Data sheet
L-9517-9318-07-A

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REXM20 ultra-high accuracy angle encoder

With zero coupling losses and exceptional repeatability, the REXM20 ultra-high accuracy angle encoder achieves better than ±1 arc second total installed accuracy.

Like the RESM20 encoder, the REXM20 is a stainless steel ring with the scale graduations marked axially onto the periphery, but with a number of differences to improve upon RESM20's already impressive accuracy.

REXM20 has a thicker cross-section, to ensure that the only significant installation error is eccentricity. Eccentricity is easily removed using two readheads, either with Renishaw's DSi (Dual Signal interface), or by combining the signals inside the host controller. The only errors remaining are graduation errors and readhead SDE, both of which are so small they are often negligible.

As a non-contact encoder, REXM20 offers dynamic performance advantages, eliminating coupling losses, oscillation, shaft torsion and other hysteresis errors that plague enclosed encoders.

Combining two readheads is easy with the DSi, which also offers an angularly repeatable reference position (*propoZ*™) which is unaffected by bearing wander or power cycling.

REXM20 total installed accuracy grades:

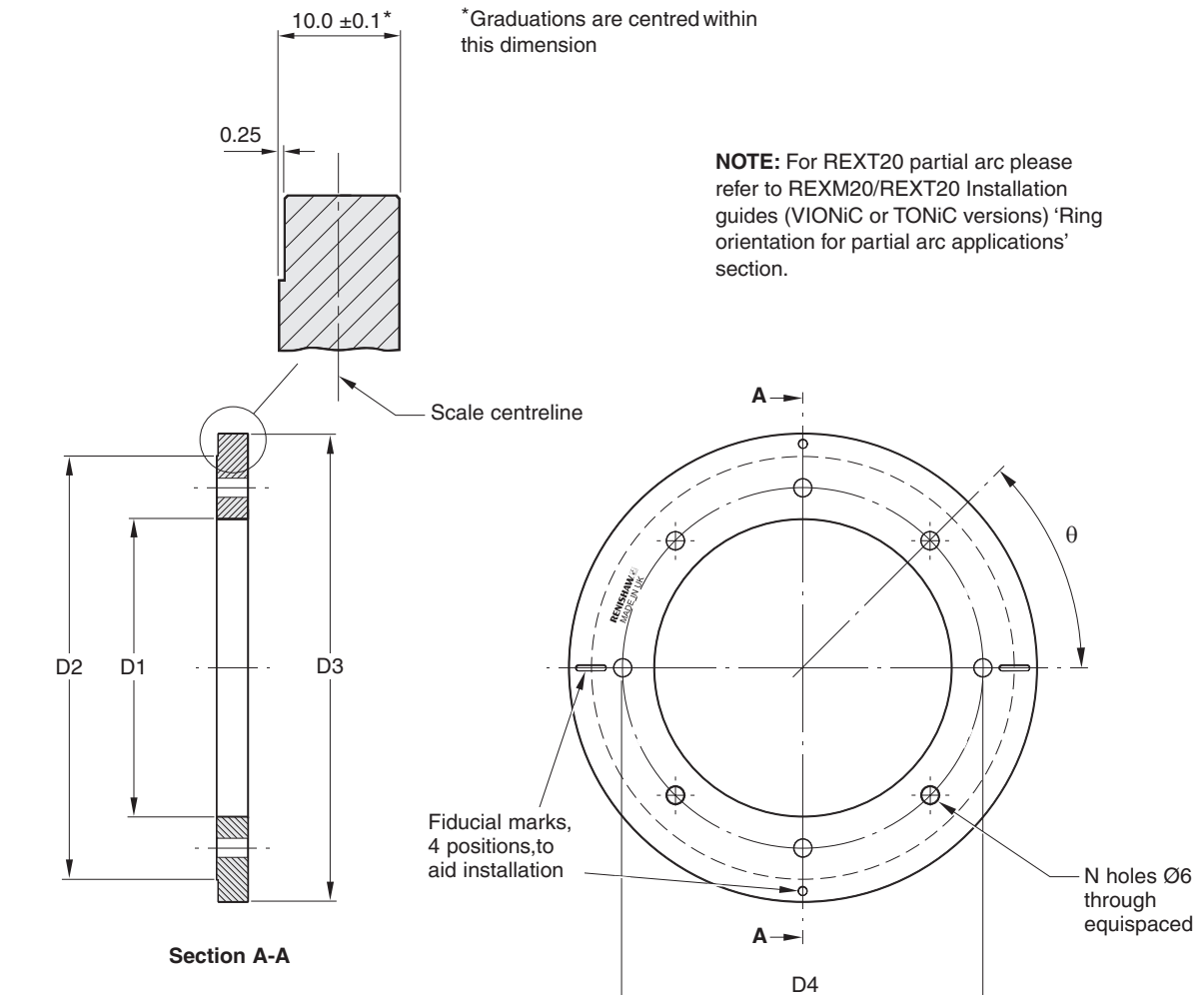
Ring diameter	Total installed accuracy
≥ 100 mm	±1 arc second
75 mm	±1.5 arc second
≤ 57 mm	±2 arc second

