YRTC and YRTCMA Rotary Axis Bearings with Absolute Value Angular Measuring System

Increased productivity with very high operational reliability

SCHAEFFLER

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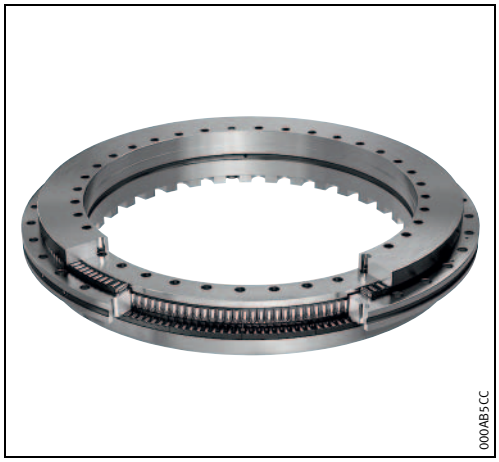

Figure 1: Axial/radial bearing YRTC

With a complete revision of its rotary table bearings, Schaeffler is achieving increased speeds, very high tilting rigidities and very low frictional torques, *Figure 1*.
This offers operators of machine tools new possibilities for achieving increased machining output as well as higher precision.

Comprehensive portfolio of rotary axis bearings

With their extremely high tilting rigidity, the products of the series YRTC are an ideal way of rounding off the Schaeffler portfolio, *Figure 2*.

YRTC bearings now consistently to X-life quality

Schaeffler will in future offer its rotary axis bearings YRTC in X-life quality. Due to the improved surfaces, it has been possible to achieve a further increase in dynamic load carrying capacities.

Expanded range with clear performance increase

With the migration to X-life, the YRTC range introduced into the market so far has been expanded stepwise to include the sizes 100 to 460, which means that a wide X-life range of YRTC rotary axis bearings is now available seamlessly up to size 1030.

YRTC bearings of sizes 100 to 460 are fully interchangeable in geometry and performance characteristics with the YRT bearings available so far.

YRTC to X-life contributes to improvements in machine performance

The size range 100 to 460 has been completely redesigned with the result that the X-life YRTC bearings from Schaeffler are significantly superior to the current performance spectrum of established YRT bearings in relation to rigidity, limiting speed and frictional torque, *Figure 2*.

The technical features of the new X-life YRTC bearings in sizes 100 to 460 comprise the newly developed plastic cage with a special grease reservoir, a heavier section bearing ring and an optimised rolling element geometry. Furthermore, the bearings have excellent axial and radial runout accuracies.

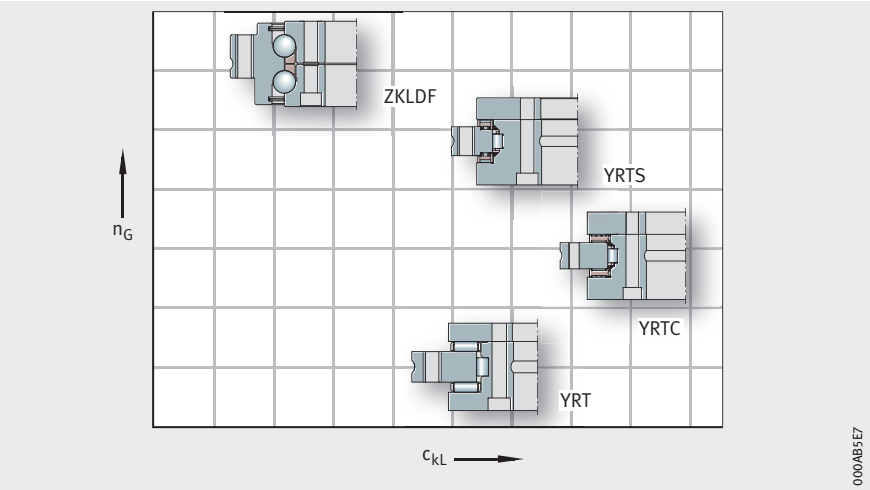

Figure 2: Limiting speed and tilting rigidity

In addition to the extremely high tilting rigidity, the new design of YRTC bearings offers very low, uniform frictional torques and thus higher limiting speeds, see *Table 1*:

- Tilting rigidities have been increased by up to 20%
- Speeds have even been increased by up to 80%

At the same time, friction has been reduced by up to 50%.

With these performance features, the series has now also been awarded the X-life badge of distinction.

The greater machining volumes now achievable, in combination with the smaller frictional energy in continuous operation, make an effective contribution to reducing operating costs (TCO), as well as workpiece costs, together with improved machine performance.

