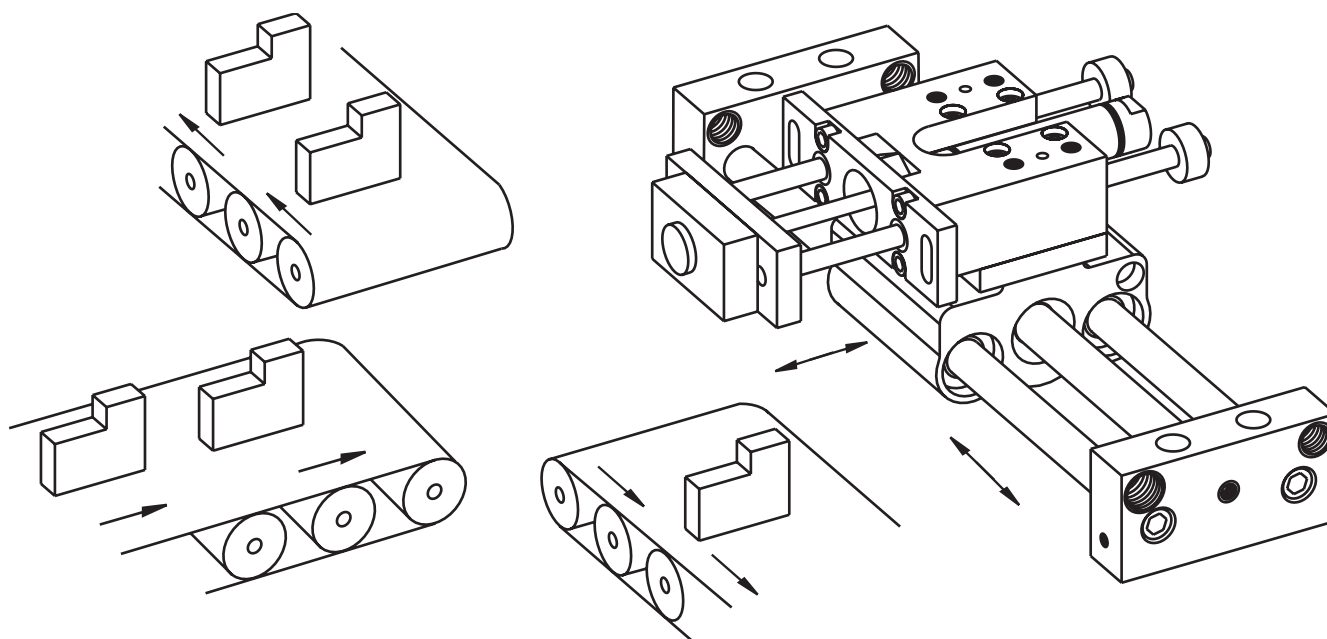


Transition Plates

Aluminum plates that couple IMI Bimba actuators—Ultran® rodless cylinders, Pneu-Turn® rotary actuators, and Linear Thrusters—into a variety of multi-axis configurations.



The customer's attachment reads a bar code on the product to determine the required paint scheme. The Ultran Slide Rodless Cylinder and Linear Thruster picks the item off the incoming conveyor and places it on the appropriate out-going one.

How to Choose a Transition Plate

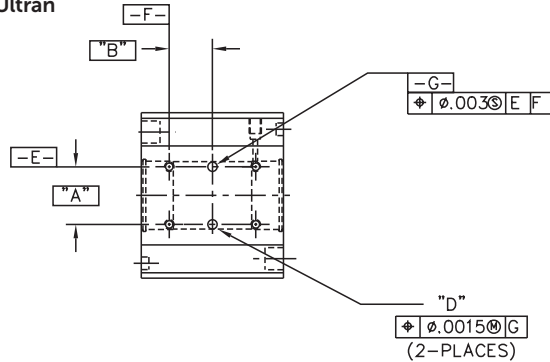
Page 596 shows how to build the Transition Plate model numbers. Choose the configuration (base product and coupled product) that best suits your application and turn to that section. It will describe the valid bore size combinations and provide basic dimensions, weights and prices for those Transition Plates. It will also show alignment of the products to help you determine the outside dimensions of your configuration, and provide information on the options you may need to include when ordering your actuators. Unless otherwise noted, all Transition Plates are designed for mounting hole center to center alignment.

NOTE: Actuators can be coupled together in the bore size combinations noted in each section. However, critical engineering specifications must be met for each specific application. In addition, for a precision positioning system, the deflection of the components should be compensated for by incorporating external adjustments into the system design. See the engineering specifications for the individual actuators for more information.

Transition Plates

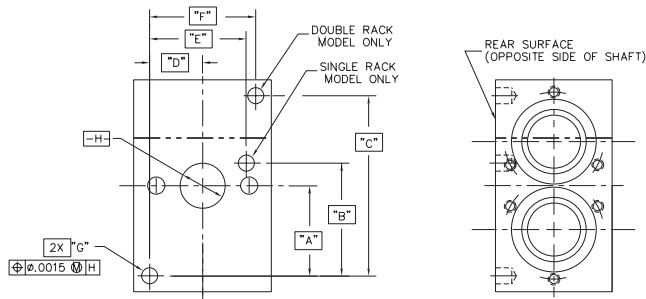
Dowel Pin Hole Locations

Ultran



Bore	A	B	D
020 (9/16")	1.000	.750	.1270/.1280 x .240/.260 DP.
040 (3/4")	1.375	.876	.1895/.1905 x .410/.430 DP.
090 (1-1/16")	1.750	1.250	.2520/.2530 x .410/.430 DP.
170 (1-1/2")	2.500	1.750	.3145/.3155 x .560/.580 DP.

