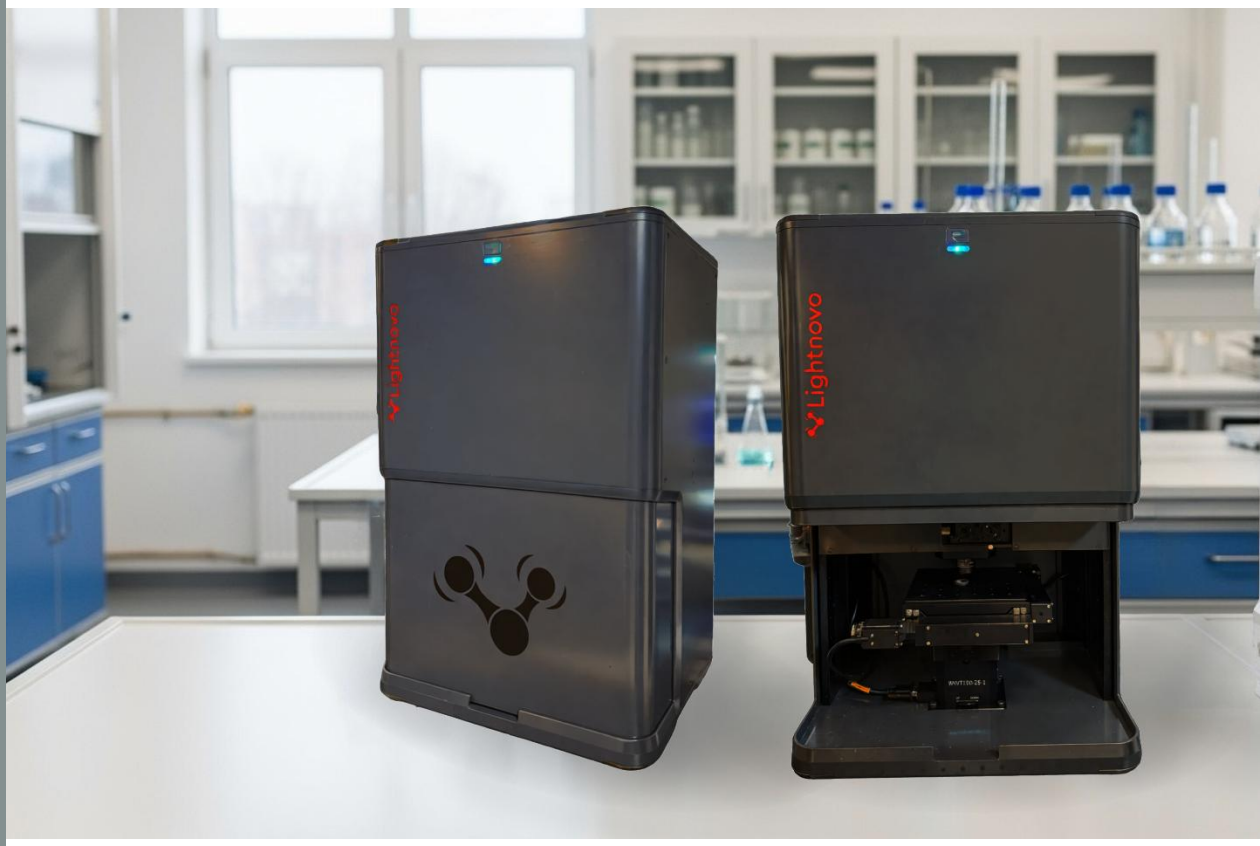
Lightnovo

RG microscope



User Manual

Version 001

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For Research Use Only. This instrument or accessory is not a medical device and is not intended to be used for the prevention, diagnosis, treatment or cure of disease.

Contents

Overview

The RG Raman Microscope is a high-performance solution for demanding Raman spectroscopy applications requiring high spectral and spatial resolution, broad spectral range, and exceptional laser stability. It is designed for flexibility and precision, this modular microscope and it delivers:

Dual Microscopy Modes – Upright and Inverted

With its unique flip design, the RG Raman Microscope easily switches between upright and inverted microscopy modes—no reassembly required.

