HIGHQ COMPONENTS

OPERATIONS MANUAL

Shutter HQ-LSA10/18/25 incl. Controller HQ-SCU16

Version 1.2

25.06.2025

1. USE OF THE MANUAL

1.1 INTRODUCTION

This manual contains information of the installation, commissioning and operation of the highQ-Components product: Shutter LSA10, LSA18 & LSA25 & Controller SCU16.

It contains important information and safety instructions to operate the product properly, as intended. The instructions help to avoid hazards, reduce repair costs and downtimes. In addition, it helps to improve the reliability and service life of the system. Non-observance with the instructions can lead to accidents resulting in injury or damage to property.

ATTENTION: Note the installation position of the shutter (Chapter 6).

1.2 STORAGE AND DISTRIBUTION OF THE MANUAL

This manual must be kept in close range of the workplace and must be always available to all operating personnel. The operator must inform his personnel about the location of this manual.

1.3 TARGET GROUP OF THIS MANUAL

This manual must be read, understood, and complied with by every person who is entrusted with any of the following tasks:

- Assembly
- Commissioning
- Operation
- Maintenance/trouble shooting
- Disassembly

2. IMPRINT

2.1 CONTACT

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2.2 COPYRIGHT AND INTELLECTUAL PROPERTY RIGHTS

2.2 WARRANTY

The warranty is provided in accordance with the legal regulations. A warranty claim exists only in the country in which the device was originally purchased.

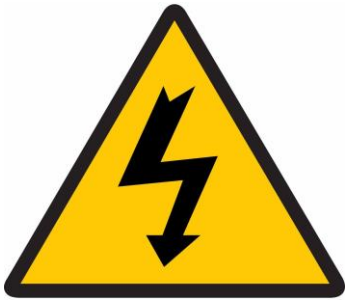
2.3 DOCUMENT HISTORY

Version	Description of change	Author
1.0	Creation	TRO
1.1	Shutter orientation details added	FHE
1.2	Pin designation added	TRO

3. Table of Contents

4. SAFTY INSTRUCTIONS

4.1 ELECTRICAL SAFETY INSTRUCTIONS



Before working on the shutter or controller, disconnect the module from the mains and secure it against unintentional power-up. Work on the electrical system may only be carried out by qualified personnel!

4.2 LASER SAFETY INSTRUCTIONS

It must be ensured that all necessary technical and organizational laser safety devices are mounted and in proper condition before the component is put into operation.

When checking the function and alignment of the shutter module, suitable laser safety goggles are mandatory when the laser is switched on.

4.3 ADDITIONAL NOTICE

Failure to comply with the safety instructions may result in danger to persons as well as to the environment and the plant. Failure to comply with the safety instructions will result in the loss of any claims for damages.

5. PRODUCT DISCRIPTION

The control system enables the design of laser systems in consideration with the highest safety aspects. The safety circuits have been designed redundantly so it meets the criteria for Performance Level PL_E or KAT3 according to the Dekra certification.

The system is designed for laser systems with pulse width modulation (PWM) but can also be used with other laser control systems.

The overall safety system always consists of a control unit HQ-SCU16 and a shutter module HQ-LSA10, HQ-LSA18 or HQ-LSA25.

5.1 FEATURES OF THE HQ-LSA10/18/25 SHUTTER MODULES

- Direct mounting on the beam output of SYNRAD laser units. Additional mounting option on the base of the shutter. Warranted functionality only in specified installation orientation (see section 6.1).

- End position detection contactless by HAL sensors. One sensor for position "open" and two sensors for position "closed".

- Sensor outputs maximum 24V/200mA (overload and short circuit protected)

- Laser beam is diverted to a heat sink when the shutter is closed. At more than 65°C the laser main power supply will be disconnected

- Shutter and shutter magnet are operated with 24VDC. Current values can be found under point 10.1.

- The closing time of the mechanical shutter is approx. 80ms. By PWM control the laser power is switched off in approx. 1ms by interlock or malfunction (safe condition).

- The SLCU16 is plug compatible to the predecessor SLCU13. However, the following changes should be noted when replacing it:
    - o EMERGENCY STOP now uses 2 NC contacts.
    - o INTERLOCK switches with 2 NO contacts.
    - o The system reset button switches with +24VDC.
    - o The general enable is switched on with +24VDC.

5.2 CHARACTERISTICS OF THE LASER SAFETY MODULE HQ-SCU16

- Function monitoring: Malfunction: Shutter leads to Error Output = low
- All outputs are 24VDC current limited and short circuit protected
- Two interlock circuits with contact and cross-circuit monitoring. Galvanically isolated interlock contacts.
- Two EMERGENCY STOP circuits with contact and cross-circuit monitoring. Galvanically isolated EMERGENCY STOP contacts
- Reset button for EMERGENCY STOP and system error (manual or PLC).
- 24V PLC inputs/outputs available
- Function monitoring via LEDs at the front
- Wiring by usage of "cage clamp" connectors (max. 2.5mm2)
- Power supply: 24VDC / min. 2A
- Easy mounting on DIN-rail module (width: 45mm)

FIGURE 1: PHOTO OF THE LASER SAFETY LODULE & SHUTTER CONTROLLER HQ-SCU16

6. ASSEMBLY & COMMISSIONING

6.1 NOTES ON INSTALLATION

ATTENTION

HQ-LSA10 and 18: to ensure proper function, the installation orientation of the shutter must be observed. Closing the shutter plate/lock against gravity must be avoided.

