RAYLASE
focus on laser

3-Axis Subsystem AS for Laser Beam Deflection

AXIALSCAN-50

This manual has been compiled by RAYLASE for its customers and employees.

RAYLASE reserves the right to change the product described in this manual and the information contained therein without prior notice.

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1 BASIC SAFETY INSTRUCTIONS

1.1 Laser safety

The user is responsible for safe operation and for safeguarding the surrounding area against hazards that can be caused by laser radiation. OEM customers must ensure compliance with all local and national regulations.

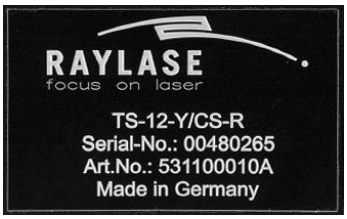
1.2 Laser shutter

The subsystem is designed to focus and deflect an input laser beam and output it again. The subsystem cannot block or weaken the laser beam. To prevent unwanted emission of the laser beam, above a particular danger class the laser device must be fitted with a shutter (⇨ page 5, Classification of laser devices).

The laser device must be of sufficient quality that the laser beam can only be emitted at the beam output on the subsystem.

1.3 Signs

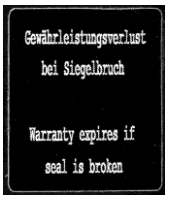
The following signs must be attached to the subsystem. These signs may not be removed. Signs that have become illegible must be replaced.



The **rating plates** and the identification codes printed on them can be used to determine the type of the subsystem (⇨ page 11, Rating plate code). The serial number and the item number are also used to identify the subsystem.

The **ground symbol** identifies the ground connection on the subsystem. This connection can be connected to the laser housing via a plug connection to increase the interference resistance.

The **CE symbol** confirms the subsystem's compliance with European directives. It indicates that the subsystem is approved for free trade within the EU.



The **seal labels** warn against unauthorized opening of the subsystem. If a seal is broken, all warranty claims against RAYLASE are void.

A **laser warning sign** must be attached at the point where laser radiation is emitted. This provides information about the type of radiation, specific hazards and the degree of protection. The laser warning sign is attached by the OEM customer in accordance with the laser device's classification (⇨ page 5, Classification of laser devices).

1.4 Classification of laser devices

The subsystem can be fitted on various laser devices. Every laser device is assigned to a particular danger class, which must be specified at the point where laser radiation is emitted, e.g. using a warning sign. The following classifications are defined in DIN EN 60825-1:

Class	Description
1	The accessible laser radiation is not dangerous under reasonable foreseeable conditions.
1M	The accessible laser radiation is in the wavelength range of 302.5nm to 4,000nm. The accessible laser radiation is not dangerous to the eyes, as long as the cross-section is not reduced by optical instruments (magnifying glasses, lenses, telescopes).
2	The accessible laser radiation is in the visible spectrum (400nm to 700nm). Short-term exposure (up to 0.25s) is not dangerous to the eyes. Additional radiation components outside the wavelength range from 400nm-700nm meet the requirements for class 1.
2M	The accessible laser radiation is in the visible spectrum from 400nm to 700nm. Short-term exposure (up to 0.25s) is not dangerous to the eyes, as long as the cross-section is not reduced by optical instruments (magnifying glasses, lenses, telescopes). Additional radiation components outside the wavelength range from 400nm-700nm meet the requirements for class 1M.
3R	The accessible laser radiation is in a wavelength range of 302.5nm to 10,600nm and is dangerous to the eyes. The power or energy is a maximum of five times the limit for permissible class 2 radiation in the wavelength range from 400nm to 700nm.
3B	The accessible laser radiation is dangerous to the eyes and frequently to the skin.
4	The accessible laser radiation is extremely dangerous to the eyes and dangerous to the skin. Even diffuse scattered radiation can be dangerous. The laser radiation can cause fires or a risk of explosion.

Note: Bear in mind that the subsystem changes the position at which the beam is emitted and the new beam output must be marked with a warning sign showing the appropriate classification.

Note: The subsystem can change the classification of the laser device, particularly if it is fitted with a focusing lens. The laser device may require additional protective equipment as a result.

1.5 Laser area

For the purposes of accident prevention, the laser area is defined as the area in which the maximum permitted radiation value can be exceeded. This is generally applicable for class 3B, 3R and 4 lasers. For class 1 to 2M laser devices, a laser area can be produced by focusing the laser beam.

A sufficient beam intensity produces a laser area that covers the entire radiation angle of the subsystem and includes the reflection from all objects that can be exposed to the radiation as a result. Note that even apparently diffuse surfaces can reflect laser radiation and a laser beam that has been reflected several times can still be dangerous.

The laser area must be indicated by corresponding warning signs or lamps and protected by appropriate shading and interlock switches.

No flammable or explosive objects or liquids should be located in the laser area.

This operating manual interprets a selection of accident prevention regulations from the point of view of using laser subsystems in industrial plants. However, the applicable local and national standards, rules and regulations are binding.

