



## **Reflected light microscopes**



**GSX-400/GSX-600**

# **Manual**

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# 1. Safety and General Instructions

**Important:** Before using the device and any additional equipment, these operating instructions must be read and followed!

This device and its accessories are delivered in a safe and tested condition. Any damage must be reported to the manufacturer immediately. In such a case, assembly of the device may only proceed after consultation with the manufacturer.

This device is a light microscope designed and intended for visual, microphotographic, and video-based examinations. Any other use is considered misuse of the device and will result in the voiding of the warranty and manufacturer liability.

This device does not have protective measures against samples with corrosive, toxic, radioactive, or other hazardous properties.

The device may only be operated with the mains voltage specified on the device. Power plugs must only be connected to the designated power outlets. Ensure that all plugs and power cords are free of damage, as defects may result in dangerous electric currents passing through the body.

Before opening the device, always disconnect it from the mains, as otherwise live parts of the device could be exposed.

## 1.1. Properties and applications

The microscope is equipped with high-quality optics that provide largely flat, color-accurate, and distortion-free images.

Various supplementary accessories are available for this device. With these, the device can be

modified and expanded, allowing it to be configured for specific applications.

For documenting material samples, the microscope can be supplemented with a camera and analysis software.

## 1.2. Structure and Function

The GSX-400 / GSX-600 microscope for reflected light applications consists of a solid stand, onto which the individual microscope components are mounted. For visual observation, a binocular tube is available, equipped with wide-field eyepieces (spectacle eyepieces).

The GSX-400 / GSX-600 features a revolving nosepiece that accommodates up to four M-Plan  $\infty$  objectives. The nosepiece is ball-bearing mounted and has indexed positions for precise objective alignment.

Various specimen stages (gliding stage, positioning stage, measuring stage) are available for specimen placement and alignment in the x and y directions.

The microscope is equipped with a compact reflected light tube that includes an integrated 3W LED illumination system, enabling coaxial illumination of material samples.

All electrical and electronic components related to illumination are integrated into the microscope stand. The lighting is controlled via a rotary knob located in the base of the stand.

The power supply is provided through the integrated connection cable with a safety plug. The device is designed to be connected to a 230V/50Hz power outlet.

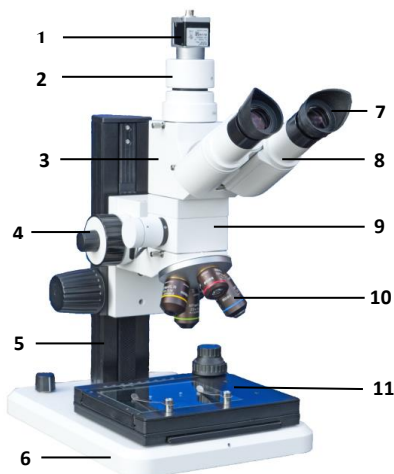


Fig. 1: Structure GSX-400 / GSX-600

- 1 Digital camera
- 2 Video adapter, C-mount connection thread
- 3 Photo tube 1x visual / 0.8x photo
- 4 Coaxial coarse and fine focus drive
- 5 Stand column with quick height adjustment
- 6 Stand base with illumination control
- 7 Eyepiece with eye cup
- 8 Binocular tube with eyepiece mount
- 9 Compact coaxial reflected light tube
- 10 Revolving nosepiece with objectives
- 11 XY Positioning Stage

### 1.3. Technical Data GSX-400 / GSX-600

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**Objectives (10) (Reflected Light) M-Plan  $\infty$**   
 5x; 10x; 20x; 50x  
 (Objective configuration according to customer requirements)

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**Eyepieces (7)**  
 GF-Pw 10x / 20

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**Photo Tube Magnification Factor (3)**  
 1x Visual; 0.8x Photo/TV

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**Video Adapter C-Mount (2)**  
 0.63x

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**Illumination (9)**  
 coaxial, 3W-LED

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**Total Magnification (Visual)**  
 $V_g = V_{obj} \times V_{ok}$       50x ... 500x  
 (when using 10x eyepieces)

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**Field of View (mm)**  
 4.0 ... 0.4

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**Maximum Sample Height**  
 approx. 170 mm (GSX-400); 370 mm (GSX-600)  
 (Distance from Optical Axis to Stand Column  
 125 mm)

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**Interpupillary Distance Adjustment (8)**  
 55...75mm

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**Diopter Compensation (8)**  
 $\pm 6$  dpt

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**Coaxial Coarse and Fine Focus Drive (4)**  
 Resolution:      2  $\mu$ m  
 Stroke:          25 mm

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Positioning stage with 70x50 mm travel and  
 vernier in x-direction

## 2. Start-Up

### 2.1. Preparing for Operation

Carefully open the microscope packaging.

