

Positioning Tables & Stages

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**PM - BEARINGS**



## Introduction

*PrecisieMetaal - BEARINGS (PM) is specialized in designing and manufacturing linear bearings in top quality. PM is providing a complete range of linear bearings, frictionless slides, positioning tables and stages, which guarantees high levels of performances at competitive prices. Thanks to a long history of experience, new findings in research, combined with innovating linear technology, PM products meet the highest accuracy and quality demands of today's industry and are successful in use worldwide.*

Since the foundation in 1966, PM has become an **innovator in linear technology** with the specialization in the production of high- and very high precision linear bearings and frictionless slides.

Starting with the specialization in precision linear bearings PM has expanded and developed the linear-program through the years. Today, PM offers the widest range models and sizes to provide the designer maximum flexibility to achieve the best operating results in linear and rotary motion.

One of the goals is **customer-satisfaction** with additional increase of productivity and reliability against lower production costs. The PM organization is **dedicated to quality** and is focused to give quick and accurate information on customers request.

The main PM-products are published in:

- Linear Bearings
- Precision Slides
- Positioning Tables and Stages

### Subassemblies

The growing market for complete subassemblies is fully supported by PM and is a major part of our Total Customer Care strategy. PM is offering not only extensive assembly-facilities, skilled workers and knowledge but also a time- and cost saving solution with increase of flexibility in today's rapid market.

### Worldwide Representation

Made by PM means the same high quality, technical support and follow-ups whether in Asia, the U.S.A. or Europe. Our worldwide representatives are selected to serve you with the best technical advice and service guaranteeing fast and reliable deliveries in all local markets. Please, contact PM for the authorized representative in your area.

The specifications and data in this catalogue are believed to be accurate and reliable. However, in the interest of technical progression, PM reserves the right to modify without prior notice.





# PM - BEARINGS

*Progressive by innovating linear technology*



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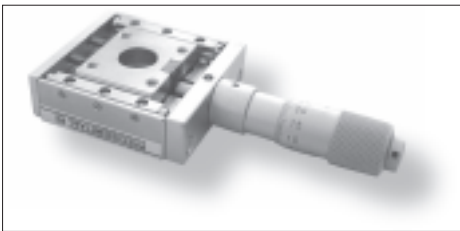


## Tables and Stages Overview

**PM's** product family of positioning tables and stages are available in various sizes and lengths for a wide range of applications requirements. They are designed to offer controlled point-to-point positioning along a linear axis. The tables provide unprecedented responses on accuracy, repeatability, lifetime and quality by using crossed roller or needle roller bearings.

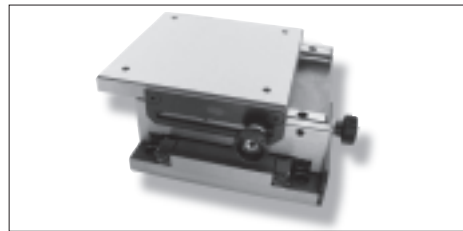
The single and multi-axis stages can be manual, lead screw, ball screw or linear motor driven, depending on customer requirements.

For special customer requirements PM offers the knowledge, flexibility and skills to provide superior high-performance linear motion solutions.



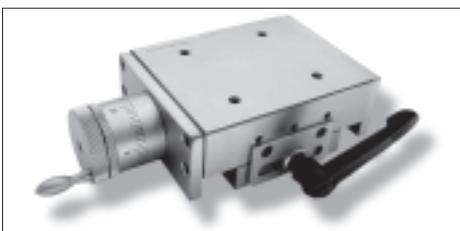
### 1 Precise Linear Positioners type MT

- Travel 7 - 50 mm
- Size 1.5 - 6 mm
- Low profile design
- High repeatability
- Load capacity up to 5.940 N



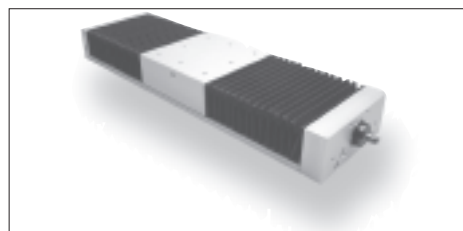
### 3. X-Y Cross Roller Table type KT

- Travel 25 – 150 mm
- Size 1.5 – 6 mm
- Compact, low profile stage
- With locking mechanism
- Load capacity up to 13.500 N



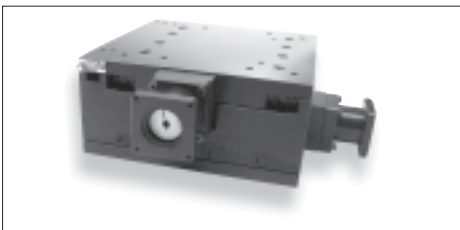
### 2. Roller Table RT-SR serie

- Travel 40 – 400 mm
- Size 3, 6 and 9 mm
- Reading accuracy 0.02 mm
- Lead screw driven
- Load capacity up to 28.350 N



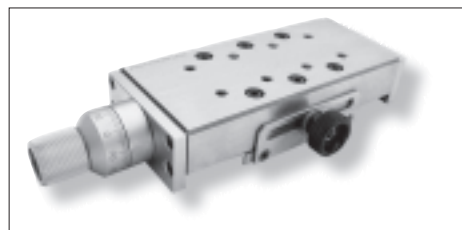
### 4. Precision Linear Stage type RTNC

- Travel 100 – 800 mm
- Fitted with needle roller bearings
- Ball screw driven
- Various options as switches, encoders ...
- Load capacity up to 264.000 N



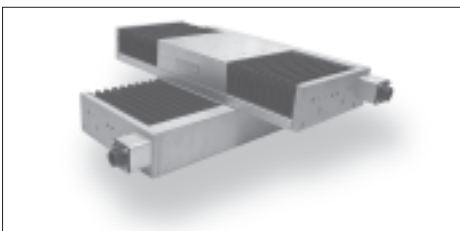
### 5. Modular Square X-Y Stages MSS

- Travel 100 - 300 mm
- Crossed roller or needle roller bearings
- Low profile, monolithic design
- Aircraft grade aluminium
- Broad range of options  
(as switches, ball screws, encoders)



### 7. Miniature Roller Table RT-SRM

- Travel 25 – 175 mm
- Fitted with crossed roller bearings
- Reading accuracy 0.01 mm
- Lead screw driven
- Load capacity up to 10.012 N



### 6. MLM Modular Linear Motor Stages

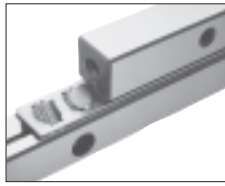
- Travel 100 - 1000 mm
- Non-recirculating linear bearings
- Aircraft grade aluminium
- Unique combination of flexibility and fast delivery
- Switches and sensors of your choice



## Technical Data

### General

PM – BEARINGS family of positioning tables and stages are linear guided with the worldwide standardized precision crossed roller bearings RSD. In this paragraph we explain you the basic fundamentals.



The Precisie/Metaal range of linear bearings and “almost frictionless” precision slides are available in various sections with matching ball- and roller diameter in a wide range of standard lengths.

The choice of sizes (cross-sections) and lengths caters for almost all load capacities, enabling the designer to solve most linear motion problems with virtual frictionfree movements, free from play, with adjustable pre-load. Due to these features PM linear bearings are almost complete free from wear, needing only minimum lubrication and maintenance, and are used successfully in a wide range of industries, e.g.:

- Packing machinery
- Machine tools + other metal working machinery
- Automation applications
- Special purpose machines + special purpose tooling

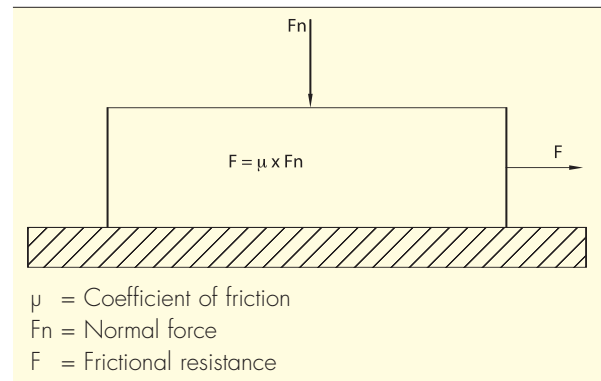
Due to the high linear accuracy, which PM linear bearings offer, they are also used widely for:

- Measuring instruments
- Tool setting equipments
- Robotic devices
- Space applications
- Research projects
- Semiconductor equipments

To sum up, PM linear bearings, have a compact size, offer facility of installation, high accuracy of running motion, long life with only minimal lubrication, low maintenance costs, and ease of replacement in the event of damage. Because the linear bearings and linear slides are vital components in the application they are manufactured with the greatest care to provide the maximum of linear accuracy and reliability that is likely to be required.

### Friction

Friction is the force necessary to move a body along a horizontal plane or track. A fine machined surface gives a positive effect on the friction. Therefore PM is using the highest quality of roller bodies in combination with precision ground anti-friction guideways type RSD which are manufactured by a team of specialists. Compared with



other types of friction, linear bearings fitted with balls or rollers offer not only much lower frictional resistance, but also an almost complete absence of static friction. For driven systems you have to take into account that the friction also includes the drive system that is chosen.

For almost absent of friction PM offers for the RSDE and N/O serie linear bearings the ultimate in high precision and frictionless linear motion: the **SF-class** technology. In this case the surface roughness of the V-grooves is dramatical reduced and looks visual mirror-smooth which has a positive effect on the friction resistance.

Other topics of the SF-class are:

- Extremely high linear accuracy <2 micron over full travel
- Special high quality finished rollers
- Vibrations in sub-micron area are significant reduced
- Much lower priced and easier to assemble in comparison with air bearings

Typical SF-class applications are the wirebonding tables in the semicon industry, material testing equipment and measuring devices.



## Lubrication

PM precision guides are a main part in the construction of machines. The standardized high quality has to be secured during the calculated lifetime. Nevertheless dust and moisture are the main enemies of the precision bearings. Lubrication creates a film between the rolling surfaces and gives a sufficient protection against corrosion. Other benefits are for example:

- Friction reduction
- Reduction of wear
- Prolongation of lifetime
- Transport of heat

We prefer lubrication by oil CLP like DIN 51519 and HLP like DIN 51524. During operation the temperature has to be between -30°C till +120°C while the viscosity is between ISO-VG15 and ISO-VG100. In case of grease, lubrication on lithium soap base is recommended. Most of our ball screw driven stages come with a single point lubrication system to facilitate the maintenance of the systems. By the application of PM precision guides which are manufactured of not standardized materials or used in special operation environments the lubrication has to be taken into account. For further information, please contact PM - BEARINGS.

