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RVP user's guide

Part number: H-1000-3322-01-D



General information

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The use of this symbol on Renishaw products and/or accompanying documentation indicates that the product should not be mixed with the 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 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

Renishaw plc warrants its equipment for a limited period (as set out in our Standard Terms and Conditions of Sale) provided that it is installed exactly as defined in associated Renishaw documentation.

Prior consent must be obtained from Renishaw if non-Renishaw equipment (e.g. interfaces and/or cabling) is to be used or substituted. Failure to comply with this will invalidate the Renishaw warranty.

Claims under warranty must be made from authorised service centres only, which may be advised by the supplier or distributor.

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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.

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
Storage box	Polypropylene	PP	05
Packaging insert	Corrugated fibreboard	PAP	20
Stylus box	Polypropylene	PP	05
Stylus box label	Polypropylene	PP	05
Bag	Low density polyethylene	LDPE	04



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Patents

Features of the RVP system and associated products (such as REVO-2), equipment and techniques are the subjects of one or more of the following patents and patent applications:

CA2925301	CN100453970	EP1086354	IN2017/009615	JP2016-513248	US2015-0362311
	CN101166951	EP1687589	IN259801	JP2016-533484	US2016-0238373
	CN101166953	EP1877727	IN279118	JP2018-514773	US2018-0058884
	CN101405563	EP1877732	IN292511	JP2018-522240	US2018-0156608
	CN101405564	EP1989504	IN294476	JP4695762	US6633051
	CN101490430	EP2002206	IN295786	JP5196356	US7533574
	CN101772690	EP2002207	IN296310	JP5350216	US7809523
	CN102037309	EP2035719	WO2006/114603	JP5425476	US7861430
	CN102305613	EP2140318	WO2007/107776	JP5638517	US7885777
	CN102906533	EP2167911	WO2009/141606	JP5653581	US7971365
	CN103842766	EP2291606	WO2011/135282	JP5658863	US8006398
	CN105190230	EP2431707	WO2014/122438	JP5706158	US8186882
	CN105408723	EP2564151	WO2014/191729	JP5851969	US8302321
	CN105793695	EP2764324	WO2015/049341	JP6013533	US8425119
	CN107532930	EP2954283	WO2018/091867	JP6199870	US8474148
	CN107850425	EP3004797		JP6348577	US8511898
		EP3052926			US8601701
		EP3289314			US8756973
		EP3322959			US8978261
					US9038282
					US9366519
					US9618329
					US9903713



Product compliance

EU declaration of conformity

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

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.

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/ChinaRoHS for the full China RoHS tabulation.





Safety

Before unpacking and installing the RVP system, the user should carefully read the safety instructions below and ensure that they are followed at all times by all operators.

The RVP vision probe system should only be used with the 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.

VM10 and VM11 LED emissions

The VM10 and VM11 vision modules incorporate high power LED lights and should not be used in the event of serious damage to any part of the VM10 and VM11 modules. In such cases immediately disconnect the power source, remove and do not attempt to reuse the parts. Contact your supplier for advice.



CAUTION: This equipment uses LED illumination that may flash at a variable rate. Avoid exposure or seek advice from your medical practitioner if you are susceptible to photosensitivity or related health effects.

Environmental and electrical specifications

Environmental specification

Ambient operating temperature range	+10 °C to +40 °C	
Storage temperature range	-25 °C to +70 °C (-13 °F to 158 °F)	
Operating humidity	0% to 80% (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 head motors are powered from the SPA3. The VPCP and VMCP are powered by a separate power supply that is supplied by Renishaw. Any additional backlighting is powered by a separate power supply that is supplied by Renishaw. No additional power supplies are required.

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 be downloaded from www.renishaw.com.

Title	Document number
Installation and user's guide: REVO-2	H-1000-7590
Installation guide: UCC S5	H-1000-7598
Installation and user's guide: MCU	H-1000-5182
Installation and user's guide: MCU5-2 and MCU W-2	H-1000-5280

System description

RVP is a non-contact vision measurement probe for use with the REVO-2 5-axis measurement system on co-ordinate measuring machines. RVP increases the multi-sensor capability of REVO-2 by adding non-contact inspection to the existing touch-trigger, high-speed tactile scanning and surface finish capability of the system.

The RVP system comprises a probe and a range of modules that are automatically interchangeable with all other probe options available for REVO. This flexibility means that the optimum tool can be selected to inspect a wide range of features, all on one CMM platform.

The RVP system is managed by the same I++ DME compliant interface as REVO-2 and full user functionality is provided by Renishaw's MODUS metrology software. New MODUS vision software capability includes RVP configuration, image processing with application specific options and automatic image storage for review and further analysis.



Design principles of the RVP system

The RVP system uses an industry standard CMOS image sensor to capture and then detect the position of features using the contrast between light and dark areas of the image. Data points are projected on to the location where the image contrast changes from light to dark. A detailed calibration model of the lens system transforms the co-ordinates of the projected point on the image to real-world, three dimensional co-ordinates on the part.



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System components overview



Кеу	Description	Part number
1	REVO-2 head	A-5759-0001
2	RVP vision probe	A-5378-0080
3	VM10 vision module	A-5378-0082
4	VM11 vision module	A-5378-0087
5	VPCP probe change port	A-5378-0081
6	VMCP module change port	A-5378-0083
7	VA10 calibration artefact	A-5378-0085



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RVP probe

RVP is the probe component of the system that houses the sensor and digital signal processor. There are currently two vision modules that attach to the probe body that enable the inspection of a range of size and shape features.

