



Camera Adapter High Power

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CONTENTS

1	ABOUT THIS MANUAL	5
1.1	Basic information	5
1.2	Display conventions	5
1.3	Other applicable documents	5
1.4	Manufacturer	6
1.5	Customer service	6
1.6	Warranty	6
2	GENERAL SAFETY INFORMATION	8
2.1	Designated use	8
2.2	Classification of laser systems	8
2.3	Laser area	9
2.4	Hazards due to laser radiation	10
2.5	Required training and instruction of operating personnel	10
2.6	Required protection measures	10
3	PRODUCT DESCRIPTION	11
3.1	Items included, accessories and spare parts	11
3.2	General description	11
3.3	Product versions	13
3.4	Signage	14
3.5	Technical data	15
3.6	Lifespan	16
4	INSTALLATION	17
4.1	Safety during installation	17
4.2	Installation location	18
4.3	Mounting variations	18
4.4	Preparation	21
4.5	Near field adjustment	22
4.6	Far field adjustment	23
4.7	Camera lens	24
4.8	Cooling circuit	25
5	START-UP	26
5.1	Safety during start-up and operation	26
5.2	Checking the installation	27

6	MAINTENANCE	28
6.1	Cleaning	28
6.2	Servicing	29
7	UNINSTALLING	30
7.1	Safety when uninstalling	30
7.2	Uninstalling the camera adapter	30
8	STORAGE	31
9	TRANSPORTATION	32
10	DISPOSAL	33
INDEX		34

1 ABOUT THIS MANUAL

1.1 Basic information

This manual provides general information about handling Camera Adapter High Power. In subsequent chapters, the general designation “product” is also used to refer to the Camera Adapter High Power. The product version is indicated by the type code on the rating plate (see page 14, Signage).

This manual contains important information about professional and safe handling of the product. As a result, you should familiarise yourself with the content of this manual before starting to use the product. In case of any queries, please contact RAYLASE Customer Service for information (see page 6, Customer service).

The manual must be accessible to anyone involved in developing, installing, uninstalling or using a laser system with a RAYLASE product. If the product is sold on, this manual or an authorised copy must be passed on with it.

1.2 Display conventions



The signal word WARNING indicates hazards that can lead to injuries or damage unless precautionary measures are taken.

The signal word NOTE indicates general precautionary measures to be observed when handling the product to prevent damage to the product itself.

- Bullet points in a list are shown with a square at the beginning of the line.

Instructions are introduced with an objective and are shown with numbered actions. If necessary, an intermediate result and a final result are specified.

1. First instruction
2. Second instruction
 - An intermediate result is represented by an arrow symbol.
3. Further instruction
 - ✓ An end result is represented by a tick.

1.3 Other applicable documents

- Production log
- Manuals for optional accessories

1.4 Manufacturer

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Argelsrieder Feld 2+4
82234 Wessling
Germany
T: +49 8153 9999 699 | F: +49 8153 9999 296
www.raylase.de | info@raylase.de
Referred to in this text as RAYLASE.

1.5 Customer service

The USB stick supplied contains the manual and answers numerous questions about RAYLASE products. If any questions are not answered, RAYLASE Customer Service will be pleased to assist:

Monday to Friday between 08:00 and 17:00
Germany (Wessling)
T: +49 8153 9999 699 | F: +49 8153 9999 296
support@raylase.de

China (Shenzhen)
T: +86 755 2824 8533 | F: +86 755 8222 8193
info@raylase.cn

1.6 Warranty

The customer's rights in the event of any material or legal defects in the product are set out in RAYLASE's general terms and conditions of business. These can be viewed at:
<https://www.raylase.de/en/terms-and-conditions.html>

RAYLASE GmbH has no obligation to repair any defects occurring under the following circumstances:

- If the product has been operated outside the specifications.
- If unauthorised repairs have been carried out on the product.
- If unauthorised modifications have been made to the product.
- If the product has been connected to non-compatible devices.
- If the product has been damaged by unacceptably high laser power or by focusing the laser on optical surfaces.
- If the product has been damaged by unqualified cleaning of the optics.
- If the warranty has elapsed.

Component Surfaces

Surfaces of aluminium products are either chemically anodised or powder coated to protect the aluminium parts from environmental damage.

Powder coating can cause small visible differences in surface colour or sheen. Anodized surfaces can show milling tracks, areas of slight shading, and localized colour changes.

These variations are due to the production process, and have absolutely no influence on the product's functionality. Such variations are not covered by warranty.

There is no implicit guarantee or warranty regarding suitability for particular purposes. RAYLASE is not responsible for damage resulting from the application. Individual assemblies or other assemblies manufactured by RAYLASE may be subject to different warranty terms. Further information can be found in the corresponding manuals.

2 GENERAL SAFETY INFORMATION

2.1 Designated use

The Camera Adapter High Power is designed for connection of a suitable sensor for monitoring processes and for examining and assessing workpiece surfaces. This typically includes examination using a camera and lens.

2.2 Classification of laser systems

The product can be installed on a range of different laser systems. Every laser system is assigned to a laser class, which must be specified at the output location of the laser radiation (e.g. using a laser warning sign).

The following laser classes are defined in DIN EN 60825-1 and described in DGUV Regulation 11:

Class	Description
1	The accessible laser radiation is not dangerous under reasonably foreseeable conditions.
1M	The accessible laser radiation is in the wavelength range 302.5 nm to 4,000 nm. The accessible laser radiation is not dangerous to the eyes, provided the beam cross-section is not reduced by optical instruments (e.g. magnifiers, lenses, telescopes).
2	The accessible laser radiation is in the visible spectral range (400 nm to 700 nm). Short exposure times (up to 0.25 s) are not dangerous to the eyes. Additional beam components outside the wavelength range 400 nm to 700 nm meet the conditions for Class 1.
2M	The accessible laser radiation is in the visible spectral range 400 nm to 700 nm. Short exposure times (up to 0.25 s) are not dangerous to the eyes, provided the beam cross-section is not reduced by optical instruments (e.g. magnifiers, lenses, telescopes). Additional beam components outside the wavelength range 400 nm to 700 nm meet the conditions for Class 1M.
3R	The accessible laser radiation is in the wavelength range 302.5 nm to 10 ⁶ nm and is dangerous to the eyes. The power or energy is a maximum of five times the permitted Class 2 radiation limit in the wavelength range 400 nm to 700 nm and five times the Class 1 limit for other wavelengths.
3B	The accessible laser radiation is dangerous to the eyes and frequently also to the skin.
4	The accessible laser radiation is very dangerous to the eyes and dangerous to the skin. Diffusely scattered radiation can also be dangerous. The laser radiation can cause a risk of fire and explosion.