Designed for axes that are limited to partial rotation, REXT20 rings have two reference marks, oriented diametrically opposed, for use with partial arc versions of DSi. DSi processes these reference marks to give a single, angularly-repeatable *propoZ* reference output.

- **Use with two VIONiC™ or TONiC™ encoders, combined with DSi to give ultra-high accuracy**
- **Installed accuracy to ±1 arc second with dual readheads**
- **Wide range of standard sizes from 52 mm to 417 mm**
- **Large internal diameter for ease of integration**
- **Flange mounted with easy 4-point adjustment method**
- **Angularly repeatable *propoZ* reference position is unaffected by bearing wander or power cycling**

Installation drawing

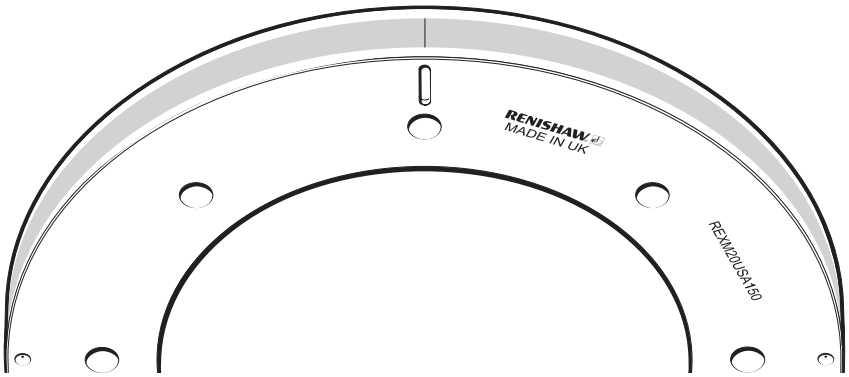
Dimensions and tolerances in mm



Nominal external diameter (mm)	Line count	Dimensions			Mounting holes		
		D1	D2	D3	N	D4	θ
52*	8 192	26	50	52.1 – 52.2	4	38	90°
57*	9 000	26	50	57.25 – 57.35	4	38	90°
75	11 840	40.5	64.5	75.3 – 75.4	8	52.5	45°
100	15 744	57.5	97.5	100.2 – 100.3	8	77.5	45°
103	16 200	57.5	97.5	103.0 – 103.2	8	77.5	45°
104	16 384	57.5	97.5	104.2 – 104.4	8	77.5	45°
115	18 000	68	108	114.5 – 114.7	8	88	45°
150	23 600	96	136	150.2 – 150.4	8	116	45°
183	28 800	122.5	162.5	183.2 – 183.4	12	142.5	30°
200	31 488	136	176	200.3 – 200.5	12	156	30°
206	32 400	140.5	180.5	206.1 – 206.5	12	160.5	30°
209	32 768	140.5	180.5	208.4 – 208.8	12	160.5	30°
229	36 000	160.5	200.5	229.0 – 229.4	12	180.5	30°
255	40 000	180.5	220.5	254.4 – 254.8	12	200.5	30°
300	47 200	216	256	300.4 – 300.6	12	236	30°
350	55 040	256	296	350.3 – 350.5	16	276	22.5°
417	65 536	305	345	417.0 – 417.4	16	325	22.5°

*52 mm and 57 mm rings have dimple fiducial features and no slots.