The RVP component of the system is automatically interchangeable with other probe options using the VPCP heated change port that can be fixed to the MRS rack system.

Vision modules

The RVP system features two interchangeable vision modules (VM10 and VM11) which are both tailored to provide inspection capability for different applications. The vision modules attach to the probe body using the same style kinematic mount utilised by all the current REVO probes.



VM10 has a wider field of view allowing larger features to be inspected and VM11 has a greater stand-off distance which improves accessibility when inspecting complex parts with hard to reach features.

VA10 calibration artefact

The VA10 is a dedicated calibration artefact used to calibrate the target feature size and stand-off distance of the RVP system when using a VM10 or VM11. The calibration routine for RVP is fully automated through MODUS and UCCsuite.

VPCP and VMCP change ports

There are two new change ports that can be mounted to an MRS rack system to allow the automated changing of all the RVP probe and module components.

The VPCP change port is used to change and house the RVP probe body on the machines rack system. The VMCP change port changes and houses the vision module components of the RVP system. Both rack ports are temperature controlled to ensure that the housed components are at the correct and most efficient operating temperature.



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Dimensional information

RVP





VM10 and VM11





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VPCP and VMCP



VA10

101



Installation

Fitting VPCP and VMCP to the MRS / MRS2 rack

The VPCP and VMCP heated change ports can be fixed to an MRS or MRS2 rack system. It is recommended that they are attached to the MRS / MRS2 rail using the following procedure, where it is assumed that the MRS / MRS2 rack system is correctly installed.

- 1. Insert one of the fixing screws through the VPCP / VMCP.
- 2. Position the VPCP / VMCP underneath the rail and locate the respective T-nut within the rail*.
- 3. Hand tighten the fixing screw into the T-nut and repeat the process for the next fixing screw.
- 4. Position the VPCP / VMCP and tighten both fixing screws using the hexagonal key supplied.



NOTE: The image above shows the VPCP change port but the procedure is the same for the VMCP change port.

* NOTE: T-nuts must be used with the MRS system. However T-nuts and D-nuts are compatible with the MRS2 system.



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Fixing VA10 calibration artefact to CMM

The VA10 calibration artefact is designed to be fixed securely to the bed of the CMM to allow accurate and repeatable calibration of the RVP system components. The diagrams below show how to fix the VA10 to the bed of the CMM.

- 1. Locate an appropriate threaded hole in the bed of the machine.
- 2. Position the artefact plate above the threaded hole.
- 3. Screw the correct size adaptor stud through the hole into the threaded hole on the machine.
- 4. Tighten with S spanner supplied.
- 5. Screw the artefact top component to the adaptor stud.
- 6. Tighten with S spanner supplied.



Illumination options

RVP lighting techniques

The RVP system has a number of illumination options to ensure that features can be correctly lit allowing accurate and consistent measurement. Both vision modules have integrated LED illumination to illuminate features that require inspection. The RVP system also uses a technique which uses back lighting to ensure good contrast of material edges or features.

The lighting technique chosen depends on the type of feature and the material of the part being inspected. RVP system image settings can be fully customised and adjusted to provide optimum contrast to inspect a range of features.

It is important that the correct exposure is achieved for both front and back lighting applications. The image on the left shows a correctly exposed back lit hole. The back edge of the hole is sharp and there is good contrast between the material and the white back lit panel.



The image on the right shows a correctly exposed front lit feature. The front edge of the hole is sharp and there is good contrast between the dark material in the hole and the bright, front lit hole area. When using front lighting, more RVP image settings may need to be adjusted to get the optimum contrast and to reduce unwanted reflections.

Ambient lighting

Ambient light is an important variable when using the RVP system. For accurate and repeatable inspection, the ambient environment lighting should be as consistent as possible. Any changes in ambient lighting can potentially affect the system's performance.

Cleaning the RVP system

CAUTION: Always adhere to the safety instructions given on the general safety recommendations and instructions in this document. 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.

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 numbered [1] 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 the electrical contacts [2] or the optical windows [3].

Electrical contacts

The electrical contacts, indicated with arrows numbered [2] in the image below, should be carefully cleaned with an alcohol-based cleaner (e.g. IPA) and a lint-free bud. The frequency of cleaning depends on the local environmental conditions, but should be at least every five hundred changes.



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Optical windows

The RVP probe and module optical windows should be cleaned using a proprietary lens cleaning kit to blow or brush debris away from the window. If debris is still visible, then the optical window should be carefully wiped with a lint free bud and high-purity isopropyl alcohol (IPA). Extreme care must be taken to avoid damaging the optical coating or scratching the glass. Latex gloves should be worn during the cleaning procedure and no attempt to directly touch the optical windows should be made.



NOTE: Cleanliness of the optical windows is important to maintain the highest level of performance of the probe and modules. If any contamination cannot be removed and is resulting in degraded metrology performance, please contact your local Renishaw office.



Technical terminology

Stand-off

This is the distance between the end of the vision module and the plane at which a feature will be at the sharpest focal distance to provide optimum image capture.





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Field of view

This is the maximum size area that will be projected onto the CMOS sensor when the correct stand-off distance is used. Any feature requiring inspection with RVP must be located within the field of view to allow inspection.





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Depth of field

The depth of field specifies the range over which a feature can deviate from the nominal stand-off distance and still be measured with acceptable levels of metrology performance. If features are measured outside the recommended depth of field range, metrology performance and accuracy will decrease.



----- = minimum / maximum deviation



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