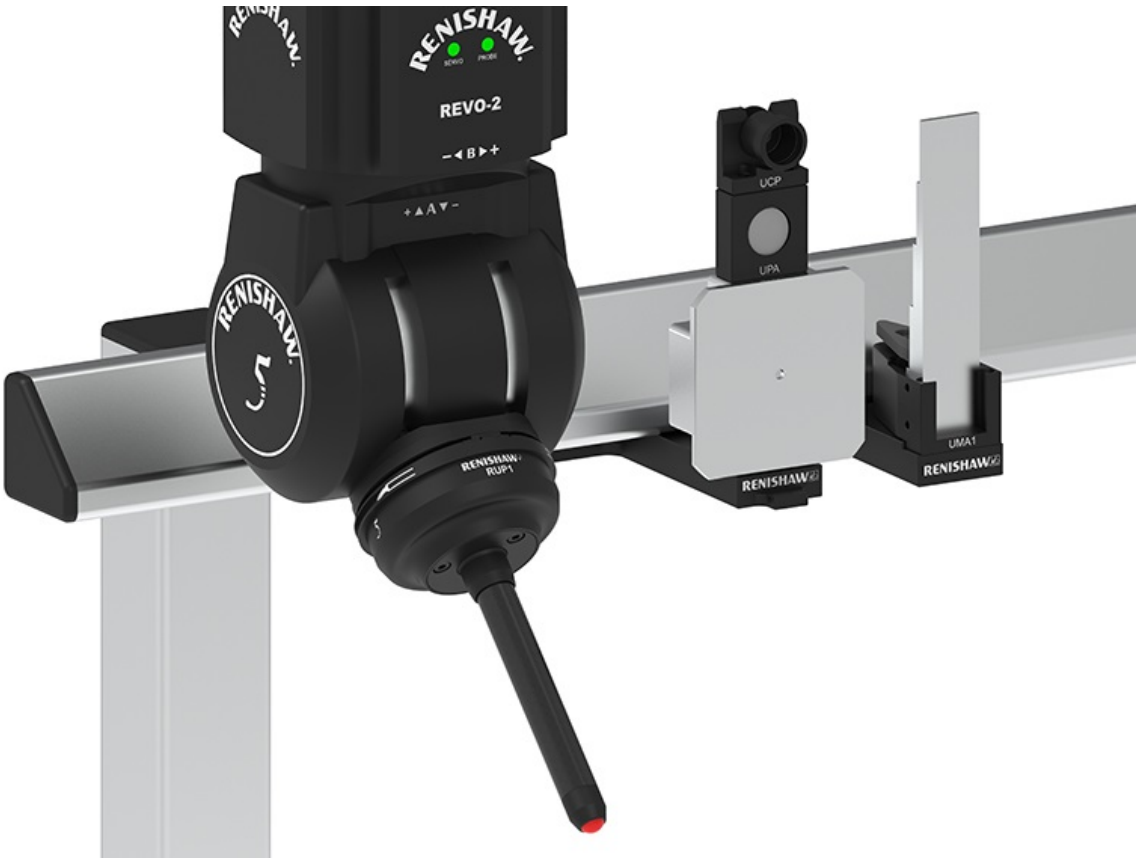
RUP1 installation and user's guide

Document part number H-1000-5396-02-A



RUP1 general information

ORIGINAL LANGUAGE VERSION

Disclaimer

WHILE CONSIDERABLE EFFORT WAS MADE TO VERIFY THE ACCURACY OF THIS DOCUMENT AT PUBLICATION, ALL WARRANTIES, CONDITIONS, REPRESENTATIONS AND LIABILITY, HOWSOEVER ARISING, ARE EXCLUDED TO THE EXTENT PERMITTED BY LAW.

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Trade marks

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Renishaw product names, designations and the mark 'apply innovation' are trade marks of Renishaw plc or its subsidiaries.

Other brand, product or company names are trade marks of their respective owners.

WEEE

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.

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.

Care of equipment

Renishaw probes and associated systems are precision tools used for obtaining precise measurements and must therefore be treated with care.

Changes to Renishaw products

Renishaw reserves the right to improve, change or modify its hardware or software without incurring any obligations to make changes to Renishaw equipment previously sold.

