



SPCS-2 Servo Pneumatic Control System User's Guide





Table of Contents

<u>Subject</u>	<u>Page</u>
Warnings & Notice	2
System Setup – Connection	3
Software and Factory Default Setting	4, 5, 6
Load & Velocity Charts	7, 8
Troubleshoot	9
Technical Data	10

Warnings & Notices

WARNING:

Installation and operation of electric and high pressure systems (fluids and compressed gas) involves risk including property damage and personal injury or death.

Installers and users should be properly trained or certified and take safety precautions. This product may cause death, personal injury, or property damage if improperly used or installed.

The information in this document and other information from Bimba Mfg. and its authorized representatives are intended for use by persons having technical expertise in selecting and using these products. Product owners ("you") should analyze all technical and safety requirements of your specific application, including the consequences of any possible failure, before selecting a product. This product may not be suitable for all applications, such as those acting upon people. Suitability is solely your responsibility. Because the requirements for each application may vary considerably, you are solely responsible for conducting any testing or analysis that may be required to determine the suitability of the product for your application, and to ensure that all performance, safety and warning requirements for your application are met.

Caution:

While the product is low voltage, it contains open-frame electronic components and care should be taken to prevent un-intentional contact with the product to avoid damage to person or property.

Notice:

Use and purchase of this product is subject to Bimba Mfg. Terms and Conditions of Sale and Use. Improper installation or use voids warranty. Consult factory regarding special applications. Specifications are subject to change. Reasonable efforts have been made to provide useful and correct information in this document, but this document may contain errors and omissions, and it is subject to change.

Contact: Bimba Manufacturing Customer Support 800-44-Bimba or cs@bimba.com or your local Bimba distributor for additional information.

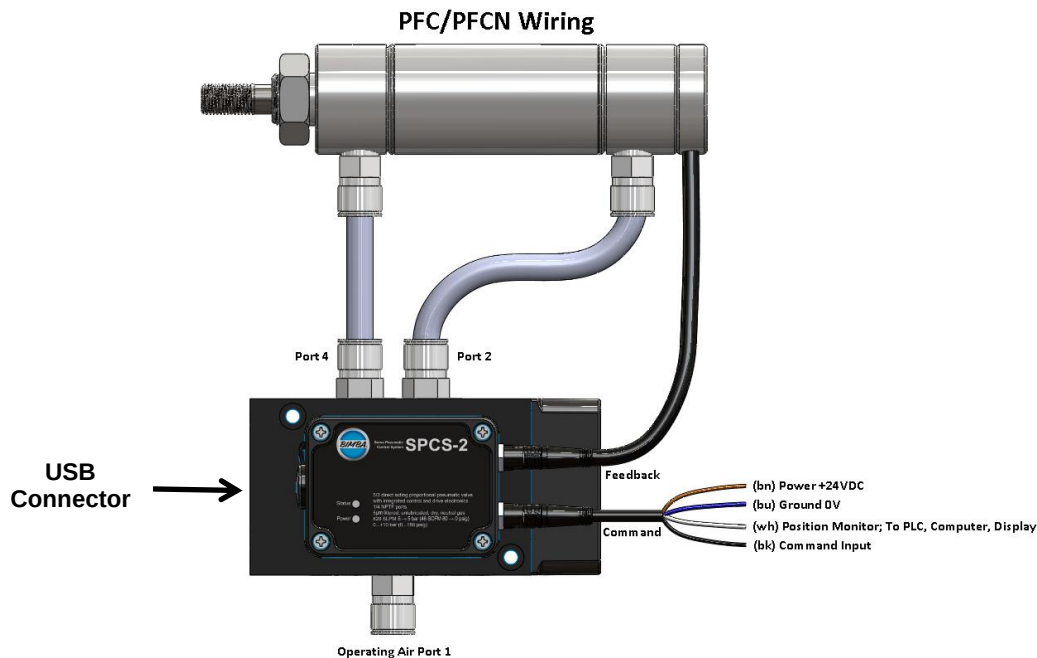
Warranty: This product is covered by a 1 year Bimba Mfg. limited warranty. Use without a coalescing filter voids the warranty. Contact Bimba Mfg. or visit website for more details.

