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Rev. 3

401/402XR Series Product Manual

Effective: November 17, 2004
Supersedes: February 27, 2002

Electromechanical Positioning Systems

Important User Information

WARNING

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401/402XR Series Product Manual

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Revision Notes

Rev. 2 – Effective February 27, 2002 – Added Revision Notes, added precision information, updated order number nomenclature, updated dimensional drawings, updated accessories & spare parts, updated mounting bracket configurations, updated mounting bracket dimensions.

Rev 3 – Effective November 17, 2004 – Modified Limit & Home Sensors section to include new 4 wire sensor. Updated sensor pack cable diagram for Limit 1 and Limit 2. Changed all logos to Parker only. Changed web address to www.parkermotion.com and removed division name from company address.

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Chapter 1 - Introduction

Product Description

401XR and 402XR Positioners

The 401XR and 402XR "Mini" Series positioners enhance the 400XR family of precision linear positioners, addressing applications that involve precise positioning of smaller payloads within a very small space envelope. These ballscrew driven positioners were developed to address the needs of industries such as photonics, life sciences, semiconductor, and instrumentation, where technology advancements dictate miniaturization of work envelopes.

400XR Product Family

'Modular Flexibility' is the attribute that clearly distinguishes the 400XR family of linear tables from all others. This product family allows each unit to be easily configured to meet unique requirements, from the very basic to the highly complex. Field upgrades and redesigns are easily accommodated; simply follow the mounting procedure that ships with the desired assembly or individual part. This compatible family of positioners offers reliable accuracy, versatility and strength. Adapters and brackets make it easy to combine 401XR and 402XR positioners, as required, to form multi-axis systems without special design or manufacturing. The 400XR family of products are rugged enough to perform well in the industrial automation environment (automotive, packaging) and yet they're precise enough to excel in the high end semi-conductor and instrumentation markets.

Unpacking



Unpacking

Carefully remove the positioner from the shipping crate and inspect the unit for any evidence of shipping damage. Report any damage immediately to your local authorized distributor. Please save the shipping crate for damage inspection or future transportation.

Incorrect handling of the positioner may adversely affect the performance of the unit in its application. Please observe the following guidelines for handling and mounting of your new positioner.

- DO NOT allow the positioner to drop onto the mounting surface. Dropping the positioner can generate impact loads that may result in flat spots on bearing surfaces or misalignment of drive components.
- DO NOT drill holes into the positioner. Drilling holes into the positioner can generate particles and machining forces that may effect the operation of the positioner. Parker Hannifin Corporation will drill holes if necessary; contact your local authorized distributor.
- DO NOT subject the unit to impact loads such as hammering, riveting, etc. Impacts loads generated by hammering or riveting may result in flat spots on bearing surfaces or misalignment of drive components.
- DO NOT push in magnetically retained strip seals when removing positioner from shipping crate. Damaging strip seals may create additional friction during travel and may jeopardize the ability of the strip seals to protect the interior of the positioner.
- DO NOT submerge the positioner in liquids.
- DO NOT disassemble positioner. Unauthorized adjustments may alter the positioner's specifications and void the product warranty.

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Return Information

Returns
All returns must reference a "*R*eturn *M*aterial *A*uthorization", *(RMA)*, number. Please call your local authorized distributor or Parker Hannifin Corporation Customer Service Department at 800-245-6903 to obtain a "RMA" number. See Parker Hannifin Corporation Catalog #8080/USA, page D34, for additional information on returns and warranty.

Repair Information

Out-of-Warranty Repair
Our Customer Service Department repairs Out-of-Warranty products. All returns must reference a "RMA" number. Please call your local authorized distributor or Parker Hannifin Corporation Customer Service Department at 800-245-6903 to obtain a "RMA" number. You will be notified of any cost prior to making the repair.

Warnings and Precautions



Vertical Operation
Depending upon your load and ballscrew selection the carriage and load may 'backdrive' in power loss situations potentially causing product damage or personal injury.



Strain Relieve Electrical Components
All electrical components (such as brakes, encoders, and limit/home switches) must be strain relieved. Failure to strain relieve electrical wires or cables may result in component failure and/or possible personal injury.

Specification Conditions and Conversions

Specifications are Temperature Dependent
Catalog Specifications are obtained and measured at 20 Degrees C. Specifications at any other temperature may *deviate* from catalog specifications. Minimum to Maximum continuous operating *temperature range* (with NO guarantee of any specification except motion) of a standard unit before failure is 5 - 70 Degrees C. Certain components can be eliminated or substituted to improve operation at these temperatures. Positioners with low temperature or high temperature components will be handled as specials, contact your local distributor.

Specifications are Mounting Surface Dependent
Catalog Specifications are obtained and measured when the positioner is *fully supported*, *bolted down* (to eliminate any extrusion deviation), and is mounted to a work surface that has a *maximum flatness error of 0.013mm/300mm (0.0005"/ft).*

Specifications are Point of Measurement Dependent
Catalog Specifications and Specifications in this manual are measured in the center of the carriage, 37.5mm above the carriage surface. All measurements taken at any other location may deviate from these values.

