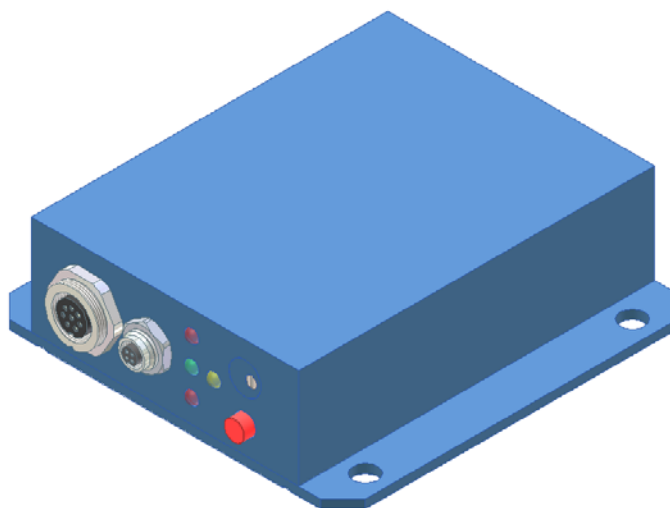


Technical Description

A-LAS-CON1

Control Unit for the A-LAS Series



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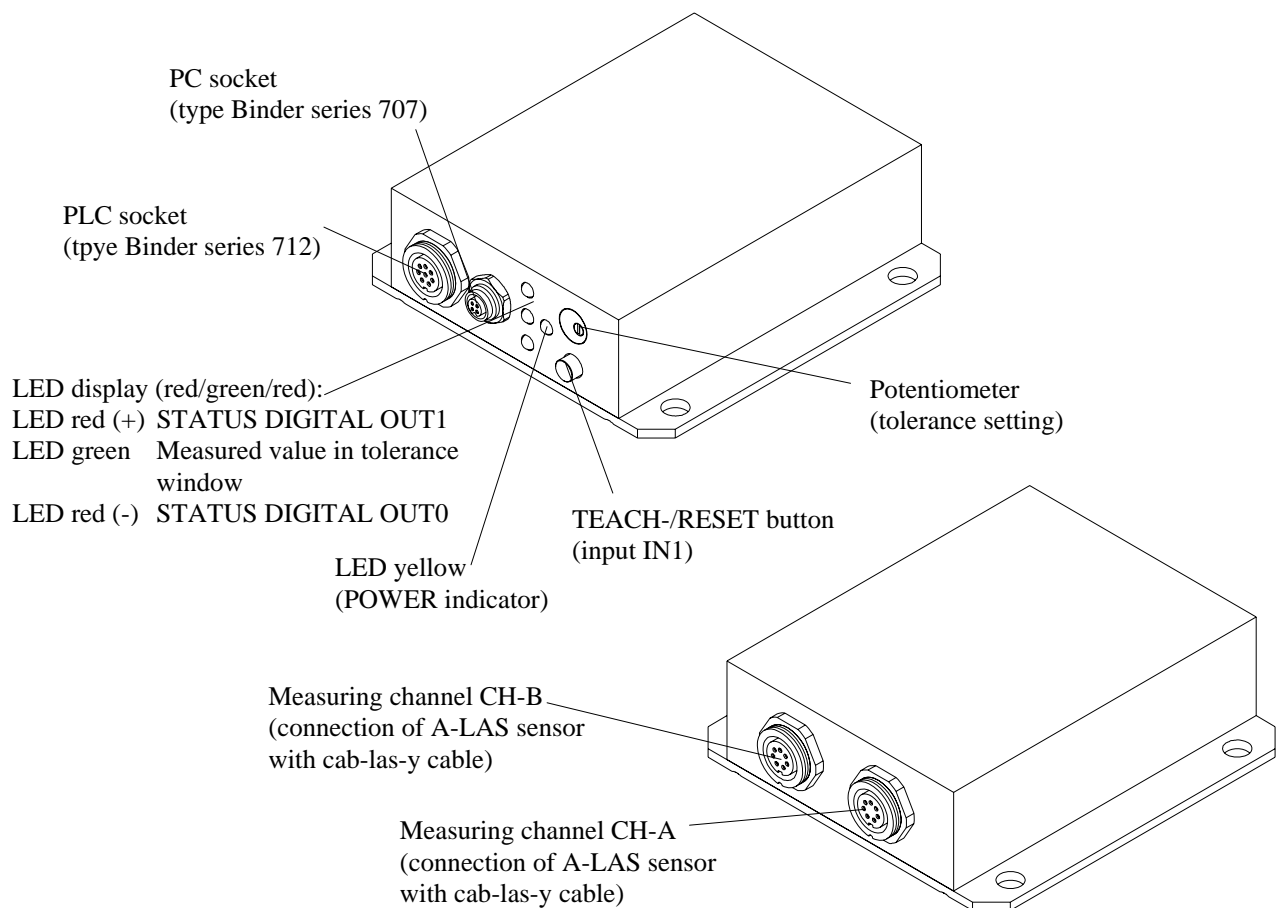
1 Functional principle: A-LAS-CON1 control unit

1.1 Technical description:

A-LAS-CON1 is a control unit that is designed for the connection of sensors of the A-LAS series.

Up to two analog sensors can be connected by way of two 7-pole sockets. A cab-las-y connecting cable is required for the connection of every sensor. The control unit serves for the 100% inspection of objects by means of tolerance-band monitoring. A high-speed 2-channel 12-bit analog/digital-converter allows simultaneous reading of the analog values at both measuring channels. The control unit is able to adjust the laser power separately for every measuring channel.

The microcontroller of the A-LAS-CON1 control unit can be parameterised through the serial RS232 interface by means of a Windows PC software. Various different evaluation and trigger modes can be set. The housing of the control unit features a TEACH/RESET button and a potentiometer for tolerance setting. Both the button and the potentiometer can be activated or deactivated with the software. Switching states are visualised by means of 4 LEDs (1x green, 1x yellow and 2x red) that are integrated in the housing of the A-LAS-CON1. The A-LAS-CON1 control unit has two digital outputs (OUT0, OUT1) whose output polarity can be set with the software. By way of two digital inputs (IN0, IN1) the external trigger function and the TEACH/RESET functionality can be set per PLC. The control unit furthermore provides a high-speed analog output (0 .. 10V) with 12-bit digital/analog resolution.




2 Installation of the A-LAS-CON1-Scope software


Hardware requirements for successful installation of the A-LAS-CON1-Scope software:

- 100 MHz Pentium-compatible processor or better.
- CD-ROM or DVD-ROM drive
- Approx. 8 MByte of free hard disk space
- SVGA graphics card with at least 800x600 pixel resolution and 256 colours or higher.
- Windows 2000 or Windows XP operating system
- Free serial RS232 interface or USB port with USB-RS/232 adaptor at the PC

Please install the A-LAS-CON1-Scope software as described below.

- 

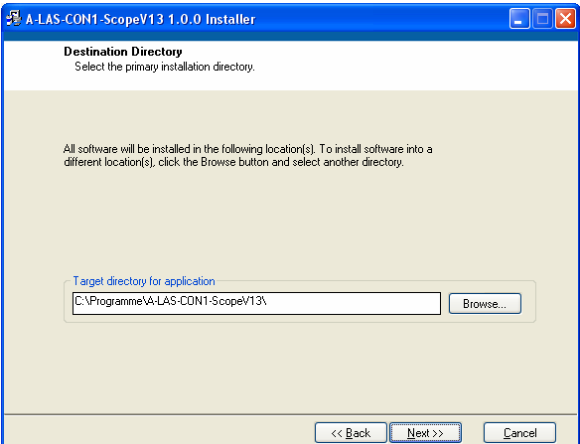
CD-Laufwerk (D:)

Insert the installation CD-ROM in your CD-ROM drive. In our example we suppose that this is drive "D".
- 

setup.exe

Start the Windows Explorer and in the directory tree of your CD-ROM drive go to the installation directory D:\Install.CON1Scope14\ .
Then start the installation program by double-clicking on the SETUP.EXE symbol.

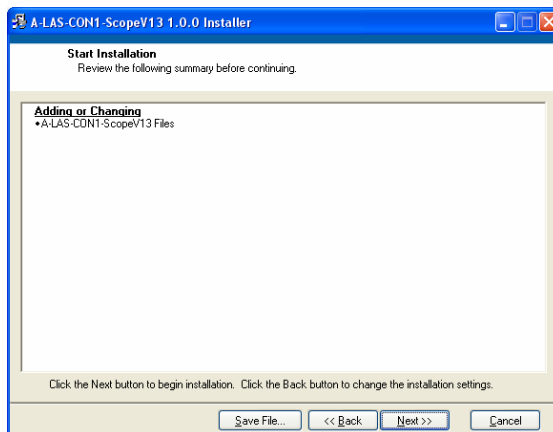
As an alternative, software installation can also be started by clicking on **START-Run...** and then entering "D:\Install.CON1Scope14\setup.exe", which must be confirmed by pressing the **OK** button.

The installation program then displays a dialog-box for A-LAS-CON1-Scope V1.4 installation.
This dialog-box shows some general information about installation.
- 

When you click on the Next> button, a new dialog field will appear and suggest an installation path. You may accept the suggested path with Next>, or you may change the installation path by clicking on the Browse button

Click on Next> to start the installation, or on Cancel to cancel the installation.