2.3 Laser area

For the purposes of accident prevention, the laser area refers to the area in which the maximum permitted radiation value can be exceeded. Laser systems must be assigned and marked according to their laser class and use.

With a corresponding beam intensity, the laser area is defined by the total radiation angle of the deflection unit and by the reflection of all objects that can be irradiated by it. It is important to note that, in addition to reflective surfaces, matt and dark surfaces can also reflect laser radiation and that a laser beam reflected several times can still be dangerous. In addition, the deflection unit can be destroyed by back reflection.

The laser area must have permanently and legibly attached markings in accordance with DIN EN 60825-1. Laser systems must be fitted with the protective mechanisms required for safe operation according to their class and use.

No combustible or explosive objects and liquids may be located in the laser area, as the energy of the laser beam can ignite them.

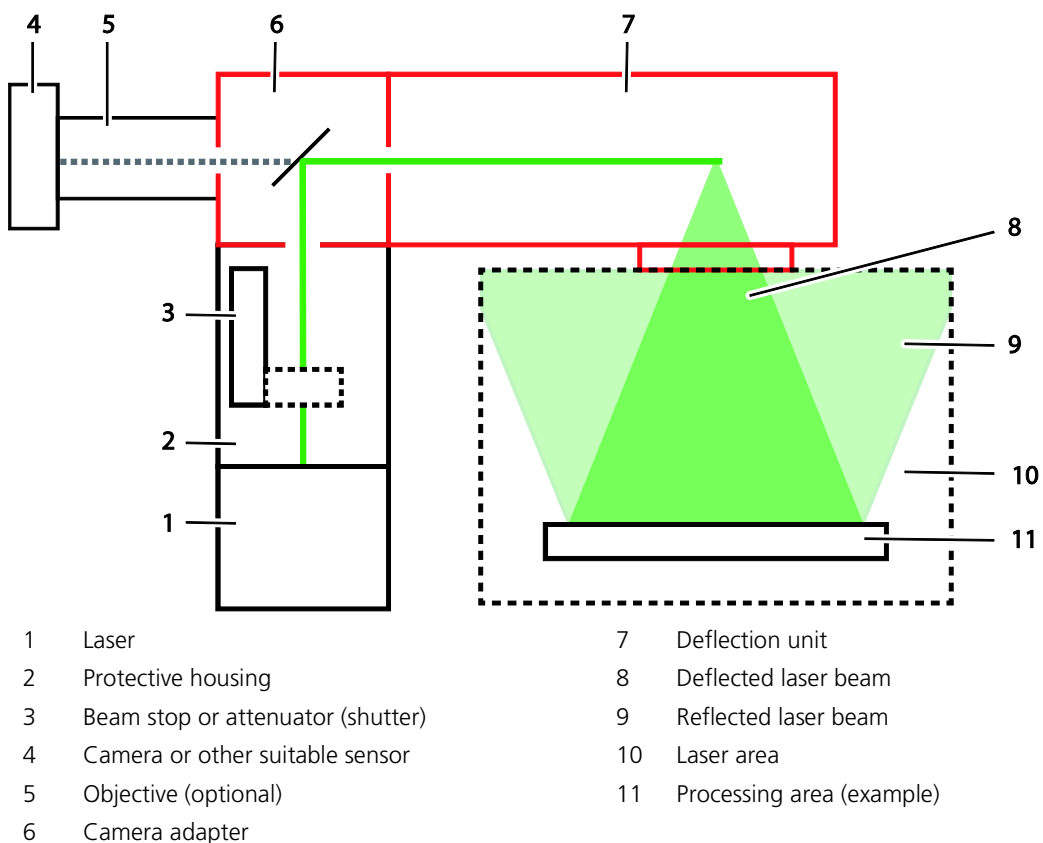


Fig. 1: Laser area

2.4 Hazards due to laser radiation

This operating manual sets out a range of accident prevention measures relating to the use of a sub-assembly for laser systems in an industrial environment.

WARNING

This chapter describes hazards that can result due to interaction with the higher-level laser system. The operator of the higher-level laser system is responsible for safe operation and for securing the surrounding area to prevent hazards that can be caused by laser radiation. They must ensure compliance with all applicable conditions, regulations, laws, standards and directives.

2.4.1 General safety measures

The following general safety measures are to be observed:

- To ensure that the laser beam is immediately switched off in the event of a fault, the laser process must always be monitored. Alternatively, the entire beam path can be in a radiation-proof housing.
- The laser system must be designed in such a way that the laser beam can only be emitted at the beam output on the deflection unit.
- Appropriate protection mechanisms must be in place to prevent unauthorised activation or use of the laser system.
- The maximum permitted input beam diameter may not be exceeded.
- If the materials to be processed can result in toxic vapours, safe extraction of these must be ensured. Oxidising material processing and processing with material removal that is precipitated onto the optics must be handled properly.

2.5 Required training and instruction of operating personnel

The deflection unit is designed exclusively for use in an industrial environment.

Start-up, operation, installation, maintenance and repairs may only be carried out by trained personnel who have been instructed by the laser protection officer and are sufficiently qualified to perform the relevant work.

2.6 Required protection measures

If present in the laser area, protective equipment such as laser protection goggles or special protective clothing is required. The required protective equipment is stipulated by the laser protection officer based on the individual hazards caused by the laser equipment. The laser area must be marked so that the required protective equipment is clearly indicated to all personnel who intend to enter the laser area.