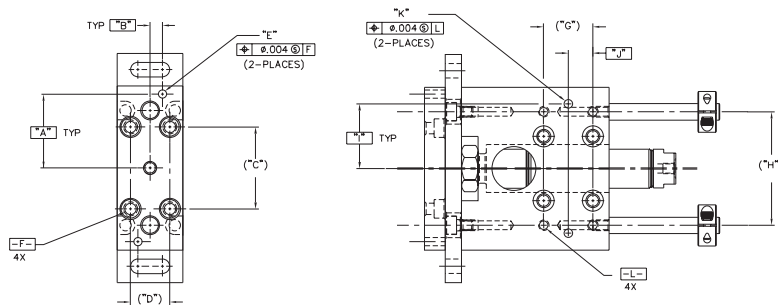
Pneu-Turn



Bore	A	B	C	D
020 (9/16")	.874	1.101	1.754	.500
040 (3/4")	1.061	1.330	2.125	.623
090 (1-1/16")	1.311	1.730	2.625	.718
170 (1-1/2")	1.811	2.281	3.625	.905
310 (2")	2.187	3.000	4.375	.625

Bore	E	F	G
020 (9/16")	.928	1.000	.1270/.1280 x .240/.260 DP.
040 (3/4")	1.139	1.250	.1895/.1905 x .410/.430 DP.
090 (1-1/16")	1.437	1.437	.2520/.2530 x .410/.430 DP.
170 (1-1/2")	1.812	1.812	.3145/.3155 x .560/.580 DP.
310 (2")	1.813	1.250	.3770/.3780 x .560/.580 DP.

Linear Thruster



Bore	A	B	C	D	E	G	H	I	J	K
020 (9/16")	1.125	.188	1.250	.600	.1270/.1280 THRU.	.750	1.750	.8750	.375	.1270/.1280 x .240/.260 DP.
040 (3/4")	1.313	.250	1.500	.750	.1895/.1905 THRU.	.938	2.125	1.1250	.469	.1895/.1905 x .290/.310 DP.
090 (1-1/16")	1.813	.375	2.000	1.000	.2520/.2530 THRU.	1.375	3.125	1.5625	.688	.2520/.2530 x .410/.430 DP.
170 (1-1/2")	2.375	.500	3.000	1.500	.3145/.3155 THRU.	1.750	4.000	2.0000	.875	.3145/.3155 x .560/.580 DP.
310 (2")	3.000	.625	4.000	2.000	.3770/.3780 THRU.	2.125	5.000	2.5000	1.063	.3770/.3780 x .810/.830 DP.
310 (2") TE	2.500	.625	3.000	2.000	.3770/.3780 THRU.	2.000	4.250	2.1250	1.000	.3770/.3780 x .810/.830 DP.
500 (2-1/2")	3.750	1.000	4.750	3.000	.3770/.3780 THRU.	2.630	6.250	3.1250	1.312	.3770/.3780 x 1.000/1.020 DP.
500 (2-1/2") TE	3.250	.750	3.750	2.250	.3770/.3780 THRU.	2.500	5.375	2.6875	1.250	.3770/.3780 x 1.000/1.020 DP.
700 (3")	4.750	1.000	6.000	3.000	.5020/.5030 THRU.	4.000	8.000	4.0000	2.000	.5020/.5030 x 1.250/1.270 DP.
700 (3") TE	4.000	1.000	4.500	2.750	.5020/.5030 THRU.	3.000	6.500	3.2500	1.500	.5020/.5030 x 1.250/1.270 DP.

Transition Plates

Linear Thruster (Base Product) to Pneu-Turn Rotary Actuator (Coupled Product) Shaft Parallel*

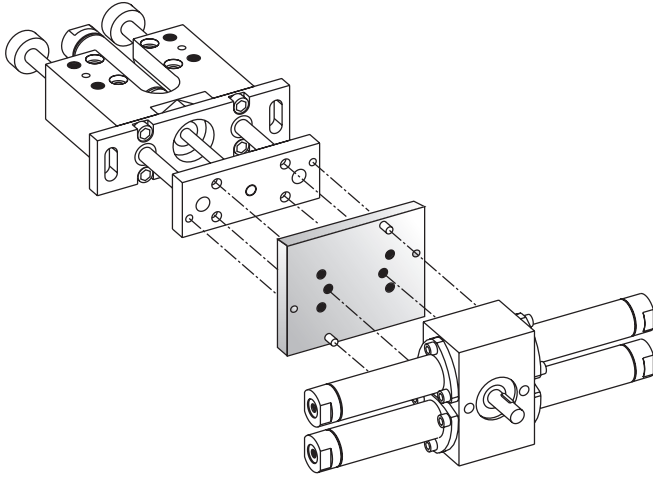
Linear Thruster			9/16" (02)	3/4" (04)	1-1/16" (09)	1-1/2" (17)	2" (31)
Pneu-Turn Rotary Actuator	9/16"	Single rack (006)	TPT02-PT006A	TPT04-PT006A			
		Double rack (014)	TPT02-PT014A	TPT04-PT014A			
	3/4"	Single rack (017)		TPT04-PT017A	TPT09-PT017A		
		Double rack (033)		TPT04-PT033A	TPT09-PT033A		
	1-1/16"	Single rack (037)			TPT09-PT037A	TPT17-PT037A	
		Double rack (074)			TPT09-PT074A	TPT17-PT074A	
	1-1/2"	Single rack (098)				TPT17-PT098A	TPT31-PT098A
		Double rack (196)				TPT17-PT196A	TPT31-PT196A
	2"	Single rack (247)					TPT31-PT247A
		Double rack (494)					TPT31-PT494A

NOTE: Use model numbers shown for both T and TE Series Linear Thrusters through 1-1/2" bore; 2" bore requires specific call-out of TE as shown. Screws and dowel pins (if ordered) are included with the Transition Plate.