4.



Another A-LAS-CON1-Scope Setup dialog field will be displayed.

<< **Back**

Click on the **Back** button to change the installation path again.

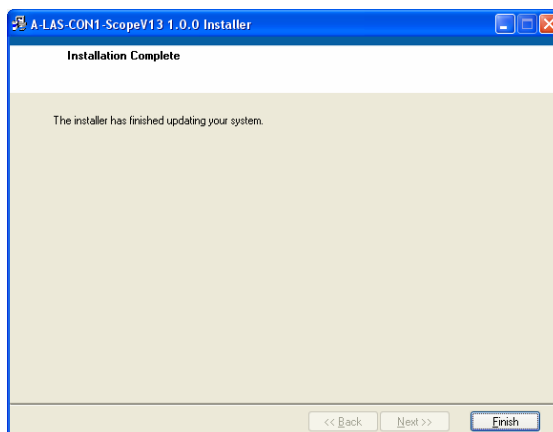
Next >>

Click on **Next>>** to start the installation or

Cancel

click on **Cancel** to cancel the installation.

5.



When installation is completed, a dialog box informs you about successful installation.

During the installation process a new program group for the A-LAS-CON1-Scope software is created in the Windows Program Manager. This program group contains the symbol for starting the software.

Finish

Click on the **Finish** button to finish the installation.

The A-LAS-CON1-Scope software can now be started by double-clicking on the program symbol.

Deinstallation of the A-LAS-CON1-Scope software:



Please use the Windows deinstallation tool to remove the software.

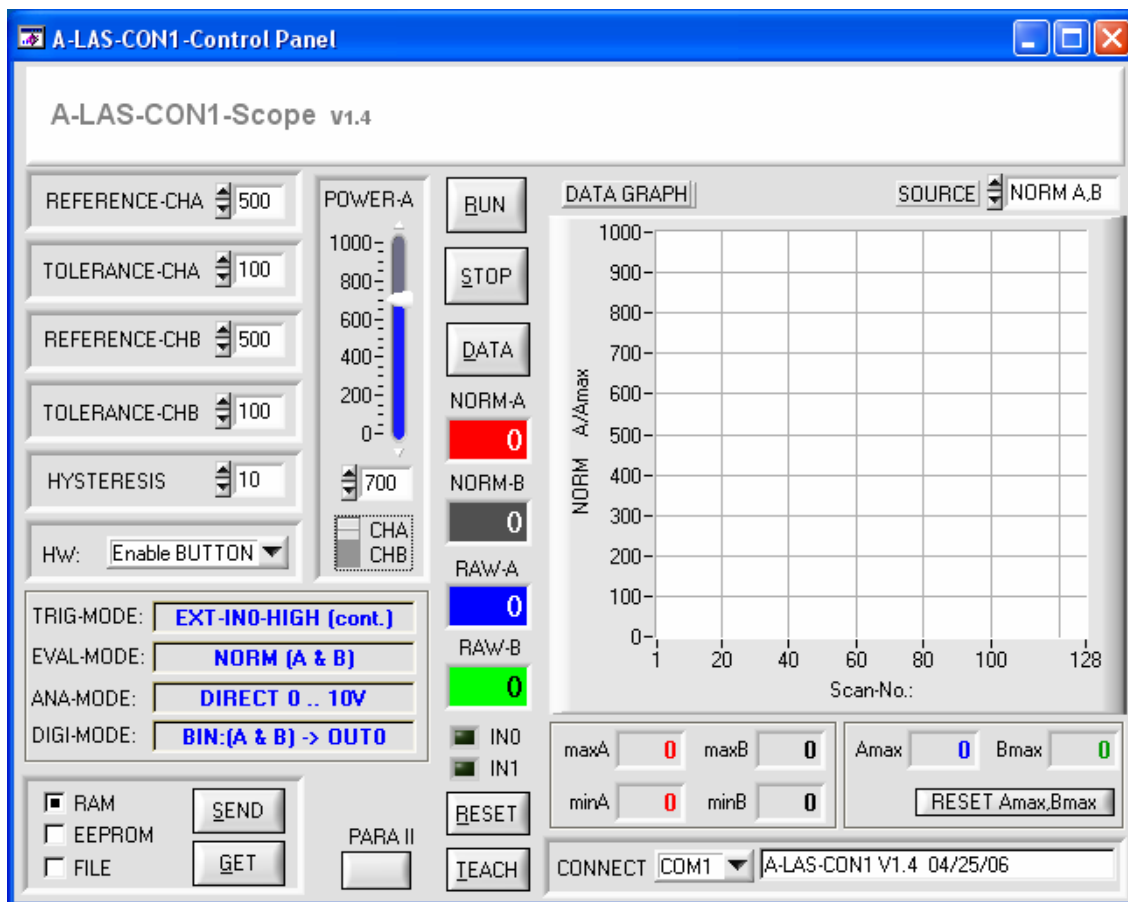
The Windows deinstallation program can be found under Start / Settings / Control Panel / Software.

3 Operation of the A-LAS-CON1-Scope software

The A-LAS-CON1-Scope software is used for parameterising the A-LAS-CON1 control unit of the A-LAS series. The measured values provided by the sensor can be visualised with the PC software, which means that the software can be used for adjustment purposes and for setting suitable tolerance limits for the inspection of the measuring object.

Data exchange between the PC user interface and the sensor system is effected through a standard RS232 interface. For this purpose the sensor must be connected to the PC with the serial interface cable cab-las-4/PC. When parameterisation is finished, the setting values can be permanently saved in an EEPROM memory of the A-LAS-CON1 control unit. The sensor system then continues to operate in "STAND-ALONE" mode without PC.

When the A-LAS-CON1-Scope software is started, the following Windows® user interface will be displayed:

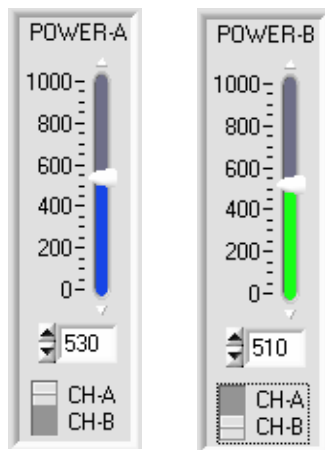


The A-LAS-CON1-Scope Control Panel provides a great variety of functions:

- Visualisation of measurement data in numeric and graphic output fields.
- Setting of the laser power for the laser transmitter.
- Setting of the polarity of the digital switching outputs OUT0 and OUT1.
- Selection of a suitable evaluation mode.
- Presetting of setpoint value and tolerance band.
- Saving of parameters to the RAM, EEPROM memory of the control unit, or in a configuration file on the hard disk of the PC.

The individual control elements of the A-LAS-CON1-Scope software will be explained in the following chapter.

3.1 Control elements of the A-LAS-CON1-Scope software:



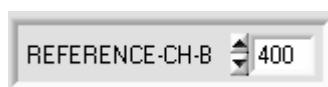
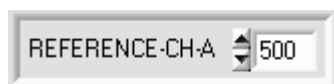
POWER-A, POWER-B:

In this function field the laser power at the A-LAS transmitter can be separately adjusted for each measuring channel by using the slider or by entering a numerical value in the corresponding input field.

The respective measuring channel can be selected by clicking on the CHA / CHB changeover switch. The slider for channel CHA has a blue background, the slider for channel CHB a green background.

Attention !

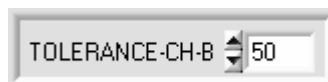
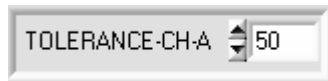
The laser power at the transmitter unit of the A-LAS sensor is only updated when the SEND button is pressed.



REFERENCE-CHA, REFERENCE-CHB:

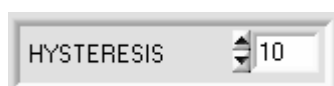
This function field serves for entering the reference value for the measuring channel CHA or CHB. The reference value is equal to the teach-in value (setpoint value), of the covering caused by the measuring object at the respective measuring channel.

Maximum value referencing results in a value range of 0 .. 1000 units. The numerical value that is preset here is proportional to the respective covering at measuring channel CHA or CHB.



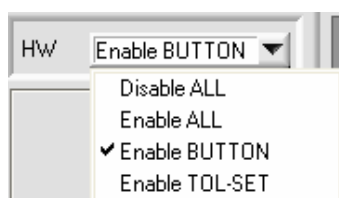
TOLERANCE-CHA, TOLERANCE CHB:

With this edit-box a tolerance band can be applied to the currently set reference value (setpoint value of the light measuring section that is covered by the measuring object). When the set tolerance limit is exceeded, this becomes effective as a change of switching state at digital output OUT0 (gray/pin5) or OUT1 (pink/pin6) at the 8-pole PLC socket.



HYSTERESIS:

This function field serves for entering a hysteresis value. The hysteresis value applies an additional switching threshold to the currently set tolerance band. This switching hysteresis affects digital outputs OUT0 or OUT1. The hysteresis increases the signal stability at the digital outputs of the A-LAS-CON1 control unit.