Integrated Optical & Raman Imaging

Equipped with transmitted visible light microscopy on a separate camera sensor, the RG system allows simultaneous optical observation (color, size, morphology) and Raman spectroscopy (chemical and structural analysis). The system supports high-resolution Raman mapping, allowing detailed spatial characterization of heterogeneous samples, while its dual operation modes enable seamless use of the spectrometer both integrated within the microscope and as a standalone Raman unit

Modularity

Thanks to its modular design, the RG microscope can be paired with either the RG Raman spectrometer or the compact miniRaman spectrometer, providing flexibility in configuration and future upgrades, adapting easily to different applications and laser wavelengths.

Combining compactness, performance, and affordability, the RG Microscope delivers confocal Raman microscopy without compromise, making advanced Raman analysis accessible to a wider range of laboratories and users.

Instrument description

The RG Microscope is a compact Raman microscope. Physical dimensions of approximately 360 mm x 450 mm x 685 mm, weighing approximately 34-43 kg. The instrument has 2 USB C ports on the bottom of the back, one for charging and the other for communication.

Figure 1. Front, back, side and top view of RG Microscope.

General specifications

Table 1. Typical values for the specifications of the RG microscope.

Feature versus model	RG microscopy platform motorized	RG microscopy platform manual	RG microscopy platform focusing stage
Compatible spectrometers*	miniRaman spectrometers miniRaman Pro spectrometers RG spectrometers RG Pro spectrometers RG expandable spectrometers – using deep cooled CCD or CMOS sensors		
Lateral resolution**	200 - 420 nm		
Axial resolution or confocality**	700 – 2400 nm		
White light microscopy	Camera visualization of the sample Reflected with simultaneous visualization of laser spot and Raman acquisition		Not included
Microscopy configuration	up-right and inverted		
Mapping travel range in XYZ	102 x 102 x 25 mm	10 x 10 x 13 mm	
Minimum step size	100 nm	5 µm	

* *Restriction on wavelengths that can be interchanged into microscope platform.*

** *Resolution depends on the laser wavelength and spectrometer used. Values represent the use of RG spectrometers, all wavelengths with microscope objective NA = 0.95, 100x magnification*

Application of use

The RG Microscope is a general purpose compact Raman microscopy analysis instrument for qualitative and semi-quantitative analysis of liquids and solids. It is intended for laboratory, industrial and field environments. Raman spectroscopy is non-destructive and can be performed without contact with the sample. This versatile and modular instrument can be used for identification, verification, and screening of a wide variety of samples, using library searching. Semi-quantitative and quantitative measurements can be performed using chemometric analysis on Lightnovo's computer software. The instrument also has the capability to perform mapping measurements of stationary samples.

Note

In Raman spectroscopy, sample fluorescence can yield a much more intense signal than the Raman scattering signal of the sample, masking any Raman bands in the spectrum. Therefore, Raman spectroscopy is normally not a suitable analysis technique for fluorescent samples.

Safety information

Read the following safety information carefully before operating the Lightnovo instrument and keep this manual for future reference available at any time. Always follow the instructions described in this manual to ensure safety operation and to avoid property damage. Improper use or failure to follow these safety instructions can result in serious injuries and/or property damage. Any non-observance of the precautions will infringe the intended use (i.e. performing measurements by Raman spectroscopy) of the instrument. In this case Lightnovo ApS will not assume any liability. It is the operator's duty to plan and implement all necessary safety measures and to supervise their observance. Moreover, the operator must ensure that the instrument is in proper functioning condition. A safe and faultless operation can only be guaranteed if the Lightnovo instrument is transported, stored, installed, operated and maintained properly according to the procedures described in this manual. Never remove or deactivate any safety systems during the instrument's operation. Ensure that objects and/or material not required for the measurement is out of the instrument operating area.