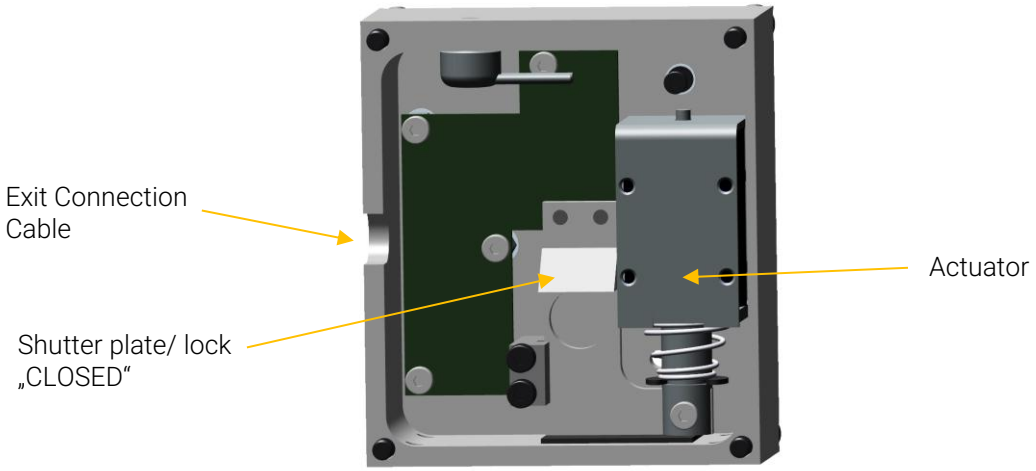


FIGURE 2: SHUTTER INTERIOR VIEW, FRONT PANEL REMOVED, LASER ENTRY SIDE, CLOSED POSITION (HQ-LSA10 GEZEIGT)

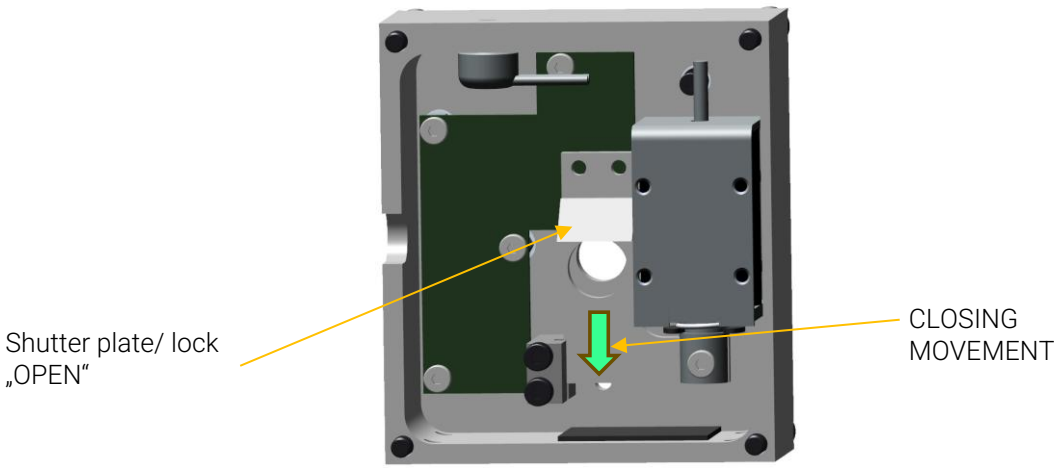
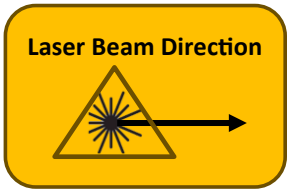


FIGURE 3: SHUTTER INTERIOR VIEW, FRONT PANEL REMOVED, LASER ENTRY SIDE, OPEN POSITION (HQ-LSA10 SHOWN)

HQ-LSA 25: any installation position possible (due to specific functionality and design).

ATTENTION

In addition to the illustration in the technical drawings (section 10.2), the beam direction is indicated on the shutter housing with the following sticker.