Company registration details

Renishaw plc. Registered in England and Wales. Company no: 1106260. Registered office: New Mills, Wotton-under-Edge, Gloucestershire, GL12 8JR, UK.

Packaging

To aid end user recycling and disposal the materials used in the different components of the packaging are stated here:

Packaging component	Material	94/62/EC code	94/62/EC number
Outer box	Non-corrugated fibreboard	PAP	21
Packaging insert	Non-corrugated fibreboard	PAP	21

CAUTION: If it is necessary to return any part of the system please ensure it is packaged carefully. Failure to do so could result in transit damage for which the customer would be liable. Products supplied in plastic boxes must be returned in the original packaging.

Patents

Features of Renishaw's RUP1 system and associated products (such as REVO-2) are the subjects of one or more of the following patents and patent applications:

CN100453970	EP1877727	JP2016-533484	US10260856	WO2014/191729
CN101166951	EP1877732	JP2017-535758	US10502712	WO2015/049341
CN101166953	EP1989504	JP2019-536032	US10627259	WO2016/051148
CN101405563	EP2002206	JP2022-522353	US11231398	
CN101405564	EP2002207	JP5196356	US2020-0049498	
CN101490430	EP2035719	JP5350216	US2022-0137005	
CN101772690	EP2140318	JP5425476	US7533574	
CN102305613	EP2167911	JP5653581	US7809523	
CN102906533	EP2431707	JP5658863	US7861430	
CN103842766	EP2564151	JP5706158	US7885777	
CN105408723	EP2764324	JP5851969	US7971365	
CN105793695	EP3004797	JP6013533	US8006398	
CN106716051	EP3052926	JP6199870	US8186882	
CN106796109	EP3201565	JP6348577	US8302321	
CN107532930	EP3201566	JP6742303	US8425119	
CN109964098	EP3289314	JP7042620	US8474148	
CN112129190	EP3542130		US8511898	
CN113544463	EP3786577		US8601701	
	EP3931526		US8756973	
			US8978261	
			US9038282	
			US9366519	
			US9903713	

RUP1 product compliance

EU declaration of conformity

Contact Renishaw plc or visit www.renishaw.com/EUCMM for the full EU declaration.

UK declaration of conformity

Contact Renishaw plc or visit www.renishaw.com/UKCMM for the full UK declaration.

EMC conformity

This equipment must be installed and used in accordance with this installation guide. This product is intended for industrial use only and should not be used in a residential area or connected to a low voltage power supply network which supplies buildings used for residential purposes.

FCC (USA only)

Information to user (47 CFR 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 you will be required to correct the interference at your own expense.

Information to user (47 CFR 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.

Equipment label (47 CFR 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.
2. This device must accept any interference received, including interference that may cause undesired operation.

ICES-001 (Canada only)

This ISM device complies with Canadian ICES-001(A) / NMB-001(A).

Cet appareil ISM est conforme à la norme ICES-001(A) / NMB-001(A) du Canada.

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

China RoHS

Contact Renishaw plc or visit www.renishaw.com/ChinaRoHSCMM for the full China RoHS tabulation.

RUP1 safety

CAUTION: Before unpacking and installing the REVO-2 system and accompanying probes, the user should carefully read the safety instructions below and ensure that they are followed at all times by all operators.

The RUP1 is only to be used with the Renishaw REVO-2 head.

Operators must be trained in the use and application of the REVO-2 system and accompanying products, in the context of the machine it is fitted to, before being allowed to operate that machine.

Permanent magnets are used in some components of the REVO-2 system and associated products. It is important to keep them away from items which may be affected by magnetic fields, e.g. data storage systems, pacemakers and watches etc.

RUP1 warnings

Beware of unexpected movement. The user should remain outside of the full working envelope of probe head and stylus. The machine supplier should ensure the user is aware of the full working envelope of the system.

In all applications involving the use of machine tools or CMMs, eye protection is recommended.

It is the machine supplier's responsibility to ensure that the user is made aware of any hazards involved in operation, including those mentioned in Renishaw product documentation, and to ensure that adequate guards and safety interlocks are provided.

Refer to the machine supplier's operating instructions.

The system components contain no user serviceable parts, with the exception of FCR25. No attempt should be made to disassemble any part of the product. In the event of a problem please contact your supplier for assistance.