## Effect of Elevated Temperatures

PM linear bearings can be used by temperatures between -40°C up to +80°C during operation. In case of doubt or questions by the use of motors, ball screws, measuring systems etc. please consult PM - BEARINGS.

When PM linear bearings are used at temperatures in excess of 150 °C, the track-rail hardness begins to fall off and the load ratings must be reduced in accordance with factor  $f_t$ , tabulated below. If different elements of a linear bearing assembly, which has been pre-loaded or adjusted for freedom of play, suffers differential temperatures, then this could have harmful effects. In the worst case, the pre-load can become excessive and causes Brinell-type indentations in the bearing ways. Accordingly, if high demands are placed on running accuracy, then such temperature differentials must be avoided.

The effect of thermal expansion becomes more important as the travel increases. As the table or environment temperature increases the parts undergo expansion, at a specific rate for any material. By our lead- and ball screw driven tables with the use of two (of more) different materials (aluminum or cast-iron table parts and steel lead- and ball screws) the expansion rates for these two materials is eliminated by the design of the tables, which captives one end of the leadscrew using a duplex, angular contact bearing set, while allowing the other end to slide freely through a bearing providing only radial support.

The amount of change is depending on the size of the component, the difference in temperature, and the material used. The equation relating dimensional change to temperature change is:

$$\Delta L = \alpha \times \Delta T$$

$\alpha$  = material dependent coefficient of thermal expansion

Through the years we have developed and designed thousands of positioning tables and stages for various applications.

By the selection of special materials, linear encoders, linear motors and other driving systems which are not in this catalog, or by the use of our positioning tables in extreme environments please consult one of our PM application engineers to assist you.

Temperature in °C	Temperature factor $f_t$
125	1
150	1
175	0.95
200	0.90
225	0.82
250	0.76
275	0.68
300	0.61





## Bellows and Covers

Whenever our tables are operating under unfavourable ambient conditions, it is advisable to protect them from the ingress of dust and dirt.

Most of our driven stages can be provided (optional to order) with bellows and sliding covers. By the use of these protections the slide base will be longer while the bellows will be attached to the front and endplate of the stage and to the carriage. Per stage are normally two bellow units used. The calculation for the no. of bellows per unit (at one side) of the carriage is:

$$(\frac{1}{2} \text{ travel} / 20) + 1$$

for the required extra length for the base can be calculated as follows:

$$L_{\text{extra}} = \text{no. of bellows} \times 6 \text{ mm}$$

We offer to our customers a wide variety of covers for different environments as protective covers, bellows with (rigid) steel telescopic sheets, telescopic steel covers.

## Maximum Velocity and Acceleration

RSD + RSDE series linear bearings:

Max. recommended speed  $v = 50 \text{ m/min}$ .

Max. acceleration  $a = 8 \text{ m/sec}^2$ .

N+O type linear bearings:

Max. recommended speed  $v = 50 \text{ m/min}$ .

Max. acceleration  $a = 150 \text{ m/sec}^2$ .

(depending on type of bearing-cage used)

To attain maximum acceleration and speeds without skidding of balls or rollers (which can result in cage creeping) the bearings must be suitable pre-loaded (for details please enquire).

In high dynamic applications like wirebonding tables in semiconductor industry with short and high speed moves, a lot of positioning systems shows migration of the cage (cage creeping) due to vibrations in the system generated by the driving components. In most cases cage creep can be prevented by selecting the right linear bearings or right ball screw nut and using the right preload setting for the linear bearings and the nut. There is a link between the frequency and velocity of the movement and the amount of preload. By light preload and an high dynamic movement, vibration will occur. By using a higher amount of preload the stiffness of the linear bearings increases and can damp the vibration. A high vibration work like an hammer on the running faces will shorten his lifetime, in most worst cases it will damage the linear bearings and the ball screw.

For existing "problem" high performance applications we offer our all metall anti-cage creep solution **ACC**. The ACC solution is integrated in the design without influencing the

external boundary or mounting dimension. This allows the customer to replace the bearings in existing problem applications with the ACC solution. ACC is used in application with high accelerations up to 15g and vertical mounting directions. Our all metal design provides dependable service in the most demanding applications where other designs that contain plastic components may fail. The ACC solution is currently available in RSDE and N/O linear bearing series in all accuracy grades.

Linear motor systems require often linear bearings including our ACC solution or in combination with our recirculating units UK / UR / SK / SR-series.

Please consult PM for the right linear bearing selection in your application.

Based on our technology leadership and long term experience in designing positioning tables and stages our systems are guaranteed free of cage creeping by a correct installation.





### **Mounting Guidelines**

In general, PM stages are highly precise devices and require proper mounting to perform at listed specifications. All tables and stages are provided with mounting holes according to a standard configuration. This permits the user a quick and easy mounting into the application.

Our tables and stages are best mounted on precisely machined flat and rigid surfaces of reasonable cross-section and supported of their entire base length. An useful guide is to make sure that the mounting surface flatness exceeds the desired stage flatness. Before attachment of the stage care must be taken to ensure that the surface is clean and that no foreign particles lie under the stage. Tapped holes should be carefully de-burred, and fasteners should be set to designated torques. By the use of granite or ceramic as supporting structure it is imperative that the treaded inserts for tightening of the stage should be installed prior to final lapping. If these inserts are installed afterwards, they may lie slightly above or below the mounting surface, with the potential to seriously degrade accuracy.

When mounted to a properly flat machined and rigid base, the stiffness of the base of the positioning stage is increased.

### **Storage Guidelines**

PM stages are highly precise devices and have to be handled with care. As a general protection against damage the following storage guideline should be followed:

- The tables and stages should be shipped and stocked in the original packaging.

### **Vacuum and Cleanroom Compatible Stages**

Most of the PM tables and stages can be prepared for use in (ultra- high) vacuum or cleanroom environments. Special care has to be taken for example with the selection of the low outgassing materials, special lubricants, surface finishings, vented stainless steel fasteners for use in blind tapped holes, special ball- or crossed roller cages and with the selection of switches and wires. For the assembly of the tables and stages we use modern clean-room cells upto ISO/FDIS 14644-1 class 5 with cleanspots class 3. With over 35 years experience in this field we are ready to meet the most challenging requirements.

For more information please consult PM.



## Definition of Specifications

Following are the definitions of and the means by which the specifications as listed in this catalog are defined and measured. These definitions are also used for customized systems.

**Backlash:** backlash means that positioning error is occurring with change of motion direction. Backlash can be caused by insufficient pre-loaded thrust or inaccurate meshing between drivetrain components, for example gear teeth in a gear-coupled drivetrain, in screw/nut fittings, bearings etc. By movement of the driven shaft there is no motion of the stage. Backlash is relative repeatable and can be compensated for by capable controllers. The amount of backlash can increase as a component grows older through handling and wastage.

PM tables and stages are inspected on absent of backlash before shipment.

**Travel:** travel listed is the total travel of the stage from hard stop to hard stop. Often the travel is listed as stroke.

**Horizontal mounting:** mounting of a linear table or stage on a flat and rigid surface in an horizontal plane.

**Vertical mounting:** mounting of a linear table or stage in any plane deviating from horizontal mounting.

**Accuracy:** positioning system accuracy means the difference in lengths and can happen in five degrees of freedom (Figure 1) and can be conveniently divided into two categories: the accuracy of the way itself, and the linear positioning accuracy along the way. The rated tolerance values are meant as "not to exceed" values; in many cases, the actual values are held to levels well below our published values.

**Positional Accuracy:** indicates the maximum difference between a commanded move and an actual move for each axis, 25.4mm (one inch) above the table top, as measured by a laser interferometer.

### Repeatability

the repeatability of a positioning system can be divided into two categories

**Uni-directional Repeatability:** indicates the ability to repeat a motion increment in one direction only. This specification is less meaningful cause it side-steps issues of backlash and hysteresis.

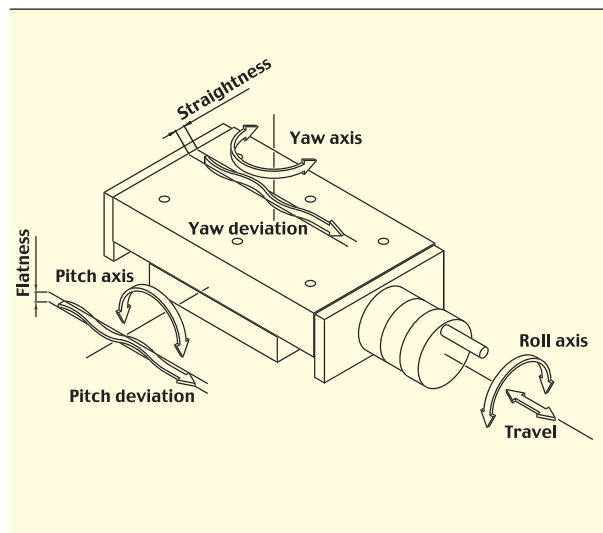
**Bi-directional Repeatability:** indicates the difference in absolute position reached when returning to a given position

from the opposing direction. This value is usually larger than the uni-directional repeatability and some manufacturers publish the values under the term motion performance. Effects such as backlash and hysteresis affect bi-directional repeatability.

**Lead screw/ball screw accuracy:** sum of the cumulative and periodic lead errors resulting from the machining of the drive screw. A wide range of accuracy grades is available.

**Lead error:** deviation of a leadscrew from its nominal pitch between two arbitrary points normally measured over 300 mm screw length. The error is often monotonic (linear), although periodic error and thermal expansion set limits to its predictability.

**Thrust capacity:** maximum allowable force or load which can be applied in any direction of travel without reducing the positioners life of damaging the positioner components.



### Linear Errors

these errors can impact the positioning of the device. However they do not contribute to a positioning error.

**Flatness of Travel:** deviation between actual measured straight line travel and ideal straight line travel in a vertical plane, also referred to as vertical runout.

**Straightness of Travel:** deviations from straight line motion in a horizontal plane. Also referred to as horizontal runout. These errors are the result of inaccuracy in the rollerway assembly.

**Orthogonality:** deviation of perpendicularity, or squareness, between two axes in a X-Y or X-Z table. This parameter is usually measured in arc-seconds or microradians.