Notice: Use and purchase of this product is subject to Bimba Manufacturing - Terms and Conditions of Sale and Use. Improper installation or use voids warranty. This product may not be suitable for all applications, such as those acting upon people, and suitability is solely the buyer's responsibility. Consult factory regarding special applications.

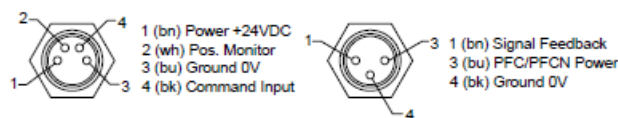


System Setup & Connection

- 1) Download the SPCS-2 setup software from Bimba's website. Double-click on the file to extract it and follow the instructions displayed on your screen.
- 2) Connect the SPCS-2 to the Bimba position feedback cylinder using cable SPCS-CBL-FBK
- 3) Connect the SPCS-2 to your power and command sources using cable SPCS-CBL-PWR-CMD
- 4) Connect Pneumatic Lines
 - a. Connect port 2 of the SPCS-2 to the back of the cylinder and port 4 to the front as shown in "System Setup" Page 4
(3/8" O.D. tubing – 10' or less length is recommended to prevent performance loss)
 - b. Inlet air should be dry (-40F dew point) non-lubricated air, non-flammable & non-corrosive dry gases (0.3 micron fine grade coalescing filter with 5 micron pre-filter) at 0-150psig.
 - c. Connect Inlet air to Port 1
- 5) Connect the valve to your computer using USB cable SPCS2-USB-CBL
- 6) Troubleshooting
 - a. See "Troubleshooting" Page 9
 - b. Contact Bimba Mfg. for additional help



Power/Command & Feedback Connectors





Software and Factory Default Setting

Basic Settings Screen – Gains

Proportional, Derivative, Force Damping, Offset – At startup the default settings are set at zero. After adjustment, if necessary they can be reset to the default value by clicking

Reset to Default Settings

Initial Setup Screen

- Communication: Select the **Select Port** dropdown window: Select a Com Port and click the **Enable Communication** check box. If communication is established the remaining screen selections will become available. You may have several Com ports from which to choose – you may have to repeat the selection process above to find the correct one.

(All selections are “grayed out” until communication is established)

- Select Input Signal – Command and Feedback by clicking in the appropriate button – 0 to 10V is the default value.
- Enter cylinder bore size and rod diameter using the up or down arrows.
- Select Port Communication

Click: Save Configuration to SPCS-2

Note: Mouse over “Tool Tips” are provided for each selection

BIMBA SPCS-2

25150 S. Governors Hwy
University Park, IL 60484
United States

Phone: 708-534-8533
Fax: 708-235-2014
Tech Support: 800-44-BIMBA

Initial Setup | Basic Settings | Advanced Settings

Communication

Select Port: [Dropdown]

☐ Enable Communication

Disconnected

Input Signals Configuration

Command: ☐ 0 - 10V ☐ 4 - 20mA

Feedback: ☐ 0 - 10V ☐ 4 - 20mA

☐ Invert Feedback Sensor Polarity

Save Configuration to SPCS-2

Cylinder Configuration

Cylinder Bore: 2.000 in.

Rod Diameter: 1.000 in.

Area ratio: 0.8920

Port Connection

☒ Standard ☐ Transposed

Diagram 1 (Standard): Shows a cylinder with two ports. Port 1 is connected to the SPCS-2 unit. Port 2 is connected to the SPCS-2 unit.

Diagram 2 (Transposed): Shows a cylinder with two ports. Port 1 is connected to the SPCS-2 unit. Port 2 is connected to the SPCS-2 unit.



Basic Setting Screen

Analog Button: Selection allows operation using a rotary potentiometer.

PC Slider Button: Selection allows operation by moving the Cylinder Command slider up and down, extending and retracting the cylinder.

PC Square Wave Button: Sends a square wave command signal based upon the gain perimeters described below, the minimum/maximum rod positions, ramp up/ramp down and period settings found on the Advance Setting screen. When selected the cylinder will operate using a square way generated by the software. You can adjust the gain, rod position and period perimeters during operation to further understand system responsiveness.

