Tolomatic
EXCELLENCE *IN MOTION*®

SERVOWELD® SYSTEM

ENDURANCE TECHNOLOGY℠

GSWA INTEGRAL MOTOR
HIGH THRUST ACTUATOR

MAXIMUM DURABILITY

What is the **GSWA**?

The GSWA is a compact, durable, high force rod-style actuator designed specifically for resistance spot welding as well as other welding applications. The GSWA integrates a hollow core servo motor with a proven mechanical design to provide efficient, repeatable high force in a compact lightweight design envelope.

Tolomatic has over 50 years of experience manufacturing rodless and rod-style electric and pneumatic actuators. The GSWA combines this experience and the power of servo motor technology into one actuator. The result: reliable, affordable power in a compact package.

INTEGRATED ACTUATOR/ MOTOR/ FEEDBACK DESIGNS SUITED FOR INDUSTRIAL RESISTANCE SPOT WELDING APPLICATIONS

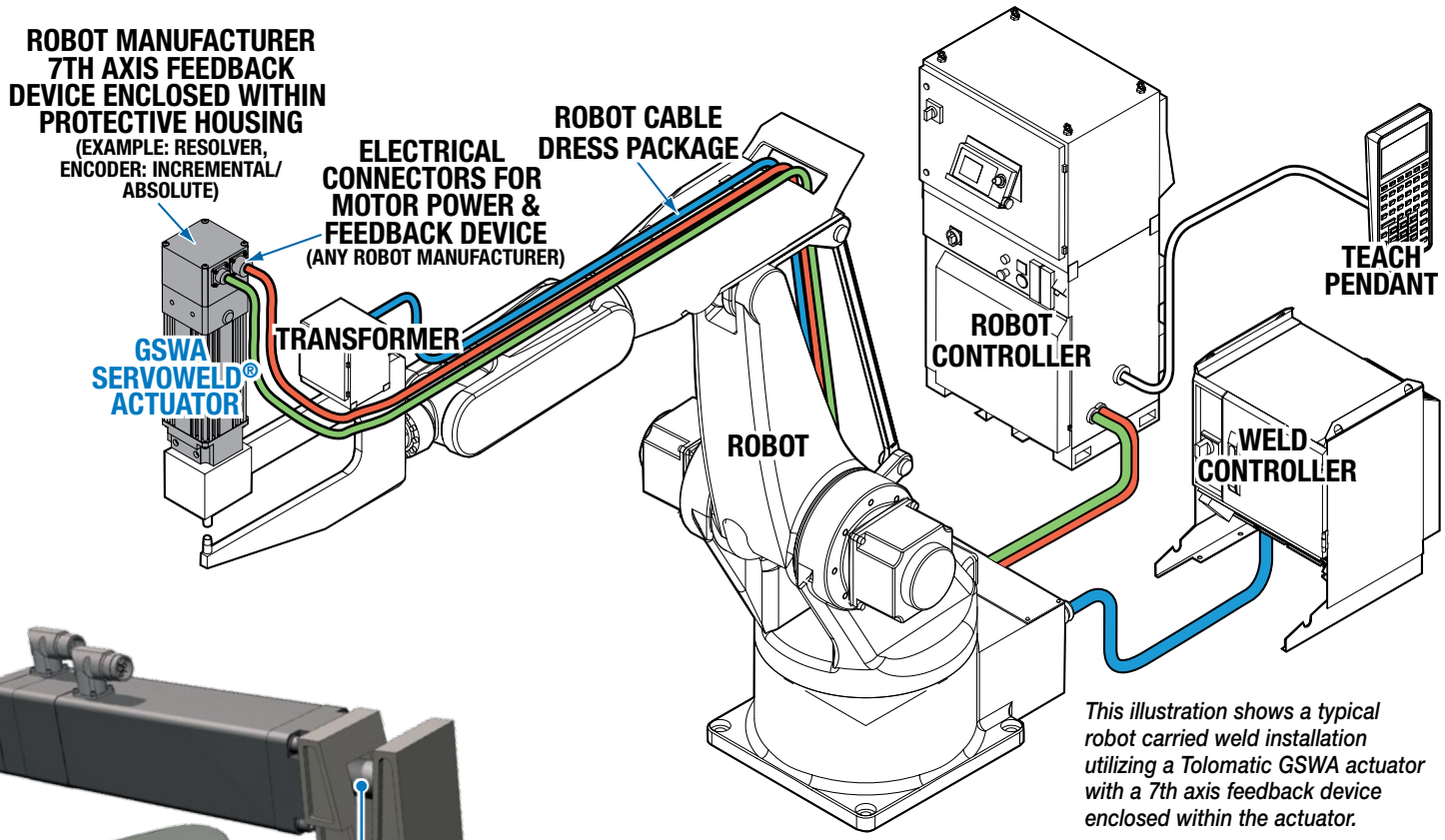
Features:

- Compact, lightweight design
- High force repeatability
- 10+ million cycles
- High force output
- High efficiency
- Flexibility
- Manual override (optional on 33)
- Compatibility
- Low inertia
- No forced cooling required
- Ball screw or roller screw

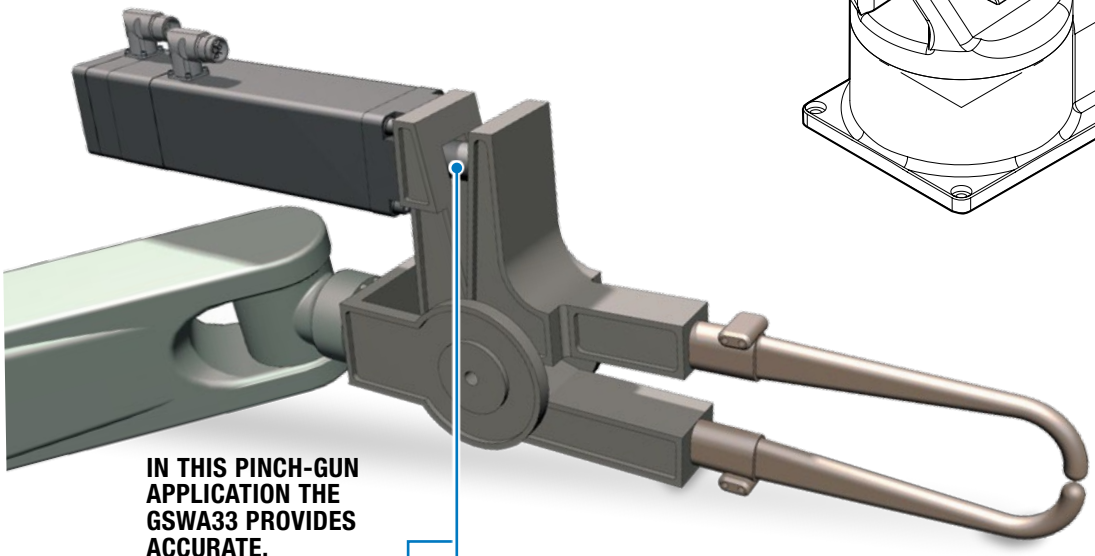
Eliminates:

- Couplers
- Adapters
- Belts
- Gears
- Assembly labor of separate components
- Forced air or water cooling

The GSWA in a Typical Robotic ServoWeld Installation



This illustration shows a typical robot carried weld installation utilizing a Tolomatic GSWA actuator with a 7th axis feedback device enclosed within the actuator.



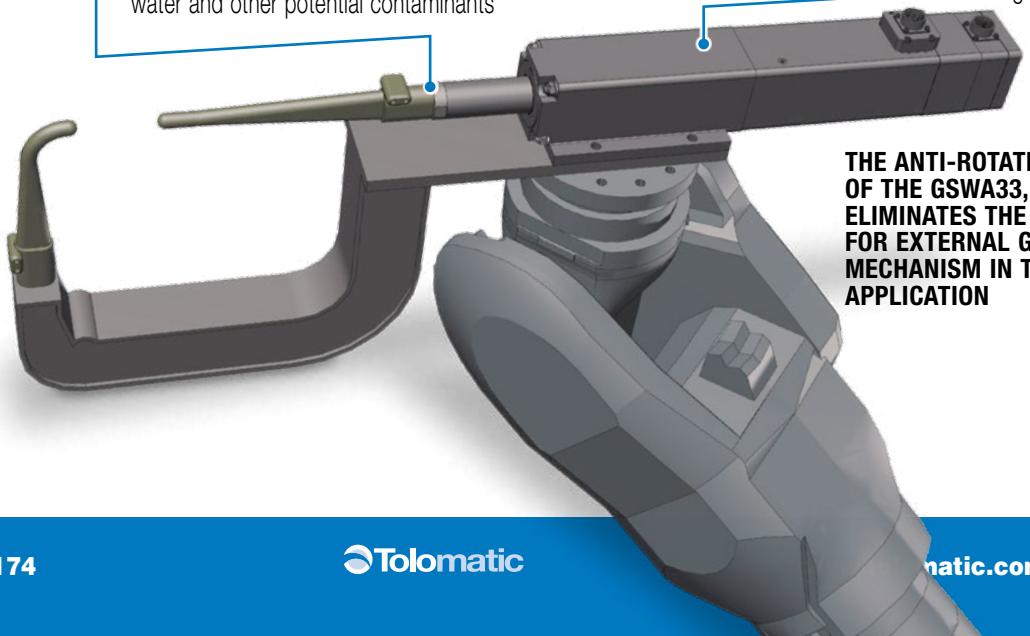
IN THIS PINCH-GUN APPLICATION THE GSWA33 PROVIDES ACCURATE, REPEATABLE FORCE IN A LIGHTWEIGHT, COMPACT PACKAGE

