User guide

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Virsa™ Raman Analyser

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Before you begin

Changes to equipment

Renishaw reserves the right to change equipment specifications without notice.

Remote instrument support disclaimer

The Renishaw Spectroscopy Products Division offers remote instrument support to assist its customers with preventative maintenance, troubleshooting and an accurate diagnosis of issues.

By requesting and accepting a remote support session from a Renishaw engineer, you accept that:

- you are responsible for providing an adequate internet connection and complying with your organisation's policies regarding the granting of remote access (including, where required, enabling Renishaw to run applications within an account that has administrative privileges);
- although Renishaw will only use reputable third-party tools for remote instrument control, Renishaw does not make any warranties or representations as to the security of such tools and the installation and running of such tools shall be at your sole risk. Renishaw further recommends that you have a properly configured network or computer firewall and up-to-date anti-virus and anti-malware software installed;
- you are responsible for exiting any applications you have open that may display any personal data or confidential information before initiating the session. Renishaw further recommends that you remain seated at your desktop throughout the remote support session (you may assume control of or terminate the session at any time);
- you are responsible for backing up your data and applications prior to any remote support session and Renishaw shall not be liable for any loss or corruption of or damage to any data or information as a result of the provision of remote support;
- Renishaw does not guarantee that any remote support will resolve your problems, however it will significantly enhance our ability to understand and potentially resolve your technical queries as soon as possible;
- you are responsible for uninstalling any third-party tools for remote instrument control after remote support has been provided, although you may opt to retain such tools for future remote support sessions at your sole discretion;
- Renishaw shall not be liable for any indirect or consequential loss or damage suffered or incurred by you in connection with the provision of remote support. Renishaw's liability shall otherwise be limited in accordance with the terms of the agreement under which the product, product warranty or support service has been provided.

Regulatory notices

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.

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

Declaration of conformity

Renishaw plc hereby declares that the Virsa™ Raman Analyser 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 upon request.

Electromagnetic compatibility

Harmonised standards

The Virsa Raman Analyser complies with the following standards which describe electrical equipment for measurement, control, and laboratory use; EMC requirements.

IEC 61326 1:2012 and BS EN 61326 1:2013

Portability

We advise you to evaluate the electromagnetic environment prior to operation.

Proximity to sources of strong electromagnetic radiation (such as equipment designed to intentionally emit in the radio frequency) may inhibit or prevent reliable and safe operation of the device.

FCC information to the user (USA only)

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 their own expense.

ICES-001 — Industrial, Scientific and Medical (ISM) Equipment (Canada only)

This ISM device complies with Canadian ICES-001/NMB-01A.

Cet appareil ISM est conforme à la norme ICES-001/NMB-01A du Canada.

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.

Laser warranty

Lasers are classified as a consumable product, (that is, a product or part which has a limited natural life). These parts are excluded from the normal warranty provided by Renishaw.

Accordingly, any component that is described by Renishaw as a laser will be supplied with the warranty period as set out in writing to you (for example, within an order acknowledgement, tender offer, or any other documentation accompanying the equipment). Where no warranty period is set out in writing, lasers will be supplied with a warranty for the lesser of; a period of 12 months from the date of delivery; or 5000 hours of energised emission from the laser source. For the purposes of the warranty, the 5000-hour period is measured by the device's firmware, and not by reference to the period of light emission from the aperture.

Patents

Features of the Virsa Raman Analyser and features of similar products are the subject of one or more of the following patents:

CXY stage manipulation: CN 101583896, EP 2115516, JP 5244819, US 8254022

Empty modelling: CN 101473201, JP 5159106, RU 2425336, US 8009289,

Orthogonally tilted filters: CN 101523170, EP 2076742, JP 5614987, US 8456628

Spatial Synchroscan: CN 101589297, EP 2106538, JP 5443171, US 8179526

Spectrometer auto alignment: EP 1373842, JP 4741561, US 7170595

LiveTrack: US 10067058

Other patents pending.

Returning equipment and biological hazards

NOTE: Any failure to follow these provisions could invalidate any warranty provided by Renishaw.

For the security of Renishaw staff and premises, the equipment should only be used to analyse materials which are unlikely to cause human disease which are listed within category 1 of the Approved List of Biological Agents (the “ALBA”).

You must not use the equipment to analyse any material hazards including but not limited to radioactive, toxic (for example, High Potency Active Pharmaceutical Ingredient), or any other biochemical hazards which fall into categories 2 to 4 of the Advisory Committee on Dangerous Pathogens (the “ACDP”).

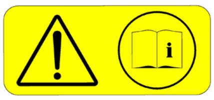
These categories and the ALBA may be published from time to time by the Health and Safety Executive on its website: **http://www.hse.gov.uk/biosafety/law.htm**.

If circumstances require you to return the equipment (in whole or in part) to Renishaw (or its agents and distributors), the following process must be followed:

1. You must contact Renishaw in advance of sending any equipment to Renishaw and obtain a decontamination procedure form.
2. You must follow the decontamination procedure diligently and follow any additional decontamination instructions provided by Renishaw.
3. You must sign and return the decontamination declaration to Renishaw in the form and method instructed by Renishaw.
4. Renishaw will determine whether the equipment can be returned to Renishaw.

NOTE: Where equipment is returned to Renishaw outside of the of the decontamination process, or where Renishaw has reason to believe that the equipment has been used to analyse materials that fall into categories 2 to 4 of ACDP, Renishaw reserves the right to destroy any such equipment without notice.

Safety information



Refer to this manual for safety information where you find these symbols displayed together.

Renishaw Raman support

If you are having difficulty with your equipment, contact the Raman technical support team or your local Renishaw distributor. Many problems can be resolved in the first instance via remote instrument support.

Email: **raman.support@renishaw.com**

Website: **www.renishaw.com/raman**

For worldwide contact details or to find an authorised Renishaw subsidiary in your region, visit: **www.renishaw.com/contact**

When you call, it will help the Renishaw support staff if you have the appropriate product documentation at hand. Please be prepared to give the following information (as applicable):

- The serial number and date of manufacture of your equipment; these can be found on the rear of the product.
- A description of what happened and what you were doing when the problem occurred.
- A description of how you tried to solve the problem.

