BRAVO
Handheld Raman Spectrometer

User Manual

1837209

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This manual is the original documentation for the handheld Raman spectrometer BRAVO.

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1 Safety

1.1 General safety information

- ➢ Read carefully all instructions and safety notes in this manual before putting the handheld Raman spectrometer BRAVO into operation. Keep the manual for future reference available at any time at a suitable place.
- ➢ Always observe the instructions and safety notes given in this manual. Failure to do so can lead to severe personal injuries and/or property damage. Non-observance of the instructions and safety notes also violates the intended use of the handheld Raman spectrometer BRAVO. (See section 1.9.)
- ➢ 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 handheld Raman spectrometer BRAVO is in proper condition and fully functioning.
- ➢ A safe and trouble-free operation of the handheld Raman spectrometer BRAVO is ensured only if it is operated, maintained and repaired according to the procedures described in this manual and in compliance with all relevant safety standards and regulation.
- ➢ The handheld Raman spectrometer BRAVO should be operated only by authorized personnel which is trained in operating the instrument and which is familiar with the relevant safety instructions and laser safety regulations.
- ➢ Do never remove or deactivate any supporting safety systems during the operation.

The handheld Raman spectrometer BRAVO has been developed according to the safety regulation EN 61010-1:2010 (IEC 61010-1:2010+Cor.:2011) for electrical equipment for measurement, control and laboratory use.

1.2 Classification of the safety notes

Depending on the degree of hazard, important safety notes are classified in this manual by signal words as follows:

DANGER

- ➢ Indicates a hazardous situation which, if not avoided, will result in death or serious (possibly irreversible) injury and major property damage.

WARNING

- ➢ Indicates a hazardous situation which, if not avoided, could result in death or serious (possibly irreversible) injury and major property damage.

CAUTION

- ➢ Indicates a hazardous situation which, if not avoided, may result in minor or moderate (reversible) injury and minor property damage.

NOTICE
➢ Indicates a practice which could result in property damage if the given instructions are not observed.

i The symbol i will draw your attention to additional pieces of information which might be useful for you.

1.3 Overview of possible types of hazard

1.3.1 Possible hazards during installation and operation

Hazards that can possibly occur during operating the analysis instrument BRAVO are indicated by the appropriate warning symbols. The following warning symbols indicate different dangerous situations which may be caused by an improper use of the analysis system:

Warning symbol	Definition
	**General hazard:** This warning symbol indicates general hazard. The label is located near the danger spot in question. Observe the safety instructions and follow the precautions described in the manual to avoid personal injury and/or property damage.
	**Laser radiation:** This warning symbol indicates the existence of laser radiation. The label is located near the opening at which hazardous laser radiation exits the instrument. Do not look directly into the laser beam or use any kind of optical instruments to look into the beam as this may cause permanent eye damage.
	**Electrical shock:** This warning symbol indicates electrical hazard. It is located near live parts or enclosures behind which are live parts that represent an accidental contact hazard. Do not touch these parts. Before removing the corresponding housing part and beginning any repair works, first turn off the mains power switch and unplug the power cord. Prevent all live parts from coming into contact with a conductive substance or liquid. Non-observance of the relevant safety instructions can cause severe injury and/or property damage.

➢ **Important note:** All warning labels on the analysis system BRAVO must always be kept legible. Immediately replace a worn or damaged label.

1.3.2 Possible hazardous sample materials

There can also be hazards caused by the sample material. Depending on the type of hazardous substances you analyze, you have to observe specific substance-relevant safety instructions. Affix the corresponding warning label on the appropriate BRAVO position. The label must be well legible and permanently discernible. The following list contains some examples of hazardous substances:

Symbol	Definition
	**Infectious material** This warning symbol indicates the possible existence of biologically dangerous and infectious material. When working with this kind of material always observe the prevailing laboratory safety regulations and take necessary precautions and disinfection measures (e.g. wearing protective clothing, masks, gloves etc.). Non-observance may cause severe personal injury or even death. For information on how to use, dilute and efficiently apply disinfectants, refer to the *Laboratory Biosafety Manual: 2004 by WHO - World Health Organization*.
	**Radioactive material** This warning symbol indicates the possible existence of radioactivity. When working with radioactive material always observe the safety regulations and take necessary protective measures. Wear protective clothing, e.g. masks and gloves. Non-observance may cause severe personal injury or even death.
	**Corrosive substances** This warning symbol indicates the possible existence of corrosive substances. When working with corrosive substances always observe the laboratory safety regulations, and take protective measures (e.g. wear protective masks and gloves). Non-observance may cause severe personal injury or even death.

➢ **Important note:** In case you have analyzed substances which are dangerous to health you have to decontaminate the BRAVO analyzer completely before you return it to Bruker for repair purposes. In addition, you have to add a declaration with which you confirm that the BRAVO analyzer is completely free of any hazardous substances. See chapter 6.

Waste disposal

Dispose all waste produced (chemicals, infectious and radioactively contaminated substances etc.) according to the prevailing laboratory regulations. Detergents and cleaning agents must be disposed according to the special waste regulations.

1.4 Laser safety

1.4.1 Laser class

The handheld Raman spectrometer BRAVO is classified as a laser class 1M product according to IEC/EN 60825-1:2007. It emits invisible laser radiation in the wavelength range 700nm to 1100nm ($P_{opt.}$ < 100nm).

Laser class 1M product means that the product is safe for all reasonable foreseeable conditions of use. This means, no laser safety equipment is required for operating BRAVO.

	This laser warning label identifies BRAVO as a laser class 1M product. It is affixed at the bottom side of the handheld Raman spectrometer.

The duration of the laser radiation emission is limited automatically to the duration of the spectroscopic measurement.

☞ For information about the laser exit points, see section 1.4.3.

1.4.2 Safety instructions

Although BRAVO is a laser class 1M product, circumstances may occur in which laser radiation poses a potential health hazard. In these cases, observe the following safety instructions:

⚠ WARNING

Health hazard because of exposure to laser radiation

Non-observance of the following safety instructions can result in serious injury (possibly irreversible eye injuries).

➢ Do not place magnifying optics (e.g. magnifying glass) into the exiting laser beam which focuses the laser beam. A focussed laser class 1M beam is capable of causing eye injuries. Note: Means used for the correction of vision defects like eye glasses or contact lenses do not pose an injury risk to the human eye in this context.

➢ In case the housing is damaged (e.g. parts of the housing are broken away) do not start a measurement. Otherwise, there is a potential risk of laser radiation emission. Instead, switch off the BRAVO spectrometer immediately and remove the battery. Contact the Bruker service.

☞ For information about how to switch off BRAVO, see section 4.1. For information about how to remove the battery, see section 4.7. For the Bruker service contact data, see section 1.10.

1.4.3 Laser exit points

The location of the laser exit point depends on the type of installed measuring tip. Only as long as a spectroscopic measurement is in progress, invisible laser radiation of laser class 1M exits the handheld Raman spectrometer at the following exit points:

	In case of an installed measuring tip for bags, directed laser radiation exits BRAVO.
	In case of an installed measuring tip for vials, diffusely scattered laser radiation exits BRAVO.
	**Important note:** If there is not any measuring tip installed, the user cannot start a measurement neither by pressing the Start Measurement button at the BRAVO spectrometer nor by touching the *Collect Data* icon on the touch screen. This safety feature prevents an accidental laser emission in case no measuring tip is installed.

1.4.4 Laser status LED

Laser status LED

The laser LED informs you about the current laser status as follows:

- **Laser LED is off:** Laser is disabled (i.e. it is not ready for emitting radiation).
- **Blue solid:** Laser is enabled (i.e. it is ready for emitting radiation) and the laser safety status of the instrument is OK.
- **Red solid:** Laser emits radiation (for measurement purposes). As soon as the measurement is finished, the laser LED will return to blue (solid).
- **Blue flashing:** This indicates a laser safety problem. In this case, you can not start a measurement. Contact the Bruker service. See section 1.10.

1.4.5 Enabling / disabling the laser

In the **enabled state**, the laser is switched on and ready to emit radiation, but it does not emit radiation. The laser does not emit radiation before the user actively starts a measurement by pressing the button at the BRAVO spectrometer or tapping the icon on the touchscreen display. The duration of the laser radiation emission is automatically limited to the measurement time. In the **disabled state**, the laser is switched off. In this case, a spectroscopic measurement cannot be performed.

1.4.5.1 How to enable the laser

Enabling the laser

1. Switch on BRAVO by pressing the ON / OFF button .

➢ After you have switched on BRAVO, the laser status LED is still off. This indicates that the laser is not yet activated.

2. Enable the laser by pressing the button at the BRAVO button panel.

➢ The laser status LED lights blue. This indicates that the laser is ready for emitting radiation and laser safety status is OK.

i Before starting a measurement, make sure that the laser is enabled. When you start a measurement with a disabled laser, BRAVO aborts the measurement and delivers a result of the category *Aborted*. The reason stated for the abortion is *Laser not enabled*.

1.4.5.2 How to disable the laser

Disabling the laser (e.g. in case of emergency)

Press the button at the BRAVO button panel.

➢ This action switches off the laser i.e. it is not ready for emitting radiation any more. As a consequence, the laser status LED turns off.

Note: To re-enable the laser, press again the button at the BRAVO button panel.

1.4.5.3 How to abort a running measurement

➢ Note: BRAVO emits laser radiation only for the duration of the spectroscopic measurement (data collection).

Either *Press to Abort* on the touch screen display...

... or disable the laser by pressing the button at the BRAVO button panel.

1.5 Fire safety

For analyzing purposes, the sample is exposed to laser radiation. This laser radiation has the capacity to ignite highly flammable materials. So especially in case of highly flammable substances, there is a potential fire hazard.

⚠ WARNING

Fire hazard when analyzing a highly flammable substance

Non-observance of the following safety instruction could result in serious injury and/or property damage.

➢ Do not analyze knowingly a highly flammable substance.

➢ When analyzing unknown material, be aware of the potential fire hazard and take appropriate precautions (e.g. a fire extinguisher within reach).

