

P-K COMPACT[®] Temperature Control Equipment Guide

To be used in conjunction with the latest editions of: P-K COMPACT[®] Semi-Instantaneous Water Heater I&OM P-K COMPACT[®] Supplemental Equipment Guide

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Table of Contents

INSTALLATION & MAINTENANCE HB SERIES CONTROL VALVE 1" - 4"	5
2-WAY WEIGHTS & DIMENSIONS	6
3-WAY WEIGHTS & DIMENSIONS	7
PNEUMATIC ACTUATORS	8
ELECTRIC ACTUATORS	9
HB SERIES SHUTOFF PRESSURES	10
INTRODUCTION	12
UNPACKING AND INSPECTING	12
INSTALLATION	13
INSTALLING ACTUATOR	15
SPRING RANGE VERIFICATION	16
VALVE DISASSEMBLY / MAINTENANCE	16
LAPPING THE SEAT AND PLUG	16
	17
	17
	20
Wiring Diagram DSL 204 Actuator	20
WITTING Diagrafii – PSL 204 Actuator	
Mains Supply	21
COMMISSIONING	22
Closing the Cover	22
SERVICE / MAINTENANCE	22
Cleaning	23
Spare Parts	23
SAFETY ON TRANSPORTATION	23
APPENDIX	23
Accessories	23
Actuator Overview	24
TRACING FAULTS	25
EC DECLARATION OF CONFORMITY	27







Installation & Maintenance HB Series Control Valve 1" - 4"



Model HB Series	
Service	Steam, Air, Water
Connections	NPT, 150#, 300#
Body Material	Stainless Steel
Plug and Seat	Stainless Steel
Body Sizes	½" to 4"
Max. Operating Pressure	720 psig
Max. Operating Temperature	450°F
Min. Operating Temperature	-20°F
Max. Air Supply Pressure	50 psig
Max. Ambient Temperature	280°F
Min. Ambient Temperature	-20°F



The HB Series is a high performance, general **Technical Information** service control valve designed using CFD technology for high control accuracy and longevity. It is a two port valve range with a contoured plug design to withstand the rigorous nature of steam service. Stainless steel body material is standard making it compatible with many fluids and environments. Modern manufacturing techniques and a modular design allow this valve range to be extremely cost effective against valves with inferior body materials. The standard valve has an equal percentage flow characteristic with metal seating and live loaded, Teflon V-ring stem packing. The HB Series is available with pneumatic or electric actuation.

3-way Valve Bodies are available for mixing and diverting applications.

Maximum Flow Coefficient (Cv)							
1/2"	3/4"	1"	1-1/2"	2"	2-1/2"	3"	4"
5	6	10	22	42	70	110	170

Plug design:	Equal Percentage, Linear, Soft Seat
Leakage rating:	ANSI/FCI 70-2 Class IV, VI
Rangeabilty:	50:1
Travel:	3/4" & 1-1/8"
Body design rating:	ASME 150/300
Stem Seals:	PTFE live loaded V-ring Graphite
Diaphragm design:	Semi-rolling
Pneumatic Design:	Multi-spring diaphragm
Action	Fail Open
(options):	Fail Close
	Field Reversible
Positioner mounting:	IEC 60534-6-1 (NAMUR)
Flow	
Characteristic:	100 1
	MO 75
	1
	50 Linear
4"	25 - Equal %
170	2
	0 20 40 60 80 100



2-Way Weights & Dimensions



ltem	Description	Material		
1	Body	316 Stainless Steel		
2	Valve Plug*	303 Stainless Steel		
3	Body Plug	316 Stainless Steel		
4	Body Gasket*	303 Stainless Steel		
5	Stem*	316 Stainless Steel		
6	Lower Seal Bushing	303 Stainless Steel		
7	Gland Nut	303 Stainless Steel		
8	Stem Seal Spring*	302 Stainless Steel		
9	Guide Bushing*	Rulon 641 / PTFE		
10	Washer	303 Stainless Steel		
11	Staking Ball	440 Stainless Steel		
12	V-ring Stem Seals*	PTFE		

	-		
	QQ		
		10	
ÌД		D	

Size A			с	с	с	Weight (lbs)			
Size	~	A B NPT 150# 300#	^D NPT 150# 30	NPT	150#	300#			
1⁄2″	1.76	2.95	4.50	7.25	7.75	3.5	6	7	
3⁄4″	1.76	2.95	4.50	7.25	7.75	3.5	7	9	
1″	1.74	2.95	4.50	7.25	7.75	5.5	10	13	
1 ½"	2.15	2.95	5.00	8.75	9.25	6.8	14	19	
2″	2.31	2.95	6.00	10	10.5	10	21	25	
2 ½"	4.38	4.25	-	10.88	11.5	-	41	46	
3″	5.56	4.25	-	11.75	12.5	-	65	74	
4″	6.19	4.25	-	13.88	14.5	-	92	112	

* Recommended Spare Parts

The HB Series valve is designed to be a rugged general service solution for flow control applications.

- Conforms to ASME B16.34 Standards
- All Stainless Steel Construction
- Minimal Parts for Long Service Life
- Simple and Easy to Maintain

Additional Flange Options for 1/2" to 2" HB Valve Bodies. Consult Factory.