HW (HARDWARE):

This drop-down function field can be used for individually activating or deactivating the potentiometer and the TEACH/RESET button at the housing of the A-LAS-CON1.

The potentiometer at the housing serves for setting the tolerance bandwidth for both measuring channels.

The T1 button has two functions:

- (I) Button is pressed for a short time (<750ms) RESET max-min values
- (II) Button is pressed for a longer time (>1.5s) TEACH function

| | |
|------------|--------------------------|
| TRIG-MODE: | CONTINUOUS |
| EVAL-MODE: | NORM-A: A/Amax |
| ANA-MODE: | DIRECT 0 .. 10V |
| DIGI-MODE: | (+) -> OUT0; (-) -> OUT1 |

INFO-FELD:

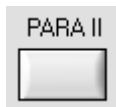
This function field displays important setting parameters that are set at the A-LAS-CON1 control unit.

TRIG-MODE: Trigger mode

EVAL-MODE: Evaluation mode

ANA-MODE: Operating mode of the analog output

DIGI-MODE: Operating mode at the digital output

**PARA II:**

This software button calls up an additional PARA II popup window where other parameters can be set.

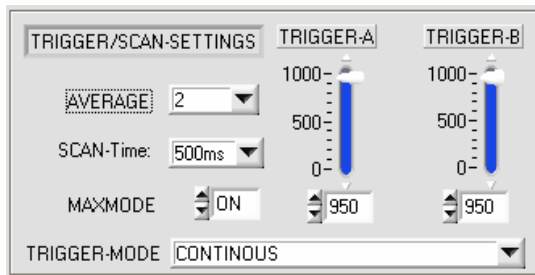
Parameter II:

This popup window serves for entering additional parameters at the A-LAS control unit.

The Parameter II window can be freely moved on the computer desktop, and it can be minimised by clicking on the respective button.

A click on the close button closes the Parameter II window.

The individual control elements of the Parameter II window are described below.

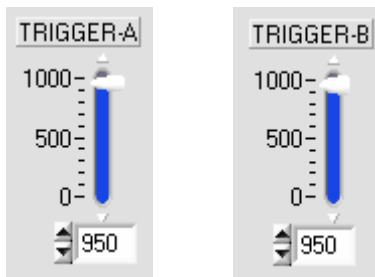


TRIGGER/SCAN-SETTINGS:

This function field serves for entering the trigger thresholds for measuring CHA and CHB.

The trigger mode at the A-LAS-CON1 control unit also can be set here.

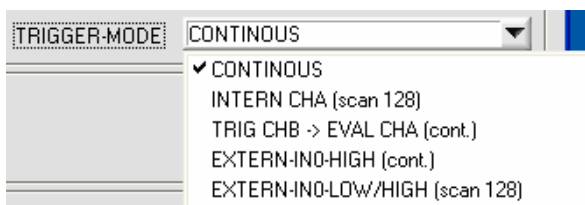
Additional function fields serve for setting the parameters for measurement data recording.



TRIGGER-A, TRIGGER-B:

These function fields are used for entering the trigger threshold at measuring channel CHA or CHB of the A-LAS control unit. The trigger threshold can be set by moving the slider or by entering a numerical value in the edit box.

The raw data at measuring channel CHA and CHB are referenced to the respective current maximum value (Amax, Bmax). If the light measuring section is not covered, referencing yields NORM values of 1000 units. The trigger threshold is absolutely referenced to this referenced NORM value.



TRIGGER-MODE:

This drop-down list field is used for setting the trigger mode at the A-LAS-CON1 control unit.

CONTINUOUS:

Continuous triggering = continuous measured value recording and evaluation.

INT-CHA-scan-128:

Internal triggering, trigger source = CHA. Data recording of 128 samples with adjustable scanning frequency.

TRIG CHB → EVAL CHA (continuous):

Internal triggering, trigger source = CHB. If CHB drops below the trigger threshold (TRIGGER-B) an evaluation of the current values at CHA is done. The trigger threshold at CHB can be adjusted by the slider TRIGGER-B.

EXT-IN0-HIGH (continuous):

External continuous triggering by way of digital input IN0 (pin3, green). A high logic level (+24V) starts continuous triggering.

EXT-IN0-LOW/HIGH (scan-128):

External triggering by way of digital input IN0 (pin3, green). A level change from LOW (0V) to HIGH (+24V) starts internal triggering. Data recording is started with an adjustable scanning frequency. 128 measured values are recorded as a maximum.



MAXMODE:

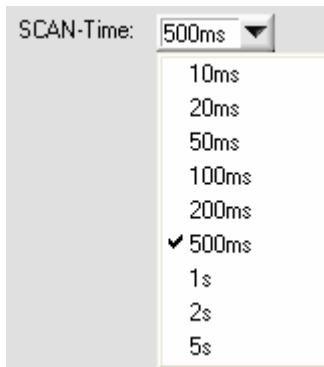
This function field is used for activating automatic maximum value adaptation of the two measuring channels.

ON: Automatic maximum value adaptation activated.

OFF: Automatic maximum value adaptation deactivated.

Maximum value adaptation compensates measured-value distortion that occurs at the optical transmitter/receiver units due to dirtying. When maximum value adaptation is activated, the last detected maximum value is decreased step by step with a fixed time interval of approx 10s, if the current measured value is smaller than the last detected maximum value.

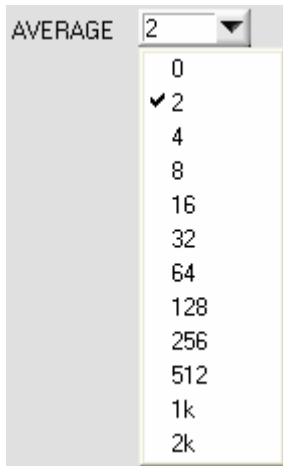
Attention: Automatic maximum value adaptation may only be activated when the light measuring section becomes completely free again after the passage of the measuring objects.

**SCAN-Time:**

This drop-down function field serves for setting the recording time when using internal trigger mode.

Since the available memory in the A-LAS-CON1 control unit is limited, only a limited number of measured values can be recorded for each measuring channel (128 samples).

For recording longer processes, a time interval for internal triggering can therefore be set in the SCAN-Time function field. The A-LAS-CON1 control unit automatically sets the internal scanning time in accordance with the SCAN-Time that is set here. A maximum of 128 scanning values are recorded. The SCAN-Time therefore is not effective for the continuous trigger modes!

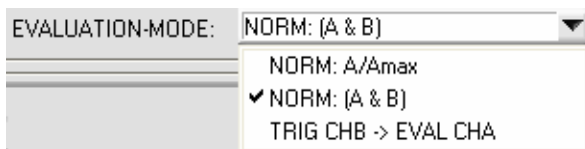
**AVERAGE:**

This drop-down function field determines the number N of measured values (raw data) over which the sensor signal arriving at the analog input of the A-LAS control unit is averaged.

Advantage: Suppression of noise by a factor of \square

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

The AVERAGE value only is effective for the continuous trigger modes!

**EVALUATION-MODE:**

This drop-down function field is used for setting the evaluation mode at the A-LAS-CON1 control unit.

NORM: A/Amax:

Evaluation of the analog value (RAW_A) at measuring channel CHA that is referenced to the current maximum value Amax.

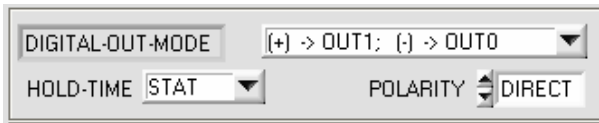
$$NORM_A = 1000 * \frac{RAW_A}{A_{max}}$$

NORM (A & B) :

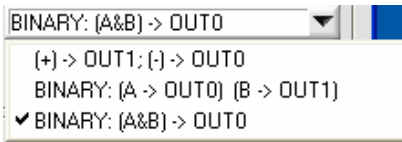
Both measuring channels CHA and CHB of the A-LAS-CON1 control unit are simultaneously recorded and evaluated according to the NORM stated above.

TRIG CHB → EVAL CHA :

After triggering at measuring channel CHB the analog value present at CHA at the trigger moment is simultaneously normalised and NORM_A is evaluated.

**DIGITAL-OUT-MODE:**

This function field group serves for setting the operating mode of digital outputs OUT0 and OUT1.

**DIGITAL OUT-MODE:**(+) -> OUT1; (-) -> OUT0

Output of the NORM-values referenced to the tolerance band currently set around the respective reference value.

NORM > TOL: (+) LED is activated, level change at OUT1 (pin6/pink)

NORM < TOL: (-) LED is activated, level change at OUT0 (pin5/gray)

BINARY: (A -> OUT0), (B -> OUT1):

This setting only is effective in the EVALMODE =

NORM (A&B) evaluation mode:

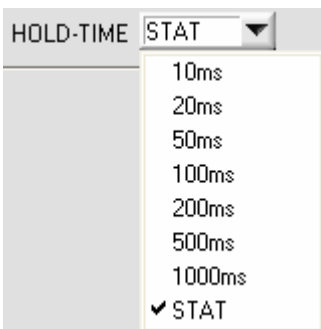
The evaluation result of measuring channel CHA is output at OUT0 (pin5/gray), and the evaluation result of measuring channel CHB is output at digital output OUT1 (pin6/pink).

