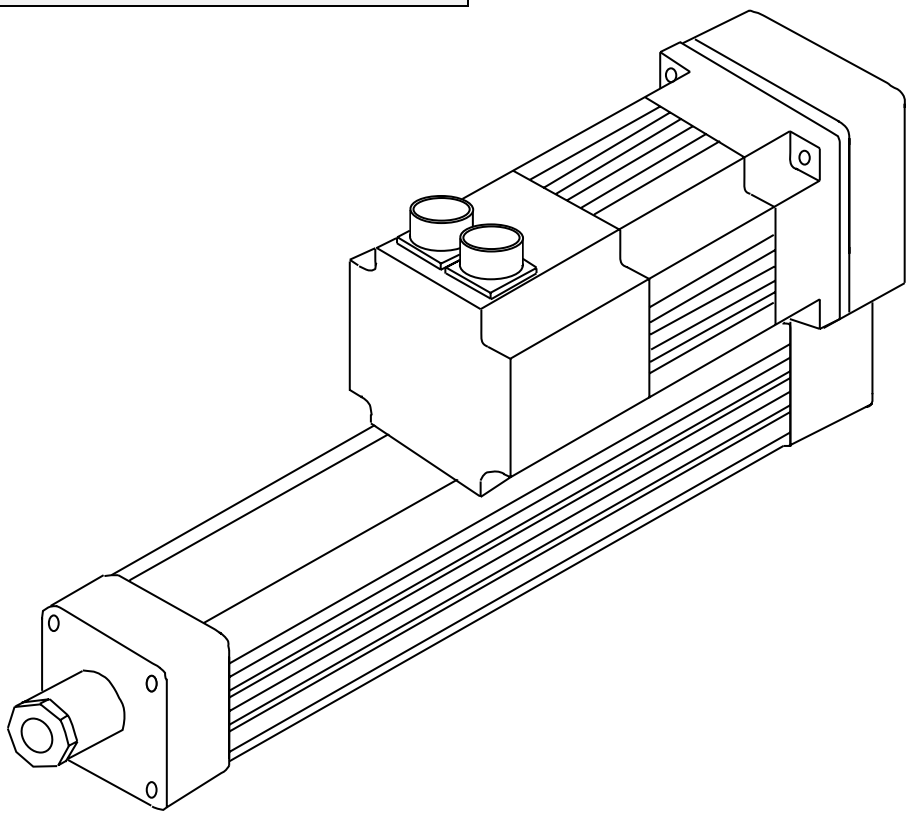
T Series
Electric Cylinders

Operator's Manual

P/N PCW-4574 Rev. 2.0 5/97

This manual covers the following IDC Products:

TH Cylinders - 160VDC Motor
TS Cylinders - Step Motor
TB Cylinders - Brushless Servo Motor



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1. Product Overview

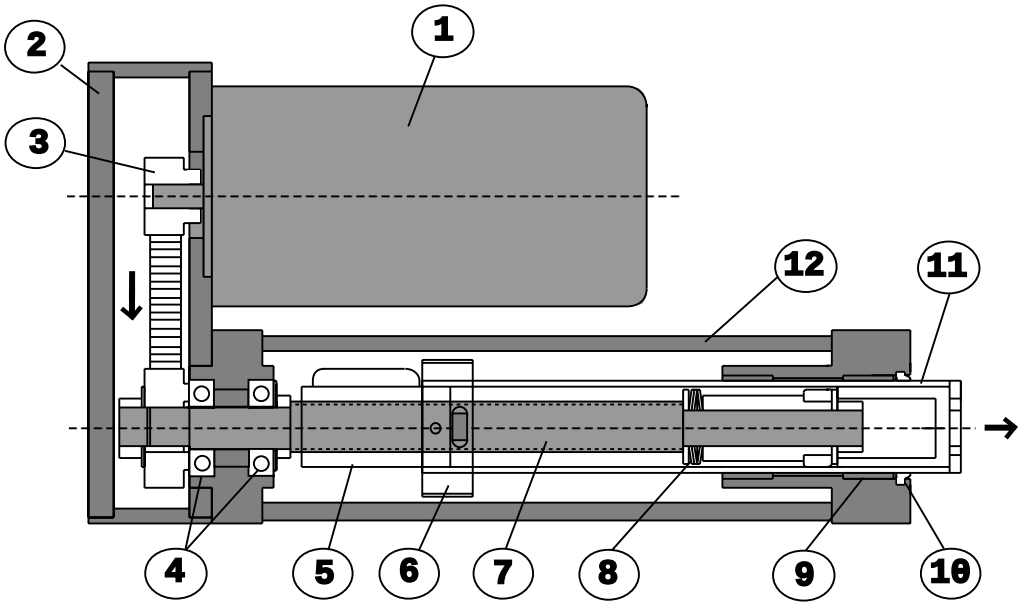
Industrial Devices Corporation (IDC) T Series Electric Cylinders are designed for use in a wide variety of industrial, scientific, and commercial applications requiring control of linear thrust, speed, or position. This operator's manual will help you properly install and operate your T Series Cylinder.

T Series Control Compatibility Chart

IDC controls will optimize performance of T Series Cylinders. Please refer to the specific control operator's manual for system operating instructions.

Cylinder Type	Compatible IDC Controls		Cylinder Options Required
TH	H4301B	B8001 B8961† B8962†	† requires -EM Option
TS	S6001 S6002	S6961 S6962	
TB	B8001 B8501*	B8961 B8962	* requires -L Option

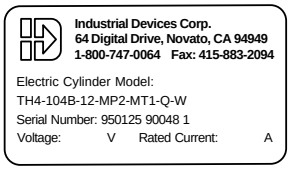
Cylinder Construction



1. Motor
2. Bearing Housing
3. Drive Train
4. Thrust Bearings
5. Drive Nut
6. Internal Guide Flange (with magnets)
7. Leadscrew
8. Spring Washer (EOT Cushion)
9. Support Bearing
10. Wiper Seal
11. Thrust Tube
12. Guide Cylinder

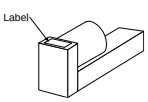
Cylinder Part Number - Identify What You Have

Model Number Breakdown

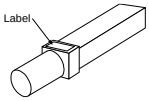


Location of Label shown on available Motor/Cylinder Mounting Configurations.

Parallel



Inline



Example:

Base Model Number				Stroke Length	Cylinder Mounting	Rod End	Options	
Rod-Type Cylinder	Motor Type	Drive Ratio	Screw Pitch,Type					
T	H4 –	10	4B –	18 –	MP2 –	MT1 –	DB –	W

H4 = H4 Motor, 160VDC, 2 Amp, Perm. Magnet
10 = 1.0 to 1 Drive Ratio - Belt/Pulley
4B = 4 Pitch (0.25"lead) Ballscrew
18 = 18 inch stroke
MP2 = Rear Double Clevis Mount
MT1 = Male Threaded Rod End
DB = Dual Rod End Bearing
W = Water Resistant Seal

Base Model Number				Stroke Length	Cylinder Mounting	Rod End	Options	
Rod-Type Cylinder	Motor Type	Drive Ratio	Screw Pitch,Type					
T	–	–	–	–	–	–	–	
①	②	③	④	⑤	⑥	⑦	⑧	

1 T Series Rod Type Cylinder

2 Motor Type

H4	160VDC, 5 Amp, Permanent Magnet DC Motor
S33[*x*]	NEMA 34 Frame, Step Motor, 3 Stack
S42[*x*]	NEMA 42 Frame, Step Motor, 2 Stack
B32	3.3 in. Brushless Servo Motor
B41	5 in. Brushless Servo Motor

[*x*] can be: **T** = Windings pre-wired in Series @ IDC Factory
V = Windings pre-wired in Parallel @ IDC Factory

3 Drive Ratio

10 = 1.0:1 Drive Belt/Pulley
15 = 1.5:1 Drive Belt/Pulley
20 = 2.0:1 Drive Belt/Pulley
30 = 3.0:1 Drive Belt/Pulley
50 = 5:1 Helical Gear
100 = 10.0:1 Helical Gear
99 = 1.0:1 Inline Coupling [Note: Direct 1:1 coupling is the only ratio available for Inline Models]

4 Screw Type

1B = 1 Pitch (1.0" lead) ballscrew
4B = 4 Pitch (0.25" lead) ballscrew
4G = 4 Pitch (0.25" lead) prec. ground ballscrew
6A = 6 Pitch (0.167" lead) acme leadscrew

5 Stroke Length

(specified in inches)

6 Mounting Styles

MF1 = Front Rectangular Flange
MF2 = Rear Rectangular Flange
MF3 = Front & Rear Rectangular Flanges
MP2 = Rear Double Clevis Mount
MP3 = Rear Double Clevis Mount (w/ Pivot Base)
MS2 = Side Lugs
MS6 = Side Tapped Mounting Holes
MT2 = Trunnion Mount
(*xxx***M** = *Metric* version of above option)