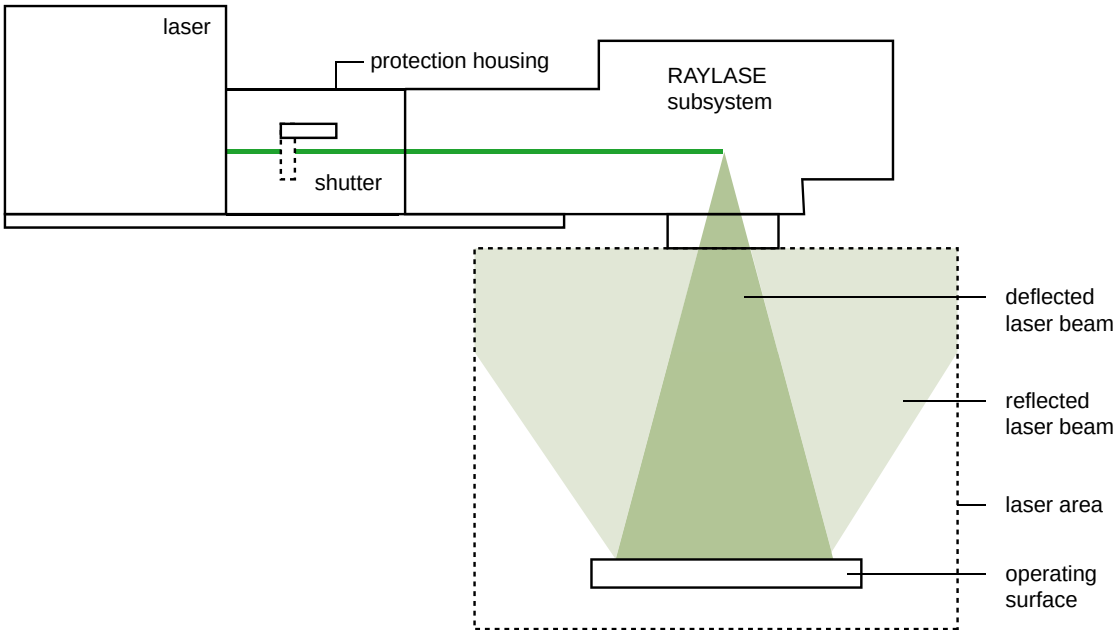


Fig. 1
Laser area

2 BASIC INFORMATION

2.1 Introduction

Chapters 1 to 8 of this operating manual describe the general handling of subsystems the following series: AXIALSCAN AS-50. See the data sheet in the appendix for the different features. For details of the type you are using, refer to the rating plate.

This operating manual contains important information on qualified and safe handling of the subsystem. You should therefore familiarize yourself with the content of this manual before using the subsystem for the first time. In case of any queries, please contact RAYLASE.

The operating manual must be accessible to anyone who will be involved in developing, installing or using a laser device featuring the RAYLASE subsystem. If the subsystem is sold on, this operating manual or an authorized copy must be passed on with it.

2.2 Package contents

Standard:

- Subsystem
- Manual

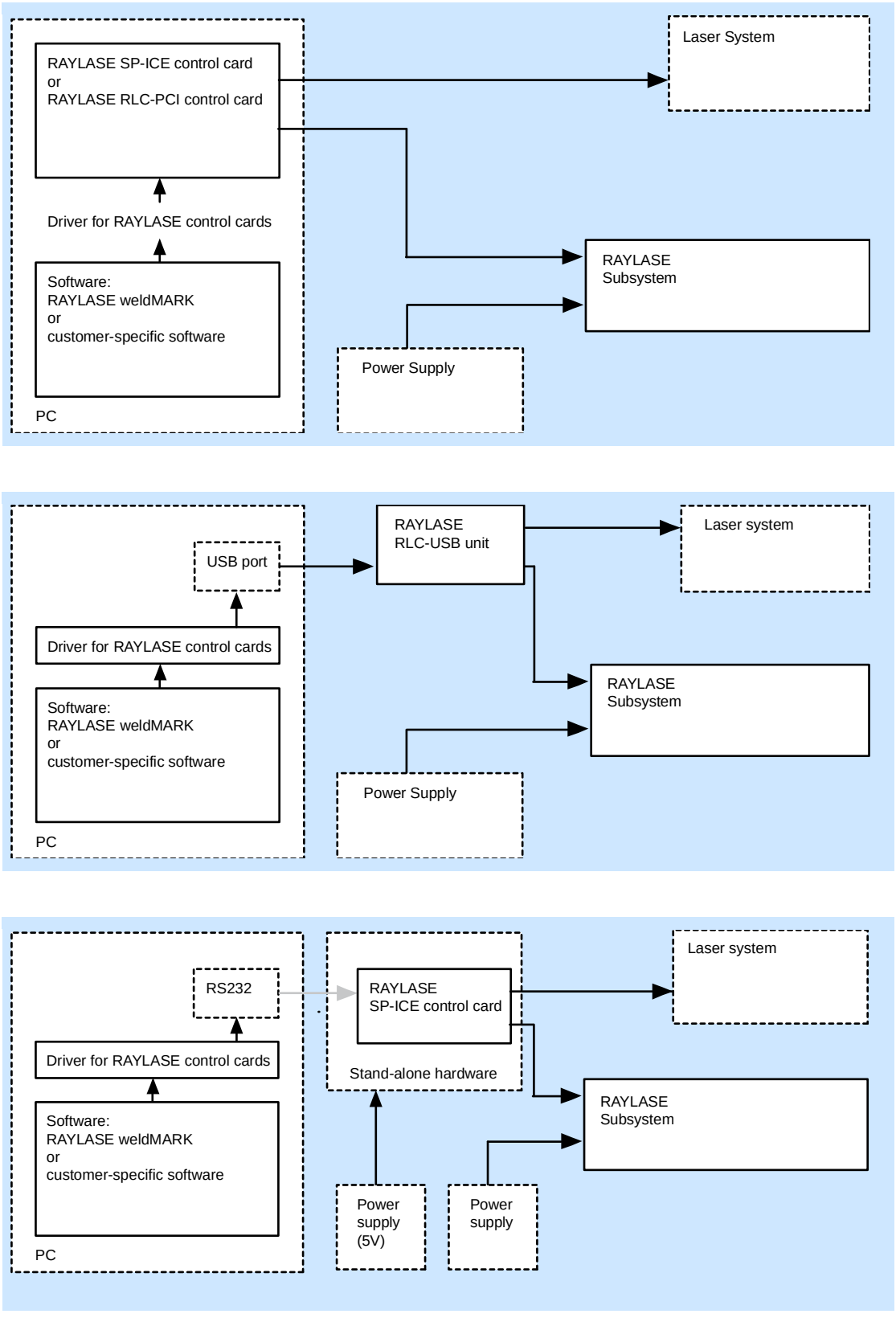
Optional:

- Protection window
- Control card
- Connecting cable between control card and deflection unit
- Software package

2.3 Module overview

The illustration below shows three typical digital laser devices that are equipped with RAYLASE and customer-specific (indicated by dotted lines) modules.