First, remove the microscope stand (6) from the box and place it on a flat surface. After taking out the reflected light tube (9), insert it into the quick-release mount of the microscope stand and secure it with the knurled screw.

Next, remove the binocular tube (8) and the photo tube (3). Insert the binocular tube into the quick-release mount of the photo tube and secure it with the knurled screw.

Then, mount the pre-assembled binocular tube and photo tube onto the quick-release mount of the reflected light tube (9) and fasten them with the knurled screw.

Now, remove the video adapter (2) and attach it to the quick-release position on the photo tube (3). Then, screw the digital camera (1) onto the C-mount thread of the video adapter (2).

To prevent dust or other dirt particles from contaminating the camera sensor, ensure that the camera's protective cover is removed only shortly before installation. We recommend always holding the camera with the sensor facing downward to prevent particles from settling on the sensor.

The optical surfaces should not be touched with bare hands.

Remove the objectives from their protective cases and screw them into the revolving nosepiece (10) in such a way that the magnification increases in a clockwise direction when rotating the nosepiece.

Insert the XY positioning stage (11) into the quick-release mount for stages in the microscope base (6) (instead of an S/W plate) and secure it

with the clamping screw located on the front side.

Finally, insert the GF-Pw 10x/20 eyepieces (7) into the binocular tube. The GF-Pw 10x/20 eyepieces can be used with or without eye cups. They are designed for users who wear glasses. For this purpose, the silicone eye cup can be folded back to protect the lenses of the glasses.

To prevent the inside of the tube from accumulating dust, the eyepieces should remain in the tube. After use, the device should be covered with the provided dust cover.

The coaxial illumination system can be adjusted in intensity (ON, OFF, BRIGHT, DARK) using the rotary knob on the microscope base after establishing the electrical connection between the reflected light tube and the power supply, located at the rear of the microscope base (6).

Focusing an object can be done either via the coaxial coarse and fine focus drive (4) or through the quick height adjustment of the stand column (5).

### 2.2. Focus Adjustment

#### Eyepiece Focus Adjustment

Eyepiece focus adjustment is only necessary when using the binocular tube.

The microscope should be adjusted so that it provides a sharp image at all magnification levels in the desired focal plane (parfocal adjustment and individual diopter correction). The following steps are required for eyepiece adjustment:

The distance between the eyepieces can be adjusted to the individual interpupillary distance by turning the eyepiece sockets on the binocular tube. The left adjustable diopter ring on the binocular tube is set to 0. The objective with the highest magnification factor is swiveled in. Use the drive (4) to focus the object in the desired focal plane. To do this, observe the focal plane of

the object with the right eye through the right eyepiece.

The objective with the smallest magnification factor is then swiveled in. While observing with the left eye through the left eyepiece, the focus is adjusted by turning the diopter ring (compensation for the individual visual defect).

The microscope is now adjusted to the user's eyesight. All objectives, from the lowest to the highest magnification, will provide a sharp image in the previously set focal plane.

### Camera Focus Adjustment

The video adapter (2) is pre-adjusted at the factory. The focus adjustment described below is only necessary if the image on the monitor appears blurry.

The 0.63x video adapter consists of two parts. The lower part is attached to the photo tube (3), the upper part is screwed into the lens connection thread of the digital camera (c-mount). The two parts are now plugged together and, with the microscope properly adjusted (focus adjustment on the eyepiece side) and using the objective with the smallest magnification factor, moved against each other until the image on the monitor appears sharp. The camera is aligned and the screws tightened.

## 2.3. General Operating Instructions

The height adjustment of the microscope is performed using either the stand column with quick height adjustment (5) or the coaxial coarse and fine focus drive (4).

