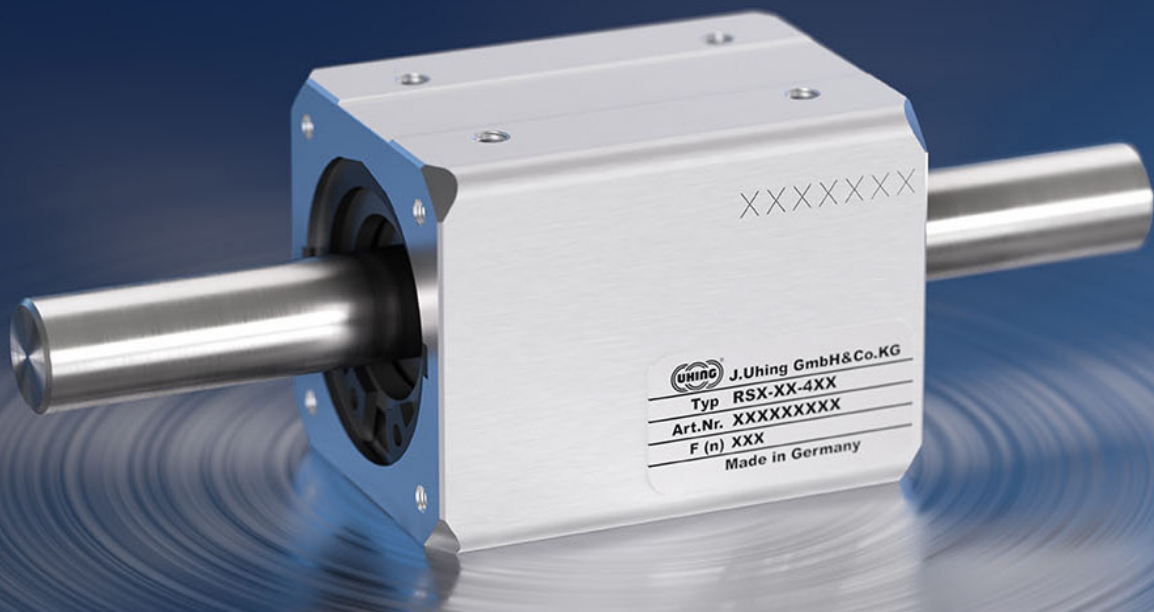




Linear Drive Nut

Uhing Linear Drives®



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Uhing Linear Drive Nut

Applications for Linear Drive Nuts:

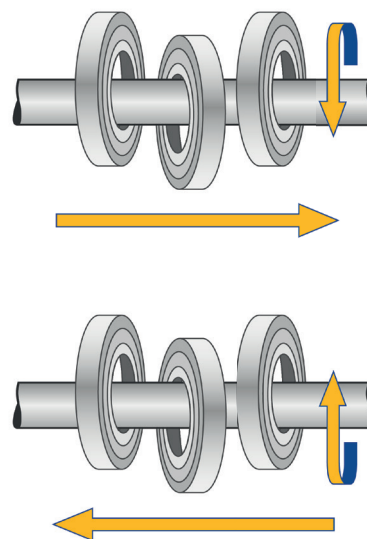
- Measurement and inspection technology
- Drive technology
- Materials handling systems
- Control systems
- Food industry
- Medical engineering

The main product features:

- backlash-free
- very smooth running
- low noise
- high efficiency
- can be disengaged on the shaft
- compact design
- low installation space requirement
- safety due to slip in case of overload
- side thrust forces adjustable at the factory
- available with different pitch
- left and right pitch possible on one shaft
- good sealing possibilities against dust, dirt, moisture, etc.

The functional principle of the Linear Drive Nut

Uhing Linear Drive Nuts are friction drives that convert the rotation of a smooth shaft into a linear movement. Rolling ring bearings are arranged at an angle to the shaft and press against the rotating shaft with their specially shaped running surfaces. Depending on the swivel angle, they generate a left- or right-handed movement. The stroke direction is reversed by changing the direction of rotation of the shaft.



