Installation guide
M-6195-9232-04-A

RENISHAW
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VIONiC™ RELM20/RSLM20 high accuracy incremental linear encoder system

www.renishaw.com/vionicdownloads

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Contents

Legal notices

Patents

Features of Renishaw's VIONiC™ and RSLM20/RELM20 encoder systems 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	CN1314511	EP1469969
JP5002559	US8987633	US8466943		

Terms and conditions and warranty

Unless you and Renishaw have agreed and signed a separate written agreement, the equipment and/or software are sold subject to the Renishaw Standard Terms and Conditions supplied with such equipment and/or software, or available on request from your local Renishaw office.

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.

Equipment and/or software purchased by you from a third-party supplier is subject to separate terms and conditions supplied with such equipment and/or software. You should contact your third-party supplier for details.

Declaration of Conformity

Renishaw plc hereby declares that the VIONiC encoder system is in compliance with the essential requirements and other relevant provisions of:

- the applicable EU directives
- the relevant statutory instruments under UK law

The full text of the declaration of conformity is available at: **www.renishaw.com/productcompliance**.

Compliance

Federal Code Of Regulation (CFR) FCC Part 15 – RADIO FREQUENCY DEVICES

47 CFR Section 15.19

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.

47 CFR Section 15.21

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.

47 CFR Section 15.105

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.

47 CFR Section 15.27

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

Supplier's Declaration of Conformity

47 CFR § 2.1077 Compliance Information

Unique Identifier: VIONiC

Responsible Party - U.S. Contact Information

Renishaw Inc.
1001 Wesemann Drive
West Dundee
Illinois
IL 60118
United States
Telephone number: +1 847 286 9953
Email: **usa@renishaw.com**

ICES-003 – Information Technology Equipment (including Digital Apparatus)

This ISM device complies with Canadian ICES-003(A).

Cet appareil ISM est conforme à la norme ICES-003(A).

Intended use

The VIONiC encoder system is designed to measure position and provide that information to a drive or controller in applications requiring motion control. It must be installed, operated, and maintained as specified in Renishaw documentation and in accordance with the Standard Terms and Conditions of the Warranty and all other relevant legal requirements.

Further information

Further information relating to the VIONiC encoder range can be found in the following documents.

VIONiC incremental optical encoder system data sheet (Renishaw part no. L-9517-9678)
RELM high accuracy incremental linear ZeroMet™ scale data sheet (Renishaw part no. L-9517-9219)
RSLM high accuracy incremental linear stainless steel scale data sheet (Renishaw part no. L-9517-9305)
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)
Advanced Diagnostic Tool ADTi-100 and ADT View software user guide (Renishaw part no. M-6195-9413)

These can be downloaded from our website at **www.renishaw.com/vionicdownloads** and are also available from your local Renishaw representative.

Packaging

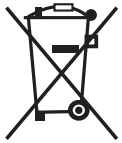
The packaging of our products contains the following materials and can be recycled.

Packing 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**.

Disposal of waste electrical and electronic equipment



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, contact your local waste disposal service or Renishaw distributor.

VIONiC software notices

Third party licences

The VIONiC product includes embedded software (firmware) to which the following notices apply:

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US government notice

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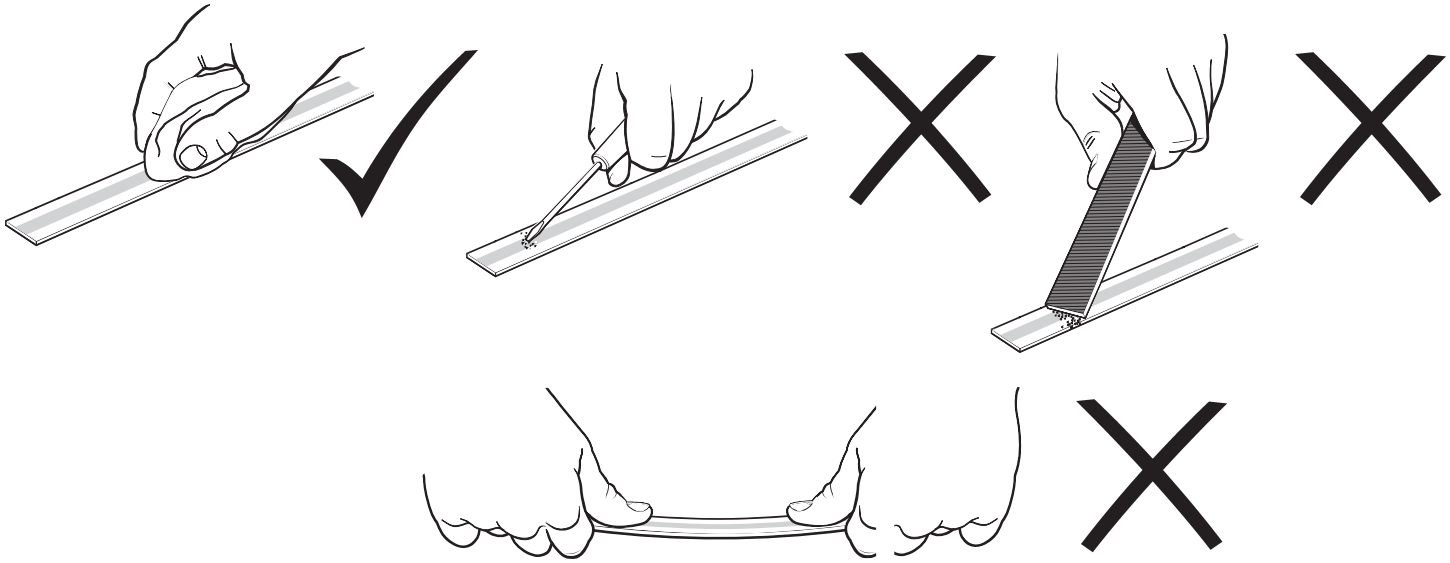
Renishaw End User Licence Agreement (EULA)

Renishaw software is licensed in accordance with the Renishaw licence at:
www.renishaw.com/legal/softwareterms.

Storage and handling

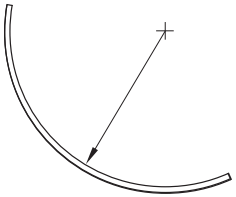
VIONiC non-contact optical encoder systems provide good immunity against contaminants such as dust, fingerprints and light oils. However, in harsh environments such as machine tool applications, use protection to prevent ingress of coolant or oil.



Minimum bend radius

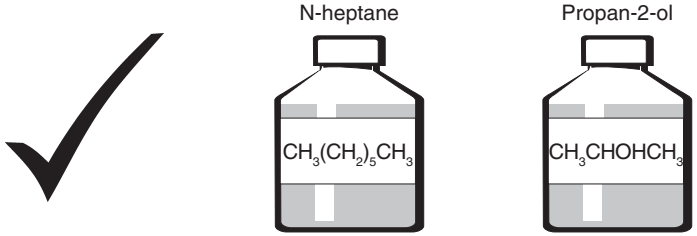
RELM20 - DO NOT BEND

RSLM20 - 250 mm

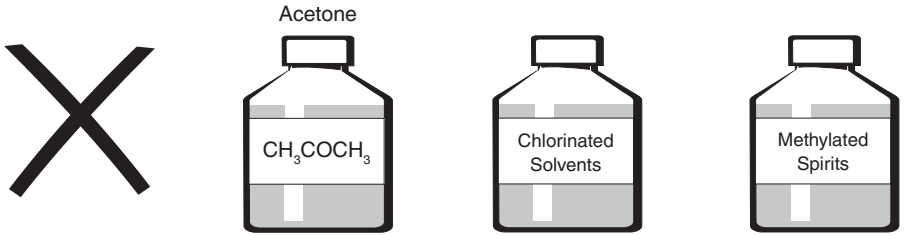


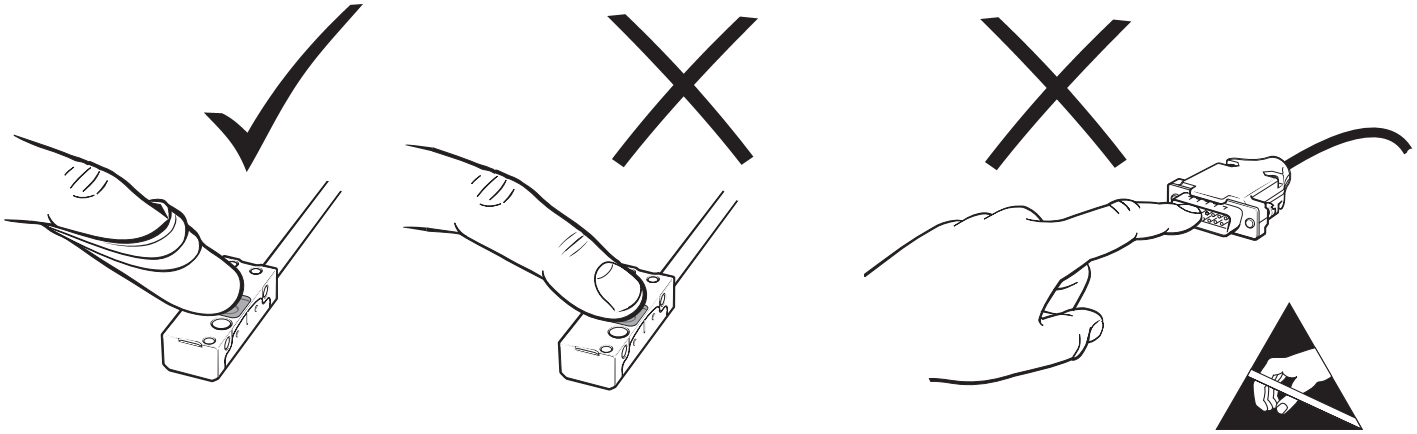
NOTE: During storage make sure the self-adhesive tape is on the outside of the bend.