3 PRODUCT DESCRIPTION

3.1 Items included, accessories and spare parts

The items included are typically:

- Camera adapter HP
- Mounting Plate Set CA HP to connect with the deflection unit
- Screen Plate Set CA HP to connect with the collimator
- Adjustment Pipe Set CA HP for adjustment purposes
- USB stick containing manual, declaration of incorporation and design data
- Production log

The product can be expanded with the following optional components:

- Camera objective
- Camera
- Illumination units
- Mounting Block Set CA HP for sideways attachment to a laser unit
- Collimator

3.2 General description

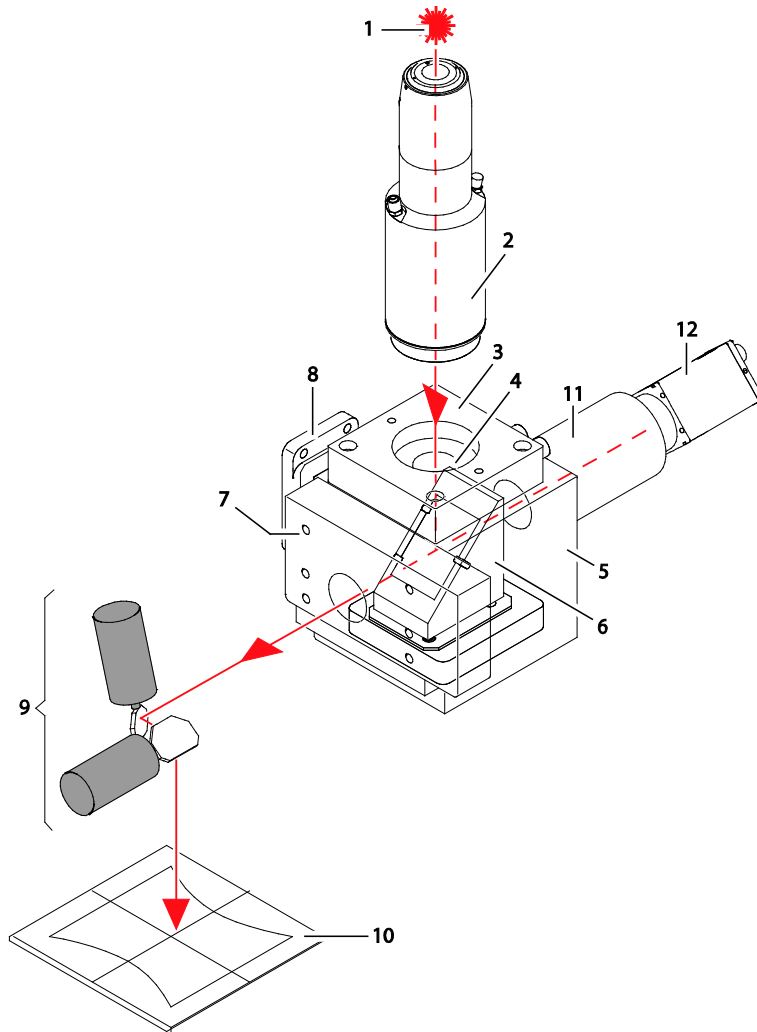
3.2.1 Camera adapter

The camera adapter is equipped with a dichroic element. The dichroic element reflects the monochromatic light from the laser and is transparent for the light used to illuminate the processing area. This enables a camera installed behind the dichroic element to view the marking process through the mirror in the deflection system.

NOTE

- The coating of the dichroic element must be optimised for the wavelength of the laser radiation used. Before mounting the camera adapter, check that the wavelength specified on the rating plate matches the wavelength of the laser used (see page 14, Signage).
- Only suitable lasers may be input (see page 15, Technical data).

The following figure shows the path of the laser beam coming from the laser unit.



- | | | | |
|---|------------------------|----|-------------------------------------|
| 1 | Laser source | 7 | Mounting Plate Set CA HP |
| 2 | Collimator (optional) | 8 | Mounting Block Set CA HP (optional) |
| 3 | Screen Plate Set CA HP | 9 | Deflection unit |
| 4 | Beam input | 10 | Processing area |
| 5 | Camera adapter HP | 11 | Camera lens (optional) |
| 6 | Dichroic element | 12 | Camera (optional) |

Fig. 2: Beam path

3.2.2 Camera lens

Optional

Five camera lenses are currently available for the camera adapter, for different resolutions and field of view sizes.

The light transmitted by the deflection mirror is captured by the adjustable camera lens and reproduced on the camera chip. The camera lenses have special filters that ensure a sharp and brilliant reproduction of the field of view.

There is a C-Mount adapter on the camera lens for attaching compatible cameras.

To improve the image quality, cameras with no infra-red filter should be used. The infra-red light is filtered in the camera lens with the minimum possible light loss. Open beam inputs and outputs must always be covered to prevent soiling or focusing of sunlight.

3.2.3 Illumination units

Optional

A wide range of different illumination units is available to correspond with the relevant observation wavelengths. RAYLASE would be happy to carry out the engineering of your process monitoring or image processing solution for you.

3.2.4 Collimator

Optional

A collimator produces a beam with parallel rays or in other words a collimated beam. A fibre laser can be connected to a RAYLASE deflection unit using a collimator, a fitting collimator mount and the camera adapter. Water-cooled collimator mounts in combination with a camera adapter go by the RAYLASE name Screen Plate Set CA, collimator mounts without water cooling are named Collimator Mount Set CA.

3.2.5 Connections

The Camera Adapter High Power has the following connections:

- to a sensor unit (camera objective)
- to a RAYLASE deflection unit
- to water cooling for the Screen Plate Set CA HP and for the mount of the optical element
- to a laser fibre collimator or laser beam path

3.3 Product versions

Every camera adapter is configured for the parameters defined when ordering and can only be used within these parameters. The parameters are specified in the type code on the rating plate.

Example: Camera Adapter HP XXXX 00X

XXXX = wavelength laser (nm)

001 = Standard model, water-cooled components made of aluminium

002 = Model with water-cooled components made of stainless steel

3.4 Signage

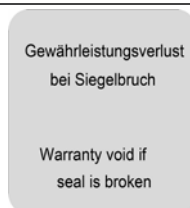
The signs listed below must be attached to the Camera Adapter High Power. These signs must not be removed. Any signs that become illegible must be replaced.