Application areas

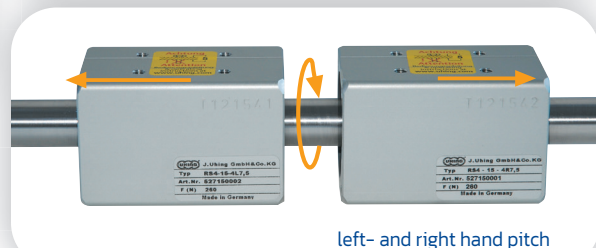
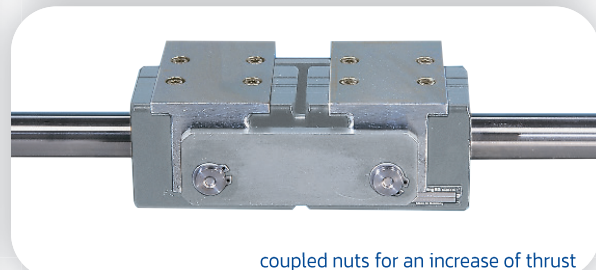
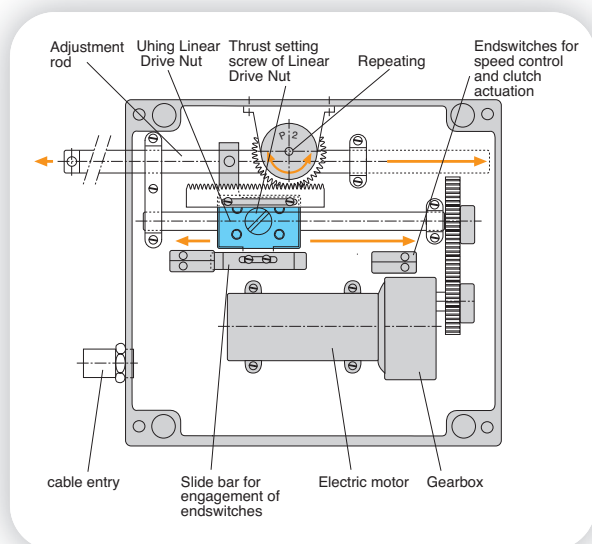
Application in control systems (Linear unit to adjust the X-, Y- and Z-axis)



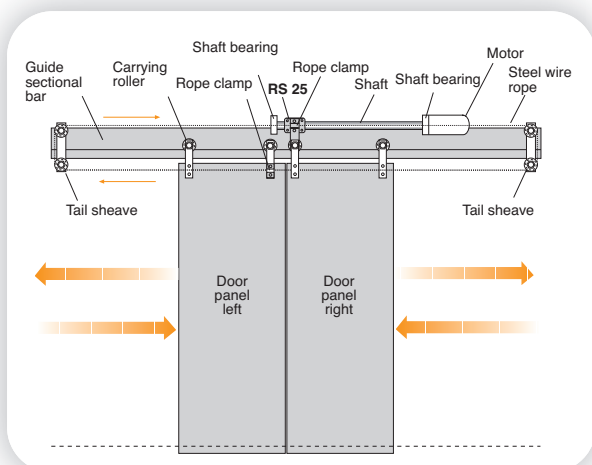
With permission of the named company

Features/Versions

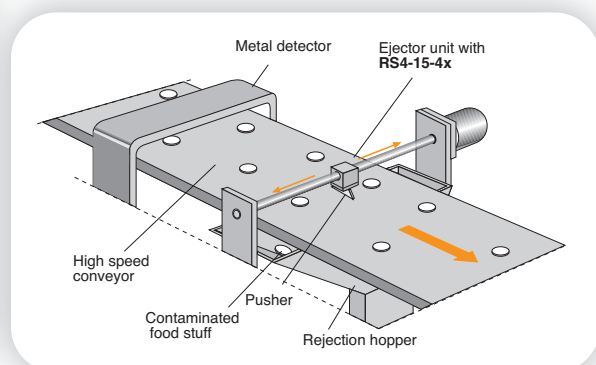
Setting unit for speed control of ship motors



