Graco Advancements in Single-Component Precision Dispense and Shot Metering Technology

WHITE PAPER

Abstract

Graco has developed three new technologies that provide significant improvements for precision dispensing control of single-component materials in the CASE (coatings, adhesives, sealants and elastomers) market. Each product provides a unique solution to a range of single-component dispensing challenges.

The **Graco PGM Metering System** provides precise metering control for single-component bead, ribbon, or extrusion applications. Using gear metering technology, programmable servo motor controls, and an optional integrated heat package, the PGM offers accuracies of +/-1% along with the ability to quickly change speed. Flow rates range from 8 cc's to 1600 cc's per minute with high viscosity materials (100,000 to 3,000,000 cps). Flow rates can be programmed using a touch screen interface. The systems can be used for dispensing materials at ambient temperatures and for hot melt materials up to 350°F (176°C), with pressures to 2500 psi (172 bar). The servo control of the dispense speed ensures the system can match almost any automated bonding, sealing, or gasketing application.

The **Graco PCF Metering System** is a continuous flow metering and dispense system that offers high accuracy with high flow rates. This is accomplished without the time delay associated with reload of typical shot metering pumps. With continuous flow control technology, adhesives or sealants are pumped from shipping containers through the PCF fluid plate. Material is constantly metered and controlled as it passes through the PCF, providing accurate control with no limitation on shot size. With an accuracy capability of +/- 1%, the PCF is ideal for a range of applications with lower material viscosities (1,000 to 1,000,000 cps).

Graco's **SmartWare™ Technology** is a revolutionary new way to meter and dispense without a secondary metering system. The SmartWare Shot Dispense Kit, when installed on a Graco pumping system, provides an accurate, cost-effective way to dose material – saving time, and material and labor costs.

A Graco pumping system provides an accurate, cost-effective way to dose material – saving time, and material and labor costs.

AUTHORS:
Dave Behrens
Graco Inc.
88 11th Ave. N.E.
Minneapolis, MN 55413

Nick DiDonato
Graco Ohio Inc.
8400 Port Jackson Ave. N.W.
North Canton, Ohio 44720

Graco PGM Metering System

The **Graco PGM Metering System**, the newest member of the Graco precision dispense family, was developed for automated applications where precise metering and bead control are critical for production.

The **Graco PGM Metering System** includes a control center and a precision dispense positive displacement gear pump that is driven by a high torque servo gear motor. Gear pump sizes available are 6cc's and 20cc's per revolution.

The **Graco PGM Metering System** is excellent for high-viscosity materials from 100,000 to 3,000,000 cps, and is capable of flow rates from 8 cc's up to 1600 cc's per minute. Metering accuracy is +/- 1%. The modular system is configured with either Graco Supply Systems for ambient materials or Therm-O-Flow® Systems for hot melt materials.

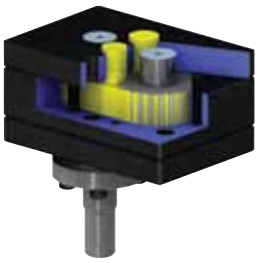

Figure 1:
Precision dispense gear pump

Figure 2: 20cc PGM with direct-mount applicator

Figure 3: PGM controls with touch screen interface

Graco PCF Metering System

The Graco PCF Metering System provides a precise, continuous flow for sealant and adhesive dispensing. This closed loop, continuous flow metering and dispense system offers high accuracy with no shot re-load times. With closed loop continuous flow technology, material is constantly metered and controlled as it passes through the PCF. This provides accurate control with no worry of shot size. The primary components of the PCF are an Advanced Display Module, fluid plate, and fieldbus interface.

The Advanced Display Module provides easy setup, monitoring, and system diagnostics. It also includes a USB interface for data download.

The fluid plate incorporates advanced sensors that provide feedback to the system controls. This is where real-time adjustments are made for changes in material temperatures, viscosities, dispense rates or robot speeds. The fluid plate supports a flowmeter and fluid regulator. The fluid control module located on the fluid plate receives a signal with requested flow rate information from the Advanced Display Module. The fluid control module then checks flow rate with the flowmeter, and adjusts air pressure to the fluid regulator. The fluid control module is constantly checking and adjusting while material is being dispensed. This configuration ensures consistent flow, taking feedback from the fluid stream, then adjusting and accommodating for changes in material temperatures, viscosities, dispense rates and robot speeds. The system offers real-time response delivering highly precise, continuous dispense.

