Interface description

# Safety circuit of the boards ASV5, ASV5 LLKM, ASV5 TWIN and ASV5 TRIPLE

TRUMPF

Interface description

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Edition **2024-06**

## Order Information

Please specify when ordering this document:

Interface description

Safety circuit of the boards ASV5, ASV5 LLKM, ASV5 TWIN and ASV5 TRIPLE

Edition 2024-06
Document number 18-22-39-BAen

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# Good to know

This interface description informs you about the safety circuit interface of the following boards:

- ASV5 (18-22-39-A1)
- ASV5 LLKM (18-22-39-A100)
- ASV5 TWIN (18-22-39-A200)
- ASV5 TRIPLE (18-22-39-A300)

These boards are used to prevent the laser light emission via beam switches if it is required for safety.

The mentioned boards differ from each other in different technical functions. The interfaces described in this document are, however, identical for all mentioned boards with regard to signal assignment and signal level.

For the sake of simplicity, the designation ASV5 is used in this document. The described functions are identical for all variants. If differences between the variants are described, the exact designation is used.

**Target group**

The document is intended for users or integrators who integrate a laser device in a system.

**Supplementary documents**

| Document | Document no. |
|---|---|
| Technical information<br>Monitoring the laser beam time with ASV5 | 18-22-39-CP |
| Spare parts description<br>Changing ASV5 board | 18-22-39-A1-EM |
| Spare parts description<br>Changing ASV5 LLKM board | 18-22-39-A100-EM |
| Software manual<br>TruControl 1000 | 10-06-80-A1-CR |

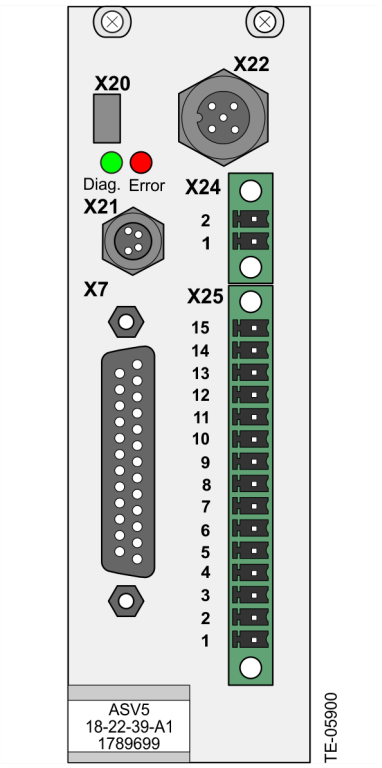
Tab. 1

Further information on interfaces of your laser device is to be found in the documents included in the delivery of your laser device.

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# 1. Overview, use, safety circuit




The safety circuit interface is located on the ASV5 board in the control of the laser device.

Existing safety equipment on the laser device and the processing station (e.g., protective covers or safety doors) are integrated via safety contacts (SC) into the safety circuit (SIK) of the respective board.

The safety circuit (SIK):

- is designed as a 24 V DC voltage circuit.
- functions according to the closed-circuit principle.
- is designed for single or two-channel operation.

**Note**

TRUMPF recommends using the 2-channel safety circuit.

Activation of the 2-channel safety circuit can be adjusted.

- If X6 = 0 (factory setting): SK1 is high-switching and SK2 low-switching (as with ASV3). The safety circuit is monitored for short circuit.
- If X6 = 1: SK1 and SK2 are high-switching. You as the user must ensure short-circuit monitoring.

As soon as a safety contact (SC) is open (e.g., open protective door):

- The corresponding safety circuit (SIK) is interrupted.
- The corresponding ASV5 board blocks the light path.
- No more laser light is emitted if the light path blocked.
- Persons are protected from laser light in the danger zone.

The ASV5 board blocks the light path:

- In laser devices with optical shutters / shutter switches: The laser beam is guided via the connected shutter or shutter switch into an absorber.
- In laser devices without optical shutters / shutter switches: The ASV5 board switches off the safe power supply of the laser.

## 1.1 Producing a safe status

When carrying out maintenance work, it may be necessary for the laser device to be switched on. In this case, it must be ensured that persons are not endangered.

**⚠ WARNING**

**When the safety circuit is closed, laser light could escape at a processing point.**

**Laser light can burn skin or clothing. Direct, reflected or scattered laser light can damage eyes irreversibly.**

➢ Interrupt all safety circuits and secure against accidental closing when working on the laser device.

1. Open monitored protective covers and secure against closing.
2. Open doors to safety cabins and secure against closing.
3. Unplug the safety circuit at X24 or X25 of board ASV5 and ensure that it cannot be plugged in accidentally.

   At least one of the plugs at X24 or X25 must be pulled out. X24 is preferable for internal device related reasons.

## 1.2 Insert plugs correctly for X24 and X25

On delivery from the plant, the laser device is provided with a plug for the X24 connection and a plug for the X25 connection for each ASV5 board.
The plugs have the following functions:

- Before the safety circuits are connected, the plugs can be used **for test purposes** to close the safety circuits so that laser light can be emitted. Plugs in delivery condition contain short-circuiting bridges which simulate a closed safety circuit of the laser control system for this reason.

  **Plugs may only be used for this purpose if it has been properly ensured that no personnel can be injured by escaping laser light.**
- You as user can use the plugs to connect to your local safety circuit with the laser control system. This interface description contains all information about the terminal assignment.

### Inserting the plug for test mode

**⚠ WARNING**

**Laser light may escape accidentally when plug X24 or X25 with built-in short-circuiting bridge is plugged in.**

**Laser light can cause severe burns and lasting damage to eyes.**

- ➢ Only trained specialist personnel may operate the laser in test mode with short-circuit plugs on X24 or X25.

1. In places where laser light could escape, ensure that there is no danger to personnel.
2. When interrupting, and at the end of the test mode, pull out the plug from X24 or X25 and ensure that unauthorized persons are not able to plug it back in.

### Connecting a local safety circuit

**⚠ WARNING**

**If the safety circuit is incorrectly connected, laser light could escape.**

**Laser light can cause severe burns and lasting damage to eyes.**

- ➢ Safety circuits may only be connected by persons with sufficient professional knowledge and the required risk awareness.

3. Connect the safety circuits to the laser control according to the information in this interface description.
4. Use adequate measures to ensure that safety circuits cannot be closed accidentally.

   Opening a monitored protective cover **is not sufficient**, since this can easily be closed.
5. Test the function of the safety circuits.

   If a monitored protective cover is opened, the accompanying light path must be switched off.
6. Only release the laser device for use if all connected safety circuits are functioning correctly.

# 2. Terms and abbreviations

**ASV5** **O**perating and **S**afety **S**hutter, version 5. The ASV5 board connects the safety circuit to the CPX control and the beam switch.

Variants:

- ASV5 (18-22-39-A1)
  Basic variant of the ASV5 board
- ASV5 LLKM (18-22-39-A100)
  ASV5 board with laser light cable monitoring (LLKM) for a light path
- ASV5 TWIN (18-22-39-A200)
  Special board with 2 ASV5 boards for activation of 2 optical components
- ASV5 TRIPLE (18-22-39-A300)
  Special board with 3 ASV5 boards for activation of 3 optical components

**Actuation** The term **actuation** is used in the EN ISO 13849-1:2015 standard and is a synonym for the term **switching cycle**. A switching cycle is a sequence of two contact movements, consisting of closing and opening the contact.

**DC** English: **d**iagnostic **c**overage

German: Diagnosedeckungsgrad or Fehleraufdeckungsgrad

**ILN3** **I**nterface **L**aser**N**etwork, Version **3**

Light path-related interface for transmission of laser number, light path number and safety circuit.