Fig. 2
Module overview



2.4 Warranty

The rights of the customer in respect of any defects in quality or deficiencies in title are governed by the general conditions of business of RAYLASE AG. These conditions are available for review on our website.

Please pack the product in the original packaging or in packaging that provides equivalent protection for shipping.

RAYLASE shall not be obliged to repair defects under the following circumstances:

- If persons not authorized by RAYLASE have attempted to repair the product.
- If persons not authorized by RAYLASE have modified the product.
- If the product has been used improperly.
- If the product has been connected to incompatible devices.
- If the product has been damaged because of inadmissible high laser power or focusing the laser on optical areas.
- If the product has been damaged because of unqualified cleaning of the optical areas.

Note: No implicit guarantee or warranty of suitability for specific purposes has been made. RAYLASE is not responsible for damages arising from use of the product. Individual assemblies or other assemblies manufactured by RAYLASE may be subject to separate warranty conditions. Refer to the corresponding manuals for further information.

2.5 Manufacturer

RAYLASE AG
Argelsrieder Feld 2+4
82234 Wessling
Germany
Tel.: +49 (0) 81 53 - 88 98 - 0
Fax: +49 (0) 81 53 - 88 98 - 10
http://www.raylase.de
E-mail: info@raylase.de

2.6 Customer Service

The RAYLASE support services are available for your problems either in respect to the sub-system or this manual. Before calling for support, please make sure you refer to any appropriate sections in this manual that may answer your questions.

If you need further assistance call RAYLASE customer service department, Monday through Friday between 8 A.M. and 4 P.M. (Middle European Time).

The customer service personnel will be able to give you direct assistance and answers to your questions.

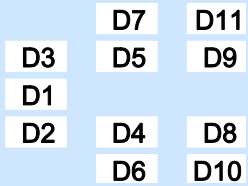
Germany (Wessling)

+49 (0) 81 53 - 88 98 - 0

... ask for the customer service department

2.7 Status LEDs

The status LEDs allow you to check important functions and statuses on the deflection unit. If the deflection unit has status LEDs (depends on type), they are located behind a window on the rear of the deflection unit.

LED arrangement	Name	Color	Meaning	
	D1	red	CLK error	Data transmission faulty. Cable defective.
	D2	red	Parity error Z	
	D3	---	not used	
	D4	green	Temp. status Z	Temperature status available if LEDs are lit.
	D5	---	not used	
	D6	orange	New data Z	New data is being transferred if status LEDs are lit.
	D7	---	not used	
	D8	red	Error Z	Galvanometer scanner or driver electronics defective. Power supply defective if LEDs are flickering.
	D9	---	not used	
	D10	green	+VCC	Power supplies ready for being used if LEDs are lit.

3 TECHNICAL DATA

This section outlines the common features of all subsystems. For type-specific features, refer to the data sheets in the appendix. The individual data can be assigned using the rating plate in conjunction with the identification code (⇨ below, Rating plate code).

3.1 Conformity with directives

The subsystem conforms to the requirements of the following directives:

- EU Directive 2004/108/EG or German law on electromagnetic compatibility (EMVG)
- EU Directive 2002/95/EC or German law on electrical equipment (ElektroG)
- For details of conformity with other directives, contact RAYLASE.

3.2 Rating plate code

The subsystem is equipped with rating plates The following type designation is used in the data sheets in the appendix:

Type designation
AS-50 AXIALSCAN
Beam input aperture (mm)
Coating
Min. field size (mm x mm)
Interface
D2...Digital interface
Additional or customer no.
XX XX XX [XXX] XX /X

4 FUNCTIONAL DESCRIPTION

4.1 Subsystem

The subsystem can be used to deflect a laser beam in X and Y directions. This results in a two-dimensional plane, within which a laser can be directed at any position. This area is known as the "operating field" and is shown in fig. 3. Deflection is performed by two mirrors, each of which is moved by a galvanometer scanner.

The focusing properties of the laser beam subsystem are determined by the linear translator. The linear translator is fitted with one or two focusing lenses. An additional lens with linear movement allows the focusing length to be adjusted.

In these systems, the lens with linear movement is moved within a small range by a galvanometer unit. This so-called linear translator allows the focusing length to be adjusted to the relevant deflection angle of the deflection unit. Compared to an F-Theta lens, this provides a relatively large operating field, in which the laser beam can be optimally focused at every point. The size of the operating field is set manually during installation (⇨ page 21, Adjusting the field size). The optical system and the electronic components of the deflection unit can be protected against contamination by installing a protection window over the beam output (⇨ page 14, Protection window).

