

## Type FD – Franke Dynamic

### 1 Designs and System Description

Aluminium Roller Guides from Franke are available as double rails with cassette or as a pair of single rails with a pair of roller shoes:

#### Double rail with cassette:

The double rail with cassette design is a Linear Guide ready-aligned as standard. Cassette and rail have standard connection borings.

#### Pair of single rails with pair of roller shoes (illustration 1):

Single rails with roller shoes are part of the construction with the advantage of a variable guide width. The mating plate is specified by the customer.



Illustration 1: Pair of Single Rails with Pair of Roller Shoes

The cassette or the pair of roller shoes of standard type FDA run on 4 crosswise needle bearing rollers on rails of tough spring steel. Other types are available for individual cases with special requirements, e.g. non-corrosive rails or also customer-specific special designs.

The Aluminium Roller Guides have lifetime lubrication. Traverse speeds of 10 m/s and accelerations of 40 m/s<sup>2</sup> can be realised. The operating temperature of the guides lies between -20 °C and +100 °C. Franke is happy to advise when solutions are requested that are suitable for temperatures outside of this range.

Cassettes mounted on rails are adjusted ex works free from clearance. It is possible to adjust the Aluminium Roller Guides to the individual load situation retrospectively using an integrated adjusting screw. The adjustment setting is best determined by measuring the slide resistance in the unloaded state (see illustration 2).



Illustration 2: Measuring Slide Resistance

The screwing of the cassette plate to the adjusting side is loosened slightly to adjust. Afterwards, the headless pin integrated in the cassette long side is readjusted. Turning the headless pin moves the roller shoe and, thus, increases or reduces the preload.

The adjustment values for the individual types are shown in table 3.6 Slide Resistances. Further details on fitting and adjusting the guide are given in the instruction manual for the Aluminium Roller Guides.

### 2 Dimensioning the Guides

The following parameters are needed for correct dimensioning of the guide:

- Selection of formation
- All invasive or emerging forces / torques (dynamic / static), (see illustration 3)
- Type of load (stationary, swelling, changing)
- Environmental influences (e.g. temperature, moisture) or special operation conditions (e.g. clean room, vacuum)
- Traverse speed and acceleration
- Stroke length
- Target lifetime in km

All forces and torques must be within the permissible limits. The relevant data are on the pages for the types.

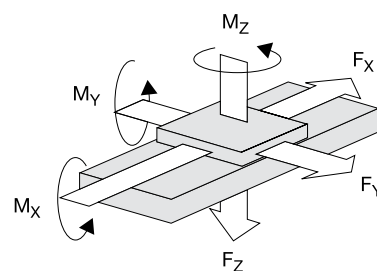


Illustration 3: Arrangement of forces and moments

Recommended safeties (for screw quality 8.8):

- Pressure load:  $s > 1.2$
- Tension load:  $s > 2.5$
- Moment load:  $s > 4.0$

### 3 Notes for Mating Structure

#### 3.1 Mating Plate for Type FD

A mating plate (bridging the roller shoes) must also be used when using single rails and roller shoes. The roller shoes and the mating plate together form the carriage.

Note on layout of the mating plate of the carriage: the roller shoes have centering grooves for better alignment during assembly. You apply a centering bar to the mating plate for this purpose (illustration 4). The dimensions for producing the centering bar are in table 1. All other dimensions, tolerances and accuracies for the guides are given on the relevant pages of the catalogue.

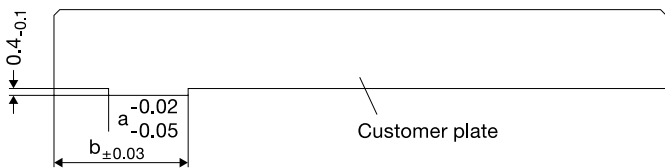


Illustration 4: Centering Shoulder

Size	a mm	b mm
12	4.5	9.6
15	5.0	12.6
20	7.5	16.1
25	10.5	17.6
35	12.5	26.1
45	15.5	31.1

Table 1: Dimensions Centering Bar

#### 3.2 Multi-Track Formations

It is recommended to define a fixed and movable bearing site on the carriage plate for multi-track formations. This is the best way to equalise tolerances between the rails.

