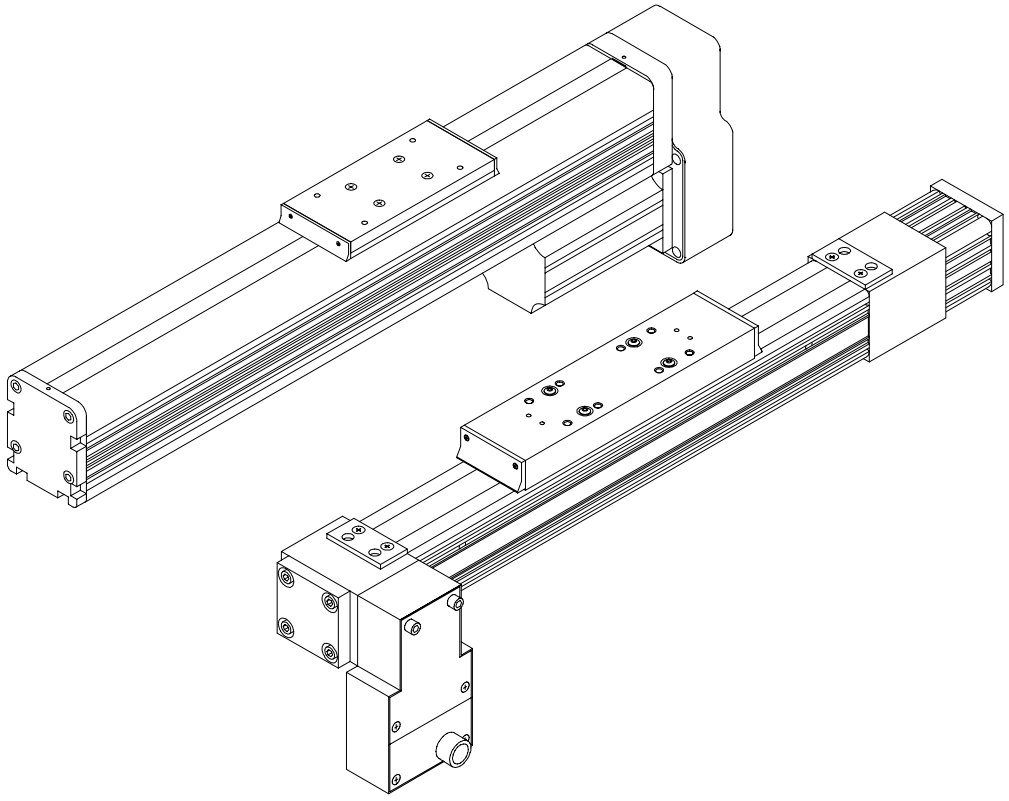
R2A/R3/R4 Series Rodless Actuators

Operator's Manual

P/N PCW-4647 Revision 1.1 7/99

This manual covers the following IDC Products:

R2A Actuators - R2AD, R2AH, R2AS, R2AB
R3 Actuators - R3D, R3H, R3S, R3B
R4 Actuators - R4H, R4S, R4B



INDUSTRIAL DEVICES CORPORATION

Table of Contents

1. Product Overview

Industrial Devices Corporation (IDC) R Series Rodless Electric Linear Actuators are designed for use in a wide variety of industrial, scientific, and commercial applications requiring control of linear thrust, speed, or position. This operator's manual will help you properly install and operate your R Series Electric Linear Actuator.

Belt-Drive vs. Screw-Drive

Rodless actuators are available in two configurations:

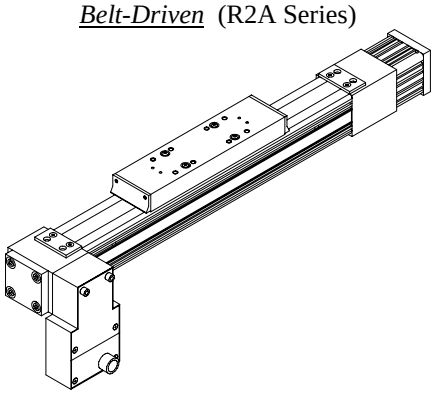
Belt-Driven Versions

- High Speed
- Moderate Force

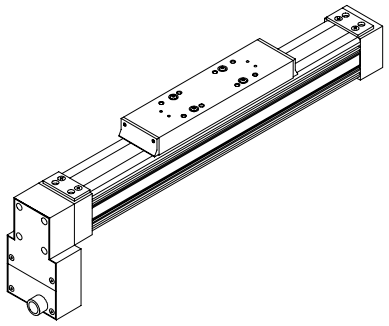
Screw-Driven Versions

- High Precision
- High Force

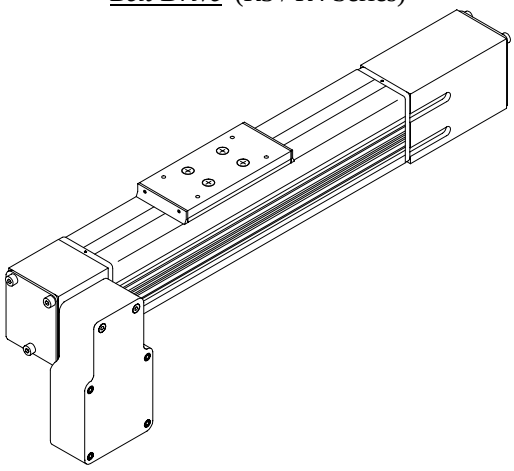
Belt-Driven (R2A Series)



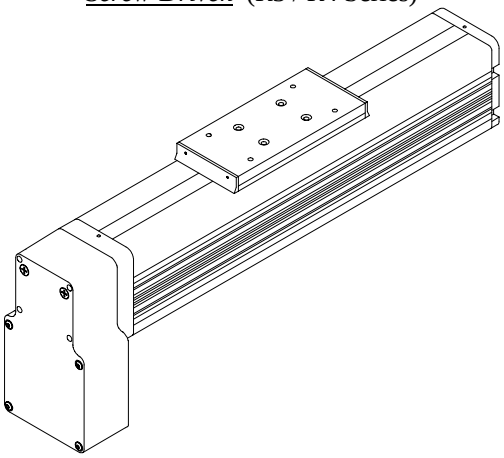
Screw-Driven (R2A Series)



Belt-Drive (R3 / R4 Series)

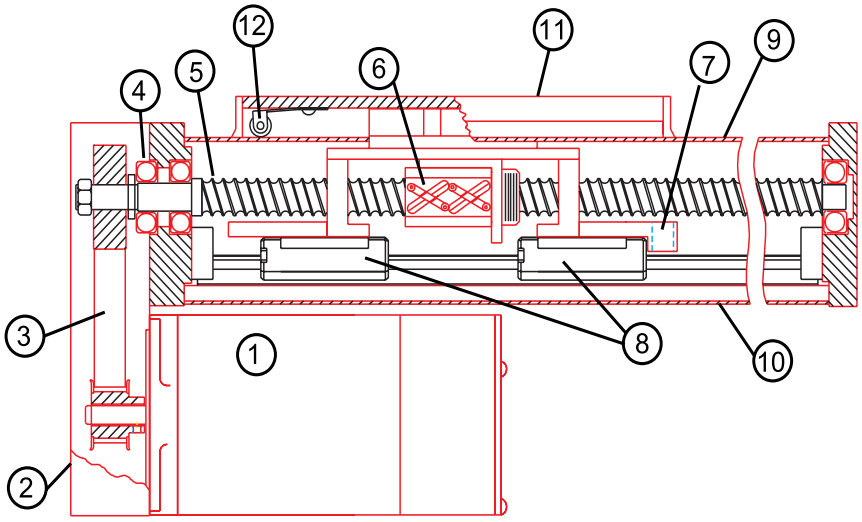


Screw-Driven (R3 / R4 Series)



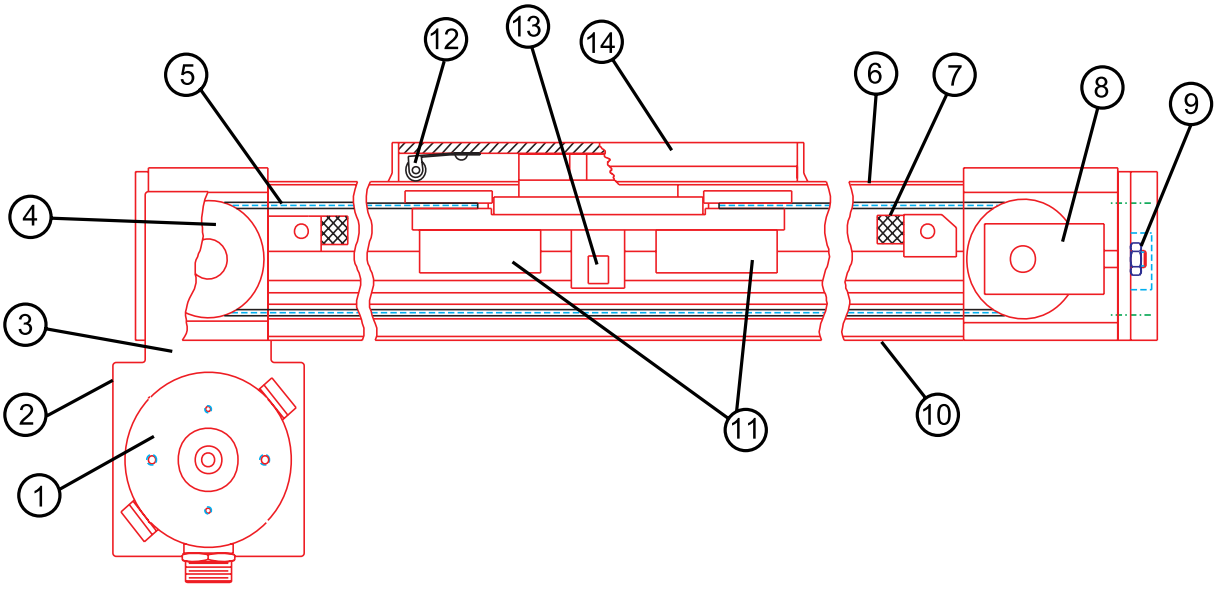
Internal Construction

Screw-Drive



1. Motor
2. Bearing Housing
3. Drive Train
4. Thrust Bearings
5. Leadscrew
6. Drive Nut
7. Magnet
8. Bearing Blocks
9. Carriage Seal
10. Guide Cylinder
11. Carriage
12. Seal Roller

Belt-Drive



1. Motor
2. Bearing Housing
3. Drive Train
4. Transport Pulley
5. Transport Belt
6. Carriage Seal
7. Bump-Stop
8. Tensioner Ass'y
9. Tensioning Nut
10. Guide Cylinder
11. Bearing Blocks
12. Seal Roller
13. Magnet
14. Carriage

R Series Control Compatibility Chart

IDC controls will optimize performance of R Series Electric Linear Actuators. Please refer to the specific control operator's manual for system operating instructions.

R2A & R3 Series Compatible Controls

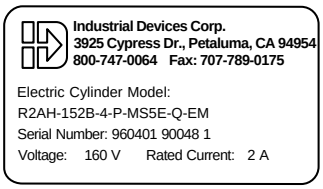
	R2AD, R3D *24V DC Motor*	**R2AH, R3H** *160V DC Motor*	**R2AS, R3S** *Step Motor*	**R2AB, R3B** *Brushless Servo*
Limit Switch Controls	D2200 Series D2300 Series D2400 Series	H3301B		
Edge Guide Controls		H3321B		
Digital Brushless Drives				B8001
Microstepping Drives			NextStep S6002	
Programmable Smart Drives			SmartStep S6961 S6962	B8961 B8962

R4 Series Compatible Controls

		R4H *160V DC Motor*	**R4S33, R4S42** *Step Motor*	**R4B32, R4B41** *Brushless Servo*
Limit Switch Controls		H4301		
Edge Guide Controls		H4321		
Digital Brushless Drives				B8001
Microstepping Drives			NextStep S6002	
Programmable Smart Drives			SmartStep S6961 S6962	B8961 B8962

Your Model Number - Identify What You Have

R2A Series Model Numbers (*see p. 6 for R3, R4 models*)



Example:

Base Model Number				Stroke Length	Motor Orientation	Mounting Style	English/ Metric	Options	
Rodless Actuator	Motor Type	Drive Ratio	Screw/Belt Pitch,Type						
R2A	H	15	2B	4	P	MS5	E	Q	EM

R2A = R2A Series Actuator Style
H = H Motor, 160VDC, 2 Amp, Permanent Magnet
15 = 1.5 to 1 Drive Ratio – Belt/Pulley
2B = 2 Pitch (.5"lead) Ballscrew
4 = 4 inch stroke
P = Parallel Motor Orientation
MS5E = Adjustable Feet Mounting (English Version Carriage / Mtg.)
Q = Quick Disconnect Option
EM = Encoder Option (on motor)

Base Model Number				Stroke Length	Motor Orientation	Mounting Style	English/ Metric	Options	
Rodless Actuator	Motor Type	Drive Ratio	Screw/Belt Pitch,Type						
R2A									

1 *R2A Series* Rodless Electric Linear Actuator

2 Motor Type

D	24VDC, 5 Amp, Permanent Magnet Motor
H	160VDC, 2 Amp, Permanent Magnet Motor
S23[*x*]	NEMA 23 Frame, Step Motor, 3 Stack [*x*] = N, T or V (see below)
S32[*x*]	NEMA 34 Frame, Step Motor, 2 Stack [*x*] = N, T or V (see below)
B23	23 Frame Brushless Servo Motor

[*x*] can be: **N** = 8 leads, windings can be wired in Series or Parallel
T = Windings pre-wired in Series @ IDC Factory
V = Windings pre-wired in Parallel @ IDC Factory

3 Speed Reducer - Ratio/Type

	R2A Series
10 = 1.0:1 Drive Belt/Pulley	*(1.0 to 1 exact ratio)*
15 = 1.5:1 Drive Belt/Pulley	*(1.5 to 1 exact ratio)*
20 = 2.0:1 Drive Belt/Pulley	*(2.0 to 1 exact ratio)*
25 = 2.5:1 Helical Gear	*(2.5 to 1 exact ratio)*
31 = 3.1:1 Helical Gear	*(3.125 or 50:16 exact ratio)*
35 = 3.5:1 Helical Gear	*(3.571…or 50:14 ratio)*
120 = 12.0:1 Helical Gear	*(12.0 to 1 exact ratio)*

4 Linear Drive Type

2A = 2 Pitch (.5" lead) acme leadscrew
5A = 5 Pitch (.2" lead) acme leadscrew
8A = 8 Pitch (.125" lead) acme leadscrew
10A = 10 Pitch (.1" lead) acme leadscrew
2B = 2 Pitch (.5" lead) ballscrew
5B = 5 Pitch (.2" lead) ballscrew
5G = 5 Pitch (.2" lead) precision ground ballscrew
5P = 5 Pitch (.2" lead) precision rolled ballscrew
T = tangential drive belt:
(R2A Pulley Circumference = 3.000")

5 Stroke Length

(specified in inches)

6 Motor Orientation

Belt Drives	**AR**	=	Motor Housing Rotated		ABOVE / RIGHT
	BR	=	"	"	BEHIND / RIGHT
	CR	=	"	"	UNDER / RIGHT
	AL	=	"	"	ABOVE / LEFT
	BL	=	"	"	BEHIND / LEFT
	CL	=	"	"	UNDER / LEFT
Screw Drives	**I**	=	Motor Mounted		INLINE
	P	=	"	"	PARALLEL
	PR	=	"	"	PARALLEL / RIGHT
	PL	=	"	"	PARALLEL / LEFT

7 Mounting Styles

MF3 = Front / Rear Rectangular Flanges
MS1 = Side End Angles
MS5 = Adjustable Feet
MS6 = Side Tapped Mounting Holes

8 Carriage

S = Single Carriage
D = Dual Carriage *(screw-drive only)*

9 English/Metric (Carriage/Mounting)

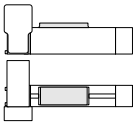
E = English carriage & mounting dimensions
M = Metric carriage & mounting dimensions

10 Actuator Options

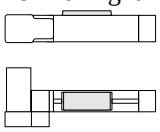
B*x*M = Brake on Motor
B*x*S = Brake on Leadscrew
E*x*M = Encoder on Motor
PN = Pre-loaded Nut
Q = Quick Disconnect
RM = Reverse Parallel Motor Mounting

Motor Orientations

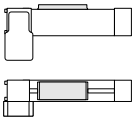
-AR Over Right



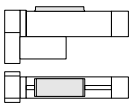
-BR Behind Right



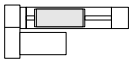
-CR Under Right



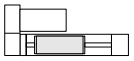
- P Parallel Underneath



-PR Parallel Right Side



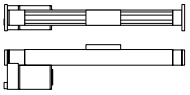
-PL Parallel Left Side



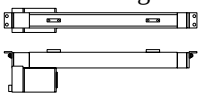
-I In-line

Mounting Styles

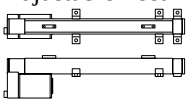
-MF3 Front / Rear Rect. Flanges



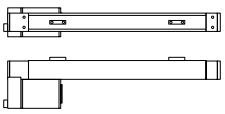
-MS1 Side End Angles



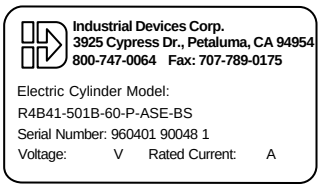
-MS5 Adjustable Feet



-MS6 Side Tapped Mtg. Holes



R3/R4 Series Model Numbers



Example:

Base Model Number				Stroke Length	Motor Orientation	Mounting Style	English/ Metric	Options	
Rodless Actuator	Motor Type	Drive Ratio	Screw/Belt Pitch,Type						
R4	B41	50	1B	60	P	AS	E	BS	

R4 = R4 Size Rodless Actuator
B41 = B41 Motor, Brushless Servo
50 = 5.0 to 1 Drive Ratio - Helical Gears
1B = 1 Pitch (1"lead) Ballscrew
60 = 60 inch stroke
P = Parallel Motor Orientation
A = Angle Bracket Mtg. Option
S = Single Carriage
E = English Version Carriage / Mtg.
BS = Brake on Leadscrew Option

Base Model Number				Stroke Length	Motor Orientation	Mounting Style	English/ Metric	Options	
R3 / R4	Motor Type	Drive Ratio	Screw/Belt Pitch,Type						

1 *R3 or R4 Series* Rodless Electric Linear Actuator

2 Motor Type

D 24VDC 5 Amp, Permanent Magnet Motor
H 160VDC 2 Amp, Permanent Magnet Motor
H4 160VDC 7 Amp, Permanent Magnet Motor
S23[*x*] NEMA 23 Frame, Step Motor, 3 Stack [*x*] = N, T or V (see below)
S33[*x*] NEMA 34 Frame, Step Motor, 3 Stack [*x*] = T or V (see below)
S42[*x*] NEMA 42 Frame, Step Motor, 2 Stack [*x*] = T or V (see below)

[*x*]can be: **N** = 8 leads, windings can be wired in Series or Parallel
T = Windings pre-wired in Series @ IDC Factory
V = Windings pre-wired in Parallel @ IDC Factory

B23 23 Frame Brushless Servo Motor
B32 34 Frame Brushless Servo Motor
B41 42 Frame Brushless Servo Motor

3 Speed Reducer - Ratio/Type

	R3 Series	R4 Series
10 = 1.0:1 Drive Belt/Pulley	*(1.0 to 1 exact ratio)*	*(1.0 to 1 exact ratio)*
15 = 1.5:1 Drive Belt/Pulley	*(1.5 to 1 exact ratio)*	*(1.5 to 1 exact ratio)*
20 = 2.0:1 Drive Belt/Pulley	*(2.0 to 1 exact ratio)*	*(2.0 to 1 exact ratio)*
30 = 3.0:1 Drive Belt/Pulley	----------	*(3.0 to 1 exact ratio)*
50 = 5:1 Helical Gear	*(5.037…or 3536 to702)*	*(5.110…or 42432 to 8303)*
70 = 7:1 Helical Gear	*(7.000…or 129030 to 18432)*	----------
100 = 10:1 Helical Gear	*(10.0 to 1 exact ratio)*	*(10.007…or68640 to 6859)*

4 Linear Drive Type

2A = 2 Pitch (.5” lead) acme leadscrew
5A = 5 Pitch (.2” lead) acme leadscrew
6A = 6 Pitch (.167” lead) acme leadscrew
8A = 8 Pitch (.125” lead) acme leadscrew
10A = 10 Pitch (.1” lead) acme leadscrew
1B = 1 Pitch (1” lead) ballscrew
2B = 2 Pitch (.5” lead) ballscrew
4B = 4 Pitch (.25” lead) ballscrew
5B = 5 Pitch (.2” lead) ballscrew
5G = 5 Pitch (.2” lead) precision ground ballscrew
5P = 5 Pitch (.2” lead) precision rolled ballscrew
T = tangential drive belt:
(Pulley Pitch Circumference:
R3=6.000”, R4=7.500”)

5 Stroke Length

(specified in inches)

6 Motor Orientation

Belt Drives	**AR**	=	Motor Housing Rotated		ABOVE / RIGHT
	BR	=	"	"	BEHIND / RIGHT
	CR	=	"	"	BELOW / RIGHT
	AL	=	"	"	ABOVE / LEFT
	BL	=	"	"	BEHIND / LEFT
	CL	=	"	"	BELOW / LEFT
Screw Drives	**I**	=	Motor Mounted		INLINE
	P	=	"	"	PARALLEL
	PR	=	"	"	PARALLEL / RIGHT
	PL	=	"	"	PARALLEL / LEFT

7 Mounting Styles

A = Side Angle Brackets
B = Adjustable T-Nuts
C = Front & Rear Rectangular Flanges

8 Carriage

S = Single Carriage
D = Dual Carriage *(screw-drive only)*

9 English/Metric (Carriage/Mounting)

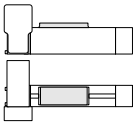
E = English carriage & mounting dimensions
M = Metric carriage & mounting dimensions

10 Actuator Options

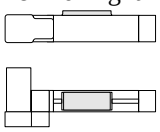
B*x*M = Brake on Motor
B*x*S = Brake on Leadscrew
E*x*M = Encoder on Motor
PN = Pre-loaded Nut

Motor Orientations

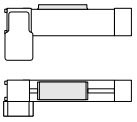
-AR Over Right



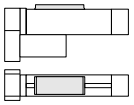
-BR Behind Right



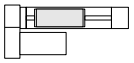
-CR Under Right



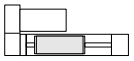
- P Parallel Underneath



-PR Parallel Right Side



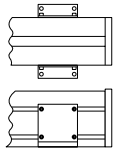
-PL Parallel Left Side



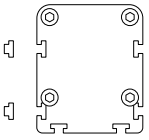
-I In-line

Mounting Styles

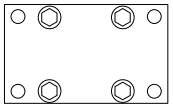
-A Angle Brackets



-B T-Nuts



-C Front / Rear Flanges



2. Mounting / Performance

WARNING! Power to the electric linear actuator should be **OFF** before attempting any physical installation or adjustments to the actuator mounting, rod end attachments, or the load.

Mounting Actuator To Machine

Surface Preparation

The mounting surface should be flat, to prevent undesired stresses in the actuator system and minimize *straightness & flatness* errors. The surface should also be free of dirt & debris.

Parallelism to External Bearings and Guides

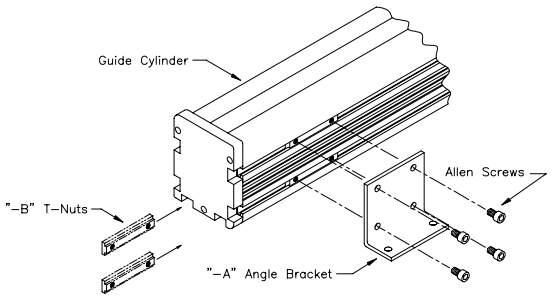
When supplemental bearings are used to guide or support the load, it is critical that the actuator and/or external bearings be in alignment at both extremes of travel. If not, severe forces may be transmitted through the load and carriage, resulting in failure or shortened service life.

Use Care When Fixing Carriage to External Bearings

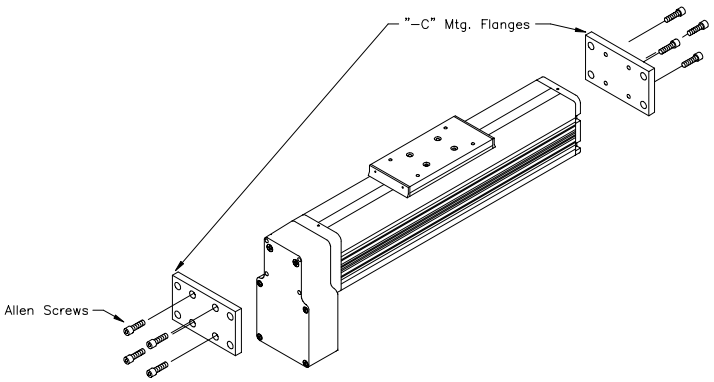
When a load is supported externally, (i.e. by a precision ball-bearing rail system) the mounting surface which attaches to the carriage must be at the same height as the carriage. Any clearance before tightening mounting screws will create severe forces on the carriage, potentially resulting in failure or shortened service life.

Mounting Options

-*A* : Side Angle Brackets
-*B* : T-Nuts

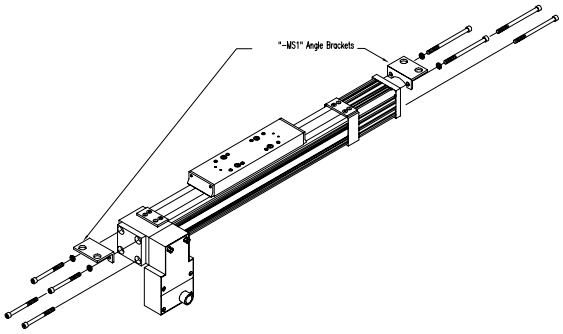


-*C* : Rectangular Flanges

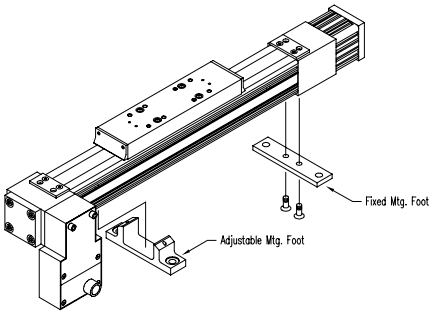


Note
When securing to the Front and Rear Mounting flanges care should be taken to align the plates to their mating surfaces so as not to cause the body of the actuator to twist.

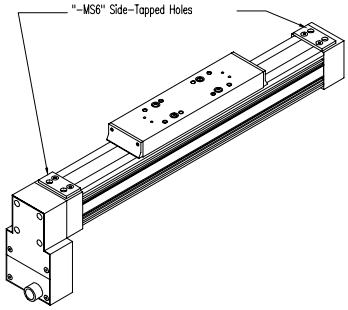
-MS1 : Side Angle Brackets



-MS5 : Adjustable Feet

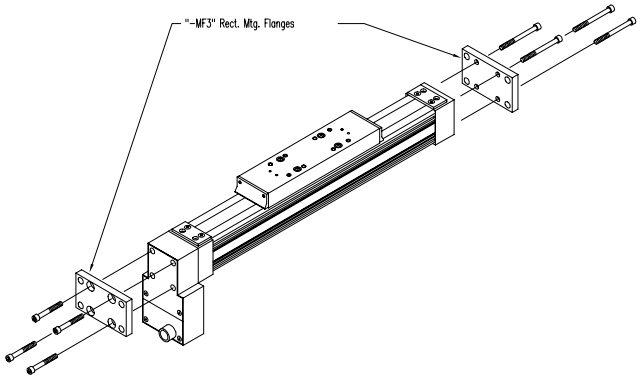


-MS6 : Side-Tapped Holes



Note: Fasteners screw into blind hole. Do not use a fastener that protrudes more than 0.31 inches [7.8mm] into tapped hole.

-MF3 : Rectangular Flanges



Recommended Torque Values - Mounting Options

Actuator Series	Mtg. Option	Fastener Size	Tightening Torque[1]	
R2A	-MS5	¼-20 SHCS	80 in-lbs	9.0 N-m
	-MS6	¼-20	80 in-lbs	9.0 N-m
		M6 × 1.0	80 in-lbs	9.0 N-m
R3	-A / -B	10-32	40 in-lbs	4.3 N-m
		M5 × 0.8	45 in-lbs	5.1 N-m
R4	-A / -B	10-32	40 in-lbs	4.3 N-m
		M5 × 0.8	45 in-lbs	5.1 N-m

[1] values are for unlubricated, stainless steel fasteners

Attaching Payload To Carriage

Recommended Torque Values - Payload to Carriage

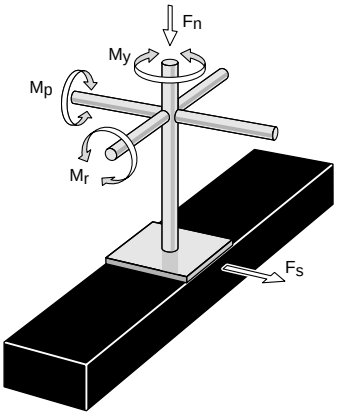
Use the following torque values when attaching the payload to the carriage:

Actuator	Fastener Size	Tightening Torque[1]
R2A / R3	10-32	40 in-lbs [4.3 N-m]
	M5 × 0.8	45 in-lbs [5.1 N-m]
R4	1/4-20	80 in-lbs [9.0 N-m]
	M6 × 1.0	80 in-lbs [9.0 N-m]

[1] values are for unlubricated, stainless steel fasteners

Carriage Load Limits

Even when loads are mounted directly to the carriage surface, bending loads are created in the carriage assembly since the force is not transmitted in a straight line with the internal screw or belt.
Using the calculations below as an example, verify that loads are within the limits of your actuator.



Actuator	F_n (Payload) lbs [N]	M_r (Roll) in·lbs [N·m]	M_p (Pitch) in·lbs [N·m]	M_y (Yaw) in·lbs [N·m]
R2A	50 [220]	200 [22.6]	200 [22.6]	200 [22.6]
R3	100 [440]	300 [33.9]	500 [56.5]	500 [56.5]
R4	300 [1300]	600 [67.8]	1000 [113]	1000 [113]

What is a "moment load?"

"Moment Load" is a term used to describe the bending loads transmitted to the carriage assembly and internal bearing system. Exceeding the limits in the table above can result in mechanical failure of the actuator.
Calculating moment loads is done as follows:

Equation: $M = F \times r$

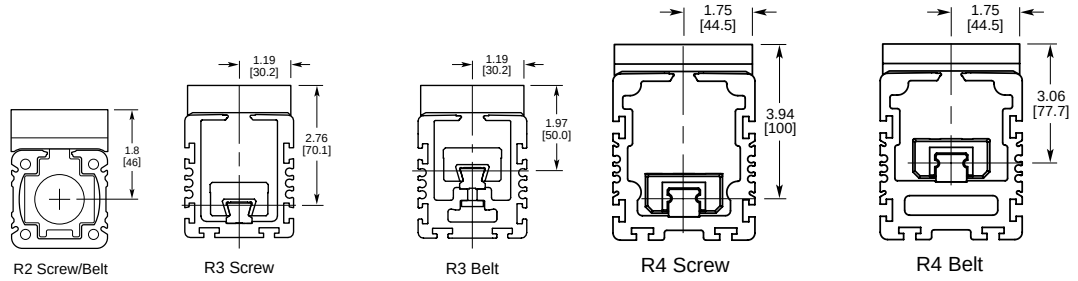
F = Force Applied

r = distance from point where force is applied to internal screw/belt

Example: M_p = (50 pounds force) × (4 inches + 2 inches)

M_p = 300 inch-pounds

Distances needed to calculate moment loads:



Mounting Limit Switches For Overtravel Protection

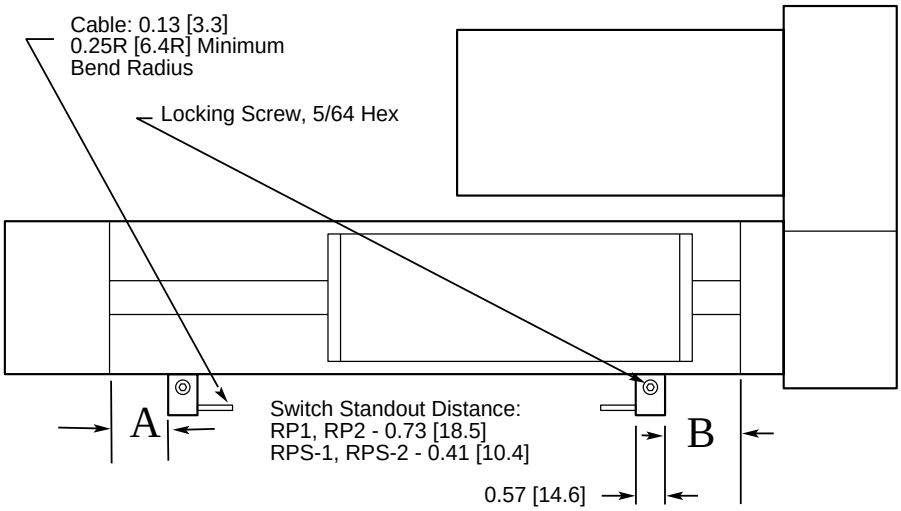
Limit switches should be mounted at each end of an actuator to limit travel within a desired operating area. IDC rodless actuators include integral position sensor tracks, allowing sensor placement anywhere over the entire travel range.

Limit switches are helpful during initial setup or testing, and program development. If the motor is accidentally commanded to move toward a hard-stop, position sensors will signal the control to stop before a collision occurs. Without limit switches, if the carriage travels to one end of the actuator, an internal *elastomeric spring* will help absorb shock loads*, but the actuator may become jammed at this extreme position limit. Position sensors (limit switches) are used to prevent such potentially damaging jam conditions.