7 Rod Ends

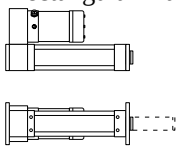
FC2 = Clevis (includes MT1)
FS2 = Spherical Joint (includes FT1)
FT1 = Female Thread
MT1 = Male Thread
(*xxx***M** = *Metric* version of above option)

8 Cylinder Options

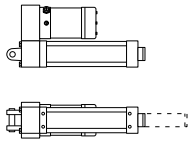
BM = Brake on Motor
BS = Brake on Leadscrew
DB = Double Bearing
EM = Encoder on Motor
F = Subfreezing
L = Linear Potentiometer
PB = Protective Boot
W = Water Resistant Seal

Mounting Styles

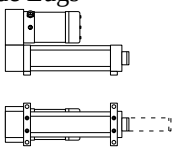
-MF1, 2, 3 Rectangular Flanges



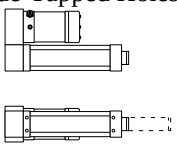
-MP2 Rear Clevis



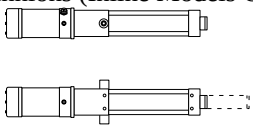
-MS2 Side Lugs



- MS6 Side-Tapped Holes

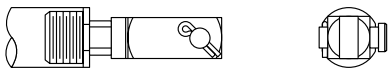


-MT2 Trunnions (Inline Models Only)



Rod Ends

-FC2 Clevis



-FS2 Spherical Joint

-FT1 Female Thread

-MT1 Male Thread

2. Mounting / Performance

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

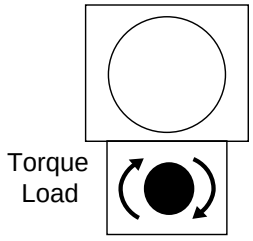
Cylinder Mounting

- The structure on which the cylinder is mounted should have ample strength to carry the maximum load and be rigid enough to prevent undue deflection or distortion of the cylinder or its supporting members.
- The cylinder should be mounted parallel to the travel of the load to ensure proper alignment (this is especially important with externally guided loads using rails, bearings, etc.)
- All mounting surfaces should be clean and flat to provide secure and stable fittings
- Units with flat mounting surfaces (MF1, MF2, MF3, MS2, MS6) should be rigidly mounted.

Mounting	Description	Recommendations
MF1	Front Flange	Not recommended for use in horizontal applications with stroke lengths greater than 12 inches unless there is additional support in the rear of the cylinder.
MF2	Rear Flange	Not recommended for use in horizontal applications with stroke lengths greater than 12 inches unless there is additional support in the front of the cylinder.
MF3	Front and Rear Flange	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 cylinder to twist.
MP2	Rear Clevis	Recommend using a flexible rod end or load attachment to compensate for any system misalignment.
MS2	Side Lugs	Bolts used to secure brackets should be able to withstand a shearing force in excess of 3600lbs.
MS6	Side Tapped Holes	Mounting screws used with side tapped holes should resist a peak shear force of up to 3600lbs. This mounting (alone) is not recommended for loads in excess of 1000lbs.
MT2	Trunnion Mount	Recommend using a flexible rod end or load attachment to compensate for any system misalignment.

Load Attachment

Do Not Apply Torque (Rotational Force) to Thrust Tube
It is important that the thrust tube **NOT** be rotated to avoid damaging the internal plastic guide flange. This is especially important when attaching the rod end to the load. Two flats are provided at the end of the thrust tube to prevent rotation while the rod end attachments are secured.

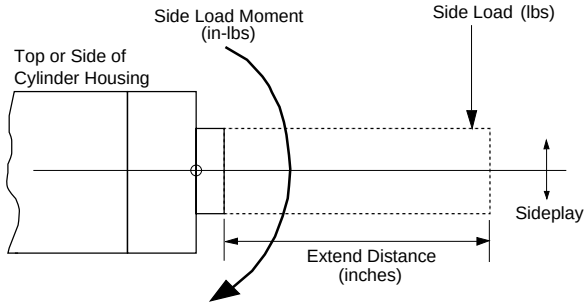


Special Notes for Mounting Rod-Ends to Load

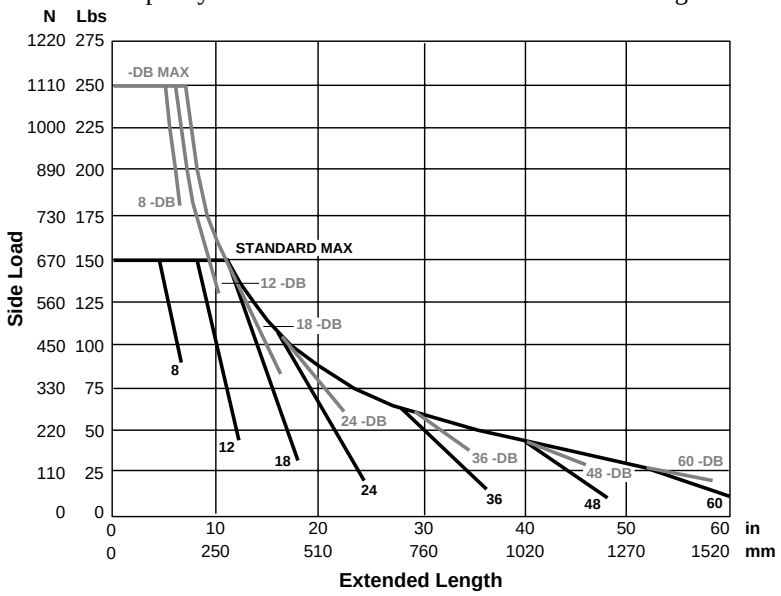
Rod End	Description	Recommendations
FC2	Double Clevis	Clevis should be securely fastened by lock nut once in desired location. In addition, the mounting pin should be secured with a cotter pin once it is inserted into the double clevis holes.
FS2	Spherical Joint	Rotating joint compensates for any misalignment in the system. Not recommended when stiff or rigid load attachment is required.
FT1	Female Thread	Thread depth (of 0.8") cannot be exceeded by the inserted member. Exceeding depth may cause contact with leadscrew or cause other internal damage when the thrust tube is fully retracted.
MT1	Male Thread	Any attached member should be secured in place by a lock nut once it is in the desired location

Thrust Tube Side Load

Thrust tube side loads create a bending force on the thrust tube sleeve bearing. If excessive, actuator performance and service life may be reduced. The side-load "bending moment" limit is a function of the perpendicular side load force and its extended length. The -DB Double Bearing option is provides additional bearing support, and is recommended for applications requiring more than 24" of travel. The side load limits shown below should not be exceeded.



Side Load Capacity with Thrust Tube Extended to Various Lengths



Mounting Position Sensors - Overtravel Protection

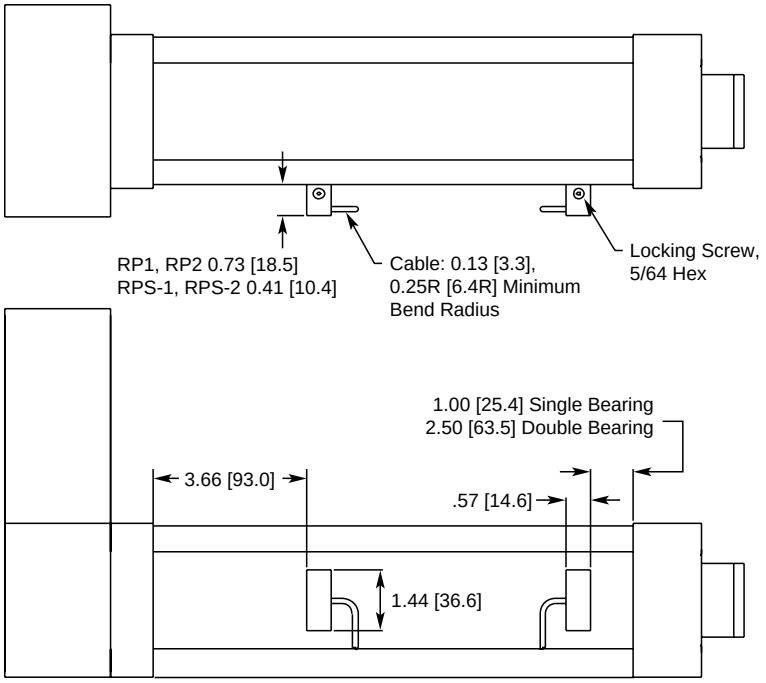
Although an "elastomeric spring" inside the actuator is designed to prevent actuator jams, position sensors (limit switches) are required to prevent such potentially damaging jam conditions. If the motor is accidentally commanded to move toward a hard-stop, position sensors can signal a stop before a collision occurs. To work properly, position sensors must be positioned inward from the hard-stop, and wired correctly to the motor controller.

Note: Using the physical limits of the cylinder (hard stops) will reduce cylinder life and can cause premature component failure.