Under certain circumstances the probe signal may falsely indicate a probe-seated condition. Do not rely on probe signals to stop machine movement.

Probe trigger override on the MCU joystick should be used with care, since it will prevent the CMM from stopping in the event of a collision.

The probe joints are designed to release the probe and / or the stylus holder in the event of a crash.

This equipment is not suitable for use in a potentially explosive atmosphere.

Pinch hazards exist between parts. Do not hold the probe or probe head during movements.

It is essential for continued safety that all fuses are replaced by the correct type and rating.

REVO-2 must be transported in Renishaw supplied packaging.

The cables must meet Renishaw specifications. Incorrect cabling could cause damage to the equipment.

RUP1

- Remove protective caps prior to use:

- The RUP1 probe should be handled with care
- Avoid dropping the RUP1 probe or colliding with workpieces or parts of the CMM structure
- Particular care should be given to the stylus tip - avoid contact with the elastomer ball unless it is being used for measurement
- Visually examine the elastomer ball for contamination of dirt or dust
- Ensure measurement surfaces are dry and clear of debris before being inspected with RUP1 probe

Elastomer balls

- The elastomer balls contain an Ethylene Glycol and distilled water solution
- Do not eat
- Do not squeeze
- Keep handling to a minimum
- Keep in a sealed bag

RUP1 references and associated documents

The following Renishaw documents are referred to in this document or may be a source of further relevant information. They can easily be acquired from Renishaw web site www.renishaw.com.

Title	Document number
Installation and user's guide: REVO-2 and RSP2	H-1000-7590
Installation and user's guide: RSP3	H-1000-5124
Installation and user's guide: SFP2	H-1000-5365
User's guide: RVP	H-1000-3322
User's guide: RFP1	H-1000-5430
Installation guide: UCC S5	H-1000-7598
Installation guide: SPA3-2	H-1000-5364
Installation & user's guide: MCUlite-2, MCU5-2 and MCU W-2	H-1000-5280
Installation and user's guide: MRS modular rack system	H-1000-5088
Installation guide: MRS2 modular rack system	H-1000-5255
Installation guide: REVO-2 change system port spacing guide	H-1000-5408
Technical specifications guide: Styli and accessories	H-1000-3200

RUP1 system description

The RUP1 probe system brings automated thickness measurement to CMMs as part of the REVO 5-axis multi-sensor measuring system.

The RUP1 system hardware is comprised of a probe, an end cap, an elastomer ball (tip) and accessories to enable automatic interchange of RUP1 or between different probe types. Calibration and setting artefacts are also available to ensure that the system is performing at its optimum capability at all times. Specific RUP1 software is also required to interpret the data collected by the REVO-2 system. Because the RUP1 system is used as part of a multi-sensor system, and uses specially designed calibration routines, the location of the stylus tip is known precisely. RUP1 thickness measurements can therefore be collected from a specific location, even if there is significant variation between nominally identical parts. The thickness data, together with its analysis results, can then be stored alongside the part's dimensional data for future reference.