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

ANTI-ROTATE ASSMBLY

- Fully enclosed to protect components from harsh environments
- Provides additional side loading support



THE ANTI-ROTATE ASSEMBLY OF THE GSWA33, GUIDED ELIMINATES THE NEED FOR EXTERNAL GUIDANCE MECHANISM IN THIS C-GUN APPLICATION

Resistance Spot Welding (RSW) With ServoWeld® GSWA

Tolomatic's ServoWeld® Products Offer RSW Users a Higher Level of Performance

HIGHER QUALITY WELDS

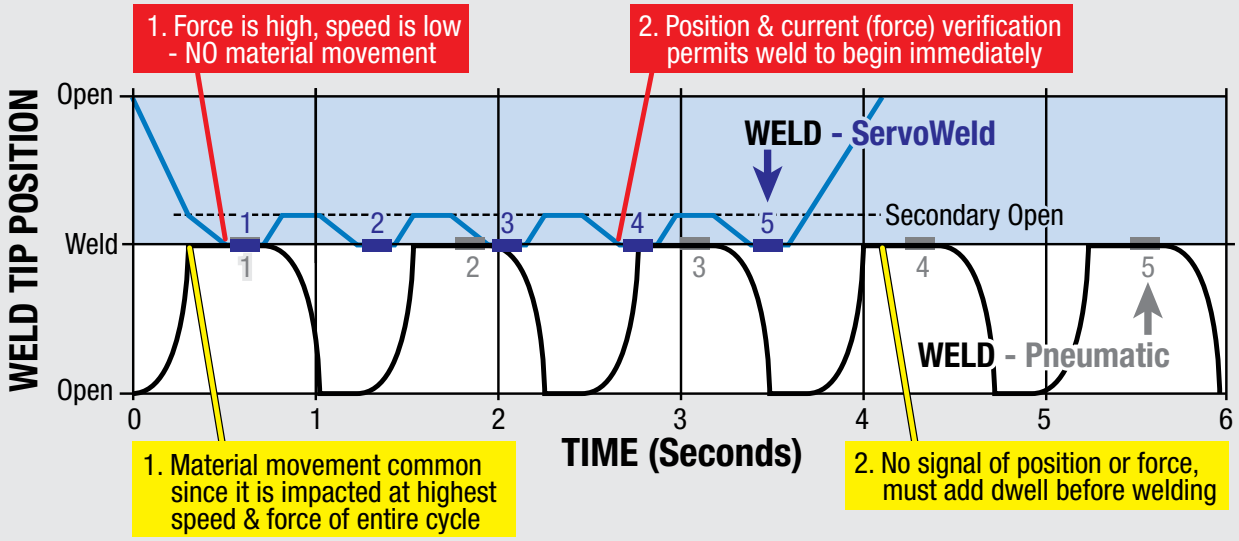
- Force repeatability for consistent welds
- "Soft-touch" position and speed control for high repeatability and eliminates high impact effects on part and weld gun for reduced wear
- Position and force can be recorded for each weld
- Position data from feedback device can provide data for weld cap wear and lost cap detection capability

COMPLETE MANUFACTURING FLEXIBILITY

- Using weld or robot controls, the GSWA can be easily programmed to accommodate model or tool changes.
- Existing 6-axis robots can be retrofitted with multiple GSWA actuators to achieve all the advantages that servo welding offers.
- Operation can be coordinated with robot axis movement.

FASTER WELDING CYCLES

- "At-force" indication allows for immediate welding (pneumatic actuators require a dwell time)
- Programmable open positions of the gun tips shorten move times between welds.



ServoWeld completes this weld sequence faster because:

1. Weld begins as soon as weld force is achieved, no dwell needed
2. Gun is opened only enough to move to next weld

With ServoWeld there is no dwell time needed so weld begins as soon as weld force is achieved. Efficiency is improved since the gun tips only open enough to move onto the next weld.

Superior Quality Welds with GSWA

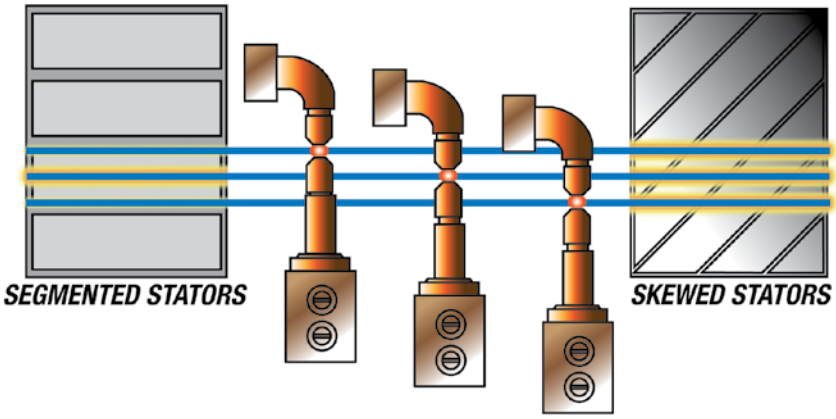
The ServoWeld GSWA Integrated Motor Actuator Design Offers Superior Quality Welds in a Compact Package

GSWA integrated motor actuator uses an 8 pole, hollow core rotor with skewed stator laminations. This allows the magnets to remain over multiple windings throughout the weld cycle for maximum torque efficiency and consistent force output at any location along the actuator stroke.

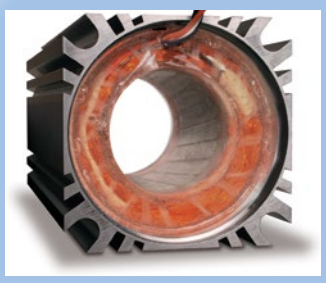
The result:

- Low cogging torque for better repeatability
- Better repeatability independent of position
- Higher quality welds

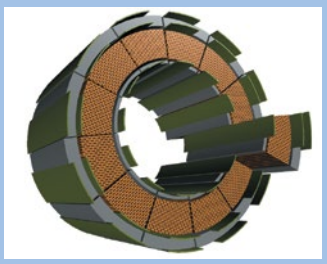
All in one compact actuator/motor package!



As the weld gun tips close on a part, the final position of the servo actuator's thrust rod is dependent on the metal thickness and tolerances, weld cap wear, etc. When the thrust rod reaches its final position and finishes the "squeeze", the motor rotor stops turning. The illustration above represents various final positions (the orange ovals between the weld tips, representing the weld nugget "squeeze" in the RSW cycle) and the varying positions of the motor rotor magnets (the straight blue lines) in comparison to the servo motor windings. The diagonal lines in the skewed stators represent the laminated motor windings used in the GSWA. At any point the rotor magnets stop, they are always positioned in an orientation that provides peak performance. In contrast, the segmented stator windings will only provide peak performance when the rotor is positioned in the center of the segmented stator phase.

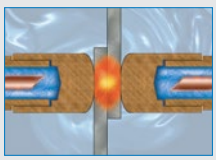


Skewed Stators
The GSWA has skewed stator laminations for low cogging torque and better repeatability, independent of tip position.



Segmented Stators
By nature of their design, segmented stators limit the number of weld positions that deliver optimal torque and repeatability.

Weld Nugget Formation



This illustration shows how a weld nugget is formed. The tips of the weld gun are programmed to close rapidly then slow to a 'soft touch' speed as they come in contact with the part for reduced part impact and low expulsion resulting in higher quality welds.

GSWA - Screw Selection

ROLLER SCREW

Capable of handling heavy loads. Force is transmitted via multi-threaded helical roller assemblies engaged with a fine threaded roller screw. Roller screws have exceptional loading capability based on many points of contact.

- 10+ million welds at high force repeatability
- ± 3% force repeatability
- Up to 3,300 lbf. (14,680 N)
- Speeds to 11.5" (292 mm) per sec.

ROLLER SCREW AND BALL SCREW PERFORMANCE COMPARISONS

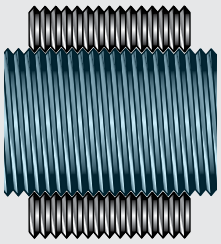
	ROLLER SCREW	BALL SCREW
Load ratings	Very High	High
Lifetime	Very long, many times greater than ball screw	Moderate
Speed	Moderate	Moderate
Accel.	Very high	Moderate
Stiffness	Very high	Moderate
Shock Loads	Very high	Moderate
Relative Space Req.	Minimal	Moderate
Maint.	None to Minimal	Minimal

BALL SCREW

Ball nut housings contain multiple ball bearings. Compared to roller nut design the ball nut has a limited number of contact points resulting in lower load capability. However, it is a robust mechanical drive system when properly applied.

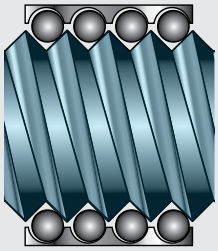
- 5+ million welds at rated force repeatability
- ± 5% force repeatability
- Up to 2,000 lbf. (8,890 N)
- Speeds to 11.5" (292 mm) per sec.

HELICAL ROLLER SCREW



Roller screws have a greater surface area and number of contact points compared to ball screws

BALL SCREW



More Advantages of the GSWA

LOWER LIFETIME COST

- ServoWeld offers longer overall service life:
  Ball Screw/Ball Nut: +5,000,000 welds
  Roller Screw/Roller Nut: +10,000,000 welds
  (Pneumatic actuators have a typical service life in the range of 3,000,000 welds and require regular preventative maintenance.)
- The GSWA actuator provides zero maintenance for increased productivity and less downtime. Pneumatic actuators require rebuilding or replacing.
- Increased energy efficiency over pneumatics of +80% with payback often less than a year.
- Supports multiple weld schedules, easily accommodating different materials and thicknesses.
- Fewer configurations required: Wide force range minimizes required configurations for varying force and stroke requirements. (Able to replace 35 to 40 different pneumatic cylinders by stocking 3 different GSWA models.)