**LLKM** **L**aser**l**icht**k**abel **M**onitoring

Laser light cable monitoring

**Light path** The light path is the way of the laser light from the laser exit (in general, output coupling mirror) to the focusing optics.

**Lasers with optical shutters / shutter switches**

The light path contains the beam guidance components, such as the deflector, shutters, shutter switches, switches, incoupling optics, laser light cable, focusing optics, etc.

**Lasers without optical shutters / shutter switches**

The light path contains the beam guiding components, such as incoupling optics, laser light cable and focusing optics.

In both cases, the light path can contain external beam splitter or switches.

**$MTTF_d$** English: **m**ean **t**ime **t**o **d**angerous **f**ailure

German: Durchschnittliche Zeit bis zu einem gefährlichen Ausfall

**NS** Proximity switch

**$PFH_d$** English: **p**robability of **d**angerous **f**ailure per **h**our

German: Wahrscheinlichkeit eines gefährlichen Ausfalls pro Stunde

**PL** English: **P**erformance **L**evel

German: Leistungsgrad

**SIK** **Si**cherheits**k**reis (safety circuit)

**SK** **S**icherheits**k**ontakt (safety contact)

**Switching cycle** A switching cycle is a sequence of two contact movements, consisting of closing and opening the contact.

The term **actuation** is a synonym for the term **switching cycle**. The term **actuation** is used in the EN ISO 13849-1:2015 standard.

**Beam switch** **Beam switch in lasers with optical shutters / shutter switches**

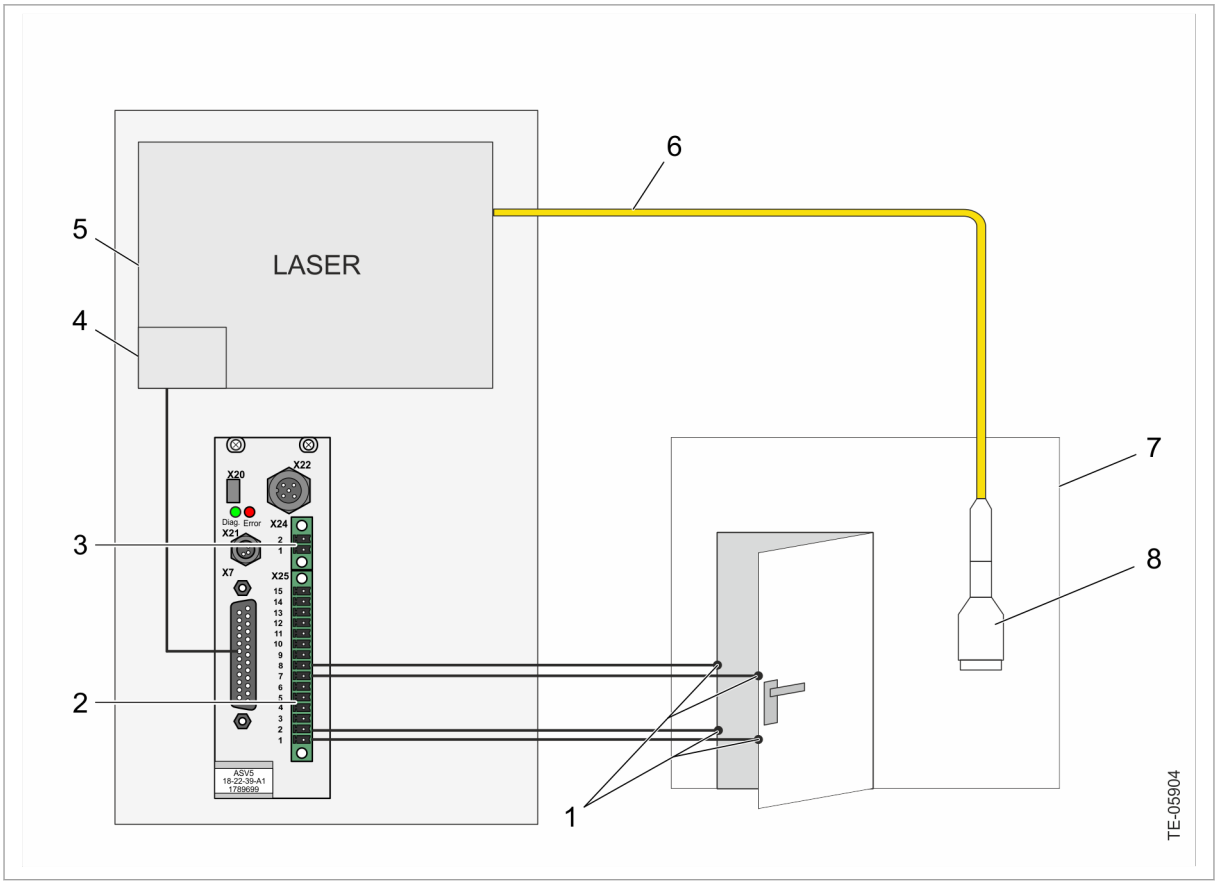
The beam switch is realized as shutter switch or shutter and deflects the laser beam into an absorber to prevent the emission of laser radiation.

**Beam switch in lasers without optical shutters / shutter switches**

The beam switch switches off the power supply of the laser to prevent the emission of laser radiation.