Qualified Personnel

Primary installation maintenance and repair works not described in this manual should only be performed by Lightnovo approved service personnel. Only authorized operating personnel that have been briefed about the instrument operation and all relevant safety aspects should operate and maintain (i.e. only maintenance works that are described in this manual) the instrument. It is the duty of the instrument owner to ensure users have proper training for use of a laser instrument and relevant risk assessments are in place. All repairs, adjustments and alignments on any instrument component must be performed in accordance with the safety regulations and standards applied in the country in which the instrument is installed.

Warning labels

This warning symbol indicates the existence of laser radiation.

Class 3B lasers are hazardous for eye exposure. They can heat skin and materials but are not considered a burn hazard. For visible-light lasers, Class 3B lasers' output power is between 5 and 499 milliwatts. Class 3B lasers are normally hazardous under direct beam viewing conditions, but are normally safe when viewing diffuse reflections.

Warning label positions

A warning label can be found on the rear of the RG microscope. A warning symbol can also be found next to the port on the top of the instrument where the laser radiation exits the instrument.

Figure 2. Warning label for RG microscope.

Safety

The following chapters describe all relevant safety aspects of the instrument operation. Depending on the degree of hazard the safety instructions are classified as follows:

Danger

indicates that death, severe personal injury or substantial property damage WILL result if proper precautions are not taken.

Warning

indicates that death, severe personal injury or substantial property damage CAN result if proper precautions are not taken.

Caution

indicates that minor personal injury or property damage CAN result if proper precautions are not taken. Important draws your attention to a particularly important information.

Note

draws your attention to useful information on the product, e.g. product operation or to a special part of the manual.

The safety instructions Danger, Warning and Caution are marked by the corresponding warning labels.

General instrument information

The RG Microscope uses a laser (405, 532, 638, 785 and/or 830 nm wavelength). The laser diodes used in the spectrometer emit continuous visible and partially visible laser radiation in the near infrared region. According to the standard EN 60825-1:2014, RG spectrometer is Class 3B laser product. Therefore, it is normally hazardous under direct beam viewing conditions but is normally safe when viewing diffuse reflections.

The door on the front of the instrument can have an enabled interlock, making the instrument a Class 1 laser product.

Safety Instructions

In addition to the safety instructions given below, one should also comply with all local regulations concerning laser safety.

The analysis system is specified as a laser class 3B product if the interlock is not enabled, i.e. it is considered safe if handled carefully, with restricted beam viewing.

It is advised that laser safety goggles that meet the specifications for the laser your system uses are worn by the user and others within the vicinity. Laser glasses should have an LB rating above 3 for code D.

Warning

Avoid eye and skin exposure to direct or scattered laser radiation under all circumstances! Failure to do so can cause permanent and irreversible eye damage and/or serious skin injuries!

Below is a table of the nominal ocular hazard distance (NOHD) values for the notable configurations at maximum laser power. Be aware these are calculated assuming direct line of sight to the objective, which is not possible in this microscope. However, these values could be useful guidance if the samples reflect the laser out of the sample compartment.

Table 2. NOHD values for the RG microscope standard configuration with different laser configurations (columns) using different probes (rows) at max laser power. Note that the actual maximum laser power of the instrument may differ from these values.

RG spectrometer wavelength	405 nm	532 nm	638 nm	785 nm	830 nm
Maximum power	80 mW	110 mW	75 mW	95 mW	70 mW
10x objective	0.26 m	0.31 m	0.25 m	0.38 m	0.29 m
20x objective	0.09 m	0.1 m	0.08 m	0.13 m	0.1 m
50x objective	0.25 m	0.3 m	0.24 m	0.37 m	0.28 m
100x objective	0.05 m	0.06 m	0.05 m	0.07 m	0.05 m
100x NIR objective	0.06 m	0.07 m	0.05 m	0.08 m	0.06 m

Table 3. NOHD values the RGs microscope with LPR configuration for different laser configurations (columns) using different probes (rows) at max laser power. Note that the actual maximum laser power of the instrument may differ from these values.

