HYPERION

User Manual

I 24319

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This manual is the original documentation for the HYPERION microscope.

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1 SAFETY

GENERAL INFORMATION

Read the following safety instructions carefully before putting the microscope into operation. Keep this manual in a suitable place for future reference.

Always observe the instructions described in this manual to ensure user safety 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. sample viewing and performing spectroscopic measurements) of the microscope. In this case Bruker Optik GmbH 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 microscope is in proper functioning condition. A safe and faultless operation can only be guaranteed if the microscope is transported, stored, installed, operated and maintained properly according to the procedures described in this manual. Never remove or deactivate any supporting safety systems during microscope operation. Ensure that objects and/or material not required for the measurement is out of the microscope operating area.

The microscope complies with the IEC/EN 61010-1 safety regulations.

Protective Earthing

To avoid personal injuries and/or property damage caused by electrical power, the microscope is equipped with a safety plug. Connect this plug only to a socket outlet with earthing contact. Make sure that the socket complies with IEC (International Electrotechnical Commission).

Qualified Personnel

Initial installation and all maintenance and repair works not described in this manual should only be performed by BRUKER service personnel. Only authorized operating personnel that have been briefed about the microscope operation and all relevant safety aspects should operate and maintain (i.e. only maintenance works that are described in this manual) the microscope.

All repairs, adjustments and alignments on any microscope component must be performed in accordance with the safety regulations and standards applied in the country in which the instrument is installed.

Correct Usage

The microscope and its components should only be used according to the instructions described in the manual or advised by a BRUKER engineer. In case of accessories or components made by other manufacturers and used in connection with the microscope, BRUKER does not assume any liability for safe operation and proper functioning.

WARNING LABELS

When operating the microscope you have to observe a number of safety instructions which are highlighted by various warning labels. This section describes the warning labels and explains their meaning. All warning labels on the microscope must always be kept legible. Immediately replace a worn or damaged label.

The following warning labels indicate different dangerous situations which may be caused by improper use of the microscope.

Caution - General Hazard

This warning symbol indicates general hazard. Observe the safety instructions and follow the precautions described to avoid personal injury and/or property damage.

Caution - Electrical Shock

This warning symbol indicates electrical hazard. The symbol is located near live parts or on enclosures behind which are live parts that represent an accidental contact hazard. Never touch these parts. Before removing the corresponding compartment covers and beginning any maintenance or repair work, first turn off the main power switch and unplug the main power cable. Ensure that all live parts do not come into contact with a conductive substance or liquid. Non-observance of these safety instructions can cause severe personal injury and/or property damage.

Caution - Hot Surface

This warning symbol indicates components and surfaces which can become very hot during microscope operation. Do not touch these components and surfaces. Risk of skin burn! Be careful when operating near hot components and/or surfaces.

Caution - Laser Radiation

This warning symbol indicates the existence of laser radiation. Never look directly into the laser beam or use any kind of optical instruments to do so. Otherwise permanent eye damage can be the result.

Caution - Frostbite

This warning symbol indicates cryogenic materials (e.g. liquid nitrogen) required to operate the microscope (e.g. cooling detector). Skin contact with these liquids or cooled components causes severe frostbite. Always handle the liquids with utmost care. Observe the safety instructions for handling of cryogenic liquids.

Caution - Harmful Material

This warning symbol indicates the existence of harmful or irritant material (e.g. the window material BaF_2). Observe the safety instructions on the packaging, and the safety data sheets attached. Non-observance may cause personal injury.

Caution - Toxic Material

This warning symbol indicates the existence of toxic material (e.g. the window material KRS-5). Observe the safety instructions on the packaging, and the safety data sheets attached. Non-observance may cause severe personal injury or even death.

Besides the dangers described above, there can also be hazardous situations caused by the sample material. Depending on the type of hazardous substances you work with, you have to observe specific substance-relevant safety instructions. Put on the corresponding warning label on the appropriate microscope position. The label must be legible and permanently discernible. The following list contains some examples of hazardous substances:

Caution - Infectious Material

This warning symbol indicates the possible presence of bio-hazardous and infectious material. When working with this kind of material always, observe the prevailing laboratory safety regulations and take all necessary precautions and disinfection measures (e.g. wearing protective clothing, masks, gloves etc.). Failure to do so 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: 1993* by WHO - World Health Organization.)

Caution - Radioactive Material

This warning symbol indicates the possible presence of radioactivity. When working with radioactive material, always observe the safety regulations and take all necessary protective measures (e.g. wearing protective clothing, masks gloves etc.). Failure to do so may cause severe personal injury or even death.

Caution - Corrosive Substance

This warning symbol indicates the possible presence of corrosive substances. When working with corrosive substances, always observe the laboratory safety regulations and take protective measures (e.g. wearing protective masks and gloves). Failure to do so may cause severe personal injury or even death.

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 local waste regulations.

SAFETY INSTRUCTIONS

The following chapters describe all relevant safety aspects of the microscope 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.

Note — draws your attention to particularly important information on the product, e.g. product operation or to a special part of the manual.

The safety instructions Danger, Warning and Caution stand out by the corresponding warning labels.

GENERAL

2

The HYPERION microscope is an accessory that can be coupled to almost any Bruker FT-IR spectrometer. It allows optimal sample visualization as well as quick and accurate infrared spectroscopic measurements of micro samples, small sample areas or the examination of inhomogeneities in samples.

CONFIGURATION PACKAGES

The new HYPERION microscope is available in three major configuration packages:

HYPERION 1000 - basic package (transmittance and reflectance)

HYPERION 2000 - extended package (video camera, color LCD, software, automatic x/y-stage)

HYPERION 3000 - imaging package (HYPERION 2000 configuration and Focal Plane Array (FPA) detector)

The HYPERION series can be upgraded from the base configuration HYPERION 1000 to the HYPERION 3000 configuration, provided that a suitable spectrometer is connected.

HYPERION 1000, Infrared Microscope

The basic package consists of:

A 670 HYPERION, infrared microscope

A 672-T transparent knife edge aperture (instead of standard rotatable wheel aperture)

Additional requirement: specific spectrometer adapter

HYPERION 2000, Infrared Microscope

The extended package consists of:

A 670 HYPERION, infrared microscope

A 672-T transparent knife edge aperture (instead of standard rotatable wheel aperture)

A 673-S motorized x/y-sample stage (instead of the standard manual sample stage)

A 689-R simultaneous observation and measurement in reflectance mode

A 689-T simultaneous observation and measurement in transmittance mode

A 698-E color video set with video digitizer

A 678-L LCD display

A 678-V video adapter

A 687 objective micrometer

O/MAP-N: OPUS/MAP software package to control the motorized stage

O/VID-N: OPUS/VIDEO software package for video interactive data acquisition

O/3D-N: OPUS/3D software package for three dimensional spectral data processing

Additional requirement: specific spectrometer adaptation, min. OPUS 4.0

HYPERION 3000, Infrared Microscope

The imaging package consists of:

A 670 HYPERION, infrared microscope

A 672-T transparent knife edge aperture (instead of standard rotatable wheel aperture)

A 673-S motorized x-y sample stage (instead of the standard manual sample stage)

A 689-R simultaneous observation and measurement in reflectance mode

A 689-T simultaneous observation and measurement in transmittance mode

A 698-E color video set with video digitizer

A 678-L LCD display

A 687 objective micrometer

A 620-3 optical adaptation for FPA detector

A 629 electronic adaptation for FPA detector (incl. OPUS/FPA with OPUS/3D and OPUS/VIDEO)

D 364 HYPERION (TM), photovoltaic MCT-FPA-detector system

O/MAP-N: software package to control the motorized stage

O/VID-N: OPUS/VIDEO software package for video interactive data acquisition

O/3D-N: OPUS/3D software package for three dimensional spectral data processing

Additional requirements: specific spectrometer adaptation A 171/x-R, suitable spectrometer.

3 INSTALLATION

GENERAL INFORMATION

The operating company has to provide an installation site that meets the site requirements described in this chapter. Unpacking and initial installation of the microscope HYPERION is done by the Bruker service. Coupling the microscope to a FT-IR spectrometer is a very complex procedure that requires specialized knowledge, skills and qualification. Therefore, the microscope can only be installed and set up by a Bruker service engineer.

This chapter describes the following installation procedures:

- connecting the microscope to the power supply,
- installing the purge gas connection.

DELIVERY SCOPE

The delivery scope depends on the microscope configuration (HYPERION 1000, 2000 or 3000) you have ordered. See chapter *General*. Moreover, the microscope of the HYPERION series allows upgrading with additional accessories and/or options. See chapter *Accessories and Options* as well as Appendix B.

Inspecting the Packaging

After having received the 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 a microscope into operation that shows signs of damage. Failure to do so may result in severe personal injuries and/or property damage.

Transportation

Due to its substantial weight (max. 45kg, depending on the configuration), HYPERION has to be carried by at least two persons. When transporting the microscope, use the original packaging to avoid damages.

SITE REQUIREMENTS

Space Requirements

The microscope dimensions depend on the configuration. See appendix D.

Take into consideration that the microscope requires a clearance of at least 25cm (10“) at the rear side. The microscope should be placed on a stable and horizontal base.

When preparing the installation location for the microscope, take into consideration that the mains power supply connection is easily accessible at any time. The mains power supply can be interrupted, for example, either by disconnecting the safety plug, or switching off the mains switch on the microscope rear side or disconnecting the primary power receptacle.

Environmental Requirements

To ensure optimum microscope performance and long-term reliability, the following environmental conditions have to be ensured:

Temperature Range: 18 - 30°C (64 - 86°F)

Humidity (non-condensing): Less than 70% (relative humidity)

Temperature variations can impair the results of long-term measurements. Therefore, the temperature variations should be less than 1°C an hour and not more than 2°C per day for this type of measurements.

Vibration

Ideally, the microscope is not installed near vibration sources (e.g. ventilation hoods, air conditioners, motors, elevator etc.) or in rooms with intense floor vibrations.

Power Supply

The microscope power supply unit automatically adapts to the most common power sources.

Valid voltage range: 110 V AC to 230 V AC

Valid frequency range: 50 to 60 Hz

HYPERION is an instrument of the protection class I.

Caution: To avoid personal injury and spectrometer damage, connect the microscope only to a socket outlet with earthing contact.

To provide for good data quality and a long microscope service life, ensure that the following site requirements are met:

- Do not install the microscope near sources of potential inductive electrical interference (e.g. pumps, switching motors, microwave ovens etc.), sources of high energy pulses, and sources that might cause magnetic or radio frequency interference.
- Do not place devices such as large electric motors, heaters, welding equipment, radio transmitting equipment, units emitting pulsed electromagnetic radiation (e.g. NMR systems), or high powered lasers in close vicinity to the microscope. These devices can interfere with the microscope and cause microscope malfunction. Ensure that these types of devices are not connected to the same electrical circuit as the microscope.
- If there are any problems concerning main power supply (e.g. brownouts, power surges, frequent thunderstorms), take precautions to ensure an uninterruptible power supply.

CONNECTING HYPERION TO THE POWER SUPPLY

General Information

Depending on the local conditions, the original power cord may need to be exchanged for a power cord that complies with the standards of the country in question. The power cord must have approbation of at least your local authority, UL for US, CSA for Canada or VDE for Europe. The microscope power supply unit automatically adapts to the local voltage and frequency range. (See section *Power Supply* in this chapter.)

The power cord length should not exceed 3m.

Procedure

- Before connecting the power cord, make sure that the microscope is switched off, i.e. the mains power switch at the microscope rear side (figure 1) is in the “O” position.
- Connect the supplied power cord to the primary power receptacle at the microscope rear side (figure 1) as well as to the mains socket outlet.

INSTALLING THE PURGE GAS CONNECTION

General Information

Unwanted atmospheric interferents (e.g. water vapor or carbon dioxide) have a negative influence on the measurement results, i.e. the absorption of the atmospheric interferents may mask weak spectral features of the sample. Therefore, purging with clean and dry air or nitrogen gas is highly recommended.

Procedure

A hose with an outer diameter of 6mm is required.

- Insert one end of the hose into the purge gas inlet (figure 1) at the microscope rear side.
- Connect the other end of the hose to your supply line for dry air or low pressure nitrogen gas.
- To remove the purge gas hose, press the lock ring inwards and pull the hose out of the inlet.

For information about the purge gas supply requirements refer to chapter *Operation*, section *Purging the Microscope*.

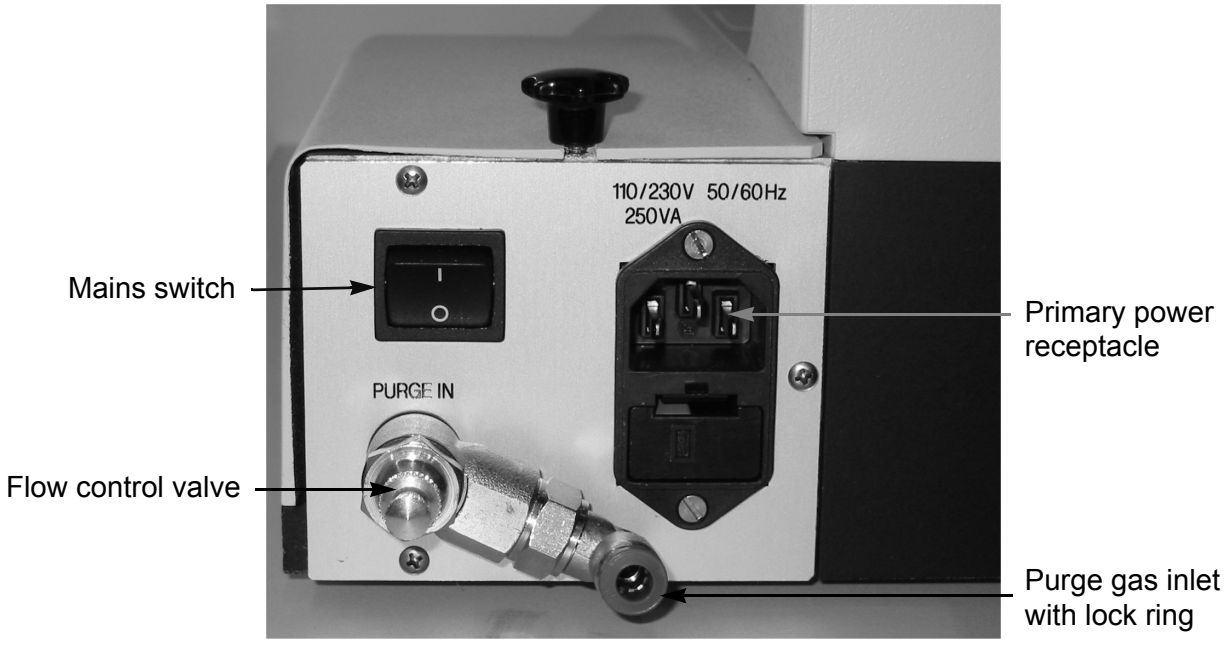


Figure 1: Microscope rear side (Detail view)

4 OVERVIEW

COMPONENT IDENTIFICATION

This chapter identifies and describes the HYPERION control elements and important external and internal components.

Note: The local indications *right* and *left* assume that the operator stands in front of the microscope. The indications *forward* and *backward* refer to the microscope front side and rear side, respectively.

Microscope Right and Left Side

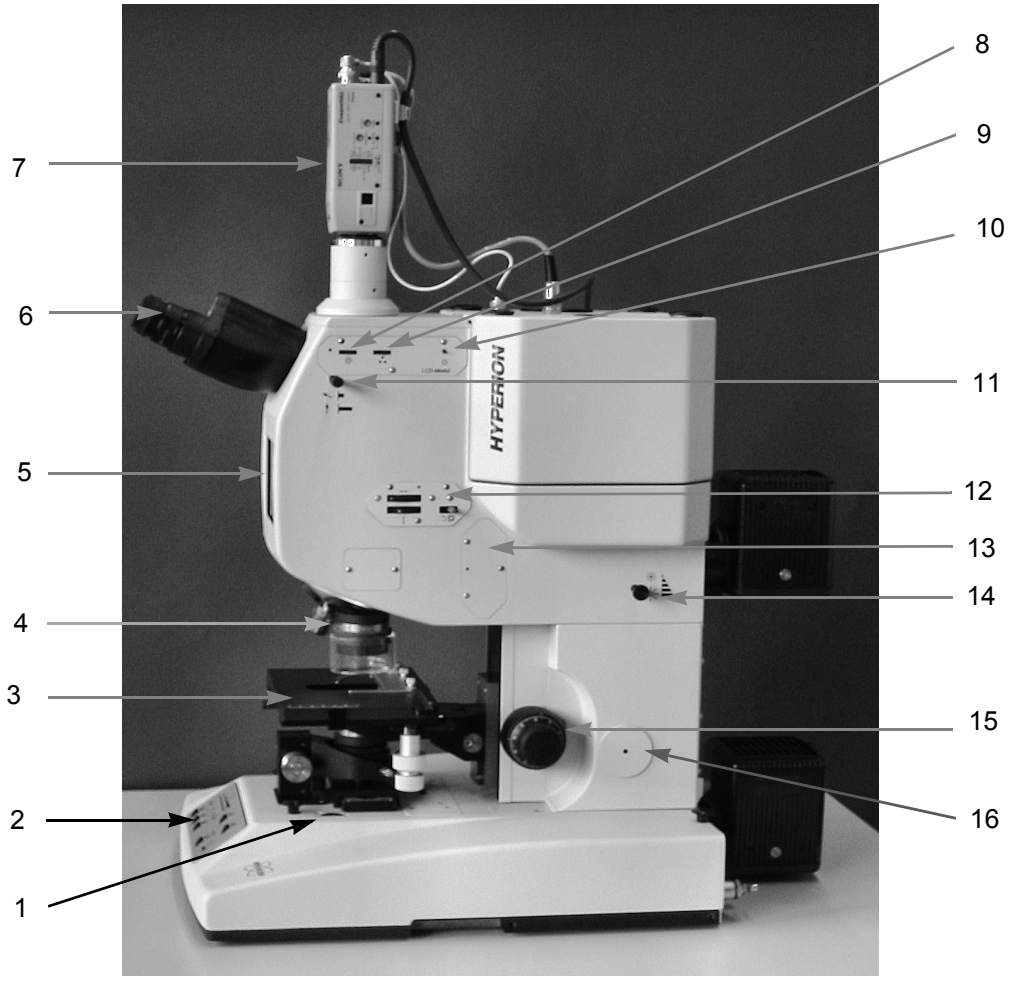


Figure 2: HYPERION - Right Side View

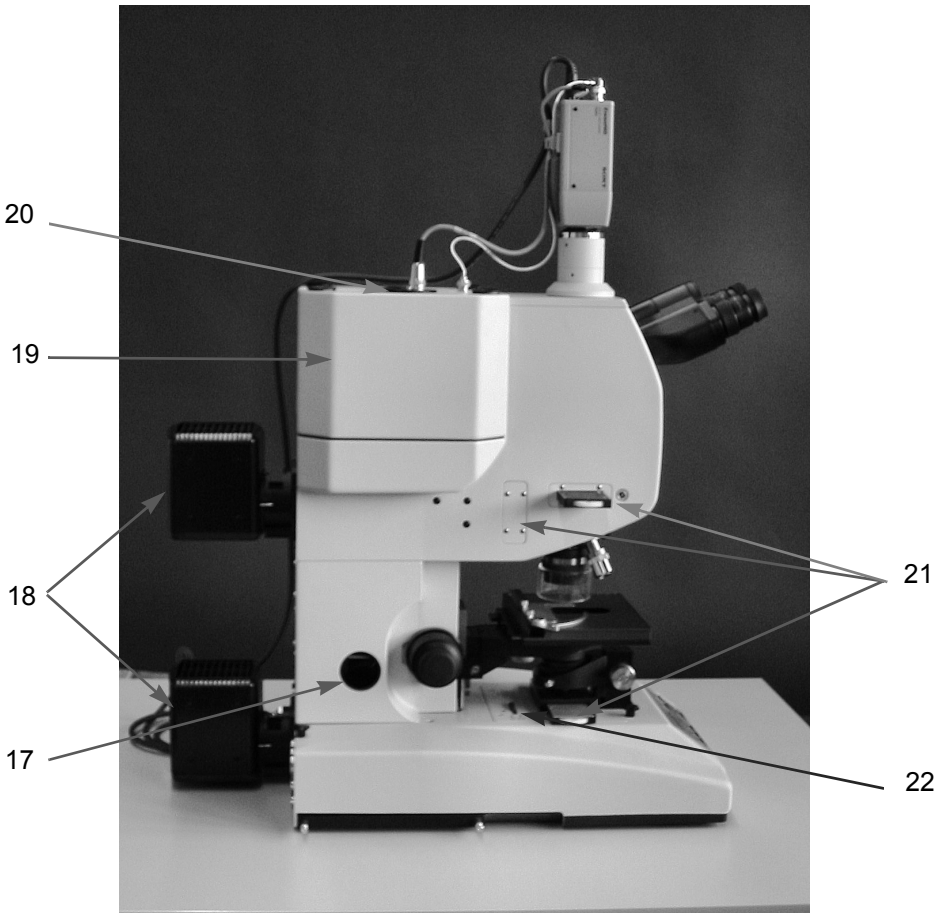


Figure 3: HYPERION - Left Side View

Number	Component
1	Visible light intensity control
2	Control panel
3	Manual sample stage (standard)
4	Revolving turret with objective
5	LCD monitor (optional)
6	Binocular eyepiece
7	Video camera
8	Illumination control of LCD monitor (optional)
9	Color control of LCD monitor (optional)
10	On/Off switch of LCD monitor (optional)
11	Visible light routing control (ocular/video camera)
12	Aperture position (in this case: transparent knife edge aperture)
13	Optional aperture installation site
14	Köhler aperture control (Köhler aperture for reflectance mode only)

Number	Component
15	Focussing controls (vertical adjustment of x/y-stage)
16	External accessory port
17	IR beam inlet port (port to which the spectrometer is coupled)
18	Visible light sources (visible light for sample illumination)
19	Detector compartment (of the standard MCT detector)
20	Detector filling port (for liquid nitrogen)
21	Polarizer insertion slot
22	Alignment aperture

Microscope Rear Side

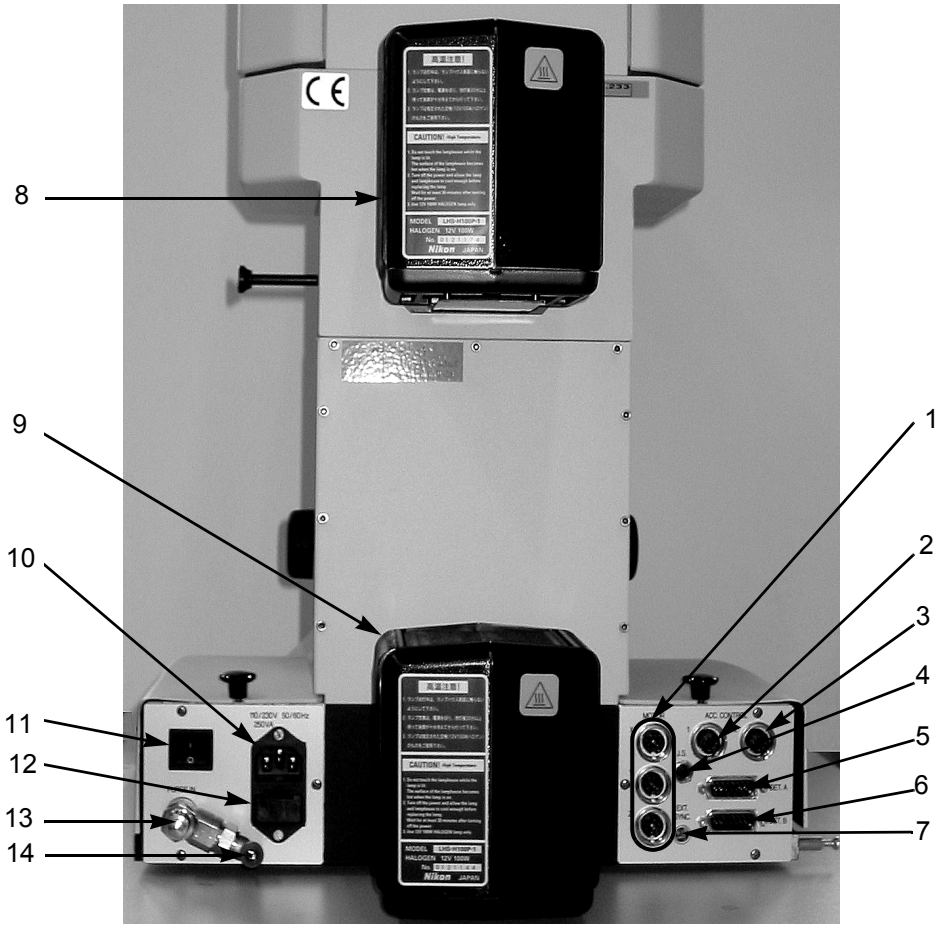


Figure 4: HYPERION - Rear Side View

Number	Component
1	Ports for connecting the motorized stage
2	Port for spectrometer or accessory (e.g. TGA unit, HTS-XT module)
3	Port for spectrometer or accessory (e.g. TGA unit, HTS-XT module)
4	Port for connecting the optional joystick
5	Port for connecting detector A (output signal)
6	Port for connecting detector B (output signal)
7	Port for connecting an external synchronizer
8	Visible light source (reflectance mode)
9	Visible light source (transmittance mode)
10	Primary power receptacle
11	Mains switch
12	Fuse box
13	Purge valve (flow control)
14	Purge gas inlet

MICROSCOPE CONTROLS

Control Panel

The control panel with most of the imaging and data acquisition control elements is situated on the microscope front base. The LEDs above the push-buttons indicate the switching status of these buttons, i.e. when a button is active (switched on) the LED above the push-button lights and when a button is inactive (switched off) the LED does not light.

Switch logic is employed, i.e. an “active“ push-button becomes “inactive“ when switching on another push-button makes it necessary (e.g. switching on the IR button automatically turns off the VIS button).