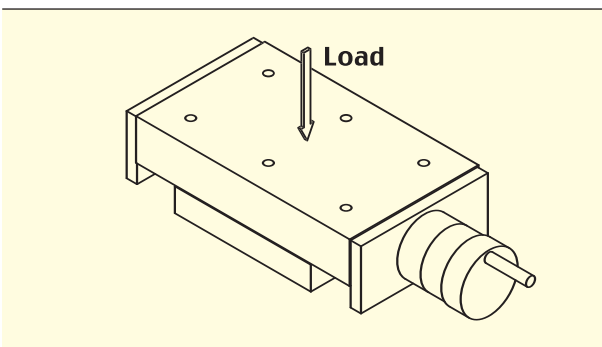
## Angular Errors

**Pitch:** an angular deviation possible in positioning systems, in which the table leading edge rises or falls (rotate around the Y axis) as the table translates along its direction of travel. This represents rotation around the horizontal axis, perpendicular to the direction of travel. This angle is caused by the waviness in the straightness height plane.

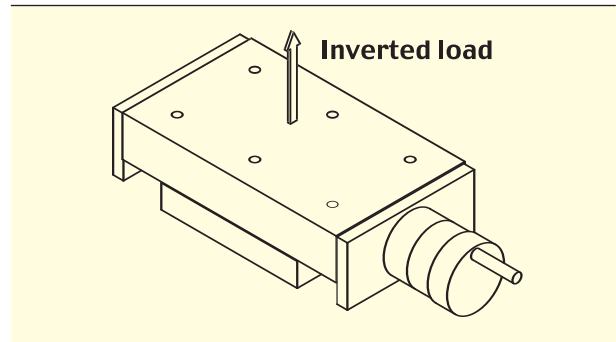
**Yaw:** an angular deviation from ideal straight line motion in which the positioning table rotates around the Z (vertical) axis during movement along its travel axis.

**Roll:** an angular deviation possible in positioning systems, in which the table rotates around the X axis as the table translates along its direction of travel. This represents rotation around an horizontal axis, perpendicular to the direction of travel. This angle is caused by the waviness in the straightness height plane.

**Load Capacity:** as defined in ISO 76-1987, is the maximum allowable downward load or force which can be applied, centered and normal to the mounting and moving surface, on a positioning table which is mounted horizontally. The center of the load/force must be located in the center of the mounting surface when the stage is in zero position. The load ratings are based on the fundamentals established by ISO standard 281.



**Inverted Load Capacity:** is specified similar to normal load except in an upward (tension) direction.

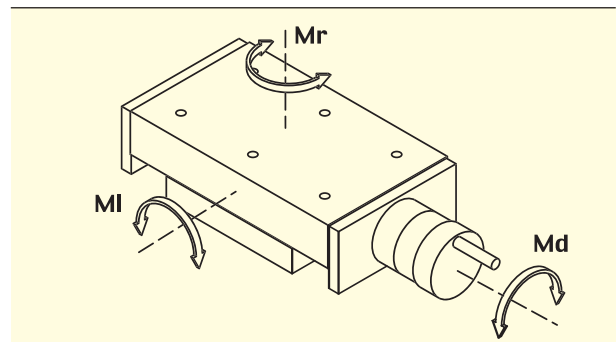


**Moment Load:** the max. allowable moment load capacities listed in this catalog are created in three orientations  
**MI** = pitch moment: when a load is cantilevered (not symmetrically mounted) off the end of an axis, parallel to the direction of travel.

**Md** = roll moment: when a load is cantilevered off the side of an axis, perpendicular to the direction of travel.

**Mr** = yaw moment: when a force causes a rotation moment about the center of an axis.

Exceeding of the listed moment ratings may reduce the life of the bearings and can degrade accuracy.



**Maximum Speed:** the highest speed recommended to prevent degradation of positioner life. For lead screw and ball screw driven tables, this may be calculated by multiplying the listed rps. (revolution per second) by the screw lead.

**Precision:** some manufacturers are using the undefined term precision. Sometimes it refers to absolute accuracy, repeatability, even to resolution.

PM stages are high precision components. Before shipping we check all stages carefully on characteristics such as: backlash, flatness, straightness, accuracy, pitch and yaw.



## Running Accuracies

PM tables and stages are delivered with accuracies as mentioned in the table below and according the specifications as mentioned on page 10 and 11. The checks on the tables are made in unloaded horizontal position. The shown values can also be used for 2-axis combinations. If so, please refer to the belonging travel.

In case more axis are used in a combination it will be more complicated and we offer in these questions our experience. On request the tables and stages will be delivered with a certificate of compliance, measured with a HP laser accuracy equipment. Special higher accuracy grade table can be requested.

Accuracy (Q8)	Travel (mm)						
	<25	25>	50>	400>	500>	800>	1000
Straightness (µm)	2	3	4	5	5	6	8
Flatness (µm)	2	2	3	4	4	5	5
Pitch / Yaw / Roll angle (mrad)				0.1			
Orthogonality XY-tables (mrad)				0.03			

Tolerance on the height: +/- 0.1 mm.

1 µm = 1 micron is approximately 0.000040 inches

1 arc/sec. = 4.848 mrad

1 mrad = 0.206 arc/sec.

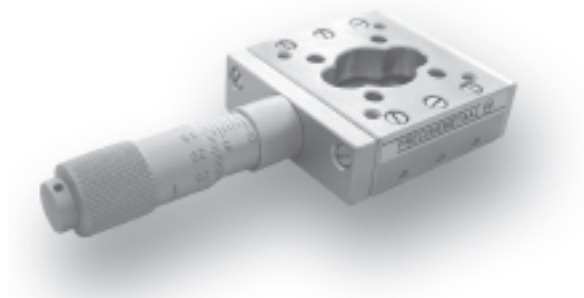
Most of the tables and stages can be supplied with a height tolerance of ±0.01 mm.



## Manual Positioning Stages

Micrometer driven 7 - 50 mm

**MT**



PM's positioning stages type **MT** are single-axis micrometer driven translation tables, designed for microscope-based inspection applications. Like all PM stages, MT stages are assembled with crossed roller ways to assure unsurpassed travel performances in flatness and straightness and excellent stability.

### Material Table Bodies

Steel, nickel plated finishing.

Stage base is through-hardened, standard bearing steel 1.2842

### Specifications

- Incorporates precision crossed roller bearings.
- Center driven by metric micrometer, division 0.01 mm
- No backlash; positive spring-loaded carriage against micrometer tip for excellent repeatability.  
For Z-axis applications the spring-load has to be taken into account. Please consult PM-BEARINGS.
- Center bored hole for through light (not in model MT-1525).
- Type MT-1525 and MT-1535 are fitted with plastic roller cage KZR. Other types are fitted with steel roller cage AA.
- All mounting surfaces are precision ground. *One flank of the slide (the side opposite to the adjustment screws) is ground parallel to the linear bearings to serve as a Reference Face.*
- The stage-top and -base comes with threaded holes, according to a standard configuration
- Accepts mounting in all directions.
- Running accuracies are shown on page 12

### Options

- Micrometers: Digital (metric, imperial)
- Lockable micrometer. (MT-2050 - MT-6150)
- XY assembly is without intermediate plate. Please use model code **KMT** (example KMT-2050)
- XYZ axis configurations with Z-bracket available.
- Special customer design (drawing required).

### Notes by ordering

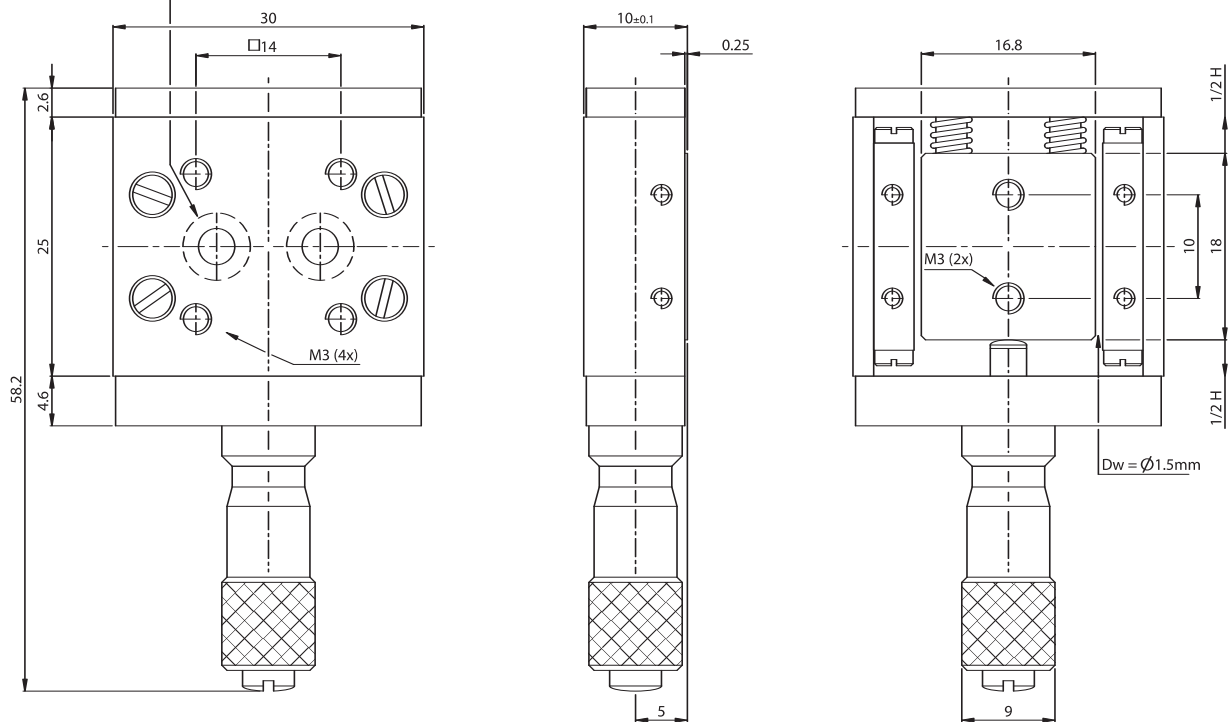
By standard items please specify by ordering the following:  
1. Model no. and quantity.

