Help-Function

Selection of Help Topics

A (acceleration)

The value „a“ indicates the acceleration and/or deceleration value from an initial speed at the beginning of the phase to a terminal velocity at the end of the phase during a movement (see accelerations a_x, $a_{trans,y}$ and $a_{trans,z}$ and/or the **input masks dynamics**).

Acceleration $a_{trans,y}$

The acceleration value $a_{trans,y}$ indicates the “transverse“ acceleration and/or deceleration of the respective mass in a phase in Y-direction. This indication is necessary for an multi-axes application, at which accelerations and/or decelerations are not only pesent in direction of motion (X-direction), but also mass forces of inertia into other directions arise (see the **input masks** [**input via dynamic cycle**, **input via percentages of time** and **input via strokes**]).

Acceleration $a_{trans,z}$

The acceleration value $a_{trans,z}$ indicates the “transverse“ acceleration and/or deceleration of the respective mass in a phase in Z-direction. This indication is necessary for an multi-axes application, at which accelerations and/or decelerations are not only pesent in direction of motion (X-direction), but also mass forces of inertia into other directions arise (see the **input masks** [**input via dynamic cycle**, **input via percentages of time** and **input via strokes**]).

Acceleration a_x

The acceleration value a_x indicates the acceleration and/or deceleration of the respective mass from an initial speed at the beginning of the phase to a terminal velocity at the end of the phase during a movement in X-direction.

Accuracy class

The permissible manufacturing tolerances of the linear guideways are specified by the accuracy class (see catalogs). The selection of the accuracy takes place in the pull-down menu of the same name in the **input mask data**.

Accuracy class	Comment	Application area
N	Normal	Handling
H	High accuracy	Handling, non-cutting operations
P	Precision	Cutting and non-cutting operations
XP	eXtra precision	Cutting operations, testing
SP	Super precision	Cutting operations, testing, measuring
UP	Ultra precision	Testing, measuring

Additional lateral retention

Without additional lateral retention, the guide rails and/or the runner blocks can withstand only a small side force. If this permissible force is exceeded and the guide rails and/or the runner blocks do not possess an additional lateral retention, the screws can be damaged. The values for additional lateral retention are shown in the catalogs (see **mask references**).

Additional load [N] due to tolerances of structure

Due to manufacturing tolerances of the mounting base construction (mounting base construction applies to the guide rails and the runner blocks) additonal loads for the runner blocks can develop.

Angles

In the **input mask angles** the rotations of angles $\propto$ and β are entered.

Application 1 guide rail - 1 runner block

With this application also moment loads can affect the runner block apart from force loads. The moment loads are converted into additional force loads with the calculation of the dynamic equivalent total load and considered thus during the theoretical life time calculation. This application can be selected by one doubleclick in the **input mask selection**.

Application 1 guide rail - 2 runner blocks

With this application also moment loads can affect the particular runner block apart from force loads. The moment loads are converted into additional force loads with the calculation of the dynamic equivalent total load and are considered thus during the theoretical life time calculation. This application can be selected by one doubleclick in the **input mask selection**.

Application 2 guide rails - 2 runner blocks

With this application also moment loads can affect the particular runner block apart from force loads. The moment loads are converted into additional force loads with the calculation of the dynamic equivalent total load and are considered thus during the theoretical life time calculation. This application can be selected by one doubleclick in the **input mask selection**.

Application 2 guide rails - 4 runner blocks

With this application pure force loads affect the individual runner block (assumption: Mounting base is ideally rigid). This application can be seleceted by one doubleclick in the input **mask selection**.

Application 2 guide rails - 6 runner blocks

With this application pure force loads affect the individual runner block (assumption: Mounting base is ideally rigid). This application can be seleceted by one doubleclick in the input **mask selection**.

Application 2 guide rails - 8 runner blocks

With this application pure force loads affect the individual runner block (assumption: Mounting base is ideally rigid). This application can be seleceted by one doubleclick in the input **mask selection**.

Attraction force, e.g. with linear motor

Linear motors possess an attraction force between the primary and secondary parts. This attraction force is often absorbed by the profiled rail guideways (dependent on the structure and arrangement of the linear motor). The acting force direction and size of the attraction force motor must be clarified by the linear motor manufacturer. For consideration during the life time calculation the data must be indicated in the input **mask forces.** The force coordinates must be included, as well as be activated in the individual phases (stroke distances).

Average velocity v_m (in the phase)

This characteristic is necessary with the **masks input via percentages of time** or **input via strokes**. Here it is to be noted, this is not the velocity at the beginning of a phase or terminal velocity, but the average speed v_m in the phase. The average speed v_m is the division of the distance by the time ($v_m=|\Delta s|/\Delta t$).

Back

Using the back button you can jump back into the previous input window (mask).