# 3. Function

## 3.1 Overview, principle

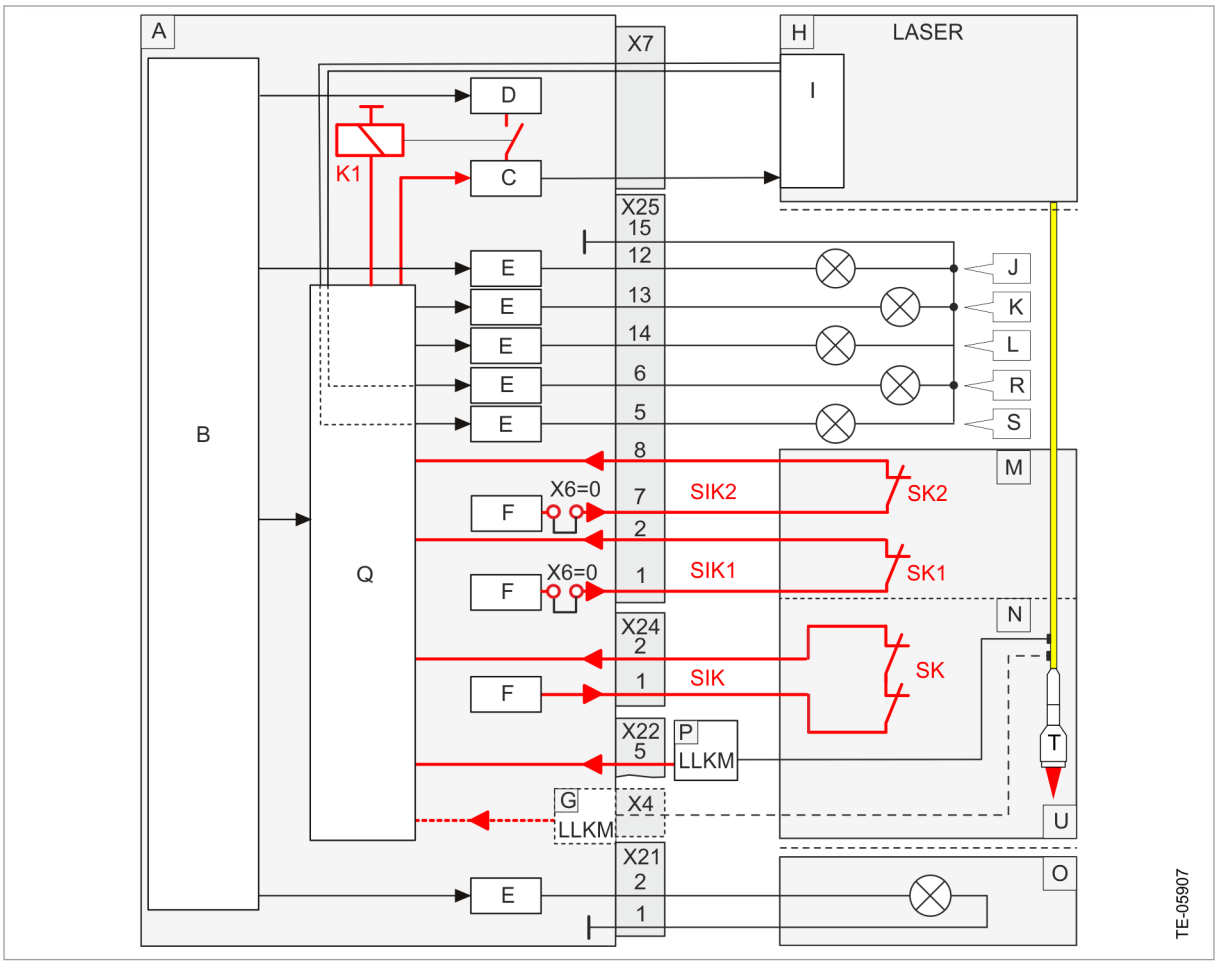



Function diagram, example with door contact Fig. TE-05904

Monitoring contacts (1) on the door of the processing station (7) are connected to connection X25 (2). Connection X25 is the two-channel interface of the safety circuit (SIK). Optionally, a single-channel safety circuit can be connected to connection X24 (3), provided it is not used for internal purposes.

If the safety circuit is interrupted, e.g. by the door being opened, the ASV5 board prevents laser light from escaping at the focusing optics (8) by means of beam switch (4).

## 3.2 Safety circuit




Wiring of the interfaces, jumper X6 = 0 (factory setting) Fig. TE-05907

| | | | | | |
|---|---|---|---|---|---|
| A | Board ASV5 | G | Integrated LLK monitoring (LLKM), option, only G or P | I | External laser warning lamp |
| B | Processor with periphery | | | R | Lamp "NS_CLOSED" |
| Q | TRUMPF safety logic | P | External LLK monitoring (LLKM), option, only G or P | s | Lamp "NS_OPEN" |
| C | Output stage for beam switch | | | M | Safety circuit 2-channel, monitored for short circuit |
| D | 24 V driver for output stage C | SIK | Safety circuit | | |
| K1 | Safety switching relay for output stage C | | SIK: 1-channel SIK | N | Single-channel safety circuit |
| | | | SIK1: 2-channel SIK channel 1 | SK | SK: Safety contact SIK |
| E | Lamp driver 24 V | | SIK2: 2-channel SIK channel 2 | | SK1: Safety contact SIK1 |
| F | 24 V driver for SIK, SIK1 and SIK2 | H | Laser | | SK2: Safety contact SIK2 |
| | | I | Beam switch | T | Focusing optics |
| X6 | Setting the activation of the 2-channel safety circuit | J | Lamp "SIK is shut" | U | Processing station |
| | | K | Lamp "ASV is open" | O | External laser warning lamp |

Tab. 2

The integrated LLK monitoring (LLKM) (G) of an ASV5 LLKM is shown in dashed lines.

The external LLK monitoring (LLKM) (P) is not allowed to be used with an ASV5 LLKM.

Examples for possible safety contacts:

- Door contact

  or
- Safety contact of a safety control (safety PLC)

**Safety circuit closed**

Laser light can only escape when a safety circuit is closed (SK1, SK2 and SK closed).

**Laser light upon "Laser On"**

If the safety circuit is closed and the shutter is open, laser light > 5 mW can be emitted from the laser beam emission openings after having switched on the laser, even if the laser has not been triggered yet.

**Safety circuit open**

As soon as the safety circuit is opened (SK1, SK2 or SK open), for example by opening the safety door at the processing station (10):

- the safety logic with periphery from TRUMPF (Q) prevents the escape of laser light.
- the output stage (C) remains supplied with voltage.

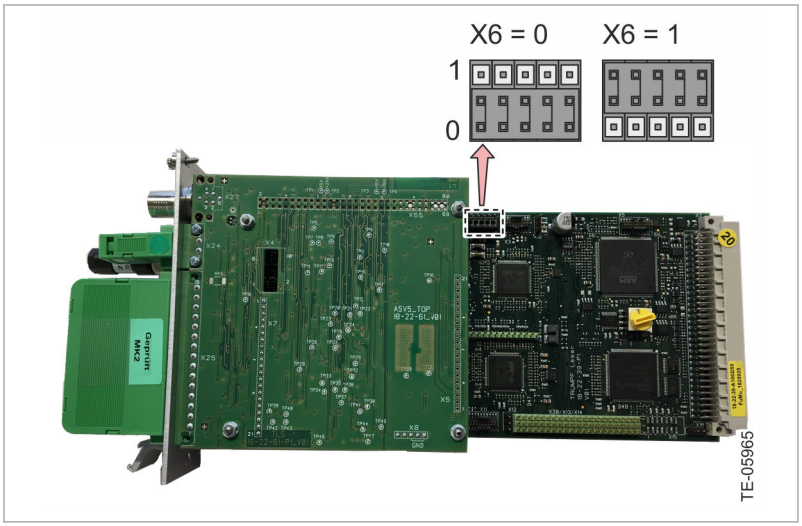
**Monitoring of the time difference**

The time difference must be ≤ 200 ms when closing and opening the safety contacts SK1 and SK2 of the 2- channel safety circuit. If the time difference is > 200 ms, the appertaining light path stays blocked. A fault message is displayed. No laser light emerges from the processing spot.

**Activation of the 2-channel safety circuit**

Activation of the 2-channel safety circuit can be adjusted.

- If X6 = 0 (factory setting): SK1 is high-switching and SK2 low-switching (as with ASV3). The safety circuit is monitored for short circuit.
- If X6 = 1: SK1 and SK2 are high-switching. You as the user must ensure short-circuit monitoring.




ASV5 board, position X6 Fig. TE-05965

**Electromagnetic compatibility**

To ensure that the electromagnetic compatibility (EMC) requirements of the laser device are met when the safety circuit line length is ≥ 30 m, lines with shielding braid must be used and the shielding braid of the lines in the laser device's cable entry system must be connected with the ground clamps.