For example, the movable bearing side can be designed with a carrier and a stroke safety. The fixed bearing side takes on the guide function, the movable bearing side equalises parallelism and height tolerances. It is recommended to locate the drive in direct proximity to the guide side, as the drive torque is taken from this.

#### 3.3 Mounting Surfaces

Contact and support surfaces essentially determine the function and precision of the guide. Inaccuracies can be added for running accuracy of the guide system. For example, double-track formations require precise parallelism and height alignment. The accuracies for the mounting and contact surfaces of the guides from table 2 must be maintained to guarantee running accuracy of the guide:

Size	12–20 mm	25–45 mm
Max. tolerance for parallelism	0.03	0.05
Max. evenness mounting surface	0.10	0.20

Table 2: Accuracies Contact and Support Surfaces

#### 3.4 Fixing the Rails

Depending on the type of load the guide rails should either:

1. be screwed
2. be screwed and dowelled
3. be laid against a contact shoulder and screwed (illustration 5).

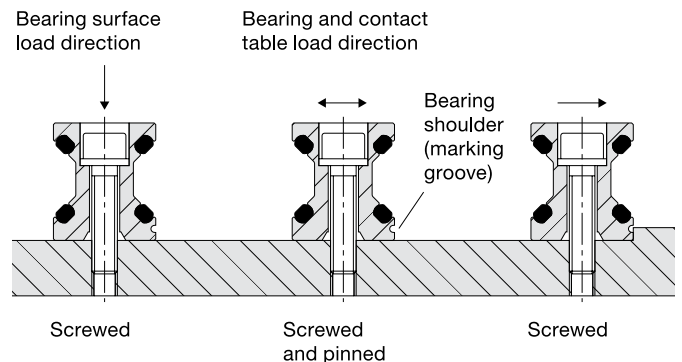


Illustration 5: Fixing Rails

The load capacity of the rails is influenced by the connections between the guide elements and the mating structure. Fixing to the mating structure is effected using screws of quality 8.8 with plain washers DIN 433.

#### 3.5 Fitting Instructions Coupled Rails

Rails over a length of 4000 mm are coupled according to Franke standards. Butt jointing according to Franke standards guarantees a universally even bore shape and optimum usage of the rail length. Divisions are also possible to customer specifications.

Coupled rails are specially aligned with one another. Therefore, the rails have sequential numbering for the right fitting (e.g. A/1-1/1-2/2-2/E).



Illustration 6: Coupled Rails / Auxiliary Cylinders

The rails are also marked with a groove on the rail underside, which must always be on the same side. The rails must be arranged free of play. The corresponding auxiliary cylinders (illustration 6) are used for this. The dimensions for the design of the auxiliary cylinders are in table 3. The cylinders are inserted at the joints of the rails in the raceway and preloaded using a device.

Size	Auxiliary Cylinder mm
12	11
15	11
20	14
25	16
35	27
45	35

Table 3: Dimensions Auxiliary Cylinder

The relevant tightening torques for the individual screws are given in table 4.