Reference mark position



REXM20

IN-TRAC™ reference mark is embedded in the scale, radially aligned to the line fiducial mark to the left of the 'Renishaw' logo. No external actuators or physical adjustment are required.

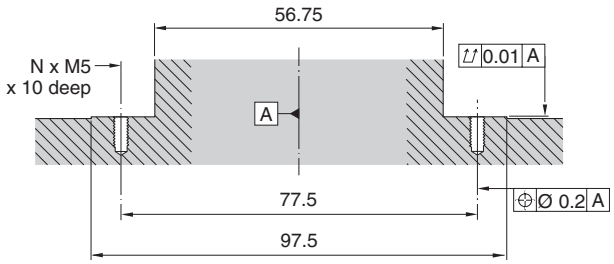
REXT20

The second reference mark is 180° from the first.

Mounting method (IMPORTANT: flange mount only. DO NOT interference fit)

Mounting surface preparation

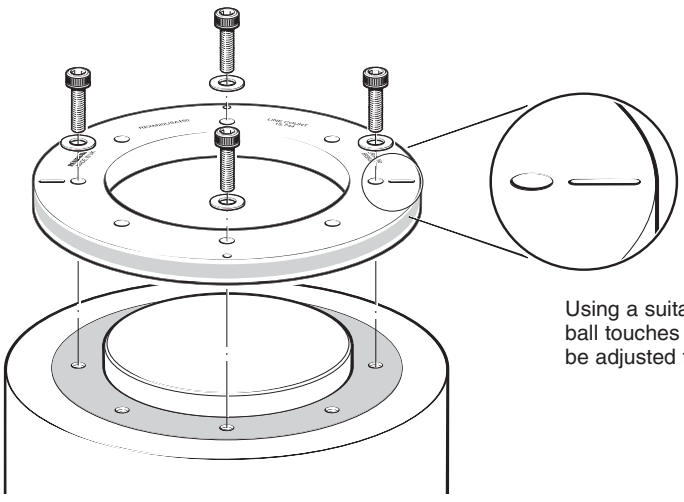
The mounting surface should have an axial run-out of 10 µm. This tolerance only needs to be held over the region where the flat surface of the ring mates to the mounting surface.



For other ring sizes refer to the VIONiC REXM20/REXT20 installation guide (M-6195-9239) or TONiC REXM20/REXT20 installation guide (M-9653-9248), which can be found on **www.renishaw.com/support**

Example of mounting surface for 100 mm REXM20

Installation technique (Please refer to the REXM20/REXT20 installation guide for full details)



REXM20 rings are made with 4 fiducial points engraved onto the top surface, which simplify alignment.

Using a suitable dial test indicator, positioned so that the stylus ball touches directly onto the scale surface, the ring only needs to be adjusted for run-out at the 4 fiducial points.

Operating specifications

Material	303/304 stainless steel		
Coefficient of thermal expansion (at 20 °C)	15.5 ±0.5 µm/m/°C		
Temperature	Storage	System	–20 °C to +70 °C
	Operating	VIONiC and TONiC	0 °C to + 70 °C

Ring mass and inertia

Ring diameter (mm)	52	57	75	100	103	104	115	150	183
Mass (kg)	0.13	0.17	0.26	0.43	0.47	0.48	0.54	0.85	1.18
Inertia (kg cm²)	0.55	0.82	2.3	7.2	8.1	8.5	12	34	71

Ring diameter (mm)	200	206	209	229	255	300	350	417
Mass (kg)	1.37	1.44	1.50	1.69	2.03	2.74	3.59	5.09
Inertia (kg cm²)	100	113	120	165	250	470	845	1700

Accuracy

The total installed accuracy of the REXM20 rings when used with two VIONiC or TONiC encoders, with the ring flange mounted onto a shaft surface prepared to the specifications detailed in the REXM20/REXT20 installation guide, centred so that the radial run-out at the fiducial points agrees to within 10 µm TIR, will be as follows:

Nominal external diameter (mm)	Total installed accuracy (arc second)
52	±2
57	±2
75	±1.5
100	±1
103	±1
104	±1
115	±1
150	±1
183	±1
200	±1
206	±1
209	±1
229	±1
255	±1
300	±1
350	±1
417	±1

NOTE: The figures in this table refer to 'total installed accuracy', not to be confused with 'system accuracy'. Total installed accuracy includes graduation errors, readhead sub-divisional errors, installation errors and errors caused by bearing wander.