Model Number	Dimensions			Weight (includes screws) (lbs)
	Length (in)	Width (in)	Thickness (in)	
TPT02-PT006A TPT02-PT014A	2.50	2.00	0.28	0.14
TPT04-PT006A TPT04-PT014A	3.00	2.00	0.28	0.17
TPT04-PT017A TPT04-PT033A	3.00	2.50	0.36	0.26
TPT09-PT017A TPT09-PT033A	4.00	2.50	0.36	0.35
TPT09-PT037A TPT09-PT074A	4.00	3.12	0.47	0.58
TPT17-PT037A TPT17-PT074A	5.38	3.00	0.47	0.74
TPT17-PT098A TPT17-PT196A	5.38	4.25	0.72	1.61
TPT31-PT098A TPT31-PT196A	6.75	4.25	0.72	2.02
TPT31-PT247A TPT31-PT494A	6.75	5.00	0.72	2.38
TPTE31-PT098A TPTE31-PT196A	5.75	4.25	0.72	1.72
TPTE31-PT247A TPTE31-PT494A	5.75	5.00	0.72	2.03

Transition Plates

Linear Thruster (Base Product) to Pneu-Turn Rotary Actuator (Coupled Product) Shaft Parallel*



Dowel Pins

In addition to ordering a Transition Plate with dowel pin option, dowel pin options must be selected for your Linear Thruster (-D option); and the ball bearing (-R) and hardened shaft (-F) options must be selected for your Pneu-Turn Rotary Actuator (the ball bearing option includes dowel pin holes). For example, your order would include:

- T-096-DM
- PT-033180-FMR
- TPT09-PT017AD

This provides: a 1-1/16" bore, 6" stroke Linear Thruster with dowel pin holes and a magnetic piston; a single rack 3/4" bore, 180° Pneu-Turn with hardened shafts, magnetic piston, and ball bearing (with dowel pin holes); and the appropriate Transition Plate with dowel pins. Refer to individual actuator sections for dowel pin option pricing.

Transition Plates

Pneu-Turn Rotary Actuator (Base Product) to Linear Thruster (Coupled Product)

Shaft Perpendicular*

Linear Thruster	Pneu-Turn Rotary Actuator				
	9/16" (006 or 014)	3/4" (017 or 033)	1-1/16" (037 or 074)	1-1/2" (098 or 196)	2" (247 or 494)
	9/16" (02)	TPPT02-T02P			
	3/4" (04)	TPPT04-T04P		TPPT09-T04P	
	1-1/16" (09)			TPPT09-T09P	TPPT31-T17P
	1-1/2" (17)			TPPT17-T17P	TPPT31-T31P
	2" (31)			TPPT31-TE31P	

NOTE: Two plates are needed for this configuration. Both plates will be included if part number TPP - T P is ordered. If needed, part TPPT can be ordered separately. Use model numbers shown for both T and TE Series Linear Thrusters through 1-1/2" bore; 2" bore requires specific call-out of TE as shown.

Screws and dowel pins (if ordered) are included with the Transition Plate.

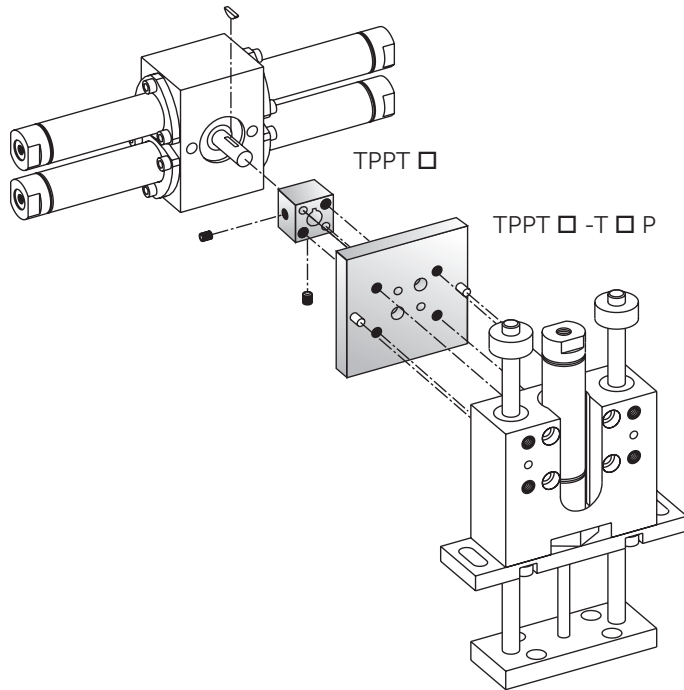
Model Number	Dimensions			Weight (includes screws) (lbs)
	Length (in)	Width (in)	Thickness (in)	
TPPT02-T02P	2.00	2.00	0.28	0.15
(includes TPPT02)	0.62	0.62	0.50	0.04
TPPT04-T04P	2.50	2.25	0.36	0.28
(includes TPPT04)	0.75	0.75	0.75	0.08
TPPT09-T04P	3.50	3.00	0.47	0.67
(includes TPPT09)	1.00	1.00	0.94	0.19
TPPT09-T09P	3.50	3.00	0.47	0.67
(includes TPPT09)	1.00	1.00	0.94	0.19
TPPT17-T09P	4.50	4.25	0.72	1.82
(includes TPPT17)	1.50	1.50	0.94	0.47
TPPT17-T17P	4.50	4.25	0.72	1.84
(includes TPPT17)	1.50	1.50	0.94	0.47
TPPT31-T17P	4.50	4.25	0.72	1.84
(includes TPPT31)	1.50	1.50	1.12	0.47
TPPT31-T31P	6.00	3.00	0.72	1.76
(includes TPPT31)	1.50	1.50	1.12	0.47
TPPT31-TE31P	5.25	3.00	0.72	1.60
(includes TPPT31)	1.50	1.50	1.12	0.47

NOTE: The key on the Pneu-Turn shaft is mounted in the 12 o'clock position, therefore, rotation of the Linear Thruster will be equal in the clockwise and counterclockwise directions. Please order sufficient angle of rotation, angle adjustment option or a Pneu-Turn rotary actuator with the key mounted in a special position as required for your application.