**Note: Repeatedly contacting the internal elastomeric spring may reduce actuator life.*

Minimum Limit Switch Mounting Distance from Actuator End

The drawing below indicates the point where the magnetic limit switch will trigger simultaneously with hitting the internal hard-stop (elastomeric spring).



Switch Location where End of Travel Occurs

Actuator	Type	**A**	**B**
R2A	Screw	3.5 in.	3.5 in.
	Belt	4.5 in.	4.5 in.
R3	Screw	0.5 in.	7.5 in.
	Belt	4.5 in.	4.5 in.
R4	Screw	2.0 in.	8.0 in.
	Belt	4.5 in.	4.5 in.

Limit Switch Mounting Location - Deceleration Distance

The limit switch's location on the actuator is associated with the *beginning* of a deceleration, not the final stopping point. Therefore, limit switches must be mounted inward of the actuator hard-stops, so as to provide a slowdown area and prevent jamming. The faster the approach speed, the longer it takes to stop the actuator, so deceleration distance varies with actuator speed, load, and actuator/control type. Some adjustment is usually necessary during initial setup.

Position Sensor Specifications

(RP1, RP2, RPS-1, & RPS-2)

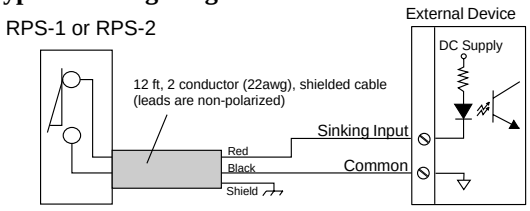
Position sensors are available in *normally open* and *normally closed* versions. Hall Effect (RP1 / RP2) and Reed Contact (RPS-1 / RPS-2) switches are compatible with the R Series Actuators. Switches are activated by two internal position indicating magnets on opposite sides of the drivenut.

- All sensors include a 12 ft [3.7m] shielded cable.
- Recommended minimum distance between switches is 0.65 inches [16.5mm].
- Sensors used for overtravel protection (mounted at the ends of travel) will reduce the actual travel by at least 0.3 inches [8mm] per sensor.

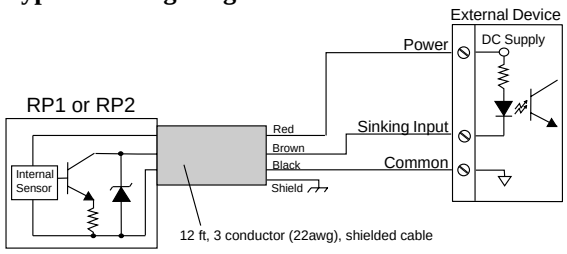
Position Sensor Specifications

Model #	**RPS-1**	**RPS-2**	**RP1**	**RP2**
Type	Magnetic Reed Switches Contact Closure		Hall Effect Sensors Open Collector, Sinking Output	
Connection	Normally Open	Normally Closed	Normally Open	Normally Closed
# of leads	2 Wire	2 Wire	3 Wire	3 Wire
Voltage (VDC)	100VDC	100VDC	8 - 28VDC	8 - 28 VDC
Voltage (VAC)	100VAC	100VAC	-----	-----
Current (Amps)	.25A	.20A	40ma	40ma
Power (Watts)	7W	2W	1.1W	1.1W
Supply Voltage (VDC)	-----	-----	8 - 28VDC	8 - 28 VDC
Supply Current (ma)	-----	-----	22ma	22ma
Supply Power (watts)	-----	-----	.6W	.6W
Operating Temperature	-22° to 212°F [-30° to 100°C]		-4° to 140°F [-20° to +60°C]	
Storage Temperature	-22° to 212°F [-30° to 100°C]		-22° to 176°F [-30° to 80°C]	
Humidity Rating	0 to 95% non-condensing		0 to 95% non-condensing	

Typical Wiring Diagram for RPS-1 and RPS-2



Typical Wiring Diagram for RP1 and RP2

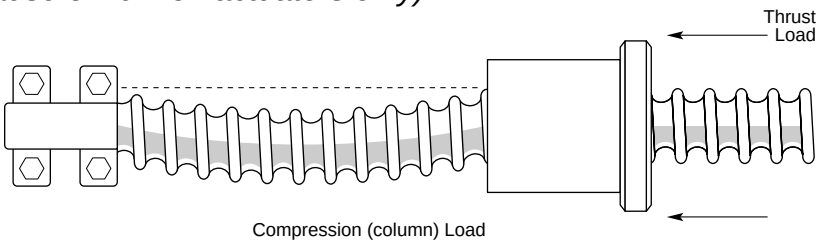


3. Application Considerations

Certain conditions can limit actuator performance and should be addressed prior to installation and operation. Please review the following information to insure that your actuator has been properly applied in your machine design.

Column Loading

(leadscrew-driven actuators only)



All leadscrews have a column loading limit which causes the screw to buckle or bend as thrust load increases. This limit is a function of unsupported leadscrew length. Exceeding this limit will cause the leadscrew to buckle and become permanently damaged.

Thrust Load Limitations Due to Length

R2A Series	Actuator Stroke Length (inches)							
Screw Type	≤18”	24”	30”	36”	42”	48”	60”	72”
2B/5B	>400 [>1779]	>400 [>1779]	>400 [>1779]	>400 [>1779]	398 [1769]	304 [1354]	195 [867]	135 [602]
5A	>400 [1779]	394 [1751]	252 [1121]	175 [778]	129 [572]	98 [438]	63 [280]	44 [195]

Note: Above loads are in units of lbs [N]

R3 Series	Actuator Stroke Length (inches)							
Screw Type	≤18”	24”	30”	36”	42”	48”	60”	72”
2B/5B	>800 [>3559]	>800 [>3559]	779 [3467]	541 [2408]	398 [1769]	304 [1354]	195 [867]	135 [602]
5A	700 [3113]	394 [1751]	252 [1121]	175 [778]	129 [572]	98 [438]	63 [280]	44 [195]

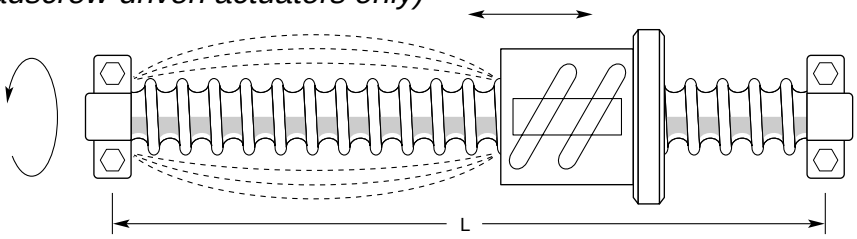
Note: Above loads are in units of lbs [N]

R4 Series	Actuator Stroke Length (inches)					
Screw Type	≤72”	72”	84”	96”	108”	
1B/4B	>1200 [>5338]	>1200 [>5338]	>1200 [>5338]	1101 [4899]	870 [3871]	
6A	>1200 [>5338]	>1200 [>5338]	>1200 [>5338]	930 [4135]	735 [3267]	

Note: Above loads are in units of lbs [N]

Critical Speed

(leadscrew-driven actuators only)



Leadscrew-driven actuators are speed-limited by the *critical speed* (also called the natural resonant speed) of the leadscrew. This speed is a function of actuator stroke length and leadscrew diameter. Operation at or above the critical speed limit can cause the leadscrew to bend permanently, resulting in low performance and noisy operation.

Speed Limitations Due to Length

R2A Series	Actuator Stroke Length (inches)							
Screw Type	18"	24"	30"	36"	42"	48"	60"	72"
2B	---	22.3[567]	15.5[393]	11.4[288]	8.7[220]	6.9[174]	4.6[116]	3.3[83]
5B	14.0[356]	8.9[227]	6.2[157]	4.5[115]	3.5[88]	2.7[70]	1.8[47]	1.3[33]
5A	10.6[268]	6.7[171]	4.7[119]	3.4[87]	2.6[67]	2.1[53]	1.4[35]	1.0[25]

Note: Above speeds are in units of inches/sec [mm/sec]

R3 Series	Actuator Stroke Length (inches)							
Screw Type	18"	24"	30"	36"	42"	48"	60"	72"
2B	---	23.6[599]	16.2[411]	11.8[299]	9.0[228]	7.1[179]	4.7[119]	3.3[85]
5B	---	9.4[240]	6.5[165]	4.7[120]	3.6[91]	2.8[72]	1.9[48]	1.3[34]
5A	11.3[287]	7.1[181]	4.9[124]	3.6[90]	2.7[69]	2.1[54]	1.4[36]	1.0[26]

Note: Above speeds are in units of inches/sec [mm/sec]

R4 Series	Actuator Stroke Length (inches)							
Screw Type	36"	42"	48"	60"	72"	84"	96"	108"
1B	---	35.4[898]	28.4[722]	19.5[496]	14.2[361]	10.8[275]	8.5[216]	6.9[174]
4B	11.3[287]	8.8[225]	7.1[181]	4.9[124]	3.6[90]	2.7[69]	2.1[54]	1.7[44]
6A	7.2[183]	5.6[144]	4.5[115]	3.1[79]	2.3[58]	1.7[44]	1.4[35]	1.1[28]

Note: Above speeds are in units of inches/sec [mm/sec]

Duty Cycle Limits

Duty Cycle is the percentage of On Time divided by Total Cycle Time for the worst case 10 minute period. The maximum power dissipation of the motor and the frictional heat losses of the internal cylinder components (primarily the leadscrew/drivenut assembly) limit operating loads to less than 100% duty cycle for some models. In general, ballscrew actuators are rated for 100% duty cycle and acme screws are rated for a maximum of 60%. Exceeding the recommended duty cycle will damage the motor or internal cylinder components. Consult IDC *Electric Linear Actuators & Controls* Catalog for individual model number ratings.

Environmental Specifications

Temperature Rating

Standard Actuator -20° to 140°F [-29° to 60°C]

Moisture/Contaminants - IP44

R Series rodless actuators are rated per the IP (Ingress Protection) industry standard for resistance to liquid and solid contaminants as **IP44**.

IP44 is defined as follows:

First Digit (4): protected against *solid objects 1 mm in diameter*
Second Digit (4): protected against *splashing water*

For applications where exposure is unavoidable with a corrosive liquid or a pressurized liquid, please consult the factory for assistance.

Backdriving

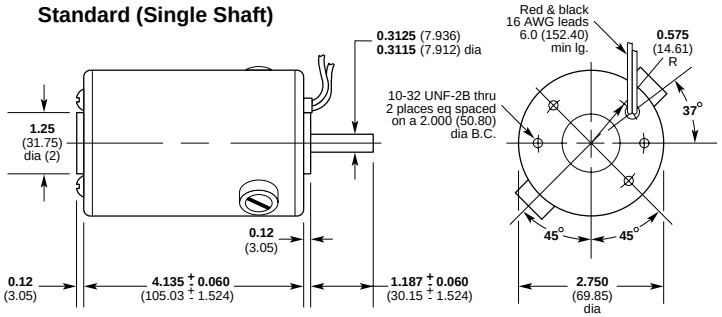
Backdriving is when the carriage is forced to move by an external force. This is an important consideration for actuators being used in a vertical orientation or when a thrust load is applied to the carriage when there is not sufficient holding torque from the motor. An actuator will hold position up to the thrust limit known as the backdrive limit. The IDC *Electric Linear Actuators & Controls* Catalog shows specific backdrive force limits for each actuator model. Acme screws, due to their inherent self-locking action, have considerably higher limits than ballscrew driven actuators. Belt-driven actuators usually offer very low backdrive limits.

Actuator Type		**Description**	**Load Required to Backdrive**	
Belt Drive	*T*	Tangential Belt / Pulley	*Do not rely on belt to hold load.*	
Ballscrew	***1B***	1 Pitch, 1.000” lead	15 - 100 lbs	[67 - 445 N]
	2B	2 Pitch, 0.500” lead	10 - 15 lbs	[45 - 67 N]
	4B	4 Pitch, 0.250” lead	75 - 450lbs	[333 - 2000 N]
	5B	5 Pitch, 0.200” lead	20 - 25 lbs	[89 - 111N]
Acme Screw	***5A***	5 Pitch, 0.200” lead	100 - 400 lbs	[440 - 1800N]
	6A	6 Pitch, 0.167” lead	2400 lbs	[10700N]
	8A	8 Pitch, 0.125” lead	600 - 800 lbs	[2700 - 3600N]

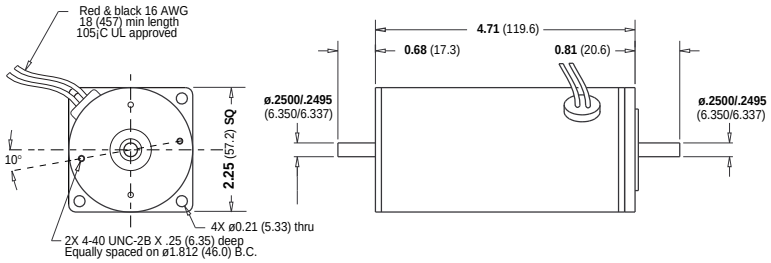
4. Motor Wiring / Specifications

D 24V DC Motor Specifications

Standard (Single Shaft)



Inline (Double Shaft)



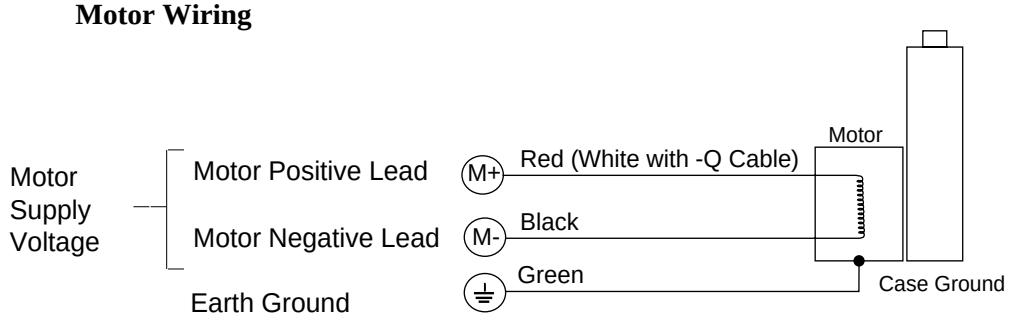
Electrical Data

Rated Voltage	V	24
Max. Continuous Current	A	4.5
Max. Operating Voltage	V	36
Inductance	mH	2.0
K_t Torque Constant (± 10%)	oz-in/A [N-m/A]	8.9 [0.062]
K_v Voltage Constant (± 10%)	V/kRPM	6.5
Winding Resistance @ Ambient	Ohms	1.0

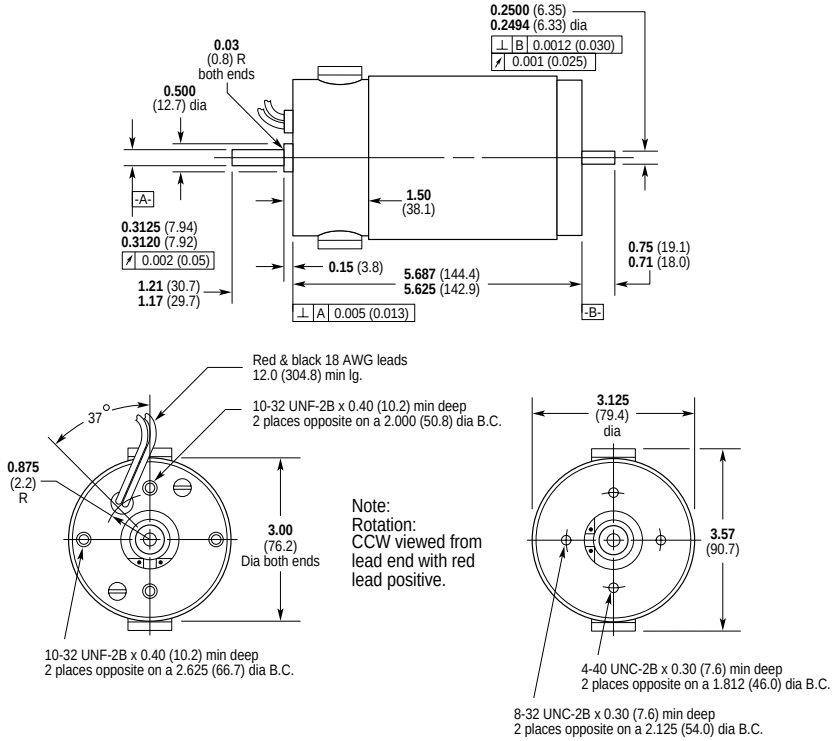
Mechanical Data

Continuous Stall Torque	oz-in [N-m]	40 [0.28]
No-load Speed at Rated Voltage	RPM	3600
No-load Current	A	0.5
Rotor Inertia	oz-in-s^2 [kg-cm^2]	0.018 [1.3]
Max. Winding Temperature	°F [°C]	180 [82]

