Photomicrography with 35 mm SLR Cameras

Operating Manual

Knowledge of this manual is required for the operation of the instrument. Would you therefore please make yourself familiar with the contents of this manual and pay special attention to hints concerning the safe operation of the instrument.

The specifications are subject to change; the manual is not covered by an update service.

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Number of this manual: B 40-046 e

Date of issue: 31.03.1999

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Notes on Instrument Safety

The following warning and information symbols are used in this manual:

NOTE
This symbol is a warning which you must observe under all circumstances.

CAUTION
This symbol is a warning which indicates a hazard to the instrument or instrument system.

The photomicrography units with 35 mm cameras, including the original accessories, may only be used for the documentation applications described in this manual.

Particular attention must be paid to the following warning notes:

The manufacturer cannot assume any liability for any other applications, possibly also involving individual modules or single parts. This also applies to all service or repair work which is not carried out by authorized service personnel. Furthermore, this forfeits all the claims against warranty

Dust and dirt can impair the performance of the instrument. Therefore, the instrument must be protected against these influences as far as possible, and covered with the dust cover if it is not used for longer periods of time. Always check whether the instrument is switched off before you cover it.

The instruments must be operated by trained personnel only who must be aware of the possible danger involved with microscopy and the relevant application.

Photomicrography units with 35 mm SLR cameras are precision instruments which can be impaired in their performance or damaged when handled improperly.

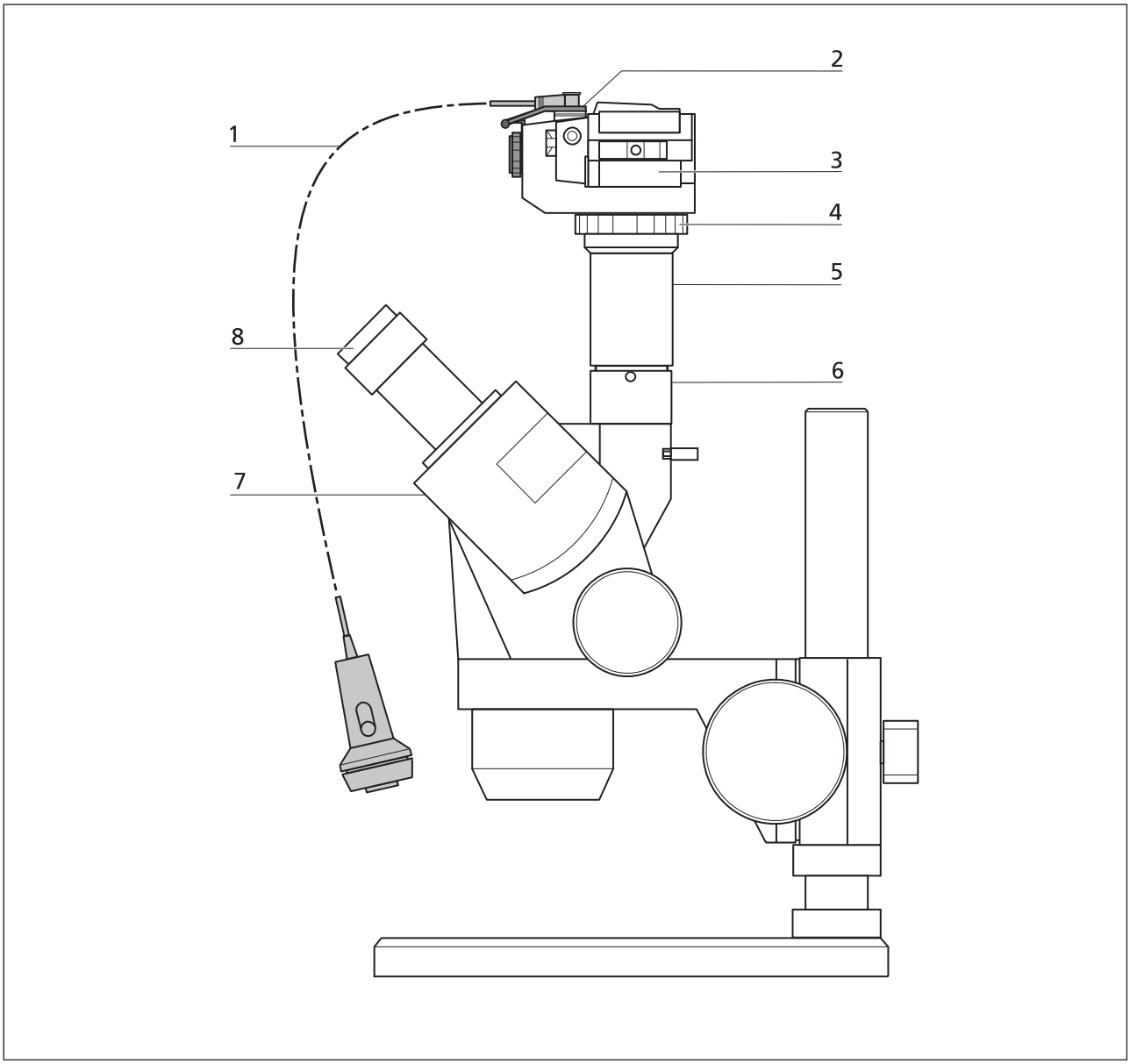
Notes on Warranty:

The manufacturer guarantees that the instrument has no material and production defects when delivered. You must inform us of any defects immediately and we must do anything to minimize the damage. If the manufacturer is informed of such a defect, he is obliged to remove it; it is his decision whether he does this by repairing the instrument or by delivering an instrument free of any defect. No guarantee is provided for defects caused by natural wear (wearing parts in particular) and improper use.

The instrument manufacturer is not liable for damage caused by faulty operation, negligence or any other meddling with the instrument, particularly the removal or replacement of instrument components, or the use of accessories from other manufacturers. This forfeits all the claims against warranty.

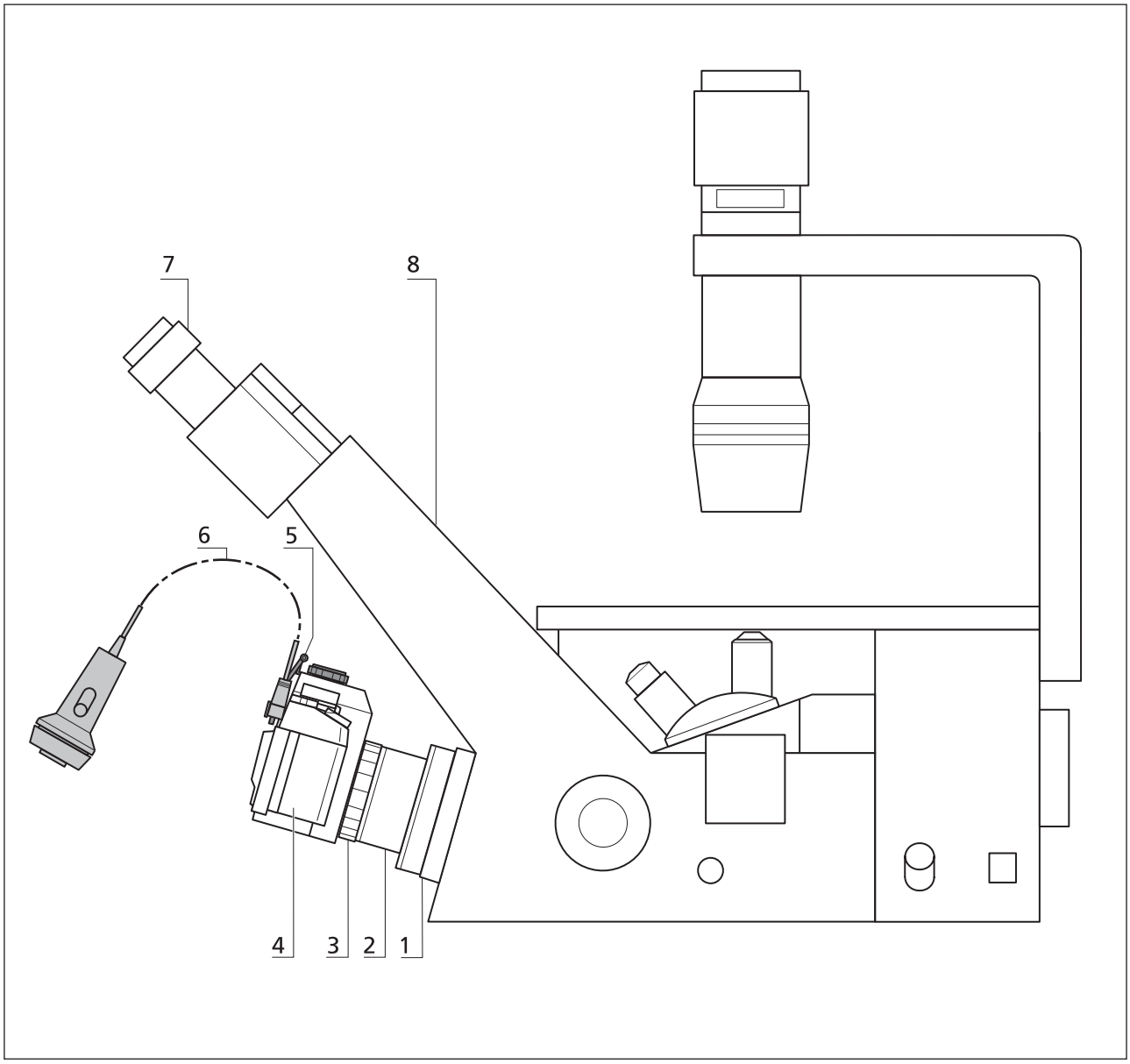
With the exception of the work specified in this manual, no maintenance or repair of the photomicrography units with 35 mm cameras may be performed. Repairs may only be performed by Carl Zeiss service staff or specially authorized personnel. Should any defect occur with the instrument, please get in touch with the Carl Zeiss microscopy service in Germany (see page 4-4) or your local Carl Zeiss agency.