The rating plate and the type code printed on it allow key properties of the product to be determined (see page 13, Product versions). The rating plate contains at least the following information:

- Company name and address
- Product designation
- Series
- Wavelength for which the product is designed
- Serial number
- Year of production (month)

The series and serial number are also used to identify the product.



The protective seal warns against unauthorised opening of the product. If the seal is broken, all warranty entitlements against RAYLASE are rendered void.



A laser warning sign must be attached at the beam output, providing information about the type of radiation, the specific hazards and the protection class. The laser warning sign must be attached in line with DIN EN 60825-1, see page 8, Classification of laser systems, by the manufacturer of the laser system.

3.5 Technical data

3.5.1 Mechanical specifications

Camera Adapter HP	HP 1030 001	HP 1030 002	HP 1070 001	HP 1070 002
Input aperture	30.0 mm			
Weight with adapter plates	approx. 5.8 kg (without objective)			
Dimension (L x W x H)	122 mm x 122 mm x 130 mm (without Screen Plate Set CA HP and Mounting Plate Set CA HP)			
Material water-cooled parts (Screen Plate Set CA HP and mount for optics)	Aluminium	Stainless steel	Aluminium	Stainless steel
Connecting thread Camera objective / sensor	M36x1			
Water connections to Screen Plate Set CA HP and mount for optics	each 2 plug connection 8 mm			

3.5.2 Ambient conditions

Ambient temperature at operation	+15 to +35 °C
Storage temperature	-10 to +60 °C
Humidity	≤ 80 % non-condensing

3.5.3 Configuration

Camera Adapter HP	HP 1030 001	HP 1030 002	HP 1070 001	HP 1070 002
Wavelength laser (reflective)	1020 nm to 1040 nm		1060 nm to 1080 nm	
Max. laser power (BPP > 3) (water-cooled)	8000 W			
Max. laser power (BPP < 3) (water-cooled)	5000 W			
Min. input beam diameter (1/e ²)	15 mm			
Recommended input beam diameter (1/e ²)	18 mm to 20 mm			
Wavelength area for observation	450 nm to 880 nm			

3.5.4 Water cooling

Camera Adapter HP	HP 1030 001	HP 1030 002	HP 1070 001	HP 1070 002
Max. water pressure	< 3 bar			
Min. pressure drop for minimum water flow rate of 2 l/min	0.4 bar			

3.6 Lifespan

The lifespan of the product is 10 years.

4 INSTALLATION

Installation may only be carried out by trained personnel. These trained personnel must be familiar with the general safety regulations that are applicable for installation and operation of opto-mechatronic systems, machines, and plant.

4.1 Safety during installation

WARNING

Risk of injury due to laser radiation

The laser beam (including a reflected beam) can cause severe injuries to the eyes and skin.

- The laser system may only be installed and started up by trained personnel.
- After all work, ensure that the laser system is switched off and secured against being switched on again.

WARNING

Risk of injury due to falling product

A falling product unit can cause injuries.

- The product should be installed by two people wearing suitable safety shoes.
- In case the product fell down it must not be used any more. It has to be sent back to RAYLASE for service.

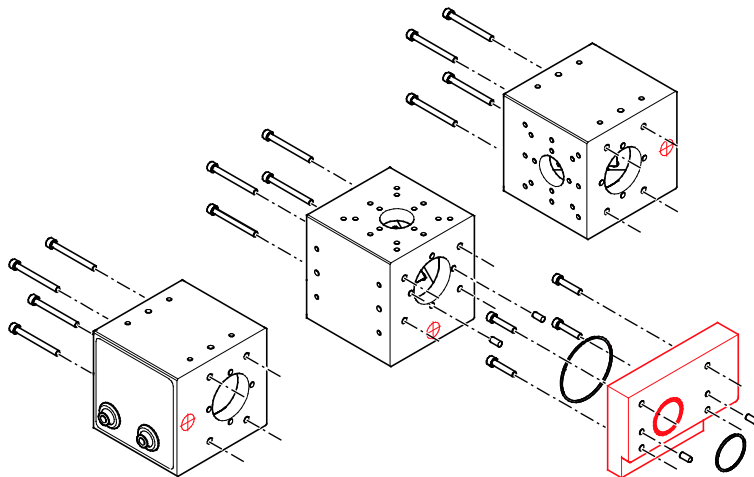
4.2 Installation location

The product may only be operated in closed rooms. It must be protected against contact with liquids. The product is not suitable for use in potentially explosive atmospheres. If the materials to be processed can result in toxic vapours, safe extraction of these must be ensured.

4.3 Mounting variations

The camera adapter can be adapted for different deflection units and scenarios using the following mounting plates shown in red.

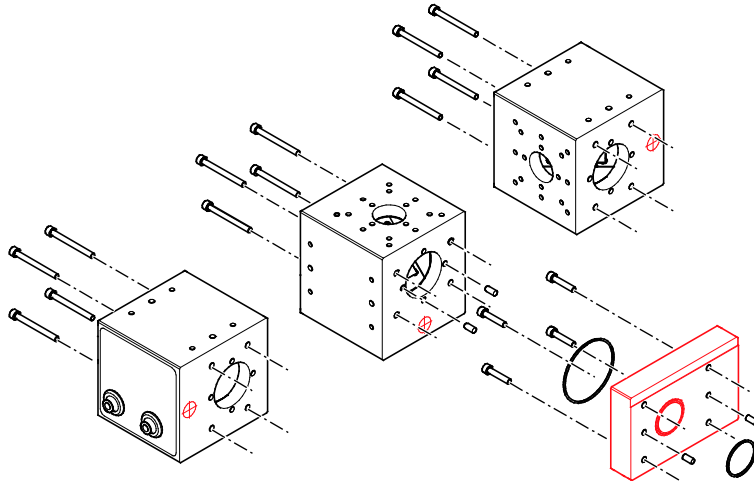
4.3.1 Mounting variation 1



Mounting plate set CA HP 001 for RAYLASE deflection units:

SS-II-E-20L
SS-III-20L
SS-IV-20
SS-II-E-30
SS-III-30
SS-IV-30
SS-V-30

4.3.2 Mounting variation 2



Mounting plate set CA HP 002 for RAYLASE deflection units:

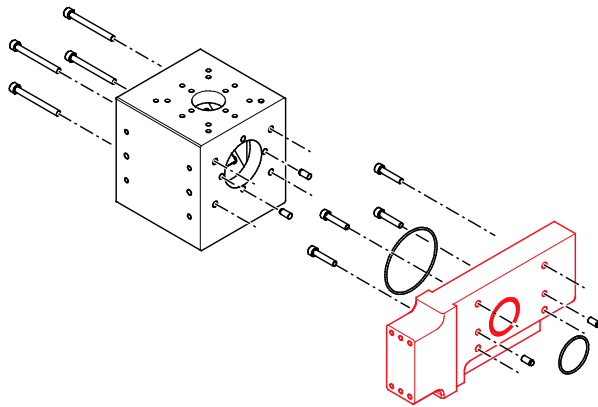
AXIALSCAN-20

AXIALSCAN-30

AXIALSCAN-20 DIGITAL II

AXIALSCAN-30 DIGITAL II

4.3.3 Mounting variation 3



Mounting plate set CA HP 003 for RAYLASE deflection units:

SS-II-E-20L

SS-III-20L

SS-IV-20

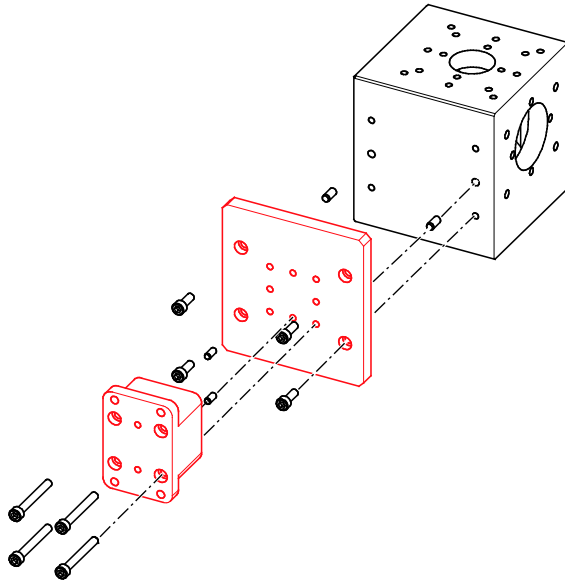
SS-II-E-30

SS-III-30

SS-IV-30

SS-V-30

4.3.4 Mounting variation 4



Mounting Block Set CA HP 001 for sideways attachment to a laser unit

4.4 Preparation

The HP camera adapter is usually supplied pre-mounted on the deflection unit and pre-adjusted as part of a high power welding module. Disconnecting the deflection unit and adjusted camera adapter should be avoided to prevent the ingress of dust particles.

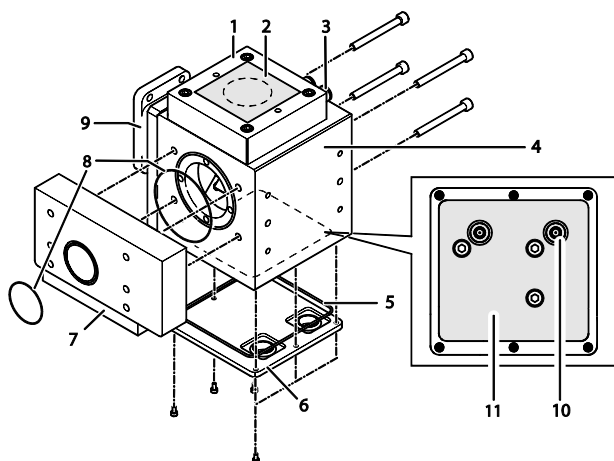
If the camera adapter is supplied as an individual component, the actions described in sections Near field adjustment (see page 22) to Far field adjustment (see page 23) are to be performed:

The following sections describe how to mount the camera adapter and adjust the dichroic element so that the laser beam is output centrally and coaxially from the camera adapter.

During mounting, make sure that the unused apertures on the camera adapter are always covered. Otherwise, dust can get onto the dichroic element. The effect of the laser beam would burn the dust into the surface of the optical element, which can subsequently destroy it.

The mounting variation "MV 001" with Mounting Plate Set CA HP 001 is described as an example. Other variations can be mounted in a similar way.

1. Screw the Mounting Block Set CA HP (9) onto the camera adapter (4).
2. Screw the camera adapter (4) with the Mounting Block Set CA HP (9) onto the mounting surface.
3. If necessary, remove the Mounting Plate Set CA HP (7) and secure the two o-ring sealing (8).
4. Open the protective cover (6). The four locking screws on the mounting plate (11) have been secured after factory adjustment and may not be unscrewed.
5. Secure the sealing cord (5).
6. Remove the protective cover from the input aperture (2).
7. Mount the collimator to the camera adapter using the Screen Plate Set CA HP (1) and connect the fibre of the laser to the collimator according to the collimator manual.