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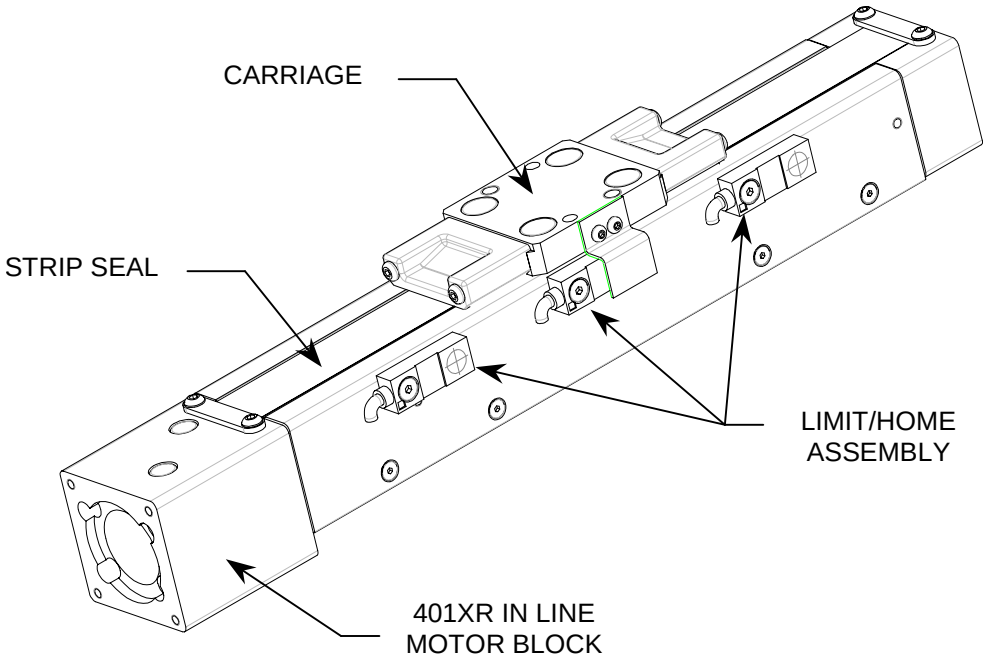
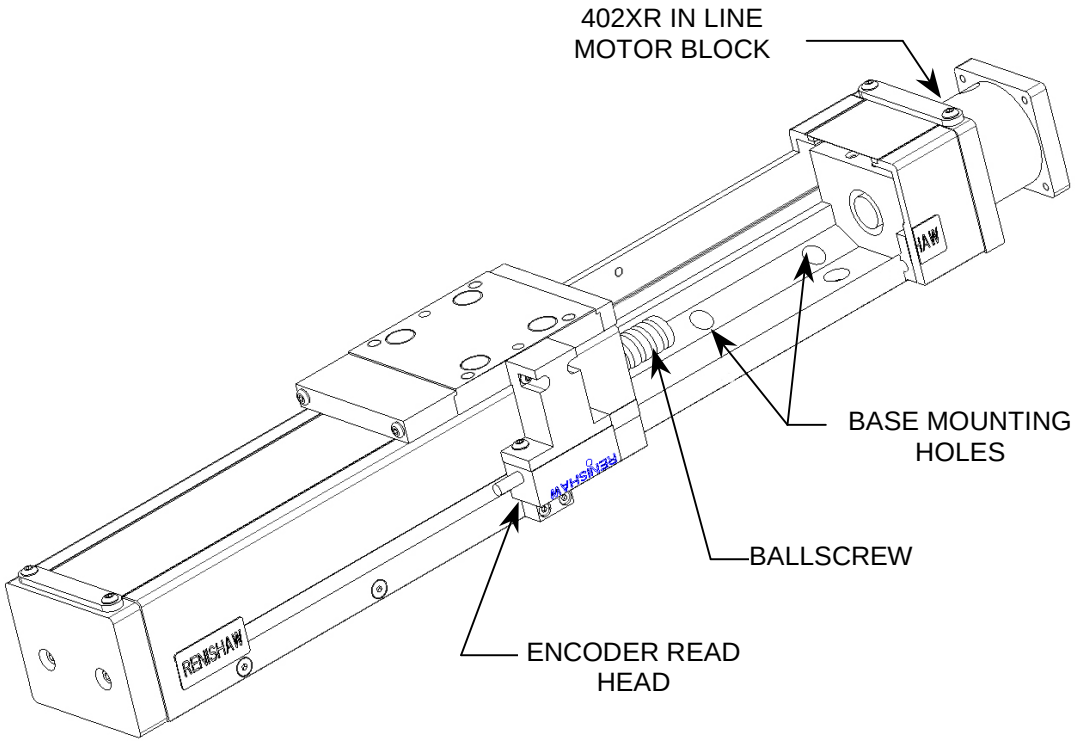
Assembly Diagrams





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Chapter 2 - 400XR Series Table Specifications

Order Number Nomenclature

401/402XR How to Order

	401	100	XR	M	S	D9	H3
Order Example							

Series
- 401
- 402

Travel (mm)
- 50 050
- 100 100
- 150 150
- 200 200
- 300 300
- 400 400
- 600 600

Model ..... XR

Mounting (metric) ..... M

Grade
- Standard ..... S
- Precision (E3 or E4 encoder option required) ..... P

Drive Screw
- 5 mm Lead D2
- 10 mm Lead D3
- 2 mm Lead D9

Home Sensor
- No sensor H1
- N.C. current sinking flying leads H2
- N.O. current sinking flying leads H3
- N.C. current sourcing flying leads H4
- N.O. current sourcing flying leads H5
- N.C. current sinking locking connector H6
- N.O. current sinking locking connector H7
- N.C. current sourcing locking connector H8
- N.O. current sourcing locking connector H9
- N.C. current sinking-sensor pack H11
- N.O. current sinking-sensor pack H12
- N.C. current sourcing-sensor pack ... H13
- N.O. current sourcing-sensor pack ... H14



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L2 C3 M2 E2 R1



R1 Required Designator

Encoder Option

- E1 No encoder
- E2 1 µm resolution linear
- E3 0.5 µm resolution linear
- E4 0.1 µm resolution linear

Motor Mount

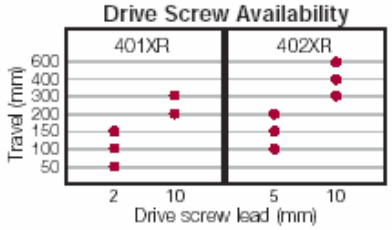
- M2 SM16 - Inline mounting
- M3 NEMA23 - Inline mounting
- M37 NEMA17 - Inline mounting
- M61 BE23 - Inline mounting

Motor Coupling

- C1 No coupling
- C2 6,3 mm (.25 in) bore Oldham
- C3 6,3 mm (.25 in) bore Bellows
- C4 9,5 mm (.38 in) bore Oldham (402XR only)
- C5 9,5 mm (.38 in) bore Bellows
- C24 5 mm bore Oldham
- C25 5 mm bore Bellows

Limit Sensors

- L1 No sensor
- L2 N.C. current sinking flying leads
- L3 N.O. current sinking flying leads
- L4 N.C. current sourcing flying leads
- L5 N.O. current sourcing flying leads
- L6 N.C. current sinking locking connector
- L7 N.O. current sinking locking connector
- L8 N.C. current sourcing locking connector
- L9 N.O. current sourcing locking connector
- L11 N.C. current sinking-sensor pack
- L12 N.O. current sinking-sensor pack
- L13 N.C. current sourcing-sensor pack
- L14 N.O. current sourcing-sensor pack



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Dimensional Drawings

401XR Series Dimensions (mm)

CAD Files...
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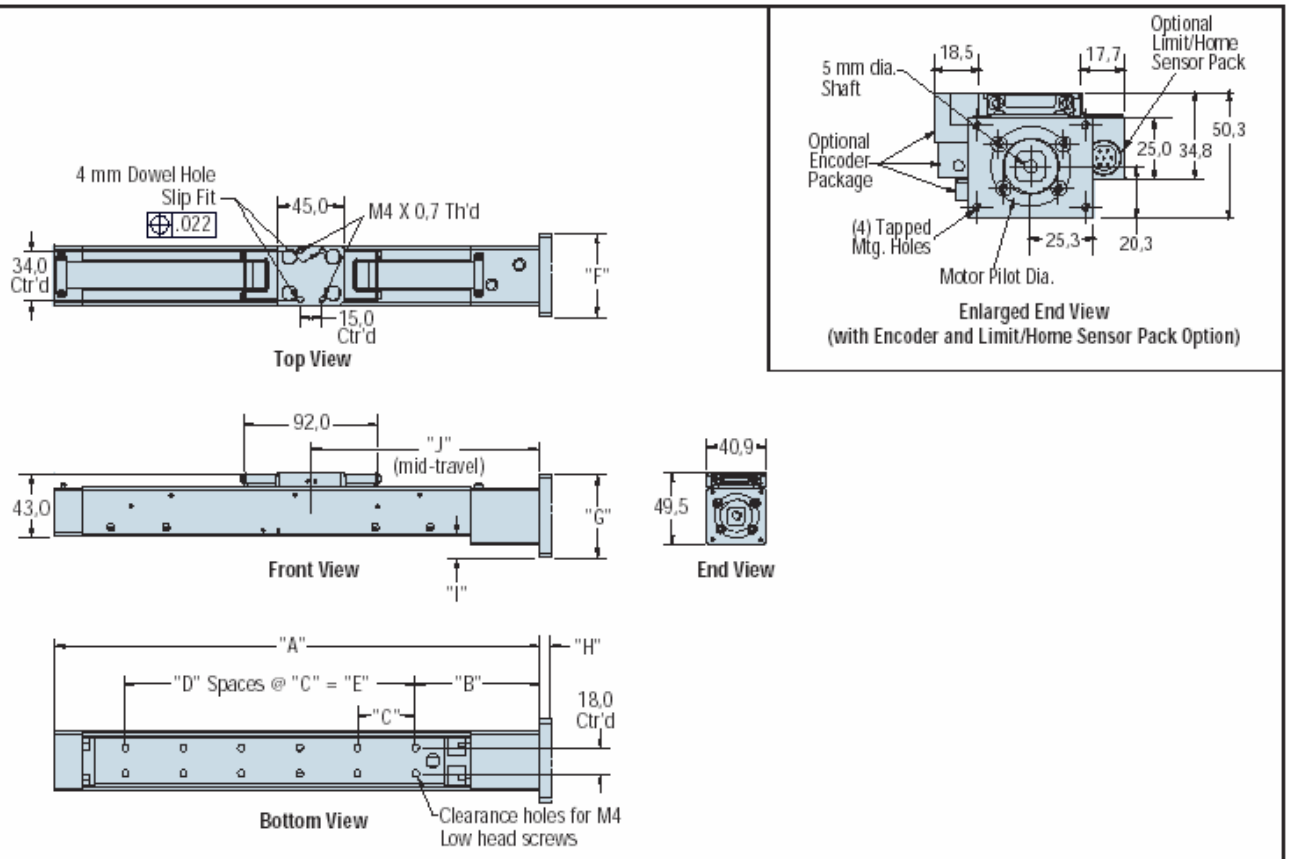