Overall View of 35 mm SLR Camera on 2.5×/T2 Adapter for SLR Cameras on 60 mm Camera Port of the Stemi 2000-C Stereomicroscope in this Example



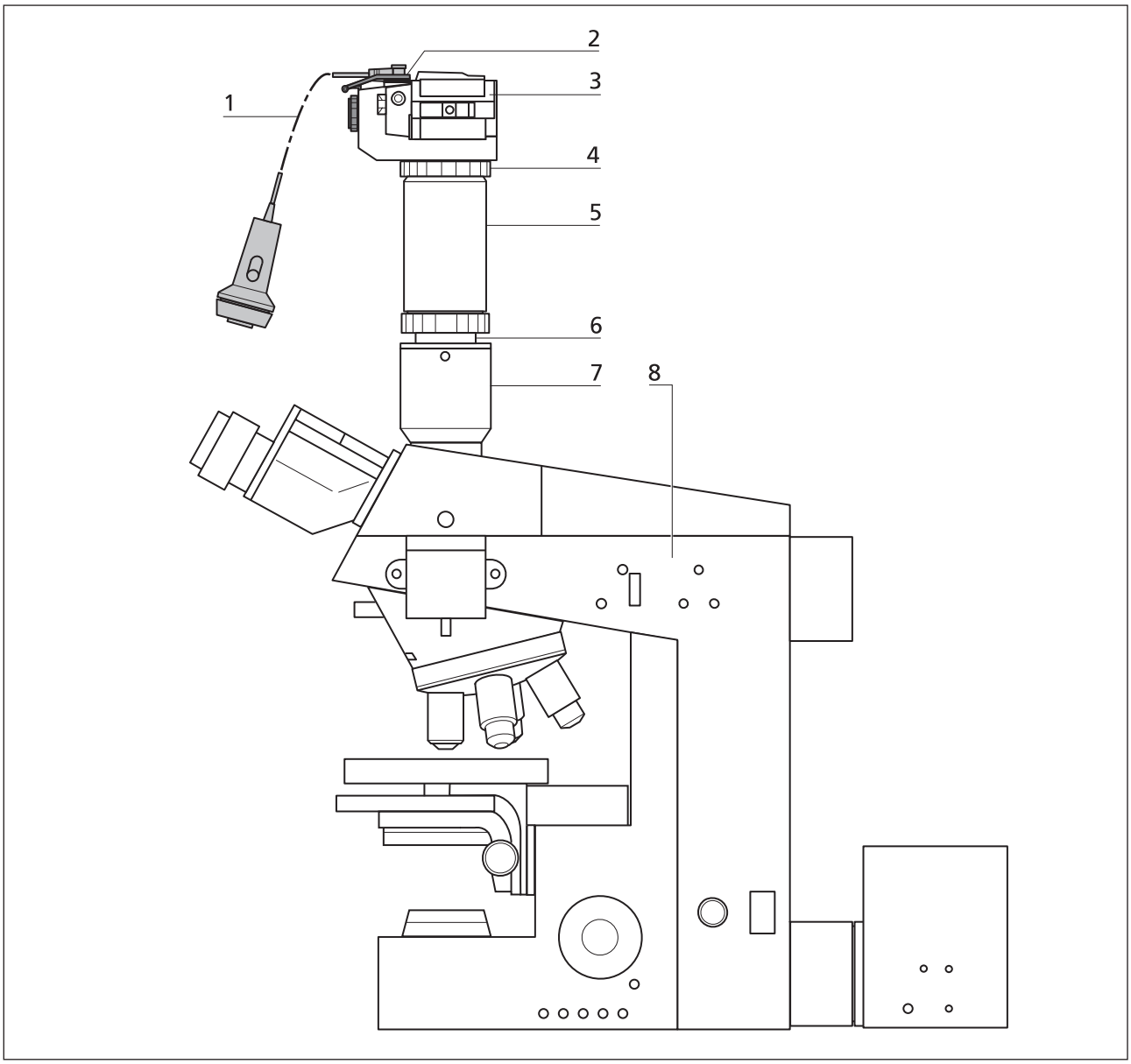
1 Cable release
2 Eyepiece cover
3 35 mm SLR camera
4 T2 adapter
5 2.5×/T2 adapter for SLR camera
6 60 mm camera port
7 Stemi 2000 C microscope body
8 Eyepiece

Overall View of 35 mm SLR Camera on 2.5× / T2 Adapter on Front Camera Port of the Axiovert 25 C



1 front camera port
2 2.5× / T2 camera adapter
3 T2 adapter
4 35 mm SLR camera
5 Eyepiece cover
6 Cable release
7 Eyepiece
8 Axiovert 25 C

Overall View of 35 mm SLR Camera on 63 mm Objective and Adapter for Microscope Camera (Image Position 44 mm) with 10× Camera Eyepiece on 44 mm Camera Port – i.e. on the Axioskop with Phototube in this Example



1 Cable release
2 Eyepiece cover
3 35 mm SLR camera
4 T2 adapter
5 63 mm objective
6 Adapter for microscope camera (image position 44 mm) with 10× phototube
7 44 mm camera port
8 Axioskop

INSTRUMENT DESCRIPTION

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1 INSTRUMENT DESCRIPTION

1.1 Name and Intended Application

The use of commercially available 35 mm SLR cameras on microscopes from Carl Zeiss is a low-price alternative to photo documentation using the MC 80 DX and MC 200 CHIP microscope cameras.

1.2 Instrument Description and Main Features

With the relevant adapters, commercially available 35 mm SLR cameras can be connected to all microscopes from Carl Zeiss for image documentation in the 24 × 36 mm format.

These adapters feature the magnification factor 2.5×, i.e. the image section covered by the 35 mm format corresponds to a 17.5 mm field diameter in the eyepiece intermediate image.

The instrument-side connection surfaces of the adapters correspond to the camera ports of the microscopes and phototubes from Carl Zeiss, while the T2 adapter is available on the camera side.

The T2 adapter is standardized: M 42 × 0.75 thread
distance between T2 contact surface and film plane = 54.9 mm

SLR cameras are screwed on the T2 connector via the T2 adapter suitable for the relevant camera. The T2 adapters are tailored to the flange focal distance (distance between lens contact surface and film plane) and the lens connector (e.g. Contax or F bayonet) of the camera. This ensures that the film plane of the SLR cameras always lies in the image plane of the microscope adapters.

Depending on the performance parameters, exposure control is performed by the SLR camera through TTL metering. Major importance has been attached to automatic exposure control, but manual metering is also possible.

1.3 35 mm SLR Camera Components

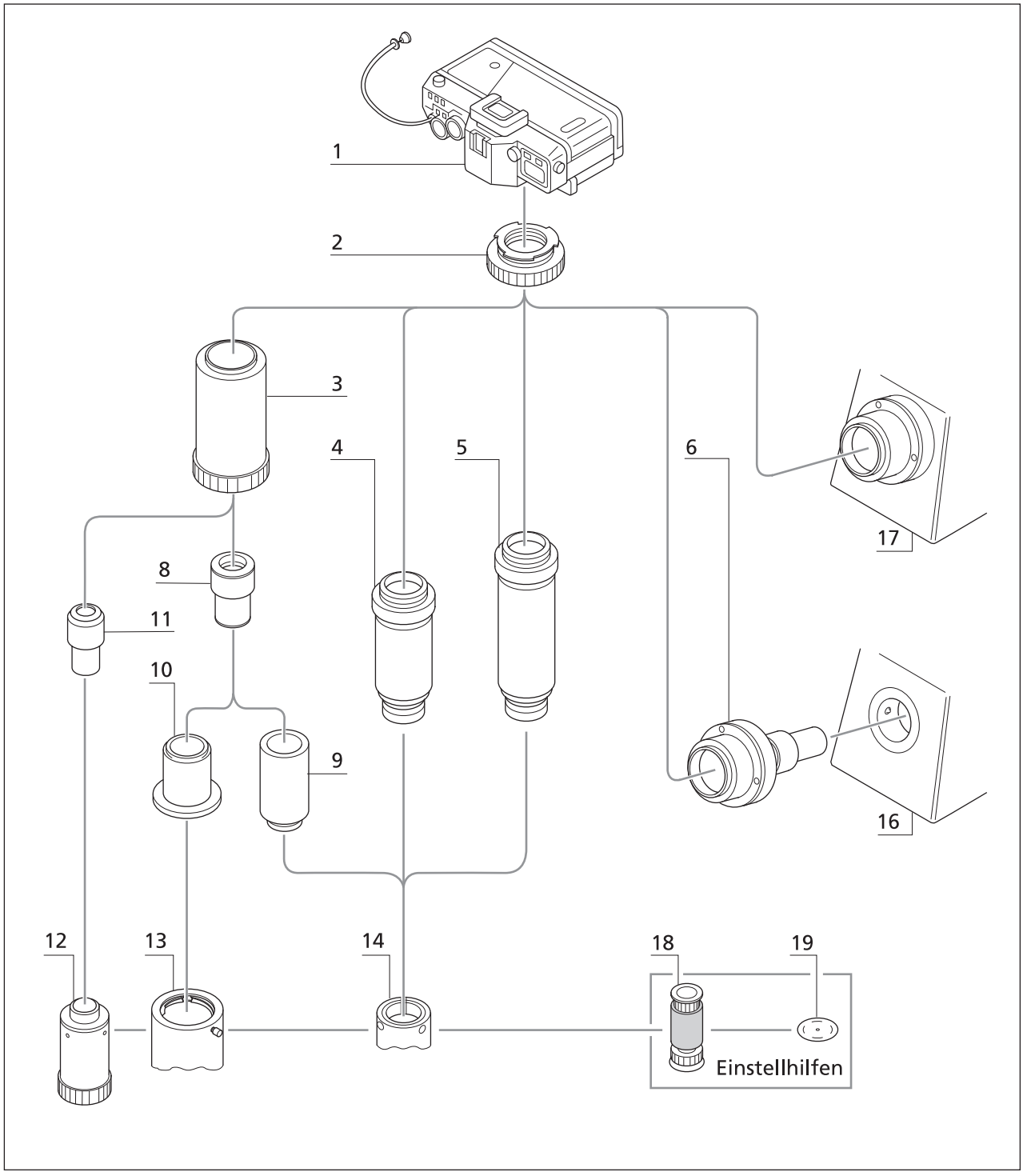

Fig. 1-1 35 mm SLR camera components

Key to Fig. 1:

1	35 mm SLR camera housing
2	T2 adapter
3	Objective f' = 63 mm in T2 mount
4	2.5×/T2 adapter for SLR cameras
5	2.5× SLR adapter comp.
6	2.5× / T2 camera adapters
8, 11	Photo eyepiece
9	Adapter for microscope camera (image position 60 mm)
10	Adapter for microscope camera (image position 44 mm)
12	Camera port clamping diameter 40 mm
13	Camera port image position 44 mm
14	Camera port image position 60 mm
16	Contact surface of Axiovert 25 C / CFL / CA front port
17	Camera connection to front port of Axiovert 35 / 35 M / 135 / 135 M
18	Monocular telescope
19	Photo reticle

