Automation

Manual No. 102-3619-01
Rev. 2

MX45S Series Product Manual

Effective: March 5, 2013
Supersedes: -

Electromechanical Positioning Systems

Important User Information

WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries, and authorized distributors provide product and/or systems options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these product systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuming that all performance, safety, and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

Since Parker Hannifin Corporation, Electromechanical Automation-Parker constantly strives to improve all of its products, we reserve the right to change this product manual and equipment mentioned therein at any time without notice.

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MX45S Series Product Manual

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Chapter 1 - Introduction

Product Description

MX45S Positioner

The MX45S is a 45 mm wide miniature screw driven positioner based on the award winning MX80 family. Like its predecessor, the MX45S is designed for OEM applications requiring reliable linear positioning in space restricted applications. Designed with anti-cage creep crossed roller bearings, the MX45S allows users to position up to 7 Kg of normal load on the stage's three standard travel lengths (5 mm, 15 mm & 25 mm).

The MX45S can be supplied with a high efficiency lead screw or a high precision ground ball screw, both of which are capable of producing 40 N of thrust and reaching a linear velocity of 20 mm/s and 30 mm/s respectively. The lead screw drive employs a PTFE coated screw with a preloaded nut to deliver extremely smooth and quiet linear motion. A choice of two leads allows the user to match the desired mix of velocity and resolution in order to best match the application's requirements. The ball screw drive is available in a 1 mm lead offering the user 3 µm bi-directional repeatability and 24/7 operation (100% duty cycle).

Unpacking

Carefully remove the positioner from the shipping container and inspect the unit for any evidence of shipping damage. Report any damage immediately to your local authorized distributor. Please save the shipping container 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 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 lift the positioner by cables or cable management system. Lifting positioner by cables or cable management system may effect electrical connections and/or cable management assembly. The unit should be lifted by the base structure only.

DO NOT expose positioner to mist, spray or submersion in liquids.

DO NOT disassemble positioner. Unauthorized adjustments may alter the positioner's specifications and void the product warranty.

Return Information

Returns
All returns must reference a "*R*eturn *M*aterial *A*uthorization" *(RMA)* number. Please call your local authorized distributor or Parker Customer Service Department at 800-245-6903 to obtain a "RMA" number.

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 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

Hot Surfaces
DO NOT touch rotary motor coils located on the MX45S after high duty operation. Motor temperature may approach 60°C. The unit itself may become warm or hot to the touch.

Electrical Shock
DO NOT take apart or touch any internal components of the positioner while unit is plugged into an electrical outlet. SHUT OFF power before replacing components to avoid electrical shock.

Pinch Points
Unit may have a pinch point because the top extends over the base of the table. Proper care should be exercised.

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

General Safety
Sometimes positioners move without warning. Keep all personnel away from dynamic travel range of positioner.

Strain Relieve Electrical Components
All electrical components (such as motor, 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

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 - 40 degrees C.

Specifications Are Mounting Surface Dependent

Catalog specifications are obtained and measured when the positioner is fully supported, bolted down, and is mounted to a work surface that has a maximum flatness error of:

0.001mm/300mm (0.00004”/ft)

Table will operate with work surface of 0.100mm/300mm flatness or worse, but performance specifications will be significantly effected.

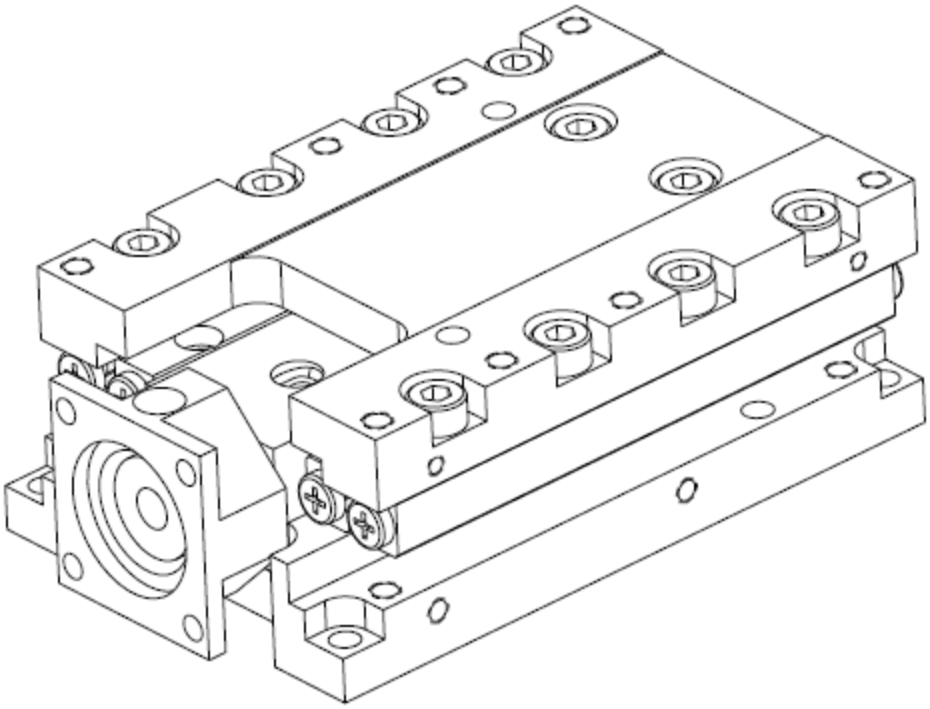
Specifications Are Point of Measurement Dependent

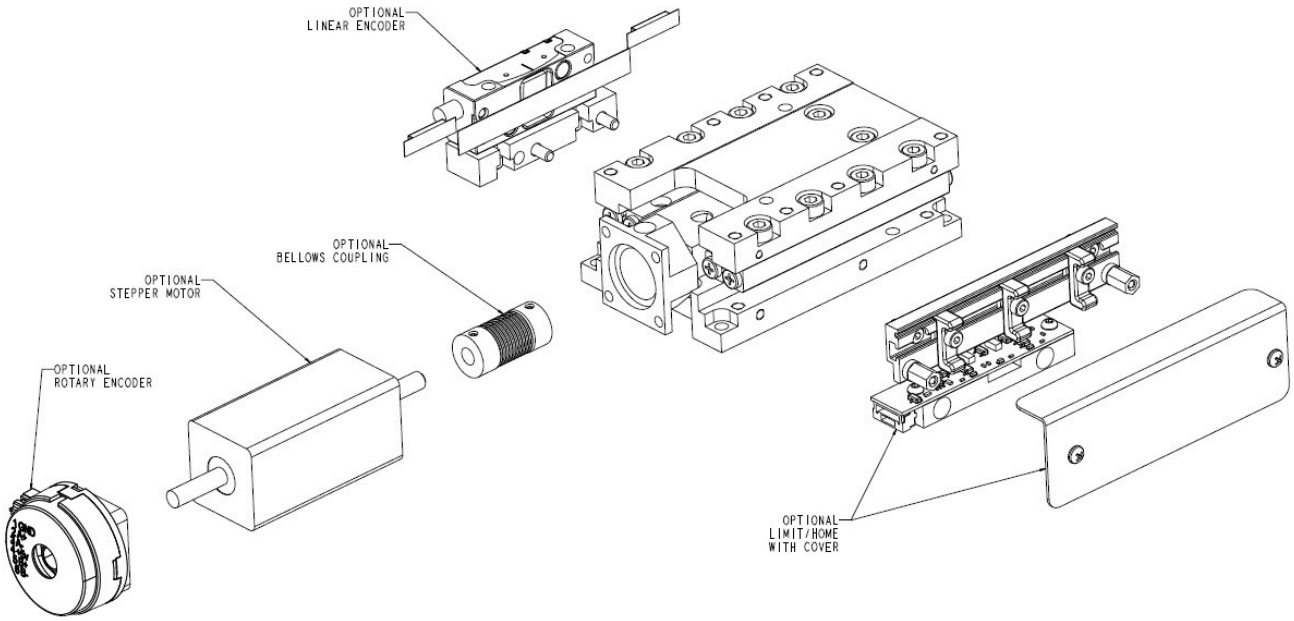
Catalog specifications and specifications in this manual are measured from the center of the carriage, 38 mm above the carriage surface. All measurements taken at any other location may deviate from these values.