BINARY: (A&B) -> OUT1):

This setting only is effective in the EVALMODE =

NORM (A&B) evaluation mode:

The evaluation result of measuring channels CHA and CHB is the logical AND-operation of CHA AND CHB. The result of the logical AND-operation is output at digital output OUT0 (pin5/gray).

**HOLD-TIME:**

The A-LAS-CON1 control unit operates with minimum scan times in the range of 100µs. For this reason most of the PLCs that are connected to the digital error outputs OUT0 and OUT1 have difficulties with the safe detection of the resulting short changes of switching states.

By selecting the respective element in the drop-down list a pulse lengthening at the digital outputs of the A-LAS-CON1 control unit can be set.

Minimum output hold time = 10ms

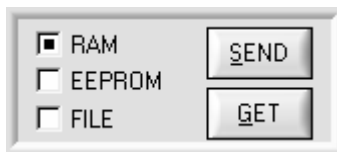
Maximum output hold time = STAT (status at the digital output remains constant until the next trigger event).

**POLARITY:**

This function field determines the polarity change of digital outputs OUT0 and OUT1 when a tolerance threshold is exceeded.

DIRECT: In case of error OUT0 or OUT1 = +24VDC (high-active), red LED on.

INVERSE: In case of error OUT0 or OUT1 = 0V (low-active), red LED off.



PARAMETER TRANSFER:

This group of function buttons is used for transferring parameters between the PC and the A-LAS-CON1 control unit through the serial RS-232 interface.

SEND:

When the SEND button is clicked, the parameters currently set on the user interface are transferred to the A-LAS-CON1 control unit. The target of data transfer is determined by the selected radio-button (RAM, EEPROM, or FILE).

GET:

When the GET button is clicked, the setting parameters are transferred from the A-LAS-CON1 control unit to the PC and are updated on the user interface. The source of data transfer again is determined by the selected radio-button.

RAM:

The currently set parameters are written to the volatile RAM memory of the A-LAS-CON1 control unit, or they are read from the RAM and transferred to the PC. Please note: The parameters set in the RAM will be lost when the power supply at the A-LAS-CON1 control unit is turned off.

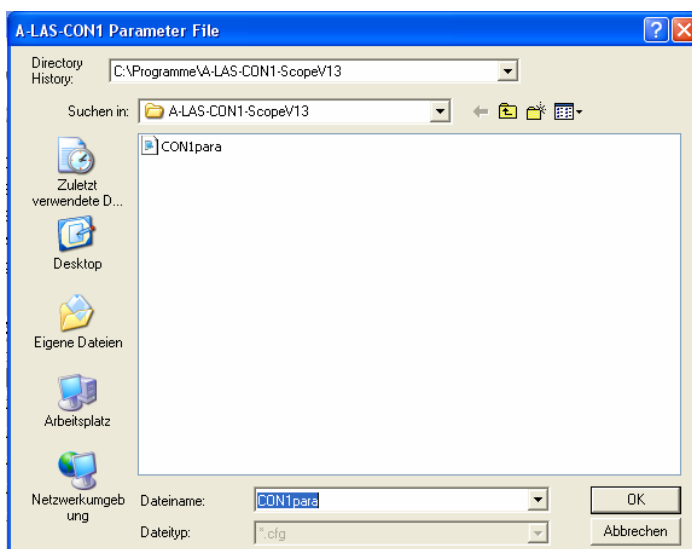
EEPROM:

The currently set parameters are written to the non-volatile EEPROM memory of the A-LAS-CON1 control unit, or they are read from the EEPROM and transferred to the PC. Parameters that are saved in the EEPROM will not be lost when the power supply is turned off.

If parameters are read from the EEPROM of the A-LAS-CON1 control unit, these must be written to the RAM of the A-LAS-CON1 by selecting the RAM button and then clicking on SEND. The A-LAS-CON1 control unit then continues to operate with the set RAM parameters.

FILE:

When the FILE radio-button is selected, a click on the SEND/GET button opens a new file dialog on the user interface. The current parameters can be written to a freely selectable file on the hard disk of the PC, or parameters can be read from such a file.



FILE dialog window:

The standard output file for the parameter values has the file name „CON1para.cfg“.

The output file can be opened with the Windows Editor program.

3.2 Serial RS232 data transfer:

RS232 COMMUNICATION:

- Standard RS232 serial interface without hardware-handshake.
- 3-line-connection: GND, TXD, RXD.
- Speed: 19200 baud, 8 data-bits, no parity-bit, 1 stop-bit in binary mode, MSB first.



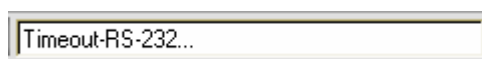
Attention !

The stable function of the RS232 interface (status message after program start) is a basic prerequisite for data transfer between the PC and the A-LAS-CON1 control unit. Due to the limited data transfer rate of the serial RS232 interface (19200 bit/s) only slow changes of the analog values at the A-LAS sensors can be observed in the graphic display at the PC. In order to guarantee the maximum switching frequency of the A-LAS-CON1 control unit it is therefore necessary to terminate the data exchange during the normal monitoring process in production (press the STOP button).



CONNECT:

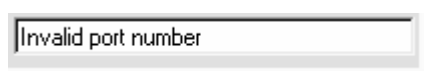
When the software is started, it attempts to establish a connection to the A-LAS-CON1 control unit through the standard COM1 interface. If connection could be established successfully, the current firmware version is displayed in the status line.



The serial connection between the PC and the A-LAS-CON1 control unit could not be established, or the connection is faulty.

In this case it should first be checked whether the A-LAS-CON1 control unit is supplied with voltage, and whether the serial interface cable is correctly connected to PC and A-LAS-CON1 control unit.

If the number of the serial interface that is assigned at the PC should not be known, interfaces COM1 to COM9 can be selected by using the CONNECT drop-down list.

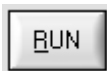


If there is an "Invalid port number" status message, the selected interface, e.g. COM2, is not available at your PC.



If there is a "Cannot open port " status message, the selected interface, e.g. COM2, may already be used by another device.

3.3 A-LAS-CON1-Scope as an aid for sensor adjustment:



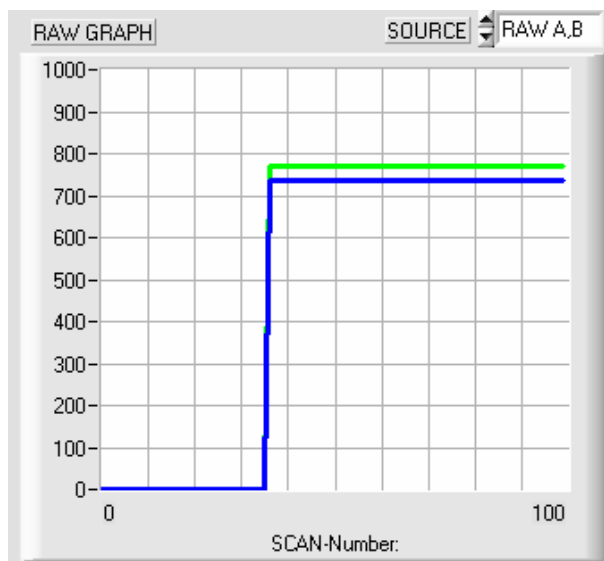
RUN:

After a click on the RUN button, the fine adjustment between A-LAS transmitter and receiver can be observed in the graphic display window RAW-GRAPH. For this purpose the graphic output source (SOURCE) must first be set to RAW A,B in the SOURCE drop-down list field. After a click on the SEND button, the raw data of the respective measuring channel pass through the graphic display window from right to left in "scroll-mode". Measuring channel CHA is shown as a blue curve, and CHB as a green curve.



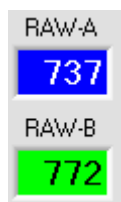
STOP:

A mouse-click on the STOP button stops the data transfer between the A-LAS-CON1 and the PC.



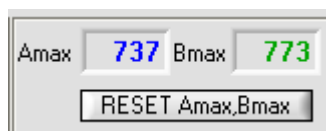
The RAW-GRAPH displays the analog values of the A-LAS sensors that are connected to measuring channel CHA or CHB of the A-LAS-CON1 control unit. The y-axis is limited to a numerical value of 1000, because the A-LAS-CON1 evaluates the measured values with 10-bit accuracy.

To make use of the dynamic range, the raw values should lie between 500-800 ADC units when the sensor is not covered. For this purpose the laser power can be adapted with the corresponding POWER slider, if necessary.