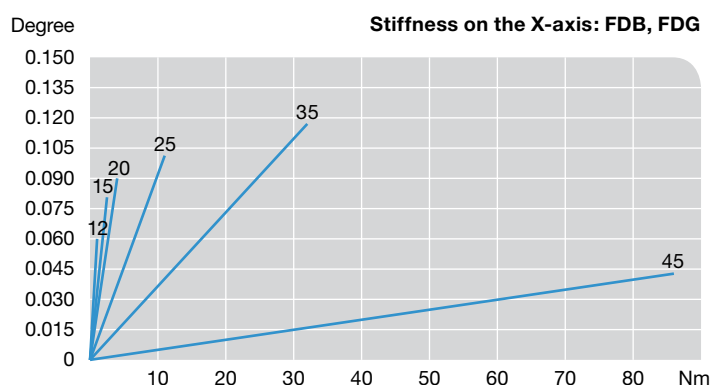
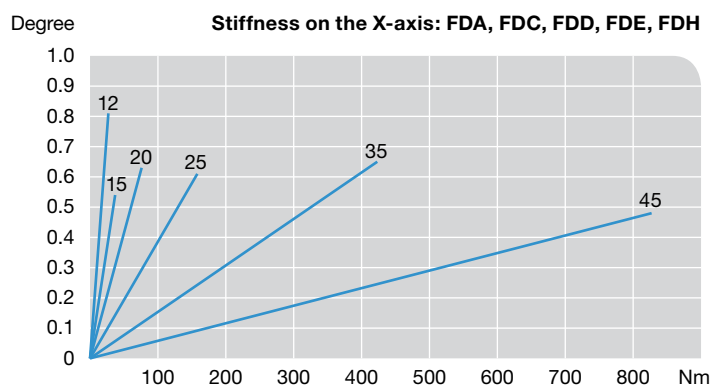
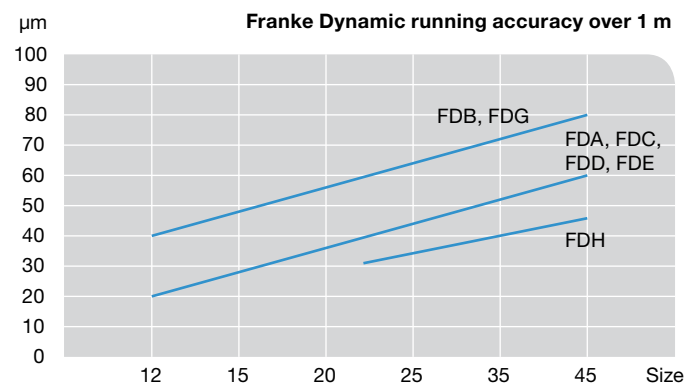
Screws	Tightening Torque
M 3	1.1
M 4	2.5
M 5	5.0
M 6	8.5
M 8	21.0
M10	41.0
M12	71.0

Table 4: Tightening Torques Screws

### 3.6 Slide Resistances

Size	Slide Resistance N							
	FDA	FDB	FDC	FDD	FDE	FDG	FDH	
12	Min.	0.2	0.2	0.5	-	0.5	0.6	-
	Max.	0.4	0.4	1.0	-	3.0	0.9	-
15	Min.	0.5	0.5	0.5	-	1.0	0.5	-
	Max.	2.0	1.0	2.0	-	3.0	1.5	-
20	Min.	1.0	0.5	1.0	-	1.0	1.0	-
	Max.	2.5	1.5	2.5	-	3.0	3.0	-
25	Min.	1.5	0.5	1.5	1.5	1.5	0.5	2.5
	Max.	3.0	2.0	3.0	3.0	3.0	2.0	5.0
35	Min.	2.0	1.0	2.0	-	2.0	1.0	4.0
	Max.	4.0	2.5	4.0	-	4.0	2.5	7.0
45	Min.	2.5	2.0	2.5	-	2.5	2.0	5.0
	Max.	5.0	4.0	5.0	-	5.0	4.0	8.0

### 3.7 Running Accuracy and Stiffness



## Type FP – Franke Power

### 1 Designs and System Description

Franke Linear Guides of the type FPA comprise double rails with cassette. The cassette has integrated recirculating rollers for high load ratings and stiffness. The rails of the type FPA are interchangeable with the rails of the Franke Aluminium Roller Guide.

Franke Recirculating Roller Guides are available in one preload class. Traverse speeds of 3 m/s and accelerations of 30 m/s<sup>2</sup> are possible. The operating temperature of the guides lies between -20 °C and +80 °C.

