Manual
A-LAS-CON1-Scope Software V4.04

(PC software for Microsoft® Windows Vista, XP, 2000, NT)

for control units of type A-LAS-CON1
**and sensor systems based thereon**

Contents

1 Functional principle: A-LAS sensors

The A-LAS sensor type comprises analog laser light barriers with rectangular or round aperture in split or fork design. A-LAS sensors consist of two components: A transmitter and a receiver. The transmitter generates a light curtain of parallel laser light that is determined by the aperture geometry. This light curtain features a highly homogeneous light intensity distribution along both main axes. When there is no object in the beam path, the light of the transmitter fully arrives at the receiver, which converts the light information into a proportional voltage and provides this voltage at an output. When there is an object in the beam path, a part of the light is covered, and the resulting reduction of the light intensity arriving at the receiver is output as a proportional voltage change.
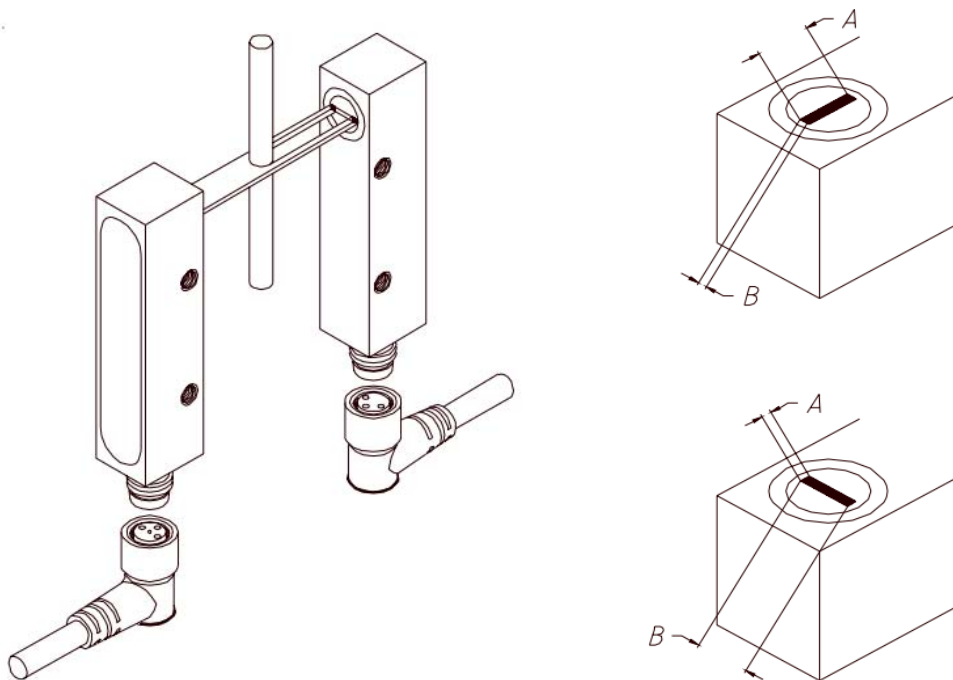
This allows various measurement and inspection possibilities. A-LAS sensors with round aperture for example can be used as high-precision trigger sensors, or for determining absorption in case of translucent objects. Sensors with rectangular aperture can be used for determining geometric dimensions such as diameter, length, or width.

A-LAS sensors require a stable, low-noise power supply for operation. Furthermore, the sensor's analog voltage information needs to be suitably processed for most applications (gain of the analog signal, defining of trigger threshold and digital output, etc.). For this purpose A-LAS sensors are operated by control units that provide the necessary power supply and perform evaluation. There are two categories of control units: Control units with analog evaluation, and control units with digital evaluation (microcontroller-based). The A-LAS-CON1 control unit belongs to this latter category.

2   Functional principle: A-LAS-CON1 control unit

The A-LAS-CON1 control unit is a microcontroller-based evaluation unit for up to two sensors of type A-LAS with a firmware that is specifically optimised for spray beam systems. The A-LAS-CON1 control unit is equipped with two digital inputs (0V..+24V), three digital outputs (0V..+24V), and one analog output (0V..+10V, as an option +4mA ..+20mA). For configuring the control unit or for visualising the current data a connection to a PC or laptop can be established through a RS232 interface. The housing of the A-LAS-CON1 control unit features four multi-color LEDs that display various states (inputs/outputs), a potentiometer, and a button that can be assigned different functions.

During operation the program of the A-LAS-CON1 control unit cyclically goes through five phases. In the first step the analog signals of the connected A-LAS sensors are scanned and digitised ("A/D SAMPLING") – either in a user-defined time pattern, or asynchronously with maximum possible speed.

Output of digital and analog results

Scanning of analog sensors

Scaling and linearisation of input data

Filtering and processing of input data

Evaluation of data
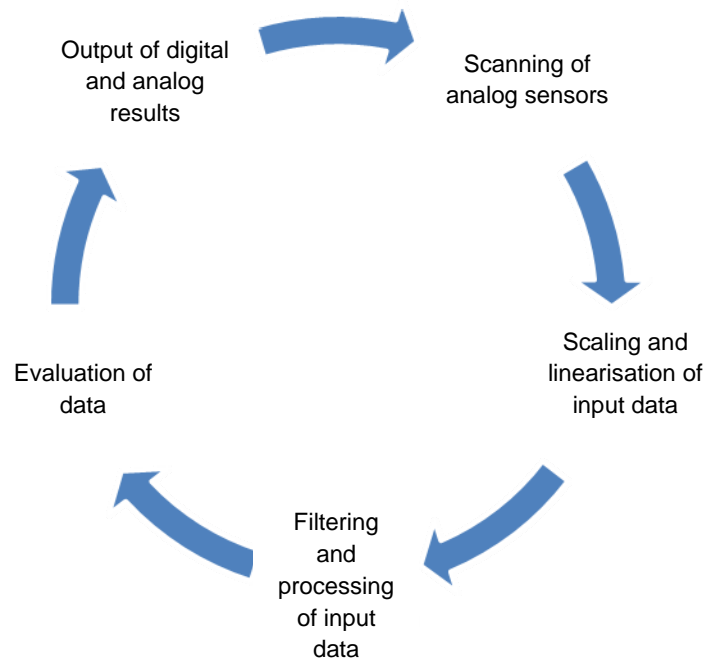
In the second step the digitised input data are scaled and (as an option) linearised. Scaling means that the input data by way of a variable, self-adapting factor are scaled to a fixed range. Linearisation is an optional step in which the non-linear behaviour of the A-LAS sensors (deviation from the ideal characteristic typically < 5%) is compensated by a previously recorded calibration curve.

In the next step the input data are filtered and processed. Apart from optional signal filtering (low-pass, etc.), minimum value and maximum value of the individual input data are determined independently of each other. An integrator allows numerical integration of input data over a period of several hours, and a counter can be used to determine how many times user-definable events have occurred.

Simultaneously states and threshold events (overshooting / undershooting) are determined by way of continuously comparing the input data with a user-definable trigger threshold.

These states and events are managed in a central table. This table also contains states and events relating to the digital inputs, and states and events relating to the two internal timer modules which are used to generate user-defined time periods or delays.

This table is used to control the actions of the A-LAS-CON1 control unit. By way of defining a "mask" or a pattern, every event or every combination of events and states can initiate an action such as starting a timer, increasing the counter reading, starting recording, resetting the minimum and maximum value filters and the integrator, and finally starting the next step: Evaluation of data.

Evaluation means the comparison of a user-definable date or function of one or several data with a tolerance band consisting of a reference and a permissible upper and separate lower tolerance. The states of the result value (within, above, below tolerance) are determined simultaneously with evaluation, and – in the next step – the digital and analog outputs are set anew in accordance with these results.

If the evaluation condition is not fulfilled, the software skips the last two steps – evaluation and setting of outputs – and starts with the first step again.

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

1.
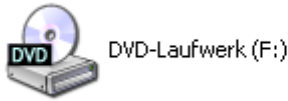
Insert the installation CD-ROM in your CD-ROM drive. In our example we suppose that this is drive "F".

2.

setup.exe
MSI Installer Bootstrapper
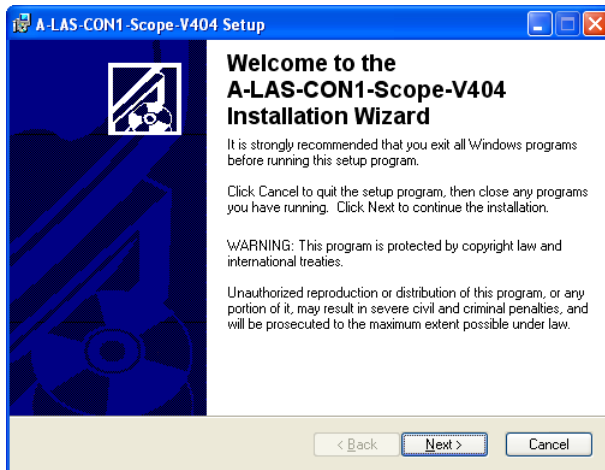National Instruments

Start the Windows Explorer and in the folder tree of your CD-ROM drive go to the installation folder F:\Install\ .
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\setup.exe", which must be confirmed by pressing the OK button.
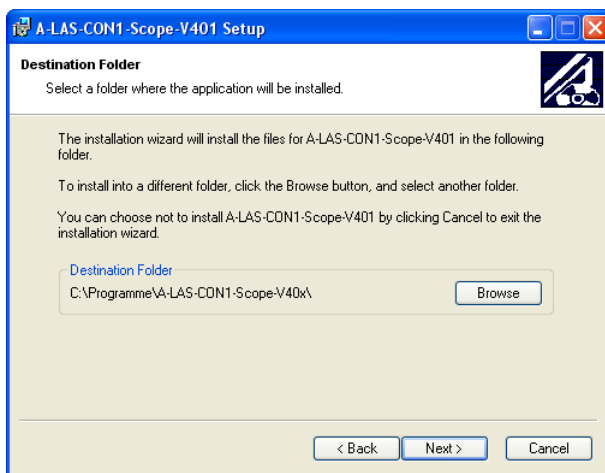
3.

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

*Click on **NEXT** to start the installation.*
*A click on **CANCEL** stops the program without installation of the A-LAS-CON1-Scope software.*

4.

*A new dialog appears for selecting the folder where the application will be installed (destination folder).*

*You may accept the suggested folder with **NEXT**, or you may change the installation folder as desired by clicking on the **BROWSE** button.*
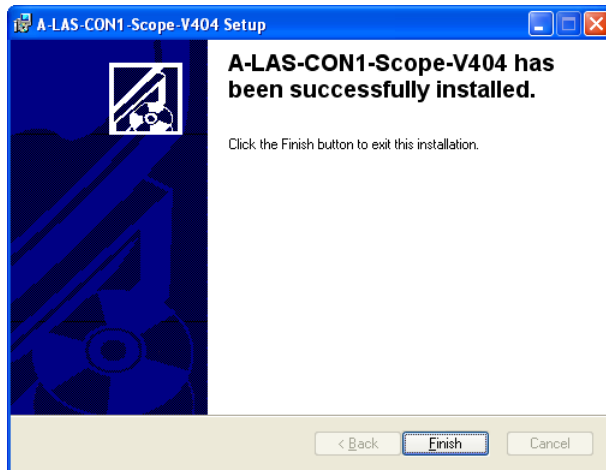
*Click on **NEXT**, if you want to continue with this selection.*
*A click on **CANCEL** stops the program without installation of the A-LAS-CON1-Scope software.*
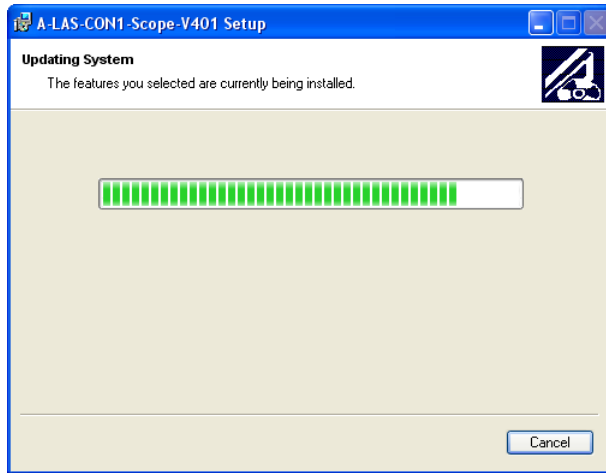
5. *Installation then is performed automatically.*

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

The A-LAS-CON1 Scope software can now be started by clicking on the respective icon in the newly created program group under:

Start >All programs >A-LAS-CON1 Scope V4.04

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

4.1 Purpose of the PC Scope software

The A-LAS-CON1 control unit operates independently and provides full functionality also without being connected to a PC. The A-LAS-CON1-Scope PC software is used for parameterisation, for visualising current data and recording these data for documentation purposes. Data can be exchanged between a PC and the control unit by way of a digital serial connection that uses the RS232 protocol. At the PC these data are visualised by a graphic user interface.

4.2 Layout of the user interface
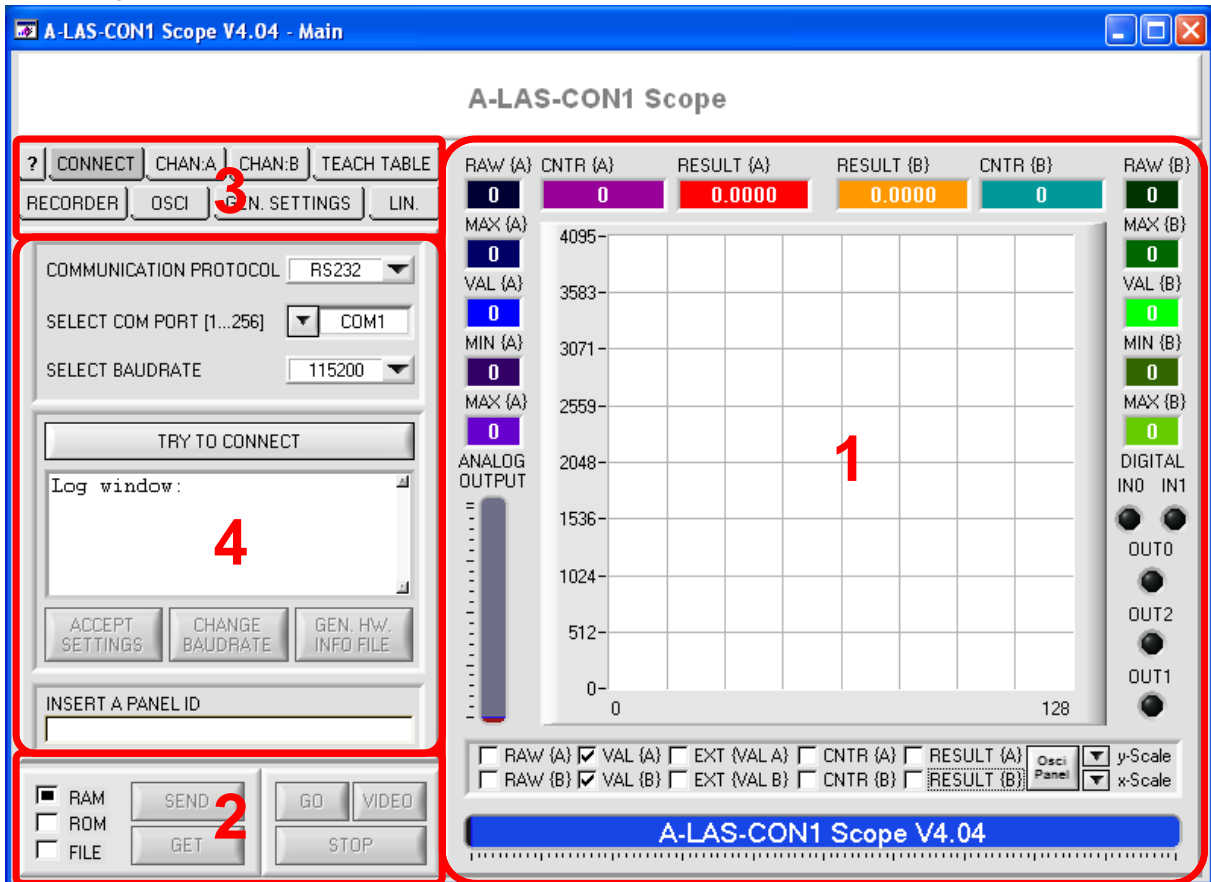
The user interface is divided into four sections: The right section (1) contains the numeric displays of the current A-LAS-CON1 data and the scroll graph display that represents the characteristics of the signals. In oscillograph mode two displays for the individual channels are shown instead of the scroll graph. Section (2) permanently displays the buttons for controlling data exchange ("GO", "VIDEO" and "STOP") and the buttons for exchanging parameters with the control unit ("SEND" and "GET"). Individual parameters of the A-LAS-CON1 can be accessed by way of several panels that are arranged centrally at the left side (4). The buttons (3) for selecting these panels and thus defining the current display are located at the top of the left side.
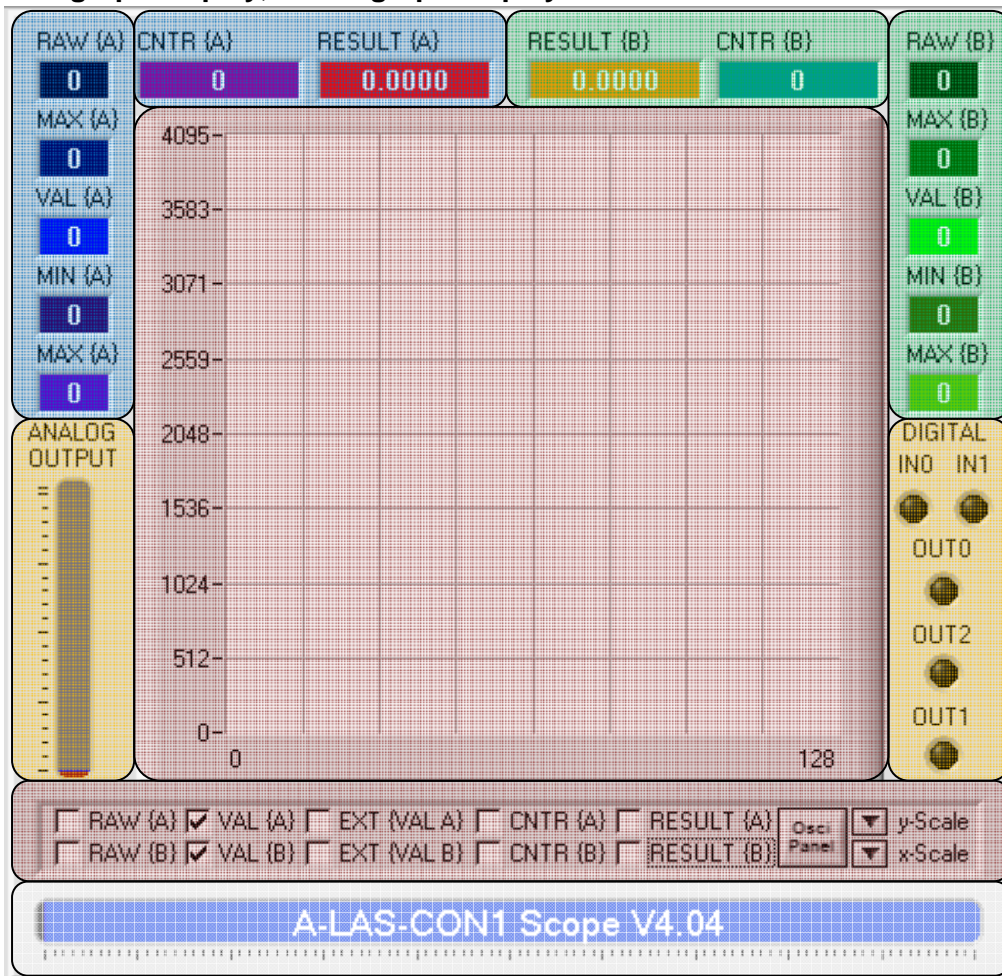

The software is in "GO" mode: Data are cyclically requested from the control unit and displayed.