Proportional

Increase or Decrease the cylinders responsiveness to changes in the command or feedback signal. Lower % slower responsive – Higher % quicker response. Note: If too high system becomes unstable. Suggested starting value 15% (Higher % needed for bore sizes 1-1/16" and below – Lower % needed for bore sizes above 1-1/16")

Gain Settings

Derivative

Prevents Overshoot – Reduces overshoot and soothes system performance. Too high of a percentage gain can cause overshoot and creep into the target position as well as system instability. Suggested starting value 0.

Force Damping

Increase or Decrease Force Damping – Increases system stability. Lower % less force damping – Higher % more force damping. Too little force damping can create an oscillating rod condition. Too much force damping can result in a nonresponsive system. Suggested starting value 15%.

Offset

Offset - Offset is used when the cylinder is mounted vertically to create symmetrical or balanced motion. If the cylinder is facing "rod up", the offset should be increased. When a cylinder is facing down the offset should be decreased (Negative setting). Value should be set to 0 for horizontal applications.

Save Configuration to SPCS-2

Save your settings -

Oscillation: If the rod begins a rapid oscillation the Proportional or Force Damping % requires adjustment. To correct this either decrease the Proportional gain or increase Force Damping.



Advance Settings

The screenshot shows the 'Advanced Settings' tab of the SPCS-2 software. It features several vertical sliders and input fields for configuring the system. The 'Cylinder Command' slider is at 0.0%. The 'Cylinder Feedback' slider is at 0.0%. The 'Squared Wave Generator' section includes 'Minimum' at 25.0%, 'Maximum' at 75.0%, and 'Period' at 2.00s. The 'Minimum Position' slider is at 0.0%, and the 'Maximum Position' slider is at 100.0%. The 'Ramp Up' and 'Ramp Down' sliders are both at 0.0%. At the bottom, there are radio buttons for 'Command Source' (Analog Input, PC Slider, PC Square Wave) and two buttons: 'Reset to Default Settings' and 'Save Configuration to SPCS-2'.

Determine the electrical offset % between the Cylinder command signal and the Cylinder feedback signal –

- Minimum Position Slide: Move the slide to zero
- Maximum Position Slide: Move the slide to 100%
- Cylinder Command Slide: Move the slide to zero (the cylinder should fully retract) – note the percentage at the top of the Cylinder Feedback Slide. The percentage shown is the offset that should be adjusted for in setting your command signal to retract the cylinder to a specific position.
- Repeat this process with the cylinder fully extended (Move the Cylinder Command to 100%) Note the % difference between the Cylinder Command and the Cylinder Feedback percentages. Use this to compensate for extending the cylinder to a specific position along the rod length.

(You may need to add the % offset to the required position when using rod positions other than fully extend and retract)

Period – This can only be selected from the Advance screen – This sets the time it takes to complete a full cycle.

Minimum Position – Retract; Zero equals full retract; Higher % sets rod retract before full mechanical retract – Ex. 5" rod, set at 35% - rod retract stopping point equals 1.75". Prevents piston bottoming out at full retract.

Maximum Position – Extend; 100% is fully extended. Lower % set maximum extend at less than mechanical full extend – Ex. 5" rod, set at 85% - full rod extension 4.25". Prevents piston striking the rod guide at full extend.

Ramp Up – increases or decreases extend speed. Higher % reduces speed; Lower % increases speed.

Ramp Down – increases or decreases retract speed. Higher % reduces speed; Lower % increases speed.

When PC Square Wave is selected and the system is operating you can change the perimeters to further adjust the valve and cylinder responsiveness.



Maximum Moving Mass

The table below recommends the maximum moving mass controlled by a SPCS-2 for horizontal and vertical applications. Actual mass will vary based on cylinder speed and mechanical assembly (e.g. friction in cylinder or system, air pressure, etc.)

