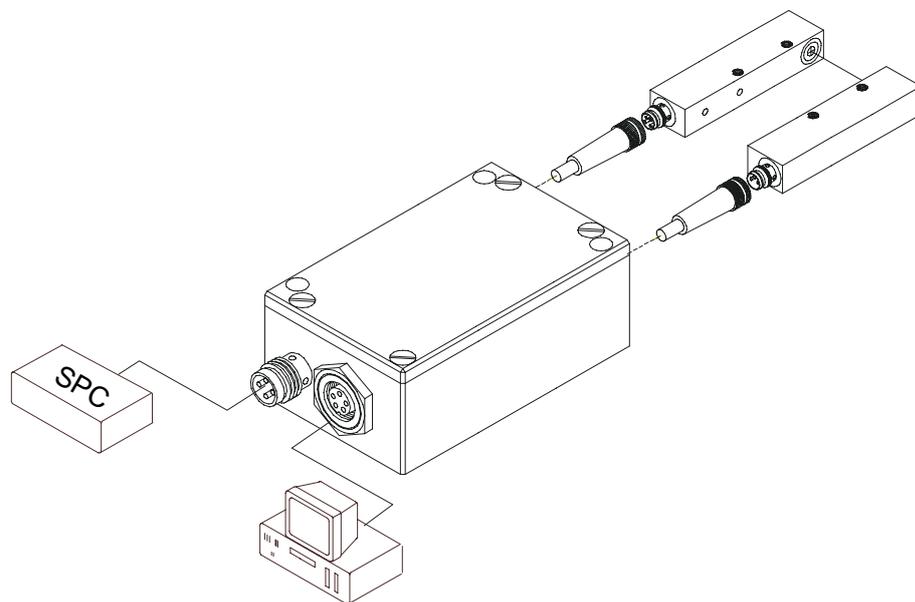


# Manual

## Software A-LAS-Scope V2.3

(PC-Software for Microsoft® Windows® XP, 2000, NT® 4.0, Me, 98, 95)

for electronic control unit **SI-CON4**



This manual describes installation and commissioning of the PC software for the electronic control unit *SI-CON4*.

All the products of the A-LAS series of Sensor Instruments can be connected to the electronic control unit *SI-CON4*. The electronic control unit *SI-CON4* guarantees a stable voltage supply for the respective transmitter / receiver of the A-LAS series. The electronic control unit *SI-CON4* also amplifies and processes the analog signal of the A-LAS receiver in a suitable manner. A micro-controller performs 8-bit analog/digital conversion of the analog signal, allowing recording and evaluation of the signal characteristics at the A-LAS sensor. Furthermore the electronic control unit *SI-CON4* offers various options for intelligent laser power control (dirt accumulation compensation) at the A-LAS sensor.

Parameters and measured values can be exchanged between the PC and the electronic control unit *SI-CON4* through the RS232 interface. All the parameters can be stored in the non-volatile EEPROM of the electronic control unit *SI-CON4* through the serial RS232 interface. The A-LAS-Scope V2.3 Windows software facilitates parameterisation, diagnostics, and adjustment of the sensor system (oscilloscope function).

When parameterisation is finished, the electronic control unit *SI-CON4* continues to run in STAND-ALONE operation, without a PC.

# 1 Installation of the A-LAS-Scope software

Hardware requirements for successful installation of the *A-LAS-Scope* software:

- IBM PC AT or compatible
- VGA graphics
- Microsoft® Windows® XP, Me, 2000, 98, NT® 4.0 or 95
- Serial RS232 interface at the PC
- Microsoft-compatible mouse
- Cable for the RS232 interface (cab-las5/PC)
- CD-ROM drive
- 5 MByte of free hard disk space

Please install the *A-LAS-Scope* software as described below:

The *A-LAS-Scope* software can only be installed under Windows. Windows must therefore be started first, if it is not yet running.