3-Way Weights & Dimensions







MIXING

DIVERTING

A	A	A	с	с	с	Weight (lbs)			
Size	NPT	150	300	NPT	150#	150# 300#	NPT	150#	300#
1/2"	2.31	4	4	4.50	7.25	7.75	4	8.5	9
34"	2.31	4	4	4.50	7.25	7.75	4	8.5	9
1″	2.31	4	4	4.50	7.25	7.75	5.5	12	13.5
1 1/2"	2.84	4.3	4.3	5.00	8.75	9.25	7	18.5	22
2″	3.19	5	5	6.00	10	10.5	11	26	35
2 ½"	1	7.13	7.38		10.88	11.5	<u></u>	50	58
3″	1	8.32	8.5	್	11.75	12.5		74	88
4"	ũ.	9.19	9.5	141	13.88	14.5	1	106	136





FAIL CLOSE - A CLOSED / B OPEN TO AB

Positioners



Pneumatic, electro-pneumatic, and digital positioners are available to be mounted on the HB series control valves

Technical Information

Input Signal: Supply Pressure: Housing: Temp Range: Weight: Pneumatic = 3 -15psi air signal E/P & Digital = 4-20mA <145psig Nema 4X / IP66 -40°F - 185°F 3.5lbs

Options:

Feedback Signal Explosion Proof Intrinsically Safe

0-10V input signal ATEX Approval Gauge Block



Pneumatic Actuators

Pneumatic Actuator 50in²



Item	Description	Material	
1	Yoke	Stainless steel	
2**	Upper diaphragm case	Epoxy painted steel	
3**	Lower diaphragm case	Epoxy painted steel	
4	Diaphragm plate	Nickel plated steel	
5*	Diaphragm	Nylon reinforced Neoprene	
6	Upper guide bush	Stainless Steel / Bronze	
7	Lower actuator stem	Stainless steel	
8	Upper actuator stem	Stainless steel	
9*	Ring nut	Stainless steel	
10	Diaphragm washer	Stainless steel	
11	Position indicator disc	Stainless steel	
12*	Spring**	Stainless steel	
13	Nameplate	Stainless steel	
14*	Stem O-ring	Viton	
15*	Yoke O-ring	Viton	
16*	Upper guide O-ring	Viton	
17	Hex nut	Stainless steel	

Pneumatic Actuator 100in²



* Recommended Spare Parts	/ ** Available in Stainless Steel
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Item	Description	Material	
1	Yoke	Stainless steel	
2	Lower diaphragm case	Stainless steel	
3	Upper diaphragm case	Stainless steel steel	
4	Diaphragm plate	Stainless steel	
5*	Diaphragm	Nylon reinforced Neoprene	
6	Spindle	Stainless steel	
7	Guide bushing Assembly	Stainless Steel / Bronze	
8*	Spring (x8)	Stainless steel	
9	Diaphragm nut	Stainless steel	
10	Nameplate	Stainless steel	
11*	Spindle O-ring	Viton	
12*	Yoke O-ring	Viton	
13*	Guide O-ring	Viton	
14	Thread Protector	Viton	

* Recommended Spare Parts

The HB series pneumatic actuators are field reversible and are offered in Air-To-Open or Air-To-Close configurations. These compact multi-spring actuators are designed to maximize the valve shut off pressures in a lightweight and efficient package.

Actuator Size	Α	В	Weight (lbs)
50in ²	10.00	9.25	18
100in ²	14.38	10.00	50



Electric Actuators

EC Fast Acting w/ Super Capacitors



The programmable EC actuator is fast acting and can be setup to fail open, closed, in place, or set point. Ideal for applications requiring a fast response such as semiinstantaneous water heaters.



SK Series w/ Spring Close

ES Economical w/ Spring Return



The ES is an economical actuator and can be ordered as spring return or spring extend. Ideal for slower HVAC applications.

Actuator	EC	ES	SKB	SKC	SKD			
Voltage	24V/1	15VAC	24VAC / 115VAC					
Ambient Temp	14	0°F	13	0°F	122°F			
Enclosure Rating	IP	65	IP54 / NEMA 1					
Stroke (in)	2.00	0.75	0.75	1.50	0.75			
Thrust (lbs)	1,011	449	6	29	224			
Cycle Time (s)	8	120	120	120	60			
Weight (lbs)	18	12.4	18.9	22.5	8.5			

The HB series electric actuators are offered in multiple configurations. All actuators are available with standard options:

- 24V and 115VAC power supplies
- 4-20mA or 0-10V signal inputs
- 4-20mA or 0-10V signal inputs

The SK series are an economical actuator and can be ordered as spring return only and is only fail close. Ideal for slower HVAC applications.