Specifications Are Load Mounting Dependent

Catalog specifications are obtained and measured when the customer load is fixed to the carriage mounting surface(s) and has a flatness of equal to or less than 0.0025mm (0.0001”). The table will operate with customer load surface greater than 0.0025mm (0.0001”) flatness, but performance specifications will be significantly effected.

Assembly Diagram





Parker Hannifin Corporation
EMN Automation - Parker
Irwin, Pennsylvania

Chapter 2 – MX45S Series Table Specifications

	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
Order Example:	MX45S	T01	S	K	D1	N00	E000	L0	K00	S

① Series
MX45S

② Travel– mm
T01 5
T02 15
T03 25

③ Grade
S Standard (specify leadscrew option, item 5)
P Precision (specify ballscrew option, item 5)

④ Bearing Type*
K Anti-Creep System (ACS) Cross Roller
* Consult factory for other bearing options

⑤ Drive Type
D1 0.5 mm Leadscrew (1)
D2 1 mm Leadscrew (1)
D3 1 mm Ballscrew (2)
(1) With Standard grade only (2) With precision grade only

⑥ Motor Options (see page 9 for drive and drive/ controller accessories)
N00 No motor, no motor mount, no coupler
N08 No motor, NEMA 8 motor mount & coupler
N11 No motor, NEMA 11 motor mount & coupler (1)
M10 NEMA 8 stepper motor (2)
M11 NEMA 8 stepper motor (3)
(1) Not available with T03 travel option
(2) With 1 meter cable, flying leads
(3) With 1 meter cable with P2 drive connector

⑦ Encoder Options (see page 8)*
E000 No Encoder
ER10 Rotary Encoder, 400-Line(1) (flying leads)
ER11 Rotary Encoder, 400-Line(1) (ViX connector)
ER12 Rotary Encoder, 400-Line(1) (ACR connector)
ER13 Rotary Encoder, 400-Line(1) (6K connector)
ER20 Rotary Encoder, 500-Line(1) (flying leads)
ER21 Rotary Encoder, 500-Line(1) (ViX connector)
ER22 Rotary Encoder, 500-Line(1) (ACR connector)
ER23 Rotary Encoder, 500-Line(1) (6K connector)
EL20 Linear Encoder (2) (1 µm resolution)
EL40 Linear Encoder (2) (0.1 µm resolution)
EL70 Linear Encoder (2) (sine output)
*Consult factory for other encoder options
(1) Encoder equipped with 1 meter high-flex cable
(2) Encoder equipped with 1 meter high-flex cable, 15-pin D-sub connector; Z– channel in center position

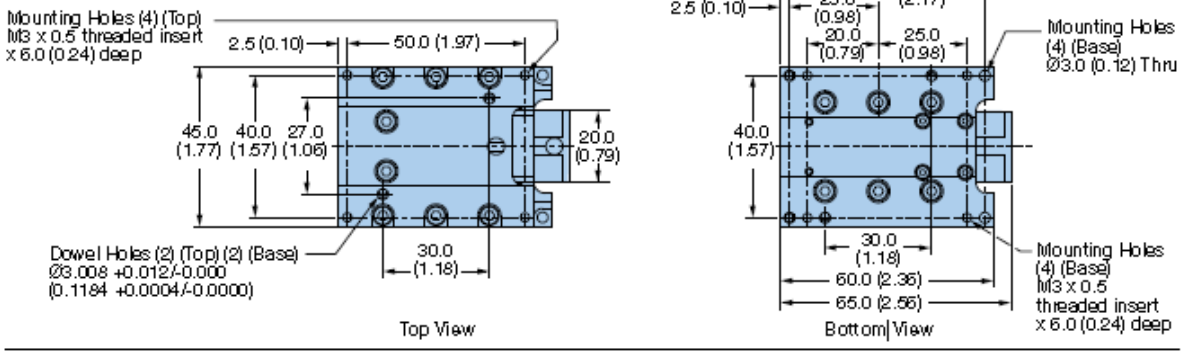
⑧ Home/Limit Switch Options (see page 8)*
L0 None
L2 N.O. Home/N.C. Limits, NPN, 1 meter cable to flying leads
L3 N.O. Home/N.C. Limits, PNP, 1 meter cable to flying leads
*NC= Normally closed; NO= Normally Open. Home switch not available with T01; use one of the limits as home for T01

⑨ Multi-axis Kit Options (see page 12)
K00 No kit (single-axis)
K20
K21
K22
K23
K24
K31
K32
K33
K34
K35
K36
Refer to system kit configuration illustrations on page 12.
Note: all appropriate mounting bracket hardware is included with the kit number.

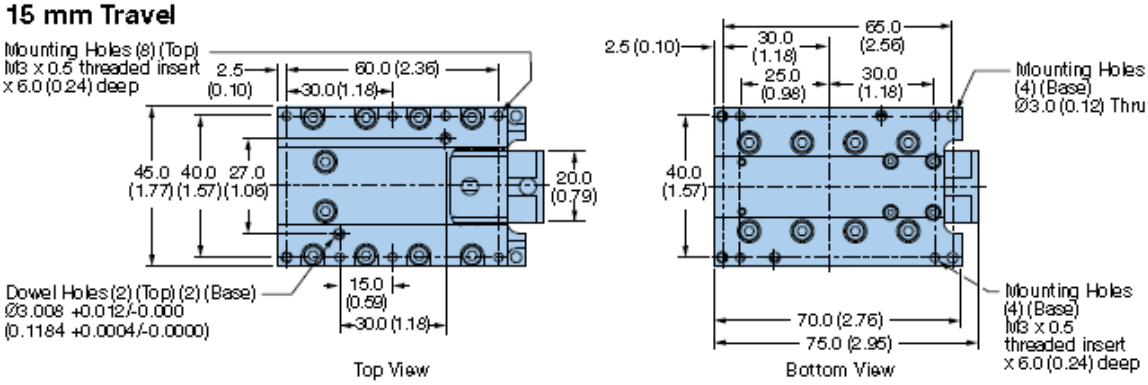
⑩ Axis Designator
S None (single-axis)
X X-axis for multi-axis system
Y Y-axis for multi-axis system
Z Z-axis for multi-axis system

MX45S Dimensions – mm (in)

