Axio Lab A1 操作手册

操作该设备必须完全了解这些说明。请您了解这些内容，并全力遵守安全说明。

为了进一步的发展技术，我们保留更改的权利。该手册不再进行更新。

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1. 引言

1.1 安全指南

Axio Lab.A1 显微镜是按照 DIN EN 61010-1（IEC 61010-1）和 IEC 61010-2-101，测量、控制和实验室仪器的安全规定，进行设计、生产和测试的。

该显微镜满足 98/79/EG（In-Vitro-Diagnostika）规定中的要求，并贴有标签。CE

本手册含有操作者必须遵守的信息和安全警告。
本手册使用了下列警告和安全符号：

注意：
这一符号表示使用人员任何情况下都必须遵守的注意事项。

警告：
这一符号提示该操作可能危害仪器或仪器系统。

警告：
这一符号提示该操作可能危害使用者。

警告：
表面发热！

警告：
发出紫外线辐射！

警告：
发出激光辐射！

警告：
在打开前断开仪器的电源线。

Axio Lab.A1 显微镜，包括原始附件，只能使用于本手册介绍的显微观察技术。
下列警告需要特别注意：

如果显微镜，及其部件或单个零件以任何不同的方式使用，厂家不承担任何责任。由未经授权的人员完成的任何服务或维修工作以及在保修期以外索要任何权利，厂家概不负责。

该显微镜只可插入配备了安全接地触点的电源插座。不得使用没有接地线的延长线。

任何安全机制明显失灵时，必须关掉显微镜，避免任何操作。再次开启显微镜之前，请联系 Zeiss 服务部门或 Carl Zeiss Microscopy Service。

Axio Lab.A1 主机体内置照明电源组件，它的适应电压范围为 100-240 V ±10 %，50 / 60 Hz，不需要在显微镜上对其进行电压调整。

打开显微镜或更换保险丝之前，必须拔下插头！

请确认保险丝符合额定电流。千万不要使用简易保险丝，不能使保险丝立柱短路。

Axio Lab.A1 显微镜没有任何特别的安全保护装置来保护你的健康免受酸、潜在的传染性、毒性、放射性或其他具有潜在危险的标本的危害。必须遵守所有的法律规定，尤其是国家事故预防规定。

污物和灰尘可能会影响显微镜的性能。不使用时，盖上防尘罩。盖上防尘罩前，始终确保仪器已关闭。

覆盖通风缝可能会积聚热量，损害仪器，甚至引起火灾。务必保持通风缝开着，不要向通风缝放置或意外地扔任何东西。

只允许经过授权的人员操作该仪器。操作人员必须知道使用显微镜时可能发生的危险。Axio Scope.A1 是一个精密仪器，处理不当时，会很容易破损或损坏。

不要在含有潜在爆炸性气体的区域中操作该仪器。
始终将其放在一个稳定和耐热的表面。

LED 危险级别为 2(按照 IEC62471 标准)
千万不要直视照明设备的光束-无论是否有光学仪器。即使您只是想看看标本，也不可以。否则眼睛可能发生无法弥补的损害！

在光路周围不要放置有任何可燃或易燃材料。

请仔细阅读 Immersol 518 N ®，Immersol 518 F ®和 Immersol W ®上的安全数据表。

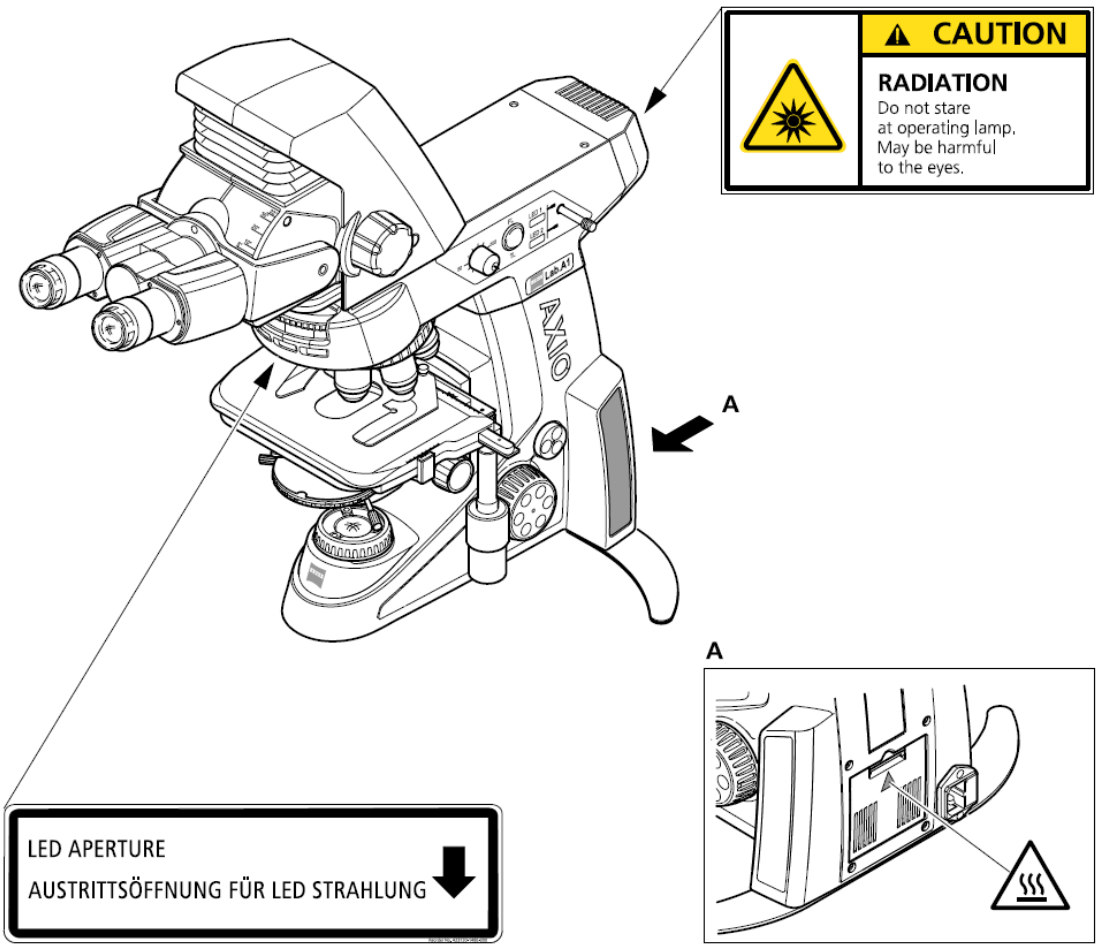
Immersol 518 N ®浸液刺激皮肤。避免与皮肤、眼睛和衣服有任何接触。
如果接触皮肤，用大量的水和肥皂冲洗。

如果接触眼睛，立即用水冲洗至少 5 分钟。如果仍有刺激，应立即向医生寻求帮助。

适当地处理 Immersol 518 ñ ®浸液： 不允许其污染地表水或进入排水管。

有缺陷的显微镜或部件不属于生活垃圾。按照适当的法律规定进行处理。
标本也必须根据有效的法律法规和内部工作指示妥善处置。

Axio Lab.A1 主机上的警告标识



警告标识：热表面!
所有显微镜的透射光照明器上均贴有

图. 1-1　在 Axio Lab.A1 上透射光和反射荧光的 "辐射" 和 "LED 辐射"警告标识

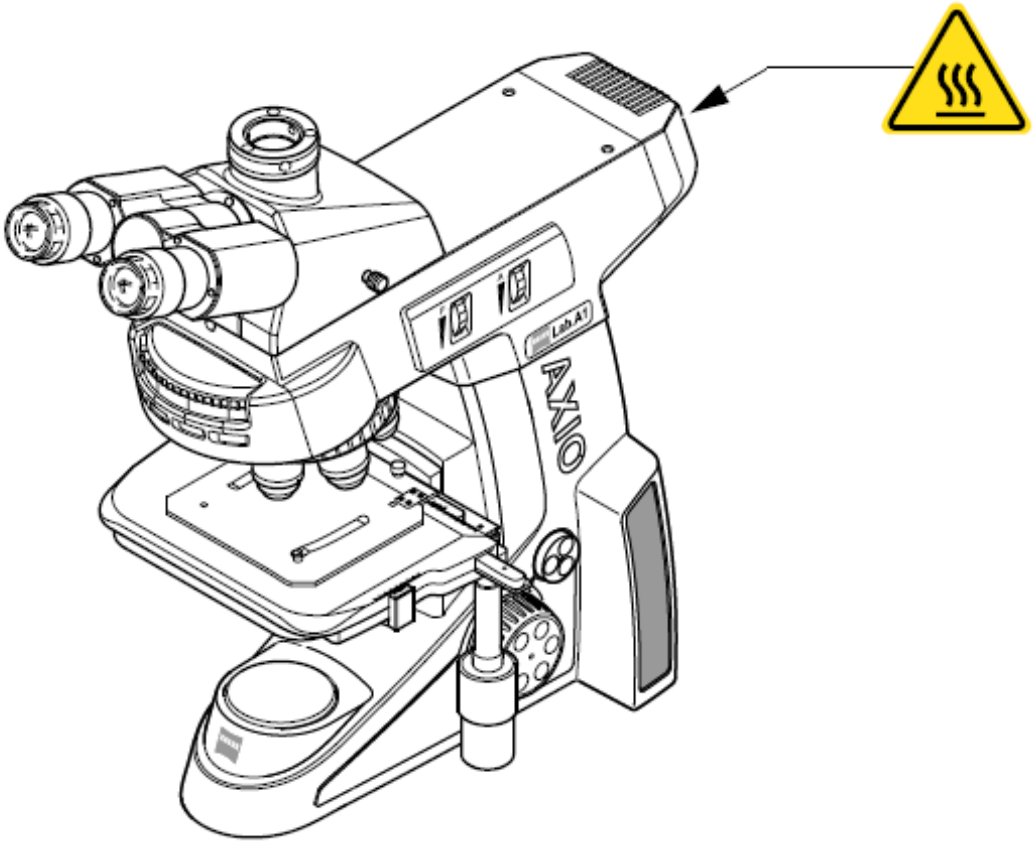


图. 1-2　Axio Lab.A1 反射光警告标识 "热表面"

1.2 此显微镜的人机工程学含义

Axio Lab.A1 显微镜是由蔡司按照职业保健医生的意见,并遵从 TÜV Rhineland 在显微镜工作站方面的大多数要求设计和制造的.这是全世界第一台带有人机工程学设计并获得 TÜV:"通过人机工程学测试"证书的显微镜,证书编号:0000025994

Axio Lab.A1 级别的实验显微镜正在应用到各个常规领域(例如:血液检查,组织和细胞检查等),并且一般每次使用时间均在几个小时.在光学显微镜没有使用人机工程学设计时,这种经常长时间的工作会导致使用者出现健康问题.这种健康风险可以通过合理的设计和改造控制手柄位置,单独调整目镜的屈光度等和显微镜整体的正确设计来降低.

这样的设计可以改善工作条件,安抚员工的情绪和提高工作效率.越来越多的国家和地区为显微镜的操作建立的严格的规章制度,尤其在医学领域.另外雇主有义务为雇员提供人机工程学类的工作场所和显微镜.

TÜV 证书编号:0000025994:"通过人机工程学测试",规定了使用者和设备之间,从桌面到控制手柄的距离.并且还规定了一个目镜调节范围,以适用于全世界使用显微镜的不同高度的男性和女性员工.因此人机工程学的观察筒要求可以垂直调节高度,并且观察角度也要可以调节.这样就可以适用于不同高度的人群(静态工程学)和偶尔会有大量的不同的人员使用(动态工程学). TÜV 人机工程学证书的基准包含以下内容:

– DIN 58959-4:	Quality management in medical microbiology – Part 4: Requirements for investigations using light microscopes
– DIN EN 1335-1:	Office work chairs – Part 1: Dimensions – Determination of dimensions
– DIN EN 12464-1:	Lighting of work places – Part 1: Indoor work places
– DIN EN 12665:	Basic terms and criteria for specifying lighting requirements
– DIN EN 13150:	Workbenches for laboratories – Safety requirements and test methods
– DIN EN ISO 15189:	Medical laboratories – Particular requirements for quality and competence
– DIN EN ISO 9241-11:	Ergonomic requirements for office work with visual display terminals – Guidance on usability
– DIN EN ISO 60601-1-6:	Medical-electrical equipment – General requirements for basic safety and essential performance

以下是人机工程学标准

– DIN 33402-2:	Ergonomics – Human body dimensions – Part 2: Values
– DIN 33406:	Workplace dimensions in production
– DIN 33408:	Body templates for seats
– DIN 33411:	Human physical strength
– DIN 68877:	Swiveling work chair - Safety requirements, testing
– DIN EN 614-1:	Ergonomic design principles – Part 1: Terms and general principles

- DIN EN 894-1: Ergonomic requirements for the design of displays and control actuators – Part 1: General principles for human interaction with displays and control actuators
- DIN EN 894-3: Ergonomic requirements for the design of displays and control actuators – Part 3: Control actuators
- DIN EN 62079: Preparation of instructions – Structuring, content and presentation
- DIN EN ISO 7250: Basic human body measurements for technological design
- DIN EN ISO 14738: Safety of machinery – Anthropometric requirements for the design of workstations at machinery
- ISO 11226: Ergonomics – Evaluation of static working postures
- SEMI S8-0307: Safety guidelines for ergonomics engineering of semiconductor manufacturing equipment

更多关于 TÜV 人机工程学证书和 Axio Lab.A1 显微镜基本的人机工程学设定和操作,请参见 3.5 章节

1.3 质保注意事项

制造厂商保证仪器在交付时没有材料或生产缺陷。如果发现任何缺陷，请立即通知制造厂商并采取一切措施将损害减到最小。制造厂商得知产品有缺陷后，有义务修复缺陷。制造厂商有权自行决定修理仪器或更换一台无任何缺陷的仪器。但是制造厂商不保障由自然磨损（特别是磨损部分和消耗品）以及使用不当造成的缺陷。

如果由于操作错误、疏忽或擅自对仪器进行更改，特别是卸下或更换仪器零件，或者使用其它厂商的附件，造成仪器损害，仪器制造厂商将不负任何责任。质保责任也同时取消。

除了在本手册中提到的工作以外，不承担对 Axio Lab.A1 显微镜的技术支持和修理。只能由蔡司公司售后服务人员或特别授权人员进行修理。如果仪器发生任何故障，请接洽 Carl Zeiss 德国维修部门或当地蔡司公司代办处。

2. 技术手册

2.1 设计用途

Axio Lab.A1 显微镜是通用的显微镜，是为生物、医疗及材料研究方面的应用特别设计的。

根据显微镜主机体的选择，它们可以只用于反射光或透射光，或用于两者的组合。

Axio Lab.A1 的典型应用领域，如：

- 实验室（研究）、医院、医生办公室的医学检查；
- 医学和生物领域的科学研究（学院，大学）；
- 工业应用（药理学，食品技术）；
- 血液分析和组织样品的分析

Axio Lab.A1 也可用于下列方面的材料分析应用：

- 金相实验室；
- 汽车工业等
- 微系统技术。
- Geoscientific institutes
- Exploration industry

根据每套仪器的配置，可以进行下列显微镜检查和对比法：

透射光

- 明视场(H)
- 暗视场(D)
- 相差（Ph）
- 偏光（Pol）
- 偏光（锥光）
- 偏光（C-Pol）

反射光

- 明视场(H)
- 暗视场(D)
- 偏光（Pol）
- 荧光
- 微分干涉（DIC）

三目观察筒和适当的照相接口允许您在显微镜上连接一个 CCD,一个单反相机或者一个数码相机用于记录图像

Axio Lab.A1 特别为那些长时间常规用用的使用者采取了人机工程学设计.例如血液检查,组织和细胞学检查.

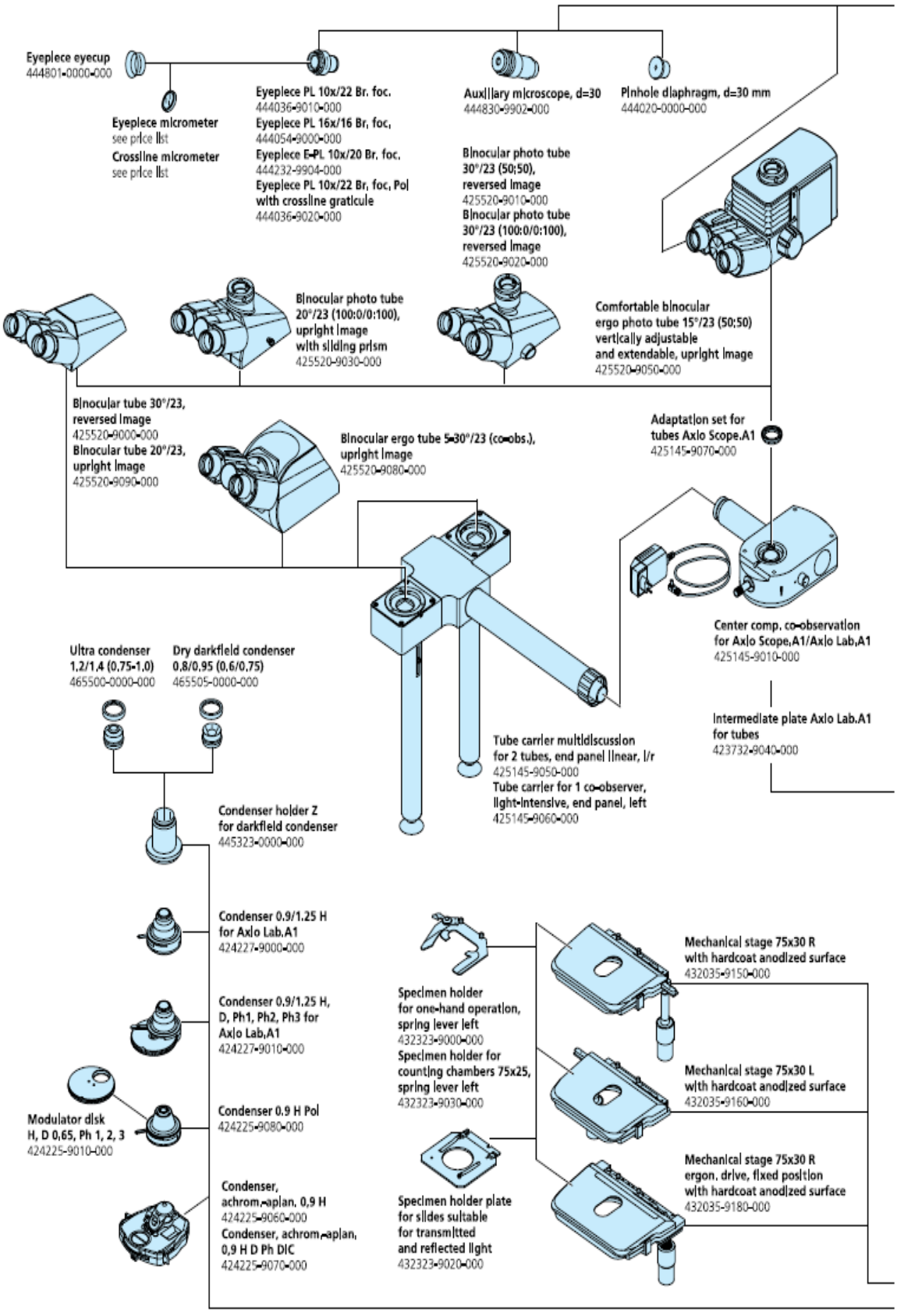
Axio Lab.A1 在人机工程学方面的设计包含:

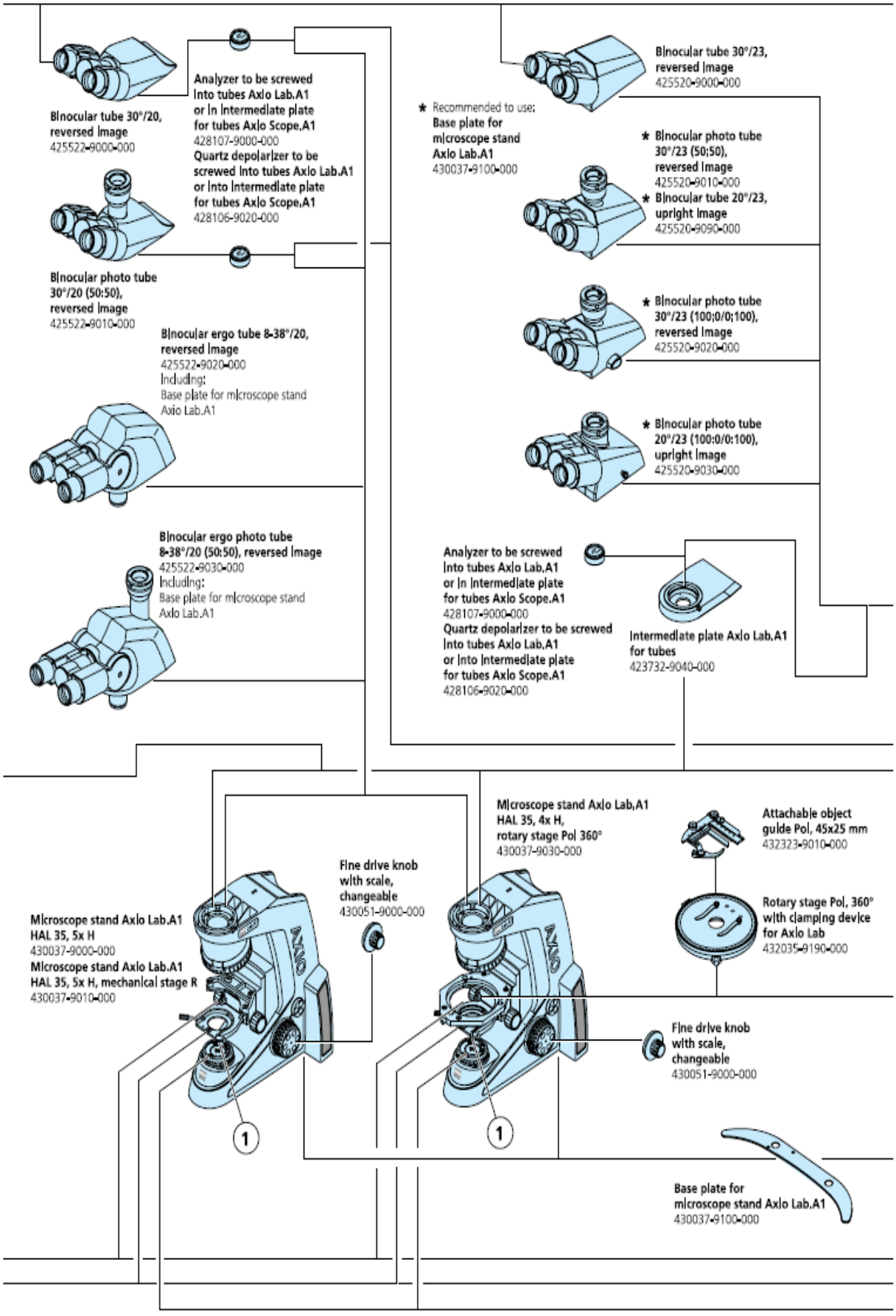
- 可垂直调节高度的观察筒
- 在观察筒,调节手柄和主机体上采用了皮肤触感的表面设计
- 固定载物台调节手柄的人机工程学载物台
- 载物台手柄可调垂直调节高度和摩擦扭矩.
- 在主机上可选使用微调焦机构或推/往返调焦机构
- 特别的是 人机工程学改进了 3 个主要的控制单元:调焦机构,载物台调节和亮度调节控制部分

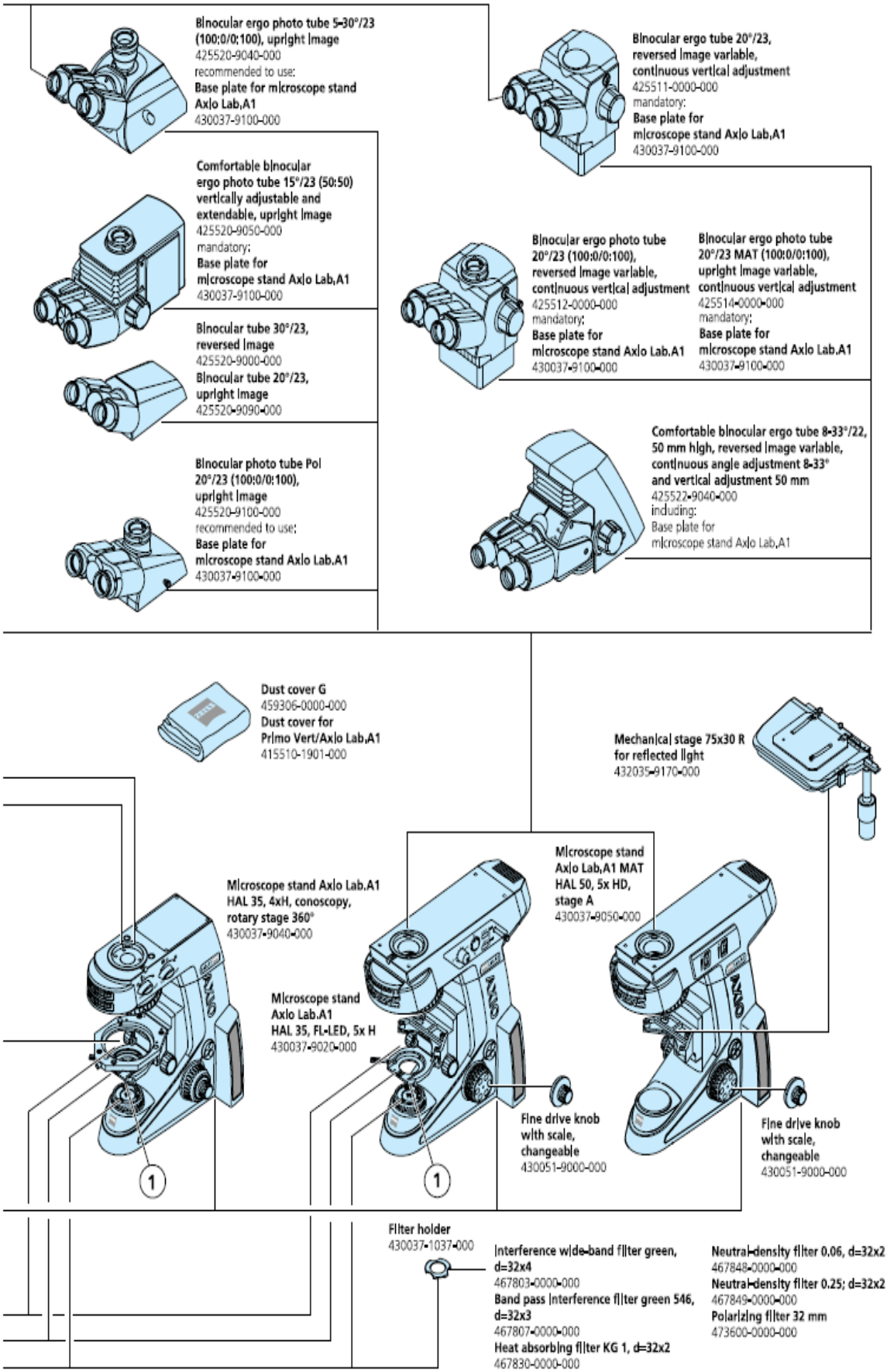
TÜV 人机工程学证书要求光学显微镜厂商与专业的健康医师还有 TÜV Rhineland 合作,并确定下列配置:

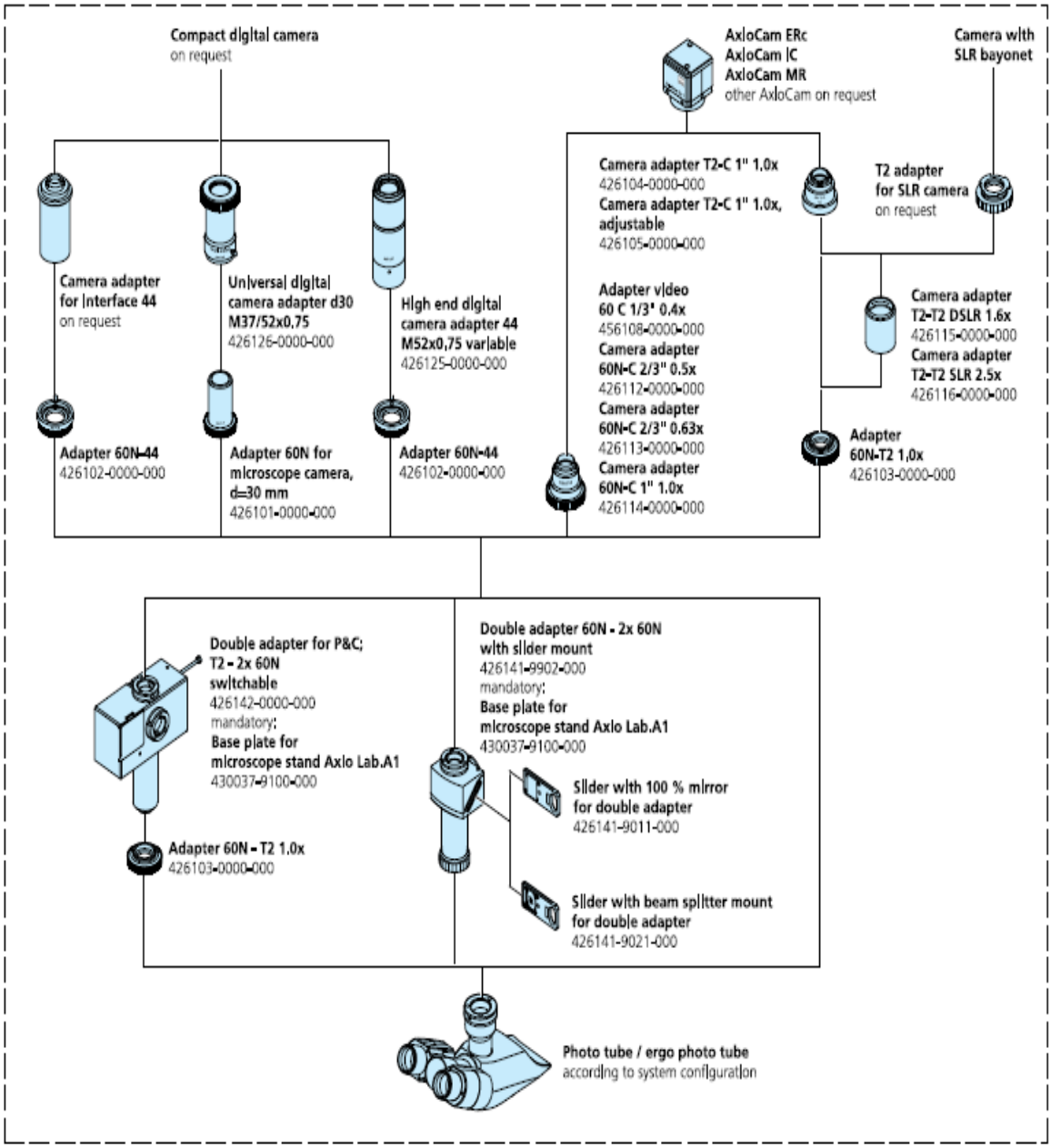
---带有人机工程学载物台和人机工程学观察筒的透射明场显微镜

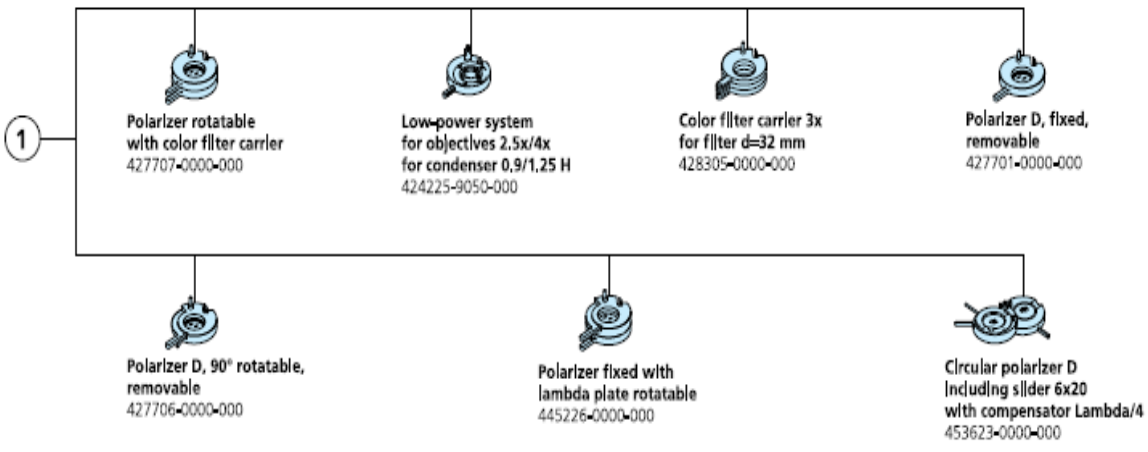
2.2 系统纵览

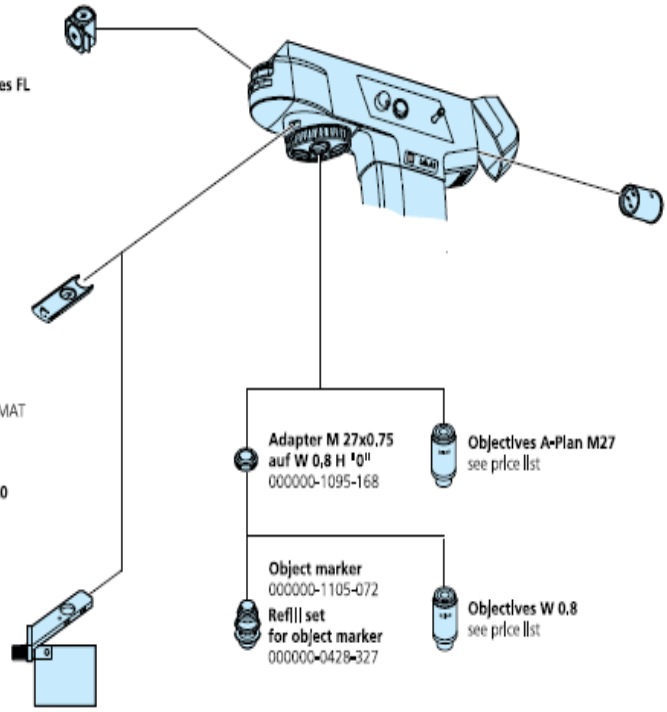

Eyepiece eyecup
444801-0000-000
Eyepiece micrometer
see price list
Crossline micrometer
see price list
Eyepiece PL 10x/22 Br. foc.
444036-9010-000
Eyepiece PL 16x/16 Br, foc,
444054-9000-000
Eyepiece E-PL 10x/20 Br. foc,
444232-9904-000
Eyepiece PL 10x/22 Br, foc, Pol
with crossline graticule
444036-9020-000
Auxiliary microscope, d=30
444830-9902-000
Pinhole diaphragm, d=30 mm
444020-0000-000
Binocular photo tube
30°/23 (50:50),
reversed image
425520-9010-000
Binocular photo tube
30°/23 (100:0/0:100),
reversed image
425520-9020-000
Binocular photo tube
20°/23 (100:0/0:100),
upright image
with sliding prism
425520-9030-000
Comfortable binocular
ergo photo tube 15°/23 (50:50)
vertically adjustable
and extendable, upright image
425520-9050-000
Binocular tube 30°/23,
reversed image
425520-9000-000
Binocular tube 20°/23,
upright image
425520-9090-000
Binocular ergo tube 5-30°/23 (co-obs.),
upright image
425520-9080-000
Adaptation set for
tubes Axio Scope.A1
425145-9070-000
Center comp. co-observation
for Axio Scope.A1/Axio Lab.A1
425145-9010-000
Intermediate plate Axio Lab.A1
for tubes
423732-9040-000
Tube carrier multidiscussion
for 2 tubes, end panel linear, l/r
425145-9050-000
Tube carrier for 1 co-observer,
light-intensive, end panel, left
425145-9060-000
Ultra condenser
1.2/1.4 (0.75-1.0)
465500-0000-000
Dry darkfield condenser
0.8/0.95 (0.6/0.75)
465505-0000-000
Condenser holder Z
for darkfield condenser
445323-0000-000
Condenser 0.9/1.25 H
for Axio Lab.A1
424227-9000-000
Condenser 0.9/1.25 H,
D, Ph1, Ph2, Ph3 for
Axio Lab.A1
424227-9010-000
Modulator disk
H, D 0,65, Ph 1, 2, 3
424225-9010-000
Condenser 0.9 H Pol
424225-9080-000
Condenser,
achrom.-aplan, 0,9 H
424225-9060-000
Condenser, achrom.-aplan,
0,9 H D Ph DIC
424225-9070-000
Specimen holder
for one-hand operation,
spring lever left
432323-9000-000
Specimen holder for
counting chambers 75x25,
spring lever left
432323-9030-000
Specimen holder plate
for slides suitable
for transmitted
and reflected light
432323-9020-000
Mechanical stage 75x30 R
with hardcoat anodized surface
432035-9150-000
Mechanical stage 75x30 L
with hardcoat anodized surface
432035-9160-000
Mechanical stage 75x30 R
ergon. drive, fixed position
with hardcoat anodized surface
432035-9180-000