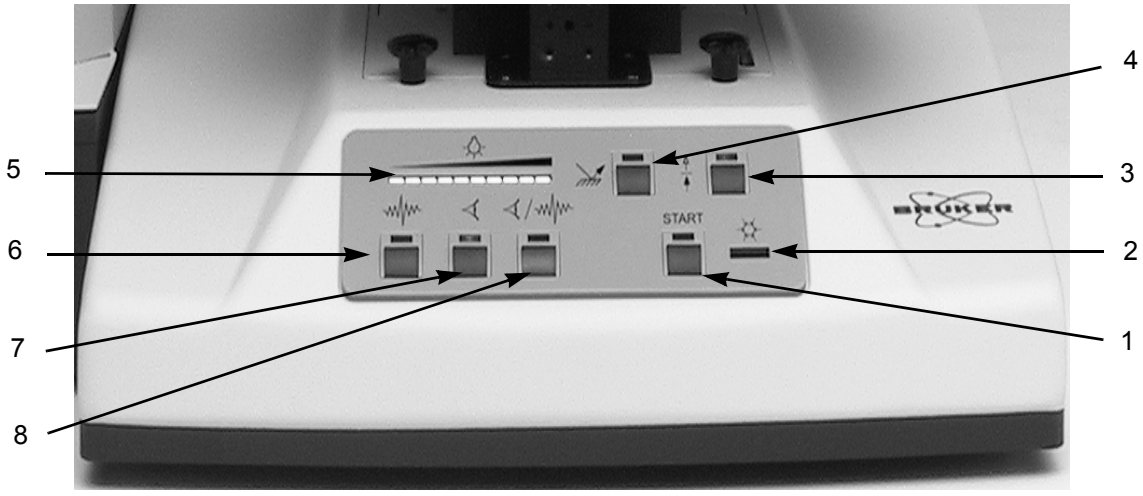


Figure 5: Control Panel

Number	Component and Description
1	**Start button:** to start a measurement directly from the microscope. Pressing this button sends a signal to the computer and the OPUS software program acquires a spectrum using the currently selected measurement parameters. **Note: Before pressing this button ensure that the OPUS program is open and the appropriate measurement parameters are selected.**
2	**Detector temperature warning indicator:** lights up when the MCT detector temperature exceeds its operating temperature range. In this case, cool the MCT detector with liquid nitrogen. (See chapter *Operation,* section *Cooling the Detector.*)
3	**Transmittance mode button:** to collect data in the transmittance mode. Pressing this button automatically turns off the reflectance mode button (4).
4	**Reflectance mode button:** to collect data in the reflectance mode. Pressing this button automatically turns off the transmittance mode button (3).
5	**Visible light intensity indicator:** indicates the current visual illumination intensity in relation to the maximum illumination intensity on a bar graph display. The visible light intensity is controlled by a thumb wheel (3 in figure 6).
6	**IR button:** to activate the IR measurement mode of the microscope. Make sure that this button is activated before starting an IR spectroscopic measurement. Activating this button automatically turns off the VIS button (7) and the VIS/IR button (8).
7	**VIS button:** to activate the viewing mode of the microscope, i.e. the sample can be viewed through the eyepiece or on the LCD display. Activating this button automatically turns off the IR button (6) and the VIS/IR button (8).
8	**VIS/IR button:** to activate the viewing and measurement mode, i.e. activating this button enables simultaneous viewing and measuring of the sample. (Transmittance Mode - A 689-T) (Reflectance Mode - A 689-R)

Manual Stage Control, Condenser, Focussing and Light Intensity Control

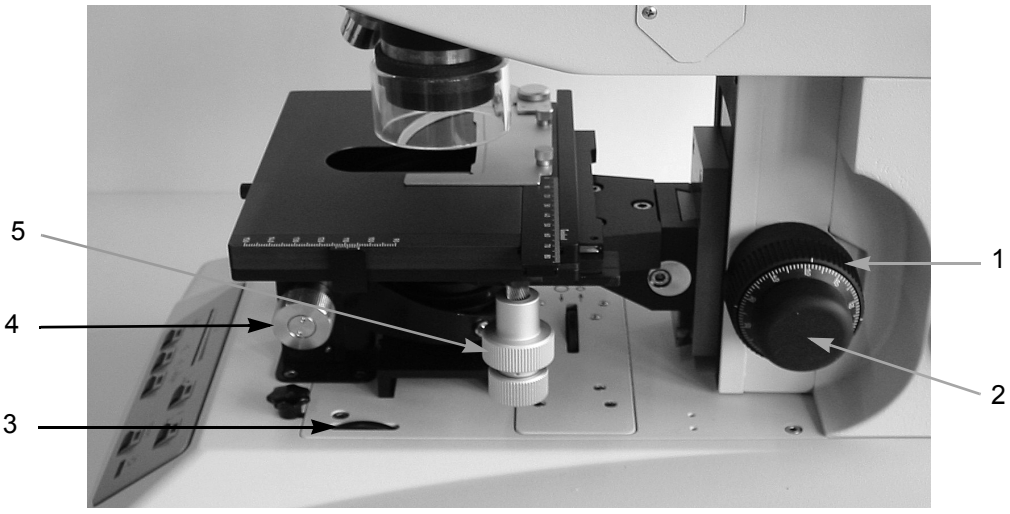


Figure 6: Manual Sample Stage - Right Side View

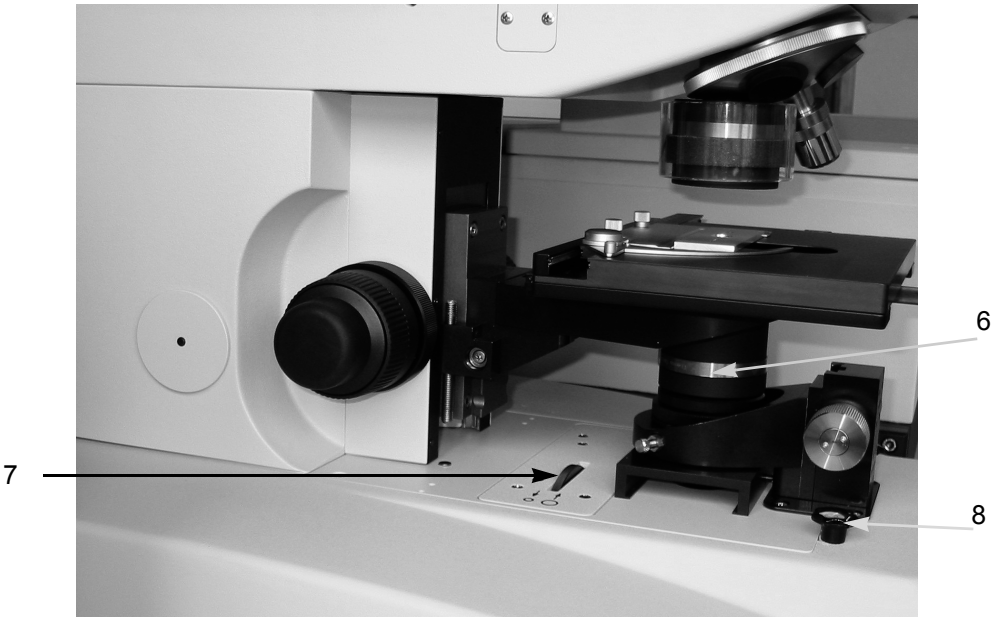


Figure 7: Manual Sample Stage - Left Side View

Number	Component and Description
1	**Coarse focus knob:** to change the distance between the sample and the objective (in larger increments than the fine focus control) to obtain a sharp image.
2	**Fine focus knob:** to change the distance between the sample and the objective (in smaller increments than the coarse focus control) to obtain a sharp image.
3	**Visible light intensity control (thumb wheel):** to adjust the visible light intensity at the sample. Rotating the thumb wheel forward decreases the visible light intensity. Rotating the thumb wheel backward increases the visible light intensity. (The visible light intensity is indicated on the control panel by a graph bar display (5 in figure 5) **Note: Do not confuse the visible light intensity control with the Köhler aperture (14 in fig. 2). The Köhler aperture is used to adjust the light intensity (in reflectance mode) without changing the color temperature. Whereas the visible light intensity control changes the amperage in the tungsten filament wire of the light source (in reflectance and transmittance mode). This can cause a color cast because the color temperature depends on the supplied amperage.**
4	**Condenser focus knobs (up and down control):** to raise or lower the condenser in relation to the sample or the sample stage in order to maximize the beam intensity in transmittance mode.
5	**Manual stage control (stage movement in x- and y-axis):** to move the stage forward and backward as well as to the left and right in order to view other sample areas of interest.
6	**Condenser:** to correct the vertical displacement of the focus caused by the specimen slide (e.g. KBr plate).
7	**Alignment aperture:** to align the condenser optics. (Transmission alignment aperture)
8	**Screws:** to secure the cover to the base.

Apertures, Illumination and Visible Light Routing Control

Figure 8: Aperture and Illumination Controls

Number	Component and Description
1	**Köhler aperture control:** to increase the image contrast in reflectance mode only. It controls the light intensity without changing the color temperature. Therefore, the color remains unchanged. To lower the light intensity push in the knob. (See fig. 11.)
2	**Installation site for additional aperture for reflectance mode:** to delimit the measurement area.
3	**On/Off switch:** to switch on/off the LCD monitor.
4	**Illumination control:** to adjust the brightness of the LCD image.
5	**Visible light routing control:** to route the visible light either to the binocular eyepiece or to the camera port and LCD monitor. The different knob positions and their effects are illustrated in figure 9.
6	**Color control:** to adjust the color contrast of the LCD image.
7	**Standard knife edge aperture control (thumb wheels):** to define the measurement area. The standard transparent knife edge aperture consists of two pairs of transparent glass blades that can be moved and rotated using the two thumbwheels. See figure 10.
8	**Standard knife edge aperture control (lever):** To rotate the blade pairs put the lever into the front position. To move the blade pairs in and out put the lever in the back position. See figure 10.

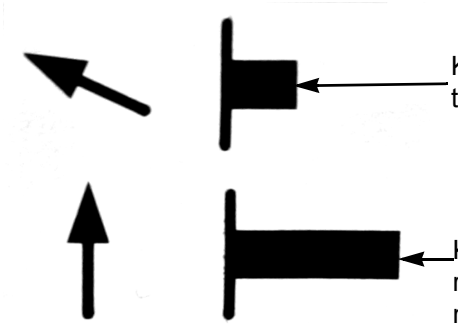


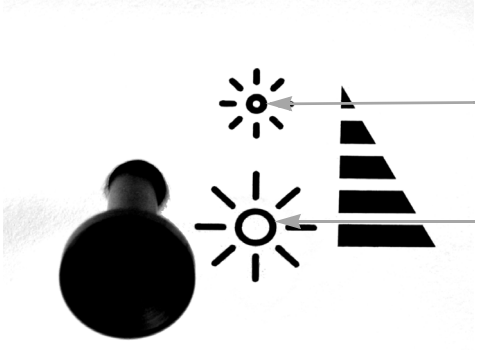
Figure 9: Visible Light Routing Control (Legend)

Depending on the lever position, either the distance between each blade pair can be adjusted or the fixed blades can be rotated by turning these thumb wheels.

Front lever position, i.e. the two blade pairs are fixed and the blade pairs can be rotated without changing the defined measurement area.

Back lever position, i.e. with this lever position, the distance between the two blade pairs can be adjusted by turning the thumb wheels.

Figure 10: Knife-Edge Aperture



Note: The light intensity is steplessly adjustable.

Figure 11: Köhler Aperture (Legend)

Turret and Objectives

Depending on the dimensions of the objectives, up to four objectives can be attached to the turret at the same time. Two of them can be IR objectives. The rotatable turret allows placing the wanted objective in the optical path. Each objective position has a detent (i.e. the turret clicks into position) to ensure the correct objective position.

Several objectives with either different magnifications or other special abilities (e.g. ATR) are available. For more information about the objectives refer to chapter *Accessories and Options,* section *Objectives*.

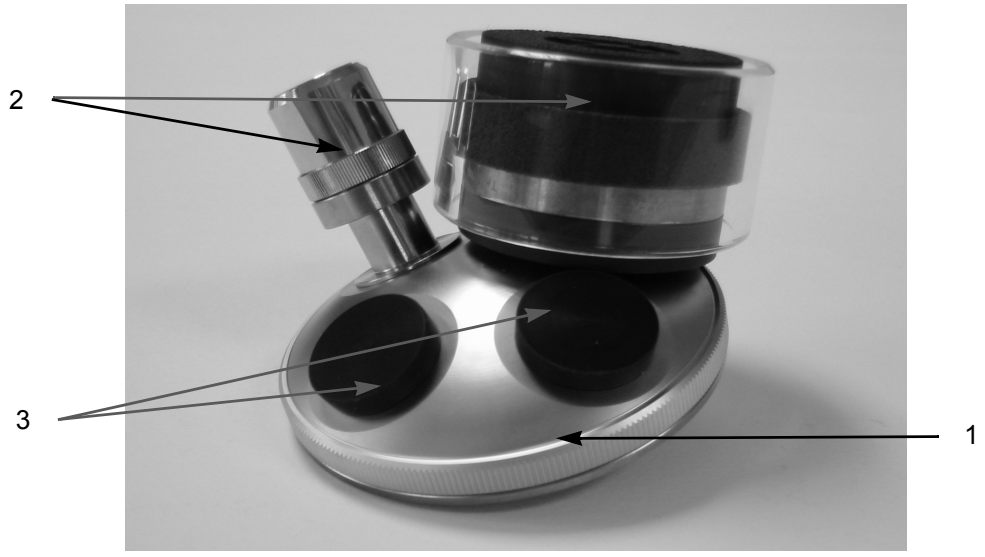


Figure 12: Turret with two Objectives

Number	Component and Description
1	**Turret:** to attach the objectives and place different objectives in the optical path. Up to four objectives (depending on the objective size) can be attached to the turret at the same time (two of them can be IR objectives). **Note: To place another objective in the optical path do not grip an objective but use the turret. Rotate the turret until the wanted objective is in the optical path. The turret always snaps into the correct position.**
2	**Objectives:** Figure 12 shows the standard 15x IR Schwarzschild objective and the 4x viewing objective (made of glass).
3	**Two vacant positions:** They are covered with caps.

Binocular Eyepiece

The microscope HYPERION is equipped with an adjustable binocular eyepiece that allows comfortable sample viewing. The two eyepieces can be adjusted to the individual interpupillary distance of the user. The interpupillary scale facilitates the readjustment.

Figure 13: Binocular Eyepiece

Number	Component and Description
1	**Binocular eyepiece:** to view the magnified sample image with both eyes. Each eyepiece can be focused separately. Looking through the right eyepiece, you will see a cross-hairs.
2	**Interpupillary scale:** to facilitate the readjustment of the binocular eyepieces to your individual interpupillary distance. While looking through the eyepieces, adjust them until you view the sample comfortably. An index mark next to the interpupillary scale indicates the currently adjusted interpupillary distance. Hint: Note your interpupillary distance so that you can quickly reproduce it.

5 OPERATION

GENERAL

This chapter describes only the basic microscope operations. Due to the different HYPERION configurations these procedures may differ slightly, depending on the used configuration.

This chapter describes the following microscope related aspects of operation:

1. Checking the signal intensity
2. Measurement in transmittance mode
3. Measurement in reflectance mode
4. Measurement with ATR objective
5. Measurement with GIR objective
6. ATR mapping measurement
7. Fluorescence microscopy
8. Cooling the MCT detector
9. Purging the microscope

For information about software related aspects of operation, refer to the corresponding OPUS manuals (OPUS/VIDEO, OPUS/MAP, OPUS/3D and OPUS/FPA).

CHECKING SIGNAL INTENSITY

- Start the OPUS software. Select the *Advanced Measurement* function in the *Measure* menu. A dialog window opens. Click on the *Advanced* tab and then on the *Load* button. Select an appropriate experiment file (’*’.xmp).
- Put the pinhole on the stage. Ensure that the light coming from below passes through the pinhole. (See figure 14.)
- Press the VIS button and the reflectance mode button on the control panel. (See figure 5.)

Figure 14: Pinhole on x-y Stage

- Adjust the stage height using the focussing control (coarse and fine focus knob) until you see a sharp image of the pinhole metal surface.
- While looking through the binocular eyepiece or observing the video image on the LCD monitor (in video assisted measurement mode) move the pinhole on the stage to align the hole with the cross-hairs. (See figure 15.)

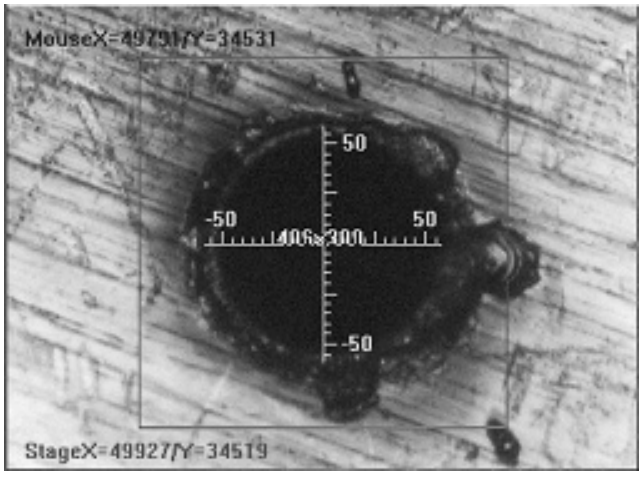


Figure 15: Visual Image of the 100µm Pinhole in Reflectance Mode

- Press the transmittance mode button on the control panel. (See figure 5). The result will be a bright and sharp image showing the light passing through the pinhole. (See figure 16.)

An unsharp image can be caused by an incorrect stage height, an improper condenser adjustment or an improper light intensity. Adjust the stage height and/or optimize the light intensity. For information on additional illumination settings, see the *Video Camera Manual*.

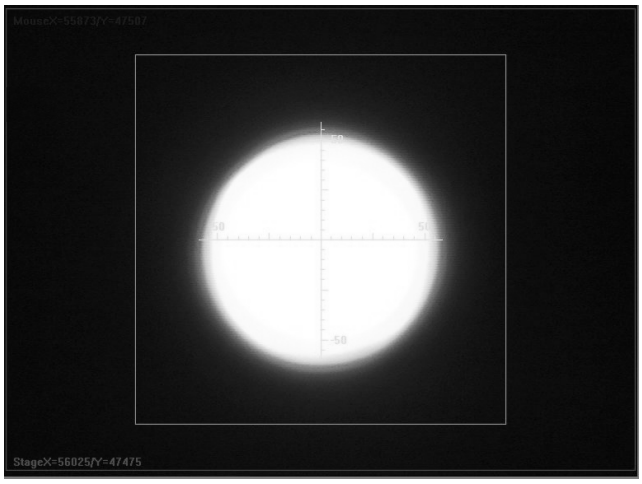


Figure 16: Image in Transmittance Mode

- Press the IR button on the control panel (figure 5).
- Select the *Advanced Measurement* function in the OPUS *Measure* menu. A dialog window opens. Click on the *Check signal* tab to check the signal intensity (amplitude value). See figure 17. Compare this value with the corresponding value of the OQ[1] test report. If the signal is too weak, check the condenser adjustment.

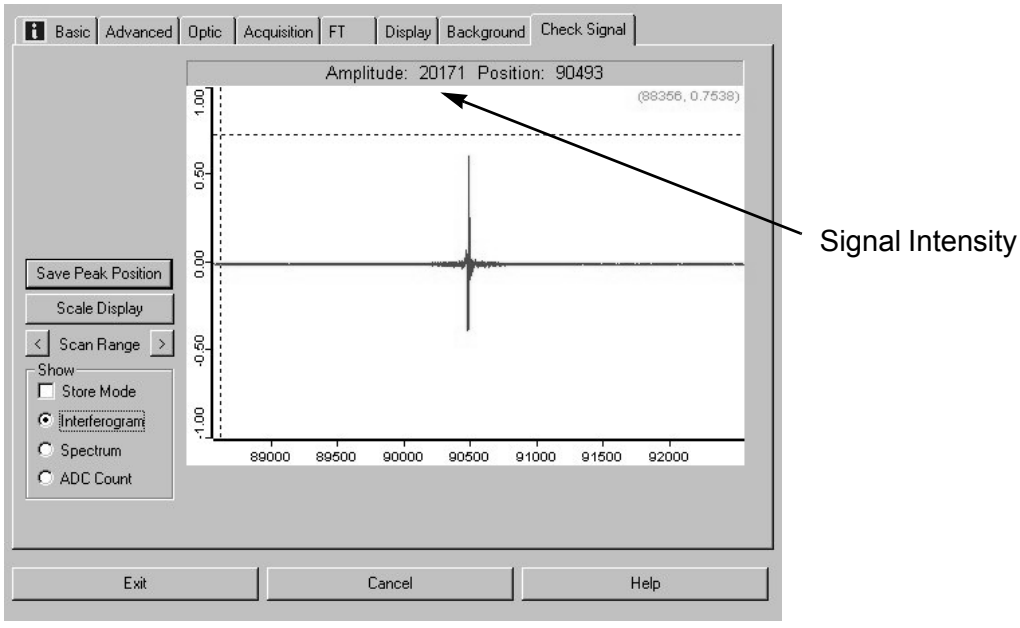


Figure 17: OPUS Window - Measurement

1. The OQ test (Operation Qualification Test) is performed using OVP (OPUS Validation Program). For more information refer to the OPUS Reference Manual.

The condenser adjustment can also be checked in the VIS mode using the alignment aperture (22 in figure 3). To do this, proceed as follows:

- Press the VIS button on the control panel.
- Rotate the alignment aperture wheel in the direction indicated by the arrow for the small circle. (See figure 18a.)
- If the condenser is adjusted properly the image will be similar to the one shown in figure 16.
- If the condenser is not adjusted properly the bright image of the hole is unsharp. In this case, adjust the condenser height using the condenser focus knob (A in figure 18b.
- If the bright image of the hole is not in the center of the cross-hairs adjust the condenser in x/y-direction using the two knurled screws (B in figure 18b.)
- After adjusting the condenser, do not forget to rotate the alignment aperture wheel back in the direction indicated by the arrow for the big circle.

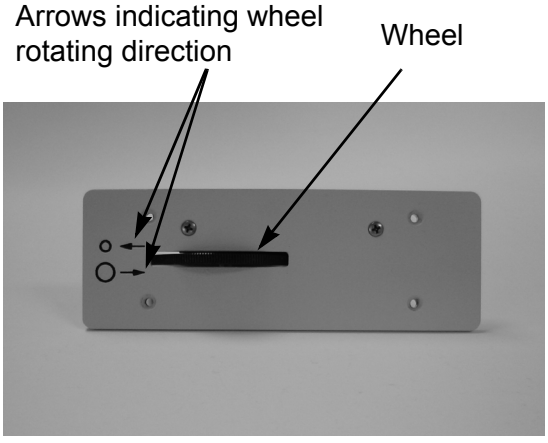
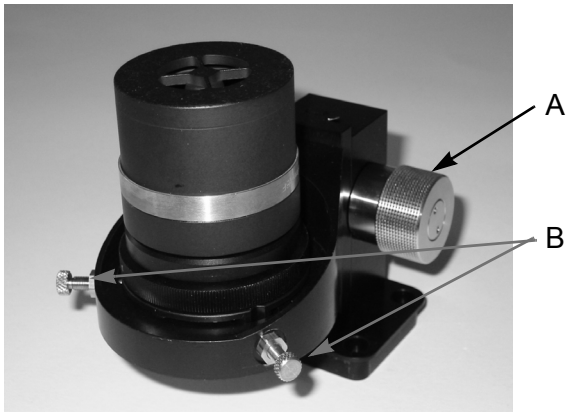


Figure 18: a) Alignment Aperture



b) Condenser

TRANSMITTANCE MEASUREMENT

General Procedure

Action	Control Elements
1. Activate the viewing mode.	VIS button on the control panel. (fig. 5)
2. Activate the reflectance mode.	Reflectance mode button on the microscope control panel. (fig. 5)
3. Place the sample on the stage and position it in the optical path.	
4. Swing the 15x objective in the optical path. **Note**: For a large sample use the 4x objective made of glass. It cannot be used for IR spectroscopic measurements. Therefore, do not forget to swing an IR objective (e.g. 15x, 36x) in the optical path before starting a measurement!	
5. Select the light path for sample viewing, i.e. the light is routed to the binocular.	Visible light routing control knob (fig. 8 and 9)
6. Adjust the light intensity starting from a low intensity level. **Caution:** Do not look through the binocular when the light intensity is set at maximum. Temporary eye irritations may occur.	Visible light intensity control (thumb-wheel) (fig. 6) Visible light intensity indicator (fig. 5)
7. Focus on to the sample.	Coarse and fine focus knobs (fig. 6)
8. Adjust the image contrast by closing the Köhler aperture for the transmittance. **Attention:** Before starting a measurement, do not forget to open this Köhler aperture again!	Rotate the black plastic ring below the condenser.
9. Activate the transmittance mode.	Transmittance mode button on the microscope control panel. (fig. 5)

Action	Control Elements
10. Find the sample area of interest by moving the stage in x- and y-direction.	Manual x/y-stage: manual stage control (fig. 6) Motorized x/y-stage: joystick
11. Define the sample area.	Knife edge aperture (fig. 8 and 10)
12. Move a sample-free area of the substrate into the optical path. **Note:** Make sure that the detector does not oversaturate. Do not change the knife-edge aperture setting!	
13. Swing the alignment aperture into the beam. Adjust the condenser in x-, y- and z-direction until the image of the alignment aperture is in focus and in the center of binocular-cross-hairs. Swing the alignment aperture out of the beam.	Alignment aperture (7 in fig. 3 and 18a) and condenser (6 in fig. 3 and 18b) See also previous section *Checking Signal Intensity.*
14. Activate the IR mode.	IR button on the control panel (fig. 5)
15. Start the reference measurement. **Attention:** Before starting a measurement, do not forget to open the Köhler aperture (for transmittance mode) again! See step 8.	OPUS program (by clicking in the *Measurement* dialog window on the *Background Single Channel* button)
16. After the reference measurement is completed, move the sample again into the optical path.	
17. Readjust the condenser in z-direction. See step 13.	Alignment aperture (7 in fig. 3 and 18a) and condenser (6 in fig. 3 and A in fig. 18b)
18. Start the sample measurement.	OPUS program (by clicking in the *Measurement* dialog window on the *Sample Single Channel* button)

General Information

Measurements in the transmittance mode are suitable for very thin samples such as microtome cuts, fibers, tiny single crystals and thin films (< 50µm). To obtain optimal measurement results, sample preparation is of crucial importance, i.e. for measurements in transmittance mode the sample must be very thin. However, too thin a sample will show only a very weak or almost no absorption while too thick a sample absorbs the IR light completely. (See figure 19.) As a result the bands will be too intense. The sample thickness can be reduced by cutting or compressing the sample (e.g. using a compression cell).

