



Leica MZ16 FA

User manual

Leica
MICROSYSTEMS

Dear User,
Dear User,

We thank you for your faith in our product, and hope it brings you both enjoyment and success.

With the new Leica MZ16 FA from Leica Microsystems, you have purchased the best fluorescence stereomicroscope on the market. Discover how you will automatically gain more information faster using the world's first motorized, automated, fully apochromatic fluorescence stereomicroscope. The Leica MZ16 FA controls the filter changer, zoom, focus, UV shutter and double iris diaphragm at the touch of a button, and replicates your multifuorescence experiments very quickly, exactly and ergonomically. The Leica MZ16 FA is the highest-performance fluorescence stereomicroscope with the greatest zoom (16:1), the highest resolution (840 Lp/mm), the highest magnification (115× with standard optics), a patented illumination and filter system for the most intense fluorescence, and the HL RC™ high-performance transmitted-light base for excellent contrast.

In developing our instruments, we place great value on simple, self-explanatory operation. However, please take the time to read the user manual and the operating safety information to become familiar with the advantages and options of your Leica MZ16 FA high-performance stereomicroscope, so that you can use it optimally and safely.

Should you ever have any questions, please consult your local Leica representative. You will find the address of your nearest local representative, as well as valuable information about Leica Microsystems products and services, from Leica Microsystems on our web site at www.leica-microsystems.com. We are gladly at your service. Customer service is a big thing with us. Not only before the sale, but afterwards as well.

Leica Microsystems (Switzerland) Ltd
Business Unit Stereomicroscopy
www.stereomicroscopy.com

Operating controls



Fig. 1 Leica MZ16 FA with ErgoTube®

- | | |
|--|--|
| <p>1 Display with function keys</p> <p>2 Motorized filter changer with four filter holders</p> <p>3 Filter holder for an individually selectable filter</p> <p>4 ErgoTube® with variable viewing angle of 10° – 50</p> | <p>5 Adjustable eyepiece tubes for adjusting the interpupillary distance from 52–76mm</p> <p>6 Knurled rings to adjust diopters from +5 to –5</p> <p>7 Adjustable and attachable eyecups</p> <p>8 Motorized focus system on/off switch</p> |
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Additional operating controls, see page 38.

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1. Safety concept

1.1 The user manual

Included with your Leica MZ16 FA fluorescence stereomicroscope is an interactive CD-ROM with all pertinent user instructions in German, English, French, Spanish, Italian, Portuguese, Dutch, Danish, Swedish, Finnish and Greek. Keep it in a safe place, and readily accessible to the user. User manuals and updates are also available for you to download and print from our web site at www.stereomicroscopy.com.

The Leica MZ16 FA is the motorized and automated fluorescence stereomicroscope of the Leica M stereomicroscope series. This operating manual describes the special functions of the Leica MZ16 FA and contains important instructions for its operational safety, maintenance, and accessories. Like all instruments of the Leica M stereomicroscope series, the Leica MZ16 FA consists of modules, which allow an almost unlimited variety of custom equipment configurations. The identical modules, such as stands, binocular tubes, accessories, etc. are described in User Manual M2-105-0 for Leica M stereomicroscopes, which also contains additional safety instructions pertaining to the stereomicroscope, accessories and electrical accessories, as well as care instructions.

Special manuals are provided for a number of accessories:

- User Manual M2-216-1 for lamp housing with high-pressure mercury burner.
- User Manual for ebq 100 isolated supply unit for 100W high-pressure mercury burners.
- User Manual M2-267-1 for the motorized focus system.



Before installing, operating or using the instruments, read the user manuals listed above. In particular, please follow all safety instructions.

To maintain the unit in its original condition and to ensure safe operation, the user must follow the instructions and warnings contained in these user manuals.

1.1.1 Diagrams

(1.2) Numbers in parentheses within the descriptions pertain to diagrams and the items in the diagrams. Example (1.2): Figure 1 is located on page 3, and item 2 is the filter changer.

1.1.2 Symbols used



Warning of a danger

This symbol indicates especially important information that, if not observed,

- can cause hazards to personnel,
- can lead to functional disturbances and damaged instruments.



Warning of hazardous electrical voltage

This symbol indicates especially important information that, if not observed,

- can cause hazards to personnel,
- can lead to functional disturbances and damaged instruments.



Danger due to hot surface

This symbol warns against touching hot surfaces, e.g. those of light bulbs.



Important information

This symbol indicates additional information or explanations that intend to provide clarity.

Action

- ▶ This symbol refers to actions described in the text that are to be carried out.

Additional notes

- This symbol indicates additional notes and explanations provided in the text.

1.2 Safety instructions

Description

The Leica MZ16 FA is a motorized fluorescence stereomicroscope with 16:1 zoom, digital display and automatic functions for fluorescence applications. The optics system consists of 2 observation beam paths, a patented TripleBeam® third beam path specifically for fluorescence illumination and the patented FLUOIII® filter system. The entire imaging system, including the 16:1 zoom, objective and ErgoTube® is apochromatically corrected.

Motorized zoom, filter changer, shutter and double iris diaphragm are motorized. They can be controlled manually, and their positions can be stored.

The Leica MZ16 FA consists of these modules:

- Motorized stereomicroscope
- Stand, binocular tube, objective, eyepieces and (if applicable) accessories for photography, etc.
- Power supply
- Filter sets with barrier and excitation filters on one filter holder with transponder
- Three filter holders without transponder for transmitted light observation and protection from UV light
- Filter holder for individual filters
- UV protection screen
- 106 z lamp housing with 50W or 100W high-pressure mercury burner with stray-light protection
- Supply unit

Permitted uses

With the Leica MZ16 FA fluorescence stereo-microscope, entire fluorescent specimens can be examined three-dimensionally and unprepared, manipulated, sorted and documented. The separate beam path for the fluorescence illumination in the Leica MZ16 FA as well as the very bright high-pressure mercury burner and specially selected filter sets enable you to distinguish the finest structures and enhance the quantity of information for incident light fluorescence. Special filter holders also enable observation without fluorescence in transmitted light or incident light.

Non-intended use

If the Leica MZ16 FA, its components and accessories are used other than as described in the user manual, injury or property damage may occur. Never:

- Install other plugs or cables.
- Change, rebuild or take apart parts, if not specifically instructed to in this in the manual.
- Allow unauthorized persons to open parts.
- Use the MZ16 FA for examining, or operating on the human eye.

The devices and accessories described in this operating manual have been tested for safety and potential hazards. The responsible Leica affiliate or the main plant in Wetzlar must be consulted whenever the device is altered, modified or used in conjunction with non-Leica components that are outside of the scope of this manual.

Unauthorized alterations to the device or noncompliant use shall void all rights to any warranty claims!

Place of use

- The Leica MZ16 FA may only be operated in a closed, dust-free room, which is free of oil vapors and other chemical vapors, as well as extreme humidity, and within a temperature range of +10 to +40.
- Electrical components must be assembled at least 10cm away from the wall and from flammable substances.
- Large temperature fluctuations, direct sunlight and vibrations should be avoided. These conditions can distort measurements and micrographic images.
- Stereomicroscopes in warm and warm-damp climatic zones require special care in order to prevent the build up of fungus.

Responsibilities of the person(s) in charge of instrument

Ensure that

- the Leica MZ16 FA and accessories are operated, maintained and repaired only by authorized and trained personnel.
- the operating personnel has read, understands, and is observing these instructions as well as those listed on page 5, and, in particular, the safety instructions.

Transport

- Use the original packaging for shipping or transporting the stereomicroscope and its accessory components.
- In order to prevent damage from vibrations, disassemble all moving parts that (according to the user manual) can be assembled by the customer and pack them separately. These include the objective, binocular tube, eyepieces, lamp housing, burner in the 106 z lamp housing, etc.

Repairs and servicing

- Only Leica Microsystems-trained service technicians, or technical specialists assigned by the person in charge of the instrument, are permitted to carry out repairs.
- Only original Leica Microsystems spare parts may be used.
- Disconnect the power cable before opening voltage-carrying parts, such as the Leica MZ16 FA, the power supply or the supply unit.



Touching the live circuit can cause injury.

Installation in third-party products

When installing Leica products into third-party products, note the following:

The manufacturer of the complete system or its dealer is responsible for following all applicable safety instructions, laws and guidelines.

Disposal

- The product must be disposed of in accordance with locally applicable laws and regulations.
- Dispose of used high-pressure mercury burners as hazardous waste.

Legal requirements

Adhere to general and local regulations relating to accident prevention and environmental protection.

Conformity with European Community directive

The Leica MZ16 FA and its accessories are constructed in accordance with the latest technologies and are provided with a statement of conformity with EC requirements.

Health risks



Workplaces with stereomicroscopes both improve and make visual tasks easier, but they also place high demands on the human visual apparatus and the muscular "holding apparatus" of the user. Depending on the duration of uninterrupted work, asthenopia and musculoskeletal problems may occur. For this reason, appropriate measures for reduction of the workload must be taken:

- Optimal arrangement of workplace, work assignments and work flow (changing tasks frequently).
- Thorough training of the personnel, giving consideration to ergonomic and organization aspects.