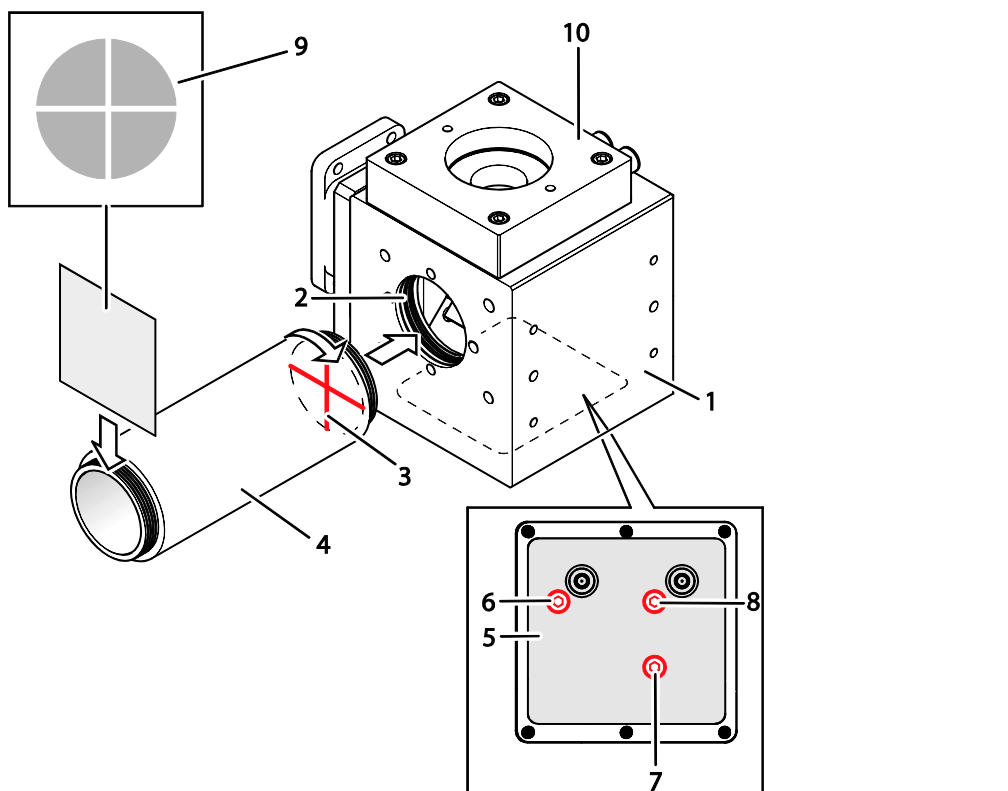


- | | | | |
|---|--------------------------------------|----|---------------------------------|
| 1 | Screen Plate Set CA HP | 7 | Mounting Plate Set CA HP |
| 2 | Input aperture with protective cover | 8 | O-ring sealing |
| 3 | Water cooling Screen Plate Set CA HP | 9 | Mounting Block Set CA HP |
| 4 | Camera adapter HP | 10 | Water cooling optical holder |
| 5 | Sealing cord | 11 | Mounting plate dichroic element |
| 6 | Protective cover | | |

4.5 Near field adjustment

The aim of the adjustment is to adjust the output point of the laser beam so that it strikes the centre of cross-hairs attached in the near field. Variations are corrected by changing the position of the dichroic element.

1. Screw the Adjustment Pipe Set CA HP (4) into the beam output (2) on the camera adapter in such a way that the cross-hairs are located on the beam output as shown.
2. Hold suitable laser paper or, even better, a mineral fibre plate onto the Adjustment Pipe Set CA HP and produce a laser shot with a weak power.
3. Use the focal spot to check whether the laser beam has struck the cross-hairs centrally.
4. If necessary, adjust the vertical position of the dichroic element by evenly screwing in or unscrewing the adjusting screws (6, 7 and 8).
5. Repeat the near field adjustment until the cross-hairs are reproduced centrally to the focal spot.
6. Repeat the far and near field adjustment until a good result is achieved at both cross-hair positions and thus correct input of the laser beam into the deflection system is guaranteed.

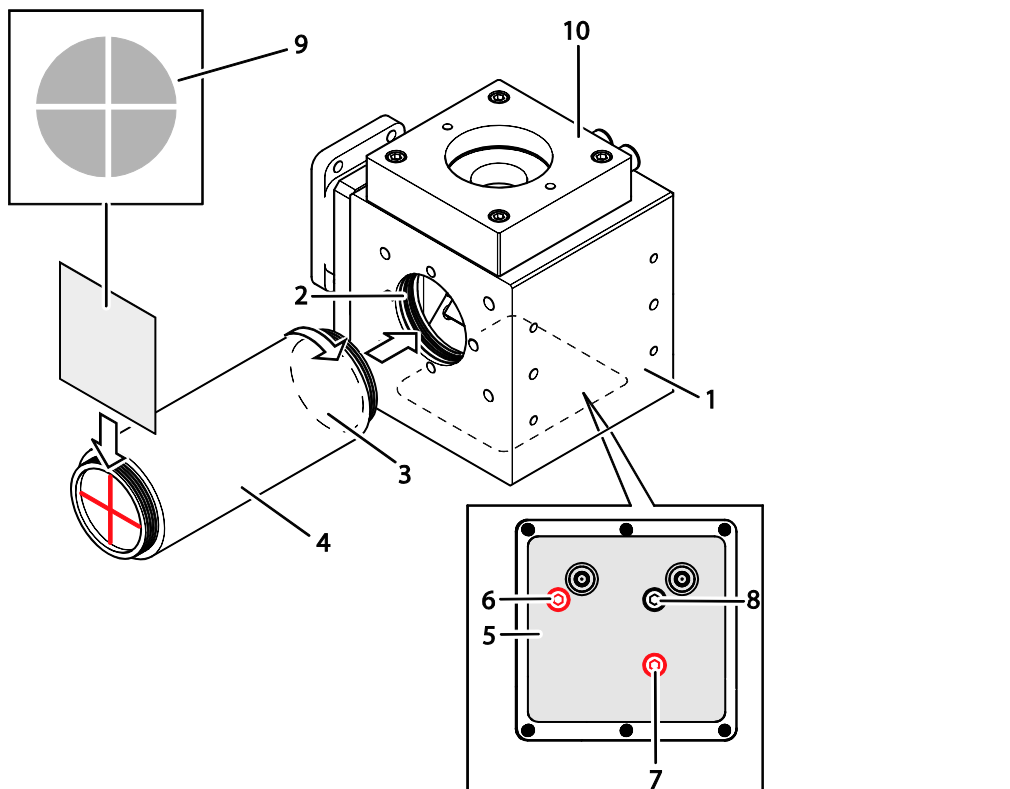


- | | | | |
|---|---------------------------------|----|-----------------------------------|
| 1 | Camera adapter HP | 6 | Adjusting screw |
| 2 | Beam output | 7 | Adjusting screw |
| 3 | Cross-hairs | 8 | Adjusting screw |
| 4 | Adjustment Pipe Set CA HP | 9 | Focal spot on mineral fibre plate |
| 5 | Mounting plate dichroic element | 10 | Screen Plate Set CA HP |

4.6 Far field adjustment

The aim of the adjustment is to adjust the output angle of the laser beam so that it strikes the centre of cross-hairs attached in the far field. Variations are corrected by tilting the dichroic element.

