Micro-Dispensing Technology

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The trend toward micro-assembly continues and micro dispensing technology is keeping pace. For the most popular electronic applications (PCs, mobile devices), circuit densities are increasing, while component and packaging sizes are decreasing. For area array devices, such as ball grid arrays (BGAs), chip scale packages (CSPs), and flip chips, dispensing materials like conductive epoxies and solder paste, often calls for dot sizes approaching 8 mils (0.008 in.) in diameter. Diameters less than 8 mils, in fact, are not uncommon.

Conventional Dispensing Pump

Conventional dispensing pumps, regardless of the configuration, needle size and technique, are hard-pressed to achieve dot sizes below 10 mils (0.010 in.). In addition to achieving this dot size, the challenge is to maintain upper and lower limits of 3-sigma performance in terms of accuracy and repeatability. Conventional pumps are acceptable for dispensing adhesives, solder paste and epoxies in mounting most leaded/unleaded devices, where volumes are larger and some tolerance variation can be accepted. For precise volumes required for micro-dispensing (0201 devices, BGAs, CSPs and flip chips), however, such pumps are often unsuitable. Where manufacturers attempt dot sizes below 10 mils with these pumps, “babysitting” of the equipment is typically required for any hope of success, and rejects can be significant.

Micro-components Mandate Micro-Volume Dispensing

Micro-volume dispensing requires three technologies. First, a pump with the electro/mechanical design and programmable control is needed to consistently dispense materials of various viscosities in volumes as little as 8 mils (0.008 in.) or less, without variation in dot profile and volume. The pumps are called micro-volume pumps, and the need for such capability by manufacturers is becoming paramount in high-density interconnect and semiconductor packaging.

Second is the requirement for dispense tips designed specifically for micro dispensing. The interior of the needle is design to reduce back pressure and clogging. The exterior of the needle is conically chamfered to
reduce the surface tension at the tip of the needle. This allows the material to break cleanly from the tip during the dispense process. There are several styles of needles. They are Surface Mount, Encapsulation, Multi Tip customs, X Form and Luer style. These needles are available in stainless and ceramic.

Third is the need for a control system. Until recently, access to micro-dispensing required an acquisition for new platforms specifically designed for micro-dispensing because conventional SMT platforms cannot support the electronics for programming and controlling the action of the micro-volume pump. There is now, however, a way to retrofit a standard platform for micro-dispensing by using DispenseLink technology, consisting of a valve, needles and micro controller.

**DispenseLink Technology**

Retrofitting micro-dispensing capability to a standard platform is straight-forward; control over the pump shifts from the platform to the micro-controller. The pump is mounted on the standard dispensing platform, replacing the conventional pump and is connected by cable to and interface port on a control box. The cable typically plugs into the output connector on the platform. Alternatively, it can be wired into the platform electronics. Special needles, machined from stainless steel featuring chamfered tips, complete the system.
**X-Y-Z platform**

The platform remains responsible for point-to-point X-Y-Z movement of the table and head, signaling DispenseLink to commence dispensing when the pump is in position. The controller sends and receives signals to and from the pump.

Installation of the micro-controller is shown in figure 2. The controller stores programs in memory; the system is capable of controlling the dispensing for dots, lines, fill routine and any combination of the above.

And because the Micro-Valve is not based on dispensing material for a prescribed amount of time, but rather on the exact increment of rotation of the auger, extremely precise amounts can be dispensed.

In operating the Micro-Valve, a display appears on the controller after power-up, enabling either manual or timed purging of the pump, and password entry. The SETUP screen can (Figure 3) can then be selected, which permits the dispensing of dots or lines to be specified and controlled directly via a RUN/VIEW screen. The PROGs screen is selected to access one of the stored programs, using a numeric keypad. Each of the programs can then be viewed and edited, as necessary, or run.

**Retrofitting on Standard Platforms**

In today’s competitive climate, substrate and component manufacturers face the challenge of accommodating higher densities and smaller components and packages. For today’s dispensing of solder paste, conductive inks, non-conductive and conductive epoxies and underfill’s it is a necessity to use micro-volume dispensing systems for precision and repeatability.

With a recent development, micro-volume pumps can now be retrofitted on standard platforms, thus saving the capital expense of a complete micro-dispensing system. Using a micro-controller cabled to the pump via an interface port, programming and operating the pump is possible for dispensing of micro-volume dots, lines, and patterns.

To learn more contact the author.

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