame that some people are so disparaging about screen printing when most advanced technologies are dependent on the process. This dependency is right at the core of the advances in the electronic control and actuation elements. For many years the production of printed circuit boards (PCB's) has been largely the domain of screen and as circuits have become smaller and the range of applications increased so screen printing has strengthened its position in electronics production. A digital printing machine would not issue a single pulse of ink were it not for the rigid and flexible circuits contained within the control system that had been screen printed.

The application of the screen printing in its various forms is growing. Where there is a need to apply specialist materials to a substrate the ability to apply a huge range of "inks" on the same printer is extremely valuable. When high volumes are required with whatever ink system, the quality of screen printing being a mass imaging process comes to the fore. There is no doubt that digital ink jet printing technology will have its place in the production of electronics but the added complication of having to precisely tailor the ink to suit the delivery mechanism is a major inhibiting factor in many applications. Getting ink to transfer through a stencil onto a substrate using the natural mechanisms of differences in surface energy/tension, known as wetting, is a very reliable process. Of course you do get the interference of the mesh that is not unlike the individual nozzles of an inkjet head. In both cases a film is formed when the ink flows to form a continuous layer.

Mesh manufacturers are constantly striving to use finer meshes and the leader in the field is G Bopp Mesh whose UK base is in Alfreton Derbyshire. Their most recent development is the BOPP-SDS is a stainless steel wire cloth with ultra-thin threads down to 18 micron. Some of the meshes in the range have a large open area of up to 72%. The use and careful selection of raw materials, using special alloys, and employing the very latest advanced weaving techniques makes the mesh very strong with exceptionally close and guaranteed mesh thickness tolerances. The ability to achieve high tensioning values allows a minimal off-contact distance, with increased precision of registration for extreme fine line high density printing. A key element of this mesh is the production of the thread itself that is carried out by G Bopp in their plant in Switzerland. Wire drawing is a high precision process that determines not only the diameter but also the tensile characteristics of the thread that govern, along with weaving, the mesh performance during the printing process.

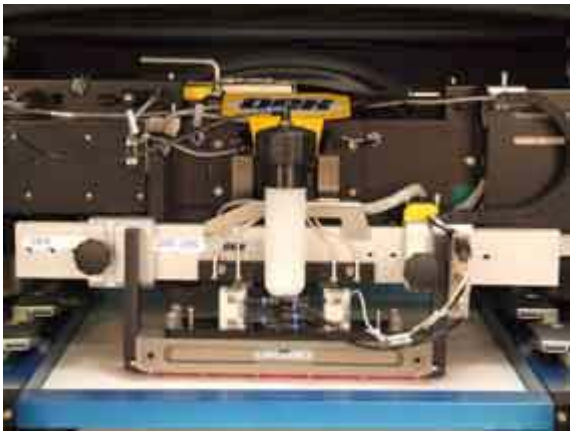
You would have noticed the use of the term "wire cloth" that is derived from sieving applications from where these and conventional polyester screen printing meshes have evolved. Another point to note is how steel meshes are designated compared to polyester. With steel mesh the manufacturer identifies it by the mesh opening and the wire diameter so SD 71/30 is a 71 micron mesh opening with a 30 micron wire diameter. A polyester mesh is identified by 100/40 Y that is 100 threads per centimetre (mesh count) and a 40 micron thread. The Y means anti-halation yellow colour. The steel mesh used in this example is also 100 threads per centimetre. Mesh suppliers provide technical data sheets that give all the characteristics of the meshes. When deciding on a mesh you should refer to these data sheets. When you have decided what you think will

work carry out trials. With standard printing inks there are recommendations as to what mesh should be used with a particular ink. If you want to print special materials make sure that the mesh opening is at least three times the largest pigment particle size otherwise the mesh will act like a sieve and separate out the larger particles that will remain on the squeegee side of the stencil. Others may block the mesh openings.

Steel mesh is generally preferred by companies who print in the electronics industry this both a historical choice and an operational choice. Before the introduction of low elongation polyester meshes steel mesh gave the dimensional stability that users required. With the development of low elongation polyester meshes this advantage was not so great but can still be significant. The latest steel mesh now goes down to an 18 micron as compared to 27 micron for polyester meshes. The advantage of the finer threads is less interference with ink flow and lower ink deposits. The same rules apply with regard to effective use of these meshes you must apply accurate process control and consistent set up. With all meshes control of off contact, squeegee pressure and flood coater profile are very important but with the finer threads they are essential.

In the UK we have a global player in screen printing for the electronics industry in the form of DEK International. DEK have been involved in the industry for 40 years and have led the way in technology development. Their printing machines exhibit the accuracy of machine tools and image size and positional tolerances are in the micron range. Used for a host of applications ranging from applying adhesives for surface mounting on circuit boards to the accurate placement of enzymes on bio-medical sensors. One of the techniques used is their **ProFlow® DirEKt Imaging** that is an alternative to a squeegee. **ProFlow®** is an enclosed print head technology will meter a wide range of fluids and materials onto substrate.

PROFLOW® ENCLOSED PRINT HEAD



Courtesy of DEK International

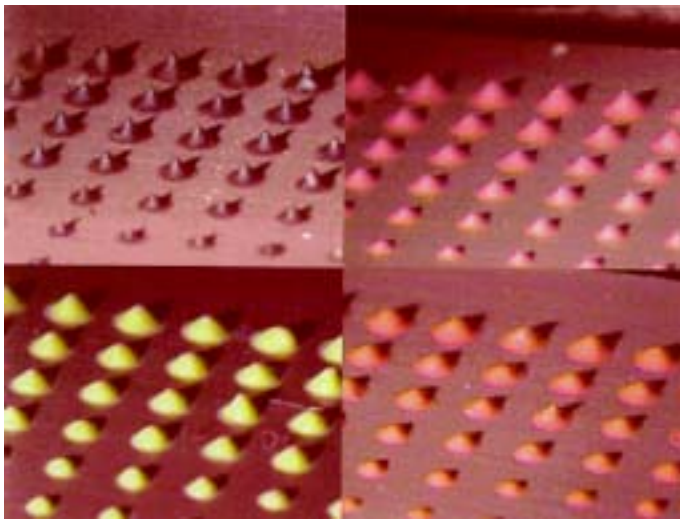
First developed 10 years ago it has been licensed to machinery manufacturers throughout the world. In its latest form the **ProFlow TX** is used for the deposition of enzymes. Here its ability to maintain the condition of water based chemistries is a tremendous advantage over a conventional squeegee. With a normal squeegee the enzyme solution has a large surface area open to the atmosphere resulting in changes in concentration due to evaporation. The enclosed print head removes this variable. The print head is similar to that used in flexographic printing where the ink is held in a chamber and dispensed on to the anilox roller. The system is used with both conventional mesh based stencils and laser cut stencils. With laser cut stencils there is no mesh and the mesh/emulsion combination is replaced with a solid steel foil that has the required image laser cut through it.

Alternatively the image can be created by this electroformed nickel. This gives very close control of the aperture wall definition.

The aim is to achieve consistent lay down and image edge definition. An alternative is to use an acrylic foil that is easily machined and can also have machining on the print side to take account of small but consistent irregularities in the surface to be printed such as tracks or small components on a circuit board.

Although some of these techniques adopted by DEK appear to be distant from graphics printing there is much to learn from their precision engineering approach. The process is the same but the culture of rigid process measurement and control is often quite different.

PRECISE DEPOSITION OF ADHESIVE PADS



Courtesy of DEK International