Binocular tube 30°/20, reversed image
425522-9000-000
Analyzer to be screwed into tubes Axio Lab.A1 or in intermediate plate for tubes Axio Scope.A1
428107-9000-000
Quartz depolarizer to be screwed into tubes Axio Lab.A1 or into intermediate plate for tubes Axio Scope.A1
428106-9020-000
Binocular photo tube 30°/20 (50:50), reversed image
425522-9010-000
Binocular ergo tube 8-38°/20, reversed image
425522-9020-000
Including:
Base plate for microscope stand Axio Lab.A1
Binocular ergo photo tube 8-38°/20 (50:50), reversed image
425522-9030-000
Including:
Base plate for microscope stand Axio Lab.A1
Binocular tube 30°/23, reversed image
425520-9000-000
* Recommended to use:
Base plate for microscope stand Axio Lab.A1
430037-9100-000
* Binocular photo tube 30°/23 (50;50), reversed image
425520-9010-000
* Binocular tube 20°/23, upright image
425520-9090-000
* Binocular photo tube 30°/23 (100;0/0;100), reversed image
425520-9020-000
* Binocular photo tube 20°/23 (100:0/0:100), upright image
425520-9030-000
Analyzer to be screwed into tubes Axio Lab.A1 or in intermediate plate for tubes Axio Scope.A1
428107-9000-000
Quartz depolarizer to be screwed into tubes Axio Lab.A1 or into intermediate plate for tubes Axio Scope.A1
428106-9020-000
Intermediate plate Axio Lab.A1 for tubes
423732-9040-000
Microscope stand Axio Lab.A1 HAL 35, 4x H, rotary stage Pol 360°
430037-9030-000
Attachable object guide Pol, 45x25 mm
432323-9010-000
Rotary stage Pol, 360° with clamping device for Axio Lab
432035-9190-000
Fine drive knob with scale, changeable
430051-9000-000
Microscope stand Axio Lab.A1 HAL 35, 5x H
430037-9000-000
Microscope stand Axio Lab.A1 HAL 35, 5x H, mechanical stage R
430037-9010-000
Fine drive knob with scale, changeable
430051-9000-000
Base plate for microscope stand Axio Lab.A1
430037-9100-000
1
1


Binocular ergo photo tube 5-30°/23 (100:0/0:100), upright image
425520-9040-000
recommended to use:
Base plate for microscope stand Axio Lab.A1
430037-9100-000
Binocular ergo tube 20°/23, reversed image variable, continuous vertical adjustment
425511-0000-000
mandatory:
Base plate for microscope stand Axio Lab.A1
430037-9100-000
Comfortable binocular ergo photo tube 15°/23 (50:50) vertically adjustable and extendable, upright image
425520-9050-000
mandatory:
Base plate for microscope stand Axio Lab.A1
430037-9100-000
Binocular ergo photo tube 20°/23 (100:0/0:100), reversed image variable, continuous vertical adjustment
425512-0000-000
mandatory:
Base plate for microscope stand Axio Lab.A1
430037-9100-000
Binocular ergo photo tube 20°/23 MAT (100:0/0:100), upright image variable, continuous vertical adjustment
425514-0000-000
mandatory:
Base plate for microscope stand Axio Lab.A1
430037-9100-000
Binocular tube 30°/23, reversed image
425520-9000-000
Binocular tube 20°/23, upright image
425520-9090-000
Comfortable binocular ergo tube 8-33°/22, 50 mm high, reversed image variable, continuous angle adjustment 8-33° and vertical adjustment 50 mm
425522-9040-000
including:
Base plate for microscope stand Axio Lab.A1
Binocular photo tube Pol 20°/23 (100:0/0:100), upright image
425520-9100-000
recommended to use:
Base plate for microscope stand Axio Lab.A1
430037-9100-000
Dust cover G
459306-0000-000
Dust cover for Primo Vert/Axio Lab.A1
415510-1901-000
Mechanical stage 75x30 R for reflected light
432035-9170-000
Microscope stand Axio Lab.A1 HAL 35, 4xH, conoscopy, rotary stage 360°
430037-9040-000
Microscope stand Axio Lab.A1 HAL 35, FL-LED, 5x H
430037-9020-000
Microscope stand Axio Lab.A1 MAT HAL 50, 5x HD, stage A
430037-9050-000
Fine drive knob with scale, changeable
430051-9000-000
Fine drive knob with scale, changeable
430051-9000-000
1
1
Filter holder
430037-1037-000
Interference wide-band filter green, d=32x4
467803-0000-000
Band pass interference filter green 546, d=32x3
467807-0000-000
Heat absorbing filter KG 1, d=32x2
467830-0000-000
Neutral-density filter 0.06, d=32x2
467848-0000-000
Neutral-density filter 0.25; d=32x2
467849-0000-000
Polarizing filter 32 mm
473600-0000-000


Compact digital camera
on request
AxioCam ERc
AxioCam IC
AxioCam MR
other AxioCam on request
Camera with
SLR bayonet
Camera adapter
for Interface 44
on request
Universal digital
camera adapter d30
M37/52x0,75
426126-0000-000
High end digital
camera adapter 44
M52x0,75 variable
426125-0000-000
Camera adapter T2-C 1" 1.0x
426104-0000-000
Camera adapter T2-C 1" 1.0x,
adjustable
426105-0000-000
T2 adapter
for SLR camera
on request
Adapter video
60 C 1/3" 0.4x
456108-0000-000
Camera adapter
60N-C 2/3" 0.5x
426112-0000-000
Camera adapter
60N-C 2/3" 0.63x
426113-0000-000
Camera adapter
60N-C 1" 1.0x
426114-0000-000
Camera adapter
T2-T2 DSLR 1.6x
426115-0000-000
Camera adapter
T2-T2 SLR 2.5x
426116-0000-000
Adapter
60N-T2 1,0x
426103-0000-000
Adapter 60N-44
426102-0000-000
Adapter 60N for
microscope camera,
d=30 mm
426101-0000-000
Adapter 60N-44
426102-0000-000
Double adapter for P&C;
T2 - 2x 60N
switchable
426142-0000-000
mandatory:
Base plate for
microscope stand Axio Lab.A1
430037-9100-000
Adapter 60N - T2 1.0x
426103-0000-000
Double adapter 60N - 2x 60N
with slider mount
426141-9902-000
mandatory:
Base plate for
microscope stand Axio Lab.A1
430037-9100-000
Slider with 100 % mirror
for double adapter
426141-9011-000
Slider with beam splitter mount
for double adapter
426141-9021-000
Photo tube / ergo photo tube
according to system configuration


1
Polarizer rotatable
with color filter carrier
427707-0000-000
Low-power system
for objectives 2.5x/4x
for condenser 0,9/1,25 H
424225-9050-000
Color filter carrier 3x
for filter d=32 mm
428305-0000-000
Polarizer D, fixed,
removable
427701-0000-000
Polarizer D, 90° rotatable,
removable
427706-0000-000
Polarizer fixed with
lambda plate rotatable
445226-0000-000
Circular polarizer D
including slider 6x20
with compensator Lambda/4
453623-0000-000



Reflector module FL EC P&C
424931-0000-000

Filter set for reflector modules FL
see price list

Optovar modules
see price list

Analyzer module
424937-9901-000

Analyzer slide fixed for transmitted light, 6x20
433605-0000-000

not usable with microscope stand Axio Lab.A1 MAT
430037-9050-000:
Compensator Lambda, 6x20
473704-0000-000
Compensator Lambda/4, 6x20
473714-0000-000
Analyzer slide D, fixed with lambda plate
453681-0000-000

Antiglare screen
452163-0000-000

Adapter M 27x0.75 auf W 0,8 H "0"
000000-1095-168

Objectives A-Plan M27
see price list

Object marker
000000-1105-072

Refill set for object marker
000000-0428-327

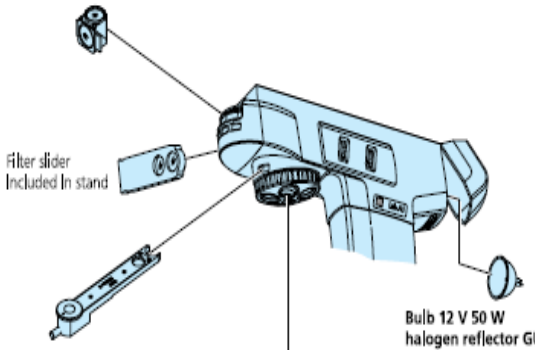
Objectives W 0.8
see price list

For fluorescence:

LED module 365 nm
423052-9510-000
LED module 625 nm
423052-9520-000
LED module 615 nm
423052-9530-000
LED module 590 nm
423052-9540-000
LED module 530 nm
423052-9550-000
LED module 505 nm
423052-9560-000
LED module 470 nm
423052-9570-000
LED module 455 nm
423052-9580-000
LED module 380 nm
423052-9590-000
LED module neutral white 540-580 nm
423052-9600-000

Reflector module brightfield ACR P&C for reflected light
424928-9901-000
Reflector module darkfield ACR P&C for reflected light
424922-9901-000
Reflector module C-DIC/TIC ACR P&C for reflected light
424941-9000-000

Reflector module DIC/Pol ACR P&C for reflected light
424939-0000-000
Reflector module DIC/Pol red I Lambda ACR P&C for reflected light
424938-0000-000
Reflector module polarizer ACR P&C for reflected light
424923-9901-000

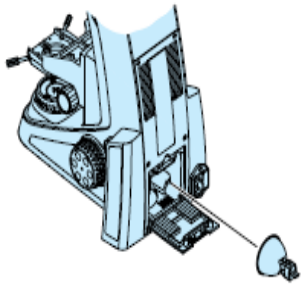


Filter slider
Included in stand

Bulb 12 V 50 W halogen reflector GU5,3
000000-0488-372

DIC slider C 6x20 for EC EPN 5x-20x
000000-1105-192
DIC slider C 6x20 for EC EPN 50x-100x
000000-1105-193
TIC slider 6x20
000000-1105-190
(usable with Reflector module C-DIC/TIC ACR P&C 424941-9000-000)

Objectives N-Achroplan Pol
see price list
Objective N-Achroplan M27
see price list
Objectives EC-Epiplan M27
see price list



Bulb 12 V 35 W halogen reflector GU5.3
000000-0425-360
Whitelight LED lamp 3 W, daylight
000000-0512-683
Whitelight LED lamp 3 W, warmlight
000000-0512-682

2.3 技术参数

尺寸（长 X 宽 X 高）

显微镜主机体 Axio Lab.A1

无观察筒 (430037-9000-000）.....约 219 mm x410 mm x 395 mm

其他类型的主机视安装的观察筒的不同在宽度和高度上有些微小的差别,各种观察筒的高度(眼点高度)可以在章节 2.3.1 中查看

主机配上不同的观察筒的高度大约可以按以下方法计算:

– 观察筒的最下位置加上10 mm 为观察高度
– 观察筒固定观察角度
–人机工程学观察筒最上限加上10mm 为观察高度

重量

显微镜主机体 Axio Lab.A1（根据版本和零件）..... 约 8-20kg

环境条件

运输（在包装中）

允许的环境温度 .....-40 到 +70°C

储存：

允许的环境温度 .....+10 到 +40 °C
允许的湿度（无凝结） .....最大 35 °C 时为 75 %

操作：

允许的环境温度 .....+10 到 +40 °C
允许的相对湿度（无凝结） .....最大 35 °C 时为 75 %
应用高度 ..... 最大 2,000 米
大气压力 ..... 800 hPa 到 1060 hPa
污染水平 2

操作说明

应用范围 ..... 室内
保护等级 I
保护类型 .....IP 20
电力安全 .....按照 DIN EN61010-1（IEC61010-1）
..... 考虑 CSA 和 UL 规定
过电压类型 II
无线电干扰音质 .....按照 EN 55011B 级
免疫 ..... 按照 DIN EN61326
电压范围 .....100-240±10 %，不需要进一步调整电压。
电源频率 .....50/60 Hz
Axio Lab.A1 功率.....110 VA

IEC 127 保险丝

Axio Lab.A1 主机..... 2xT 3.15 A/H,5x20 mm

光源

LED 透射光

功率 .....最大 3W

调节范围 .....连续可调 0.5 到 12V

透射卤素灯光源

功率 .....最大 35W

反射卤素灯光源

功率 50W

调节范围 .....连续可调 0.5 到 12V

可更换的 LED 反射荧光光源

波长选择 ..... 365,380,455,470,505,530,590,615,625nm 或者白光(540-580nm)

LED 安全级别..... 按照 IEC62471 LED 2 级

Axio Lab.A1:

带手动载物台的主机调焦

粗调 4mm/圈

微调 0.4mm/圈;最小精度 4µm

调焦范围 30mm

最高限位 ..... 使用之前设置

可选聚光镜 0.9/1.25 H,使用或不使用模块转盘

..... 明场,暗场和相差 1,2,3

手动物镜转盘 ..... 依物镜转盘而定,4X H Pol 或 5X HD,M27

手动反射模块转盘 .....4X 反射模块转盘

2.3.1 观察高度和角度

货号	观察筒	观察角度	是否可调	观察高度 mm
425522-9000-000	Binocular tube 30°/20	30°	- none -	434 / 470
425522-9010-000	Binocular photo tube 30°/20 (50:50)	30°	- none -	434 / 470
425522-9020-000	Binocular ergo tube 8-38°/20	8-38°	Angle	407 - 534
425522-9030-000	Binocular ergo photo tube 838°/20 (50:50)	8-38°	Angle	407 - 534
425522-9040-000	Binocular ergonomic tube 8-38°/22	8-33°	Angle Height	412 - 603
425520-9000-000	Binocular tube 30°/23	30°	- none -	449 / 485
425520-9010-000	Bin. photo tube 30°/23 (50:50)	30°	- none -	449 / 485
425520-9020-000	Bin. photo tube 30°/23 (100:100) Bio	30°	- none -	449 / 485
425520-9030-000	Binocular photo tube 20°/23 (100:100)	20°	- none -	442 / 481
425520-9040-000	Bin. ergo tube (100/100), angle-adjustable, upright image	5-30°	Angle	395 - 537
425520-9050-000	Bin. ergo tube 15°/23 (50/50), telescopic, height, upright image	15°	Height telescopic	410 - 509
425520-9090-000	Binocular tube 20°/23	20°		442 / 481
425520-9100-000	Bin. photo tube 20°/23 Pol (100:100)	20°		442 / 481
425511-0000-000	Binocular ergo tube 20°/23, 44 mm height	20°	Height	457 - 574
425512-0000-000	Bin. ergo tube 20°/23 (100/100), reverse image, 44 mm height	20°	Height	457 - 574
425514-0000-000	Bin. ergo tube 20°/23 (100/100), upright image, 44 mm height	20°	Height	457 - 574

- 观察高度:
  固定观察角度不带人机工程学的观察筒:
  观察筒最低/最高　　例如 442/481 即 442 到 481 mm

  角度和垂直高度可调的人机工程学观察筒:
  观察筒最低/最高　　例如:457/574 即 457 到 574mm

  所有的数据是以瞳距 65mm 测量得出.

2.3.2 防尘罩,中间板和底板的配置

观察筒货号	观察筒	透射光 430037-9000-000 430037-9010-000 430037-9030-000	锥偏光 430037-9040-000	反射光 430037-9020-000 430037-9050-000
425522-9000-000	Binocular tube 30°/20 Bio	Small	Small	
		---	---	
		---	---	
425522-9010-000	Binocular photo tube 30°/20 (50:50)	Small	Small	
		---	---	
		---	---	
425522-9020-000	Binocular ergonomic tube 8-38°/20	Small		

		M*		
425522-9030-000	Binocular photo tube 8-38°/20 (50:50)	Medium		

		M*		
425522-9040-000	Binocular ergonomic tube 8-33°/22	Medium	Medium	Medium
		Spacer	Spacer	---
		M*	M*	M*
425520-9000-000	Binocular tube 30°/23 Bio	Small	Small	Small
		Spacer	Spacer	---
		---	---	---
425520-9010-000	Binocular photo tube 30°/23 (50:50) Bio	Medium	Medium	Medium
		Spacer	Spacer	---
		M	*M*	*M*
425520-9020-000	Binocular photo tube 30°/23 (100:100) Bio	Medium	Medium	Medium
		Spacer	Spacer	---
		M	*M*	*M*
425520-9030-000	Binocular photo tube 20°/23 (100:100) upright image	Medium	Medium	Medium
		Spacer	Spacer	---
		M	*M*	*M*
425520-9040-000	Binocular ergo photo tube (100/100), angle-adjustable, upright image	Medium	Medium	Medium
		Spacer	Spacer	---
		M	M	M

观察筒货号	观察筒	透射光 430037-9000-000 430037-9010-000 430037-9030-000	锥偏光 430037-9040-00 0	反射光 430037-9020-000 430037-9050-000
425520-9050-000	Binocular ergo tube 15°/23 (50/50), telescopic, height, upright image	Medium	Medium	Medium
		Spacer	Spacer	---
		M	**M**	**M**
425520-9090-000	Binocular tube 20°/23 Mat (analog 9030 without camera output)	Small	Small	Small
		Spacer	Spacer	---
		---	---	---
425520-9100-000	Binocular photo tube 20°/23 Pol (100/100)	Medium	Medium	Medium
		Spacer	Spacer	---
		M	*M*	*M*
425511-0000-000	Binocular ergo tube 20°/23, reverse image, 44 mm height	Medium	Medium	Medium
		Spacer	Spacer	---
		M	**M**	**M**
425512-0000-000	Binocular ergo tube 20°/23 (100/100), 44 mm height	Medium	Medium	Medium
		Spacer	Spacer	---
		M	**M**	**M**
425514-0000-000	Binocular ergonomoic tube 20°/23 (100/100), upright image, 44 mm height	Medium	Medium	Medium
		Spacer	Spacer	---
		M	**M**	**M**

* 包含在配置中

表格的解释

防尘罩	Small (小号):415510-1901　　Medium (中号):459306-0000-000
中间板 (423732-9040-000)	中间板:necessary(需要)　　----unnecessary(不需要)
底板	**M: 必须**　　M:推荐　　--- 不需要

防尘罩

2.4 显微镜的控制和功能组件

2.4.1 主机型号

总共有 5 种型号的主机可供选择:

1,应用于生物行业,可使用明场,暗场和相差观察模式的透射光型主机

2 应用于生物行业,可使用明场,暗场,相差和偏光观察模式的透射光型主机

3 应用于生物行业,可使用明场,暗场,相差,偏光(透射)和荧光(反射)观察模式的透/反射光型主机

4 应用于材料行业,可使用明场,暗场,相差,偏光和 C-DIC 观察模式的反射光型主机

5 应用于材料行业,可使用明场,暗场,相差,偏光和锥偏光观察模式的透射光型主机

并且,这些主机均通过了两项人机工程学测试,并获得了 TÜV 证书.

TÜV 人机工程学证书要求光学显微镜厂商与专业的健康医师还有 TÜV Rhineland 合作,并确定下列两项配置:

- 透射光型主机带人机工程学载物台和舒服的观察筒
- 反射荧光型主机带人机工程学载物台和人机工程学观察筒

2.4.2 透射光型主机

1 基本主机
2 机械载物台支架
3 光强控制
4 调焦机构-微调(右侧,指肚旋转型)
5 调焦机构-粗调(右侧)
6 机械载物台 X 方向调节旋钮
7 机械载物台 Y 方向调节旋钮
8 聚光镜垂直方向调节旋钮(右侧)
9 聚光镜对中螺丝(右侧)
10 出光口-视场光栏
11 聚光镜及孔径光栏(可选功能模块转盘)
12 机械载物台 75x3 及样品夹(可选左手或右手型,或带人机工程学调节手柄)
13 5xH 物镜转盘
14 6x20 插片口
15 目镜
16 观察筒
17 观察筒/三目观察筒
18 提手
19 聚光镜对中螺丝(左侧)
20 聚光镜垂直方向调节旋钮(左侧)
21 调焦机构-粗调(左侧)
22 调焦机构-微调(左侧)
23 ON/OFF 开关
24 主机内透射光灯泡
25 工具仓/缆线仓

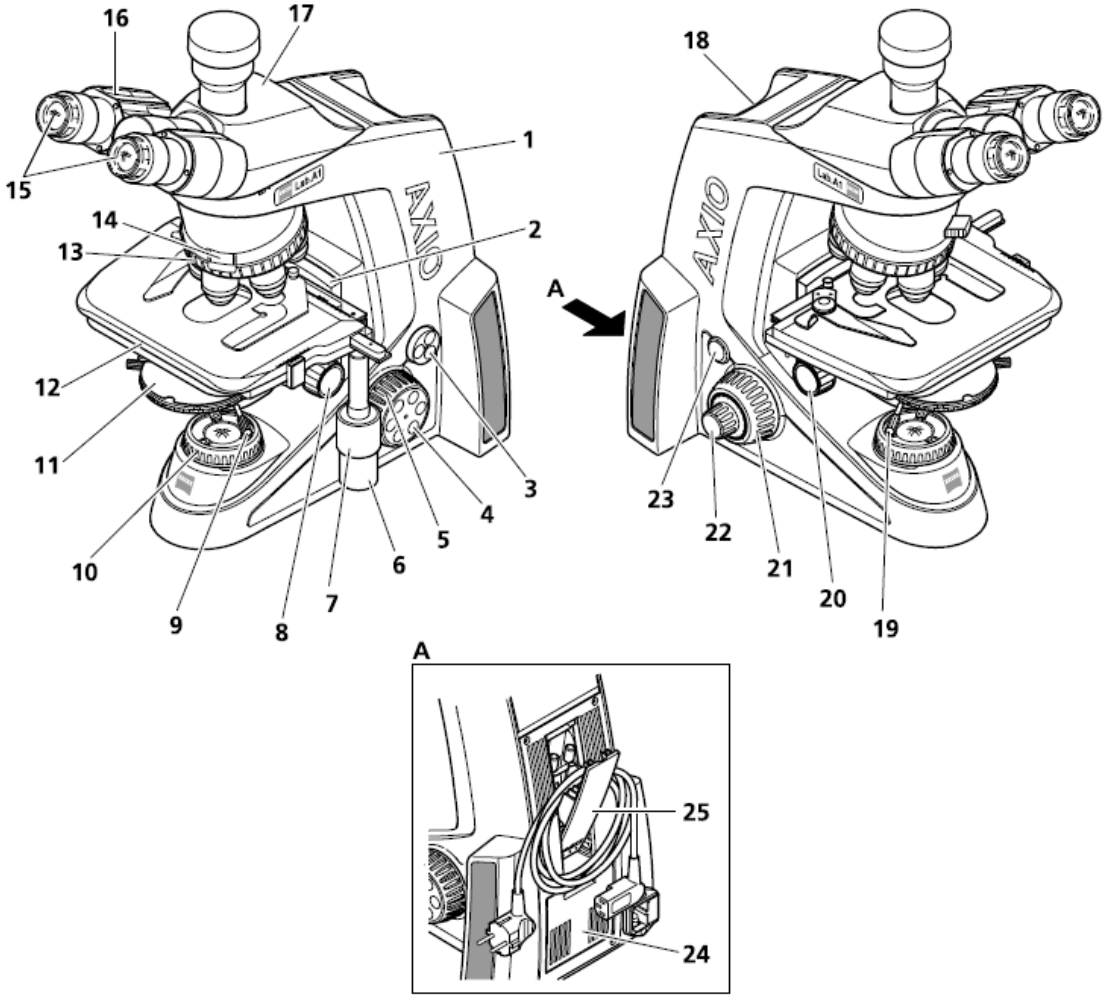


图. 2-1　Axio Lab.A1, 透射光主机

2.4.3 透射偏光型主机

1 基本主机
2 旋转载物台支架(也适用于机械载物台)
3 光强控制
4 调焦机构-微调(右侧,指肚旋转型)
5 调焦机构-粗调(右侧)
6 聚光镜垂直方向调节旋钮(右侧)
7 聚光镜对中螺丝(右侧)
8 出光口-视场光栏
9 旋转载物台锁死螺丝(禁止旋转)
10 聚光镜及孔径光栏(可选功能模块转盘)
11 旋转载物台锁入载物台支架
12 偏光旋转载物台及样品夹
13 4xH Pol 物镜转盘(3 个可调中,1 个固定)
14 6x20 插片口
15 目镜
16 观察筒
17 观察筒/三目观察筒
18 提手
19 聚光镜对中螺丝(左侧)
20 聚光镜垂直方向调节旋钮(左侧)
21 调焦机构-粗调(左侧)
22 调焦机构-微调(左侧)
23 ON/OFF 开关
24 工具仓/缆线仓
25 主机内透射光灯泡

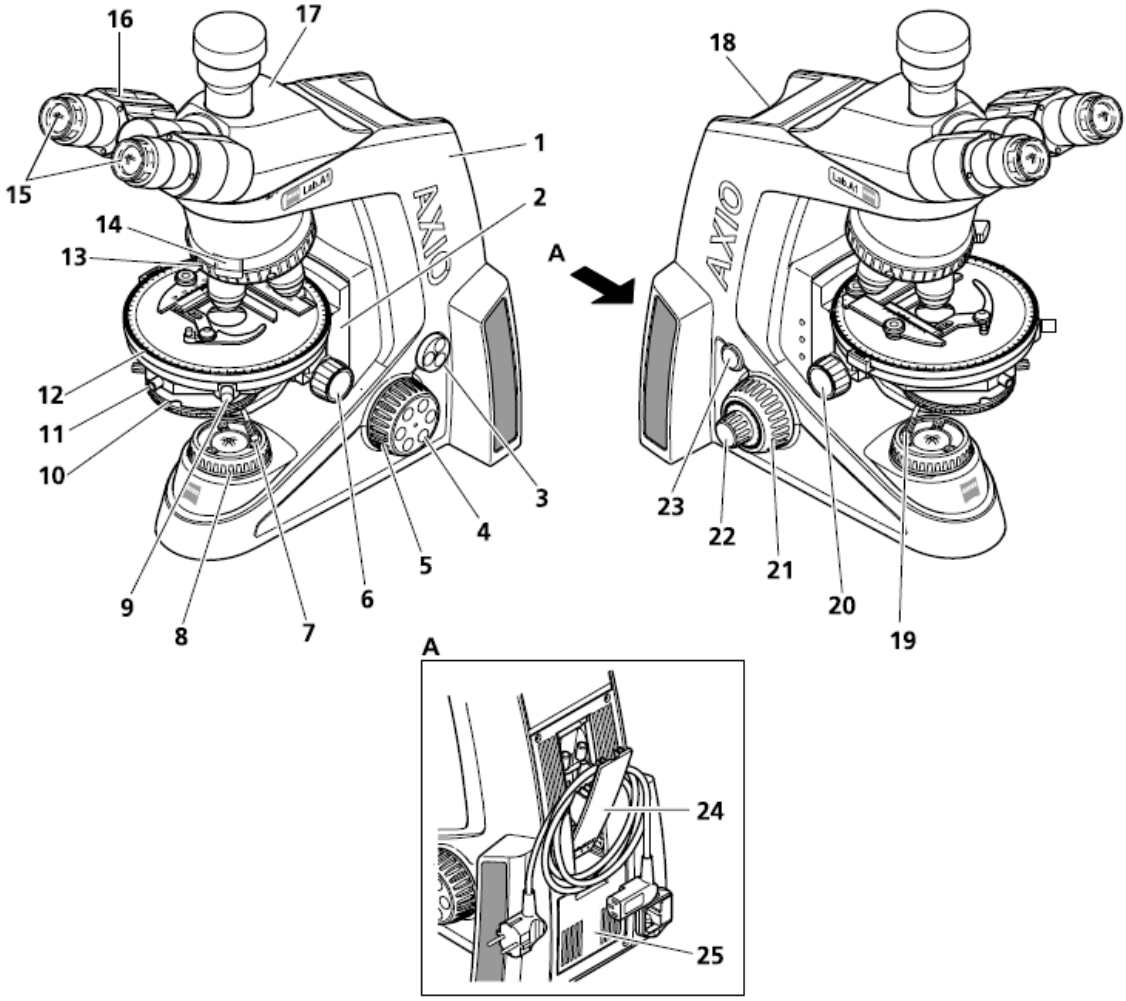


图. 2-2　Axio Lab.A1，透射偏光主机

2.4.4 透射光加反射荧光型主机

1 反射光强控制
2 FL/TL 转换开关(FL-反射荧光;TL-透射光)
3 推拉杆转换 LED1 和 LED2
4 LED 反射光照明器盖子
5 主机
6 5X H FL-LED 物镜转盘
7 机械载物台支架
8 透射光强控制器
9 显微镜主机的底板
10 调焦机构-微调(右侧,指肚旋转型)
11 调焦机构-粗调(右侧)
12 机械载物台 X 方向调节旋钮
13 机械载物台 Y 方向调节旋钮
14 聚光镜垂直方向调节旋钮(右侧)
15 聚光镜对中螺丝(右侧)
16 出光口-视场光栏
17 聚光镜及孔径光栏(可选功能模块转盘)
18 6x20 插片口
19 机械载物台 75x3 及样品夹(可选左手或右手型,或带人机工程学调节手柄)
20 4x 反射转盘
21 目镜
22 观察筒
23 观察筒/三目观察筒
24 聚光镜对中螺丝(左侧)
25 聚光镜垂直方向调节旋钮(左侧)
26 调焦机构-粗调(左侧)
27 调焦机构-微调(左侧)
28 ON/OFF 开关
29 工具仓/缆线仓
30 主机内透射光灯泡