The Gateway fieldbus module allows the PCF to communicate with other automated systems within the manufacturing process. (Devicenet, Ethernet/IP, Profibus, and Profinet options)

Figure 4:
Advanced Display Module

Figure 5: Fluid plate

Figure 6:
Gateway fieldbus interface

TYPICAL URETHANE APPLICATIONS FOR PGM AND PCF INCLUDE:

- Solar panel rail bonding and frame sealing
- Window assembly
- Automotive - urethane windshield sealants
- Automotive - robotized window sealing
- Automotive - carpet bonding
- Automotive - headliner assembly bonding
- Automotive - bonding lead battery cells to polypropylene cases
- Automotive - head and tail lamp bonding
- Automotive - mirror bonding to casings
- Bonding ABS plastic housings
- Automotive - dashboard insert bonding
- Speaker assembly bonding
- Filter end cap bonding and seam sealing

The Graco PGM Metering System and the Graco PCF Metering System must be used in conjunction with ambient or heated bulk unloader feed systems. These can be configured for either 5 or 55-gallon containers.

Figure 7:
Graco Ambient Supply System

Figure 8:
Graco Warm Melt Supply System

Figure 9:
Therm-O-Flow Hot Melt System

SmartWare Technology

Graco's SmartWare Shot Dispense Kit allows end-users to dose a preset amount of single-component material using a Graco pump. The SmartWare Shot Dispense Kit consists of a Local Control Module, sensors, cables and mounting hardware. When the SmartWare Shot Dispense Kit is installed on a Graco Supply System, or Dura-Flo™ or Check-Mate® pump, it turns the pump into a dosing system. The Graco pump must be equipped with an NXT™ Air Motor.

This revolutionary new shot dispense system provides accurate dosing without flow-meters or gear meters in the fluid stream. Instead, a linear sensor tracks the pump position so the pump becomes the flowmeter. Using the primary pump as a metering system removes all secondary metering components from the fluid stream, reducing cost and wear issues. This technology gives end-users a low cost solution when faced with urethane batching or dosing applications. It is an economical alternative to both manual methods such as mechanical counters, scales, and also fully automated batch systems.

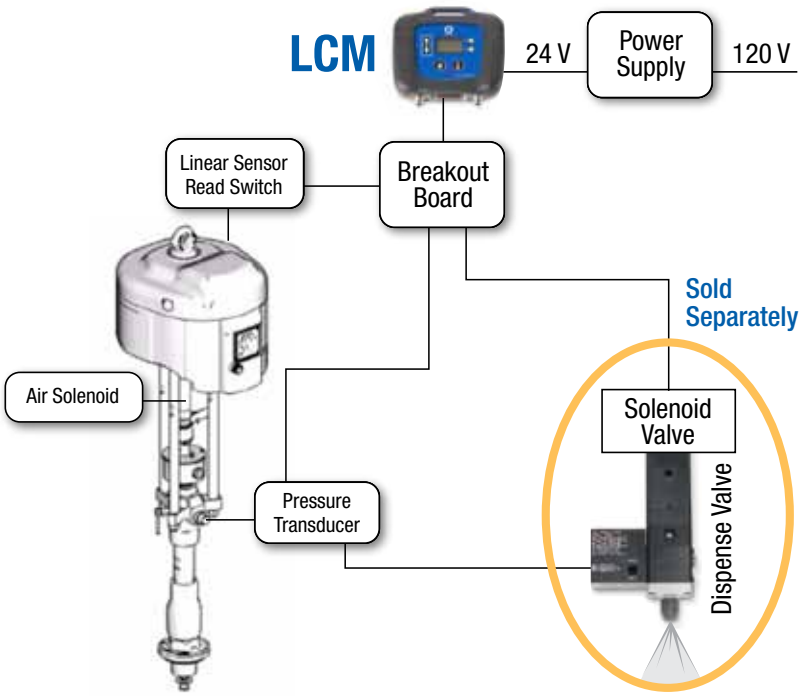

Figure 11: Graco SmartWare layout

Figure 10: 20 liter Supply System with SmartWare Shot Dispense Kit

The SmartWare system allows for shot sizes from 6 cc's to 1,000 gallons. Shot size accuracies range from 0.25% to 3%, depending on material, volume output, and system setup.

