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## Servo Motor Drive Dispensing Systems

Servo Motors improve adhesive and sealant application quality and product assembly flexibility for manufacturers.

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Adhesive dispensing systems can be difficult to specify when buying new machines and hard to understand when trying to improve their existing performance. Two items critical to dispensing performance and resulting product quality are the metering principle and motor drive selection. The metering principle defines the adhesive delivery process and the motor drive determines the fluid control method for adhesive delivery. The purpose of this guide is to present the purpose of Servo Motor drives used in dispensing adhesives and sealants.

### SERVO MOTORS LOWER COSTS

Does the adhesive dispensing system have a servo drive motor? That's the question being asked today by many manufacturers who require quality parts and reliable production when dispensing adhesives and sealants. Servo drive technology continues to grow in product assembly but is sometimes being overlooked by some manufacturers due to its initial capital cost compared to non-servo drive equipment.

While it is important to realize capital cost expenditures when buying motor controlled dispensing equipment, it is equally important to account for full life cycle financial gains provided by servo drive technology. When dispensing adhesives and sealants onto products, bead placement and size are important factors to consider. Servo motor driven dispensing equipment usually has a better Return on Investment (ROI) than other lower cost drive devices including stepper motors, VFD motors, hydraulic drives and pneumatic drives.

ROI considers the full life cycle of the production equipment and includes the initial capital cost less the cost due to the increase in production rate, reduction of process setup and programming time, reduction of material waste, reduction of product repair, reduction of scrap, reduction of returns, reduction of downtime, reduction of spare parts and reduction of maintenance.

### SERVO MOTOR ADVANTAGES

Servo motors with related controls provide very precise and repeatable control of both position and velocity, and its various feedback parameters allow users to closely monitor the dispensing process and detect any abnormalities before they can become major problems. There are three main advantages to servo drive technology in adhesive and sealant dispensing equipment:

1. Servo drive motors allows you to have preset, multi-segment shot profiles, with each segment having its own material volume and flow rate, and with the ability to smoothly blend the motion of each segment into the next one in the profile. The user can then select from among these preset profiles before initiating the dispense cycle.
2. Servo technology also allows you to continuously vary the material flow rate during the dispense cycle based upon a command reference from the process control. This allows the user to either apply a continuous bead of material with varying bead widths, or conversely, to maintain the same bead width despite changes in the applicator's linear speed, for example when a robot slows down to negotiate a complex curve.
3. A major advantage to servo control is its ability to reliably maintain the commanded volumetric flow rate of material despite changes in the physical conditions of the dispensing system or its environment. Examples of these types of changes are variations in material viscosity, and therefore in the back pressure it generates during the dispense cycle, due to such things as variations in ambient temperature or differences in batches of material; variations in the plant utilities supplied to the dispensing equipment, such as air pressure or electrical voltage; and load changes due to physical wear on the dispensing equipment as it ages. The servo drive simply increases or decreases the amount of current it supplies to the motor as required to maintain the commanded material flow rate, up to the current limits of the drive. If those limits are ever exceeded, the drive generates a fault and stops the cycle, which prevents the customer from unknowingly making out of spec parts.

### **APPLICATIONS FOR SERVO MOTORS**

When adhesive applications require higher production rates, multiple parts with different beads or volumes, correct bead size and placement, exact amounts of adhesives, fewer product and equipment repairs and less product scrap for improved quality and lower costs, then consider servo driven adhesive dispensing systems and their latest innovations for product assembly. Many robotic systems already use high-end servo drive technology yet the adhesive dispensing system may use out of date pneumatic, hydraulic or electric drive systems that may cause monitoring, communication and downtime issues.

Servo drive innovations continue to develop in all industries and provide users with high quality and easy to use dispensing equipment that cannot be made available without servo control devices. For example, a traditional mechanically linked drive and metering cylinders on two component dispensing machines can now be independently servo driven and controlled by innovative servo drive technology that uses easy to understand and highly accurate operator interface controls.

