

New Adhesive Dispensing Technologies Keep Pace With Trend Toward Smaller Products, Tighter Tolerances

By Terrence Woldorf

As companies pack more features into smaller packages with ever-tighter tolerances, the ability to put the right amount of UV-cure adhesive or other assembly fluid in the right location is becoming increasingly critical. This article discusses some of the newest dispensing technologies for helping manufacturers achieve these objectives on their manual, semi-automated and fully automated assembly lines.

Taking the Guesswork Out of Manual Adhesive Dispensing

Air-powered dispensers are a popular choice for benchtop assembly processes because they allow any worker to put an identical amount of adhesive on every part.

These systems operate on compressed air and electricity and use a combination of time, air pressure and tip size to control the amount of adhesive dispensed. Setup and operation are simple—the operator fills a disposable syringe barrel with adhesive, connects it to the dispenser with a lightweight air line, and sets the time and pressure controls to produce the desired deposit size. To apply adhesive, the operator holds the syringe barrel like a pen, places the tip in position, and presses an electric foot pedal to initiate the dispensing cycle. Figure 1 shows how using different pressures, times and dispense tips affects the size of the adhesive deposit.

Traditional dispenser designs—horizontal consoles with a digital time display and analog gauges for air pressure and vacuum—have been providing good results for well over a decade. Today's trends toward smaller products, "lean" manufacturing initiatives and international production facilities are prompting many companies to seek greater accuracy, easy reconfiguration for rapidly changing products and applications, and simple operation for global workforces.

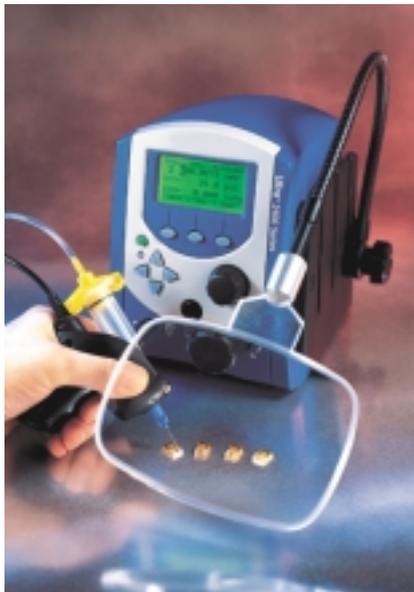
Standard benchtop dispensers allow the time setting (the most precise way to set deposit size) to be adjusted in tenths, hundredths or thousandths of a

FIGURE 1

How different pressures, times and tips affect deposit size *

Dot Size	Air Pressure	Dispense Time	Tip Size
●	30 psi	0.25 seconds	18 gauge (0.84 mm ID)
●	20 psi	0.25 seconds	18 gauge (0.84 mm ID)
●	20 psi	0.10 seconds	18 gauge (0.84 mm ID)
●	30 psi	0.15 seconds	22 gauge (0.41 mm ID)
●	20 psi	0.15 seconds	22 gauge (0.41 mm ID)
●	20 psi	0.10 seconds	22 gauge (0.41 mm ID)

*not to scale



New adhesive dispensers increase process control.

second, but critical applications like medical devices and fiberoptics often require even greater precision.

To meet the growing need for better process control, a new generation of dispensers has been developed. These units feature a unique internal air reservoir and an extra decimal place. This allows manufacturers to fine-tune dispense time in increments as small as 0.0001 seconds, and produce consistent deposits as small as 0.004" in diameter.

Since many companies today have both domestic and offshore production facilities, the new dispensers incorporate features that simplify setup and help ensure that all facilities produce identical results, regardless of geographic location. These include automatic adjustment of input voltage, menus in different languages, and simultaneous display of all dispensing parameters in standard or metric units. To save benchtop space, they have a unique vertical configuration with a footprint 60% smaller than traditional designs.

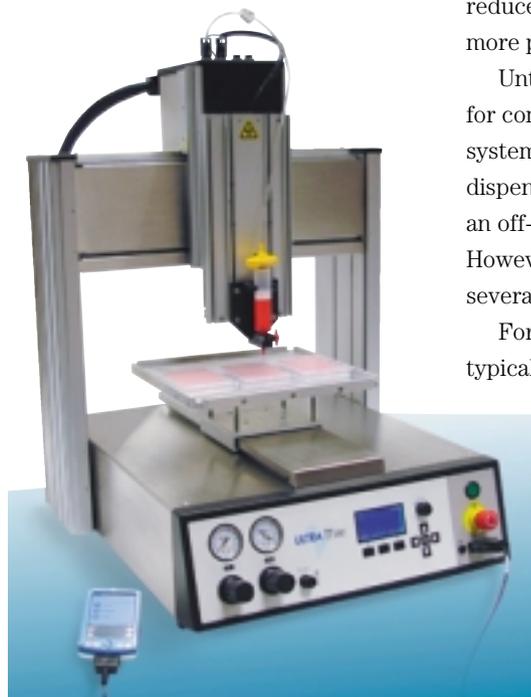
Positive displacement dispensers are another option for benchtop assembly processes. Instead of using air power and a timer to regulate shot size, these all-mechanical units use a stepper motor

and a mechanical link to extend and retract a piston inside the syringe barrel. This ensures a consistent shot size when using adhesives that are prone to changes in viscosity or sensitive to ambient temperature.