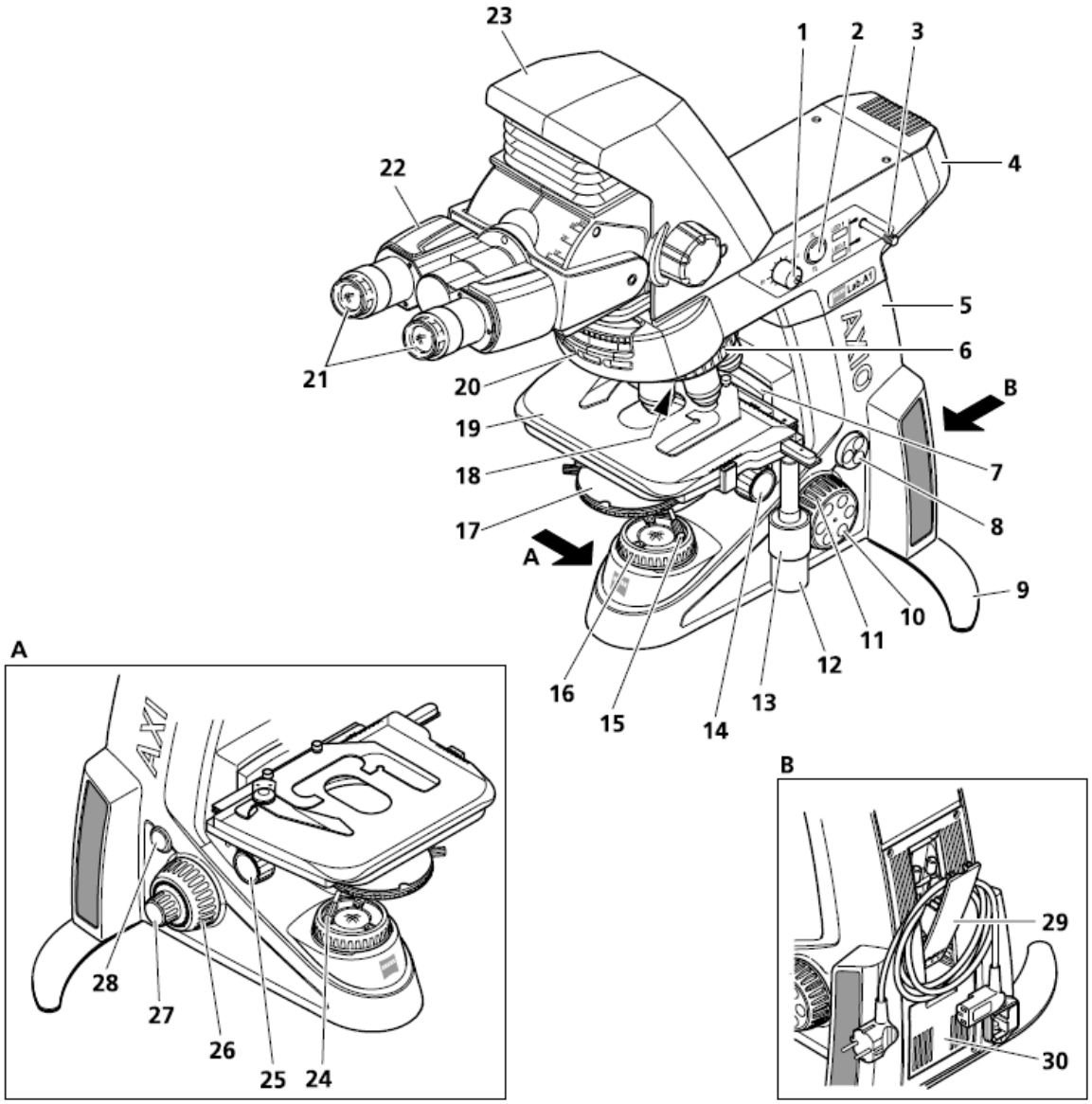


图. 2-3　Axio Lab.A1, 透射光加反射荧光型主机

2.4.5 反射光型主机

1 反射光照明器
2 出光口/视场光栏(已对中)
3 孔径光栏(已对中)
4 主机
5 5x H HD 物镜转盘
6 机械载物台支架
7 光强控制
8 调焦机构-微调(右侧,指肚旋转型)
9 调焦机构-粗调(右侧)
10 机械载物台 X 方向调节旋钮
11 机械载物台 Y 方向调节旋钮
12 机械载物台 75x30 及样品夹用于反射光
13 6x20 插片口
14 4x 反射转盘
15 目镜
16 观察筒
17 观察筒/三目观察筒
18 调焦机构-粗调(左侧)
19 调焦机构-微调(左侧)
20 ON/OFF 开关
21 反射光滤色片支架
22 工具仓/缆线仓

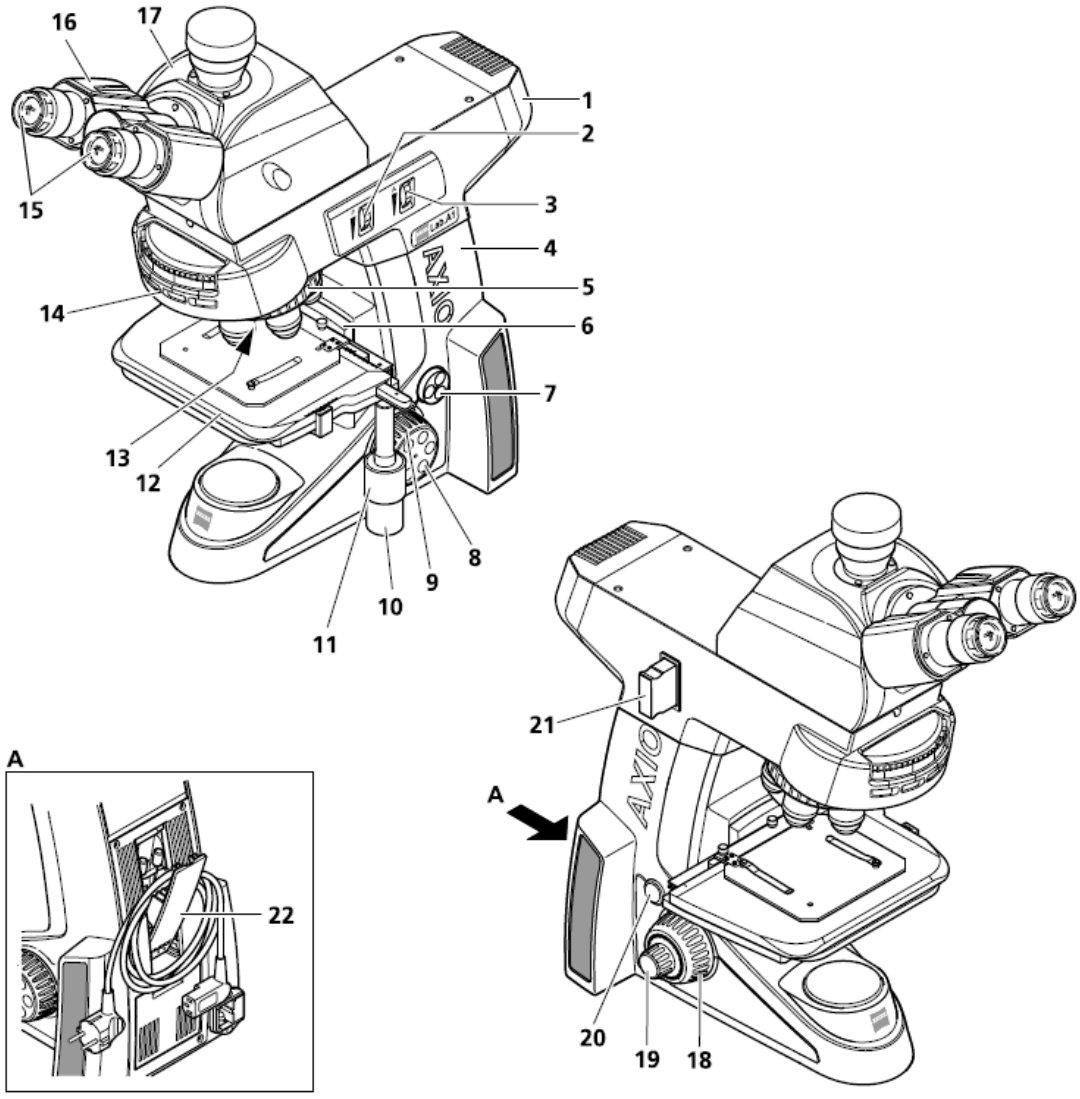


图. 2-4　Axio Lab.A1，反射光型主机

2.4.6 透射锥偏光型主机

1 旋钮 A:转进/出检偏器
2 旋钮 BL:转进/出勃特兰透镜
3 主机
4 4x H Pol 物镜转盘(3 个可调中,1 个固定)
5 旋转载物台支架(也适用于机械载物台)
6 光强控制
7 调焦机构-微调(右侧)
8 调焦机构-粗调(右侧)
9 聚光镜垂直方向调节旋钮(右侧)
10 聚光镜对中螺丝(右侧)
11 出光口-视场光栏
12 旋转载物台锁入载物台支架
13 聚光镜及孔径光栏(可选功能模块转盘)
14 偏光旋转载物台及样品夹
15 6x20 插片口
16 检偏器方向调节转盘
17 勃特兰调节转盘
18 目镜
19 观察筒
20 观察筒/三目观察筒
21 聚光镜对中螺丝(左侧)
22 聚光镜垂直方向调节旋钮(左侧)
23 调焦机构-粗调(左侧)
24 调焦机构-微调(左侧)
25 ON/OFF 开关
26 提手
27 6x20 插片存储仓
28 透射光照明器
29 工具仓/缆线仓

注意:
活动的旋钮 A 和 BL(图 2-5/1 和 2)以及调节转盘(图 2-5/16 和 17)是一一对应的.只有在相应的旋钮被使用,才可以调节其转盘.否则可能会损害其部件.

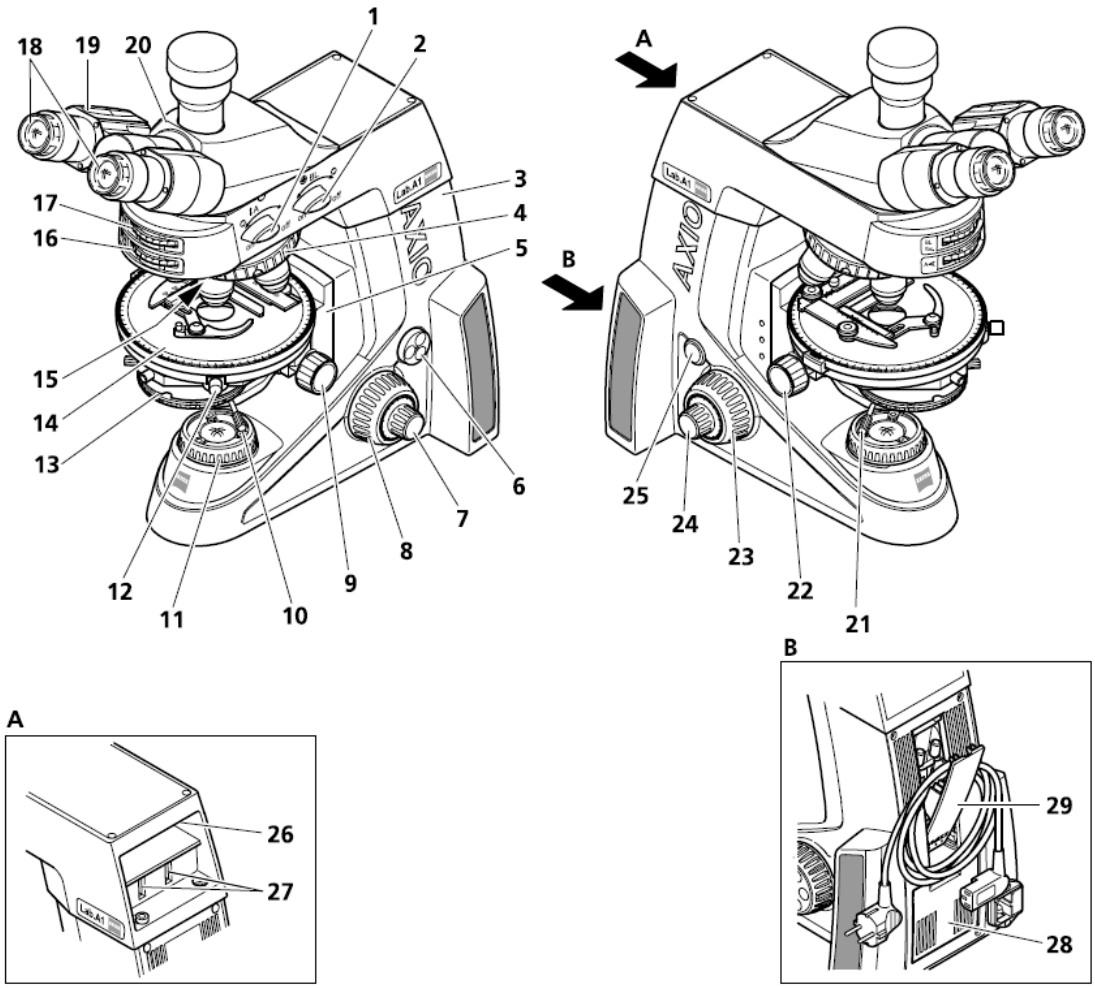


图. 2-5　Axio Lab.A1, 透射锥偏光型主机

2.4.7 带 TÜV 证书的人机工程学主机

1 人机工程学观察筒 8-33° ,50mm 垂直调节范围
2 带固定调节手柄的 75x30 人机工程学机械载物台
3 带透射光和反射荧光的主机

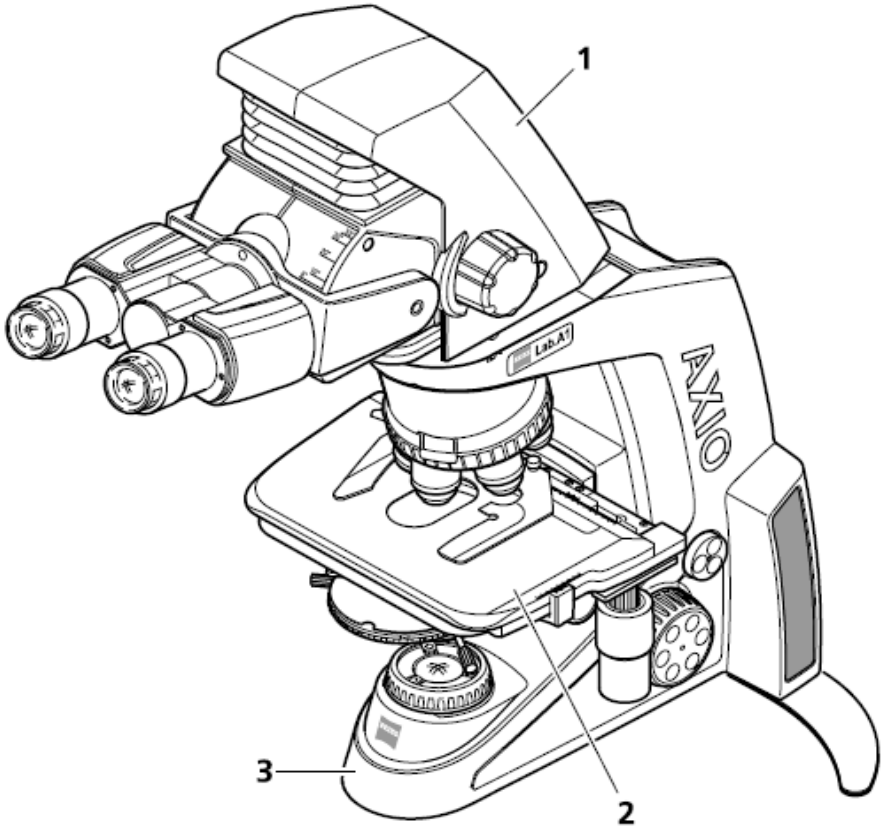


图. 2-6 Axio Lab.A1 带 TÜV 证书的人机工程学主机

☞ 更多显微镜的正确的人机工程学设置和操作见章节 3.5

2.5 可选组件的控制和功能

2.5.1 观察筒/照相观察筒

连接至显微镜的 CCD 或视频相机可以接入三目观察筒的预留相机接口(图 2-7/1 或图 2-8/1)

三目观察筒 **30°/20**,采用固定分光比 50:50
50%的光直接到眼睛,50%到相机(图 2-7)

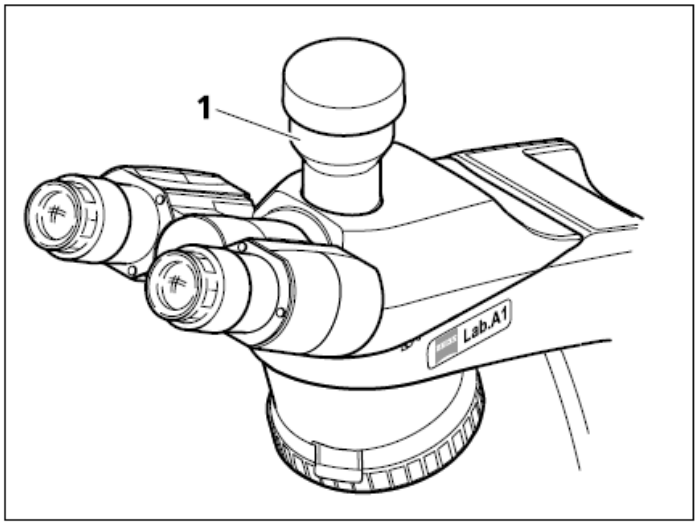


图. 2-7　50:50 固定分光比的三目观察筒 30°/20

三目观察筒 **30°/23(100:0/0:100)**

光路可任意通过翻转开关控制转向目镜后者连接的相机

- 翻转开关(图2–8/2)至前端(眼睛标记):光路100% 到目镜
- 翻转开关(图2–8/2)至后端(相机标记):光路100% 到相机
- 推拉杆(图2–8/3)推入:眼睛光路被完全关闭
- 推拉杆(图2–8/3)拉出:眼睛光路被完全打开
- 特别是想使用相机长时间曝光拍摄的时候,可能会有残余的光通过目镜进入光路,可以通过使用推拉杆或者目镜盖帽(包含在防尘罩套装中).如果两者都没有,那么可以卸下目镜,将目镜防尘盖帽安装到目镜接口!

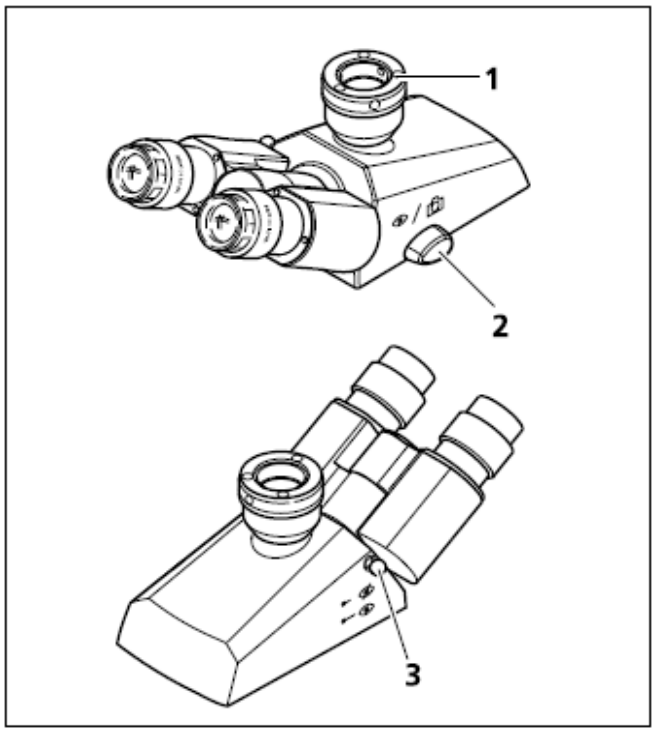


图. 2-8　100:0/0:100 可选分光比的三目观察筒 30°/20

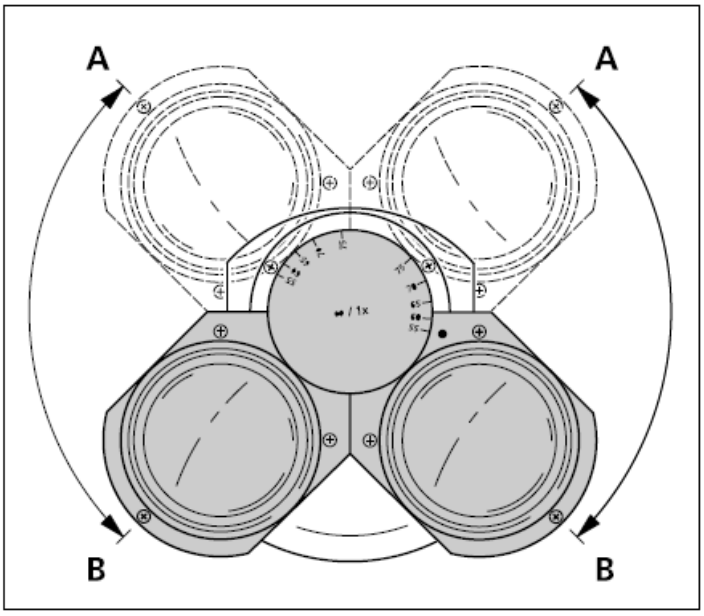


图. 2-9　设置观察筒的观察高度

瞳距和观察高度

适用于所有的观察筒:

- 通过调节两个目镜筒可以任意的调节瞳距
- 通过调节两个目镜筒的至最上(图 2-9/A)或最小(图 2-9/B 可以改变观察高度

☞ 对于偏光显微镜推荐使用带十字线的偏光三目观察筒

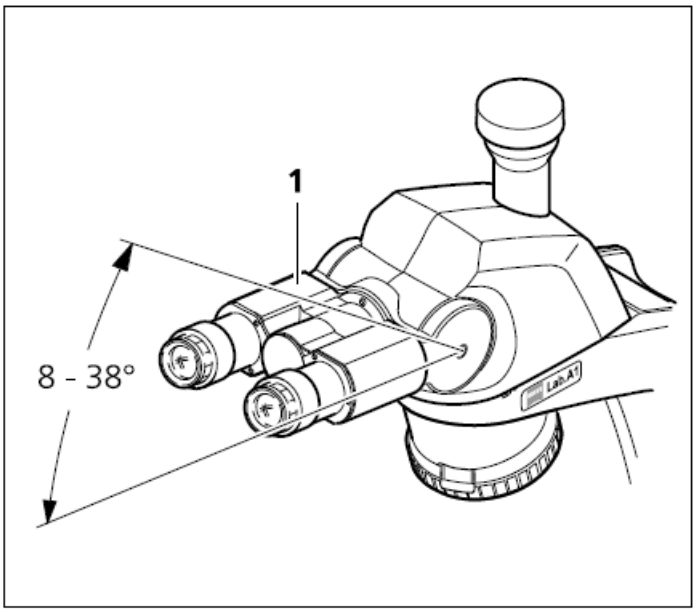


图. 2-10　50:50 固定分光比的人机工程学三目观察筒 8-38°/20

人机工程学观察筒/三目观察筒 8-38°/20

这些观察筒设计的视野范围是 20 通过转动目镜筒,观察的角度在 8 到 38°之间连续可调.

三目观察筒的分光比为 50:50
即　50%的光进入目镜,50%静茹照相接口.

注意

人机工程学观察筒/三目观察筒 **8-38°/20,**只允许安装在带有底板(430037-9100-000)的 Axio Lab.A1 上.否则可能导致显微镜的倾倒,而损伤仪器或者伤害到使用者.

可垂直调节高度(50mm)的舒适人机工程学观察筒/三目观察筒 8-33°/22

这款舒适的人机工程学观察筒设计的视野范围是 22

通过转动目镜筒(图 2-11/3)以及角度显示比例盘(图 2-11/2),观察的角度在 8 到 33°之间连续可调.

观察的高度调节依赖于观察的角度.通过调节旋钮(图 2-11/1),极限的调节范围是从 0mm 到 50mm.可以通过读取垂直显示刻度(图 2-11/4)读取当前的高度.

另外通过调节目镜筒至最上或最下的观察位置还有一些调节的余量可以被使用(范围依赖于瞳距的大小).

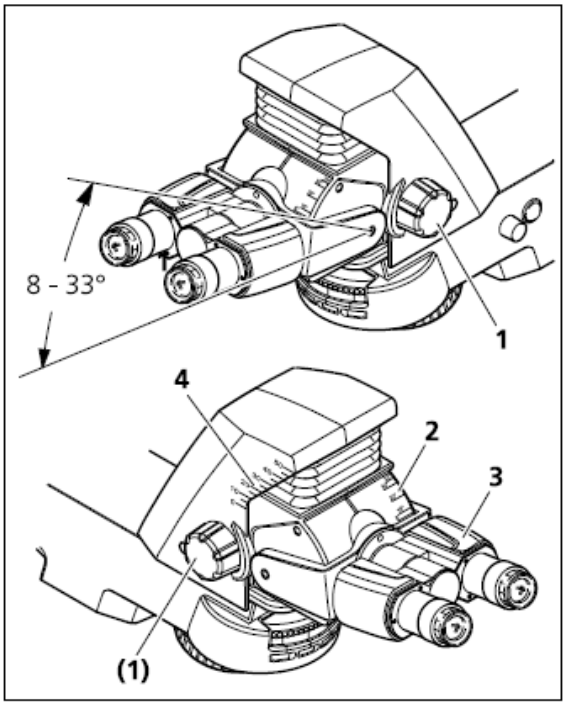


图. 2-11 高度可调 50mm 的人机工程学三目观察筒 8-33°/22

注意

人机工程学观察筒/三目观察筒 **8-33°/22,**只允许安装在带有底板(430037-9100-000)的 Axio Lab.A1 上.否则可能导致显微镜的倾倒,而损伤仪器或者伤害到使用者.

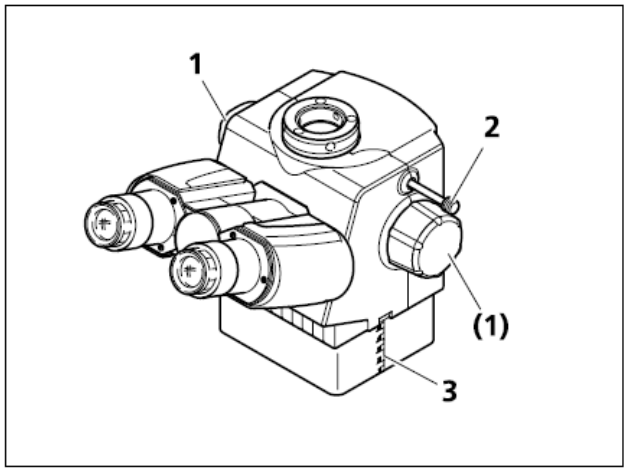
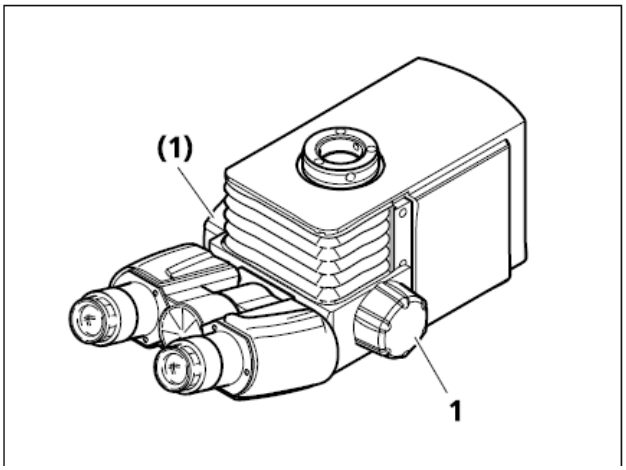


图. 2-12　高度可调的人机工程学三目观察筒 30°/20



可垂直调节高度的舒适人机工程学观察筒/三目观察筒 20°/23 和三目观察筒 15°/23

这些观察筒设计的视野范围是 23.但是如果用于 Axio Lab.A1,那么最大的视野范围是 22.观察角度是 **20°或 15°**

观察筒的垂直连续可调的范围是 0mm 到 44mm

另外通过调节目镜筒至最上或最下的观察位置还有一些调节的余量可以被使用(范围依赖于瞳距的大小).

- 高度的调节通过旋钮(图 2-12/1 和图 2-13/1)来实现
- 观察筒 **20°/23** 调节的高度可以通过侧面的刻度(图 2-12/3)读出

人机工程学观察筒 20°/23 有两个转换位置

– 推拉杆(图2–12/2)推入:100%光路转转至目镜
– 推拉杆(图2–12/1)拉出:100%光路转转至相机接口

人机工程学三目观察筒 15°/23 只能成正立像,并且分光比为固定的50:50.

此观察筒的垂直连续可调的范围是 50mm

2.5.2 显微镜载物台

75x50 右手或左手机械载物台或带固定手柄的人机工程学 75x50 右手机械载物台

- 机械载物台(图 2-14/7)可以放置,定位和使用样品夹固定样品

- 样品夹(图 2-14/2)为单手操作,或者更换为多孔板类样品座(松开螺丝(图 2-14/1)后更换)

- 载物台 X(图 2-14/6)和 Y(图 2-14/7)方向调节旋钮
  载物台 X 和 Y 方向调节旋钮,在高度和摩擦扭矩方面可以因人而设.工具(图 2-14/8)位于旋钮上方
  .
- X 方向(图 2-14/3)和 Y 方向(图 2-14/4)的游标尺显示其所调节的范围.

- 左手或右手调节旋钮依赖于所选的型号

- 人机工程学载物台(图 2-15/1)采用的是右手固定位置的 X/Y 调节旋钮(图 2-15/2)

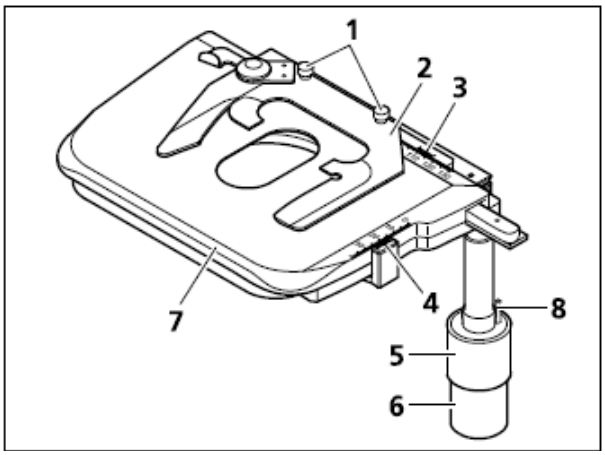


图. 2-14 75x50 右手机械载物台带样品夹

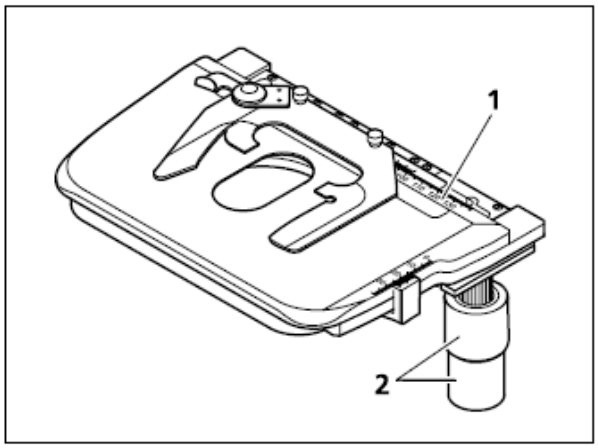


图. 2-15 75x50 带人机工程学的右手机械载物台

75x50 右手反射光机械载物台

- 机械载物台(图 2-16/2)可以放置,定位和使用带弹簧片的样品托板固定样品

- X 和 Y 方向的调节旋钮位于右手册

- X 方向和 Y 方向的游标尺显示其所调节的范围.

