

# ServoWeld<sup>TM</sup> Actuators

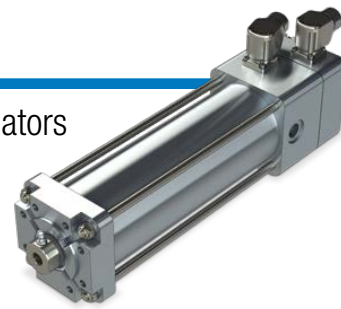
## SWA & SWB MODELS



**INTEGRAL MOTOR HIGH THRUST ACTUATOR**

# ServoWeld SWA & SWB

Tolomatic is the world's leading manufacturer of integrated servo actuators for resistance spot welding, used by the world's top weld gun OEM's and numerous global vehicle manufacturers.



## Superior Integrated Servo Motor Actuators

Tolomatic's ServoWeld family of integrated servo actuators are designed for best-in-class performance with the factors that are most important for resistance spot welding gun applications.

### NUMBER OF WELDS/ PRODUCT LIFE

Tolomatic's superior roller screw design has the **highest dynamic load rating for more welds** than any competitive technology (other roller screws, ball screw, pneumatic).

### FORCE REPEATABILITY

Skewed winding designed for welding minimizes motor cogging and **provides industry best actuator force repeatability:** •  $\pm 3\%$  Over the Lifetime of the Actuator

### EFFICIENCY

All elements of actuator (winding, screw, rod scraper, bearings) are designed to optimize the efficiency of the actuator system and provide the **most energy efficient solution on the market.**

### WELDS/ MINUTE

All elements of the actuator (winding, screw, rod scraper, bearings) are designed to last and run as cool as possible in welding applications, with the ability to add water cooling as an option. This means **more welds per minute than any competitive technology** (other roller screws, ball screw, pneumatic).

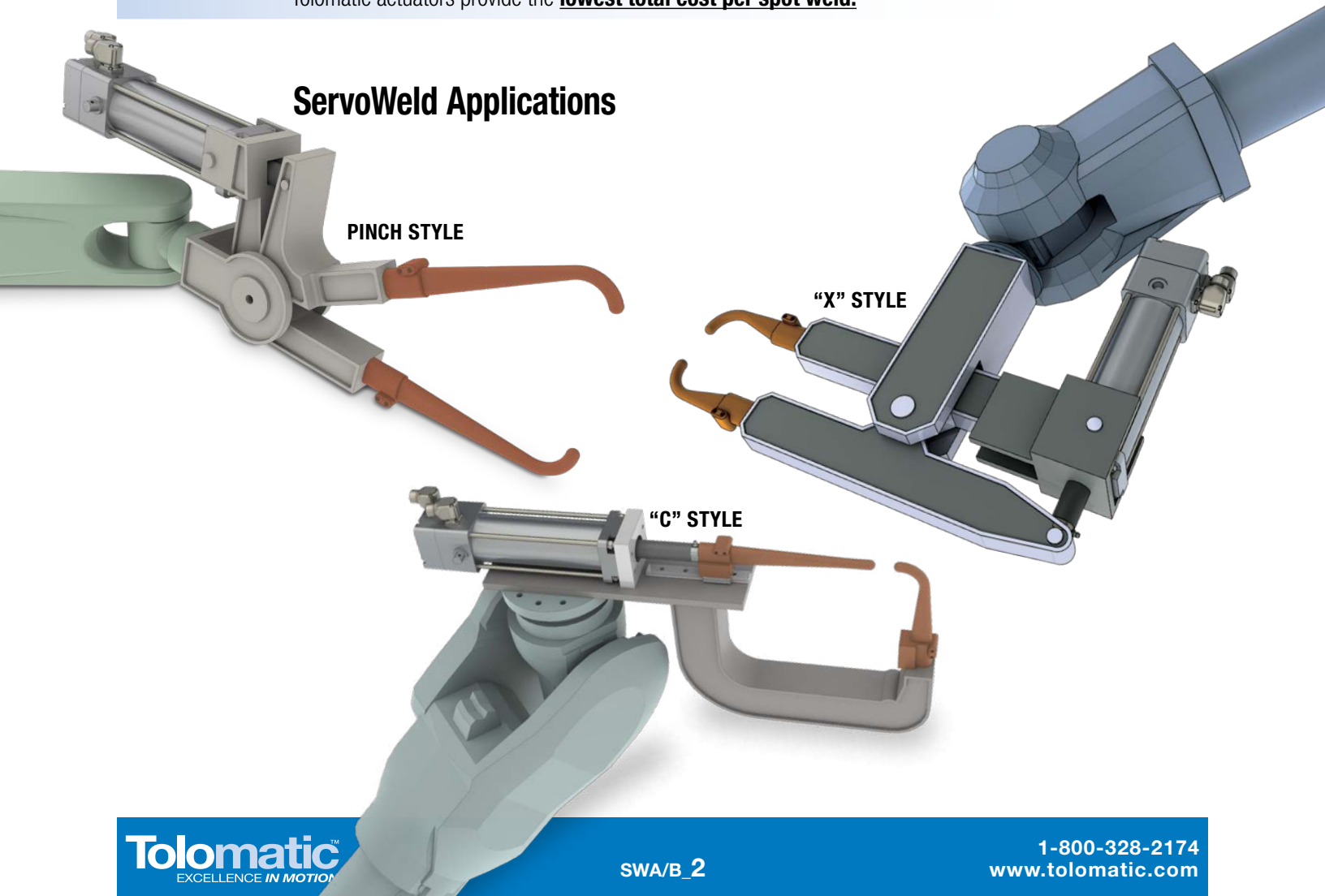
### WEIGHT

Tolomatic integrated servo actuators minimize weight when designed into the weldgun. Additionally, Tolomatic can customize actuators for a specific weldgun applications to provide **industry leading light weight designs.**