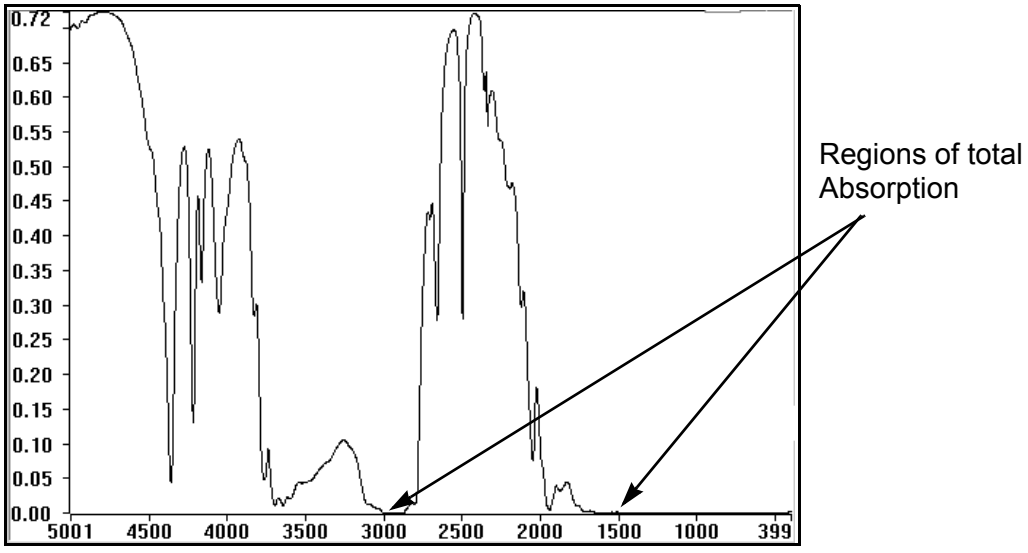


Figure 19: Transmittance Spectrum of a too thick Sample

If the microtome cut or the fibre is big enough put the sample across the hole of the supplied specimen carrier. (See chapter *Accessories and Options*, section *Accessory Box*.) It is recommend not to cover the hole completely with the sample but to leave some hole area uncovered for the reference measurement using the predefined knife-edge aperture size.

If the sample is minuscule and fragile put it on a window material (e.g. KBr) used as substrate. For samples containing water, use CaF_2-window material. (The cutoff of CaF_2-window material is 900cm^{-1}.)

If a window material is used as substrate a condenser height adjustment is required. Adjust the condenser height until the maximum signal intensity (amplitude) is obtained. (See chapter *Operation*, section *Checking Signal Intensity*). This readjustment is necessary because of the shifted focus position. The shift is caused by the refractive index of the window material. Adjust the condenser using a clean substrate and a small aperture in order to prevent a detector oversaturation.

REFLECTANCE MEASUREMENT

General Procedure

Action	Control Elements
1. Activate the viewing mode.	VIS button on the control panel. (fig. 5)
2. Activate the reflectance mode.	Reflectance mode button on the control panel. (fig. 5)
3. Place the sample on the stage and position it in the optical path.	
4. Swing the 15x objective in the optical path. **Note**: For a large sample use the 4x objective made of glass. It cannot be used for IR spectroscopic measurements. Therefore, do not forget to swing an IR objective (e.g. 15x, 36x) in the optical path before starting a measurement!	
5. Select the light path for sample viewing, i.e. the light is routed to the binocular.	Visible light routing control knob (fig. 8 and 9)
6. Adjust the light intensity starting from a low intensity level. **Caution:** Do not look through the binocular when the light intensity is set at maximum. Temporary eye irritations may occur.	Visible light intensity control (thumb-wheel) (fig. 6) Visible light intensity indicator (fig. 5)
7. Focus on to the sample.	Coarse and fine focus knob (fig. 6)
8. Adjust the image contrast.	Köhler aperture (fig. 8 and 11)
9. Find the sample area of interest by moving the stage in x- and y-direction.	Manual x/y-stage: manual stage control (fig. 6) Motorized x/y-stage: joystick

Action	Control Elements
10. Define the sample area.	Knife edge aperture (fig. 8 and 10)
11. Exchange the sample for the supplied gold mirror. **Note**: Make sure that the mirror is free of contaminants! Do not change knife-edge aperture setting!	
12. Focus on to a mirror edge or on a scratch on the mirror surface.	Coarse and fine focus knobs (fig. 6)
13. Activate the IR mode.	IR button on the microscope control panel (fig. 5)
14. Start the reference measurement.	OPUS program (by clicking in the *Measurement* dialog window on the *Background Single Channel* button)
15. After the reference measurement is completed, exchange the mirror for the sample again.	
16. Activate the viewing mode.	VIS button on the microscope control panel (fig. 5)
17. Focus on to the sample.	Coarse and fine focus knobs (fig. 6)
18. Find the sample area of interest by moving the stage in x- and y-direction.	Manual x/y-stage: manual stage control (fig. 6) Motorized x/y-stage: joystick

Action	Control Elements
19. Activate the IR mode.	IR button on the microscope control panel (fig. 5)
↓	
20. Start the sample measurement.	OPUS program (by clicking in the *Measurement* dialog window on the *Sample Single Channel* button)

General Information

IR spectroscopic measurements in reflectance mode are only suitable for samples with a very smooth surface such as chips, polymers, coatings, impurities or thin coatings on metals.

Do not measure typical non-metallic materials in reflectance as they reflect only less than 5% of the light; the remaining light is absorbed by the sample. The reflectance spectra of such samples are not informative.

ATTENUATED TOTAL REFLECTANCE (ATR) MEASUREMENT

Information about the ATR Objective

For attenuated total reflectance measurements, use the 20x ATR objective. See fig. 20.

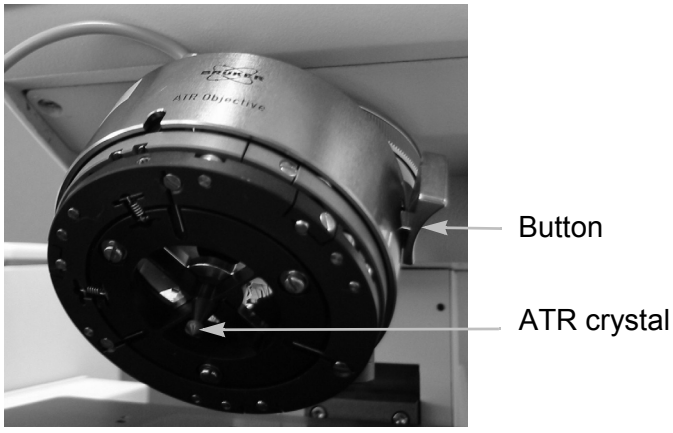


Figure 20: 20x ATR-Objective

The ATR objective allows for both viewing mode and measurement mode. The respective mode is realized by the corresponding ATR crystal position. See fig. 21a and 21b. To lift or lower the ATR crystal holder, move the holder up- or downwards while pressing the button (fig. 20).

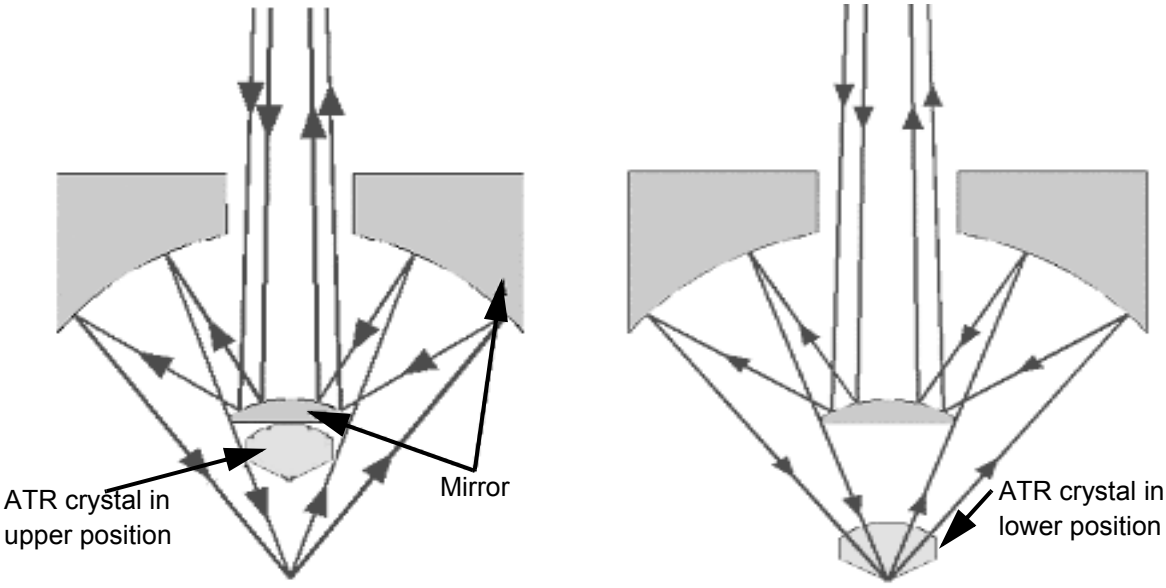
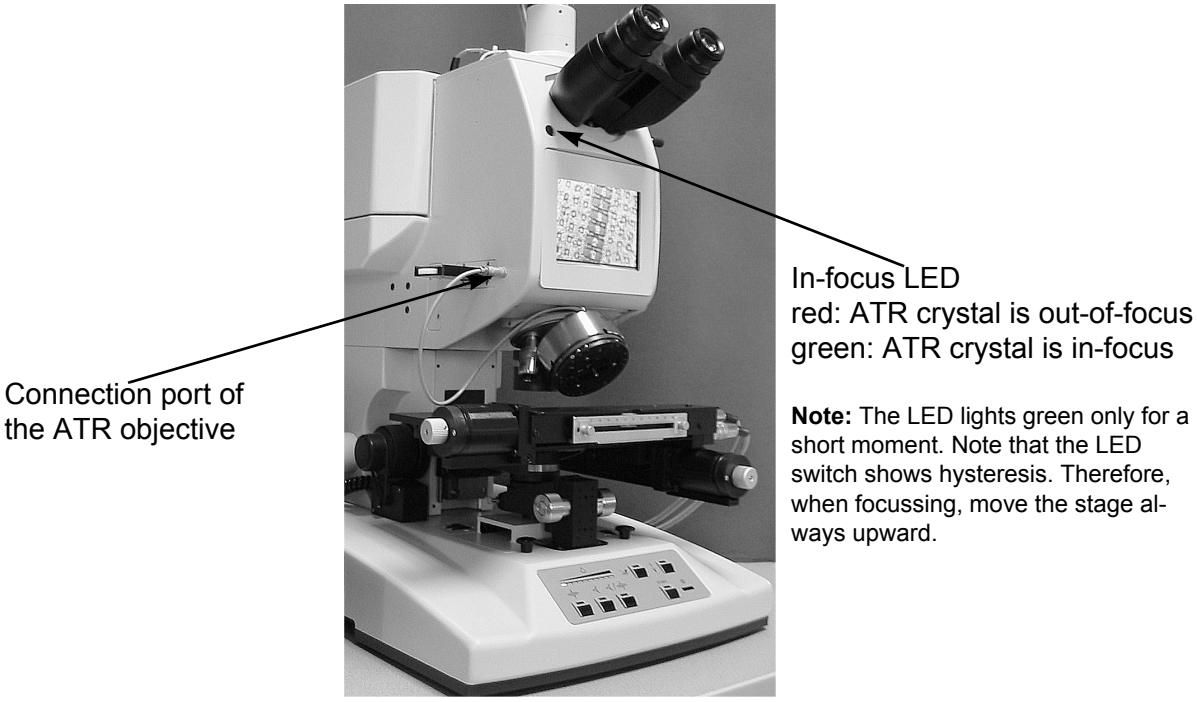


Figure 21: a) Viewing Mode b) Measurement Mode

Caution: Prevent the ATR crystal from hitting the stage or sample. Risk of crystal damage! For this reason, be careful when lowering the ATR crystal holder or moving the stage upward.

The focus position of the ATR crystal is displayed by the in-focus LED at the microscope front side below the binocular. See figure 22.



Note: The LED lights green only for a short moment. Note that the LED switch shows hysteresis. Therefore, when focussing, move the stage always upward.

Figure 22: Microscope with installed ATR objective

For ATR measurements, the adequate contact pressure of the ATR crystal is of crucial importance for the measurement result. In case of the ATR objective, the contact pressure is adjustable in steps. Depending on the degree of hardness/softness of the sample, five different contact pressures (pressure levels) can be set (pressure level 1 for very soft samples, pressure level 5 for very hard samples). The currently set pressure level is indicated by a red point. See figure 23b.

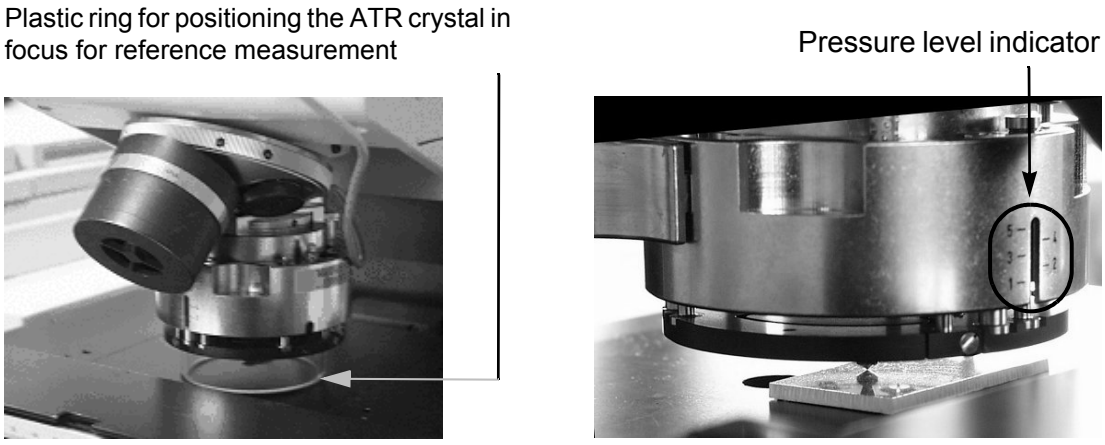


Figure 23: a) Reference Measurement b) Sample Measurement

Reference measurement and sample measurement have to be performed with the same microscope settings (e.g. aperture setting, ATR crystal pressure level).

In the ATR mode, the reference spectrum is a single channel spectrum of the ATR crystal. Make sure that the ATR crystal contacts neither the stage nor the sample and that it is free of contaminants.

General Measurement Procedure

Before starting an ATR measurement, it is recommended to check the signal intensity using the OPUS software. This action can reveal whether the ATR crystal is damaged or not.

Action	Control Elements
1. Activate the microscope viewing mode.	VIS button on the microscope control panel (fig. 5)
2. Activate the reflectance mode.	Reflectance mode button on the microscope control panel (fig. 5)
3. Put the sample on the stage.	

Action	Control Elements
4. Swing the ATR objective in the optical path and set it to the viewing mode. (See fig. 21a.)	ATR objective
5. Select the light path for sample viewing, i.e. light is routed to the binocular.	Visible light routing control knob (fig. 8 and 9)
6. Find a measurement spot by moving the stage in x- and y-direction.	Manual x/y-stage: manual stage control (fig. 6) Motorized x/y-stage: joystick
7. Define the sample area of interest. **Note:** The measurement spot of the ATR crystal is about 32µm.	Knife-edge aperture (fig. 8 and 10)
8. Move the stage downward.	Coarse focus knob (fig. 6)
9. Exchange the sample for the plastic ring. Put the ring below the ATR objective. (See fig. 23a.) **Note:** The plastic ring is included in the delivery scope of the ATR objective.	
10. Set the ATR objective to measurement mode by pulling down the ATR crystal holder. Select the same pressure level as for the subsequent sample measurement.	ATR objective (See fig. 21b and fig. 23b.)
11. Move the stage upwards until the in-focus LED lights up green (fig. 22) and it beeps.	Coarse focus knob (fig. 6)
12. Activate the microscope IR mode.	IR button on the microscope panel. (fig. 5)
13. Start the reference measurement.	OPUS program (by clicking in the *Measurement* dialog window on the *Reference Single Channel* button)

Action	Control Elements
14. Move the stage downward and exchange the plastic ring for the sample.	Coarse focus knob (fig. 6)
15. Set the ATR objective to the viewing mode.	ATR objective (See fig. 21a.)
16. Activate the microscope viewing mode.	VIS button on the microscope control panel (fig. 5)
17. Move the stage upwards until the sample is in focus.	Coarse and fine focus knobs (fig. 6)
18. Find sample area of interest.	Manual x/y-stage: manual stage control (fig. 6) Motorized x/y-stage: joystick
19. Move the stage downwards.	Coarse focus knobs (fig. 6)
20. Set the ATR objective to the measurement mode by pulling down the crystal holder. Set the crystal holder to the pressure level that is adequate to the consistency of the sample.	ATR objective (See fig. 21b and fig. 23b.)
21. Activate the microscope IR mode.	IR button on the microscope panel. (fig. 5)
22. Move the stage carefully upwards until the ATR crystal tip contacts the sample (fig. 23b) and the in-focus LED lights up green (fig. 22) and it beeps.	Fine focus knob (fig. 6)
23. Start the sample measurement.	OPUS program (by clicking in the *Measurement* dialog window on the *Sample Single Channel* button)

GRAZING INCIDENCE REFLECTION (GIR) MEASUREMENT

General Information about the GIR Objective

For grazing incidence reflection measurements, use the 15x GIR objective. The GIR objective allows for both viewing mode and measurement mode. The respective mode is set using the mode selector knob. See figure 24.

(For detailed information refer to the chapter *Accessories and Options*, section *Objectives*, subsection *Grazing Angle Objective (15x)*.

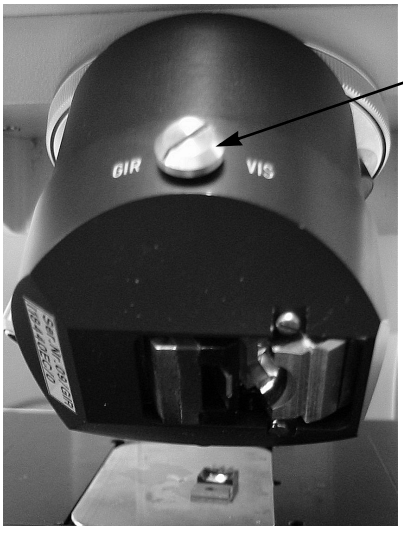


Figure 24: Grazing Angle Objective (15x)

The GIR objective is optimized for measurements of very thin layers (e.g. impurities, monolayer structure) on highly reflecting substrates such as metals. Thin layers on paper or impurities on polymers, for example, can not be analyzed using this objective. For measurements using the GIR objective, the sample surface has to be smooth.

General Procedure

Action	Control Elements
1. Activate the microscope viewing mode.	VIS button on the microscope control panel (fig. 5)
2. Activate the reflectance mode.	Reflectance mode button on the microscope control panel (fig. 5)

Action	Control Elements
3. Put the supplied gold mirror on the stage.	
4. Swing the GIR objective into the optical path and set it to the viewing mode (VIS).	GIR objective, mode selection knob (fig. 24)
5. Focus on to mirror (a scratch on surface or mirror edge). **Caution:** Due to the small working distance (0.7mm), be careful when moving the stage upward. Risk of damaging the GIR objective mirrors!	Coarse and fine focus knob (fig. 6)
6. Set the GIR objective to the measurement mode (GIR).	GIR objective, mode selection knob (fig. 24)
7. Activate the microscope IR mode.	IR button on the microscope control panel (fig. 5)
8. If available, use a polarizer for p-polarized light.	For polarizer installation positions see chapter *Accessories and Options*, section *Polarizer*.
9. Start the reference measurement.	OPUS program (by clicking in the *Measurement* dialog window on the *Reference Single Channel* button)
10. Move the stage downward and exchange the mirror for the sample.	Coarse focus knob (fig. 6)
11. Set the GIR objective to the viewing mode (VIS).	GIR objective, mode selection knob (fig. 24)
12. Activate the microscope viewing mode.	VIS button on the microscope control panel (fig. 5)

Action	Control Elements
13. Find the sample area of interest. **Note:** The measurement spot has to be in the center of the cross-hairs.	Manual x/y-stage: manual stage control (fig. 6) Motorized x/y-stage: joystick
14. Focus on the sample. **Caution:** Due to the small working distance (0.7mm), be careful when moving the stage upward. Risk of damaging the GIR objective mirrors!	Coarse and fine focus control (fig. 6)
15. Set the GIR objective to the measurement mode (GIR).	GIR objective, mode selection knob (fig. 24)
16. Activate the microscope IR mode.	IR button on the microscope control panel (fig. 5)
17. Start the sample measurement.	OPUS program (by clicking in the *Measurement* dialog window on the *Sample Single Channel* button)

ATR MAPPING MEASUREMENT

ATR mapping allows the acquisition of spectra at a set of predefined measurement positions using the ATR objective and the built-in single-element detector (usually MCT detector). The measurement positions are predefined using the OPUS/MAP or the OPUS/VIDEO software package.

Note: This kind of measurement can not be performed in combination with the automatic knife edge aperture.

This measurement method requires the following hardware components and software packages:

- HYPERION 2000 (A 670-L)
- Computer controlled focussing assembly (A 673-FA)
- Motorized stage (A 673 or A 673-S)
- 20x ATR-objective with focus sensor (end switch for z-axis) (A 677-A10)
- LStep PCI board
- OPUS/MAP or OPUS/VIDEO and OPUS/ATRMAP
- OPUS/3D

Note: The installation of the computer controlled focusing assembly, the computer controlled sample stage and the LStep PCI board is done by the Bruker service.

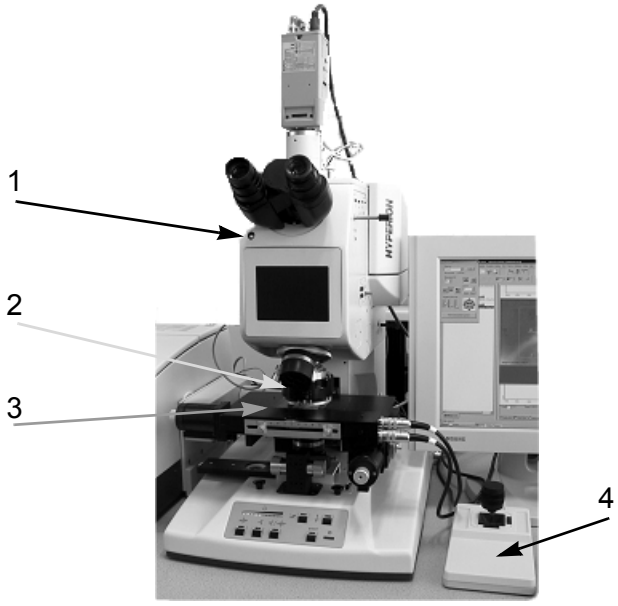


Figure 25: HYPERION 2000 equipped for ATR Mapping

Number	Component
1	In-focus LED
2	20x ATR-objective
3	Motorized x/y-stage
4	Joystick (for stage movement in x- and y-direction) **Note: For ATR mapping, the stage movement in z-direction using the joystick is disabled. This precaution is intended to prevent ATR crystal damage. In this case, the stage movement in z-direction is completely software-controlled.**

The hardware is set up using the OPUS/VIDEO or OPUS/MAP software. For information about the setup procedure refer to the corresponding software manuals. When you set up the hardware for ATR mapping, select the *LStepATR* stage and the *20x ATR* objective.

Note: When you perform an ATR mapping measurement, it is advisable to fix the sample on the stage to avoid displacements of the sample.

Before starting the measurement lift the stage manually until the distance between the sample surface and the crystal tip is less than 2mm. After you have started the mapping measurement using the OPUS software, the PCI controller automatically elevates the sample stage into the focus position. The focus position is indicated by a beep and the

In-focus LED does not lit anymore. (The functioning mode of the ATR objective is described in detail in chapter *Accessories and Options*, section *Objectives*.) After a spectrum has been acquired, the PCI controller automatically lowers the sample stage and moves the stage to another predefined measurement position. This procedure recurs at every predefined measurement position.

If the ATR mapping measurement has failed, check whether:

- the In-focus LED cable is connected properly.
- the computer controlled sample stage is correctly calibrated (in the video-assisted measurement mode)
- the correct stage (LStep ATR) has been selected in the hardware setup using the OPUS software.
- the objective (20x ATR) has been selected in the hardware setup using the OPUS software.
- the distance between the crystal tip (with pulled down crystal holder) and the sample surface is less than 2mm.

FLUORESCENCE MICROSCOPY

General Information

For fluorescence microscopy, the option A 674 is available. This option includes all hardware components (e.g. special filters) that are required for this special observational technique. By the instrumental set-up shown in figure 58, an image contrast enhancement of a fluorescent sample can be achieved. See also chapter *Accessories and Options*, section *Fluorescence Option*.

General Measurement Procedure

Action	Control Elements
1. Insert the compensation plate and the excitation filter into the intended slots at the left microscope side. See fig 59.	
2. Activate the viewing mode.	VIS button on the microscope control panel (fig. 5)
3. Activate the reflectance mode.	Reflectance mode button on the microscope control panel (fig. 5)

Action	Control Elements
4. Put the fluorescent sample on the stage. **Note:** Due to the excitation filter, the sample image is blue.	
5. Activate the fluorescence mode of the microscope using the OPUS program.	*Measure* menu → *Direct Command Entry* function. Enter the direct command *mot56=14*. **Note:** This command moves the dichroic mirror in position.
6. Increase the light intensity of the tungsten lamp. **Note:** As a result, the sample fluoresces green-yellow.	Visible light intensity control (thumb wheel) fig. 6
7. Find the sample area of interest.	Manual x/y-stage: manual stage control (fig. 6) Motorized x/y-stage: joystick
8. Activate the IR mode.	IR button on the microscope control panel (fig. 5)
9. Remove the compensation plate from the microscope.	For the installation position of the compensation plate see fig. 59.)
10. Focus on to the sample.	Coarse and fine focus knob (fig. 6)
11. Start the sample measurement.	OPUS program (by clicking in the *Measurement* dialog window on the *Sample Single Channel* button)

COOLING THE DETECTOR

General Information

Before starting a measurement, check whether the MCT detector has its operating temperature. See the detector temperature warning indicator on the microscope control panel (2 in figure 5). Cryogenic detectors (e.g. MCT detectors) have to be cooled regularly with liquid nitrogen. The typical hold time depends on the detector type. There are MCT detectors with a hold time of 8, 12 or 24 hours. To fill the detector dewar with liquid nitrogen you need neither to remove the detector nor to open the detector compartment. See figure 26.

Safety Notes

MCT detectors are cooled with liquid nitrogen. The temperature of liquid nitrogen is minus 196 °C (minus 320.8 °F). Therefore, handling liquid nitrogen requires the observance of the following safety notes:

Warning: Handle liquid nitrogen always with utmost care. Due to its extremely low temperatures, skin contact can cause severe frostbites! Also the gases escaping from the liquid nitrogen are extremely cold and can cause frostbite. The delicate eye tissue can be damaged if exposed to this cold gas even for a short time. Protect your eyes by wearing a face shield or safety goggles! Note that goggles without side shields do not provide adequate protection!