Ball rail system and/or ball runner block

In a ball rail system and/or a ball runner block balls are used as rolling members. The selection of ball runner blocks takes place in the **mask data** under the pull-down menu „design of the guidance“.

Type:	Comment:	Description:
R1621	SNH	Slimline, Normal, High
R1624	SLH	Slimline, Normal, High
R1622	SNS	Slimline, Normal, Standard height
R1623	SLS	Slimline, Long, Standard height
R1651	FNS	Flanged, Normal, Standard height
R1653	FLS	Flanged, Long, Standard height
R1663	FKN	Flanged, Short, Low-profile
R1664	SKN	Slimline, Short, Low-profile
R1665	FKS	Flanged, Short, Standard height
R1666	SKS	Slimline, Short, Standard height
R1693	FNN	Flanged, Normal, Low-profiled
R1694	SNN	Slimeline, Normal, Low-profiled

Super Ball Runner Block

R1661	FKS	Flanged, Short, Standard height
R1662	SKS	Slimline, Short, Standard height

Wide Ball Runner Block

R1671	BNS	Wide, Normal, Standard height
R1672	CNS	Compact, Normal, Standard height

Ball Runner Block made of aluminium:

R1631	FNS	Flanged, Normal, Standard height
R1632	SNS	Slimline, Normal, Standard height

High Speed Ball Runner Block:

R2001…90	FNS	Flanged, Normal, Standard height
R2011…90	SNS	Slimline, Normal, Standard height
R2002…90	FLS	Flanged, Long, Standard height
R2012…90	SLS	Slimline, Long, Standard height

Ball Runner Block Resist NR (Runnerblock body made of corrosion-resistant steel)

R2000…3x	FKS	Flanged, Short, Standard height
R2001…3x	FNS	Flanged, Normal, Standard height
R2002…3x	FLS	Flanged, Long, Standard height
R2010…3x	SKS	Slimline, Short, Standard height
R2011…3x	SNS	Slimline, Normal, Standard height
R2012…3x	SLS	Slimline, Long, Standard height

Ball Runner Block Resist NR II (All steel parts made of corrosion-resistant steel)

R2000…0x	FKS	Flanged, Short, Standard height
R2001…0x	FNS	Flanged, Normal, Standard height
R2002…0x	FLS	Flanged, Long, Standard height
R2010…0x	SKS	Slimline, Short, Standard height
R2011…0x	SNS	Slimline, Normal, Standard height
R2012…0x	SLS	Slimline, Long, Standard height

Ball Runner Block Resist NRFG (steel parts made of corrosion-resistant steel, plastic parts made of certified material)

R2000…14	FKS	Flanged, Short, Standard height
R2001…14	FNS	Flanged, Normal, Standard height
R2002…14	FLS	Flanged, Long, Standard height
R2010…14	SKS	Slimline, Short, Standard height
R2011…14	SNS	Slimline, Normal, Standard height
R2012…14	SLS	Slimline, Long, Standard height

C_0/F_{max} and/or $C_{0,red}/F_{max}$

This value indicates the ratio between the static load capacity and the maximum occurring load F_{max}. In the calculation, an ideally rigid mounting base is assumed and oscillations, dirt, and/or temperature influences are not considered. Therefore, this value should be at least ≥ 4. For the respective application this ratio with consideration of the valid safety regulations must be met. Here substantially higher values can be necessary. The screw stregth must be checked separately. That means, there is no control of the permissible load on the screw connection in the calculation program.

Calculation assumptions and/or calculation conditions

The calculation is based on the following conditions:

- Mounting base is ideally rigid.
- Guide rail(s) and runner block(s) are securely mounted (for example through reference areas or reference edges on both sides) to take all loads. There is no slipping between the mounting surfaces and linear guide components.
- The screw stregth must be checked separately.That means, there is no control of the permissible load on the screw connection in the calculation program.
- The friction of the runner block(s) is neglectable low and therefore not considered.
- Influencing parameters such as dirt, temperature, and vibration factors are not considered.
- Guide rail(s) fixed and runner blocks(s) moving. In instances, in wich this is not the case (guide rail(s) moving und runner block(s) fixed), please contact department VPR3.
- The preload of runner block is considered in the total load.

Continue

Over this button the next input window (mask) can be achieved. Each input window (mask) must be gone through. So the danger does not exist that an input window (mask) is ignored by mistake.

Coordinate system

In the **mask coordinates**, the direction of the X , Y, and Z-axis are represented. The position of the zero point is also indicated.
Coordinates of force

The coordinates of the application force in X, Y and Z-direction are specified in the **input mask forces** for the respective force.

Coordinates of mass

The coordinates of the center of mass in X, Y and Z-direction are specified in the **input mask masses** for the respective mass.

Customer data

In the **input mask printout** the specific customer data, e.g. name, address and project are registered.