The software is in "VIDEO" mode: Data are cyclically requested as in "GO" mode. When recording is finished and available, the respective data are then read out and displayed.

4.3 Scroll graph display, oscillograph display

This display is shown when "GO" mode is active or was active last. It contains the following individual display elements:

The bottom section contains the status display (white background) which is permanently shown and provides information about the current action of the Scope PC software. The status display for example shows the firmware information string, the current data exchange rate, or user inputs and user actions. A progress bar furthermore provides information about the progress of each action.
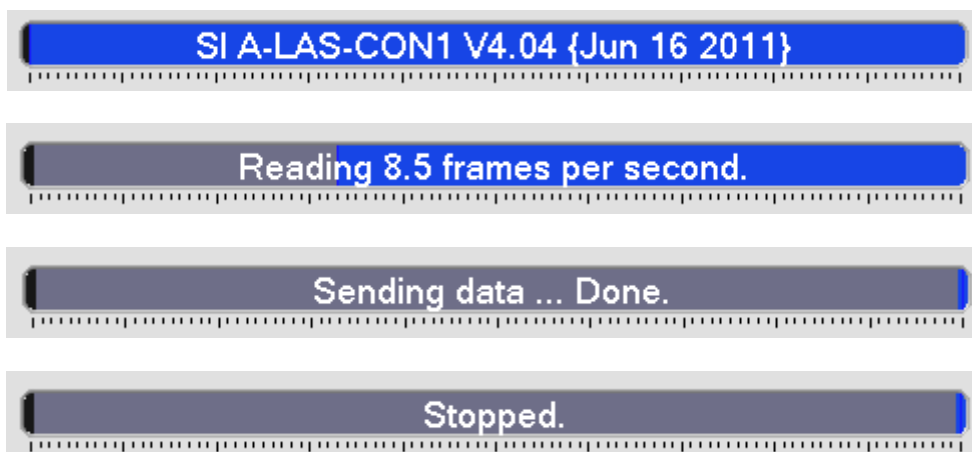
The section above the status display contains the scroll graph control fields and (above this) the scroll graph (red background). These control fields can be used to select the lines ("TRACES") that should be displayed. The rightmost point of the line represents the current numerically represented value. The further to the left the points lie, the older is their value. The numeric value and the scroll graph are updated with every data exchange.

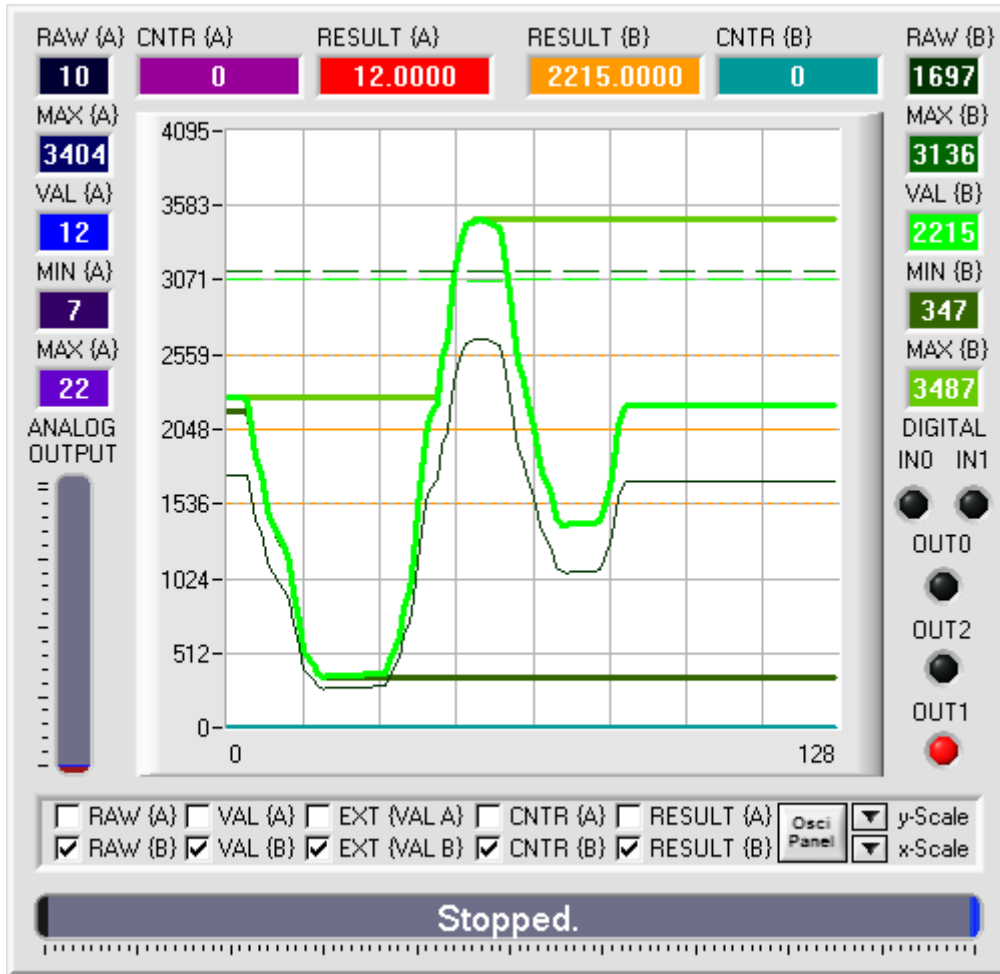| Numeric display	Scroll graph line	Description
RAW {A}	fine, continuous, dark blue	unscaled current value of channel A
MAX {RAW A}	fine, dashed, dark blue	maximum value of the unscaled values of channel A
VAL {A}	bold, continuous, light blue	scaled value of channel A
---	fine, dashed, light blue	current trigger threshold assigned to channel A
MIN {VAL A}	bold, continuous, dark violet	minimum scaled value of channel A
MAX {VAL A}	bold, continuous, violet	maximum scaled value of channel A
CNTR {A}	bold, continuous, light violet	current counter reading of the counter assigned to channel A
RESULT {A}	bold, continuous, red	last evaluated result value of channel A according to the evaluation mode
---	fine, finely dashed, red	upper and lower tolerance limit for the result of channel A
---	fine, continuous, red	reference value of the tolerance band of channel A
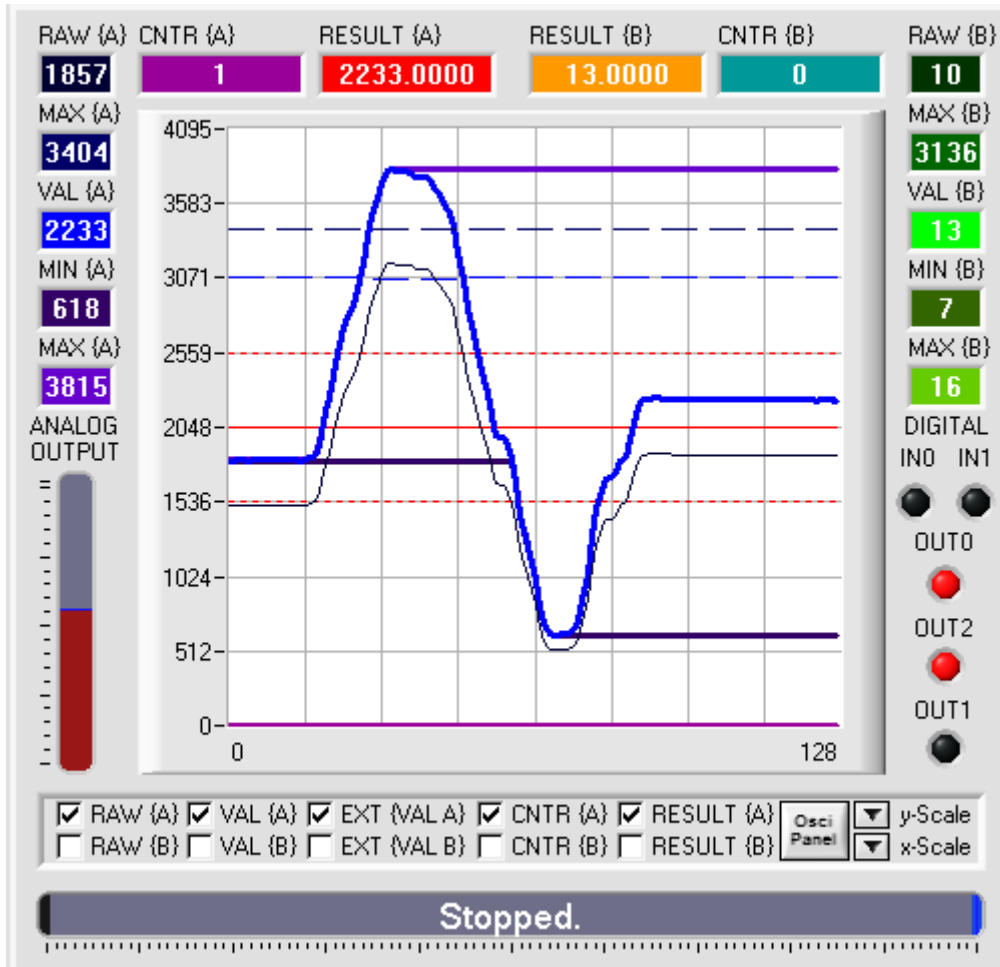
Numeric display	Scroll graph line	Description
RAW {B}	fine, continuous, dark green	unscaled current value of channel B
MAX {RAW B}	fine, dashed, dark green	maximum value of the unscaled values of channel B
VAL {B}	bold, continuous, light green	scaled value of channel B
---	fine, dashed, light green	current trigger threshold assigned to channel B
MIN {VAL B}	bold, continuous, light green	minimum scaled value of channel B
MAX {VAL B}	bold, continuous, green	maximum scaled value of channel B
CNTR {B}	bold, continuous, turquoise	current counter reading of the counter assigned to channel B
RESULT {B}	bold, continuous, yellow	last evaluated result value of channel B according to the evaluation mode
---	fine, finely dashed, yellow	upper and lower tolerance limit for the result of channel B
---	fine, continuous, yellow	reference value of the tolerance band of channel B

Not all the data that are sent during data exchange are numerically and/or graphically represented. Data that represent the current status of the digital inputs and outputs and of the analog output (yellow background) only are visualised by the LEDs and by the bar graph display, respectively.

The "y-Scale" and "x-Scale" drop-down lists can be used to influence the display and resolution of the scroll graph and oscillograph display. In the scroll graph the y-axis is scaled in relation to the maximum and minimum average value of the displayed lines, so that the average values always are displayed centrally.

y-Scale selection	Influence on the scroll graph	Influence on the oscillograph
FULL	0 < y-axis < 4095	---
1024	min-1024 < y-axis < max+1024	---
256	min-256 < y-axis < max+256	---
MAX ZOOM	min-32 < y-axis < max+32	---

x-Scale selection	Influence on the scroll graph	Influence on the oscillograph
FULL	128 values	read all 1024 points
MED1	64 values	read 512 points
MED2	32 values	read 512 points
FAST	16 values	read 256 points

In the oscillograph the x-Scale selection determines the number of recorded points that should be read. "FULL" setting means that all data points are read in four separate read processes. With "FAST" setting only 256 distributed data points are read. The points lying inbetween are interpolated by the PC software. This makes it possible to increase data throughput by a factor of 4 with a reduction of the resolution.
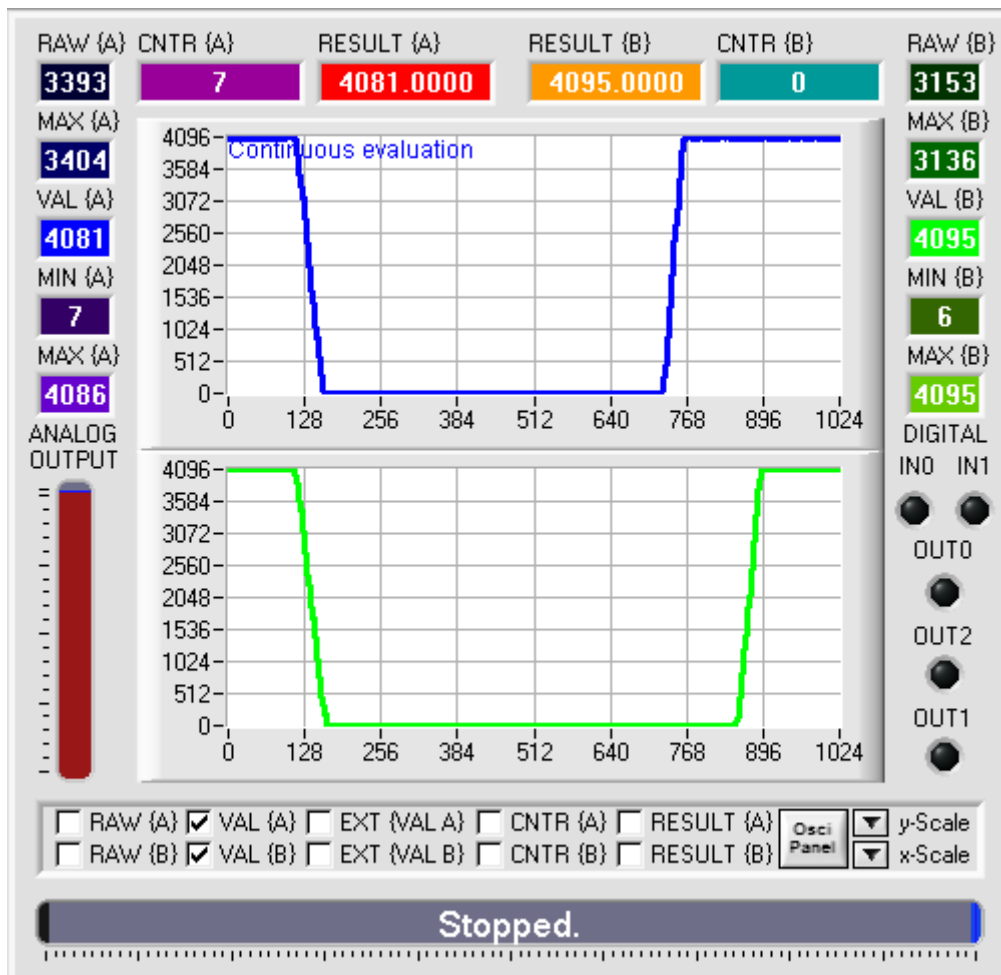
4.4 "Oscillograph" panel
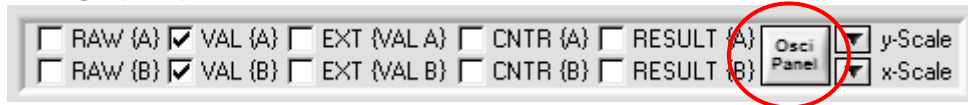
For analysis purposes the sensor system is able to record the corresponding analog values for every connected sensor. For this the analog value optionally is intermediately stored at every digital-analog conversion. This value is kept as long as the control unit is supplied with power and during this time can be read out by the PC software. This makes it possible to observe high-speed processes (passage of an object through the light barrier) in great detail. Because of the limited speed of data exchange in "RUN" mode this is not possible in most cases with the required time resolution. Recording can be started by various adjustable events – either synchronously for both cannels, or at different events.

For parameterisation please refer to the "Oscillograph Panel OSCI" chapter.

For the representation and analysis of data a dedicated panel is available that can be started by clicking on the "**Osci Panel**" button.
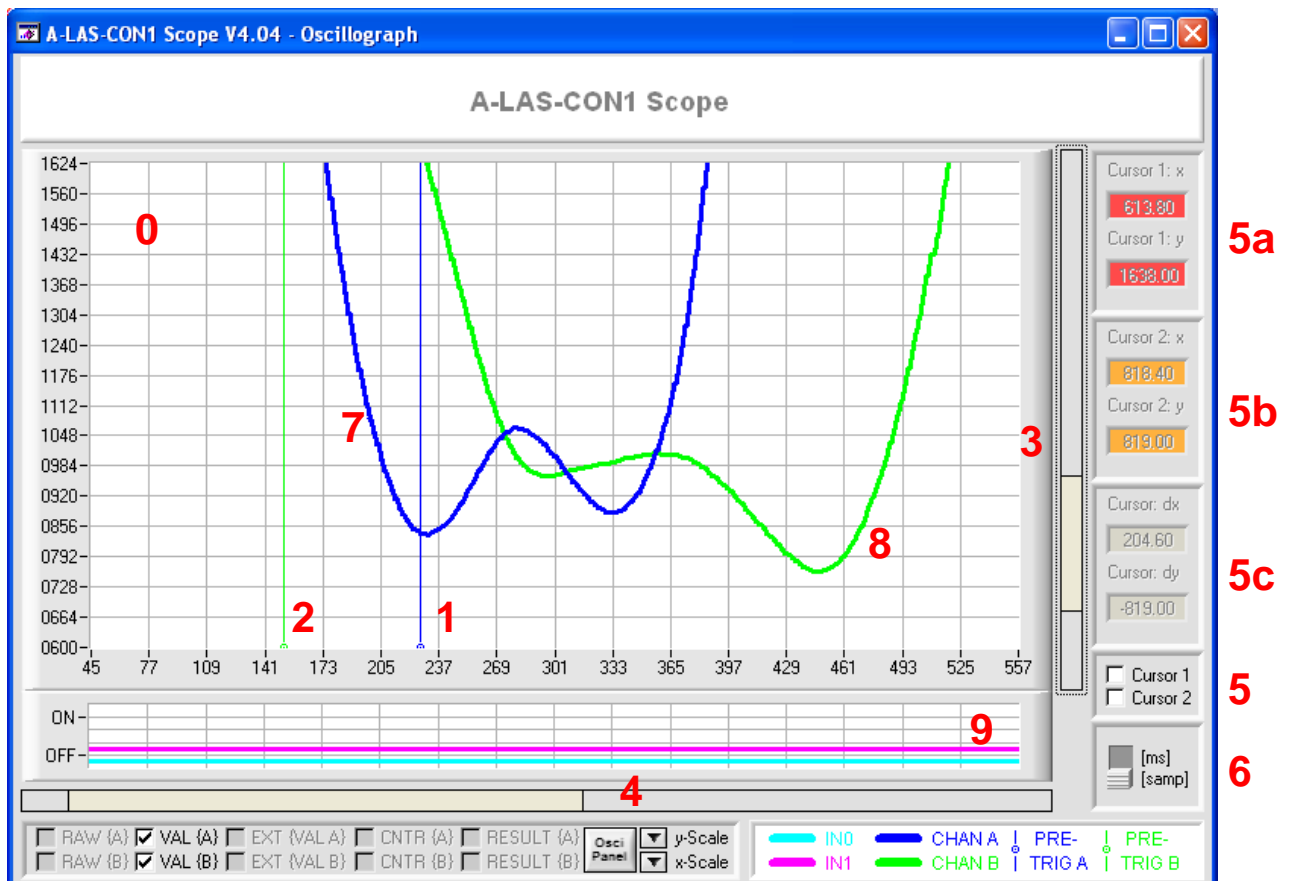
The central graph field (0) displays the data – blue (7) for sensor 1, and green (8) for sensor 2. The trigger moments are shown as vertical cursor lines (1: Sensor 1; 2: Sensor 2). These cursor lines can be moved by means of "Drag-and-Drop", which simultaneously adapts the parameter in the "OSCI" panel. Reversely, the cursors are correspondingly updated when the "**PRETRIGGER**" parameter is changed.