Position Sensor Mounting Location - Deceleration Distance

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

Position Sensor Mounting Dimensions



Position Sensor Specifications

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

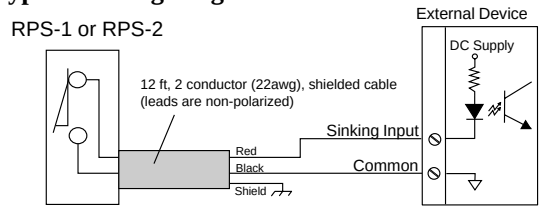
Position sensors are available in *normally open* and *normally closed* versions. Hall Effect (RP1 / RP2) and Reed (RPS-1 / RPS-2) type switches are compatible with the T Series cylinders. Switches are activated by two internal position indicating magnets on opposite sides of the drivenut.

- 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 may reduce the available stroke, due to deceleration region.

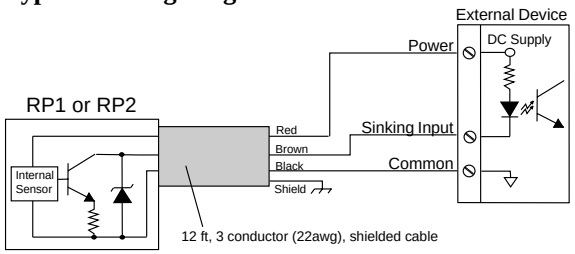
Position Sensor Specifications

	Magnetic Reed Switches		Hall Effect Sensors	
Output Type	Contact Closure		Open Collector, Sinking Output	
Model #	**RPS-1**	**RPS-2**	**RP1**	**RP2**
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



Maximum Thrust and No-Load Speed, by Model Number

The following charts indicate the MAXIMUM THRUST and NO-LOAD SPEEDS for a given model number. Detailed Thrust, Speed and Duty Cycle performance curves can be found in the IDC *Electric Linear Actuators & Controls* Catalog.

- See Chapter 3 - *Application Considerations*, for speed and thrust limitations due to stroke length.

TH4 Series

Cylinder Model	Thrust lbs [N]	Speed in/sec [mm/s]
TH4-101B	120 [534]	40.0 [1016]
TH4-151B	180 [801]	27.0 [686]
TH4-201B	260 [1157]	20.0 [508]
TH4-501B	540 [2402]	8.0 [203]
TH4-1001B	1080 [4804]	4.0 [102]
TH4-104B	480 [2135]	10.0 [254]
TH4-154B	720 [3203]	6.7 [170]
TH4-204B	1040 [4626]	5.0 [127]
TH4-504B	2160 [9608]	2.0 [51]
TH4-1004B	2400 [10676]	1.0 [25.4]

Cylinder Model	Thrust lbs [N]	Speed in/sec [mm/s]
TH4-106A	280 [1245]	6.7 [170]
TH4-156A	440 [1957]	4.4 [112]
TH4-206A	640 [2847]	3.3 [84]
TH4-506A	1333 [5930]	1.3 [33]
TH4-1006A	2400 [10676]	0.67 [17]
TH4-991B	120 [534]	40.0 [1016]
TH4-994B	480 [2135]	10.0 [254]
TH4-996A	280 [1245]	6.7 [170]

TS33 Series

Cylinder Model	Thrust lbs [N]	Speed in/sec [mm/s]
TS33*x*-101B	110 [489]	40.0 [1016]
TS33*x*-151B	160 [712]	27.0 [686]
TS33*x*-201B	220 [979]	20.0 [508]
TS33*x*-501B	460 [2046]	8.0 [203]
TS33*x*-1001B	900 [4003]	4.0 [102]
TS33*x*-104B	430 [1913]	10.0 [254]
TS33*x*-154B	650 [2891]	6.7 [170]
TS33*x*-204B	850 [3781]	5.0 [127]
TS33*x*-504B	1850 [8229]	2.0 [51]
TS33*x*-1004B	2400 [10676]	1.0 [25.4]

Cylinder Model	Thrust lbs [N]	Speed in/sec [mm/s]
TS33*x*-106A	205 [912]	6.7 [170]
TS33*x*-156A	310 [1379]	4.4 [112]
TS33*x*-206A	410 [1824]	3.3 [84]
TS33*x*-506A	860 [3825]	1.3 [33]
TS33*x*-1006A	1700 [7562]	0.67 [17]
TS33*x*-991B	110 [489]	40.0 [1016]
TS33*x*-994B	430 [1913]	10.0 [254]
TS33*x*-996A	205 [912]	6.7 [170]

Notes: Values are based on operation with S6000 Series Controls. x can be T or V which indicates motor wiring configuration.

TS42 Series

Cylinder Model	Thrust lbs [N]	Speed in/sec [mm/s]
TS42*x*-101B	250 [1112]	40.0 [1016]
TS42*x*-151B	380 [1690]	27.0 [686]
TS42*x*-201B	500 [2224]	20.0 [508]
TS42*x*-501B	1080 [4804]	8.0 [203]
TS42*x*-1001B	2150 [9564]	4.0 [102]
TS42*x*-104B	1020 [4537]	10.0 [254]
TS42*x*-154B	1530 [6806]	6.7 [170]
TS42*x*-204B	2040 [9074]	5.0 [127]
TS42*x*-504B	2400 [10676]	2.0 [51]
TS42*x*-1004B	2400 [10676]	1.0 [25.4]

Cylinder Model	Thrust lbs [N]	Speed in/sec [mm/s]
TS42*x*-106A	525 [2335]	6.7 [170]
TS42*x*-156A	790 [3514]	4.4 [112]
TS42*x*-206A	1050 [4671]	3.3 [84]
TS42*x*-506A	2250 [10009]	1.3 [33]
TS42*x*-1006A	2400 [10676]	0.67 [17]
TS42*x*-991B	250 [1112]	40.0 [1016]
TS42*x*-994B	1020 [4537]	10.0 [254]
TS42*x*-996A	525 [2335]	6.7 [170]

Notes: Values are based on operation with S6000 Series Controls. x can be T or V which indicates motor wiring configuration.

TB32 Series

Cylinder Model	Thrust lbs [N]	Speed in/sec [mm/s]
TB32-101B	240 [1068]	40.0 [1016]
TB32-151B	360 [1601]	27.0 [686]
TB32-201B	475 [2113]	20.0 [508]
TB32-501B	1050 [4671]	8.0 [203]
TB32-1001B	1950 [8674]	4.0 [102]
TB32-104B	950 [4226]	10.0 [254]
TB32-154B	1450 [6450]	6.7 [170]
TB32-204B	1800 [8007]	5.0 [127]
TB32-504B	2400 [10676]	2.0 [51]
TB32-1004B	2400 [10676]	1.0 [25.4]

Cylinder Model	Thrust lbs [N]	Speed in/sec [mm/s]
TB32-106A	480 [2135]	6.7 [170]
TB32-156A	725 [3225]	4.4 [112]
TB32-206A	960 [4270]	3.3 [84]
TB32-506A	2025 [9008]	1.3 [33]
TB32-1006A	2400 [10676]	0.67 [17]
TB32-991B	240 [1068]	40.0 [1016]
TB32-994B	950 [4226]	10.0 [254]
TB32-996A	480 [2135]	6.7 [170]

Note: Values are based on operation with B8000 Series Controls.

TB41 Series

Cylinder Model	Thrust lbs [N]	Speed in/sec [mm/s]
TB41-101B	425 [1890]	35.0 [889]
TB41-151B	630 [2802]	23.0 [584]
TB41-201B	850 [3781]	17.0 [432]
TB41-501B	1800 [8007]	6.7 [170]
TB41-1001B	2040 [10676]	3.5 [89]
TB41-104B	1700 [7562]	8.5 [216]
TB41-154B	2400 [10676]	5.8 [147]
TB41-204B	2400 [10676]	4.3 [109]
TB41-504B	2400 [10676]	1.7 [43]
TB41-1004B	2400 [10676]	0.85 [22]

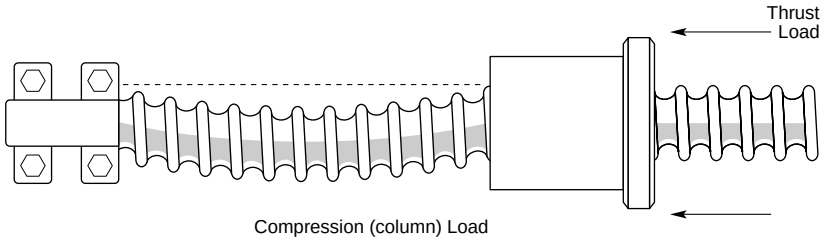
Cylinder Model	Thrust lbs [N]	Speed in/sec [mm/s]
TB41-106A	860 [3825]	5.6 [142]
TB41-156A	1300 [5783]	3.7 [94]
TB41-206A	1750 [7784]	2.8 [71]
TB41-506A	2400 [10676]	1.1 [28]
TB41-1006A	2400 [10676]	0.56 [14]
TB41-991B	425 [1890]	35.0 [889]
TB41-994B	1700 [7562]	8.5 [216]
TB41-996A	860 [3825]	5.6 [142]

Note: Values are based on operation with B8000 Series Controls.