Example: 1 piece stage type MT-2050



**Model MT-1525, travel 7 mm**

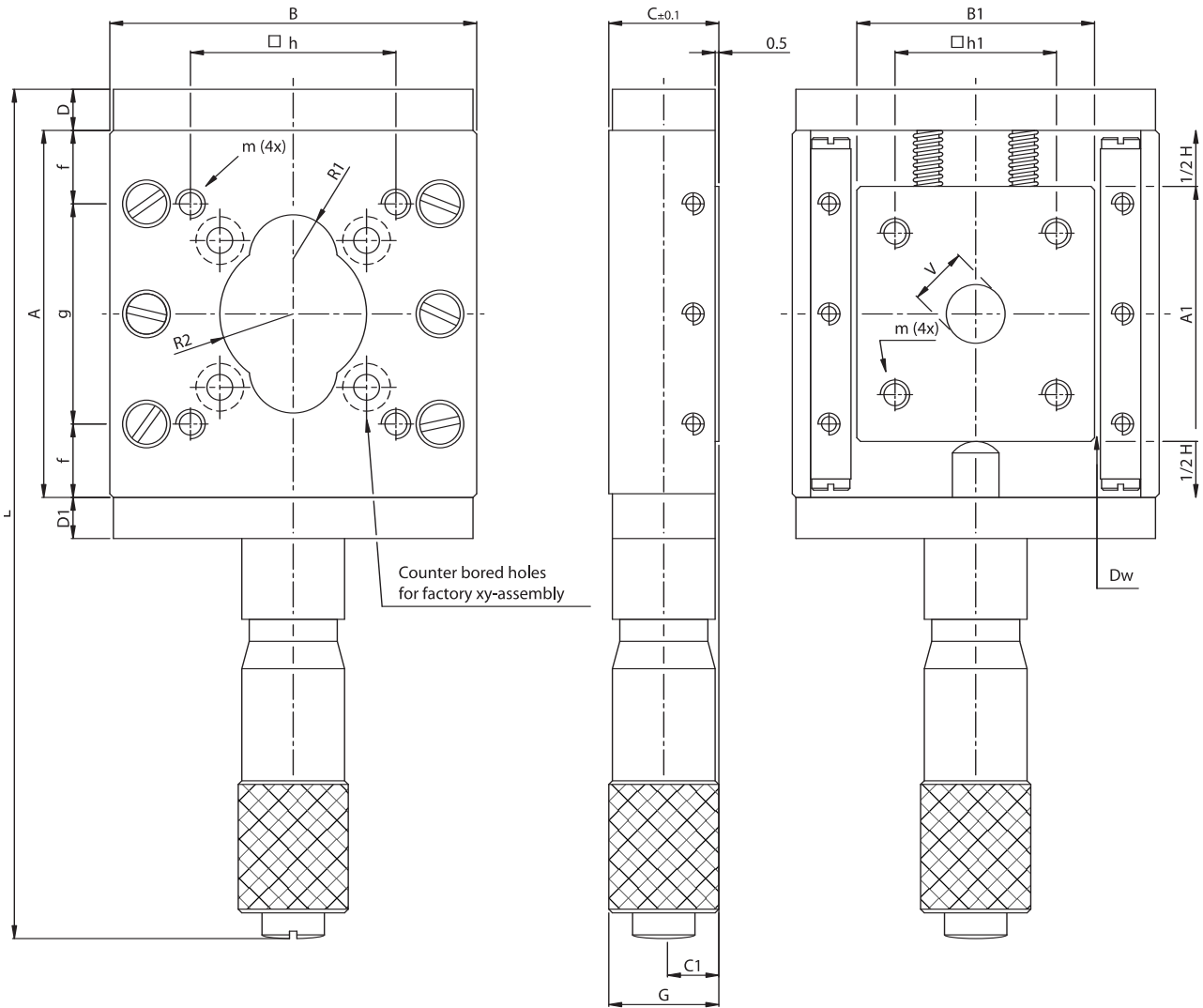
Counter bored holes  
for factory xy-assembly



Type	mm								H Travel	D	D1	G	f	g	h	h1	m	L	V
	A	A1	B	B1	C	C1	Dw												
MT-1525	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	
MT-1535	35	22	40	26.8	13	6.5	1.5	13	2.6	4.6	15	7.5	2x10	26	17	M3	90.5	10	
MT-2050	50	35	50	32	15	7.5	2	15	3.6	5.6	17	10	2x15	30	22	M3	122.5	8	
MT-2065	65	42	60	42	15	7.5	2	20	3.6	5.6	17	10	3x15	40	30	M3	166.5	15	
MT-3080	80	50	80	56	17	8.5	3	25	3.6	5.6	17	15	2x25	50	32	M4	175.5	31	
MT-3105	100	65	100	76	17	8.5	3	35	5.6	5.6	20	15	3x25	60	44	M4	266.5	45	
MT-6150	150	98	150	105	30	15	6	50	7.6	11.6	20	25	2x50	100	70	M6	309	70	



From model MT-1535 on...



R1 + 0,2 +/- 0,2 - 0	R2 + 0,2 +/- 0,2 - 0	C in N	Weight in kg	Md in Ncm	Ml in Ncm	Mr in Ncm	Options Order no.		
							without micrometer (suffix <b>-M</b> )	without micrometer and springs (suffix <b>-M-V</b> )	as XY-assembly (suffix <b>-KMT</b> ) <sup>1</sup>
-	-	312	0.09	2.7	1.3	1.9	MT-1525-M	MT-1525-M-V	KMT-1525
4.5	8	364	0.20	5.7	3.1	3.3	MT-1535-M	MT-1535-M-V	KMT-1535
6	10	774	0.43	12.8	8.3	7.0	MT-2050-M	MT-2050-M-V	KMT-2050
8.5	15	860	0.63	22.2	13.8	9.7	MT-2065-M	MT-2065-M-V	KMT-2065
10	17.5	1.360	1.00	46.9	24.5	19.9	MT-3080-M	MT-3080-M-V	KMT-3080
15	25	1.768	1.80	84.3	35.4	27.5	MT-3105-M	MT-3105-M-V	KMT-3105
28	37.5	5.940	5.50	400.7	213.8	156.7	MT-6150-M	MT-6150-M-V	KMT-6150

<sup>1</sup> Orthogonality < 1.54 mrad



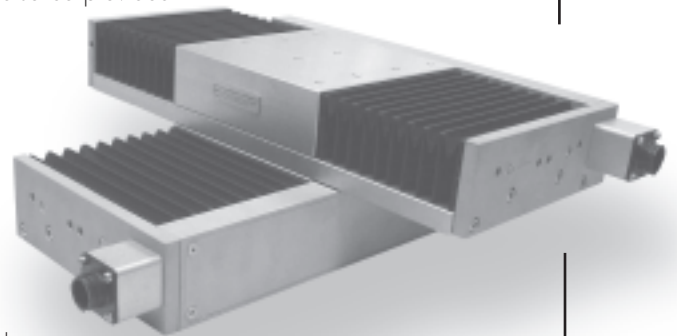


## **Modular Linear Motor Stages (MLM)**

*The new MLM stages offer an unique combination of  
Flexibility and Fast Delivery.*

The standard features of our MLM stages are:

- . The industry's only recirculating needle roller bearings offer the highest speed and stiffest bearing design of any linear motor stage
- . For ultra smoothness, non-recirculating needle bearings can also be provided
- . All mounting surfaces are precision ground, not just milled like most suppliers
- . Aircraft grade aluminum is standard for a stronger stiffer structure
- . PM Class SF, highest accuracy bearings are available on all stages



Since we maintain a stock of the basic stage tops and rough machined bases we can finish them to the required specs and assemble them quickly with any combination of the following optional features:

- . Motors provided from a variety of manufacturers
- . Switches or sensors of your choice
- . Linear encoders either optical or magnetic and with a variety of resolutions
- . Standard finishes of clear or black anodized, or nickel plated
- . X-Y mounting without an intermediate plate
- . Electrical pin-out customized to your specs

### **MLM stages...**

***The economic, fast delivery solution for linear motor stage applications***



## Miniature Positioning Tables

Manual driven 25 - 150 mm

RT-...-SRM



PM's lead screw tables series **RT-...-SRM** are miniature cross roller translation tables for manual operation. The tables provide accurate positioning capability and extremely smooth running operation along a linear axis. A positive position locking device eliminates drift when idle. RT-SRM slides are equipped with crossed roller ways achieving high load carry capacity and stiffness with very smooth motion.

### Material Table Bodies

Upper table: cast-steel, nickel plated finishing.

Base table: bearing steel No. 1.2842, through-hardened 58-62 Hrc. (ways are integrated in the design).

### Specification

- Incorporates precision crossed roller bearings for high stiffness.
- Manual center driven by lead screw (steel) M8 x 1 mm pitch fitted with spring-loaded double nut (bronze), division on adjustable vernier ring 0.01 mm.
- Tables have a longer upper section. This means that the guides are protected against the ingress of dirt from above.
- Stroke limited by endscrews in way ends.
- All mounting surfaces are precision ground to assure smoothness and flatness. *One flank of the slide (the side opposite to the adjustment screws) is ground parallel to the linear bearings to serve as a Reference Face.*
- The table-top and -base comes with threaded mounting holes according to a standard configuration.
- Locking device is standard right-hand mounted as picture shows.
- Accepts mounting in all directions.
- Running accuracies are shown on page 12.

### Options

- Selected tables with  $C \pm 0.01$  mm.
- Precision ball screw, home/limit switches, motor flange (Nema) and coupling.
- Locking device left-hand mounted.
- XY-assembly is with intermediate plate. For XY assembly please indicate model code KT-base table/upper table (KT-3075/3050-SRM).
- Z-axis assembly with bracket.
- Special customer design. (drawing required)  
For further options please consult PM - BEARINGS.