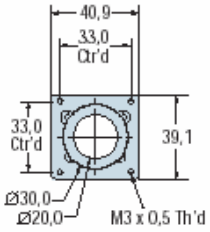
Travel	A	B	C	D	E	J
50	209,3	82,8	80,0	1	80,0	123,0
100	284,3	80,3	40,0	4	160,0	160,0
150	334,3	85,3	40,0	5	200,0	185,0
200	384,3	90,3	40,0	6	240,0	210,0
300	484,3	92,8	40,0	9	360,0	260,0

Motor Size	Order Code	F	G	H	I
SM 16	M2	40,9	39,1	0	6,5
NEMA 23/SM 23	M3	57,2	57,2	4,0	15,6
NEMA 17	M37	40,9	39,1	0	6,5
BE 23	M61	57,2	57,2	8,0	15,6

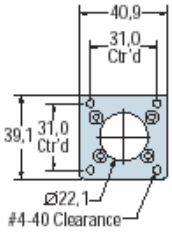
In-Line Motor Adaptors

Used to easily accommodate the mounting of different servo or stepper motors.

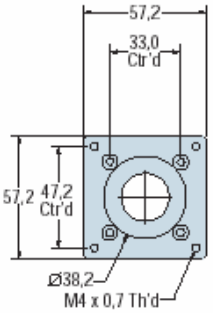
SM 16



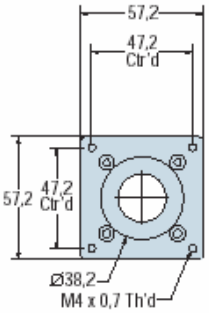
NEMA 17



SM 23 or NEMA 23



BE 23



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402XR Series Dimensions (mm)

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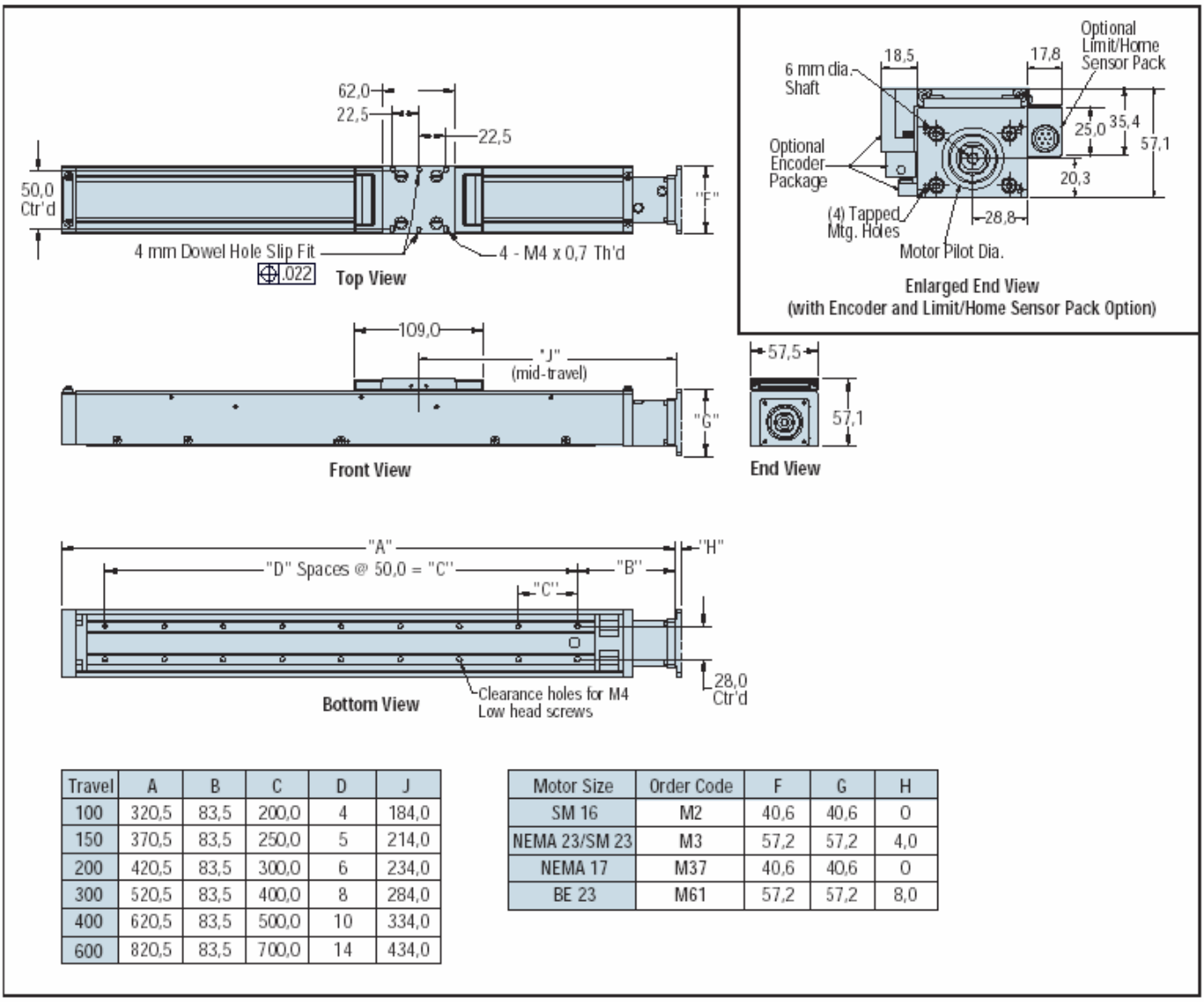


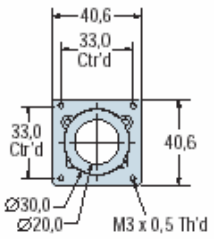
Travel	A	B	C	D	J
100	320,5	83,5	200,0	4	184,0
150	370,5	83,5	250,0	5	214,0
200	420,5	83,5	300,0	6	234,0
300	520,5	83,5	400,0	8	284,0
400	620,5	83,5	500,0	10	334,0
600	820,5	83,5	700,0	14	434,0

Motor Size	Order Code	F	G	H
SM 16	M2	40,6	40,6	0
NEMA 23/SM 23	M3	57,2	57,2	4,0
NEMA 17	M37	40,6	40,6	0
BE 23	M61	57,2	57,2	8,0

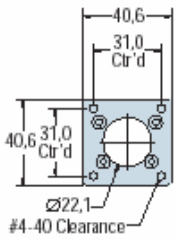
In-Line Motor Adaptors

Used to easily accommodate the mounting of different servo or stepper motors.