IMPROVED WELD CAP LIFE

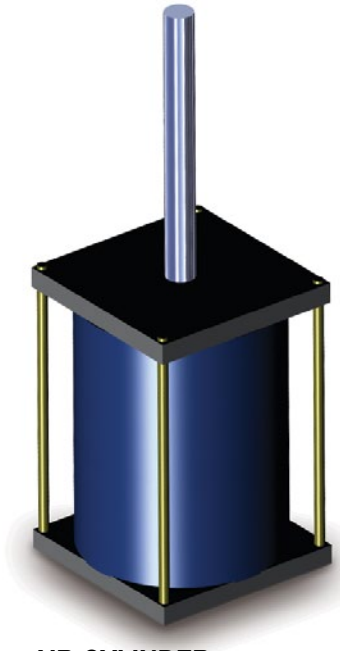
- Impact force in pneumatic systems can cause weld cap deformation. Weld cap life improvements with ServoWeld range from 5 - 35%, depending on application.

MINIMAL ENVIRONMENTAL IMPACT

- Less energy, noise and contamination than pneumatically powered systems which employ air exhaust.

Improved Technology, Better Performance

Air cylinders, and competing servo actuator designs can't compare to ServoWeld®



AIR CYLINDER

- High cost of use
- Frequent repair and maintenance
- Poor repeatability, reduced weld quality
- "Bang-bang" welds - greater tooling wear
- Limited adaptability
- More configurations required to address varying weld schedule requirements

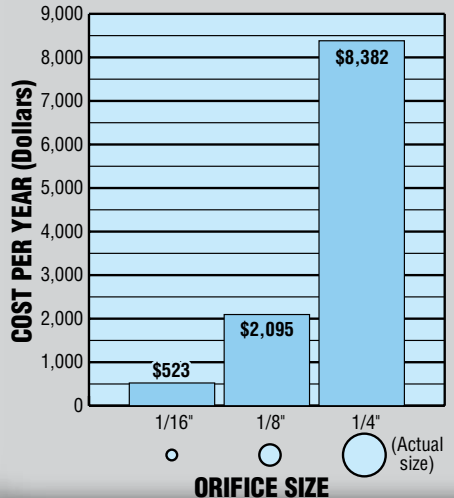
SERVO: Reverse-parallel motor configuration, belt driven

- Size and weight create payload challenge (increase of 10% to 30% compared with an integrated design)
- Mechanical linkage of belt is not as responsive as direct drive
- Transmission belt is a maintenance item and failure point

SERVO: - Integrated motor segmented laminations

- Segmented stator design does not offer the performance of skewed windings
- Actuators employing segmented stators may compromise weld repeatability due to undesired high cogging torque
- Higher cogging torque results in force repeatability variations with position changes, potentially compromising weld quality

THE COST OF AN AIR LEAK



Costs calculated using electricity rate of $0.05 per kWh, assuming a constant operation and an efficient compressor.

From: Improving Compressed Air System Performance, A Sourcebook for Industry published by the Office of Industrial Technologies, US Department of Energy

GSWA33 INTEGRATED MOTOR ACTUATOR

ENDURANCE TECHNOLOGY℠

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

MULTIPLE SCREW TECHNOLOGIES YOU CAN CHOOSE:

- Ball nuts offer positioning accuracy and repeatability

- Roller nuts provide the highest thrust and life ratings available

INTERNAL BUMPERS

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

INTEGRAL MOUNTING

- Four threaded holes on front face are available for direct mounting or addition of customized options

ROD WIPER WITH SCRAPER

- Prevents contaminants from entering the actuator for extended life

THREADED ROD END

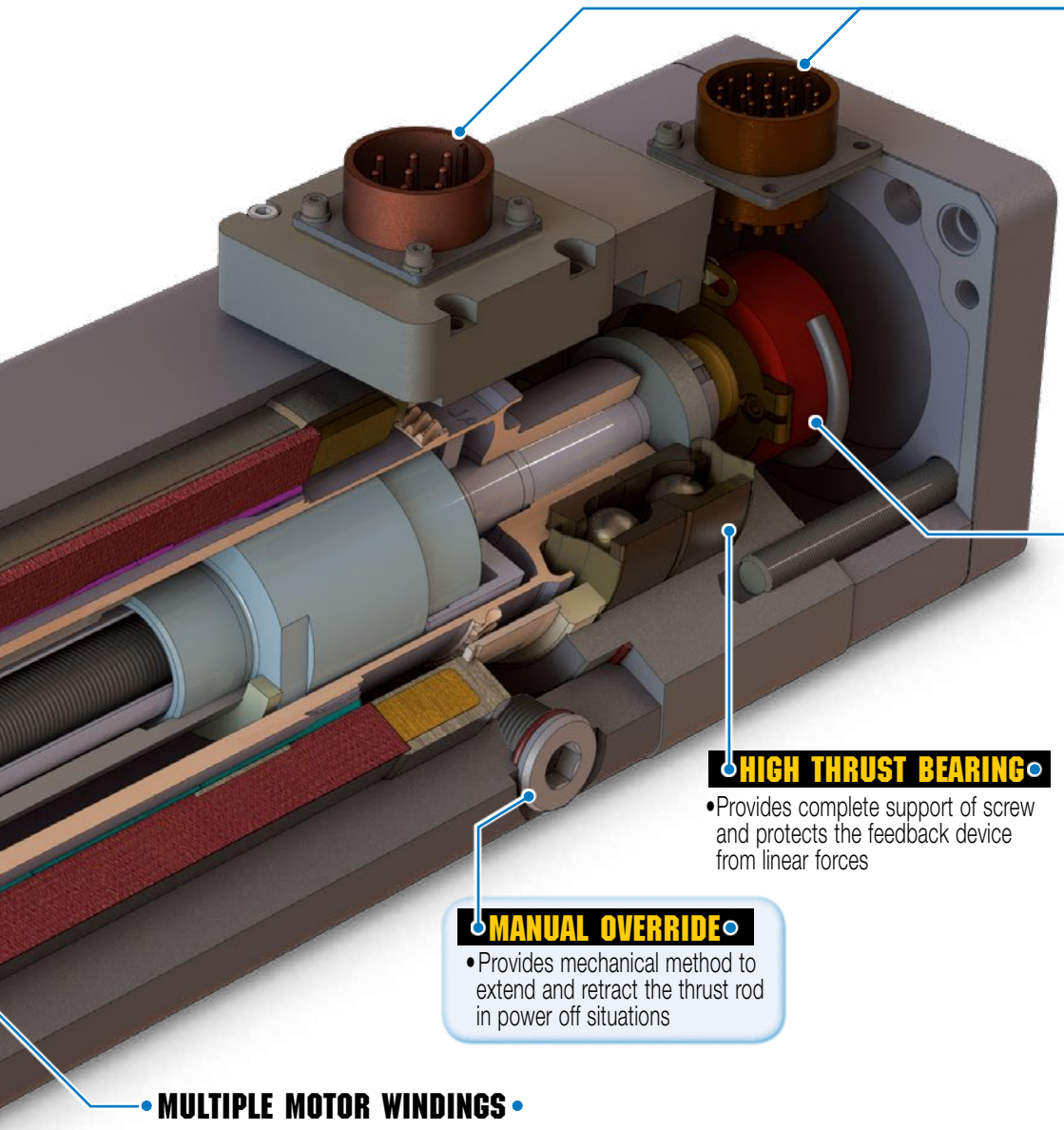
- Zinc plated alloy steel construction for corrosion resistance
- Provides a common interface to multiple rod end options

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

LIGHTWEIGHT ALUMINUM DESIGN

- Black anodized extrusion design is optimized for rigidity and strength



CONNECTORS
YOUR CHOICE:
- For integration with many robot / drive manufacturers
- STAGGERED CONNECTORS for more convenient installation

- Connectors and feedback manufacturers include:
  - + ABB
  - + Fanuc
  - + Kawasaki
  - + Kuka
  - + Nachi
  - + Motoman/Yaskawa
  - + Allen Bradley
  - + Bosch-Rexroth
  - + WTC-Medar
  - + Comau & more

HIGH RESOLUTION FEEDBACK
YOU CAN CHOOSE:
- Digital encoder
- Multi-turn absolute encoder
- Resolver
- Customer specified

HIGH THRUST BEARING
- Provides complete support of screw and protects the feedback device from linear forces

MANUAL OVERRIDE
- Provides mechanical method to extend and retract the thrust rod in power off situations

MULTIPLE MOTOR WINDINGS
YOU CAN CHOOSE:
- 230V or 460V rated windings potted directly into actuator housing
- Skewed motor windings provide minimal torque ripple for force repeatability and smooth linear motion
- Integral thermal switch for over temperature protection