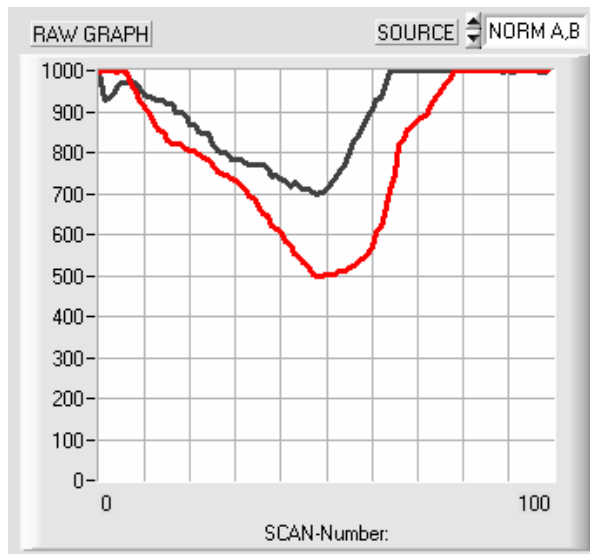
RAW-A, RAW-B:

These two numerical display fields show the current raw data of measuring channels CHA and CHB as 10-bit ADC values.



Amax, Bmax:

These numerical display fields show the current maximum value at measuring channel CHA (Amax) and CHB (Bmax). The current maximum value is updated with a non-return pointer. If the laser power is changed with the POWER slider, the current maximum values must be updated by clicking on the RESET Amax,Bmax button.

SOURCE

When NORM A,B is selected in the SOURCE drop-down list element, the normalised measured values for CHA (red curve) and CHB (black curve) are shown in the graphic display window.

The RUN button must be pressed to activate the "scroll mode".

If the light measuring sections are not covered, referencing (normalising) to the respective current maximum value results in the NORM value = 1000 (see below).

For example, a light measuring section that is half covered results in a NORM value of = 500.

NORM-A
998
NORM-B
998

NORM-A, NORM-B:

These two numerical display fields show the normalised measured values. The normalising equations are:

$$NORM_A = 1000 * \frac{RAW_A}{A_{max}}$$

$$NORM_B = 1000 * \frac{RAW_B}{B_{max}}$$

maxA **1000** maxB **1000**
minA **500** minB **697**

Current maximum/minimum values:

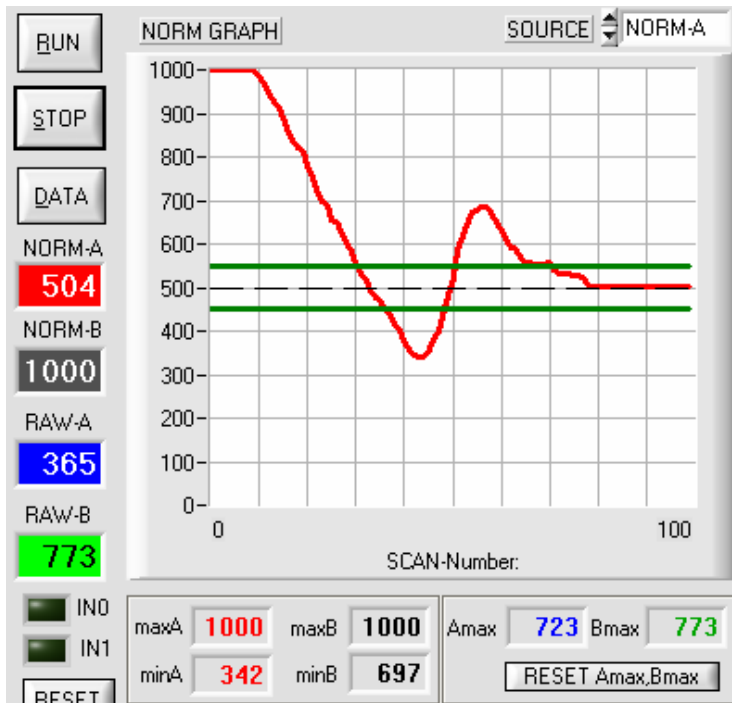
These numerical display fields show the current maximum or minimum values for measuring channel CHA or CHB that were found since the last RESET.

These are normalised values (referenced to Amax, Bmax). The above graphic display shows a minimum value minA=500 (red curve) and a minimum value minB=697 (black curve).

A click on the RESET button resets the current maximum and minimum values.

As an alternative to the software RESET button, it is also possible to press the red pushbutton at the housing of the A-LAS-CON1 control unit for a short time (<750 ms).

The RESET function also can be initiated by applying a short (<750ms) HIGH level to digital input IN1 (pin4/yellow).



SOURCE NORM-A

When NORM-A is selected in the SOURCE drop-down list element, the normalised measured values for measuring channel CHA (red curve) are shown in the graphic display window.

RUN

The RUN button must be pressed to activate the "scroll mode".

In addition to the red measurement curve, two green horizontal lines show the set tolerance band TOLERANCE-CHA = 50. The tolerance band is formed symmetrically (+/-50 units) around the reference value.

The REFERENCE-CHA value = 500 is shown as a black broken line in the middle of the tolerance band.

NORM-A
998
NORM-B
998

NORM-A, NORM-B:

These two numerical display fields show the normalised measured values. The normalising equations are:

$$NORM_A = 1000 * \frac{RAW_A}{A_{max}}$$

$$NORM_B = 1000 * \frac{RAW_B}{B_{max}}$$

4 Trigger modes and evaluation modes

4.1 CONTINUOUS trigger mode:

TRIGGER-MODE CONTINUOUS

CONTINUOUS:

In this operating mode the A-LAS-CON1 control unit continuously performs the following cyclic sequences (1) – (5):

- (1) Raw data recording (A/D conversion simultaneously for CHA and CHB)
- (2) Normalising of the raw data to the current maximum value
- (3) Evaluation of the normalised measured values according to the set evaluation mode
- (4) Activation of digital outputs OUT0, OUT1 (depending on the digital-out mode)
- (5) Applying of the analog voltage at the analog output (depending on the analog-out mode).

AVERAGE 2

In this trigger mode the AVERAGE parameter determines the maximum possible switching frequency at the A-LAS-CON1.

| <u>AVERAGE</u> | <u>Switching frequency</u> |
|----------------|----------------------------|
| 0 | approx. |
| 2 | approx. |
| 4 | approx. |
| 8 | approx. |
| 16 | approx. |
| 32 | approx. |
| 64 | approx. |
| 128 | approx. |
| 256 | approx. |
| 512 | approx. |
| 1024 | approx. |
| 2048 | approx. |

EVALUATION-MODE: NORM: [A & B]
 NORM: A/Amx
☒ NORM: [A & B]
 TRIG CHB -> EVAL CHA

EVALUATION-MODE:

In CONTINUOUS trigger mode all the evaluation modes can be set.

ANALOG-OUT-MODE DIRECT 0..10V
☒ DIRECT 0..10V
 MAXIMA-value
 MINIMA value
 <MAX-MIN> value

ANALOG-OUT-MODE:

In CONTINUOUS trigger mode all the possible operating modes for the analog output (pin8/red 8-pole PLC socket) can be set.

DIGITAL-OUT-MODE (+) -> OUT1; (-) -> OUT0
☒ (+) -> OUT1; (-) -> OUT0
 BINARY: (A->OUT0), (B->OUT1)

DIGITAL-OUT-MODE:

In CONTINUOUS trigger mode all the possible operating modes for the digital outputs OUT0 and OUT1 can be set.

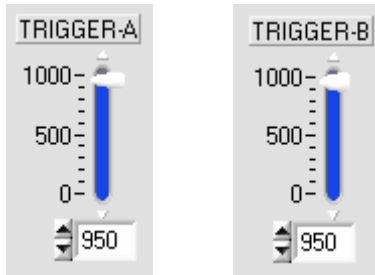
4.2 INTERN CHA and INTERN CHB trigger mode:

TRIGGER-MODE: INT-CHA-scan-128

TRIGGER-MODE: INT-CHB-scan-128

INTERN-CHA, INTERN-CHB:

In this operating mode the A-LAS-CON1 control unit uses a "self-triggering" mode, which means that the passage of the measuring object initiates the self-trigger at the respective activated measuring channel.



The trigger threshold can be set separately at the respective measuring channel by means of TRIGGER-A or TRIGGER-B slider.

The raw data at measuring channel CHA and CHB are referenced to the respective current maximum value (Amax, Bmax). If the light measuring section is not covered, referencing results in NORM values of 1000 units. The trigger threshold is absolutely referenced to these referenced NORM values.

Triggering is initiated when the normalised measured value falls below the trigger threshold.

SCAN-Time: 500ms

- 10ms
- 20ms
- 50ms
- 100ms
- 200ms
- ✓ 500ms
- 1s
- 2s
- 5s

SCAN-Time:

This drop-down function field is used for setting the recording time when using the internal trigger mode.

Since the available memory in the A-LAS-CON1 control unit is limited, only a limited number of measured values can be recorded for each measuring channel (128 samples).

For recording longer processes, a time interval for internal triggering can therefore be set in the SCAN-Time function field. The A-LAS-CON1 control unit automatically sets the internal scanning time in accordance with the SCAN-Time that is set here. A maximum of 128 scanning values are recorded..