### LIFETIME COST

By building the longest lasting, most efficient and highest weld per minute actuators on the market, Tolomatic actuators provide the **lowest total cost per spot weld.**

## ServoWeld Applications

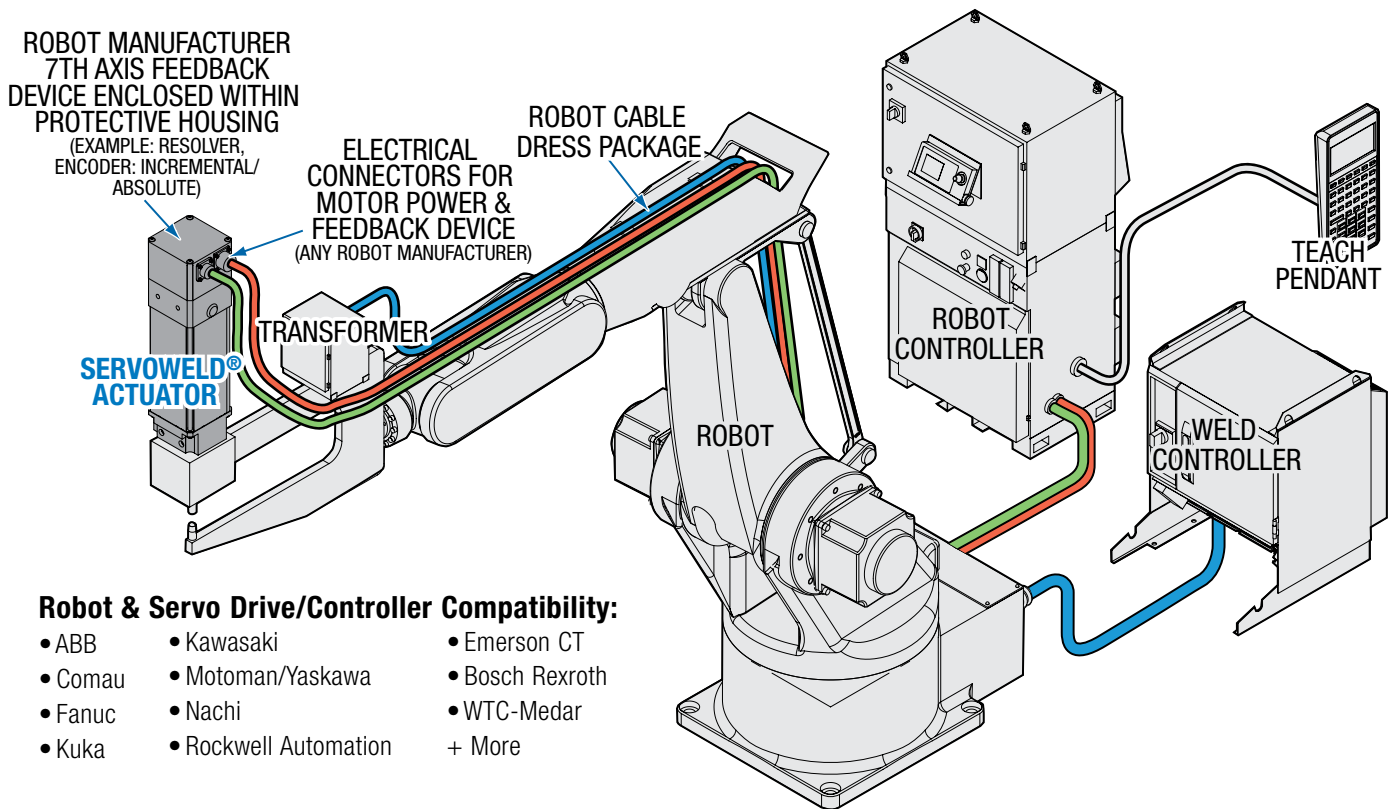


PINCH STYLE

"X" STYLE

"C" STYLE

# Typical Robotic ServoWeld Installation



## Tolomatic Offers the Broadest, Most Capable Family of Integrated Servo Actuators for Resistance Spot Welding

Model:	GSWA	SWA/SWB	CSWX
<b>Number of Welds<sup>1</sup> (millions):</b>	20+	20+ (10+ SWB)	30+ (20+ CSW)
<b>Re-lubrication without Disassembly:</b>	Yes <sup>4</sup>	Yes	Yes
<b>Peak Force:</b>	24.5 kN [5,500 lbf]	24.0 kN [5,395 lbf] SWA 22.0 kN [4,950 lbf] SWB	18.0 kN [4,047 lbf] CSWX 15.6 kN [3,500 lbf] CSW
<b>Actuator Output Force<sup>2</sup> (Lifetime) Repeatability:</b>	± 3%	± 3% (± 5% SWB)	± 3%
<b>Weight (size 33, 3)<sup>3</sup> (size 44, 4)<sup>3</sup>:</b>	8.3 kg [18.3 lb] 13.8 kg [30.4 lb]	7.2 kg [15.9 lb] 14.2 kg [31.2 lb]	min: 10.2 kg [22.6 lb]
<b>Water Cooling:</b>	Optional	Optional	Optional
<b>Manual Override:</b>	Optional	No	Optional
<b>Full Force Direction:</b>	Push and Pull	Push	Push and Pull

<sup>1</sup> Based on properly lubricated ServoWeld unit used as recommended in user manual. Weld schedule, tip force, environment and lubrication are factors in the total number of welds achievable with ServoWeld actuators.