Scale and readhead



Readhead only

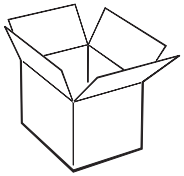


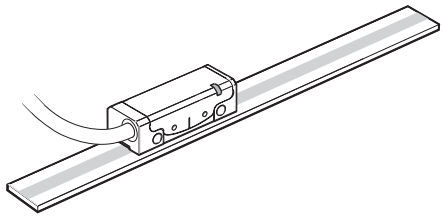


Temperature

Storage	
System	–20 °C to +70 °C

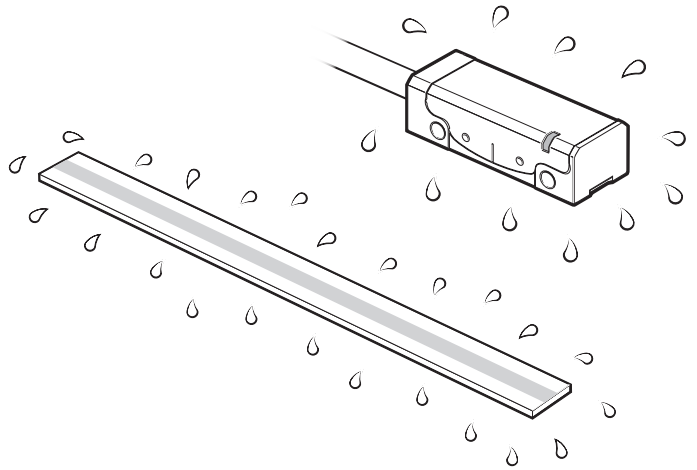
Operating	
System	0 °C to +70 °C





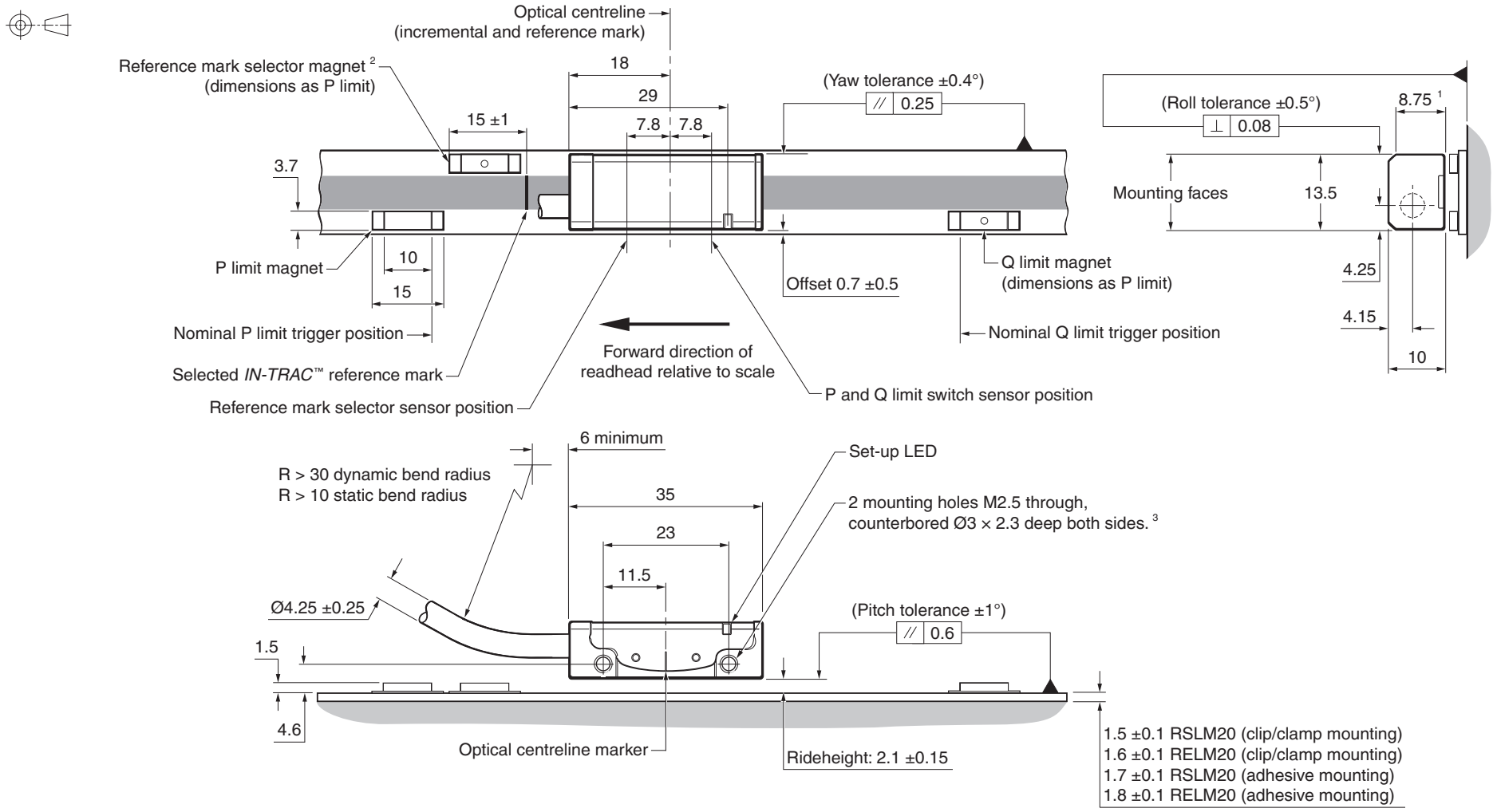
Humidity

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



VIONiC readhead installation drawing

Dimensions and tolerances in mm

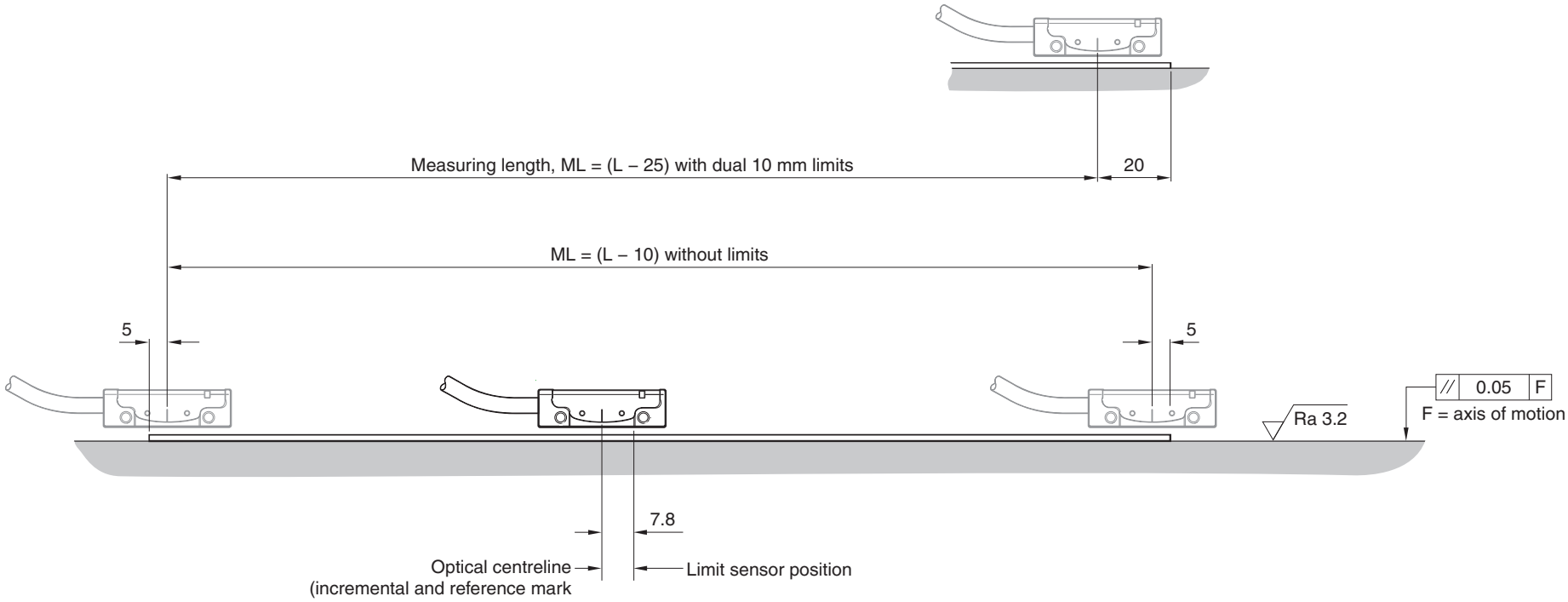


[1] Extent of mounting faces.

[2] The reference mark selector magnet is only required with RSLC20 scale.

[3] The recommended thread engagement is 5 mm minimum (7.5 mm including counterbore) and the recommended tightening torque is 0.25 Nm to 0.4 Nm.

Measuring lengths

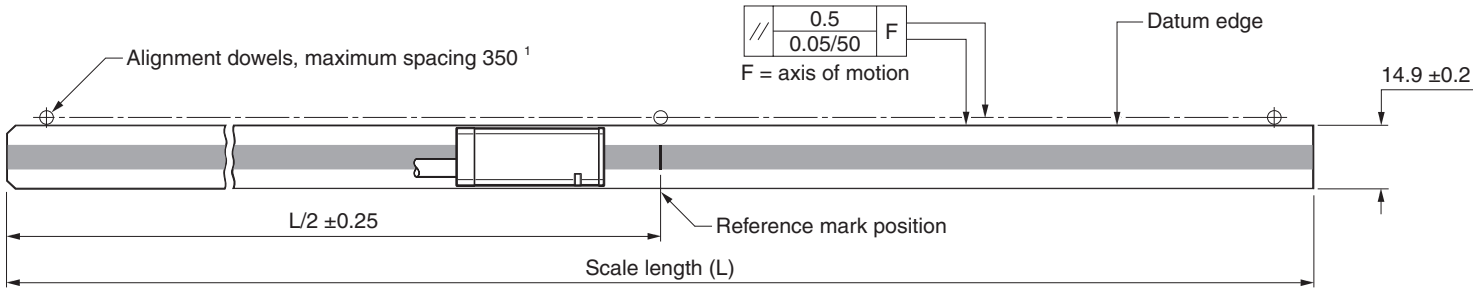


RELx20 adhesive mounting installation drawing

Dimensions and tolerances in mm

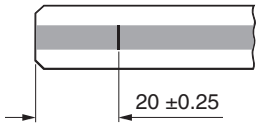
RELM20

(Centre reference mark)



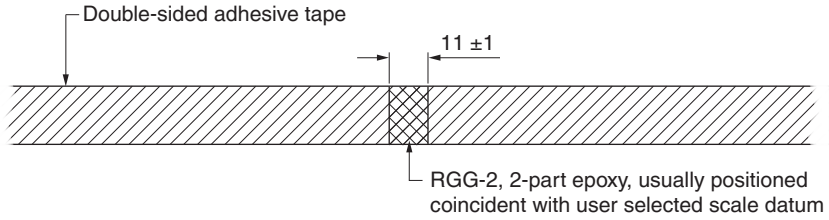
RELE20

(End reference mark)



Adhesive datum clamp

Clamping in this way ensures scale positional stability relative to substrate.