# 4. Technical Data

## 4.1 General

| | |
|---|---|
| **Mechanical elements** | |
| Connector, X21 | Cable plug:<br>Type: SACC-M 8MS-4CON-M, 4-pole, M8 |
| Connector, X24 | Cable plug:<br>Type: MC1,5/2-STF-3,81, Phoenix, 2-pole, socket.<br>Housing for cable plug:<br>Type: KGG-MC1,5/2. |
| Connector, X25 | Cable plug:<br>Type: MC1,5/15-STF-3,81, Phoenix, 15-pole, socket.<br>Housing for cable plug:<br>Type: KGG-MC1,5/15. |
| **Safety circuit supply** | |
| If jumper X6 = 0 | Internal, 24 V DC, short-circuit proof, not electrically isolated (factory setting). |
| If jumper X6 = 1 | External, 24 V DC, electrically isolated (≥ 500 kΩ/≥ 200 V). |
| **Safety circuit** | |
| Single-channel via X24 | Not potential-free, redundant positively driven safety contacts required. |
| Two-channel via X25 | If X6 = 0 (factory setting): not potential-free. The safety circuit is monitored for short circuit.<br>If X6 = 1: potential-free. You as the user must ensure short-circuit monitoring. Monitoring the time difference when closing and opening the two safety channels: max. 200 ms. |
| Admissible total resistance in the safety circuit | ASV5 TWIN: max. 50 Ω.<br>ASV5 TRIPLE: max. 33 Ω<br>All other variants: max. 100 Ω. |
| Max. permitted test pulse length | 1000 µs |
| Switching frequency | unlimited |
| Properties | Short-circuit proof and current-limited to 1.0 A against GND. |
| Operating current on X24 at 24 V | 10 mA |
| Operating current per channel on X25 at 24 V | ASV5 and ASV5 LLKM: 10 mA.<br>ASV5 TWIN: 20 mA.<br>ASV5 TRIPLE: 30 mA. |
| **Inputs** | |
| Signal level | 24 V DC / open. |
| **Outputs of the lamp driver** | |
| Output voltage | 24 V DC, not electrically isolated.<br>When output signals are to be evaluated by an external control, electrical isolation is mandatory.<br>For the signals NS_CLOSED, X25.6, and SIK_IS_CLOSED, X25.12, no correct information is available if the output voltage is < 16 V. |
| Output current $I_{Out}$ per output:<br>Fault message at:<br>Message "broken wire" (for X21.2 and X25.14) if | $0.012\ A \leq I_{Out} \leq 0.2\ A$.<br>$I_{Out} > 0.5$ A, constant.<br>$I_{Out} < 0.012$ A |

General, part 1 Tab. 3

| | |
|---|---|
| **Ambient conditions** | |
| Temperature | +10 °C - +50 °C. |
| Relative humidity | 95 % at 28 °C ambient temperature. |
| **Voltage supply of the ASV5 board** | |
| Characteristic | PELV power supply |
| Grounding | The output potentials of the PELV power supply must be connected to ground potential. |

General, part 2 Tab. 4

## 4.2 Response times

| Response time | Initial situation | Duration | |
|---|---|---|---|
| **Lasers with optical shutters / shutter switches** | | | |
| Time from closing the SIK to the laser light emission. | Safety circuit (SIK) open | 40 .. 100 ms [1] | |
| Time from the movement of the optical component (e.g. shutter) to the laser light emission. | Safety circuit (SIK) closed | 30 .. 95 ms [1] | |
| Time from the opening of the safety circuit to the end of laser light emission (deflection of the laser light into the absorber). | Safety circuit (SIK) is opened | 35 .. 75 ms [1, 2] | |
| **Lasers without optical shutters / shutter switches** | | | |
| Time from closing the SIK to the laser light emission. | Safety circuit (SIK) open | TruFiber (FD89, FD43, FD45), 20-14-xx-xx | max. 55 ms |
| | | TruFiber (FD34), 20-13-xx-xx | max. 90 ms |
| | | TruFiber (FD15), 20-08-04-xx TruDiode (FD19), 20-11-02-xx | max. 180 ms |
| | | Other laser types: | max. 100 ms |
| Time from the opening of the safety circuit to the end of laser light emission (switching off the laser power supply). | Safety circuit (SIK) is opened. | 25 ms [2] | |

Response times Tab. 5

[1] The reaction time depends on the switching time of the optical component used. Further information can be obtained from TRUMPF.

[2] Safety-related switch-off time: 350 ms.

Maximum time from opening the safety circuit (SIK) until the exit of laser light. This time takes into account a shutdown function error (error condition according to EN 60825-1).

## 4.3 Safety contacts

Only contacts and switches of safety devices with the following features may be incorporated in the safety circuits of the laser device:

- **electrically isolated**

  External supply not permissible to any pin.

  Exception: If jumper X6 = 1: external supply for 2-channel safety circuit.
- **positive opening** (e.g. positive opening position switch).

**Notes**

- You can find further information in the BIA manual (Berufsgenossenschaftliches Institut für Arbeitssicherheit – Institute for Occupational Safety and Health of the German Social Accident Insurance) ,
  ISBN: 3 503 02030 6, worksheet 330210,
  "Verriegelung beweglicher Schutzeinrichtungen" (Locking moveable safety devices).
- TRUMPF recommends only using bounce-free contacts and switches for the safety circuits of the laser device.

## 4.4 Wiring with 1-channel safety circuit

With a 1-channel safety circuit (SIK), the following requirements apply:

- movably connected lines which are not laid in a cable duct, must be routed in 2 separate cladding lines.
- the connections of the safety circuit in the connectors must be insulated (e.g. shrink hose).

## 4.5 Safety-related characteristics

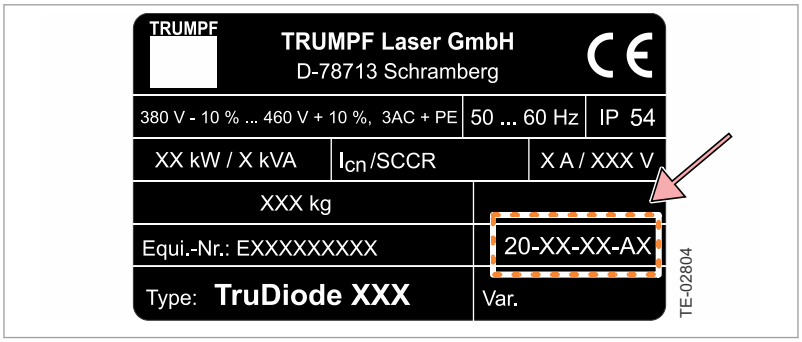
| **Basis** | **DIN EN ISO 13849-1:2016-06**<br>**Safety of Machinery - Safety-Related Parts of Control Systems - General Principles for Design** | |
|---|---|---|
| Service life | 20 years | |
| Tested safety functions | Designation | PL |
| 1 | Preventing the escape of laser radiation with open one-channel safety circuit X24. | d |
| 2 | Preventing the escape of laser radiation with open two-channel safety circuit X25. | e |
| 3 | Preventing the escape of laser radiation in the event of a defective or incorrectly connected laser light cable by internal laser light cable monitoring. | |
| 4 | Preventing the escape of laser radiation in case of defective or incorrectly connected laser light cable, detected by an external monitoring board. | |
| 5 | Preventing the escape of laser radiation in case of incorrect information of the status output X25.6 "NS_CLOSED". | |
| 6 | Preventing the escape of laser radiation in case of incorrect information of the status output X25.12 "SIK_IS_CLOSED". | |