Data

In the **input mask data** you can select the runner block and you get information about theoretical life time expectancy of the highest loaded runner block.

Deflections

In the **mask deflections,** the deflections are listed for the individual application force points in individual phases. The deflections apply under the assumption, that the structure is totally rigid. Furthermore, the point of reference for the deflections is determined freely, i.e. each phase of the load cycle can be selected as starting point for the deflections and therefore deflections are indicated based on the misalignment of the individual application force point regarding to this phase.

Design of the guidance

In this pull down menu the design type of the desired linear guideways can be selected in the **input mask data**. The following designs are possible:

- Ball rail system
- Ball rail system (High speed)
- Ball rail system (Resist NR)
- Ball rail system (Resist NRII)
- Ball rail system (Resist NRFG)
- Miniature ball rail system
- Roller rail system

(Description to the runner block types see **B**all rail system, **M**iniature ball rail system, **R**oller rail system

Dimensions

In the **input mask dimensions,** the system dimensions, e.g. position of drive system LA1 in Y-direction, position of drive system LA2 in Z-direction, runner block center to center distance LW 1, runner block center to center distance LW 2, guide rail center to center distance LS and drive stiffness in X-direction are entered.

Drive stiffness in X-direction

The value specifies the stiffness of the drive in X-direction and is necessary for deflection calculation of application force points. This input takes place in the **mask dimensions**.

Dyn. equi. external force loads

The dynamic equivalent external force load on the runner block exclusively develops due to external forces, e.g. for masses -, acceleration -, deceleration -, working and process forces. In this circumstance the influence of the preload is not considered. The height difference Δz between the mounting surface of the runner blocks and the middle of the raceways can only be factored into the calculation after selecting the guideway system (before the height difference Δz is defaulted to 0 mm). With the applications 1 guide rail - 1 runner block, 1 guide rail - 2 runner blocks, 2 guide rails - 2 runner blocks additional external dynamic moment loads for the guideway runner blocks can occur.

Dyn. equi. external moments

The dynamic equivalent external moments indicate the moment loads for the respective runner block exclusively due to external forces, e.g. mass forces, acceleration -, deceleration -, working and process forces. Here the influence of the preload is not considered. The height difference Δz between the mounting surface of the runner blocks and the middle of the raceways can only be factored into the calculation after selecting the guideway system (before the height difference Δz is defaulted to 0 mm).

Dyn. equi. total load

The dynamic equi. total load indicates the resulting total load, with which the theoretical life time for each individual runner block is calculated. In the total load both the pure external force loads and the external moment loads are converted into one equivalent load (N). Furthermore, the influence of the pre-load is considered in the dynamic equivalent total load.

With "highly" preloaded profiled rail guideway systems (preload classes 8% and 13 %) the following two cases are differentiated with the calculation of the total load on the runner blocks in the respective phase (stroke). With a pre-loading of 2 % (ball runner blocks) and/or of 3 % (roller runner blocks) the total load for each phase is calculated exclusively per case b:

a.) External Loading $F_{external} \leq 2{,}828 \times F_V$ (preload force)

In this case, the total load F_{total} can be calculated according to formula (1).

$$F_{total,phase} = \left(\frac{F_{external,Phase}}{2{,}828 * F_V} + 1 \right)^{\frac{3}{2}} \times F_V \qquad (1)$$

with:

$F_{external,Phase}$	=	loading on the guideway resulting from mass, acceleration, deceleration, machining and process forces
F_V	=	preload on the raceways without external load in the individual phase

Due to the high dynamics, it must be ensured that all raceways are within the preload range when subjected to the operating load.

This ensures, that the rollling elements will not slide.

To assure this with a sufficient safety margin, $F_{external}$ should be $\leq$2.5 F_V (preload force). Figure 1 shows, that the preload force F_V is based on a deformation of δ_V. If the loading is such that one side is loaded more than the other, the force or the loading on the opposite side will decrease according to the deformation path (see Fig. 2 and Fig. 3). If the deformation path exceeds δ_V, then the preload on the opposite side will be completely canceled out. This state must be avoided in high dynamic applications.