- 移除样品托板(拧松两颗固定螺丝)

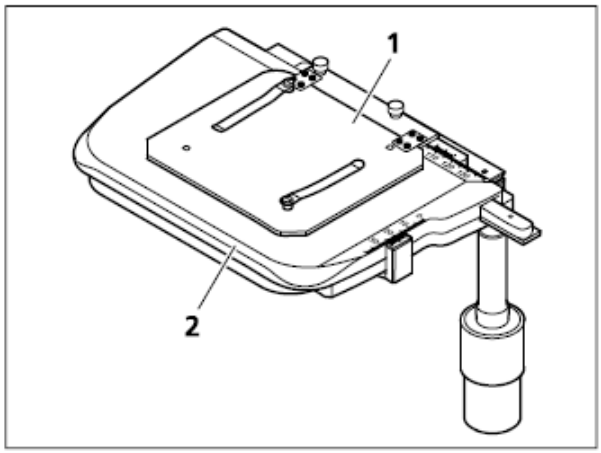


图. 2-16 75x50 反射光右手机械载物台带样品夹

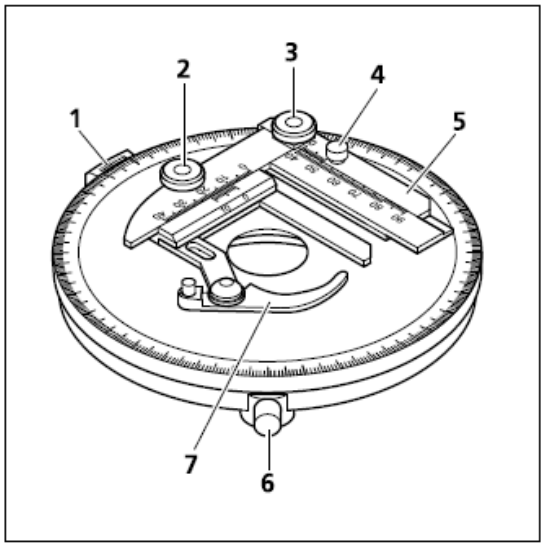


图. 2-17　偏光旋转载物台

带锁位的 360° 旋转偏光载物台

- 旋转偏光载物台(图 2-17) 可以放置,定位
  和使用带有导向装置(图 2-17/5)的样品夹(图 2-17/7)固定样品

- 通过调节螺丝(图 2-17/6)载物台可 360° 旋转

- 通过角度标尺(图 2-17/1)可以读出当前的角度
- 移除样品导向装置(图 2-17/5).(松开制动螺丝图 2-17/4,之后.有两颗螺丝分别位于两个导向装置上,将导向装置固定在旋转载物台上.)

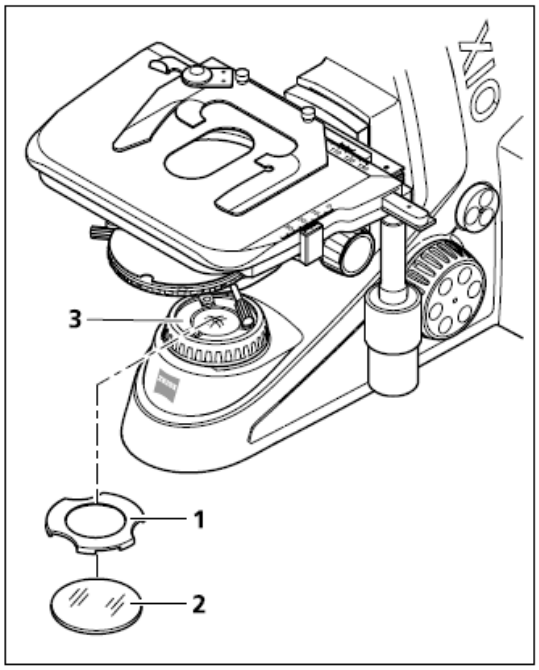


图. 2-18 视场光栏滤色片套 32x4 mm 的安装

视场光栏滤色片套 32x4 mm 的安装

- 在视场光栏处(图 2-18/3)放好滤片(图 2-18/2)

- 将滤色片夹具(图 2-18/1)固定在视场光栏上

- 如果更换滤片,抓紧滤色片夹具,将其从视场光栏上拔出即可

2.5.3 聚光镜

0.9/1.25 H,D,Ph1,Ph2,Ph3 聚光镜

带有孔径光栏(图 2-19/4)和功能转盘(图 2-19/3)的 0.9/1.25 H 聚光镜(图 2-19/1)可以观察:

- 明场(H)
- 暗场(D)
- 相差 ph1,ph2,ph3

通过转动功能模块转盘调节环(图 2-19/2)来实现位置的转换.

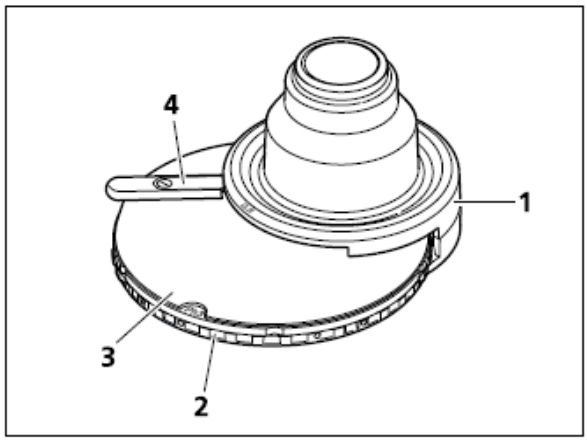


图. 2-19 带转盘的聚光镜 0.9/1.25 H, D, Ph1, Ph2, Ph3

这款聚光镜也可以不使用功能转盘,例如只看明场

0.9/1.25 H 聚光镜

带有孔径光栏(图 2-20/2)的聚光镜(图 2-20/1)只用于明场的观察

这款聚光镜也可以加上功能转盘

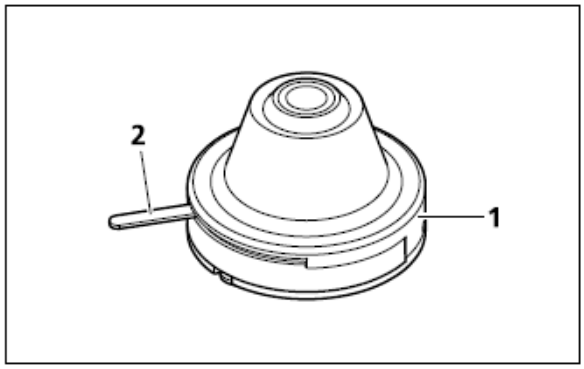


图. 2-20 聚光镜 0.9/1.25 H

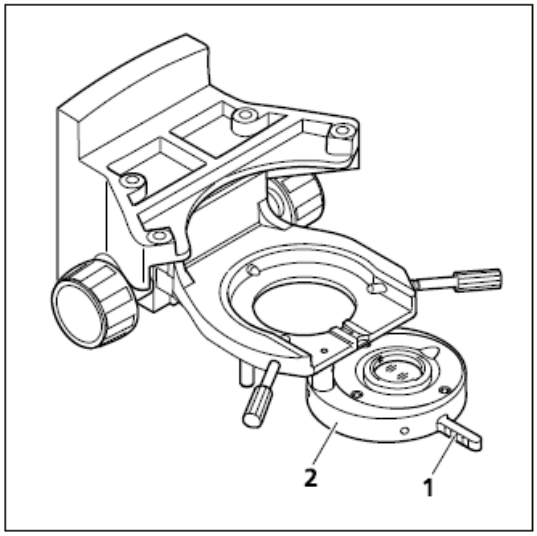


图. 2-21　低倍聚光镜

低倍聚光镜 2.5x-4x

当使用低倍物镜(2.5X-4X)时,配合阿贝聚光镜 0.9/1.25H(424227-9000-000),即可以观察完整的视野范围

此部件可以转入光路或者移出光路,以适用于不同的物镜.

- 低倍聚光镜(图 2-21/2)的移入/出光路通过拨动杆(图 2-21/1)来实现.移入光路时要确认此部件已经卡紧至固定位置

使用此部件时,需要使用调心螺丝来调节其中心位置.在此之前需要使用其他物镜来调节好聚光镜的中心位置.

,如果聚光镜支架被移到最低的位置,低倍聚光镜可能碰到视场光栏

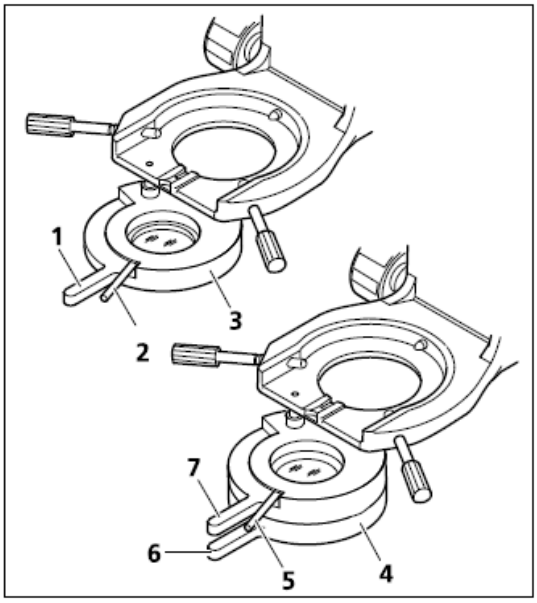


图. 2-22　起偏器

摆入试起偏器, 90°旋转(图 2-22/3)

- 起偏器可以通过杆(图 2-22/1)摆入/出光路

- 起偏器通过操纵杆(图 2-22/2)调节角度

带可旋转 Lambda 板,起偏器 (图 2-22/4)

- 起偏器可以通过杆(图 2-22/6)摆入/出光路
- Lambda 板可以通过杆(图 2-22/7)摆入/出光路
- 通过操纵杆(图 2-22/5)调节 Lambda 的角度

,如果起偏器支架被移到最低的位置,起偏器支架可能碰到视场光栏

2.5.4 4X 模块转盘

4X 模块转盘装备有反射功能模块

功能模块位置的转换通过转动转盘(图 2-23/1)来实现.转盘上的标记(图 2-23/3)显示当前光路中使用的模块

额外的标签可以用来标记模块的功能,这些标签可以粘贴的标签位置(图 2-23/2)上

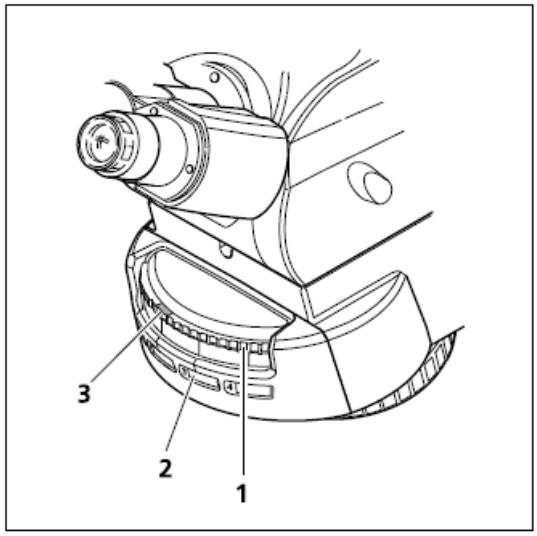


图. 2-23 4-位反射模块转盘

物镜转盘

- 带 M27 接口的 4x 或 5x 物镜转盘依所选不同主机而可装入 4 个或 5 个物镜.
- 通过旋转物镜转盘(图 2-24/2)来快速的更换物镜
- 6-20 插片插口(图 2-24/3)可插入补偿片,检偏器或 1/4Lambda 片
- 带 4x 物镜转盘的透射偏光主机和透射锥偏光主机,其 3 个可调中物镜可通过两个螺丝(图 2-24/1)来调节

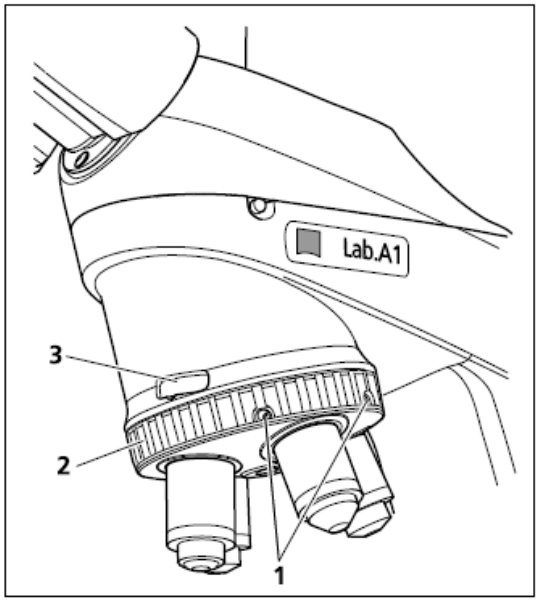


图. 2-24 带补偿接口的透射偏光主机的物镜转盘

注意
不要将螺丝(图 2-24/1)拧的太紧

反射光主机的滤片

- 反射光滤色片支架有两个 d=25mm 的位置(可安装中灰片,彩色滤片或白平衡片)
- 从左侧插入滤色片支架,并使用相应的位置(图 2-4/22)

3. 开始

客户可选择自己安装,调试 Axio Lab.A1，或付费请 Zeiss 客户服务来安装和调试.

☞ 组装和操作显微镜前，请仔细阅读**安全指南**(见章节 1.1)。

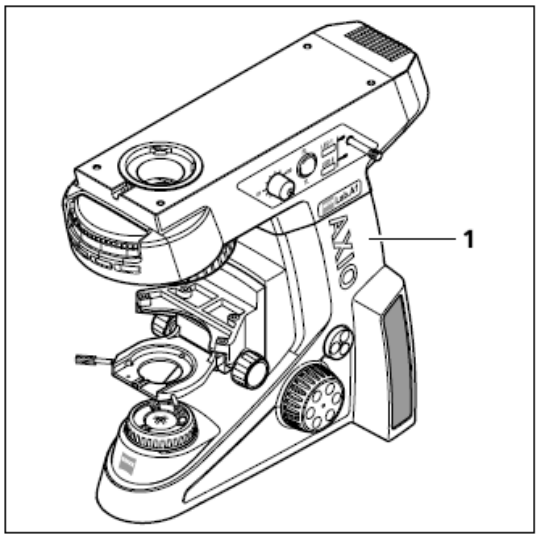


图. 3-1　安装显微镜

以下章节描述的显微镜插图大部分是一个型号的,不过其他型号的也是类似的,特别的部分我们会做特别的说明

3.1 组装标准零件

3.1.1　打开包装，组装显微镜主机体

- 打开所有的包装,并通过提货单检查所有的部件
- 在一个没有震动,水平的坚固的无易燃物的台面上摆好显微镜主机(图 3–1/1)
- 保存好原始的包装箱,用于再次存储或运输显微镜,或者返修显微镜.也可以恰当的处理掉这些包装
- 安装和调试所需要的工具(图 3-2/1)存储在显微镜后部的工具仓(图 302/2)中,按下其下部即可打开.

工具仓内包含以下工具:

- 3mm 内六角螺丝刀
- 两把 1.5mm 内六角螺丝刀用于调节聚光镜内的相差环.

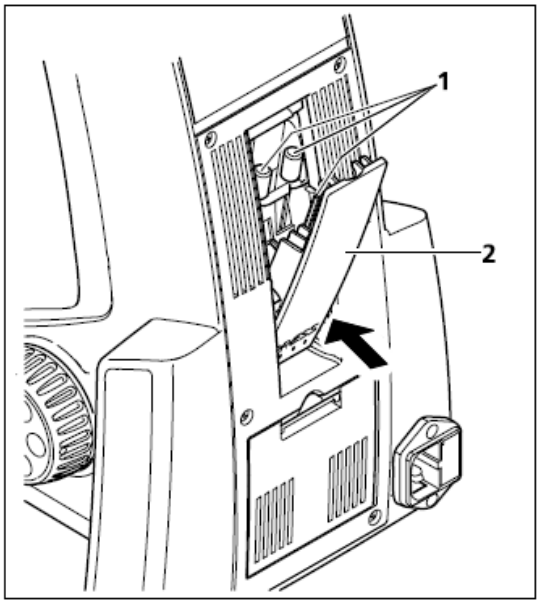


图. 3-2　存放工具的存储间

为了搬运方便,可以将电源线(图 3-3/1)盘起放在打开的工具仓盖(图 3-3/2)上

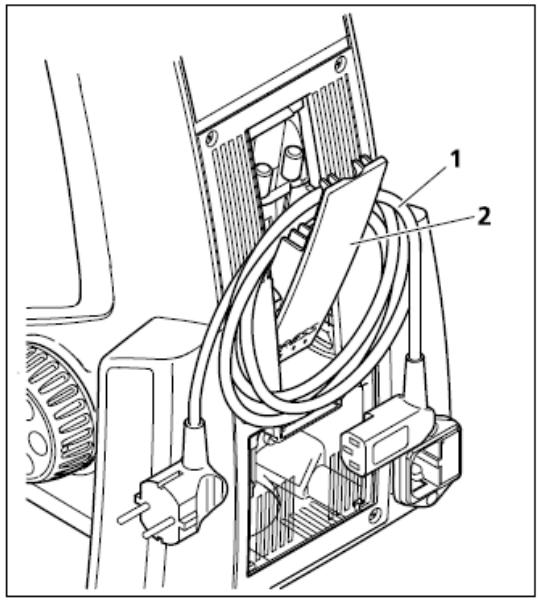


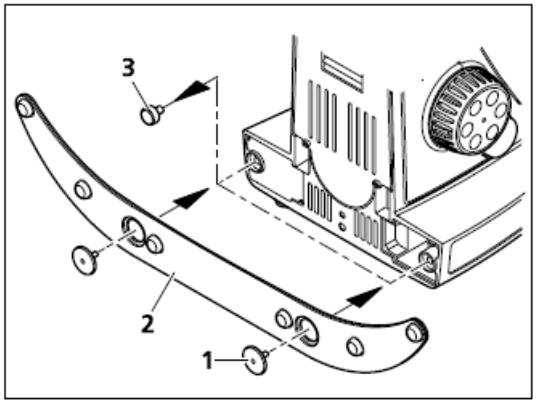
图. 3-3　电源线

3.1.2 安装底板

在使用大多数的人机工程学观察筒或三目观察筒时应该在显微镜主机上必须安装底板,以增加其稳定性.其他主机我们也推荐安装底板
其他注意事项请参看章节 2.2

☞ 在使用观察筒30°/20(425522-9000-000和425522-9010-000)已及观察筒20°/23和30°/23(425520-9090-000和425520-9000-000)时,底板不是必须安装的

- 将显微镜向后放倒
- 将主机底部的橡胶垫(图 3-4/2)拔出
- 将底板(图 3-4/2)放置在主机的下部,通过两颗螺丝(图 3-4/1)固定
- 将主机重新按正确位置放好



☞ 保存好拔出的橡胶垫,以后会用到.

图. 3-4　安装底板

3.1.3 安装双目镜筒/三目观察筒

“系统总览”（2.2 章）中提到的所有双目观察筒都可以按照下面的描述安装在显微镜上。不管任何类型的主机和观察筒.有些还需要安装中间板(见章节 2.2)

安装没有中间板的观察筒步骤如下:

- 使用 3mm 内六角螺丝刀将螺丝(图 3-5/3)拧松,从观察筒下部和主机上的燕尾槽连接头取下防尘盖(图 3-5/2,5)
- 调节观察筒的角度(图 3-5/1)将其燕尾槽插入主机连接口处(图 3-5/4),确保已经完全插入,成水平状态,旋转至需要的角度,重新拧紧螺丝(图 3-5/3)

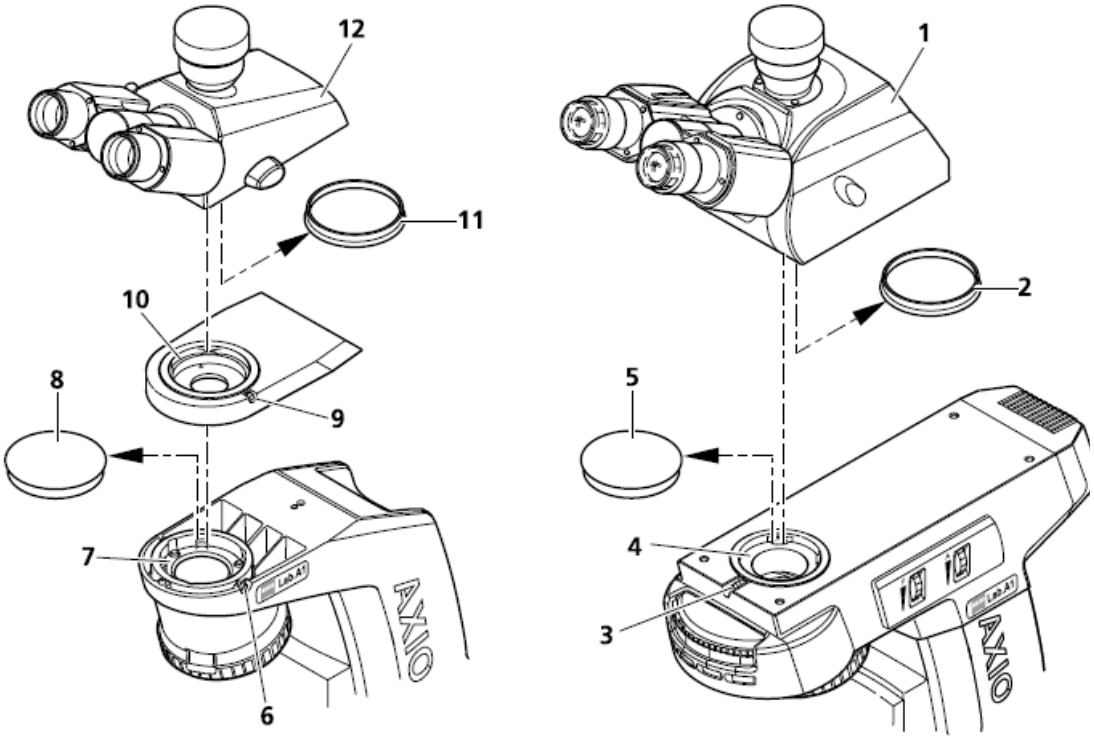


图. 3-5　安装观察筒

安装有中间板的观察筒步骤如下

- 使用 3mm 内六角螺丝刀将螺丝(图 3-5/6)拧松, 从观察筒下部和主机上的燕尾槽连接头取下防尘盖(图 3-5/8,11)
- 将中间板(图 3-5/10)的燕尾槽插入主机连接口处(图 3-5/7), 重新拧紧螺丝(图 3-5/6)
- 将观察筒(图 3-5/12)燕尾槽插入中间板连接口处 ,重新拧紧螺丝(图 3-5/9)固定

安装目镜或辅助调节镜

- 从双目观察筒上取下防尘的盖子（图 3-6/1 和 5）。
- 从盒子中取下两个目镜（图 3-6/2），将其插入到双目观察筒，直到插不进去为止。

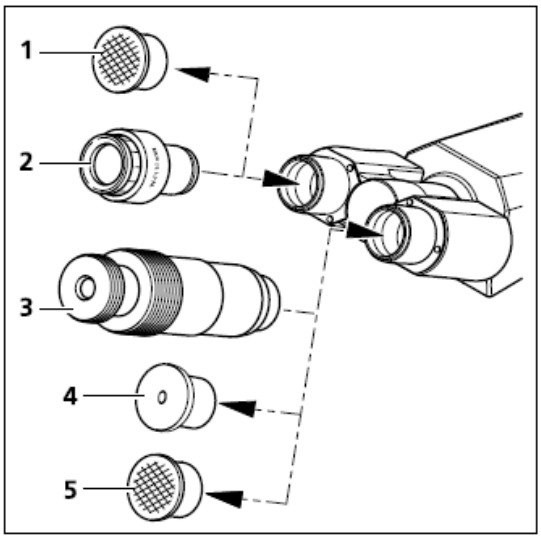


图. 3-6　安装目镜

☞ 插入没有十字线的偏光目镜之前,在目镜的反面将相应的螺丝拧松,否则目镜不能完全插入观察筒.

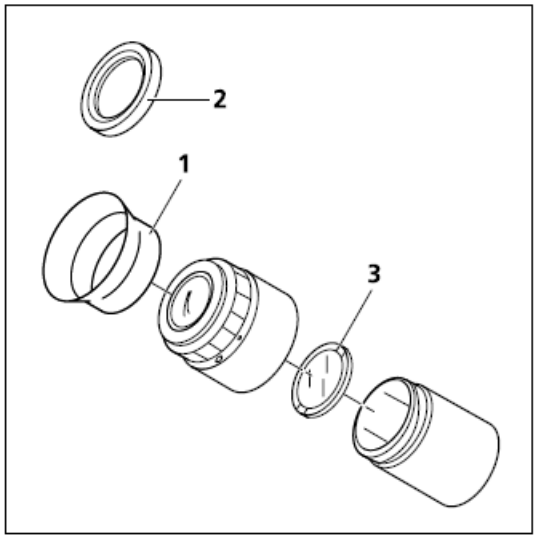
- 为了检查和调中孔径光栏、相位环和暗视场光阑的调中相位和暗视场光阑，您可以将一个辅助调节目镜（图 3-6/3）插入目镜位置。并可通过调节前镜头来聚焦这些光阑。
- 辅助调节目镜（图 3-6/3,4）可用来观察锥偏光图像

安装目镜十字线

装好目镜十字线(图 3-7/3)后,需要经目镜调节至红点位置

当安装了目镜测微尺后,会造成一定的图像偏移,因此目镜校准位置应该从白点位置校准至红点位置.

一定要确认十字线一定要面向视场光栏



☞ 目镜十字线一定要在无尘的条件下安装,这个操作应有 zeiss 的工程师来完成

图. 3-7　安装目镜十字线

安装目镜罩

目镜带装有具有保护功能的橡胶环，以保护眼镜免受刮伤。可以用目镜罩代替橡胶环。

- 从目镜中取下橡胶环（图 3-7/2），然后换上目镜罩（图 3-7/1）。

如果您发现很难从目镜槽中取下橡胶环，尝试用细木棒将其撬下取出。

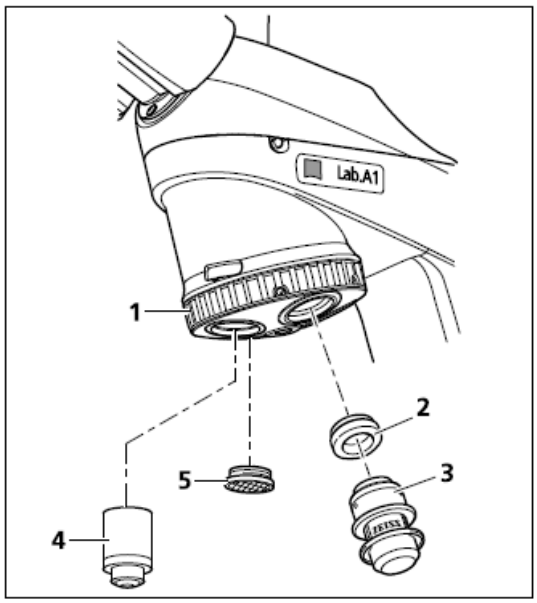


图. 3-8　安装物镜

3.1.5　安装物镜

- 将载物台降至最低位置
- 将物镜转盘上的防尘盖(图 3-8/5)取下
- 从盒子中取出物镜（图 3-8/4），将其安装到物镜转盘（图 3-8/1），从最小的放大倍数开始安装（顺时针）。
- 如果不装物镜，您可以在 W0,8/M27 转接环（图 3-8/2）的帮助下，将打标器（图 3-8/3）安装在物镜转盘的任何位置。不使用时，不要忘记盖上打标器的盖子，以免脱水。

☞ 物镜转盘当前不被使用的地方一定盖上防尘盖

☞ W0,8/M27 转接环必须与 W0,8 物镜一起使用

3.16 在反射模块转盘中安装和卸载标准模块

4x 反射模块转盘可以安装在透射光主机和反射生物型主机以及反射材料型主机上
将反射模块转盘的前部罩盖打开后即可安装或卸下标准模块

安装标准模块

- 卸下主机前部的罩盖(图 3-9/4)
- 如图所示,将模块(图 3-9/2)的左右侧翼(图 3-9/3)向上插入反射模块转盘的上部弹簧夹(图 3-9/1)中
- 接着用力向下压模块,将其压入反射模块转盘下部的弹簧夹中
  标准模块所在的位置编号在模块仓的右侧显示.
- 将描述模块功能的说明标签贴在罩盖的前部相应的预留位置上(图 3-9/5,位置 1 到 4)

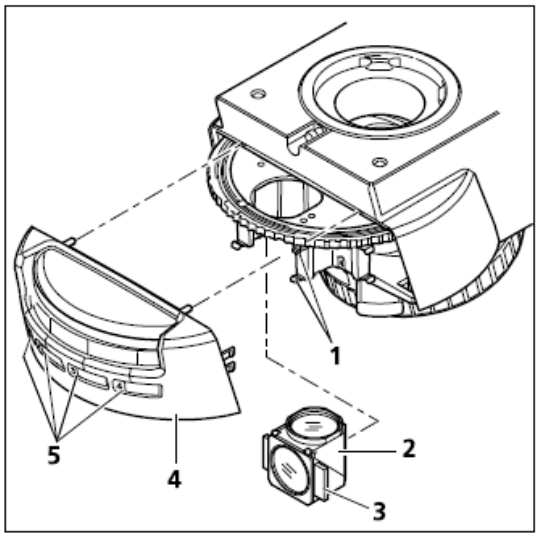


图. 3-9　安装反射模块

卸下标准模块

- 稍微用力,将模块下部从模块转盘的下部弹簧夹中取出,然后从上部弹簧夹中取出模块
- 一旦反射模块被装入或卸下,请安装好罩盖.避免反射模块转盘发生故障或被损坏
- 用力压下罩盖,直至其完全卡入相应的锁扣中.

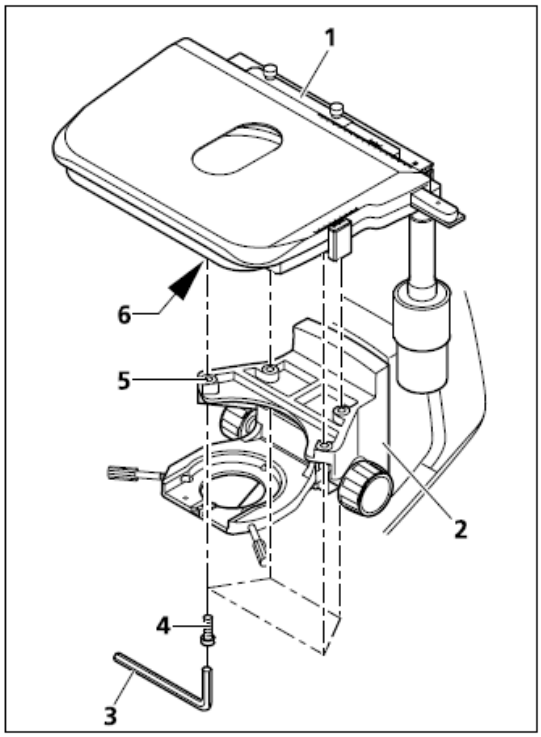


图. 3-10　安装机械载物台

3.1.7 安装机械载物台

Axio Lab.A1 主机在工厂组装时会按照客户的要求安装相应的载物台.

调节手柄的摩擦扭矩会按照工厂出的平均值设置

如果需要更换或重新设置载物台,请按照以下步骤设置:

3.1.7.1 卸下载物台

- 使用 3mm 螺丝刀(图 3-10/3)卸下载物台支架(图 3-10/2)下的 4 颗螺丝(图 3-10/4)
- 从载物台支架上拿下载物台(图 3-10/1)

3.1.7.2 安装载物台

- 将载物台(3-10/1)放置在载物台支架上(3-10/2),并将载物台底部的螺丝孔(图 3-10/6)对准载物台支架上螺丝孔(图 3-10/5)
- 从载物台支架下的螺丝孔中向上插入 4 颗紧固螺丝(图 3-10/4),并固定紧
- 调节载物台的方向,并固定好紧固螺丝.