Motor Wiring



H 160V DC Servo Motor Specifications



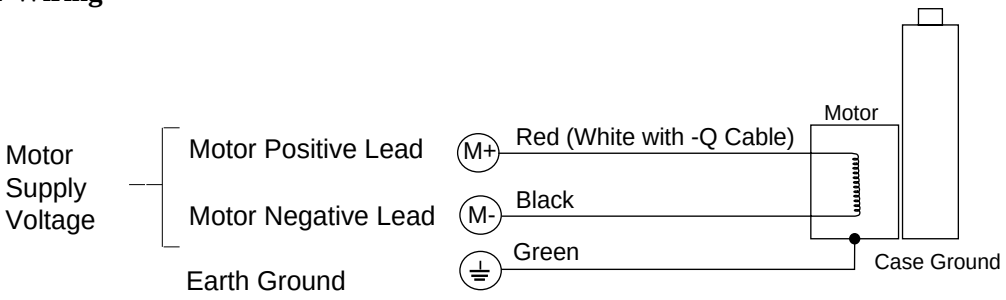
Electrical Data

Rated Voltage	V	160
Max. Operating Voltage	V	180
Max. Continuous Current	A	2.0
Max. No-load Current	A	0.22
Number of Poles		2
Inductance	mH	25
Winding Resistance @ Ambient	ohms	6.4
K_t Torque Constant (± 10%)	oz-in/A [N-m/A]	54 [0.38]
K_v Voltage Constant (± 10%)	V/kRPM	40

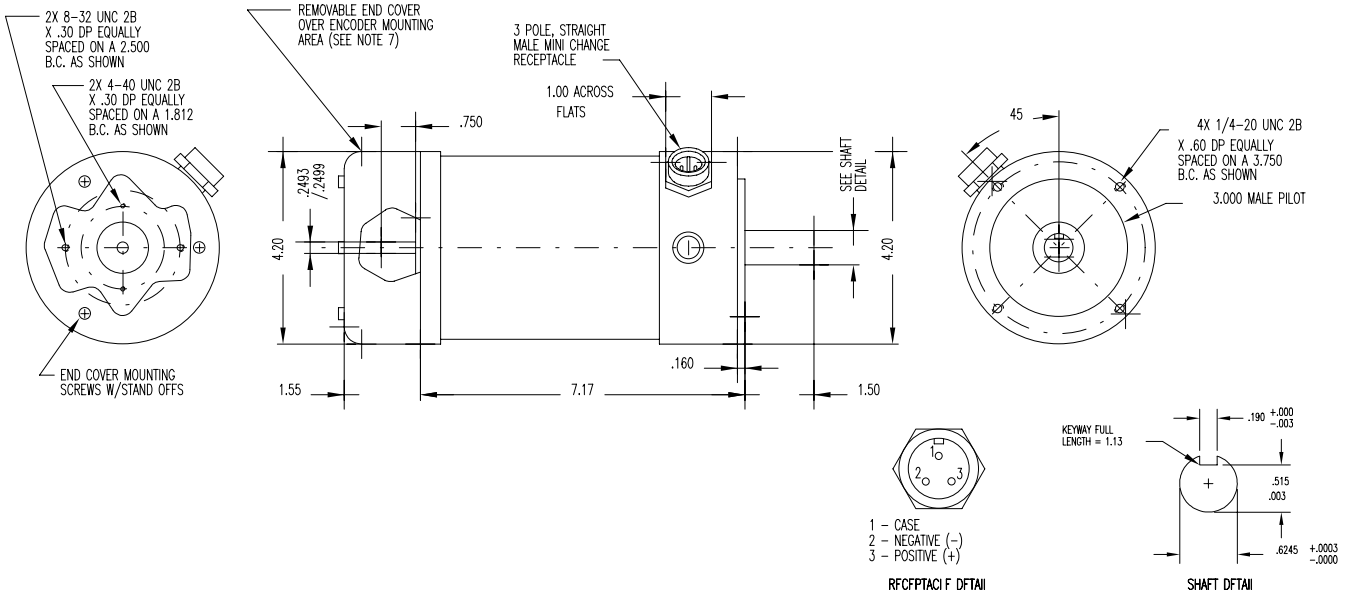
Mechanical Data

Continuous Stall Torque	oz-in [N-m]	108 [0.76]
No-load Speed at Rated Voltage	RPM	3900
Rotor Inertia	oz-in-s^2 [kg-cm^2]	0.049 [3.46]
Max. Winding Temperature	°F [°C]	180 [82]

Motor Wiring



H4 160V DC Servo Motor Specifications



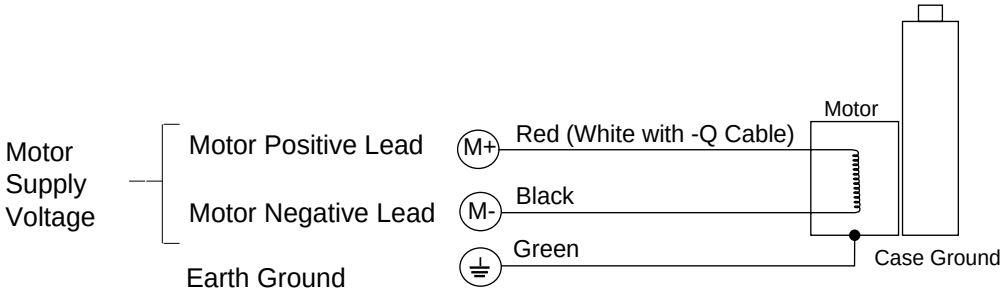
Electrical Data

Rated Voltage	V	160
Max. Operating Voltage	V	180
Max. Continuous Current	A	7.0
Max. Starting Current	A	0.7
Number of Poles		2
Inductance	mH	12
Winding Resistance @ Ambient	Ohms	1.5
K_t Torque Constant (± 10%)	oz-in/A [N-m/A]	67 [0.47]
K_v Voltage Constant (± 10%)	V/kRPM	49

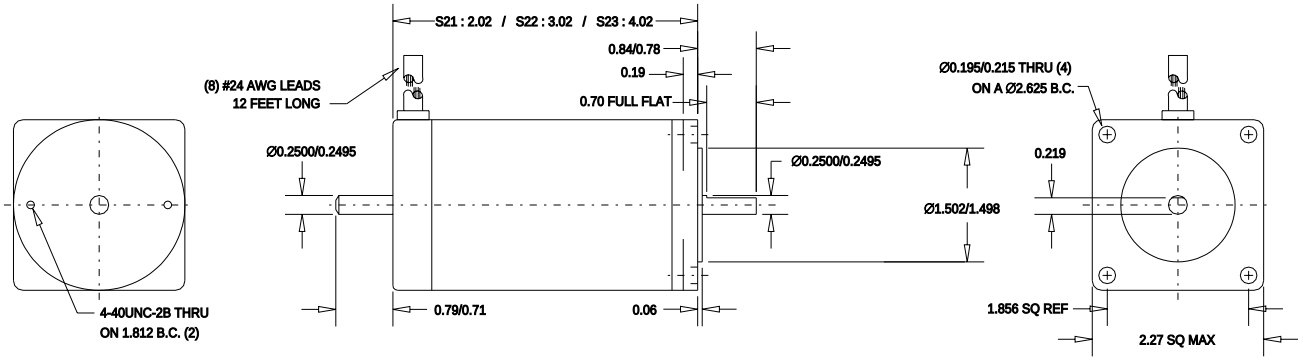
Mechanical Data

Continuous Stall Torque	oz-in [N-m]	425 [3.0]
No-load Speed at Rated Voltage	RPM	3200
Rotor Inertia	oz-in-s^2 [kg-cm^2]	0.20 [14]
Weight	lbs [kg]	12 [5.4]

Motor Wiring



S21/S22/S23 Hybrid Step Motor Specifications



Electrical Data

		S21T (Series)	S21V (Parallel)	S22T (Series)	S22V (Parallel)	S23T (Series)	S23V (Parallel)
Continuous Stall Torque	oz-in [N-m]	65 [0.46]		100 [0.71]		125 [0.88]	
Recommended Current/Phase	Amps	1.2	2.4	1.5	3.0	1.75	3.5
Winding Resistance @ Ambient	Ohms	5.4	1.35	4.8	1.2	4.4	1.1
Inductance	mH	18	4.5	18	4.5	18	4.5
Max. Winding Temperature	°F [°C]	212 [100]		212 [100]		212 [100]	

Mechanical Data

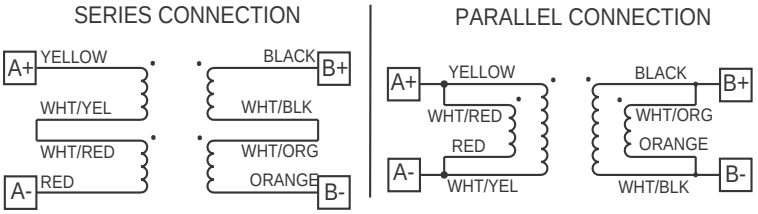
		S21(T / V)	S22(T / V)	S23(T / V)
Rotor Inertia	oz-in-s^2 [kg-m^2]	1.66×10^{-3} [1.17×10^{-5}]	3.31×10^{-3} [2.34×10^{-5}]	4.97×10^{-3} [3.51×10^{-5}]
Axial Shaft Load	lbs [N]	25 [111]	25 [111]	25 [111]
Radial Shaft Load - @ 0.5”	lbs [N]	5.6 [25]	5.6 [25]	5.6 [25]
Motor Weight	lbs [kg]	1.6 [0.73]	2.4 [1.1]	3.2 [1.5]
Step Angle (full step)	degrees	1.8	1.8	1.8

Notes

- Parallel (V) Wiring: 60% Duty Cycle Max. Above 5 rps (300 rpm).
- Always use at least 50% torque safety margin when applying step motors.

Motor Wiring

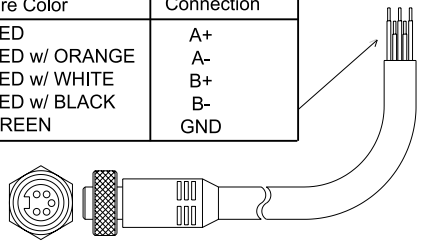
12 ft [3.7m] Wire Leads - Models S21N / S22N / S23N



Quick-Disconnect - Models S21(T/V) / S22(T/V) / S23(T/V)

(Available with NS23T/V and R2AS23T/V actuators only)

Quick Disconnect Wire Color	Drive Connection
RED	A+
RED w/ ORANGE	A-
RED w/ WHITE	B+
RED w/ BLACK	B-
GREEN	GND



S6000 Drive Settings

S21T (Series)

Motor Current	Inductance
1.2 Amps	**16* mH**
Amps / Tenths of Amps	mH

S21V (Parallel)

Motor Current	Inductance
2.4 Amps	**4* mH**
Amps / Tenths of Amps	mH

*Drive setting closest to actual motor specifications.

S22T (Series)

Motor Current	Inductance
1.5 Amps	**16* mH**
Amps / Tenths of Amps	mH

S22V (Parallel)

Motor Current	Inductance
3.0 Amps	**4* mH**
Amps / Tenths of Amps	mH

*Drive setting closest to actual motor specifications.

S23T (Series)

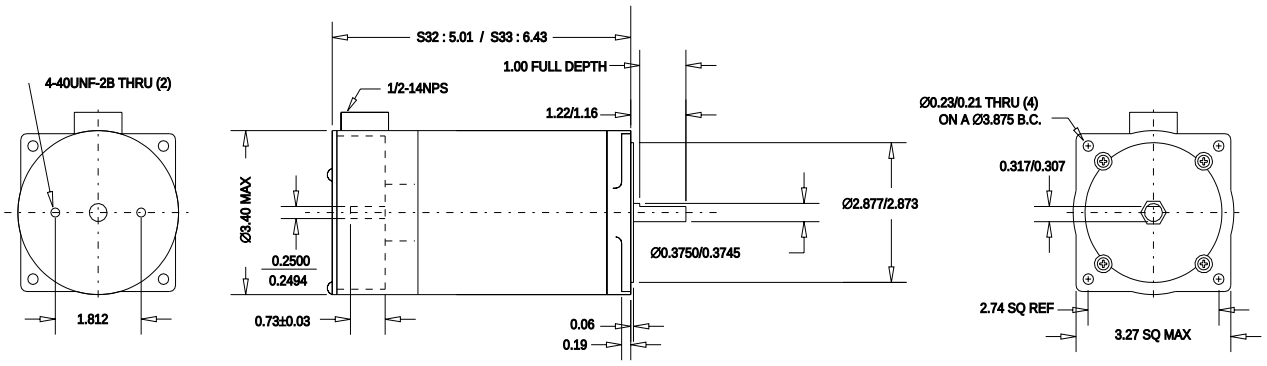
Motor Current	Inductance
1.7* Amps	**16* mH**
Amps / Tenths of Amps	mH

S23V (Parallel)

Motor Current	Inductance
3.5 Amps	**4* mH**
Amps / Tenths of Amps	mH

*Drive setting closest to actual motor specifications.

S32/S33 Hybrid Step Motor Specifications



Electrical Data

		S32T (Series)	S32V (Parallel)	S33T (Series)	S33V (Parallel)
Continuous Stall Torque	oz-in [N-m]	300 [7.1]		400 [5.3]	
Recommended Current/Phase	Amps	2.8	5.6	3.5	7.0
Winding Resistance @ Ambient	Ohms	1.03	.26	.96	.24
Inductance	mH	10	2.5	10	2.5
Max. Winding Temperature	°F [°C]	212 [100]		212 [100]	

Mechanical Data

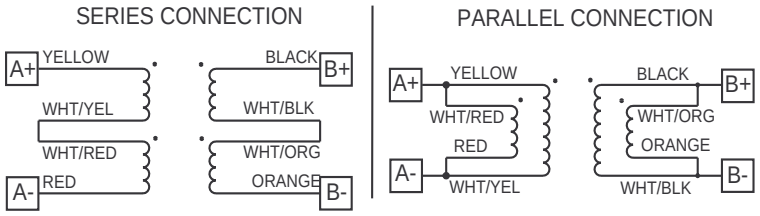
		S32(T/V)	S33(T/V)
Rotor Inertia	oz-in-s^2 [kg-m^2]	0.017 [3.51×10^{-5}]	0.0265 [3.51×10^{-5}]
Axial Shaft Load	lbs [N]	50 [222]	50 [222]
Radial Shaft Load - at .5 in	lbs [N]	14.5 [64.4]	14.5 [64.4]
Motor Weight	lbs [kg]	5.1 [2.3]	8.3 [3.8]
Step Angle (full step)	degrees	1.8	1.8

Notes

- Parallel (V) Wiring: 60% Duty Cycle Max. Above 5 rps (300 rpm).
- Always use at least a 50% torque safety margin when applying step motors.

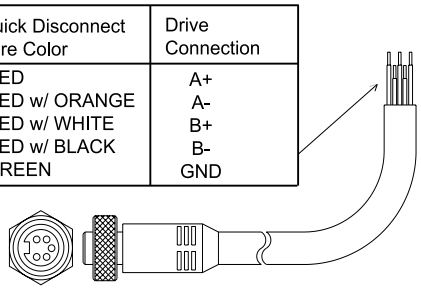
Motor Wiring

12 ft [3.7m] Wire Leads : S32N/S33N



Quick-Disconnect : S32(T/V) / S33(T/V)

Quick Disconnect Wire Color	Drive Connection
RED	A+
RED w/ ORANGE	A-
RED w/ WHITE	B+
RED w/ BLACK	B-
GREEN	GND



S6000 Drive Settings

S32T (Series)

Motor Current	Inductance
2.8 Amps	**8* mH**
Amps	mH
Tenths of Amps	

S32V (Parallel)

Motor Current	Inductance
5.6 Amps	**4* mH**
Amps	mH
Tenths of Amps	

*Drive setting closest to actual motor specifications.

S33T (Series)

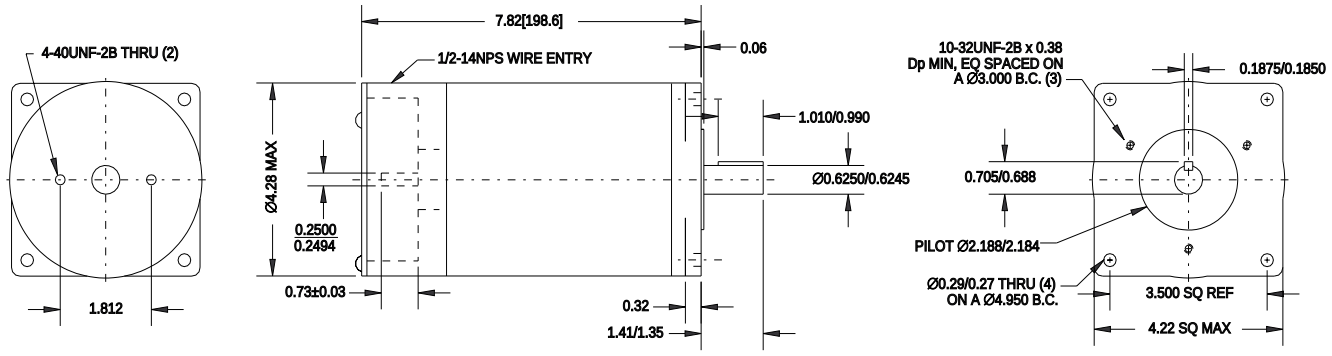
Motor Current	Inductance
3.5 Amps	**8* mH**
Amps	mH
Tenths of Amps	

S33V (Parallel)

Motor Current	Inductance
7.0 Amps	**4* mH**
Amps	mH
Tenths of Amps	

*Drive setting closest to actual motor specifications.