The ergonomic design and construction of Leica M series stereomicroscopes are intended to reduce the exertion of the user to a minimum.



Direct contact with eyepieces is a potential transmission method for bacterial and viral infections of the eye.

The risk can be kept to a minimum by using personal eyepieces for each individual or detachable eyecups.

1.3 Light source: safety instructions

Precautions by the manufacturer

- UV protection screen in front of the specimen plane prevents the user from looking directly into the UV rays.
- Automatic shutter locking during rotation of the filter changer, observation without fluorescence and removal of the filter holders prevents UV radiation from reaching the eyes.
- Filter holders without transponders in the free positions of the rapid filter changer prevent direct UV radiation from reaching the eyes.
- UV filters in the observation beam path protect the eyes.
- The stray-light protection on the lamp housing prevents irradiation of the hands.



Warning

UV radiation can harm the eyes.
Therefore:

- Never look into the light spot on the specimen plane without a UV protection screen.
- Always fill all of the filter positions with filter holders.
- Fill the empty filter positions with filter holders without transponders.
- Do not select a white, strongly reflective background for the stage.
- Never open the lamp housing while the lamp is switched on.

Risk of explosion, UV exposure, blinding!

Supply unit

Always unplug the supply unit from the power supply:

- When installing and disassembling the lamp housing
- Before opening the lamp housing
- When replacing the high-pressure mercury burner and other parts, such as the heat-absorbing filter or the collector
- During maintenance work on the supply unit.

Lamp housing

The Leica MZ16 FA may be used only together with the Leica 106 z lamp housing for the 100W or 50W mercury burner, supply unit and stray-light protection.



Leica Microsystems accepts no liability for damages resulting from the use of lamp housings from other manufacturers.

- Never open the lamp housing while the lamp is switched on. Unplug the supply unit from the power supply;

Risk of explosion, UV exposure, blinding!

- Before opening the lamp housing, allow it to cool off for at least 15 minutes.

Danger of explosion, danger of burns.

- Never cover the air duct on the lamp housing.

Danger of fire!

- Use the stray-light protection.

Danger to eyes from UV radiation.

2. Overview of the instrument

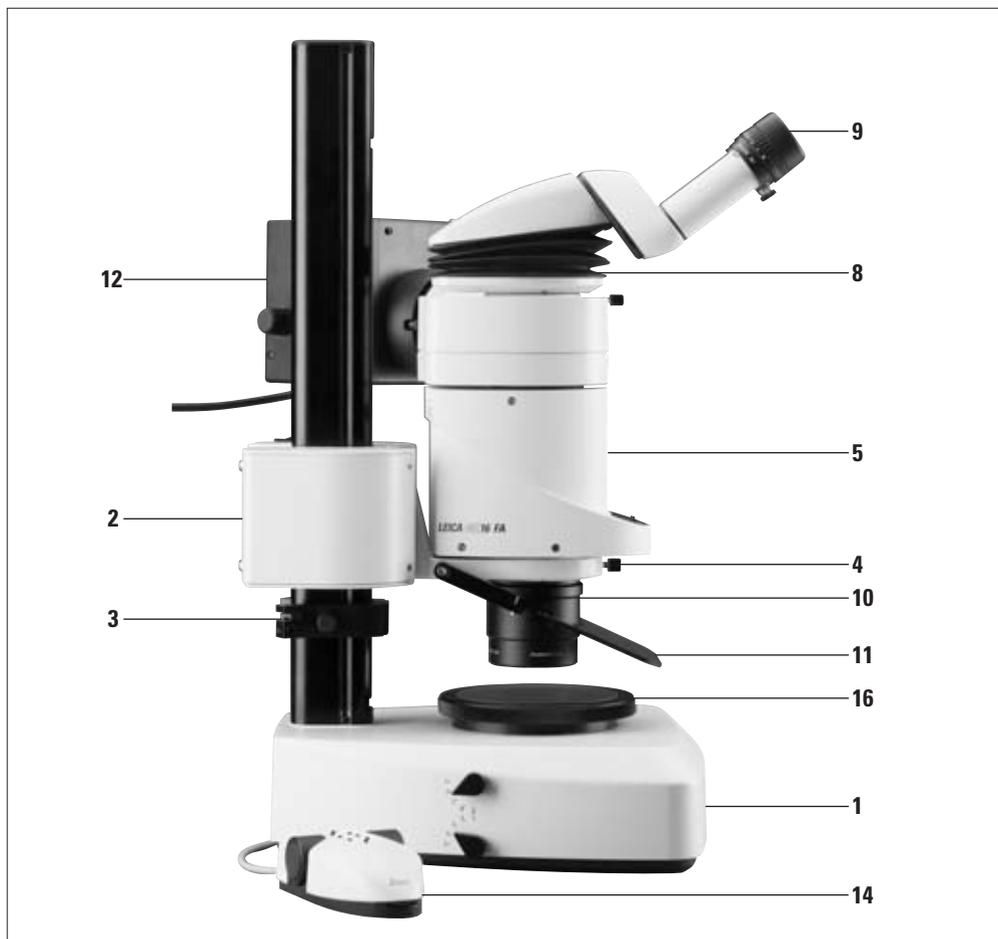


Fig. 2 Left side of the Leica MZ16 FA with ErgoTube® from the user's perspective

- 1** Stand (transmitted or incident light stand with corresponding illumination). Pictured here is the HL RC™ transmitted-light base for best relief contrast.
- 2** Focusing drive: motorized focus system with column (pictured) or manual coarse/fine drive (see User Manual M1-105-0)
- 3** Focusing stop
- 4** Microscope carrier
- 5** The Leica MZ16 FA with two observation beam paths and a TripleBeam® third beam path, motorized FLUOIII® filter system and adapter for 106 z lamp housing
- 6** Filter sets: the scope of delivery includes three filter holders without transponders for empty filter positions and transmitted or incident light observation without fluorescence. Additionally, filter sets of your choice for fluorescence (excitation and barrier filter on one filter holder) are available.

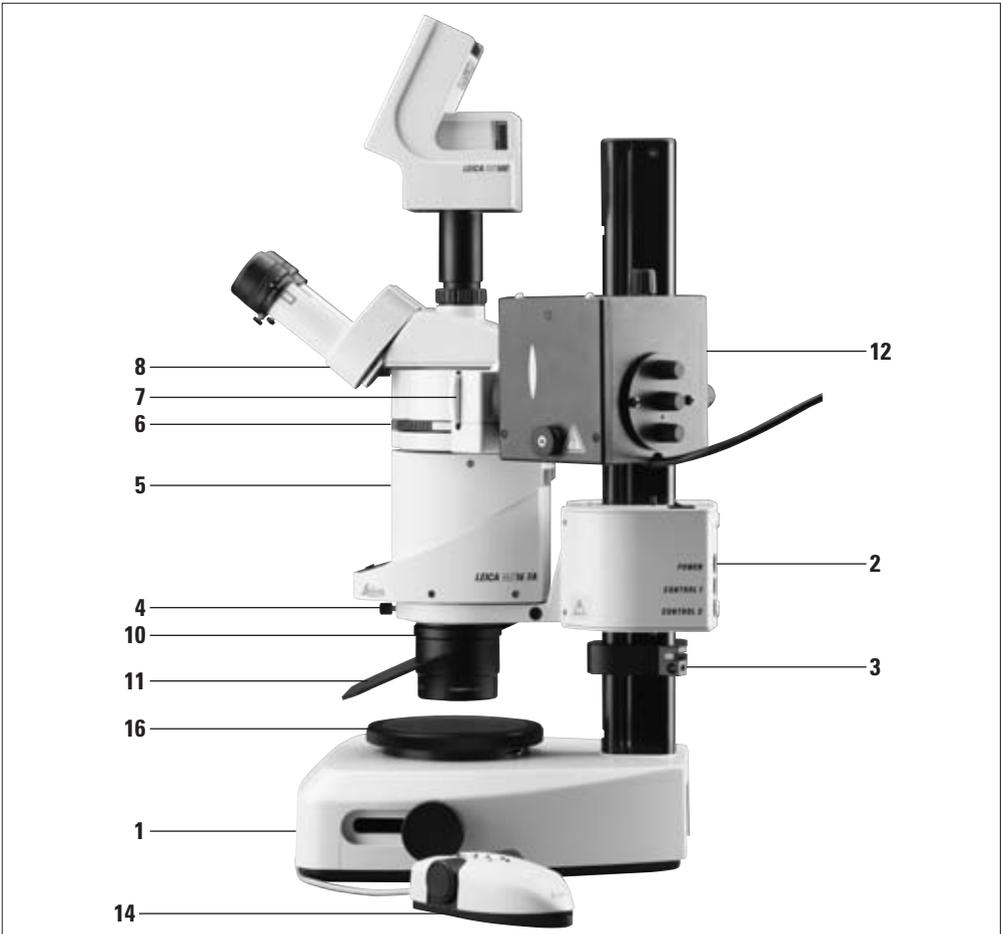


Fig. 3 Right side of the Leica MZ16 FA from the user's perspective with trinocular tube, video objective and Leica DC500 digital camera

- 7** Filter holder for an individually selectable filter, such as a gray filter
- 8** ErgoTube® (2.8) or trinocular tube (3.8), pictured with video objective and Leica DC500 digital camera
- 9** Wide-field eyepieces for persons wearing glasses
- 10** Interchangeable objective planachromatic or planapochromatic
- 11** UV protection screen with arm
- 12** Leica 106 z lamp housing for 50W or 100W mercury burner with stray-light protection (not pictured)
- 13** Supply unit for 106 z lamp housing (not pictured)
- 14** Manual controls for zoom, motorized focus, filter changer, shutter with connection to optics carrier and/or footswitch (not pictured)
- 15** Transformer (not illustrated)
- 16** Gliding stage (optional)

3. Assembly

Basic components such as the stand, column, microscope carrier, binocular tubes and optical accessories are, thanks to their modular design, identical for all Leica M series stereomicroscopes. Therefore, please refer to User Manual M2-105-0 for Leica M stereomicroscopes for installation and assembly instructions.