3. Application Considerations

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

Column Loading



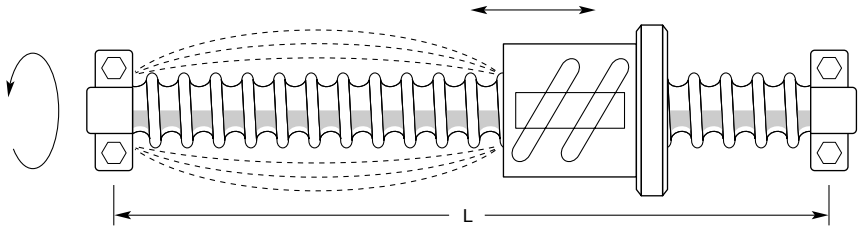
All leadscrews have a column loading limit which causes the screw to buckle or bend as thrust load increases. This limit is a function of unsupported leadscrew length. Exceeding this limit will cause the leadscrew to buckle and become permanently damaged.

Thrust Load Limitations Due to Length

	Cylinder Stroke Length (inches)	
Screw Type	<60"	60"
1B/4B	----	2400 [10676]
6A	----	2400 [10676]

Note: Above loads are in lbs [N]

Critical Speed



All leadscrew systems have a rotational speed limit where harmonic vibrations occur. This limit is a function of unsupported leadscrew length. Sustained operation beyond this critical speed will cause the leadscrew to vibrate (whip violently), eventually bending or warping the screw.

Speed Limitations Due to Length

	Cylinder Stroke Length (inches)				
Screw Type	<36"	36"	42"	48"	60"
1B	40 [1016]	40 [1016]	34.3 [871]	27.7 [704]	22.8 [579]
4B	12.5 [318]	12.5 [318]	10.9 [277]	8.6 [218]	5.7 [145]
6A	8.3 [211]	8.3 [211]	7.0 [178]	5.5 [140]	3.6 [91]

Note: Above speeds are in 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. During operation, it represents the maximum acceptable power dissipation of the motor and the frictional heat losses of the internal cylinder components, primarily the leadscrew/drivenut assembly. 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 Ratings

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

Contaminants

Liquids: Standard T Series Cylinders are not water (nor any liquid) resistant. If liquid or moisture contaminates internal components, damage may occur. A Water Resistant option (-W) is available for environments with a slight mist or spray. The Protective Boot option (-PB, which includes the -W Water Resistant) option is available to protect the thrust tube/wiper interface.

For applications where exposure is unavoidable with a corrosive liquid or a pressurized liquid, an external protective enclosure is recommended. Consult the factory for assistance.

Solid Particles: Rod-type cylinders are generally well protected against particle contaminants. For environments with exposure to fine or abrasive particles, the Water Resistant (-W) option provides added resistance to entry, by sealing mating surfaces with RTV during assembly. The Protective Boot (-PB) option is recommended when the thrust tube/sleeve bearing interface is exposed to abrasive particles.

Backdriving

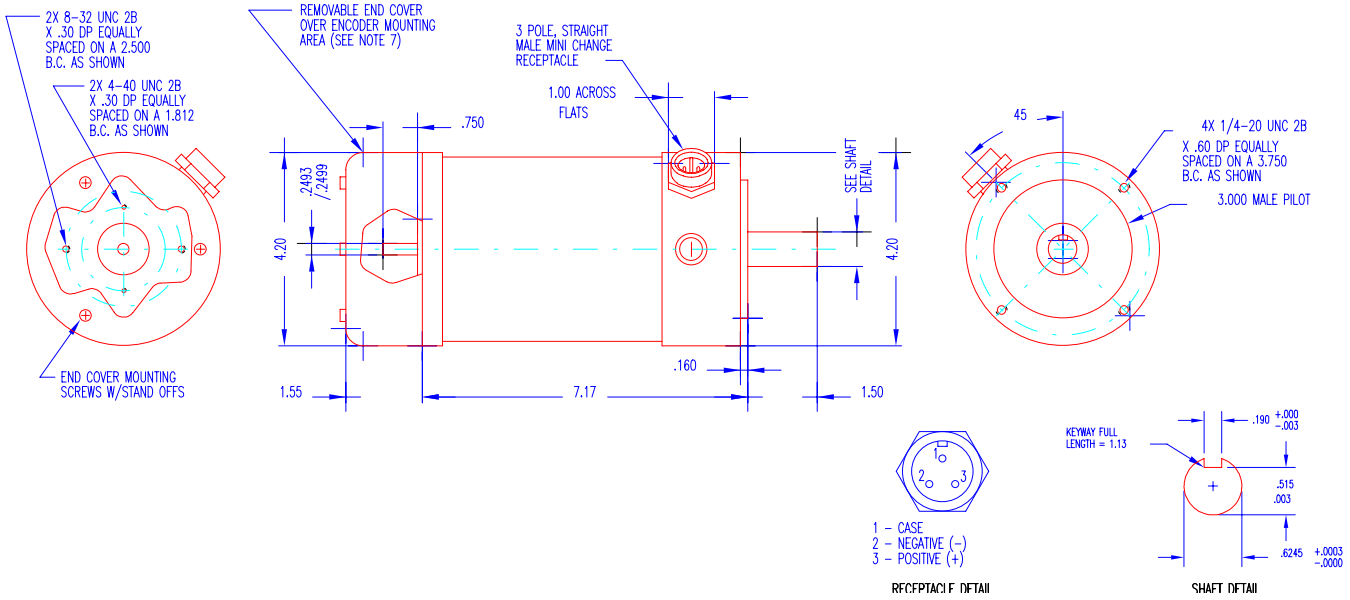
Backdriving is when the thrust tube is forced to extend or retract by an external force. This is an important consideration for cylinders being used in a vertical orientation or when a external thrust load is applied to the cylinder. A cylinder (without motor holding torque) will hold position up to the thrust limit known as the backdrive limit (determined by the screw type and pitch used). The IDC *Electric Linear Actuators & Controls* Catalog shows backdrive force limits for each individual cylinder model. Acme screws, due to their inherent self-locking action, have considerably higher limits than ballscrew driven actuators.

Screw Type	Description	Load Required to Backdrive
Ballscrew	1B: 1 Pitch, 1.000” lead	15 - 100 lbs [66 - 440 N]
	4B: 4 Pitch, 0.250” lead	75 - 450 lbs [330 - 2000N]
Acme Screw	6A: 6 Pitch, 0.167” lead	2400 lbs [10700N]

4. Motor Wiring / Specifications

H4 160VDC Servo Motor Specifications

Permanent Magnet 2-Pole Brushed DC Motor



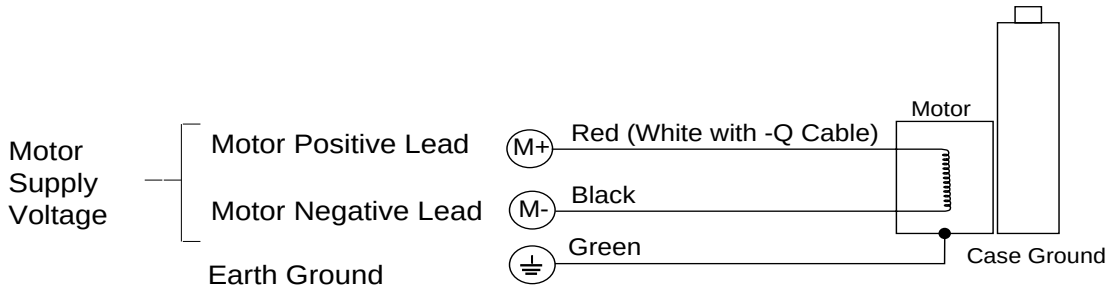
Electrical Data

Rated Voltage	V	160
Max. Operating Voltage	V	180
Max. Continuous Current	A	7.0
Max. Starting Current	A	0.7
Inductance	mH	12
Winding Resistance @ Ambient	ohms	1.5
K_t Torque Constant	oz-in/A	67 ± 10%
K_v Voltage Constant	V/kRPM	49 ± 10%