S42 Hybrid Step Motor Specifications



Electrical Data

		S42T (Series)	S42V (Parallel)
Continuous Stall Torque	oz-in [N-m]	1000 [7.1]	725 [5.1]
Recommended Current/Phase	Amps	6.0	7.9
Winding Resistance @ Ambient	Ohms	.36	.09
Inductance	mH	7	1.75
Max. Winding Temperature	°F [°C]	212 [100]	

Mechanical Data

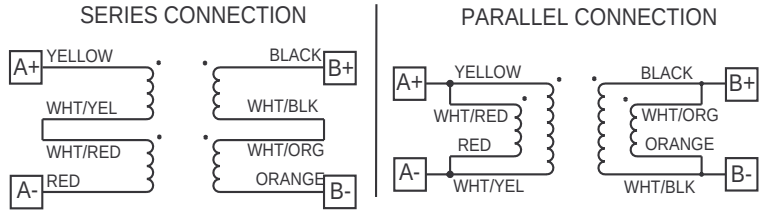
		S42 (T/V)
Rotor Inertia	oz-in-s^2 [kg-m^2]	114×10^{-3} [80.5×10^{-5}]
Axial Shaft Load	lbs [N]	65 [289]
Radial Shaft Load - @ 0.5”	lbs [N]	23.6 [105]
Motor Weight	lbs [kg]	19.1 [8.66]
Step Angle (full step)	degrees	1.8

Notes

- Parallel (V) Wiring: 60% Duty Cycle Max. Above 5 rps (300 rpm).
- Always use at least 50% torque safety margin when applying step motors.

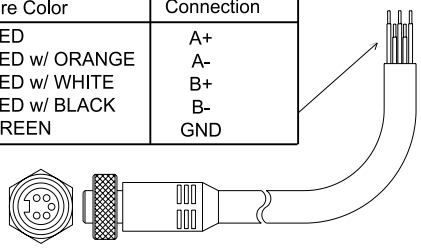
Motor Wiring

12 ft [3.7m] Wire Leads : S42N



Quick-Disconnect : S42(T/V)

Quick Disconnect Wire Color	Drive Connection
RED	A+
RED w/ ORANGE	A-
RED w/ WHITE	B+
RED w/ BLACK	B-
GREEN	GND



S6000 Drive Settings

S42T (Series)

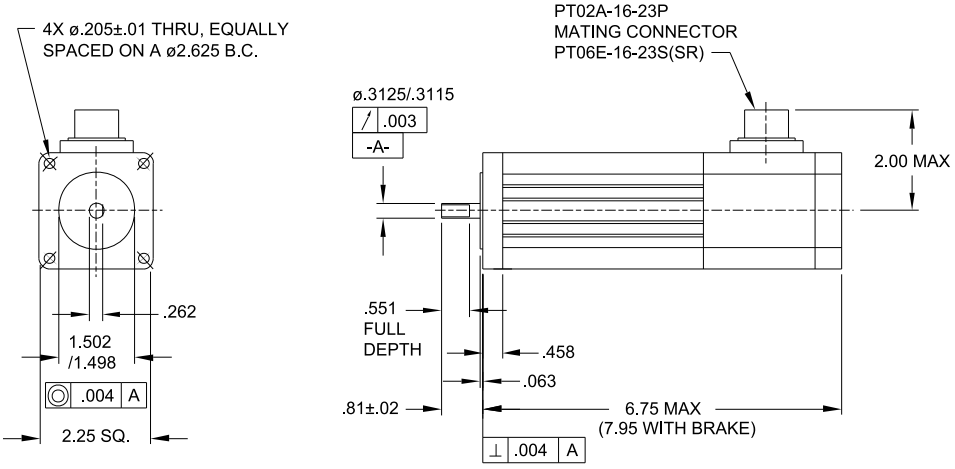
Motor Current	Inductance
6.0 Amps	**8* mH**
Amps	mH
Tenths of Amps	

S42V (Parallel)

Motor Current	Inductance
7.9* Amps	**4* mH**
Amps	mH
Tenths of Amps	

*Drive setting closest to actual motor specifications.

B23 Brushless Servo Motor Specifications



Electrical Data

Continuous Stall Torque	oz-in [N-m]	161 [1.14]
Cont. Torque at Rated Speed	oz-in [N-m]	144 [1.02]
Winding Resistance @ Ambient	ohms	10.6
Winding Resistance @ T_{max}	ohms	15.2
Inductance	mH	16.1
K_t, Phase to Phase Peak	oz-in/A [N-m/A]	57.6 [0.41]
K_v	Vp-p/kRPM	45.5
Number of Poles		4
Electrical Time Constant	ms	1.769

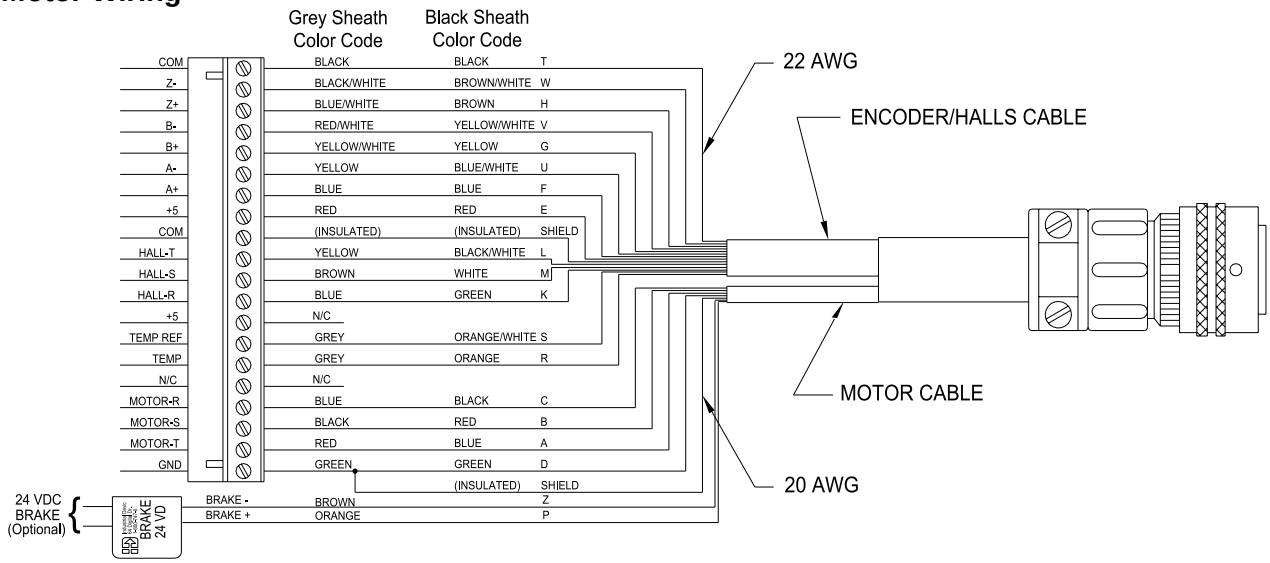
Mechanical Data

Rotor Inertia	oz-in-s2 [kg-m2]	0.0019 [1.34×10^{-5}]
Static Friction	oz-in [N-m]	12.8 [0.09]
Dynamic Friction	oz-in/kRPM [N-m/kRPM]	2.0 [0.01]
Thermal Resistance	°C/W	1.07
Max. Winding Temperature	°F [°C]	118 [155]
Mechanical Time Constant	ms	0.684
Axial Shaft Load	lbs [N]	15 [65]
Radial Shaft Load @ 1/2 in	lbs [N]	40 [180]
Weight	lbs [kg]	4 [1.8]

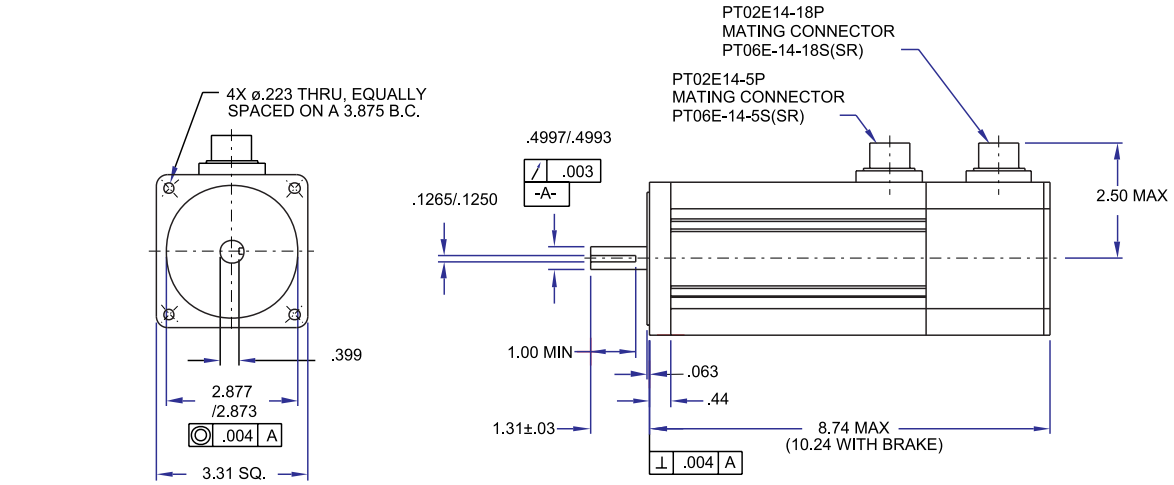
System Data with B8000 Series

		110VAC	*220VAC*
Max. Speed	RPM	3200	6500
Drive Bus Voltage	V	155	311
Drive Peak Current	A	8.3	
Ambient Temperature	°F [°C]	77 [25]	
RMS Output Power	W	288	355
Nominal Peak Power	W	353	1238
Nominal Peak Stall Torque	oz-in [N-m]	478 [3.38]	

Motor Wiring



B32 Brushless Servo Motor Specifications



Electrical Data

Continuous Stall Torque	oz-in [N-m]	480 [3.4]
Cont. Torque at Rated Speed	oz-in [N-m]	400 [2.8]
Winding Resistance @ Ambient	ohms	3.4
Winding Resistance @ T_{max}	ohms	5.1
Inductance	mH	9.8
K_t, Phase to Phase Peak	oz-in/A [N-m/A]	99.2 [0.70]
K_v	V_{p-p}/kRPM	77.8
Motor Constant	oz-in/$\sqrt{W}$ [N-m/$\sqrt{W}$]	53.4 [0.38]
Number of Poles		6
Electrical Time Constant	ms	2.837

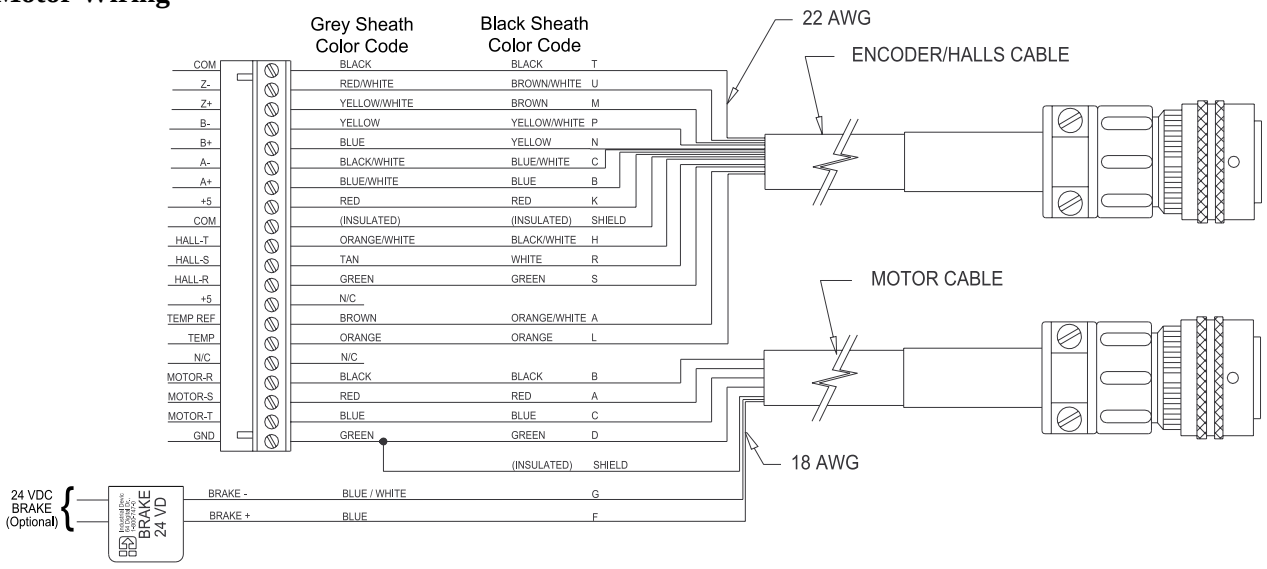
Mechanical Data

Rotor Inertia	oz-in-s^2 [kg-cm^2]	0.016 [1.13]
Static Friction	oz-in [N-m]	12.8 [0.09]
Dynamic Friction	oz-in/kRPM [N-m/kRPM]	2.0 [0.014]
Thermal Resistance	°C/W	1.0
Max. Winding Temperature	°F [°C]	310 [155]
0 Ohm Damping	oz-in/kRPM [N-m/kRPM]	2110 [14.9]
Mechanical Time Constant	ms	0.793
Axial Shaft Load	lbs [N]	25 [111]
Radial Shaft Load @ 1/2 in	lbs [N]	48 [214]
Weight	lbs [kg]	12 [5.4]

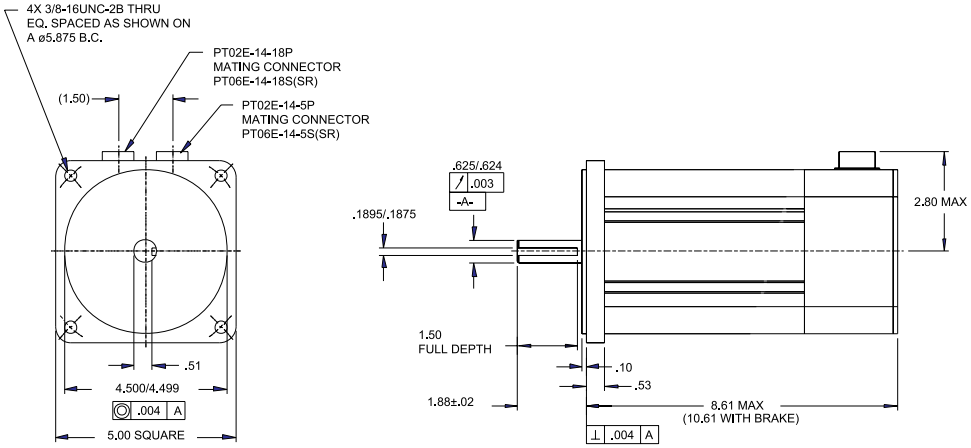
System Data with B8000 Series

		110VAC	*220VAC*
Max. Speed	RPM	1900	3800
Drive Bus Voltage	V	155	311
Drive Peak Current	A	10.0	10.0
Ambient Temperature	°F [°C]	77[25]	
RMS Output Power	W	459	918
Nominal Peak Power	W	978	1957
Nominal Peak Stall Torque	oz-in [N-m]	853 [6.0]	

Motor Wiring



B41 Brushless Servo Motor Specifications



Electrical Data

Continuous Stall Torque	oz-in [N-m]	864 [6.1]
Cont. Torque at Rated Speed	oz-in [N-m]	768 [5.4]
Winding Resistance @ Ambient	ohms	3.6
Winding Resistance @ T_{max}	ohms	5.4
Inductance	mH	24.0
K_t, Phase to Phase Peak	oz-in/A [N-m/A]	187 [1.32]
K_v	V_{p-p}/kRPM	148
Motor Constant	oz-in/$\sqrt{W}$ [N-m/$\sqrt{W}$]	98.3 [0.69]
Number of Poles		6
Electrical Time Constant	ms	6.667

