

# Watts Pneumatic / Electric Actuation and Controls



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# Pneumatic Actuators

## PA / PAS Series



### Pneumatic Double Rack and Pinion Actuators

#### Double Acting and Spring Return

(180 to 7000 in./lbs. Torque Output @ 80 psig)

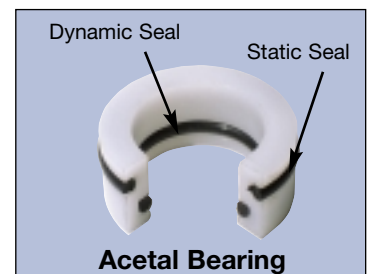
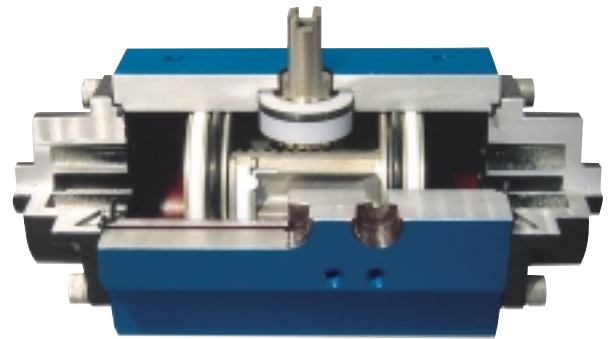
Watts designed Series PA and PAS pneumatic actuators to meet end-user requirements. From the design stage, the concept of extended service life with virtually no maintenance has been paramount with maximum torque output per dollar and reduction of overall profile as key design considerations.

The double acting version (PA) and spring return version (PAS) fully comply with the original design concepts. The anodized aluminum body and end caps and die cast aluminum pistons protect against premature failure due to corrosion and provide superior wear resistance. Using special die casting methods, pistons are produced with maximum density and wear resistance at the gear tooth location.

With special consideration toward safety, Watts revolutionizes rack and pinion actuator design with an internally loaded output shaft that cannot be removed. Additionally, PA units can be converted to PAS units simply by adding appropriate springs providing flexibility and simple inventories.

All pinions are supported with non-metallic, non-corrosive, upper and lower bushings containing a dynamic seal. Dynamic pinion seals do not come in direct contact with the actuator body.

Extended life, contemporary design, safety, simplicity, and lower inventory levels combine to make Watts PA/PAS Series actuators the logical choice for quarter-turn pneumatic actuation requirements.

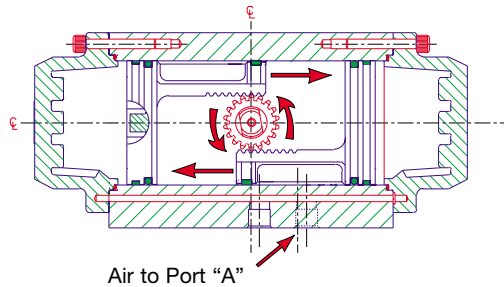


Features	Benefits
• Epoxy coated, anodized aluminum extruded body	• Corrosion resistant
• One piece shaft	• Blow-out proof
• Internally loaded full tooth engagement	• Length of piston, self-contained
• Standard end caps for PA & PAS	• Modular design, simple conversion
• Position indicator	• High visibility position
• ISO /Namur mounting	• Universal adaptability
• Top & bottom non-metallic shaft bearings	• Side load support, minimum dynamic seal wear
• Rolled threads	• 30% higher retaining capacity
• Permanently lubricated assembly	• Maintenance free
• Travel stops	• Open & closed adjustment
• Dual mounting pads	• Ease of accessory mounting
• 4 dynamic seals	• Low coefficient of friction surfaces
• 4 static seals	• No pinion seal wear
• Manual override	• Emergency override on air failure
• Internal ports	• No external tubing
• Female drive	• Low profile direct mounting
• All stainless steel fasteners	• Maximum corrosion protection



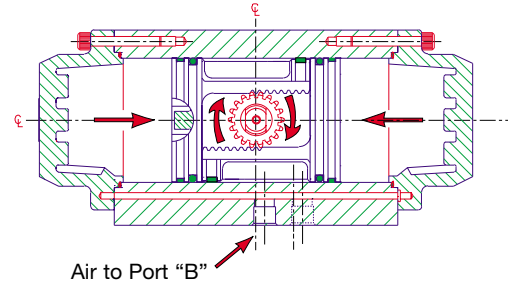
## Modes of Operation

### Double Acting PA



**Figure 1**

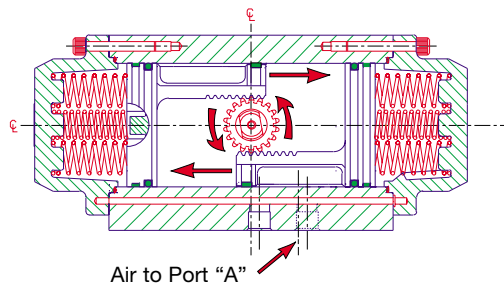
Air is supplied to Port A, pressurizing the inside chamber, forcing the pistons outward resulting in a counter-clockwise rotation of the piston shaft. The air in the outside chambers is vented through Port B.



**Figure 2**

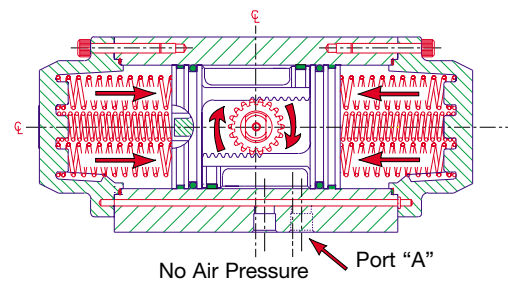
Air is supplied to Port B, pressurizing the outside chambers, forcing the pistons inward resulting in a clockwise rotation of the piston shaft. The air in the inside chamber is vented through Port A.

### Spring Return PAS



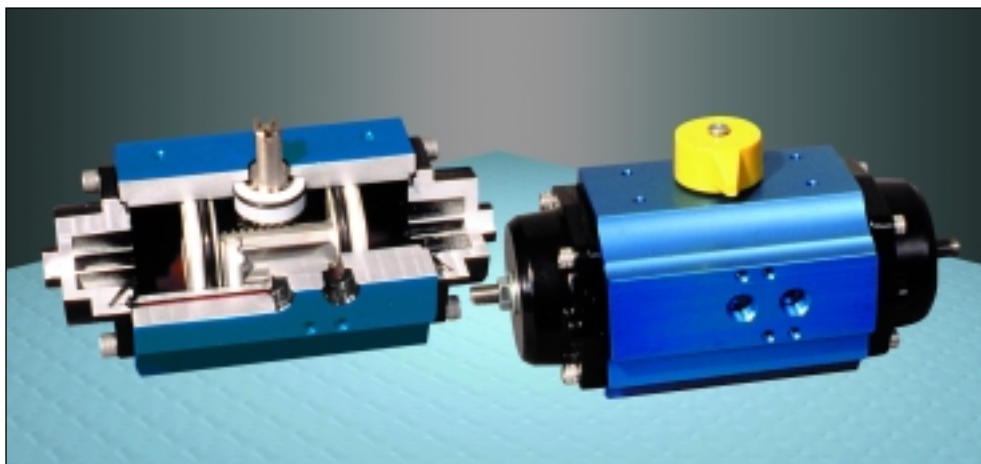
**Figure 3**

Air is supplied to Port A, pressurizing the inside chamber, forcing the pistons outward, compressing the springs that are located in the outside chambers, resulting in a counter-clockwise rotation of the piston shaft. Any air that is in the outside chambers is vented through Port B.



**Figure 4**

With loss of air pressure to the actuator, the pistons are forced inward by the energy of the compressed springs, resulting in a clockwise rotation of the piston shaft. Any air that is in the inside chamber is vented through Port A.





# Pneumatic Actuator Sizing Instructions

To select an actuator to meet the valve's operating conditions, the following can be used as a conservative method of selecting the appropriate actuator:

- 1: The minimum actuator operating air pressure must be established.
- 2: Valve operating torque at the flowing condition, (maximum valve operating torque can be used if flow details are not available).
- 3: The mode of operation must be determined to select a Double-Acting (PA Series) or Spring Return (PAS Series) actuator. When the position of the valve in the failure mode is inconsequential to the application, a pneumatic double-acting actuator may be used. If there is a loss of air, the actuator will stay in its last position; except when valve dynamic torques exceed the frictional torque of the actuator pistons.

If the valve must return to a closed or open position with power or air failure, a Spring Return actuator must be selected. When there is a power or air failure, the springs will automatically return the actuator to the 0 (zero) position. Depending on how the actuator is mounted, the valve will travel either to the full open or full closed position. Fail-open or fail-closed modes must be selected for air or electrical failures when using a solenoid.

- 4: Using the charts on page 7 and 8 of this manual, select the correct actuator for your application with the following method.

## Example - PA

- 1 - Air Supply = 80 PSIG
- 2 - Valve Torque: 350 in/lbs.
- 3 - Mode of Operation = air double-acting (PA Series)
- 4 - Chart from page 7: @ 80 PSIG a PA-400 output is 400 in/lbs.

## Example - PAS

- 1 - Air Supply = 60 PSIG
- 2 - Valve Torque: 380 in/lbs.
- 3 - Mode of Operation = spring return, fail closed (PAS Series)
- 4 - Chart from page 8: @ 60 PSIG a PAS-1500 output is 690 in/lbs. (See note below)

## Example:

*On a spring return unit there are several factors requiring review to ensure that the actuator torque will operate the valve in all conditions. Spring Return units have a lower output torque than the equivalent size in Double-Acting.*

To size a spring return actuator correctly you must look at three numbers.

First, identify which column you should be working in. Since actuator air supply is 60 PSIG you should use the 60 PSIG and spring columns. Start with the spring end which must be equal or slightly greater than the operating torque of the valve. This is the torque that the actuator can put out at the end of the spring stroke. We can select a PAS-1500 with 10 springs, (410 in/lbs).

Next, move across to the 60 PSIG column to verify that the Air start is larger than the valve torque (690 in/lbs). Confirm that the air end torque of the actuator will fully open the valve at the end of the air stroke (air end = 400 in/lbs).

The actuator has now been sized to ensure the valve requirements have been met.

## TORQUE DATA in/lbs @ supply pressure (PSIG)

Spring Return	No. of Springs	40 PSIG		60 PSIG		70 PSIG		Spring	
		Start	End	Start	End	Start	End	Start	End
	14	-	-	422	128	562	278	576	324
PAS-1500	6	454	280	854	680	1054	880	672	378
	8	372	140	772	540	972	722	420	246
	10	-	-	690	400	890	600	560	324
	12	-	-	608	260	808	460	700	410
	14	-	-	526	120	726	320	840	492
PAS-2250	6	963	722	1637	1506	1960	1591	980	574
	8	803	455	1480	1196	1808	1305	582	266
	10	-	-	-	-	-	-	777	346
									476





## PA/PAS Series Options and Accessories

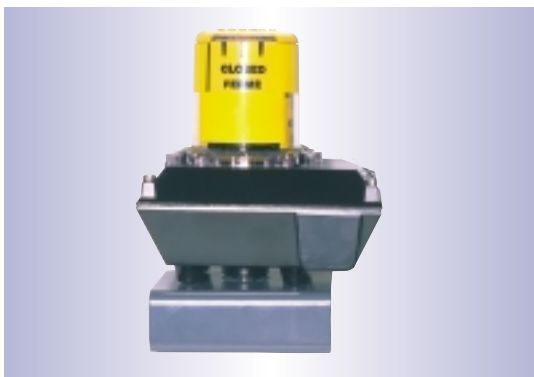
### Positioners

For control applications, WATTS offers a complete line of pneumatic rotary positioners for input signals of 3-15 (std.), 6-30, 3-9 and 9-15 psi; and electro-pneumatic positioners for input signals of 4-20 mA (std.), or 0-20 mA.



DIRECT MOUNT POSITIONER SERIES PW-496

ACTUATOR WITH ISO-MOUNTED POSITIONER



### Top mounted, rotary limit switches

Watts offers both mechanical and proximity type limit switches for the PA/PAS Series Pneumatic Actuators. Each limit switch comes complete with all the hardware necessary for quick and easy mounting. Standard features of our switches include NEMA IV rating (NEMA VII, IX optional), various switch complements and position indicators.