Drive for double sliding doors



Ejector unit for contaminated foodstuffs



Dimensions and technical details

Uhing Linear Drive Nut types RS

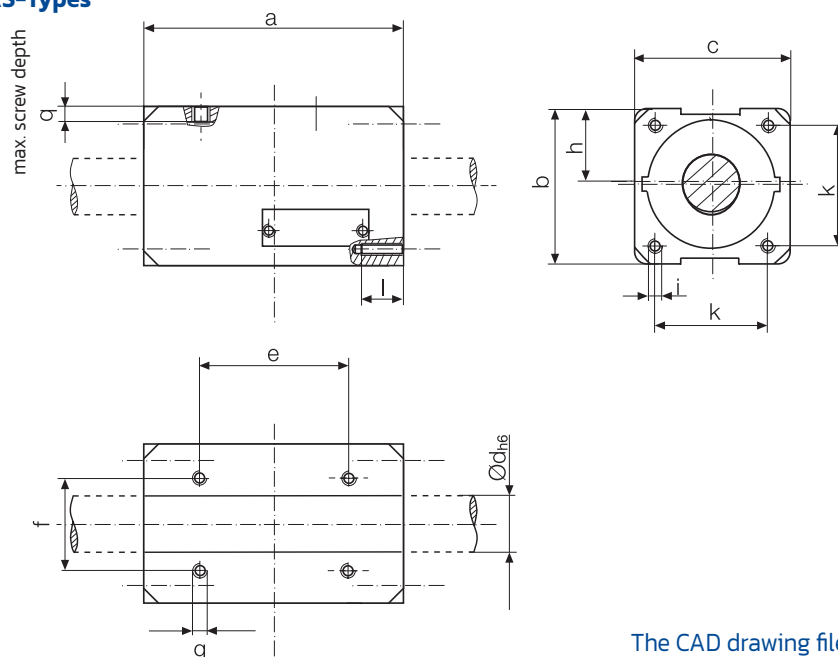


RS Types

Dimensions for RS-types (mm)

Type	weight m (kg)	a*	al*	b	c	dh6	e	f	g	h ^{±0,3**}	i	k	l	q	FRS (N)	Mo (Ncm)	h _{max} (mm)
RS3-08-4	0,09	40	54	30	30	8	26	16	M 4	15	M 3	24	6	5	50	1,0	4,0
RS4-08-4	0,11	48	62	30	30	8	26	16	M 4	15	M 3	24	6	5	100	1,9	4,0
RS3-10-4	0,14	47	65	35	35	10	30	18	M 4	16,8	M 3	26	6	5	100	1,8	5,0
RS4-10-4	0,18	55	73	35	35	10	30	18	M 4	16,8	M 3	26	6	5	200	3,8	5,0
RS4-15-4	0,24	62	82	40	40	15	26	18	M 4	19,6	M 4	30	8	5	260	2,8	7,5
RS4-20-4	0,55	83	108	52	52	20	40	30	M 5	26	M 5	40	11	8	420	8,8	10,0
RS4-25-4	0,71	85	110	60	60	25	40	30	M 5	29,4	M 5	45	10	9	600	17,5	12,5
RS4-35-4	1,52	105	126	80	80	35	50	40	M 6	40	M 6	60	12	13	900	39,0	17,5
RS4-50-3	2,70	120	140	100	100	50	50	50	M 8	48,8	-	-	-	16	1300	140,0	25,0
RS4-60-3	4,24	130	156	120	120	60	69	62	M10	58,4	-	-	-	15	2000	200,0	30,0

RS-Types



FRS (N) = Maximum available side thrust

Mo (Ncm) = Idling torque

h_{max} (mm) = Maximum pitch

Attention:

* If wipers are used, dimension a becomes al.

** Valid only for standard pitch 0,5 x d.
If pitches are less than standard, the value decreases.

The CAD drawing files are available at www.uhing.com

Product survey and ordering specifications

Product survey

Product group Type reference	Uhing Linear Drive Nut RS							
Style (number of rolling rings)	3 or 4		3 or 4					
Size shaft diameter	8	10	15	20	25	35	50	60
Design category	4	4	4	4	4	4	3	3
Pitch direction	L (= left), R (= right)							
Pitch	0,1 · 0,2 · 0,3 · 0,4 · 0,5 x Ø Shaft							
Available features ¹	F, P, R							
Customer specific features ²	X							

Heavy print: standard version

1) Available features

- F Free movement lever (mechanical)
- P Free movement lever (pneumatical)
- R Steady Rollers

2) Customer specific features

- Adapter
- Wipers
- Felt rings
- Increased protection against corrosion
- Specific pitch
- Grease nipples
- Reduced side thrust