### 2 Dimensioning the Guides

The following parameters are needed for correct dimensioning of the guide:

- Selection of formation
- All invasive or emerging forces / torques (dynamic / static), (see illustration 1)
- Type of load (stationary, swelling, changing)
- Environmental influences (e.g. temperature, moisture) or special operating conditions (e.g. clean room, vacuum)
- Traverse speed and acceleration
- Stroke length
- Target lifetime in km

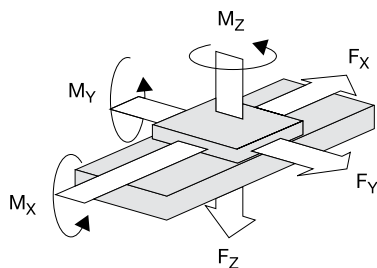


Illustration 1: Arrangement of forces and moments

All forces and torques must be within the permissible limits. The relevant data are on the pages for the individual types.

Recommended safeties (for screw quality 8.8):

- Pressure load:  $s > 1.2$
- Tension load:  $s > 2.5$
- Moment load:  $s > 4.0$

Calculations can be performed by Franke.

### 3 Notes for Mating Structure

#### 3.1 Multi-Track Formations

It is recommended to define a fixed and movable bearing site on the carriage plate for multi-track formations. This is the best way to equalise tolerances between the rails.

For example, the movable bearing side can be designed with a carrier and a stroke safety. The fixed bearing side takes on the guide function, the movable bearing side equalises parallelism and height tolerances. It is recommended to locate the drive in direct proximity to the guide side, as the drive torque is taken from this.

#### 3.2 Mounting Surfaces

Contact and support surfaces essentially determine the function and precision of the guide. Inaccuracies can be added for running accuracy of the guide system. For example, double-track formations require precise parallelism and height alignment. The accuracies for the mounting and contact surfaces of the guides from table 1 must be maintained to guarantee running accuracy of the guide:

Size	25 mm
Max. tolerance for parallelism	0.05
Max. evenness mounting surface	0.20

Table 1: Accuracies Bearing and Contact Surfaces

All other dimensions, tolerances and accuracies for the guides are given on the relevant pages of the catalogue.

#### 3.3 Fixing the Rails

Depending on the type of load the guide rails should either:

1. be screwed
2. be screwed and dowelled
3. be laid against a contact shoulder and screwed (illustration 2).

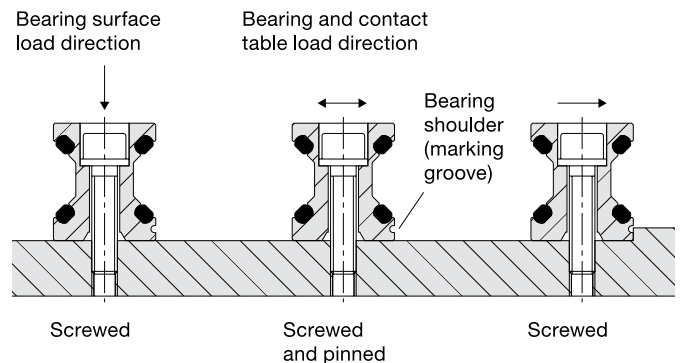


Illustration 2: Fixing Rails

The load capacity of the rails is influenced by the connections between the guide elements and the mating structure. Fixing to the mating structure is effected using screws of quality 8.8 with plain washers DIN 433.

### 3.4 Fitting Instructions Coupled Rails

Rails over a length of 4000 mm are coupled according to Franke standards. Butt jointing according to Franke standards guarantees a universally even bore shape and optimum usage of the rail length. Divisions are also possible to customer specifications.

Coupled rails are specially aligned with one another. Therefore, the rails have sequential production numbering for the right fitting (e.g. A/1-1/1-2/2-2/E).

The rails are also marked with a groove on the rail underside, which must always be on the same side. The rails must be arranged free of play. The corresponding auxiliary cylinders (illustration 3) are used for this. The dimensions for the design of the auxiliary cylinders are in table 2. The cylinders are inserted at the joints of the rails in the raceway and preloaded using a device.