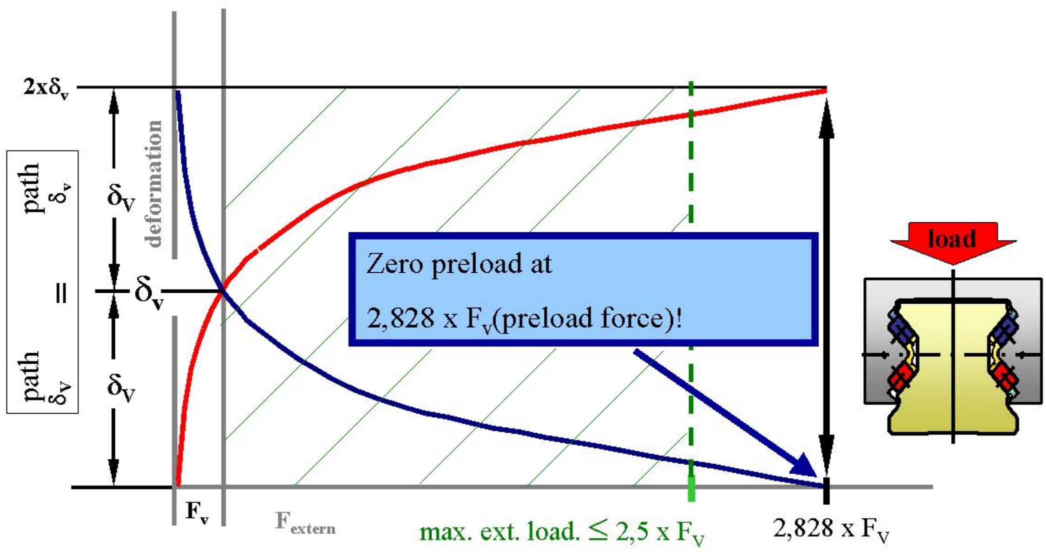


Figure 1: Rolling element/raceway deformation diagram

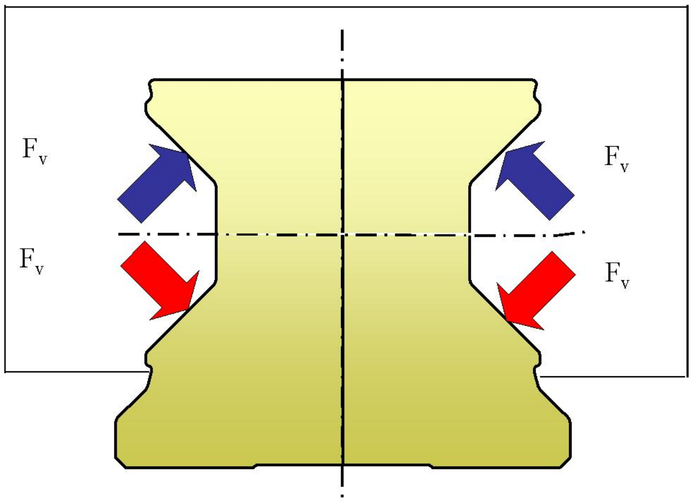


Figure 2: Preload on the reaceways without external load

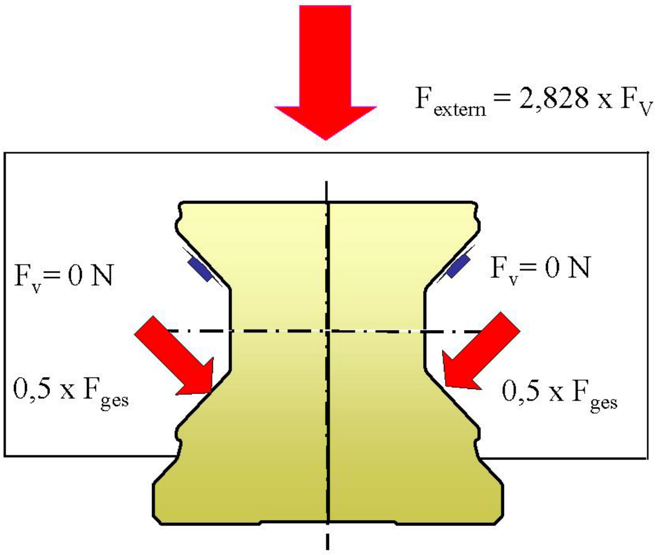


Figure 3: Loading of the raceways at external load of 2,828 F_V

b.) External loading $F_{external}$>2,828 x F_V (preload force)

In this case the total load F_{total} in a discrete step is determined according to formula (2).

$$F_{total,phase} = F_{external,phase} \tag{2}$$

The equivalent total load $F_{equi,total}$ is determined according to formula (3).

$$F_{equi,total} = \sqrt[n]{F_{total,1}{}^{n} \times \frac{q_1}{100} + F_{total,2}{}^{n} \times \frac{q_2}{100} + ... + F_{total,l}{}^{n} \times \frac{q_l}{100}} \tag{3}$$

with:

$F_{total,1}..F_{total,l}$	=	Total load on each runner block per phase [N]
q_1...... q_l	=	stroke percentage of individual phases [%]
l	=	number of phases per cycle
n	=	10/3 for roller runner blocks
n	=	3 for ball runner blocks

The theoretical life time (90% lifetime probability) is determined according to formula (4)

$$L = \left(\frac{C}{F_{Equi,total}} \right)^q * 10^5 \qquad (4)$$

with:

L	=	nominal lifetime (m)
$F_{Equi,total}$	=	equivalent total load (N)
C	=	dynamic load capacity (N)
q	=	10/3 for roller runner blocks
q	=	3 for ball runner blocks

File

In this listing the following functions are available for the user: **File new**, **file open**, **file close**, **file save**, **file save as** and **Exit**.

