

# SI-JET Series

## SI-JET3-CON5 SI-JET3-FK-200/100-H

By way of the three red light beams, the SI-JET Spray Jet Monitoring System monitors the density and the symmetry around the opening angle of the spray jet. With the comprehensive SI-JET-Scope software the system can be parameterised under Windows®.

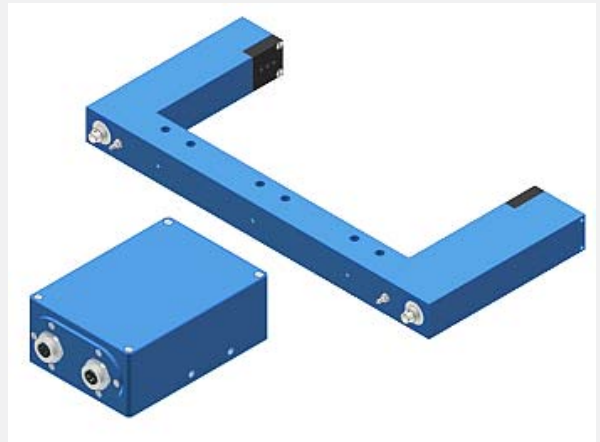
- Telecentric design enables a big fork width
- Insensitive to dirt accumulation due to pressed air facility (at transmitter and receiver side of the fork)
- Averaging (over 32000 values)
- RS232 interface (USB or Ethernet adapter is available)
- Windows® user interface
- Teachable by means of integrated teach button, PLC, or PC
- Insensitive to outside light due to clocked red light LED (30 kHz)
- High dynamic range (due to light power adjustment of LED via RS232)
- High resolution (12-bit-A/D-converter)

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### Design

#### Product name:

#### SI-JET3-CON5

(electronic control unit, incl. software SI-JET-Scope)

#### SI-JET3-FK-200/100-H

(sensor frontend, optics horizontal)

Accessories (cf. page 11):

#### SI-JET3-CAL (calibration unit)

5-pole fem. connector  
Binder 712  
(RS232 interface)  
Connecting cable:  
cab-las5/PC or  
cab-5/USB or  
cab-5/ETH-500

Sturdy aluminum housing,  
anodized in blue

Reverse:  
3-pole fem. connector  
Binder 712  
7-pole fem. connector  
Binder 712

3x potentiometer for adjust-  
ment of the gain for the  
3 red light beams

Transmitter

SI-JET3-FK-200/100-H

Sturdy aluminum fork,  
anodized in blue

Pressurized  
chamber  
(transmitter)

TEACH button  
for external  
teaching  
(via input IN0)

Red light beams  
(3x ø 3mm)

8-pole fem.  
connector  
Binder 712  
(PLC connection)  
Connecting cable:  
cab-las8/SPS

Mounting holes  
(threaded)

Switching state indication  
(5 yellow LEDs)

Connector 3-pole  
type Binder 712

Connecting cable:  
cab-las3/FE-1m

Mounting holes  
(threaded)

Compressed-air  
supply

Pressurized chamber  
(receiver)

Receiver

Connector 7-pole type Binder 712

Connecting cable: cab-las7/FE-1m



**Technical Data**

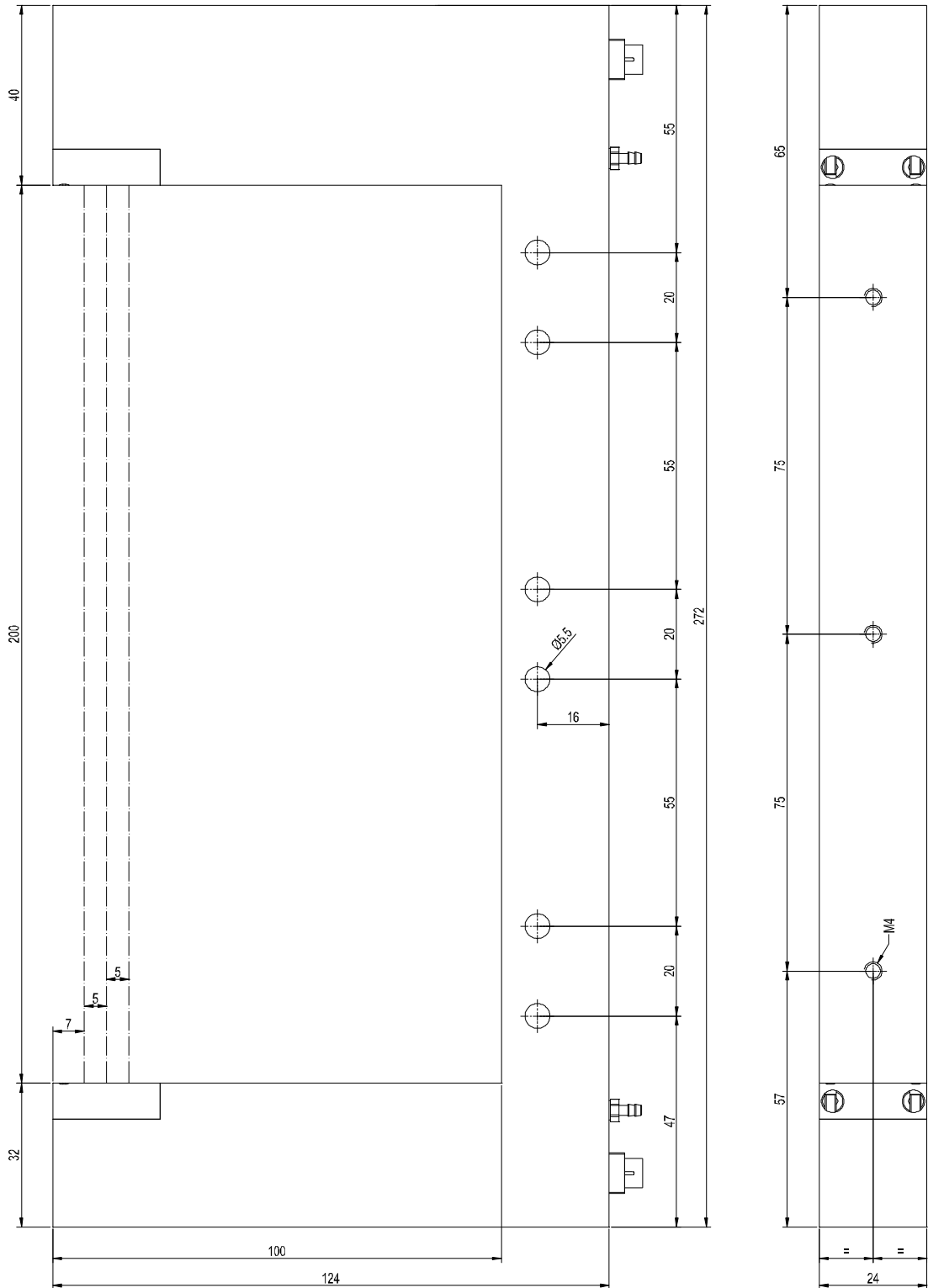
Model	SI-JET3-CON5 (electronic control unit)
Voltage supply	+24VDC ( $\pm 10\%$ ), reversed-polarity protected, overload protected
Current consumption	typ. 200 mA
Operating temperature	-10°C ... 50°C
Enclosure rating	IP64
Housing material	Aluminum, anodized in blue
Housing dimensions	approx. 80 mm x 65 mm x 30 mm (without connectors)
Type of connector	Connection to PC: 5-pole female connector type Binder 712 Connection to PLC: 8-pole female connector type Binder 712 Connection to frontend, transmitter side: 3-pole female connector type Binder 712 Connection to frontend, receiver side: 7-pole female connector type Binder 712
Transmitter	Super bright LED (red, 650 nm), modulated 30 kHz
External teaching	by means of an integrated push-button
Switching state indication	by means of 5 yellow LEDs
Interface	RS232, parameterizable under Windows®
Averaging	adjustable under Windows: max. 32768 values
Outputs	OUT0 ... OUT4, digital (0V/+U <sub>B</sub> ), short-circuit-proof, 100 mA max. switching current; npn- or pnp-capable (bright- and dark-switching can be adjusted)
External teach input IN0	+U <sub>B</sub> -Signal (min. pulse length 250 ms, max. pulse length 1000 ms)
Pulse lengthening	adjustable under Windows®: 0 ms .. 100 ms
EMV test acc. to	DIN EN 60947-5-2