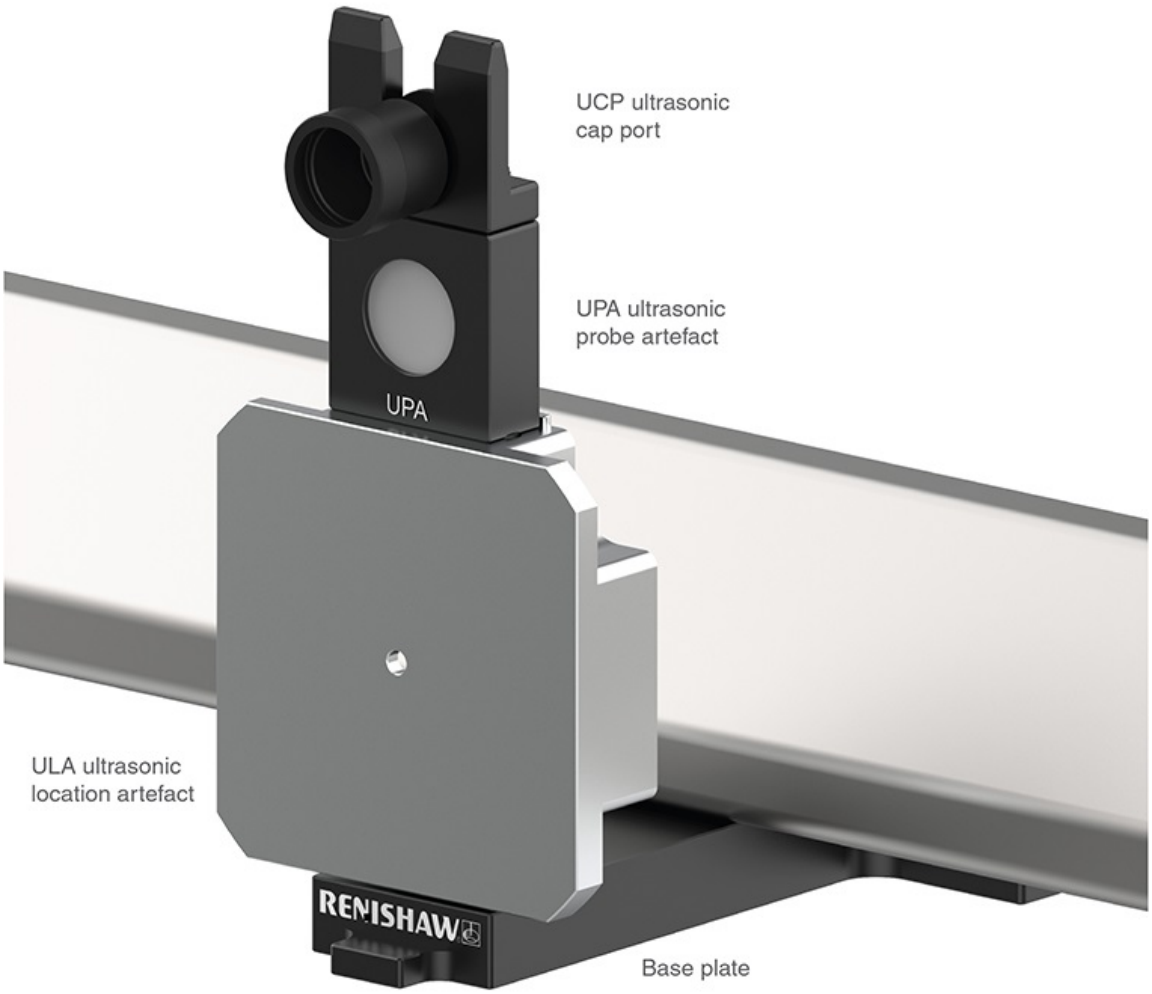
System components overview

RUP1 (REVO ultrasonic probe)

Elastomer ball (tip)

End cap

Protective cap


UCP ultrasonic
cap port
UPA ultrasonic
probe artefact
UPA
ULA ultrasonic
location artefact
RENISHAW
Base plate

RUP1 probe

The RUP1 probe houses the electronics to condition the signals from the transducer so that they can be communicated to the controller via the REVO-2 head.

Protective cap

The RUP1 should always be stored with the protective cap in-place as it extends the life of the tip (elastomer ball). The protective cap fits over the “endcap” and is held in-place by the friction of the sealing ring. Automated routes automatically remove and replace the cap during use.

UCP ultrasonic cap port

The UCP holds the protective cap during use. The UCP sits on the top of the calibration assembly.

UPA ultrasonic probe artefact

The UPA is used to determine the RUP1 probe length (tip Z) and the ultrasonic axis.

ULA ultrasonic location artefact

The ULA determines the XY of the position of the ultrasonic axis (location).

CAUTION: Take great care not to damage or scratch the artefact.

UMA1 ultrasonic material artefact

The UMA1 holds the four or five step ASTM E797 spec ultrasonic calibration artefact.

NOTE: The precision of the artefact affects the system performance.
The artefact should be made from the same material grade and be subjected to the same processes (e.g. heat treatments, forging, shot peening) as the part being measured.

RUP1 specifications

Environmental specification

Operating temperature range	+10 °C to +40 °C (+50 °F to +104 °F)
Storage temperature range	-25 °C to +70 °C (-13 °F to +158 °F)
Operating humidity	0% to 65% (non-condensing)
Storage humidity	0% to 80% (non-condensing)

Electrical specification

The REVO-2 head and probe electronics are powered from the UCC S5.