Example of Ordering specifications

Type reference	RS	4	-	25	-	4	R	12,5	P	X
Version	●									
Size (shaft dia.)		●								
Design category				●						
Pitch direction					●					
Pitch						●				
Available features								●		
Customer specific features										●

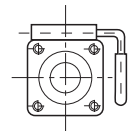
Features



Free-Movement Lever

F Mechanical

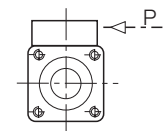
when operated, the nut can be slide freely along the shaft



P Pneumatic

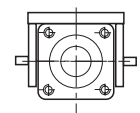
as above, operated with a pressure of p = 6 bar

Attention: Units supplied with P have a reduced thrust. Refer to supplier for details



Adapter

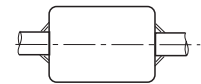
for twist free coupling system



Wipers

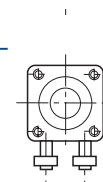
for sealing between nut and shaft

Attention: For units with wipers please note dimension a1 on page 4.



R Steady Rollers

Rollers on Linear Drive Nut (in conjunction with a guide bar) prevent the rotation of the nut on the shaft



Material

Aluminium housing, silver anodized

Details of other types upon request.

Selection

If you wish Joachim Uhing GmbH & Co. KG to make a selection for you in respect of your application, please contact us.

Formulae and related units

d(mm)	= shaft diameter
F(N)	= side thrust required
F _{RS} (N)	= side thrust produced by Linear Drive Nut type RS
F _R (N)	= frictional force ($F_N \cdot \mu$) equired only if the payload is moved on its own guiding system
F _N (N)	= normal force of total weight of associated mass and carriage
μ	= coefficient of friction
F _z (N)	= additional force e.g. component of the cutting force of a separator
f(mm)	= shaft sag from Fig.1
g(m/s ²)	= acceleration due to gravity (9,81m/sec ²) Note: for horizontal applications $m \cdot g = 0$
h(mm)	= pitch of unit (stroke per shaft revolution)
l(mm)	= length of shaft between centres of bearing brackets
m(kg)	= total mass to be moved, including Drive Nut, connections etc.
M _d (Ncm)	= drive torque
M _o (Ncm)	= idling torque
n (r.p.m.)	= shaft speed
n _{crit} (r.p.m.)	= critical shaft speed
P (kW)	= drive power required
t (s)	= acceleration or braking time
v (m/s)	= max. stroke speed required
C (N)	= dynamic loading of Rolling Rings
P _R (N)	= radial loading of Rolling Rings

1. Side Thrust

$$F = 2 \left(\frac{m \cdot v}{t} + m \cdot g \right) + F_R + F_z$$

A Drive Nut should be selected which has a greater side thrust than the value calculated.

$$F < F_{RS}$$

If the available installation space requires it, the linear drive nuts can also be coupled. With coupled RS, the side thrust is 80 - 90% of the sum of the individual side thrust.

2. Shaft Speed

$$n = \frac{v \cdot 6 \cdot 10^4}{h_{\max}}$$

2.1. Max. theoretical shaft speed

RS 3-08-4	= 10000 min ⁻¹
RS 4-08-4	= 10000 min ⁻¹
RS 3-10-4	= 10000 min ⁻¹
RS 4-10-4	= 10000 min ⁻¹
RS 4-15-4	= 8000 min ⁻¹
RS 4-20-4	= 7000 min ⁻¹
RS 4-25-4	= 6000 min ⁻¹
RS 4-35-4	= 4000 min ⁻¹
RS 4-50-3	= 3400 min ⁻¹
RS 4-60-3	= 2500 min ⁻¹

2.2. Critical Shaft Speed

$$n_{\text{crit}} = 1,225 \cdot 10^8 \frac{d}{l^2}$$

Note:

Depending on its geometrical quality, the shaft can begin to resonate at a value that is 25% lower than that specified above.

If a critical speed range must be passed through to reach the operating speed, shaft vibrations may occur temporarily. This has no effect on the operation of the Drive Nut.

If the operational speed is in the critical speed range, this can be rectified as follows:

1. With a double bearing support at one end:
Increase factor approx. 1,5.
2. With double bearing supports at both ends:
Increase factor approx. 2,2.