1. Insert the cross-hairs (3) in the Adjustment Pipe Set CA HP (4) and screw the Adjustment Pipe Set CA HP into the beam output (2) on the camera adapter.
2. Hold suitable laser paper or, even better, a mineral fibre plate onto the Adjustment Pipe Set CA HP and produce a laser shot with a weak laser power.
3. Check whether the shadow of the cross-hairs is reproduced centrally to the focal spot on the mineral fibre plate (9).
4. If necessary, tilt the dichroic element in a horizontal and vertical direction using the adjusting screws (6) and (7).
5. Repeat the far field adjustment until the cross-hairs are reproduced centrally to the focal spot.
6. Check the near field adjustment again and repeat the process until the optical path of the laser beam is set precisely for both positions.

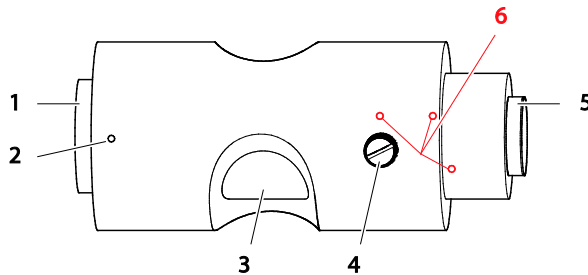


- | | | | |
|---|---------------------------------|----|-----------------------------------|
| 1 | Camera adapter HP | 6 | Adjusting screw |
| 2 | Beam output | 7 | Adjusting screw |
| 3 | Cross-hairs | 8 | Bearing screw (do not twist) |
| 4 | Adjustment Pipe Set CA HP | 9 | Focal spot on mineral fibre plate |
| 5 | Mounting plate dichroic element | 10 | Screen Plate Set CA HP |

After successful adjustment of the laser beam alignment:

1. Mount the deflection unit as described in the associated manual.
2. Mount the camera lens and the camera.

4.7 Camera lens



- | | | | |
|---|-----------------------------------|---|---|
| 1 | Connecting thread for camera lens | 4 | Knurled screw |
| 2 | Grub screws | 5 | Connecting thread for camera (C-Mount) |
| 3 | Inner cylinder | 6 | Locking screws (secured by lacquer, do not unscrew) |

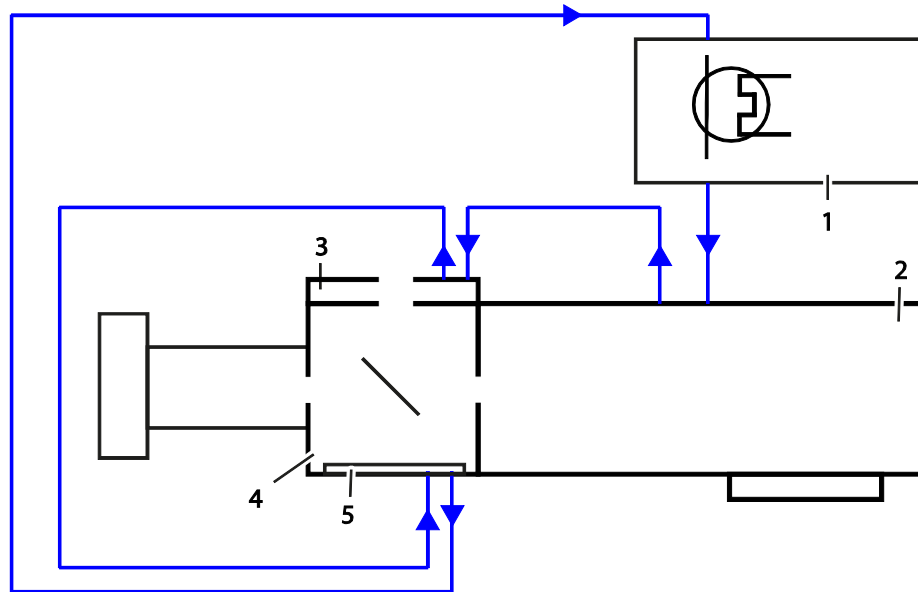
Fig. 3: Camera lens

The aim of the adjustment is to align and focus the camera image on the processing area.

1. Screw the camera lens into the camera adapter as far as it will go using the connecting thread (1). Only tighten the camera lens slightly at the stop.
2. Screw the camera onto the connecting thread (5) as far as it will go. Only tighten the camera slightly at the stop. Excessive tightening damages the thread and can lead to destruction of the camera or the camera lens.
3. Establish an electrical connection between the camera and the control computer and start up the camera in line with the associated manual.
4. Unscrew the knurled screw (4), approximately set the focus and tighten the knurled screw again.
5. Slightly unscrew the three grub screws (2) and turn the entire camera lens until the field of view corresponds to the X/Y alignment of the processing area. While the grub screws are unscrewed, the focus may not be adjusted, otherwise there is a risk of mechanical damage.
6. Slightly tighten one of the grub screws (2) again to prevent accidental twisting.
7. Precisely set the focus and fix the setting by slightly tightening the knurled screw (4).

4.8 Cooling circuit

For effective cooling, the components that carry cooling water should be connected as shown below:



- | | | | |
|---|-------------------------------|---|----------------|
| 1 | Cooler (provided by customer) | 4 | Camera adapter |
| 2 | Deflection unit | 5 | Optical holder |
| 3 | Screen Plate Set CA HP | | |

5 START-UP

Start-up and operation may only be carried out by trained personnel with regular laser safety training. When preparing for operation, it must be ensured that the mirrors in the deflection unit are always correctly actuated and that the laser beam is switched off when the mirrors are stationary.