Illustration 3: Coupled Rails/Auxiliary Cylinders

Size	Auxiliary Cylinder mm
25	16

Table 2: Dimensions Auxiliary Cylinder

The relevant tightening torques for the individual screws are given in table 3.

Screws	Tightening Torque
M6	8.5
M8	21.0

Table 3: Tightening Torques Screws

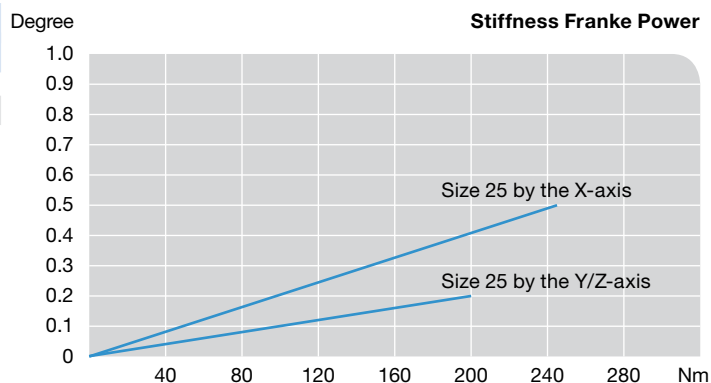
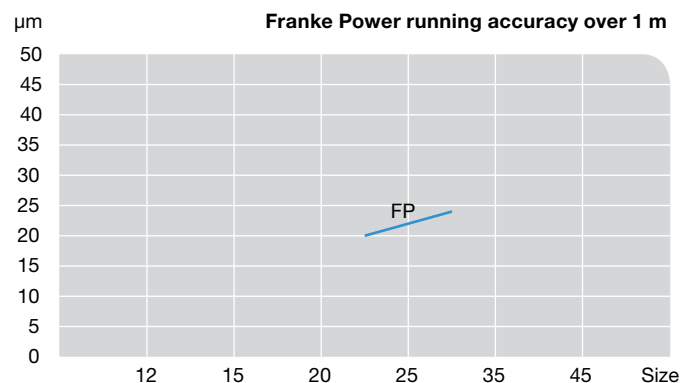
### 4 Lubrication

The Recirculating Roller Guides are initially lubricated ex works. After approx. 2000 km of running performance, the guides must be relubricated with 1 to 2 grams of lubricant.

### 5 Slide Resistances

Size	Slide resistance N	
		FP
25	Min.	17.5
	Max.	30.0

### 6 Running Accuracy and Stiffness



## Type FR – Franke Robust

### 1 Designs and System Description

Aluminium Recirculating Ball Guides of type FRA comprise two individual rails and recirculating elements. The recirculating elements are mounted on the mating plate and together form the carriage. The construction of the mating plate is specified by the customer.

Guides of the type FRA are particularly robust and have high load capacity. The max. traverse speed is 3 m/s, the max. acceleration is 30 m/s<sup>2</sup>. Use is possible in a temperature range of -10 °C to +80 °C.

The slide resistance can be adjusted for Linear Guides of the type FRA. The fixing screws on the slider plate on the adjustment side must be loosened. Using an optional tool the recirculating element can be moved towards the carriage plate and the adjustment is altered. The adjustment setting is best determined by measuring the slide resistance in the unloaded state.

The adjustment values are shown in table 5 Slide Resistances. Further details on fitting and adjusting the guide are given in the instruction manual for the Aluminium Recirculating Ball Guides.

### 2 Dimensioning the Guides

The following parameters are needed for correct dimensioning of the guide:

- Selection of formation
- All invasive or emerging forces / torques (dynamic / static), (see illustration 1)
- Type of load (stationary, swelling, changing)
- Environmental influences (e.g. temperature, moisture) or special operating conditions (e.g. clean room, vacuum)
- Traverse speed and acceleration
- Stroke length
- Target lifetime in km

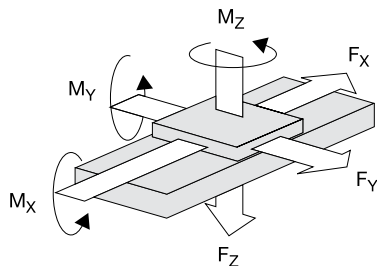


Illustration 1: Arrangement of forces and moments

All forces and torques must be within the permissible limits. The relevant data are on the pages for the individual types.