Maximum speed (rev/min)

For details of maximum speeds for other clocked options, please contact your local representative.

VIONiC system: For 20 MHz clocked option

Nominal external diameter (mm)	Line count	Output resolution											
		5 µm	1 µm	0.5 µm	0.2 µm	0.1 µm	50 nm	40 nm	25 nm	20 nm	10 nm	5 nm	2.5 nm
52	8 192	4 395	4 395	2 950	1 180	590	295	236	148	118	59	30	15
57	9 000	4 000	4 000	2 686	1 074	537	269	215	134	107	54	27	13
75	11 840	3 041	3 041	2 041	817	408	204	163	102	82	41	20	10
100	15 744	2 287	2 287	1 535	614	307	154	123	77	61	31	15	7.7
103	16 200	2 222	2 222	1 492	597	298	149	119	75	60	30	15	7.5
104	16 384	2 197	2 197	1 475	590	295	148	118	74	59	30	15	7.4
115	18 000	2 000	2 000	1 343	537	269	134	107	67	54	27	13	6.7
150	23 600	1 525	1 525	1 024	410	205	102	82	51	41	20	10	5.1
183	28 800	1 250	1 250	839	336	168	84	67	42	34	17	8.4	4.2
200	31 488	1 143	1 143	768	307	154	77	61	38	31	15	7.7	3.8
206	32 400	1 111	1 111	746	298	149	75	60	37	30	15	7.5	3.7
209	32 768	1 099	1 099	738	295	148	74	59	37	30	15	7.4	3.7
229	36 000	1 000	1 000	671	269	134	67	54	34	27	13	6.7	3.4
255	40 000	900	900	604	242	121	60	48	30	24	12	6.0	3.0
300	47 200	763	763	512	205	102	51	41	26	20	10	5.1	2.6
350	55 040	654	654	439	176	88	44	35	22	18	8.8	4.4	2.2
417	65 536	549	549	369	148	74	37	30	18	15	7.4	3.7	1.8

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Maximum speed (rev/min)

For details of maximum speeds for other clocked options, please contact your local representative.

TONiC system: For 20 MHz clocked option

Nominal external diameter (mm)	Line count	Output resolution											Analogue*
		Ti0004 5 µm	Ti0020 1 µm	Ti0040 0.5 µm	Ti0100 0.2 µm	Ti0200 0.1 µm	Ti0400 50 nm	Ti1000 20 nm	Ti2000 10 nm	Ti4000 5 nm	Ti10KD 2 nm	Ti20KD 1 nm	Ti0000
52	8 192	3 673	3 673	2 479	992	496	246	99	50	25	10	4.8	3 673
57	9 000	3 350	3 350	2 261	904	452	224	90	45	23	9.0	4.4	3 350
75	11 840	2 546	2 546	1 719	688	344	171	69	34	17	6.9	3.3	2 546
100	15 744	1 910	1 910	1 289	516	258	128	52	26	13	5.2	2.5	1 910
103	16 200	1 854	1 854	1 251	501	250	124	50	25	12	5.0	2.4	1 854
104	16 384	1 836	1 836	1 239	496	248	123	50	25	12	5.0	2.4	1 836
115	18 000	1 661	1 661	1 121	448	224	111	45	22	11	4.5	2.2	1 661
150	23 600	1 273	1 273	859	344	172	85	34	17	8.6	3.4	1.7	1 273
183	28 800	1 044	1044	705	282	141	70	28	14	7.0	2.8	1.4	1 044
200	31 488	955	955	645	258	129	64	26	13	6.4	2.6	1.2	955
206	32 400	927	927	626	250	125	62	25	12	6.2	2.5	1.2	927
209	32 768	914	914	617	247	123	61	25	12	6.2	2.5	1.2	914
229	36 000	834	834	563	225	113	56	22	11	5.6	2.3	1.1	834
255	40 000	749	749	506	202	101	50	20	10	5.0	2.0	1.0	749
300	47 200	637	637	430	172	86	43	17	8.6	4.3	1.7	0.8	637
350	55 040	546	546	369	147	74	37	15	7.4	3.7	1.5	0.7	546
417	65 536	458	458	309	124	62	31	12	6.2	3.1	1.2	0.6	458

*Currently Renishaw do not offer an analogue Dual Head summing box: customer would have to do their own summing.

