Installation guide
M-6195-9218-03-C

RENISHAW
apply innovation™

VIONiC™ RESM20/REST20 angle encoder system

Contents

Legal notices

Copyright

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Patents

Features of Renishaw's encoder systems and similar products are the subjects of the following patents and patent applications:

EP1173731	IL146001	JP4750998	US6775008	CN100543424
EP1766334	JP4932706	US7659992	CN100507454	JP5386081
US7550710	CN101300463	EP1946048	JP5017275	US7624513
CN101310165	EP1957943	US7839296	EP1094302	IL138995
JP5442174	US6481115	CN1293983	GB2397040	JP4813018
US7723639	JP4423196	US7367128	CN1314511	EP1469969
JP5002559	US8987633	US8466943		

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Renishaw warrants its equipment and software for a limited period (as set out in the Standard Terms and Conditions), provided that they are installed and used exactly as defined in associated Renishaw documentation. You should consult these Standard Terms and Conditions to find out the full details of your warranty.

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Product compliance

Renishaw plc declares that the VIONiC™ encoder system complies with the applicable standards and regulations. A copy of the EU declaration of conformity is available from our website at **www.renishaw.com/productcompliance**

Compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The user is cautioned that any changes or modifications not expressly approved by Renishaw plc or authorised representative could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

NOTE: This unit was tested with shielded cables on the peripheral devices. Shielded cables must be used with the unit to ensure compliance.

Further information

Further information relating to the VIONiC encoder range can be found in the *VIONiC series encoder system* data sheet (Renishaw part no. L-9517-9678), *Advanced Diagnostic Tool ADTi-100* data sheet (Renishaw part no. L-9517-9699), *Advanced Diagnostic Tool ADTi-100 and ADT View software* quick-start guide (Renishaw part no. M-6195-9321), and the *Advanced Diagnostic Tool ADTi-100 and ADT View software* user guide (Renishaw part no. M-6195-9413). These can be downloaded from our website **www.renishaw.com/vionicdownloads** and are also available from your local Renishaw representative.

Legal notices (Continued)

Packaging

The packaging of our products contains the following materials and can be recycled.

Packaging Component	Material	ISO 11469	Recycling Guidance
Outer box	Cardboard	Not applicable	Recyclable
	Polypropylene	PP	Recyclable
Inserts	Low density polyethylene foam	LDPE	Recyclable
	Cardboard	Not applicable	Recyclable
Bags	High density polyethylene bag	HDPE	Recyclable
	Metalised polyethylene	PE	Recyclable

REACH regulation

Information required by Article 33(1) of Regulation (EC) No. 1907/2006 (“REACH”) relating to products containing substances of very high concern (SVHCs) is available at **www.renishaw.com/REACH**

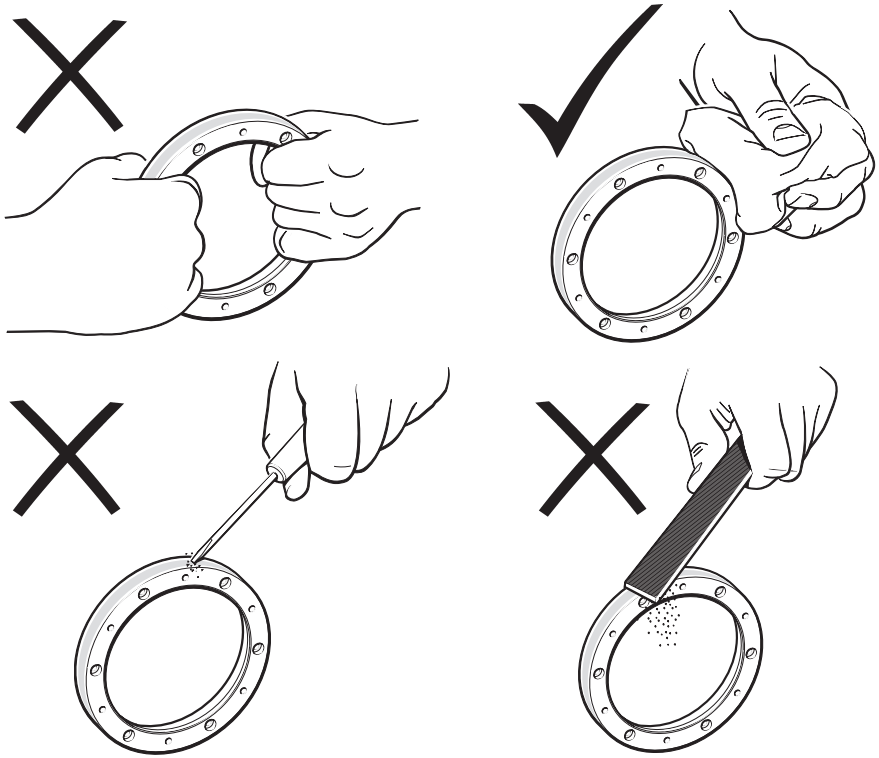
WEEE recycling guidelines

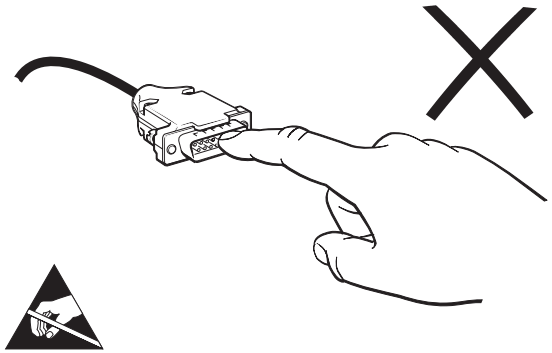
The use of this symbol on Renishaw products and/or accompanying documentation indicates that the product should not be mixed with general household waste upon disposal. It is the responsibility of the end user to dispose of this product at a designated collection point for waste electrical and electronic equipment (WEEE) to enable reuse or recycling. Correct disposal of this product will help to save valuable resources and prevent potential negative effects on the environment. For more information, please contact your local waste disposal service or Renishaw distributor.

Storage and handling

RESM20 and REST20 are non-contact optical encoders that provide good immunity against contaminants such as dust, fingerprints and light oils.

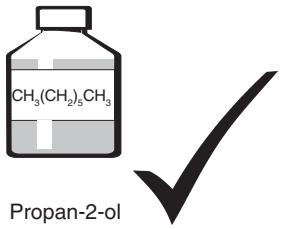
However, in harsh environments such as machine tool applications, protection should be provided to prevent ingress of coolant or oil.