Model	SI-JET3-FK-200/100-H (frontend)
Fork width	200 mm
Red light beam alignment	telecentric, 3 x $\varnothing$ 3 mm, distance between the beam bundles: 5 mm SI-JET3-FK-200/100-H: beam bundles arranged horizontally
Optical filter	Red light filter RG630
Beam divergency	typ. 10 mrad
Enclosure rating	IP 67
Operating temperature range	-10°C ... +50°C
Storage temperature range	-20°C ... +85°C
Housing material	Aluminum, anodized in blue
Housing dimensions	approx. 272 mm x 124 mm x 24 mm
Type of connector	Transmitter side: 3-pole circular connector type Binder Series 712 Receiver side: 7-pole circular connector type Binder Series 712
Pressed air connector	at transmitter side and at receiver side



Dimensions

SI-JET2-FK-200/100-H  
(Sensor frontend)

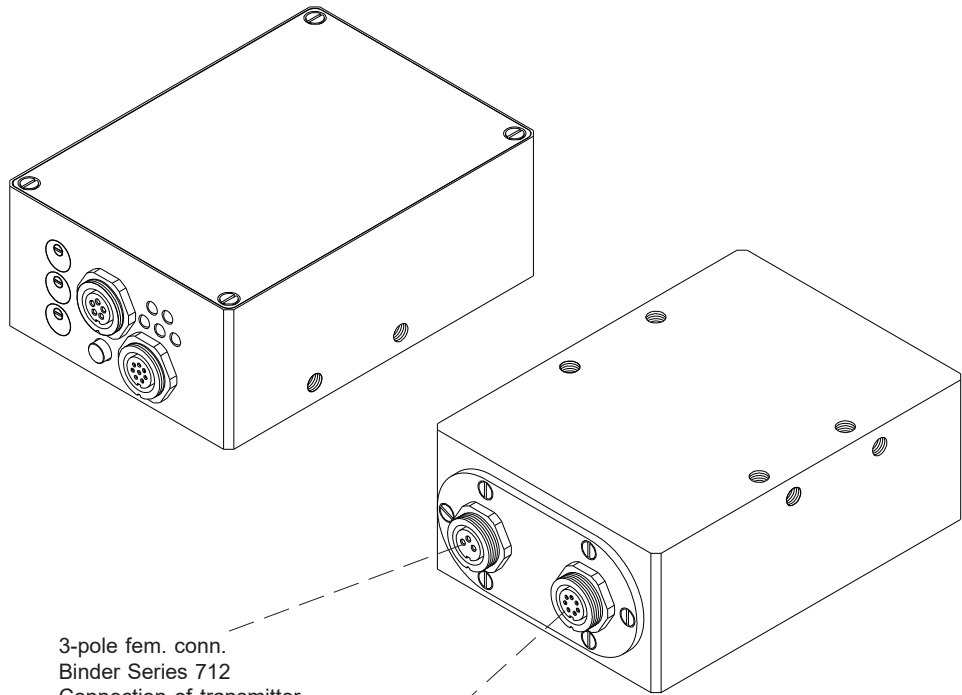


All dimensions in mm



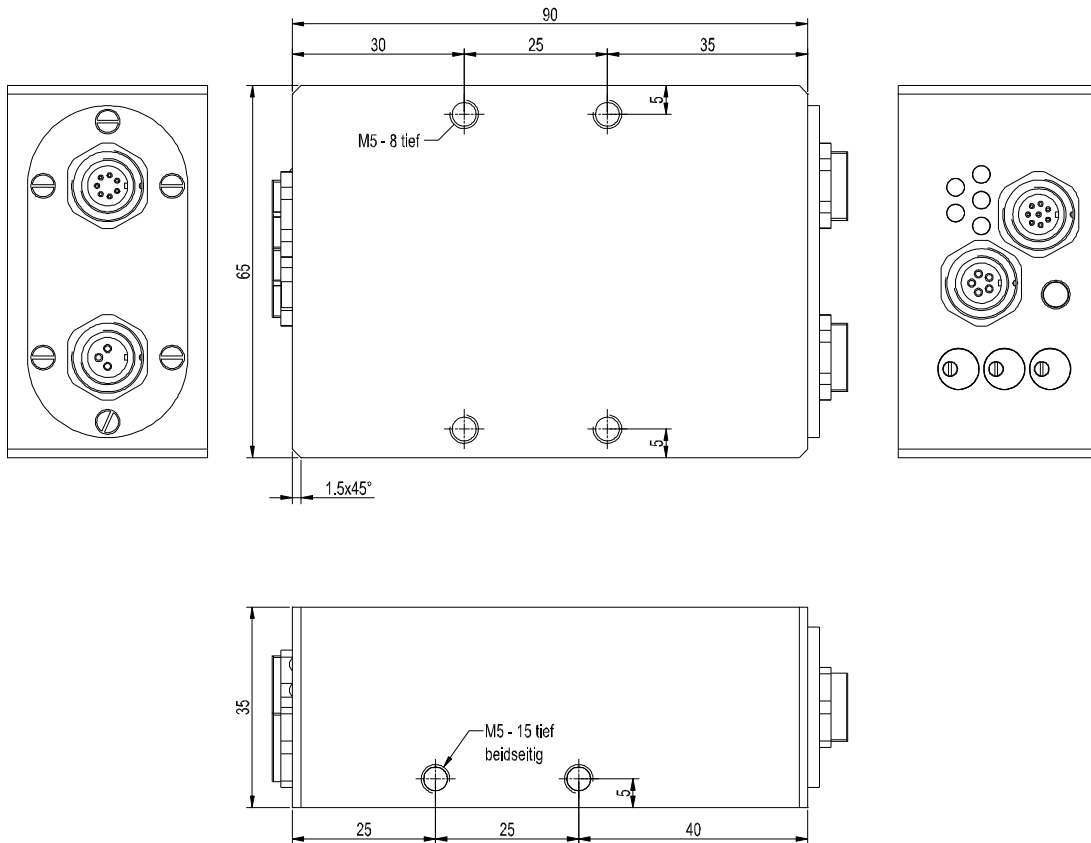
Dimensions

**SI-JET3-CON5**  
(Electronic control unit)