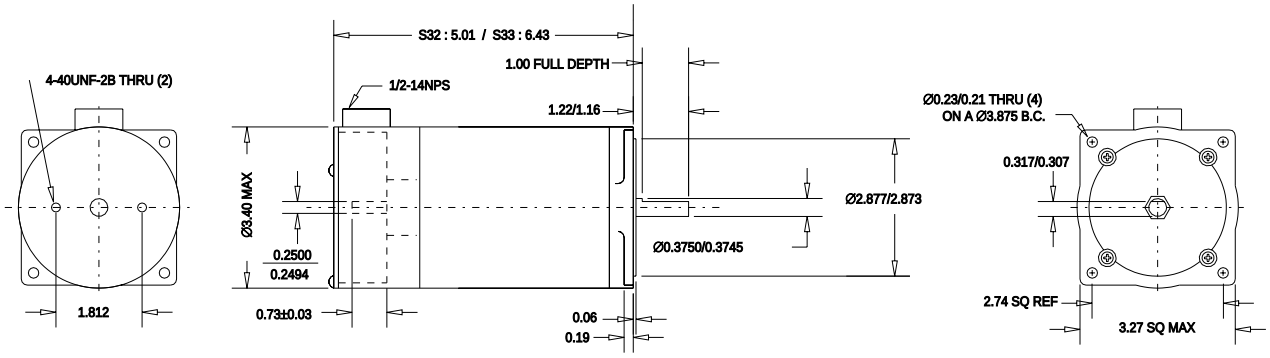
Mechanical Data

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

Motor Wiring



S33 Hybrid Step Motor Specifications



Electrical Data

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

Mechanical Data

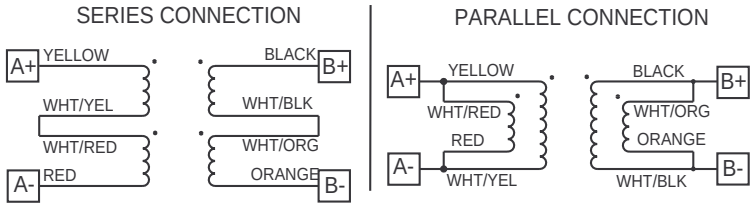
		S33(T/V)
Rotor Inertia	oz-in-s^2 [kg-m^2]	0.0265 [3.51×10^{-5}]
Axial Shaft Load	lbs [N]	50 [222]
Radial Shaft Load - at .5 in	lbs [N]	14.5 [64.4]
Motor Weight	lbs [kg]	8.3 [3.8]
Step Angle (full step)	degrees	1.8

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.

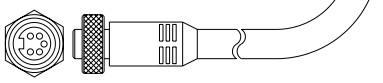
Motor Wiring

12 ft [3.7m] Wire Leads : S33N



Quick-Disconnect : 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

S33T (Series)

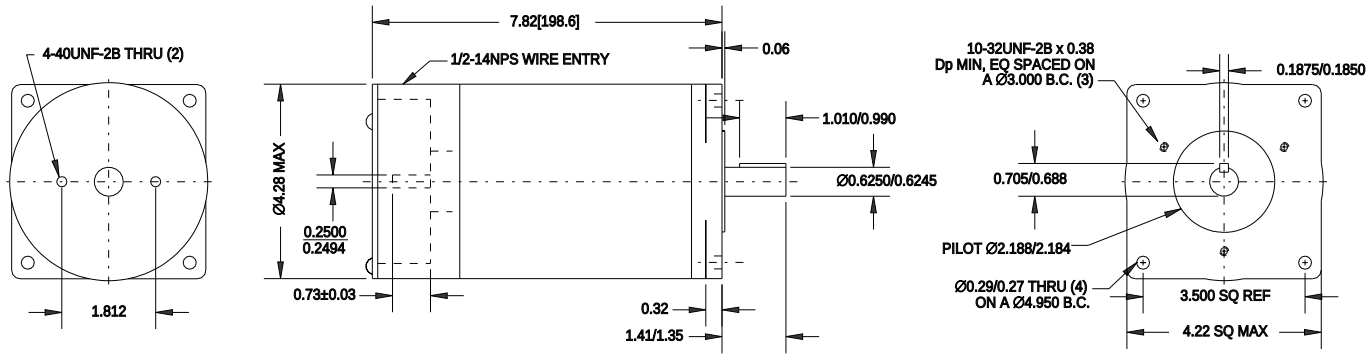
Motor Current	Inductance
3.5 Amps	**8* mH**
Amps	mH
Tenths of Amps	

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

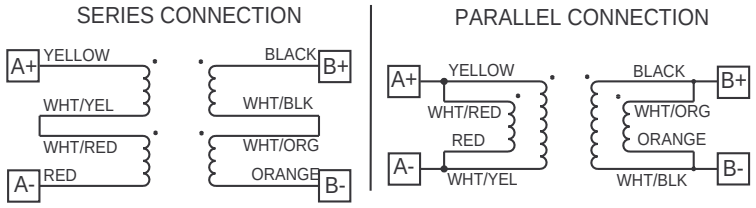
		S42 (T/V)
Rotor Inertia	oz-in-s^2 [kg-m^2]	114×10^{-3} [80.5×10^{-5}]
Axial Shaft Load	lbs [N]	65 [289]
Radial Shaft Load - @ 0.5"	lbs [N]	23.6 [105]
Motor Weight	lbs [kg]	19.1 [8.66]
Step Angle (full step)	degrees	1.8

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.

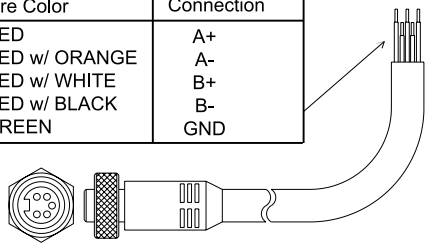
Motor Wiring

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)

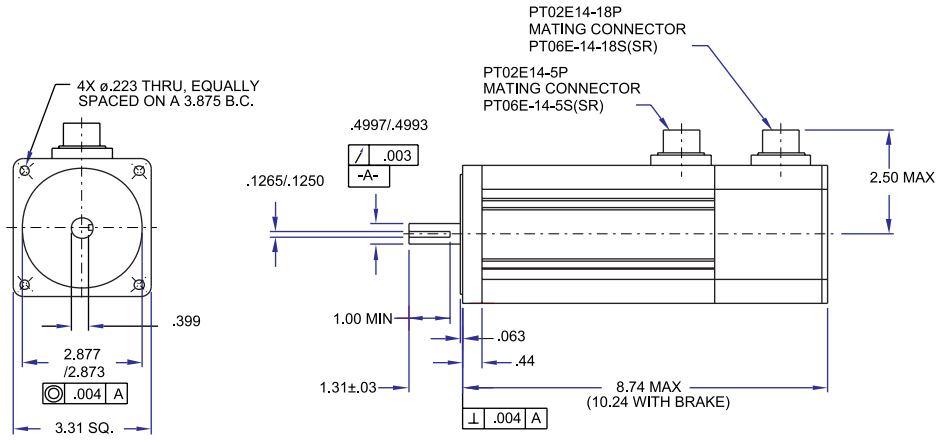
Motor Current	Inductance
6.0 Amps	**8* mH**
Amps	mH
Tenths of Amps	

S42V (Parallel)

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

*Drive setting closest to actual motor specifications.

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

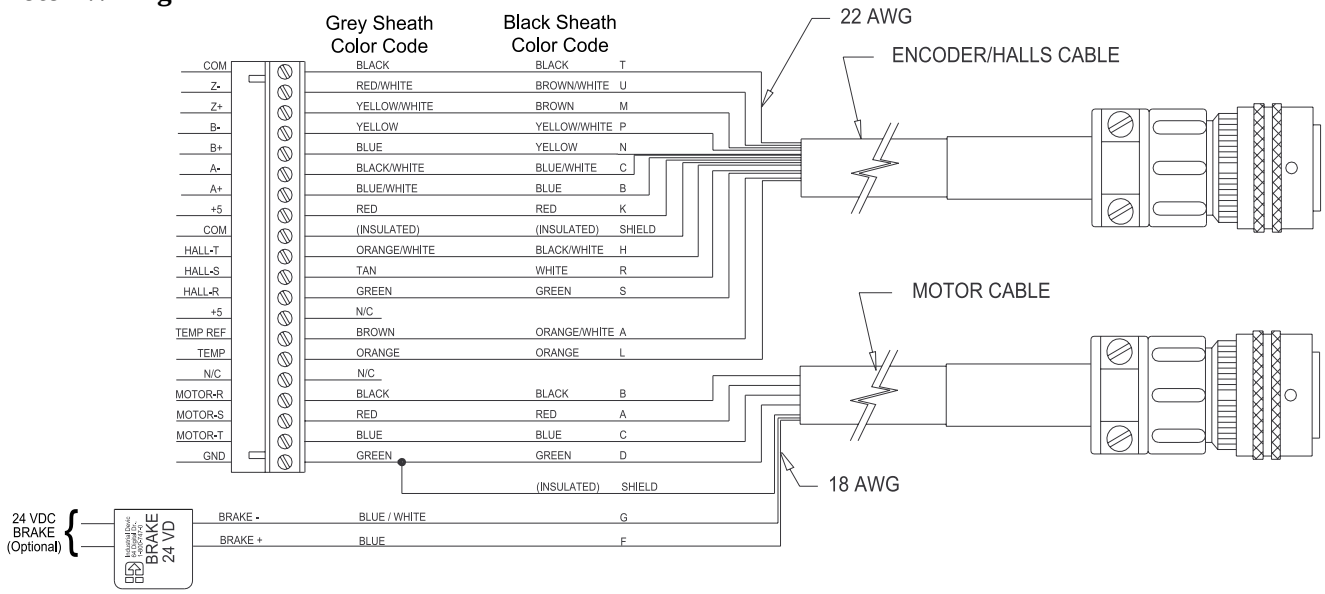
Mechanical Data

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]