Renishaw Raman Assist

Training and support for your Renishaw Raman system

Get the most from your Raman system with our comprehensive training and support package. We help you to explore all of the advanced features and capabilities of your system to ensure it produces the best data.

This package is available to all users, following the purchase of a Raman system from Renishaw. It offers the following benefits:

- Support from our global network of highly-qualified Raman applications scientists, via a dedicated email address. The applications team can help you interpret and optimise your data.
- Access to our comprehensive online library of training modules and videos
- Online remote-access support and diagnostic checks from your support team
- Access to Renishaw's Raman Revealed training sessions
- Invitations to our worldwide Inside Raman seminars, where you can find out about new system capabilities and software, and hear from other users.
- Free point release software updates

Support package details

Installation and service

Renishaw's international service team will install and test your system. Specialist Raman engineers ensure that you get the optimum performance from your system.

The service engineer will fully test your system and give you two days of personalised interactive 'start-up' training. This will highlight the system's functions and demonstrate its data capture, processing, and analytical capabilities. This comprehensive training will show you all the operation, preventive maintenance, calibration, and alignment that you will need in the future to ensure that your system produces consistent, reliable results.

On-site or remote access service, system support, and diagnostics can be provided on request. Choose from a range of service plans that will ensure your system is maintained and working at optimum performance. Contact our service and installation team for details: **raman.support@renishaw.com**.

Raman customer hub

The Raman customer hub features everything you need to help you get the most from your instrument. You can register to gain access to our dedicated training portal, contact our service and support team and explore the latest articles and news. To find out more, visit **www.renishaw.com/ramancustomerhub**.

Support and advice for the lifetime of your Renishaw system

For advice on system configuration, data processing and analysis, or sample preparation, contact our dedicated Raman global applications team: **raman.applications@renishaw.com**.

We run regular Raman Revealed training workshops. These are ideal for new users and existing users who want to optimise the use of their Raman system. Visit **www.renishaw.com/rr** to find out more.

Contact **raman@renishaw.com** for more information.

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Virsa™ Raman Analyser

Introduction

The Virsa™ Raman Analyser is a compact, transportable, and flexible spectrograph suitable for remote sampling and a variety of different applications. It can house up to two lasers, that you can switch between automatically, and is compatible with a variety of different probe types. A PC running Renishaw's Windows®-based Raman Environment (WiRE™) software controls the Virsa Raman Analyser via a USB connection.

Fibre-coupled laser probes can be configured for use individually or arranged in a proprietary probe mounting stack for easy multi-wavelength analysis.

Optional accessories from Renishaw include a video unit for integration with the laser probes, and a motorised XYZ stage for digital focus, and programmed sample mapping (the Renishaw SB100 or SB200).

Read this manual before using your Virsa Raman Analyser for the first time. This manual describes best practice, safety, and user maintenance.

Refer to the Renishaw WiRE software help system for operational information.

Renishaw will provide supplemental user guides for the accessories described above, or for customised systems.

NOTE: Consult all user guides supplied with the Virsa Raman Analyser and any related equipment before use.

CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Laser probe options

Probe type	Probe part number
Standard	VRP11-XXX
Confocal	VRP21C-XXX

Where XXX is the wavelength (for example, VRP11-532). Virsa supports wavelengths in the range 400 nm to 785 nm.

Table 1: Laser probe options

Contact Renishaw to discuss customised probe options (for contact details, see **www.renishaw.com/contact**).

Electrical safety

WARNING: Modifications not expressly approved by Renishaw may impair the engineered protections, and will void your warranty.

WARNING: You must connect the Virsa Raman Analyser to a Protective Earth (PE) via the three-core mains cable provided with the system.

Only insert the mains cable into a socket with a PE contact.

Do not defeat the protection by adding a two-core extension cable into the circuit (that is, one without a PE wire).

If you need to replace the supplied mains lead, take care to meet the following specification.

V Max.	250 V
I Max.	10 A
Wire standard	HD 21 or UL 62

Disconnection device

WARNING: Position the Virsa Raman Analyser so that the IEC-terminated mains lead can be easily disconnected if necessary.

Remove the three-wire mains cable from the IEC socket.

Supply voltage

Voltage	100 VAC to 240 VAC ±10%
Frequency	50 Hz / 60 Hz
Maximum power	140 W

Fuse rating

2 Ampere, time delay, cartridge fuse.

Class	T2AH250V
Size	5 mm × 20 mm

Live and neutral are both fused.

WARNING: Using a fuse of higher rating may allow an electrical hazard to go unnoticed.

Always isolate the electrical supply before checking or changing the fuse.

Laser safety

The Virsa Raman Analyser is a Class 3B laser product as defined by, and in conformity with:

- IEC 60825-1:2014;
- EN 60825-1:2014;
- US 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

WARNING: You must write and adopt laser safety protocols and safe operating procedures (SOP), appropriate to the circumstances of installation.

You may find guidance on writing SOP in PD IEC TR 60825-14:2004 or US ANSI Z136.1.

Nominal ocular hazardous distance (NOHD)

NOHD is the radial distance from the aperture or incident surface, within which the emitted radiation may damage the human eye. It is determined by the power and wavelength of the laser, combined with the degree to which the radiation is collimated or diffused.

WARNING: Safe operation of your product requires that you calculate the NOHD for the variables that are specific to your circumstance.

WARNING: The NOHD of a collimated laser beam will be greater than the dimensions of any typical room.

The table below shows the NOHD for standard objectives and wavelengths on the Virsa Raman Analyser. Renishaw recommends that you use the method formalised by the University of Essex, which can be viewed here:

https://www.essex.ac.uk/-/media/documents/directories/health-and-safety/calculating-nohd.docx

When dealing with combined probes attached to a video unit, the NOHD will be the longest of those given by the probes/objective combination.

When using non-standard objective lenses, the NOHD distance should be calculated before they are used.

If you require assistance with this calculation, contact Renishaw Spectroscopy Products Division (for contact details, see **www.renishaw.com/contact**).