110.0/4		Max Operating Pressure (PSI)														
HB 3/4	Travel	Air t	o Open S	iignal (Fai	l Close)	Airt	to Close S	Signal (Fai	l Open)	3-	Way	El	ectric /	Actuato	ors	
Valve Size	Orifice	Bench Set	Range Code	3-15psi STD I/P	0-30psi Positioner	Bench Set	Range Code	3-15psi	0-30psi Positioner	3-15psi STD I/P	0-19psi Positioner	ES	EC	SKB SKC	SKD	
		5-15	05	145	350		<u>_</u>	2	-	-	-		×			
2010/1022		8-15	00	315	515	3-8	00	430	720	÷	-					
1/2"	0.89	12-21	10	620	720	2.52	ā			-		605	720	720	290	
chird 1		6-11	31	-	146	12	-	÷	<u></u>	220	425					
		13-22	32			10	- 9			- × (720					
		5-15	05	75	180	- 385				- 2						
		8-15	00	170	270	3-8	00	220	665	2	2		720			
1-1/2"	1.25	12-21	10	320	430	1	4	2		2	×	315		450	150	
		6-11	31			100		. *		110	215					
		13-22	32		123		2		1.72	2	430					
		5-15	05	40	95		2	1	-	- A	-		5			
		8-15	00	85	140	3-8	00	115	350	÷.,	-					
2"	1,75	12-21	10	165	225	10	-	<u>s</u>				160	380	230	75	
	j j	6-11	31	3	140	- 22	9	2		55	110					
		13-22	32	-	- 140	1	÷			25	220					
		5-15	05	15	40		3	~		- 2	-					
2-1/2"	2.5	8-15	00	35	60	3-8	00	50	160	20		74	179	108	8	
		12-21	10	75	100		-	~								

HB Series Shutoff Pressures

* Standard Spring Range Set

						1	Max Ope	erating Pro	essure (PSI)						
HB 1-1/3	8" Travel	Airt	o Open S	ignal (Fail	Close)	Air	to Close S	ignal (Fai	l Open)	3-	Way	E	ectric A	Actuato	ors
Valve Size	Orifice	Bench Set	Range Code	3-15psi STD I/P	0-30psi Positioner	Bench Set	Range Code	3-15psi	0-30psi Positioner	3-15psi STD I/P	0-36psi Positioner	ES	EC	sкс	SKB SKD
		8-15	00	100	160	3-8	00	140	435	-			0		
2 4 /20		13-23	11	185	245	1.00		~		<u>.</u>	- × -	74	170	100	
2-1/2	2.5	6-11	31		10.00	132	12		50	59	118	/4	179	109	-
		13-22	32	2		142	2	- 2			245				
		8-15	00	75	120	3-8	00	106	331		*				
28	2.00	13-23	11	140	185	7.52			120	-		5.4	174	80	
5	2.88	6-11	31		- S25	122	- 2	2		44	90	24	134	80	
		13-22	32			1.00			(a)		185		_		
		8-15	00	40	65	3-8	00	56	180						
411	2.00	13-23	11	75	100	(74V)	<u>_</u>		<u> </u>		1	20	77		
4	3.88	6-11	31	8	()+);	28				22	47	29	12	43	×
		13-22	32	×.	3+3	$\langle \mathbf{v} \rangle$					100				

* Standard Spring Range Set



PK COMPACT® Temperature Control Equipment Guide

				Valve B	Body					Con	nectio	n	Actuator						
Model	Code	Trim Style	Code	Seat Type	Code	Packing	Code	Port Type	Code	Size	Code	Connect	Code	Actuator	Code	Power Supply	Code	Bench Set	
				Metal	0	Teflon	F	Full	12	1/2"	N	NPT	PA1	50in Air to Open		8	00	8-15psi	
HB1	0	Equal %	0	Seat	1	Graphite	R	Reduced	13	3/4"	1	150# FLG	PA2	50in Air to Close	1	115VAC	10	12-21psi	
	1	Linear	1	Soft Seat		-	-i		14	1"	3	300# FLG	P81	100in Air to Open	2	24VAC/DC	05	5-15psi	
				PTFE					16	1-1/2"	В	BSP	PB2	100in Air to Close			11	13-23psi	
	~	2.14		The second					17	2"	6	PN16	ECA	Capacitor Fail Close			00	ATC 3-8psi	
	3	3-way	CF.	Elast.					18	2-1/2"	2	PN20	ECB	Capacitor Fail Open	1		31	6-11psi	
		· · · · ·							19	3"			ESA	Spring Fail Close]		32	13-22psi	
									20	4"	1		ESB	Spring Fail Open	1			Electric	
													SKB62U	SKB Fail Close	1			Control Signal	
													SKC62U	SKC Fail Close]		0	4-20mA	
													SKD62U	SKD Fail Close	1		1	0-10V	
															1		2	0-20mA	
																	3	2-10V	

Optional Accessories

Air Filter Regulator

40 Micron & 5 Micron available

Orifice Plate

Used in steam applications to reduce noise and aid in large pressure drops

Cavitation Adapter

Used with water applications with large pressure drops and elevated temperatures



INTRODUCTION

The HB Series is a high performance; general service control valve designed using CFD technology for high control accuracy and longevity. Stainless steel body material is standard making it compatible with many fluids and environments. The standard valve has an equal percentage flow characteristic with metal seating and a live loaded, Teflon V-ring stem packing. The spring and diaphragm configuration allows the actuator to be used across the ½" to 4" valve size range with varying differential pressures. Easy field reversibility allows the actuator to be installed as either an ATO (air-to-open) or ATC (air-to-close) option. The use of a multi-spring setup permits the units to be compact and lightweight. This valve series can be used to automate control valves in both throttling and on/off control of liquids or gases. The HB Series is also available with electric actuation.

NOTE: This manual is intended to provide detailed information about the installation, operation, and maintenance of the HB series Actuator. Please refer to the factory for any clarifications about the instructions provided within or replacement parts required.