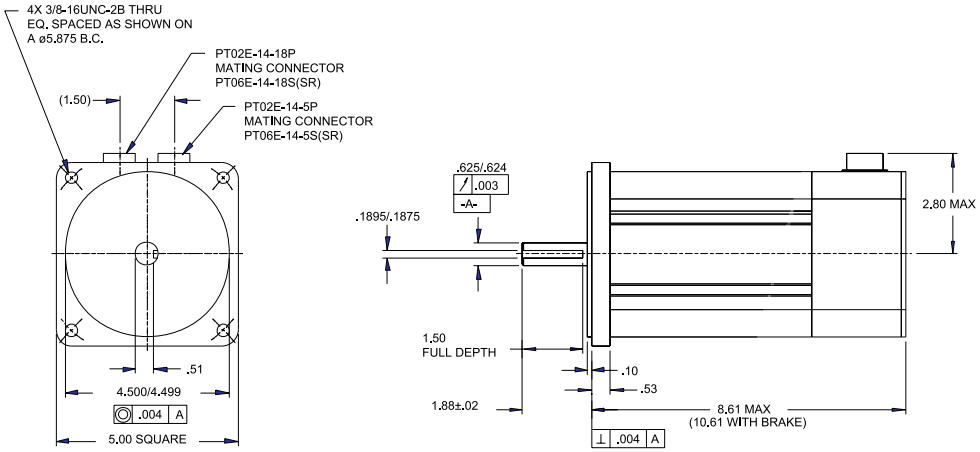
System Data with B8000 Series

		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

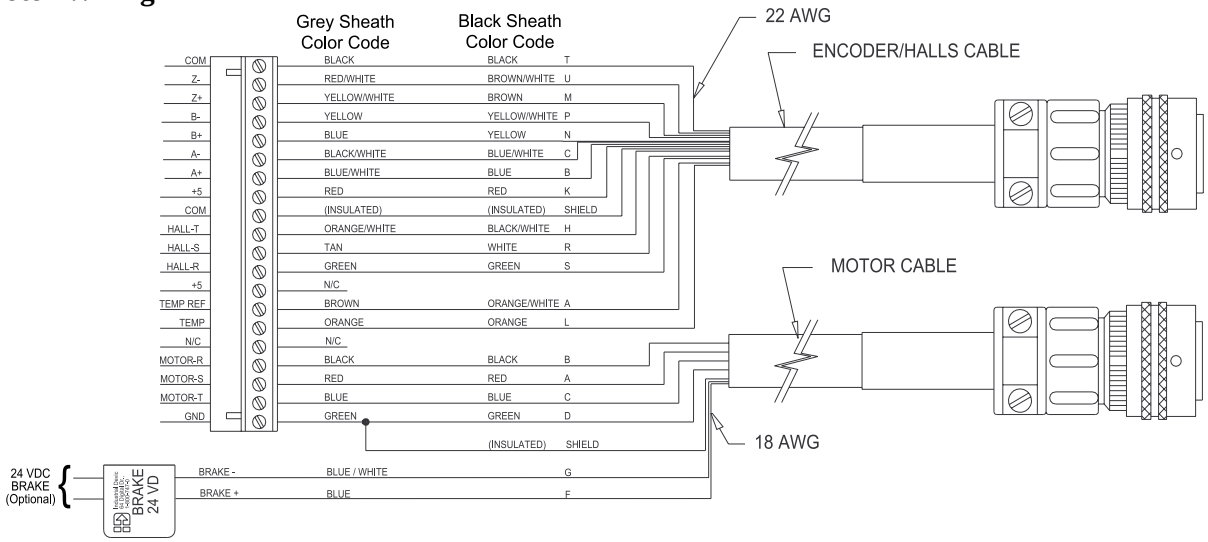
Mechanical Data

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: Wiring and Specifications

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.

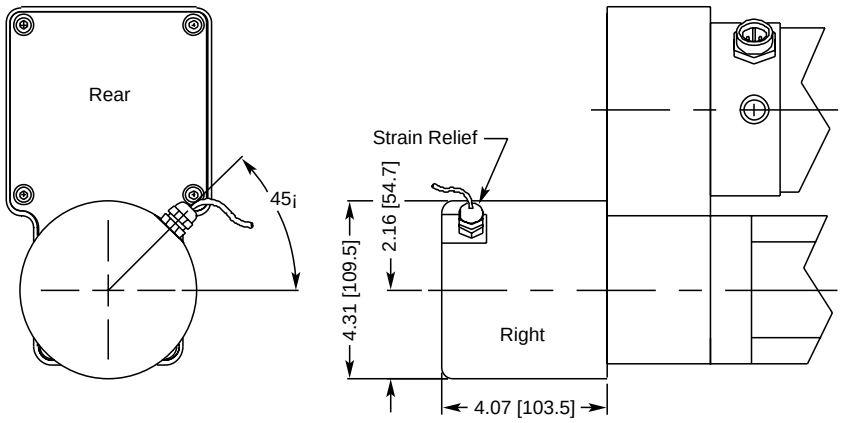
Without power, the brake is engaged. Applying 115VAC releases the brake, allowing motion to occur.

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

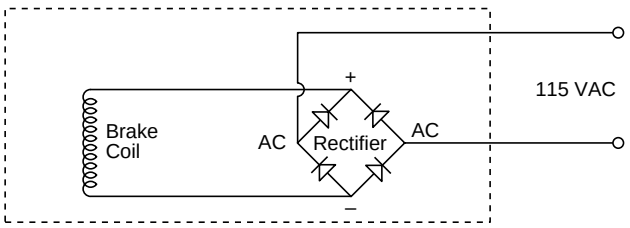
Specifications

Mounting Location	Leadscrew (see diagram below)
Voltage	115VAC
Current	0.14 Amps
Holding Torque	75 in-lb [8.4 N-m]
Cable Length	12 ft [3.7 m]
Holding Force	
Screw Type and Pitch	Holding Force with -BS lbs [N]
1B (1 Pitch Ballscrew)	550 [2,400]
4B (4 Pitch Ballscrew)	2200 [9,800]
6A (6 Pitch Acme Screw)	2400 [10,700]

Dimensions



Electrical Connections



Encoder (-EM) Option

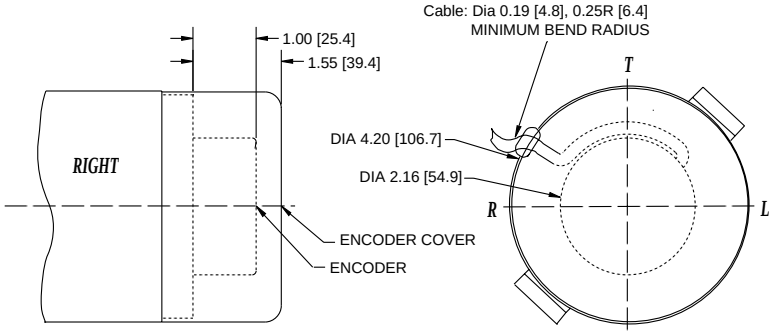
The encoder option provides an incremental 500 line rotary encoder, factory mounted directly to the rear shaft of an IDC motor (H4, S33, or S42) on an T Series Cylinder. The digital pulse output is used to provide position feedback to external devices such as motor controllers, counters, or PLC's.

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

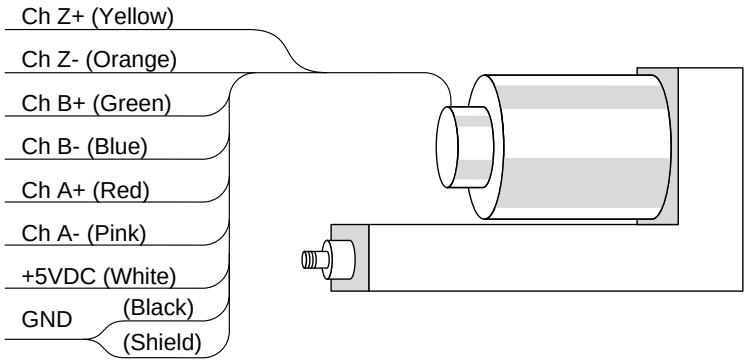
Output Type	Incremental, TTL Level, dual channel square wave. Differential Line Driver.
Pulses Per Revolution	500 line with quadrature (2000 PPR), One index pulse
Supply Voltage	5VDC+/-10%
Current Requirements	80mA max
Frequency	100khz pre-quadrature, max

Dimensions



Note: Cover shown is supplied only with H4 Motor. The S33 and S42 motor housings enclose the encoder in a cavity opposite the output shaft.