NOTES:

- Adhesive mounted scale must not be reused after installation.
- When installing the scale in a groove, allow a tolerance for scale width.
- See 'Measuring lengths' on page 13 for information on using limits.

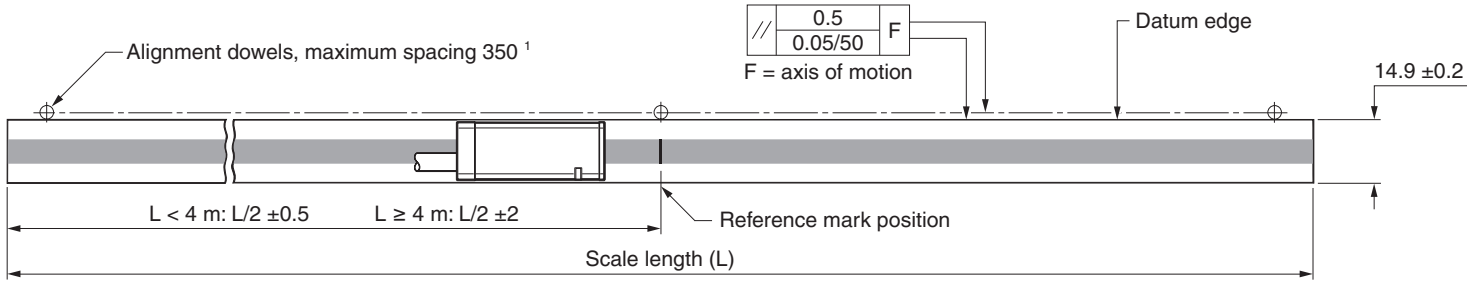
[1] When scale is to be mounted horizontally on a vertical surface, position the dowels so that the datum edge is supported.

RSLx20 adhesive mounting installation drawings

Dimensions and tolerances in mm

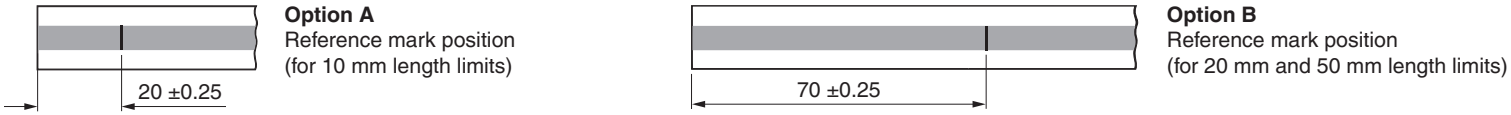
RSLM20

(Centre reference mark)



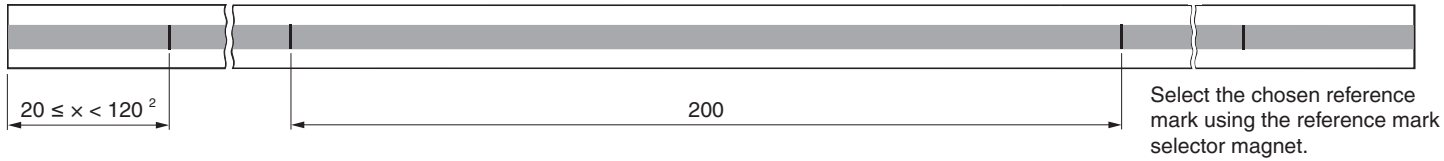
RSLE20

(End reference mark)



RSLC20

(Customer selected reference mark)



NOTES:

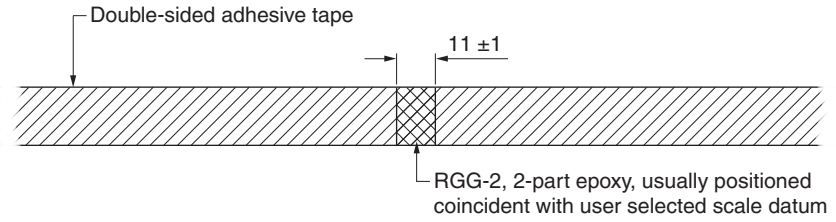
- Adhesive mounted scale must not be reused after installation.
- When installing the scale in a groove, allow a tolerance for scale width.
- See 'Measuring lengths' on page 13 for information on using limits.

[1] When scale is to be mounted horizontally on a vertical surface, position the dowels so that the datum edge is supported.

[2] Reference marks positioned equidistant from scale ends.

Adhesive datum clamp

Clamping in this way ensures scale positional stability relative to the substrate.



Equipment for installing adhesive mounted scale

Required parts:

- Lint-free cloth
- RELx20 (see page 14) or RSLx20 (see page 15) spar scale
- RGG-2 two part epoxy adhesive (A-9531-0342)
- Appropriate cleaning solvents (see 'Storage and handling' on page 10)
- Pencil or other appropriate marker
- Scissors
- 5 m reel of double-sided adhesive tape (A-9584-2111)

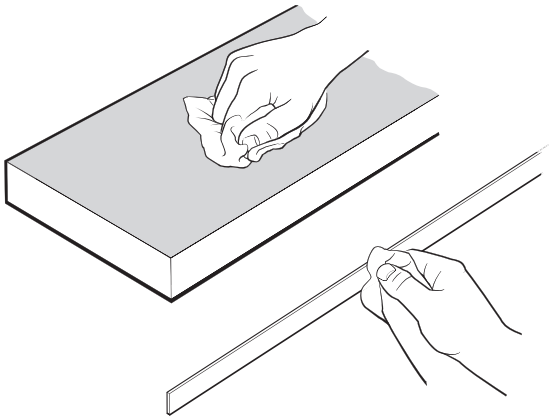
Optional parts:

- Renishaw scale wipes (A-9523-4040)
- Reference mark selector magnet [1] (A-9653-0143)
- Q limit magnet (A-9653-0139)
- P limit magnet (A-9653-0138)
- Magnet applicator tool (A-9653-0201)
- Applicator for double-sided adhesive tape. Aids the application of the tape to the scale (A-9584-0601).

[1] The reference mark selector magnet is only required for 'Customer selectable reference mark' readheads. For more information refer to *VIONiC™ incremental optical encoder system* data sheet (Renishaw part no. L-9517-9678).

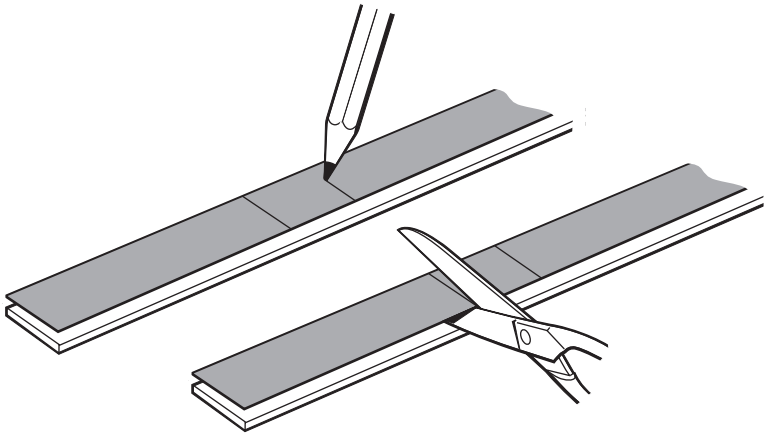
Installing the adhesive mounted RELx20/RSLx20 scale

1. Thoroughly clean and degrease the substrate with a lint-free cloth. Clean the underside of the scale using approved solvents (see 'Storage and handling' on page 10)

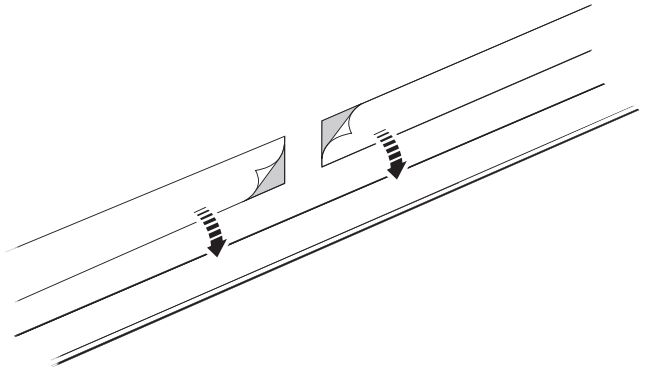


2. Mark the area for the epoxy datum clamp on the adhesive tape and cut the tape accordingly. The epoxy datum clamp fixes the scale rigidly to the substrate at the chosen location.

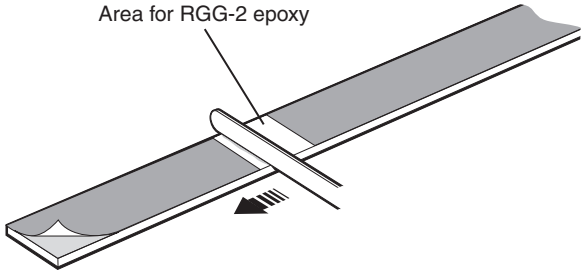
CAUTION: The metrology of the system may be compromised if the epoxy datum clamp is not used.