Ring and readhead

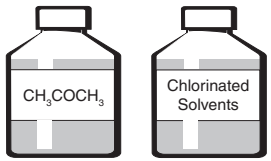
N-heptane

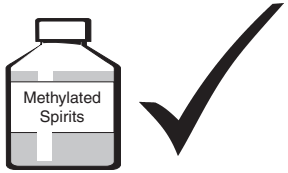


Propan-2-ol

Ring only

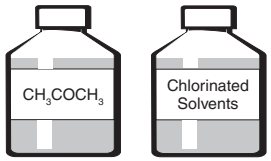
Acetone



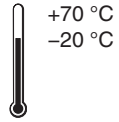


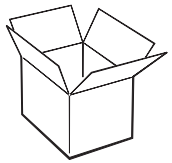
Readhead only

Acetone

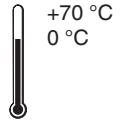


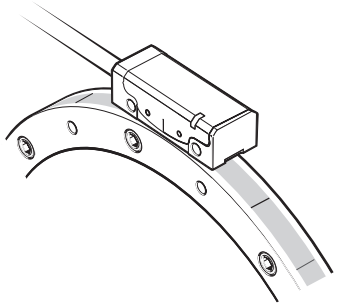
Storage



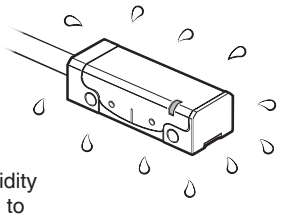


Operating

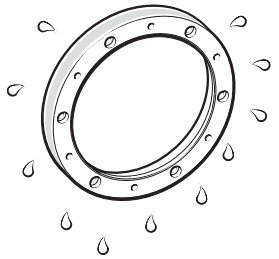




Humidity



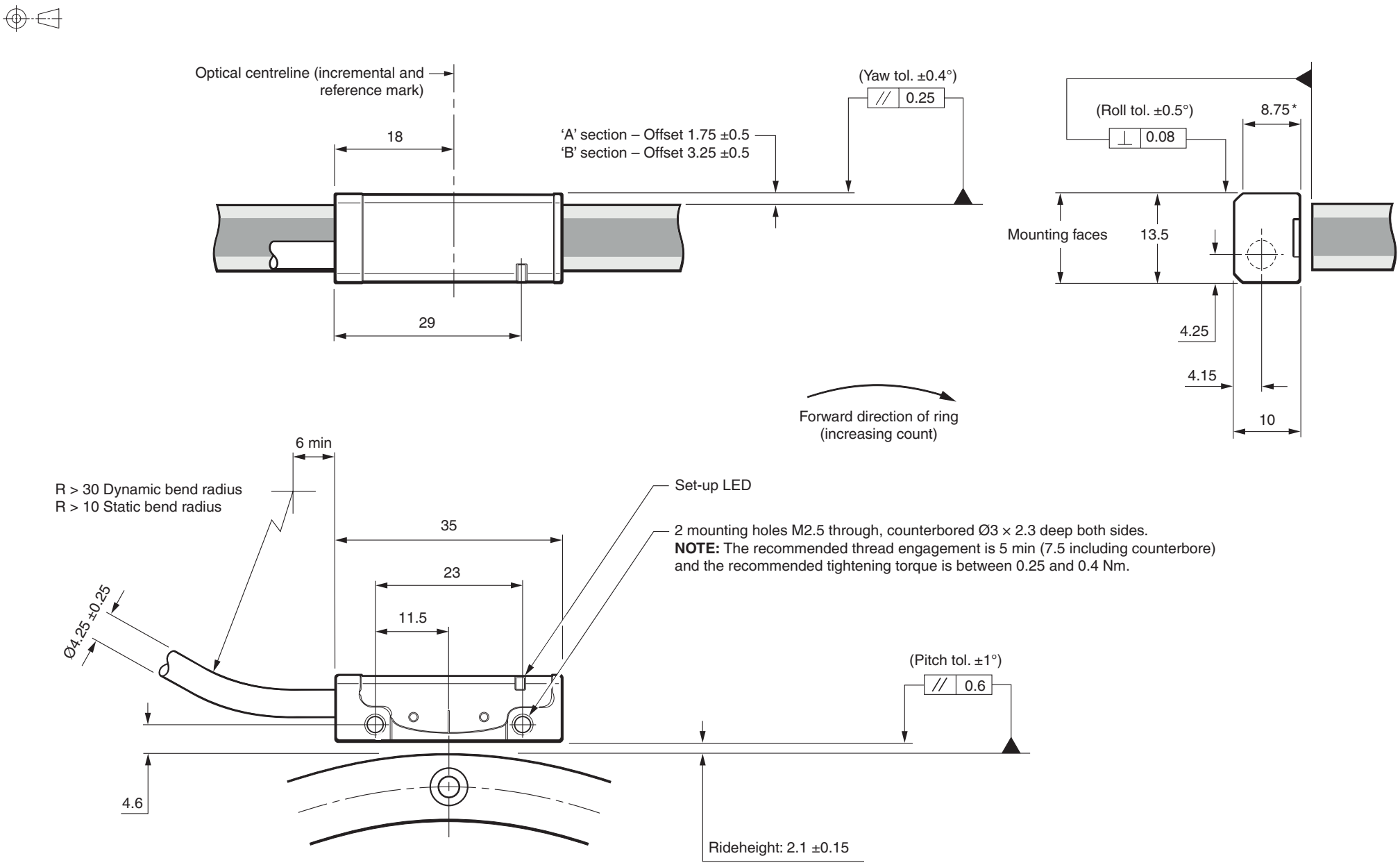
95% relative humidity (non-condensing) to IEC 60068-2-78



VIONiC readhead installation drawing

(RESM20 ‘A’ section ring shown)

Dimensions and tolerances in mm

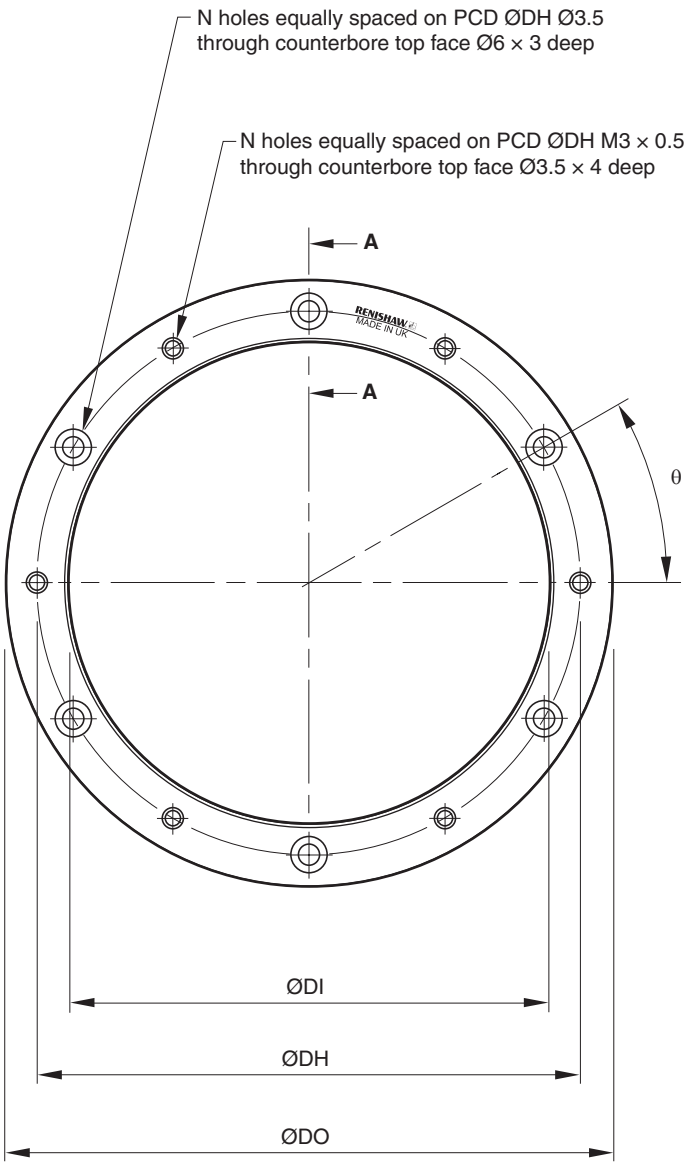


*Extent of mounting face.