4.2 Functional principle

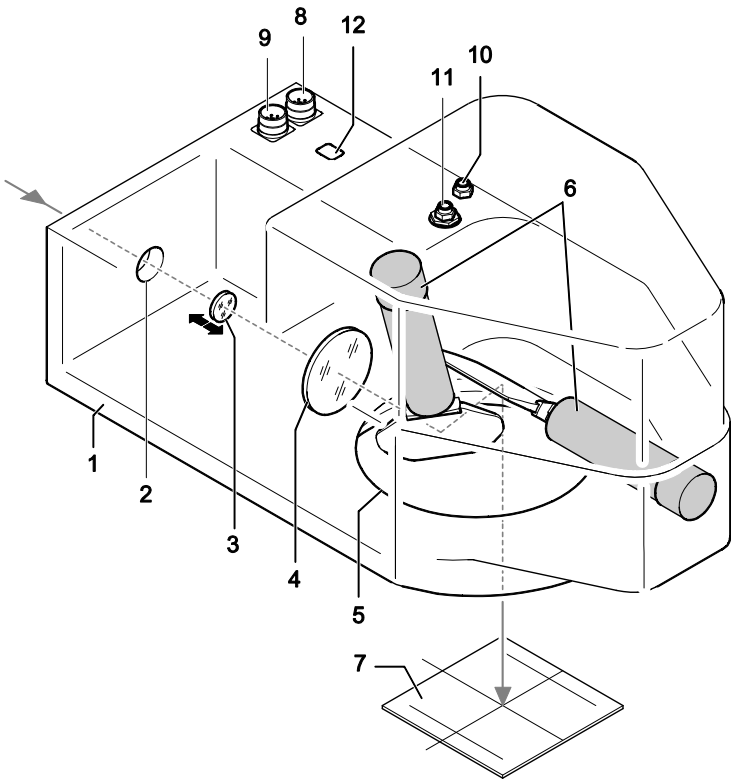


Fig. 3
Functional description

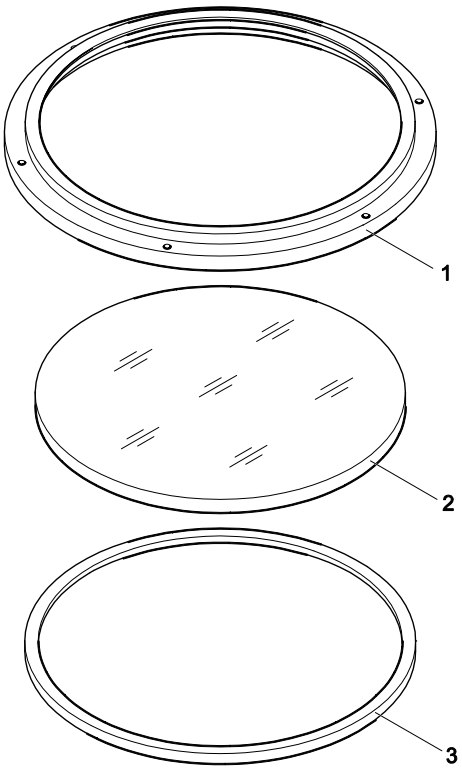
1 Subsystem
2 Beam input
3 Lens with linear movement
4 Focusing lens
5 Beam output
6 Galvanometer scanner with mirror
7 Operating field
8 Power supply of subsystem
9 Digital interface of deflection unit
10 Input coolant
11 Output coolant
12 Status LEDs

Important information:
When connecting the water cooling, make sure that no coolant gets into the subsystem. The units are not waterproof and liquids can damage both the optical system and the electronics.

For subsystems fitted with a protection window only

4.3 Protection window

Fig. 4
Protection window



1 Mount
2 Protection window
3 Clamp ring

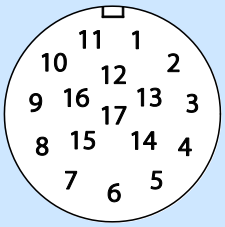
Installation instructions

- Before installation, check the protection window for dirt, scratches or cracks.
  - If the protection window is dirty, it must be cleaned (⇨ page 23, Instructions for cleaning protection windows).
  - If the protection window is scratched or cracked, it must be replaced.
- Screw the protection window and mount into the beam output on the deflection unit until it is positioned securely.

4.4 Interfaces of the subsystem

4.4.1 Digital Interface

The subsystem is connected to a RAYLASE control card using the 17-pin EPIC connector. All signals are compatible with RAYLASE's extended function XY2-100 standard.



17pol EPIC female

PIN	Signal	PIN	Signal
1	-CK	10	+ZCH
2	+CK	11	-Status1
3	-Sync	12	+Status1
4	+Sync	13	-PCH
5	-XCH	14	+PCH
6	+XCH	15	-Status2
7	-YCH	16	+Status2
8	+YCH	17	GND
9	-ZCH		

I = Diff. Input, nc = not connected, O = Diff. Output

Specifications

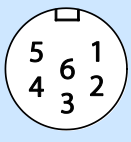
Diff. Input-, Diff. Input+	
Input voltage	5V
Input threshold	200mV
Hysteresis	typ. 45mV
Input impedance	120Ω
ESD protection	±15kV

-

Diff. Output-, Diff. Output+		
Output low	max. 0.6V	max. 40mA
Output high	min. 2V @ 50Ω	max. 40mA
ESD protection	±10kV	

4.4.2 Power supply

The 6-pin EPIC connector provides the linear translator with power. The power supply must be provided by the OEM customer. Refer to the following connection and parameter table:



9 PIN EPIC male

PIN	Designation	PIN	Designation
1	+15V	4	-15V
2	+15V	5	+15V
3	GND	6	GND

5 INSTALLATION

The following sections describe installation of the subsystem in a laser device. When doing this, it is essential to check that the laser beam is input into the subsystem and output from the subsystem centrally. Otherwise, misalignment of the laser beam will occur each time the focus is changed. The subsystem is adjusted prior to delivery and do not need to be adjusted in the field.