RGs wavelength	405 nm	532 nm	638 nm	785 nm	830 nm
Maximum power	70 mW	100 mW	65 mW	80 mW	65 mW
10x objective	0.24 m	0.29 m	0.23 m	0.35 m	0.28 m
20x objective	0.08 m	0.1 m	0.08 m	0.12 m	0.09 m
50x objective	0.23 m	0.28 m	0.22 m	0.33 m	0.27 m
100x objective	0.05 m	0.06 m	0.04 m	0.07 m	0.05 m
100x NIR objective	0.05 m	0.06 m	0.05 m	0.08 m	0.06 m

Table 4. NOHD values the RG microscope with Power configuration for different laser configurations (columns) using different probes (rows) at max laser power. Note that the actual maximum laser power of the instrument may differ from these values.

RGs wavelength	638 nm	785 nm	830 nm
Maximum power	330 mW	490 mW	380 mW
10x objective	0.55 m	0.89 m	0.7 m
20x objective	0.19 m	0.3 m	0.24 m
50x objective	0.53 m	0.86 m	0.68 m
100x objective	0.1 m	0.17 m	0.13 m
100x NIR objective	0.12 m	0.19 m	0.15 m

Table 5. NOHD values the RG microscope with Power & LPR configuration for different laser configurations (columns) using different probes (rows) at max laser power. Note that the actual maximum laser power of the instrument may differ from these values.

RGs wavelength	638 nm	785 nm	830 nm
Maximum power	280 mW	490 mW	330 mW
10x objective	0.51 m	0.89 m	0.65 m
20x objective	0.17 m	0.3 m	0.22 m
50x objective	0.49 m	0.86 m	0.63 m
100x objective	0.1 m	0.17 m	0.12 m
100x NIR objective	0.11 m	0.19 m	0.14 m

Installation

Scope of Delivery

Standard Components

- RG spectrometer (including user manual and quality test report)
- RG Microscope (including user manual and quality test report)
- Accessories (includes spares, adaptors, objective lenses, sample preparation tools etc.) typically:
    - Objective adaptor
    - Microscope objective
    - Goggles for laser protection
    - Accessories for independent spectrometer use
    - Accessories for sample preparation
- USB-C data cable
- USB-C power adaptor

Inspecting the Packaging

After having received RG microscope, inspect the packaging for damages. If there are any signs of damage, contact your local shipping representative before opening the shipping box.

Warning

Do not put RG spectrometer and microscope into operation if there are signs of damage. Failure to do so may result in severe personal injuries and/or property damage.

Transportation

When transporting the microscope, we recommend you use stable rolling table to avoid damages.

When transporting the RG Microscope by plane it is recommended to use the Lightnovo transport package or ask for information on instructions for transport.

Site requirements

Space Requirements

RG Raman microscope requires a space of 40 x 50 cm in lateral dimensions and 65 cm in height. (For the exact instrument dimensions refer to Specification.) At the rear instrument side, take a clearance of at least 10 cm into account.

When defining the installation site, take into consideration that the power supply connections are easily accessible at any time.

Note

A power outlet box to which RG Raman microscope connected provides a suitable solution.

RG Raman microscope requires a stable and horizontal base which can carry the instrument (ca. 34-45 kg) with possible accessories. This is critical for applications that require high spatial resolution.

Environmental Requirements

To ensure optimal instrument performance and long-term reliability the following environmental conditions are essential:

- Ambient temperature range:18 - 35°C (64 - 95°F)
- Humidity (non-condensing): ≤ 70% (relative humidity)

Note

RG spectrometer is an instrument of protection class I (electric safety).

Accessories

One will receive in the package a set of accessories. Depending on the order each accessory is recommended to be used for a particular type of measurement and test.

The probes for contact and distance measurements should be oriented by the upper side as shown in Table 6.