1.6 Battery safety instructions

⚠ WARNING

Health hazard because of an exploding battery

Non-observance of the following safety instructions can result in serious injury and / or property damage.

➢ Do not expose the battery to fire, sparks or glowing embers. Do not dispose the battery in fire. Otherwise, it will explode. Risk of explosion and fire!

NOTICE

➢ Avoid excessive physical shock or vibration.

➢ Do not short-circuit the battery terminals.

➢ Do not disassemble or deform the battery.

➢ Do not use a battery which has visible signs of damage.

➢ Do not immerse the battery in water or other liquids. Do not allow the battery to get wet.

1.7 Safety notes regarding the LCD

The liquid crystal in the LCD is poisonous. During normal operation, it does not pose any health hazard. However, should the touchscreen display break and liquid crystal leaks, be careful.

⚠ CAUTION

Health hazard because of improper handling of leaking liquid crystal

Non-observance of the following safety instructions can result in minor injury.

➢ Avoid any skin contact. If you your skin or clothes have come in contact with liquid crystal, wash it off immediately using soap and water.

➢ Do not put liquid crystal in your moth.

1.8 Electromagnetic compatibility (EMC)

EU regulations

The BRAVO analyzer has been developed according to EN 61326-1:2013 *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements*. The BRAVO analyzer is a class A equipment.

Class A equipment is suitable for the use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

➢ **Important note:** In a domestic environment, BRAVO may cause radio interference. In this case, the operator may be required to take corrective actions in order to stop radio interference.

US / FCC regulation

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.

➢ **Important note:** This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

1.9 Intended use

BRAVO is a handheld spectrometer intended for Raman spectroscopic measurements and subsequent qualitative evaluation for the purpose of raw material verification.

Due to the measurement technique, BRAVO is suited for analyzing all kinds of solid and liquid samples which are Raman active, excluding highly flammable substances for safety reasons.

BRAVO is intended for indoor usage under the ambient conditions specified in appendix A.2.

The intended use includes also the compliance with the relevant standards and regulations, especially:

- EN 60825-1 - Safety of laser products - Part 1: Equipment classification and requirement
- national and local safety regulations
- national and local accident prevention regulations
- generally recognized technical regulations

The intended use also includes the strict observance of all instructions given in this manual, namely:

- safety instructions
- operation and handling instructions
- cleaning instructions

⚠ WARNING

Health hazard because BRAVO is used other than for its intended purpose

Non-observance of the following safety instruction could result in serious injury (possibly irreversible skin and/or eye injuries).

➢ Use BRAVO only as intended. Do not take any action that violates the intended use. The operational safety BRAVO is ensured only if it is used as intended.

1.10 Service contact data

In case you have questions about safety, operation and / repair of the BRAVO analyzer or you need technical assistance in case of a hardware and / or software problem, you can contact the Bruker service as follows:

- Service hotline hardware: +49 (0) 72 43 504-2020
- Service hotline software: +49 (0) 7243 504-2030
- Fax: +49 (0) 72 43 504-2100
- E-mail: Service.BOPT.DE.mailing@bruker.com

☞ On our website **www.bruker.com/about-us/offices/offices/bruker-optics** you will find also the current contact data of all Bruker Optics services offices worldwide.

Safety 1

2 General information

2.1 Fields of application

BRAVO is a handheld Raman spectrometer designed for raw material verification and raw material identification. It is approved for indoor usage only, namely in laboratory and warehouse environments. A typical field of application is the incoming goods inspection.

There are two different types of measuring tips which are interchangeable. These measuring tips can be used for measuring liquid and solid samples being filled in a vial or in a plastic bag, in a barrel, for example. With BRAVO, the samples are measured in a non-contact way.

2.2 Technical feature

The BRAVO analyzer is characterized by the following technical features:

Duo Laser™ excitation

The BRAVO analyzer is equipped with two laser diodes which emit radiation in the wavelength range between 700nm and 1100nm. This dual laser excitation provides for a very high sensitivity across the entire spectral range. This in turn ensures a very high degree of unambiguous sample identification.

Fluorescence mitigation by sequentially shifted excitation (SSE™)[1]

Normally, the Raman spectroscopic measurement technique is not suitable for samples which tend to fluoresce when being exposed to laser radiation because sample fluorescence can yield a much more intense signal than the Raman scatter of the sample, masking any Raman bands in the spectrum.

The patented SSE™ technique, however, allows for obtaining pure Raman spectra even in the presence of intense fluorescence by exciting the sample with a sequentially shifted laser radiation. Due to the implemented fluorescence mitigation technique SSE™, BRAVO can also be used for measuring samples which tend to fluoresce when being exposed to laser radiation.

Inbuilt wavenumber calibration

The automated wavenumber calibration ensures highly reproducible measurement results and an unmatched wavenumber accuracy. They are crucial for a raw material identification in a validated environment.

Automatic recognition of the measuring tip

BRAVO recognizes automatically the currently installed type of measuring tip. In addition, this information is stored automatically in the measurement records.

1. US patent 8,570,507, other patents pending

In case, the user has explicitly defined a certain type of measuring tip for a certain sample when setting up a library, than BRAVO automatically prompts the user to use the previously defined tip for measuring the sample in question. This special feature prevents the user from measuring a certain sample using the wrong measuring tip.

The design of the measuring tip allows for an easy interchange and ensures always a precise positioning.

Wireless and wired data transmission

BRAVO is equipped by default with an integrated WLAN device. This technical feature allows for a wireless data exchange between the BRAVO analyzer and a PC station via a wireless network. If demanded, the wireless connectivity can be deactivated. Alternatively, a wired data transmission via an Ethernet network is also possible by using the optional docking station.

2.3 Scope of delivery

The items of the default delivery scope are delivered in a robust carrying case.

Standard Components:	The carrying case includes the following items: • handheld Raman spectrometer BRAVO with installed BRAVO software • 1x measuring tip for vials • 1x measuring tip for bags • 2x rechargeable batteries (Note: The rechargeable batteries are delivered in a charged state.) • 1x battery charger • 1x polystyrene standard (reference standard for OQ and PQ test measurements) • 1x calcite standard (reference standard for OQ test measurement) • 1x microfibre cloth • 1x carrying strap (including the required items and tools for mounting / demounting the strap) • OPUS software delivered on an USB stick (including OPUS online help) Note: By default, the following OPUS software packages are delivered: OPUS/IR, OPUS/BRAVO, OPUS/SEARCH and OPUS/VALIDATION. • Quick Start Guide (printed version) • BRAVO Analyzer User manual and BRAVO Software User Manual (electronic version, delivered on an USB stick)
Optional Components:	• Docking station with power cord and external power supply unit (Note: The docking station is delivered in a storage case. • 1x Ethernet cable (crossover) • Validation kit containing the following Raman reference standards: 1x vial cyclohexane, 1x vial naphthalene, 1x vial benzonitrile, 1x vial tylenol, 1x PE bag tylenol with certificate-of-origin • Bruker validation manual • optional OPUS software packages (e.g. OPUS/IDENT) • Data system

2.4 Inspecting the packaging

After having received the BRAVO analyzer, inspect the packaging for damages.

⚠ CAUTION

Possible damage to the delivered goods because of transport damage

Non-observance of the following safety instructions could result in injury.

➢ Check the packaging visually or damages. If there are signs of damage contact the shipping company.

➢ A BRAVO analyzer delivered in a damaged packaging may be damaged as well. Therefore, do not put BRAVO into operation in this case. Contact Bruker instead. (See section 1.10.)

2.5 Ambient conditions and power supply

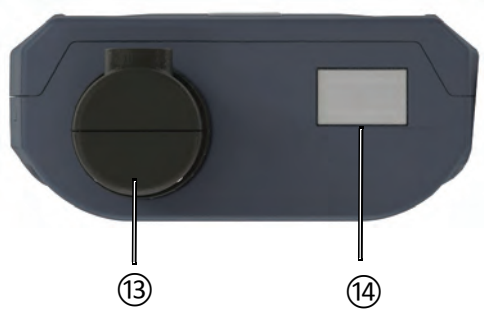
For proper and error-free operation of the instrument, ensure that the following conditions are met:

Ambient conditions / environmental requirements:	• Approved for indoor use only (in laboratory and warehouse) • Ambient temperature range: 5°C - 35°C (41°F to 95°F) • Humidity (non-condensing): 0 - 95 % (relative humidity) • BRAVO is shielded against electromagnetic interferences. Nevertheless, the instrument should not be installed near high electric and/or magnetic fields.
Power supply:	BRAVO is designed for both battery operation (standard) and mains operation (option). Note: For mains operation, put BRAVO in the docking station. The docking station is an optional item. In this case, the power supply has to fullfil the following requirements: 100 - 240 VAC ± 10%, 50/60 Hz ☞ For information about battery specifications, see appendix A.3. ☞ For information about how to recharge a battery, see section 4.8.

3 BRAVO analyzer - Overview

3.1 Components and control elements - Overview

<table>
<tr>
<td>Top side
 
</td>
<td>① - Laser status LED
② - Measuring tip (exchangeable)
③ - Touchscreen
④ - Start measurement button
⑤ - Laser enabling / disabling button
⑥ - ON / OFF button
⑦ - Barcode scanner button
⑧ - Carrying strap (removable)</td>
</tr>
<tr>
<td>Bottom side
 
</td>
<td>⑨ - Contact bar for the docking station
⑩ - Laser label
⑪ - Type label
⑫ - FCC label</td>
</tr>
</table>

Front side  	⑬ - Measuring tip (exchangeable) ⑭ - Barcode reader
Back side  	⑮ - Battery compartment door (removable)

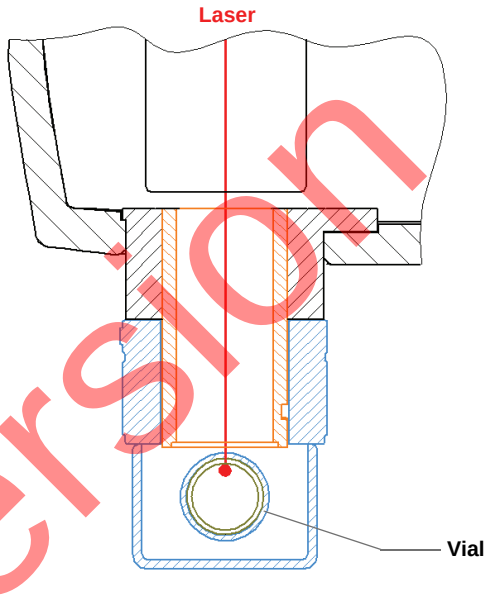
3.2 Laser status LED

	**Laser status LED is off.** ➢ The laser is disabled (i.e. it is not ready for emitting radiation).
	**Laser status LED lights continuously blue.** ➢ Laser is enabled (i.e. it is ready for emitting radiation) and laser safety status is OK.
	**Laser status LED lights up red.** ➢ Laser emits radiation. Note: The red laser status LED is of a temporary nature only. As soon as the measurement is finished, the laser status LED returns to blue indicating that the laser radiation emission is over.
	**Laser status LED is flashing blue.** ➢ This indicates a laser safety problem. In this case, you cannot start a measurement. Contact the Bruker service. ☞ For service contact data, see section 1.6.