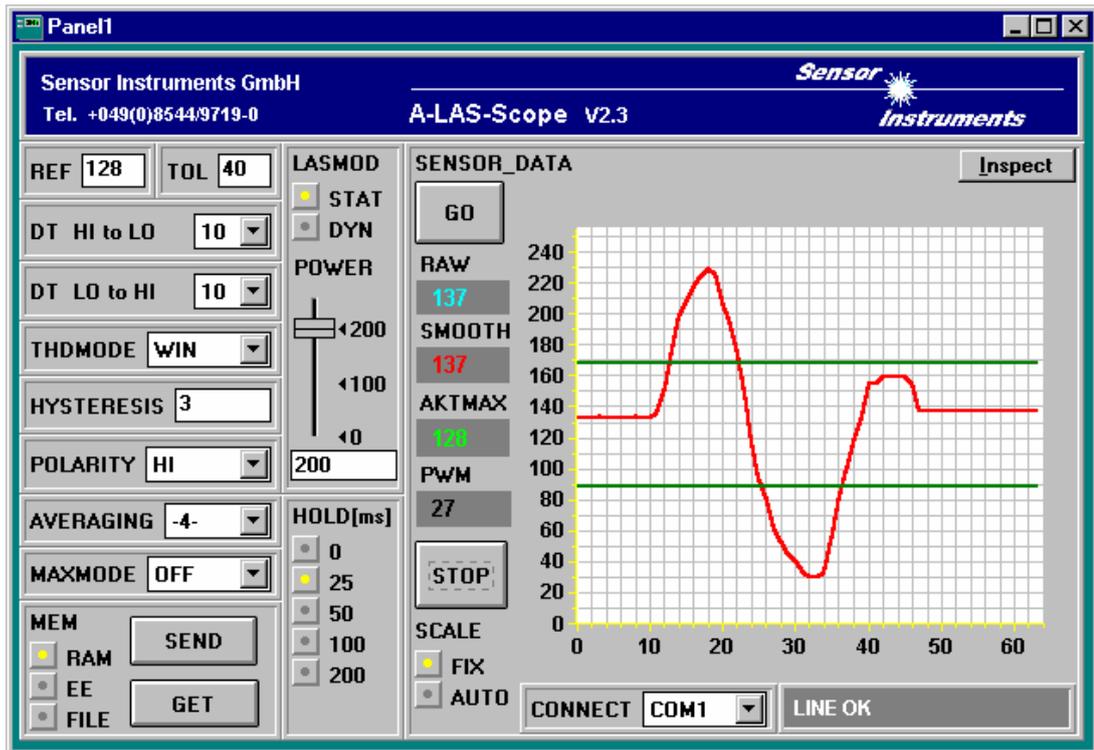
1. The software can be installed directly from the installation CD-ROM. To install the software, start the SETUP program in the INSTALL folder of the CD-ROM.
2. The installation program displays a dialog and suggests to install the A-LAS-Scope software in the C:\CON4 directory on the hard disk. You may accept this suggestion with **OK** or **[ENTER]**, or you may change the path as desired. Installation is then performed automatically.
3. During the installation process a new program group for the A-LAS-Scope software is created in the Windows Program Manager. In the A-LAS-Scope program group an icon for starting the software is created automatically. When installation is successfully completed the installation program displays "Setup OK".
4. After successful installation the software can be started with a left mouse button double-click on the A-LAS-Scope icon.

Windows™ is a trademark of the Microsoft Corp.  
MS-DOS® is a registered trademark of the Microsoft Corp.  
VGA™ is a trademark of the International Business Machines Corp.

## 2 Operation of the A-LAS-Scope software

When the A-LAS-Scope software is started the following window appears on the Windows interface:

Please read this chapter first before you start to adjust and parameterise the A-LAS / SI-CON4 sensor system.



The function of the individual A-LAS-Scope control elements will be explained on the following pages:



### REF Setting:

After a mouse-click on this edit-box the reference value can be specified here by entering a numerical value. The reference value corresponds with the teach-in value (setpoint value) of the degree of covering at the light measuring section caused by the target.

Because of the 8-bit analog/digital converter the dynamic range is 0 ... 255 A/D units, which is proportional to the respective covering (analog signal 0 ... 10V) at the light measuring section of the sensor.



### TOL Setting:

With this edit box a tolerance band can be applied around the currently specified reference value (setpoint value). If the set tolerance limit is exceeded, this leads to a change of switching state at pin 4 (blk) of the 4-pole M8-plug (digital output DIGITAL OUT).

DT HI to LO 4

**DT HI to LO:**

In this function field a time constant DT for the speed of automatic threshold correction can be set. The current maximum value is cyclically checked by the  $\mu$ C software. The numerical value specified here determines the time interval between two maximum value scans. If the current maximum-value decreases (HI to LO), the current monitoring threshold is automatically corrected with the set delay DT.

Value range: 0 ... 15

Value 0: Minimum time delay, fastest correction.

Value 15: Maximum time delay, slowest correction.

DT LO to HI 12

**DT LO to HI:**

In this function field a time constant DT for the speed of automatic threshold correction can be set. The current maximum value is cyclically checked by the  $\mu$ C software. The numerical value specified here determines the time interval between two maximum value scans. If the current maximum-value increases (LO to HI), the current monitoring threshold is automatically corrected with the set delay DT.

Value range: 0 ... 15

Value 0: Minimum time delay, fastest correction.

Value 15: Maximum time delay, slowest correction.

THDMODE HI

**THDMODE:**

In this function field one of three possible positions of the monitoring thresholds with respect to the reference can be selected.

**LOW:**

The monitoring threshold (green line) lies below the current reference value. If the current measured value (red graph) falls below this threshold, the digital error output DIGITAL OUT is activated.

**HI:**

The monitoring threshold (green line) lies above the current reference value. If the current measured value (red graph) rises above this threshold, the digital error output DIGITAL OUT is activated.

**WIN:**

The monitoring thresholds (green lines) form a symmetric tolerance band around the current reference value. If the current measured value (red graph) violates this tolerance band, the digital error output DIGITAL OUT is activated.

