



Automating the Dispensing Process

Manual, time/pressure and automated dispensing systems all have their place within the manufacturing support spectrum; the evolution of one system to the next follows a logical progression.

Dispensing technologies are advancing as rapidly as other sectors in support of the manufacturing process, and offer end-users systems from manual to fully automated. Before discussing the criteria for evaluating the automated version and the applications best suited for it, a brief discussion of the various types of dispensing available is appropriate.

Manual Dispensing

The low end of the materials dispensing process is the manual form. Its basic components are extremely simple: a solution to be dispensed, for example adhesives, sealants or lubricants and some form of applicator. A typical manual system includes a dispensing barrel and stopper filled with a material. Another might feature a barrel and a dispensing gun. While component sophistication varies, many of the characteristics of manual dispensing are common to all.

Manual dispensing is perfectly suitable for low-volume/accuracy/repeatability applications where product yields of 70 or 80% are acceptable. Techcon Systems produce a comprehensive range of manual dispensing products designed to suit such needs. Encompassing valves, controllers, syringes, dispensing tips, receiver heads, hoses, adapters and dispensing guns, the Techcon Systems manual dispensing range is ideal for operations that produce less than one million units per year and where dispense repeatability of greater than 10% is acceptable. However, although manual dispensing is a viable and economical fluid-delivery process for these applications, low product throughput and yield can be significant limitations.

Although a typical operator can dispense material for approximately 4,000 units per day, accuracy is inconsistent since operators must control both the time and pressure characteristics of the dispensing cycle. This process variability can result in higher reject rates or lower product yields versus those of the alternative fluid dispensing methods.

Time/Pressure Dispensing (TPD)

TPD is the next step in the process's evolutionary cycle and it eliminates many of the inaccuracies of manual dispensing. TPD adds a regulated pressure control and timing circuit to the manual dispensing components to increase product throughput and yields.

Because dispensing accuracy is highly affected by pressure and timing, regulating these variables significantly increases a system's accuracy. Techcon Systems offers a range of TPD equipment that can easily upgrade a standard manual dispensing system. With controllers, syringes, dispensing tips, receiver heads, adapters, hoses and pressure containers, the comprehensive range ensures that the upgrade to TPD will offer greater accuracy and tighter process control, creating higher product yields and greater overall throughput than manual systems. Yields of greater than 95% are frequent while repeatability errors of less than 3% are regularly achievable with TPD.

A typical TPD system is shown in Figure 1. In operation, the electronic controller delivers a measured air pressure for a specified time span to a disposable syringe barrel or other time/pressure valve. The latter may be a pinch tube, needle, mini-spool or spray filled with a fluid material. This controlled shot of air forces the material out of the delivery end of the barrel, through a dispensing tip and onto the application surface. Standard dispensers control the discharges via an adjustable regulator and gauge that varies air pressure from 1 to 100 psi.

While faster, TPD systems remain limited by operator constraints and do not provide the means to increase throughput beyond certain volumes. Applications that require higher throughput must look for other, more advanced dispensing alternatives.

Automated Dispensing

Automated dispensing systems are the next technological step in fluid dispensing and offer options ranging from simple X-Y axis movement to sophisticated, autonomous, vision-controlled robotic operation. There are two main characteristics of an automated dispensing system: time/pressure regulation (temporal control) and motion or spatial control. Automated dispensing systems combine the tight dispensing control of TPD with the head-placement accuracy of stepper and servo-motor controls, resulting in highly accurate, repeatable and reliable dispensing processes.

Figure 2 shows an industry-standard X-Y-Z table system. A microprocessor-driven controller regulates time and pressure while the gantry arms are controlled by precision servo-motors. The dispensing programme is developed and managed by a Windows-driven software development environment and can be used (or modified) as often as needed.