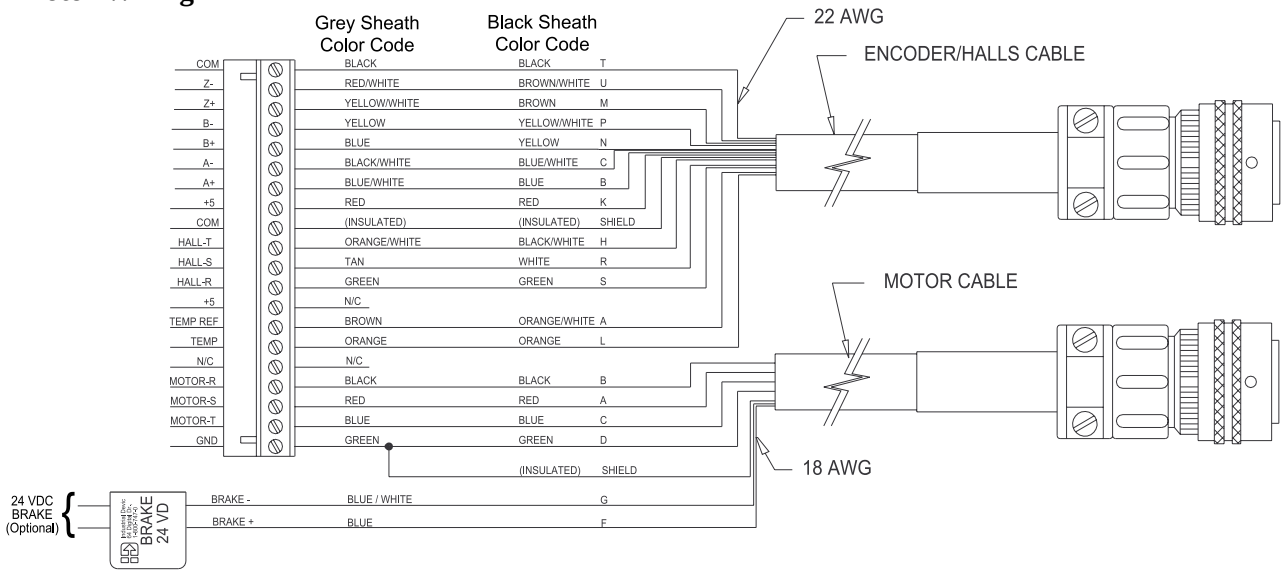
Mechanical Data

Rotor Inertia	oz-in-s^2 [kg-cm^2]	0.0416 [2.94]
Static Friction	oz-in [N-m]	16.0 [0.11]
Dynamic Friction	oz-in/kRPM [N-m/kRPM]	8.0 [0.056]
Thermal Resistance	°C/W	0.47
Max. Winding Temperature	°F [°C]	310 [155]
0 Ohm Damping	oz-in/kRPM [N-m/kRPM]	7150 [50.5]
Mechanical Time Constant	ms	0.609
Axial Shaft Load	lbs [N]	50 [222]
Radial Shaft Load @ 1/2 inch	lbs [N]	110 [490]
Weight	lbs [kg]	20 [9.1]

System Data with B8000 Series

		110VAC	*220VAC*
Max. Speed	RPM	1000	2000
Drive Bus Voltage	V	155	311
Drive Peak Current	A	10.0	10.0
Ambient Temperature	°F [°C]	77 [25]	
RMS Output Power	W	455	909
Nominal Peak Power	W	888	1770
Nominal Peak Stall Torque	oz-in [N-m]	1500 [10.6]	

Motor Wiring

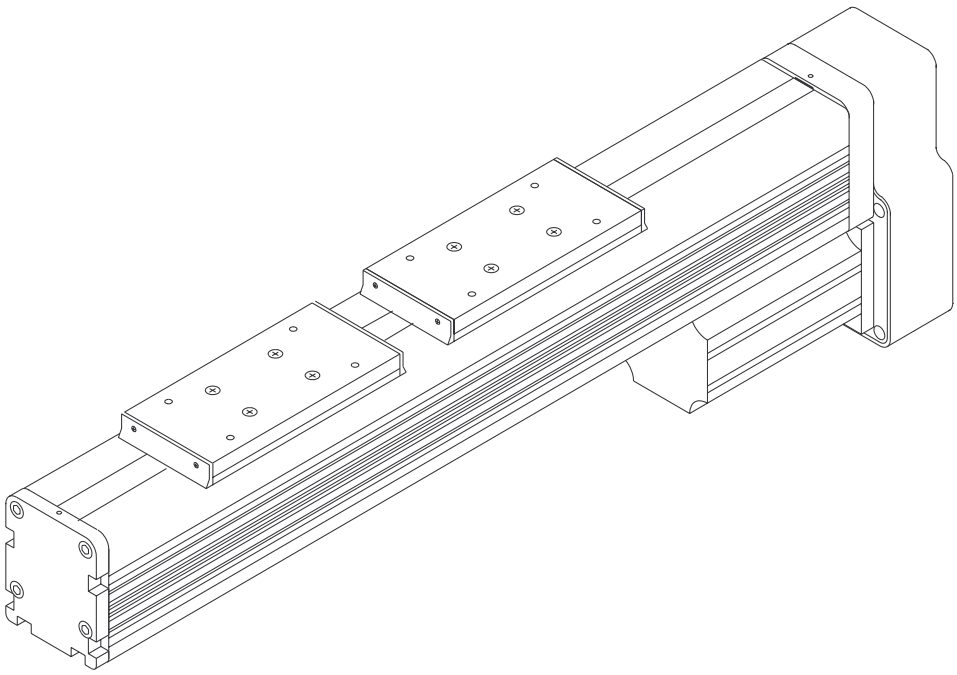


5. Options

Dual Carriage (-□D) Option

(screw-driven actuators only)

The dual carriage option provides a second, non-driven carriage to better support larger loads, by increasing the distance between support points. The second carriage is not attached to the leadscrew drive, but does connect to the internal bearing system. This allows field adjustment of the spacing between the two carriages. Since the load is attached to both carriages, the second carriage will travel together with the first.



Brake (-BS) Option

The brake option provides an electrically released, spring-set, friction brake mounted to an extension of the leadscrew. It prevents backdriving when the unit is at rest, or in the case of a power failure.

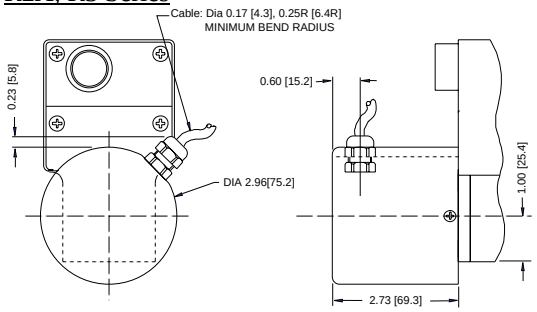
Without power, the brake is engaged. Applying 115VAC releases the brake, allowing motion to occur.

Note: The brake option is used only for in-position holding, it should not be used for stopping a moving load more quickly.

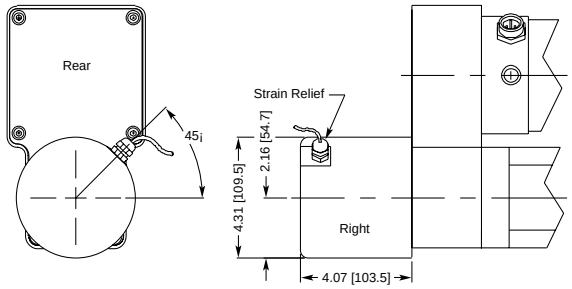
Specifications	R2A, R3 Series	R4 Series
Mounting Location	Leadscrew (see diagram below)	
Voltage	115VAC (to release)	
Current	0.11 Amps	0.14 Amps
Holding Torque	20 in-lbs	75 in-lbs
Cable Length	12 ft	12 ft
Holding Force		
Screw Type and Pitch	Holding Force with -BS lbs [N]	
1B (1 Pitch Ballscrew)	n/a	550 [2450]
2B (2 Pitch Ballscrew)	240 [1100]	n/a
4B (4 Pitch Ballscrew)	n/a	2200 [9790]
5B (5 Pitch Ballscrew)	640 [2900]	n/a
5A (5 Pitch Acme Screw)	800 [3600]	n/a
6A (6 Pitch Acme Screw)		2400 [10700]

Dimensions

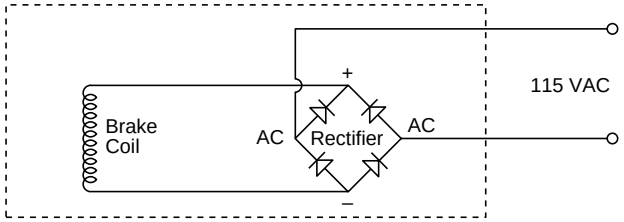
R2A, R3 Series



R4 Series



Electrical Connections



Encoder (-EM) Option

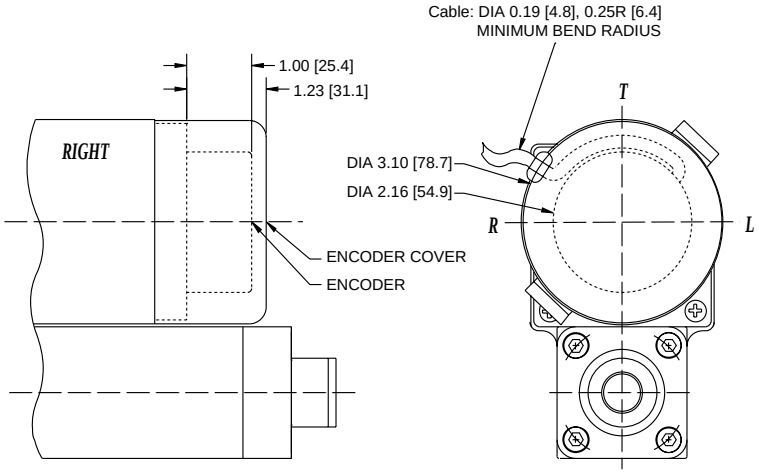
The encoder option provides an incremental 500 line rotary encoder, factory mounted directly to the rear shaft of an IDC motor. The digital pulse output is used to provide position feedback to external devices such as motor controllers, counters, or PLC's.

Note: 1. All encoders come with a 12ft [3.7m], 8 conductor (22AWG) cable.
2. Encoder cables can be extended up to a maximum of 200ft [60m].

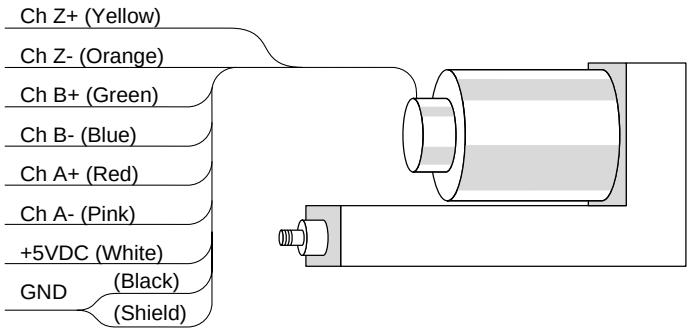
Specifications

Output Type	Incremental, TTL Level, dual channel square wave. Differential Line Driver.
Pulses Per Revolution	500 line with quadrature (2000 PPR), One index pulse
Supply Voltage	5VDC+/-10%
Current Requirements	80mA max
Frequency	100khz pre-quadrature, max

Dimensions



Electrical Connections



6. Maintenance and Troubleshooting

IDC Rodless Electric Linear Actuators are designed for maintenance-free operation over the service life of the product.

Periodic inspection and service can extend service life, especially under extreme operating conditions, such as continuous high speed operation, shock loading, high speed stops/starts, or exposure to harsh environments. In such applications, it is recommended that the screw and gears be re-lubricated, and an internal inspection be completed periodically. Inspection/re-lube consists of partial disassembly, cleaning, visual evaluation, and re-lubrication.

Factory Repair Service

IDC offers factory repair service for both *in-warranty* and *out-of-warranty* Electric Linear Actuators. Factory Service is the most reliable method of replacing damaged parts. In most cases, factory repair is quicker than field repairs, even considering shipping time. We return repaired units using the same shipping method as the unit was received by IDC, automatically decreasing turnaround time on urgent repairs.

Field Service / Lubrication / Maintenance

While we recommend our factory repair service for most customers, we recognize that occasionally it may be necessary to perform minor repairs or maintenance in the field. Such cases include replacing accessible worn or broken components such as belts or mounting hardware, and lubrication of leadscrew or gears as required. Actuators with certain options are more difficult to disassemble without special tools and instruction, and these are noted in the table below in the Factory columns.

Parts can be ordered through your local IDC Distributor.

Note: Improper field assembly which causes damage or premature wear voids warranty.

Field Service Chart

All field service work should be done ONLY on authorized items, by qualified personnel.

	Motor, Belt / Gear Speed Reducer	Leadscrew / Belt Assembly	Mounting Options, Carriage, and Other Options
Maintenance	Field • Gear Lubrication • Re-tension Motor Drive Belt	Field • Lubrication	Field • Clean External Surfaces
Conversion	Factory • Belt / Pulley Ratios (1:1, 1.5:1, 2:1, 3:1 ratios) • Helical Gears (2.5:1, 3.1:1, 3.5:1, 5:1, 10:1, 12:1 ratios)	Authorized at Factory Only	Field • Motors Factory
Repair	Field • Motor Pulleys • Drive Belts • Gears - Motor Pinion - Intermed. Gear • Inline Coupling Factory • Driven Pulley • Driven Gear • Driven Coupling • BS Option	Authorized at Factory Only	Field • Motors • Mounting Options • Actuator Housing • Encoder • Quick Disconnect Factory • -BS Option • 2.5, 3.1, 3.5, 5, 10 or 12 Drive Ratios

Lubrication

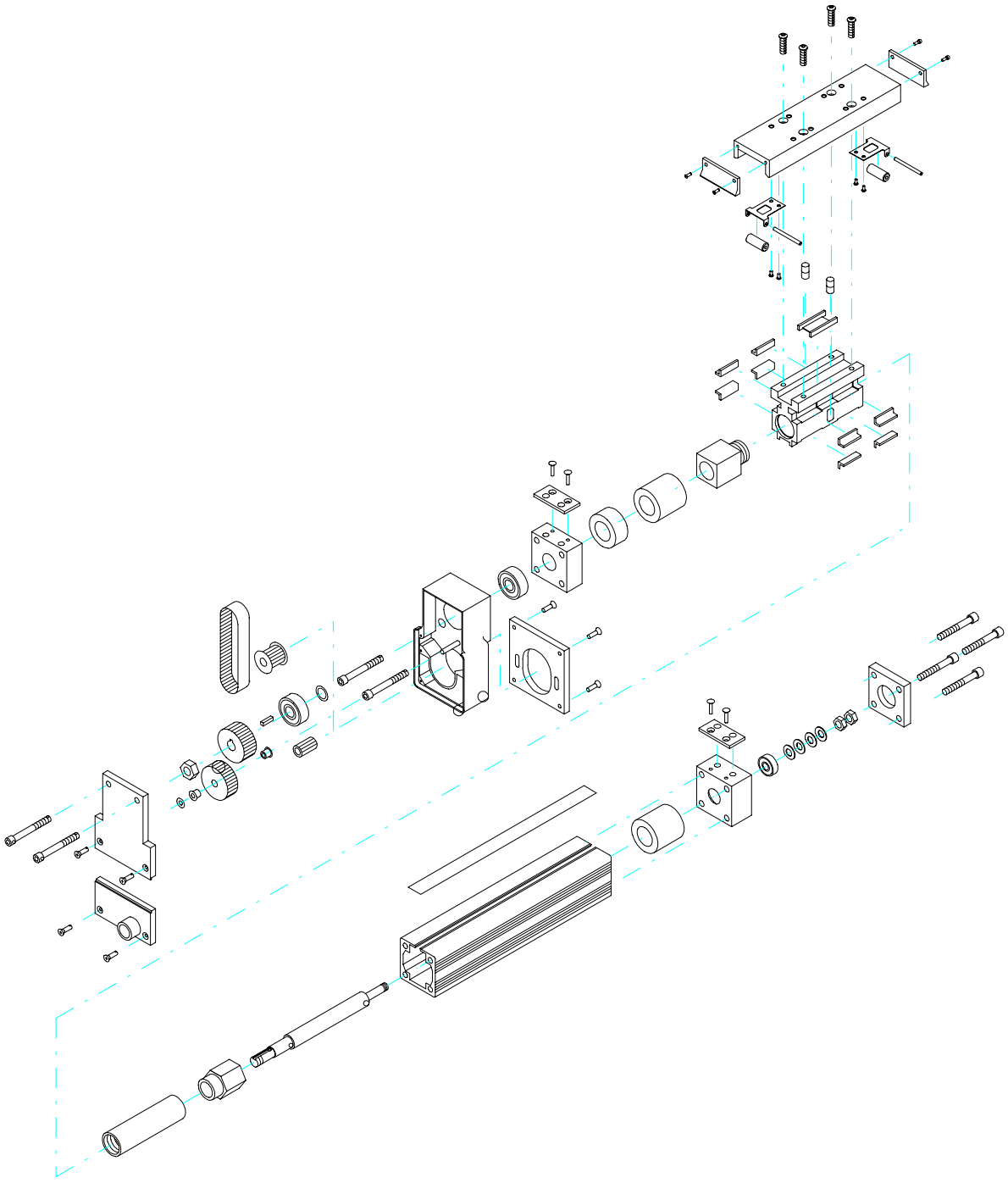
Recommended Re-Lubrication Interval: Every 4 million inches [100km] of travel.

Example: An application which operates at a peak speed of 40"/sec each cycle will travel one million inches in 41.7 hours.