Resolution – VIONiC

The REXM20 offers a range of standard ring diameters, as well as sizes that offer line counts that provide 2^n counts per revolution or resolutions that are precise sub-divisions of degrees or arc seconds.

NOTE: 1 arc second resolution = 1.296×10^6 counts per revolution ≈ 2.778×10^{-4} degree resolution.

	Nominal external diameter (line count)	Digital resolution (interpolation factor)											
		5 µm (×4)	1 µm (×20)	0.5 µm (×40)	0.2 µm (×100)	0.1 µm (×200)	50 nm (×400)	40 nm (×500)	25 nm (×800)	20 nm (×1 000)	10 nm (×2 000)	5 nm (×4 000)	2.5 nm (×8 000)
Standard outside diameters	75 mm (11 840)	≈ 27.4"	≈ 5.47"	≈ 2.74"	≈ 1.1"	≈ 0.55"	≈ 0.27"	≈ 0.22"	≈ 0.14"	≈ 0.11"	≈ 0.055"	≈ 0.028"	≈ 0.014"
	100 mm (15 744)	≈ 20.6"	≈ 4.12"	≈ 2.06"	≈ 0.82"	≈ 0.41"	≈ 0.21"	≈ 0.16"	≈ 0.010"	≈ 0.082"	≈ 0.041"	≈ 0.021"	≈ 0.010"
	150 mm (23 600)	≈ 13.7"	≈ 2.75"	≈ 1.37"	≈ 0.55"	≈ 0.27"	≈ 0.14"	≈ 0.11"	≈ 0.07"	≈ 0.055"	≈ 0.028"	≈ 0.014"	≈ 0.007"
	183 mm (28 800)	≈ 11.3"	≈ 2.25"	≈ 1.13"	≈ 0.45"	≈ 0.23"	≈ 0.11"	≈ 0.090"	≈ 0.056"	≈ 0.045"	≈ 0.023"	≈ 0.011"	≈ 0.0056"
	200 mm (31 488)	≈ 10.3"	≈ 2.06"	≈ 1.03"	≈ 0.41"	≈ 0.21"	≈ 0.1"	≈ 0.08"	≈ 0.05"	≈ 0.041"	≈ 0.021"	≈ 0.010"	≈ 0.005"
	255 mm† (40 000)	≈ 8.1"	≈ 1.62"	≈ 0.81"	≈ 0.32"	≈ 0.16"	≈ 0.081"	≈ 0.06"	≈ 0.04"	≈ 0.032"	≈ 0.016"	≈ 0.0081"	≈ 0.004"
	300 mm (47 200)	≈ 6.9"	≈ 1.37"	≈ 0.69"	≈ 0.27"	≈ 0.14"	≈ 0.069"	≈ 0.05"	≈ 0.03"	≈ 0.027"	≈ 0.014"	≈ 0.0069"	≈ 0.003"
	350 mm (55 040)	≈ 5.9"	≈ 1.18"	≈ 0.59"	≈ 0.24"	≈ 0.12"	≈ 0.059"	≈ 0.05"	≈ 0.03"	≈ 0.024"	≈ 0.012"	≈ 0.0059"	≈ 0.003"
2^n line count	52 mm (8 192)	≈ 39.6"	≈ 7.9"	≈ 3.96"	≈ 1.58"	≈ 0.79"	≈ 0.4"	≈ 0.32"	≈ 0.20"	≈ 0.16"	≈ 0.079"	≈ 0.040"	≈ 0.020"
	104 mm (16 384)	≈ 19.8"	≈ 3.96"	≈ 1.98"	≈ 0.79"	≈ 0.4"	≈ 0.2"	≈ 0.16"	≈ 0.010"	≈ 0.08"	≈ 0.040"	≈ 0.020"	≈ 0.010"
	209 mm (32 768)	≈ 9.89"	≈ 1.98"	≈ 0.99"	≈ 0.4"	≈ 0.2"	≈ 0.1"	≈ 0.8"	≈ 0.05"	≈ 0.04"	≈ 0.02"	≈ 0.0099"	≈ 0.005"
	417 mm (65 536)	≈ 4.9"	≈ 0.99"	≈ 0.49"	≈ 0.2"	≈ 0.1"	≈ 0.05"	≈ 0.04"	≈ 0.02"	≈ 0.02"	≈ 0.0099"	≈ 0.0049"	≈ 0.002"
Subdivisions of degrees	57 mm (9 000)	0.01°	0.002°	0.001°	0.0004°	0.0002°	0.0001°	0.00008°	0.00005°	0.00004°	0.00002°	0.00001°	0.000005°
	115 mm (18 000)	0.005°	0.001°	0.0005°	0.0002°	0.0001°	0.00005°	0.00004°	0.00003°	0.00002°	0.00001°	0.000005°	0.000003°
	229 mm (36 000)	0.0025°	0.0005°	0.00025°	0.0001°	0.00005°	0.000025°	0.00002°	0.00001°	0.00001°	0.000005°	0.0000025°	0.000001°
Subdivisions of arc second	103 mm (16 200)	20"	4"	2"	0.8"	0.4"	0.2"	0.16"	0.10"	0.08"	0.040"	0.020"	0.010"
	206 mm (32 400)	10"	2"	1"	0.4"	0.2"	0.1"	0.08"	0.05"	0.04"	0.020"	0.010"	0.0050"