Warning: High nitrogen gas concentrations in an enclosed area can cause asphyxiation! Use liquid nitrogen only in well-ventilated areas. Nitrogen gas is colorless, odorless and tasteless. Therefore, it can not be detected by human senses and will be inhaled as if it were normal air.

Detector Cooling Procedure:

- Insert the supplied funnel into the detector filling port (figure 26) and fill in slowly liquid nitrogen. At first the liquid nitrogen evaporates and streams out again.

Warning: Liquid nitrogen boils and splashes when it is filled in a warm container. Therefore, fill in the liquid nitrogen slowly to minimize boiling and splashing. Stand clear of boiling and splashing liquid nitrogen and its issuing gas.

- Wait until the funnel is empty before refilling. When the liquid nitrogen stops streaming out the dewar has cooled down sufficiently. Then, fill the funnel again with liquid nitrogen. Avoid spilling liquid nitrogen on the housing.

- Repeat this procedure until the detector dewar has been filled to maximum. (As a rough rule of thumb for the standard MCT detector: the maximum dewar capacity is about the quantity of two funnel fillings. Note that the first two funnel fillings will evaporate almost completely.) Avoid overfilling. Otherwise, the liquid flows into the detector compartment.
- After having filled in sufficient liquid nitrogen, remove the funnel and insert the supplied plug instead.
- Wait about 20 minutes before starting the measurement to allow the detector to stabilize thermally.

Figure 26: Filing the MCT Detector with Liquid Nitrogen

Note: The cooling procedure for the standard detector and the FPA detector is identical. However, there are a few aspects you must observe to ensure a long and trouble-free service life of the FPA detector:

- During FPA detector operation it is recommended to fill the FPA detector regularly (about every 4 hours) with liquid nitrogen.
- After filling the FPA detector with liquid nitrogen, wait a few minutes before starting a measurement.
- After having finished the measurement, switch off the FPA detector using the On/Off switch on the detector compartment bottom side (6 in figure 45b). This prevents the FPA detector from warming up overnight. If the FPA detector is switched off the typical hold time is about 20 hours, if the FPA detector is switched on the typical hold time is about 8 hours.

If the hold time has decreased significantly, evacuate the FPA detector. See chapter *Operation*, section *Evacuating the Detector*.

PURGING THE MICROSCOPE

During normal operation, purging the microscope interior is not necessarily required. However, purging the optics with dry air or nitrogen gas:

- reduces the peak intensity of water vapor, CO_2 or other environmental contaminants in the mid IR region of the spectrum,
- protects air-sensitive sample, (In this case, using the purge shroud is recommended.)
- reduces the amount of dust and contaminants that has entered the microscope interior.

Note: Regardless of purging the microscope, the microscope covers should not be removed unnecessarily.

Purge the microscope with dry air or low pressure nitrogen. Provide the following purge gas conditions:

- Dry (dew point < -40°C, that corresponds to 128 ppm humidity), oil-free and dust-free air or nitrogen gas
- Maximum pressure of 2 bar (29 psi)
- Gas flow rate should not exceed 300 liters/hour

To regulate the purge gas pressure install a pressure control valve between the purge gas line and the purge gas inlet (14 in figure 4).

Adjust the purge gas flow rate using the flow control valve (13 in figure 4) at the microscope rear side. (The flow control valve is a needle valve.)

Danger: Do not use flammable gases for purging the microscope. Some microscope components become very hot during operation. If flammable gases come in contact with hot components there will be a risk of fire and/or explosion.

6 Accessories and Options

This chapter describes the following accessories and options available for the HYPERION microscope:

- Objectives
- Apertures
- Detectors
- Stages and sample holder
- LCD monitor
- Video camera and video digitizer
- Polarizer
- Accessory / spectrometer port
- External sample chamber
- Fluorescence option
- Accessory box
- Miscellaneous accessories

OBJECTIVES

The following objectives are available:

- 4x viewing objective (made of glass, only for sample viewing)
- 40x viewing objective (made of glass, only for sample viewing), adapter is required
- 15x Schwarzschild IR objective (standard)
- 36x Schwarzschild IR objective
- 20x ATR objective (Ge-crystal)
- 15x Grazing angle objective

For objective specifications refer to appendix A.

Note: For the HPYERION microscope, also all Nicon glass objectives can be used. To attach them to the turret, a special adapter is required.

Viewing Objective and IR Objective (Standard)

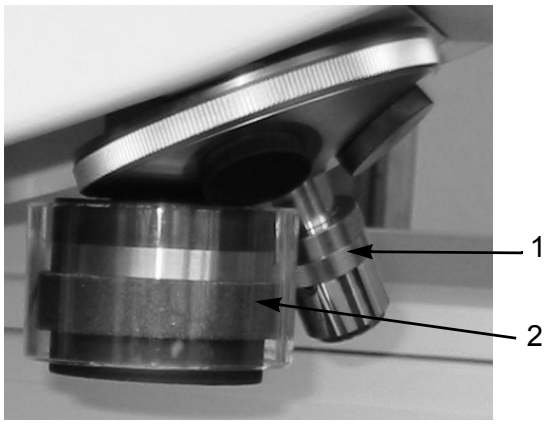


Figure 27: 4x Viewing Objective and 15x IR Objective

Number	Component and Description
1	**4x viewing objective:** to view the sample **using visible light only**. Due to its low magnification it is suitable for finding the sample area of interest if the viewing area of a high-power objective is not large enough. **Note: Do not use this objective for IR data acquisition because glass absorbs mid-infrared light.**
2	**15x IR objective:** to image the sample surface in IR mode or viewing mode. This objective is equipped with a clear plastic purge shroud on the outside. The shroud can be pulled down to cover the sample and purge it with dry air or nitrogen gas.

Note: Opposite to the standard 15x objective another Schwarzschild objective (ATR objective or grazing angle objective) can be attached. When attaching the ATR objective, first remove the plastic shroud of the 15x objective.

36x Objective

The 36x objective is a high-power objective (i.e. it allows for a high magnification) which can be used in IR light mode or visible light mode. The table in appendix A lists the nominal measurement area available when using a rotational aperture wheel (A 672-R or A 672-RT) and the 36x objective.

Note: The 36x objective cannot be attached to the turret if the other two large objectives (15x and ATR) are already installed (due to lack of space). In this case, detach one of the two large objectives before attaching the 36x objective to the turret.

ATR Objective (20x)

The ATR objective (20x) is equipped with a Ge crystal and allows for measurements in attenuated total reflection.

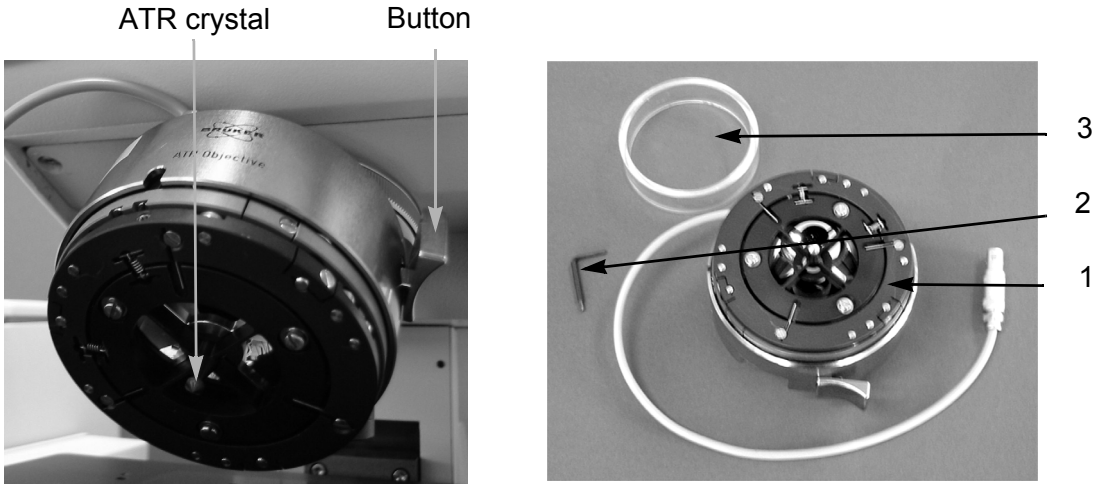


Figure 28: a) ATR-Objective (installed) b) Delivery scope

Number	Component
1	20x ATR-objective (including cable for connecting the objective to the microscope)
2	Isolated hex wrench for adjusting the ATR crystal
3	Plastic ring for positioning the ATR crystal in focus for the reference measurement

ATR Objective Adjustment

The adjustment procedure involves the following steps:

1. Horizontal adjustment (centering) the ATR crystal
2. Vertical adjustment of the ATR crystal

Horizontal adjustment of the ATR crystal

For optimal objective performance, the ATR crystal has to be exactly in the objective center. To center the ATR crystal, proceed as follows:

- Attach the ATR objective to the revolving turret.
- Put a stripe of self-adhesive tape on the gold mirror.
- Press the button (fig. 28a) and lower the crystal holder carefully until the crystal contacts the tape. The tip of the ATR crystal should give an impression in the center of the binocular cross-hairs. (See figure 29a and b.) Otherwise, the ATR crystal needs to be adjusted using the supplied hex wrench.

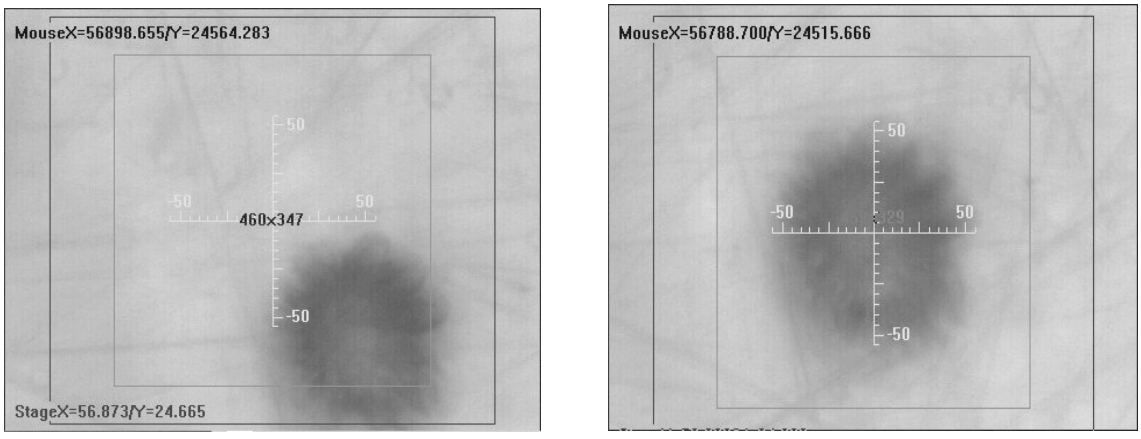


Figure 29: a) ATR crystal out of center position b) ATR crystal in center position

- To gain access to the ATR objective bottom side, move the stage downward and rotate the revolving turret until the ATR objective is at the front.

Caution: Be careful not to damage the ATR crystal when turning the revolving turret.

- Loosen the three screws at the bottom side of the crystal holder slightly. (See figure 30.)
- Insert the hex wrench in one of the two holes of the crystal holder (figure 30) and move the ATR crystal in the x and/or y direction.
- Repeat the above described procedure with the other hole and check whether the impression of the crystal tip is now exactly in the center of the binocular cross-hairs as shown in figure 29b.
- Fasten the three screws at the bottom side of the crystal holder again.

Figure 30: Centering the ATR Crystal

Vertical Adjustment of the ATR Crystal

- Connect the ATR objective to the in-focus LED on the left side of the microscope. (See figure 31a.)

Figure 31: a) Microscope with attached ATR objective b) ATR objective top side

- Move the stage downward.
- Select in the OPUS *Measure* menu the *Advanced Measurement* function. A dialog window opens. Click on the *Check Signal* tab and check the actual signal intensity (amplitude value). See figure 17.
- Press the button (figure 28a) and pull down the crystal holder to the first pressure stage (figure 23b). The crystal should be below the focus position of the objective.

Caution: Be careful that the crystal does not hit the stage.

- Put the plastic ring (figure 28b) on the sample stage underneath the ATR objective.
- Move the stage carefully upward until the crystal is in focus position. The focus position is indicated by a green in-focus LED (figure 31a).

The signal intensity (amplitude), displayed in OPUS, should be at maximum when the in-focus LED changes from red to green. If this is not the case, adjust the height of the crystal holder using the supplied isolated hex wrench. To do this, proceed as follows:

- The adjustment screw is at the top of the ATR objective next to the LED cable exit (figure 31b). Insert the isolated hex wrench straight and turn the hex wrench slightly while monitoring the signal intensity in OPUS.

Grazing Angle Objective (15x)

The GIR objective (15x) allows for measurements in grazing incidence reflection.

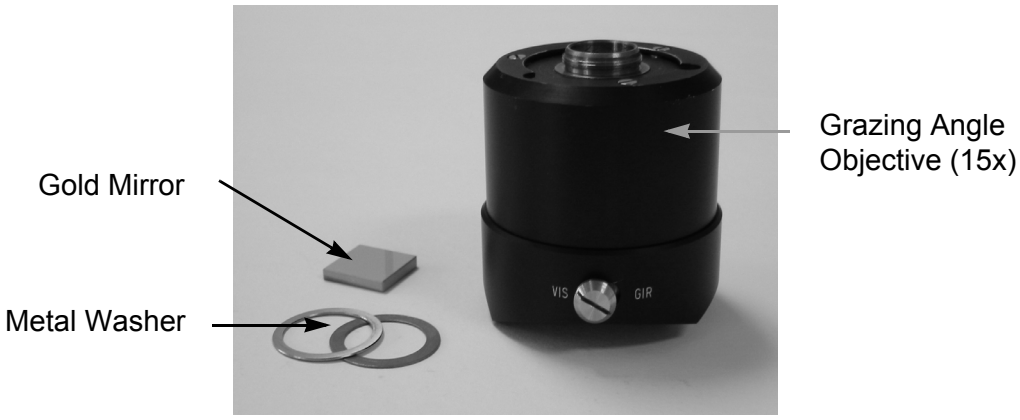


Figure 32: 15x Grazing Angle Objective (Delivery Scope)

General Information

The grazing angle objective is optimized for measurements of very thin layers (e.g. impurities, monolayer structure) only on highly reflecting substrates such as metals. Thin layers on paper or impurities on polymers can not be analyzed using this type of objective.

You can use the grazing angle objective for measurements with polarized light. Due to the exactly defined plane of incidence, the orientation of the polarized light is maintained. P-polarized light (i.e. light polarized in parallel to the plane of incidence) leads to an enhanced absorption, whereas s-polarized light (i.e. light polarized perpendicular to the plane of incidence) shows little or no absorption. (See figure 33.) Thus, the exclusion of s-polarized light can enhance the sensitivity.

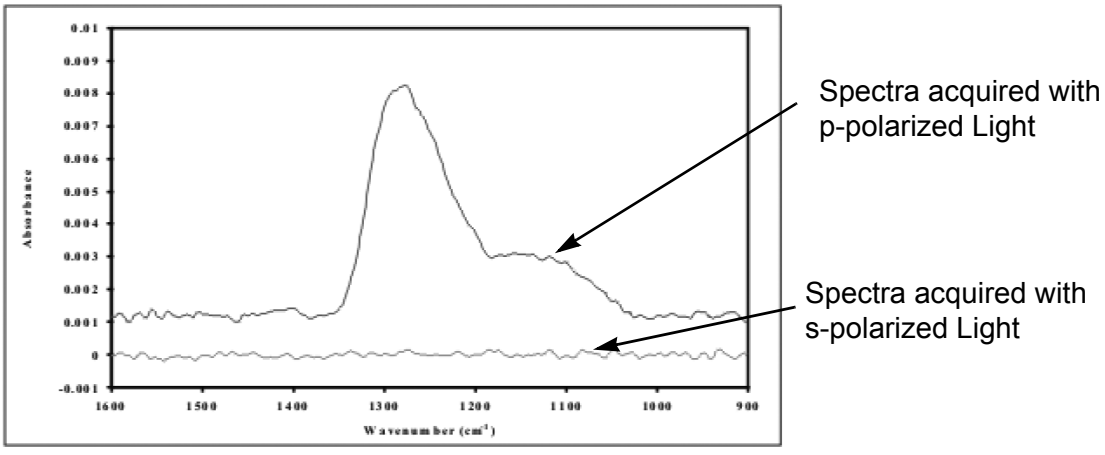


Figure 33: Spectra (acquired with GIR-Objective)

For the determination of molecular orientations, the use of an IR polarizer is recommended. (See also section *Polarizers*.) To check the orientation of the polarized light use an aluminium mirror. (For a reference measurement use a clean gold mirror.) In case of p-polarized light, there is a band of natural aluminium oxide (of the aluminium mirror) at 1100cm^{-1}, whereas in case of s-polarized light nearly no or no absorption can be observed.

For small measurement areas use apertures. As the incidence angle is max. 83°, the beam shape is elliptic. (See figure 34.) Therefore, the measurement area is extended in the beam direction. The reference measurement and the sample measurement have to be performed with the same aperture size.

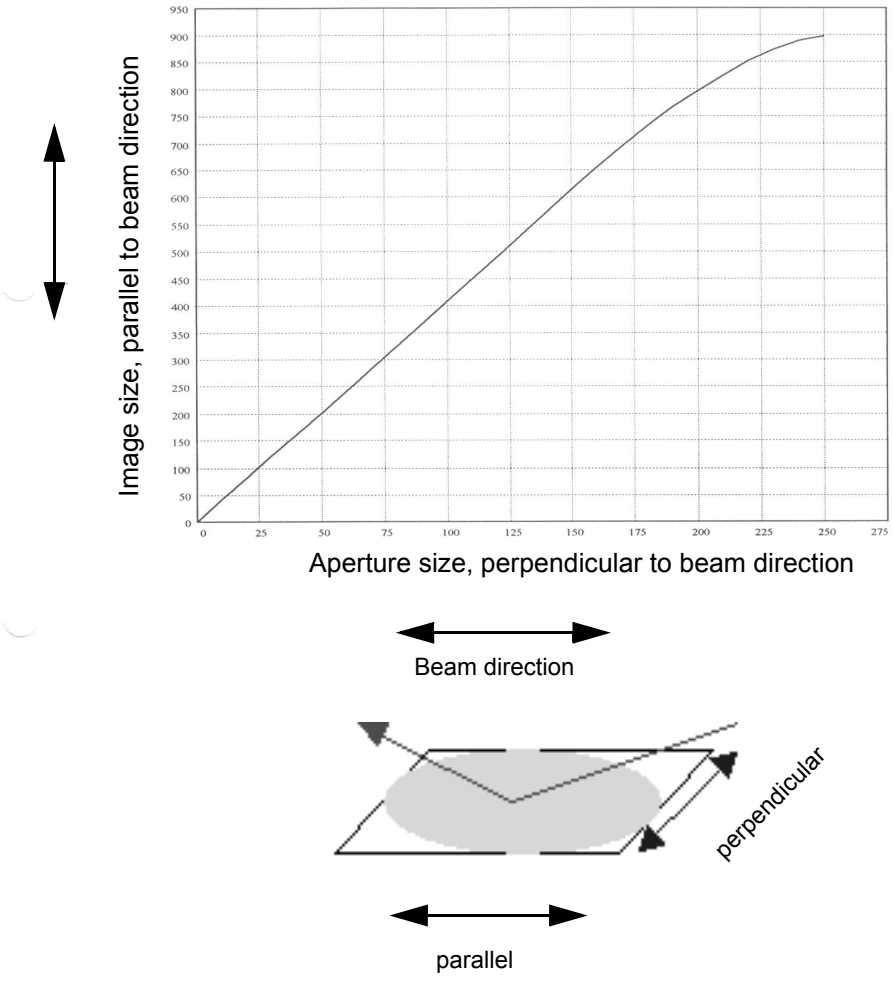


Figure 34: Image Size (Parallel to Incidence Plane)

INSTALLATION AND ADJUSTMENT INSTRUCTIONS

- When attach the grazing angle objective to the revolving turret, put the supplied metal washers between the turret and the grazing angle objective to ensure proper objective orientation. (We cannot make any recommendation on the optimum number of washers to obtain the correct objective orientation. The user has to find it out empirically.)

- Attach the grazing angle objective to the revolving turret opposite to the standard 15x objective. Ensure that the label VIS - GIR points exactly forward (as shown in figure 35). Correct objective orientation is crucial for both polarized light measurements and defining the measurement area.

Figure 35: Grazing Angle Objective (installed)

- Check the objective alignment by placing the gold mirror in the optical path, switching the grazing angle objective into the viewing mode (VIS mode) and focussing on a small insulated impurity spot.
- Move this spot to the center of the cross-hairs.
- Switch the grazing angle objective into the measurement mode (GIR mode).

In the measurement mode (GIR mode), there are two images of the same spot as in this mode the light is reflected twice from the sample surface. These two images will be referred to as the primary image (from the first reflectance) and the secondary image (from the second reflectance, after the light has been reflected from the ellipsoid mirror). The secondary image is both inverted and mirrored relative to the primary image. Ideally, both images should lie one upon the other.

Functional Description of the GIR Objective

The grazing angle objective operates in two modes: the viewing mode (VIS mode) and the measurement mode (GIR mode). You can switch between these modes by shifting the two adjusting knobs (figure 36) in the corresponding direction. In doing so, the position of the plane mirror pair is changed. In the viewing mode the two parallel plane mirrors only displace the focal point of a 15x Schwarzschild objective. In the measurement mode the position of the plane mirrors is changed in a way that the beam is deflected onto the sample surface at grazing angle incidence. After being reflected from the sample surface the beam impinges on an ellipsoid mirror and is refocused on the same sample spot. Then, it goes through the objective again and impinges on the detector. This unique geometry has several advantages. Firstly, the objective has a very high throughput. Secondly, as the beam is reflected twice from the sample surface the sample absorbs the light twice. The combination of these two factors provides excellent sensitivity.

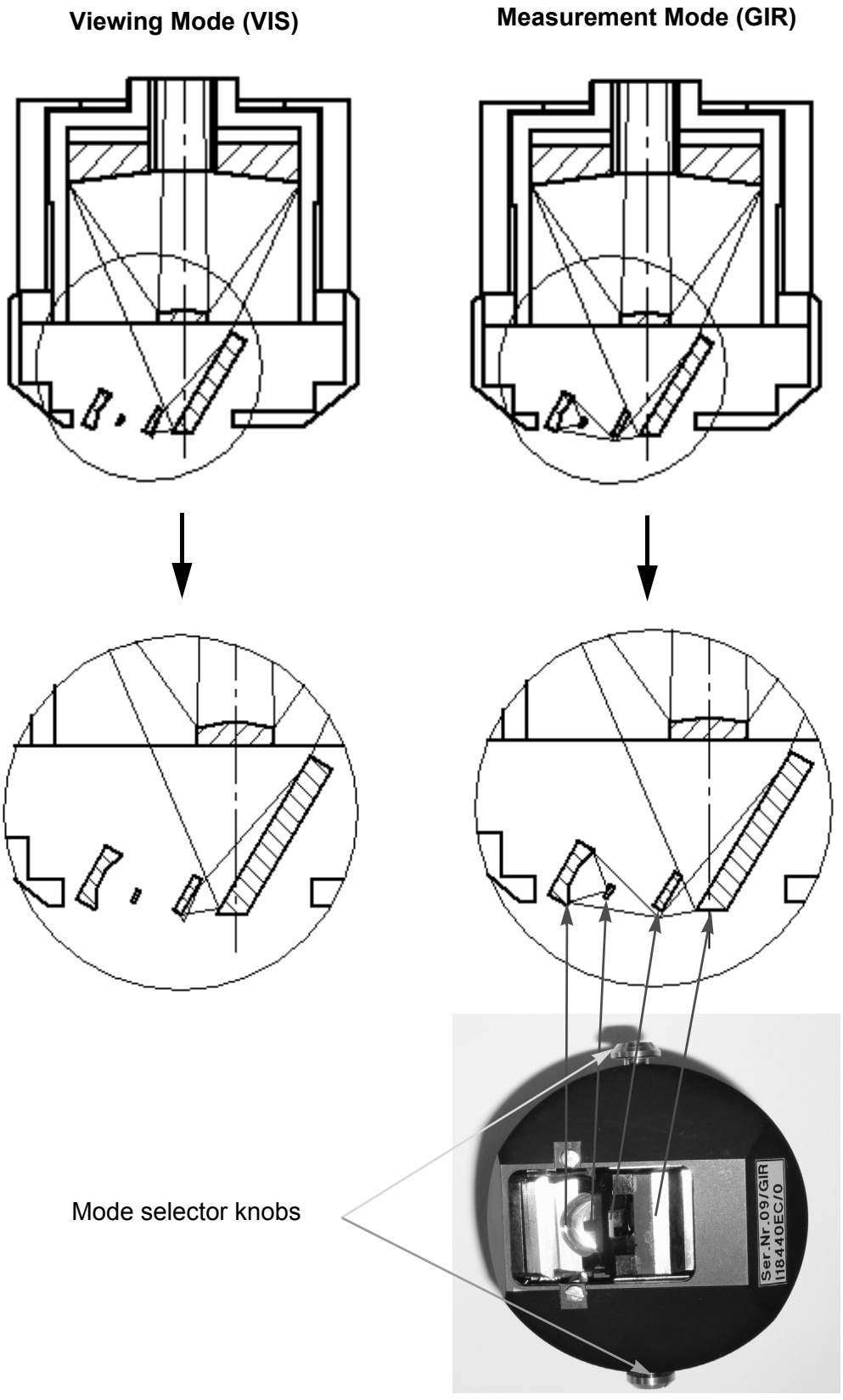


Figure 36: Position of the plane mirror pair in VIS and GIR mode

APERTURES

Apertures are used to mask off a certain sample area that is not intended for the spectral analysis. The following apertures are available:

- Rotatable wheel aperture
- Knife edge aperture with metal knife edges
- Knife edge aperture with transparent knife edges
- Automatic knife edge aperture (with transparent knife edges)

The aperture locations are shown in figure 39 and 40.