Warning:

- The laser beam can cause severe injury to the eyes and the skin. Note that even apparently matt objects can reflect the wavelength of laser beams. All personnel in the room must wear appropriate laser protection goggles and, if necessary, protective clothing.
- Never look directly at the laser beam, even when wearing protective goggles.
- The subsystem may require the laser device to be assigned to a different danger class (⇨ page 5, Classification of laser devices).
- The laser must be switched off during installation.
- We recommend that the laser area is completely protected by an appropriate working chamber. If this is not possible, appropriate protective measures for the laser class must be implemented.
- The mirrors in the deflection unit must move freely after installation of the deflection unit. No components of the laser device may protrude into the deflection unit.
- The laser device must be of sufficient quality that the laser beam can only be emitted at the beam output on the deflection unit.
- The "Laser radiation" accident prevention regulations (BGV B2) must be observed.
- Connecting cables may not be subjected to mechanical strain.
- The subsystem must be protected against moisture, dust and corrosive vapors.
- The optical components may only be touched when wearing unpowdered latex gloves.
- The subsystem must be protected against static discharge and strong electromagnetic fields.
- The power density of the input laser radiation may not exceed the maximum permissible power density of the optical components in the subsystem.
- The beam path and the function of the subsystem must be tested after installation.
  We recommend performing all tests with a danger class 1 or 2 laser to minimize the risk of injury. If this is not possible, the laser used must be set to the lowest possible power. This setting must be secured against accidental adjustment.

5.1 Mount subsystem

- Carefully remove the protective cover over the beam input with a small screwdriver.
- To install the subsystem, insert locating pins into the corresponding holes and attach the subsystem to the prepared installation surface using screws.
  Note: The subsystem may only be installed using the pins and screws specified by RAYLASE. Follow the installation drawing supplied.

5.2 Checking the beam coupling

5.2.1 Preparation

In order to be able to check the beam coupling, all components located in the beam path must be removed. Take note of the following steps:

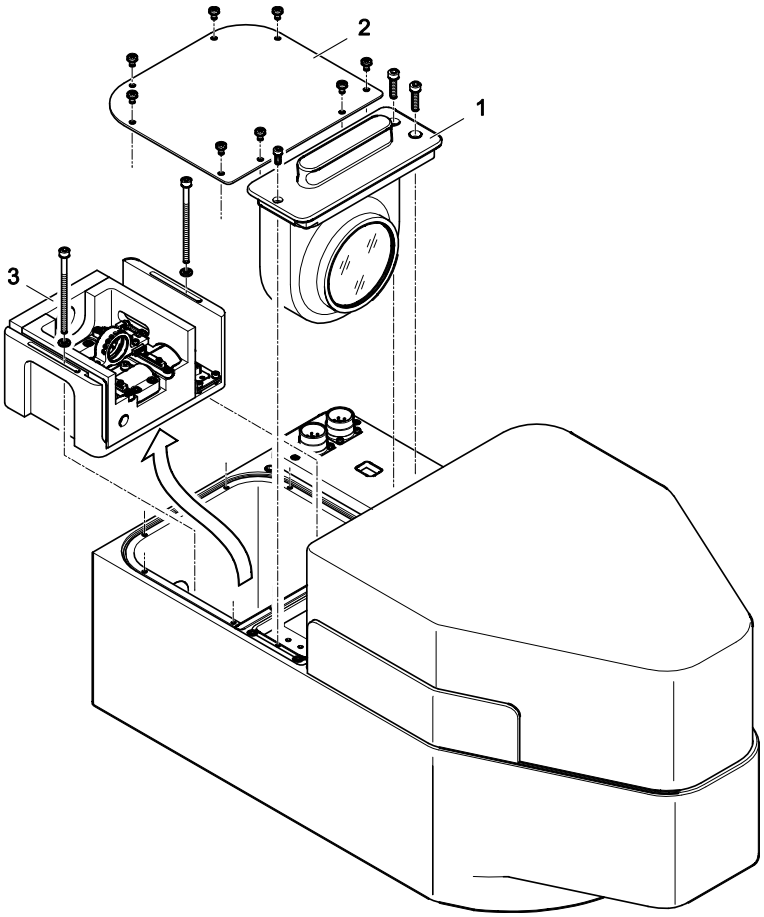


Fig. 5
Preparing the beam coupling

- Remove the Focusing lens (1)
- Open the cover (2)
- Mark the position of linear translator (3)
- Remove linear translator (3)
- Protect the focusing lens and linear translator against dust.

5.2.2 Checking procedure

The following steps are used to check that the laser beam is coaxial to the linear translator. If this is not the case, the input point and, if necessary, the input angle of the laser beam must be adjusted as described below.

Warning:
The laser beam can cause severe injury to the eyes and the skin. Make sure that all personnel in the laser area are wearing appropriate protective goggles and, if necessary, protective clothing.