The RCP TC-3 is powered by a separate power supply that is supplied by Renishaw.

No other additional power supplies are required.

Probe specification

Parameter	Specification
Material thickness range	1 mm to 20 mm (metal parts excluding cast iron and additive parts) * / **
Thickness measurement accuracy	Near-parallel surfaces better than 0.025 mm *** Non-parallel surfaces up to 10 degrees - 0.100 mm ***
Tip composition	Leaves minimal chemical residue on the surface
Tip life - in use	1 - 5 shifts (will depend on environment) ****
Tip life - ready to use	7 days in a rack stored with protective cap ****
Tip life - shelf life	12 months minimum (when stored in packaging)
Measurement method	Point measurement of near-parallel surfaces Capability to measure non-parallel surfaces (up to 10° wedge angle) ***
Probe changing	Fully automated to work with standard REVO-2 multi sensor set-up

* Near-parallel surfaces

** The range has been verified on aluminium 4032/ 6020, 303/316/416 stainless steels, titanium alloys. Other metals will be able to be measured but may not achieve these specifications.

*** Relies on the calibration artefact being manufactured of the same material, same manufacturing processes, same location from bar stock as the part.

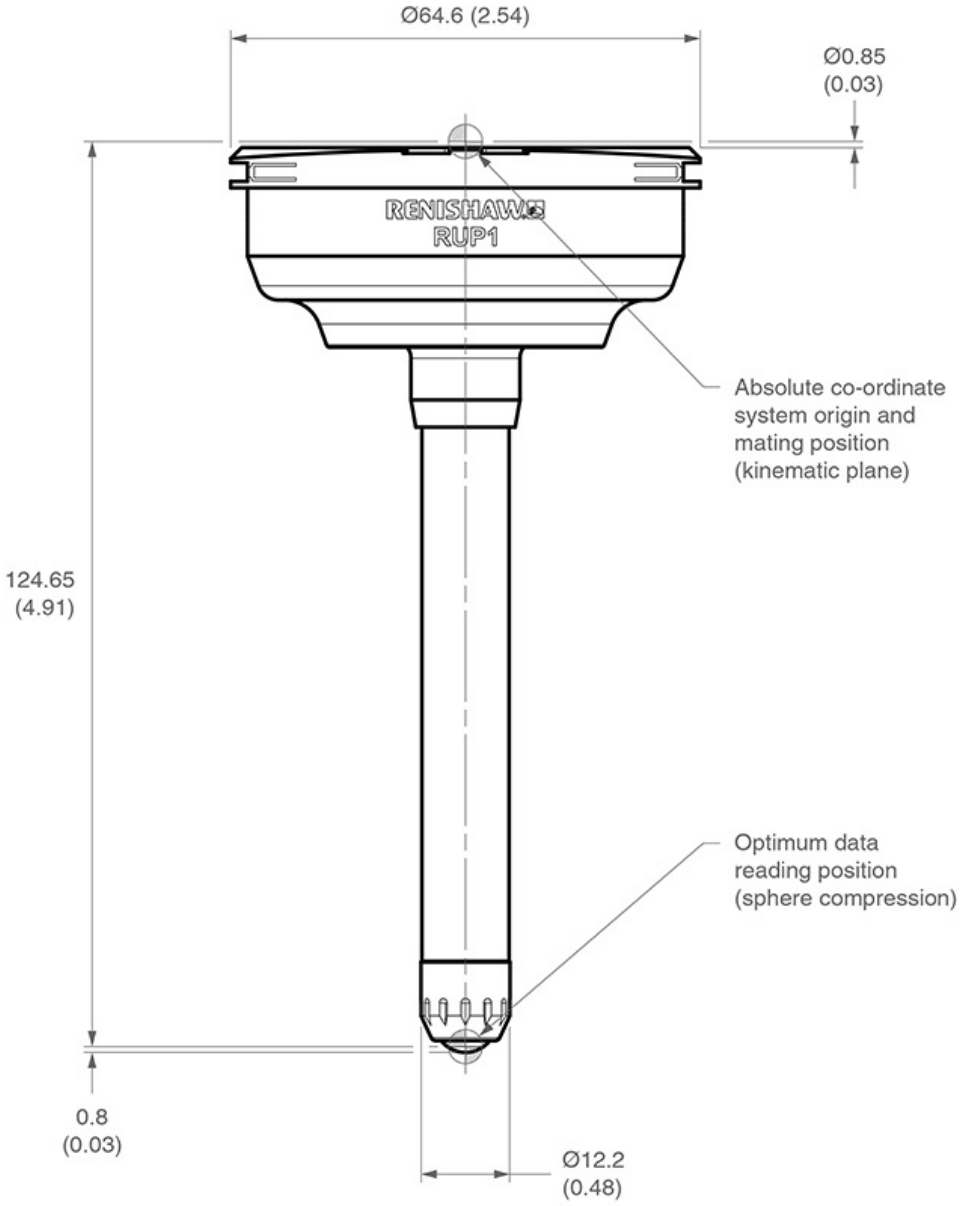
**** 1 shift = 8 hours and in a 20 °C calibration room.