The information should be thoroughly reviewed prior to any installation or maintenance performed on the equipment. All personnel should be properly trained and aware of the instructions shipped with the valve/actuator assembly.

UNPACKING AND INSPECTING

After receiving valve, unpack and inspect to ensure it was not damaged. Verify that the valve stem is true and was not bent during shipping.

CAUTION	When servicing or installing this valve in systems, all steam and /or water pressure must be turned off and any fluids should be drained completely. Lines must be free of pressure.
CAUTION	While air is applied to the actuator to retract the spindle, there is an extreme finger trapping danger if this air pressure is lost or reduced or if there is loss of air pressure due to diaphragm failure for example. Loss of air pressure can lead to rapid extension of the actuator spindle under high force.
CAUTION	Never clamp or use a tool to hold the valve on the sides of the body. Damage can occur. Clamp the valve end to end and use the hexes at the ends of the body for tightening.
CAUTION	PTFE under normal working temperatures is a safe product. Care should be taken avoid heating PTFE to its sintering temperatures which could give way to gaseous fumes that would require proper ventilation.



INSTALLATION

- 1. The valve should be installed in horizontal piping with the actuator vertically positioned above the valve.
- 2. Be sure to clean and remove any scale or debris in piping prior to installation of valve.
- 3. Locate the Flow Arrow on the side of the valve body and verify the fluid flow will match the flow arrow orientation.
- 4. A strainer is recommended upstream of the valve to prevent any debris from potentially interfering with operation.
- 5. To ease maintenance procedures, it is recommended to have isolation valves installed with unions or flange connections before and after the valve.
- 6. An optional bypass line can be installed parallel to the control valve.
- 7. Thread sealant should be applied to connections.
- 8. Pipe insulation should only be installed on the body and not the actuator.
- 9. Install the control signal to the actuator via an air or current signal that may use an I/P or Positioner.



Figure 2: Recommended Valve Installation



START UP

- 1. All valves in the installation need to be closed.
- Check to verify that the control signal properly connected to the valve and that the actuator responds to the signal.
- Open the valve ahead of the steam trap or other drain valve to remove all condensate from the inlet piping. Follow the same procedure for a steam trap on the outlet piping. Note: Serious damage to the piping system and control valve could occur from the effects of water hammer.
- 4. Verify that the bypass valve is closed.
- 5. After the condensate has been removed from the system, slowly open the outlet gate valve.
- Slowly open the inlet gate valve to the HB valve
 and varify there are no indications of water

and verify there are no indications of water hammer.

- 7. Blow down the main inlet strainer.
- Slowly adjust the control signal, via a controller or other device, so that the control valve begins

to actuate.

- 9. Allow time for the system to adapt to the change due to the piping system volume.
- 10. After the system has stabilized check the control condition and readjust as required.
- 11. Inspect the piping system and valve for any leaks and tighten as required.

CAUTION

Never thread the valve stem into the actuator spindle while the valve plug is seated or close to seated. Damage to the seat and plug could occur.

REMOVING ACTUATOR

1. Place the valve body securely in a vise so that the end connection points are being clamped and not the sides of the body.

CAUTION

Improper positioning in a vise could cause the valve body to distort and permanently damage.

- 2. Loosen the two jam nuts on the valve stem that lock to the actuator spindle. Take care not to rotate the valve stem
- Apply air pressure to the actuator so that the valve stem moves and is positioned at about the midpoint of the stroke. Take care to apply air only to the non-spring side of the diaphragm.
 - a. For air-to-open (fail closed) valves this will be to the connection at the top of the actuator diaphragm case.
 - b. For air-to-close (fail open) valves this will be to the connection on the side of the actuator yoke.
- 4. Unthread the valve stem from the actuator spindle. Be careful not to twist the actuator spindle which could damage the diaphragm.
- 5. Loosen the large actuator mounting nut that retains the actuator yoke to the valve body.
- 6. After the valve stem has been completely disconnected from the spindle, lift the actuator from valve.
- 7. Release the air pressure to the actuator.



INSTALLING ACTUATOR

- 1. Place the valve body securely in a vise so that the end connection points are being clamped and not the sides of the body. Note: Improper positioning in a vise could cause the valve body to distort causing permanent damage.
- 2. Apply air pressure to the non-spring actuator connection to position the actuator spindle in the approximate midpoint of travel. Take care not to exceed the maximum air pressure marked on the actuator nameplate.
 - a. For air-to-open (fail closed) valves this will be to the connection at the top of the actuator diaphragm case.
 - b. For air-to-close (fail open) valves this will be to the connection on the side of the actuator yoke.
- 3. Push down on the valve stem to ensure that the valve is in the open position.
- 4. Lower the actuator over the valve body and into place.
- 5. Fit the large actuator clamping nut to the valve body and tighten it. Do not over tighten
- 6. Actuator positioning:
 - a. For air-to-open: Adjust the air pressure in the actuator so that the actuator spindle extends 1/3 to 1/2 of travel.
 - b. For air-to-close: Adjust the air pressure in the actuator so that the actuator spindle extends 1/2 to 2/3 of travel.
- 7. Thread the valve stem into the actuator spindle approximately 3/4 of an inch.
 - a. For air-to-open (fail closed) slowly remove air pressure from the actuator.
 - b. For air-to-close (fail open) slowly apply air pressure to the actuator until it fully strokes.
- 8. Check the gap between the actuator spindle and the upper guide bushing. The gap should be between 0.02" & 0.06". A thickness gauge will verify the gap.
- 9. Repeat steps 6 through 8 until the gap is properly set.
- 10. Thread the 2 stem jam nuts up to the actuator spindle and tighten the screws until secure.
- 11. Verification by applying air pressure to the valve inlet:
 - a. For air-to-open: Reduce the actuator air pressure to 0psig.
 - b. For air-to-close: Increase the actuator air pressure until the valve closes, over 18psig will be enough.
- 12. Apply approximately 40psig air pressure to valve inlet and check for leaks at valve outlet.
- 13. Re-adjust the stem coupling position if necessary.