3.1.7.3 设置调节手柄的长度

通过上下滑动相应的调节手柄(图 3-11/4 或 1)来调节 X 和 Y 方向的调节手柄的长度.可调范围为 15mm

3.1.7.4　调节机械载物台的调节手柄的摩擦扭矩

(1) X 轴

- 将 X 轴调节手柄(图 3-11/4)调至最低位置
- 从 Y 轴的调节手柄(图 3-11/1)上取下调节工具(图 3-11/5)并将其插入下部的螺母调节孔(图 3-11/3)中
- 握住 X 轴调节手柄(图 3-11/4),使用调节工具顺时针(减小摩擦力)或逆时针(增大摩擦力)调节螺母,直至感觉合适为准.(见图 3-11)
- 调节范围不能超过一圈!

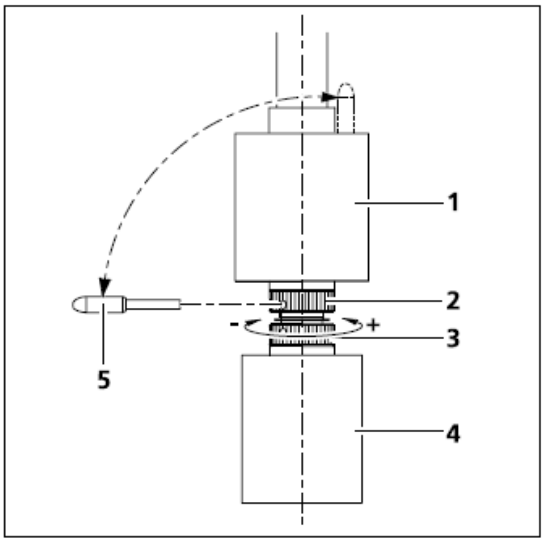


图. 3-11　设置摩擦扭矩

(2) Y 轴

- 将 Y 轴调节手柄(图 3-11/1)调至最高位置
- 将调节工具(图 3-11/5)插入上部的螺母调节孔(图 3-11/2)中
- 握住 Y 轴调节手柄(图 3-11/1),使用调节工具顺时针(减小摩擦力)或逆时针(增大摩擦力)调节螺母,直至感觉合适为准.
- 调节范围不能超过一圈!
- 将调节工具中心插入 Y 轴调节手柄中(图 3-11/1)

☞ 人机工程学,固定 X,Y 调节手柄的机械载物台设置摩擦扭矩是不需要工具.通过调节各自的调节螺母(银色)接口改变摩擦扭矩.

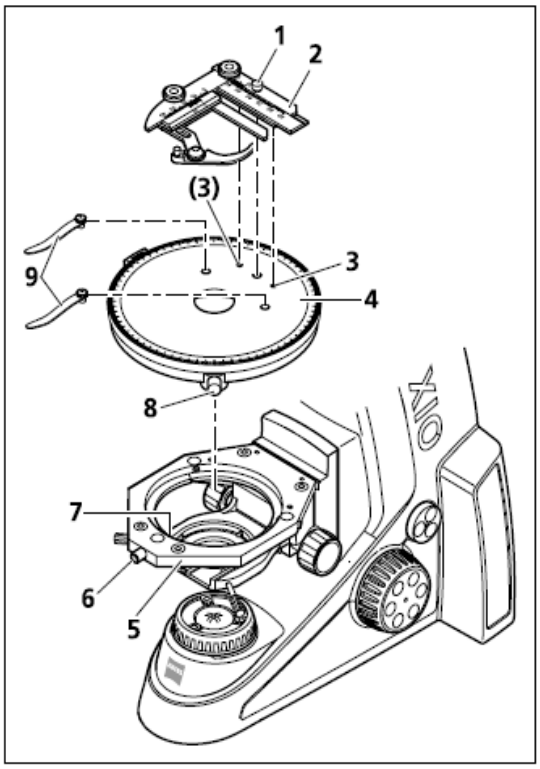


图. 3-12　安装旋转偏光载物台,偏光样品夹或常规样品夹

3.1.8 Mounting rotary stage Pol

3.1.8.1 Removing rotary stage pole

• Loosen screw cap (Fig. 3-12/6) from the spring housing (about three rotations).
• Press rotary stage Pol (Fig. 3-12/4) to the front against spring-loaded pin (Fig. 3-12/7), lift it off the stage carrier (Fig. 3-12/5) from the back and remove it upwards.
• Re-tighten screw cap (Fig. 3-12/6).

3.1.8.2 Attaching rotary stage Pol

- Where necessary, loosen screw cap (Fig. 3-12/6) of spring housing with approx. three rotations.
- Place rotary stage Pol with the groove of the dovetail (stage bottom) on spring-loaded pin (Fig. 3-12/7).
- Attach the rotary stage with the clamp screw (Fig. 3-12/8) pointing to the front right.
- Press the rotary stage Pol to the front against the spring-loaded pin and lower it towards the back into the stage carrier (Fig. 3-12/5), then release it.
- Re-tighten screw cap (Fig. 3-12/6).

☞ The rotary stage must be mounted so that the vernier scale is on the left side and clamp is onthe right side.

3.1.8.3 Dismantling the detachable specimen guide and mounting stage clips

- Loosen the knurled screw (Fig. 3-12/1) on the specimen guide Pol. Withdraw the specimen guide Pol (Fig. 3-12/2) upwards.
- Insert the stage clips (Fig. 3-12/9) into the holes provided.

3.1.8.4 Removing the stage clips and mounting the detachable specimen guide Pol

- Remove the stage clips (Fig. 3-12/9) from the rotary stage Pol.
- Insert the specimen guide Pol (Fig. 3-12/2) with the two cylindrical pins on the underside into the holes provided (Fig. 3-12/3) and tighten the clamp screw (Fig. 3-12/1).

3.1.8.5 Centering rotary stage Pol

With high-power objectives centering can be exact only for one selected objective.
All stages are factory-precentered, i.e. while rotating the stage the specimen feature set to the center will remain in the center. If the specimen feature moves off the center of the field of view (Fig. 3-13/5), while rotating the stage, the stage should be re-centered by following this procedure:

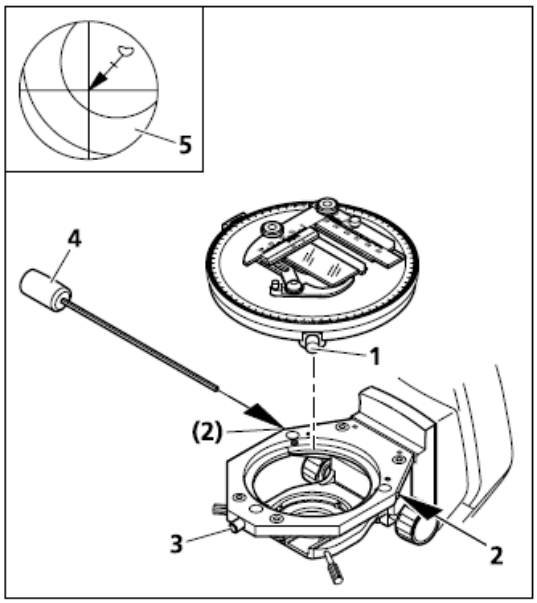


图. 3-13　调中旋转偏光载物台

- The KÖHLER illumination on the microscope must be adjusted before centering the stage (see Section 4.1.1).
- Turn the nosepiece to swing the non-centring objective mount.
- For centering the stage, use a contrasting specimen and an eyepiece with crossline reticle.
- Loosen the stage clamping screw (Fig. 3-13/1) and screw cap on the stage carrier (Fig. 3-13/3).
- Rotate the stage to determine the position of maximum offset of the specimen feature (Fig. 3-13/5, origin of arrow) from the center of the eyepiece reticle.
- Reset the two centering screws on the stage carrier (Fig. 3-13/2) using a SW 1.5 socket wrench (Fig. 3-13/4) to move the specimen detail by half an arrow length in the direction of the crossline center. Check whether the specimen detail moves when the stage is rotated again; repeat the procedure, when required.

☞ The SW 1.5 socket wrenches are located in the storage compartment on the rear side of the microscope stand.

- When centering is finished, re-tighten screw cap (Fig. 3-13/3).

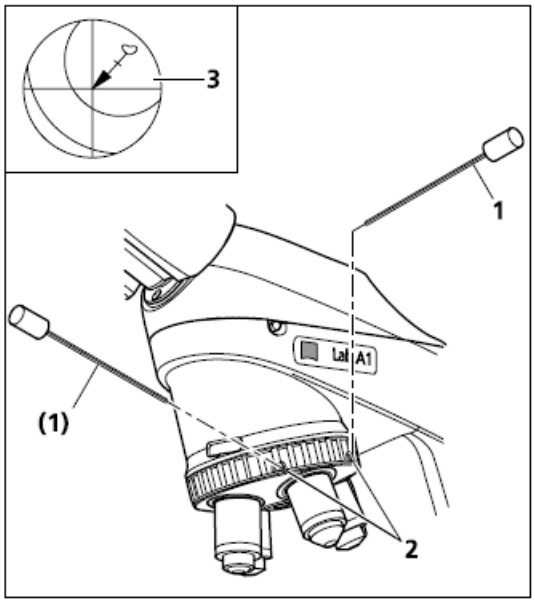


图. 3-14　调中物镜.

3.1.8.6 Centring objectives of the polarization stand

The nosepiece 4x Pol is equipped with one fixed and three centerable objective positions. Stage centering of the non-centering objective mount is necessary to ensure that a specimen feature located in the center of the field of view does not drift out while rotating the stage. By centering of the remaining objectives, the specimen feature remains in the center of the field of view even after changing the objective.

• The KÖHLER illumination on the microscope must be adjusted before centering the stage (see Section 4.1.1).

• For centering the stage, use a contrasting specimen and an eyepiece with crossline reticle.
• First turn the nosepiece to swing the noncentering objective mount. Center the rotary stage for the non-centering objective mount as described under 3.1.8.5.
• Turn the nosepiece to move a centering objective mount into the light path.
• Rotate the stage to determine the position of maximum offset of the specimen feature (Fig. 3-14/3, origin of arrow) from the center of the eyepiece reticle.
• Reset the two centering screws on the stage carrier (Fig. 3-14/2) using one SW 1.5 Allen screw-driver (Fig. 3-14/1) each to move the specimen detail by half the arrow length in the direction of the crossline center. Check whether the specimen detail moves when the stage is rotated again; repeat the procedure, when required.
• Center the other two objectives in the same manner

☞ To maintain this centering accuracy, when replacing it is important not to hold the objective itself, but the knurled ring of the nosepiece to rotate the latter.

3.1.9 安装聚光镜

- 通过调焦旋钮将载物台调节至最高位置

注意:
不要撞到物镜

- 通过聚光镜调节杆(图 3-15/7)将顶透镜放下(如果可动)
- 将聚光镜支架上的调节螺丝(图 3-15/5)拧松至看不见顶端.
- 通过聚光镜调节旋钮(图 3-15/2)将聚光镜支架(图 3-15/3)降至最低位置
  如果安装有低倍聚光镜,确认其不会碰到视场光栏.

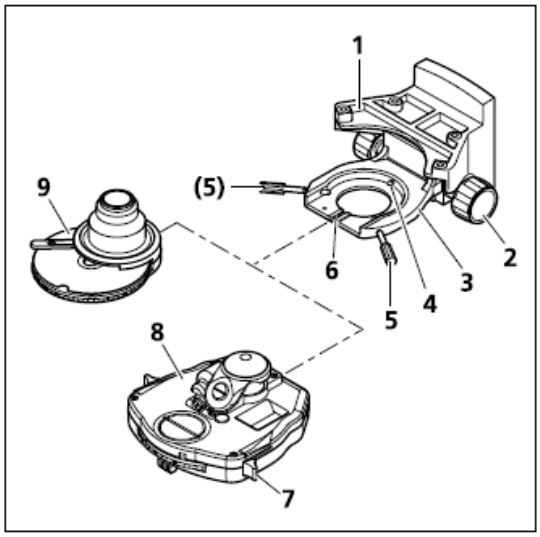


图. 3-15　安装聚光镜.

- 将聚光镜(图 3-15/9 或 8)插入到聚光镜支架(图 3-15/3)中,并将聚光镜下部的螺丝对准聚光镜支架中沟槽(图 3-15/6)
- 向内挤压聚光镜至聚光镜支架顶端螺丝(图 3-15/4),直至聚光镜水平的位于聚光镜支架内.
- 摆好聚光镜的位置,使得聚光镜下部的螺丝对准聚光镜支架中沟槽
- 拧紧支架上调节螺丝,使得聚光镜个顶端螺丝紧密接触.

☞ 安装其他聚光镜的步骤与此类似

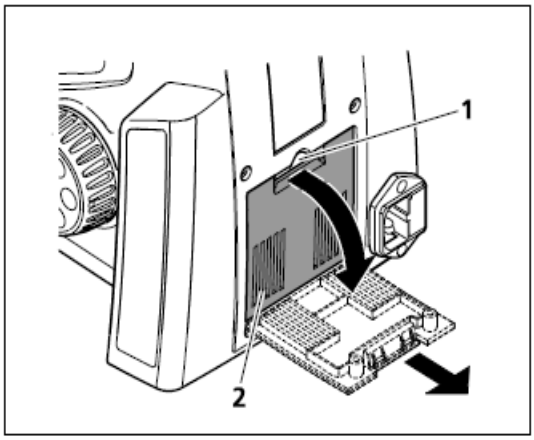


图. 3-16　拆除盖板

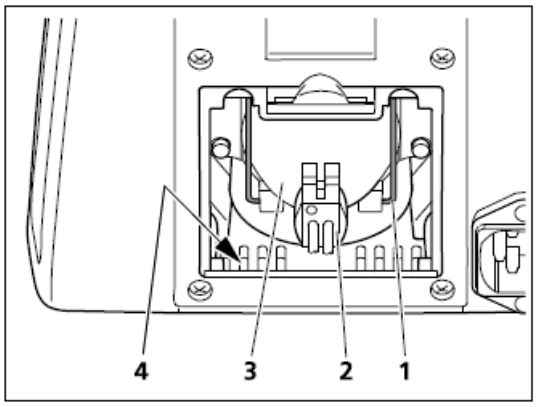


图. 3-17　拆除 LED 灯泡

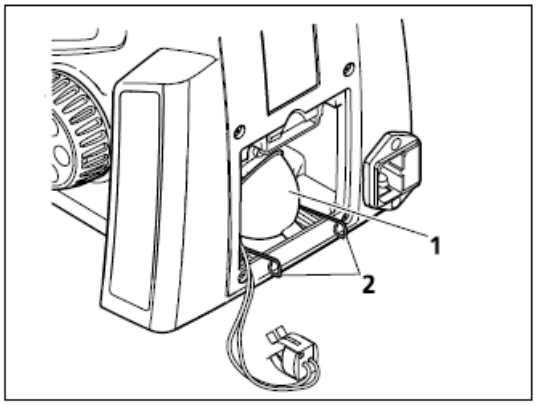


图. 3-18 安装 LED

3.1.10 安装或更换 35W 卤素灯泡或 3W 白光 LED 灯泡

如果需要, Axio Lab.A1 透射光主机可以配备白色光谱或暖色调光谱的 3W LED 灯泡.

安装或更换卤素灯泡/LED 灯泡,步骤如下:

- 关闭显微镜,拔出主机后方的电源线,冷却 15 分钟
- 向下按下盖板(图 3-16/2)上夹爪(图 3-16/1),向下摆动盖板,从主机后滑槽(图 3-17/4)处取出盖板,放置在一边
- 从照明系统(图 3-17/3)上拔下灯泡的连接线头(图 17/2)
- 按下灯座固定弹簧夹(图 3017/1)上的环形夹(图 3-18/1),将其向后摆出
- 更换灯泡时,取出照明系统(图 3-17/3)
- 将新的照明系统/LED 灯泡(图 3-18/1)的下弧面接触至固定弹簧夹,然后将其固定在弹簧夹上
- 向上抬起弹簧夹(图 3-18/2)紧密的固定照明系统

- 检查灯泡已经安装好,在照明系统针脚(图 3019/1)上插入连接线(图 3-19/2).确认连接好并且没有弄弯针脚.
- 将电线收好放入主机内部,防止安装盖板时弄坏电线
- 放入盖板(图 3-16/2)的下脚到主机滑槽中(图 3-17/4),向上将盖板按入至夹爪卡(图 3-16/1)住盖板.
- 连接好电源线

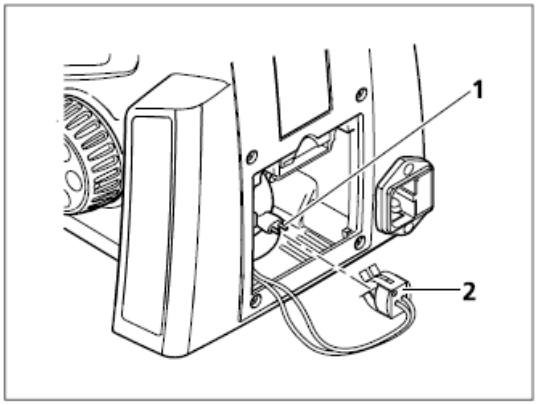


图. 3-19 安装连接线

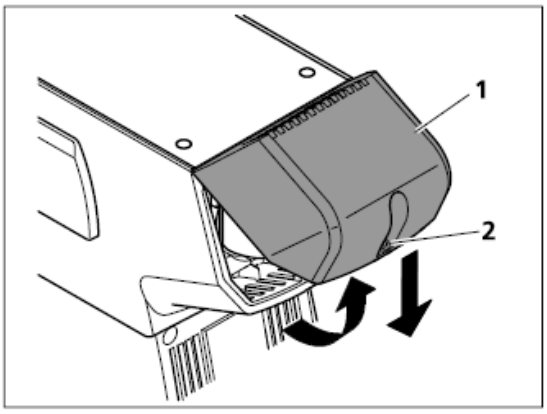


图. 3-20 移除盖板

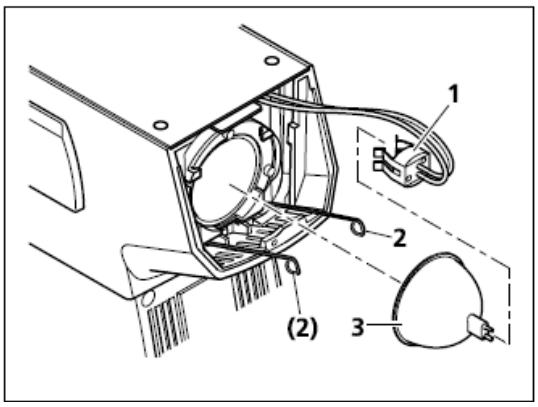


图. 3-21 取出 12V 50W 卤素灯泡

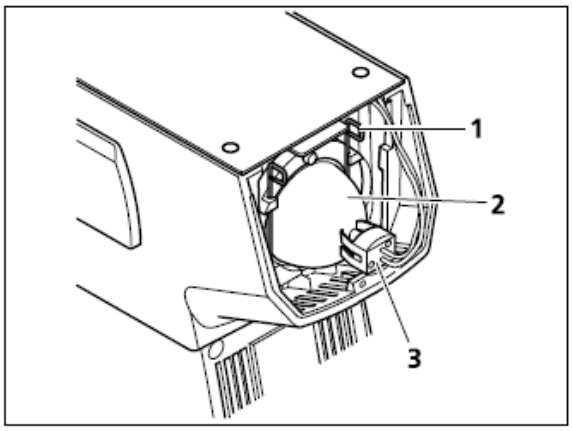


图. 3-22 安装 12V 50W 卤素灯泡

3.1.11 安装或更换 50W 卤素灯泡

每个 Axio Lab.A1 反射光型主机都配备 12V50W 的卤素灯泡.安装和更换灯泡的步骤如下:

- 关闭显微镜,拔下电源线,冷却 15 分钟
- 拧松盖板上螺丝(图 3-20/2)
- 在主机后部从下向上翻转盖板,将其取下
- 拔下灯泡(图 3-21/3)上的连接线(图 3-21/1)
- 将夹在灯泡上的弹簧夹(图 3-21/2)向下掰开
- 取下要更换的灯泡(图 3-21/3)
- 将新的灯泡(图 3-22/2)安装上(灯泡会通过沟槽卡紧)
- 将弹簧夹(图 3-22/1)重新向上掰至卡住灯泡位置
- 检查灯泡是否放好,插紧连接线(图 3-22/3),注意确保不要弄弯针脚.
- 将电线收好放入主机内部,防止安装盖板时弄坏电线

- 将盖板(图 3-20/1)安装到显微镜主机后部上方,然后向下扣好,拧紧螺丝(图 3-20/2)
- 重新连接好电源线

3.1.12 安装或更换 LED 模块

Axio Lab.A1 透/反两用主机允许配备透射 35W 卤素灯或 3WLED 灯泡(将 3.1.10 章)和 2 个反射荧光 LED 模块(见章节 2.2).安装或更换 LED 模块的步骤如下:

- 关闭显微镜,拔下电源线.
- 拧松盖板上螺丝(图 3-23/2)
- 在主机后部从下向上翻转盖板(图 3-23/1),将其取下
- 使用推拉杆(图 3-24/4)来转动模块使其处于中心位置(使用位置)
- 将要更换的 LED 模块(图 3-24/2)的连接线(图 3-24/1)从连接的接口处拔下,向上掰开灯泡卡位弹簧夹(图 3-24/3),将需要更换的 LED 模块(图 3-24/2)取出
- 向上掰开弹簧夹,将新的 LED 模块(图 3-25/5)放入位置中直至卡住位置.松开弹簧夹,使其卡住 LED 模块.
- 将 LED 模块的连接线(图 3-25/2)接入接线口.并卡紧
- 使用推拉杆将另一个 LED 换入光路,同样的方法开始安装或更换第二个 LED 模块(图 3-25/1)
- 将盖板(图 3-23/1)安装到显微镜主机后部上方,然后向下扣好,拧紧螺丝(图 3-23/2)
- 在主机前部的反射模块转盘上更新相应的 LED 模块信息
- 重新连接好电源线

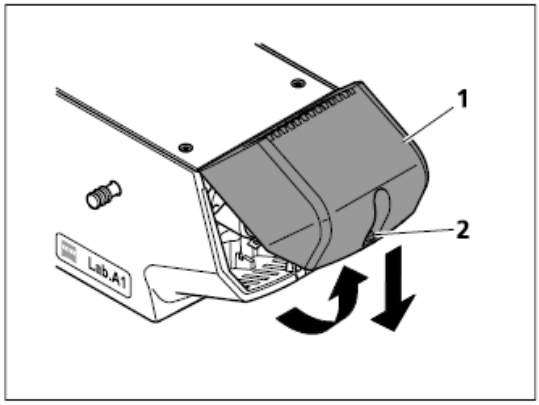


图. 3-23 移除盖板

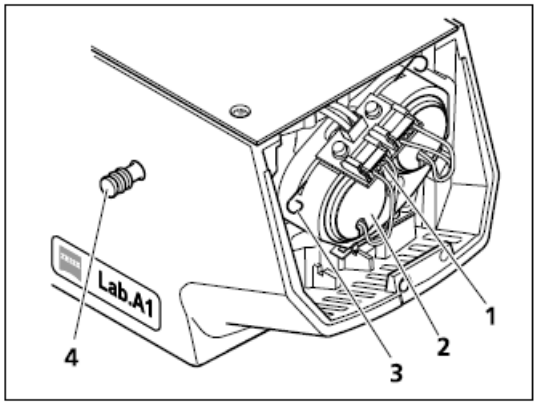


图. 3-24 取出 LED 模块

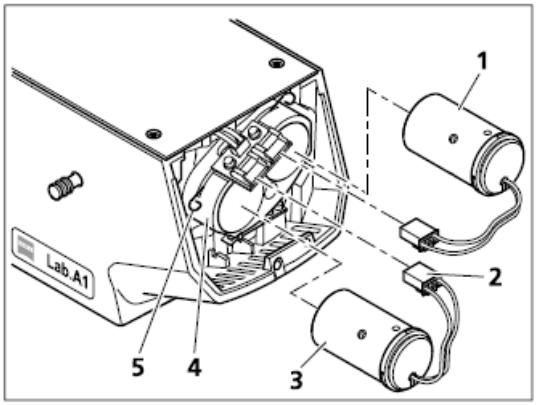


图. 3-25 安装 LED 模块

3.2 安装可选组件

开始工作之前,请确认已经关闭显微镜并将电源线拔下.

所有的工作完成后, 各个模块的功能应该确认是没有问题的(见章节 3.1 到 3.4)

3.2.1 Mounting the light intensive co-observer unit

The light-intensive co-observer unit is mounted on the Axio Lab.A1 with a main observer and one or two co-observers in accordance with the separate instructions for use for multi-discussion facilities (Publication No. M60-2-0048).

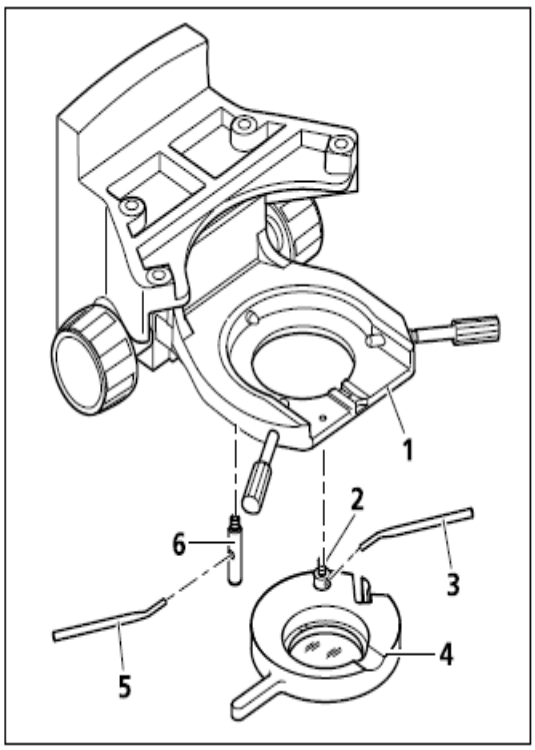


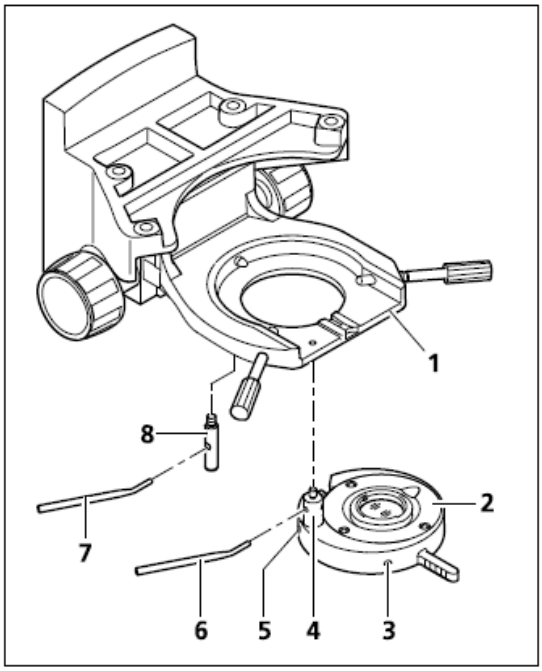
图. 3-26 安装起偏器

3.2.2 Mounting polarizer D or filter holder

- Lift the condenser carrier together with its drive knob upwards as far as it will go.
- If necessary, unscrew locking and holding pinstogether with the overview fixture from thecondenser carrier.
- Hold the polarizer or filter holder (Fig. 3-26/4)parallel to the underside of the condenser carrier (Fig. 3-26/1) and screw the holding pin (Fig. 3-26/2) of polarizer (Fig. 3-26/4) with the angled adjusting lever (Fig. 3-26/3) into the front left threaded hole below the condenser carrier as far as it will go.
- Screw the locking pin (Fig. 3-26/6) with adjusting lever (Fig. 3-26/5) as far as it will go into the rear threaded hole of the condenser carrier.

The other components shown in the system overview at this point must be mounted analogously.

3.2.3 安装和调中低倍聚光镜



- 通过聚光镜的调节旋钮将聚光镜向上调节至最高位置.
- 将起偏器或滤色片支架从聚光镜支架上卸下
- 将低倍聚光镜或滤色片支架(图 3-27/2)拿起并水平与聚光镜支架(图 3-27/1)下部紧密接触.并使用工具(图 3-27/6)将低倍聚光镜的固定螺丝(图 3-27/4)与聚光镜支架下部左前的放的螺丝孔对好并紧固
- 使用工具(图 3-27/7)将锁定销(图 3-27/8)紧固至聚光镜左后支架上.
- 转动低倍聚光镜至光路,确认其可以锁入其正常的工作位置
- 完全打开视场光栏和孔径光栏
- 使用 1.5mm 的螺丝刀伸入调节孔(图 3-27/3 和 5)调节视野范围至最佳模式.

☞ 低倍聚光镜只能固定在 0.9/1.25 聚光镜上

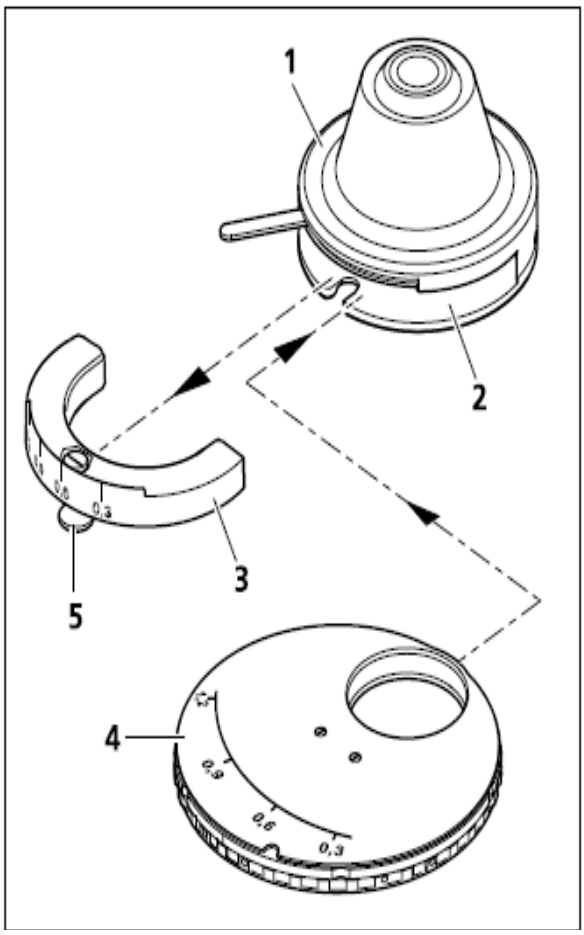


图. 3-28 安装 0.9 H Pol 聚光镜转盘

3.2.4 在 0.9HPol 聚光镜上安装功能转盘

- 将聚光镜(图 3-28/1)从聚光镜支架(见章节 3.1.9)上卸下.如果聚光镜支架不能降的足够的低,例如安装了低倍聚光镜,那么必须将其卸下,以方便降低聚光镜支架卸下聚光镜
- 使用 3mm 螺丝刀松开聚光镜标尺(图 3-28/3)处螺丝(图 3-28/5).并将其向前取出
- 将功能转盘 (图 3-28/4) 有两个豁口的部分朝前,将其插入聚光镜,并将紧固螺丝口对准聚光镜上的螺丝孔
- 使用 3mm 螺丝刀将功能转盘紧固在聚光镜上.
- 将聚光镜重新安装进聚光镜支架(见章节 3.1.9)

3.3 连接电源线

所有型号的主机电源线接口均位于主机后部

- 将电源线连接显微镜的接口(图 3-29/1)
- Axio Lab.A1 使用电压范围是 100 到 240V 交流电,50/60HZ.电源部分是自动适应电压的.