3-pole fem. conn.  
Binder Series 712  
Connection of transmitter  
side of frontend  
SI-JET3-FK-200/100-H

7-pole fem. connector  
Binder Series 712  
Connection of receiver  
side of frontend  
SI-JET3-FK-200/100-H



All dimensions in mm

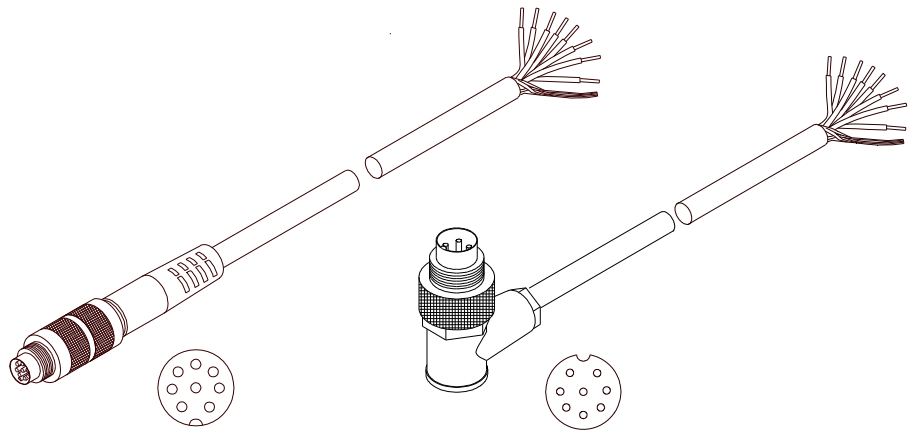


**Connector Assignment**

**Connection SI-JET3-CON5 to PLC:  
8-pole fem. connector Binder Series 712**

Pin:	Color:	Assignment:
1	white	GND (0V)
2	brown	+24VDC (±10%)
3	green	IN0
4	yellow	OUT0
5	grey	OUT1
6	pink	OUT2
7	blue	OUT3
8	red	OUT4

Connecting cable:  
cab-las8/SPS-(length)  
cab-las8/SPS-w-(length) (angle type, 90°)  
(standard length 2m)



cab-las8/SPS-...  
(max. length 25m, outer jacket: PUR)

cab-las8/SPS-w-...  
(max. length 25m, outer jacket: PUR)

**Connection to PC:  
5-pole fem. connector Binder Series 712**

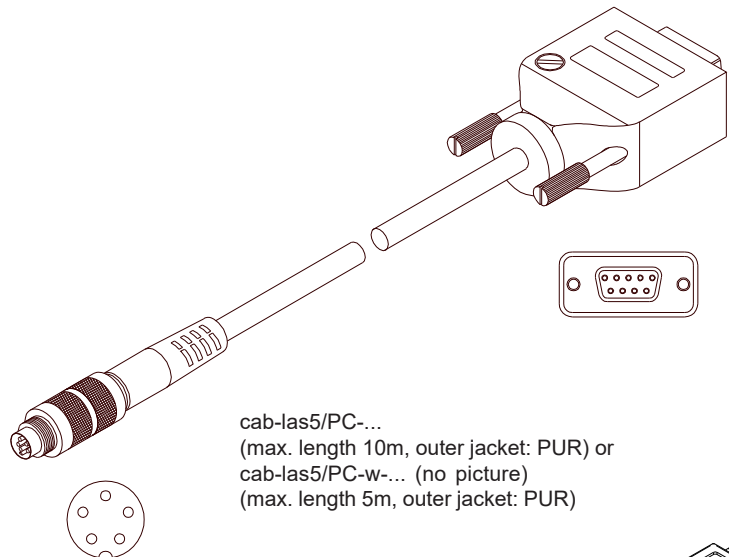
Pin:	Assignment:
1	GND (0V)
2	TxD
3	RxD
4	+24VDC (+Ub, OUT)
5	not connected