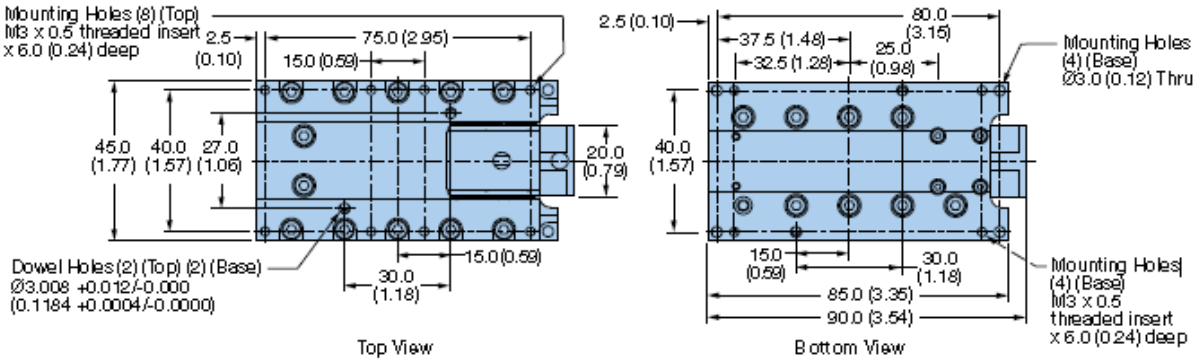
T01 — 5 mm Travel



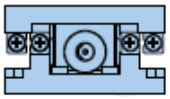
T02 — 15 mm Travel

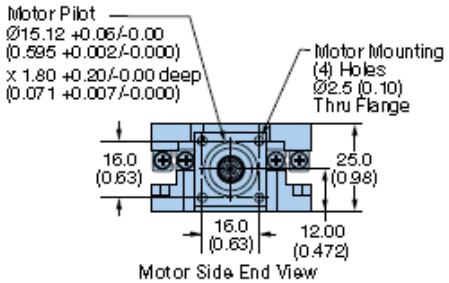


T03 — 25 mm Travel



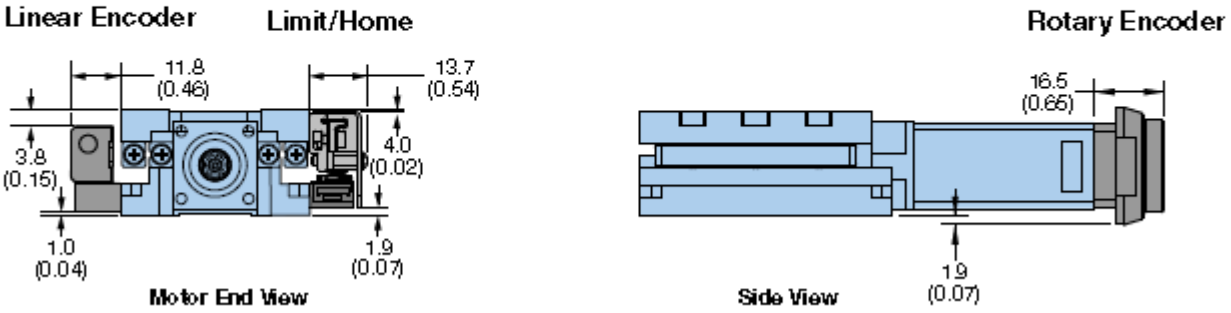
Common Dimensions for T01, T02, T03





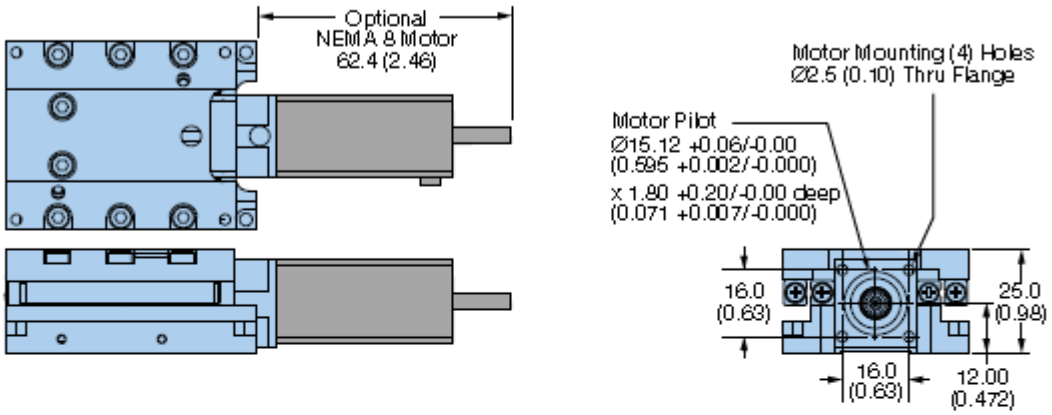
MX45S Dimensions – mm (in)

Encoder and Limit/Home (T01, T02, T03)

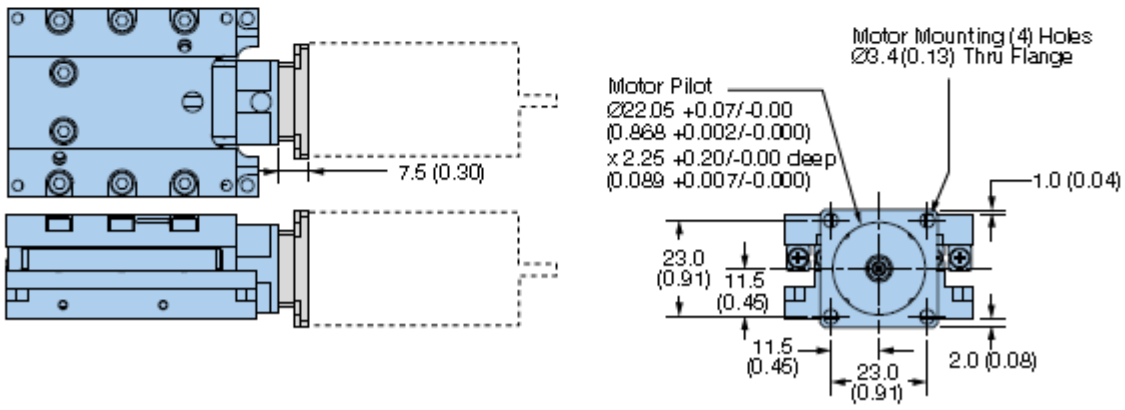


Motor Mounting (T01, T02, T03)

NEMA 8 Motor Mount



NEMA 11 Motor Mount



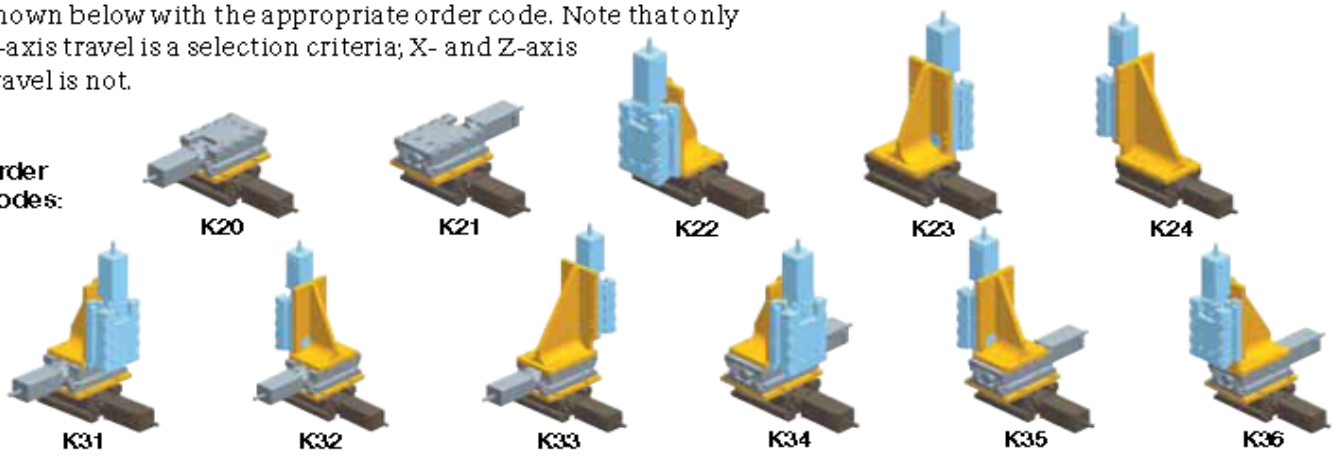
Multi Axes Configurations

Consult factory or visit our website for complete bracket dimensions.