<sup>2</sup> At weld force

<sup>3</sup> Weight varies with choice of feedback device and mounting options

<sup>4</sup> Some exceptions, see GSWA user manual



# SWA & SWB INTEGRATED MOTOR ACTUATOR

## ENDURANCE TECHNOLOGY<sup>SM</sup>

A Tolomatic Design Principle

Endurance Technology features are designed for maximum durability to provide extended service life.

### MULTIPLE MOTOR WINDINGS

YOU CAN CHOOSE:

- 460VAC or 230VAC rated windings potted directly into actuator housing
- Integral thermal switch for over temperature protection

### ROBUST BUSHINGS

Supports the thrust tube and nut assembly through entire stroke length

### WATER SLOTS

Allows for water to flow away from thrust rod to prevent ingress into the actuator

### THRUST TUBE

- Steel thrust tube supports extremely high force capabilities
- Salt bath nitride treatment provides excellent corrosion resistance, surface hardness and is very resistant to adherence of weld slag, water and other potential contaminants

### GREASE PORT

- Screw re-lubrication system provides extended screw life
- Convenient lubrication without disassembly

### THREADED ROD END

- Zinc plated steel construction for corrosion resistance
- Provides a common interface to multiple rod end options

### INTERNAL BUMPERS

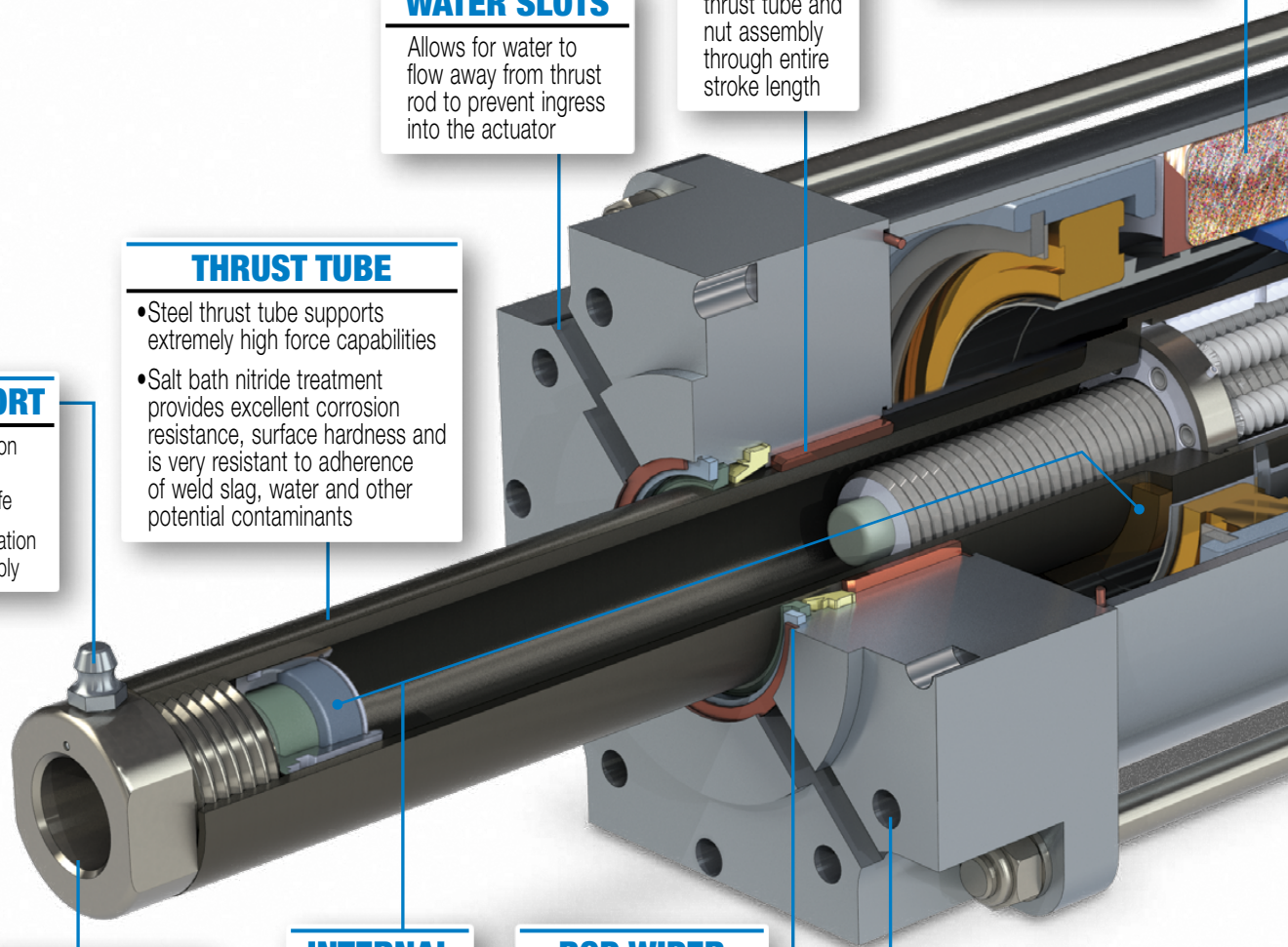
Bumpers protect the screw and nut assembly from damage at end of stroke