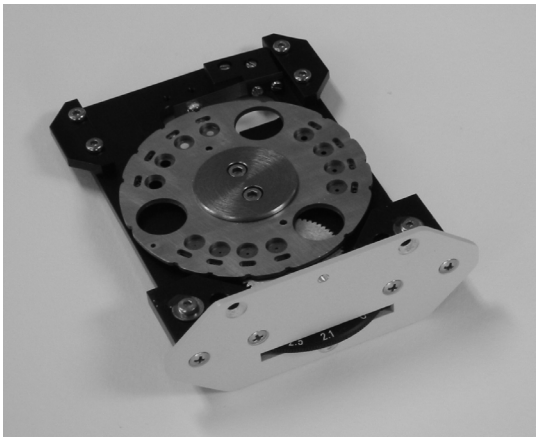
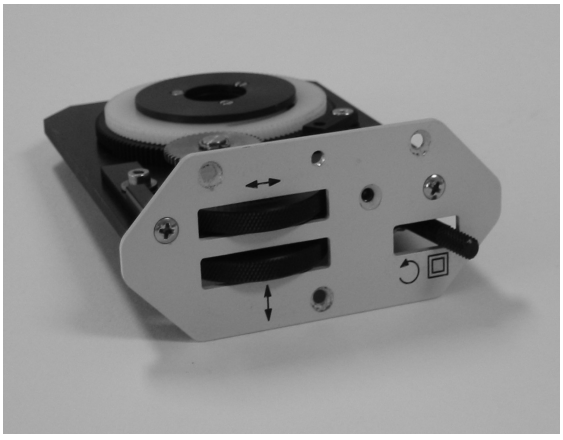


Figure 37: a) Rotatable Wheel Aperture



b) Knife Edge Aperture

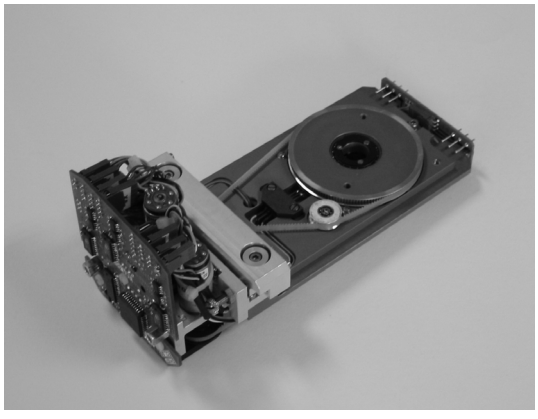


Figure 38: a) Automatic Knife Edge Aperture with Housing b) without Housing

Replacing the apertures is fast and easy; no realignment is required. In location A (figure 39), apertures for transmittance and/or reflectance measurements can be installed. To reduce the diffraction effect in the reflectance mode, an additional aperture of the same type can be installed in location B (figure 39).

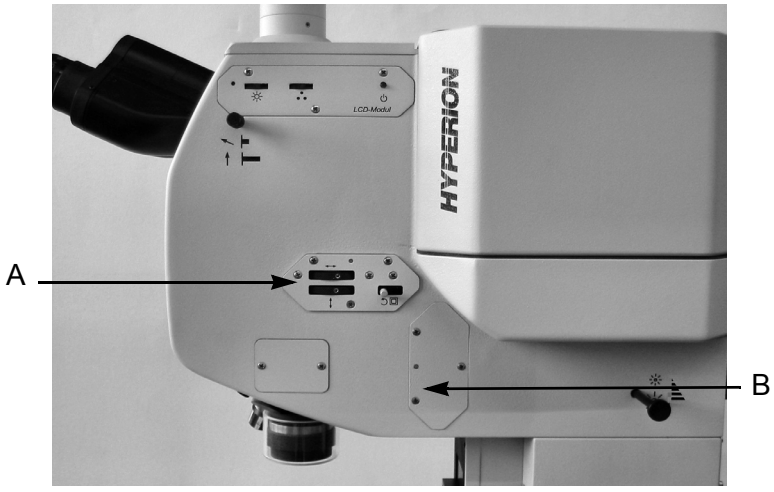


Figure 39: Aperture Locations

In order to reduce the beam diffraction in transmittance mode, apertures (A 672-RT, A 672-KT or A 672-TT) can be installed in location C (figure 40). (This option is not available in the U.S.A.)

Note: The apertures for reflectance and transmittance measurements installed in location A and B in fig. 39 (B only for reflectance) are interchangeable with each other. However, the apertures for transmittance measurements only installed in location C (fig. 40) are not interchangeable with the apertures installed in location A and B.

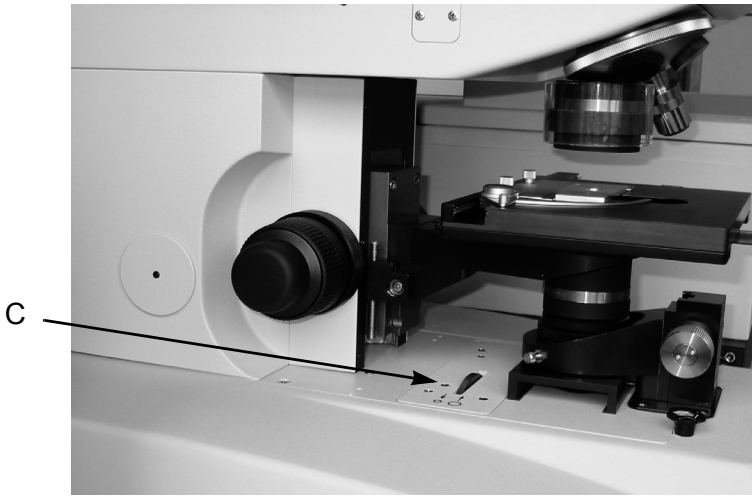


Figure 40: Location for additional Aperture (Transmittance Mode)

Knife Edge Aperture

Depending on the material of the knife edges, there are two types of knife edge apertures available:

- knife edge aperture with knife edges made of metal
- knife edge aperture with knife edges made of glass

The knife edge aperture with the metal knife edges can be used for measurements in both IR-regions, near-infrared and mid-infrared, whereas the transparent knife edge aperture with the glass knife edges can only be used for measurements in the mid-infrared region.

The knife edge aperture (figure 37b) consists of two pairs of blades (knife edges) to define a certain sample area for spectral data acquisition. The gap between the opposite blades is controlled by two thumbwheels (A and B in figure 41). The upper thumbwheel (A) changes the gap between the left and the right knife edge. The lower thumbwheel (B) changes the gap between the upper and the lower knife edge. The lever is used to lock and rotate the knife edges. If the lever points to the back of the microscope (D in figure 41), the blade rotation is locked and the aperture area size can be changed. If you rotate the lower thumbwheel (B) while the lever points to the front of the microscope (C in figure 41), the defined sample area (i.e. gap between the knife edges) remains unchanged but rotates around the center of the viewing field.

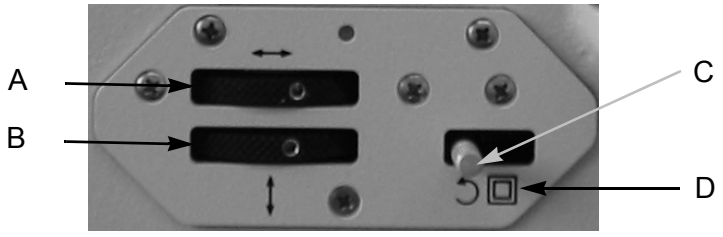


Figure 41: Knife Edge Aperture Controls

Automatic Knife Edge Aperture

The automatic knife edge aperture (figure 38a and b) allows a computer controlled adjustment of the sample area to be measured. For information about installing the automatic knife edge aperture refer to chapter *Installation*, section *Installing the automatic knife edge aperture*. For information on operating the automatic knife edge aperture refer to the OPUS/VIDEO and the OPUS/MAP software manual.

DETECTORS

One single-element detector is installed in the left detector compartment. Optionally, a second detector can be installed in the right detector compartment.

Figure 42: MCT Detector Compartment

The following detector types are available:

- MCT detector (standard), liquid nitrogen cooled
- InSb detector (optional)
- FPA detector (optional) (FPA - Focal Plane Array)

The MCT detector is available with three different cut-off frequencies. The cut-off frequency of the standard MCT detector is 600cm^{-1}.

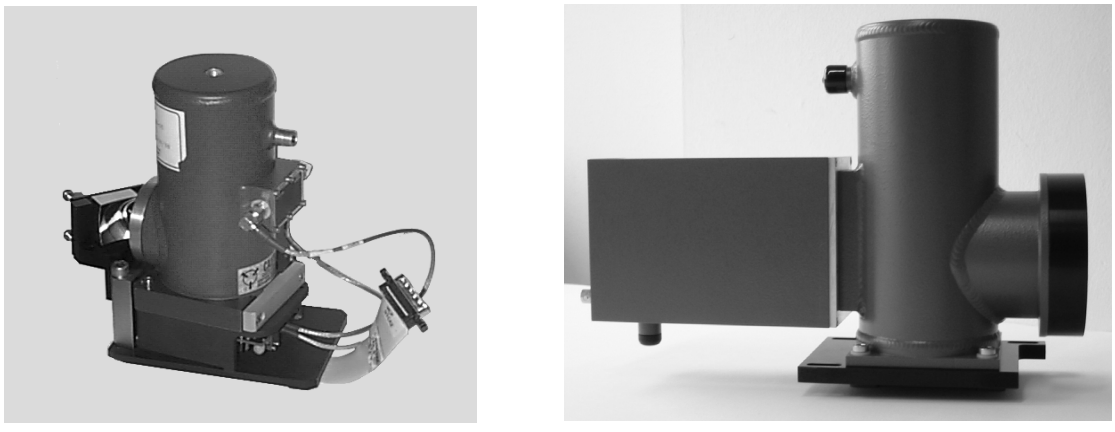


Figure 43: a) MCT Detector with Mounting Plate b) FPA Detector with Mounting Plate

MCT Detector and InSb Detector

HYPERION 1000 and HYPERION 2000 are equipped with the standard MCT detector. The MCT detector is used for measurements in the MIR spectral region, while the InSb detector is used for measurements in the NIR spectral region. Both detectors are single-element detectors. Up to two single element detectors can be installed in microscope at the same time.

Note: The installation of a second single element detector (optional) also requires the mirror switching device (A 605) and an optical adaptation for the second detector (A 616).

The available single-element detectors are mounted on a pinned mounting plate so that they can be easily removed and reinstalled without requiring a realignment. You only need to unscrew the mounting screws of the mounting plate and remove the detector together with the mounting plate.

FPA Detector (Focal Plane Array)

The FPA detector (figure 43b) is a multi-element detector, i.e. the detector consists of a quadratic raster of detector elements (64 x 64 or 128 x 128). Depending on the FPA detector type, 1024 up to 16384 spectra are acquired simultaneously per measurement. In case of a mapping measurement using the FPA detector, the number of spectra increases correspondingly. An advantage of this detection system is the fast measurement of a large sample area. Normally, a measurement using the FPA detector takes only a few seconds. The optional FPA detector can only be used in conjunction with the HYPERION 3000 microscope.

Start-up Procedure

The FPA detector requires a certain start-up procedure of the measurement system.

- Boot the computer.
- Switch on the detector. The On/Off switch is at the FPA detector compartment bottom side (6 in figure 45b).

Note: Always observe the order: first boot up the computer, then switch on the FPA detector. This order is necessary for the system to recognize the detector. Also after a computer reboot switch the FPA detector off and on again.

Required additional components

Performing measurements with the FPA detector requires additional components. See figure 44.

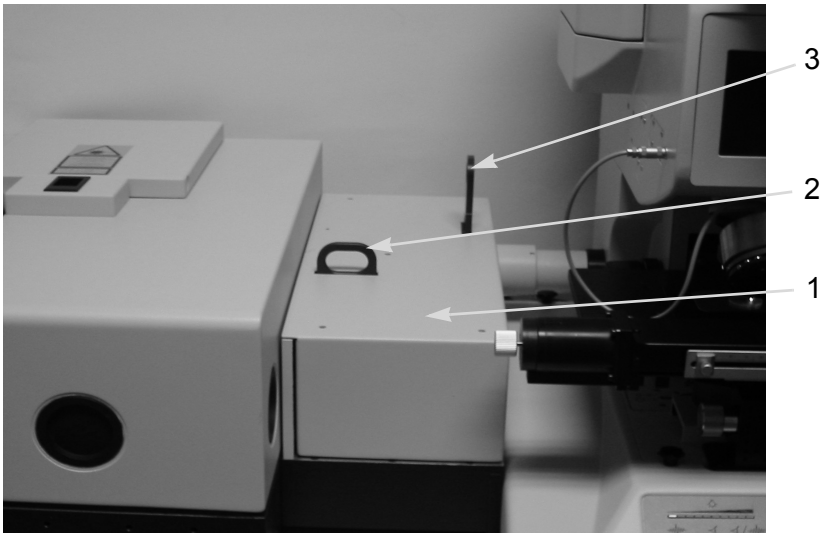
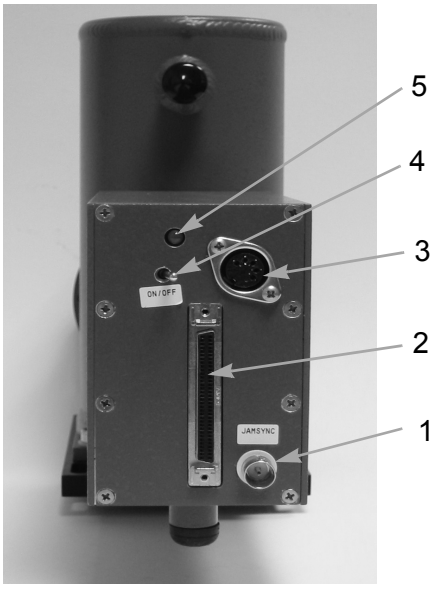


Figure 44: HYPERION 3000 connected to Spectrometer

Number	Component
1	Optical adaptation box for FPA detector with slots for filter and beam attenuator
2	Beam attenuator
3	Optical filter

Note: Insert the beam attenuator and the optical filter into the corresponding slots until they lock. Ensure that they are not inserted completely. Otherwise the beam attenuator or the optical filter is NOT in the optical path. In figure 44 the beam attenuator is not in the optical path while the optical filter is in the optical path.



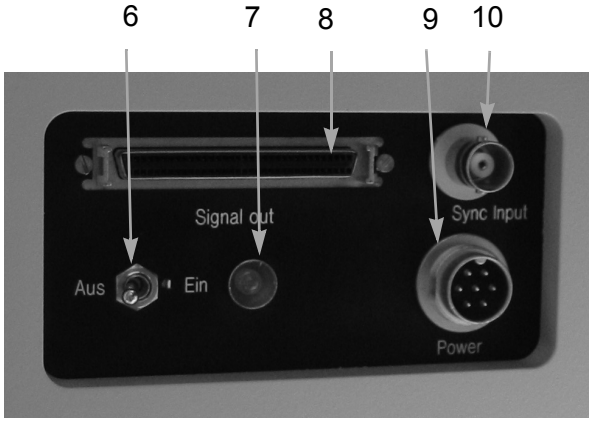


Figure 45: a) FPA Detector - Rear Side b) FPA Detector Compartment - Bottom Side

Number	Component
1	Connector socket for trigger cable (for continuous scan measurements)
2	Connector socket for data transfer cable
3	Connector socket for power supply cable
4	On/Off switch (detector rear side)
5	LED (detector rear side)
6	On/Off switch (detector compartment bottom side)
7	LED (detector compartment bottom side)
8	Connector socket for data transfer cable (detector compartment bottom side)
9	Connector socket for power supply cable (detector compartment bottom side)
10	Connector socket for trigger cable (detector compartment bottom side)

Connect the power supply cable and the data transfer cable properly to ensure a correct seat of the cables. For continuous scan measurements connect also the trigger cable.

There are two switches to switch the FPA detector on and off: one switch at the FPA detector rear side (4 in figure 45a) and the other at the detector compartment bottom side (6 in figure 45b). Before mounting the detector cover do not forget to switch on the FPA detector using the On/Off switch on the FPA detector rear side. For switching the FPA detector on or off during normal operation use the On/Off switch on the detector compartment bottom side.

SAMPLE STAGES AND SAMPLE HOLDERS

The following optional sample stages and sample holders are available:

- Manually operated x/y-stage (Standard)
- Motorized x/y-stage (optional)
- Temperature-controlled sample holder (optional)
- Heatable sample holder (optional)

Motorized x/y-stage

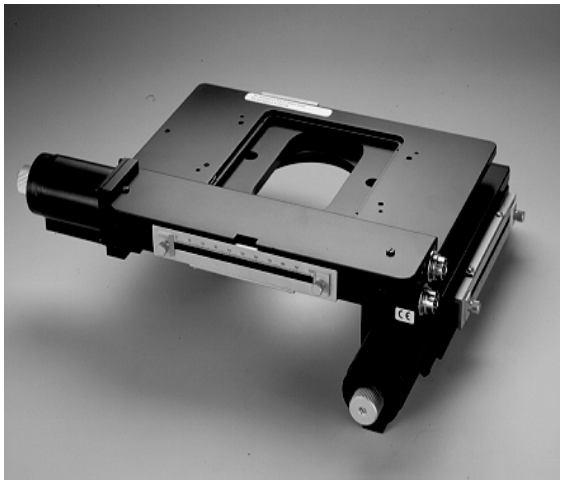
The motorized x/y-stage allows the mapping of microscopic samples with an adjustment accuracy of 1 micrometer across an area of:

- 50mm x 75mm (A 673-S)
- 100mm x 80mm (A 673).

The two stages differ only in dimension and range of movement.

The scope of delivery includes:

- Control unit with joystick (for manual control)
- Line cable
- x/y-stage
- Interconnecting cables
- Various inserts for different samples



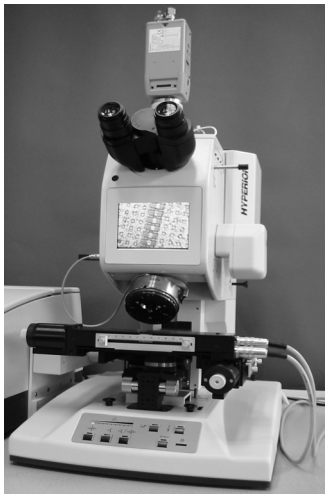


Figure 46: a) Computer-Controlled x/y-Stage b) Computer-Controlled x/y-Stage installed

JOYSTICK OPERATION

The motorized x/y-stage can be moved using the joystick (figure 47). The speed of the stage movement depends on the pressure you exert on the joystick.

Figure 47: Joystick

COMPUTER-CONTROLLED OPERATION

In case of a computer-controlled stage operation, the stage movement is controlled by the OPUS program, i.e. the user defines several measurement positions in advance and after the measurement start the stage moves automatically to these predefined positions. For defining the measurement positions, the optional software packages OPUS/MAP or OPUS/VIDEO are required.

For this operation mode, the motorized stage has to be connected to RS 232 port on the PC data station and the PC com port has to be configured as follows:

Parameter	Value
Baud rate	9,600
Parity	none
Data bits	8
Stop bits	2
Handshake	hardware

Caution: When operating the x/y-stage pay attention to the moveable parts, especially in case of the motorized x/y-stage. There is the risk of crushing or catching your fingers.

Temperature-controlled sample holder

The temperature-controlled sample holder (A 699-T) is mounted onto the sample stage of the HYPERION using an adapter plate. To do this, the manual stage or the optional computer-controlled stage must be removed first. The temperature-controlled sample holder can be used with the 15x IR objective.

A temperature sensor keeps the set temperature constant. The temperature can be set either manually or using the OPUS software (an OPUS macro). For temperatures below the ambient temperature, the coolant (liquid nitrogen) is filled directly into the cooling block.

All components required for the temperature control are included in the scope of delivery. For specifications refer to appendix A.

Heatable sample holder

The heatable sample holder (A 699) enables IR analysis of small samples at temperatures up to 180°C in transmittance or reflectance mode.

The accessory consists of:

Temperature control unit

Sample holder (2“ x 3“)

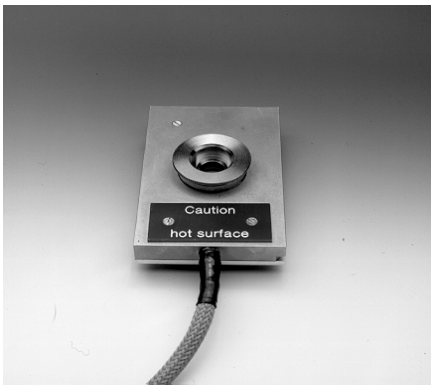
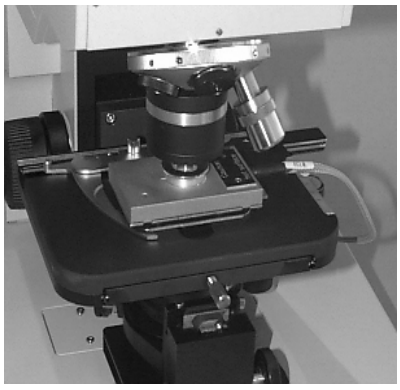


Figure 48: a) Heatable Sample Holder



b) Heatable Sample Holder installed

Caution: During operation, the sample holder becomes very hot. Do not touch! Can cause burns! Wait until the sample holder has cooled down sufficiently.

Figure 49: Temperature Controller

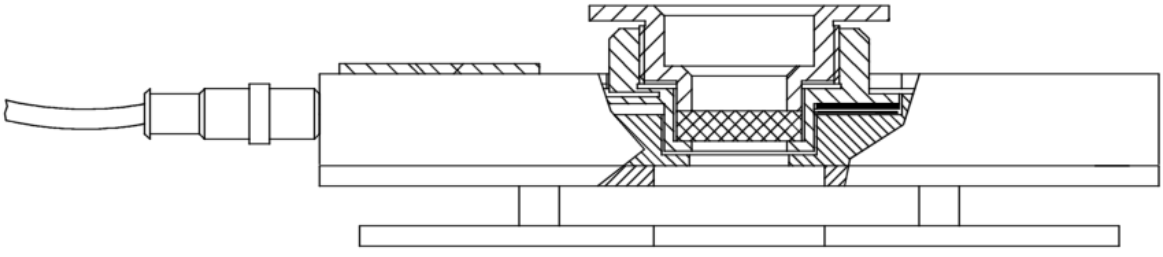


Figure 50: Cross Sectional View of Heatable Sample Holder

The temperature control unit uses a digital PID algorithm to control the temperature manually set. Indicators show the deviation from the set temperature. The heating cycle can be adjusted. The current temperature is sensed by a fast thin film Pt100 resistor and reported digitally. The heatable sample holder is placed on the standard x/y-stage. The sample is fixed in a 13mm diameter opening (standard pellet size). Smaller samples can be fixed on or sandwiched between IR–transparent discs (materials of low refractive index are preferable (e.g. KBr or NaCl) to reduce reflection loss and focus shift). Bruker recommends using only the 15x objective for these kinds of experiments. A threaded ring is supplied which can be used to compress a sample sandwiched between two discs, thereby reducing the sample thickness and the possible interference.

The sample holder is heated by the temperature control unit using a low voltage current. The sample holder and the temperature control unit are connected by a flexible cable. Optionally, a RS 232 interface for remote temperature control is available.

For specifications refer to appendix A.

LCD MONITOR

The HYPERION 2000 is equipped with a high resolution 5” color LCD monitor (figure 51a) that is situated at the microscope front. This option allows easy and real time control of the inspected sample area even during spectra data acquisition (only in simultaneous VIS/IR mode). For specifications refer to appendix A.

This option requires additional components: a color video camera, a video digitizer, the OPUS software and the software package OPUS/VIDEO (A 678-E). See chapter *General*.

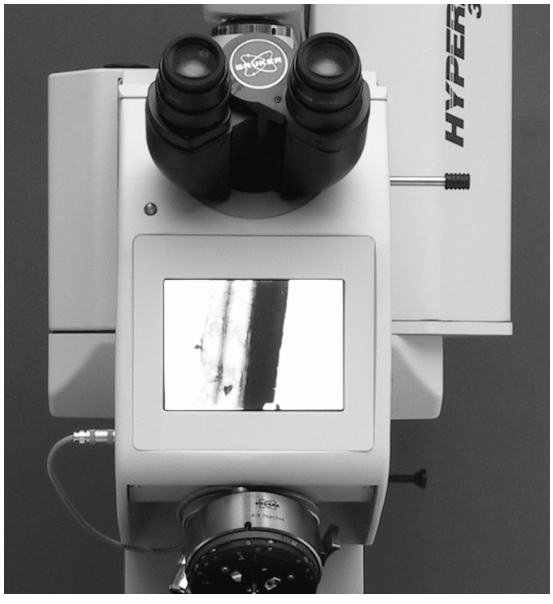


Figure 51: a) LCD Monitor b) Video Camera

VIDEO CAMERA AND VIDEO DIGITIZER

The video package (A 678-E) includes a color video camera (figure 51b) and video digitizer (PC card). The camera can be connected to the microscope using the camera port without any additional optics. However, a video adapter (A 678-V or A 678-VO) is required. If you wish to match the viewing field as seen through the binocular with the video display, an optical adapter (A 678-VO) is necessary.

POLARIZER

Both visible light polarizers and IR polarizers are available.

Note: The IR polarizer (A 675-P) requires the polarizing device for visible light (A 675) because it includes the rotatable mount for the IR polarizer.

The analyzer in position (A in figure 52) can be used for both measurement modes: transmittance and reflectance mode. For viewing the sample surface in reflectance mode using crossed polarizers, a second polarizer can be inserted at location (B in figure 52). To perform analysis with polarized light in transmittance mode, a second polarizer has to be inserted at location (C in figure 52). The holders are interchangeable and can be inserted at location (A), (B), or (C). For IR-spectroscopic measurements, usually one IR-polarizer either in position (A), (B) or (C) is sufficient.

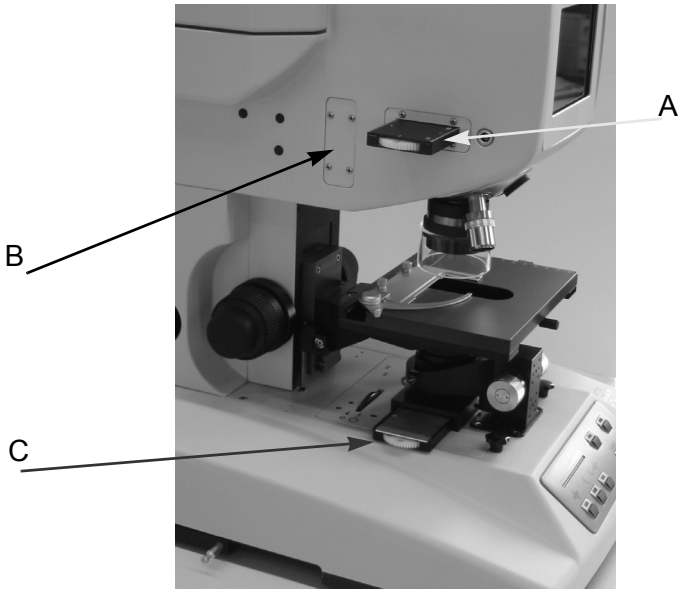


Figure 52: Polarizer Locations

If you have purchased the IR polarizer (A 675-P) separately, the polarizer must be inserted with the correct orientation into the rotatable mount of the polarizing device. Be careful not to touch the delicate grating structure on the polarizer crystal surface.