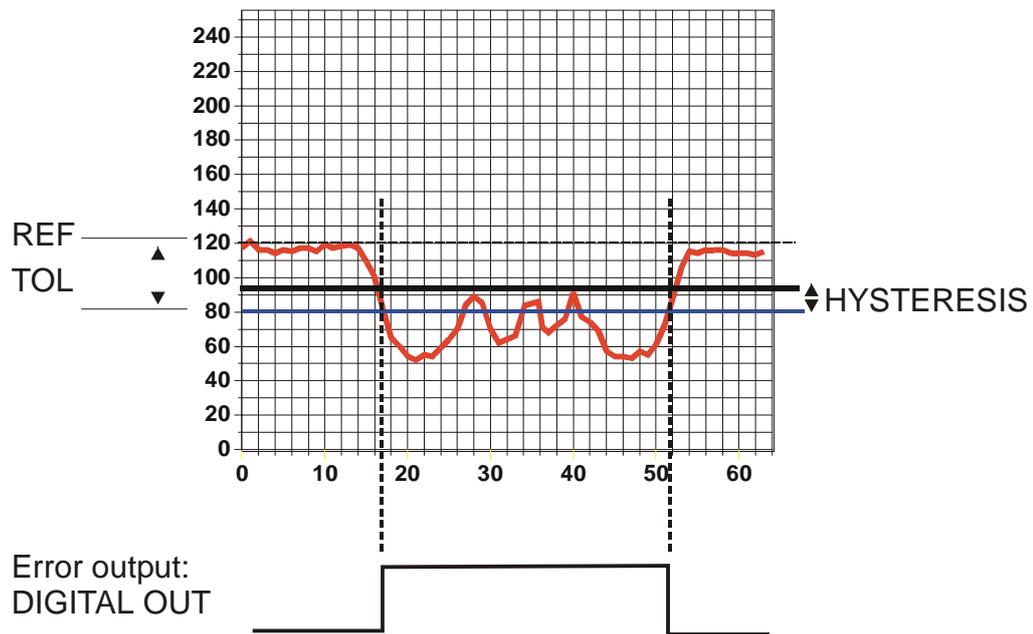
**HYSTERESIS**

**HYSTERESIS:**

The hysteresis setting value applies an additional switching threshold around the currently set tolerance threshold. The switching hysteresis has an effect on the output DIGITAL OUT. It increases the signal stability at the digital output of the electronic control unit *SI-CON4*.

The illustration below demonstrates the effect of HYSTERESIS presetting:

REF: 120  
TOL: 40  
HYSTERESIS: 15  
POLARITY: HI  
THDMODE: LOW



**POLARITY**

**POLARITY:**

Determines the polarity change of digital output DIGITAL OUT in case of exceeding of a tolerance threshold.

L0 := with error DIGITAL OUT = 0VDC (Low-active)

HI := with error DIGITAL OUT = +24VDC (High-active)

**AVERAGING**

**AVERAGING:**

Determines the number N of measured values (raw data) over which the sensor signal arriving at the *A-LAS* receiver is averaged.

Advantage: Noise suppression by a factor of  $\frac{1}{\sqrt{N}}$

Disadvantage: Reduction of the switching frequency by a factor of  $\frac{1}{N}$



**MAXMODE:**

With this function field automatic correction of the monitoring thresholds can be switched on and off.

**ON:**

Automatic threshold correction is active. The current maximum value is checked cyclically.

If the current maximum value decreases, e.g. due to increasing dirt accumulation, the set monitoring thresholds are automatically corrected accordingly.

**OFF:**

Automatic threshold correction is deactivated.



**MEM :**

This group of function buttons is used for exchanging parameters between the PC and the *SI-CON4* electronic control unit through the serial RS232 interface.

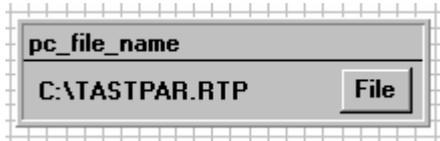
**SEND:** When the SEND button is clicked, all the currently set parameters are transferred between PC and *SI-CON4* electronic control unit or are sent to an output file. The target of the respective parameter transfer is determined by the selected button (RAM , EE, or FILE).

**GET:** With a click on the GET button the current setting values can be interrogated from the *SI-CON4* electronic control unit. The source of data exchange is determined by the selected (RAM, EE, or FILE).