To *optimize* illumination, the brightness can be adjusted to the respective specimen using the rotary knob on the microscope base (6).

The *tube exchange* process is the same for all viewing and intermediate tubes. Loosen the knurled screw beneath the tube, lift the front of the tube, and remove it at an angle upwards. When attaching a new tube, insert the rear edge

first. Ensure that the guide screw on the back of the tube mount engages with the groove of the tube. Finally, tighten the knurled screw.

If necessary, the tubes can also be mounted in a 180° rotated position. The simultaneous use of two or more intermediate tubes is only possible to a limited extent.

The *objective exchange* process is the same for all objectives. The revolving nosepiece has a W0.8" (RMS) threaded connection, which is centered and pre-aligned. When changing an objective, ensure that it does not fall and that the optics are not touched with bare hands.

Removed objectives should always be placed in their designated protective cases.

For *eyepiece replacement*, all fixed and adjustable eyepieces from laboratory and technical microscopes can be used. These should be inserted into the eyepiece mounts until they reach the stop.

### 3. Maintenance and Care

The GSX-400 and GSX-600 microscopes and their accessories are maintenance-free over an extended period under normal use. However, in cases of continuous operation (shift work) or particularly unfavorable environmental conditions (e.g., dust), the listed maintenance tasks should be performed as needed.

**Before performing any maintenance on the device, ensure that the power plug is disconnected.** Additionally, improper handling of optical components can lead to imaging errors or reduced sharpness.

#### 3.1. Care of Various Components

**3.1.1.** The *diopter ring* should be unscrewed, and the threads should be lightly greased. By turning the diopter ring back and forth several times, the grease will be evenly distributed. When reattaching the ring, make sure that the markings align with the index lines on the eyepiece mount.

We recommend using the following grease, available from BAQ:

Precision Mechanics Grease DMP-2 (low viscosity)

**3.1.2.** *Eyepieces, tubes, and objectives* should be regularly dusted using a soft hairbrush and an optical dust cloth (available from optical accessory suppliers). These components should be removed from the device, and all accessible optical parts should be carefully cleaned.

Any attempt to disassemble an objective will inevitably result in complete misalignment.

Externally accessible optics can be cleaned with an optical cleaning cloth. As a cleaning solution, isopropanol with a small amount of ethanol can be used.

**3.1.3.** When the *microscope* is not in use, it should be covered with the supplied dust cover (if included in the order).

**3.1.4.** For lubricating the *sliding surfaces* of the *stage*, we recommend the following grease:

Precision Mechanics Grease DMP-4 (high viscosity), available from BAQ

Both surfaces should be coated with a thin layer of this grease at regular intervals. Before applying new grease, the old grease should be carefully removed using a grease-dissolving agent.

**3.1.5.** To clean the *exterior surfaces* of the *microscope*, we recommend wiping them with a damp cloth. For heavy soiling, ethanol can be used to dissolve dirt.

## 4. Accessories (Optional)

### 4.1. Eyepieces

**4.1.1.** *Fixed eyepieces* are available in various magnifications (*first number*) and with different field-of-view numbers (*second number*). They allow for changes in total magnification beyond the range of the magnification changer without affecting the working distance. All eyepieces can be equipped with eye cups. The **GF-Pw 10x/20** and **GF-Pw 16x/12.5** eyepieces are suitable for eyeglass wearers (indicated by an eyeglass symbol).

**4.1.2.** *Adjustable eyepieces* are ideal for measurement and counting purposes. A variety of measuring reticles is available, which can be inserted into the eyepieces as needed. To do this, the eyepiece reticle holder is unscrewed, and the reticle is placed inside with the engraving facing downward toward the object. Afterward, the cover is screwed back in. The fixed eyepiece is then removed from the calibrated microscope and replaced with the adjustable eyepiece. By adjusting the eye lens, the adjustable eyepiece is focused on the reticle.

### 4.2. Tubes

**4.2.2.** The *binocular tube* allows the use of two eyepieces with the same magnification. Both fixed and adjustable eyepieces can be used.

Focus adjustment is performed as described in Chapter 2.2.

The binocular tube is designed for eyepieces with an insertion diameter of 30 mm (e.g., GF-Pw 10x/20, GF-Pw 12.5x/20, ...).