The display size (zoom) can be adjusted with the "**y-Scale**" and "**x-Scale**" drop-down lists. Different zoom factors result in different views of the field. The scroll bars for the vertical axis (3) and for the horizontal axes (4) can be used to adjust the displayed area to the desired section.

Two cursors can optionally be used to analyse swings or times of the analog signal. These cursors can be activated or deactivated with two selection switches (5). Cursor 1 (5a) is shown in red, and cursor 2 (5b) in yellow. The difference (x2-x1; y2-y1) of the two cursors (5c) only is shown numerically, i.e. without an own cursor.
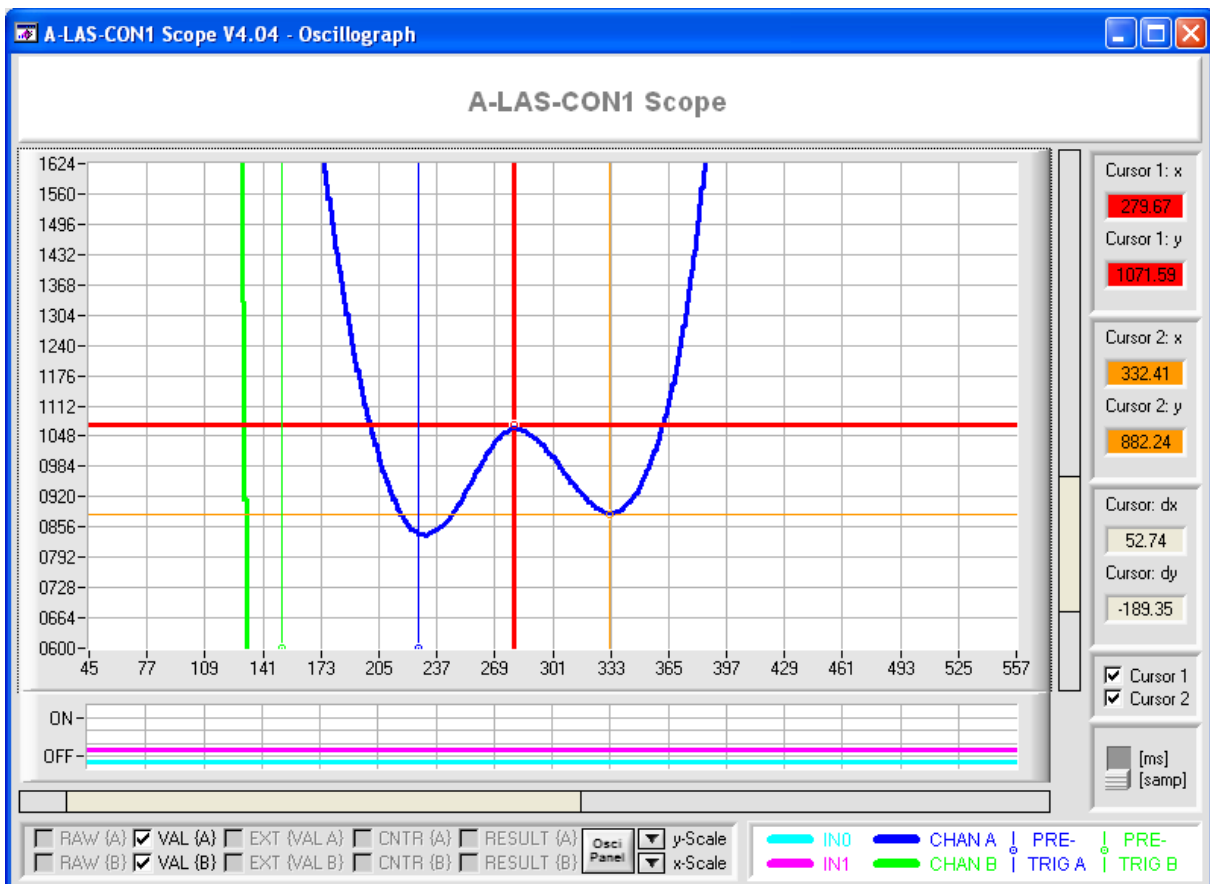
The scan rate is determined by the control unit. If the other recording parameters of both channels are synchronous, the time axis can be scaled in ms. Scaling is activated or deactivated by means of a changeover switch (6). If parameter settings are not synchronous, scaling is not possible, and a corresponding warning will be displayed.

Setting mismatch

Oscillograph cannot be scaled in milliseconds because the settings of chan A and B do not match. Set the parameter to identical values (by using the 'A = master' or the 'B = master' buttons), update the control unit and restart the 'VIDEO' mode.

OK

In this case the parameters of one or of both channels should be set to match, and the control unit should be parameterised anew. Scaling will then be possible. The cursors (x-values) also are scaled in ms. For this, however, the cursors need to be set anew.

In addition to the analog values, the states (on/off) of the digital inputs IN0 and IN1 also are displayed (9). IN0 is shown in cyan, and IN1 in magenta. The display of the input states always is synchronous with the last represented analog curve. Both channels should be set identically to use this function!

4.5   "CONNECT" panel

The CONNECT panel is used to define the connection settings for communication with the A-LAS-CON1. These settings include the PC parameters such as COM port number and baud rate when RS232 is selected as the connection protocol.
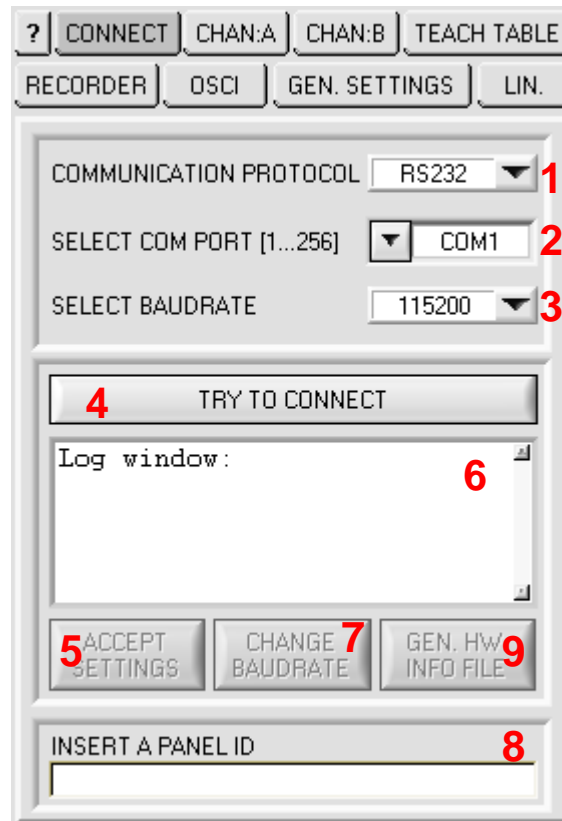
	Selection field for setting the communication protocol:	
1.	• RS232: For establishing a connection through the asynchronous, serial, full-duplex two-wire connection. This connection always uses 8 data bits, 1 stop bit, no parity, and no hardware and software handshake. The baud rate is set separately (see 3) • TCP/IP: For establishing a connection through a TCP socket. In this case a RS232-to-Ethernet adaptor must be used with the control unit. This adaptor functions as a TCP server, and its IP address and port number must be known.	
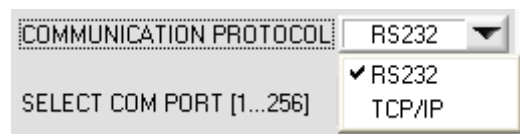
	Input field for defining the RS232 COM port: It is possible here to select both real COM ports (older PCs or industry-type PCs usually have one or several nine-pole SUB-D sockets at the back side) and virtual COM ports, which for example are generated by the corresponding Windows® driver when a USB-to-RS232 converter is used.
2a.	*The desired COM port (in this example COM 2) can be entered in the following formats:* • *"2" (without quotation marks)* • *"com2" (without quotation marks)* • *"COM2" (without quotation marks)*
	The PC Scope software saves the list of the last eight COM ports that were used. The COM port used last is at the first position in this list.
2b.	*Input field for defining the IP address of the TCP server that provides the data of the control unit. The IP addresses that were last used are listed in a history. The IP address must be entered with the keyboard.*
3a.	*Selection field for defining the baud rate that should be used. The following baud rate values can be selected* • *9600 baud* • *19200 baud* • *38400 baud* • *57600 baud* • *115200 baud* *The baud rate must be selected in advance. The current connection then is established with the selected baud rate. In the status line the PC software displays a message if the baud rate does not match (i.e. is not set to this value at the control unit).*
3b.	*Input field for defining the port number of the TCP connection. The value must be entered with the keyboard.* *When using a TCP-to-Ethernet converter of Sensor Instruments, the standard port number is 10001.*
4.	*The "TRY TO CONNECT" button is used to determine whether a suitable type of control unit is available at the selected interface with the defined settings. When a connection is successfully established the corresponding interface is assigned and will thus be blocked for any other access as long as no other interface is selected with the PC software or the software is closed.*
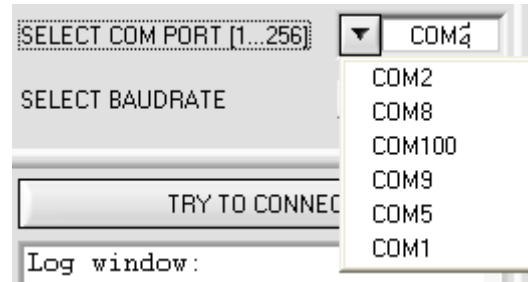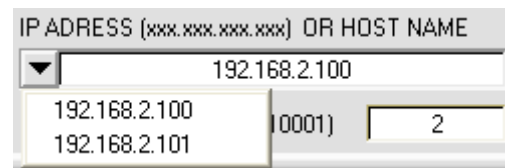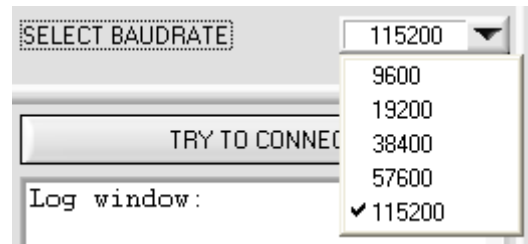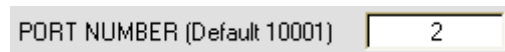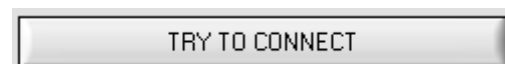
Connection is established in three stages:
1. *Old communication connections – if existing – are disconnected, and connection is re-established with the new settings.*
2. *A "ping" is sent to the control unit, and the echo is tested.*
3. *The version number is read from the control unit and displayed in the status line.*

Searching for control unit ...

Searching for control unit ... Success.

Requesting version info ...

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If connection with the control unit could be successfully established, a button will be enabled that can be pressed to accept this connection. Once the connection has been confirmed by pressing "ACCEPT SETTINGS", various other buttons will also be enabled.

ACCEPT SETTINGS

ACCEPT SETTINGS

5. *When the "ACCEPT SETTINGS" button is pressed, a selection box will be displayed offering the option to update the parameters and setting fields of the PC software with the current parameters of the A-LAS-CON1. This ensures that the parameters of the PC software and of the control unit are synchronised. If you select "NO" here, the parameters of the PC software will remain unchanged.*

Load parameter from RAM

Do you want to synchronize with the sensor and load RAM parameter?

Yes   No
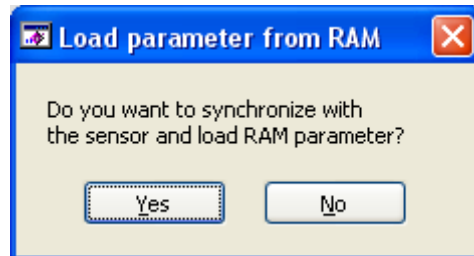
6. *The "Log window" displays a list of the current and of the last connection states. It also shows various information and error displays.*

```
Log window:

SCOPE CONNECTED TO COM1
PROTOCOL ERROR
SCOPE CONNECTED TO COM2
```

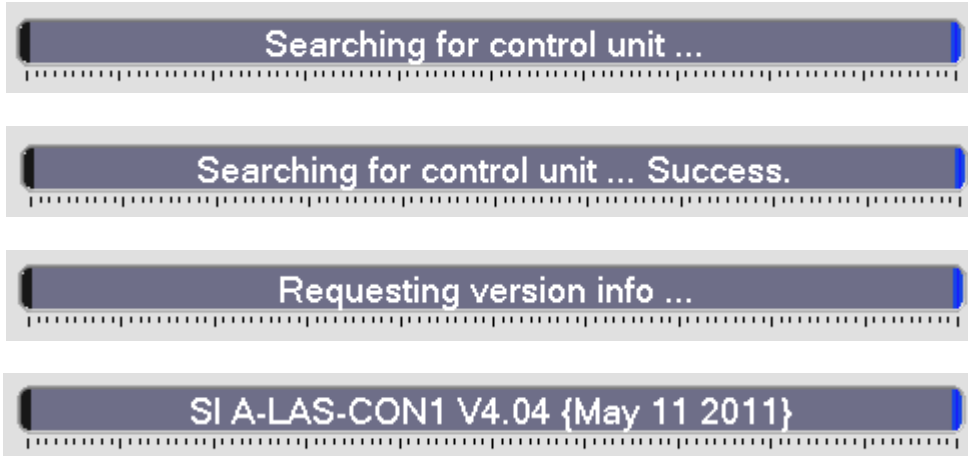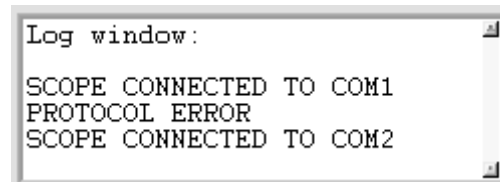**7.** *This button only is available when connection with a control unit has been successfully established. To change the baud rate, select the new desired baud rate from the drop-down list, and then click on the "CHANGE BAUDRATE" button to inform the control unit about the changed baud rate. If this is successful, the connection will be re-initialised with the new baud rate, and the version number will then be displayed in the status line.*

1. 115200

    115200
    9600
    19200
    38400
    57600
    ✔ 115200

2.

3.
```
38400  ▼
```

4.
```
CHANGE
BAUDRATE
```
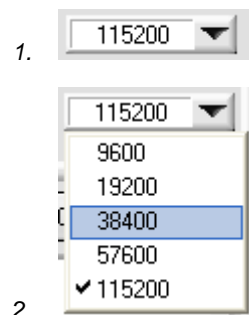
The "PANEL ID" makes it possible to simultaneously work with several instances of the PC software. An alphanumeric information string can be specified for every instance – and thus for each of all the connected sensors. The desired identifier with a maximum length of 35 letters can be entered in the text field with the keyboard. This identifier will then be displayed in the title of the main panel, in the recorder, and in the recorded recorder file.

```
INSERT A PANEL ID
|            Test            |
```

8.

```
🖼 A-LAS-CON1 Scope V4.04 - Test - Main
```
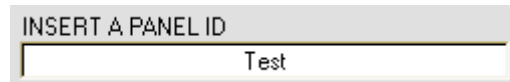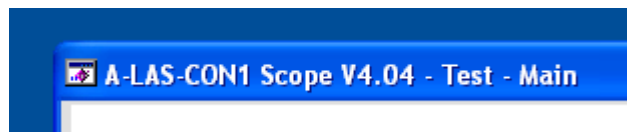
All printable characters can be used for the "PANEL ID", but not the "password" character string (without quotation marks). If this string is entered and confirmed with <ENTER>, access to the password entry will be enabled. If the alphanumeric password is known, and if it is entered here with the keyboard, the password-protected area of the PC software will be enabled. Every time the panels are changed the password entry will be hidden again.

```
INSERT A PANEL ID
|          password          |
```

```
PASSWORD
|           xxxxx            |
```
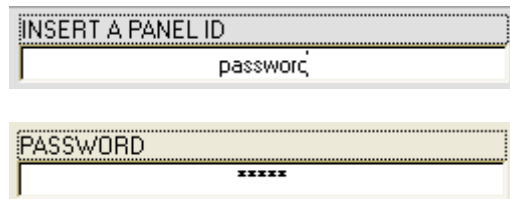
*The "**GEN. HW. INFO FILE**" button reads all the relevant data of the control unit and PC software and exports these data in an ".ini" format file.*

```
GEN. HW.
INFO FILE
```

9.

Export harware info to file

Directory History: D:\Work

Speichern in: 📁 Work

Zuletzt verwendete D...