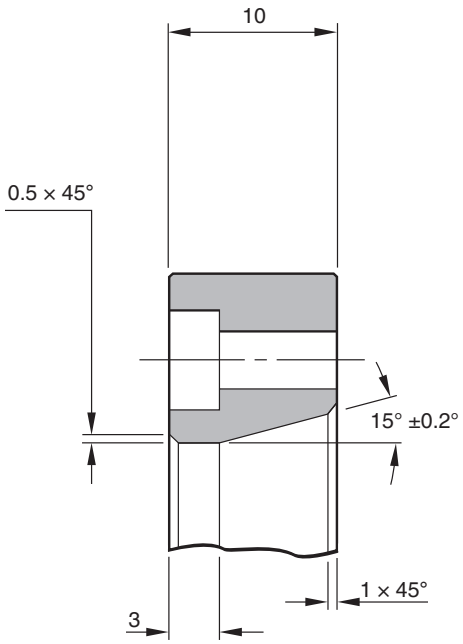
NOTE: External magnetic fields greater than 6 mT, in the vicinity of the readhead, may cause false activation of the limit and reference sensors.

RESM20/REST20 installation drawing (‘A’ section)

Dimensions and tolerances in mm



Section A–B



NOTE: For REST20 partial arc please refer to ‘Ring orientation for partial arc applications’, page 10.

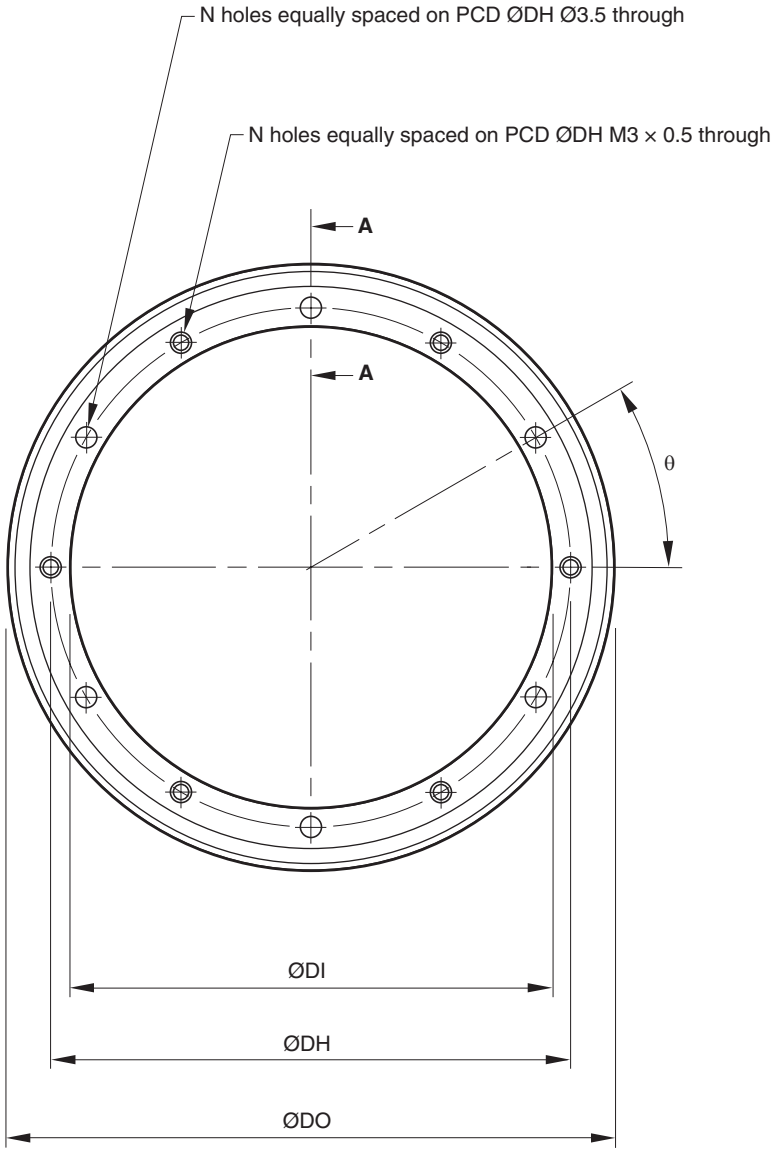
NOTE: θ is the angle between one tapped hole and the adjacent clearance hole. The angle between two clearance holes is 2θ.

Nominal external diameter (mm)	Line count	DO (mm)	DI (mm)	Mounting holes			Readhead model
				DH (mm)	N	θ	
52	8 192	52.20 52.10	30.04 30.00	40	6	30°	**V2CL**
57	9 000	57.35 57.25	37.04 37.00	47	6	30°	
75	11 840	75.40 75.30	55.04 55.00	65	6	30°	**V2CK**
100	15 744	100.30 100.20	80.04 80.00	90	6	30°	
103	16 200	103.20 103.00	80.04 80.00	90	6	30°	
104	16 384	104.40 104.20	80.04 80.00	90	6	30°	
115	18 000	114.70 114.50	95.04 95.00	105	6	30°	
150	23 600	150.40 150.20	130.04 130.00	140	9	20°	**V2BJ**
200	31 488	200.40 200.20	180.04 180.00	190	12	15°	
206	32 400	206.50 206.10	186.05 186.00	196	12	15°	
209	32 768	208.80 208.40	186.05 186.00	196	12	15°	
229	36 000	229.40 229.00	209.05 209.00	219	12	15°	
255	40 000	254.80 254.40	235.06 235.00	245	12	15°	
300	47 200	300.40 300.20	280.06 280.00	290	16	11.25°	
350	55 040	350.40 350.20	330.06 330.00	340	16	11.25°	
413	64 800	412.70 412.30	392.08 392.00	402	18	10°	
417	65 536	417.40 417.00	380.10 380.00	390	18	10°	
489	76 800	489.12 488.72	451.10 450.90	462	20	18° *	
550	86 400	550.20 549.80	510.10 510.00	520	20	9°	

* There are no tapped holes on the 489 mm ring.

RESM20/REST20 installation drawing (‘B’ section)

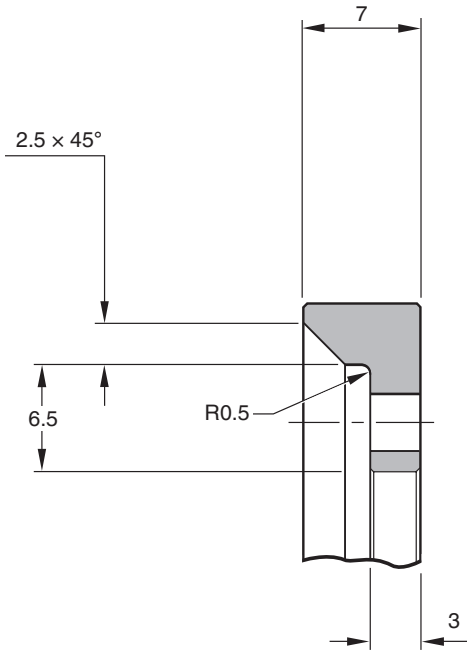
Dimensions and tolerances in mm



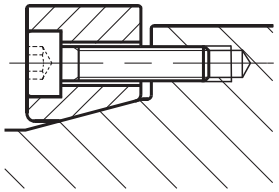
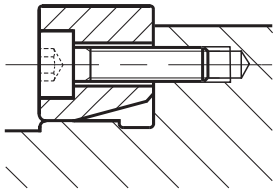
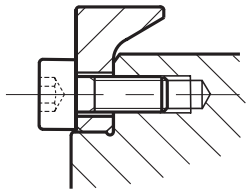
NOTE: θ is the angle between one tapped hole and the adjacent clearance hole. The angle between two clearance holes is 2θ.