Reasons for Automation

Reasons for automating a dispensing process relate to both increased productivity and product quality. For example, the automated system shown in Figure 2 is capable of dispensing fluids at 3,600 parts per hour, approximately one part per second. This starkly contrasts with manual dispensing rates of 500 parts per hour, a throughput increase of 720%. Such a rise in productivity is significant and provides an almost immediate return on capital investment.

It is with these automated dispensing options that Techcon Systems comes into its own. Whilst offering a comprehensive range of dispensing solutions for both manual and TPD applications, we specialise in the provision of X-Y-Z tables to suit even the most demanding of situations. Whether you work with smaller components, with a small footprint or with larger parts or pallets, we can offer the automated dispensing solution to ensure improved product quality. Due to heightened dispensing accuracy, overall product yields are increased on account of lower material waste, rework costs and reject rates. Depending on production volume and assembly expense, the cost savings due to higher product quality can be significant.

Additional cost savings may be achieved with automation through greater assembly line flexibility (faster changeover), decreased downtime and lower set-up costs.

Evaluation Factors to Consider

The first step to considering process automation is to completely understand the dispensing process's requirements and how it is to be used in product assembly. Key questions include:

- What material must be dispensed?
- What volumes are to be dispensed and at what (exact) sites?

- What is the dispensing pattern?
- What are the human (limiting) factors? Can these be "engineered " out?
- Do the parts lend themselves to being palletised i.e. organised for easy and repeatable dispensing?

The better the understanding of these dispense requirements, the better the analysis for determining whether the process can be automated. In cases where the exact dispensing parameters are not well understood, manufacturers are urged to contact their automated equipment supplier for a more detailed analysis of the dispensing process.

The second key factor in considering automation is the cost analysis. The major points include:

- What is the cost of the automated dispensing machine?
- What are the production/labour rates for operating the machine?
- What are the current product yields and how much would increasing these save?
- How many more parts can be made (increased throughput) and how much incremental revenue will each part generate?

Other less tangible considerations include the perceived market value of increased product quality and operator/personnel issues.

Automated Dispensing Options

Once the decision has been made to change from manual dispensing to a more automated operation, there are numerous options available. The first is to remove the human time variable and install a simple time/pressure system (Figure 2). The second is to use a stationary dispensing station with a syringe mounted on a stand as an operator moves the part underneath. Next is to add true motion control, ranging from a simple, pneumatic up-down motion to a multi-head and multi-axis robotic dispensing table. The final step in the evolution is to add "intelligence" in the form of features such as vision sensing and true volumetric control.

The fully automated Techcon TS3030 Dispense Robot, for example, is a system that can lead you from the basic dispensing process right through to the most advanced. With its flexible modular design, the TS3030 allows users to add only the features they need as they are required, ranging from elevated repetition and resolution accuracy using Technosoft dispense software through to vision alignment and automatic height sensing.

The Best Candidates

While the factors influencing automation of a dispensing line vary by application, there are many common parameters. Generally, those processes that require a consistent and repeatable operation on similar parts are good candidates for automation. Automation is best suited for medium to high volume applications, or processes that dispense more than one million parts per year. Parts with high 'per unit cost' and a high degree of value-added labour are also prime candidates for an automated dispensing machine. Additionally, parts that can be mounted on a standard platform (palletised) are ideal for automation.

With a vast product range, to suit every type and level of dispensing application system, Techcon's systems can be optimised to suit any process specifications. The automation of the fluid dispensing system is the efficient and cost effective key to the future for the modern SMT manufacturer. With Techcon Systems you will find the system and the consumables to match or upgrade to your specific process requirements.

Summary

As manufacturers grow and assembly processes evolve, the number of options for automating fluid-dispensing systems reciprocally increases. Manual dispensing processes have inherent limitations in quality and throughput, which may be solved by the use of time/pressure systems. Adding both temporal and spatial control to dispensing processes significantly increases the quality and reliability of dispensing, which equates to increased product yields and greater overall line efficiency. Existing technology offers manufacturers unprecedented opportunities to automate their dispensing processes quickly, efficiently and cost effectively.