Desktop

Eigene Dateien

Arbeitsplatz

Netzwerkumgebung

Dateiname: InfoFile.ini   Speichern

Dateityp: [*.ini]   Abbrechen
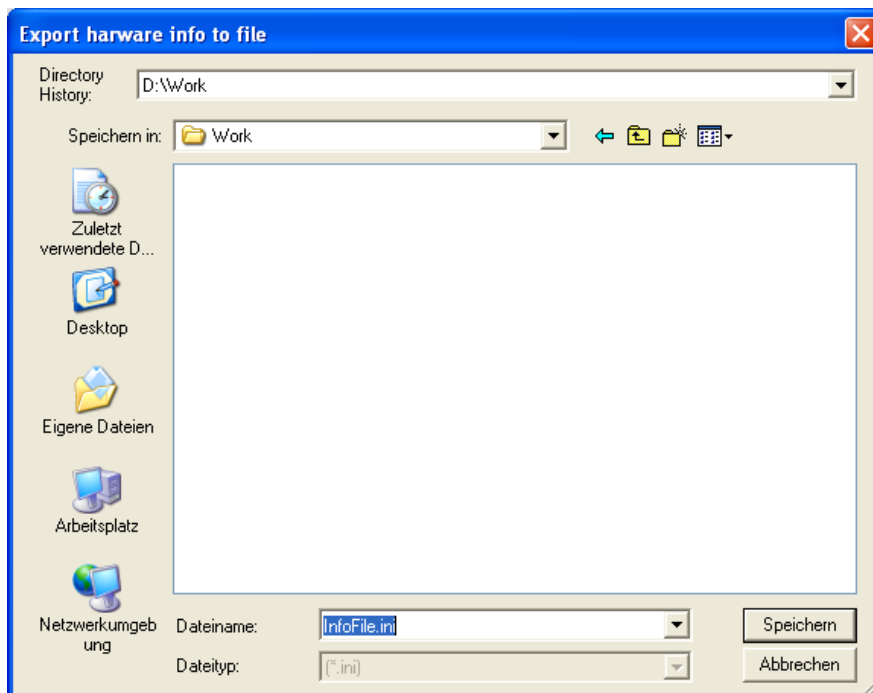
4.6 "CHAN:A" and "CHAN:B" parameter panels

These panels contain all those parameters that directly and exclusively relate to the two internally provided processing channels named "A" and "B". Other parameters that simultaneously apply to channel A and B are listed under "GENERAL SETTINGS".
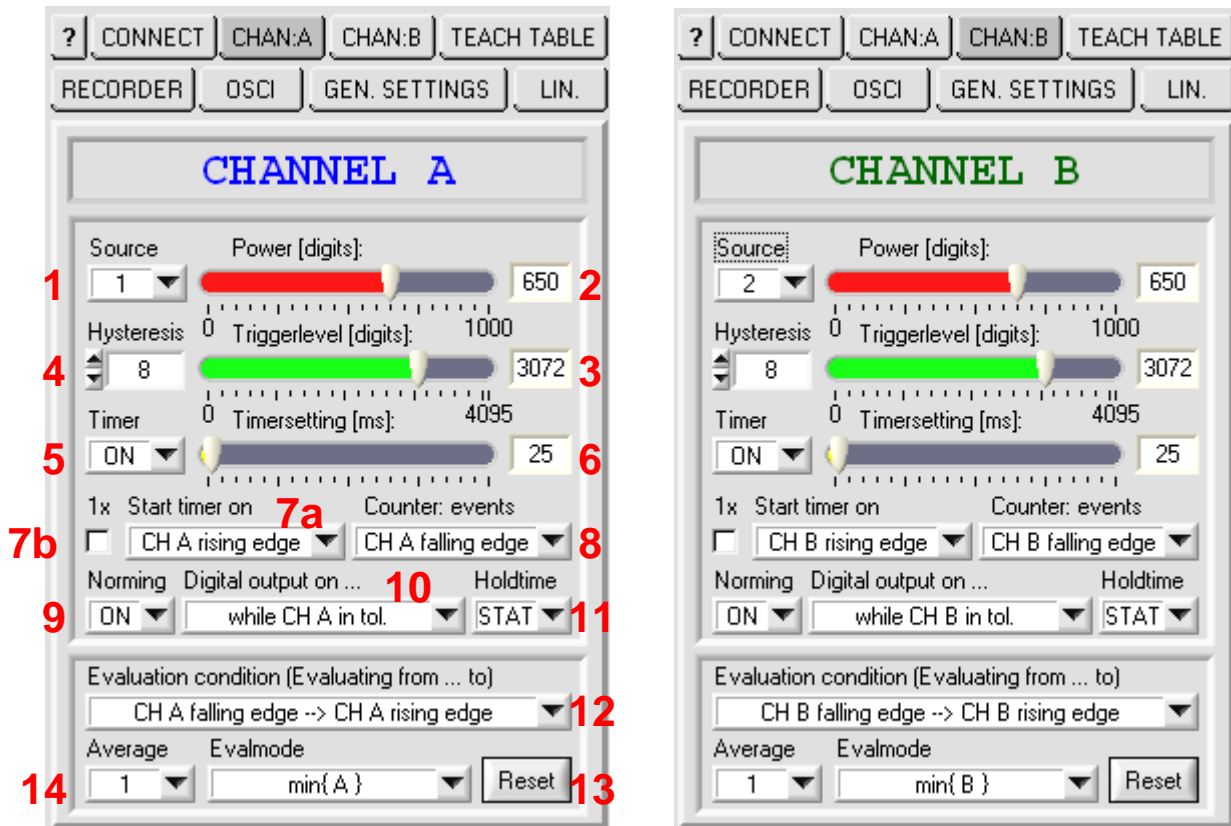
1.	*Selection field for assigning a sensor to a processing channel. The sensors are labelled with numbers "1" and "2". The physical sockets for connecting the cables at the control unit are identified with a corresponding engraved label.*
	Channel A is constantly connected with sensor 1. Channel B can either be connected with sensor 1 or sensor 2. As an option processing channel B also can be deactivated.
	If sensor 1 is selected as the source for channel B, it is possible to parallely process the sensor that is connected at channel A.
	If channel B is deactivated by selecting "OFF", the processing speed can be increased by up to 100%.
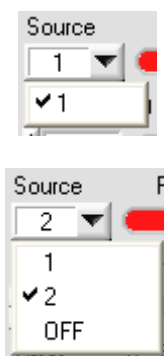
| 2. | *"Power" represents the currently set laser power of the A-LAS transmitters. Each channel A and B (i.e. sensor 1 and sensor 2) has its own slider.* |

| 2. | *In case of parallel processing of sensor 1 by channel A and channel B, the slider for channel B is deactivated.*

The laser power can be set between 0 (laser off) and 1000 (laser at maximum). The laser power should be set such that the non-scaled signal of the sensor with free beam path lies between 3300 and 3600. This guarantees that the receiver is not overloaded and that at the same time the resolution remains at a sufficient level. |

| 3. | *If the corresponding channel is activated, the optionally normed and linearised sensor signal continuously is compared to a trigger threshold. This comparison provides a state ("below threshold" or "above threshold") or a state change or event ("threshold overshooting" or "threshold undershooting"). These states and events together are managed in a state table and can be used for controlling the behaviour of the control unit.*

The trigger threshold can be set to a value between 0 and 4095. |

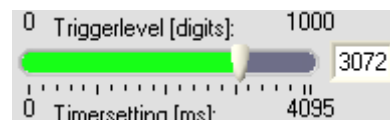| 4. | *The hysteresis is an extension of the trigger threshold. To avoid multiple triggering due to the jitter of the sensor signal in the area of the trigger threshold, this threshold at the first transit of the signal is increased or decreased by the value of the "Hysteresis" parameter. This removes the trigger threshold from the area of the jitter and prevents additional trigger events. When the sensor signal passes through the threshold again, the original threshold is restored.* |

| 5. | *Control field for the function of the "timer". The timer can either be activated ("ON") or deactivated ("OFF"). The timer also can be deactivated by setting its time to 0.* |

| 6. | *Slider for setting the timer time in milliseconds (0 means the timer is deactivated). When the timer is started it runs for the preconfigured time and then stops. The function of the timer generates states ("Timer running" or "Timer inactive") and events ("Timer starting" or "Timer stopping"). These states and events together are managed in a state table and can be used for controlling the behaviour of the control unit.* |
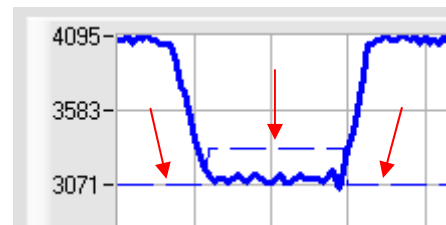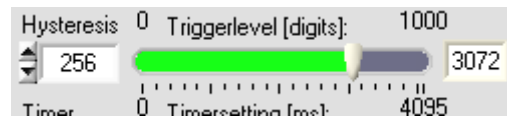
7a.
+
7b.
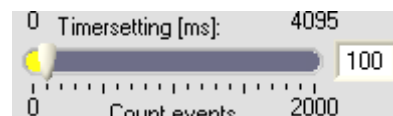
The timer modules are started upon an adjustable event. This event can be selected from a table. If a new start event occurs while the timer is still running, the timer will be restarted without changing its state or generating a state change. The timer time so to speak will be "lengthened".

INFO: Using the timer's own start event as starting condition for the timer may have unpredictable effects and must always be avoided!

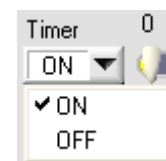*As an option the timer can be set such that "retriggering", i.e. a restart due to another start event during the running time, is eliminated.*
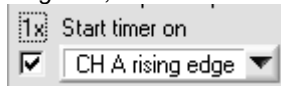
For this purpose the "1x" option field must be activated. With this setting the timer only can be started if it was inactive at the time of the starting event.

8.
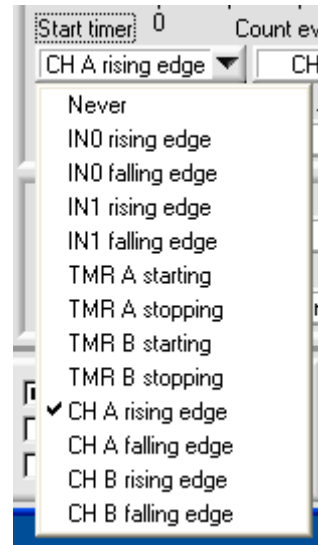
The "counter" module counts the occurrence of a user-specified event. The counter internally is limited to a maximum value of 4095. It can thus be used for evaluation by means of the tolerance band. The current counter reading apart from the user-specified event that increments the counter reading also is influenced by a RESET – i.e. the resetting of measurement values to their starting values upon an event. A RESET sets the counter reading to 0.

INFO: Selecting "Never" deactivates the respective counter module.

9.
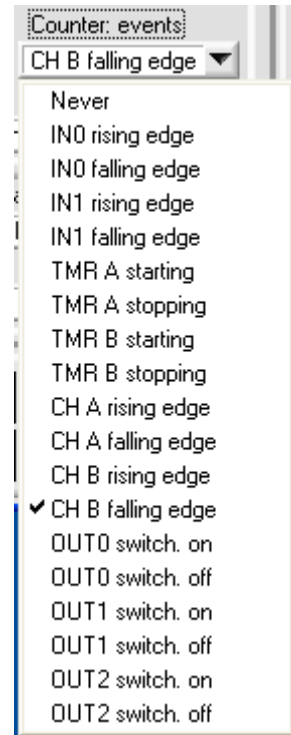
Norming is an operation that by means of a variably timed, continuously adapted factor scales the digitised so-called "raw" value in such a way that the resulting value (so-called "norm" value) lies in a range from 0 to 4095.

The factor is calculated from the maximum raw value with the following formula:

$$Norm = \frac{4095}{max\{Roh\}} \cdot Roh$$
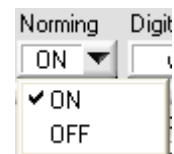
How the maximum raw value (or factor) is determined is defined under the "GENERAL SETTINGS". If norming for the respective channel is set to "OFF", the factor is set to "1", and the norm value is calculated as follows:

$$Norm = Roh$$

The control unit in fact then operates with raw values.

With this selection field a digital output can be assigned to the evaluation result of a channel. To make the assignment easier, digital output OUT0 can be assigned to a selection of states of channel A, and digital output OUT1 to a selection of states of channel B. The available options are:

0) Digital output deactivated.

State-determined output modes:
The output is activated (ON) as long as ...
1) Lower tol. limit < value < upper tol. limit
2) Value < lower tol. limit   OR
    Value > upper tol. limit
3) Value < lower tol. limit
4) Value > upper tol. limit

Dynamic output modes:
The output provides a pulse (OFF → ON → OFF) with a length that is defined by "HOLDTIME" ...
5) If (lower tol. limit < value < upper tol. limit) AND evaluation condition is true
6) If value < lower tol. limit AND evaluation condition is true
7) If value > upper tol. limit AND evaluation condition is true

10.

Single pulse output modes:
The output provides a pulse (OFF → ON → OFF) with a length that is defined by "HOLDTIME" ...
*8) If (lower tol. limit < value < upper tol. limit) AND evaluation condition is true for the first time*
9) If (value < lower tol. limit OR value > upper tol. limit) AND evaluation condition is true for the first time
10) If value < lower tol. limit AND evaluation condition is true for the first time
11) If value > upper tol. limit AND evaluation condition is true for the first time

As soon as there is a new evaluation result of the corresponding channel – which is defined by the setting of the evaluation condition (12) – the result is checked against the tolerance band and the corresponding digital outputs are activated anew.

The difference between dynamic and single pulse modes lies in the response to a new evaluation with identical result. Example: If the evaluation condition "on IN0 rising edge" is true two times in sequence, two pulses are provided in dynamic mode, while in single pulse mode a pulse only is provided at the first rising edge of IN0 (the second rising edge of IN0 does not generate a second pulse).

Digital output on ....   Holdtime
while CH A in tol.   ▼   STAT ▼
Never
✔ while CH A in tol.
while CH A out of tol
while CH A under tol.
while CH A over tol.
dyn. on CH A in tol.
dyn. on CH A under tol.
dyn. on CH A over tol.
single p. on CH A in tol.
single p. on CH A out of tol.
single p. on CH A under tol.
single p. on CH A over tol.

Digital output on ....   Holdtime
while CH B in tol.   ▼   STAT ▼
Never
✔ while CH B in tol.
while CH B out of tol
while CH B under tol.
while CH B over tol.
dyn. on CH B in tol.
dyn. on CH B under tol.
dyn. on CH B over tol.
single p. on CH B in tol.
single p. on CH B out of tol.
single p. on CH B under tol.
single p. on CH B over tol.

11.

The output hold time ("Holdtime") makes it possible to lengthen very short evaluation results (e.g. in the range of a few 100 µs) to such an extent that they can be processed by a PLC or evaluation unit.

For this purpose a minimum hold time is defined. If the state of the digital output changes from LOW to HIGH (i.e. from GND to +24V), a timer is simultaneously started and for a preset time ensures that the digital output remains at HIGH level. When this time is over the state of the digital output returns to the digital value that is valid at this time and that corresponds with the evaluation result. The timer only is started again when the state again changes from LOW to HIGH.

The "STAT" option stands for static and means that digital outputs are directly set or reset without any lengthening.

Holdtime
STAT ▼

✔ STAT
1ms
2ms
5ms
10ms
20ms
50ms
0.1s
0.2s
0.5s
1s
2s
10s

12.
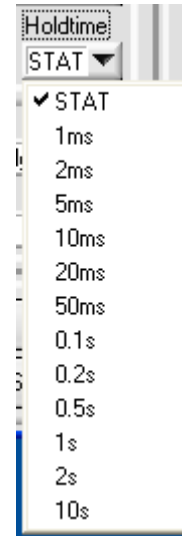
This selection field represents the central configuration of channel evaluation. The selection determines the moment at which the data of the channel are reset to their initial value (counter → 0, integrator → 0, maximum value → current value, minimum value → current value) – corresponding to a RESET – and the time when the evaluation result should be present.

There are three different option groups here:
All the "on" options describe modes in which there is no RESET. Evaluation is performed at discrete moments or events.
All the "-->" options describe modes in which the RESET or evaluation actions only are performed at the described discrete moments. The evaluation result therefore is not updated before the evaluation event.
All the "while" options describe modes in which a RESET is performed at the beginning, but in which evaluation results are continuously generated while the condition is true.

Example: "on IN0 rising edge"
When a rising edge is detected at digital input IN0, counter, integration, and maximum and minimum value filtering are performed internally. A RESULT is calculated and the outputs are updated.

Example: "IN0 rising edge → IN0 falling edge"
When a rising edge is detected at digital input IN0, a RESET is performed. As long as the status of input IN0 is HIGH, counter, integration, and maximum and minimum value filtering are performed internally. When a falling edge is detected at digital input IN0, the evaluation result is updated in accordance with the evaluation mode.

Example: "while IN0 high"
When a rising edge is detected at digital input IN0, a RESET is performed. As long as the status of input IN0 is HIGH, counter, integration, and maximum and minimum value filtering are performed internally. At the same time, however, every determined value is interpreted as a result in accordance with the evaluation mode, and the evaluation result thus is continuously updated.

The "Continuous" option means continuous evaluation without condition and without RESET.

INFO: With every continuous evaluation condition the scan rate is reduced due to the higher calculation efforts. For speed-relevant applications an event-controlled evaluation condition should be preferred.

Continuous
✓ on IN0 falling edge
on IN0 rising edge
on IN1 falling edge
on IN1 rising edge
on TMR A stopping
on TMR A starting
on TMR B stopping
on TMR B starting
on CH A falling edge
on CH A rising edge
on CH B falling edge
on CH B rising edge
IN0 rising edge --> IN0 falling edge
IN0 falling edge --> IN0 rising edge
IN1 rising edge --> IN1 falling edge
IN1 falling edge --> IN1 rising edge
TMR A starting --> TMR A stopping
TMR A stopping --> TMR A starting
TMR B starting --> TMR B stopping
TMR B stopping --> TMR B starting
CH A rising edge --> CH A falling edge
CH A falling edge --> CH A rising edge
CH B rising edge --> CH B falling edge
CH B falling edge --> CH B rising edge
while IN0 high
while IN0 low
while IN1 high
while IN1 low
while TMR A running
while TMR A stopped
while TMR B running
while TMR B stopped
while CH A over thres.
while CH A under thres.
while CH B over thres.
while CH B under thres

on IN0 falling edge

Page | 28

13.

While the evaluation condition (12) defines the timing for evaluation, the evaluation mode determines which value should be calculated and compared with the tolerance band. Calculation and comparison only are performed if the evaluation condition is true.

Apart from the "simple" values that are generated in evaluation (norm value, minimum and maximum value, counter value), more complex calculations also can be selected here (integral, symmetry, sum, difference, derivation, comparative derivation, or "wire mode", etc.)

In the control unit the results of the evaluation modes are scaled in such a way that they are compatible with the conditions set with reference and tolerance limits (i.e. the results of evaluation always lie in a range between 0 and 4095, in part with decimal places).

14.
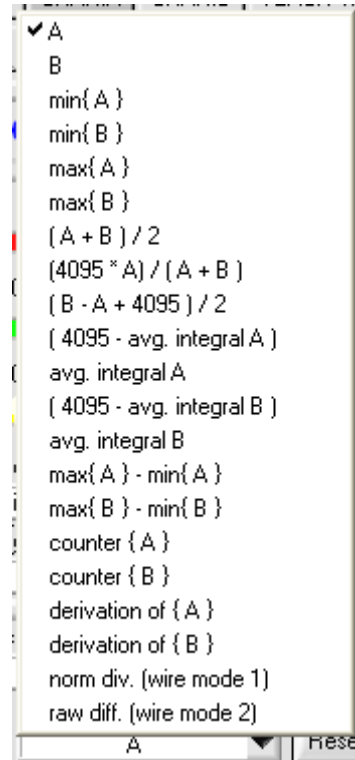
"Averaging" is the concluding part of evaluation before the comparison with the tolerance band. If the evaluation results are subject to a system-related fluctuation that should not be considered, the basic trend can be analysed by way of averaging.

With settings from n=2 to n=32 moving averaging is performed, i.e. for every new value this value and the previously determined n-1 values are averaged and output.

With settings higher than 32 averaging is performed "at a stretch". This means that every time the evaluation condition is true and there is a new evaluation result, this result becomes a part of the average sum according to the formula:

$$avg. = \frac{\sum_{1}^{n} result}{n}$$

The averaged result therefore only is updated if there have been "n" evaluation results since the last averaging. The setting value "1" deactivates averaging, and the control unit compares every evaluation result with the tolerance band.
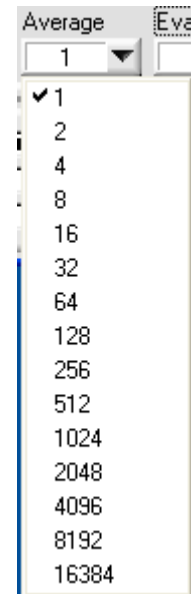
4.7 "GENERAL SETTINGS" parameter panel

This panel contains parameters that equally relate to processing channels A and B and to the control unit as a whole. Parameters that specifically relate to A and B can be set in the "CHAN:A" and "CHAN:B" panels.