Recommended safeties (for screw quality 8.8):

- Pressure load:  $s > 1.2$
- Tension load:  $s > 2.5$
- Moment load:  $s > 4.0$

Calculations can be performed by Franke.

### 3 Notes for Mating Structure

#### 3.1 Mounting Surfaces

Contact and support surfaces essentially determine the function and precision of the guide. Inaccuracies can be added for running accuracy of the guide system. Therefore, the linearity and parallelism of the mating structure must be considered. The maximum permissible deviation across the whole stroke is 0.04 mm.

#### 3.2 Fixing the Rails

The rails are fixed against a bearing shoulder and screwed (see illustration 2). The two guide rails must be fitted parallel to one another. This is how you control the linearity and parallelism of the rails. The maximum total error must be less than 0.06 mm.

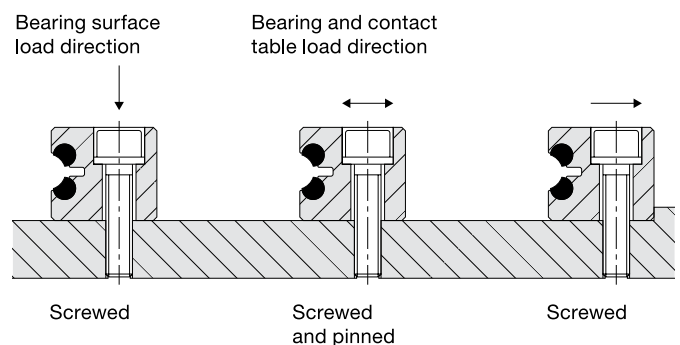


Illustration 2: Fixing Rails

The load capacity of the rails is influenced by the connections between the guide elements and the mating structure. Fixing to the mating structure is effected using screws of quality 8.8 with plain washers DIN 433.

Note: the raceways of the type FRA 08-13 can be exchanged in the event of wear. A rail's raceways must always be completely exchanged. The new raceways are ordered according to the original order or the item number of the rail.

### 3.3 Fitting Instructions Coupled Rails

Rails over a length of 4000 mm are coupled according to Franke standards. Butt jointing according to Franke standards guarantees a universally even bore shape and optimum usage of the rail length. Divisions are also possible to customer specifications.

Coupled rails are specially aligned with one another. Therefore, the rails have sequential production numbering for the right fitting (e.g. A/1-1/1-2/2-2/E). The top side of the rails is consistently marked with a bevel.

The rails must be evenly aligned during fitting. There must be a fitting gap between the rails. The rails should be fitted at a temperature of approx. 20 °C. The screw tightening torques from table 1 apply in this instance:

Screw	Tightening Torque
M 5	6.0
M 6	10.0
M 8	25.0
M 10	49.0

Table 1: Tightening Torques Screws FRA

There are more detailed instructions on fitting the rails in the instruction manual for Franke Linear Guides with Recirculating Balls.

### 4 Lubrication

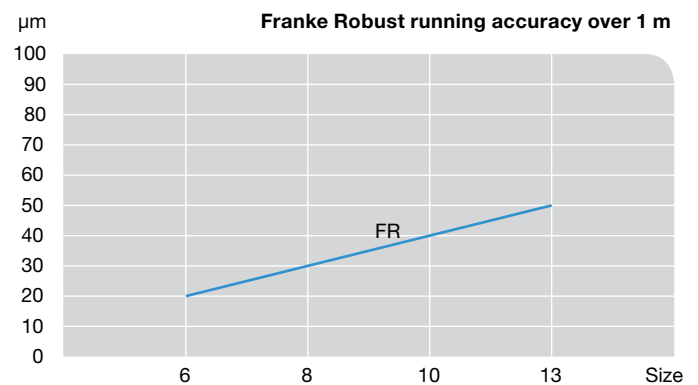
The Aluminium Recirculating Ball Guides must always be coated with a film of lubricant. The system needs to be lubricated every 500 to 700 operating hours or 1 to 2 times a year.