File close

Via this function in the listing file, a **open file** (application) can be closed.

File open

Via this function in the listing file, a **stored file** (application) can be loaded into the program and the data can be changed later.

File new

Via this function in the listing file, a **new file** can be started. This new file starts with the input mask selection of the application.

File save

Via this function in the listing file, a **file** (application) can be stored.

File save as

Via this function in the listing file, a **file** (application) can be stored under a name.

$F_{max, permissible}/F_{max}$

This value indicates the ratio from the maximally permissible force $F_{max,\ permissible}$ to the maximally arising load force F_{max}. The ratio $F_{max,\ permissible}/F_{max}$ must be met for the respective application with consideration of the valid safety regulations.

Force

In the **input mask forces** the individual components (Fx, Fy and Fz) can be indicated to the respective force in the field force. These forces are entered and activated for the individual phases of the total procedure stroke (see **input mask of forces**).

Force direction F_x

The force direction F_x indicates the component of the respective force in X-direction (see **input mask forces**).

Force direction F_y

The force direction F_y indicates the component of the respective force in Y-direction (see **input mask forces**).

Force direction F_z

The force direction F_z indicates the component of the respective force in Z-direction (see input **mask forces**).

Forces

In this **input mask,** the coordinates of the respective application force point and individual force components are entered. Furthermore, the respective forces are assigned and activated in the respective phases.

General references

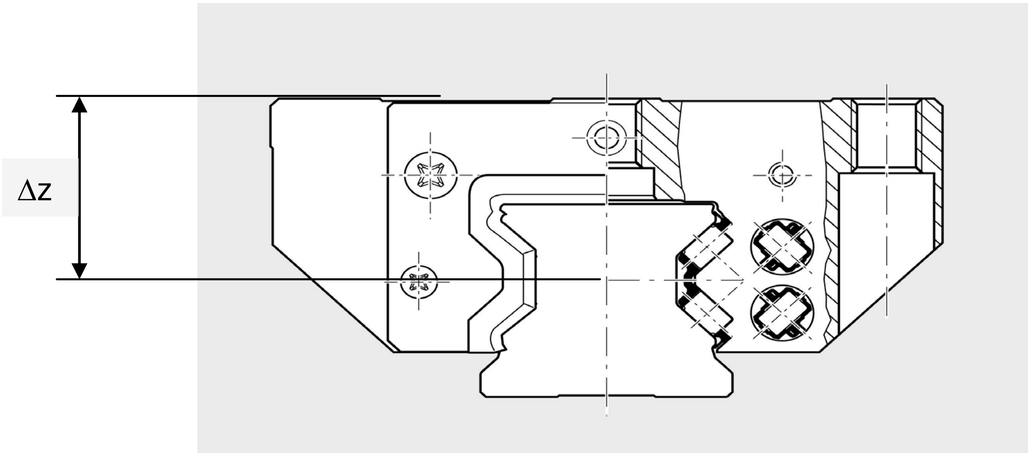
(see imprint)

Guide rail center to center distance LS

The guide rail center to center distance LS indicates the distance of the two parallel rails in Y-direction (see **input mask dimensions**).

Height difference Δz between mounting surface of runner blocks and the middle of race ways

Height difference Δz indicates the height difference between surface of runner block and the resulting middle of race ways (see picture 1).



Picture 1: Height difference Δz between surface runner block and the middle of race ways

Input via dynamic cycle

With this input method the total stroke is entered as a dynamic cycle. This input method is the most exact input, since for each individual phase e. g. the starting and/or terminal velocity and stroke distance are precisely defined this case. Only with this input method can all the program integrated control inquiries, e.g. maximum permissible speed etc. be used.

Input via percentages of time

With this input method for the individual phases, the respective average speed v_m, the respective allocated time, and/or cyclic duration are entered. From this data the average speed for the total cycle and the stroke percentage are then calculated.

Input via strokes

With this input method, the total stroke is entered through individual stroke distances. Here the indication of the average speed v_m per phase is necessary in addition to the individual stroke. For the calculation of the average speed for the total cycle, the total switch on time of the axis [%] must be entered.

L_{10}

The nominal life L_{10} is understood as being the achievable calculated liefe expectany with a probability of survival of 90%. This means that 90% of a sufficiently large quantity of identical bearings achieve or exceed the theoretical life expectancy before material faigue occurs. This size is represented in the **input mask data**.