SPRING RANGE VERIFICATION

Notes: To prevent any damage to the control valve, it is best to remove the actuator from the valve prior to testing.

Actuators will have this test performed at the factory and this will not be required for new installations.

If the actuator has not been removed from the valve, read the section below for proper disassembly instructions. The spring range will be labeled on the tag mounted on the side of the actuator yoke. The lower pressure value will indicate approximately when the stem will begin to actuate while the upper pressure value will indicate the diaphragm pressure at approximately full stroke.

- 1. Install a pressure gauge and regulator with an accurate range to the proper 1/4" NPT inlet port.
- 2. Slowly open the regulator until the stem begins to move.
- 3. Compare the value with the lower spring range pressure.
- 4. Continue to open the regulator until the stem reaches its max travel and observe the pressure reading.
- 5. If the pressure reading does not match the range listed on the name tag then the wrong springs may be installed or internal components may not be functioning properly. Parts should be checked for wear or damage. Consult the factory with questions.

VALVE DISASSEMBLY / MAINTENANCE

NOTE: A spare parts kit is strongly recommended when disassembling the valve.

- 1. Make sure fluid supply is safely shut off.
- 2. Allow sufficient time for valve to cool if required.
- 3. Remove the actuator assembly from the valve. See the Removing Actuator section for instructions.
- 4. Remove the body plug from the bottom of the valve body
- 5. Loosen and remove the packing gland nut located at the top of the body.
- 6. Push down on the valve stem to remove from body.
- 7. Remove the packing and spring out of the packing chamber. Reinserting the valve stem back through the packing may help to push packing out of chamber.
- 8. From the bottom, use a 9/16" socket to remove the lower seal bushing. The packing washer and o-ring should drop out with the bushing.
- 9. Inspect the guide bushings in the packing gland nut and lower seal bushing. Replace as required.
- 10. Replace the packing O-ring as required. Be sure to lubricate prior to install.
- 11. Clean all surfaces of the stuffing box, seat, stem, and plug. If the stem or plug is corroded, worn or marred, it must be replaced.

LAPPING THE SEAT AND PLUG

- 1. Follow the disassembly instructions above for the valve.
- 2. Loosely reinstall the gland nut and lower seal packing into the body.
- 3. Apply a thin amount of lapping compound around the plug at the taper near the bottom.
- 4. Slide the stem through the packing until the plug rests on the seat.
- 5. Apply a very light pressure to the plug on the seat and rotate back and forth. Rotation should not exceed 90 degrees.
- 6. Lift the plug away from the seat and rotate 90 degrees.
- 7. Repeat steps 5 and 6 several times to ensure a proper seat. Then remove the stem & plug and clean the lapping compound off of the parts.



VALVE ASSEMBLY

1. Install the packing washer, O-ring, and lower seal bushing from the bottom opening of the valve body. Be sure to lubricate the O-ring prior to install.

CAUTION Packing must be clean and free of dirt or debris.

- 2. Install spring from the top of the valve body.
- 3. Slide the stem up through the packing area.

CAUTION

V rings must be carefully installed over the stem threads and into the stuffing bore to avoid snagging of the lips on threads or on the bore. A sharp edge on the lips is imperative for sealing.

- 4. Install new packing onto the stem and lower into the packing cavity. The V-ring packing should be installed so that the point of the V is aimed up toward the actuator.
- 5. Install and tighten the packing gland nut onto the valve body.
- 6. Verify that the stem slides through the packing without any binding or extreme sticking. Disassemble and check trueness and cleanliness of parts if issue occurs.
- 7. Install the bottom plug with gasket into the bottom of the valve body.
- 8. A leak test may be performed to verify all components have been properly installed and tightened prior to service install.

ACTUATOR ASSEMBLY / REVERSABILITY

NOTE: The actuator does not need to be completely removed from the valve body to reverse the actuation.

- 1. Remove air pressure from the actuator and shut off upstream and downstream isolation valves.
- 2. Disconnect the valve stem from the actuator spindle. See the Removing Actuator section for details.
- 3. Remove the thread protectors from the long screws on the actuator case.

CAUTION

The actuator springs are compressed when installed and care should be taken when relieving compression as to not cause injury or damage.



Figure 1: Air to Open



- 4. Slowly loosen the screws around the actuator case. Be sure to loosen the screws in a star pattern.
 - a. For air-to-open (fail closed) the actuator case does not hold compression on the springs.
 - b. For air-to-close (fail open) the actuator case does maintain compression on the springs. The long case screws must be used to slowly decompress the springs during removal.
- 5. Remove the upper case. For air-to-close (fail open) the springs should be removed at this time as well.
- 6. Now the actuator spindle needs to be separated from the upper actuator stem. Use the diaphragm nut or upper stem to hold the diaphragm and upper stem in place while unthreading the spindle.