6.1.1 ASSEMBLY PROCESS

1. Removal of the base plate of the shutter from the housing (4 screws).

2. Mounting the base plate to the laser with 4 countersunk screws (not included)

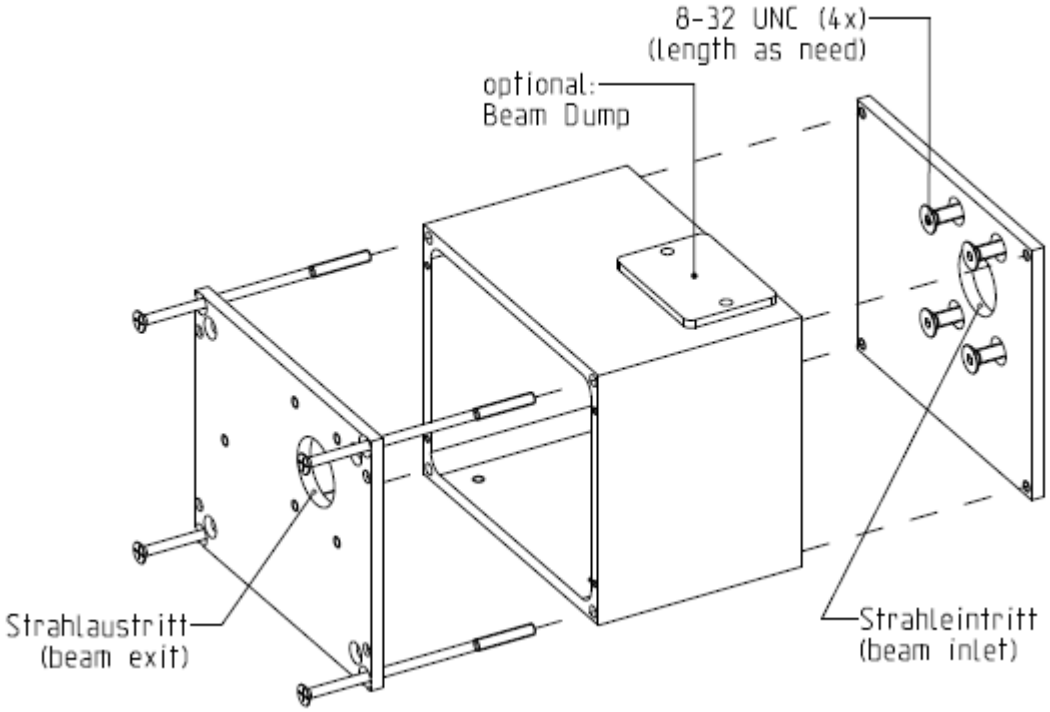


FIGURE 4: EXPLODED VIEW OF THE SHUTTER (HQ-LSA25)

3. Attaching the shutter body and frontside to the base plate (screws included)

4. Wiring of the shutter with the SCU16 control module.
    a. Plug with white cable into socket B1
    b. Plug with brown cable in socket C1

5. If the length of the cable (approx. 50 cm) is not sufficient, it can also be extended.

6. For instructions on wiring the control module, see chapter 10.3

7. To achieve the highest possible safety, two relays/contactors are mandatory, which interrupt the supply of the laser in case of EMO. The relays are not included in the scope of delivery and should be designed according to the power consumption of the laser.

    Examples for suitable emergency off contactors:
    a. EATON DILA-31(24VDC)
    b. SIEMENS 3RH2131-1BB40 & SIEMENS 3RT2916-1DG00

6.2 NOTES ON INITIAL COMMISSIONING

- The EMO circuit and interlock circuit can be bridged for the first functional test.
- For operation, the shutter must be reset manually. For this purpose, 24V must be applied to pin E8 for at least 500ms. In addition, the General Enable (pin B8) must be connected to 24V.
- If the wiring is correct and the reset is activated, the green LEDs H-L light up. In addition, the blue LED "Laser enabled" also lights up when the laser is connected.

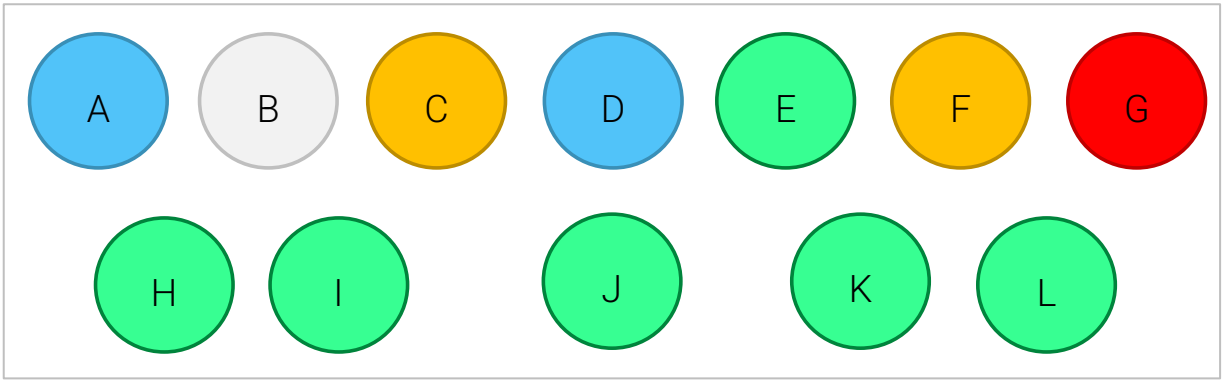


FIG. 2: LED OVERVIEW & DESIGNATION

Description	LED color	Meaning when LED lights up
A	blue	Laser enable signal active
B	white	PWM signal active
C	orange	Laser ready signal active
D	blue	Error cooler
E	green	Shutter is closed
F	orange	Shutter ist open
G	red	Error
H	yellow	Door is closed I
I	green	Door is closed II
J	green	24/5V supply OK
K	yellow	Emergency stop is not actuated I
L	green	Emergency stop is not actuated II

7. MAINTENANCE & TROUBLESHOOTING

7.1 MAINTENANCE

To prevent malfunctions, hazards and damages, the module including all associated components must be checked at regular intervals depending on the operating conditions. Worn or damaged parts must be replaced using original spare parts or standard parts.