	35 mm SLR camera components	**Cat. No. .**
	The following components for the attachment of 35 mm SLR cameras to microscopes from Carl Zeiss have been offered and are continued to be offered::	
1	**35 mm SLR camera housing**	
	Contax 167 MT including eyepiece cover	416181-0000-000
	Contax Aria including eyepiece cover	000000-1057-127
	Ricoh XR - X 3000 (mainly for use with Axiovert microscopes)	416116-0000-000
	Praktica BX 20 35 mm SLR camera housing (mainly for use with Axiovert microscopes)	000000-0219-086
	Cable release for Contax 167 MT and Contax Aria	416167-0000-000
2	**T2 adapters for 35 mm SLR camera housings**	
	T2 adapter for Contax (Contax bayonet)	416010-0000-000
	T2 adapter for Olympus OM (OM bayonet)	416002-0000-000
	T2 adapter for Minolta (SR bayonet)	416003-0000-000
	T2 adapter for Canon (FD bayonet)	416004-0000-000
	T2 adapter for Nikon (F bayonet)	416009-0000-000
	T2 adapter for Pentax (KA bayonet) - also for Ricoh XR - X 3000	416011-0000-000
	T2 adapter for Minolta Autofocus (Minolta Dynax)	416012-0000-000
	T2 adapter for Canon Autofocus (Canon EOS)	416013-0000-000
	T2 adapter for Praktica L (M 42 × 1 thread)	263060-2505-124
	Adapter bayonet / M 42 × 1 thread	000000-0225-954
	T2-Adapter for Praktica B bayonet, consisting of T2-Adapter for Praktica L (M 42 × 1 thread) and adapter bayonet / M 42 × 1 thread	
	T2 camera adapters:	
4	Adapter for 2.5× SLR camera for T2	456005-0000-000
5	SLR adapter 2.5× comp. for Standard 20/25 with phototube 452902-0000-000	456001-0000-000
6	Camera adapter 2.5× / T2 for Axiovert 25 C / CFL / CA	451265-0000-000
7		
3	Objective f'=63 mm in T2 mount with clamping ring d = 40 mm for microscopes with ICS optics	456029-0000-000
8	with photo eyepiece S-PI 10× / 20 for	444040-0000-000
9	connection of microscope camera (image position 60 mm)	456006-0000-000
	or	
10	connection of microscope camera (image position 44 mm)	452996-0000-000
	or with	
11	wide-angle eyepiece Kpl 10× / 20 Br. for Standard, WL and IM inverted microscope on camera port with clamping diameter 40 mm	464044-9902-000
	Focusing aids:	
18	Monocular telescope 3 × 12 B	522012-0000-000
19	Photo reticle MC 2.5× / d = 26 mm	454075-0000-000
19	Photo reticle MC 2.5× / d = 21 mm	454025-0000-000
19	Photo reticle MC 2.5× / d = 19 mm	476021-0000-000

1.4 Overview of Image Positions (Tube Adapters), relevant Phototubes and Microscope Stands

Image Position (Tube Adapter)	Cat.No. of Phototube	Microscope Stand
60 mm	452902-0000-000	KF 2, Standard 20 / 25
	452929-0000-000	KF 2 ICS, Standard 25 ICS, Axiostar
	452909-0000-000 452941-0000-000 452970-0000-000 452974-0000-000 450960-0000-000 450962-0000-000 450963-0000-000 450964-0000-000	Axiolab / Axiolab A / Axiolab Pol
	455005-0000-000	Stemi DRC
	455080-0000-000 455081-0000-000 455082-0000-000	Stemi SV 6 / SV 11 / SV 11 Apo
	455053-0000-000 455055-0000-000	Stemi 2000-C / 2000-CS
	452934-0000-000	Axiotech / Axiotech vario
	451321-0000-000 451322-0000-000 451324-0000-000 451325-0000-000	Axiovert 100 / 135 / 135 M
	452947-0000-000 452972-0000-000	Axioskop
	452342-0000-000 452344-0000-000	Axioskop 2
	452142-0000-000 452143-0000-000 452145-0000-000 452146-0000-000 453020-0000-000	Axioplan 2

Image Position (Tube Adapter)	**Cat.No. of Phototube**	**Microscope Stand**
44 mm	452910-0000-000 452911-0000-000 452912-0000-000 452914-0000-000	Axioskop / Axioskop 20
	451722-0000-000	Axiovert 10 / 35 / 35 M
	452920-0000-000 452921-0000-000 452923-0000-000 452925-0000-000 452926-0000-000 452930-0000-000 452931-0000-000 452932-0000-000	Axioplan / Axiotron / Axiotron 2
	452146-0000-000	Axioplan2
Clamping diameter 40 mm	452903-0000-000	Standard 20 / 25
	451474-0000-000	Co-observation equipment
	473024-0000-000	Universal, Photomicroscope
	475083-0000-000	Stemi SR / SV 8
	475084-0000-000	Stemi DRC; old
Special adapter		Telaval 31 front port
		Axiovert 25 C / CFL / CA front port
T2 adapter		Axiovert 35 / 35 M / 135 / 135 M front port

1.5 Technical Data

Dimensions (outer diameter × depth / height)

35mm SLR camera housing Contax 167 MT ..... approx. 150 × 94 × 52 mm
35mm SLR camera housing Contax Aria ..... approx. 137 × 92 × 54 mm
35mm SLR camera housing Ricoh XR - X 3000 ..... approx. 151 × 95 × 62 mm
35mm SLR camera housing Praktica BX 20 ..... approx. 138 × 90 × 48 mm
T2 adapter ..... approx. 60 × 15 mm
Adapter bayonet / M 42 × 1 thread ..... approx. 60 × 2 mm
Adapter for SLR camera 2.5× for T2 ..... approx. 42 × 88 mm
SLR adapter 2.5× comp. for Standard 20/25 ..... approx. 44 × 166 mm
Camera adapter 2.5× / T2 for Axiovert 25 C / CFL / CA ..... approx. 76 / 58 / 35 × 125 mm
Connection for microscope camera (image position 60 mm) ..... approx. 30 × 72 mm
Connection for microscope camera (image position 44 mm) ..... approx. 60 / 40 × 56 mm
Objective f' = 63 mm in T2 mount with clamping ring for D = 40 mm ..... approx. 56 × 107 mm
Photo eyepiece S-PI 10× / 20 ..... approx. 28 × 60 mm
Wide-angle eyepiece Kpl 10× / 20 Br ..... approx. 25 × 60 mm
Monocular telescope 3 × 12 B ..... approx. 28 × 62 mm
Photo reticle MC 2.5× ..... approx. 26 / 21 / 19 × 2 mm

Weights

35 mm SLR camera housing Contax 167 MT ..... 0.620 kg
35 mm SLR camera housing Contax Aria ..... 0.460 kg
35 mm SLR camera housing Ricoh XR - X 3000 ..... 0.480 kg
35 mm SLR camera housing Praktica BX 20 ..... 0.625 kg
Adapter bayonet / M 42 × 1 thread ..... 0.020 kg
T2 adapter ..... 0.052 kg
Adapter for SLR camera 2.5× for T2 ..... 0.136 kg
SLR adapter 2.5× comp. for Standard 20/25 ..... 0.225 kg
Camera adapter 2.5× / T2 for Axiovert 25 C / CFL / CA ..... 0.320 kg
Connection for microscope camera (image position 60 mm) ..... 0.106 kg
Connection for microscope camera (image position 44 mm) ..... 0.106 kg
Objective f' = 63 mm in T2 mount with clamping ring for D = 40 mm ..... 0.434 kg
Photo eyepiece S-PI 10× / 20 ..... 0.120 kg
Wide-angle eyepiece Kpl 10× / 20 Br ..... 0.056 kg
Monocular telescope 3 × 12 B ..... 0.076 kg
Photo reticles MC 2.5× ..... 0.003 kg

Power supply for 35 mm SLR camera housing

Contax 167 MT ..... 4 batteries AAA / 1.5 V
Contax Aria ..... 2 batteries CR 2 / 3 V
Ricoh XR - X 3000 ..... 4 batteries AA / 1.5 V (LR 6 / LR 03)
Praktica BX 20 ..... 1 battery KS 28 / 6V or 4 batteries LR 20 / 1.5 V

Ambient conditions

Storage and transport (in packaging)

Permissible ambient temperature ..... -10 to +60 °C
Permissible relative humidity ..... 20 % to 85 % at +35 °C
Atmospheric pressure ..... 800 hPa to 1060 hPa

Operation

Permissible ambient temperature ..... +10 to +45 °C
Permissible relative humidity ..... 20 % to 85 % at +35 °C
Permissible altitude for operation ..... max. 2000 m
Atmospheric pressure ..... 800 hPa to 1060 hPa
Pollution degree 2

Operating data

Category of use ..... closed rooms

START-UP

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2 START-UP

The components for photomicrography with 35 mm SLR cameras can be installed, converted and started up by the customer himself.

However, if requested, it is also possible to have the photomicrography components installed or converted by Carl Zeiss service staff against payment.

2.1 Unpacking the Photomicrography Components

The photomicrography components from Carl Zeiss are delivered in separate packaging.

- Remove all components from the packaging and use the delivery note to check for completeness.
- Properly dispose of original packaging, or keep it for storage or return of the instrument to the manufacturer.

2.2 Insertion of Photo Reticles MC 2.5×

2.2.1 Assignment of Photo Reticles MC 2.5×

- The photo reticle shows the boundaries of the image section covered by the 35 mm SLR camera (2-1/**1**).
- The double-line cross (2-1/**2**) in the center is used for focus checking. It must be in focus together with the object image.
- The following table shows the MC 2.5× photo reticles and their assignment to the various eyepieces.

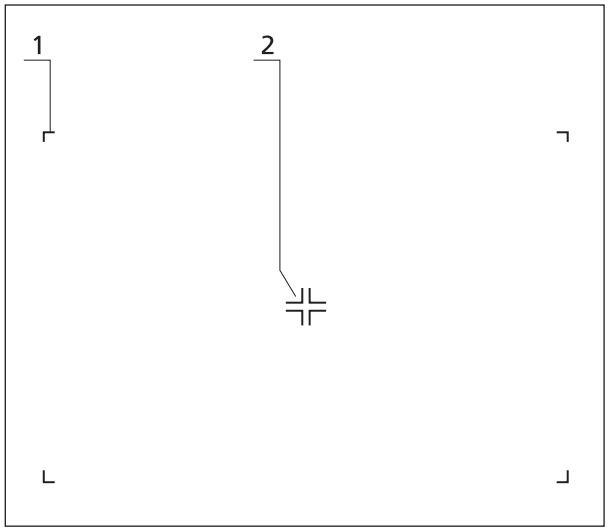

Fig. 2-1 Photo reticle MC 2.5×

Photo Reticles	**Cat. No.**	**Eyepieces**	**Cat. No.**
MC 2.5× / d = 26 mm	454075-0000-000	PL 10× / 18 Br. foc.	444132-9901-000 *
		E-PL 10× / 20 Br. foc.	444232-9902-000 *
		W 10× / 21 foc.	455042-0000-000
		PL 10× /23 Br. foc.	000000-1026-548
		W-PL 10× / 23 Br. foc.	455043-0000-000 *
			455044-0000-000
			000000-1016-758
		E-PL 10× / 23 Br. foc.	444235-0000-000
		PL 10× / 25 Br. foc.	444034-0000-000
		E-PL 10× / 25 Br. foc.	444234-0000-000
MC 2.5× / d = 21 mm	454025-0000-000	Kpl 10× / 20 Br. foc.	464048-9902-000
		E-PL 10× / 20 Br. foc.	444232-0000-000
			444236-0000-000
		PL 16× /16 Br. foc.	444054-0000-000
		W-PL 16× / 16 Br. foc.	455048-0000-000
		W 25× /10 foc.	455046-0000-000
MC 2.5× / d = 19 mm	476021-0000-000	KF 10× / 18 Br. foc.	464027-9901-000
		Kpl 10× / 18 Br. foc.	464043-9902-000
		... and other comp. eyepieces	

* For insertion of the photo reticles please see page 2-4.

