Products & Solutions

proportional pneumatic valves & electronics
specialty systems & engineering services

performance
proportional
fast
smooth
quiet
efficient
economical

control
position
pressure
force
flow
velocity
switching

systems
pneumatic
hydraulic
electromechanical
sensors
instrumentation
control electronics
The LS-Series valves are the ultimate in proportional control for both closed loop and open loop systems. With shifting times less than 2.5 ms and linear proportionality, the LS-Series surpasses even high performance solenoids, allowing designers to create breakthrough applications.

**Features**
- 5/3 Bi-Directional Proportional Flow Control
- Direct Acting Linear Force Motor
- Infinitely Variable Valve Positioning (3 Extreme Positions)
- Low Hysteresis
- High Bandwidth
- Fast Shifting Time
- Low Leakage

**Applications**
High performance open and closed loop systems. Included but not limited to:
- Motion Control
- Flow Control
- Pressure Control
- Force Control
- Vacuum Control
- Ultra-Fast Switching (<5 ms)

**Compatibility**
Controllers
- C1 Controller & Driver
- LS-C10 Controller & Driver
- LS-C41 Controller & Driver

Drivers
- D1 Proportional Linear Motor Valve Driver

**Mechanical Specifications**
- **Pressure:** -1...10 bar (vacuum...150 psig)
- **Connector:** 3-pin M8 x 1 (male)
- **Gating Element:** Spool and Sleeve
- **Mounting:** (2) Thru Holes
- **Temperature Range:** 0°C – 50°C (32°F - 122°F)
- **Filtration:** 5 μm particulate
- **Media:** Unlubricated, Dry, Neutral Gas

**Material Specifications**
- **Body:** Aluminum 6061
- **Spool & Sleeve:** Stainless Steel 440C
- **Seals & Gaskets:** Nitrile
- **Other:** Nickel Plated Steel & Copper

**Electrical Specifications**
- **Current:** -1A...0...1A from Enfield Electronics
- **Power Consumption:** Maximum Consumption < 8W

**Performance Specifications**
- **Shifting Time:** < 2.5 ms
- **Hysteresis:**
  - Average Hysteresis < 5 % of full scale range
  - Maximum Hysteresis <10% of full scale range
- **Valve Type:** 4-Way, Proportional
The LS High Speed Proportional Pneumatic Control Valves deliver highly linear flow output overcoming traditional speed and control barriers. With three different valve sizes, the LS-Series can cover a wide range of applications with unprecedented valve aperture control. Designers can use one valve where two or more are often needed, decreasing complexity and lowering both purchase and maintenance costs – a simple and cost effective solution.

<table>
<thead>
<tr>
<th>Valve Specifications</th>
<th>LS-V05s</th>
<th>LS-V15s</th>
<th>LS-V25s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Aperture</td>
<td>5 mm²</td>
<td>15 mm²</td>
<td>25 mm²</td>
</tr>
<tr>
<td>Flow Capacity</td>
<td>170 SLPM</td>
<td>460 SLPM</td>
<td>1300 SLPM</td>
</tr>
<tr>
<td>5.5 → 0 bar (6 SCFM)</td>
<td></td>
<td>(16 SCFM)</td>
<td>(46 SCFM)</td>
</tr>
<tr>
<td>Ports</td>
<td>10-32 UNF-3B</td>
<td>1/8” NPTF</td>
<td>1/4” NPTF</td>
</tr>
<tr>
<td>Dimensions</td>
<td>71 x 41 x 25 mm (2.8 x 1.6 x 1.0 in)</td>
<td>99 x 61 x 35 mm (3.9 x 2.4 x 1.4 in)</td>
<td>122 x 72 x 45 mm (4.8 x 2.9 x 1.7 in)</td>
</tr>
<tr>
<td>Weight</td>
<td>158 g (5.6 oz)</td>
<td>462 g (16.4 oz)</td>
<td>824 g (29.1 oz)</td>
</tr>
<tr>
<td>Turndown Ratio</td>
<td>100:1</td>
<td>150:1</td>
<td>200:1</td>
</tr>
</tbody>
</table>
The M-Series valves are instrument grade, proportional, pneumatic directional control valves engineered for high performance applications. Designed to directly interface with a PLC, motion controller, or with compatible Enfield electronics, the M-Series valves provide high speed linear control.