### Solenoid Valves

Watts solenoid valve features include balanced spool construction that allows ports to be plugged for 2 or 3-way operation, coil hermetically sealed and guaranteed for life against burnout, manual override aids in machine set-up, Nema IV (Std), VII and IX configurations, UL and CSA recognized, and mounts directly to PA/PAS housing without tubing.



### Other Options and Accessories:

- Speed Controls
- Special Coatings
- Filter/Regulators
- Feedback Options (Potentiometers)

*Consult Watts for additional information on optional accessories.*



## PA / PAS Suggested Specifications

### General

The actuator shall be pneumatically operated, travelling a minimum of 90° in each direction and be able to overtravel at 1½° more in each direction. The actuator shall be totally enclosed without external moving parts. All pneumatic passageways must be integral to the actuator housing eliminating the need for external tubing. Actuators shall be of rack and pinion design with output torque linear throughout travel. Actuator shall be provided with 2 piston guide rings to extend actuator life and reduce friction. Actuator must be supplied with travel adjustments and a mechanical visual position indicator that can be easily removed to expose the output shaft to manually override the actuator. The output pinion must be electroless nickel plated for corrosion protection. Actuators shall be capable of all mounting orientations.

All actuator housings shall be of hard anodized aluminum with external fasteners made of stainless steel. Springs shall be spring steel, zinc-plated for corrosion protection. All seals shall be of BUNA-N (nitrile) and shaft bearings of acetal resin.

The actuator shall be factory lubricated and require no additional lubrication and shall be factory tested to ensure minimum torque.

### Spring Return - Modular Design

The Spring Return System for failsafe applications must be installed in the same housing and end caps as the double acting actuator. The use of extended bolts shall be used so that the spring torque can be safely released prior to the end cap being removed.

### Standard Materials shall be

Body:	Epoxy coated, Anodized aluminum alloy, Type 1
End Caps:	Epoxy coated, die-cast aluminum alloy
Output Shaft:	Carbon Steel, ENP Coated
Piston Bearings:	Teflon
Shaft Bearings:	Acetal
Fasteners:	Stainless Steel
Springs:	Zinc-plated, Spring Steel
O-Rings Seals:	BUNA-N

### Service Data

Actuators shall be designed for pneumatic operation up to a maximum pressure of 120 PSIG (8.6 bars) and for temperature ranges of - 4°F (-20°C) to 180°F (85°C). Filtered air is recommended but not required. The units shall be able to operate with other media such as hydraulic oil or water. All double acting and spring return units shall be suitable for both on/off and throttling applications. Standard one year warranty.



### Optional Equipment

#### Solenoids

Solenoid control module for electrical operation of actuator on/off requirements. The solenoid shall be supplied in NEMA IV waterproof and NEMA VII explosion-proof enclosures. Solenoid shall be provided with manual override built into the body. Solenoid shall have a ¼" NPT pneumatic port and a ½" NPT electrical connection and operate at 115 Volts AC, 50/60 HZ. Two-way speed controls shall be provided as options and shall be adjustable in each direction of actuator travel.

#### Limit Switches

Limit Switch Control Module for electrical signal indication of actuator and valve position. The limit switch shall be mounted directly to the top of the actuator. The housing shall be NEMA IV waterproof or NEMA VII explosion-proof construction with two S.P.D.T. switches with two separately adjustable cams that can be adjustable through 90° of travel. The switch must be rated at 15 amps for 115 or 230 Volts A.C. Additional switches can be added when specified. The switches must be pre-wired to a terminal strip that is built into the switch housing. The conduit entry shall be minimum ½" NPT.

#### Positioner PW496

Pneumatic Positioner Module for Control Valve Services. The standard positioner input signal shall be 3-15 PSIG (4-20mA optional), suitable for both double-acting and spring return actuator requirements. Positioner shall be suitable for direct and reverse acting operation and split range applications. The positioner shall operate with a maximum air supply of 120 PSIG and a maximum air consumption not to exceed 0.28 Standard Cubic Feet per Minute (SCFM) in a balanced condition with 87 PSIG air supply pressure. Positioner Linearity 0.7%, Dead band 0.8%, Repeatability 0.5%. Positioner shall direct mount to the top of the actuator housing.

### MILITARY SPECIFICATION ANODIC COATINGS FOR ALUMINUM AND ALUMINUM ALLOYS:

The PA/PAS epoxy coated, anodized aluminum alloy, Type 1 body meets the specification for use by all Departments and Agencies of the Department of Defense.

Type 1 - Chromic acid anodizing, conventional coatings produced from chromic acid bath. (see 3.4.1)



## PA / PAS Engineering & Performance Data

### Pressure/Temperature

	PA		PAS	
	psi	bars	psi	bars
Min. Air Supply Required	20	1.4	40	2.8
Max. Air Supply Allowed	120	8.6	120	8.6
	°F	°C	°F	°C
Min. Ambient Temperature Rating	-4	-20	-4	-20
Max. Ambient Temperature Rating	180	82	180	82

Note: For applications at or below -4° F/-20° C, the optional low temperature repair kit must be supplied.

### Weights

Model No.	PA-Double Acting		PAS-Spring Return	
	lbs.	kg	lbs.	kg
180	2.70	1.22	2.90	1.32
400	5.40	2.45	6.10	2.77
750	10.23	4.64	11.84	5.37
1000	12.30	5.58	13.90	6.30
1500	16.00	7.27	18.00	8.16
2250	27.41	12.43	29.61	13.43
3000	32.30	14.65	34.50	15.64
7000	68.00	30.84	82.00	37.19

\*Full complement of springs.

### Recommended Tubing Sizes

PA/PAS Model No.	4 FT (1.2 M)	OVER 4 FT (1.2 M)
180 , 400 , 750	1/8" (3mm)	1/8" (3mm)
1000 , 1500	1/8" (3mm)	1/8" (3mm)
2250 , 3000	1/4" (6mm)	1/4" (6mm)
7000	1/4" (6mm)	1/2" (12mm)

### Cycle Time, seconds

PA/PAS Model No.	PA	PAS
180	<1.0	<1.0
400	<1.0	<1.0
750	<1.0	<1.0
1000	<1.0	<1.0
1500	<1.0	<1.0
2250	<1.0	<1.0
3000	<1.0	<2.0
7000	<1.0	<4.0

Note: Cycle time determined at 80 PSIG, no load, no solenoid.

### Air Consumption

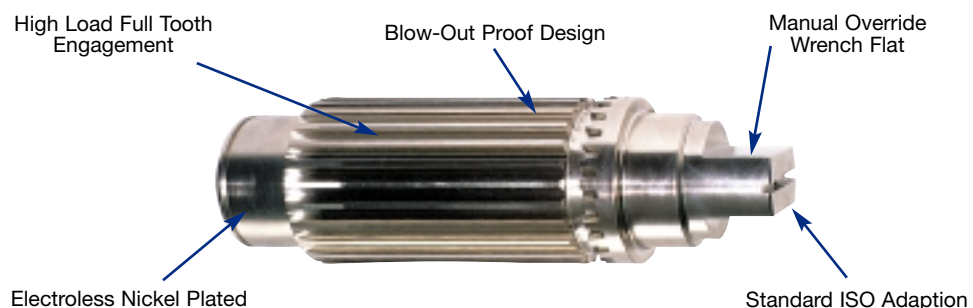
Air to Port	180		400		750		1000		1500		2250		3000		7000	
	cu-in	cc	cu-in	cc	cu-in	cc	cu-in	cc	cu-in	cc	cu-in	cc	cu-in	cc	cu-in	cc
A	8	131	16	262	34	557	44	721	61	1000	95	1557	125	2048	272	4457
B	8	131	23	377	57	934	56	918	81	1327	106	1737	232	3802	458	7505

Note: In standard cubic inches/cubic centimeters per 90° stroke.

### SERIES PA DOUBLE-ACTING TORQUE @ PSI/BARS

Double Acting	20/1.4		40/2.8		60/4.1		80/5.5		100/6.9		120/8.3	
	in/lbs	N-m	in/lbs	N-m	in/lbs	N-m	in/lbs	N-m	in/lbs	N-m	in/lbs	N-m
180	45	5	90	10	135	15	180	20	225	25	270	31
400	100	11	200	23	300	34	400	45	500	56	600	68
750	188	36	422	48	563	64	750	85	937	106	1171	132
1000	270	27	520	59	800	90	1080	122	1360	154	1640	185
1500	375	36	700	79	1100	124	1500	169	1900	215	2300	260
2250	563	72	1266	143	1688	191	2250	254	2810	317	3513	397
3000	779	88	1558	176	2338	264	3116	352	3896	440	4674	528
7000	1750	198	3500	395	5250	593	7000	791	8750	989	10500	1186

### Blow-Out Proof Stem





## PAS Series

### Double Acting - Spring Return



All actuators are torque and pressure tested.