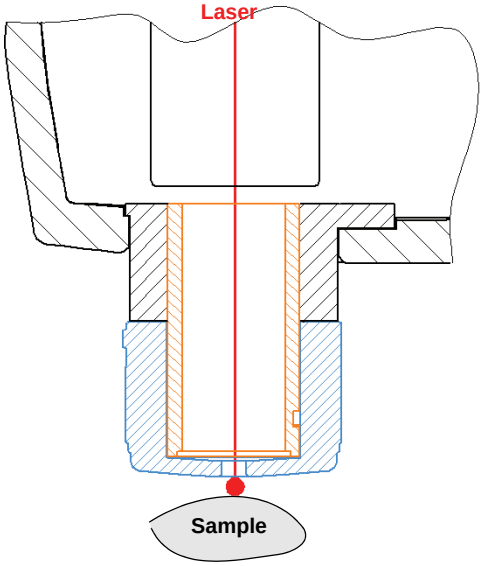
3.3 Measuring tip

Depending on the type of container in which the sample material is filled, there are two different types of measuring tips: a measuring tip for vials and a measuring tip for bags.

Measuring tip for vials
(for measuring liquid or solid samples being filled in a vial)



Measuring tip for bags
(for measuring samples being filled in a plastic bag, in a barrel etc.)



i The available measuring tips are automatically recognized by the BRAVO analyzer when they are attached. The type of measuring tip and relevant data about the measuring tip are stored with each measurement.

3.4 Button panel - Control buttons

The button panel includes the following control buttons:

	**ON / OFF button** Depending on whether the BRAVO analyzer is currently on or off, pressing this button switches BRAVO on or off.
	**Laser enabling / disabling button** Pressing this button enables or disables the laser. (Note: In the enabled state, the laser is ready to emit radiation.) ➢ An enabled laser is indicated by a blue laser LED. When the laser is disabled, the laser LED is off.
	**Barcode scanner button** When you press this button, the barcode reader scans the barcode placed in front of it. Note: Alternatively, you can start the barcode scanning process using the BRAVO software.
	**Start measurement button** Pressing this button starts the spectroscopic measurement. Note: Alternatively, you can start the measurement using the BRAVO software.

3.5 Touchscreen

General information

BRAVO is equipped with high-resolution TFT display with touchscreen 7" (15.0 cm x 9.4 cm).

Handling instructions

NOTICE

Damaged touchscreen because of improper handling

Observe the following handling and operating instructions to avoid damages.

- ➢ Operate the touchscreen only with your fingers. Do not use a sharp object because it can damage of scratch the display surface.
- ➢ Do not touch the touchscreen with a conducting metallic object as this can cause interferences / lead to a touchscreen disfunction.
- ➢ Operate the touchscreen only with clean and dry fingers.
- ➢ Clean the touchscreen only as described in section 5.1.2.

3.6 Docking station

The docking station is an optional item. It provides for:

- a data transfer (up-/downloading data) via Ethernet network (wired network) between BRAVO and the data station on which OPUS is installed
- recharging the battery inside BRAVO and the spare battery which is stored inside the docking station
- storing the measuring tip which is currently not used and the reference sample for the PQ test
- data transfer via USB stick

① - Contact bar for connecting with BRAVO

② - Blue lamp indicates whether the electric contact with BRAVO is established

③ - Green lamp indicates the current state of charge of the battery which is inside BRAVO

④ - Indentation intended for the storage of the measuring tip

⑤ - Indentation intended for the storage of the reference sample or a vial

⑥ - Compartment for the spare battery (for storing and recharging the spare battery)

⑦ - Ethernet port for connecting the data cable in case the instrument is connected to a wired network

⑧ - Low-voltage socket for connecting the low-voltage cable to establish the power supply

⑨ - USB port for connecting an USB stick

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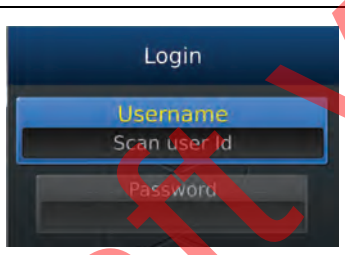
4 Operation

> **i** This manual is restricted mainly to the hardware-related aspects of operation. For detailed information about the software-related aspects of operating BRAVO, refer to the BRAVO Software Manual.

4.1 Switching on / off BRAVO

	**1. Switching on BRAVO** Press the ON / OFF button ⏻. ➢ BRAVO starts to boot up. The boot-up process takes approx. 10 seconds.
	**2. Waiting for BRAVO to boot up** Wait until the boot-up process is finished and the Login screen is displayed on the touch-screen. ☞ For information about how to log in, see the following section 4.2.

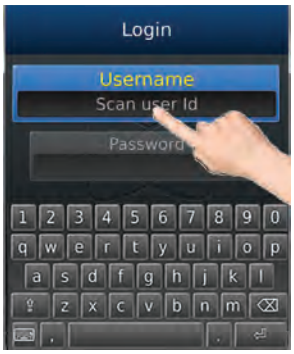
> **i** in the switched-on state, there is typically a slightly increased heat dissipation at the bottom side of the BRAVO analyzer.

	**1. Switching off BRAVO** Press the ON / OFF button ⏻. ➢ This action switches off the handheld Raman spectrometer BRAVO. The laser LED turns off as well.

> **i** It is recommended to switch off BRAVO when it is not in use for a longer period of time in order to prevent the rechargeable battery from discharging unnecessarily.

4.2 Logging in

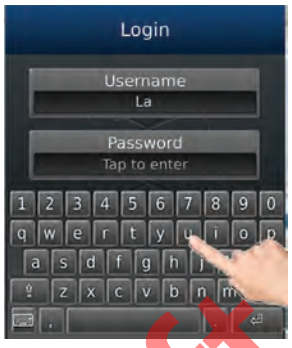
For your username and password, ask the responsible OPUS administrator.



1. Entering the user name and password

a) Tap the *Username* entry field.

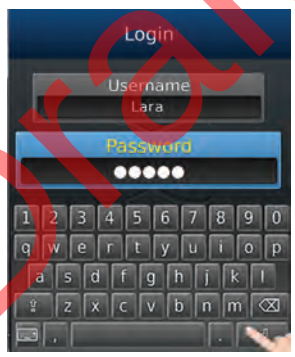
➢ The on-screen keyboard pops up.



b) Enter your user name using the on-screen keyboard.

Alternatively, you can scan the user ID, provided the user name is available as barcode. In this case, place the user ID barcode in front of the barcode reader and press the button at the BRAVO button panel.

c) Tap the *Password* entry field and enter your password using the on-screen keyboard.

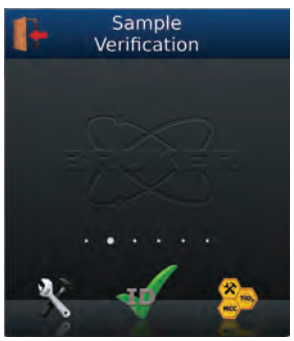


2. Confirming the entered username and password

Touch the return key on the on-screen keyboard.

➢ The on-screen keyboard disappears and the start screen of the BRAVO software program is displayed.

➢ Note: For closing the on-screen keyboard without confirming the entered data, press the key .



➢ After you have logged in, the on-screen keyboard disappears and the start screen of the BRAVO software program is displayed.

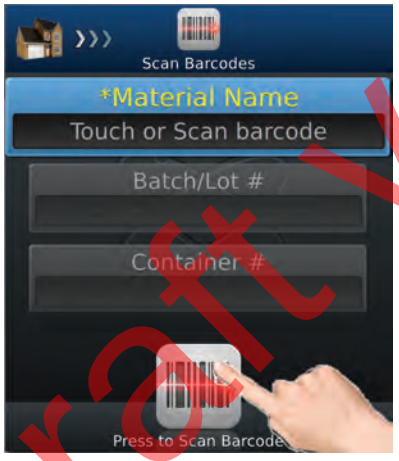
To proceed with scanning the barcode of the sample tap the icon in the navigation bar.

For information about how to scan the sample barcode, see the following section 4.3.

4.3 Scanning the barcode of the sample

1. Positioning the sample barcode in front of the barcode reader

Position the barcode on the sample container in front of the barcode reader. Make sure that the barcode reader can scan the complete barcode.



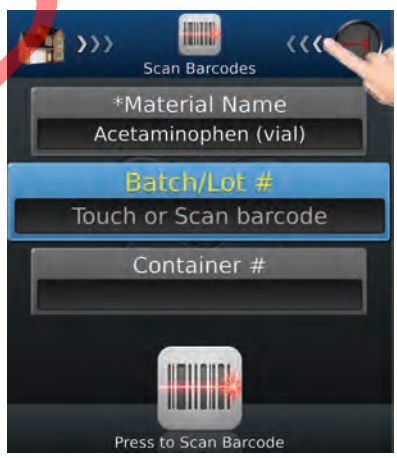
2. Scanning the barcode

Either press the button at the BRAVO button panel...