Table 6. Accessories for Lightnovo microscope

Accessory	Description	Type of measurement and test
 	10x objective	ZEISS Olympus
	20x objective	Olympus
	50x objective	Olympus
	100x objective	ZEISS

	100x NIR objective	ZEISS
	RMS Thread adaptor for Olympus objective	To attach the objective to the magnetic adaptor
	M25 adaptor for Nikon objectives	To attach the objective to the magnetic adaptor
	M27 adaptor for Zeiss objective	To attach the objective to the magnetic adaptor
	Magnetic adaptor	To attach the objectives to the microscope
	M27/0.75 thread adaptor for LN Spectrometers for Zeiss objectives M25/0.75 thread adaptor for LN Spectrometers for Nikon objectives (+ extra metal adaptors)	To attach the objectives to the microscope

Software installation

1. Download Miraspec software package from the Lightnovo website: https://lightnovo.com/miraspec/
2. Open the manual inside for detailed installation and instrument connection instructions.

Operation

Attaching & removing probes

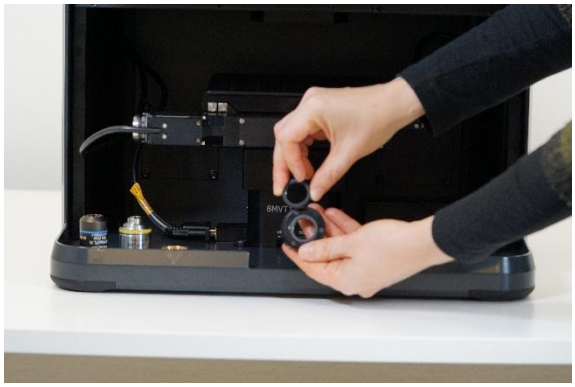
Push the button on the top to open the from door. It will open automatically.

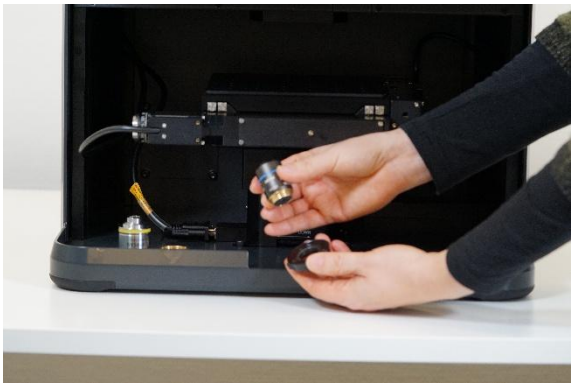
To attach an objective, check the threading of the objective.

If the objective is M27 threaded, go to the next step.

If the objective is M25 or RMS, then first attach the adapter ring to the objective.

Screw the objective (with adaptor if needed) onto the magnetic adaptor (M27).





Place the objective with the magnetic adaptor at the top into the slot in the microscope.

Removing and replacing the spectrometer

Open the top platform by removing the 4 small screws.

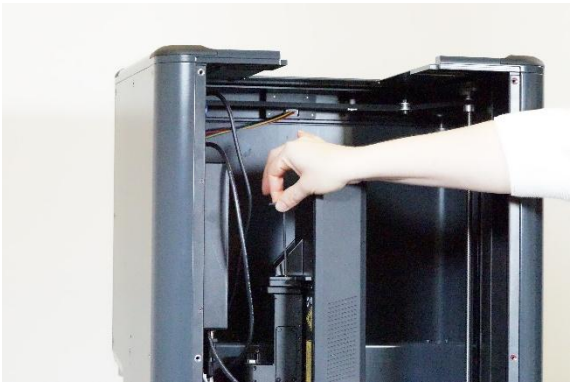
Tools attached in the pack of the microscope.

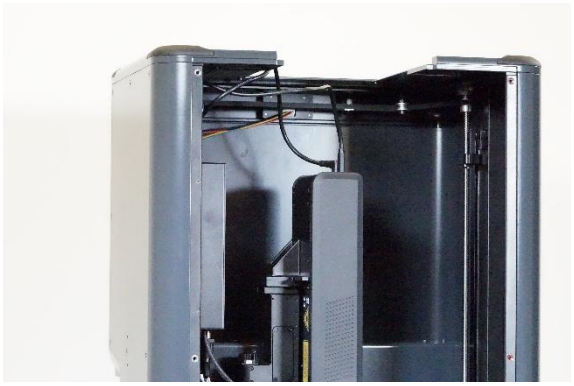
Size required 2.5 mm.