CAUTION

For air-to-open (fail closed) this will relieve the compression from the springs. The spindle must be rotated so the springs don't move out of position which could cause injury or damage.

- 7. The diaphragm nut is then removed from the upper stem to free the diaphragm, diaphragm plate, and washer.
- 8. Inspect the diaphragm and stem O-ring for wear. Replace as required.
- To reassemble the diaphragm, diaphragm plate, and washer will fit on the end of the upper stem and tightened with the diaphragm nut. See figures 1 & 2 for proper orientation of the ATO or ATC actuation.



Figure 2: Air to Close

- 10. Lubricate the stem O-ring and slide down onto the step of the spindle.
- 11. Assemble the upper stem to the spindle by sliding the spindle in from the bottom of the guide bushing and the upper stem from the top. Keep the outer diaphragm holes lined up with the lower case holes
 - a. If this is for air-to-open, 6 springs must sit between the lower case and the diaphragm plate. Make sure to line the springs up with the depressions on the diaphragm plate and only rotate the spindle so that the springs remain seated while tightening. See Figure 1.
 - b. For air-to close place 3 springs on top of the diaphragm plate.
- 12. Add the top case.
- 13. For air-to-close use the long bolts, equally spaced around the case, to compress the springs.
- 14. Insert the small bolts around the perimeter of the cases and tighten in a star pattern.
- 15. Check that the air fitting is in the proper location, if not reposition.
 - a. Air-to-open is on the top case.
 - b. Air-to-close is located on the side of the yoke.

NOTE: The spring count will differ for ATO

(6 springs on 50in & 8 springs on 100in) and ATC

(3 springs on 50in & 4 springs on 100in)



3-WAY VALVE

The HB 3-Way valve will follow the same start up procedures. The Common Port, AB, will be used as an inlet for diverting applications and an outlet for mixing. The valve is set as a standard for Port A to fail close.

Consult factory for other options.



TROUBLESHOOTING

PROBLEM	POSSIBLE	CAUSE CORRECTION					
	a) Valve undersized	a) Check capacity of valve against load					
	b) Downstream piping undersize	 b) Check velocity of steam in piping system 					
1 Lack of fluid	c) Inlet or outlet gate valve partially closed	c) Open valves					
downstream flow	d) Upstream pipeline strainer blocked	d) Clean strainer screen					
domina caminon	 e) Inlet pressure too low causing reduced capacity thru valve 	 e) Check with gage and correct as required 					
~	f) Actuator diaphragm failed	f) Replace diaphragm					
	a) Valve is extremely oversized	a) Check catalog for rated capacities					
2. Flow conditions	b) Bypass valve open	b) Close valve					
downstream are	c) Control Loop issue	c) Readjust/check control loop					
swinging and erratic	 d) Foreign object lodged between valve plug and seat 	 d) Check valve plug and seat. Check stem guide bushing for binding 					
	 a) Foreign object lodged between valve plug and seat 	a) Check valve plug and seat. Check stem guide bushing for binding					
2 Value looking	b) Bypass valve open	b) Close valve					
3. Valve leaking	c) Valve stem not set correctly with actuator	c) Readjust/check					
~	d) Inlet pressure is too high	d) Check shut off capacity of actuator against load					
4. Packing leaking /	a) Packing / O-Ring is worn	a) Replace packing					
Fluid around stem	b) Stem is worn or scratched	b) Replace stem					



INSTALLATION & MAINTENANCE ELECTRIC ACTUATOR

Electric Supply

Wiring Diagram – PSL 204 Actuator

Electric terminals are provided in a terminal box at the actuator.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	\bigcirc		P145	Taster
Ŧ	۴	↑	¥	¥	¥	1	1	1	1	1	-	Ŧ	¥	Ŧ	Ť	Ť	1	1	1	1	٠	Ŧ			TTL	Button
+ 0(2) - 10 V	+ 0(4) - 20 mA	GND	+ 0(2) - 10 V	+ 0(4) - 20 mA	GND	24 VDC	max. Last / max. Load	L/+ AUF/ OPEN 24 A 11 23 A	V 5 V 0 V		L/+ (24V AC/DC)	N/- (24V AC/DC)	24 VDC / 100 mA	+ 0(2) - 10 V	+ 0(4) - 20 mA	GND	(Option)	(Option)	(Option)	(Option)	L/+ (siehe Typenschild/ see tag plate	N/- (siehe Typenschild/ see tag plate	PE	(Option)		
Se	ollwe ngai	rt- ng	Po	Aktiv	e ns- jung	Störm poten	eldung Binäre tialfrei Ansteuerung ^a		Binäre Ansteuerung sigr		Netz- ausfall- signal		Ver- sor- gung	lstv	vert		Clo. W	sed legs tent	O ₁ chalt	ter ter	Ver	sorg	ungs- ung	Feldbus- Anschluß	PC Kommu- nikation	Inbetrieb nahme
Se	t val input	ue	p fe	Active ositic edba	ə on ck	Monito potent	Binary input signals		Fa sa sig	ail ife nal	Supply	Act val	ual lue		Po	Kor sition	ntakt 7 swi ial-fr	itch ee	1	Powe suppl oltag	ər ly je	Fieldbus interface	PC commu- nication	Com- missio- ning		
	(Galv	vanisch getrennt / Galvanically isolated 1 kV							Proc	ess-	Sen	sor	ξ	con	tact		-				3013770 - S-	217 E			



PE earth connection on housing plate has to be connected!