General characteristics Tab. 6

| Product name | ID No. | $PFH_d$ | $MTTF_d$ | PL | Cat. | DC |
|---|---|---|---|---|---|---|
| TruDisk 1000 | 20-05-17-A1 | $9.81 * 10^{-9}$ | 284 years | **e** | **4** | ≥ 99% |
| TruDisk 1xxx/2xxx/3xxx/4xxx/5xxx/6xxx/8xxx/10xxx/12xxx/16xxx | 20-10-xx | | | | | |
| TruPulse | 20-06-xx-xx | | | | | |
| TruMicro | 20-09-xx | | | | | |
| TruDiode 6xx/9xx | 20-11-03-xx | | | | | |
| TruDiode 8xx/1xxx/2xxx/3xxx/4xxx | 20-11-01-xx | | | | | |
| TruDiode 6xxx | 20-11-05-xx | | | | | |
| TruDiode 1xx/3xx (FD19) | 20-11-02-xx | $5.25 * 10^{-8}$ | 49 years | | | |
| TruFiber 1000 (FD15) | 20-08-04-xx | $8.39 * 10^{-9}$ | 284 years | | | |
| TruFiber 500/1000/1500/2000 (FD34) | 20-13-xx-xx | $9.38 * 10^{-9}$ | 195 years | | | |
| TruFiber 500/1000/1500/2000/3000/4000/6000 P (FD89) | 20-14-01-xx | $1.34 * 10^{-8}$ | 170 years | | | |
| TruFiber 3000 S/4000 S/5000 S/6000 S (FD43) without optical component | 20-14-02-xx | $1.34 * 10^{-8}$ | 170 years | | | |
| TruFiber 3000 S/4000 S/5000 S/6000 S (FD43) with optical component | 20-14-02-xx | $9.81 * 10^{-9}$ | 284 years | | | |
| TruFiber 300x P/300x R (FD45) without optical component | 20-14-04-xx | $1.47 * 10^{-8}$ | not specified | | | |
| TruFiber 400x P/600x P/6001 R (FD45) without optical component | 20-14-04-xx | $1.96 * 10^{-8}$ | | | | |
| TruFiber 9000 P/9001 R (FD45) without optical component | 20-14-04-xx | $2.45 * 10^{-8}$ | | | | |
| TruFiber 12001 P/12001 R (FD45) without optical component | 20-14-04-xx | $2.95 * 10^{-8}$ | | | | |
| TruFiber 300x S/400x S/600x S/900x S/12001 S (FD45) with optical component | 20-14-04-xx | $9.81 * 10^{-9}$ | 284 years | | | |

Product-specific characteristics in relation to safety function 2 Tab. 7

Contact TRUMPF if your laser device is not in the table. The ID no. is to be found on the nameplate of the laser device (see "Fig. TE-02804", pg. 15).




Nameplate of the laser device, example Fig. TE-02804

The general and product-specific characteristics were determined with an ASV5.

The general and product-specific characteristics apply to all laser operating modes:

- Automatic mode
- Inspection
- Maintenance and cleaning
- Setting up
- Testing
- Programming and troubleshooting

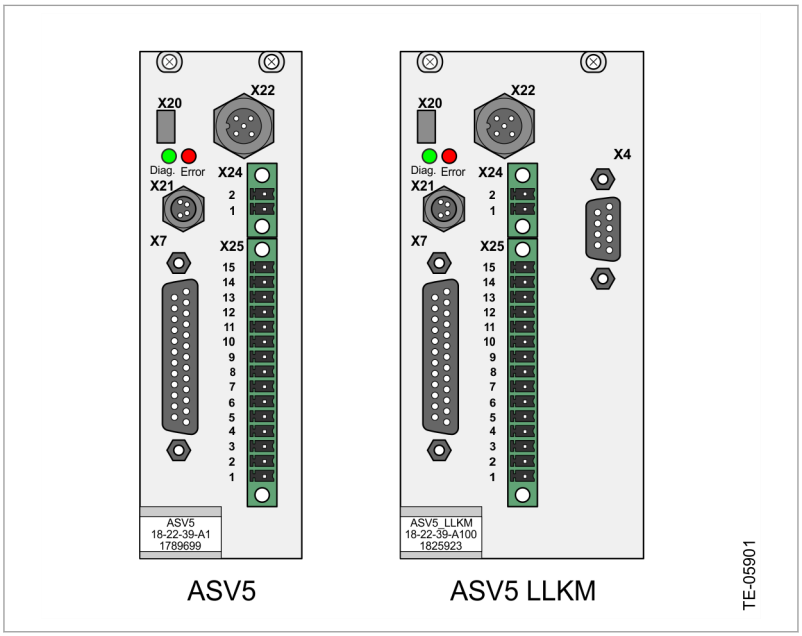
# 5. Interfaces

## 5.1 Overview

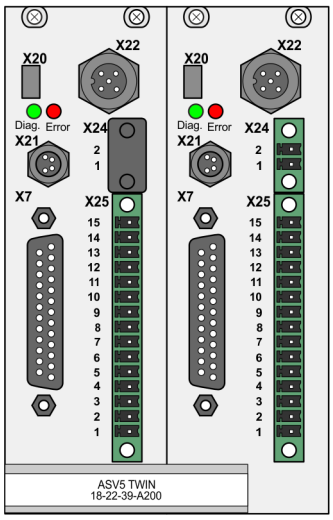
The connections of the safety circuit interface are located on the front plate of the board.

| Connec-tion: | Function |
|---|---|
| X4 | Internal interface (only for ASV5 LLKM) |
| X7 | Internal interface |
| X20 | Test and diagnostics (only for test purposes) |
| X21 | External laser warning lamp |
| X22 | Internal interface |
| X24 | Single-channel safety circuit |
| X25 | Dual-channel safety circuit |

Connections ASV5 Tab. 8



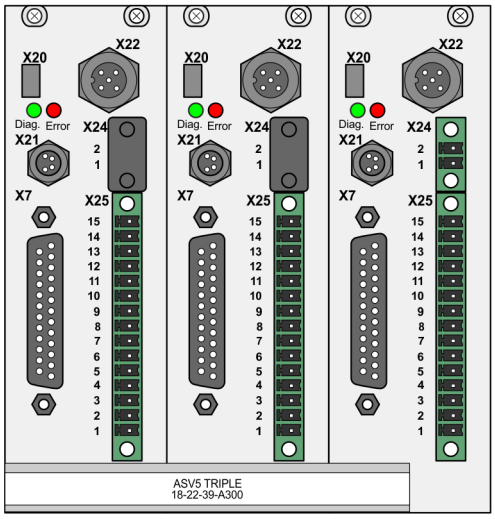

Front plates ASV5 and ASV5 LLKM Fig. TE-05901




ASV5 TWIN

TE-05902

Front plate ASV5 TWIN Fig. TE-05902




ASV5 TRIPLE

TE-05903

Front plate ASV5 TRIPLE Fig. TE-05903

# LED indicator functions

| LED | Indicator functions | |
|---|---|---|
| Diag. | LED is lit permanently<br>LED flashes slowly | = Standard operation<br>= Error status |
| Error | LED flashes quickly<br>LED is lit | = The board has detected a fault |

Indicator functions of the Diag. and Error LEDs Tab. 9

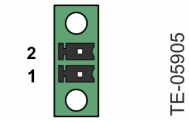
## 5.2 Pin assignment of the interfaces

### External laser warning lamp (X21)

| X21 | Pin no. | Direction | Signal | Function |
|---|---|---|---|---|
|  TE-05910 | 1 | | GND | Reference potential for external laser warning lamp |
| | 2 | \|→ | LASER_ WARNING_LAMP | Output for indicator light (fiber breakage monitoring): external laser warning lamp |
| | 3 | - | RESERVE | Not used |
| | 4 | - | RESERVE | Not used |
| | Direction: \|→ = Output | | | |

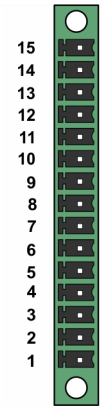
Tab. 10

### Safety circuit single-channel (X24)

| X24 | Pin no. | Direction | Signal | Function |
|---|---|---|---|---|
|  TE-05905 | 1 | \|→ | SIK_OUT | Single-channel safety circuit to the safety contact |
| | 2 | \|← | SIK_IN | Single-channel safety circuit from the safety contact |
| | Direction: \|→ = output, \|← = input | | | |