Disconnect/Connect the USB-C to/From the instrument.

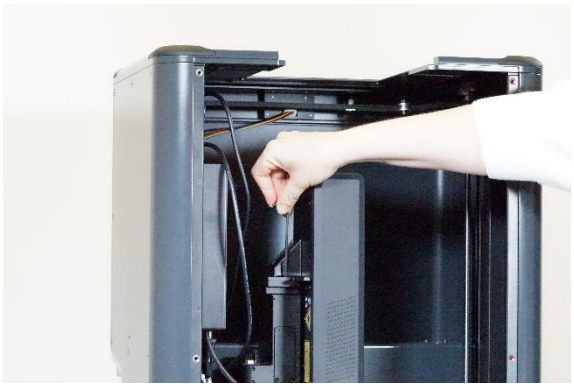
Disconnect / Connect the power supply to/ from the instrument.

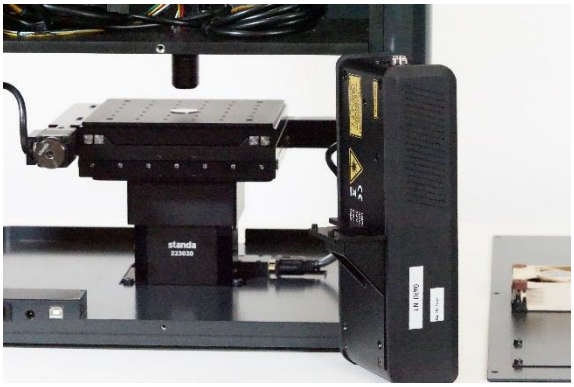
To attach the Spectrometer inside the microscope - attach it to the support and fix it inside.





To remove the spectrometer – remove the two screws that attach the spectrometer support to the microscope. Use the tool 2,5 mm.





Note

If you use the spectrometer outside the microscope there is no sue to reattach the two screws of the support of the microscope.

Caution

Always attach and remove the spectrometer from above.

Caution

DO NOT REMOVE THE BACK plate of the instrument.

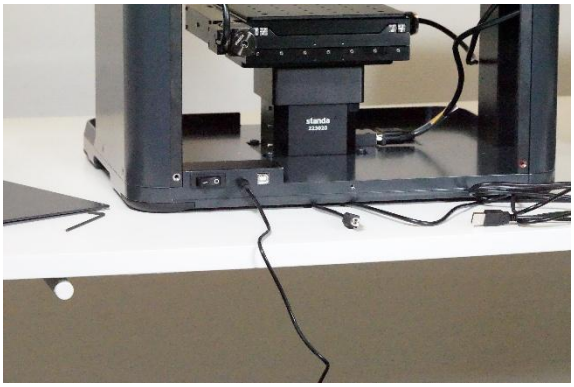
LED guide

Blue	The microscope is turned on.
Blue / Green	The system is connected to computer, the laser. Ready to operate. is on and the system is ready to operate.
Blue / Red	The system trying to connect. Something is not connected properly.
Amber / Yellow	The system is mapping.

Hardware connection

To connect the microscope to a computer first plug the P-cable into the port on the bottom of the rear of the microscope. Connect the power cable.

Turn on the microscope from the of/off button of the rear of the computer – next to power supply port.



Plug the USB end of the cable into the computer.

Open the Lightnovo Miraspec on the computer.

Choose the right configuration for the microscope

Press the connect button on the software to begin communication with the instrument (see software manual for details).