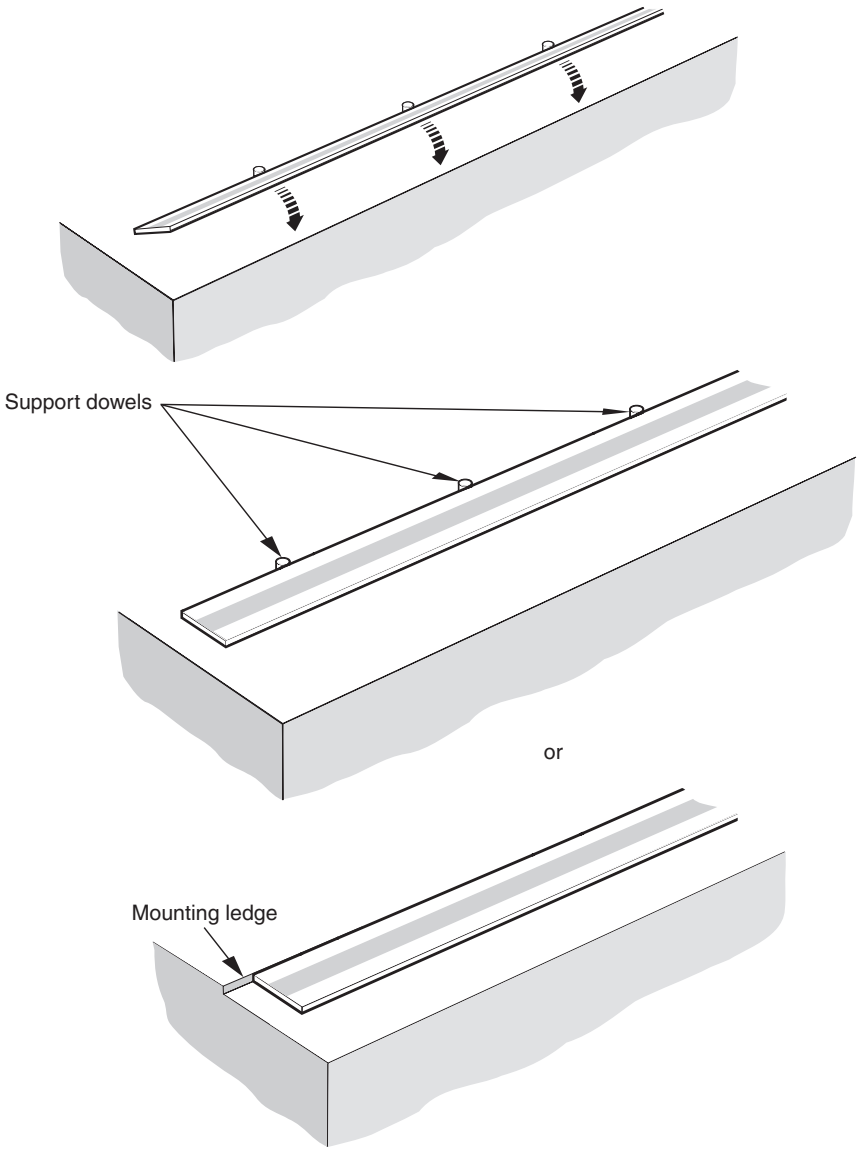
3. Remove the backing liner from one side of the adhesive tape and stick it to the underside of the scale.



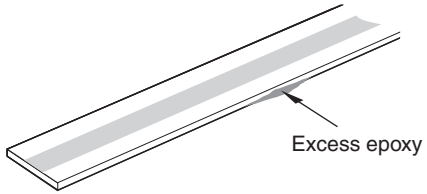
4. Thoroughly mix and apply the epoxy to the back of the scale and then remove the remaining backing liner.



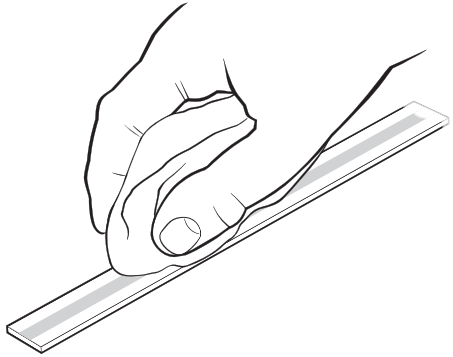
5. Locate the scale against dowels or a ledge and rotate it down onto the substrate. Press down firmly.



6. Remove any excess epoxy



7. Allow 24 hours for the epoxy to cure fully then clean the scale using the Renishaw scale wipes or a clean, dry, lint-free cloth.

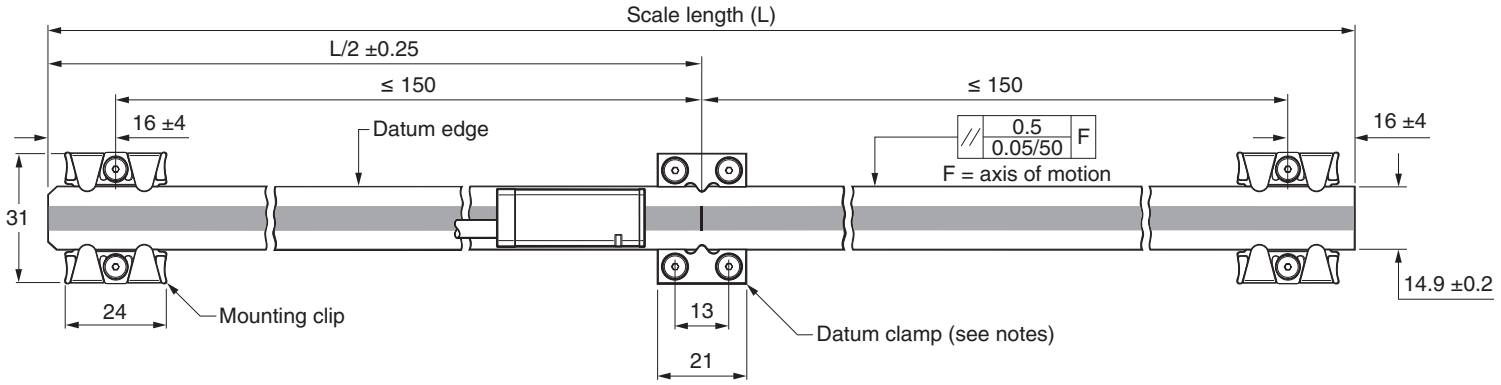


RELx20 clip/clamp mounting installation drawing

Dimensions and tolerances in mm

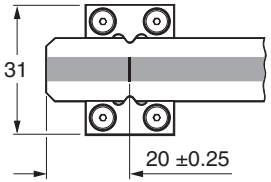
RELM20

(Centre reference mark)



RELE20

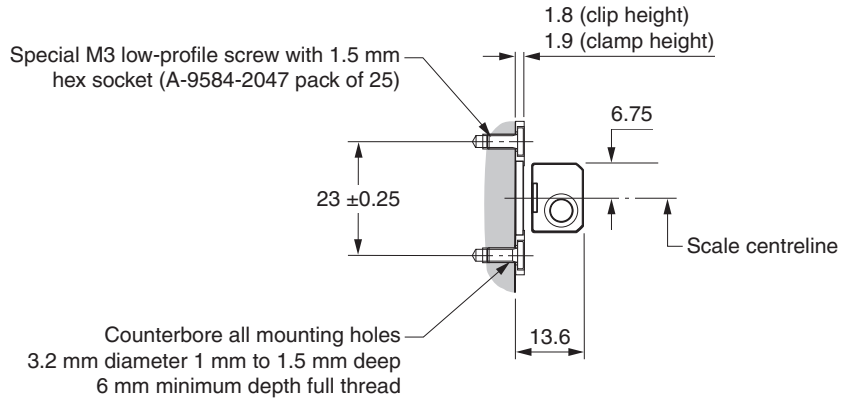
(End reference mark)



NOTES:

- The datum clamp usually coincides with the selected IN-TRAC reference mark. However the position is user-selectable depending upon application.
- For lengths 80 ≤ L ≤ 190, clip or clamp the scale in the middle as well as at both ends.
  - The installation should use the least number of clips possible.
  - For lengths not specified, contact your local Renishaw representative for further advice.
- For optimum performance install the readhead close to the nominal geometry.
- Leave sufficient clearance between the readhead/mounting bracket and the clips/datum clamp.
- Only use special low-profile screws. Screws are provided with all clips and datum clamps. Spares can be supplied if required.