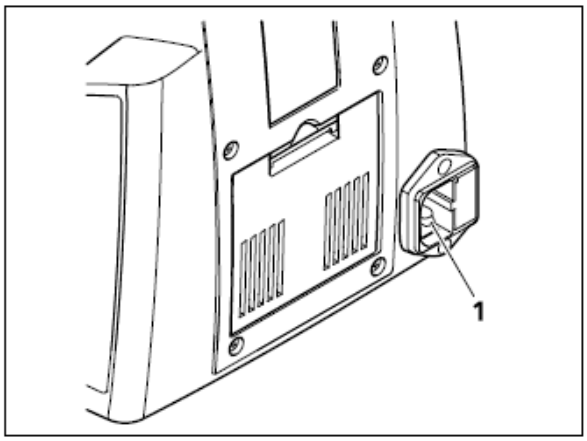


图. 3-29 主机后部电源插口

3.4 显微镜的开和关

- 通过主开关(图 3-30/1)来开关显微镜
- 通过调节亮度控制旋钮(图 3-31/3)来控制图像的亮度.
  通过使用手指转动旋钮,调节至需要的亮度

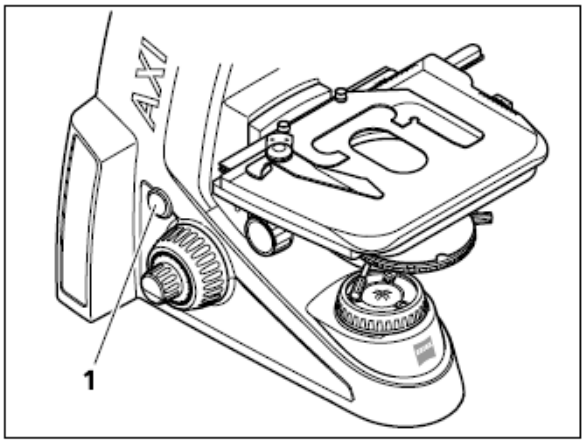


图. 3-30 显微镜左侧电源开关

只有透射光和反射荧光主机:

- 旋转 FL/TL 摆动开关(图 3-31/1)至所需的位置 (FL=选择反射荧光,TL=选择透射光)
- 根据所选的 FL/TL 摆动开关的位置,图像亮度的调节使用透射光亮度控制旋钮(图 3-31/3)或反射荧光亮度控制旋钮(图 3-31/2)

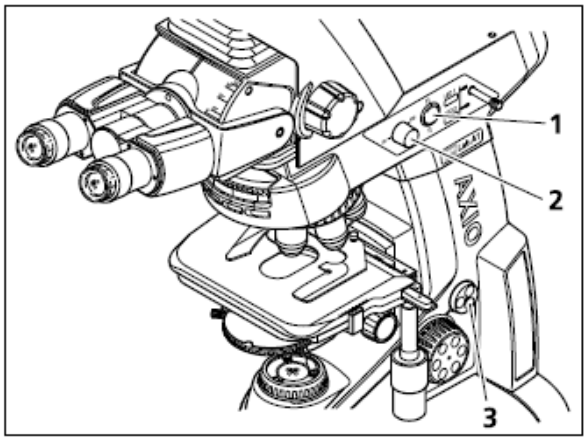


图. 3-31 光强控制和透/反转换开关

3.5 人机工程学显微镜的基本设定

3.5.1 人机工程学显微镜的背景

Axio Lab.A1 显微镜是由蔡司按照职业保健医生和 TÜV Rhineland 的意见设计的,能够满足显微镜工作站在人机工程学方面的大多数要求. 这是全世界第一台带有特定人机工程学设计并获得 TÜV:"通过人机工程学测试"证书的显微镜,证书编号:0000025994. 此外, Axio Lab. A1 的其他产品特征和人机工程学元件也能够保证显微镜工作站具有满足人机工程学要求.

Axio Lab.A1 级别的实验显微镜正在应用到各个常规领域(例如:血液检查,组织和细胞检查等),并且一般每次使用时间均在几个小时.在光学显微镜没有使用人机工程学设计时,这种经常长时间的工作会导致使用者出现健康问题.这种健康风险可以通过合理的设计和改造控制手柄位置,单独调整目镜的屈光度等和显微镜整体的正确设计来降低.

这样的设计可以改善工作条件,安抚员工的情绪和提高工作效率.越来越多的国家和地区为显微镜的操作建立的严格的规章制度,尤其在医学领域.另外雇主有义务为雇员提供人机工程学类的工作场所和显微镜.

本用户手册的以下章节将在强调人机工程学的基础上，提供正确调节 Axio Lab.A1 显微镜的建议. 显微镜工作站的整体人机工程学调节也包含在内.

3.5.2 TÜV 证书编号:0000025994 "通过人机工程学测试"

TÜV 证书编号:0000025994 " 通过人机工程学测试",规定了使用者和设备之间,从桌面到控制手柄的距离.并且还规定了一个目镜调节范围,以适用于全世界使用显微镜的不同高度的男性和女性员工.因此人机工程学的观察筒要求可以垂直调节高度,并且观察角度也要可以调节.这样就可以适用于不同高度的人群(静态工程学)和偶尔会有大量的不同的人员使用(动态工程学).此外,TÜV 人机工程学认证只有在其余显微镜工作站在照明和高度可调节桌椅方面满足人机工程学设计时才完全有效.

如章节 1.2 此显微镜的人机工程学含义中所列，一系列基本工作台标准是 TÜV 证书的基础. TÜV 证书（图 3 － 3 2 ）位于指定人机工程学认可设置的人机学目镜观察筒上.

Fig. 3 － 3 2　TÜV 证书 " 通过人机工程学测试"

此认证的详细资料可以在线搜索，网址：www.tuv.com　输入 I D：0000025994

除了具有 TÜV 人机工程学设计的特征,还可以通过选择合适的人机学目镜观察筒或带有固定载物台驱动的人机工程学工作台，来增加 Axio Lab.A1 显微镜的人机工程学特性.

3.5.3　显微镜工作站的人机工程学设计

除了使用具有人机工程学设计的显微镜，Axio Lab.A1，显微镜工作站还有其他方面的人机工程学要求，包括照明调节，室温，湿度，常规实验室要求和高度可调节桌椅. 这些要求将在后文有详细描述；请参见方括号中的附加信息标准. 推荐以坐姿使用 Axio Lab.A1 显微镜.

请根据使用者的视觉舒适度和清晰度调节照明条件. 视觉舒适能够使使用者感觉良好，提供工作效率. 视野清晰能够令使用者在比较困难的条件下长时间完成观察任务. 这意味着工作站不能使用直接的太阳照明或其他光源的反射照明. 对于荧光显微观察，工作站需要处于照明度低于 5 0 l u x [EN 12464-1]的暗室[EN 58959, 1997].

气温，湿度，风速和环境辐射温度将根据其对人体热反应的影响而变化. 只有上述条件在一定范围内时，才能保证使用者的舒适，健康和工作效率. 目标值为室温 20 °C，相对湿度大约 6 0 %. [DIN 33403-2]

显微镜工作站必须独立于其他公共实验区，以保证工作特别是中长期工作不受打扰．工作站内应无尘，无酸蒸汽，以减少对显微镜性能的影响．每个工作站必须预留空间以储存观察工作所需的耗材．必须安装实验台以保证显微镜在工作时不会晃动[EN 58959, 1997; EN 12464-1]．工作台下应当可以保证最小放腿空间[参见 EN 527-1:2000 章节 6；DIN EN 13150].

至少应当通过使用带有脚踏的高度可调节座椅来满足在固定工作高度的坐姿工作站中实现个体调节[DIN 33406: 产品工作空间规格]．高度可调节的工作台更佳．

坐姿应调节至手臂与桌面平行，上臂放松，不必耸肩或弯腰．上体尽可能保持直立[DIN EN 1335-1:办公室工作椅]．办公室转椅的坐垫和靠背应满足人机工程学要求并支持不同的坐姿[TÜV 2PfG974: 办公室转椅的人机工程学要求]. 需要使用高度可调节座椅来满足不同使用者的要求．

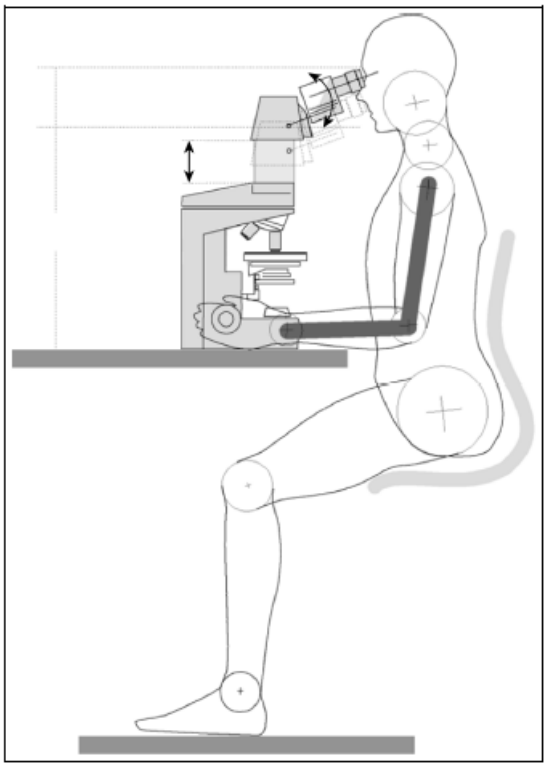


图. 3-33 显微镜的人机工程学调整

3.5.4 显微镜的人机工程学调节

显微镜，特别是目镜，需要针对不同体型的使用者完成个体调节．又称为，静态人机工程学．需要强调的是，应使用支持人机工程坐姿的高度可调节的目镜观察筒来满足目镜高度调节．观察高度的精细调节也可通过旋转目镜插孔完成．但是，理论上讲，这应当是连续高度和旋转范围的结合．

为了缓解肩颈肌肉，头部的前倾角度不应超过 30°．另一方面，为了符合放松状态下的正常头位和视角，这一角度也不能小于 8°.

观察角度和／或高度的个体调节同样可以满足工作姿态的动态变化．这称为动态人机工程学.

例如，包括人机学目镜观察筒(425522-9040-000)在内的TÜV认证的人机工程学设计可以令目镜观察高度和角度连续变化，满足５％的女性和９５％男性的需要．如果使用Axio Lab.A1系列中的其他人机学目镜观察筒，可能会在一定程度上减少这一范围．

使用者需要根据个人需要调节坐姿和目镜观察高度．坐姿应调节至手臂与桌面平行，上臂放松，不必耸肩或弯腰．上体尽可能保持直立[DIN EN 1335-1:办公室工作椅]．办公室转椅的坐垫和靠背应满足人机工程学要求并支持不同的坐姿[TÜV 2PfG974: 办公室转椅的人机工程学要求]．此时，可以通过上下旋转固定目镜观察筒的双目部分或连续调节人机学目镜观察筒的倾斜目镜和／或观察角度来调节目镜观察．观察角度应当在 8°到３０°之间．目镜观察高度应使使用者处于放松直立坐姿．应尽可能降低用户骨骼肌系统的静态肌肉工作，来减少颈部和背部肌肉紧张的可能．此外，由于使用人机学目镜观察筒，使用者可以随时调节设置来降低由于长期工作造成的肌肉紧张．

Axio Lab.A1 的 TÜV 人机学认证配置提供了最优条件．其他 Axio Lab.A1 配置，包括人机学载物台和／或人机学目镜观察筒，可以在最大程度内完成显微镜工作站的人机工程学配置．这些人机工程学的设计理念应在设计实验室显微镜工作站时使用．使用者在显微镜工作站连续工作的时间越长，这些设计理念的应用就越重要．

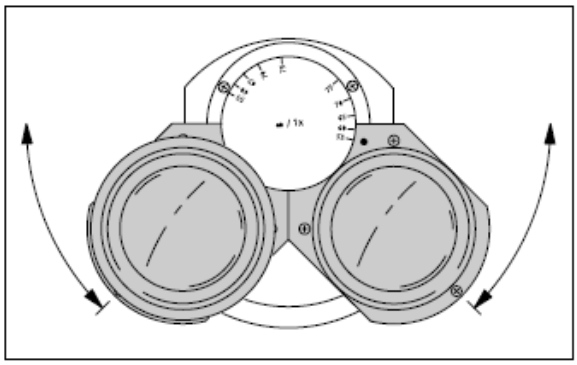


图. 3-34 设置观察筒的瞳距

3.5.5 在观察筒处设置瞳距

- 通过对称调节两个目镜筒可以任意的调节瞳距（图３－３４）

当双眼通过目镜观察时能形成一个圆形的视野即是合适的瞳距

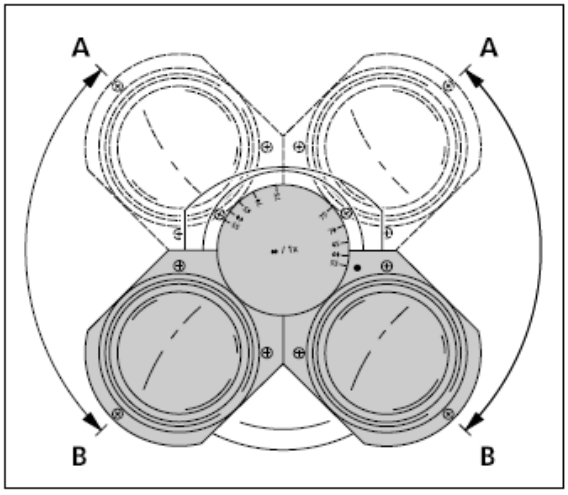


图. 3-35 设置观察筒的观察高度

3.5.6 设置观察高度

- 通过调节两个目镜筒的至最上(图３－３５/A)或最小(图 ３－３５ /B)可以改变观察高度

Axio Lab.A1 的双目观察筒均具备两个高度可用（上部或下部）．观察高度依赖于不同的瞳距和观察筒的角度，依赖于不同型号的观察筒，观察高度可以是固定或连续可调．当瞳距为６５ｍｍ观察角度是30°时，调节高度范围大约是４０ｍｍ

人机工程学观察筒（三目）（425511-0000-000,425512-0000-000, 425514-0000-000, 425520-9050-000）具备在４４ｍｍ或５０ｍｍ的连续高度调节范围．

人机工程学三目观察筒（425522-9020-000 和 425522-9030-000）的观察角度具备8° 到 38°的连续调节范围．

更舒适的人机工程学观察筒（425522-9040-000）具有最多５０ｍｍ连续可调的高度范围和8° 到 ３３°的角度范围．此款观察筒是被TÜV显微镜部分作为最佳推荐客户使用

3.5.7 使用目镜十字线时的屈光度校准

正确使用目镜十字线的前提条件是使用两个可调屈光度的目镜以补偿使用者双目不同的屈光度

- 通过调节目镜的焦距，将目镜十字线调焦清楚.
- 使用带目镜十字线的目镜通过调焦机构将载物台上的样品调节清楚.
- 当显微镜图像和目镜十字线均聚焦清楚后，调节另一个目镜，使其将显微镜图像聚焦清楚.

目镜十字线和显微镜图像调节清楚后，以后的调焦只能通过调焦机构来调焦

4. 操作

4.1 透射光的照明方式和观察方法

4.1.1 校准透射明场的科勒照明

（1） 常规原理

在所有的光学显微镜检查方法中，透射光/明视场是最常用的方法。它能够轻松而迅速地检测高对比度或染色标本（例如，血涂片）。

为了使成像结果尽可能地忠实于物体，不仅要考虑所谓的直接光束，也要考虑间接光束，间接光束是从标本细部发生的衍射和散射。根据 ABBE，尽可能地增强间接光束的衍射，即可能使图像更接近于真实的物体。

根据柯勒照明原理调节聚光镜、视场光阑和孔径光阑，是充分发挥显微镜性能的最佳方法（对于物镜尤其如此）。有关校准显微镜的基本规则的详情，请参见第4.1.1(3)节“校准柯勒式透射光/明视场”。

（2）透射明场的使用

所有的Axio Lab.A1显微镜除了反射光主机外都能够以透射光/明视场的方式工作。

所提供的聚光镜（像暗视场聚光镜之类的特殊聚光镜除外）都可用于透射明视场观察。

（3）**校准透射明场的柯勒照明**

- Axio Lab.A1 已经被正确安装（见章节 3）
- Axio Lab.A1 已经打开了电源

- 使用显微镜主机体上的光强度控制旋钮（图4-1/2）调节图像亮度。

- 把高对比的标本放置于机械载物台的样品夹上。

- 把聚光镜的前端透镜（如果在使用中）置入工作位置（≥ 10x 的物镜），并转动调整旋钮，把聚光镜（图4-1/3和图4-2/2）垂直调节到上限位。调节该限位，确保能防止聚光镜顶到标本（有关调节聚光镜限位的详情，请参见第4.1.1(4)节）。

- 在配有功能转盘的聚光镜上：转动转盘（图4-2/3）到位置 H（明视场）

- 使用物镜转盘上10x 物镜（图4-1/6），并使用调整旋钮（图4-1/1）聚焦标本。

- 缩小视场光阑（图4-1/5），直到可以在视场中看到它（即使是模糊的）（图4-1/A)。

- 调整聚光镜旋钮，进行垂直调节，直到视场光阑的边缘变得清晰（图4-1/B)。

- 调节聚光镜支架（图4-1/C）上的两个调心螺丝（图4-1/4），使视场光阑图像位于中心位置。放大视场光阑，直到光阑的边缘从视场中消失（图4-1/D）。

- 为了调节孔径光栏（对比度），从镜筒中取出一个目镜。观察镜筒，使用调节手柄（图4-2/4）把光圈大约调节到物镜出射光瞳（图4-1/E）直径的 2/3 到 4/5。对于大多数情形，在近于最大分辨率下，这个光圈将达到最高对比度，因此，也是相对于人眼的最佳对比度

- 把目镜装回镜筒。

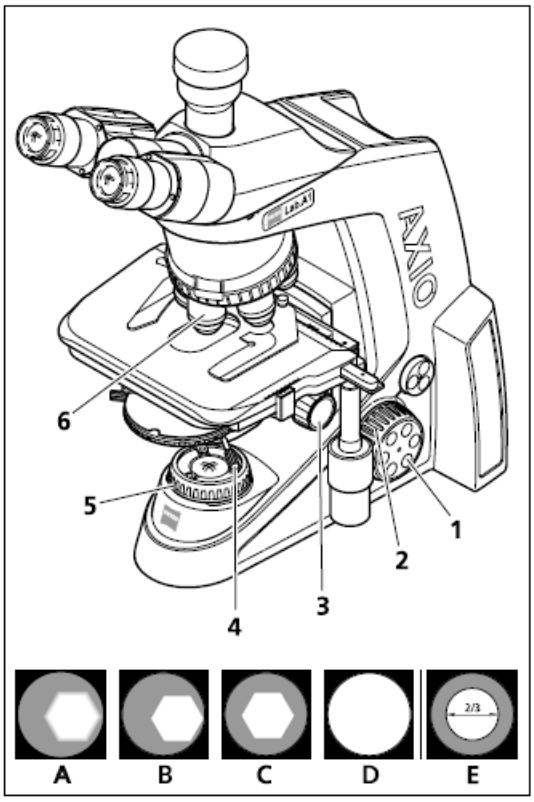


图. 4-1 显微镜透射明场的设置

☞ 注意：每更换一个物镜都会改变视场光栏和孔径光栏的大小。对于不同的物镜，中心定位也会有微小的变化，因此，为了获得最佳的效果，必须反复调节视场光阑和光圈。

使用小于 10x 的物镜时，聚光镜的前端透镜（如果安装有旋转接头）应旋出，光圈应完全开启。为了获得更好的对比度，在观察大视场时，视场光阑应闭合更多。要达到这个目的，应把孔径光栏减少到一定的范围。但是，为了保证视场中照明的一致性，不能闭合过多

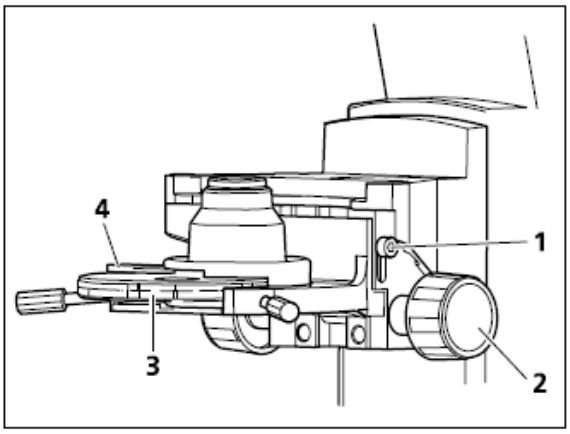


图. 4-2 设置聚光镜的最高上限

（4）**设置聚光镜支架的最高限位**

- 使用 SW3 内六角螺丝刀松开垂直限位上的固定螺丝钉（4-2/1）。
- 使用调焦机构聚焦到标本。
- 缩小视场光阑，并垂直调节聚光镜（图4-2/2），直到光栏图像清晰为止。
- 向上稍微增加调节量，但应避免碰到标本。
- 固定垂直限位的固定螺丝钉（图4-2/1）。

4.1.2 根据科勒照明调节透射暗场

（1）操作的基本原理

未染色的生物标本（比如细菌或活体细胞培养品）呈半透明状态，透射明场有时难以检查。不过，采用透射暗场的方法检查这些标本时，取得的效果却截然不同。从本质上来说，就是采用高于所用物镜孔径的照明孔径来照明标本。

在暗视场中，只有对于成像过程很重要的衍射和散射光线进入物镜，而直接非衍射光束则不进物镜。因此，就获得了细微结构的分辨力，这个分辨率要比光学显微镜的分辨能力略低一些。此时，细微结构在黑色的背影上呈现明亮的像。

（2）使用仪器

所有的Axio Lab.A1显微镜，除了反射光主机．是可以配备暗场的

使用聚光镜功能转盘位置 **D**，例如：

- 配有 H、D、Ph 1、Ph 2、Ph 3 调光盘的 0.9/1.25 H 聚光镜。
- 消色差-消球差 0.9 H D Ph DIC 聚光镜
- 具有干式暗视场的暗视场聚光镜。
- 超聚光镜

（3）准透射暗场

- 根据柯勒方法校准照明，其过程类似于透射明场校准。不过，这里不再使用 10x 物镜，而是使用孔径尽可能大的物镜。但孔径不应超过所用聚光镜其暗视场的围孔。

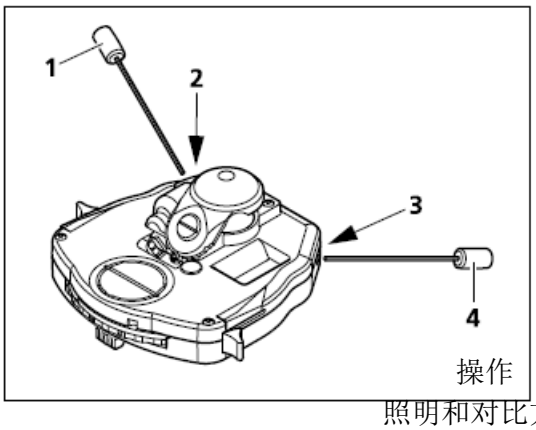
- 调节聚光镜功能转盘至位置 **D**，并使用聚光镜的前端透镜（如果有）。

- 从镜筒中取出目镜（或者替之以辅助显微镜），并检查物镜出射光瞳暗视场光阑的定位中心。如果通用聚光镜的中央暗视场光阑 D 部分偏出，或者未定位到物镜出射光瞳的中央，且光瞳中的暗色看起来不一致，那么就有必要重新校准暗视场光阑的中心。

- 如果暗视场光阑需要调中，请使用两把 SW 1.5 的内六角螺丝刀（图4- 3 /1和4），调节两个调心螺丝（图4- 3 /2和3），直到物镜出射光瞳中的暗色一致性良好为止。完成调中的步骤后，从聚光镜中取出 SW 1.5 的 Allen 螺丝刀。

☞ 注意：对于透射暗场来说，配有可变光阑孔径的物镜其孔径过大。应缩小可变光阑孔径小于 0 . 6 5 ，使之至少达到所用聚光镜暗视场的围孔

暗视场方法的性能标准就是视场的背景状况，背景应当尽可能地黑。



操作

图. 4-3 居中 achromatic-aplanatic 0.9 H D Ph DIC 聚光镜的暗场环

- 把目镜装回镜筒。
- 如果暗场聚光镜的高度设置正确的话，在视野的左侧是没有任何光的．并且视场光栏的焦距是非常清楚的．
- 现在把视场光阑直径放大到视场的大小。

用于暗视场检测的标本应当完全保持清洁，对该标本清洁度的要求应高于任何其照明和对比方法的方法。指印、灰尘、甚至任何沙粒都会造成不良影响他，因为它们会让背景变亮，从而减小被检物体图像的对比度。

4.1.3 校准透射相差

（1）操作的基本原理

对于薄的，未染色的标本（例如，培养细胞）时，相衬镜检术是一种理想检测方法。通常情况下，人眼不能分辨不同细胞结构内的相位差（折射率或厚度的不同而引起的变化）。

相差技术是采用光学调节器（比如，“环状相位光阑和相板”），相衬镜检术把微小的相位差转变为增强及有色的振幅差，从而能够为人眼识别。产生这种图像的要点在于中间图像中不同光束之间的干涉现象。

使用光学上定义的环形通道“环状相位光阑和相板”，高强度的直接光线被衰减，并产生一定距离的相位移动。不过，间接光线因不同的细胞微粒而产生衍射，绕过了光学通道，它们的相位只取决于标本的折射率和厚度的不同。

在中间图像板上，各种光束受到的影响互相不同，从而形成干涉，相互间发生增强或减弱——由它们的相位决定。因此，这些干涉产生的图像其内容将具备不同的强度，就能为人眼观测得到。

（2）使用部件

所有的Axio Lab.A1显微镜，除了反射光主机．是可以配备相差的

- 相差物镜，内有不同相差环的 Ph 1、Ph 2 或 Ph 3 相板，也可用于明视场。
- 聚光镜，配有功能模块转盘，包括可调中的相差光阑，规格有 Ph 1、Ph 2 或 Ph 3，用于不同相差环。
- 用于聚光镜的相位环状光阑应与所使用物镜上的标识，例如 Ph 1。

（3）校准透射相差

- Ÿ 把相差物镜（例如，标识为 Ph1）放置于光路中。
- Ÿ 旋转聚光镜功能转盘上的相差光阑，该光阑上的标签应与相差物镜上的标签相同，例如 1。
- Ÿ 为了使较亮的相差光阑（聚光镜上）的中心和重叠匹配较暗的相板（物镜上），从镜筒中取出目镜，替之以辅助显微镜。使用辅助显微镜上的调节装置，聚焦环状光阑和物镜出射光瞳里的相板。

- Ÿ 如果重叠并不精确（图 4- 4 /A），较亮的环状光阑必须使用两把 SW 1.5 内六角螺丝刀（图4- 3 /1和4）重新调中。调节两个调心螺丝（图4- 3 /2和3），直到与较暗的相板完全重叠（图4- 4 /B）。
- Ÿ 从镜筒中取出辅助显微镜，代之以目镜。

为了增加图像对比度，应在视场光阑上或者插入滤色片支架上安装一个干涉宽带滤光片（绿色 32 x 4）（如果有提供）。

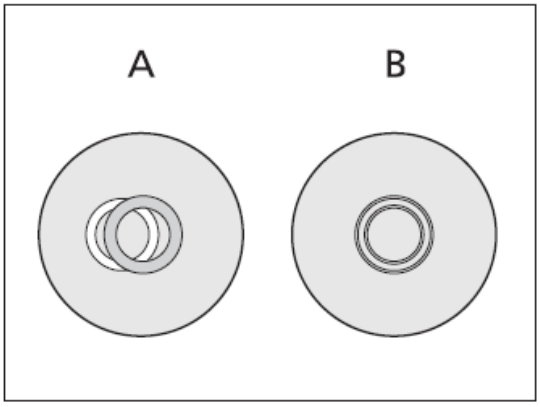


图. 4-4 调节相差环(聚光镜中的亮环)与相差环的重合(物镜中的暗环)

在照明光路中（图 4- 4 /B），当亮色相差光阑（聚光镜上）与暗色相板（物镜上）精确重叠，才能得到完整的相差。

4.1.4 Setting transmitted light polarization

4.1.4.1 Detecting birefringence

(1) Application

The transmitted light polarization method is used for specimens which change the state of polarization of light. These specimens, such as crystals, minerals or polymers, are referred to as birefringent. When these birefringent substances are viewed between crossed polarizers (polarizer ⊥ analyzer), they appear bright while their surroundings remain dark.

Birefringent substances are identified in that they show four bright and four dark positions when rotated through 360° between crossed polarizers. Depending on birefringence, thickness and orientation of the specimen, interference colors ranging from gray (mostly with biological specimens) to white, yellow, red and blue appear in this process. These interference colors can be of the first or any higher order.

(2) Instrumentation

Polarization methods can be used in the transmitted light on Axio Lab.A1 microscopes for transmitted light polarization and conoscopy.

- Tension-free objectives
- Rotary stage Pol
- Polarizer D (rotatable or fixed)
- Analyzer slide D, fixed, or lambda or lambda/4 compensator
- Depolarizer (for screwing into Axio Lab.A1 tubes) to avoid undesirable polarization effects

☞ The depolarizer is already incorporated in the Axio Lb.A1 stand for conoscopy.

A depolarizer (quartz depolarizer) should be installed in all microscopes used for examining mineral/geological specimens.

A depolarizer suppresses undesirable polarization effects which may occur after the analyzer (e.g. on prism surfaces in the tube), or shifts these to higher orders.

(3) Setting the microscope

- Set the microscope as in the transmitted light brightfield according to KÖHLER (see Section 4.1.1 (3)).
- Center rotary stage Pol (Fig. 4-5/**1**) (see Section 3.1.8.5) and objectives (see Section 3.1.8.6).
- Swivel polarizer (Fig. 4-5/**3**) into the light path and, if it is rotatable, position it at 0°.
- Insert the analyzer slider (Fig. 4-5/**2**) into the slit for compensators (if tube does not already have an analyzer). The field of view will appear dark due to the crossed polarizers. With screw-on analyzers, care must be taken to ensure that they are aligned with polarizer D (i.e. crossed position).
- Move the specimen into the field of view and turn it with the rotary stage. As a rule, while being rotated between crossed polarizers, birefringent (anisotropic) specimens will now display the variations in color and intensity described above. However, optically anisotropic substances may also remain dark, if an isotropic direction, e.g. of optically uniaxial or biaxial crystals, is oriented parallel to the direction of observation.

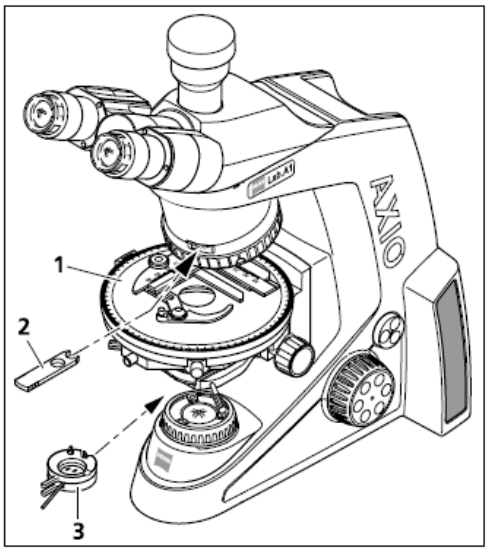


Fig. 4-5 **Components for transmitted light polarization**

4.1.4.2 Determination of gout and pseudogout

- Set the microscope as in the transmitted light brightfield according to KÖHLER (see Section 4.1.1 (3)).
- Then swivel the polarizer, rigidly fixed to the lambda plate (445226-0000-000) (Fig. 4-5/**3**) into the beam path.
- Insert the analyzer slider (Fig. 4-5/**2**) into the slit for compensators.
- The field of view will appear dark due to the crossed polarizers.
- Swivel the rotatable lambda plate into the beam path and set the metal adjusting lever of the lambda plate to 45°.
  The gamma direction is orthogonal to the position of the level and is indicated by a white line on the top of the lambda plate.

☞ The 45° position is at the third white marking on the scale. The scale graduation from one marking to the next is 15°. The 45° position is at the third marking, calculated from the 0° marking. As a further reference point for the correct position of the lever, the Greek letter λ has been engraved on the upper side of the lambda plate, likewise at the 45° position.

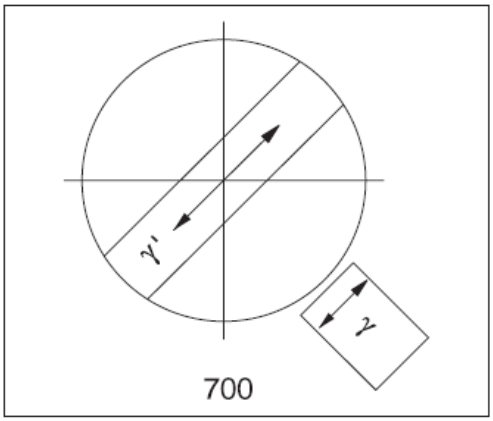


Fig. 4-6 Gamma direction

- Select crystals which are oriented in the gamma direction (Fig. 4-6).