MX45S to MX45S Mounting Bracket Kits

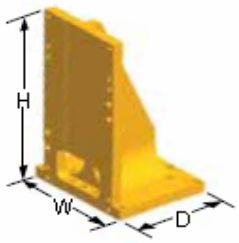
To build multi-axis MX45S systems, mounting bracket kits are available to build the two and three-axis configurations shown below with the appropriate order code. Note that only Y-axis travel is a selection criteria; X- and Z-axis travel is not.

Order Codes:



Bracket Kit	Part Number		
	T01	T02	T03
K20	002-2956-200	002-2956-201	002-2956-202
K21	002-2956-200	002-2956-201	002-2956-202
K22	—	002-2956-220	—
K23	—	002-2956-220	—
K24	—	002-2956-240	—
K31	002-2956-310	002-2956-311	002-2956-312
K32	002-2956-310	002-2956-311	002-2956-312
K33	002-2956-330	002-2956-331	002-2956-332
K34	002-2956-310	002-2956-311	002-2956-312
K35	002-2956-310	002-2956-311	002-2956-312
K36	002-2956-330	002-2956-331	002-2956-332

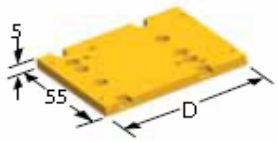
Z-Axis Bracket



Z-Axis Bracket – H x W x D (mm)

Bracket Kit	T01, T02, T03
K22, K23	85 x 45 x 55
K24, K33, K36	104 x 45 x 55
K31, K32, K34, K35	85 x 55 x 45

X-Y Axis Transition Plate Bracket



X-Y Axis Bracket – Dimension "D" (mm)

Bracket Kit	T01	T02	T03
K20, K21, K31, K32, K33, K34, K35, K36	60	70	85

MX45S to MX80 Mounting Brackets

MX45S positioners can also be used as a Y- or Z-axis in conjunction with MX80 positioners.

Kit	Configuration	Part Number	H x W x D (mm)
X-Y	MX45ST01 to MX80	002-2958-01	5 x 80 x 80
	MX45ST02 to MX80	002-2958-02	5 x 80 x 80
	MX45ST03 to MX80	002-2958-03	5 x 80 x 92.5
X-Z	MX45S (all) to MX80	002-2958-04	87.5 x 80 x 80

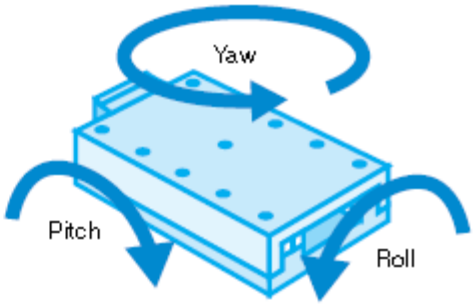
General Table Specifications

		MX45S Leadscrew Drive			MX45S Ballscrew Drive		
Travel [1]	mm	5	15	25	5	15	25
Normal Load Capacity	kg (lb)	5.0 (11.0)	5.0 (11.0)	7.0 (15.4)	5.0 (11.0)	5.0 (11.0)	7.0 (15.4)
Thrust Load Capacity	N (lb)		40 (9)			40 (9)	
Maximum Velocity [2]							
0.5 mm lead	mm/sec		10			—	
1.0 mm lead			20			30	
Acceleration/Deceleration	g		2			2	
Running Torque	mNm (oz-in)		11.0 (1.5)			11.0 (1.5)	
Duty Cycle	%		50			100	
Straightness & Flatness [3]	µm	3	5	8	3	5	8
Positional Accuracy [4]							
With 2000 Count Rotary Encoder	µm	10	18	30	8	12	15
With 1 or 0.1 µm linear Encoder		6	10	12	6	10	12
Bi-directional Repeatability [4,5]							
With 2000 Count Rotary Encoder	µm		±8			±3	
With 1 µm Linear Encoder			±4			±2	
With 0.1 µm Linear Encoder			±2			±1	
Input Inertia (without motor)							
0.5 mm lead	10^{-8} Kg-m^2	2.37	2.76	3.14	—	—	—
1 mm lead		2.58	2.96	3.35	1.41	1.6	1.79
Maximum Screw Speed	rps		20			30	
Screw Efficiency							
0.5 mm lead	%		30			—	
1 mm lead			47			90	
Screw Diameter	mm		4.7			4.0	
Bearing Coefficient of Friction			0.003			0.003	
Unit Mass							
Stage Only	g	177	200	238	182	205	243
Carriage Only		70	82	100	73	84	104
Additional Mass of Motors & Options							
NEMA 8 Stepper [6]			95			95	
Linear Encoder Option [7]			16			16	
Limit option Sensor Board [7]			5			5	
Limit Option Tripper Assembly [7]		12	13	15	12	13	15

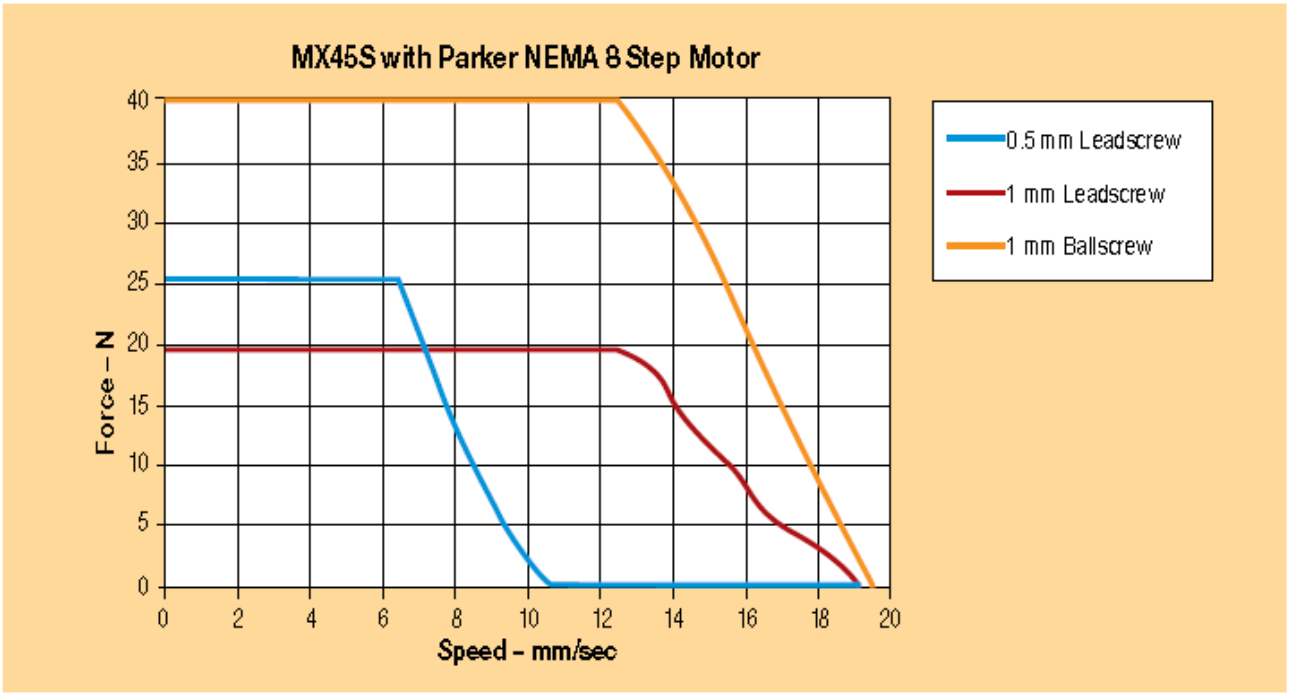
Notes:
[1] Travel is in the direction of the motor mount only.
[2] See speed/force curve on page 14 for performance with Parker motor.
[3] Measured at the carriage center, 35 mm above the mounting surface @ 20°C with no load. Unit bolted to granite surface, flat within 1µmm/300 mm.
[4] Total accuracy and bi-directional repeatability over full travel (peak to peak) (with 0.5 or 1 mm leadscrew)
[5] Repeatability valid with NEMA 8 stepper motor and encoder noted.
[6] Includes rotary encoder (part of base)
[7] Part of base.