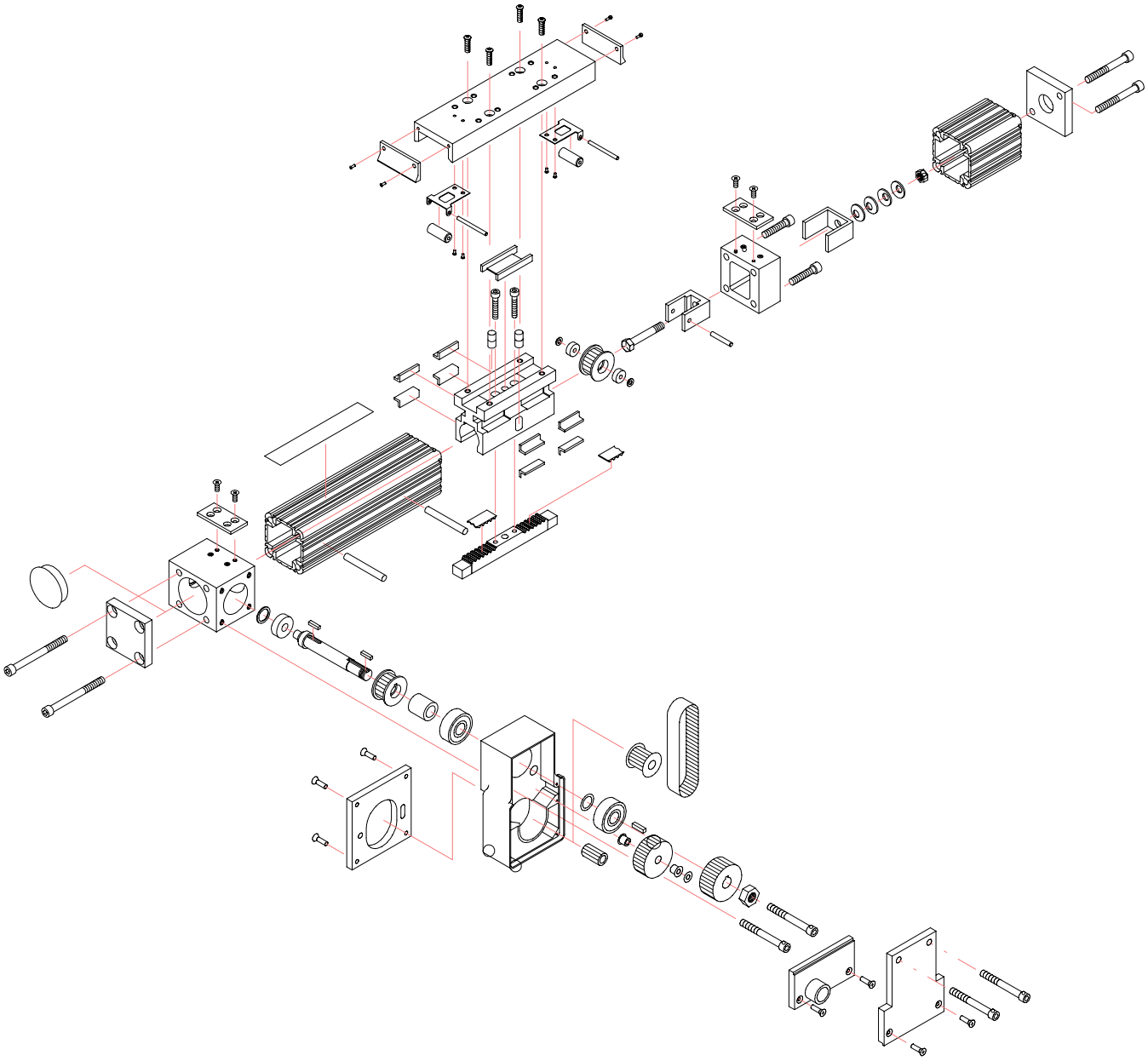
- 40 in/sec ÷ 1.5 = Average 26.7 in/sec (assuming 1/3-1/3-1/3 trapezoidal move profile)
- 4,000,000 in ÷ 26.7 in/sec = 150,000 seconds ÷ 3600 sec/hr = 41.7 hours
- This high speed application requires re-lubrication of critical components once every 41.7 hours of operation.

Component	Lubricant	Lubrication Interval
Carriage Seal	IDC P/N 600-041, Silicone Grease	4 million inches
Internal Rail Bearing *(R3/R4 Series Only)*	IDC P/N 600-035, Lithium Grease	4 million inches
Leadscrew	IDC P/N 600-025 for Ball screws IDC P/N 600-022 for Acme screws	4 million inches
Leadscrew Thrust Bearings	IDC P/N 600-035, Lithium Grease	4 million inches
Helical Gear Speed Reducer	IDC P/N 600-035, Lithium Grease	4 million inches

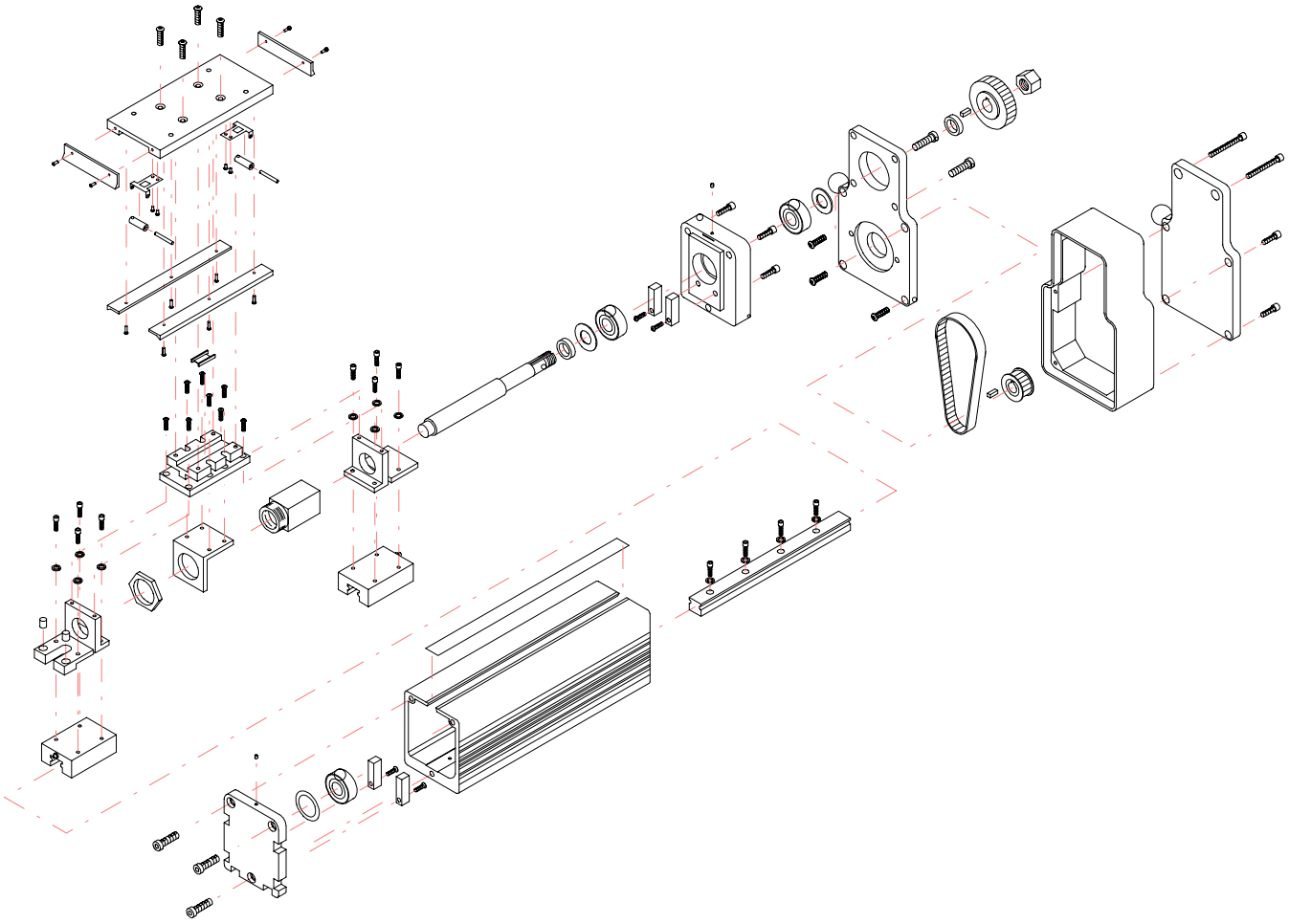
R2 Screw-Drive Exploded Parts Drawing



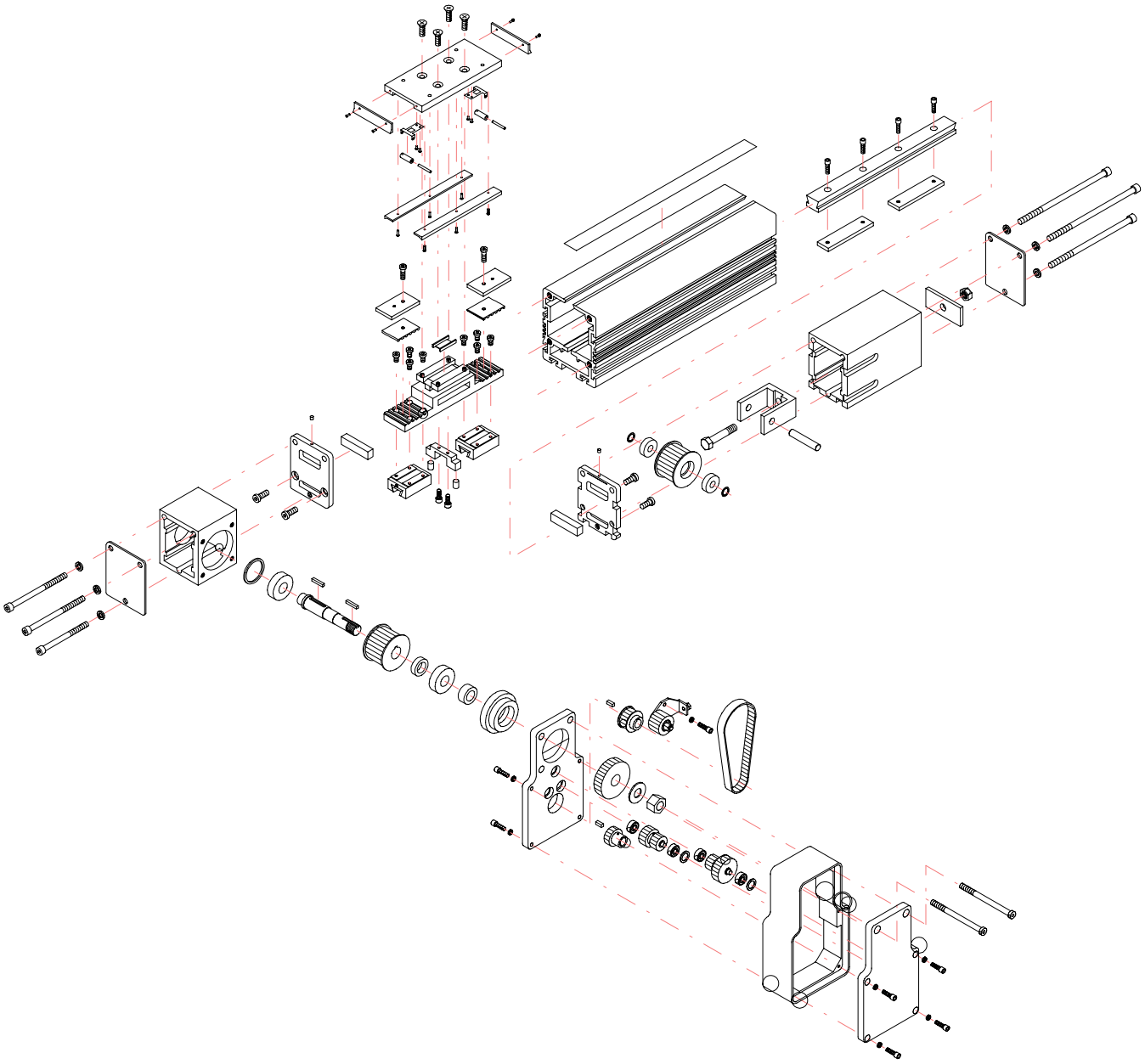
R2 Belt-Drive Exploded Parts Drawing



R3/R4 Screw-Drive Exploded Parts Drawing



R3/R4 Belt-Drive Exploded Parts Drawing



Troubleshooting Chart

The guide below offers assistance when troubleshooting basic actuator problems related to mechanical operation. When troubleshooting actuator performance, the cause may be related to the Drive/Motor used with the actuator. Refer to your IDC Control Manual for additional assistance on troubleshooting your control/actuator system.

Problems Related to...

A. Audible Noise (emitting from actuator)
B. Actuator Motion
C. Positioning and Travel Length
D. Thrust Tube
E. Actuator Parts and Options

A. Audible Noise (emitting from actuator)

Symptom	Cause
1. Knocking, squealing or grinding during operation	a) Excessive carriage loading b) Carriage Bearing / Leadscrew needs re-lubrication c) Entry of foreign matter into actuator body

B. Actuator Motion

1. Stalls/Binds/Sticks during a move (erratic motion)	a) Load too great for actuator/motor b) Pulley, gear, or coupling slipping c) Erratic motor/drive operation d) Drive nut or internal bearing seizing (locking up) typically due to too high a duty cycle/temperature or entry of foreign matter into actuator
2. Extends when it should retract (and vice versa)	a) Motor polarity reversed
3. Vibrates during motion	a) Motor Unstable (servo-gains, stepper-resonance) b) Actuator being operated at or above critical speed c) Misalignment of internal components
4. Does not move at all when commanded to move	a) Motor damaged, miswired, or wire loose b) Load too great for actuator/motor c) Problem with drive/motor
5. Does not move (or is erratic) although motor is rotating	a) Gear, pulley or coupling not secured to motor shaft b) Belt is loose or damaged c) Bad gear alignment or stripped teeth d) Threads are stripped on the drive nut (Acme)
6. Not running at rated speed	a) Load is too great for desired speed b) Limited by critical speed (oscillation) of screw c) Incorrect screw pitch or drive ratio d) Actuator option (i.e. bronze drivenut) causing excessive friction

C. Positioning and Travel Length

1. Actuator backdriving (without holding torque on motor)	a) Backdriving force generated by load is greater than the static holding capacity of the actuator b) Excessive external vibration
2. Actuator backdriving (with holding torque on the motor)	a) Backdriving force generated by load is greater than the holding capacity of the screw/nut of the actuator and the holding torque of the motor b) Loss of motor holding torque (servo and steppers)
3. Not enough travel	a) Position sensors reducing "actual" travel b) Actuator option (may be limiting stroke) c) Excessive side-loading d) Customer mounting (physically limiting travel)

4. Expected linear travel distance not corresponding to number of motor revs	a) Incorrect screw pitch or drive ratio b) Incorrect scaling factor (programmable controls)
5. Expected stop position not repeatable (in same direction)	a) Varying Load b) Erratic motor or control operation c) Excessive system backlash

D. Carriage

1. Excessive backlash	a) Carriage drive belt not tensioned sufficiently b) Motor belt stretching or geartrain backlash excessive c) Pulley, pinion gear, or coupling slipping d) Servo motor gains too low - motor not "stiff enough" e) Leadscrew/nut is worn
2. Excessive deflection	a) Leadscrew/nut or internal bearings are worn b) Excessive side-loading c) Improper actuator mounting
3. Stuck in fully extended or retracted position	a) Physically jammed into end of travel b) Load too great for actuator/motor c) Pulley, pinion gear, or coupling slipping d) Erratic motor/drive operation
4. Wobbles during travel	a) R3/R4: Internal carriage components broken or loose b) R2A: Leadscrew or thrust tube is bent c) R2A: Excessive wear on carriage bearings

E. Actuator Parts and Options

1. Driving belt breaking or gears stripping	a) Motor torque is too great b) Motor accel/decel too great for given load c) Load is too great for actuator d) Excessive shock loading (running into physical hardstop, rapid change in direction)
2. Position Sensors not being activated by internal magnet	a) Misalignment of internal components b) Weak internal magnet c) Switch/sensor is damaged or miswired d) Sensors positioned improperly on actuator (not on actuator side where magnet is located) e) Actuator speed too fast
3. Linear Potentiometer (LP) not reading properly	a) LPO wiper lifting off track (misalignment or LP bending due to excessive load b) Damaged / contaminated LP (by liquid/particle)
4. Motor overheating	a) Duty cycle too high b) High ambient temperature c) Incorrect current setting on drive
5. Brake not holding load	a) Brake not coupled to motor or leadscrew properly b) Load exceeds holding capacity of actuator/brake c) Brake damaged or improperly wired
6. Encoder reading improperly	a) Encoder damaged or wired improperly b) Incorrect supply voltage to encoder

Replacement Parts List for R2A Series Actuators

Replacement parts can be ordered through your local IDC Distributor.