Evaluation:

If the crystal needles parallel to the gamma direction are yellow and those perpendicular to the gamma direction are blue, they are monosodium urate crystals (gout).

If the crystal needles parallel to the gamma direction are blue and those perpendicular to the gamma direction are yellow, they are calcium pyrophosphate crystals (pseudogout).

☞ Alternatively, a combination of fixed polarizer (427701-0000-000) and analyzer with fixed lambda plate, 45° (453681-0000-000) can also be used. This offers the advantage that the lambda plate is pre-set to 45°, precluding the risk of incorrect setting. The evaluation is performed in the same way as described above.

4.1.4.3 Determining the direction of oscillation n_γ

(1) Application

The determination of the direction of oscillation of $n\gamma$ and $n\gamma'$ (direction of oscillation with the absolutely or relatively highest refractive index) and n_α and $n_{\alpha'}$ (direction of oscillation with the absolutely or relatively lowest refractive index) in relation to the morphological directions, e.g. of crystal surfaces, crystal needles or fibers, provides an important criterion for recognition. It is also employed for the diagnosis of biocrystals (e.g. gout, pseudogout).

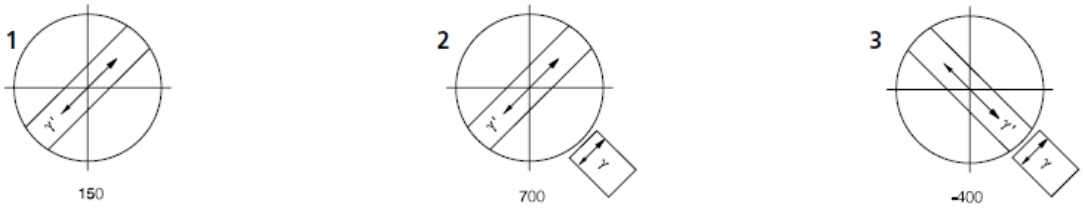


Fig. 4-7 Determining the direction of oscillation $n\gamma'$ using a synthetic fiber as an example

(2) Instrumentation

- Eyepiece with crossline reticle
- Tension-free objectives
- Rotary stage Pol (Fig. 4-5/**1**)
- Polarizer D (rotatable or fixed)
- Screw-in fixed analyzer slide D or lambda/lambda4 compensator combined with analyzer (in Axio Lab.A1 tubes)
- Alignment specimen for polarization microscope (453679-0000-000)

(3) Setting the microscope

- Set the microscope as for the transmitted light brightfield (see Section 4.1.1), taking care to ensure the correct interpupillary distance in the binocular tube (see Section 3.5.5).
- Center rotary stage Pol (Fig. 4-5/**1**) and objectives (see Sections 3.1.8.5 and 3.1.8.6).
- Swivel polarizer (Fig. 4-5/**3**) into the light path and, if it is rotatable, position it at 0°.
- Insert the analyzer slider (Fig. 4-5/**2**) into the slit for compensators (if tube does not already have an analyzer). The field of view will appear dark due to the crossed polarizers. If not, align the analyzer in the tube or the intermediate plate.
- Set the alignment specimen Pol on the microscope stage and turn to the dark position of the alignment specimen.
- Remove the analyzer and align the crossline reticle with the cracks in the specimen.
- Subsequently reinsert the analyzer and remove the alignment specimen. The pass directions of the polarizer and analyzer will now be parallel to the crossline reticle (polarizer EW, analyzer NS).

☞ An adjustment of the crossline reticle is not necessary when working with the intermediate plate and the binocular photo tube Pol (425520-9100-000).

- Rotate the rotary stage Pol with the specimen, e.g. a synthetic fiber, until the specimen appears as dark as possible. In this position, the fiber extends parallel to one of the two directions of the crossline reticle.

☞ Do not change the interpupillary distance on the binocular tube, as the the angle of the crossline reticle to the fiber will be changed.

- Now turn the stage on by 45° so that the longitudinal axis of the fiber is oriented NE-SW (Fig. 4-8). The specimen will display the greatest brightness here (diagonal position). In this position the specimen may have any color.
- Insert the compensator λ (only possible if used with screw-in analyzer in tube or intermediate plate).

Like the specimen, the compensator λ is a birefringent object, albeit with a defined path difference of 550 nm and the principal direction of oscillation n_γ definitely oriented in a NE-SW direction.

By moving compensator λ into the light path, the specimen changes its color. The type of color change depends on the orientation of the specimen (NE-SW or NW-SE).

The changes in color are attributable to optical interference. The interference colors (path differences) in both diagonal positions (NE-SW and NW-SE) of the specimen must be compared in this connection.

The path difference results from the superposition (interference) of the direction of oscillation of the specimen with the direction of oscillation of the compensator λ.

The greater path difference occurs, if the direction of oscillation of the specimen with the absolutely or relatively highest refractive index (n_γ or $n_{\gamma'}$) is parallel to the principal direction of oscillation of the compensator λ. The specimen will then appear, for instance, in greenish-blue (Fig. 4-7/**2**).

The smallest path difference occurs, if the direction of oscillation of the specimen with the absolutely or relatively lowest refractive index (n_α or $n_{\alpha'}$) is perpendicular to the direction of oscillation of the compensator λ. The specimen will then appear, for instance, in yellow (Fig. 4-7/**3**).

(4) Conclusions

The grayish-white color appearing first in the bright position in the above example (Fig. 4-7/**1**) corresponds to a path difference of 150 nm according to the Michel-Lévy color chart (Fig. 4-8).

When the compensator λ is brought into the light path, the non-birefringent "surroundings" of the synthetic fiber appear in a dark red color, which corresponds to the path difference of the compensator of 550 nm (1st order interference color for the path difference of 550 nm corresponds to 1 λ).

If the direction of oscillation (n_γ or $n_{\gamma'}$) of the birefringent specimen to be examined is parallel to the principal direction of oscillation (n_γ) of the compensator λ, i.e. in NE-SW direction, the path difference of the specimen (e.g. grayish-white: 150 nm) and the path difference of the compensator λ (red: 550 nm). This results in a color change of the specimen from grayish white to greenish-blue (resulting path difference = 700 nm).

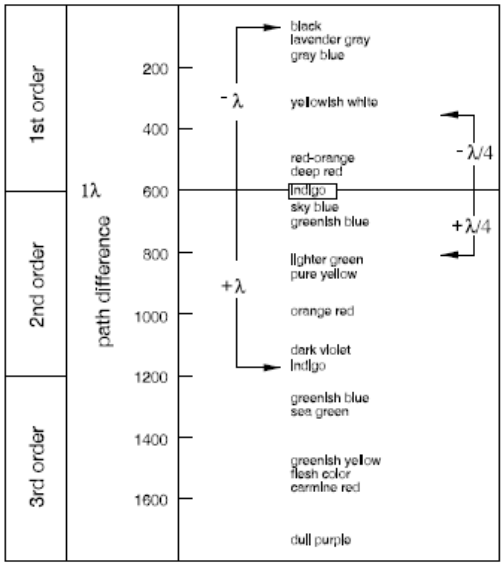


Fig. 4-8 **Schematic diagram of the color charts according to Michel-Lévy**

If the direction of oscillation of the specimen to be examined is perpendicular to the principal direction of oscillation of the compensator λ, i.e. in NW-SE direction, the path difference of the compensator λ (e.g. grayish-white: 150 nm) is subtracted from the path difference of the compensator (red: 550 nm). In this case, the interference color of the specimen visibly changes from grayish-white to orange (resulting path difference = 400 nm).

☞ Color charts according to Michel-Lévy are available under Cat. No. 42-312.

4.1.4.4 Measuring path differences

The measurement compensators are required for exact measurement of path differences. These return, i.e. compensate, the path difference created by the specimen to zero (black of the first order).

Whereas in the above-described methods the addition or subtraction position was of interest, **solely** the subtraction position is of interest in the measurement.

Path differences in the specimen can assume very small values (1/50 λ or 10 nm) and very great values (more than 10 λ or approx. 5500 nm and more) and with that determine the compensator appropriate for the measurement.

The suitable compensator is determined as follows:

- Set the microscope as for the transmitted light brightfield (see Section 4.1.1), taking care to ensure the correct interpupillary distance in the binocular tube (see Section 3.5.5).
- Accurately position the specimen to be examined on the center of the crosshairs.

- Limit to aperture to a value of about 0.2.
- Turn the rotary stage Pol until the specimen is almost obliterated, i.e. **completely dark**, and set the 45° locking position.
- Rotate the stage **once** (by 45°) so that the specimen is in a diagonal position (bright).

The interference intensity or color leads to the following conclusion:

– If more or less strong interference colors appear on the specimen, the path difference ranges approximately between 1/2 λ and 5 λ.
The suitable compensator is:
Tilting compensator B 0-5 λ.
– If the specimen-side color changes from light gray/white to a strong interference color, when a compensator λ (473704-0000-000) is inserted in the compensator slot, the path difference is (1/4 ...1/2) λ.

☞ A prerequisite for occurrence of the color change effect may be the evaluation in two specimen positions rotated at an angle of 90° from one another, plus a centered stage.

The suitable compensator is:
Tilting compensator B 0-5 λ or the compensation method according to DE SENARMONT up to 1 λ using the **Senarmont compensator 546/4 nm**.

☞ The compensation method according to DE SENARMONT requires the use of the rotatable analyzer.

– After insertion of the compensator λ and rotation of the object by 90°, the interference color remains white; in this case, however, it is a "higher-order white" and thus the path difference is > 5 λ.
The suitable compensator is:
Tilting compensator K 0-30 λ (Accessory 000000-1115-698)
– A dark gray as appearing interference color suggests very small path differences (λ/10 or 54.6 nm).
The suitable compensator is:
Brace–Köhler rotary compensator λ/10 (Accessory 000000-1115-703).

- Insert the compensator into the slit as far as it will go.

The accompanying instructions must be observed for measurement preparation and procedure.

4.1.4.5 Circular polarization contrast

(1) Application

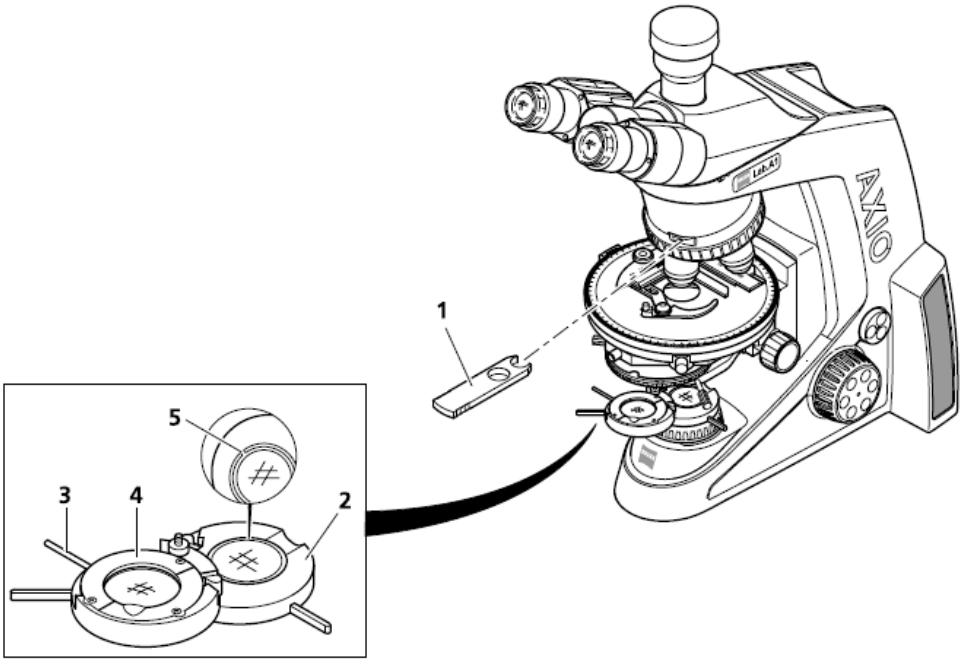
Unlike standard polarization contrast, circular polarization contrast does not show any dark (extinction) positions that depend on the angle of rotation (azimuth) of the specimen relative to polarizer or analyzer. This means that when the stage is rotated the same image impression remains, as the light/dark positions are omitted. With optical anisotropy, all transparent specimens display the characteristic interference colors.

(2) Instrumentation

- Tension-free objectives
- Rotary stage Pol
- Circular polarizer D (no polarizers may be adapted on the condenser) including corresponding λ/4 plate.
- Stationery analyzer slide D or screw-in analyzer (in Axio Lab.A1 tubes).

(3) Setting the microscope

- Set the microscope as in the transmitted light brightfield according to KÖHLER (see Section 4.1.1).
- Center rotary stage Pol or objective (if this has not already been done – see Section 3.1.8.5 or 3.1.8.6).
- Initially do **not** use a specimen for the further settings.
- Swivel in the lower part of circular polarizer D (Fig. 4-9/**2**) into the beam path until it engages and evaluate the extinction (darkening) of the field of view without the specimen at full light intensity. If this is not optimum, align the analyzer in the tube or intermediate plate as necessary.
- Insert the respective slide 6x20 with λ/4 plate (Fig. 4-9/**1**) as far as it will go into the slot for compensators above the nosepiece.
- Then swivel the upper part of circular polarizer D (Fig. 4-9/**4**) into the beam path.
- Rotate the lever of the λ/4 plate of the circular polarizer D (Fig. 4-9/**3**) until the extinction is maximum (dark-gray field of view) (lever points 45° to the right).



1 Slide 6x20 with λ/4 plate
2 Lower section of circular polarizer
3 Lever for rotating λ/4 plate
4 λ/4 plate in upper part of the circular polarizer
5 Adjustment slits

Fig. 4-9 Components for circular polarization contrast

- An (anisotropic) specimen should not be observed until after the above adjustment.
- Reinsert the specimen to be examined.

In their interference color – dependent on material, specimen thickness and orientation – the specimens appear constant and independent of stage rotation.

☞ For a high-contrast image with higher objective enlargements (from approx. 20x) the illumination aperture must be reduced to a value between 0.15 and 0.20, i.e. the aperture diaphragm must be closed accordingly.

The effect of the λ/4 plate (Fig. 4-9/**4**) can be undone by either swiveling it out of the light path or turning it with lever (Fig. 4-9/**3**) into one of its two click-stop positions.

4.1.5 Setting transmitted light polarization with the conoscopy stand

4.1.6 Determining the optical character of crystals

For the classification (and thus identification) of crystalline material – instead of the observation of the specimen itself – the analysis of an interference image in the objective pupil provides the more valuable information. This image is visible in the eyepiece when an additional lens (so-called Bertrand lens) is switched on. Alternatively, the auxiliary microscope or a diopter may be used to view the interference image.

In contrast to orthoscopy, this is referred to as conoscopy, because the illumination is ideally provided by a wide open cone. In practice this means that the aperture diaphragm is fully open and the objective should likewise have a high aperture.

(1) Application

The crystal diagnosis is for determining the optical character of transparent and weakly absorbent crystals. This method is also referred to as conoscopy.

Its main application is the classical mineral microscopy. However, synthetic crystals, industrial minerals and plastics (e.g. films) can also be identified and characterized.

(2) Instrumentation

Conoscopic viewing is preferably carried out on the Axio Lab.A1 microscope for transmitted light conoscopy.

- Tension-free objectives; recommended:
  N-Achroplan 50x/0.8 Pol objective or
  EC Plan-Neofluar 40x/0.9 Pol objective
- Rotary stage Pol
- Polarizer D (rotatable or fixed)
- 0.9 Pol condenser

(3) Setting the microscope for conoscopy

In the case of uniaxial crystals, the most favorable orientation for conoscopic viewing is obtained with those specimen features (e.g. of a thin section) that in orthoscopic viewing change the brightness as little as possible. In this case, the direction of viewing and the optical axis are parallel. The same applies to biaxial crystals if viewed in or approximately in the direction of one of the two optical axes.

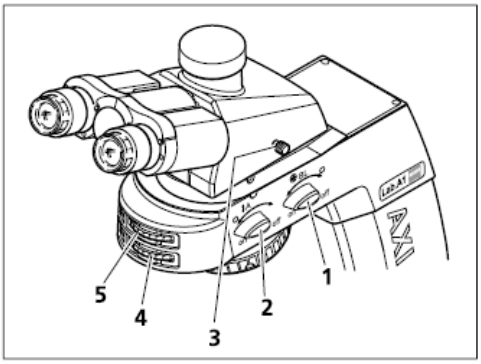


Fig. 4-10 Axio Lab.A1 for transmitted light conoscopy

- Set the microscope as in the transmitted light brightfield according to KÖHLER (see Section 4.1.1).
- Place the specimen on the stage and focus on it.
- Swivel the analyzer into the beam path (**on** position) with rotary knob **A** (Fig. 4-10/**2**). The direction of oscillation can be changed using the setting wheel (Fig. 4-10/**4**) of the analyzer.

CAUTION
The movements of rotary knobs **A** and **BL** and the respective setting wheels are coupled with one another. Only **one** control element should therefore be operated at a time and the movement of the other should not be inhibited or blocked. Mechanical damage may otherwise occur.

If rotary knob **BL** is set to the **on** position, if it is not already at the **on** position rotary knob **A** is automatically carried.
If, on the other hand, rotary knob **A** is set to the **off** position, if it is not already at the **off** position rotary knob **BL** is automatically carried.

- Place a selected crystal in the center of the crossline reticle.
- Swivel in objective N-Achroplan 50x/0.8 Pol or EC Plan-Neofluar 40x/0.9 Pol and focus with the focusing drive.
- If necessary, close the luminous-field aperture to avoid superimposition of the axial figure by axial figures of neighboring crystals. The smallest crystal range that can be faded out is 170 µm.
- Switch on Bertrand lens **BL** (Fig. 4-10/**1**) (Position **on**). The axial figure will appear in the field of view.
- Bring the axial figure into focus with setting wheel (Fig. 4-10/**5**).

(4) Evaluation

Crystalline anisotropic specimens can be separated into optical uni- and biaxial, in each case with "optically positive" or "negative" character.

Uniaxial crystals display a **black cross** when the optical axis is parallel to the direction of view. **Depending on the size of the birefringence and specimen thickness**, concentrically arranged colored **interference rings** (so-called isochromes) may appear (see also Fig. 4-11 second row).

This cross remains closed when the stage is rotated. Depending on the section it may lie within or outside the displayed objective pupil.

With **optically biaxial** crystals, the cross resolves into two **dark hyperbola branches** (the so-called isogyres) **depending on stage rotation**, which are surrounded by colored interference patterns depending on the amount of birefringence and specimen thickness (suggestive of the figure "8").

Inserting a compensator λ (473704-0000-000) or λ/4 (473714-0000-000) or a wedge compensator 0-4 λ (000000-1140-663) in the compensator slot with the initial state of the axial figure being as illustrated in Fig. 4-11 results in the following changes in color shown schematically (blue and yellow areas) to the axial figure, thus allowing differentiation in "optically positive" and "optically negative".

	Optically uniaxial		Optically biaxial		
	Positive	Negative	Positive	Negative	
λ-Plate (white → blue → yellow)					+ = blue – = yellow
Quartz wedge (Direction of motion at insertion)					↗ Direction of ↙ movement
λ/4 plate (position of black spots)					

Fig. 4-11 Determining optical character

In the case of less favourable sections in which the cross-hair center is optically uniaxial or the isogyres are optically biaxial specimens outside the objective pupil, an assessment is possible as follows:

- If the black isogyres are **straight** and they run parallel to the pupil (in relation to the cross-hairs), the specimen is **optically uniaxial**.
- If the black isogyres are **curved lines** which wander on a circular path through the pupil, the specimen is **optically biaxial**.

Paying appropriate attention, also such axial figures not illustrated in Fig. 4-11 can be interpreted.

☞ Axial figures can often be better displayed with circular polarization. Particularly the axis angle of optically biaxial specimens (quasi distance between the isogyres) can be determined more clearly. The optical character can also be determined. For this purpose the compensator λ (6 x 20), arranged in the compensator slot, is used.

☞ Two storage compartments for 6x20 slides are located on the reverse side of the conoscopy stand.

4.1.6.1 Demonstrating birefringence with the Axio Lab for conoscopy

(1) Application

The transmitted light polarization method is used for specimens which change the state of polarization of light. These specimens, such as crystals, minerals or polymers, are referred to as birefringent. When these birefringent substances are viewed between crossed polarizers (polarizer ⊥ analyzer), they appear bright while their surroundings remain dark.

Birefringent substances are identified in that they show four bright and four dark positions when rotated through 360° between crossed polarizers. Depending on birefringence, thickness and orientation of the specimen, interference colors ranging from gray (mostly with biological specimens) to white, yellow, red and blue appear in this process. These interference colors can be of the first or any higher order.

(2) Instrumentation

On the Axio Lab.A1 microscope for transmitted light conoscopy:

- Tension-free objectives
- Rotary stage Pol
- Polarizer D (rotatable or fixed)
- Compensator lambda or lambda/4

☞ The depolarizer is already incorporated in the Axio Lb.A1 stand for conoscopy.

A depolarizer (quartz depolarizer) should be installed in all microscopes used for examining mineral/geological specimens.

A depolarizer suppresses undesirable polarization effects which may occur after the analyzer (e.g. on prism surfaces in the tube), or shifts these to higher orders.

(3) Setting the microscope

- Set the microscope as in the transmitted light brightfield according to KÖHLER (see Section 4.1.1 (3)).
- Center rotary stage Pol (Fig. 4-12/**1**) (see Section 3.1.8.5) and objectives (see Section 3.1.8.6).
- Swivel polarizer (Fig. 4-12/**3**) into the light path and, if it is rotatable, position it at 0°.
- Swivel the analyzer into the beam path and adjust on the setting wheel until the field of view is dark.(Fig. 4-12/**2**)
- Move the specimen into the field of view and turn it with the rotary stage. As a rule, while being rotated between crossed polarizers, birefringent (anisotropic) specimens will now display the variations in color and intensity described above. However, optically anisotropic substances may also remain dark, if an isotropic direction, e.g. of optically uniaxial or biaxial crystals, is oriented parallel to the direction of observation.

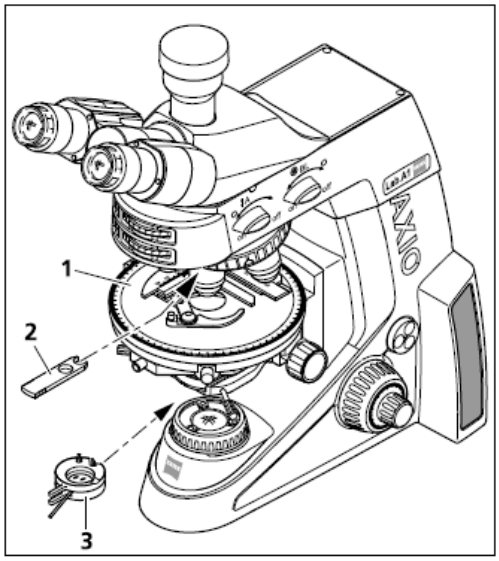


Fig. 4-12 Components for transmitted light polarization on conoscopy stand

4.1.6.2 Determination of gout and pseudogout

- Set the microscope as in the transmitted light brightfield according to KÖHLER (see Section 4.1.1 (3)).
- Swivel the polarizer, rigidly fixed or rotatable (Fig. 4-12/**3**) into the beam path. Set the rotatable polarizer to the 0° position.
- With the Axio Lab for polarization push the analyzer (453681-0000-000) into the 6x20 slider mount. (Fig. 4-12/**2**)
- With the AxioLab for conoscopy swivel the analyzer into the beam path and bring it into a crossed position using the setting wheel. Additionally, insert compensator 6x20 (473704-0000-000) into the slider mount 6x20.
- The field of view will appear dark due to the crossed polarizers.
- Select crystals which are oriented in the gamma direction (Fig. 4-13).

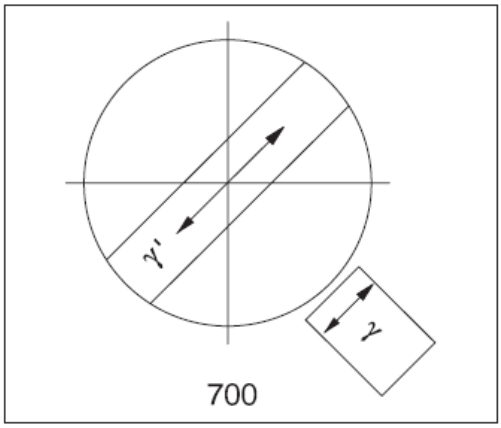


Fig. 4-13 Gamma direction

Evaluation:

If the crystal needles parallel to the gamma direction are yellow and those perpendicular to the gamma direction are blue, they are monosodium urate crystals (gout).

If the crystal needles parallel to the gamma direction are blue and those perpendicular to the gamma direction are yellow, they are calcium pyrophosphate crystals (pseudogout).

4.1.6.3 Determining the direction of oscillation n_γ

(1) Application

The determination of the direction of oscillation of n_γ and $n_{\gamma'}$ (direction of oscillation with the absolutely or relatively highest refractive index) and n_α and $n_{\alpha'}$ (direction of oscillation with the absolutely or relatively lowest refractive index) in relation to the morphological directions, e.g. of crystal surfaces, crystal needles or fibers, provides an important criterion for recognition. It is also employed for the diagnosis of biocrystals (e.g. gout, pseudogout).

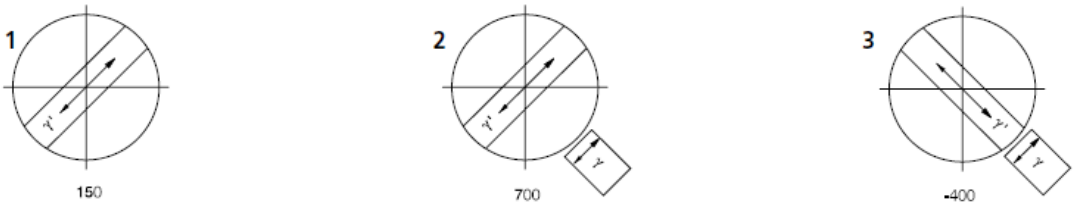


Fig. 4-14 Determining the direction of oscillation $n_{\gamma'}$ using a synthetic fiber as an example

(2) Equipment configuration for Axio Lab for conoscopy

- Eyepiece with crossline reticle
- Tension-free objectives
- Rotary stage Pol (Fig. 4-12/**1**)
- Polarizer D (rotatable or fixed)
- Compensator lambda or lambda/4 as required
- Alignment specimen for polarization microscope (453679-0000-000)

(3) Setting the microscope

- Set the microscope as for the transmitted light brightfield (see Section 4.1.1), taking care to ensure the correct interpupillary distance in the binocular tube (see Section 3.5.5).
- Center rotary stage Pol (Fig. 4-5/**1**) and objectives (see Sections 3.1.8.5 and 3.1.8.6).
- Swivel polarizer (Fig. 4-5/**3**) into the light path and, if it is rotatable, position it at 0°.
- Swivel the analyzer into the beam path and bring it into a crossed position using the setting wheel (Fig. 4-5/**2**). The field of view will appear dark due to the crossed polarizers.
- Set the alignment specimen Pol on the microscope stage and turn to the dark position of the alignment specimen.
- Swivel out the analyzer and align the crossline reticle with the cracks in the specimen.
- Subsequently swivel the analyzer back in and remove the alignment specimen. The pass directions of the polarizer and analyzer will now be parallel to the crossline reticle (polarizer EW, analyzer NS).

☞ An adjustment of the crossline reticle is not necessary when working with the intermediate plate and the binocular photo tube Pol (425520-9100-000).

- Rotate the rotary stage Pol with the specimen, e.g. a synthetic fiber, until the specimen appears as dark as possible. In this position, the fiber extends parallel to one of the two directions of the crossline reticle.

☞ Do not change the interpupillary distance on the binocular tube, as the the angle of the crossline reticle to the fiber will be changed.

- Now turn the stage on by 45° so that the longitudinal axis of the fiber is oriented NE-SW (Fig. 4-15). The specimen will display the greatest brightness here (diagonal position). In this position the specimen may have any color.
- Inserting compensator λ (473704-0000-000).

Like the specimen, the compensator λ is a birefringent object, albeit with a defined path difference of 550 nm and the principal direction of oscillation n_γ definitely oriented in a NE-SW direction.

By moving compensator λ into the light path, the specimen changes its color. The type of color change depends on the orientation of the specimen (NE-SW or NW-SE).

The changes in color are attributable to optical interference. The interference colors (path differences) in both diagonal positions (NE-SW and NW-SE) of the specimen must be compared in this connection.

The path difference results from the superposition (interference) of the direction of oscillation of the specimen with the direction of oscillation of the compensator λ.

The greater path difference occurs, if the direction of oscillation of the specimen with the absolutely or relatively highest refractive index (n_γ or $n_{\gamma'}$) is parallel to the principal direction of oscillation of the compensator λ. The specimen will then appear, for instance, in greenish-blue (Fig. 4-14/**2**).

The smallest path difference occurs, if the direction of oscillation of the specimen with the absolutely or relatively lowest refractive index (n_α or $n_{\alpha'}$) is perpendicular to the direction of oscillation of the compensator λ. The specimen will then appear, for instance, in yellow (Fig. 4-14/**3**).

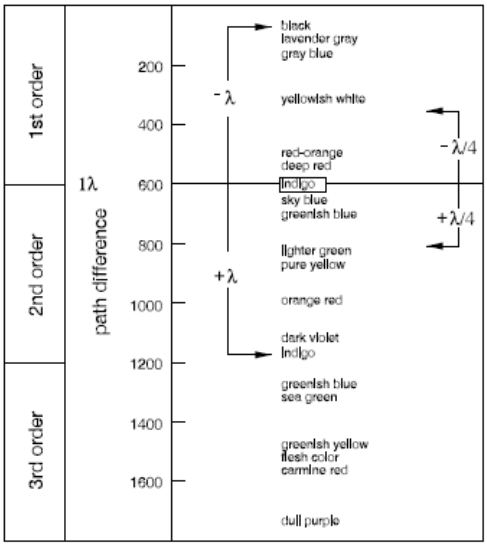


Fig. 4-15 **Schematic diagram of the color charts according to Michel-Lévy**

(4) Conclusions

The grayish-white color appearing first in the bright position in the above example (Fig. 4-14/**1**) corresponds to a path difference of 150 nm according to the Michel-Lévy color chart (Fig. 4-15).

When the compensator λ is brought into the light path, the non-birefringent "surroundings" of the synthetic fiber appear in a dark red color, which corresponds to the path difference of the compensator of 550 nm (1st order interference color for the path difference of 550 nm corresponds to 1 λ).

If the direction of oscillation (n_γ or $n_{\gamma'}$) of the birefringent specimen to be examined is parallel to the principal direction of oscillation (n_γ) of the compensator λ, i.e. in NE-SW direction, the path difference of the specimen (e.g. grayish-white: 150 nm) and the path difference of the compensator λ (red: 550 nm). This results in a color change of the specimen from grayish white to greenish-blue (resulting path difference = 700 nm).

If the direction of oscillation of the specimen to be examined is perpendicular to the principal direction of oscillation of the compensator λ, i.e. in NW-SE direction, the path difference of the compensator λ (e.g. grayish-white: 150 nm) is subtracted from the path difference of the compensator (red: 550 nm). In this case, the interference color of the specimen visibly changes from grayish-white to orange (resulting path difference = 400 nm).

☞ Color charts according to Michel-Lévy are available under Cat. No. 42-312.

4.1.6.4 Measuring path differences with the Axio Lab for conoscopy

The measurement compensators are required for exact measurement. These return, i.e. compensate, the path difference created by the specimen to zero (black of the first order).

Whereas in the above-described methods the addition or subtraction position was of interest, **solely** the subtraction position is of interest in the measurement.

Path differences in the specimen can assume very small values (1/50 λ or 10 nm) and very great values (more than 10 λ or approx. 5500 nm and more) and with that determine the compensator appropriate for the measurement.

The suitable compensator is determined as follows:

- Set the microscope as for the transmitted light brightfield (see Section 4.1.1), taking care to ensure the correct interpupillary distance in the binocular tube (see Section 3.5.5).
- Accurately position the specimen to be examined on the center of the crosshairs.

- Limit to aperture to a value of about 0.2.
- Turn the rotary stage Pol until the specimen is almost obliterated, i.e. **completely dark**.
- Rotate the stage **once** (by 45°) so that the specimen is in a diagonal position (bright).

The interference intensity or color leads to the following conclusion:

– If more or less strong interference colors appear on the specimen, the path difference ranges approximately between 1/2 λ and 5 λ.
The suitable compensator is:
tilting compensator B 0-5 λ.
– If the specimen-side color changes from light gray/white to a strong interference color, when a compensator λ (473704-0000-000) is inserted in the compensator slot, the path difference is (1/4 ...1/2) λ.