Nominal external diameter (mm)	Line count	DO (mm)	DI (mm)	Mounting holes			Readhead model
				DH (mm)	N	θ	
52	8 192	52.20 52.10	32.04 32.00	38	6	30°	**V2CL**
75	11 840	75.40 75.30	55.04 55.00	61	6	30°	**V2CK**
100	15 744	100.30 100.20	80.04 80.00	86	6	30°	
115	18 000	114.70 114.50	95.04 95.00	101	6	30°	
150	23 600	150.40 150.20	130.04 130.00	136	9	20°	**V2BJ**
200	31 488	200.40 200.20	180.04 180.00	186	12	15°	

Section A–A



Select a mounting option

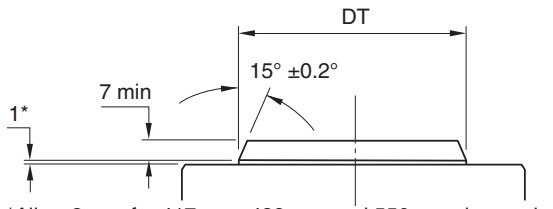
	Taper mount	Interference fit
'A' section		
'B' section	Not applicable	
Notes	**Recommended for all installations** ▶ Enables simplest adjustment. ▶ Offers highest accuracy. ▶ Enables eccentricity to be compensated. ▶ Offers excellent mechanical stability against thermal cycling, shock and vibration. ▶ Minimises cost of substrate preparation.	**Alternative installation** Will not correct eccentricity of the supporting shaft.

Taper mount method

Step 1 Mounting shaft specifications

Recommended taper roundness:

Diameter (mm)	Roundness value (mm TIR)
≤ 115	0.025
150 to 225	0.050
≥ 300	0.075



*Allow 2 mm for 417 mm, 489 mm and 550 mm rings only.

Recommended taper roundness when using two heads and DSi:

Diameter (mm)	Roundness value (mm TIR)
≤ 115	0.0125
150 to 225	0.025
≥ 300	0.0375

Recommended taper diameter (DT):

DO (mm)	DT (mm)
52	33.85 33.65
57	40.85 40.65
75	58.85 58.65
100	83.85 83.65
103	83.85 83.65
104	83.85 83.65
115	98.85 98.65

DO (mm)	DT (mm)
150	133.85 133.65
200	183.85 183.65
206	189.85 189.65
209	189.85 189.65
229	212.85 212.65
255	238.85 238.65
300	283.85 283.65

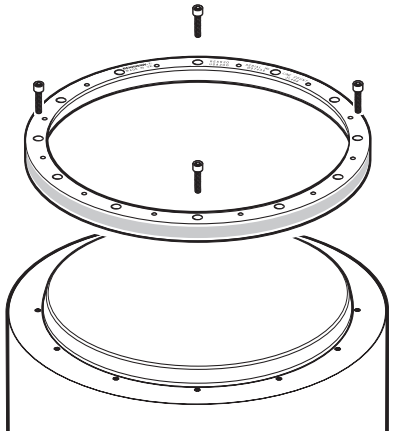
DO (mm)	DT (mm)
350	333.85 333.65
413	395.85 395.65
417	383.85 383.65
489	454.85 454.65
550	513.85 513.65

DO = Nominal external diameter.

Recommended surface finish ≤ Ra 1.2.

NOTE: It is recommended that the mounting surface is a turned, rather than ground finish.

Step 2

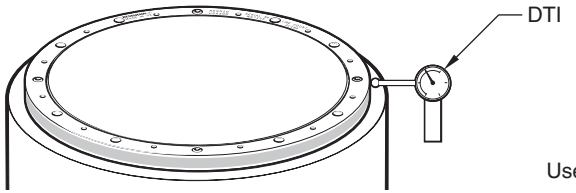


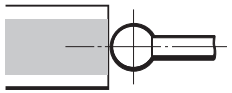
- Remove the protective film from the surface of the RESM20/REST20.
- Clean shaft taper and internal taper of the RESM20/REST20 as recommended in 'Storage and handling', page 3.
- Insert the first screws:
  - For RESM20/REST20 rings with 6, 9 or 18 mounting holes, use 3 equally spaced M3 screws.
  - For RESM20/REST20 rings with 12, 16 or 20 mounting holes, use 4 equally spaced M3 screws.

  NOTE: Do not lubricate screws.

  NOTE: Recommended screw type M3 × 0.5: ISO 4762/DIN 912 grade 10.9 minimum/ANSI B18.3.1M.
- Insert the screws so that the RESM20/REST20 is loosely connected to the shaft, then roughly align the ring by eye and touch.
- Lightly tighten the screws. Use a Dial Test Indicator (DTI) to check the radial displacement at the screw locations.

  NOTE: Disregard the radial displacement between the screw locations.

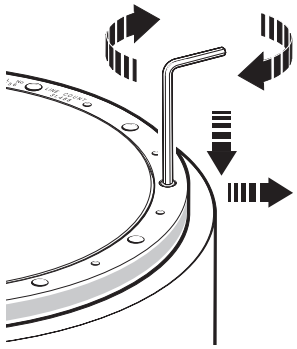


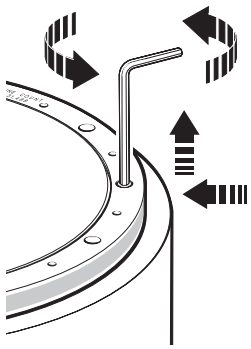


Use a DTI with low exertion force to avoid scratching the scale surface. A DTI with a ruby ball stylus is recommended as a further precaution against scratches.

- Adjust the screws to reduce the range of radial displacement. When adjusting, identify the screw location with the lowest radial displacement and tighten that screw, aiming for the average of the highest and lowest indicator readings.
- Repeat this process until the DTI readings are within ±5 µm at the screw locations.

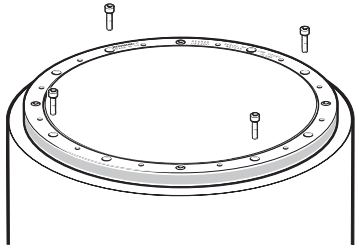
  NOTE: It may be necessary to loosen screws whilst tightening other screws.





NOTE: At this stage, the screws should only be lightly tightened (less than 0.5 Nm) to allow further final adjustment.