OPTION
BRAKE
- Spring held / 24V electrically released

GSWA33, GUIDED INTEGRATED MOTOR ACTUATOR

ENDURANCE TECHNOLOGY℠

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

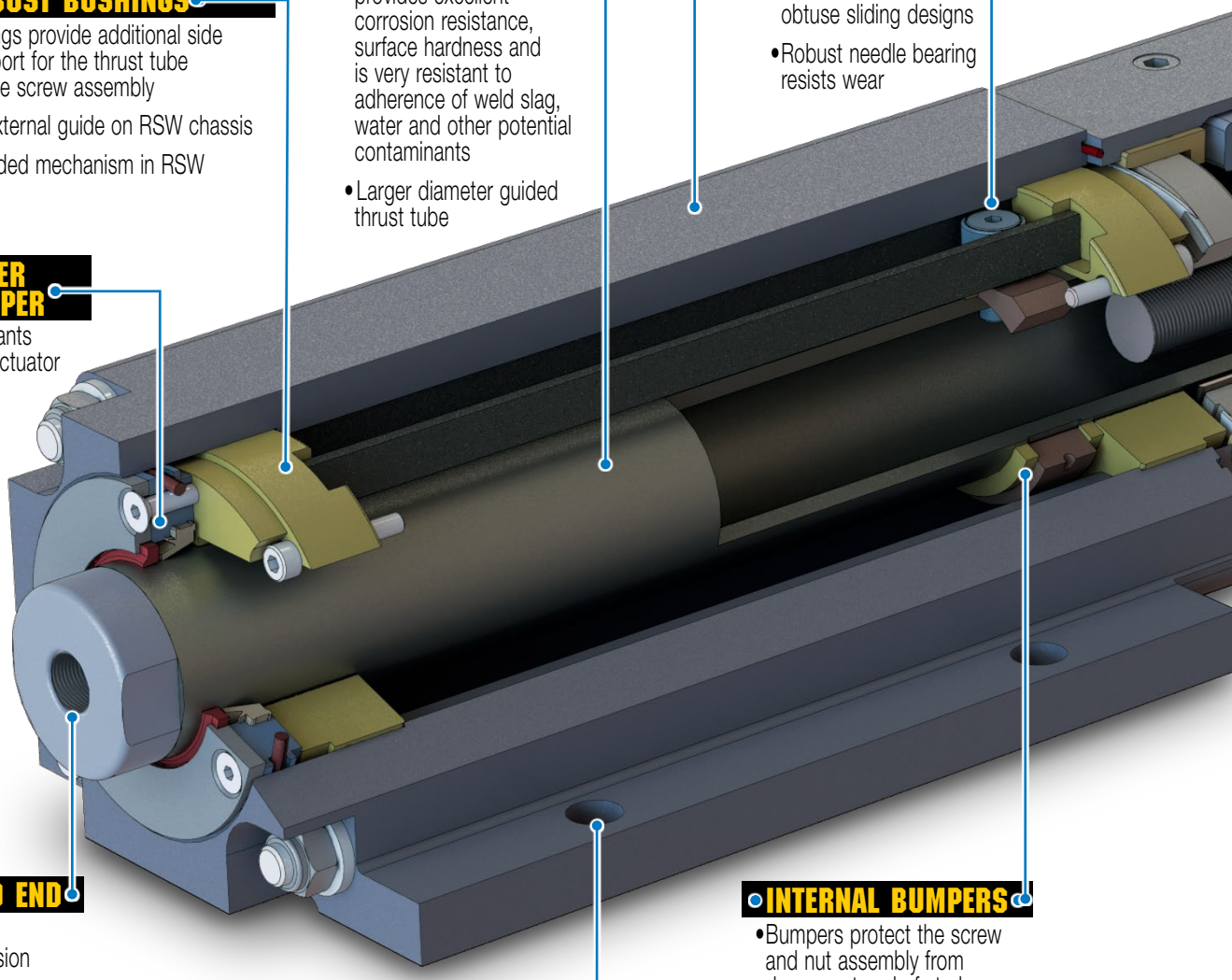
ANTI-ROTATE ASSEMBLY
- Fully enclosed to protect components from harsh environments
- Provides additional side loading support

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
- Larger diameter guided thrust tube

ANTI-ROTATE MECHANISM
- Far more efficient than obtuse sliding designs
- Robust needle bearing resists wear

ROBUST BUSHINGS
- Large bushings provide additional side loading support for the thrust tube protecting the screw assembly
- Eliminates external guide on RSW chassis
- Protects guided mechanism in RSW environment

ROD WIPER WITH SCRAPER
- Prevents contaminants from entering the actuator for extended life



THREADED ROD END
- Zinc plated alloy 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

INTEGRAL MOUNTING
- Four holes on anti-rotate assembly are available for direct mounting or addition of customized options
- 2 dowel pins are located a bottom of anti-rotate unit for accurate positioning

...MAXIMUM DURABILITY

MULTIPLE MOTOR WINDINGS

YOU CAN CHOOSE:

- 230V or 460V rated windings potted directly into actuator housing
- Skewed motor windings provide minimal torque ripple for force repeatability and smooth linear motion
- Integral thermal switch for over temperature protection

CONNECTORS

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- For integration with many robot / drive manufacturers

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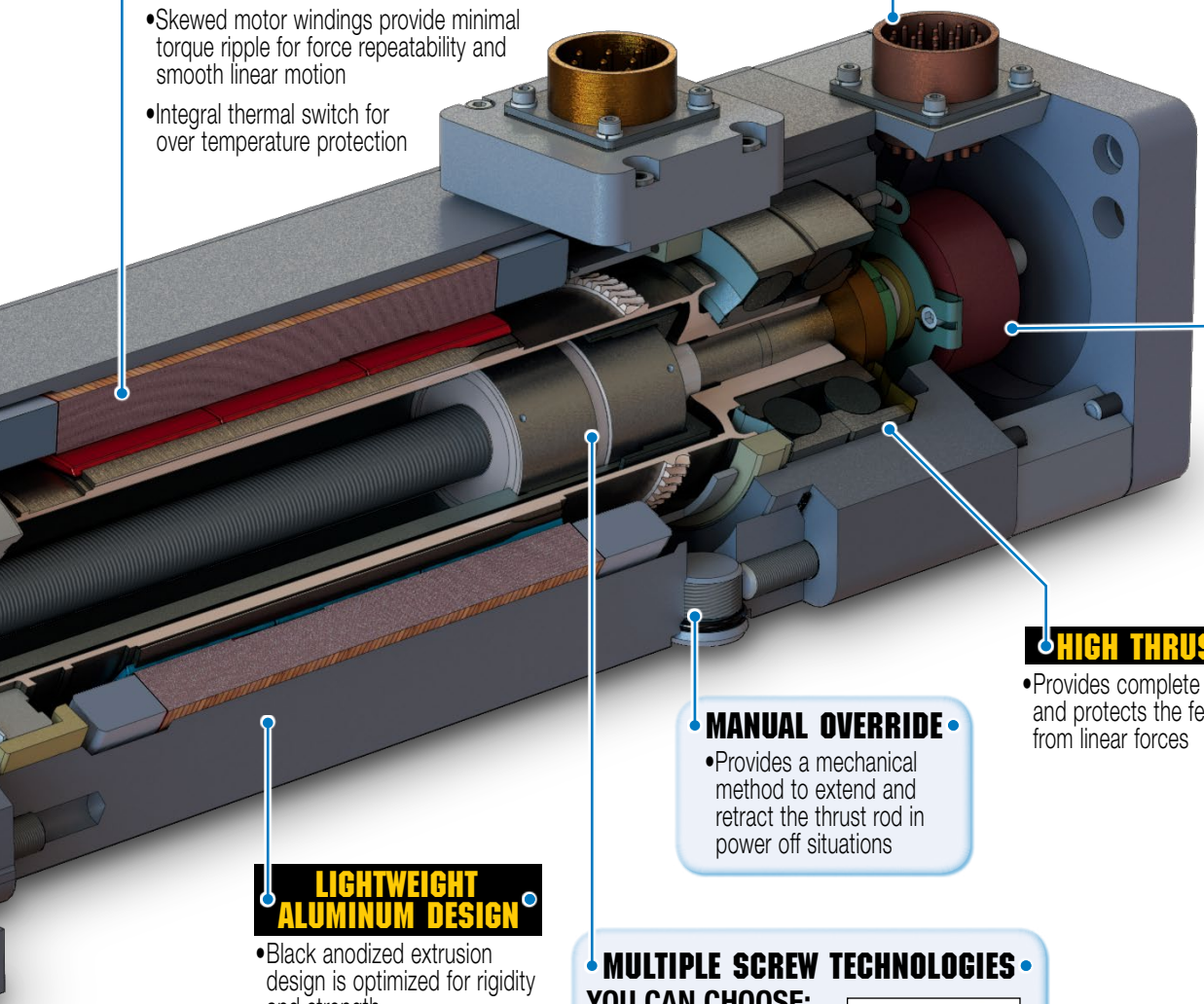
  + Comau
  & more



HIGH RESOLUTION FEEDBACK

YOU CAN CHOOSE:

- Digital encoder
- Multi-turn absolute encoder
- Resolver
- Customer specified

HIGH THRUST BEARING

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

MANUAL OVERRIDE

- Provides a mechanical method to extend and retract the thrust rod in power off situations

LIGHTWEIGHT ALUMINUM DESIGN

- Black anodized extrusion design is optimized for rigidity and strength

MULTIPLE SCREW TECHNOLOGIES

YOU CAN CHOOSE:

- Ball nuts offer positioning accuracy and repeatability

- Roller nuts provide the highest thrust and life ratings available

OPTION

☐ **BRAKE**

- Spring held / 24V electrically released

GSWA INTEGRATED MOTOR ACTUATOR

ENDURANCE TECHNOLOGY℠

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

MANUAL OVERRIDE
- Provides a mechanical method to extend and retract the thrust rod in power off situations (2 access ports 180° apart)