Application features

Product feature	
Calculating bore diameters from thicknesses	Measure the outside diameter and the thickness allows the internal diameter to be calculated. Internal diameter must exceed 100 mm.
Measuring internal distances to square shoulders	Start at the small diameter, take a series of points into the large diameter. Application trials show an accuracy 0.15 mm can be achieved.
Ball diameter damage detection	The system consistently checks the ball condition.
Signal quality indication	A signal quality 'Q' value is available. If signal quality is poor, logic can be used to retry points or the point can be substituted with orbital discovery mode (ODM).
Tip life - ready to use	System reports if the ball / tip becomes too small or damaged.
Temperature	Temperature affects the material speed of sound more than the thermal expansion. Calibrating the speed of sound on the same material as the part eliminates this, providing there are no large temperature changes.

RUP1 dimensions

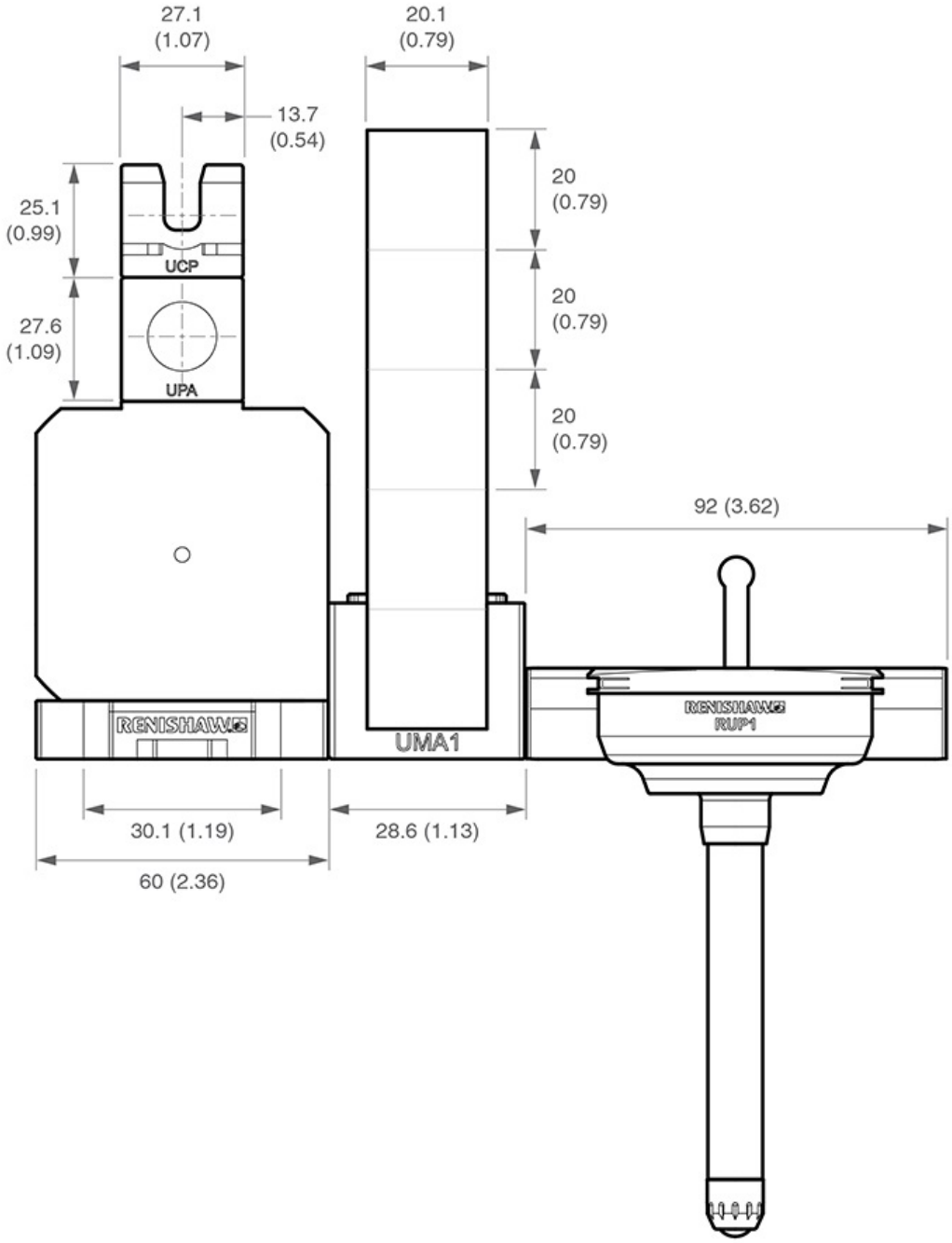
RUP1



NOTE: Dimensions in mm (in).