**Features**
- 5/3 Bi-Directional Proportional Flow Control
- Direct Acting Linear Force Motor
- Infinitely Variable Valve Positioning (3 Extreme Positions)
- Low Hysteresis
- High Bandwidth
- Fast Shifting Time
- Low Leakage
- High Linearity

**Applications**
High performance open and closed loop systems.
Included but not limited to:
- Motion Control
- Flow Control
- Pressure Control
- Force Control
- Vacuum Control
- Ultra-Fast Switching (<5 ms)

**Compatibility**

**Controllers**
- C1 Controller & Driver (M2s)
- LS-C10 Controller & Driver (M2s)
- LS-C41 Controller & Driver (All)

**Drivers**
- D1 Proportional Linear Motor Valve Driver (M2s)

**Mechanical Specifications**
- **Pressure:** -1...15 bar (vacuum...225 psig)
- **Ports:** 3/8" NPTF
- **Mounting:** 2 x 10–32 Thru Holes
- **Temperature Range:** 0°C– 50°C (32°F – 122°F)
- **Filtration:** 5 μm particulate
- **Media:** Unlubricated, Dry, Neutral Gas
- **Environmental Protection Class:** IP65
- **Gating Element:** Spool and Sleeve

**Material Specifications**
- **Body:** Aluminium 6061
- **Spool & Sleeve:** Stainless Steel 440C
- **Seals & Gaskets:** Nitrile
- **Other:** Nickel Plated Steel & Copper

**Performance Specifications**
- **Shifting Time:** < 2.8 ms
- **Hysteresis:**
  - Average Hysteresis < 5 %
  - Maximum Hysteresis <10%
- **Valve Type:** 4-Way, Proportional
- **Flow (80 → 0 psig):**
  - 60 SCFM (1750 SLPM)
- **Turndown Ratio:** 250:1

**ISO M-Series Diagram**
The M-Series High Speed Proportional Pneumatic Valves enable high precision industrial and automation applications. In addition to the proportional response and ultra-fast response time, the construction of these valves feature an IP65 environmental protection rating. With 3/8” NPTF ports, the M-Series offers the highest flow capacity of the entire product line allowing for faster responses and quicker dynamics. Featuring three different electronics packages, users can select the M-Series valve that most easily integrates into their design.

<table>
<thead>
<tr>
<th>Valve Specifications</th>
<th>M1d</th>
<th>M2d</th>
<th>M2s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical Connection</strong></td>
<td>3-Pin M8 x 1 (Male)</td>
<td>6-Pin Alden PL500 (Female)</td>
<td>3-Pin M8 x 1 (Male)</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>0...5 VDC</td>
<td>-10...-10 VDC</td>
<td>-1A...0...1A from Enfield electronics</td>
</tr>
<tr>
<td></td>
<td>0...10 VDC</td>
<td>-5...5 VDC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0...20mA</td>
<td>0...5 VDC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4...20mA</td>
<td>0...10 VDC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PWM (&gt;2 kHz)</td>
<td>0...20 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4...20 mA</td>
<td></td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>158.7 x 55.0 x 45.0 mm (6.25 x 2.17 x 1.77 in)</td>
<td>171.9 x 55.0 x 45.0 mm (6.77 x 2.17 x 1.77 in)</td>
<td>158.3 x 55.0 x 45.0 mm (6.23 x 2.17 x 1.77 in)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>818 g (28.8 oz)</td>
<td>852 g (30.0 oz)</td>
<td>795 g (28.0 oz)</td>
</tr>
</tbody>
</table>
Compact and powerful, the C1 controller and driver pairs with the LS and M-series valves to deliver the optimal performance for pressure, position, force, vacuum and flow control applications.

**Features**
- Small Footprint
- Lightweight
- Two Control Modules
- Test Ports for Troubleshooting
- RoHs Compliant
- Enclosed Circuitry Preventing ESD
- Works with LS & Enfinity Style Valves

**Applications**
- Material Removal
- Temperature Control
- Bi-Directional Air Motor
- Bottle & Bag Filling
- Glass Forming
- Quality Control Sorting
- Pick & Place
- Product or Pallet Indexing
- Rotary Indexing

**Compatibility**
- LS-Series Valves
  - LS-V05s
  - LS-V15s
  - LS-V25s
- M-Series Valves
  - M2s

**Mechanical Specifications:**
- Temperature Range: -40°C to 65°C (-40°F to 150°F)
- Connector: 8 pin pluggable terminal block
- Mounting: Removable DIN clip w/ flush option
- Height: 45 mm (1.76 in)
- Width: 46 mm (1.76 in)
- Length: 56 mm (2.20 in)
- Weight: 45 g (1.6 oz)