**Connection via RS232 interface at the PC:**  
Connecting cable:  
cab-las5/PC-(length)  
cab-las5/PC-w-(length) (angle type 90°)  
(standard length 2m)

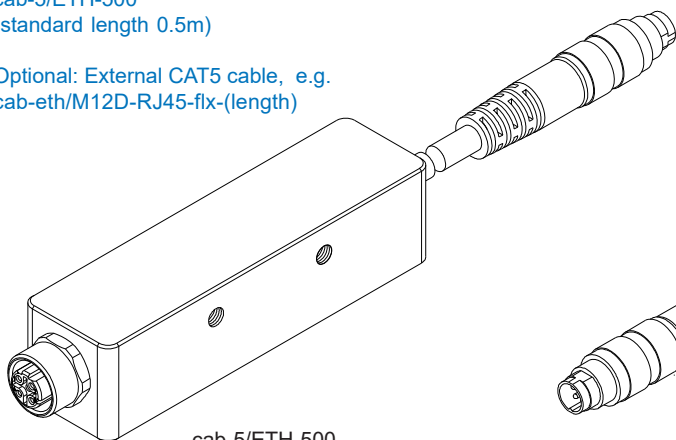
**alternative:**  
**Connection via USB interface at the PC:**  
Connecting cable (incl. driver software):  
cab-5/USB-(length)  
cab-5/USB-w-(length) (angle type 90°)  
(standard length 2m)

**Connection to local network via Ethernet bus:**  
Adapter (incl. software „SensorFinder“):  
cab-5/ETH-500  
(standard length 0.5m)

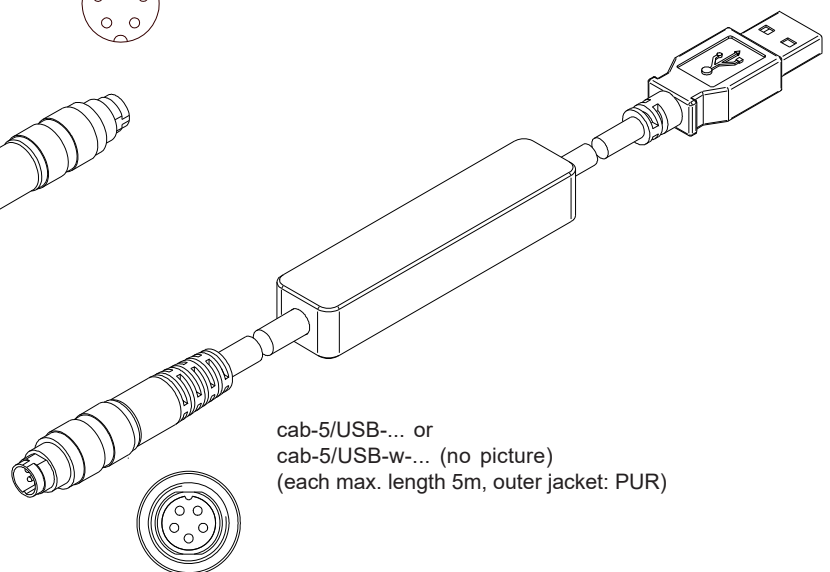
Optional: External CAT5 cable, e.g.  
cab-eth/M12D-RJ45-flx-(length)



cab-las5/PC-...  
(max. length 10m, outer jacket: PUR) or  
cab-las5/PC-w-... (no picture)  
(max. length 5m, outer jacket: PUR)



cab-5/ETH-500  
(length 0.5m, outer jacket: PUR)  
4-pole M12 fem. conn. (D-coded)  
for connection of an external  
CAT5 cable, e.g.  
cab-eth/M12D-RJ45-flx-(length)



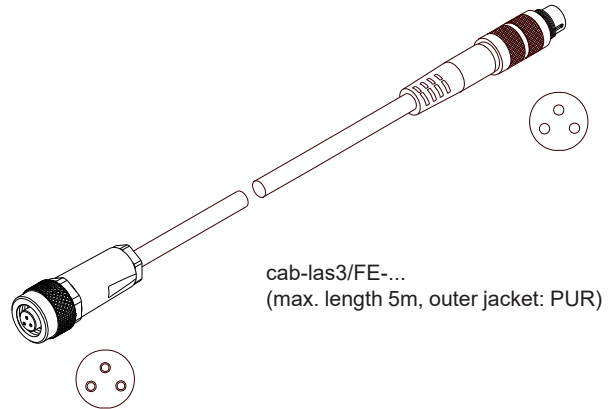
cab-5/USB-... or  
cab-5/USB-w-... (no picture)  
(each max. length 5m, outer jacket: PUR)

Connector Assignment

**Connection SI-JET3-CON5 to  
SI-JET3-FK-200/100-H (transmitter side)**  
3-pole fem. connector Binder Series 712 (at SI-JET3-CON5)