The connections of the manual controls, footswitch, and PC, as well as the assembly of the UV protection screen, are described in the user manual you are now reading.

The lamp housing, supply unit and adjustment of the high-pressure mercury burner are described in User Manual M2-216-1.

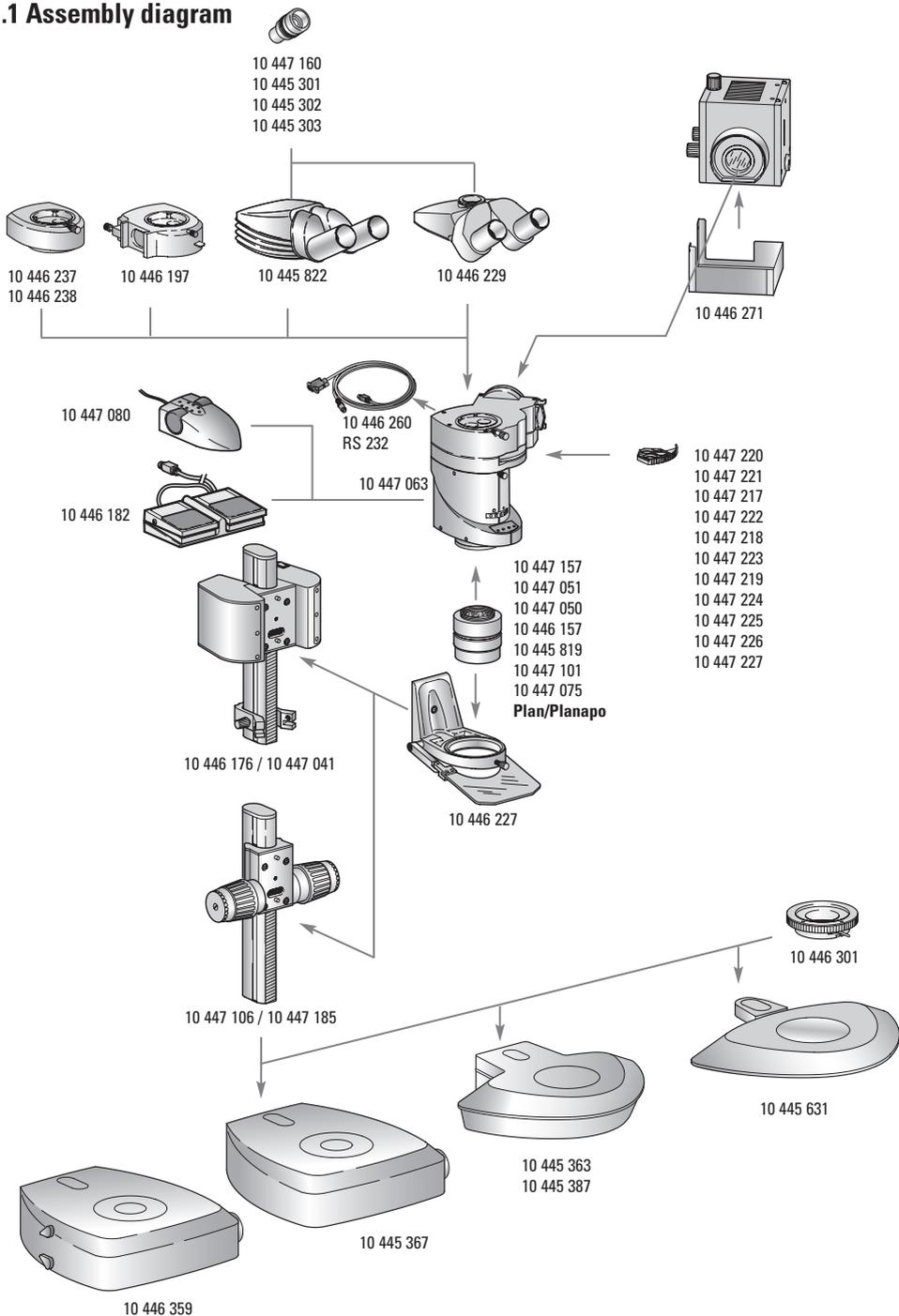
3.1 Assembly sequence

The microscope components are best assembled in this order:

- Stand: base and column with focusing drive (manual or motorized) and focus and focusing stop
- Microscope carrier
- Leica MZ16 FA optics carrier
- Binocular or trinocular tube
- Eyepieces and eyecups
- Stage plate or special stage (gliding stage, heating stage)
- Objective
- UV protection screen with arm
- with light source
- Lamps: high-pressure mercury burner in lamp housing; for the HL RC™ transmitted-light stand, fiber-optic light guide with light source
- Supply unit for lamp housing
- Electrical connections
- Manual controls and/or footswitch and PC (if applicable)
- Equipment of filter changer

Either the integrated clamping screws or an Allen key is necessary for assembly; these are included in delivery.

3.1.1 Assembly diagram



3.2 Assembly of stereomicroscope with stand



Do not yet connect the stereomicroscope and peripherals to the power supply!

Focusing drive → stand base

► Fasten the manual or motorized focusing drive (4.2) to the column according to User Manual M2-105-0 (manual) or M2-267-1 (motorized) on the base (4.1).

Tool: Allen key.

► Fasten the focusing stop (4.3) using the clamping screw on the stand column under the focusing drive.



When using the motorized focus, be certain to read the corresponding User Manual M2-267-1, in particular the safety instructions.

Microscope carrier → focusing drive

► Fasten the microscope carrier (4.4) to the Leica MZ16 FA according to User Manual M2-105-0 on the focusing drive (4.2).

Tool: Allen key.

Optics carrier → microscope carrier



The Leica MZ16 FA optics carrier and the FLUOIII® filter system make up a single unit, which is factory-adjusted. They may not be taken apart.

► Insert the Leica MZ16 FA optics carrier (4.5) according to User Manual M2-105-0 into the microscope carrier (4.4) and fasten it using a clamping screw.

Additional components

► Fasten the other components and other individual accessories according to User Manual M2-105-0:

- Insert the binocular tube (2.8) into the ring connector on the FLUOIII® filter system and fasten it using the clamping screw.

- Insert the eyepieces (4.9) in the tubes and fasten them using the clamping screws. If necessary, attach soft eyecups (see User Manual M2-105-0).
- Screw the objective (4.10) into the bottom of the optics carrier (4.5) counterclockwise.

3.2.1 Video/photo tube

We recommend using the trinocular video/photo-tube (4.8) or the HU video/phototube with 100% light in the video/photo output, in order to achieve shorter exposure times at low fluorescence levels.

- Insert the video/photo tube (4.8) into the ring connector on the FLUOIII® filter system according to User Manual M2-105-0 and fasten it using the clamping screw.
- Fasten a binocular tube to the HU video/photo tube using a clamping screw.

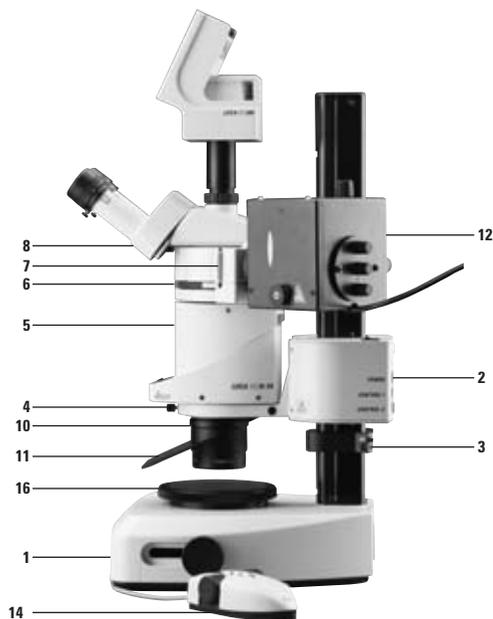


Fig. 4 Right side of the Leica MZ16 FA

3.2 UV protection screen → microscope carrier

- ▶ Fasten the UV protection screen (5.1) using a hexagon-head screw (5.3) to the left or right side of the microscope carrier.

Tool: Allen key.