Mains Supply



Isolate the power supply. Safeguard the line against unauthorized and unintended restarting.



Open the terminal box.

The terminal box provides terminals to accommodate rigid and flexible cables of wire widths of 0.14 mm² to 2.5 mm² as well as a PE screw on the housing.



Caution: Please observe the supply voltage and the maximum power consumption of the actuator as indicated on the actuator's tag plate!

Connect supply and control lines to terminals (as indicated in the wiring diagram).



Commissioning

- Put the cover on, and re-install the handwheel (fig. 14 Closing the cover).
- Drive the valve to the center of the stroke using the handwheel
- Switch on the mains.
- Switch the setting signal briefly between OPEN and CLOSE and check that the drive operates in the correct direction. If necessary, reverse the setting signal for OPEN/CLOSE.
- Drive the actuator, in both directions, using the setting signal until the limit switch cuts-off. Check that the limit switch position is correct. If necessary re-adjust the limit switch.

Closing the Cover

PSL201-PSL210 (IP65)

Please observe the label on the cover of the actuator.

PSL201-PSL210 (IP67/IP68) and PSL214

- Put the cover on the actuator and ensure that the two fixing screws are positioned over the corresponding threaded holes.
- Slightly tighten down the fixing screws with an Allen key. If the screws don't lock, move the cover slightly.
- Push the cover downwards and ensure that it slips over the sealing ring of the actuator.
- Tighten the screws.

PSL320-PSL325



- Check that the sealing ring on the periphery of the housing sits correctly in the groove.
- Put the cover on the actuator and ensure that the 3 fixing screws are positioned over the corresponding threaded holes and that the button is positioned over the release pin of the actuator housing.
- Tighten down the fixing screws with a corresponding screwdriver.

Service / Maintenance

The actuators are maintenance-free if used under the operating conditions as designated in the data sheet. The gearboxes are lubricated for life and do not require further lubrication.



Caution !

During maintenance and repair the actuator must not be operated electrically.



Cleaning

The actuators should be cleaned dry. Do not operate the actuator during the cleaning process.

Spare Parts

Defective actuators should be returned to our factory in Pottstown, Pennsylvania, or to our representatives, to be checked for damages and their possible causes.

If you prefer repairs in-house, we can provide you our price list for spare parts.

Safety on Transportation

For transportation and storage all cable glands and connection flanges have to be closed to prevent ingress of moisture and dirt. A suitable method of packaging is required for transporting to avoid damage of coating and any external parts of the actuator.

Appendix

Accessories

Various options are available in order to adapt the actuators to the various service conditions. A list of accessories for each actuator type is shown on the actuator data sheet.

	Supply Voltage		230 VAC 1~	115 VAC 1~	24 VAC 1~	400 V 3~	24 VDC
	Position Signal Switches	2WE	•	•	•	•	÷
ies/	Position Signal Switches Gold	2WE Gold	•			•	٠
ori o	Positioner	PSAP	•	•)1	•)1	•) ²	
ti SS	Position Transmitter	PSPT	•	•	•	•	•
jä G	Space Heating	HR	•	•)		•)³	
S C	Potentiometer	PD	•	•	•	٠	•
A	Reversing Starter Contactor	WSM01				٠	
	IP67 Metal Cover	IP		Increa	se of enclosure	to IP67	
	IP68 Metal Cover	IP	Incre	ase of enclosur	e to IP68 (only v	alid for PSL201	-214)