5 Appendix

5.1 Technical data:

| Designation | A-LAS-CON1 |
|------------------------------|---|
| Power supply | +12VDC ... +32VDC |
| Current consumption | typ. 200 mA |
| Min. detectable object | < 10 μm (depending on the aperture of the A-LAS sensor) |
| Resolution | 0.1% (100% = aperture size of the A-LAS sensor) |
| Operating temperature range | -20°C ... +55°C |
| Storage temperature range | -20°C ... +85°C |
| Type of protection | IP54 |
| Digital inputs (IN0, IN1) | Input voltage +Ub/0V, with protective circuit |
| Digital outputs (OUT0, OUT1) | pnp-brigh-switching/npn-dark-switching or pnp-dark-switching/npn-bright-switching, adjustable under Windows®, 100 mA, short-circuit-proof |
| Analog output | 0 ... +10V |
| Bandwidth of analog signal | 6 kHz (-3dB) |
| Sensitivity adjustment | adjustable with potentiometer TOL or under Windows® at a PC |
| Laser power correction | adjustable under Windows® at a PC |
| Housing material | Aluminium, anodised in blue |
| Housing dimensions | LxWxH approx. 80 mm x 80 mm x 25 mm (without flange female connectors) |
| Connectors | 8-pole circular female connector type Binder series 712 (PLC/power) 4-pole circular female connector type Binder series 707 (PC/RS232) 7-pole circular female connector type Binder series 712 (A-LAS sensor CH1) 7-pole circular female connector type Binder series 712 (A-LAS sensor CH2) |
| Teach button | Teach button at the housing for teaching in the setpoint value |
| LED indicators | LED red (+) : Status tolerance output OUT1 LED green : Power indicator / visualisation of the teach process LED red (-) : Status tolerance output OUT0 |
| EMC test acc. to | IEC - 801 ... |
| Scanning frequency | max. 100 Hz |
| Max. switching current | 100 mA, short-circuit-proof |
| Interface | RS232, parameterisable under Windows® |
| Connecting cables | To PC: cab-las4/PC or cab-las4/PC-w To PLC: cab-las8/SPS or cab-las8/SPS-w To A-LAS sensor CH1: cab-las-y To A-LAS sensor CH2: cab-las-y |

LASER WARNINGS

Solid-state laser, $\lambda=670\text{ nm}$, 1mW max. optical power,
laser class 2 acc. to EN 60825-1

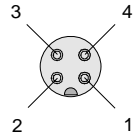
Therefore no additional protective measures are required for the use of these laser transmitters.



5.2 Connector assignment

RS232 connection to PC:

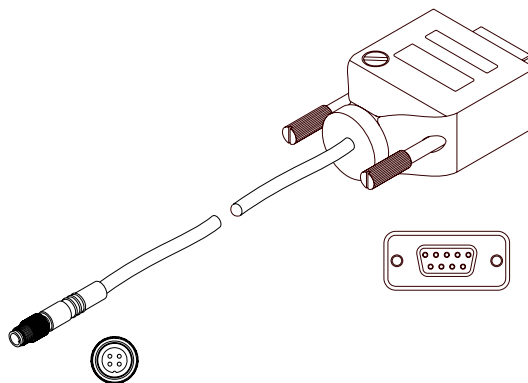
4-pole M5 socket type Binder 707



| Pin: | Assignment: |
|------|-------------|
| 1 | 0V (GND) |
| 2 | 0V (GND) |
| 3 | RxD |
| 4 | TxD |

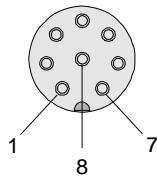
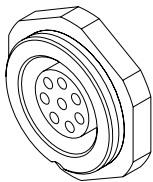
Connecting cable:

cab-las4/PC (length 2m, cable sheath: PUR)



Interface to PLC/power supply:

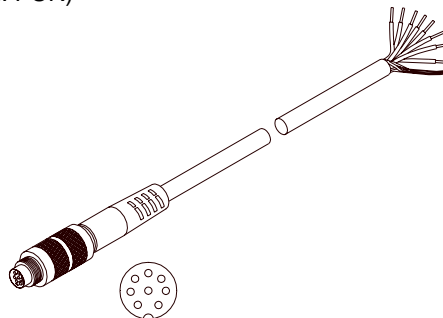
8-pole socket type Binder 712



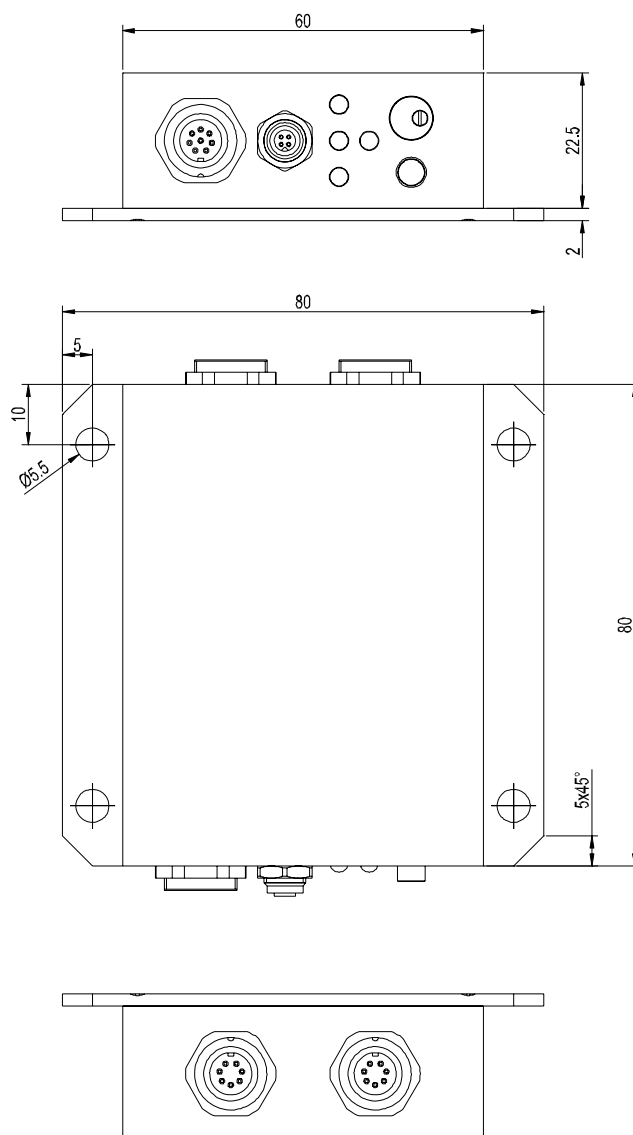
| Pin: | Color: | Assignment: |
|------|--------|----------------------|
| 1 | white | 0V (GND) |
| 2 | brown | +12VDC ... +32VDC |
| 3 | green | IN0 (TRIGGER EXTERN) |
| 4 | yellow | IN1 (TEACH / RESET) |
| 5 | grey | OUT0 |
| 6 | pink | OUT1 |
| 7 | blue | 0V (GND) |
| 8 | red | ANALOG (0 ... 10V) |

Connecting cable:

cab-las8/SPS (length 2m, cable sheath: PUR)



5.3 Housing dimensions:



All dimensions in mm

5.5 RS232 interface protocol

RS232 interface protocol PC ↔ A-LAS-CON1

- Standard RS232 serial interface, no hardware handshake.
- 3-line-connection: GND, TXD, RXD
- Speed: 19200 baud, 8 data-bits, no parity-bit, 1 stop-bit, binary-mode

The control device (PC or PLC) must send a data frame with a length of *18-words* (*1 word = 2 byte = 16 bit*) to the A-LAS-CON1 control unit. All words must be transferred in binary format. The higher-order byte of each word must be transferred first (MSB-first).

METHOD:

The microcontroller of the A-LAS-CON1 control unit permanently reads the input buffer of the RS-232 module (polling). If the arriving word is *0x0055* (*0x55 hexadecimal = 85 decimal*), this is interpreted as a synchronisation event: **<sync-word>**. When the 1st word <sync-word> has been read in, the 2nd word is read in. The 2nd word contains the order number: **<order-word>**.

After the order word <order-word>, the number of the parameter set (0 or 1) must be transferred in the 3rd word = **<parameter-set-no>**.

After the number of the parameter set (0 or 1), the A-LAS-CON1 reads in 15-parameters = **<parameter-word>**. When the complete data frame (18-words = 36 bytes) has been read in, the A-LAS-CON1 executes the order transferred in the 2nd word **<order-word>**.