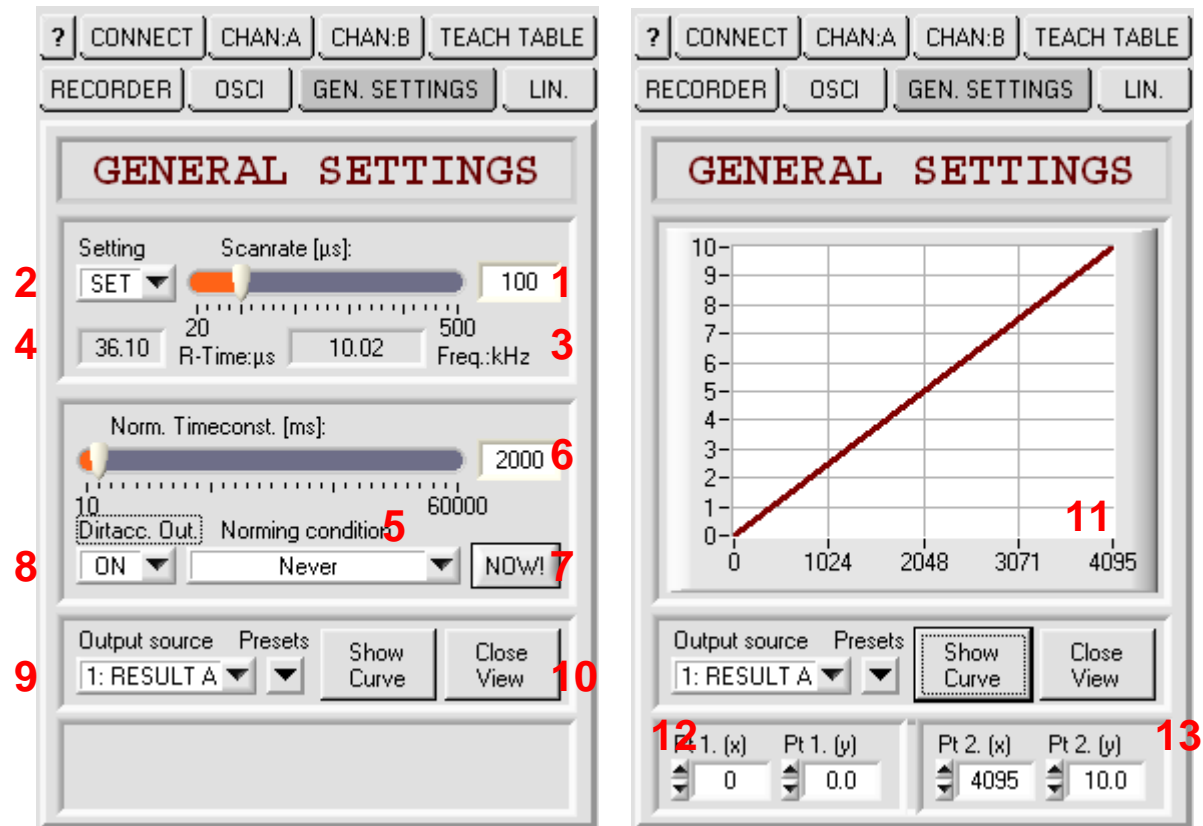|	
	The scan rate for the analog signals of the two connected sensors 1 and 2 can be set to a fixed pattern. This pattern can be set between 20 and 500 µs. According to the formula ...
	$$Frequenz = \frac{1}{Abtastrate}$$
1.	*... this results in fixed frequencies from 2 kHz to 50 kHz.*
	INFO: Evaluation according to the set parameters takes a certain time. If evaluation takes longer than one period of the time pattern, the next evaluation will be skipped, which effectively halves the preset frequency.
2.	*As an option the scan frequency can be set to a fixed value ("SET"). However, if no fixed time pattern is used it also is possible to increase the speed with a setting. With the "MAX" setting the control unit is configured such that the next evaluation seamlessly follows the previous one, which avoids free time units.*

3. *This numeric field displays the current scan frequency (averaged over several hundred evaluation cycles) of the control when the PC Scope software is in "GO" or "VIDEO" mode. The frequency is shown in kilohertz.*

INFO: The displayed frequency is not necessarily identical with the expected frequency resulting from a fixed time pattern. The reason for this may be that the necessary time for evaluation according to the parameters is longer than the time provided by the scan rate. This means that one or several scan cycles are skipped, which reduces the frequency.

| 20.06 | 5UU Freq.:kHz |
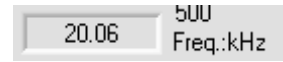
4. *This numeric display shows the averaged (over several hundred evaluation cycles) time in microseconds that evaluation according to the set parameters takes for one evaluation cycle. This value always is smaller than the set scan rate or the resulting scan frequency with "MAX" setting, because other operations (data exchange with the PC, TEACH, etc.) also are performed between individual evaluations.*

| 28.62 | 20 R-Time:µs |
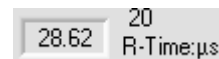
5. *For the norming process the appropriate maximum raw value of the channels must always be known. This raw value is necessary for the repeated recalculation of the scaling factor according to the formula:*
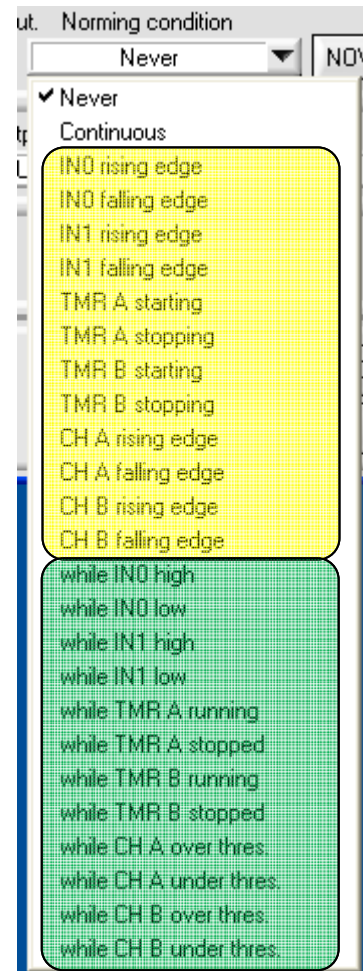
$$Norm = \frac{4095}{max\{Roh\}} \cdot Roh$$

The "max {raw}" value is determined according to two different principles:

If a single event is set (modes with yellow background) the maximum raw value is determined at every occurrence of this event. The event should be chosen in such a way that the beam path of both sensors is free when the event occurs.

$$max\{Roh\} = Roh$$

If a state is selected (modes with green background) two mechanisms are simultaneously used to determine the maximum raw value.

1. *The current raw value is continuously compared with the maximum raw value, which is adapted when necessary.*
2. *In a fixed adjustable time pattern the maximum raw value is decimated by an exponentially increasing value. This is performed in every time pattern until the current raw value is higher than or equal to the maximum raw value.*

ut. Norming condition
Never ▼ NOV
✔ Never
Continuous
IN0 rising edge
IN0 falling edge
IN1 rising edge
IN1 falling edge
TMR A starting
TMR A stopping
TMR B starting
TMR B stopping
CH A rising edge
CH A falling edge
CH B rising edge
CH B falling edge
while IN0 high
while IN0 low
while IN1 high
while IN1 low
while TMR A running
while TMR A stopped
while TMR B running
while TMR B stopped
while CH A over thres.
while CH A under thres.
while CH B over thres.
while CH B under thres.

5.

```
┌─────────────────────┐
│   New raw value     │
└─────────────────────┘
          │
          ▼
      ╱╲
     ╱  ╲
    ╱ Raw > ╲      Ye      ┌──────────────────────────┐
   ╱ max {Raw} ╲──────────▶│  max {Raw} = Raw;        │
    ╲        ╱             │  Decimation value = 1;   │
     ╲      ╱              └──────────────────────────┘
      ╲╱
       │ No
       ▼
      ╱╲
     ╱  ╲
    ╱ Time ╲        Ye     ┌──────────────────────────┐
   ╱ interv. ╲─────────────▶│  max {Raw} =             │
    ╲ over  ╱               │  max {Raw} – Decimation value; │
     ╲     ╱                │  Decimation value =      │
      ╲╱                    │  Decimation value * 2;   │
       │ No                 └──────────────────────────┘
       ▼
┌─────────────────────┐
│ Calculation of the  │
│      factor         │
└─────────────────────┘
```

Apart from the state-controlled and event-controlled norming modes there also are two special settings:

1. *"NEVER" completely deactivates the adaptation of the norming factor which, however, can still be started by the PC Scope software or through the interface.*
2. *"CONTINUOUS" means that norming factor search is continuously performed without a condition.*

ıt. Norming condition
Never ▼

ıt. Norming condition
Continuous ▼

6.

The time constant for the continuous adaptation of the maximum raw value can be flexibly set with this slider. The time constant should be chosen such that the light barrier becomes free at least once between two time intervals. This minimises the negative influence that norming (due to the recalculation of the factor during a running measurement) has on the measurement value.

Norm. Timeconst. [ms]:
1000
10   60000

7.

The "NOW!" button provides another possibility of influencing norming factor determination. Every time this button is pressed the control unit determines the norming factor anew based on the current raw value:

$$max\{Roh\} = Roh$$

This button allows the operation of the control unit with norming condition "NEVER".

NOW!

As an option digital output OUT2 can be assigned a monitoring function. For this purpose the raw signals of one channel (or both channels, if both are activated) are monitored for a certain period of time. If in this period of time the average of the raw signal (or the individual averages of both raw signals) lie under a certain threshold, the output is activated. This function serves as dirt accumulation indication.

8.
INFO: If one of the two sensor sockets is not used and dirt accumulation indication function is active, this always results in a positive dirt accumulation indication. In this case the one sensor that is used should be connected at socket 1, and channel B should be deactivated or also used for the evaluation of sensor 1.
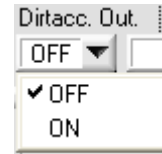
INFO: The duration and threshold for the dirt accumulation indication function can be set.

9.
The analog output of the control unit as standard is realised as a 0 .. 10V voltage output. The output format has a 12bit resolution. The analog output is updated after every evaluation cycle, which means that the output exactly has the speed that is defined by the evaluation frequency.

The date that should be provided through the analog output can be selected from a table. Apart from the evaluation results ("RESULT A", "RESULT B") that only depend on the evaluation condition, it also is possible to output the "RAW A", "RAW B", "VAL A", "VAL B", etc. signals that are continuously determined with the scan frequency.
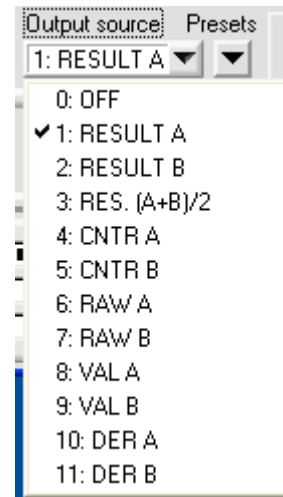
**10.
+
11.**
The analog output can be modified with a linear transformation:

$$ana. = m \cdot Ausgabewert + t$$

This can be used for various purposes, e.g. a zoom function, linking of the reference value with the 5V level, inversion of the output, etc.. Different scaling options are available for various data sources of the analog output:

For "RESULT A" and "RESULT B" the available options are:
- *"ZOOM TOLERANCE": Values between the lower and upper tolerance threshold are output between 0 .. 10V.*
- *"REF -> 5V, ...": The reference value always is output as 5V. The slope of the straight line through the reference value either is used positively ("Gain:") or negatively ("Inv:"). The slope is 10V/4096 ("x1"), 5V/4096 ("x2") or 2.5V/4096 ("x4").*
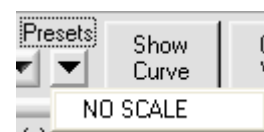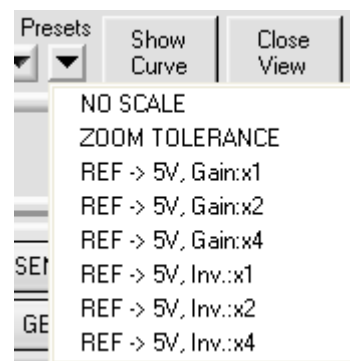
For all options there also is this setting possibility:

- "NO SCALE": The slope here always is 10V/4096 and the offset is 0. The source value thus is directly output.

10. + 11.

INFO: A window is displayed that shows how the analog output is transferred. This window at a glance shows the relation between value and analog output voltage. The window is automatically displayed when the analog output is rescaled. A LEFT CLICK on the graph area closes the window.

INFO: A click on the "**SHOW CURVE**" button displays the transfer curve in a graphic window and thus visualises the current transfer function without changing any settings. A click on "**CLOSE VIEW**" restores the previous display (the graph covers some parameters).
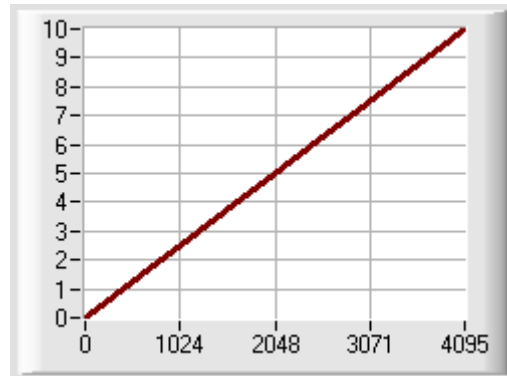
If none of the presettings (PRESETS) seem to be suitable for analog value output, the transfer curve of the analog value also can be defined by way of entering two points.

12. + 13.

In this case two points are defined in the plane that determine the transfer curve. Calculation is as follows:

$$ana. = m * edit\ value + t$$

$$ana. = m \cdot Ausgabewert + t$$

$$m = \frac{y2 - y1}{x2 - x1}, t = y2 - m * x2 = y1 - m * x1,$$

4.8 "TEACH TABLE" panel

Each of the two processing channels A and B is assigned a tolerance band comprising a reference value and a permissible upper and lower tolerance. This tolerance band is used to assess the measurement results, i.e. the measurement value is assigned the attribute "OK" or "Not OK" and can then be further transferred through the digital outputs. In this panel the reference value (referred to as the TEACH value) can be directly entered, or the TEACH function (saving of the current measurement value as reference value) can be assigned to an external input.
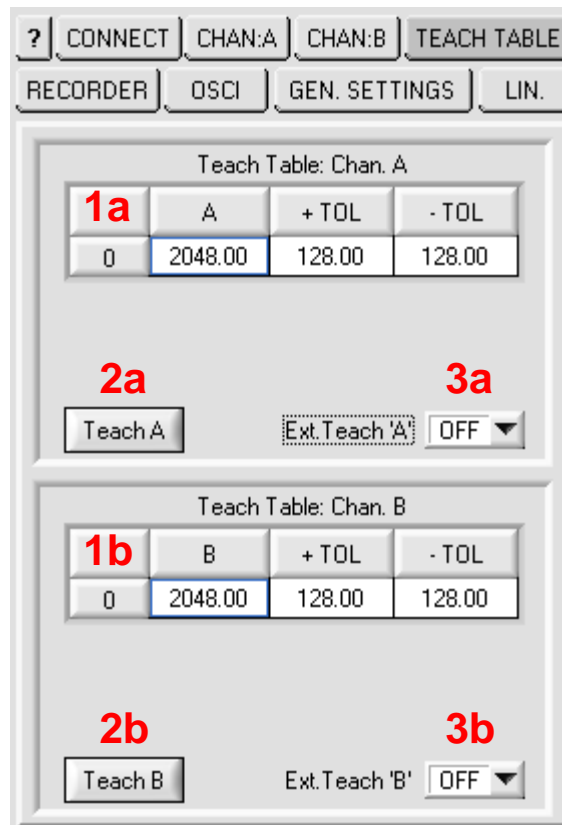
|	In this table the reference, the upper permissible tolerance, and the lower permissible tolerance for the respective channel (1a → channel A, 1b → channel B) can be entered (from left to right). The values may have up to two decimal places.	
1.		
	INFO: The decimal places only can be used with correspondingly high averaging (see "Average") or with the integral function. In all other cases the decimal places have no function.	
2.	A click on the "TEACH" button copies the measurement value that is currently displayed in the PC Scope software to the "Reference" column of the respective channel. The "SEND" button then performs this "TEACH" at the control unit.	

3.

A "TEACH" also can be performed without a PC connection directly by the control unit. The reference in the same way is replaced by the current measurement value of the respective channel, and the tolerance band around the reference is correspondingly adapted. For this purpose every channel can be assigned a "TEACH" input, which either can be one of the digital inputs (IN0 or IN1) or the button at the housing of the control unit (BTN).
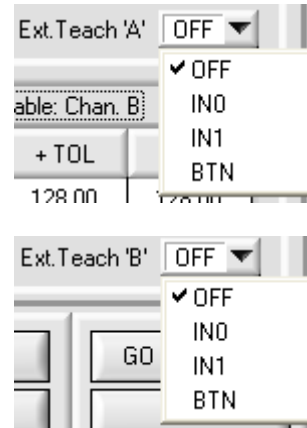
INFO: If one of the digital inputs is used for the "TEACH" function it can only to a limited extent be simultaneously used for other functions (triggering or controlling evaluation). It must always be ensured that such a multiple function of an input does not lead to any conflicts.

The "TEACH" process itself always is performed in the same way irrespective of the type of input (digital input or button). To perform a "TEACH" to the volatile ("RAM") memory of the control unit, the signal must remain active (or the button remain pressed) for more than 1 second. While this second passes, the control unit indicates this by a flashing yellow status LED (right of the LED row). When the time is over the LED goes off and remains off for the next 2 seconds. If during these 2 seconds the signal is reset (or the button is released), the "TEACH" request is accepted and the "TEACH" process is performed.

3.

Visualisation OUT0

Visualisation OUT2/POWER

Visualisation OUT1

Potentiometer

Button
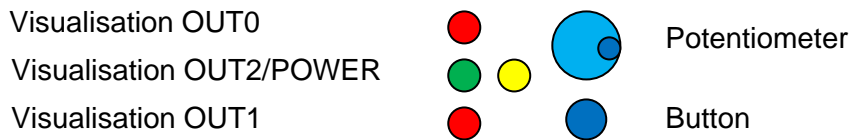
The control unit indicates that a "TEACH" process is performed by a flashing green Power/OUT2 LED (middle of the LED row). During normal operation the green LED flashes in a 1 Hz cycle. In case of a parameter change and/or a "TEACH" process the green LED flashes at a faster rate.

To perform a "TEACH" to the non-volatile ("EEPROM") memory of the control unit, the signal must remain active (or the button remain pressed) at least for 4 seconds. The control unit indicates the passing of these 4 seconds by a second flashing process, after which the LED remains on. If during the next 2 seconds the signal is reset (or the button is released), the "TEACH" request is accepted and the "TEACH" process is performed.