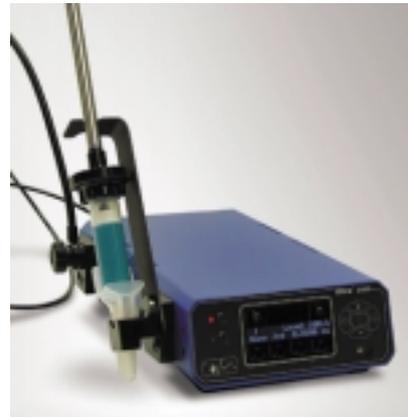
Both dispensing technologies—air-powered and positive displacement—use the same syringe barrels, barrel pistons and dispense tips. The wide range of equipment and disposable components available today allows companies to obtain a dispensing system customized for their specific application at a very reasonable cost.

Increasing Output with Tabletop Automation

Tabletop dispensing systems can be a good solution for manufacturers who need to increase output without adding personnel or who require more precise adhesive placement than manual application can provide. By removing variability from both the positioning and the dispensing process, they make



By removing variability from both the positioning and the dispensing process, tabletop dispensing systems make it possible to apply adhesives and other assembly fluids with greater speed and accuracy.



Positive displacement dispensers regulate shot size by using a stepper motor and mechanical link to extend and retract a piston inside the syringe barrel.

it possible to apply fluids with greater speed and accuracy.

With a tabletop dispensing system, the operator simply loads a part or batch of parts into a fixture, places the fixture on the system's worktable, and presses the start button. With all variations in deposit placement, size and application speed eliminated, workflow and product quality are improved, bottlenecks are reduced, and production rates become more predictable.

Until recently, the standard solution for companies needing a tabletop system was to attach an air-powered dispenser or dispense valve system to an off-the-shelf industrial robot. However, this "make-do" approach had several drawbacks.

For one, small industrial robots typically use stepper motors that cannot provide the positioning accuracy required for many precision dispensing applications, especially as part geometries grow smaller and more complex. For another, it is often left up to the user to figure out a way to mount the dispensing system on the robot and program dispense time, acceleration, deceleration



Using a dedicated controller with each dispense valve makes it easy to purge bubbles from adhesive feed lines, simplifies setup, and allows adjustments to be made at the dispensing station without stopping the production line or reprogramming a PLC (programmable logic controller).

and other parameters using general robotic programming software.

Recently developed tabletop systems eliminate these issues by integrating the dispensing controls into the platform, employing a user-friendly graphic program interface instead of menu-driven software, and incorporating cable drive and closed-loop feedback technology normally found in larger, more expensive equipment.

In addition, the versatility of the new systems makes them ideal for today's lean manufacturing environments. They are easily reprogrammed for different products and applications, and can even be mounted on a cart and moved to different work cells in response to changing production requirements.

Reducing Downtime on Automated Assembly Lines

When choosing a dispensing system for an automated dispensing line, potential issues such as complexity of setup and adjustment, extent of maintenance and downtime, and ease of cleaning should be considered.

Pneumatic valves are often chosen for dispensing light-cure adhesives because of their accuracy, reliability and low-maintenance requirements. Like benchtop dispensers, they regulate shot volume through a combination of fluid pressure, tip size and valve open time.

Diaphragm or needle valves are the styles typically used for UV- and light-cure applications because they provide accurate shots, minimize turbulence

and bubbles, and have no seals or tubing to wear out and leak.

Using a dedicated valve controller (photo on the left) with each dispense valve will make it easy to purge bubbles from adhesive feed lines, simplify setup and allow adjustments to be made and observed at the dispensing station without stopping the production line or reprogramming a PLC (programmable logic controller)—useful when working with different products and specifications.

Dispense Tip Quality Can Make a Surprising Difference

Users of dispensing equipment are often surprised to learn what a big effect the quality of the dispense tip (photos, below left) can have on the accuracy of the deposit, but it makes sense when you consider that this is the final path the fluid will travel before it is placed on the part.

No matter how accurate or expensive the dispensing system, leftover “flash” from the molding process inside tip hubs, burrs and other imperfections in steel needles, or packaging contaminated with dust or lint can all degrade accuracy, especially when making very small deposits.

Unfortunately, most dispense tips look similar from the outside. When accuracy and repeatability are critical, the best insurance is to buy tips from a reputable manufacturer who is willing to certify them for industrial use. ▶



“Flash” inside low-quality dispense tips (left) restricts fluid flow and reduces accuracy. High-quality tips (right) provide unrestricted flow and produce accurate, consistent deposits.

Acknowledgment

Photos provided by EFD.

—Terrence Woldorf is director of marketing, EFD Inc., East Providence, R.I.