... or tap the icon in the navigation bar of the *Scan Barcodes* screen.

i Alternatively, you can enter the material name, the batch / lot # and the container # manually by touching the corresponding entry field. In doing so, the on-screen keyboard pops up. Enter the data using the on-screen keyboard. Entering the *Material Name* is mandatory, entering *Batch / Lot #* and *Container #* is facultative.

☞ For more details, refer to the BRAVO Software Manual. This manual is delivered as pdf file on an USB flash drive.



i To proceed with verifying the sample, swipe left in the workflow bar to put the icon into the center position.

☞ For information about sample verification, see section 4.5.

4.4 Exchanging the measuring tip

General information

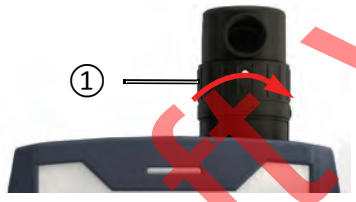
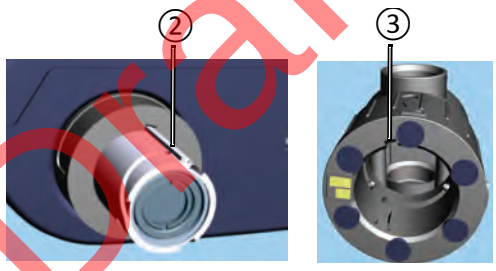
Depending on the type of container in which the sample material is filled, there are two different types of measuring tips:

	**Measuring tip for bags** ➢ Use this measuring tip for samples being filled in a plastic bag, in a barrel etc.
	**Measuring tip for vials** ➢ Use this measuring tip for measuring liquid or solid samples being filled in a vial.

☞ For additional information about the available measuring tips, see section 3.3.

Exchange procedure

Depending on the type of sample container, install the appropriate measuring tip.

	**1. Removing a measuring tip** Rotate the bayonet socket ① a quarter turn. The direction of rotation is indicated by the red rotation arrow in the left image. Take off the measuring tip.
	**2. Installing a measuring tip** Fit the measuring tip on the objective unit with the groove of the measuring tip ③ being in alignment with the tongue of the objective unit ②.
	Rotate the bayonet socket until it engages. The direction of rotation is indicated by the red rotation arrow in the left image. **Note:** The bayonet coupling is properly engaged when the arrow is in line with the lock icon  .

4.5 Verifying a sample

1. Putting the sample in the measurement position

In case you verify samples which are filled in vials, place the vial in the holder of the measuring tip.

In case you verify samples which are filled in bags, press the bag against the laser exit opening of the measuring tip.

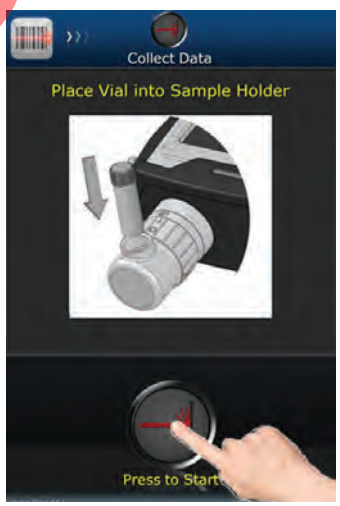
☞ In case the measuring tip needs to be exchanged, see section 4.4.

2. Enabling the laser (only if not yet done)

Press the button at the BRAVO button panel. If the laser is already enabled, skip this step.

i An enabled laser is indicated by a blue (solid) laser LED.

Note: When you start a measurement with a disabled laser, BRAVO aborts immediately the measurement and delivers a result of the category *Aborted*. The reason stated for the abortion is *Laser not enabled*.



3. Starting the sample measurement

Either press the button at the BRAVO button panel...

... or touch the icon in the navigation bar of the *Collect Data* screen.

☞ For more details, refer to the BRAVO Software Manual. This manual is delivered as pdf file on an USB flash drive.

4. Waiting until the measurement is finished and the result is displayed on the touchscreen

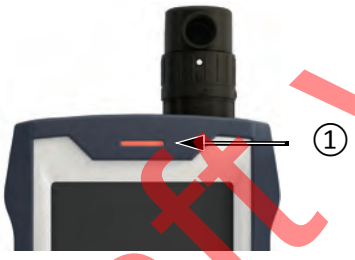
Sample measurement in progress

WARNING! LASER EMISSION POSSIBLE!

☞ For detailed information about the laser exit points and laser safety, refer to section 1.4.

The measurement progress is indicated by a countdown timer showing the remaining measurement time.

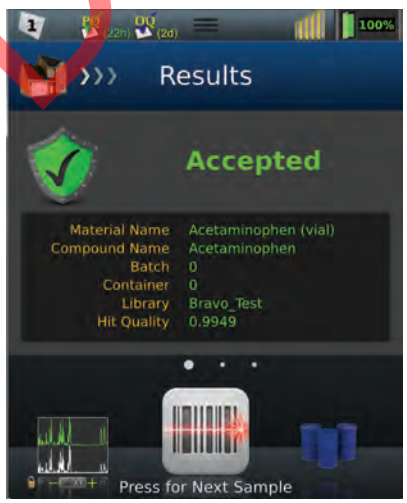
Note: If additional time is required, a second countdown timer will appear after the pre-scan.



Important Note: As long as the measurement is in progress, the BRAVO spectrometer emits laser radiation. This is indicated by a red laser status LED ①. As soon as the measurement is finished, the laser status LED returns to blue (solid). This means, the laser is enabled but it emits no radiation.

Automatic comparison of spectra

Immediately after the data collection, the BRAVO software compares automatically the measured sample spectrum with the reference spectra of the used spectra library.



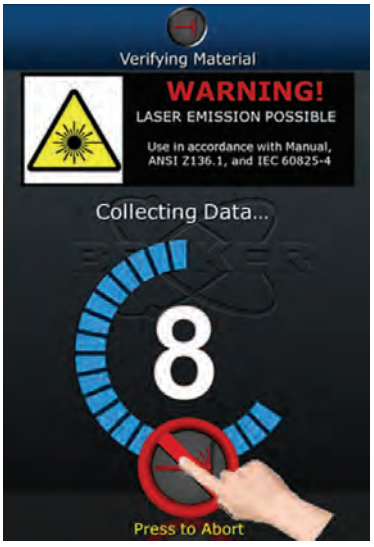
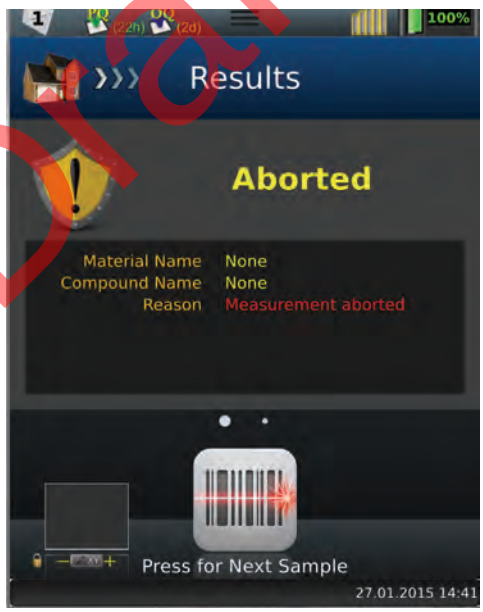
Automatic display of the result

Afterwards, the result of the spectra comparison is displayed automatically. The result categories *Accepted* and *Rejected* tell the user whether the expected material is confirmed clearly on the basis of the used spectra library or not.

☞ For detailed information about this topic, refer to the BRAVO Software user manual. This manual is delivered as pdf file on an USB flash drive.

i To proceed with scanning the barcode of the next sample, touch the icon  in the navigation bar.

4.6 Aborting a running measurement

	Either *Press to Abort* on the touchscreen display or ...
	.... press the button  at the button panel. Note: Pressing this button disables the laser and aborts a running measurement.
	➢ In case of a measurement abort, no data is saved. And consequently, BRAVO is not able to verify the sample and to deliver a verification result. Instead, the BRAVO software programme informs the user about the reason for the abort.

4.7 Exchanging the battery

The standard delivery scope includes two rechargeable batteries. One of them serves as spare part.

Before starting with the battery removal, it is recommended to log out the system and to switch off BRAVO.

	**1. Opening the battery compartment** Rotate the cover of the battery compartment counter-clockwise up to the stop. Take the cover off.
	**2. Removing the empty battery** Pull out the battery.
	**3. Inserting the charged battery** Insert the battery with the electric contact strip ① pointing upwards. Push the battery into the battery compartment.
	**4. Closing the battery compartment** Insert the two lock hooks at the cover into the corresponding recesses of the guide slots at the battery compartment. Rotate the cover clockwise until it snaps into place.

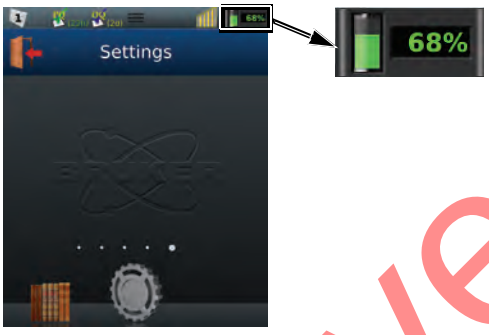
4.8 Recharging the battery

4.8.1 General information

There are two ways of recharging the battery:

- by using the batter charger which is included in the standard delivery scope
- by using the optional docking station

Display of the battery state of charge

	In case of the battery inside the BRAVO analyzer, the current battery state of charge (in precise percentage) is displayed by the BRAVO software in the upper right corner of the touchscreen display.
	The current battery state of charge is also displayed on the battery itself by a five-segment bar-graph display ① (in steps of 20%).

Handling instructions

☞ For detailed battery safety instructions, see section 1.6.

NOTICE
To ensure a long service life of the rechargeable battery, observe the following handling instructions: ➢ Do not expose the battery to high temperatures. ➢ Store the battery in a cool, dry and well-ventilated place.

4.8.2 Recharging the battery with the battery charger

In this case, the battery needs to be removed from the BRAVO analyzer.