Tab. 11

# Safety circuit two-channel (X25)

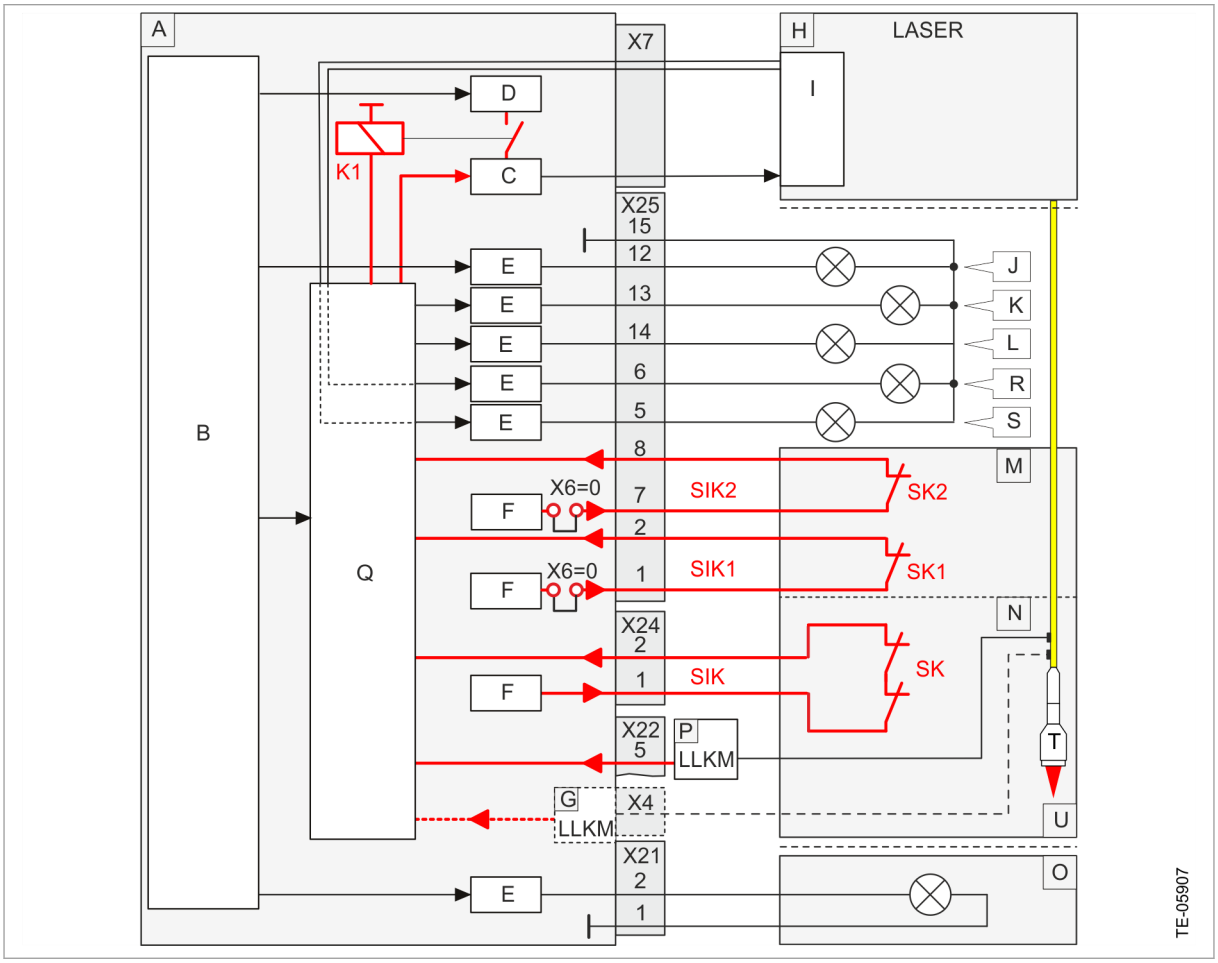
| X25 | Pin no. | Direction | Signal | Function |
|---|---|---|---|---|
|  TE-05906 | Safety circuit | | | |
| | 1 | \|→ | SIK1.1_OUT | 2-channel safety circuit, channel 1 to safety contact 1 |
| | 2 | \|← | SIK1.2_IN | 2-channel safety circuit, channel 1 from safety contact 1 |
| | 7 | \|→ | SIK2.1_OUT | 2-channel safety circuit, channel 2 to safety contact 2 |
| | 8 | \|← | SIK2.2_IN | 2-channel safety circuit, channel 2 from safety contact 2 |
| | Laser warning lamp, status displays and signaling contacts | | | |
| | 3, 4 | - | RESERVE | Not used |
| | 5 | \|→ | NS_OPEN | Proximity switch: shutter switch (VW) is open. |
| | 6 | \|→ | NS_CLOSED | Proximity switch: shutter switch (VW) is closed. Safe output (PLe) in accordance with tested safety function no. 5 (see "Safety-related characteristics", pg. 14). |
| | 9 ... 11 | - | RESERVE | Not used |
| | 12 | \|→ | SIK_IS_CLOSED*) | Output for indicator light (no fiber breakage monitored): safety circuit is closed. Safe output (PLe) in accordance with tested safety function no. 6 (see "Safety-related characteristics", pg. 14). |
| | 13 | \|→ | ASV_IS_OPEN | Output for indicator light (no fiber breakage monitored): shutter or switch is open. |
| | 14 | \|→ | LASER_WARNING_LAMP | Output for indicator light (fiber breakage monitored): laser warning lamp. |
| | 15 | - | GND | Reference potential for indicator lights and proximity switches. |
| | Direction: \|→ = output, \|← = input | | | |

| X25 | Pin no. | Direction | Signal | Function |
|---|---|---|---|---|
| **Notes**<br>▪ If X6 = 0 (factory setting): **SK1 (safety contact 1)** is high-switching and **SK2 (safety contact 2)** low-switching (as with ASV3).<br>The safety circuit is monitored for short circuit.<br>▪ If X6 = 1: **SK1 (safety contact 1)** and **SK2 (safety contact 2)** are high-switching.<br>You as the user must ensure short-circuit monitoring.<br>▪ **NS_OPEN** and **NS_CLOSED** can be used for external beaming time monitoring,<br>see technical information "Monitoring the laser beaming time with ASV5", doc.-No.: 18-22-39-CP.<br>▪ The outputs for the **indicator lights** and the **proximity switches of the optical components** are not electrically isolated. If these signals are to be evaluated via an external control, electrical isolation must be implemented.<br>▪ The outputs for the **indicator lights** and the **proximity switches of the optical components** are available with the ASV5 TWIN and ASV5 TRIPLE boards for each output separately.<br>▪ The signals **SIK1.1_OUT**, **SIK1.2_IN**, **SIK2.1_OUT** and **SIK2.2_IN** are only available on the ASV5 Twin and ASV5 TRIPLE boards at X25 on the far right. | | | | |
| *) The signal SIK_IS_CLOSED, ASV5, X25, Pin 12, is inverted compared to signal SIK_IS_OPEN, ASV3, X25, Pin12.<br>Reason:<br>With signal SIK_IS_CLOSED, the state of the SIK is safely indicated and external applications can safely use this signal. | | | | |