**Material Specifications:**
- Main Body: ABS
- Gray Cap: PAGF 30% Glass Filled Nylon
- DIN Clip: ABS

**Electrical Specifications:**
- Power Requirement: 12 ± 2 VDC
  24 ± 4 VDC @ 15W
- Command Input Impedance: 0...10 VDC: 100kΩ; 4...20mA: 210Ω
- Feedback Input Impedance: 0...10 VDC: 100kΩ; 4...20mA: 210Ω
- Command Input: Configurable 0...10 VDC; 4...20mA
- Feedback Input: Configurable 0...10 VDC; 4...20mA
- Output: -1A...0...1A
- Electronic Adjustments: Four configurable potentiometers
  Jumpers select analog input signal types
  Jumper for control algorithm
- Status Indications: Two power and status LEDs
- Excitation: +10V (15mA max)
- Electrical Connection: Eight pin pluggable terminal block

**Control Algorithms:**
- **Configuration 1:**
  Proportional, Ramp Rate, Minimum Position & Maximum Position
- **Configuration 2:**
  Proportional, Ramp Rate, Integral & Derivative.
The C1 Controller & Driver is compact in size yet expansive in capability. This powerful combination of controller and driver is the ideal solution for pressure, position, force, vacuum and flow controls. The C1 features two independent control algorithms selected via an on-board jumper. Each selectable algorithm configures the functionality of the four potentiometers delivering maximum performance and flexibility.

Control Algorithms

\[
W_c = (k_p \varepsilon)
\]

\[
W_c = (k_p \varepsilon + k_i \int \varepsilon dt + k_d \frac{\partial \varepsilon}{\partial t}) + k_i W_r
\]

\begin{align*}
W_s &= \text{command setpoint} \\
W_r &= W_s \text{ ramped} \\
X_s &= \text{sensor feedback} \\
W_c &= \text{drive control effort} \\
W_m &= \text{motor effect}
\end{align*}
Compact and easy to use, the D1 proportional linear motor valve driver is designed to optimize the performance of Enfield Technologies' valves. With selectable input options, the D1 allows for quick interfacing between the valve and PLC, computer or motion controller.

**Features**
- Lightweight
- Compact Size
- Enclosed Circuit
- No Heat Sink Required
- RoHS Compliant
- Digital Closed Loop Current Control
- Accepts PWM Input from PLC
- LED Indicators for Power and Status

**Applications**
- Rotary Positioning
- Pump & Compressor Control
- Lane Divide & Divert
- Material Processing
- Lifecycle Testing
- Pneumatic Press
- Material Processing
- Tensioning and Braking

**Compatibility**
- LS-Series Valves
  - LS-V05s
  - LS-V15s
  - LS-V25s
- M-Series Valves
  - M2s

**Mechanical Specifications:**
- Temperature Range: -40°C to 65°C (-40°F to 150°F)
- Connector: 6 pin pluggable terminal block
- Mounting: Removable DIN clip w/ flush option
- Height: 45 mm (1.76 in)
- Width: 46 mm (1.76 in)
- Length: 56 mm (2.20 in)
- Weight: 45 g (1.6 oz)

**Material Specifications:**
- Main Body: ABS
- Gray Cap: PAGF 30%
- DIN Clip: ABS

**Electrical Specifications:**
- Power Requirement: 12 ± 2 VDC
  24 ± 4 VDC @ 15W
- Command Input Impedance:
  0...5VDC or 0...10VDC: 100kΩ
  0...20mA or 4...20mA: 210Ω
- Feedback Input Impedance:
  0...5VDC or 0...10VDC: 100kΩ
  0...20mA or 4...20mA: 210Ω
- Command Input:
  Selectable 0...5 VDC, 0...10 VDC, PWM (>2 kHz), 0...20mA, 4...20mA
- Output:
  -1A...0...1A
- Electronic Adjustments:
  Three configurable potentiometers
  Jumpers select analog input signal types
- Status Indications:
  2 power and status LEDs
- Electrical Connection:
  6 pin pluggable terminal block

**Potentiometer Adjustments:**
- Deadband Elimination:
  11 Turn Potentiometer (RP1)
- Dither Amplitude:
  11 Turn Potentiometer (RP2)
- Maximum Drive Current:
  11 Turn Potentiometer (RP3)
The D1 Proportional Linear Motor Valve Driver provides a readily available solution that is compact and easy to implement. The D1 helps users avoid the effort and expense of characterizing valves and developing electronics for their application. For applications using PLCs or computers, the D1 easily interfaces with the valve. This eliminates the need to write valve management routines which consume valuable processing cycles needed for other machine functions.