☞ For detailed information about how to remove and re-insert the battery, see section 4.7.

1. Connect the battery charger to the mains power supply.
2. Place the battery into the battery bay of the charger ensuring that the 5-way connector is fully seated.

➢ The charger will automatically begin charging the battery.

LEDs ① at the battery charger indicate the charge state of the battery as follows:

- Green flashing: The battery is charging.
- Green solid: The battery is fully charged.
- Red solid: Error

Battery charger - Safety notes

⚠ CAUTION

Non-observance of the following safety instructions may result in minor or moderate (reversible) injury and minor property damage.

➢ Do not expose the charger or power supply to water or liquids. It is not a sealed case.

➢ Place the charger in a cool spot, away from external heat sources.

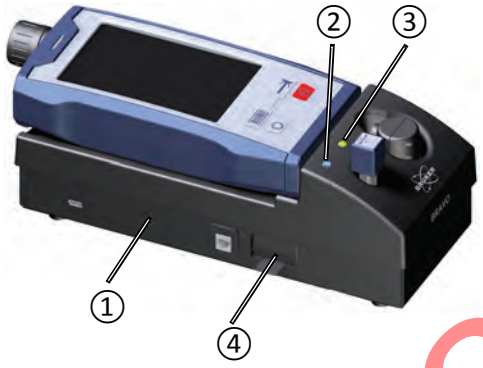
➢ Do not cover the air vent or obstruct the air flow. This will cause overheating.

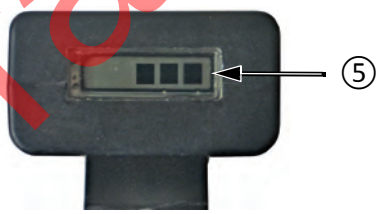
➢ Do not open the charger or the power supply unit. There are no serviceable parts inside.

➢ Use only the manufacturer's power supply and observe the terminal polarity.

4.8.3 Recharging the battery via the docking station

i With the docking station, two batteries can be charged at the same time: the battery inside the BRAVO analyzer and the spare battery placed in the battery storage compartment of the docking station.





1. Connect the power cord to both the docking station ① and the wall socket.

Charging the battery inside BRAVO

2. Put the BRAVO analyzer with inserted battery into the docking station as shown in the left image.
3. Make sure that the blue lamp ② at the docking station lights. This indicates that the BRAVO analyzer is properly connected with docking station.

The green lamp ③ at the docking station indicates the charge state of the battery as follows:

- The green lamp is flashing. --> The battery is recharging.
- The green lamp lights continuously. --> The battery is fully recharged.

4. As soon as the battery is fully recharged, you can take BRAVO out of the docking station and proceed with your work.

Charging the spare battery

5. Insert the spare battery into storage compartment ④ of the docking station.

➢ Note: Insert the battery with the electric contact strip pointing upwards.

The current battery state of charge is displayed on the battery itself by a five-segment bar-graph display ⑤ (in steps of 20%).

i To have always a charged battery at hand, make a habit of putting the spare battery into the battery storage compartment of the docking station.

☞ For more information about the optional docking station, see section 3.6.

4.9 Establishing a wireless connection between BRAVO and a data station

By default, the BRAVO analyzer is designed for a wireless connection between BRAVO and data station.

➢ **Important Note:** For a wireless connection between BRAVO and data station, a WLAN-capable data station (e.g. notebook, tablet PC) is required. In case there is no WLAN available at your site, a router is required in addition. In case the data station is not WLAN-capable, a wireless access point is required.

Establishing a wireless connection between BRAVO and the data station involves the following basic steps:

1. Connecting the data station to the WLAN
2. Connecting the BRAVO analyzer to the WLAN
3. Connecting the data station to the BRAVO analyzer via WLAN

➢ **Important Note:** BRAVO and data station have to be connected to the same WLAN!

➢ **Note:** The BRAVO analyzer is equipped with a WiFi module which supports the standards IEEE 802.11b/g/n.

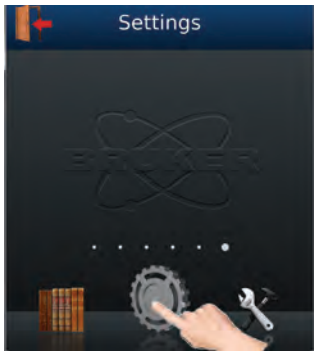
4.9.1 Connecting the data station to the WLAN

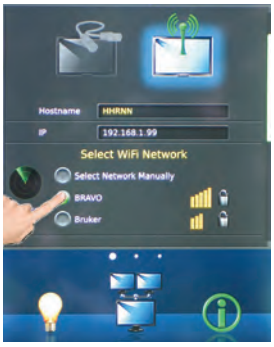
The precise procedure depends on the used wireless LAN-equipment and the wireless local area network (WLAN) at your site.

☞ For this reason, ask your responsible IT administrator for information about how to connect your data station to your WLAN.

	1. Activate the WLAN card which is integrated in your data station. ☞ For information about this subject, refer to the user manual of the data station in question. Note: In case a router is used, switch it on as well. ☞ For information about this subject, refer to the user manual of the router in question.
	2. Connect the data station to a WLAN which is available at your site (e.g. a company-internal WLAN). Wait until the wireless connection is established. ☞ If you have any questions on this subject, contact your IT administrator.

4.9.2 Connecting BRAVO to the WLAN

	**Opening the *Settings* workflow** 1. Open the *Settings* workflow by swiping left or right in the navigation bar until the icon is in the center. 2. Touch the icon .
	**Opening the *Network* screen** 3. Swipe left or right in the navigation bar until the icon is in the center.
	**Selecting the network type *Wireless*** 4. Touch the *Wireless Network* icon .
	**Performing a WiFi scan to find out which WLANs are available at your site.** 5. Touch the *WiFi Scan* icon . ➢ Wait until the WiFi scan is finished. Afterwards, all WLANs which are currently available at your site are displayed.



Selecting the desired WiFi network.

6. Touch the corresponding option button.

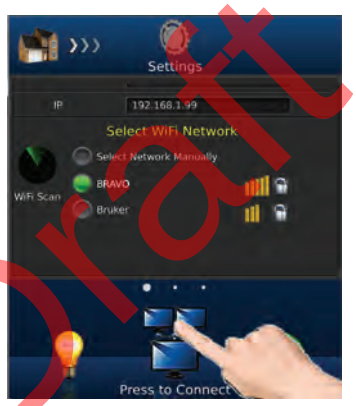
➢ **Important:** The BRAVO analyzer and the data station have to be connected to the same WLAN!

Configuring the WiFi network

7. In case you have selected the option *Select Network Manually*, you have to configure the WiFi network you intend to use. Enter the *Network Name (SSID)* using the on-screen keyboard.
8. In case you have selected a password-protected network, enter the password using the on-screen keyboard.

☞ For the network password, ask the responsible IT administrator.

➢ In case you have selected a non-password-protected network, you can skip this step.



Establishing the connection between BRAVO and WLAN

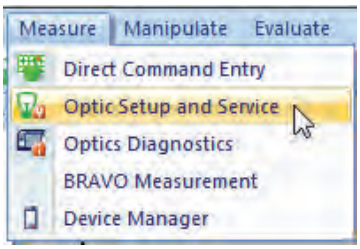
9. In the navigation bar, *Press to Connect*.

10. Wait until the wireless connection is established.

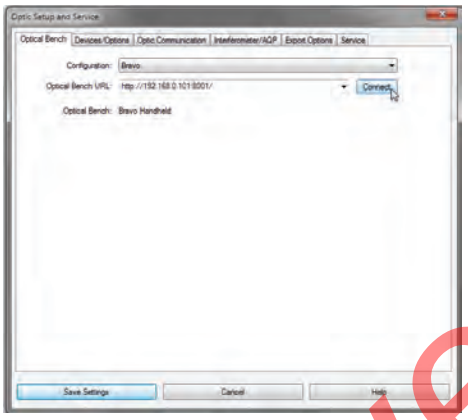
➢ In case of a successful connection attempt, the following message appears: *Config. saved. Connection successful!* In addition, the connectivity icon  in the top bar lights yellow.

☞ In case the connection attempt failed, see section 7.2.8 for troubleshooting. If you do not succeed in solving the problem, contact the responsible IT administrator.

4.9.3 Connecting the data station to BRAVO via WLAN



1. Select in the OPUS *Measure* menu the *Optic Setup and Service* function.



2. Select in the *Configuration* drop-down list the option BRAVO.
3. Enter the *Optical Bench URL* of the BRAVO analyzer to which you want to connect. The *Optical Bench URL* has the following syntax: *http://<IP address of the BRAVO analyzer>:8443*.

➢ Note: You find the IP address ① of the BRAVO analyzer in the *Network* screen of the BRAVO software.

4. Click on the *Connect* button.
5. Exit this dialog by clicking on the *Save Settings* button.

4.10 Establishing a wired connection between BRAVO and a data station

4.10.1 General information

Only with the optional docking station, you can establish a wired Ethernet connection between the BRAVO analyzer and a data station (e.g. PC, notebook) for data transfer purposes.

i The optional docking station is not included in the standard delivery scope. But if desired, you can reorder a docking station. For the order number, see appendix B, section B.5.

➢ **Important Note:** For a wired connection between the BRAVO instrument and the data station, a data station (e.g. PC) with Ethernet port is required.