☞ A prerequisite for occurrence of the color change effect may be the evaluation in two specimen positions rotated at an angle of 90° from one another, plus a centered stage.

The suitable compensator is:
tilting compensator B 0-5 λ or the compensation method according to DE SENARMONT up to 1 λ using the **Senarmont compensator 546/4 nm**.

☞ The compensation method according to DE SENARMONT requires the use of the rotatable analyzer.

– After insertion of the compensator λ and rotation of the specimen by 90°, the interference color remains white; in this case, however, it is a "higher-order white" and thus the path difference is > 5 λ.

The suitable compensator is:
tilting compensator K 0-30 λ (Accessory 000000-1115-698)
– A dark gray as appearing interference color suggests very small path differences (λ/10 or 54.6 nm).
The suitable compensator is:
Brace-Köhler rotary compensator λ/10 (Accessory 000000-1115-703).

- Insert the compensator into the slit as far as it will go.

The accompanying instructions must be observed for measurement preparation and procedure.

4.1.6.5 Circular polarization contrast with Axio Lab for conoscopy

(1) Application

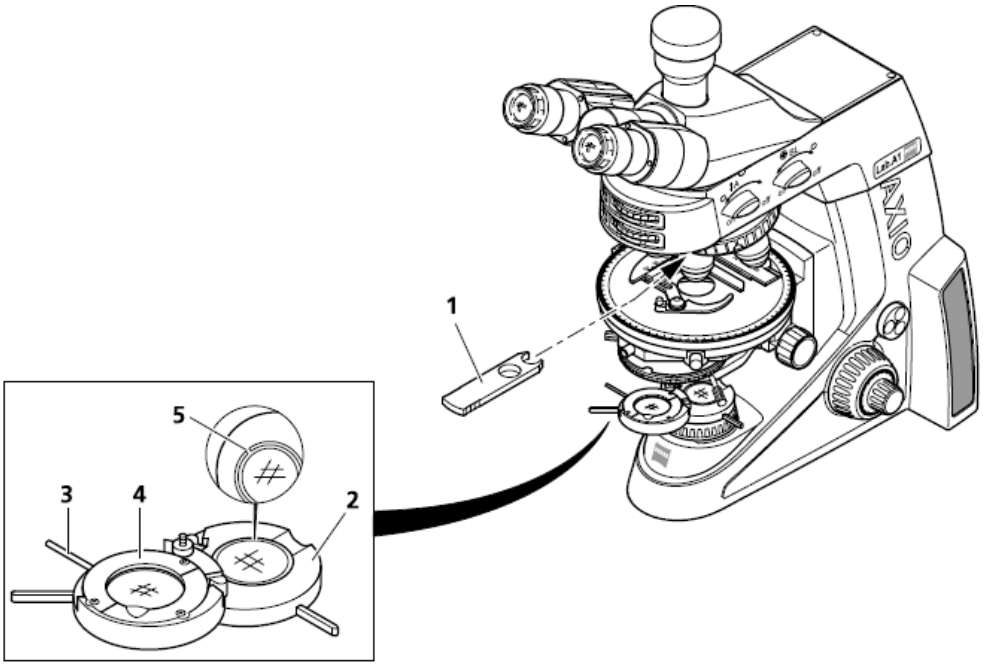
Unlike standard polarization contrast, circular polarization contrast does not show any dark (extinction) positions that depend on the angle of rotation (azimuth) of the specimen relative to polarizer or analyzer. This means that when the stage is rotated the same image impression remains, as the light/dark positions are omitted. With optical anisotropy, all transparent specimens display the characteristic interference colors.

(2) Instrumentation

- Tension-free objectives
- Rotary stage Pol
- Circular polarizer D (no polarizers may be adapted on the condenser) including corresponding λ/4 plate.

(3) Setting the microscope

- Set the microscope as in the transmitted light brightfield according to KÖHLER (see Section 4.1.1).
- Center rotary stage Pol or objective (if this has not already been done – see Section 3.1.8.5 or 3.1.8.6).
- Initially do **not** use a specimen for the further settings.
- Swivel the analyzer into the beam path.
- Swivel in the lower part of circular polarizer D (Fig. 4-16/**2**) into the beam path until it engages and evaluate the extinction (darkening) of the field of view without the specimen at full light intensity. If this is not optimum, align the analyzer as necessary.
- Insert the respective slide 6x20 with λ/4 plate (Fig. 4-16/**1**) as far as it will go into the slot for compensators above the nosepiece.
- Then swivel the upper part of circular polarizer D (Fig. 4-16/**4**) into the beam path.
- Rotate the lever of the λ/4 plate of the circular polarizer D (Fig. 4-16/**3**) until the extinction is maximum (dark-gray field of view) (lever points 45° to the right).



1 Slide 6x20 with λ/4 plate
2 Lower section of circular polarizer
3 Lever for rotating λ/4 plate
4 λ/4 plate in upper part of the circular polarizer
5 Adjustment slits

Fig. 4-16 Components for circular polarization contrast on conoscopy stand

- An (anisotropic) specimen should not be observed until after the above adjustment.
- Reinsert the specimen to be examined.

In their interference color – dependent on material, specimen thickness and orientation – the specimens appear constant and independent of stage rotation.

☞ For a high-contrast image with higher objective enlargements (from approx. 20x) the illumination aperture must be reduced to a value between 0.15 and 0.20, i.e. the aperture diaphragm must be closed accordingly.

The effect of the λ/4 plate (Fig. 4-16/**4**) can be undone by either swiveling it out of the light path or turning it with lever (Fig. 4-16/**3**) into one of its two click-stop positions.

4.1.7 Setting transmitted light polarization for conoscopic observation – determining the optical character of crystals

For the classification (and thus identification) of crystalline material – instead of the observation of the specimen itself – the analysis of an interference image in the objective pupil provides the more valuable information. This image is visible in the eyepiece when an additional lens (so-called Bertrand lens) is switched on. Alternatively, the auxiliary microscope or a diopter may be used to view the interference image.

In contrast to orthoscopy, this is referred to as conoscopy, because the illumination is ideally provided by a wide open cone. In practice this means that the aperture diaphragm is fully open and the objective should likewise have a high aperture.

4.1.7.1 Application

The crystal diagnosis is for determining the optical character of transparent and weakly absorbent crystals. This method is also referred to as conoscopy.

Its main application is the classical mineral microscopy. However, synthetic crystals, industrial minerals and plastics (e.g. films) can also be identified and characterized.

(1) Instrumentation

Conoscopic viewing is preferably carried out on the Axio Lab.A1 microscope for transmitted light conoscopy.

- Tension-free objectives; recommended:
  N-Achroplan 50x/0.8 Pol objective or
  EC Plan-Neofluar 40x/0.9 Pol objective
- Rotary stage Pol
- Polarizer D (rotatable or fixed)
- 0.9 Pol condenser

(2) Setting the microscope for conoscopy

In the case of uniaxial crystals, the most favorable orientation for conoscopic viewing is obtained with those specimen features (e.g. of a thin section) that in orthoscopic viewing change the brightness as little as possible. In this case, the direction of viewing and the optical axis are parallel. The same applies to biaxial crystals if viewed in or approximately in the direction of one of the two optical axes.

- Set the microscope as in the transmitted light brightfield according to KÖHLER (see Section 4.1.1).
- Swivel polarizer (Fig. 4-12/**3**) into the light path and, if it is rotatable, position it at 0°.
- Swivel the analyzer into the beam path and bring into a crossed position with the setting wheel. (The field of view will now appear dark)
- Place the specimen on the stage and focus on it.
- Swivel the analyzer into the beam path (**on** position) with rotary knob **A** (Fig. 4-17/**2**). The direction of oscillation can be changed using the setting wheel (Fig. 4-17/**4**) of the analyzer.

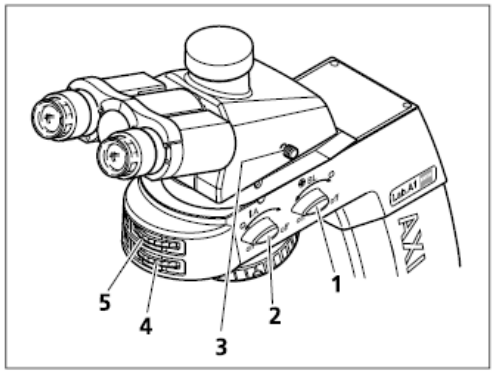


Fig. 4-17 Axio Lab.A1 for transmitted light conoscopy

CAUTION
The movements of rotary knobs **A** and **BL** and the respective setting wheels are coupled with one another. Only **one** control element should therefore be operated at a time and the movement of the other should not be inhibited or blocked. Mechanical damage may otherwise occur.

If rotary knob **BL** is set at the **on** position, rotary knob **A** is automatically carried if it is not already in the **on** position.
If, on the other hand, rotary knob **A** is set to the **off** position, if it is not already at the **off** position rotary knob **BL** is automatically carried.

- Place a selected crystal in the center of the crossline reticle.
- Swivel in objective N-Achroplan 50x/0.8 Pol or EC Plan-Neofluar 40x/0.9 Pol and focus with the focusing drive.
- If necessary, close the luminous-field aperture to avoid superimposition of the axial figure by axial figures of neighboring crystals. The smallest crystal range that can be faded out is approx. 170 µm.
- Switch on Bertrand lens **BL** (Fig. 4-17/**1**) (Position **on**). The axial figure will appear in the field of view.
- Bring the axial figure into focus with setting wheel (Fig. 4-17/**5**).

4.1.7.2 Evaluation

Crystalline anisotropic specimens can be separated into optical uni- and biaxial, in each case with "optically positive" or "negative" character.

Uniaxial crystals display a **black cross** when the optical axis is parallel to the direction of view. **Depending on the size of the birefringence and specimen thickness**, concentrically arranged colored **interference rings** (so-called isochromes) may appear (see also Fig. 4-11 second row).

This cross remains closed when the stage is rotated. Depending on the section it may lie within or outside the displayed objective pupil.

With **optically biaxial** crystals, the cross resolves into two **dark hyperbola branches** (the so-called isogyres) **depending on stage rotation**, which are surrounded by colored interference patterns depending on the amount of birefringence and specimen thickness (suggestive of the figure "8").

Inserting a compensator λ (473704-0000-000) or λ/4 (473714-0000-000) or a wedge compensator 0-4 λ (000000-1140-663) in the compensator slot with the initial state of the axial figure being as illustrated in Fig. 4-18 results in the following changes in color shown schematically (blue and yellow areas) to the axial figure, thus allowing differentiation in "optically positive" and "optically negative".

	Optically uniaxial		**Optically biaxial**		
	Positive	Negative	Positive	Negative	
λ-Plate (white → blue → yellow)					+ = blue – = yellow
Quartz wedge (Direction of motion at insertion)					↗ Direction of ↙ movement
λ/4 plate (position of black spots)					

Fig. 4-18 Determining the optical character

In the case of less favorable sections in which the cross-hair center is optically uniaxial or the isogyres are optically biaxial specimens outside the objective pupil, an assessment is possible as follows:

- If the black isogyres are **straight** and they run parallel to the pupil (in relation to the cross-hairs), the specimen is **optically uniaxial**.
- If the black isogyres are **curved lines** which wander on a circular path through the pupil, the specimen is **optically biaxial**.

Paying appropriate attention, also such axial figures not illustrated in Fig. 4-18 can be interpreted.

☞ Axial figures can often be better displayed with circular polarization. Particularly the axis angle of optically biaxial specimens (quasi distance between the isogyres) can be determined more clearly. The optical character can also be determined. For this purpose the compensator λ (6 x 20), arranged in the compensator slot, is used.

☞ Two storage compartments for 6x20 slides are located on the reverse side of the conoscopy stand.

4.2 Lighting and contrasting method in reflected light

4.2.1 Adjusting the reflected light brightfield according to KÖHLER

(1) Application

Reflected light brightfield microscopy is the simplest and most common optical microscopy method for examining opaque samples or specimens, e.g. material sections or wafers.

For a true-to-object imaging, indirect ray bundles, i.e. ray bundles diffracted and scattered on the specimen details, are of major importance in addition to the so-called direct ray bundles. The higher the portion of indirect bundles of rays (aperture), the more realistic the microscopic image according to ABBE will be.

The bundled light emitted by the reflected light unit is reflected on a color-neutral beam splitter and then passes through the objective which focuses the beam on the surface of the sample (so-called condenser function). The objective collects the light reflected by the specimen and together with the tube lens it generates the microscopic intermediate image which can then be visually observed or objectively documented.

(2) Instrumentation

Reflected light brightfield viewing is only possible with the stand for reflected light.

- Reflector module brightfield ACR P&C for reflected light in the reflector turret

(3) Setting the reflected light brightfield

- The microscope has been started up correctly as described in Section 3.
- The microscope is switched on.

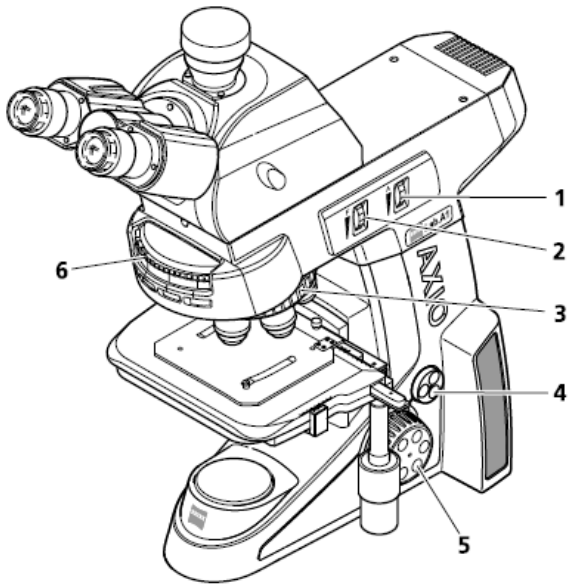
- Adjust the light intensity by turning the regulator (Fig. 4-19/**4**).
- Position a high-contrast reflected light specimen on the microscope stage.
- Swivel in the 10x objective on the nosepiece (Fig. 4-19/**3**).
- On the nosepiece (Fig. 4-19/**6**) swivel in the position with the reflector module brightfield.
- Bring the specimen into focus with the focusing drive (Fig. 4-19/**5**). If possible, always focus away from the specimen in order to avoid a collision between the objective and the specimen.
- Set the knurled wheel of aperture diaphragm **A** (Fig. 4-19/**1**) in the middle position (about half open/closed).
- Adjust (reduce) the knurled wheel of luminous-field aperture **F** (Fig. 4-19/**2**) until the luminous-field aperture is visible in the field of vision.
- Use the focusing drive to adjust the focus on the edge of the luminous-field aperture.
- Now open the luminous-field aperture until the latter just disappears behind the edge of the field of view.
- For aperture diaphragm adjustment (image contrast) remove an eyepiece from the tube socket and look into the socket with the naked eye, or use the auxiliary microscope instead of the eyepiece. This functions only with sufficiently reflecting specimens.

- For specimens with medium contrast characteristics, set the aperture diaphragm with the knurled wheel (Fig. 4-19/**1**) to about 2/3 to 4/5 of the exit pupil diameter of the objective.

In most applications, this aperture diaphragm setting provides optimum contrast at almost ideal resolution, and is therefore the best compromise for the human eye.

- Then reinsert the eyepiece, adjust the focus with the coaxial coarse and fine focusing knob and adjust the brightness to the reflected light specimen.

☞ Never use the aperture diaphragm for controlling image brightness. Use the adjusting knob (Fig. 4-19/**4**) for illumination intensity!



1 Knurled wheel of aperture diaphragm A
2 Knurled wheel of luminous-field diaphragm F
3 Nosepiece
4 Light intensity control
5 Focusing drive
6 Reflector turret

Fig. 4-19 Microscope settings in reflected light brightfield

4.2.2 Adjusting the reflected light darkfield

(1) Application

The reflected light darkfield method is used for examining incompletely reflecting surfaces with different degrees of reflectivity (ideal reflected light brightfield specimens), i.e. with scratches, ruptures, pores or other disruptions to the even surface. All these light-scattering details light up brightly in the darkfield, whereas the even surface remains dark.

(2) Instrumentation

Observations in the reflected light darkfield can only be made on Axio Lab.A1 microscopes for reflected light.

- Epiplan-Neofluar, EC Epiplan-Neofluar, Epiplan objectives with the additional designation "HD"
- Reflector module darkfield ACR P&C for reflected light

☞ The stand for reflected light is equipped with a built-in darkfield stop.

(3) Adjusting the reflected light darkfield

- Adjust the microscope as described in Section 4.2 for the reflected light brightfield. In order to avoid reflexes, the displayed luminous-field aperture should be located slightly beyond the edge of the field of view.
- If used, remove the 6x20 compensator slide.
- Swivel in the objective position with darkfield objective (HD) on the nosepiece.
- If necessary, swivel in the reflector module darkfield on the reflector turret.
- Completely open the aperture diaphragm and switch off or remove the neutral filter as necessary.
- Place the specimen on the stage and sharpen the image.

4.2.3 Adjusting reflected light polarization – Proof of bireflexion and reflexion-pleochroism

(1) Application

Reflected light polarization is a further contrasting method for cut surfaces of mineral ore, coal, ceramic products, certain metals and alloys, as depending on the orientation of the crystals and object details, the cut surfaces often react differently when reflected in linear polarized light

The illumination light is linear polarized by the polarizer before passing through the objective onto the specimen surface, where it is reflected. Here the beam parts experience phase differences depending on the structure and polarization optical rotations which, when passing through the analyzer, are displayed in different shades of grey. The grey can be converted into a color contrast with the aid of a compensator with λ-plate.

With objectives of very low magnification, a rotatable λ/4 plate arranged in front of the objective (Antiflex cap) permits the reflections to be eliminated even with "dark" specimen surfaces, which otherwise would be unavoidable.

(2) Instrumentation

Observations in the reflected light darkfield can only be made on Axio Lab.A1 microscopes for reflected light.

- Rotary stage Pol
- Epiplan-Neofluar Pol, EC Epiplan-Neofluar Pol, Epiplan Pol objectives
- C DIC/DIC/TIC ACR P&C or DIC/Pol ACR P&C or DIC Red I ACR P&C reflector module or Pol ACR P&C reflector module in reflector turret
- Analyzer slide D, fixed or compensator Lambda, 6x20 or Lambda/4, 6x20

(3) Adjusting reflected light polarization

- Adjust the microscope as described in Section 4.2 for the reflected light brightfield.
- Swivel reflector module P&C (for DIC or Pol) on the reflector turret into the beam path and insert the analyzer slide (or lambda, lambda/4 compensator) into the 6x20 compartment.
- Insert a specimen, adjust the desired magnification level, focus and observe the specimen in the polarization contrast now present while turning the rotary stage Pol.

A specimen is bireflective when the details display differences in brightness and color which change when the stage is rotated.

For samples with low bireflexion it is advisable to use the analyzer with lambda plate, rotatable.

Pleochroism can be detected when the color of the specimen changes when the stage is rotated (reflected light polarizer turned on, analyzer turned off).

4.2.4 调节反射荧光

（1）操作的基本原理

反射荧光用于高对比地显示荧光物质特有的荧光颜色。在反射荧光显微镜中，由高性能的照明灯产生照明光，该光通过一个热保护滤光片到达一个激发滤光片（带通）。经过滤的短波激发光经一个二色分光镜反射，然后再通过物镜聚焦于标本上。标本吸收短波辐射，再发出长波长荧光发射光（Stokes 定律）。该发射光再由物镜捕获，然后通过二色分光镜。最后，发射光通过一个带阻滤光片（长通/带通），只有标本发出的长波辐射荧光得以通过。

激发光谱和发射滤光片必须严格匹配。它们与相应的二色性滤光片一起装入 FL P&C 反射模块。

在 Axio Lab.A1 显微镜中只使用高功率的 LED 作为荧光激发光.

（2）使用部件

反射荧光观察只能通过使用 Axio Lab.A1 反射光主机好哦反射荧光主机实现.

- 合适的物镜，例如 增强反差型平场消色差荧光物镜 或 Fluar（UV-激发）
- 作为激发光源的LED模块（最多配备 2 个）
- 装入不同滤片组的荧光模块
- 荧光保护装置

（3）校准反射光荧光

如果物镜的平均放大倍数达到 20x/0.50（例如，增强反差型平场消色差荧光物镜），且标本的荧光亮度很高，即可调节反射光荧光。开始校准时，最好使用示范标本。

☞ 注意：如有必要，在校准反射光荧光前，必须移除 λ 补偿镜，λ 补偿镜用于透射光偏振镜检术。

- 把荧光保护罩（图４－２０／８）推入物镜转盘上的补偿镜隔仓内。
- 使用 20x/0.50 增强反差型平场消色差荧光物镜（图４－２０／４）。
- 将开关（图４－２０／２）转至TL（透射光）
- 如果需要，将聚光镜的功能模块转盘（图４－２０／７）转至H位（或相差位置，如果使用PH物镜），以便于观察清楚样品.
- 通过亮度控制器（图４－１０／５）调节亮度，和调节焦距（图４－２０／６）

Ÿ 在荧光模块转盘（图４－２０／９）中选择所需要的荧光模块（视激发光而定），并将开关转换至FL

Ÿ 使用推拉杆（图４－２０／１）选择所需要的LED激光光（１或２）

☞ 当切换LED光源时，其亮度是会保存的.

⚠ 为了防止耀眼，在切换ＬＥＤ光源时，其亮度会自动降低

I 将开关转换至FL位置（反射荧光）

I 通过光强控制旋钮（图４－２０／３）调节发射光的亮度

I 聚焦样品，使其清楚

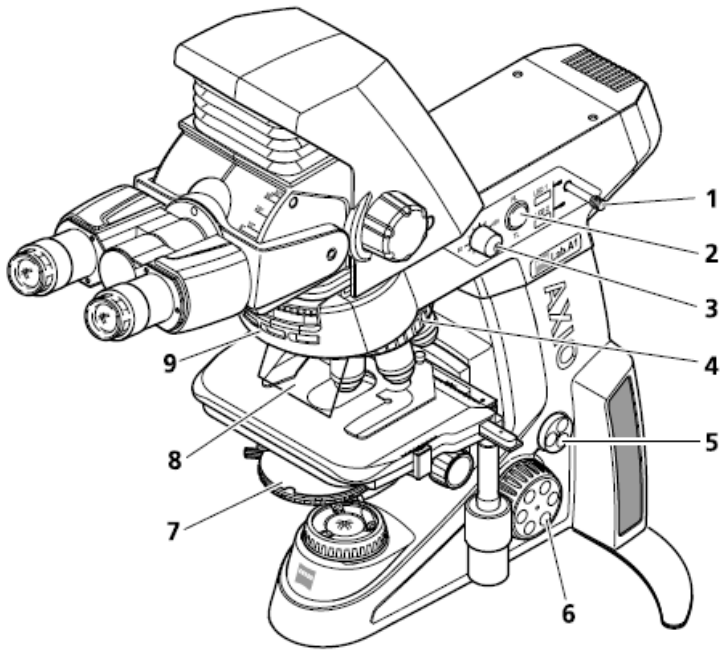


图. 4-20反射荧光组件

1 切换 LED 1 和 LED 2 的推拉杆
2 FL／TL 转换开关（反射荧光／透射光）
3 反射光强控制旋钮
4 物镜转盘
5 透射光强控制旋钮
6 调焦机构
7 功能模块转盘
8 荧光防护板
9 反射模块转盘

5 维护、更换保险丝和售后服务

5.1 维护

Axio Lab.A1必须的维护行为有以下这些：

- Ÿ 每次使用完毕后，关闭仪器，并盖上相应的保护罩（防尘防潮）。
- Ÿ 不要在潮湿的环境中使用或存放仪器（最大湿度应小于等于75%）。
- Ÿ 把所有的开放镜筒覆盖以防尘盖。
- Ÿ 从可视光学表面擦除灰尘或脏物，只能使用软刷、吹风球、棉签、镜头纸或棉布。
- Ÿ 擦除水溶性污迹（咖啡、可口可乐等），应使用无尘棉布，只能沾上少许的水或者水稀释的温和清洁剂。
- Ÿ 擦除油性或油脂性污迹（浸油、指印），应使用棉签或无尘棉布，以及特定的光学清洁剂。

  这种清洁剂的成分为 90 Vol% 汽油和 10 Vol% 异丙醇（IPA）。这些成分也被冠以下列名称：

  汽油： 甲基化酒精、石油醚
  异丙醇： 2-丙醇
  二甲基甲醇
  2-羟基丙烷

清洁光学表面时，应从中央开始，以圆周方式向边缘运动。按压不可用力过猛。

Pol 聚光镜的前透镜不能使用丙酮清洁

如果需要在高温高湿环境中使用显微镜，请遵循下列指导原则：

- Ÿ 应把仪器安置在明亮、干燥且通风良好的房间；湿度应小于等于75%；像物镜和目镜这样的精密部件尤其应保存在特别干燥的储藏柜中。

如果在下面的条件中使用精密光学仪器，发霉有可能导致损伤：

- 在三天以上的时间内，相对湿度 > 75%，湿度在 +15°C 到 +35°C 之间。
- 放置于黑暗的房间中，通风不良。
- 光学表面存在脏物或指印。

5.2 技术服务

5.2.1 检查设备

Ÿ 确保电压符合要求（例如，使用 HBO 100W 的变压器作为供电电源)。
Ÿ 检查电源电缆和电源插头，有无损伤之处。
Ÿ 只要发现任何损坏，立即关闭仪器并保证安全。致电合格的专业人员，解决问题。

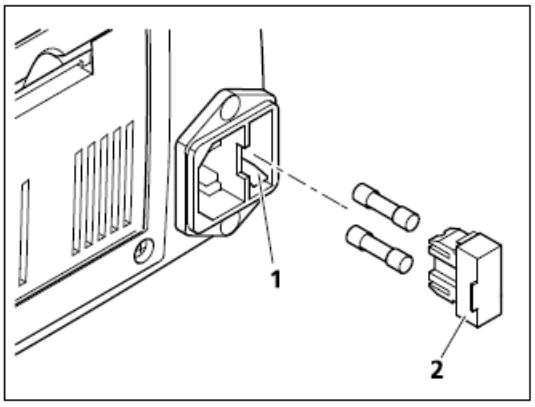


图. 5-1 更换主机保险丝

5.2.2 更换保险丝

注意：更换任何保险丝之前，应拔出电源插头。
如果保险丝损坏，必须首先找到原因，并采取技术措施补救.

保险丝盒位于显微镜后面。与插座合并在一起，里面包括两个保险丝，型号为 T 3.15 A/H /250V。

Ÿ 拔出插头。
Ÿ 借助小型螺丝刀（如有必要），向外拔出保险丝座（图5-1/2）。
Ÿ 从保险丝座中取出保险丝，换入新保险丝。
Ÿ 把保险丝座推入保险丝盒（图5-1/1），使之到位为止。
Ÿ 插上插头
。

5.3 常见问题

问题	原因	解决办法
观察的视野范围内光强不均匀;部分视野不能完整的观察	可见/荧光推拉杆或翻转开关没有在正确的位置(中间位置)	将可见/荧光推拉杆或翻转开关移到正确的位置(所选位置的尽头)
	物镜转盘没有移到咔嗒位置	旋转物镜至正确位置
	聚光镜没有正确的调节	正确的设置聚光镜(调节对中.见 72 页)
	孔径光栏没有正确的调节	正确的设置孔径光栏(打开,见 72 页)
	视场光栏没有正确的调节	正确的调节视场光栏(见 72 页)
	滤色片支架上的滤色片没有正确的安装	正确的安装好滤色片
很低的图像分辨率和很低的图像对比度	孔径光栏没有正确的调节	正确的设置孔径光栏至物镜数值孔径的 2/3(打开,见 72 页)
	聚光镜没有正确的聚焦,顶透镜没有转入/出光路	调节聚光镜,并确认顶透镜的使用与否(见 72 页)
	样品的盖玻片使用不准确,透射物镜要求使用 0.17mm 的盖玻片	使用标准的 0.17 盖玻片
	样品反着放置	正确的放置样品,盖玻片朝上
	油镜没有使用浸油	使用 zeiss 的 518N/F 浸油
	浸油中存在气泡	重新更换浸油
	干物镜前端存在浸油	清洁物镜
	物镜调节环没有调节至和盖玻片相应的数值	调节调节环,使之与盖玻片厚度对应
	在物镜,目镜,聚光镜,或滤色片上存在灰尘或脏点	清洁光学部件

问题	原因	解决办法
图像对比度不对称,例如一个很好,一个很模糊	没有正确的设置聚光镜	正确的调节聚光镜的设置见 72 页
	物镜转盘没有移到咔嗒位置	旋转物镜至正确位置
	样品没有被很好的固定在样品夹上	正确的放置样品
更换物镜是焦距存在很大偏差	目镜的焦距没有被正确的调节或者是使用偏光目镜,但没有配置十字线	调节目镜的焦距见 70 页
	物镜没有完全拧入物镜口	完全拧紧物镜
	Tube Lens 没有安装或者松动了	安装好 Tube Lens
左眼和右眼所见的视野不能重合	目镜的距离(瞳距)没有被正确的调节	调节瞳距见 70 页
	目镜的焦距没有被正确的调节	调节目镜的焦距见 70 页
使用显微镜眼睛很容易疲劳	目镜的距离(瞳距)没有被正确的调节	调节瞳距见 70 页
	目镜的焦距没有被正确的调节	调节目镜的焦距见 70 页
	图像的亮度不正确	调节亮度控制旋钮或加入滤色片
	观察筒存在问题	询问工程师维修或更换
视野内存在灰尘或脏点	聚光镜没有正确的聚焦,顶透镜没有转入/出光路	调节聚光镜,并确认顶透镜的使用与否(见 72 页)
	孔径光栏调节的太小了	正确的调节孔径光栏将 72 页
	在物镜,目镜,聚光镜,或滤色片上存在灰尘或脏点	清洁光学部件

问题	原因	解决办法
LED/卤素灯不亮,即使已经掰至开的位置	主电源线没有安装	将电源线插入至主电源接口
	灯泡没有安装	安装灯泡将 58 页
	灯泡已经损坏	更换灯泡见 58 页
	保险丝损坏	更换保险丝见 108 页
	内部电路板可能损坏	询问维修工程师检查如有必要更换部件见 112 也
	电源插线板中无电	更换另一个插线板
LED/卤素灯闪烁,照明强度不稳定	卤素灯泡的寿命就要到了	更换灯泡见 58 页
	电源线没有接触紧密或有损坏	重新安装或更换电源线
	LED/卤素灯的连接线没有安装好	重新安装连接线见 58 页

5.4 服务

Axio Lab.A1显微镜的服务工作，无论涉及到仪器内和电气设备上的机械、光学和电气部件，都应当由 Carl Zeiss 服务部门或者经特别授权的技术人员负责。

在尽可能长的时间内，为了使贵方的显微镜保持无故障的最佳工作状态，我们建议贵方与 Carl Zeiss 签订服务/维护合同。

如果贵方需要其他订单，或者发生要求服务事件，请联系贵方的 Carl Zeiss 代表。

拔打服务电话时，请联系负责贵方区域的代表，或者联系我方总部：

Carl Zeiss MicroImaging GmbH

P.O.Box 4041, D - 37030 Goettingen
Telephone: +49 551 5060 660
Telefax: +49 (551 5060 464
E-mail: micro@zeiss.de
www.zeiss.de

6 附录

6.1 缩写列表

AC	交流电
BL	勃特兰透镜
Br.	适用于眼镜配带者
CSA	加拿大标准协会
C-DIC	环状偏振光微分干涉相差
D	盖玻璃厚度
D	暗视场
d	直径（例如，滤光片的直径）
DIC	微分干涉
DIN	Deutsches Institut für Normung (德国标准化协会)
EC	欧共体
EN	Euronorm (欧洲标准)
Ergo	Ergonomic /人机工程学
FL	荧光
foc.	可调焦的
fot	可照相的
H	明视场
IEC	国际电工委员会
IP	国际保护
ISO	国际标准化组织
L	左侧
LED	发光二级管
Ph	相位差
PL	平场
Pol	偏光
P&C	推动并吻合
R	右手（位于机械载物台右侧的调整旋钮）
SLR	单反照相机
SW	内六角螺丝刀
T	慢速（保险丝类型）
TIC	环状偏振光全干涉相差
TL	透射光
UL	美国优力安全认证公司
UV	紫外线
VAC	交流电压
vis	可视的

6.2 名词索引

A

B

C

D

6.3

在本手册内,设备,设备的部件或描述的方法受以下专利法的保护:

- 见显微镜主机的标签