The Local Control Module offers a sequence mode, allowing the end-user to dispense a series of up to 14 different shot sizes. The display shows the programmed shot size and also displays the amount actually dispensed.

Target urethane markets/applications

- General industrial applications:
  - Cartridge fill
  - Kitting
  - Converting
  - Cavity fill / potting
  - Batch formulating / blending

GRACO CONTROL ARCHITECTURE

The PCF Metering system and SmartWare Technology incorporate Graco Control Architecture, the framework that provides end-users with a quantum improvement in their ability to monitor and control fluid management processes.

Graco Control Architecture reduces point-to-point wiring and unique circuit boards. This reduces cost and points of failure. Graco Control Architecture also incorporates shared modular components that are easily upgraded with a software token.

These features lead to significantly improved process monitoring and control capability, shorter lead times, and improved product quality.

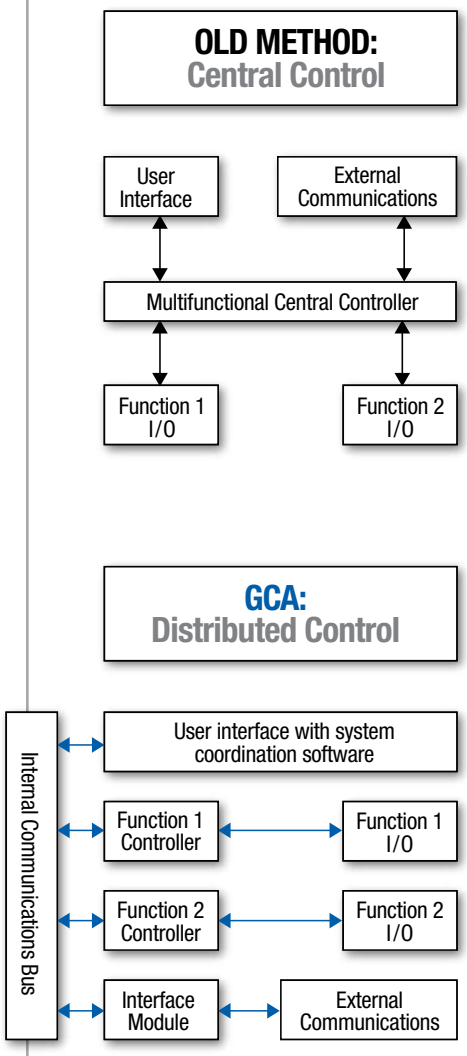

Figure 12: Central Control vs. Graco Control Architecture

DISPENSE VALVES

All three systems (PGM, PCF, and SmartWare Technology) are used in conjunction with hoses (ambient and or heated) and Graco dispense valves including the EnDure® Auto Dispense Valve, the 1K Ultra-Lite™ Precision Dispense Valve, the Auto Plus™ Valve.

Figure 13:
EnDure Auto Dispense Valve

Figure 14:
1K Ultra-Lite Precision Dispense Valve

Figure 15:
Auto Plus Valve

Summary

PGM, PCF, and SmartWare technology offer advancements in metering and flow control for ambient and heated single component urethanes. PGM and PCF offer additional control for both robotic bead placement and volumetric dispense, while SmartWare offers control of volumetric shots and batch dispense. All three new products represent significant advancements in the ability to meter and dispense single-component materials.

BIOGRAPHY

DAVE BEHRENS

Dave Behrens is a Product Marketing Manager within the Applied Fluid Technologies Division of Graco Inc. Dave has over six years experience with fluid handling equipment for sealants and adhesives.

NICK DiDONATO

Nick DiDonato is a Business Development Specialist within the Applied Fluid Technologies Division for Graco Inc. Nick has over 20 years experience with fluid dispense equipment for coatings, adhesive, and sealant applications.