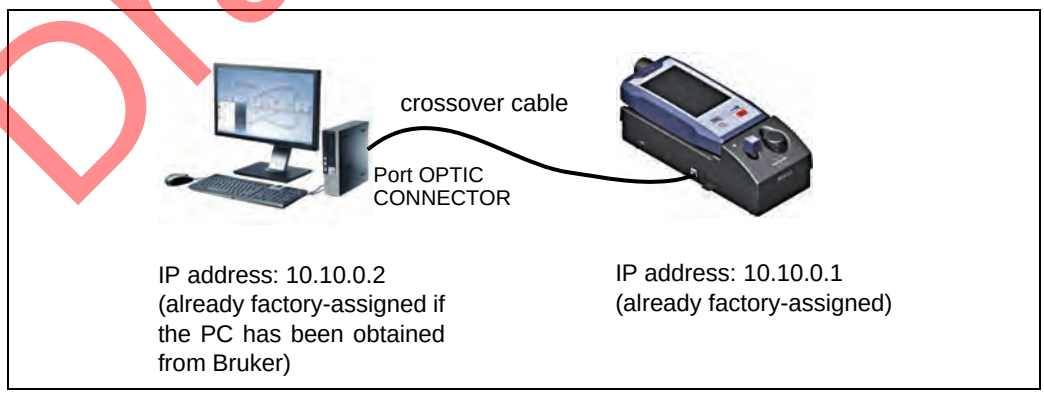
Note: In case the data station has been delivered by Bruker, the integrated network interface cards are labelled OPTIC CONNECTOR and LAN. The LAN port has to be used for the connection between data station and network hub; the OPTIC CONNECTOR port has to be used for the connection between data station and BRAVO analyzer.

4.10.2 Possible connection variants

Basically, the following connection variants are possible:

- Connecting the docking station directly to a stand-alone data station
- Connecting both the docking station and the data station(s) to a local area network
- Connecting the docking station to a data station which is connected to a local area network

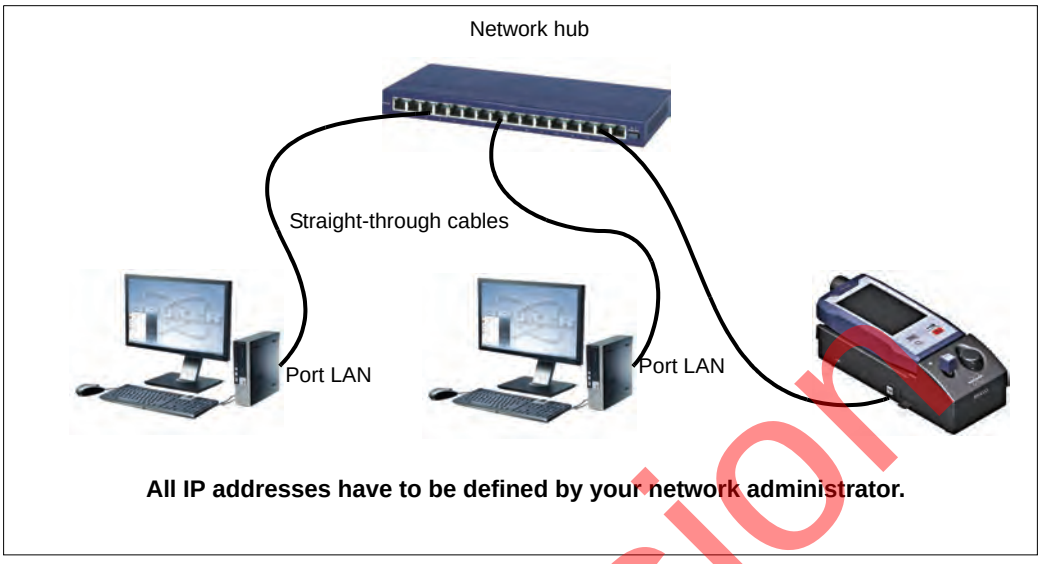
Variant A: Connecting the docking station directly to a stand-alone data station



For establishing this connection variant, one crossover Ethernet cable with RJ45 connector is required.

i Bruker provides crossover Ethernet cables of different lengths. For the order number, see appendix B, section B.5.

Variant B: Connecting the docking station and the data station(s) to a network



For establishing this connection variant, straight-through Ethernet cables with RJ45 connector are required.

In case of this connection variant, all IP addresses (i.e. IP addresses for data station(s) and BRAVO analyzer) have to be defined by your network administrator. To the BRAVO analyzer, both IP address types - static and dynamic - can be assigned. In the latter case, however, a DHCP server is required.

☞ For information about how to assign a network address to BRAVO, see section 4.10.3.

Variant C: Connecting the docking station to a network data station

General information

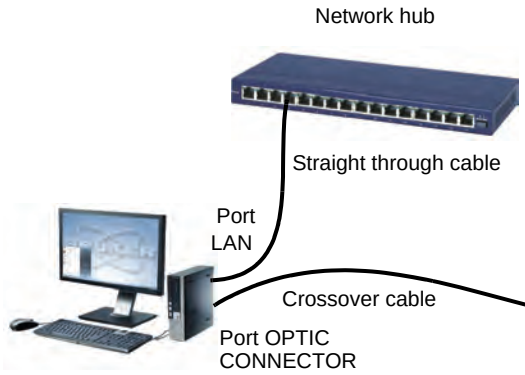
This connection variant requires two network interface cards: one for the communication between BRAVO and data station and another for the communication between data station and network hub. In case the data station is equipped with only one network interface card, a LAN USB adapter is required for establishing the connection between data station and network hub.

i Bruker provides the required network equipment. For the order number, see appendix B, section B.6.

For establishing the connection between data station and network hub, a straight through Ethernet cable with RJ45 connector is required. For establishing the connection between BRAVO analyzer and data station, a crossover Ethernet cable with RJ45 connector is required.

i Bruker provides crossover Ethernet cables of different lengths. For the order number, see appendix B, section B.5.

Computer equipped with two network cards

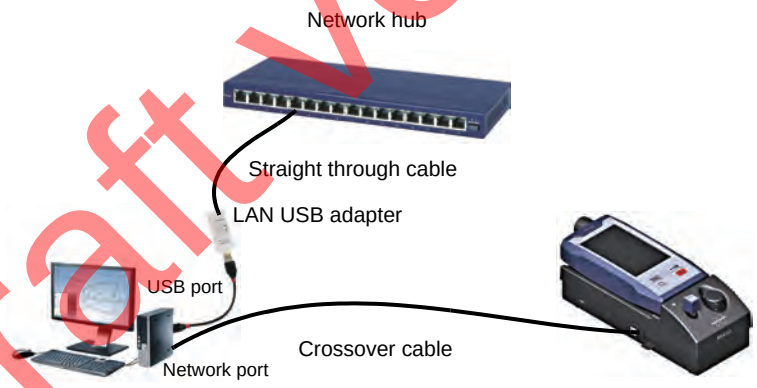


OPTIC CONNECTOR network card:
IP address: 10.10.0.2
(already factory-assigned if the PC has been obtained from Bruker)

LAN network card:
IP address has to be defined by your network administrator.

IP address: 10.10.0.1
(already factory-assigned)

Computer equipped with one network card



Integrated network card:
IP address: 10.10.0.2
(already factory-assigned if the PC has been obtained from Bruker)

LAN USB adapter:
IP address has to be defined by your network administrator.

IP address: 10.10.0.1
(already factory-assigned)

4.10.3 Assigning network addresses to BRAVO

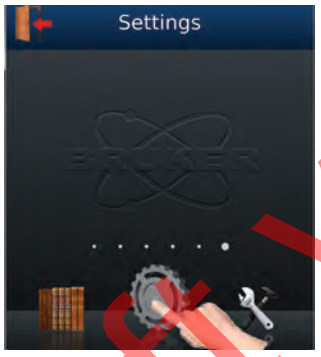
General information

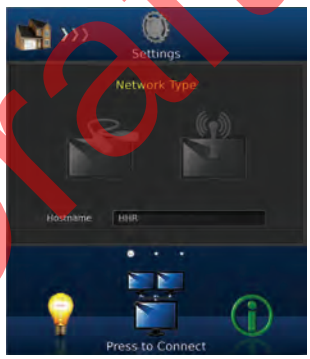
The BRAVO analyzer is delivered with the factory-assigned IP address 10.10.0.1. In case the network connection established at your site requires a different IP address, you have to assign a different IP address to the BRAVO analyzer. In this case, the IP address has to be defined by your network administrator.

To the BRAVO analyzer, both IP address types - static and dynamic - can be assigned. In the latter case, however, a DHCP server is required.

➢ **Important note:** Only a person with the access right *Administrator* is authorized to assign network addresses to the BRAVO analyzer.

Address assignment procedure





Opening the *Settings* workflow

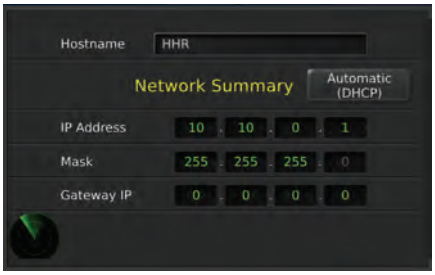
1. Open the *Settings* workflow by swiping left or right in the navigation bar until the icon is in the center.
2. Touch the icon .

Opening the *Network* screen

3. Swipe left or right in the navigation bar until the icon is in the center.

Selecting the network type *Wired*

4. Touch the *Wired Network* icon .

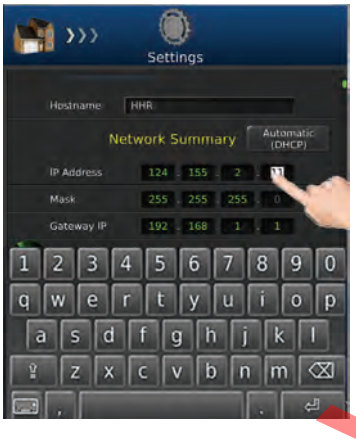


5. Scroll down until the *Network Summary* is displayed.

➢ The *Network Summary* displays the currently assigned network addresses, namely IP address, subnet mask and gateway IP.

➢ A static as well as a dynamic address assignment is possible. Note: For a dynamic address assignment, a DHCP server is required.

Proceed with either of the two assignment variant.



Manual assignment of a static IP address

6. Tap an entry field.

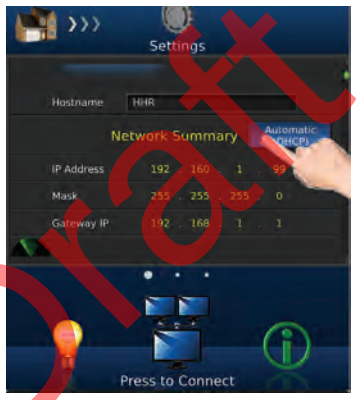
➢ The on-screen keyboard pops up.