### ROD WIPER WITH SCRAPER

Prevents contaminants from entering the actuator for extended life

### UNIVERSAL MOUNTING

Tapped holes in front face allow for mounting in any orientation ... 0°, 90°, 180° or 270°



# Tolomatic... MAXIMUM DURABILITY

EXCELLENCE IN MOTION

## SKEWED MOTOR WINDINGS

Skewed motor windings provide minimal torque ripple for force repeatability and smooth linear motion

## ROBOT & DRIVE/CONTROLLER COMPATIBILITY

Compatible feedback, connector(s) and wiring to match the following robot & drive/controller manufacturers' cable dress packages

### YOUR CHOICE:

- + ABB
- + Comau
- + Fanuc
- + Kawasaki
- + Kuka
- + Motoman/Yaskawa
- + Nachi
- + Rockwell Automation
- + Bosch-Rexroth
- + Emerson CT
- + WTC-Medar
- & more

## FEEDBACK CHOICES

- Customer specified to robot manufacturer
- Multi-turn absolute encoder
- Resolver
- Digital encoder

## WATER COOLING



- Option that is attached to any side of the actuator
- Allows increased duty cycle and increased jobs/hour

## HIGH THRUST BEARING

Provides complete support of screw and protects the feedback device from linear forces

## IP65

IP65 rating protects actuator from ingress of water, weld slag and other debris (static)

## ADVANCED SCREW TECHNOLOGY

- Roller screws provide the highest thrust and life ratings available
- SWA: Highest DLR roller screw provides longest life
- SWB: Lower DLR roller screw, provides longer life than ball screws or inverted roller screws






## OPTIONS

*BRAKE*  
*WATER COOLING*  
*REAR TRUNNION MOUNTING*



# ServoWeld SWA & SWB - Integrated Motor Actuator

**Table 1: Performance & Mechanical Specifications:**

SERIES		SWA3 or SWB3				SWA4 or SWB4								
FRAME SIZE	mm	90.0				110.0								
	in	3.54				4.33								
MOTOR WINDING		A3 / B3			A2 / B2		A3 / B3				A4 / B4			
NUT/SCREW		RN04	RN05	RN10	RN05	RN10	RN04	RN05	RN05XR	RN10	RN04	RN05	RN05XR	RN10
§ SCREW LEAD	mm	4.0	5.0	10.0	5.0	10.0	4.0	5.0	5.0	10.0	4.0	5.0	5.0	10.0
PEAK FORCE	kN	11.1	11.1	5.8	14.5 / 12.8	7.3 / 6.4	17.8	14.7	22.1	11.1	17.8	14.7	24.0	17.8
	lbf	2500	2500	1306	3261/2882	1630/1441	4000	3300	4958	2500	4000	3300	5395	4000
MAX. VELOCITY	mm/sec	234	292	584	292	584	234	292	292	584	234	292	292	584
	in/sec	9.2	11.5	23.0	11.5	23.0	9.2	11.5	11.5	23.0	9.2	11.5	11.5	23.0
SWA SCREW DLR (DYNAMIC LOAD RATING)	kN	41.1	53.6	47.2	73.3	76.4	67.2	73.3	91.74	76.4	67.2	73.3	91.7	76.4
	lbf	9240	12050	10611	16479	17175	15107	16479	20624	17175	15107	16479	20624	17175
SWB SCREW DLR (DYNAMIC LOAD RATING)	kN	24.25	31.63	27.85	43.25	45.07	39.65	43.25	-	45.07	39.65	43.25	-	45.07
	lbf	5452	7110	6260	9723	10133	8913	9723	-	10133	8913	9723	-	10133
NOMINAL BACK DRIVE FORCE	N	436	347	173	405	205	507	405	405	205	507	405	405	205
	lbf	98	78	39	91	46	114	91	91	46	114	91	91	46
WEIGHT*	kg	7.80	7.80	7.80	11.25	11.25	12.29	12.29	12.29	12.29	14.16	14.16	14.16	14.16
	lbf	17.2	17.2	17.2	24.8	24.8	27.1	27.1	27.1	27.1	31.2	31.2	31.2	31.2
STROKE	mm	150	150	150	150	150	150	150	150	150	150	150	150	150
	in	6	6	6	6	6	6	6	6	6	6	6	6	6
BASE INERTIA	kg-cm <sup>2</sup>	4.8997	4.8997	4.8997	8.1108	8.1108	9.7864	9.7864	9.7864	9.7864	11.4073	11.4073	11.4073	11.4073
	lb-in	1.6723	1.6723	1.6723	2.7716	2.7716	3.3442	3.3442	3.3442	3.3442	3.8966	3.8966	3.8966	3.8966
AMBIENT TEMP ** RANGE	°C	0 to 50												
	°F	32 to 122												
IP RATING	Standard IP65 (static)													
AGENCY LISTINGS	  													