Objective power	Confocal probe NOHD / m									
	VRP21C-405	VRP21C-457	VRP21C-473	VRP21C-488	VRP21C-515	VRP21C-532	VRP21C-561	VRP21C-633	VRP21C-660	VRP21C-785
× 5 standard (NA = 0.1)	13.3	11.3	7.8	5.6	4.2	4.2	4.2	4.2	4.2	3.5
× 10 standard (NA = 0.25)	6.7	5.7	3.9	2.8	2.1	2.1	2.1	2.1	2.1	1.8
× 20 standard (NA = 0.4)	3.4	2.9	2	1.4	1.1	1.1	1.1	1.1	1.1	0.9
× 50 standard (NA = 0.75)	1.5	1.3	0.9	0.6	0.5	0.5	0.5	0.5	0.5	0.4
× 100 standard (NA = 0.9)	0.9	0.8	0.6	0.4	0.3	0.3	0.3	0.3	0.3	0.3

Objective power	Standard probe NOHD / m									
	VRP11-405	VRP11-457	VRP11-473	VRP11-488	VRP11-515	VRP11-532	VRP11-561	VRP11-633	VRP11-660	VRP11-785
× 5 standard (NA = 0.1)	5.3	4.5	3.1	2.2	1.7	1.7	1.7	1.7	1.7	1.4
× 10 standard (NA = 0.25)	2.8	2.4	1.6	1.2	0.9	0.9	0.9	0.9	0.9	0.7
× 20 standard (NA = 0.4)	1.5	1.3	0.9	0.7	0.5	0.5	0.5	0.5	0.5	0.4
× 50 standard (NA = 0.75)	1.1	0.9	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.3
× 100 standard (NA = 0.9)	0.8	0.7	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.2

NOTE: NOHD is calculated for worst case 500 mW laser power (Class 3B AEL).

Table 2: NOHD for magnification objectives fitted to probes by probe part number

Laser apertures

The fibre coupler ports inside the fibre connection bay on the rear of the instrument are laser apertures. These apertures will emit Class 3B radiation if you do not fit a fibre optic or a blanking plug.

The fibre connection bay cover provides strain relief for the fibres and is not a safety cover. The presence of fibres, fibre returns, and laser sources may result in scattered laser radiation within the fibre connection bay. The fibre connection bay is therefore treated as a laser aperture with radiation patterns that may vary and, in their worst case, will be identical to the radiation patterns from the laser apertures within the bay. As such, the fibre connection bay cover should always be secured during operation; see “Virsa fibre connection bay” on page 24.

The fibre optic probes are laser apertures and are fitted with manual shutters, providing reliable control over emission at the aperture that is independent of the WiRE controls.

NOTE: Due to mechanical constraints, a single manual shutter is provided for all the fibres in the video unit assembly.

The Virsa Raman Analyser has motorised laser shutters for each laser source that will stop all radiation. Renishaw WiRE software controls the motorised laser shutters. The motorised laser shutters are not safety devices. Always use the manual shutters on the probes to block the beam.

Radiation patterns

Parameter	Laser (before fibre)									
	405 nm	457 nm	473 nm	488 nm	515 nm	532 nm	561 nm	633 nm	660 nm	785 nm
Maximum beam divergence / mrad	1.2	1.2	1.2	1.3	1.2	1.2	1.2	1.6	1.5	2.0
Pulse duration and frequency	CW	CW	CW	CW	CW	CW	CW	CW	CW	CW
Maximum power* @ diode / mW	360	400	400	200	400	400	400	200	400	300
Nominal power @ aperture / mW	30	30	50	40	50	50/100	50	30	50	120

* Maximum power output published by the laser manufacturer.

Table 3: Radiation pattern for the laser module (pre-fibre)

Objective power	Beam divergence at probe / rad	
	VRP11-XXX (6 mm beam diameter)	VRP21C-XXX (2.5 mm beam diameter)
× 5 standard (NA = 0.1)	0.15	0.06
× 10 standard (NA = 0.25)	0.29	0.12
× 20 standard (NA = 0.4)	0.54	0.24
× 50 standard (NA = 0.75)	0.79	0.56
× 100 standard (NA = 0.9)	0.17	0.21

Table 4: Beam divergence for standard objectives fitted to probes

Laser safety eyewear

You must select laser safety eyewear according to laser power and wavelength.

WARNING: Wear wavelength appropriate laser safety eyewear whenever there is a risk of exposure to harmful laser radiation.

Renishaw recommends laser safety eyewear compliant with EN 207:2017.

Recommended laser safety eyewear

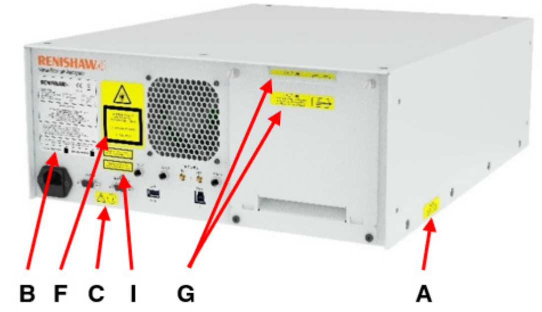
Renishaw recommends the following specification with reference to EN 207:2017, calculated for worst case 500 mW laser power (Class 3B AEL) and no objective fitted to the probe.