**RAM:** The current parameters are written to the RAM memory of the *SI-CON4* electronic control unit, or they are read from the RAM, **i.e. these parameters are lost when the voltage at the *SI-CON4* electronic control unit is switched off.**

**EE:** The current parameters are written in the non-volatile EEPROM memory of the *SI-CON4* electronic control unit, or they are read from the EEPROM, **i.e. the parameters in the internal EEPROM are stored when the voltage at the *SI-CON4* electronic control unit is switched off.**

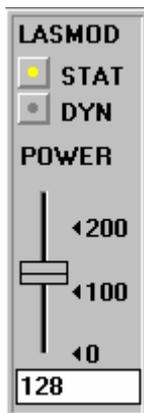
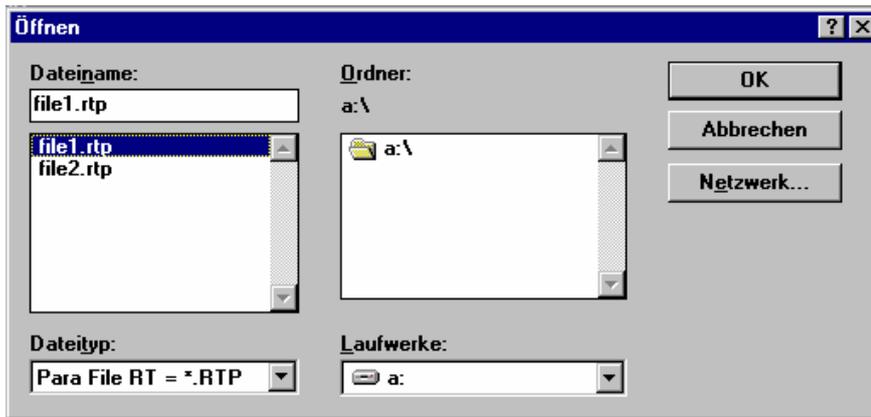
**FILE:** A click on this selection button opens an info field with the file name of the current parameter file.  
**PLEASE NOTE: The current parameters are only stored in the current output file, or retrieved from the current output file, when the SEND or GET button is activated with a mouse click.**



**pc\_file\_name:**

This info field displays the currently selected file name of the output file with the corresponding directory path. The current parameters are stored (SEND button) or retrieved (GET button) in or from the output file displayed here.

If another output file should be accessed, the file button must first be activated with the mouse pointer. Another dialog window will open then, where an existing output file can be selected, or where a file name for a new output file can be entered.



**LASMOD setting:**

In this function group the laser operating mode and the laser power at the electronic control unit *SI-CON4* can be adjusted.

**STAT:**

With this selection button the laser power is constantly kept at the value that is set at the slider.

**DYN:**

The laser power is automatically and dynamically adjusted by means of radiation reflected to the receiver. By way of dynamic adaptation of the laser power the  $\mu$ C software tries to keep the current maximum value detected at the receiver in the range 100 to 200 A/D values. In this operation mode the POWER slider has no effect.

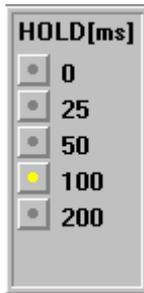
**POWER:**

With this slider the laser power is adjusted to a fixed value between 0 and 255 in STAT mode. Any change only becomes effective after the SEND button is pressed.



**Attention !**

**Any change of the laser power at the A-LAS sensor only becomes effective after the SEND button is pressed!**



**HOLD :**

The electronic control unit *SI-CON4* operates with minimum scan times in the range of 100µs. For this reason most of the SPCs that are connected to the digital error output **DIGITAL OUT** have difficulties with the safe detection of the resulting short changes of switching states. By activating the respective **HOLD** selection button a pulse lengthening at the digital output of the electronic control unit *SI-CON4* of up to 200 ms can be set.



**NUMERICAL VALUE OUTPUT FIELDS:**

**RAW:**

Display of the current measured value (raw data) from the *A-LAS* receiver.

**SMOOTH:**

Display of the current average value over the last N measured values. The value N of the measured value to be averaged is specified in the **AVERAGING** function field.

**AKTMAX:**

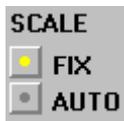
Display of the current maximum value.

**PWM:**

Display of the current laser power in **DYN** mode. The laser power is adjusted by way of pulse width modulation **PMW**.

**PLEASE NOTE:**

**These output fields are only updated in case of active data transfer (GO button) between PC and electronic control unit *SI-CON4*.**



**SCALE setting:**

These selection buttons are used for setting the scaling type of the y-axis.

**FIX:**

Fixed y-axis scaling (value range 0 ... 255 - resulting from 8-bit A/D conversion)

**AUTO:**

Automatic adaption of y-axis scaling to the current measured values (zoom function).



**Inspect button:**

This button fixes the current screen of the display window. A dialog box then opens and offers different possibilities for further processing of the display window under Windows. The individual function elements of the **Inspect** button are excellently suited for documentation purposes..

**Print:** Prints the current display window.

**Copy Page:** Copies the display window to the Windows clipboard, from where it can be inserted and further edited in various Windows programs (documentation in the word processor, graphics software, spreadsheet, ...).

**Zoom:** For zooming in or zooming out the display window.

The following chapters describe how the *A-LAS-Scope* can be used as an aid for setting the A-LAS sensors in practice.

The stable function of the RS232 interface (**LINE OK status message after program start**) is a basic prerequisite for measured value transfer from the PC to the electronic control unit *SI-CON4*.

After the *A-LAS-Scope* software is started, it displays the standard configuration COM1 and the respective communication status.