Electrical Connections



Linear Potentiometer (-L) Option

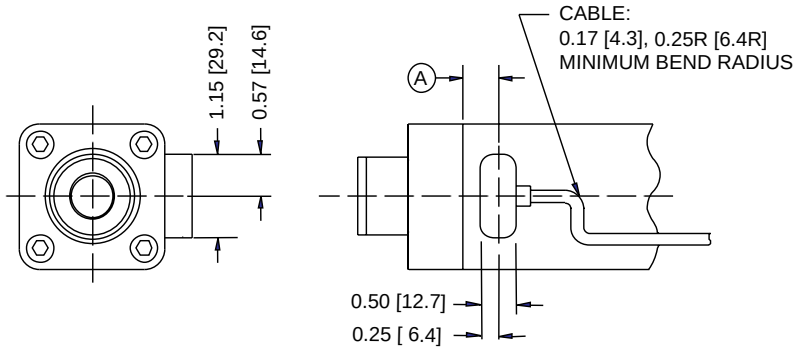
The Linear Potentiometer resides within the cylinder housing and is energized by an external DC power supply. The potentiometer wiper moves in conjunction with the cylinder thrust tube providing an analog voltage feedback signal that is proportional to the linear displacement. (Example: Using a 5 Volt supply; 0VDC = 0% Stroke, 2.5VDC = 50% Stroke and 5 VDC = 100% Stroke)

Note: 1. Not recommended for high vibration environments.
2. Required option when used with B8501 Control.

Specifications

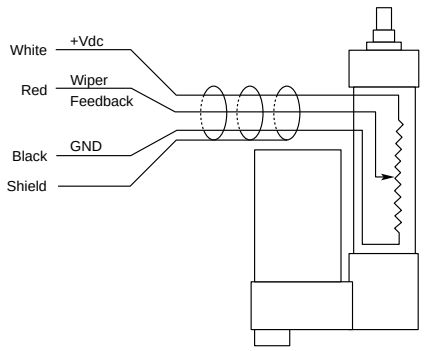
Cylinder Stroke (in)	Resistance (ohms)	Max. Non-Linearity
2	3000Ω +/-30 %	1%
4	6000Ω +/-30 %	1%
6	9000Ω +/-30 %	1%
8	9000Ω +/-30 %	1%
12	7000Ω +/-30 %	1%
18	7000Ω +/-30 %	1%
24 (max. length)	7000Ω +/-30 %	1%

Dimensions



CYLINDER TYPE	DIM "A" WITH 2,4,6,8" STROKE	DIM "A" WITH 12,18,24" STROKE
ACME	0.86 [21.9]	0.99 [25.2]
BALL	0.50 [12.7]	0.63 [16.1]

Electrical Connections



6. Maintenance and Troubleshooting

Basic Maintenance

T Series Electric Cylinders are designed for maintenance-free operation for the 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 these extreme applications, it is recommended that the screw and gears be re-lubricated, and an internal inspection be completed periodically. Inspection/re-lube typically consists of partial disassembly, followed by cleaning, visual evaluation, and re-lubrication.

Field Service

While we recommend our factory repair service in most cases, we recognize that on occasions, it may be desirable to perform minor repairs or maintenance in the field. Such cases include replacing accessible worn or broken components such as belts, rod ends, or mounting hardware, and lubrication of leadscrew or gears as required in extreme applications.
Note: Improper field assembly which causes damage or premature wear voids warranty.

Maintenance Instructions

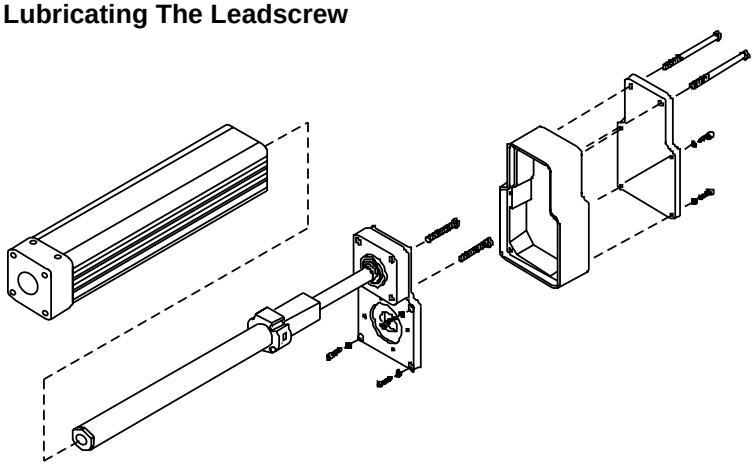
Instructions are shown below for basic maintenance procedures. Parts can be ordered through your local IDC Distributor.

Certain options are difficult to disassemble in the field, and should only be repaired at the factory. These options are listed in the Field Service Chart on page 24.

Lubricating the Leadscrew

A. Remove mounting screws (3/8-16 and 1/4-20 Allen Screws) securing cover plate to drive housing.
B. Remove screws (3/8-16 and 1/4-20 Allen Screws) securing bearing and guide housing.
C. Remove guide housing by sliding it forward over the thrust tube.
D. Position the drive nut (attached to thrust tube) to the extend (away from the motor) end of the leadscrew.
E. With most of the leadscrew exposed, apply a thin coating of grease over the length of the screw. Run the drive nut over the screw length to spread the grease evenly. Reassemble Unit.

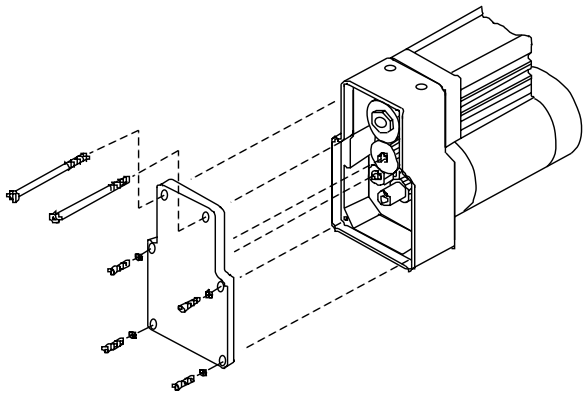
Assembly Drawing:
Lubricating The Leadscrew



Lubricating Gears

A. Remove mounting screws (3/8-16 and 1/4-20 Allen screws) securing cover plate to drive housing
B. With the gears exposed, apply sufficient grease to coat all surface contact areas of gear train.
C. Reassemble unit.

Assembly Drawing:
Gears & Drive Belt



Tensioning the Drive Belt

A. Remove mounting screws (3/8-16 and 1/4-20 Allen screws) securing cover plate to drive housing.
B. Adjust belt tension by adjusting pivot arm (On 1:1 and 1.5:1 units ONLY). Properly tensioned, the belt should not deflect more than 1/8" from stationary centerline, with pressure from fingers.

Field Service Chart

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

	Belt/Gear Drivetrain	**Leadscrew Assembly**	**Mounting Options, Rod Ends, and Options**
Maintenance	• Gear Lubrication • Re-tension Drive Belt *(except cylinders with -W or -L options)*	• Lubrication *(except cylinders with -W, -BS, -L, or cylinders with gear reduction)*	• Clean External Surfaces (i.e. thrust tube, motor, etc.)
Conversion	Factory • Belt/Pulley Ratios (1:1, 1.5:1, 2:1 ratios) • Helical Gear Systems (5:1, 10:1 ratios)	Factory Only	Field • Rod Ends MT1→ FC2, FS2 FC2 → MT1, FS2 FS2 → MT1, FC2 • Mounting Adapters Factory • Rod Ends not listed to left • Change Motor Orientation
Repair	Field • Motors • Motor Pulley's • Drive Belts • Gears - Motor Pinion - Intermed. Gears • Inline Coupling / Sleeve Factory • Driven Pulley • Driven Gear • Driven Coupling • -W Option • -BS Option	Factory Only	Field • Mounting Options • Guide Cylinder • Encoder • Quick Disconnect • Protective Boot • Rod Ends Factory • -W Option • -BS Option • -L Option • 5:1, 10:1 Drive Ratios

Troubleshooting

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

Problems Related to...