⚠ Always position the UV protection screen so that the operator can never look directly at the light spot (see page 9):

- ▶ Set the UV protection screen (5.1) laterally using the arm (5.2).
- ▶ Loosen the hexagon-head screw (5.3).
- ▶ Move the UV protection screen up or down using the arm.
- ▶ Tighten the hexagon-head screw (5.3).



Fig. 5 UV protection screen

- 1 UV protection screen
- 2 Arm
- 3 Hexagon-head screw

3.3 Light source

The Leica 106 z lamp housing is the light source for the Leica MZ16 FA and is used with 100W or 50W mercury lamps, corresponding supply units and stray-light protection.



Please read

- the separate User Manual M2-216-1 for the Leica lamp housing
- the user manual and safety instructions for the ebq 100 supply unit
- the user manual and safety instructions provided by the lamp manufacturer, and, in particular, the section on how to proceed if a lamp breaks and releases mercury.



Do not switch on the supply unit until you have read and familiarized yourself with the functions of the Leica MZ16 FA in transmitted light, provided in the «Operation» chapter.

After it is switched on, the burner must be adjusted immediately.

3.3.1 Lamp housing 106 z

Fasten the 106 z lamp housing (4.12) to the adapter part as described in User Manual M2-216-1.

3.3.2 Supply units

The supply unit for 50W mercury burners is described in User Manual M2-216-1. The 100W mercury burners are powered by the ebq 100 supply unit. Please read the separate instruction manual provided by the manufacturer.

3.4. Electrical connections

The connections are used differently according to the configuration. Diagrams with connections and paths for typical configurations with manual controls, motorized focus, footswitch, and PC are provided on page 29.

PWR: Connection for Leica MZ16 FA power pack, or empty (for feed from power pack of motorized focus)

CTL1: Foot switch connection and/or PC interface kit (with Y cable)

CTL2: Connection for manual controls, or empty (when connected to the second CTL2 socket)

CTL2: Connection for manual controls, or empty (when connected to the first CTL2 socket) or connection for short connecting cable for connecting CTL2 to motorized focus

 **For models equipped with motorized focus, be certain to adhere the cable clip to the motorized focus and insert the short connecting cable. Otherwise the cable could be squeezed between the stop and motorized focus during focusing.**

Connection to PC

The connection to a PC requires a standard PC with RS232 interface and a Leica PC Interface Kit. The individual commands are described in a separate command description supplied with the PC Interface Kit.



Fig. 6 Rear side of Leica MZ16 FA with connections to power supply, motorized focus, manual controls, footswitch, PC

3.5 Equipping the filter changer

 The patented FLUOIII® filter system consists of a filter changer for barrier and excitation filters, a built-in motorized shutter and a filter insert for a filter holder with your choice of filter.

The filter changer can hold a total of 4 filter sets. The filter sets for fluorescence are marked and equipped with a transponder for automatic filter detection (see page 17 for details).

Three filter holders without transponders are included in the scope of delivery of the Leica MZ16 FA. These filter holders have two empty openings for the observation beam paths. The third opening to the illumination beam path is closed.

 **If you are using fewer than four filter holders with fluorescence filters, be absolutely certain to insert the included filter holders without transponders with closed illumination beam path into the free positions.**

Otherwise, there is a risk of danger to the eyes from direct UV radiation from the third beam path. Also, they protect the system from dust.



Fig. 7 Filter changer, equipped with filter holders
1 Filter sets
2 Filter slide for filter holder with individual filters

3.5.1 Filter sets for fluorescence

The filter sets for fluorescence contain, on one filter holder, two barrier filters to the visual beam paths and one excitation filter to the illumination beam path. A transponder is located on the fluorescence filters with the specific filter data. The transponder guarantees dependable automatic operation with filter recognition. The filter sets are labeled (see page 28).



Please order Leica filter sets for fluorescence from Leica Microsystems. The transponders on the filter sets are required to ensure proper function of the automatic filter detection.

3.5.2 Filter holders without transponders

Three filter holders without transponders are included in the scope of delivery of the Leica MZ16 FA. These filter holders have two empty openings for the observation beam paths. The third opening, to the illumination beam path, is closed. Use these filter holders

- if you want to change to transmitted light or incident light observation without fluorescence
- at all times in empty filter changer positions, in order to protect yourself from UV radiation and protect the system from dust.



If you are using fewer than four filter holders with fluorescence filters, be absolutely certain to insert the included filter holders without transponders with closed illumination beam path into the free positions.

Otherwise, there is a risk of danger to the eyes from direct UV radiation from the third beam path.

3.5.3 Inserting the filter



When inserting the filter sets, avoid touching the filters if at all possible, in order to avoid fingerprints. If you touch them, clean the filters using a soft, lint-free cloth and pure alcohol.

- ▶ Insert the filter holder (7.1) into the filter changer (2.6) such that the label (e.g. GFP1) is upright and legible on the right side of the slide slot.
- Ensure that the contour of the filter holder matches the contour of the microscope.
- ▶ Then, connect the power supply to the power, so that you can rotate the motorized filter changer.
- ▶ Rotate the filter changer using the **F** keys on the manual controls, until the stop (see page 21).
- If the filter holder has not been inserted correctly, the filter changer does not rotate.

Insert a total of four filter holders.

3.5.4 Slot for filter slide

There is a slot (7.2) in the filter changer system for an individually selectable filter, for example a gray filter.

4. Operation

4.1 Functional principle

- The most important functions of the Leica MZ16 FA are motorized and automated.
- Motorized functions: zoom, motorized focus (optional), filter changer, aperture and double iris diaphragm.
- Automated functions: automatic filter detection, automatic shutter, automatic control of five working procedures, calculation of measurements, the current total magnification, and the field of view diameter.
- Memory functions: zoom, motorized focus (optional), filter changer, and double iris diaphragm.
- Variable function keys: the microscope is delivered with pre-assigned functions of the function keys of the manual control system and the footswitch. These functions can be reprogrammed and/or adapted to your individual wishes.
- The selector buttons of the Leica MZ16 FA are intended for selecting the objective, eyepieces, video objective and acoustic signal. The data are used when calculating the magnification, the field of view diameter and the measurements.
- The current total magnification, field of view diameter and measurements are displayed on-screen.
- Light emitting diodes for the aperture of the double iris diaphragm.

4.2 Starting up



Caution:

Do not switch on the supply unit for the high-pressure mercury burner yet.

After it is switched on, the burner must be adjusted immediately. First, work in transmitted light mode in order to familiarize yourself with the microscope's controls.



Follow the safety instructions.

- ▶ Attach the power supply to an outlet.

All motorized microscope components first undergo an initialization phase. The display indicates:

init V1.xx (software version, e.g. SW V1.xx)

The unit is being initialized (beeps).

MZ16 FA appears quickly to indicate that initialization is finished (beeps twice).

Display of the current magnification

Factory settings

Objective 1.0×

Eyepiece 10×

Video objective 0.63×

CAL C dist. (reference distance)

REF FOV (field of view diameter)

Acoustic signal on

4.2.1 Disconnecting from the power supply



Unplug the power cable from the power supply.

Status when unplugging the power cable:

- The selection under **OPT**, the calibration and the diameters of the reference circles remain the same.
- The positions stored using the manual control system (**Set** button) are cleared.
- The last selected function on the footswitch remains active if you switch on the system without activating the footswitch.

4.3 Button functions of the Leica MZ16 FA

In the menu, the **Z** up/down zoom buttons on the manual control system assume the function of selection keys (see Fig. 9).

OPT_c

- Select eyepiece and objective factors
- Select the factor
- Acoustic signal (on/off)

SEL_{ect}

Confirm and display the selection

CAL_{ibration}

Calibrating the motor zoom

REF_{erence}

Display diameter of reference circle for measurements

SEL + CAL (simultaneously)

Travel to the calibrated zoom position

SEL (press for approx. 2 seconds)

Reset user settings to factory settings
Display: def. val.

4.3.1 Menu selection **OPT**

Selection of eyepiece / objective / video objective / acoustic signal

In the menu, the **Z** up/down zoom buttons on the manual control system assume the function of selection keys (see Fig. 9).

OPT

Select the eyepiece factor

Z up/down zoom buttons

- ▶ Confirm and display the selection
SEL (beep)

Select the objective factor

Z up/down zoom buttons

- ▶ Confirm and display the selection
SEL (beep)

Select **video objective factor Z** zoom up/down buttons

- ▶ Confirm and display the selection
SEL (beep)



This factor does not influence the calculation or display of the magnification or of the measurements. During image capture via digital camera, it calculates the magnification of the live image.