The system provides the following status messages:

**TRY SER LINE :** The PC tries to establish a connection with the electronic control unit *SI-CON4* through the respective selected interface, or the serial interface is activated.

**LINE OK:** The connection between PC und electronic control unit *SI-CON4* could be established successfully.

**TIMEOUT:** A connection between the electronic control unit *SI-CON4* and PC could not be established, or the connection is faulty.

**In this case it should first be checked whether the electronic control unit *SI-CON4* is supplied with voltage, and whether the RS232 interface cable (cab-las5/PC) is correctly connected.**

If the interface assignment at the PC is not known, a selection can be made from COM1, COM2, COM3, and COM4 by clicking on the [↓] selection field in the CONNECT group.

**NOT AVAIL:** The selected interface is not available at the PC.

The following is based on the assumption that the connection between PC and electronic control unit *SI-CON4* could be successfully established (**LINE OK status message after program start**).

## 2.1 A-LAS-Scope as an aid for sensor adjustment:

**Prior to the use of the software aids (graphic display of the sensor signal) the A-LAS sensor must be manually adjusted to the respective target as accurately as possible.**

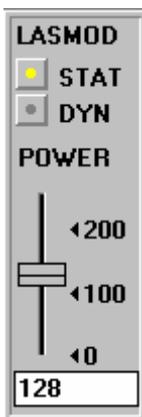
Fine adjustment of the A-LAS sensor is facilitated by the graphic display of the analog signal (raw signal from the receiver diode - red graph). For this purpose measurement data transfer from the electronic control unit *SI-CON4* to the PC must first be activated by clicking on the GO button.



**GO:**

Activation of measurement data transfer through the serial interface.

The current raw data are shown in scroll mode in the graphic display window (red graph, the latest value comes from the right side).



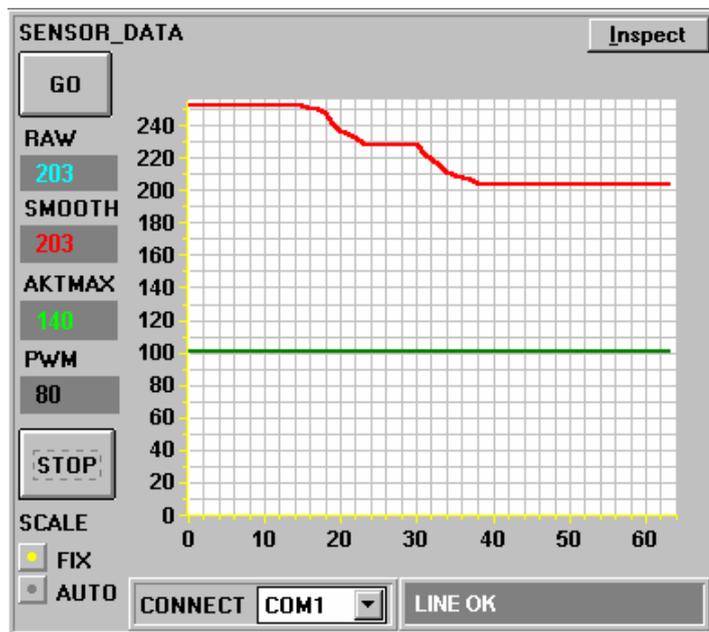
The raw signal (red graph) from the receiver diode of the A-LAS sensor should now appear in "scroll mode" in the graphic display window. If this is not so (signal at the upper limit = 255, or at the lower limit = 0), the laser power must first be set correctly.

For this purpose the laser mode must be set to STAT (static), and the laser power must then be adjusted with the POWER slider until the raw signal (red) lies in the upper third of the measuring range (0 ... 255 8-bit A/D converter).



**Please note:**

**The change of the laser power is only updated at the electronic control unit *SI-CON4* after a click on the SEND button!**



The laser power should be adjusted such that the receiver of the A-LAS sensor is not in saturation (A/D value >240).

If, with a split A-LAS version, a too low analog signal (raw signal - red graph) arrives at the receiver, e.g. due to the distance between transmitter and receiver, the laser power must be correspondingly increased.

**The aim of fine adjustment and laser power setting is to achieve a raw signal value in the upper third of the dynamic range in the uncovered situation of the light measuring section („sensor free“).**

## 2.2 A-LAS-Scope as an aid for threshold setting:

### Threshold mode THDMODE HI:

In this mode the monitoring threshold lies above the current reference value. The distance of the TOL threshold from the reference value REF is determined by the TOL presetting value. In THDMODE HI the hysteresis range lies below the TOL threshold.