Fig. 2:  
*Binocular tube with 30 mm insertion diameter and eyepieces*

### 4.3. Objectives

For working with the microscope, a variety of objectives with different magnifications (5x, 10x, 20x, 50x, 100x) and imaging performance are available (plan or apochromatic (color-corrected)). The objectives are designed for infinity-corrected tube optics.



Fig. 3: *Example Objectives*



## 4.4. Photo Tube 1x Visual / 0.8x Photo

The 50/50 photo tube with image orientation is ideal for both visual observation and simultaneous photo and video documentation. For optimal viewing, the visual output is tilted by 30°. The photo output, with a magnification factor of 0.8x, allows for appropriate field-of-view adjustment, ensuring efficient pixel utilization for digital cameras and providing larger fields of view without edge shading.

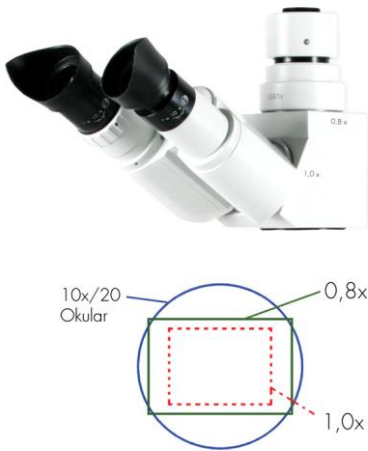


Fig. 4: Photo Tube  $\infty$  1x/0.8x

## 4.5. Measuring Instruments

### 4.5.1. Eyepiece Reticle

Eyepiece reticles can be used in adjustable eyepieces (Section 4.1.2).

### 4.5.2. Object Micrometer

The object micrometer serves as a standard for microscopic length measurements and for calibrating the measuring software. The scale is located on the top of the scale carrier. For calibration, the scale is oriented towards the objective, and for direct length measurements on flat objects, the scale is brought into contact with the object surface. The object micrometer 70/0.5 has a scale length of 70 mm, with a subdivision of 0.5 mm. In the center of the scale, the division length is 10 mm or 2 mm, with a subdivision distance of 0.1 mm or 0.01 mm.

### 4.5.3. Measuring Software

With a measuring program, it is possible to measure objects captured by the microscope after calibration and store them in digital form.

Various measuring programs are available. To use these programs, a computer with the installed software and a suitable digital camera (digital single-lens reflex camera or digital USB3 camera) are required.

The camera is connected directly to the photo tube via a suitable video adapter (c-mount). The use of the software is described in a separate user manual provided by the software manufacturer.

## 4.6. Video Adapter

For proper adjustment of the camera's field of view to the eyepiece image, four video adapters with magnifications of 0.3x, 0.4x, 0.63x, and 1x are available. For video output, in addition to the camera and monitor, only a photo tube and a video adapter are required.

The photo tube is mounted on the illumination tube. The video adapter is then placed on its upper exit, to which a video camera can be attached (in most cases, this uses a c-mount threaded connection).

All video adapters are factory-calibrated, so the clamp typically does not need to be adjusted (for focus calibration). Focus adjustment, as described in Section 2.2, only needs to be performed if the object is not displayed sharply on the sensor plane.



Fig. 5: Video Adapter 0.4x; 0.63x; 1.0x

## 4.7. Tables

A quick-change point makes it easy to switch between the sliding table and positioning table.

### 4.7.1. Sliding Table

The sliding table enables sensitive positioning of the object within a diameter of 30 mm.



Fig. 6: Sliding Table

### 4.7.2. XY Positioning Stage 70 x 50

The positioning table enables simple sample alignment in the x-y direction in the 70 x 50 mm range.



Fig. 7: XY Positioning Stage 70 x 50

## 5. Complaints, Warranties

Obvious defects must be reported in writing immediately after detection, and at the latest within one week of receiving the goods, along with a statement regarding the findings. The warranty period is 2 years.

Failure to inspect is considered an unconditional acceptance of the goods' condition. Custom-made products are excluded from exchange.

Changes to the electrical, electronic, or external features of the goods may be made without prior notice to the buyer, provided that the value and function of the delivered products are not affected.

With respect to possible improvements or other reasons for changes, we reserve the right to make deviations from our brochures and price lists.

Such changes do not obligate us to provide separate notification.



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