Acoustic signal on/off (beep)

Z up/down zoom buttons

- ▶ Confirm and display the selection
SEL (beep)

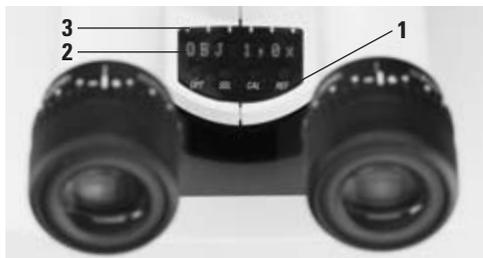


Fig. 8 Display with function keys

1 Function keys:

OPT Selection of eyepiece / objective / video or photo objective / acoustic signal

SEL Confirm and display the selection

CAL Calibrate motor zoom

REF Display diameter of reference circle for measurements

2 Display: objective magnification / eyepiece magnification / video objective / total magnification / field of view diameter / measurements

3 Light emitting diodes aperture of the double iris diaphragm.

4.4 Motorized functions

The motorized zoom, focus, filter changer, shutter and double iris diaphragm allow ergonomic work using the manual controls. The store button allows you to store five combinations of zoom, focus, filter changer, and double iris diaphragm and to replicate experiments quickly and exactly. Compared to a manual stereomicroscope, the automated and motorized Leica MZ16 FA offers:

- Improved ergonomics
- Uniform and simple operation
- More flexibility for the user
- Free hands for manipulation tasks
- Faster replication of repetitive tasks.

If desired, either zoom, shutter or filter changer can be operated using the footswitch. This frees both hands for manipulation, sorting and preparation.

4.5 Manual controls

The manual controls (Fig. 9) can be arranged as desired at the workplace—ideal for both left and right-handers. The touch-free settings of the Leica MZ16 FA prevent vibrations, which can cause distortion, particularly at high magnification.

The manual controls are configured ergonomically, and the outer edge is illuminated, so that it is also visible in darkness.

Every user can store individual functions of the buttons and dials using a PC and recall them using a password (see Manual M2-216-3). On the following pages, the functions are described according to their preset factory button assignments.

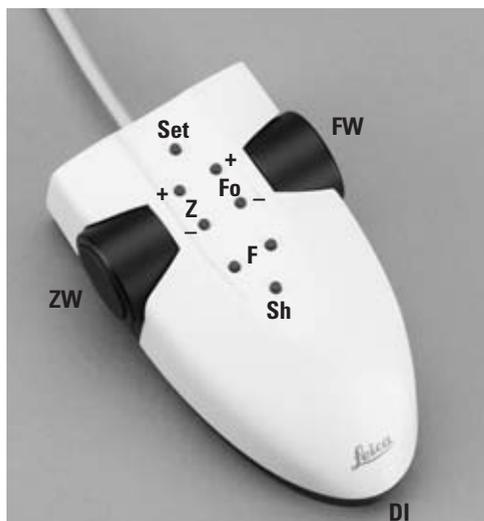


Fig. 9 Manual controls: factory preset button assignments

- | | |
|------------|---|
| Set | Store the current positions of zoom/focus/filter changer/double iris diaphragm for five combinations. |
| Z | Function 1: Zoom up/down, quick zoom
Function 2: menu selection buttons |
| ZW | Zoom up/down, fine zoom |
| Fo | Focus up/down, quick focus |
| FW | Focus up/down, fine focus |
| F | Filter changer, clockwise/counterclockwise rotation |
| Sh | Shutter for opening/closing the illumination beam path (only possible in fluorescence mode) |
| DI | Aperture of the double iris diaphragm |

4.5.1 Changing button assignments

Each user can individually select the functions of the buttons and wheels using a PC. Multiple users can store their own configurations and recall them using passwords. The scope of delivery includes a CD-ROM with the configuration program and its description.

4.5.2 Zoom (change magnification): Z and ZW

Use the **Z** buttons to zoom quickly, using the zoom wheel **ZW** for fine and precise movements up and down.

Z Zoom buttons

- Constant pressure: motorized zoom travels continuously up/down.

Precise fine setting using the ZW wheel.

- One quick click: the motorized zoom adjusts to the highest/next level of magnification.



The speed accelerates to the maximum speed. The motorized zoom stops when the **Z** button is clicked again or the **ZW** zoom wheel is moved.

ZW Precise zooming using the zoom wheel.

4.5.3 Focusing: Fo and FW

Use the **Fo** buttons to focus quickly, and use the focus wheel **FW** for fine and precise up/down focusing.

Fo Focus buttons

- Constant pressure: the motorized focus travels continuously up/down.

FW Precise fine focusing with focus wheel



For fine focusing with the focus wheel **FW**, the system recognizes the level of magnification. The higher the magnification, the more slowly the motorized focus moves.

4.5.4 Filter change: F



For observation with fluorescence light, always position the aperture protection correctly to protect the observer (page 15).

F buttons Filter changer left/right rotation buttons

At the touch of a button, the filter changer rotates to the left or the right into the next position at maximum speed. During this process, the shutter automatically closes the illumination beam path to preserve sensitive specimens and protect users from UV radiation. The active filter set is always the one with its label visible on the left side of the slide slot. The UV shutter opens automatically if a fluorescence filter with transponder is in position, and stays closed if a filter holder without transponder is in position.

4.5.5 UV shutter: *Sh*

The UV shutter *Sh* opens and closes the illumination beam path.



The UV shutter closes the illumination beam path automatically and cannot be opened manually

- during the filter change process.
- if the system recognizes a filter holder in the filter changer without a transponder in the beam path.
- if you remove a filter holder from the filter changer and then turn the filter changer to an empty position.

The UV shutter opens automatically if a fluorescence filter with transponder is in position. If this occurs, you can close or open the UV shutter using the *Sh* button on the manual controls.

Sh UV shutter open/close

When work is interrupted, you do not have to switch off the high-pressure mercury burner to preserve sensitive preparations from burning out or bleaching out. Frequently switching the mercury lamp on and off decreases its life and causes delays, as the lamp can only be lit after it has cooled off. Instead, you can close the UV shutter at the touch of a button and reopen it when you return to your workplace.

4.5.6 Double iris diaphragm: *DI*

You can use the *DI* to regulate the aperture and enhance the depth of field for plastic specimens. On-screen display of the aperture with light-emitting diodes. Each light-emitting diode stands for 20%. If all LEDs are lit, the double iris diaphragm is completely open.

4.5.7 Store the current position: *Set*

The MZ16 FA offers you the ability to reproduce your multifuorescence experiments exactly, cutting the time needed for this immensely. Store the typical working procedures with the desired positions for zoom, focus, filter changer, and double iris diaphragm. For the next experiment, the Leica MZ16 FA automatically configures all settings at the touch of a button.

Set Store the current positions of zoom/focus/filter changer/double iris diaphragm for a maximum of five combinations.

- Store: Hold down the button for approx. two seconds until a short signal is heard.
- Quickly move to positions: press button quickly
- Clear: press button for approx. four seconds, until a long signal is heard.

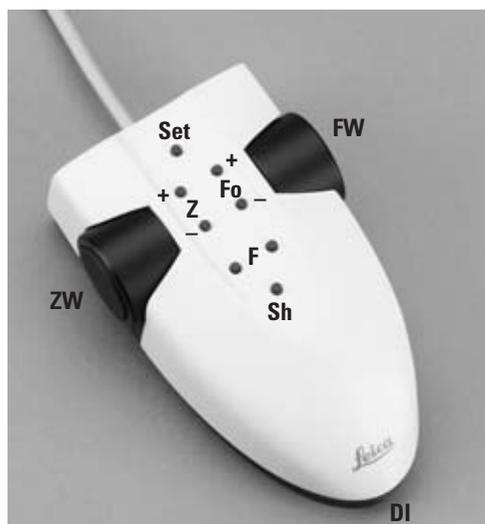


Fig. 10 Manual controls: factory preset button assignments



You can use the **Set** store button on the manual controls to store, activate or clear the current positions of zoom/focus/filter changer/double iris diaphragm.

- A maximum of five combinations can be stored.
- If a sixth combination is stored, the one nearest to it will be cleared.
- Each combination can be cleared individually.
- The system will travel to each of the individual combinations in the sequence in which they were stored.
- Switching off the system clears the stored combinations.

Activating the stored positions

Quickly move to positions: press **Set** button quickly

- The Leica MZ16 A automatically sets the stored positions of zoom, focus, filter changer, double iris diaphragm.

Deleting the stored positions

Press the **Set** button for approx. four seconds, until a long signal is heard.

4.5.8 A typical work process might be as follows:

1. First, you want to examine your specimen in overview in bright field transmitted light.
 - ▶ Use the zoom keys **Z** to switch to the lowest level of magnification and then use the zoom wheel **ZW** to adjust the magnification to exactly the level you desire.
 - ▶ Rotate the filter changer using the **F** keys until the filter holder without transponder for transmitted or incident light observation without fluorescence is positioned in the beam path.
 - ▶ Focus using the focusing buttons **Fo** and make fine adjustments using the focus wheel **FW**.
 - ▶ As necessary, adjust the depth of field of the double iris diaphragm using the **DI** wheel.
 - ▶ To store all positions: Press the **Set** button for approx. two seconds until a short signal is heard.



For fluorescence, always position the aperture protection correctly to protect the observer (page 15).