\*Weight varies per feedback device or mounting option. See table below for details.  
 \*\*From 0-10°C (32-50°F), additional startup procedure may be required for optimal performance. See user manual for details.  
 §NOTE: Screw/Lead Accuracy: 0.023 mm/300 mm; 0.0009 in/ft

		Weight Adder						
		Water Cooling	Rear Trunnion	FEEDBACK OPTION				
				F1	F2	A1	K1***	W1
SW_3	kg	0.36	0.10	0.3	0.77	0.59	1.27	1.03
	lb	0.80	0.22	0.65	1.70	1.30	2.80	2.26
SW_4	kg	0.52	0.24	0.3	0.48	0.64	1.34	0.72
	lb	1.15	0.52	0.65	1.05	1.41	2.96	1.59

\*\*\*Weight adder for K1 option includes weight of brake

# ServoWeld SWA & SWB - Integrated Motor Actuator

**Table 3: Motor Specifications:**

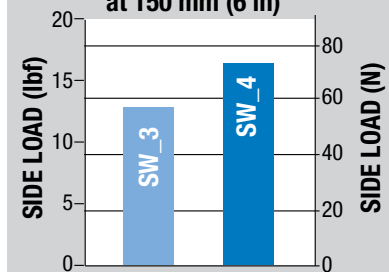
SERIES		SW_3		SW_4						
MOTOR WINDING		A3	B3	A2	B2	A3	B3	A4	B4	
<b>TORQUE CONSTANT (Kt)</b>	N-m/A Peak	0.62	1.21	0.52	0.90	0.61	1.20	0.64	1.29	
	in-lb/A Peak	5.5	10.7	4.6	8.0	5.4	10.6	5.7	11.4	
<b>VOLTAGE CONSTANT (Ke)</b>		V/Krpm Peak	79.8	154	66.1	107.2	78.1	153.1	81.1	162.3
<b>CONTINUOUS STALL TORQUE</b>	No Water Cooling	N-m	4.4	4.3	5.5	4.9	8.4	8.5	14.6	14.6
		in-lb	39	38	48.8	43.0	74	75	129	129
	With Water Cooling	N-m	8.8	8.6	11.0	9.7	16.7	17.0	20.8	20.8
		in-lb	78	76	97.6	86	148	150	184	184
<b>CONTINUOUS STALL CURRENT</b>	No Water Cooling	A <sub>RMS</sub>	5	2.5	7.5	3.8	9.7	5.0	16	8
	With Water Cooling	A <sub>RMS</sub>	10.0	5.0	15.0	7.6	19.4	10.0	23	12
<b>PEAK TORQUE</b>	N-m	13.2	12.9	16.5	14.6	25.1	25.4	43.7	43.7	
	in-lb	117	114	146	129	222	225	387	387	
<b>PEAK CURRENT</b>	A <sub>RMS</sub>	15	7.5	22.5	11.4	29.1	15.0	48	24	
<b>RESISTANCE</b>	Ohms	2.07	8.3	0.9	4.2	0.58	2.32	0.36	1.46	
<b>INDUCTANCE</b>	mH	3.8	15	9.7	15.7	2.75	11.5	2.04	12.11	
<b>NO. OF POLES</b>		8								
<b>BUS VOLTAGE</b>	V <sub>RMS</sub>	230	460	230	460	230	460	230	460	
<b>SPEED @ RATED V</b>	RPM	3,500								

## SIDE LOADING

Some weld gun designs may subject the actuator to excessive side loading reducing overall service life. Measures are required, especially in "C" style designs, to limit side loading. For life optimization Tolomatic recommends side loads of less than 5% of axial load (thrust rod output force) for all roller screw configurations.



## SW\_SIDE LOAD SPECIFICATIONS at 150 mm (6 in)



## MOTOR WINDING

A4  
B4 = 4 Stack Motor



A3  
B3 = 3 Stack Motor



A2  
B2 = 2 Stack Motor



**Table 4: Brake Specifications:**

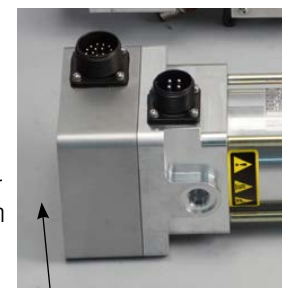
SERIES	SW_3	SW_4	
<b>ROTOR INERTIA</b>	gm-cm <sup>2</sup>	73	239
	oz-in <sup>2</sup>	0.400	1.307
<b>CURRENT</b>	Amp	0.43	0.67
<b>HOLDING TORQUE</b>	N-m	4.0	10.0
	in-lb	35	89
<b>ENGAGE TIME</b>	mSec	40	25
<b>DISENGAGE TIME</b>	mSec	50	50
<b>VOLTAGE</b>	Vdc	24	24

## BRAKE CONSIDERATIONS

In all vertical application an un-powered SWA will require a brake to maintain position. Tolomatic recommends that the nominal back drive force specification (listed in Table 1) be used for reference only. Back drive force is subject to change throughout the life of the actuator, due to mechanical break in, ambient temperature, and duty cycle variation.

A brake can be used with the actuator to keep it from backdriving, typically in vertical applications. A brake may be used for safety reasons or for energy savings allowing the actuator to hold position when un-powered.