The distance between the bearing support brackets should be at least 2.5 x the diameter of the shaft.

3. Drive Torque

$$M_d = \frac{F_{RS} \cdot h}{20 \cdot \pi} + M_o$$

Values for M_o to be taken from the technical detail tables.

4. Shaft Sag

see Diagram Fig. 1

5. Calculation of the operational life of Uhing Rolling Rings

1. Select C	Type	C (N)
RS 8		3200
RS 10		4620
RS 15		5590
RS 20		9560
RS 25		11200
RS 35		15900
RS 50		21600
RS 60		29600

2. Calculate P_R
All RS3-types: $P_R = 5 \cdot F_{RS}^*$
All RS4-types: $P_R = 2,5 \cdot F_{RS}^*$
*F = calculated value of the side thrust according to 2.1 and 2.2 only if increasing of operational life time of the Rolling Rings is really necessary. In case of order it is an absolute must to mention.

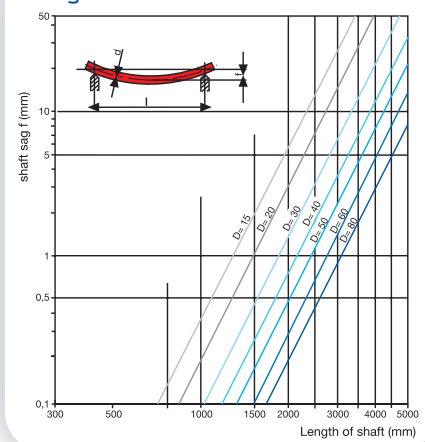
3. Divide C by P_R

4. Calculate the required shaft speed

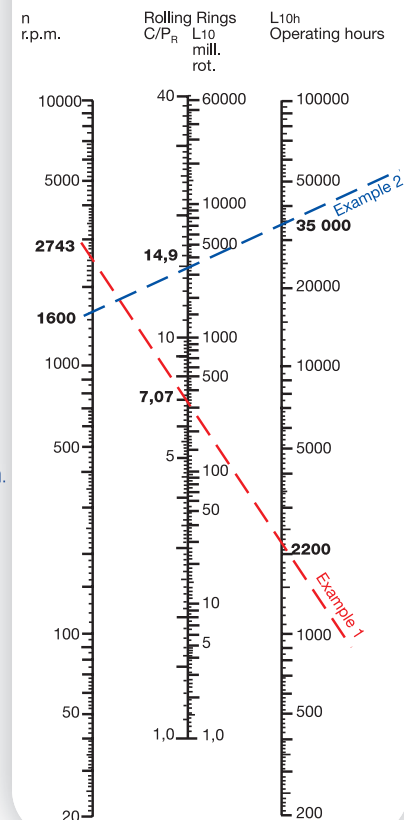
$$n = \frac{v \cdot 6 \cdot 10^4}{h_{\max}}$$

5. Determine the operational life in hours from the nomogram.

Fig. 1



Nomogram



Example 1	Example 2
RS4-35-4R17.5 Speed 0.8 m/sec.	RS4-15-4R7.5 Speed 0.2 m/sec. reduced side thrust 150 N
1. $C = 15,900$	$C = 5,590$
2. $PR = 2.5 \cdot 900 \text{ N} = 2,250 \text{ N}$	$PR = 2.5 \cdot 150 \text{ N} = 375 \text{ N}$
3. $\frac{C}{PR} = \frac{15,900}{2,250} = 7.07$	$\frac{C}{PR} = \frac{5,590}{375} = 14.9$
4. $n = \frac{0.8 \cdot 6 \cdot 10^4}{17.5} = 2,743 \text{ rpm}$	$n = \frac{0.2 \cdot 6 \cdot 10^4}{7.5} = 1,600 \text{ rpm}$
5. $L_{10h} = 2,200$ Hours of operation	$L_{10h} = 35,000$ Hours of operation

Operational Guide

1. Shaft material

1.1. Basic requirements

Uhing linear drives generally require inductively surface-hardened shaft steel that has been ground and finished. Minimum requirements:

- surface hardness: 50 HRC
- tolerance on diameter: h6
- roundness: maximum 50% of the diameter deviation permitted by ISO tolerance h6
- run out tolerance (DIN ISO 1101): $\leq 0,1 \text{ mm/m}$

Please feel free to ask us for a quote for a suitable shaft.