### Notes by ordering

By standard items please specify by ordering the following:

1. Model no. and quantity.
2. Position of locking device if deviating from standard.

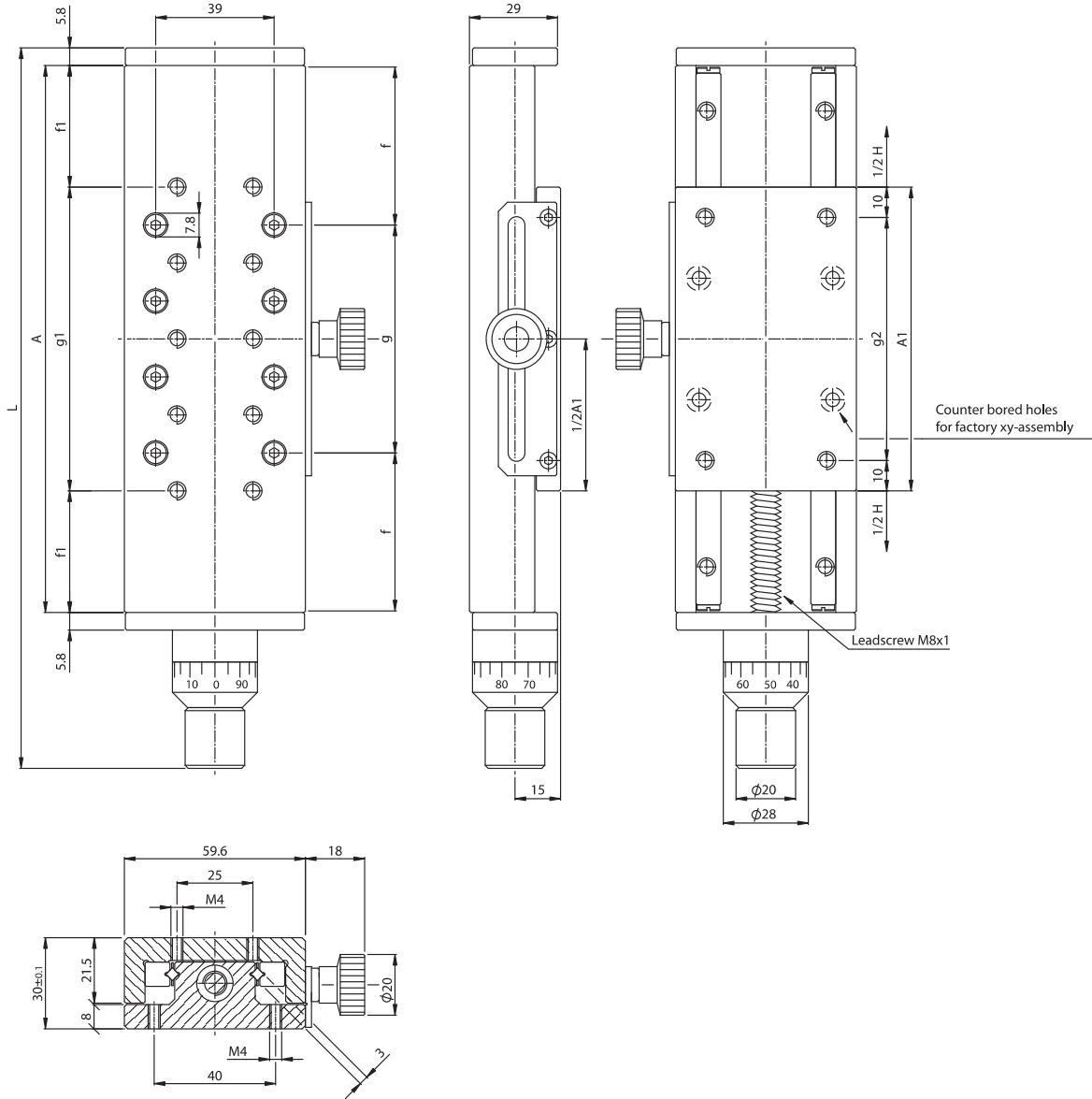
Example: 1 piece table type RT-3075-SRM,  
left-hand mounted.



division on adjustable vernier ring 0.01 mm.



# RT...-SRM

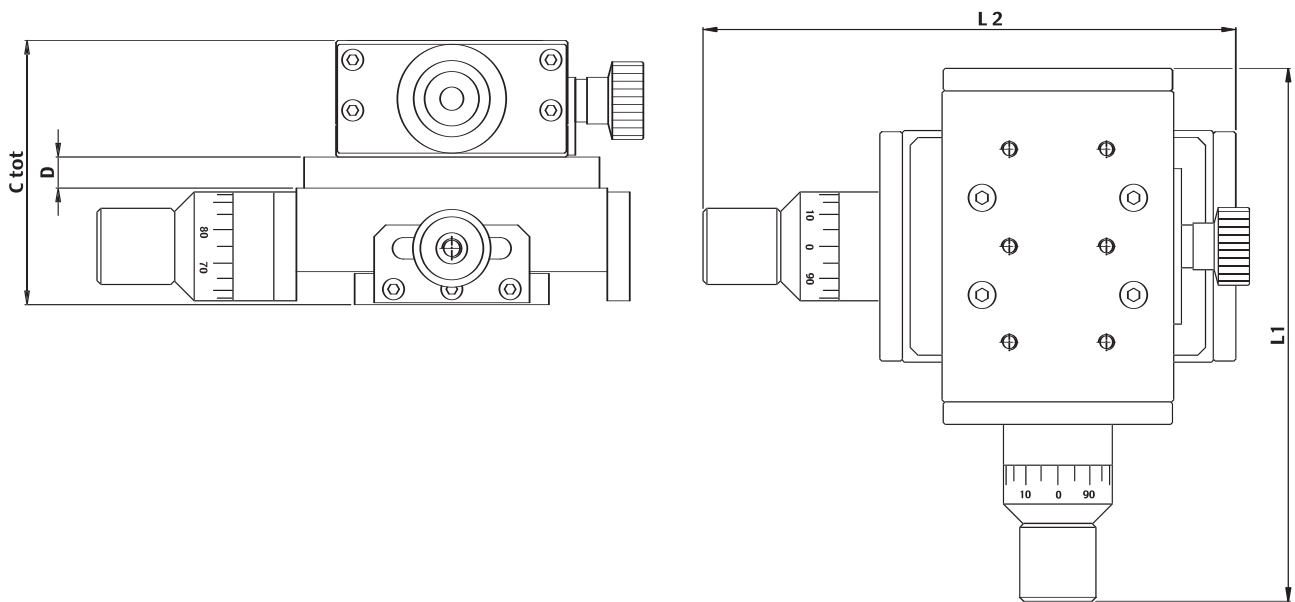
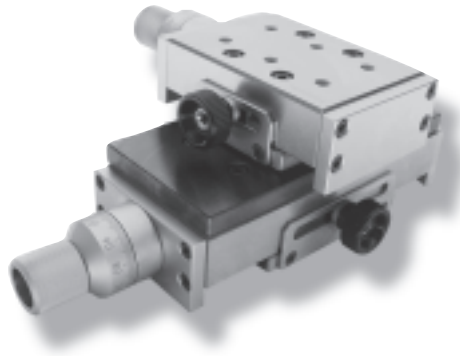


Type	mm			Travel	g	g1	g2	f	f1	C in N	Weight	Md	MI	Mr
	A	A1	L	H							in kg	in Nm	in Nm	in Nm
RT-3050-SRM	80	50	138	25	1x25	2x25	30	27.5	15	952	1	13.3	10.9	9.4
RT-3075-SRM	130	75	190	50	2x25	3x25	55	40	27.5	2.040	1.4	19.0	19.0	8.4
RT-3100-SRM	180	100	238	75	3x25	4x25	80	52.5	40	2.992	1.8	22.8	24.5	14.4
RT-3125-SRM	230	125	290	100	4x25	5x25	105	65	52.5	4.080	2.2	28.6	32.6	18.0
RT-3150-SRM	280	150	338	125	5x25	6x25	130	77.5	65	5.032	2.6	32.4	38.1	20.5
RT-3175-SRM	330	175	390	150	6x25	7x25	155	90	77.5	7.072	3	38.1	46.2	24.3
RT-3200-SRM	380	200	438	175	7x25	8x25	180	105	90	10.012	4	43.8	54.3	28.1



As XY-Assembly

KT-...-SRM



Type	Travel H	L1	L2	D	C tot	C in N	Weight in kg
KT-3050/3050-SRM	25 x 25	138	138			952	2.28
KT-3050/3075-SRM	25 x 50	138	190			952	2.87
KT-3050/3100-SRM	25 x 75	138	238			952	3.23
KT-3050/3125-SRM	25 x 100	138	290	8	68	952	3.72
KT-3050/3150-SRM	25 x 125	138	338			952	4.22
KT-3050/3175-SRM	25 x 150	138	390			952	4.7
KT-3050/3200-SRM	25 x 175	138	438			952	5.8

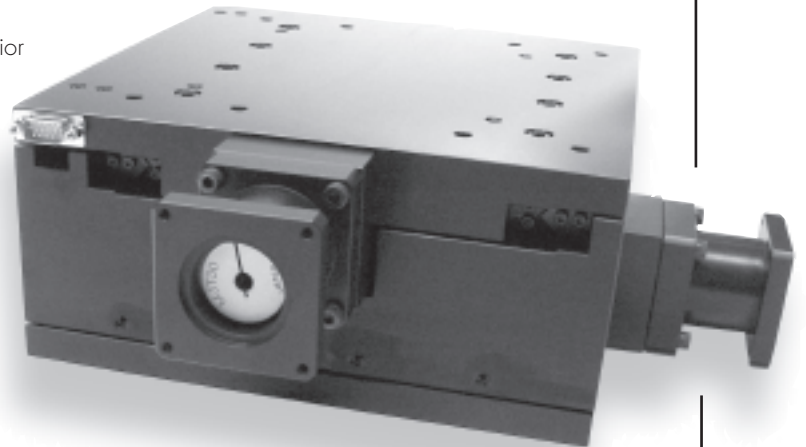


## **Modular Square X-Y Stages**

*The new MSS stages offer an unique combination of  
Flexibility and Fast Delivery.*

The standard features of our MSS stages are:

- . Strong monolithic stage construction insures superior orthogonality and stiffness
- . All mounting surfaces are precision ground, not just milled like most suppliers
- . Aircraft grade aluminum is standard for a stronger stiffer structure
- . PM Class SF, highest accuracy bearings are available on all stages



Since we maintain a stock of the basic monolithic crossed roller stage components we can assemble them quickly with any combination of the following optional features:

- . Ball screws or lead screws with different leads and accuracies
- . Crossed roller or Needle roller bearings of any accuracy class
- . Switches or sensors of your choice built into the sides of the monolithic center stage
- . Linear encoders either optical or magnetic
- . Standard finishes of clear or black anodized, or nickel plated
- . Electrical pin-out customized to your specs

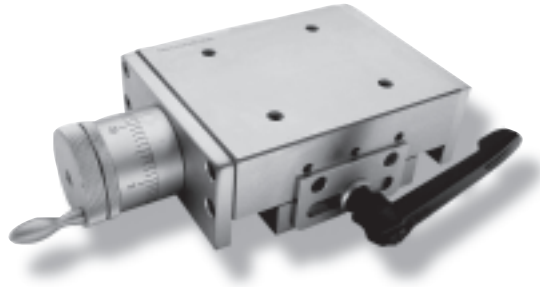
**- MSS stages, finally a totally customized stage delivered in a couple weeks -**



## Precision Positioning Tables

Manual driven 40 - 400 mm

RT-...-SR



PM's precision lead screw table type **RT-..-SR** are single-axis factory pre-loaded positioning tables for manual operation. The tables can be locked in every position using the clamping mechanism. They offer high-load carry capacity, high stability and first class running performances.