Linear Cylinder
Horizontal Applications

Bore Size	Average Velocity Without Overshoot @ Max Payload [in/sec]	Maximum Payload [lbs.]	Average Velocity @ 50% Max Payload [in/sec]	Average Velocity @ 25% Max Payload [in/sec]
09	20	50	20	30
17	10	100	20	30
31	15	200	20	30
50	15	315	25	30
70	15	450	20	20

Linear Cylinder
Vertical Applications

Bore Size	Average Velocity Without Overshoot @ Max Payload [in/sec]	Maximum Payload [lbs.]	Average Velocity @ 50% Max Payload [in/sec]	Average Velocity @ 25% Max Payload [in/sec]
09	70	5	100	100
17	70	10	60	60
31	50	30	40	60
50	15	95	30	30
70	20	135	20	20

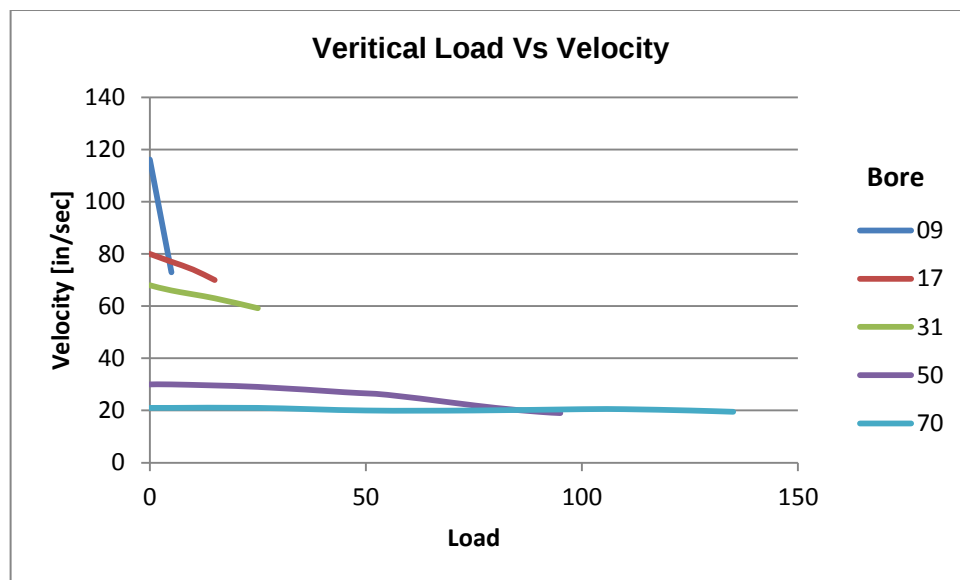
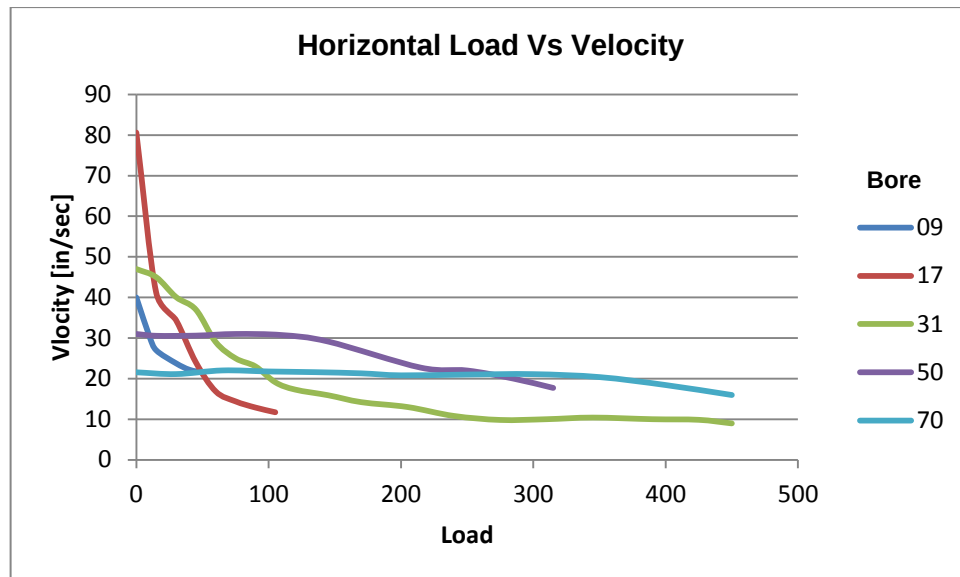
Rotary Actuator

Rack and Pinion - Single Rack			
Bore Size	Rotation	Average Velocity	Max Torque
1-1/2"	0 to 360°	150° per second	30 in/lb.
2"	0 to 360°	150° per second	84 in/lb.