7. Enter the new IP address.

8. Press the return key  on the on-screen keyboard to confirm the entered IP address.

➢ The on-screen keyboard disappears.

Note: For closing the on-screen keyboard without confirming the entered data, press the key  .



Dynamic IP address assignment via DHCP

9. Tap the button *Automatic (DHCP)*.

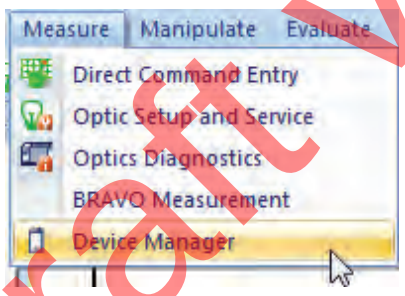
Note: To deactivate the dynamic address assignment, tap again the button *Automatic (DHCP)*.

4.10.4 Connecting BRAVO to data station

In the toolbar, press the network icon to establish the connection.

4.10.5 Checking the connection between BRAVO and data station

To find out whether there is a communication connection between the BRAVO analyzer and the data station, proceed as follows:



1. Select in the OPUS *Measure* menu the *Device Manager* function.

On the *Device Manager* page *General Settings* you see the serial number of the BRAVO analyzer to which the data station is currently connected.

In case there are no version information and device information displayed, this means that the data station is not connected to a BRAVO analyzer at all.

4.11 Mounting / demounting the carrying strap

4.11.1 General information

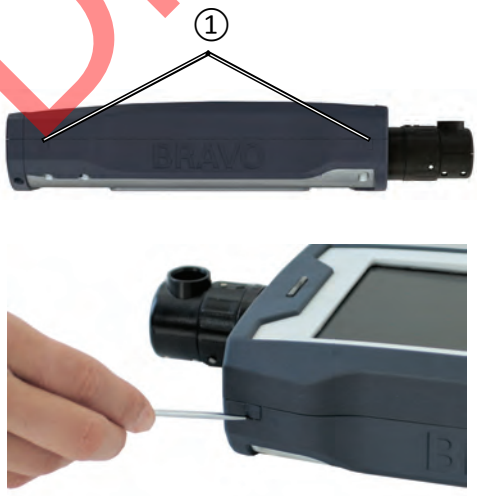
BRAVO is delivered with the carrying strap not being mounted. The carrying strap can be mounted on either side of the BRAVO analyzer.

i We recommend the usage of the carrying strap. It facilitates carrying and holding the BRAVO analyzer and provides for a more secure hold of the BRAVO analyzer.

The delivery scope includes the following items:

	1x carrying strap
	2x mounting elements 2x slotted pan head screws ((M2x6)
	1x flat tip screwdriver

4.11.2 Procedure

	1. Remove the two covering caps ① using the flat tip screwdriver.

2. Put the slotted head screw in the mounting element and ...

... screw the mounting element tight at the BRAVO analyzer.

➢ Note: Attach the mounting element with the hole pointing upwards.

3. Remove the screw from the swivel plug at the end of the carrying strap.

4. Attach the carrying strap by fitting the swivel plug on the mounting element and tightening the screw you have removed before.

5. Attach the other end of the carrying strap at the BRAVO analyzer in the same way.

Operation 4

5 Cleaning and Decontamination

5.1 Cleaning the BRAVO analyzer

5.1.1 Cleaning the plastic cover

Wipe the plastic housing clean with a dry or damp cloth. Damp the cloth with water, if required.

NOTICE

BRAVO analyzer damage because of improper cleaning

➢ Do not immerse the BRAVO analyzer in water or any other liquid cleaning agent.

➢ Do not wash down the BRAVO analyzer.

5.1.2 Cleaning the touchscreen

Cleaning utensils

- a soft and lint-free cloth
- ethanol

➢ Do not use any organic solvent or detergent other than ethanol.

i For cleaning the touchscreen, we recommend using a microfiber cloth.

Cleaning procedure

Wipe off the touchscreen gently with a soft cloth moistened with ethanol. Do not rub and do not press too hard on the screen.

i We recommend switching off the BRAVO analyzer before beginning to clean the touchscreen. Usually it is much easier to see where the fingerprints and other smudges are when the BRAVO analyzer is switched off.

NOTICE

BRAVO analyzer damage because of improper touchscreen cleaning

➢ Do not clean the touchscreen with something that is abrasive. Otherwise, there is the risk of scratching the touchscreen.

➢ Do not spray or pour ethanol directly onto the touchscreen. There is a risk of liquid leaking into the BRAVO analyzer and damaging it. Instead, moistened the cloth with ethanol and wipe the touchscreen with the damp cloth.

5.2 Decontaminating the BRAVO analyzer

5.2.1 Approved decontaminating agents

The following detergents are approved for decontaminating the BRAVO analyzer:

- Ethanol (C_2H_6O 70%)
- Isopropanol (C_3H_8O 70%)
- Sodium hydroxide (NaOH 5%)
- Sodium hypochlorite (NaClO 6%)
- Hydrogen peroxide (H_2O_2 5%)

5.2.2 Decontamination procedure

1. Damp a cloth with an appropriate decontaminating agent. Use only an approved decontaminating agent. (See the above list.)
2. Wipe off the BRAVO analyzer thoroughly.
3. Strictly observe the application time of the decontaminating agent in question. (Note: The correct application is stated by manufacturer of the decontaminating agent.)
4. Afterwards, remove the decontaminating agent by wiping off the BRAVO analyzer thoroughly with a damp cloth (i.e. damped with water).

NOTICE

BRAVO analyzer damage because of improper decontamination method

➢ Use only an approved decontaminating agent. See the above list. (Note: Only for the above listed detergents, the material compatibility has been tested.)

➢ Do not immerse the BRAVO analyzer into the liquid decontaminating agent.

➢ Do not wash down the BRAVO analyzer.

6 Repair

6.1 General information

➢ **Only Bruker service personnel is authorized to repair the BRAVO analyzer!**

⚠ WARNING

Health hazard because of an unauthorized repair attempt by the user

➢ Do not attempt to repair the BRAVO analyzer. Otherwise there is a potential health hazard (e.g. exposure tho hazardous laser radiation). Instead, proceed as described in the following section 6.2.

If your BRAVO analyzer is in need of repair, contact the Bruker service. For repair purposes, the BRAVO analyzer needs to be returned to Bruker.

☞ For the Bruker service contact data, see section 1.10. For a complete list with the addresses and telephone numbers of all Bruker headquarters, branch offices and representations worldwide, visit our website **www.brukeroptics.com**.

6.2 Procedure

In case your BRAVO analyzer is in need of repair, proceed as follows:

1. Contact the Bruker service and notify us the problem.
2. Then, Bruker will send you a repair request form (RMA form).
3. Fill in this form completely and truthfully.
4. Clean the BRAVO analyzer thoroughly. In case you have analyzed substances which are dangerous to health you have to decontaminate the BRAVO analyzer completely before you return it to Bruker.

➢ Note that you have to confirm with the RMA form that the returned BRAVO analyzer is free of any hazardous material (e.g. infectious, radioactive, toxic or corrosive material).

Important note: You have to ensure that the returned analyzer is completely free of any hazardous material so that no person involved in repairing the BARVO analyzer will suffer temporary or permanent damage to their health. You assume full responsibility if we determine a health risk caused by hazardous substances on your BRAVO analyzer.

☞ For detailed information about how to clean and decontaminate the BRAVO analyzer, see chapter 5.

5. Return the RMA form together with the cleaned BRAVO analyzer to Bruker.

Repair 6

7 Troubleshooting

7.1 General information

This chapter deals with the most common problems that may occur as experience has shown. It provides information about possible causes of the problem and presents solutions for troubleshooting. If the solutions listed in this chapter do not solve the problem, contact the Bruker service.

☞ For the Bruker service contact data, see section 1.10.

7.2 Problem - possible cause - solution

7.2.1 BRAVO does not boot up

After being switched on, BRAVO does not boot up.

Possible causes	Solutions
Empty battery	Substitute the empty battery for a charged battery. ☞ See section 4.7. Recharge the empty battery. ☞ See section 4.8.
No battery is inserted in the BRAVO analyzer.	Insert a charged battery. ☞ See section 4.7.
A failed BRAVO software update A defective partition on the SD card	Recover the system by pressing the ON/OFF button and the laser enabling / disabling button simultaneously.
A major BRAVO defect (e.g. damaged touchscreen)	Contact the Bruker service. ☞ For the service contact data, see section 1.10. For detailed information about the repair procedure, see section 6.2.

7.2.2 Log in attempt failed

Possible causes	Solutions
You have entered the wrong username and / or the wrong password.	Enter the correct username and / or password. ☞ For your login-data, contact the responsible administrator.
The administrator has locked your user record in OPUS.	Contact the responsible administrator.
Your user record has not yet been transferred form the data station to the BRAVO analyzer.	Contact the responsible administrator.

7.2.3 Barcode cannot be scanned

Possible causes	Solutions
The distance between the barcode label and the barcode scanner is too short or too long.	Hold the BRAVO analyzer in such a way that the barcode label is within the depth of field range. ☞ For information about the depth of field range, see section A.6.1
The window in front of the barcode scanner is dirty, scratched or damaged.	In case of a dirty barcode scanner window, clean it. In case of a scratched or damaged barcode scanner window, contact the Bruker service. ☞ For the service contact data, see section 1.10. For detailed information about the repair procedure, see section 6.2.
Barcode label is dirty or damaged.	In case of a dirty barcode label, clean it carefully without damaging it.

7.2.4 Black touchscreen display

Possible causes	Solutions
After a certain period of time without any user interaction, the touchscreen display switches automatically in the power-saving mode, i.e. it becomes black.	Touch the touchscreen at any spot.

7.2.5 Failed PQ test / OQ test

Possible causes	Solutions
Wrong reference standard has been used.	Repeat the test with the correct reference standard.
The test has been performed with no reference standard being placed in the vial holder of the measuring tip.	Repeat the test with the correct reference standard being placed in the vial holder of the measuring tip.
Sapphire window is dirty.	Clean it. Afterwards, repeat the test.
Hardware problems	Contact the Bruker service. ☞ For the service contact data, see section 1.10. For detailed information about the repair procedure, see section 6.2.