CONNECTORS
YOUR CHOICE:
- For integration with many robot / drive manufacturers

- Connectors and feedback manufacturers include:
  + ABB
  + Fanuc
  + Kawasaki
  + Kuka
  + Motoman/Yaskawa
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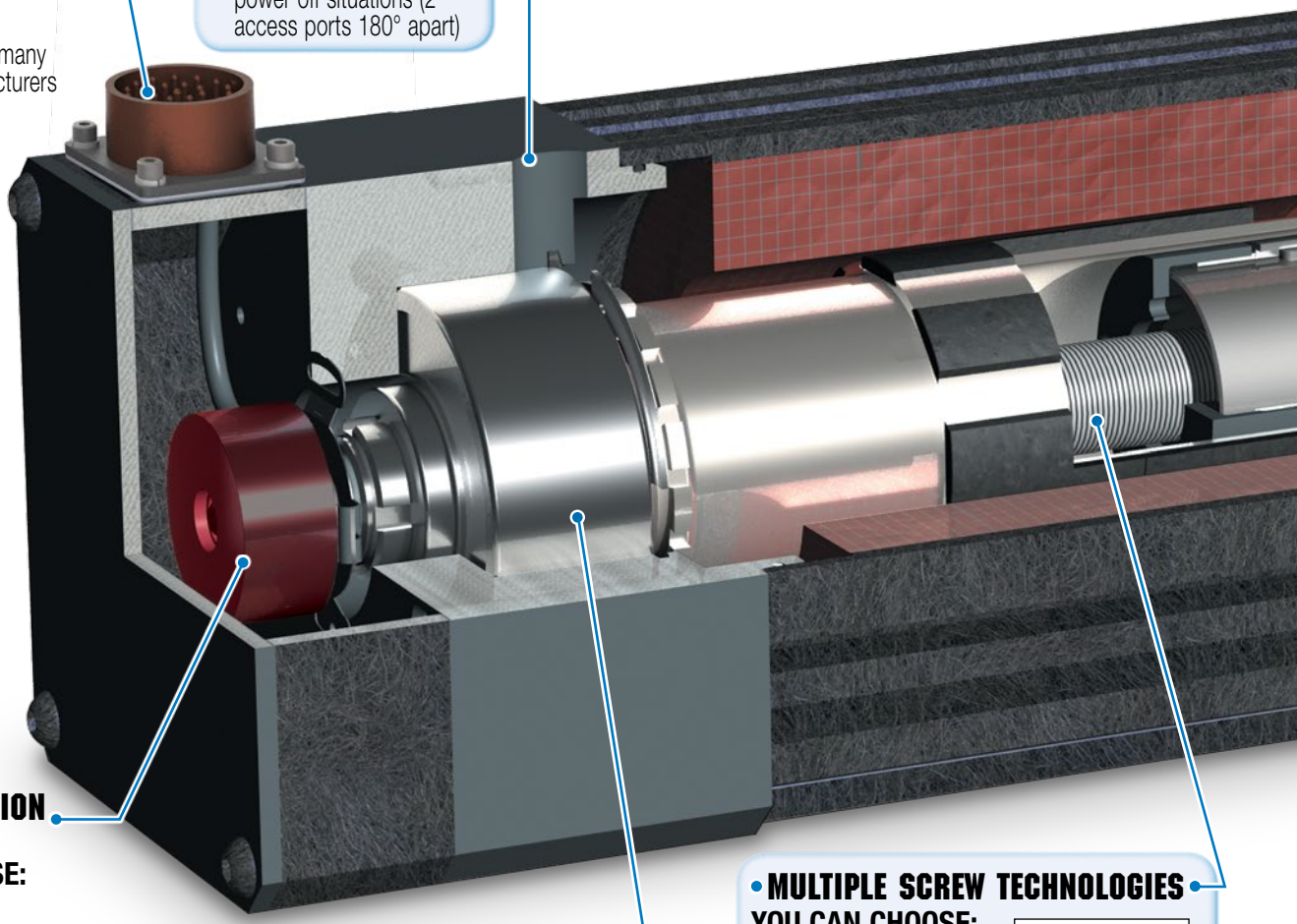
  + Bosch-Rexroth
  + WTC-Medar
  +Comau
  & more



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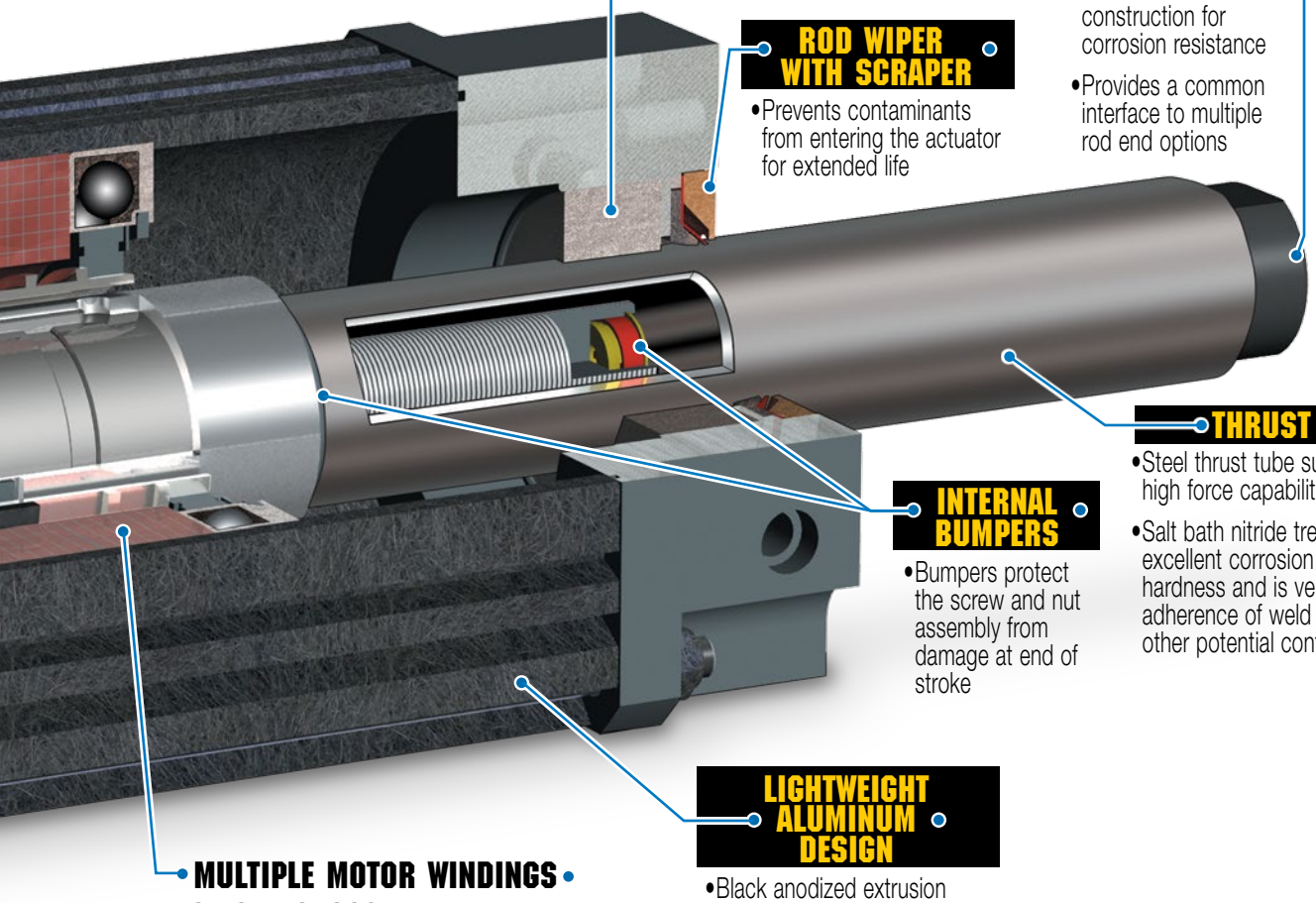


ROBUST BUSHINGS

- Supports the thrust tube and nut assembly through entire stroke length

ROD WIPER WITH SCRAPER

- Prevents contaminants from entering the actuator for extended life

THREADED ROD END

- Solid stainless steel construction for corrosion resistance
- Provides a common interface to multiple rod end options

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

INTERNAL BUMPERS

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

LIGHTWEIGHT ALUMINUM DESIGN

- Black anodized extrusion design is optimized for rigidity, strength and heat dissipation

MULTIPLE MOTOR WINDINGS

YOU CAN CHOOSE:

- ☐ 460V or 230V rated windings potted directly into actuator housing
- Skewed motor windings provide minimal torque ripple for force repeatability and smooth linear motion
- Integral thermal switch for over temperature protection