2. You now want to change to fluorescence observation, while maintaining the same zoom setting.
 - ▶ Rotate the filter changer using the **F** buttons until the desired fluorescence filter is positioned in the beam path.
 - ▶ As necessary, make fine adjustments to the focus level using the focus wheel **FW**, and to the double iris diaphragm using the **DI** wheel.
 - ▶ To store the new positions: Press the **Set** button for approx. two seconds until a short signal is heard.
3. You now want to change to a high level of magnification, while maintaining the same zoom setting.
 - ▶ Use the zoom keys **Z** to switch to the highest level of magnification or use the zoom wheel **ZW** to adjust the magnification to exactly the level you desire.
 - ▶ As necessary, make fine adjustments to the focus level using the focus wheel **FW**, and to the double iris diaphragm using the **DI** wheel.
 - ▶ To store the new positions: Press the **Set** button for approx. two seconds until a short signal is heard.

4.5.9 Observation without fluorescence

If you want to change to transmitted light or incident light observation without fluorescence, use a filter holder without transponder with closed illumination beam path. The openings in this filter holder are empty; there is no barrier filter in the beam path. The color reproduction is genuine.

- Three filter holders without transponders are included in the scope of delivery of the Leica MZ16 FA.
- The Leica MZ16 FA system recognizes that a filter holder without transponder is in position. The shutter remains closed to prevent the filter holder from overheating.

4.6 Footswitch

As desired, either zoom, shutter or filter changer can be operated using the footswitch. This frees both hands for manipulation, sorting and preparation.

- Zoom: right switch up / left switch down
- Shutter: right switch open / left switch closed
- Filter changer: right switch clockwise rotation / left switch counterclockwise rotation

The footswitch is preset at the factory to control the zoom. You can change the functions by operating the footswitch when switching on the system:

- ▶ The zoom control function on the footswitch remains active if you switch on the system without pressing the footswitch.
- ▶ The shutter control function is activated if you press the footswitch while switching on the system.
- ▶ If you want to use the footswitch to control the filter changer, switch the system off again and then on, and press the footswitch while switching the system on.

The last selected function on the footswitch remains active if you switch on the system without activating the footswitch.



Fig. 11 Foot switch

4.7 Dioptic correction

 Please refer to User Manual M1-105-0 for adjusting the individual settings of the Leica MZ16 FA, such as interpupillary distance, eyelenses, eyepoint, eyecups, viewing angle, etc.

 Perform dioptic correction in transmitted light or incident light.

- ▶ Use the **F** buttons on the manual controls to rotate the filter holder without transponder and with closed illumination beam path into the beam path (page 21).
- The shutter closes automatically.
- ▶ Open the double iris diaphragm completely using the wheel **DI** on the manual controls (all LEDs are lit up).
- ▶ Illuminate the flat object using transmitted light or oblique incident illumination.
- ▶ Perform the dioptic correction in accordance with User Manual M1-105-0.

4.8 Focussing and observing the specimen

 Follow the safety instructions. After switching on the supply unit, adjust the burner immediately (User Manual M2-216-1). For fluorescence observation, always position the aperture protection correctly to protect the observer (page 15).

 In the filter changer, all four positions must be equipped with filter holders. The active filter set is the one with its label visible on the left side of the slide slot.

- ▶ Switch on the supply unit. Wait two to three minutes (User Manual M2-216-1).
- ▶ If you have not done so already, adjust the burner as described in User Manual M2-216-1.
- ▶ Rotate the desired filter into the beam path using the **F** buttons on the manual controls.

 Automatic filter detection: on the filter holders with fluorescence filters, there is a transponder with the specific filter data. The Leica MZ16 FA system recognizes whether a fluorescence filter is in position and opens the UV shutter accordingly. If the system recognizes a filter holder without transponder, the UV shutter remains closed.

- ▶ Use the **Z** buttons to adjust to the lowest level of magnification.
- This provides a better overview and allows you to find areas that are of interest more easily.
- ▶ Use the **Fo** buttons to focus, and use the focus wheel **FW** to fine focus.
- ▶ Use the **Z** buttons to select a higher magnification or to switch to the highest magnification to observe greater details.
- ▶ As necessary, set the magnification exactly using the **ZW** zoom wheel.

4.8.1 Reflexes

When using the 1.6× planapochromatic objective, a light reflex appears between zoom positions 0.8 and 1.6, which disappears at higher zoom settings. This reflex does not occur when using the 1.0× and 0.63× planapochromatic objectives.

4.9 Calibrating the motorized zoom

The adjustment accuracy of the motor zoom is factory-set to $\pm 5\%$. If you want to work more precisely (for example, while measuring), you can calibrate the system. The calibration is stored until it is modified or cleared.



- Always perform the calibration at a ratchet step (50.0 in the example).
- Calibration modes: Magnification (C magn.) or reference distance (C dist.)
- Calibration aids: Stage micrometer in the specimen plane and graticule (10447182) in the eyepiece. The diameter of the inner circle measures 7mm. For more information on inserting the graticule, see User Manual M2-105-0.
- The optional gliding stage facilitates the precise movement of the stage micrometer.

At Limit

If this message appears on the display during calibration of the reference distance with the handwheel, you have traveled beyond the adjustable range.

Initializing calibration

Clearing previous calibrations (see p. 27).

- ▶ Move to the desired zoom ratchet step by pressing the **Z** zoom button on the manual controls (in the example, 50.0).
- ▶ Initialize the calibration using the **CAL** button on the Leica MZ16 FA.

Selecting a calibration mode

- ▶ Use the **Z** zoom button on the manual controls to select a calibration mode: magnification (C magn.) or reference distance (C dist.); in the example, it is C magn.
- ▶ Confirm and display your selection using the **SEL** button (beep).

Depending on the selected calibration mode, continue with the section "Calibrating CM" or "Calibrating CD."

Calibrating magnification (CM)

Display after confirming the selection: CM 50.3 in the example (CM = process start)

Look into the eyepieces. In the example, we are working with 10× eyepieces.

Focus the stage micrometer.

- In the example, the diameter of the small circle of 7mm at zoom position 50 (with 10× eyepieces) corresponds to a distance of 1.40mm on the specimen micrometer (7:5). (With 16× eyepieces, the distance corresponds to 2.24mm.)

Adjust the magnification using the **ZW** wheel on the manual controls exactly so that the diameter of the small circle (inside line) matches the distance of 1.40 on the stage micrometer.

Confirm and display the calibration: press the **CAL** button twice (beeps).

- In the display appears (in the example) **A 50**: i.e. A = mark of zoom position at which calibration was performed.

Calibrating the reference distance (CD)

Initialize the calibration and select the calibration mode see p.26.

- After confirming the selection using the **SEL** button, the following appears in the display (in the example): **CD 1.418** (CD = start of procedure)
- ▶ Look into the eyepieces.
- ▶ Focus the stage micrometer.
- ▶ Adjust the magnification using the **ZW** hand-wheel on the manual controls exactly, so that the diameter of the small circle (inside line) matches the distance of 1.40 on the stage micrometer.
- ▶ Confirm and display the calibration: press the **CAL** button twice (beeps).
- In the display appears (in the example) **A 50**: A = mark of zoom position at which calibration was performed.

Clearing the calibration

Press the **CAL** key at any zoom position.

- Display, depending on the mode selected: **C dist.** or **C magn.**
- ▶ Press the **SEL** button.
- Display: according to the mode selected **CD XXX** or **CM XXX**.
- ▶ Press the **CAL** button for 2 seconds (2 beeps).
- To indicate that the calibration was cleared, the A in front of the magnification is cleared.

4.10 Measuring

With the help of the stage micrometer in the specimen plane and the graticule (10447182) with two reference circles in the eyepiece, you can perform exact measurements. To insert the graticule see User Manual M2-105-0.

As the reference circle for measurements, you can select either the large or small reference circle on the graticule in the eyepiece, or the complete field of view. The selected reference circle remains stored until it is cleared or replaced by a different mode. After the reference circle has been selected and the baseline adjusted to the reference circle, the Leica MZ16 FA displays the measurements at the desired magnification with the selected unit of measure.

4.10.1 Selecting the reference circle and unit of measure

- ▶ Activate the menu using the **REF** button.
 - The display shows the reference circle **C2** (or **C1** or **FOV**) selected last and the diameter for the current magnification. The current magnification is displayed again after three seconds.
- ▶ Activate the selection menu using the **REF** button while the current reference circle is still being displayed.
- ▶ Select **Circle 1** or **2** or **FOV** (field of view) using the **Z** zoom buttons on the manual controls.
- ▶ Confirm and display your selection using the **SEL** button (beep).
 - Depending on the selection chosen, the following is displayed: **C2** (or **C1** or **FOV**) and mm (or inches or mil).
- ▶ Select mm, inches or mil using the **Z** zoom buttons on the manual controls.
- ▶ Confirm and display your selection using the **SEL** button (beep).
 - The current magnification is displayed again after three seconds.
- ▶ Return to the unit of measure display using the **REF** button.

4.10.2 Measuring



We recommend using the optional gliding stage for very fine positioning of the specimen for measurement purposes.