Pin:	Assignment:
1	LED anode
2	LED cathode
3	not connected

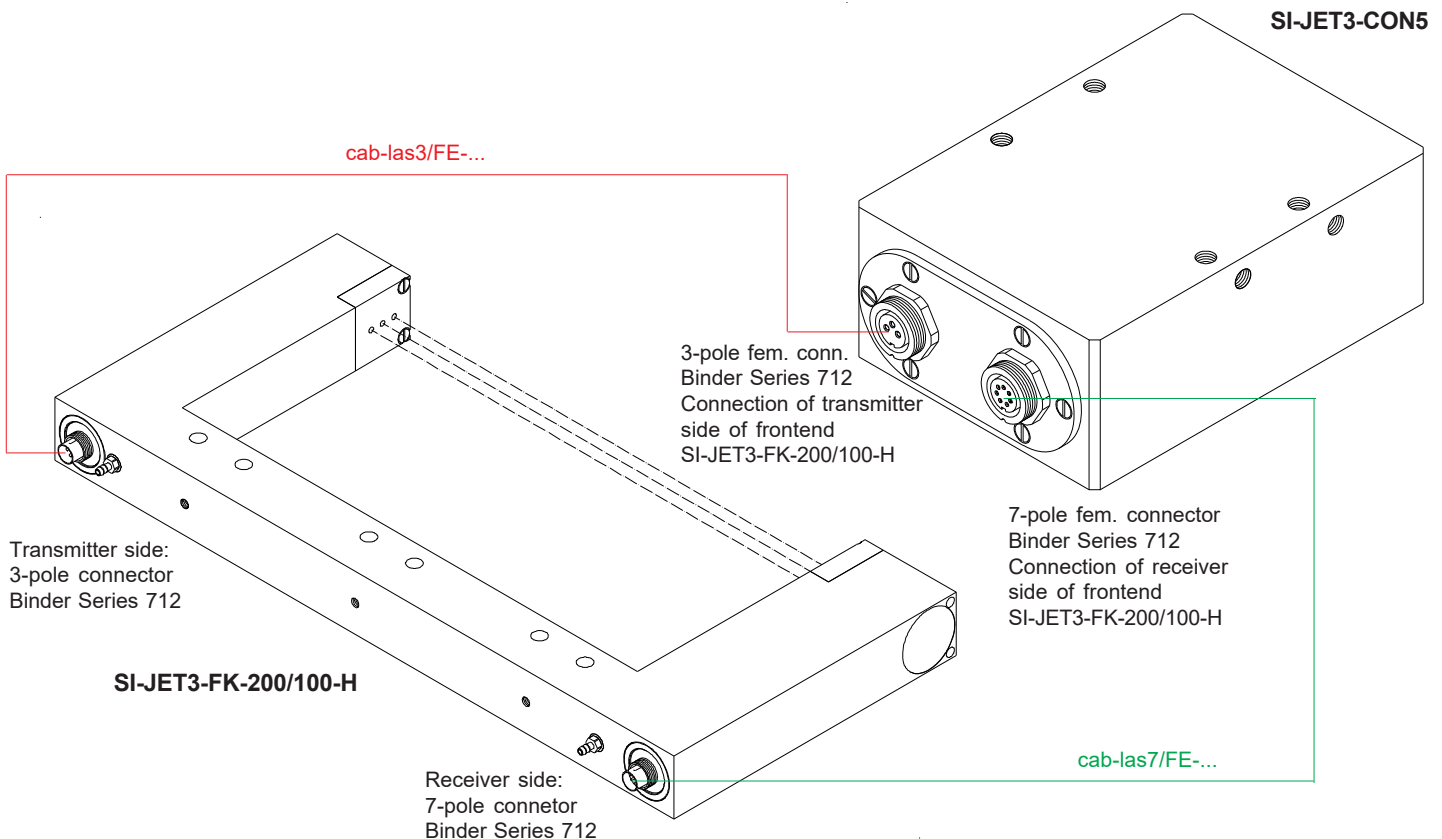
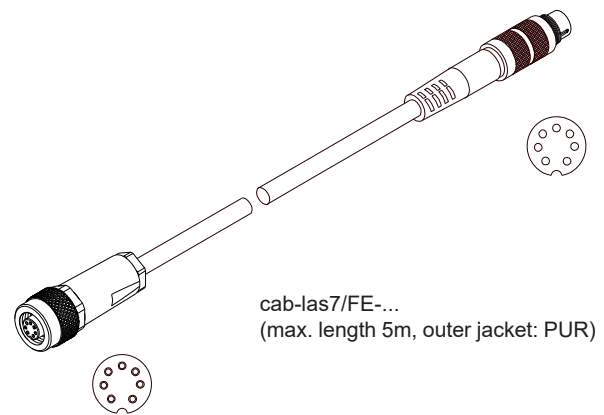
Connecting cable:  
cab-las3/FE-(length)  
(standard length 1m)



**Connetion SI-JET3-CON5 to  
SI-JET3-FK-200/100-H (receiver side)**  
7-pole fem. connector Binder Series 712 (at SI-JET3-CON5)

Pin:	Assignment:
1	0V
2	+Ub (+24VDC ± 10%)
3	ANA1
4	ANA2
5	ANA3
6	0V
7	not connected

Connecting cable:  
cab-las7/FE-(length)  
(standard length 1m)