Warning: The polarizer material is KRS-5 (thallium bromide iodide), an extremely toxic substance. Observe the safety instructions on the packaging, and the safety data sheets attached. Non-observance may cause serious health problems or even death.

The polarizer holder has two positions, one for a visible light polarizer (A in figure 53) and the other for an IR polarizer (B in figure 53). The holder has “stops” (C in figure 53) so that each of the two possible polarizers (visible light or IR) can be placed in the optical path. When you insert the polarizer into the microscope the holder snaps noticeably into the corresponding position. In order to use non-polarized light the polarizers must be removed.

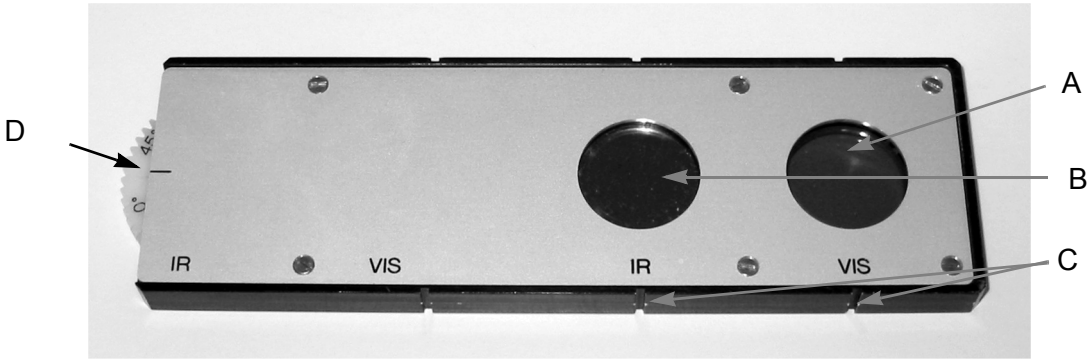


Figure 53: Polarizer (VIS and IR)

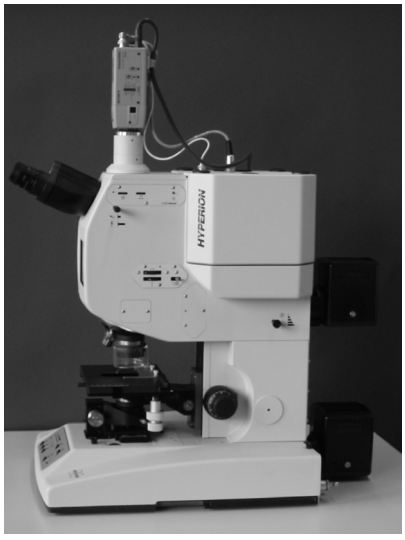
For enhanced sample visualization with visible light two polarizers (i.e. a polarizer in front of the sample and an analyzer behind the sample) are recommended. The first polarizer produces linearly polarized light. When this light goes through an anisotropic sample, the direction of polarization may change. The second polarizer can be rotated, using thumbwheel (D in figure 53), to permit polarized light to pass only in a certain direction. If the two polarizers are ’crossed’, (i. e. their polarization directions are perpendicular) an isotropic sample such as liquid will appear black. An anisotropic sample (e.g. an oriented polymer or many crystalline materials) will appear brightly colored. In transmitted light a single visible light polarizer can sometimes improve the image contrast. In reflected light a polarizer-analyzer pair will produce effects similar to those obtained in transmitted light if some or all of the light passes through at least one layer of the sample.

A single IR polarizer can be used to measure the dichroism of micro samples. Each anisotropic sample has two (or possibly three) independent infrared spectra, depending on the polarizing direction of the IR light in relation to the optical axis of the material. Measurements of IR dichroism can be used, for example, to determine the orientation of polymer fibers.

Note: Do not use an IR polarizer with a visible light analyzer or vice versa. Both elements must be intended for the same wavelength range. When you perform a measurement, ensure that the VIS polarizer is not inserted into the measurement position.

ACCESSORY / SPECTROMETER PORT

The HYPERION is equipped with two IR beam entry ports, one on the left side and the other on the right side of the microscope. The spectrometer can be connected either to left or the right microscope entry port using an adapter. The unused port can be used to connect an accessory (e.g. for the IMAC) to the microscope. In this case, the IR beam goes through the microscope without passing the microscope imaging optics. If no accessory is connected to the microscope, this port is covered with a flange cap.



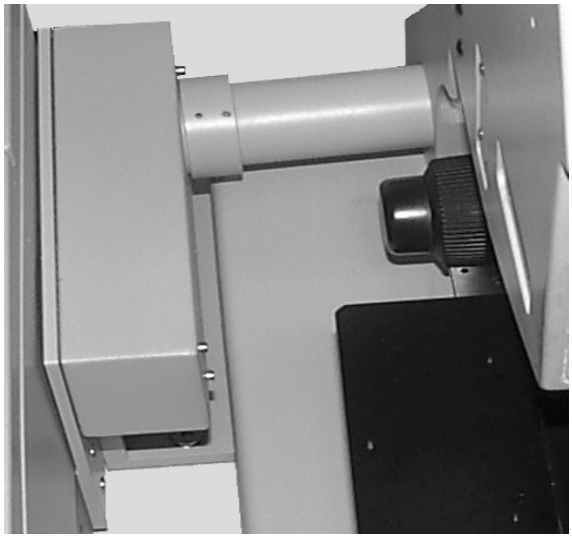
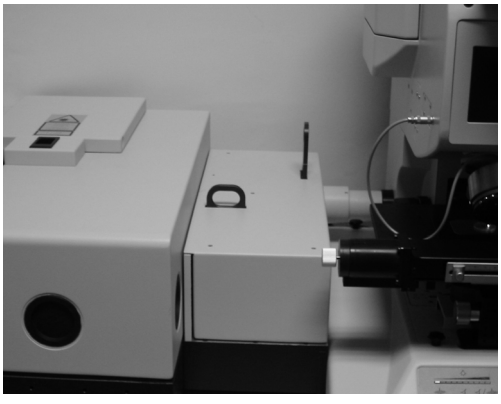


Figure 54: a) Accessory Port with Flange Cap b) HYPERION1000/2000 connected to Spectrometer



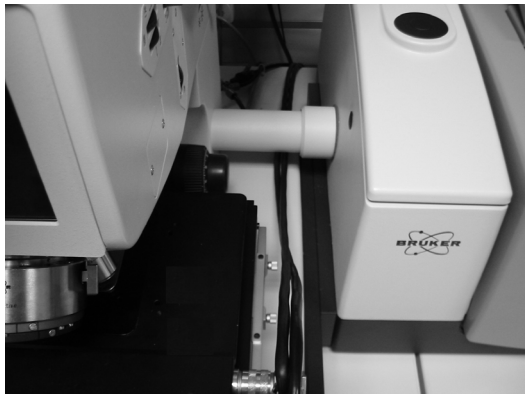


Figure 55: a) HYPERION 3000 connected to Spectrometer b) IMAC connected to HYPERION 3000

EXTERNAL SAMPLE CHAMBER

The external sample chamber (IMAC) (figure 56) is designed for spectral measurements of large sample areas. IMAC is supplied with a sample holder for transmittance measurements. This sample holder is adjustable in x and y-direction. For reflectance measurements we recommend the reflectance accessory (A 517-P/Q) and/or the ATR unit (A 529-S/Q) (not available in the U.S.). These measurement accessories can easily be exchanged due to the QuickLock base plate. (See the spectrometer User Manual.) Further requirements for IMAC are listed in appendix B.

Note: The reflectance accessory and the ATR unit have to be modified before they can be installed into the IMAC.

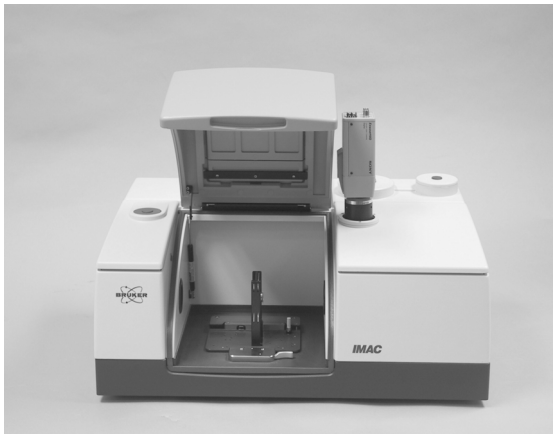


Figure 56: External Sample Chamber (IMAC)

FLUORESCENCE OPTION

The fluorescence option (A 674) includes the following components:

- Dichroic mirror (505nm)
- Excitation filter (420 - 490nm)
- Emission filter (520 - 1100nm)
- Compensation plate
- Lens assembly (eliminates stray light)
- 2 x Cover frames

Note: The dichroic mirror, the emission filter and a lens assembly are factory-installed or installed in the field by a Bruker service engineer.

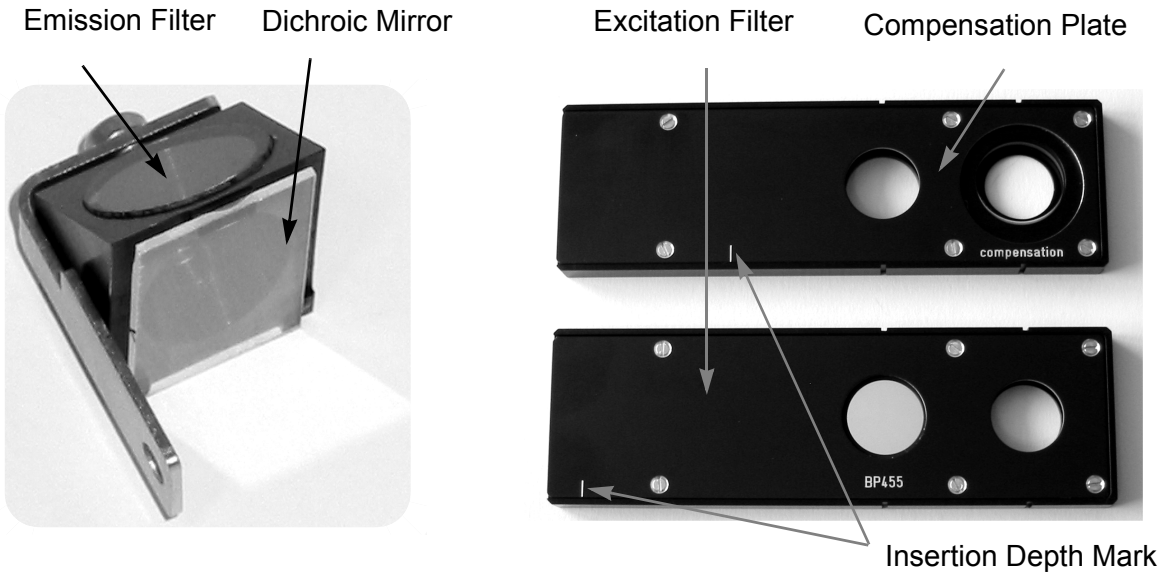


Figure 57: Components of the Fluorescence Option

The fluorescence option (A 674) allows viewing a fluorescent sample in reflection mode using the visible light of a tungsten lamp. The visible light is blue-filtered by the excitation filter to excite the sample with higher-energy light, called excitation light. (The excitation filter is placed prior the dichroic mirror.) The sample (or dye in the sample) converts the blue, higher-energy light into lower-energy light (e.g. green-yellow) and fluoresces (i.e. the sample emanates fluorescence light). The emission filter eliminates the blue excitation light from the fluorescence light. The dichroic mirror has two functions: it reflects the blue excitation light and it transmits the green-yellow fluorescent light, i.e. it separated excitation and emission light path. See the following figure.

Note: The compensation plate eliminates a vertical shift of the sample observed in the fluorescence mode with respect to the IR or VIS/IR-mode.

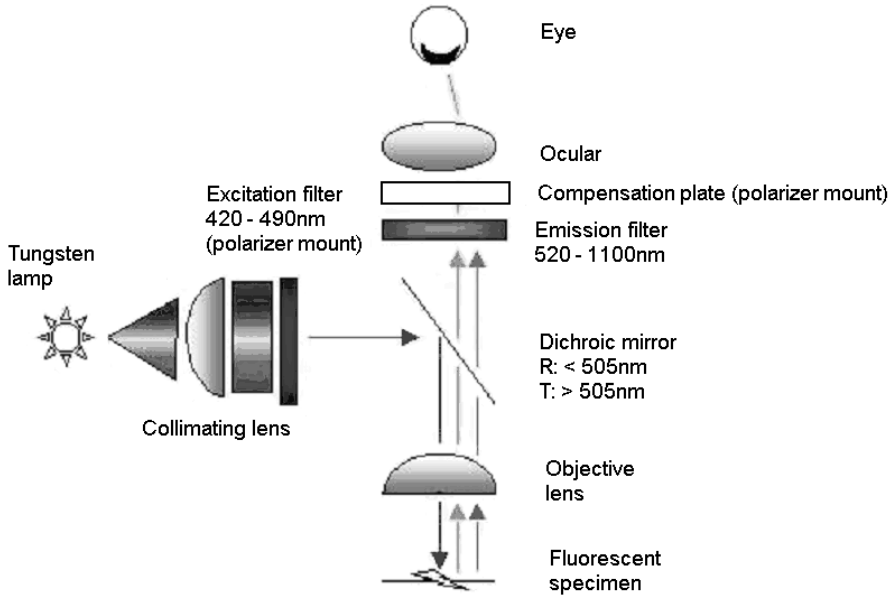


Figure 58: Light Path - Fluorescence Option

The figure 59 shows the slots for inserting the excitation filter and the compensation plate. The correct insertion depth is indicated by a white mark on the excitation filter and the compensation plate. See figure 57.

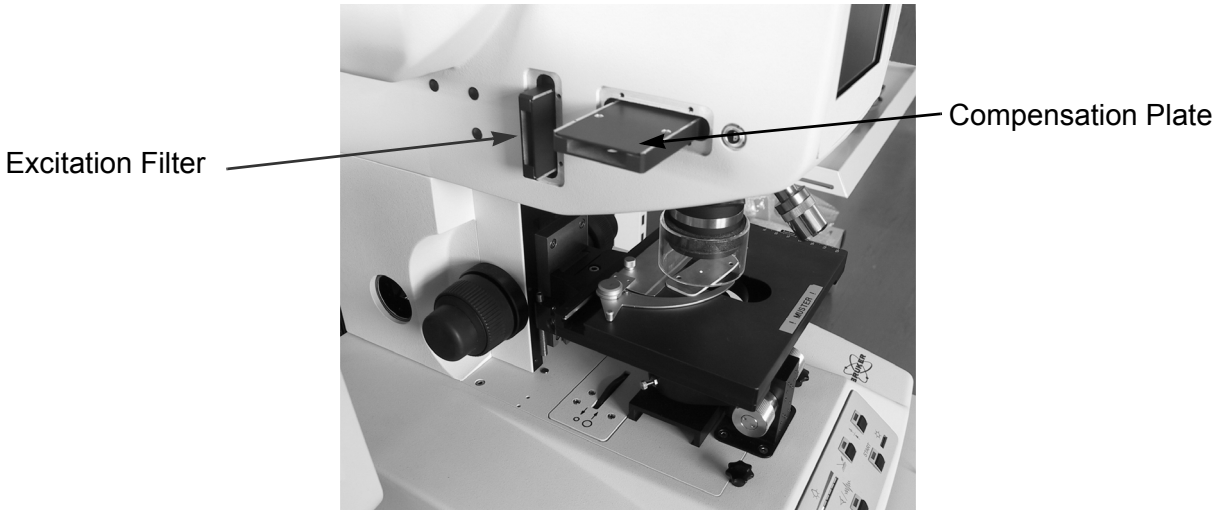


Figure 59: Insertion Positions

Note: If necessary, install the two supplied cover frames at the slot openings.

ACCESSORY BOX

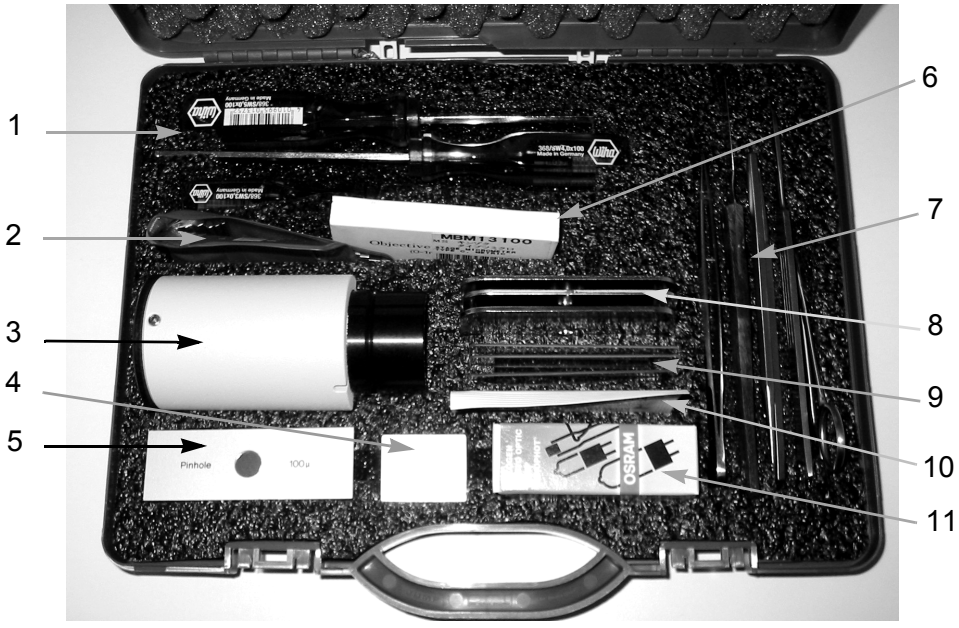


Figure 60: Content of the Accessory Box

Number	Component
1	3 x ball hex drivers (3mm, 4mm, 5mm)
2	Allen wrench set
3	Camera adapter (tube)
4	Plane mirror 30 x 24 x 3 (aluminium)
5	Pinhole (100µm)
6	Stage micrometer (for HYPERION 2000 and 3000)
7	Sample preparation tools (e.g. a pair of scissors, pincers, spatula)
8	3 x Specimen carrier (diameter: 5mm, 10mm, 17mm)
9	3 x Microscope slides 76 x 26 x 1
10	2 x KBr windows (diameter: 13mm, thickness: 2mm)
11	Halogen lamp, 12V, 100W, OSRAM

MISCELLANEOUS ACCESSORIES

Plexiglas Purge Housing

The optional Plexiglas purge housing (A 684-3) allows purging with dry air or nitrogen gas to minimize the interference of water vapor and CO_2 absorption.

Compression Cells

The following compression cells are available for the use with the IR-microscope:

- Micro compression cell *Diamond EX-Press* (low pressure) - A 565-S1
- Micro compression cell *Specac* with KBr window (low pressure) - A 565-S2

These compression cells are used to flatten materials (e.g. rubber, plastics, polymers). By applying pressure on a sample using one of these cells, the sample is thinned to an uniform thickness across the measuring area to ensure maximum throughput without detector saturation.

Miniature Sample Holder

The miniature sample holder is designed to hold individually shaped samples for microscope study. Its mode of functioning is comparable with a vise.

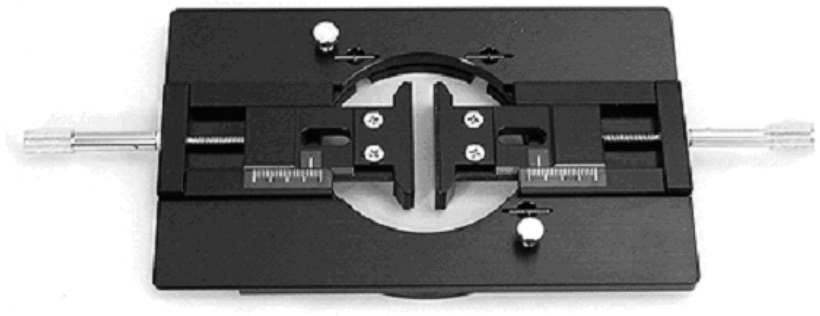


Figure 61: Miniature Sample Holder

The following figures illustrate the possible fields of application:

- Round samples can be clamped.
- Oblique samples can be adjusted.
- Samples can be stretched.

Figure 62: Ways of clamping a Sample in the Miniature Sample Holder

7 Maintenance and Repair

The HYPERION microscope is a low-maintenance instrument. Evacuating the MCT detector is the only maintenance work that has to be performed in case the need arises. All other works are required only if the component in question is defect.

This chapter describes the following maintenance and repair procedures:

- Evacuating the MCT detector
- Replacing the light bulb
- Replacing the fuses
- Replacing the power cord
- Cleaning the microscope

Perform only the maintenance and repair works which are described in this manual. Adhere strictly to the described procedures and observe all relevant safety precautions. Otherwise, personal injury and/or instrument can be the result. In this case, Bruker does not assume any liability. Maintenance and repair works that are not described in this manual have to be performed by the Bruker service. (For service addresses and telephone numbers refer to appendix F.

Evacuating the MCT Detector

The liquid nitrogen-cooled MCT detector is mounted in a re-pumpable vacuum dewar (except for those which are sealed permanently). Evacuating the detector dewar becomes necessary if the hold time decreases considerably (i.e. a hold time of less than four hours). The existence of condensation water on the detector outside indicates that the dewar must be evacuated soon. If there is frost on the detector outside the dewar must be evacuated immediately. Before evacuating the dewar, the detector must be removed from the microscope and warmed-up to room temperature.

To evacuate the dewar the following evacuating equipment is required:

- turbo molecular pump / oil-free high-vacuum pump (that generates an vacuum of at least < 10^{-5}mbar)
- vacuum adapter

Note: Bruker offers both suitable evacuating equipment (# S105-V) and the service of evacuating the MCT detector (# D128). So if you do not have suitable evacuating equipment at your disposal you can send in the complete MCT detector at Bruker.

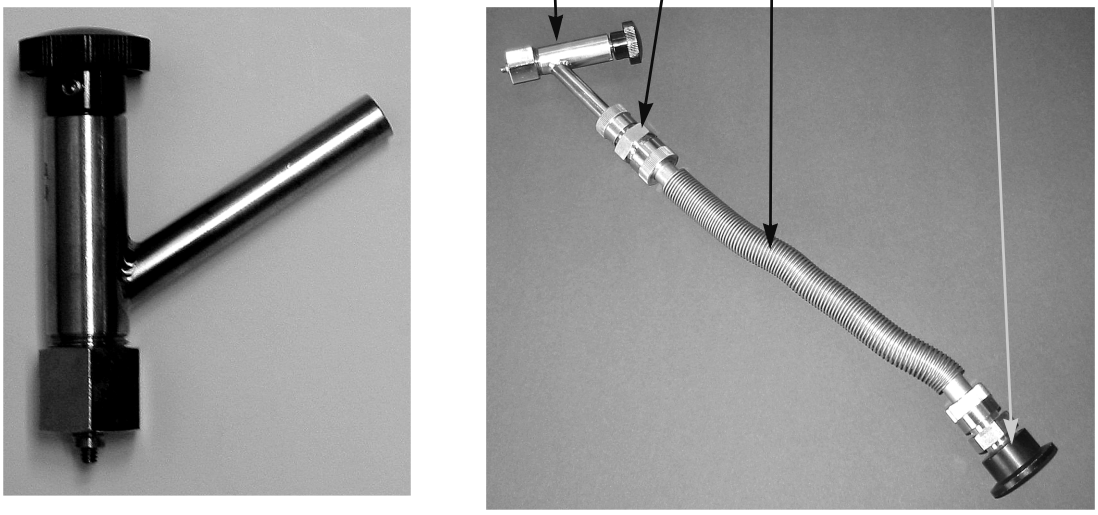


Figure 63: a) Vacuum Adapter b) Vacuum Adapter with flexible Metal Hose and Flange

	Component
A	Vacuum adapter
B	Flange
C	Flexible metal hose
D	NW 25 flange

Evacuation Procedure:

1. Remove the MCT detector from the microscope.
2. Connect the connecting piece of the vacuum adapter (E in figure 64) to the vacuum pump. (The connecting piece has an OD of 9.7mm.)
3. Pull the knob (H in figure 64) to the open position and loosen the coupling nut (A in figure 64).
4. Push the vacuum adapter carefully over the connection nozzle of detector dewar and fasten the coupling nut finger-tight. Additional tightening is not necessary.
5. Push the knob in the closed position until the threaded rod (D in figure 64) of the vacuum adapter is in contact with the dewar evacuation valve.
6. Screw the threaded rod in the evacuation valve closure of the dewar by turning the knob clockwise; 2 to 3 rotations are sufficient.
7. Evacuate the vacuum adapter using the vacuum pump.

Note: The dewar must not contain any liquid nitrogen and must be at or slightly above room temperature (max. 60°C).

8 Pull the knob to the open position in order to open the dewar evacuation valve. Evacuate the detector dewar using the vacuum pump.

Note: Evacuating the dewar takes several hours. Therefore, it is recommendable to evacuate the dewar overnight. The final pressure in the dewar should be less than 10^{-5} mbar.

9 When the desired vacuum is achieved, push the knob to the closed position in order to close the dewar evacuation valve.

10 Vent the section between vacuum pump and vacuum adapter.

11 Rotate the knob several turns counterclockwise in order to screw the threaded rod off the dewar evacuation valve. Be careful not to vent the dewar.

12 Pull the knob to the open position, loosen the coupling nut and remove the vacuum adapter from the connection nozzle of the dewar.