RUP1 probe change system

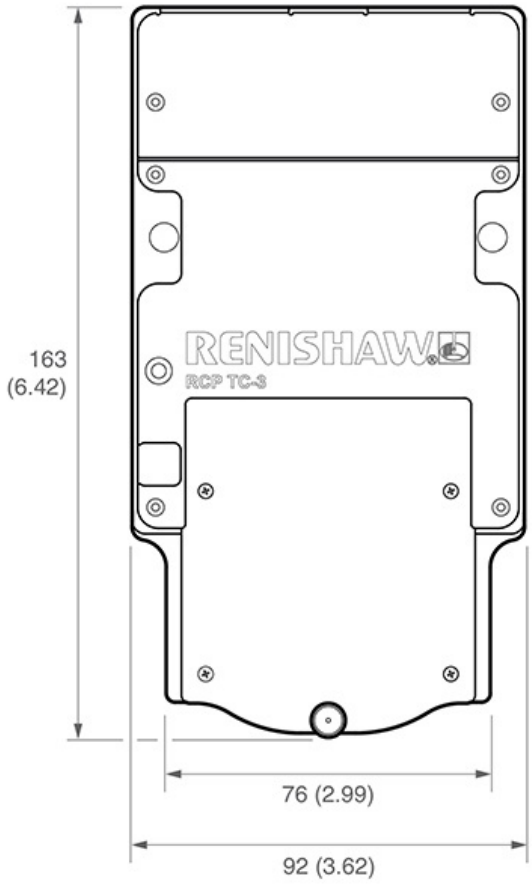
The RUP1 system requires 182 mm (7.17 in) of MRS rail length to mount the calibration and probe holder.



NOTE: Dimensions in mm (in).

RCP TC-3

The RCP TC-3 is a thermally controlled port for changing RSP3-6, SFP2 and RUP1 probes.



NOTE: Dimensions in mm (in).

Manually mounting / removing the RUP1 probe from REVO-2

To manually mount or remove the probe from the REVO-2 head you need to:

1. Align the front of the head with the probe (look at the "Renishaw" engraving on the front of probe or alignment marks as applicable).
2. Carefully align the probe to the head, allowing the magnetic attraction to gently connect the kinematic joints.
3. Gently rotate the probe to ensure correct location.
4. To remove, securely hold the probe and gently tilt to break the kinematic joints.

WARNING: Avoid touching the probe when the REVO-2 head LEDs are both green and the head is ready for measurement. Green LEDs indicate that the head is engaged and the controller has a valid probe calibration.