Tab. 12

# 6. Using interfaces

## 6.1 Wiring of the interfaces, X6 = 0 (factory setting)



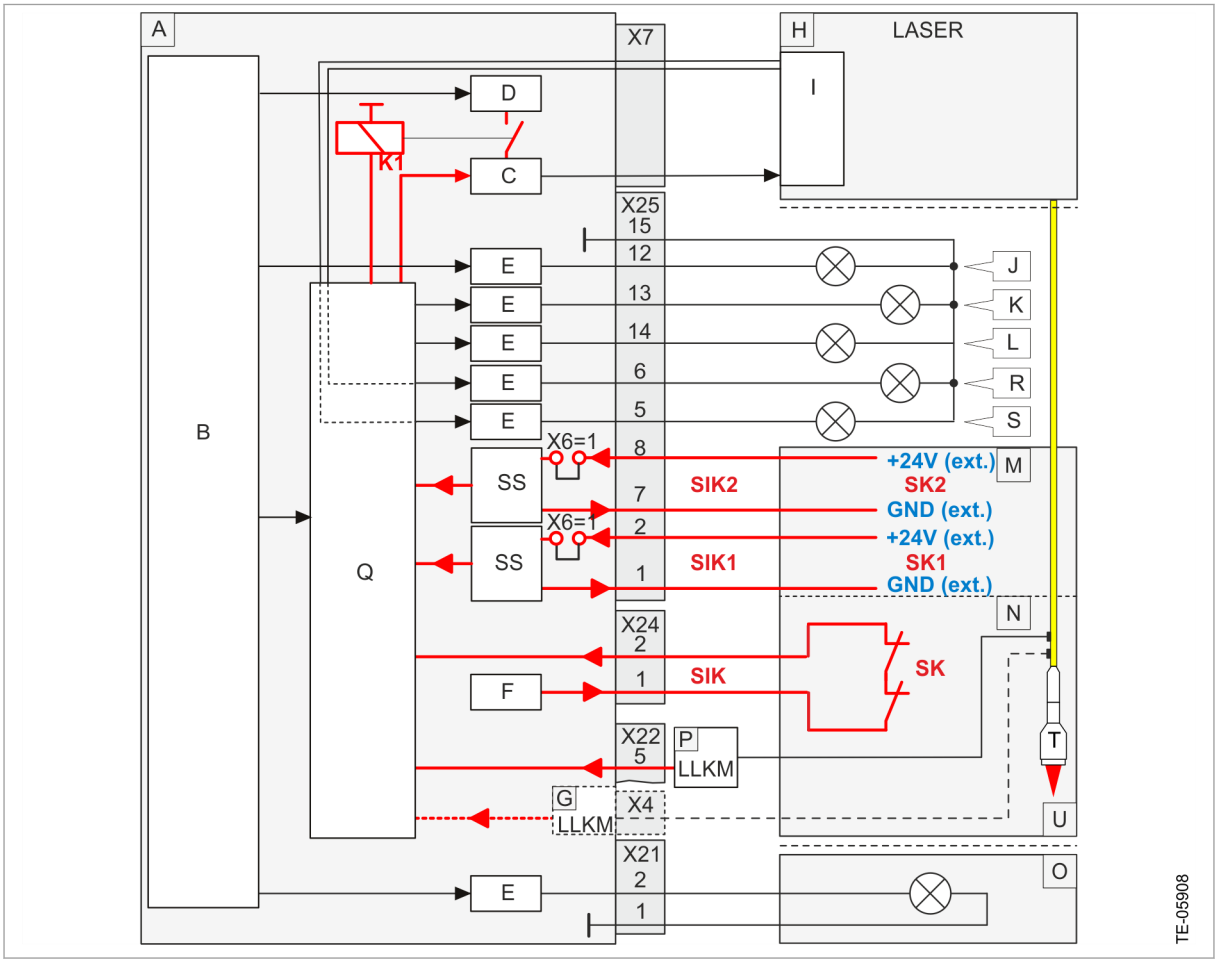

Wiring of the interfaces, jumper X6 = 0 (factory setting) Fig. TE-05907

| | | | | | |
|---|---|---|---|---|---|
| A | Board ASV5 | G | Integrated LLK monitoring (LLKM), option, only G or P | I | External laser warning lamp |
| B | Processor with periphery | | | R | Lamp "NS_CLOSED" |
| Q | TRUMPF safety logic | P | External LLK monitoring (LLKM), option, only G or P | s | Lamp "NS_OPEN" |
| C | Output stage for beam switch | | | M | Safety circuit 2-channel, monitored for short circuit |
| D | 24 V driver for output stage C | SIK | Safety circuit | | |
| K1 | Safety switching relay for output stage C | | SIK: 1-channel SIK | N | Single-channel safety circuit |
| | | | SIK1: 2-channel SIK channel 1 | SK | SK: Safety contact SIK |
| E | Lamp driver 24 V | | SIK2: 2-channel SIK channel 2 | | SK1: Safety contact SIK1 |
| F | 24 V driver for SIK, SIK1 and SIK2 | H | Laser | | SK2: Safety contact SIK2 |
| | | I | Beam switch | T | Focusing optics |

| | | | | | |
|---|---|---|---|---|---|
| X6 | Setting the activation of the 2-channel safety circuit | J | Lamp "SIK is shut" | U | Processing station |
| | | K | Lamp "ASV is open" | O | External laser warning lamp |

Tab. 13

## 6.2 Wiring of the interfaces, X6 = 1




Wiring of the interfaces, jumper X6 = 1 Fig. TE-05908

| | | | | | |
|---|---|---|---|---|---|
| A | Board ASV5 | E | Lamp driver 24 V | R | Lamp "NS_CLOSED" |
| B | Processor with periphery | SS | SIK sensor | s | Lamp "NS_OPEN" |
| Q | TRUMPF safety logic | F | 24 V driver for SIK | M | 2-channel safety circuit, external voltage supply (24 V and GND, short-circuit monitoring required) |
| C | Output stage for beam switch | G | Integrated LLK monitoring (LLKM), option, only G or P | | |
| X6 | Setting the activation of the 2-channel safety circuit | | | N | Single-channel safety circuit |
| | | P | External LLK monitoring (LLKM), option, only G or P | SK | SK: Safety contact SIK<br>SK1: Safety contact SIK1<br>SK2: Safety contact SIK2 |
| D | 24 V driver for output stage C | | | | |
| K1 | Safety switching relay for output stage C | H | Laser | | |
| | | I | Beam switch | | |

| | | | | | |
|---|---|---|---|---|---|
| SIK | Safety circuit<br>SIK: 1-channel SIK<br>SIK1: 2-channel SIK channel 1<br>SIK2: 2-channel SIK channel 2 | J | Lamp "SIK is shut" | T | Focusing optics |
| | | K | Lamp "ASV is open" | U | Processing station |
| | | I | External laser warning lamp | O | External laser warning lamp |

Tab. 14

## 6.3 Interface for two-channel safety circuit (X25)

The user can use the following functions via the X25 connector:

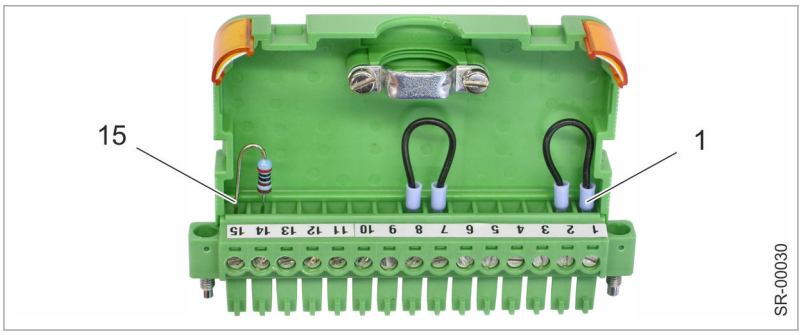
- Integrate safety equipment into the 2-channel laser device safety circuit by means of safety contacts (SC1 and SC2).
- Connect an external laser warning lamp (external function display).
- Connect external indicator lamps:
  - SIK is closed (safety circuit is closed)
  - ASV is open (laser light can be emitted)

The laser warning lamp behaves as described in standard DIN EN 60825-1. The lamp driver for the external laser warning lamp monitors the functionality of the lamp connected.