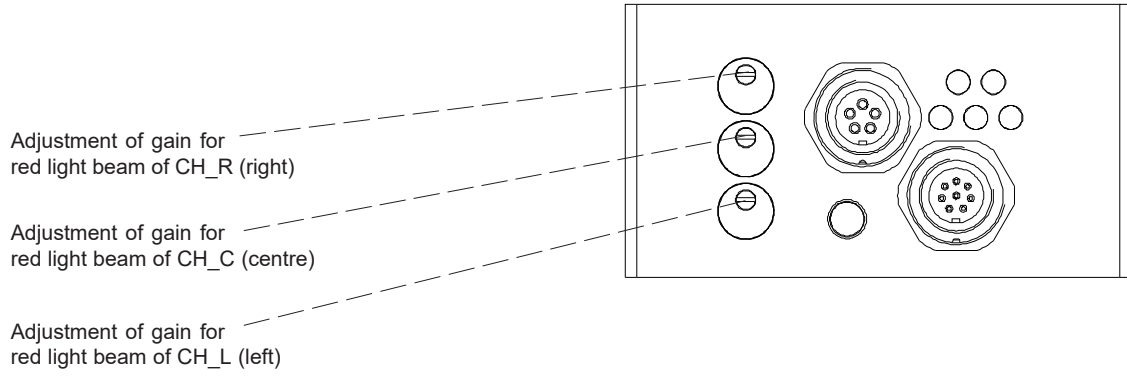




Settings

**Potentiometer for adjustment of gain:**

Rotation clockwise: Increase of signal





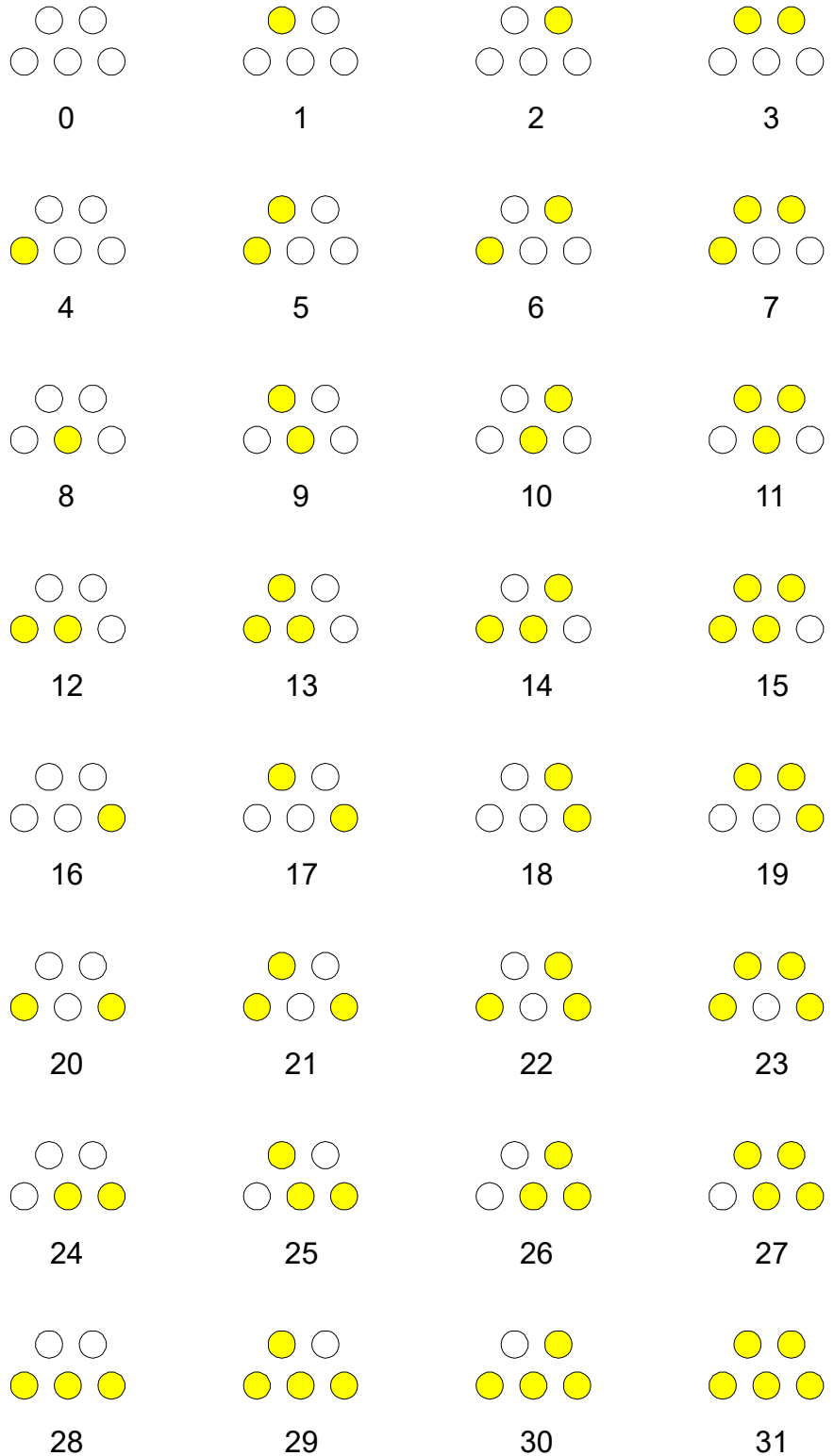
LED Display

**LED display:**

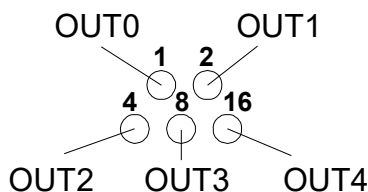
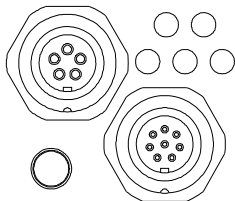
The line vector is visualised by way of 5 yellow LEDs at the housing of the SI-JET sensor. At the same time in the BINARY mode (OUTMODE BINARY) the line vector indicated on the LED display is output as 5-bit binary information at the digital outputs OUT0 to OUT4 of the 8-pole SI-JET/PLC female connector.

The SI-JET sensor is able to process a maximum of 31 line vectors (0 ... 30) in accordance with the corresponding lines in the TEACH TABLE. An "error" or a "not detected" is displayed by the lighting of all LED (OUT0 ... OUT4) digital outputs are set to HIGH-level).

In the DIRECT mode (OUTMODE DIRECT HI or OUTMODE DIRECT LO) the maximum numbers of line vectors to be taught is 5 (no. 0, 1, 2, 3,4).



„Error“  
or  
„not detected“







**Measuring Principle**
**Measuring principle:**

With the help of a super-bright red-light LED modulated light is aligned in parallel in the collimator optic unit. A suitable aperture technology ensures that three beams of red light ( $\varnothing$  3 mm each, 5 mm distance to each other) leave the transmitting branch of the transmitter, and at the receiving side are again directed onto three receiving optical-fibers by mean of 3 apertures with suitable receiving optics.