With this combination of characteristics, X-life YRTC bearings are particularly suitable for use in gear hobbing machines as well as in positioning and swivel axes operating under high loads for ultra-precision machining.

YRTCMA with absolute value angular measuring system for machine tools

Optionally, the new X-life YRTC rotary axis bearings are also available with a measuring system integrated in the bearing.

The absolute, inductive measuring system comprises the rotary axis bearing YRTCMA and the separately ordered measuring head, *Figure 3*.

The measuring head is available in the interface designs SSI +1 Vss or EnDat2.2.

Measuring systems integrated in the bearing have significant advantages over conventional solutions.

Advantages of the measuring system integrated in the bearing

The ideal location for mounting a measuring system is directly in the bearing arrangement, which means that higher system accuracies can be achieved with measuring systems integrated in the bearing than with measuring systems that are attached to the axis a significant distance from the relevant bearing arrangement.

The measuring system integrated in the bearing also benefits from the extremely precise radial runout of the precision rotary axis bearing YRTCMA.

Table 1: Performance data of rotary axis bearings YRTC and YRTCMA

Designation	Basic load ratings						Rigidity		Tilting rigidity		Limiting speed	Bearing frictional torque
	axial			radial			axial	radial	Rolling elements	Bearing		
	C_a	C_{0a}	c_{aL}	C_r	C_{0r}	c_{rL}	c_{aL}	c_{rL}	c_{kL}	c_{kL}	n_G	M_r at 5 min^{-1}
	kN	kN	kN/µm	kN	kN	kN/µm	kN/µm	kN/µm	kNm/mrad	kNm/mrad	min^{-1}	Nm
YRTC(MA)200	132	850	15,5	123	275	6,2	4,9	4,1	128	37	450	3
YRTC(MA)260	150	1 090	19	140	355	8,1	6,9	5,3	265	82	300	4
YRTC(MA)325	222	1 900	33	183	530	9,9	7,1	6,3	633	130	200	9
YRTC(MA)395	237	2 190	37	200	640	13	9,9	5,8	1 002	228	150	15
YRTC(MA)460	259	2 550	43	267	880	17	12	6,5	1 543	348	150	21
YRTC(MA)580	577	4 450	41,8	235	730	11,2	11,9	2,9	1 960	735	80	60
YRTC(MA)650	916	6 800	51,4	458	1 300	8 ,2	20,6	7,3	3 554	1 193	70	70
YRTC(MA)850	900	8 500	61,9	520	1 690	12	26,5	11,9	6 772	2 351	50	130
YRTC(MA)1030	1 000	10 300	74,9	577	2 050	14,2	36,4	11,2	11 165	5 400	40	250

The absolute angular measuring system integrated directly in the bearing offers not only system accuracy but further advantages:

- an absolute interface, dispensing with the need for reference travel (leading to increased productivity)
- a hollow shaft design, freeing up the centre of the machine for other components
- the facility for highly dynamic and precise control loops
- savings in terms of design envelope
- simplifications in design and mounting (no setting of the measurement gap)
- maintenance-friendly due to plug and play principle
- resistant to oils, greases and cooling lubricants.

Functional principle of the absolute measuring system integrated in the bearing

The inductive measurement method ABSYS (AMO) is based on contact-free scanning of a structured dimensional scale that is applied directly as a measurement ring to the bearing inner ring, *Figure 4*.

The electronic evaluation system is integrated in the measuring head, so the system can be connected directly to the controller.

Specification and system accuracies, see *Table 2* and *Table 3*. Other designs available by agreement.

The measuring head that is used to scan the dimensional scale, is designed such that it can be screw mounted directly to the stationary bearing outer ring and, without adjustment, has the correct air gap relative to the measurement ring.

The measuring head is easily accessible from outside and can be fitted or replaced without additional adjustment work, *Figure 5*.

Dimensions and characteristics

The absolute value angular measuring system is available in the bearing size range YRTCMA180 to YRTCMA460, with further sizes available by agreement.