5.1 Safety during start-up and operation

WARNING

Risk of injury due to improper handling

Improper handling can overload and destroy the dichroic element during operation. Destroyed optical elements can deflect the laser beam onto the protective housing, heating it severely or destroying it. This can result in a risk of burns or uncontrolled escape of laser radiation from the protective housing.

- Ensure optically correct input of the laser beam into the camera adapter and check this before start-up. Fibre collimator and Screen Plate Set CA HP have to fit perfectly.
- Make sure that no water is splashed onto the camera adapter.
- Check whether the laser wavelength corresponds to the specified wavelength of the camera adapter.

WARNING

Risk of burns and fire due to heating

If the diameter of the laser input beam exceeds the permitted value, the mechanical system is severely heated. This results in a risk of burns when touching the hot components. If any highly flammable materials are in the vicinity, it can result in fire.

- Observe the specified maximum input beam diameter.
- Before starting up the deflection unit, make sure that the input beam diameter is not exceeded.

WARNING

Risk of injury due to laser radiation

The laser beam (including a reflected beam) can cause severe injuries to the eyes and skin.

- The laser system may only be installed and started up by trained personnel.
- After all work, ensure that the laser system is switched off and secured against being switched on again.

5.2 Checking the installation

Before start-up and operation of the deflection unit, check the following points:

1. Check whether the mechanical installation has been carried out completely and correctly (see page 17, Installation).
2. Check that the camera adapter has a suitable dichroic element. To do this, refer to the camera adapter rating plate and compare the details with the application (see page 15, Technical data) and (see page 13, Product versions).
3. Check that the accessible optical components are free of dust and clean. If not, they must be cleaned (see page 28, Cleaning).

6 MAINTENANCE

Maintenance may only be carried out by trained personnel. These trained personnel must be familiar with the general safety rules for electrical engineering, optics, mechanics and laser technology.

6.1 Cleaning

WARNING

Risk of injury due to incorrect cleaning

Incorrect cleaning can cause damage to optical elements (e.g. due to scratching). Damaged optics can then be destroyed during operation, deflecting the laser beam onto the protective housing. This can result in a risk of burns or uncontrolled escape of laser radiation from the destroyed protective housing.

- Only clean optical components if you have sufficient knowledge and experience of handling optics for laser components and laser systems.
- Precisely follow the instructions for cleaning the optics set out in this chapter.

6.1.1 Cleaning the housing

1. When cleaning the housing, do not touch the optical surfaces. Cleaning these is a separate task.
2. Before cleaning, ensure that the laser system is switched off and secured against being accidentally switched on again.
3. Clean the camera adapter housing with a soft lint-free duster.
4. If there is more severe dirt, moisten the cloth with a non-aggressive cleaning solution (e.g. soap solution).

6.1.2 Cleaning the dichroic element

The dichroic element is maintenance free. In case of soiling, it may only be cleaned by experienced specialist technicians. The dichroic element can only be cleaned through the output aperture on the camera adapter.

1. Before cleaning, ensure that the laser system is switched off and secured against being accidentally switched on again.
2. Blow off any loose particles from the surface with clean and oil-free compressed air. Note that the compressed air in workshops may contain oil particles and in this case is unsuitable for cleaning optics.
3. Fold a lens cleaning paper several times until it is relatively stiff. Pick up one end of the paper with angled beak tweezers and moisten the other end with ethanol.
4. Place the end of the moistened cloth on the optics and pull it slowly across the optics. Exert as little pressure as possible and do not rub it over the optics.
5. Remove any remaining ethanol residue with a folded dry lens cleaning paper.
6. Repeat this procedure until the surface is completely clean. Use a new lens cleaning paper each time.

6.2 Servicing

No specific service interval is specified.

1. Check regularly whether all stickers and signs are present and legible (see page 14, Signage).
2. Replace any missing or illegible stickers or signs.

7 UNINSTALLING

7.1 Safety when uninstalling

WARNING

Risk of injury due to falling product

A falling product unit can cause injuries.

- The product should be installed by two people wearing suitable safety shoes.
- In case the product fell down it must not be used any more. It has to be sent back to RAYLASE for service.

7.2 Uninstalling the camera adapter

1. Switch off the laser system and secure it against accidentally being switched on again.
2. First follow the dismantling instructions in the deflection unit manual.
3. Detach the connection to a beam delivery or remove the fibre collimator.
4. Unscrew the fastening screws and carefully remove the camera adapter.
5. Pack the camera adapter in a dust-proof container.

8 STORAGE

The camera adapter must be stored in a dust-free location and under the specified ambient conditions (see page 15, Ambient conditions).

9 TRANSPORTATION

WARNING

Damage due to improper transportation

During transportation or shipping of the camera adapter there is a risk of it being damaged.

- Seal the camera adapter in a dust-proof container before transportation.
- Transport and ship the camera adapter only in the original packaging.

10 DISPOSAL

Observe the applicable regulations for disposal of the product.

Index

A

Accessories	11
Ambient conditions	15

C

Checking the installation	27
Classification (laser systems)	8
Cleaning	28
Configuration	15
Connections	13
Customer service	6

D

Designated use	8
Dichroic element	28
Display conventions	5
Disposal	33
Documents, other applicable	5

H

Hazards	10
---------	----

I

Installation	17
Safety	17
Instruction, required	
instruction	10
Items included	11

L

Laser area	9
Laser radiation	10
Laser system	
classification	8
Laser warning sign	14

M

Maintenance	28
Cleaning	28

Servicing	29
Manufacturer	6

O

Operating personnel	
training and instruction	10
Other applicable documents	5

P

Product description	11
Product versions	13
Protection measures, required	10
Protective equipment, required	10
Protective seal	14

R

Rating plate	14
--------------	----

S

Safety	
Installation	17
Uninstalling	30
Servicing	29
Signage	14
Spare parts	11
Start-up	26
Storage	31

T

Technical data	15
Training, required	10
Transportation	32

U

Uninstalling	30
Safety	30

W

Warranty	6
Water cooling	15



MVC - Machine Vision Control

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