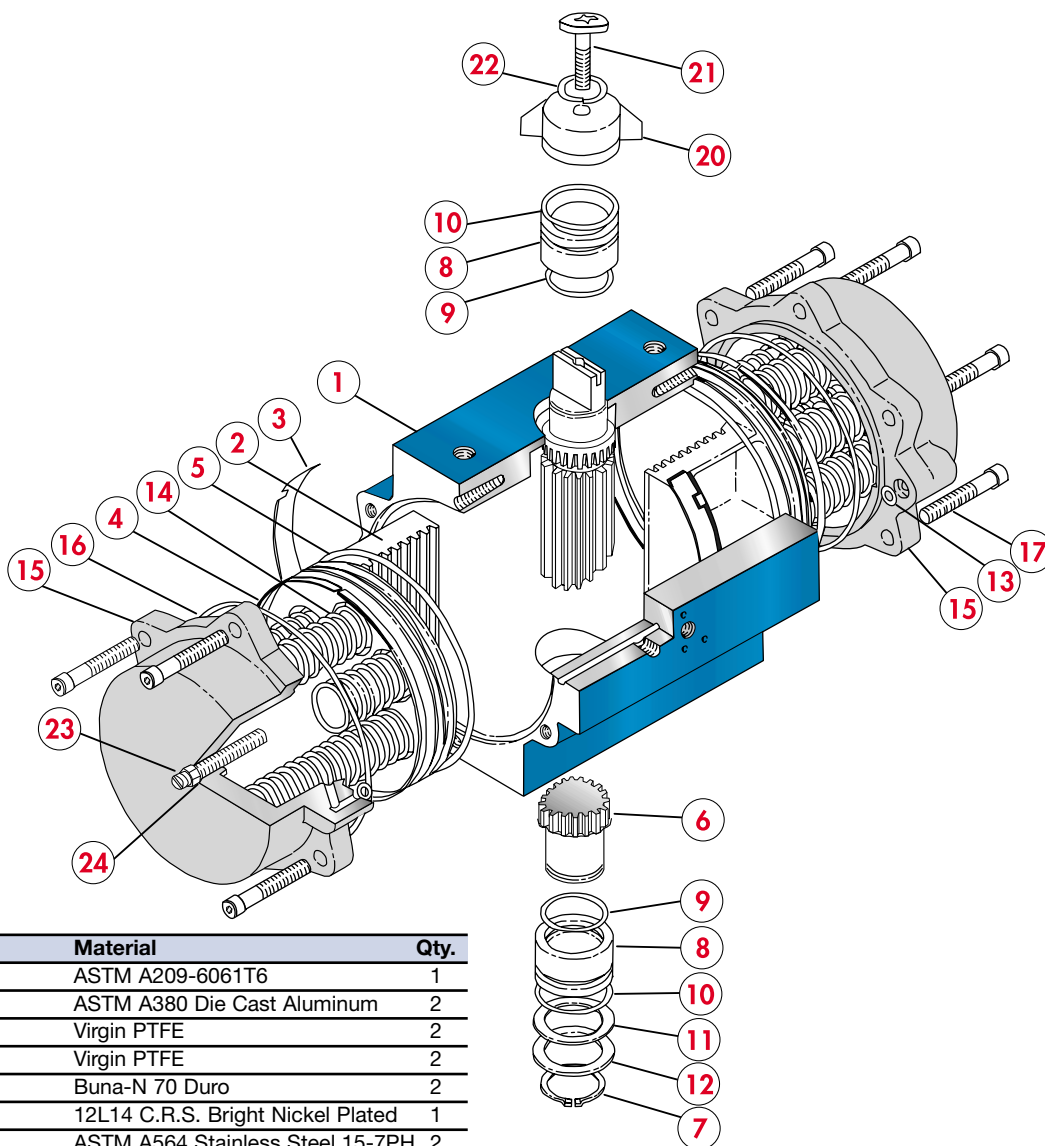


#### Torque Data - in./lbs. @ supply pressure (PSIG)

Spring Return	No. of Springs	40 PSIG		60 PSIG		70 PSIG		80 PSIG		100 PSIG		120 PSIG		Spring	
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
PAS-180	6	60	42	100	82	120	102	140	122	180	162	220	202	48	33
	8	50	26	90	66	110	86	130	106	170	146	210	186	64	44
	10	-	-	80	50	100	70	120	90	160	130	200	170	80	55
	12	-	-	70	34	90	49	110	64	150	114	190	154	96	66
	14	-	-	60	20	80	34	100	48	140	98	180	138	112	77
PAS-400	6	122	68	222	168	272	218	322	268	422	368	522	468	132	78
	8	96	24	196	124	246	174	296	224	396	324	496	424	176	104
	10	-	-	170	80	220	130	270	180	370	280	470	380	220	130
	12	-	-	144	36	194	86	244	136	344	236	444	336	264	156
	14	-	-	-	-	109	46	218	92	318	192	418	292	308	182
PAS-750	6	312	149	696	477	1009	760	1254	988	1654	1256	2054	1556	588	408
	8	236	46	604	336	912	607	1254	901	1654	1256	2054	1556	588	408
	10	-	-	514	202	816	453	1116	752	1516	1116	1916	1416	528	368
	12	-	-	425	79	720	300	1020	634	1420	1020	1820	1320	432	312
	14	-	-	304	74	404	160	504	247	704	515	904	784	308	255
PAS-1000	6	358	232	638	512	778	652	918	792	1178	1052	1458	1332	288	162
	8	304	136	584	416	724	556	864	696	1124	956	1404	1236	384	216
	10	250	40	530	320	670	460	810	600	1070	860	1350	1140	480	270
	12	-	-	476	224	616	364	756	504	1016	764	1296	1044	576	324
	14	-	-	422	128	562	278	702	428	962	668	1242	948	672	378
PAS-1500	6	454	280	854	680	1054	880	1254	1080	1654	1480	2054	1880	420	246
	8	372	140	772	540	972	722	1172	904	1572	1340	1972	1740	560	328
	10	-	-	690	400	890	600	1090	800	1490	1200	1890	1600	700	410
	12	-	-	608	260	808	460	1008	660	1408	1060	1808	1460	840	492
	14	-	-	526	120	726	320	926	520	1326	920	1726	1320	980	574
PAS-2250	6	963	722	1637	1506	1960	1591	2200	1851	3022	2536	3753	3221	582	266
	8	803	455	1480	1196	1808	1305	2141	1549	2872	2296	3603	2981	777	346
	10	661	148	1323	886	1655	1084	1992	1371	2723	2056	3453	2742	971	426
	12	-	-	1166	576	1503	831	1842	1131	2573	1816	3304	2502	1165	505
	14	-	-	1008	266	1350	578	1692	891	2423	1576	3154	2262	1359	585
PAS-3000	6	1070	690	1820	1440	2220	1840	2620	2240	3416	3036	4170	3790	860	480
	8	890	460	1640	1210	2040	1610	2440	2010	3190	2760	3990	3560	1090	660
	10	750	150	1500	900	1900	1300	2300	1700	3050	2450	3850	3250	1400	800
	12	-	-	1340	620	1740	1020	2140	1420	2090	2170	3690	2970	1680	960
	14	-	-	1180	340	1580	740	1980	1140	2730	1890	3530	2690	1960	1120
PAS-7000	6	2410	1520	4160	3270	5035	4145	5910	5020	7660	6770	9710	8520	1980	1090
	8	2030	860	3780	2610	4655	3485	5530	4360	7280	6110	9030	7860	2640	1470
	10	1630	200	3380	1950	4255	2825	5130	3700	6880	5450	8630	7200	3300	1870
	12	-	-	3030	1285	3905	2160	4780	3035	6530	4785	8280	6535	3965	2220
	14	-	-	2500	625	3375	1500	4250	2375	6000	4125	7750	5875	4625	2750



## PA / PAS Materials of Construction



Item	Description	Material	Qty.
1	Body	ASTM A209-6061T6	1
2	Piston	ASTM A380 Die Cast Aluminum	2
*3	Piston Bearing	Virgin PTFE	2
*4	Piston Bearing	Virgin PTFE	2
*5	Piston O-Ring	Buna-N 70 Duro	2
6	Pinion Shaft	12L14 C.R.S. Bright Nickel Plated	1
*7	Inverted Retaining Ring	ASTM A564 Stainless Steel 15-7PH	2
*8	Shaft Bearing	Acetal	2
*9	Pinion O-Ring	Buna-N 70 Duro	2
*10	Bearing O-Ring	Buna-N 70 Duro	2
*11	Thrust Washer	Virgin PTFE	2
12	Washer	316 Stainless Steel	2
13	By-Pass O-Ring	Buna-N 70 Duro	2
*14	Spring (PAS only)	Music Wire	14
15	End Cap	ASTM A380 Die Cast Aluminum	2
*16	End Cap O-Ring	Buna-N 70 Duro	2
17	Hex Socket Head Cap Screw	Stainless Steel 18-8	varies
18	Nameplate (not shown)	Mylar	1
19	Decal, PAS only (not shown)	Aluminum	2
20	Position Indicator	ABS	1
21	Screw	Stainless Steel	1
22	Lockwasher	Stainless Steel	1
23	Travel Stops	Zinc Plated Mild Steel	2
*24	Travel Stop O-Ring	Buna-N 70 Duro	2

\*These are recommended spare parts and are included in all repair kits.  
Consult Watts for repair kit ordering codes.



Model		M	N	O	P	Q	R	S	T
180	in. mm	0.355/0.357 9.02/9.07	0.575/0.580 14.61/14.73	1/4-20 UNC N/A	N/A N/A	0.7 17.78	1.39 35.31	N/A N/A	N/A N/A
400	in. mm	0.441/0.443 11.20/11.25	0.629/0.631 15.98/16.03	1/4-20 UNC N/A	5/16-24 UNF N/A	0.7 17.78	1.39 35.31	0.97 24.64	1.95 49.53
750	in. mm	0.504/0.506 12.80/12.85	0.792/0.794 20.12/20.17	1/4-20 UNC N/A	5/16-24 UNF N/A	0.7 17.78	1.39 35.31	0.97 24.64	1.95 49.53
1000	in. mm	0.504/0.506 12.80/12.85	0.792/0.794 20.12/20.17	1/4-20 UNC N/A	5/16-24 UNF N/A	0.7 17.78	1.39 35.31	0.97 24.64	1.95 49.53
1500	in. mm	0.629/0.631 15.98/16.03	0.880/0.882 22.35/22.40	5/16-24 UNF N/A	7/16-14 UNF N/A	0.97 24.64	1.95 49.53	1.42 36.07	2.84 72.14
2250	in. mm	0.629/0.631 15.98/16.03	0.880/0.882 22.35/22.40	5/16-24 UNF N/A	7/16-14 UNF N/A	0.97 24.64	1.95 49.53	1.42 36.07	2.84 72.14
3000	in. mm	0.629/0.631 15.98/16.03	0.880/0.882 22.35/22.40	5/16-24 UNF N/A	7/16-14 UNF N/A	0.97 24.64	1.95 49.53	1.42 36.07	2.84 72.14
7000	in. mm	0.817/0.819 20.75/20.80	1.14/1.15 28.96/29.08	N/A N/A	7/16-14 UNF N/A	N/A N/A	N/A N/A	1.42 36.07	2.84 72.14



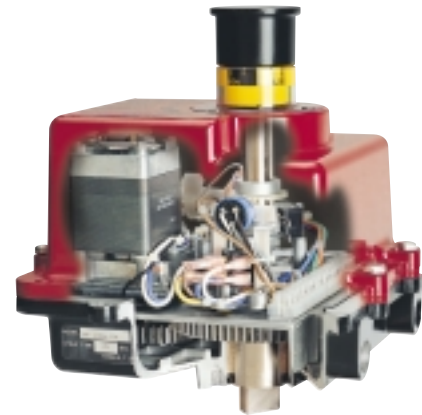
## PF Series Power-Flex Electric Actuator

### Designed with the two most important electric actuator requirements in mind — POWER and FLEXIBILITY.

At Watts, we pride ourselves on keeping up with the demands of the marketplace, and meeting those demands with innovative product development. The PF Series is no exception. With the Power-Flex electric actuator, we have developed a versatile unit that packs the power required for your specific application.

This rugged electric actuator is designed to outlast and outperform similar designs. Our split phase, reversing motor, coupled with an efficient spur gear design, produces torques of 400, 700, 1100 and 2000 in./lbs., with a standard extended duty cycle motor. The unique combination NEMA IV, VII and IX enclosure is suitable for both weatherproof and hazardous environments - simultaneously. The heavy-duty male output shaft ensures positive valve cycling without fear of shaft fatigue over time. Additional features include a declutchable manual override, a highly visible position indicator beacon, and corrosion resistant epoxy coating - all examples of Watts' continued philosophy of offering more features as standard at no extra cost.

The PF Series can be tailored to your application requirements by incorporating such options as: additional auxiliary SPDT limit switches, heater/thermostat, 0-1000 OHM feedback potentiometer, cycle length modules, 4-20 mA control board, and fail safe battery pack. Power voltages 115 VAC, 230 VAC, single phase, 12 and 24 VAC, 12 and 24 VDC.



PF2000 shown



FEATURES	BENEFITS
<ul style="list-style-type: none"> <li>Combination NEMA IV, VII and IX enclosure</li> </ul>	<ul style="list-style-type: none"> <li>Watertight, explosion-proof and dust-tight.</li> </ul>
<ul style="list-style-type: none"> <li>Protective hybrid epoxy coating</li> </ul>	<ul style="list-style-type: none"> <li>Provides corrosion and ultraviolet light resistance; cannot be easily scratched.</li> </ul>
<ul style="list-style-type: none"> <li>Stainless steel cover bolts</li> </ul>	<ul style="list-style-type: none"> <li>Corrosion resistant; bolts will not seize in place.</li> </ul>
<ul style="list-style-type: none"> <li>Declutchable manual override</li> </ul>	<ul style="list-style-type: none"> <li>Isolates gear drive from motor for safety precautions; less torque required to manually operate.</li> </ul>
<ul style="list-style-type: none"> <li>Split phase reversing motor w/thermal overload protection</li> </ul>	<ul style="list-style-type: none"> <li>Protects motor from overheating and burning out.</li> </ul>
<ul style="list-style-type: none"> <li>4140 hardened steel gear drive</li> </ul>	<ul style="list-style-type: none"> <li>Life cycle capabilities far exceed powdered metal or fiber gears.</li> </ul>
<ul style="list-style-type: none"> <li>Two SPDT 15 amp limit switches, Two auxiliary switches optional</li> </ul>	<ul style="list-style-type: none"> <li>For position indication and/or interlocking other auxiliary equipment.</li> </ul>
<ul style="list-style-type: none"> <li>Electro - mechanical motor brake</li> </ul>	<ul style="list-style-type: none"> <li>Prevents motor Run-On or hunting of valve disc/ball.</li> </ul>
<ul style="list-style-type: none"> <li>Electroless nickel plated carbon steel male output shaft</li> </ul>	<ul style="list-style-type: none"> <li>Strong, corrosion resistant actuator - valve linkage.</li> </ul>
<ul style="list-style-type: none"> <li>Pinion and output shafts supported by needle bearings</li> </ul>	<ul style="list-style-type: none"> <li>Reduces side loading for efficient gear drive output.</li> </ul>
<ul style="list-style-type: none"> <li>16 point terminal strip</li> </ul>	<ul style="list-style-type: none"> <li>Easy installation of all options connections.</li> </ul>
<ul style="list-style-type: none"> <li>Highly visible position indicator</li> </ul>	<ul style="list-style-type: none"> <li>Determine valve position easily and from a greater distance away.</li> </ul>
<ul style="list-style-type: none"> <li>Nameplate affixed to base</li> </ul>	<ul style="list-style-type: none"> <li>All necessary information available; no mix up of different models during installation.</li> </ul>



## PF Series Standard Design Features

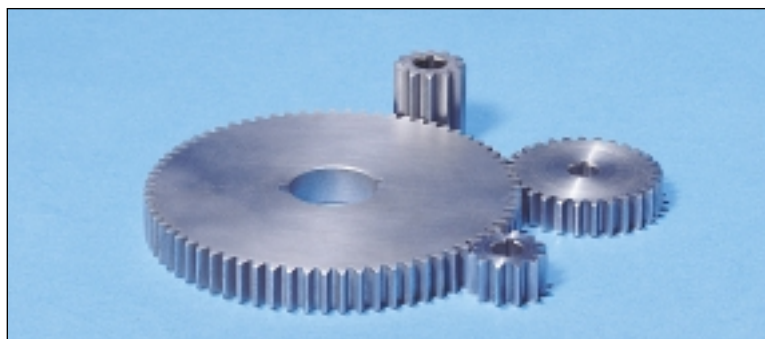
### ENCLOSURE

The PF Series electric actuator employs a unique enclosure design that meets NEMA IV Watertight and NEMA VII & IX Hazardous Environment standards, all within the same housing. The flange width is wider than a standard NEMA VII enclosure, incorporating an O-ring groove on the inside diameter, thus providing the capability for use in indoor and outdoor hazardous environment applications. A protective hybrid epoxy coating provides corrosion and ultraviolet light resistance.