Technical drawings

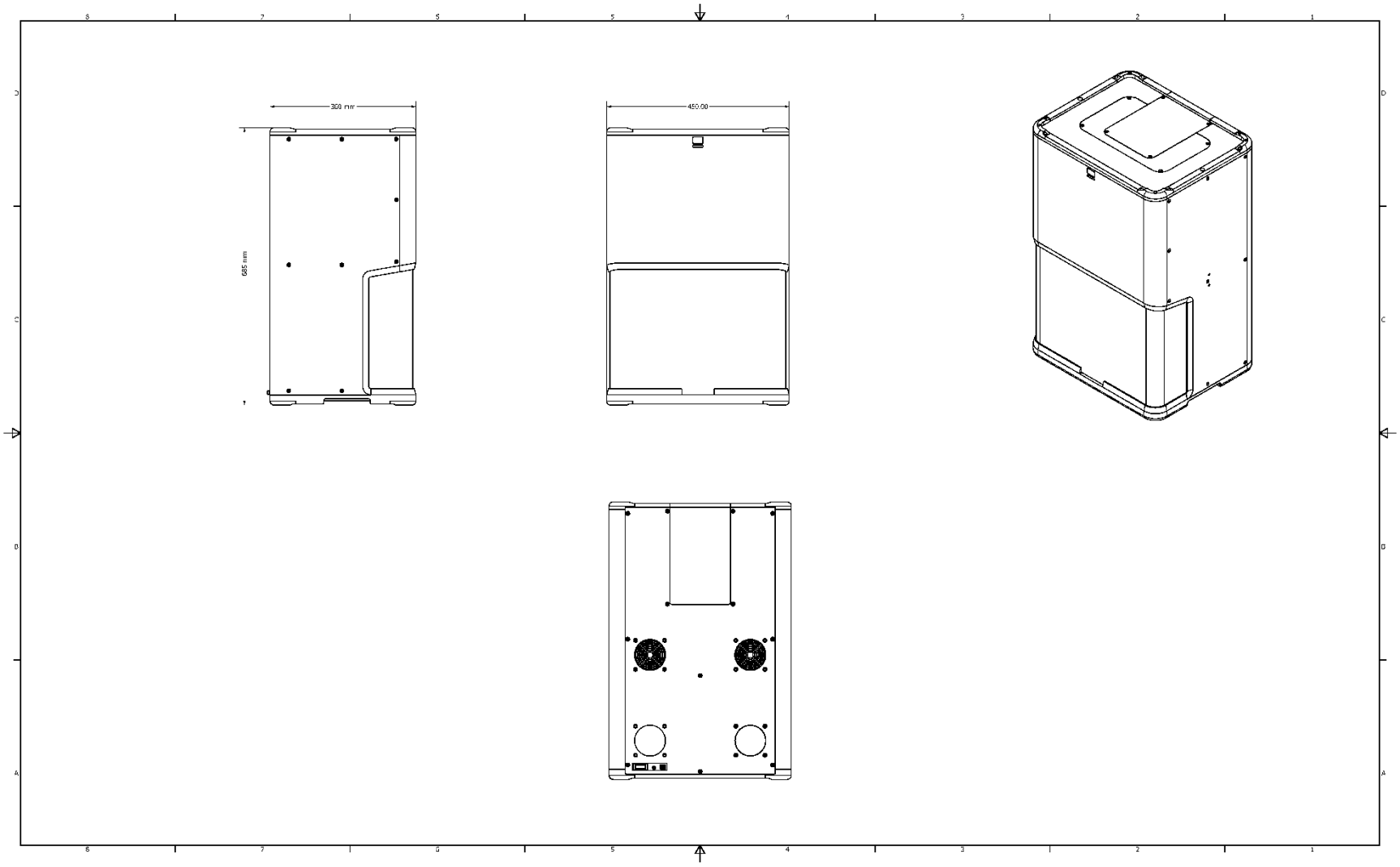


Figure 3. RG microscope drawing with dimensions

Service

Recommended care

Switching the system ON/OFF

When the analysis system is not used for a longer period of time, it is highly recommended to switch off the Raman excitation laser. This action will prolong the service lifetime of the laser.

Warning

Do not work with RG spectrometer at laser power that is higher than specified for particular model. This could lead to the decreased life time of the laser diode or laser damage.

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