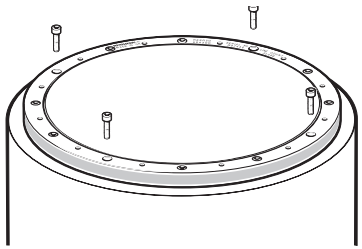
Step 3



- Insert the next screws:
  - For RESM20/REST20 rings with 6, 9 or 12 mounting holes, insert all the remaining M3 screws.
  - For RESM20/REST20 rings with 16 mounting holes, insert 4 equally spaced M3 screws.
  - For RESM20/REST20 rings with 18 mounting holes, insert 6 equally spaced M3 screws.
  - For RESM20/REST20 rings with 20 mounting holes, insert 8 equally spaced M3 screws (in four groups of two) between existing screws.
- As described in Step 2, adjust all the screws inserted thus far so that the radial displacement at each screw location is within ±5 µm.
- Again, at this stage, the screws should only be lightly tightened (less than 0.5 Nm).

  NOTE: You may notice that the torque required to achieve the radial displacement tolerance will be slightly higher during Step 3 than during Step 2. This is normal.

Step 4



- Insert screws into the remaining mounting holes.

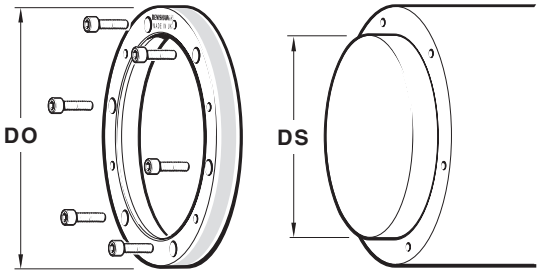
Step 5

Diameter (mm)	Recommended torque range (Nm)
≤ 115	1.5 - 2.1
150 to 255	0.8 - 1.1
300 to 413	0.5 - 0.7
≥ 417	1.2 - 1.7

- Rotate the RESM20/REST20 ring, measuring the radial displacement at all of the screw locations.
- Tighten the screw with the lowest radial displacement so that it matches the average radial displacement, whilst ensuring the maximum torque specified in the table is not exceeded.
- Again, rotate the RESM20/REST20 ring and re-check the radial displacement at all of the screw locations, tightening the screw with the lowest radial displacement so that it matches the average.
- Repeat this process until the radial displacement at all of the screw locations is within ±3 µm and that all screw torques are within the specified range.
- Excessive tightening of screws can have a small effect on accuracy. Please contact your local Renishaw representative for more details.

Interference fit method

Mounting shaft specifications



- Remove the protective film from the surface of the RESM20/REST20 ring.
- Clean the mounting faces of the shaft and the RESM20/REST as recommended in 'Storage and handling', page 3.

NOTES:

- Ensure that all screws are tightened to 1.6 Nm.
- The recommended thread engagement is 6 mm.
- 417, 489 and 550 mm rings should be taper mounted only.

DO (mm)	DS (mm)
52*	30.033 30.017
57	37.033 37.017
75	55.039 55.020
100	80.045 80.023
103	80.045 80.023
104	80.045 80.023
115	95.045 95.023
150	130.052 130.027
200	180.052 180.027
206	186.060 186.031
209	186.060 186.031
229	209.060 209.031
255	235.060 235.031
300	280.066 280.034
350	330.073 330.037
413	392.073 392.037

DO = Nominal external diameter.
DS = Recommended shaft diameter to enable interference fit.
*52 mm 'B' section ring = 32.033
32.017.

Ring orientation for partial arc applications

The partial arc DSi is based on a ring with two reference marks opposite each other. The ring must be installed so that when the ring rotates **only** H1 can see R1 and **only** H2 can see R2.

Small angular movements

To allow the DSi to operate with very small angular movements the ring must be mounted in a certain way in relation to the two readheads. Figure 1(a) shows how the ring must be initially mounted with reference mark **R1** to the left of readhead **H1**. This position could be the maximum travel the ring can be rotated in an anti-clockwise direction (limited by the user).

The angle ϕ determines the minimum amount of angular movement the ring can be rotated for the DSI to become initialised. With optimum readhead and ring positioning, the minimum angle of rotation required to initialise a system is 3°. This is to make sure that there is enough rotational travel for both readheads to see a reference mark. The ring will now be rotated clockwise so that H1 will see R1 and H2 will see R2, at this point the DSI will become initialised (Figure 1(b)).

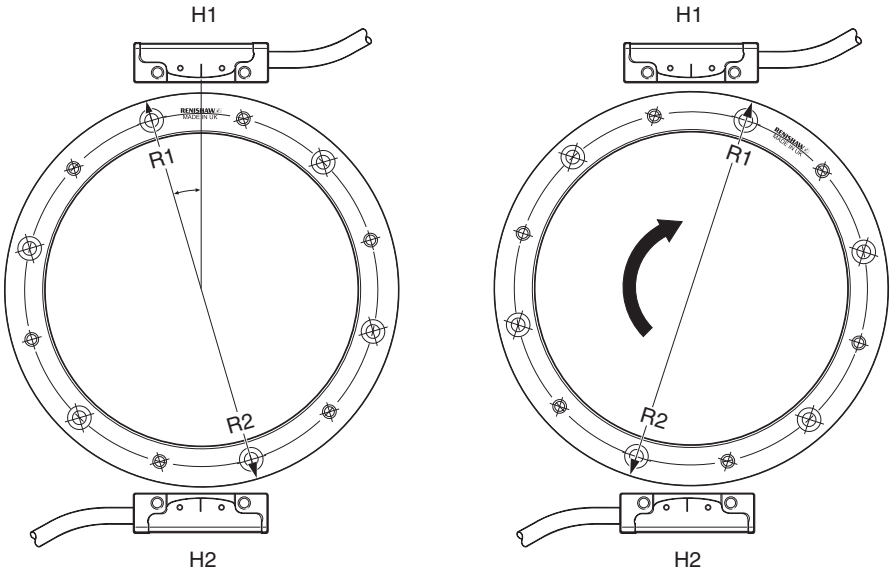


Figure 1: Small angular movements

Large angular movements (< 357°)

When the DSi is used in applications where large amounts of rotation are required the ring must be installed correctly. Figure 2(a) shows the maximum position the ring can be rotated in an anti-clockwise direction. Reference mark R1 must be positioned to the left of H2 so H2 will **never** see R1 upon initialisation. The angular position ϕ of R1 to H2 must again be greater than 1.5°, therefore the maximum amount of angular movement of the ring, this being 357°.

Figure 2(b) shows the ring after it has been fully rotated in a clockwise direction to its maximum travel. During this rotation H1 would have seen R1 and H2 would of seen R2. The DSI is now initialised.

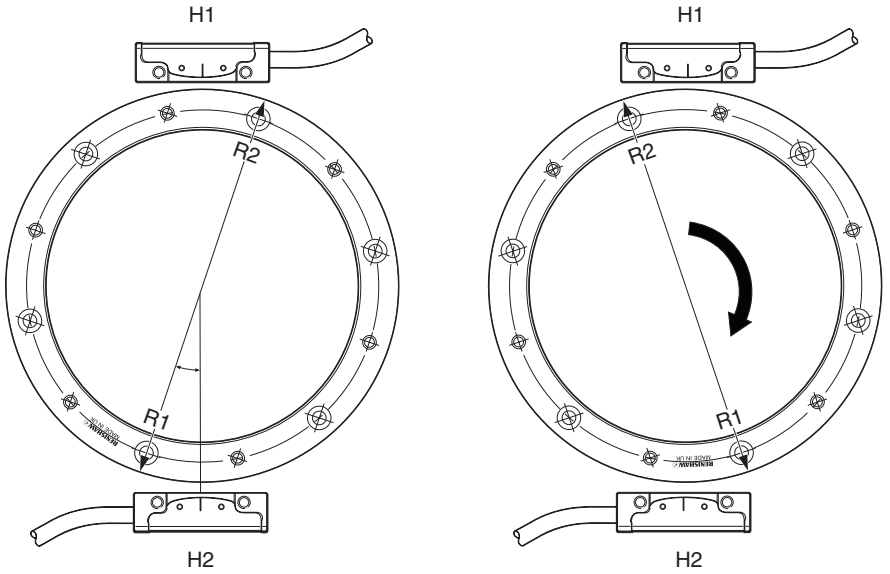


Figure 2: Large angular movements

VIONiC encoder system quick-start guide

This section is a quick-start guide to installing a VIONiC encoder system.