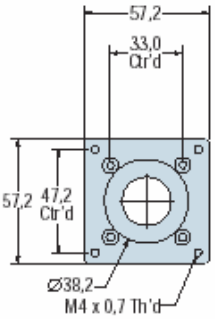
SM 16



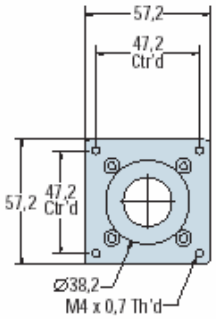
NEMA 17



SM 23 or NEMA 23



BE 23



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General Table Specifications

	Precision Grade		Standard Grade	
Common Characteristics	**401XR**	**402XR**	**401XR**	**402XR**
Performance				
Bidirectional Repeatability (μm)				
2 mm lead	+/-1.3	NA	+/-5	NA
5 or 10 mm lead	+/-1.3	+/-1.3	+/-12	+/-12
Duty Cycle	100%	100%	100%	100%
Max Acceleration – m/sec^2 (in/sec^2)	20 (773)	20 (773)	20 (773)	20 (773)
Rated Capacity				
Normal load – kgf (lbs)	50 (110)	100 (220)	50 (110)	100 (220)
Axial load – kgf (lbs)				
2 mm lead	5.5 (12.1)	NA	5.5 (12.1)	NA
5 or 10 mm lead	15.5 (34.2)	38 (84)	15.5 (34.2)	38 (84)
Motor Sizing	80%	80%	80%	80%
Drive Screw Efficiency				
Max Break-Away Torque Nm (in-oz)	0.03 (4.2)	0.086 (12.0)	0.03 (4.2)	0.086 (12.0)
Max Running Torque – Nm (in-oz)	0.028 (4.0)	0.08 (11.3)	0.028 (4.0)	0.08 (11.3)
Linear Bearing – Coefficient of Friction	0.01	0.01	0.01	0.01
Ballscrew Diameter – mm				
2 mm lead	6	NA	6	NA
5 or 10 mm lead	8	12	8	12
Output Shaft Diameter – mm	5	6	5	6
Carriage Weight – kgf (lbs)	0.045 (0.1)	0.11 (0.25)	0.045 (0.1)	0.11 (0.25)

Travel (mm)	Positional Accuracy (μm)				Straightness & Flatness Accuracy (μm)		Input Inertia 10^{-3} kg-cm^2				Max Screw Speed (Revs Per Second)		Unit Weight (kg)	
	401		402				401		402		401	402	401	402
	P*	S	P*	S	401	402	2 mm	10 mm	5 mm	10 mm				
50	10	20	-	-	20	-	0.6	-	-	-	70	-	1.0	-
100	10	20	10	20	20	20	0.9	-	12.0	-	70	70	1.2	2.3
150	12	20	12	20	20	20	1.1	-	15.0	-	70	70	1.3	2.6
200	16	30	16	30	25	25	-	4.7	20.0	-	70	70	1.5	2.8
300	18	40	18	40	25	25	-	5.2	-	25.0	70	70	1.7	3.2
400	-	-	21	40	-	30	-	-	-	29.0	-	55	-	3.8
600	-	-	25	50	-	30	-	-	-	39.0	-	30	-	4.8

*Accuracy stated is at 20°C utilizing slope correction factor provided.

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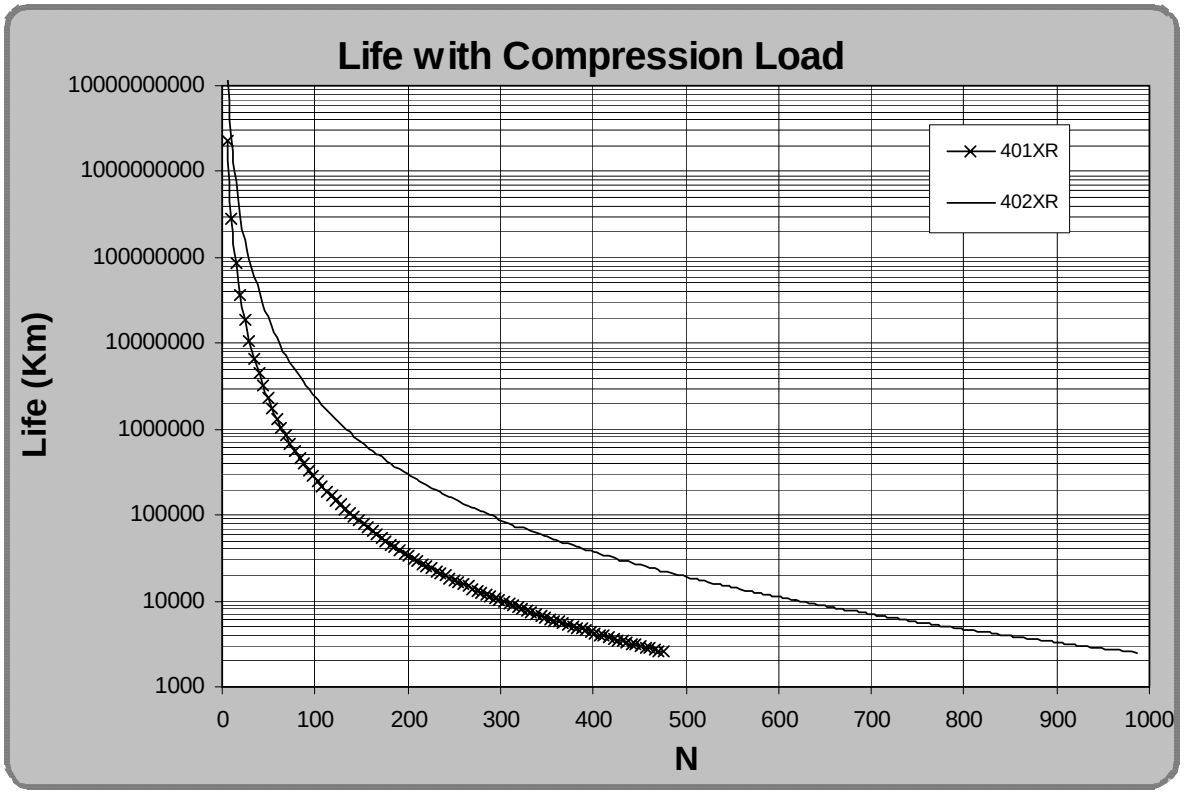
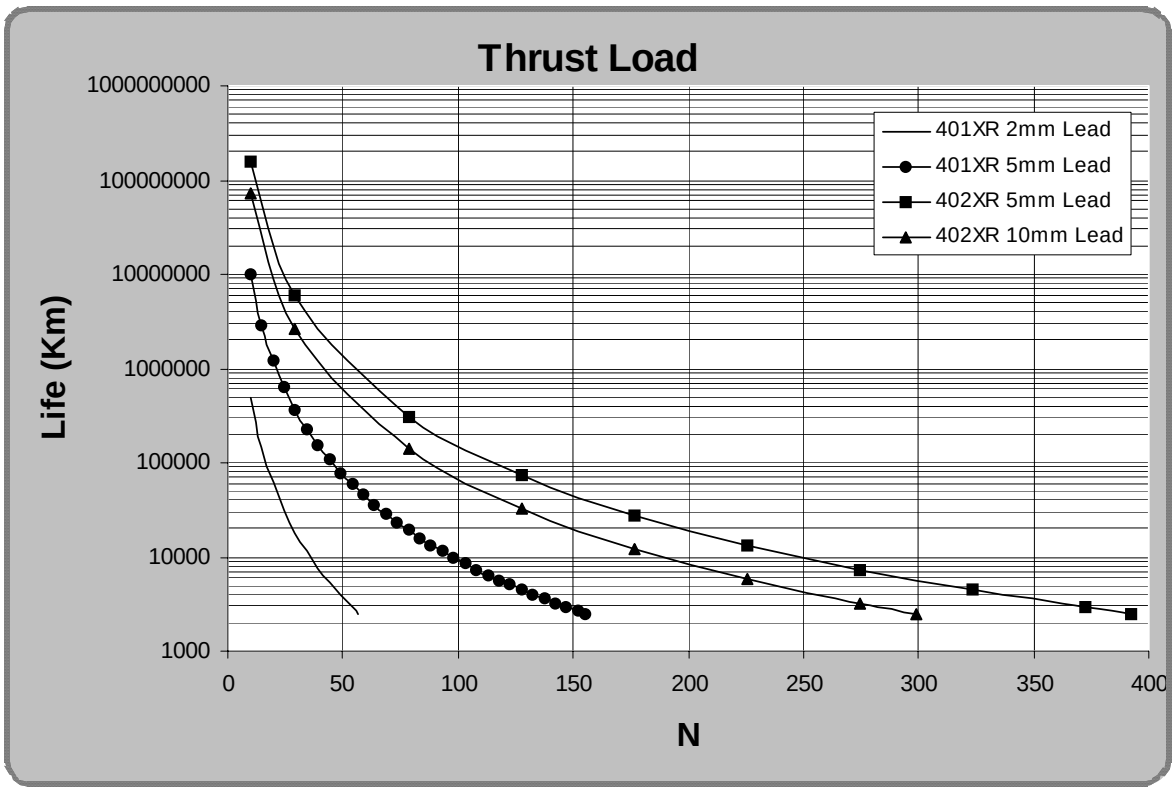
401-402XR Series Technical Data