If the signal or the button remains active/pressed for more than 6 seconds, no "TEACH" will be performed. After 6 seconds the yellow LED therefore goes off. In this case the parameters will not be changed.
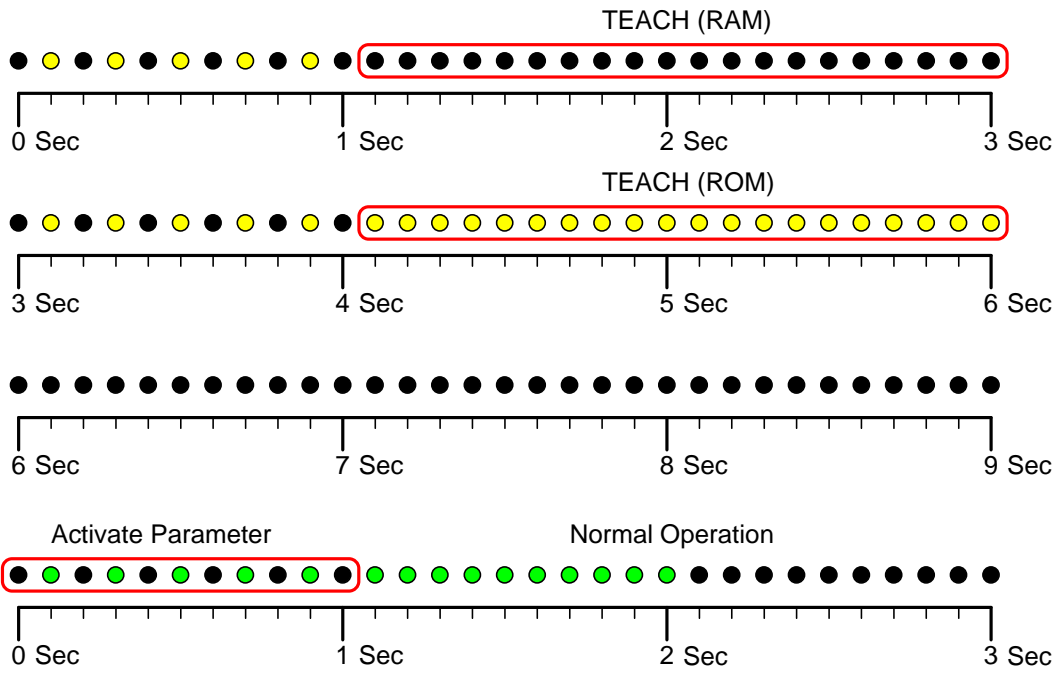
4.9 "OSCI" oscillograph control panel

The control unit provides a feature that allows a detailed inspection of the characteristics of the analog signals from the connected sensors. This function that is similar to an oscilloscope is independent of the evaluation of the channels and is used for analysing and optimising the configuration. Each of the two channels has its own independent storage area that can record 1024 scans ("samples") of the normed analog signal. Recording can be started upon any desired trigger signal.
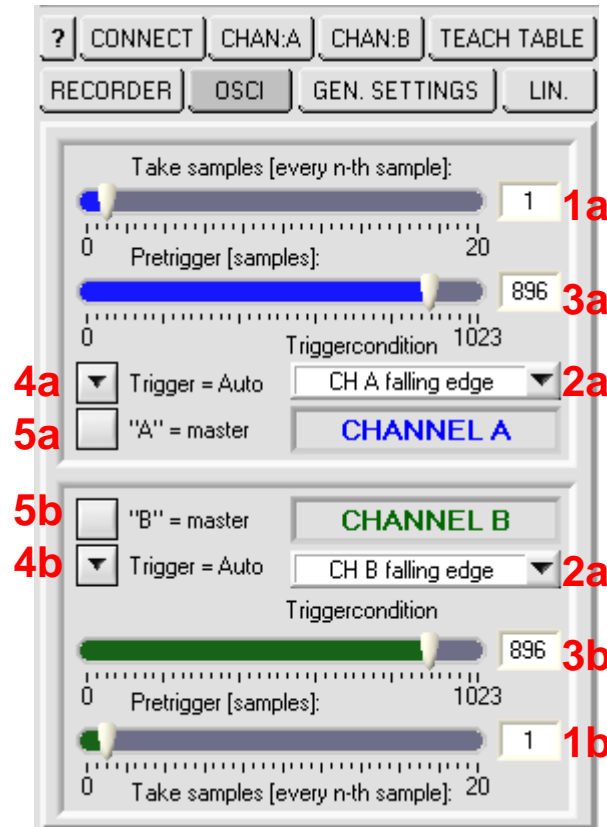
| 1.	*What the oscilloscope function basically has in common with normal evaluation is the common pool of scans ("samples"). Each of the samples can be recorded. The representable time window therefore is limited to (1024 times the current scan rate). If longer periods of time should be represented, samples can be "skipped". If, for example, 3 scans are skipped, the representable time range increases by a factor of 4. This can be separately configured for every channel. Up to 19 scans can be skipped.*
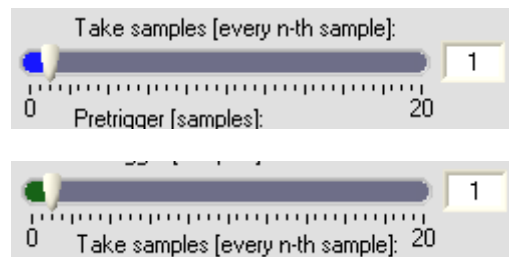
2. *Each of the two channels can be assigned its own trigger condition for recording. This condition can be selected as desired.*
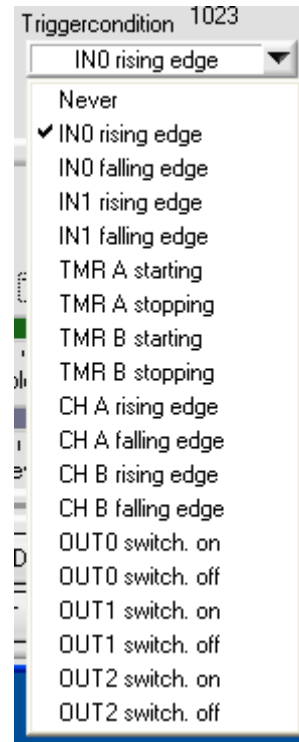
3. *As with an oscilloscope the trigger moment can be positioned within the window. This makes it possible to look "into the past" or "into the future" from a certain event. This can be set with the "PRETRIGGER" parameter that has a value range between 0 .. 1023. The pretrigger value defines the number of samples that should still be recorded after the event.*
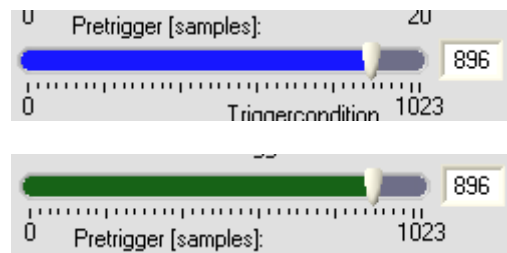
4. *It is possible to either record an event only once and to then stop recording (as with the "SINGLE SHOT" setting of an oscilloscope), or to record and then display every new event as with the "NORMAL" setting of an oscilloscope. The "AUTO" setting of an oscilloscope would be the same as the display of the scroll graph in "GO" mode and is therefore not available.*
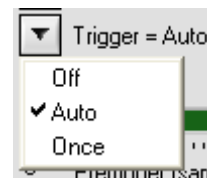
The "OFF" option can be used to prevent any wasting of time with the reading of the memory of a channel that is not needed. In this case all the settings of this channel are deactivated.
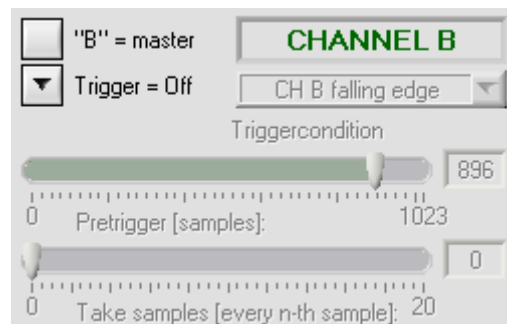
5. *Every channel has a "MASTER" button that can be used to transfer all the settings of one channel to the other channel.*

! *INFO: The parameters described under (4) and (5) only exist at the PC side and are reset to their initial state when the PC software is restarted!*
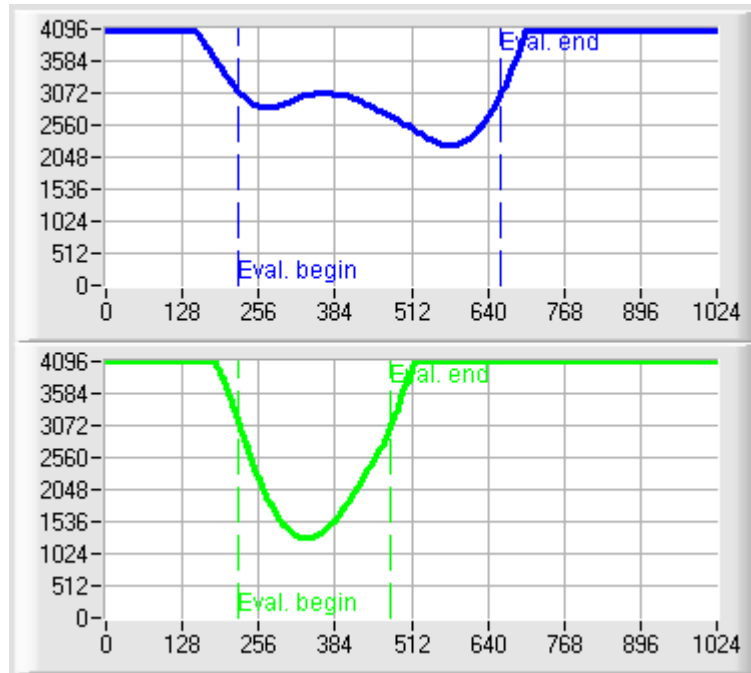
The display of the recorded curves apart from the data also shows the evaluation conditions. The represented result is determined between "EVAL. BEGIN" and "EVAL. END". This does not apply to continuous evaluation.

!

INFO: If no sensor is connected at one of the channels, the combination of active recording with activated norming may cause that the basic noise of the inputs of the control unit leads to a signal with accidental triggerings that show such a behaviour:
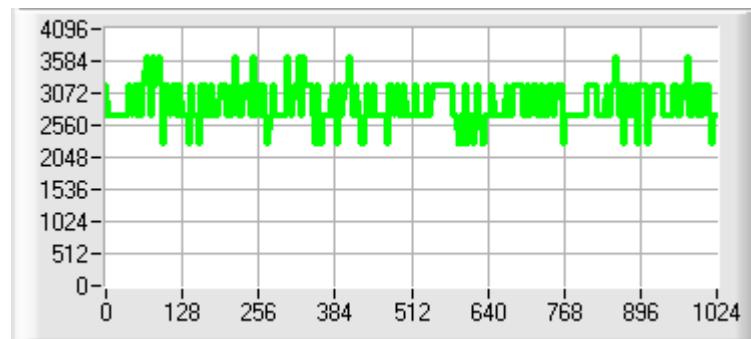
In such a case the second channel must be deactivated or set to sensor 1!

For a more detailed view the display of the curves can be zoomed and/or moved, which can be controlled with mouse and keyboard.

- *<STRG> + <HOLD LEFT MOUSE BUTTON>*
  to zoom in the display
- *<STRG> + <HOLD RIGHT MOUSE BUTTON>*
  to zoom out the display
- *<STRG> + <SHIFT> + <HOLD AND DRAG LEFT MOUSE BUTTON>*
  to move the display
- *<LEFT BUTTON DOUBLE CLICK>*
  to restore the original display

4.10 "RECORDER" data recorder panel

The PC Scope software features dedicated functions for recording current data of the control unit for quality inspection or analysis purposes. With various recording modes data can be locally saved to the PC's hard disk as ASCII files in a standardised format.
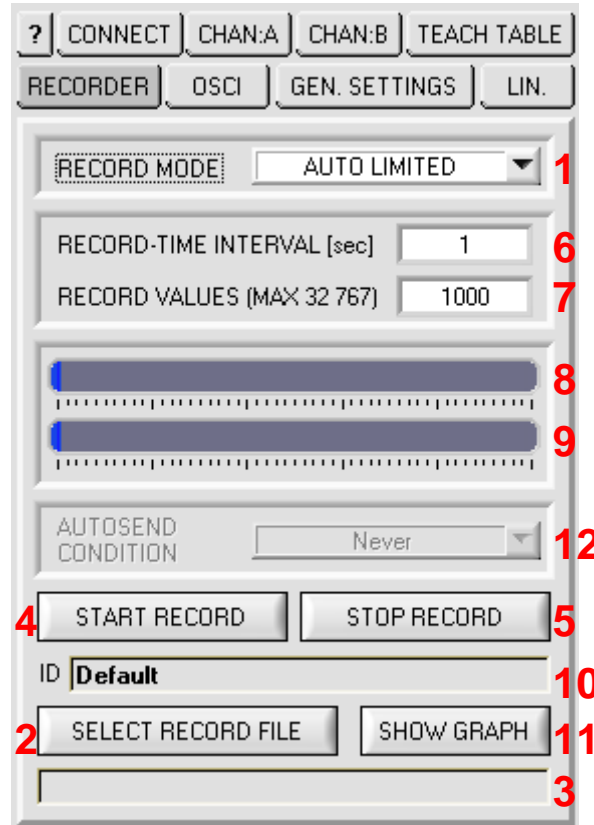
Data can be recorded in four different modes:

1. *"AUTO LIMITED": The PC Scope software determines the number of data to be recorded (max. 32767) and the time interval for recording. Recording runs automatically until the preset number of data is reached or recording is stopped by the user.*
2. *"AUTO UNLIMITED": The PC Scope software determines the time interval for recording. Recording runs automatically until it is stopped by the user or until the maximum number of data is reached (32767 frames).*
3. *"MANUAL RECORDING": By (repeatedly) pressing a button the user determines the moments when data should be recorded. Recording does not end (but is limited to a maximum of 32767 data).*
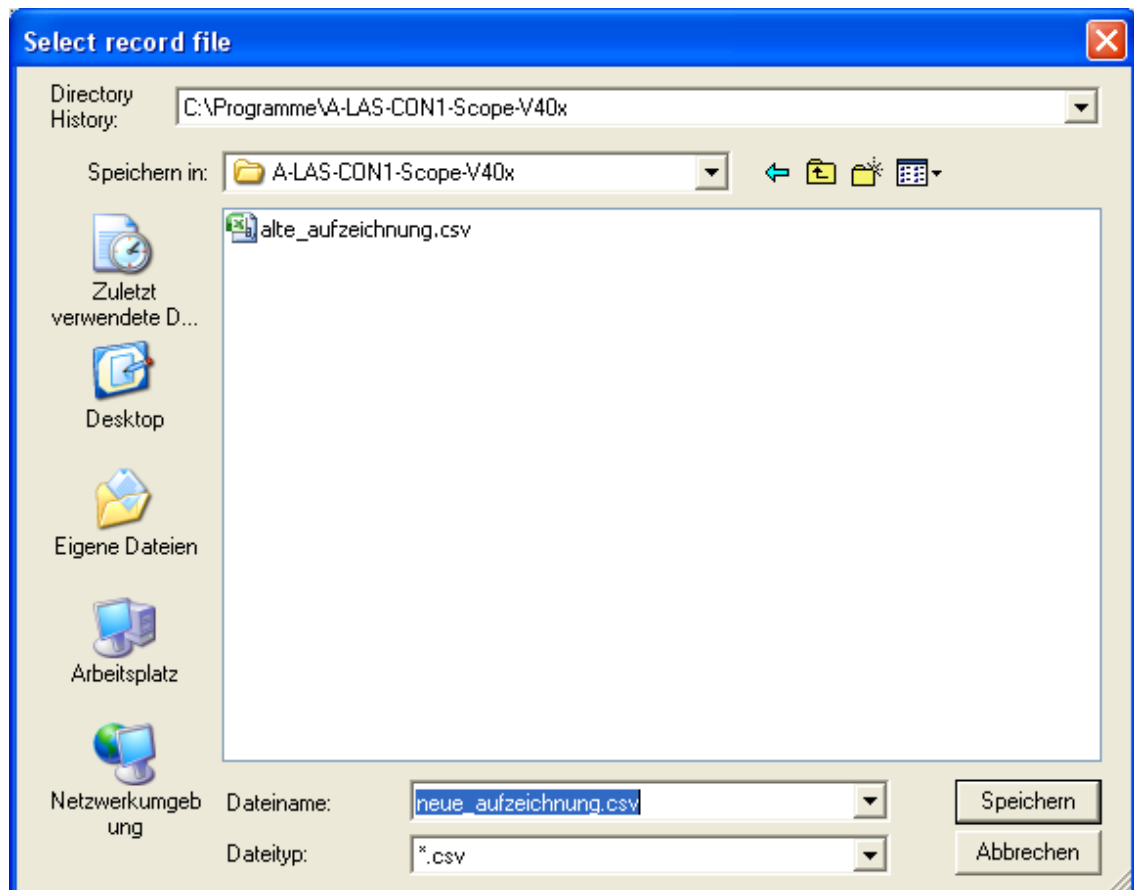
1.

1.	4. *"AUTO TRIGGERED": The user defines a condition in the control unit. When this condition is TRUE, the control unit automatically sends a data package that is received and stored by the PC Scope software. This mode is not limited with respect to time (the repeat rate of occurrence of the specified event is not defined) and with respect to number (but recording is limited to a maximum of 32767 data).*	

A target file must be specified for every recording process. To select or create this file, click on the "SELECT RECORD FILE" button. A file selection box will be displayed where the directory, the file name, and the file extension can be specified. Click on "Save" to confirm the selection you made here.
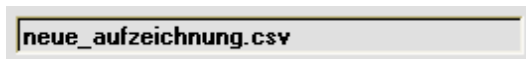
INFO: Although ".csv", "*.dat" or "*.txt" can be set for the file extension, the recording format as standard is a comma separated ASCII format.*

SELECT RECORD FILE

2.

Select record file

Directory History: C:\Programme\A-LAS-CON1-Scope-V40x

Speichern in: A-LAS-CON1-Scope-V40x

alte_aufzeichnung.csv

Zuletzt verwendete D...