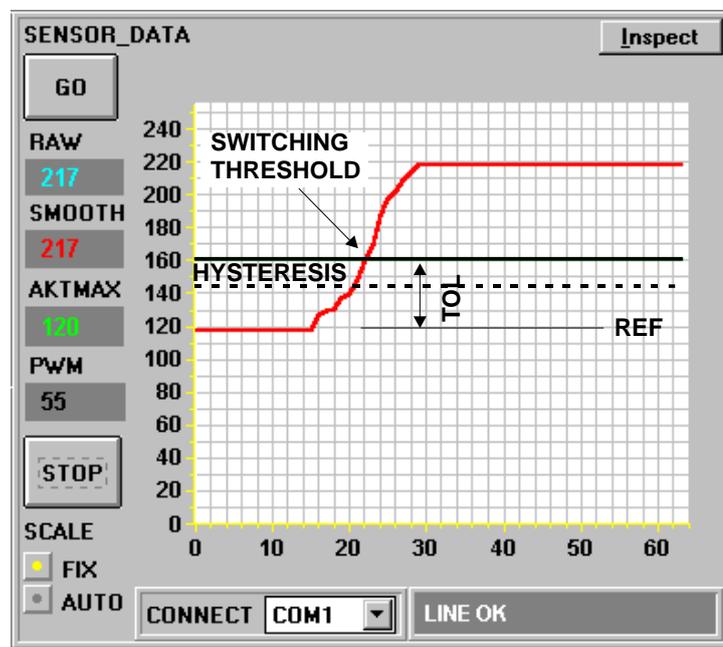
If automatic threshold correction is active (MAXMODE=ON), the time constants for threshold correction must be chosen appropriately:

DT LO to HI

A high value must be chosen for the DT LO to HI time constant (slow correction). Slow threshold correction prevents the threshold from „moving along“ in case of slow exiting of the target from the laser beam.

DT HI to LO

A low value must be chosen for the DT HI to LOW time constant (fast correction). After entering of the target into the laser beam the TOL threshold is brought to the reference value again.



For example the target (reference part, accept part) is placed in the light measuring section of the A-LAS sensor in such a way that the covering by the target results in a raw signal value at the receiver of approx. 120 A/D units (light measuring section covered half). This value of covering is declared as the reference value, in this case e.g. REF=120.

If a target is now brought into the light measuring section, the outer dimension of which increasingly sets the light measuring section free, a monitoring threshold can be preset that can be used for checking the permissible outer dimension of the targets.

The TOL value must be chosen such that the TOL threshold is in any case exceeded when a faulty target (NOK part) is measured by the light measuring section.

Accept parts (OK parts) should lie in the range between reference value REF and the tolerance threshold. The scope of the tolerance range TOL is determined, for example, by the production-related variance of accept parts.

The HYSTERESIS presetting value prevents switching of the digital output, if the measured value falls below the TOL threshold for a short time.

**Threshold mode THDMODE LOW:**

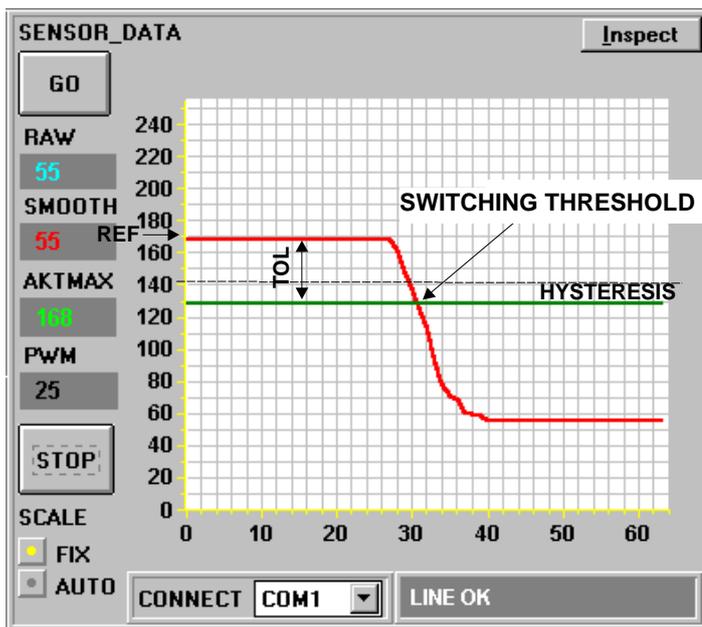
In this mode the monitoring threshold lies below the current reference value. The distance of the monitoring threshold from the reference value REF is determined by the TOL presetting value. In this mode the hysteresis range lies above the TOL threshold. If automatic threshold correction is active (MAXMODE=ON), the time constants for threshold correction must be chosen appropriately:

DT LO to HI

A low value must be chosen for the DT LO to HI time constant (fast correction). After passage of the target through the laser beam the TOL threshold quickly is brought to the reference value again.

DT HI to LO

A high value must be chosen for the DT HI to LO time constant (slow correction). Slow threshold correction prevents the threshold from „moving along“ in case of slow entering of the target into the laser beam.



For example the target is placed in the light measuring section of the A-LAS sensor in such a way that the covering by the target results in a raw signal value of approx. 170 A/D units at the receiver (light measuring section covered 2/3). This value of covering is declared as the reference value (setpoint value), in this case e.g. REF=170. The decrease of the signal intensity (red graph in the graphic display window) is caused by the increasing covering of the light measuring section due to the movement of the target into the laser beam.