2.2.2 Insertion of MC 2.5× Photo Reticles in the Eyepiece

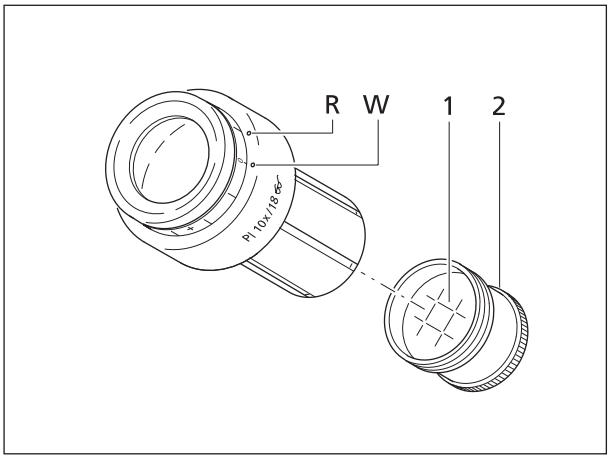

Fig. 2-2 Attachment of photo reticle MC 2.5× in eyepiece

A focusing eyepiece with photo reticle **must** be used if focusing is **not** to be performed through the viewfinder of the SLR camera.

The MC 2.5× photo reticles are inserted into the eyepieces 10× foc. of the relevant microscope.

The photo reticles (2-2/**1**) from Carl Zeiss have been adhered to screw-in mounts (2-2/**2**) to allow easy replacement.

To insert the photo reticles, just unscrew the empty reticle mount and replace it with a new mount (2-2/**2**) containing the required photo reticle (2-2/**1**).

The slight image shift caused by the additional path through the glass is taken into account on the diopter scale by the fact that the zero point position is indicated not by the white dot **W** (2-2/**W**) but by the red dot (2-2/**R**).

For focusing eyepieces without photo reticle ⇒ set diopter zero position to the white dot (2-2/**W**), and for focusing eyepieces with photo reticle ⇒ set diopter zero position to the red dot (2-2/**R**).

☞ If photo reticles are inserted into the unscrewed mount by the customer, attention must be paid to the labeling being visible the right way up after insertion.

2.2.3 Focusing of Eyepieces through the Binocular Tube

- Insert the eyepiece with photo reticle in one side of the binocular phototube and align the photo reticle with the microscope camera (microscope camera normally pointing to the observer).
- Use the eyepiece to focus on the line figure of the photo reticle.
- Use the focusing drive to focus on the microscope image of the specimen through the eyepiece set as described above.
- Then use the eyepiece without photo reticle to focus the microscope image for the second eye. The position of the focusing drive on the microscope stand must not be changed.

2.3 Attachment of 35 mm SLR Cameras

The attachment of 35 mm SLR cameras to various camera ports is described in detail in the following and can be performed by the users themselves.

2.3.1 Attachment of 35 mm SLR Cameras with SLR Adapter 2.5× to the 60 mm Camera Port

- Remove dust cover or lens from the SLR camera housing.
- Attach camera-specific T2 adapter (2-3/**3**) to the relevant SLR camera housing (2-3/**2**).
- Remove dust cover from 2.5× / T2 adapter for SLR cameras (2-3/**4**) or SLR adapter 2.5× comp. (2-3/**5**).
- Screw thread of 2.5× / T2 adapter for SLR cameras (2-3/**4**) or of SLR adapter 2.5× comp. (2-3/**5**) in the T2 adapter (2-3/**3**) attached to the SLR camera housing (2-3/**2**).
- Remove dust cover from phototube (2-3/**6**).
- Insert 2.5× / T2 adapter for SLR cameras (2-3/**4**) or SLR adapter 2.5× comp. (2-3/**5**) with SLR camera housing in the 60 mm camera port (2-3/**6**) until stop.
- Align unit in the required position and tighten the three hexagonal screws (2-3/**7**) using the supplied ball-headed screwdriver (2-3/**8**).
- Fix cable release (2-3/**1**), if required.

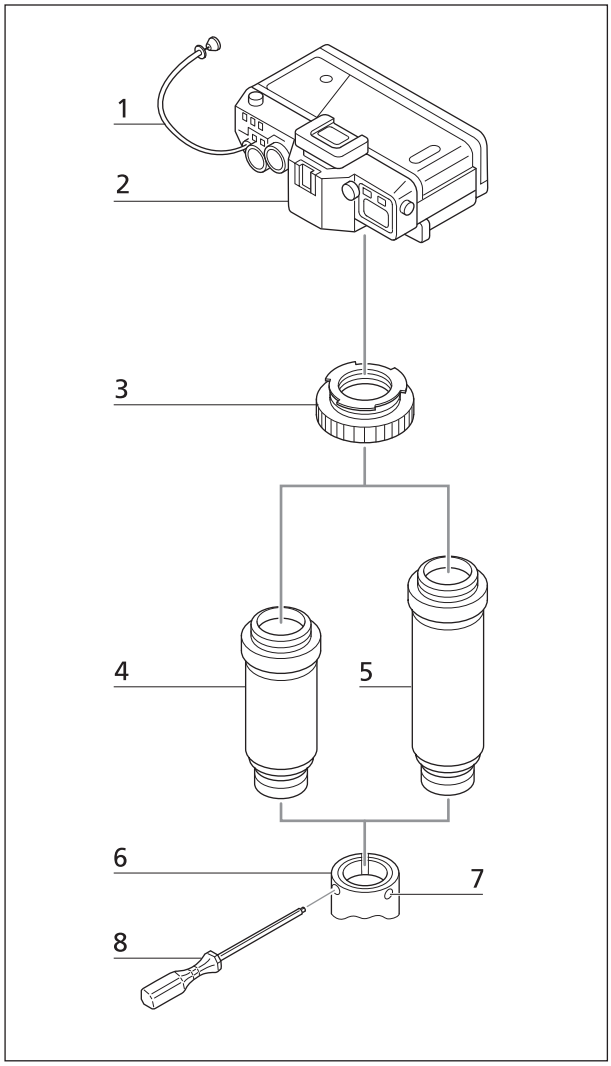

Fig. 2-3 **Attachment of 35 mm SLR cameras with SLR adapter 2.5× to 60 mm camera port**

2.3.2 Attachment of 35 mm SLR Cameras with Objective f' = 63 mm to 60 mm and 40 mm Camera Ports

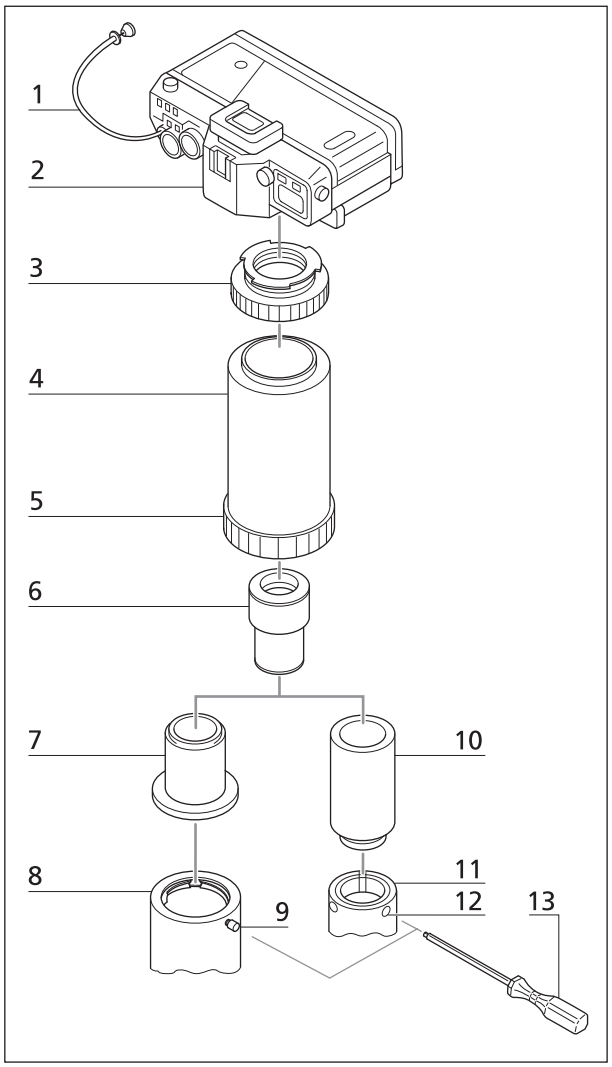

Fig. 2-4 **Attachment of 35 mm SLR cameras with objective f' = 63mm to camera ports 44 mm and 60mm**

- Remove dust cover or lens from the SLR camera housing.
- Attach camera-specific T2 adapter (2-4/**3**) to the relevant SLR camera housing (2-4/**2**).
- Remove dust covers from objective f' = 63 mm (2-4/**4**).
- Insert thread of objective f' = 63 mm (2-4/**4**) in the T2 adapter (2-4/**3**) attached to the SLR camera housing (2-4/**2**).
- Remove dust cover from the 44 or 60 mm camera port (2-4/**8,11**).
- Insert connector for microscope camera with image position 44 mm (2-4/**7**) in the 44 mm camera port (2-4/**8**), or the connector for microscope camera with image position 60 mm (2-4/**10**) in the 60 mm camera port (2-4/**11**).
- Tighten clamping screws (2-4/**9,12**) to the 44 or 60 mm camera ports using the supplied ball-headed screwdriver (2-4/**13**).
- Insert photo eyepiece S-Pl 10× / 20 (2-4/**6**) in the connectors for microscope cameras (2-4/**7,10**).
- Attach objective f' = 63 mm (2-4/**4**) with camera housing to the connectors for microscope cameras (2-4/**7,10**) containing the photo eyepiece (2-4/**6**) until stop.
- Align objective f' = 63 mm (2-4/**4**) with SLR camera housing in the required position and secure it by turning clamping ring (2-4/**5**) anti-clockwise.
- Fix cable release (2-4/**1**), if required.

2.3.3 Attachment of 35 mm SLR Cameras with 2.5× / T2 Adapter to Front Port of Axiovert 25 C / CFL / CA

- Remove dust cover or lens from the SLR camera housing.
- Attach camera-specific T2 adapter (2-5/**3**) to the relevant SLR camera housing (2-5/**2**).
- Remove dust covers from 2.5× / T2 camera adapter for Axiovert 25 (2-5/**4**).
- Screw thread of 2.5× / T2 adapter for Axiovert (2-5/**4**) in the T2 adapter (2-5/**3**) attached to the SLR camera housing (2-5/**2**).
- Remove dust cover from the front camera port of the Axiovert 25 (2-5/**6**).
- Push 2.5× / T2 camera adapter for Axiovert 25 (2-5/**4**) with SLR camera housing in the front camera port of the Axiovert 25 (2-5/**6**) until stop.
- Align SLR camera horizontally and tighten clamping screws (2-5/**7**) using the ball-headed screwdriver (2-5/**10**).
- Fix cable release (2-5/**1**), if required.