Wavelength / nm	Safety protection requirement
405	D LB5 / OD5+
457	D LB5 / OD4+
473	D LB5 / OD4+
488	D LB5 / OD4+
515	D LB5 / OD4+
532	D LB5 / OD4+
561	D LB5 / OD4+
633	D LB5 / OD4+
660	D LB5 / OD4+
785	D LB5 / OD3+

Table 5: Recommended laser safety eyewear

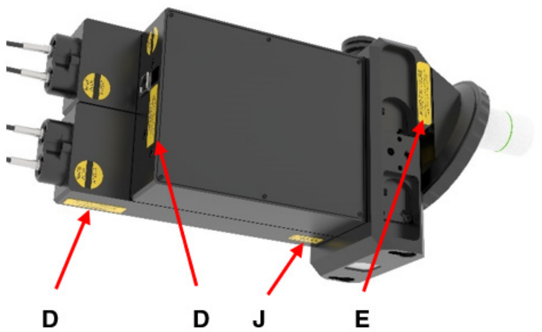
Laser safety labelling

Spectrometer

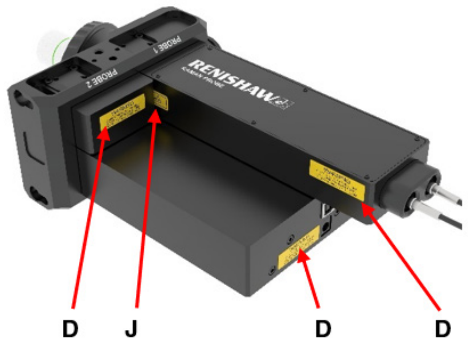


Fibre connections bay

Dual fibre probes and video unit



Single fibre probe and video unit with blanking cap

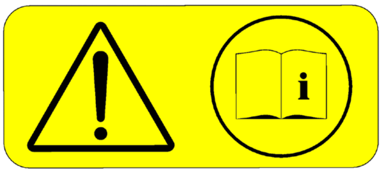


Single fibre probe

A

B

C



D

E

F

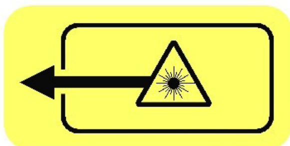
G

H

I

NOTE: Wavelength depends on specification.

J



Installation

WARNING: The safety of any system incorporating the Virsa Raman Analyser is the responsibility of the system assembler.

Unpacking

If the Virsa Raman Analyser is to be installed by an authorised Renishaw service engineer, Renishaw recommends that you leave your Virsa Raman Analyser and its accompanying optical components in their packaging. This will ensure the components remain free from dust or contamination and avoids the risk of damage.

Before unpacking the Virsa Raman Analyser, take note of the weights of each part of the product (see “Specifications” on page 36), and follow good manual handling practice.

The packaging is made from recycled cardboard.

Lifting and carrying

Before lifting and moving the Virsa Raman Analyser, it is recommended that the fibre probes and cables are disconnected from the spectrometer. The spectrometer and some of the accessories are heavy. Take note of the weights of each part of the product before lifting (see “Specifications” on page 36), and follow good manual handling practice.

CAUTION: Do not carry the spectrometer by the rack mounting bracket handles.

Benchtop mounting

Place the Virsa Raman Analyser on a stable flat surface, on its rubber feet. Ensure that the front and rear air vents are unobstructed.

CAUTION: Do not store or operate the Virsa Raman Analyser on its side.

Rack mounting

Before mounting into a rack, remove the feet using a 3 mm Allen key.

Install the Virsa Raman Analyser in a 19 inch rack using the mounting brackets provided.

CAUTION: The weight of the Virsa Raman Analyser requires you to support it on a sliding shelf in the rack. Do not leave the weight solely supported by the brackets.

Mount the system in the rack before making any other connections.

Suitable environments

The Virsa Raman Analyser should be stored and operated in the conditions described in “Specifications” on page 36.

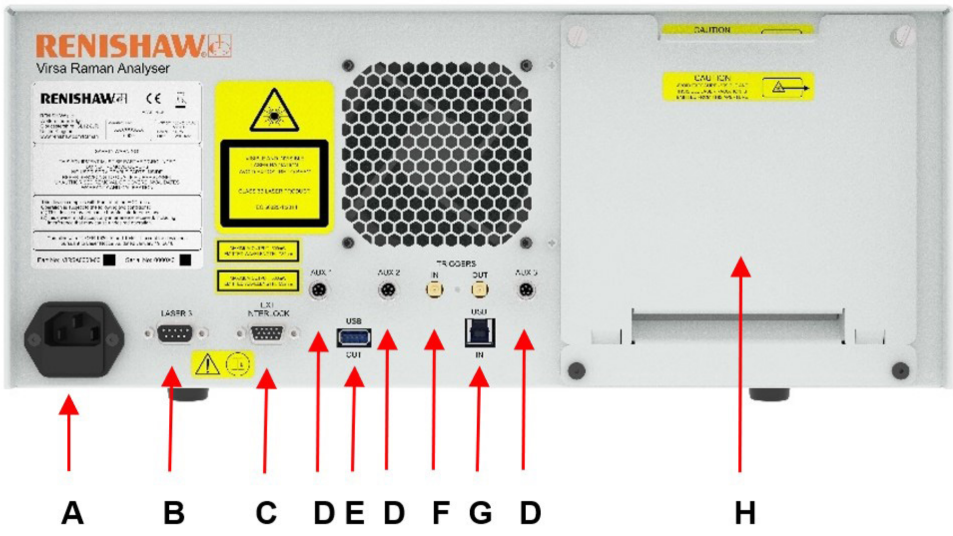
WARNING: Do not use the Virsa Raman Analyser in damp or wet conditions. Water ingress inside the covers may result in damage to the product and risk of electric shock.

If the Virsa Raman Analyser becomes wet, switch off and disconnect from the mains supply immediately. Dry surfaces with a clean dry cloth.

Connection layout and system assembly

All connections to the spectrometer are made via the rear panel.

Virsa rear panel



A. **Mains inlet.** For an IEC mains cable, Renishaw supplied; see “Electrical safety” on page 14.

B. **Laser 3.** For connection to an optional, Renishaw supplied, external laser.

C. **External interlock.** For connection to a remote interlock circuit; see “Remote interlock connector” on page 34.

D. **AUX 1 to 3.** For connection to Renishaw system accessories. For more information on available accessories and prices and to find your local distributor, see **www.renishaw.com/contactdetails**.

E. **USB out.** Optional connection to USB-controlled Virsa peripherals.

F. **Triggers in and Triggers out.** For connection to an electronic measurement trigger.

G. **USB in.** Requires USB3 superspeed connection to a PC for WiRE software control.

H. **Fibre connection bay cover.** Removing this cover gives access to the fibre connection bay; see “Virsa fibre connection bay” on page 24.