Transition Plates

Pneu-Turn Rotary Actuator (Base Product) to Linear Thruster (Coupled Product)

Shaft Perpendicular*



* Shown is 9/16" (02) bore Linear Thruster. Bolt pattern for this size only is offset 1/2" from center axis of housing.

Dowel Pins

In addition to ordering a Transition Plate with dowel pin option, the ball bearing (-R) and hardened shaft (-F) options must be selected for your Pneu-Turn Rotary Actuator (the -R option includes dowel pin holes), and the dowel pin option (-D) must be selected for your Linear Thruster. For example, your order would include:

- PT-247180-FMR
- T-096-DM
- TPPT31-T17PD

This provides: a single rack 2" bore, 180° Pneu-Turn with hardened shafts magnetic piston, and ball bearing (with dowel pin holes); a 1-1/2" bore, 6" stroke Linear Thruster with dowel pin holes and magnetic piston; and the appropriate Transition Plate with dowel pins. Refer to individual actuator sections for dowel pin option pricing.

Toleranced Clearance Hole Sizes

TPPT02	.1270/.1280
TPPT04	.1895/.1905
TPPT09	.2520/.2530
TPPT17	.3145/.3155
TPPT31	.3145/.3155

NOTE: Dowel pins to attach part TPPT are not provided, although clearance holes are available for dowel pins.

Transition Plates

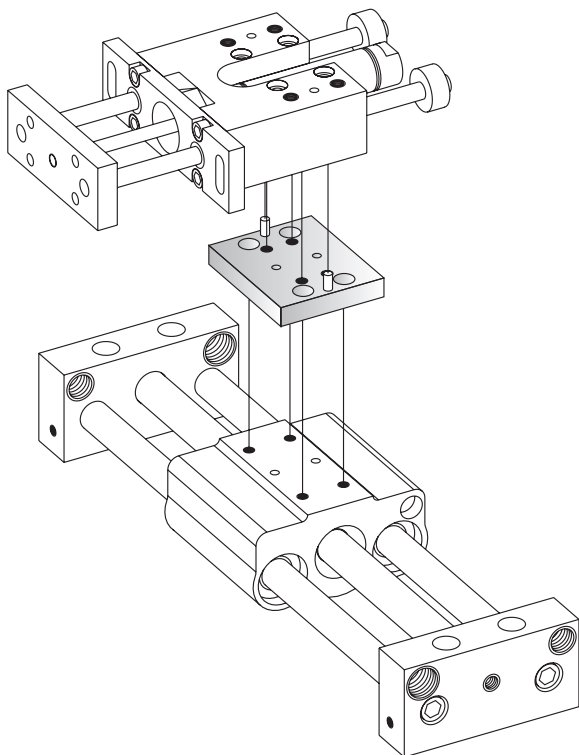
Ultran Rodless Cylinder (Base Product) to Linear Thruster (Coupled Product)

Mounted Perpendicular*

Linear Thruster	Ultran Rodless Cylinder			
	9/16" (02)	3/4" (04)	1-1/16" (09)	1-1/2" (17)
	9/16" (02)	TPU02-T02P		
	3/4" (04)	TPU04-T04P	TPU09-T04P	
	1-1/16" (09)	TPU09-T09P		TPU17-T09P
	1-1/2" (17)	TPU17-T17P		

NOTE: Use model numbers shown for both T and TE Series Linear Thrusters. Screws and dowel pins (if ordered) are included with the Transition Plate.

Model Number	Dimensions			Weight (includes screws) (lbs)
	Length (in)	Width (in)	Thickness (in)	
TPU02-T02P	2.00	2.00	0.28	0.11
TPU04-T04P	2.50	2.25	0.36	0.20
TPU09-T04P	3.50	3.00	0.47	0.48
TPU09-T09P	3.50	3.00	0.47	0.48
TPU17-T09P	4.50	4.25	0.72	1.35
TPU17-T17P	4.50	4.25	0.72	1.35



Dowel Pins

In addition to ordering a Transition Plate with dowel pin option, dowel pin options must be selected for your Ultran rodless cylinder and Linear Thruster (-D option). For example, your order would include:

- UGS-0915-ADT
- T-096-DM
- TPU09-T09PD

This provides: 1-1/16" bore, 15" stroke Ultran Slide with gold coupling strength, stroke adjustment on both ends, dowel pin holes and switch track; a 1-1/16" bore, 6" stroke, Linear Thruster with dowel pin holes and a magnetic piston; and the appropriate Transition Plate with dowel pins. Refer to individual actuator sections for dowel pin option pricing.

* Shown is 9/16" (02) bore Linear Thruster. Bolt pattern for this size only is offset 1/2" from center axis of housing.