OPTIONS

☐ INTEGRAL FORCE FEEDBACK DEVICE

Provides a linear signal for verification or data acquisition of actual force

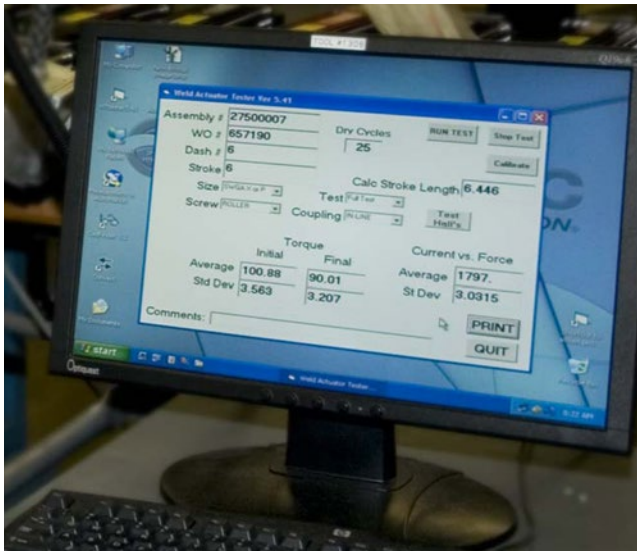
☐ HEX THRUST ROD

Provides integrated anti rotation

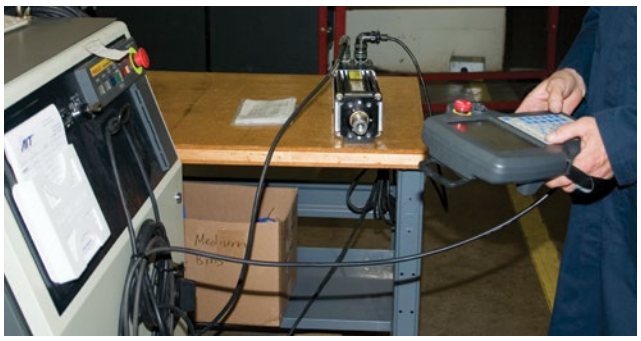
Complete Verification Testing is Performed on Each Actuator

Properly applied, every GSWA actuator shipped is guaranteed for millions of cycles of maintenance free or minimal maintenance performance.

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 GSWA 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 GSWA motor.

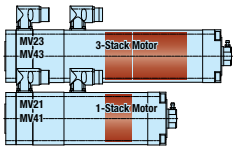
GSWA - Integrated Motor Actuator

Performance & Mechanical Specifications:		GSWA33, GSWA33-GUIDED						GSWA44 GSWA04			GSWA55	
		MV21/41			MV23/43							
SIZE	in	3.3						4.4			5.6	
	mm	*83.0*						*110.0*			*142*	
NUT/ SCREW		RN04	RN05	RN10	RN04	RN05	RN10	RN04	RN05	RN10	RN05	RN10
SCREW LEAD	in	0.157	0.197	0.397	0.157	0.197	0.397	0.157	0.197	0.397	0.197	0.397
	mm	*4.0*	*5.0*	*10.0*	*4.0*	*5.0*	*10.0*	*4.0*	*5.0*	*10.0*	*5.0*	*10.0*
WELD THRUST	lbf	450	350	175	2,100	1,700	850	4,000	3,300	1,650	5,500	2,756
	N	*2,003*	*1,558*	*779*	*9,345*	*7,562*	*3,783*	*17,800*	*14,679*	*7,343*	*24,475*	*12,238*
MAX. VELOCITY	in/sec	9.6	12.0	24.0	9.2	11.5	23.0	9.2	11.5	23.0	7.9	15.7
	mm/sec	*244*	*305*	*610*	*234*	*292*	*584*	*234*	*292*	*584*	*201*	*399*
AMBIENT TEMP RANGE	°F	50 to 122										
	°C	*10 to 50*										
IP RATING		Standard IP65										
BACK DRIVE FORCE	lbf	98	78	39	98	78	39	114	91	46	152	76
	N	*436*	*347*	*173*	*436*	*347*	*173*	*507*	*405*	*205*	*676*	*338*

Motor Specifications:		GSWA33		GSWA33 GSWA33, GUIDED		GSWA04		GSWA44 GSWA04		GSWA55	
		MV21	MV41	MV23	MV43	MV22	MV42	MV23	MV43	MV23	MV43
BUS VOLTAGE	Vrms	230	460	230	460	230	460	230	460	230	460
TORQUE CONSTANT (KT)	in-lb/A Peak	5.4	10.7	5.5	10.7	4.6	8.0	5.4	10.6	6.7	13.4
	N-m/A Peak	*0.61*	*1.21*	*0.62*	*1.21*	*0.52*	*0.90*	*0.61*	*1.2*	*0.76*	*1.51*
VOLTAGE CONSTANT (KE)	V/Krpm Peak	81	160	79.8	154	66.1	107.2	78.1	153.1	100	201
CONTINUOUS STALL TORQUE	in-lb	16		39	38	48.8	43.0	74	75	112	
	N-m	*1.8*		*4.4*	*4.3*	*5.5*	*4.9*	*8.4*	*8.5*	*12.7*	
CONTINUOUS STALL CURRENT	Arms	2.1	1.1	5.0	2.5	7.5	3.8	9.7	5.0	11.8	5.9
PEAK TORQUE	in-lb	48		78	76	146	129	148	150	280	
	N-m	*3.6*		*8.8*	*8.6*	*16.5*	*14.6*	*16.7*	*16.9*	*25.3*	
PEAK CURRENT	Arms	6.3	3.3	10	5	22.4	11.9	19.4	10.0	29.5	14.3
RESISTANCE	Ohms	10	40.1	2.07	8.3	0.9	4.2	0.58	2.32	0.57	2.93
INDUCTANCE	mH	13.6	54.1	3.8	15.0	3.65	15.7	2.75	11.5	1.4	5.8
SPEED @ RATED V	RPM	4,264		3,500						2,400	
NO. OF POLES		8									

		GSWA33		GSWA33-GUIDED		GSWA04		GSWA44	GSWA55
		MV21,41	MV23,43	MV21,41	MV23,43	MV22,42	MV23,43	MV23,43	MV23,43
WEIGHT (W/6" STROKE)	lb	15.4	18.1	25.8	28.5	29.8	32.0	35.2	67.2
	kg	*6.98*	*8.2*	*11.7*	*12.9*	*13.5*	*14.5*	*16.0*	*30.5*
STROKE	in	6.0 to 18.0		6.0				6.0 to 18.0	
	mm	*152.4 to 451.2*		*152.4*				*152.4 to 451.2*	
WEIGHT PER UNIT OF STROKE	lb/in	0.6603		NA				1.1035	2.1115
	kg/mm	*0.0118*						*0.0197*	*0.03771*
BASE INERTIA	lb/in	0.9525	1.6723	NA				3.3442	3.3442
	kg-cm²	*2.7874*	*4.8997*					*9.7864*	*9.7864*
INERTIA PER UNIT OF STROKE	lb-in²/in	0.00358		NA				0.00984	0.00984
	kg-cm² /mm	*0.00041*						*0.00113*	*0.00113*

MV21,41 = 1 Stack Motor
MV22,42 = 2 Stack Motor
MV23,43 = 3 Stack Motor



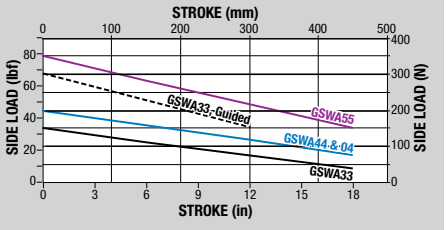
RoHS COMPLIANT RoHs Compliant Components,

CE Approved

SIDE LOADING

Some weld gun designs may subject the actuator to excessive side loading reducing overall service life. The GSWA33, GUIDED actuator (page 8) will accommodate side loading. For other GSWA 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.

GSWA SIDE LOAD SPECIFICATIONS



DISTANCE TRAVELED UNDER LOAD

Distance traveled under load is a derivative of weld gun deflection/ spring rate. Tests demonstrate the overall service life of actuators is extended when travel distance under load is minimized.

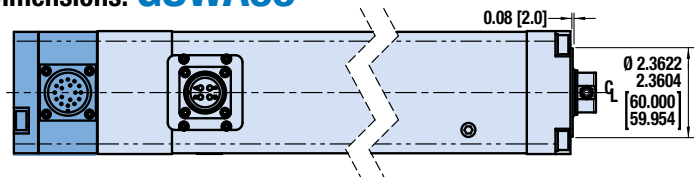
When these service life factors are considered at the design phase, millions of trouble free cycles are possible. Please contact Tolomatic for more information.

WELD THRUST DEFINITION:

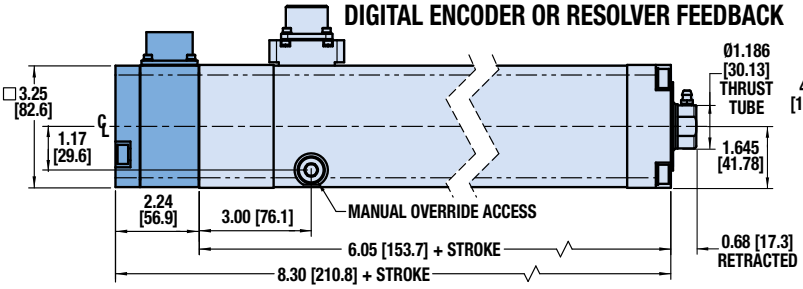
Weld thrust is specified using a normal RSW duty cycle, which is 20 welds/mis completing the following twice/min: one full actuator weld cycle of 152mm, followed by 9 strokes of 25mm each; simulated weld time held at force for 50 cycles.