- ▶ Set the magnification you want to use for measurement exactly using the **Z** zoom buttons on the manual controls or the **ZW** wheel.
- ▶ Focus the specimen.
- ▶ Activate the menu using the **REF** button.
- ▶ Activate the selection menu using the **REF** button while the current reference circle is still being displayed.
- ▶ Observe which reference circle most closely matches the specimen portion you want to measure, and select **Circle 1** or **Circle 2** or **FOV** (field of vision) accordingly using the **Z** zoom buttons on the manual controls.
- ▶ Confirm and display your selection using the **SEL** button (beep).
 - Depending on the selection chosen, the following is displayed: **C2** (or **C1** or **FOV**) and **mm** (or inches or mil).
- ▶ Select mm, inches or mil using the **Z** zoom buttons on the manual controls.
- ▶ Confirm and display your selection using the **SEL** button (beep).
 - The current magnification is displayed again after three seconds.
- ▶ Observe the specimen portion you want to measure and set the magnification using the **ZW** zoom wheel on the manual controls so that the reference circle is completely filled by the specimen portion.
- ▶ Display the measurement using the **REF** button.
 - The current magnification is displayed again after three seconds.
- ▶ Return to the unit of measure display using the **REF** button.

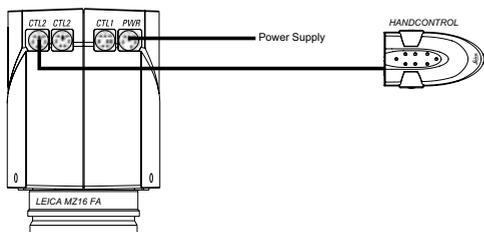
5. Annex

5.1 Filter sets

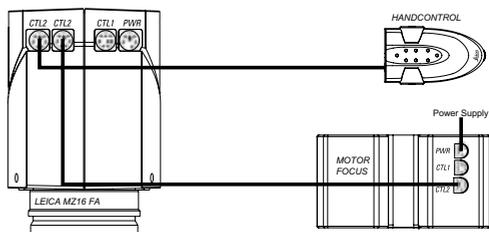
Filter sets	Excitation filter	Barrier filter	Designation
GFP	425/60nm (395–455nm)	480nm	GFP1
GFP Plus	480/40nm (460–500nm)	510nm	GFP2
GFP Plants	470/40nm (450–490nm)	525/50nm (500–550nm)	GFP3
UV	360/40nm (340–380nm)	420nm	UV
Violet	425/40nm (405–445nm)	460nm	V
Blue	470/40nm (450–490nm)	515nm	B
Green	546/10nm (541–551nm)	590nm	G
CFP	436/20nm (426–446nm)	480/40nm (460–500nm)	CFP
YFP	510/20nm (500–520nm)	560/40nm (540–580nm)	YFP
Texas Red	560/40nm (540–580nm)	610 LP nm	TXR
DsRED	545/12nm (510–560nm)	620/60nm (590–650nm)	DSR

5.2 Electrical connection diagrams

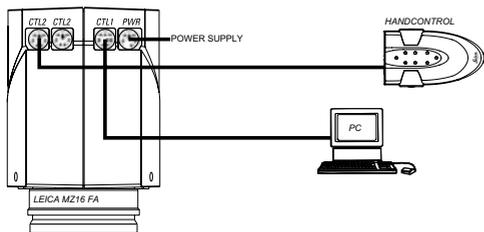
Configuration: Leica MZ16 FA with manual controls



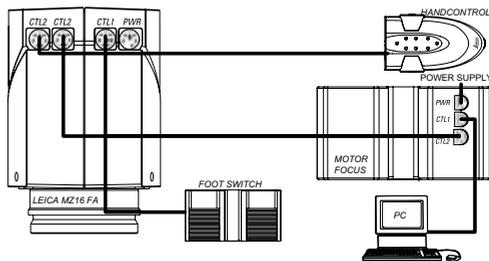
Configuration: Leica MZ16 FA with manual controls and motorized focus



Configuration: Leica MZ16 FA with manual controls and PC



Configuration: Leica MZ16 FA with manual controls, motorized focus, footswitch and PC



5.3 Technical data

Optics carrier	
Designation	Leica MZ16 FA
Microscope type	Motorized and automated fluorescence stereomicroscope with apochromatic optics system, patented TripleBeam® third beam path and patented FLUOIII® fluorescence filter system.
100% apochromatic optics system	CMO design (common main objective), lead-free
Motorized functions	Zoom, filter changer, UV shutter, double iris diaphragm, motorized focus (optional)
Control system	Manual control system, foot switch
Manual controls, illuminated, switch positions via PC individually configurable	<ul style="list-style-type: none"> – For control of zoom, filter changer, UV shutter, double iris diaphragm, motorized coarse and fine settings for zoom and focus, focus speed corresponding to zoom (the higher the finer) – Buttons for storing the positions of zoom, filter changer, double iris diaphragm, motorized focus
Foot switch	For zoom, filter changer or UV shutter
PC connection	Via RS232 interface
Display	For objective magnification, eyepiece magnification, total magnification, measured values, aperture of the double iris diaphragm, camera objective
Automated functions	<ul style="list-style-type: none"> – Absolute or user-defined calculation of the total magnification – Filter detection – Control system for stored functions such as zoom, focus, filter change, double iris diaphragm – UV shutter – Calibration of measured values when changing zoom – Automatic control of multifuorescence experiments
Double iris diaphragm for balancing the depth of field	Installed, motorized

Fluorescence system	
Illumination beam path TripleBeam®	2 observation / 1 separate illumination beam path for intensive fluorescence illumination, coupling to the zoom optics
FLUOIII® Filter System	Horizontally integrated quick changer for 4 filter sets, motorized, automatic and motorized UV shutter
Fluorescence filter transponder	Excitation filter and barrier filter on a filter holder with
Filter sets	GFP, GFP Plus, GFP Plants, UV, violet, blue, green, CFP, YFP, TXR, DSR with transponder, filter holder without transponder for transmitted light
Filter holder without transponder	For transmitted light or incident light observation without fluorescence
Light source	High-intensity mercury lamp 50 or 100W, lamp housing 106 z, chromatically corrected collector, focusable, centerable lamp mount
Safety measures	UV protection screen, UV barrier filter, stray-light protection for lamp housing, filter holder for transmitted light or empty filter positions, automatic UV shutter for filter change and transmitted light
Optical data	
Zoom	16:1, motorized
Switchable zoom positions for (repetitive tasks)	5 individually stored positions
Data	with standard optics (objective 1×/eyepieces 10×)
– Zoom range	7.1× – 115×
– Resolution	420 Lp/mm
– Numerical aperture	0.14
– Field of view	∅ 29.6mm – 1.8mm
Maximum values (based on optics combination)	
– Magnification	920×
– Resolution	840 Lp/mm
– Visible structural width	0.6 micron
– Numerical aperture	0.28
– Field of view	∅ 59mm
Optical accessories	
Objective	Planapochromatic 1×, 2×, 1.6×, 0.63×, lead-free Planachromatic 1.0×, 0.5×, 0.8× with long focal length, lead-free
Working distances	55mm (Planapo 1×), 19mm (Planapo 1.6×), 15mm (Planapo 2×), 97mm (Planapo 0.63×), 60mm (Plan 1×), 112mm (Plan 0.8×), 135mm (Plan 0.5×)
Binocular tube, ergonomic	Apochromatic ErgoTube® 10° – 50° with synchronous interpupillary distance adjustment, various ErgoModules® (optional) ErgoTube® and ErgoModule® are registered with the «United States Patent and Trademark Office».
Eyebase (interpupillary distance)	55mm – 75mm
Wide-field eyepieces for persons	10×, 16×, 25×, 40×, distortion-free, wearing glasses plug-on eyecups for protection from infection

Stands, illuminators	
Transmitted light	Stand HL RC™ high-performance base with innovative contrast methods, stands for bright field and bright/dark field
Incident light	Stand With stage plate, black/white
Stand for large objects	Swinging arm stand, stage clamp stand, universal stand
Motorized focus	With 300mm or 500mm column, control via hand switch, foot switch or PC
Manual focusing drive	Coarse/fine focus, adjustable ease of movement, with 300mm or 500mm column
Stages	Leica MATS heating stage thermocontrol system, gliding stage, polarization
Illuminators	Cold light sources
Various accessories	
Video system	Leica IC A, integrated
Photography	<ul style="list-style-type: none"> – Digital camera systems for fluorescence Leica DC350 F, DFC350 F, DC300 F, DFC300 F, DC300 FX, DFC300 FX, DC350 FX, DFC350 FX, DC480, DC500 – Leica MPS60 modular photomicrographic system with data back
Software	For image grabbing, archiving, processing and analysis: Leica Image Manager with Image Overlay and Multifocus modules, FW4000, QWin
Measuring	Measurement graticule for automatic calibration and measurement

Technical data

Weight

– Leica MZ16 FA optics carrier	3.14 kg
– Lamp housing	2.5 kg
– Filter set	20 g
– Manual controls	390 g
– Planapochromatic objective 1×	21.1 kg
– Focusing drive, coarse/fine, with column	1.15 kg
– Microscope carrier	0.495 kg