Recirculating elements are connected to central lubrication as standard. This provides relubrication via the boring on the mounting surface.

### 5 Slide Resistances

Size	Slide Resistance per Pair of Recirculating Elements	
	N	FR
6	35–	45
8	60–	80
10	90–	120
13	150–	200

### 6 Running Accuracy



## Linear Tables/Modules

### 1 Design

Franke Linear Systems are suitable for example for automation tasks in measuring and testing processes or for rationalisation in the handling and fitting sector. The selection ranges from strokes from 100 mm to 7000 mm, drive is effected via a spindle or belt drive. The light aluminium construction combined with the integrated Franke guide system allows high load ratings and torque loads. Precise technical details are on the relevant pages in the catalogue.

### 2 Area of Use

We recommend use of Franke Linear Systems with safety  $s \geq 3$  for simple loads or acceleration and moment loads. A safety of  $s \geq 6$  should be used for dynamic torques. You can choose any installation position. We recommend a bedstop or a brake for vertical operation.

The position accuracy of the type FTB Linear Systems is  $\pm 0.025/300\text{mm}$  (IT7) in accordance with the spindle stiffness accuracy. Other accuracies are possible on request. The repeat accuracy is  $\leq 0.01\text{mm}$ . The run accuracy of the FTB Linear Tables is  $0.02/300\text{ mm}$ . Franke Linear Tables can be used in a temperature range of  $-20\text{ }^\circ\text{C}$  to  $+80\text{ }^\circ\text{C}$ . The FTD 15 – 35 Linear Systems are suitable for permanent operation at temperatures of  $-30\text{ }^\circ\text{C}$  to  $+80\text{ }^\circ\text{C}$ . Please contact us concerning use in other temperature ranges.

### 3 End Switches and Reference Switches

- Reference switches: Franke Linear Systems of type FTB have inductive proximity switches, which are set to the final stroke position. A further proximity switch can be provided as a reference switch if desired. With the type FTC and FTD Linear Modules there is the possibility of attaching a freely adjustable end switch to the outside. Franke Linear Systems are equipped with inductive end and reference switches PNP-nc 10-30VDC as standard. PNP-no, NPN-no and NPN-nc switches are available on request. The addition or integration of a length measuring system with sinus or square wave signal is possible on request. Shaft encoders can be mounted on the motor.
- Multi axis units: Franke Linear Systems can be combined to form multi-axle units. The necessary angles and adaptor plates are selected according to your needs. We supply completely fitted units, ready cabled and aligned, with other accessories on request.
- Motorisation: An array of step or servo motors can be connected to the Linear Systems. Connection flanges and couplings are modified accordingly. The customer's own motors can also be considered.

- Motor Redirection, Gears: the motor is mounted in the extension of the stroke axle as standard. For special applications, e.g. in limited space, a motor redirection can be integrated on request using a toothed belt or reversing gears.

Please call us.

### 4 Maintenance and Lubrication

Franke Linear Systems are low-maintenance and have lifetime lubrication ex works. No relubrication is required up to the ball screw. In the event of grease escaping through the spindle, relubrication – depending on the individual case – is required. We recommend relubrication at intervals of approx. 700 working hours with approx. 1–2 g grease. If necessary clean the inner areas and the guide tracks and coat these with grease.

Fully synthetic lubricants are preferred for long-term lubrication. Franke uses the fully synthetic special lubricant ISOFLEX TOPAS NCA52 at the factory (manuf. Klüber). We recommend high-quality lithium-saponificate grease based on mineral oil. When mixing lubricants, the compatibility of the variants must be considered with regard to type of base oil, thickening agent, base oil viscosity and NLGI class. For extreme conditions or extraordinary operating conditions (vacuum, radiation, high temperature), you should speak to us or the lubricant manufacturer.