In the event of a defective laser warning lamp, the control signals monitoring. Shut down with malfunction is not performed, as a defective laser warning lamp does not pose a hazard.

**Note**

Criterion for the functionality test is the fiber breakage of a light bulb. If LEDs are to be used for the display, it must be ensured that the displays internally check their functionality and simulate a fiber breakage in the event of a failure.




Provided plug for X25 Fig. SR-00030

In the connector provided, the external laser warning lamp is simulated by a resistor (2 kΩ). The two channels of the 2-channel safety circuit are bridged by means of wire jumpers.

**Note**

The respective resistor must be removed, when an external laser warning lamp is being connected.

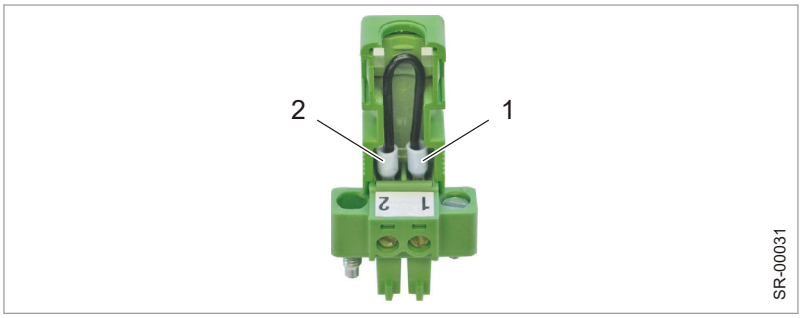
Insulated wire end ferrules must be used for the safety circuit wiring.

## 6.4 Interface for one-channel safety circuit (X24)

**Notes**

- TRUMPF recommends using the 2-channel safety circuit.
- The 1-channel safety circuit is not available to the user if connector X24 is already being used for internal functions.

Using connector X24, the user can integrate safety equipment into the 1-channel safety circuit of the laser device via a redundant safety contact (SC).




Provided plug X24 Fig.

In the supplied connector, the 1-channel safety circuit is bridged by a jumper wire.

**Note**

Insulated wire end ferrules must be used for the safety circuit wiring.

**Wiring with 1-channel safety circuit**

With a 1-channel safety circuit (SIK), the following requirements apply:

- movably connected lines which are not laid in a cable duct, must be routed in 2 separate cladding lines.
- the connections of the safety circuit in the connectors must be insulated (e.g. shrink hose).

## 6.5 External laser warning lamp on X21

An external laser warning lamp (external function display) can be connected directly to the connector X21 of an ASV5.

The laser warning lamp behaves as described in standard DIN EN 60825-1.

The lamp driver monitors the functionality of the externally connected laser warning lamp.

In the event of a defective laser warning lamp, the control signals monitoring. Shut down with malfunction is not performed, as a defective laser warning lamp does not pose a hazard.




Provided plug X21, opened Fig. TE-05909

In the connector provided, the external laser warning lamp is simulated by a resistor (2 kΩ).

**Note**

The existing resistor must be removed when an external pilot lamp is being connected.

## 6.6 LED display as laser warning lamps

The following elements can be used if an LED display is to be used as a laser warning lamp:

**Order information**

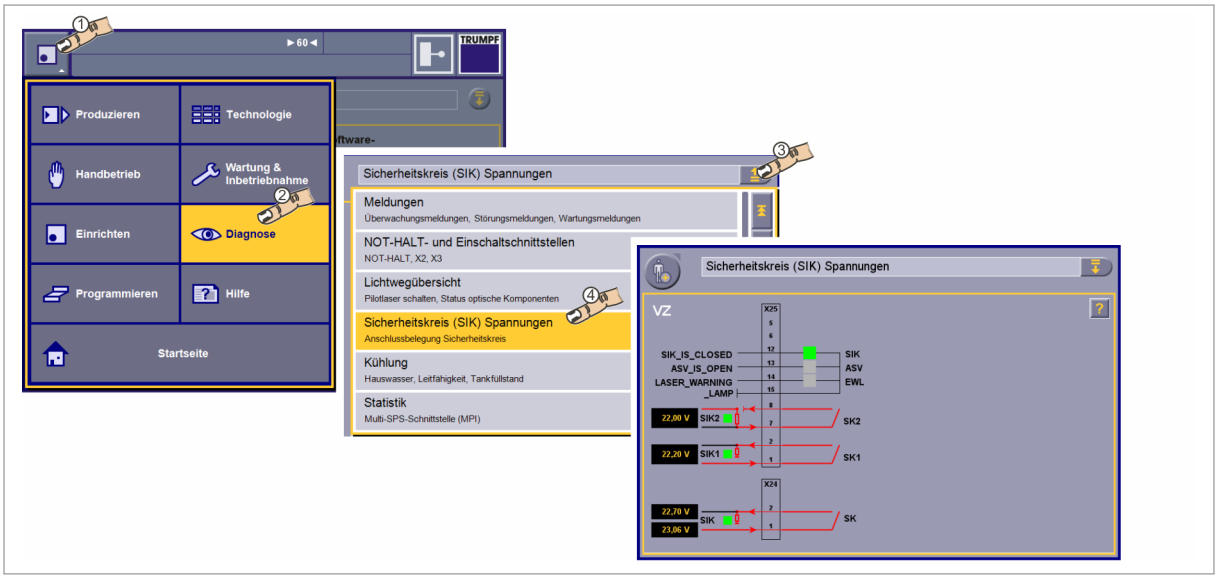
24 V LED continuous light element for laser warning lamp (yellow)
Material no.: 0799554

Base
Material no.: 0768022

Laser warning lamp, complete
Material no.: 0779297

## 6.7 Diagnostics

The status of the safety circuits and the applied voltages can be displayed in the >*Diagnostics* >*Safety circuit (SIK) voltages* dialog.




Diagnostics safety circuit (SIK), example Fig. TE-05964

| Signal | Description |
|---|---|
| SIK | Signal **SIK_IS_CLOSED** is active. An external indicator light can be operated with this signal. |
| ASV | Signal **ASV_IS_OPEN** is active. An external indicator light can be operated with this signal. |
| EWL | Signal **LASER_WARNING_LAMP** is active. An external laser warning lamp can be operated with this signal. |
| SK2 | Safety contact 2 (SC2) in safety circuit channel 2 (SIK2) is closed. |
| SK1 | Safety contact 1 (SC1) in safety circuit channel 1 (SIK1) is closed. |
| SK | Safety contact (SC) in one-channel safety circuit (SIK) is closed. |
| For further information: see software manual "TruControl 1000", doc. no. 10-06-80-A1-CR. | |

Tab. 15

# 7. Information on changing a board

Information for changing a board can be found in the following spare parts descriptions:

- "Changing ASV5 board", document no. 18-22-39-A1-EM, applicable to the following boards:
  - ASV5
  - ASV5 TWIN
  - ASV5 TRIPLE
- "Changing ASV5 LLKM board", document no. 18-22-39-A100-EM, applicable to the ASV5 LLKM board.

The spare parts descriptions are included with the delivery of a replacement board.