Virsa fibre connection bay

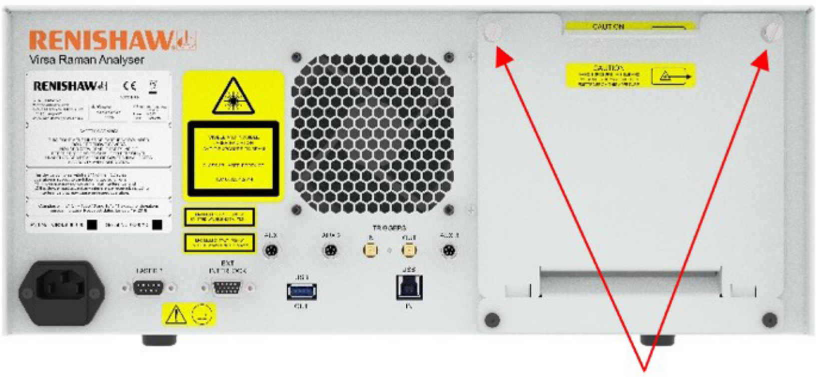
The fibre connection bay cover helps to reduce light and dust ingress into the connection bay. The Virsa Raman Analyser is highly sensitive. Light ingress at the point of fibre connection may result in the appearance of interference patterns or elevated background levels in your spectra. Keep the cover in place and use covers on the fibre connections for best results.

CAUTION: Always turn the power OFF before accessing the fibre connection bay and changing fibre optic connections. Be aware of the risk of exposure to radiation from the optical couplers.

All laser ports should be connected to a fibre optic, permanently blanked, or fitted with a laser blocking cap.

The fibre strain relief bracket and fibre connection bay cover are not part of the protective housing.

You can gain access to the fibre optic connections by removing the fibre connection bay cover. Undo the two captive thumbscrews (see figure below), push downwards on the cover and gently pull the top of the bracket towards you.



Thumbscrews

Below is the internal view of fibre connection bay showing:

A. **AUX 4.** For connection to Renishaw system accessories.

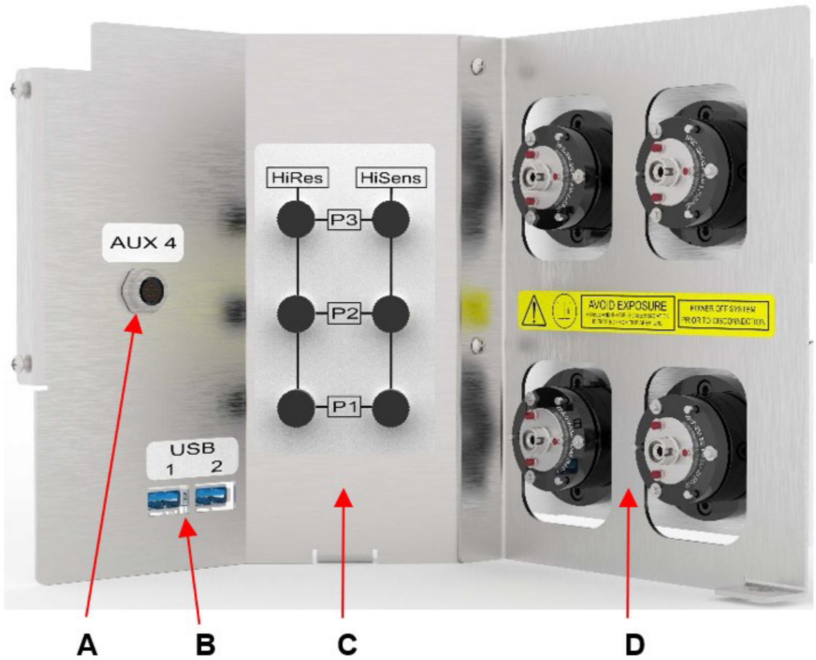
B. **USB3 ports.** For connecting to the video/white light unit.

C. **Six fibre return ports.** Three for high-resolution Raman spectroscopy measurements, and three for high-sensitivity Raman spectroscopy measurements.

NOTE: Fibre return ports are shown fitted with protective caps.

D. **Laser fibre ports.** Four are shown. There may be fewer depending on the configuration of the system.

NOTE: Laser blocking caps are not shown.



Fibre and video connections

WARNING: Read and act on all laser safety labelling on the instrument. All probe connections are made via the fibre connection bay.

Always turn the power OFF before accessing the fibre connection bay and changing fibre optic connections.

Be aware of the risk of exposure to radiation from the optical couplers.

Renishaw configures the fibre-launch ports at the factory based on your specification. Up to four ports may be configured.

NOTE: Do not attempt to switch the ports or you may compromise the optical throughput. Contact Renishaw to reconfigure or add to your Virsa Raman Analyser. For contact details, see **www.renishaw.com/contact**.

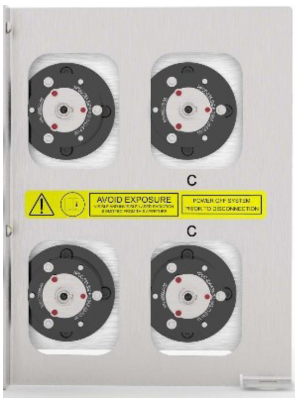
Laser-launch ports suitable for a confocal probe are marked with a C and the wavelengths are indicated on the chassis, next to the ports.

Each probe has two fibre optic cables: one for laser delivery, and one for the Raman return. The fibre connections are a standard FC/PC type.

Fibre optic cables for laser delivery are labelled with wavelength and type. For example, a 785 nm bulk probe is labelled as ‘785 Laser’, a 532 nm bulk probe is labelled as ‘532 Laser’, and a 532 nm confocal probe is labelled as ‘532 C Laser’.

Connect fibres labelled ‘LASER’ first:

1. Identify the wavelength and type.
2. Unscrew the cap from probe fibre and unscrew the cap from an appropriately labelled laser port. See below for an example configuration of laser ports, with the wavelength identified and ‘C’ denoting a confocal port.