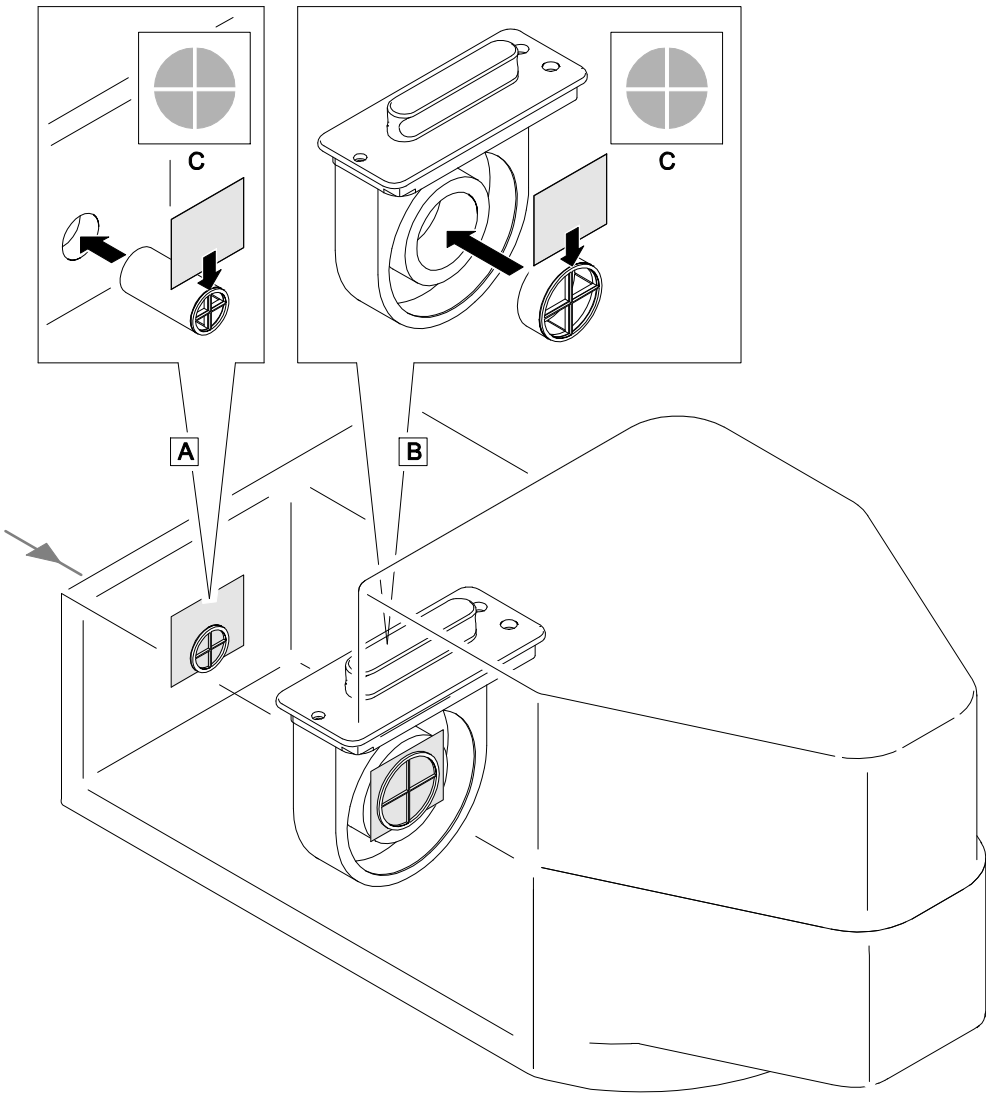


Fig. 6
Checking the beam coupling

Checking the input point

- Place a piece of thermo transfer paper behind the cross hair device (A).
- Insert the cross hair device at position (A).
- Turn on the laser at low power for just long enough for a clearly visible effect to appear on the thermo transfer paper (C).
- Check the beam diameter. It must be smaller than the input aperture specified in the data sheet.
- Check that the laser beam appears in the center of the cross hairs. If not, the input point of the laser beam needs to be adjusted.

Checking the input angle

- Place a piece of thermo transfer paper behind the cross hair device (B).
- Insert the cross hair device in the lens holder.
- Insert the lens holder in its slot.
- Turn on the laser at low power for just long enough for a clearly visible effect to appear on the thermo transfer paper.
- Check the beam diameter. It must be smaller than the input aperture specified in the data sheet. If the beam diameter at the beam output is greater than that measured at the beam input, this indicates excessive divergence of the laser beam. In this case, reduce the beam diameter, e. g. by using beam expander with lower amplification.
- Check that the laser beam appears in the center of the cross hairs. If not, the input angle of the laser beam needs to be adjusted.

Optimizing settings

- Repeat the entire adjustment process until optimum laser beam input point and input angle settings are achieved.

5.2.3 Assembly

- Assemble the linear translator and the focusing lens in vice versa order as described in the disassembly (⇨ page 17).
- You must now set the field size (⇨ page 21, Adjusting the field size).

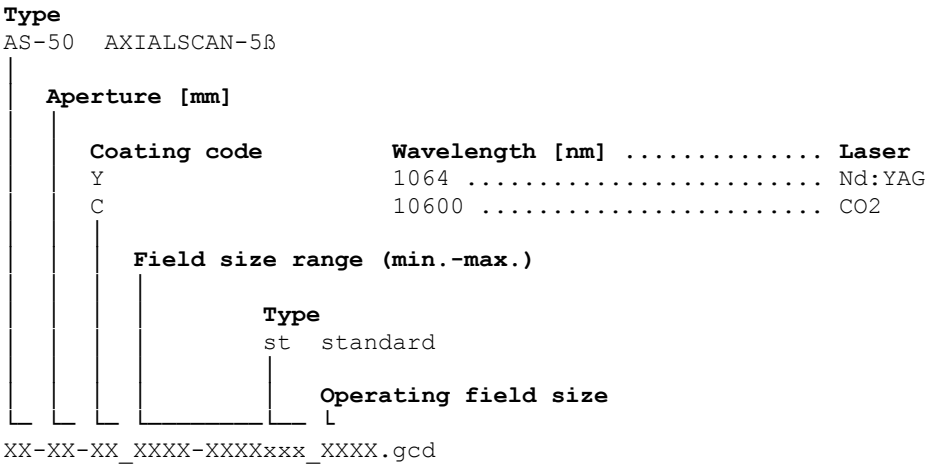
5.3 Adjust field sizes

The subsystem can be adjusted to different field sizes as follows. The field sizes that can be set are listed in the data sheet. If you want to set a different field size, you must consult RAYLASE for assistance.