L_{h10}

The 90%-reliable lifetime in hours of a single bearing or of a group of apparently identical bearings operating in identical conditions (according to DIN 636 part of 2). This value is represented in the **mask data**.

$L_{h,MTTF}$

$L_{h,MTTF}$ indicates the mean life time in hours. MTTF stands for Mean Time To Failure and designates the mean time between start-up and the instant of failure. You receive an empirical estimation of MTTF when you divide the sum of the total test time of all inspection items by the sum of the number of failed test specimens.

L_{MTTF}

L_{MTTF} indicates the mean life time in meters. MTTF stands for Mean Time To Failures and designates the mean time between start-up and the instant of failure. You receive an empirical estimation of MTTF when you divide the sum of the total test time of all inspection items by the sum of the number of failed test specimens.

L_{na}

If this probability is too low the calculated life expectancy must be reduced by a certain factor, this being the life expectancy coefficient a_1 for the probability of survival. This results in the modified life expectancy L_{na}.

$$L_{na} = a_1 * \left(\frac{C}{F_{Equi,total}} \right)^q * 10^5 \qquad (1)$$

with:

L_{na}	=	nominal lifetime (m)
a_1	=	lifetime probability
$F_{Equi,total}$	=	equivalent total load (N)
C	=	dynamic load capacity (N)
q	=	10/3 for Roller-Runner Blocks
q	=	3 for Ball-Runner-Blocks

table 1: Dependence of the factor a_1 from the lifetime probability

Lifetime Probability %	90	95	96	97	98	99
Factor a_1	1,00	0,64	0,55	0,47	0,37	0,25

Load capacity reduction due to the block center to center distance is less than 1.5 x runner block housing length

If the runner blocks lie very close together (runner block center to center distance ≤1.5 runner block housing length), a load capacity reduction results. The reduced load capacity C_{red} can be calculated according to the following formula (1).

$$C_{red} = C \times \frac{n_{rb}^{\ 0,7}}{n_{rb}} \tag{1}$$

with:

C_{red}	=	reduced load capacity [N]
C	=	load capacity [N]
n_{rb}	=	number of runner blocks on a guide rail with a center to center distance less than 1.5 runner block housing length

table 1: Overview over resulting load capacity reduction

	$LW1<1,5*B_1$			$LW1>1,5*B_1$		
	no LW2	$(LW2-LW1)/2>1,5*B_1$	$(LW2-LW1)/2=<1,5*B_1$	no LW2	$(LW2-LW1)/2>1,5*B_1$	$(LW2-LW1)/2=<1,5*B_1$
1 gr-1rb						
1 gr-2rb	2					
2 gr-2rb						
2 gr-4rb	2					
2 gr-6rb	3					
2 gr-8rb		2 (for all rb)	4 (for all rb)			2 (for all rb)

Load capacity reduction, e.g. with short-stroke

With strokes ≤ 2 x runner block length, the special lubricating and servicing instructions in the catalog for short-stroke must be considered (e.g. reciprocal lubrication connections, lubrication strokes and possibly lubrication through the guide rail). With extreme short-stroke sometimes a reduction of the dynamic load capacity C is necessary. In the calculation program there is an input size reduction [%]. The load capacity reduction determines the proportional reduction of the dynamic load capacity C for short-stroke. To define this value for a runner block, in each case an exact analysis of the stroke and the loads is necessary. Therefore no or only very general recommendations for this value can be indicated. I.e. this load capacity reduction must be individually specified for each case. With questions you please contact the field representative and/or distribution center responsible for your account (**see input mask data**).

Mass

The respective mass is entered into the **input mask masses**. Furthermore it is defined whether the mass in the individual phases is active or not. Beyond that, the accelerations a_x in X-direction (input via percentages of time or input via strokes), acceleration $a_{trans,y}$ in Y-direction (input via dynamic cycle, input via percentages of time and input via strokes) and acceleration $a_{trans,z}$ in Z-direction (input via dynamic cycle, input via percentages of time and input via strokes) are specified (see acceleration $a_{trans,y}$ and/or to acceleration $a_{trans,z}$).

Mass active in

In the line „mass active in“ in the **input mask masses** it is specified whether or not the respective mass affects the runner block in the particular phase (see **input mask masses** (**input via dynamic cycle**, **input via percentages of time** and **input via strokes**)).

Masses

In the **input mask masses,** the mass and the coordinates of the mass center for the respective mass (9 masses are possible) are entered. Furthermore it is defined whether the mass in the individual phases is active or not. Beyond that, the accelerations in X-direction (input via percentages of time or input via strokes), acceleration in Y-direction (input via dynamic cycle, input via time percentages and input via strokes) and acceleration in Z-direction (inputvia dynamic cycle, input via time percentages and input via strokes) are specified (see acceleration Y and/or acceleration Z) (possibly insert pictures of the **input masks masses (input via dynamic cycle**, **input via percentages of time and input via strokes**)).