For example this may happen because of a faulty target, the outer dimensions of which are larger compared to the reference object.

The TOL value must be chosen such that the measured value in any case falls below the TOL threshold in case of faulty targets.

Permissible accept parts (reference parts) should in any case lie in the tolerance range between REF and (REF-TOL). The variance of the accept parts determines the possible selection of the lower tolerance limit.

The HYSTERESIS presetting value prevents switching of the digital output, if the TOL-threshold is again exceeded from below to above for a short time.

**Threshold mode THDMODE WIN:**

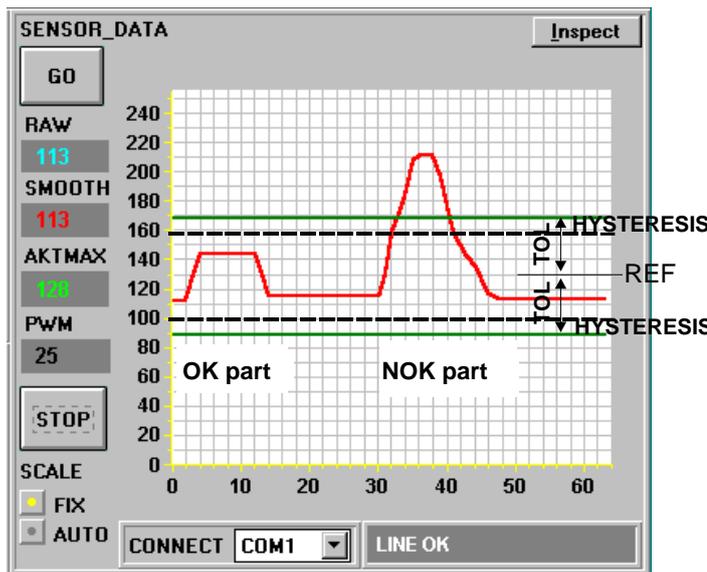
This mode operates with two monitoring thresholds that lie symmetrically around the current reference value REF. The distance of the monitoring thresholds from the reference value REF is determined by the TOL presetting value. In this mode the two hysteresis ranges lie within the tolerance band. If automatic threshold correction is active (MAXMODE=ON), the time constants for threshold correction must be chosen appropriately:

DT LO to HI 10

A high value must be set for the DT LO to HI time constant (slow correction). Slow threshold correction prevents the upper threshold from „moving along“ in case of slow entry of the target into the light measuring section.

DT HI to LO 10

A high value must be chosen for the DT HI to LOW time constant (slow correction). Slow threshold correction prevents the lower threshold from „moving along“ in case of slow entry of the target into the light measuring section..



The target (reference object, accept part) is placed in the light measuring section in such a way that the light measuring section is covered half (reference value REF=128). The intensity detected at the receiver of the A-LAS sensor is proportional to the covering at the light measuring section.

A tolerance band of width +/- TOL is applied symmetrically around this reference value.

The picture on the left shows the signal characteristics of an accept part (OK) and of a reject part (NOK). The faulty target (NOK) is detected when the tolerance band is exceeded (change of switching state at the DIGITAL OUT output).

The HYSTERESIS presetting value prevents switching of the digital output, if the current measured value for a short time „re-enters“ the tolerance band.

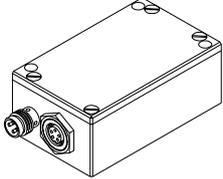
When suitable parameters for the respective application have been found by observing the signal characteristics, the current parameters must be written to the non-volatile EEPROM memory of the electronic control unit SI-CON4.

Attention ! The selection button in the MEM field must be set to EE !!

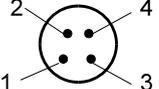
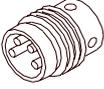
When the parameters have been entered and the sensor has been adjusted with the help of the graphic representation provided by the A-LAS-Scope software, the PC is no longer required for the actual measuring task. The PC can then be disconnected from the electronic control unit SI-CON4 by removing the RS232 interface cable.

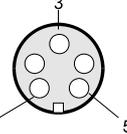
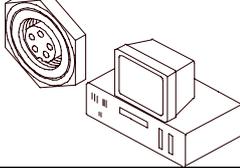
The electronic control unit SI-CON4 then performs the measuring task in STAND-ALONE operation in accordance with the parameters stored in the EEPROM.