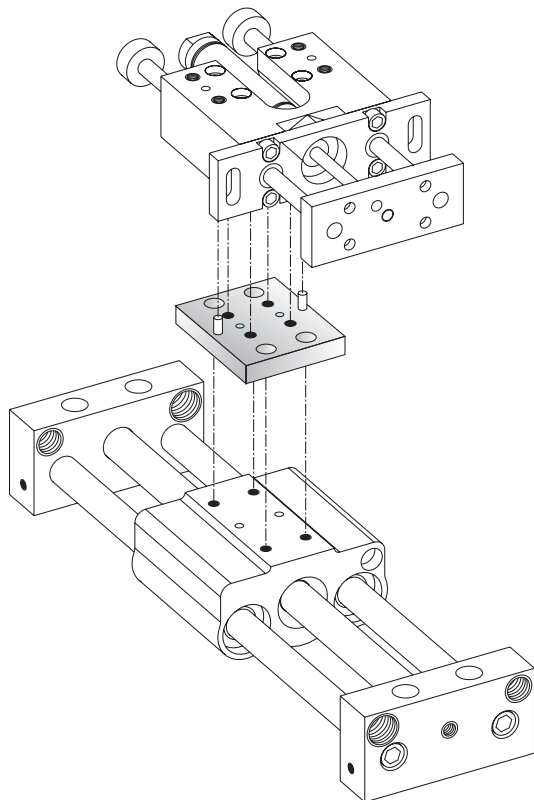
Transition Plates

Ultran Rodless Cylinder (Base Product) to Linear Thruster (Coupled Product) Mounted Parallel*

Linear Thruster	Ultran Rodless Cylinder			
	9/16" (02)	3/4" (04)	1-1/16" (09)	1-1/2" (17)
	9/16" (02)	TPU02-T02A		
	3/4" (04)	TPU04-T04A		TPU09-T04A
	1-1/16" (09)	TPU09-T09A		TPU17-T09A
	1-1/2" (17)	TPU17-T17A		

NOTE: Use model numbers shown for both T and TE Series Linear Thrusters. Screws and dowel pins (if ordered) are included with the Transition Plate.

Model Number	Dimensions			Weight (includes screws) (lbs)
	Length (in)	Width (in)	Thickness (in)	
TPU02-T02A	2.00	2.00	0.28	0.11
TPU04-T04A	2.50	2.25	0.36	0.20
TPU09-T04A	3.50	3.00	0.47	0.48
TPU09-T09A	3.50	3.00	0.47	0.48
TPU17-T09A	4.50	4.25	0.72	1.35
TPU17-T17A	4.50	4.25	0.72	1.35



Dowel Pins

In addition to ordering a Transition Plate with dowel pin option, dowel pin options must be selected for your Ultran rodless cylinder and Linear Thruster (-D option). For example, your order would include:

- UGS-0915-ADT
- T-096-DM
- TPU09-T09AD

This provides: 1-1/16" bore, 15" stroke Ultran Slide with gold coupling strength, stroke adjustment on both ends, dowel pin holes and switch track; a 1-1/16" bore, 6" stroke, Linear Thruster with dowel pin holes and a magnetic piston; and the appropriate Transition Plate with dowel pins. Refer to individual actuator sections for dowel pin option pricing.

* Shown is 9/16" (02) bore Linear Thruster. Bolt pattern for this size only is offset 1/2" from center axis of housing.

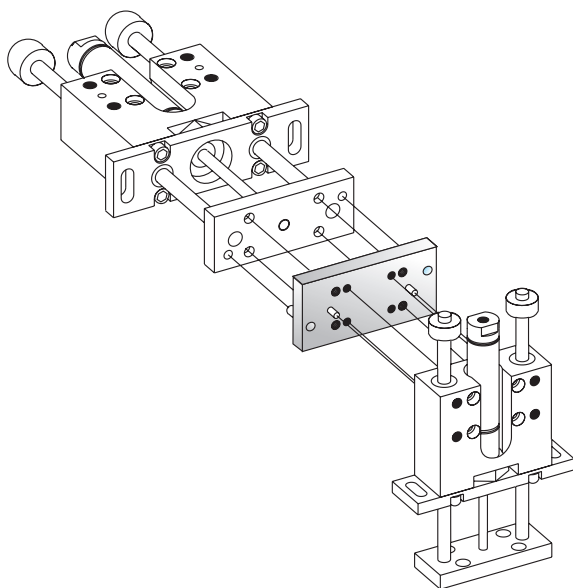
Transition Plates

Linear Thruster (Base Product) to Linear Thruster (Coupled Product) Mounted Perpendicular*

Linear Thruster	Linear Thruster				
	9/16" (02)	3/4" (04)	1-1/16" (09)	1-1/2" (17)	2" (31)
	9/16" (02)	TPT02-T02P	TPT04-T02P		
	3/4" (04)		TPT04-T04P	TPT09-T04P	
	1-1/16" (09)		TPT09-T09P	TPT17-T09P	
	1-1/2" (17)			TPT17-T17P	TPT31-T17P TPTE31-T17P
	2" (31)				TPT31-T31P TPTE31-TE31P

NOTE: Use model numbers shown for both T and TE Series Linear Thrusters through 1-1/2" bore; 2" bore requires specific call-out of TE as shown. Screws and dowel pins (if ordered) are included with the Transition Plate.

Model Number	Dimensions			Weight (includes screws) (lbs)
	Length (in)	Width (in)	Thickness (in)	
TPT02-T02P	2.50	1.50	0.28	0.10
TPT04-T02P	3.00	1.50	0.36	0.16
TPT04-T04P	3.00	1.50	0.36	0.16
TPT09-T04P	4.25	2.00	0.47	0.39
TPT09-T09P	4.25	2.00	0.47	0.39
TPT17-T09P	5.50	3.00	0.72	1.16
TPT17-T17P	5.50	3.00	0.72	1.16
TPT31-T17P	7.00	3.00	0.97	2.00
TPT31-T31P	7.00	4.50	0.97	2.99
TPTE31-T17P	6.00	3.00	0.97	1.71
TPTE31-TE31P	6.00	4.50	0.97	2.57



Dowel Pins

In addition to ordering a Transition Plate with dowel pin option, dowel pin options must be selected for your Linear Thrusters (-D option). For example, your order would include:

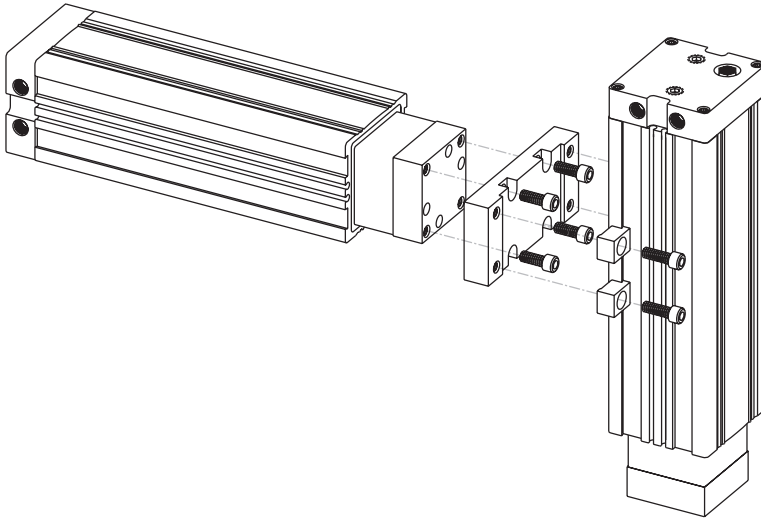
- T-096-DM
- T-042-DM
- TPT09-T04PD

This provides: a 1-1/16" bore, 6" stroke Linear Thruster with dowel pin holes and a magnetic piston; a 3/4" bore, 2" stroke Linear Thruster with dowel pin holes and magnetic piston; and the appropriate Transition Plate with dowel pins. Refer to individual actuator sections for dowel pin option pricing.

* Shown is 9/16" (02) bore Linear Thruster. Bolt pattern for this size only is offset 1/2" from center axis of housing.

Transition Plates

PneuMoment to PneuMoment



Mounting Kits

Model Number	Type
TPPM09-PM09	Imperial
TPPMM09-PMM09	Metric

Kits Include: the plate, four clamps and four S.H.C.S.

Components

Plates:	Anodized aluminum alloy. Part TPPT □, for Rotary Actuator to Linear Thruster configuration, is 303 stainless steel.
Socket head cap screws and socket set screws:	Heat treated high alloy Grade 8 carbon steel with black oxide coating.
Dowel pins:	Hardened and ground carbon steel alloy with black oxide coating.

Recommended Seating Torque

Recommended Seating Torque (in/lbs)		
Nominal Diameter - Threads per Inch	Socket Head Cap Screws	Socket Set Screws
8-32	20	15
10-24	35	25
1/4-20	60	50
5/16-18	125	100
3/8-16	225	N/A

Transition Plates

Sizing a Multi-Axis Configuration

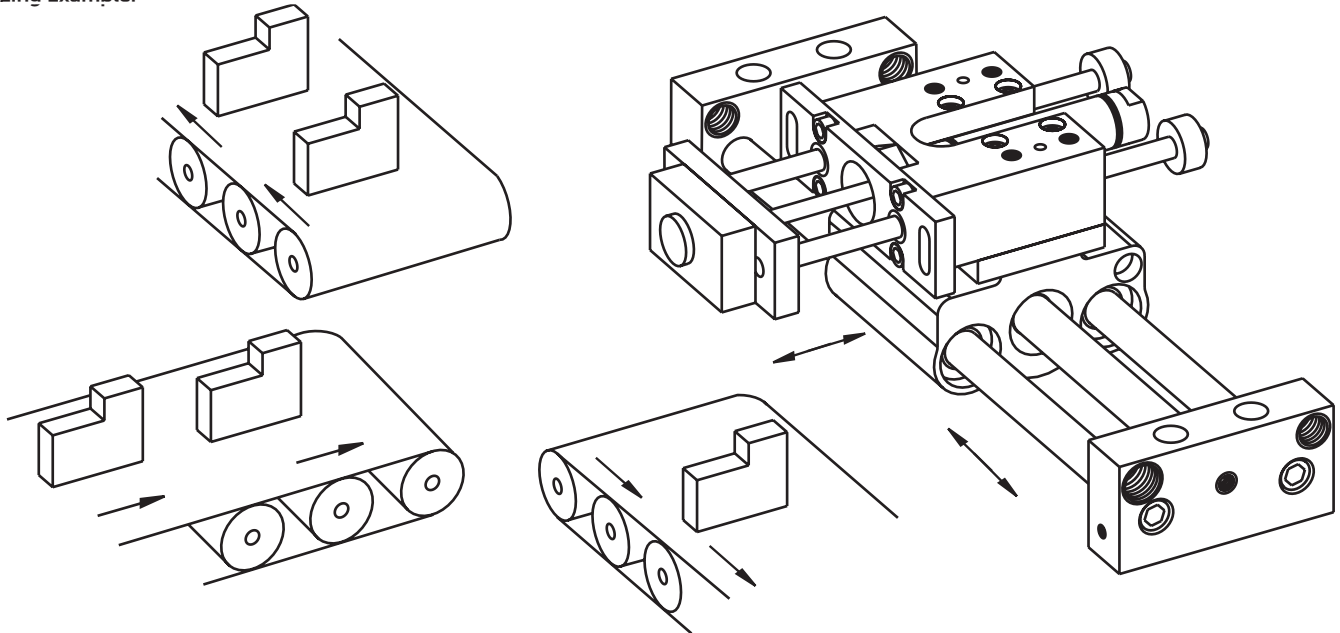
General Comments:

Selection of the actuators and the transition plates that connect them is the most important part of engineering a motion system. To begin the sizing of individual actuators into a complete motion system, you should begin at your attachment or item to move. As you select the type of IMI Bimba product to use, be sure to reference the size and engineering data in this bulletin and in the individual product catalogs. We recommend the following method:

1. Determine the weight and center of gravity of your attachment or item to move.
2. Determine the best actuator to be connected to your attachment or item to create the desired movement.
3. Determine the size of the actuator by referencing the engineering data in this catalog and in the specific product catalog. Select the product by its load, moment, torque, and speed capability as compared to those required by your application. Remember to add in any loads, moments or torques created by any attached actuators.
4. Select the next actuator that will create movement you need.
5. Continue with steps 3 through 5 until all the motion requirements are satisfied.