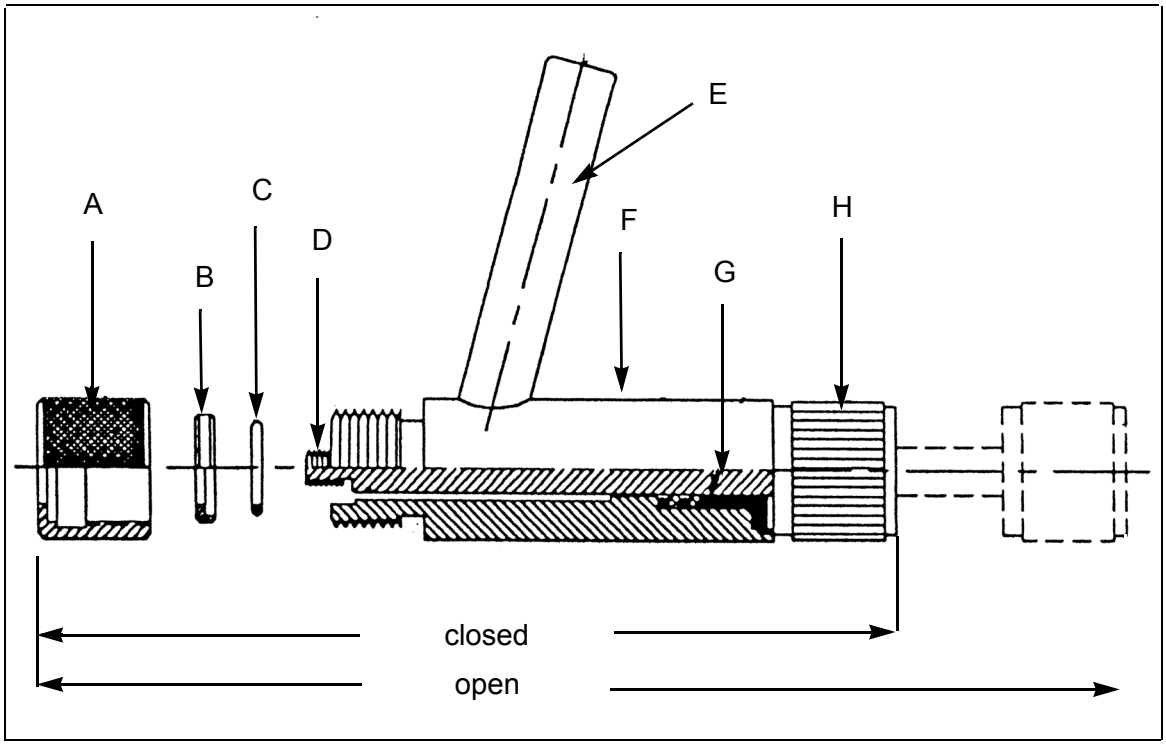


Figure 64: Vacuum Adapter - Cross Section

	Component
A	Coupling nut
B	O-ring retainer
C	O-ring
D	Threaded rod (to remove the valve closure of the detector dewar)
E	Connecting piece for vacuum pump (OD = 9.7mm)
F	Vacuum adapter
G	Washer and O-ring packing
H	Knob

REPLACING THE BULB

Safety Notes

The estimated lifetime of the bulbs is >1000 hours. If there is no illumination after adjusting the light intensity control through its full range, a bulb replacement is necessary.

Caution: The quartz halogen bulb is sensitive to contaminations. For this reason, put on non-contaminating gloves before touching the replacement bulb. Fingerprints or other contaminations on the bulb can significantly reduce its lifetime.

Warning: During operation the light bulb become very hot. Risk of burns! Do not touch it! Wait at least 30 minutes after having turned off the power before removing the bulb.

Figure 65: Light Source - Warning Label

Replacement Procedure

HYPERION is equipped with two light bulbs (one for the transmittance mode and the other for the reflectance mode). They are at the microscope rear side. See figure 4. The replacement procedure is identical for both light bulbs.

Proceed as follows:

1. Switch off the microscope, i.e. turn the main power switch (A in figure 67) to the “O“ position.
2. Unplug the power cable from the microscope.

Warning: First switch off the microscope and unplug the power cable before starting any maintenance work. Otherwise, there is the risk of electric shock.

3. Wait until the bulb housing has cooled down sufficiently.
4. Remove the screw attaching the bulb housing to the microscope.
5. Pull out the bulb housing carefully. Do not twist or cant the housing while removing it.
6. Put the housing on a flat surface and unscrew the screw (A in figure 66a). Remove the housing from the bulb holder.
7. Press down the two spring clips (B in figure 66b) that grip the two electrical leads on the bulb while taking the bulb out of the holder.
8. Inspect the bulb and the filament. If necessary, measure the ohmic resistance across the two spring clips (C). A resistance of about 0.3 ohms indicates an intact bulb. If the resistance exceeds this value significantly, the bulb needs to be replaced. In case the measured resistance indicates an intact bulb but the bulb does not light the cause of the problem is something else.
9. Press down the two spring clips (B in figure 66b) and insert the two leads of the new bulb. Ensure proper contact between the spring and the leads. The bulb must be aligned vertically to the base. Do not tilt the bulb to the front. Do not touch the glass bulb!
10. Place the upper part of the bulb housing over the bulb holder.
11. Tighten the screw (A in figure 66a) to secure the bulb holder to the box housing.
12. Attach the box to the microscope and align the two pins with the holes on the backside of the microscope by inserting the pins into their corresponding hole to secure the bulb housing to the microscope.
13. Tighten the attaching screw to mount the bulb housing to the microscope.
14. Reconnect the power cable to the microscope.
15. Switch on the microscope.

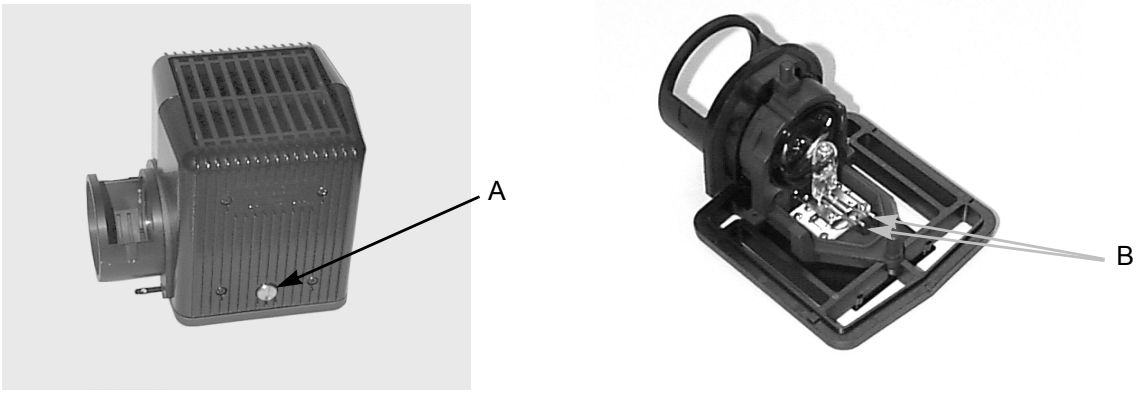


Figure 66: a) Bulb Housing b) Bulb Holder

REPLACING THE FUSES

If the LEDs on the control panel do not light although the microscope is switched on (assuming the power supply is sufficient) the main power supply fuses may be blown. In this case the fuses must be replaced. They are located on the microscope rear side.

Figure 67: Fuses Location

Proceed as follows:

1. Turn the main power switch (A in figure 67) to the “Off“ position (“O“ position).
2. Unplug the power cable from the microscope.

Warning: First switch off the microscope and unplug the power cable before starting any maintenance work. Otherwise, there is the risk of electric shock.

3. Find the fuse holder assembly (B in figure 67).

4 Insert a small flat ended screwdriver into the slot (C in figure 67).

5 Gently raise the screwdriver to release the spring clip holding the fuse holder assembly. Now open the assembly.

6 Remove the two defective fuses and install two new ones (5x20mm, with a rating of 4AF, fast blow).

7 Press the fuse holder assembly against housing until the spring clip locks into place.

8 Reconnect the power cable to the microscope.

9 Turn on the power switch.

Note: Recommended fuses are WICKMANN series 191, 4.00AF, order code 191 1400 002, for a set of 10 fuses (www.wickmannusa.com). Alternatively, order single fuses (part no. 2277) at Bruker.

REPLACING THE POWER CORD

If there are any visible damages to isolation, connectors or cable, replace the power cord. Do not try to repair it. Use only replacement power cords rated for at least 250V AC, 10A and approved by your local safety standards: UL (USA), CSA (Canada) or TÜV (Europe).

CLEANING THE MICROSCOPE

Clean the microscope only with a dry or a damp cloth. Do not use detergents containing organic solvents, acids or bases.

Warning: Do not clean the microscope interior. This can lead to serious microscope damages.

TROUBLESHOOTING

8

This section describes the most common potential microscope problems, their possible causes and recommended solutions.

Depending on how a problem becomes apparent, they are subdivided into the following categories:

- No or dark field of view in the binocular
- No video image and /or no LCD image
- No IR signal
- Problems with the sample stage step motors
- Mapping problems
- Problems with the FPA detector

If the recommended solutions do not solve the problem, contact your local BRUKER service. For service addresses and telephone numbers refer to appendix F.

No or Dark Field of View in the Binocular

GENERAL CAUSES

Possible Cause	Solution
All light is routed to the video port.	Check the knob position of the visible light routing control. (See figure 9.)
Visible light intensity is too low.	Increase the visible light intensity using the thumb wheel. (See 3 in figure 6.)
Wrong measurement mode is selected.	Check the transmittance and reflectance mode buttons. (See figure 5.)
Defective bulb	Check the bulb. Replace it, if necessary. (See chapter *Maintenance*).
IR polarizer is in the optical path.	Remove the IR polarizer. Ensure that either no polarizer or only the VIS polarizer (not the IR polarizer) is in the optical path.

IN TRANSMITTANCE MODE

Possible Cause	Solution
Sample is not transparent.	Use a thinner sample or a compression cell.
Stage or sample holder block the beam	Check the optical path for objects blocking the beam.
Condenser is not aligned properly.	Align the condenser. (See chapter *Maintenance*, section *Check Signal*.)
Köhler aperture is closed.	Check the Köhler aperture knob position. (See 1 in figure 8 and figure 11.)

IN REFLECTANCE MODE

Possible Cause	Solution
Sample is not positioned properly.	Reposition the sample into focus.
Sample does not reflect light.	Try to find a sample area with better reflective characteristics.
Köhler aperture is closed.	Check the Köhler aperture knob position. (See 1 in figure 8 and figure 11.)

No Video Image and/or no LCD Image

Possible Cause	Solution
LCD monitor is not switched on.	Switch on the LCD monitor. (See 3 in figure 8.)
All light is routed to the binocular.	Check the knob position of the visible light routing control. (See figure 9.)
Video camera is switched off.	Switch on the video camera.
CCD of the video camera is saturated.	Reduce the visible light intensity using the thumb wheel. (See 3 in figure 6.)

No IR Signal

GENERAL CAUSES

Possible Cause	Solution
Wrong measurement channel	Check the settings in the OPUS dialog window *Set Optic Parameter*.
MCT detector is not cooled down.	Cool the detector with liquid nitrogen. See chapter *Operation*.
Detector is oversaturated	Use a smaller aperture to reduce the signal intensity.
Sample is not positioned properly.	Reposition the sample in the VIS mode.
Wrong measurement mode is selected	Check the transmittance and reflectance mode buttons. (See figure 5.)
VIS polarizer is in the optical path.	Remove the VIS polarizer. Ensure that either no polarizer or only the IR polarizer (but not the VIS polarizer) is in the optical path.
Aperture is closed	Open the aperture until a sufficient signal is obtained.
4x objective is used.	The 4x objective is not suitable for IR measurements.
Spectrometer problems	Consult the spectrometer manual.

IN TRANSMITTANCE MODE

Possible Cause	Solution
Köhler aperture is closed.	Check the Köhler aperture knob position. (See 1 in figure 8 and figure 11.)
Condenser is not aligned properly.	Align the condenser. (See chapter *Maintenance*.)
Sample is not transparent.	Use a thinner sample or a compression cell.

IN REFLECTANCE MODE

Possible Causes	Solutions
Sample does not reflect light.	Try to find a sample area with better reflective characteristics.

Stage Step Motor Failure

Possible Cause	Solution
Stage motors are not calibrated.	Calibrate the sample stage using the OPUS/MAP software. (See OPUS/MAP manual.)
Video camera is not aligned.	Move the stage horizontally while monitoring the video image. The stage edge should travel exactly parallel to the grid of the screen. If the camera is out of alignment turn the camera slightly around its vertical axis until it is aligned exactly.

Mapping Problems

Possible Cause	Solution
Stage motors are not calibrated.	Calibrate the sample stage using the OPUS/MAP software. (See OPUS/MAP manual.) After calibrating the stage motors never try to move the stage manually.
Parameters of the previous measurement are still loaded.	Check the experiment parameters set in the OPUS software. Clear the parameters of the previous measurement, if necessary.
No integration method is selected.	If the integration mode is selected, an integration method must be selected or setup as well. See the OPUS software manual.

Problems with the FPA detector

FPA DETECTOR CANNOT COMMUNICATE WITH CAMERA HEAD

The following error message appears: *Unable to communicate with camera head. Check connection*.

Possible Cause	Solution
FPA detector is not switched on.	Switch on the FPA detector.
FPA detector is not connected at all or not correctly.	Check the cable connection to the detector as well as to the computer. Ensure that the data transfer cable is connected to correct PC serial interface.
FPA detector has been switched on before booting up the PC.	Close the software. Switch the detector off and on again. Restart the software.

NO DETECTOR SIGNAL

Possible Cause	Solution
FPA detector has warmed up.	Refill liquid nitrogen.
Wrong measurement channel.	Check the measurement experiment.
Imaging optics has not been selected. (When restarting the microscope the single element detector is selected automatically.)	Select the imaging optics using the OPUS software.
Wrong measurement mode (reflectance mode instead of transmittance mode).	Press the transmittance mode button on the microscope control panel.
Wrong mode (VIS mode instead of IR mode).	Press the IR button on the microscope control panel.

LOW SIGNAL INTENSITY

Possible Cause	Solution
Beam attenuator in optical path.	Remove beam attenuator.
Condenser is not aligned properly (transmittance measurements using the microscope).	Align the condenser. (See chapter *Maintenance*.)
Köhler aperture is closed (transmittance measurements using the microscope).	Open the Köhler aperture.
Aperture in the spectrometer has not been opened sufficiently.	Always open the aperture completely when performing a measurement using the FPA detector.

UNUSUAL SPECTRAL CURVES

Possible Cause	Solution
Data have been acquired up to the convolution limit of 3900cm^{-1} without using an optical filter.	Use an optical filter.
A glass polarizer has been in optical path during measurement.	Remove the glass polarizer.

DETECTOR OVERSATURATION (EVEN AT HIGHEST FREQUENCY; IMAC)

Possible Cause	Solution
IR intensity is too high.	Use a beam attenuator.

A

SPECIFICATIONS

MICROSCOPE

Specifications	HYPERION 1000/2000	HYPERION 3000
Dimensions	38cm (W) (+ 7cm for adapter) x 60cm (D) x 82cm (H) (with video camera)	38cm (W) (+ 17cm for adapter) x 80cm (D) x 92cm (H) (with video camera)
Weight	35kg	45kg
Power Consumption	115 / 230V; 60 / 50 Hz; 70W (typical); 200W (max.) fuses: 4.0A, fast	
Spectral Range	600 to 7,500cm^{-1} (extended spectral range is optional)	
Spectral Resolution	depends on the connected FT-IR spectrometer	
Measured Area	Optimized for a diameter of 250µm; minimum diameter of 20µm with the standard objective	
Adjustment Accuracy	± 1µm in the measured spot	
Temperature Range	18°C to 30°C (64°F to 86°F)	
Humidity	less than 70% relative humidity	

OBJECTIVES

Objective	Objective Magnification	Visible Magnification	Numerical Aperture	Working Distance* (in mm)
4x viewing objective	4x	57x	0.1	21
40x viewing objective	40x	572x	0.65	0.6
15x IR objective	15x	215x	0.4	24
36x IR objective	36x	515x	0.5	10
ATR objective	20x	286x	0.6	6**
GIR objective	15x	215x	0.4	0.8

* Distance between sample and objective

** Distance between sample and crystal

15x and 36x Objective

Aperture Diameter (in mm)	**Measuring Area Diameter (in µm) with 36x objective**	**Measuring Area Diameter (in µm) with 15x objective**
0.30	8.3	20.0
0.45	12.5	30.0
0.60	16.7	40.0
0.75	21.0	50.0
0.90	25.0	60.0
1.20	33.0	80.0
1.50	42.0	100.0
1.80	50.0	120.0
2.10	58.0	140.0
2.50	69.0	170.0
3.00	83.0	200.0
3.75	104.0	250.0

ATR Objective

ATR crystal material	Ge; refraction index = 4
Pressure	0.5 to 8 Newton (5 pressure modes)
Diameter of the ATR crystal tip	ca. 100µm

SAMPLE HOLDER

Temperature-controlled Sample Holder (Linkam)

Temperature Range	-196^{o}C to 600^{o}C (For temperatures below room temperature, liquid nitrogen is required.)
Sample Size	diameter: max. 22mm thickness: 1.5mm
Sample Movement Range	16mm x 16mm
Required Working Distance	min. 4.5mm
Sample Mounting	Samples are inserted from the side of the stage
Spectral Range	750cm^{-1}(BaF_2 window) – visible

Heatable Sample Holder

Maximum Temperature Rating	**180 ^{o}C**
Temperature variation	1^{o}C at 150 ^{o}C
Maximum sample diameter	13mm
Sample stage dimensions	75mm x 50mm x 10mm
Temperature control unit dimensions	260mm x 150mm x 270mm
Cable length	~ 50cm
Power requirements	115 / 230V, 100W, 50/60Hz

LCD MONITOR

Specification	Value
Resolution	320x234
Input signal	according PAL
Operating temperature	between 0°C and 60°C
Max. brightness	200cd/qm
Contrast ratio	120
Operating voltage	between 10 and 30V

B

CONSUMABLE SPARES

Part #	Description
1001653	Specimen slides made of CaF_2 for MIR measurements up to 1200cm^{-1} dimension: 20mm x 20mm, thickness: 1mm, packet of 5
1001651	Specimen slides made of BaF_2 for MIR measurements up to 900cm^{-1} dimension: 20mm x 20mm, thickness: 1mm packet of 5
A682A	Plane mirror coated with aluminum, dimensions: 30mm x 24mm x 3mm packet of 5
A682G	Plane mirror coated with gold, dimensions: 30mm x 24mm x 3mm packet of 5

C

OPTICAL PATH

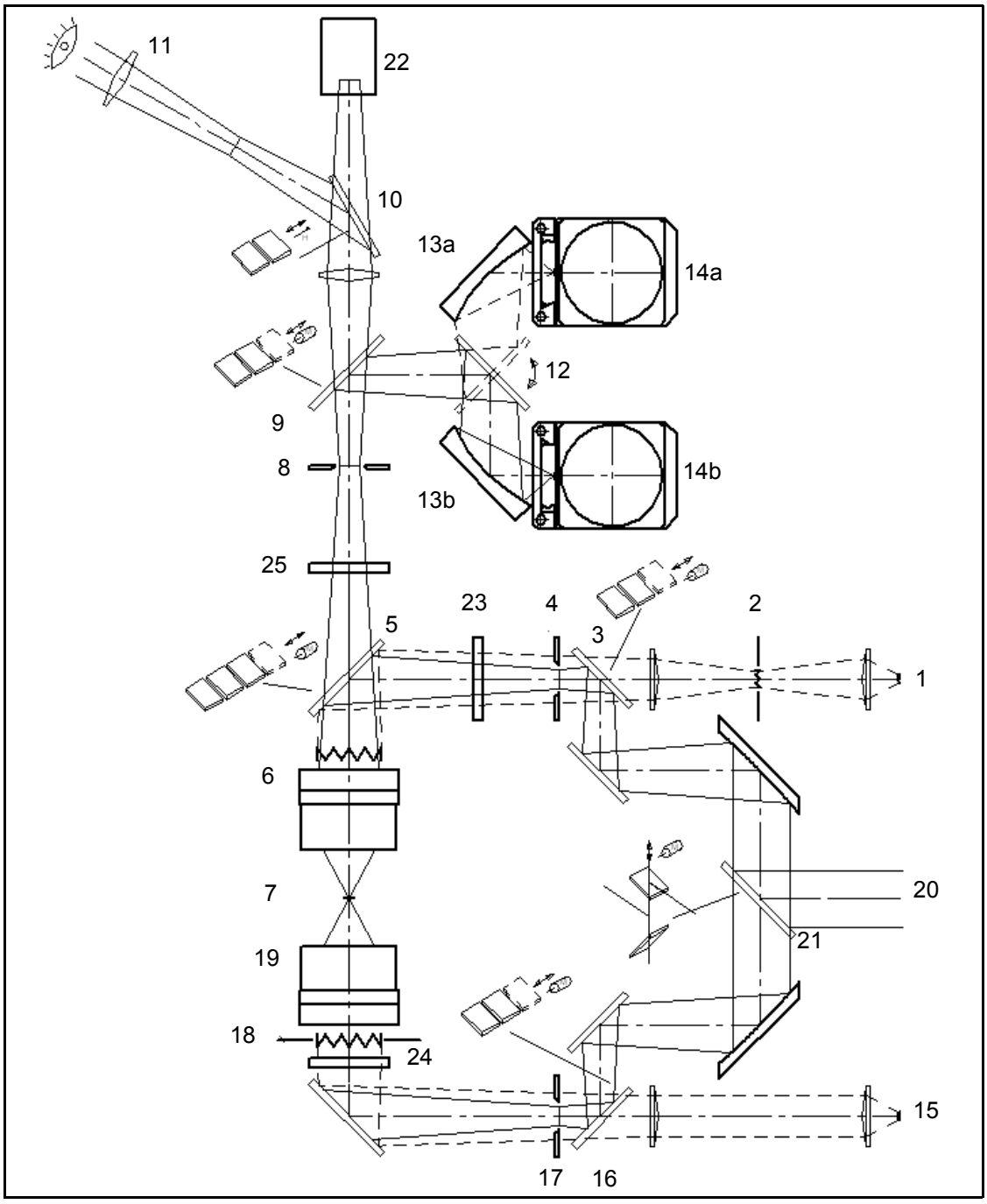


Figure 68: HYPERION 1000 and 2000 - Optical path showing both reflectance and transmittance path

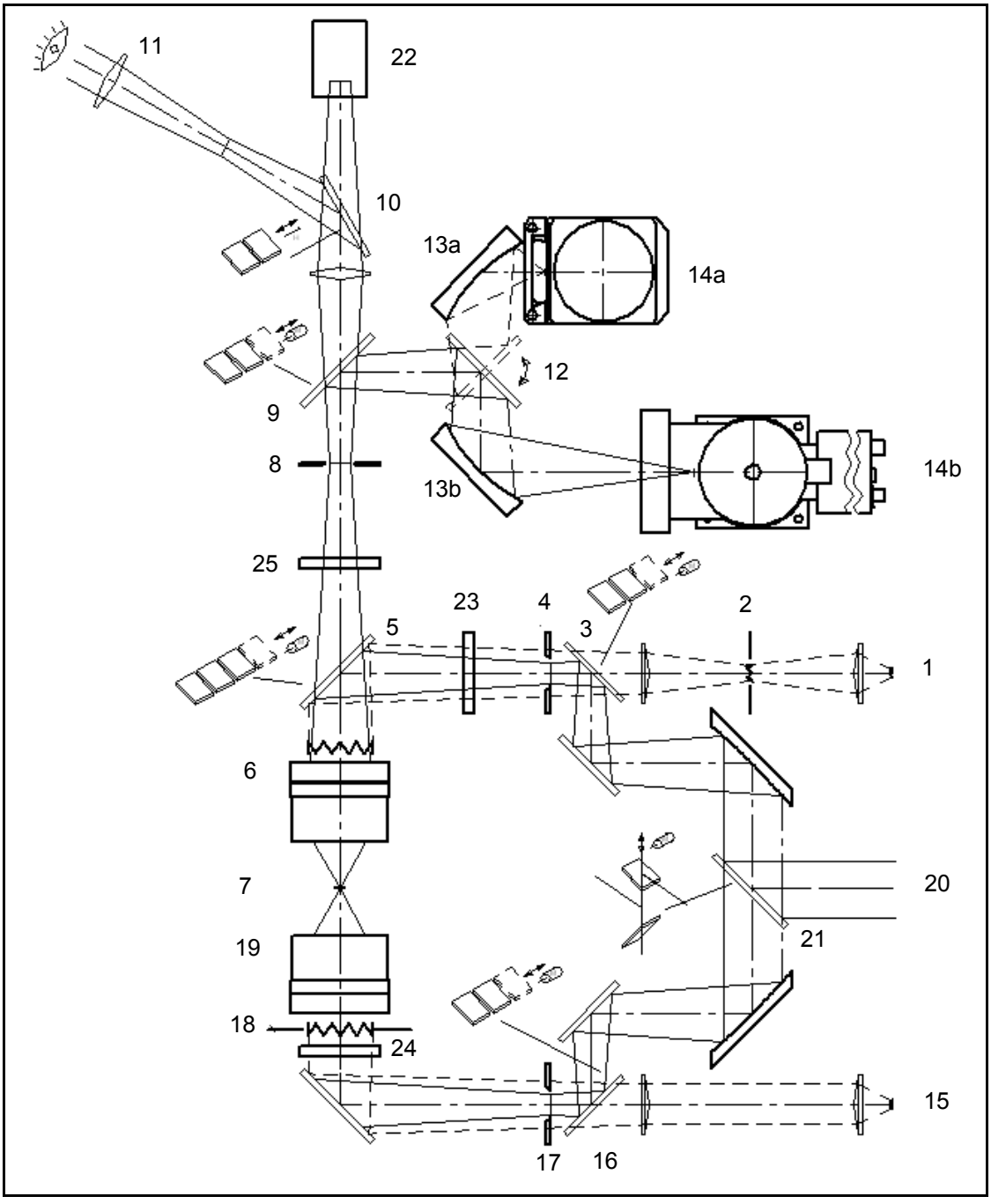


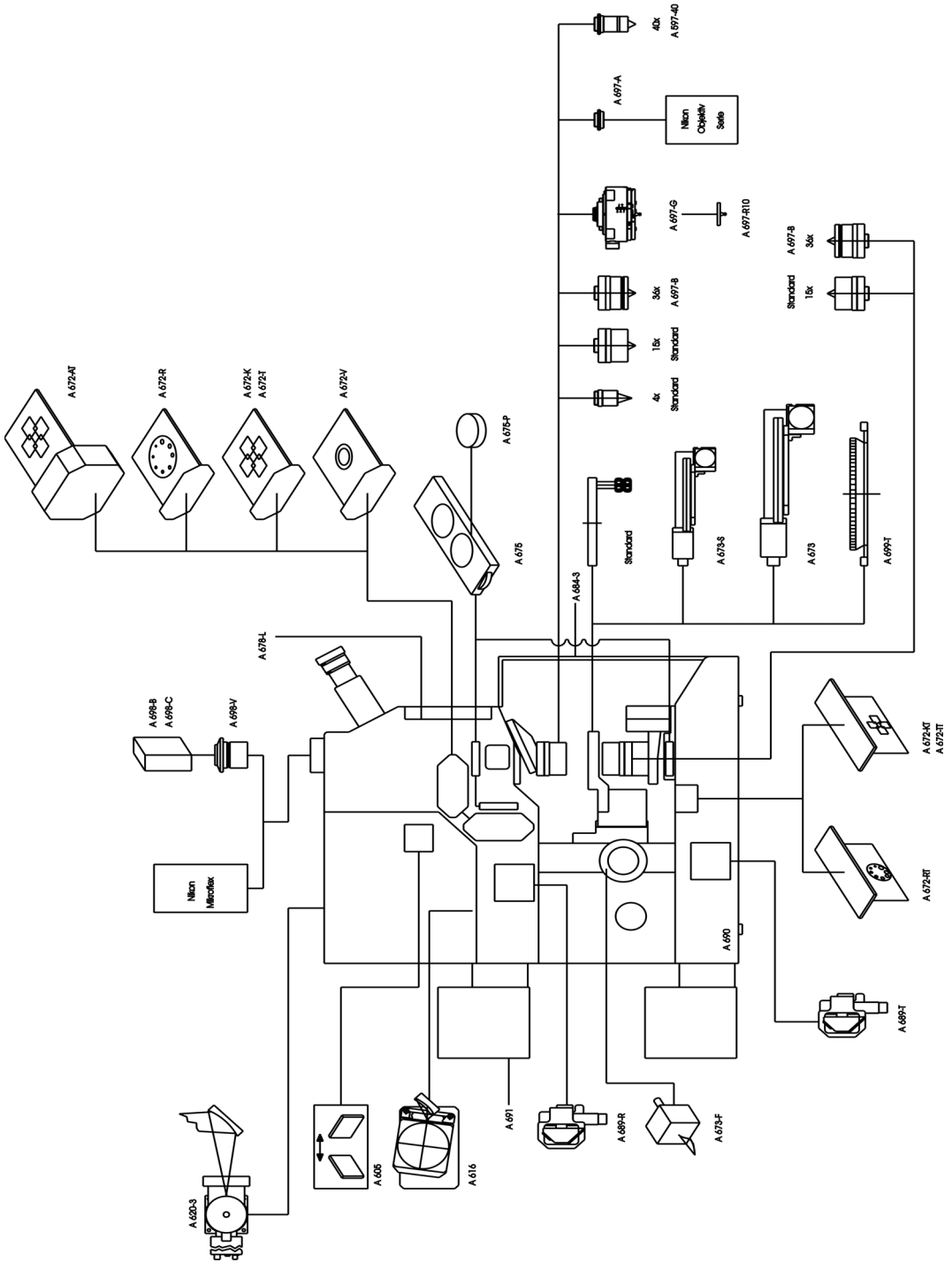
Figure 69: HYPERION 3000 - Optical Path showing both Reflectance and Transmittance Path