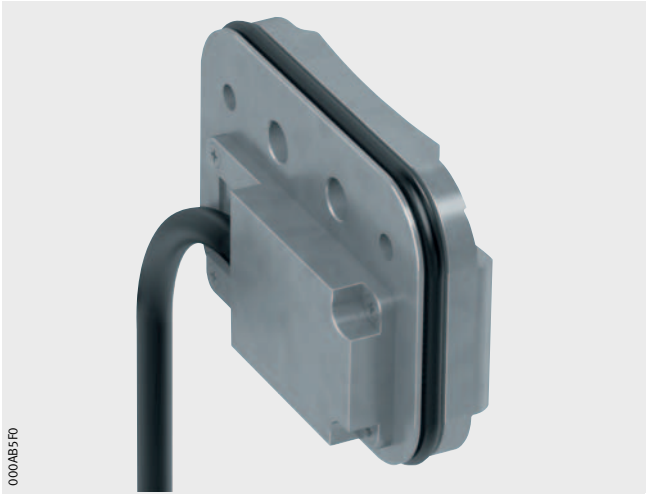

Figure 3: Measuring head suitable for radial screw mounting MHA..-0

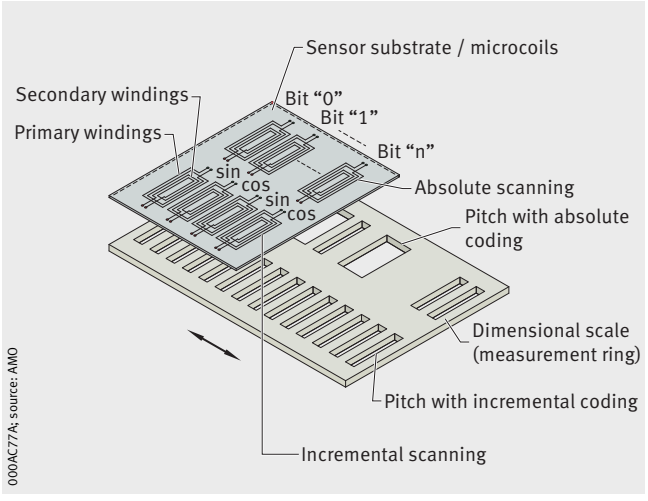

Figure 4: Functional principle of inductive scanning

Tabelle 2: Absolute, inductive angular measuring system for rotary axes

Bearing type	System accuracy of specific measuring device[1)] ±angular seconds
YRTCMA150[2)]	14,5
YRTCMA180	12,7
YRTCMA200	11,3
YRTCMA260	8,9
YRTCMA325	7,5
YRTCMA395	6,4
YRTCMA460	5,5

Basis:
Pitch accuracy of grating (of measuring ring) ±3 µm.
Measuring head interface SSI +1 Vss without analogue signal interpolation.

1) System accuracy: Pitch accuracy of grating (measuring ring).
Positional deviation within a signal period. Mechanical deviation due to the bearing arrangement.
No account is taken of the following: Mechanical deviations due to mounting. Electronic influences and resolution of the positional regulator and controller. Measurement errors in a reference measuring device.

2) Available only by agreement, special type.

Table 3: Integrated electronic measuring system

Data	Specification
Pitch period	1000 µm
Electronic interface	SSI + 1 Vss
	ENDat2.2
Supply voltage	DC 3,6 V to DC 14 V
Power consumption	≈ 1,5 W at DC 5 V
Cable length of measuring head	1 m
Plug connections	M23, 17 pin, pin for SSI + 1 Vss
	M12, 8 pin, pin for EnDat2.2
Working temperature range	–10 °C to +85 °C
Storage temperature range	–20 °C to +85 °C
Rotary table bearing series	YRTCMA180 to YRTCMA460 (optionally up to YRTCMA1030)

Figure 5: Easy-to-mount rotary table assembly with axial/radial bearing YRTCMA, easily accessible measuring head, no adjustment of measurement gap in fitting or replacement

Conclusion

With the new YRTC rotary axis bearing to X-life quality, Schaeffler is offering the opportunity for a significant increase in productivity through reductions in operating and workpiece costs.
When Schaeffler rotary axis bearings from the optimised production portfolio are used, the machine operator can achieve sustained increases in competitiveness through longer operating periods, high speeds and very high machining performance.

The comprehensive portfolio of rotary axis bearings and associated measuring systems ensures that Schaeffler can offer the ideal solution for the specific application.
As a result, the most technically and economically adequate solution is available for each application.

Ordering example, ordering designation

Structure and meaning of designations

The structure of the designations of rotary table bearings and the measuring head is specific to the series.

The designation of the series is followed by indications of the bearing size and finally indications of the design variants and seals, see *Table 4*, *Table 5*, *Figure 6* and *Figure 7*.