In the case of a precision positioning system, the deflection of the components should be compensated for by incorporating external adjustments into the system design.

Sizing Example:



Transition Plates

Sizing a Multi-Axis Configuration

An example of a motion system is shown on page 595 using an Ultram Slide rodless cylinder combined with a Linear Thruster by means of a Transition Plate. The application requires a product to be painted in one of two paint colors. The product coming down the conveyor is identified by a bar code which indicates the required paint color. The Linear Thruster extends to the end of its six inch stroke and picks the product by means of a vacuum system. The Linear Thruster retracts three inches before the Ultram Slide begins to move in the direction of one of the two outgoing conveyors. The slide must move eight inches in either direction from its center position to place the product on an outgoing conveyor which will send it to a specific paint booth.

To begin the sizing, we will start with the item that is to be moved. Each product weighs 5lbs and has flat surfaces that allow a vacuum gripper to grasp and lift it from the incoming conveyor. The center of gravity of the product is 3" from the grip surface and in the middle of the product width and height. The vacuum gripper weighs 1lb and has a center of gravity that is .75" from the tooling plate surface and in the middle of its width and height. The gripper is mounted on the center of the Linear Thruster tooling plate. A Linear Thruster with a 6" stroke is chosen to move the product. The combined weight of the product and gripper is 6lbs. Comparing the 6lb load to the maximum side load table for a standard Linear Thruster with a 6" stroke, a 3/4" bore unit has the capability of 11.09lbs. This should be sufficient to handle

the 6lb load and take into account any light, unforeseen loads. Since the product and gripper will be centered on the tooling plate, there are no radial moments. The 3/4" bore Linear Thruster will be chosen as the coupled unit.

An Ultram Slide was chosen to move the Linear Thruster, vacuum gripper and product into position on an outgoing conveyor. The 3/4" bore Linear Thruster will be fastened to the center of the Ultram Slide carriage by means of a Transition Plate. The Ultram Slide must carry the load of the Transition Plate (0.20lb), Linear Thruster (2.82lbs), the gripper (1lb), and the product (5lbs) The total weight the Ultram Slide will move is 9.02lbs Comparing this to the maximum allowable radial loads for 16" stroke Ultram Slides, a 3/4" bore unit can carry approximately a 20lb load. The Linear Thruster is fully extended when it picks the product from the incoming conveyor, then retracts 3" before the Ultram begins to move toward an out-going conveyor. In this case, the dynamic side loading conditions on the Ultram Slide will be determined when the Linear Thruster has retracted 3". Since the Linear Thruster has retracted to half of its stroke length, the guide shafts are extending the same amount from each side of the Linear Thruster body. In this case there is no side load because of the guide rods. The actual side load created by the product, gripper, and Linear Thrusters are found by rearranging and solving the equation found on page 595 and then comparing the result to the 20lb limit.

Transition Plates

Sizing a Multi-Axis Configuration

$$\text{Side Load} = \sum \text{Actual Load} * [2 * [(Y1/Z + 1)]]$$

Actual Loads: product - 5lbs
gripper - 1lb
Linear Thruster tooling plate - .40lb

$$\text{Side Load} = 5\text{lbs} * [2 * [(8.25 \text{ in} / 2.518 \text{ in}) + 1]] + 1\text{lb} * [2 * [(4.50 \text{ in} / 2.518 \text{ in}) + 1]] + .40\text{lb} * [2 * [(3.56 \text{ in} / 2.518 \text{ in}) + 1]]$$

$$\text{Side Load } 3/4" \text{ bore} = 50.25\text{lbs}$$

This side load is greater than the 20lb maximum for a side loading condition on a 3/4 bore Ultran Slide. The next larger Ultran Slide, 1-1/16" inch bore, has a side load capability of approximately 55lbs. This Slide will be reviewed for the side load condition using the equation above.

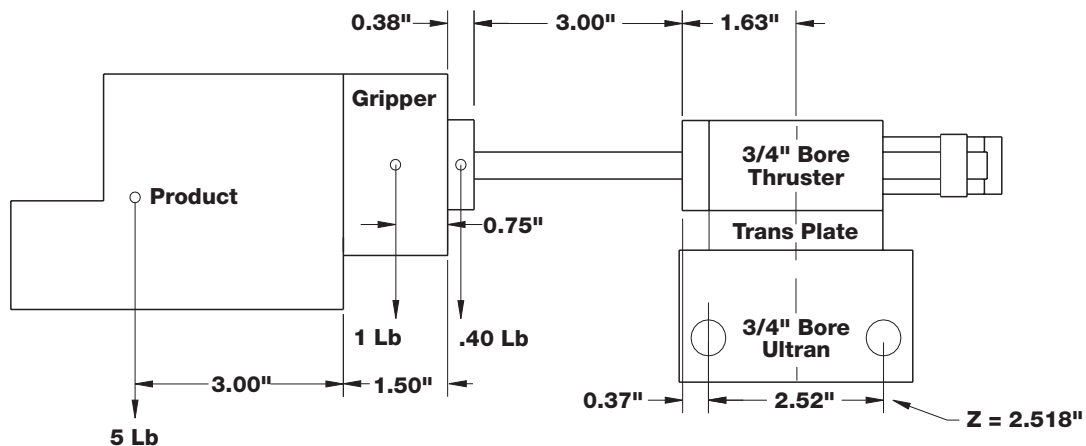
$$\text{Side Load } 1-1/16 \text{ bore} = 42.48\text{lbs}$$

This side load is within the capability of an 1-1/16 inch bore Ultran Slide and this unit will be chosen as the base unit. Other considerations in choosing a model include:

1. The need for a Hall Effect switch that will signal a controller when the Linear Thruster has retracted three inches. Also, external bumpers will be used to soften the impact at end-of-stroke.
2. Hall Effect Switches will be used for end-of-stroke and mid-stroke signalling on the Ultran Slide rodless cylinder.
3. Dowel pins will be used with the Transition Plate.