		R2AD 24V Brushed DC		R2AH 160V Brushed DC		R2AS23 2.3" Stepper		R2AB23 Brushless Servo	
Motor		D Motor D Inline	810-101 830A302	H Motor H Mtr. w/ Quick Disc.	820-213 820-214	S23N/T/V Inline S23T Parallel S23V Parallel S23N Parallel	801-123 801-223-T 801-223-V 801-223	B23 Motor B23-BM Motor w/ brake B23A Motor	810-023 810-023B 810-025
	Brushes	Brush Set (for 810-101 only)	810-199	Brush Set, H	820-298				
	Cables	12' Quick Disc. (3-lead)	QF1-12	12' Quick Disc. (3-lead)	QF1-12	12' Quick Disc. (5-lead)	QF3-12	12' B23 / B23-BM (includes leads for –BM brake)	QBB2-12 optional
Drive Train									
	Pulleys								
	1:1	15 tooth, motor 15 tooth, leadscrew	851-122A 850-123A			15 tooth, motor 15 tooth, leadscrew	858-115A 850-123A	15 tooth, motor 15 tooth, leadscrew	872-015A 850-123A
	1.5:1	12 tooth, motor 18 tooth, leadscrew	851-118A 850-120A			12 tooth, motor 18 tooth, leadscrew	858-112A 850-120A	12 tooth, motor 18 tooth, leadscrew	872-012A 850-120A
	2:1	10 tooth, leadscrew 20 tooth, leadscrew	851-119A 850-121A			10 tooth, leadscrew 20 tooth, leadscrew	855-130A 850-121A	10 tooth, leadscrew 20 tooth, leadscrew	872-010A 850-121A
	Motor Belt	901-106K Motor Belt for all 1:1, 1.5:1, 2:1 ratios							
	Gear Sets								
	3.1, 3.5:1	3.5:1 Pinion Int. Gear Leadscrew Gear	950B001 950-035 950-015	3.1:1 Pinion Int. Gear Leadscrew Gear	950J031 950-035 950-015	3.5:1 Pinion Int. Gear	950D002 950-035	3.1:1 Pinion Int. Gear	950J031 950-035
	12:1	Pinion Upper Cluster Lower Cluster Leadscrew Gear	950K001 950K051 950K052 950K011	N/A		Pinion Upper Cluster Lower Cluster Leadscrew Gear	950K102 950K051 950K052 950K011	N/A	
	Inline Coupling	Motor Adapter Sleeve Leadscrew Adapter	950-019 950-021U 950-020	Motor Adapter Sleeve Leadscrew Adapter	950-024 950-021U 950-020	Motor Adapter Sleeve Leadscrew Adapter	950-019 950-021U 950-020	Motor Adapter Sleeve Leadscrew Adapter	950-024 950-021U 950-020
Carriage									
	Seal Strip	661-201	Ordered by the foot (i.e. Qty 6 = 6 feet) To calculate required seal length: Add 10 to stroke in inches, divide by 12 to get feet of seal required. Example: 36" stroke R2A actuator – *Seal Length (ft)* = [36 *inches + 10*] ÷ *12* = *3.8 ft of seal required (order 4 ft.)*							
	Seal Roller Assembly	517-007 103F150 517-005	Seal Roller *(Two required per carriage)* Seal Roller Dowel Pin *(Two required per carriage)* Roller Bracket Flat Spring *(Two required per carriage)*						
	Sliding Bearings	518-001	R2 Carriage Bearing *(Eight required per carriage) **not required on R2A updated roller bearing design*						
	Transport Belt	518R501	Ordered by the foot (i.e. Qty 12 = 12 feet) To calculate required belt length: Multiply stroke in inches by 2, add 24, divide by 12 to get feet. Example: 36" stroke R2A actuator – *Belt Length (ft)* = [36 *inches* × *2 + 24*] ÷ *12*= *8 feet of belt required*						
Lubrication		990-002 600-025 600-035 600-041	Lubrication Packet for Acme Screws *(12.5 oz grease gun cartridge)* Lubrication Packet for Ballscrews *(one packet per 36 inches of stroke)* Lubrication Packet for Gears, Leadscrew Thrust Bearings *(12.5 oz grease gun cartridge)* Lubrication Packet for Carriage Seal *(1 oz container, up to 108 inches of stroke)*						
Encoder		E1KIT	Encoder Assembly Kit						

Replacement Parts List for R3 Series Actuators

Replacement parts can be ordered through your local IDC Distributor.

		R3D 24V Brushed DC	R3H 160V Brushed DC	R3S23 2.3" Stepper	R3S33 3.4" Stepper	R3B23 Brushless Servo
Motor		D Motor 830A302 (2 leads)	H Motor w/ 820-214 Quick Disc. Fitting	S23 Motor 801-123 (8 leads)	S33N Motor 801-133-N S33T Motor 801-133-T S33V Motor 801-133-V	B23 Motor 810-023 B23-BM Mtr 810-023B w/ brake B23A Motor 810-025
	Brushes	lifetime rated	Brush Set, H 820-298			
	Cables	N/A (attached to motor)	12' Quick Disc. QF1-12 (3-lead)	N/A (attached to motor)	12' Quick Disc. QF3-12 (5-lead)	12' B23 & B23-BM QBB2-12 (includes leads for optional –BM brake)
Drive Train						
	Pulleys					
	1:1	15 th, motor 858-115A 15 th, screw 850-123A	15 th, motor 851-122A 15 th, screw 850-123A	15 th, motor 858-115A 15 th, screw 850-123A	15 th, motor 858-128A 15 th, screw 850-123A	15 th, motor 872-015A 15 th, screw 850-123A
	1.5:1	12 th, motor 858-112A 18 th, screw 850-120A	12 th, motor 851-118A 18 th, screw 850-120A	12 th, motor 858-112A 18 th, screw 850-120A	12 th, motor 858-129A 18 th, screw 850-120A	12 th, motor 872-012A 18 th, screw 850-120A
	2:1	10 th, motor 855-130A 20 th, screw 850-121A	10 th, motor 851-119A 20 th, screw 850-121A	10 th, motor 855-130A 20 th, screw 850-121A	12th, motor 858-129A 24th, screw 850-126A	10 th, motor 872-010A 20 th, screw 850-121A
	Motor Belt	Motor Belt 901-112K	Motor Belt 901-112K	Motor Belt 901-112K	Motor Belt 901-117	Motor Belt 901-112K
	Gear Sets					
	5:1	Pinion Gear 955R002 Upper Clust. 955S001 Lwr Cluster 950S002 Bushing 750P002 Ldscrw. Gear 950T001	Pinion Gear 955R001 Upper Clust. 955S001 Lwr Cluster 950S002 Bushing 750P002 Ldscrw. Gear 950T001	Pinion Gear 955R002 Upper Clust. 955S001 Lwr Cluster 950S002 Bushing 750P002 Ldscrw. Gear 950T001	Pinion Gear 955R003 Upper Clust. 955S001 Lwr Cluster 950S002 Bushing 750P002 Ldscrw. Gear 950T001	Pinion Gear 955R001 Upper Clust. 955S001 Lwr Cluster 950S002 Bushing 750P002 Ldscrw. Gear 950T001
	10:1	Pinion Gear 950R002 Upper Clust. 950S001 Lwr Cluster 950S002 Bushing 750P002 Ldscrw. Gear 950T001	Pinion Gear 950R001 Upper Clust. 950S001 Lwr Cluster 950S002 Bushing 750P002 Ldscrw. Gear 950T001	Pinion Gear 950R002 Upper Clust. 950S001 Lwr Cluster 950S002 Bushing 750P002 Ldscrw. Gear 950T001	Pinion Gear 950R003 Upper Clust. 950S001 Lwr Cluster 950S002 Bushing 750P002 Ldscrw. Gear 950T001	Pinion Gear 950R001 Upper Clust. 950S001 Lwr Cluster 950S002 Bushing 750P002 Ldscrw. Gear 950T001
	Inline Coupling	Mtr. Adapter 950-019 Sleeve 950-021U Screw Adapt. 950-020	Mtr. Adapter 950-024 Sleeve 950-021U Screw Adapt. 950-020	Mtr. Adapter 950-019 Sleeve 950-021U Screw Adapt. 950-020	Mtr. Adapter 950-022 Sleeve 950-021U Screw Adapt. 950-020	Mtr. Adapter 950-024 Sleeve 950-021U Screw Adapt. 950-020
Carriage						
	Seal Strip	661-201 Ordered by the foot (i.e. Qty 6 = 6 feet) To calculate required seal length: Add 11 to stroke in inches, divide by 12 to get feet of seal required. Example: 36" stroke R3 actuator -- *Seal Length (ft)* = [36 *inches + 11*] ÷ *12* = *3.9 ft of seal required (order 4 ft.)*				
	Seal Roller Assembly	517-007 Seal Roller *(Two required per carriage)* 103F150 Seal Roller Dowel Pin *(Two required per carriage)* 517-005 Roller Bracket Flat Spring *(Two required per carriage)*				
	Transport Belt	516R501 Ordered by the foot (i.e. Qty 12 = 12 feet) To calculate required belt length: Multiply stroke in inches by 2, add 26, divide by 12 to get feet. Example: 36" stroke R3 actuator -- *Belt Length (ft)* = [36 *inches* × *2 + 26*] ÷ *12*= *8.2 ft of belt required (order 9 ft.)*				
Lubrication		990-002 Lubrication Packet for Acme Screws *(12.5 oz grease gun cartridge)* 600-025 Lubrication Packet for Ballscrews *(one packet per 36 inches of stroke)* 600-035 Lubrication Packet for Gears, Rail Bearing Blocks, Leadscrew Thrust Bearings *(12.5 oz grease gun cartridge)* 600-041 Lubrication Packet for Carriage Seal *(1 oz container, up to 108 inches of stroke)*				
Encoder		E1KIT Encoder Assembly Kit				

Replacement Parts List for R4 Series Actuators

Replacement parts can be ordered through your local IDC Distributor.

		R4H 160V Brushed DC	R4S33 3.4" Stepper	R4S42 4.2" Stepper	R4B32 3.3" Brushless Servo	R4B41 5" Brushless Servo
Motor		H4 Motor w/ Quick Disc. Fitting 810-106	S33N Motor 801-133-N S33T Motor 801-133-T S33V Motor 801-133-V	S42N Motor 801-142-N S42T Motor 801-142-T S42V Motor 801-142-V	B32 Motor 801-032 B32 w/ brake 801-032B	B41 Motor 810-041 B41 w/ brake 810-041B
	Cables	12' Quick Disc. (3-lead) QF1-12	12' Quick Disc. (5-lead) QF3-12	12' Quick Disc. (5-lead) QF3-12	12' B32 QFB3-12 12' B32 brk QBB3-12	12' B41 QFB3-12 12' B41 brk QBB3-12
Drive Train						
	Pulleys					
	1:1	30 th, motor 864-102 30 th, screw 873-102 Motor Belt 901-108	30 th, motor 869-102 30 th, screw 873-102 Motor Belt 901-108	30 th, motor 864-102 30 th, screw 873-102 Motor Belt 901-108	30 th, motor 870-102 30 th, screw 873-102 Motor Belt 901-108	30 th, motor 864-102 30 th, screw 873-102 Motor Belt 901-108
	1.5:1	24 th, motor 864-101 36 th, screw 873-101 Motor Belt 901-108	24 th, motor 869-101 36 th, screw 873-101 Motor Belt 901-108	24 th, motor 864-101 36 th, screw 873-101 Motor Belt 901-108	24 th, motor 870-101 36 th, screw 873-101 Motor Belt 901-108	24 th, motor 864-101 36 th, screw 873-101 Motor Belt 901-108
	2:1 (no tensioner)	24 th, motor 864-101 48 th, screw 873-103 Motor Belt 901-109	24 th, motor 869-101 48 th, screw 873-103 Motor Belt 901-109	24 th, motor 864-101 48 th, screw 873-103 Motor Belt 901-109	24 th, motor 870-101 48 th, screw 873-103 Motor Belt 901-109	24 th, motor 864-101 48 th, screw 873-103 Motor Belt 901-109
	3:1			16 th, motor 869-103 48 th, screw 873-103 Motor Belt 901-109	16 th, motor 867-003 48 th, screw 873-103 Motor Belt 901-109	
	Gear Sets					
	5:1	Pinion Gear 944-23LH Upper Clust. 946-051H Lwr Cluster 946-052H Ldscrw. Gear 943-52RH	Pinion Gear 945-23L Upper Clust. 946-051H Lwr Cluster 946-052H Ldscrw. Gear 943-52RH	Pinion Gear 944-23LH Upper Clust. 946-051H Lwr Cluster 946-052H Ldscrw. Gear 943-52RH	Pinion Gear 945B23LH Upper Clust. 946-051H Lwr Cluster 946-052H Ldscrw. Gear 943-52RH	Pinion Gear 944-23LH Upper Clust. 946-051H Lwr Cluster 946-052H Ldscrw. Gear 943-52RH
	10:1	Pinion Gear 944-19LH Upper Clust. 946-101H Lwr Cluster 946-102H Ldscrw. Gear 943-52RH	Pinion Gear 955-19LH Upper Clust. 946-101H Lwr Cluster 946-102H Ldscrw. Gear 943-52RH	Pinion Gear 944-19LH Upper Clust. 946-101H Lwr Cluster 946-102H Ldscrw. Gear 943-52RH	Pinion Gear 945B19LH Upper Clust. 946-101H Lwr Cluster 946-102H Ldscrw. Gear 943-52RH	Pinion Gear 944-19LH Upper Clust. 946-101H Lwr Cluster 946-102H Ldscrw. Gear 943-52RH
	Inline Coupling	Coupl. Ass'y 950-100	Coupl. Ass'y 950-106	Coupl. Ass'y 950-100	Coupl. Ass'y 950-107	Coupl. Ass'y 950-100
Carriage						
	Seal Strip	661-201 Ordered by the foot (i.e. Qty 6 = 6 feet) To calculate required seal length: Add 11 to stroke in inches, divide by 12 to get feet of seal required. Example: 36" stroke R4 actuator -- *Seal Length (ft)* = [36 *inches + 12*] ÷ *12* = *4.0 ft of seal required (order 4 ft.)*				
	Seal Roller Assembly	517-007 Seal Roller *(Two required per carriage)* 103F150 Seal Roller Dowel Pin *(Two required per carriage)* 517-005 Roller Bracket Flat Spring *(Two required per carriage)*				
	Transport Belt	517R501 Ordered by the foot (i.e. Qty 12 = 12 feet) To calculate required belt length: Multiply stroke in inches by 2, add 33, divide by 12 to get feet. Example: 36" stroke R4 actuator -- *Belt Length (ft)* = [36 *inches* × *2 + 33*] ÷ *12*= *8.75ft of belt required (order 9 ft.)*				
Lubrication		990-002 Lubrication Packet for Acme Screws *(12.5 oz grease gun cartridge)* 600-025 Lubrication Packet for Ballscrews *(one packet per 36 inches of stroke)* 600-035 Lubrication Packet for Gears, Rail Bearing Blocks, Leadscrew Thrust Bearings *(12.5 oz grease gun cartridge)* 600-041 Lubrication Packet for Carriage Seal *(1 oz container, up to 108 inches of stroke)*				
Encoder		E1KIT Encoder Assembly Kit				

Warranty and Service Coverage

Industrial Devices Corporation warrants all R Series Actuators to be free of defects in material & workmanship for a period of one year from the date of shipment to the user. Products returned prepaid to the factory will be repaired or replaced at our option at no charge, and returned prepaid to the user.

Products that have expended their useful life after one year or have been improperly used or damaged, in the opinion of Industrial Devices, are not subject to the terms of this warranty.

Technical Support

Industrial Devices offers technical support through its factory authorized and trained Distributors, and through its factory-based Applications Engineering and Inside Sales department.

If an application problem exists or if the product has failed, contact your Distributor or Industrial Devices for technical assistance. Contact our factory at 1-800-747-0064, outside the U.S. at 707-789-1000.

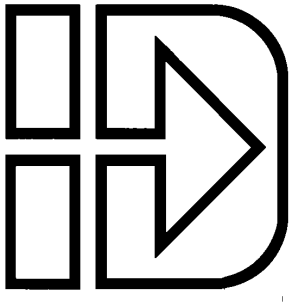
Factory Repair Service

Product repairs are performed at our factory in Petaluma, California. Prior approval by Industrial Devices is required before returning a product for any reason. All returned products must be accompanied by an Industrial Devices supplied RMA (Return Material Authorization) number.

In Case of Failure

1. Get the Model and Serial Number of the defective unit, and document the nature of the failure using the RMA Data Form to help us repair the unit.
2. Prepare a purchase order for the repair cost in case the unit is out of warranty.
3. Contact your IDC Distributor (or Industrial Devices at 1-800-747-0064) for an RMA#.
4. Ship the unit prepaid, with the RMA number and documentation to:

Industrial Devices Co., LLC
3925 Cypress Drive
Petaluma, CA 94954
Attn.: RMA # _____



INDUSTRIAL DEVICES CO., LLC
3925 Cypress Drive • Petaluma, CA USA 94954
(800) 747-0064 • Fax (707) 789-0175
OUTSIDE THE U.S. CALL (707) 789-1000
Internet: http://www.idcmotion.com
E-mail: support@idcmotion.com