The useful life of a linear table at full catalog specifications is dependent on the forces acting upon it. These forces include both static components resulting from payload weight, and dynamic components due to acceleration/deceleration of the load. In multi-axes applications, the primary positioner at the bottom of the stack usually establishes the load limits for the combined axes. When determining load/life, it is critical to include the weight of all positioning elements that contribute to the load supported by the primary axis. The life/load charts are used to establish the table life relative to the applied loads.

Table Load Chart
The "Table Load" chart is intended to provide a rough-cut evaluation "life/load" characteristics of the carriage support bearings. This curve is based on the applied load being centered on the carriage, normal to the carriage mounting surface.



Thrust Load Chart
The "Thrust Load" chart illustrates table ballscrew life relative to the axial load.



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Ground Ballscrew Drive

Technical Data

Topic: ***Maximum Screw Speed*** *(Revs/Sec)*

	401				402			
Travel mm	2 mm lead		10 mm lead		5 mm lead		10 mm lead	
	rps	mm/s	rps	mm/s	rps	mm/s	rps	mm/s
50	70	140	-	-	-	-	-	-
100	70	140	-	-	70	350	-	-
150	70	140	-	-	70	350	-	-
200	-	-	70	700	70	350	-	-
300	-	-	70	700	-	-	70	700
400	-	-	-	-	-	-	55	550
600	-	-	-	-	-	-	30	300

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Chapter 3 - Component Specifications

Linear Encoders

Description	Specification
Input Power	5 VDC +/- 5% 150mA
Output (incremental)	Square wave differential line driver (EIA RS422) 2 channels A and B in quadrature (90) phase shift
Reference (Z channel) – see below for additional information	Synchronized pulse, duration equal to one resolution bit. Repeatability of position is unidirectional moving toward non-motor end.
Positional Accuracy	+/- 3 microns after linear slope correction
Maximum Speed – see page 14 for additional information	1.0 micron resolution = 3.0 meters/sec 0.5 micron resolution = 1.5 meters/sec 0.1 micron resolution = 0.3 meters/sec

Z-Channel Position Reference

The Z channel is an output on the encoder. Many servo controllers support this input. The Z channel on the 401/402XR is located at mid travel. The Z channel is a unidirectional device. This means that the final homing direction must occur in one direction. The 401/402XR is set so that the final home direction is to be toward the non-motor end of the table. The repeatability of the Z channel is equal to +/- 2 resolution counts of the encoder (except for 0.1 micron scales which have a repeatability of +/-1 microns). Thus the repeatability of the "Z" channel equals:

Encoder Resolution	Z Channel Repeatability
1 micron	+/- 2 micron
0.5 micron	+/- 1 micron
0.1 micron	+/- 1 micron

NOTE: Home repeatability is also very dependent on controller input speed and homing algorithms. The above repeatability does not include possible controller tolerance. Additionally, to achieve the highest repeatability the final homing speed must be slow. Slower final speed usually results in higher repeatability.

NOTE: The "Z" channel output is only one resolution count wide. Thus the *on-time* may be very brief. Due to this some controllers may have difficulty reading the signal. If you are experiencing the positioner not finding the "Z" channel during homing, try reducing final homing speed; also refer to your controller manual for frequency rates of the "Z" channel input.

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Linear Encoder Speed Limit

The linear encoder has speed limits relative to encoder resolution; these limits are listed below:

Encoder Resolution	Maximum Velocity (2)	Required Post Quadrature Input Bandwidth (1)
1 micron	3 meters/second	6.7 Mhz
0.5 micron	1.5 meters/second	6.7 Mhz
0.1 micron	0.3 meters/second	10 Mhz

(1) This is the bandwidth frequency that the amplifier or servo control input should have to operate properly with the encoder output at maximum speeds. This frequency is post-quadrature, to determine pre-quadrature divide above values by 4. Above frequencies include a safety factor for encoder tolerances and line loses.

(2) Maximum encoder speed may exceed maximum speed of positioner – See page 11, General Table Specifications, for maximum screw speed.