†Line count as a multiple of 1000.

NOTE: The symbol " indicates units of arc seconds.

NOTE: Numbers preceded with a ≈ symbol show rounded resolution values. To calculate the exact resolution in arc seconds, use the following equation:

$$\theta \text{ (arc seconds)} \quad \frac{1.296 \times 10^6}{[\text{Line count}] \times [\text{Interpolation factor}]}$$

Resolution – TONiC

The REXM20 offers a range of standard ring diameters, as well as sizes that offer line counts that provide 2^n counts per revolution or resolutions that are precise sub-divisions of degrees or arc seconds.

NOTE: 1 arc second resolution = 1.296×10^6 counts per revolution ≈ 2.778×10^{-4} degree resolution.

	Nominal external diameter (line count)	Digital resolution (interpolation factor)										
		5 µm (×4)	1 µm (×20)	0.5 µm (×40)	0.2 µm (×100)	0.1 µm (×200)	50 nm (×400)	20 nm (×1 000)	10 nm (×2 000)	5 nm (×4 000)	2 nm (×10 000)	1 nm (×20 000)
Standard outside diameters	75 mm (11 840)	≈ 27.4"	≈ 5.47"	≈ 2.74"	≈ 1.1"	≈ 0.55"	≈ 0.27"	≈ 0.11"	≈ 0.055"	≈ 0.028"	≈ 0.011"	≈ 0.0055"
	100 mm (15 744)	≈ 20.6"	≈ 4.12"	≈ 2.06"	≈ 0.82"	≈ 0.41"	≈ 0.21"	≈ 0.082"	≈ 0.041"	≈ 0.021"	≈ 0.0082"	≈ 0.0041"
	150 mm (23 600)	≈ 13.7"	≈ 2.75"	≈ 1.37"	≈ 0.55"	≈ 0.27"	≈ 0.14"	≈ 0.055"	≈ 0.028"	≈ 0.014"	≈ 0.0055"	≈ 0.0027"
	183 mm (28 800)	≈ 11.2"	≈ 2.25"	≈ 1.13"	≈ 0.45"	≈ 0.23"	≈ 0.11"	≈ 0.045"	≈ 0.023"	≈ 0.011"	≈ 0.045"	≈ 0.023"
	200 mm (31 488)	≈ 10.3"	≈ 2.06"	≈ 1.03"	≈ 0.41"	≈ 0.21"	≈ 0.1"	≈ 0.041"	≈ 0.021"	≈ 0.010"	≈ 0.0041"	≈ 0.0020"
	255 mm† (40 000)	≈ 8.1"	≈ 1.62"	≈ 0.81"	≈ 0.32"	≈ 0.16"	≈ 0.081"	≈ 0.032"	≈ 0.016"	≈ 0.0081"	≈ 0.0032"	≈ 0.0016"
	300 mm (47 200)	≈ 6.9"	≈ 1.37"	≈ 0.69"	≈ 0.27"	≈ 0.14"	≈ 0.069"	≈ 0.027"	≈ 0.014"	≈ 0.0069"	≈ 0.0027"	≈ 0.0014"
	350 mm (55 040)	≈ 5.9"	≈ 1.18"	≈ 0.59"	≈ 0.24"	≈ 0.12"	≈ 0.059"	≈ 0.024"	≈ 0.012"	≈ 0.0059"	≈ 0.0024"	≈ 0.0012"
2^n line count	52 mm (8 192)	≈ 39.6"	≈ 7.9"	≈ 3.96"	≈ 1.58"	≈ 0.79"	≈ 0.4"	≈ 0.16"	≈ 0.079"	≈ 0.040"	≈ 0.016"	≈ 0.0079"
	104 mm (16 384)	≈ 19.8"	≈ 3.96"	≈ 1.98"	≈ 0.79"	≈ 0.4"	≈ 0.2"	≈ 0.08"	≈ 0.040"	≈ 0.020"	≈ 0.0080"	≈ 0.0040"