NOTE: The optional Spring-Applied / Electronically-Released Brake requires 24V power.



Brake will increase actuator length and weight, see Table 2 (K1).



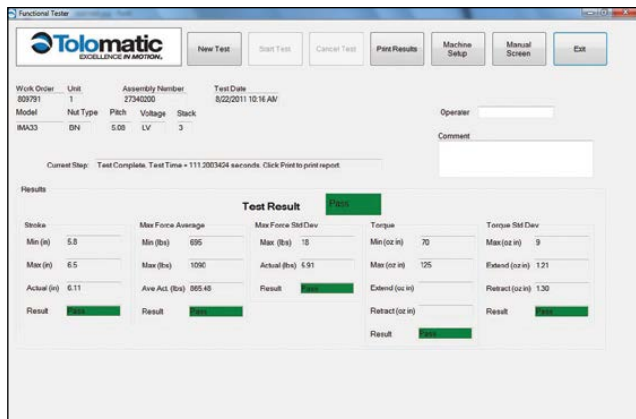


# Complete Verification Testing is Performed on Every Actuator

Every ServoWeld actuator has to pass rigorous testing at our factory. With this extra quality step we provide peace of mind to our customers and enable them to start their production faster, worry free!



Functional unit testing for hundreds of cycles quantifies stroke, length, torque under no load, input current vs force standard deviation.



Testing parameter results in progress for the Functional Test procedure.



Final system test ensures the feedback device is properly aligned with the ServoWeld motor poles.

We verify the performance of each individual unit before delivery to ensure they conform to Tolomatic's high standard of performance.

## 1. High POT (High Potential/High Voltage Test)

This standard electric motor test procedure is a 3-part test that checks the insulation system of the assembly to verify proper armature and thermal wire insulation.

## 2. Electronic phasing of ServoWeld® and feedback device (Encoder, Resolver, Feedback Device)

Using a fixed current and a specially designed fixture the feedback device is physically and electronically aligned relative to the phasing of the ServoWeld motor.

## 3. Functional Testing

Performed with Tolomatic motion control components and dedicated data acquisition equipment. Operated for hundred of cycles, this test quantifies these parameters - stroke length, torque under no load, input current vs force average, input current vs force standard deviation - using an electronic load cell in conjunction with data acquisition equipment.

## 4. Tolomatic System Test

Using a single-axis control unit the test ensures that the feedback device is properly aligned with the poles of the ServoWeld motor.

# ServoWeld Application Guidelines

**SIDE LOADING:** Some weld gun designs may subject the actuator to excessive side loading, reducing overall service life. The GSWA33, GUIDED actuator will accommodate side loading. For other ServoWeld configurations, measures are required, especially in “C” style designs, to limit side loading. For life optimization Tolomatic recommends side loads of less than 5% of axial load (thrust rod output force) for all roller screw configurations and less than 1% of axial load for all ball screw configurations.

For maximum service life, external guiding is recommended to minimize side loading to the thrust rod and provide consist weld gun movable tip/fixed tip alignment throughout service life.

**THRUST ROD WIPER/SCRAPER:** The thrust rod wiper/scrapper assembly is field replaceable. For maximum service life, measures should be taken to reduce/eliminate contamination, weld slag, and water in the thrust rod wiper/scrapper interface area. Implementation of industrial thrust rod boot and/or deflective device can be effectively utilized in this area.

**CABLES:** Shielded power & feedback cables are recommended to minimize electrical noise/grounding issues. Electrical noise or inadequate grounding can corrupt the feedback device signal.

**RSW SERVO SYSTEM CALIBRATION:** RSW weld gun servo system consists of robot 7th axis amplifier, robot feedback device, robot RSW software, weld gun chassis, & ServoWeld.

For optimal RSW weld gun servo system performance the calibration process should include maximum weld tip force from the production weld schedule, tip dress force, and multiple weld tip forces in-between. Utilizing all the available robot manufacturer force table inputs will provide best RSW weld gun servo system performance. The same weld tip part contact speed should be used for both RSW weld gun servo system calibration and production weld schedule.

**WELD TIP/PART CONTACT SPEED:** Tolomatic testing confirms the highest ServoWeld repeatability (**INPUT CURRENT** verses **OUTPUT FORCE**) at a weld tip part contact speed of 25mm/second or less. Speeds greater than 25mm/second can create “impact contribution” to the weld force. This impact contribution to the weld force deteriorates prior to completion of the weld cycle.

**ROBOT CARRIED APPLICATIONS:** Robot carried RSW gun applications have reduced exposure to water pooling/water ingress by virtue of the continuous robot movement and various RSW gun positions. In addition, in robot carried applications positioning of the RSW gun can be programmed as part of the weld cap change program/routine to eliminate ServoWeld exposure to water. (ServoWeld above weld caps)

**ROBOT MANUFACTURER SERVO FILE:** Robot manufacturer servo parameter files for operation of ServoWeld are available only from the robot manufacturer. Each robot manufacturer creates 3rd party motor servo parameter files, validates operation of ServoWeld via their 7th axis, and maintains servo motor parameter file for operation of ServoWeld.

**TOOL CHANGER APPLICATIONS:** Weld gun storage fixture in cell should position weld gun so movable electrode is not loading ServoWeld thrust rod - back driving the ServoWeld. Weld gun tips should be positioned to weld gun closed at low force prior to disconnect from robot/tool changer. Consider ServoWeld configured with integral brake option.