Linear Encoder Wiring Diagram

Termination: Flying Leads

Function	Signal Name	Wire Color
Power	+5V	Brown
	0V	White
Incremental Signal	A+	Green
	A-	Yellow
	B+	Blue
	B-	Red
Reference	Z+	Violet
	Z-	Grey
Alarm	E+	Black
	E-	Orange
Set-up Signal	X	Clear
Inner Shield	Inner Shield	Bare (Connect to White Lead - 0V Ground)
Outer Shield	Outer Shield	Bare (Connect to Earth Ground)

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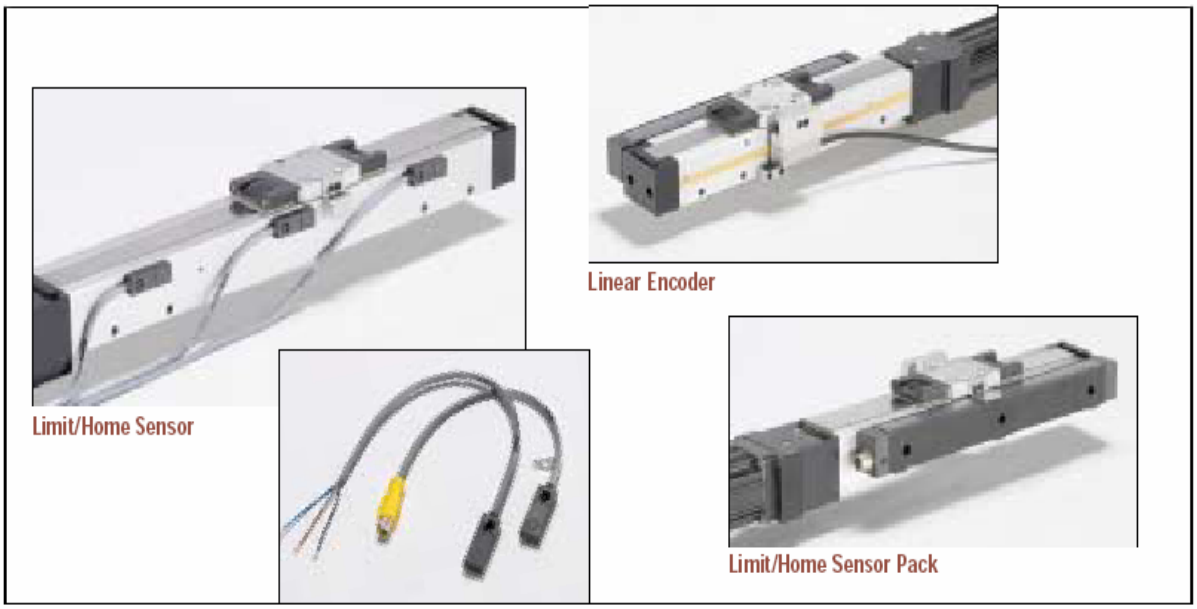
Limit & Home Sensors

Switch Type	Proximity				
Input Power	5-30VDC, 20mA				
Output	100mA (max)				
Repeatability	+/- 10 microns (unidirectional)				
Wire Color Code	3 Wire Sensor		4 Wire Sensor		
	(+) Supply	Brown	(+) Supply	Brown	
	Output	Black	(N.O.) Normally Open Output	Black	
	(-) Supply	Blue	(N.C.) Normally Closed Output	White	
			(-) Supply	Blue	
Cable Length	Refer to ordering information in Appendix B				
LED Color	Yellow				
Switch Location	The L2-L9 limit sensors are fixed at the end of travel locations. The H2-H9 home sensors are fixed at the center of travel.				
Sensor Pack Switch Location	The L11-L14, H11-H14 Limit/Home options are enclosed in a sensor pack that is bolted to the side of the table. These sensors are adjustable along the length of the sensor pack. (Wire terminates in a 5-pin connector; extension cable included)				
N.O./N.C. Options	Normally Open (N.O.) switches are typically used as home sensors and are typically located between the limit sensors. Normally Closed (N.C.) switches are generally used as defense circuits to prevent damage to components caused by over-travel.				
Sinking/Sourcing Options	Sinking Switches (a.k.a. NPN): The output lead of this switch provides an electrical path to ground when activated. Sourcing Switches (a.k.a. PNP): The output lead of this switch provides a positive (+) voltage potential relative to ground. Note: refer to the controller's manual for input compatibility.				
Temperature Range	-14° F to +158° F				
Vacuum Rating	1 x 10^{-3} Torr				

CAUTION: REVERSING SUPPLY POTENTIAL WILL DESTROY SENSOR
Brown: +5 to +30VDC Supply
Blue: Ground Supply
Black: Signal Output



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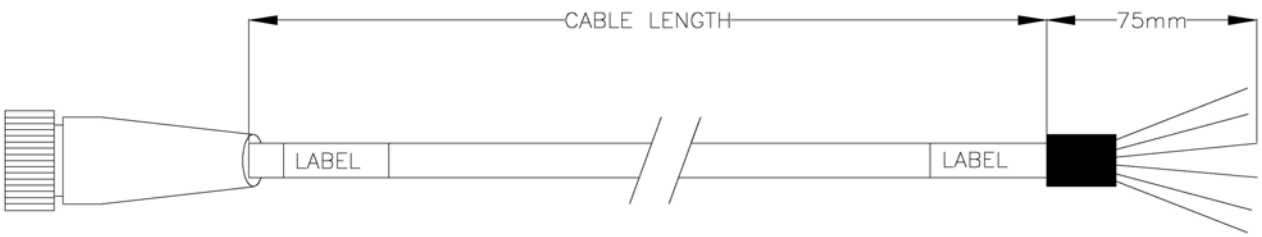
Sensor Pack Cable Wiring Diagram



DAEDAL PART NO.	CABLE LENGTH
006-1742-01	3 METERS
006-1742-02	7.5 METERS

WIRE COLOR	FUNCTION	PIN #
RED	+5 to +24V DC	A
BLUE	LIMIT 1 (LXR -)	B
ORANGE	LIMIT 2 (LXR +)	C
GREEN	HOME	D
BLACK	GROUND	E
GREEN w/ YELLOW STRIPE	SHIELD	Shield Case

Note: Limit 2 is the limit switch on the connector end of the sensor pack housing.

Couplings

Coupling Grade (Style): ***Standard Grade*** *(Oldham)*

Catalog Coupling Code	Bore Diameter (Motor Side)	Outside Diameter (mm)	Length (mm)	Rated Torque (Nm)	Torsional Windup (Nm/Rad)	Misalignment Specifications		
						Lateral (mm)	Axial (mm)	Angular
C2 *	0.250"	19	22	1.69	115	+/- 0.203	+/- 0.102	+/- 0.5°
C2 **	0.250"	25	28.5	3.95	204	+/- 0.203	+/- 0.102	+/- 0.5°
C4 **	0.375"	25	28.5	3.95	204	+/- 0.203	+/- 0.102	+/- 0.5°
C24	5 mm	19	22	1.69	115	+/- 0.203	+/- 0.102	+/- 0.5°

Coupling Grade (Style): ***Precision Grade*** *(Bellows)*

Catalog Coupling Code	Bore Diameter (Motor Side)	Outside Diameter (mm)	Length (mm)	Rated Torque (Nm)	Torsional Windup (Nm/Rad)	Misalignment Specifications		
						Lateral (mm)	Axial (mm)	Angular
C3	0.250"	20	26	1.5	748	+/- 0.1	+/- 0.25	+/- 1.2°
C5	0.375"	20	26	1.5	748	+/- 0.1	+/- 0.25	+/- 1.2°
C25	5 mm	20	26	1.5	748	+/- 0.1	+/- 0.25	+/- 1.2°

* 401XR only
** 402XR only

Output Shaft Diameter: 401XR 5mm
402XR 6mm

Replacement Couplings: Consult factory for replacement couplings.