Performance Loading with 2540 km Life Rating

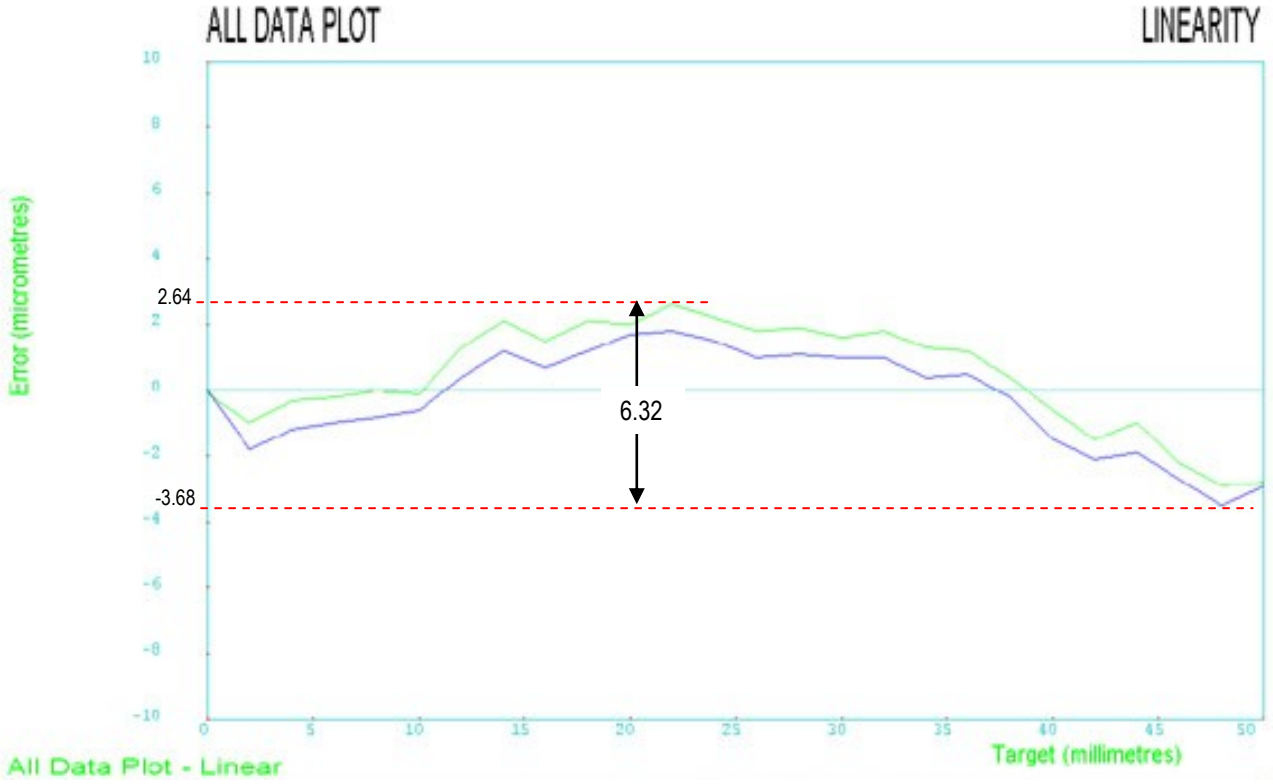
Normal Load Capacity		
5 mm travel	kg (lb)	5.0 (11.0)
15 mm travel		5.0 (11.0)
25 mm travel		7.0 (15.4)
Pitch & Yaw Moment Loading		
25 mm Lever Arm	kg (lb)	1.0 (2.2)
50 mm Lever Arm		0.6 (1.3)
75 mm Lever Arm		0.5 (1.1)
100 mm Lever Arm		0.4 (0.9)
Roll Moment Loading		
25 mm Lever Arm	kg (lb)	2.0 (4.4)
50 mm Lever Arm		1.2 (2.7)
75 mm Lever Arm		0.9 (2.0)
100 mm Lever Arm		0.7 (1.5)



Speed-Force Performance



Test Methodology



Published accuracy and repeatability specifications are subject to the testing methodology. Parker's methodology provides specifications over the entire table travel regardless of start or finish position. The accuracy and repeatability specifications are based on the peak to peak error measured by a laser interferometer and prism located at 38mm above the center of the table. This type of measurement sums the X, Y, Z, roll, pitch, and yaw errors. Temperature deviations from test condition may cause deviations in straightness, flatness, accuracy, and repeatability from catalog specifications. Tests are performed with the table mounted to a granite table, unloaded at 20° C.

In this example, the accuracy ranges from -3.68 microns to 2.64 microns. This table would have its accuracy specified as 6.32 micron since the worst case would be starting at one extreme and traveling to the other.

Encoder Specifications

Description	Specification
Input Power	5 VDC +/-10% Analog < 100mA, Digital<200 mA depending on encoder
Output (Incremental)	Digital- Square wave differential line driver (EIA RS422A) 2 channels A and B in quadrature (90°) phase shift. Analog– 2 channels V_1 and V_2 differential sinusoids in quadrature
Reference (Z Channel)	Digital- Synchronized pulse, duration equal to one resolution bit. Repeatability of position is unidirectional moving toward positive direction and is equal to table repeatability specifications. Analog– Differential pulse, bi-directional repeatability
Maximum Speed	Limited by table speed

Digital Outputs		Interface
Function	Signal	Pin
Power	5 V	7,8
	0 V	2,9
Incremental	A+	14
	A-	6
	B+	13
	B-	5
Reference mark	Z+	12
	Z-	4
Limits	P	11
	Q	10
Set-up	X	1
Alarm	E-	3
Shield	Inner	*
	Outer	Case

Analog Outputs			Readhead	Interface
Function		Signal	Color	Pin
Power		5 V	Brown	4,5
		0 V	White	12, 13
Incremental	Cosine	V_1+	Red	9
		V_1-	Blue	1
	Sine	V_2+	Yellow	10
		V_2-	Green	2
Reference mark		V_o+	Violet	3
		V_o-	Grey	11
Limits		V_p	Pink	7
		V_q	Black	8
Set-up		V_x	Clear	6
Remote CAL		CAL	Orange	14
Shield		Inner	Green/Yellow	*
		Outer	Outer screen	Case

* Inner Shield is connected to 0V inside the Ti interface

Limit and Home Sensor Specifications

Description	Specification
Input Power	NPN: +5 to 24 VDC +/- 5%, 25 mA PNP: +5 to 24 VDC +/- 5%, 25 mA plus up to 50mA per output
Output	NPN - Normally Closed Current Sinking Limits, Normally Open Current Sinking Home PNP - Normally Closed Current Sourcing Limits, Normally Open Current Sourcing Home NPN - +5 to +24 VDC All outputs Sink a max. of 50mA each PNP - +5 to +24 VDC All outputs Source a max. of 50mA each
Repeatability	Home Sensor: +/- 5 µm (unidirectional) plus repeatability of the positioner

ViX Drive Specifications

Refer to Specifications provided in ViX Manual, available at www.Compumotor.com.