**FIXED /PEDESTAL APPLICATIONS:** One of the more challenging RSW applications is a pedestal RSW gun, ServoWeld mounted vertical – thrust rod up. Measures should be taken to reduce and/or eliminate the ServoWeld to water exposure, water pooling/spray in the access areas of the ServoWeld unit to maximize overall service life.

- Pedestal RSW guns that can be mounted with the ServoWeld vertical – thrust rod down should be considered.
- Pedestal RSW guns that must be mounted with the ServoWeld vertical – thrust rod up should be mounted at an angle of a least 10 – 15° to minimize water pooling.
- Water channels on interfacing mounting components of the ServoWeld/RSW Gun to minimize water pooling
- Any RSW gun applications that are suspect for water exposure should utilize an external deflector (bib) or a thrust rod boot to keep the water away from the thrust rod wiper/scrapper interface area.
- Any RSW gun application that is suspect for water exposure should consider utilizing a manual shut-off valve in the water saver circuit at the RSW gun. Shutting off the water prior to weld cap change can significantly reduce water exposure issues in the RSW gun environment.
- Pedestal RSW gun applications should have the mating electrical connectors (90 degree) on the cable dress package facing down with the cable dress cables looped to reduce water ingress via the electrical connectors (power/feedback).
- Allow adequate cable length so the cables are not in tension.
- Molded mating electrical connectors on the cable dress package for pedestal RSW gun applications
- Confirming full engagement of the cable dress connector to the appropriate mating receptacle on ServoWeld.

# ServoWeld SWA & SWB Integrated Motor Actuators

## Ordering

MODEL SELECTION (MUST BE IN THIS ORDER)

**S W A 4 A 1 A 3 F 1 B 1 A 1 X 2 A**

MODEL	
<b>SWA</b>	ServoWeld Advanced
<b>SWB</b>	ServoWeld Base

SIZE	
<b>3</b>	3 Series Actuator
<b>4</b>	4 Series Actuator

STROKE LENGTH	
<b>A</b>	150mm (6") Stroke
<b>X</b>	Special

SCREW LEAD		
Screw/Nut combinations available		
Code	Screw	Description
<b>1</b>	<b>RN05</b>	Roller Nut, 5 mm lead
<b>2</b>	<b>RN10</b>	Roller Nut, 10 mm lead
<b>3</b>	<b>RN04</b>	Roller Nut, 4 mm lead
<b>5</b>	<b>RN05 XR</b>	Roller Nut, 5 mm lead, XR

MOTOR VOLTAGE	
<b>A2</b>	230 Vac, Motor Voltage, 2 Stack Winding
<b>B2</b>	460 Vac, Motor Voltage, 2 Stack Winding
<b>A3</b>	230 Vac, Motor Voltage, 3 Stack Winding
<b>B3</b>	460 Vac, Motor Voltage, 3 Stack Winding
<b>A4</b>	230 Vac, Motor Voltage, 4 Stack Winding
<b>B4</b>	460 Vac, Motor Voltage, 4 Stack Winding

FEEDBACK, CONNECTOR, WIRING	
<b>A1</b>	ABB Resolver
<b>C1</b>	Comau Resolver
<b>F1</b>	Fanuc a128
<b>F2</b>	Fanuc a64
<b>M1</b>	Motoman Absolute
<b>N1</b>	Nachi Absolute FD11 Series
<b>W1</b>	Kawasaki Absolute E Series
<b>XX</b>	Special

FEEDBACK SUPPLIED BY:	
<b>A</b>	Customer
<b>B</b>	Tolomatic

BRAKE OPTION	
<b>1</b>	NO Brake
<b>2</b>	Brake

MOUNTING OPTIONS	
<b>A1</b>	Front Face
<b>T1</b>	Rear Trunnion
<b>XX</b>	Special

ROD END OPTIONS	
<b>A</b>	<b>Standard</b> , Metric internal, threaded rod end
<b>X</b>	Special

WATER COOLING	
<b>1</b>	NO Water Cooling
<b>2</b>	Water Cooling, Bottom, 10mm tube fitting
<b>X</b>	Special

SPECIAL OPTIONS	
<b>A</b>	No Special Options
<b>X</b>	Special

**⚠ Not all codes listed are compatible with all options.**

Call Tolomatic 1-800-328-2174 to determine available options and accessories based on your application requirements.



# The Tolomatic Difference Expect More From the Industry Leader:



## INNOVATIVE PRODUCTS

Unique linear actuator solutions with Endurance Technology<sup>SM</sup> to solve your challenging application requirements.



## FAST DELIVERY

The fastest delivery of catalog products... Built-to-order with configurable stroke lengths and flexible mounting options.



## ACTUATOR SIZING

Online sizing that is easy to use, accurate and always up-to-date. Find a Tolomatic electric actuator to meet your requirements.



## YOUR MOTOR HERE<sup>®</sup>

Match your motor with compatible mounting plates that ship with any Tolomatic electric actuator.