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Chapter 4 - Base Mounting Procedures

Mounting Surface Requirements

Proper mounting of the 401/402XR is *essential* to optimize product performance. All specifications are based on the following conditions:

- The positioner must be bolted down along its entire length.
- The positioner must be mounted to a flat, stable surface with a flatness error less than or equal to 0.013mm/300mm.
    - Catalog specifications may deviate for positioners mounted to surfaces that do not meet the above conditions.
    - If the surface does not met these specifications the surface can be shimmed to comply with these requirements.
- If mounting conditions require that the table base is *overhung*, table specifications will not be met over that portion of the table. Additionally, in *X-Y Systems* the *overhung* portion of the Y-axis may not met specifications due to the additional error caused by deflection and non-support of the base. Contact Parker Hannifin Corporation for guidelines on specifications of overhang applications.

Base Mounting Methods

Base thru holes

The 401/402XR tables have counter bored holes in the base of the unit. See Dimensional Drawings, Chapter 2, for hole locations. See Internal Access Procedure, Chapter 6, to gain access to mounting holes.

Riser Blocks

Tools Required: Allen Key

Most of the motors used with the 401/402XR series have a taller profile than the positioner. Thus the unit cannot be mounted with the motor and table in the same plane. Riser blocks can be provided to space the table above a mounting surface.

- Locate sufficient amount of Riser Blocks for the required length of travel.
- Lay out Riser Blocks such that the entire length of the positioner is supported.
- Access interior of the positioner. See Internal Access Procedure Chapter 6.
- Mount Riser Blocks to the positioner using screws provided.
- Mount positioner to the work surface using counter-bored holes in the riser blocks.
- Reassemble positioner.

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Chapter 5 - Component Mounting Procedures

Center Drive Motor Mounting

Tools Required: Allen Key

- Slip coupling over drive shaft and tighten the screw on the drive shaft side of the coupling. **Note: Do not use Loctite on coupling screws.**
- Slide motor into motor adapter plate and into coupling. Select the appropriate hardware and tighten all bolts.
- Tighten the coupling screw on the motor shaft side. Turn motor by the rear shaft to make sure carriage moves. Then hold carriage and rotate motor again by the rear shaft to make sure coupling won't slip. If the motor does not have a rear shaft be certain that the coupling screws are tight. **Note: Do not use Loctite on coupling screws.**

Limit/Home Switch Mounting Procedure

Tools Required For Adjustment: Allen Key

Travel limit sensors signal the motor to stop whenever the table carriage is approaching the end of travel. These sensors are fixed at the end of table travel. The home sensor provides a fixed reference point which the carriage can be commanded to return repeatedly. This sensor is fixed at the center of travel.

- Identify limit/home sensors and mounting hardware per the configuration, which is appropriate to the application.
    - Normally Closed, Current Sinking
    - Normally Open, Current Sinking
    - Normally Closed, Current Sourcing
    - Normally Open, Current Sourcing
- Attach the limit and home switches to side of unit using flat head screws, making sure they run parallel to the side of the carriage.
- Attach sensor flag to side of carriage with button head screws.
- Run the carriage the full travel and make sure that the sensors do not interfere with the sensor flag.
- Refer to Wire Color Code in Chapter 3.

NOTE: When adjusting Sensor Pack switches, the screws may be turned a maximum of 1/4 turn. Any further loosening may result in the nut becoming disengaged. If this occurs the sensor pack will need to be disassembled so that the nut can be reattached.

Chapter 6 – Internal Access and Lubrication

Internal Access Procedure

Tools Required: Ball driver or Allen Key

Procedure: The following procedure outlines the steps required to access the mounting holes located inside the unit.

- Remove the strip seal clamps and carefully pull back strip seal.
- **CAUTION:** Edges of strip seal are very sharp. Use caution while handling the strip seal.
- If you are using a round ended ball driver you will be able to tighten/loosen the base mounting screws.
- If you are using an Allen key you will need to remove the side covers. Remove the screws on the bottom of the side cover and slide off the side. You will now be able to access the base mounting screws with the Allen key.

Square Rail Bearing Lubrication

The square rail bearings are lubricated for the life of the table. No further lubrication is required.

Ground Ballscrew Lubrication

The ballscrew is lubricated for the life of the table. No further lubrication is required.

Appendix A - Internal Protection

The 404XR is protected from its environment via magnetically retained Protective Seals. Parker Hannifin Corporation has conducted testing to determine the *degree* to which the positioner is protected by using a British standard called an **Ingress Protection Rating (IP Rating)**.

Definition

Reference: British standard EN 60529: 1992
This standard describes a system of classifying degrees of protection provided by enclosures of electrical equipment. Standardized test methods and the establishment of a two digit numeric rating verify the extent of protection provided against access to hazardous parts, against ingress of solid foreign objects, and against the ingress of water.

First Number – The first number indicates protection of persons against access to dangerous parts and protection of internal equipment against the ingress of solid foreign objects.

1 - Protection against access to hazardous parts with the back of a hand, and protected against solid foreign objects of 50 mm diameter and larger.

2 - Protection of fingers against access to dangerous parts, and protection of equipment against solid foreign objects of 12.5 mm diameter and larger.

3 - Protection against access to hazardous parts with a tool, and protection against solid foreign objects of 2.5 mm diameter and larger.

Second Number – The second number indicates protection of internal equipment against harmful ingress of water.

0 - No special protection provided.

Note: Number Indicators above represent only a partial list of IP Rating specifications.

Warnings (Points of Clarity)

- The specification applies to protection of particles, tools, parts of the body, etc., against access to hazardous parts inside the enclosure. This does not cover external features such as switch pinch points, pinch points causes by the motion of the carriage, or cable carrier assemblies.
- The testing method as specified in the standard uses a solid steel rod of the appropriate diameter at a specified force. The specification does not consider soft or pliable particles. Due to the design of the table and sealing method, a soft particle can compress due to the motion of the table, and reduce its cross-section. This can allow particles to enter the unit.
- In application, shavings or chips commonly created in a machining operation are a greater concern. If any edge or dimension of the “chip” is under the appropriate diameter, it can wedge under and start to the lift the seals. This action will allow larger particles to do the same until failure is reached.

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Using the "IP Ship Kit"

All standard configurations will pass IP20 specifications with the following exception:

All standard configurations can be configured to pass IP30 specifications by utilizing the “IP ship kit” supplied with each unit as follows:

- Using the supplied *aluminum foil disks*, cover all *counter-bored base mounting holes* that are not covered by your mounting surface. The disks should be installed from the outside of the unit. Depending on the travel length, some disks will not be used. Use the 0.75 inch diameter disk to cover the large hole on the drive end of the unit.

- Using the supplied *aluminum foil disks*, plug any *exposed holes on side covers* of the unit. The number of holes on the side covers will vary with the options ordered.

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Appendix B - Accessories & Spare Parts

Home H_ or Limit Sensor L_

End of Travel and Home Sensors for the 400XR series are available in a variety of styles. The sensors can be ordered as part of the table or as separate components with the associated mounting hardware or in an enclosed sensor pack. A 5 meter "hi-flex" extension cable (Part No. 003-2918-01) is available for use with the 401XR thru 406XR models having the locking connector option.