### SPUR GEAR DESIGN

The heavy duty spur gear design constructed of 4140 hardened steel far exceeds the life cycle capabilities of powdered metal or fiber gears. The efficiency of this design allows for use of a smaller motor, resulting in less energy consumption.



### Electro-Mechanical Brake

Available with AC voltage motors to prevent motor RUN-ON and maintains position of the valve disc on resilient seated butterfly valves.



### POSITION INDICATOR

One of the features that received much attention to its design criteria was the method of valve position indication. After careful consideration of several different ideas, the agreed upon design was determined to be the best approach.

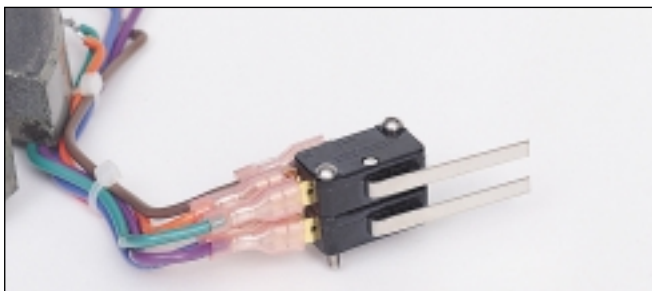
Unlike other methods employed by our competitors that require close proximity to the unit, this highly visible indicator allows for easy determination of valve position from greater distances.







## PF Series Options and Controls



### Additional Limit Switches

For position indication and/or interlocking other auxiliary equipment.



### 0-1000 OHM Potentiometer

Provides a resistance feedback proportional to the actuators position.



### Heater and Thermostat

Maintains a constant 70°F temperature in cold climates and eliminates condensation in high humidity areas.



### Cycle Length Control Module

Can be factory installed for applications where fast opening or closing are not warranted. Cycle time can be field adjustable up to 10 minutes.

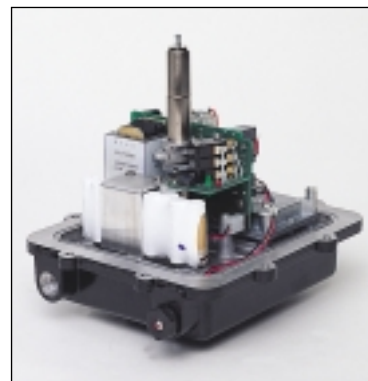
### 4-20 mA Control Board

Watts 4-20 mA control boards are factory installed and available with the 115 VAC motor only. The 4-20 mA input provides modulating control for valves, dampers and other devices requiring accurate positioning control. In response to input command signal, the control board supplies electrical power to the motor driving the actuator in the direction necessary to bring the system into balance. Zero, Range and Anti-Hunt adjustments are easily accessible for field adjustment. Direct acting or reverse acting modes, as well as, split range signals are optional.



### Failsafe Electric Actuators

Watts PF Series fail-safe electric actuators feature rechargeable battery packs built into the actuator enclosure. Torque outputs of 400-2000 in./lbs. are available. All optional voltages are available. A built-in trickle charger (automatic battery recharge) maintains battery life. The actuator is capable of 25 continuous cycles under full load without recharging batteries. The outside of the housing has a low battery charge indicator light. A remote local switch inside the housing facilitates start up and/or maintenance.





# PF Series Specifications

## TORQUE

400, 700, 1100 and 2000 in./lbs.

## ENCLOSURE

Combination NEMA IV Watertight and NEMA VII and IX Hazardous Environment:

Class I, groups C and D,

Class II, group E, F and G.

## ENCLOSURE FINISH

Hybrid epoxy coating with ultraviolet light inhibitor

## MOTOR

Capacitor start/run split phase reversing with thermal overload protection (AC models only)

Voltages available in 115 VAC (Standard), 230 VAC, 12 & 24 VAC, and 12 & 24 VDC.

## TEMPERATURE LIMITS

-40°F (with heater & thermostat) to maximum 150°F

## OUTPUT CONNECTION

Male output shaft

## GEARING

Hardened 4140 steel spur gear design; permanently lubricated

## LIMIT SWITCHES

Two SPDT 15 amp standard; cam operated and adjustable to 300°

## MOTOR BRAKE

Electro-mechanical motor brake to prevent motor Run-On

## MANUAL OVERRIDE

Declutchable, wrench operated PF400, PF700 and PF1100. Declutchable handwheel operated PF2000.

## CONDUIT CONNECTION

1/2" NPT; optional 2nd connection available

## AVAILABLE OPTIONS

- Auxiliary SPDT 15 amp limit switches (2)
- Heater/thermostat
- Extended duty cycle motors
- 4-20 mA positioner board
- 4-20 mA control board with 4-20 mA Feedback
- 0-1000 OHM feedback potentiometer
- Cycle length control module
- Multi-turn operation
- Power Voltages:
  - 230 VAC, single phase
  - 12 & 24 VDC, 12 & 24 VAC
- Fail safe battery pack
- CSA-Nema IV; PF700 and 1100

## ENGINEERING DATA

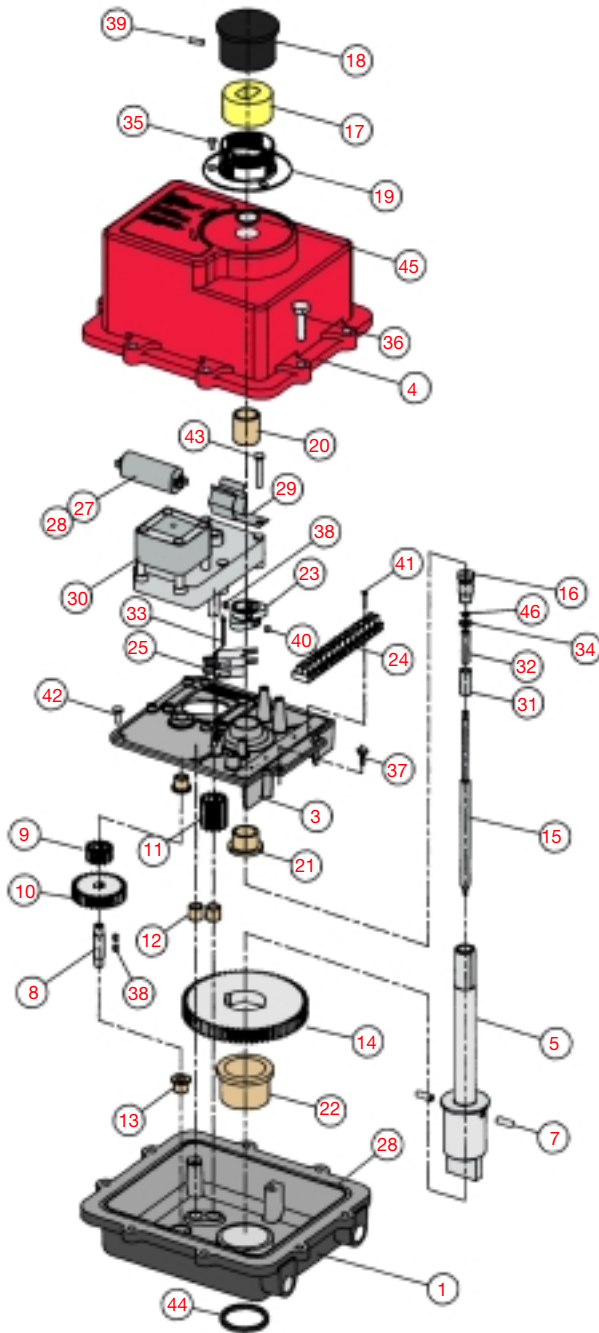
Model	Torque in./lbs.	115VAC		230VAC		12VDC		24VDC		12VAC		24 VAC		Cycle Time/90° (Sec.)	Weight (Lbs.)
		Amp Draw	Duty Cycle	Amp Draw	Duty Cycle	Amp Draw	Duty Cycle	Amp Draw	Duty Cycle	Amp Draw	Duty Cycle	Amp Draw	Duty Cycle		
PF400	400	.05	100%	.8	75%	2.0	75%	4.0	75%	2.0	75%	3.0	75%	10	10
PF700	700	.75	75%	.8	50%	2.0	75%	4.0	75%	2.0	75%	3.0	75%	10	10
PF1100	1100	.05	100%	.8	75%	2.0	75%	4.0	75%	2.0	75%	3.0	75%	25	11
PF2000	2000	1.00	65%	.8	50%	2.0	75%	4.0	75%	2.0	75%	3.0	75%	25	15

Note: Amp rating is considered locked rotor.

Duty cycle @ ambient temperature.



## PF Materials of Construction

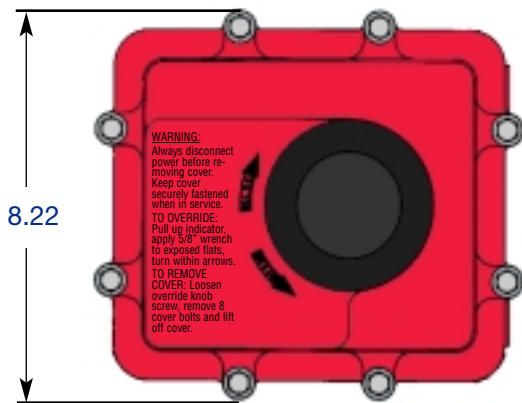


Series PF 400, 700 and 1100 shown.

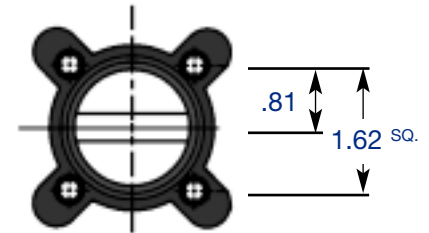
ITEM	QTY.	DESCRIPTION	MATERIAL
1	1	Base	Aluminum, Hybrid Epoxy Coated
3	1	Base Plate	Aluminum
4	1	Cover	Aluminum, Hybrid Epoxy Coated
5	1	Shaft Main	Carbon Steel, Electroless Nickel Plated
7	2	Pin	Carbon Steel
8	1	Shaft Stub	Carbon Steel
9	1	Spur Gear	Carbon Steel
10	1	Spur Gear	Carbon Steel
11	1	Gear Pinion	Carbon Steel
12	2	Pinion Bearing	Bronze
13	1	Spur Gear Bearing	Bronze
14	1	Gear Main	Carbon Steel
15	1	Shaft Inner	Carbon Steel, Zinc Plated
16	1	Shaft Retainer	Carbon Steel, Electroless Nickel Plated
17	1	Position Indicator	Polycarbonate
18	1	Override Knob	Aluminum, Hybrid Epoxy Coated
19	1	Collar	Polycarbonate
20	1	Cover Bearing	Bronze
21	1	Base Plate Bearing	Bronze
22	1	Base Bearing	Bronze
23	2	Cam	Aluminum
24	1	Terminal Block	
25	2	Switch	
26	1	O-Ring Base/Cover	Buna-N
27	1	Capacitor	
28	1	Capacitor	
29	1	Clamp, Capacitor	
30	1	Motor	
31	1	Shell	Aluminum
32	1	Spring	
33	2	Screw Round Hd.	4-40 x 1.00 Lg.
34	1	Washer, Flat #10	.45 Dia. x .06 Thk.
35	3	Screw, Flat Hd.	8-32 x .25 Lg. Stainless Steel
36	8	Screw, Hex Hd.	5/16-18 x 1.00 Lg. Stainless Steel
37	1	Screw, Self Tapping Slot/Hex (Green)	#10 x .5 Lg.
38	1	Key, Woodruff	3/32
39	1	Screw, Slot Set	8-32 x .5 Lg. Stainless Steel
40	4	Screw, Set	8-32 x .12 Lg.
41	4	Screw, Self Tapping	#4 x .5 Lg.
42	5	Screw, Self Tapping Slot/Hex	#10 x .5 Lg.
43	4	Screw, Slot/Hex	10-32 x 1.62 Lg.
44	1	Seal, Base	Buna-N
45	1	Seal, Cover	Buna-N
46	1	O-Ring, Shaft	Buna-N

Note: Items 8, 9, 10, 13 and 27 are for 1100 and 2000 in./lb. units only.  
Item 18 is a 10" diameter handwheel on PF-2000.