3. To insert a fibre connection, carefully align the key position on the fibre plug with the same key mark on the socket connector and gently insert.

4. Once the connector is fully inserted, tighten the knurled ring using finger strength only.

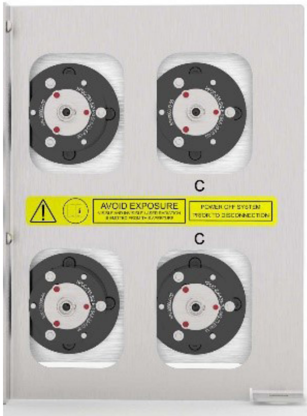
5. Retain any removed blanking caps for future use.

Fibre optic cables for Raman return are labelled with wavelength and type. For example, a 785 nm bulk probe is labelled as ‘785 Signal’, a 532 nm bulk probe is labelled as ‘532 Signal’, and a 532 nm confocal probe is labelled as ‘532 C Signal’.

Connect the fibres labelled ‘Signal’ second:

1. Identify the wavelength and type. Refer to the Renishaw WiRE software for the laser name which identifies the correct return port; for example, 532-C P1-HiRes identifies the HiRes port on row P1.

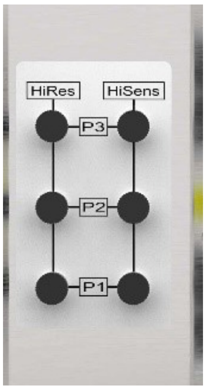
2. Unscrew the cap from the probe fibre and the dust cap from the matching labelled signal port.



3. To insert a fibre connection, carefully align the key position on the fibre plug with the same key mark on the socket connector and gently insert.

4. Once the connector is fully inserted, tighten the knurled ring using finger strength only.

5. Retain any removed blanking caps for future use.



6. Connect the USB cable for the video unit, if using, to either USB1 or USB2.

To disconnect a probe from the Virsa Raman Analyser, perform the above actions in reverse. Replace protective caps to prevent contamination of the fibres and couplers and to reduce the effects of stray light.

Video unit and probe assembly

NOTE: Renishaw probes, optical fibres and the optional video unit are pre-assembled. Disassembly is not required except for service and this should only be performed by a Renishaw support engineer.

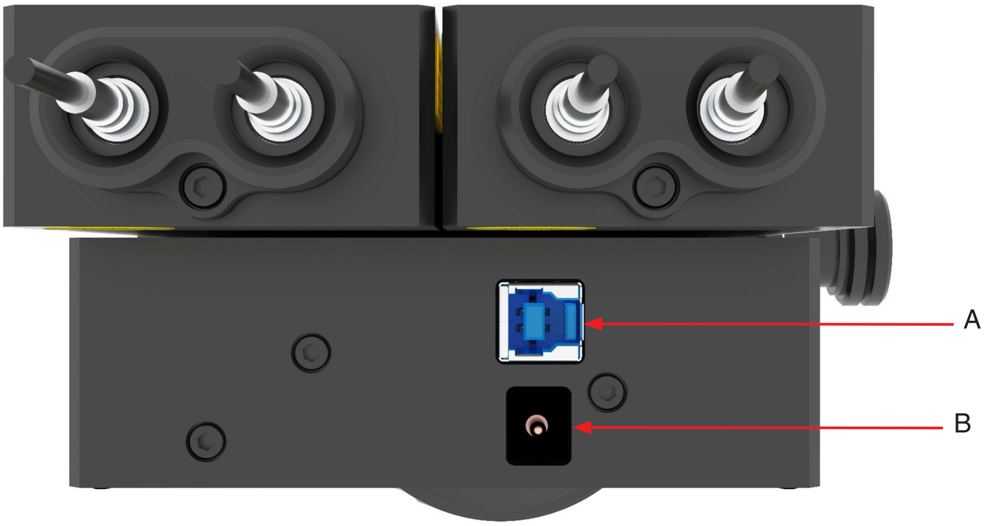
CAUTION: Ensure the video unit shutter/selector is closed during set-up and while not in use; see “Laser controls and operation” on page 31. It is essential to turn off the Virsa Raman Analyser if the fibre connection bay is accessed during set-up of the video unit.

Fit objectives to the turret and hand-tighten only. Blank off unused objective ports.

Do not remove the objective turret from the probe coupler.

WARNING: Unoccupied objective ports must be fitted with a blanking cap to prevent access to collimated laser light.

The video unit may also contain an optional LiveTrack unit for performing focus tracking when used with the SB200 stage stack.



A. USB3 connector: Connect the video probe to either connectors USB1 or USB2 inside the Virsa fibre connection bay using the USB3 cable provided.

B. 5V auxiliary power socket.

WARNING: Do not use this connection.

Single probe assembly

A single probe solution is also available. A single probe is provided with a single objective mount and safety shutter.

WARNING: The single probe assembly, manual safety shutter and optical fibres are pre-assembled. Disassembly is not required except for service and this should only be performed by a Renishaw support engineer.

Fibre stability, safety and mounting options

Stability

Mount the probe heads securely and in a manner that guarantees mechanical stability during data collection. The focal depth for the high magnification objectives is as small as 0.5 µm.

Safety

Consider the NOHD and its safety implications before mounting the probes, particularly if they will be close to eye level or mounted horizontally. For such arrangements, the use of screens or lightproof curtains is recommended.

CAUTION: Ensure that trailing fibres do not represent a trip hazard that could result in the probe being pulled from its housing and laser light entering the room.

Mounting options

The Renishaw SB200 Probe Positioner is available for mounting and manipulating the fibre probes and video unit. If supplied, see the *SB200 Three-Axis Probe Positioner* user manual (Renishaw part no. H-9879-0694) for connections and set-up.

Alternatively, mount the probe or video unit assembly using the three mounting points provided on the base of the unit. Contact Renishaw for further details.

Laser controls and operation

WARNING: The use of controls, or adjustments, or performance of procedures other than those described herein may result in exposure to hazardous laser radiation.