Table 4: Structure of designations of rotary table bearings YRTCMA

Components of designation		Possible data
①	Bore diameter	180, 200, 260, 325, 395, 460
②	Pitch accuracy	03 (±3 µm)
③	Pitch periods/360°	0768 (with YRTCMA180) 0860 (with YRTCMA200) 1088 (with YRTCMA260) 1302 (with YRTCMA325) 1530 (with YRTCMA395) 1760 (with YRTCMA460)

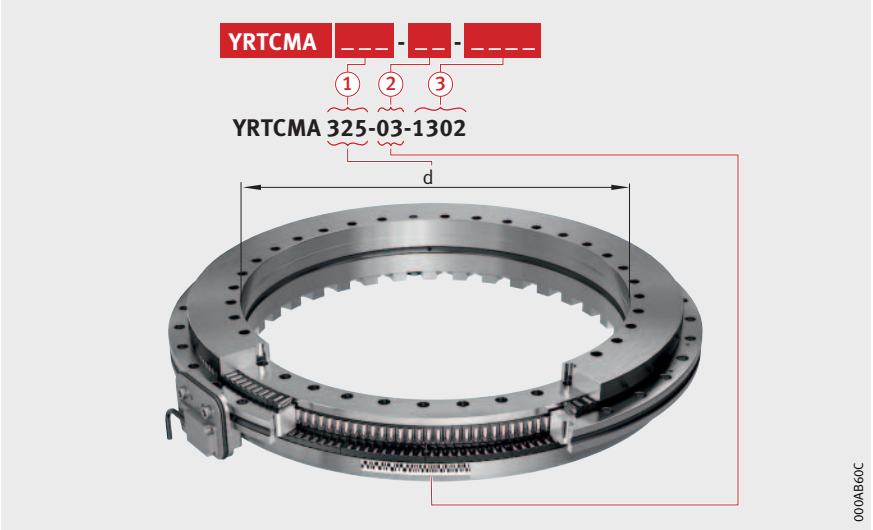

Figure 6: Structure of ordering designations of rotary table bearings YRTCMA

Table 5: Structure of designations of measuring head MHA

Components of designation		Possible data	Description
①	Type	180, 200, 260, 325, 395, 460	Matched to bearing type (bore diameter)
②	Mechanical design	0	radial
		2	axial
③	Electronic interface	0	SSI + 1 Vss
		5	EnDat2.2
④	Absolute resolution per pitch period	1	10 bit (SSI)
		3	14 bit (EnDat2.2)
⑤	Maximum output frequency	4	20 kHz (standard)
⑥	Analogue interpolation factor (for SSI)	0	1 Vss
		N	EnDat2.2
⑦	Pitch periods/360°	0768 0860 1088 1302 1530 1760	with MHA180 with MHA200 with MHA260 with MHA325 with MHA395 with MHA460
⑧	Cable length in m	01,0	Standard
⑨	Plug	7	Plug M23, 17 pin, pin for SSI+1 VSS
		8	Plug M12, 8 pin, pin for EnDat2.2
⑩	Direction of cable connection	1	Left (standard)
⑪	Circuit version	A	PoSi6

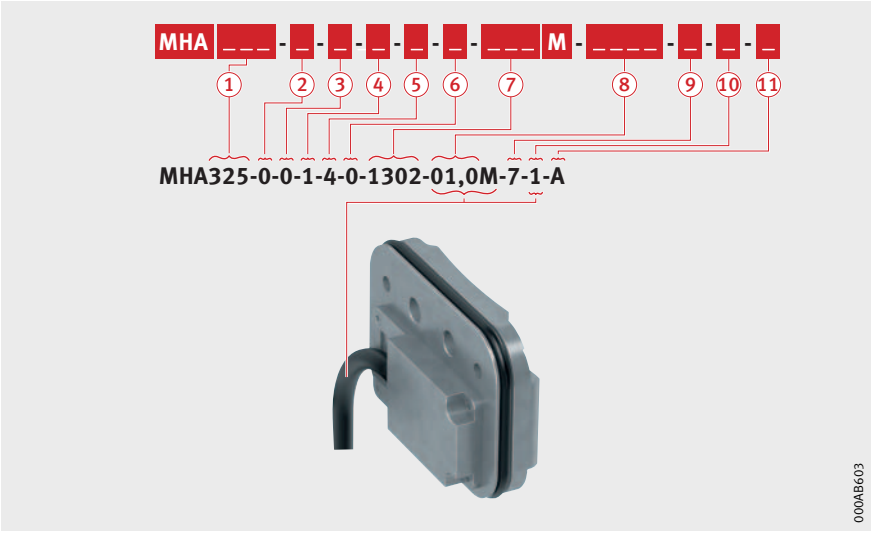

Figure 7: Structure of ordering designations of measuring head MHA

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Schaeffler Technologies AG & Co. KG

Georg-Schäfer-Straße 30
97421 Schweinfurt
Germany
Internet www.schaeffler.de/en
E-mail faginfo@schaeffler.com

In Germany:
Phone 0180 5003872
Telefax 0180 5003873

From other countries:
Phone +49 9721 91-0
Fax +49 9721 91-3435

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