Maximum load

The field maximal loads in the **mask data** indicates, in which phase and which runner block the maximal load affects.

Miniature ball rail system and/or miniature ball runner block

The miniature ball rail systems and/or miniature ball runner blocks are ball guide runner blocks in miniature design. In a ball rail system and/or a ball runner block balls are used as rolling members. The selection of ball runner blocks takes place in the **mask data** under the pull-down menu design of the guideway.

Type:	**Description:**
R0442	Short
R0444	Long
R0443	Wide, Short
R0441	Wide, Long

MTTF-Data (mean life time)

MTTF stands for Mean Time To Failures and designates the mean time between start-up and the instant of failure. You receive an empirical estimation of MTTF when you divide the sum of the total test time of all inspection items by the sum of the number of failed test specimens (see L_{MTTF} and/or $L_{h,MTTF}$).

Operating Factor k_f

Via the operating factor k_f the lifetime reducing influences and factors can be considered. The operating factor k_f effects according formula (1) the theoretically lifetime.

$$L = \left(\frac{C}{k_f * F_{Equi,total}} \right)^q * 10^5 \qquad (1)$$

with:

L	=	nominal lifetime (m)
k_f	=	operating factor
$F_{Equi,total}$	=	equivalent total load (N)
C	=	dynamic load capacity (N)
q	=	10/3 for Roller Rail System
q	=	3 for Ball Rail System

Permissible loads on the mounting screw connection

The screw connections specified in the standard DIM 645-1 can be subjected to excessive loads due to the performance capability of the profile guide rails. If the lifting loads or the moments are higher than the permissible loads, the screw conections can be damaged. Please clarify this data with the screw manufacturer. The screw stregth must be checked separately.That means, there is no control of the permissible load on the screw connection in the calculation program.

Phase T

A total cycle can consist of several phases. For the calculation of the equivalent total loads, and thus the theoretical life time, the determination of the total loads is necessary in the individual phases (stroke distances). From the loads in the individual phases the total equivalent load for the respective runner block is computed according to formula (1).

$$F_{Equi,total} = \sqrt[n]{F_{total,1}{}^{n} \times \frac{q_1}{100} + F_{totals,2}{}^{n} \times \frac{q_2}{100} + ... + F_{total,l}{}^{n} \times \frac{q_l}{100}} \qquad (1)$$

with:

$F_{total,1}..F_{total,l}$	=	total load on the runner block in the individual phase [N]
q_1...... q_l	=	stroke percentage of each phase [%]
l	=	number of Phases per cycle
n	=	10/3 for roller runner block
n	=	3 for ball runner block

Position of drive system LA1 in Y-direction

The position of drive system LA1 in Y-direction indicates the distance of the drive to the zero point (point of reference for all dimensions) in Y-direction. Here it must be also indicated, whether the distance is positive or negative. This input takes place in the **mask dimensions**.

Position of drive distance LA2 in Z-Direction

The position of drive system LA2 in Z-direction indicates the distance of the drive to the zero point (point of reference for all dimensions) in Z-direction. Here it must be also indicated, whether the distance is positive or negative. This input takes place in the **mask dimensions**.

Preload

The ball and/or roller runner blocks are manufactured in different preload classes. With high dynamic processes the preload should not be negated by the external load; otherwise the rolling members can slide and thus a premature failure of the runner blocks can take place.

Code	Preload:	Description:
C0	without preload	Smooth-running guide systems with lowest possible friction and large installation tolerances.
C1	Preload 2% C	Precise guide systems with low external loads and High demands on overall rigidity.
C2	Preload 8% C	Precise guide systems with both high external loads and high demands on overall rigidity.
C3	Preload 13% C	Highly rigid guide systems. Above average loads and moments can be absorbed with the least possible elastic deflection.

Preload with high dynamic processes

During high dynamic processes the preload in the guideway systems should not be negated. Otherwise the danger exists, that the rolling members slide and thus intensified wear takes place. Thus a premature loss of the linear guideway system can take place.

Printout

In this **mask** the printout is represented. In the printout the calculated results and all calcualtion parameters are listed. Thus a complete examination of the calculation parameters is possible by the application engineer and the customer. Further customized data (e.g. name, address etc.), the address of the design engineer and the designation of the individual masses can be entered.

Q_s (stroke percentages)

The stroke portions of q_s indicate for all phases (strokes) the distance portion of the respective phase. Profiled rail systems (e.g. ball and roller rail systems) are computed „distance-critical".

Q_t (time percentages)

The time percentages q_t indicate for all phases (stroke distances) the allocated time of the respective phase.

Quit

Quit is located in the listing file. Thus the calculation is closed and/or terminated.