1.2. Uhing Precision Shaft

Standard: Material Cf 53, Mat.-Nr. 1.1213, induction surface hardened, 60-64 HRC

Rust and acid resistant:

Material X 90 CrMoV 18, Mat.-Nr. 1.4112, induction surface hardened, 52-56 HRC

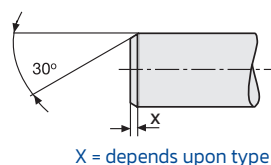
- all ground and superfinished
- surface roughness: mean value (DIN 4768 T.1)
 $Ra \leq 0.35 \mu\text{m}$
- tolerance on diameter: h6
- out of roundness: maximum 50% of the diameter variation permitted by ISO tolerance h6
- true running tolerance (DIN ISO 1101): $\leq 0.1 \text{ mm/m}$

1.3. Uhing precision shafts with enhanced true running tolerance

Same specifications as above, but with a runout tolerance (DIN ISO 1101): $\leq 0.03 \text{ mm/m}$

1.4. Leading end chamfer

The leading end of the shaft should be chamfered to avoid damage to the Rolling Rings when screwing the unit on to the shaft.



2. Pitch

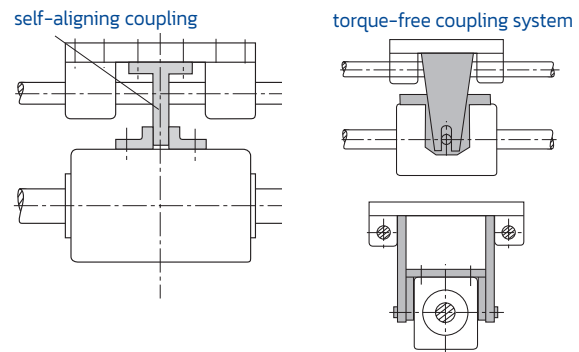
The standard pitch is $0,5 \times d$. This can be ordered for RS as either a right- or a left-handed pitch.

Unless otherwise specified, units having a right-handed pitch will be supplied. For RS subsequent alterations to the pitch are possible with units having a design category -4 reference by changing the associated pitch control wedges.

Non-standard pitches $0,1 - 0,2 - 0,3$ and $0,4 \times d$ are available. In this version reduction of the side thrust is recommended to improve the smooth running.

3. Separately carried loads

If Uhing Linear Drive Nuts are used to move separately carried loads, allowance should be made in the coupling to compensate for any misalignment between the drive shaft and the carriage. The available side thrust will otherwise be affected. If the application so permits, we recommend the use of our twistfree coupling system.



4. Vertical applications

For vertical applications we advise the use of a directly braked motor so as to avoid the possibility of the shaft rotating backwards and the Drive Nut falling due to the high efficiency of the drive.

Depending upon the application (safety considerations and value of the installation) a reserve of side thrust should be built in (using a second Drive Nut).

Note:

With units having a free-movement lever, care must be taken before its operation to ensure that they are unable to drop in an uncontrolled manner – **danger of injury!**

5. Temperature range

Uhing Linear Drive Nuts are suitable for operation at temperatures from -10°C to $+50^\circ\text{C}$.

Please enquire for other temperatures.

6. Maintenance

For the lubrication of the shaft, commercially available MoS₂-free ballbearing greases can be used, e. g. SKF Al-falub LGMT2, Shell Alvania R2 or G2, Esso Beacon 2, BP Energrelse LS2.

The matching shaft grease is also available from us. Please ask us for a quote.

Procedure: Clean the shaft and spread the grease as thinly as possible with a rag.

Frequency: Depends upon application area. We recommend once every ten weeks.

7. Symmetry

The maximum difference in pitch for the two directions of travel is 2 %. We therefore recommend the use of positional sensors for positioning applications.

We reserve the right to make technical alterations. For further information please refer to our Operating Instructions, available on request or in the internet as download: www.uhing.com





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Joachim Uhing GmbH & Co. KG | Konrad-Zuse-Ring 20 | D-24220 Flintbek
Tel. +49 (0) 4347 906-0 | Fax +49 (0) 4347 906-40 | E-Mail: sales@uhing.com | www.uhing.com