To prevent damage or life-threatening injuries during maintenance of the module, the following points must be observed:

- Maintenance and cleaning procedures should be done by trained personnel only
- Every maintenance, cleaning, adjustment and servicing activity that is carried out with the laser switched on must be supervised by the laser safety officer.
- In particular, the laser safety officer must monitor the use of protective clothing and compliance with the safety regulations when handling class 4 lasers.
- For all inspections, maintenance and servicing work, the General Safety Instructions must be observed
- Secure the area for maintenance work
- Switch off all energy sources and secure the energy sources against unintentional restarting

The following work should be carried out at regular intervals to ensure trouble-free operation of the system:

Activity to perform	Turnus
Visual inspection of the optical and mechanical components	monthly
Cleaning the cover with a slightly wet sheet	monthly
Checking the status LEDs on the controller	monthly

7.2 TROUBLESHOOTING

In the event of a malfunction of the shutter or the controller, it has status LEDs on the front of the housing which can provide information about the cause of the error. A detailed description of all LEDs can be found in chapter 6.2.

Possible error possibilities are listed in the following table:

LED-Display	Possible cause of error
LED H&I or K&L do not light up simultaneously	Short circuit, incorrect wiring, interruption or contact fault
J does not light	Supply not given. Please check the supply voltage.
LED G lights up	Shutter does not reach end position Contact error or timeout Interlock or emergency stop circuit Shutter housing is warmer than 65°C
LED D lights up	Error message by the cooler, e.g. temperature, flow, pressure, or similar.

8. TRANSPORT & STORAGE

The following points must be observed for the transport and storage of the product:

- The module and all associated connectors and cables must be carefully packed and handled during transport to avoid damage
- If possible, the module should be transported or stored in the original packaging
- After transport, ensure that all required components are included and undamaged

- If the module is not installed immediately after transport, it should be stored properly. Here it must be ensured that the temperature is always above 5°C and the air humidity is less than 70% (non-condensing).

- In case of storage over a longer period of time, the component should be packed in a moisture-resistant manner

9. DECOMMISSIONING & DISPOSAL

The following points must be observed during decommissioning and disposal:

- If the module is shut down for a longer period of time, the components must be stored properly to prevent contamination and corrosion

- Personnel responsible for disposal of the module or associated components must comply with applicable federal, state, and local regulations.

- If ZnSe optics can only be removed by destroying them, the entire unit must be stored dust-tight and in its original packaging and disposed of properly (only applicable for components with mirror insert and CO_2 laser)