More detailed information on installing the system is contained on page 12 and page 13 of this installation guide.

The optional Advanced Diagnostic Tool ADTi-100* (A-6165-0100) and ADT View software† can be used to aid installation and calibration.

INSTALLATION

Ensure scale, readhead optical window and mounting faces are clean and free from obstructions.

Connect the readhead to receiving electronics and power-up. The set-up LED on the readhead will flash.

Install and align the readhead to maximise signal strength over the full axis of rotation as indicated by a Green flashing LED.

CALIBRATION

Cycle the power to the readhead to initiate the calibration routine. The LED will single flash Blue.

Rotate the axis at slow speed (< 100 mm/s), ensuring the readhead does not pass a reference mark, until the LED starts double flashing Blue.

No reference mark

If a reference mark is not being used, the calibration routine should now be exited by cycling the power. The LED will stop flashing.

Reference mark

Move the readhead back and forth over the reference mark until the LED stops flashing.

The system is now calibrated and ready for use. Calibration values, Automatic Gain Control (AGC) and Automatic Offset Control (AOC) status are stored in readhead non-volatile memory at power down.
NOTE: If calibration fails, restore factory defaults by obscuring the readhead optical window on power-up (page 14). Repeat the installation and calibration routine.

*For more details refer to the *Advanced Diagnostic Tool ADTi-100 and ADT View software* quick-start guide (Renishaw part no. M-6195-9321) and *Advanced Diagnostic Tool ADTi-100 and ADT View software* user guide (Renishaw part no. M-6195-9413).

†The software can be downloaded for free from **www.renishaw.com/adt**

Readhead mounting and alignment

Mounting brackets

The bracket must have a flat mounting surface and should enable conformance to the installation tolerances, allow adjustment to the rideheight of the readhead, and be sufficiently stiff to prevent deflection or vibration of the readhead during operation.

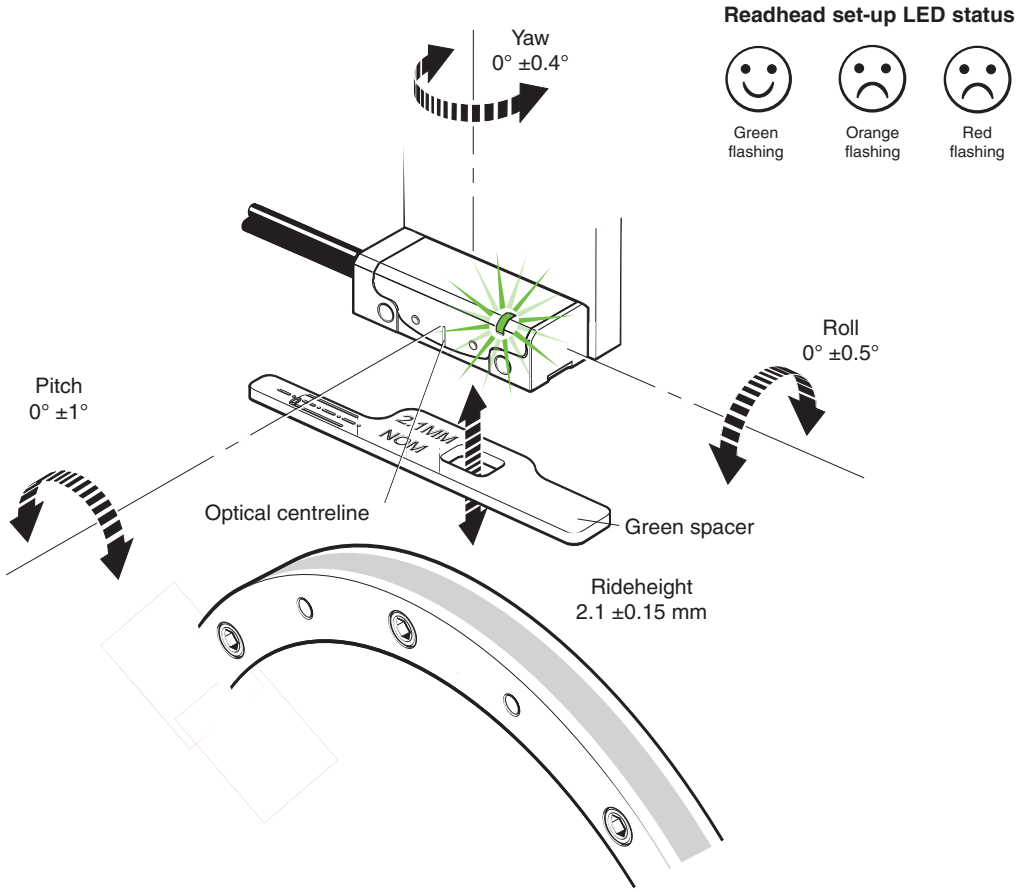
Readhead set-up

Ensure that the scale, readhead optical window and mounting face are clean and free from obstructions.

NOTE: When cleaning the readhead and scale apply cleaning fluid sparingly; do not soak.

To set nominal rideheight, place the green spacer with the aperture under the optical centre of the readhead to allow normal LED function during set-up procedure. Adjust the readhead to achieve a flashing Green LED for a complete rotation. The faster the flash rate, the closer it is to optimum set-up. The optional Advanced Diagnostic Tool ADTi-100 (A-6195-0100) and ADT View software can be used to optimise signal strength in challenging installations. See **www.renishaw.com/adt** for more information.

NOTE: When re-installing the readhead factory defaults should be restored (page 14).



Readhead set-up LED status

Readhead LED diagnostics

Mode	LED	Status
Installation mode	Green flashing	Good set-up, maximise flash rate for optimum set-up
	Orange flashing	Poor set-up, adjust readhead to obtain Green flashing LED
	Red flashing	Poor set-up, adjust readhead to obtain Green flashing LED
Calibration mode	Blue single flashing	Calibrating incremental signals
	Blue double flashing	Calibrating reference mark
Normal operation	Blue	AGC on, optimum set-up
	Green	AGC off, optimum set-up
	Red	Poor set-up; signal may be too low for reliable operation
	Blank flash	Reference mark detected (visible indication at speed < 100 mm/s only)
Alarm	4 red flashes	Low signal, over signal, or overspeed; system in error

Reference mark position

IN-TRAC™ reference mark is integrated in the scale, radially aligned with the centre of the mounting hole to the left of the 'Renishaw' logo within ±0.5 mm. No external actuators or physical adjustment are required.

System calibration

NOTE: The functions described below can also be carried out using the optional ADTi-100 and ADT View software. See **www.renishaw.com/adt** for more information.