Cabling and Wiring Diagrams

Connector Pin Out and Extension Cable Wire Color Codes for the 1 and .1 micron and sin resolution encoders

006-2382-length Limit Cable- Flying Lead L2, L4		
Pin #	Function	Wire Color
1	+V	Red
2	Ground	Black
3	+ Limit	Orange
4	Home	Green
5	- Limit	Blue

006-2409-length Motor Extension Cable- Flying Lead M10, M20	
Function	Wire Color
A+	Red
A-	Black
B+	White
B-	Green

006-2410-length Rotary Encoder Cable- ViX Connector ER11, ER21		
Pin #	Function	Wire Color
3	Ground	White
5	+5V	Brown
7	A-	Yellow
8	A+	Green
11	B-	Red
12	B+	Blue
SHLD	SHLD	SHLD

006-2399-length Rotary Encoder Cable- 9pin DSUB ER12, ER13, ER22, ER23		
Pin #	Function	Wire Color
1	+5V	Brown
2	A+	Green
3	A-	Yellow
4	B+	Blue
5	B-	Red
9	GND	White
SHLD	SHLD	SHLD

006-2398-length Rotary Encoder Cable- Flying Lead ER10, ER20	
Function	Wire Color
Ground	White
A+	Green
A-	Yellow
Power	Brown
B+	Blue
B-	Red

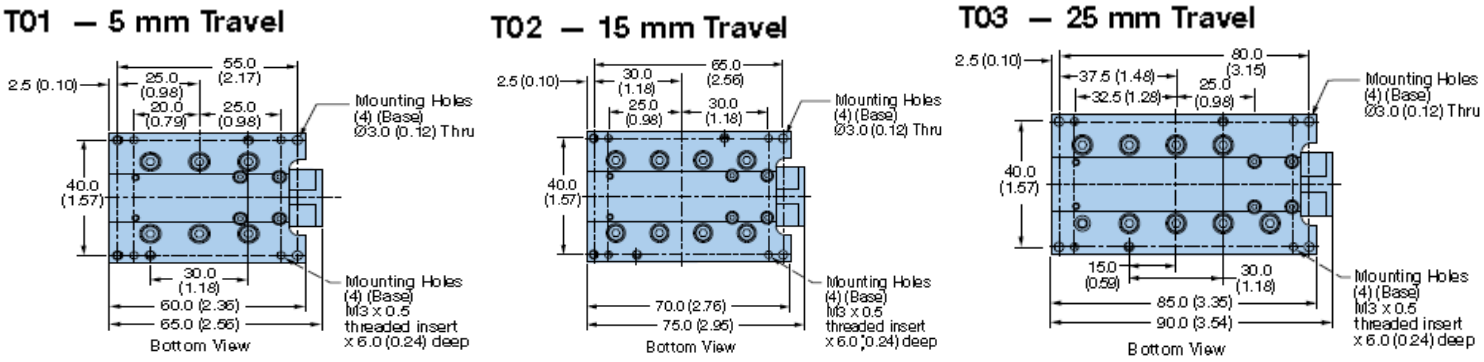
Chapter 3 - How to Use the MX45S

Mounting Orientations

The MX45S can be mounted horizontal, inverted, or side. For all mounting orientations, the cables should be secured as to not interfere with the movement of the carriage and bearings.

Mounting Surface Requirements

- The positioner must be mounted to a flat, stable surface, with a flatness error less than or equal to 0.025mm/300mm for operation or specifications will be greatly varied from published specification. To meet catalog specifications the surface must have a flatness error less than or equal to 0.003mm/300mm for Standard grade and 0.001mm/300mm for Precision grade.
- Catalog specifications may deviate for positioners mounted to surfaces that do not meet the above conditions.
- If the intended mounting surface cannot meet these specifications a separate rigid mounting plate meeting these specifications should be used to mount to the main structure.
- 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 for guidelines on specifications of overhang applications.
- Dowel holes are included in the base of the MX45S for repeatable mounting of the positioner.



Load Mounting Requirements

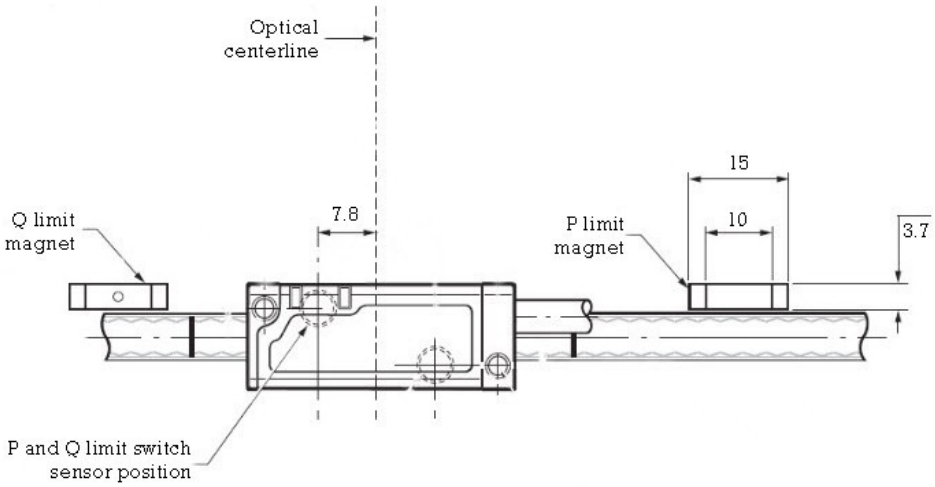
Dowel holes are included in the carriage of the MX45S for repeatable mounting of loads/fixturing. When bolting payload to carriage take precaution in using M3 bolts with no more than 7mm of engagement as to not damage the table.

Use appropriate length bolt.

The MX45S compact design requires proper sized bolts to be used when mounting payloads to the carriage. Excessive length bolts can damage bearings.

Limit Sensors Magnets for Optional Linear Encoder

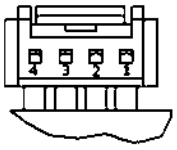
If the optional linear encoder option is ordered with the MX45S positioner, two limit magnets will be supplied that are not assembled to the positioner. These are supplied loose in the packaging so that they can be assembled at the desired locations or not assembled at all. These magnets are supplied with an adhesive backing for ease of installation. See the drawing below for installation of magnets. For more information on the magnets and installation see Renishaw installation guide #M-9653-9154-01-A.



Optional NEMA 8 Motor

Following are the motor properties if the “M10” or “M11” motor options are selected.

MX45S Motor Specifications		Motor Part #006-2360-04
Rated Torque	N-M	0.03
Rated Current (rms)	Amps/ Phase	0.80
Max. Current (peak)	Amps/ Phase	1.13
Rated Resistance	Ohms/Phase	5.4
Rated Inductance	mH	1.5
Rotor Inertia	g-cm²	1.8
Number of Phases	-	2
Step Angle	Degrees	1.8



Motor Connector	
Pin	Function
Pin 1	A+
Pin 2	A-
Pin 3	B+
Pin 4	B-

CCW	Switching Sequence			
Color	Red	Blue	Green	Black
Step	A+	A-	B+	B-
1	+	-	+	-
2	+	-	-	+
3	-	+	-	+
4	-	+	+	-
Note: Viewed from Front Motor Shaft End				

Limit and Home Sensor Operation

The MX45S utilizes an innovative compact, adjustable, and field installable method of setting limit and home positions. The magnetic sensors are embedded in small adjustable brackets that are attached to the carriage, moving part of the positioner. The limit brackets are black in color, while the home bracket is silver in color. See Step #7 of the "Field Install of Limit/Home Option and Adjustment" for setting the trigger point of the limits and home. The limit and home magnetic sensors are mounted to a PCB in a fixed position to the base of the unit. There are two different PCBs which define whether the switch functions as normally open or normally closed.