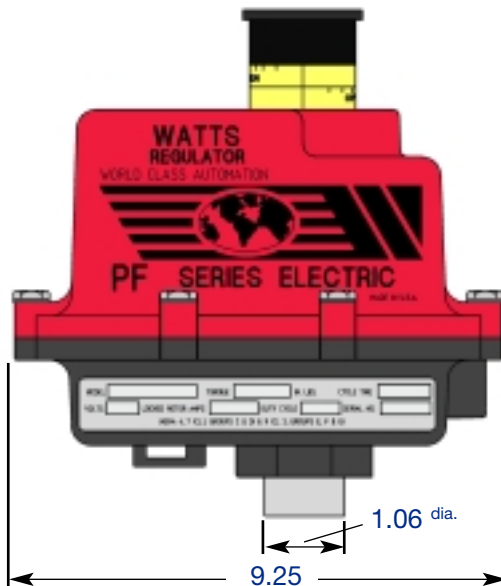
## PF Dimensions



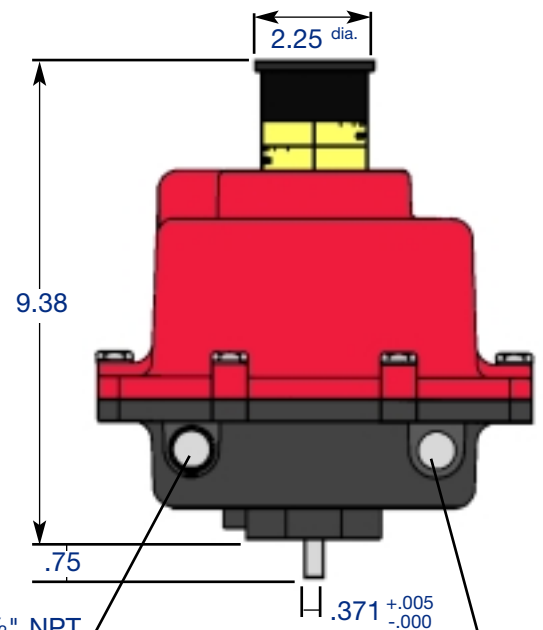
### MOUNTING DIMENSIONS



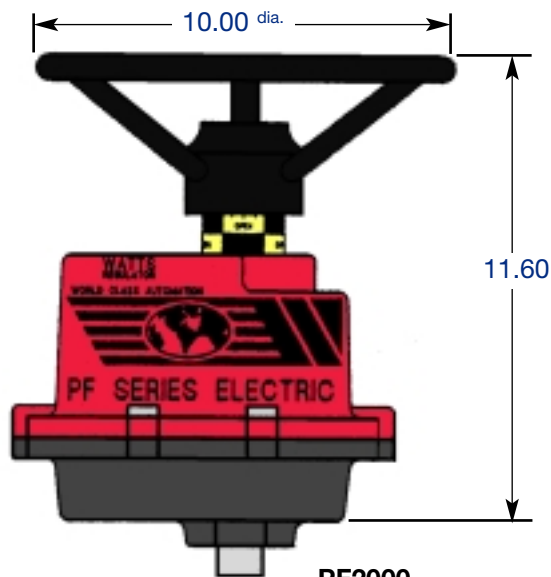
$\frac{5}{16}$ -24 UNF (4) places



PF400, PF700, PF1100



4-20mA positioner  
option has  
additional  $\frac{1}{2}$ " NPT  
conduit connection



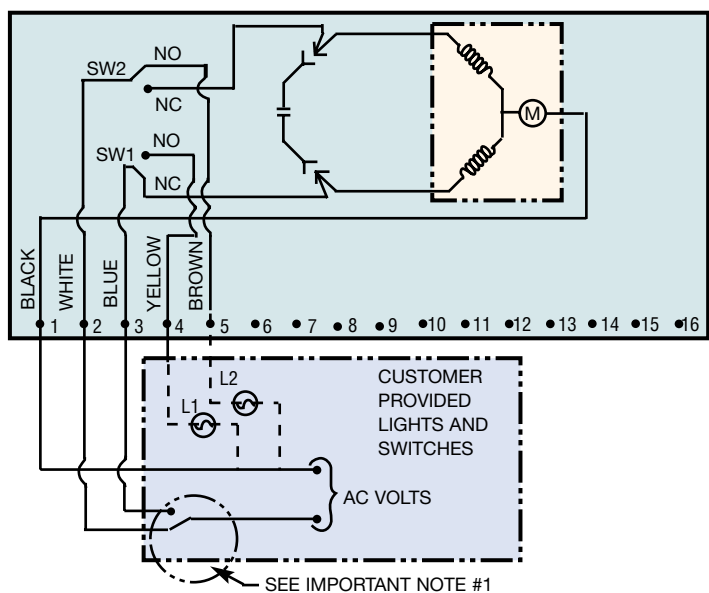
PF2000



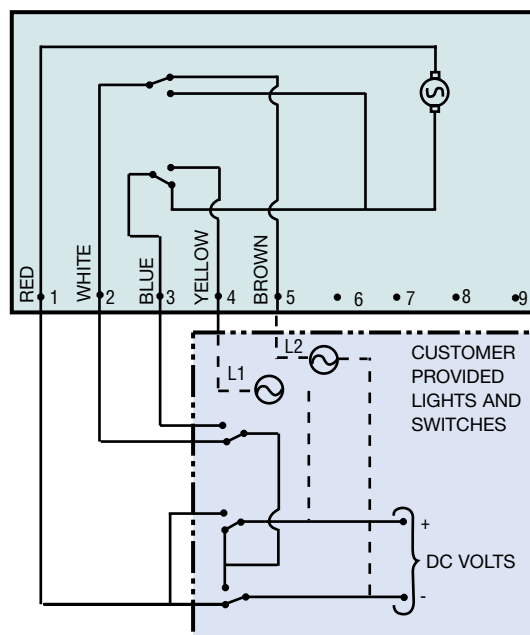
## Standard PF Actuator Wiring Diagram

Actuator shown in counter-clockwise extreme of travel, or "Open" position.

### AC WIRING



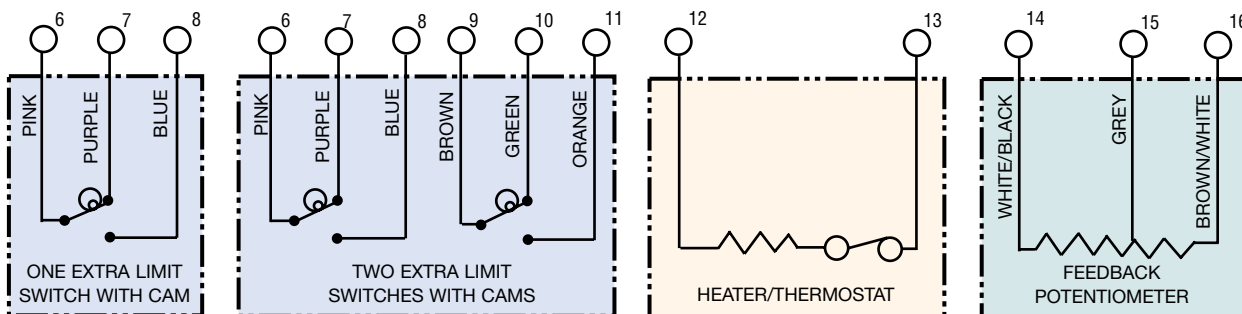
### DC WIRING



### NOTES:

1. Each actuator must be powered through its own individual switch contacts to avoid cross feed.
2. Motor has a thermal protector as shown in diagram.

### ACTUATOR OPTIONS



For other wiring diagrams, refer to IOM-PF.





## LVW Series Electric Actuators

Series LVW Electric Actuators are designed for rugged and reliable performance. Their modular, plug-in design simplifies actuator set-up and calibration. Upgrades and modifications can be done in the field in a matter of minutes, with no hard wiring, soldering or factory returns. The LVW Series is designed to offer highly efficient operation in a compact package; from on-off duty, to modulating or proportional control.

### Simplified Set-up

The LVW control board offers simplicity in setting up the actuator. With the Mode Selector Switch and the touch of a simple “enter, set and go” push button, the LVW Series Control Board simplifies actuator set-up. On-board push buttons and slide switches make manual positioning easy and simplifies the selection of input signal type, feedback signal type and actuator fail position in the event of a loss of control signal. With a simple turn of a dial, signal sensitivity (dead band) and cycle time (speed) are easily adjusted.



Actuator shown with optional handwheel installed.

### Standard Features At A Glance

- Electronics are simple to set-up and calibrate with a clearly labeled terminal strip and easy access to user wiring.
- Plug-in electronics for simple upgrades and modifications with coded connectors to make internal mis-wiring impossible.
- On AC Hot and AC Common connections, fuses will isolate damage to the Motor Board if power is misapplied, allowing for quick and easy repair.
- Auto-resetting .25 amp fuses protect limit switches and internal circuitry from overloads caused outside the actuator. They reset automatically, approximately 3 minutes after the overload condition is corrected.
- Standard 75% duty cycle at ambient temperatures up to 104°F.
- Visual position indicator is provided as part of the cover and clearly shows valve position.
- Dual conduit openings make wiring easier and keep power and control wiring separate.
- Limit switches provide end of travel control and position indication.
- Electro-mechanical motor brake is provided to prevent motor Run-On or hunting of valve.
- Manual override is declutchable and wrench operated for valve positioning when electricity is not available.
- Locked rotor stall protection stops the motor if excessive torque is encountered, providing protection from stall conditions (AC modulating applications only).
- Thermal overload breaker protects the motor from overheating for any reason and automatically shuts down until it cools and then resumes normal operation.
- Permanently lubricated, hardened steel spur gears throughout.
- Highly efficient, split-phase, capacitor run AC motors provide long life and high duty cycles with very low power consumption.



## LVW Series Specifications

<b>Temperature Range</b>	32°F to 150°F (without heater and thermostat), -40°F to 150°F (with heater and thermostat)
<b>Conduit Connections</b>	(2) ¾" NPT
<b>Mounting</b>	ISO 5211 F07 and F10 bolt circles with 1" female square
<b>Torque Output</b>	Upon power up, the actuator supplies the rated torque when it is needed to break the valve away from its seat
<b>Duty Cycle</b>	AC applications: The actuator may run continuously at ambient temperatures at or below 104°F for up to 15 minutes. After running for 15 minutes, actuators may operate up to 75% duty cycle (that is, between each 90 degree rotation, the actuator must rest for ⅓ of the 90° cycle time) Note: AC Applications: At 50Hz, the duty cycle is 60% @ 104°F. DC Applications: Continuous
<b>Voltage</b>	115VAC (50 or 60 Hz), 230 VAC (50 or 60 Hz), 12 VDC, 24 VDC
<b>Limit Switches</b>	(2) Single pole, double throw switches rated for ⅓ hp, 10 amps @ 115/230VAC, CSA certified, fuse protected. The two standard switches are used for end of travel control, and may also be used for pilot or position indication in on/off or jogging applications.
<b>Motor</b>	AC Applications: Split phase, capacitor driven motor with Class B or better insulation; sub-fractional horsepower. DC Applications: Brushed, DC, sub-fractional horsepower.
<b>Lubrication</b>	Permanently lubricated gear train and bearings
<b>Gear Train</b>	Hardened steel spur gears
<b>Approximate Weight</b>	31 lbs. for NEMA 4/4X/7/9 (21 lbs. in NEMA 4/4x applications)
<b>Enclosure</b>	Base: die cast aluminum Cover: NEMA 4/4x - PVC w/UV inhibitors Cover: NEMA 4/4x/7/9 - Cast aluminum

### LVW Series Control Board Specifications 115VAC and 230VAC Modulating Applications

<b>Input Impedence</b>	Voltage Input 35k ohms; Current Input 200 ohms
<b>Control Signal</b>	May be either 4-20mA or 0-10VDC (selectable via on-board slide switch). Fully compatible with ISA-S50.1 as a type 4, class L, power isolated device. Input minus and transmit minus are tied together and isolated from power and earth ground.
<b>Position Readback Signal</b>	Either 4-20mA or 0-10VDC (jumper selectable) Minimum resistive load for voltage input 1k ohm. Maximum resistive load for current input: 500k ohm
<b>Locked Rotor Protection</b>	If actuator cannot achieve position commanded by control signal after 2 seconds, it will stall motor. Actuator will remain stalled until the control signal commands it to drive in the opposite direction.
<b>Control Fail Position</b>	In event of loss of control signal (with power still supplied), user can choose between Zero and Last via slide switch.
<i>Note: If the minimum control signal = 0, fail position must be last.</i>	
<b>Cycle Rate (Speed) Control</b>	User can choose 90° rotation times of : normal, 2x normal, 3x normal, 5x normal, and 10x normal.