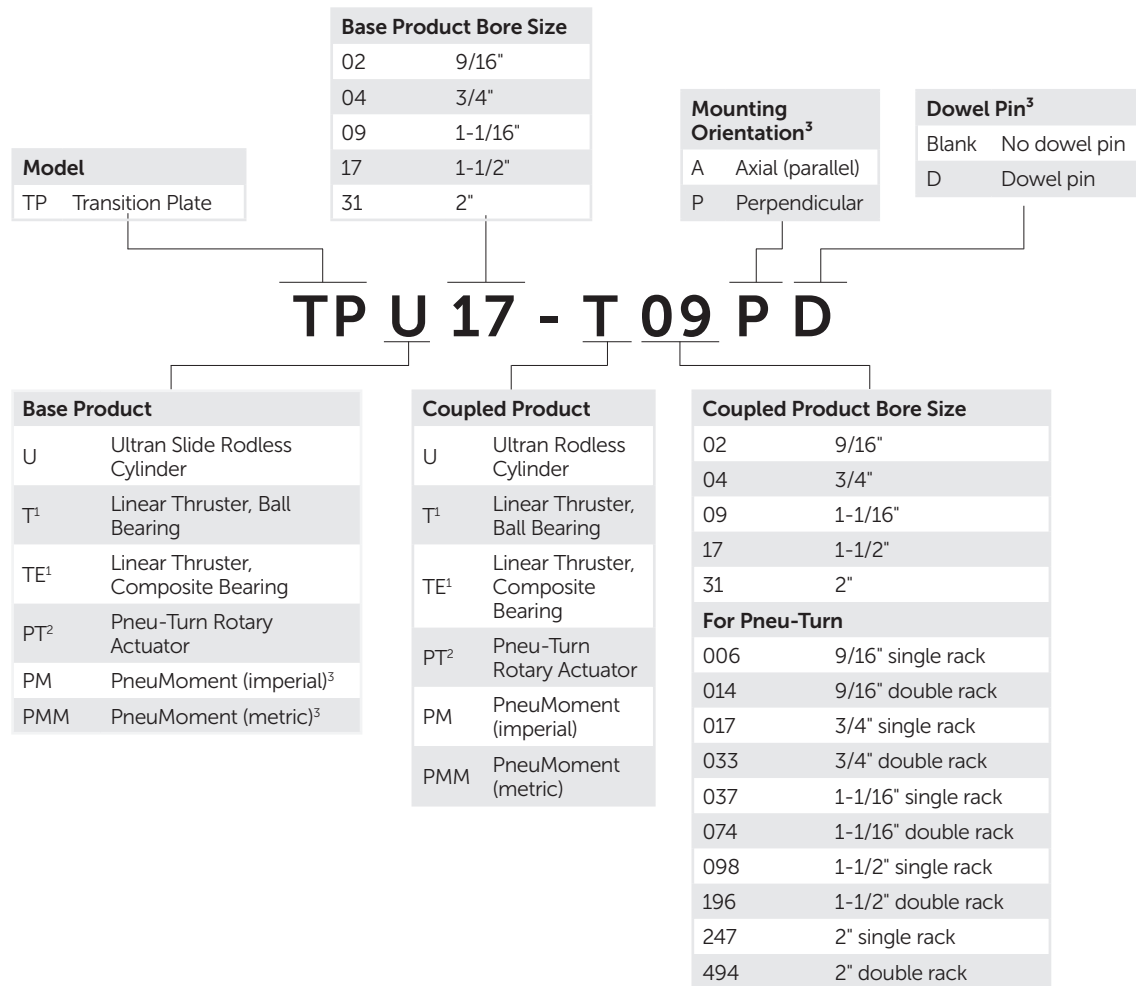
Thus the products selected will be:

Linear Thruster	T-046-EB2MD
Ultran Slide rodless cylinder	USS-0916-TD
Transition Plate	TPU09-T04PD



Transition Plates

The model number of all Transition Plates consists of two alphanumeric clusters. The first cluster designates product type, base product and bore size of the base product. The second cluster designates coupled product and bore size of the coupled product, mounting orientation, and an optional character for dowel pins. Please refer to the charts below for an example of model number TPU17-T09PD. This is a transition plate for a 1-1/2" bore Ultram rodless cylinder that will be coupled to a 1-1/16" bore Linear Thruster (ball bearing), in a perpendicular orientation, with dowel pins.



NOTE: See sections on specific configurations for more information on valid product combinations.

¹ As shown on the following pages, use the "T" designation for either T or TE Series Linear Thruster, except where the TE is specifically called out.

² Pneu-Turn Rotary Actuator must be ordered with both the ball bearing (-R) and the hardened shaft (-F) options.

³ PneuMoment to PneuMoment only. Mounting orientation and dowel pin do not apply. Only available for the 1-1/16" bore.

Transition Plates are attached to the base and coupled products with socket head cap screws and socket set screws. Screws are included with the Transition Plate. Dowel pins can be ordered as an option for ease of assembly and/or improved shear loading.