Mounting clip/Datum clamp

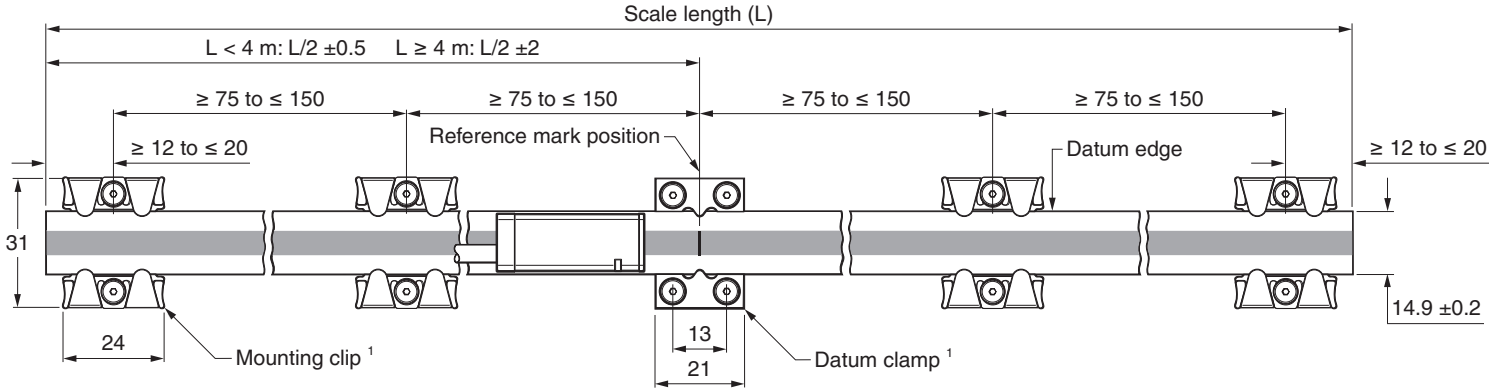


RSLx20 clip/clamp mounting installation drawings

Dimensions and tolerances in mm

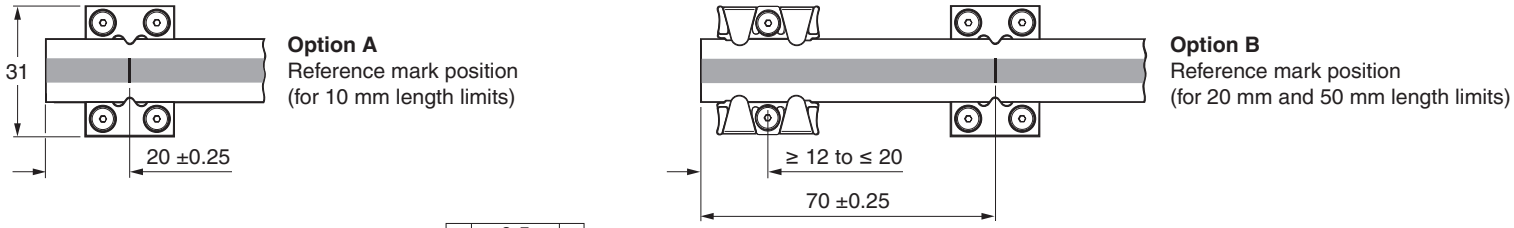
RSLM20

(Centre reference mark)



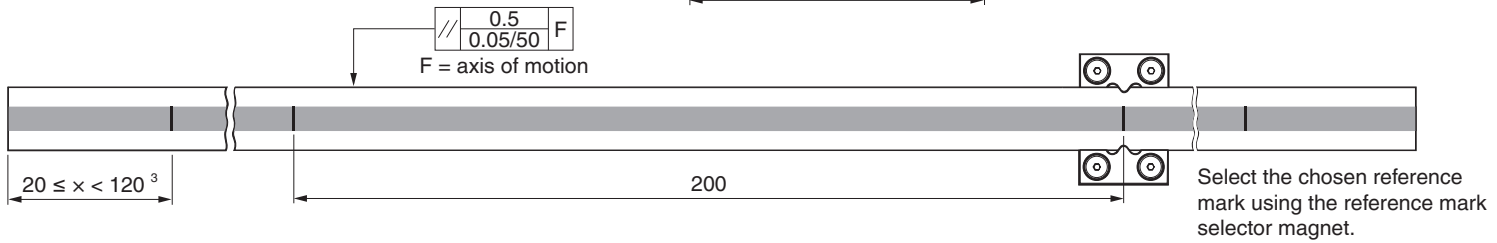
RSLE20

(End reference mark)



RSLC20 [2]

(Customer selected reference mark)



1 See notes and 'Mounting clip/Datum clamp' on page 19 for further details on mounting clips and the datum clamp.

2 The clips are omitted from the RSLC20 scale drawing for clarity.

3 The reference marks are positioned equidistant from the scale ends.

Equipment for installing clip/clamp mounted scale

Required parts:

- RELx20 (see page 19) or RSLx20 (see page 20) spar scale
- Clip set (A-9584-2049) containing a pair of clips with screws
- Clamp set (A-9584-2050) containing:
    - Pair of clamps with screws
    - Clip setting shim (M-9584-0928)
    - 1.5 mm hex key
- Lint-free cloth
- Appropriate cleaning solvents (see 'Storage and handling' on page 10)
- Dial Test Indicator (DTI)

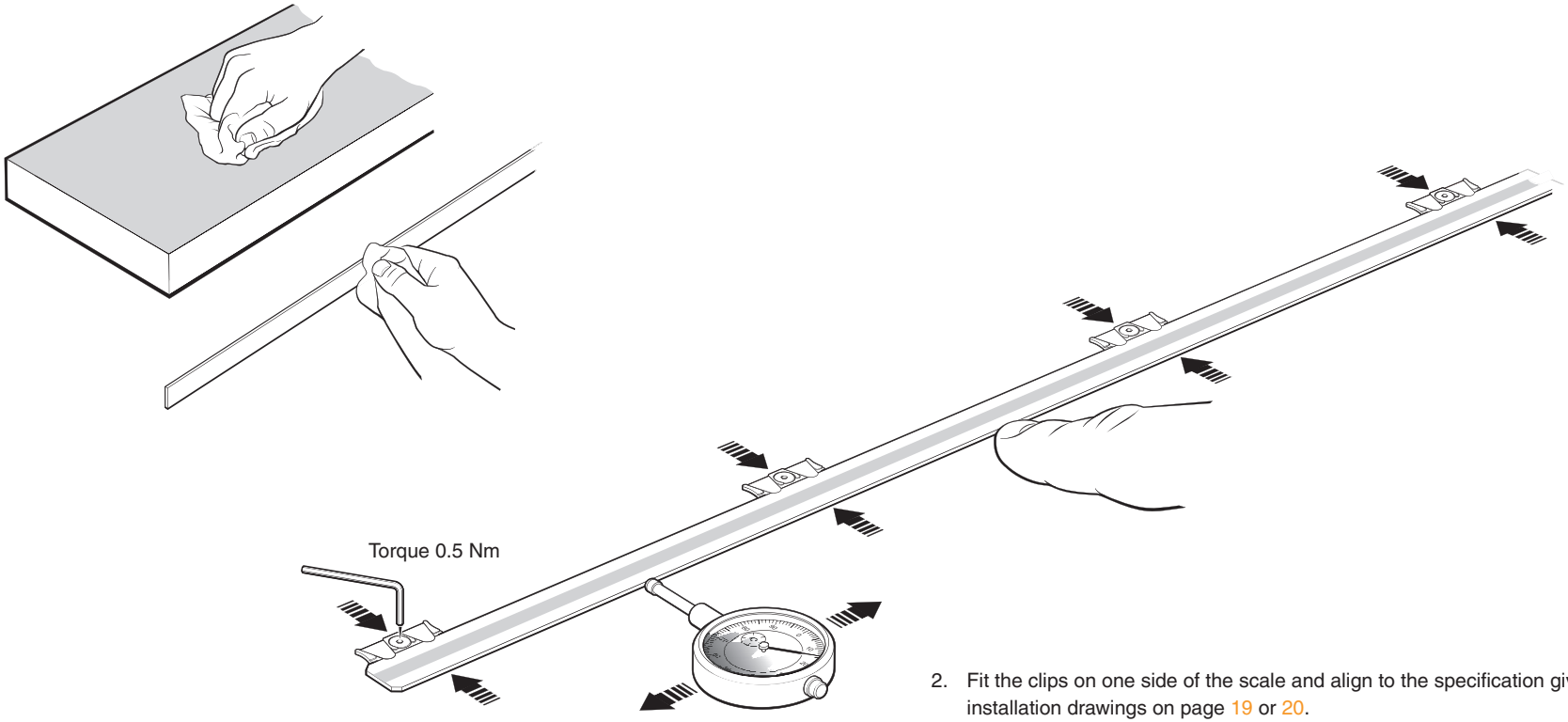
Optional parts:

- Renishaw scale wipes (A-9523-4040)
- Temporary bridge clamps (A-9584-2112)
- Pack of 25 additional low profile screws (A-9584-2047)
- Reference mark selector magnet [1] (A-9653-0143)
- Q limit magnet (A-9653-0139)
- P limit magnet (A-9653-0138)
- Magnet applicator tool (A-9653-0201)

[1] The reference mark selector magnet is only required for 'Customer selectable reference mark' readheads. For more information refer to *VIONiC™ incremental optical encoder system* data sheet (Renishaw part no. L-9517-9678).

Installing the clip and clamp mounted RELx20/RSLx20 scale

1. Thoroughly clean and degrease the substrate with a lint-free cloth. Clean the underside of the scale using approved solvents (see 'Storage and handling' on page 10).

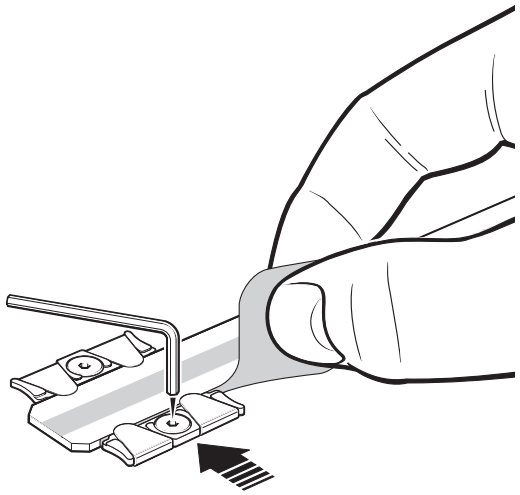


2. Fit the clips on one side of the scale and align to the specification given in the relevant installation drawings on page 19 or 20.