<b>Dead Band</b>	The amount of change in control signal that the actuator will ignore before the output shaft begins to move. Adjustable from 1% to 3%.
<b>Accuracy</b>	1% (dead band settings)
<b>Repeatability</b>	For any given control signal value, the ability of the actuator to drive to same physical position (i.e., a 12mA signal should result in a 45° actuator output position). ± 1%
<b>Resolution</b>	The smallest amount of actuator response that can be obtained by changing the input signal. 1%
<b>Split Range</b>	Actuator may accept split range (i.e., 4-12mA or 12-20mA) control signal with no wiring changes.
<b>Reverse Acting</b>	With no wiring changes required, the actuator may be calibrated to drive clockwise upon increasing control signal, and counter-clockwise upon decreasing control signal.
<b>On-Board Supervisory Control</b>	Push buttons override the analog control signal, allowing the user to manually position the valve.

## LVW Series Specifications Cont.

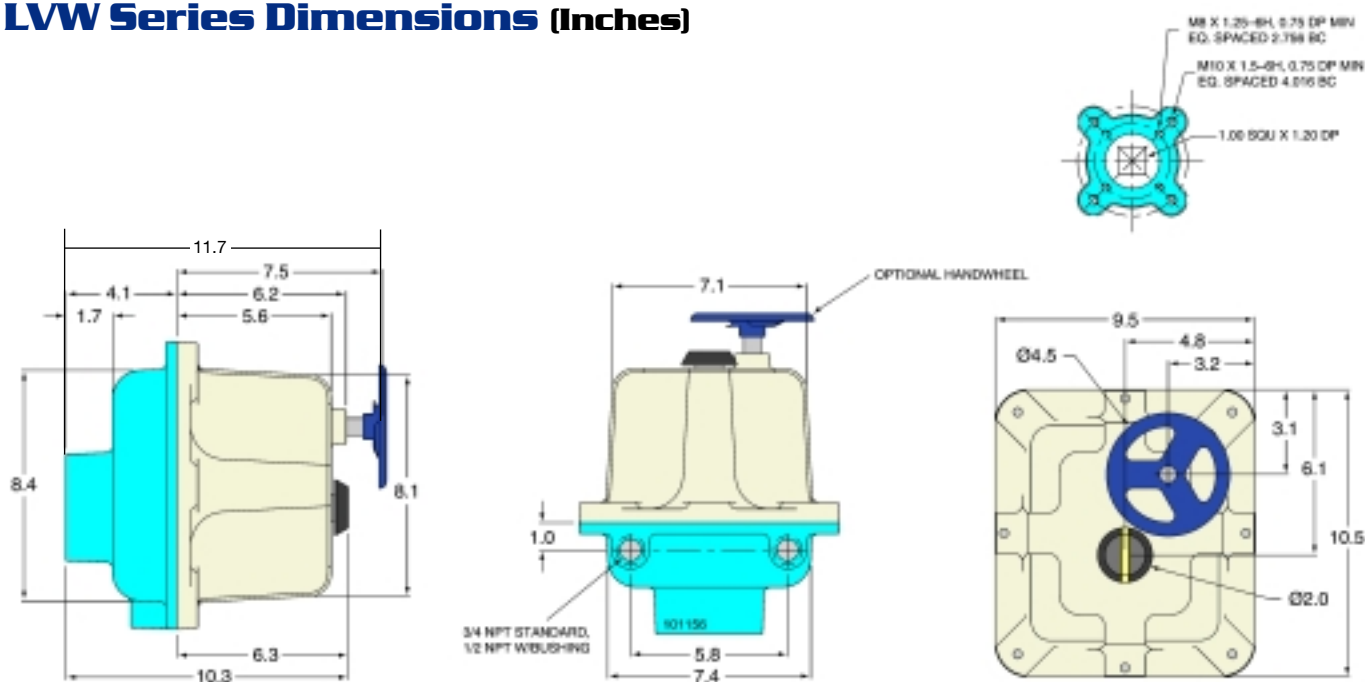
## Technical Data 115 & 230VAC / 12 & 24VDC Models

Torque Output (breakaway)	Speed (seconds per 90° rotation)	Duty Cycle	VA Rating		Max Running Current at Full Load (true RMS)		Max Effective Peak Inrush Current (=.66 x peak inrush)	
			115VAC	230VAC	115VAC	230VAC	115VAC	230VAC
2500 in/lbs.	70	75%	92vA	161vA	.8 amps	.7 amps	1.66 amps	1.29 amps
3000 in/lbs.	75	55%	92vA	161vA	.8 amps	.7 amps	1.66 amps	1.29 amps
Torque Output (breakaway)			Speed seconds (per 90°rotation)		Duty Cycle		Current Draw at full running	
			12VDC	24VDC			12VDC	24VDC
2500 in/lbs.			30	30	Continuous		4.8 amps	4.8 amps
3000 in/lbs.			30	30	Continuous		4.8 amps	4.8 amps

**Notes:**

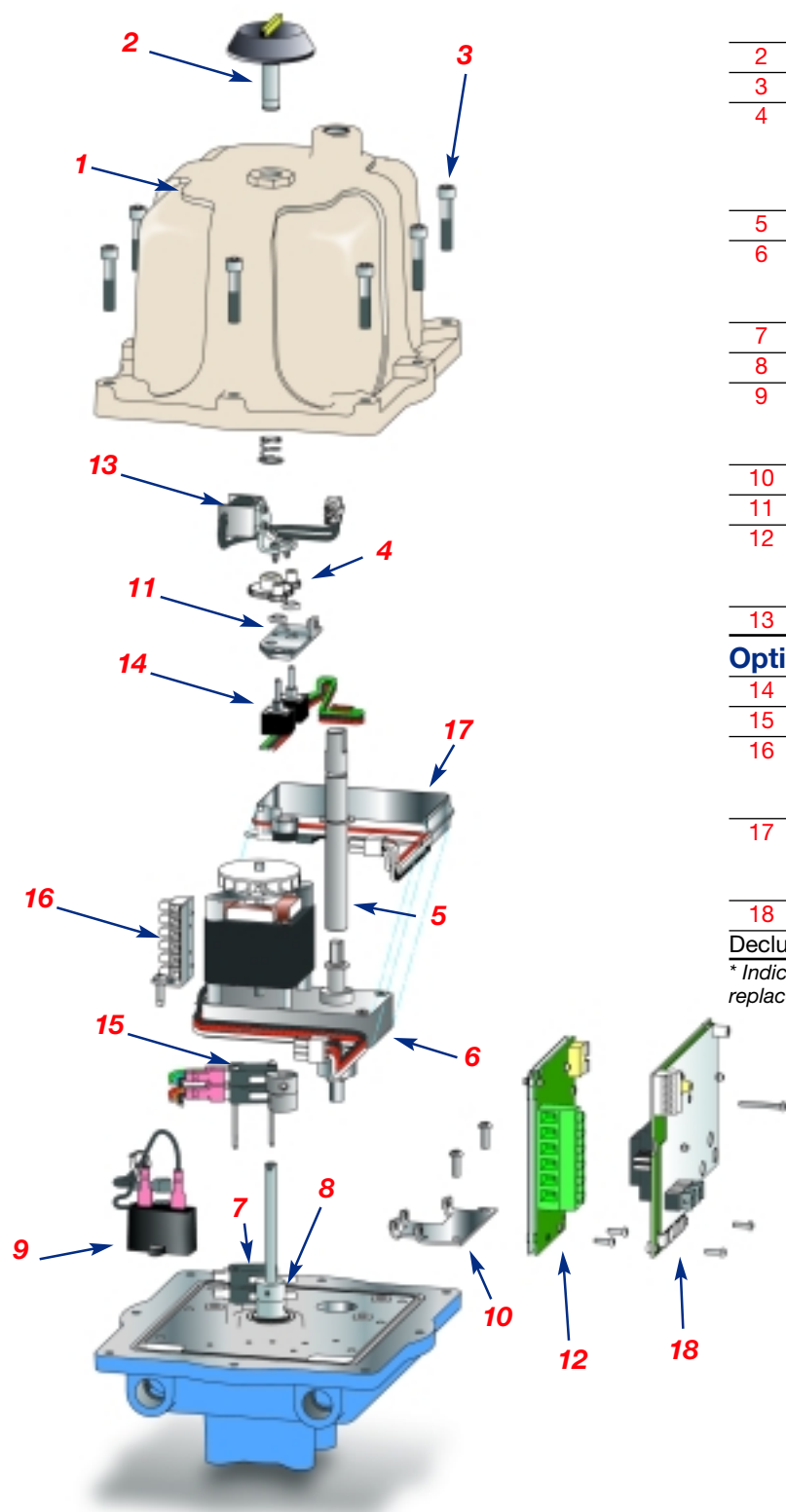
1. The Current Draws stated include all options. If motor brake and/or heater & thermostat are not installed, the actual current draws will be less.
2. For DC models, Current Draws are provided at full running torque. If the actuator encounters an over-torque condition, such as a stall condition, the Current Draw will be vastly increased.
3. DC actuators have motors that do not generate heat, so they are not limited by duty cycle restraints. However, due to limited brush life of the motors, it is not recommended that the LVW series be used in applications that require continuous operation.

## LWV Series Dimensions (Inches)





## Series LVW Spare Parts and Option Kits



### Spare Parts

Item	Description	Part #
1	Cover with Position Indicator	
	Cast Aluminum	9301
	PVC	97145
2	Position Indication Knob*	91392
3	Cover Screw	91564
4	Pot/Cam Shaft Gears	
	90° Operation	99090
	180° Operation	99180
	270° Operation	99270
5	Override Shaft*	93023
6	Motor Gearbox	
	115VAC	90201
	230VAC	90202
7	Limit Switch	1020
8	2 Cams with Set Screw	91352
9	Capacitor with Wires	
	115VAC	93061
	230VAC	93071
10	Mounting Bracket, Motor Board, Lwr.	91698
11	Mounting Bracket, Motor Board, Upr.	91688
12	Motor Board with Screws	
	115VAC	92015
	230VAC	92030
13	Brake	99715

### Option Kits

14	Feedback Potentiometer	99200
15	2 Extra SPDT Limit Switches	99000
16	Terminal Block	
	1-6 Connections	91420
	1-12 Connections	91430
17	Heater Thermostat	
	115VAC	99515
	230VAC	99523
18	Control Board	99642
	Declutchable Hand Wheel (not shown)	9098

\* Indicates items sold as replacement parts only. Consult Watts for replacement parts ordering codes.