5.3.1 Preparation

- Load the correction file corresponding to the desired operating field size.
  Make sure that you use the following identification code:

The following identification code is used for AXIALSCAN-50 type subsystems:



- Create all electrical connections for the power supply and for control of the subsystem (⇨ page 12, Subsystem).
- For details of connecting the deflection unit to a RAYLASE control card and operation with RAYLASE software, refer to the corresponding manuals.

5.3.2 Adjusting the field size

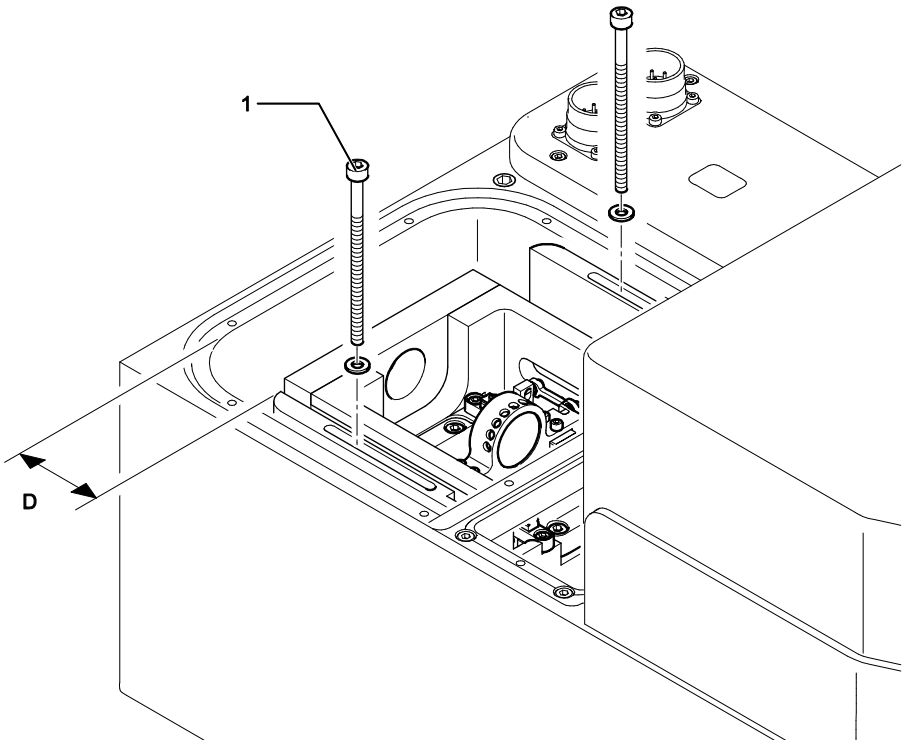


Fig. 7
Field size adjustment

- Loosen the two retaining screws (1).
- Move the linear translator to the distance (D) specified in the reference table in the appendix. As shown above, the distance (D) is measured from the front edge of the linear translator to the inner side of the housing plate.
- Lightly screw in the linear translator at the set position.

Fine adjustment

Fine adjustment is used to adjust the linear translator to the laser-specific divergence.

Warning:
The laser beam can cause severe injury to the eyes and the skin. Make sure that all personnel in the laser area are wearing appropriate protective goggles and, if necessary, protective clothing.

- Place a target of the same size as the operating field at the specified working distance from the deflection unit.
- In turn, use the laser to mark a square in the center of the field and at one corner.
- Check that the spot diameter is the same in the center of the field and at the corner.
- If necessary, move the linear translator within the range provided by the slots and repeat the fine adjustment until a satisfactory result is obtained in the center of the field and at the corner.
- Fix the linear translator in place with the two fastening screws (1).

6 CLEANING

6.1 Cleaning the housing

Warning:
The laser beam can cause severe injury to the eyes and the skin. Before cleaning, make sure that the laser device is switched off and secured against accidentally being switched on.

The subsystem housing is dust proof. It can be cleaned with a duster. If it is very dirty, the duster can be moistened with a light and non-aggressive cleaning solution (e.g. soap solution).

6.2 Cleaning the optical system

Warning:
The laser beam can cause severe injury to the eyes and the skin. Before cleaning, make sure that the laser device is switched off and secured against accidentally being switched on.

Dirty optical surfaces result in increased absorption of the laser radiation. This can cause the dirt to heat up sufficiently for it to burn into the optical surfaces and permanently damage them.

The following circumstances can cause increased accumulation of dirt:

- The ambient atmosphere is contaminated with dirt, grease or other particles.
- Vapors and particles are produced while working.
- Talking, coughing or sneezing close to optical surfaces.

In general, all contamination of the optical system should be avoided wherever possible. However, as contamination cannot be completely avoided, the optical system must be cleaned at appropriate intervals. Regular checking and cleaning of the optical surfaces can prevent permanent damage.

Note: RAYLASE accepts no liability for damaged optical components!

Note: Damage caused during the laser process, e.g. when processing metals, is irreversible and cannot be resolved by cleaning.

For subsystems fitted with a protection window only

6.2.1 Instructions for cleaning protection windows

Warning:
The laser beam can cause severe injury to the eyes and the skin. Before cleaning, make sure that the laser device is switched off and secured against accidentally being switched on.

Fingerprints contain aggressive substances that can damage the optical surfaces. Optical surfaces should therefore only be touched when wearing suitable gloves or with a lens cleaning cloth.