Rack and Pinion - Double Rack			
Bore Size	Rotation	Average Velocity	Max Torque
1-1/2"	0 to 360°	150° per second	60 in/lb.
2"	0 to 360°	150° per second	144 in/lb.



Performance Graphs





Troubleshooting

Symptom	Probable Causes	Corrective Action
System Totally Unresponsive	Power not Applied	Apply power, check all power wiring
	Air Off	Turn air on
	Proportional Gain too Low	Basic Settings – Increase Proportional Gain
	Inverted Sensor Polarity	Initial Setup – Click the “Invert Feedback Sensor Polarity” checkbox
System Mildly Responsive or Sluggish	Pneumatic Connections to Cylinder are Backwards	Initial Setup – Click the “Transposed” button under Port Connection
	Proportional Gain too Low	Basic Settings – Increase Proportional Gain
	Force Damping Gain too High	Basic Settings - Decrease Force Damping
	Power Supply Voltage not Stable	Check power wiring; change power supply
	Cylinder too Small	Decrease moving mass, increase cylinder size, or increase inlet pressure.
System Freezes Fully Extended or Retracted	No Feedback Signal	Connect Feedback Signal
	Feedback Connected Improperly	Verify all wiring is as shown in application examples and as described in the “System Setup” section of this document
	Cylinder Connected Improperly	Verify airline connections
System Fails to Operate or is Inaccurate	Incorrect Wiring	Verify all wiring is as shown in the System Setup section of this document
	Mechanical System	Insure mechanical system is free from binding and high friction.
	Proportional Gain too Low	Basic Settings – Increase Proportional Gain
	Force Damping Gain too high	Basic Settings - Decrease Force Damping
	Offset Gain Adjusted incorrectly	Basic Settings - Adjust Offset
	Incorrect Cylidner Bore or Rod Diameter Entered	Initial Setup - Check Cylidner Bore and Rod Size
	Air Leaks	Insure there are no air leaks in the system
	SPCS-2 Sticking	Insure that inlet air meets valve specifications. See “System Setup” – Contact Bimba
	Force Damping too Low	Basic Settings - Increase Force Damping
	Proportional Gain too High	Basic Settings - Decrease Proportional Gain
System Overshoots	Proportional Gain too High	Basic Settings - Decrease Prportional Gain
	Input Signal Noise (possibly 60Hz)	Verify that large or high power machinery is not operating nearby. Also, verify input signal integrity by examining the signal with an oscilloscope.
System ‘Buzzes’	Input Signals not connected	Verify all wiring as shown in the “System Setup” section of this document
	DC Common not connected	Verify all DC common connections



Technical Data

Mechanical Specifications	
Pressure: 0 – 150 psig (0 – 10 bar) Un-lubricated, Dry, Neutral Gas	
Ports: 1/4" NPT	
Connector: 4-pin M8 x 1 (male) and 3-pin M8 x1 (male)	
Mounting: 2 x 10-32 thru Holes	
Temperature Range: 32°F- 104°F (0°C - 40°C)	
Filtration: 5 µm particulate 0.3µm coalescing	
Weight: 2.0Lbs. (0.91 kg)	
Body: Aluminum 6061	
Performance	
Position Accuracy: +- 1% of full stroke	
Repeatability: 3mV	
Flow: 46 SCFM @ 80 psig (820 SLPM @ 6 bar)	
Leak Rate: 12 SCFM @ 150 psig (5.7 SLPM @ 10 bar)	
Electrical Specifications	
Power: 24 VDC nominal @ 20W	
Command Input Impedance: 100kΩ	
Feedback Input Impedance: 100kΩ	
Command Input: Configurable 0...10 VDC; 4...20mA	
Feedback Input: Configurable 0...10 VDC; 4...20mA	
Excitation: +10V (15mA max)	