Innovation will continue for servo driven adhesive dispensing systems due to the requirement for equipment to be integrated with high end automation, longer maintenance cycles, more precision, higher torque in smaller packages and lower cost. The benefit for the system supplier with servo driven equipment is to offer their customers the ability to have fully integrated systems that can be continuously monitored for performance, quickly adjusted for changes in product assembly or new products, provide warnings and fault data to address repairs and prevent scrap and actually lower total system operating cost.

## **COMPARE MOTOR DRIVE TECHNOLOGY**

Motor drives for adhesive dispensing systems have increased in technology from the beginning when a pneumatic cylinder drive was first used. Pneumatic drive is a good choice for shot volume dispensing with little need for repeatable flow control. When the air pressure varies the flow rate varies. The need for improvement is the same today as when the air cylinder was upgraded to an air-over-oil drive or hydraulic cylinder.

Air-over-oil drive motors are two cylinders where the air cylinder is attached to an oil cylinder with an oil flow control valve to provide smoother and consistent adhesive flow. A single hydraulic cylinder provides the same reliable adhesive flow but requires a hydraulic power pack which can offer higher pressure and variable flow rates.

Electric drive motors in adhesive dispensing systems provide a higher level of system capability, degree of performance and may use gear reducers or ball-screws to control the flow rate. AC drive motors are lowest cost and use variable-frequency drives to vary the flow. DC Stepper motors are usually open-loop and do not know their position which requires homing upon start-up or after emergency stop. AC or DC Servo motors are used with a closed-loop encoder, has higher resolution for better position control and is normally smoother in motion.

## **WHEN TO USE SERVO MOTORS**

Servo Motor drive technology is recommended when there is a current or future need for:

- Complex bead paths, tight tolerance beads, precise adhesive volumes
- Multiple parts with different dispensing requirements
- Varying the volume or flow of material during a dispensing cycle
- High speed automated dispensing
- Integrating a dispensing system with robot automation
- Using the dispensing system meter unit as a 7<sup>th</sup> robot axis
- Meter systems with dual independent drive meters
- Eliminating a stepper motor's requirement for "homing" at start-up or re-start
- Eliminating a stepper motor's accumulative position variances

## **HOW SERVO MOTOR TECHNOLOGY WORKS**

In an adhesive dispensing system the Servo Motor is controlled by a Servo Drive Control. A programmable logic controller (PLC) communicates with the Servo Drive Control via DeviceNet or equivalent network. At the human-machine interface (HMI) panel the operator first enters values to create a volume and flow rate for each one of preset dispense Profiles stored in the PLC. The desired Profile is selected remotely by the customer's automation control for the defined part or, manually by the operator on the HMI. The shot size and flow rate for this Profile is then downloaded by the PLC into the Servo Drive Control.

When a Dispense Cycle is started, manually or by automation, the PLC commands the Servo Drive Control to start this Dispense Cycle Profile. The Servo Drive Control then independently controls the closed loop motion of the servo motor, which provides the tightest loop with the best velocity control and the finest position resolution. Position and velocity feedback from the servo motor are monitored by the PLC over the DeviceNet connection and typically displayed on the HMI.

When the Dispense Cycle Profile is completed, the Servo Drive Control signals the PLC, and passes this indication to the customer's automation. The PLC then commands the Servo Drive Control to start its Dispense Cycle Complete Profile to prepare for the next Dispense Cycle. The PLC coordinates the opening and closing of the Material Valves with the motion of the Metering

device that is controlled by the Servo Motor, monitors the system sensors and delivers any necessary data and a Dispense Ready signal for the next part.

## **SUMMARY**

Select the motor drive to match the dispensing application and process. Don't settle for a low-technology drive or the only motor drive available for your dispensing system as it may cost you a lot more during production. Define what are the important product and production requirements for your adhesive and sealant dispensing application and have the dispensing equipment manufacturer meet those specifications.

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