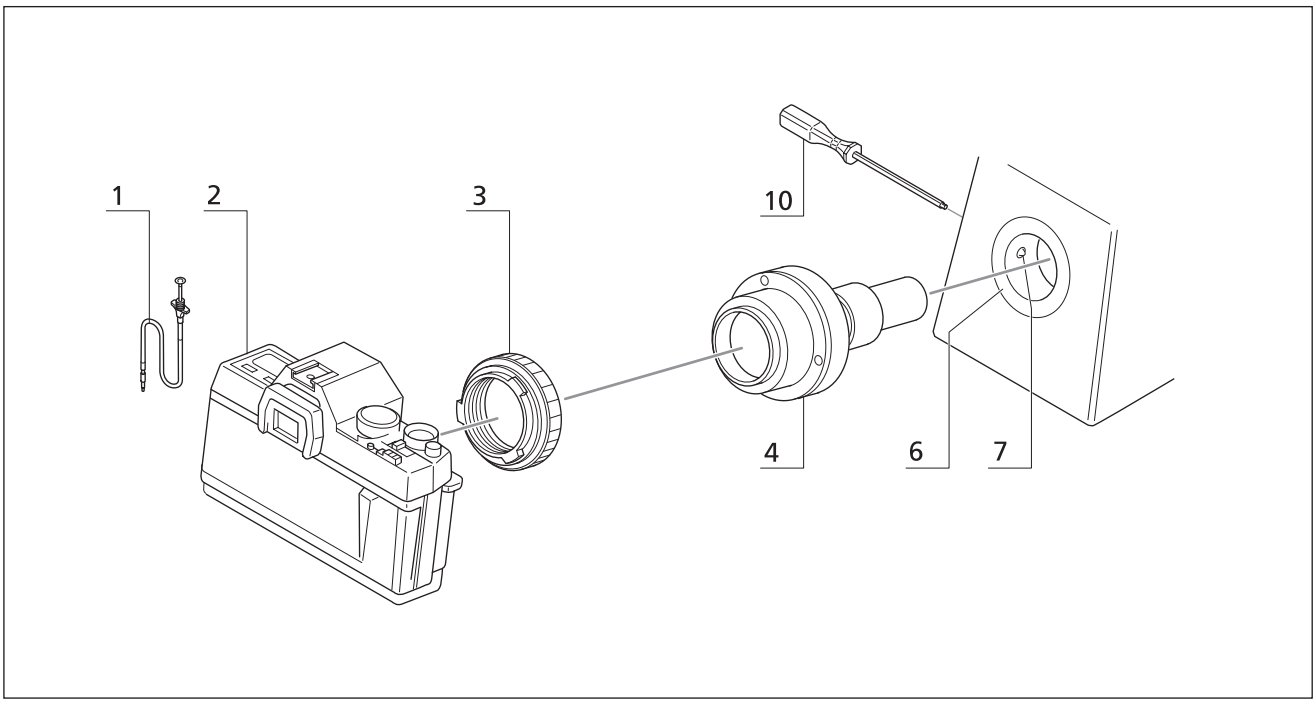

Fig. 2-5 Attachment of 35 mm SLR cameras with camera adapter 2.5× / T2 to front-port of Axiovert 25 C / CFL / CA

2.3.4 Attachment of 35 mm SLR Cameras to Front Camera Port of Axiovert 35 / 35 M / 135 / 135 M

The front camera port (2-6/**5**) of the Axiovert 35 / 35 M / 135 / 135 M is a T2 adapter with camera factor 2.5× attached to the stand.

- Remove dust cover or lens from the SLR camera housing (2-6/**2**).
- Remove dust covers from the front camera ports (2-6/**5**) of the Axiovert 35 / 35 M/135 / 135 M.
- Screw camera-specific T2 adapter (2-6/**3**) to the camera port (2-6/**5**) of the Axiovert 35 / 35 M / 135 / 135 M.
- Attach the SLR camera housing (2-6/**2**) to the relevant T2 adapter (2-6/**3**).
- If required, align camera horizontally: loosen three set screws (2-6/**4**) on the T2 adapter (2-6/**3**) using watchmaker's screwdriver, align camera (2-6/**2**) horizontally, and tighten set screws (2-6/**4**) again using the watchmaker's screwdriver.
- Attach cable release (2-5/**1**), if required.

If the T2 adapter for the Contax bayonet (2-6/**7**) has already been attached to the camera port in the factory, only the Contax camera housing (2-6/**6**) must be attached to the camera port with Contax bayonet (2-6/**7**) after removal of all the dust covers. In that case, the SLR camera is also aligned horizontally.

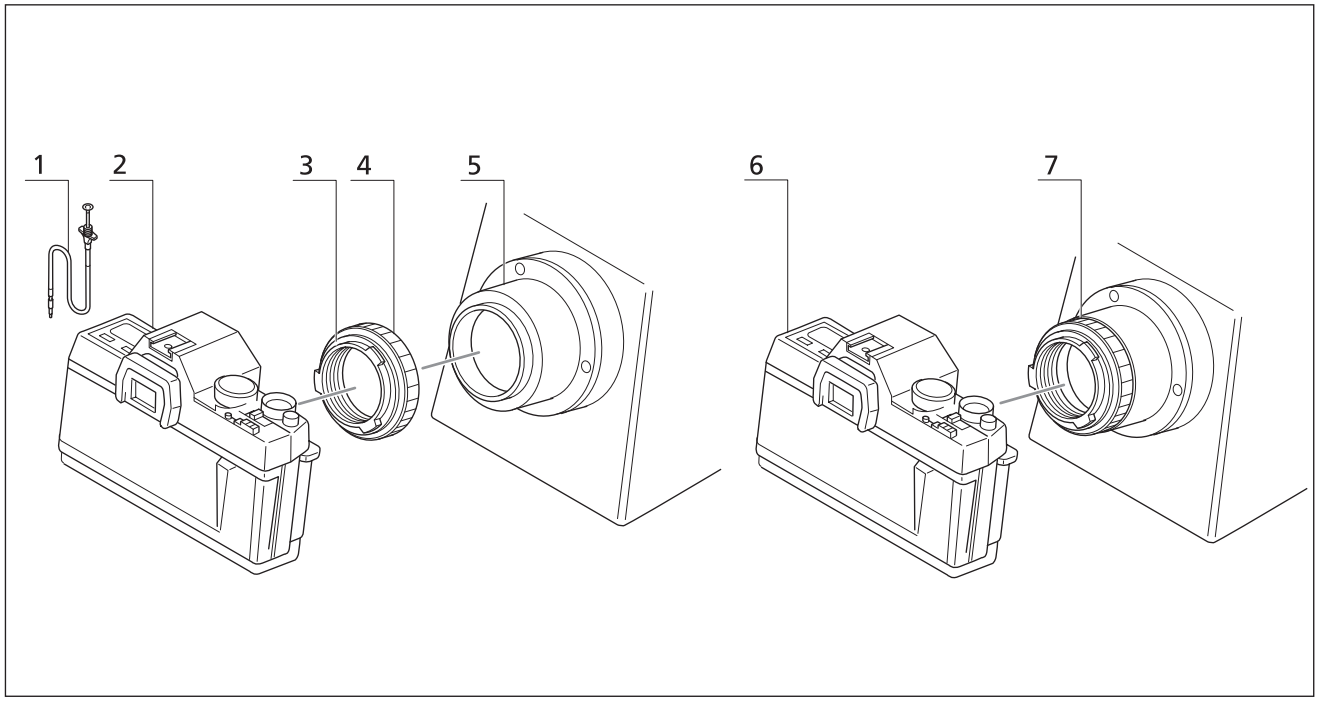

Fig. 2-6 Attachment of 35 mm SLR cameras to front camera port of Axiovert 35 / 35 M / 135 / 135 M

2.3.5 Attachment of 35 mm SLR Cameras with Objective f' = 63 mm to Camera Ports with 40 mm Clamping Diameter

For photomicrography with 35 mm SLR cameras on Standard, WL and IM microscope stands with phototubes (40 mm outer clamping diameter of camera port)

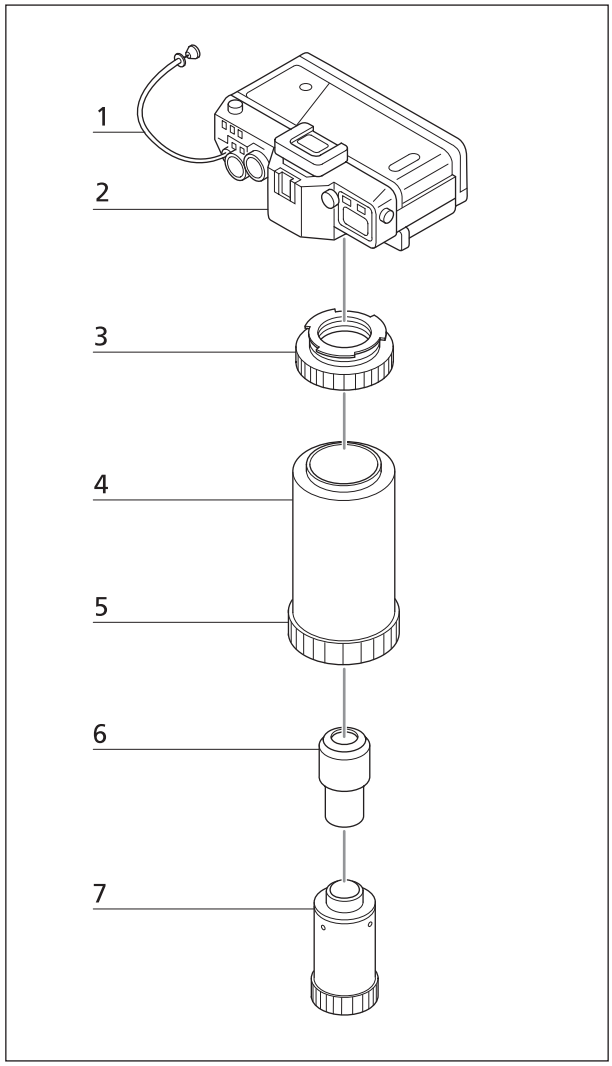

Fig. 2-7 **Attachment of 35 mm SLR cameras with objective f' = 63mm to camera port with 40mm clamping diameter**

- Remove dust cover or lens from the SLR camera housing.
- Attach camera-specific T2 adapter (2-7/**3**) to the relevant SLR camera housing (2-7/**2**).
- Remove dust covers from objective f' = 63 mm (2-7/**4**).
- Screw thread of objective f' = 63 mm (2-7/**4**) in the T2 adapter (2-7/**3**) attached to the SLR camera housing (2-7/**2**).
- Remove dust cover from the camera port with 40 mm clamping diameter (2-7/**7**)
- Insert wide-angle eyepiece Kpl 10× / 20 Br. (2-7/**6**) in camera adapter (2-7/**7**).
- Attach objective f' = 63 mm (2-7/**4**) with SLR camera housing to adapter (2-7/**7**) containing the photo eyepiece (2-7/**6**) until stop.
- Align objective f' = 63 mm (2-7/**4**) with SLR camera housing in the required position and secure it by turning clamping ring (2-7/**5**) anti-clockwise.
- Attach cable release (2-3/**1**), if required.

2.4 Determination of the Exposure Time Range for Unblurred Photographs

The limits of the exposure time range for unblurred photographs depend on the used SLR camera, the microscope adaptation, the microscope magnification and the microscope stand to which the camera is attached.