Ensure signal strength has been optimised over the full axis of rotation; the LED will be flashing Green. Cycle the power to the readhead or connect the 'Remote CAL' output pin to 0 V for < 3 seconds. The readhead will then single flash Blue to indicate it is in calibration mode as detailed in 'Readhead mounting and alignment', page 12. The readhead will only enter calibration mode if the LED is flashing Green.

Step 1 – Incremental signal calibration

- Rotate the axis at slow speed (< 100 mm/s or less than the readhead maximum speed, whichever is slowest), ensuring the readhead does not pass a reference mark, until the LED starts double-flashing. This indicates that the incremental signals are now calibrated and the new settings are stored in the readhead memory.
- The system is now ready for reference mark phasing. For systems without a reference mark, cycle the power to the readhead or connect the 'Remote CAL' output pin to 0 V for < 3 seconds to exit calibration mode.
- If the system does not automatically enter the reference mark phasing stage (LED continues single flashing) the calibration of the incremental signals has failed. After ensuring failure is not due to overspeed (> 100 mm/s or exceeding the readhead maximum speed), exit the calibration routine, restore factory defaults as detailed below, and check the readhead installation and system cleanliness before repeating the calibration routine.

Step 2 – Reference mark phasing

- Move the readhead back and forth over the reference mark until the LED stops flashing and remains solid Blue (or Green if AGC is disabled). The reference mark is now phased.
- The system automatically exits the calibration routine and is ready for operation.
- AGC and AOC are automatically switched on once calibration is complete. To switch off AGC refer to 'Enabling/disabling AGC', page 14.
- If the LED continues double-flashing after repeatedly passing the reference mark it is not being detected. Ensure correct readhead alignment.

Calibration routine manual exit

- To exit the calibration routine at any stage cycle the power to the readhead or connect the 'Remote CAL' output pin to 0 V for < 3 seconds. The LED will then stop flashing.

LED	Settings stored
Blue single flashing	None, restore factory defaults and recalibrate
Blue double flashing	Incremental only
Blue (auto-complete)	Incremental and reference mark

Restoring factory defaults

When re-installing the system, or in the case of continued calibration failure, factory defaults should be restored.

To restore factory defaults:

- Switch system off.
- Obscure the readhead optical window (using the spacer supplied with the readhead ensuring the cut-out is NOT under the optical window) or connect the 'Remote CAL' output pin to 0 V.
- Power the readhead.
- Remove the spacer or, if using, the connection from the 'Remote CAL' output pin to 0 V.
- The LED will start continuously flashing indicating factory defaults have been restored and the readhead is in installation mode (flashing set-up LED).
- Repeat 'Readhead set-up' procedure on page 12.

Enabling/disabling AGC

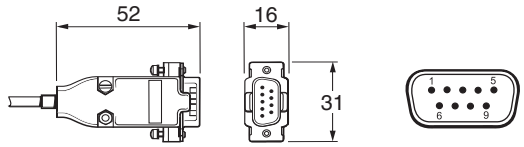
The AGC is switched on once the system has been calibrated indicated by a Blue LED. AGC can be manually switched off by connecting the 'Remote CAL' output pin to 0 V for > 3 seconds < 10 seconds. The LED will then be solid Green.

Output signals

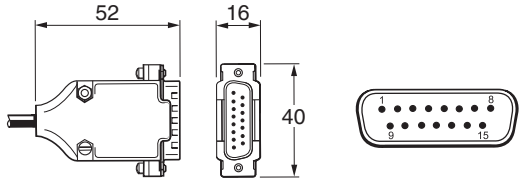
Digital outputs

Function	Signal		Colour	9-way D-type (A)	15-way D-type (D)	15-way D-type alternative pin-out (H)	12-way circular connector† (X)	14-way JST‡ (J)
Power	5 V		Brown	5	7, 8	4, 12	G	10
	0 V		White	1	2, 9	2, 10	H	1
Incremental	A	+	Red	2	14	1	M	7
		–	Blue	6	6	9	L	2
	B	+	Yellow	4	13	3	J	11
		–	Green	8	5	11	K	9
Reference mark	Z	+	Violet	3	12	14	D	8
		–	Grey	7	4	7	E	12
Limits	P		Pink	-	11	8	A	14
	Q		Black	-	10	6	B	13
Alarm	E	–	Orange	-	3	13	F	3
Remote CAL*	CAL		Clear	9	1	5	C	4
Shield	-		Screen	Case	Case	Case	Case	Ferrule

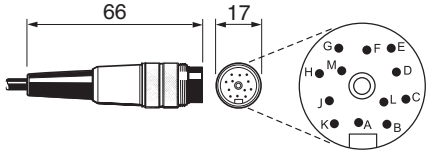
9-way D-type connector (termination code A)



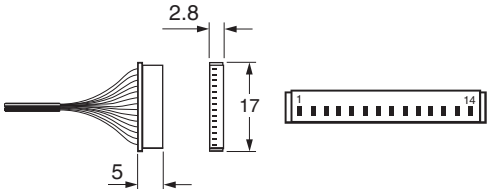
15-way D-type connector (termination code D, H)



12-way in-line circular connector (termination code X)



14-way JST connector (termination code J)‡



*Remote CAL line must be connected for use with ADTi-100.
†12-way circular Binder mating socket – A-6195-0105.
‡Pack of 5 14-way JST SH mating sockets:
A-9417-0025 – Bottom mount;
A-9417-0026 – Side mount.
Maximum of 20 insertion cycles for JST connector.

Speed

Clocked output option (MHz)	Maximum speed (m/s)												Minimum edge separation* (ns)
	5 µm (D)	1 µm (X)	0.5 µm (Z)	0.2 µm (W)	0.1 µm (Y)	50 nm (H)	40 nm (M)	25 nm (P)	20 nm (I)	10 nm (O)	5 nm (Q)	2.5 nm (R)	
50	12	12	12	7.25	3.63	1.81	1.45	0.906	0.725	0.363	0.181	0.091	25.3
40	12	12	12	5.80	2.90	1.45	1.16	0.725	0.580	0.290	0.145	0.073	31.8
25	12	12	9.06	3.63	1.81	0.906	0.725	0.453	0.363	0.181	0.091	0.045	51.2
20	12	12	8.06	3.22	1.61	0.806	0.645	0.403	0.322	0.161	0.081	0.040	57.7
12	12	10.36	5.18	2.07	1.04	0.518	0.414	0.259	0.207	0.104	0.052	0.026	90.2
10	12	8.53	4.27	1.71	0.850	0.427	0.341	0.213	0.171	0.085	0.043	0.021	110
08	12	6.91	3.45	1.38	0.690	0.345	0.276	0.173	0.138	0.069	0.035	0.017	136
06	12	5.37	2.69	1.07	0.540	0.269	0.215	0.134	0.107	0.054	0.027	0.013	175
04	12	3.63	1.81	0.730	0.360	0.181	0.145	0.091	0.073	0.036	0.018	0.009	259
01	4.53	0.910	0.450	0.180	0.090	0.045	0.036	0.023	0.018	0.009	0.005	0.002	1038

*For a readhead with a 1 m cable.