### Material Table Bodies

Size 3: cast-steel, nickel plated finishing

Size 6, 9: cast-iron, nickel plated finishing

### Specification

- Incorporates precision crossed roller bearings for high stiffness.
- Center driven by lead screw fitted with spring-loaded double nut, division on adjustable vernier ring 0.02 mm.
- Stroke limited by endplates.
- All mounting surfaces are precision ground.  
*One flank of the slide (the side opposite to the adjustment screws) is ground parallel to the linear bearings to serve as a Reference Face.*
- The table-top and table-base comes with threaded mounting holes according to a standard configuration.
- Accepts mounting in all directions.
- Running accuracies are shown on page 12.

### Options

- N/O needle roller bearings for higher loadings and moments available for RT-6-SR and RT-9-SR.
- Precision ball screw, motor flange (Nema) and coupling.
- Home/limit switches.
- Protective bellows.
- XY assembly is without intermediate plate. Please use model code **KT**.
- Special customer design. (drawing required)



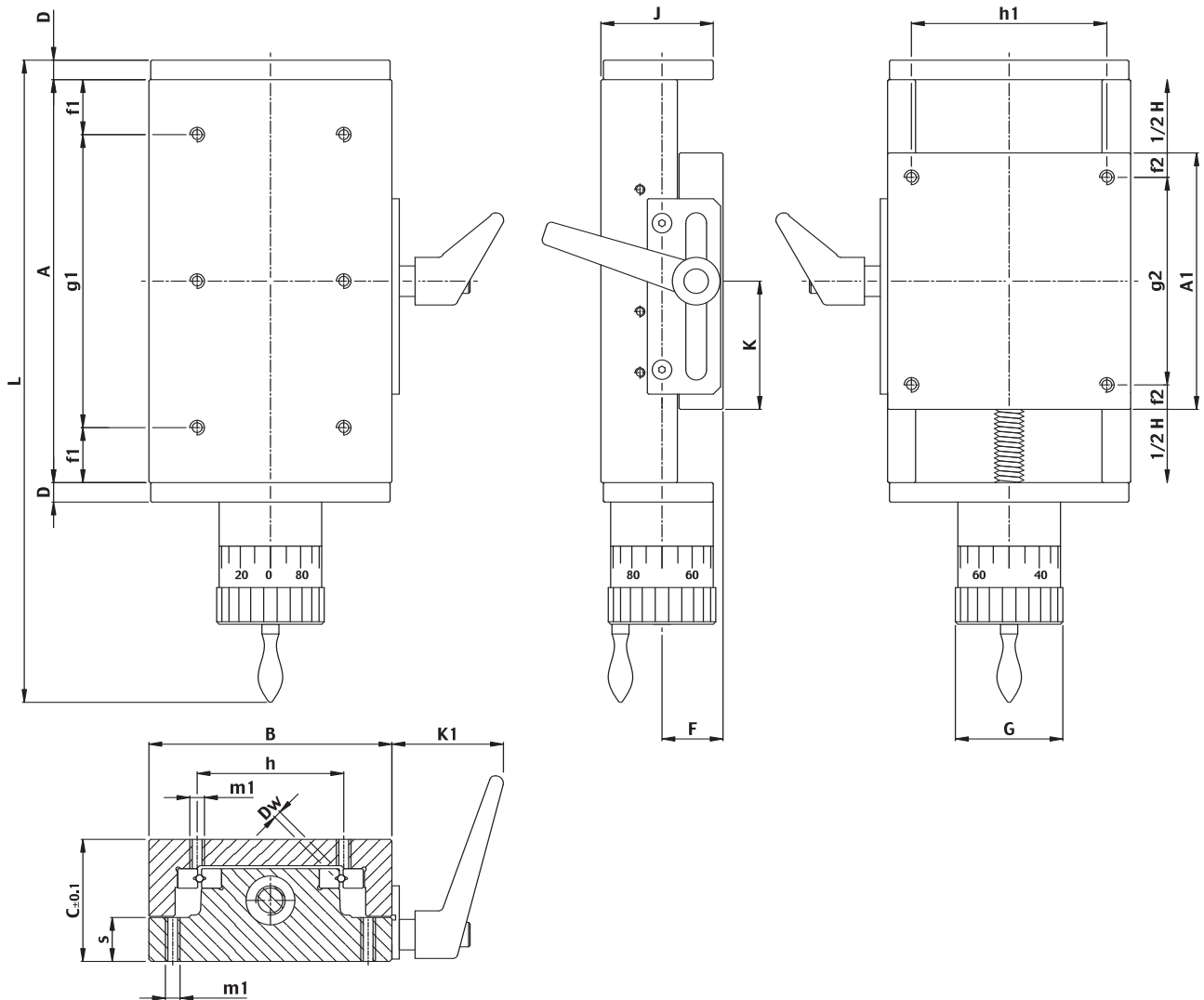
### Notes by ordering

By standard items please specify by ordering the following:  
1. Model no. and quantity.

Example: 1 piece table type RT-6150-SR



# RT...-SR



Type	mm		B	C	Dw	L	Travel H	g1	g2	f1	f2	h	h1	m	s
	A	A1													
RT-3075-SR	120	80				213	40	1 x 60	1 x 60	30					
RT-3100-SR	165	105	99.5	50	3	258	60	2 x 60	1 x 85	22.5	10	60	80	M6	18
RT-3150-SR	260	160				353	100	3 x 60	2 x 70	40					
RT-6100-SR	180	110				311	70	1 x 100	1 x 80						
RT-6150-SR	280	160	148	80	6	411	120	2 x 100	1 x 130	40	15	120	120	M8	26
RT-6200-SR	380	210				511	170	3 x 100	2 x 90						
RT-6250-SR	480	260				611	220	4 x 100	2 x 115						
RT-9300-SR	510	310				647	200	3 x 100	2 x 135						
RT-9400-SR	710	410	200	100	9	847	300	5 x 100	2 x 185	105	20	160	160	M10	32
RT-9500-SR	910	510				1047	400	7 x 100	2 x 235						



**RT...-SR**

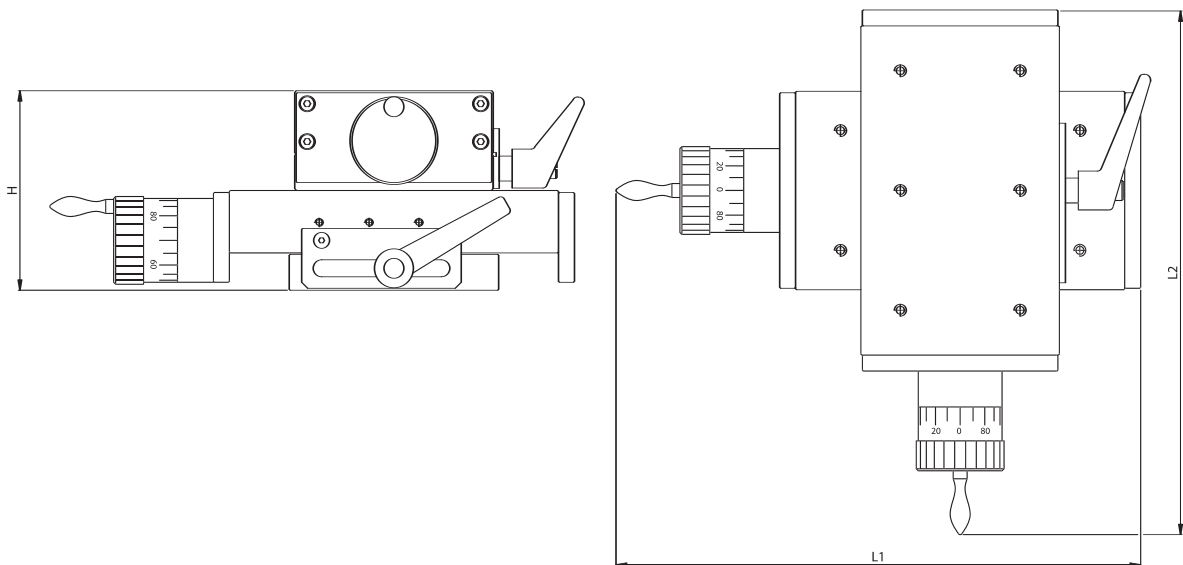
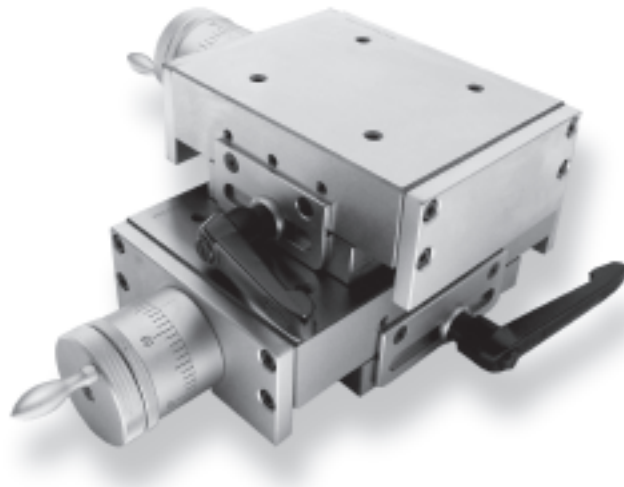
Lead screw	D	F	G	J	K	K1	C in N	Weight in kg	Md in Nm	MI in Nm	Mr in Nm
12 x 1	8	25	44	46	40	48	1.496	4	12.0	21.8	11.7
					52.5		1.904	5	15.2	29.9	15.6
					70		2.720	7.1	21.8	46.2	23.5
16 x 2	11.5	40	67	72	55	48	3.780	13.5	48.2	77.8	47.6
					80		5.400	18.6	68.9	136.1	73.4
					90		6.480	23.9	82.6	175.0	91.7
					115		8.100	28.5	103.3	233.3	119.8
16 x 2	15	50	67	90	60	18.900	61.2	869.4	831.6	484.4	
				185		22.950	80.6	1055.7	1058.4	584.6	
				235		28.350	98.9	1304.1	1360.8	724.3	





As XY-Assembly

RT...-SR

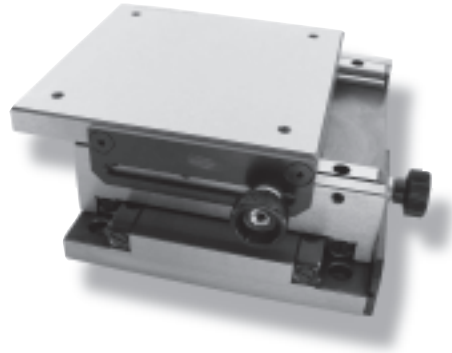


Type	Travel	L1	L2	H	C in N	Weight in kg
KT-3075/3075-SR	40 x 40	213	213		1.496	8
KT-3075/3100-SR	40 x 60	258	213	100	1.496	9
KT-3075/3150-SR	40 x 100	353	213		1.496	11
KT-6100/6100-SR	70 x 70	307	307		3.780	27
KT-6100/6150-SR	70 x 120	407	307	160	3.780	32
KT-6100/6200-SR	70 x 170	507	307		3.780	37
KT-6100/6250-SR	70 x 250	607	307		3.780	42



## X-Y Positioning Tables

**KT**  
**KT-SRM**



PM's XY-tables type **KT** are compact two axis crossed roller tables with equal strokes for manual operation. The tables are low profile designed and equipped with precision crossed ways. They can operate in every direction and locked in every position. For manual driven operation we supply model **KT-SRM** with a side mounted lead screw. Table and bearing specifications are similar to model KT.