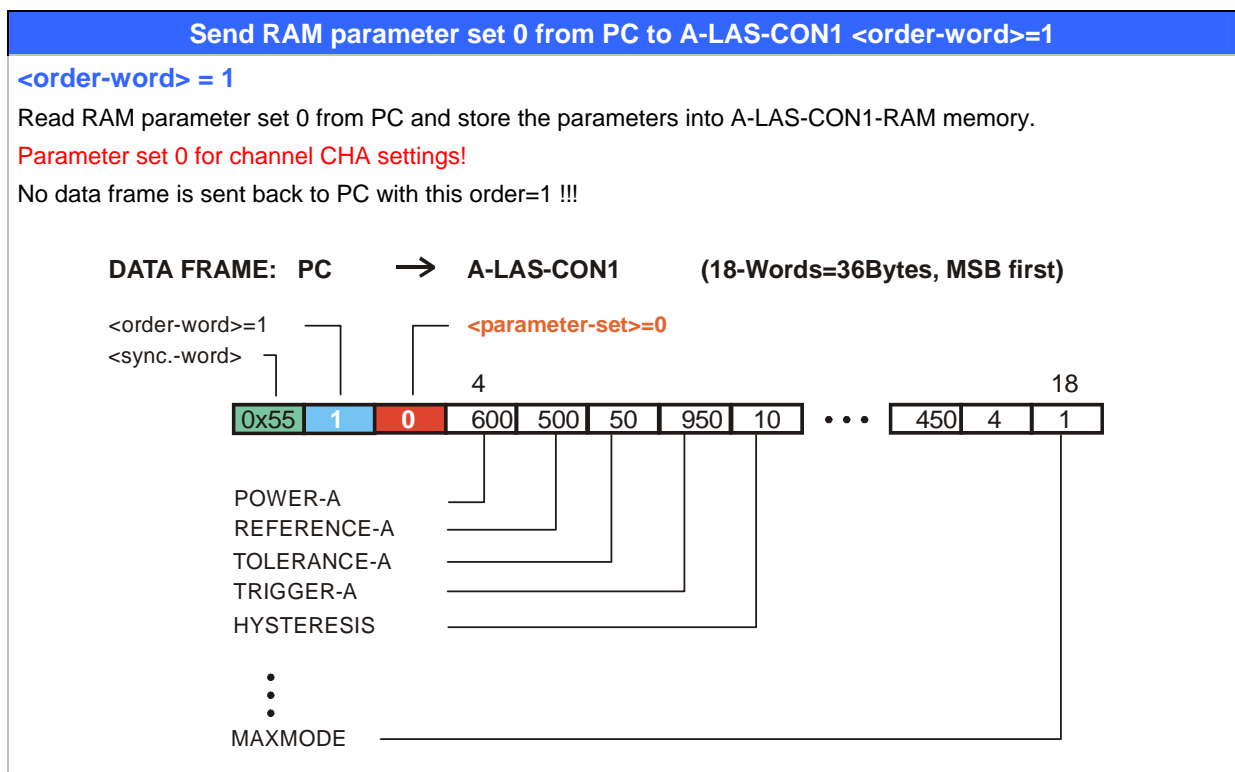
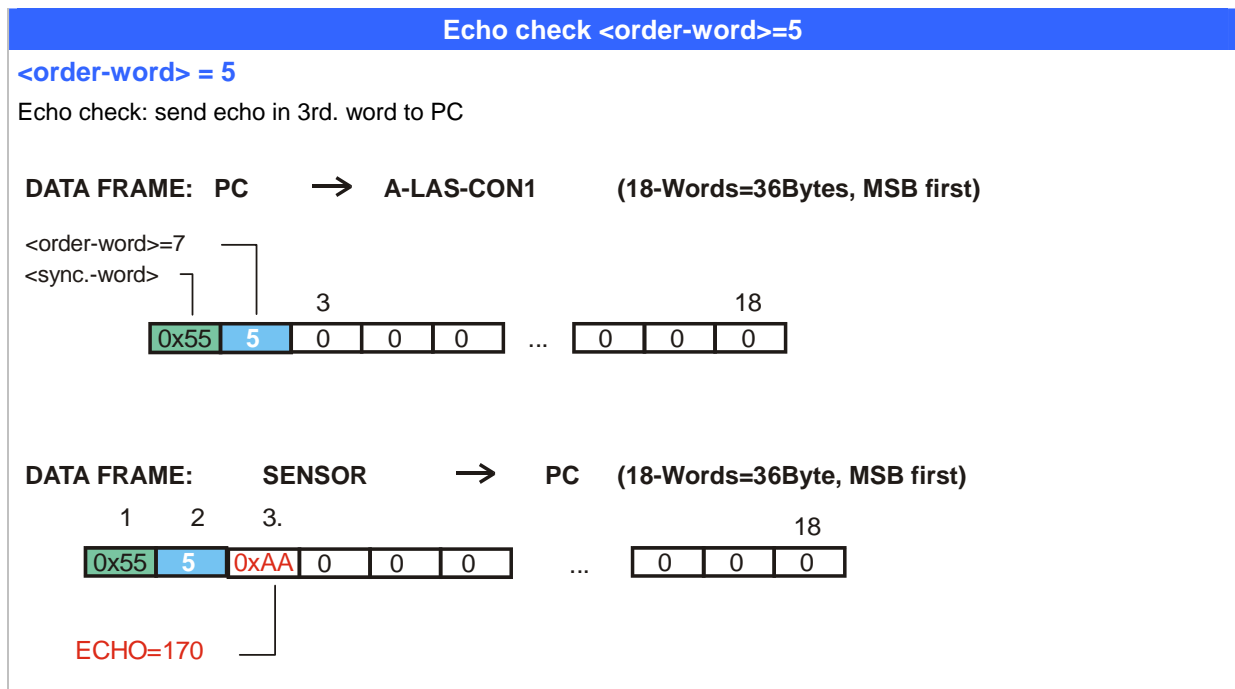
Format of the parameter frame (parameter set 0 = measuring channel CHA)

| Word No. | Meaning | Comment |
|----------|-------------------------------------|--|
| 1 | <sync-word> = 0x0055 | hex-code 0x0055, binary=0000 0000 0101 0101, dec.=85 |
| 2 | <order-word> | Order word (see table below) |
| 3 | <parameter-set-no> = 0 | Parameter set number = 0 |
| 4 | parameter POWER-A | Laser power measuring channel CHA (0 ... 1000) |
| 5 | parameter REFERENCE-A | Reference preset value (teach value) CHA (1 ... 1023) |
| 6 | parameter TOLERANCE-A | Tolerance preset value CHA (1 ... 1000) |
| 7 | parameter TRIGGER-A | Trigger threshold measuring channel CHA (1... 1000) |
| 8 | parameter HYSTERESIS | Hysteresis value (in the tolerance window) (0 ... 130) |
| 7 | parameter POLARITY | Output polarity for OUT0,OUT1 (0=DIRECT, 1=INVERSE) |
| 8 | parameter HOLD | Output hold time for OUT0,OUT1 (10,20,50,100,200,500,100,65534) |
| 9 | parameter AVERAGE | Average value (1,2,4,8,16,32,64,128,256,512,1024 or 2048) |
| 10 | parameter HWMODE | Hardware mode (0:Disable all, 1:Enable all, 2:Enable button, 3: Enable potentiometer) |
| 11 | parameter EVALMODE | Evaluation mode (0:NORM-A, 1:NORM-B, 2:NORM (A&B), 3:TRIGG-B -> EVAL-A, 4: TRIGG-A -> EVAL-B) |
| 12 | parameter TRGMODE | Trigger mode (0:CONTINUOUS, 1:INTERN-A, 2:INTERN-B, 3:EXTERN-HIGH, 4:EXTERN-L/H) |
| 13 | parameter TRGLEVEL | Trigger level for internal trigger |
| 14 | parameter MAXMODE | Unload actual maxima (0:off, 1:on) |
| 15 | parameter DIG-MODE | Operating mode of digital outputs (0:(+)/(-)TOL-WIN, 1:BINÄR) |
| 16 | parameter ANA-MODE | Operating mode of analog output: (0=DIRECT 0..10V, 1=MAXIMA-value, 2=MINIMA-value, 3=<MAX-MIN>value) |
| 17 | parameter SCAN-TIME | Scan-Time: (6=10ms, 27=20ms, 95=50ms, 210=100ms, 410=200ms, 1125=500ms, 2175=1s, 4375=2s, 11250=5s) |
| 18 | parameter MAXMODE | Automatic maximum value adaptation (0:off, 1:on) |

| Format of the parameter frame (parameter set 1 = measuring channel CHB): | | |
|--|------------------------|--|
| Word No. | Meaning | Comment |
| 1 | <sync-word> = 0x0055 | hex-code 0x0055, binary=0000 0000 0101 0101, dec.=85 |
| 2 | <order-word> | Order word (see table below) |
| 3 | <parameter-set-no> = 1 | Parameter set number = 1 |
| 4 | parameter POWER-B | Laser power measuring channel CHB (0 .. 1000) |
| 5 | parameter REFERENCE-B | Reference preset value (teach value) CHB (1 ...1000) |
| 6 | parameter TOLERANCE -B | Tolerance preset value CHB (1 .. 1000) |
| 7 | parameter TRIGGER-B | Trigger threshold measuring channel CHB (1.. 1000) |
| 8 | parameter free | Default=0 |
| 7 | parameter free | Default=0 |
| 8 | parameter free | Default=0 |
| 9 | parameter free | Default=0 |
| 10 | parameter free | Default=0 |
| 11 | parameter free | Default=0 |
| 12 | parameter free | Default=0 |
| 13 | parameter free | Default=0 |
| 14 | parameter free | Default=0 |
| 15 | parameter free | Default=0 |
| 16 | parameter free | Default=0 |
| 17 | parameter free | Default=0 |
| 18 | parameter free | Default=0 |

| Meaning of the 2 nd word in the data frame: <order-word> | | |
|---|---|---|
| Value | Meaning / Action | |
| 0 | Nop | no operation |
| 1 | Send parameter from PC into RAM of A-LAS-CON | volatile: 18 words: PC ⇒ A-LAS-CON1-RAM |
| 2 | Get A-LAS-CON1 RAM-parameter | 18 words, A-LAS-CON1-RAM ⇒ PC |
| 3 | Send parameter from PC into EEPROM of A-LAS-CON1 | 18 words, PC ⇒ A-LAS-CON-EEPROM |
| 4 | Get EEPROM parameters of A-LAS-CON1 | 18 words, A-LAS-CON1-EEPROM ⇒ PC |
| 5 | Echo check: Get echo of A-LAS-CON1, Line ok = 0x00AA | 18 words, 1 st word=0x00AA (Echo=170) |
| 6 | Activate Teach at A-LAS-CON1, store in RAM | 18 words , PC ⇒ A-LAS-CON1-RAM |
| 7 | Get software version info from A-LAS-CON1 | 36 words, A-LAS ⇒ PC (version-string) |
| 8 | Get measured values out of A-LAS-CON1-RAM | 18 words, A-LAS-CON1-RAM ⇒ PC |
| 9 | Get data-buffer-block out of A-LAS-CON1-RAM, | 64 words, A-LAS-CON1-RAM ⇒ PC |