- Only touch the optical elements when wearing unpowdered latex gloves and only touch the edges.
- Blow loose particles from the surface with clean and oil-free compressed air. Note that the compressed air in workshops can contain oil particles and is therefore unsuitable for cleaning the optical system.
- Moisten a suitable lens cleaning cloth with ethanol suitable for cleaning optical components.
- Place one end of the moistened cloth on the optical system and slowly move it over the optical components. Do not exert any pressure and do not rub the optical components.
- Remove any remaining ethanol residue with a dry optical cloth.
- Repeat the procedure until the surface is completely clean. Use a new cleaning cloth for each repetition.

6.2.2 Instructions for cleaning focusing lenses and mirrors

Warning:
The laser beam can cause severe injury to the eyes and the skin. Before cleaning, make sure that the laser device is switched off and secured against accidentally being switched on.

The optical surfaces are extremely sensitive and may only be cleaned by experienced personnel.

The procedure for cleaning the focusing lenses in the linear translator is as follows:

- Mark the installation position of the focusing lens to be cleaned to allow easy re-installation.
- Remove the focusing lens from the linear translator.
- Clean the focusing lens as described above (⇨ page 23, Instructions for cleaning protection windows).
- We recommend leaving the lens in the lens holder during cleaning. However, if you do remove the lens from its holder, when replacing it make sure that the lens is precisely positioned in the guide on the holder and refer to the data sheet for the specified direction for the focusing lens. Close the lens holder with a torque wrench with a maximum force of 15 cNm.
- Install the lens holder in the linear translator. Pay attention to the corresponding markings.

For cleaning the mirrors and the moving lens, we strongly recommend sending the subsystem to RAYLASE, as opening of the deflection unit or dismantling of the moving lens by unauthorized personnel voids the warranty.

However, if you do want to clean the mirrors yourself, follow the same procedure as for cleaning the protection window but with even more care (⇨ page 23, Instructions for cleaning protection windows).

6.2.3 Special instructions for zinc selenide optical elements

Zinc selenide (ZnSe) is an inorganic orange material that can be used in different forms for optical components (e.g. lenses, beam splitters, mirrors) in CO_2 laser systems.

Properties of zinc selenide

Melting point:	1,520°C
Density:	5.27g/cm³ at 25°C
Solubility:	Sensitive to water

To improve the optical properties of the material, zinc selenide is often given an anti-reflex coating that can contain thorium fluoride. Thorium is a α emitter and is slightly radioactive. Thorium is potentially hazardous to health if it is inhaled or swallowed. As the coating containing thorium is enclosed between non-radioactive layers, there is no risk to the user under normal circumstances.

Damage to zinc selenide optical elements

Under normal circumstances, no special precautions are necessary when handling or storing zinc selenide.

In case of damage to a zinc selenide optical element or its anti-reflex coating, follow the instructions below.

Damage to anti-reflex coating

- Possible causes:
  - Coating coming into contact with water, acids or alkalis
  - Mechanical damage due to improper cleaning or handling
- Action:
  - Pack the optical elements in an airtight sealed plastic container.
  - Return the container to your supplier. The supplier is responsible for professional disposal of the material.

Damage to optical element

- Possible causes:
  - Optical element coming into contact with water, acid or alkali
  - Mechanical damage due to improper cleaning or handling
- Action:
  - Avoid inhaling dust!
  - Carefully collect up fragments and pack them in an airtight sealed plastic container.
  - Return the container to your supplier. The supplier is responsible for professional disposal of the material.
  -

Damage to optical element due to laser radiation

- Cause:
  - Damage to optical element due to laser radiation (laser radiation is no longer completely transmitted but is absorbed into the element due to damage to the anti-reflex coating or contamination of the optical element)
- Action:
  - Switch off the laser device immediately!
  - Leave the room for at least 30 minutes!
  - Wear gloves and a mouth protector while performing the subsequent steps!
  - Carefully collect up all fragments and pack them in an airtight sealed plastic container.

- Clean all contaminated components and surfaces with a damp cloth and pack the cleaning cloths in a sealed plastic container.
- Return the containers to your supplier. The supplier is responsible for professional disposal of the material.

Warning: Because of the risks outlined, zinc selenide optical elements must be cleaned with special care and is performed entirely at your own risk!

7 MAINTENANCE

The subsystem does not contain any user-serviceable parts. Repairs may only be carried out by RAYLASE, as special know-how and comprehensive testing methods are required.

8 TROUBLESHOOTING

Warning:
The laser beam can cause severe injury to the eyes and the skin.

- Never look directly or indirectly into the laser beam during troubleshooting.
- Do not disable any safety precautions to protect against laser radiation.
- Wear protective clothing and/or goggles appropriate for the relevant laser class.

In case of malfunctions, check whether the symptom and a possible remedy are included in the following checklist.

Problem	Possible cause and remedy	
Poor marking quality	Defective power supply	
	Incorrect marking parameters	
Marking quality has deteriorated	Dirty optical system	⇨ page 23, Instructions for cleaning protection windows ⇨ page 23, Instructions for cleaning focusing lenses and mirrors
	Laser power decreasing	The RAYLASE "weldMARK™" marking software can compensate for a loss of laser power. Menu: System > Global adjustments
	Marking parameters changed	
	Beam expander changed	
Laser spot changed	Dirty optical system	⇨ page 23, Instructions for cleaning protection windows
	Dirty or damaged mirrors	⇨ page 23, Instructions for cleaning focusing lenses and mirrors
		Send deflection unit in for repair
	Laser system out of adjustment	
No laser beam, although process started from PC.	Beam path blocked.	Remove protective cover from beam input and/or output
	Fault in laser drive	
	Fault in laser system	
The deflection unit only deflects the laser beam in one direction or not at all.	Data cable defective	
X and Y axis reversed	Incorrect cabling	

If the fault cannot be resolved, contact RAYLASE Customer Service for further assistance.

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