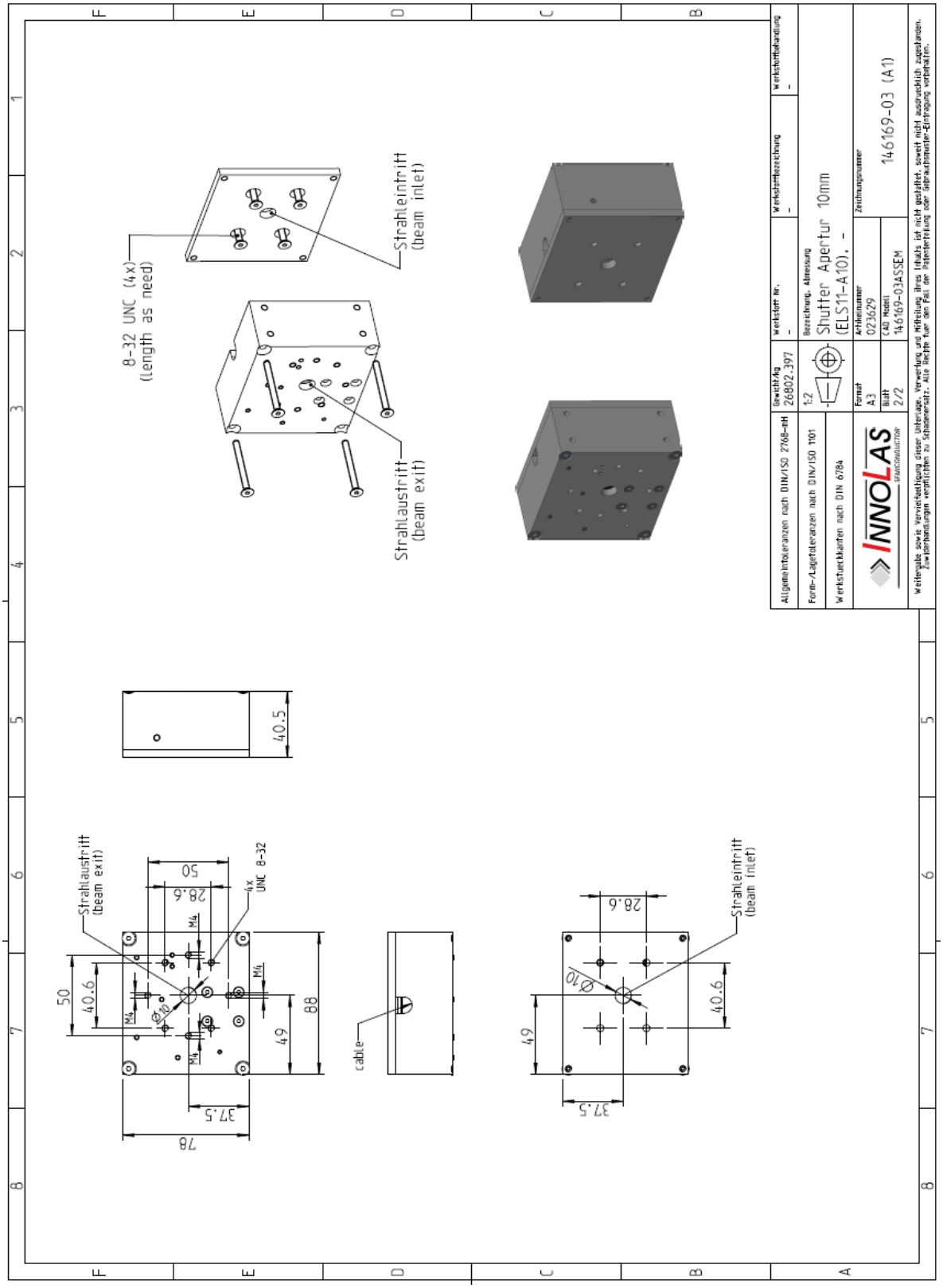
10. TECHNICAL DATA

10.1 SPECIFICATION

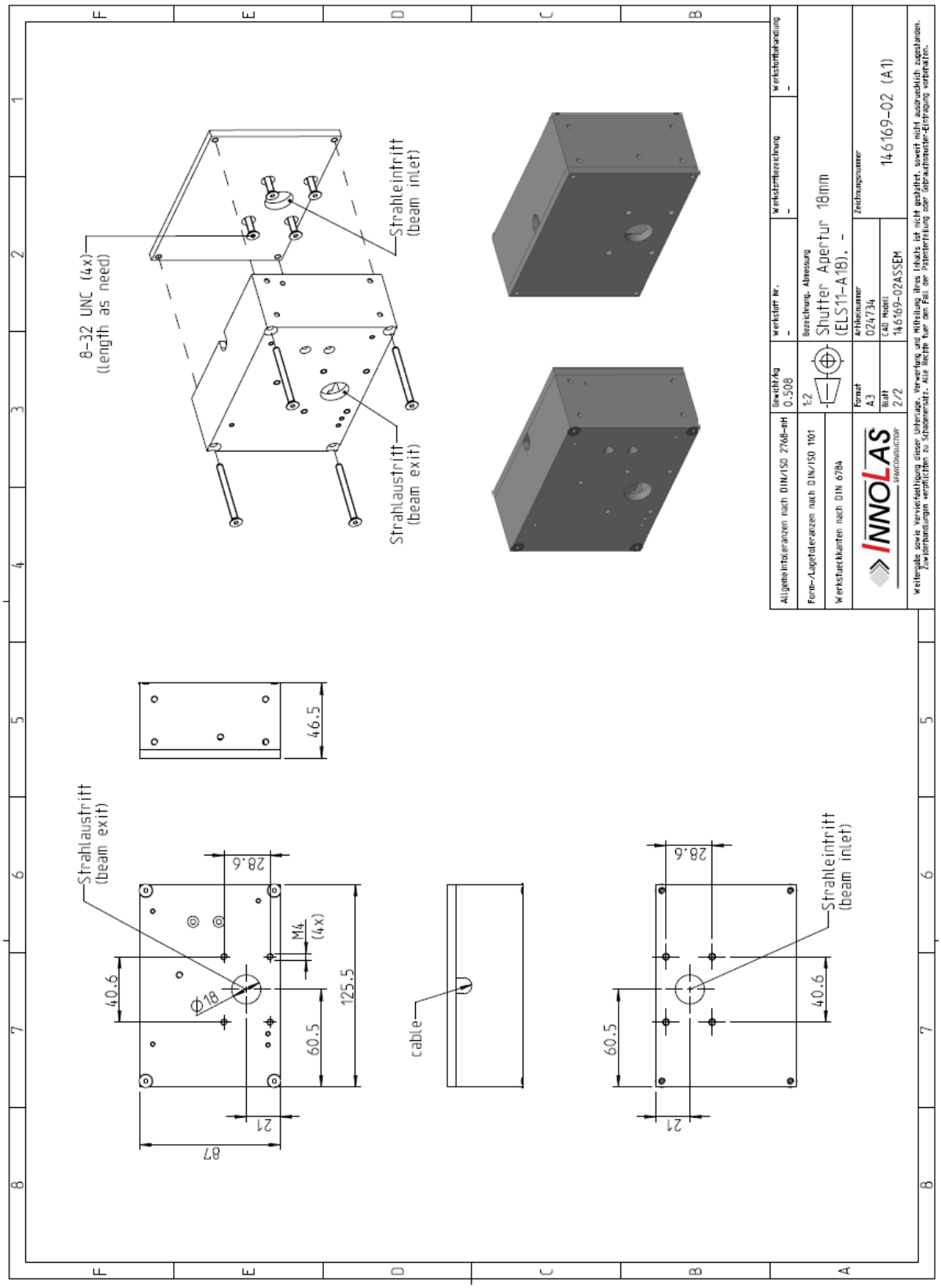
MODEL	HQ-LSA10	HQ-LSA18	HQ-LSA25
			
MECHANICS			
SIZE (LXBXH)	88 x 78 x 40,5mm	126 x 87 x 47mm	119 x 100 x 90mm
WEIGHT	480 g	760 g	1.200 g
INSTALLATION OPTIONS	horizontal & vertical	horizontal & vertical	horizontal & vertical
MATERIAL CASE	anodized aluminum	anodized aluminum	anodized aluminum
ELECTRONICS			
VOLTAGE	24VDC	24VDC	24VDC
CURRENT (POSITION CLOSE)	190mA	190mA	200mA
CURRENT (POSITION OPEN)	320mA	420mA	250mA
ACTUATOR	solenoid	solenoid	rotary drive
DEFAULT SHUTTER POSITION	closed	closed	closed
OPTICS			
APERTURE	10mm	18mm	25mm