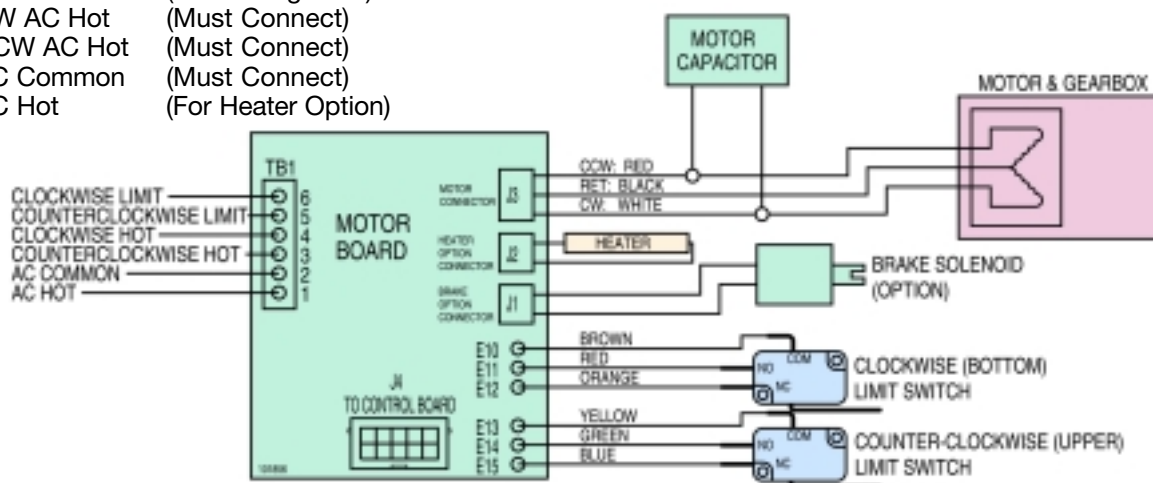


# LVW Series Wiring Diagrams

## 115VAC and 230VAC On/Off Applications

### Motor Board Wiring

Terminal 6	CW Limit	(Line Voltage Out)
Terminal 5	CCW Limit	(Line Voltage Out)
Terminal 4	CW AC Hot	(Must Connect)
Terminal 3	CCW AC Hot	(Must Connect)
Terminal 2	AC Common	(Must Connect)
Terminal 1	AC Hot	(For Heater Option)

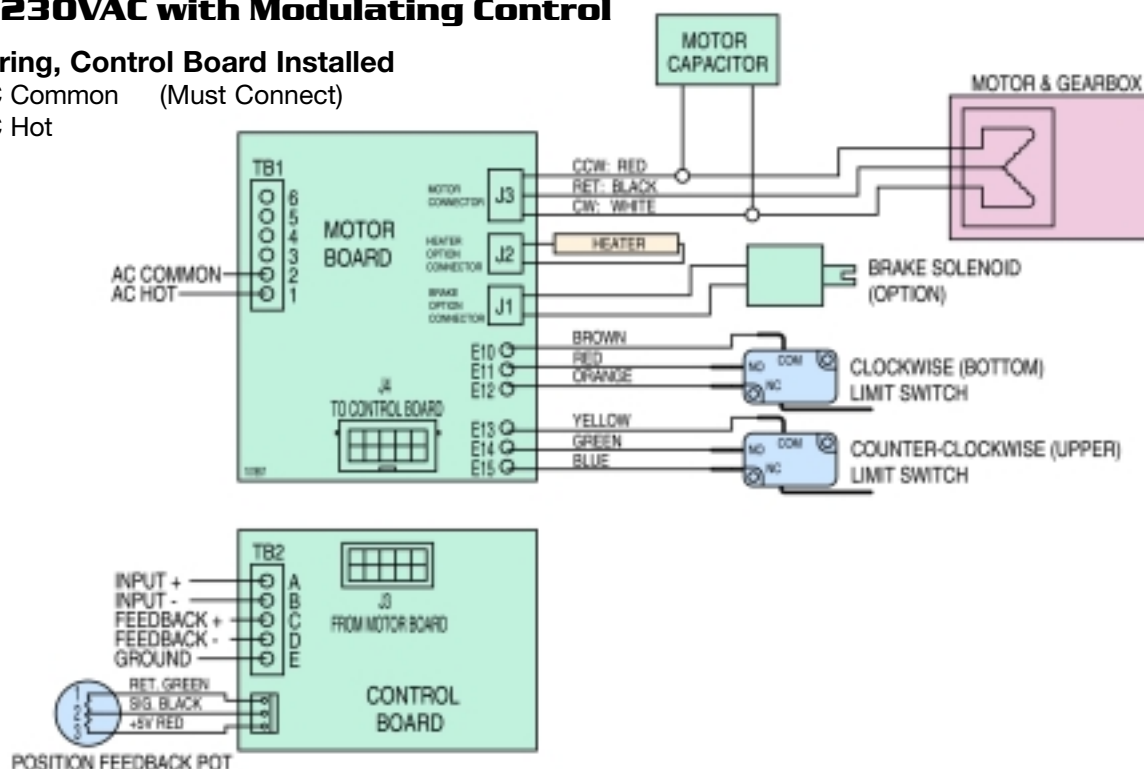


**Caution:** AC voltage actuators use reversing induction motors which cause high voltages. **Devices connected to terminal 3 and terminal 4 must be rated for a minimum 250VAC (550VAC for 230VAC applications).** Due to the induced feedback voltage, multiple actuators can not be wire in parallel. Separate isolated contacts must be provided for each actuator.

## 115VAC and 230VAC with Modulating Control

### Motor Board Wiring, Control Board Installed

Terminal 2	AC Common	(Must Connect)
Terminal 1	AC Hot	



**Caution:** When control board is installed, power to terminal 3 or terminal 4 will damage electronic circuit boards. Use “CW” Clockwise and “CCW” Counter Clockwise buttons to drive actuator.





## **LVW Series Suggested Actuator Specification**

### **115VAC and 230VAC Standard Electric Actuator**

#### **General**

The quarter-turn electric actuator will comply with Part 15, Class A of the FCC regulations for emissions and conducted radiation. It will also be certified by the Canadian Standard Association (CSA) for weathertight or weather-tight and hazardous locations. It will be composed of a compact cast aluminum housing, motor, gearing, limit switches controlled by metal cams for end of travel control, electro-mechanical motor brake, mechanical position indicator, and declutchable override as one complete unit. Composite (non-metallic) housing covers are permitted for non-hazardous locations. All internal connections (motor leads, limit switch leads, option connectors, etc.) will be coded, using different style connectors for each function to prevent mis-wiring. All connections will plug-in to simplify field repairs and upgrades. No preventive or periodic maintenance of any type will be required.

#### **Motor**

The motor will be capable of running continuously at full torque for up to 15 minutes at ambient temperatures at or below 104°F. Subsequently, the motor must be capable of 75% duty cycle. Motors will be split phase, capacitor driven with an auto reset thermal sensor and will provide high starting torque and be totally enclosed within the actuator housing cover.

#### **Lubrication**

All rotating power train components will be coated with a multi-purpose grease. Lubricants will be suitable for ambient conditions of -40°F to 150°F. For temperatures between 32°F and -40°F a heater and thermostat assembly should be provided.

#### **Gearing**

The powertrain will be comprised of hardened steel, machine cut spur gears. Stamped or cast gearing will not be allowed.

#### **Manual Operation**

A wrench-operated override shaft will be provided for manual operation. As an option, a metallic hand wheel may also be provided. The override device will be engaged through a declutching mechanism that separates the final output drive from the motor output.

#### **Limit Switches**

Actuators will have two standard end of travel switches, single pole double throw, rated at 10 amps at 115/230 VAC. The limit switches will be activated by metal cams mounted on the actuator drive shaft. At the end of travel, the power will be routed through the limit switches to a terminal strip location for pilot or position indication applications. The limit indicator outputs will be fuse protected with auto-resetting polyfuses with a working limit of 0.25



amps to protect the limit switches and internal circuitry from possible overloads originating outside the actuator. To simplify maintenance, these polyfuses will be permanent and do not need to be replaced. They reset automatically after the overload condition is corrected - in approximately 3 minutes. Two additional limit switches may be added to the actuator, adjustable to operate at any position, as required by the process application.

#### **Open/Close Operation**

Open/Close actuators will be controlled via two, powered, maintained contacts, one for driving in the clockwise direction and one for driving in the counter-clockwise direction. Power may be removed mid-stroke to position the valve. The AC input power will be fuse protected on both AC Hot and AC Common. The fuses will never blow in normal operation and will be conservatively rated and soldered in place for high reliability.

#### **Proportional Control (Modulating Operation)**

Modulating control actuators will accept a variable, proportional 4-20 mA or 0-10VDC valve position signal and respond by positioning the valve linearly with an accuracy of 1%. Normally, the actuator will drive clockwise in response to a decreasing control signal; however, the actuator will be capable of "reverse acting" operation (driving counter-clockwise in response to a decreasing control signal) with no necessitated internal wiring changes. The actuator will also supply a 4-20 mA or 0-10VDC position re-transmit signal, and provide the ability to adjust the cycle time of the actuator via motor pulsing. A slide switch will enable the user to set the actuator response to a loss of control signal. Locked rotor protection will detect whenever the actuator is unable to achieve the position commanded by the control signal and will terminate power to the motor in order to prevent damage due to repeated stall conditions.



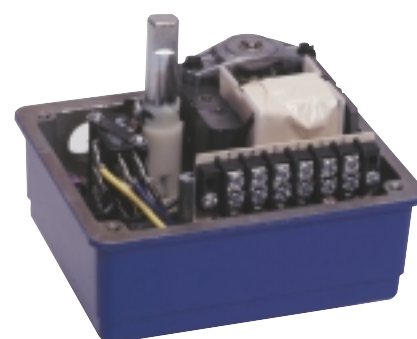
# EA350 Series Unidirectional Electric Actuator For Quarter-Turn Applications

Series EA350 Unidirectional Electric Actuators are specifically designed for use with ball valves and other applications requiring a compact, high efficiency actuator. The EA350 Series is offered in 115VAC and 24VAC models with standard 8 and 35 second cycle times for 90° rotation; 24VAC cycle time is 18 and 40 seconds (25 seconds for 2½" - 3"). The EA350 is ideal for use with Watts ¼" - 3" B-6400 series standard port ball valves.

## Features

- High efficiency, extremely compact size
- Standard 100% duty cycle\*
- Hardened precision gear train
- Permanently lubricated
- Unique visual indicator on side of actuator housing, in addition to standard visual indicator
- Standard terminal strip connections
- Standard manual override
- Mounting pattern identical to Watts Pneumatic Actuators
- Heavy duty shaded pole motor
- Adjustable start/stop positions
- UL listed components
- Standard auxiliary SPDT switch
- Standard NEMA-4 construction

\*EA350 units will deliver max. rated torque for 1 hr. continuous.



## Terminal Functions

Terminal #	Function	Output Shaft Positions
1	Makes when output shaft flats are perpendicular to housing	
2	Auxiliary Common Terminal	
3	Makes when output shaft flats are parallel to housing	
4	When powered, output shaft rotates until flats are perpendicular to housing length	
5	Operating Common	
6	When powered, output shaft rotates until flats are parallel to housing length	

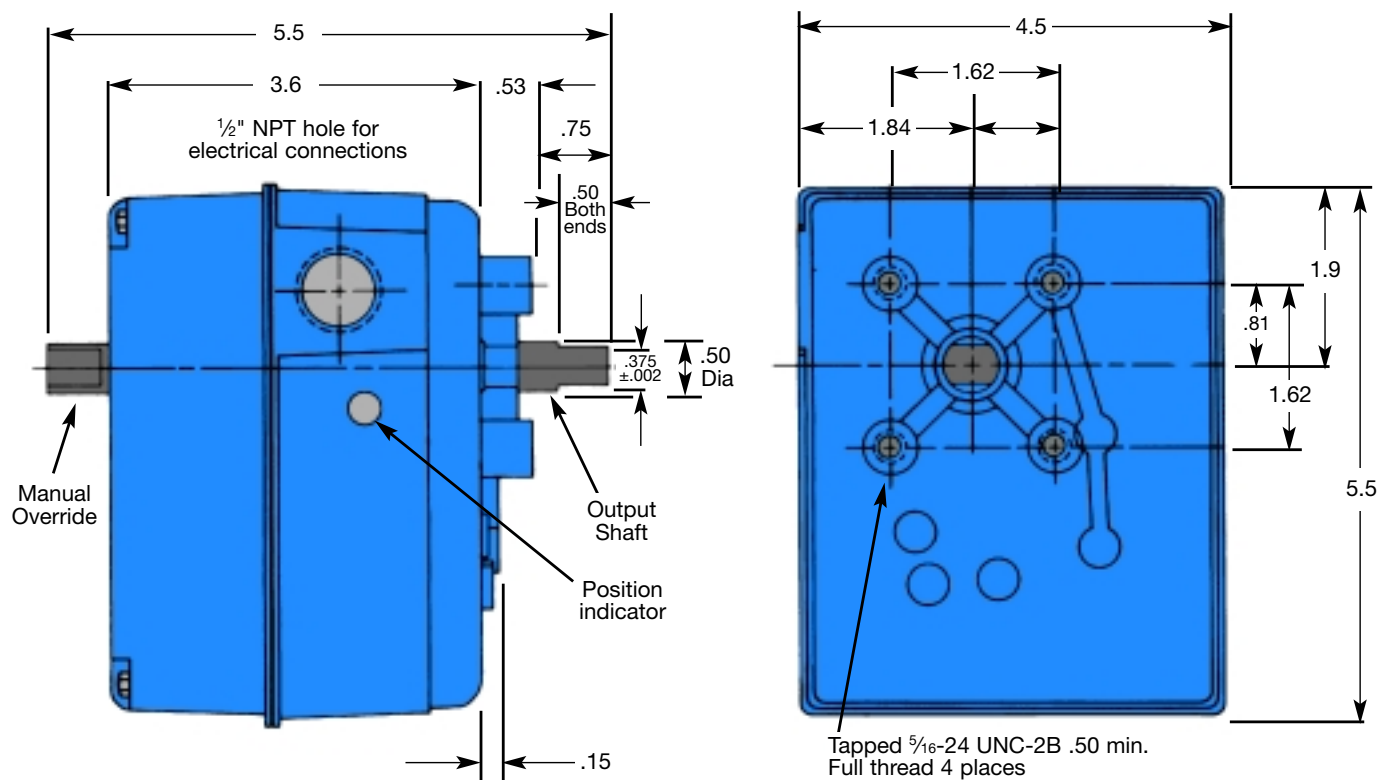
All illustrations are shown viewed from bottom (output shaft side) of actuator



## EA350 Specifications

<b>Rated Voltage:</b>	115VAC or 24VAC
<b>Cycle Time/90°Rotation:</b>	115VAC - 8 or 35 seconds 24VAC - 18 and 40 seconds (25 sec. for 2½"-3")
<b>Enclosure Rating:</b>	NEMA 4
<b>Duty Cycle Rating:</b>	25%
<b>Output Torque:</b>	350 in./lbs. at rated voltage
<b>Amp. Draw at Full Load:</b>	1.6 amps - 115VAC / 2.2 amps - 24VAC
<b>Amp. Rating of Auxiliary SPDT Switch:</b>	10 amps @ 115VAC
<b>Output Shaft Size:</b>	⅝" across flats
<b>Conduit Connection:</b>	½" NPT

### Dimensions (Inches) - Weight



Weight: 6 lbs.