Determining Desired Position

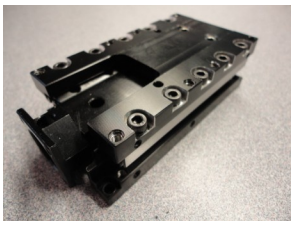
The limit sensors are set at the factory for maximum travel. These factory settings only allow for 0.5mm (0.02") before the carriage contacts the end stop. In slow speed applications this may be adequate, however as the top speed of the application increases the required deceleration distance increases. To determine the safe Deceleration Distance the Maximum Speed and the Maximum Obtainable Deceleration Rate must be known or calculated. The maximum speed should be known from your application requirements. Velocity limits should be set in your program or in your amplifier to cause a fault if the speed exceeds this value. The maximum deceleration is a factor of load and available peak force of the table. Using F = ma, calculate maximum acceleration and then required deceleration distance.

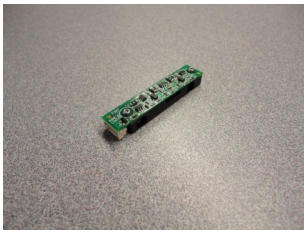
Field Install of Limit/Home Option and Adjustment

The following procedure is to be used for field installing and adjusting the activation position of the limits and home on the MX45S:

Step 1: Remove power from the unit and allow time for stage base and carriage to reach room temperature.

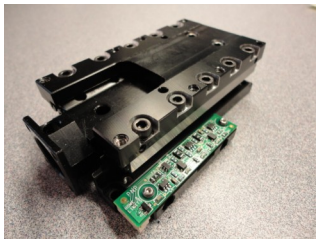
Step 2: Position the MX45S as shown in the picture to the right. This is the right side of the positioner when looking from the motor end of the positioner.





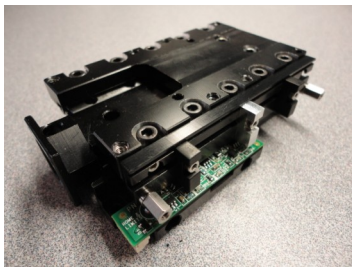
Step 3: Locate PCB/Bracket assembly and two M2.5 x 5mm cap screws supplied in the Limit/Home Kit.

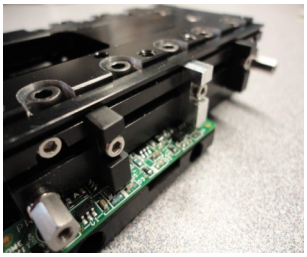
Step 4: Attach the PCB/bracket assembly to the base of the MX45S using the two M2.5 x 5mm cap screws.



Step 5: Locate limit/home magnet bracket assembly and two M2 x 6mm cap screws supplied in the Limit/Home Kit.

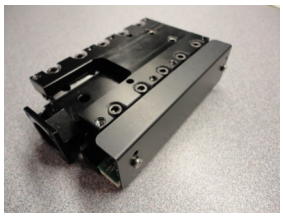
Step 6: Attach the limit/home magnet bracket assembly to the carriage of the MX45S using two the M2 x 6mm cap screws. Verify that there are no interferences between the stationary and moving parts. If there is either adjust the limit/home magnet bracket assembly up of the PCB/Bracket assembly down using the





Step 7: The trigger point of each limit or home can be adjusted by loosening the screw holding the limit/home bracket and sliding it to the desired position. The PCB has LEDs that will assist in the positioning and trigger point for each sensor. Please note that the T01 (5mm) travel positioner only has limits and no home bracket due to the short travel of the positioner.

Step 8: Locate the limit/home cover and assemble it to the limit/home magnet bracket assembly with two M2 x 4mm Phillips head screws. These two screws will thread into the two hex standoffs on the limit/home magnet bracket assembly.



Z Channel Position Reference

The Z channel is an output on the encoder. Many servo controllers support this input. The Z channel on the MX45S is at mid travel. The Z channel is a unidirectional device. This means that the final homing direction must occur in one direction. The MX45S is set that the final home direction is to be toward the positive end of the table (See Chapter 2, *Dimensional Drawing*, for positive direction definition). The repeatability of the Z channel is equal to the repeatability of the table. Thus the repeatability of the "Z" channel equals: the unit of resolution repeatability.

Encoder Resolution	Z Channel Repeatablilty
0.1 Micron	+/- .1 micron
1 Micron	+/- 1 micron
Sin	N/A

Grounding / Shielding

All cables are shielded. These shields are to be grounded to a good earth ground. Failure to ground shields properly may cause electrical noise problems. These noise problems may result in positioning errors and possible run away conditions.

The motor cable has an area of the shield exposed to allow a grounding path from shield to drive ground. MX45S purchased with ViX drives as part of the configurable part number come equipped with p-clips designed for the small OD of the motor cable to allow the cable shield to be grounded to the ViX ground.

Cabling

The MX45S is provided with high flex cabling.

The encoder cable is terminated with a Renishaw Tonic Interface adapter (15 pin “D” type connector).

The motor cable is terminated with flying leads which are stripped and tinned and ready for installation into the screw terminals on the ViX drive.

The limit/home cable is terminated with flying leads which are stripped and tinned and ready for installation into the screw terminals on the ViX drive.

For wire color codes and pin outs see tables in electrical section of manual.

Recommended bend radius for these cables is 50mm. This radius will provide a minimum of 10 million cycles of the cable. Smaller bend radius will reduce cable life while larger bend radius will increase life.

If the positioner is mounted in a multi-axis configuration special care should be taken in routing and strain relieving the cables so as to prevent flexing of the cable at the connection to the table and where mounted stationary to the structure. Provide sufficient service loop that the cable bends a minimum of 25mm from these end points. It is also recommended to avoid twisting the cable. The cable should be secured in a position which will orient it in a direction that creates a single plane of operation for the cable.

Cable Management

For multi-axis configurations special attention needs to be taken into account for the moving cables on the non-base axis.

TIP: For Multi-axis Configurations.
Consider using the top axis for the highest frequency move in the application. The top axis will have the least amount of weight to move and will reduce the cycles on the cables.

Chapter 4 - Performance

Acceleration Limits

Acceleration of linear servo driven tables is typically limited by four *(4)* factors:

- **Linear Bearings**
  The linear bearings used in the MX45S have a continuous acceleration limit of 2 g's. This means that the bearings are designed to take repetitive accelerations of 2 g's and maintain the rated bearing life.

- **Reduced Bearing Life**
  Bearing loading due to high acceleration may reduce bearing life to an unacceptable application limit. This is not usually a limiting factor unless loading is significantly cantilevered causing high moment loads during accelerations.

- **Available Motor Force**
  This is the primary factor that reduces acceleration. This is simply the amount of motor force avail able to produce acceleration. The larger the inertial and or frictional load the lower the accelera- tions limit.

- **Settling Time**

  In many applications reducing cycle time is a primary concern. To this end, the "settling" time (the amount of time needed after a move is completed for table and load oscillating to come within ac ceptable limits) become very important. In many cases where very small incrementing moves are executed, the settling time is greater than the actual move time. In these cases accelerations may need to be reduced thus reducing the settling time.

Speed Limits

Acceleration of the MX45S table is limited by the maximum screw speed:

Screw Lead	Maximum Velocity
0.5mm Leadscrew	8 mm/second
1mm Leadscrew	16 mm/second
1mm Ballscrew	16 mm/second

Chapter 5 - Connecting to the ViX Amplifier— Stepper

The MX45S is designed to be plug and run compatible with the Parker ViX drive. The cables on the MX45S are labeled to match the labels on the ViX for ease of use and quick installation. When purchased as part of the part number, the ViX will have the motor parameters already downloaded.