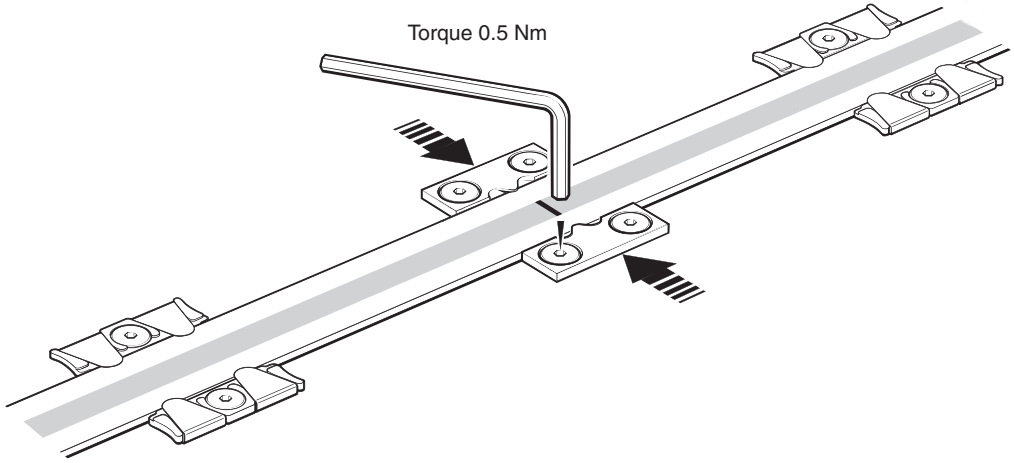
NOTES:

- Only use the special low-profile screws supplied with the clips.
- Additional screws can be purchased from Renishaw.
- When mounting the scale to vertical surfaces, temporary bridge clamps are available which support the scale prior to fitting clips.

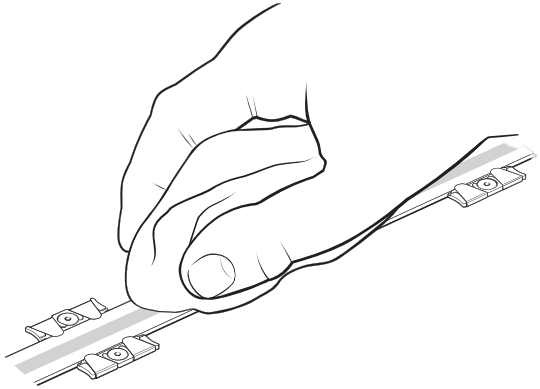
3. Fit the remaining clips using the clip setting shim (provided with the clamp set).



4. Place the datum clamps against the scale and secure them using the special M3 low-profile screws supplied.



5. Clean the scale using the Renishaw scale wipes or a clean, dry, lint-free cloth.



Reference mark selector and limit magnet installation

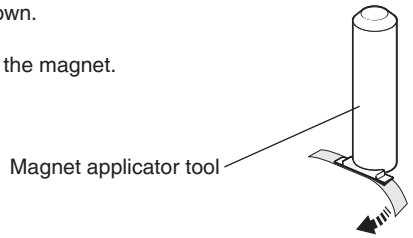
IMPORTANT: Allow 24 hours after the scale application before fitting the magnets.

As the readhead passes the reference mark selector magnet or limit switch magnet, a force of up to 0.2 N is generated between the magnet and the concentrators on the readhead.

- The design of the bracket should be sufficiently stiff so that it is able to tolerate such force without distorting.
- Fitting the scale according to the instructions in this manual prevents the magnetic force from disturbing the scale.

Use the applicator tool to position the reference mark selector and limit magnets accurately and easily.

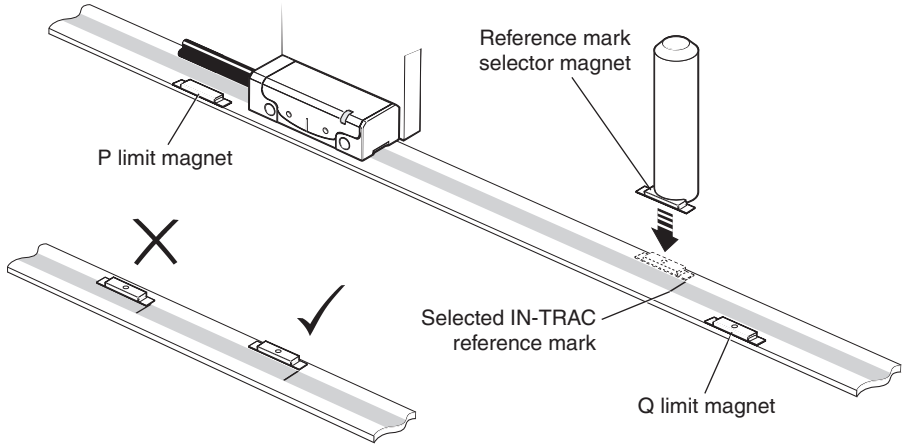
1. Attach the magnet to the applicator tool as shown.
2. Remove the self-adhesive backing paper from the magnet.



3. Place the magnet in the chosen location alongside the edge of the scale ensuring that it is not mounted on the scale.
   - Limit magnets can be positioned at any user defined location along the axis length.
   - Position the reference mark selector magnet adjacent to the selected IN-TRAC reference mark as shown. [1]

[1] The reference mark selector magnet is only required for 'Customer selectable reference mark' readheads. For more information refer to *VIONiC™ incremental optical encoder system* data sheet (Renishaw part no. L-9517-9678).

NOTE: The reference mark selector and limit actuator locations are correct for the readhead orientation shown.



4. Press the magnet down firmly using a clean, dry, lint-free cloth for complete adhesion.

NOTES:

- The limit output is nominally asserted when the readhead limit switch sensor passes the limit magnet leading edge, but can trigger up to 3 mm before that edge (see 'VIONiC readhead installation drawing' on page 12).
- The reference and limit magnets may creep when influenced by magnetic materials in close proximity. In such cases, use an additional fillet of epoxy glue or similar along the outer edge of the magnet assembly to hold them in place.
- External magnetic fields greater than 6 mT, in the vicinity of the readhead, may cause false activation of the limit and reference sensors.

VIONiC readhead quick-start guide

INSTALLATION

Make sure the scale, readhead optical window, and mounting faces are clean and free from obstructions.

↓

If required, check the reference mark selector magnet is positioned correctly (see 'VIONiC readhead installation drawing' on page 12).

↓

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

↓

Install and align the readhead to maximise the signal strength over the full axis of travel 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.

↓

Move the readhead along the scale at slow speed (< 100 mm/s), without passing a reference mark, until the LED starts double-flashing blue.

↓

No reference mark

If a reference mark is not being used, cycle the power to exit the calibration routine now. The LED will stop flashing.

Reference mark

Move the readhead back and forth over the selected 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 the calibration routine fails (LED remains single-flashing blue), restore the readhead factory defaults (see 'Restoring factory defaults' on page 28) and repeat the installation and calibration routine.

See pages 26 to 27 for more detailed information on installing the readhead. The optional ADTi-100 Advanced Diagnostic Tool [1] (A-6165-0100) and ADT View software [2] can be used to aid installation and calibration.

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

[2] 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 provide adjustment to 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

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

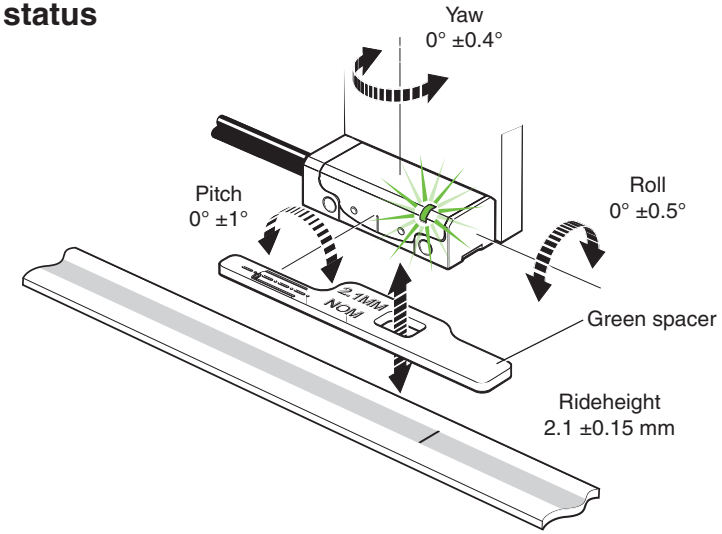
NOTE: When cleaning the readhead and the scale apply the cleaning fluid sparingly, do not soak.

1. Mount the readhead to the bracket using 2 M2.5 screws.
2. To set the 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.
3. Adjust the readhead to achieve a flashing green LED along the full axis of travel. 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: Restore the factory defaults to reinstall the readhead (see 'Restoring factory defaults' on page 28).

Readhead set-up LED status



Readhead LED diagnostics [1]

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	Four red flashes	Low signal, over signal, or overspeed; system in error

[1] See 'Troubleshooting' on page 29 for more information on diagnosing faults.

System calibration

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

Before system calibration:

1. Clean the scale and readhead optical window.
2. If reinstalling, restore the factory defaults (see 'Restoring factory defaults' on page 28).
3. Maximise the signal strength along the full length of travel (set-up LED is flashing green).

NOTE: During calibration do not exceed 100 mm/s or the readheads' maximum speed, whichever is slowest.

Incremental signal calibration

1. Cycle the power to the readhead or connect the 'Remote CAL' output pin to 0 V for < 3 seconds. The readhead will then periodically single-flash blue to indicate it is in calibration mode as detailed in 'Readhead mounting and alignment' on page 26. The readhead will only enter calibration mode if the LED is flashing green.
2. Move the readhead at slow speed along the axis. Make sure the readhead does not pass a reference mark until the LED starts double-flashing. This shows the incremental signals are now calibrated and the new settings are stored in the readhead memory.
3. 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.
4. If the system does not automatically enter the reference mark phasing stage (LED continues single-flashing) the calibration of the incremental signals has failed. Make sure the failure is not due to overspeed (> 100 mm/s, or exceeding the readhead maximum speed).
5. Exit the calibration routine and restore factory defaults (see 'Restoring factory defaults' on page 28).
6. Check the readhead installation and system cleanliness before repeating the calibration routine.

Reference mark phasing

1. Move the readhead back and forth over the selected reference mark until the LED stops flashing and remains solid blue. The reference mark is now phased.

   NOTE: Only the chosen reference mark that has been used in the calibration routine is guaranteed to remain phased.