Rights to use

(see imprint)

Roller rail system and/or roller runner block

With roller rail systems and/or roller runner blocks, rollers are used as rolling members. The selection of roller runner blocks takes place in the **mask data** under the pull-down menu design of the guidance.

Type:	Comment:	Description:
R1821	SNH	Slimline, Normal, High
R1824	SLH	Slimline, Long, High
R1822	SNS	Slimline, Normal, Standard height
R1823	SLS	Slimline, Long, Standard height
R1851	FNS	Flanged, Normal, Standard height
R1853	FLS	Flanged, Long, Standard height
R1854	FXS	Flanged, extra long, Standard height (Gr. 65)
R1861	FNS	Heavy duty, Flanged, Normal, Standard height
R1863	FLS	Heavy duty, Flanged, Long, Standard height
R1872	BLS	Wide, Long, Standard height

Runner block center to center distance LW 1

The runner block center distance LW 1 indicates the runner block center to center distance of the "internal runner blocks".

Runner block center to center distance LW 2

The runner block center distance LW 2 indicates the runner block center to center of the runner block center distance of the "outside runner blocks".

S (stroke distance)

S indicates for each phase the distance (stroke). The stroke is needed in order to calculate the stroke portion of q_s. Thus the equivalent total load is computed according to formula (1).

$$F_{Equi,total} = \sqrt[n]{F_{total,1}{}^{n} \times \frac{q_1}{100} + F_{total,2}{}^{n} \times \frac{q_2}{100} + ... + F_{total,l}{}^{n} \times \frac{q_l}{100}} \qquad (1)$$

with:

$F_{total,1}..F_{total,l}$	=	Total load for each runner block per stroke [N]
$q_1 ...... q_l$	=	stroke percentage of each phase [%]
l	=	number of phases per cycle
n	=	10/3 for roller runner blocks
n	=	3 for ball runner blocks

Selection of language

The calculation program offers both a German and English-language version. The selection takes place under language.

Selection of application

In the **input mask selection** one of the following applications: 1 guide rail - 1 runner block, 1 guide rail - 2 runner blocks, 2 guide rails - 2 runner blocks, 2 guide rails - 4 runner blocks, 2 guide rails - 6 runner blocks and 2 guide rails - 8 runner blocks can be selected. The selection is made by double clicking on one of the applications.

Short stroke

Short-stroke is present, if the stroke is smaller than 2 x runner block length. In this case special maintenance and lubrication references in the catalog must be considered. With extreme short-stroke sometimes a reduction of the load capacity is necessary (see load capacity reduction,e.g. with short stroke in the **mask data**).

Stroke distance percentages q_s

The stroke percentages q_s indicate the distance percentages of the respective phase for all phases (strokes). Thus the equivalent total load is calculated according to formula (1).

$$F_{Equi,total} = \sqrt[n]{F_{total,1}{}^{n} \times \frac{q_1}{100} + F_{total,2}{}^{n} \times \frac{q_2}{100} + ... + F_{total,l}{}^{n} \times \frac{q_l}{100}} \qquad (1)$$

with:

$F_{total,1}..F_{total,l}$	=	total load for each runner block per stroke [N]	
$q_1 ...... q_l$	=	stroke percentage of individual phases [%]	
l	=	number of phases per cycle	
n	=	10/3	for roller runner blocks
n	=	3	for ball runner blocks

Switch on time in the phase q_t

The switch on time in the phase q_t indicates the proportional cyclic duration of the individual phase in comparison to the total period.

Switch on time of the axis

The switch on time indicates the total cyclic duration of the axis during the input via strokes. Thus the total average speed and the theoretical life time can be calculated.

System requirements

- MS Windows 98, ME, XP and Windows NT, Win7, Win8
- Actual PC, performance like Pentium IV 1 GHz
- $\geq$ 128 MB
- MS Internet Explorer $\geq$ 5.5 and actual Word

T (Phase)

The „t“ indicates, the time duraction of the respective phase (stroke distance) (see **masks input via dynamic cycle**, **input via percentages of time** and **input via strokes**).

Theoretical lifetime of the maximum loaded runner block

The theoretical lifetime of the maximum loaded runnner block is indicated in km/miles and h in this field (**input mask data**) (see L_{10} and/or L_{h10}).

Training

courses on request

Transverse forces e.g. with rack or crankshaft drive

With different drive systems, e.g. with rack or with crankshaft, transverse forces seperate from the driving power in X-direction can be developed. These forces have to be taken up by the linear guides. For the consideration of these transverse forces with the computation of the theoretical life time, the transverse forces must be entered and activated in the **input mask forces** (see **input mask of references**).

Type of runner block

In the pull-down menu of the same name, the type of the runner block is selected in the **input mask data** (see **mask data**).

With/without chain

In the pull-down menu of the same name, the execution (with or without chain) is selected in the **input mask data** (see **mask data**).