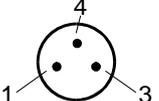
## Appendix:

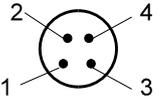
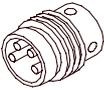
<b>Technical data: Electronic control unit SI-CON4</b>	
	
Power supply	+12VDC ... +32VDC, protected against polarity reversal, overload-protected
Current consumption	max. 150mA
Operating temp. range	-20°C to +55°C
Storage temp. range	-20°C to +85°C
Type of protection	IP 64
Threshold correction	Can be activated under Windows®
ANALOG output	0V ... 10V
DIGITAL output	nnp break-contact / pnp make-contact, pnp break-contact / npn make-contact adjustable through PC
Current control input (I-CONTROL)	Laser power adjustable on the PC
Switching state display	Visualisation by means of one LED
Connector type	Connection to the SPC: 4-pole M8 plug Connection to the PC: 5-pole flange socket Binder series 712 Connection to the sensor unit / transmitter: 3-pole M8 plug Connection to the sensor unit / receiver: 4-pole M8 plug
Dynamic switching output (pulse lengthening)	Can be activated on the PC (0ms ... 200ms)
Switching frequency	approx. 6kHz
Max. switching current	100mA, short circuit proof
Band width (analog signal)	Scanning frequency max. 25kHz
EMC testing acc. to	IEC - 801 .. CE
Interfacing	RS232, parameterisable under Windows®
Housing	Aluminium, anodised in blue
Housing dimensions	approx. 60mm x 40mm x 22mm (without connector plug)

**CONNECTOR ASSIGNMENTS**

4-pole M8-plug <b>SI-CON4 / SPC</b>				
Pin No.:	Colour	Assignment:		
1	brn	+U <sub>b</sub> (+12VDC ... +32VDC)		
2	wht	ANALOG_OUT (0V ... +10V)		
3	blu	GND		
4	blk	DIGITAL OUT		

5-pole socket <b>PC-RS232</b>				
Pin No. :		Assignment:		
1		GND		
2		TX0		
3		RX0		
4		n.c.		
5		n.c.		

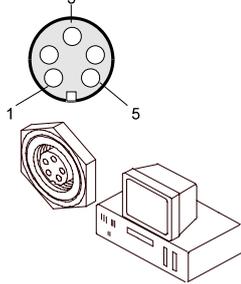
3-pole M8-plug <b>SI-CON4 / transmitter</b>				
Pin No.:		Assignment:		
1		+5VDC		
4		I-Control ( 0V ... +5V )		
3		GND		

4-pole M8-plug <b>SI-CON4 / receiver</b>				
Pin No.:		Assignment:		
1		+12VDC		
2		GND		
3		Shield		
4		ANALOG ( 0V ... +12V )		



**RS232 communication protocol / SI-CON4 control unit**

**serial data transfer**



The personal computer (PC) can be replaced by any system (e.g. PLC unit), which executes a special serial communication protocol.

It is possible to connect a PLC to the serial interface of the *SI-CON4* control unit by using the 5-pole connection at the housing of the *SI-CON4*:

- Pin 1 GND
- Pin 2 TX0
- Pin 3 RX0
- Pin 4 not connected
- Pin 5 not connected

Standard RS232 serial interface without hardware-handshake:

3-wire: GND, TX0, RX0

4800 baud, 8 data bits, no parity bit, 1 stop bit in binary mode

The control device (PC or PLC) has to send a data frame of 14 bytes to the *SI-CON4* hardware. All bytes must be transmitted in binary format. The meaning of the parameters are described in the software manual *A-LAS Scope V2.3*.

Method:

The *SI-CON4* hardware is permanently reading (polling) the incoming byte at the RS232 connection. If the incoming byte = 0x55 (**synch-byte**), then the 2. byte (**order-byte**) is read in, after this, 12 bytes (parameters) are read in.

After reading in the completely data frame, the *SI-CON4* hardware executes the order which is coded at the 2. byte (**order-byte**).

**SI-CON4 format of the RS232 data frame:**

Byte No.	Meaning	Comment
1	synch-byte = 0x55	hex-code, binary 01010101
2	<b>order-number</b>	order byte,
3	parameter TOL	tolerance band width (0 ... 127)
4	parameter POLARITY	polarity of digital output (0,1)
5	parameter HOLD [ms]	hold time 0,25,50,100 or 200 ms coded to (0,1,2,3,4)
6	parameter LASMOD	operating mode of the laser power control STAT or DYN (0,1)
7	parameter POWER	laser power: 0 ... 255 – attention inverse operation!!
8	parameter HYSTERESIS	Hysteresis band (0 ... 50)
9	parameter AVERAGEING	signal averaging (0,4,8,16,32,64) coded to (0,1,2,3,4,5)
10	parameter MAXMODE	automatic threshold correction ON/OFF (1,0)
11	parameter REF	reference value (0 ... 250)
12	parameter THDMODE	positon of tolerance threshold (LOW,HI or WIN) coded to (0,1,2)
13	parameter DT HI to LO	time constant for auto threshold correction DOWN (0 ... 15)
14	parameter DT LO to HI	time constant for auto threshold correction UP (0 ... 15)

**SI-CON4 order number:**

No.	Order	Comment
0	nop	no operation
1	save parameter from PC into RAM	volatile - normal operation
2	save parameter from PC into RAM + EEPROM	nonvolatile
3	send parameter from RAM to PC	12 byte binary to PC
4	send parameter from EEPROM to RAM + to PC	12 byte binary to PC
5	send raw data from RAM to PC (RAW,SMOOTH,AKTMAX,PWM1)	4 byte binary to PC
6	nop	no operation
7	send line ok = 0xAA to PC	1 byte binary to PC

KW 01/01