These limits for unblurred photographs can be determined as follows:

- Place a suitable object on the stage (high-contrast specimen featuring large and small object details, testing grid or stage micrometer).
- Swing in 10× objective.
- Focus on the object.
- Set brightfield illuminator according to KÖHLER.
- Make an exposure series:
  trigger one photograph each with the exposure times 1/250s - 1/125s - 1/60s - 1/30s - 1/15s - 1/8s - 1/4s - 1/2s and 1s in the "Automatic" mode.
  The different exposure times must be set by adjusting the lamp voltage and, if required, by insertion of neutral density filters into the illumination beam path.
- Make a second exposure series using the 40× objective.
- Evaluate the photographs after the film has been developed:
  The photographs featuring high contrast and clearly defined object details are blurless.
  The exposure time of the first photograph featuring high contrast and clearly defined object details is the border exposure time of the exposure time range for unblurred photographs.
  All the photographs with exposure times ≥ the border exposure time are unblurred.

OPERATION

Contents

List of illustrations

3 OPERATION

3.1 Adaptation and Functions

The adaptation components for 35 mm SLR cameras for photomicrography are simple screwing and clamping adapters which are described in chapter 2, Start-up.

The functions important for photomicrography with 35 mm SLR cameras (e.g. exposure programs, film insertion) are described in the operating instructions of the relevant SLR camera.

The T2 adapters suitable for the used 35 mm SLR cameras are attached and removed in the same way as camera lenses. This is also described in the relevant camera instructions.

Further information on the use of 35 mm SLR cameras for photomicrography are given in section 3.2, photomicrography with SLR cameras.

The following section will not deal with the setting of microscopes for photomicrography. The necessary steps are described in the relevant operating manuals of the microscopes from Carl Zeiss.

3.2 Photomicrography with 35 mm SLR Cameras

3.2.1 Photography in a Few Steps

- Carefully set the microscope for observation. If possible, select beam path for simultaneous observation and photography (see the relevant operating manual of the microscope).
- Select and implement illumination technique, objective magnification and condenser setting of the microscope in the usual way (also see the relevant operating instructions of the microscope).
- For photography, set the microscope illuminator to the color temperature 3200 K.

☞ also see section 3.2.2, setting of color temperature and image brightness.

- Insert 135 film (35 mm) in 35 mm SLR camera

☞ also see section 3.2.3, selecting a film.

- Set exposure correction for illumination technique.

☞ also see section 3.2.4, exposure correction depending on microscopy technique.

- If a suitable data back is used with the 35 mm SLR camera: enter the data.

☞ also see the operating instructions of the used data back.

- Carefully adjust and focus the image frame.

☞ also see section 3.2.5, adjusting and focusing of image frame.

- Set the illumination mode.

☞ also see section 3.2.6, correct exposure functions.

- Trigger the exposure

☞ also see section 3.2.7, trigger exposures.

- After the exposure, the film is automatically advanced by one frame; when old cameras without motorized film advance are used, the film advance lever must be activated.
- The next exposure can be triggered.

3.2.2 Setting the Color Temperature to 3200 K and Setting the Image Brightness

When using color reversal films for artificial light (3200 K), it is recommended to set the illuminator to the color temperature 3200 K (approx. maximum lamp voltage in the case of halogen lamps). Image brightness is very high. In brightfield and with high film speeds in particular, the resulting exposure times are very short, and are therefore beyond the range permitting unblurred exposures. The image brightness must be attenuated by using color-neutral gray filters.

☞ also see section 3.2.8,1, avoiding blur.

3.2.3 Selecting the Film

In photomicrography, reversal films (slide films) are used for color exposures. In general, reversal films for artificial light (3200 K) are recommended. If daylight film is used, a conversion filter 3200 - 5500 K is required.

Conversion filter 3200 - 5500 K	d = 32 mm 467847-0000-000	d = 25 mm 447825-000-000	d = 18 mm 467854-0000-000

Films labeled **Professional** feature closer tolerances for speed and color balance, i.e. exposure and color are more homogenous.

DX-coded films should always be used in their original cartridge.

Use of **bulk film**;
We would not recommend the use of bulk film because light leak and scratches or dirt on the film may lead to complications or problems with film advance if the cartridges are damaged.

If you want to use bulk film nevertheless, please note the following:

☞ Only use film cartridges conforming to DIN 4335 or ISO 1007-1977. Ensure that the maximum dimensions given in these standards are not exceeded.

Film cartridges are not suitable for continuous operation! They must be scrapped after approx. 10 refills.

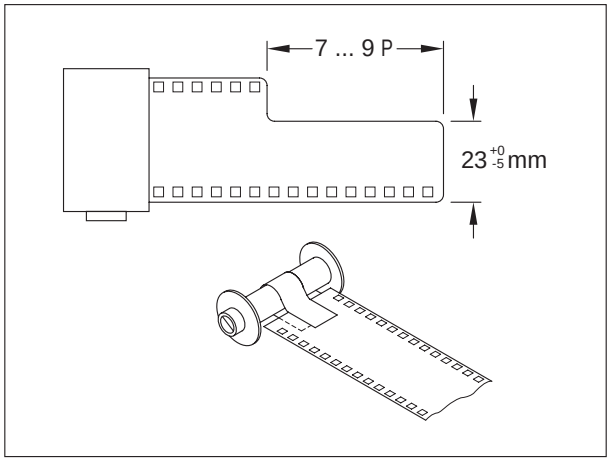

Fig. 3-1 Use of bulk film

The film cuts must always be performed as stipulated in DIN 4536 or ISO 1977 (also see Fig. 3-1).

- The film should be cut so that none of the perforation holes are cut open.
- The film cut must be 7...9 perforation holes long and it must be parallel to the film edge.
- The edges should be rounded to ensure that the film does not get caught at the mouth of the cartridge or at parts of the cassette.
- The end of the film must be cut with a straight edge and adhered to the film spool with a piece of adhesive tape.
- Avoid overly long film, as some cartridges cannot be used for 36 frames or for every film. This could damage the film advance mechanism in the film cassette.

3.2.4 Exposure Correction Depending on the Microscopy Technique

Exposure corrections may be required, depending on which microscopy technique is used. The following values are standard in photomicrography:

Microscopy technique	**Correction value**	**Extension factor**
Brightfield - Few or very small dark structures on a very bright background	+2	Factor 4×
Brightfield - Dark structures on a bright background	+1	Factor 2×
Phase or interference contrast	0	Factor 1×
Darkfield / Fluorescence - Many bright structures on a dark background	-1	Factor 0.5×
Darkfield / Fluorescence - Bright structures on a dark background	-2	Factor 0.25×

Example 1:

The correction value +1 means that one exposure value (+ 1 EV) is added to the exposure time in brightfield recommended by the automatic exposure control for zero setting (i.e. twice the exposure time: negatives will be denser, slides and Polaroid photos brighter).

The correction value -2 means that two exposure values (-2 EV) are subtracted from the exposure time for darkfield / fluorescence recommended by the automatic exposure control for zero setting (i.e. exposure time is reduced by one quarter: negatives will be brighter, slides and Polaroid photos denser).

Most 35 mm SLR cameras feature an exposure correction ring which allows the exposure time to be corrected in steps of 1/3 EV within a range between +2 EV and -2 EV

Furthermore, some SLR cameras permit exposure bracketing to be made. When the exposure has been triggered, three photos are taken with different correction values - the correction value is automatically changed by -1 EV from exposure to exposure.

Example 2:

The exposure correction ring has been set to +1. The first photo is exposed with +1 EV, the second with ±0 EV and the third with -1 EV.

☞ For the setting of exposure correction and exposure bracketing please see the operating instructions of the used 35 mm SLR camera!

3.2.5 Setting and Focusing of Image Section

– Via binocular tube;
the section of the microscope object set in accordance with the photo reticle is imaged on the film in focus when the focusing cross and the specimen are clearly defined simultaneously. To achieve correct focusing even with low objective magnifications, it is recommended to use the 3x12 B monocular, focused to infinity, as an adjusting aid (monocular attached to eyepiece with photo reticle).

☞ Insert photo reticle as described in section 2.1.2.1 and focus eyepieces in binocular tube in accordance with 2.1.2.2.

– Via the usual focusing screen in the viewfinder of the SLR camera;
the image section on the focusing screen is slightly smaller than the image section on the film. Therefore, all the image details visible on the focusing screen are also visible on the film. The set image section is sharply imaged on the film if the structures of the microprism collar with split image indicator and the image of the microscope object in the matte area or microprism collar are in focus at the same time.

☞ Fine object structures and details may be lost because of the granularity of the matte area and the microprism collar.
Object details which can still be well recognized should therefore be selected for focusing.

☞ If the structures of microprism ring and split image indicator are not seen in focus, attach the special eyepiece for eyeglass wearers to the viewfinder.

– Fine object structures and details can be focused in accordance with the image in the clear glass areas of the split image indicator.
  However, this requires some practice because photomicrographic cameras have different pupil positions and sizes than standard camera lenses. Therefore, the clear glass areas of the split image indicator in the center of the focusing screen are dark when you look into the center of the viewfinder.
  We would therefore recommend you not to look into the center of the viewfinder: depending on the position of the split image edge, move your eye upwards / downwards or obliquely upwards / obliquely downwards. An image will then be seen in one field of the split image indicator, while the other field remains dark.
  The fine object structures and details can then be focused in the field of the split image indicator with the visible image.

☞ Focusing screens with matte area and central clear glass spot with reticle are ideal for the setting and focusing of the image section.
  Some camera manufacturers offer such a changeable screen.

3.2.6 Exposure Functions

35 mm SLR cameras with TTL (Through The Lens) metering

These 35 mm SLR cameras permit the following metering modes: center-weighted averaging, spot metering and multiple-area metering. Each of these metering modes permits selection between different exposure modes, e.g.

– Automatic exposure control:
  the camera automatically selects the optimum combination of exposure time and aperture value

– Automatic exposure mode with preselected shutter speed:
the camera automatically selects the aperture value for a desired shutter speed depending on the image brightness.

– Automatic exposure mode with preselected aperture:
the camera automatically selects the shutter speed for the desired aperture value depending on the image brightness.

– Exposure after manual exposure alignment with preselected aperture:
depending on the image brightness, the shutter speed is matched for a desired aperture by turning the shutter speed knob until zero alignment of an indicator (e.g. pointer on indicator).

– Exposure after manually set exposure time and B/T function.

The measuring range of 35 mm SLR cameras is determined by the ranges of exposure values (EV), shutter speed and film sensitivity in combination with the aperture range of the camera lens.