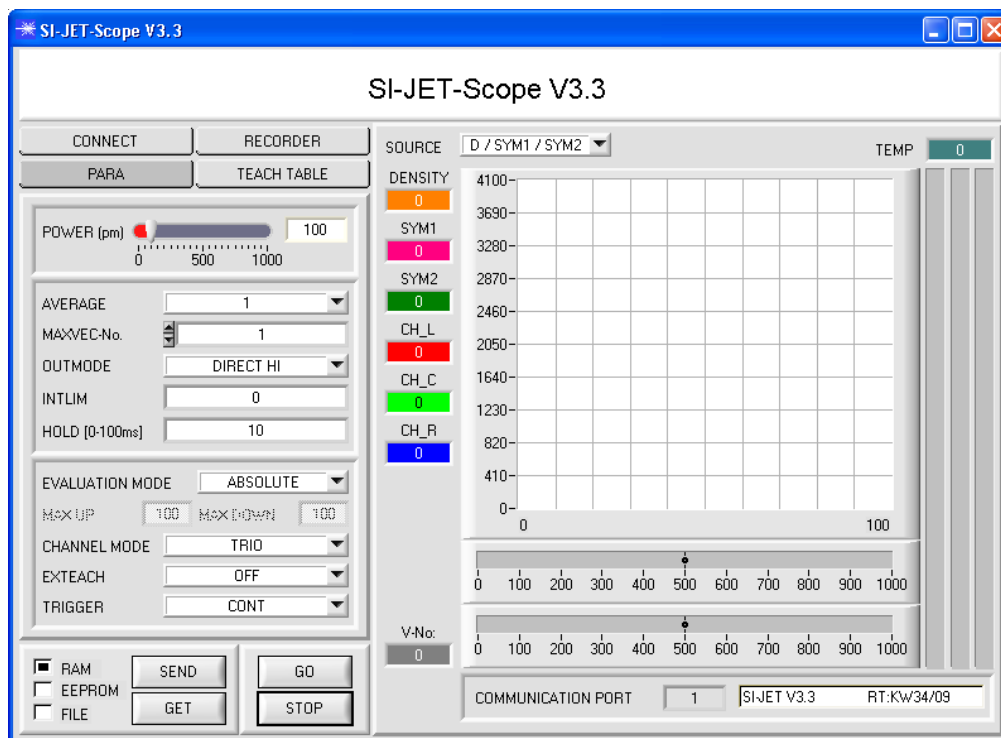
By means of the optoelectronic detectors, the three light signals are converted into three electronic signals and are digitised by way of 12-bit-A/D-converters. When a spray jet now crosses the path of the three red light beams, the respective light beams are attenuated due to light absorption and/or light deflection at the droplets contained in the spray jet. The degree of attenuation of the respective signal is a measure for the droplet contraction at the place of the light beam.



**Parameterization**
**Parameterization under Windows® with software SI-JET-Scope:**

The following three measurands are picked up and monitored in the production process by the SI-JET spray jet monitoring system:

- Spray jet density (average of the 3 red light parts CH\_L, CH\_C, CH\_R )
- Symmetry 1 (the two outer channels are put into proportion to each other)
- Symmetry 2 (Symmetry 1 is put into proportion to the centre channel)

**Evaluation modes:**

The SI-JET3 can be operated with two different evaluation modes.

**ABSOLUTE:** The absolute status of the three channels CH\_L, CH\_C, and CH\_R is used for evaluation.

**RELATIVE:** The current status of the three channels CH\_L, CH\_C, and CH\_R relative to their maximum values in the last 60 seconds is used for evaluation.

**TEACH process:**

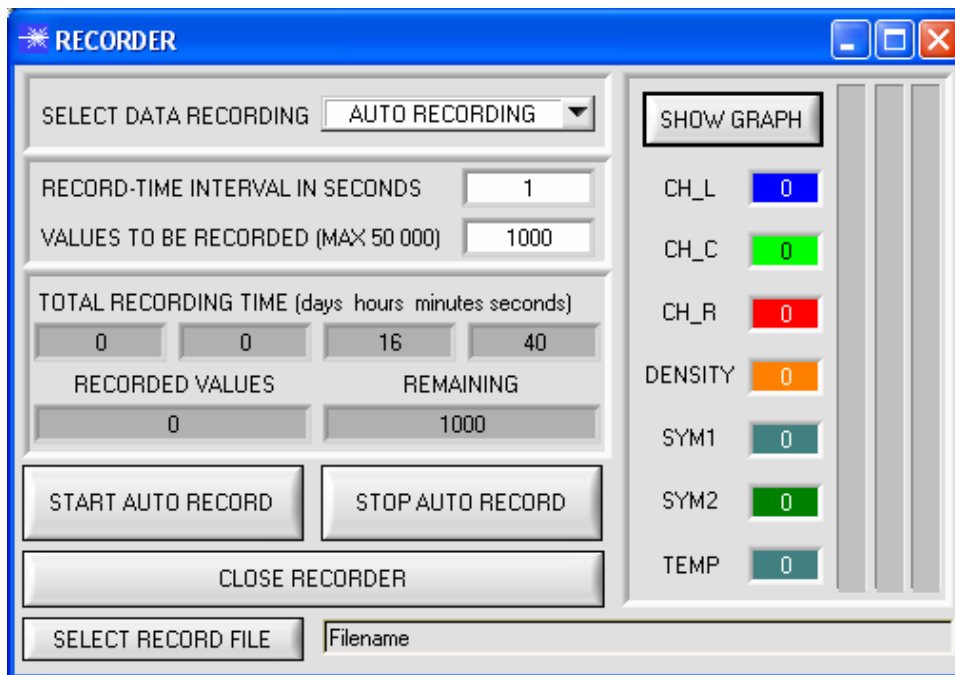
The teach process can be performed either with the parameterisation software, by way of the teach input (IN0 PIN3 green at the cab-las8/SPS cable), or by means of the switch at the housing. When teaching is performed through the IN0 input, the tolerance values for density and symmetry must first be stored once in the EEPROM of the control unit with the help of the parameterisation software. Before input IN0 is activated, the status to be taught must be present at the sensor frontend, i.e. spraying must first be switched on, and then IN0 must be set to +24V.