Power pack

– Input voltage	85 V to 264 V
– Input frequency	47 Hz to 63 Hz
– Output voltage	12 VDC
– Supply connector	IEC 320
– Low-voltage connector Mini-DIN	5-pole
– Operating temperature	+10°C to +40°C
– Relative humidity	< 85 %
– Storage temperature	–20°C to +55°C

ebq 100 supply unit

For indoor use only.	
– Supply voltage	90–250 V~
– Frequency	50–60 Hz
– Power consumption	155 VA max.
– Fuses	2×T2A (IEC 127)
– Ambient temperature	15 – 35°C
– Relative humidity	maximum 80% up to 30°C
– Overvoltage category	II
– Degree of pollution (see instructions provided)	

Column with motorized focus on incident light or transmitted light basis, type MST31

– Resolution	2 microns
– Input voltage	85 to 264 VAC
– Input frequency	47 to 440 Hz
– Input current	max. 0.80 A at 115 VAC max. 0.50 A at 230 VAC
– Operating voltage	30V
– Operating temperature	+10°C to +40°C
– Storage temperature	–20°C to +55°C
– Maximum mechanical loading	12 kg

Focusing drive, coarse/fine

maximum load	<15 kg
– 1 micron resolution at 5 kg load	
– 2 micron resolution at 10 kg load	

Operating controls



Fig. 12 Manual controls: factory preset button assignments

- Set** Store the current positions of zoom/focus/filter changer/double iris diaphragm for five combinations.
- Z** Function 1: Zoom up/down, quick zoom
Function 2: menu selection buttons
- ZW** Zoom up/down, fine zoom
- Fo** Focus up/down, quick focus
- FW** Focus up/down, fine focus
- F** Filter changer, clockwise/counterclockwise rotation
- Sh** Shutter for opening/closing the illumination beam path (only possible in fluorescence mode)
- DI** Aperture of the double iris diaphragm

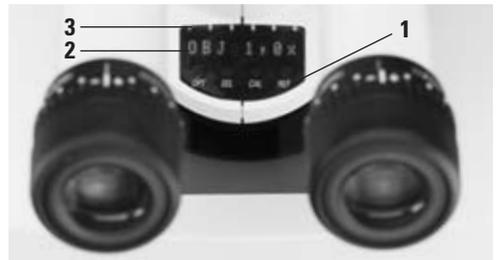


Fig. 13 Display with function keys

- 1** Function keys:
 - OPT** Selection of eyepiece / objective / video or photo objective / acoustic signal
 - SEL** Confirm and display the selection
 - CAL** Calibrate motor zoom
 - REF** Display diameter of reference circle for measurements
- 2** Display: objective magnification / eyepiece magnification / video objective / total magnification / field of view diameter / measurements
- 3** Light emitting diodes aperture of the double iris diaphragm

Additional operating elements see page 3.

5.4 Optical data

Objectives		1× Plan 1× Planapo		0.5× Plan		0.63× Planapo		0.8× Plan		1.6× Planapo		2× Planapo	
Eyepieces	Magnification changer	Working distances in mm											
		60 Plan 55 Planapo		135 Plan		97 Planapo		112 Plan		19 Planapo		15 Planapo	
		Total magnification	Field of view diameter (mm)	Total magnification	Field of view diameter (mm)	Total magnification	Field of view diameter (mm)	Total magnification	Field of view diameter (mm)	Total magnification	Field of view diameter (mm)	Total magnification	Field of view diameter (mm)
10×/21B	0.71	7.1	29.6	3.5	59.1	4.5	47	5.7	37	11.4	18.5	14.2	14.8
	0.8	8	26.3	4	52.5	5.1	41.2	6.4	32.8	12.8	16.4	16	13.1
	1	10	21	5	42	6.4	32.8	8	26.3	16	13.1	20	10.5
	1.25	12.5	16.8	6.3	33.3	8	26.3	10	21	20	10.5	25	8.4
	1.6	16	13.1	8	26.3	10.2	20.6	12.8	16.4	25.6	8.2	32	6.6
	2	20	10.5	10	21	12.8	16.4	16	13.1	32	6.6	40	5.3
	2.5	25	8.4	12.5	16.8	16	13.1	20	10.5	40	5.3	50	4.2
	3.2	32	6.6	16	13.1	20.5	10.2	25.6	8.2	51.2	4.1	64	3.3
	4	40	5.3	20	10.5	25.6	8.2	32	6.6	64	3.3	80	2.6
	5	50	4.2	25	8.4	32	6.6	40	5.3	80	2.6	100	2.1
	6.3	63	3.3	31.5	6.7	40.3	5.2	50.4	4.2	100.8	2.1	126	1.7
	8	80	2.6	40	5.3	51.2	4.1	64	3.3	128	1.6	160	1.3
	10	100	2.1	50	4.2	64	3.3	80	2.6	160	1.3	200	1.1
11.5	115	1.8	57.5	3.7	72.5	2.9	92	2.2	184	1.1	230	0.9	
16×/14B	0.71	11.4	19.7	5.7	39.4	7.2	31.3	9.1	24.6	18.2	12.3	22.8	9.8
	0.8	12.8	17.5	6.4	35	8.2	27.3	10.2	22	20.5	10.9	25.6	8.8
	1	16	14	8	28	10.2	22	12.8	17.5	25.6	8.8	32	7
	1.25	20	11.2	10	22.4	12.8	17.5	16	14	32	7	40	5.6
	1.6	25.6	8.8	12.8	17.5	16.4	13.7	20.5	10.9	41	5.5	51.2	4.4
	2	32	7	16	14	20.5	10.9	25.6	8.8	51.2	4.4	64	3.5
	2.5	40	5.6	20	11.2	25.6	8.8	32	7	64	3.5	80	2.8
	3.2	51.2	4.4	25.6	8.8	32.8	6.8	41	5.5	81.9	2.7	102.4	2.2
	4	64	3.5	32	7	41	5.5	51.2	4.4	102.4	2.2	128	1.8
	5	80	2.8	40	5.6	51.2	4.4	64	3.5	128	1.8	160	1.4
	6.3	100.8	2.2	50.4	4.4	64.5	3.5	80.6	2.8	161.3	1.4	201.6	1.1
	8	128	1.8	64	3.5	81.9	2.7	102.4	2.2	204.8	1.1	256	0.9
	10	160	1.4	80	2.8	102.4	2.2	128	1.8	256	0.9	320	0.7
11.5	184	1.2	92	2.4	115.9	1.9	147.2	1.5	294.4	0.8	368	0.6	
25×/9.5B	0.71	17.7	13.4	8.9	26.8	11.1	21.2	14.2	16.7	28.3	8.4	35.4	6.7
	0.8	20	11.9	10	23.8	12.8	18.6	16	14.8	32	7.4	40	5.9
	1	25	9.5	12.5	19	16	14.8	20	11.9	40	5.9	50	4.8
	1.25	31.3	7.6	15.6	15.2	20	11.9	25	9.5	50	4.8	62.5	3.8
	1.6	40	5.9	20	11.9	25.6	9.3	32	7.4	64	3.7	80	3
	2	50	4.8	25	9.5	32	7.4	40	5.9	80	3	100	2.4
	2.5	62.5	3.8	31.3	7.6	40	5.9	50	4.8	100	2.4	125	1.9
	3.2	80	3	40	5.9	51.2	4.6	64	3.7	128	1.9	160	1.5
	4	100	2.4	50	4.8	64	3.7	80	3	160	1.5	200	1.2
	5	125	1.9	62.5	3.8	80	3	100	2.4	200	1.2	250	1
	6.3	157.5	1.5	78.8	3	100.8	2.4	126	1.9	252	0.9	315	0.8
	8	200	1.2	100	2.4	128	1.9	160	1.5	320	0.7	400	0.6
	10	250	1	125	1.9	160	1.5	200	1.2	400	0.6	500	0.5
11.5	287.5	0.8	143.8	1.7	181.1	1.3	230	1	460	0.5	575	0.4	
40×/6B	0.71	28.4	8.4	14.2	16.9	17.9	13.4	22.7	10.5	45.4	5.3	56.8	4.2
	0.8	32	7.5	16	15	20.5	11.7	25.6	9.4	51.2	4.7	64	3.8
	1	40	6	20	12	25.6	9.4	32	7.5	64	3.8	80	3
	1.25	50	4.8	25	9.6	32	7.5	40	6	80	3	100	2.4
	1.6	64	3.8	32	7.5	41	5.9	51.2	4.7	102.4	2.3	128	1.9
	2	80	3	40	6	51.2	4.7	64	3.8	128	1.9	160	1.5
	2.5	100	2.4	50	4.8	64	3.7	80	3	160	1.5	200	1.2
	3.2	128	1.9	64	3.8	81.9	2.9	102.4	2.3	204.8	1.2	256	0.9
	4	160	1.5	80	3	102.4	2.3	128	1.9	256	0.9	320	0.8
	5	200	1.2	100	2.4	128	1.9	160	1.5	320	0.8	400	0.6
	6.3	252	1	126	1.9	161.3	1.5	201.6	1.2	403.2	0.6	504	0.5
	8	320	0.8	160	1.5	204.8	1.2	256	0.9	512	0.5	640	0.4
	10	400	0.6	200	1.2	256	0.9	320	0.8	640	0.4	800	0.3
11.5	460	0.5	230	1	289.8	0.8	368	0.6	736	0.3	920	0.3	

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