### Material Table Bodies

Steel, nickel plated finishing

### Specification

- Compact monolithic design.
- Incorporates precision crossed roller bearings for high stiffness.
- Model KT-SRM: Manual driven by lead screw fitted with spring-loaded double nut, division on adjustable vernier ring 0.01 mm. (size 3) and 0.02 mm (size 6) model KT: XY-table with locking mechanism.
- Stroke limited by end screws in way ends.
- All mounting surfaces are precision ground.  
*One flank of the slide (the side opposite to the adjustment screws) is ground parallel to the linear bearings to serve as a Reference Face.*
- The table-top comes with threaded mounting holes according to a standard configuration. The base with counterbored attaching holes.
- Accepts mounting in all directions.
- Orthogonality < 10 arc-seconds.
- Running accuracies are shown on page 12.

### Options

- Precision ball screws
- Home/limit switches, motor flange (Nema) and coupling
- Linear encoders either optical or magnetic
- Special customer design (drawing required)

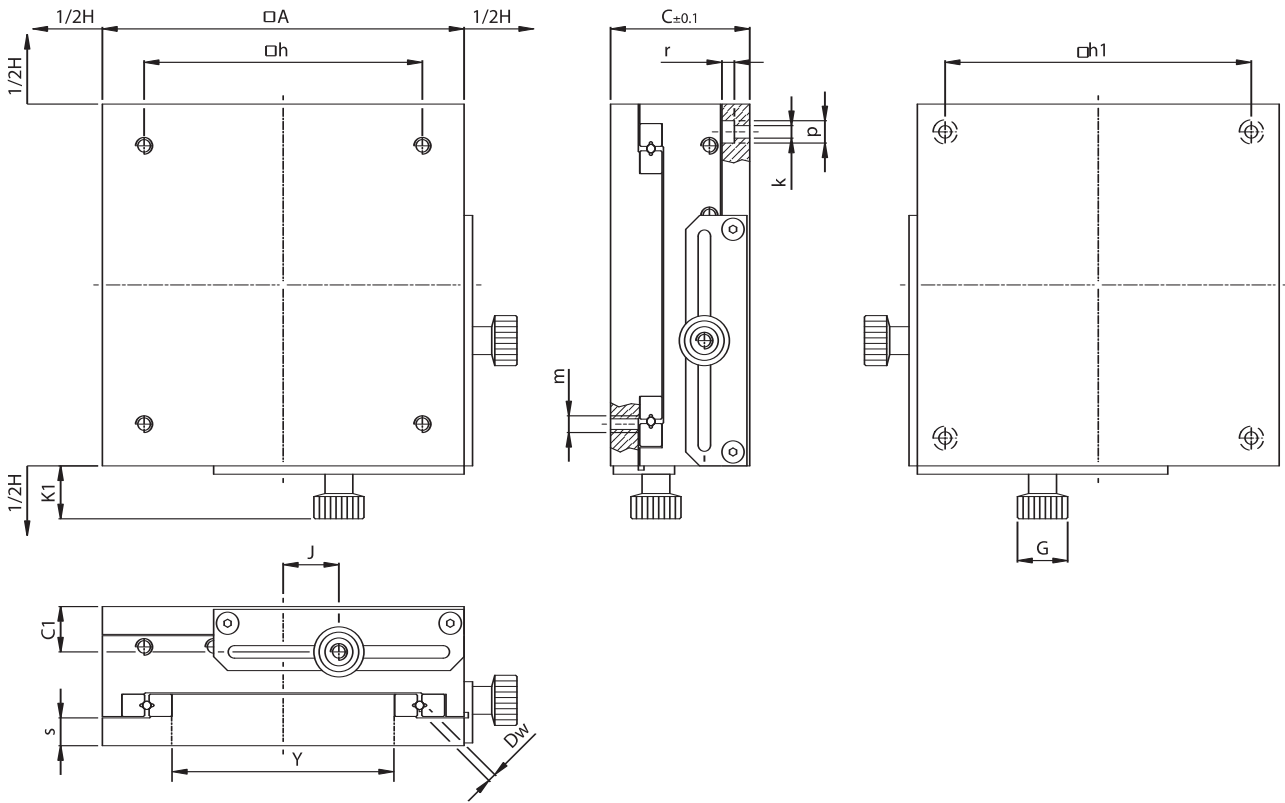
### Notes by ordering

By standard items please specify by ordering the following:  
1. Model no. and quantity.

Example: 1 piece XY-tables type KT-3050-60  
with lead screw type KT-3050-60-SRM



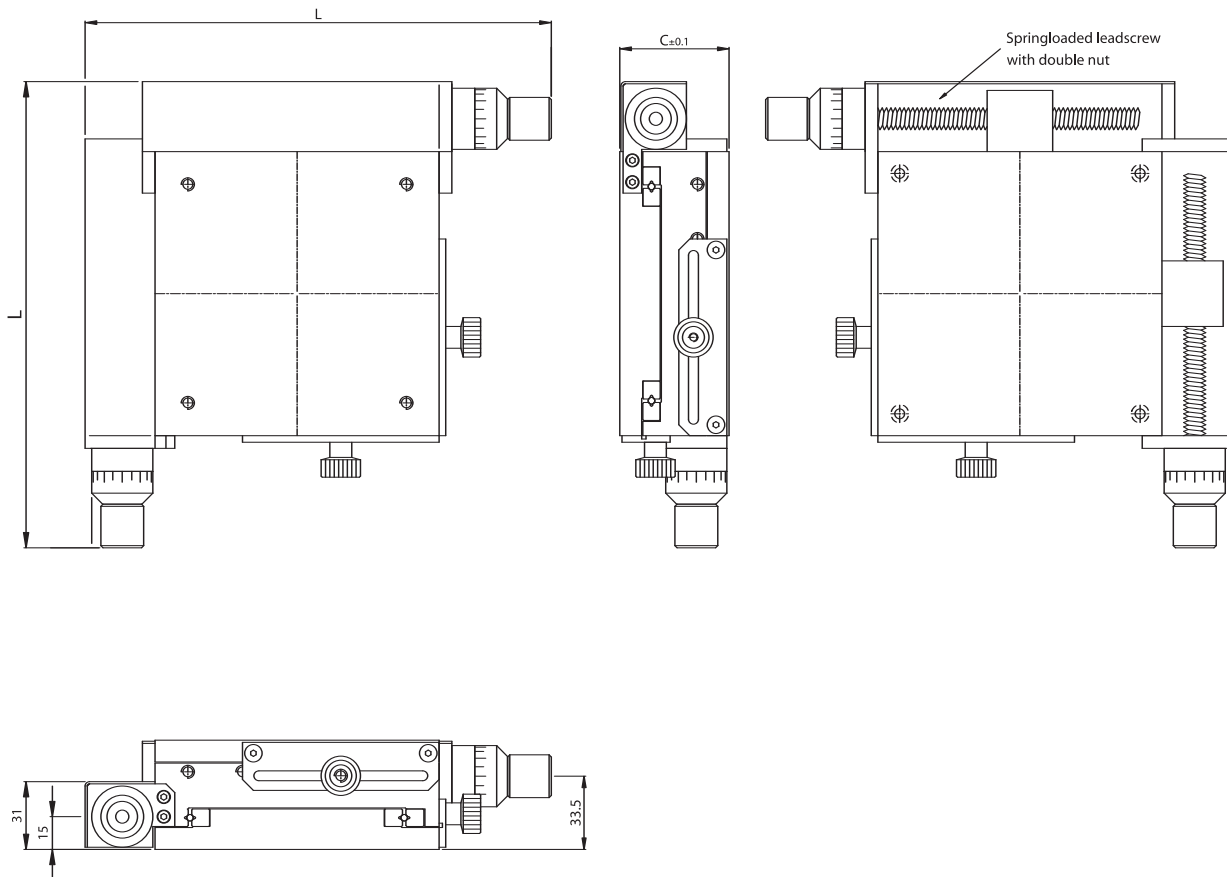
# KT



Type	mm A	C	C1	Dw	Travel H	G	J	K1	h	h1	k	m	p	r	s	y
KT1520-30	30	25	8.25	1.5	10 x 10	-	-	-	20	25	3.8	M2.5	6.3	3.3	6	
KT2030-40	40	35	10.75	2	15 x 15	12.5	0	11.5	30	30	3.8	M3	6.3	3.3	7.5	
KT3050-60	60				25 x 25		10		40	40						10
KT3075-80	80				40 x 40		12.5		60	60						30
KT3100-105	105	50	14.5	3	60 x 60	18	15	18.5	80	85	5	M4	8	4.5	10	55
KT3125-130	130				75 x 75		25		100	110						80
KT3150-155	155				100 x 100		20		120	135						105
KT6100-110	110				50 x 50		15.5		80	70						
KT6150-160	160	75	24.5	6	100 x 100	30	28	22.5	100	120	6.8	M6	11	6.3	14.5	
KT6200-210	210				150 x 150		40.5		120	170						



# KT-SRM



Suffix - <b>SRM</b>		C in N	Weight in kg	Md in Nm	Ml in Nm	Mr in Nm
L	Lead screw					
-	-	260	0.2	1.8	1.3	1.5
-	-	430	0.4	3.9	2.8	3.3
144	M8 x 1	952	1.3	13.3	10.9	9.4
164		1.496	2.3	35.9	21.8	17.0
189		1.904	3.9	69.5	29.9	24.9
214		2.992	5.9	113.3	38.1	32.8
239		4.080	8.4	167.3	46.2	40.7
193	M8 x 1	4.320	6.1	118.8	97.2	76.7
243	M12 x 1	8.640	12.9	311.9	155.5	137.5
293	M16 x 2	13.500	22.2	544.1	194.4	193.5



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Visit our website

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# Couplings Direct



We offer some of the best precision couplings in the world at substantial savings to OEM customers.

We deliver every basic type of precision coupling. Each coupling type has his own unique characteristics, so you can be sure to find the coupling best suited to your application.