The current status is taught to as many rows in the Teach Table as have been selected under MAXVEC-No. Classification is performed by way of different set tolerances.


 Data Recorder
**Function of the data recorder:**

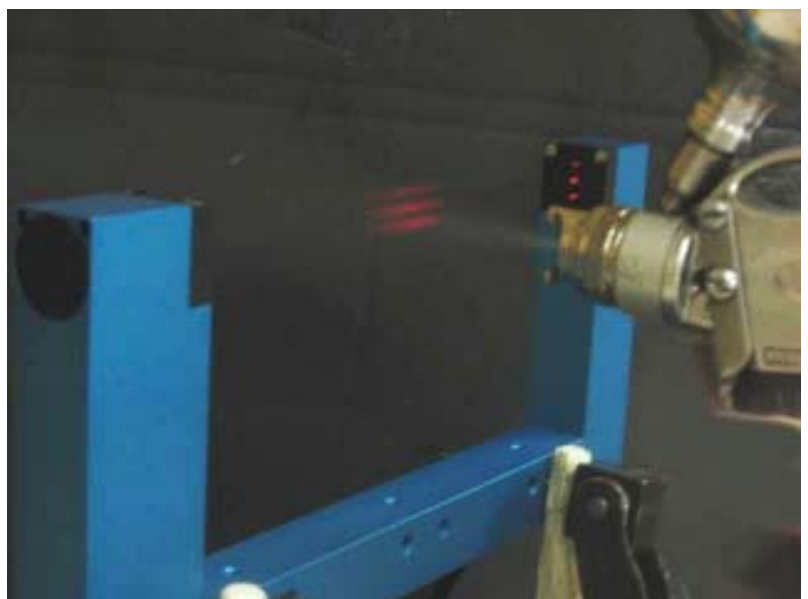
The SI-JET-Scope software features a data recorder that makes it possible to save a certain number of data frames. The recorded file is saved to the hard disk of the PC and can then be evaluated with a spreadsheet program.

The created file has eight columns and as many rows as data frames were recorded. A row is structured as follows: Date and time, CH\_L, CH\_C, CH\_R, DENSITY, SYM1, SYM2, TEMP.



 Application Example
**Monitoring of the spray jet cone**

Three parallel aligned red light bundles will be compared to each other.





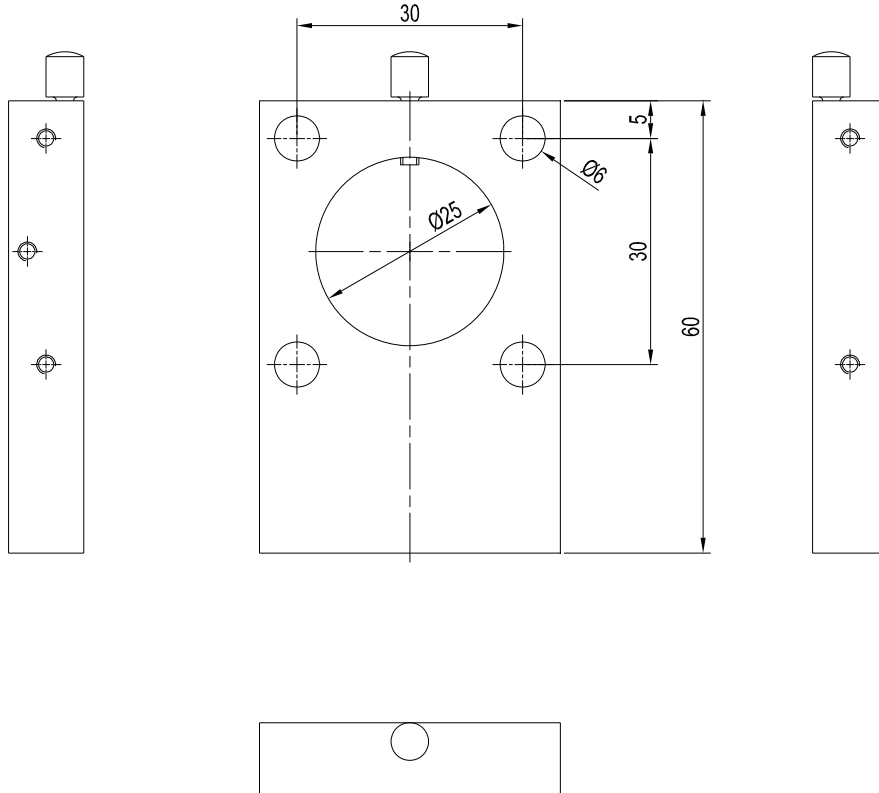
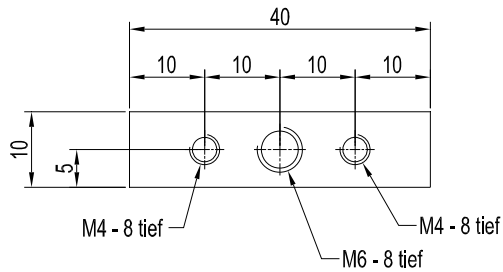
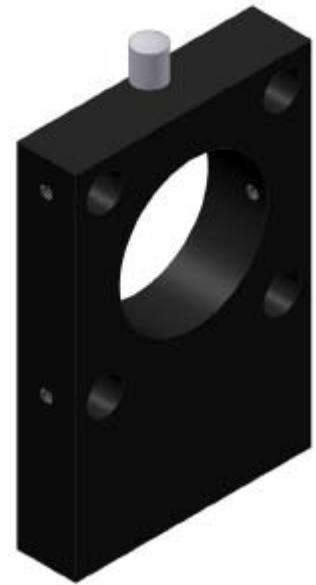
Accessories

**Calibration unit SI-JET3-CAL:**

incl. 6 different neutral glass filters:

Easy-change filters OD 0,1; 0,3; 0,6; 1,0; 2,0; 3,0; Ø 25 mm

(please order calibration unit separately)



All dimensions in mm