7.2.6 Aborted measurement

Possible causes	Solutions
The spectroscopic measurement has been started with a disabled laser.	Enable the laser. Then restart the measurement. ☞ For information about how to enable the laser, see section 1.4.5.

7.2.7 Problems regarding the detected spectral signal

These kinds of problems become apparent as follows, for example:

- No spectrum has been acquired.
- The spectral intensity of the spectrum is too weak.
- Unexpected spectrum has been acquired.

Possible causes	Solutions
No sample in the sample position during the measurement.	Put the sample in the measurement position and repeat the measurement. Note: In case you verify samples which are filled in vials, place the vial in the holder of the measuring tip. In case you verify samples which are filled in bags, press the bag against the laser exit opening of the measuring tip.
Entrapped air in the vial i.e. entrapped air between vial and sample powder.	Shake the vial to remove the air inclusions.
The barcode label on the vial or bag prevents the laser beam from reaching the sample.	When inserting the vial in the vial holder, make sure that the label on the vial is not in the beampath of the laser beam. When pressing the bag against the laser exit opening of the measuring tip, make sure that the exiting laser beam will impinge on the sample and not on the label.

7.2.8 Problems regarding wireless data transfer

Possible causes	Solutions
Interferences of the WiFi network caused by microwaves etc.	Eliminate the source of interference.
WiFi signal strength is to weak at your current location.	Move to a different location where the WiFi signal strength is higher.
	If the above listed solutions do not solve the problem, contact your administrator who is responsible for the wireless network at your site.

7.2.9 Problems regarding the docking station

You have put the BRAVO analyzer into docking station, but the blue lamp at the docking station does not light up.

Possible causes	Solutions
You have not put the BRAVO analyzer properly into docking station.	Put the BRAVO analyzer again into the docking station. Pay attention to the correct sit of the contacts.
The corresponding contacts are dirty.	Remove the dirt. ☞ For the location of the contact bars, see section 3.1 and section 3.6.

Troubleshooting 7

A Specification

A.1 BRAVO

Parameter	Specified Parameter Value
Dimensions	27.0 cm (w) x 15.6 cm (d) x 6.2 cm (h)
Weight	ca. 1.5 kg (3.25 lbs)
Voltage	100 to 240 VAC, 50/60 Hz (for battery charger of the docking station)
Spectral range	3.200 to 250 cm^{-1}
Spectral resolution	10 cm^{-1} to 12 cm^{-1}
Laser class	The BRAVO analyzer is classified as a laser class 1M product according to IEC/EN 60825-1:2007.
Laser	P_{opt} < 100mW @ λ = 700 - 1100nm Note: The two integrated laser diodes are classified as laser class 3B lasers.
Detector	CCD
Touchscreen display	High resolution touchscreen (15.0 cm x 9.4 cm), 7" back-lit IPS HD display Resolution: 1280 x 800 (219ppi) Viewing angle: 178 °

A.2 Environmental conditions

BRAVO is intended for indoor usage only, namely in laboratory and warehouse environments.

Parameter	Specified Parameter Value
Operating site	BRAVO is intended for indoor usage only, namely in laboratory and warehouse environments. ≤ 2000 above sea level
Ambient temperature range	5°C to 35°C (41°F to 95 °F)
Atmospheric humidity (non condensing)	0 to 95% (relative humidity)
Ingress protection	IP 64

A.3 Battery and battery charger

A.3.1 Battery

Parameter	Specified Parameter Value
Recharge time for a full charge (from 0% to 100%)	3.5 hours
Voltage	V_{max} = 8.4 V V_{nom} = 7.2 V V_{cutoff} = 4.8 V
Max. current discharge	3A continuous
Max continuous power	14.4 W (to cutoff voltage)
Battery chemistry	Lithium Ion

A.3.2 Battery charger

Parameter	Specified Parameter Value
Input voltage range	100 - 240 VAC ± 10%, 50/60 Hz
Power consumption	1.5 A max.
Dimension	180 mm (length) x 92 mm (width) x 58 mm (height)
Weight	235 g

A.4 Docking Station

Parameter	Specified Parameter Value
Input voltage range	100 - 240 VAC ± 10%, 50/60 Hz
Power consumption	2.5 A max.
Dimension	36 cm x 15 cm x 13 cm
Weight	ca. 1.9 kg (4.2 lbs)

A.5 WiFi module

The BRAVO analyzer is equipped with a WiFi module which supports the standards IEEE 802.11b/g/n.

This WiFi module has an approval certificate for the U.S. and Canada.

approval certificate for the U.S.	FCC ID: 2AD88-BRAVO-01
approval certificate for Canada	IC: 5969A-TIWI101

A.6 Barcode reader

A.6.1 Depth of field range

Symbology	Depth of field - Typical range
100% U.P.C.	46 mm to 419 mm (1.8” to 16.5”)
5 mil Code 39	64 mm to 163 mm (2.5” to 6.4”)
10 mil Code 39	28 mm to 338 mm (1.1” to 13.3”)
6.7 mil PDF417	46 mm to 185 mm (1.8” to 7.3”)
10 mil Data Matrix	53 mm to 203 mm (2.1” to 8.0”)

A.6.2 Resolution

Type of barcode	Resolution
linear barcode	0.127 mm (5.0 mil)
2D matrix code	0.169 mm (6.7 mil)

Specification A

B Orderable items

B.1 Spare parts & replacement parts

Order number	Item
C610	Single battery charger
C612	Rechargeable battery 7.2 V (< 100 Wh), initial operating time > 4h
R420	Measuring tip for bags
R421	Measuring tip for vials
S152	Strap for carrying / holding the BRAVO analyzer
1826953	Battery compartment cover (replacement part for the battery compartment cover included in the standard delivery scope)
S150	Carrying case for the BRAVO analyzer (replacement part for the carrying case included in the standard delivery scope of the BRAVO analyzer)
S151	Storage case for the docking station (replacement part for the storage case included in the delivery scope of the optional docking station)

B.2 Reference standards and certified samples

Order number	Item
BRM400	Polystyrene rod (reference sample for performing the PQ test)
BRM420	Validation Kit (for validating BRAVO in accordance USP35, Ph.Eur. 7.0, ASTM E1840-96,ASTM E2529-06 and ASTM E2911-13) The validation kit includes the following Raman reference standards: • 1x vial with cyclohexane • 1x vial with naphthalene • 1x vial with benzonitrile • 1x vial with tylenol • 1x PE bag with tylenol For each Raman reference standard, the certificate of origin is included.

Order number	Item
BRM421	Raman standard cyclohexane with certificate of origin for validation with measuring tip for vials
BRM422	Raman standard naphthalene with certificate of origin for validation with measuring tip for vials
BRM423	Raman standard benzonitrile in vial with certificate of origin for validation with measuring tip for vials
BRM424	Raman standard tylenol in vial with certificate of origin for validation with measuring tip for vials
BRM425	Raman standard tylenol in PE bag with certificate of origin for validation with measuring tip for bags

B.3 Consumables

Order number	Item
S153	200x glass vials including stoppers Recommended: S154 - septa for stoppers
S154	septa for stoppers in S153

B.4 Cleaning utensils

Order number	Item
1828002	1x microfiber tissue for cleaning the touchscreen display (especially for removing fingermarks)

B.5 Optional parts

Order number	Item
S201	Docking station The delivery scope includes: • docking station • power supply unit and power cord • storage case

B.6 Network equipment

Order number	Item
C295-E	USB-LAN adapter
C295-PCIE	Network interface card (for PC model HP Elite 800 G1 Tower, 800 G1-Ultra Slim) 10/100/1000 Mbit, RJ45, PCIe-interface

For establishing a direct Ethernet connection between the docking station and the data station (e.g. PC, notebook), a crossover cable with RJ 45 connector is required. This type of cable is available in the following lengths:

Order number	Item
I21329	Ethernet cable (crossover) with RJ 45 cable length: 10 m
I24010	Ethernet cable (crossover) with RJ 45 cable length: 30 m
I24011	Ethernet cable (crossover) with RJ 45 cable length: 50 m
I24012	Ethernet cable (crossover) with RJ 45 cable length: 100 m

Orderable items B

EC-DECLARATION OF CONFORMITY

The undersigned, representing the following manufacturer

Manufacturer: BRUKER OPTIK GMBH
Address: Rudolf-Plank-Straße 27, 76275 Ettlingen, Germany

herewith declares that the product

Product identification: **BRAVO**

is in conformity with the provisions of the following EC directive(s)
(including all applicable amendments)

Reference no.	Title
2004/108/EC	Directive of the European Parliament and of the Council of 15 December 2004 (Electromagnetic Interference Directive)
2006/95/EC	Directive of the European Parliament and of the Council of 12 December 2006 (Low Voltage Directive)
1999/5/EC	Directive of the European Parliament and of the Council of 9 March 1999 (Radio and telecommunications terminal equipment)

and that the standards and / or technical specifications referenced overleaf have been applied.

Ettlingen (Place)

May 8, 2014 (Date)

(Signature)

Dr. Roland Harig, Development Manager

(Name and function of the signatory empowered to bind the manufacturer or his authorized representative)

Page 1 of 2 of EC-Declaration of Conformity of BRAVO

References of standards and/or technical specifications applied for this declaration of conformity, or parts thereof :

Harmonized standards:

No.	Issue	Title
EN 61326-1:2013 Emission: Class A	July 2013	Electrical equipment for measurement, control and laboratory use – EMC requirements
EN 61000-3-2:2014	March 2015	Electromagnetic compatibility Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16A)
EN 61000-3-3:2013	March 2014	Electromagnetic compatibility; Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems for equipment with rated current ≤ 16A
ETSI EN 300 328 V1.8.1	April 2012	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4GHz ISM band and using wide band modulation techniques; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
EN 61010-1:2010 (3rd Edition)	July 2011	Safety requirements for electrical equipment for measurement, control and laboratory use
EN 60825-1:2007	May 2008	Part 1: General requirements Safety of laser products Part 1: Equipment classification and requirements