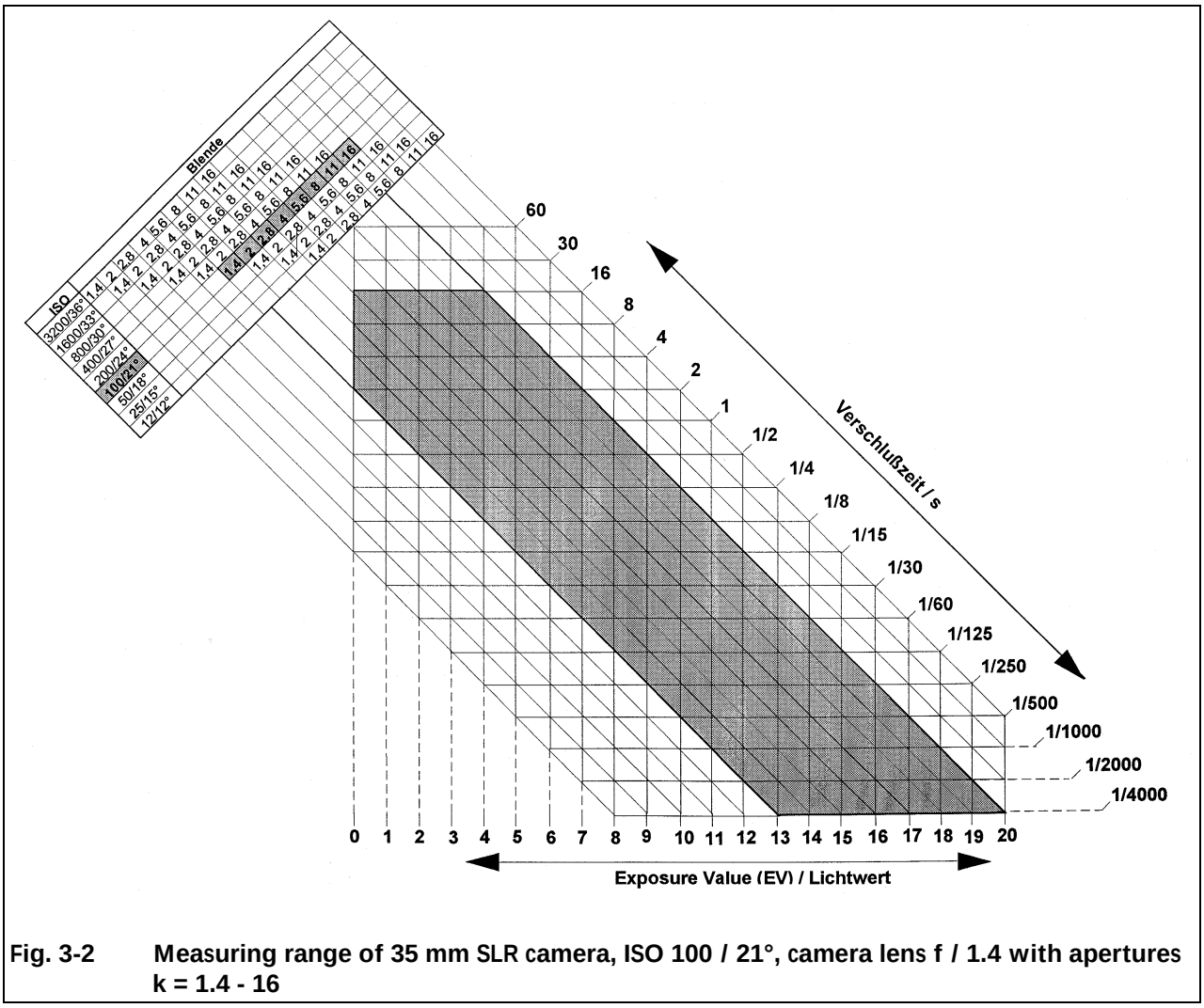

Fig. 3-2 **Measuring range of 35 mm SLR camera, ISO 100 / 21°, camera lens f / 1.4 with apertures k = 1.4 - 16**

Example 3:
The camera in Fig. 3-2 measures shutter speeds between T_{max} (here = 16s) and T_{min} (here = 1/4000 s) for Iso 100 /21° films and apertures between 4 and 16.

The shortest shutter speed T_{min} of 1/4000 s is also measured with apertures 2.8 - 2 - 1.4, while the longest shutter speed for aperture 2.8 is 8s, 4s for aperture 2 and only 2 s for aperture 1.4.

35 mm SLR cameras for photomicrography

Center-weighted averaging, spot metering and multiple area metering can also be used for photomicrography with 35 mm SLR cameras. For photomicrography with 35 mm SLR cameras, T2 adapters are attached to the camera housings with TTL metering instead of the camera lens. Aperture functions are not transmitted, the camera housing has been informed that the aperture is fully open.

Therefore, only the following exposure modes are possible:

- Automatic exposure control with open aperture (automatic control with preselected aperture); depending on the image brightness, the camera automatically selects the shutter speed for the open aperture, i.e. aperture 1.2 or 1.4
- Exposure after manual exposure time alignment with preselected open aperture; depending on the image brightness, the shutter speed is matched for the open aperture, i.e. aperture 1.2 or 1.4, by turning the shutter speed knob until zero alignment of an indicator (e.g. pointer on indicator).
- Exposure after manually set exposure time and B function.

The measuring range of cameras with T2 adapter is determined by the ranges of exposure values (EV), shutter speeds, film sensititvity and by the open aperture 1.2 or 1.4.

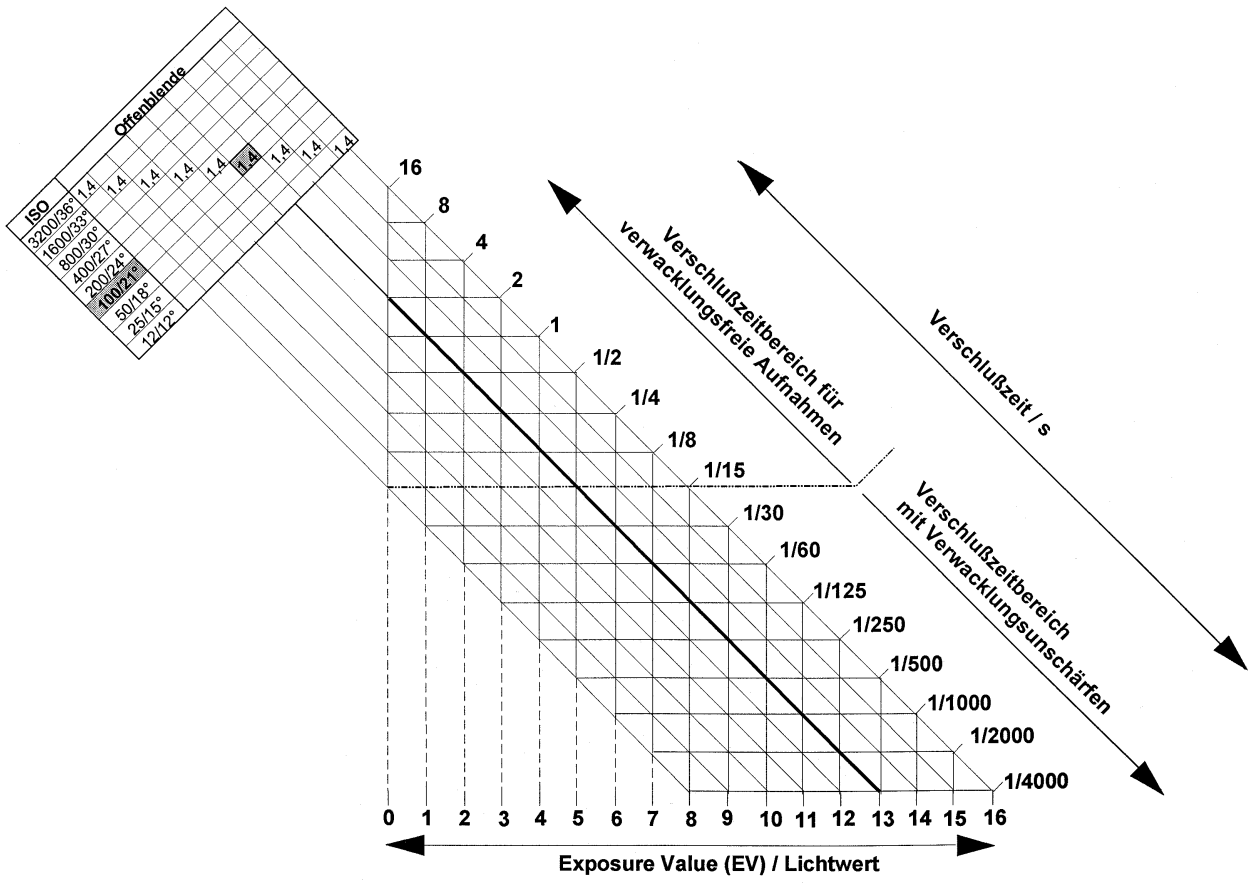

Fig. 3-3 Measuring range of 35 mm SLR camera with T2-Adapter, ISO 100 / 21°

Example 4:
The longest shutter speed measured with cameras with T2 adapter (Fig. 3-3) for ISO 100/21° and the open aperture 1.4 is T_{max} = 2s, and the shortest shutter speed T_{min} = 1/4000 s.
The shortest shutter speed T_{min} of 1/4000 s is measured with film speeds ranging from ISO 25 / 15° to ISO 3200 /36°; the longest shutter speed of 16s is only measured at ISO 12 / 12°; the longest shutter speed with ISO 3200 / 36° is only 1/15s.

According to section 3.2.8.1, no blurring occurs with shutter speeds ≥ 1/15s.

Therefore, the working ranges for cameras with T2 adapter (Fig. 3-3) are as follows:

- shutter speeds 1/15 s...16 s for ISO 12/12°,
- shutter speeds 1/15 s...2 s for ISO 100/21°,
- shutter speed 1/15 s for ISO 3200/36°.

☞ Any kind of stray light entering the viewfinder of the camera falsifies the measuring result of the exposure time to be controlled. Therefore, you should work in a darkened room and, after reading or aligning the exposure time in the viewfinder, you should always cover the viewfinder with the eyepiece cover for SLR before the automatic exposure is triggered.

☞ For the setting of the various measuring techniques and exposure modes, and for the display of exposure times, please see the operating manual of the used 35 mm SLR camera.

3.2.7 Trigger the Exposure

Triggering the exposure by pressing the release button of the SLR camera with your index finger exerts lateral pressure on the camera structure. This can result in blurred micrographs.

Therefore, the exposure should always be triggered with the cable release attached to the SLR camera. There should be no strain between the cable release and the SLR camera.

If available, the selftimer function of the SLR camera can also be used to trigger the exposure. The vibration of the camera structure caused by the short pressing of the release button is no longer effective until the exposure is triggered after the exposure delay (usually 8 ... 10 s).

3.2.8 Further Notes

3.2.8.1 Avoid Blurs

Mirror and shutter functions of the SLR camera can cause vibration of the photomicrography structure resulting in blurred micrographs. The image will be dull, the object structures washed out. This is normally the case with shutter speeds ≤ 1/30 s, and the effect becomes more pronounced with increasing magnifications. The expected exposure time for the exposure to be taken must lie within that shutter speed range in which blurs no longer occur - in this case ≥ 1/15 s. If required, the brightness of the light in the illumination beam path must be attenuated using color-neutral gray filters.

The following gray and neutral-density filters are available for this purpose:

Filter	**d = 32 mm**	**d = 25 mm**	**d = 18 mm**
gray filter 0.50 (50 % transmission)	467840-0000-000		
gray filter 0.12 (12 % transmission)	467841-0000-000		
gray filter 0.03 (3 % transmission)	467842-0000-000		
neutral-density filters 0.25 (25 % transmission)		447836-0000-000	467856-0000-000
neutral-density filters 0.06 (6 % transmission)		447835-0000-000	467855-0000-000

☞ The exposure time for the exposure to be taken can be read off the outside of the camera housing (display or shutter speed setting knob) or from the viewfinder display. The viewfinder must be occluded with the eyepiece cover for SLR after the exposure time has been read or aligned in the viewfinder.