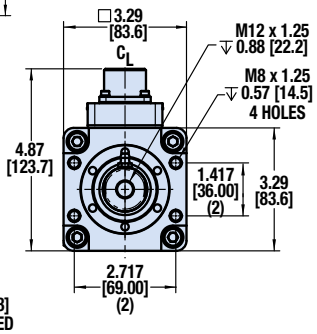
GSWA Dimensions

Dimensions: GSWA33

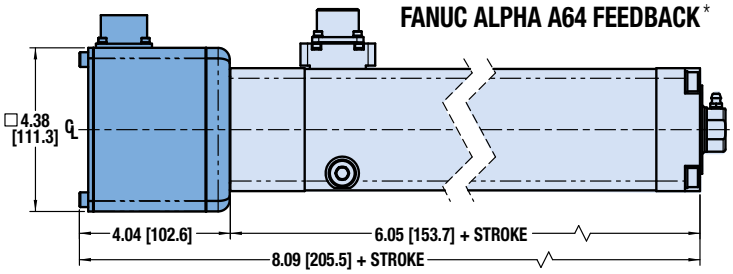


DIGITAL ENCODER OR RESOLVER FEEDBACK

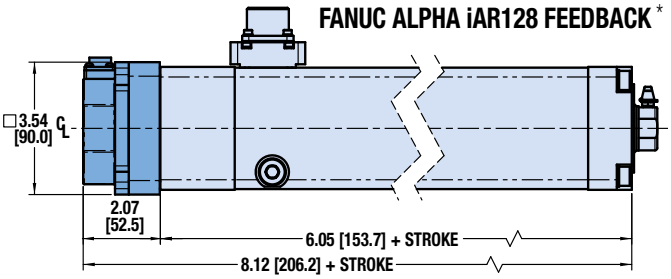




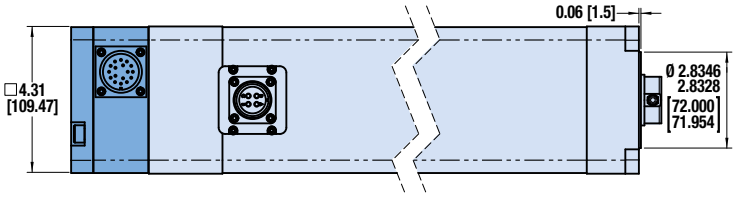
FANUC ALPHA A64 FEEDBACK*



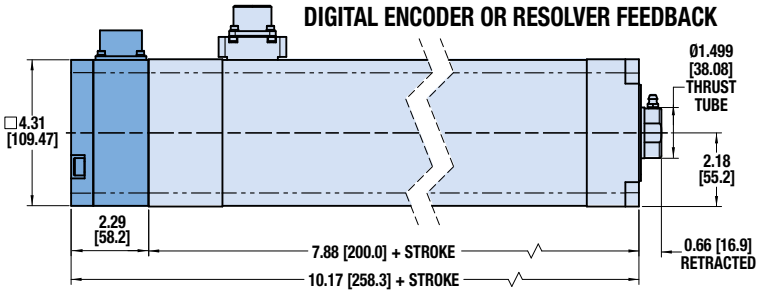
FANUC ALPHA iAR128 FEEDBACK*

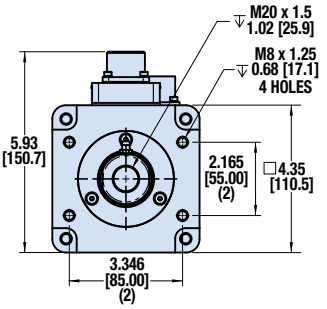


Dimensions: GSWA44



DIGITAL ENCODER OR RESOLVER FEEDBACK





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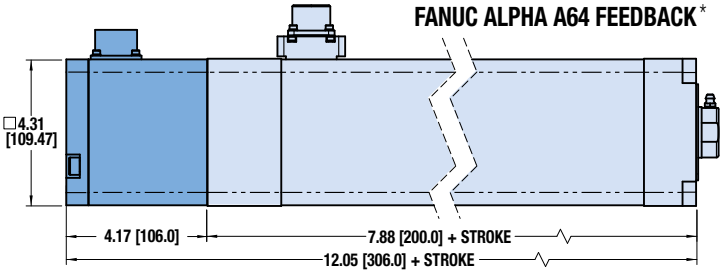
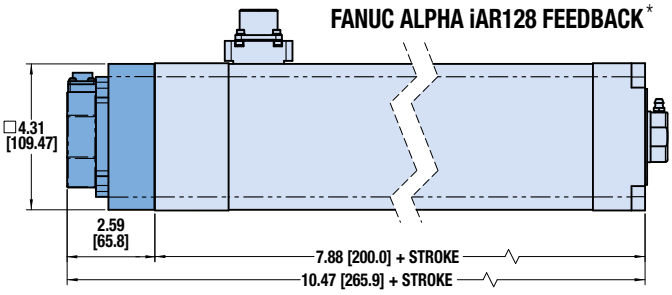