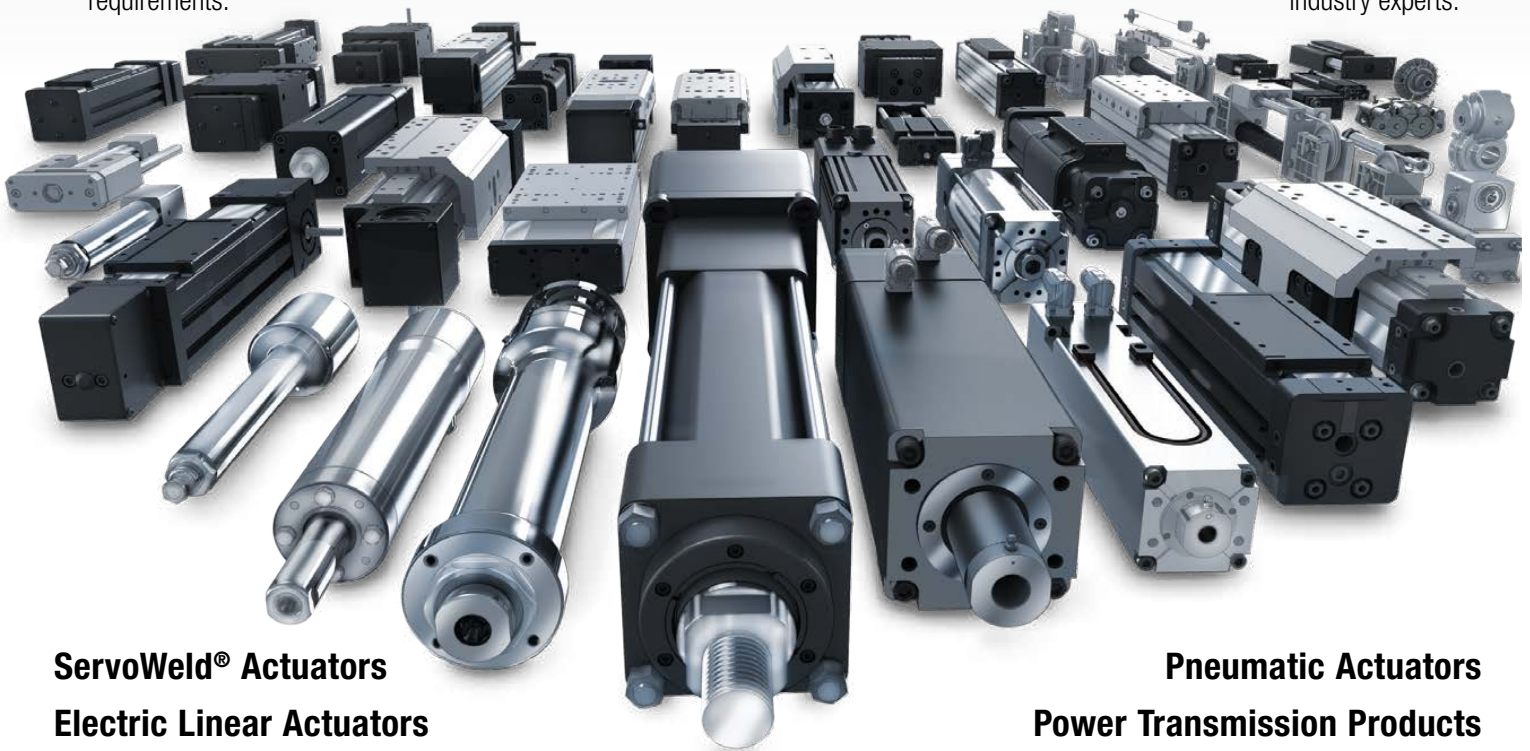
## CAD LIBRARY

Easy to access CAD files available in the most popular formats to place directly into your assembly.



## TECHNICAL SUPPORT

Extensive motion control knowledge: Expect prompt, courteous replies to any application and product questions from Tolomatic's industry experts.



**ServoWeld<sup>®</sup> Actuators**  
**Electric Linear Actuators**

**Pneumatic Actuators**  
**Power Transmission Products**



MADE IN U.S.A.

**Tolomatic**<sup>TM</sup>  
EXCELLENCE *IN MOTION*

COMPANY WITH  
QUALITY SYSTEM  
CERTIFIED BY DNV  
= ISO 9001 =  
Certified site: Hamel, MN

### USA - Headquarters

**Tolomatic Inc.**  
3800 County Road 116  
Hamel, MN 55340, USA  
**Phone:** (763) 478-8000  
Toll-Free: **1-800-328-2174**  
sales@tolomatic.com  
[www.tolomatic.com](http://www.tolomatic.com)

### MEXICO

**Centro de Servicio**  
Parque Tecnológico Innovación  
Int. 23, Lateral Estatal 431,  
Santiago de Querétaro,  
El Marqués, México, C.P. 76246  
**Phone:** +1 (763) 478-8000  
help@tolomatic.com

### EUROPE

**Tolomatic Europe GmbH**  
Elisabethenstr. 20  
65428 Rüsselsheim  
Germany  
**Phone:** +49 6142 17604-0  
help@tolomatic.eu  
[www.tolomatic.com/de-de](http://www.tolomatic.com/de-de)

### CHINA

**Tolomatic Automation Products (Suzhou) Co. Ltd.**  
No. 60 Chuangye Street, Building 2  
Huqiu District, SND Suzhou  
Jiangsu 215011 - P.R. China  
**Phone:** +86 (512) 6750-8506  
TolomaticChina@tolomatic.com

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