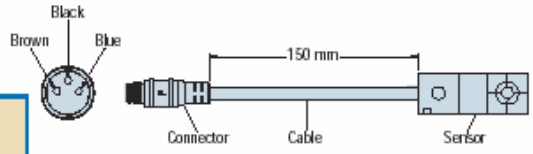
- NPN (Sinking) or PNP (Sourcing)
- Normally Closed (N.C.) or Normally Open (N.O.)
- Flying Leads or Locking Connector

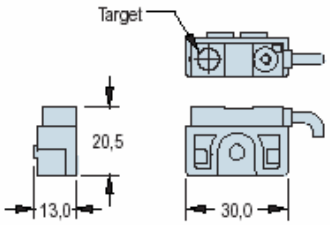
Input Power	5-30VDC, 20mA
Output	100mA max
Repeatability (Typical)	±10 microns (unidirectional)
Wire Color Code	(+) Supply: Brown Output: Black (-) Supply: Blue



Order Code	Part No. (Includes Target & Mounting Bracket)	Switch Type	Logic	Cable Length	Connector Option
H2 or L2	006-1639-01	N.C.	Sinking	2,0 m	Flying Leads
H3 or L3	006-1639-02	N.O.	Sinking	2,0 m	Flying Leads
H4 or L4	006-1639-03	N.C.	Sourcing	2,0 m	Flying Leads
H5 or L5	006-1639-04	N.O.	Sourcing	2,0 m	Flying Leads
H6 or L6	006-1639-09	N.C.	Sinking	150 mm	Locking Connector
H7 or L7	006-1639-08	N.O.	Sinking	150 mm	Locking Connector
H8 or L8	006-1639-11	N.C.	Sourcing	150 mm	Locking Connector
H9 or L9	006-1639-10	N.O.	Sourcing	150 mm	Locking Connector

* Applies to 401XR thru 406XR models. 412XR models have limits and homes internally mounted with a connector termination.





Sensor / Bracket Detail

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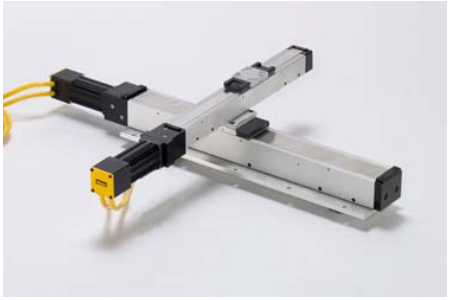
Mounting Bracket Configuration

X – Y	Y Axis			
X Axis		401XR 50mm	401XR > 50mm	402XR
	401XR	002-2126-01	002-2065-01	N/A
	402XR	002-2130-01	002-2066-01	002-2066-01



X – Y Cartesian	Y Axis			
X Axis		401XR 50mm	401XR > 50mm	402XR
	401XR	002-2123-01	002-2068-01	N/A
	402XR	002-2069-01	002-2069-01	002-2069-01



X – Z	Z Axis			
X Axis		401XR 50mm	401XR > 50mm	402XR
	401XR	N/A	002-2068-01	N/A
	402XR	N/A	002-2069-01	002-2069-01

X – Z Side Mount	Z Axis			
X Axis		401XR 50mm	401XR > 50mm	402XR
	401XR	002-2123-01	002-2068-01	N/A
	402XR	002-2125-01	002-2069-01	002-2069-01



Riser Plates	
401XR	002-2063-01
402XR	002-2064-01

Additional Mounting Plates	
To 404XR	100-9193-01
To 406XR	100-9194-01

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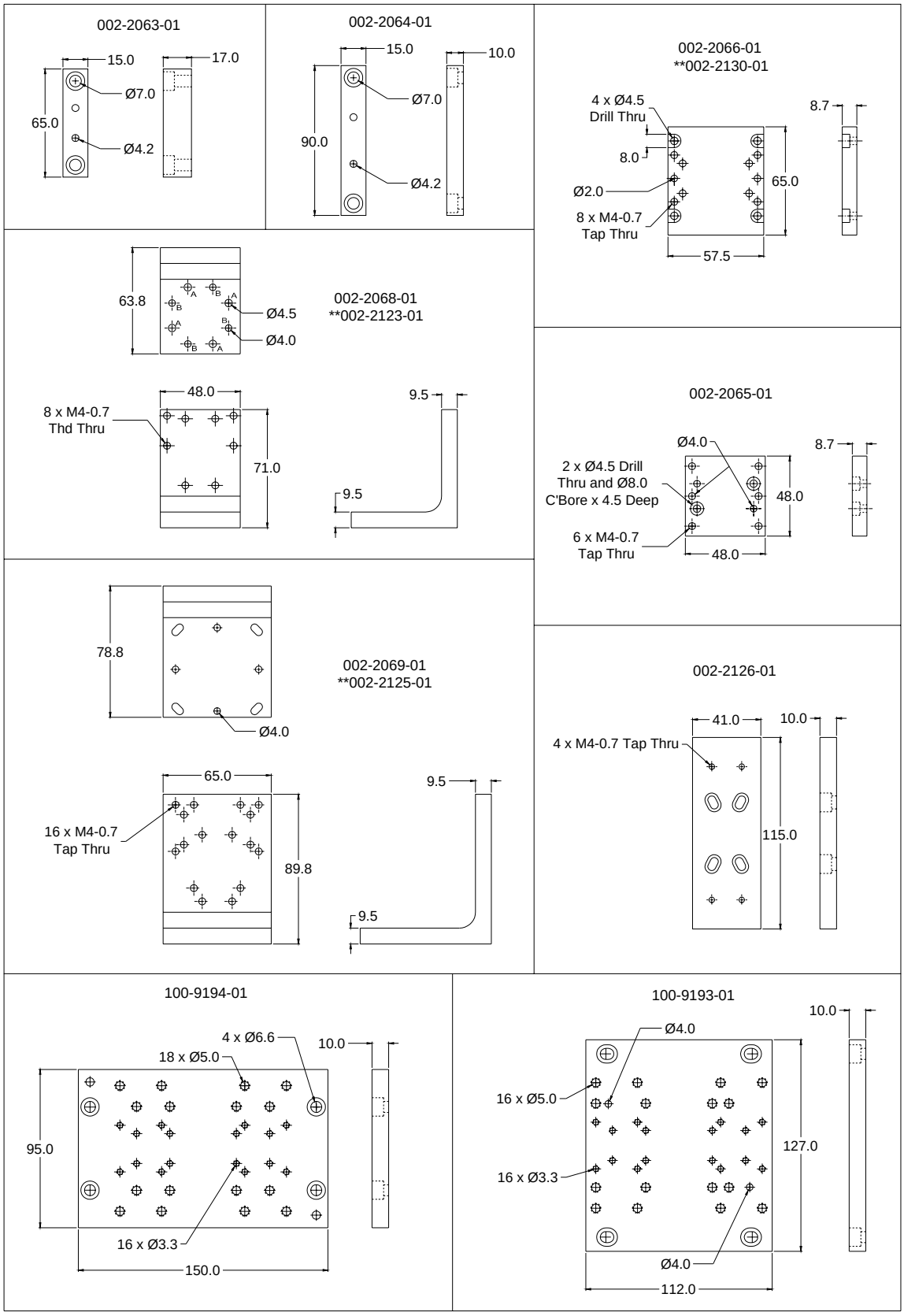
Mounting Bracket Dimensions



**Part Number Includes 002-2129-01

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