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

A. Audible Noise (emitting from cylinder)

Subject and Symptom	Cause
1 Knocking, squealing or grinding during operation	a) Misalignment of internal components b) Excessive Side-loading c) Internal lubrication dried d) Entry of foreign matter into cylinder body

B. Cylinder Motion

1 Stalls/Binds/Sticks during a move (erratic motion)	a) Load too great for cylinder/motor b) Excessive thrust tube side-loading c) Pulley, gear, or coupling slipping d) Erratic motor/drive operation e) Drive nut or internal bearing seizing (locking up) typically due to too high a duty cycle/temperature or entry of foreign matter into cylinder
2 Running rough, not running smoothly	a) Misalignment of internal components b) Excessive side-loading c) Internal lubrication dried d) Entry of foreign matter into cylinder body
3 Extends when it should retract (and visa versa)	a) Motor polarity reversed
4 Vibrates during motion	a) Motor Unstable (servo-gains, stepper-resonance) b) Cylinder being operated at critical speed c) Misalignment of internal components
5 Does not move at all when commanded to move	a) Motor not connected or is damaged b) Load too great for cylinder/motor c) Problem with drive/motor
6 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)
7 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) Cylinder option (such as bronze drivenut) causing excessive friction

C. Positioning and Travel Length

1 Cylinder backdriving (without holding torque on motor)	a) Backdriving force generated by load is greater than the static holding capacity of the cylinder b) Excessive external vibration
2 Cylinder backdriving (with holding torque on the motor)	c) Backdriving force generated by load is greater than the holding capacity of the screw/nut of the cylinder and the holding torque of the motor d) Loss of motor holding torque (servo and steppers)

3 Not enough travel	a) Position sensors reducing "actual" travel b) Cylinder 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/Control operation c) Excessive system backlash

D. Thrust Tube

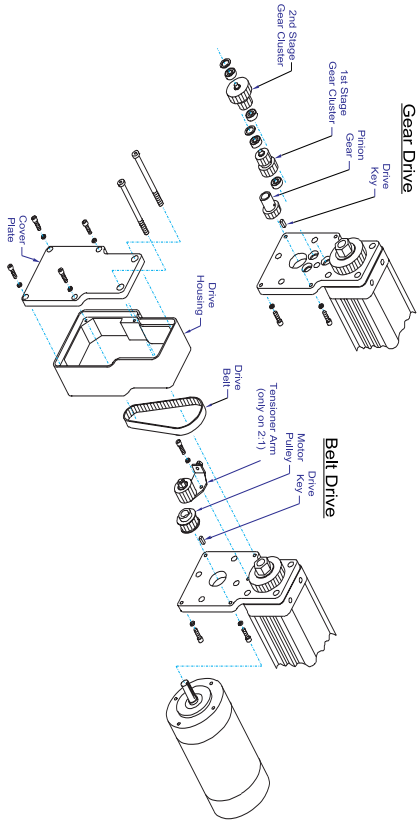
1 Wobbles during extension	a) Leadscrew or thrust tube is bent b) Excessive wear on leadscrew/nut c) Improper mounting of cylinder
2 Deflects too much during extension (Excessive lateral endplay)	a) Leadscrew/nut or internal bearings are worn b) Excessive side-loading c) Improper cylinder mounting
3 Bent	a) Load too great for cylinder b) Excessive side-loading c) Improper cylinder mounting
4 Rotates (excessive radial play)	a) Internal guide flange is damaged b) Thrust tube not fully engaged on drivenut
5 Stuck in fully extended or retracted position	a) Drive nut physically jammed into end of travel b) Load too great for cylinder/motor c) Excessive side loading d) Pulley, gear, or coupling slipping e) Erratic motor/drive operation
6 Excessive axial endplay (system backlash)	a) Leadscrew/nut is worn b) Gears worn/ Belt stretching

E. Cylinder Parts and Options

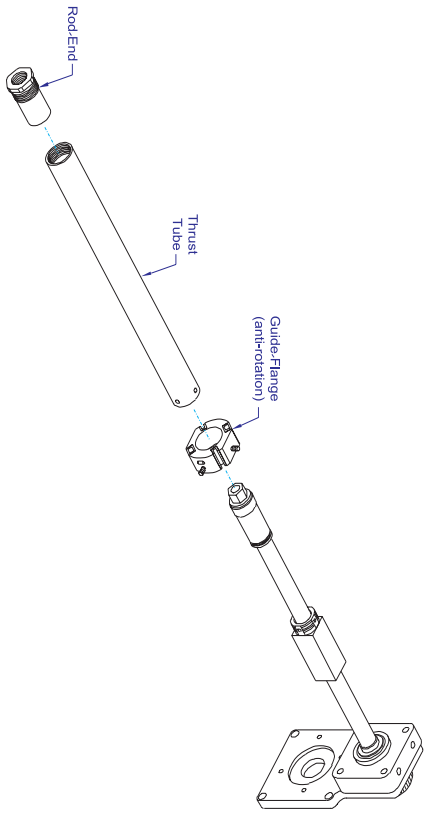
1 Driving belt breaking or gears stripping	a) Motor torque is too great b) Motor accel/decel too great for given load c) Load is too great for cylinder d) Excessive shock loading (running into physical hardstop, rapid change in direction)
2 Position Sensors not being activated by internal magnet	a) Misalignment of internal components b) Weak internal magnet c) Switch/sensor is damaged or miswired d) Sensors positioned improperly on cylinder (not on cylinder side where magnet is located) e) Cylinder 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 cylinder/brake c) Brake damaged or improperly wired
6 Encoder reading improperly	a) Encoder damaged or wired improperly b) Incorrect supply voltage to encoder

Exploded Parts Diagrams

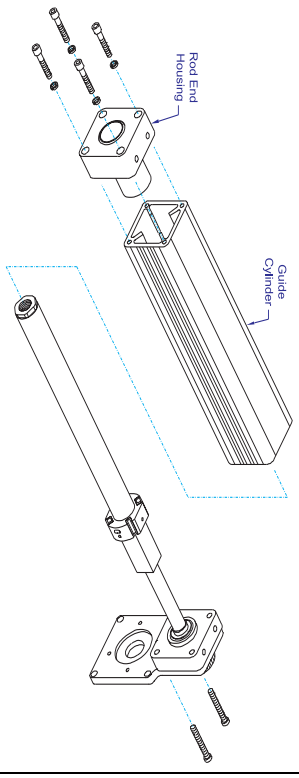
Belt / Gear Drive Assembly



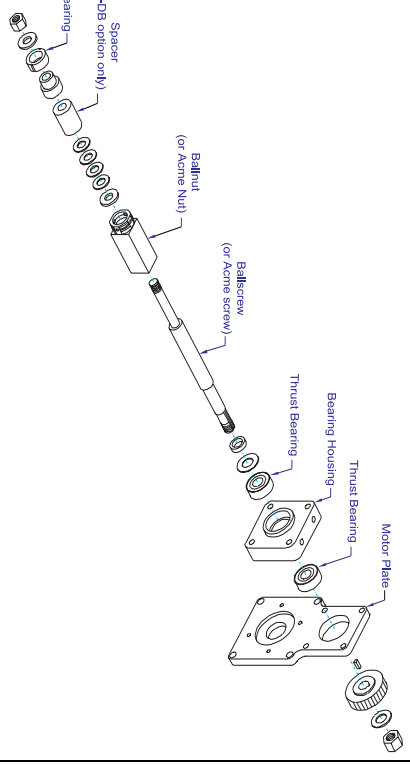
Thrust Tube / Guide Flange Assembly



Rod End / Guide Cylinder Assembly



Leadscrew / Thrust Bearing Assembly



Parts List for T Series Cylinders

Parts can be ordered through your local IDC Distributor.

		TH 160V Brushed DC	TS33 3.4" Stepper	TS42 4.2" Stepper	TB32 3.3" Brushless Servo	TB41 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	Coupling Assembly 950-100	Coupling Assembly 950-106	Coupling Assembly 950-100	Coupling Assembly 950-107	Coupling Assembly 950-100
Lubrication		600-022 Lubrication Packet for Acme Screws *(one packet per 36 inches of stroke)* 600-025 Lubrication Packet for Ballscrews *(one packet per 36 inches of stroke)* 600-035 Lubrication Packet for Gears, Leadscrew Thrust Bearings *(12.5 oz grease gun tube)*				
Encoder		E1KIT Encoder Assembly Kit				
Protective Boots		TBOOTKIT-2 Boot for 2" Unit TBOOTKIT-4 Boot for 4" Unit TBOOTKIT-6 Boot for 6" Unit TBOOTKIT-8 Boot for 8" Unit TBOOTKIT-12 Boot for 12" Unit	TBOOTKIT-18 Boot for 18" Unit TBOOTKIT-24 Boot for 24" Unit TBOOTKIT-36 Boot for 36" Unit TBOOTKIT-48 Boot for 48" Unit TBOOTKIT-60 Boot for 60" Unit	50P213 Wire Ties (Qty 2) *Note: Kits contain BOOTS ONLY*	
Rod Ends		FC2-T-KIT Conversion Kit for Clevis Rod End Option (includes ¾-16 MT1 male threaded fitting) FS2-T-KIT Conversion Kit for Spherical Rod End Option (includes ¾-16 MT1 male threaded fitting)				

Warranty and Service Coverage

Industrial Devices Corporation warrants all T Series Cylinders 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 fail due to improper use or misapplication 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 415-883-3535.

Factory Repair Service

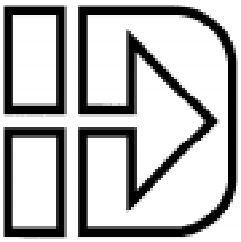
Product repairs are performed at our factory in Novato, California. Prior approval by Industrial Devices is required before returning a product for any reason. All returned products must be accompanied by an Industrial Devices supplied RMA (Return Material Authorization) number.

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 Corporation (at 1-800-747-0064) for an RMA#.
4. Ship the unit prepaid, with the RMA number and documentation to:

Industrial Devices Corporation.
64 Digital Drive
Novato, CA 94949-5704

Attn.: RMA # _____



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