☞ It is recommended to determine the shutter speed range for blur-free exposures of the relevant camera structure before setting up the instrument (see section 2.5).

3.2.8.2 Color Balance in Color Reversal Films

The color balance of a color reversal film of the same type can differ from batch to batch. Such deviations can be compensated for by using commercial color-compensating (CC) filters.
The filter density is designated by a two-digit number and the color by its first letter.

Example 5:

05 - B (blue), 10 - G (green), 20 - R (red): correction of the color balance in color reversal films.

Assessing the Color Balance

- Make test exposures of a specimen area with as much empty background as possible in transmitted-light brightfield.
- View slides on a standard light box, the light source of which has the correct illuminance and the spectral energy distribution of 5500 K.
- The empty background in an exposure series should range from dark gray to middle gray, light gray and white

Determine the Correction Filter

- Place filter of complementary color of the color distortion on the slide to be corrected.

Color distortion	**Color of the CC filter**
Blue	Yellow Y
Green	Magenta M
Red	Bluish green (Cyan) C
Yellow	Blue B
Magenta	Green G
Bluish green	Red R

If, for example a filter of density 10 does not display the required color balance on viewing, you should use a CC filter of half the density for the following exposure (i.e. 05 in this example). Filters of density CC - 05 to CC 10 are usually sufficient for correction.

☞ Perfectly corrected color exposures require the microscope setting, the development process and the film batches to remain unchanged.

3.2.8.3 Darkfield and Fluorescence Photography

Compared to standard photomicrography, the following special conditions apply to darkfield and fluorescence photography:

- The low brightness level frequently encountered calls for long exposure times. In the case of low brightness, switch the beam splitter on the phototube to "100% of light to camera port".
- Fluorescence light is neither daylight nor artificial light, but is generated inside the specimen itself. Normally, daylight film renders better fluorescence micrographs than indoor film.
- Do not be afraid to use fast films. Granularity is hardly ever a problem in fluorescence micrographs.
- The dark or black background often accounts for a substantial part of the area used for automatic exposure metering. Estimate the ratio of bright and dark areas, and correct the exposure time accordingly.
- Because of the high contrast, the exposure latitude is rather high, since luminous structures are always well set off against a dark background, even if different exposure times are used. However, if an exact rendition of fluorescence colors is required, it is recommended to make a series of exposures with different exposure times.
- Some fluorescence dyes will bleach out quickly, especially under highly intense, high-energy excitation light. To protect the specimen, use the aperture diaphragm to use the excitation intensity at least temporarily.

Weak fluorescence is easier to discern in a dark room.

3.2.8.4 Computing the Magnification

– SLR connections, 2.5× / T2 adapters:
The magnification of the image on the 35 mm film M_{film} is the product of objective magnification M_{obj} and the factor of the T2 adapter 2.5×.

$$\mathbf{M_{film} = M_{obj} \times 2.5}$$

– Objective f' = 63 mm with photo eyepieces $M_{eyep.}$, = 10×:
The magnification of the image on the 35 mm film M_{film} is calculated from the objective magnification M_{obj},, the focal length of objective f_{Ob}' = 63 mm and the reference distance of vision l = 250 mm

$$M_{film} = \frac{M_{obj} \times M_{eyep.} \times f_{Ob}'}{l} \qquad M_{Film} = \frac{M_{obj} \times 10 \times 63\ mm}{250\ mm}$$

$$\mathbf{M_{film} = M_{obj} \times 2.5}$$

– If an intermediate imaging system is also used, e.g. an Optovar or zoom system, the factor of the M_z intermediate imaging optics also plays a part in the magnification:

$$\mathbf{M_{film} = M_{obj} \times M_z \times 2.5}$$

3.2.8.5 Further Filters

In addition to the conversion, gray and neutral-density filters listed on page 3-11, the following filters are also available for photomicrography:

Filter	**d = 32 mm**	**d = 25 mm**
Conversion filter CB 6	467851-0000-000	
Conversion filter CB 3	467852-0000-000	
Interference green filter	467803-0000-000	447805-9901-000

3.3 Using Digital Cameras

Some digital cameras have the same or a similar housing as standard 35 mm SLR cameras. The film gate of these cameras contains an area sensor or a scan sensor array instead of the film, and the T2 adapters suitable for the relevant camera can be attached to the objective mount.

These digital cameras can therefore be attached to microscopes from Carl Zeiss, as described in sections 2.3.1 through 2.3.5. However, the following must be taken into consideration:

- Cameras with scan sensor array, e.g. Praktica Color Scan, Leica S1.
  During the exposure, a RGB sensor array, which is approx. 36 mm long, scans the image line by line by moving beyond the 24 mm image height.
  The content of the scanned image is approximately identical to that on 35 mm film.
  The time for the exposure (scanning time for one image) depends on the image brightness and the required resolution, e.g. 180 - 2400 s for full resolution. The motion of the sensor array can cause vibrations resulting in blurred photos.
- Cameras with area sensor, e.g. Kodak EOS DCS 1 (Canon EOS 1 camera housing),
  Kodak DCS 460 (Nikon N90s camera housing)
  The outer dimensions of the sensor chip, i.e. 18.4 mm x 27.6 mm, determine the image contents of the digital photo. Here, the image contents totals approx. ¾ of the photo on 35 mm film.
  Exposure is made via the shutter of the camera.
  In the case of short exposure times, the shutter and mirror slap can cause blurred images (see section 3.2.8.1). The Kodak EOS DCS 1 permits the effect of mirror slap being eliminated by mirror pre-lock.
- The camera models Kodak EOS DCS 3, Kodak EOS DCS 5 and Kodak DCS 420 have integrated area sensors of smaller dimensions.
  If the outer dimensions of the sensor chip are 16.4 mm × 20.5 mm, the image contents of the digital photo totals approx. 2/3 of a photo on 35 mm film.
  If the outer dimensions of the sensor chip are 9.3 mm × 14 mm, the image contents of the digital photo totals approx. 2/5 of a photo on 35 mm film.

Further information on the use of digital cameras is available from your local Carl Zeiss agency or from the following Internet address:

micro@zeiss.de

www.zeiss.de/micro

MAINTENANCE, CARE, TROUBLESHOOTING AND SERVICE

Contents

4 MAINTENENANCE, CARE, TROUBLESHOOTING AND SERVICE

4.1 Instrument Care

Maintenance of the photomicrography components attached to the microscopes is limited to the following operations:

- Switch off the instrument after every use and place instrument cover on it to protect it from dust and humidity.
- Never expose the instrument to inadmissible climatic conditions (high humidity and temperature).

The best way to remove stubborn dirt on glass surfaces, e.g. finger prints or traces of grease and immersion oil, is the use of a piece of cotton wrapped around a wooden stick and a small amount of distilled water or a non-aggressive solution.

- distilled water: clean glass surface using a slightly moistened wad of cotton by moving in circles starting in the middle.
- Optics cleaning solution, consisting of 85% isopropanol and 15% medical alcohol (benzoline): clean glass surface using a slightly moistened wad of cotton by moving in circles starting in the middle.
- Remove dust from optical surfaces using a natural hair brush or an air blower.

Please also see the additional notes on camera maintenance contained in the operating manual of the used SLR camera.

When using the components in humid climatic zones, proceed as follows:

- Store instrument in bright, dry and well ventilated rooms with a humidity of less than 65%: optical components and accessories which are particularly susceptible to the growth of fungus, e.g. objectives and eyepieces, should be stored in a dry closet.
- When the equipment is stored in closed cases for a longer period of time, the growth of fungus can be avoided by including cloths soaked in fungicide in the cases.

The risk of growth of fungus on opto-mechanical instruments always exists in the following conditions:

– Relative humidity of more than 75% and temperatures between +15° C and +35° C for more than three days.

– Installation in dark rooms without air ventilation.

– Dust deposits and fingerprints on optical surfaces.

4.2 Instrument Maintenance

4.2.1 Performing Checks

- Check the battery voltage for operation of the SLR camera. If the battery voltage is no longer sufficient, this is indicated in the SLR camera (e.g. by flashing of the display).
- If any damage is visible, switch off the SLR camera. Repairs may only be performed by authorized service staff; therefore, please contact the Carl Zeiss service department (see page 4-4).

4.2.2 Changing the Batteries

See the relevant notes in the manual supplied by the camera manufacturer.

4.3 Troubleshooting

See the relevant notes in the manuals of the used microscopes and the used SLR cameras.

4.4 Consumables and Tools

Description	Cat. No.	Application
SW 3 ball-headed screwdriver	000000-0069-551	to change tubes and illuminators
Dust cover G	459312-0000-000	to cover the instrument after use

4.5 Requesting Service

All repairs of mechanical, optical or electronic components of the 35 mm SLR camera may only be performed by Carl Zeiss service staff or specially **authorized** personnel.

To ensure the optimum setting and trouble-free function of the components even for a longer period of time, we would recommend you to conclude a service/maintenance contract with Carl Zeiss.

Should any components have to be ordered subsequently, or if service is required, please get in touch with your local Carl Zeiss agency.

Further information is also available in the Internet:

micro@zeiss.de

www.zeiss.de/micro

ANNEX

List of Abbreviations

B	blue
B-function	ball-function (shutter remains open until release button, formerly a ball, is pressed; see T-function)
Br.	suitable for eyeglass wearers
C	Camera, Cyan
CA	Camera, Auflicht (=incident light)
CB	Color Blue
CC	Color Compensation
CFL	Camera and fluorescence(application)
Cpl	Compens-Plan (eyepiece model)
D, d	diameter (e.g. of filters, photo reticles)
DIN	Deutsches Institut für Normung (German standards association)
DX	coding system for the storage of electronically legible information (e.g. film speed)
E-PL	Extra-Plan (eyepiece model)
EV	Exposure Value (of light)
f/1.4	camera lens with focal length f with aperture ratio 1 : 1.4
f'	focal length on the image side
f'_{Obj}	focal length of objective
FL	fluorescence
foc.	focusing
G	green
ICS	Infinity Color-Corrected System
IM	Inverted Microscope
ISO	International Organization for Standardization
k	stop value
Komp.	compensation
Kpl	Kompens-Plan (eypiece model)
l	reference viewing distance 250 mm
M	metric thread, magenta
MC	microscope camera
M_{Film}	magnification of the image on 35 mm film
PL	Plan
R	red
SLR	Single Lens Reflex (camera)
S-Pl	Sonder-Plan (photo eyepiece, projection lens for photomicrography)

SW	wrench opening
T2-Adapter	standard adapter for 35 mm cameras
T-function	Time function (shutter remains open after first press and closes only after second press, see B-function)
T_{max}	maximum exposure time
T_{min}	minimum exposure time
V_{Obj}	magnification of the objective
$V_{eyep.}$	magnification of the eyepiece
V_Z	intermediate magnification
W-PL	Weitfeld-Plan (wide-angle eyepiece model))
Y	Yellow

Physical and Technical Data

°C	Centigrade
hPa	Hecto-Pascal
K	Kelvin
kg	kilogram
m	meter
mm	millimeter
s	second
V	Volt

List of Key Words