Front panel

Key switch

The key switch located on the front panel is the mains power switch for the Virsa Raman Analyser. Insert the key and turn it to the ON **(I)** position to power up the Virsa Raman Analyser and operate the laser. The lock mechanically retains the key while it is in the ON position.

To switch off the Virsa Raman Analyser and cease laser emission, turn the key to the OFF **(O)** position.

It is recommended that you remove and secure the key when the laser is not in use to prevent unauthorised activation.

Front panel indicators

Power (static green)

Activity (flashing green/orange)

Laser emission warning (orange)

Laser emission LED

This LED illuminates orange when the interlock is enabled. When in this state, shorting the external interlock and opening a motorised laser shutter will result in laser emission.

BEST SAFETY PRACTICE: Whenever the machine is powering the emission LED, consider all apertures to be hazardous.

WARNING: If the emission LED is illuminated, removing a fibre optic cable or a blanking plug from the fibre connector bay will expose you to Class 3B collimated laser radiation.

Motorised laser shutter

Each laser is fitted with a motorised laser shutter. You can close a motorised laser shutter from the WiRE software, for each individual laser source. The motorised laser shutter can also be used to partially eclipse the laser beam to reduce the power of the laser.

WARNING: Wear wavelength-appropriate laser safety eyewear whenever there is a risk of exposure to harmful laser radiation even when the motorised laser shutter is used to attenuate the beam.

Renishaw recommends laser safety eyewear compliant with EN 207:2010.

WARNING: The motorised laser shutter is not a safety device. Always close the manual safety shutter on the probe or the video unit to block wavelengths that are not in use in order to prevent exposure to harmful laser radiation.

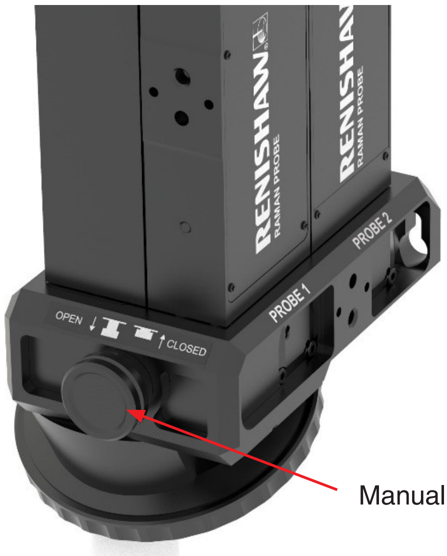
Probe manual shutter

Each probe has a manual shutter, except when integrated into a video probe, in which case there is one manual shutter for all wavelengths (see below). The probe manual shutter enables the operator to block the laser beam manually.

A single probe without a video unit fitted incorporates a manually operated laser safety shutter. To open the shutter, rotate the shutter until it is perpendicular to the objective face and one of the dots aligns with the starburst symbol, as shown below. To close the shutter, rotate the shutter until it is parallel to the objective face and one of the dots aligns with the solid circle.

Manual safety shutter

The video unit incorporates a manually operated laser safety shutter. To close the shutter, push it fully into the housing, as shown below. To open the shutter, pull it out of the structure. The laser safety shutter has four positions: CLOSED, AUTO (both wavelengths simultaneously), PROBE 1 (wavelength 1) and PROBE 2 (wavelength 2). These positions are indicated on the shutter barrel.



Manual safety shutter

WARNING: Always close the manual shutter on any probe that you do not need for the immediate measurement, and always close all manual shutters when the Virsa system is not in use or is powered off. Always wear the correct safety eyewear for the wavelength in use.

Remote interlock connector

The remote interlock connector provides the means to interlock the lasers to the security of access panels or doors leading into the room. When correctly connected, the act of opening an interlocked door or viewing port while the laser is emitting, will immediately interrupt its operation. Likewise, an open circuit across pins 14 and 15 of the 15-pin high-density D-type connector will interrupt laser emission. The laser emission will be re-enabled when the interlock connection is re-established.

Pin	Function	Connection
14	Interlock out (12 Vdc)	Door switch
15	Interlock return	Door switch

Table 7: External interlock connector pin-out

CAUTION: Do not connect any components other than switches to the remote interlock connector. Do not connect powered interlocked circuits to the remote interlock connector.

You can bypass or override the external interlock using the shorting plug (Renishaw part no. A-9836-0685).

Power on

1. Insert the key and rotate the switch clockwise to the ON **(I)** position. The Power ON LED will illuminate and temperature stabilisation will begin.

2. Launch the Renishaw WiRE software on your PC. The laser will begin emission and the Laser emission LED on the front panel will illuminate.

   WARNING: If the laser shutter is open, laser radiation may be emitted from the probe head.

   The laser will not be emitted until the laser attenuator is opened using the WiRE software.

System stabilisation

It may take up to 15 minutes for the system to reach thermal stability after power ON.

Power off

1. Close the Renishaw WiRE software.
2. Turn the key switch counterclockwise to OFF **(O)**.
3. Remove and secure the key.

Reset the laser interlock

If the interlock LED has extinguished, the interlock is no longer enabled.

To reset the interlock, restore the continuity of the circuit by closing any doors or panels in the interlock chain. Reset the interlock using the WiRE software. The process is described in the WiRE software help system.

Specifications

Electrical		
Supply voltage range		100 Vac to 240 Vac ±10%
Frequency		50 Hz / 60 Hz
Maximum power consumption		140 W
Fuse		T2AH250V 20 mm (live and neutral)
Mechanical		
Dimensions of spectrometer		435.6 mm (W) × 181.5 mm (H) × 549 mm (D) Add 13 mm to height for optional feet. Width does not include handle kit.
Mass of spectrometer		15.3 kg (single laser), 17.5 kg (dual laser)
Dimensions of one probe		199 mm × 57 mm × 29 mm (excluding fibre optic cables)
Mass of one probe		0.94 kg (excluding fibre optic cables)
Dimensions of video unit with LiveTrack and fibre coupler		164 mm × 192 mm × 88 mm (excluding probes, turret and objectives)
Mass of video unit with LiveTrack and fibre coupler		2.04 kg (excluding probes, turret and objectives)
Environmental [1]		
Ambient temperature	**Recommended**	15 °C to 30 °C stable to ± 1 °C
	Operating	5 °C to 40 °C
	Storage	0 °C to 50 °C
Altitude		Up to 2000 m
Humidity		0% to 80% RH <= 31 °C decreasing linearly to 0% to 50% RH <= 40 °C non-condensing
Transient voltages		Installation category II
Pollution degree		2
IP rating [2]		IP20 [3]

[1] As defined in EN BS 61010-1:2010.