### Materials

**Housings:** Die Cast Zinc

**Gear Train:** Hardened, Permanently Lubricated Steel

**Output Shaft Seals:** Buna-N

**Manual Override and Output Shaft:** Hardened Steel, Zinc Plated



# Valve Actuation Data Sheet

In order to provide properly sized butterfly valve and actuator units to meet specific applications, it is important that Watts be provided as much of the following data as possible. Please note that Watts provides the following standard features with its actuators.

1. A motor brake is standard with electric actuators to prevent motor Run-On or hunting of valve position.
2. Pneumatic actuators standardly sized at 80 psi air supply pressure. Consult Watts when using an air supply of less than 80 psi.
3. Solenoid valves mounted directly to the pneumatic actuator housing when ordered with Watts pneumatic actuators.

## 1. Valve information:

A. Model No. \_\_\_\_\_ Size \_\_\_\_\_ Quantity \_\_\_\_\_  
B. Media \_\_\_\_\_ Inlet Pressure \_\_\_\_\_  
Differential Pressure \_\_\_\_\_ System Velocity \_\_\_\_\_  
System GPM \_\_\_\_\_ Temperature \_\_\_\_\_

## 2. Actuator information:

### A. Electric

Voltage:	115 VAC	<input type="checkbox"/>	230 VAC	<input type="checkbox"/>
Time for 90° Rotation:	Standard	<input type="checkbox"/>	Required _____ (Sec.)	<input type="checkbox"/>
Type Enclosure:	NEMA 4 (Weather proof)	<input type="checkbox"/>	NEMA 7 (Explosion proof)	<input type="checkbox"/>
Special Requirements:	Modulating Control	<input type="checkbox"/>	Heater & Thermostat	<input type="checkbox"/>
	Extra SPDT Switches	<input type="checkbox"/>	Position Transmitter	<input type="checkbox"/>
	Potentiometer	<input type="checkbox"/>		

### B. Pneumatic

Actuator air supply:	80 psi	<input type="checkbox"/>	Other _____ (psi)	<input type="checkbox"/>
Actuator Type:	Air to Air	<input type="checkbox"/>	Pneumatic Speed Control	<input type="checkbox"/>
	Air to Spring	<input type="checkbox"/>	Failsafe: Open <input type="checkbox"/> Closed <input type="checkbox"/>	
Solenoid Valve:	NEMA 4 (Weather proof)	<input type="checkbox"/>	NEMA 7 (Explosion proof)	<input type="checkbox"/>
Switch Box:	NEMA 4 (Weather proof)	<input type="checkbox"/>	NEMA 7 (Explosion proof)	<input type="checkbox"/>
	Extra SPDT, Qty _____	<input type="checkbox"/>		
Positioner:	3-15 psi	<input type="checkbox"/>	4-20mA _____	<input type="checkbox"/>

## 3. Special Notes:

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# For Technical Assistance Call Your Authorized Watts Agent.

			Telephone #	Fax #
	<b>HEADQUARTERS:</b> Watts Regulator Company	815 Chestnut St., North Andover, MA 01845-6098 U.S.A.	978 688-1811	978 794-1848
North East	Edwards, Platt & Deely, Inc. Edwards, Platt & Deely, Inc. W. P. Haney Co., Inc.	271 Royal Ave., Hawthorne, NJ 07506 368 Wyandanch Ave., North Babylon, NY 11703 51 Norfolk Ave., South Easton, MA 02375	973 427-2898 631 253-0600 508 238-2030	973 427-4246 631 253-0303 508 238-8353
Mid Atlantic	J. B. O'Connor Company, Inc. RMI The Joyce Agency, Inc. Vernon Bitzer Associates, Inc. WMS Sales, Inc. (Main office)	P.O. Box 12927, Pittsburgh, PA 15241 Glenfield Bus. Ctr., 2535 Mechanicsville Tpk., Richmond, VA 23223 8442 Alban Rd., Springfield, VA 22150 980 Thomas Drive, Warminster, PA 18974 9580 County Rd., Clarence Center, NY 14032	724 745-5300 804 643-7355 703 866-3111 215 443-7500 716 741-9575	724 745-7420 804 643-7380 703 866-2332 215 443-7573 716 741-4810
South East	Billingsley & Associates, Inc. Billingsley & Associates, Inc. Francisco J. Ortiz & Co., Inc. Mid-America Marketing, Inc. Mid-America Marketing, Inc. Mid-America Marketing, Inc. Smith & Stevenson Co., Inc. Spotswood Associates, Inc. Target Marketing Enterprises, Inc.	2728 Crestview Ave., Kenner, LA 70062-4829 478 Cheyenne Lane, Madison, MS 39110 Charlyn Industrial Pk., Road 190 KM1.9 - Lot #8, Carolina, Puerto Rico 00983 203 Industrial Drive, Birmingham, AL 35211 1364 Foster Avenue, Nashville, TN 37210 5466 Old Hwy. 78, Memphis, TN 38118 4935 Chastain Ave., Charlotte, NC 28217 6235 Atlantic Blvd., Norcross, GA 30071 118 West Grant St., Building M, Orlando, FL 32806	504 602-8100 601 856-7565 787 769-0085 205 879-3469 615 259-9944 901 795-0045 704 525-3388 770 447-1227 407 245-7838	504 602-8106 601 856-8390 787 750-5120 205 870-5027 615 259-5111 901 795-0394 704 525-6749 770 263-6899 407 245-7833
North Central	Aspinall Associates, Inc. Dave Watson Associates Disney McLane & Associates BWA Company Mid-Continent Marketing Services Ltd. Soderholm & Associates, Inc. Stickler & Associates	6840 Hillsdale Court, Indianapolis, IN 46250 1325 West Beecher, Adrian, MI 49221 428 McGregor Ave., Cincinnati, OH 45206 17610 S. Waterloo Rd., Cleveland, OH 44119 1724 Armitage Ct., Addison, IL 60101 7150 143rd Ave. N.W., Anoka, MN 55303 333 North 121 St., Milwaukee, WI 53226	317 849-5757 517 263-8988 800 542-1682 216 486-1010 630 953-1211 763 427-9635 414 771-0400	317 845-7967 517 263-2328 877 476-1682 216 486-2860 630 953-1067 763 427-5665 414 771-3607
South Central	Hugh M. Cunningham, Inc. Mack McClain & Associates Mack McClain & Associates, Inc. Mack McClain & Associates, Inc. OK! Sales, Inc. Phoenix Marketing, Ltd.	13755 Benchmark, Dallas, TX 75234 11132 South Towne Square, Suite 202, St. Louis, MO 63123 1450 NE 69th Place, Ste. 56 Ankeny, IA 50021 15090 West 116th St., Olathe, KS 66062 2200 Blue Creek Dr., Norman, OK 73026 2416 Candelaria N.E., Albuquerque, NM 87107	972 888-3808 314 894-8188 515 288-0184 913 339-6677 405 360-6161 505 883-7100	972 888-3838 314 894-8388 515 288-5049 913 339-9518 405 360-0092 505 883-7101
Western	Delco Sales, Inc. Delco Sales, Inc. Fanning & Associates, Inc. Hollabaugh Brothers & Associates Hollabaugh Brothers & Associates P I R Sales, Inc. Preferred Sales R. E. Fitzpatrick Sales, Inc.	1930 Raymer Ave., Fullerton, CA 92833 111 Sand Island Access Rd., Unit I-10, Honolulu, HI 96819 6765 Franklin St., Denver, CO 80229-7111 6915 South 194th St., Kent, WA 98032 3028 S.E. 17th Ave., Portland, OR 97202 3050 North San Marcos Place, Chandler, AZ 85225 31177 Wiegman Road, Hayward, CA 94544 4109 West Nike Dr. (8250 South), West Jordan, UT 84088	714 888-2444 808 842-7900 303 289-4191 253 867-5040 503 238-0313 480 892-6000 510 487-9755 801 282-0700	714 888-2448 808 842-9625 303 286-9069 253 867-5055 503 235-2824 480 892-6096 510 476-1595 801 282-0600
Canada	Watts Industries (Canada) Inc. (Watts Regulator Co. Division) Con-Cur West Marketing, Inc. D.C. Sales, Ltd. D.C. Sales, Ltd. GTA Sales Team. Hydro-Mechanical Sales, Ltd. Hydro-Mechanical Sales, Ltd. Hydro-Mechanical Sales, Ltd. Le Groupe B.G.T., Inc. Le Groupe B.G.T., Inc. Mar-Win Agencies, Ltd. Northern Mechanical Sales Palser Enterprises, Ltd. RAM Mechanical Marketing RAM Mechanical Marketing Walmar Mechanical Sales	5435 North Service Road, Burlington, Ontario L7L 5H7 #109-42 Fawcett Rd., Coquitlam, British Columbia V3K 6X9 10-6130 4th St. S.E., Calgary, Alberta T2H 2A6 11420 142 Street, Edmonton, Alberta T5M 1V1 Greater Toronto Area 3700 Joseph Howe Dr., Ste. 1 Halifax, Nova Scotia B3L 4H7 297 Collishaw St., Ste. 7 (shipping) Moncton, New Brunswick E1C 9R2 85 Tolt Rd., St. Phillips, Newfoundland A1B 3M7 23 du Buisson, Pont Rouge, Quebec G3H 1X9 86 des Entreprises #208, Boisbriand, Quebec J7G 2T3 1123 Empress St., Winnipeg, Manitoba R3E 3H1 P.O. Box 280 (mailing) 163 Pine St. (shipping), Garson, Ontario P3L 1S6 1885 Blue Heron Dr., #4, London, Ontario N6H 5L9 1401 St. John St., Regina, Saskatchewan S4R 1S5 510 Ave M South, Saskatoon, Saskatchewan S7M 2K9 24 Gurdwara Rd., Nepean, Ontario K2E 8B5	905 332-4090 604 540-5088 403 253-6808 780 496-9495 888 208-8927 902 443-2274 506 859-1107 709 895-0090 418 657-2800 450 434-9010 204 775-8194 705 693-2715 519 471-9382 306 525-1986 306 244-6622 613 225-9774	905 332-7068 604 540-5084 403 259-8331 780 496-9621 888 479-2887 902 443-2275 506 859-2424 709 895-0091 418 657-2700 450 434-9848 204 786-8016 705 693-4394 519 471-1049 306 525-0809 306 244-0807 613 225-0673
0408	<b>EXPORT Hdqtrs.:</b> Watts Regulator Co.	815 Chestnut St., North Andover, MA 01845-6098 U.S.A.	978 688-1811	978 794-1848



Watts USA website: [www.wattsreg.com](http://www.wattsreg.com)  
Watts Canada website: [www.wattscanada.ca](http://www.wattscanada.ca)