Number	Component and Description
1	Visible light source (reflectance mode).
2	Köhler aperture: to control the visible light intensity and the contrast in the reflectance mode. The knob for the iris diameter adjustment is situated on the right side of the microscope. (See figure 9).
3	Three position motorized changer. 1) Only visible light can pass. 2) Only IR light can pass. 3) Both visible light and IR light can pass. A beam splitter (Option A689-R) is required.
4	Aperture: to define the measurement area in reflectance mode.
5	Four-position motorized changer. 1) Transmittance mode (open). 2) Reflectance mode (glass beamsplitter), for visible light. 3) Reflectance mode for IR (measurement) and VIS/IR (viewing and measurement) (50% of the light is reflected by a mirror) 4) Dichroic mirror that transmits only fluorescent light for fluorescence option
6	Objective (15x IR and 4x visual objective - standard).
7	Sample
8	Aperture (normal or automatic knife edge aperture): to define the sample area for the analysis (transmittance or reflectance mode).
9	Three-position motorized changer. 1) Viewing only - an opening allows visible light to reach the binocular eyepiece or the camera port. 2) Spectral data acquisition - IR beam is routed **only** to the detector using a mirror. 3) Simultaneous viewing and spectral data acquisition (optional). The IR beam is directed to the detector, while the visible light is routed to the binocular eyepiece or the camera port.
10	Two-position manual changer. 1) All light goes to the binocular eyepiece (11). 2) All light goes to the camera port (22).
11	Binocular eyepiece: to view the sample.
12	Two-position detector selection mirror: routes IR beam to detector 1 (14a) or optional detector 2 (14b).
13a	Mirror: routes IR beam to detector 1 (14a).
13b	Mirror: routes IR beam to detector 2 (14b).
14a	Infrared detector
14b	IR detector or FPA detector (optional)

Number	Component and Description
15	Visible light source for transmittance mode.
16	Three-position motorized changer. 1) Only visible light can pass. (hole) 2) Only IR light can pass. (mirror) 3) Both visible light and IR light can pass (Option A689-R). This option includes a beamsplitter.
17	Field aperture (see component no. 8.)
18	Aperture for transmittance mode: to define the numerical aperture of the illumination. (See component no. 2, but transmittance mode.)
19	Condenser (adjustable in beam direction): to maximize the light intensity on the sample in transmittance mode.
20	IR beam from the spectrometer.
21	Three-position motorized changer. 1) Mirror deflects the IR beam to the transmittance optics. 2) Mirror deflects the IR beam to the reflectance optics. 3) No mirror intercepts the IR beam. The beam can go to the external accessory port (16 in figure 2).
22	Camera port
23	Optional polarizer (for reflectance mode): for visible light only or visible light and IR light (two polarizers). An analyzer (component no. 25) is required. (It is part of the VIS polarizer.)
24	Optional polarizer (for transmittance mode): for visible light only or visible and IR light (two polarizers). The IR polarizer (A675-P) requires the holder (A 675) including the polarizer for visible light.
25	Optional analyzer: for visible light only or visible and IR light (two polarizers).

SYSTEM DIAGRAM

D



DIMENSIONAL DRAWINGS

E

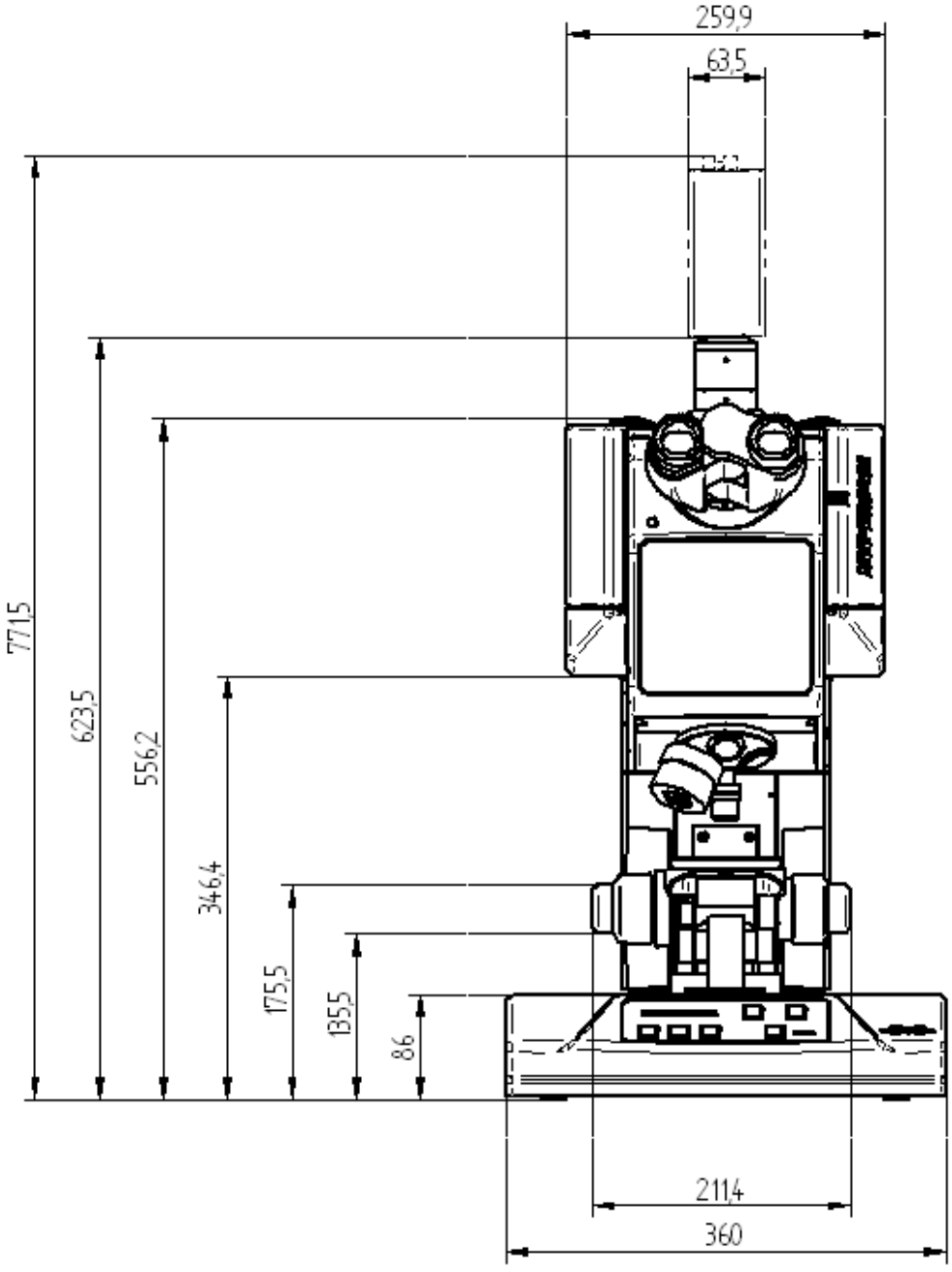


Figure 70: HYPERION 1000/2000 - Front View

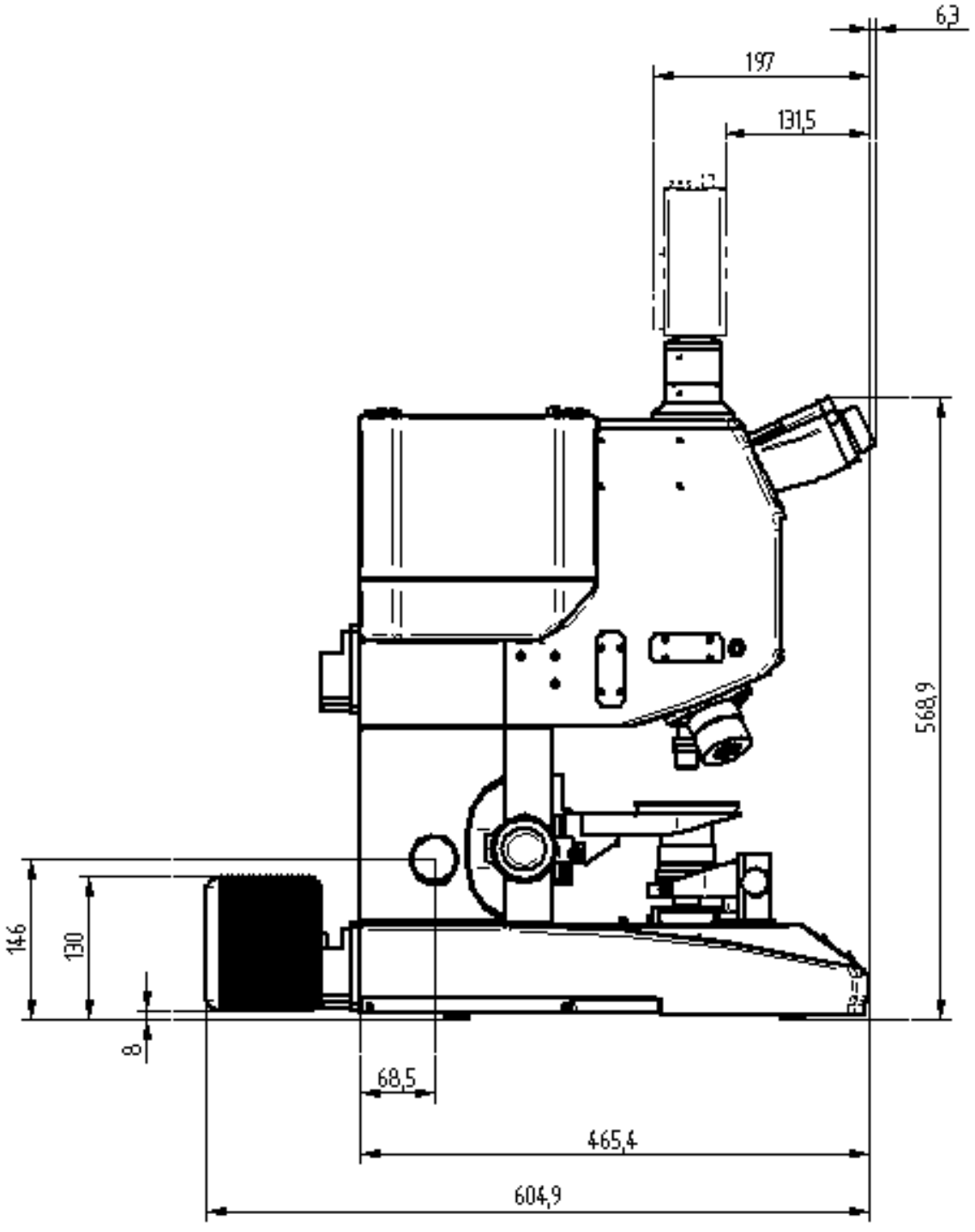


Figure 71: HYPERION 1000/2000 - Left Side View

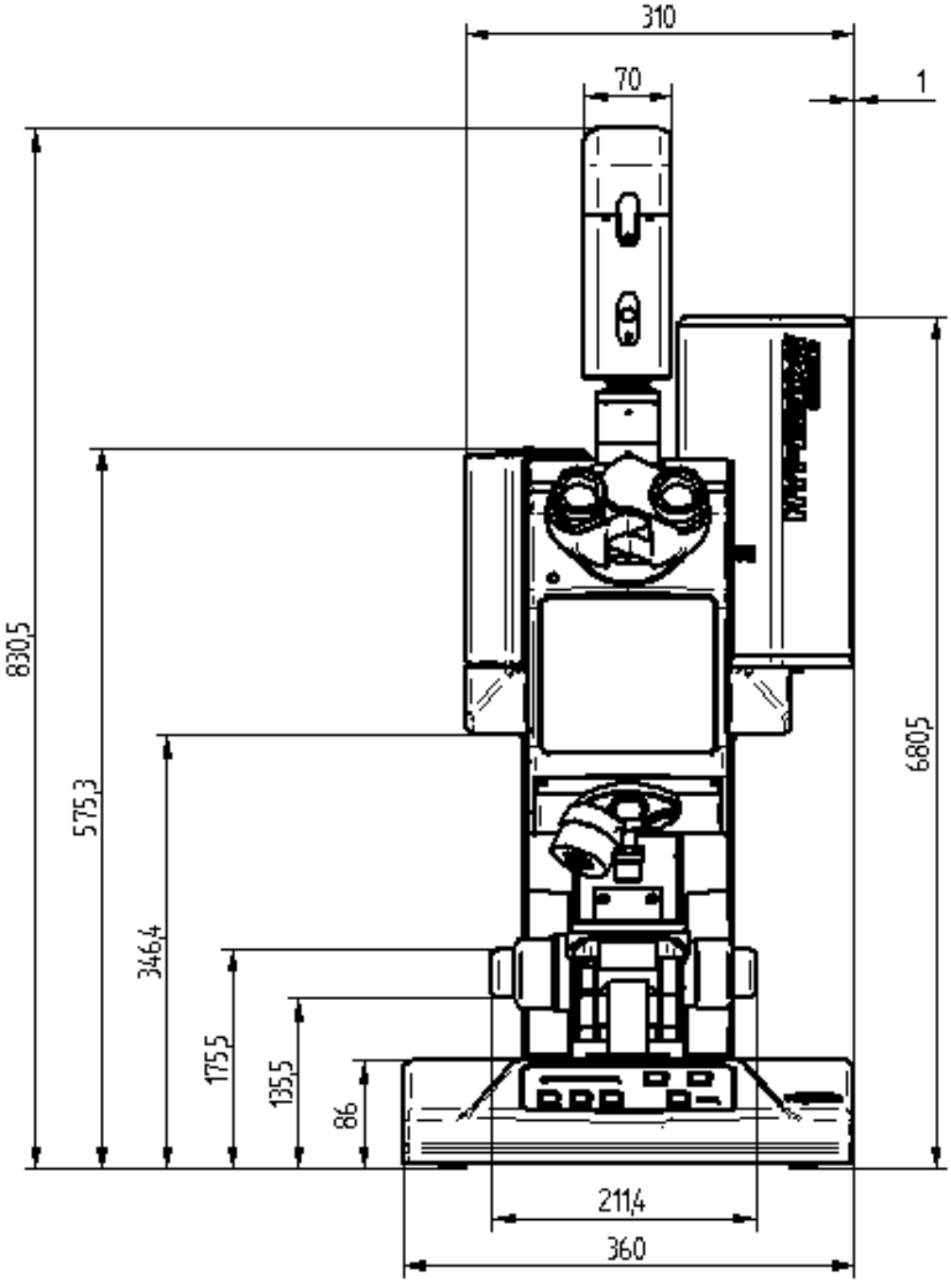


Figure 72: HYPERION 3000 - Front View

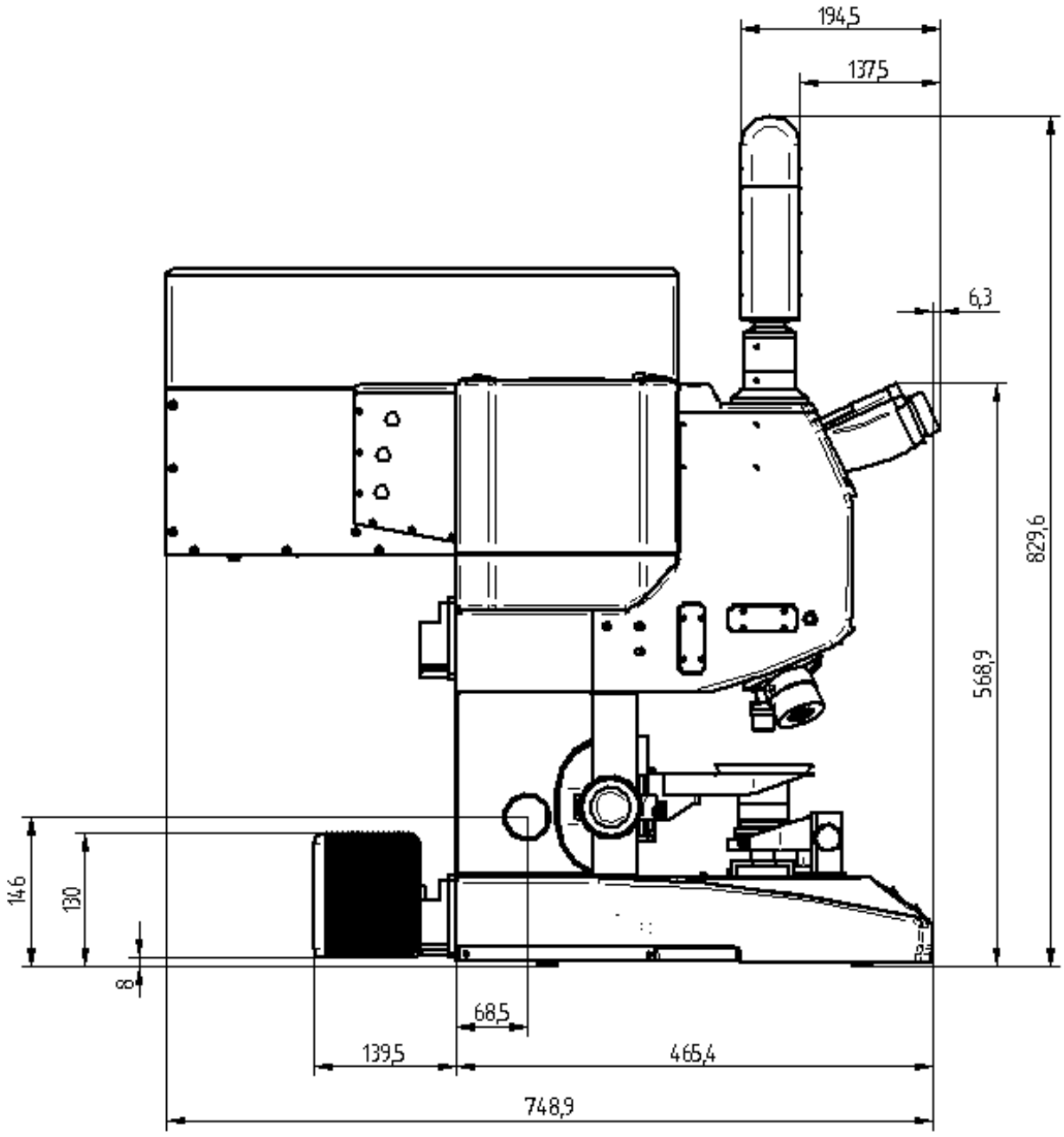


Figure 73: HYPERION 3000 - Left Side View

SERVICE ADDRESSES

F

Bruker Optik has an international network of branch offices and representations to ensure worldwide a competent customer service. Below the addresses of the Bruker headquarters are listed.

For a complete list with the addresses and telephone numbers of the Bruker branch offices and representations worldwide refer to the internet: **http://www. brukeroptics.com/contacts/worldwide.html**

North America

Bruker Optics Inc
19 Fortune Drive
Billerica, MA 01821
USA

Phone: +1-978-439-9899 (ext. 5227)
Fax: +1-978-663 9177
www.brukeroptics.com
info@brukeroptics.com

Europe

Bruker Optik GmbH
Rudolf-Plank-Str. 27
76275 Ettlingen
Germany

Phone: +49 7243/504-619 / -600
Fax: +49 7243/504-698
www.brukeroptics.de
ir_service@brukeroptics.de

Asia

Bruker Optik Asia Pacific Ltd.
Unit 505, 5/F, Tower III
Enterprise Square, No. 9
Sheung Yuet Road
Kowloon Bay
Hong Kong

Phone: +852 2796 6100
Fax: +852 2796 6109
asiapacific@brukeroptics.com.hk

No responsibility can be taken for the correctness of this information. Subject to change.

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FT-IR
FT-NIR
FT-Raman
BioMed
TD-NMR
Software

EC-DECLARATION OF CONFORMITY

The undersigned, representing the following manufacturer

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

herewith declares that the product

Product identification: **IR MICROSCOPE HYPERION 1000/2000/3000**

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

Reference no.	Title
73/23/EWG	Directive of the commission from February 19th, 1973 (Low Voltage Directive)
89/336/EWG	Directive of the commission from May 3rd, 1989 (Electromagnetic Interference Directive)
92/31/EWG	Directive of the commission from April 28th, 1992 (Amendment Electromagnetic Interference)
93/68/EWG	Directive of the commission from July 22nd, 1993 (Amendment Electromagnetic Interference/Low Voltage Directive)
98/13/EG	Directive of the commission from February 12th, 1998 (Amendment Electromagnetic Interference)

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

Last two digits of the year in which the CE marking was affixed: 04
(when compliance with the provisions of the Low Voltage Directive 73/23/EWG is declared)

Ettlingen ..... (Place)

October 8, 2004 ..... (Date)

..... (Signature)

Dr. Arno Simon, Development Manager

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

Bruker Optik GmbH
E-Mail: info@brukeroptics.de
www.brukeroptics.de

76275 Ettlingen/Germany
Rudolf-Plank-Str. 27
Tel. +49 (0)7243 504-600
Fax +49 (0)7243 504-698

28359 Bremen/Germany
Fahrenheitstr. 4
Tel. +49 (0)421 22319-10
Fax +49 (0)421 22319-70

04318 Leipzig/Germany
Permoserstr. 15
Tel. +49 (0)341 24109-10
Fax +49 (0)341 24109-70

76287 Rheinstetten/Germany
Silberstreifen
Tel. +49 (0)721 5161-141
Fax +49 (0)721 5161-237

Sitz der Gesellschaft ist Ettlingen HRB 2608E, Geschäftsführer: Dipl.-Phys. Jürgen Gast, Dr. Dieter Schmalbein, Dr. Arno Simon
Dresdner Bank Karlsruhe Nr. 562 081 800, BLZ 660 800 52 · Deutsche Bank AG Karlsruhe Nr. 013 159 900, BLZ 660 700 04 ·
Commerzbank Karlsruhe Nr. 242 706 000, BLZ 660 400 18
USt-IdNr. DE812440710 · Steuer-Nr. 31190 39703 Finanzamt Ettlingen

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

Harmonized standards:

No.	Issue	Title	Parts(1)
EN 61326:1997 +A1:1998+A2:2001	March 2002	Electrical equipment for measurement, control and laboratory use – EMC requirements	1
EN 61000-3-2:2000 +Corrigendum 1	December 2001	Electromagnetic compatibility; Part 3-2: Limits - Limits for harmonic current emissions	3-2
EN 61000-3-3:1995 +Corrigendum:1997+ A1:2001	May 2002	Electromagnetic compatibility; Part 3-3: Limits - Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤16A	3-3
EN 61010-1:2001 (2nd Edition)	August 2002	Safety requirements for electrical equipment for measurement, control and laboratory use; Part 1: General requirements	1

Other standards and/or technical specifications:

No.	Issue	Title	Parts (1)

Other technical solutions, the details of which are included in the technical documentation or the technical construction file: ....

Other references or information required by the applicable EC directive(s):

.....

(1) Where appropriate, the applicable parts or clauses of the standard or the technical specification shall be referenced.

Bruker Optik GmbH
E-Mail: info@brukeroptics.de
www.brukeroptics.de

76275 Ettlingen/Germany
Rudolf-Plank-Str. 27
Tel. +49 (0)7243 504-600
Fax +49 (0)7243 504-698

28359 Bremen/Germany
Fahrenheitstr. 4
Tel. +49 (0)421 22319-10
Fax +49 (0)421 22319-70

04318 Leipzig/Germany
Permoserstr. 15
Tel. +49 (0)341 24109-10
Fax +49 (0)341 24109-70

76287 Rheinstetten/Germany
Silberstreifen
Tel. +49 (0)721 5161-141
Fax +49 (0)721 5161-237

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Dresdner Bank Karlsruhe Nr. 562 081 800, BLZ 660 800 52 · Deutsche Bank AG Karlsruhe Nr. 013 159 900, BLZ 660 700 04 · Commerzbank Karlsruhe Nr. 242 706 000, BLZ 660 400 18
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