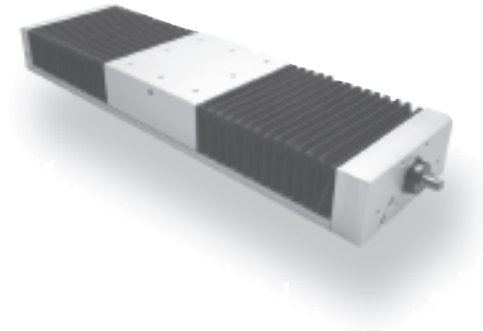
PM – BEARINGS precision tables and stages are standard provided with Couplings Direct precision couplings.



## Precision Linear Stages

*Ball screw driven*

**RTNC**



PM's needle roller linear translation stages type **RTNC** are developed to match the ever increasing demands for speed, accuracy and greater rigidity. Standard travel range is 100 – 800 mm, longer lengths are by customer request. RTNC-slides offer unsurpassed precision combined with the ultimate in load capacity and stiffness.

### Material Table Bodies

Aluminum, clear anodize finishing

### Specification

- Incorporates anti-friction precision needle bearings type M/V/ML (with adjusting gib) and protruding needle roller cages. Provide long travel.
- Driven by precision ball screw with pre-loaded double nut.
- Guides and ball screw are covered by synthetic protective bellows.
- Central lubrication system for linear guides and ball screw.
- Standard lead accuracy ball screw G-25. (0.025 – 300 mm travel)
- All mounting surfaces are precision ground.  
*One flank of the slide ( the side opposite to the adjustment screws) is ground parallel to the linear bearings to serve as a Reference Face.*
- The stage-top comes with threaded mounting holes according to a standard configuration. The stage-base has countersunk mounting holes.
- Accepts mounting in all directions.
- Running accuracies are shown on page 12.

### Options (consult PM)

- Several leads and precision classes.
- Internal home/limit switches.
- Linear encoder either optical or magnetic
- Motor flange with NEMA motor mount
- Protective bellows with steel plates
- XY assembly without intermediate plate
- Special customer design (drawing required)
- Assembly bracket for Z-axis
- Electrical pin-out customized to your specs
- Black anodized or nickel plated

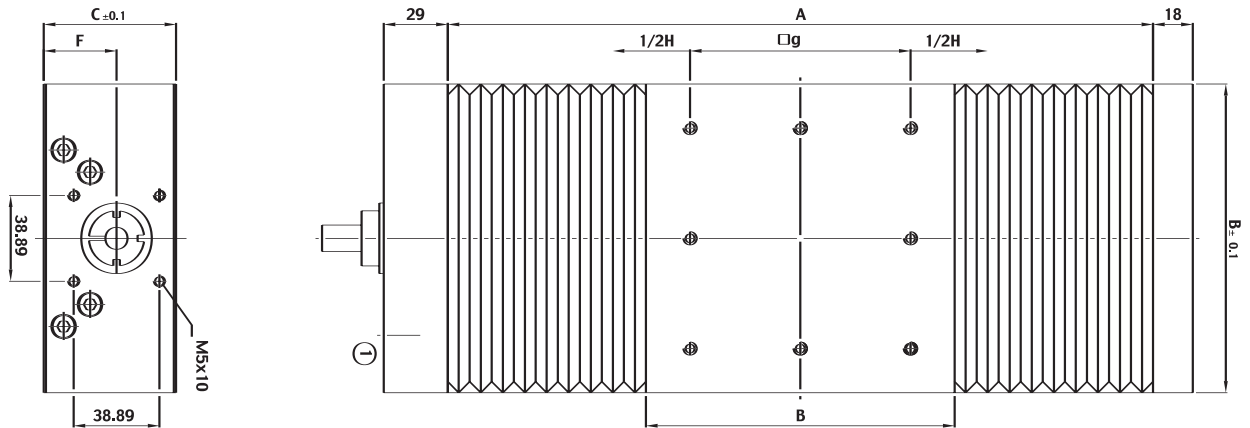
### Notes by ordering

By standard items please specify by ordering the following:  
1. Model no. and quantity.

Example: 1 piece stage type RTNC-3200



# RTNC

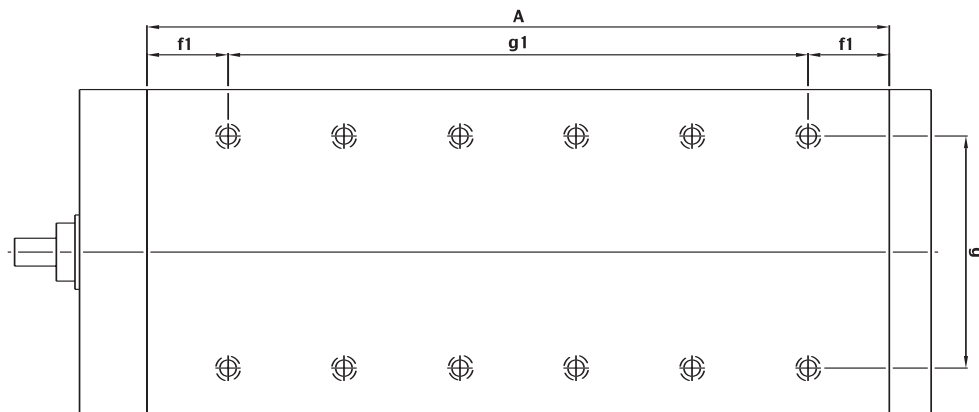
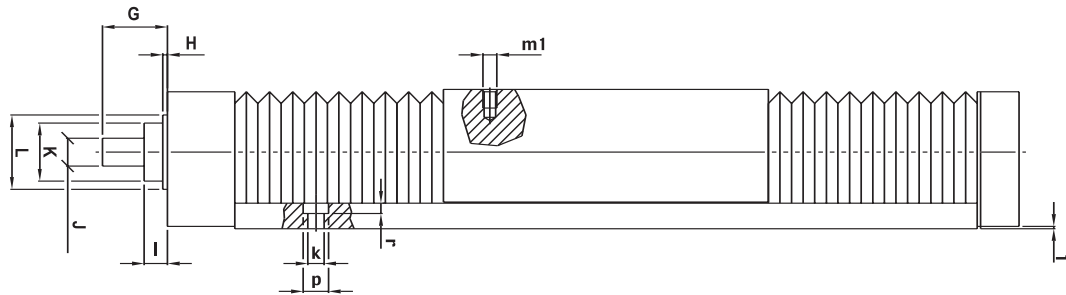


① Optional socket to connect limit switches

Type	mm A	B	C	F	Travel H	Ball screw $\varnothing \times$ pitch	f1	g	g1	k	m1	p	r
RTNC-3100	320				100		35	5 x 50					
RTNC-3150	380				150		40	6 x 50					
RTNC-3200	460				200		30	8 x 50					
RTNC-3300	600	140	60	33	300	16 x 5	25	100	11 x 50	7 M6 x 10	11	6	
RTNC-3400	740				400		20	14 x 50					
RTNC-3500	880				500		40	16 x 50					
RTNC-3600	1020				600		35	19 x 50					
RTNC-3700	1140				700		45	21 x 50					
RTNC-3800	1260				800		30	24 x 50					
RTNC-6100	380				100		50	4 x 70					
RTNC-6200	520				200		50	6 x 70					
RTNC-6300	660				300		50	8 x 70					
RTNC-6400	800	200	75	38	400	20 x 5	50	140	10 x 70	7 M6 x 12	11	6	
RTNC-6500	940				500		50	12 x 70					
RTNC-6600	1080				600		50	14 x 70					
RTNC-6700	1220				700		40	16 x 70					
RTNC-6800	1320				800		65	17 x 70					
RTNC-9200	620				200		70	4 x 120					
RTNC-9300	760				300		20	6 x 120					
RTNC-9400	900				400		90	6 x 120					
RTNC-9500	1060	300	100	50	500	20 x 5	40	240	8 x 120	9 M8 x 12	14	8.5	
RTNC-9600	1200				600		50	9 x 120					
RTNC-9700	1320				700		50	10 x 120					
RTNC-9800	1460				800		50	11 x 120					



RTNC



C in KN	Weight in kg	Md in Nm	Ml in Nm	Mr in Nm	G	H	I	J	K	L
96	5.5 6.7 8.0 9.2 10.4 11.6 12.8 14.1 15.3	3.980	1.403	836	26	2	10	Ø10h6	Ø28	Ø32h6
176	13.7 15.9 18.2 20.4 22.6 24.9 27.2 29.4	11.528	2.952	1.810	28	2	10	Ø12h6	Ø32	Ø35h6
264	47.9 55.1 62.2 69.3 76.4 83.6 90.7	14.200	3.350	2.420	28	2	10	Ø12h6	Ø32	Ø35h6



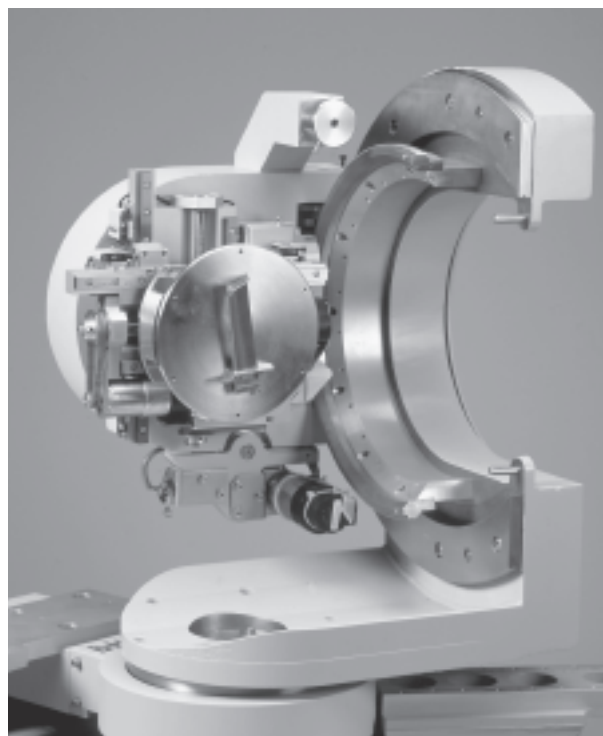


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## Special Customer Design

At PM, we are able to supply linear bearings, frictionless slides and positioning tables to your specific application requirements. Relying on long history experience, know-how and manufacturing capabilities, our product engineers are able to design the most technical and economical solutions according to your demands, even when they're extreme. Special customer designed slides can be delivered within 6 weeks after approval.

*Please, feel free to contact one of our product specialists for more information.*



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