MAX. LASER POWER	n/a	n/a	n/a
SUITABLE WAVELENGTH	10,6µm	10,6µm	355nm – 10,6µm
ADD-ONS	no	no	1" mirror & beam dump
SAFETY			
PERFORMANCE LEVEL	PL_E (Dekra)	PL_E (Dekra)	PL_E (Dekra)
COMFORMITY	CE	CE	CE
TEMPERATURE CONTROL	yes, max. 65°C	yes, max. 65°C	yes, max. 65°C
STATUS CONTROL	LED Display on HQ-SCU16	LED Display on HQ-SCU16	LED Display on HQ-SCU16
CLOSING TIME MECHANICAL	approx. 80ms	approx. 80ms	approx. 80ms
CLOSING TIME PWM	approx. 1ms	approx. 1ms	approx. 1ms
CONTROL END POSITIONS	non-contact, redundant	non-contact, redundant	non-contact, redundant

10.2 CAD DRAWING

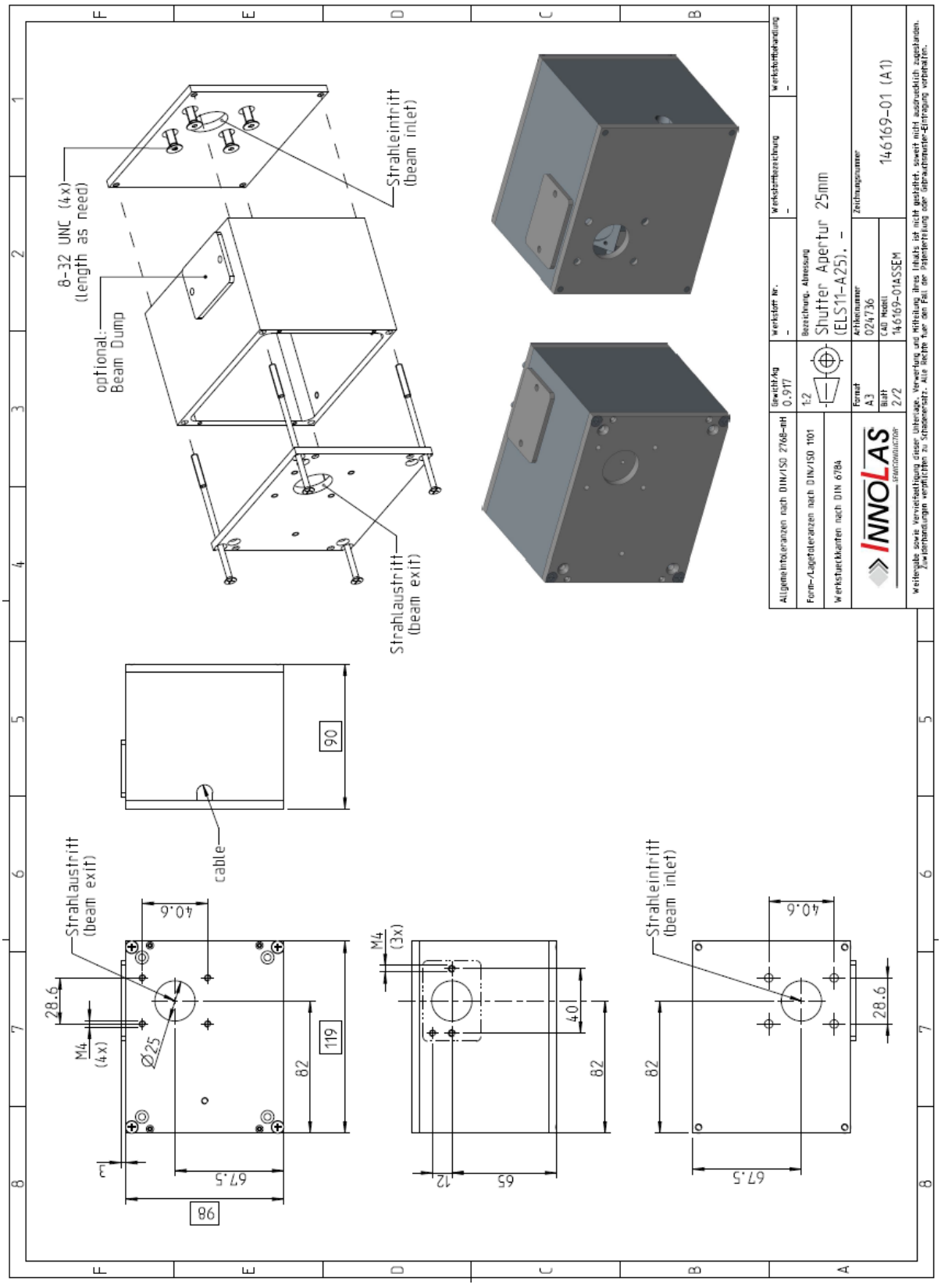
HQ-LSA10 (10mm Aperture)