Desktop

Eigene Dateien

Arbeitsplatz

Netzwerkumgebung

Dateiname: neue_aufzeichnung.csv   Speichern

Dateityp: *.csv   Abbrechen

3.	*For the information of the user the selected record file is displayed in this field.*	neue_aufzeichnung.csv
4.	*This button starts recording in "AUTO LIMITED", "AUTO UNLIMITED" and "AUTO TRIGGERED" mode*	START RECORD
5.	*This button stops or cancels recording. It is available in "AUTO LIMITED", "AUTO UNLIMITED" and "AUTO*	STOP RECORD

TRIGGERED" mode.

| 6. | *For "AUTO LIMITED" and "AUTO UNLIMITED" mode the time interval for recording of the individual data packages can be set here. The permissible values are 0 .. 3600. A setting of 0 means that every received value is recorded. The rate here is undefined and typically fluctuates between 12 and 30 frames per second. All the other setting values define a fixed time pattern in which data packages are recorded.* | RECORD-TIME INTERVAL [sec] 1 |

| 7. | *Only for "AUTO LIMITED" mode the number of data packages to be recorded can be defined here. The permissible values are 1 .. 32767.* | RECORD VALUES (MAX 32 767) 1000 |

| 8. + 9. | *The status of recording is indicated by way of two displays that show the remaining (or elapsed) time (8) and the number of recorded data (or data still to be recorded) (9).* | 0 Days, 0 Hours, 16 Min., 26 Sec., / 986 of 1000 remaining ... |

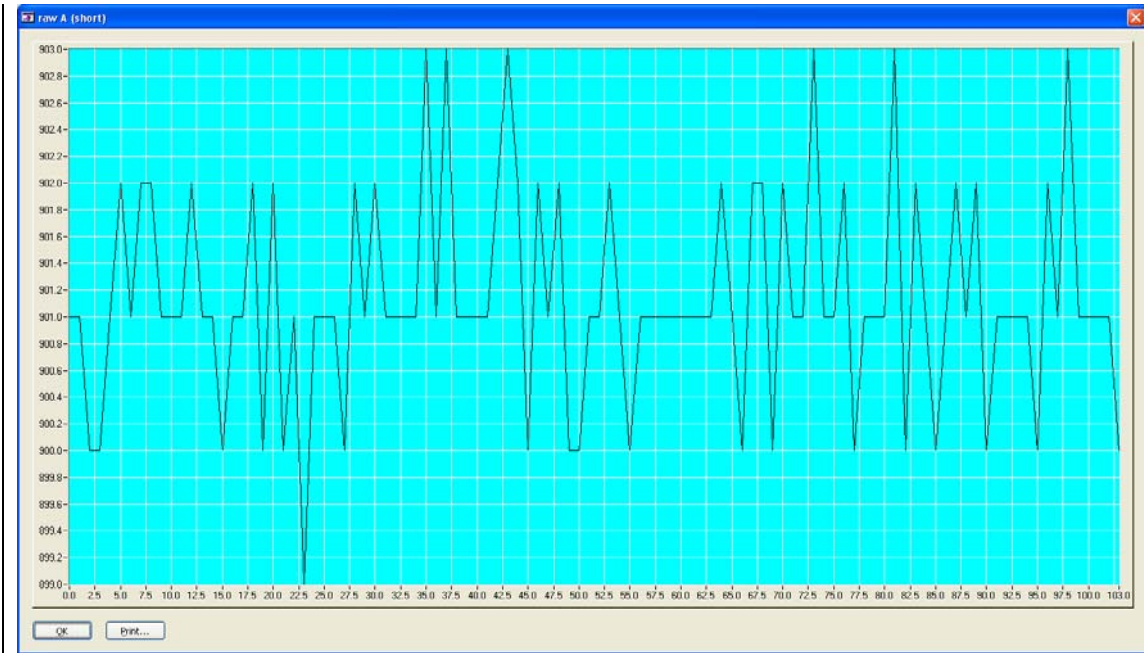| 10. | *This field shows the "PANEL ID" that can be specified and changed in the "CONNECT" panel. During recording this identification information also is saved in the file.* | ID Default |

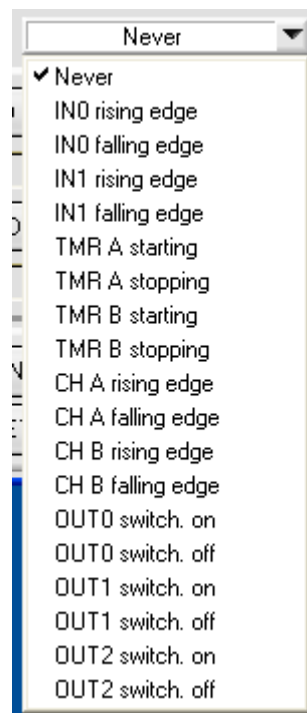| 11. | *When data recording is finished the graph of the recorded data can be displayed. A click on the "SHOW GRAPH" button opens a popup list where the corresponding data value can be selected. A click on "SELECT" opens the graph. The "Print ..." button can be used to print the data.* | SHOW GRAPH

Graph source
result A (float) ▼
✔ result A (float)
counter A (short)
raw A (short)
max{raw A} (short)
val A (short)
min{val A} (short)
max{val A} (short)
result B (float)
counter B (short)
raw B (short)
max{raw B} (short)
val B (short)
min{val B} (short)
max{val B} (short)

POPUP1
Graph source
result A (float) ▼
SELECT   DISCARD |

11.

raw A (short)

12.

In this field the autosend condition can be specified for the "AUTO TRIGGERED" mode.

INFO: The autosend condition is a parameter that the control unit must be informed about by pressing the "SEND" button.

INFO: The autosend function is started by clicking on the "START RECORD" button. Every other request or command that is sent the control unit (e.g. "SEND" and "GET") deactivates the autosend mechanism again.
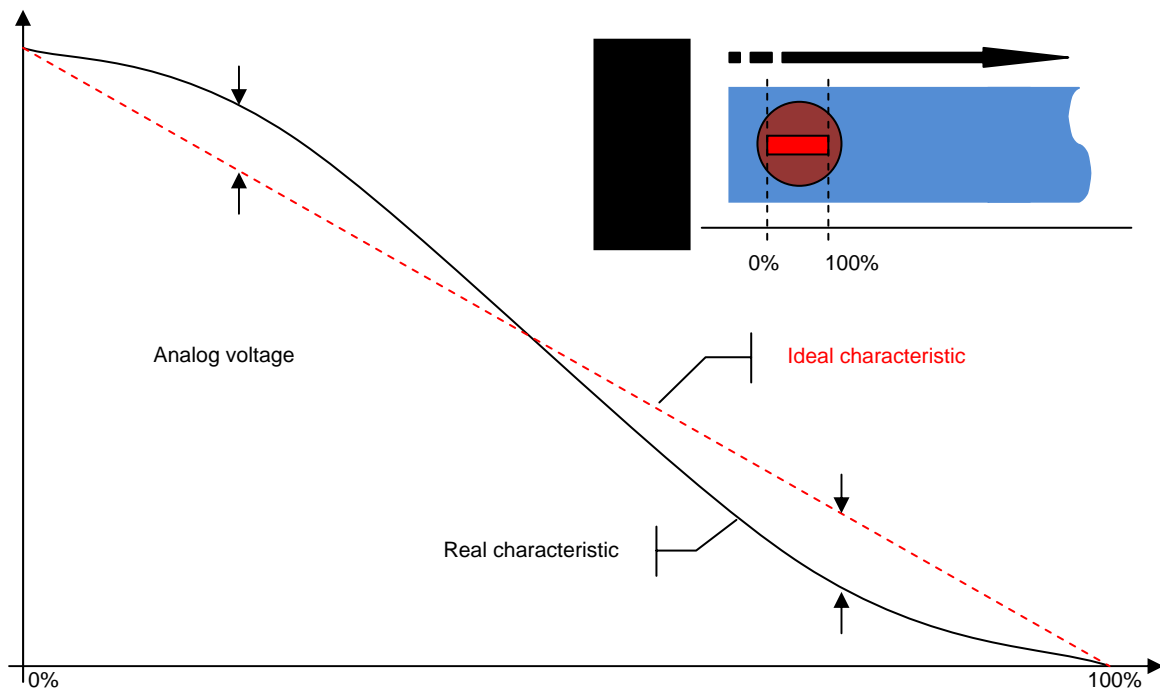
Never

✔ Never
IN0 rising edge
IN0 falling edge
IN1 rising edge
IN1 falling edge
TMR A starting
TMR A stopping
TMR B starting
TMR B stopping
CH A rising edge
CH A falling edge
CH B rising edge
CH B falling edge
OUT0 switch. on
OUT0 switch. off
OUT1 switch. on
OUT1 switch. off
OUT2 switch. on
OUT2 switch. off

!   *Panel view in "AUTO LIMITED" mode:*

!   *Panel view in "AUTO UNLIMITED" mode:*

!   *Panel view in "MANUAL RECORDING" mode:*

!   *Panel view in "AUTO TRIGGERED" mode:*

4.11 "LIN." linearisation panel

4.11.1 Linearisation of A-LAS sensors with the A-LAS-CON1
A-LAS sensors mostly show good linearity in the range below 5%. This means that the deviation from an imaginary ideal transfer characteristic that puts the percentage covering and the output analog voltage signal into relation maximally is 5% referred to the maximum swing of the analog signal.

If an even higher accuracy should be required, a transfer characteristic (covering → analog voltage) can be used with the help of digital evaluation and of the internal memory of the A-LAS-CON1 to perform a reverse calculation (analog voltage → covering) that provides information about the actual value of covering.

For every A-LAS sensor unit a transfer characteristic is recorded during production. The PC software of the A-LAS-CON1 (starting from version 4.00) supports the conversion of these data and the configuration of the control unit for applying these linearisation data.

4.11.2 Application requirements for linearised operation
Not every application can benefit from the higher accuracy of linearised operation. The basic prerequisites are as follows:

1. The measurement principle of the application must correspond with the method of characteristic recording. According to this method a non-transparent object that is bigger than or of the same size as the length of the aperture of the A-LAS starting from one side covers the light curtain in its full width.

2. The A-LAS sensor unit must be operated over its full length. Constant partial covering with covering to be measured in a partial area is not permissible. In this case linearisation cannot be used.

3. The A-LAS sensor unit must not be overloaded. With a non-covered light beam the unnormed digital value should not be higher than 3500 digits.

4. The A-LAS-CON1 must operate in normed mode. Norming represents the analog voltage value of the A-LAS in a 12bit value range. Since the linearisation function expects a normed input area, proper operation only is possible with active norming. Care must also be taken to ensure that automatic norming adaptation is set such that it matches the application and makes sense.

5. The linearisation characteristic must match the A-LAS sensor (which can be verified by means of the serial number).


Fixed positioning
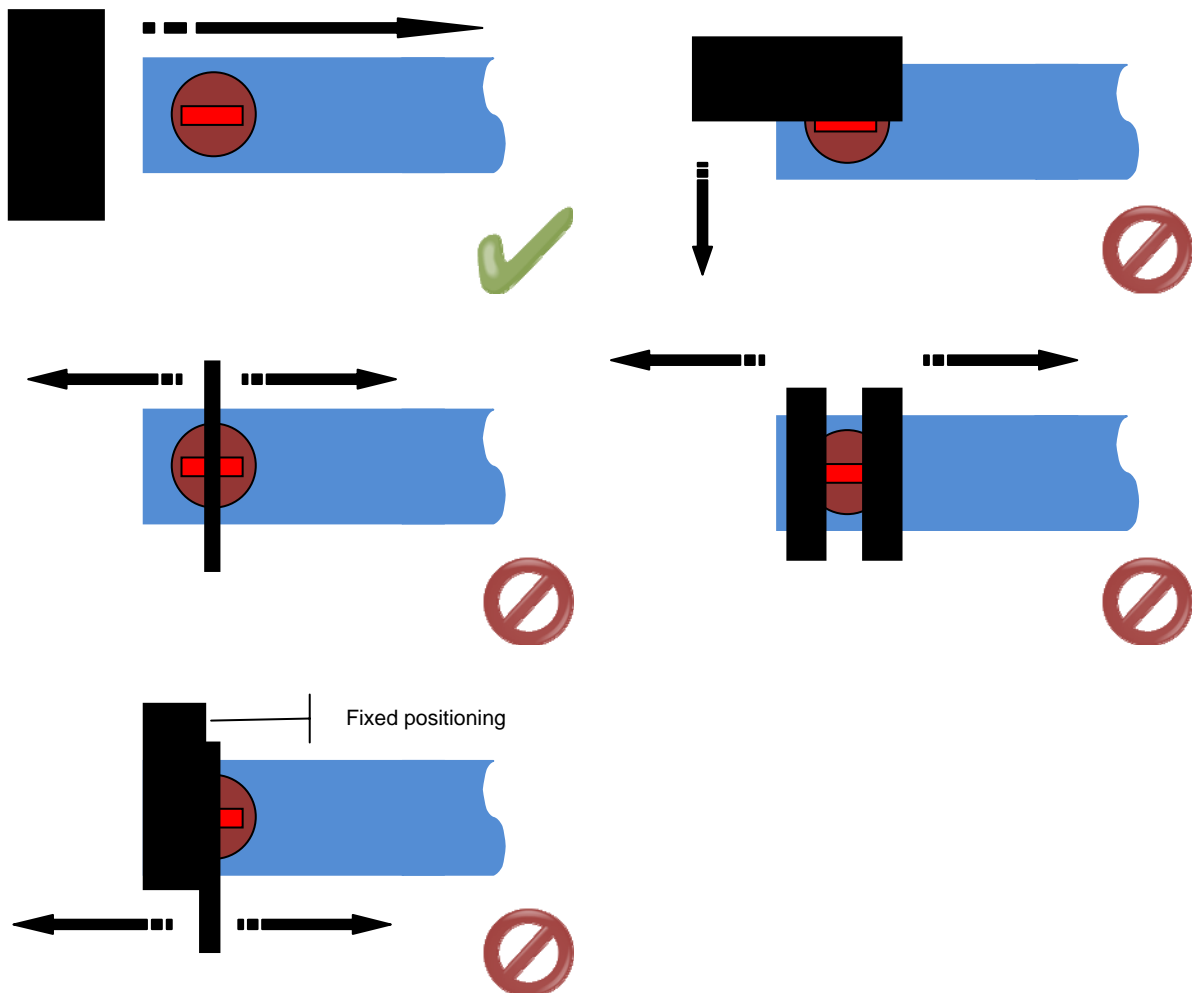
4.11.3 Linearisation parameters

A-LAS sensors show a relation between the percentage covering of the laser light curtain and the percentage change of the output voltage level that is linear to the largest extent. The deviation from the ideal characteristic – depending on the A-LAS sensor – is between a few per mille and maximally 5%. Provided that the measurement is performed identically, it is possible to use a reference curve for which both the relative covering and the respective voltage value are known for the compensation of the linear error. The control unit performs this task by allowing the user to load, transform, and save the calibration curve for the corresponding sensor. Reference curves for calibration on request can be obtained from the sensor manufacturer.
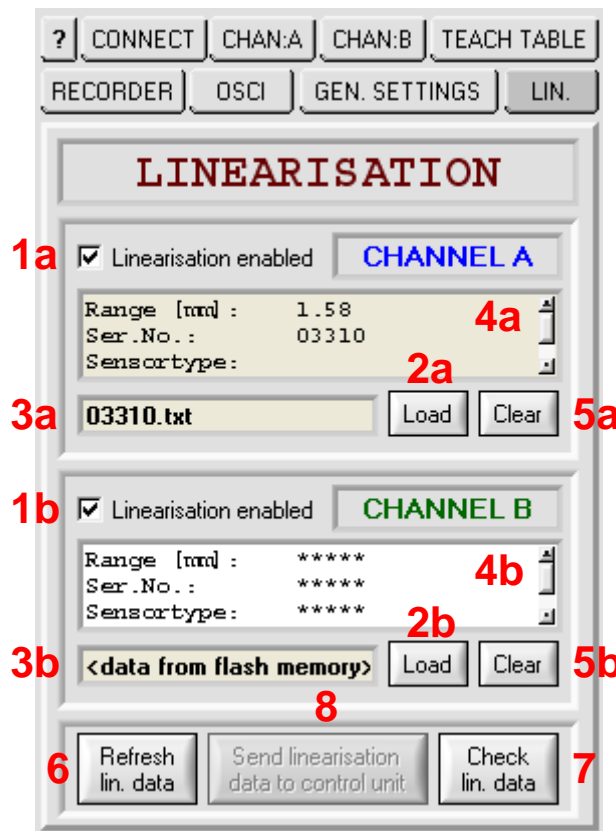
|	
1.	*Irrespective of the currently loaded calibration data, linearisation can be activated or deactivated for each of the two channels.*
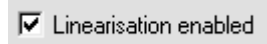
|	
2.	*As the first step for the calibration of a channel the reference curve must be loaded from a file. A click on the "LOAD" button opens a file selection box where the corresponding file can be selected.* *INFO: Only calibration data from valid files may be loaded. Do not edit the calibration data in the files yourself, because this may lead to unpredictable behaviour of the control unit.*

2.

3.
+
4.
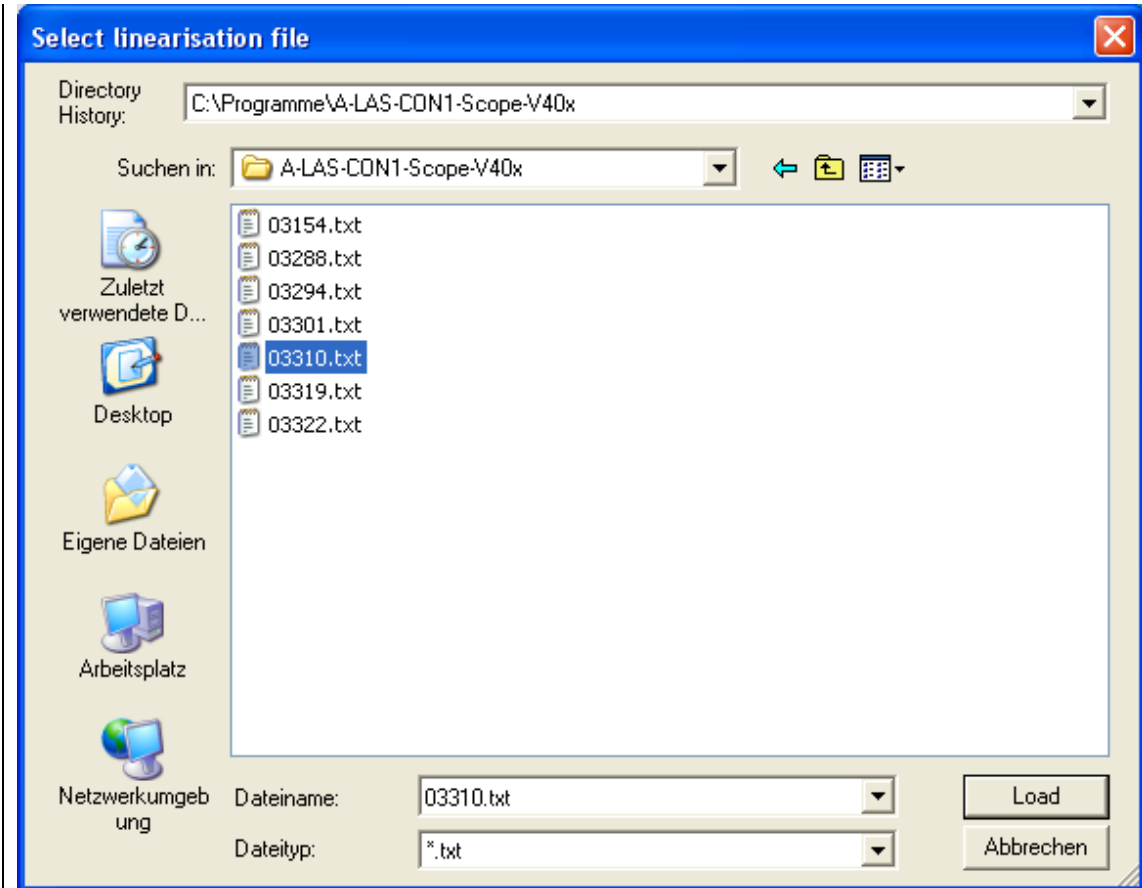
The selected file and the information contained in the file about the sensor, reference curve recording, and creator of the record, are displayed in two fields.