Assembling the elastomer balls into the end cap

1. Unscrew the end cap from the RUP1.

2. Remove the elastomer ball.

3. Open the bag containing the new elastomer ball. Without touching it tip the new ball in to the end cap.

4. Screw the end cap back on to the RUP1.

WARNING: Try not to touch the elastomer ball by hand.

RUP1 artefact assembly

The following sections outline the assembly of the various RUP1 artefacts:

- Attaching the UCP, UPA and ULA assembly to an MRS2 rail
- UMA1 assembly and step block

Attaching the UCP, UPA and ULA assembly to an MRS2 rail

1. Insert the D-nut into the groove on the underside of the MRS2 rail by rolling into place.

2. Align the ULA base plate assembly and the screw with the threaded hole in the D-nut.

3. Screw in to place and tighten fully.

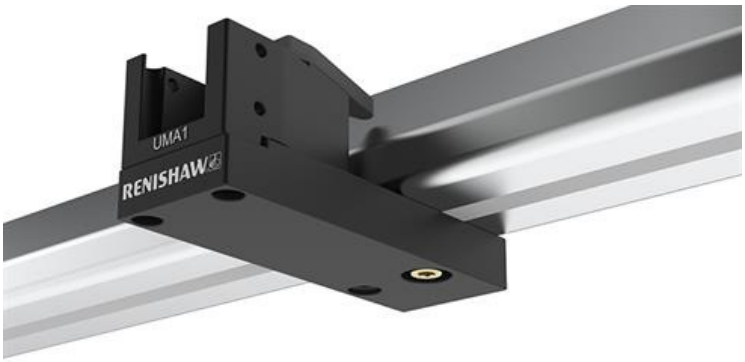
UMA1 assembly and step block

Attaching the UMA1 assembly to the rail

1. Insert the D-nut into the grove on the underside of the MRS2 rail by rolling into place.

2. Align the UMA1 assembly and the screw with the threaded hole in the D-nut.

3. Screw in to place and tighten fully.



Installing a step block into a UMA1

1. Loosen the screw and slide the clamp back towards the rail.

2. Insert the step block into the UMA1 with the steps facing the rail.

3. Slide the clamp forwards until it is pressing against the step block. Retighten the screw whilst holding the clamp firmly in place.

RUP1 probe change system

The REVO-2 probe change system is designed to allow automatic REVO-2 probe and accessory changing on a CMM. For optimum metrology, RUP1 should be changed automatically using REVO-2 change port (RCP TC-3). These ports are mounted on the modular rack system (MRS or MRS2).

RCP TC-3

The RCP TC-3 is a thermally controlled port for changing RSP3-6, SFP2 and RUP1 probes.

RUP1 maintenance

CAUTION: Always refer to the 'Safety' and 'Warnings' sections of this guide. Failure to do so could lead to personal injury.

Following the simple procedures given below will prolong the operational life and maintain the high performance of the system. The user should determine the frequency of inspection and maintenance actions according to the conditions of use.

All system components should be cleaned using a soft, lint free cloth and must be kept dry.

Kinematic couplings

The kinematic coupling mechanisms incorporated throughout the system have precision ball seating and permanent magnets. It is recommended that all these features be cleaned before first use, and thereafter at regular intervals.

A cleaning kit for the precision ball seating and permanent magnet is available from your Renishaw supplier (part number A-1085-0016). It comprises strips of yellow tack material. Use the yellow tack to clean the areas indicated with arrows on the image below.

With clean hands, tear off a small piece, shape into a small ball and press into / onto each of the features in turn, rotating to a fresh piece of material as you work around.

CAUTION: Ensure no yellow tack debris is left on the surface. The yellow tack should not be used for electrical contacts.

Electrical contacts

The electrical contacts, indicated with arrows in the image below, should be carefully cleaned with an alcohol-based cleaner (e.g. IPA) and a lint-free cloth.

Rack port maintenance

CAUTION: Always refer to the 'Safety' and 'Warnings' sections of this guide. Failure to do so could lead to personal injury.

Periodic cleaning of the ports, lids and outer surfaces using a soft, lint free cloth is recommended to prevent contamination of stored probes and modules.

ULA maintenance

Periodically visually inspect the ULA for scratches and wear, and replace if necessary. Cleaning with a lint free cloth at regular intervals is recommended.

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