EXAMPLES:



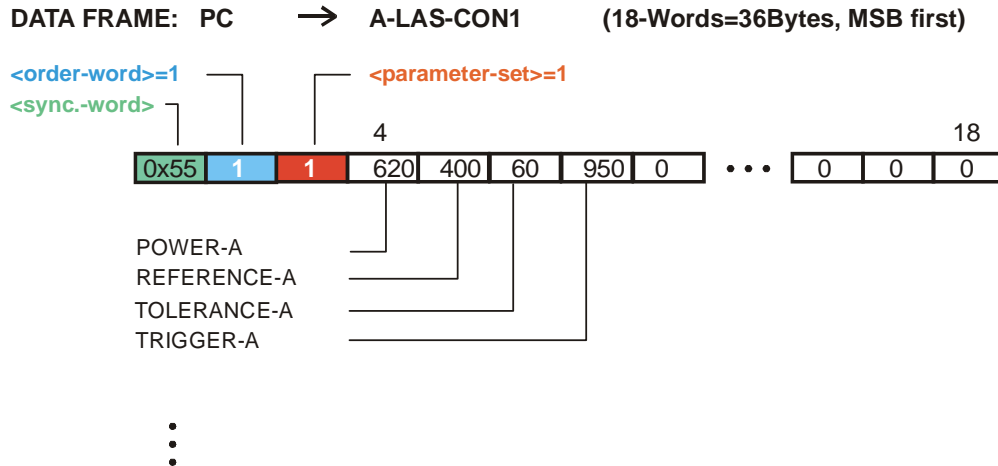
Send RAM parameter set 1 from PC to A-LAS-CON1 <order-word>=1

<order-word> = 1

Read RAM parameter set 1 from PC and store the parameters into A-LAS-CON1-RAM memory.

Parameter set 1 for channel CHB settings!

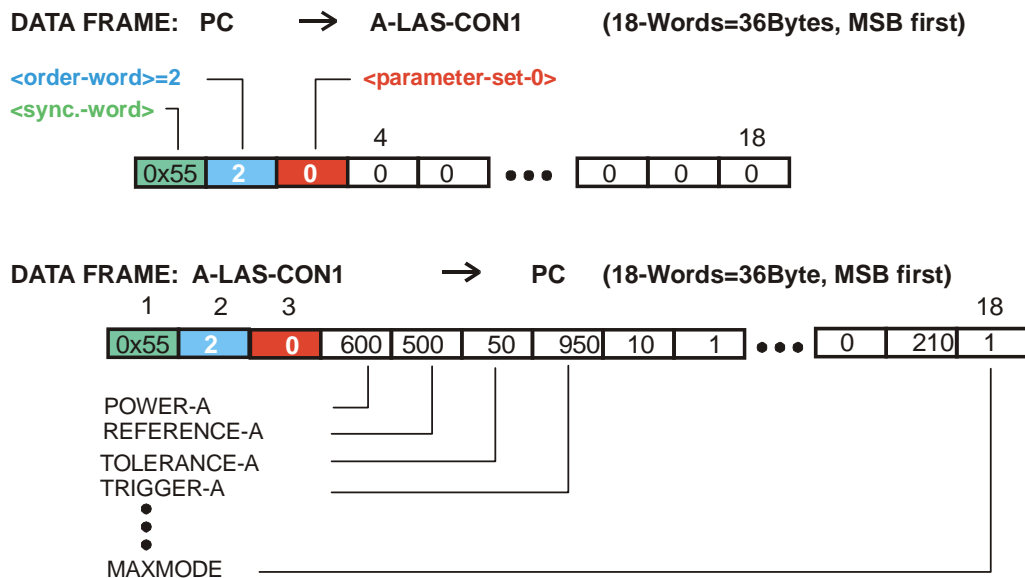
No data frame is sent back to PC with this order=1 !!!



Get A-LAS-CON1-RAM parameter set 0 <order-word>=2

<order-word> = 2

Send A-LAS-CON1 RAM parameter set 0 to PC



GET measured values of A-LAS-CON1 unit <order-word>=8

<order-word> = 8

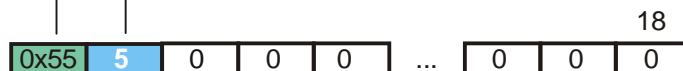
The A-LAS-CON1-unit sends the actual measured values to the PC.

The 3rd word is the actual measurement value **NORM-A**The 4th word is the actual measurement value **NORM-B**The 5th word is the raw-value of channel : **CHA**The 6th word of the raw-value of channel: **CHB**

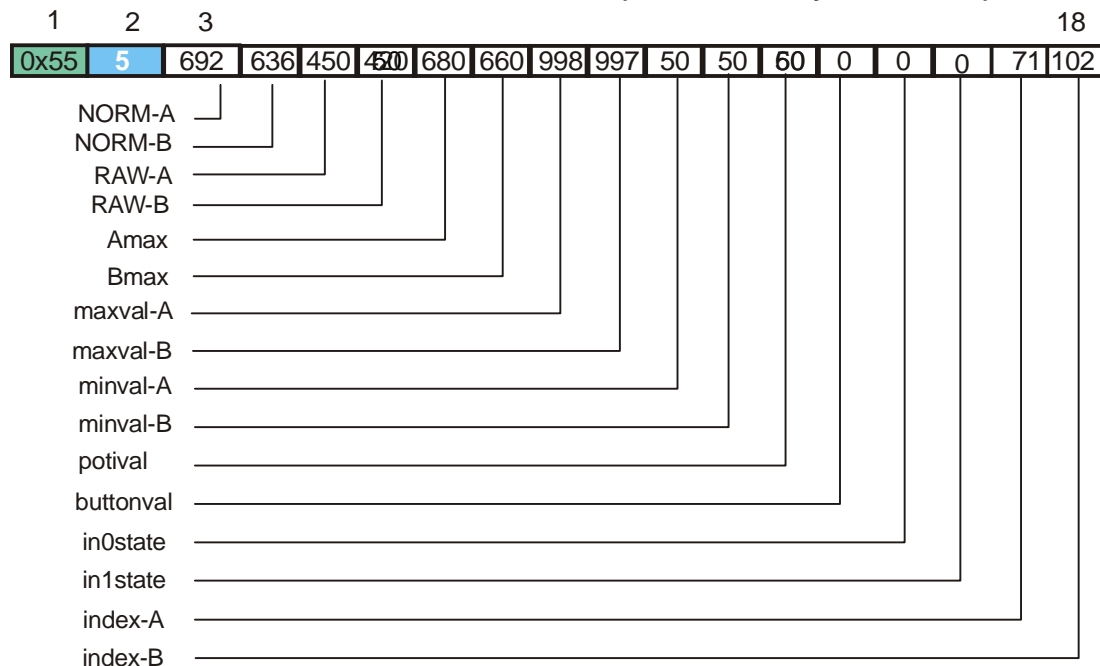
DATA FRAME: PC → A-LAS-CON1 (18-Words=36Bytes, MSB first)

<order-word>=8

<sync.-word>



DATA FRAME: A-LAS-CON1 → PC (18-Words=36Byte, MSB first)



| | |
|-----------|---|
| NORM-A | := Normalised measured value of measuring channel CHA |
| NORM-B | := Normalised measured value of measuring channel CHB |
| RAW-A | := Raw value of measuring channel CHA |
| RAW-B | := Raw value of measuring channel CHB |
| Amax | := Current maximum value (RAW value) of CHA |
| Bmax | := Current maximum value (RAW value) of CHB |
| maxval-A | := Normalised maximum value of CHA detected since the last trigger or reset |
| maxval-B | := Normalised maximum value of CHB detected since the last trigger or reset |
| minval-A | := Normalised minimum value of CHA detected since the last trigger or reset |
| minval-B | := Normalised minimum value of CHB detected since the last trigger or reset |
| potival | := Analog value at the tolerance potentiometer |
| buttonval | := Status of the Teach/Reset button at the housing (activated = 1) |
| in0state | := Status at digital input IN0 (0= LOW, open , 1=HIGH-level) |
| in1state | := Status at digital input IN1 (0= LOW, open , 1=HIGH-level) |
| index-A | := General index counter measuring channel CHA |
| index-B | := General index counter measuring channel CHB |