[2] As defined in BS EN 60529:1992+A2:2013.

[3] IP rating applies only when the fibre connection bay cover is in place.

Service and maintenance

Safety

WARNING: There are no user-serviceable parts inside the housing. Servicing and maintenance operations that require the housing to be opened must be performed by Renishaw authorised personnel only.

Dismantling and repair of equipment manufactured by Renishaw is a specialised operation. Attempting to service this equipment yourself will expose you to both laser and electrical hazards.

Unauthorised disassembly of the equipment invalidates both the warranty and calibration.

For further technical support details, see “Renishaw Raman support” on page 10.

Safety information for authorised service personnel

WARNING: There are hazardous voltages and laser light contained within the enclosure. Isolate from the mains supply before removing the cover. Following a service or repair operation that requires removal of the cover, a portable appliance test must be performed, and laser guards must be restored and inspected.

Maintenance permitted to be undertaken by the user

You may undertake the safety compliance checks and maintenance routines described below.

WARNING: Follow laser safety procedures, including the use of laser safety eyewear, when carrying out the following checks.

Perform the following checks at least annually, or immediately if the product is subjected to adverse environmental conditions (for example, mechanical shock, spilled liquids). These checks ensure that the laser product remains compliant with the safety standards to which it was designed and built it. If damage, or a fault, is identified, stop using the product immediately and contact Renishaw to arrange for repair or replacement of the faulty part.

- Verify that removing the interlock cable prevents laser operation.
- Verify that you can only start emissions when the key switch is in the “ON” position, and that you can only remove the key when the switch is in the “OFF” position.
- Verify that the LEDs illuminate as described in “Power on” on page 34.
- Verify that the “LASER ON” LED is illuminated when the interlock is enabled in the WiRE software.
- Verify that the laser shutter blocks the beam when you move the slider to the closed position.
- Ensure that all safety warning labels remain firmly attached to the laser.
- Inspect fibre optic cables and the protective housing for damage that could result in the emission of harmful laser radiation.

Cleaning external surfaces

Clean external surfaces using a dry cloth only.

CAUTION: Do not use solvents, detergents or other cleaning substances as these may enter the laser system and impair performance.

Cleaning and care of objective lenses

The microscope objective lens may easily become contaminated by contact with a sample. Contamination is not always visually apparent, but you may observe a reduction in system performance. To clean an objective lens:

1. Carefully remove the objective from the turret
2. Using “optical tissue” and isopropanol (IPA) or water, lightly “drag wipe” a moistened optical tissue over the lens surface. Do not apply pressure or use any cloth coarser than optical tissue.
3. After wiping, check the results by eye and repeat if necessary.
4. Refit the objective to the turret.

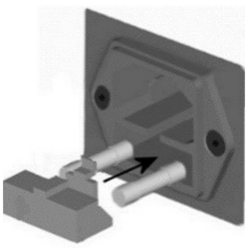
When handling or using objective lenses, to avoid permanent damage:

- Take care not to touch the glass.
- Do not drop the objective lens.
- Do not touch the sample with the lens or crash the lens into the sample.

Changing the fuse

CAUTION: Always use a fuse of the correct rating. See “Fuse rating” on page 14.

1. Ensure the system is switched off and the mains cable is removed from the mains inlet socket.
2. Remove the fuse holder, using a small flat head screwdriver. The fuse holder pulls out of the mains inlet socket, as shown below.



3. Once the fuse holder is removed, replace the blown fuse.
4. Reinsert the holder and reconnect the mains cable.

Fault-finding

<table>
<tr><th rowspan="2">Status LEDs</th><th colspan="2">Status</th><th rowspan="2">Cause</th><th rowspan="2">Action</th></tr>
<tr><th>Off</th><th>On</th></tr>
<tr><td>POWER</td><td>✓</td><td></td><td>Mains power off.</td><td>Check connections.
Disconnect the mains cord and check the fuses.</td></tr>
<tr><td>LASER ON</td><td>✓</td><td></td><td>Interlock chain not enabled.</td><td>Check cable connections.
Check that the interlock chain is closed.
Reset interlock in WiRE software.</td></tr>
<tr><th colspan="3">Symptom</th><th>Cause</th><th>Action</th></tr>
<tr><td colspan="3">Background in spectra.</td><td>Ambient light ingress.</td><td>Secure the fibre strain relief bracket.
Check fibre input covers.</td></tr>
<tr><td colspan="3">Poor response or diminished peaks.</td><td>Low fibre throughput.</td><td>Clean the fibre tips by drag-wiping with a lint-free cloth dampened with acetone.
Do not apply pressure to fibre tips with any material; this may cause microabrasions.</td></tr>
<tr><td colspan="3">Raman peaks at incorrect position (wavenumber).</td><td>System requires calibration.</td><td>Calibration can be performed with an external source, following the procedure in WiRE.</td></tr>
<tr><td colspan="3">WiRE does not find the spectrometer or fails to identify all the motors.</td><td>USB communication failure.</td><td>Check that all peripherals are powered up, and plugged in.</td></tr>
<tr><td colspan="3">Sluggish/stuttering video image when using the video unit.</td><td>Insufficient bandwidth available on the USB3 port.</td><td>Check the USB port type is USB3 superspeed and, if not, select a port that is.</td></tr>
<tr><td colspan="3">“LASER ON” LED does not illuminate when the interlock is enabled in the WiRE software.</td><td>Failed LED indicator.</td><td>Stop using the Virsa Raman Analyser and contact Renishaw to arrange for repair.</td></tr>
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www.renishaw.com/virsa

#renishaw

+44 (0)1453 524524

raman.support@renishaw.com

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