INFO: If information on reference data is displayed that originates from a file, the text box has a beige background. If the data originate from the control unit itself (as description of respective data stored in the control unit), the text box has a white background.
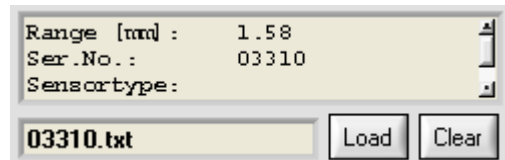

5.

If the currently selected file cannot be used, it can be removed by clicking on the "CLEAR" button. In this case the PC Scope software offers to replace it with a default data curve. Field (3) will then be cleared, and field (4) displays the information "<no file selected>".
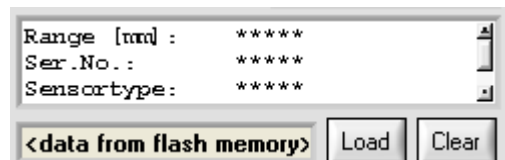

6.

The linearisation data that are currently active in the control unit can at any time be read. A click on the "REFRESH LIN. DATA" button reads these data and displays them in fields (3) and (4). Since these data originate from the control unit, the file info field shows the information "<data from flash memory>".
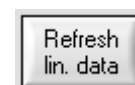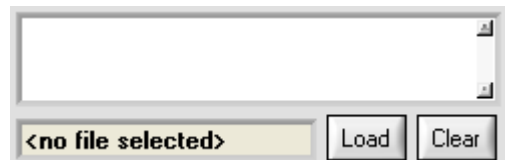
|		
7.	*When the required files have been loaded (or removed with "CLEAR") the next step of control unit calibration can be started by clicking on the "CHECK LIN. DATA" button. In this step the files are checked for integrity, and the linearisation information is extracted and transformed. If no linearisation file was selected, the user will be prompted to answer whether a default curve (a 1:1 representation) should be used instead.*	
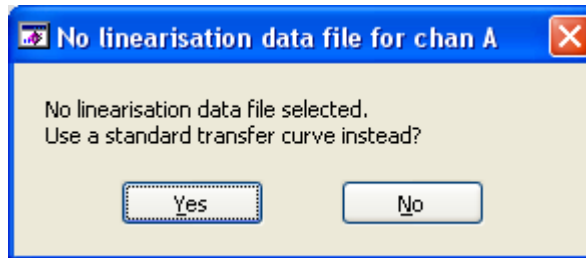
|		
8.	*If all the files are OK (or if the respective replacement curves are used), the "SEND LINEARISATION DATA TO CONTROL UNIT" button will be enabled. With a click on this button the determined data are sent to the non-volatile memory of the control unit.*	
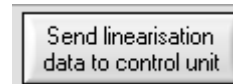
4.11.4 Example – Data

The example below shows the level of covering that is determined by the control unit once without linearisation and once with linearisation. The A-LAS sensor type used in the example is a "A-LAS-F24-16x1-50/60" (ser-no.: 03268), the control unit is a A-LAS-CON1 with firmware "A-LAS-CON1-V4.01".
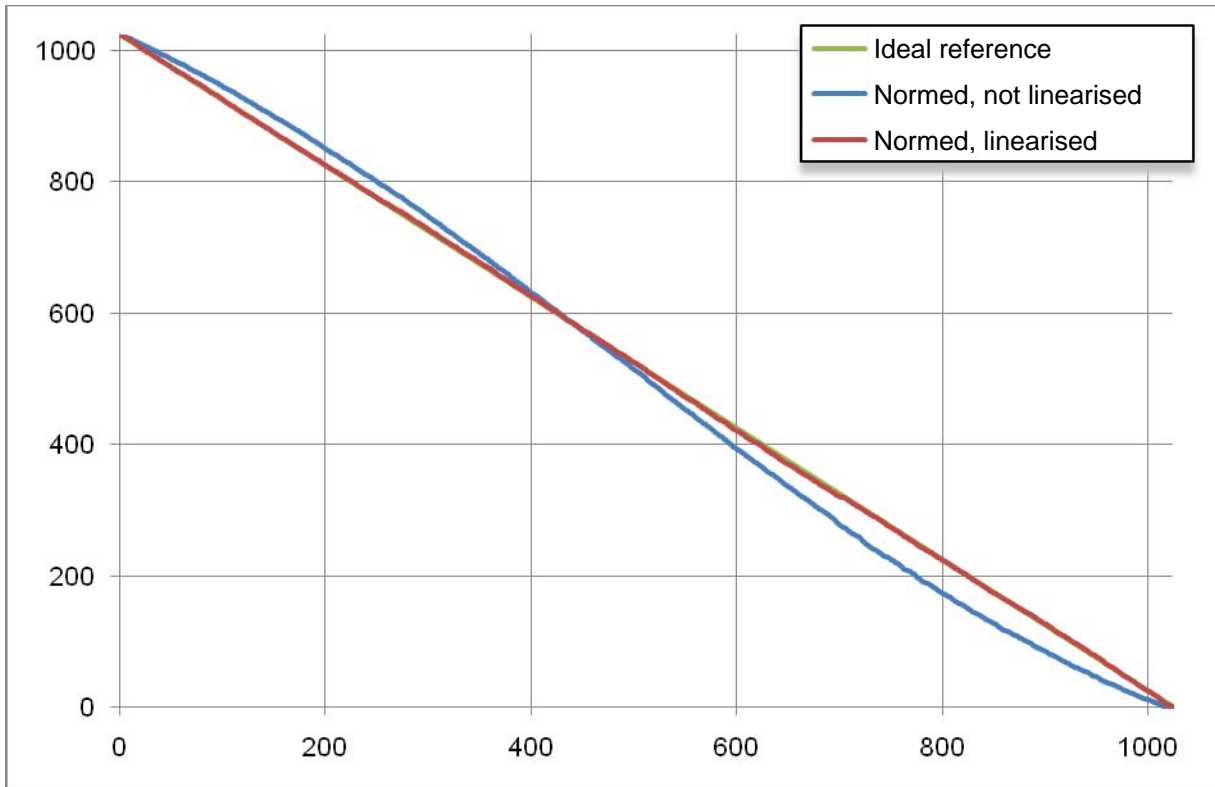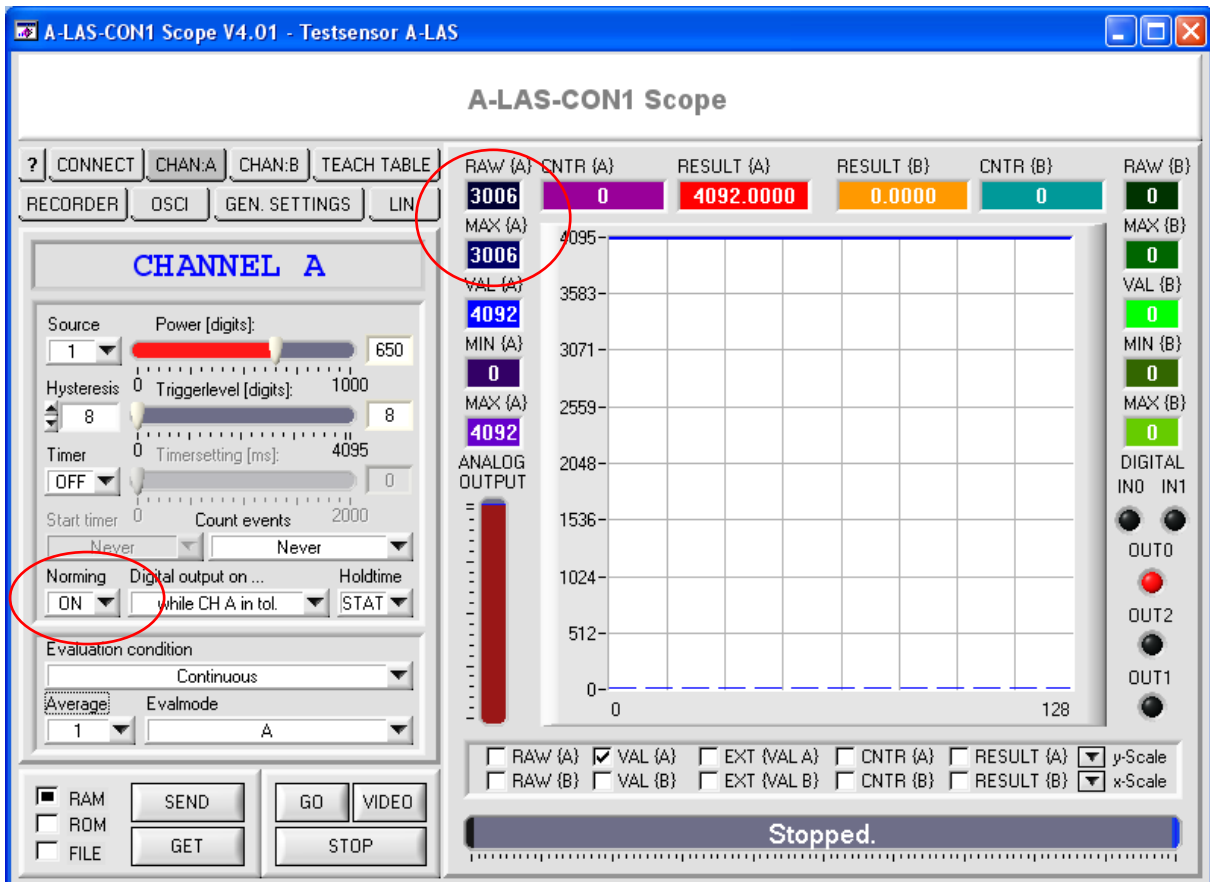
The blue (normed, not linearised) curve shows the typical "S"-shaped curvature. The red (linearised) curve only minimally deviates from the green ideal reference.
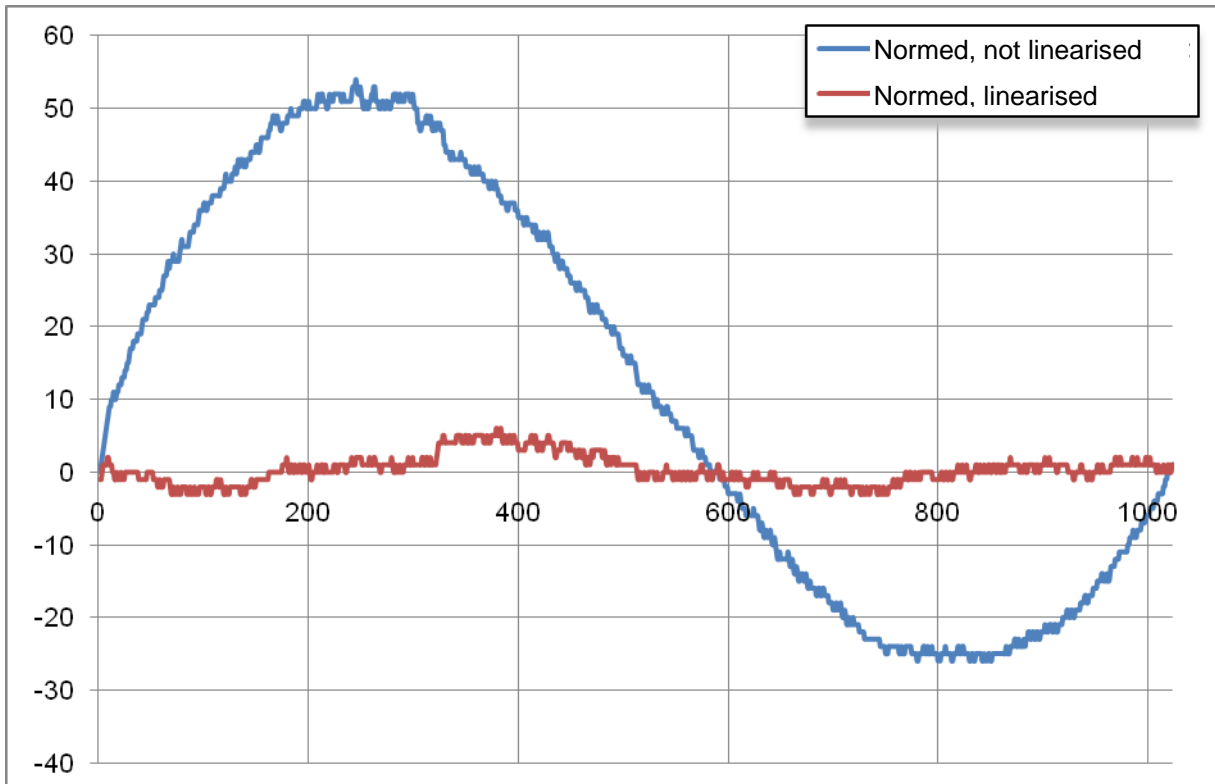
Deviation from the ideal transfer curve of the linearised (red) and not linearised (blue) signal in per mille.

4.11.5 Example – Parameters

The example below shows the settings of the A-LAS-CON1 control unit. Important settings are highlighted.

- The "MAX {A}" and "MAX {B}" values should be set in a range between 3000 and 3500. For this it may be necessary to adjust the power values and/or to check the alignment of the sensor.
- The norming function of the respective channel should be set to "ON" ("NORMING = ON")
- The linearisation information for the respective channel should be stored at the control unit (To check the data that are stored for the channel, these data can be read with "REFRESH LIN. DATA").
- Linearisation for the respective channel should be activated ("LINEARISATION ENABLED = 1")

When these parameters are correspondingly set, linearised operation is active.

1.

4.12 Help function for the PC Scope software

Apart from the manual, the PC Scope software also provides additional support functions to make it easier for the user to work with the software. The so-called "TOOLTIPS" are one of these functions. When these "TOOLTIPS" are activated, an info box with yellow background appears when the mouse pointer hovers over an input field or button. This info box in a short sentence explains the function of the respective field or button.
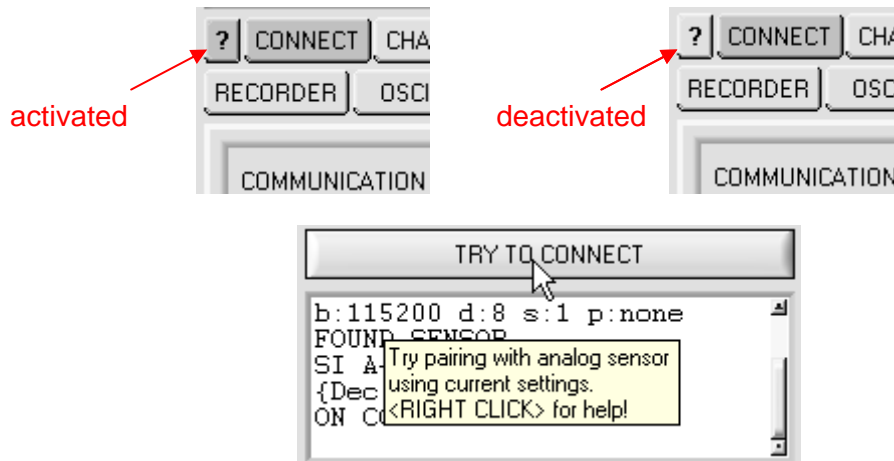
Most of the input fields and buttons furthermore display additional information upon a right mouse button click on the respective field or button. A help window will then be displayed instead of the scroll graph or oscillograph display.
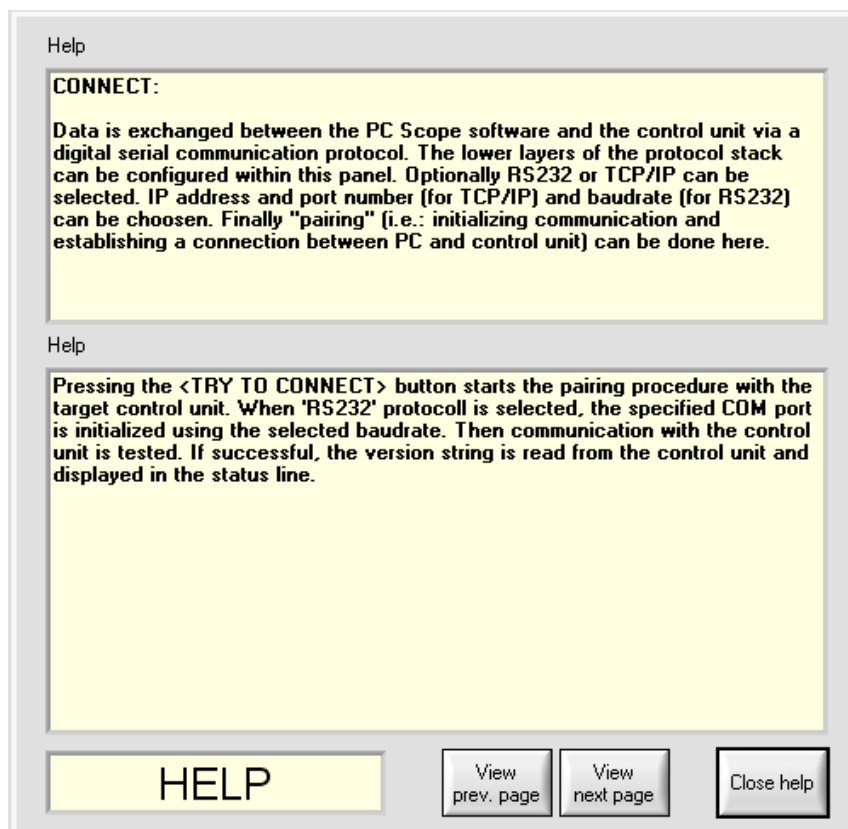
The top part always shows general information about the higher-level group to which the input field belongs. The bottom part contains a detailed description of the input field, its function, and (if available) its configuration options. This help display is clearly identified by the yellow background and by the "HELP" label. Click on the "Close help" button in the bottom right corner or right-click with the mouse anywhere in the help panel to close the help window and return to the normal display.

Some of the input fields furthermore feature a dynamic simulation that is intended to clarify the function. Use the "View prev. page" and "View next page" buttons to switch between the help text and the simulation. The respective display contains the explanation/legend for the represented curves and data. The description always refers to a simple application example for the respective input field or display.

Example: Help text for the numeric display "CNTR A"

Help

While active, the A-LAS-CON1 continuously gathers different information and measurement data. The PC Scope software is able to display this data as a numerical value and optionally as a data trace in a continuous stripchart. The available data contain <RAW>, <VAL>, <MIN>, <MAX>, <CNTR>, and <RESULT> values for both channels A and B.

Help

The <CNTR A> data displays the number of specified events counted by the A-LAS-CON1 since the last reset event. The event to be counted is set with the <COUNT EVENTS A> parameter.

HELP   View prev. page   View next page   Close help

NORM value (red), triggerlevel (blue)

4095
3583
3071
2559
2048
1536
1024
512
0

10   137

NORM   TRIG-LVL   CNTR

2635   3072   1

PAUSE

Trigger signal (blue), reset signal (red)

ON
OFF
ON
OFF
ON
OFF

10   137

SIMULATION   View prev. page   View next page   Close help