Driver Adjustments

- **RP1**: Increasing Dedband Elimination reduces the effective overlap in the valve
- **RP2**: Decreasing Maximum Drive Current reduces the maximum opening of the valve
- **RP3**: Increasing Dither Amplitude reduces the hysteresis in the valve
Simple by design, the S2 is an all-in-one pneumatic positioning system capable of tackling high speed and high force applications while linearly positioning a cylinder anywhere along its stroke.

**Features**
- Easy Tuning
- Simple Setup and Wiring
- Wide Range of Input Pressures
- Minimized Air Consumption
- All-in-One Package

**Applications**
- Line and Hopper Feed Rate
- Edge Guide Positioning
- Case Erect and Pack
- Pick and Place
- Lane Divide and Divert
- Gripper Position Control
- Quality Control Sorting
- Component Placing
- Actuate and Pilot Process Valves
- Material Processing
- Level and Elevator Control
- Sluice Gate Control
- Rotary Indexing and Positioning

**Compatibility**
Add position control to almost any application.
Typical compatibility:
- Double Acting
- Non-Repairable Cylinders
- ISO & Tie Rod Cylinders
- Grippers & End Effectors
- Vane or Rack & Pinion
- Rotary Cylinders

**Mechanical Specifications**
- Pressure:
  - 0...10 bar (0...150 psig)
- Ports:
  - ¼” NPTF
- Connector:
  - 5-pin M8 x 1 (male)
- Mounting:
  - 2 x M5 (10-32) Thru Holes
- Temperature Range:
  - 0º – 40ºC (32º– 104ºF)
- Filtration:
  - 5 μm Particulate
  - 0.3 μm Coalescing
- Media:
  - Unlubricated, Dry, Neutral Gas
- Height:
  - 126 mm (5.00 in)
- Width:
  - 64 mm (2.50 in)
- Length:
  - 68 mm (2.75 in)
- Weight:
  - 0.91 kg (2.00 lbs)

**Material Specifications**
- Body:
  - Aluminum 6061
- Caps:
  - PA66 30% Glass Filled Nylon
- Other:
  - Nitrile, 440C SS, Nickel Plated Steel

**Electrical Specifications**
- Power Requirement:
  - 12 ± 2 VDC
  - 24 ± 4 VDC @ 20W
- Command Input Impedance:
  - 0...10VDC: 100kΩ
  - 4...20mA: 210Ω
- Feedback Input Impedance:
  - 0...10VDC: 100kΩ
  - 4...20mA: 210Ω
- Command Input:
  - Configurable 0...10 VDC; 4...20mA
- Feedback Input:
  - Configurable 0...10 VDC; 4...20mA
- Electronic Adjustments:
  - USB-Connectable User Interface
- Status Indications:
  - 2 Power and Status LEDs
- Excitation:
  - +10V (15mA max)

**Performance Specifications**
- Positional Accuracy:
  - ± 0.1...1% of Full Scale (typical)
- Flow:
  - 1300 SLPM 5.5 → 0 bar
  - (46 SCFM 80 → 0 psi)
- Leak Rate:
  - 5.7 SLPM 10 → 0 bar
  - (12 SCFH 150 → 0 psi)
- Order Code:
  - S2-025-U-04
The S2 Servo Pneumatic Proportional Control System is ideal for applications requiring high speed and high forces simultaneously. Speeds up to 2.0 m/sec are achievable while slowing the cylinder to a smooth controlled stop, preventing premature cylinder wear and damage. Handling 50+ kilogram masses, it is capable of 0.5 m/sec across a selection of cylinders. The ability to handle heavy loads while quickly and accurately following a changing input signal makes the S2 the ideal choice for machine designers.

Maximum Cylinder Speed vs Moving Mass: Bore Size Comparison

Note: Based on test results from typical setup: 250mm stroke guided horizontal cylinder with 5.5 bar inlet pressure. Changes in moving mass, cylinder orientation or other system parameters will impact maximum speed. Figures are to be used for general guidance only.
Enfield Technologies is an expert in high performance proportional control systems. Our standard product line focuses on pneumatics. With custom products and engineering services, we also apply our expertise in other areas of fluid power, electromechanical systems, and control electronics. New developments in pneumatic technology are opening doors for design engineers to create unique, market leading products and systems.

Enfield Technologies is leading this innovation. Our control valves and electronics solve many of the challenges posed by compressible fluids. The additional functionality and performance from Enfield Technologies helps our customers create breakthrough applications and enhance existing systems. Simply put, we make pneumatics do things that others declare impossible.

Response Time Matters

Enfield Technologies Valves: 4 to 7x faster

| 5ms | high performance solenoid valve | 19.5ms | typical solenoid valve | 35.5ms |

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