STEPPER MOTOR LEADS	
WIRE COLOR	DRIVE
RED	A+
BLACK	A-
WHITE	B+
BLUE/RED	B-
GREEN/YELLOW	GROUND

X1	Power & Motor
10	24-80V DC +HV
9	0V / GND -HV
8	Earth PE
7	24V DC
6	0V (GND 24v DC)
5	Motor Gnd
4	Motor phase (A+)
3	Motor phase (A-)
2	Motor phase (B+)
1	Motor phase (B-)

Feedback, Digital encoder	
X2	Function
1	Feedback enc. Z+
2	Feedback enc. Z-
3	GND
4	Reserved
5	+5V output
6	GND
7	Feedback enc. A-
8	Feedback enc. A+
9	Reserved
10	Motor overtemp
11	Feedback enc. B-
12	Feedback enc. B+
13	Reserved
14	Reserved
15	Reserved

Communications	
X3	Function
1	Rx+/Tx+ (RS485)*
2	Drive reset
3	RS232 GND
4	RS232 Rx
5	RS232 Tx
6	Rx-/Tx- (RS485)*
7	RS232 Tx (D loop)
8	Do not connect
9	+5V output

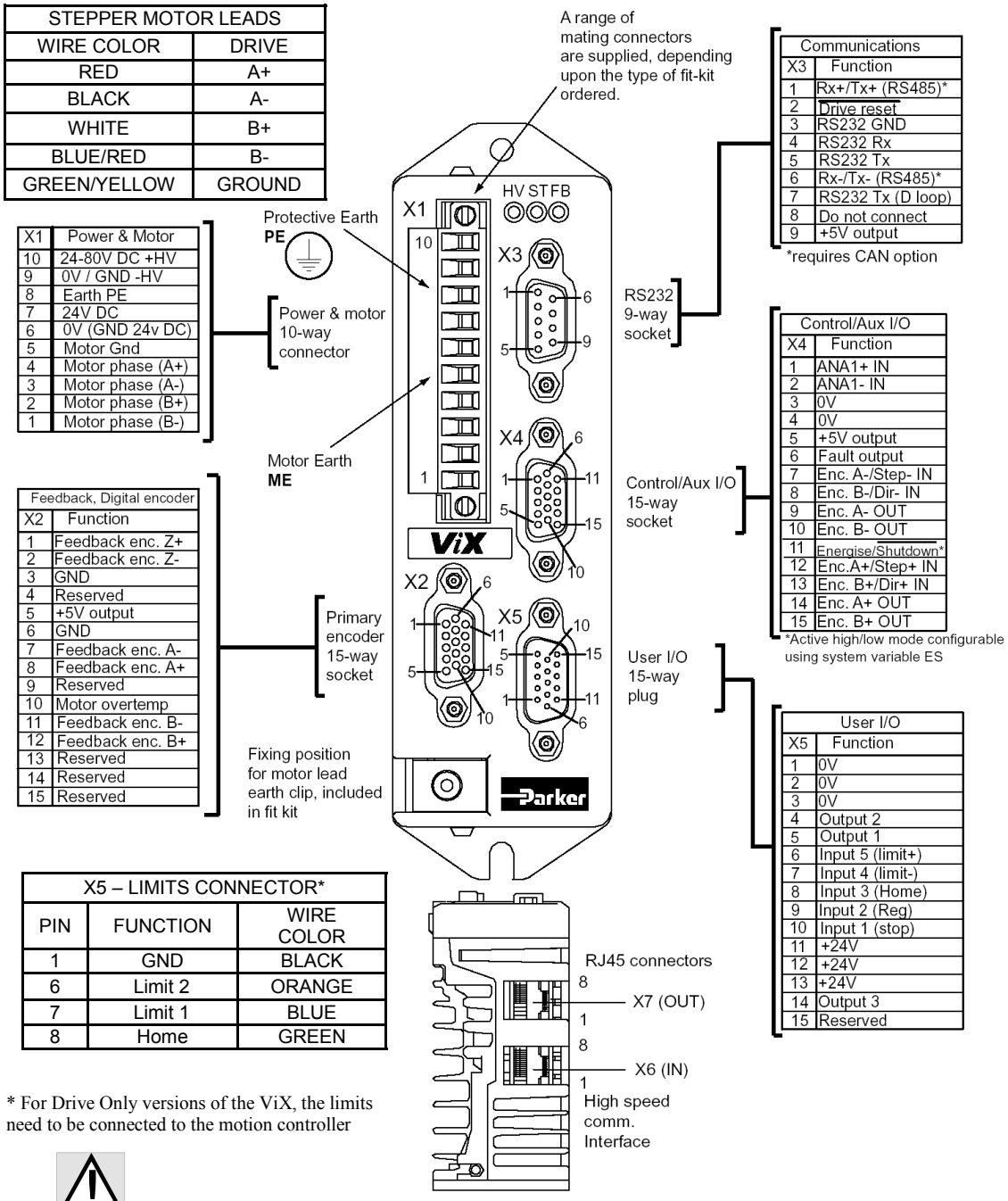
*requires CAN option

Control/Aux I/O	
X4	Function
1	ANA1+ IN
2	ANA1- IN
3	0V
4	0V
5	+5V output
6	Fault output
7	Enc. A-/Step- IN
8	Enc. B-/Dir- IN
9	Enc. A- OUT
10	Enc. B- OUT
11	Energise/Shutdown*
12	Enc.A+/Step+ IN
13	Enc. B+/Dir+ IN
14	Enc. A+ OUT
15	Enc. B+ OUT

*Active high/low mode configurable using system variable ES

User I/O	
X5	Function
1	0V
2	0V
3	0V
4	Output 2
5	Output 1
6	Input 5 (limit+)
7	Input 4 (limit-)
8	Input 3 (Home)
9	Input 2 (Reg)
10	Input 1 (stop)
11	+24V
12	+24V
13	+24V
14	Output 3
15	Reserved

X5 – LIMITS CONNECTOR*		
PIN	FUNCTION	WIRE COLOR
1	GND	BLACK
6	Limit 2	ORANGE
7	Limit 1	BLUE
8	Home	GREEN



* For Drive Only versions of the ViX, the limits need to be connected to the motion controller

Limits use Inputs

The ViX drive has 5 digital inputs. When using with MX45S, the EOT Limits and Home use 3 of the 5 inputs. A VM15-FC-02 screw terminal breakout board may be purchased to allow access to the remaining 2 inputs and all of the outputs.

Chapter 6 - Maintenance and Lubrication

Cross Roller Bearing and Screw Lubrication

Materials Required: Replacement bearing and screw lubrication (See below for lubrication type and ordering information), clean cloth, small brush

Lubrication Type

Use:

Mobil Vactra Oil No.2 on crossed roller bearings
Kyodo Yushi Multemp PS2 Grease on drive ballscrew
Drive Leadscrews do not require lubrication

Lubricant Grease Appearance

Translucent-white, smooth and buttery.

Maintenance Frequency

Cross roller bearings and drive screws are lubricated at our facility prior to shipment. For lubrication inspection and supply intervals following shipment, apply grease/oil every 1000 hours of usage. The time period may change depending on frequency of use and environment. Inspect for contamination, chips, etc, and replenish according to inspection results.

Lubricant Application

Apply lubrication on the rails or screw, using a small brush or syringe where possible.

Notes:

Do not use/mix petroleum base grease with synthetic base grease at any time. For lubrication under special conditions consult factory.

Shorter lubrication interval may be required in environments with high amounts of dust and other contamination.

Appendix A - Internal Protection

Parker 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)**. The MX45S has an IP 10 protection 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.

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.

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Notes

Notes

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