• = available, for further information see respective datasheet

)1 = PSL series 204 to 320-325: PSAP with external relay required

)² = only to be used with reversing starter contactor

)³= supply voltage 24 V or 115-230 V



Actuator Overview





8











28.3





PSL201-204

225 lbf to 1012 lbf Maximum Thrust

0.01 to 0.06 in/s Stroking speed

maximum 2 in Stroke

PSL208-210

1798 lbf to 2248 lbf Maximum Thrust

0.014 to 0.04 in/s Stroking speed

maximum 2 in Stroke

PSL214

3147 lbf Maximum Thrust

0.018 in/s Stroking speed

maximum 2.56 in Stroke

PSL320-325

4496 lbf to 5620 lbf Maximum Thrust

> 0.04 in/s Stroking speed

maximum 3.74 in Stroke





Tracing Faults

Red LE	D			Green	LED			8		
Glowing permanently	Flashing quickly	Flashing slowly	aff	Glowing permanently	Flashing quickly	Flashing slowly	off			
	3	3	<u>]</u>	3	8		8 5	Status	Probable reasons	Possible remedy
2			X				x	Actuator does not respond, both LEDs are off	1) No supply voltage applied 2) The applied voltage does not match the actuator voltage on the tag plate	1) Check mains supply 2) Apply correct supply voltage
			X	x			5 5	Actuator does not drive the full stroke	1) Actuator not correctly commissioned 2) Too small stroke programmed (in mode "one position- dependent cut- off")	 Repeat commissioning Check valve stroke parameters -> see instructions AMS-PSCS
			x	×				Actuator does not close the valve properly	1) Actuator not correctly commissioned 2) Actuator closing force/ torque too low	1) Repeat commissioning 2) Check actuator selection
			x	x				Actuator is in normal operating condition, but does not respond to set- value changes	1) Fixed digital set-value is activated 2) Actuator is configured to work with process controller	1) Check set-value parameters -> see instrucions AMS-PSCS 2) Connect process sensor
2 =	8	2	x	×		8===	8	Actuator position does not correspond to set-value input	A non-linear valve curve has been parameterised	Verify parameterised characteristic -> see instructions AMS-PSCS
1	2	2	4	8	8 I	94 - 4	2 2	Operating conditions	Probable reasons	Possible remedy
1	-	-	x	x			2	Normal operating condition		
	8 8	3 3	x		x		б —) с —)	Actuator in commissioning mode	i.	Commissioning mode will be left automatically after completion
	51	5	x			x		Actuator not commissioned		Depending on the type of cut-offs, the actuator has to be commissioned either automatically or manually
								Faults within the actuator's environment	Probable reasons	Possible remedy
		×		x				Too high torque has been encountered within the valve stroke	1) Actuator not correctly commissioned to the valve 2) Mechanical block within the stroke path 3) Improper selection of the actuator	 Repeat commissioning Check valve and actuator for unobstructed running Check actuator selection
		×			x			1) No proper process feedback (only in combination with PSIC) 2+3) Maximum control range exceeds (only in combination with PSIC)	1) Process feedback wrongly or not at all connected 2) Process feedback outside od adjusted range	 Apply the correct process feedback signal and check polarity Ensure the correct process feedback range Check the process sensor and its supply voltage



Red LE	Ð			Green	LED					
Glowing	Flashing quickly	Flashing slowly	Off	Glowing permanently	Flashing quickly	Flashing slowly	off			
		Ī	-						3) No process sensor signal available	
		×		2		×		Actuator drives into a preset position	1) Signal is applied to the binary fail- safe input 2) Supply voltage failure on actuators with optional PSEP	1) Disconnect the signal 2) Check supply voltage
	3	×	8		6 1		x	Set-value disconnected or outside the parameterized range	1) Set-value not connected 2) Wrong polarity of set-value 3) set-value signal outside parameter range, please check	1) Apply set-value 2) Check the set-value polarity 3) Check the set-value range
	x	2	8	×	h	8	8	Stored end position could not be	Loose or dirty	Check the valve seat
		2	2					reached	valve seat	
	x				x			passed over	or defective	Check the valve seat
	×					x		Actuator supply voltage too low	1) Improper wiring of the mains supply 2) Jitter in supply voltage 3) Too low supply voltage from PSEP (with optional psep)	1) Check mains wiring 2) Check supply voltage -> see datasheet 3) Contact PS service team
		1		1				Faults within the actuator	Probable reasons	Possible remedy
*				×				Actuator has reached lifetime limit	Wear and/ or running time	Contact PS service team
*		2			x		8	Faulty electronics or invalid parameters	1) Supply voltage interrupted during commissioning 2) Defective electronic component	1) Reload parameters (-> see manual AMS- PSCS), then repeat commissioning 2) Contact PS service team
*						*		Critical or maximum temperature reached	1) Too high numbers of starts 2) Ambient temperature too high	1) Check application and its adjustment 2) Check ambient temperature and try to reduce it -> see relevant data sheet
*	8	8	<u>8</u>	8	8	8 3	x	Mechanical fault in the actuator	Defective mechanical part	Contact PS service team



EC Declaration of Conformity

Declaration of Incorporation of Part Completed Machinery and EC Declaration of Conformity in compliance with the Directives on EMC and Low Voltage

We,

PS Automation GmbH Philipp-Krämer-Ring 13 D-67098 Bad Dürkheim

Declare under our sole responsibility that we manufacture electric actuator series

PSR-E...; PSQx03...; PSQ-E...; PSQ-AMS...; PSL-Mod.4...; PSL-AMS...

according the requirements of the

EC Directive 2006/42/EC

as part completed machinery. These actuators are designed to be installed on industrial valves. It is prohibited to take the actuator into service until it has been ensured that the complete machine conforms the applicable machinery directives. The technical documentation described in Annex VII, part B has been prepared.

The above actuators further comply with the requirements of the following directives.

2014/30/EU	Electromagnetic Compatibility (EMC)
2006/95/EC 2014/35/EU	Low Voltage (LVD) (valid until 04/19/2016) Low Voltage (LVD) (valid from 04/20/2016)
2011/65/EU	Restriction of Hazardous Substances (RoHS)
and have been successfully te	sted in accordance with the following harmonized standards
EN 61000-6-2: 2005	Electromagnetic compatibility (EMC), Generic standards- Immunity for industrial environments
EN 61000-6-3: 2007	Electromagnetic compatibility (EMC), Generic standards- Emission standard for residential, commercial and light-industrial environments
EN 61010-1: 2010	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory use

Bad Dürkheim, 2015

Wax Jumida

Max Schmidhuber (General Manager)

CAUTION

To ensure combiance of these actuators with the above directives, it is the responsibility of the specifier, purchaser, installer and user to observe the relevant specifications and limitations when taking the product into service. Details are available on request, and are mentioned in the Installation and Maintenance Instructions.