



Fluidic Systems
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Fluidic Systems Technology

Fluidic's technology is based on patented Linear Displacement Pumps (LDPs) and PLC Control System. By means of precision motion control (similar to robotic controls and drives), powered by closed loop DC servo motors with ball screw drives, and coupled to LDP positive displacement double-acting pumps results in a fluid metering system with a wide range of dispensing parameters:

- Continuous Metered Flow: Virtually pulse-free fluid flow
- Multiple Axis Metering: 1 part to 3 components standard; 4+ optional
- Mix Ratios: 1:1 to 100:1 (+/- 1% accuracy)
- Precision Flow Control: Robotic flow ramping (1cc/min. to 2gal/min.)
- Viscosity Range: <1cps to heavy non-flow abrasive compounds
- Pressure Range: 1psi to 3,500psi

LINEAR DISPLACEMENT PUMP (LDP)

Fluidic's patented LDP is a volumetrically accurate double-acting continuous flow rod displacement pump. LDPs have the advantage of no material slip (material bypass) and are unaffected by viscosity variations. Gear Meter pumps have inherent slip factors and Piston and Progressive Cavity pumps wear with abrasive compounds resulting in material slip. Slip factors adversely affect metering accuracy. LDP pumps have no slip factor regardless of pressure. LDP rods do not contact the cylinder wall and perform well with abrasive compounds. And unlike Gear Meter pumps, LDPs are unaffected by batch to batch and temperature induced viscosity variations that require calibration adjustments. LDP rods simply displace their own volume regardless of fluid viscosity variations. The LDP has two sets of fluid cylinders; one set for filling, the other set for dispensing. The fill and dispense functions alternate between the cylinder sets as the LDP reciprocates. Both cylinder sets are connected to a single four-way cross-over valve (XV2) that reverses fill and dispense port orientations when the LDP reciprocates.

XV2 Cross-Over Valve

Each LDP cylinder set is filled and dispensed from a single port. This is facilitated by Fluidic's patent pending XV2 4-way cross-over valve that redirects fill and dispense port orientations. This design eliminates separate fill and dispense ports utilizing check valves. Check valves are not efficient and malfunction affecting metering accuracy. When the LDP changes direction, the XV2 is simultaneously actuated to reverse the Fill and Dispense porting. The LDP reciprocation and XV2 actuation happens in milli-seconds to provide a continuous fluid dispense output. Additionally, the fill input pressure is balanced to match the dispense output pressure so there is no differential fluid pressure during LDP reciprocation. The combination of the simultaneous LDP reciprocation/XV2 actuation and balanced fill/dispense pressures provides continuous and virtually pulse-free metered flow.

LDP CONTROLS

LDP Control and Drive Components:

A PLC sends a run control output through a Servo Drive Amplifier to a closed loop DC Servo Motor. The Servo Motor is coupled to a Gear Box that turns a Ball Screw to drive the LDP. The LDP reciprocation is controlled by PLC motor reversing commands. As the LDP reciprocates, the XV2 reverses the Fill and Dispense fluid ports so one set of cylinders is always filling while the other cylinder set is dispensing.

Linear Transducer:

Each LDP has a Linear Transducer that is monitored by the OIT/PLC controls. The Linear Transducers track the exact position of the LDP through its reciprocation range. The primary function is to reverse the direction of the LDP at the end of its stroke during normal operation. Secondly, they are used for positioning the LDP's stroke position relative to another LDP for Ratio Check, Shot control, and Diagnostic functions. The Linear Transducers are also monitored for open-loop and short-circuit conditions.

Pressure Transducers:

Each LDP outlet is provided with a pressure transducer that is monitored by the OIT/PLC controls. When the pressure for an active LDP reaches the maximum pressure set point the LDPs stop and start again upon sensing a set pressure drop. They provide utility for Limiting Pressure in certain dispense/spray applications, pressure sensing for Material Supply Sensing (MSS), Detecting Flow Obstructions, and Over Pressure Safety protection. The pressure transducers are also monitored for open-loop and short-circuit conditions.

PLURAL COMPONENT METERING

Fluidic PK (Plural “K”omponent) units are variable ratio from 1:1 to 100:1 with a +/- 1% accuracy. The PK units have one LDP for each material component that is independently controlled. Dispensing fluids at specific ratios is achieved by controlling the relative velocities of two or more LDPs. Examples: 1:1 volumetric ratio both LDPs run at the same speed; 10:1 volumetric ratio - one LDP runs ten times faster than the other. Input mix ratios can be set to .01. Set mix ratios are validated by measuring metered samples at the Ratio Check Module. Additionally, SPC Ratio Tracking monitors mix ratios within settable limits. Once the velocities of the LDPs are set to a specific ratio, variable flow rates are achieved by changing the speed of the LDPs while maintaining the ratio speed differential. The flow rates can be rapidly ramped up and down on the fly by means of the servo controlled drive.

OPERATOR INTERFACE TERMINAL CONTROL FEATURES

All functions for set up, monitoring, and controlling of spray/dispense parameters are operated from an OIT touch screen display. Control functions are intuitively easy to use. No programming skills are necessary. Keypad Protection is available for all control functions. The PLC control system permits easy integration with other factory automation systems.

Typical Control Functions & Displays:

- Main Page Display
 - Pump Selection & Ratio Set Points:
 - Pressure Settings & Flow Rate:
 - Dispense Shots:
 - Ratio Check Mode:
 - Pump & Line Flush:
 - Material Supply Sensors (MSS):
 - Recirculation:
 - Pot Life Purge Alarms:
 - SPC Display & Network Reporting:
 - Temperature Settings:
 - Liquid Level Scales (LLS)
 - Robotic Interface:
 - Fault Page Display:
 - Maintenance Pop-Up Reminders:
- Key Parameter Settings & Output Displays
 - Single & Multiple Pump Selection / Ratios settable to .01
 - Robotic Flow Ramping on the fly
 - Metered Shot set up and control
 - Metered Fluid Samples for Mix Ratio Validation
 - Flush Routines for Mixers, Hoses, Guns and Pumps
 - Monitoring Material Supply Feed
 - Activation Timer & Flow Rate Control
 - Alarm & Purge/Flush Activation Timer
 - Production Outputs/Ratio Tracking to printer or network
 - Heated Reservoirs, Hoses, Pumps, Dispense Valves
 - Virtual Displays of actual Material Supply Levels
 - Enable and Disable Modes
 - Date & Time Fault History
 - XV2, DV2, and LDP Seal Lubrication

TECHNICAL SPECIFICATIONS

Air Consumption: 25 CFM @ 80 – 120 PSI

Electric Supply: 120 VAC – 20 – 30 AMPS
30 KV Power Surge/Filter Suppressor
Standards*:

Class I, Division 2 Groups C & D

Optional Standards*:

Class I, Division 1 Zone 0 & 1 Hazardous Classified Locations, Group D

*Manufacturing Standards. UL Test Certification in process.

SYSTEM DESIGN

Fluidic PK units are housed in a sheet metal electronic enclosure 24"x27"x57" FIG1. The enclosure is divided into two sections separated by a metal bulkhead. The top cabinet section is the electronics enclosure that is pressurized, sealed, and gasketed with a lockable door FIG 2. The OIT touch screen is mounted on the door with a lockable bezel door. The unpressurized lower cabinet section contains the LDPs, XV2 valves, and linear transducers FIG 3. LDPs, fittings, and plumbing are stainless steel. Mix manifold and pressure transducers are mounted on rear enclosure FIG 4.



FIG 1



FIG 2



FIG 3



FIG 4