### 5 Definitions

- The running accuracy is the greatest possible deviation of any one place on the moved table surface from the ideal straight lines when the entire stroke track passes (subject to the unevenness of the subconstruction).
- The position accuracy is the greatest possible deviation from the achievement of a preselected point, which is passed from a predefined point of origin.
- The repeat accuracy is the greatest possible deviation from the multiple achievement of a preselected point. The measuring system used is crucial for the level of accuracy.
- The resolution is the smallest possible traverse path. It depends on the spindle pitch, the ratio, the step angle and the classification of the measuring system. Errors in the positioning or repeat can be neutralised using the resolution. Therefore, it should always be greater than the deviation from the permissible position accuracy.

**Please follow assembly and maintenance instructions. They are included with every delivery.**

## Type FTH

### 1 Design

Franke Linear Motor Modules FTH Drive are suitable for example for tasks in measuring and testing processes as well as in the handling and fitting sector. Strokes from 200 mm to 5,300 mm are available. Drive is effected via an integrated linear motor. The light aluminum construction of the integrated Franke guide system allows high load ratings and torque loads.

### 2 Area of Use

We recommend use with safety  $S \geq 3$  for simple loads or acceleration and moment loads. A safety of  $S \geq 6$  should be used for dynamic torques. You can choose any installation position. We recommend a bedstop or a brake for vertical operation.

Franke Linear Motor Modules FTH Drive can be used in a temperature range of  $-20\text{ °C}$  to  $+80\text{ °C}$ . Please speak to us about use in other temperature ranges.

### 3 Accuracy

The positioning accuracy is  $\pm 0.01\text{ mm/m}$  and depends on the measuring system used. Other accuracies and measuring systems are possible. The repeat accuracy is  $\leq 0.02\text{ mm}$ . The running accuracy is  $0.04\text{ mm/m}$ .

### 4 Dynamic

The performance given in the diagrams (page 119) can be realized with Franke Linear Motor Modules FTH Drive. These are guide values that relate to the horizontal feed motion in the trapeze and triangle positioning. We are happy to design the perfect linear motor for your application.

### 5 Motorization

The Linear Motor Modules FTH Drive are powered by linear servomotors without mechanical drive components. The linear motor consists of a slide element and guide element. The slide element houses the coils, the position acquisition and temperature monitoring. The drive magnets are located in the guide element.

The linear motors used are characterized by extremely high power density (highest dynamic with smallest size), thus, facilitating acceleration up to  $100\text{ m/s}^2$  and movement speeds up to  $9\text{ m/s}$ .

### 6 Control



Dimensions		
mm		
h (incl. ventilator)	w	d (incl. connector)
345	70	243

We recommend the S700 amplifier from Kollmorgen to power the Linear Motor Modules FTH Drive. The S700 offers many special features, e. g. the free graphic Windows® software to operate the amplifier. The Auto-Tuning function also simplifies operation. A Safe Torque Off is included as standard. The S700 can memorize many different return systems and can evaluate up to three lots of position information in parallel.

You can get more information from our service team or in the internet at [www.kollmorgen.com](http://www.kollmorgen.com).

### 7 Measuring System and End and Reference Switches

Franke Linear Motor Modules are equipped with an integrated, magnetic length measuring system as standard. The positioning accuracy is  $\pm 10\text{ }\mu\text{m}$  with a resolution of  $\pm 1\text{ }\mu\text{m}$ . Absolute measuring systems can also be fitted.

Inductive proximity switches are available to record end or reference positions, which can be freely positioned in the guide profile.

### 8 Multi-Module Units

Linear Motor Modules of type FTH Drive can be combined into multi-module units. The necessary angles and adaptor plates are selected according to your needs. We supply completely fitted units, ready cabled and aligned, with other accessories on request.

**Please follow assembly and maintenance instructions. They are included with every delivery.**