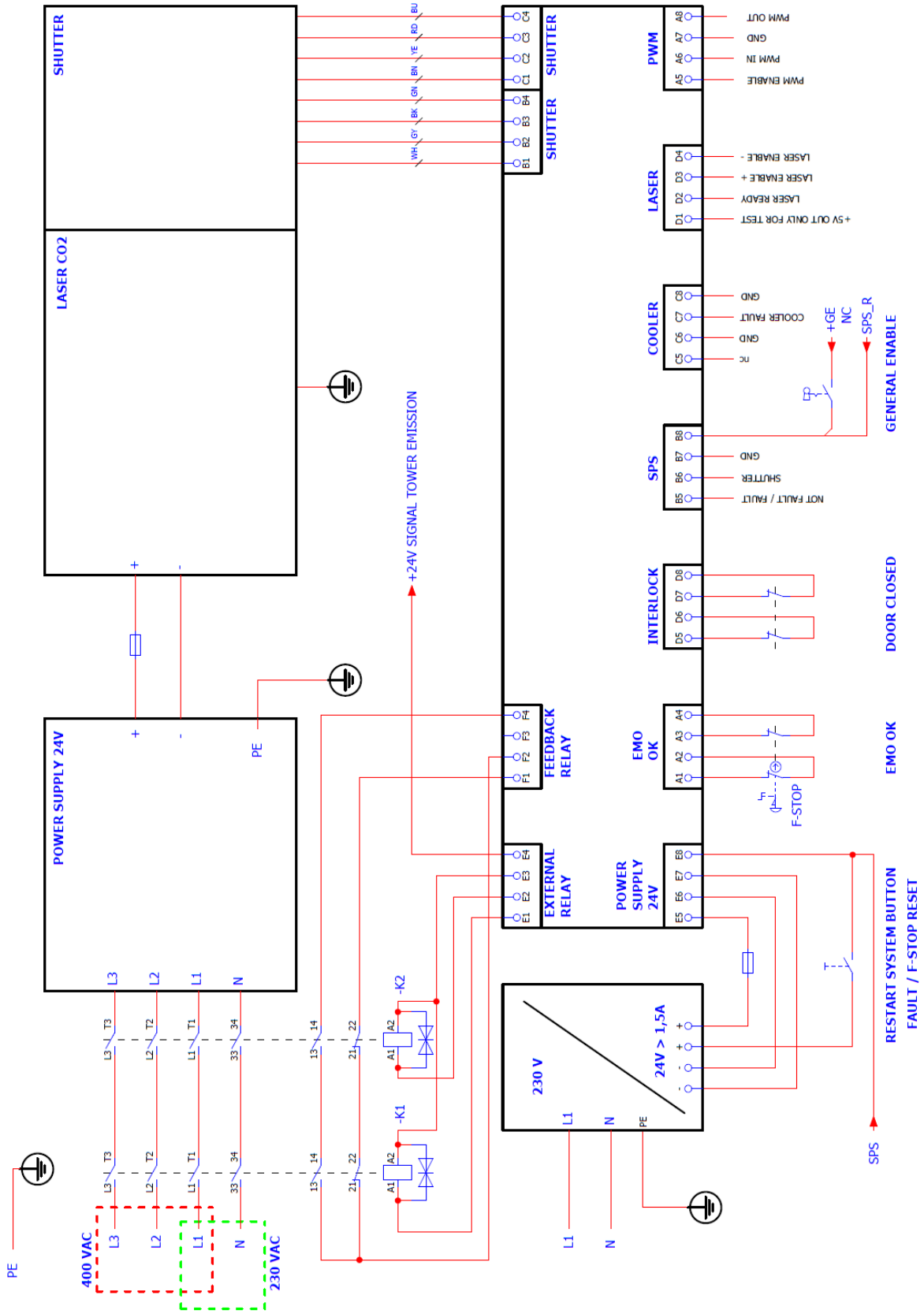
HQ-LSA18 (18mm Aperture)