2. The system automatically exits the calibration routine and is ready for operation.
3. AGC and AOC are automatically switched on once calibration is complete. To switch off AGC refer to 'Switching Automatic Gain Control (AGC) on or off' on page 28.
4. If the LED continues double-flashing after repeatedly passing the chosen reference mark it is not being detected.
   - Make sure that the correct readhead configuration is being used. Readheads can either output all reference marks or only output a reference mark where a reference selector magnet is fitted depending on the options chosen when ordering.
   - Check that the reference mark selector magnet is fitted in the correct location relative to readhead orientation (see 'VIONiC readhead installation drawing' on page 12).

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 stop flashing.

LED status during system calibration

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

Restore factory defaults when realigning the readhead, reinstalling the system, or if there is continued calibration failure.

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

To restore factory defaults:

1. Switch off the system.
2. Obscure the readhead optical window (using the green 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.
3. Power the readhead.
4. Remove the spacer or, if using, the connection from the 'Remote CAL' output pin to 0 V.
5. The LED will start continuously flashing indicating factory defaults have been restored and the readhead is in installation mode.
6. Repeat the 'Readhead set-up' procedure on page 26.

Switching Automatic Gain Control (AGC) on or off

The AGC is automatically enabled 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.

NOTE: AGC can be switched on or off using the optional ADTi-100 and ADT View software. See **www.renishaw.com/adt** for more information.

Troubleshooting

Fault	Cause	Possible solutions
LED on the readhead is blank	There is no power to the readhead	• Make sure 5 V is supplied at the readhead • For cable variants, check the correct wiring of connector

LED on the readhead is flashing red during installation mode	The signal strength is < 50%	• Check the readhead optical window and scale are clean and free from contamination
		• Restore factory defaults (see page 28) and check the alignment of the readhead. In particular:
		  • Rideheight
		  • Yaw
		  • Offset
		• Make sure the scale and readhead combination is correct

Unable to get a green LED over the complete axis length	System run-out is not within specification	• Use a DTi gauge and check the run-out is within specifications • Restore factory defaults (see page 28) • Realign the readhead to obtain a green flashing LED at the mid-point of the run-out • Recalibrate the system (see page 27)
Can't initiate the calibration routine	Signal size is < 70%	• Realign the readhead to obtain a green flashing LED

Fault	Cause	Possible solutions
During calibration the LED on the readhead remains single-flashing blue even after moving it along the full axis length	The system has failed to calibrate the incremental signals due to the signal strength being < 70%	• Exit CAL mode and restore factory defaults (see page 28) • Check the readhead set-up and alignment (see page 26)
During calibration the LED on the readhead is double-flashing blue even after moving it past the reference mark several times	The readhead is not seeing a reference mark	• Position the reference mark selector magnet correctly • Move the readhead past your chosen reference mark several times • Check the readhead/selector magnet orientation • Check the readhead optical window and scale are clean and free from contamination

No reference mark output		• Do not move the readhead too fast during calibration mode (maximum speed < 100 mm/sec)
		• Calibrate the system (see page 27)
		  • If the system completes the calibration mode, it has successfully seen and calibrated the reference mark. If you still do not see a reference mark, check the system wiring.
		  • If the system does not calibrate the reference mark (LED on the readhead remains double-flashing blue), see above for possible solutions.

Reference mark is not repeatable	Only the chosen reference mark that has been used in the calibration sequence is repeatable; other reference marks may not be phased	• Use the reference mark that has been calibrated for referencing your system • The readhead bracket must be stable and not allow any mechanical movement of the readhead • Clean the scale and readhead optical window and check for damage then recalibrate the system over the chosen reference mark (see page 27)

Fault	Cause	Possible solutions
LED on the readhead is flashing red over the reference mark	The reference mark is not phased	• Use the reference mark that has been calibrated for referencing your system, as only this reference mark will be guaranteed to remain phased • Clean the scale and readhead optical window and check for scratches, then recalibrate the system over the chosen reference mark (see page 27)
Multiple reference marks are being output	The readhead reference mark option is either option B or F, 'All reference marks are output'	• Calibrate the system ensuring all the incremental signal calibration steps and the reference mark phasing steps are completed (see page 27) • Calibrate the reference mark used for referencing your system, as only this reference mark will be guaranteed to remain phased
LED on the readhead is flashing red four times upon switch on	Low signal, over signal, or the readhead speed is too fast. The system is in error.	• Check the readhead set-up and alignment (see page 26)

Output signals

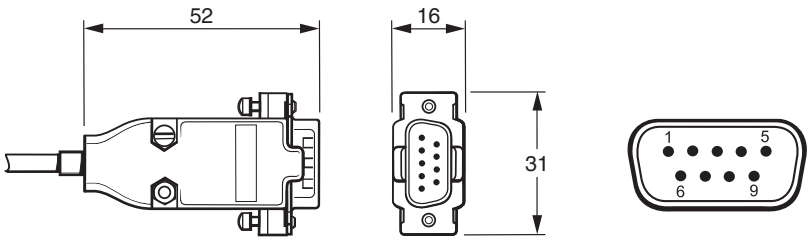
Digital outputs

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 [1]	CAL		Clear	9	1	5	C	4
Shield	-		Screen	Case	Case	Case	Case	Ferrule

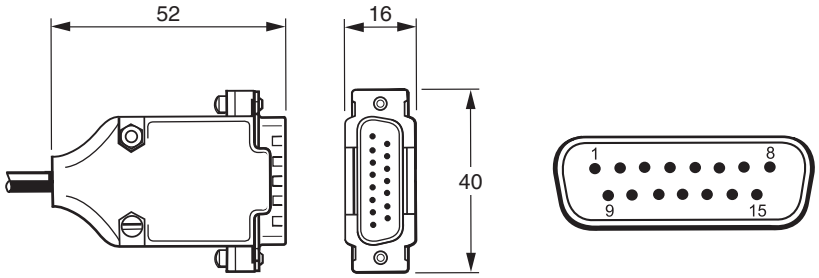
[1] The remote CAL line must be connected for use with the ADTi-100.

VIONiC readhead termination options

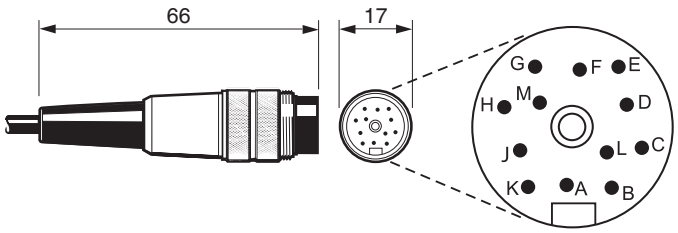
9-way D-type connector (termination code A) [1]



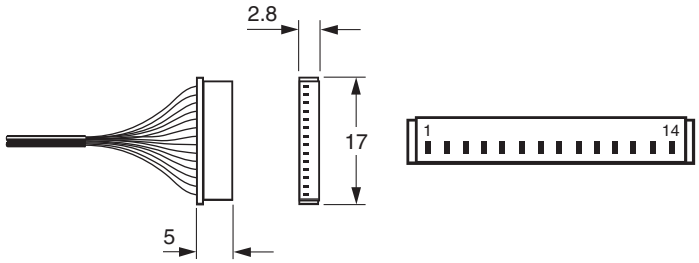
15-way D-type connector (termination code D [1], H)



12-way in-line circular connector (termination code X) [2]



14-way JST connector (termination code J) [3]



[1] For cable lengths > 3 m the connector contains a pcb and should not be removed.

[2] 12-way circular Binder mating socket (A-6195-0105).

[3] Pack of 5 14-way JST SH mating sockets:
Bottom mount (A-9417-0025);
Side mount (A-9417-0026).
Maximum of 20 insertion cycles for JST connector.

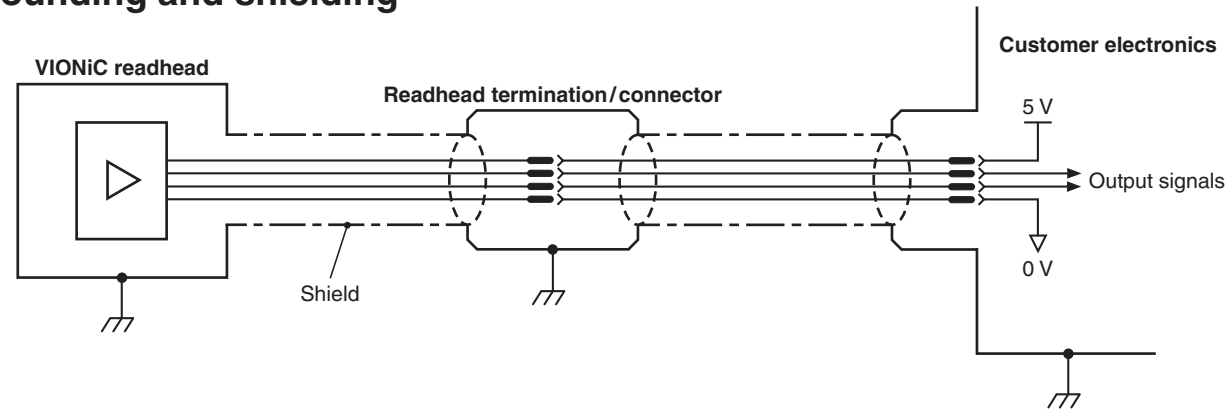
Speed

Clocked output option (MHz)	Maximum speed (m/s)												Minimum edge separation [1] (ns)
	D (5 µm)	X (1 µm)	Z (0.5 µm)	W (0.2 µm)	Y (0.1 µm)	H (50 nm)	M (40 nm)	P (25 nm)	I (20 nm)	O (10 nm)	Q (5 nm)	R (2.5 nm)	
50	12	12	12	7.25	3.63	1.81	1.45	0.906	0.725	0.363	0.181	0.091	25.1
40	12	12	12	5.8	2.9	1.45	1.16	0.725	0.58	0.29	0.145	0.073	31.6
25	12	12	9.06	3.63	1.81	0.906	0.725	0.453	0.363	0.181	0.091	0.045	51.0
20	12	12	8.06	3.22	1.61	0.806	0.645	0.403	0.322	0.161	0.081	0.04	57.5
12	12	10.36	5.18	2.07	1.04	0.518	0.414	0.259	0.207	0.104	0.052	0.026	90.0
10	12	8.53	4.27	1.71	0.85	0.427	0.341	0.213	0.171	0.085	0.043	0.021	109
08	12	6.91	3.45	1.38	0.69	0.345	0.276	0.173	0.138	0.069	0.035	0.017	135
06	12	5.37	2.69	1.07	0.54	0.269	0.215	0.134	0.107	0.054	0.027	0.013	174
04	12	3.63	1.81	0.73	0.36	0.181	0.145	0.091	0.073	0.036	0.018	0.009	259
01	4.53	0.91	0.45	0.18	0.09	0.045	0.036	0.023	0.018	0.009	0.005	0.002	1038

[1] For a readhead with a 1 m cable.