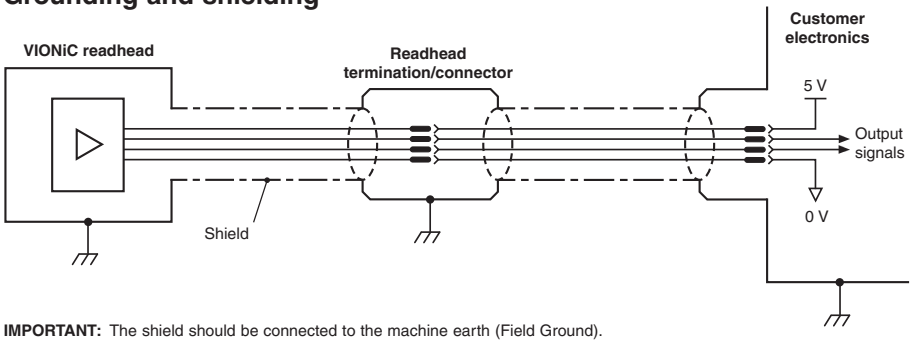
Angular speed depends on ring diameter – use the following equation to convert to rev/min.

$$\text{Angular speed (rev/min)} = \frac{V \times 1000 \times 60}{\pi D}$$

Where V = maximum linear speed (m/s) and
D = external diameter of RESM20/REST20 (mm).

Electrical connections

Grounding and shielding



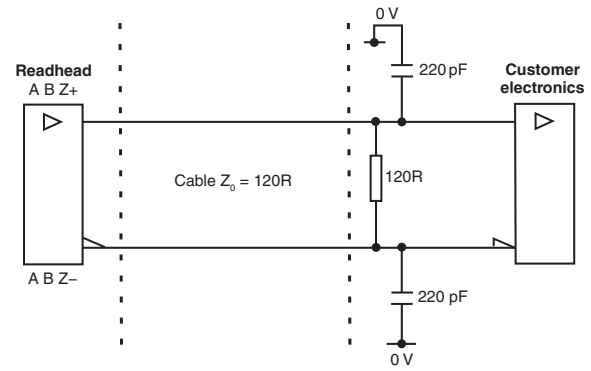
IMPORTANT: The shield should be connected to the machine earth (Field Ground).
For JST variants the ferrule should be connected to machine earth.

Maximum readhead cable length: 3 m

Maximum extension cable length: Dependent on cable type, readhead cable length and clock speed.
Contact your local Renishaw representative for more information.

NOTE: The maximum cable length between the readhead and the ADTi-100 is 3 m.

Recommended signal termination

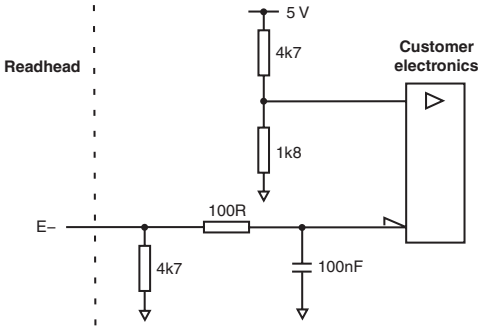


Standard RS422A line receiver circuitry.

Capacitors recommended for improved noise immunity.

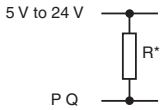
Single ended alarm signal termination

(Not available with 'A' cable termination)



Limit output

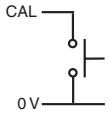
(Not available with 'A' cable termination)



*Select R so that maximum current does not exceed 10 mA.

Alternatively, use a suitable relay or opto-isolator.

Remote CAL operation



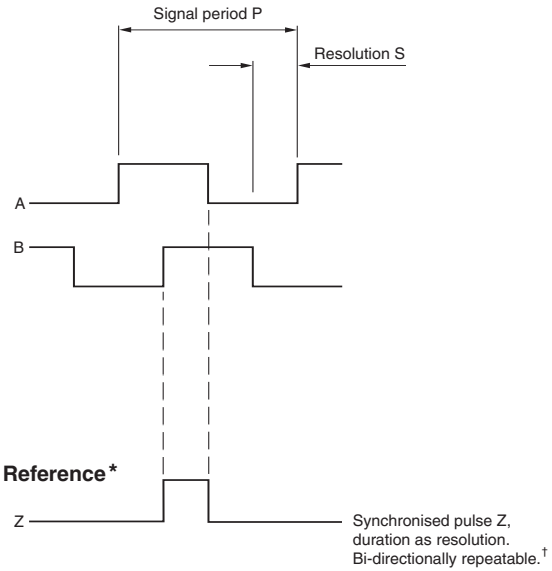
Remote operation of the CAL/AGC is possible via CAL signal.

Output specifications

Digital output signals

Form – Square wave differential line driver to EIA RS422A (except limits P and Q)

Incremental* 2 channels A and B in quadrature (90° phase shifted)



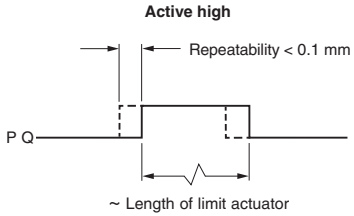
Resolution option code	P (µm)	S (µm)
D	20	5
X	4	1
Z	2	0.5
W	0.8	0.2
Y	0.4	0.1
H	0.2	0.05
M	0.16	0.04
P	0.1	0.025
I	0.08	0.02
O	0.04	0.01
Q	0.02	0.005
R	0.01	0.0025

NOTE: A wide reference mark option, outputting a reference pulse for the duration of the signal period is available.

Contact your local Renishaw representative for more information.

Limits Open collector output, asynchronous pulse

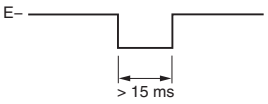
(Not available with 'A' cable termination)



Alarm

Line driven (Asynchronous pulse)

(Not available with 'A' cable termination)



Alarm asserted when:
– Signal amplitude < 20% or > 135%
– Readhead speed too high for reliable operation

or 3-state alarm

Differentially transmitted signals forced open circuit for > 15 ms when alarm conditions valid.

*Inverse signals not shown for clarity.

†Only calibrated reference mark is bi-directionally repeatable.

General specifications

Power supply	5V –5%/+10%	Typically 200 mA fully terminated
		Power from a 5 Vdc supply complying with the requirements for SELV of standard IEC 60950-1
	Ripple	200 mVpp maximum @ frequency up to 500 kHz
Temperature	Storage	–20 °C to +70 °C
	Operating	0 °C to +70 °C
Humidity		95% relative humidity (non-condensing) to IEC 60068-2-78
Sealing		IP40
Acceleration (system)	Operating	400 m/s², 3 axes
Shock (system)	Operating	500 m/s², 11 ms, ½ sine, 3 axes
Vibration (system)	Operating	100 m/s² max @ 55 Hz to 2000 Hz, 3 axes
Mass	Readhead	8.6 g
	Cable	26 g/m
Readhead cable		Single-shielded, outside diameter 4.25 ±0.25 mm
		Flex life > 20 × 10^6 cycles at 30 mm bend radius
		UL recognised component
Maximum readhead cable length*		3 m

*Extension cables available. Contact your local Renishaw representative for details.

CAUTION: Renishaw encoder systems have been designed to the relevant EMC standards, but must be correctly integrated to achieve EMC compliance. In particular, attention to shielding arrangements is essential.

Ring technical specifications

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

Renishaw plc

New Mills, Wotton-under-Edge,
Gloucestershire GL12 8JR
United Kingdom

T +44 (0)1453 524524
F +44 (0)1453 524901
E uk@renishaw.com

www.renishaw.com

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

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