	209 mm (32 768)	≈ 9.89"	≈ 1.98"	≈ 0.99"	≈ 0.4"	≈ 0.2"	≈ 0.1"	≈ 0.04"	≈ 0.02"	≈ 0.0099"	≈ 0.0040"	≈ 0.0020"
	417 mm (65 536)	≈ 4.9"	≈ 0.99"	≈ 0.49"	≈ 0.2"	≈ 0.1"	≈ 0.05"	≈ 0.02"	≈ 0.0099"	≈ 0.0049"	≈ 0.0020"	≈ 0.00099"
Subdivisions of degrees	57 mm (9 000)	0.01°	0.002°	0.001°	0.0004°	0.0002°	0.0001°	0.00004°	0.00002°	0.00001°	0.000004°	0.000002°
	115 mm (18 000)	0.005°	0.001°	0.0005°	0.0002°	0.0001°	0.00005°	0.00002°	0.00001°	0.000005°	0.000002°	0.000001°
	229 mm (36 000)	0.0025°	0.0005°	0.00025°	0.0001°	0.00005°	0.000025°	0.00001°	0.000005°	0.0000025°	0.000001°	0.0000005°
Subdivisions of arc second	103 mm (16 200)	20"	4"	2"	0.8"	0.4"	0.2"	0.08"	0.040"	0.020"	0.0080"	0.0040"
	206 mm (32 400)	10"	2"	1"	0.4"	0.2"	0.1"	0.04"	0.020"	0.010"	0.0040"	0.0020"

† Line count as a multiple of 1 000.

NOTE: The symbol " indicates units of arc seconds.

NOTE: Numbers preceded with a ≈ symbol show rounded resolution values. To calculate the exact resolution in arc seconds, use the following equation:

$$\theta \text{ (arc seconds)} \quad \frac{1.296 \times 10^6}{[\text{Line count}] \times [\text{Interpolation factor}]}$$

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RENISHAW
apply innovation™

REXM20 ultra high accuracy angle encoder part numbers

REXM 20U S A 183

High accuracy angle encoder series

REXM20 – Single reference mark for axes capable of full rotation

REXT20 – Two reference marks for partial-rotation axes

Pitch

20U – 20 µm

Material

S – Stainless steel

Form

A – Standard section

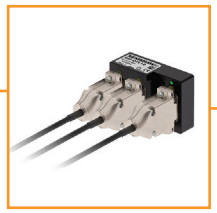
Diameter

052 – 52 mm
057 – 57 mm
075 – 75 mm
100 – 100 mm
103 – 103 mm
104 – 104 mm
115 – 115 mm
150 – 150 mm
183 – 183 mm
200 – 200 mm
209 – 209 mm
229 – 229 mm
255 – 255 mm
300 – 300 mm
350 – 350 mm
413 – 413 mm
417 – 417 mm

REXM20 compatible readheads

REXM20

VIONiC DSi



VIONiC

TONiC DSi

TONiC

For worldwide contact details, visit www.renishaw.com/contact

L-9517-9318-07

Part no.: L-9517-9318-07-A
Issued: 03.2019