Electrical connections

Grounding and shielding

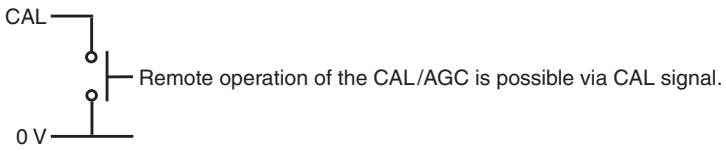


IMPORTANT: Connect the shield to the machine earth (Field Ground). For JST variants connect the ferrule to the machine earth.

Maximum cable length

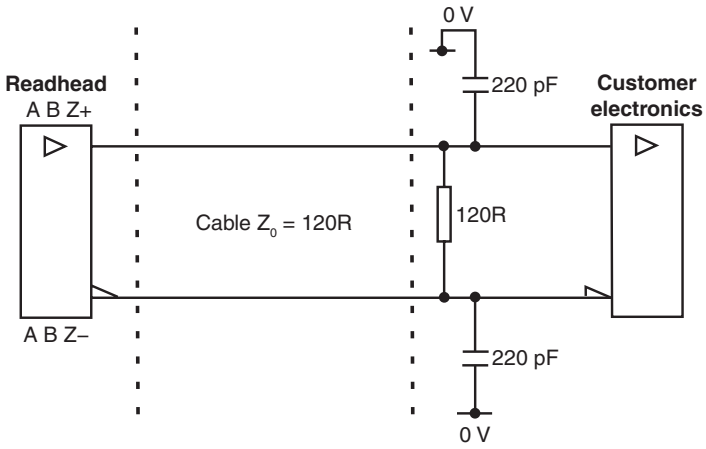
Readhead cable	10 m [1]
Maximum extension cable length	Dependent on the cable type, the readhead cable length and the clocked output option. Contact your local Renishaw representative for more information.
Readhead to ADTi-100	10 m [1]

Remote CAL operation



[1] Cable lengths > 3 m are fitted with an active connector that should not be removed.

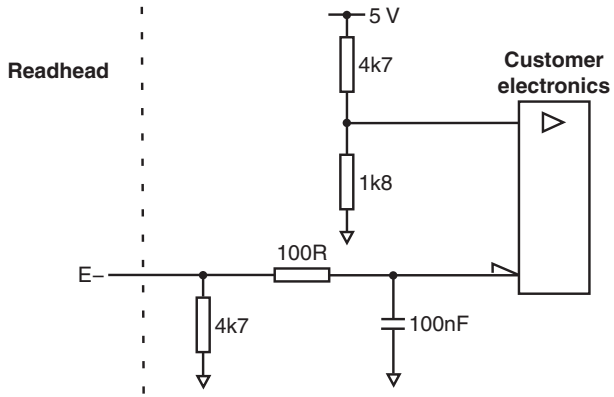
Recommended signal termination



Standard RS422A line receiver circuitry.
The capacitors are recommended for improved noise immunity.

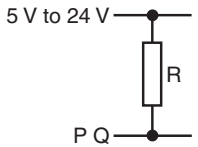
Single-ended alarm signal termination

(not available with 'A' cable termination)



Limit output

(not available with 'A' cable termination)



NOTE: Select R so that maximum current does not exceed 20 mA. Alternatively, use a suitable relay or opto-isolator.

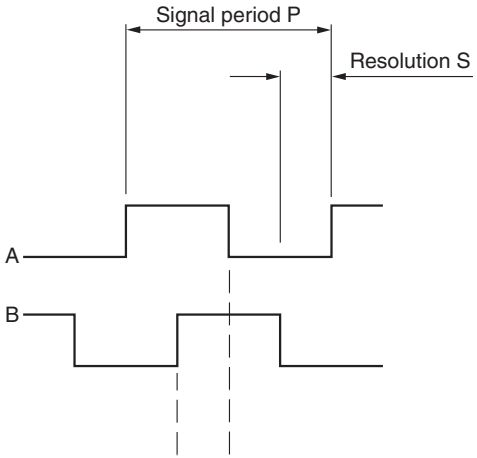
Output specifications

Digital output signals

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

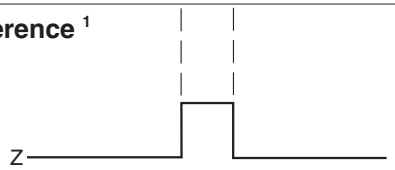
Incremental [1]

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

Reference [1]



Synchronised pulse Z, duration as resolution. Bi-directionally repeatable. [2]

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.

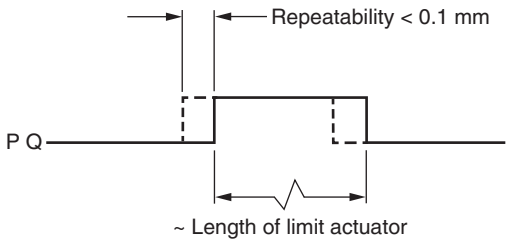
[1] For clarity, the inverse signals are not shown.

[2] Only the calibrated reference mark is bi-directionally repeatable.

Limits

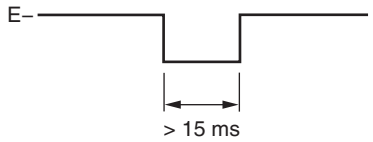
Open collector output, asynchronous pulse (not available with 'A' cable termination)

Active high



Alarm

Line driven (asynchronous pulse)
(not available with 'A' cable termination)



Alarm asserted when:

- The signal amplitude is < 20% or > 135%
- The readhead speed is too high for reliable operation

or 3-state alarm

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

General specifications

Power supply	5V –5%/+10%	Cable lengths ≤ 3 m, typically 200 mA fully terminated Cable lengths > 3 m, typically 250 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	System (storage)	–20 °C to +70 °C
	System (operating)	0 °C to +70 °C
Humidity	System	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	Readhead (operating)	Sinusoidal 100 m/s² max @ 55 Hz to 2000 Hz, 3 axes
	Scale (operating)	Sinusoidal 300 m/s² max @ 55 Hz to 2000 Hz, 3 axes
Mass	Readhead	8.6 g
	Cable	26 g/m
EMC compliance		IEC 61326-1
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 length [1]	10 m
Connector options		**Code - connector type** A - 9-way D-type D - 15-way D-type (standard pin-out) H - 15-way D-type (alternative pin-out) X - 12-way circular connector J - 14-way JST connector
Typical Sub-Divisional Error (SDE)		< ±15 nm

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.

[1] Extension cables available. Contact your local Renishaw representative for further details.

RELx20 spar scale specifications

Form (height × width)	1.6 mm × 14.9 mm
Pitch	20 µm
Accuracy (at 20 °C) **(includes slope and linearity)**	Certified to ±1 µm for lengths up to 1 m ±1 µm/m for lengths > 1 m to 1.5 m Calibration traceable to International Standards
Supplied lengths	20 mm to 1.5 m (available in increments of 10 mm)
Material	ZeroMet™ high stability low-expansion nickel-iron alloy
Mass	184 g/m
Coefficient of thermal expansion (at 20 °C)	0.75 ±0.35 µm/m/°C
Mounting	Epoxy datum point and adhesive tape (nominal thickness 0.2 mm) or mechanical datum clamp and mounting clips

RSLx20 spar scale specifications

Form (height × width)	1.5 mm × 14.9 mm
Pitch	20 µm
Accuracy (at 20 °C) **(includes slope and linearity)**	±1.5 µm/m for lengths up to 1 m ±2.25 µm/m for lengths from 1 m to 2 m ±3 µm/m for lengths from 2 m to 3 m ±4 µm/m for lengths from 3 m to 5 m Calibration traceable to International Standards
Supplied lengths	20 mm to 5 m (available in increments of 10 mm)
Material	Hardened martensitic stainless steel
Mass	172 g/m
Coefficient of thermal expansion (at 20 °C)	10.1 ±0.2 µm/m/°C
Mounting	Epoxy datum point and adhesive tape (nominal thickness 0.2 mm) or mechanical datum clamp and mounting clips
Storage	Lengths over 1.13 m are coiled (> 600 mm diameter)

Reference mark

Type		Customer selected IN-TRAC reference mark, directly embedded into the incremental track.
Position	RELM20	Midpoint of the scale length
	RELE20	20 mm from the scale end
	RSLM20	Midpoint of the scale length
	RSLE20 (option A)	20 mm from the scale end (for use with 10 mm limits)
	RSLE20 (option B)	70 mm from the scale end (for use with limits ≥ 20 mm)
	RSLC20	Reference marks every 200 mm. Use customer positioned selector magnet (A-9653-0143) for selecting desired IN-TRAC reference mark
Repeatability		Unit of resolution repeatability (bi-directional) across full system rated speed and temperature ranges

Limit switches

Type	Magnetic actuators; with dimple triggers Q limit, without dimple triggers P limit (see 'VIONiC readhead installation drawing' on page 12)
Trigger point	The limit output is nominally asserted when the readhead limit switch sensor passes the limit magnet leading edge, but can trigger up to 3 mm before that edge
Mounting	Customer placed at desired locations
Repeatability	< 0.1 mm

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