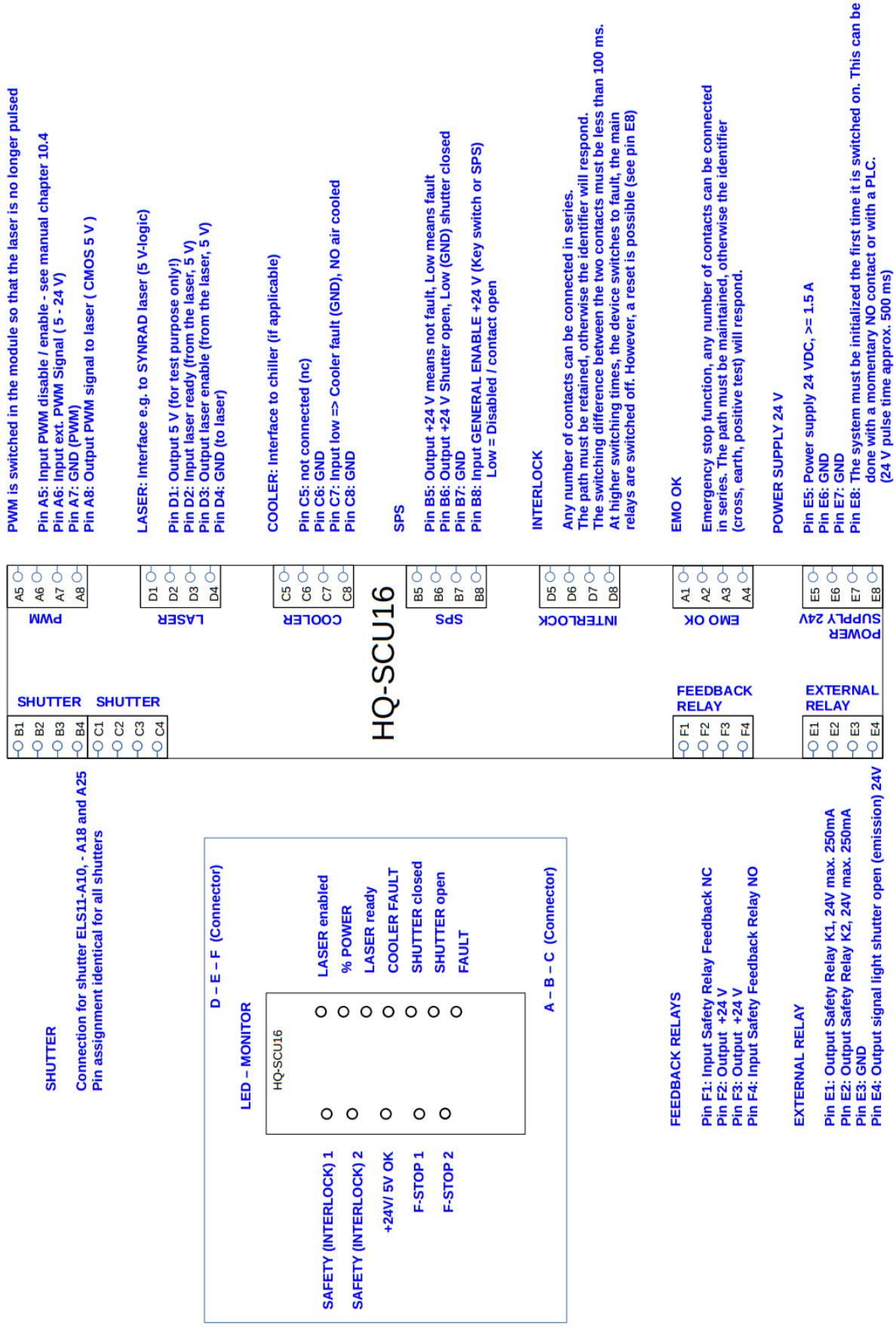
HQ-LSA25 (25mm Aperture)



10.3 CIRCUIT DIAGRAM



10.4 PIN DESIGNATION INCLUDINIG CONTROL



Change of the PWM – Control

- SLCU16 – 024733

  Pin A5 Low (GND) = Disable PWM, +24V or NC = Enable PWM

- SLCU16 – 024733-1 ab SN: C16-01001

  Pin A5 24V = Disable PWM, Low (GND) or NC = Enable PWM

10.5 COMPATIBILITY AND IMPORTANT NOTES

Recommended use of safety controller HQ-SCU16 (Art. Nr. 024733) in combination with:

- HQ-LSA 10 – 023629
- HQ-LSA 18 – 024734 (Predecessor with 100 Ohm series resistor)
- HQ-LSA 25 – 024736

Recommended use oft he safety conrtoller HQ-SCU16 (Art. Nr. 024733-1) with increased PTC-fuse in combination with:

- HQ-LSA 10 – 023629
- HQ-LSA 18 – 024734 (Predecessor with 100 Ohm series resistor)
- HQ-LSA 18 – 024734-2 (with 30 – 33 Ohm series resistor)
- HQ-LSA 25 – 024736