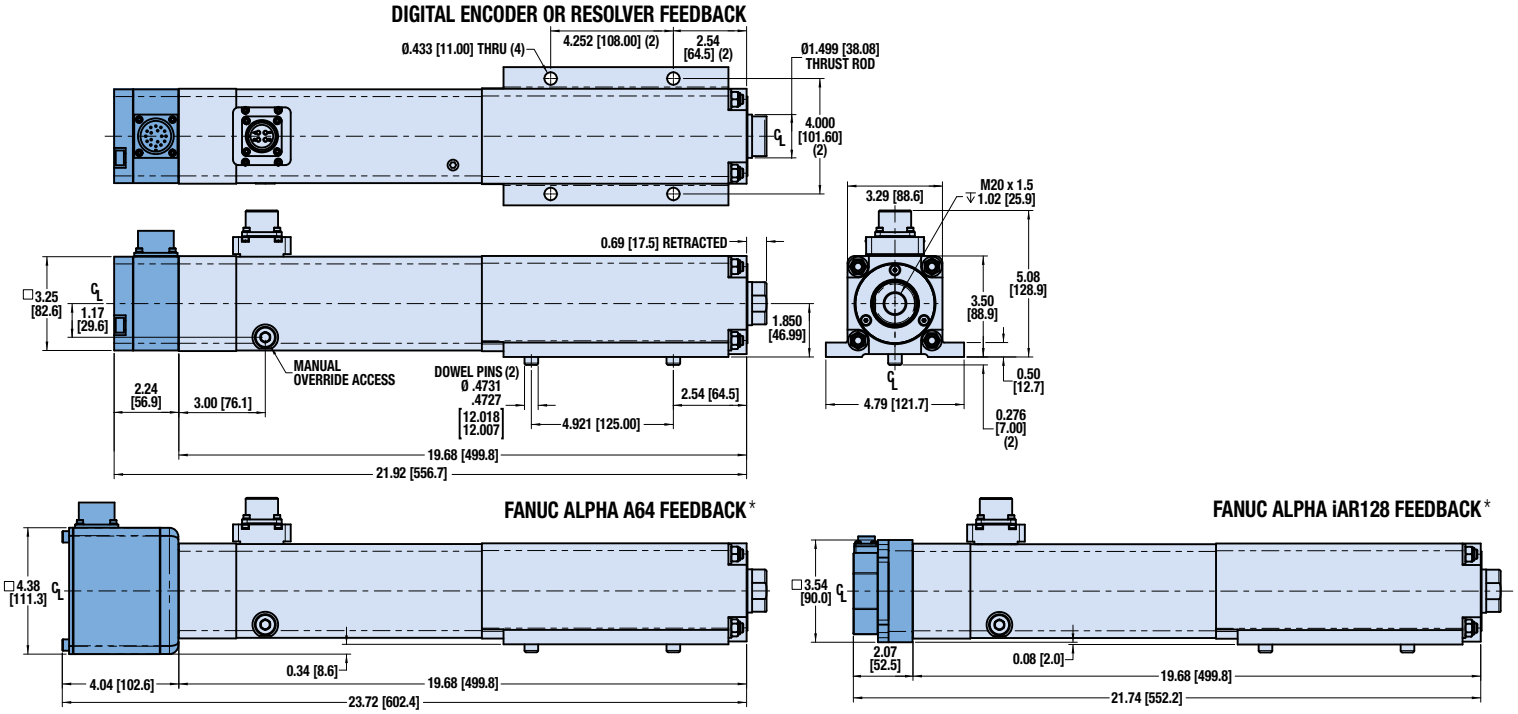
FANUC ALPHA iAR128 FEEDBACK*



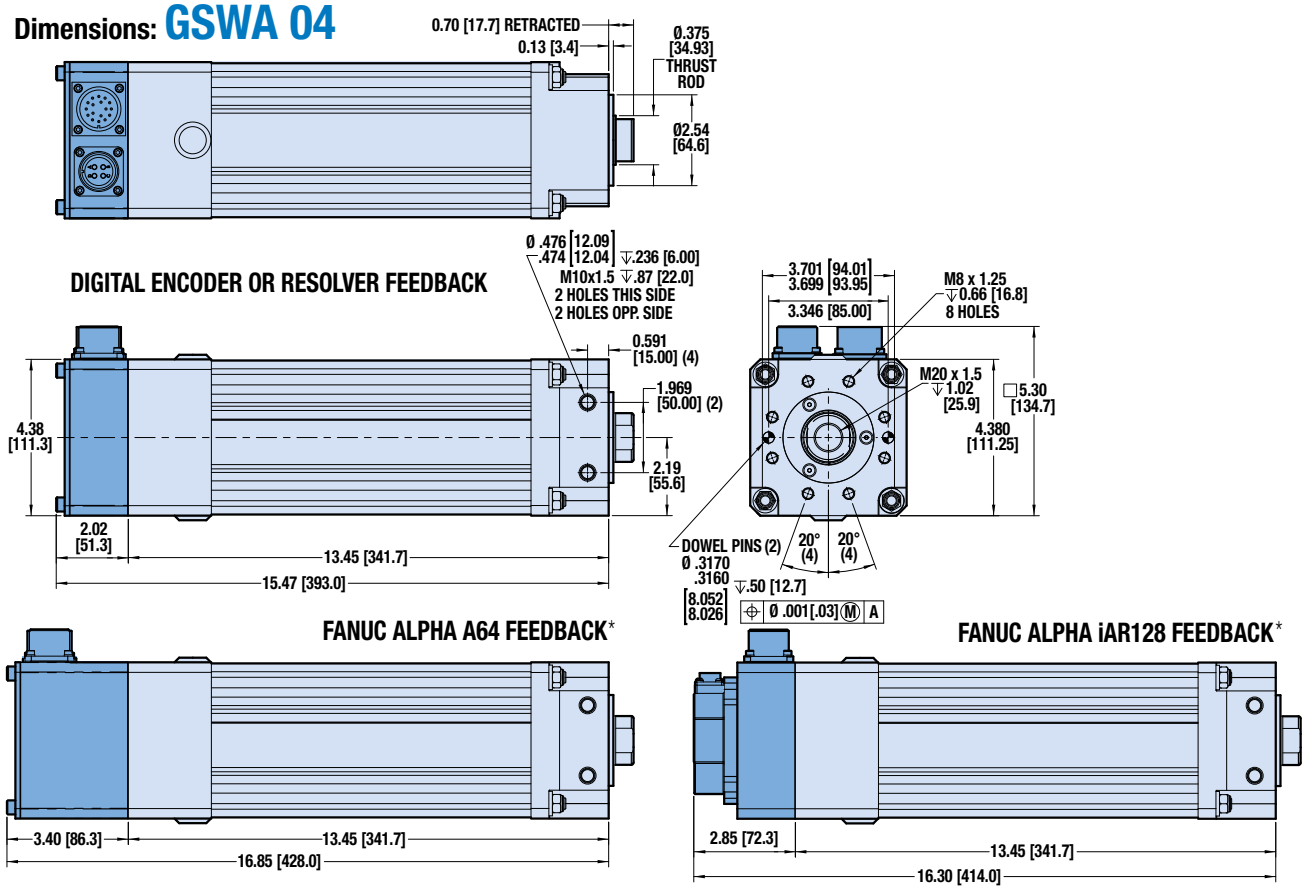
*Shown fully assembled with customer supplied feedback

GSWA - Dimensions

Dimensions: GSWA33, Guided



Dimensions: GSWA 04

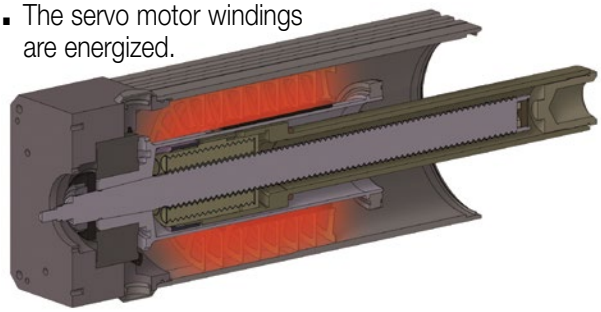


*Shown fully assembled with customer supplied feedback

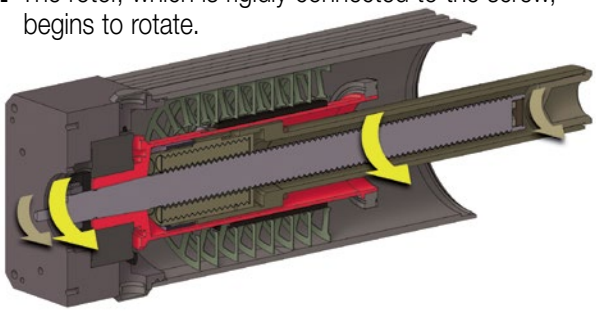
How it Works

The illustrations below show how the inner components of the GSWA work together to provide optimal performance. For clarity, only the extend movement is shown.

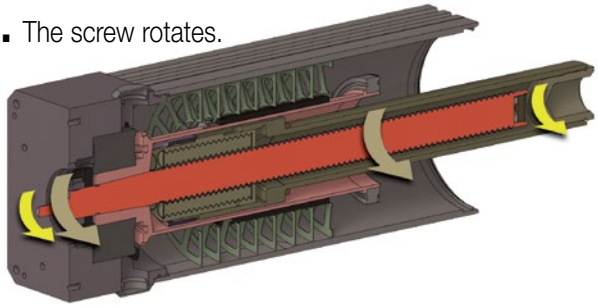
1. The servo motor windings are energized.



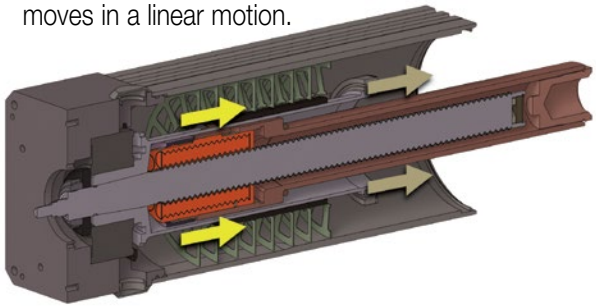
2. The rotor, which is rigidly connected to the screw, begins to rotate.



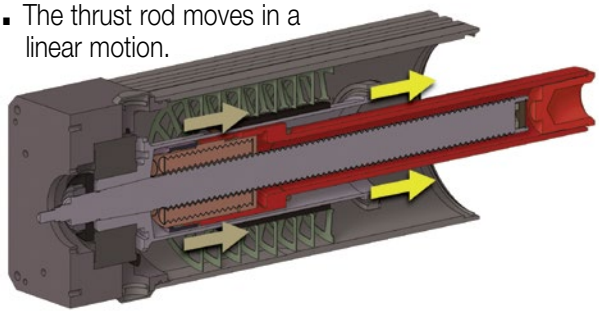
3. The screw rotates.



4. The nut, mechanically captured by the thrust rod, moves in a linear motion.



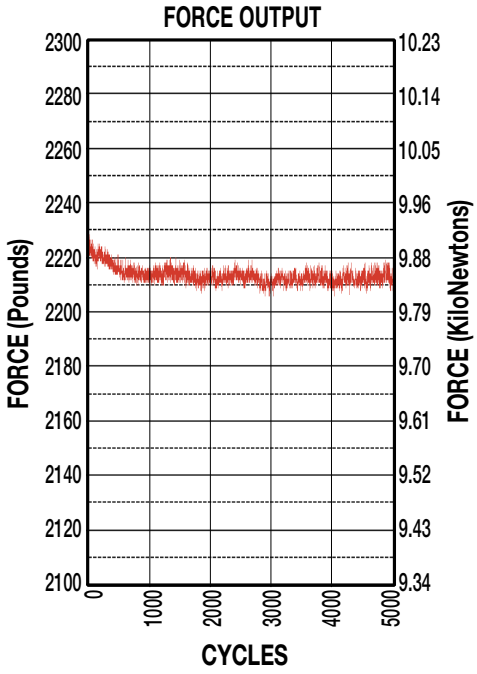
5. The thrust rod moves in a linear motion.



Tested Performance Results

Tolomatic's GSWA actuator (with roller screw/nut selection) is designed and built to maintain ±3.0% force repeatability throughout the actuator life.

The data presented in the "GSWA Force Output" chart at right was collected from a ServoWeld® configured unit with a roller screw and low-voltage windings. The temperature of the actuator was not monitored during the test.



The force output data in this chart is from GSWA actuator run at a fixed current. Each sample is representative of a single "weld cycle." The test was run for 4-1/2 hours.

DATA POINTS OF INTEREST:

- The overall range of 5,000 samples is 27 lbf., or less than 1.2% of nominal.
- The drop in force from cold start is 0.5% nominal (appr.), which means the weld-to-weld force variation is relatively constant regardless of temperature.
- Standard deviation remains relatively constant regardless of weld force, which means repeatability improves relative to higher weld forces. Tolomatic measures repeatability as (6) (Std. Dev.)/Nominal Force.

GSWA Application Guidelines

SIDE LOADING: Some weld gun designs may subject the actuator to excessive side loading reducing overall service life. The GSWA33, GUIDED actuator (page 8) will accommodate side loading. For other GSWA 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.

Optional hex nose bearing/thrust rod configuration prevents thrust rod rotation. 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/scraper 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/scraper 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: For optimal RSW servo system performance, low weld force from the production weld schedule and tip dress force should be included in the RSW servo system calibration process.

RSW servo system consists of robot 7th axis amplifier-feedback device-software, ServoWeld, & RSW chassis.

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 by virtue of the continuous robot movement and various RSW gun positions have reduced exposure to water pooling/water ingression. 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)

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 ServoWeld overall service life. Because water is a factor in the RSW gun environment as a result of regular weld cap changes there are a number of steps which can be taken to reduce and/or eliminate ServoWeld exposure to water.

- 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/scraper 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 ingression 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.

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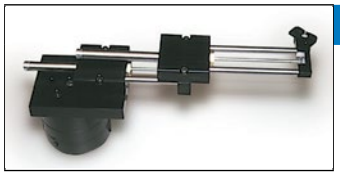

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From standard catalog products... to modified products... to completely unique custom products, Tolomatic designs and builds the best solutions for your challenging applications.

ONLINE SIZING & SELECTION SOFTWARE

Online sizing that is easy to use, accurate and always up-to-date. Input your application data and the software will determine a Tolomatic electric actuator to meet your requirements.

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201510021351
LITERATURE NUMBER: 3604-4172_03.06